Coastwatch

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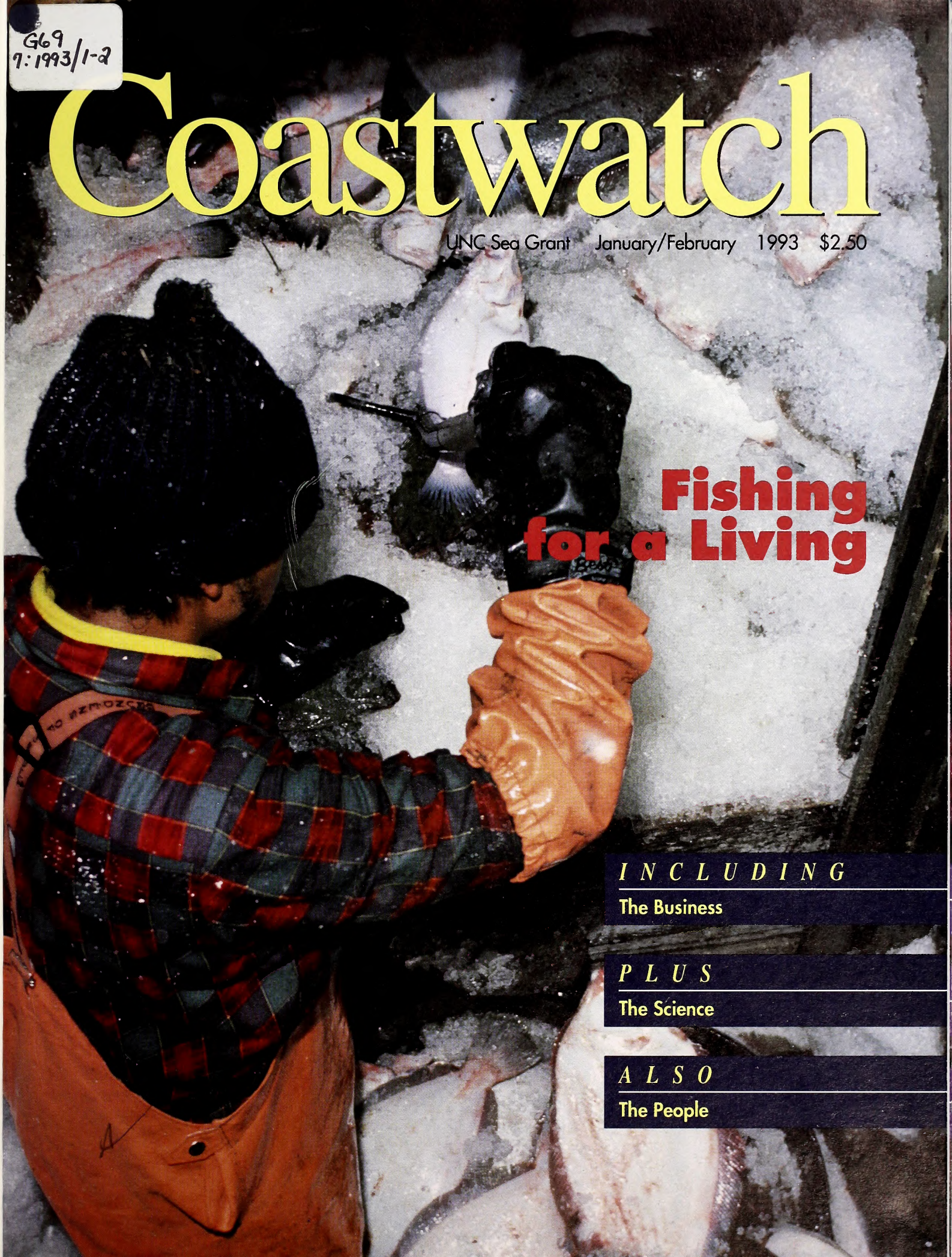

Fishing for a Living

INCLUDING

The Business

PLUS

The Science

ALSO

The People

Coastwatch

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The University of North Carolina Sea Grant College Program is a federal/state program that promotes the wise use of our coastal and marine resources through research, extension and education. It joined the National Sea Grant College Network in 1970 as an institutional program. Six years later, it was designated a Sea Grant College. Today, UNC Sea Grant supports several research projects, a 12-member extension program and three communicators. B.J. Copeland is director. The program is funded by the U.S. Department of Commerce's National Oceanic and Atmospheric Administration and the state through the University of North Carolina.

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Front cover photo of fisherman icing winter flounder catch by Michael Halminski.

Inside front cover photo of big catch of the day by Scott D. Taylor.

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from the top

Dear Readers:

Commercial fishing. It's a way of life in small North Carolina communities such as Stumpy Point, Hobucken, Salter Path, Sneads Ferry and Varnumtown. For decades that way of life went unchanged.

But times are different.

What was once a simple matter of catching a few fish is now much more complicated. Watermen must purchase expensive gear, study mountains of regulatory information and lobby policymakers for more say in the rules that govern their livelihoods.

No doubt bureaucracy has changed the industry. Regulations are rampant, but resource managers feel a need to protect fish populations that are dwindling because of overharvesting, pollution and habitat degradation.

Fishermen, however, think there is too much government interference. They long for the days when they could call the oceans and sounds their own.

Carla Burgess outlines the problems and complexities facing today's commercial fishing industry. She talks to federal and state fisheries managers, policymakers and representatives from commercial fishing organizations.

I talk with Sea Grant scientists who are looking at innovative ways to address the problems. Sea Grant's social and economic research may give resource managers more to think about than just biological statistics when it comes to forming regulations.

For the fishermen's side of the story, Jeannie Faris interviews four Tar Heel watermen whose family histories are steeped in saltwater and seafood. They relate their frustrations, possible solutions and hopes for the future.

I hope that you enjoy the issue and learn more about the unique people who call themselves commercial fishermen.

During February, some of you will receive a survey for evaluating *Coastwatch.* We want to know what you like and don't like and how you rate our efforts thus far. Please take a few minutes to honestly answer our questions. Your responses and opinions are important to us and will help shape future issues.

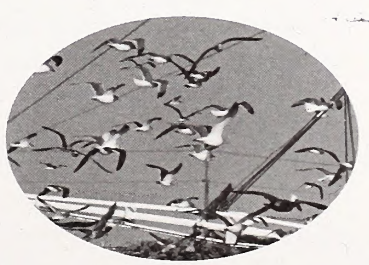
Until next issue,

Kathy Hart

Page 14

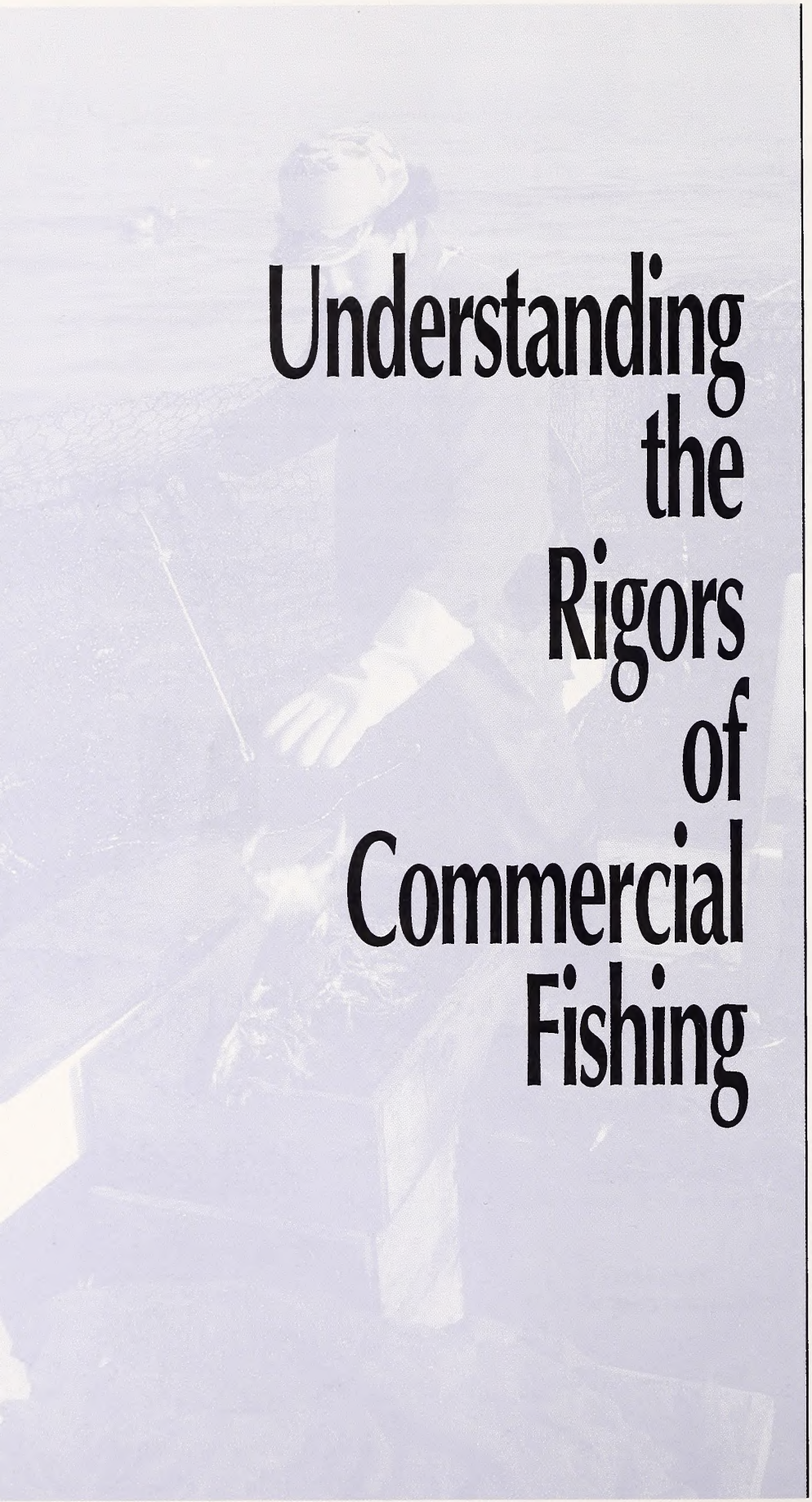
in this issue

Page 3



Page 16

Understanding the Rigors of Commercial Fishing



Michael Halminski

By Carla B. Burgess

North Carolina watermen have always been mavericks. Sure, they share stories with each other about life on the water, a new piece of gear that has worked well, what's biting and what's not.

But for the most part, they've been fiercely independent, solving their own problems their own way. They've chosen where to go, what to fish for, how to catch it and when to call it a day. Hard work was the key to a good living; bad weather or bad luck was the enemy apparent.

During the past two decades, however, North Carolina's commercial fishermen have begun to see their grasp on this age-old profession weakening. New pressures have surfaced, and new foes are staking their claim on the ocean frontier. Some of these perceived opponents have flesh-and-blood personas — environmentalists, developers, sportfishermen. But many of the enemies are faceless — declining water quality, ebbing ecology and a bureaucracy that many fishermen neither understand nor want to understand.

Day after day, commercial fishermen feel they are being sucked into a quagmire of regulations invented by a government they perceive as unfeeling and uncaring. And they don't really know how to participate in the regulatory system that shapes their very livelihood.

For each hour at sea hauling in shrimp, flounder and mackerel, fishermen spend another two or more doing paperwork — filling out permit applications, making sure their vessels meet current safety codes, filing reports, staying abreast of proposed policy changes and trying to get their two cents worth into the management process.

"The fisherman is faced with a wide variety of regulations coming from a number of different sources, and it's almost impossible to keep up with

all the changes that are going on," says Bill Foster, a Hatteras fisherman and a member of the N.C. Marine Fisheries Commission. The commission sets the policies that are implemented by the state's Division of Marine Fisheries.

"It's not uncommon for fishermen here to fish for 10 to 15 different species," says Foster. "The biggest problem I have is the volume of regulations and trying to adjust the fishing to them. For instance, in the ocean there are different regulations for bottom fishing, mackerel fishing and trolling. You almost have to decide what fish you're going to fish for before you go into the ocean. If you've got gear for one fishery, then you're illegal in another. Going into the ocean now, it is almost impossible not to be in violation of something."

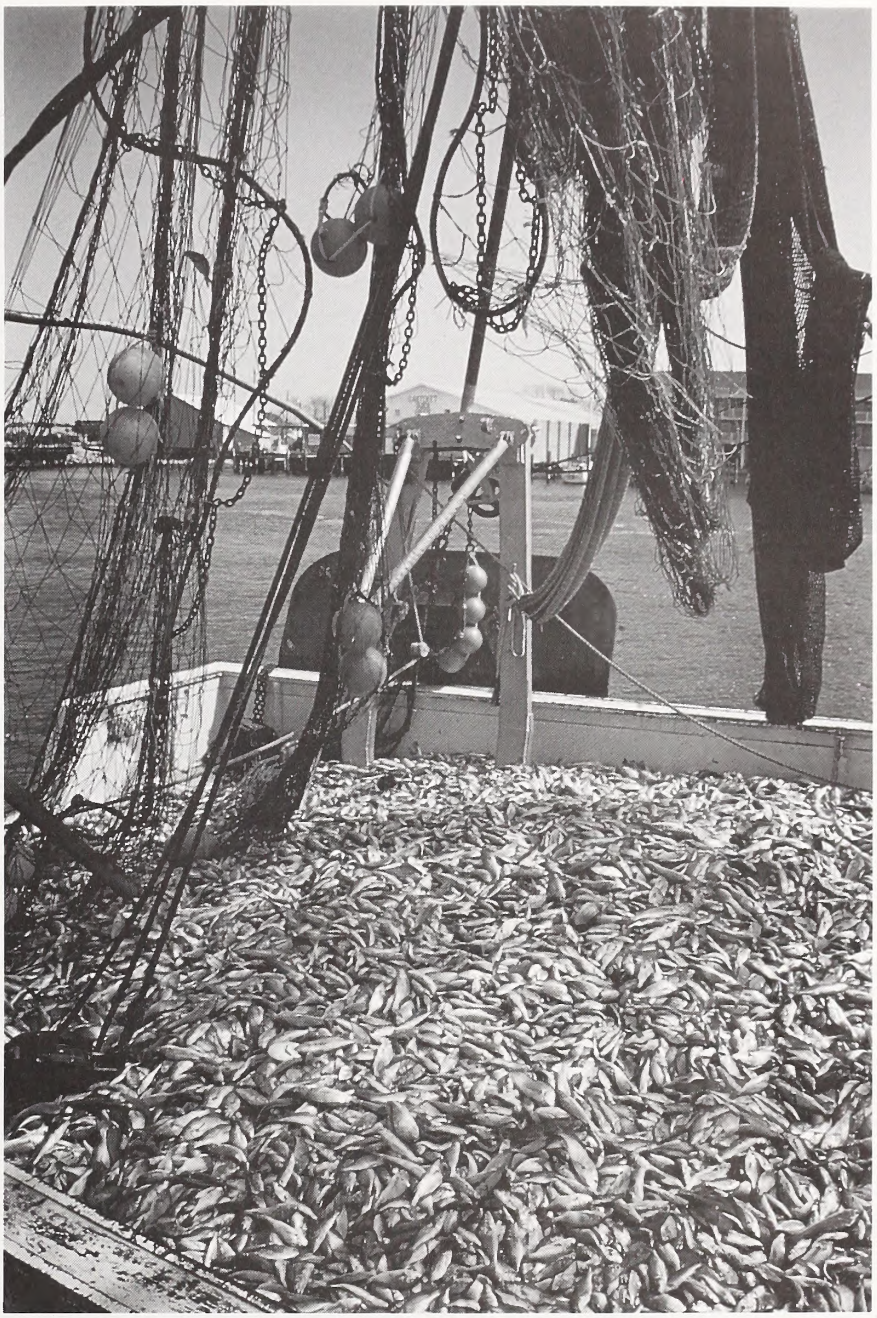
Fishermen in North Carolina harvest more than 90 marketable species of fish using the largest variety of gear allowed nationwide. The state's inshore fishing grounds are the third largest in the nation — harboring 2.3 million acres of estuarine waters.

As managers try to get a tighter regulatory handle on a multitude of fisheries, Tar Heel watermen are feeling the squeeze that neighboring states have experienced for years.

"We in North Carolina have traditionally had minimal regulations, but it doesn't look that way to the fishermen," says Michael Orbach, a Sea Grant scientist, a professor of anthropology at East Carolina University and a member of the Marine Fisheries Commission. "We've been blessed by being out of sight, out of mind for a long time."

Recreational fishermen and environmental groups, who often view fisheries as underregulated with regard to conservation, says Orbach, have demanded and are receiving more attention.

"Clearly what's happening is all the constituencies are more organized," says Orbach.



Scott D. Taylor

Spot, a species targeted by commercial fishermen.

Except, it seems, commercial fishermen.

"I think the independent nature of fishermen is such that they don't want to belong to any group," says Jerry Schill, executive director of the N.C. Fisheries Association.

Lack of common ground is another possible cause of disunity. A shrimper and a snapper/grouper fisherman have interests as divergent as a tobacco farmer and a peach grower, says Jim Murray, UNC Sea Grant's Marine Advisory Service director. And even within a given fishery, says Schill, there are factions, such as clammers who harvest with machinery — "clam kicking" — vs. those who extract the bivalves with hand-held rakes.

Compounding this lack of organization is a Grand Canyon-sized rift of communication between the commercial fishing community and the agencies that regulate it. Both sides are

Continued

talking at one another instead of with each other, especially with regard to federal regulations.

Fishermen feel that their opinions can barely be heard over the ruckus of managers putting forth yet another restriction. Watermen have learned to expect a knee-jerk reaction from Washington. And once the federal government has ordained a solution, commercial fishermen feel like it's written in stone.

"We have become so that there's no contact between National Marine Fisheries Service and fishermen," says Melvin Shepard, president of the Southeastern North Carolina Waterman's Association. "In order to have any influence at all, we have to go to our representatives (in Congress)."

But the relationship between those who make their livings at sea and the people charged with managing their livelihoods has not always been so polar.

The marriage between commercial fishermen and the federal government required no shotgun wedding — fishermen were willing partners at the onset. In fact, when foreign fishing fleets began collecting the United States' offshore bounty of seafood, commercial fishermen courted intervention from Uncle Sam.

In the middle of this century, the world's landings of fish were skyrocketing, while U.S. landings crept slowly by comparison. To make matters worse, America's voracious appetite for seafood was being fed by hauls of imported fish caught just off U.S. shores.

This monolithic foreign fishery was also extremely agile — well-equipped to exploit our resource and then move on to more fertile fishing fields. In the 1970s, U.S. fishermen asked for help and a Congressional debate was set in motion. At this time, scientists deemed at least 16 offshore species overfished. In 1976, the Fishery Conservation and Management Act was enacted.

The Magnuson Act, as it is also called, extended U.S. fishery management jurisdiction to 200 nautical miles offshore and established eight regional management councils charged with managing fisheries within this zone. Prior to its passage, the states had the only real comprehensive management authority.

The National Marine Fisheries Service (NMFS), under the U.S. Department of Commerce and the National Oceanic and Atmospheric Administration (NOAA), was charged with administering the act and its provisions.

As more and more Americans have turned to the ocean and estuaries to make their living — aided by highly efficient gear and technology — the impact of federal management has trickled down. Its mission is still to protect and conserve the resource, but now the restrictions are starting to hit home.

"You have fishermen now who consider National Marine Fisheries (Service), the Secretary of Commerce and NOAA to be (their) bloody enemies," says Shepard.

It doesn't help matters that fishermen often fail to distinguish the government agencies that manage fisheries and the various sources of regulations. The furor over sea turtles, the Endangered Species Act and turtle excluder devices (TEDs) illuminates this confusion.

"Fishermen do not understand the character of the Endangered Species Act or the Marine Mammal Protection Act," says Orbach. "Both say you can't even take them (protected species) at all. You can't even make them ner-

Michael Halminski

Hatteras drop-netters bailing fish.

vous. Literally, you can get a federal citation for coming too close to a whale with a boat."

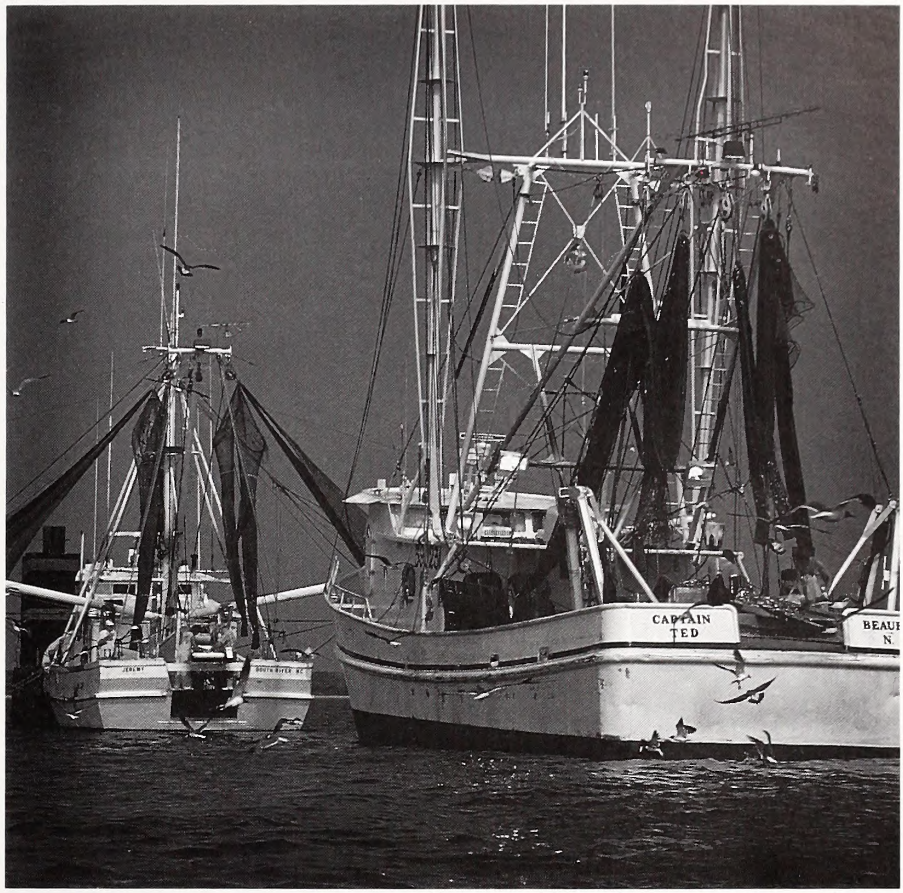
But commercial fishermen often think that if they are careful not to capture too many sea turtles, then they have fulfilled the requirement of the law.

"So you tend to see a lot of resistance, for example, in our trawl flounder fishery in North Carolina when turtles start showing up dead on the beaches during flounder season," says Orbach. "It may be that the trawl fishery is not causing those deaths; we really don't have a good system for autopsying turtles and marine mammals. Rather than trying to develop gear that will allow the release of turtles ... they say, 'We shouldn't have to do this at all. We aren't the big problem with turtles. It's coastal development and RVs running over turtle nests; that's the problem.'

"The point is, no matter how small a part of the problem you are with marine mammals and endangered species, you're a problem," Orbach says.

TEDs have been less than popular among commercial fishermen. Shrimpers claim that the device not only releases turtles but a big percentage of their catch. And in the summer flounder fishery, the gear clogs with sea grasses, and the whole of their catch gets lost. In some areas, limited tow times have been approved by NMFS as an alternative to TEDs, the theory being that any captured turtle could survive a brief entrapment in the net.

Despicable as they seem, requirements such as TEDs and limited tow times are the very vehicle through which fishermen are allowed to trawl at all. And they are not an invention by NMFS to torture fishermen, say federal officials. The Endangered Species Act takes precedence over the Magnuson Act.



Morehead City shrimp trawlers. Scott D. Taylor

"The law is doggone tough; we don't really have a choice," says Andrew Kemmerer, director of NMFS's Southeast region. "There are solutions like TEDs that prevent us from having to close the fishery."

But fishermen are perched perpetually on the defensive.

"Fishermen get their backs up any time NMFS even mentions anything," says Shepard. "They will be put in an adversarial relationship, and they know in their minds that this federal regulation is going to happen."

Watermen often don't know about a new regulation until it has been implemented, and the appeal process is painstaking, time-consuming and often expensive.

"The main problem that I see is that there is a lack of communication between fishermen and the various agencies at the very early stages of regulation," says Foster.

A recent regulation spawned by Florida recreational fishermen is a prime example, says Shepard. The dispute among Florida fishing interests over the use of pots in the snapper/grouper fishery resounded to Tar Heel shores when a regulation prohibiting the traps was adopted by the South Atlantic Fishery Management Council (SAFMC). The council governs the region from Key West, Fla., to the North Carolina/Virginia border. Based on research conducted by NMFS, the council develops management plans for species that migrate between state borders.

"There had been a move over a period of time to prohibit the use of fish traps in federal waters offshore," says SAFMC Executive Director Bob Mahood, adding that the council voted to prohibit the traps. "In doing so, the council knew that there was an extensive sea bass pot fishery off North Carolina, South Carolina and Georgia.

Continued

Scott D. Taylor

Digging with tongs for clams.

When they wrote the plan, it was written in such a way that allowed black sea bass pot fishing to continue."

But, says Mahood, fishermen could no longer possess fish pots on board if they were fishing for snapper/grouper species with hook and line or hydraulic lines.

And, says Shepard, "if you went to a black sea bass pot with anything other than sea bass in it, you had to throw 'em away." In the past, the odd marketable species caught in a bass pot could help you meet your fuel expenses for that trip, says Shepard.

Shepard and two other fishermen made a trip to Key West to appeal the regulation, and upon review, the council agreed one vote short of unanimous to recommend an emergency rule correcting the problem. The dissenting vote came from the NMFS representative on the council. Shepard says the NMFS representative is instructed never to vote in favor of an emergency rule because a unanimous vote by the council would oblige the Secretary of Commerce to approve it. Even though this particular rule was ultimately approved by the secretary, this policy often makes NMFS the odd man out, says Shepard.

Bill Hogarth, who heads the state's Division of Marine Fisheries, says this kind of politics doesn't help the already tenuous relationship between watermen and Washington.

"It makes you look sort of stupid as far as they (fishermen) are concerned," says Hogarth. "I think it's extremely difficult to get the national office to back off once they've made a decision."

At the state level, he says, "it's a lot easier to manipulate a problem politically by just screaming and hollering at us."

Even though the trip resulted in a victory for Shepard, he says it cost him and his companions close to $5,000 in time and traveling expenses to correct a management mistake they think should never have happened.

And though he says the fish pot dispute was not an issue of the greatest magnitude, it stands out as a particularly telling example of how government ignores what would be valuable feedback from the fishing community. If the real issue was limiting the number of large, spawning-size snapper/grouper species caught, says Shepard, then redesigning pots to exclude fish of that size would have been a more logical solution — not banning pots and continuing to allow fishermen to angle for their catch.

"A hook doesn't know what size fish bites it," says Shepard.

But in Mahood's opinion, the convincing arguments presented by Shepard and his colleagues was a perfect example of fishermen learning to use the system to meet their needs. He says the appeal was well-argued and that the three coordinated their testimony so that they weren't all saying the same thing.

"They did a sales job," he says, and the effort paid off. "North Carolina fishermen have become very sophisticated."

There's not a lengthy sign-up sheet of fishermen wanting to learn the rules of this political game. But Schill has issued the call.

"The commercial industry is overregulated, and there's a lot of justification for them (fishermen) to be upset," he says. "But you just can't keep going to meetings saying you're the redheaded stepchild. You've got to start participating in the process, whether you like it or not."

The oldest trade group in the state and one of the oldest in the nation, the N.C. Fisheries Association is entering its 41st year of representing the interests of commercial fish dealers and fishermen. The Southeastern North Carolina Waterman's Association has

been in existence about as long. Though there have been other promising starts of fishing groups and associations, the follow-through rate has been dismal, Schill says.

"When you get into this kind of mess, you have to be in it for the long haul because the opposition is in it for the long run," says Schill. "It amazes me how when they (fishermen) get into politics, they give up. There is little to be hoped for in terms of the industry trying to save itself if they don't start tackling the government like they do Mother Nature.

"They say, 'I'm sick of this because there's politics in fisheries management,'" says Schill. "There's politics in education; there shouldn't be, but there is. There's politics in every aspect of our life.

"Commercial fishing is the last true bastion of free enterprise in our life," he says. "Commercial fishermen will either learn to play the political game, or support those who are playing the political game for them, or they will see their demise."

Fishermen must learn to fight back and learn whom to fight.

"The agencies, by their very nature, assume that everybody out here knows their area of authority," says Schill, adding that the sea turtle situation is a prime example of misdirected anger. "The bureaucrats did not pass the Endangered Species Act. We spend probably too much time beating on bureaucrats."

People who make policy would also benefit from unity among fishermen.

"We want the fishermen to be organized so they can tell us in one voice what they want to see in the fishery," says Mahood.

But managers want to hear a credible voice, not angry threats and insults hurled their way at public hearings.

Fishery managers, too, would benefit from a study in semantics; their careless comments breed as much contempt. After all, poor communication is a two-way street.

"I personally feel that NMFS does not know how to deal with people," says Shepard, adding that he's heard managers voice their intent to eliminate a specific percentage of fishermen with more stringent regulations. Such statements evoke the image of the college professor who announces the first day of class that half the students will eventually flunk.

As North Carolina's commercial fishing community begins to feel the pinch of gear limitations, catch quotas and other restrictions, they will need to know who's who.

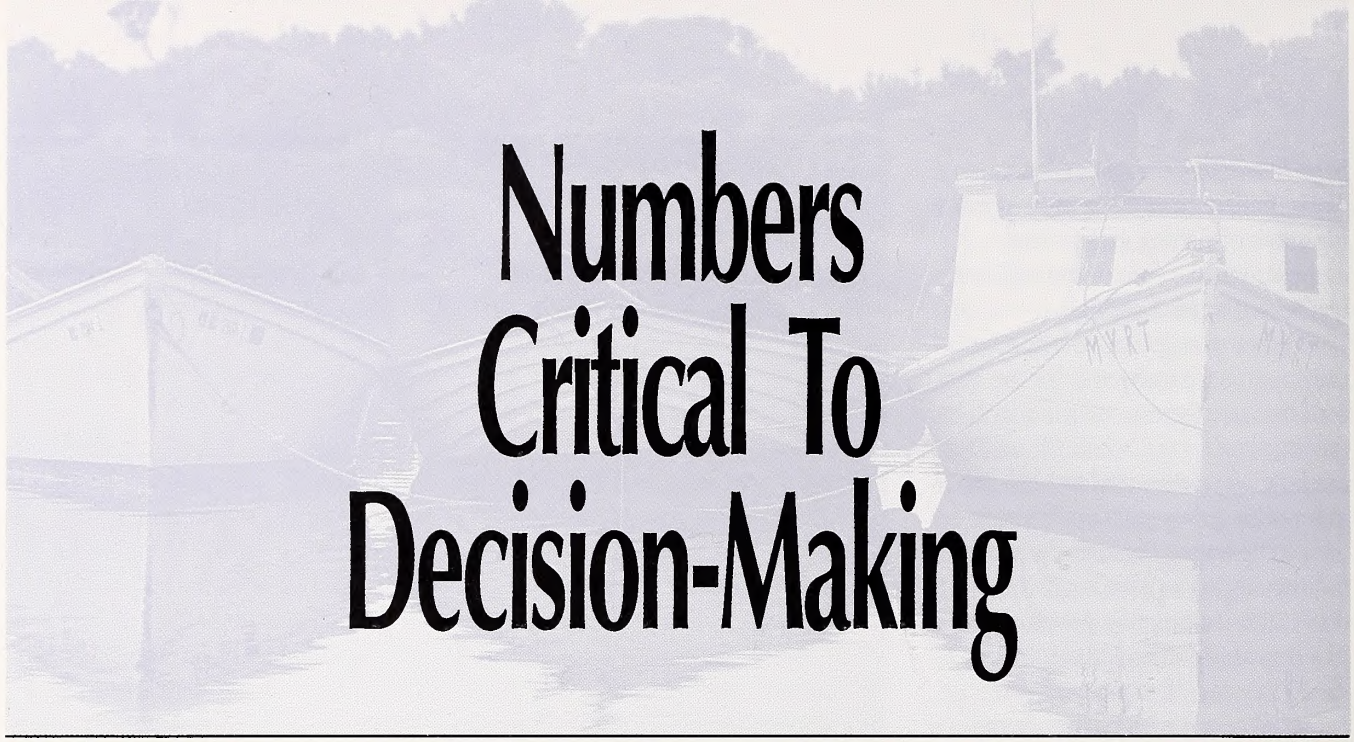
"Fishermen, particularly North Carolina fishermen, are just now being impacted by regulations," says Kemmerer. "This is forcing them to get involved and start to understand where we're coming from."

Both Shepard and Schill see a glimmer of hope in fishing association auxiliaries, in which families of fishermen become involved in the regulatory process. Another promising startup is an association of the state's crab-potters, formed to address the problem of space conflicts.

Shepard is also hoping for improvements to the Magnuson Act, scheduled for reauthorization this year. If fishermen could achieve a swifter avenue of appeal for federal regulations, for instance a hearing within 30 days, he says, "you'd see a great change."

Ocean and Coastal Law, *written by Richard G. Hildreth and Ralph W. Johnson, was a helpful source in outlining the history of the Magnuson Act.*

An old trawler at dock. Scott D. Taylor



Numbers Critical To Decision-Making

Michael Halminski

By Carla B. Burgess

How can you make decisions about protecting and conserving a fishery when you have little information to base them on?

Fishery managers and watermen encounter this dilemma daily.

"One of the most severe limitations that everybody runs up against in fisheries and environmental management is lack of good data and information," says Michael Orbach, a Sea Grant scientist, a professor of anthropology at East Carolina University and a member of the N.C. Marine Fisheries Commission. "We really don't know how many fishermen are applying how much effort out there to get the stocks. We don't even know how much is being caught."

In North Carolina, reporting of the recreational and commercial catch is voluntary, and the annual statistics stem from a lot of sampling, scientific surveying and estimating.

"We've had fishermen say, 'I've had more oysters in my house than you reported for the entire state,'" says Bill Hogarth, director of North Carolina's Division of Marine Fisheries.

And neither recreational nor commercial fishermen are licensed — a commercial fishing license applies to the vessel, not the fisherman. So numbers don't accurately reflect the numbers of people fishing on a given vessel.

On the license application, fishermen describe their activity as full-time commercial, part-time commercial or recreational (listed as "pleasure"). Of 19,714 vessels licensed for 1991, 9,306 were in the pleasure category, 5,016 described their efforts as full-time commercial and 5,392 listed their efforts as part-time commercial, says Mike Street, the division's research section chief.

Though almost half of the applicants describe themselves as recreational fishermen, many of these anglers sell their catch.

A deficit of comprehensive data about fishing efforts and landings often leaves regulatory agencies in the dark. And charged with using the "best available data" on which to base decisions, regulatory agencies are often forced to impose regulations that can cut deeply.

"What the council has to look out for mainly is the health of the resource long-term," says Bob Mahood, director of the South Atlantic Fishery Management Council, which develops management plans for the region stretching from the North Carolina/Virginia border south to Key West, Fla. "Any time you severely restrict, you're going to impact people.

"The council has to make a number of decisions with very shaky or absent information in many cases," says Mahood. "If you don't have the information, you have to take the most conservative direction."

And the executive director of the N.C. Fisheries Association says the results can be devastating.

"We're getting more regulations, and things are getting worse," says Jerry Schill. "Maybe we should try the opposite."

Schill and others representing commercial interests say fishermen themselves are often in the best position to assess problems in a fishery, such as reduced catch. But they often feel if they point out a decline, restrictions will ensue immediately.

"The way we manage fisheries now is crisis management, and we go at it with the attitude that it's going to

be the end of the world if we don't do something right now, even if it's wrong," says Bill Foster, a commercial fisherman from Hatteras and a member of the N.C. Marine Fisheries Commission. "Typically, we do not have the data that will let us say whether fishing is the real problem instead of just natural cycles and natural mortality."

Not only are fishermen distrustful of government data, they are also reluctant to comment on changes they notice on the water for fear of rash reaction by managers.

sharpen the numbers on actual landings of fish. Under its provisions, fishermen who sell their catch would be required to present a card — similar in appearance to a credit card — to the buyer prior to each sale. A similar system has been successful in Florida.

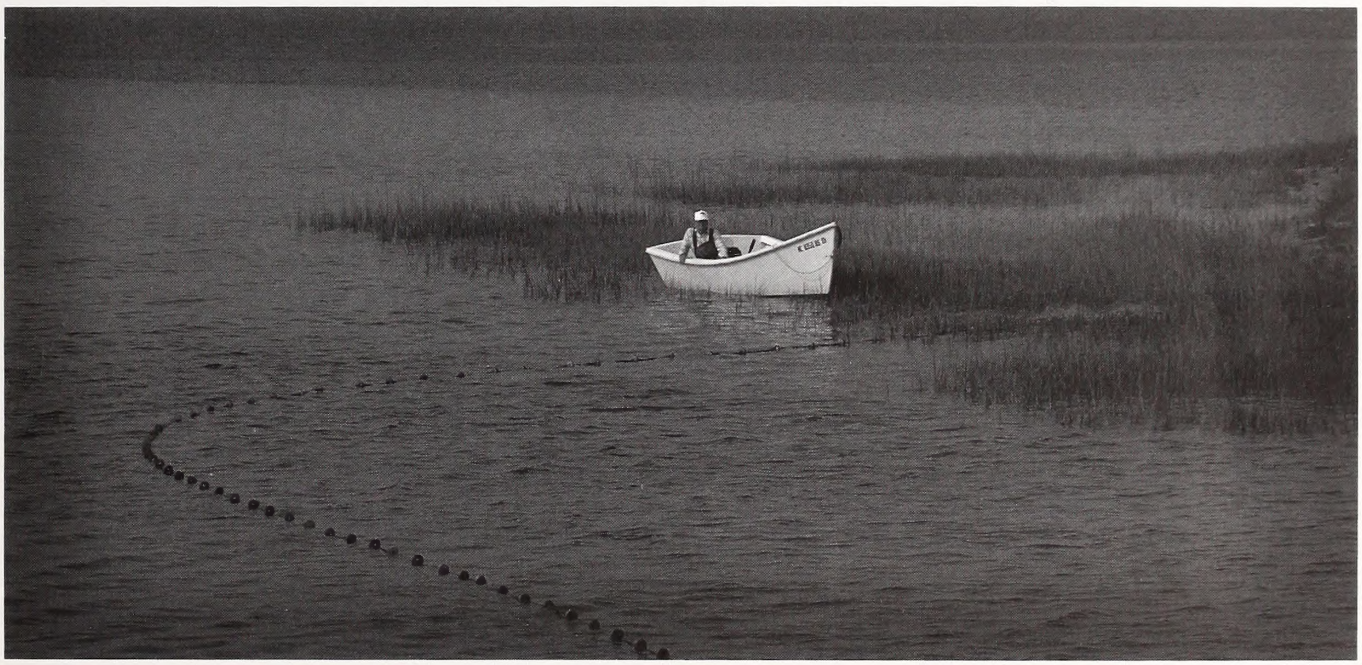
"If the license to sell is enacted with a requirement to provide data on a per catch basis, it will help tremendously with the quality of the data," says Street.

And it may even help fishermen, says Schill, if the bill is structured so

mackerel. In quota fisheries, resource managers place caps on the total allowable catch of a given species.

"Let's say I'm a recreational fisherman, but as soon as I sell that king mackerel, it counts against the commercial man's quota," he says. And once that commercial quota is filled, says Schill, "the guy who really depends on making his living off the water can no longer sell king mackerel."

Another possible boon to more accurate data collection could be a saltwater sportfishing license, which



A waterman gillnets for his catch.

Scott D. Taylor

"Quite often, the interest will be raised in a fishery when a population is in a decline for whatever cause," says Foster. "The next thing that happens is restrictions are put into effect.

"The hardest part is trying to separate out what is the real problem, to separate perception from problems and the rationalizations people use to support their view," says Foster.

A "license to sell" bill, scheduled to be introduced in the N.C. General Assembly this year, could help

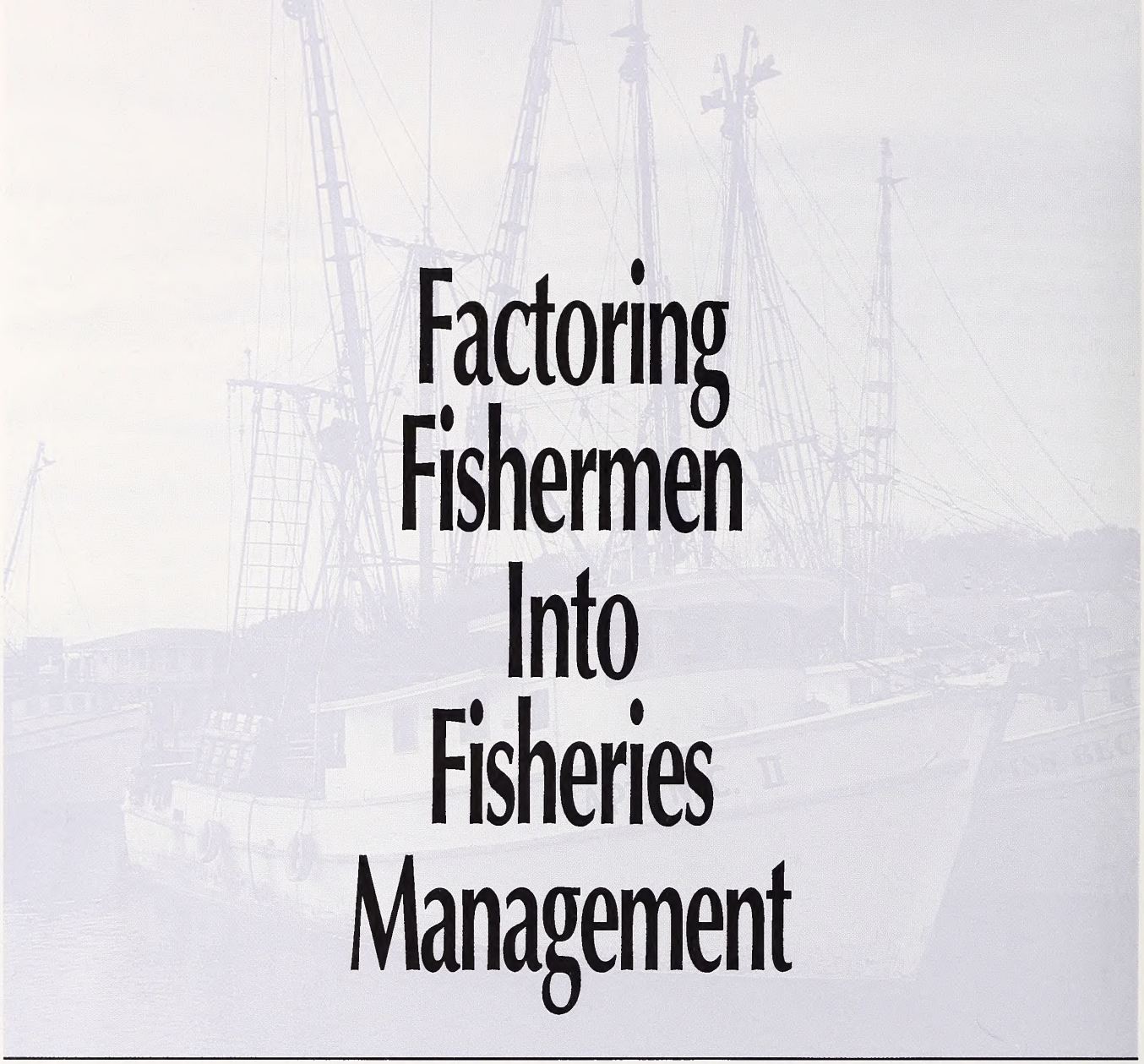
that the privilege to sell certain species is limited to those fishermen who need it to sustain their livelihood.

"The way the Florida system is set up is that you have to derive 25 percent of your income from commercial fishing or $5,000 a year," says Schill, adding that he approves of similar qualifications for North Carolina.

Otherwise, he says, commercial fishermen could be hurt by recreational fishermen who sell their catch from a quota fishery, such as king

has been proposed. Coastal recreational anglers in North Carolina are not currently required to purchase a license to fish unless they are using commercial gear, says Street.

The idea of a recreational fishing license does not appeal to many tourism officials and to some in the commercial fishing community, many of whom also fish recreationally. But Street says the information from such licenses could provide another valuable contribution to fishing statistics.



Factoring Fishermen Into Fisheries Management

Michael Halminski

By Kathy Hart

Let's face it, the term fisheries management is a misnomer. Try as you might, there is no way to tell a fish what to do.

Scientists can count the fish, learn their biology, study their habits and track their travels. But forget explaining to a flounder or clam about seasons, territories, quotas, size limits and net mesh sizes.

Instead, saltwater fishery resource managers are left with a tougher job: managing people.

And tough might be an understatement for describing the monumental task of managing hundreds of fishermen involved in dozens of fisheries using gear that ranges from a simple rake for gathering clams to sophisticated, multitrawl nets used by big commercial rigs to catch ocean species.

And that's just the commercial fishermen.

Resource managers must also consider saltwater anglers, who are every bit as diverse as their commercial counterparts. The angler who casts a line from the beach for spot is just as much a recreational fisherman as the sportsman who travels miles offshore to catch the big game fish.

So how do resource managers make decisions?

In the past, their decisions have been based largely on biological and resource data. And Sea Grant scientists have readily supplied a bounty of scientific data for them to draw upon.

But the decisions are getting harder to make.

Many fish and shellfish stocks are dwindling, either because of overfishing, habitat degradation or water quality problems. As a consequence, competition is heated as fishermen strive to fill their nets and their coolers with the catch of the day.

Fishery managers are faced with parceling out today's catch while conserving for tomorrow's. At the

same time, they must strike a balance between commercial fishermen who fish to feed their families and recreational fishermen who feed the coastal economies with millions of tourism dollars.

Circumstances are complex and decisions, pressure-packed. Managers are realizing that they need to know just as much about people as they know about fish and shellfish.

This biennium, Sea Grant is funding several efforts aimed at learning more about fishermen, their problems, their conflicts and their real value to the economy.

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Commercial fishermen hate turtle excluder devices, or TEDs as they call them in polite company.

Their list of reasons for despising these devices is as long as a child's wish list at Christmas. Most frequently, fishermen say TEDs lose the catch they need to fill their nets and their pockets, can't be used in areas thick with submerged grasses and add yet another cost to doing business.

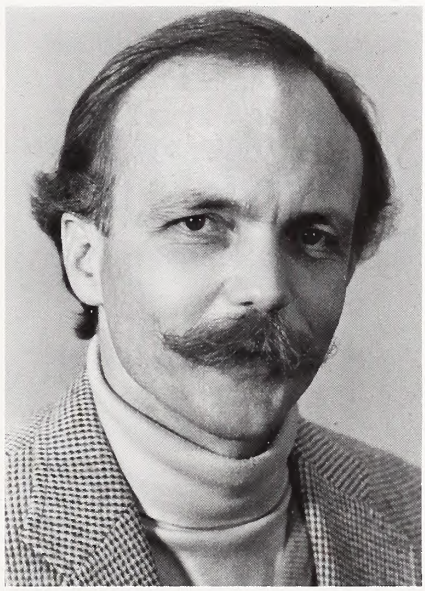
But also on that list is a gripe against the National Marine Fisheries Service (NMFS), the agency that developed TEDs and the regulations that govern their use. Watermen have never forgiven the agency for designing the excluders without input from the commercial sector and for forcing the regulations down fishermen's throats like an unwanted dose of bad-tasting castor oil.

Fishermen don't want that to happen again, says Sea Grant researcher Michael Orbach. Orbach and Jeff Johnson, anthropologists at East Carolina University, are midway through a two-year Sea Grant project designed to solicit fishermen's input into the regulations needed to manage the state's multifaceted fisheries.

When compared to other states, North Carolina has relatively few fisheries regulations for watermen to adhere to, Orbach says. But recent problems with overfishing and resource decline have fisheries managers talking about a full plate of new rules.

Many of the considerations center around a concept Orbach calls direct effort control.

Three types of direct effort control have been tested and used in other states. One type limits the number of people licensed to fish for a certain species. Most people call this type of management limited entry.



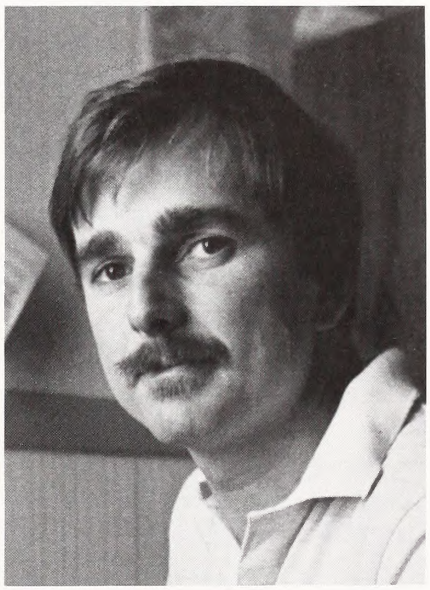
Michael Orbach ECU News Bureau

A second type of direct effort control limits the amount of fish or shellfish a fisherman is allowed to catch. The fisherman is allotted a quota, or percentage of the total harvest, that he can catch himself or that he can sell to others. This type of management is commonly called Individual Transferable Quotas, or ITQs.

A gear-based control system is the hallmark of the third type of control system. Under this plan, the amount of gear a fisherman uses, for instance crab pots, is limited.

Fisheries managers are giving these management alternatives serious consideration. But Orbach says before any decisions are made, fisheries managers must consider what effects these strategies will have on commercial fishermen.

To find out that information, Orbach, Johnson and graduate research assistant Patrick Stanforth are using a variety of methods to learn more about commercial fishermen, their way of life, their problems and how they feel about proposed solutions.



Jeff Johnson ECU News Bureau

During the first year of their project, the team has pored over N.C. Division of Marine Fisheries license information to learn what fisheries watermen are engaged in and what gear they use. From the license information, the researchers chose a subsample of fishermen to complete a mail survey. In the survey, fishermen were asked their fishing history, which species they sought, when they targeted certain fish and shellfish, and what kind of boats and gear they used.

Continued

Soft crabs packed for market.

Scott D. Taylor

Based on that information, Johnson was able to determine some distinctive fishing patterns and the fishermen central to those patterns. Then, Stanforth conducted in-depth, face-to-face interviews with these fishermen to gather even more detail about North Carolina's complex fishing scenario.

Beginning this spring, the research team will round out its Sea Grant project with three workshop series.

During the first workshops, fishermen will be asked to talk about the problems and issues they face. Researchers will discuss some of the management options tried in other areas of the country.

In the second series of workshops, scheduled for early summer, Orbach and Johnson will talk with fishermen about possible management options for North Carolina. Then fishermen will be asked how they think these management schemes would affect them.

"We will give them examples of systems that limited the number of people and tell them what happened," Orbach says. "We'll give them examples of where they put in ITQs and tell them what happened. We'll give them examples of where they put in gear-based controls and tell them what happened. Then we'll say to them: 'Given this is what happens when you do this, what do you think we should do here?'"

Finally, in late summer, fishermen will be asked to attend a final series of workshops. Here, they will hammer out the management and enforcement details for the options favored most heavily during the second workshops.

Orbach says this project offers several advantages. It will provide a comprehensive report that documents the complexities and interrelatedness of Tar Heel fisheries.

But more importantly, "going through the extensive workshops, the fishermen will: A, understand what's going on and B, have a stake in it," Orbach says. "That's what we call the bottom-up theory of developing fish regulations."

Orbach readily admits that if fishermen had their druthers, there would be less regulation instead of more.

"All things considered, they'd really rather not have regulations, but I'd rather not have speed limits too when I drive the car," Orbach says. "Most people I talk to say we really need to do something. They just want to be in on it."

And Orbach says if fishermen ignore the need for regulations and effort control, then they may lose their place in the resource allocation system. Other competitive forces such as developers, recreational fishermen, marina operators, conservationists and tourist interests could essentially edge fishermen out of business.

"There is a two-edged sword with the lack of regulation and the lack of property rights in the fisheries," he says. "The good part is there aren't a lot of people telling you what to do. There aren't a lot of rules and regulations.

"The bad part is you are kind of hanging out to dry when these other competitive forces come in, and you have no publicly recognized rights or privileges in the system," Orbach says. "In fact, this is the case in most of our fisheries today. That's what these direct effort control systems do. They give commercial fishermen a publicly defined and recognized place in the system. They grant private ownership of the privilege, not the resource, to people who are going to have to depend on that resource."

But it is in the fishermen's interest to tailor the privileges they receive to meet the problems and challenges they face. And Orbach is hoping his project will provide fishermen the input into the management that they deserve.

"NMFS has got (itself) into the position at least of appearing to push one type of solution — ITQs," Orbach says. "The danger in that is the tool kit

problem. You need a hammer, but you are using a screwdriver. You have got to pick out what your problem is and use the right tool. You are not going to fix everything with a screwdriver.

"Our approach is to say, 'Let's look at the whole tool kit and let fishermen help us choose the right tool,'" he says.

Orbach says his project will provide resource managers with plenty of information to think about but not any ready-made answers.

"If you're a public policymaker, you still will have to make value decisions once you have our data," he says. "But biological data doesn't tell you the answers either."

.....

Commercial fishermen and recreational anglers are like siblings. Sometimes they get along; sometimes they don't.

But as stocks of many popular fish have declined in recent years, the bickering between the two groups has increased as they compete for fish, fishing grounds and the right to catch certain species.

In North Carolina, the strife has come over striped bass, redfish, flounder and speckled trout.

And the arguments usually go something like this.

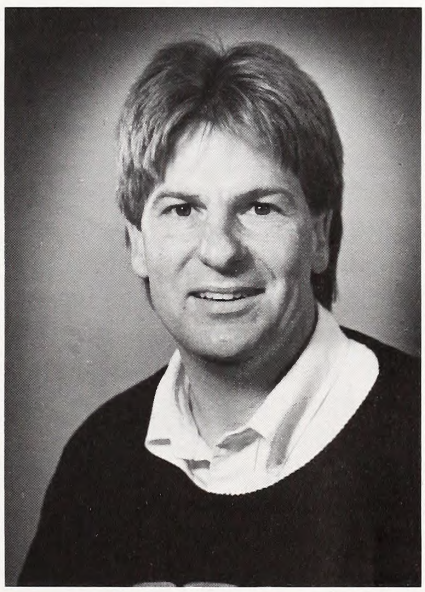
Recreational anglers claim that the commercial fishermen are greedy, catching more than their fair share of the resource and leaving nothing behind for the sportsmen to catch. And, the anglers claim that their weekend fishing fun feeds millions of dollars into the coastal economy, giving them the right to a ready supply of fish.

Commercial fishermen say it's just the opposite. It's the recreational fishermen who are greedy. After all, they say, watermen are trying to make a living from fishing, and they provide the only avenue for wild fish to reach a public hungry for this high quality protein.

The mediators for the two groups have been management groups such as the N.C. Marine Fisheries Commission and the South Atlantic Fishery Management Council. So far, they have arbitrated most of the disputes, with both groups making concessions.

But what about the future? Will there be more competition? Will the friction between the two groups become more heated as it has in other states?

Sea Grant anthropologists David Griffith and Jeff Johnson plan to find some answers during a two-year project that delves into the midst of the fray between recreational and commercial fishermen.



ECU News Bureau

David Griffith

Jim Easley

First, the ECU duo completed a 10-year history of conflict between the two groups. Now, they are focusing on four specific conflicts — trawling and habitat destruction, king mackerel, redfish and flounder.

"The purpose of the study," says Griffith, "is to figure out the cause of the conflict, the differences between perceived conflict and real conflict, actual incidences of conflict and any possible solutions."

To find the answers, Griffith and Johnson are interviewing recreational anglers, commercial fishermen, resource managers and the agents from Sea Grant's Marine Advisory Service who specialize in fisheries.

Griffith says he and Johnson will also study how disagreements between the recreational and commercial fishermen become politicized and how other groups such as environmentalists sometimes become involved in conflicts. The team will also determine if class, kinship and friends affect the formation of alliances during hostilities.

After compiling the results of its interviews, the team will use a complex sociological modeling tool to see if there is a consensus among the squabbling fishermen about the conflicts and their possible resolutions.

Griffith says the team's findings should be helpful for resource managers in three ways.

One, it will identify whether conflicts are real or perceived. If

Continued

Scott D. Taylor

Fisherman mends his nets.

many conflicts are largely perceived, then they may be resolved easily by providing accurate information to opposing groups.

Two, the research will show how conflicts reflect political and social alliances, thus identifying key groups of people who need to be involved in solving frictions.

Finally, it is hoped the research will reveal local, informal ways of dissolving disharmony that may be incorporated into more formal resource management techniques.

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Everywhere you turn, economists are shaping policies that will mold our country's future.

The same holds true for fisheries management. Economic theory is gradually becoming a greater factor in management decisions.

Fisheries managers are beginning to utter words such as assets, net values, net benefits, supply, demand and optimum yields. And rightly so, says N.C. State University economist Jim Easley.

Easley, a Sea Grant researcher, recently organized an economics summit for North Carolina's fisheries managers, bringing in several of the nation's top natural resource and fisheries economists to introduce the complexities of economic theory.

The summit, co-sponsored by Sea Grant and the Division of Marine Fisheries, focused specifically on how managers can make tough decisions about allocating stocks between commercial and recreational fishermen.

"There's a lot of competition for our fish, between different commercial groups, between commercial and recreational fishermen, a whole range of people," Easley says. "The backdrop is there have been a lot of numbers thrown about justifying larger shares of allocation, and in many cases, inappropriate numbers or inappropriate economic analysis to undergird that sort of decision.

"If you are going to decide to shift part of a harvest from one group to another," he says, "you want to make sure there are net gains. That's the sort of issue we took up. ... We probably presented more economic principles ... than those folks ever want to see again. But I think it was a productive workshop."

When making allocation decisions between commercial and recreational fishermen, people often compare expenditures for the two groups. But Easley says this is like comparing the proverbial apple and orange.

"What you really want to measure is net benefits," he says, "That is, benefits to consumers or users of a resource that are above the costs of harvesting. We need demand functions for these harvests and then net out ... the costs of the harvesting. We need the same sort of analysis for both groups."

When it comes to deriving the net benefit for recreational fishing, managers should substract the costs — the gasoline, the lodging, tackle rentals and devaluation of the boat — associated with recreational fishing from what an angler would pay rather than forego the pleasures of snagging a bluefish or king mackerel.

In examining commercial benefits, Easley says all profits for harvesting seafood, from the vessel to the processor to the seafood market to the consumer, must be considered in allocation decisions.

Once managers can determine the net benefits for commercial and recreational fishermen, then they can start making comparisons and analyzing different allocation scenarios.

Using demand functions, managers can see how shifts in quantities of fish caught affect each harvesting sector and the economy.

Easley stresses this is the kind of economic analysis that fishery managers must begin doing, and doing soon, if they want to manage the state's fisheries responsibly and with an eye on having stocks of fish for the future.

Are Fishermen Nearing Their Last Cast?

By Jeannie Faris

On a late-winter Sunday in 1989, Billy Carl Tillett was warming up the engines of his commercial fishing boat to go trawling for trout. The crew was standing ready.

Then, he switched off the ignition and stepped back onto the dock.

In one impulsive gesture, the eldest son of a leading Wanchese fishing family ended his 30-year career on the water. He handed the keys over to his younger brother Craig.

"I was getting to where I was sick and tired of fishing," Tillett says. "The rules and regulations I was seeing I couldn't put up with. I was used to doing what I wanted to all my life."

The fishing trade was passed down several generations to the Tillett brothers, and now Billy Carl's 19-year-old son works for the family business, Moon Tillett Fish Co. In the three years since he gave up his boat, Tillett has tended to the dockside operations of the business.

His story isn't altogether unique these days.

All along the coast, North Carolinians with fishing in their blood are souring on the business. They say it's because rules and regulations designed to protect the stocks are being handed down by state and federal agencies that have no appreciation for their trade and precious little input from the commercial fishermen.

Accustomed to living by their wits, these fishermen claim they'll be financially shipwrecked by restrictions on their gear, limits on bycatch they're allowed to land and cordoned-off fishing grounds. They can't even buy new nets for their boats without wondering if they'll be legal in six months or a year.

"It's gotten so you don't know

Continued

Scott D. Taylor

Scott D. Taylor

Birds in the wake of a working trawler.

what's legal and what's not legal," says Clinton Willis, a Marshallberg shrimper. "You need a lawyer to read the handbook."

But it hasn't always been that way.

North Carolina fishermen are proud of their heritage as aggressive and versatile workers, able to shift from one fishery to the next with a change in seasons. They've developed gear and techniques to mine the shoreline for finned fortunes.

Fishermen learn their trade through years on the water, most often as understudies to their fathers. They know how the tides, moon, weather and water temperatures influence the catch. In the summer, many of them shrimp. In the fall, they harvest clams, trawl for flounder, flyfish for trout and croaker, and gillnet for spot.

No doubt, they're efficient.

And that efficiency has helped turn the critical eye of regulators, sportfishermen and environmentalists onto the fishing industry in recent years. State and federal agencies manage the fish populations, including those that are overharvested or threatened by human activities.

Fishermen, however, are not suited to these growing regulations, says Jim Bahen, a Sea Grant marine advisory specialist. They think regulators are picking on them. And they're frustrated because they don't know what the future holds or how to respond.

"It's like everybody has discovered the coast in the last 12 years," says Willis, whose pickup sports a bumper sticker declaring commercial fishermen an endangered species. "We've had the coast for the last 100 years, and I think we've been good stewards to it."

Irate fishermen admit, though, that they are part of the problem. They have difficulty learning what's at stake when a regulation is pending; they tend to not organize or voice their opinions.

"We don't react until (a regulation) is already here, and that's our fault," Tillett says. "It's our fault for being that way. But it's hard to keep it all in your head. It's hard to run that boat. You've got three men depending on you. Some of the boats are owned by somebody else, and the captain has to produce or he's not going to be there."

Organizing is simply not their nature, Tillett explains. Fishermen are not politically connected or especially articulate. They're either working or tired from working when it's time to meet.

They feel outnumbered and overpowered. But perhaps more importantly, they don't organize because feuding divisions within their own ranks are at odds over fishing grounds and resources. Often, the battle lines are drawn over gear.

"That's really the bad thing," says Joey Daniels, part-owner of Wanchese Fish Co. and manager of its two North Carolina facilities. "You take your long-netters; they can't stand crab potters. Gill-netters don't like trawlers. They think they catch up all the fish. It's one thing after another. They just don't get along."

The commercial fishermen in North Carolina have long been portrayed as a monolithic group of conservative, independent people living in rural coastal areas. But in truth, they're more complicated than that.

They are as varied as the catches they harvest from the ocean and estuaries.

Unlike Tillett — whose family owns two 85-foot, steel-hulled boats — Willis is a one-man operation. He has little else to fall back on. He built his own vessel, the wooden 37-foot *Capt. Will*, named for his grandfather. He shrimps by himself in the spring and summer. Come winter, he moors his boat and creates stained-glass art and windows to shore up his income.

North Carolina is home to many fishermen who stay close to the shores they grew up on, harvesting oysters and clams from small boats. Others like Willis are more mobile, with larger boats to shrimp and gillnet.

Only a handful of successful

operations can send their boats north to scallop off New Jersey or to fish off Florida, the Gulf of Mexico and even Alaska. The Daniels operation falls into this category, along with the business owned by the Smith family in Beaufort and Atlantic.

The Luther Smith & Son Fish House is owned by Billy Smith Sr., and it runs seven boats 60 to 85 feet long. The Daniels' Wanchese Fish Co. owns 12 boats and operates facilities in North Carolina, Virginia and Massachusetts. Both families send boats north to scallop.

These differences among them suggest that some fishermen — the smaller ones especially — are more vulnerable to changes in an industry pitching on waves of change.

"There was a time when change was a welcome thing — better ways to do things, more fisheries to get into," Bahen says. "But by now, new fisheries have been entered into. Not that many options are available to them anymore."

The age-old fishing business is the only trade many of them know. And rather than change, some would prefer to return to the old ways and simpler days, back when their fathers and grandfathers fished the North Carolina coastline. Then, all a commercial fisherman needed was a boat, gear and willingness to sift the waters for his livelihood.

"A fisherman was able to go fishing when he wanted to go and stay home when he wanted to," Bahen says. "He could have a lot of money in his pocket one day and be broke the next. There were a lot of fish and little or no regulations."

Today, fishermen are wrestling with new restrictions on their gear and their territory. They face affronts from groups that question their impacts on fish stocks and the environment. And they reckon with water pollution and habitat destruction caused by construction and other human activities.

Fishermen complain that their nets are being unfairly singled out as the cause for declining stocks when other problems are contributing. If anything is responsible for population dips, it's water quality that has been compromised by development and pollution, they say.

"We get blamed for overfishing," Daniels says. "When people come down on vacation to go fishing, they don't see the fish, and they think they've all been caught up by the nets. And that's not the case."

Industry leaders say that increasingly, regulations are being slapped onto fishermen through public pressure and knee-jerk reactions to natural fluctuations in stocks that are beyond their control.

The tide of public opinion is against them, they say, and it's being driven by perceptions rather than actual problems.

"One of the hardest things that I have to deal with is the public claiming to have as much right to the resource as we do," Tillett says. "It's true; it's the law of the land. But still, they don't know what it's like.

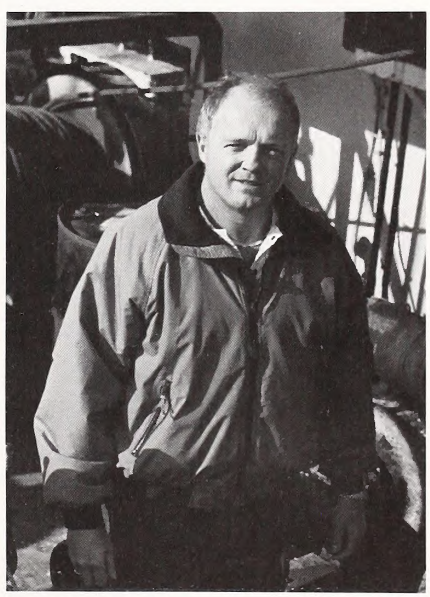
"Sometimes we catch the small fish," he says. "We have to kill small fish to get the big ones, but that's going to happen. You're not going to change that with all the gear that you modify. You're still not going to completely correct it."

Even so, fishermen say, regulations are necessary, and the fish stocks should be protected. But the gear to protect sea turtles, declared endangered species by Congress, has created by far the greatest flap in the commercial fishing industry.

On a brisk December day, Tillett fidgets in the processing area of the fish house with a turtle excluder device (TED) that is required by law on his nets. Designed for shrimp trawls, the TEDs are not yet optimal for the flounder fishery and will probably cost fishermen part of their catch, he says.

This oval-shaped gadget is designed to release a turtle trapped in the nets, but it's the commercial fisherman's biggest headache, Tillett says. Local fishermen are also on edge about requirements that they meet new quotas, size limits and mesh sizes in their flounder nets.

Billy Carl Tillett — *Jeannie Faris*



Joey Daniels — *Jeannie Faris*

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"In the United States, they'll knock out a hundred million pounds of seafood to save one turtle," Smith says. "They're going to starve every fisherman."

The National Marine Fisheries Service (NMFS) is the frequent target of commercial fishermen's rage. Daniels keeps a manila folder stuffed with 50 proclamations — or new rules — issued in 1992. And Smith complains that an NMFS proclamation didn't give fishermen enough time to comply with a new 5 1/2-inch mesh-size limit in their nets. He'd purchased $4,000 worth of new webbing, but couldn't get nets made in time for the deadline.

Jeannie Faris

Billy Smith Sr.

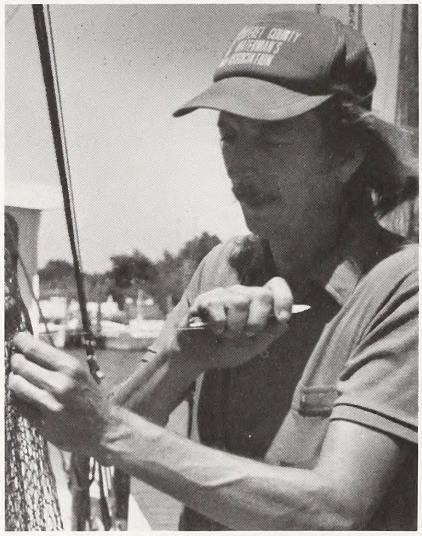
For Tillett, Daniels and Smith, regulations and paperwork are now daily rigors as common as negotiating fish prices. No longer on the boats, they manage the business from sparse offices steeped in the smells of fresh seafood. Men in knee-high, rubber boots thud in and out, unloading the latest catch or biding their time until the next trip out.

Like farmers, commercial fishermen have adjusted their work habits and equipment over the years to get the greatest yield from nature.

Some critics, however, say they should take a cue from farmers who leave their fields feral to rejuvenate. Waters left untrawled or unfished could allow the stocks to rebound. But fishermen claim they're more in tune with the resource — and the reasons for keeping it well — than they get credit for.

Historically, the weather and the marketplace have regulated the fishing business. They would fish for whatever was out there, and when the fish got cheap, they would move onto something else, Daniels says.

Nets were adapted to target multiple catches during a trawl. Tillett says fishermen learned to catch trout off Wanchese in the early 1970s by



Jim Strickland

Clint Willis

fiddling with a flounder net.

"Maybe we shouldn't have, but we always tried to increase and do better," he says. "Maybe having to increase and do better sometimes was a way of telling us we should have left well enough alone and fished the way we were."

His boats forced in by stormy forecasts, Tillett surveys the docks and muses that perhaps fishermen believed the fish were "thicker" than they actually were. But the gear made them think so, he says.

Smith, however, holds the hard line in the debate over resources. There are enough fish for commercial and recreational fishermen, he says. Though declines have been observed, they're only a blip in the natural ebb and flow of stock populations. Fish were even scarcer during a dry spell in the 1950s and 1960s, but they rebounded, he says.

"Anybody who's been around 30 or 40 years knows that fish disappear and they come back," Smith says.

But that message is difficult to sell at a time when value is placed more than ever on preservation and conservation of natural resources.

Tillett says he's frustrated at the public's willingness to join the clamor against fishermen. Organizing to speak out and fight back is key, he says.

In Marshallberg, Willis helped organize the Carteret County Waterman's Association in 1985, but it unraveled after seven years of working to stave off new regulations. At its peak, it had 250 members.

The N.C. Fisheries Association also speaks for commercial fishermen, but many are reluctant to join because 75 percent of the members are seafood dealers, says Daniels, president of the association. Yet 75 percent of the problems it tackles are the fisherman's, he says.

Rather, fishing communities hope to get some political mileage from the budding auxiliaries of women who have the spare time and the drive to lobby lawmakers and policymakers. Their message is about a jeopardized way of life that supports many coastal families and communities totally dependent on fishing, Smith says.

It's a message they expect to ring true in hard economic times that have placed a national emphasis on jobs.

Also, Tillett says, commercial fishermen should seek better representation on the South Atlantic Fishery Management Council, which

decides how many fish can be caught in a region that includes North Carolina. The council is appointed by the U.S. Secretary of Commerce on recommendation from the governor of each member state, and it crafts federal law using NMFS recommendations.

The fishermen need more front-end involvement before a regulation is put into place, Tillett says. Keeping the lines of communication open and staying in good graces with the regulators is important. But finding the time on a fisherman's schedule isn't easy.

"There's so much traveling, so many meetings, that you couldn't fish and tend to it," says Tillett, who is on the board of directors for the N.C. Fisheries Association. "There's no way you could fish and make a living with all we're going through and tend to all that stuff."

Tillett, however, is among the more optimistic of North Carolina fishermen. It's darkest just before dawn, he says, and commercial fishermen just may get the message and organize. If they don't, the future doesn't look bright.

Eventually, some fishermen predict, the commercial fishery may lose the diversity of its members. Only the large, well-heeled operations will survive.

"If it keeps going the way it is today, with us having no more voice than we've got and we don't get together just a little bit better than we are, I see it being mighty difficult to make a living," Tillett says. "And you're going to see a lot of people go out."

Bahen speculates there will always be a commercial fishing industry in North Carolina. But the extent of it, and the number of people it will support, is unclear.

Versatility will be crucial, and anybody who can't afford the gear to switch his catch may be squeezed out, he says.

Scott D. Taylor

Commercial trawlers at rest in Oriental.

"The guy who makes a good living at it, who works full time and treats it as a business, with capital to diversify — he will do better," Bahen says. "If there's a good market for shark, dogfish, he can shift gears and go fishing for that. They're all going to be affected by changing laws and regulations and how they manage this renewable resource. But this guy will probably survive."

The Wanchese Fish Co. has done this. Moored in a Wanchese harbor is a 185-foot ship that is being renovated by the Daniels family for scalloping expeditions in Alaska.

Down the coast, Willis simply takes comfort in the fact that his home-made boat is paid for. But he wonders about the small fishermen like himself who don't own their boats outright.

Still, fishing is a way of life that most of them won't surrender, even under the worst of circumstances.

Smith learned the trade from his uncle when he was 6, and he's seen six generations of his family enter the business. Willis learned it from his father and grandfather. Tillett began his career at age 7 when he helped his father run charter boats in the summer. And Daniels has grown up in the business, but never quite took to the water like some of his brothers.

"I certainly don't do it for the money," says Willis. "You're your own person. It's the last bastion of free enterprise. If you got the equipment, and you're willing to do it, you can earn what you want to."

Fishing has traditionally provided a good living for young men who quit school to join their fathers on the boat, Smith says. Gear, boats and knowledge were handed down from father to son.

"That's the greatest life in the world, out on the water," he says.

Tillett holds out hope that his son will make a good living in the well-established family business.

But Daniels says he's trying to steer his 20-year-old son away from the family's East Coast fishing empire.

"I believe fishermen are on the endangered species list," he says. "They're not going to get any thicker. They're going down. The numbers are going to grow smaller and smaller."

Specialist Focuses on Seafood Safety

Consumers are clearly more concerned about the foods they eat. Shoppers are asking more questions about ingredients, nutrient content, quality and safety.

Joyce Taylor, Sea Grant's seafood education specialist, says she's fielding a barrage of questions at workshops about the quality of our coastal catch. In fact, quality and safety have become such a concern for the seafood industry and consumers that Taylor is now focusing most of her education efforts in that area.

When asked about pollution and the subsequent contamination of fish and shellfish in North Carolina waters, Taylor says species harvested along Tar Heel shores get a clean bill of health.

Clams and oysters, however, could pose a problem if they are taken from waters closed to harvest because of contamination from bacteria. But consumers shouldn't worry if they buy their clams and oysters from a seafood dealer certified by the N.C. Division of Shellfish Sanitation.

A certified dealer can properly document that shellfish are harvested from non-contaminated, open waters, thus assuring customers of the safety of the product, Taylor says.

Then comes the next question. Can fish and shellfish be eaten raw?

Taylor says she advises against eating raw seafood.

Shellfish, in particular, can carry rare, but naturally occurring bacteria, *vibrio vulnificus*, that can cause a severe or potentially fatal infection in people whose immune systems are compromised by a variety of diseases and prescribed drugs.

Parasites pose a risk with raw finfish and shellfish. But that risk can be minimized if the fish is adequately frozen to destroy the parasites.

In countries where raw fish is served frequently, the fish are usually frozen prior to preparation. And Taylor urges U.S. consumers of sushi, sashimi and ceviche to do the same.

Joyce Taylor Scott D. Taylor

She says the fish should be held in the freezer at -4 F for four to five days.

Taylor says people who prepare ceviche, raw fish steeped in lemon or lime juice flavored with onions, peppers and seasonings, mistakenly think the marinade kills any parasites.

"People think the marinade cooks the fish," Taylor says. "It looks that way. But it is not cooked."

To ensure the safety of seafood, Taylor recommends cooking the catch. Any fish or shellfish should reach an internal temperature of 145 F or be cooked until it loses its translucence or flakes easily.

But no amount of cooking will improve a poor quality or spoiled fish, Taylor says. Use your nose and eyes when buying seafood to ensure you are getting the freshest product possible.

Don't expect, however, to be able to detect seafood contaminated by pollution. No amount of sniffing, looking or tasting can help consumers determine if PCBs, dioxin, mercury, bacteria or other pollutants are present in fish and shellfish. Seafood that tastes bad has been mishandled or has spoiled.

Taylor says she is frequently asked by consumers how to handle seafood safely at home. She offers these recommendations:

- Wash your hands frequently with soap and water for at least 20 seconds after going to the bathroom, before starting food preparation, before working with new food or new utensils, after finishing food preparation and before serving food.
- Prevent cross-contamination. Never let raw seafood or other meats come in contact with cooked seafood or meat or any other food, raw or cooked.
- If you use a cloth for cleaning in the kitchen, use a clean one after working with raw seafood or meat. You may find it easier to use paper towels and dispose of them after each cleaning.
- Cut raw seafood on an acrylic cutting board, never a wooden one. Clean the board thoroughly after each use.
- Wash boards, counters and all utensils with detergent and hot water after each use.
- Serve cooked seafood on clean plates. Never put it back on the plate with raw juices.
- Refrigerate food as soon as possible after cooking, always within two hours.
- Always thaw seafood in the refrigerator or under cold running water. Never thaw seafood at room temperature.

Kathy Hart

Pollution and Seafood: What People Think

In recent years, noted media outlets such as *Consumer Reports*, *The Washington Post*, *USA Today*, *Time* and *The Today Show* have taken swipes at the seafood industry, claiming the products are uninspected and contaminated by toxins, heavy metals, bacteria and viruses that pollute our coastal waters. In some cases, this negative information has caused decreases in seafood consumption.

But how do news reports about coastal pollution really affect people's feelings about the fishermen's catch? Will stories about syringes on the New Jersey shore stop people in North Carolina from buying flounder fillets at the grocery store?

No one knew until recently.

Two Sea Grant scientists, David Griffith and Jeff Johnson, anthropologists at East Carolina University, recently completed a two-year study aimed at understanding people's perceptions of coastal pollution and its effects on the quality of seafood.

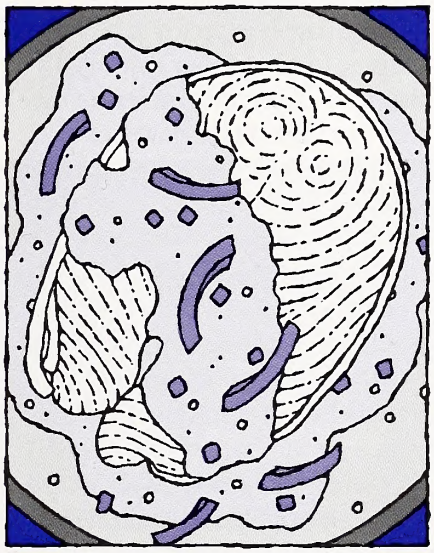
They interviewed and asked questions about seafood and pollution to a random sample of 140 individuals in two North Carolina towns, Siler City and Hobucken, and in Baltimore, Md. Then the team analyzed and interpreted the results.

Their findings suggest that consumers do agree there is a direct relationship between seafood safety and pollution. But people aren't exactly sure what that relationship is and how it works.

For instance, they understand that PCBs contaminate fish. But they aren't sure if certain species of fish are more susceptible to contamination than others or where the PCB concentrates in the fish's body.

Griffith says that people tend not to discriminate between different types of pollution, believing that the presence of any kind of pollutant will have negative effects on human health.

And interestingly, the general public puts great faith in its powers of taste and smell to detect any contaminated seafood. "In fact, during our interviewing, some respondents voiced the belief that seafood which tasted bad had been tainted by a pollutant of some kind," Griffith says.



Perhaps their reliance on their sensory perceptions underlines another ambiguity people have about seafood. Griffith says people were unclear whether they could trust the food industry to keep seafood contaminated by pollution off the shelves.

When it comes to stopping pollution, respondents believed some types — litter and some industrial contaminants — can be reduced. But other forms of pollution, for instance acid rain and oil spills, can't be controlled and are the price we pay for progress.

A message such as this, Griffith says, sends the signal to the food industry that, at least for the time being, fishermen, farmers, processors, grocers and restaurateurs probably need not worry that the public will reject foods based on its understanding of the relationship between food safety and pollution. There exists an almost fatalist attitude that pollutants have become a fact of life.

What can the seafood industry learn from these findings?

First, people's limited knowledge led them to lump fish and shellfish together and to consider it all tainted by any incidence of coastal pollution.

Government and industry need to educate consumers about the differences between effects of pollutants on various seafood products, Griffith says. And it may be wise to educate consumers about the depth, breadth and diversity of marine environments and about the sea's capability to cleanse itself of pollutants over time.

Additionally, space and time figure prominently in how consumers think about pollution and seafood safety. The ability to think about pollutants in terms of where and how rapidly they affect the environment may mean they will be predisposed to information that illustrates how the effects of pollutants may be confined to certain places and times.

This finding also suggests that the industry would do well to supply more information about where and when seafood is harvested.

Finally, Griffith says there seems to be a lack of faith in the industry's capability to police itself. To combat this problem, he suggests supplying more information about inspection programs currently in place and expanding these programs to include more products in the future.

For more information about Griffith's findings, write: Institute for Coastal and Marine Resources, East Carolina University, Greenville, NC 27858. *Kathy Hart*

Lucas Verdict

The wheels of justice have finally churned out a ruling in the *Lucas vs. S.C. Coastal Council* lawsuit.

In a recent decision, the S.C. Supreme Court ordered the state to pay beachfront property owner David Lucas for the temporary loss of the use of his land.

The loss covered a four-year period from 1988 — when the state barred development on Lucas' property — to 1992. The court, however, did not specify the amount of compensation due or a means for calculating it.

The roots of the case reach back to 1986, when Lucas paid $975,000 for two beachfront lots on the Isle of Palms. At the time, no permits to build were required from the Coastal Council.

But in 1988, the state enacted the Beachfront Management Act to preserve and protect the South Carolina coastlands by restricting their use and by establishing a 40-year plan for moving construction setback lines landward.

Lucas' property was on the coastward side of the setback line, and as a result, was no longer eligible for any construction larger than a walkway or small deck.

The resulting lawsuit traveled as far as the U.S. Supreme Court, where Lucas claimed the state owed him compensation for the land regardless of its reasons for passing the act.

The nation's high court ruled in June that the Coastal Council had failed to prove that any state interest justified the total taking of Lucas' land, and it indicated he was due payment. The case was returned to the S.C. Supreme Court to determine whether any South Carolina nuisance and property law would block Lucas' development plans.

The S.C. Supreme Court subsequently ruled that the Coastal Council failed to give any common-law basis for limiting use of the land. But it deemed the taking of Lucas' land only temporary because a 1990 amendment to the Beachfront Management Act allowed him to apply for a special permit to build.

The case is expected to be a shaping force in policy that weighs the rights of property owners to use their land against the power of regulatory agencies to restrict uses of certain areas.

The circumstances that gave rise to the Lucas case are not unusual, especially on the coast, says Walter Clark, Sea Grant coastal law specialist. There has been an evolution in recent years of regulations to deal with a growing number of people competing for natural resources and land, particularly environmentally sensitive and hazardous areas, he says.

The winter 1993 issue of Sea Grant's *Legal Tides* will feature an article on the ruling, co-authored by David Brower, Department of City and Regional Planning at the University of North Carolina at Chapel Hill, and Dave Owens, Institute of Government at UNC-Chapel Hill. For a copy of *Legal Tides*, write Sea Grant at Box 8605, N.C. State University, Raleigh, NC 27695.

Zebra Mussel Conference

Sea Grant programs from five Mid-Atlantic states will join in a March conference in Baltimore, Md., to discuss the latest efforts to control the spread of the non-native zebra mussels.

The meeting will target biologists, water-use managers, educators and outreach specialists concerned about the havoc waged in Great Lakes waters by the fast-spreading mollusks. Their colonies can damage boats, docks and buoys and block water intake pipes of industries and municipalities.

The conference, scheduled March 10-12, will be a first for the coalition of Sea Grant programs that is preparing for and fighting the invasion of the zebra mussel. The region includes North Carolina, Virginia, Maryland, Delaware and New Jersey.

Speakers will discuss other states' experiences with the mollusk, including its economic impact in the Northeast; biological and physiological characteristics that may have a bearing on the Chesapeake and Mid-Atlantic estuaries; dispersal in freshwater and estuarine systems; impacts on recreational water use; control measures and monitoring strategies.

Coastal water quality specialist Barbara Doll will participate in the March conference and give a synopsis of North Carolina efforts to prepare for the mollusk, which has not yet reached Tar Heel waters.

Coastal Celebration

The fifth annual Save Our Sounds Coastal Celebration is scheduled for April 3-4 at the Kerr Scott Building on the N.C. State Fairgrounds in Raleigh.

The theme this year is "Preserving the Environment ... For the Children," with an emphasis on involving North Carolinians in preserving their coastal resources and heritage.

More than 15,000 people attended the 1992 celebration, which featured about 40 booths and demonstrations. Among last year's attractions were exhibits by Sea Grant, the N.C. Nature Conservancy, the Sierra Club, the N.C. Aquarium, the N.C. Coastal Federation and the Ocracoke Preservation Society.

In addition to these displays, coastal artisans will exhibit their crafts in boat building and decoy carving, balladeers

and storytellers will share coastal folklore, and environmental education groups will perform skits and musicals.

The celebration will also feature hands-on exhibits such as a touch-tank stocked with marine animals and crafts using shells and sand. The winners of poster and essay contests carried throughout state schools will be unveiled.

Hours are 10 a.m. to 6 p.m. A $2 donation is requested at the door; children are admitted free. For more information, call 919/821-8790.

Managing the Coastal Ocean for the 21st Century

How should North Carolina manage the coastal ocean in the next century?

A panel of experts will address this question in "Managing the Coastal Ocean for the 21st Century: North Carolina's Role," a May conference at the University of North Carolina at Wilmington.

The two-day conference, May 20-21, will be held at the University Center. It will target the state's resource managers, local and regional government officials, researchers and ocean users.

Speakers will define the boundaries and significant natural resources of North Carolina's coastal ocean; identify the status of, and potential risks to, coastal ocean resources; and identify current resource management strategies, use conflicts, informational gaps and future directions.

Among the speakers will be Walter Clark, coastal law specialist for Sea Grant; Gene Huntsman, leader of the reef resources and coastal pelagics team at the Beaufort Laboratory of the National Marine Fisheries Service; and Stan Riggs, a geologist at East Carolina University.

Sponsors include Sea Grant, N.C. Office of Marine Affairs/N.C. Ocean Affairs Council, N.C. Division of Coastal Management, UNC-Wilmington and the UNC system. Conference proceedings will be prepared by Sea Grant.

Registration is $25. For information, call 919/733-2290 or write the Office of Marine Affairs, 417 N. Blount St., Raleigh, NC 27601.

C.R. Edgerton

Seining for bass and bream in Lake Phelps during Paddle to the Sea I in July 1991.

Paddle To The Sea II

Wanted: 20 middle-grade science teachers from the Albemarle-Pamlico Sound area to join in an experiential learning workshop that involves canoeing through Lake Phelps, the Scuppernong River, Shallowbag Bay and Atlantic coastal waters.

Why: to educate teachers about the basic ecological concepts and environmental issues important to the Coastal Plain of North Carolina and to share curriculum materials and activities that will enable them to transfer this information into the classroom.

When: June 21-25, Aug. 13 and Oct. 9.

Participating teachers will take part in the five-day workshop, with two one-day follow-ups to allow for production and evaluation of lessons.

Modeled after the 1991 "Paddle to the Sea," this workshop targets the sparsely populated counties of Dare, Hyde, Tyrrell and Washington. This area is under intense research scrutiny for its water quality, biological diversity and management practices.

The program involves a partnership among local school systems, Sea Grant, Pettigrew State Park, the N.C. Aquarium on Roanoke Island and other resources such as the U.S. Fish and Wildlife Service, the N.C. Wildlife Resources Commission and the Nature Conservancy.

The project is funded by the U.S. Department of Education Eisenhower Act and the N.C. Mathematics and Science Education Network.

Teachers interested in participating in "Paddle to the Sea II" should request applications from Sea Grant by writing or calling 919/515-2454. Applications are due by March 9, and selections will be made by April 9.

John Miller Appointment

A Sea Grant researcher has been named to a prestigious, three-year appointment as a visiting scientist at the Netherlands Institute for Sea Research.

As a visiting scientist, John Miller, professor of zoology at N.C. State University, will make biannual visits to the institute to share his

Continued

expertise on flatfish. Miller has distinguished himself in research of flatfish migration and ecology, which is related to the institute's activities. Flatfish include plaice, halibut, sole and, in North Carolina, flounder.

The appointment will reap benefits for North Carolina by giving Miller new insights for researching and managing flatfish in this area, says B. J. Copeland, director of Sea Grant. By knowing more about flatfish around the world, North Carolinians will be better able to manage their own flatfish populations.

Ocean Outfall Forum

The low-lying coastal region of North Carolina has problems with a routine service that most inland areas take for granted — wastewater disposal.

Millions of gallons of wastewater are generated daily along the coast, and state planners must now find environmentally sound solutions for an area that can no longer sustain its hodgepodge of septic tanks and sewer systems.

An ocean outfall sewage treatment system is one solution.

The pros and cons of the system will be explored in a two-day conference, April 19-20, at the Atlantic Beach Sheraton in Carteret County.

A cadre of national and state experts will give talks on the engineering and scientific feasibility of the system and the economic and environmental impacts. The forum will also offer a period for audience discussion and interaction.

The resulting information will be used to help the N.C. Division of Environmental Management (DEM) develop a policy on waste disposal in coastal North Carolina. No position on ocean wastewater discharges currently exists.

The Neuse River Council of Governments is sponsoring the forum, which is being financed by a grant from DEM. The forum was recommended by a steering committee named to explore the waste issue.

The committee members are B. J. Copeland, director of Sea Grant; Roy Fogle, executive director of the Neuse River Council of Governments; Jay Sauber, environmental supervisor of DEM's water quality section; Don Kirkman, executive director of the Carteret County Economic Development Council; and Todd Miller, executive director of the N.C. Coastal Federation.

About 300 state and regional leaders are expected to attend the forum. Participation is by invitation. Anyone interested in an invitation should call Fogle at 919/638-3185 or write the Neuse River Council of Governments, P.O. Box 1717, New Bern, NC 28563.

Scott D. Taylor

Teacher Litter Workshops Linked by Video

Elementary and middle-grade teachers interested in litter education are encouraged to apply for an interactive workshop on March 4. The workshop will connect by video six sites statewide in a program to share materials and ideas.

The workshop, which is being offered by N.C. Big Sweep, can accommodate 150 teachers across North Carolina. Big Sweep is a volunteer statewide cleanup that targets litter in lakes, streams, rivers and beaches.

Each of the six workshop sites will register 25 teachers on a first-call basis. The sites, linked by state-of-the-art CONCERT technology, will be at the University of North Carolina at Asheville, N.C. A&T in Greensboro, UNC-Charlotte, N.C. State University in Raleigh, UNC-Wilmington and UNC-Chapel Hill.

Participants will discuss the problems, sources and solutions of litter and try out classroom activities and materials. The workshop is aimed at increasing litter awareness by sharing materials, resources and ideas for litter education.

Among others, presentations will be given by Lundie Spence, marine education specialist for Sea Grant; Anne Hice, education specialist for the N.C. Wildlife Resources Commission; Big Sweep Executive Director Susan Bartholomew; Big Sweep county coordinators; and Lois Nixon, director of Wake County Keep America Beautiful.

To register, call Bartholomew at 919/856-6686 or the Sea Grant office at 919/515-2454. This free workshop will be funded by CP&L, Duke Power and TVA. Teachers can apply for half-day substitute reimbursement.

Back by Popular Demand — Coastal Indians

The recent issue of *Coastwatch* about coastal Native Americans was very popular. Our extra copies of the magazine left the office as fast as wrapping paper at an after-Christmas sale. Teachers, libraries and others were clamoring for more.

So we decided to reprint the popular Sept./Oct. issue of *Coastwatch*, minus some of the dated material in the back sections. If you would like extra copies of the coastal Indians issue, write Sea Grant. Ask for UNC-SG-92-13. The cost is $2.50 per copy.

Coastwatch wants to hear from you on topics relating to the North Carolina coast. Letters should be no longer than 250 words and should contain the author's name, address and telephone number. Letters may be edited for style. Send all correspondence to *Coastwatch*, UNC Sea Grant, Box 8605, N.C. State University, Raleigh, NC 27695. Opinions expressed on this page are not necessarily those of UNC Sea Grant employees and staff.

Why No "Year of the Indian?"

I received your Sept./Oct. issue of *Coastwatch* today and found it most interesting. It's not often we get an entire issue of a magazine devoted to our history. I'm not one of the Carolina Indians, having just moved here about two years ago. But I do have friends here, and we share our history. I am a Shawnee/Cherokee elder. I am just learning that I may have some Choctaw blood on my grandfather's side.

While you mentioned the fanfare and hoopla going on in the celebration of Columbus, you missed an opportunity to inform your readers of a more appropriate celebration to go with your Native American issue. I am very, very disturbed by this and find it most unpleasant that I must as a Native American call your attention to it. Never before have the American Indians been so honored. My friends, 1992 was the "Year of the American Indian" as stated in public law 102-188 passed by Congress and signed by President Bush. I am respectfully asking those who contributed to this issue to write to me and explain why they could not include this. I am enclosing a copy of this proclamation.

Pat Rollingcloud, Pittsboro, NC

We did not mention the "Year of the American Indian" because our focus was very specific — Native Americans in coastal North Carolina, their past and present.

Pictures Please

Is it possible to get framed copies of your covers? I like the uptown changes.

Henri Franklin, Greensboro, NC

Sorry, we don't offer framed copies of our covers. But you can contact the cover photographers for prints that you can frame yourself. If the cover photograph is taken by a Sea Grant staff person, then we'll be glad to have a print made for you at a minimal cost. But most of our cover photos are taken by freelance photographers, usually Scott Taylor or Michael Halminski. I feel sure they would be happy to sell you a print, and both take beautiful photographs. To contact Taylor or Halminski, write or call us at Sea Grant. We'll be glad to provide you with an address and phone number.

Baffled By Regulations

I have been a subscriber to *Coastwatch* for quite some time. I keep a boat at Wrightsville Beach and get to go fishing five to eight times a year. At times, I hear about various fishing laws and bag limits. However, I am not down there often enough to really know what these limits are or even which fish they pertain to. It would certainly be helpful for *Coastwatch* to occasionally publish a synopsis of such laws so that the occasional coastal fisherperson may be able to keep up to date. I completely enjoy *Coastwatch* and read every bit of each issue. The new format is outstanding.

J. Toms Dover, Charlotte, NC

We certainly understand your dilemma. Fishing regulations seem to change about as frequently as the weather. But Jim Bahen, a Sea Grant fisheries specialist, stays abreast of these regulations and the associated bag limits, size restrictions and seasons. He has a flyer, A Recreational Guide to Management of Fish in South Atlantic Waters, *which lists the state and federal regulations for more than 25 species of recreationally caught fish. He updates the guide any time there are changes in regulations. The guide is free and yours for the asking. Just write Sea Grant, Box 8605, N.C. State University, Raleigh, NC 27695. Ask for UNC-SG-89-06.*

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As I mentioned earlier, we will be surveying Coastwatch *readers to learn how you feel about our magazine. We plan to survey every fifth person on our zip-sorted mailing list of about 3,500. That means we'll be sending out approximately 700 surveys. Each survey packet will include a letter, a survey form and a self-addressed, business-reply envelope. Your only cost will be the time it takes to fill out the survey.*

I urge you to be candid and thorough in completing the survey form. The information you provide will help us in several ways. First, we'll learn more about you and why you read our magazine. Second, we'll find out what you like and don't like about everything from our design to our selection of topics. We'll also ask for story suggestions.

By surveying you, we hope to tailor Coastwatch *to better meet your needs for information about the coast. If you don't receive a survey, but would like to comment, please write, and I'll send you a survey form.*

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North Carolina State University
Raleigh, NC 27695-8605

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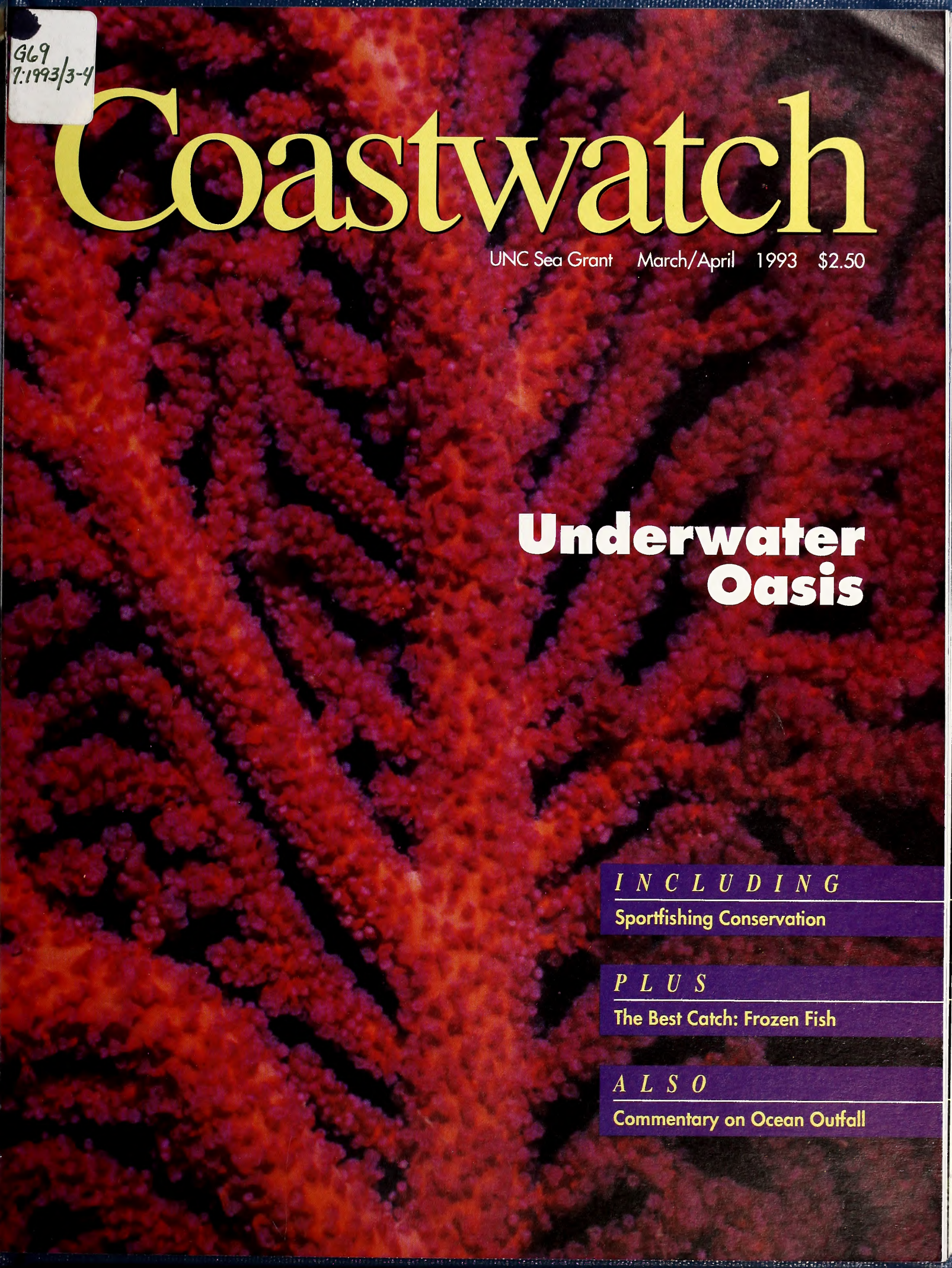

Underwater Oasis

INCLUDING

Sportfishing Conservation

PLUS

The Best Catch: Frozen Fish

ALSO

Commentary on Ocean Outfall

Coastwatch

Coastwatch Staff:
Kathy Hart, Managing Editor
Jeannie Faris and Carla B. Burgess,
Staff Writers and Editors
L. Noble, Designer
Debra Lynch, Circulation Manager

The University of North Carolina Sea Grant College Program is a federal/state program that promotes the wise use of our coastal and marine resources through research, extension and education. It joined the National Sea Grant College Network in 1970 as an institutional program. Six years later, it was designated a Sea Grant College. Today, UNC Sea Grant supports several research projects, a 12-member extension program and three communicators. B.J. Copeland is director. The program is funded by the U.S. Department of Commerce's National Oceanic and Atmospheric Administration and the state through the University of North Carolina.

Change of address, subscription information or editorial correspondence: *Coastwatch*, UNC Sea Grant, Box 8605, N.C. State University, Raleigh, NC 27695. Telephone: 919/515-2454. Fax: 919/515-7095. Please use the subscriber number that appears on your label when changing addresses. *Coastwatch* is published six times a year. A year's subscription is $12.

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Front cover photo of soft coral by Hardbottoms Project Team.

Inside front cover photo of sea oats and surf by John R. Rottet.

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from the top

Dear Readers,

This month, *Coastwatch* offers a potpourri of articles for your reading pleasure.

First, Carla Burgess takes readers offshore to the continental shelf where she explores underwater natural reefs called hardbottoms. These underwater oases are the subject of a multidisciplinary Sea Grant project aimed at understanding the value of these reef ecosystems.

Next, Jeannie Faris explains a new trend in recreational fishing — catch-and-release. This conservation-minded approach to sportfishing allows anglers to cast a line today while planning for tomorrow's catch.

Finally, I'll treat you to a seafood dinner taken fresh from the freezer. I'll explain why quickly frozen top-quality fish and shellfish are sometimes preferable to the "fresh" seafood found in retail counters.

Besides broadening the focus of *Coastwatch* this month, we're introducing a new department page in the back section. Coastal Commentary will appear sporadically throughout the year and feature an editorial point of view by a writer qualified to speak on an issue of coastal concern. Sea Grant Coastal Water Quality Specialist Barbara Doll kicks off the new page with a look at the possibilities for an ocean outfall in North Carolina.

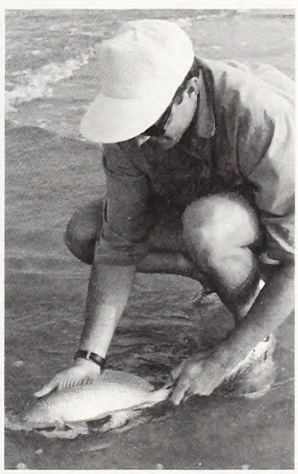
We hope you enjoy our mixed bag of articles. And even better than that, we hope you learn something new.

Don't forget to write us if you have comments or questions.

Until next issue,

Kathy Hart

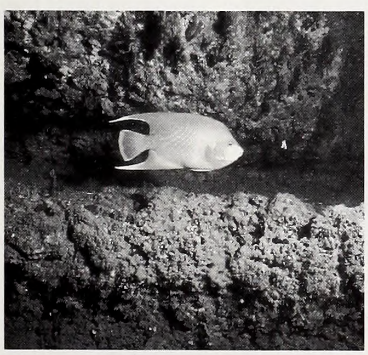
in this issue



Joel Arrington

Recycling Fish
Page 8

Hardbottoms Project Team



Hardbottoms
Page 3

Fish Fatalities
Page 23

A Hard Rock Oasis

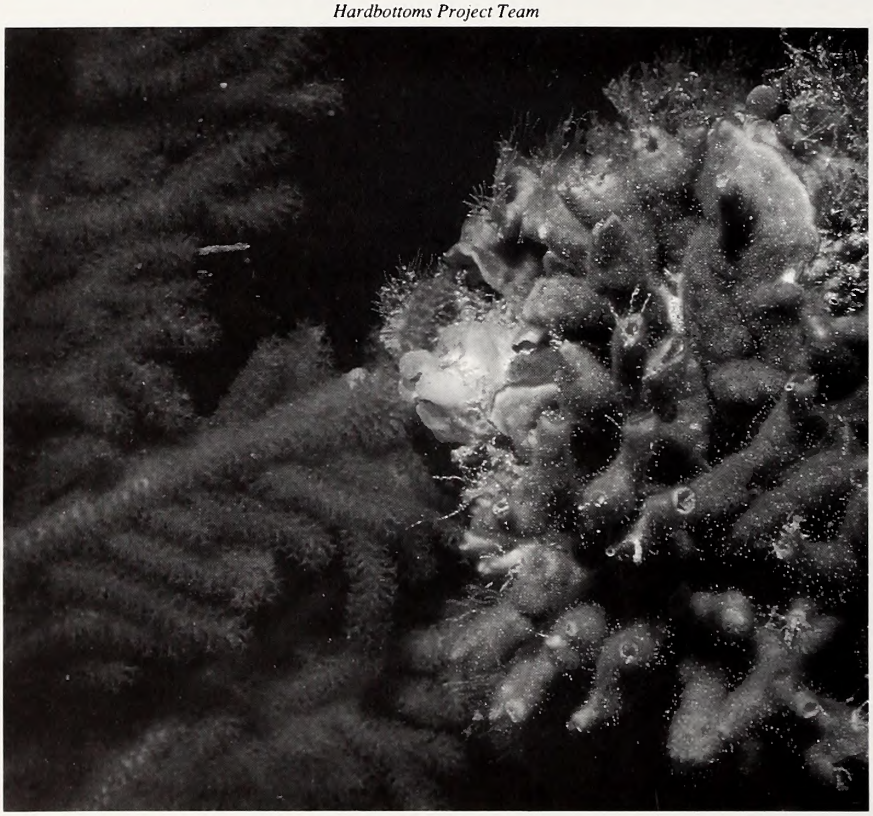
Under The Sea

By Carla B. Burgess

There's something exciting under the ocean floor off the coast of southeastern North Carolina. It's seeping from beneath beds of limestone, phosphate and other sedimentary rock that make up the continental shelf, and it may dissolve a perplexing mystery surrounding the abundance of marine life on rocky reefs known as hardbottoms.

It's groundwater, says Sea Grant researcher and East Carolina University geologist Stan Riggs, and it has immersed scientists into a new understanding of these underwater ecosystems.

Hardbottoms Project Team



For years, the productivity of the rocky seafloor outcroppings that occur throughout Onslow Bay — the coastal waters that extend from Cape Lookout to Cape Fear's Frying Pan Shoals — seemed a paradox. Some of the rocky hardbottoms are veritable oases covered with algal meadows, sponges, soft whip corals, tropical fishes and territorial and predatory animals. These habitats provide shelter and food to sustain valuable commercial and recreational fish such as grouper and snapper, worth millions of dollars to the state's economy. More than 300 species of fish and hundreds of thousands of invertebrates call these reefs home. Yet, the waters above the shelf are often nutrient-poor; few coastal rivers empty into Onslow Bay, and most sediments are trapped in the sounds behind barrier islands and the nutrients used by estuarine organisms.

"Biologists and chemical oceanographers for years have said there are more organisms out there than we can account for — there are not enough nutrients," says Riggs. "They've always known that nutrients came from upwellings below the Gulf Stream or down the rivers and out of the estuaries. But they analyze the water and don't find enough nutrients. Some researchers have concluded that there's got to be another source of nutrients, but nobody knew what that source was."

The answer may lie in the submarine groundwater discharges, which appear to be dissolving nutrients from the sedimentary rock and releasing ammonia and phosphorus into the water column.

"What we've got is an in-house fertilizer system that's helping to make Onslow Bay very productive," says Riggs.

Riggs and his colleagues will be unveiling their groundwater theory to the scientific community in papers to be submitted for publication this spring; other surprises are sure to follow. After all, little is known about the structure and function of hardbottom habitats, and until recently, dollars for research were as scarce as

the beach at high tide.

The existence of hardbottoms has been no secret. For decades fishermen have pursued the irregular topography with depth-finders, then anchored above these fertile fishing holes, hauling in grouper as long as their arms span. But as pressure has increased on these bountiful bottomlands, the catch has shrunk in size and quantity. The majority of North Carolina's reef species are overfished, and fisheries managers are in a quandary over how to preserve the resource. Size and bag limits are the extent of management so far, but the impact of these tactics is like trying to fend off a swarm of bees with a flyswatter.

Gene Huntsman, reef resources and coastal pelagics team leader for the National Marine Fisheries Service's Southeast Fisheries Science Center in Beaufort, painted a bleak outlook for reef species at the 1992 N.C. Marine Recreational Fishing Forum.

"We try with basic regulations to protect reef fish, but many reef scientists are skeptical that we know enough to protect their populations by using ordinary means," he said in his address. "Reef fish don't exist as individuals. The species do not live isolated from others. They live in complex communities.

"We have only fragmentary data on some species, and our models are very simplistic," says Huntsman. "We know that life histories of many animals are very complex and poorly understood. We know, for instance, that grouper change sex. They are born girls and become boys late in life. So an intense fishery that takes the old fish would remove the males from the population, perhaps to the detriment of the overall spawning success of the species."

Grouper, one of the most sought after reef species, don't reach sexual maturity until six years and older; they can thrive to 20 or 30 years.

While stocks dwindle, scientists are just beginning to get a close look at reef habitats and how they function.

Meanwhile, the state has sunk more than 60 artificial reefs to the ocean's depths to create more habitat for snapper, grouper, king mackerel and black sea bass. Placement has often been arbitrary and recruitment poorly monitored; artificial reef managers aren't even sure if the structures actually foster productivity or merely lure fish from another reef.

"In order to understand artificial reefs, we need to first understand the real reefs," says Riggs.

With the multimillion-dollar resource of reef fish threatened, federal agencies have loosed the flow of dollars to study the hows and whys of hardbottoms.

"As long as people were catching fish, noboby cared," says Riggs, who has been probing and pondering hardbottoms since 1964. "People now recognize the importance of hardbottoms; it's one of the 'in' things right now."

Riggs assembled a multidisciplinary team of scientists to look at the interactive geology, biology and chemistry of hardbottom habitats. The team's research is funded by Sea Grant and the University of North Carolina at Wilmington's National Undersea Research Center, both programs of the National Oceanic and Atmospheric Administration, and the Cooperative Institute for Fisheries Oceanography, which is comprised of the University of North Carolina, Duke University and the National Marine Fisheries Service.

"Our whole objective in putting this project together was to force the interaction between disciplines," says Riggs, whose principal investigative team includes fellow ECU paleontologist Scott Snyder and ECU biologist Will Ambrose, N.C. State University geological oceanographer Steve Snyder, UNC-W biologist Martin Posey and Florida State University geochemist Bill Burnett. "It's not unusual to do these interdisciplinary projects. What's unusual is to have it work."

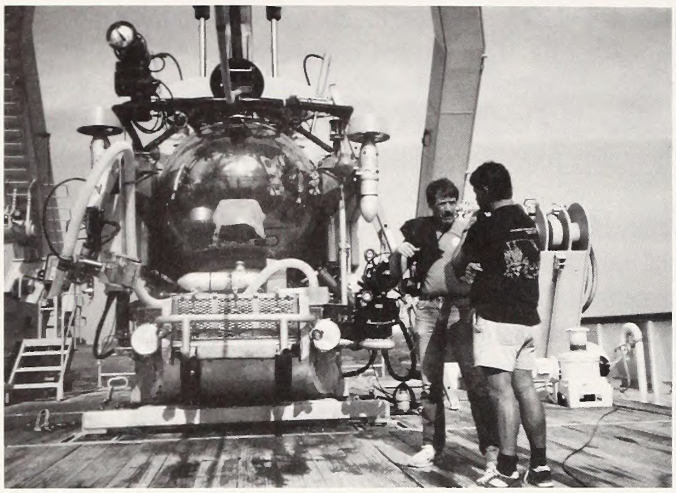
People who have never dove to the floor of Onslow Bay may have a hard time picturing the kind of reef habitats common to North Carolina. They probably never imagined that the richness and diversity typical of Florida's coral reefs exist here.

All hardbottom habitats aren't equally productive, and discovering the reasons for this is at the heart of the research team's mission. The scientists also want to know how much productivity an individual reef can sustain. There's more to attracting fish and other organisms than plopping a piece of rock down on the seafloor. You're always going to attract critters; but they'll only stay as long as there is food to eat.

People who have never dove to the floor of Onslow Bay may have a hard time picturing the kind of reef habitats common to North Carolina. They probably never imagined that the richness and diversity typical of Florida's coral reefs exist here.

Continued

Susan Askew



Stan Riggs (left) and Martin Posey on the deck of the research vessel Edwin Link.

Though the large, branching reef corals are absent, many of the fish and invertebrates common to tropical reef systems — including the four-eyed butterfly fish and the blue damsel fish — are present. The main difference is that coral reefs are alive and accreting; hardbottoms are literally crumbling down, eroded by the action of boring organisms.

Swim over much of Onslow Bay, and the seafloor resembles a desert — as far as the eye can see. But brush aside an inch or more of sand and you'll discover a hard rock floor beneath. Almost 90 percent of Onslow Bay is rock bottom, criss-crossed at wide intervals with the channels of ancient rivers that carved the mesas thousands of years ago. This part of the continental shelf lay exposed during periods of low sea level.

The edges of these channels are like cliffs, and the scarps — or cliff faces — actually produce the most productive of hard-bottom habitats. As the rock beneath the limestone-capped mesas is undercut by boring marine animals, the edges of the top rock break off into slabs. These huge chunks of rock form a "rubble ramp" and provide more surface area for increased habitat.

"It's nothing to have rubble blocks 5 to 10 meters in diameter broken off out there in front — sometimes 100 meters out in front of a rock scarp," says Riggs.

The nooks and crannies in and around the rubble become hiding places for many reef fish and invertebrates such as arrow crabs and spiny lobsters; seaweeds such as brown sargassum or green calcareous algae attach to the rock surfaces, and boring animals gnaw into the substrate. And with the right combination of crevices, ledges and overhangs come the grouper, black sea bass and other large predators, says Riggs. In the 1960s, before every fisherman and his brother had learned to scout out the high-profile scarps, Riggs commonly spotted packs of "freight-train" grouper with girths large enough to wrap your arms around.

"Without (the bioerosion) you just get a vertical wall; you don't get any grouper," says Riggs. "But if you get the right shape of overhang on that complex, which is dependent upon the geology of the different hardbottom beds, you get the grouper ledges. If you want to think in terms of farming out there or habitat construction or modification, you have to understand these kinds of processes first."

High-relief scarps — which rise from 10 to as much as 25 feet above the seafloor — are just one type of hardbottom community. Any place a rock substrate can get as little as 6 inches relief above the abrasive, mobile bottom sands, some organisms can attach and prosper; but the higher the relief, the greater the productivity. Only about 10 percent of the floor of Onslow Bay is exposed reef rock, says Riggs.

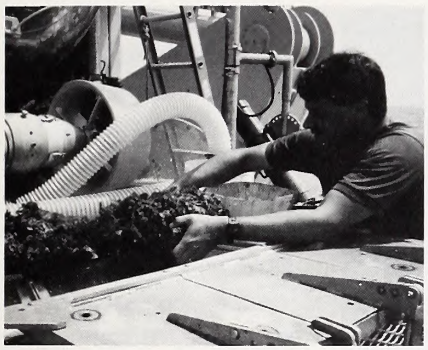
"Most of it is sand with abundant worms, some burrowing clams and vagrant animals such as starfish and sea cucumbers," he says. "The only place where it looks like a forest ... is where you get some topography and

Some of the rocky hardbottoms are veritable oases covered with algal meadows, sponges, soft whip corals, tropical fishes and territorial and predatory animals. These habitats provide shelter and food to sustain valuable commercial and recreational fish such as grouper and snapper, worth millions of dollars to the state's economy.

Hardbottoms Project Team

The research team boards the Johnson Sea-Link *submersible.*

Susan Askew



Martin Posey lifts a hunk of rock collected by the submersible's robotic arm.

morphology, and all of a sudden it goes bananas; the algae become very abundant."

Set in motion by coastal storms such as northeasters, sediments in the extensive sand flats provide too harsh an environment for attached animals. Moving grains of sediment are as big as bowling balls to microscopic larvae trying to attach to a flat hardbottom, says Riggs.

On land, plants grow in soil and gather nutrients from the ground. In the ocean, the rock provides the stable medium on which attached plants flourish, and the nutrients are absorbed from the surrounding waters.

"One of the things we're trying to get a handle on is how much sand is out there, how it's moving and how mobile it is. We don't know whether it moves in decades or moves with each storm," Riggs says. "There are many places where the scarps are totally buried."

One way to increase biomass — the amount of living matter — is to remove the sand, re-expose the rock and use the sediment as a source of beach renourishment, he says.

"Now the worm people squirm like crazy when I say that," says Riggs, adding that the sand substrate is important for worms and micro-algae.

"There've been a few biologists and geologists poking around on hardbottoms for a long time, but they didn't talk together," says Riggs. "Now when we go down and look at this stuff, we argue like crazy, and the biologists say, 'Wow, maybe there's something to the substrate control.' And the geologists say, 'Wow, look at the role the animals are playing in the bioerosion.' It turns out the animals are very important, just chewing the hell out of these rocks. ... If I had to guess right now, I would say that some of those rock scarps out there are receding at the rate of a foot per decade. For a hard rock, that's pretty fast."

"There are a lot of fish that use the hardbottom areas to feed or as a refuge from bigger fish — a place to hang out — and they leave these areas at night to feed in the surrounding sand," says Ambrose. "So what we expect to see ... is sort of a halo of low food abundance around these hardbottoms.

"In other words, the fish don't go out forever because the farther they go out, the more likely they're going to become somebody's dinner," he says. "If the further we get away from these hardbottoms, the more food we find, then we know that they're foraging a lot nearby and not so much far away."

The existence of hardbottoms has been no secret. For decades fishermen have pursued the irregular topography with depth-finders, then anchored above these fertile fishing holes, hauling in grouper as long as their arms span. But as pressure has increased on these bountiful bottomlands, the catch has shrunk in size and quantity.

Another significant area of biological study is the benthic — or ocean bottom — sand community in the periphery of hardbottoms. Hardbottom reefs were once thought of as islands that sustained themselves, but it turns out that the surrounding sand flats or "softbottom" areas may be critical in sustaining the system's foraging fauna. Maybe these worms and microorganisms are significant to the food chain of reef species, says Ambrose.

Designating reef reserve areas may become necessary to allow long-lived and older reproductive-age fish of

Continued

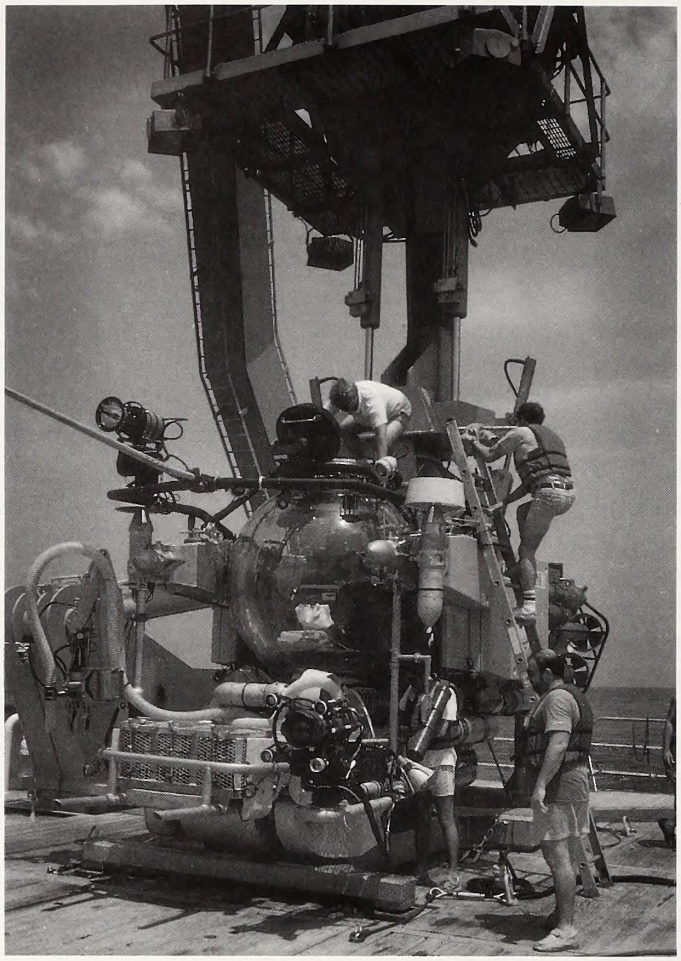
Hardbottoms Project Team

(Left to right) Will Ambrose, Paul Renaud and Martin Posey in the lab.

hardbottoms to reproduce. If there are strong nutritional links, then protective zones may also be required in the surrounding softbottom communities.

Ambrose and Posey are also studying the organism development near the areas with groundwater seeps. Scott Snyder is studying several microscopic animals that inhabit the substrate, particularly foraminifera.

The research team's scientific instruments are as simple as the sawed-off tops of 55-gallon drums modified to monitor flow of groundwater seepage and as sophisticated as the battery-powered submersible through which the scientists investigate, photograph, videotape and collect rocks, sediments, plants and animals. The 168-foot research vessel *Edwin-Link* is the launching pad for the Florida-based *Johnson Sea-Link* submersible. The team is studying five geologically diverse sites within Onslow Bay. The field work began in 1991 and will continue through 1994 under currently funded projects.



Hardbottoms Project Team

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Riggs worked with both Scott and Steve Snyder throughout the 1980s on a National Science Foundation-funded project to study the origins of the continental margin and associated phosphate sediment in Onslow Bay. Sea Grant also funded part of that project. It was then that the scientists first got an inkling of the high levels of nutrients in groundwater leaking from the Miocene-age rock bottom and observed the spectacular reefs they are now studying.

From that research, the team already had an extensive data set from Onslow Bay that included seismic profiles — or cross-sections — of the rock layers below the seafloor and side-scan sonar images, which when pieced together provide a graphic mosaic much like an aerial photograph of the ocean bottom.

Steve Snyder is continuing to work with those and new data sets to map the habitats on the seafloor, as well as analyzing the nutrient chemistry of the water column and the seep fluids.

The fifth research site, which will be studied this summer, is in an Oligocene-age area in the bay, where lithology — or rock formation — is completely different from the previous four study sites. It is a little bit west of the Miocene-age study sites, and it, too, likely has groundwater seeps.

"The source of the nutrients in the seep fluid is unknown at this point," says Steve Snyder. "It could be coming from fertilized watersheds on the adjacent coastal plain. The dissolved nutrients then flow into the aquifer system and percolate to the surface someplace on the continental shelf. If that's the case, then we should see nutrient-enriched fluids in this Oligocene area as well."

If the fluids are actually coming through the phosphate-rich units and stripping out soluble nutrients that were buried there 15 million years ago, then Snyder says the team should see a big difference between the fluid character seeping out of the Miocene

(phosphate-rich) and Oligocene (not phosphatic) study sites.

"There are lots of different sources the nutrients can be coming from, and the next five years will help us determine which sources are important and how significant they are to primary productivity in shelf waters on a global basis," Snyder says.

"Can they co-exist?" says Snyder. "Can we actually enhance the primary productivity of this area by creating new hard substrate? The nutrient story is going to be the answer to that."

Another relevant question is whether hardbottom habitats could be improved by removing sand, which could then supply extensive beach renourishment in areas such as Carolina and Wrightsville beaches. The sand used in today's projects comes from nearby inlets. But these new shelf deposits could be a viable source of new beach sediment for renourishment, Riggs says.

Designating reef reserve areas may become necessary to allow long-lived and older reproductive-age fish of hardbottoms to reproduce. If there are strong nutritional links, then protective zones may also be required in the surrounding softbottom communities.

All of these variables will factor into future economic ventures in this area. Snyder says the value of the phosphate beneath Onslow Bay may equal or outweigh the value of the material being mined by Texasgulf Inc. in Aurora. Beaufort County's phosphate mining constitutes a significant portion of the world's phosphate resource.

With the world population expected to double again in less than 30 years, phosphate to fertilize crops will be critical, he says. A choice will have to be made whether to extract ore from the estuaries, where mining activities disrupt and contaminate finfish and shellfish nursery areas, or to move activity offshore, says Snyder.

The team's research may shed light on the interaction between the "live" benthic resources and the underlying hard mineral resources. In other words, asks Snyder, could the disruption from phosphate mining create prolific, high-relief hardbottom habitats? Could new natural reefs be artificially created by breaking up the rock surfaces now covered by mobile sands?

"But first you have to understand the system. How important are sandbottoms to hardbottoms? And at some point in time, some judgment has to be made on what you want to manage for. That's what farming does; you eliminate the woodlands and you cultivate the cornfields.

"Our goal is to understand the processes, so we can have some sound basis for making some decisions," says Riggs. "This is pioneering work. We're opening doors, and every time we go down to the bottom we learn something new about what's going on down there. It's sort of mind-boggling.

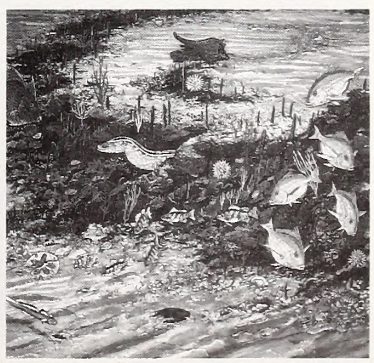
"It has to be like ... in the 1800s when the early scientists went out West, across the plains and to the Rocky Mountains, and described those areas for the first time," he says. "That's what it's like going out on the shelf."

To get a true picture of Onslow Bay hardbottoms, you might dress out in SCUBA gear and dive to the ocean depths. If you prefer a tamer — but still colorful — adventure, send for a copy of Sea Grant's hardbottom distribution poster and fishing map.

This 39-by-27-inch poster is a guide to the natural offshore reefs between Cape Lookout and Cape Fear. The flip side of the poster features five four-color paintings of the reefs. It is an excellent education tool for showing various hardbottom habitats and their flora and fauna.

For a copy, send $5 to Sea Grant Publications, Box 8605, NCSU, Raleigh, NC 27695. Ask for UNC-SG-86-25.

And stay tuned for an undersea journey through these hard rock oases via an upcoming Sea Grant educational video.



Recycling Fish

The Right Thing to Do

By Jeannie Faris

These days, conservation is "in."

It shows in our attention to recycling, carpooling, saving water and reduced product packaging. And it's casting new appeal in the sport of fishing with the catch-and-release ethic.

For ages, the creed of the honorable sportsman has been to respect the quarry, limit the take and use the remains in a productive way. He lowers his rod with an eye toward preserving the population for another day.

But fishing, like hunting duck and deer, is above all else a sport for many who sink a line off the North Carolina coast. And though sportfishermen frequently make a meal of their catch, they take to the water to enjoy the outdoors and a good fight with a lively fish.

That fish, however, can be recycled with a few catch-and-release skills.

Rather than dropping it into a cooler or leaving it for dead on the shore, an angler returns the fish to the water and takes steps to ensure that it can survive to spawn and perhaps bite another angler's hook another day.

It's more than good sportsmanship, supporters say. It's an investment in the fast return to the sport of fishing. Otherwise, the trends toward dwindling stocks and growth in fishing spell doom for the sport.

"No one has a problem with someone taking home enough fish for him to eat," says Jim Murray, director of the Sea Grant Marine Advisory Service. "But the days of catching more than you can eat to bring back to the dock and brag about are over."

Anglers are more conservation-minded now, perhaps because they can see for themselves that the stocks are declining, Murray says. The success of a trip is no longer gauged by the number of fish in the cooler at the end of the day. The smaller fish go back into the water.

For ages, the creed of the honorable sportsman has been to respect the quarry, limit the take and use the remains in a productive way. He lowers his rod with an eye toward preserving the population for another day.

Even so, the quality of recreational fishing is not what it used to be, says Bo Nowell, president of the N.C. chapter of the Atlantic Coast Conservation Association (ACCA-NC). In the late 1970s, Nowell trekked to Ocracoke every May to catch gray trout. The Cary sportfisherman no longer does this.

"There's no reason to," he says. "The fish are so small. They're fewer and harder to catch. And when you catch them, why keep them? I don't want a 10- or 11-inch fish. And I don't want to kill the bigger fish because they support the population."

Nowell began "preaching the gospel" about catch-and-release after 1988, when he saw a fellow at Oregon Inlet cleaning spots hardly more than 4 inches long. Perhaps the man had children who caught them, he says, but a lesson in catch-and-release would be more appropriate than killing undersized fish.

Obviously, the complexities of fishing ethics run deep. What is right or enough varies from person to person, and it's hard to get anglers to practice catch-and-release when they often don't abide by the legal limits on some fish, Nowell says.

Sometimes anglers just get caught up in the excitement of the moment, keeping more fish than they could possibly use. But this type of behavior is also a reflection of entrenched values, which are sometimes difficult to change.

Education — to change attitudes and destructive behavior — has helped.

As recently as the early and mid-1980s, the catch-and-release ethic hadn't caught on in North Carolina. Nowell remembers seeing trophy-sized red drum hanging from scales at every tackle shop from Avon to Buxton.

"They were every place you turned. We used to call them dead drum," he says. "People were proud to have caught a large fish. They got a

picture and left it for dead because it was a big fish. It's not as good to eat (as the smaller fish)."

Angler attitudes have since improved. But the stakes today are higher than ever because the stocks of fish living off North Carolina's coast are dwindling. The causes are multiple: pollution of the waters and nursery areas, habitat destruction and overfishing.

Meanwhile, the sport is growing in popularity, says Ron Schmied, special assistant for recreational fisheries in the Southeast regional office of the National Marine Fisheries Service.

There was a threefold increase in national saltwater sportfishing between 1955 and 1985, he says. And that demand is expected to increase nationally by 36 percent between 1985 and 2025. In the Southeast, where outings and catch accounted for half of the nation's fishing activity in 1991, the projected increase is closer to 45 percent.

Rather than dropping it into a cooler or leaving it for dead on the shore, an angler returns the fish to the water and takes steps to ensure that it can survive to spawn and perhaps bite another angler's hook another day.

The situation is compounded by the fact that a stunning majority of fishermen are not even bringing their catch to dock.

Throughout the Southeast in 1991, only 26 percent of fish caught were actually landed, brought to shore and used, Schmied says. When you consider that 201 million fish were caught in the Southeast in 1991, that means roughly 149 million fish were hooked but not brought to shore. They were either cast overboard dead, used for bait or released.

Landing rates for popular species are higher, but the big picture is clear. All of this would be great news if anglers were using catch-and-release skills to return their unkept catch to the sea. But people like Schmied are doubtful. They wonder what happens to the fish that weren't landed and whether anglers understand that the way they handle a fish determines whether it will survive.

"We want to change angler beliefs such that they understand that their actions can have a tremendous effect on the resource and that they make a

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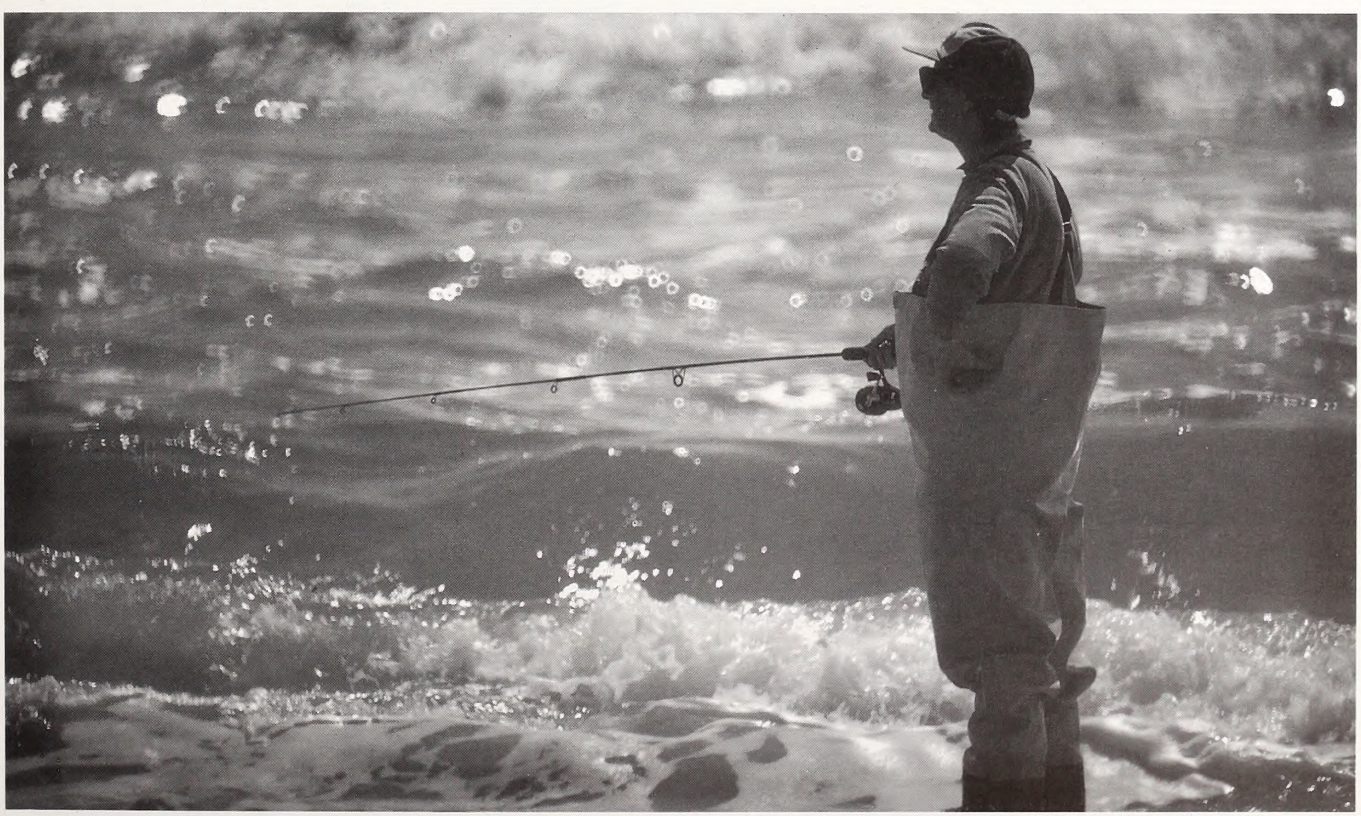


Lawrence S. Earley

voluntary decision not to waste any more fish, Schmied says.

"If anglers were taught how to catch-and-release, then roughly three-quarters of the fish they catch could be put back alive to be caught again another day and to spawn and speed up the rebuilding of the fish stocks."

The argument in favor of catch-and-release is that fish, large or small, are not totally expendable. Small fish need a chance to spawn. And removing the larger, prolific fish from the water shifts the profile of the population and reduces its ability to reproduce.

"Once fish become spawners, one large adult spawner puts out more eggs than do maybe 20, 100 or 200 of the younger ones, depending on the species and size," Schmied says.

The reality, however, is that many anglers believe they aren't part of the problem. It's hard to understand the cumulative impact when each fisherman sees himself as taking only a few at a time.

Rather, they have a "we vs. they" attitude, and they view commercial fishermen, developers and water polluters as the real culprits, Schmied says. In the early 1980s, many anglers were convinced commercial gillnetters were singularly to blame for overfishing the king mackerel stock in the Southeast. But analysis of catch statistics showed anglers accounted for 70 percent of the king mackerel harvest, Schmied says.

"I work for an agency that is responsible for managing marine fisheries. We have to look at who's catching what, recreational

The argument in favor of catch-and-release is that fish, large or small, are not totally expendable. Small fish need a chance to spawn. And removing the larger, prolific fish from the water shifts the profile of the population and reduces its ability to reproduce.

and commercial fishermen," Schmied says. "And you realize quickly there's a big disparity between angler perception of their effect on a resource and the statistics."

In a battle waged from the nation's Capitol to town halls, recreational and commercial fishermen are locked in a struggle over who gets what share of a disappearing resource. And as sportfishermen criticize the commercial industry's bycatch problems, the commercial fishermen are pointing out recreational wastes.

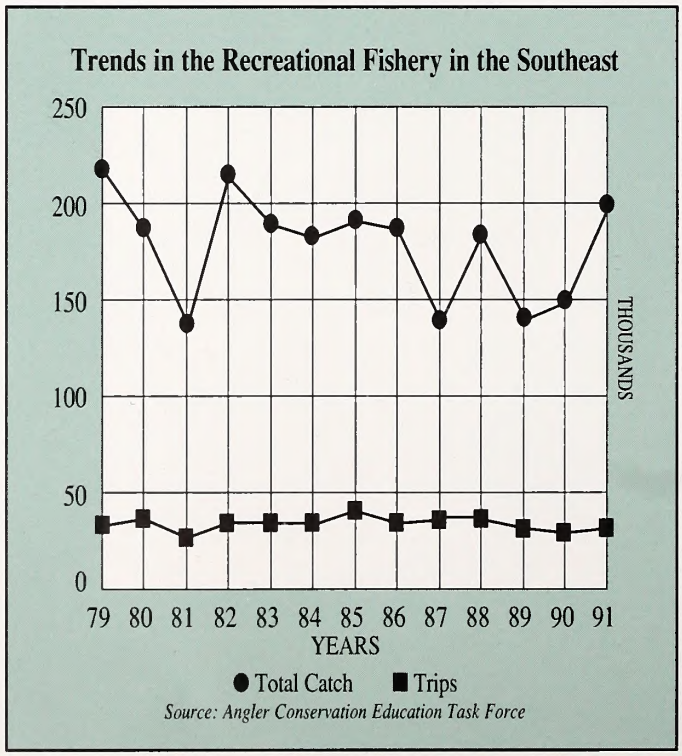
It's not uncommon for some anglers to catch species in excess of bag limits and discard all but the largest fish at the end of their trip to comply with the limit, according to a draft report prepared by the Angler Conservation Education Task Force.

The task force was assembled by Schmied to develop a plan for promoting effective angler involvement in fisheries management, personal stewardship and new norms of responsible fishing. The report says catch-and-release fishing skills are becoming increasingly important as more species become regulated and as non-wasteful fishing practices become more accepted. In effect, nearly all sportfishermen should practice catch-and-release at some time if they're abiding by the law.

"In most areas of the South Atlantic and Gulf, there has been a virtual explosion of fishing regulations, which means you have to release fish that don't meet the size limits or the bag limits, or when there's a closed season, Schmied says.

"So the question is, when an angler says he released it, did he really release it with skill so the fish had a chance of survival, or did he just toss it over the side?"

A pioneer of saltwater catch-and-release programs, Schmied launched a campaign 10 years ago to



educate anglers about their impact on the stocks and how to properly return fish to the water. The effort would be a success, he says, if it approaches the effectiveness of the Smokey Bear and seat belt campaigns in changing behaviors.

"I think that because fish stocks have declined to the extent that they have, people are beginning to recognize something is wrong, that maybe they are part of the problem and need to be part of the solution," he says.

The first task is to sensitize people to the issues. Then, provide information they can use to evaluate their own beliefs about these issues. By changing their beliefs, voluntary behavior changes are more likely to occur.

Schmied says he targets the segment of the sportfishing community that understands the issue. These are "change agents," highly visible and credible, and by their example on the water, they can help others to see the value in catch-and-release.

"Like the charter captain who tells a client to release fish and shows him how to do it," Schmied says. "That captain is held in a position of esteem by the fishermen. So when he displays proper handling, others will follow suit."

Avid anglers, however, are more likely to change their behavior than younger or less experienced fishermen, the task force study says.

Nowell agrees most fishermen go through an ethical progression of behavior before they're ready to release their catch. When they are young or inexperienced, they tend to keep every fish caught, big or small. They want to fill the cooler because to them, a great day equals a cooler full of fish.

"For these anglers, the benefits of landing and retaining their catch is paramount," according to the angler conservation report. "They are more concerned with today and expect fish to be available tomorrow."

At some point, however, they start to throw back the fish that are too small. And that's when the conservation voice begins to speak to them, Nowell says. With maturity and experience, fishermen learn to respect the resource.

In a battle waged from the nation's Capitol to town halls, recreational and commercial fishermen are locked in a struggle over who gets what share of a disappearing resource.

1991 - 1992 Catch-and-Release Comparisons
N.C. Saltwater Fishing Tournament

Species	*Year*	*Released*	*Kept*
Amberjack	1991	72	35
	1992	40	101
Cobia	1991	48	114
	1992	30	124
Red Drum	1991	308	27
	1992	422	30
Blue Marlin	1991	253	7
	1992	424	4
White Marlin	1991	274	3
	1992	730	3
Sailfish	1991	390	25
	1992	497	11
Tarpon	1991	10	7
	1992	8	11

Source: N.C. Division of Marine Fisheries

"It's that natural growth, maturing, that when you go fishing, you don't go necessarily to kill fish," he says. "You do occasionally because they're great to eat. But you go for the enjoyment. And after you catch a number of fish, it becomes a whole lot more fun to let them go."

The task of changing anglers' behavior is monumental, but there are reasons to be optimistic.

In North Carolina last year, 2,151 fish (amberjack, cobia, red drum, blue marlin, white marlin, sailfish and tarpon) were released in the yearlong saltwater fishing tournament, compared to 1,355 in 1991, according to the N.C. Division of Marine Fisheries (DMF).

And in Louisiana, a 1990 survey conducted by Louisiana State University and the state Wildlife and Fisheries Department showed that 75 percent of fishermen polled would attend fishing clinics.

This finding is significant, Schmied says, because Louisiana anglers tend to be consumption-oriented, fiercely independent and great seafood lovers. In other words, it's a "sportsman's paradise," he says.

The survey also gauged saltwater anglers' interest in topics for fishing clinics. Between 68 and 87 percent of fishermen rated the following topics as moderately to extremely beneficial: fish identification, fisheries management, care and handling, fishing regulations, fishing methods, fish biology and fishing ethics.

And a resounding 92 percent of respondents wanted a publication on fishing regulations.

"These responses indicate to me

Continued

that the angling community seems to be increasingly receptive to information and educational efforts to help them do the right thing," Schmied says.

Nowell says he's seen the same evolution in North Carolina.

"I'm impressed to see fishermen on the beach catching big fish and releasing them," he says. "To some extent, it's the future of fishing. But more than that, it's the right thing to do."

Tournaments are also riding the tide of conservatism. Although some billfish contests with prizes and enormous cash pools still call for the prizewinning catch to be killed, many North Carolina tournaments are promoting catch-and-release. They document the catch using onboard observers, measuring boards and Polaroid cameras, or they use the honor system.

Part of the change is due to an enlightened view of fishing and attention to public relations; part is necessity when quotas have been met in a particular fishery. But either way, catch-and-release tournaments plant the seed of conservation in the mind of anglers and onlookers, says Murray of Sea Grant.

By their actions, fishermen either improve or damage the status of the stocks. Releasing them with catch-and-release skills and researching their populations are the best way to restore their numbers.

"The movement in the last 10 years was led in part by the sportfishing community to become more conservation-minded," Murray says. "The days of the old marlin tournaments, back 15 years ago, when they'd kill the fish, bring it in, take a picture and throw it in the dumpster, are gone."

King mackerel tournaments, for their part, have raised the minimum size limits to 28 inches, and sometimes 30 inches, Nowell says. The federal regulation is 20 inches. And aggregate prizes — rewarding the angler who hooked the five largest and heaviest fish — are a thing of the past.

This year, Wilmington will host the nation's only tag-and-release king mackerel tournament, sponsored by the ACCA-NC, says Kurt Fickling, past president of the ACCA-NC and tournament organizer. The May 22 contest will be an honor tournament with 150 boats fishing and no prizes — just prestige.

"All (other) king mackerel tournaments are based on the largest fish," says Fickling. "So if you catch

Lawrence S. Earley

a 30- to 40-pound fish, you've got to bring it in; you've got to kill it. That's what we're trying to get away from."

A release in the ACCA tournament will garner an angler five points; a tag-and-release, 10 points.

Tagging is important to fisheries management because it helps identify migratory stocks and growth rates. For instance, research has suggested that the entire North Carolina king mackerel population may not migrate to Florida in the winter, as once believed. Most appear to stay off the North Carolina shore. And establishing these patterns can work to the advantage of Tar Heel fishermen because now local stocks are regulated with the entire South Atlantic. An overfishing problem in Florida, for example, might not justify the closure of an unaffected population this far north, Nowell says.

The king mackerel tagging program is in its infancy in North Carolina, says Randy Gregory, a DMF technician. About 105 fish were tagged last year, the program's first, but interest is picking up. It's in the anglers' best interest to learn more about where these fish migrate and how they live, he says.

And above all, anglers should keep in mind that they can be fisheries managers, Schmied says. By their actions, fishermen either improve or damage the status of the stocks. Releasing them with catch-and-release skills and researching their populations are the best ways to restore their numbers.

HOW TO RELEASE YOUR CATCH

Most released fish can survive, contrary to traditional angler lore. Fishermen simply need to learn how to release the fish properly to reduce stress and wounding, which are the two major causes of angling mortality.

Here's how to begin:

♦ Land your quarry quickly; don't play it to exhaustion. Stress is caused by exertion fighting the rod, which allows lactic acid to accumulate in a fish's muscles.

♦ Set the hook immediately. Try to prevent a fish from swallowing the bait.

♦ Work a fish out of deep water slowly so it can adjust to the pressure change.

♦ Use hooks that are barbless and made from metals that rust quickly. Baited hooks are more likely to cause serious injuries than lures.

♦ Always keep your release tools handy.

When handling the catch:

♦ Leave the fish in the water if possible, and don't handle it. Use a tool to remove the hook or cut the leader.

♦ Keep the fish from thrashing.

♦ Net your catch only if you cannot control it any other way.

♦ When you must handle a fish: use a wet glove or rag to hold it, turn it on its back or cover its eyes with a wet towel to calm it, don't put your fingers in the eyes or gills, avoid removing mucus or scales, get it back into the water as quickly as possible.

♦ Larger fish can be kept in the water by holding the leader with a glove or by slipping a release gaff through the lower jaw.

♦ Protect against personal injury by handling each fish carefully and correctly.

When removing the hook:

♦ Cut the leader close to the mouth if a fish has been hooked deeply or if the hook can't be removed quickly.

♦ Back the hook out the opposite way it went in.

♦ Use needle-nose pliers, hemostats or a hookout to work the hook and protect your hands.

♦ For a larger fish in the water, slip a gaff around the leader and slide it down the hook. Lift the gaff upward as you pull downward on the leader.

♦ Do not jerk or pop a leader to break it. This damages vital organs and kills the fish.

The final moments before release:

♦ Place the fish in the water gently, supporting its midsection and tail until it swims away.

♦ Resuscitate an exhausted fish by moving it back and forth or tow it alongside the boat to force water through its gills.

♦ Use an ice pick, needle or hook point to puncture the expanded air bladder on a fish taken from deep water.

♦ Watch your quarry to make sure it swims away. If it doesn't, recover the fish and try again.

♦ Remember, a released fish has an excellent chance of survival when handled carefully and correctly.

Catch-and-release, however, may not be as effective on every species. The deeper the water a fish is pulled from, the higher the mortality due to injuries caused by decompression. Reef fish, for instance, live in 50 to 200 feet of water.

Deflating these deep-dwelling fish is better than leaving them floating on the surface, where they're susceptible to predation and exposure to the sun.

It's the same principle as leaving the hook in a gut-hooked fish. Sure, it isn't the ideal situation, but at least the fish has a chance.

Adapted from tips by the National Marine Fisheries Service

Fresher Than Fresh May Be Frozen

By Kathy Hart

If you want to serve the freshest flounder or cod possible for dinner, then you may want to bypass the fresh seafood counter for the frozen food section.

What? Bypass that supple white flounder fillet lying atop a bed of ice in the fresh seafood counter for a frosty fillet boxed in the frozen food section?

Yes. If properly frozen and thawed, that frozen flounder fillet may be superior in flavor, texture and freshness to a "fresh" fish that has passed along the distribution chain, says Joyce Taylor, Sea Grant's seafood consumer agent.

In some instances, that "fresh" fish has been out of the water five to 10 days. It has taken a journey from the fishing vessel to the grocery store that includes stops at the processor/packing house, distributor and supermarket warehouse.

However, a good quality frozen fish can be rendered stiff and frosty within hours of hoisting it from the water. And even better, some fish and shellfish are frozen almost immediately upon harvest onboard the fishing vessel.

By freezing freshly caught seafood in prime condition and holding it at very cold temperatures, processors can lock in the high quality that consumers demand. In fact, much of the raw fish dished up in Japan's popular sushi bars has been previously frozen. But most people assume it is fresh because of its impeccable quality.

Likewise, some fish and shellfish sold in supermarket counters and seafood displays have been previously frozen and thawed by grocers. It is placed alongside fresh product, and often consumers are never the wiser.

Many retailers may not label the fish as previously frozen or volunteer this information unless asked because frozen fish has such a poor image in the minds of consumers.

For years, some processors, distributors and retailers resorted to freezing fish and shellfish that didn't sell on the "fresh" market, and often that seafood teetered on the verge of spoilage. Freezing of marginal quality fish offered one last opportunity for distributors to recoup their costs and sell their products to consumers.

But that practice backfired. Consumers caught on, and frozen seafood lost favor.

A good quality frozen fish can be rendered stiff and frosty within hours of hoisting it from the water.

Then came the 1980s, the decade of "freshness."

Supermarket chains hurried to install fresh seafood counters, where mounds of shellfish, layers of fish fillets and stacks of seafood steaks were laid out on beds of chipped ice and adorned with parsley and lemons.

"There was a fresh hysteria in the mid-1980s," says Tyre Lanier, a Sea Grant researcher in the N.C. State University food science department. "The airlines promised to deliver fresh fish anywhere in the country in a matter of hours. And they could. But they squashed any effort to promote frozen seafood, which in my opinion is a more sane way to handle fish and shellfish."

But just because the only frozen seafood bought directly by consumers was breaded fish sticks and

Scott D. Taylor

Live Atlantic blue crabs enter CryoTech Industries.

Scott D. Taylor

Workers place crabs on an automated backing machine that removes the crabs' backs, viscera and gill feathers.

shrimp doesn't mean that the fisherman's catch wasn't hitting the freezer.

Quite the opposite.

More fish and shellfish were handled frozen than fresh. Supermarket chains and restaurants bought large quantities of frozen product, thawed it and sold it to customers, and people ate it up without so much as a thought of the freezer.

At least some processors in the seafood industry had learned their lesson. They were freezing prime quality seafood faster and using better equipment to do it with.

About this time, seafood consumption skyrocketed as nutritionists and dietitians touted fish and shellfish as a high quality source of protein that was low in fat and cholesterol. Meeting the steady demand for the catch of the day meant freezing became an industry standard.

And freezing certainly offers the seafood industry several advantages.

It stabilizes supply and price. It means seafood can be distributed using ships, trains and trucks rather than the more expensive air service. It helps grocers and restaurateurs to buy in bulk at substantial savings. And it permits the flood of foreign

Continued

Q: What is Fresh?

A: Some in the seafood industry question the use of the word "fresh" to describe a fish that hasn't seen the ocean in more than a week.

In many cases, distributors and retailers use fresh to mean a fish that has never been frozen or processed, not as a measure of the time since its harvest and, hence, its quality.

But consumers think differently, and they are often misled by the use of the word. Many shoppers steadfastly believe that "fresh" indicates a fish was recently harvested.

Frequently, however, that's just not the case, and not surprisingly, many grocers and retailers have no idea how old their seafood products are. They receive them in their stores, slap a three-day pull date on the package and rotate them onto the counter.

But Sea Grant researcher Tyre Lanier would like to change that. In his N.C. State University food science laboratory, Lanier has begun experimenting with a simple test strip to evaluate fish for degrees of freshness.

If developed, the strip could help wholesalers and retailers distinguish acceptable from unacceptable quality seafood and to predict how long a product can be expected to remain fresh at a given temperature.

Then, retailers could more accurately label their "fresh" seafood products.

Scott D. Taylor

The people in this post-processing inspection line remove improper cuts and miscellaneous pieces prior to cooking.

Scott D. Taylor

Crab clusters roll out of the cryogenic freezer tunnel where they receive a water glaze to prevent dehydration.

seafood imports needed to satisfy an American hunger for the ocean's bounty that outstrips domestic supply.

In short, freezing is a more efficient, more economical and now a more quality-conscious way to sell seafood.

But how do processors produce a high quality frozen product?

"They plan ahead," says David Green, Sea Grant's seafood technology specialist. "They use appropriate handling and freezing techniques with prime quality fish or shellfish. Freezing is their intention from the beginning; they don't use freezing as a salvage method."

In freezing seafood, Green says it is imperative to lower the temperature on seafood quickly because ice crystals will form as water in the flesh freezes. These ice crystals can tear the flesh, thus affecting the textural quality of the fish. So processors strive to drop the internal temperature of seafood as fast as possible, particularly in the zone of crystalization between 32 F and 22 F.

Once seafood is frozen, keeping it consistently cold is also important. Fish and shellfish must be kept below zero, preferably below -10 F to maintain quality. Your home freezer holds foods between zero and 10 F; commercial freezers, between -10 F and -20 F. The Japanese, who have a partiality for quality seafood, store their minced fish at -30 F and their sushi-grade tuna at a frigid -80 F.

Inside the freezer, frozen fish and shellfish can come up against another problem: freezer burn or dehydration. Processors commonly prevent this problem by water glazing or using a moisture-barrier film or vacuum pouch.

By freezing freshly caught seafood in prime condition and holding it at very cold temperatures, processors can lock in the high quality that consumers demand.

Dehydration presents a problem for anyone who freezes, be it the home cook or the food processor, because of the mechanics of freezer technology. Freezers are designed to remove the heat, or thermal energy, from products by using compounds called refrigerants that boil at very low temperatures.

Liquid refrigerants, usually freon or ammonia, are pumped into a freezer through evaporation coils. Since refrigerants boil at temperatures well below zero, they vaporize inside the coils, which are exposed to the relatively warm confines of the freezer.

As the refrigerant vaporizes into a gas, it absorbs heat. The heat-absorbed gas is pumped back to the compressor to be liquefied under very high pressure in the condenser coils. This compression process generates heat, and that's why the back or bottom of the freezer is always warm.

But by drawing heat from products, moisture can be pulled out too. The tiny water crystals frozen inside the flesh of fish will evaporate, leaving thousands of tiny spongelike holes behind. When thawed, an unprotected fish that has dehydrated will be chewy, tough and possibly rancid because the tiny holes allowed oxygen to penetrate the fish and react with fats and proteins.

To prevent these problems, most processors glaze their frozen products with a thin layer of ice that will evaporate without damaging the fish, or they package the seafood, creating a barrier that doesn't allow moisture out or oxygen in.

To lower the temperature on seafood in a matter of minutes, processors can use any number of freezing methods. And they choose their method based on the type of product they are freezing.

For freezing fillets and minced fish, most processors use plate or drum freezers. For plate freezers, refrigerants are pumped through metal plates that are pressed directly against a block of minced fish or a 5-pound wax carton of fillets for a quick freeze. In the case of drum freezers, thin fillets or minced fish are placed on the outside surface of a chilled, revolving drum and scraped off when frozen.

In short, freezing is a more efficient, more economical and now a more quality-conscious way to sell seafood.

Blast freezers work as their name suggests by freezing whole, large or irregularly shaped fish with a super-cold blast of air of about -40 F in an insulated room. Fish are loaded and unloaded in the freezing room for each blast cycle. Air circulation is critical, and dehydration can be a problem.

The spiral and tunnel freezers are variations of the blast freezer that eliminate dehydration problems because products are frozen so quickly. In the tunnel, fillets ride along a continuously moving mesh conveyer to be individually quick frozen (IQF).

In immersion freezers, processors dip irregularly shaped seafood into a very cold heavy brine. The immersed fish or shellfish freeze rapidly because heavily salted water doesn't

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Buying and Thawing Frozen Seafood

When it comes to buying frozen seafood, Joyce Taylor, Sea Grant's seafood consumer agent, has the following tips.

If possible, look for signs of freezer burn that usually appear as light colored spots. Check for rancidity by smelling the frozen product and by looking for yellow discoloration of fatty areas.

Good quality frozen seafood should have few ice crystals in the package, and the grocer should have it stored below the freezing line in the freezer case.

Read the frozen seafood package. Check to see if the processor offers information about how the product was handled or frozen. Does the processor suggest methods for thawing and preparation? Processors who offer such information are usually committed to a quality product.

Learn to identify brand names and return to purchase those brands that consistently deliver high quality frozen seafood.

To thaw seafood, place it in the refrigerator. A 1-pound package will defrost overnight.

For quicker thawing, place seafood under cold running water. Whole shellfish, such as shrimp or clams, can be placed in a colander with cold water running over them. Place dressed seafood, such as fillets or shucked shellfish, in a tightly closed plastic bag, then immerse them in a deep pan of cold water.

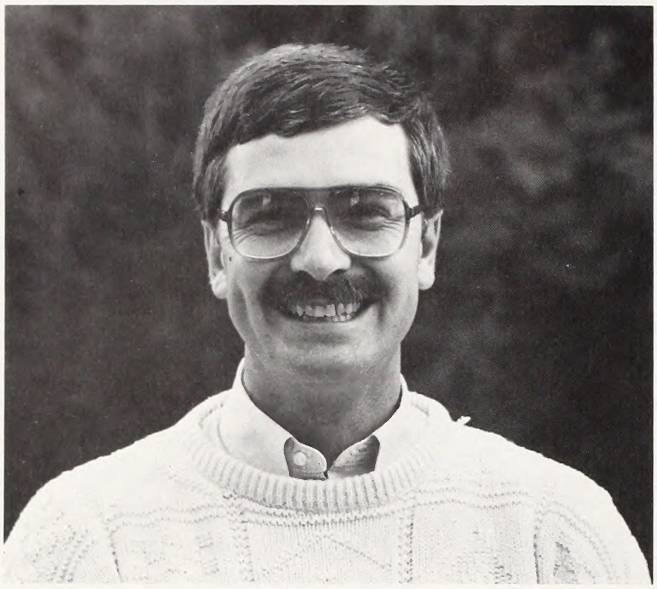
Never thaw seafood at room temperature or with hot or warm water because you could encourage the growth of harmful bacteria.

When using your microwave to thaw fish, defrost at about 30 percent power. Follow the manufacturer's instructions to determine defrosting time (a pound of fillets defrosts in about five to six minutes).

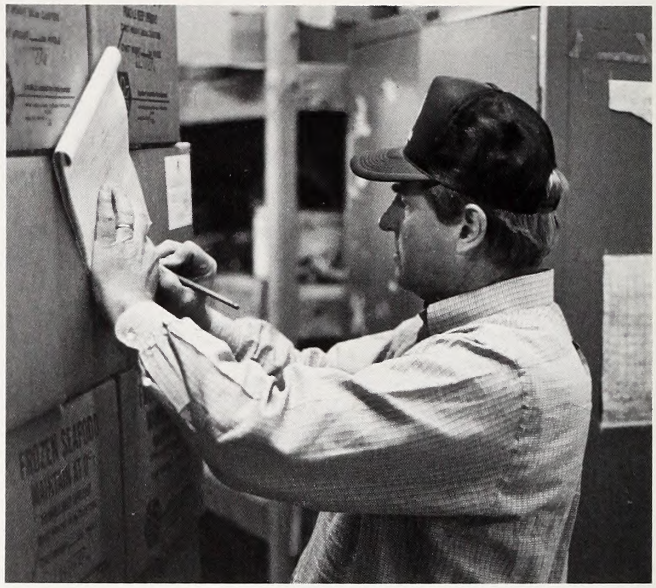
Fish defrosted in the microwave should be cooked immediately after thawing.

If you're buying previously frozen fish or shellfish from your grocer, Taylor advises consumers to ask how long it has been since the seafood was thawed, and as always, use your nose to check for the odors of spoilage.

Scott D. Taylor



David Green



Scott D. Taylor

Sam Thomas

freeze until well below the freezing point for pure water.

For the fastest freeze possible, processors turn to cryogenic technology. This more expensive freezing method uses ultracold liquid nitrogen or carbon dioxide to drop the temperature on fish and shellfish in a matter of seconds.

The product passes along a conveyor belt through a cryogenic tunnel where liquid nitrogen or carbon dioxide is sprayed. As the liquid vaporizes in the air, it picks up heat from the product, leaving behind one of the best frozen products you can find, says Sam Thomas of CryoTech Industries Inc.

Just outside of Aurora, Thomas runs CryoTech, which specializes in cryogenically freezing Atlantic blue crab — whole and in half-clusters. Blue crabs enter his plant alive and kicking and pass down a series of conveyers belts to be cleaned, cooked, frozen to a frosty temperature of -20 F, glazed, packed and stored in the holding freezer in less than one hour.

Thomas says he chose cryogenic freezing to ensure a consistent supply of top quality frozen crab. He supplies his frozen crab clusters to a restaurant chain that sells the frozen crustaceans year-round to throngs of hungry customers.

When it comes to freezing blue crabs and crab meat, Thomas says cryogenic freezing does the best job of retaining a freshlike texture, moisture and good flavor. The process is more expensive than other freezing methods, but the crab's irregular shape and the texture of its meat make cryogenics a better, more quality-conscious freezing alternative.

Inside the freezer, frozen fish and shellfish can come up against another problem: freezer burn or dehydration. Processors commonly prevent this problem by water glazing or using a moisture-barrier film or vacuum pouch.

In fact, the crab meat is in such good shape that Green has been working with Thomas to see if the meat from previously frozen crabs can be picked and packed for the crab meat market. In a project funded by the National Coastal Resources Research and Development Institute, Green has been evaluating the quality, yields and safety of cryogenically frozen meat.

Thomas says cryogenic freezing isn't for every seafood product. Some products freeze just as well using the less expensive mechanical methods.

But no matter what method you use, Thomas says to ensure a good quality frozen product, freezing should be the goal of the processor from the beginning.

"Freezing shouldn't be used as a backup plan for seafood that can't be distributed fresh because of seasonal

gluts and price drops," Thomas says. "Processors who freeze as an afterthought don't offer the same quality advantages as processors who are set up to freeze.

"Some products are not frozen with the consumer in mind," he says. "They are frozen in bulk, not IQF. Quality does suffer, and that's how consumers get a bad taste for frozen seafood. It's not flavorful, or it's rancid. Until the industry consistently produces a good quality product with the consumer in mind from the beginning, consumers are going to have reservations."

Companies whose reputations and sales depend on the quality of their frozen seafood choose good fish and shellfish to freeze and freeze it the best way possible, Thomas says.

Companies whose reputations and sales depend on the quality of their frozen seafood choose good fish and shellfish to freeze and freeze it the best way possible.

To help companies like Thomas' to improve even more, Lanier is testing some new freezing technology. Recently in a New Zealand laboratory, Lanier learned that minced fish injected with certain sugars or starches fared better in the freezer.

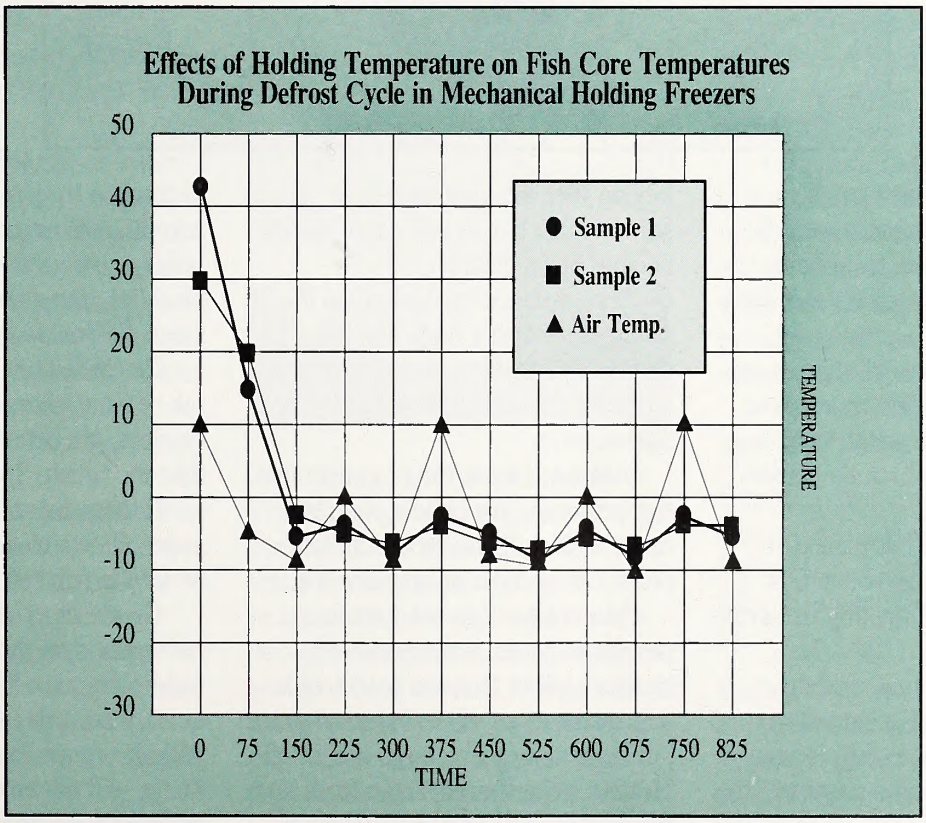
The sugars and starches protect the proteins in the fish during freezing and yield the kind of quality product researchers see only when fish is stored at temperatures of -50 F, a setting too costly for most processors to use.

Lanier is eager to experiment more with the sugars and starches in his NCSU laboratory. He would like to develop an injection system that would allow the infusion of the starches or sugars into fillets, the product form used most often by the processing industry.

Lanier would like to help processors produce better quality frozen seafood so these products would be more readily accepted by the public.

"The ideal way to sell seafood would be to freeze it and sell it frozen to consumers," Lanier says. And Thomas thinks that with more consumer education and the right marketing strategy, consumers could be sold on frozen fish.

"If a processor would develop a frozen line of seafood products that included directions on how to thaw the product, when to use it and how to use it, then consumers could consistently get better quality seafood year-round," Thomas says. "The only seafood that would be better would be that bought dockside."



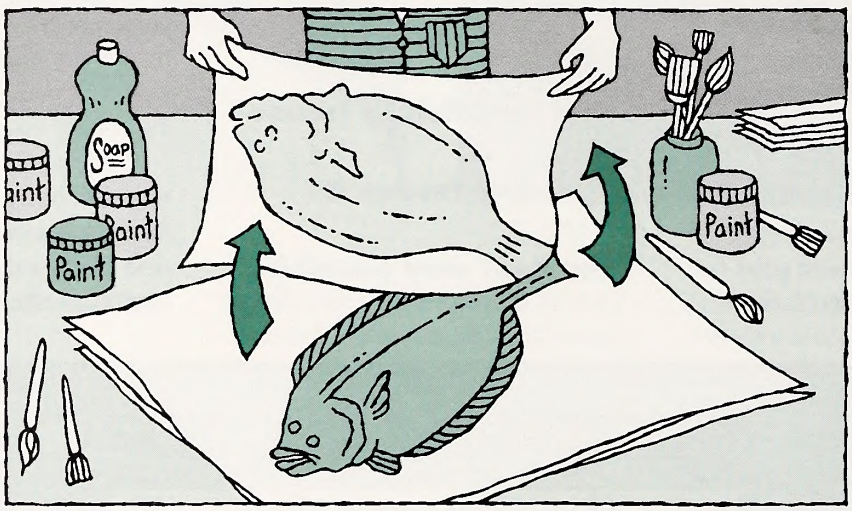
This chart illustrates the effects of fluctuating temperatures during the defrost cycle in mechanical refrigeration systems. The core temperatures of frozen fish follow the rise and fall of holding temperatures in the freezer. The fluctuation is detrimental to the long-term storage of the seafood because ice crystals will slowly grow in the fish. To remedy the problem, hold the frozen fish at lower temperatures, -20 F to -30 F if possible, to compensate for the defrost cycle.

Fish Prints – Art in the Ocean

Boost your child's art confidence by making fish prints.

It's easy. It's fun. It's educational. And all you need are a few supplies.

You simply coat an object, in this case a fish, with a light coat of ink. Then you press a clean piece of paper against it. An impression of the fish, often a very beautiful one, is left on the paper when it is lifted.



The art of fish printing has its roots in Japan, where sport-fishermen began using the practice more than a century ago as proof of the size of their catch. *Gyotaku,* from the Japanese words *gyo,* or fish, plus *taku,* for rubbing, is the traditional term used for this form of nature printing.

But today children of all ages can use the art form to learn more about fish and their environment, says Lundie Spence, Sea Grant's marine education specialist.

Spence says she has made fish prints with children as young as 4 years old. For them, making fish prints is an enjoyable craft.

For older children and adults, producing fish prints "changes from a craft to an art in which skill is needed to record each scale and nuance of the fish," Spence says.

And no matter what the age, fish printing can be a learning experience.

"Kids can actually observe differences in fish more closely," Spence says. "Often children think a fish is a fish. But by making fish prints, they learn that the flounder has two eyes on the same side of the head, the black sea bass has long fins, the shad has large scales and the pompano has only a few scales."

By determining the differences among fish, the youngsters can start to see how fish live in and adapt to their habitat, Spence says.

"For instance, by looking at the shape of the fish's body and fins, children can determine which species are fast swimmers and which are not," Spence says.

But don't think for a moment that fish prints are just child's play. If made with skill and precision, fish prints can become an art form too.

Materials: You need blank newsprint paper, water soluble printer's ink or tempera colors, old newspaper to cover desks, small jars to hold the ink or paint, large and small brushes, paper towels and a fresh or frozen whole fish that has not been gutted or scaled.

Procedure: For printing, it's best to chose a flat fish such as a flounder, spot, pinfish or triggerfish. But any fish will do, fresh or frozen. Frozen fish do particularly well, Spence says, because the fish dehydrate in the freezer, causing the scales to pull away from the fish and become more prominent. The fish should be whole, neither gutted nor scaled.

First, wash the fish with soap and water to remove body slime. Dry thoroughly with a paper towel.

Lay the fish on an old newspaper and extend its fins. To extend the fins, you may need to prop them against a ball of clay and insert pins.

Brush a thin coat of ink or paint on top of the fish, avoiding the eye if possible. To add flair and distinction to your fish print, use several different colors of ink. Traditional *gyotakus* were made with just black ink, but different colors add more dimension to the print.

Be careful not to apply too much ink or paint because the image will not be clear. It's better to have too little ink than too much, Spence says.

If the paint smears onto the newspaper, slide a clean piece of paper under the fish before printing.

Gently drop a sheet of blank newsprint over the fish. Press evenly and lightly over the entire body. Work quickly because otherwise the paper will absorb too much ink and the image will not be crisp. Peel off the paper without blurring the print. Add the eye dot later.

You can freeze your fish for future prints, or if you use water soluble inks, you can clean and cook the fish.

Happy fish printing.

Kathy Hart

Water, Water Everywhere

What is the most distinguishing feature about our coastal environment?

Water. The salty wet stuff is everywhere — in estuaries, creeks, river mouths, bays and, of course, the ocean.

Because water is so seemingly abundant along our shorelines, we don't think much about it. But here are some startling facts about one of life's necessities.

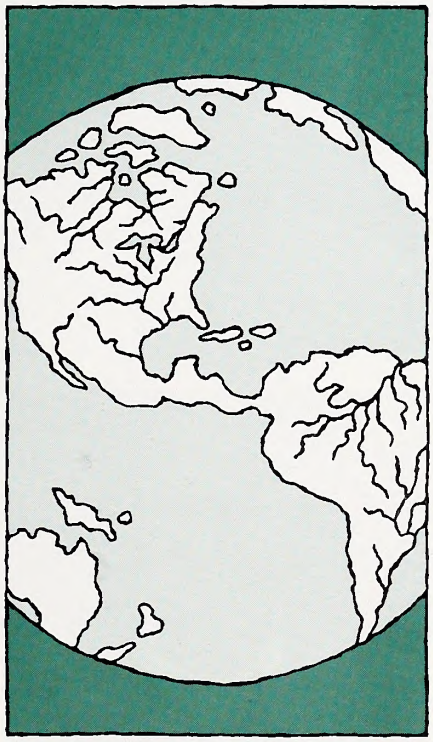
♦ If Earth were the size of an egg, the total volume of water would be the equivalent of one drop. Of this total, only about one-third of 1 percent is actually available to humans as fresh water for drinking and irrigating (the water in lakes, rivers and the accessible water table below ground).

♦ Earth's total volume of water, some 1.36 billion cubic kilometers, would cover the globe to a height of 2.7 kilometers (1.6 miles) if spread evenly above its surface. But more than 97 percent is seawater, 2 percent is locked in ice caps and glaciers, and a large portion of the remaining 1 percent lies too far underground to exploit.

♦ More than three-quarters of the fresh water on the earth's surface is frozen in the Antarctic ice cap.

♦ The hydrologic cycle, the circulation of water on and below the earth's surface and in the atmosphere, uses more energy in a day than humankind has generated throughout history.

♦ At any one time, only about .005 percent of the total water supply is moving through the hydrologic cycle. A drop of water spends about nine days in the air as vapor; once it condenses and falls as precipitation, it may remain in a glacier for 40 years, in a lake for 100 years or in the ground for 200 to 10,000 years. A water molecule may float in the ocean for 40,000 years before being cycled, but eventually every drop of water on Earth is moved through the hydrologic cycle.



♦ Today, 26 countries, home to 232 million people, are water-scarce. They have less than 723 gallons of water per person per day. U.S. residents use, directly and indirectly through the manufacture of products and growth of foods, 1,840 gallons per person per day. Many of these water-deficient countries have very high population growth rates.

♦ Africa has the largest number of water-scarce countries — 11 in all by the end of this decade. By the year 2000, the total number of Africans living in water-scarce countries will climb to 300 million, a third of the continent's projected population.

♦ Almost every organism depends on water for more than 50 percent of its body weight. The average amount of water in the human body is 65 percent.

♦ The average human has about 50 quarts of water in his or her body. Most of this water is found between the cells, bathing and lubricating them. The wettest part of the body, blood, is 83 percent water; the driest, tooth enamel, is 2 percent.

♦ So vast is the world ocean that one of its regions, the Pacific Ocean, is 25 percent larger than all of the land surface of the world combined.

♦ The Amazon, the largest river in the world, discharges 7.06 million cubic feet of water per second. Its volume nearly equals that of all the other largest rivers combined.

♦ Russia's Lake Baikal is the oldest of all freshwater lakes (about 30 million years), the deepest (5,712 feet) and the greatest in volume (812 billion cubic feet). It supports the highest proportion (60 percent) of species that occur nowhere else on Earth.

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Sea Grant Agents are Talking TEDs

About this time every year, commercial fishermen take to the docks to tune up their trawlers for the spring shrimp season. But this year, there's a stir in the air, and it's more than the prospect of steady work.

Instead, it has to do with new turtle excluder device (TED) regulations passed by the National Marine Fisheries Service (NMFS) in December.

For the first time ever in inside waters, many commercial watermen are required to place a TED in their shrimp nets to allow endangered turtles to escape. But like other complicated gear requirements that frequently befuddle commercial fishermen, the TED regulations are difficult to understand.

And as a result, rumors and misinformation abound.

Sea Grant marine agents Jim Bahen and Bob Hines are trying to clear the air and educate North Carolina's professional watermen to the new TED rules.

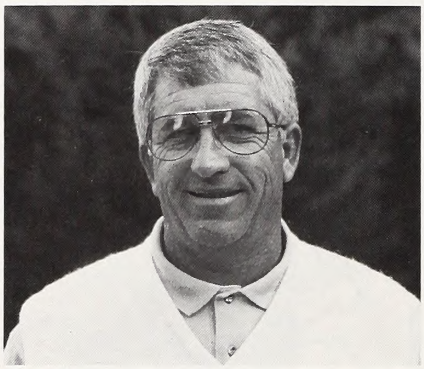
Working one-on-one and with groups, Bahen and Hines want to bring fishermen into compliance with the law to help them avoid citations and to quickly address NMFS' concerns about turtle casualties. Failure to comply is a violation of the federal Endangered Species Act.

So far, most of the queries have come from the northwest region of the Pamlico Sound, but Bahen says he's fielded questions from points all along the coast and even out-of-state.

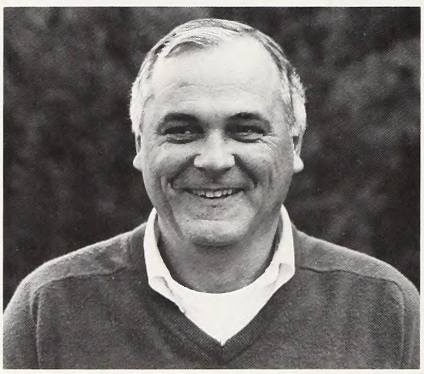
"The questions will go through the season," he predicts. "There are so many people involved. There will be so many rumors going around."

Many commercial watermen are still at a loss over how these new regulations affect them and what equipment they should fit into their nets, Bahen says. They want to know where to buy TEDs, how much they cost, whether they can build their own and whether they can modify them.

And there's also the larger question of how this equipment will perform in



Jim Bahen



Bob Hines

North Carolina's inner waters, which are shallower than offshore waters and contain more TED-clogging grasses.

In a recent round of NMFS workshops, North Carolina shrimpers said they were concerned that TEDs haven't been tested in the Core and Pamlico sounds and that they would fail to work in these inside waters.

"They're saying that normally, even without anything in their nets, they have problems with algae and grass," Bahen says. "Now the government is asking them to put something in their nets that fishermen say shouldn't be there, gets clogged and isn't going to work."

And fishermen are frustrated, Hines says, because he can't say definitively which model of TED would work best in the Pamlico and Core sounds. They can choose among several models, but none have been tested there and singled out as most effective.

Fishermen are going to have to organize, test the TEDs themselves and document trouble with the equipment, if any, Hines says. Only then can they apply to NMFS for a reprieve from pulling TEDs in the area. Hines has volunteered to organize the effort for the watermen.

"If there's going to be a catastrophe, rather than everyone running around willy-nilly, they have to document the problem," says Hines.

Only in the algae-laden waters near Sneads Ferry and designated Florida waters still strewn with hurricane debris has NMFS recently granted fishermen an exemption for TEDs. Otherwise, reprieves are rare.

And any exemption granted for an area is subject to constant re-evaluation. Already, some fishermen have said it's not worth the trouble, Hines says. They'll target another catch. Others have said they'll switch to skimmer gear, which doesn't need a TED but is limited to shallow water.

Fishermen who intend to stay with their gear can contact Bahen for guides describing who must use the hardware. Watermen who want to build their own TEDs can get guidance from publication UNC-SG-BP-93-01, authored by Bahen. For more information, contact Bahen at 919/458-5498, or Hines at 919/247-4007. To order the free publications, call Sea Grant at 919/515-2454.

Jeannie Faris

Soundside Sleuths

Two Sea Grant scientists want your help tracking an elusive killer.

Forget guns, flak vests and stakeouts. All that's needed to stalk this killer is a clean glass or plastic container.

JoAnn Burkholder and Ed Noga, two N.C. State University researchers, are tracking the new toxic dinoflagellate they discovered in 1991. This alga, named *Pfiesteria piscimorte*, attacks fish in coastal waters.

The microscopic dinoflagellate stalks fish, kills them, feeds on their decaying flesh and retreats to the bottom to await more victims. Burkholder and Noga believe the dinoflagellate is responsible for as many as 25 percent of the fish kills in the Pamlico and Neuse rivers since 1986.

But the research team wants to know more about this newly discovered killer — what triggers its toxic activity, how long does it remain toxic, how does it "attack" fish and shellfish, and when does it return to its dormant state?

To find answers, the team needs to find fish kills. And that's where you can help.

If you spot a fish kill, call Burkholder or Noga at one of three NCSU telephone numbers: 919/515-2726, 919/515-3421 or 919/829-4236. If neither researcher is in the office, please leave a message on the answering machine with details about where the fish kill is located, what day and time it is, who you are and where you can be reached.

If you would like to provide more help, take a water sample from the vicinity of the fish kill. Use a clean, well-rinsed plastic or glass container.

Steve Murray

Lower the container an arm's length below the water's surface in an area where the most fish are still dying. If the fish are already dead, then sample where there are high numbers of dead fish drifting toward shore.

After the sample is collected, keep the container in the shade or at room temperature.

If you're frequently on the water in areas where fish kills are likely to occur, then you may want to contact Burkholder or Noga for sampling supplies. They are willing to provide a preservative — an acidic Lugol solution — for collecting samples.

To collect these samples, volunteers follow the same procedure as above. But after the sample is collected, they add drops of Lugol solution until the sample turns golden orange.

Besides taking samples, Burkholder and Noga also want volunteers to be good detectives and to use their powers of observation.

Volunteers should take special note of the kill "scene." They should observe whether the water is discolored, whether fish are exhibiting erratic behavior or whether they are dying quickly. Good detectives should also write down the date, time, location, type of fish affected, whether birds are eating the dead or dying fish and other details that seem unusual or of interest.

Once volunteer detectives collect their evidence (samples) and jot down the details of the scene, then the information needs to be sent immediately to Burkholder and Noga for analysis.

The samples and information can be sent via state courier mail (# 536121) from a state or county office in your area. Or you can contact Noga and Burkholder to make arrangements for delivery and reimbursement.

The scientists will be able to confirm the presence of *Pfiesteria piscimorte* within one day after receiving water samples. However, it takes several weeks for the researchers to determine toxic activity.

By becoming research detectives for this Sea Grant duo, you can help in the quest to find ways to control these killer algae.

Kathy Hart

Is North Carolina Ready for Ocean Outfalls?

The beauty of North Carolina's coastline has won it admirers from near and far. The permanent population of the 20 coastal counties grew by 19 percent in the 1980s, and the burgeoning tourism industry has kept pace.

But the price of this growth and popularity has not been cheap. People generate wastewater, and many of the coastal disposal methods are reaching their limits. Planners are looking for new wastewater disposal options.

One possibility, an ocean outfall, would collect waste from a large region, treat it and dispose of it offshore. This disposal method is already in place in many U.S. coastal regions, including Virginia Beach.

But proximity alone won't assure that a North Carolina proposal would get the same degree of support as Virginia's ocean outfall.

The Tar Heel coastline is among the best known and least developed in the eastern United States. Largely on the strength of the prominent Outer Banks, our relatively undisturbed beaches have been ranked among the best in the nation by Stephen Leatherman, a noted coastal researcher at the University of Maryland.

Virginia Beach, on the other hand, has been developed for more than two generations as part of the Hampton Roads metropolitan area, which also includes the densely populated cities of Norfolk and Portsmouth.

Its development is driven by tourism and growth of several naval bases in Hampton Roads. Consequently, a large portion of the population is not native to the area and knows little about its heritage. These people would not recall the maritime forest, grassy dunes and untainted sounds and marshes. To them, Virginia Beach has always been a vista of high-rise motels, fast-food stores, boulevards, neon signs and gas stations.

So public resistance was not strong enough to stop an ocean outfall when it was proposed there in 1974. By 1983, the system was operational and today discharges 28 million gallons of wastewater daily.

North Carolina's coastal changes, on the other hand, are less extensive and more recent. Residents are aware of their coastal heritage and the changes wrought by development. They remember the natural areas destroyed, and they treasure those that remain. Generations have hunted duck, fished or crabbed in the marshes and sounds and walked for miles on the beaches without a single high-rise blocking the afternoon sun.

This strong link to their past could be an obstacle to building an ocean outfall in North Carolina. Many new residents also advocate protecting the coastal environments that drew them to the area in the first place. Waste disposal is a considerable constraint on development for most of coastal North Carolina. Some fear an ocean outfall would remove that constraint and accelerate change.

In the short-term, the water quality of our inland waters may benefit by the removal of treatment plant and septic tank wastewater discharges. But in the long run, the water quality impacts caused by increased development as a result of an ocean outfall may be more severe.

Public attitude, however, is only one of a number of potential obstacles to building an ocean outfall in North Carolina. Another may be geography of the area.

Our tripartite coast is separated by the east- and west-oriented Albemarle and Pamlico sounds. It is estimated that discharge of at least 35 to 40 million gallons of treated wastewater per day is necessary to economically justify construction of an ocean outfall. At current coastal population densities, this would require sewage collection from a minimum of two counties, and in most locations more.

But the lateral separation of North Carolina's tripartite coast would limit the construction of northbound and southbound collection pipes. It would not be feasible to cross the Albemarle or Pamlico sounds with pipes. Therefore, to collect an adequate volume of wastewater, the network would have to extend far inland. This would raise the cost for pipe, which typically accounts for 60 to 80 percent of the total expense of providing public sewer service.

Historically, ocean outfalls have met with varying degrees of success, depending on their locations and local oceanographic conditions. Variables such as longshore drift, upwellings, downwellings, the Gulf Stream and currents in the nearshore ocean would have a bearing on the success of an outfall.

An effective waste disposal policy in coastal North Carolina should take into account all of these considerations — oceanography, geography and heritage. The first opportunity will be at an ocean outfall conference at the Atlantic Beach Sheraton April 19-20. For information, call 919/638-3185.

Barbara Doll, Sea Grant Coastal Water Quality Specialist

Skimming Bayou Technology

Before controversy about bycatch of the shrimp fishery reached a rolling boil, two North Carolina fishermen took a cue from Louisiana watermen and a funny-looking shrimp trawler skimming the bayous. It seems their Cajun cousins had taken a fancy to the "skimmer" trawl, a cross between a butterfly net and a Vietnamese "chopstick" rig.

The otter, the traditional choice of North Carolina shrimpers, caught bunches of shrimp. But it also caught sea turtles and other non-targeted finfish and shellfish species known as bycatch. Burdened with requirements such as turtle excluder devices (TEDs) — and anticipating measures to further reduce finfish and shellfish bycatch — the two fishermen wondered whether the skimmer might be an alternative in estuarine waters. Since each net lies alongside the boat, and the tailbag can be conveniently retrieved with a pickup line while the net fishes, it appeared easy to dump and required no loss of fishing time. The fishermen reasoned that shrimpers would be willing to dump the catch about every 30 minutes; any turtle caught in the net should survive such a brief tow, eliminating need for a TED. Second, they believed that finfish bycatch would be less with skimmers since the effective spread of the gear over the bottom is less.

The fishermen, Clinton Willis and Craig Schreck, couldn't have been more right. Four years later, they have the data to prove it — thanks to the cooperative efforts of fishermen, netmakers, Sea Grant agents and supporters in Louisiana and North Carolina and to funding from the National Marine Fisheries Service and the Gulf and South Atlantic Fisheries Development Foundation. Not only did the skimmer reduce bycatch, it blew the otter out of the water in amount of white shrimp caught in shallow estuarine waters. With future improvements and modifications, the skimmer promises to hold its own against the otter trawl in pink and brown shrimp catches.

The effort to transfer Bayou technology to North Carolina's inshore waters is outlined in a brand-new, fully illustrated publication, *The Skimmer Trawl in North Carolina Estuaries*. This 24-page manual compares the skimmer and otter in regard to both shrimp catch and bycatch, based on tests in North Carolina during the summer of 1991; details how to build and fish the skimmer trawl; outlines the advantages and disadvantages of both gear (cost, fuel efficiency, shrimp and bycatch mortality, haul-back, cull time, etc.) and provides a brief history of the bycatch controversy. The booklet includes detailed construction diagrams, photographs and tables.

For a copy, send $2.50 to Sea Grant, Box 8605, NCSU, Raleigh, NC 27695. Ask for publication number UNC-SG-93-01. Please make check or money order payable to UNC Sea Grant.

What is Sea Grant?

Has the name Sea Grant left you wondering what this program is and what it does? Well wonder no more. Sea Grant has a new brochure designed to explain this unique university program and its mission.

Sea Grant is dedicated to bringing the best in research, education and advice to coastal North Carolina. We conduct relevant research, explore innovative ideas and give sound advice.

To learn more about what Sea Grant means to coastal North Carolina, send for our new brochure. It's free for the asking. Or stop by the Sea Grant office closest to you.

Big Sweep Needs You

The N.C. Big Sweep, the nation's largest statewide waterway litter cleanup, needs volunteer help to answer phones and stuff envelopes during the busy summer months prior to the cleanup.

Susan Bartholomew, the Big Sweep executive director, is looking for volunteers, adults or teenagers, from the Wake County area to help in the Big Sweep office, located in the Wake County office building in downtown Raleigh.

In particular, Bartholomew is seeking volunteers to answer the Big Sweep hotline and direct potential participants to cleanup sites throughout the state. She also needs help packaging supplies for county coordinators and T-shirts for participants.

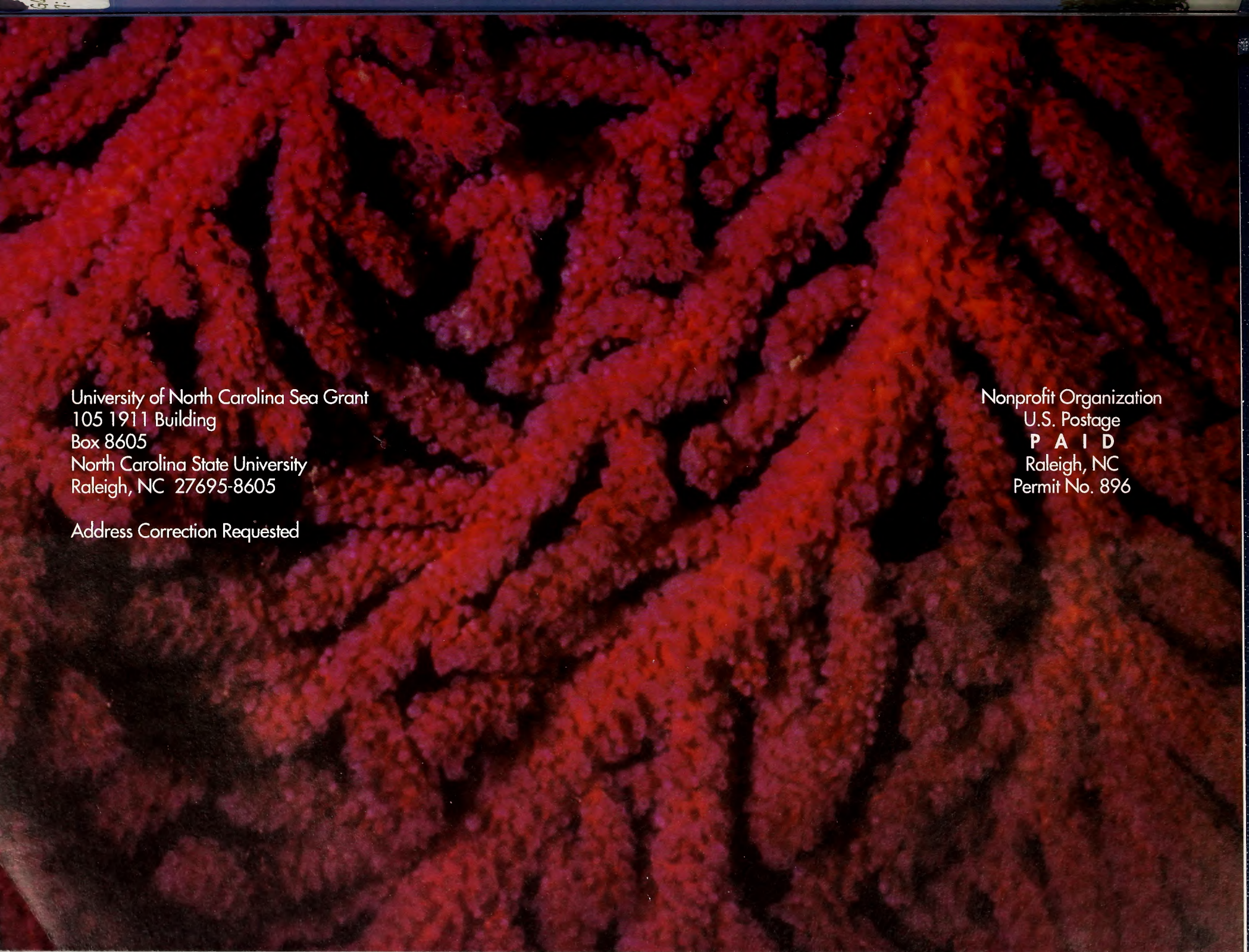
"It would be an ideal summer activity for high school students who want to show potential college recruiters or employers that they are involved in the community," Bartholomew says.

To volunteer, call Bartholomew at 919/856-6686.

Introduce Us to Your Friends

Tell your friends about *Coastwatch* by allowing us to send them a free copy for their perusal. Just send us the name and complete address of a friend whom you think would be interested in our magazine. Then we'll send him or her a free copy with no strings attached. If the person is interested, he or she can send back an enclosed subscription card along with a check. If not, we won't bother your friend again.

To take advantage of this offer, write *Coastwatch* Sample Copy, UNC Sea Grant, Box 8605, NCSU, Raleigh, NC 27695.



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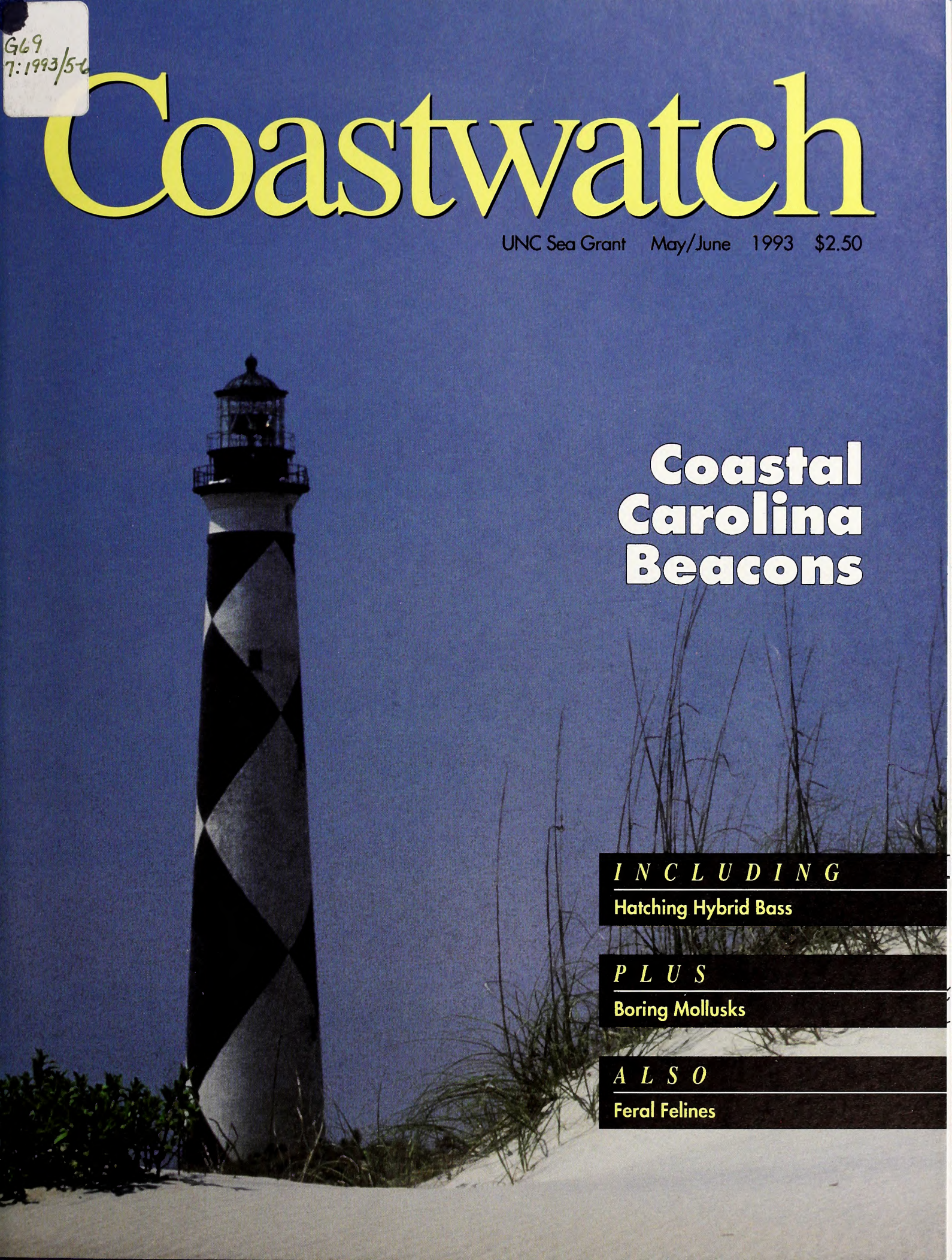

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PLUS

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The University of North Carolina Sea Grant College Program is a federal/state program that promotes the wise use of our coastal and marine resources through research, extension and education. It joined the National Sea Grant College Network in 1970 as an institutional program. Six years later, it was designated a Sea Grant College. Today, UNC Sea Grant supports several research projects, a 12-member extension program and three communicators. B.J. Copeland is director. The program is funded by the U.S. Department of Commerce's National Oceanic and Atmospheric Administration and the state through the University of North Carolina.

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Front cover photo of Cape Lookout Lighthouse by Scott D. Taylor.

Inside front cover photo of Hatteras Lighthouse by Scott D. Taylor.

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from the top

Dear Readers,

This month, free-lance writer Sarah Friday Peters lights up the pages of *Coastwatch* with a story about the North Carolina lighthouses. Peters relates the history of these glowing navigational guides, which now beckon thousands of coastal tourists.

Free-lance writer Alison Davis gives a synopsis of the coastal issues facing the newly elected and appointed officials of our federal and state governments. From wetlands to the proposed Oregon Inlet jetties, Davis explains which coastal issues are sure to inspire debate.

I introduce you to two Sea Grant researchers, a scientific odd couple of sorts, who are unlocking the secrets of striped bass reproductive physiology. Understanding striper biology is important to the hybrid bass aquaculture industry, which is dependent on the striper for parental stock.

Lundie Spence, Sea Grant's marine education specialist, provides "boring" details about shipworms and gribbles, those marine mollusks that eat away at the hulls of wooden boats.

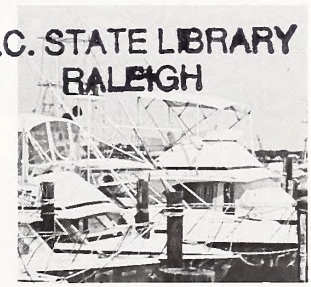
And don't forget to read "From Sound to Sea" and "Marine Advice." The first is a thought-provoking article on the feral cats of the Outer Banks, and the latter will update you on the new laws affecting marinas and the boaters who use them.

Thanks to all of you who responded to our survey. I was very pleased with the large number of surveys returned and all of the wonderful suggestions. In the next issue of *Coastwatch,* I will tell you what readers told us about the magazine.

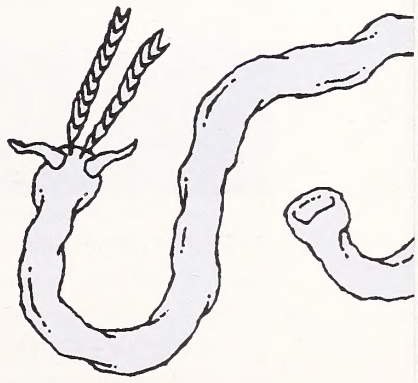
Until next issue,
Kathy Hart

in this issue

Page **2**
Lighthouses

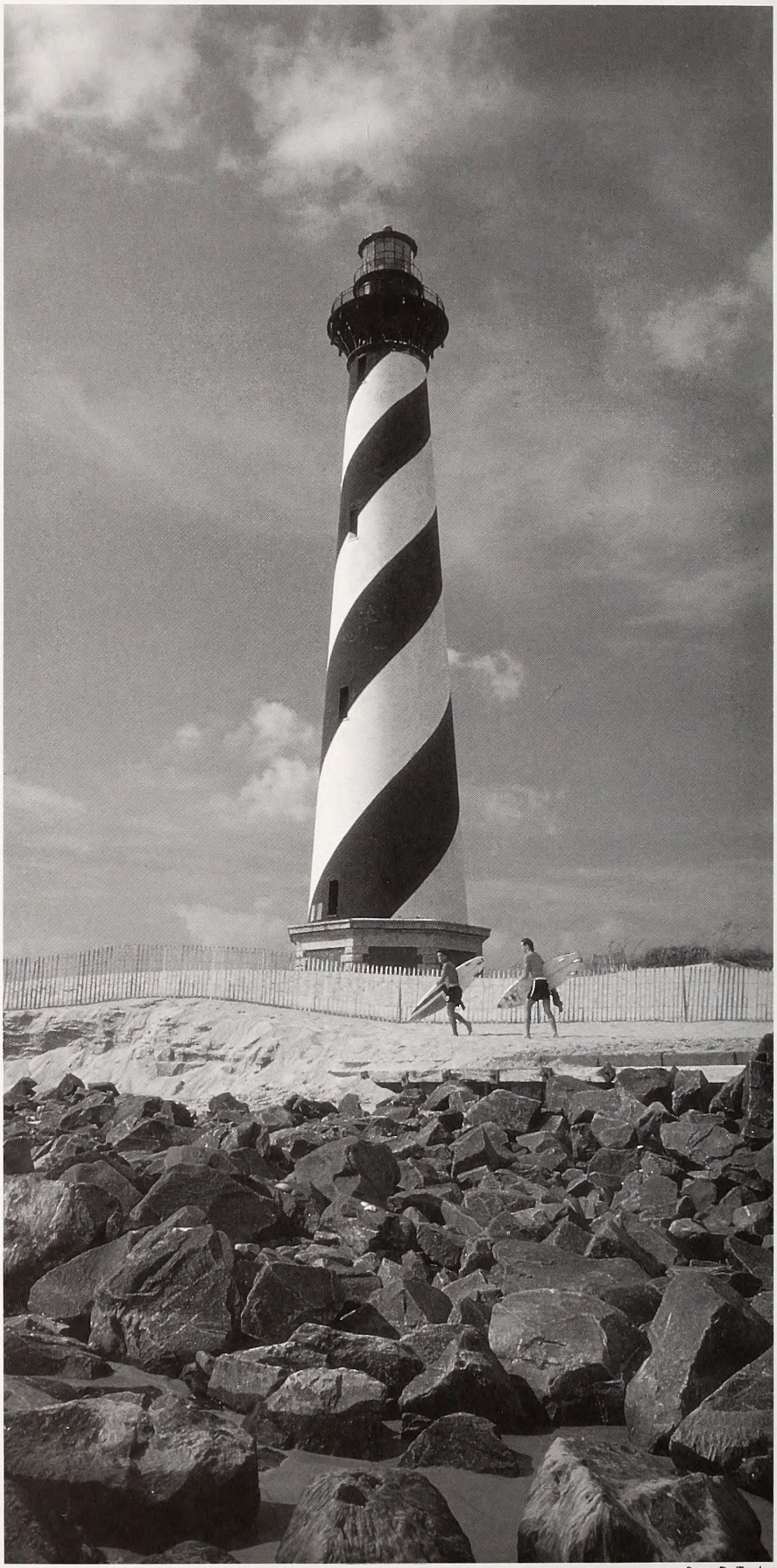


Page **20**
Marina Laws



Page **17**
Shipworms & Gribbles

TAR HEEL BEACONS LIGHT THE WAY



Scott D. Taylor

Riprap lies in front of the Cape Hatteras Lighthouse.

By Sarah Friday Peters

It's almost midnight. Your plane from New York is ready to land in Raleigh, and the pilot's voice comes on the intercom.

"I'm sorry to report that the airport tower and lights are out," he says. "Please remain calm while I try to land in the dark."

CALM?

Any second now the plane, its cargo and you might smack the runway like a hundred tons of brick!

Now you know how navigators felt before lighthouses guarded North Carolina's coast.

Early mariners sailed along the Tar Heel barrier islands like seamen in blindfolds, dodging unmarked capes, currents and shoals. Except for occasional fires set on high dunes or in crude towers, no markers signaled the hazards along the Carolina shores.

But the shifting sands and the lack of markers didn't stop mariners from skimming the state's coastline.

Many who passed were northbound on an offshore highway of current that today we call the Gulf Stream. Spanish explorers carried home Caribbean treasures on its path. Sir Walter Raleigh once considered it a shortcut to China. And later Colonial ships carrying coffee from South America and molasses from the West Indies rode the current northward.

At Hatteras, the warm waters of the Gulf Stream collided with the cold, southbound Labrador Current, creating constant turbulence and shifting underwater sandbars such as Diamond Shoals. Winds, too, pushed ships north of the cape, stalling them for days.

Even the light of day didn't keep ship captains from running aground on shallow shoals, where they were at the mercy of the ocean's pounding waves. And night was even more perilous; the only warning of impending danger was the crashing breakers.

Shifting sands, fickle winds and battling currents took their toll on vessels such as the *Tiger*, the *Tyrrel* and *Betsy*. More than 2,300 vessels met their demise, earning North Carolina maritime distinction as the "graveyard of the Atlantic."

Inshore hazards posed problems too.

Without stable landmarks, mariners rarely knew where to enter Cape Lookout, Cape Fear, Beaufort Inlet and other harbors. Shallow inlets and inland shoals such as Royal Shoals at the Pamlico River created other roadblocks to coastal trade.

EARLY MARINERS SAILED ALONG THE TAR HEEL BARRIER ISLANDS LIKE SEAMEN IN BLINDFOLDS, DODGING UNMARKED CAPES, CURRENTS AND SHOALS. EXCEPT FOR OCCASIONAL FIRES SET ON HIGH DUNES OR IN CRUDE TOWERS, NO MARKERS SIGNALED THE HAZARDS ALONG THE CAROLINA SHORES.

"Commerce was frustrated and adversely affected by the treacherousness of the inlets," says David Stick, an author and chronicler of Outer Banks history. "We had no major ports. That was our trouble. The only reliable port of entry was Cape Fear, and even that had its problems with Frying Pan Shoals."

But colonists needed to trade. The livelihood of a growing province depended on its commerce.

Roanoke Inlet near Roanoke Island and Currituck Inlet at the Virginia boundary marked early entrances into the Carolina colony. But by the 1700s, Ocracoke and the Cape Fear River had become the largest ports.

As early as 1730, the colony's river and port pilots asked for buoys and beacons at Ocracoke Inlet to aid navigation. But the British weren't interested in safeguarding Colonial shores, despite the heavy exchange of goods between the mother country and colonists.

After the Revolutionary War, few goods came and went from England. But trade between the new state ports increased.

"It wasn't lucrative or easy to trade with North Carolina," says Connie Mason, a historian at the N.C. Maritime Museum. "Because of that, North Carolina was economically on the downside."

The South had only a few important ports of call, Charleston and Savannah being the largest. Clearly, the North was the center of commerce for the young nation, and consequently, the country's first lighthouses were placed at Boston; Nantucket, Mass.; Sandy Hook, N.J.; Plymouth, Mass.; and five other points north.

The lighthouses were built and maintained primarily by the cities' merchants and shippers. But the South was dominated by farmers who saw little need for lighthouses and beacons.

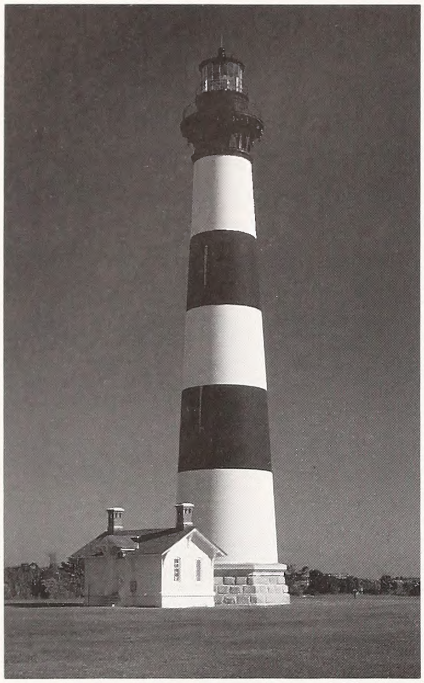
All that changed by 1784.

North Carolina made attempts to erect lighthouses at Ocracoke and the Cape Fear River. The state proposed that the first lighthouse be built on the southeast side of the mouth of the Cape Fear River at Bald Head Island.

Benjamin Smith donated 10 acres of his island to the state, and a tax on

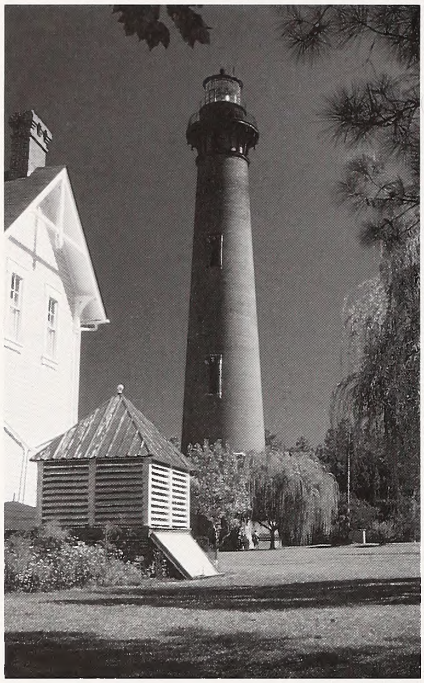
Continued

Scott D. Taylor



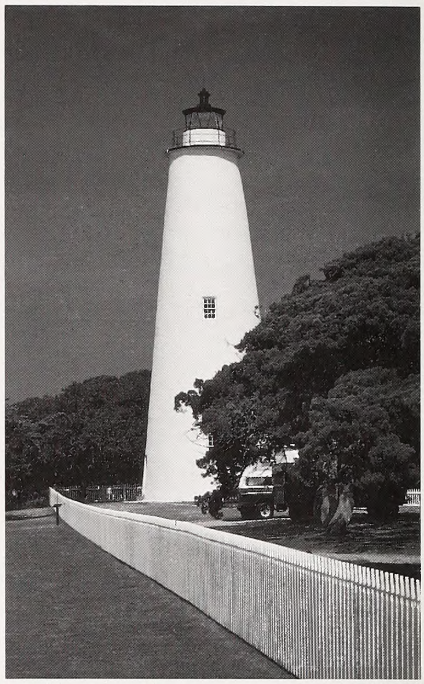
Bodie Island Lighthouse

Scott D. Taylor



Currituck Lighthouse

Scott D. Taylor



Ocracoke Lighthouse

vessels entering the Cape Fear River helped pay for the project. Construction began in 1789. That same year, the legislature proposed a second light at Ocracoke to foster foreign trade.

But the newly formed federal government saw trade as a national priority, and on Aug. 7, 1789, Congress passed its ninth act, one for the authorization and support of lighthouses, beacons, buoys and public piers. A new Lighthouse Service would locate, oversee — and most importantly — pay for new lighthouses and finish those already under construction.

In North Carolina, that meant completion of the Cape Fear Light.

Construction proceeded slowly, but by 1795 a tall, brick tower with an iron lantern and Boston glass burned brightly over the lower Cape Fear.

Congress next moved the site of the state's second lighthouse from Ocracoke to a nearby barren island made of oyster shells. The Shell Castle Island beacon was lit about 1800.

As America flourished, trade, travel and the safety of both became increasingly important to growth of the new nation. The Lighthouse Service finally saw the need to build beacons where navigational hazards, not just commerce, demanded them.

EVEN THE LIGHT OF DAY DIDN'T KEEP SHIP CAPTAINS FROM RUNNING AGROUND ON SHALLOW SHOALS, WHERE THEY WERE AT THE MERCY OF THE OCEAN'S POUNDING WAVES. AND NIGHT WAS EVEN MORE PERILOUS; THE ONLY WARNING OF IMPENDING DANGER WAS THE CRASHING BREAKERS.

Since before the mid-1700s, pilots sailing the East Coast begged for aids to help them navigate by North Carolina's shores, especially Cape Hatteras. Shipwrecks off the Outer Banks, like the *Tyrrel*, told the story too well.

On June 28, 1759, the New York brig set sail for Antigua. Fifteen crewmen and a cabin boy steered the boat south until angry squalls three days later tossed the *Tyrrel* upside down.

With only one biscuit, a few oars and the rudder, the crew boarded a 19-foot lifeboat. By nightfall they drifted — lost — off North Carolina's coast. Twenty-three days later, a passing ship found the boat off Marblehead, Mass. Only Thomas Purnell, the brig's first mate, survived.

A towering light at Cape Hatteras could have changed the *Tyrrel's* fate. The crew drifted so close to shore the first night that a beacon could have

Scott D. Taylor

Cape Lookout Lighthouse

Scott D. Taylor

Bald Head Lighthouse

Department of Conservation & Development

Oak Island Lighthouse

guided them safely in. Instead, they headed out to sea.

Alexander Hamilton, too, felt the power of Hatteras' angry fists when at age 17, the passenger ship he sailed on caught fire and lost control on the dangerous shoals. Hamilton never forgot his trip on the *Thunderbolt*. As a high-ranking member of George Washington's cabinet, he helped form the Lighthouse Service in 1789 and initiate construction of the first Cape Hatteras Lighthouse.

The original lighthouse, completed in 1802, was an octagonal tower 90 feet tall made of sandstone. The lighthouse keeper, one of the faithful men who maintained the beacons, kept nine 200-gallon cisterns full of whale oil to fuel the Hatteras Light.

With their beams, lighthouses guarded two capes, Cape Fear and Cape Hatteras, as well as ports at the Cape Fear River and Ocracoke. But Cape Lookout and Beaufort remained dark.

Early maps listed Cape Lookout as "Promontorium tremendum," which sailors translated later as "horrible headland." Shoals 10 miles offshore fueled the fear. But mariners came to know the quiet harbor behind the point as a refuge from storms and a rendezvous site for pirates, Spanish privateers and British warships.

AS AMERICA FLOURISHED, TRADE, TRAVEL AND THE SAFETY OF BOTH BECAME INCREASINGLY IMPORTANT TO GROWTH OF THE NEW NATION. THE LIGHTHOUSE SERVICE FINALLY SAW THE NEED TO BUILD BEACONS WHERE NAVIGATIONAL HAZARDS, NOT JUST COMMERCE, DEMANDED THEM.

By 1812, a 96-foot lighthouse rose above the southern harbor.

The Lighthouse Service had hardly finished the Cape Lookout Lighthouse when it began to receive complaints about the lights at Bald Head and Shell Castle Island. Lt. David D. Porter went as far as to say: "The lights on Hatteras, Lookout and Cape Florida, if not improved, had better be dispensed with as the navigator is apt to run ashore looking for them," recounts Francis Holland in *America's Lighthouses*.

The trouble came with shifting inlets and inadequate lamps that couldn't be kept burning.

In 1818, Congress appropriated money to replace the deteriorated Cape Fear Light with a 110-foot lighthouse on Bald Head. "Old Baldy," as it came to be called, shone its beacon past Bald Head and Frying Pan Shoals most years until 1958. Today, it's the oldest standing lighthouse in the state.

Continued

Photographer captures an aerial view of the Cape Lookout. *Gene Furr*

By 1820, the Shell Castle Light needed replacing, too, as it stood a mile away from the channel it was supposed to mark. By 1822, a new, more effective lighthouse guarded Ocracoke Inlet. The conical, whitewashed tower stood 75 feet above the island. One hundred seventy years later, the Ocracoke Light is the oldest operating lighthouse in the state.

A hurricane ripped open a new inlet in North Carolina in 1846. Two years later, the first of three Bodie Island lights was built south of Oregon Inlet. The 56-foot marker filled a dark gap between Cape Hatteras and Cape Henry on the Chesapeake and enabled mariners traveling south to round Cape Hatteras without hitting the northward-flowing Gulf Stream.

Like many of the old lights, the federal Lighthouse Service was deemed ineffective in 1851 and replaced by a Lighthouse Board. The change brought quick advancements in the quality of the country's lights. By 1856, modern Fresnel lenses topped 330 of the nation's 331 lighthouses. Wick lamps replaced whale oil. And lighthouse construction and reconstruction boomed.

In 1854, the Cape Hatteras Lighthouse was raised to 150 feet to boost its beam seaward. And two new lighthouses went up at Cape Lookout and Bodie Island in 1859.

"People in North Carolina had more power in Congress then," says Richard Bauman, former chief of the U.S. Office of Navigation, which oversees federal lighthouses. In the 1840s and 1850s, "North Carolina made out like a bandit. Then the Civil War came and they ruined everything they had worked for."

Yankee troops set fire to a small light at Pamlico Point Shoals in an attempt to destroy it, but the Confeder-

ates arrived in time to put out the fire. Usually the opposite happened.

North Carolina rebel troops blew up the new Bodie Island Light in 1861 so Union troops wouldn't claim it. Confederates also damaged the beacons at Cape Lookout and Bald Head and removed the lenses at Cape Hatteras and Ocracoke so Union soldiers couldn't find their way to shore.

After the war, North Carolina and the South faced immense hurdles. The lighthouses, dark since 1861, crumbled in disrepair, leaving the coast's warning system like a light fixture without a bulb.

Recognizing the need, the federal government funneled money first to the lighthouses on the Outer Banks. Construction and keeper jobs opened, and local merchants secured contracts for fuel and supplies. Weather stations, lifesaving stations and post offices followed, putting the Banks back on its feet.

But what Cape Hatteras really needed was a new light. The Lighthouse Board proposed to build "the most imposing and substantial brick lighthouse on this continent, if not the world." The light, 208 feet tall, would be a showpiece, the tallest lighthouse in the country. It would stand guard over the graveyard of the Atlantic and contribute to the commerce of the United States.

Nearly 100 Outer Banks workers endured searing sun, mosquitoes, biting flies, fevers and long delays while constructing the new tower of granite, brick and iron. By 1870, the new lighthouse beamed.

AFTER THE WAR, NORTH CAROLINA AND THE SOUTH FACED IMMENSE HURDLES. THE LIGHTHOUSES, DARK SINCE 1861, CRUMBLED IN DISREPAIR, LEAVING THE COAST'S WARNING SYSTEM LIKE A LIGHT FIXTURE WITHOUT A BULB.

One of the first sites to support a separate lighthouse and lifesaving station in North Carolina was Currituck. In 1874, a 158-foot tower lit a dark spot in an 80-mile stretch between Cape Henry and Bodie Island. Its light, which could be seen for 19 miles, often aided rescuers from the nearby Currituck Lifesaving Service station.

To help mariners in their daytime visual identification, the Lighthouse Board devised a painting scheme for the barrier island towers in 1873. The diamonds, swirls, red brick and stripes we see today remain as the monuments' distinguishing marks.

Rumors still fly that the painters became confused and painted the wrong patterns on the Cape Lookout and Cape Hatteras lighthouses. People erroneously surmised that Cape Lookout's diamond pattern should have been painted on the Cape Hatteras structure because of its proximity to Diamond Shoals. But the lighthouses were painted as they were meant to be: diamonds on Cape Lookout and swirls on Cape Hatteras.

It is believed to be true, however, that the small whaling town near the Lookout Lighthouse called Diamond City got its name in 1885 from its nearby guardian. Bankers, tired of taking beating after beating from coastal storms, deserted the town after the turn of the century.

With kerosene, then electricity in the early 1890s, the number of lighthouse keepers dwindled. Advanced technology and more powerful ships reduced the urgent need for lighthouses. In 1958, North Carolina built its last lighthouse to overlook the Cape Fear at Oak Island.

Three of the state's seven lighthouses still flash their beams at Oak Island, Ocracoke and Hatteras. Charter boat captains and fishermen trawling inland waters chart their courses by them. Tourists soak in their beauty. And Bankers write poems and sing songs to capture their awe.

"This lighthouse means a lot to the local people here," Mason says of the Cape Lookout Lighthouse. "It's still a marker. It still means home."

Lighthouse Recollections

Rany Jennette remembers climbing all 268 steps to the top of the Hatteras Light with his father, Unaka, the last lighthouse keeper to work there.

"I guess I probably have more memories of it than anyone," says Jennette, now a ranger at the Cape Hatteras National Seashore.

"Going to the top at night was the most special treat of all," he once wrote. "It's hard to describe the feeling or the beauty of all those prisms casting diamonds of multicolored light to dance on the deck below."

The keeper's job was a busy one. He had to haul fuel to the lantern daily and keep lenses clean and light calibrations correct. The keeper stocked food and supplies. And he kept a constant watch for stranded vessels and shipwrecks off the coast.

LOCATING THE LIGHTHOUSES

The Cape Lookout Lighthouse Scott D. Taylor

CURRITUCK

The Currituck Light, off N.C. 12 near Corolla, is open Easter weekend through Thanksgiving. Fee: $3. Hours: 10 a.m. to 6 p.m. except Sunday. For more information: 919/453-8152.

BODIE ISLAND

The Bodie Island Light, off N.C. 12 near Nags Head, is closed to visitors, yet still operates its light. Free. A visitors' center on the site is open five days a week. Volunteers are available to give talks on the tower. For more information: 919/473-2111.

CAPE HATTERAS

The nation's tallest lighthouse, off N.C. 12 near Buxton, opens its doors Memorial Day for the first time since 1984. Visitors can take free guided tours. Call for hours. A museum and visitors' center nearby is free and open daily from 9 a.m. to 6 p.m. Memorial Day through Labor Day. Interpretive talks are also available. For more information, call the Cape Hatteras National Seashore at 919/473-2111 or the visitors' center at 919/995-4475.

OCRACOKE

The state's oldest operating light is closed. But the island visitors' center offers a walking tour brochure that includes the light's history. The center is open five days a week. Call for hours. Ocracoke is accessible by ferry. For information: 919/473-2111.

CAPE LOOKOUT

A ferry ride takes you to the Lookout Lighthouse, which is closed to the public. Three ferries run from Harkers Island and Davis. Prices are $12 for adults, and $5 to $6 for older children. Barrier Island Transportation Co.: 919/728-3575 or toll-free in N.C. 800/423-8739. Sand Dollar Transportation: 919/728-3533. Alger Willis Fishing Camps: 919/729-2791. For more information on the lighthouse, call the Cape Lookout National Seashore from 8 a.m. to 4:30 p.m. daily at 919/728-2250.

BALD HEAD ISLAND

Old Baldy can be reached by a ferry that leaves Southport on the hour daily from 7 a.m. to 9 p.m., except at noon and 8 p.m. Ferry fee: $14 round-trip. Visitors can climb the light this summer. A lunch and historic tour of Bald Head is available for $25 Tuesday through Saturday. Ferry leaves at 10 a.m. from Southport and returns about 2 p.m. For more information: 800/234-1666. For lunch tour reservations: 919/457-5003.

OAK ISLAND

The state's newest lighthouse, located off N.C. 133 near Caswell Beach, is closed to the public. But free tours of the U.S. Coast Guard Station and pamphlets on the lighthouse are available. Tours run on weekdays 5 p.m to 7 p.m. and weekends noon to 5 p.m. For information: 919/278-1144 or 919/278-1133.

A STORM OF CONTROVERSY OVER THE HATTERAS LIGHT

The Cape Hatteras Lighthouse once fended away ships from the perilous crook in North Carolina's Outer Banks shoreline. Today, it's a beacon to visitors to discover our state's rich nautical history.

But its place in history may change, literally. The surf has gradually taken its toll on the foothold of the 208-foot tower. Today, after 123 years of battering by wind and waves, all that is left standing between the monument and the ocean is about 150 feet of sand and a buttress of sandbags.

Sooner or later, Mother Nature or the National Park Service will claim the nation's tallest brick beacon from its post.

The Park Service, which owns the lighthouse, has found itself in a storm of controversy that could match any Outer Banks northeaster in intensity. On one side, groups such as the Move the Lighthouse Committee argue for pulling it back 1,500 feet from the shoreline. Others, many native to Hatteras Island, want the Park Service to continue shoring up the coast and leave the lighthouse on its original site.

"I don't think you'd find a native, by that people who live here and love the lighthouse, who wants to move it," says Carol Dillon, who owns nearby rental cottages. "There's no way to successfully move it. And they're only doing it to see if they can."

The Park Service has forged a plan to move the lighthouse, but only when absolutely necessary. A relocation would keep the monument safe for 100 years and re-establish it 1,500 feet from the surf, its original distance from the water before erosion claimed the beach.

Mary Collier, management assistant for the Park Service, says Congress hasn't allotted the $8.7 million needed to move the lighthouse. But the park is pursuing the funding request. In the meantime, it is protecting the monument with a 250-foot sandbag buffer, repairing the buffer as needed after storms and extending it.

> SOONER OR LATER, MOTHER NATURE OR THE NATIONAL PARK SERVICE WILL CLAIM THE NATION'S TALLEST BRICK BEACON FROM ITS POST.

The Park Service has also asked the U.S. Army Corps of Engineers to inspect the southernmost of three groins — walls built out from the shore to trap sand — in front of the lighthouse to gauge its stability and need for repairs. A fourth groin may be built to the south to help hold the beach in place.

Once Congress grants the money for moving the lighthouse, no less than three years will be needed to plan and carry out the task, Collier says.

This concerns proponents, who argue that delaying the move will risk the chance of a powerful storm sweeping the sand from under the foundation sooner than expected. And a stepped-up emergency move will be costly, says David Fischetti, president of Move the Lighthouse Committee.

Heavy erosion on islands such as Hatteras is a natural occurrence, says Spencer Rogers, Sea Grant's coastal engineering specialist. Wave action at Cape Hatteras, Cape Lookout and Cape Fear erodes the east-facing shore and deposits the sand on the south-facing shore. Historically, such sandy capes experience 15 feet of erosion per year, Rogers says.

But erosion is not an immediate threat to North Carolina's other five coastal lighthouses.

At Hatteras, Rogers says, the groin field is the only thing saving the lighthouse today and keeping it stable for the foreseeable future. And it's the only thing saving the oceanfront buildings in Buxton, he adds.

A now-discarded alternative for saving the lighthouse was to build a seawall around its base. Eventually, the sand would have eroded around the revetment, possibly creating a small island, Collier says. That project would have cost $6.5 million.

Jeannie Faris

New **Federal** *and* **State** *Administrations*

By Alison Davis

Speculation is rampant in North Carolina as a new president, a new governor, new government leaders and a new legislature dance around the issues of the day.

For coastal North Carolina, the biggest dance may be the wetlands shuffle. The N.C. Division of Environmental Management will classify all of the state's wetlands, and a rumble may ensue between state agencies about how wet a wetland is and how these valuable saturated soils should be managed.

Over at the Legislature, lawmakers hope to waltz their way through several fisheries bills, while the N.C. Division of Coastal Management tries to rumba legislators out of money for beach and coastal river access areas.

And sides are once again being drawn for a cha-cha over the jetties at Oregon Inlet. State leaders and fishermen are lobbying the Clinton administration to get the jetties off the drawing board and into the water. Meanwhile, environmentalists and geologists are lining up in opposition to what they believe could be a costly environmental mistake.

But so far, neither the state's new administration nor the 1993 General Assembly has made any sweeping proposals or pronouncements regarding coastal policy.

That's not to say that changes haven't been made, however — or that some controversial coastal issues aren't in the offing.

C.R. Edgerton

Wetlands **Wars?**

What is expected to be the hottest statewide environmental issue of 1993 will be of great importance to the North Carolina coast.

As required by the U.S. Environmental Protection Agency, the N.C. Environmental Management Commission (EMC) will try this year to classify all of the state's wetlands — coastal and otherwise.

The N.C. Division of Environmental Management has proposed putting every North Carolina wetland into one of four classes. All coastal wetlands would fall into the same class, described as "salt marsh," according to Environmental Management.

The rules are not intended, Environmental Management officials say, to set levels of development allowed in wetland areas. But like the EMC's watershed classifications did last year, the wetlands proposal is expected to set off a battle between developers and environmental groups. And it may lead to some disagreement among state agencies.

Already, comments on Environmental Management's proposal show differences in agency approaches to wetlands protection.

Environmental Management's proposal, as required by the EPA, protects only water quality. But wetlands perform other valuable functions, such as providing wildlife habitat — and should be protected for all those values, say officials with the state's Division of Coastal Management.

"Our rules make no distinction between values of coastal wetland types based on species, location or the nature of the surrounding water or land," Coastal Management Director

Dance *Around Coastal* **Issues** . . .

Roger Schecter wrote in a March 19 memo to Preston Howard, director of Environmental Management.

"Basically," Schecter wrote, "they are such a limited and important resource that they should be afforded the most protection possible under the law."

Schecter also wrote that Environmental Management's proposals to classify some wetlands based on the classification of adjacent waters might lead to a lack of protection for the very waters that need help most.

Environmental Management officials say they're being careful to ensure that threatened waters, such as those sensitive to nutrients, are indeed protected. The EMC is expected to begin considering the issue in late summer or early fall.

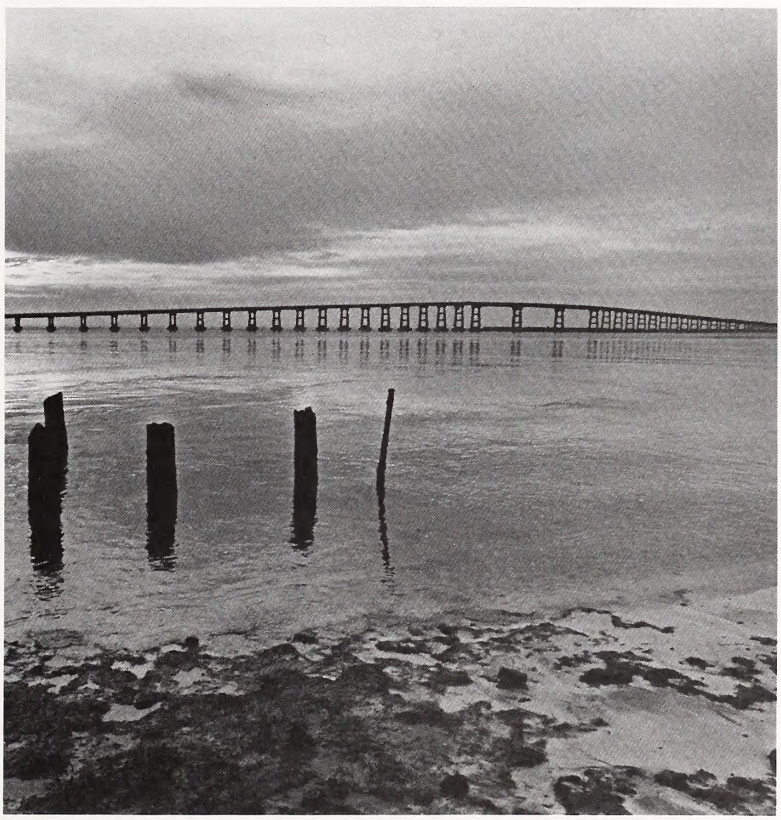
Opposition *at Oregon Inlet*

Out of state hands for now — but of interest to commercial fishermen, geologists and environmental groups — are the proposed Oregon Inlet jetties.

The 23-year-old controversy over the project escalated again recently, when Interior Secretary Bruce Babbitt visited North Carolina to promote President Clinton's national service initiative.

During that visit, Gov. Jim Hunt urged Babbitt to allow the project to go forward.

Steve Murray



For years, the U.S. Department of Interior refused to permit the project, based on predictions that the jetties would cause erosion at the adjacent Pea Island National Wildlife Refuge and Cape Hatteras National Seashore.

But in 1990, under pressure from Sen. Jesse Helms, R-NC; former Sen. Terry Sanford, D-NC; and former Gov. Jim Martin, then-Interior Secretary Manuel Lujan granted conditional permits for the twin mile-long rock structures.

In December, the CRC cleared the way for the project to bypass a state ban on shoreline hardening by altering its rules to allow such structures — if their purpose is protecting commercial navigation areas of regional significance.

The jetties have remained stalled, however, pending the revision of an environmental impact statement and the appropriation of $84 million needed for construction.

Commercial fishermen and many northeastern North Carolina officials have continued to push the project, saying it is necessary to keep the shoaling Oregon Inlet open and safe for people who make their living harvesting the Atlantic.

But national environmental groups long have disagreed. In the wake of Hunt's request to Babbitt, those groups, along with several North Carolina scientists, have renewed their objections, asking Babbitt to withdraw federal support for the jetty project. Among their predictions: the jetties would exacerbate erosion on adjacent Hatteras Island and the project would increase fishing access in areas they consider already overfished.

Babbitt has remained noncommittal, saying only that he would study the issue.

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At the **General Assembly**

In the early months of the 1993 session, North Carolina lawmakers did not introduce bills concerning the coastal environment or development — and some legislators say they don't expect to see any this session.

However, several fisheries bills have surfaced, the most controversial of which may require that any person selling North Carolina fish have a license. That license, according to early versions of the bill in both the House and Senate, would cost $35 for North Carolina residents and $250 for nonresidents.

Also proposed this session are bills to provide money to continue a shellfish enhancement research program, to fund the support of the N.C. State University Seafood Laboratory and to transfer freshwater aquaculture licensing authority from the Division of Marine Fisheries to the Department of Agriculture.

Fisher **Fortification**

A decision on another shore-hardening project is expected this year.

At the same time that it cleared the way for the Oregon Inlet jetties, the CRC agreed to allow erosion-control structures to protect historical sites of national significance — in other words, Fort Fisher.

The Department of Cultural Resources has applied for a permit to build a revetment to protect the fort from the churning Atlantic Ocean. Schecter will make the final decision on that permit, which Coastal Management is reviewing now.

Scott D. Taylor

Access **Anticipation**

Coastal Management has plans to ask legislators for money to add to the state's Public Beach and Water Access Program, division officials say. But first, the division needs to find a sponsor for the bill.

Legislators first funded the access program in 1981, largely in response to the access difficulties created by increasing private ocean-front development. The program expanded two years later to include estuarine access.

As of 1992, the division had spent $5.6 million in federal, state and local money to complete more than 135 projects, which provided 220 access sites.

The division wants to continue that expansion and to add riverine access sites to the program, says Jeanette Johnson, division spokeswoman.

No state money has been allocated for access since 1989.

Changes *at the CRC? Not by the* **House** *or the* **Senate.**

The Sierra Club and the N.C. Coastal Federation both had plans to ask legislators to hasten the end of some Coastal Resources Commission (CRC) members' terms by one year — an attempt to allow Gov. Hunt to place his own members on the commission more quickly than the law currently allows.

But Hunt apparently didn't favor the proposal, says environmental lobbyist Bill Holman. "So we dropped it," he says.

But Hunt's administration has brought change to the CRC. After chairman Jim Harrington resigned, Hunt appointed member Gene B. Tomlinson of Southport to lead the panel as interim chairman.

Tomlinson immediately instituted a public forum — time to be set aside at each CRC meeting for the public to address commission members.

Environmentalists were pleased with the change. "It just sets the impression that the commission is really accessible," says Todd Miller, director of the Coastal Federation.

Nine people spoke at the CRC's first public forum in March.

Meanwhile, two commission seats remain vacant, one for an at-large member and the other for a local government representative. Appointments could be made as early as May.

Hunt also has appointed a new chairman to the Marine Fisheries Commission: Bob Lucas, a Selma attorney and sport-fisherman. Lucas replaced C.B. Caroon as chairman; the Southport crab processor then resigned from the commission. Caroon's seat is vacant; it must go to another seafood processor.

Erosion *Adjustments*

Coastal Management officials will be updating erosion rates this year — a step that builders and would-be builders will be watching closely.

Using aerial photos of the coast taken in 1992, division scientists will determine average annual erosion rates for the 320 miles of North Carolina coastline.

Those rates are used to determine setback distances required for new oceanfront development. Current setbacks — landward of the first line of stable vegetation — are 30 times the erosion rate for structures smaller than 5,000 square feet and 60 times the erosion rate for other large structures.

The erosion rates were last updated in 1986. The CRC adopted those in 1987.

Scott D. Taylor

Increasing Reserve

Coastal Management is also striving to add more land to the N.C. National Estuarine Research Reserve.

Since 1982, the state (with the help of federal money) has purchased four sites to preserve natural areas and provide research sites for scientists and students.

Those sites — Currituck Banks, Rachel Carson, Masonboro Island and Zeke's Island — all border the Atlantic. Coastal Management officials say they want to add some estuarine sites, possibly on the Albemarle and Pamlico sounds.

Before they ask for money to buy land, however, officials want $10,000 in federal funds to do a one-year study to identify potential sites. Coastal Management wants scientists from Sea Grant and North Carolina universities to help develop that list, says Rich Shaw, the division's assistant director.

CAMA *Anniversary*

Next year marks the 20th anniversary of the state's Coastal Area Management Act, or CAMA.

The act, approved by legislators in 1974, was designed to balance economic development and the protection of natural resources in the state's 20 coastal counties.

CAMA required land-use planning in those counties and established the CRC, which regulates development in designated areas of environmental concern.

State environmental officials, backed by the Coastal Federation, are expected to ask Gov. Hunt to appoint a blue-ribbon panel of experts to review CAMA's two decades, assessing its successes and its failures.

SCIENTISTS BOOST HYBRID INDUSTRY WITH NEW DISCOVERIES

By Kathy Hart

They're a scientific odd couple.

First, there's Craig Sullivan, the Felix Unger sort, a zoologist at N.C. State University specializing in fish reproduction.

He's fastidiously neat, well-organized and intense; he waves charts and graphs around like flags at a Fourth of July parade.

Speaking with a slight Boston accent and dressed with the care of a man concerned about his appearance, Sullivan seriously calls himself a "fish gynecologist" and talks about the reproductive cycles of striped bass with the kind of passion some men reserve for sports teams and fast cars.

Then there's Ron Hodson, the Oscar Madison type, an aquaculture specialist and associate director of UNC Sea Grant.

Hodson is kind of gruff, never minces words and dresses like the farm boy he once was. And, the 6-foot-3 researcher is just about as at home in a pond of fish as the fish themselves.

Put Sullivan and Hodson together, and you have a top-notch scientific team that knows as much about the life cycles and characteristics of striped bass, white bass and their mixed offspring, the hybrid, as they know about their own families.

From the beginning of their scientific partnership in 1988, Hodson and Sullivan were determined to ensure the development and growth of a hybrid bass aquaculture industry. They wanted to spur farmers to forsake the plow for the pond and place the hybrid alongside catfish and trout in acres of U.S. production.

To do that, the Sea Grant team needed to domesticate a parental stock of fish, called broodstock, to assure a ready supply of larvae and fingerlings. And the researchers wanted to gain control over the reproductive cycle of the fish in hopes of spawning them more than once a year.

If those two objectives could be met, then raising hybrid bass could become "as routine as raising broiler chickens," Sullivan says.

But first the Sea Grant scientists had to solve some problems.

Hybrid bass have been around for years. South Carolina researchers learned that fertilizing striped bass eggs with white bass sperm produced a hybrid bass that grew faster and was more disease-resistant and hardier than either of its parents.

Researchers fertilize eggs with sperm. Scott D. Taylor

Scientists hoped the hybrid would fill the void and the space on the menu left by drastic reductions of wild populations of striped bass, or rockfish as they are called by fishermen.

Scientists took the first steps

toward making the hybrid the food fish of tomorrow with ease.

It was relatively simple to cross-fertilize the eggs and produce the hybrid larvae. Then Sea Grant researchers at NCSU found that hybrid stripers could be successfully raised in ponds. And researchers soon learned how to inject the striped bass and white bass with hormones that caused them to spawn.

What wasn't easy was always getting a ready supply of viable eggs. Often the female stripers harvested from the wild were not far enough along in the maturation cycle to successfully use available hormones to force them to spawn healthy eggs.

To comply with state regulations governing the catch of striped bass, the mother stripers had to be caught at the mouth of rivers such as the Roanoke and the Pasquotank, miles away from their spawning grounds and days to weeks away from completing their spawning cycle.

Occasionally, researchers lucked upon a "ripe" female striped bass ready for spawning that produced healthy eggs receptive to white bass sperm. But the success rate was far below what was needed to sustain a growing, thriving aquaculture industry, and the technology didn't allow for a domesticated broodstock.

Scientists, including Hodson, realized the research needed to take a few steps back before hybrid bass aquaculture could step forward. Researchers needed to completely understand striped bass and white bass physiology and most importantly, their reproductive cycles, if the hybrid was going to make a splash on the aquaculture scene.

A box of hybrid striped bass is readied for market. C.R. Edgerton

That's why Hodson sought the help of Sullivan, a fish gynecologist and a new faculty member at NCSU. Together, the two wrote their first Sea Grant proposal in 1987 for a research project aimed at unlocking the secrets of striped bass physiology.

The project received funding. Sullivan began his detailed laboratory work at the university while Hodson tested the team's theories and findings in an actual aquaculture setting at the NCSU Aquaculture Research Center in Aurora.

"First, we did a detailed characterization of the striped bass," Sullivan says. "We looked at what hormones were present, the actions of these hormones and how to measure them. We developed early pregnancy tests for striped bass females and subjected the fish to ultrasounds and biopsies."

Striped bass females, like all female fish, make their egg yolks in the liver, and this egg production occurs over a 10-month period. By taking blood samples, Sullivan could determine if a female striper was sexually mature and capable of producing eggs for the next spawning season.

Then came the larger question of how to force the striper mothers to release eggs, specifically healthy ones capable of hatching larvae. The answer came in the use of a new synthetically produced hormone, GnRHa.

The hormone is combined with cellulose and cholesterol to form a pellet that can be injected under the skin of a female striped bass. The hormone affects the striper's brain, causing it to release another hormone, called gonadotropin, that sets the fish's reproductive maturation process in motion at an accelerated rate. The hormone works similarly on male

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white bass.

By using the GnRHa hormone, Sullivan and Hodson can synchronize the spawning of the male white bass and female stripers. And better still, the females produce viable eggs ready for fertilization.

The Sea Grant scientists are excited about their breakthrough because now they feel certain that hatcheries can produce a more consistent and larger supply of fingerlings to a hybrid bass industry that could be producing 10 million pounds of fish by the turn of the century. And the discovery holds promise for a step Hodson has been awaiting since he began his striped bass work: domestication of a broodstock.

Don't think for a moment that this one accomplishment has Hodson and Sullivan sitting back on their heels. Quite the contrary.

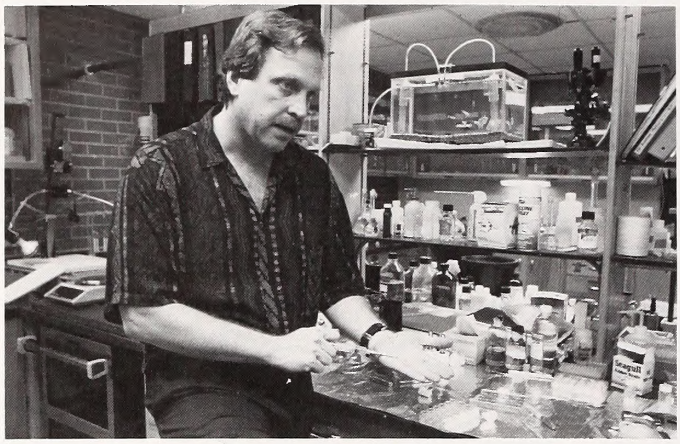
The researchers are hard at work testing other ways to manipulate the striper's reproductive cycle.

Sullivan points to a series of charts on his laboratory wall to show the team's latest work on manipulating the fish with light and temperature.

"By changing the water temperature and light cycle, you can change the time the fish spawns," Sullivan says. "We have been able to spawn the fish in six-, nine- and twelve-month cycles."

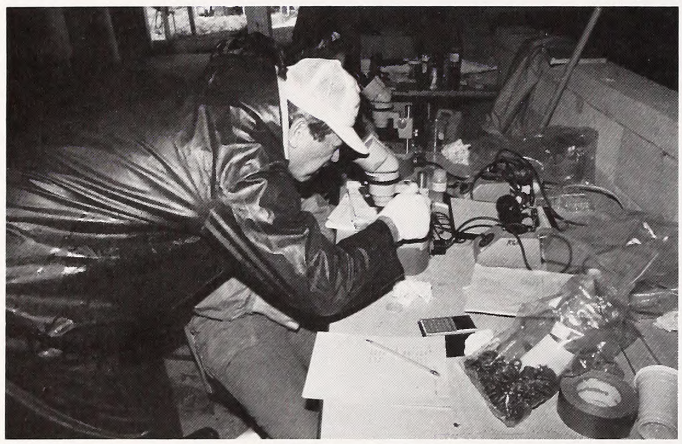
Sullivan admits that spawning female stripers every six months may be too much for the females to bear. However, it may be feasible to spawn them as often as every nine months.

Jeannie Faris



Craig Sullivan prepares hormone pellets.

C.R. Edgerton



Ron Hodson checks striper eggs with microscope.

FROM THE BEGINNING OF THEIR SCIENTIFIC PARTNERSHIP IN 1988, HODSON AND SULLIVAN WERE DETERMINED TO ENSURE THE DEVELOPMENT AND GROWTH OF A HYBRID BASS AQUACULTURE INDUSTRY. THEY WANTED TO SPUR FARMERS TO FORSAKE THE PLOW FOR THE POND AND PLACE THE HYBRID ALONGSIDE CATFISH AND TROUT IN ACRES OF U.S. PRODUCTION.

And with the kind of controls developed by the duo, aquaculturists may soon be spawning striped bass and white bass year-round.

"We used to wait all year for that twelve-week period in the spring when the fish spawned," Sullivan says. "And then with each female striper, we only had a fifteen-minute window of spawning opportunity.

"Now we're capable of spawning the fish year-round, and I'm waiting for the day when I can drive into McDonald's for a 'Mc-Rockfish' sandwich," he says.

"No, don't say that," Hodson says from across the room. "I hope hybrid bass are never so cheap that we see them in McDonald's."

Hodson envisions the hybrid as a high quality, gourmet fish fit for tables in upscale restaurants like Tavern on the Green in New York or Brennans in New Orleans.

But restaurants, fast food or gourmet, aren't a big concern for the Sea Grant scientists. Hodson and Sullivan are busy transferring their technology to hybrid bass growers throughout the Southeast.

So far, the team has worked with fish farmers in North Carolina, South Carolina, Virginia, Georgia, Maryland and Arkansas. And the researchers have extended their findings to foreign audiences in France, England, Scotland and Italy. Even Japanese scientists, who are considered among the world's leading aquaculture experts, have visited Sullivan's NCSU lab and the Pamlico facility to glean information from this scientific odd couple.

Shipworms and Gribbles: The Wooden Boat Eaters

By Lundie Spence

Tiny marine borers eating their way into the hulls of ships may have changed the course of civilization.

In February 1588, the Spanish Armada sailed with 196 ships to attack England. It had taken months to outfit the ships with guns and crews. Once under way, the fleet was buffeted by North Sea winds in the English Channel and sent back to ports for emergency repairs.

Months later, the ships again sailed toward England. But the victory that King Philip II of Spain thought he had won was lost as storms and Queen Elizabeth's navy sank ship after ship. By August 1588, the fleet was in shambles and scattered around the shores of the British Isles. Was it the North Sea winds, inept Spanish strategy, a superior British navy or Philip's hole-riddled ships that cost Spain the war and altered the course of history?

Four hundred years later, some naval historians speculate that vessels in the Spanish Armada, infested with shipworms, were unable to withstand the heavy weather.

Marine borers are typically two types of animals. Shipworms, or teredos, are mollusks, tiny clams with long, soft bodies — perhaps a foot in length. Boat repairers describe them as worms with bony heads. The hard parts are actually the two valves of the shell. Gribbles, also called sand fleas along parts of the Atlantic coast, are arthropods — crustaceans like shrimp and lobsters, although much smaller. Adults measure only about 5/8 inch in length. Gribbles are closely related to the wood lice or marine roaches that run around piers and floats.

Although both borers are vegetarians, their styles of dining differ. Shipworms, like termites, have bacteria in their gut to break down wood fibers. But their main source of food is the plankton drawn into their burrows.

Gribbles nibble on wood, using the digestive enzyme cellulase. They tend to follow in the path of wood rot or fungus, and fungi are the principal

Was it the North Sea winds, inept Spanish strategy, a superior British navy or Philip's hole-riddled ships that cost Spain the war and altered the course of history?

food of these crustaceans. Their tunnels provide a safe haven for shelter and reproduction.

Shipworms can make large tunnels throughout wood. Gribbles make numerous, very small passageways just below the surface of wood. Shipworms can weaken wood much faster than gribbles, but each is an

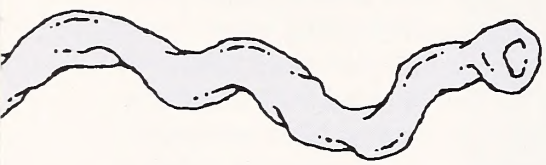
Continued

effective engineer.

Shipworm and gribble damage have plagued maritime enterprises throughout recorded history, particularly in warmer waters. Warships, merchant craft and small coastal trading vessels had short lives before the 18th century. Two years without care and the bottom timbers exposed to the sea would be mined with tunnels.

To take the bite out of these borers, shipbuilders from the Columbus era through the 1850s used wood sheathing. Planks of pine or fir were attached to the hull, with hair and pine tar sandwiched between.

In 1758, the first copper sheathing was mounted to warships, using tar paper over the wood sheathing. Though costly, copper was so effective in preventing teredo boring that by the



1790s, most British naval ships were sheathed with the metal. However, only a few well-built merchant ships could afford this kind of protection.

Pitch and tar, the standard preventive treatment for Colonial craft, protected the hull as long as no bare wood showed. But the coatings had to be reapplied often.

To protect the keel timber, mariners attached a worm shoe. This sacrificial timber, which is still used today, attracted shipworms away from the keel.

Portuguese and Japanese ship owners, although worlds apart, careened their vessels at the highest tide and surrounded them with straw. Then they set the straw afire. Their hope was to boil or steam the teredos to death in their tunnels without destroying the boat.

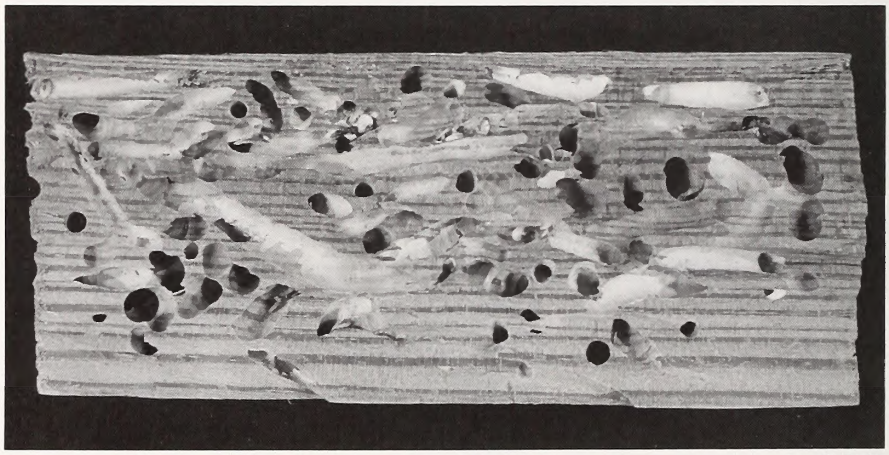
Baltimore shipwrights, using an old Chinese treatment, brushed a bottom paint made of cayenne pepper and shellac on their hulls. Geoffrey Scofield, former curator of historical maritime technology at the N.C. Maritime Museum, said that pepper was added to cheap paint and used as a preventive in Caribbean islands. These traditional methods are still applied today.

Georgia boatbuilders waited for the cold. When night temperatures were expected to drop below 26 F, they hauled vessels from the water. A freeze was considered successful if, in the warming of morning, slime oozed from hundreds of pinpoint holes in the hull. Then, each hole was laboriously scraped and sealed.

Of course, one of the oldest and most energy-efficient ways to protect a vessel was, and is, to sail up a freshwater creek and dock there for three or four weeks. Marine borers have a low tolerance for fresh water. However, they can seal themselves up for weeks in poor environments. Although most borers prefer a normal seawater salinity of about 35 parts per thousand, some species can survive at least a month in brackish water of four parts per thousand. For effective treatment, mariners should locate flowing rivers of fresh water, not tidal currents in which the water frequently contains salt.

Today, the most effective and controversial treatment for avoiding shipworm damage is the use of anti-fouling paints. Copper-based paints release metal ions into the adjacent water, preventing organisms from surviving on the painted surface. But copper, even in paint, is very expensive and has a short life span.

Shipyards were experimenting with lead compounds by the 1700s. Longer-lasting heavy metals, such as arsenic, mercury and lead, were incorporated into paints. But these metals are hazardous to workers preparing and applying them and are now banned.



A piece of wood riddled with holes from shipworms and gribbles. Scott D. Taylor

Recently, extremely toxic tributyltin (TBT) was incorporated into anti-fouling paints. Tests showed that TBT kept a hull free of surface organisms and prevented shipworm damage up to four years, but leaching of TBT into estuarine water, even in extremely low amounts (such as a few parts per trillion), can harm crabs and oysters. The use of these paints has now been restricted.

The biology of shipworms can explain why wooden ships have problems and how some cures work. First, shipworms are bivalves, or two-shelled mollusks, related to clams and oysters.

The animal consists of three basic parts: valves, a wormlike body and

pallets. The two shells are just boring tools. The edges of these shells have small teeth that rasp wood efficiently. The long, soft body extends in length from inches to feet, depending on age, environment and species. At the end nearest the outside of the hull, each teredo has a pair of calcified pallets that act as a plug in times of distress.

Otherwise, two siphons, sort of biological straws, extend into the outside water; one sucks in water for breathing and feeding on microscopic plankton, and the other flushes wastes. Contrary to popular belief, wood dust is not the major part of their diet.

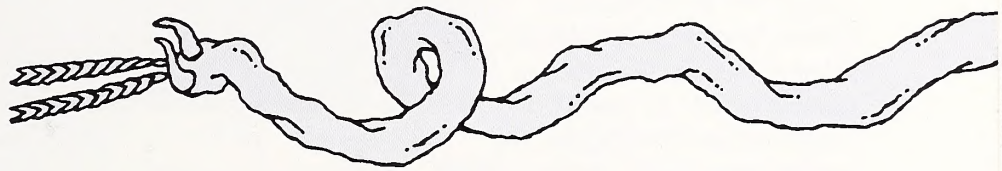
Scientists and engineers are trying to devise new preventive treatments that do not degrade the marine environment. Meanwhile, wooden boats continue to be vulnerable to borers.

Shipworms vary in their reproductive patterns. In some species, fertilization of eggs and sperm occur in the water; in others, eggs are fertilized in the body. Either way, shipworms produce up to 100 million eggs per female.

The fertilized egg develops into a free-swimming larva, moving weakly in the currents with tiny beating hairs called cilia. After two or three weeks, it assumes an adult form, loses its swimming ability and finds a wooden home.

As with oyster larvae, luck plays a major role in finding suitable settlement. Tiny shipworm larvae could land on mud or rock or drift away in ocean currents, in which case they will not survive. Landing on chemically treated wood is just as lethal. Or the wood can be too crowded with other fouling organisms to provide a secure spot for shipworm larvae. Strong currents can carry larvae away before attachment; likewise, ship movement makes attachment difficult. Shipworm infestation occurs when ships are moored. Thus, the transformation period from swimmer to burrower is the weak link in the life of the shipworm.

When the larva or young adult shipworm finds a suitable spot, its shape continues to change. The shells become rasping tools, and the ciliated swimming parts disappear. It digs a tiny hole, just large enough to admit its body. As the shipworm lengthens and enlarges its internal burrow as it grows, the outside hole through which it entered remains the same size — about the diameter of a pinhead.



The shipworm lines its burrow with a calcareous coating. *Bankia setacea,* the major shipworm north of San Francisco, can grind and line a burrow up to 6 feet long. The burrows of *Teredo navalis,* common in the Chesapeake and warmer waters of the Atlantic and Pacific, measure 1 to 2 feet in length. If the lining is worn or the outside hole enlarges beyond the capacity of the pallets to plug it, then shipworms are exposed to predation and the vagaries of water quality.

Shipworms are found worldwide. Wooden ships, floating logs and ocean currents have carried the adults and larvae to all oceans, seas and estuaries. Temperature, salinity and the availability of wood are the limiting factors to their spread. Larvae are more susceptible to extremes in temperature and salinity, but adults are considered tolerant. Shipworm damage is more common and more quickly accomplished in warm, tropical waters.

No one knows the limits of depth distribution. An unknown species of boring clam digested the *Titanic's* elaborate woodwork on the ocean floor at a depth of 13,000 feet.

Gribbles (*Limnoria lignorum*) are different from shipworms in their life biology. Gribbles reproduce more like crabs. The female broods hundreds of fertilized eggs and then releases well-developed young into the water. They are able to start burrowing into suitable wood surfaces immediately. They actually use wood as food. As with shipworms, the critical period for gribbles is their search for hospitable habitat. Coated, covered or painted surfaces deter the young from boring that initial hole and entering the wood.

Research continues on shipworms and gribbles. The economic impact on wooden structures such as boats, pilings and bulkheads is enormous. Borer-resistant woods, such as the trees from Fraser Island, Australia, are available and were used in pilings for the Suez Canal.

Scientists and engineers are trying to devise new preventive treatments that do not degrade the marine environment. Meanwhile, wooden boats continue to be vulnerable to borers. Regular inspection and use of an anti-fouling paint on the boat's bottom can prevent infestation.

(This story was originally printed in WoodenBoat Magazine.*)*

New Laws Making Waves With Marinas

Coastal marinas are a flash point in the simmering debate over water quality.

In the eyes of boating enthusiasts, they're a safe mooring place and a valuable point of entry to open water. To some others, the contaminants that seep from marinas are a threat to productive estuarine waters.

Both points have merit, says Rich Novak, a Sea Grant marine advisory specialist. Yet it's possible to have easy marina access and measures to keep the water clean of boaters' sewage and polluted runoff.

Increasingly, state and federal laws are shepherding marinas toward environmentally sensitive management practices that will protect our coastal waters and natural resources. The impacts of these laws can be felt all along North Carolina's coast, where more than 300 marinas rent slips and provide commercial services.

But many marina operators are still in the dark about the changing regulations. Novak and Spencer Rogers, Sea Grant's coastal engineering specialist, want to take the message to the docksides.

"Marinas are a congregation of people," Novak says. "And with that comes the potential to pollute. Whether we say they're polluting or not, we see potential because marinas are on the water and could cause problems."

First, Novak is educating boaters and marina operators about the Clean Vessel Act. Backed by Congress, this program will offer $40 million in grants over five years to help states build pumpout and dump stations for boaters' sewage and educate them to use the equipment. Pumpout stations are used to pump the waste from holding tanks; dump stations are used to empty portable toilets.

Pumpouts are available at 40 of 181 coastal marinas that responded to a recent survey by the N.C. Division of Coastal Management. The surveys were sent to 293 marinas in the coastal counties. Among those responding, 25 had pumpouts open to the public.

Doug Yoder

Typically, marinas install pumpouts when they seek a permit to renovate or build, Rogers says. But use is low because an estimated 90 percent of boaters still dump their waste overboard, often in violation of federal law.

The Coastal Management survey found that pumpouts were used about 1,300 times in 1991. The fee, ranging from free to $50, was the most influential factor in the use of public pumpouts.

The survey also found that 14 of the responding marinas planned to install pumpout services within the next two years. Among the 103 that didn't offer the service, 79 percent cited lack of demand as the reason.

"The marinas haven't seen an increase in requests for pumpouts," Rogers says. "In part because of that, they've not seen fit to invest $5,000 to $10,000 on motorized equipment and connections to land-based treatment systems."

One point is clear, Novak says. Boaters must be educated to use the equipment and shoulder the responsibility for water quality.

Novak is part of a Sea Grant effort to secure pumpout funds for the region. The money, awarded by the U.S. Fish and Wildlife Service, is part of the Wallop-Breaux fund raised through taxes on fishing equipment and fuel.

But boaters' sewage isn't the only water quality concern for marinas. Polluted runoff, also called nonpoint pollution, is another.

Novak explains that marinas can contaminate water by sandblasting and cleaning boats with toxic bottom paints and other pollutants. Also, fuel can spill into the water, and the paved area is an easy avenue for pollution to wash away.

As a result, marinas are being called on to engineer stormwater runoff plans and impoundments.

North Carolina is among 29 states with a federally approved coastal zone management program that must submit new nonpoint pollution control programs to the Environmental Protection Agency and the National Oceanic and Atmospheric Administration by July 1995. Congress required this in its Coastal Zone Act Reauthorization Amendments of 1990.

If marinas are heavily renovated, they may be subject to stricter siting and design standards suggested by EPA. The EPA guidelines may be adopted as law by most states, but boating interests have a two-year window to negotiate, Novak says. The nonpoint pollution control programs must be in place by 1999.

Jeannie Faris

Outer Banks Wild Cats

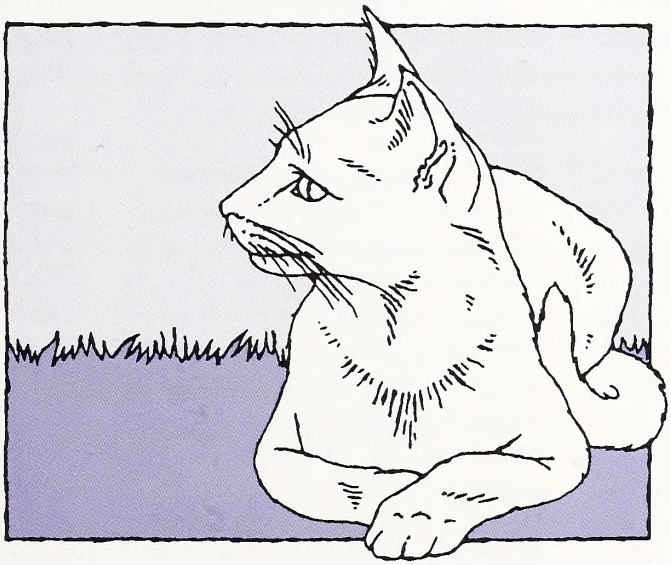
Mary Willis' husband calls her the saint of Frisco. Debbie Martin is known as the cat lady of Avon. And Ocracoker Margaret Harris is best known by her 25 adopted "Ocracats." Though other feline fanciers dwell in these Outer Banks villages, these three women have a greater common bond — a soft spot for stray and wild cats and a commitment to curb their numbers through spaying and neutering.

With collection jars placed in community motels and restaurants, each of these cat lovers has raised money to spay and neuter feral cats roaming Outer Banks back yards and back alleys. Martin's organization, Friends of Felines, has "fixed" more than 75 cats in its four years of existence; this year Avon's ferals are given rabies shots as well. Harris estimates she's spayed or neutered about 30 cats on the island since forming Ocracats in January. And Willis of CATS (Citizens Advocating Trapping and Sterilization) has fixed about 85 Hatteras strays, 60 of which were treated with money collected since April 1992.

"I figure that's at least 500 or 600 kittens that aren't being born this time this year," says Willis, who patterned CATS after a national nonprofit organization called Alley Cat Allies (ACA). ACA advocates stabilizing the United States' estimated 60 million feral cats through sterilization. A feral cat is simply a domesticated cat that has gone wild or was born in the wild.

Willis says tourists have given generously to the cause and that some residents are more receptive to and tolerant of the sterilized ferals, especially the stray males, which before they were neutured "sprayed" urine on boats in a local marina. The caterwauling of many females in heat has also subsided.

"After they were spayed and neutered, everyone's attitudes toward the cats changed," says Willis, adding that vaccinations for rabies, which is on the increase in some coastal areas, are provided now too. "They are keeping the rat population down. It has just made such a difference."



Many of the cats are trapped and sterilized at the request of residents, who are often happy to feed the felines, but either can't or won't pay the fee for spaying and neutering or are unable to apprehend the strays. As time permits, Harris says she also tries to tame and place the animals in homes.

Overpopulation of cats is a worldwide dilemma, but ferals pose a unique problem on North Carolina's barrier islands. The Outer Banks are cramped quarters for this prolific species; the spits of seashore are also host to many tourists and much transience. Cottage renters often leave or lose pets, and irresponsible cat owners find dense parkland and maritime forests an irresistable dumping ground for unwanted kitten litters.

"People who abandon cats delude themselves into thinking the animal finds a nice home and is happy," says D.D. Shumway, a Hatteras veterinarian who offers reduced fees to CATS and Friends of Felines.

The Humane Society of the United States estimates that one unspayed female cat and her offspring can produce 420,000 kittens in seven years. Given these numbers, the cat sterilization advocates are doing a service to the community. Willis says her activity has positively influenced pet owners on the island to spay or neuter their companions; she distributes reduced sterilization certificates from Friends of Animals to sweeten the deal.

But not everyone is raving about the efforts of Willis and the other advocates. The Outer Banks SPCA (Society for the Prevention of Cruelty to Animals), which provides the area's animal control, frowns on the trap-sterilize-release programs.

"We don't feel that is the humane solution," says President Gail Kowalski. "When we do collect a feral cat, that animal is euthanized as quickly as possible to lessen the chance of injury and minimize stress.

"I think the important thing that a lot of people do forget is the ultimate welfare of the animal," she says. "Humans feel better in themselves spaying the animal and turning it loose."

Continued

Kowalski says it is hard enough to find homes for the shelter's docile strays and contends that ferals are dangerous and breed disease.

"I guess the basic philosophy difference is some people say cats are not meant to live in the wild — that a cat without a human companion is not living a full life," says Shumway. "There are others who say yes, cats make fine pets, but they also live a happy, complete existence in the wild. As a veterinarian I can see both points of view. They are both aiming toward the same goal, which is reducing the population of feral cats."

Just up N.C. 12 at Pea Island National Wildlife Refuge, feral cats are caught in Havahart (cage) traps and shot, says park biologist Bob Noffsinger. Removal of non-native species is consistent with park policy. The number of feral cats in the refuge is not known; Noffsinger estimates 10 to 12 have been exterminated within the past year.

Feral cats are blamed for the destruction of the eggs and young of nesting waterbirds such as gadwalls and black ducks, he says, adding that feral cats also prey on stilts and other wading birds, although they've never been caught in the act.

"Not very often do you see a predator take something out there," says Noffsinger, adding that the only other culprits might be raccoons and the occasional mink. If raccoons become a problem, they will be relocated. Noffsinger says there is no appropriate place to relocate feral cats.

Ries Collier, a biologist at Cape Hatteras National Seashore, says that the loss of piping plover nests shows "a fairly clear indication of cats." He says the seashore's only direct control program to date has been predator-proof trash cans at fish cleaning stations along the beach.

Statistics linking feral cats and free-roaming housecats to the destruction of wildlife and songbirds are copious indeed. The mere title of a 1992 article in *American City and County* magazine is chilling: "Feral Cats and Silent Spring." In it, a Golden Gate Audubon Society spokesman attributes the extermination of wrens in a San Francisco park to the resident feral cat colony. Another Bay area naturalist quoted in the article estimates that millions of birds are destroyed each year by both feral and pet cats.

But evidence from the other side of the fence suggests that feral cats are sometimes unfairly left holding the bag of blame for bird mortalities. For example, in San Francisco's Golden Gate Park, decline in bird numbers also coincided with new park landscaping that altered habitats and food sources, according to a 1992 article in ACA's newsletter, *Alley Cat Action*. Ferals are a visible, convenient target, says ACA; since canaries warned coal miners of deadly gas levels, birds have been considered "indicators" of ecological distress.

N.C. State University zoologist Roger Powell says free-roaming pet cats are probably a bigger hazard to birds and small mammals than feral cats. A well-fed pet cat that goes outdoors will still hunt, and in urban areas with less wildlife habitat, even slight predation can be detrimental.

Free-roaming pet cats can be as dense as 200 per square mile, says Powell. "The density of feral cats is going to be relatively low," he says.

The trap-sterilize-release philosophy adopted by ACA and the groups on the Outer Banks is based on a method now used in parts of the United Kingdom and South Africa. Adopted after extermination of colonies failed to rid areas of feral cats, the method is advocated by some veterinarians and zoologists. ACA and its supporters believe that as long as there is a food source — be it garbage, rodents or birds — other ferals will move in to claim the territory and breed to carrying capacity. The premise is that a sterilized colony will be healthier — because of reduced mating and fighting — and keep out encroachers. But trap-sterilize-release programs are encouraged only in areas where there are people who agree to feed the animals.

The situation of ferals on the Outer Banks may be another story. Feral cats are opportunistic feeders with an extremely varied diet. On small islands with flightless and ground-feeding birds and few or no native predators, the effects of feral cats can be harmful.

"One of the most bizarre examples was the discovery and extinction of the Stephen Island wren ... by a single domestic cat," writes Andrew Kitchener in *The Natural History of the Wild Cats*. "This tiny island in the Cook Strait of New Zealand was home to an almost flightless native species of wren. In 1894, a lighthouse keeper arrived on the island with his cat, which dispatched the entire population."

The impact of feral cats varies by situation and is dependent on many factors, including available prey and geography.

Feral house cats are one of five non-native species cited in *Birds and Mammals of the Cape Hatteras National Seashore*, a 35-year inventory of the park's fauna. The others — which are also food sources for cats — include the house mouse, Norway rat, black rat and nutria. Though the effect of these non-natives is not well-known, it is "not natural and therefore probably not beneficial," writes co-author James Parnell, a University of North Carolina at Wilmington ornithologist.

Though the debate over whether to sterilize or euthanize is fierce, both factions are drawing attention to a problem — uncontrolled feline breeding — that has everything to do with people and little to do with cats.

Carla B. Burgess

Sea Grant Hosts Zebra Mussel Conference

Industries and municipalities that pump large volumes of water would be hardest hit by an infestation of the zebra mussel, which can clog intake pipes and reduce pumping capacity. Already, millions of dollars have been spent in the Great Lakes to control the mussels and repair the damage to water treatment facilities, power plants, farms and other large-scale water pumping facilities.

But operations in the mid-Atlantic can take precautions against these costly non-native mollusks.

The Sea Grant programs of North Carolina and Virginia are hosting a conference to inform large water-users of the latest zebra mussel findings and to provide the most effective means of monitoring and control.

The conference will be held June 17-18 in Greensboro. Among other topics, experts will discuss the mollusks' impacts on agribusiness, pulp and paper industries, golf courses, water treatment, power production, aquaculture and navigation.

Control methods — chemical, mechanical and filter — will also be discussed.

For more information, call Barbara Doll, Sea Grant's coastal water quality specialist, at 919/515-5287. Or write Sea Grant at Box 8605, N.C. State University, Raleigh, NC 27695.

N.C. 4-H Sailing and Marine Science Camp

Summertime means great weather to enjoy the outdoors and camp. And this summer, the N.C. 4-H Sailing and Marine Science Camp is offering 11- to 16-year-olds the thrill of learning to sail and of exploring the wonders of the water beneath their sailboats.

This June 20-26 camp combines the basics of sailing with classes, field trips and laboratory studies designed to teach youngsters about coastal resources and the complexities of a salt marsh. They learn to sail a Sunfish, and as their skills improve, advance to a catamaran. Campers also have a choice of camp activities such as swimming, canoeing, archery and ropes.

Special features include field trips to the N.C. Aquarium at Pine Knoll Shores, the N.C. Maritime Museum in Beaufort and the Croatan National Forest; a ferry ride to Hammocks Beach; lessons in setting up and maintaining saltwater aquariums and touch tanks; and exploration of marine science careers.

The facilities, located near Swansboro, are accredited by the American Camping Association. Campers should register on June 20, 2 to 4 p.m. The fee is $185. Space is limited to the first 110 paid applicants. Registration includes meals, lodging, insurance, field trips and equipment fees.

For more information, talk to a county Cooperative Extension Service 4-H office. Or contact Martha Warner at the Department of 4-H Youth Development by writing Box 7606, NCSU, Raleigh, NC 27695-7606 or calling 919/515-3243.

Friends of the Museum Sailing Program

Friends of the Museum is sponsoring a junior program this summer to teach 8- to 15-year-olds to sail on Optimist dinghies built in the watercraft center of the N.C. Maritime Museum.

The Optimist is the most popular junior training and racing pram in the world, with over 250,000 built since 1947.

The sailing program is designed for beginners and uses the fun of sailing and the competition of racing to teach seamanship, navigation and maritime traditions to young sailors. It also opens the door to a sport that can provide a lifetime of pleasure while helping youngsters develop an attitude of self-reliance and appreciation for the forces of nature.

The program director is certified by the U.S. Sailing Association as a Level 1 Dinghy Instructor and is certified by the Red Cross in first aid and CPR. Instruction will stress boating safety as well as sailing skills.

There will be four two-week courses, each with a morning and afternoon class, Monday through Friday.

Session I runs June 14-25, Session II runs June 28-July 9, Session III runs July 12-23 and Session IV runs July 26-Aug. 6. Cost for the two-week session is $100 per person. Children or grandchildren of Friends of the Museum members may participate for $90. Contact the museum, Monday through Friday, for an application. Either write the N.C. Maritime Museum, 315 Front St., Beaufort, NC 28516, or call 919/728-7317.

Sea Grant Publishes Zebra Mussel Fact Sheet

Reams of information have been published about the zebra mussel, from its destructive colonization of the Great Lakes to its voyage south through freshwater avenues. But until now, little had been written about the possibility for a colonization of the mid-Atlantic region, which includes North Carolina.

The *Mid-Atlantic Zebra Mussel Fact Sheet*, published by UNC Sea Grant, is tailored to the East Coast region that also encompasses Virginia, Maryland, Delaware and New Jersey.

The six-page fact sheet was authored by Coastal Water Quality Specialist Barbara Doll, who drew on the expertise of Sea Grant staff in the

Continued

other mid-Atlantic states.

The publication explores the possible routes of entry the zebra mussel might take into this region and examines the environmental characteristics that would make the mid-Atlantic a hospitable host for the prolific mollusks. It also explores the mollusks' biology, reproduction, predation and dispersal methods, as well as the impacts of colonization on the region and possible control measures.

A native of the Black, Caspian and Aral seas, the zebra mussel most likely arrived in the United States in the mid-1980s through the discharge of European shipping ballast water. They were discovered in Lake St. Clair in 1988 and have spread rapidly into several major river systems.

The fact sheet will help boaters, property owners, educators, extension workers and large water-users who might be impacted by the small, striped mollusk. The threat to the region lies in the zebra mussel's ability to thoroughly colonize hard surfaces, ruin equipment and block water intakes.

The *Mid-Atlantic Zebra Mussel Fact Sheet* is free in quantities of 10 or less. Larger orders will cost 35 cents per fact sheet. To order, contact Sea Grant, Box 8605, NCSU, Raleigh, NC 27695. Ask for publication UNC-SG-FS-93-01.

Get A Taste of Strange Seafood

If you think sea lettuce soup will tingle your tastebuds or a periwinkle appetizer will leave your mouth watering, then buy tickets to the 17th annual Strange Seafood Exhibition at the N.C. Maritime Museum in Beaufort on Aug. 17.

Each year, the buffet of unusual ocean edibles attracts hundreds of hungry tasters. Attendees feast on exotics such as sea urchin, whelk, stingray, eel and mullet pluck, the gizzard of the mullet.

The annual August event has become so popular that the Maritime Museum has begun limiting attendance to 250. Tickets for the Strange Seafood Exhibition go on sale June 1 at the museum for $15 each.

For more information about the exhibition, call the museum at 919/728-7317.

Sea Grant Launches Newsletter: *WaterWise*

Water quality is an ever-growing concern among people who love the coast. But now more than ever, there's an urgency attached to understanding what's happening to our coastal and marine waters.

To fishermen, both commercial and recreational, water quality has a bearing on the quality and availability of the catch. And it's weighty business to industries and local governments required by law to keep pace with new regulations that can be complex and far-reaching.

UNC Sea Grant has launched its latest newsletter, *WaterWise,* out of a recognition that topical water quality information will help North Carolinians make wise decisions about their coastal resources. The free, quarterly publication targets an audience of municipal and county planners, policymakers, businesses, developers affected by water quality regulations, environmental organizations and state regulators. Its contents are relevant to anybody who has more than a passing interest in water quality and coastal resources issues.

Each edition of *WaterWise* will look in-depth at a timely water quality issue, giving it perspective and describing related research. News items and a calendar of events will also be included.

The inaugural issue looks to the future and the prospect of ocean outfalls, a system to collect and treat regional wastewater and release it into the ocean. The disposal of domestic wastewater into the coastal zone has become a crucial component in the balance between economic development and the protection of precious coastal habitats. Ocean outfall is a relatively unexplored disposal alternative in North Carolina.

Upcoming issues will be devoted to other topics of concern to the Tar Heel coast, such as the toxic dinoflagellate that kills fish in our waters.

Barbara Doll, Sea Grant's coastal water quality specialist and editor of *WaterWise*, will draw on Sea Grant's staff for expertise in marine extension, education, law and policy — as well as outside sources of information. To get onto the mailing list and receive a back copy of the first issue, contact Sea Grant, Box 8605, NCSU, Raleigh, NC 27695.

Sea Grant Researcher Authors Book

Sea Grant researcher David Griffith, an anthropologist at East Carolina University, has authored a book, *Jones's Minimal: Low-Wage Labor in the United States*, published by the State University of New York Press.

The book addresses how employers in the U.S. seafood and poultry processing industries use race, gender, ethnicity and institutions of the state and the church to manipulate workers' networks and communities, and ultimately, to control the supplies and characteristics of their labor.

Griffith pays particular attention to the growing use of new immigrant workers, women and minority workers in these food processing industries.

The book costs $14.95 in paperback and $44.50 in hardcover. It can be ordered from State University of New York Press, c/o CUP Services, P.O. Box 6525, Ithaca, NY 14851. Add $3 to cover the cost of postage and handling.

Wood vs. Acrylic

I finished reading *Chemical and Engineering News* and began reading *Coastwatch* (Jan./Feb. issue). On page 20, Joyce Taylor recommends cutting raw seafood on an acrylic cutting board, never a wooden one. Apparently the people at the University of Wisconsin recommend just the opposite. Who's correct?

H. Edwin Carley,
Chalfont, PA

You have raised an excellent question, one we don't have a clear answer for now. For those of you who haven't read about this controversy, University of Wisconsin (UW) researchers have found that bacteria have a greater survival rate on acrylic cutting boards than on wooden ones. This is contrary to what experts have been telling the public. They believed that disease-causing bacteria which soaked into porous wooden surfaces would later contaminate other uncooked foods cut on the surface, such as salad ingredients, if the board was not adequately cleaned. Plastic, they thought, was less hospitable to bacteria. But not so, say UW scientists. They claim bacteria disappear quickly from the surface of wooden cutting boards, without sanitizing and for a yet unknown reason .

David Green, Sea Grant's seafood technology specialist, and Joyce Taylor, Sea Grant's seafood education agent, say they want to hold judgment on the study until more scientific information is published. A paper is being prepared for the Journal of Food Protection *that will provide details about how the study was conducted, the conditions of the boards used and other factors, such as temperature. These variables could greatly affect the outcome of the study. Green, for instance, would like to know the conditions of the wooden boards. Were they new and smooth? Or were they older boards full of nicks and cuts? Until the paper is published and the study is validated by other researchers, Green and Taylor say home cooks can use either type of board. Green stresses that it is not the type of board used, but how well it is cleaned after cutting meats and seafood that makes the difference. Under commercial conditions, public health regulations require food-contact surfaces be smooth and readily cleanable, a condition which disqualifies wood. Rest assured that Sea Grant's seafood experts will be watching for further information on this controversy and that* Coastwatch *will offer you that information as soon we can.*

Reply Not Good Enough

I just received your Jan./Feb. '93 issue of *Coastwatch*. I noticed you decided to respond to my letter by placing it in your letters column and letting your readers decide.

Your reason stated for not mentioning the Year of the Indian is unacceptable. You fail to realize the significance of the proclamation signed by the president. This honor was for all American Indians, past and present, and I feel strongly you could have added a great deal more to your Sept./Oct. issue by calling your readers' attention to the special year. Instead you chose to ignore it, and in effect denied the Carolina Indians the honor. It's like saying, "It's not for you."

Well, the Year of the American Indian has passed but will not be forgotten as long as I'm around.

Another event is coming up. Full moon March 8 begins the Algonquian Indian New Year 12,897. We share this with everyone. If you would like to celebrate the new year, we welcome you to do so.

Pat Rollingcloud,
Pittsboro, NC

I know you find this hard to believe, but none of the Native American experts, archaeologists or Native Americans that we interviewed for our articles mentioned this proclamation. And since our focus was primarily on Native American history prior to English contact, we saw nothing about the proclamation in our background reading.

Obviously, you put great store in this presidential proclamation. But we felt it was better to honor North Carolina Native Americans by dispersing accurate information about their history and their tremendous contributions to our present society.

Liked Fishing Issue

The recent issue of *Coastwatch* on commercial fishing was very good. You managed to present an even-handed report on the business, which is rare to see these days. I've been shrimping here in Beaufort, S.C., for 16 years, putting my degree in psychology from N.C. State University to great use. Keep up the good work.

Steve Kerchner,
St. Helena, SC

Coastwatch *wants to hear from you on topics relating to the North Carolina coast. Letters should be no longer than 250 words and should contain the author's name, address and telephone number. Letters may be edited for style. Send all correspondence to* Coastwatch, *UNC Sea Grant, Box 8605, N.C. State University, Raleigh, NC 27695. Opinions expressed on this page are not necessarily those of UNC Sea Grant employees and staff.*

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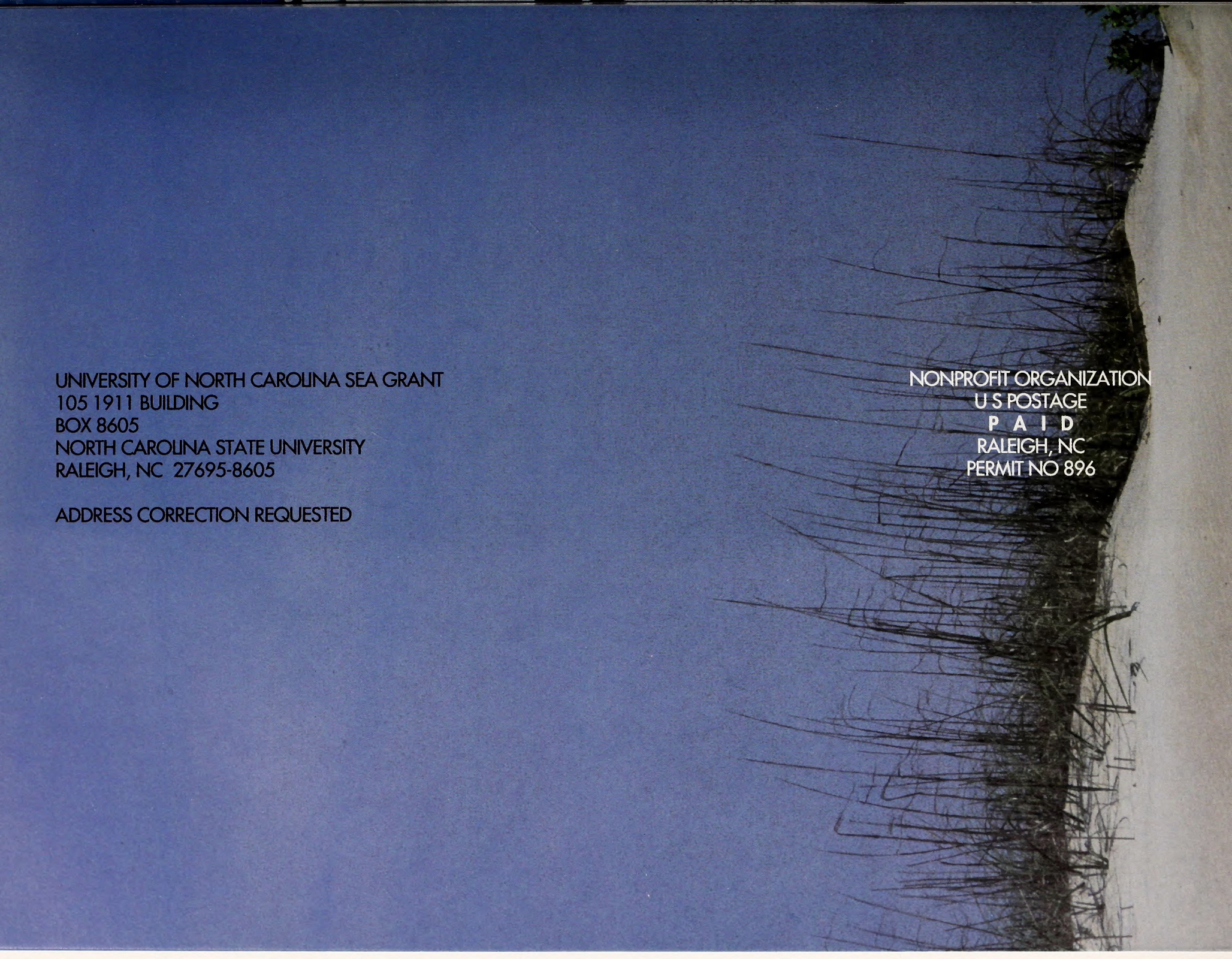

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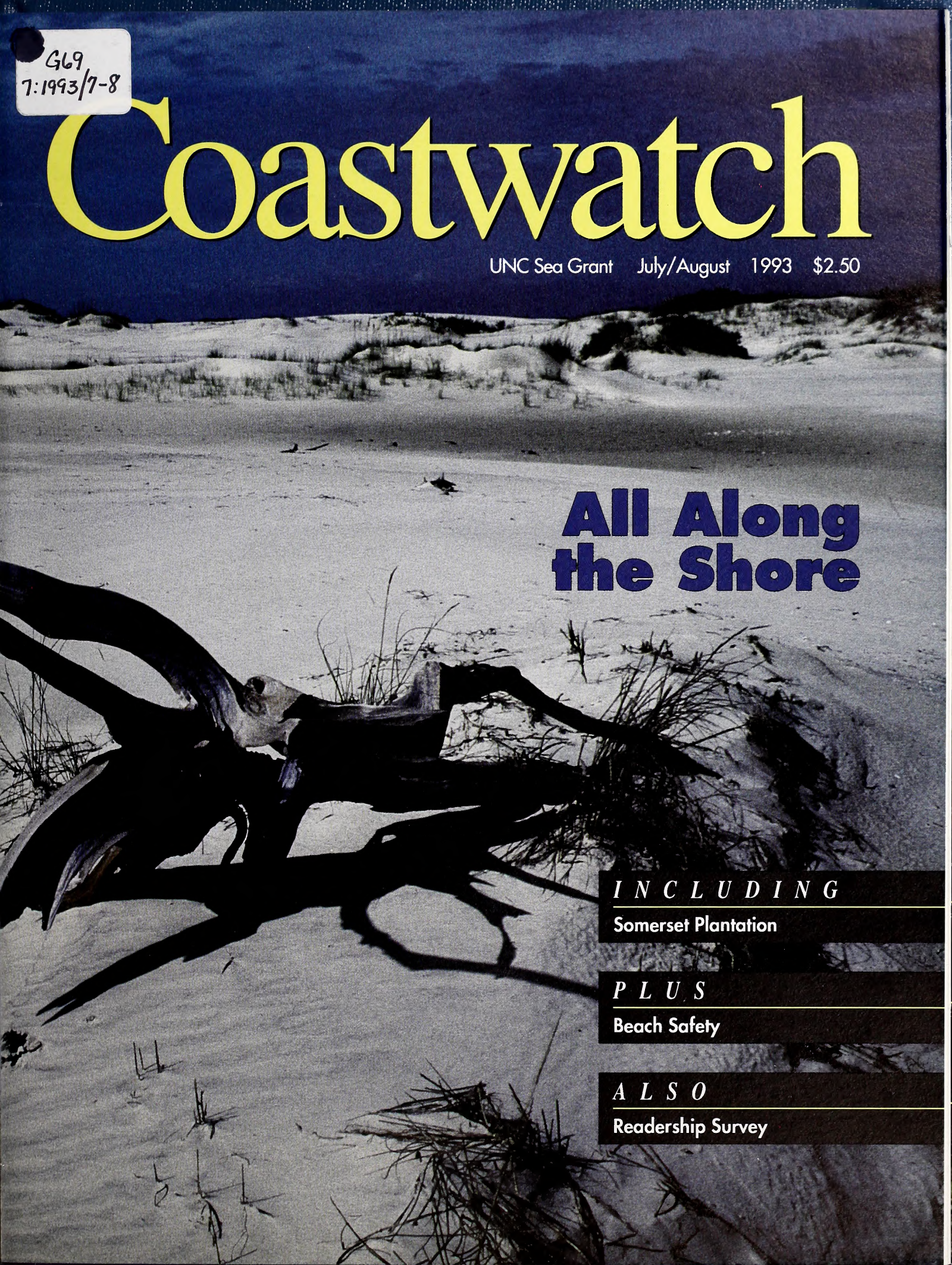

All Along the Shore

INCLUDING

Somerset Plantation

PLUS

Beach Safety

ALSO

Readership Survey

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from the top

Dear Readers:

Is a coastal vacation on your summer schedule? If it is, be sure to take your *Coastwatch* along as a guide to seaside critters, beach safety and a historical site called Somerset.

First, Jeannie Faris provides a field guide to the creatures that live and feed along the beachfront, from the base of the dunes to the breaking waves. This inhospitable habitat where land meets sea is home to a host of critters — ghost crabs, velvet ants, willets, mole crabs — capable of withstanding crashing waves, arid sands and the wax and wane of the tides.

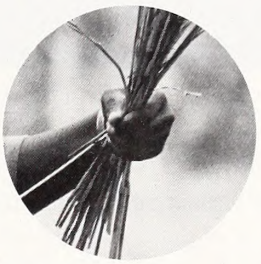
Outside the Albemarle town of Creswell, Carla Burgess introduces us to a historic plantation called Somerset and an energetic woman, Dot Redford, intent on educating visitors about plantation life and, most importantly, about the people — the African slaves — who made it thrive.

Back at the beach, I familiarize readers with the rules of the sand. Understanding currents, exercising restraint and knowing your own physical limitations can go a long way toward making your beach vacation a safe and happy experience.

We have a correction from our last *Coastwatch*. In the story about North Carolina lighthouses, it was stated that only three of the seven lighthouses still flash their beams. That's incorrect. Six of the lighthouses are in working order. The Cape Lookout Light flashes 24 hours a day. The Currituck, Bodie Island, Cape Hatteras, Ocracoke and Oak Island lighthouses flash from dusk to dawn and in times of low visibility. Only the Bald Head Lighthouse is not operable. But many people think it does work because a regular light burns at the top of the lighthouse at night, giving it visibility from the mainland and the illusion of being operable.

Don't forget to mark your calendars for the First Citizens Bank Big Sweep, the nation's largest statewide waterway litter cleanup, Sept. 18 from 9 a.m. to 1 p.m. Cleanup sites will be scattered statewide, so choose one and make a dent in the accumulation of waterway debris.

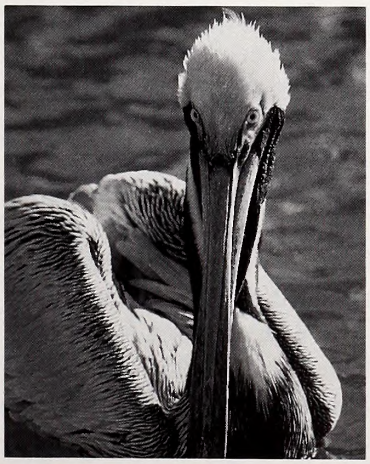
Until next time,
Kathy Hart



Page 10
Somerset Awakening

in this issue

Page 2
Coastal Creatures



Page 16
Summer Safety

Coastal

Scott D. Taylor

Ghost Crab

N.C. Wildlife Resources Commission

Osprey

By Jeannie Faris

Picture your favorite beach. Now think how you'd describe it to someone who's never been there.

Chances are, you'd paint a mental portrait of crystalline sand, dunes capped with sea oats, the quietening rhythm of waves, sun on the sea. The coastline you conjure is probably nature's sweeping collision of land, water and wind.

These small coastal wonders can be dwarfed by the sheer scale of the seashore. Though they don't leave footprints like ours, they do leave other clues of their presence.

But think again. What about the little critters that live in the sand and the shallow ocean waters? These small coastal wonders can be dwarfed by the sheer scale of the seashore. Though they don't leave footprints like ours, they do leave other clues of their presence.

Beachgoers can tune in to these clues and learn to identify and appreciate these creatures, says Lundie Spence, Sea Grant's marine education specialist. "You don't necessarily need a nature guide. Just be willing to get a little wet and sandy," she says.

The water's edge is a good place to start.

Scoop up a double handful of sand after a wave washes over. The tickling of little feet digging into your palm is a mole crab doing what comes naturally. This tiny crustacean, no more than 1/2 to 1 inch long, lives at the surf's edge and digs its body backward into the sand after a wave passes.

In that same handful of sand, you might find a few coquina clams — tiny, colorful mollusks that also bury themselves in the surf.

Creatures

Scott D. Taylor

Cabbage Head Jellyfish

Scott D. Taylor

Pelican

Both creatures rely on the sand to protect them and the sea to bring them food. And both are a tasty snack for shorebirds that socialize at the waterline and count on the outgoing waves to remove the sandy camouflage.

You can watch this high stakes hide-and-seek on any summertime day. These small creatures are permanent residents of the swash or intertidal zone, which is one of three distinct beach zones that are home to animals specially equipped to live there.

Equally compelling are the creatures that live in the shallows and wave-churned waters of the subtidal zone and the desert-dry strand of the supratidal zone.

intertidal zone

This is the area of beach where you build drip castles with wet sand or sit low in a lounge chair to cool your feet in the surf. It's where you feel your toes sink as a wave washes sand from beneath them.

The constant push and pull of sand is key to the survival of animals that live here. Waves lap at the sand, removing the creatures' protective cover and delivering food; tides reach high and then low again.

Few but the heartiest animals can live in this zone.

You can spot the mole crab in its shallow burrow by the V-shaped antennae it extends to filter backwash for plankton. Perhaps better known as the sand fiddler, it is not a true crab at all and has no pincers. This egg-shaped crustacean can be identified by gender by the orange patch of eggs a mature female carries on her underbelly in the summer.

The colorful coquina clam, only 1/2 to 3/4 inch long, is one of the smallest mollusks on the beach. It's also among the most vivid, with solid, rayed and ringed patterns in white, blue, yellow, red and purple. It digs into the sand with its foot and lifts its siphons into the water. Sometimes colonies as dense as 1,500 clams per square foot color the sands of Carolina beaches.

Many of us walk past the surf without giving a thought to these animals, but kids will spend hours digging them out of the sand, says Andy Wood, curator of education at the N.C. Aquarium at Fort Fisher.

"A kid will run up to his parents with a great big mole crab, and if they're not familiar with it, they'll say it's a pretty shell," Wood says. "And then when they flip it over and it moves all those wriggly legs, they start screaming. They tell the kid to put it down or he'll get pinched."

With a little experience, though,

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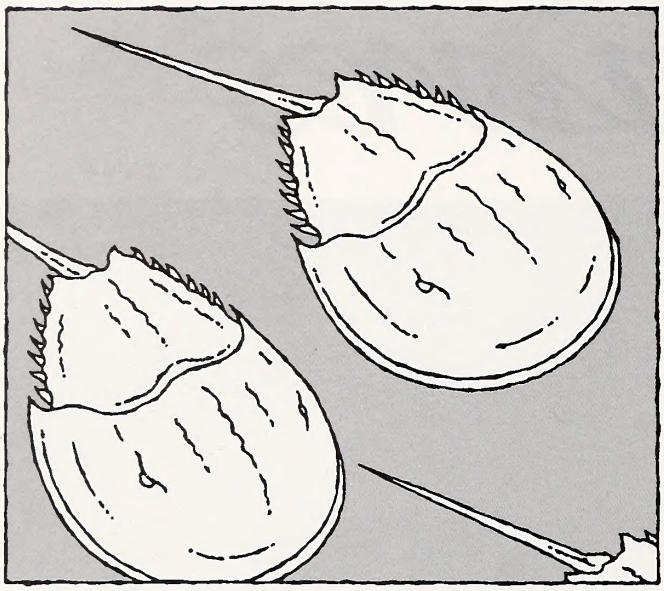
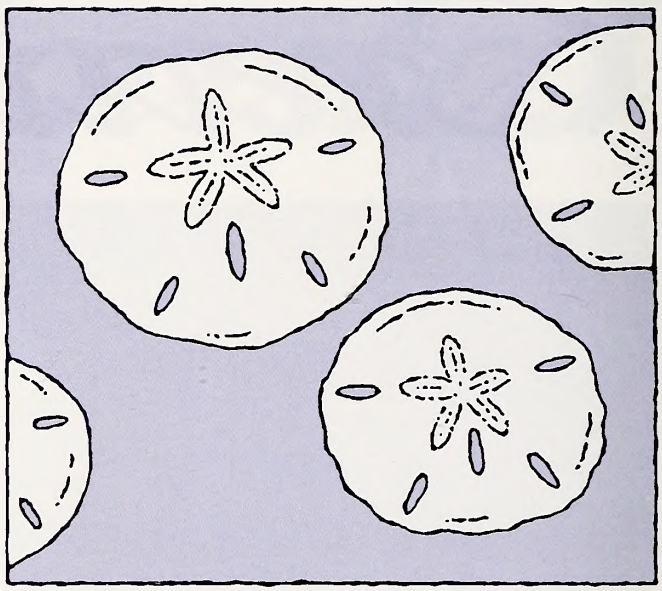


Horseshoe Crab



Sand Dollar

many parents take an interest in the marine life at the waterline and will join their kids there, bucket in tow, to hunt mole crabs and coquina clams, he says.

In their ever-shifting burrows, these creatures are also easy prey to the beak of the gray-and-white sanderling. This supercharged bird, only 2 or 3 ounces, skitters behind the waves to eat creatures exposed by the backwash. Unlike many shorebirds that feed in the marsh at low tide and the beach at high tide, the sanderling is primarily a beach feeder.

It can be seen fraternizing and eating with the ruddy turnstone, another common shorebird. The name turnstone comes from the bird's feeding habits — it turns over shells, stones and seaweed with its beak in search of beach fleas, fly larvae and other animals that are found in the drift line. Its distinctive black bill is short and slightly upturned. It appears to be wearing a black vest, with a black-and-white face mask and orange legs.

A third bird that patrols the shoreline is the willet, which is most easily identified in flight. Only then does it flash its unusual chevron pattern — a wide V — of white and black stripes across its wings. It stands a foot tall, considerably larger than the sanderling, and wanders the waterline probing with a long bill for mole crabs and other small animals.

These birds entertain centerstage on nearly all North Carolina coastlines. But perhaps the best-known shorebirds are gulls and terns. Because they are similar in appearance — white with black or gray markings — they are frequently mistaken as the same bird.

"Most people don't know much about shorebirds," says JoAnne Powell, curator of education at the N.C. Maritime Museum. "They see terns diving, and because they're at the beach they think these are sea gulls. To them, terns are gulls."

But differences do set the birds apart.

For one, the tern is more slender than a gull and has a straight, slim bill and forked tail. The gull has a thick bill and square tail.

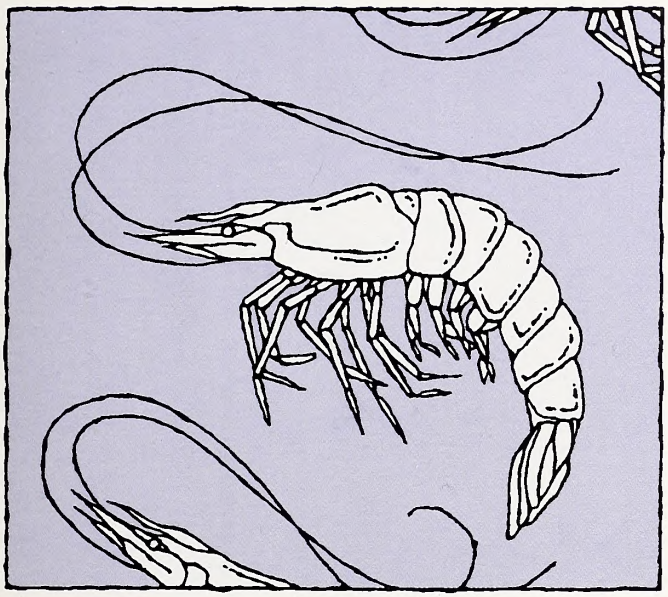
And any beach picnicker knows that a gull will circle overhead, begging shamelessly for scraps. It fishes occasionally, picking its prey from the surface of the water. But it primarily scavenges, gathering quickly at feeding sites in reply to the call of the first gull on the scene.

The tern, on the other hand, is a pursuit-oriented predator. It doesn't scavenge, but fishes with headfirst dives from the air. It typically swallows its catch while flying or takes it back to its offspring.

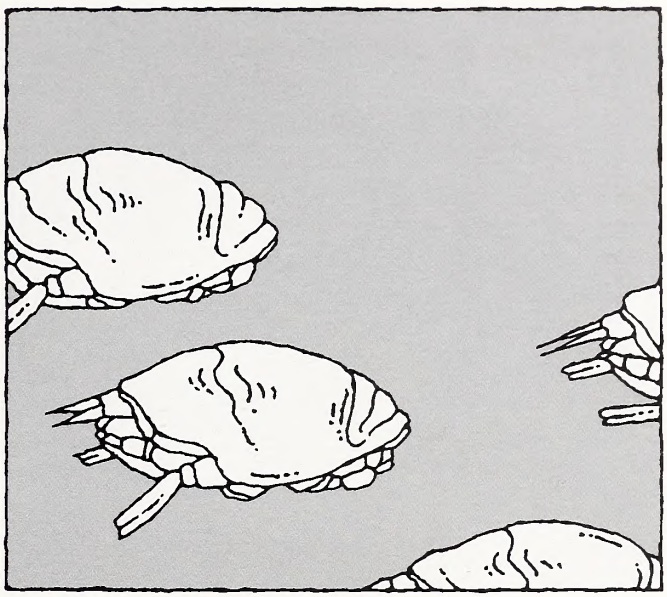
Gulls and terns also have different ideas about rearing their young. A parent tern, for instance, carries tiny fish in its beak and thrusts them into the youngsters' gullets. A gull simply regurgitates already-swallowed food onto the ground and the offspring scoop it up.

supratidal zone

This beach zone is where you see the oiled-down sunbathers stretched across blankets or matched



Shrimp



Mole Crab

off at a volleyball net — the region that reaches from the damp waterline to the arid dunes.

It is here that the desert beach community lives. And few species, most of them arthropods, can withstand the intense heat and light.

The ghost crab, though perfectly camouflaged, is perhaps the most familiar of these sand-dwelling residents. If nothing else, its front-and-back-entranced hole is a common sight to anyone who's spent time in the sand. Curious children sometimes mistakenly call them snake holes, Wood says.

With a sideways scurry on spindly, jointed legs, the ghost crab prefers to leave its burrow under the cover of darkness. But nature sometimes forces it to make light, feathery tracks across the sand during the day to wet its gills. It also steps out routinely for a detritus meal left by the last high tide or to sample beach fleas, mole crabs, coquina clams or sea turtle hatchlings.

The plant and animal debris that ghost crabs find so tasty arrives special delivery from the ocean on its two daily high tides. One of the richest food sources in the marine environment, this debris provides nourishment and protection for many creatures that live here.

The sand hopper scavenges these stranded remains and sometimes lives under them or in a burrow nearby. This 1/8- to 1-inch crustacean looks like a cross between a shrimp and a flea, and it can be seen hopping around the strand line when its hiding place is disturbed. Some can also deliver an itching bite.

At the dune line you can find the raised tunnel of the mole cricket, an insect that resembles its landlubbing namesake — the cricket. A vegetarian, this beach creature favors young roots and the seedlings of dune plants that it burrows under in the daytime.

The digger wasp also burrows under the scorching surface of the upper beach to the cooler sands where it keeps its young. The wasp will cover the burrow to protect the offspring from predators and parasites. It preys on flying insects, pulling them into the nest to nourish its larvae.

It shares these sands with the velvet ant, which is actually a fiery red wingless wasp with a painful sting. Its body is furred for insulation. The female lays her eggs in the nest of the digger wasp, where the hatchlings feed on the wasp's larvae.

Real ants are the spoils of the ant lion, a ticklike insect with grasping jaws that lies in wait for its prey at the bottom of a sandy funnel. When a hapless ant spills into the funnel, 2 inches wide by 2 inches deep, it cannot gain footing to climb out. The sandy-colored, 1/4-inch ant lion then has its next meal within reach.

The earwig, a slender, elongated insect with prominent pincers, gets its unusual name from an old tale that it crawls into the ears of sleeping children and sews them up. The 1/2- to 3/4-inch insect does prefer to step out at night, when it scavenges on beach and dune refuse or eats the larvae of other insects. It seeks shelter under the beach debris by day.

The beach wrack that sustains

Continued

N.C. Wildlife Resources Commission

Royal Tern

N.C. Wildlife Resources Commission

Black Skimmer

these upper-beach communities holds other treasures as well. When sargassum seaweed blows ashore on strong southeast winds from the Gulf Stream, its cargo can include tropical fish and other animals that use it for shelter, Wood says.

"Attached are all kinds of different animals and algae," he says. "And inside the clump, if you find it fresh, there's a chance you'll find dead fish or even live fish if they're still moist."

Look for a long-leafed, brown plant with tiny air sacs. Tangled within, you might see pipe fish, file fish, sea horses, crabs, snails and sea slugs. This landing is a great find for beachcombers, but it's a field day for the ghost crab and other scavengers that rely on the tides to deliver their next meal.

You might also see purple bubble shells washed in from the Gulf Stream, sometimes by the thousands, or stranded sea urchins, sand dollars and starfish bleached by the sun.

But perhaps the most remarkable sight you could encounter in this zone is a female sea turtle trudging ashore to lay eggs in the sand. This is a nighttime ritual that occurs during summer months on mostly undisturbed beaches. The endangered loggerhead and green turtles are two species that routinely nest on Carolina beaches.

Remember, if you happen onto this nesting ritual, turtles are disturbed by flashlights and voices. Give the turtle her space. And in 45 to 80 days, a batch of tiny hatchlings will dig out of the sand at night and head into the ocean, guided only by moonlight. The odds, however, are stacked against their survival. Hatchlings must maneuver an obstacle course over the sand and past hungry predators such as ghost crabs, gulls and raccoons. Nighttime is the right time to see many of these coastal animals – from ghost crabs near the dunes to fish in the shallows – because they're out looking for food. On dark nights, you can see hundreds of ghost crabs hunting in the swash or mole crabs glowing a faint green from their diet of bioluminescent microorganisms.

"This is a wonderful time to explore the beach," Powell says.

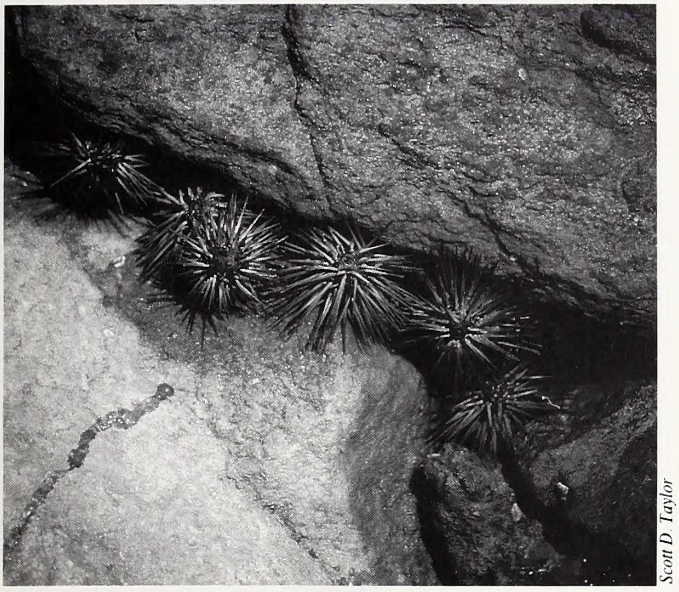
subtidal zone

This is the wettest of the three beach zones, where a raft serves you better than a lawn chair, and a wave carries you faster than your feet can. Here, where the waves churn shallow coastal waters, small fish and a bevy of unique sea creatures live.

This zone is especially rich in life you can't see — the microscopic phytoplankton and zooplankton that hang in the water. In turn, it nourishes the fountain of life that springs out of this zone.

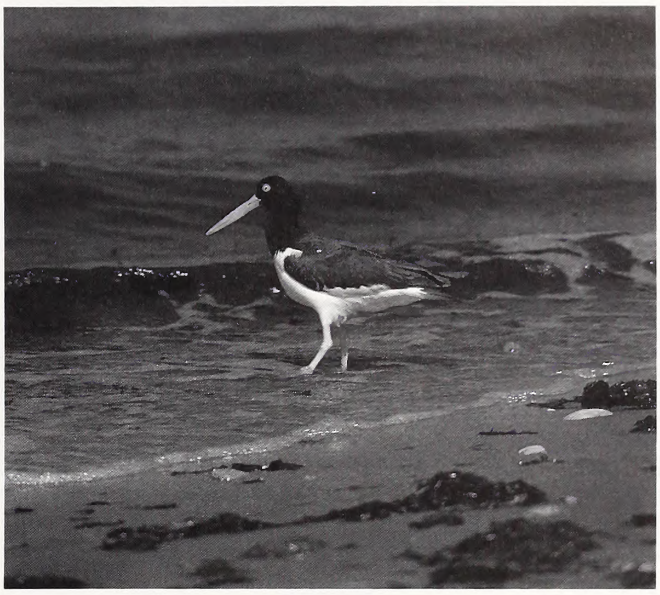
If you pick your time right — usually the still of early morning or evening — you can see schools of small fish running in the thinning crests of waves just before they break, says Spence of Sea Grant. The translucent green water frames the hand-sized fish, usually menhaden, like an aquarium.

Another favorite among children are the surf fish — the minnowlike sil-



Scott D. Taylor

Sea Urchins



N.C. Wildlife Resources Commission

Oystercatcher

ver perch, silversides and killifish that swim in wading waters. Visible from above as a flash or a shadow, these underwater moving targets are much too fast for young hands or a bucket to catch.

Beyond the shallows, you can find sand dollars and starfish living near sandy, offshore spits. Most people know them best as the bleached skeletons that they gather from the beach for jewelry and decorations.

When alive, however, the cookie-shaped sand dollar plows slowly under loose sand on the ocean floor using its brown-green velvety spines for locomotion. As it walks, tubes tipped with suction discs move organic particles and animals into its central mouth. The chewing apparatus, called a "peace dove" for its dovelike appearance, is the remnant that rattles when its skeleton is shaken.

The five-legged starfish, another bottom dweller, uses hundreds of tiny tubelike feet on its underside to travel over sand. When it comes across a meal, such as a clam or oyster, it wraps its arms around the prey, pries open the shell and everts its stomach. It digests the soft parts and draws its stomach back in. You can see its kinship to the sand dollar in the five-rayed pattern they have in common.

Yet another kinship in these waters is shared by the crustaceans, the seaside equivalent of insects.

This comparison to insects is especially true for shrimp, which were once called "bugs" by coastal residents and not widely eaten. Today the most consumed seafood in the United States, certain species of shrimp can be found in the shallows from early summer to fall.

Its subtidal neighbor, the blue crab, is also likely to end up on a dinner plate. Olive-green with blue claws and legs, it can crawl across the bottom, swim rapidly or burrow into the sandy bottom for protection. The female is distinguished by her red-tipped claws. The blue crab is a scavenger and capable predator, feeding on small fish, shrimp and other crabs. Though it can be found off the beach, it spends most of its life in the brackish water of estuaries.

The surf equivalent of the blue crab is the look-alike speckled crab, which can be distinguished by the flecked pattern on its shell. An opportunistic feeder, the speckled crab moves up with high tide to prey on mole crabs and coquina clams. It is also a good swimmer and catches fish whenever it can.

These crabs share the subtidal zone with the horseshoe crab, which is not really a true crab or even a crustacean. Its closest living relative is a spider, which is evident when you look at the jointed legs under its armor. Upright, it looks like a crushed helmet with a serrated tail. But don't let this creature's ominous appearance or name startle you. It's harmless. It ventures ashore from its home in the shallows to mate in early summer and to leave fertilized eggs in the sand. It then returns to its daily task of plowing through bottom sand and mud, feeding on mollusks, crustaceans, worms and other small animals.

A likelier threat to swimmers is the jellyfish, a pulsing, translucent in-

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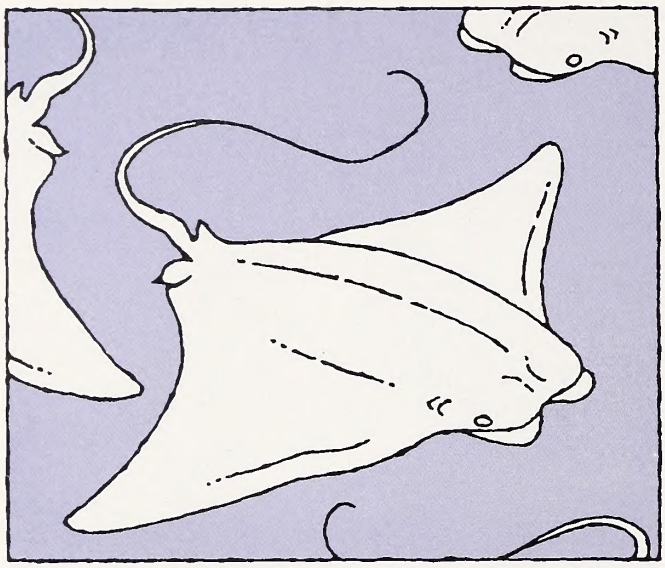
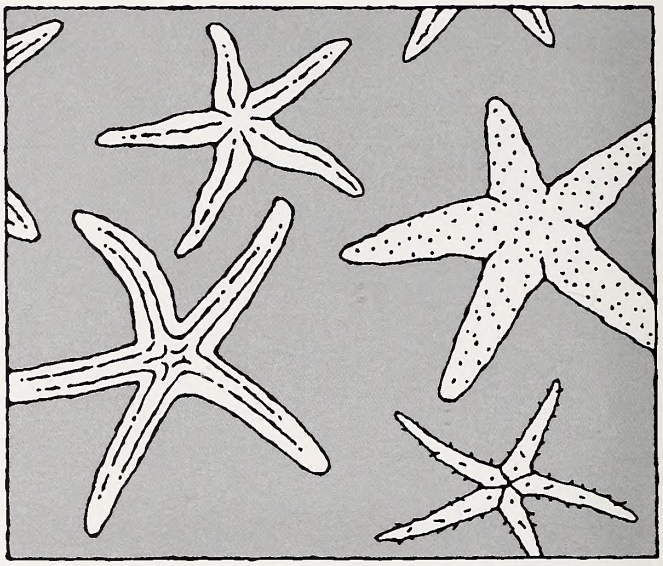


Stingray



Starfish

vertebrate with tentacles for trapping prey. Its long tentacles can sting, but this primitive animal does not give chase. Rather, the passive jellyfish is washed inland by offshore storms and passed along the coast by currents. During summer spawning months, jellyfish release larvae into the water that can also cause swimmers some skin irritation.

The venomous defense of the stingray is another shallow-water hazard, especially to bare feet. Like the cownose ray and its harmless cousin, the skate, the stingray has a long, thin tail. But it also has a barb on its tail that can cut the skin and deliver a painful slime. It feeds on a rising tide, so avoid injury by shuffling in shallow, murky water.

And like the horseshoe crab, the appearances of the skate and ray are more menacing than their behavior. Their unusual, pancake-flat bodies have pectoral fins like wings. Both skates and rays stay close to the ocean floor, flapping their wings and stirring mud and sand to find their food. Their favorite meals are crabs, shellfish, worms, small fish and shrimp.

on wing

Unlike the sanderling, gull and willet, many species of birds cannot be pegged to a particular beach zone. It's simplest to say they're "on wing."

Fortunately in North Carolina, many beaches are still relatively undisturbed. Even the most tepid bird enthusiast can watch from a lawn-chair perspective as an osprey dives like a spear for a fish, or a vivid, red-billed oystercatcher probes shellfish for dinner.

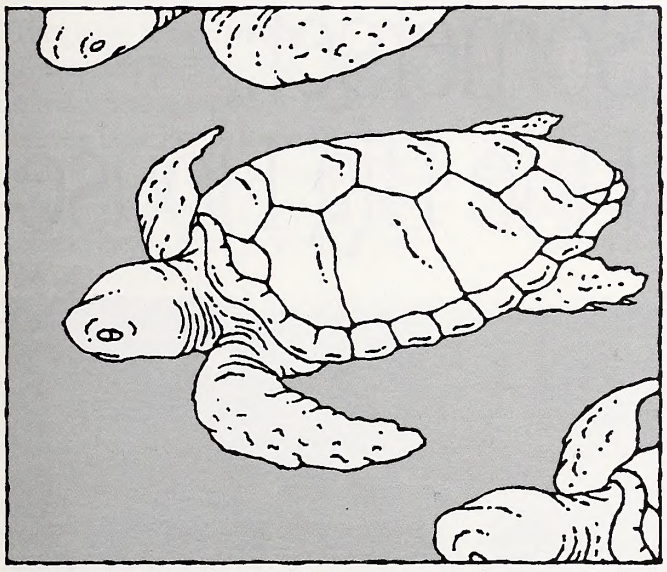
Their beaks, first, can tell you about their lifestyles and diets. Consider the differences between the thin bill of the tiny sanderling, which probes for mole crabs, and the powerful beak of the pelican, which gulps up prey and water.

Beaks, however, aren't the only tool for catching food. The sturdy osprey fishes with its feet. When it sights its prey in the water, it hovers, folds its huge wings and dives. Grabbing the fish with its talons, this bird sometimes submerges itself entirely. With a shake like a dog, it sheds the water and powerfully lifts itself and prey aloft.

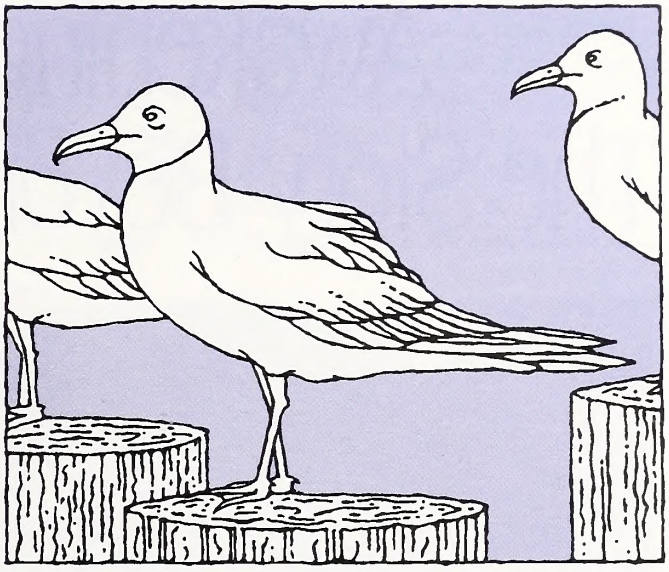
Also called a fishhawk, the osprey is recognized by its 5-foot wingspan and characteristic crook in its wings. Its feathers are dark above, white below, with a dark stripe running across its head and through its eye.

Another large coastal bird, the brown pelican, has a wingspan up to 6 or 7 feet, though it's light for its size at only 8 pounds. The pelican's beak is long and solid with a pouch at the bottom to store water that it gulps when it dives headfirst for fish. It forces the water out through gaps in the side of its beak and swallows the prey.

The unique feeding habits of the black skimmer also set it apart from other coastal birds. This graceful flyer catches food by skimming just above the water with its lower bill cutting the surface. When it hits an object with its beak, the upper jaw snaps down and grabs hold. This striking bird — black on top and white on bottom with a red, black-tipped bill — feeds more in the early evening and night, though it can be seen fishing during the day. And because it prefers a smooth surface, it feeds more on the still backwaters of



Turtle



Sea Gull

tidal creeks than the ocean.

The oystercatcher is best known for its long red beak, which it uses to open shellfish and prey on small seashore creatures. A heavy-bodied bird with white underbelly and black head and back, it doesn't mingle with other species when it feeds. It does, however, nest with terns.

Human destruction of nesting grounds used by the oystercatcher and others — such as the skimmer, tern and gull — can take a toll on the vitality of bird populations, says Peter Meyer, author of *Nature Guide to the Carolina Coast.*

Growth on beaches has forced ground nesters to retreat to the safety of our national parks, estuarine reserves, spoil banks and uninhabited islands, where their populations have been fairly stable.

"We've seen what overbuilding and construction of rigid structures can do, how you lose the beach, lose habitat," Meyer says. "I think we need to open people's eyes to the splendor and the need for protection. North Carolina is making some pretty good efforts compared to other states. ... If you can't learn from your mistakes, that would be a sin."

On the whole, Meyer says, Tar Heel beaches are still among the better protected for its critter communities. That's because people are making that crucial leap from thinking of the coastline as a daytime spot for sun and fun to a fragile environment worthy of respect and long-term care.

The small gestures are important.

Always leave the beach as you found it, or better. Pick up your trash – and somebody else's – and leave the animals as they were. Don't take living creatures home with you and don't destroy their homes.

For instance, respect birds' nesting grounds. Turn around when parent birds dive at your head because you've wandered into their nesting area; they've left their eggs unprotected in the sun to chase you off.

And always leave the beach as you found it, or better. Pick up your trash — and somebody else's — and leave the animals as they were. Don't take living creatures home with you and don't destroy their homes. Even an innocent game among children to excavate a ghost crab hole could collapse its burrow.

"This is (the animals') environment, and we in a sense are intruding in it when we go onto the beach," Powell says. "I tell (children's groups) that we're visiting, and after we leave, the animals have to make their daily living out of this area. So the less we do to it, the better they are able to survive."

Nature Guide to the Carolina Coast, written by Peter Meyer, and *Seacoast Life: An Ecological Guide To Natural Seashore Communities In North Carolina*, written by Judith Spitsbergen, were helpful sources for this article.

Awakening Somerset: The Story Beyond the Big House

Scott D. Taylor

Josiah Collins III built his 14-room mansion at Somerset in 1830.

By Carla B. Burgess

A "false" door produced what designers call symmetry of architecture inside the antebellum home of planter Josiah Collins III. But it took a descendant of one of the Collins family's 353 slaves to restore balance to the story of Somerset Place.

It's easy enough for visitors to find this coastal North Carolina plantation, which once completely encircled the 16,600-acre Lake Phelps. From U.S. 64, the brown historical signs lead tourists through the sleepy town of Creswell, past fields of corn and beans sprinkled with shocks of wild mustard, across the Scuppernong River, onto Spruill and 30-Foot Canal roads and almost to Pettigrew State Park.

But Dorothy Redford — a seventh generation descendant of the first slaves to toil this plantation — had to find her homeplace the hard way, by a painstaking 10-year pilgrimage through thick volumes of federal censuses, courthouse records and deeds, old newspapers and hours of oral history gathering.

Her search led this former Portsmouth, Va., social worker in 1985 to the steps of the "Big House" on the Collins' plantation, where a teenage guide gave her a tour of the home that included scant mention of African-Americans.

The young woman alluded only twice to Somerset blacks — once to the slaves who dug the 6-mile canal connecting Lake Phelps to the Scuppernong River and once to "hired girls" who kept the house, a sanitized reference to the enslaved people that were the lifeblood of this once 100,000-acre farm.

Redford recalls the tour of the 14-room mansion, built in 1830, as unremarkable, and the state of the visitors' center, lamentable. Buzzing flies and two drab pictures of Collins and his wife kept vigil in the dusty visitors' center. Known as the Colony House, this two-story building provided overnight lodging when Somerset was still an absentee-owner farm in the late 1700s. The outbuildings such as the kitchen and smokehouse were mere storage bins. Trees and tangled undergrowth obscured the lake. And in a clearing west of the mansion, one lonely wooden sign commemorated 26 disappeared slave cabins.

Almost a decade later, Somerset is in a striking metamorphosis.

It began with the culmination of Redford's genealogy, which not only included her own direct maternal line, but 20 other families that made up Somerset's slave community. She celebrated in grand style, with a homecoming of slave descendants — as well as Collins heirs — at the site in September 1986. Redford, then-Gov. Jim Martin and 120 oak trees cinched with yellow ribbon welcomed Alex Haley, national media and nearly 2,000 kinfolk from across the country to the commemoration of Somerset's roots.

Redford was hired as program specialist the following year, and Somerset began to emerge from its cocoon. With the help of then-legislator Howard B. Chapin, she cleared the growth from the lakeshore. The outbuildings — including the kitchen, laundry and salting house — were cleaned, furnished and opened to the public. Books binding both black and white histories, broomsedge brooms and colorful pottery are now sold in the adjoining room. Archaeologists are reclaiming the shards of Somerset's black history, and Redford soon hopes to break ground on rebuilding of the slave chapel, hospital, field hand kitchen and two cabins.

Scott D. Taylor

Dorothy Redford watches Virginia fifth-graders dip candles.

"The entire way we look at Somerset Place has changed," says Redford. "Sometimes you were met on the porch, and it was said this was the home of Josiah Collins III, and then you were taken over for a tour of the house and furniture. ... We no longer look at it as a plantation house, but we interpret the culture that lived here.

"Ninety percent of the compliments we get is that we don't say servants; we say enslaved people or slaves, and we acknowledge what everyone did on the plantation. And we find no one is offended," she says. "Sometimes when you start it's like a big relief because everybody's got millions of questions. And when you go to other sites and the 's' word is never mentioned, you come with the questions and you leave with the questions. Here, because we're opening it up, people can ask."

The room next to the gift shop is now an orientation room for visitors.

"It has black faces, people who were born slaves hanging on the walls, so that the moment you begin your interpretation of the site, people understand that more than one population lived here," says Redford. "Now you see the work buildings, you see the salting house, you see the smokehouse, ...

Continued

kids go into the kitchen and prepare meals.

"I did really inexpensive things like put up areas with cast iron pots so that you understand that plantations were places of work; they were not places where only owners lived," she says.

The site now offers a unique hands-on educational program that is a national model. And *Somerset Homecoming*, written by Redford and Michael D'Orso, is not only a beautiful outline of Redford's search for her heritage, it is being used in classrooms to inspire others to explore their ancestry. At Somerset, school groups get an integrated lesson of slave history and go back in time to experience work 18th-century style.

"It's not role-playing, but it's assuming a role 150 years ago, and each kid has to assume it," says Redford. "There's a difference in a child being able to watch someone and actually participating in the craft. The learning experience is entirely different when they come out of the kitchen sweating or come out with a bucket and they've got to haul the water. When they come out of that experience, they certainly understand the difference technology has made."

On a muggy Wednesday morning in May, a steady breeze off Lake Phelps rustles Somerset's sycamores and cypresses. Company's coming, and Redford and her staff are getting ready. Busloads of ninth-graders from Northeastern High School in Elizabeth City and fifth-graders from a Virginia private school are on the way.

No slide projectors are warming up. No exhibits are being roped off.

Scott D. Taylor

Broommakers work toward their daily quota.

Instead, Fred Spear stokes the fire under a cast-iron pot in the yard. He drops bricks of paraffin in the kettle, and carefully drapes wicks one-by-one over a nearby railing. In the kitchen, seasoning for a pot of beans simmers in a pot hanging over the brick hearth. A wood fire crackles underneath. Outside the laundry, empty chairs circle a big basket of raw cotton.

At 10 a.m., the ninth-graders arrive. Redford greets them outside the Colony House with a basket filled with bits of colored paper. She instructs each of them to take one before stepping inside the visitors' center.

"You have just traveled back in time to 1786, a time in which if you were thirsty you'd have water out of the well," she says, as the students pack into the orientation room. "And you wouldn't have a lot of choice about your daily work."

She begins to tell the story of the plantation, which began as a business venture between three 18th-century Edenton entrepreneurs — Josiah Collins I, Nathaniel Allen and Samuel Dickinson. These men had a vision to develop a large rice plantation. Under a partnership called the Lake Company, the three bought 100,000 acres of land, including Lake Phelps, through land grants. It probably cost them 10 pounds for each 1,000 acres, says Redford.

"So you have two elements of a plantation: number one, land, and number two, a plan for development," she says. "What's the third element that characterized plantations in North Carolina?"

Some of the students respond: "Work!"

"And what kind of labor force characterized plantations in North Carolina and in most of the South?" she asks. When no one responds, she

adds, "Enslaved people.

"Why do we say enslaved people as opposed to just the word slaves?" asks Redford. "Because they were people; in fact, they were enslaved Africans."

The first slave labor force at Somerset was 40 American-born slaves; they were artisans such as carpenters and brick masons. Collins brought the second group of slaves directly from the west coast of Africa in 1784. Redford talks about what these Africans offered to Somerset: experience in growing their native okra, yams, watermelons, gourds, and — most importantly — rice.

These slaves bore the brunt of the rice scheme. Caged as they worked, expelling dirt and mud through the bars, they labored two years through swamp and forest to dig a canal 6 miles long, 20 feet wide and 4 to 14 feet deep. Malaria, injuries and exhaustion claimed many lives.

By 1816, Collins had bought out his partners, and by the time his grandson, Josiah Collins III, took over the plantation in 1830, Somerset was one of the largest farms in the Southeast. The rice paddies were converted back to fields for corn and wheat. Rice farming, its intensive labor and its malaria-carrying mosquitoes took too great a human and financial toll. The canal emerged as an avenue of commerce for the grain that fed the plantation's gristmill and the cypress planks that rolled through Somerset's sawmill.

"Which gets to our focus today — technology," says Redford, smiling at the students still clutching their bits of paper.

Scott D. Taylor

An Elizabeth City high schooler tries Colonial cooking.

"Two things you learn immediately about the antebellum period; one is your lack of choice. If you were living here in 1786 you really wouldn't have any choice about what you were going to do," she says. "Another thing you're going to understand is everything came with a task and quantity to be completed. Since some people will be cooking and won't have time to be cotton pickers or broommakers or gourdmakers, you all are going to have to make enough so that everybody will have something to take home."

Immediately, several of the students raise their hands asking, "May I be a cook?"

Redford responds firmly: "Today, you will do whatever I tell you to do."

Glancing around the room, she announces that everyone holding yellow slips of paper will be a cotton picker. The yellow people groan.

"Blue will be broommakers, and you may be candle dippers, and you may have to help the cotton pickers," she says.

The ninth-graders disperse, while Redford helps suit up the cooks outside the Colony House. A.C. Robinson preens and bats his eyelashes as he dons a long skirt and apron. He and fellow cook Trey Boyce begin hauling buckets of water to the kitchen for cooking and dishwashing.

Betty Pledger, dressed in a long checked skirt and white bonnet, assembles her people, who begin picking the seeds and hulls from large tufts of cotton. Later she will help them stitch the picked cotton into pincushions.

Spear directs the candlemakers, who repeatedly circle the cauldron, alternately dipping and drying their wicks.

In the shade, Jerry Raveling shows his artisans how to peel the rough pieces from stalks of broomsedge and bind them together with fabric strips.

Continued

In the kitchen and adjoining laundry, Darlene Davenport helps the cooks grind corn to make meal for cornbread. They also prepare hopping John — black-eyed peas with rice — and gingerbread.

Meanwhile, the younger students from Norfolk Collegiate are at their assigned tasks.

Rebecca Repass watches her 10-year-old son David carefully crack eggs into a bowl. She says his worst fear about the trip — that he'd be picked as a cook — has come true. But David works steadily as he pushes coals under the skillet full of sizzling corn bread. He's equally confidant during cleanup, skillfully pouring hot water into an enamel bowl and scrubbing the dishes clean with a well-worn piece of loofah.

Seasoned chefs Trey and A.C. take a breather in the doorway of the adjoining laundry.

"In the kitchen, you burn up," says A.C. "It showed you how they really did it, with no air conditioning, no drinks."

Trey says it taught him respect for the women who cooked from sunup to sundown in heavy clothes. "It's very, very hot," he says, raising the hem above his ankles. "Wearing these skirts restricts your movement."

The high schoolers have been tracing their genealogy as a class project, some of them back as far as seven generations, says teacher Linda Hodnett.

Akiysha Scales says Redford's work has been inspiring to her. In her past, she found the names of slave ancestors and her great-great grandfather, a Blackfoot Indian who lived on a reservation. She also learned of a black ancestor who was an inventor; he was hanged after he got a white woman pregnant.

Scott D. Taylor

A lone artisan husks broomsedge.

"I didn't know him, but still, if it's a part of you, it does hurt you," she says.

Fellow broommaker Felicia Felton found white, black and American Indian in her family tree. "It made me proud to know I had different cultures in my background," she says. Asked whether she was scared to poke into her past, she says, "I was ready for the good or the bad."

Back at the cotton picking circle, the Norfolk fifth-graders are taking their turn with the spurs and seeds. "You get calluses on your finger after a while," says Redford, looking over the youngsters' shoulders. "Yeah, this is really making me a man," says 10-year-old Matt Trogdon as he fidgets with his cotton pod.

This sends Redford into a fit of laughter. Pledger smiles also; then the two women suggest that the kids hold on to their keepsakes from today.

"There might not even be a plantation around by the time you have grandchildren," says Pledger, a Creswell native who has worked at Somerset for three years.

As the day winds down, the last bunch of fifth-graders hastily scrapes dried pith and seeds from gourds using oyster shells. After a quick tour through the house, the young artisans will soon be leaving with their wares. Resting for a spell in the kitchen, Pledger talks with wonder of the welcome awakening at Somerset.

"This place was like Rip van Winkle; that's the only way I can describe it," she says. "Ms. Redford, she has done wonders since she came here. She is giving them something they will pass on to their children and their grandchildren, and they'll have something to pass on to another generation.

"I was here before Somerset was what Somerset is today," she says. "When I was a kid it was an old abandoned house. It was fun to run all through it because it was big.

"It's time to put that to rest," she says. "I'm kind of excited about it."

Keeping History Whole

The pendulum swings heavy and hard. After the first homecoming of slave descendants in 1986, some whites felt alienated from Somerset Place. But Dot Redford had a tonic.

Take a healthy dose of Christmas cheer, simmer up 8 pounds of beans, throw in hoards of homemade cookies, smother it in song, and you've got some fine community relations.

It's called the Christmas Open House, and it happens every year at Somerset. Every church in the area is invited to decorate one room of the Collins House to honor a church member, living or dead. And in the process, people mingle. They sing together. They laugh, they eat and they eat some more.

"Our house is decorated to pieces," says Redford.

Pine and holly wreaths are sprinkled with pods of cotton. Dried okra, gourds and other natural decorations adorn the 14-room house.

"All the church choirs come together and sing together," says Somerset employee and Creswell native Betty Pledger. "It's not white churches. It's not black churches. It's both. You'd think they had been practicing and singing together for years.

"There's a nip in the air. They have hot apple cider," she says. "Every church has to bring homemade cookies — you cannot bring them in cellophane. We cook a big pot of beans, and that is sopped out by the end of the day."

And when Open House is over, there are a dozen or more stories to weave into the history of this coastal county. Each church puts together a short biography of its honoree. The write-ups are published each year as *Reflections: A Somerset Christmas.*

"I'm an advocate of seeing history whole," says Redford.

And no one wants to miss out on the celebration.

"A lot of people say, 'I'm going to go because that's my mother being honored," says Pledger. "It just brings so many people from far and away."

Scott D. Taylor

Trey Boyce and A.C. Robinson fetch water for cooking and dishwashing.

HOMECOMING 1993

The 1993 Somerset Place Homecoming will be 9 a.m. to 6 p.m. on Saturday, Sept. 4. The theme of the program and activities is "Our Children."

Entertainment will include the Somerset Children's Choir and the Marie Brooks Dance Theatre, an international troupe from New York specializing in African and Caribbean dance. Both groups range in age from 3 to 18.

Storytellers Lloyd Wilson and Gloria Lowery Tyrrell will tell tales. Children will make broomsedge brooms, small kitchen baskets, split oak baskets and pincushions. Group photographs of descendants are scheduled throughout the day. An hour of open mike sharing for people more than 80 years old is also slated. And of course there'll be games and lots of food.

For information about local lodging and activities, call 919/797-4560.

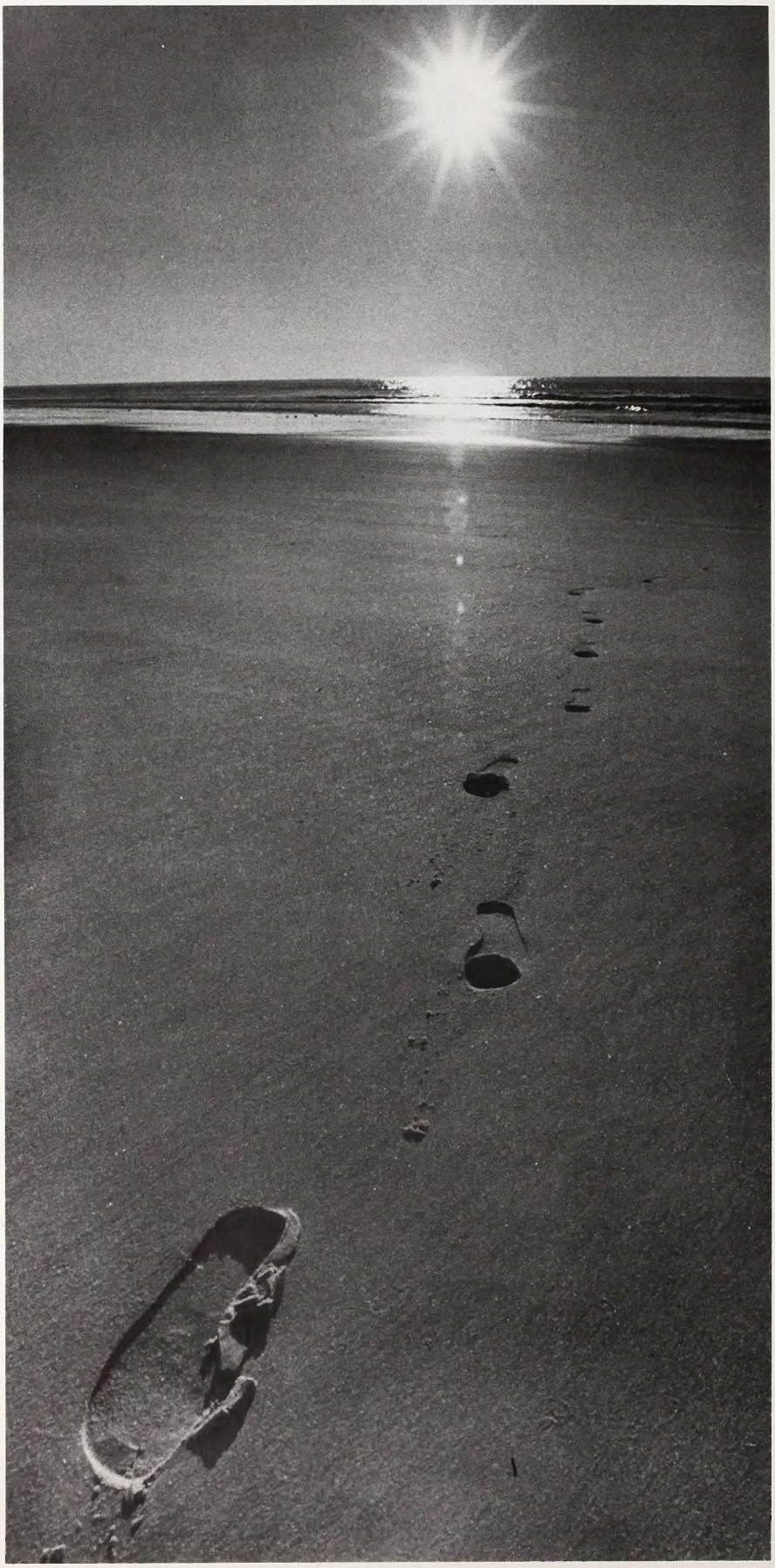
Somerset Place Visiting Hours

April 1 — Oct. 31: Monday through Saturday, 9 a.m. to 5 p.m.; Sunday, 1 p.m. to 5 p.m.

Nov. 1 — March 31: Closed on Monday. Tuesday through Saturday, 10 a.m. to 4 p.m.; Sunday, 1 p.m. to 4 p.m.

Shore Safety for the Summer

Each summer, thousands of people enjoy the unique blend of sand, surf and sun that is distinctive to the oceanfront and bountiful along the North Carolina shore. But in all of that wonder and beauty, there is also danger on the beach and in the water.



Steve Murray

By Kathy Hart

The ocean.

It's irresistible. It attracts people like a powerful magnet.

They are drawn to its sun-washed shores, revitalized by its beauty, its warmth, its endless rhythm and its cleansing brine.

Each summer, thousands of people enjoy the unique blend of sand, surf and sun that is distinctive to the oceanfront and bountiful along the North Carolina shore.

But in all of that wonder and beauty, there is also danger on the beach and in the water.

Tobie Dodge, a supervisor for Nags Head Ocean Rescue, has spent 10 years on the beach protecting the lives of others. As a public safety professional, Dodge says that a lack of understanding of ocean dynamics poses the biggest problem for the average beachgoer.

"They underestimate natural forces such as winds, waves, currents and weather, and they overestimate their own abilities in the water," Dodge says. "They don't understand that a longshore current can quickly pull a swimmer down the beach or that an offshore wind can carry a person on a float down and out 100 to 200 yards in minutes."

Mirek Dabrowski, a lifeguard for 13 years along the Outer Banks, puts it like this: "One of the biggest dangers is that people don't foresee what might happen. This doesn't mean that the ocean is a big monster out to get you, but you can't take it for granted."

Dodge and Dabrowski agree that people should develop a healthy respect for the ocean and its fickle nature.

"It's changing every minute," Dodge says.

As a system in motion, ocean waves, currents and sands respond to changes in tides and weather.

Tides creep in and out continuously, and as they do the profile of the beach and nearshore changes too. The gently sloping beach at low tide may give way to a steeper beach with a faster drop-off at high tide.

And an approaching storm can alter the serenity of a calm day faster than most people can spell Chicamacomico, the lifesaving station near Rodanthe. Gentle waves, light winds and sluggish currents can be whipped into a frenzy of churning breakers, powerful gusts and strong currents.

Steve Murray

But most people, especially tourists who spend only one to two weeks a year seaside, aren't aware of the ocean's power or overestimate their ability to handle it.

Most folks hone their swimming skills in swimming pools and inland lakes and are often unprepared for currents, backwash, crashing waves and shifting sand.

"Most people don't know their limitations when it comes to the ocean," Dabrowski says. "They don't know how to handle waves that can throw them into the sand hard enough to cause head and neck injuries or how to recognize currents.

"That's a lifeguard's biggest job — educating people about the problems they might face," he says. "People should look at us as doctors of the ocean. We know the ocean. We know where you can swim and where you can't. People should listen to what we have to say."

But vacationers aren't always good listeners. Bent on making their vacation all it can be, visitors often overexert themselves and take unreasonable chances with their lives in the name of a good time, Dabrowski says.

Vacationers will begin exercising after weeks or even years of inactivity without a doctor's approval. They soak up too much sun or become too hot and dehydrated. They swim on days when the ocean is too rough or rip currents are rampant.

The result of such foolhardiness can mean rescue, resuscitation or, in extreme cases, death. So public safety professionals urge vacationers to employ restraint and use common sense on the beach.

Safety tips include:

1. Come to the beach prepared. Bring sunscreen, hats and protective clothing, especially for children. Wear footwear — sandals, loafers, tennis shoes or flip-flops — because sand temperatures near the base of the dunes can reach 110 F to 120 F. Bring fluids to

Continued

drink to prevent dehydration and sunglasses to cut down on glare from the water and sand. If older adults and children are among your beach party, bring a beach umbrella to offer respite from the sun.

2. Choose a beach that has a lifeguard or is monitored by a beach patrol. "I always swim where there's a lifeguard," Dabrowski says. "If I was someone who didn't know much about the beach, I would sure swim near someone who did know something about it."

3. As soon as you arrive on the beach, check with the lifeguard about ocean conditions. Ask about the location and strength of the backwash, rip currents and longshore currents; the possibility of submerged hazards such as groins, loose pilings or old fishing piers; the prevalence of jellyfish and stingrays; and the depth of the nearshore waters. For example, ask how fast the beach drops off beneath the breakers and whether there are any nearshore holes or gullies.

4. Heed what the lifeguard says or any warnings posted. When rip currents are frequent, Dare County officials warn swimmers against swimming in nearshore waters, says H.B. Sanderson, director of Dare County Public Safety. They announce the warnings through local media and by posting red flags. The town of Nags Head prohibits swimming when the red flags are flying, and violators are ticketed.

5. Don't overdo. Don't run a beach marathon during the heat of the day unless you are conditioned for it. Don't soak up too much sun. If you feel compelled to tan despite dermatologists' warnings, do so gradually by using sunscreens. Don't drink too much alcohol. It can impair your judgment, causing you to attempt feats beyond your ability.

6. If you are bringing children to the beach, "always, ALWAYS watch them," Dodge says. He cautions that parents should keep small children within arm's reach when they are playing in the surf. "It's so easy for children to step out over their heads and into trouble," Dodge says.

Scott D. Taylor

As a further precaution, Dabrowski advises parents to outfit their kiddies with U.S. Coast Guard-approved personal flotation devices — life jackets — when they are in the surf. If properly fitted on the child, the life jacket should buoy the child's head and shoulders out of the water. But beware of the lightweight, air-inflated floats and water wings. Children develop a false sense of security with these floats, which can be easily punctured.

7. Beware of other people on the beach and their activities. During peak summer vacation months, beaches and nearshore waters swarm with people who are sunning, swimming, fishing, surfing, sailing and riding jet skis and tandems. These activities are not always compatible, Dodge says. Be like the defensive driver. Watch what you are doing and what others are doing too.

Sanderson says the growing use of personal watercraft — jet skis and tandems — and the danger they pose to swimmers has caused some municipalities to limit or prohibit their use. Although the craft are not a problem along the Dare County beaches yet, Sanderson predicts that municipalities will begin regulating their use within the next few years.

Despite precautions, accidents happen, and that's why it is best to choose a beach monitored by a lifeguard.

Contrary to the Hollywood image of the lifeguard as an empty-headed, muscle-bound he-man more intent on watching women than beachgoers, lifeguards are smart, well-trained and physically adept men and women dedicated to beach safety, Sanderson says.

Before becoming lifesavers, Dare County guards must complete a Red Cross Lifesaving course, be currently certified in cardiac pulmonary resuscitation (CPR) and pass a physical agility training test, Sanderson says. Unlike lifeguards at swimming pools, ocean guards must be able to run and swim long distances, in other words, be in top physical shape.

"It's not an easy job," he says. "Guards work 10-hour days. One hour every morning is spent in ongoing training; then they're in the sun another nine hours.

"They're exposed to the sun's damaging rays, and now they have potential for coming in contact with HIV (the AIDS virus). They can't

wear a mask or gloves in the water" to protect themselves from the deadly AIDS virus like land-bound rescue personnel.

And lifeguards must have one other attribute: eagle eyes. They must always have one eye focused on people in the water and the other on people on the beach.

What clues a guard that a person is in trouble?

"They'll have big eyes because they're panicked," Sanderson says. "You'll also notice the panicked look on their face. Their head will be back, their feet under them and their arms flailing around. They look like someone trying to climb a ladder."

In addition to the flailing, screaming person, Dabrowski also looks for the "silent victim." These are people who have become exhausted and given up.

"I look for someone who is floating and continues to float, often with his head in the water," Dabrowski says. "If a person is waving his hands and arms, he's in better shape because his shoulders are still above water. He has some energy left."

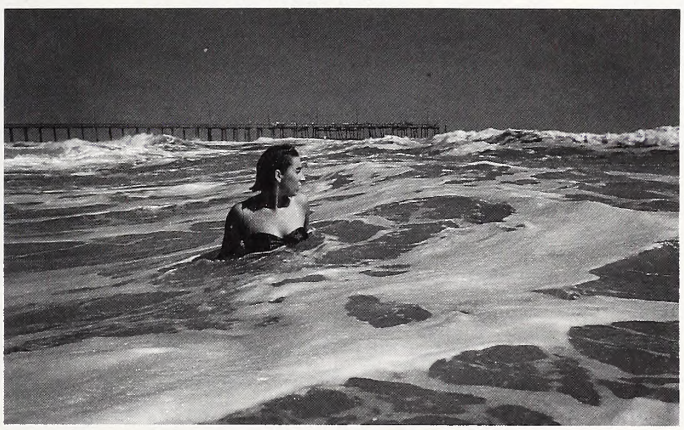
Drowning is really hypoxia — lack of oxygen in the body, particularly the lungs and brain. Dr. Mary Eberst, assistant professor of emergency medicine at the University of North Carolina, describes two kinds of drowning.

For some victims, drowning occurs when the larynx clamps shut because of the irritation of the water being drawn into the upper part of the airway. This is called dry drowning, and it cuts off oxygen to the lungs, says Eberst.

In other victims, the lungs fill with water, cutting off air supply to the blood and the brain. This is called wet drowning. Eberst says 80 percent to 90 percent of the people who drown are wet-drowning victims.

If you are conscious after a rescue, Eberst says your chances for survival are very good, although you may suffer some lung injury. If you're unconscious, chances of survival drop significantly, and those who do survive often suffer neurological damage.

Michael Halminski



Eberst says lifeguards or rescue personnel have three to five minutes to get victims out of the water and breathing. After that, victims suffer irreversible brain damage or death.

Most drowning victims are either very young or old, Eberst says. And, she adds, alcohol is often a factor for victims who don't fall into the young or old categories.

In North Carolina, beach drowning statistics supplied by the N.C. Medical Examiners Office in Chapel Hill reveal the following patterns: eight drownings in 1987, 18 in 1988, 17 in 1989, 19 in 1990 and 29 in 1991. In this five-year period, 17 of 91, or 19 percent of the victims, had blood alcohol levels that would classify them as legally intoxicated.

To lessen your chances of becoming a drowning or near-drowning victim, remember these tips, Dabrowski says.

Never swim alone.

If you get in trouble, don't panic. A panicked person quickly expends valuable energy that could be used to save his or her life.

To conserve energy if you're in trouble, float. The salt water will buoy your body upward. Use that buoyancy to keep your head above water so that you can shout for help.

Learn to swim. If you can't swim, don't get in the water.

Don't drink too much alcohol before swimming. Alcohol impairs your physical abilities and clouds your judgment.

And choose a beach with a lifeguard.

In North Carolina, not all beaches are protected by lifeguards. Some municipalities, wanting to offer tourists an amenity that could save their lives, provide or contract with an agency to provide oceanfront rescuers. Others can't afford the service. To compensate, some resort areas, condominium complexes and hotels employ their own guards.

Liability factors into the decision for some municipalities when they're deciding whether to fund a rescue service.

"Some city and town governments believe if they don't do anything there will be no liability for them if an accident occurs," Sanderson says.

But Dare County takes the opposite approach.

"We're a tourist-oriented recreational area and as responsible tenants for that beach, we feel we have to provide responsible lifesaving services," Sanderson says.

Beach Dangers

Waves/Surf

Before entering the surf, watch the waves. Waves usually break in sets, with a lull between. If the waves seem too large and powerful, do not go into the water.

Waves pack a punch. They can easily drag you across the sand, skinning your body and perhaps even breaking bones.

When swimming through the breakers, swim over rounded waves and dive under cresting waves. Always watch and ready yourself for the next one.

If you get caught in a wave, don't struggle. Relax, curl up and wait until the wave passes or pushes you on the beach.

Currents

BACKWASH — This is the return flow of water from a wave that is often mistakenly called the undertow. "There is no such thing as undertow," says Nags Head lifeguard Tobie Dodge, who explains that backwash can only be felt along the bottom and may knock you off your feet. It may pull you seaward, but it doesn't suck you under, he says.

The speed and strength of this current depend on the speed and strength of the waves and upon the steepness of the beach. The backwash will last only until the next wave breaks.

If caught in a backwash, don't panic. Simply brace your feet on the bottom, maintain your balance and wait until the pull slackens. If the backwash knocks you off your feet, float on the surface and swim shoreward with the next wave.

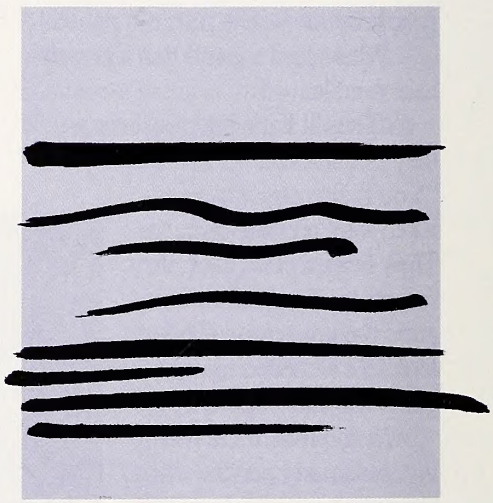
LONGSHORE CURRENT — This current runs parallel to the beach and is formed by waves striking the beach at an angle. Mark your towel or a landmark on the beach, and watch for drifting, especially if you have children in the water.

In the water, be aware of your movement in the current. Do not try to swim against a strong longshore current. Simply swim or float to shore and walk back to your towel.

RIP CURRENTS — Under certain conditions, rip currents can be the most dangerous natural hazard on the beach. They are associated with many of the rescues that occur each summer and with more than a few drowning deaths.

These currents are formed when waves break on the nearshore sandbar, says Spencer Rogers, Sea Grant's coastal engineer. Water falls into the trough between the beach and the bar and becomes trapped. As the water piles up, it begins seeking a path seaward, which it usually finds in a hole or break in the bar. The water flows quickly through the break in the bar, creating a fast-moving current that flows offshore 50 to 150 feet in Tar Heel waters before dissipating.

Rip currents are common and usually sluggish. But they are killers when they become large and fast, too fast for the best swimmers. If caught in a rip current, do not swim against it. In North Carolina, the rips are usually narrow, 10 to 20 feet. Swim across the rip current, parallel to the beach, until you're free of the current. Then swim shoreward. Or ride the rip out until it dissipates before swimming to the beach.



Learn to identify rip currents. Signs that indicate their presence are: 1) water or sea foam moving through the breakers and offshore, 2) differences in water color caused by the turbulence from the breaking waves, 3) waves breaking either closer to shore due to deeper waters in the sandbar break or farther offshore due to the currents, and 4) rougher or choppy water on both sides of the sandbar.

Rip currents are usually worse at specific tide elevations, Rogers says. If rips were prevalent at low tide yesterday, it is likely the same conditions will

be present today. But gradually sandbar and wave conditions change. Rip currents may disappear or change location. And other weather conditions such as wind directions and approaching storms can affect the appearance of rips.

Rip currents are most persistent around natural features such as the rock croppings at Fort Fisher or man-made features such as jetties, groins or piers.

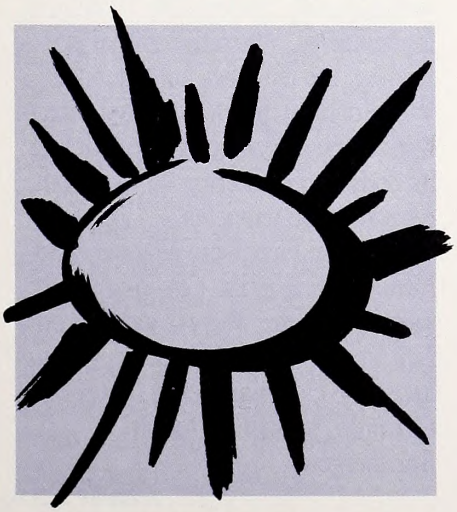
Sun Exposure

SUNBURN — Avoid too much exposure to the sun. Heed dermatologists' advice: wear sunscreen to protect your skin and avoid the possibility of skin cancer. Sunburn puts a damper on a fun vacation.

Severely sunburned beachgoers can experience painful, red skin; blisters; fever; nausea; vomiting and headache. To combat these symptoms, stay out of the sun, use cool rags on the burn, take a pain reliever every four hours, drink fluids and seek medical assistance.

Remember that you can be sunburned any time of the day, in the shade or on cloudy days.

HEAT EXHAUSTION, HEAT CRAMPS AND STROKE — Prolonged exposure to the heat or sun without the proper intake of fluids can cause heat exhaustion, heat cramps or, even worse, heat stroke. These problems occur when the body loses fluid through sweating and has difficulty releasing excess heat.



Symptoms of heat exhaustion are perspiration, general weakness, pale and clammy skin, nausea and dizziness. Heat cramps, which occur in the abdomen or calves, are usually associated with heat exhaustion.

To treat heat exhaustion and cramps: lie down and raise the legs a foot above the head; loosen clothing; apply cool, wet cloths; rest in an air-conditioned room and slowly drink liquids, such as Gatorade, which restore important electrolytes and salts, every 15 minutes. If vomiting occurs, discontinue fluids and seek a doctor.

The symptoms for heat stroke, a life-threatening emergency, include rapid pulse, very high temperature (104 F to 106 F) and hot, dry skin. To treat heat stroke, immediately cool the victim by immersing in or sponging with ice water. The victim will become unconscious if his or her internal body temperature exceeds 104 F. Seek medical assistance immediately if heat stroke is suspected. Death will occur if the victim is not treated.

Dangerous Marine Life

Marine life teems along Tar Heel beaches, but luckily most of the creatures who call North Carolina home pose no danger for the beachgoer. Only a few creatures can be considered dangerous.

STINGRAYS — These graceful creatures sometimes lie partially buried along sound beaches and sand flats near inlets. Although stingrays are generally timid, they will respond if stepped on by lashing out with their poisonous barbed tail. If a ray attacks, you may suffer muscular aches and pains with possible paralysis, diarrhea, vomiting and possibly shock.

Dodge recommends that stingray victims seek medical help because often the barb must be removed. To avoid this creature's barb, do the stingray shuffle — shuffle your feet along the bottom instead of picking them up and setting them down.

JELLYFISH — Numerous varieties of jellyfish in an assortment of sizes, shapes and translucent colors float in Tar Heel nearshore waters, but only some have stinging tentacles. Although the sting of a jellyfish is painful, it usually subsides quickly after treatment with rubbing alcohol or meat tenderizer. The Portuguese man-of-war, a purplish jellyfishlike creature that floats at the water's surface, packs more punch with its venomous tentacles, which can extend 50 feet from its body. The tentacles can even release their venom after the man-of-war has died and washed up on the beach. Stay well away from these creatures, and seek a doctor if stung.

Homegrown Critters

Familiarity can breed indifference.

After all, the creatures of the North Carolina coast are just garden-variety fish, crabs and oysters. The really interesting animals live in the deep, dark reaches of the ocean. Right?

Wrong. More than likely, there are a few things about our homegrown beach creatures that you never knew. Here's a sampling.

• The male sea horse — not the female — incubates the eggs of their offspring in his brood pouch. The female passes her eggs to the male, who fertilizes them in his pouch. Then, the lining of the pouch thickens with folds charged with blood vessels that carry oxygen and food to the developing embryos. In three weeks, the male expels the fully formed young by flexing his body.

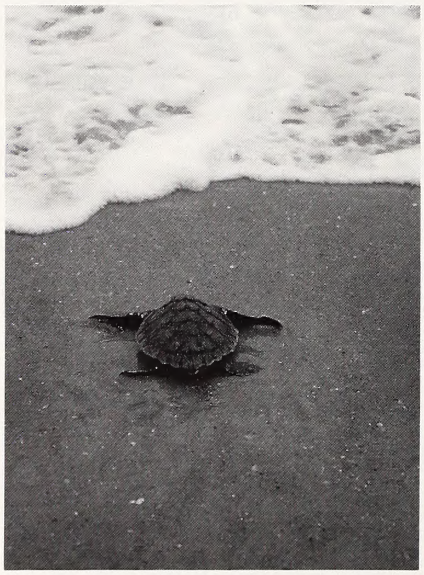
• Before much was known about starfish, irate watermen may have unwittingly increased their populations. Starfish entangled in their nets were cut up and thrown back to sea. What the fishermen didn't know was that starfish can grow new arms. And in some species, one arm can regenerate an entire animal.

• Bird feathers are made of keratin, the same substance of human nails and reptile scales.

• The snowy and great egrets were hunted to near-extinction in the late 1800s, when their feathers were in great demand as decorations on women's hats. The same trend nearly decimated the least tern, which was used whole to trim fashionable hats. Laws were eventually passed to protect these birds.

• Ospreys normally mate for life, returning each year to the same nest and adding branches. The nest grows over the years, sometimes reaching 1,000 to 1,500 pounds.

• The appendages of the horseshoe crab have unusual functions. It uses its spiked tail as a lever if turned on its back. Its legs provide locomotion and grind food, much like teeth. The food is then passed backward through its legs into the mouth. As a result, the horseshoe crab is unable to eat except when walking.



Michael Halminski

• Crustaceans are able to escape a predator by breaking off one or more legs at a specific joint specially adapted not to bleed. A crab, for instance, can break off its own leg to flee; or a predator can snap the leg. A crab regrows the lost limb at later molts.

• The ghost crab is apparently in the midst of an evolutionary change from a past existence as a sea animal to a future as a dry-land animal. Every day, it must return to the ocean shallows from its home in the upper beach zone to wet its gills.

• Every autumn, the spiny lobster exhibits an unusual migration into deeper waters. In groups as large as 60, it walks along the ocean bottom in single file, maintaining contact with only antennae. It travels up to 30 miles over several days for reasons unknown.

• The loggerhead turtle is temperature-sex-dependent (TSD), since it has no X or Y chromosome to determine sex. Instead, the sex ratio of a loggerhead nest is determined by the temperature of the sand at incubation. Under laboratory conditions, as incubation temperatures exceed 84.5 F, more females are produced. As temperatures cool, more male hatchlings result.

• The oyster changes sex repeatedly during its life. The grouper starts life as a female and later becomes a male.

• Find a shell riddled with hundreds of tiny holes? It was likely the victim of a boring sponge or marine worms. Orange-colored sponges attach to a shell and secrete an acid substance that eats through the shell. Marine worms bore tunnels into the shell.

• The sea cucumber has the unique ability to throw out its entire insides to deter an enemy. It can soon grow a new set of internal organs. The sea cucumber is a hollow sack with a mouth bordered by 10 branching tentacles. When the animal is feeding, the tentacles are extended. When danger threatens, it first tries to discourage a predator by contracting its body and puckering up its mouth, retracting the tentacles.

These facts were adapted from *Nature Guide to the Carolina Coast*, written by Peter Meyer, and *Seacoast Life: An Ecological Guide to Natural Seashore Communities in North Carolina*, written by Judith Spitsbergen.

Jeannie Faris

Big Sweep Sweeps Again

If it's September, it must be time for Big Sweep.

The First Citizens Bank Big Sweep, the nation's largest statewide waterway litter cleanup, will be held Saturday, Sept. 18 from 9 a.m. to 1 p.m. at more than 300 shoreside sites from the mountains to the sea.

The cleanup, now in its seventh year, strives to rid waterways of litter that can kill and maim wildlife, injure people, ruin boat motors and render our natural vistas unsightly.

Litter pickup sites are located in almost every Tar Heel county; so volunteers can choose a waterway close to home or a beach, river or lake close to their heart.

To locate cleanup sites, call the MCI toll-free hotline at 1-800-27-SWEEP between 10 a.m. and 6 p.m. Monday through Friday. Volunteer operators will be standing by to help callers choose a location or direct them to county coordinators.

Or stop by a branch of First Citizens Bank in late August to pick up a brochure describing the event and listing Big Sweep locations.

Big Sweep Executive Director Susan Bartholomew encourages individuals, families and groups — civic clubs, school classes, Scout troops, church groups and 4-H clubs — to join the cleanup effort. Collecting litter provides an education in stewardship of natural resources and a lesson in litter awareness.

Participants also receive an education in data collection. Besides bagging litter, volunteers record their trashy finds on data cards. Later the information is compiled and used by Big Sweep coordinators to pinpoint trends and determine the sources of aquatic debris.

"I can almost guarantee that anyone who attends Big Sweep and fills bag after bag with nasty trash will never toss a piece of litter overboard or drop it shoreside again," says Bartholomew. "Four hours of picking up litter will make you disgusted with other people, but it can also make you feel good about yourself for doing something positive to clean up the environment."

Last year, about 12,500 volunteers bagged 256 tons of debris from state waterways. Trash collectors amassed tons of tires, piles of plastic bottles, mounds of metal cans and gallons of glass.

To further support this environmental effort, buy a Big Sweep T-shirt conveying the message: "I've Had It Up To Here With Water Pollution." This year's shirt sports a gray background with an array of inland and coastal water critters in colorful tones of blue, teal and magenta.

T-shirts, available in medium and extra-large sizes, cost $12, which includes postage. They can be purchased from Big Sweep, P.O. Box 550, Raleigh, NC 27602. Make checks or money orders payable to Big Sweep. All the money collected from T-shirt sales aids educational efforts.

One educational project aimed at boaters and fishermen will keep litter from washing ashore. Big Sweep just produced a nylon mesh boat litterbag imprinted with the message: "Don't Splash Your Trash."

The 12-by-23 inch drawstring bags are being given to boaters and fishermen at fishing tournaments, marinas, boating safety classes and N.C. Wildlife Resources Commission CATCH clinics. Carolina Power & Light, Duke Power and Tennessee Valley Authority, the sponsors of the bags, will also be helping to distribute them at their company-owned lakes.

If you would like a bag, please write Big Sweep at the address above, and enclose $1.50 to cover mailing costs.

Big Sweep is led by a board of directors representing Sea Grant; First Citizens Bank; Carolinas Glass Recycling Program; Carolina Power & Light; Duke Power; Keep North Carolina Clean and Beautiful; Keep Wayne County Beautiful; N.C. 4-H; N.C. Department of Environment, Health and Natural Resources; N.C. Division of Coastal Management; N.C. Division of Parks and Recreation; N.C. Wildlife Resources Commission; Rowan County Parks and Recreation; R.J. Reynolds Tobacco Co.; Wake County Keep America Beautiful; and WGHPiedmont 8.

Posters Foster Water Stewardship

Connecticut Sea Grant has two new colorful posters about water pollution that are ideal for educators.

The smaller 11-by-18 1/2 inch poster, *How Bays and Estuaries are Polluted*, uses four-color graphics from *U.S. News and World Report* to describe how factories, farms and residential areas contribute to coastal contamination.

The larger 18-by-24 inch poster, *Environmental Stewardship*, was produced to educate people about the link between their everyday activities and water pollution. It describes the water cycle, watersheds, runoff and proper disposal of hazardous wastes. The poster also provides a clean water shopping guide and tips about how homeowners can help improve water quality.

To receive single copies of these free posters, write Connecticut Sea Grant, University of Connecticut, 1084 Shennecossett Road, Groton, CT 06340-5108.

Readers Have Their Say

Below are the results of our *Coastwatch* reader survey. We mailed surveys to about 1,100 subscribers — every third person on our zip-sorted mailing list. We received 537 completed surveys back in our office, which constitutes an excellent response rate of almost 50 percent. Thanks to all of you who took the time to complete the survey and send it back. Your comments and suggestions will be helpful as we plan for next year.

Here's what you had to say. Reader comments are preceded by this symbol: ◊, and editor's comments appear in italic.

How many people read your *Coastwatch*?
One (18%)
Two (43%)
Three (14%)
Four (11%)
Five or more (13%)
Based on this information, we know that 2.55 people read each copy of Coastwatch *mailed for a readership of about 8,500.*

How long have you subscribed to *Coastwatch*?
Three or more years (68%)
One to three years (25%)
Less than one year (7%)

How often do you read the following sections of *Coastwatch*?

	Always	*Usually*	*Sometimes*	*Never*
From the Top/Editor's Letter	(57%)	(31%)	(8%)	(1%)
Young Mariners/Children's Page	(34%)	(24%)	(27%)	(17%)
From Sound to Sea/Nature Page	(61%)	(28%)	(11%)	(2%)
Marine Advice/Extension Page	(61%)	(30%)	(11%)	(2%)
Field Notes/Science Page	(63%)	(31%)	(8%)	(1%)
Aft Deck/News Briefs and Updates	(60%)	(31%)	(6%)	(1%)
Back Talk/Letters from Readers	(53%)	(25%)	(20%)	(3%)
The Bookstore	(40%)	(29%)	(23%)	(6%)

◊ It is read from front cover to back cover.

What type of stories do you find most interesting or useful? (Check all that apply.)
Stories about coastal history (83%)
Stories about coastal resources (76%)
Stories about coastal controversies (70%)
Stories about specific places (68%)
Science stories (59%)
People profiles (54%)

Which of the following best describe *Coastwatch's* presentation of information?
Fair and accurate (54%)
Easy to read (45%)
Outstanding (31%)
Informative (19%)
Too environmental (3%)
Too simple (2%)
Biased (1%)
Too technical (1%)
Too sentimental (1%)
Other (1%)
◊ Good language — carefully documented facts.
◊ While not biased, a bit too tolerant of those who feel God and the coastal waters owe them a livelihood from fish/shellfish in the wild.
◊ You can't have it all, but with your newsletters and publications you have it all.
◊ Not environmental enough. This is not a criticism. I just don't think a responsible publication about natural/cultural/historical resources can be "too environmental."
◊ Writing is journalistic, not professional. *That's the style we strive to achieve. All the staff members and free-lance writers are trained, professional journalists. We believe journalists do the best job of translating difficult technical or scientific information into layman's terms.*

Are the length of the *Coastwatch* feature articles:
About right? (93%)
Too short? (5%)
Too long? (3%)

Which of the following best describes *Coastwatch's* visual presentation? (Check all that apply.)
Attractive (78%)
Typeface easy to read (28%)
Not enough photographs (16%)
Not enough color (7%)
Other (3%)
Too flashy (2%)
Typeface hard to read (1%)
Too much copy (1%)
Too conservative (1%)
Too many photos (1%)
◊ New version great!
◊ Good balance of photos and copy. New format is an improvement.
◊ Forget color. Use money to increase pages.
◊ Use more photos if possible.
◊ Very interesting photos that go well with stories.
◊ New magazine is too costly. Same information could be given cheaper. The old newsletter was adequate. Don't need color, pictures, history, etc.
◊ I look forward to every issue. The cover is very attractive. The insides should be too. Photos are good, but they should be in color.
◊ Excellent photos; interesting design and layout.

How useful to you is *Coastwatch*?
Moderately useful (42%)
Very useful (39%)
Marginally useful (11%)
Not useful (2%)
◊ Since I don't live at the coast, I read *Coastwatch* mainly for my own enjoyment.
◊ Covers information not otherwise available to me.
◊ I use it in my educational curriculum.
◊ Especially when explaining coastal phenomena, i.e. northeasters, how to judge wind speed by ocean foam, etc.
◊ As an oceanography teacher, *Coastwatch* is my current events literature.
◊ We enjoy the magazine immensely and look forward to reading it.

How do you find the cost of *Coastwatch*?
Just right (91%)
Too high (9%)
Too low (4%)
We didn't ask this question to justify a price increase. We plan to hold at the $12 price as long as we possibly can. Some of you indicated that you thought $6 or $8 would be a better price. We would like to charge a low price too. But we must cover our printing, design and mailing costs. The federal government has virtually level-funded the National Sea Grant College Program during the last 12 years. Consequently, UNC Sea Grant can no longer afford to subsidize the magazine beyond paying the salaries of the staff. And we do not accept advertising to help defray costs. Why not? We don't want readers to think our writing is compromised by advertisers.

As a result of reading *Coastwatch*, have you: (Check all that apply.)

Increased your awareness of marine/coastal issues? (89%)
Gained a greater awareness of Sea Grant efforts on behalf of the marine and coastal environment? (82%)
Developed a better understanding or appreciation of marine science? (69%)
Become a better-informed voter on coastal issues? (55%)
Ordered any Sea Grant publications? (53%)
Subscribed to any of Sea Grant's other free newsletters? (25%)
Used the information as supporting material in a classroom or other educational situation? (21%)
Attended Big Sweep, the statewide waterway litter cleanup? (16%)
Used the information to help your community or state better manage or use its coastal resources? (12 %)
Called a Sea Grant agent or specialist? (9%)
Used the information in your business to develop solutions or answers to marine-related problems? (8%)
Attended a Sea Grant workshop? (7%)

Rate the importance of the following uses of *Coastwatch* to you:

	Very Important	*Important*	*Fairly Important*	*Not Important*
Raises awareness of marine/coastal issues	(63%)	(28%)	(3%)	(2%)
Educates about coastal/marine issues	(60%)	(31%)	(3%)	(3%)
Is a source of regional coastal information	(46%)	(40%)	(6%)	(4%)
Makes science understandable	(25%)	(40%)	(19%)	(11%)
Presents latest coastal research	(37%)	(39%)	(12%)	(7%)
Presents latest coastal extension activities	(28%)	(34%)	(21%)	(13%)
Is a source of marine publications	(28%)	(32%)	(18%)	(9%)

How long do you keep copies of *Coastwatch*?

Regularly save them (39%)
Pass on to others (36%)
Don't know, varies (12%)
Discard after reading (8%)
Save each issue until the next issue (6%)
◊ It depends. I still have issues about Ocracoke ponies, hurricanes, wetlands preservation. But if the issue is devoted to fish, commercial industries or real estate, it goes straight to the trash can.

What do you like most/least about *Coastwatch*?

MOST

◊ It is informative. Since receiving *Coastwatch*, we have become more enlightened about sea grasses, shells, etc. — things we took for granted when we visited the coastal region.
◊ Ease of reading for students — appropriate topics for use in the class.
◊ Variety of information — "one-stop shopping" for marine information.
◊ I like it as it is — an improvement over the previous newsletter format.
◊ Sincere and scientific environmental concern for coastal areas regarding health, food, recreation and the future.
◊ I am very glad *Coastwatch* is printed on recycled paper.
◊ Don't change it, PLEASE!
◊ The breadth and variety of good topics and the interesting writing style that conveys information and ideas with clarity and ease.
◊ Well-written — one of the hundreds of things that hit my desk that I actually read!
◊ From my grade school years, my parents and I have vacationed along the North Carolina coast, and I attended the University of North Carolina at Wilmington. I have always loved the coast, and *Coastwatch* is a continuing education. Keep up the outstanding work.
◊ Up-to-date information on an important area of our living (dying) planet that needs to be used in an intelligent way.
◊ I think it is very well-balanced for a layman like myself.

LEAST

◊ I dislike *Coastwatch* coming in the mail in the middle of its two-month period. Most magazines come before the month printed on the magazine.

We are trying to move our production schedule forward. Please bear with us.

◊ A bit "light" from scientific perspective. Tends to avoid controversial development issues.
◊ Features too long. They are very well-written, but sometimes the length seems daunting when so little time is available for reading.
◊ History, people profiles, fancy format.
◊ *Coastwatch* is not available on-line.
◊ Time between publications.
◊ I think I liked it better when it was free — not because it was free, but it was more informative and less flashy. We will probably not renew this year.
◊ Liked old format better. Currently too much emphasis on commercial fishing.
◊ The new color format makes it look like any other magazine.
◊ Cost excludes some. Too many do not know it exists. Find free advertising.
◊ Articles are "light" and often not well-researched.

Is there something you would like to see included in *Coastwatch* that is not there now?

◊ More seafood recipes.
◊ More reader forum, questions and answers. *That's how we intend for Back Talk to be used, but only a few readers have asked questions.*
◊ More information on recreational fishing.
◊ More on the environmental effects of waterfront construction and development.
◊ I would like to see more about how kids can become more involved with marine issues.
◊ More ideas from Sea Grant on programs concerning positive ways to produce seafood and not damage the environment.

Please suggest story ideas for *Coastwatch* articles.

◊ Beach erosion.
◊ Boatbuilding.
◊ Articles about individual barrier islands — geography, history, development, preservation.
◊ Any historical information about small towns — Ocracoke, Swan Quarter, Oriental — along the North Carolina coast.
◊ Pirates of the coast.
◊ Intracoastal Waterway.
◊ Controversy about the horses at Currituck vs. the horses at Rachel Carson.
◊ Stories on Masonboro Island preservation, Oregon Inlet, whales and artificial reefs.
◊ Beach grasses and shrubs for erosion.
◊ Charter industry.
◊ Impacts of overfishing.
◊ Wastewater treatment.
◊ Hunting, decoys, decoymakers.

Age of subscibers:

18 and under (0%)
19 to 29 (3%)
30 to 49 (39%)
50 to 65 (30%)
Over 65 (26%)
No response (1%)

Sex of readers:

Male (54%) Female (32%)

Education: (Check highest grade completed.)

Grade school (1%)
High school (15%)
College (51%)
Master's (23%)
Doctorate (10%)

Area of residence:

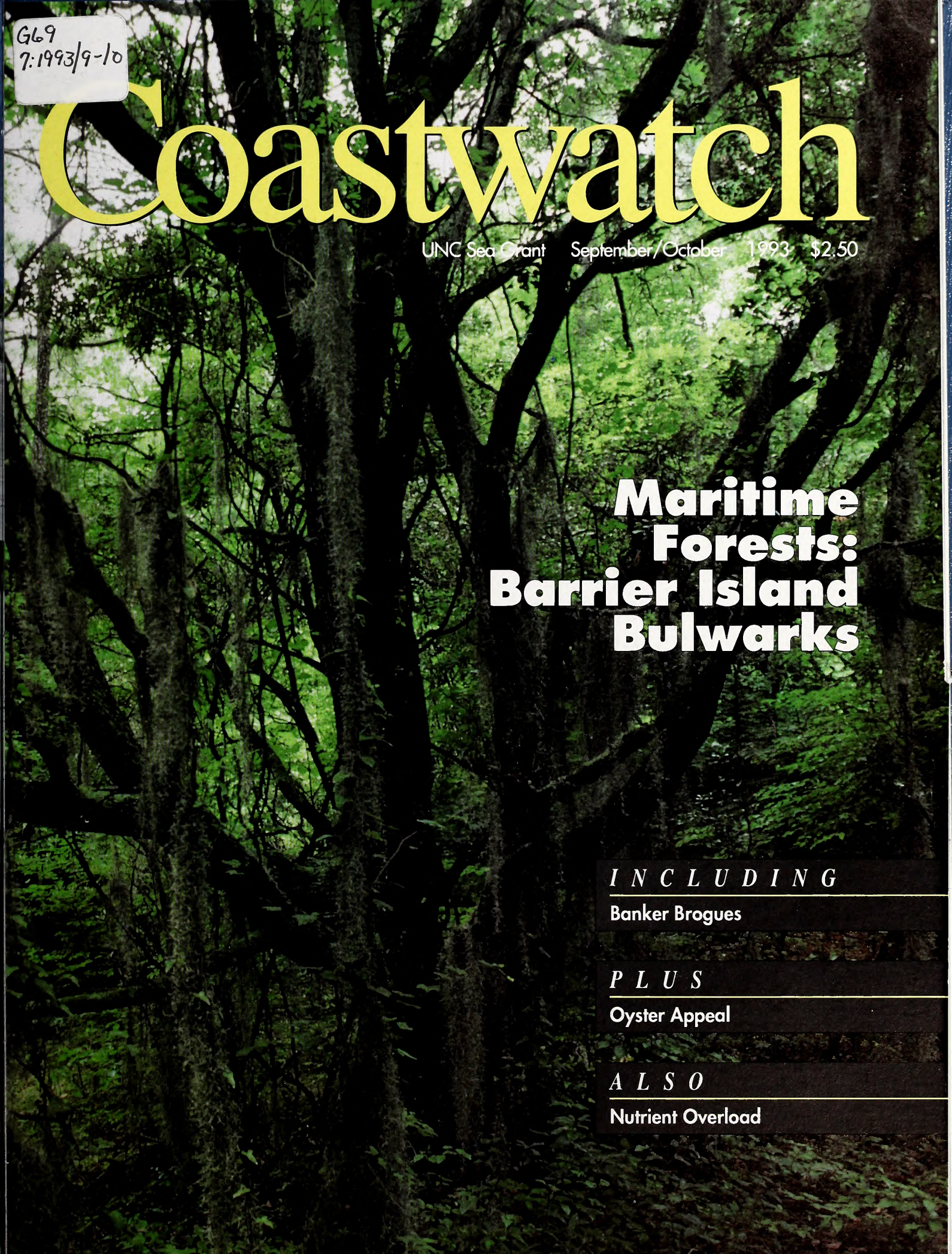
Coastal (36%)
Piedmont (35%)
Mountains (2%)
Out-of-state (27%)

UNIVERSITY OF NORTH CAROLINA SEA GRANT
105 1911 BUILDING
BOX 8605
NORTH CAROLINA STATE UNIVERSITY
RALEIGH, NC 27695-8605

ADDRESS CORRECTION REQUESTED

Coastwatch

UNC Sea Grant September/October 1993 $2.50



Maritime Forests: Barrier Island Bulwarks

INCLUDING

Banker Brogues

PLUS

Oyster Appeal

ALSO

Nutrient Overload

Coastwatch Staff:
Kathy Hart, Managing Editor
Jeannie Faris and Carla B. Burgess,
Staff Writers and Editors
L. Noble, Designer
Debra Lynch, Circulation Manager

The University of North Carolina Sea Grant College Program is a federal/state program that promotes the wise use of our coastal and marine resources through research, extension and education. It joined the National Sea Grant College Network in 1970 as an institutional program. Six years later, it was designated a Sea Grant College. Today, UNC Sea Grant supports several research projects, a 12-member extension program and three communicators. B.J. Copeland is director. The program is funded by the U.S. Department of Commerce's National Oceanic and Atmospheric Administration and the state through the University of North Carolina.

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Front cover photo of Nags Head Woods by Lundie Spence.

Inside front cover photo of a live oak at Shackleford Banks by Scott D. Taylor.

Printed on recycled paper by Highland Press Inc. in Fayetteville, N.C.

from the top

Dear Readers:

Explore the coastal canopies of North Carolina's diminishing maritime forests. Let Jeannie Faris explain these fragile, yet hardy ecosystems and their importance to our coastal communities. Learn what state and local governments are doing to protect these forests for the future.

Next, get a lesson in language coastal-style. Free-lance writer Sarah Friday Peters delves into the distinctive dialects that distinguish coastal communities from one another and from their inland neighbors. Discover the brogue of the Outer Banks and the cadence of the Carteret County localisms, and learn the difference between a "slumgullion" and a "dingbatter."

Then take a seat at the table and set your taste buds for a coastal fall favorite — oysters. After separating the myths from the truths, I'll offer you some safety tips for buying and cooking these delectable mollusks. And to top it off, I've provided some tried-and-true oyster recipes developed by Joyce Taylor, Sea Grant's seafood education agent.

Don't forget to read Coastal Commentary. Coastal Water Quality Specialist Barbara Doll explains why too many nutrients can cause problems in coastal waters.

Until next issue, Kathy Hart

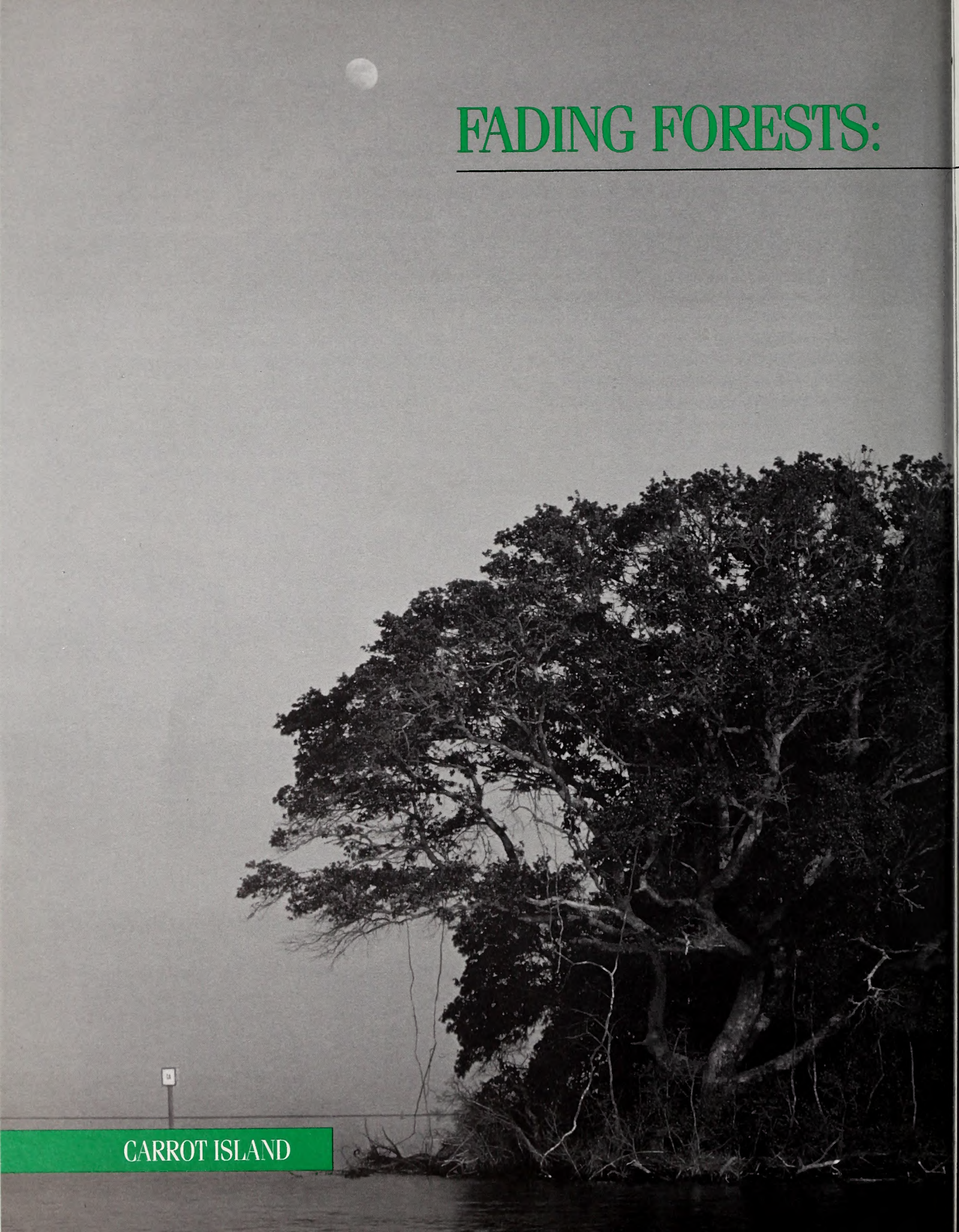
in this issue

Page 10
Oysters

Page 11
Binoculars & Bird Calls

Page 2
Maritime Forests

FADING FORESTS:



CARROT ISLAND

Saving Maritime Forests Tract by Tract

We abuse land because
we regard it as a commodity
belonging to us.
When we see land as a
community to which we belong,
we may begin to use it
with love and respect.
– A Sand County Almanac

By Jeannie Faris

Naturalist Aldo Leopold penned these words 45 years ago, and they're a guiding principle for conservationists even today. But somehow the message has been muted by the demand for land, especially when valuable coastal real estate is at stake.

Witness North Carolina's shrinking maritime forests. Sanctuaries for migratory birds, they grow on the coastline and barrier islands, thick with twisted live oaks, red cedars and loblolly pines, woven with sinewy vines and skirted by green underbrush.

Without question, people love these forests, even to the point of thinning them out and building in them. They have become a commodity. And as their value is measured by the possibilities for construction — the view — the plant and animal life they support is destroyed.

Historically, little has shielded maritime forests from the bulldozer other than the landowner's preference for dense cover or an on-site wetland that was eligible for protection.

But that was before a 1988 inventory showed that by the turn of the century, all privately owned maritime forests in North Carolina would be cleared, pruned or developed. The window of opportunity was about to slam shut. The only remaining stands would be locked into protected preserves, owned by the government and conservation groups.

State regulators took notice.

Today, the outlook is improved. The state has rallied local governments to protect their own maritime forests. Local ordinances, though subject to the winds of political change, can be honed as more effective protection tools than sweeping state regulations, says Mike Lopazanski, coastal program analyst for the N.C. Division of Coastal Management (DCM).

Scott D. Taylor

Historically, little has shielded maritime forests from the bulldozer other than the landowner's preference for dense cover or an on-site wetland that was eligible for protection.

"Local ordinances have been getting better all the time," he says. "People have recognized that these forests are important."

Still, ordinances can only manage — not stop — development on privately owned lots. The best recourse is to buy the remnants, protecting the unusual barrier island habitat. Conservationists say the maritime forests are worth the effort. But not all agree they're worth the price. Because the forest sites are in such high demand, they command prices that the government and conservation groups are hard-pressed to pay.

Buxton Woods is a good example. The price of saving 700 acres there was $4.9 million in state and federal dollars. Close to half of that land was bought in the last two years, and more purchases are expected.

Even costlier is the maritime forest on Bald Head Island, where a 128-acre site recently cost $2.4 million. The Nature Conservancy North Carolina Chapter arranged the purchase and is negotiating a second phase of 70 to 90 acres.

"You literally almost have to buy land by the square foot rather than by the acre," says Fred Annand, associate director of The Nature Conservancy North Carolina Chapter.

So conservation groups snap up scraps of these woods through donations, grants, conservation easements and bargain sales. In the case of the Bald Head Woods purchase, money was raised through a $4 million grant from the U.S. Fish and Wildlife Service, a $1 million land donation and $325,000 from the Recreation and Natural Heritage Trust Fund, which receives proceeds from the sale of personalized license plates. About $2.9 million remains for future purchases.

Continued

Annand and Todd Miller, executive director of the N.C. Coastal Federation, lament that it's come to this. The history of maritime forest preservation in North Carolina is full of missed opportunities to buy and regulate the land, they say. The state passed up chances in the 1960s and 1970s to buy Bald Head Island property for its assessed tax value. Similarly, Buxton Woods tracts were passed over when they were much more affordable.

"It's really unfortunate that here in North Carolina, the state itself didn't have the vision or foresight to protect maritime forests years ago, when land was more affordable," Annand says.

On the regulatory front, the Coastal Area Management Act doesn't offer a protection category for maritime forests. Nor has any site been specifically listed as an Area of Environmental Concern, worthy of special requirements on development.

"Are we doing enough to protect maritime forests?" Miller asks. "No."

Nobody knows precisely how many acres stood before the start of the coastal development boom of the 1970s. But today, less than 12,000 acres, owned publicly and privately, stand on barrier islands, according to the 1988 survey commissioned by the DCM. About 30 percent have been corralled by preservation efforts.

The remaining maritime forests number 20 along North Carolina's barrier islands, ranging from 12 acres to 3,000 acres. The top-priority sites, the jewels of our coast, are Kitty Hawk Woods, Nags Head Woods, Buxton Woods and Bald Head Woods. Efforts continue to save them. But at sites less known, the rate of development has been dizzying, and it's been accelerated in recent years by talk of protecting maritime land. Since 1988, when the 12,000 acres were inventoried, four forests have fallen to development. They were Atlantic Station, Emerald Isle Canal, Ocean Ridge and Piney Point — all on Bogue Banks.

North Carolina is the meeting point of subtropical, broad-leaf evergreen trees of the southern coastal forests and the temperate, deciduous elements of the northern forests. Bald Head Island, for example, is the northernmost range for the cabbage palmetto, while American beech is found only in the maritime forests from Nags Head north.

The tortuous shape of the maritime trees may be their most distinguishing feature – at points all along the coast. Salt spray and wind seem to age the oaks beyond their years, giving them an ancient, gnarled appearance.

Lundie Spence

Consequently, there is no such thing as a typical maritime forest in this state. They vary to the north and south, inland and shoreward, and eventually they blend into mainland forests. But that's not to say that they don't share defining features. The tortuous shape of the maritime trees may be their most distinguishing feature — at points all along the coast. Salt spray and wind seem to age the oaks beyond their years, giving them an ancient, gnarled appearance. Their branches reach wide over the forest floor, and their waxy leaves form a canopy to deflect salt and heat. Underneath this leafy umbrella grows an understory of smaller trees and plants, as well as a population of animals hardy enough to live in this rigorous environment.

The uniform appearance of maritime forests, belying the regional differences, is one of several paradoxes of these unique wooded habitats.

There are others. Maritime forests are at once fragile and hardy. Fragile because they're crippled by intrusive breaks in their canopy that let in salt and wind. The airborne salt tips the fragile balance of nature, and the trees begin to die. But they're hardy enough to grow on inhospitable barrier islands, where they live life on the edge, already stressed by the natural forces of salt spray, wind and nutrient-poor and droughty soils.

"I think these are the toughest forests we have," says Ralph Heath, now retired from the U.S. Geological Survey. "If they weren't tough, they wouldn't be living in these environments."

Maritime forests anchor the shifting soils of barrier islands, preventing erosion, protecting against storm damage, preserving groundwater and providing habitat. But these bulwarks of nature, disfigured by the elements, appear to crawl away from the ocean spray.

The shrubs tilt landward. Trees reach and twist for inland shelter, all the while changing size, shape and species as they retreat from the water and wind. Closest to the water, stumpy shrub thickets take root. They

Scott D. Taylor

fade into high-canopied maritime woods and wetland scrubs farther inland.

This progression of the maritime forest from the seaward edge of barrier islands has been studied by the N.C. Natural Heritage Program, which inventories and prioritizes the state's rare plant and animal species.

Maritime **shrub forests** live closest to the salt water. The sculpted vegetation that grows here — usually live oak, wax myrtle and yaupon — has been sheared by salt spray. Looking more like brushy footstools than their inland kin, these trees and plants develop a thick protective leaf covering.

Behind the maritime shrub grow **evergreen forests** and **deciduous forests**, depending on the region. In both, branches thick with leaves knit a canopy over the forest floor. It cloaks the more vulnerable subcanopy of shrubs, herbs and smaller stands of red bay, ironwood, Virginia red cedar and flowering dogwood. But beyond these similarities, the species that weave the canopy and underbrush of the two forest types vary like the handiwork of different seamstresses.

The sweeping canopy of the evergreen forest, most common from Buxton Woods south, is dominated by live oak and loblolly pine. Its northern counterpart, the maritime deciduous forest, is thick with loblolly pine and hardwoods such as Spanish oak, beech, sweet gum and water oak. A greater diversity of greenery sprouts from the floors of the deciduous forests, which grow in Nags Head Woods, Kitty Hawk Woods and Currituck Banks.

In both forests, a skirt of shrubs brightens the brown matted floor with the green of yaupon, wax myrtle, beautyberry, blue huckleberry and cane. Vines, some as thick as an adult's forearm, twist up the tree trunks and along the reach of their limbs. Rainwater washes over the vines and lichens of red and green to revitalize the roots and soil of the forest floor.

Maritime forests grow on a washboard topography of swales and ridges that correspond to old dunes of long-dried beaches. Swales are the low-lying valleys between the dunes; ridges are the dune peaks anchored in place by the maritime trees. Without this greenery stronghold, the dunes would be active again.

Continued

Scott D. Taylor

Like the changing canopies of evergreen and deciduous forests, the tree and plant populations shift from ridge to swale. Live oak and red cedar dominate the canopy on dune ridges. They stand low and reach high with their branches. The loblolly pine, ash, maple and other mixed hardwoods that stand in the swales grow taller and less branched. A mixture sinks roots in the slopes between.

In the bottom of these swales and other barrier island depressions grow freshwater wetland forests: **swamp forest** or **shrub swamp**. Both are wet because the ground surface is below the water table, but their height and vegetation differ.

The swamp forests — with a tall canopy of red maple, sweet gum, green ash and bald cypress — can be found at Kitty Hawk Woods, Southern Shores Cypress Swamp, Nags Head Woods, Theodore Roosevelt Natural Area and Emerald Isle Woods. The underbrush is thick with vines, herbs and a population of ironwood, swamp red bay and sweet bay.

The low-standing maritime shrub swamps emerge from the forests as a dense canopy of shrubs or small trees, including red bay, swamp dogwood and occasional loblolly pine or red maple. Rich in ferns and tangled with the vines of greenbrier and Carolina supplejack, they are found in Buxton Woods and Nags Head Woods.

These freshwater wetlands range from moist soil to knee-deep sloshing water, all habitat that is critical to the biodiversity of a maritime forest, says Vince Bellis, a biology professor at East Carolina University. Species that aren't tolerant of salt water thrive here. Frogs and some turtles populate the wetland, where they're prey to snakes, birds and alligators. Raccoons also rely on this critical habitat, foraging at night for frogs, toads, snakes and birds. But they don't mind moving to the fringe of the salt marsh for mussels and crabs. Deer, too, graze on marsh and inner dune grasses.

Still, the habitat is less than hospitable. The forests on barrier islands support only one-third to one-quarter of the biodiversity on the adjacent mainland, Bellis says.

Few rare animals live only in the maritime forest, but this habitat is important for a wide range of wildlife. It offers critical feeding, resting and roosting sites for migratory land birds, especially in the fall. Unfortunately, barrier island wildlife is also

vulnerable to forest fragmentation or clearing for development, roads, power lines, water and sewer lines. The continuity and habitat of the forest is lost, isolating populations and preventing gene flow.

Protecting maritime forests as disconnected patches of woods won't be enough for North Carolina, says Alan Weakley, a botanist and assistant coordinator for the N.C. Natural Heritage Program in the Division of Parks and Recreation. Only as functioning ecosystems — with canopy, understory and wetlands intact — will the biodiversity and habitat for rare species be preserved, he says. That calls for preserving tracts of undisturbed maritime forest.

But saving these woods is more than an esoteric exercise in conservation.

Maritime forests are valuable for recreation, educational programs, green space and tourism. Tens of thousands of people visit each year and take nature walks in the Theodore Roosevelt Natural Area, Hammocks Beach State Park, Nags Head Woods and Buxton Woods.

They also protect the water supply on barrier islands by collecting rainwater in their sandy soils. Aquifers below maritime forests in Nags Head and Hatteras Island supply local water taps.

And these forests have a fascinating history. Since Native Americans inhabited North Carolina shores, the maritime forests have drawn people to their shaded cover. The early settlers built their homes in the sheltered forests, gardened in humus under the trees and built their boats from the gnarled live oak and Atlantic white cedar.

For all these valuable qualities, however, the options for preserving maritime forests are limited.

The Coastal Area Management Act of 1974 does not protect maritime forests from being cleared. It was a missed opportunity, Miller says. As a result — in the absence of local regulations — the maritime forest ecosystem can be destroyed by unmanaged activities that include widespread clearing of forest vegetation, wetland alteration, leveling of dune ridges and drawdown of the water table.

"To a large extent, the issue has already been decided," Miller says.

A specific maritime forest would come under the protective jurisdiction of DCM only if it was granted status as an Area of Environmental Concern (AEC), a unique natural area of statewide significance, says Lopazanski. AEC status requires that development meet standards to protect a specific coastal resource.

Maritime forests anchor the shifting soils of barrier islands, preventing erosion, protecting against storm damage, preserving groundwater and providing habitat. But these bulwarks of nature, disfigured by the elements, appear to crawl away from the ocean spray.

Lundie Spence

The Coastal Resources Commission (CRC) alone has the power to designate AECs, but it grants them sparingly. It has consistently declined to grant special protection for any maritime forest, starting with its Buxton Woods decision in 1989. That decision, however, hinged on Dare County's agreement to protect the state's largest maritime forest with a strict local ordinance.

And though Buxton Woods was not the precedent-setting case that conservationists had hoped for, it did invite a closer look at the condition of maritime forests. DCM contracted with Duke University researchers to inventory all of the state's barrier island woodlands. The unsettling findings of the 1988 report were taken up by a working group, named by the CRC, to suggest ways to protect them.

Weakley, a member of the working group, says he doubted the ability of AEC status to preserve the integrity of maritime forests. It can only limit the impact of development, he says. The working group suggested several other courses of action.

It directed the state to explain to maritime forest landowners the importance of their property and options for protecting it, to help developers and small lot owners prepare site plans to minimize the impacts and to encourage local governments to pass ordinances that protect the maritime forests.

As a result, some local governments, especially in Dare County, have forged new protection packages for their maritime forests. Nags Head and Kitty Hawk now have strict zoning. In Carteret County, Pine Knoll Shores limited the area

Continued

of a lot that can be altered adjacent to the Theodore Roosevelt Natural Area to 25 percent. Farther south, in Brunswick County, Bald Head Island passed vegetation protection ordinances.

But above all, the working group urged the state and nonprofit conservation groups to buy the remaining quality tracts. It recommended a general AEC designation for maritime forests as a last resort if these lands couldn't be adequately protected.

Nine maritime forests were ranked by the panel as the state's top priorities: Kitty Hawk Woods, Nags Head Woods, Buxton Woods, Theodore Roosevelt Natural Area, Emerald Isle Woods, Huggins Island, Bluff Island, Middle Island and Bald Head Woods. Emerald Isle Woods was eventually dropped. The sites were nominated for AEC designation by several environmental groups but dismissed by the CRC in favor of other options cited by the working group.

And so continues the struggle between conservationists and regulators over how best to protect valuable natural areas. But it's a struggle that has spawned some successes, Lopazanski says. Today, nearly 3,300 of the 5,000 acres in these high-priority sites are managed as natural areas for conservation. More than 95 percent of the remaining 1,700 acres is subject to strict local protection ordinances.

Weakley offers mixed reviews of recent efforts to save the remaining maritime forests. Since the 1988 inventory, four Bogue Banks sites have been lost; on the other hand, significant tracts have been saved.

"Over the last several years, there have been notable victories and notable losses," he says. "Every year, a few more acres of maritime forest are assured protection. But also every year, there are fewer acres of maritime forest remaining. This threatened ecosystem is still declining in North Carolina, but at least we're making progress in protecting a few of the most important remnants."

Future gains, however, may be modest since the financial means for purchasing the tracts are limited. Market forces are a major determinant in what can be done. Maritime forest land is some of the most expensive in the state, though prices vary by location.

The state is actively pursuing the path of acquisition that was suggested by the working group, especially in Buxton Woods, Bald Head Woods and Kitty Hawk Woods, Lopazanski says. The unfolding phase-two purchase in Bald Head Woods wraps up three years of work by the CRC, DCM and local and private groups.

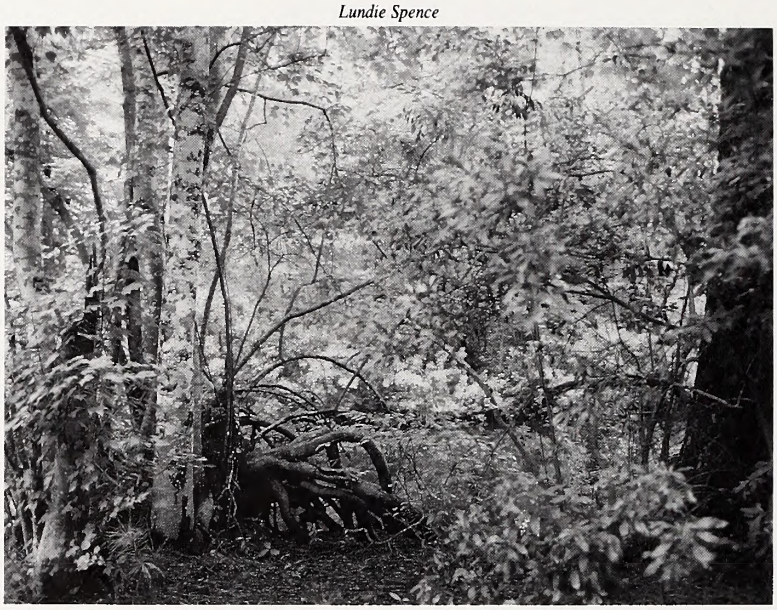
Miller, however, predicts that the conservation effort will eventually turn away from the barrier island maritime forests and focus on burgeoning development along the estuaries, sounds and bays. The effort to save the maritime forest ecosystems began too late, he says. As a result, the best that can be hoped for most sites is to preserve the appearance of the forest.

But the lesson can be applied to other ecosystems that are in danger of encroachment. And the hard question then is how to allocate the money.

"The costs will have to be weighed: $10 million for 100,000 acres of wetland versus $4 million for several hundred acres of maritime forest," Miller says.

Information about maritime forest types was provided by the N.C. Natural Heritage Program. Other helpful sources of information were *An Assessment of Maritime Forest Resources on the North Carolina Coast* and *Final Report of the Maritime Forest Working Group*, both Division of Coastal Management publications.

Lundie Spence



The shrubs tilt landward. Trees reach and twist for inland shelter, all the while changing size, shape and species as they retreat from the water and wind. Closest to the water, stumpy shrub thickets take root. They fade into high-canopied maritime woods and wetland scrubs farther inland.

Rating North Carolina's Maritime Forests

Eight maritime forests stand out among others on North Carolina's barrier islands because of their ecological significance and potential for preservation. In 1990, a citizens' working group studying the state of maritime forests rated them as high-priority sites for preservation efforts.

KITTY HAWK WOODS, Dare County, received attention when nearly 600 acres of the 1,900-acre forest were donated as a conservation easement for a natural area. The state and Kitty Hawk split the easement, which is a permanent tool that limits future uses of the land. The forest is more than 50 percent maritime swamp forest; the remainder is deciduous forest owned by developers. It is on the widest part of Currituck Banks with gently rolling dune ridges and low, wet swales. And it is the largest site in North Carolina with species more typical of northern maritime forests. The forest's significance lies in its size, lack of disturbance and extensive forest wetlands. It is also the only forest site in the state with stands of bald cypress.

NAGS HEAD WOODS, Dare County, is an ecological preserve owned by The Nature Conservancy North Carolina Chapter and the town of Nags Head. Today, 755 acres of the remaining 900-acre maritime forest have been set aside for conservation. The effort was launched more than a dozen years ago with a small land donation from a concerned couple. Most recently, The

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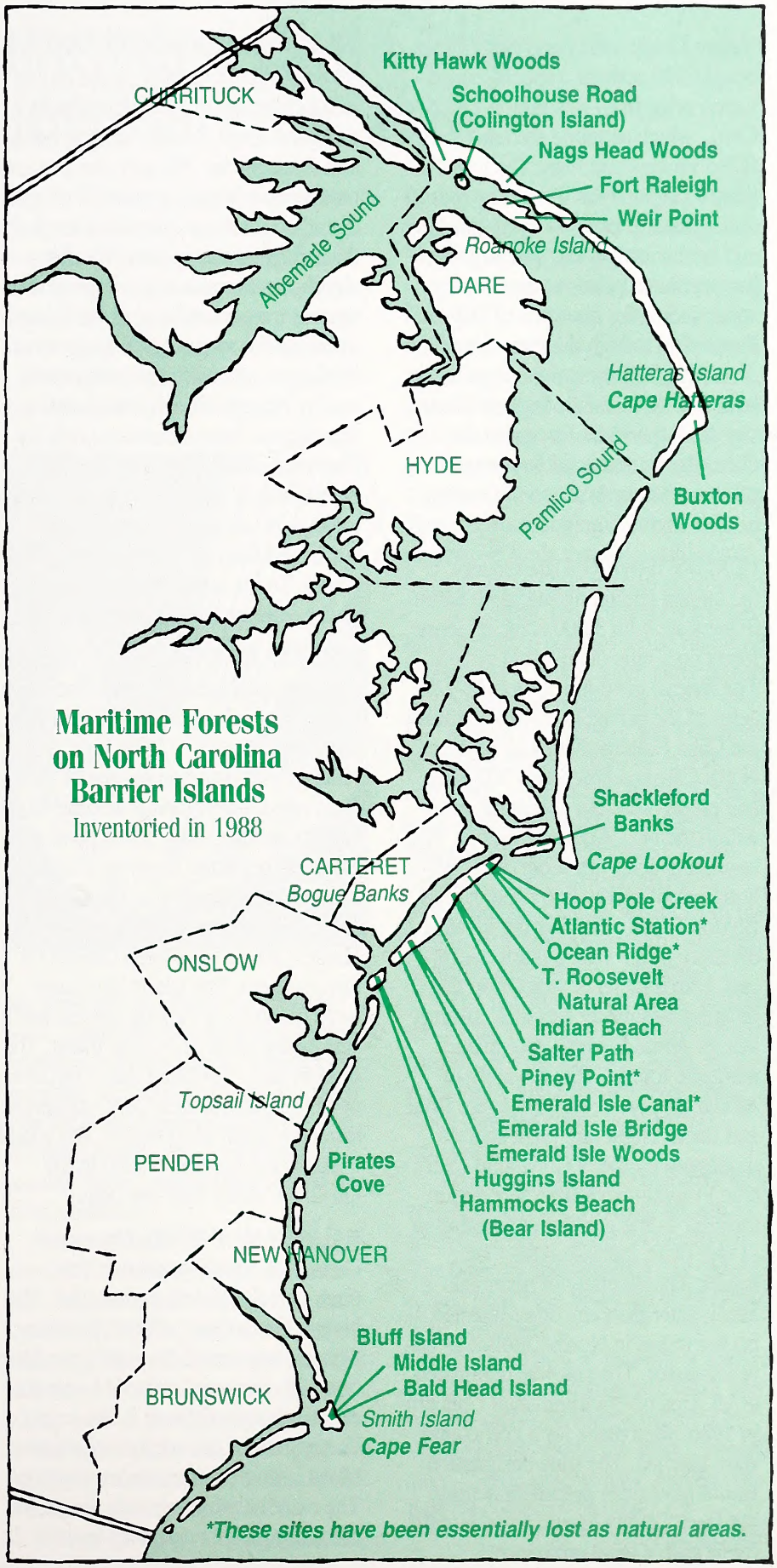


Nature Conservancy and Nags Head bought 390 acres at a special conservation price from Resolution Trust Corp., which acquired the land from a failed savings and loan. The forest's steep topography is formed by relic dunes that dip into low-lying swales and freshwater ponds. The largest of the interdunal ponds is the primary water source for the town of Nags Head. And though the forest has a low diversity of plants compared to mainland forests, it has the highest diversity of all maritime forests on the Outer Banks and is habitat for rare plant species such as woolly beach heather and fen orchid.

BUXTON WOODS, Dare County, is the largest remaining maritime forest in the state with 3,000 acres of dense forest on a relic dune-swale system. The federal government bought 920 acres of the privately owned forest for the Cape Hatteras National Seashore; North Carolina purchased 700 acres and preserved them as natural areas within the N.C. Coastal Reserve. The remaining acres are subdivided into hundreds of privately owned parcels. Buxton Woods displays the greatest diversity of the state's maritime forests, with a range of vegetation that includes freshwater marshes, swamp forests, shrub swamps and upland maritime forests. This diversity of habitat supports a variety of rare flora and fauna. Eight rare plant species monitored by the N.C. Natural Heritage Program have been reported in the area — the greatest concentration of rare plant species on the Outer Banks. The diversity of mammals is also greater than any other forested barrier island in North Carolina or adjacent states. The site was nominated as an Area of Environmental Concern in 1986 when plans for a golf course were hatched. The state designation would have been precedent-setting, but Dare County agreed to protect the forest with a local ordinance.

THEODORE ROOSEVELT NATURAL AREA, Carteret County, is the largest remaining tract of the Bogue Banks maritime forest. North Carolina owns and manages the 290-acre site as a state natural area, which is valued for its undisturbed maritime forest and extensive dune ridge-swale system. The forest is significant because it is a large, contiguous tract containing all the common maritime forest species, swamp forest, freshwater and saltwater marshes. In nearby Atlantic Beach, the maritime forests have been cleared entirely for commercial development. But Pine Knoll Shores, where the natural area is located, is one of the highest, most stable and heavily forested parts of the island. To the south, Emerald Isle is under extreme development pressure.

HUGGINS ISLAND, Onslow County, is 100 acres and generally flat. The steep sides of the island leading up from the marsh are about 6 1/2 feet high. It is relatively undisturbed on one of the most rapidly developing sections of the North Carolina coast. It is a good example of maritime forest on a sound, rare along the North Carolina coast because the larger sound islands such as Harkers Island have been cleared for development. The island has many large old trees of various species and a significant stand of swamp forest. The owners have stipulated that it be developed as a natural area, park, corporate retreat or small subdivision. The island is classified as conservation in the Onslow County land-use plan.

BALD HEAD WOODS, Brunswick County, is chiefly a resort in the three-part Smith Island Complex. The Nature Conservancy North Carolina Chapter negotiated the state's purchase of a 128-acre tract in the 414-acre forest; another purchase is in the works. Today, half of the original maritime forest is golf course and development. The extremely old trees are one of its most significant remaining features. It is also the largest maritime forest in the state that has undeveloped natural transition zones with both soundside salt marshes and oceanside dune systems. Its sparse canopy, fallen to storms, allows light to penetrate and nourish a thick undergrowth of vines. The entire Smith Island Complex is registered as a National Natural Landmark. Bald Head is the southernmost island in the complex and supports maritime vegetation resembling that of the South Carolina sea islands, such as an abundance of cabbage palmettos.

MIDDLE ISLAND, Brunswick County, is 100 acres and located between Bluff Island and Bald Head Island. The privately owned island is almost completely surrounded by marsh and has two to three dune ridges that are pronounced at the western end. Like the other islands of the Smith Island Complex, its sparse canopy is disturbed by frequent storms that increase light and promote dense undergrowth. Although this island is being developed, enough of the woods remains natural to merit its protection as an excellent example of a maritime forest with subtropical elements.

BLUFF ISLAND, Brunswick County, is the smallest and northernmost island of the Smith Island Complex. The state owns, but doesn't actively manage, the 70-acre tract. It is surrounded by marsh on its northern, southern and western boundaries; its eastern boundary is a dune system and active beach. There is little topographical relief on the island, which is flat except for two dune ridges that run down its middle. The forest canopy is thin due to frequent storms that allow the growth of understory and vines. Its freshwater pond is unusually close — about 330 feet — to the beach.

From *An Assessment of Maritime Forest Resources on the North Carolina Coast*, a report submitted in 1988 to the Division of Coastal Management.

Jeannie Faris

Binoculars and Bird Calls: Tracking Maritime Fowl

John Fussell enters the maritime forest, cresting the ridges, wrestling thorny vines, until he's found a suitable clearing among the pines and live oaks. He holds his binoculars at attention, just in front of his chest.

Silence. Then he calls:

Sh, sh, sh, sh, sh.

Sh, sh, sh, sh.

Sh, sh, sh, sh, sh.

From deep inside the Theodore Roosevelt Natural Area, an unseen prothonotary warbler answers him with triple "tweets."

A Carolina wren weighs in with a "toodle de doo."

The noise that Fussell, a biologist, is making is a distress call. And it's supposed to draw birds close to investigate.

This time, no birds come into view. But several sound off.

The species of birds singing today in this Carteret County natural area have changed some since 1974, when Fussell first surveyed a 25-acre plot there.

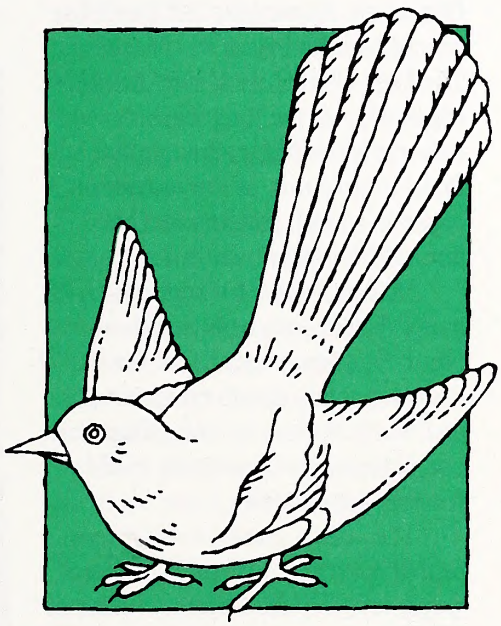
Some are new to the area; others have disappeared.

For better or worse, this pattern is emerging all along the Carolina coast as barrier island forests are fragmented and cleared away. The effect is compounded by the fact that barrier islands, by their nature, support lower diversity of plants and animals than the mainland, Fussell says.

Carolina chickadees, for instance, have been traditionally absent from barrier islands in North Carolina, but they began moving into the Roosevelt natural area 25 years ago.

"In the 1970s, you wouldn't have heard a chickadee singing here," Fussell says, adding that they're still not nesting at Cape Hatteras or Buxton Woods.

The same pattern of migration is true for starlings, an introduced species from Eurasia that has driven out some native birds by taking over their nest cavities. Starlings could be responsible for a decline in the numbers of



the great crested flycatcher, Fussell says. Similarly, the black-throated green warblers may have fallen victim to the growing population of brown-headed cowbirds and common grackles. The cowbird lays its eggs in the nests of smaller birds, forcing them to find new living quarters.

A more welcome sight to bird enthusiasts was the arrival of the white ibis, which started nesting along the coast in the 1960s. Only a rare summer visitor to North Carolina earlier in this century, it's now a common species along most of the Carolina coast, even in the winter. Likewise, the osprey was rarely sighted nesting in barrier island treetops before the early 1970s.

"You had to go to a big effort to see an osprey nest," Fussell says. "But today, they're on channel markers. They're all over the place."

The osprey is making a comeback from DDT poisoning that left its eggs brittle and unviable. Other immigrants are riding the wings of "progress" around North Carolina's maritime forests. As the coast is developed, its woods are fragmented by roadways and clearings for sewer systems and power lines. These openings are road maps for non-native birds that fly in and sometimes flush out the original populations.

In general, the ubiquitous species have grown in number in the maritime forests; the Carolina wren and northern cardinal are the most common.

Fussell's surveys of the Theodore Roosevelt Natural Area — in 1974, 1977 and 1993 — show that common grackles have increased. But the species of the forest interior have declined. Black-throated green warblers, and perhaps other species, are now absent from the island as breeders. Once, 10 pairs nested in the area each breeding season.

The red-shouldered hawk, present in the 1970s, is gone, Fussell says. This is true also for the red-eyed vireo, white-eyed vireo, great crested flycatcher, black-throated green warbler and chuck-wills-widow.

The brown-headed cowbird was not represented in the 1970s at all, but showed strongly in the 1993 survey. The blue jay and Carolina chickadee turned up for the first time in 1977 and have remained.

"Those kinds of patterns would be the case in other maritime forests, and not just maritime forests but a lot of wooded areas along the coast," Fussell says. "Some species have moved out; they've ceased to be there.

Jeannie Faris

COASTAL DIALECTS:

By Sarah Friday Peters

Spend any time around Harkers Island, Ocracoke or the other nooks and crannies of North Carolina's coast, and you're likely to hear something akin to a foreign language.

Take the words of a young fisherman from Cedar Island.

"Oi loike to catch them lon thans that look loike snakes — eels, yeah," the 6-year-old boy said. "Meeny toimes" that summer, he'd brought them home to his mother's fry-pan. "It'd have a 'hole mess of eels in it, and she chopped'em in half and we eat'em."

"Did they taste good?" someone asked.

"Noit to me they didn't," the boy said. "Taists like snake."

Not only do the words sound funny — a sharp detour from the genteel, rolling drawl of the South — but the vocabulary itself takes a curve down a road less traveled by most North Carolinians.

Words like "begaumed," "benambered," "wadjit" and "jellywhopper" color coastal speech from Duck to Wilmington and leave visitors intrigued as to the mysteries of their origins.

Some natives say the dialects survive from the time of Queen Elizabeth and Sir Walter Raleigh. Others say shipwrecks left English ancestors stranded on the beaches. The Lost Colony itself may mark the beginnings of the tongue, some believe. More likely, though, the dialects are a mix of foreign and regional speech patterns that have threaded together over time.

No one knows for sure how many dialects can be heard along North Carolina's coast. But since a dialect is made up of certain sounds and words spoken by one group or in one place, each community could feasibly have its own.

The state's coastal towns were settled at different times in different ways, says Wynne Dough, curator of the Outer Banks History Center and a native of Roanoke Island. Differing settlement patterns affected the way the people of Manteo, Hatteras and other communities lived. And it influenced their speech.

Today, the brogues of Ocracoke and Harkers Island — often called "Hoigh Toide" — sound the most intense. But the dialects of Hatteras, Cedar Island, Salter Path and other sites along the Outer Banks carry their own blend of spoken signatures. Only a stretch of coastline near Wilmington lacks well-defined patterns of speech.

The way the "Ocockers" (Ah-cockers) of Ocracoke, the "Ca'e" (Kay) Bankers of Cape Lookout and other coastal natives speak today can be traced to the beginnings of European settlement some 300 years ago. People came to the Carolina coast first by way of the Albemarle region in the mid-1600s. Then they sailed into Ocracoke, Cape Lookout, Wilmington and other points south during the next 100 years.

Where these 17th- and 18th-century pioneers settled, their dialects followed. And American English began to take shape.

English settlers influenced the speech of the Carolina coast the most. Yet marked differences arose from Wilmington south. In the Piedmont, where Scotch-Irish and Scottish Highlanders moved in, other language lines were drawn. And to the west, Scotch-Irish and German settlers brought a different tongue.

It was isolation, coupled with a slow rate of change, that kept hints of the Old World speech alive at the coast.

Queen's English or a Language of Their Own?

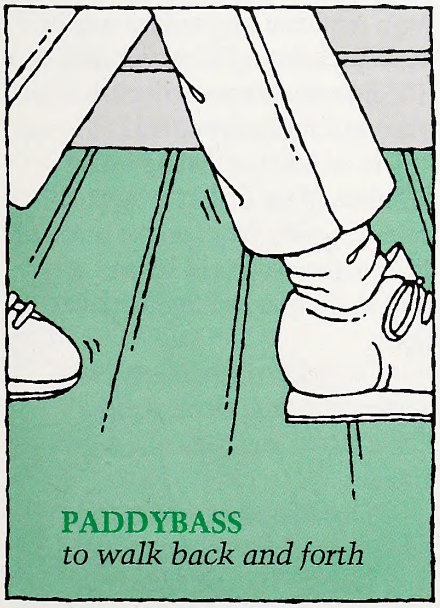
NORTH SHORE SETTLEMENT

Until the mid-1600s, few pioneers ventured to the desolate strip of sand called the Outer Banks.

English settlers first followed the lead of Sir Walter Raleigh to the Albemarle region and Virginia in the 1640s. The king's lord's proprietors deeded huge tracts of land there in the hopes that settlement would take place.

Celts, Turks, Moors, Italians, Dutchmen, Africans and others came, too, Dough wrote in a 1982 essay. But the English and Celts came in the greatest numbers.

They migrated first into Virginia, says historian R.D. Connor in *North Carolina: Rebuilding an Ancient Commonwealth.*



PADDYBASS
to walk back and forth

"The sand reefs, the shifting inlets, the ocean currents and the breakers off Cape Fear, Cape Lookout and Cape Hatteras determined the fact that North Carolina should not be settled by colonists coming directly from Europe, but by overflows from her neighbors," he wrote.

By the 1660s, settlers began filtering down from the Albemarle to the North Shore of the Outer Banks in search of fertile farmland and navigable waterways. Primarily natives of west and southwest England, they raised cattle, grew tobacco, fished and piloted ships on the Potomac, James, Meherrin and Chowan rivers.

And they stayed. Many of the surnames recorded on the Outer Banks in the 1790 U.S. Census remain the same today, Dough says. Only wars and hurricanes uprooted Outer Bankers from their land beside the sea.

With the people remained traces, or relics, of their dialects.

OUTER BANKS BROGUE

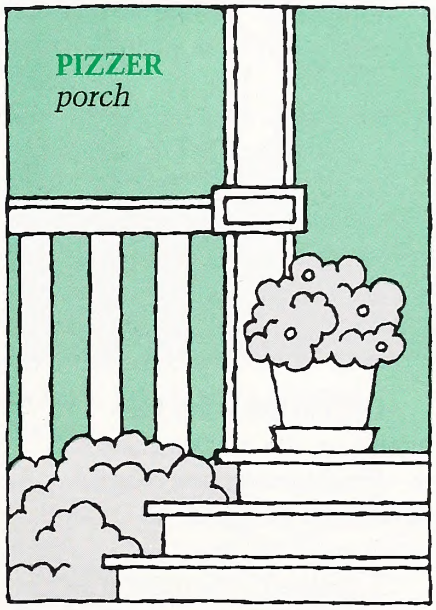
Along the Outer Banks lingered Old English words such as "couthy" for kindly, "yallow" for yellow and "a" before participles, such as "a' goin'" and "a' huntin'."

So did pronouncing the final "r" in words distinctly, instead of slurring over it, a trait more Southern than English.

Bankers speak in rhythms, too, emphasizing different syllables in certain words. They say "ax" instead of "ask" and often use a "v" instead of "th," as in "mover" and "brover" for "mother" and "brother," Dough explains.

More noticeably, they exaggerate the letter "o" in words like "house," "out" and "about." Called a diphthong, two sounds blended into one, the letter combines the sound of "e" as in "bed" or "let," and "u" as in "put" for an ever-so-English ring.

Visitors may hear bits and pieces of the Outer Banks brogue



PIZZER
porch

repeated around Cape Lookout and especially in Ocracoke. Many of the dialect's traits remain distinct, but others are shared between towns like dandelion seeds scattered down the coast. Age-old myths cloud the true picture of the dialects of Ocracoke and the Outer Banks.

ISLAND SOUNDS

To help clear the fog, sociolinguist Walt Wolfram of N.C. State University has identified characteristics of Ocockers' speech in a current study on the island.

Ocockers keep a "t" on the end of words such as "oncet," he found. They say "h'it's" for "it's" and "weren't" for "wasn't" just as

Continued

English natives did. And words like "bear" and "there" sound more like "bar" and "thar."

Old English words keep turning up, too, on Ocracoke.

If a dingbatter gets quamish standing on the pizzer, an Ococker won't mammick him.

Translated: If an outsider gets a stomachache standing on the porch, an Ocracoke native won't bother him.

But the trait that sets many Ocockers, Outer Bankers and Ca'e Bankers apart from other coastal communities — and keeps tourists and the media agog — are the "Hoigh Toide" pronunciations that sound more British than crumpets to our American ears.

"What toime is it hoigh toide on the sound soide?" you might hear in Wanchese, Ocracoke or Hatteras, says Ford Reid in *The Coast*.

More a "uhy" sound than an "oy" sound, this diphthong links the dialects of the Outer Banks together like a long, sturdy rope. To a trained ear, the sound comes from the back of the tongue, not the lips (as in "boy"), blending the "au" sound in "astronaut" and "box" with the "i" sound in "sister" and "milk."

"I think what we're dealing with is an Outer Banks phenomenon," Wolfram says. Migrations between islands, following fish and escaping storms, were typical years ago.

MYTH AND MYSTERIES

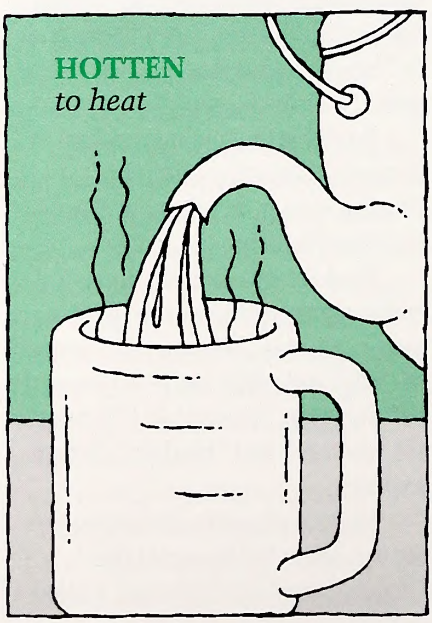
Such strange and wonderful speech must have exotic explanations, people think. So for decades, they've been searching for an answer and the holy grail of language — a pure English dialect straight from the queen.

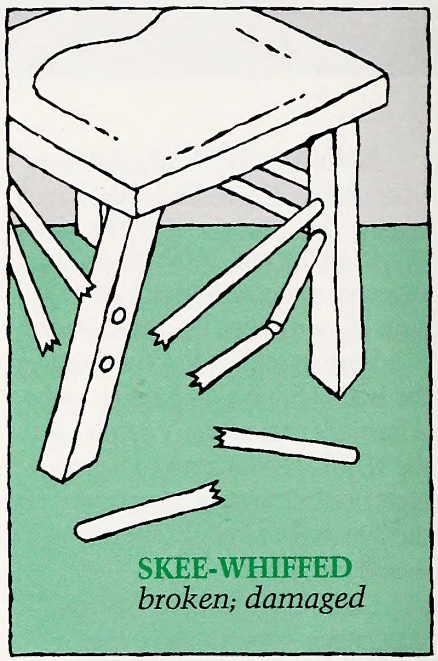
Some islanders think pirates, castaways from England or travelers shipwrecked off the coast first brought the brogue to the Outer Banks and Ocracoke.

Others say it's Australian or Arabian.

Not so, Dough says.

Talk about Arabs began after Cal H. Wylie published a novel in which he portrayed the sandy soils of the Outer Banks as "Arabia," Dough says.





Some natives say their ancestors sailed straight to the Outer Banks from England.

"My suspicion is that there was a bit more migration between the mainland," Wolfram says. Most likely, Ocracoke's first settlers came from southeast England by way of the Maryland and Virginia colonies. The first records show English ship pilots staking land in 1715.

In addition to finding strong affinities of the dialect to Appalachian English, Wolfram has noted links to the dialects of Ireland, as well as Tangier and Smith islands north.

One other myth lingers like a stubborn stain in Ocracoke, the Outer Banks and parts of Carteret County.

"One thing that refuses to go away is this Elizabethan canard," says Dough. Though fabled by writers, no evidence supports the theory.

"The language of the island (Roanoke), particularly the older forms of the speech found there, is that of the better classes or at least

the middle classes in England in the better days of Queen Elizabeth," wrote Collier Cobb in 1910. "The Raleigh voyagers having counted among their number gentlemen adventurers from all parts of the kingdom, it is not difficult to imagine that these forms were introduced by them."

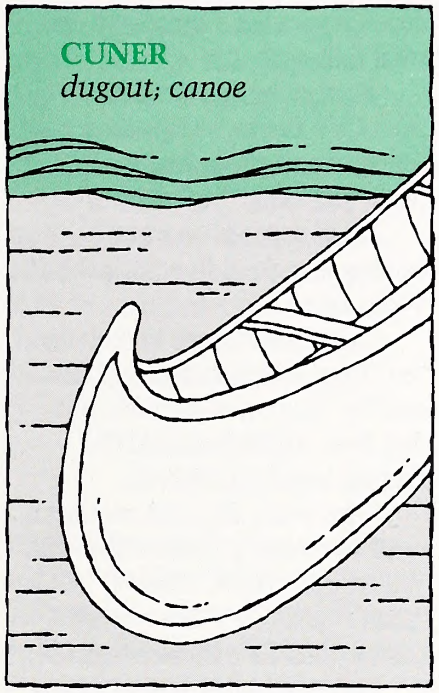
Words such as "couthy," "travel" for walk and "may" for maid convinced him of that connection.

Twenty-three years later, Blanch N. Epler echoed Cobb's words in an article in *National Geographic*. Even *The New York Times* got in the act, reporting, "These people speak the nearest to the Elizabethan English of any people anywhere in the United States."

But the idea that the "pure" English of Queen Elizabeth's time lives on is only a romanticization, which often occurs in physically and socially isolated communities, Wolfram says.

"That association stems from the fact that there are some retentions of older forms which may have been used in the 1600s and the 1700s," such as "h'it's" and "a' goin'," he says.

SNITCHIT
just a pinch



CUNER
dugout; canoe

With documentable older forms of words, grammar patterns and pronunciations, people think English has been retained in its "pure" state.

But language is always changing. The dialect may keep some relic forms, but new words and patterns are added. Because it has the new, no one can say any dialect spoken today is the dialect of Old English, he explains. It's too far removed.

"The only languages that are frozen like that are dead languages," Wolfram says. "So if you want that, go to Latin. This for sure ain't no dead language."

His reasoning is not necessarily what islanders want to hear.

"It's a myth that fits comfortably with the island ethos," he says. "And if you can do that, you can get prestige. You're looking for the language of Shakespeare, man.

"It sounds good, and it adds to the island uniqueness," he adds. "But it'd be even better if it were true."

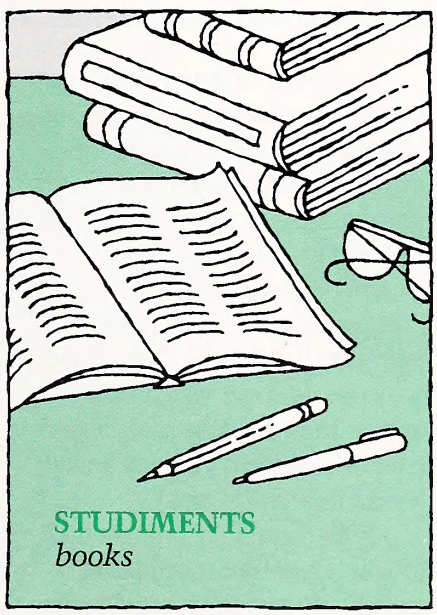
CA'E BANKS BROGUES

The myth of the queen's language and many similar relic forms also live on just 20 miles southwest of Ocracoke in Carteret County.

Only Pamlico Sound separates the barrier islands and this boot-shaped coastal county. Migration between the regions 200 years ago seems as likely as neighbors sharing sugar.

The Ca'e Bankers, like Outer Bankers and Ocockers, exaggerate their "o's" and "i's" in words such as "house" and "high." They say "far" instead of "fire" and leave the "r's" on ends of words, too.

But the Ca'e Banks brogue has its own sound, says Jim Willis of Atlantic Beach, and a separate history.



STUDIMENTS
books

No one knows for sure where the first settlers to Cape Lookout came from, but the first who could read and write arrived just before 1700, according to *Island Born and Bred*. Whaling, trade and fishing

Continued

thrived in such towns as Diamond City, Cedar Island, Harkers Island and Wade's Shore until the late 1800s. Then two hurricanes in 1896 and 1899 virtually wiped clean Diamond City, Shackleford Banks and much of the Cape Lookout area.

SLUMGULLION
multi-ingredient stew

Residents strapped what was left of their houses across two boats, called dories, and moved to the mainland, landing primarily in Marshallberg, Stacy, Broad Creek, Salter Path, Harkers Island and a section of Morehead City called "the Promised Land." They called it the Promised Land, Willis says, because someone on shore watching the exodus from the cape said, "There come the children of Israel bound for the Promised Land."

With them, they brought their brogue. Over time, one dialect melted into several as each community developed its own variation.

"Our brogue is kind of like a train with each word hooked together, and your language is like a bunch of cars going down a highway," says Willis, a student of brogue since he was young. "So our word — the way we pronounce it — depends on what's ahead of it and what follows."

That's why they drop the "p" from Ca'e Banks, so two consonant sounds won't clash. And the "t" from "jest" as in "jes' right."

"It all depends on what's coming to make it flow smoothly," Willis says.

Ca'e Bankers tend to drop the "en" from words such as "spoken" and "ly" from most adverbs. But they love contractions and Old English negatives, he adds.

"Anywhere they can contract a word and make it smaller they will," Willis says. "Ain't," "hain't," "shan't" and "i'n't" are typical contractions Ca'e Bankers still use.

For example, instead of saying, "I have not never been over there," "hain't" takes care of that, he explains.

That brings up another point.

"We have a thing about negatives," says Willis, a retired chemist.

Once, they were used in England to emphasize or stress, he says. The more negatives you could pile in a sentence the better.

"Always," Willis preaches, "you need to use at least a double negative. Triple is even better. Quadruple if you can do it. I don't usually use it, but my land, you'd be high society if you used quadruple negatives."

Willis has studied most the dialects of the Salter Pathers and Promised Landers, the two most divergent of the Ca'e Banks brogue.

"Now a Promised Lander is slow and uses stress: 'Ain't yoou ne-ver gon-na finish that?' Or 'I ain't a never goin' over there with her no more.'

"Whereas a Salter Pather would say, 'I ain'tanever goinoverthere withher nomore.' Jest as fast as you can. And Salter Pathers don't move their lips hardly none ... . You can't hardly understand none of it."

Either way is right, he contends. A brogue, like an opinion, should be taken at face value, not criticized for bad grammar or chastised as wrong, just savored like a bit of history on display.

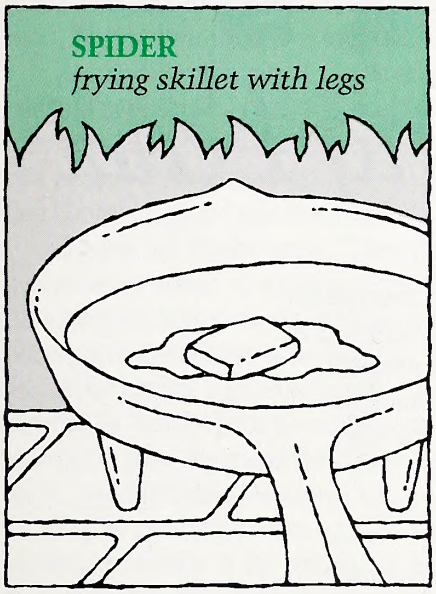
PORT CITY SPEECH

Much less is known today about the speech of the people farther south. Little research has been done in Wilmington. Only theories circulate.

TERRECKLY
at a later, unspecified time

A port since the 1730s, the Wilmington area was the last part of the Carolina coast to be settled. The busy port attracted a large and wide mix of people. Men, women and children from England, Barbados, Ireland, Scotland and France came to a town north, called Brunswicktown, where the pines grew tall and tar ran thick. But the majority of the newcomers came from other English colonies and primarily coastal towns, says Harry Warren, a historian at the Cape Fear Museum

in Wilmington. They came from Virginia and South Carolina, especially; Charleston, particularly.



"It was a port, and it was cosmopolitan, always has been," says Wilmington native Claude Howe, 77.

Because the population varied so, and people constantly moved in and out, a strong dialect never had time to develop, some historians speculate.

Or it may be because Wilmington, first known as New Carthage, was settled so much later than other parts of the coast, Warren says. By the time people arrived at the port city, they had lost their strong verbal connection to the Mother Country or their homeland.

A clear connection lingers, though, between Wilmington and southeast Virginia and northeast South Carolina.

Most colonial trade from Wilmington was between large coastal cities, Howe says. People traveled the same routes, too. Today, the subtle dialect has more flavor of Charleston than that of northeastern North Carolina or the Piedmont.

Retired Southport riverboat pilot Robert Thompson characterizes what he hears in Wilmington as "dry and flat." Someone else might call it "refined."

Howe's mother, from southern Virginia, added a "y" in words such as "gyarden" and "cyanal," which can still be heard spoken by older Wilmington natives. She said "house," as in "host," instead of "howse," as well, Howe says.

FALLING TO A WHISPER

All along the Eastern Seaboard and into the Deep South, similarities and differences in dialects can be heard. But like a shout falling to a whisper, many of the old words and pronunciations are fading.

Change — World War II, the road from Kitty Hawk to Nags Head built in 1932, the bridge from Harkers Island to the mainland in 1941, and tourism — began the slow erosion of the speech once isolated by water on almost every side. Recently, radio and television may have had some effect.

But, says Wolfram, "television doesn't make nearly the inroad that it's given credit or blame for. We get our language from the folks we interact with. We don't want to talk like people on television unless we want to pick up some cool words. We really want to talk like the people we hang out with."

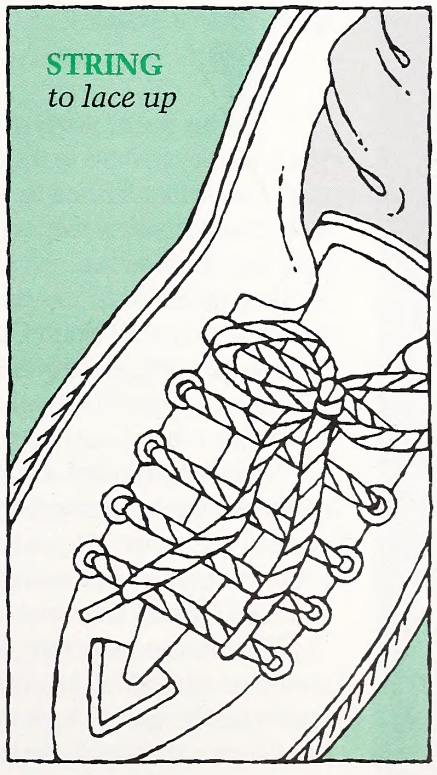
To help preserve the Ocockers' speech, he plans to contribute his research tapes to an island library, write a general-interest book on the dialect and teach a course on it at the Ocracoke School next spring.

Other projects are under way to record the vocabulary and speech of communities such as Harkers Island and Morehead City.

"It's at least very important, I believe, to recognize the people who speak that way and realize they will be no more in a few years," says Alton Ballance, author of *Ocracokers* and a native of the island. "That person's voice, if it doesn't get recorded, will never be heard again."

But the dialects of North Carolina's coastal communities will survive, in person, on paper or on tape, Dough writes.

"The speech of the Banks is a dynamic, thriving organism," he writes. "No matter how much of it is retained, no matter how many new terms are created locally or brought in by newcomers, the dialect ... will remain distinctive, for the Bankers — an independent, indomitable crew — will remain distinctive in the face of development just as they have done in the face of displacement, occupation and natural disaster for over three centuries."



OYSTERS
Offer a Stimulating Feast

A Royal Royster with the Oyster

Let us royster with the oyster — in the shorter days and moister,
That are brought by brown September, with its roguish final R,
For breakfast or for supper, on the under shell or upper,
Of dishes he's the daisy, and of shellfish he's the star.
We try him as they fry him, and even as they pie him;
We partial to him luscious in a roast;
We boil and broil him, we vinegar-and-oil him,
And O he is delicious stewed with toast.
We eat him with tomatoes, and the salad with potatoes,
Nor look him o'er with horror when he follows the coldslaw;
And neither does he fret us if he marches after lettuce
And abreast of cayenne pepper when his majesty is raw.
So welcome with September to the knife and glowing ember,
Juicy darling of our dainties, dispossessor of the clam!
To the oyster, then, a hoister, with him a royal royster
We shall whoop it through the land of heathen jam!
Anonymous, The Detroit Free Press, Oct. 12, 1889

This poetic verse written more than a hundred years ago pays tribute to the delectable oyster. Obviously, the author fancied these sweet but briny mollusks, no matter how they were cooked or when in the meal they were served.

And the same can be said for many a man, woman and child in coastal North Carolina. When the breeze turns to the north, the leaves fall from the trees and the waterfowl are on the wing, it's time to light the fire for a good all-you-can-eat oyster roast.

Many a family and community gathering has centered around the time-honored traditions of roasting or steaming oysters. Dipped in butter, splashed with lemon juice or dabbed in cocktail sauce, the oysters are consumed bushel after bushel.

But for some, steaming the mollusks is a gastronomic sin that ranks alongside grilling a T-bone steak until it is well-done. They want 'em raw, savoring the briny liquor, the marshy aroma and the glib way the plump oysters slide down the back of the throat.

Raw oysters have another appeal — sex appeal. For centuries, these raw mollusks were the equivalent of virility on the half shell.

Louis XIV was said to consume a hundred or so at one sitting. Casanova reputedly ate 50 or more every evening. And Byron's Don Juan attributed some of his success with the ladies to this amatory food.

Unfortunately, this aphrodisiacal attribute of the oyster is mythical.

Perhaps people assumed that the oyster's own fruitfulness could be transferred to those who ate it. After all, one oyster is capable of producing about 500 million eggs in a single spawning season.

Another possibility may be the mollusk's cholesterol level. At one time, oysters were labeled high in cholesterol. Since cholesterol is a basic building block for male and female hormones, some thought that oysters boosted their bedroom abilities.

Now, scientists know that oysters are not high in cholesterol, and we realize that cholesterol intake does not stimulate sexual prowess.

A lack of bedroom benefits isn't enough to turn raw oyster lovers away from their favorite food. But another problem is. Contamination.

Because oysters can be contaminated by bacteria and viruses, naturally occurring toxins or chemical and industrial pollutants, consumers eat raw oysters at their own risk, says Joyce Taylor, Sea Grant's seafood education agent.

Oysters are filter feeders. They filter massive quantities of water, as much as 25 gallons per day, through their bodies to extract their meals — one-celled plants known as diatoms. If the water they filter carries a gastrointestinal virus or the potentially deadly pathogenic bacteria *Vibrio vulnificus*, then the mollusks collect these contaminants, making their raw appeal risky.

Taylor cautions people against eating raw oysters, especially if the person has an underlying disease that might impair the immune system. But properly cooked to a temperature of 145 F, oysters are a safe bet for any dinner table.

Even in the months without an "r" in their name, you ask?

Yes, Taylor says. Toss out that adage about eating oysters only from September to April — the months with an "r."

The origin of this myth has two possible explanations. Oysters are highly perishable, and before refrigeration, they would spoil quickly during warm summer months — those without an "r."

Also, from May to September, oysters spawn, becoming more watery and less flavorful, unlike the plump mollusks harvested in the fall and winter.

If oysters have a place on your fall menu, be it oyster stew or oyster stuffing, be choosy when selecting these mollusks, Taylor says. Oysters in the shell should be alive. Shells should be closed or should close tightly when tapped.

Hold live oysters between 35 F and 45 F until cooking, and limit the holding time to two to three days. Discard any oysters that die.

To shuck live oysters, purchase a sharp shucking knife and a pair of rubber gloves to protect your hands. Holding the oyster in the palm of a gloved hand, use your other hand to insert the knife between the lips of the oyster near the hinge. Then slide the knife around the oyster until you cut the muscle that holds the shell shut.

Voila. Out slides a plump, juicy oyster.

It's best to shuck the oysters over a colander to sieve out pieces of broken shell and to collect every drop of the briny liquor.

If shucking sounds like too dangerous a dinner sport, buy your oysters already shucked in containers at the grocer.

Shucked oysters should be plump with a natural creamy color and clear or slightly opalescent liquid. They should not contain more than 10 percent liquid and should have a mild odor.

And oysters occasionally have a slight coloration — red, pink, green or mottled. These colors are harmless, usually associated with the oyster's diet. The red color disappears when the oyster is cooked. Do beware, however, of any pink color accompanied by a sour odor. This is caused by a spoilage yeast, and the oysters should not be eaten.

Otherwise, oysters can be eaten to your heart's content and health. The mollusks are high in protein, minerals and vitamins, and low in cholesterol, calories and fat. Easily digested, oysters are often recommended for special diets, Taylor says.

And despite the emphasis on eating the mollusks raw or steamed, there are countless ways to cook an oyster. Taylor and the NCSU Seafood Laboratory's Health, Food and Nutrition Leaders have developed the following smorgasbord of oyster recipes.

OYSTER SOUP

Pure oyster flavor is what you'll have when you cook this rich soup. No milk or other ingredient dilutes the flavor. Only green onions and fresh parsley enhance the oyster taste and render the soup attractive.

2 pints standard oysters with liquor
6 tablespoons margarine
4 tablespoons flour
1/2 cup thinly sliced green onion tops
3 tablespoons finely chopped fresh parsley
1 teaspoon salt
1/2 teaspoon freshly ground white pepper

Strain oyster liquor into a medium saucepan. Chop oysters coarsely. Heat liquor over medium heat, add chopped oysters and simmer for 5 minutes. Remove oysters and reserve. Add hot water to the liquor to make 5 cups.

Continued

Melt margarine in large saucepan over medium heat. Add flour gradually, stirring constantly until smooth. Gradually add the hot liquid, whisking constantly, and cook until smooth. Add onions, parsley, salt and pepper. Simmer for 15 minutes. Add reserved oysters and heat thoroughly. Serve immediately. Serves 8.

OYSTER-MUSHROOM STUFFING

This stuffing can make a delicious addition to your holiday meals. It hearkens to the days when oysters were a traditional part of holiday fare in coastal homes.

1 pint standard oysters
1/2 cup margarine
1 pound coarsely chopped fresh mushrooms
1 1/2 cups chopped celery, including leaves
1 cup chopped onion
2 cups toasted bread cubes
1/4 cup chopped fresh parsley
1/2 teaspoon salt
1 1/2 teaspoons poultry seasoning
1/4 teaspoon freshly ground black pepper
2 eggs, beaten

Drain oysters. Melt margarine in large skillet over medium heat. Sauté mushrooms, celery and onion until tender. Place in large bowl. Stir in bread cubes, parsley, salt and poultry seasoning. Add eggs and oysters and mix thoroughly. Place in well-greased baking dish. Bake at 350 F for 20 minutes or until done in center and lightly browned. Makes about 6 cups.

SCALLOPED OYSTERS

This delightful oyster casserole makes an easy addition to a family meal or an elegant entrée for guests.

1 pint standard oysters
2 1/2 cups crushed saltines
1/4 cup finely chopped green onions
salt
freshly ground black pepper
paprika
2 tablespoons margarine
1/2 cup heavy cream
1 tablespoon Worcestershire sauce
1/8 teaspoon Tabasco sauce
1/4 cup dry white wine

Drain oysters, reserving 1/2 cup liquid. Place one-fourth of the saltines in well-greased small casserole. Cover with one-third of the oysters, and sprinkle with one-third of the onions. Sprinkle with salt, pepper and paprika; dot with margarine. Repeat layers twice, then sprinkle remaining saltines. Dot with margarine. Combine reserved oyster liquor with cream, Worcestershire, Tabasco and wine; pour over casserole. Bake at 400 F for 30 minutes. Serves 6.

OYSTERS ROCKEFELLER

The original version of this recipe was developed in Antoine's, a famous New Orleans eatery. Four generations of the family of Antoine Alciatore have kept the recipe for this now legendary dish secret. However, this version is sure to delight your taste buds.

24 oysters on the half shell
6 tablespoons margarine
6 tablespoons frozen chopped spinach, thawed
3 teaspoons minced onion
1 tablespoon dried parsley flakes
3 tablespoons minced celery
1/8 teaspoon fennel seed, ground
1/8 teaspoon dried tarragon leaves
1/8 teaspoon dried chervil leaves
1/8 teaspoon cayenne pepper
1/8 teaspoon garlic powder
1/4 cup fresh bread crumbs
rock salt

Combine margarine, spinach, onion and seasonings. Simmer 15 minutes. Purée in blender.

Spread layer of rock salt in baking pan. Place deep halves of oyster shells level on rock salt. Place oyster in each. Spread spinach mixture over each oyster. Sprinkle bread crumbs on top. Broil 4 to 5 inches from heat for 8 minutes or until desired doneness. Serves 4.

CRABMEAT AND OYSTER FRITTERS

This rich mixture of flavorful shellfish can take center stage at your next sit-down dinner or buffet.

2 dozen small oysters, liquor reserved
1 pound backfin crab meat
1 tablespoon cornstarch
1/2 cup heavy cream
2 eggs
2 eggs, separated
2 tablespoons margarine
1 tablespoon minced green onion
1/4 teaspoon salt
1/2 teaspoon freshly ground black pepper
1/8 teaspoon Tabasco sauce
1/4 cup minced fresh parsley
1 teaspoon dried tarragon
3/4 cup flour
3 cups fresh bread crumbs
vegetable oil

Poach oysters in their liquor in small saucepan over medium heat until curled, about 5 minutes. Remove from heat and allow to cool.

Mix cornstarch into cream in small bowl; blend in egg yolks. Melt margarine in heavy large skillet over low heat. Add green onion, cover and cook until tender, about 5 minutes, stirring occasionally. Mix in crab meat, salt, pepper and Tabasco. Stir in cream mixture. Increase heat to medium and bring to boil. Blend in parsley and tarragon. Cool, then cover and refrigerate until well chilled.

Measure 1 1/2 tablespoons crab meat mixture into palm. Press to form well in center. Place one oyster in well. Top with additional crab meat mixture and press into oval shape, covering oyster. Set on large waxed paper-lined plate. Repeat with remaining crab meat and oysters. Place in freezer until fritters are firm but not frozen, about 20 minutes.

Place flour, eggs and egg whites, and bread crumbs in separate bowls; beat eggs and egg whites to blend. Dip fritters in flour, then egg. Roll in crumbs, coating thoroughly. Return to plate. Cover with plastic wrap and refrigerate.

Heat oil in large saucepan or deep fryer to 350 F. Add fritters to oil in batches and fry, turning once, until golden brown, about 4 to 5 minutes. Drain on paper towels. Serve immediately. Serves 6.

OYSTERS ON TOAST

This recipe offers an unusual combination — tomato paste and oysters. Nonetheless, it provides an elegant luncheon or dinner addition.

1 pint oysters, undrained
2 tablespoons margarine
2 tablespoons olive oil
1 clove garlic, pressed
1/2 cup chopped onion
3 tablespoons tomato paste
1 1/2 cups hot water
1/2 cup dry white wine
1/2 teaspoon dried oregano
1/4 teaspoon salt
1/4 teaspoon freshly ground black pepper
1 teaspoon sugar
6 slices French bread
1 tablespoon chopped fresh parsley

Melt margarine in medium skillet over medium heat. Add olive oil and heat thoroughly. Add garlic and onion and cook until tender. Blend in tomato paste. Add water and wine. Stir well. Add oregano, salt, pepper and sugar. Stir to blend and bring to simmer.

Toast bread. Spread lightly with margarine. Cut into points and keep warm.

Add oysters, together with their juice, to skillet. Baste several times with sauce, and cook until oysters reach desired doneness. Place pieces of toast on individual heated plates. Place oysters and sauce on individual pieces of toast. Sprinkle tops with parsley. Serves 6.

Kathy Hart

Digital Mapping to Benefit Brunswick

When Hurricane Hugo brushed southeastern North Carolina in September 1989, high winds and water bruised Brunswick County's year-round homes and businesses to the tune of $2.5 million, according to the state's Division of Emergency Management. Injury to beaches, roads and public structures was upward of $72 million.

So when the Federal Emergency Management Agency provided money to assuage part of the damage on the coast and inland areas such as Charlotte, it reserved a percentage of the funds to brace for the future. This standard FEMA procedure is known as hazard mitigation.

"Rather than just use the disaster relief money to pick up the pieces, the mitigation grants are used to reduce the damage next time," says Spencer Rogers, Sea Grant's coastal engineering specialist.

A $328,000 federal grant — matched equally by N.C. State University and its benefactors — will be used to map vulnerable areas along such beaches as Long and Sunset and to keep future damage to a minimum.

NCSU civil engineering professors John Fisher and Margery Overton will use existing aerial photographs to produce digital maps of erosion-prone areas.

"This project will seek to develop new techniques using state-of-the-art computer mapping systems to identify the most threatened stretches of ocean shoreline in Brunswick County," says Fisher, adding that the models could be applied in other areas of North Carolina in the future.

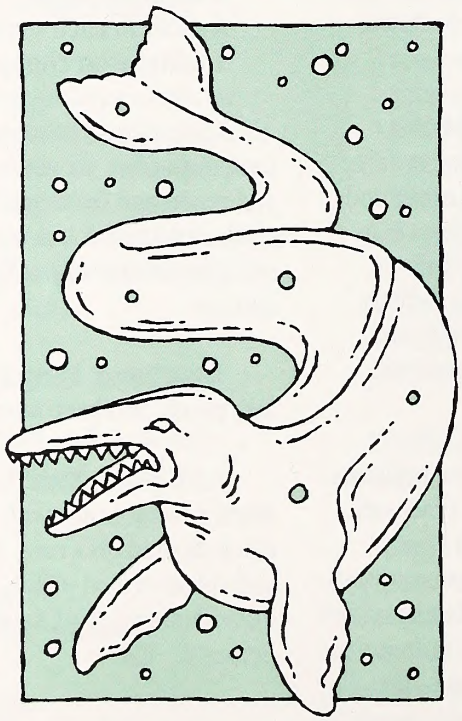
This small-scale pilot study could help target safe evacuation routes for the county, identify at-risk structures and provide local planners with information regarding shoreline erosion rates, dune elevations and flood-prone areas.

Work on the project began this fall and should take three years to complete.

Underwater Dinosaurs

Treat yourself, your family or your students to an unforgettable "undersea" adventure at the N.C. State Fair, Oct. 15-24. Drop by Dinamation's *Sea Creatures, Dinosaurs of the Deep*, an exhibit sponsored by the N.C. State Museum of Natural Sciences and the Friends of the Museum.

Encounter lifelike animated creatures that inhabited our oceans millions of years ago.



Shudder at the Kronosaurus, a ferocious marine reptile with a huge head, short neck and immense jaws as much as 9 feet long that were equipped with 80 sharp 9-inch teeth.

Gasp at the Basilosaurus, a slender-bodied, lizardlike marine mammal that measured between 40 and 80 feet long.

Gawk at the armor-plated 5-ton Dunkleosteus, a savage-looking fish with cleaverlike projections that jutted from its powerful jaws, enabling it to crush and slice its prey.

And after visiting these amazing creatures, be sure to allow time for the "Discovery Tent." Hands-on learning stations offered in the tent will reinforce and supplement information presented in the exhibit area.

Activities will include a fossil dig, crayon rubbings of prehistoric animals and several water-based interactive displays that encourage discovery of what it means to live in water.

Admission to the exhibit is $3 and is not included in the general fair admission cost. School groups can purchase advance tickets for $2, and teachers should reserve a scheduled time slot for visiting the exhibit. To purchase advance tickets and schedule a time slot, call the Friends office at 919/733-7450.

Sea Grant Agent Outstanding in Field

Sea Grant Marine Advisory Service Agent Bob Hines was selected as a 1993 recipient of N.C. State University's Outstanding Extension Service Award. Each year, the Chancellor's Office bestows the honor on six to eight employees who serve the university in extension roles.

Hines, an agent for 14 years in the Pine Knoll Shores office, has responsibilites in fisheries in a five-county area of central coastal North Carolina. Hines has built a rapport with local commercial fishermen, an independent group that is often shy of government agencies. Most recently, Hines has worked exten-

sively with shrimpers to tackle the problem of bycatch of nontargeted species. He has helped introduce the skimmer trawl, a type of gear that has proven to minimize bycatch, into North Carolina estuaries.

Hines' extension work over the years has also led to advances in closed recirculating crab shedding operations, the use of pound nets in shrimping and peeler crabbing, floating pound nets and other bycatch reduction devices.

Sea Grant extension agents have been consistent winners in the competition for Outstanding Extension Service Awards.

Kudos to Coastwatch

Coastwatch and its staff recently won a Grand Award in the APEX '93 Publication Excellence Competition sponsored by the editors at Communications Concepts, publishers of *Communications Manager* and *Writing Concepts*.

Coastwatch was one of four Grand Award winners in the magazine and journal category, which attracted 427 entries. The award was based on excellence in graphic design, editorial content and the success of the entry in achieving overall communications effectiveness and excellence.

Judges for the competition were Bill Londino, Concepts editor and publisher; Nancy Rathburn, *Communications Manager* managing editor; and Paul Fisher, a former professor at the University of Missouri School of Journalism.

Entries in the fifth annual awards were very competitive, according to Concepts competition organizers.

"The overall quality of entries was excellent, arguably the best ever in an APEX competition. From them, they selected the award-winning entries."

Also, Sea Grant publication *Shoreline Erosion Control Using Marsh Vegetation and Low-Cost Structures* won an Award of Excellence in the instructional and educational manual category. *University of North Carolina Sea Grant College Program, Building a Better Tomorrow for the Coast* won in the brochure category.

Limited Entry Workshops Continue

Sea Grant researchers Mike Orbach of Duke University and Jeff Johnson of East Carolina University are learning what commercial fishermen have to say about a management strategy called limited entry fishing. Under this strategy, specific fishing privileges are assigned to specific fishermen or vessels. It's a management plan already in use in other states and other countries.

But what do Tar Heel fishermen think about using the strategy here, and how do they think it should work? Orbach and Johnson want to get fishermen's opinions firsthand, so they planned three rounds of workshops along the coast during the late summer and fall.

The workshops are designed to allow fishermen to participate "from the ground up" in discussions of possible management options. Now, limited entry is only a possibility for the future, but it could become a reality. That's why it's important for fishermen to speak out at these workshops.

The first two rounds of workshops have already been held, but the third is yet to come. Orbach and Johnson hope fishermen will mark their calendars and plan to come, regardless of whether they have attended any of the earlier workshops.

Below is a listing of the dates for the third round of workshops. All of them begin at 7 p.m. and last until every fisherman is heard.

- Nov. 30 — Pamlico County Courthouse
- Dec. 1 — New Hanover County Cooperative Extension Service Office
- Dec. 2 — Smyrna Elementary School
- Dec. 7 — Beaufort County Community College
- Dec. 8 — N.C. Aquarium in Manteo
- Dec. 9 — Hatteras Civic Center

If you would like more information about the research or workshops, contact: Mike Orbach, Duke University Marine Laboratory, Pivers Island, Beaufort, NC 28516, 919/728-2111. Or call the Sea Grant Marine Advisory Service office nearest you: Raleigh, 919/515-2454; Fort Fisher, 919/458-5498; Bogue Banks, 919/247-4007; and Manteo, 919/473-3937.

Murray Earns Ph.D.

As director of Sea Grant's Marine Advisory Service, Jim Murray spends most days embroiled in resource management and policy issues.

The job requires more than a grounding in marine biology, he says. Marine resources are an increasingly valuable commodity in North Carolina. Murray has responded to the job demands by earning a Ph.D. in resource management from the School of Forestry at N.C. State University. Murray assessed the policy and management of artificial reef programs in his doctoral thesis, and he tailored his degree for an emphasis on marine resources management.

Providing guidance in his program were co-major professors David Adams, department of forestry, and Arthur Cooper, head of the department of forestry. Murray has held his post at UNC Sea Grant for 11 years. Before that, he was MAS director of the New Jersey Marine Sciences Consortium.

Nutrients in Our Coastal Waters: Too Much of a Good Thing?

Eating and excreting are an unavoidable part of our daily lives.

We take these activities for granted, but the resulting nutrient loading into our rivers and estuaries is unquestionable and far-reaching. As the population of North Carolina continues to grow, so too will the damaging levels of nutrients we are introducing into our waters. Unfortunately, this growth is outpacing the ability of regulations to protect water quality and technology to remove wastewater nutrients.

But nutrients, in and of themselves, are not harmful. They are a vital component in natural coastal processes. The problem is that we are overloading the system, and now scientists are investigating the environmental repercussions. Perhaps the most compelling research is under way in the laboratory of JoAnn Burkholder, who is examining the link between high levels of phosphorus and outbreaks of a newly discovered toxic dinoflagellate. Burkholder is a Sea Grant researcher and assistant professor of botany at N.C. State University.

Food for Thought

The food we eat and the clothes we wear don't originate in the stores. North Carolina and the United States are checkered with agricultural and animal farming operations that provide the bulk of the food we serve on our tables. Farmers must fertilize their crops with nutrients, primarily nitrogen and phosphorus, for profitable production. These nutrients are essential for plant growth. But the nutrients applied aren't always used, depending on growth rates and weather conditions. When it rains, excess nutrients may wash into nearby waters or seep into the ground where they accumulate, degrade or migrate into groundwater. Nutrient-rich groundwater can then filter into nearby surface waters.

Wandering Waste

Nutrients are also in animal and human wastes.

Animal waste can be washed by rain into nearby surface waters from livestock confinement or feed lots.

Human waste or sewage is collected and treated. In North Carolina, most wastewater is treated by septic tanks or municipal wastewater treatment plants that do not completely remove nutrients. These nutrients then meander into our coastal waters, where even low levels can be damaging. Septic tanks, for instance, can discharge nutrients into nearby coastal waters through the movement of groundwater. Most municipal wastewater treatment plants release nutrient-laden effluent directly into surface waters after treatment. And some industries, such as food processors, discharge nutrients into surface waters. A few municipal facilities try another tack: they treat their waste less extensively and apply it to large areas of land. If sited and operated properly, land application can minimize the release of treated effluent into coastal waters.

In Coastal Waters

Once in our coastal waters, these nutrients travel various paths. They can be used by aquatic plants, remain dissolved in the water column or settle to the bottom where they are stored in the sediments. All of this can cause eutrophication, which is, among other things, the excessive growth of algae. During the day, algae produce oxygen by photosynthesizing; at night, they respire and consume oxygen. Decomposition of the algae also consumes large quantities of dissolved oxygen. So large algal blooms can seriously deplete coastal waters of oxygen that is life-essential to aquatic organisms, especially fish. Eutrophication, however, is not the only way excess nutrients harm aquatic life. Burkholder and other scientists are investigating the link between the frequency of toxic phytoplankton outbreaks and the increased level of nutrients in our coastal waters. Toxic algae sometimes rob the water of oxygen, but they can affect aquatic life and humans in other ways, even causing death.

Progress Against Pollution

North Carolina has made significant reductions in point source discharges of nutrients from wastewater treatment plants and industries since 1975, when it was delegated the authority of the National Pollution Discharge Elimination System program by the U.S. Environmental Protection Agency. As a result, the state determines when, how much and where wastewater can be discharged, using federal standards.

In addition, the state's 1988 ban on phosphate detergents has significantly reduced phosphorus inputs. Today, our largest contributor of nutrients is agriculture, which is considered a nonpoint source of pollution. The EPA and N.C. Department of Environment, Health and Natural Resources are moving toward new regulatory strategies that will reduce nonpoint source nutrients in our surface waters.

But still unmeasured is the contribution of nitrogen from air pollution in North Carolina's coastal waters. Nitrogen from automobiles or smokestacks can land directly on the water or accumulate in rainfall.

Barbara Doll, Sea Grant
Coastal Water Quality Specialist

Wild Shores and Wild Places

"George Washington Slipped Here ..."

If you answer to the call of the wild, you'll want a copy of *Wild Shores* for the journey.

Author Walter K. Taylor has scouted the wet and wild places of North Carolina's coastal plain by horse, motorcycle, canoe and foot. Along the way he's gathered more than enough snake stories — the cottonmouth is the star of these viper vignettes — and invaluable tips on camping (primitive and pampered), hunting, fishing, hiking and nature-ogling, from Mackay Island to Portsmouth to Green Swamp.

The Washington native takes readers along the banks of Potecasi Creek with a Meherrin Indian chief, gathering medicinal plants and shaking the fruits from this Chowan tributary's wild grape vines. He stops to sip the juniper-steeped waters of the Dismal Swamp Canal and nets spring runs of Roanoke river herring.

He even includes a few stories you didn't know you needed to know. Like how the beauty of Ocracoke distracted poet Robert Frost from his plans of suicide in the macabre Dismal Swamp. Or where George Washington reportedly slipped into — and subsequently named — the swamp's Deep Creek.

He explores Cedar Island on a quarter horse and advises readers how they can do the same. He tells where to spy eagles and hooded mergansers, rare dwarf trillium and wild camellias, and virgin stands of cypress and juniper.

Taylor also shares his pick for the best day hike along the Outer Banks and reminds potential campers to bring mosquito netting and extra-long sand pegs to anchor tents on Bodie Island. He advises what levels of wilderness expertise are necessary for which expeditions — be it a foray in the Enchanted Forest of Merchants Millpond or a plunge down the rapids of the Roanoke River.

Anne Marshall Runyon

Wild Shores is no trendy vacation guide or coffee-table piece. The 159-page manual is illustrated best by the writer's anecdotes and practical information about exploring the state's coastal parks and natural playgrounds, accented by local lore and legend and current information about coastal communities. Taylor divides the coast into eight sections; each chapter features reference lists of addresses and phone numbers.

The book is $13.95. Check with your local bookstore or the publisher: Down Home Press, P.O. Box 4126, Asheboro, NC 27204 (919/672-6889).

Homing in on Habitat

The primary audience for *North Carolina WILD Places: A Closer Look* is schoolteachers and other educators who participate in the N.C. Wildlife Resources Commission's conservation education workshops. But individual students of nature will also appreciate this beautifully illustrated guide to 13 of the state's major habitats.

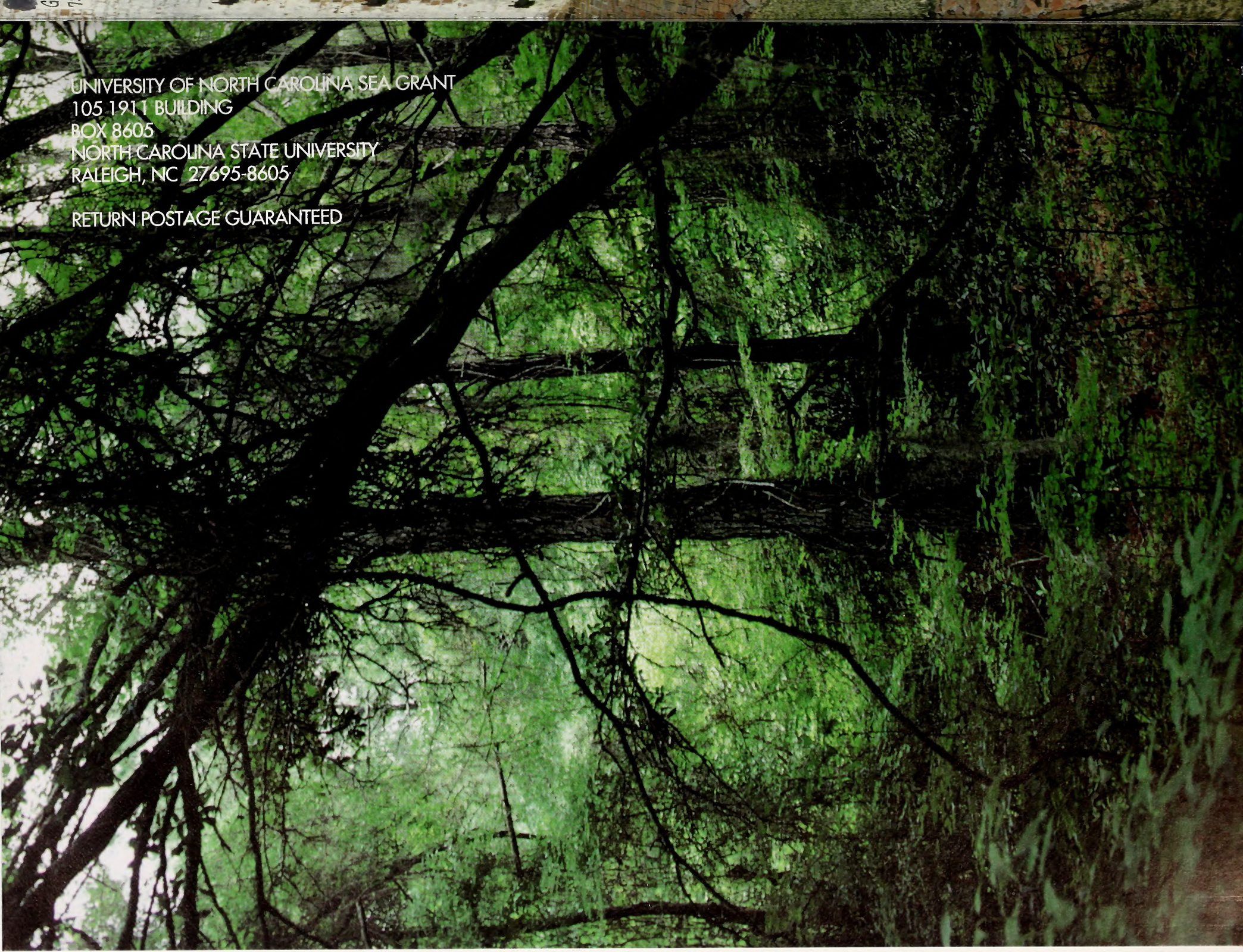
From mountain cove forests and beaver ponds to salt marshes and maritime forests, this 82-page guide focuses on plant and animal communities and their dynamics, natural histories and importance, and the forces that threaten them. The sections also list public areas where visitors can explore examples of the respective habitats.

The book, which was published by the N.C. Wildlife Resources Commission's Division of Conservation Education, features detailed drawings by Anne Marshall Runyon, including several in color, and other illustrations by Jim Brown. The text was written by various naturalists and journalists.

"*WILD Places* represents the only concise descriptions and illustrations of some of the diverse ecosystems found in North Carolina," says Sea Grant Marine Education Specialist Lundie Spence, who authored a section on ocean hardbottoms.

"It's a real important educational tool for teachers, 4-H groups, Scouts and museums," says Spence. "Families who want to introduce themselves and their children to North Carolina's natural habitats will also find this book very useful."

WILD Places is $10. Copies are available from the N.C. Wildlife Resources Commission, Division of Conservation Education, 512 N. Salisbury St., Raleigh, NC 27604-1188 (919/733-7133).



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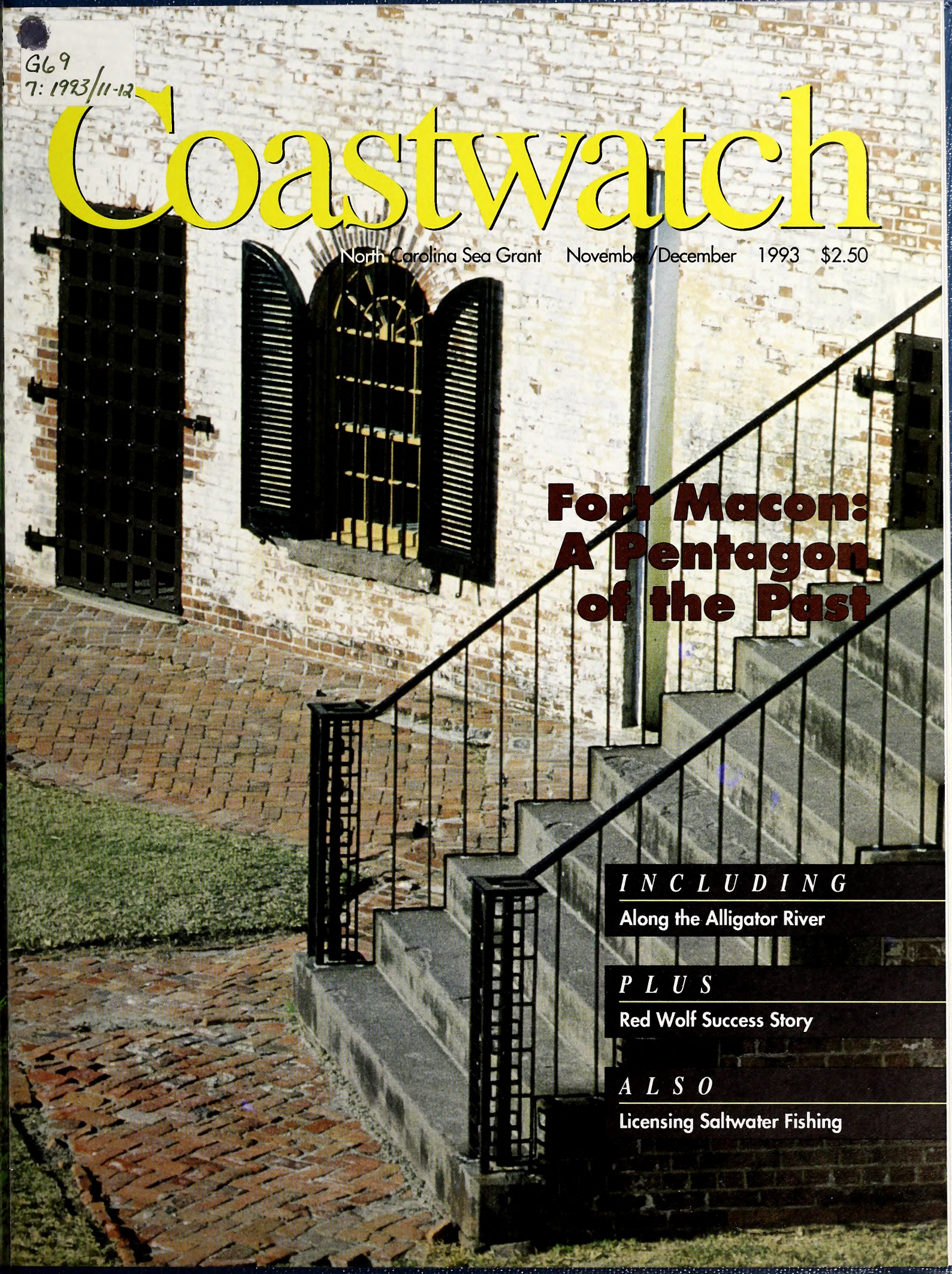

Fort Macon: A Pentagon of the Past

INCLUDING

Along the Alligator River

PLUS

Red Wolf Success Story

ALSO

Licensing Saltwater Fishing

Coastwatch

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The North Carolina Sea Grant College Program is a federal/state program that promotes the wise use of our coastal and marine resources through research, extension and education. It joined the National Sea Grant College Network in 1970 as an institutional program. Six years later, it was designated a Sea Grant College. Today, N.C. Sea Grant supports several research projects, a 12-member extension program and three communicators. B.J. Copeland is director. The program is funded by the U.S. Department of Commerce's National Oceanic and Atmospheric Administration and the state through the University of North Carolina.

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Front cover photo of Fort Macon by Scott D. Taylor.

Inside front cover photo of Newport River estuary by Scott D. Taylor.

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table of contents

Features

Scott D. Taylor

Page 2

Off the Beaten Path: A Trek Through the Alligator River Refuge

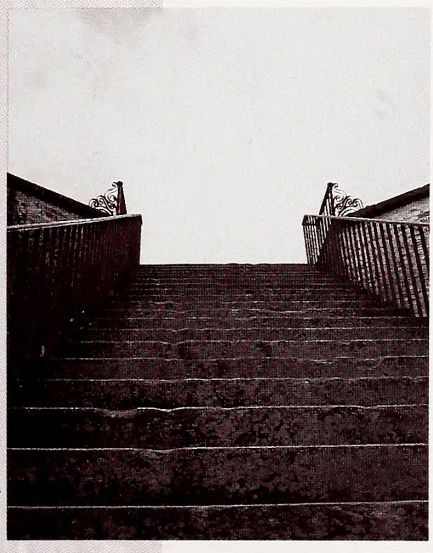
Home to wolves, gators and red-cockaded woodpeckers, Alligator River is a wilderness worth witnessing. Access isn't easy, but writer Alison Davis braves the mosquitoes, yellow flies and head-high gallberry bushes to profile this ambitious national wildlife haven that thrives on a modest budget. 2

Michael Halminski

Page 8

Coaxing the Red Wolf from the Brink of Extinction

Shunned in other parts of the country, endangered red wolves have found safe haven on an eastern North Carolina wetland. Six years ago, U.S. Fish and Wildlife officials released the first pair of red wolves on the Alligator River National Wildlife Refuge. But writer Alison Davis has found that the campaign to restore *Canis rufus* has been arduous. Though Dare Countians have been hospitable on the whole, the wolves worry some landowners and developers. 8



C.R. Edgerton

Page 12

A Five-Sided Fortress Lures History-Hungry Visitors

History and unique architecture lure visitors to Fort Macon like bluefish to a chunk of salt mullet. The casemate fortress of five sides and 9 million bricks is North Carolina's most visited state park, hooking 1.4 million tourists each year. Former *Coastwatch* writer C.R. Edgerton chronicles the legend of this Civil War bulwark, which fell to the Union in April 1862. 12

Page 21

Departments

Scott D. Taylor

OFF THE BEATEN PATH:

A Trek Through the Alligator River Refuge

By Alison Davis

EAST LAKE — For most of us, Dare County means many things. Beaches and seafood. Graveyard of the Atlantic. Kitty Hawk. Deep-sea fishing. The Lost Colony.

But there is another Dare County — a lesser-known, wilder place between a river and two sounds.

To reach this other world, take Buffalo City Road across from the East Lake landfill. Head south, past Tull's hunting shack, along the glassy, black canals toward Sawyer Lake.

At first the road may seem empty; the quiet, overwhelming. But if you sit for a while, you will hear the noises. The incessant hum of mosquitoes. The flutter of green and blue dragonflies. Songbirds.

Look around. You may see snakes, rabbits or a barred owl leaving the dirt road for a flight into the forest.

If you want to see more, you will have to work for it, paddling a canoe or kayak along the black waters of

Continued

Mill Tail Creek or braving the mosquitoes and the yellow flies to hike deep into the woods.

There, you may glimpse deer, wood ducks, raccoons or perhaps an alligator or two. And if you're lucky, you just might see a black bear or maybe, some local residents say, the shadowy figure of the eastern cougar, thought to be extinct.

These are just some of the wild things on the nearly 150,000 acres of dense, forested wetland that is the Alligator River National Wildlife Refuge.

Lying just a dozen or so miles west of the motels and beach houses at Nags Head, the Alligator River refuge is a wild, tangled place, crisscrossed by drainage ditches and nearly impassable dirt roads. Access is difficult without boats or four-wheel drive vehicles.

This remoteness is exactly what makes the wetland a good home for wildlife. And its wildness lures people to visit.

"It's a very, very wild area," says Manteo resident and refuge fan Ken Dyar. "Very primitive. And very wonderful."

The Alligator River refuge was created in 1984, when The Nature Conservancy acquired 120,000 acres of land from First Colony Farms, an agribusiness consortium, and donated it to the U.S. Fish and Wildlife Service.

The land is one of the last large pocosin tracts in North Carolina. Aside from the Department of Defense's Dare County bombing range, the refuge today covers an entire peninsula, bordered by the Alligator River to the west, the Albemarle Sound to the north and the Pamlico Sound to the east.

Since its creation, the Alligator River refuge has gained recognition through a landmark experiment to restore the endangered red wolf to part of its original range.

Lying just a dozen or so miles west of the motels and beach houses at Nags Head, the Alligator River refuge is a wild, tangled place, crisscrossed by drainage ditches and nearly impassable dirt roads. Access is difficult without boats or four-wheel drive vehicles. This remoteness is exactly what makes the wetland a good home for wildlife. And its wildness lures people to visit.

But the Fish and Wildlife Service, which runs the refuge, is working on a lot more. It has projects to track the American alligator. Dare County is the alligator's northernmost range. And it supports work to help the endangered red-cockaded woodpecker survive. A graduate student is taking an intensive bear census that could help officials determine whether bears could be hunted on refuge lands. Fish and Wildlife officials are exploring a project with the Defense Department to restore Atlantic white cedar in the area. And biologists are experimenting with growing natural food for waterfowl.

Yet Fish and Wildlife's biggest goal at Alligator River doesn't single out a specific bird or animal. In what would seem to be an overwhelming task, the agency is attempting to restore 19th-century water balances to the pocosin.

Since the turn of the century, this wetland has been crisscrossed by logging roads and firebreaks and sliced by ditches and canals — all tools used to prepare the land for food crops or for tree harvesting.

The tools worked, but not without negative effects. Surface water levels dropped, making the pocosin less hospitable to some wildlife, most notably the wood duck, which needs shallow flooded areas to breed. Rainwater raced into the sounds in great acidic slugs rather than filtering slowly through the swamp. Drier soils meant that fire — a natural part of the pocosin ecosystem that is necessary for perpetuating some plants and creating food for wildlife — became a greater danger.

Still, the changes didn't alter the essential nature of the area, says Bob Noffsinger, deputy manager for Alligator River and its subrefuge, the Pea Island National Wildlife

Refuge on Hatteras Island.

"It changed the water levels over there on the swamps, but it didn't really convert them from forested wetlands," Noffsinger says.

To restore Alligator River to its original pocosin state, or as near to that as possible, Fish and Wildlife plans to raise the water table. To do so, workers are building a series of water blockades known as flashboard risers, installing large pieces of metal culvert pipe and blocking water flow with 2-by-6 planks at the level of the swamp floor.

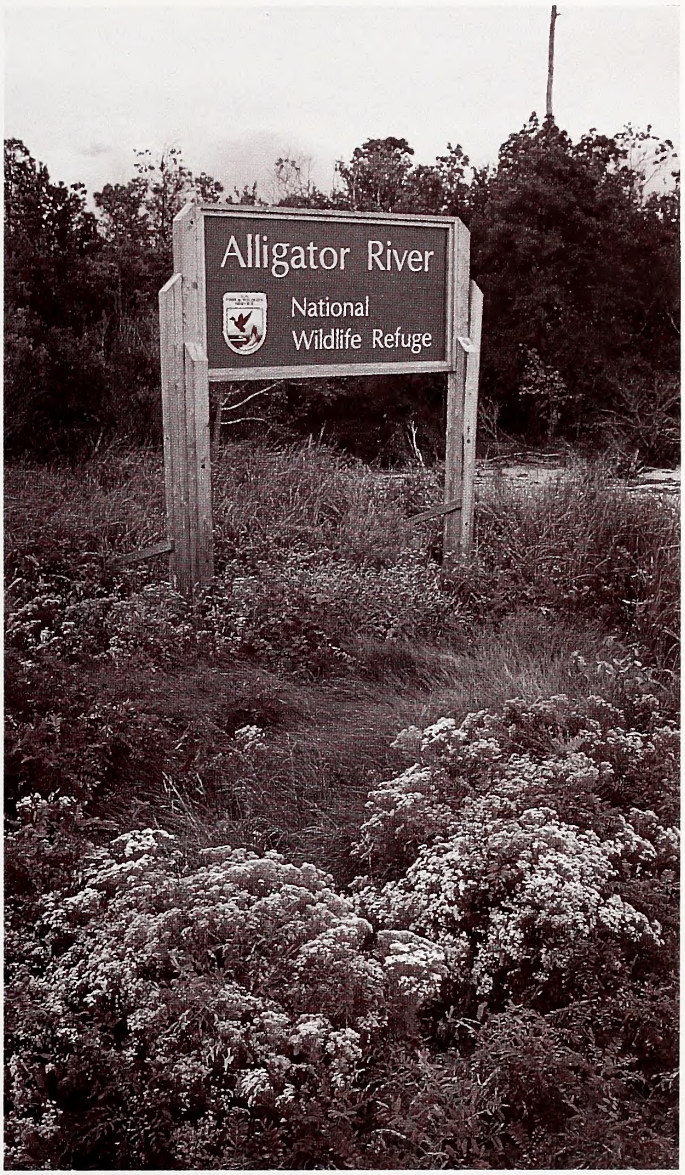
The water levels never will be exactly what they were before buildings, agriculture and roads, Noffsinger says. But if the agency is successful, the water-level changes should benefit much of the wildlife on the refuge, from raccoon to waterfowl, he says. Waterfowl populations have dropped in recent years, primarily because of a lack of breeding area in the Northeast, Noffsinger says. Refuge managers are experimenting with ways to draw waterfowl back. They are using pumps, which once drained farmland, to seasonally flood and dry the area. Birds will be attracted to food that grows there.

Five years ago, workers counted just 200 wood ducks at Alligator River, Noffsinger says. By 1990, they counted 30,000 ducks.

"To me," Noffsinger says, "that is a real success that we've achieved so far."

But what hasn't happened at Alligator River is the creation of easy access for the public.

Ask for refuge information at the Dare County visitors' center and you'll get a brochure on Pea Island, but nothing on Alligator River, save a warning about snakes — or simply a statement that the refuge isn't open to visitors.



Scott D. Taylor

That's not quite true; people are allowed on parts of the refuge — on Buffalo City Road, the canoe trails and soon on foot trails the service is creating.

Volunteers and refuge staff lead educational programs in the community and occasionally lead groups of visitors onto the refuge for special outings, such as nighttime howling at the wolves.

But access is limited. There are several reasons, not the least of which is the refuge's annual budget ($250,000 for Alligator River and Pea Island combined).

The pocosin itself isn't visitor friendly. Head-high gallberry, for example, doesn't naturally create areas for easy hiking.

And then there is the purpose of the refuge itself. This is not, after all, a national park.

"The primary goals of the refuge are for wildlife," Noffsinger says. "If somebody wants to do something out there, and it's going to be of significant negative consequence for wildlife, we're not going to allow that."

For now, the best refuge access is at Pea Island, nearly 5,800 acres of beaches and ponds that provide haven to migrating waterfowl and nesting areas for loggerhead turtles.

Reaching Pea Island is simple. There are parking areas near the beach. And on the sound side, boardwalks and trails lead visitors past a turtle pond. Just beyond, observation towers equipped with heavy-duty, permanent binoculars bring a bird's image closer.

Volunteers lead nature walks for children and birding walks for adults. On any given day, visitors may see a litany of waterfowl — from the glossy ibis to the least tern to willets, lesser yellowlegs and Wilson's plovers. And if you're willing to sit late on the beach, you may see female logger-

Continued

head turtles dragging themselves ashore to deposit their eggs in the sand.

Over the years, Pea Island has remained popular; people are nearly always there, quietly watching birds.

But people also are interested in Alligator River — so interested that a nonprofit support group formed several years ago, in large part to raise money to build a visitors' center. The Fish and Wildlife Service purchased land for the center on Roanoke Island; the Coastal Wildlife Refuge Society is raising money for construction.

The center would be used for refuge offices and for teaching the public about the work Fish and Wildlife is doing there, with descriptions of land management, a nature trail and a live red wolf exhibit.

People would view the wolves through a one-way mirror — much like those used in police lineups — to protect the skittish canids from too much human attention.

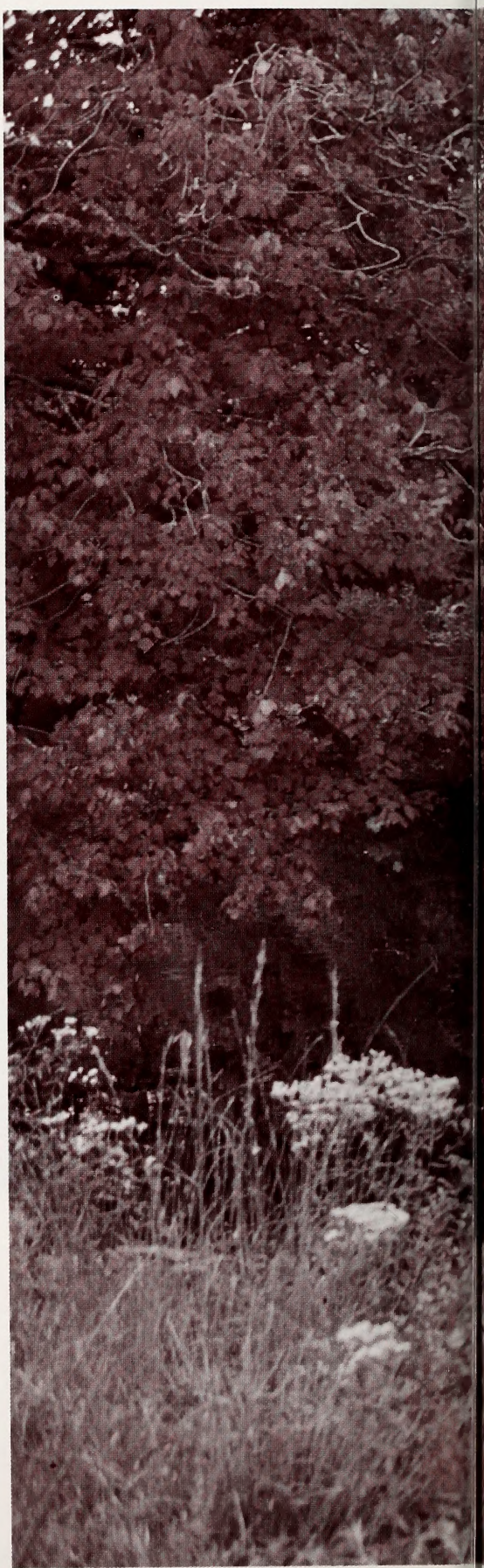
At an estimated $4.5 million to $5.5 million, the center will cost nearly 20 times the refuge's annual budget. But volunteers and staff alike say the refuge needs more ways to teach people what is going on at Alligator River — a key element in maintaining public support for their projects.

Noffsinger acknowledges the critical role public support plays; opposition can quickly kill the best of projects. And the importance of such support will only increase, he says. Noffsinger predicts future conflict about what people can and cannot do on the refuge as human populations increase and wild areas grow more scarce.

"We like for people to be able to use it," he says. "We want the support that comes with that. We want people to be able to see what wonderful things we're doing.

"You allow them to participate as much as possible, try to provide the experience for them," Noffsinger says. "But we're very cautious."

The land is one of the last large pocosin tracts in North Carolina. Aside from the Department of Defense's Dare County bombing range, the refuge today covers an entire peninsula, bordered by the Alligator River to the west, the Albemarle Sound to the north and the Pamlico Sound to the east.



Scott D. Taylor

Coaxing the Red Wolf

Michael Halminski

By Alison Davis

SANDY RIDGE — *The male eyes the humans warily as they approach the large pen, deep in the forested swamps of eastern Dare County.*

When they open the gate, he moves quickly away — as far away as the chain-link fence will let him.

Reada Evans, a volunteer at the Alligator River National Wildlife Refuge, and Jennifer Dagen, a U.S. Fish and Wildlife Service biologist, enter the pen. The male begins to circle like an expectant, yet distrustful father.

Evans walks to the pen's center and kicks what looks like a wooden doghouse. A female skitters out and joins the male in his nervous run along the fence.

Evans lifts the roof off the box and looks inside. There, huddled together despite the warming temperatures, are six puppies. Red wolf puppies.

Nearly six years have passed since the first two red wolves, captive born and raised, were released here in a groundbreaking experiment to give the canid a chance at escaping extinction.

During that time, no one has huffed and puffed and blown the house down. Little Red Riding Hood hasn't disappeared.

In fact, people haven't seen the wolves very often. And that's good, say Fish and Wildlife Service biologists. It's one more sign that the shy, nocturnal red wolf is remaining wild.

"It's been better than anybody ever expected," says Dagen, a biologist who works with the wolf re-establishment program. "They're

from the Brink of Extinction

real hardy, highly adaptable creatures."

Twenty years ago, hardy was hardly the word for it. That's when the Fish and Wildlife Service, fearing *Canis rufus* was about to become extinct, began an ambitious program to save the wolf.

It was almost too late.

Red wolves once roamed a large portion of the southeastern United States, including North Carolina. But hunting, trapping and land conversion for forestry and agriculture pushed them out of the state by the early 1900s. Aggressive predator eradication programs eliminated more wolf territory by mid-century.

By the 1960s, the wolves were concentrated in a small, marshy area of Texas and Louisiana. Populations dwindled, and in 1967, *Canis rufus* was declared an endangered species.

But the species was not only losing its habitat; it was also losing its identity. As their habitat grew poor and populations declined, red wolves began to breed with coyotes, leading biologists to fear the true wolf quickly could vanish.

In the 1970s, Fish and Wildlife workers began capturing every wild red wolf they would locate. They discovered there weren't many left. They trapped hundreds of animals, finding only about 40 that might be true red wolves. Extensive study and testing narrowed that pool to 14 wolves that would serve as stock for the species.

Several years passed before North Carolina was chosen as the wolves' new home, however. Fish and Wildlife officials first wanted to release them on the Tennessee Valley Authority's Land Between the Lakes region in Kentucky and Tennessee.

Red wolves once roamed a large portion of the southeastern United States, including North Carolina. But hunting, trapping and land conversion for forestry and agriculture pushed them out of the state by the early 1900s. Aggressive predator eradication programs eliminated more wolf territory by mid-century.

It seemed an ideal place for the wolves. But the plan met with stiff opposition from hunters and ranchers, who were afraid the wolves would threaten their property rights and their livestock. Unable to sway them, the agency gave up in 1984.

Enter Alligator River. While Fish and Wildlife had been capturing wolves and trying to appease wolf opponents in Kentucky and Tennessee, The Nature Conservancy had begun talking with First Colony Farms about a deal to protect a large pocosin peninsula in eastern Dare County.

The talks had nothing to do with red wolves. But in 1984, just as Fish and Wildlife officials gave up on releasing the wolves on Land Between the Lakes, The Nature Conservancy presented the agency with a gift: nearly 120,000 acres of land. And it was perfect for the red wolf.

Fish and Wildlife officials quickly decided Alligator River would be the red wolf's new home. But the wolves didn't arrive immediately. The agency had learned some lessons from Land Between the Lakes.

Before approaching Dare County about the wolf, officials declared the animal "experimental/nonessential," meaning the population released would not be essential for the species' survival.

Under this designation, wolves could be moved if they began showing up in town or causing problems on a farm. They could be killed if they were threatening a human life. A person who killed a wolf by accident

Continued

wouldn't face prosecution. And deer hunting on the refuge could continue.

The wolves would be outfitted with radio collars that allowed Fish and Wildlife biologists to track their travels.

Even with all of this, support of the project was by no means unanimous. This was, after all, a wolf.

"People have very strong emotions about wolves," biologist Dagen says. "Usually it's one way or the other. There is no middle ground."

Scott D. Taylor

Compared to Land Between the Lakes — or to the opposition to current plans to reintroduce wolves to Yellowstone National Park — the Dare County opposition was minimal.

"For the most part, the local folks have been very tolerant, if not outright supportive," Dagen says. "It's really not that big a deal."

In the five years following the first release, 40 more wolves were released on the refuge. Twenty-two wolves were born, and 22 wolves died, mostly from vehicle accidents, fights with other wolves and drowning. One wolf choked on a raccoon kidney. Although not pleased with the deaths, Fish and Wildlife officials point out that none resulted from public hatred of the canids.

But some deaths did indicate the wolves' lack of fear of things associated with humans — mostly motor vehicles. Fish and Wildlife officials continue to tinker with the program to increase the captive animals' dislike of people (and of trucks and cars) to boost their chances of survival after release. "Wild-born animals," Dagen says, "are much more wise."

Evans and Dagen don latex gloves before lifting the pups, one by one, out of the whelping box. Dagen holds the pups while Evans dabs antibiotic ointment on their feet — a treatment for staph infections.

For the most part, the wolf pups look like dog puppies. But their guard hairs — long, stiff hairs that help protect them — are starting to come in, giving some of the pups a slightly startled look.

They are unquestionably cute, and it would be tempting to cuddle them the way you would a family pet.

But that's exactly what biologists cannot do. They want the wolves to distrust humans, to continue to fear them. So Evans and Dagen are businesslike. They work quickly.

The parents circle constantly, almost frantically, while the humans are in the pen. They look terrified.

So much for the big, bad wolf.

About 30 red wolves now roam the Alligator River refuge. Biologists track them with radio collars, flying over the refuge about three times weekly to chart each wolf's location.

Red wolves are reclusive and nocturnal, traveling alone or in small family groups. Most of the groups have shown an affinity for disturbed areas — areas that have been logged or farmed — where primary succession has begun. Here, small rodents (marsh rabbits are a favorite food) tend to be more plentiful.

"Wolves like edges of things," Dagen says. "They do well in varying habitats. They range over a huge area, and they have done all that dispersing on their own."

This year, Fish and Wildlife officials plan to aid in the dispersion, releasing one family of wolves on the Pocosin Lakes National Wildlife Refuge, which covers remote portions of Hyde, Tyrrell and Washington counties. A six-puppy family will be released on a small island north of the peninsula.

Fish and Wildlife biologists consider Pocosin Lakes an ideal location for the wolf because of its similarity to the Alligator River refuge. But this release may not be as smooth as the Dare County release of six years ago.

Last year, county commissioners in Washington and Hyde counties resolved to oppose the wolf release out of fear that the canid would attack livestock or children. And the commissioners were concerned that the animal later would be declared endangered and landowners would lose rights on their land should the

wolves choose to use it.

Fish and Wildlife officials say that's not the case. The wolf feeds on small animals. It's afraid of humans. And, they say, it will continue to be classified as nonessential, meaning it wouldn't impinge on landowner rights. Yet they have been unable to satisfy many opponents.

Indeed, opposition stems from worries about more than just the wolf. The two counties are economically strangled by high unemployment rates and low tax bases. Washington County officials, for example, see the refuge as an economic loss, as land that long-range plans had designated for industrial use until it was donated to Fish and Wildlife.

"We don't have a lot of industry in this area," says Andy Allen, chairman of the Washington County Board of Commissioners. "We need to expand our industrial base. We would love to see some industry develop in that area. I doubt that it ever will now."

Allen says people aren't angry enough to start fighting. But he worries they will. If they do, the program could suffer.

"Once we get off Alligator River and Pocosin Lakes, it's private land," says Art Beyer, a biologist with the wolf program. "If we can't work with these people, there's no way this will work."

For the most part, biologists say, residents aren't even aware of the wolf once it's released. The animals are nocturnal and shy, and people rarely see them.

"We get a lot of people who want to come out and see wolves," Beyer says. "We know where they're at, and we don't see them very often."

DURANT ISLAND — There is a wolf in the tree. At least, that's what it looks like just for a minute.

The branch near the wolf's head moves, revealing a chain-link overhang that prevents the animal from doing what he wants to do: leave his pen.

There's a thud as the wolf falls to the ground. He leaps up, runs to a corner of the pen. He pauses momentarily to eye his human visitors, then charges again for the fence, scaling a full 8 feet before the overhang sends him tumbling to the ground once more.

It is the puppy play of a 3-month-old, yet it is a sign. These wolves want out. In fact, one of the puppy's siblings already has succeeded in escaping. She was recaptured a few days later.

Biologists may keep the Durant Island wolf family caged a few months longer to give the wolves time to identify with the island. The last family of wolves released here did not make the connection.

"They didn't associate Durant with home," Beyer says. The wolves tried to leave by crossing a wide expanse of the Albemarle Sound. All but one drowned.

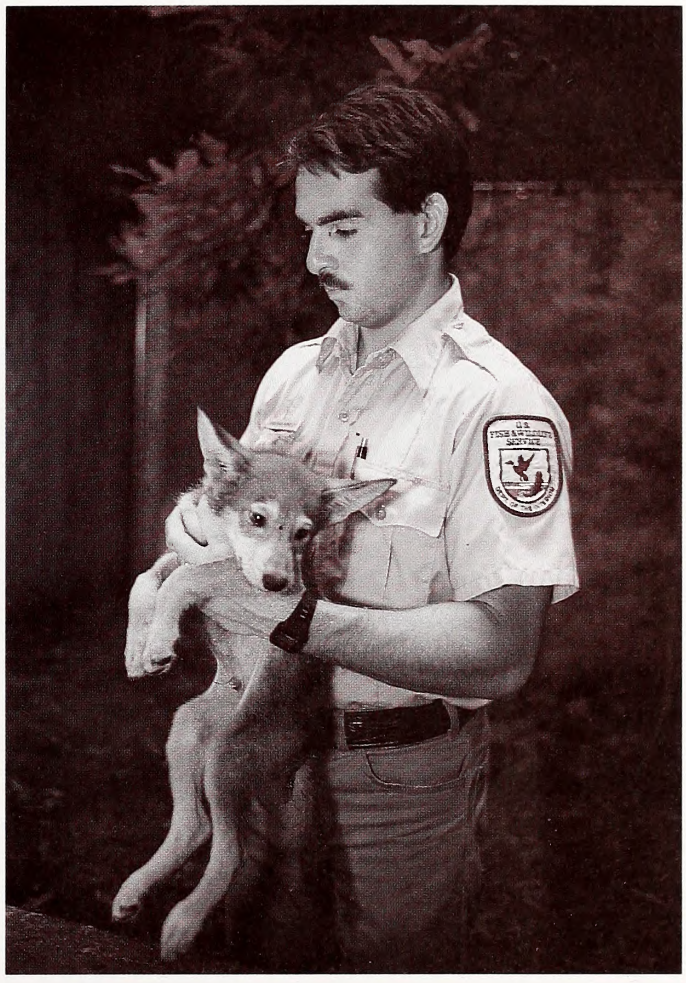
As the possible release dates near, biologists are doing everything they can to increase the pups' chances of survival: rabies shots, parvo vaccinations, help with food.

In addition to the bowls of kibble and weekly horse meat "C-logs," or "carnivore logs," biologists leave carcasses of road-kill deer to help the wolves practice eating other animals and to make sure they are at a healthy weight. Released wolves don't always begin to hunt immediately.

Biologists will continue to supplement the wolves' food for a short while after the release, until analyses of the animals' scats show hair and bone, meaning they are hunting on their own.

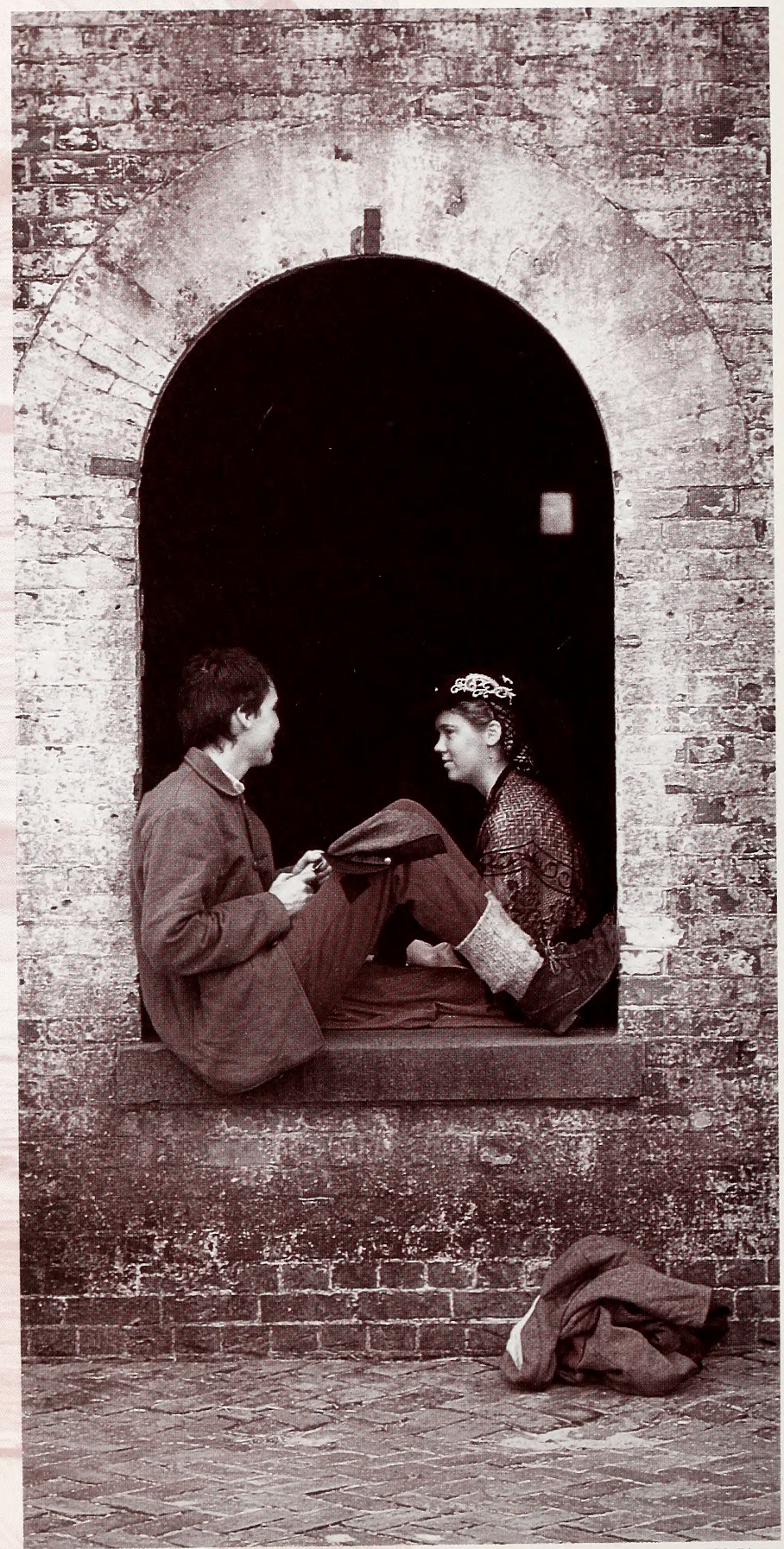
"Once we do, we quit," Dagen says. "We have found that they really don't seem to lose the hunting instinct."

From then, biologists' only contact with the wolves will be by radio collar, save for occasional trappings for shots and collar changes. The wolves will be watched closely, but they'll be on their own.



Ken Taylor, N.C. Wildlife Resources Commission

A Five-Sided Fortress Lures History-Hungry Visitors



The fort is five-sided, making it North Carolina's own "pentagon."

C.R. Edgerton

By C.R. Edgerton

Nine million bricks.

Tons and tons of shifting sand.

And a hole big enough to hold a small ship.

That's what Fort Macon meant to the slaves and day laborers who built it in the early decades of the last century.

Today, 157 years later, Fort Macon is North Carolina's most visited state park.

If you think the beautiful beaches that kiss the lips of this old fort are the real drawing card of Fort Macon State Park, think again.

"Our coastal parks are by far the most visited," says Margaret Hassell of the N.C. Division of Parks and Recreation. "But in this case, the fort itself is the drawing card. It's unique to that part of the state."

Hassell says almost 1.4 million people strolled into Fort Macon State Park in 1992. And few of those beachgoers left without taking at least a peek at the brick structure lying just a few hundred yards from the sand and surf.

An overriding sense of shared history lures people of both Northern and Southern persuasion from the scrunchy sand of the park's wide beaches into the grass and brick pentagon that make up Fort Macon proper.

On its way to becoming one of North Carolina's most popular tourist attractions, this stately brick monument paid its dues as a sentinel for the state's barrier islands. It has weathered the fiercest hurricanes, the ravages of war and the abuse of men who left it more than once abandoned. It's a curious landmark for seabirds and a place to which catbrier clings.

Of the fort's decades of history, perhaps no period is better known than the Civil War years. "That's why most people come to the fort," says Christy Skojec, a park guide and historical interpreter. "There's just a great deal of interest in the Civil War."

The climax of that history began at dawn on April 25, 1862. Warm sea breezes signaled the coming of spring. Sea gulls squawked at schooling fish. It was a perfect day at the beach.

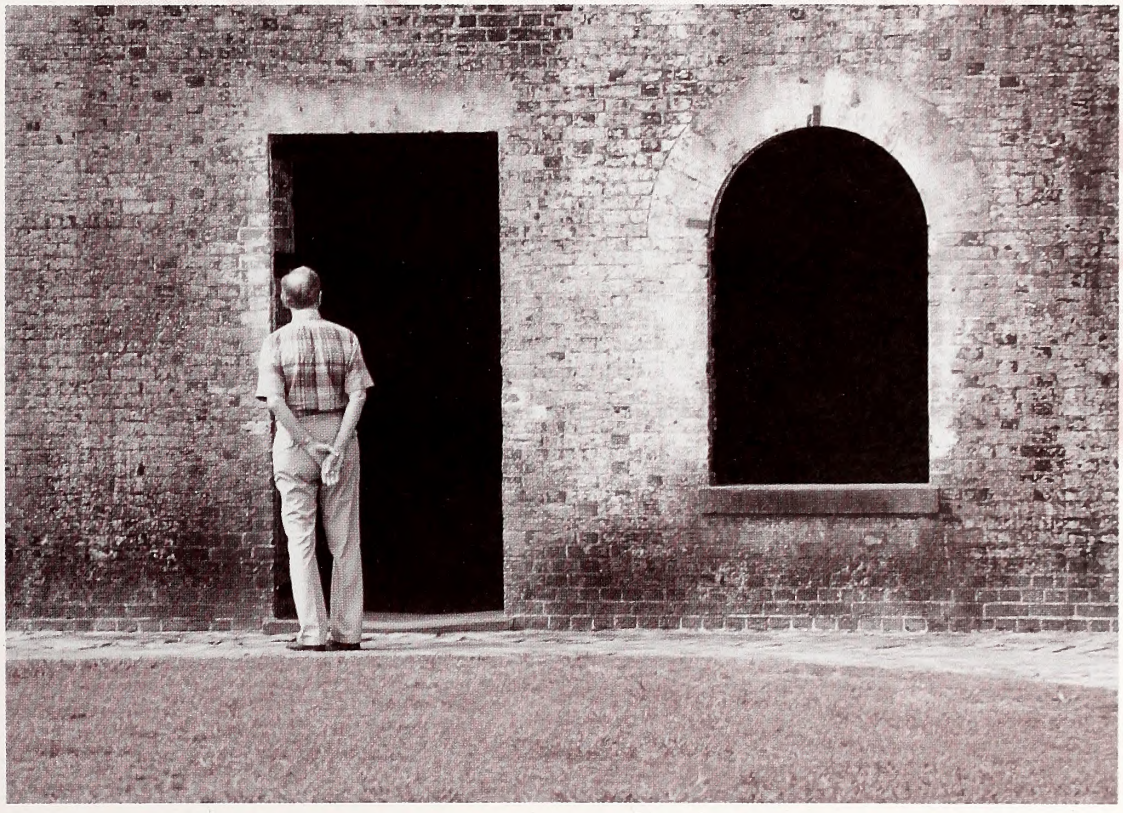
But not so perfect for Col. Moses White, the Confederate officer commanding Fort Macon. He hadn't come to the desolate spit of sand at the tip of Bogue Banks for a vacation. He was sent there to defend a fort that some military people considered already obsolete.

Like other commanders before him, the colonel saw his service at Fort Macon as less than desirable. The isolation and mundane daily tasks of drill and prepare made duty there an exile of sorts.

But that's the way the duty had always been. Since the first of its 9.3 million bricks was laid in 1826, the fort had been the dropping-off place

Continued

Gen. Robert E. Lee never entered the fort during the Civil War, but he did visit in the 1840s. As a young lieutenant, he came to Bogue Banks to design a system of jetties to help prevent erosion.



C.R. Edgerton

for the men of the U.S. Army. President Thomas Jefferson ordered that Fort Macon — named for revolutionary war hero Nathaniel Macon, a North Carolina senator who procured funds to construct the fortress — be built as one of a line of 38 brick forts along the East Coast. Jefferson reasoned that building strong forts armed with heavy weapons would protect coastal commerce without the need for a large national navy.

Two other forts, Dobbs and Hampton, predated Fort Macon. Begun in 1756, Fort Dobbs was never finished, leaving the inlet defenseless against pirates and other seagoing scoundrels who struck fear in the hearts of even the most hardy coastal residents.

In 1808, Fort Hampton was built at Old Topsail (now Beaufort) Inlet. It was located about 300 feet from the site of Fort Macon. For about two decades, this small brick fort protected the harbor. Duty at Fort Hampton was not desirable, and it was deserted. In 1825, a hurricane lashed the tip of Bogue Banks and swept the little fort into the sea.

Fort Hampton was gone, but the need for a strong, long-lasting coastal defense for Beaufort had not diminished. Enter Fort Macon.

From its inception, Fort Macon was to be a fine example of a brick, casemate fort. Built mainly with slave labor and local materials, the fort became a showcase of coastal fortress construction.

But again, isolation, coastal storms and a Spartan existence for its garrison made Fort Macon one of the worst duty posts in the country. Now and then, a generous soul would be assigned to command the fort. Such a man was Gen. Samuel French, a veteran soldier.

"I spent most of my time sailing on the sound and fishing," the general wrote of his duty in 1843. "The water teemed with fish, and both game and oysters were abundant."

When he was transferred a year later, French had trouble saying goodbye. "My stay at Fort Macon was pleasant," he wrote. "And I was not overjoyed to leave the place."

Twenty years later, Moses White would use any word but pleasant to describe his difficult duty at the fort.

The Confederate colonel knew the Union Army had vowed to recapture Fort Macon. A year earlier, Confederate Capt. Josiah Pender of Beaufort and his garrison of local troops took the fort from an ordnance sergeant without firing a shot. Restoring Fort Macon to the Union would be a lift for morale and return another major Confederate fort to the hands of the U.S. government. It would also secure safety for ships that had to pass the fort to supply major Union strongholds like New Bern and Kinston.

For weeks, the Union Army had prepared for its attack on Fort Ma-

The fort was constructed between 1826 and 1834 using 9.3 million bricks. The walls inside the moat are 4.5 feet thick. The moat is connected by a series of canals to Bogue Inlet so that water from the inlet could be used to flood the moat in the event of an attack. The moat was never used for this purpose.

C.R. Edgerton

con. Union Gen. Ambrose Burnside, who had only recently won a decisive battle for New Bern, decided that taking Fort Macon by sea would be a futile effort with great loss of men and equipment. The fully armed fort, a moat, 54 huge guns and a garrison of more than 400 troops, would be the clear winner in a water-based assault. Fort Macon was designed to protect Beaufort Harbor from attack by sea, and the men inside the fort knew how to perform that task with deadly skill.

Burnside didn't base his plan of attack on surprise. It would be a land assault on a fort built on the basically flat plain of a barrier island. Only a few sand dunes separated the Union Army's efforts from the watchful eyes of the men posted as the fort's spotters.

In plain view of the Confederates, Union artillerymen in March 1862 began digging entrenchments and setting up large guns and mortars. Now and then, the Confederates in the fort would fire a volley from one of the fort's large guns. The missile would pierce the air over the heads of the Union artillerymen only to continue down the strand, falling harmlessly into the white sand a half mile away. The Confederates needed mortars, weapons that could lob an explosive shell behind the dunes and into the waiting Union batteries. But mortars had never been sent to the fort, despite White's efforts to acquire them.

Realizing the fort's weapons were useless against their advance, the Union Army continued its patient building of batteries for the final assault on Fort Macon.

As White watched the sun rise on that fateful April morning, he needed no warning. He was as prepared as possible. Only weeks before the Union began its slow assault on the fort, he'd managed to procure supplies to last six months. Those supplies were dwindling now, and the men in the fort were beginning to complain about food and living conditions. All the men's toilet facilities were outside the fort proper, a danger zone by anyone's standards. The possibility that his men might plan a mutiny had crossed the colonel's mind more than once.

As the sun rose clearly out of the Atlantic, a sharp report and a puff of smoke issued from the enemy's batteries a quarter mile up the windswept banks. In time too short to count, the shot sliced the air over Fort Macon with an eerie shrill. The men in the fort, most of whom had been preparing for this day for months, watched as the deadly missile bypassed the fort and slammed into Beaufort Harbor, skipping through the whitecaps like a child's tossed rock.

Ten minutes later, Fort Macon's artillery crews responded with a round of fire from the fort's big guns. The battle was on. Shot after shot from the Union ranks soared

Continued

While the fort was being used as a federal penitentiary after the Civil War, several prisoners escaped from one of the casements through an air vent no more than 18 inches in diameter. Three were later recaptured; the rest were never found.

C.R. Edgerton

Scott D. Taylor

over the fort, falling harmlessly into the water beyond. As the crisp morning changed to a warm noon, the shots began to rain upon the fort with more accuracy. A Union signalman stationed at Beaufort had a bird's-eye view of the attack. As the Union artillerymen fired, he signaled to them ways to adjust their aim.

Meanwhile, the Confederates in Fort Macon were slinging their own powerful artillery at their Union opponents. But the shells failed to shut down the Union thrust. Because the Rebs had no mortars, the Union troops avoided the fort's guns by simply ducking behind the dunes. The big guns could only fire in a straight line.

During the battle, Burnside ordered an attack on the fort by sea. But this proved to be the Confederates' only victory of the day. No seagoing craft could match the fort's great guns.

For 11 hours the two sides bombarded each other. The Yanks fired more than 1,000 shells at the fort, with about 565 hitting their mark. Amazingly, the dead included only seven Confederates and one Union soldier — one who failed to heed the warning, "Duck!"

But the fort was a shambles. What had been hailed as one of the finest forts of its kind had been reduced to rubble. The Union's rifled cannons had thrust their bombs with such accuracy and force that some areas of the fort were literally splitting under the pressure. The missiles struck ever closer to the fort's main gunpowder magazines. White knew he was outnumbered. He feared a gigantic explosion and the loss of many lives. Realizing he was being attacked by the same people who had designed Fort Macon, the colonel raised the white flag of truce.

Later, White and Burnside agreed to simple terms: the fort would be turned over to the U.S. government,

Continued

During World War II, a man in the Atlantic anti-submarine force stationed at the fort used an old Civil War shell casing as an andiron in a fireplace. The shell exploded, injuring the man. The fort became internationally known when "Ripley's Believe It or Not" published the incident as "the last shot fired in the American Civil War."

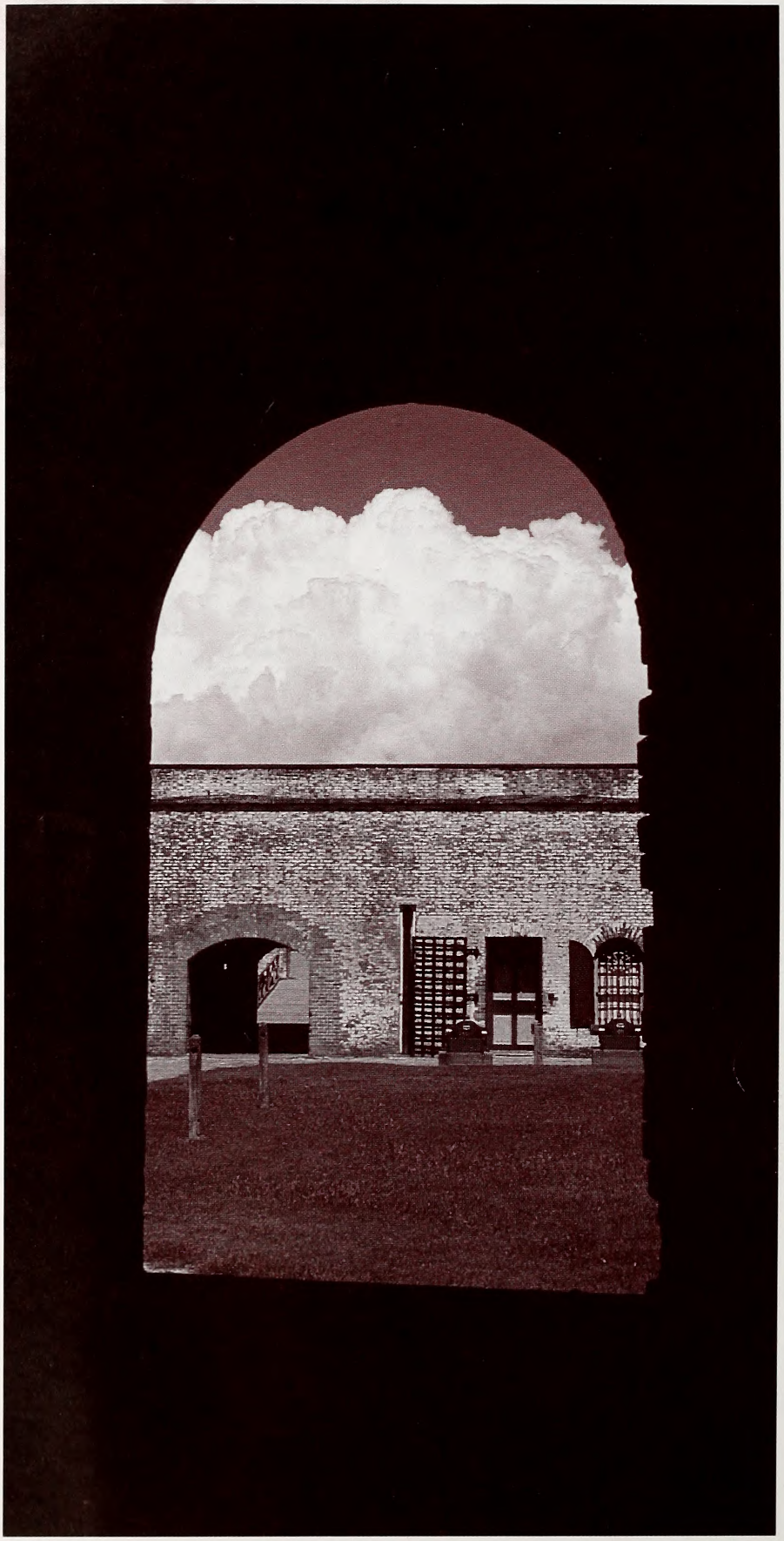
and the men stationed there would surrender their arms. The general generously pardoned all the Confederates as prisoners of war for exchange.

For the remainder of the war, Fort Macon stayed in Union hands, guarding the entrance to Beaufort Harbor from Confederate gunships and privateers.

After the Civil War, its glory made obsolete by sophisticated weaponry like rifled cannons, the fort was abandoned by the U.S. Army. The federal government used the structure as a penitentiary until 1876, and the Army stationed a garrison of men there during the Spanish-American War in 1898.

By 1903, the Army abandoned Fort Macon permanently and allowed the catbrier, yaupon and blowing sand to attack at will. In 1924, after the Army offered the fort and its compound for sale as surplus property, the U.S. Congress allowed North Carolina to acquire the fort for $1. And on May 1, 1936, Fort Macon became the state's first functional state park.

The fort's last official duty came during World War II, when the federal government again leased the property as quarters, this time for anti-submarine forces stationed on the barrier islands.



Scott D. Taylor

Letting Bycatch Out of the Bag

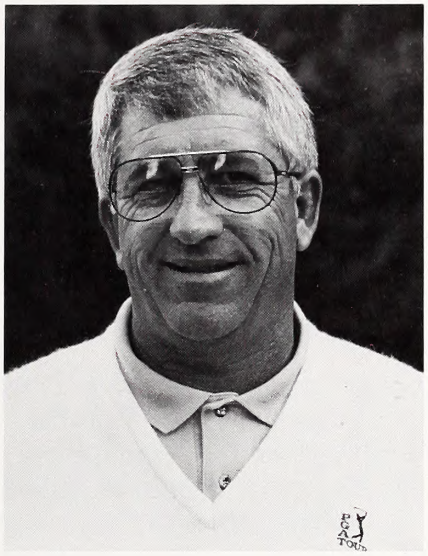
A new North Carolina fisheries regulation has commercial watermen who fish state waters rigging their nets with bycatch reduction devices (BRDs). The regulation's purpose is to reduce the amount of nontargeted catch — bycatch — that fishermen net along with their intended catch. North Carolina is the only state to require use of BRDs in inshore waters.

Fisheries managers believe that reducing bycatch may help restore the deficits in some fisheries. But any device that allows unintended catch to escape may let the target catch out of the tailbag too.

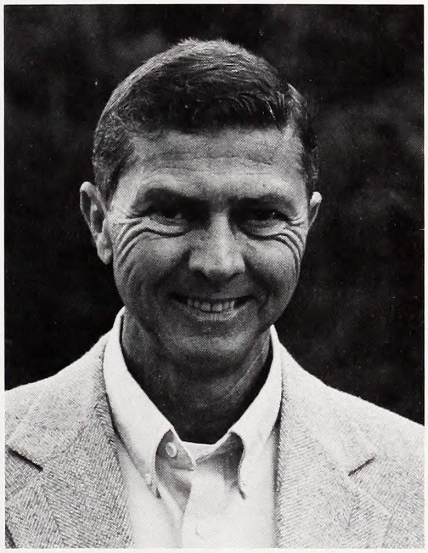
That's why Sea Grant fisheries agents Jim Bahen and Wayne Wescott have been testing different types of BRDs and net configurations to see how they work over various kinds of inshore bottom areas.

Bahen's project, funded by the National Marine Fisheries Service (NMFS) through the Marine Fisheries Initiative Program, had the cooperation of several fishermen. They tested four BRD designs at four locations — the Cape Fear River, Pamlico Sound, Core Sound and the estuary behind Topsail Beach — for 10 nights during peak brown shrimp season. The BRDs were used in conjunction with turtle excluder devices (TEDs), which resource managers also require inshore shrimpers to use to release endangered sea turtles.

The fishermen tested two hard BRD designs — the Florida Fish Separator and a PVC pipe design. The soft BRD designs were variations of what fishermen call the "snake eye." The snake eye is a diamond-mesh extension that is attached behind the turtle excluder device. Diamond-shaped holes in the extension allow the bycatch to escape. The extension was tested with and without an accelerator, which funnels the catch to the tailbag.



Jim Bahen



Wayne Wescott

During testing, the boats were rigged on one side with a BRD. On the other side, the BRD was sewn shut according to a testing protocol established by NMFS. A technician and a graduate student gathered bycatch reduction and catch data and monitored the equipment.

After testing, Bahen sent all of the data to NMFS for analysis.

"The verdict is still out," he says. "All of the designs reduced bycatch. But we're waiting to see which one reduced bycatch and retained the most shrimp. We want to see the percentages on shrimp loss and bycatch reduction before we make any recommendations about BRD designs."

Meanwhile, Wescott tested another bycatch reduction method — large mesh webbing in the belly of the shrimp net. Fishermen had suggested to Wescott that large webbing in the belly might reduce bycatch without having to add gear or extensions in the tailbag.

They theorized that the shrimp would be swept into the tailbag, bypassing the large mesh. Fish, however, would be able to escape the net through the big-mesh belly.

During initial tests last year, the idea seemed to work. This year, Wescott received a Saltonstall-Kennedy grant from NMFS to pursue the idea on a larger scale.

"Our goal was to have 50 percent reduction in bycatch with only a 3 percent loss in shrimp," Wescott says.

With the help of a fisherman, Wescott tested 4-inch, 6-inch and 8-inch webbing in the belly. All reduced bycatch. The reduction varied between 24 and 74 percent, Wescott says.

But the webbing also allowed between 20 and 60 percent of the shrimp to escape too.

"That kind of shrimp loss is totally unacceptable," Wescott says. "It simply didn't work, and I hope our work will prevent fishermen from spending money on this type of modification."

Kathy Hart

Sea Which

Here's a playful, artistic activity for kids that has an air of suspense and mystery. With "Sea Which," it's easy to become a fast draw.

Use this page or photocopy for a whole group to use. Follow these simple instructions:

1. Cut out circle.

2. Place circle on a sheet of paper with a piece of carbon paper in between (leftovers from duplicating masters work).

3. Thumbtack "Sea Which" through center. (You may want to use an old magazine or piece of thick cardboard as a base.)

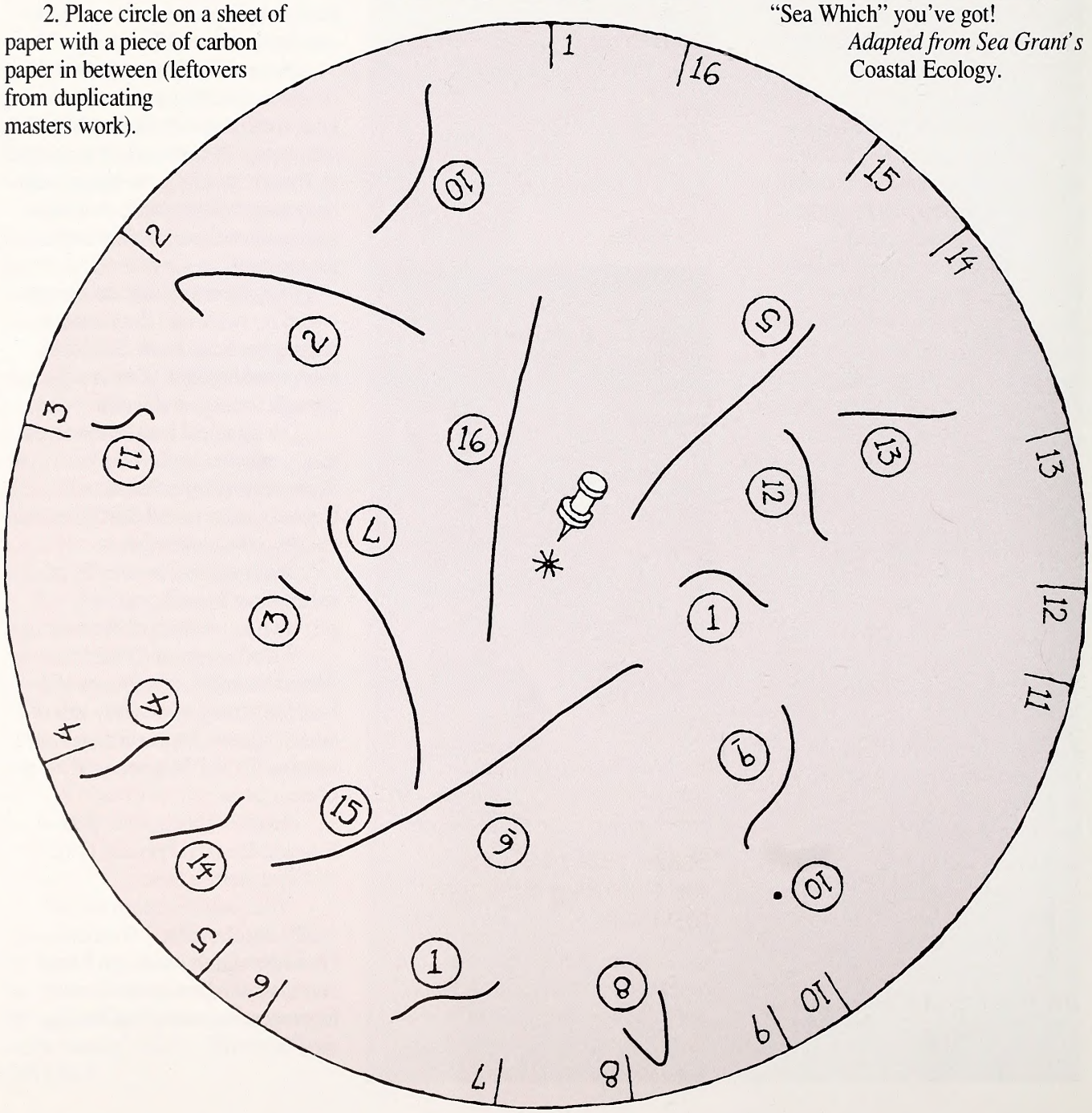
4. Pencil a reference mark on paper at top of circle.

5. Swivel circle until number 1 on circle edge is on the mark. Then trace over all thick solid lines (there's one solid dot in puzzle) marked "1." (There are two marks that correspond to numbers 1 and 10.)

6. Swivel circle to number 2. Repeat until all lines have been traced.

7. Lift circle and carbon and "Sea Which" you've got!

Adapted from Sea Grant's Coastal Ecology.



Coastwatch *wants to hear from you on topics relating to the North Carolina coast. Letters should be no longer than 250 words and should contain the author's name, address and telephone number. Letters may be edited for style. Send all correspondence to* Coastwatch, *N.C. Sea Grant, Box 8605, N.C. State University, Raleigh, NC 27695. Opinions expressed on this page are not necessarily those of N.C. Sea Grant employees and staff.*

Lighthouses Issue

May/June was a great issue. I enjoyed lighthouses and striped bass. No mention of Gen. George Meade, whom I thought had a lot to do with building lighthouses.

Walter E. Diemer,
Lancaster, PA

You're right. Gen. George Meade figured prominently in the history of East Coast lighthouses, particularly efforts to improve the performance of the fledgling beacons. In 1853, when Meade was assigned to lighthouse duty as a young lieutenant in the army engineers, he designed a lamp that was adopted and used in the lighthouse service. Two years later, the nation's Lighthouse Board dispatched him to inspect the failing Barnegat Light Station in New Jersey and make recommendations as to its fate. Meade later oversaw the construction of two significant East Coast beacons: the Absecon light tower, lighted in 1857, which became one of the most frequently visited stations during its active days in Atlantic City, N.J., and the Sombrero Key light in 1858, which was part of a chain of beacons built on ocean reefs to protect the Florida Keys.

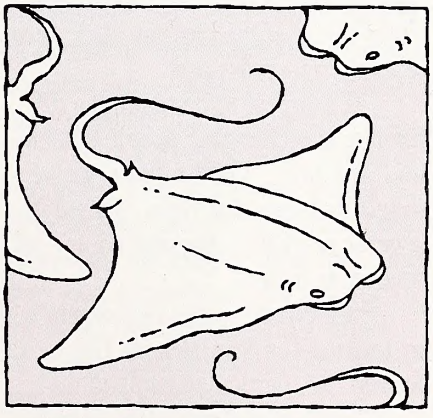
I'm sure the history of lighthouses is full of innovators such as Meade, who by the way, commanded the Union forces in the Battle of Gettysburg. Our story, however, focused less on the innovations that made the lighthouses possible and more on the individual histories of the North Carolina beacons.

Coastwatch Staff Gets Pat on the Back

Thanks for all you do to educate your readers about our beautiful Carolina shore. I've been enjoying *Coastwatch* since its days as a simple newsletter. The new format is terrific.

Julia Batten Wax,
Emerald Isle, NC

Thank you for your support and kind comments. We're enjoying the new Coastwatch *too, especially the ability to bring you more in-depth articles about our coast and its environment.*



More Information on Treating Stingray Injuries

I was pleased Jeannie Faris could extract some pearls from my book, *Nature Guide to the Carolina Coast*, for two articles in the July/August *Coastwatch*. As an emergency medicine doctor with a special interest in hazardous animals, I'd like to offer some medical pearls to augment the "Beach Dangers" article in the same issue.

The hallmark of both stingray and jellyfish stings is intense pain at the site of the sting. These wounds are rarely serious, however, and most often can be treated with simple home remedies.

Stingray wounds should be treated by immediate immersion of the stung area in hot water (plunk the foot into a bucket of hot water). Hot water provides dramatic relief of pain and possibly helps prevent complications such as local tissue death and wound infection. The water should be as hot as a victim can tolerate without scalding; immersion should continue for 30 to 60 minutes. Treatment for jellyfish or man-of-war stings consists of application of vinegar soaks. Cover the stung area with a towel or shirt, saturate the cloth with vinegar and leave in place for 30 to 60 minutes. Vinegar is the solution that best inactivates the stinging cells.

In the majority of cases, these simple remedies provide adequate treatment.

If whole-body symptoms or shock is present, care should obviously be sought on an emergency basis. If hot water/vinegar application fails to control pain, or if a piece of stingray barb is thought to remain in a wound, treatment on a less urgent basis can be sought.

Dr. Peter K. Meyer
Wilmington, NC

Thank you, Dr. Meyer, for providing this information. I'm sure these words of wisdom will be helpful for swimmers who encounter a stingray or jellyfish during a beach visit.

Emily Summons New Flood Maps for Hatteras

Nature isn't always evenhanded. Hurricane Emily demonstrated this in September, flooding homes on the Pamlico Sound and eating away at the Outer Banks beachfront near rip currents and shifting sandbars.

Sea Grant's coastal engineer, Spencer Rogers, says the building code served the communities well with regard to wind damage, but predicted flood elevations fell short.

"The flooding in the area from Hatteras to Buxton was 1 to 2 feet higher than the predicted 100-year storm," he says. This will probably result in revised flood maps for the area within the next year, Rogers says.

"Most of the major wind damage occurred to either older buildings or buildings that hadn't been constructed to code," says Rogers, adding that shingle damage was widespread. "The things that were damaged by the winds were what you'd expect to be damaged: poorly connected roofs, porches, eaves, mobile homes."

But he says the storm provided less than a full test of the wind code. The building code is based on 110 mph winds. Emily never exceeded sustained winds of more than 80 to 90 mph. Peak gusts on the ground measured 107 mph.

Rogers spent the weeks after the hurricane measuring water marks and observing the wreckage on the island. Setting up camp with the state's Division of Emergency Management and the U.S. Geological Survey, he looked at debris and water lines inside houses and assessed damage along the shoreline and dunes.

Recently constructed homes on pilings fared well. But the old, low-lying houses on the sound side were hardest hit by flooding. The worst damage was to the old villages of Avon, Buxton, Frisco and Hatteras. About 700 buildings along Cape Hatteras were damaged or destroyed, including about 100 mobile homes, says Rogers.

An expert on hurricane-resistant construction, Rogers is comparing his findings to past storms and evaluating possibilities for future storm damage. Also, Sea Grant is sponsoring engineering research with N.C. A&T University that will examine shingle damage on homes blasted by the storm.

Record Numbers Sweep Shorelines

In numbers of volunteers, First Citizens Bank Big Sweep '93 was the biggest cleanup ever of North Carolina's beaches and inland waterways. The annual September cleanup attracted 12,287 volunteers to the cause of bagging aquatic debris.

The bounty — more than 223 tons of garbage — fell short of last year's 256 tons. Executive Director Susan Bartholomew says that's because many of the cleanup sites were repeats from years past.

"We appear to be making a difference and changing people's behavior," she says. "On the coast, we've found that sites that were cleaned up several years in a row often don't get littered as badly."

Bartholomew says organizers will be looking for new sites for Big Sweep '94, particularly inland.

"Some of our mountain organizers reported that they could have used many more volunteers to get at the problem there," she says. "Next year, we're going to target some of those areas."

As usual, volunteers found the unusual — a scarecrow in Transylvania County and X-rated videos in Forsyth County. Volunteers also removed more than 1,500 tires from rivers and estuaries.

Participants counted and recorded every piece of litter they bagged. The tally sheets will be sent to the Center for Marine Conservation in Washington, D.C., for tabulation. Big Sweep uses the results to tailor educational programs for target audiences.

The N.C. Big Sweep is a year-round educational program. For more information about the event, its committees or programs, call 919/856-6686. Or write N.C. Big Sweep, P.O. Box 550, Raleigh, NC 27602.

Saving Turtles in North Carolina Waters

These days, turtle excluder devices (TEDs) are a common net accessory on boats that fish the South Atlantic Coast. The rectangular and oval-shaped contraptions have bounced turtles out of shrimp nets here and in the Gulf of Mexico for about six years.

But only recently have North Carolina flounder fishermen been added to the list of commercial watermen required to fit their nets with TEDs. For the second consecutive season, the National Marine Fisheries Service (NMFS) is mandating this turtle-protection measure in flounder boats that trawl the ocean between the North Carolina-South Carolina state line and Cape Charles,Va.

The poor performance of TEDs in flounder nets last year had commercial fishermen apprehensively preparing for the 1993-94 season.

Last year, fishermen in this region landed nearly 11 million pounds of summer flounder worth about $14 million. But they complained that their harvests were marred by conchs clogging TEDs early in the season, between November and December. Dogfish piled into the nets through January, the end of the season.

TEDs in flounder nets are more susceptible to clogging because the nets are large and skim the ocean floor. A flounder net can collect as much as 20,000 pounds of dogfish when they're schooling off the coast, causing the TED and tailbag to rip off from the weight.

These complications, however, are outweighed by the risk of flounder fishermen inadvertently drowning endangered sea turtles in their nets, NMFS has concluded. The federal agency mandated the use of TEDs through an emergency rule under the Endangered Species Act, which covers the sea turtles. Of the five species found off the U.S. coast, all sea turtles are listed as threatened or endangered and are protected by federal law.

According to fisheries service technicians, two types of TEDs, the Anthony Weedless and a structurally strengthened version of the Supershooter, proved successful in excluding turtles and retaining flounder during last year's summer flounder bottom-trawl season. Both are NMFS-approved devices. A third TED, developed last season, is expected to be certified this year. Formerly called the Conch TED, the Flounder TED shoots turtles out the top of the net and releases conchs through a row of 10-inch holes in the bottom.

Sea Grant and NMFS hosted a series of fall workshops to help commercial fishermen come into compliance with the federal TED requirements and know the best gear options.

Barracuda: A Risky Catch

Anglers are more open-minded about eating their catch as declining stocks force them to wait longer between bites. They're trying new dishes, sampling fish that swallowed hooks baited for another species. But fishermen bent on new culinary excursions should take heed. Some fish, such as barracuda, can be dangerous to their health.

Barracuda can carry a toxin called ciguatera that causes nausea, vomiting and tingling or numbness in the lips, tongue and mouth within hours of ingestion. In severe cases, it causes hot-to-cold sensory reversal so that cold objects feel hot and hot objects feel cold.

Joyce Taylor, Sea Grant's seafood education specialist, cautions against eating any amount of barracuda. Some reports of ciguatera poisoning have turned up in North Carolina in the last five years, and there is no way to detect the toxin in fish. It can't be smelled, seen or tasted. And unlike bacteria, it can't be killed by cooking or freezing.

"We can no longer safely say that there aren't cases of ciguatera in temperate waters such as North Carolina's," Taylor says. "There is a remote possibility of coming into contact with the toxin, so we have to tell people to use their own judgment."

A spate of recent phone calls to Sea Grant and the N.C. Division of Marine Fisheries may indicate a heightened concern among anglers and seafood consumers about the risks of ciguatera. But recreational landings of barracuda — a tasty, flaky fish — have remained fairly stable this year.

Taylor tells callers that ciguatera can inflict toxic symptoms within three to five hours of ingestion. The symptoms are usually short-lived, but they vary according to the severity of the case. The neurological symptoms of severe ciguatera poisoning can recur for years, she says.

Barracuda are not inherently toxic. The poison originates in microplankton or dinoflagellates that are eaten by small reef fish. These fish are prey to larger fish, and in time the larger fish can become toxic. Anglers hook them and take them home or to market.

The tropical waters of the Virgin Islands and Guam are breeding grounds for ciguatera. Miami, too, has had problems that prompted the city to ban the sale of barracuda. From the South Atlantic, the fish travel to North Carolina via the Gulf Stream, where they can be caught year-round, says Doug Mumford, a fisheries technician for the division. Barracuda venture as close as 5 to 10 miles offshore during warm months, and sometimes their larvae use the estuaries for nurseries.

Some people think that it's safer to eat the smaller barracuda — 2 to 3 feet and smaller — that are less likely to have accumulated high levels of the toxin, says Frank Schwartz, a marine biologist for the University of North Carolina Institute of Marine Sciences. But he points out that the ciguatera cases in North Carolina involved smaller fish.

N.C. Marine Recreational Fishing Forum

As long as a valuable natural resource is limited, there will be a struggle over who can harvest it.

This is especially true in the case of commercial and recreational fishermen who are jockeying for the right to catch the limited fish stocks off North Carolina's coast.

Over the years, the debate has been increasingly contentious, circling such issues as who is most entitled to these fish, who invests more in the economy by fishing and who most impacts the resource.

The third annual N.C. Marine Recreational Fishing Forum will focus on finding common ground in the conflict between these two camps.

For more information about the upcoming forum, slated for Feb. 19, contact Jim Murray at Sea Grant by calling 919/515-2454 or writing Box 8605, N.C. State University, Raleigh, NC 27695.

Fishing for a Saltwater License

Saltwater fishermen to the north and the south of us pay for the privilege of casting a line for the catch of the day. But not in North Carolina.

Yet.

The N.C. Marine Fisheries Commission is working on a saltwater sportfishing license package that is expected to be ready for the General Assembly by spring 1995.

This much is certain — wherever a saltwater fishing license has been proposed elsewhere, it has ignited disagreement among supporters and detractors equally dedicated to their position. A saltwater license is either an assault on one of the few remaining untaxed pleasures of life or a tool to raise money for enhancing troubled fish stocks.

All can agree on one thing, however. If recreational fishermen don't get involved in the debate, for or against the license, they could find themselves with a license that they don't like.

N.C. Sea Grant doesn't have a position on the issue, says Jim Murray, director of the Marine Advisory Service. But he organized the 1993 N.C. Recreational Fishing Forum to give the issue a thorough airing out.

"The important thing is to set up the process to develop the license openly and fairly, giving all sides, and not just fishermen, a chance for input," he says. "It affects the chambers of commerce and tourism, and they need to be part of the process. My only stance is, if we're going to do it, do it right."

The license is an idea that's already caught on in other states. In South Carolina, resident anglers pay $5.50 for a stamp that entitles them to fish in salt water all year. In Florida, the price is $12 for locals. In Virginia, local and visiting fishermen pay $7.50. The prices vary from state to state for nonresidents, charter boats, pier fishermen and others. Anglers can also buy a license for just a few days or a few years.

The payback is twofold, supporters say. The license revenues give recreational anglers a power base from which to voice their views. Currently, sportfishermen say, they're not well represented on the boards and commissions that manage fisheries. In short, they're not vested players. But dollars and a unified voice would give them the ear of the N.C. Marine Fisheries Commission, they say.

Also, their money can be used to enhance the fish that they angle for. In Florida, where the license has raised $12 million per year, the state has expanded research on tarpon, snook and spotted sea trout; spent more on artificial reef development; and monitored and assessed stocks of juvenile fisheries.

But there have been tough lessons learned in every state. When fishermen start paying for a license, they expect immediate dividends on their investment in the form of better fishing. And skeptics fear that taxing fishermen would discourage tourism, damage local economies and penalize subsistence fishermen.

Plus, the state could dump the proceeds into the general fund and spend the money elsewhere. It's hard for the state to invest in a resource that can swim away, says critic John Newbold, a board member of the N.C. Beach Buggy Association. But supporters say anglers can guarantee that their money is invested in fisheries by writing the spending formula into law.

Nearby states are continuing to fine-tune their programs, and North Carolina can gain from their experiences. For example, each state at the outset wanted the license to measure the impact of recreational fishing on the stocks. But because of wide-reaching exemptions, the system doesn't tell how many anglers are out there, who they are or where they fish. All three states exempt anglers under 16 and over 65. Florida exempts fishermen on a licensed pier or vessel. Virginia licenses Chesapeake Bay anglers and exempts ocean fishermen. South Carolina exempts shore-based fishermen. The problem might be remedied, however, by licensing all saltwater fishermen and charging only select groups.

To the criticism that the license would be expensive to implement and enforce, supporters say profits can be used to beef up law enforcement. Still, this could be difficult. In Virginia, an angler can say he was fishing in the ocean if he's questioned about his license. And North Carolina is already pinched with 47 Division of Marine Fisheries officers patrolling its 2.5 million acres of water.

Overall, it's important for the public to understand the costs and benefits of a saltwater license from the outset. And the process should involve everyone: fishermen, business and tourism, piers and charter boat operators. The saltwater license and other recreational fishing issues were discussed by panelists and an audience of anglers, scientists, policy-makers and businesspeople at the 1993 N.C. Marine Recreational Fishing Forum. This dialogue has been compiled into a booklet that can be ordered through Sea Grant. Write N.C. Sea Grant, Box 8605, N.C. State University, Raleigh, NC 27695, and ask for UNC-SG-93-06. Enclose a check or money order for $3.50.

Underwater Exploration

N.C. Sea Grant's latest video, *Undersea Oases: The Science of Hardbottoms*, plunges viewers to the continental shelf between North Carolina and Florida for a view of the perplexing rocky outcrops called hardbottoms.

Surrounded by sand flats, the crumbling ledges of these rocky cliffs are topped by algal meadows that attract a surprisingly abundant array of marine life. In fact, the amount of life along these hardbottoms is more abundant than on other parts of the continental shelf.

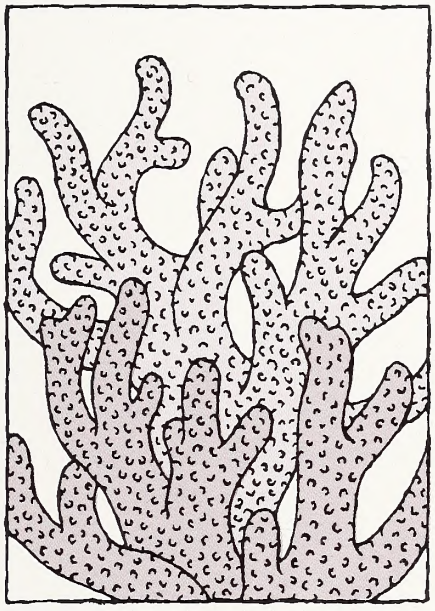
Using submersibles and remote sensing devices, scientists explore, map and analyze hardbottom habitats on video before your very eyes. They are striving to unravel questions of geologic origin, diversity, nutrient chemistry and productivity.

Through footage taken from submersibles and by SCUBA divers, scientists guide viewers through the hardbottom ecosystem and their ongoing research.

Undersea Oases is ideal for junior and senior high school earth and marine science classes and for undergraduate geology and oceanography courses. It can also add an educational splash to meetings of dive clubs, commercial fishing associations, recreational fishing groups and conservation organizations. An enclosed brochure lists organisms that appear in the video, scientists, equipment and suggested further reading.

Lundie Spence, Sea Grant's marine education specialist, wrote and produced the video. And featured in the footage are N.C. Sea Grant researchers Stan Riggs, Martin Posey, Scott Snyder, Will Ambrose and Steve Snyder.

To buy a copy of *Undersea Oases*, contact Environmental Media at 800/368-3382 between 9 a.m. and 5 p.m. EST, Monday through Friday. The cost for the 15-minute video is $19.95. Or fax your order to 919/942-8785. Environmental Media accepts Visa and Mastercard.



Whom Do You Call?

It's every vessel owner's nightmare. The engine on your boat dies, and you and your crew are adrift offshore in a storm.

What should you do?

Issue a marine distress call on your radio or radiotelephone.

What do you say?

You follow the procedure outlined in N.C. Sea Grant's new marine distress communications sticker.

The form provides 14 steps you should follow when making a marine distress call to the U.S. Coast Guard or another vessel. The form helps provide vital information that could be easily overlooked in a stressful emergency situation. It's information that could mean the difference between life and death for you, your family or crew.

The 9 by 4 1/2-inch form is a peel-off sticker that can be applied to any hard surface near your boat radio.

Who should get a marine distress communications sticker?

Anyone who spends time on the water — commercial fishermen, recreational fishermen, boaters, sailors and charter boat and dive boat operators.

How do you get one?

Single stickers are free for the asking. Just write Sea Grant, and ask for UNC-SG-93-04.

The marine distress communications sticker is a joint effort of the Maine/New Hampshire and N.C. Sea Grant College programs.

Crisis Preparedness for the Seafood Industry

No industry is free from crisis. Experts contend that every business, at some time, will experience a crisis.

And seafood processors and retailers like other food handlers may be particularly susceptible. Consumer uneasiness about food and drug safety is at an all-time high.

What would a processor do if confronted with an outbreak of food poisoning or forced by the U.S. Food and Drug Administration to recall contaminated product? Unless a crisis plan is in place, the processor may be left floundering.

To help seafood processors and retailers plan for these unpleasant situations, Sea Grant Seafood Technology Specialist David Green has developed a Blueprint, *Managing in a Crisis: Being Prepared.*

It offers steps for developing a crisis plan, guidelines for handling the media and a sample product recall policy.

To receive a free copy of this Blueprint, write Sea Grant. Ask for UNC-SG-BP-93-02.

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