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Coastwatch

UNC Sea Grant January/February 1992

Feathered Friends



I N C L U D I N G

Managing Colonial Waterbirds

P L U S

The Bird Man of Carteret County

A L S O

The Comeback Birds



Coastwatch

Coastwatch Staff:

Kathy Hart, *Managing Editor*

C.R. Edgerton and Carla B. Burgess,
Staff Writers and Editors

L. Noble, *Designer*

Julie Snyder and Debra Lynch,
Circulation Managers

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Front Cover photo of a short-billed dowitcher by James Parnell

Inside front cover photo of laughing gulls by J. Foster Scott

Back cover photo of shorebirds by Steve Murray



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From The Top

Dear Reader,

What's a beach without birds?

Can you imagine a salt marsh without graceful egrets and ibises?

The birds that inhabit our coast are precious resources, not only to people who watch them for pleasure, but for scientists who study them too.

Some scientists even say that the health of birds is a good indicator of the shape of the environment.

In this issue of *Coastwatch*, we look through the binoculars of journalism at some of North Carolina's native shorebirds.

In our first story, I explored the state's management of the following coastal nesters — gulls, terns, skimmers, egrets, ibises, herons and pelicans. These birds nest in groups called colonies, hence their name — colonial waterbirds. But it's this tendency to

flock together that requires management of their habitat to maintain their populations.

To gain an appreciation of what it takes to be a die-hard coastal birdwatcher, Carla Burgess spent a day with John Fussell — Carteret County's very own "bird man" — at the wonderfully wild Rachel Carson Estuarine Research Reserve near Beaufort.

And C.R. Edgerton delved into one of the great success stories of the coastal bird world: the recent boom in brown pelican populations in North Carolina.

We hope these stories and their accompanying photographs will give you new insight into the wonderful world of North Carolina coastal birds.

See you next issue,
Kathy Hart

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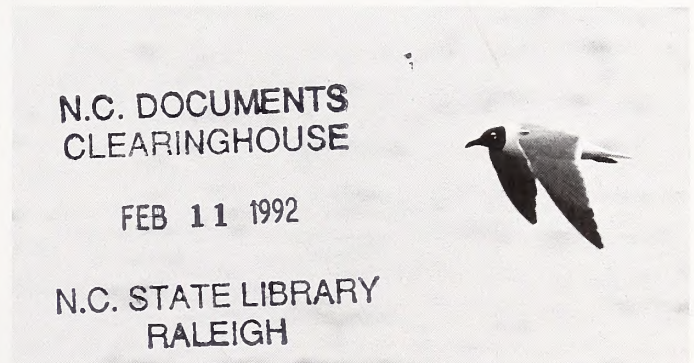
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PROVIDING SAFE HAVEN FOR NESTING WATERBIRDS



Scott Taylor

White ibises sun themselves on Carrot Island near Beaufort, N.C.

By Kathy Hart

Approach one of the small, bare estuarine islands that dots North Carolina's brackish waters on a May day, and you'll create mayhem.

A massive cloud of squawking terns will rise off the sandy substrate and billow into the sky, careening and crying out a chorus of "stay away."

Below the hovering mass of anxious birds lie hundreds of speckled eggs spaced inches apart in an equidistant geometric formation that defies the usual random patterns of Mother Nature.

The bare, sandy island is a hatchery for a nesting colony of royal terns — one of 25 species of waterbirds that nest en masse along the Tar Heel coast.

Colonial waterbirds — gulls, terns, skimmers, herons, egrets, ibises and pelicans — are as much a part of the coastal panorama as sea oats, crashing

waves and fiddler crabs. And they're an important part too, says Walker Golder, manager of the National Audubon Society's N.C. Coastal Island Sanctuary System.

"These birds are important to the coastal food chain," Golder says. "They provide energetic pathways in wetlands. They're pretty to look at. And they are excellent indicators of environmental quality."

In fact, these waterbirds are thought to be so vital to our coastal ecosystem as to require management of their nesting and feeding habitat.

In what is considered a unique agreement, state and federal resource management agencies and private organizations have banded together to manage the habitat needs of colonial waterbirds in North Carolina.

The N.C. Wildlife Resources Commis-

sion acts as the lead agency for this interagency coordinating committee that includes the U.S. Fish and Wildlife Service, the National Park Service, the N.C. Division of Parks and Recreation, the N.C. Department of Administration, the U.S. Army Corps of Engineers, the National Marine Fisheries Service, the Nature Conservancy and the National Audubon Society.

For scientific advice about these birds, the committee relies heavily on the word of one man — James Parnell, a nationally renowned ornithologist at the University of North Carolina at Wilmington. Parnell has devoted much of his research career to studying the habits and habitats of colonial waterbirds.

Sea Grant funded Parnell's first North Carolina colonial waterbird census in 1976, the atlas resulting from the census, subsequent population evaluations and

numerous publications about avian management.

It was Parnell who first realized the importance of the hundreds of man-made dredge-spoil islands that mark the state's estuaries. These dredge-material islands are a byproduct of the construction of the Atlantic Intracoastal Waterway and the maintenance of navigational channels.

The islands have provided nesting habitats for large colonies of waterbirds, most of which used to nest along the undeveloped beachfront. But as many of North Carolina's beaches became lined with houses, condos and hotels, the birds began looking for less developed real estate.

Luckily these man-made and other natural estuarine islands met many of the birds' needs. But now the islands are posing some problems for resource managers, Parnell says.

Part of the difficulty lies in the multi-habitat needs of colonial waterbirds. Royal and sandwich terns prefer to nest on bare sand that has a lot of shell fragments. Common and gull-billed terns and black skimmers want areas with a sparse cover of low vegetation.

Brown pelicans and laughing gulls like dense grasses, but herons, egrets and ibises most readily nest in dense shrub thickets.

Meeting this hodgepodge of nesting needs requires a wide variety of habitat. And maintaining this habitat variety is the most critical problem facing North Carolina's Colonial Waterbird Management Committee.

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**BIRDWATCHERS AND OTHERS
SEEKING AN ISOLATED SLIP
OF BEACH CAN DEVASTATE A
NESTING COLONY.**

■ ■ ■ ■

Parnell says some of the islands are eroding away, and others are covered with vegetation. Only a few bare substrate islands remain.

This means the bare-sand nesters, the terns, are being crowded onto fewer and fewer islands. And that, says Tom Henson, coastal project leader for the N.C. Wildlife Resources Commission's Non-game and

Endangered Wildlife Program, is a recipe for disaster.

"Royal terns have only four places in North Carolina to nest," Henson says. "If we lose one of those sites because of predation or human disturbance, then we lose 25 percent of that year's young birds. Nesting colonies are definitely more vulnerable than birds that nest individually."

The loss of bare islands has forced some birds back to protected beaches managed by the National Park Service and the N.C. Division of Parks and Recreation, Parnell says.

At locations such as the Cape Hatteras National Seashore and the Ft. Fisher State Recreation Area, rangers are working to protect the nesting birds from people and vehicles. But they can't protect the nests and eggs from marauding bandits such as foxes, raccoons and feral cats.

That's why the dredge-material islands promise a better, more protected habitat, Parnell says.

The U.S. Army Corps of Engineers used to refurbish these islands with new

C O N T I N U E D

White ibises take flight



Scott Taylor

dredge material as part of its regular channel maintenance program.

But not any more.

Tougher environmental regulations limit the dumping of materials that can readily wash back into the estuary and potentially damage fish and shellfish habitats, Parnell says. And now there is competition for dredge material too.

Beach communities are clamoring for the clean sand with which to renourish eroding beaches. In most areas in North Carolina, dredge fits the bill as "clean sand"; so, more often than not, it ends up on the beach.

What's a management committee to do?



"ON A HOT SUMMER DAY, A HALF HOUR OFF THE NEST...CAN MEAN A COLONY OF COOKED EGGS."

JAMES PARNELL



Pinpoint critical islands and apply for permits, Parnell says. This year, the Wildlife Resources Commission applied for permits to renourish South Pelican and Ferry Slip islands — two important nesting sites in the Cape Fear River that were eroding away.

The committee just received word in late October that the permits were approved, and this winter the corps will give the islands a heapin' helpin' of fresh sand.

Other islands may be considered for future replenishment, but managers aren't going to rely solely on this method of habitat restoration. Golder says he and teams of volunteers have manually stripped vegetation from some of the 10 private islands or sanctuaries managed by the Audubon Society.

Henson says he has done the same on some of the state-owned islands. Other times they have used salt or environmentally safe herbicides to reduce vegetation.

Whatever the method, the Waterbird Management Committee is striving to offer nesting populations of terns, gulls, herons

and ibises a variety of nesting choices. They want to spread the birds over more sites, reduce the size of their colonies and diminish the threat posed by human interference.

Although habitat tops the list as the biggest concern for waterbird managers, they are also worried about increased disturbance from people.

the nest by the parents can mean a colony of cooked eggs, Parnell says.

Even after they hatch, young nestlings can't regulate their body temperature for about 10 days, Golder says. They can die of exposure if their parents aren't nearby to shade them from the heat.

"People just don't think," Henson says. "They see this large number of birds



Herring gull at rest

Nellie Matthews

Birdwatchers and others seeking an isolated slip of beach can devastate a nesting colony.

"Waterbirds are very susceptible," Golder says. "One person can completely wipe out a colony site."

The birds react to people by leaving their nests and flying overhead or nearby. This leaves the eggs vulnerable to predation from other birds such as crows and to heat and cold.

On a hot summer day, a half hour off

on this island, and they think the birds abound. They never realize they may be looking at a large chunk of this state's nesting population of that particular bird."

This vulnerability has led the Wildlife Resources Commission to pass regulations that will deter people from disturbing the birds during nesting season, which lasts from April until August.

Wildlife officers post warning signs on the 21 islands managed by the commission. Federal and state park officials post



A colony of nesting gulls

signs and rope off nesting sites along the beaches. And the Audubon Society also takes steps to protect the birds in their sanctuaries.

Although wildlife managers can warn off people, they can't warn away another people problem — marine debris, such as discarded fishing line, six-pack yokes and abandoned fishing nets.

Parnell, Henson and Golder say they rarely visit a colony site without finding one or more birds entangled in debris. Waterbirds, because they nest in these colonies, are particularly susceptible to discarded fishing line and nets.

While scavenging for food, one bird can become entangled in line, then return

A pelican nesting colony



to the colony to eventually entangle its neighbors.

"I've found as many as five pelicans in the same piece of fishing line," Golder says.

The solution to this entangling problem?

Education.

Golder says fishermen need to learn not to throw fishing line overboard and not to cut line that becomes snagged or tangled. Fishing line should be taken back to shore and discarded in a covered container.

Sea Grant's Lundie Spence agrees. Spence, coordinator of The Big Sweep, the nation's largest statewide waterway litter

cleanup, says animal entanglement is the main reason the cleanup of beaches, rivers and streams began six years ago.

Now The Big Sweep and the Audubon Society are considering a team approach to fisherman education. Spence and Golder are discussing the possible publication of a poster aimed at educating recreational boaters and fishermen about entanglement.

With so many agencies and groups teaming up to help colonial waterbirds, what does the future hold for these coastal nesters?

Continued support.

Parnell says the waterbird populations would decline without the kind of strong management North Carolina is providing now. And even with good management, some species are on the decline.

"None of the birds are officially on the Fish and Wildlife's endangered and threatened list, but some of their numbers are relatively low, particularly the gull-billed terns and the glossy ibises," Parnell says.

To beef up its support of the birds, the state is looking to extend its management beyond nesting habitat to include the feeding areas too.

"We're moving on to manage the whole area, not just the nesting sites," Henson says. "We feel total management is the way we have to go now."

And the state and Audubon Society strive to add more estuarine islands to their management realms. The Wildlife Resources Commission works to have unassigned, state-owned islands placed under their jurisdiction so they can post and monitor them.

Likewise, the Audubon Society tries to acquire more privately owned islands either through gifts or leases to add to their bird sanctuary system.

Although North Carolina works hard to do its part to help colonial waterbirds, Parnell says it takes more than effort from one state to maintain bird populations.

"Wildlife management needs to become a global concept," Parnell says. "Birds and other animals are declining so significantly that we can't sit back." 🌐

DOWN EAST WITH A BIRD'S BEST FRIEND



Carla B. Burgess

John Fussell

By Carla B. Burgess

When the eye of Hurricane Diana passed over the southern coast of North Carolina in September 1984, most people tried to put as much distance as possible between the coast and them.

But John Fussell followed in the footsteps of some bird-watching friends who had gone to Lake Waccamaw to capture a rare glimpse of pelagic birds. These birds, which normally spend their lives on the open sea, were blown to the lakeshore by the storm winds.

Jaegers, black-capped petrels and Wilson's storm petrels touched down on this inland "ocean." Fussell arrived in time to see south polar skuas and greater shearwaters before the storm — and the birds — moved on.

As the New Year's Eve northeaster of 1987 battered the state's southeastern shores, Fussell and a companion were slogging around in the marshes of Carteret County's North River in hopes of sighting

the secretive yellow rail.

"It was raining and my glasses were covered with water ... I couldn't see anything," he says.

A self-employed consulting biologist and avid coastal birdwatcher, Fussell says that being good at identifying birds is less

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"ORNITHOLOGY,
MORE THAN ANY OTHER SCIENCE,
IS FURTHERED BY AMATEURS."

JOHN FUSSELL
■ ■ ■ ■

interesting to him than forecasting when a variable such as weather might make for an unusual sighting.

"I like to predict when something rare might show up," says Fussell, during a recent outing to one of his favorite birding spots, the Rachel Carson component of the

N.C. National Estuarine Research Reserve in Beaufort.

A native and resident of Morehead City, Fussell wrote and published a field guide to Carteret County's birds and sites in 1985. He also co-authored a brochure, *Birds of the Outer Banks*, which lists the nearly 400 species of birds that have been sighted within Cape Hatteras National Seashore and its surrounding waters.

He's working on a book, tentatively titled *Finding Birds on the North Carolina Coast*, to be published by the University of North Carolina Press.

Some folks have called Fussell "the bird man of Carteret County." They could call him the plant man too. A graduate of N.C. State University, Fussell holds degrees in zoology and botany.

Fussell is working for the Natural Heritage Program, searching for rare plants in the Croatan National Forest. Through the Albemarle-Pamlico Estuarine Study, he's also conducting inventories of natural

areas in Carteret, Craven and Jones counties. And Camp Lejeune has hired him to locate, map and count endangered and threatened birds, particularly the Bachman's Sparrow.

On a late November day, Fussell takes some time to visit Bird Shoal, a man-made, shifting spit of sand among the mud flats, salt marshes and tidal creeks of the Rachel Carson reserve. This birding hot spot is only accessible by boat. Joyce Bland, overseer of the reserve and director of education for the N.C. National Estuarine Research Reserve Program, captains her skiff for the trip.

"I like shorebirds because they in general are very approachable," says Fussell, as he anchors and steps ashore. He warns that there is more high ground at low tide, and the birds will be spread out.

The first bird sighted is the black-bellied plover, but Fussell hears it first.

"Chir-eee," he calls, aiming his binoculars toward the sound. "I like the black-bellied plover call a lot. It's a clean, wild sound."

He points out the low-flying bird, which has distinct black markings in its armpits. Though its breast is black during breeding season, it never actually has a black belly. However, the golden plover does, says Fussell.

Learning bird calls is like learning a foreign language, Fussell says, and the



Laughing gulls

Clay Nolen

earlier you start, the easier. "The bird songs I learned in college or later, I have to put into words — tweet, tweet, tweet," he says. It's like translating French to English in your head as you hear it.

Treading through the muck of the mud flats, Fussell points out two red knots, which have a rusty hue and yellowish-green legs. He also sights a ruddy turnstone, which can be identified by a distinctive harlequin pattern on its back and wings during flight.

A bird's song, its physical markings and its flight patterns all aid in identifying

its species. But other variables can be helpful too, Fussell says. For example, it's easier to identify species when they're assembled in a group.

"I can identify knots by how they look relative to other shorebirds," he says.

It also helps to consider where you are, Fussell says. Long-billed and short-billed dowitchers can be difficult to differentiate. "But the long-billed dowitcher shuns intertidal areas, and the short-billed doesn't," he says. "I've seen two long-billed dowitchers out here, but it's very unusual."

Fussell is helping Bland develop a field checklist for Bird Shoal; so far 140 species have been counted.

The list for the day grows quickly — oystercatchers, dunlins, godwits, Forster's terns, least sandpipers and semipalmated plovers. Fussell even counts eight of the threatened piping plovers — one an individual (identified by its banding) that is making its fourth winter appearance here from North Dakota. (For more on piping plovers, see story on page 15.)

Most avid birdwatchers compile "life" lists comprised of every species they've sighted; many will travel great distances to add a "lifer."

Fussell says he varies the game to keep from becoming jaded. He keeps a "state list" of all the birds he spots in North

Forster's terns



J. Foster Scott

CONTINUED

Carolina in a year. "You get kind of excited — on January 1st you say, 'Hey, a cardinal!' It whets your appetite again."

Fussell came by his love for birds honestly. His family introduced him to avians at an early age. "My father and I used to 'squeak up' catbirds and other common birds," he says.

To this day, his mother bakes pound cakes for the Baltimore orioles that winter in his parents' back yard; they're also treated to Kool-Aid and apple jelly.

Fussell chose birds as the subject for a third-grade school project. And in fourth grade, his parents gave him his first pair of binoculars.

Not long after that, he signed up for a bird-banding expedition sponsored by a museum. The group's plans to band pelicans at Ocracoke was foiled by bad weather, so Fussell and his older and experienced companions "mostly just sat around in the cabin and talked about birds." It was thrilling, he says.

The group made it to Cape Lookout later in the trip, where they banded young terns and skimmers.

In 1962, Fussell was given a gift subscription to *The Chat*, an ornithology journal. It was there he read about the annual Audubon Christmas Bird Count, in which he eagerly participated the following year and many years since. The event takes place throughout North America over a 2 1/2-week period that always includes Christmas Day; participants count every individual bird and species they can find within a 15-mile diameter circle from midnight to midnight on a given day at each site.

The information collected by Christmas Bird Count volunteers is invaluable. For example, the findings can help define the parameters of a bird's range. "Ornithology, more than any other science, is furthered by amateurs," Fussell says.

Fussell "hit a plateau" during his high school years. Surfing quickly took priority over birding.

His college ornithology classes and association with other bird enthusiasts brought him back to birding. During graduate school, he kept a boat at Pivers Island so he could row over to Bird Shoal

Scott Taylor



Rachel Carson Estuarine Research Reserve

whenever he wanted.

Bird Shoal is immediately enticing. In Fussell's opinion, it's the best spot to see intertidal shorebirds. Visitors can also see feral horses grazing and wandering through the estuary.

Fussell points out patches of beach amaranth, a candidate for the federal endangered plant species list, and *Polygonum glaucum* or "seaside knotweed," a likely possibility for the threatened plant list.

Later in the afternoon, he spots a common species — another group of

birdwatchers. They are waving from Town Marsh. Fussell recognizes the three.

"Is there a long-billed curlew down there?" shouts one of the men.

Fussell looks back mischievously. "What kind of rare bird can we make up," he says, cupping his hands around his mouth as he yells back, "Spoonbilled sandpiper!"

As the tide starts to rise, he heads back toward the boat. Fussell calls to a Forster's tern flying overhead. No response. "They usually call back," he says.

A crowd of ring-billed and laughing gulls have gathered along the outer beach. As some of the birds take flight, Fussell lifts his binoculars.

"That one hatched two winters ago," he says, pointing to one of the fleeing birds. The gull is in its third winter plumage — he can tell from the hint of black in its tail.

On the trip back to the Beaufort waterfront, his eyes and ears are alert to any bird activity along the way. He might even be wishing for a storm or two. ☁

■ The free brochure, ***Birds of the Outer Banks***, contains a checklist of nearly 400 species of birds that have been sighted along Cape Hatteras National Seashore and its

surrounding waters and tells when you might see them. For a copy, write Cape Hatteras National Seashore, Rt. 1, Box 675, Manteo, NC 27954. Or call 919/473-2111.

■ ***Finding Birds in Carteret County***, 96 pp., describes birds and birding sites for serious birders and even those with a casual interest in these avian creatures. It's available for \$6.75 (\$5, plus \$1.75 postage and handling) from John Fussell, 1412 Shepard Street, Morehead City, NC 28557.

PROSPECTS FOR BIRDING...

John Fussell admits that Bird Shoal in the Rachel Carson Estuarine Research Reserve is the closest thing to avian heaven. But he shared some other coastal North Carolina spots that also rate high on his birdwatching scale. Here are a few of them:

• **Outer Banks/Cape Hatteras National Seashore/Pea Island National Wildlife Refuge.** Prime for waterfowl and waterbirds in winter. Good "ocean watching" — what you can spot from the beach — year-round. Shorebird migrations are very good July through October. Many land bird migrants are visible in fall.

Overall area is good for shorebirds, gulls and rare birds. In spring, Hatteras Point is good for sighting pelagics offshore. (This year, a herald petrel and soft-plumaged petrel were sighted from the deep Gulf Stream waters offshore from Oregon Inlet; these birds are rare in North America, much less the East Atlantic.)

• **Currituck Banks.** Ocean watching is good in late winter. Spring migrations can also be interesting.

Pine Island Sanctuary south of Corolla has an observation platform. Mackay Island National Wildlife Refuge on Knott's Island has waterfowl impoundments. Any time of year is good to see birds from the causeway between the Virginia mainland and Knott's Island. Look for such marshbirds as bitterns and rails.

• **Lake Mattamuskeet.** Good spot for waterfowl during cooler months. Most birds per acre. Bald eagles, hawks, golden eagles. As many as 140 species of birds recorded during the Christmas Bird Count. A tropical kingbird once sighted.

• **Swan Quarter Refuge.** Take the 6:30 a.m. ferry from Swan Quarter

to Ocracoke late November through March to see scoters, oldsquaws and red-throated loons.

• **Croatan National Forest.**

Good savannah habitat. Look for Bachman's sparrows and red-cockaded woodpeckers.

• **Cape Lookout Point.** Good for certain pelagic species. Also good for land bird migrants during fall. For about \$15, you can board headboats (the *Captain Stacy* at Atlantic Beach, the *Carolina Princess* or *Continental Shelf* out of Morehead City) in the hopes of glimpsing a tropicbird. Boats run from April through November. There will probably be a low density of birds, but the ones you see may be very unusual. Cross your fingers for a red phalarope, northern fulmar or Manx shearwater.

• **Fort Fisher.** A lot of habitat in close proximity. Coquina outcrops make for good ocean watching. Best place for great cormorants. Loons, grebes and scoters abound.

The rocks just north of Fort Fisher are the best place to bird-watch from your car. Shorebirds congregate there at high tide. The shrub thickets are ideal for painted buntings. Also, the Carolina Beach sewage treatment plant nearby is a good place to bird in cooler weather.

MUSEUM PROGRAMS AND OUTINGS

The N.C. Maritime Museum at 315 Front St. in Beaufort has many opportunities for birders.

January through May, the museum will present videos and slide programs, including the Ducks Unlimited video guide to waterfowl during January and February.

"We have a slide show, to music, of the birds found on our coast in the

winter," says director of education JoAnne Powell. "It's nice, and it gives people a chance to hear the sounds of the animals."

The museum also offers half-day and extended field trips to local birding hot spots, including Bird Shoal on the Rachel Carson component of the N.C. National Estuarine Research Reserve.

The museum works closely with Joyce Bland, education specialist and coordinator for Rachel Carson, to make sure young and old alike have the opportunity to visit this rich composite of salt marshes, tidal flats and man-made islands.

The museum's field trips even have international flavor; an outing to Costa Rica and Peru is planned for July.

For a museum calendar or specific information about events, call 919/728-7317.

BIRDS OF A FEATHER

If you live in North Carolina and like to watch birds and other wildlife, consider joining your peers in the Carolina Bird Club.

The club meets each winter, spring and fall. Meeting sites are selected to give participants opportunities to see many of the state's different species of birds.

Informative programs, guided field trips and mini-weekend outings to good birding areas are available to members, says membership chairman John Fussell.

Members receive *The Chat*, a quarterly ornithological journal that contains field notes and scientific papers, and the *CBC Newsletter*, which informs members about meetings, trips and club news.

Individual memberships are \$12. For information, write the Carolina Bird Club Inc., Box 27647, Raleigh, NC 27611.

BROWN PELICANS: AN ENVIRONMENTAL SUCCESS STORY



Scott Taylor

By C.R. Edgerton

At first glance the plump pelican seems an awkward flier.

He's heavier, less graceful than other shorebirds.

His breast heaves downward with each upward thrust of wing. His long, thick bill rests on his chest like strapped on luggage.

But a closer look reveals a different bird.

The pelican shoots up and down the beach, hugging the line where sudsy waves kiss the damp shore. He spies a small fish and dives, scooping the fish and

surrounding water in his dipper-like bill. He swallows the fish and lets the water drain out. And all this as he slides through the salt air like a well-designed glider.

He is, after all, a creature of grace and efficiency.

And he's a bird that is making his presence known along North Carolina's shores.

Once classified as endangered, the brown pelican is achieving a special kind of comeback.

In recent years, the population of brown pelicans has reached phenomenal

heights, enough to cause delighted bird lovers to remove this unique bird from the list of endangered or even threatened species.

"Yes, I would say we've got pelicans coming out of our ears," says James Parnell, an ornithologist at the University of North Carolina at Wilmington. "These birds are doing just great."

That hasn't always been the case, although Parnell says pelicans have been seen in North Carolina for almost a century. He cites a book published in 1909 by the renowned birdwatchers T. Gilbert Pearson, C.S. Brimley and H.H. Brimley.

“These men mentioned the brown pelican as coming as far north as the Outer Banks, but never did they say they had seen or heard of a nesting site here,” he says.

The earliest known nesting site for pelicans in North Carolina was discovered in 1929 near Ocracoke. Over the next 50 years, nests were few and only about 100 pairs of mating pelicans were counted in the state.

Then, in the early 1980s, pelicans moved into North Carolina with a passion. They began nesting in the Cape Fear area around 1981. More and more people reported seeing these large birds feeding on schools of small fish.

Over the next ten years, pelicans moved northward at a rapid clip. At last count, more than 4,000 nests were recorded along Tar Heel shores. This strictly Southern bird has broken its own traditions and has nested recently in the Chesapeake Bay area and along Maryland’s Eastern Shore.

Why the sudden comeback? Is it a comeback at all?

“Well, that’s a good question,” Parnell says. “Because we don’t really know if the brown pelican ever nested all that much in

North Carolina until recent years. We don’t have records that go very far back.”

But one thing is certain, he adds. “We’ve got plenty of them now.”

The hope of increased populations of pelicans led several dedicated scientists to begin banding and counting activities in the early 1980s. One of these was John Weske, a Maryland ornithologist.



“I WOULD SAY
WE’VE GOT PELICANS
COMING OUT OF OUR EARS.”

JAMES PARNELL



In Jan DeBlieu’s book, *Hatteras Journal*, she describes an outing with Weske during which more than 90 pelican chicks were banded and counted on a dredge-material island at Oregon Inlet, then the northernmost pelican colony in the state.

“Suddenly, a convoy of adult pelicans lifted quietly from the center of the island,” she writes. “By the time I reached the edge of the colony, Weske had conducted a

quick survey of the site, and the chicks had set up a clamor of throaty, tremulous calls that sounded something like the scared whinnies of horses. They certainly did not sound much like birds.”

DeBlieu described the nesting site as a clearing littered with “thick brown reed stems, dry and crunchy underfoot.” On small mounds of rotting twigs sat several small chicks, those left behind when the older hatchlings shot into the reeds.

“I moved tentatively after them as the birds screamed louder and scrambled to find an escape,” she says. “A long-armed boy reached for one of the fleeing chicks and closed his fingers around its yellow snapping bill. Pinning its wings together just above the crook, he handed the chick to me and reached for another. I grasped the bird’s wings at the base and lifted, surprised when its body went limp and its legs dangled below.”

This process was repeated until Weske and his associates had banded 92 chicks. Meanwhile, DeBlieu says, the adult pelicans remained overhead, circling round and round, “sprinkling us with bursts of waste.”

C O N T I N U E D



J. Foster Scott



James Parnell



Scott Taylor

“As we pushed off (in our boat) for the ride home, the adult pelicans tightened their circle to a funnel,” she writes. “With each pass, a few more dropped to the ground to soothe their young and regurgitate fish. By the time we reached the channel that led to the public dock, only a few birds remained in the air. The rest had settled like dust from the still air of a summer day.”

Banding operations like the one conducted by Weske have helped scientists track the routes of pelicans, which are migratory birds. Some species have migrated as far as south of the equator.

“They’re migratory birds, but some migrate and some choose to stay here during the winter, especially if it’s mild,” Parnell says. “Chicks that have been banded here have been returned to us after having died as far south as Cuba.”

Some scientists have linked the drastic decline of brown pelicans 20 years ago with man’s efforts to eradicate mosquitoes and other insects from coastal areas.

The use of DDT-laden pesticides in more southern states such as Texas and Louisiana — where the pelican is the state bird — in the 1950s and 1960s caused pelicans and other carnivorous birds, like ospreys and peregrine falcons, to lay thin-shelled eggs.

Those eggs stood an unlikely chance of hosting a healthy bird, Parnell says. Thus, pelican populations in Texas were almost eradicated.

In North Carolina, where there had been no evidence of thinner eggs, DDT was sprayed along the Outer Banks in mosquito removal programs.

“We’ve never really linked DDT to the decline of the pelican here,” Parnell says. “But it may have been a factor.”

DDT-laden pesticides were banned in this country in the late 1960s. But that event may not be the single most important factor in the rise in pelican populations.

“I don’t think pesticides are an issue and haven’t been an issue here,” Parnell says. “I’ve never seen thin eggs and that kind of thing.”



Baby pelican chicks

He's speculating that the boom in pelican populations can be traced to more natural events.

"Number one, I think a series of warmer winters that we've had over the last decade has contributed to the pelican moving northward into North Carolina and Virginia," he says. "You see, a pelican is a warm-weather bird. We've had a couple real cold spells in the last couple years and a lot of pelicans have died. But the warmer winters in general have helped them."

Also, Parnell says the rise in the numbers of pelicans has increased along with the rise in the number of juvenile menhaden off the coast.

The increase in menhaden schools might be the result of a recent state law

that forbids fishermen to seek these fish within one mile of shore.

"I'm not sure why the menhaden have increased," Parnell says. "I just know that I

■ ■ ■ ■
"WE'VE NEVER REALLY LINKED DOT
TO THE DECLINE
OF THE PELICAN HERE."
■ ■ ■ ■

JAMES PARNELL

don't see as many of those menhaden boats as I used to."

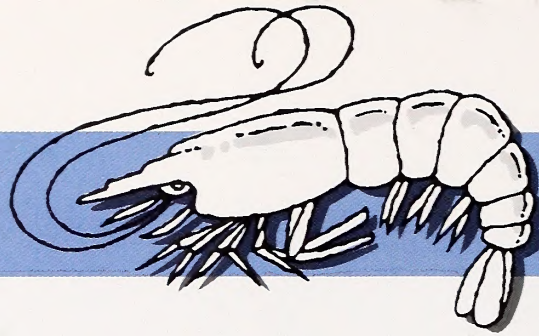
The pelican's penchant for clear, unmurky water is satisfied in North

Carolina's large coastal sounds.

"They're visual feeders," Parnell says. "A pelican must be able to see its prey. That's easier for him to do here than in other locations."

These ideas are speculative, Parnell says. But there are people who are beginning serious study of the possibilities.

In any case, he sees the upswing in pelican populations as long-term. "The trend is going nicely upward and will probably stay that way for a long time," he says. "And that's encouraging, because birds, especially fish-eating birds, are a good indicator of the general health of an area. If the pelican is any indication, our coastal areas are in better shape than some people think." 🌐



Create Your Own Paper Whale

Marine mammals are part of North Carolina's diverse coastal and oceanic ecosystems. Offshore are sperm, fin, humpback and rare right whales. Nearshore are dolphins of several species and pilot whales.

Occasionally, a harbor seal will stray to the northern Outer Banks. And once in a blue moon, a Florida manatee will wander past the Cape Fear

River through the waterways.

With just a piece of paper, a felt marker and a pair of scissors, you can create a marine mammal of your own to admire. How about a whale?

Origami Whale

Using the figures below as a guideline, complete the following steps.

1. Fold a square piece of paper along BE and BF so that

edges BA and BC meet at center line BD (Figs. 1 & 2).

2. Fold along CD and HD (Fig. 2) so that ED and FD meet at center line BD (Fig. 3).

3. Pull out corners A and C so that they meet at center line BD (Fig. 4).

4. Fold back along MN and OP so that G and H meet at center line on the other side (Fig. 5).

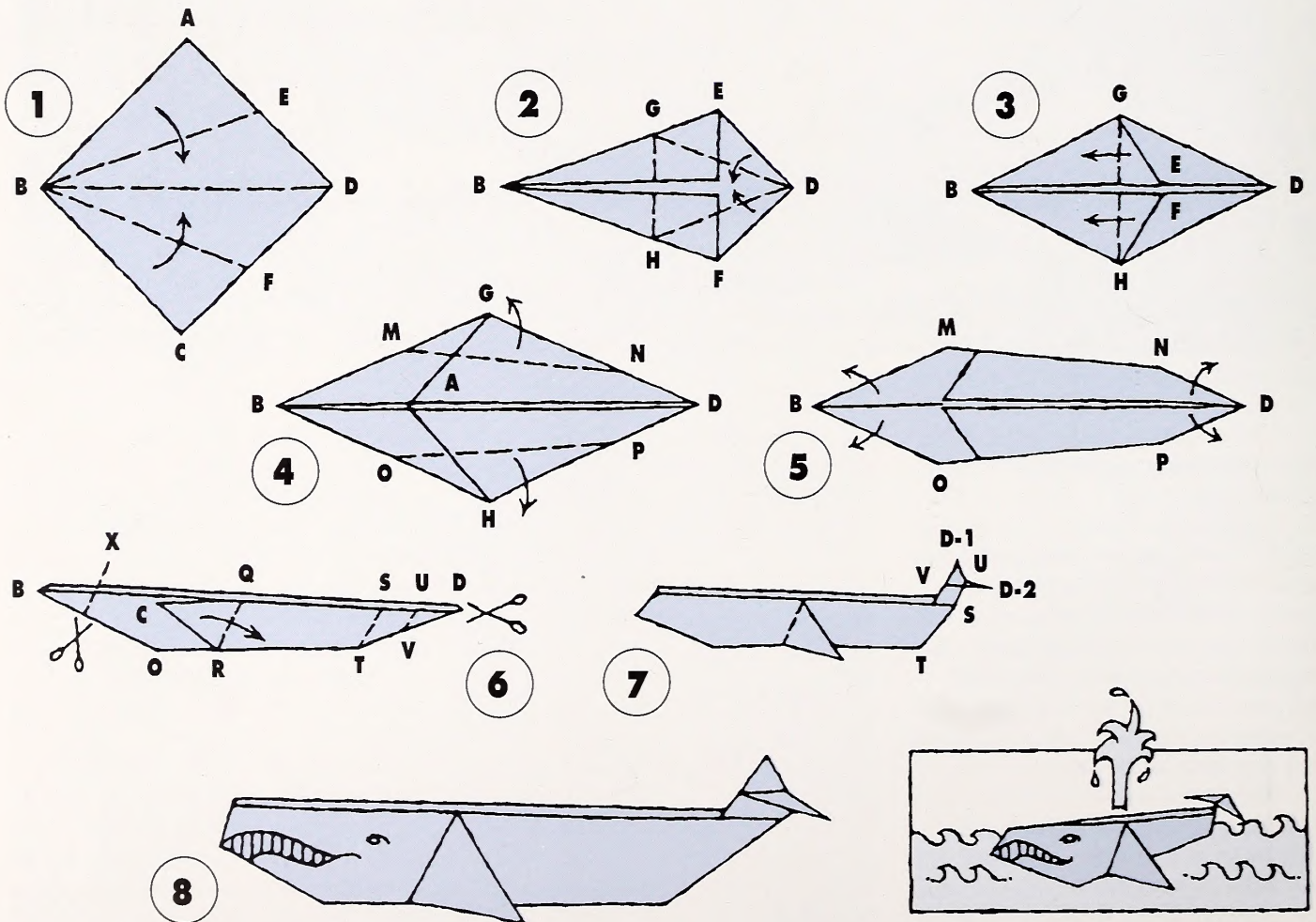
5. Fold in half along BD to

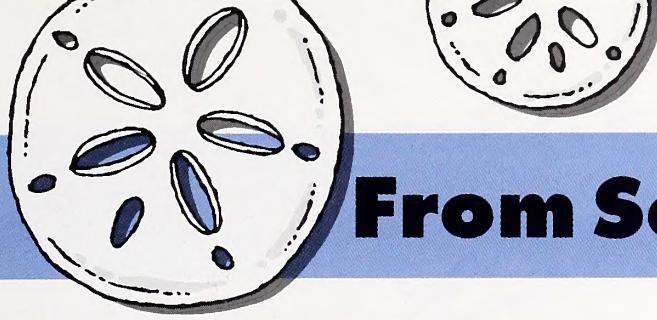
make the body (Fig. 6).

6. To make the fins, fold at QR, bringing corner C downward and away from the body (Fig. 6). Do the same for the other side.

7. To make the tail, fold back along ST (Fig. 6). Make a slit at UD and open D1 and D2 at VU (Fig. 7).

8. Cut off point B at XY (Fig. 6) and draw the mouth and eyes (Fig. 8).





From Sound To Sea

Natural Wonders of the Coast

A Small Bird With Big Problems

When the tiny piping plover makes a home on the beach, everything and everyone else has to leave.

This plover is listed as a threatened species in North Carolina by the U.S. Fish and Wildlife Service. In other states, it's endangered.

When a handful of them were spotted feeding on the beaches near Frisco and Cape Hatteras in July, National Park Service officials immediately closed two short sections of beach.

This shorebird deserves special attention because its numbers are limited, says James Parnell, an ornithologist at the University of North Carolina at Wilmington. Only about 800 pairs have been sighted nationwide in recent counts.

"These little birds feed in the intertidal zone at the beach and often nest at the base of dunes and on overwashed flats," Parnell says. "They're beach birds."

And that's their primary problem. As residents of the immediate beach areas, they are more prone than other species to be affected by human activity. Simply put, their reduction in numbers can be traced directly to loss of habitat through development and beaches crowded with sunbathers and fishermen.

"That's why there's been a great effort to protect them," Parnell says.

A major part of that effort has been beach closings, such as the one in July at Cape Hatteras.

"Each year we close areas to all human activity, including vehicular and pedestrian," says Reis Collier, a biologist at the Cape Hatteras National Seashore. "We put up symbolic fencing — a post with rope and signs — and hope people respect it."

Unfortunately, though human response has been good, the tiny birds "don't always read signs and notice where the posts are," Collier says. "So we have to do daily patrolling and changing of fences."

These efforts have been successful. At last count the population of piping plovers at Cape Hatteras has remained steady, with 14 nests reported.

"The only problem is that those 14 nests produced only one chick that survived to adulthood," Collier says. He points to predation by ghost crabs, feral cats and other birds as the reason for the low mortality of plover chicks.

"Also, we're on the southern end of the range for piping plovers," he says. "The heat may be too much for them in the summer."

A new three-year study of piping plover problems is expected to crank up soon, Collier says. Scientists will be studying ways to control plover habitats — including vegetation and beach control — to make them more attractive to the birds.



James Parnell

Meanwhile, Collier invites people who think they've seen piping plovers nesting in unprotected areas to call him at 919/473-2117.

How will you know if you've seen one of these rare birds? The following description is from *Birds of the Carolinas* by Eloise Potter, James Parnell and Robert Tuelings.

Piping plovers usually remain singly or in small flocks on the drier portions of beaches and mudflats.

Eggs are buffy and lightly marked with fine black, blackish-brown and purplish-gray dots. Nests usually contain four eggs, but there may be fewer. The shallow nest dug into sand may contain bits of shell. Nesting probably begins in late April, but a nest with three eggs was found on Ocracoke in July.

Piping plovers, like most other shorebirds, eat mollusks, crustaceans and other small aquatic animals that they obtain by probing into mud or wet sand with their bills.

This small bird is white below and gray above with a white rump. Summer birds have a narrow black neck band (often incomplete) and a black band extending across the top of the head from eye to eye.

Collier says the piping plover's yellow legs and bill are hard to miss. "They also have a distinctive walk and call, both of which are unmistakable," he adds.

— C.R. Edgerton

Marine Advice

Extending Knowledge to the Coastal Community

Bayou Technology Makes Good in Tar Heel Waters

Fishermen in North Carolina's commercial shrimping industry are finding that a little borrowed technology and a willingness to experiment can be a lucrative combination.

Trials of a new "skimmer" trawl rig during the summer and fall provided encouraging results — increased catch, particularly in autumn's white shrimp or "greentail" fishery, and reduced bycatch.

The skimmer, which is pushed alongside the boat rather than towed behind it, promised many advantages over the conventional otter trawl.

The idea to try the rig, first used by Louisiana shrimpers in the Gulf of Mexico, originated within the Carteret County Waterman's Association. President Clinton Willis says an article about the skimmer in *National Fisherman* caught the eye of association members two years ago.

The group then approached Sea Grant advisory agent Bob Hines about the possibility of adapting the skimmer for use in North Carolina's estuaries.

In the spring of 1990, Hines and a few companions took a trip to Louisiana to test the waters. While there, they consulted with netmaker Layne "Ike" Pelas. It looked like the net would work in Tar Heel waters and potentially reduce bycatch mortality. With these advantages in mind, Sea Grant was able to obtain a grant from the National Marine Fisheries Service to test the net.

Experiments with the skimmer gear and Pelas' net began in North Carolina in June 1991 aboard the *Frankie and Al*, owned and operated by Paul Biermann of Beaufort. Willis' boat, the *Captain Will*, was used as the control for the experiment. He pulled two 35-foot otter trawls with sleds.

Hines says initial results were disappointing — the skimmer caught less

brown shrimp than its conventional counterparts.

But unusual circumstances may have impaired the results. Problems with the gear during initial testing decreased efficiency. It took several days to learn how to operate the gear properly. And a drought in July caused brown shrimp to enter deep channels, prohibiting effective shrimping with the skimmer.

By the time nets and gear were properly tuned at the end of July, the available brown shrimp were being caught in deeper water (15-16 feet) in the channel and the skimmer couldn't reach bottom. The skimmer works best in water no deeper than 8 to 10 feet.

But when white shrimp began to show up in North River in August, the skimmer gear proved its worth, outfishing conventional trawls by as much as 5 to 1. News spread fast; within a week, five other Carteret County shrimpers rigged skimmers of their own to fish the estuary.

Jim Murray, Sea Grant's Marine Advisory Service director, heard reports of at least one fishermen catching 8,000 pounds of white shrimp in a matter of weeks. At \$1.75 a pound, that translates to \$14,000 at the market, he says.

Hines and Murray offer one theory in regard to the skimmer's superiority on white shrimp. This species has a tendency to swim higher in the water column; they swim above or jump out of conventional shrimp nets, says Hines. But since the top of the skimmer net extends above the surface of the water, it is able to contain the feisty greentails.

The skimmer has many other advantages over conventional trawls:

- The tailbag fishes near the stern of the boat, which allows for frequent haulbacks and no loss of fishing time because the mouth of the net is still fishing.

- Because it's not dragging the heavy otter doors, the skimmer can travel faster. Willis says it reduces nearly a third of the strain on the vessel.

- Shorter tow time keeps bycatch in better condition. Also, preliminary data show the amount of bycatch is reduced with skimmer use.

- The bycatch is returned overboard behind the mouth of the net so the same bycatch is not caught repeatedly. Also, the more frequent haulbacks mean there's less catch to cull, reducing the time bycatch is on the culling table.

Disadvantages include:

- The gear is heavy and cumbersome to set and pick up.

- The gear cannot reach bottom in water deeper than the rigid frames will allow.

- The skimmer doesn't fish well over irregular bottoms, such as along steep channel edges.

- Seaweed tends to clog the net, requiring special attention during fishing.

North Carolina fishermen are already working on their own adaptations of the skimmer to improve efficiency. They are talking about constructing lightweight frames of aluminum for easier handling, using polywebbing to alleviate seaweed clogs and making other structural changes to improve maneuverability.

"My guess is that by next year there will be a lot of perfection," says Murray. Once the bugs are worked out, Murray thinks the skimmer will be competitive in the brown shrimp fishery also.

As for Willis, he'll trade in his "control vessel" status next season and build skimmer rigs of his own.

"If they can catch as good or better, I'd be a fool not to put 'em on," he says.

— Carla B. Burgess



Field Notes

Insights into Current Sea Grant Research

Placing a Value on Recreational Resources

Everything in today's society has a value.

But when it comes to determining what clean water, pristine beaches and maritime forests are worth, it's not always easy to ring up a value on the cash register or the calculator.

Knowing there's no direct method for assessing the value of such natural assets, Sea Grant researchers Kerry Smith and Ray Palmquist, economists in the Resource and Environmental Economics Program at N.C. State University, have devised some indirect ways.

First, they began studying surveys of recreational fishermen to determine how the fish caught during fishing trips could be linked to water quality. They also assessed how the prospects for different fishing conditions affected the quality of the anglers' fishing experiences, their choice of fishing locations and the amount of money they spent.

They fed the information into sophisticated economic models that could attach values to improvements in water quality.

"Because our models incorporated fishing party decisions that were based on the quality of the available fishing spots, we can use them to assess what it's worth to improve water quality at specific locations," Smith says.

The researchers looked at fishing in the Albemarle-Pamlico estuarine system, including the Tar-Pamlico River. They determined how effluent from factories and farms along the river affected fishing quality and people's decisions about where to fish.

Using their findings, they were able to say how much people would pay for reductions in pollution from factories or the implementation of farm practices to reduce nutrient runoff.

"Changes in the quality of environmental resources can be valued even when they are freely accessible," Smith says. "The true value of such changes can be measured by what people would pay to obtain improvements or to avoid deterioration."

Now Smith and Palmquist are looking at more than just recreational fishing as a way to determine the value of coastal amenities. In Dare County, the duo are broadening their focus to include other recreational activities.

Using vacation property rents and occupancy rates, they plan to describe how differences in the quality of coastal resources affect people's demands for beach trips.

Smith says it comes as no surprise that people are willing to pay more for vacation rental property that is close to the ocean or sound. They value the state's beautiful beaches and undeveloped sounds.

The high valuation of these resources can mean very real dollars to coastal communities such as Nags Head, Kill Devil Hills



Gene Fuhr

and Kitty Hawk. And those values could also come into play when state officials have to make coastal resource management decisions.

Already Smith and Palmquist have provided information to the N.C. Department of Administration about the proposed offshore oil exploration by Mobil Oil Corp.

In future models, the Sea Grant economists could evaluate how an oil spill would affect the value of natural resources, the activities associated with these resources and the communities dependent on these activities.

Or they could plug in different restoration schemes for Outer Banks beaches and determine how the consequences of the Halloween northeaster will affect the economies of the northern beach communities.

From the hardening of shorelines with seawalls to water quality in our estuaries, decisions about resource management can be improved by using Smith and Palmquist's "price measures for environmental resources."

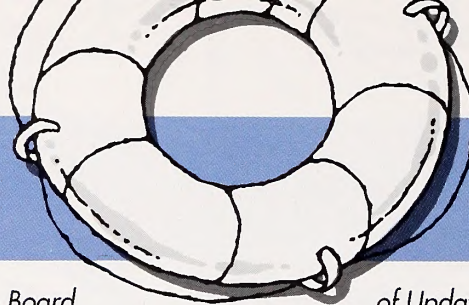
And people value natural assets whether they directly use them or not, Smith says.

Joe Vacationer may never drop a fishing line into Roanoke Sound, but he wants to know that the resource is there in good condition should he or others want to use it in the future.

These implicit values also figure into the duo's resource models — models that have gained Smith a place on the Environmental Protection Agency's highest ranking committee of scientific advisers.

— Kathy Hart

The Aft Deck



A Bulletin Board

of Updates and Events

Nor'easter Offers A Lesson In Science

Coastal processes are part of every wave and tidal cycle. But when a big nor'easter howls throughout the Atlantic, the changes speed up.

The late October and early November series of storms that pummeled the Outer Banks fascinated students of weather. Sea Grant's coastal engineer Spencer Rogers says the timing of the waves made the Halloween nor'easter unique.

allows it to be moved about.

Long waves transport sand from the beachface to the dune line instead of to the offshore bar. This means there is loss of sand on the beach where you walk (the foreshore or beachface) back to the base of the dunes. The result is fatter dunes.

The back of the beach gained more sand, so the dunes appeared to be less tall.

"Because the beach elevation is so misleadingly high, things aren't as bad as they might seem in many of the

than the first, but with high tides, it had no trouble moving through the breached dunes.

The Halloween nor'easter caused damage to more than 500 homes and businesses.

A Double Standard For Treated Wood

If you're planning to buy treated lumber to build a bulkhead or dock in salt water, remember that looks can be deceiving.

The familiar green color of wood treated with chromated copper arsenate doesn't mean your structure will be safe from shipworms. Saltwater structures won't repel pesky marine borers unless the lumber they're made of has been treated with the proper chemical strength — usually 2 1/2 pounds of CCA per cubic foot, says Sea Grant coastal engineer Spencer Rogers.

"It may all look green, but if it's not treated at that level it won't work," he says.

However, where wood is used for decking or in areas farther inland (for fence poles or house pilings), lower levels of CCA treatment are acceptable, says Rogers.

If you choose to use cut lumber or boards, it's also important to know whether you're buying sapwood or heartwood, says Rogers. The CCA chemical can't penetrate heartwood, so marine borers can munch right through areas where heartwood is exposed. (If you use round pilings, the treated sapwood covers and protects the heart.)

The Southern Pine Inspection Bureau recently developed standards for treated wood, and in limited areas, inspected and labeled lumber is available for purchase, says Rogers.

"Seawall" grade lumber is comprised of heartwood on only one side. This grade is intended for bulkhead sheathing, because the vulnerable heartwood can be



Scott Taylor

The period of the wave or the time between two crests passing the same point was longer than usual — 21 seconds, as opposed to the eight seconds typical of a local storm and the 10 to 15 seconds for the average nor'easter. This indicated that the length of the waves was longer.

Wave length is indicative of how deep the wave action penetrates the water column, says Sea Grant marine education specialist Lundie Spence. A wave causes water to move in an orbital fashion to a depth of one half the wave length. Thus a longer wave affects the bottom sediment sooner and over more distance. This mobilizes more nearshore sediment and

locations," says Rogers. "There's actually more storm protection in place than is obvious to the layman."

When a second storm hit a few weeks after the Halloween nor'easter, the waves hit a more formidable dune line in many areas.

Moving the sand from the beach to the dune line steepens the angle of the beach. The flat summer beach is now sloped. If you get to the coast, says Spence, look for the difference.

In some cases, waves breached dunes, transporting sand to the roads behind. This is the overwash process in action. The second storm had less energy

turned toward the soil during construction.

"Marine framing" grade lumber contains no heartwood, and is appropriate for submerged parts of bulkheads such as whalers, which lie between the sheathing and the pilings.

If you want your structure to last, you should think seriously about looking for these standards, says Rogers, even though it may mean shopping around. If you're not doing the construction yourself, tell your contractor.

Copeland Named to CCMA, CIFO

Governor James Martin has appointed UNC Sea Grant Director B.J. Copeland to the North Carolina Coordinating Commission for Marine Affairs.

As a member of the 16-member commission, Copeland will report to the governor and the Secretary of Administration concerning the status of the state's coastal and marine resources.

The commission is responsible for assessing the strengths and weaknesses of North Carolina's coast and for recommending policies that will ensure proper management of resources.

Copeland has also accepted the responsibility of directing the Cooperative Institute for Fisheries Oceanography, an organization that involves the University of North Carolina system, Duke University and the National Oceanic and Atmospheric Administration in coastal research projects.

As director, Copeland will administer the program and disburse funds to develop projects in the interest of NOAA that will be supported in subsequent years.

The CIFO will serve as a center from which scientists may focus on fishery problems in the South Atlantic. It will also stimulate the training of scientists and engineers involved in fishery and oceanographic sciences.

Celebrating The Coast

The fourth annual WRAL-TV/Save Our Sounds Coastal Celebration will be held April 11-12 in the Kerr Scott Building at the N.C. State Fairgrounds.

The two-day event is part of WRAL's Save Our Sounds project, a continuing effort to involve North Carolinians in

preserving our coastal resources.

In its first three years, the Coastal Celebration attracted about 40,000 people. For these Tar Heels, learning comes from many sources: coastal artisans demonstrating boat building and netmaking; coastal folklore from balladeers and storytellers; delicious seafood, fresh from the Carolina coast; and children's activities, including a touch tank.

As usual, Sea Grant will be there with the latest information about everything from skimmer trawls to clam culture. Our booth will feature our new full-color display and many of our best publications. Sea Grant employees will be there to help answer your questions about the coast.

If you want more information about the Coastal Celebration, contact Barbara Mannen at 919/821-8790 in Raleigh. The celebration is sponsored by WRAL-TV, the North Carolina Coastal Federation, and a host of other governmental and non-profit groups.

Brochure Answers Food Questions

People are paying closer attention to the food they eat. For health and safety reasons, consumers are asking questions about ingredients, product labeling, freshness and organic origin.

They're questioning seafood too.

They want to know about seafood inspection, perishability, the effects of water pollution and the consumption of raw fish and shellfish.

To answer these questions and to allay some unfounded fears about the fisherman's catch, the N.C. Cooperative Extension Service has published a question-and-answer pamphlet about seafood safety.

Sea Grant seafood specialists David Green and Joyce Taylor along with Donn Ward of the N.C. State University Department of Food Science answer 18 of the most common questions asked about the safety of our coastal catch.

These include questions about ciguatera, scombroid poisoning, freshness, parasites, raw seafood, and thawing fish and shellfish.

For a copy of this pamphlet, write Communications, N.C. Cooperative Extension Service, Box 7603, N.C. State University, Raleigh, N.C. 27695.

Perestroika Texas-Style

Can you imagine a Russian Sea Grant College network?

That vision may become a reality if officials from Kiev in the Ukraine have their way.

After several visits to Texas this year, those officials have asked for help from Texas A&M Sea Grant to set up a network in the Ukraine similar to the National Sea Grant College Program.

The Russians are interested in using this network to help find environmentally compatible ways of developing the Crimean peninsula on the Black Sea.

Ukraine officials were impressed with Sea Grant's track record of linking research with information exchange and technology transfer. They also wanted to know more about how Sea Grant programs leverage funds from federal, state and industry sources to make their programs work.

Things are off to a great start. Texas Sea Grant folks are already helping Ukrainians assess the potential for developing recreational diving resources in the Crimea and in establishing marine sanctuaries.

Less Mud, Better Fish

North Carolina has become a leader in the growing field of aquaculture. More and more folks are turning to farm-raised fish as natural sources of fish diminish.

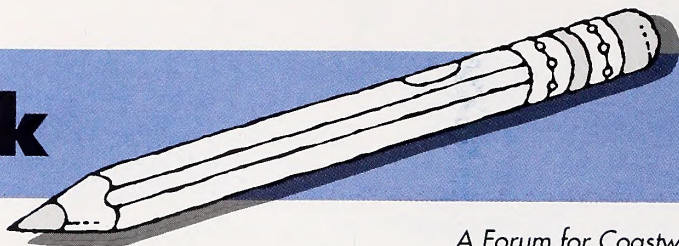
But some fish that are raised in ponds or tanks tend to have a slightly muddy taste.

Sea Grant scientists from Virginia Polytechnic Institute are studying the natural mechanisms in fish that produce these off flavors. They are analyzing catfish grown in high-density ponds.

The VPI researchers are using gas chromatography mass spectroscopy to separate and analyze the organic compounds that may be causing the off-taste.

They will examine ways to reduce these compounds in farm-raised fish. The researchers will try placing the fish in a cleaner environment a few days to a few weeks before harvesting, or using filters or water treatments.

Back Talk



A Forum for Coastwatch Readers

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, North Carolina State University, Raleigh, NC 27695. Opinions expressed on this page are not necessarily those of UNC Sea Grant employees and staff.

(These letters were written to UNC Sea Grant seafood specialist, Joyce Taylor in Morehead City.)

Biting A Barracuda

Dear Joyce Taylor,

I was wondering if I should eat the two barracuda I caught yesterday. Some people have said it's fine to eat the fish; others have warned against it. I hate to waste two good fish. Would you please advise me what to do?

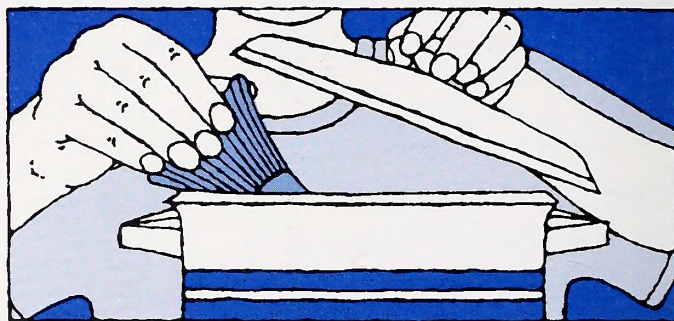
Danny Conner, Wilmington, N.C.

There is always some question about the safety of eating barracuda because they can harbor the ciguatera toxin, says Joyce Taylor, Sea Grant's seafood education specialist. Ciguatera is a type of food poisoning associated with tropical waters and fish. The toxin originates in certain species of microplankton or dinoflagellates, and it's passed up the food chain to large fish. Ciguatoxic fish cannot be detected by appearance, taste or smell, and cooking does not inactivate the toxin, Taylor says.

The symptoms of ciguatera begin within six hours after contaminated food is eaten. They include nausea, cramping and vomiting, followed by neurological discomforts such as headache, flushing and a tingling or numb sensation on the lips, tongue and mouth. In more severe cases, the most definitive symptom is cold-to-hot sensory reversal so that cold objects feel hot and hot objects feel cold.

Until recently, there were no reported cases of ciguatera poisoning from fish caught in North Carolina's temperate waters. But this is no longer true. Several years ago, 18 to 20 people were poisoned with the toxin. All had eaten two or three species of fish caught off Harker's Island. There was never a firm decision regarding which species caused the illness, but barracuda was one of those implicated, Taylor says.

"Since there is a remote possibility for illness, we cannot in good conscience advise people that it is entirely safe to eat barracuda," Taylor says. "Knowing this, we tell people to use their judgment."



A Flaky Subject

Dear Joyce Taylor,

I must tell you that I enjoy your essays in *Mariner's Menu* as much as the delicious recipes.

The January/February issue on flaked fish was especially useful since I fish the western lakes and rivers often and find flaking to be great with large trout and pike. And the flaked fish seem to keep so much better in my freezer than the whole fish.

Lewis Pendleton, Kernersville, N.C.

If you've ever eaten tuna salad, you've eaten flaked fish, Taylor says. Flaked fish is no different from a cooked fillet; it's just in a form that's more suitable for certain dishes. The fish are usually poached or steamed. Then the meat is flaked away from the bone to use in other dishes.

For delicately flavored fish flakes and broth, Taylor recommends the following steps:

- Use scaled, gutted, degilled fish. Leave heads on, but be sure body cavity is free of membrane and blood.
- Melt 1/4 cup margarine in an electric skillet or pan. Lightly saute a bed of cut onions, carrots and celery in the margarine, adding garlic powder, freshly ground black pepper and a bay leaf.
- Place the fish on the vegetable bed. Half submerge the fish in water. Uncover and bring to boil. Reduce heat and steam until the fish flakes easily with a fork.
- Remove fish and cool. Scrape off skin. Remove dark meat and rib portion. Gently flake meat from backbone with a fork.
- Use the broth as is. Or, make it richer by returning backbone and head to skillet. Cover and cook until liquid is reduced by half.
- Use the vegetables as they are or mash them as puree in the broth. Cool broth in refrigerator until it congeals. Then, remove solid fat layer from top. Strain broth before using.

For a copy of Sea Grant's brochure, *Flaking Fish*, send 50 cents to UNC Sea Grant, Box 8605, N.C. State University, Raleigh, NC 27695. Ask for publication number UNC-SG-87-05. Write to the same address for a free subscription to *Mariner's Menu*.

The



Book Store

Publications to Enrich Your Coastal Library

If you'd like to know more about North Carolina's coastal bird populations, there's no shortage of information available. The following publications should help.

FINDING BIRDS

The *Atlas of Colonial Waterbirds of North Carolina Estuaries* is a compilation by James F. Parnell and Robert F. Soots Jr. of all the waterbirds of North Carolina that nest in colonies. The atlas describes the biology, nesting habitats and habits, range, population trends and breeding characteristics of herons, pelicans, egrets, ibises, gulls, terns and others. This 274-page book is a must for all serious Tar Heel birdwatchers.

For your copy, send \$5 to Sea Grant and ask for publication number UNC-SG-78-10.

A companion to the above volume, *Supplement to the Atlas of Colonial Waterbirds of North Carolina Estuaries* should be on the shelf of anyone with serious interest in North Carolina birds. This 64-page book updates the population trends and management needs of coastal colonial nesting birds. Parnell and Soots are the authors.

For your copy, send \$1 to Sea Grant and ask for publication number UNC-SG-84-07.

MANAGING BIRDS

It's one thing to count and locate all of our state's

waterbirds. It's another thing to see that they are managed properly to secure their future.

In *Management of North Carolina's Colonial Waterbirds*, James Parnell and Mark Shields outline the results of more than 20 years' study of the nesting habits of herons, gulls, terns and other colonial waterbirds. The book contains a series of maps pinpointing the exact locations of nesting sites and presents a serious discussion of how state and federal officials might manage these sites for optimum benefit to the birds.

The book was published jointly by Sea Grant and the N.C. Wildlife Commission.

For your copy of this 165-page work, send \$5 to Sea Grant. Ask for publication number UNC-SG-90-03.

INDISPENSABLE BIRD BOOK

No North Carolina birdwatcher should be without a copy of *Birds of the Carolinas* by Eloise Potter, James Parnell and Robert Teulings.

This invaluable book lists most birds common to North and South Carolina and includes information regarding their size, colorations, nesting and feeding habits and habitats. Many of the species identified are pictured in full-color photographs.

This book can be found in most bookstores and is available in paperback field editions. It is published by The University of North Carolina Press.

For more information

about ordering, write UNC Press, 116 Boundary Street, Chapel Hill, NC 27514 or call 919/966-3561.

BIRDS AND OTHER CREATURES

Another publication that features birds as well as the fish, shellfish and other creatures of Carolina shores is *Nature Guide to the Carolina Coast* by Peter Meyer of Wilmington.

This 160-page paperback is a practical and interesting guide to shore life in both the Carolinas. Meyer's writing style is aimed at the layman, the average person who finds beachcombing a fascinating pastime. More than 100 color photographs make identification of the different species easy.

For information on prices and ordering, write to Peter Meyer at the Avian-Cetacean Press, PO Box 4532, Wilmington, NC 28406, or call 919/392-5537.

ISSUES FOR CHESAPEAKE

A new publication from the Sea Grant program in neighboring Maryland will be interesting to naturalists in that state as well as in the Carolinas.

Issues for the Chesapeake, a 24-page magazine-style booklet, offers case studies for the management of striped bass and oysters, two popular and controversial species.

The reader will learn about the bay's geologic and

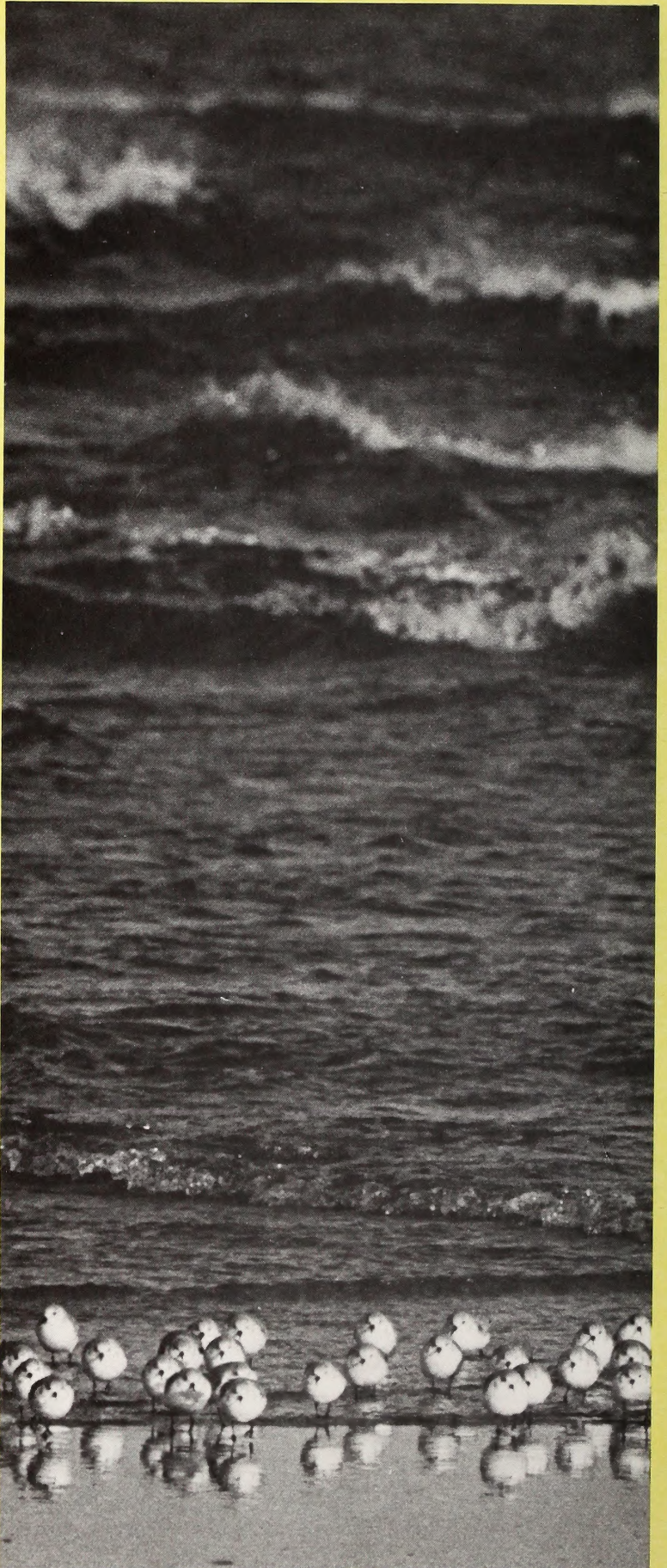
social past and how these events have affected today's Chesapeake Bay, one of the largest estuaries in the world. The booklet was written by Jack Greer, Maryland Sea Grant's director of communications.

For your copy, send \$2 to Maryland Sea Grant Program, H.J. Patterson Hall, University of Maryland, College Park, MD 20742. Ask for publication number UM-SG-ES-91-01.

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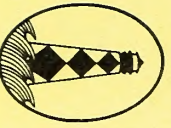
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Coastwatch

UNC Sea Grant March/April 1992



Fathoming Wetlands

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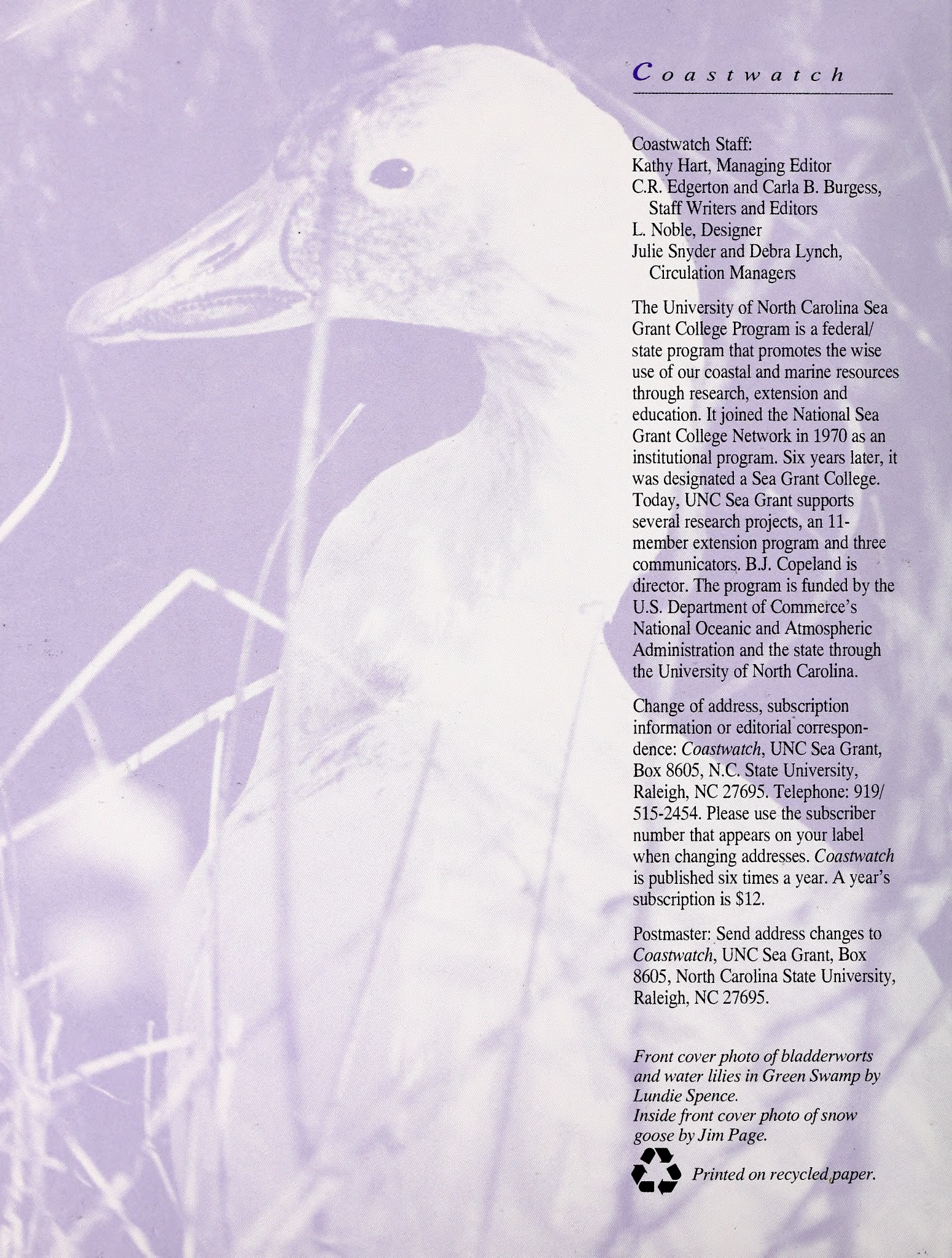
The Nature of Wetlands

PLUS

The Regulatory Tangle

ALSO

The Timber Debate



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Coastwatch Staff:

Kathy Hart, Managing Editor
C.R. Edgerton and Carla B. Burgess,
Staff Writers and Editors
L. Noble, Designer
Julie Snyder and Debra Lynch,
Circulation Managers

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, an 11-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 bladderworts and water lilies in Green Swamp by Lundie Spence.

Inside front cover photo of snow goose by Jim Page.



Printed on recycled paper.

Wetlands. It's a word you hear a lot these days. And rightly so.

North Carolina's valuable wetlands are dwindling. The culprits are many — a burgeoning population and accompanying development; expansive farming operations; the timber industry and consumer hunger for its byproducts.

Can we rescue our remaining wetlands? Can a balance be struck between those who want goods and services for our ever-growing population and those who want wetlands to remain pristine and untouched?

In this issue of *Coastwatch*, we tackle those questions.

Carla Burgess digs deep into wetlands and helps us distinguish between the different types. She shows us the scientific and practical value of this resource.

Raleigh freelance writer Sarah Friday Peters, a former member of the Sea Grant communications staff, returns to *Coastwatch* to untangle the myriad regulations and laws that govern the use of wetlands in North Carolina. She brings us up to date on the sometimes confusing world of

managing pocosins, swamps and other wetlands.

C.R. Edgerton takes a long look at the major source of wetland loss in North Carolina: the timber industry. He explores the conflict between timber officials — who say large tree farms are a good use of wetlands — and environmentalists, who want stricter regulations for wetland forestry.

While you're reading this issue, we hope you'll take note of some of the changes that have occurred in *Coastwatch*. You've probably already noticed that we are printing full color cover photos each issue. What you may not have noticed is that *Coastwatch* is now being printed on recycled paper. We're proud of the evolution of our magazine over the last few issues, and we hope you are too. Thanks for being faithful to us during this period of change.

Happy reading, and see you next time.

Kathy Hart

in this issue



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by Carla B. Burgess

The Nature of Wetlands

**Stand in a
seaside marsh,
following the flipping
of fish and sucking in
the salty breeze. Hip-
high in cordgrass and
brackish water, your
toes will sink into
the soft bottom.
Stand in a pocosin,
thick with scrub-
shrubs and deep in
coastal plain wilder-
ness, and the peaty
ground might be dry
enough to burn
beneath your feet.
Which is the
wetland?**



Raccoons and other wildlife abound in Tar Heel wetlands

J. Foster Scott

Anyone who can tell dust from a dewdrop knows it's the marsh, right?

Actually, both areas are wetlands, and both contribute in their own way to our natural heritage and ecology.

"Most people think of wetlands as places where you slosh through," says J. Merrill Lynch, a biologist and protection specialist for the N.C. Nature Conservancy.

There's more to defining wetlands than the soggy boot test. Some areas that qualify are wet only a fraction of the year. It is then that these drier wetlands do what they do best — absorb floodwaters like a sponge and release them slowly into the ground, surface waters or atmosphere. These wetlands accommodate the spillover from rain-swollen rivers and streams, filtering impurities from the flow that feeds coastal basins.

Of North Carolina's original 11 million acres of wetlands, less than half remain, the U.S. Fish and Wildlife Service reports.

Wetland diversity in the Tar Heel state is vast — from the nearly 2.7 million acres of bottomland hardwood forests that are home to grand cypress trees and gum swamps to wee winter puddles that provide a temporary breeding ground for tiny amphibians and food and shelter to migrating ducks and geese.

Equally diverse are the myriad functions of these sometimes enigmatic expanses.

You don't have to travel far on a North Carolina road before you spy a blue bumper sticker proclaiming, "No Wetlands, No Seafood."

Most people know now that these productive nursery wetlands for fish and shellfish are the lifeblood of our multimillion-dollar commercial and recreational fishing industries. But 30 years ago, many of us would have stood at the edge of a salt marsh with only such words as "mosquitoes," "muggy" and "miserable" seeping through our minds.



Black ducks pairing up for the spring mating season

Wetland

diversity in the Tar Heel state is vast — from the nearly 2.7 million acres of bottomland hardwood forests that are home to grand cypress trees and gum swamps to wee winter puddles that provide a temporary breeding ground for tiny amphibians and food and shelter to migrating ducks and geese.

That salt marsh of three decades ago is where much of the public stands today in its understanding of freshwater wetlands. Despite evidence that these areas are equally valuable, some people see only swampy, snaky sinkholes of wasteland and wilderness.

"Scientists already know the value," says Sea Grant marine education specialist Lundie Spence. "Now it's time to educate the public."

That campaign of enlightenment might favor bumper stickers with new messages: No Wetlands, No Flood Control. No Wetlands, No Waterfowl ... No Habitat, No Erosion Protection, No Clean Water.

Ironically, drier freshwater wetlands, threatened by proposed regulatory changes that could exclude them from protection, are the most critical in providing functions such as flood control and water purification.

In the United States, flooding causes more than \$3 billion in damages each year and kills nearly 200 people, according to a joint report by the Environmental Defense Fund and the World Wildlife Fund.

Wetlands detain floodwaters, reducing downstream flooding and slowing these high-energy flows. The drier the wetland, the greater its capacity to absorb floodwaters.

Natural wetland areas that have not been filled or channelized can reduce peak flow volumes by 40 to 60 percent, says Doug Rader, senior scientist with the N.C. Environmental Defense Fund.

Isolated wetlands, or as Rader describes them — "black holes on the landscape," prevent floodwater from ever reaching permanent bodies of water. Their destruction could create new problems downstream.

Wetlands are also the first line of defense against surface water

Continued

pollution from contaminated runoff, Rader says.

Wetlands near the headwaters of streams are the most important in removing pollutants such as sediment and nitrates, according to some researchers. These areas are less likely to be inundated for extensive periods.

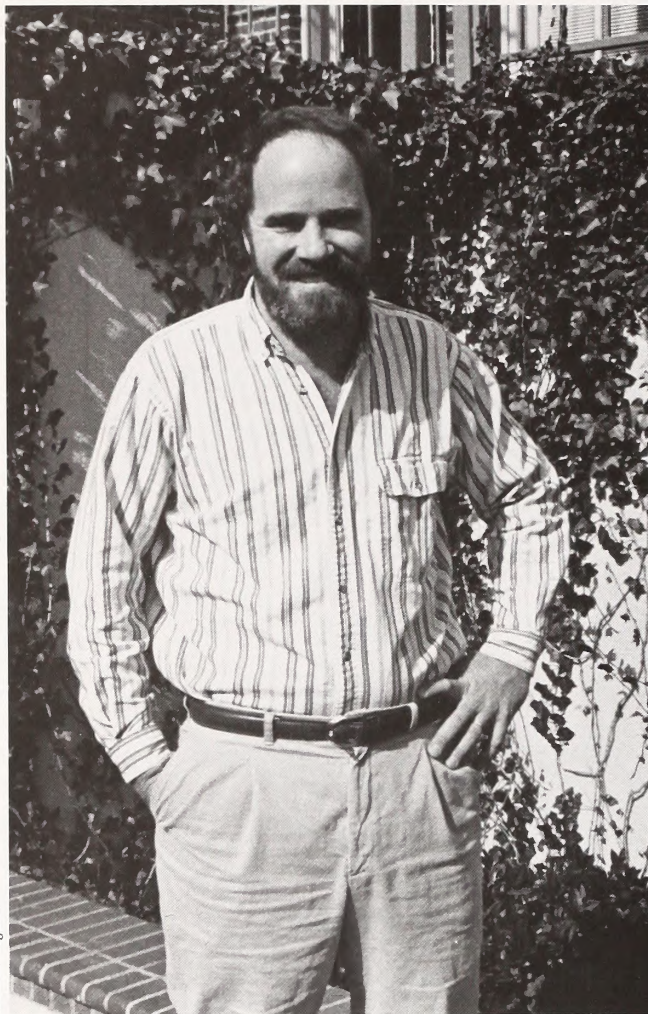
"When water flows over the land, it carries with it sediments, nutrients from fertilizer and toxic metals that pose a real threat to surface waters," says Rader. He estimates that more than 60 percent of the state's surface water degradation is caused by non-point source pollution, primarily agricultural in origin.

Turbid waters can create real problems in the aquatic community. Excess sediment buries the eggs and larvae of fish and other aquatic organisms on river bottoms. It also interferes with the respiration and filter feeding of aquatic organisms and prevents light from reaching bottom-dwelling plants.

"In landscapes where wetlands are still intact, the vast preponderance of sediment is trapped by wetlands," says Rader.

Wetlands also convert potentially harmful nutrients such as nitrates and phosphates — which can cause algal blooms and fish kills in coastal basins — into nourishment for microorganisms adapted to the anaerobic condition of wetland soils. If these wetlands are lost, the additional nitrogen pollution could require billions of dollars in improvements to U.S. sewage treatment plants alone, some scientists say.

Because of their ability to remove nutrients and minerals, some wetlands — such as cypress swamps — have



Carla B. Burgess

Doug Rader,
N.C. Environmental Defense Fund

**"Regulations
should be made
according to
functions and values,
not more or less
protected,
but differently,"
Rader says.**

actually been used as a natural method of sewage treatment. In other areas, people have constructed artificial wetlands to cleanse polluted water.

Because they absorb sediment and nutrients, wetlands can be highly productive. To witness this, one need only survey the incredibly fertile farm land in the Roanoke River floodplains.

Fisheries

North Carolina's sport and commercial fishery is directly dependent on the habitat, food and water supply of saltwater and brackish wetlands. But the fishery is inextricably bound to the preservation of freshwater wetland areas as well.

Anadromous fish, which spawn in fresh water but live their adult lives in the ocean, and freshwater fish depend on shallow pockets of freshwater wetlands and flooded

bottomlands for rearing and feeding their young.

In coastal North Carolina, wetlands such as pocosins — fire-adapted shrubby areas that naturally filter rainwater — are the source of high quality fresh water that flows into streams and estuaries. These areas maintain the necessary balance of fresh and salt water in productive coastal estuaries that are home to fish and shellfish. (See story on pocosins, page 15.)

Drainage of these upstream wetlands can result in too much freshwater discharged too fast into fragile, primary nursery areas and spell disaster for species such as brown shrimp.

Waterfowl

Millions of ducks, geese and swans depend on wetlands for food, breed-

ing habitat and rest stops during migration.

America's most popular and prevalent game duck, the mallard, has halved in population since the mid-1950s. Scientists attribute this decline mainly to loss of wetlands.

Temporary and seasonal wetlands are as critical to these animals as broad rivers and sloshy marshes. They provide privacy and isolation for breeding, shallow water for birds that prefer it and brief but bountiful productions of insects, amphibians and other food supplies when wetter wetlands do not.

Biological Diversity

Nearly 40 percent of rare and endangered plants species in Tar Heel mountain regions are harbored in wetlands; coastal wetlands are home to about 70 percent, according to the state's Natural Heritage Program.

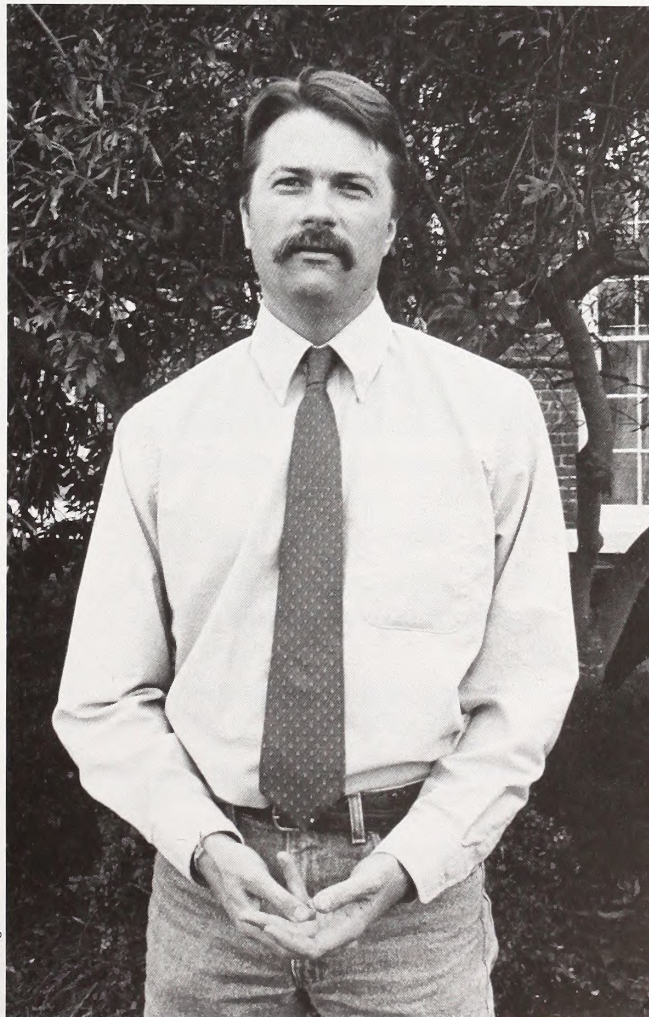
The black bear, southeastern fox squirrel, red-cockaded woodpecker and the Eastern diamondback rattler — all species on the decline — hang their hats in coastal plain wetlands.

"Eighty-five percent of rare animal species in North Carolina are either aquatic or dependent on wetlands," says Rader.

Unusual species such as the insectivorous pitcher plants, sundews and flytraps make their natural home in the nutrient poor soils of bogs, pocosins, savannas and flatwoods.

Drier wetlands feature the highest diversity of species, says a botanist at the Natural Heritage Program. In wet pine savannas of North Carolina's Green Swamp, as many as 52 vascular plant species have been

Carla B. Burgess



**"Who's to say
that some little
insignificant plant
we consider a weed
today may not be a
cure for AIDS
tomorrow,"
says Lynch.**

*J. Merrill Lynch,
N.C. Nature Conservancy*

counted in a single square meter.

"There is a common misconception that wetter is better," says Rader.

But there is perhaps an even greater misconception that any one wetland is "better" than another.

"For biological diversity, drier is better," says Rader. But to rate any wetland as more important than another is "nonsensical," he says.

"All wetlands are not created equal in terms of their function," he says.

If you're going to say that a salt marsh is more important than a seasonally dry wetland, be prepared to decide which you value more — water quality, shoreline erosion protection or habitat preservation, says Rader.

"I don't believe it's possible to make a linear scale of wetlands value," he says. "Regulations should be made according to functions and values, not more or less protected, but differently."

With developers attributing billion-dollar economic losses to the preservation of wetlands, it's sometimes hard for the public to swallow the enshrinement of a dense, scrubby thicket or an insect it has never heard of.

But if people can't appreciate an animal or an ecological community for its singular beauty or "right to exist," there's always the more selfish approach — recognizing its potential value to mankind.

J. Merrill Lynch cites the yew of the Pacific Northwest — once considered a junky tree of little value — and its recent contribution to the treatment of ovarian cancer.

"Who's to say that some little insignificant plant we consider a weed today may not be a cure for AIDS tomorrow," says Lynch. 🌿

by Sarah Friday Peters

The Muddle over Wetlands Protection



C.R. Edgerton

Bald cypress trees in a pocosin lake

The issues tie so closely to the land. But so much seems to be up in the air for one of North Carolina's most important natural resources.

Once, people considered wetlands to be wastelands. The filled, open waters, marshes, floodplains, bogs and pocosins made good farmland and terrain for forests. Wetlands covered 11 million acres of the state in 1780, according to the U.S. Fish and Wildlife Service. Now about 5.5 million acres remain.

State and federal regulations are intended to protect remaining

**The problem
becomes muddy in
North Carolina
because different sets
of rules govern
different types
of wetlands.**

wetlands. But the laws wind and tangle like roads with no destinations. No one has a road map, either, as comprehensive wetlands policies don't exist. Loopholes open avenues to bypass the laws. And hazy definitions of wetlands muddle the protection process.

Recent attempts to streamline wetland management sparked new controversies between environmentalists and developers. The furor fumes mostly over revisions to the 1989 Federal Manual for Identifying and Delineating Wetlands and a bill before

the N.C. General Assembly calling for a statewide wetland policy.

Meanwhile, landowners are caught in a regulatory limbo. Farmers aren't sure what fields they can farm. And bankers are reluctant to lend money for properties that may be considered wetlands.

"North Carolina is in the middle of the pack as far as protecting wetlands," says Doug Rader, a senior scientist with the N.C. Environmental Defense Fund. "Some states have done nothing. Others have done a lot more."

The problem becomes muddy in North Carolina because different sets of rules govern different types of wetlands.

On the edge of the Roanoke River National Wildlife Refuge in Bertie County, heavy rains frequently flood the flatland, drowning the trunks of ash, cypress, tupelo gum and sycamore trees.

About 140 miles west, in Durham, Ed Harrison, wetlands co-chairman for the N.C. Sierra Club, treks through the dense, woody hillside of New Hope Creek, pointing out pockets that occasionally flood.

In North Carolina, both sites are considered as wetlands. But one region — the wetlands of New Hope — lacks the protection afforded the refuge's waterlogged lands. Under proposed federal legislation, both areas stand to lose even more.

About 95 percent of North Carolina's wetlands lie in the coastal plain. But wetlands stretch to the Piedmont flatlands and mountain bogs, too. Surprisingly, 75 percent of all the state's wetlands classify as freshwater wetlands.

Eighteen states have freshwater wetland protection, says Rader. But so far, North Carolina's protection targets coastal, saltwater wetlands.

"The regulations for coastal wetlands really stand alone," says Walter Clark, Sea Grant's coastal law specialist. "They weren't written to

protect freshwater wetlands."

The Coastal Area Management Act protects coastal wetlands in 20 eastern North Carolina counties. CAMA designates these salt and brackish marshes that serve as important natural feeding and nesting grounds as

The issues tie so closely to the land. But so much seems to be up in the air for one of North Carolina's most important natural resources. Wetlands covered 11 million acres of the state in 1780, according to the U.S. Fish and Wildlife Service. Now about 5.5 million acres remain.

"Areas of Environmental Concern." It sets up specific standards that must be met for development to be permitted.

Dock and pier sizes are limited, for example, to avoid shading important wetlands, and excavations must bypass them.

The state Dredge and Fill Act limits dredging and filling of estuaries, tidelands, marsh and state-owned lakes by requiring a permit for such activities.

These two acts work in conjunc-

tion with the major federal program that has limited wetland losses over the past 18 years. Section 404 of the Clean Water Act gives the U.S. Army Corps of Engineers the authority to regulate the discharge of dredge and fill material into waters of the United States, which include freshwater and saltwater wetlands.

In North Carolina, anyone who applies for a federal 404 permit must get certification that the proposed activity — such as building a marina — complies with North Carolina's water quality standards. If the state says "no," the permit is denied.

Section 404 provides the sole protection for freshwater wetlands in North Carolina.

Since CAMA only covers 20 coastal counties, "we're relying on federal protection for freshwater wetlands in North Carolina," says Ed Harrison of the Sierra Club.

Some say the state and federal regulations are too rigid. Drier, flat wetlands that rarely flood make prime development areas. If the land isn't wet, why call it a wetland, some argue.

Others say the regulations are too flexible.

No comprehensive state or federal program clearly defines what a wetland is. And since Section 404's primary mandate is to regulate dredge and fill, wetland protection occurs. But plenty of loopholes exist.

The Environmental Protection Agency, the U.S. Fish and Wildlife Service and the Food Security Act of 1985 each have their own definitions of a wetland.

Although the definitions vary, they outline the basic criteria used to determine a wetland — soil type, saturation level and vegetation.

Even when a wetland is designated, exceptions to the rules persist.

The U.S. Fish and Wildlife Service estimates that as much as 80 percent of the nation's wetland losses have

Continued

come through legal and unregulated operations.

Ongoing forestry and farming operations are exempt from wetlands legislation. New agricultural activities that convert an existing wetland to a dry, usable land only require a permit from the corps. Chances are, the permit will be approved. Only about 500 of 15,000 permit applications reviewed by the corps each year are denied.

Piers, marinas, highways and other projects routinely are built in wetlands. And draining, clearing and channelizing wetlands are not specifically prohibited by law.

Statewide dissatisfaction with current wetland management practices led to the formation of a legislative Wetlands Protection Study Commission in 1990. After a year, no consensus developed, Rader says.

**"It is possible
to make policies
that protect coastal
and freshwater
wetlands but don't
hurt the economy,"
says Clark.**

Three or four drafts of state wetlands policies have crossed the desks of officials at the N.C. Department of Environment, Health and Natural Resources since 1990, Rader adds. But none have been adopted. The state now uses a system to rank freshwater and saltwater wetlands, but the system has not been officially approved.

In early 1991, a coalition of major environmental groups encouraged



Tundra swans on Pungo Lake

the N.C. General Assembly to protect the state's remaining marshes, swamps and other types of wetlands. The N.C. Sierra Club, the N.C. Environmental Defense Fund, the N.C. Coastal Federation and eight other groups formed the N.C. Wetlands Coalition.

The group saw fruition with the introduction of a bill by Rep. Bruce Etheridge of Carteret County in the 1991 General Assembly. The bill calls for a "no net loss" policy for wetlands and requires the state Environmental Management Commission to define which areas should be protected.

The policy, made popular by President George Bush during his election campaign, basically means that any wetlands destroyed or impaired by development will be replaced by creating wetlands elsewhere.

Nationally, frustration over unclear wetlands definitions and over the loss of wetlands brought concerned citizens and federal agencies together for the 1988 National Wetlands Policy Forum. Out of that grew the now controversial 1989 Federal Manual for Identifying and Delineating Wetlands.

This manual created an uproar among developers, homebuilders and farmers who claimed that it failed to discriminate adequately among different types of wetlands and led to inconsistencies in federal authority.

In response, the Bush administration published a revised manual on

Aug. 14, 1991. As of February, the period for citizen comment on the manual had been extended three times.

The 1991 manual proposes a tighter system to rank wetlands, classifying them as high, medium and low value; a revision of the methods for identifying wetlands; a requirement that the government buy all wetlands classified as "high-value"; and elimination of the EPA's role in regulation.

Under the proposal, field tests by the N.C. Division of Environmental Management found that 51 percent of all wetlands previously regulated, or about 2 million acres, would no longer be covered if the delineation were based on the 1991 manual's requirements. About half of the loss would be in wet pine flatwoods and the other half in bottomland hardwood forests.

David R. Kitts, assistant manager of the Pocosin Lakes National Wildlife Refuge, estimates that about 20,000 acres of the eastern North Carolina refuge's 111,000 acres could be lost under the proposed standards. Long-term, specific water control structures could remedy the situation, he says.

Westward, in Durham's New Hope Creek, 95 percent of the existing wetlands would be gone, Harrison estimates.

In both regions, and in wetlands across the state, an area was previously considered wet if water satu-

rated the soil within 18 inches of the ground's surface for at least seven days a year. Under 1991 federal manual revisions, wetlands must be saturated at the surface for at least 21 days in a row.

As the pot boils in Washington over wetland reforms, North Carolina feels the heat, too, over additional wetland-related issues.

Rader expects peat mining controversies to resurface soon as technology improves methods to dig the rich, organic soil found in many coastal counties.

The state also must tackle the question of wetland management in urban areas, he adds. As the federal government insists on more stringent stormwater controls in urban areas, local officials are grappling with whether to keep a wetland intact or to build retention ponds there for stormwater.

One of the biggest wetland protec-

tion issues facing North Carolina now, however, is mitigation.

Should the state allow someone to destroy a natural wetland and create an artificial wetland? Is it possible to trade resources adequately and evenly?

The questions resounded loudly in a case that pointed to the gaps in state mitigation policies.

In early 1990, developers planned to fill about 18 acres of wetlands along U.S. 158 in Kitty Hawk to build Shoreside Shopping Center. In exchange for the wetlands, the developers — Kitty Hawk Woods Partnership — offered to donate 455 acres of woods to Kitty Hawk Woods maritime forest and to restore a 30-acre wetland area in Tyrrell County.

Opponents said the project did not fit federal guidelines and that issuing a corps permit based on the donation of the forest would be illegal. It would also be a green light for other developers to negotiate similar plans.

But state coastal management officials supported the proposal, saying it would preserve acres of valuable maritime forest.

"We made a very precedent-setting decision and said 'yeah, this is a good deal,'" says Rich Shaw of the N.C. Division of Coastal Management.

The idea of trading resource for resource appeals to economists, landowners and developers. Mitigation allows developers to obtain wetland permits with greater certainty and in a shorter time. The option may also encourage new or restored wetlands.

But wetlands have specific purposes in specific locations, such as water purification, says Rader. For mitigation projects to be successful they must be in-kind and in the same watershed, he adds. They must become self-sustaining systems that replace the lost functions of the natural wetlands.

Two Sea Grant research projects are testing the viability of building and rebuilding wetlands.

Scientists have known for years that transplanted marsh grass can help produce new marshes. But no one has learned how long it takes the new marsh to develop and if it can be as productive. In one project, researchers with Sea Grant, the National Marine Fisheries Service and other cooperating national universities are using marsh grasses and submerged aquatic vegetation to see how well a new

**One of the biggest
wetland protection
issues facing North
Carolina now,
however,
is mitigation.**

ecology can be created in new marshland, in marshes that may have been destroyed or on lands acquired through mitigation.

Other research by Sea Grant and the Coastal Ocean Program of the National Oceanic and Atmospheric Association looks for new ways to propagate these wetland plants. Through biotechnology, scientists are finding ways to create new plants solely from plant cells.

"It's working like gangbusters for marsh grass," says UNC Sea Grant Director B.J. Copeland. "When it's effective is when you can create new marshes without having to borrow from or impact the old marshes. You're just using the genetics."

Science can also help determine the criteria that make wetlands important and where sacrifices can be made, says Sea Grant's Clark. "It is possible to make policies that protect coastal and freshwater wetlands but don't hurt the economy." ☼

Cypress tree, Southern Lake Phelps



by C.R. Edgerton

Forestry: Friend or Foe?



C.R. Edgerton

Roanoke River Bottoms near Windsor

Mike Canada steers a pickup truck down a dirt path so bumpy you think you're on a mechanical bull.

On each side of the muddy road, the cola-colored waters of the Roanoke River bottomlands soak woods and fields.

"You wanted to see wetlands, well here it is," he says.

Canada, one of two U.S. Fish and Wildlife Service rangers charged with managing the Roanoke River National Wildlife Refuge in Bertie County, points to a stream of water rushing over the road.

"That water's coming from the

**The truck slows down
as a family of
raccoons crosses the
road and disappears
into the thick road-
side cover of sweet
bay and gallberry.**

Roanoke River," he says. "With all the rain we've been having, things are pretty much saturated."

Canada maneuvers his truck through large plots of slightly elevated land hosting long rows of young sycamores. The sycamores, medium-hardwood trees that make excellent paper pulp, are a strong reminder that large timber companies like Weyerhaeuser, Union Camp, Champion International and others have a tight grip on many thousands of acres of wetland swamps and pocosins in North Carolina.

"You see, the timber companies

come in and clearcut an area of its original hardwoods, cedars and other such trees," Canada says. "Then, they plant these sycamore plantations here in the swamps and pine plantations on the pocosins. It's their way of making sure they've got plenty of timber in the future."

A good hour's drive to the south, David Kitts, a U.S. Fish and Wildlife Service ranger, bounces his truck on a similar dirt road.

Kitts points out the barren landscape of one of the largest tracts of publicly owned pocosin swamp in the world. It's the new Pocosin Lakes National Wildlife Refuge near Creswell.

Encompassing thousands of acres in and around lakes Phelps and Pungo, the refuge is the latest effort to save these valuable wetlands from destruction by timber companies and big-time farmers.

The truck slows down as a family of raccoons crosses the road and disappears into the thick roadside cover of sweet bay and gallberry.

Later, a fresh set of black bear tracks in the middle of the road gives Kitts and his riders good reason to stop and take pictures. The bear isn't visible through the shrubs, thickets and pond pines of the pocosin. But the tracks give evidence that he'd passed that way only minutes before.

Both Canada and Kitts are keepers of wetlands, those fragile and diverse ecological communities that some experts say are important to the well-being of coastal waters.

Yet there are those who say wetlands are good for one thing and one thing only: harvesting and growing timber for a nation hungry for wood pulp and lumber.

Therein lies the controversy.

When European explorers first set foot on North Carolina's vast coastal plain forests, they were amazed at the seemingly endless expanse of nature's timber bounty.

These men couldn't imagine that

all those trees would ever fall prey to the axe and saw of man.

It wasn't until this century that

**Clearcutting of
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The question is
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How do you keep up
with the demands of
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nation and keep
wetlands intact?**

people developed technology that would allow them to sustain profitable forays into the magnificent stands of

cedar, cypress, poplar and other species that dominated the landscape.

Only then did clearcutting in Tar Heel coastal wetlands become a reality.

And only in the past few years has that type of forestry met the scrutiny of the public eye.

Clearcutting of valuable wetland forests has come under fire. The plantation system of renewing those valuable timber resources — growing trees on vast "tree farms" — is gaining more and more opponents.

The question is simple, yet attracts no easy answers: How do you keep up with the demands of a timber-hungry nation and keep wetlands intact?

Until recently, no one argued much with the timber companies. They provided valuable jobs in poverty-stricken coastal counties. Though some people have blamed paper mills for many of the ills in coastal waters, the timber industry was eager to renew the profitable resource.

Now environmentalists and other anti-timber groups have an easier time finding fault with the plantation system of growing trees on wetlands.

Though recent studies have shown that plantations do not cause serious damage to a wetland's ability to filter and purify water that eventually finds its way into coastal estuaries, environmentalists say water quality is not the only issue.

They believe that a pocosin or other wetland turned into a pine plantation is no longer viable and productive as a wetland.

So the two sides have drawn battle lines. The battleground is a 5,000-acre tract of wetlands in the remnants of the once-vast (100,000 acres) East Dismal Swamp in Washington County.

In a lawsuit filed recently for the N.C. Wildlife Federation, the N.C.

Continued

Coastal Federation, the N.C. Environmental Defense Fund, the National Audubon Society and the Sierra Club, the Southern Environmental Law Center hopes to use the East Dismal as a test case for further regulation of forested wetlands.

On the other side of the ditch is the Weyerhaeuser Corporation, owners of the East Dismal tract. The company wants to clearcut the old-growth hardwoods there and turn the cleared land into a pine plantation.

To do that, the clearcut land must be drained and bedded and roads must be built into the property. Weyerhaeuser says all of this activity is exempt from Section 404 of the 1972 Clean Water Act, the legislation that regulates the types of activities that can occur on wetlands.

The act says that any activity that discharges dredge or fill into wetlands must first go through the permitting process. Traditional interpretation of the regulations has allowed turning wetlands into pine plantations, claiming that this activity does not fit into the dredge-and-fill definition.

“But what we’re contending in the suit is that making roads, clearing land, etcetera meet the dredge-and-fill

process. But the timber companies argue a strong case when they claim that turning wetlands into pine plantations is “normal silviculture,” or the growing of trees.

- Because pocosins are located on mostly level ground, large tracts of timber are easier to manage and harvest, saving time and money.
- Pocosins that are not in public



C.R. Edgerman

Sycamore plantation, Roanoke River floodplains

“We’re contending that Weyerhaeuser’s actions in the East Dismal of draining, clearing, bedding and replanting trees is not normal silviculture,” Carter says. “Clearly, to us, changing the use of this wetland from hardwood to pine plantation is a violation of the exemption.”

The timber companies claim that changing the type of tree grown in the wetland doesn’t change the use of the land and that draining, clearing, bedding and building roads does not change the site’s hydrology — the action of water on the land.

Why are these wetlands so attractive to the timber industry? Why are large companies now vying to hold on to wetlands as a place to grow trees?

The forestry people give several reasons:

- Wetlands, especially pocosins, represent expansive tracts of land that are as yet undeveloped and uninterrupted by civilization.
- Trees planted in bedded and drained pocosins grow two to three times faster than trees planted on upland agricultural lands.

protection represent some of the cheapest land in the coastal plain. (Some companies have accumulated vast tracts of wetlands for as little as \$5 per acre.)

• Plantation growing provides the most timber for the least money, an important criteria for the future, when timber officials say the world’s supply of timber will be short.

There are negative sides, say the environmentalists. “Forestry is the primary cause of wetland degradation and loss,” says Derb Carter. “It’s essential that this activity require some environmental review.”

Carter cites startling numbers. More than 1.2 million acres of North Carolina’s coastal wetlands system have been lost to tree plantations in this century.

A recent study by a Duke University graduate student showed that more than 52 percent of North Carolina’s wetland loss can be attributed to timber companies.

If the trend continues unchecked, the U.S. Fish and Wildlife Service estimates that the number of pine plantation acres in

Can the two sides

strike a balance?

The timber industry

has noted that they

are achieving a

balance already.

requirements,” says Derb Carter, an attorney with the Southern Environmental Law Center in Chapel Hill.

Carter says the Clean Water Act exempts agriculture and “normal silviculture” from the permitting

North Carolina could increase to more than 2 million by the year 2030.

"Unless this activity is regulated, the future is going to be that tens of thousands or more acres in North Carolina are going to be pine tree farms," Carter says. "This is the single greatest cause of wetlands degradation. There's not even a close second."

The tree companies, who already own more than 2 million acres of coastal Tar Heel wetlands, say degradation is too strong a word. Nowhere in the South are pine trees grown so well as on intensively managed wetlands.

They say changing a pocosin or other wetland into a pine plantation doesn't change the fact that the land is still a wetland. They challenge environmentalists to prove that intensive forestry is bad for the environment.

"We contend that their activities modify the hydrology and quality of water entering the sounds," Carter says. "There are off-site effects of the activities."

Carter says the goal of environmentalists is to maintain water quality

woodpecker of pine barrens and savannas — are endangered or threatened.

Pocosins, which at first glance seem to lack much diversity of fauna, are the natural home of the black bear, the gray fox and a host of other smaller animals. Swamps are the pecking grounds of the ever-growing wild turkey population and the free range of the populous white-tailed deer.

Pine plantations, say the environmentalists, do not provide the floral diversity required to sustain these animal species.

"They (the timber companies) say the wetland is not lost when it's changed to a pine plantation, but we disagree," Carter says. "From an ecological perspective, it's no longer a wetland because we've lost so much of the function and value of the land."

Can the two sides strike a balance?

The timber industry has noted that they are achieving a balance already. They say they are changing

an environmentally safe manner.

But environmentalists say the balance won't come until the timber industry's wetlands operations come

Pocosins, which at first glance seem to lack much diversity of fauna, are the natural home of the black bear, the gray fox and a host of other smaller animals.

under some kind of fair permitting process.

"Our goal is not to turn these pine plantations back into wetlands," Carter says. "We're not fighting to undo the past. We're fighting to get some review where there currently is no review."

"This case, this suit against Weyerhaeuser, is only going to decide if permits should be required for Weyerhaeuser on East Dismal Swamp," he says. "But, it could be used as a precedent for future cases that are similar."

The balance will never be achieved if large timber companies are kept out of the regulatory process, Carter adds. "Once they're in, there are mechanisms built into the process to strike the balance," he says.

Until the suit comes before a judge, environmentalists are keeping a close watch on the East Dismal. So far, Weyerhaeuser has kept chainsaws and log trucks out of this piece of wetlands. 🌲



Back hoe on a superfarm

as well as the biological diversity of the wetlands.

Wetlands are home to a variety of plant and animal species. Some — such as the insectivorous plants of eastern swamps and the red-cockaded

largely unproductive land into land that provides a much needed commodity — pulp for paper and lumber for furniture and housing — at a fraction of the cost of growing it naturally. They say it's being done in

Rare Finds in Wetlands

Picture this. Four large paw prints look like stamps in the sand. Down the road, more bear prints follow into the woods.

In wetlands, it's easy to be a detective, searching for clues to the animals that live there. Trees, channels, ponds, brush and mud all make good homes for birds, reptiles, amphibians, insects and mammals.

Harder to find are endangered or threatened plants and animals. The U.S. Fish and Wildlife Service and the state of North Carolina have long lists of species that need special protection. Wetlands make up 5 percent of the nation's land, but more than one-third of the rare and endangered species depend on these areas for breeding, nesting and feeding grounds.

The next time you visit a wetland, take a pair of binoculars and a camera. See if you can find some of these plants and animals.

Bald eagle – These dark brown birds of prey have white heads and tails. Sometimes you can see them soaring above lakes, rivers and marshes. In flight, their wingspan may reach 6 feet across. They swoop down to the water to feed on fish, herons, small mammals and wounded ducks. Illegal shooting and water pollution have diminished the number of bald eagles.

Red-cockaded woodpecker – You may hear this woodpecker before you see it. This endangered bird has a black and white ladderback pattern on

its back and white patches on its cheeks. Its name comes from a red spot found on the back of the male's head. These striking birds prefer open stands of longleaf, loblolly, shortleaf and slash pines. They love to eat wood-boring insects and frequently feed on fire ants. Changes in land use and a loss of habitat due to development and clearing for timber planta-

C.R. Edgerton



Fresh bear track, Pocosin Lakes National Wildlife Refuge

tions, for instance, have contributed to the decline of this woodpecker.

Rough-leaf loosestrife – In America, 95 to 100 percent of these federally endangered plants grow in the savannas and pocosins of North Carolina's coastal plain. Conversion of these areas to pine plantations and farms, as well as fire suppression, have severely reduced the numbers of this tall, showy flower. The rough-leaf loosestrife grows on a stalk about 1 to 1 1/2 feet tall and has a spike of large yellow flowers that typically bloom in June.

Venus' flytrap – This unusual native plant lives in semi-bogs that

don't get too wet or too dry. Flytraps grow 4 to 12 inches tall and can be found in about 100 locations in North Carolina, especially in soggy ditches of the lower coastal plain. It's easy to pick out this intriguing plant with its bristle-fringed leaf blades that make a trap for insects. As insects touch down on one of the two bright red blades, a trigger near the center of the

blade springs and the two halves snap shut. Fewer and fewer Venus' flytraps exist because of poaching and conversion of wetlands.

Wood stork – The wood stork doesn't nest in North Carolina, but it is a fairly common summer resident around coastal swamps, marshes and mudflats. Full-grown wood storks are large white birds with black flight feathers, dark

legs and bill, and a dark head without feathers. Wood storks like to feed in groups. With one foot, each bird stirs the mud and water in front of it to frighten fish and other small critters from their hiding places. Then the birds snatch whatever prey comes their way. Their numbers have decreased drastically since around 1950. Unstable habitat conditions in Florida, their native state, continue to threaten this wetland bird. Droughts and increased water needs in southern Florida draw down water in lakes and ponds where wood storks feed. Too little water, or too much, has forced the wood stork northward to find better habitats.

Sarah Friday Peters

Peeking into Pocosins

The dense, shrubby pocosin wetlands that cover more than a half-million acres of the Tar Heel coastal plain are a curious wonderland.

Their acidic, nutrient-poor soils give rise to odd greenery — trees and shrubs that thrive in the wake of a wildfire, plants that “dine” on insects.

Consider the scattered, gnarly pond pines, a common sight in pocosins (pronounced puh-kos-uhns). Their closed cones, when heated by a raging blaze, burst open like grenades, scattering seeds that will rejuvenate the forest.

The trumpet-like leaves of some species of pitcher plants trap insects to supplement their otherwise nutrient-poor diet. Insectivorous plants such as butterworts, bladderworts, sundews and flytraps also flourish in pocosins’ low, shrubby areas.

Pocosins also harbor titi, honeycup, bitter gallberry and sweet bay in their shrubby undergrowth.

North Carolina’s coastal plain is home to 70 percent of the nation’s remaining pocosins. These peaty, fire-adapted wetlands are little understood and often unappreciated.

Pocosins apparently originated more than 10,000 years ago from drainage basins blocked by sand and layered with clay, according to a U.S. Fish and Wildlife Service report. Anaerobic conditions in the water that accumulated fostered accumulation of organic matter or peat. Eventually, the open water was replaced with swamp forest.

As the peat surface gradually accumulated, nutrients from upland areas no longer entered. The forest was replaced by pocosin.

The name pocosin was derived from an Algonquin Indian term that means “swamp on a hill.” Pocosins are characterized by tangles of thick-leaved evergreen (and a few decidu-

ous) shrubs, pond pines and bay trees. The soil is typically highly organic, drains poorly and is periodically saturated with water.

The highly flammable vegetation and soils have left pocosins vulnerable to fires, and the environment has adapted. Pond pines and shrubs sprout profusely after a blaze. Pocosins regain their biomass at an astounding rate after fire, also.



But although fire has figured naturally into pocosin biology, population explosion and the surrounding developed areas mandate strict management of pocosin fires.

Pocosins have succumbed to intensive development — less than one-third of the 2.2 million acres recorded in North Carolina in the 1940s and 50s remain unaltered. In the past, conversion of pocosins for agricultural purposes was popular. Today, pocosins are increasingly altered for silviculture.

Peat mining is a relatively new use, and when perfected by miners may be another source of destruction in pocosins.

Meanwhile, scientists are grasping a better understanding of the importance of these wetlands to water quality, wildlife habitat and the well-being of the environment.

Pocosins are not regarded as the most productive wetland areas. But as

adjoining wetlands are developed, the declining black bear population and other animals seek refuge in these large tracts of undisturbed land.

Because of their dense vegetation, pocosins attract mostly air and tree foragers, and mainly cater to insectivores and omnivores. Bobcats are the only true carnivores found in pocosins, according to the U.S. Fish and Wildlife Service.

Pocosins cleanse, retain and store rainwater. Draining and ditching of pocosin wetlands on a large scale can be detrimental, resulting in a surge of fresh water and excess nutrients to coastal basins.

“Primary nursery areas are fed by waters that originate in pocosins,” says Mark Brinson, professor of biology at East Carolina University and a wetlands scientist. “They (pocosins) should be maintained for their capacity to produce high quality water.”

Major timber companies own about 44 percent of the state’s pocosins, the N.C. Environmental Defense Fund reported in 1989. Large farms own 21 percent; state and federal agencies, about 20 percent.

Brinson says the most valuable resource of pocosins is peat, “not for fuel in the future, but for producing much of the landscape there.” He prizes the areas for their contribution to global health.

As the water table of a pocosin is lowered, the peat is vulnerable to oxidizing by exposure to the atmosphere and from fire, increasing the concentration of carbon dioxide in the atmosphere.

“A good policy in terms of global change would be to protect areas like (pocosins) and actually convert them into carbon dioxide accumulators,” Brinson says.

Carla B. Burgess

The Nose Knows Good Seafood

Joyce Taylor has a nose for seafood.

At fish markets from Cedar Island to Salter Path in the county of Carteret, Sea Grant's seafood education specialist can be seen sniffing the catch.

What drives this woman to such a nosey task?

Taylor knows her nose never lies when it comes to detecting freshness in fish and shellfish.

Fresh seafood has the odor of the ocean — a briny aroma that smells of salt spray and breaking waves.

And only the freshest fish and shellfish will do for Taylor. She knows that no amount of fancy preparation, cooking or sauces can salvage a spoiled fish.

Freshness is the basis for Taylor's gospel of seafood cooking, a gospel Taylor preaches in pamphlets, newsletters, demonstrations and cooking schools.

In the face of recent media reports questioning the quality and safety of the fisherman's catch, Taylor says a fresh product is usually a quality one. And faced with a display case full of fish and shellfish, consumers should judge for themselves what is fresh and what isn't, Taylor says.

The first assessment of freshness should be made with the consumer's own nose.

A fish that smells bad or fishy is spoiling. Don't be embarrassed to ask your fishmonger to smell any seafood you propose to take home.

Poor handling, which usually translates to inadequate cold storage, can cause seafood's rapid deterioration and bad smell.

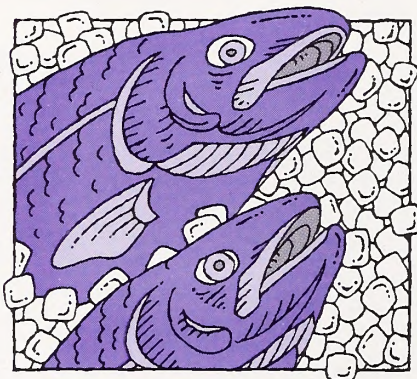
Taylor says spoiled fish is rarely a health threat if thoroughly cooked, but it can leave a bad taste in your mouth.

But she warns that no amount of cooking will destroy the harmful histamines released by spoiled tuna.

Taylor says not to buy fresh tuna unless you are sure it has been handled correctly.

Taylor says to also take a hard look at your prospective buy.

In whole fish, the eyes should be bright, clear and bulging. Eyes that are sunken or cloudy are signs of spoilage, Taylor says.



The skin on a fresh fish has a vivid color. It is not dull, discolored, blemished or covered with mucus.

If the fish has already been steaked or filleted, the flesh should be translucent and moist. Fillets that look dry have been improperly handled.

Shellfish, such as clams, oysters and mussels, should be alive at purchase. This means no gaping shells. Any bivalve with an open shell is dead and should be discarded.

Don't be shy. Ask your fishmonger some questions, Taylor says.

Quiz him or her about what is in season, how long the fish and shellfish have been in the display case, and where the seafood was caught.

Taylor says consumers should examine how seafood is displayed. Fish that is piled high or displayed beneath warm lights should be checked for spoilage. Ideally, fish should be kept in individual containers placed directly on ice.

And under no circumstances

should cooked products, such as surimi or seafood salads, be displayed near raw fish or shellfish.

And Taylor warns that some consumers, especially pregnant women and families with young children, should avoid certain fish, such as Great Lakes salmon, shark, swordfish and lake whitefish, because they may be high in PCBs. PCBs can be harmful to a growing fetus and young children under the age of six.

Similarly, swordfish and tuna can concentrate mercury.

For others, consumption of these fish should be limited to once a week.

After selecting a mackerel steak or flounder fillet for dinner, there are a few things you should do to keep your catch its freshest, Taylor says.

Bring your seafood home immediately. Don't leave fresh seafood in a hot car.

At home, place the fish or shellfish in the coldest part of the refrigerator. This will maximize its shelf life, Taylor says. But she advises that most seafood should be consumed 24 to 36 hours after its purchase.

After handling seafood, wash your hands, cutting boards and utensils thoroughly to prevent cross-contamination. When grilling, be careful not to use the same plate for raw and cooked seafood.

Taylor advises that all seafood should be thoroughly cooked. Eating raw fish and particularly shellfish is inviting a health risk.

For more information about fresh fish, send for Taylor's pamphlet, *Hooked on Fresh Fish*. The cost is 50 cents. Write Sea Grant, Box 8605, N.C. State University, Raleigh, N.C. 27695.

And don't forget: When it comes to seafood, your nose knows best.

Kathy Hart

Phantom Algae Sends Scientists Sleuthing

Scientists have never seen anything quite like this.

It's a microscopic algae that stalks fish, kills them, feeds on their decaying flesh and then retreats to the bottom, waiting for its next victim.

Sea Grant researchers JoAnn Burkholder and Ed Noga are blaming this mysterious new "phantom" algae for several massive fish kills that have occurred in North Carolina's coastal rivers and sounds.

Burkholder and Noga are "almost positive" that this strange microscopic plant is a new species.

"There's no documented case in the literature anywhere in the world of an algae exhibiting this kind of behavior," Burkholder says. "It's one of several newer species that have been showing up in recent years."

Besides its fish-killing traits, this new algae has shown several other startling characteristics:

- It is a waterborne algae but can live at least 35 days without water.
- Its cystic "shell" is not penetrable by a 100 percent solution of sulphuric acid.
- It has been known to live at least two years in its dormant stage without sustenance.
- It has only one known natural enemy, a microscopic protozoan that eats it slowly. Yet, the algae can make an incredible change, turn itself into an amoeba and eat its enemy.
- The new algae does not accumulate in fish or shellfish muscle, but is known to accumulate in a fish's liver and other organs. Its

effects on humans are not known.

- It can live equally well in fresh water or in salt water and can kill fish at a wide range of water temperatures.

because no one had done serious study of the fish kill problem in the Pamlico and Neuse rivers until Noga began his work.

The new algae has been associated with as many as 25 percent of the major fish kills in the two rivers since 1986.

In February, the algae was blamed for fish kills at a freshwater aquaculture facility near Plymouth and in tanks at the N.C. Aquarium at Pine Knoll Shores. The algae also caused fish kills in tanks at the N.C. Maritime Museum and the National Marine Fisheries Service in Beaufort.

The two scientists realize their work with this strange new algae won't be finished until they come up with a way to control it, to keep it from killing again.

Burkholder says the secret to controlling the species could lie in simply getting a handle on the quality of coastal waters. The new algae seems to thrive in phosphorous-rich waters and areas loaded with unnatural amounts of nutrients.

"This is speculative at this point, but I believe that if we could reduce nutrient levels we could control it, help the situation, probably discourage growth of the organism," Burkholder says.

Because it seems to thrive on poor quality waters, the algae may not be unique to North Carolina, she says. It may be active in other East Coast waters such as the Chesapeake Bay. And scientists have discovered similar algae in the New England states.

"It's a bizarre thing," Burkholder says. "It's killing more fish every day. We've got to find some way to stop it."

C.R. Edgerton

Courtesy of Cecil Hobbs and JoAnn Burkholder



A newly discovered "phantom" algae

- It can kill crabs and some shellfish if they happen to be in the area when the algae activates its toxins.

In non-lethal concentrations, the algae could be making fish weaker and more susceptible to other diseases, like ulcerative mycosis, the red sore disease.

Noga's recent work focuses on finding a cause and cure for red sore, which has devastated fish populations in the state for many years.

The newly discovered organism is closely related to the red tide algae that invaded some Tar Heel fishing waters about four years ago. The new algae could have preceded its red tide cousin by several years.

The algae has remained "hidden"

Tackling Tax Time

If you're a fisherman preparing your own tax return, you might get some helpful tips from *Tax Guide for Commercial Fishermen*.

Internal Revenue Service Publication 595 outlines changes in filing procedures for business use of your home and for capital construction fund investments.

Other changes affect the standard mileage rate, which for 1991 is 27.5 cents per mile for business use of a private vehicle; tax rates and maximum net earnings for self-employment; tax rates and wage maximums for Social Security and Medicare taxes; federal unemployment tax rate; medical insurance for self-employed persons and tax rate on capital gains.

For a copy, write to Sea Grant advisory agent Bob Hines, P.O. Box 3146, Atlantic Beach, NC 28512. Or call 919/247-4007.

Free Pamphlet Gives Composting Tips

Growing concerns over solid waste disposal have put composting at the top of the heap in terms of solutions.

Whether it's the fish heads and entrails from your latest fishing adventure or Sunday's leftovers, a great deal of your household garbage can be composted with relatively little work on your part.

The bonus is that the compost that is formed can be used in your garden or flower beds, reducing the need for fertilizers and organic amendments.

A new publication from the Mississippi Cooperative Extension Service, *Composting: Nature's Way to Recycle*, can provide you with the facts about composting and the know-how to set up and operate a backyard compost pile.

The seven-page pamphlet addresses a number of commonly asked ques-

tions concerning composting, including what type of materials can be used, how to locate, build and care for a pile, and how to deal with the most frequent problems that occur.

The publication is free and may be ordered from Mississippi Sea Grant Advisory Service, 2710 Beach Blvd., Suite 1-E, Biloxi, MS 39531. Or call 601/388-4710.

Fishy Ingenuity, California-Style

When Mendocino County outlawed the dumping of seafood waste in the county landfill in the mid-1970s, California seafood producers were pressured to find alternative uses for seafood waste.

The Sea Pal Company responded by developing a liquid fish product for distribution to garden supply outlets, reports the latest newsletter from the California Sea Grant Extension Program. The company sold the emulsion in 1-gallon containers.

But the local market for fish emulsion could not absorb all the county's seafood waste.

Another entrepreneur developed a composting formula using fish waste and sawdust. Seafood waste not used by Sea Pal and other producers was made into "Albert's Best Fish Compost Formula."

Whole fish carcasses, shark skins and crab shells were completely broken down in Albert Hall's composting process. Only a few crab claw tips defied complete decomposition.

The compost, mixed with soil before planting and occasionally limed, supported such Mendocino crops as peas, potatoes, corn, lettuce, cabbage, brussels sprouts and mustard greens.

The liquid fish emulsion was often used as a supplemental fertilizer. Landscape and local gardeners also bought Albert's Best Fish Compost.

Water Quality Gets a Voice

Everyone's talking about water quality.

Coastal residents are increasingly concerned about the pollutants that find their way into creeks, rivers and sounds.

Fish are dying. Shellfish are contaminated. Answers aren't easy to come by.

The Sea Grant advisory board has ranked water quality as its number one priority for future initiatives.

That's why Sea Grant has taken a bold new step. Sea Grant Director B.J. Copeland and Marine Advisory Service Director Jim Murray have secured funding from the national office of Sea Grant to add a water quality expert to Sea Grant's staff of advisory agents and specialists.

This new specialist will develop and implement a coastal water quality extension education program using research from a variety of coastal entities, including Sea Grant and the Albemarle-Pamlico Estuarine Study.

With these resources in hand, the water quality expert will help teach the public how to keep North Carolina's coastal waters as clean as possible. Emphasis will be placed on programs designed to assist coastal governments in interpreting, understanding and using the latest water quality technology.

Murray says the new advisory agent should be in place by early summer.

A Cheaper Way To Fight Erosion

Are you looking for a low-cost, innovative way to control eroding shoreline on your soundside property?

A combination of planted marsh grasses with a small wooden breakwater might be the solution, says Sea Grant coastal engineer Spencer Rogers.

Is the water offshore shallow? Is there too much wave activity for marsh grasses alone to control erosion on your property?

If the answer is yes, then marsh-breakwaters could be a more environmentally desirable alternative, at one-third to one-half of the cost of bulkheads.

With funding from the Albemarle-Pamlico Estuarine Study, eight marsh-breakwater demonstration sites have already been selected in northeastern North Carolina. At selected sites, cost-sharing is available for up to 50 percent of a 100-foot demonstration project, says Rogers.

To keep the cost reasonable, waters 50 feet offshore should be no deeper than 3 feet, he says.

If you'd like to participate, call Rogers at 919/458-5780.

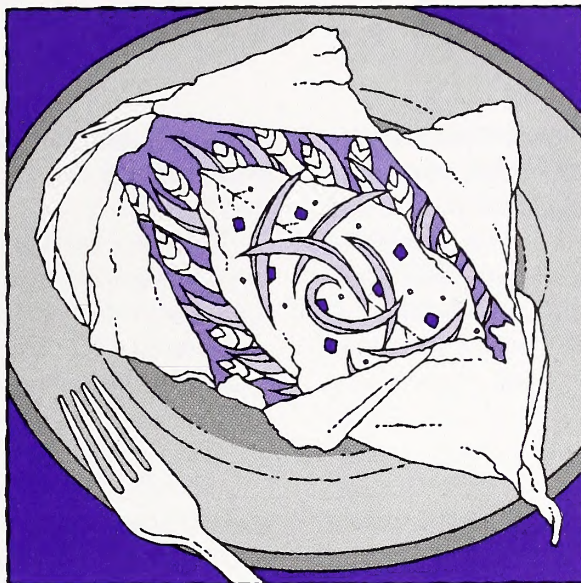
The Paper Gourmet

Food cooked and served in parchment is a specialty item on some restaurant menus. But you don't have to be a gourmet cook to use this method. It's really quite simple. Just seal food in parchment packages, place in the oven, and soon you'll have a great meal.

And cooking in parchment, or *en papillote*, is fun! Just cut a slit in the top of each package and let everyone at the table cut or tear one open. Each packet is an individual serving. As the food cooks, steam fills and inflates the packages. The flavors mingle and the natural juices are held in.

Some cookbooks tell you to precook food, then reheat it about five minutes *en papillote*. But for most preparations this is an unnecessary step. The seafood recipes we prepared were cooked entirely in the parchment. They were attractive, moist and delicious.

Try using skinless fillets in your parchment cooking. They hold



together well, and you don't have to worry that they'll break apart when you serve them. Always feel free to substitute species. Use the freshest fish you can find at the market. You can easily adapt favorite seafood recipes to parchment cooking. Don't be afraid to try.

Parchment packages can be made several hours ahead of time and refrigerated. They can go directly from the refrigerator to the oven.

Parchment can be cut into rectangular or oval shapes. But the classic pattern is a heart shape.

1. Cut a piece of parchment 12 x 18 inches or twice as wide as the fillet to be cooked. Fold in half (9 x 12 inches). Starting at the fold, draw half a heart shape and cut it. Unfold.

2. Lightly oil all but a 2-inch border of the parchment. Center food on one side of the heart, near the fold. Leave a 2-inch border at the edge.

3. Fold the paper over the food so the cut edges meet. Starting at one end, fold a small section of parchment together, then fold again. Hold this section down and fold the next section. Continue until edges are completely sealed.

4. Place the papillote on a baking sheet and place in a preheated oven. Cook for the designated time.

5. The pouch will puff up with steam and will brown during cooking.

Although it is difficult, you may want to check for doneness the first time or two that you cook in parchment. Just open one package to check. You can't reseal it well enough for steam to rebuild, but it will still continue to cook if you have to return it to the oven.

Don't be afraid to try cooking *en papillote*. It's easy and fun. And you'll have some delicious seafood!

Flounder Baked in Parchment

- 6 small flounder or other lean fillets
- Vegetable oil
- 3 Tbs. freshly grated Parmesan cheese
- 1 tsp. dried basil
- 1/2 tsp. salt
- 1/2 tsp. garlic powder
- 1/2 tsp. freshly ground black pepper
- 3 canned tomatoes, coarsely chopped
- 3 Tbs. minced green onion, incl. tops
- 3 tsp. minced green pepper

Prepare 6 pieces of parchment. Lightly oil each.

Place a fillet on each piece. In a small bowl, combine Parmesan, basil, salt, garlic powder and pepper. Sprinkle evenly over fish. Place equal amounts of tomato, onion and green pepper on top.

Close parchment. Place on baking sheet. Bake at 400 F until puffed and lightly browned, about 12 to 15 minutes. Place on individual plates. Serves 6.

For more parchment recipes, write Joyce Taylor at the N.C. State University Seafood Laboratory, P.O. Box 1137, Morehead City, NC 28557. To receive bimonthly doses of cooking wisdom from North Carolina's seafood guru, subscribe to *Mariner's Menu*, Taylor's free newsletter. To subscribe, write Sea Grant, NCSU, Box 8605, Raleigh, NC 27695.

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 or staff.

A Call For Balance

Dear Editor:

As a regular reader of *Coastwatch*, I want to commend you on your excellent coverage of environmental issues facing North Carolina's coastal region. As an economic development advocate for one of North Carolina's coastal counties, I am aware of the vital role that water quality plays in our tourism and fishing industries. Increasingly, however, those traditional industries are not capable of providing adequate employment for the citizens of coastal counties.

In many coastal counties, unemployment levels are running as much as 50 percent over last year. Our social services populations in Carteret County, including food stamp and AFDC (Aid to Families with Dependent Children) recipients, have increased over 40 percent from levels of a year ago. Many rural residents of the coastal area are employed in low-wage, no-benefits jobs with no health coverage other than that which is provided through Medicaid programs.

It is easy to develop a narrow, single-issue, reactive approach to coastal development. Many of the environmental interest organizations highlighted in your November/December issue have been extremely effective in curtailing coastal growth, sometimes at the expense of economic opportunities that are available to residents in other areas of the state.

I hope that in future years environmental interest organizations will expand their focus to help craft strategies for addressing infrastructure deficiencies and expanding employment opportunities in the coastal region, while maintaining a commitment of environmental protection. Expanding centralized wastewater treatment and extending natural gas are examples of improvements which can benefit the economy and the environment.

Donald A. Kirkman
Director, Carteret County Economic
Development Council
Morehead City, NC

Marinas Environmentally Positive

Dear Editor,

Thank you for mentioning both points of view in the article by Carla Burgess, "Strength in Numbers: Pooling Resources to Make an Impact" (November/December 91).

I was quoted in Ms. Burgess' article as saying that "marinas probably get picked on by environmentalists because they are highly visible and they border on industrial."

I think what I said was marinas are highly visible because they sit at the water's edge and therefore are more susceptible to scrutiny.

The photograph on page four of a marina is Minnesott Beach Yacht Basin, which is my family's business. As marina owners, we are extremely concerned that the environment remain pristine so that we, our boaters and the next generation will enjoy the magic of the Neuse River. We enforce a closed-head policy in our facility. We provide dumpsters and solvent-waste/spent-oil disposal free of charge. We also have a pumpout station.

Marinas provide access to the water for many people and help to protect water quality by enforcing an environmentally healthy policy in-house. With this in mind, marinas are one positive way to develop the waterfront.

I have enclosed my subscription request, as I enjoyed reading *Coastwatch*.

Susan Hebert
Minnesott Yacht Repairs, Arapahoe, NC

Curious About Photographs

Dear Editor:

The cover of the November/December issue of *Coastwatch* is excellent. It looks similar to our view from Hampstead, and we are curious to know the location.

May I suggest that you publish the identity of all your pictures and covers? Obviously, some of them are general and represent non-specific scenes, but in the last issue, I think it would be helpful to know the locations on pages 4, 8 and 9 as well as the cover.

Barbara Thorn, Hampstead, NC

The cover shot in our November/December issue was taken by Beaufort photographer Scott Taylor from the Emerald Isle bridge over the Intracoastal Waterway. The photo on page four is of the Minnesott Beach Yacht Basin (see previous letter) and the photo on page nine, also by Scott Taylor, is of Bird Shoal and Beaufort. The location of the photo on page eight is unknown.

Fishing season is right around the corner. If you want to know more about catching, cleaning, storing and eating your favorite species, the following publications should help. See ordering information at the end of this page.

HOW MANY FISH CAN I CATCH?

No North Carolina fisherman should be without *A Recreational Guide to Management of Fish in South Atlantic Waters*. This reference provides current biological data and the latest state and federal regulations for popular species of marine fish found off the North Carolina coast. A handy table describes catch limits in total length, fork length and pounds. This popular guide is updated as regulations change. Free. Ask for publication number UNC-SG-89-06.

DRESSING FOR SUCCESS

If you want to know the best ways to handle, transport, dress and store fresh fish, you will want to see two of Sea Grant's colorful brochures, *Bringing the Catch Home* and *Dressing Finfish*. These brochures are aimed at making sure your catch is protected until it reaches your plate. *Bringing the Catch Home* shows proper methods for handling, transporting and storing

fresh fish. *Dressing Finfish* is a handy illustrated guide to cleaning your fish. The brochures are 50 cents each. Ask for publication numbers UNC-SG-86-26 and UNC-SG-86-10, respectively.

NO-NONSENSE NEWSLETTERS

Keep up with the latest trends in the commercial fishing world. Subscribe to



Marine Advisory News. Edited by Sea Grant marine advisory specialists, this quarterly newsletter provides information on research, gear, fishing techniques and upcoming events. A subscription is free.

Another free newsletter, *Mariner's Menu*, focuses on different seafood preparation and cooking topics and includes six to 10 recipes per issue. This bimonthly newsletter is written by Sea Grant seafood education specialist Joyce Taylor, who is well-known for her culinary expertise. Ask to be placed on the mailing list.

NEW FROM UNC SEA GRANT

The presses keep

rolling at Sea Grant. The latest in our collection of books on the natural history of North Carolina is *Birds and Mammals of the Cape Hatteras National Seashore*. This book takes a 35-year look at the birds and animals that call the Cape Hatteras National Seashore home. Research for the book was compiled by James Parnell, William David Webster and Thomas

Quay, all recognized ornithologists. The text shows how the populations and habitats of hundreds of birds and animals in the Cape Hatteras Seashore have changed over the years. Included are photographs of some of the listed species. For your copy, send \$7 and ask for publication number UNC-SG-92-01.

Also fresh from the Sea Grant presses is *Turtle Resuscitation Procedures*, a laminated card that describes how trawl net fishermen can help save the lives of turtles caught accidentally in their nets. The N.C. Division of Marine Fisheries helped fund this important project. Though aimed expressly at commer-

cial trawl fishermen, non-fishermen may obtain this free publication from Sea Grant (ask for publication number UNC-SG-92-02) or from the N.C. Division of Marine Fisheries, P.O. Box 769, Morehead City, NC 28557.


CATALOG LISTS THEM ALL

UNC Sea Grant has many more books, brochures, pamphlets, technical reports, posters and manuals in its new publications catalog. The catalog contains something for anyone interested in the people and processes that make the North Carolina coast unique. It's free. Just ask us for a copy.

Ordering Information

When ordering Sea Grant publications, please use your mailing label from Coastwatch or the customer identification number that appears above your name. This will speed delivery. Also, be sure checks are made payable to Sea Grant, unless otherwise specified.

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Blue Crab Bonanza



I N C L U D I N G

Hard Crab Heyday

P L U S

A Crustacean's Coming Out

A L S O

The Process of Picking

Coastwatch Staff:

Kathy Hart, Managing Editor
Jeannie Faris and Carla B. Burgess,
Staff Writers and Editors
L. Noble, Designer
Julie Snyder and Debra Lynch,
Circulation Managers

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, an 11-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 blue crabs by Scott Taylor.

Inside front cover photo of floating shedding trays by Lundie Spence.



Printed on recycled paper.

Dear Readers,

This issue, *Coastwatch* takes a close look at the blue crab. This coastal curmudgeon makes up the state's largest fishery. Last year, North Carolina watermen harvested a record 41 million pounds of hard blue crabs valued at slightly more than \$9 million. Only the shrimp fishery is more valuable.

Since blue crabs are such an important part of coastal North Carolina, we thought you might want to know more about these feisty crustaceans.

Former *Coastwatch* writer Sarah Friday Peters examines the hard crab fishery. She talks with fishermen who make their living from the wire pots that dot our coastal estuaries.

Shoreside, Carla Burgess explains the intricacies of shedding soft-shell blue crabs. She describes the language, lore, mechanics and economics of a business dependent on the blue crab shirking its hard shell.

I take readers into the Carolina crab houses, those places where they cook and handpick tub after tub of

sweet, succulent meat. The processing plants are undergoing a quiet revolution as they grapple with ways to bring new technology and higher profits to the industry.

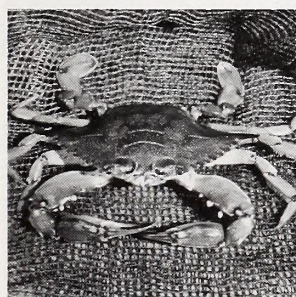
This month, I'd also like to introduce you to our newest staff member, Jeannie Faris. Faris comes to Sea Grant from *The Greenville News* in South Carolina, where she covered the legislature in Columbia. Despite spending a few years in the Palmetto state, Faris grew up along the North Carolina coast in Wilmington.

But with our welcome to Faris, we must bid farewell to C.R. Edgerton. Edgerton left Sea Grant to return to *The Smithfield Herald* in Johnston County. We'll miss Edgerton's folksy writing, beautiful photographs and thoughtful ways.

We hope you enjoy learning more about blue crabs. For many, it will be the last issue of your subscription. We hope you'll stay with us, and we'll see you next issue.

Happy reading,
Kathy Hart

in this issue



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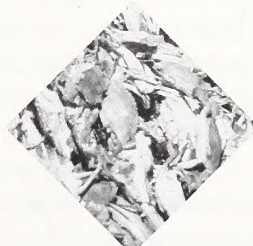
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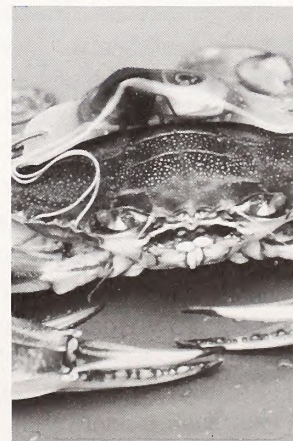


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COASTWATCH 1



Capturing Crabs Along the Carolina Coast

By Sarah Friday Peters

The March morning wind blows cold against Russell Howell's ruddy face as he steers his 24-foot skiff down Pettifords Creek toward White Oak River.

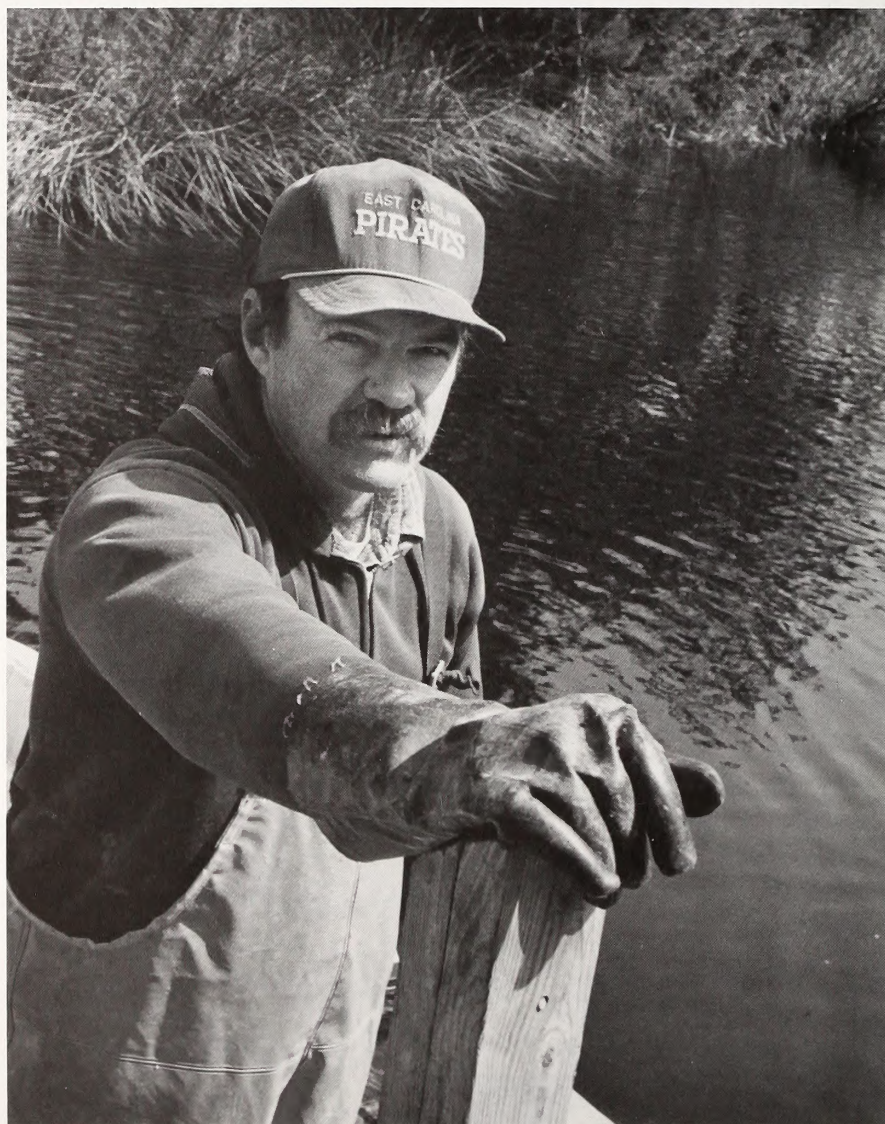
"We don't have to go far away from home to work," the crabber says, as he maneuvers through the reedy wetlands between his home and the open river. His companion, Mad Dog, paces quietly across the boat as blue herons ahead take flight in the morning sun.

By 8:30 a.m., the air remains a cool 40 degrees — too cold to catch many crabs.

"We'll be working in the channel today," Howell says. "Most of the crabs today will be in deep water because of the weather."

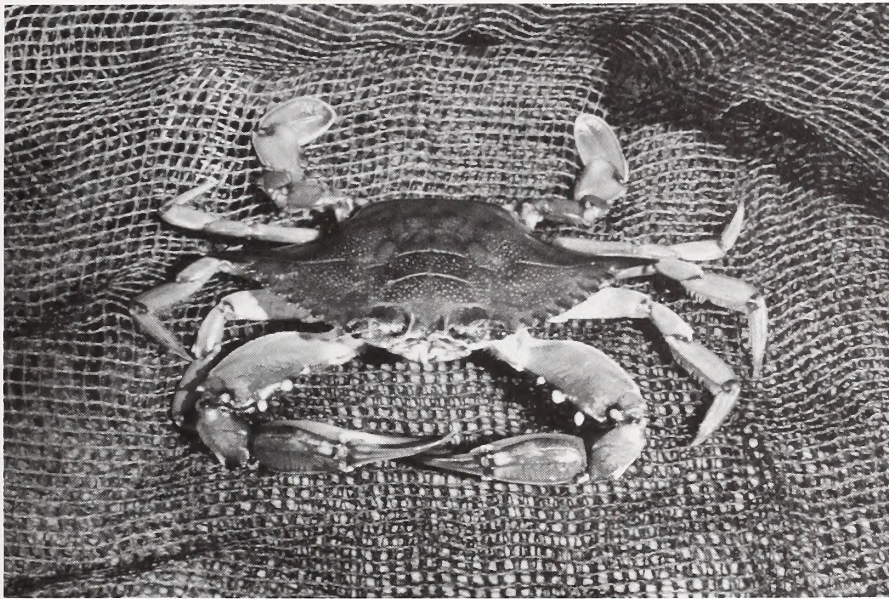
As crab fishermen like Howell learn, weather and the seasons chart the cycles of their work on the water. The intricate mesh of sun and tides, winds and water temperatures determine the place and time blue crabs in North Carolina become ready for catching. To most, success in the fishery, one of the state's largest, comes in reading nature's clues and following its ebbs and flows.

North Carolina's coastal rivers,



Carteret County crabber Russell Howell.

Sarah Friday Peters



A newly shed crab being readied for market.

salt marshes, sea grasses and estuaries create prime habitat for blue crabs. Their bounty has placed North Carolina in the top three crab-producing states on the East Coast for the past 20 years. The state follows Virginia and Maryland, says Mike Street of the N.C. Division of Marine Fisheries. Last year, crabbers landed more than 41 million pounds valued at \$9 million in the state, DMF reports.

The abundance of crabs and a year-round fishery in some parts lure crab fishermen to the water like fish to fresh bait.

In 1991, 7,605 commercial fishermen acquired state licenses to set an estimated 623,450 crab pots in North Carolina waters. Another 1,671 trawled for crabs. The year before, DMF licensed 7,511 fishing vessels for crabbing.

Most crabbers, like Howell, work on their own, setting and checking crab pots almost every day. Some man larger boats — 25 to 75 feet — to trawl for crabs with large fishing nets. Less than a handful crab the old-timey way, using a line of string called a trotline to tempt crabs with dangling baits.

Crabbers comb the shoals of Pamlico, Albemarle, Croatan and Core sounds, as well as coastal rivers such

as the Neuse and the Pamlico.

On White Oak River, Howell begins his rounds alone this March morning, except for one other crabber half a mile away. A flannel-lined jacket, sturdy orange waders, boots and an East Carolina University baseball cap protect him from the cold as he guides his skiff around the shoals.

The abundance of crabs and a year-round fishery lure crab fishermen to the water like fish to fresh bait.

In peak season, from April to October, about 50 crabbers work this river and Bogue Sound, Howell explains. This morning, they know most pots would come up empty.

March's cold weather sends most blue crabs burrowing in the muddy bottomland. Males, especially, winter in the deeper, fresher waters, while females seek saltier waters near the ocean.

"As weather warms and winds warm, crabs move into this river like a school of fish from the ocean," Howell says. "The females do all the migrating. The males stay in the

rivers, sounds and creeks."

Young crabs spawned in nearshore ocean waters migrate to the protective estuaries rich with food. In 12 to 18 months, they mature and the cycle begins again.

Normally, Howell sets about 400 crab pots in the river and sound, checking about half of them each day. This morning, he checks only 30 or so.

"This one don't even have nothing in it," he says, hauling in another seaweed-covered, wire-mesh cube. "It's got to have a little more than that in it."

Mad Dog races back and forth on the boat, barking at pelicans as the crabber replaces the soggy bluefish in the pot's bait chamber.

"Generally, you can't go to work out here without the pelicans bothering you," Howell says. "I've had pelicans get their beaks stuck in the hole [of a crab pot]. With a dog on the boat, they'll stay at least 40 to 50 feet away."

Like many crabbers, Howell works full time in the fishery, catching hard crabs in the winter, spring and fall, and shedding soft crabs through the summer. More and more fishermen in his area are

Continued

Crab pots await duty in the estuary.

crossing over to crabbing, following poor harvests of clams, scallops and oysters in the past few years.

“As far as a year-round thing, it’s pretty good,” Howell says. In North Carolina, crabbing provides a steady income for him and his family. He fishes all but six weeks from Christmas to mid-February. That’s why he moved to Carteret County 11 years ago from Long Island, N.Y., where the season lasted only two months.

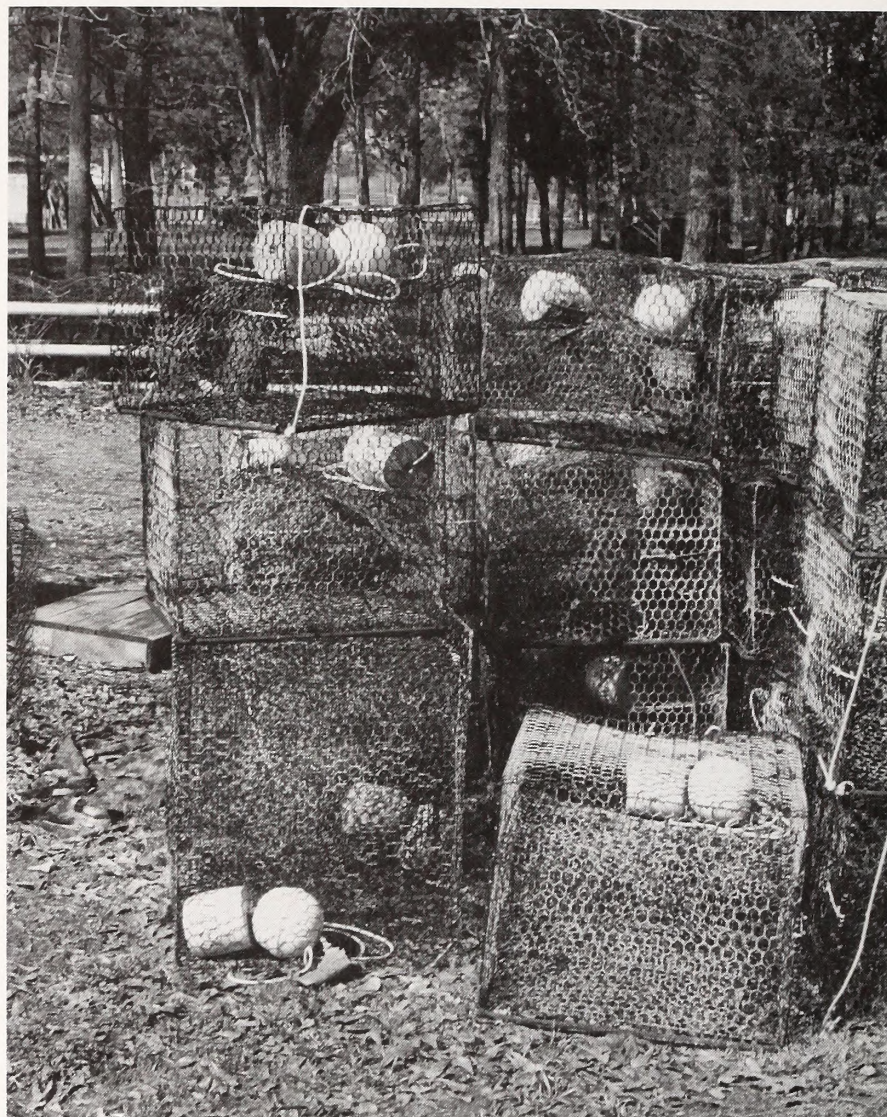
Tradition draws others to the fishery in North Carolina. Since the 1800s, commercial fishermen in the state have sought the savory crustacean for local and regional markets. Over the years, crabbing has stayed much the same with few advances in gear.

Before 1936, fishermen primarily courted crabs with trotlines or wire-mesh scrapers that looked like baskets on a stick. That year, fishermen in the Chesapeake Bay introduced the crab pot, a 2-by-2 mesh box with chambers for catching and most importantly — keeping — crabs.

Trawls, which graze the waters for crabs, and hydraulic pot pullers

March’s cold weather sends most blue crabs burrowing in the muddy bottomland.

made the work easier too. But for the most part, crabbing remains a one-man, small-boat fishery in North Carolina. About 90 percent of today’s crabbers use crab pots for fishing, estimates Street, the DMF research section chief.



Sarah Friday Peters

Tar Heel fishermen who trawl typically ply the waters around Pamlico Sound in the winter, when crabs bury in the deep waters. “There are more trawlers around here than there are pots,” says fisherman Levi Hopkins of Beaufort County.

When the water warms to 50 degrees, he and other fishermen rig their boats for crabbing. And as long as their nets fill with crabs, they keep fishing.

“You go different places all the time,” he says. “You don’t stay in one place. You move around.”

Unlike Howell, Hopkins rotates fisheries throughout the year to make a living.

“I do a little bit of all of it, whatever I can make the most money at,” Hopkins says. “I think you make your advantages. Whoever works the hardest comes out on top. If you’re going to make any money out of it, you work hard.”

Hard work is one thing crabbers agree it takes to make a living.

“As fisheries go, it’s probably a relatively inexpensive thing to get into,” says Bob Hines, Sea Grant’s marine advisory agent at Pine Knoll Shores. “But it’s not cheap.”

Howell invests about \$1,200 for every 100 crab pots he buys. With zinc to protect the pots from corrosion, and rope and buoys, expenses add up to about \$15 to \$20 per pot.

Bait costs about 25 cents a pot. Crabbers usually buy scrap fish such as menhaden and bluefish in the summer and pinfish and croaker in the winter. Others fish for their bait, but most say it takes too much time.

Howell uses 12 gallons of gas to cover 80 miles on a typical day. When the harvest is good, it's worth it. But when the pots don't fill, it hurts.

Some days, he makes 50 cents to \$1 a pot. "And some days you can make nothing," he adds.

Most state crabbers sell their catch to local restaurants or to fish houses that ship the product to other markets. Prices for live crabs fluctuate like the tides. In the winter, when crabbers catch few hard crabs, the price goes to 40 and 50 cents a pound. Jimmies, or large male crabs, sometimes garner \$1 a pound since they're sold to Northern markets. But by summer, when crabbers can catch up to 1,000 pounds a day, the price drops to 15 cents a pound.

"You can tell how good the crabbing is because of the price," Howell says. "At forty and fifty cents a pound, you know you're not going

to catch too much."

When the crabs start moving in the sounds, crabbers follow, sometimes working 18 hours a day, seven days a week.

"You work real hard when the crabs are there," Howell says. "You have to make the money if the opportunity is there."

Hard work is one thing crabbers agree it takes to make a living.

"Some make very good livings and some barely get by," Hines says.

Street estimates a highliner, or expert fisherman, fishing 500 to 1,000 crab pots a day could gross \$50,000 a year — before paying expenses and one helper. And Howell estimates a fisherman can make about \$30,000 working with hard and soft crabs.

With rising operating costs and competition from imports and other crabbers, "the real return to fishermen is probably considerably less than it was 10 years ago," Street says. "To maintain their market

share, they must use more pots. They get the same catch with twice the pots they used five years ago."

Crabbers face other challenges as well. A shell disease struck crabs in the Pamlico area. And a constant feud boils between shrimpers and crab potters over territories.

One of Howell's biggest concerns is declining water quality. Runoff from nearby development and the Croatan National Forest infuses harmful nutrients. And storms upset the delicate balance between fresh and salt water, he says. Wetlands help filter the nutrients, but they're threatened now, too.

"Wetlands are a must for crabs," he says. "Without them, we'd have nothing. Marshes, creeks, rivers and sounds — without that, that's the end of the fishery. The more it disappears, it affects the cycle."

Howell has banded with other Bogue Sound fishermen to preserve the area's fishery. Crabbers tend to assemble in small, localized groups rather than in large associations, he says, so they can voice their concerns for the waters they work.

Howell's hope for the fishery's future is uncertain. "Somebody will always be doing it," he says.

At the end of his morning on White Oak River, he circles the shoals and heads home with a box half full of blue crabs. For now, nature's bounty seems elusive. But nature's clues promise something better. 🐞

Howell and Mad Dog head out on White Oak River for a morning of crabbing.



Sarah Friday Peters

Shedding a Soft Commodity



Scott Taylor

By Carla B. Burgess

Jerry Wolff moves around inside his gas-heated shed like an expectant parent. The Otway fisherman scoops blue crabs from a basket with his hands, placing them carefully in one of a dozen wooden trays filled with water.

The afternoon of trawling in Core Sound produced a good sample of peelers, crabs that are about to shuck their shells to grow in an annual rite of spring.

Like other commercial fishermen, Wolff has learned the telltale signs of an impending molt — the color changes on the creature's paddle fins and apron, its docile behavior. It's a skill that can mean the difference between pennies or dollars a crab.

Once they bust loose, the nearly 2,000 crabs he's so diligently tending this late March day will bring a hefty \$2 apiece on Northern soft-shell markets. In the restaurant atop the

World Trade Center in New York City, customers will salivate over the soft, sautéed crustaceans to the tune of \$50 to \$75 a plate.

As April, May and June warm the waters north of here and more soft crabs are available, prices will drop. Still, an estimated 800 soft crab shedders will haul in \$6 million or more this year in a burgeoning North Carolina industry.

Tar Heel fishermen have joined Chesapeake Bay crabbers as top contenders in the soft crab business. Dare County leads the state, with more than 1 million pounds landed in 1991.

In the restaurant atop the World Trade Center in New York City, customers will salivate over the soft, sautéed crustaceans to the tune of \$50 to \$75 a plate.

Sea Grant estimates the value of North Carolina's soft crab industry — including income from selling and shedding peelers, sales of gear and crab pots, labor and shipping and packing expenses — at \$12 million annually.

While many other fisheries are on the decline, blue crabs are booming. But the demand for soft crabs is still growing faster than North Carolina fishermen can pull in their peeler pots.

Wolff plucks a soft crab from a tank and invites a reluctant visitor to handle it. Newly shed of its armor, the usually aggressive animal sits as harmless as a Gummy Bear in the guest's outstretched palm.

A few hours earlier this crab struggled with every ounce of energy in its 3-inch body to escape its old shell. Crabs molt to grow, and will shed some 20 to 30 times in their two- to three-year lifespan.

"There'll never be a time when it doesn't amaze me," says Wolff of the shedding ritual. "Especially when you have a tank of 50 or 60, and they're all coming out."

For seven years, Wolff collected peelers to sell to other Carteret County crab shedders. But three years ago, he decided to go for the glory and shed them himself.

Thanks to the miracle of closed,

Mark Hooper and Mr. B en route to pull pots in Middens Creek.



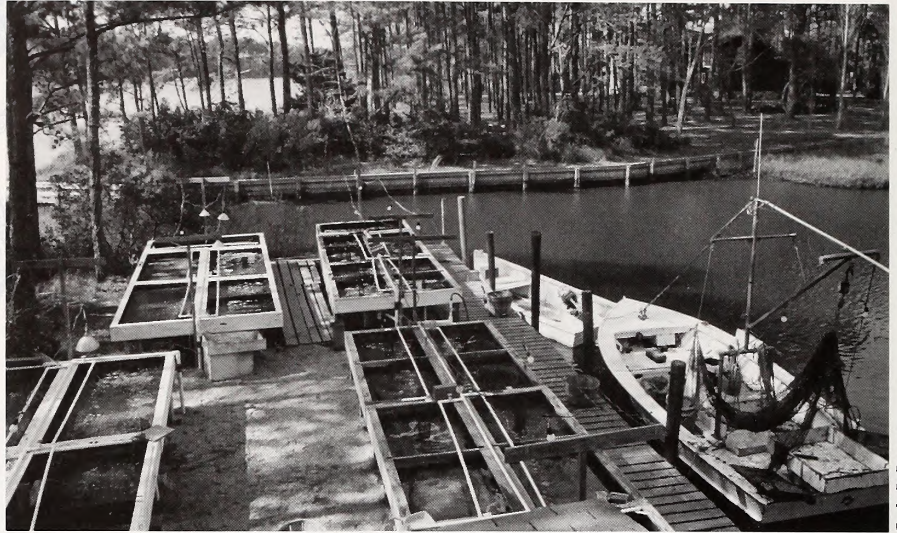
Carla B. Burgess

recirculating systems that draw water from a reservoir, Wolff can shed crabs in his backyard, despite the lack of waterfront property. (See *Marine Advice*, page 20.)

He darts from tray to tray, plucking out stills, crabs that did not survive the trauma of shedding their tough outer shells. His wife, Dawn, shows him the new sorting order for the crabs in their various states of undress.

Continued

A bird's-eye view of Hooper Family Seafood's shoreside shedding system.



Carla B. Burgess

“Bust, soft, crack,” she says, pointing to a tank sectioned off into three areas.

The couple has begun what for the next two months will be a 24-hour-a-day, seven-day-a-week work schedule. The estuarine waters hugging this coastal county warm earlier than other areas in North Carolina. Core Sound's early run of peelers gives Wolff and other locals even more edge on the market.

“We get a higher price for less crabs,” he says. Although the money is alluring, there's little glamour — or shuteye — in crab shedding. Peelers have to be checked constantly.

“I don't sleep at night,” says Jerry. “I get naps — four or five hours here and there.” He and Dawn swap shifts throughout the night to check and sort the crabs during their various stages.

Jerry rattles off a litany of liabilities — thousands of dollars for crab pots, hundreds of dollars for gear, sky-high bills for electricity to keep pumps and lights running. “Right now if I make \$1,000 in a week, I haven't even begun to pay my expenses,” he says. “The early stuff pays the bills. The jimmie potting is my income.”

Jimmies, or large, mature male crabs, lure female peelers to specially

adapted crab pots. Isolated in a trap door, jimmies release a chemical that draws multitudes of amorous females clamoring for company.

Female blue crabs reach sexual maturity after their final or “terminal” molt. The male carries her around until she sheds, then cradles her to mate and protects her afterward until her shell hardens.

Of course, female crabs that fall prey to jimmie pots won't be allowed to reproduce. But Sea Grant agent and soft-crab expert Wayne Wescott

Though frozen crabs will sell later in the season, most restaurants want the soft-shells alive.

says there is little chance the soft crab fishery will upset the natural balance. The she-crabs that remain in the wild are a prolific lot.

Females mate only once but can store sperm to fertilize more than one batch of eggs. “A female may produce 6 million babies from one mating,” says Wescott.

A few miles east in Smyrna, Penny Hooper leans in anticipation over a tank of crabs along the shore of Middens Creek. A medium-sized crab has almost backed out of its

greenish-brown exoskeleton. Only the shell of one blue claw impedes the crab's escape.

“You want to help them but you can't,” says Penny, who along with husband Mark, keeps Hooper Family Seafood afloat. “If you touch them, they'll drop a claw.”

Chefs like their crabs intact, she says, with at least one claw if not both.

Ignoring her own advice, she tugs gently at the sleeve of the old shell and the crab jerks its arm free.

The crab will remain in the tray for two to three hours while it pumps water and puffs out the wrinkles in its enlarged body. It is separated from other pre-molt crabs, who are quick to cannibalize busters and those that are newly shed. If left in the water longer than a few hours, the crab would begin to harden again.

Timing is everything in the soft crab business. Once the Hooper's crabs have recuperated from shedding, they are removed from the water, packed in a straw-lined cardboard box, topped with wax paper and a drizzle of ice, and shipped via refrigerated truck to the Fulton Market in New York.

Though frozen crabs will sell later in the season, most restaurateurs want the soft-shells alive. Chefs will

clean the crustaceans by removing the eyes, mouth, gills and apron, a movable flap on the crab's abdomen. (See Cleaning Soft-Shell Crabs, page 16.)

A soft crab has 10 to 15 times more edible meat than a hard crab. "Out of 100 pounds of hard crabs, if you get 10 pounds of meat, you're doing good," says Wescott.

Soft crabs are classified by size. The crab is measured from the distance between the two points of its carapace. Mediums are 3 1/2 to 4

inches across; hotels, 4 to 4 1/2 inches; primes, 4 1/2 to 5 inches; jumbos, 5 to 5 1/2 inches; and whales, 5 1/2 inches and over.

During the early peeler run, there's even a market for 2- to 3-inch crabs, which are served as hors d'oeuvres in swank eateries.

Penny Hooper calls these harbingers of spring "Core Sound Petites." Smaller crabs, which molt early and often, herald the shedding season.

In May and June, the Hoopers

will be moving 'round their 20 shedding trays day and night in a high-speed game of molting musical chairs. The payoff is sweet, but in peak season, crabs bust as fast as shedders can pull and pack them.

"I imagine it's like Christmas Eve in a department store," says Penny. "You live through it and you're happy the next day."

As peelers advance toward their molt, shedders grade them according to the color of the distinct line that appears on the outer edge of the last

A soft crab has 10 to 15 times more edible meat than a hard crab.

two joints of their paddle fins.

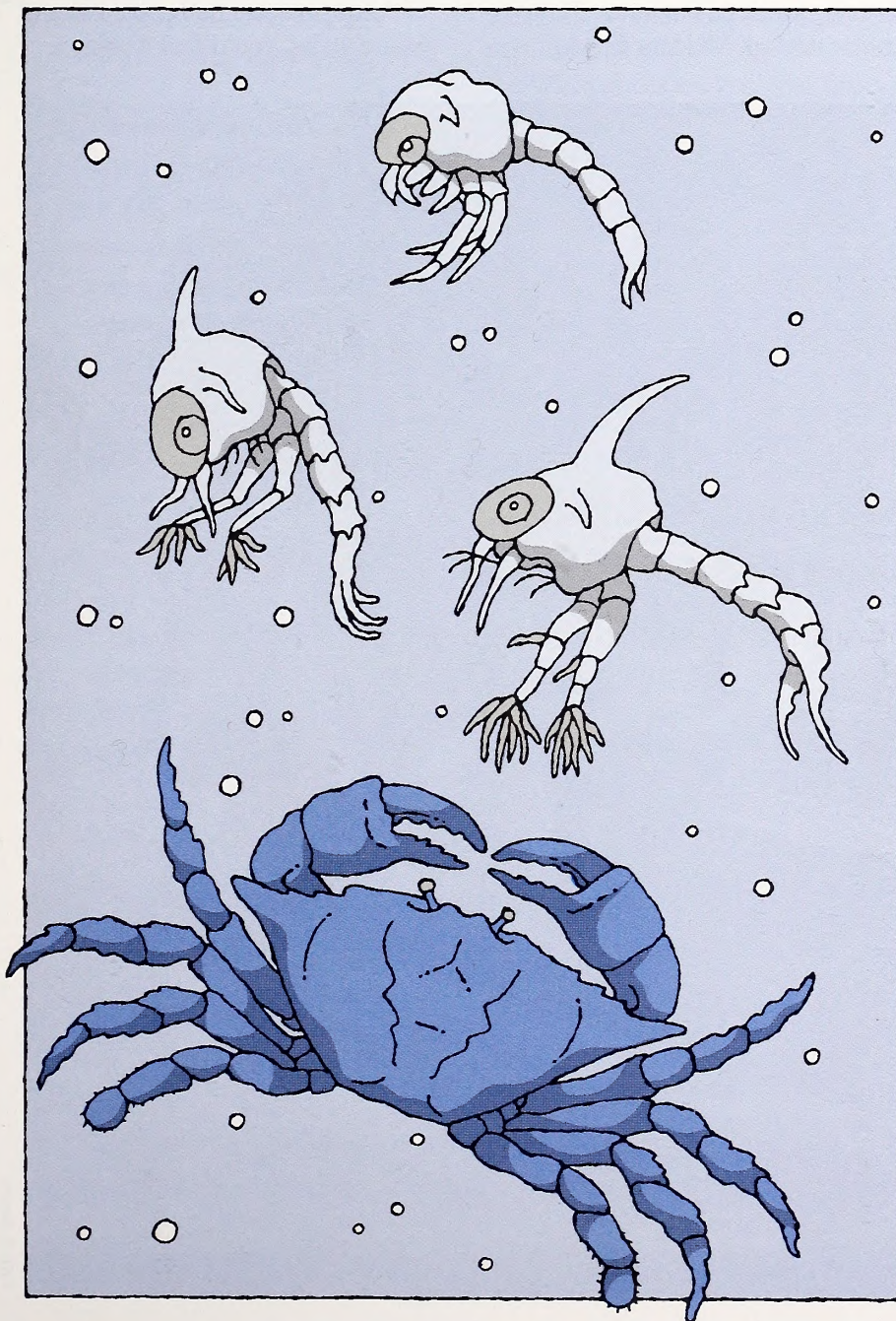
White-line peelers have a white or transparent line and are five to 14 days from shedding. When the line turns pinkish or light purple, the crab is two to six days from its molt and is called a pink-line peeler. A deep red or purple line indicates a "rank" or red-line peeler, which will shed in one to three days.

The buster is the last stage before shedding. A crack develops at the base of the crab's top shell between its two paddle fins.

It takes a skilled and experienced crabber to distinguish peelers. But the good ones can cull whites, pink and reds from hard crabs as easily as a confectioner sorts jelly beans.

Continued

Crabs metamorphose through several larval stages before reaching their familiar adult form.



There are other ways to tell a peeler, such as nicking the hinged side of a crab's claw to check the development of the soft crab inside. But overuse of this method can increase mortality, says Wescott.

Ideally, soft crabbers should harvest only those peelers that will shed in five days or less. White-lines require extra attention and sometimes feeding. Holding crabs two weeks or longer usually results in 70 to 80 percent mortality, says Wescott.

"You should shoot for never holding a crab longer than three days," he says. Shedders should aim to emulate natural shedding mortality,

Ideally, soft crabbers should harvest only those peelers that will shed in five days or less.

which in the wild is between 8 and 10 percent, he says.

Peelers are usually caught in special crab pots — those wire cages that allow crabs to enter through a funnel-like hole on either end and from which they can't crawl out. The pots are lowered to the bottom and attached by a rope to floats on the water's surface.

Peeler pots have a smaller mesh size than standard crab pots, and most don't have bait wells. Besides the sexual hunger that attracts female crabs to jimmies, Wescott explains, not much is appetizing to a pre-molt crab. "Their teeth are soft, their heart is soft, their lungs are soft — they can't eat right before they shed," he says.

Wescott speculates that the pot

itself is inviting to a peeler seeking shelter for its molt. These first few walk-ins entice others. "Crabs like to congregate," says Wescott. "You get one or two in there, and they'll stop and visit."

As Penny Hooper keeps an eye on the peelers, her husband and their assistant Brad Woodward, "Mr. B," prepare the boat for an afternoon of checking some 300 peeler pots. Before leaving, they place several foil-wrapped sandwiches on the engine manifold — a hot supper for an evening break on the water. They motor through Middens Creek,

stopping to pull pots as they head toward Core Sound.

Mark, who fishes for hard crabs in the fall and winter, trawls for peelers as well as bare potting and jimmie potting.

Early in the season, high tide is a good time to trawl near creek edges, where peelers seek shelter in clumps of grasses.

Peeler harvesting methods and fishing locations vary. A good working knowledge of migratory and mating habits is an asset to the serious soft crabber.

"Any time you find populations of mature males, you'd find immature



Penny Hooper and J.R. keep an eye on the peelers.

females," says Mark. "And where there are lots of mature female crabs, you wouldn't find many peelers in that area."

Males live most of their lives in areas of low salinity, such as creeks, rivers and ditches. Females prefer the higher salinity of inlets.

For mating, the two sexes seek middle ground, such as the main sounds between inlets and upper creeks.

After mating, the females migrate downstream toward higher salinity areas, such as the mouths of estuaries, where eggs are laid and hatched.

Mature females usually remain in

**North Carolina's
shedding industry,
like the blue crab that
sustains it, is on the
verge of explosion.**

the spawning area or move a short distance out to sea.

Crab larvae feed on ocean plankton until they transform to the first crab stage, after which they begin their migration to estuarine waters.

The peak shedding season runs from early spring through June, but crabs will continue to molt throughout the summer and into early fall if the water stays warm. The best water temperature for shedding is between 68 F and 72 F.

"The peelers are kind of like the elk coming down from the mountain, but there are always stragglers all summer," says Wescott.

During the winter months, crabs burrow into the bottom and stop growing until spring.

Blue crabs seem to shed relative to the position of the moon, says Wescott.

"There seems to be more soft crab shedding on new moon and full moon," he says. "More children are born on the full moon too. No one

really knows why."

The first full moon in either May or June usually produces the biggest shed, he says.

Crabbers such as the Hoopers and the Wolffs usually call it quits after the peak. But soft-crabbing magnate Murray Bridges, a Dare County shedder with more than 150 trays, will shed until the last crab has crawled into the mud. Through May and early June, Bridges will be shedding up to 180,000 crabs a week.

"By the time we get into the full swing of it, the price will come down to six, eight or ten dollars a dozen," says Wescott.

When prices are very low, many shedders freeze the crabs and hold them until prices rise again.

Bridges' operation in Collington is the largest in the state. But Wescott says a new shedder in Wanchese, with 100 trays and 1,000 crab pots, is gaining ground.

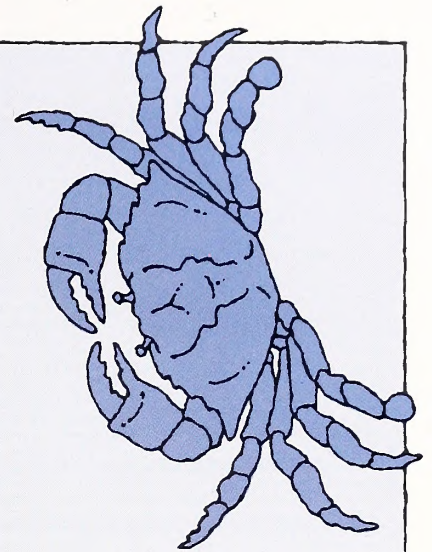
Wescott says North Carolina shedders have hardly tapped the soft crab market, which has tremendous potential for growth.

"Probably more people are in the hard crabbing business than any other fishery we have," he says. "Only 5 to 10 percent of people that are harvesting crabs (in the northern coastal part of the state) are shedding them."

Millions of peelers are caught and sold on the hard crab market. If hard crab fishermen culled and shed their peelers — or sold them to other shedders — soft crab production could more than double without increasing blue crab landings, says Wescott.

The state has a winning combination of salt, estuarine and fresh waters — and plenty of calm, shallow stretches of marsh that make prime crab habitat, he says.

North Carolina's shedding industry, like the blue crab that sustains it, is on the verge of explosion. ❁



What does it cost to set up a flow-through system of your own?

"Ten shedders could easily be constructed for under a thousand dollars," says Sea Grant agent Wayne Wescott.

If you build it yourself, each box costs about \$30, including the cost of plywood sheets, shelving board and wood for bracing. The pump, plumbing and wiring will run about \$500, he says.

You'll need to fish about 100 crab pots, which cost \$15 to \$17 apiece.

Shed 600 crabs in each box twice a week, and you'll produce 12,000 soft crabs. Multiply that 1,000 dozen critters by an average market price of \$10 a dozen, and you've made \$10,000.

Before your pupils turn into dollar signs, subtract your expenses — electricity, gear maintenance and fuel, packing supplies and labor.

And of course, you'll need a boat and waterfront property.

For publications on crab shedding, see The Bookstore, page 25.

Picking New Ways to Process Crabs

Four women pick the white lump meat from a mountain of freshly cooked blue crabs.



By Kathy Hart

After years of stagnation, the North Carolina blue crab processing industry is changing.

Used to be, it was almost a misnomer to call what happened in the crab houses along the Tar Heel coast "processing."

Large carts of hard blue crabs were cooked to a bright red, cooled and dumped onto long stainless steel tables. In the surrounding chairs sat women, black and white, usually older, with hair nets hugging their

gray and white locks to their heads.

With their eyes trained on their fingers and a short knife in one hand, these women nimbly plucked snow-white meat from blue crabs that had more compartments than a lady's handbag. With their fingers a blur and bits of crab meat flying, these pickers could easily fill more than three 1-pound plastic cups with succulent meat each hour.

Once the meat weighed in at its anointed 1-pound weight, a top would be slapped on the container, and the

so-called "processing" was complete. The 1-pound containers of crab were then ready for market, usually in northern cities such as Baltimore, Philadelphia and New York.

Some processors invested in the equipment needed to pasteurize crab meat. Others bought machines to extract the small bits of meat found in the claw and other compartments of the body cavity. Called machine or minced meat, this crab was sold cheaply for use in stuffings and deviled crab.

Despite these attempts at mechani-

industry is being forced to change.

What's forcing the revolution?

Pure and simple economics — the laws of supply and demand.

Harold Stephenson, owner of the Washington Crab Co., says the crab industry is overproducing product. This overabundance of crab meat is driving wholesale prices down and making it hard for processors to survive in an industry saddled with high labor costs and low yields per pound of raw product.

Stephenson estimates that each

Inside a crab processing plant.



David Green

zation, the mainstay of the North Carolina blue crab processing industry continued to be the handpicked meat sold in 1-pound tubs.

There was no fancy equipment, little automation and no new product forms. The processing was labor-intensive and seasonal, lasting from May to November.

But the crab houses made a profit, stayed in business and turned out pound after pound of crab meat.

Now, however, after years of complacency, the blue crab processing

pound of meat he sells costs him \$3.50 in labor. That doesn't include the cost of the live crustaceans he must buy from crabbers.

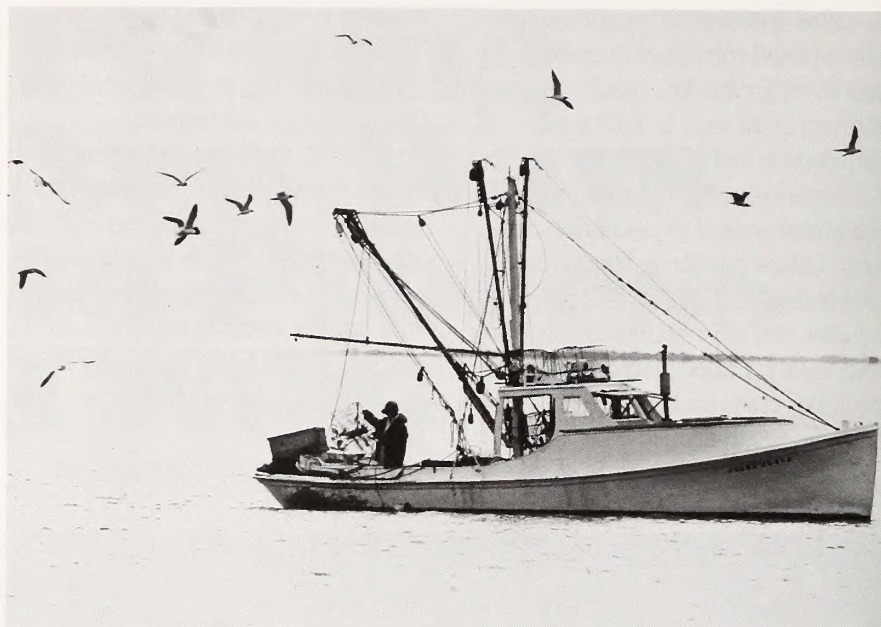
Processors pay watermen, on average, 22 to 25 cents per pound, according to statistics from the N.C. Division of Marine Fisheries. During peak summer supplies, the price drops to 15 cents a pound.

That seems cheap. But it takes 100 pounds of hard crabs to yield 7 to 8 pounds of cooked, picked meat.

Continued



A crabber on an early morning run off Harkers Island.



Steve Murray

Run those figures through a calculator, and you'll find the meat itself costs \$2 to \$3 a pound. Add meat and labor costs together, and the sum approaches \$6.

Last summer, wholesale prices dropped to less than \$6 per pound, Stephenson says. That means processors in many cases were making pennies a pound, and that kind of measly profit isn't enough to keep a crab processor cooking.

"Several major producers in Virginia went out of business last summer," Stephenson says. "I personally think if things don't change, operators in this state will be forced out too. And I don't like to see anybody go under."

Overproduction isn't the only problem facing the industry. U.S. processors are competing against imported and imitation crab meat products, and they are battling regulatory restrictions and labor shortages.

So what's needed to revive the crab processing industry?

A healthy dose of change.

"We need new ways to handle the crab, new processing techniques, new packaging and new health regulations that will allow the industry to grow," Stephenson says.

David Green, Sea Grant's seafood industry specialist, agrees. Green has been working with crab processors to introduce new technology.

With the help of a grant from the National Coastal Resources Research and Development Institute, Green is introducing the industry to cryogenic freezing.

This innovative process uses liquid carbon dioxide or liquid nitrogen to

Because the highly perishable blue crab is marketed as fully cooked and ready-to-eat, Shellfish Sanitation has stringent regulations and guidelines for processing the crustaceans.

flash freeze a product, in this case crabs, in a matter of seconds. Conventional freezing does not work well for blue crab meat because it leaves the meat dry and stringy.

Working with CryoTech Industries Inc. in Florida and Carolina's Pride Seafood Inc. in Plymouth, Green is flash freezing steam-cooked, in-shell crab cores. He's examining the freezing and handling process to

ensure quality, yields and safety.

Using this alternative processing strategy, processors can store the flash-frozen crustaceans at low temperatures (-20 C), then thaw and handpick them later. By using this storage technique, processors could hold their crabs until wholesale prices rise, thereby eliminating some of the seasonal glut and improving their profit margin.

As an added bonus, crab pickers would be assured a longer working season, perhaps even full-time employment.

Green is also looking at cryogenically freezing handpicked meat. The meat would be frozen in 6-ounce, 12-ounce and 16-ounce packages for consumer use.

Green says there is a market for frozen handpicked meat, and consumers are asking for more usable quantities than the traditional 1-pound tubs.

"Meat that is cryogenically frozen during peak supply and held three months is often superior to what's on the fresh market in late fall because of the seasonality of crab supplies," Green says. "Crabs bought in the fall and winter are usually caught in the dredge fishery, so the meat is sandy, gritty, watery and less desirable."

Stephenson says this freezing

technology may be just what the industry needs to stabilize product supplies and just what consumers need to spur demand.

But before processors rush to install atmospheric cookers and cryogenic freeze tunnels, they must get approval for the alternative processing technique from the N.C. Shellfish Sanitation Branch. Shellfish Sanitation certifies Tar Heel blue crab houses for sanitation, facility design and worker hygiene. They also monitor the safety of the finished product.

Because the highly perishable blue crab is marketed as fully cooked and ready-to-eat, Shellfish Sanitation has

Despite an injection of new technology and a fresh look at old regulations, crab processing is still a labor-intensive industry.

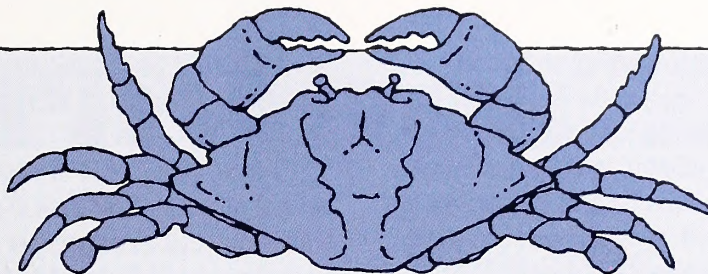
stringent regulations and guidelines for processing the crustaceans.

One such concern is for the presence of a newly discovered pathogen, *Listeria monocytogenes*. *Listeria* is a common bacteria found in nature that can cause serious illness or even death if consumed by humans susceptible to the infection. It's frequently found on raw vegetables, meats, fish and shellfish, including crabs, but is killed during proper cooking.

However, processors must be careful that workers do not reintroduce the bacteria to cooked crab through improper hygiene or through cross-contamination with raw product.

If *listeria* is found in a tub of crab meat, the state and federal health authorities will force the recall of the product from the market and may close a crab processing plant to take corrective action. During the peak of season, such a closure would be

Continued



If you've ever cooked and cleaned your own blue crabs, you know three things.

It takes a lot of work to clean a crab. You don't get much meat for your effort. And you're left with a lot of waste.

The same three principles apply to the commercial processing of blue crabs.

Most crabs still must be handpicked. The meat yield is low, and you have a lot of shell and cartilage left after the crab is picked clean.

There's not anything blue crab processors can do about handpicking or meat yields. But processors are beginning to look for alternative ways to use the mountains of crab waste they produce each year.

Until recently, most processors buried their waste in landfills. But fees for dumping waste have risen, and the space available for new landfills is diminishing.

As counties look for ways to meet the state's requirement for waste reduction, they quickly look to those who dump large quantities of refuse. In coastal counties, their gaze often falls on crab-picking houses.

But they may have to look in a different direction as crab processors try new methods to reduce their waste.

Harold Stephenson of the Washington Crab Co. is giving his ground crab shells to an organic farmer in Beaufort County. The farmer is tilling the

crabby byproduct into the soil to fertilize the fields.

To recoup a little money, Stephenson also sells blue crab back shells to deviled crab processors. These processors thoroughly clean the shells and stuff them with deviled crab for restaurants and supermarkets.

Stephenson says he tried to sell the ground crab scrap to catfood producers, but the pay — 15 cents a pound — did not cover his costs.

Although Stephenson couldn't make a catfood connection, a dehydration plant in Pamlico County is selling dehydrated crab meal to chicken feed producers in the United States and to aquaculture feed producers in Japan, says David Green, Sea Grant's seafood industry specialist.

And in a project with the U.S. Soil and Water Conservation Service, Rich Novak, a Sea Grant specialist on Roanoke Island, has been working with a crab processor in Hyde County to compost crab waste.

Funded by the Albemarle-Pamlico Estuarine Study, the project will explore the feasibility of crab composting in a three-phase procedure that mixes the crab scrap with pine bark and shredded wood.

The project team will also test decomposition rates and the effects, if any, this composting has on the underlying groundwater.

For more information about composting crab waste, contact Novak at 919/473-3937. ☎

equivalent to hanging an "out of business" sign on the door of any of North Carolina's 42 crab houses.

Ever mindful of the threat from this ubiquitous bacteria, processors are careful with their crab meat, in some cases choosing to pasteurize their products instead of selling them fresh.

Although many of Shellfish Sanitation's regulations are designed to protect the public, some producers say the tight controls are doing more than limiting health hazards. They're also limiting expansion of the industry.

Under present regulations, Shellfish Sanitation does not allow blue crab processors in North Carolina to repack crab meat. This minimizes handling that might introduce safety problems.

But processors say the risks are minimal and rewards could be bountiful.

If permitted to do so, large processors could buy crab meat from small processors, Stephenson says. Then they could repack it and either pasteurize or freeze it to sell in the off-season.

Holding the meat would eliminate seasonal gluts, boost wholesale prices for all processors and allow large producers the ability to supply big-dollar buyers such as supermarket and restaurant chains. Other states already allow repacking, putting Tar Heel producers at a disadvantage.

In a meeting between industry producers and Shellfish Sanitation in March, processors asked officials to rescind the repacking regulation. Officials are considering the repeal.

Other regulations under consideration include a requirement for tamper-evident packaging to reduce the potential for fraud once the crab containers leave the processing plant.

Stephenson says such packaging could add 4 to 5 cents to each pound of crab meat sold. But he has no objections to the regulation as long as

North Carolina processors aren't the only ones having to use such packages.

Despite an injection of new technology and a fresh look at old regulations, crab processing is still a labor-intensive industry. And in recent years, that labor has been hard to find.

Many women, on whose nimble fingers the crab industry has relied, have retired or gone to their graves. Younger women and men don't want the job. And there's not a machine around that can extract the white lumps of savory meat so prized by restaurants and consumers.

What's a crab processor to do? Hire Mexican migrant workers.

Last year in the face of a dwindling work force of handpickers, processors brought 300 migrant workers into North Carolina crab houses, Green says. Many of the pickers were experienced, having worked in the Mexican crab industry.

Green says the workers are brought to the Tar Heel state for the peak season, May until Thanksgiving, and make as much money in those six months as they would make in five years in their home country.

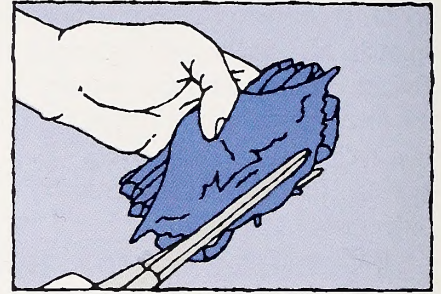
Some processors grumble that producers who use migrant help are getting off cheap. These producers don't have to pay federal unemployment taxes and workers' compensation — costs that increase labor costs and lower profit margins.

Not all processors can employ migrant workers. An employer must show a lack of available local labor willing to do the job before hiring migrants.

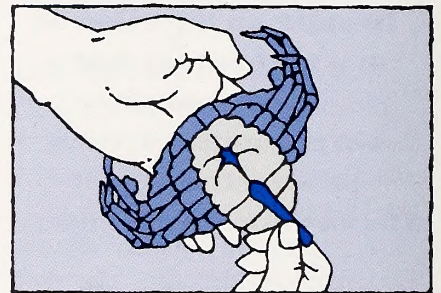
Migrant workers. Flash freezing. Health regulations. All are issues the crab industry must grapple with as it tries to grow and change.

"I tell the children every day the traditional way of doing things is not good enough anymore," Stephenson says. "You've simply got to change if you're going to get ahead." ☹️

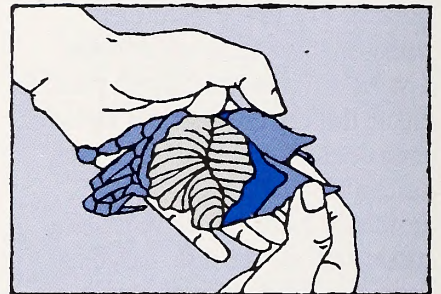
Cleaning Soft-Shell Crabs



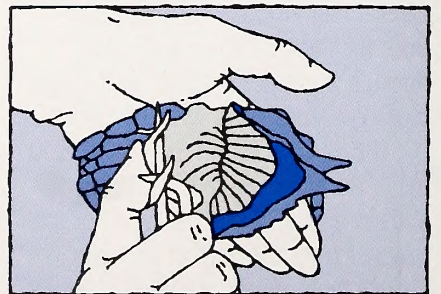
1. Cut across body just behind eyes to remove eyes and mouth.



2. Turn crab on its back. Lift and remove apron and vein attached to it.



3. Turn crab over and lift one side of top shell.



4. With a small knife, scrape off grayish-white gills. Repeat procedure on other side. Rinse gently with cold, running water; then pat dry.

Crab Cravings...

Blue crabs may be bought live or cooked. Or you can catch your own. But because of the difficulty in picking meat from the shell, most people buy crab meat that is cooked, picked and ready to eat.

Picked crab meat is available in several forms. The four most common are lump, backfin, special and claw. Lump, or jumbo lump, is the large white lumps of meat that come from the area of the body adjacent to the back swimmer fin. Backfin meat consists of some lumps plus other meat from the body.

Special, also called regular or flake, is the white meat without lumps. Claw meat is often brownish in color and is used in recipes where a white appearance is not important.

Picked meat is also available pasteurized, which extends its storage life. And you can buy canned crab meat in the supermarket.

Be especially careful in handling crab meat. Keep crabs alive until ready to cook. Discard any that die. When storing cooked crab meat, place the container in ice and refrigerate it.

Crab meat is high in protein, low in fat and calories. The meat of the blue crab is moderately high in cholesterol. It contains an average of 100 milligrams per 3 1/2-ounce serving.

For information about cooking and cleaning hard and soft blue crabs, see *The Bookstore*, page 25.

Deviled Crab

1 pound claw or special crab meat
2 tablespoons margarine
1/2 cup finely chopped onion
1/2 cup fine, soft bread crumbs
1 cup heavy cream
1/2 teaspoon cayenne pepper
1/2 teaspoon dry mustard

1/2 teaspoon salt
1/8 teaspoon Tabasco sauce
1/4 cup liquid egg substitute (or 1 egg, beaten)
1/4 cup fine, soft bread crumbs
2 tablespoons margarine, melted
Melt 2 tablespoons margarine in a large skillet over medium heat. Sauté onion until tender. Add 1/2 cup bread crumbs. Add cream, stirring constantly. Add cayenne, mustard, salt and Tabasco. Stir in egg. Gently fold in crab meat. Place in 6 lightly greased shells or ramekins. Sprinkle with 1/4 cup crumbs and drizzle with 2 tablespoons melted margarine. Bake at 350 F for 15 to 20 minutes, or until golden brown and bubbly. Serves 6.

Deluxe Crab Cakes

1 pound claw or special crab meat
1/4 cup liquid egg substitute (or 1 egg, beaten)
2 tablespoons reduced calorie mayonnaise
1/2 teaspoon dry mustard
1/8 teaspoon cayenne pepper
1/8 teaspoon Tabasco sauce
1/2 teaspoon finely chopped fresh parsley
1 1/2 teaspoons fresh cracker crumbs
vegetable oil for frying
lemon wedges (optional)

In a medium bowl, place egg, mayonnaise, mustard, cayenne, Tabasco and pepper, and whisk until smooth. Add crab meat, parsley and crumbs, and toss together lightly with a fork. Shape into 6 to 8 patties. Wrap in wax paper and chill for 30 minutes.

Fry in hot oil until golden brown on one side, about 4 to 5 minutes. Turn and repeat on other side. Drain on paper towels. Serve with lemon wedges. Serves 6 to 8.

She-Crab Soup

1 pound lump crab meat
6 tablespoons margarine
3 tablespoons flour
2 cups light cream
2 cups milk
1 teaspoon Worcestershire sauce
1/4 teaspoon salt
1/4 teaspoon grated lemon peel
1/4 teaspoon mace
1/4 teaspoon freshly ground white pepper
yolks of 4 hard-cooked eggs
2 tablespoons dry sherry
paprika

In top of double boiler, melt margarine. Blend in flour. Stirring constantly, add cream and milk, then Worcestershire, salt, lemon peel, mace and pepper. Add crab meat and cook slowly for 20 minutes. Do not allow to boil or even simmer. Remove from heat.

Sprinkle crumbled egg yolks in bottom of individual soup bowls. Stir sherry into soup. Pour into bowls, then sprinkle with paprika. Serves 6 to 8.

Baked Soft-Shell Crabs

12 soft-shell crabs, cleaned
2 eggs, beaten
1/4 cup milk
1/2 teaspoon salt
1/4 teaspoon freshly ground black pepper
1/8 teaspoon cayenne pepper
3/4 cup flour
3/4 cup dry bread crumbs
6 teaspoons margarine

Combine eggs, milk, salt, pepper and cayenne in shallow dish. Combine flour and crumbs in another shallow dish. Dip crabs in egg mixture and roll in flour mixture. Place in a lightly greased baking pan. Place 1/2 teaspoon margarine on each crab. Cook at 400 F for 8 to 10 minutes, or until tender and browned. Serves 6.

Paper Plate Fun

The blue crab is a small creature with a big name — *Callinectes sapidus*. *Calli* is Latin for beautiful, and *nectes* means swimmer. *Sapidus* means savory.

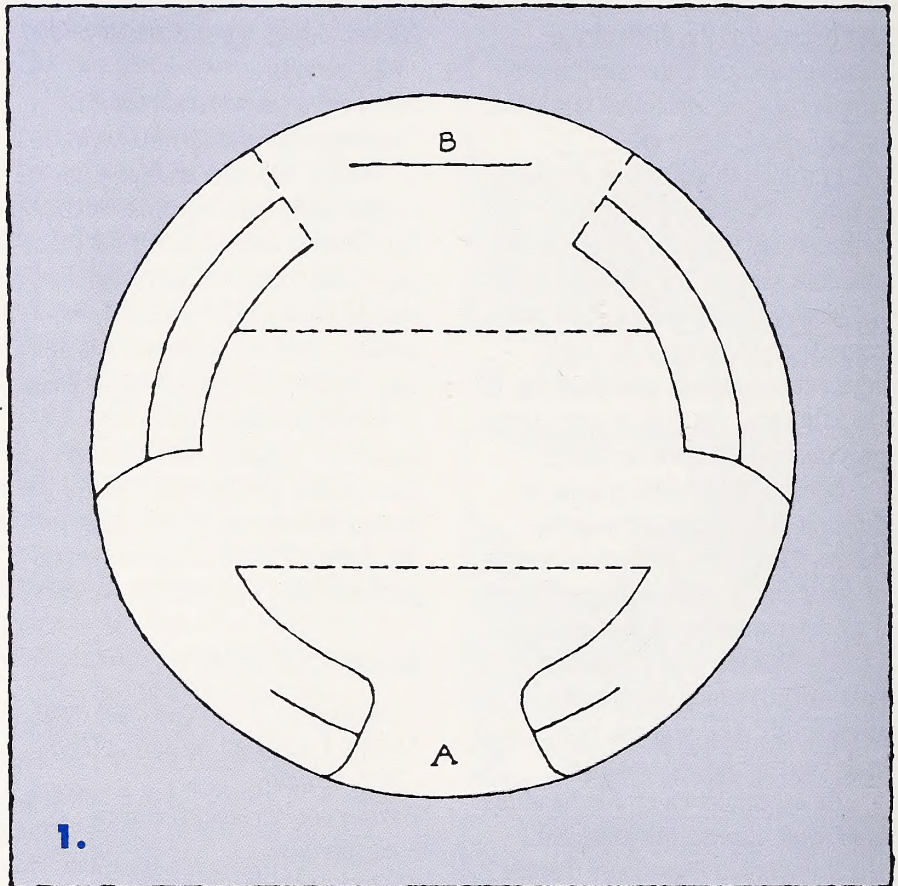
A beautiful swimmer that tastes good must be swift to survive. These agile creatures sometimes travel miles in their peculiar sideways strut.

A crab has a tough outer shell extending to a point on either side. Perhaps this creature walks sideways because its body points that way.

Crabs are aggressive and feisty animals. People who are in a bad mood are often called crabby!

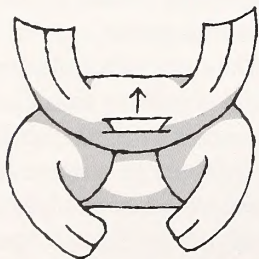
These cute crustaceans are the heroes in many fairy tales. They've even landed a few roles in major motion pictures. Maybe they aren't so hard to get along with after all.

Why don't you make a crab to be your playmate? It's easy. All you need is a paper plate or thick paper, some colored markers or crayons and a pair of scissors.

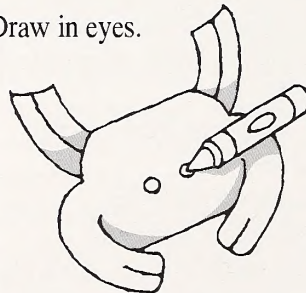


Instructions:

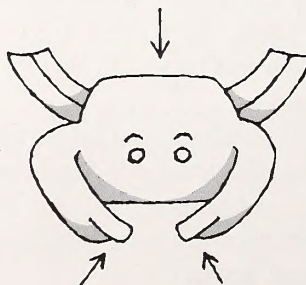
1. Have someone help you make an enlarged photocopy of the crab shown here on heavy paper. Or draw your own, using our crab as a guide, on a paper plate.
2. Cut on all solid lines and fold on the dotted lines.
3. Tuck front point (A) into slit (B).



4. Draw in eyes.

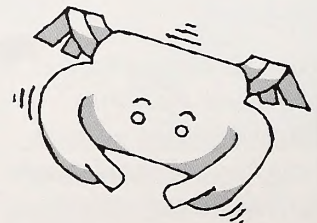


5. Flatten the crab slightly and bend back the bottom half of the pincers.



6. Bend back the legs in the middle so the bottom of the legs jut out and rest on the ground.

Now that your crab is assembled, practice walking it sideways. You might want to give him or her a name. How about Crusty or Charlene? Pretend your crab is looking for a tasty clam for its dinner. Happy hunting!



Carla B. Burgess

Gators for Neighbors

The Cape Fear River is Charlie's neighborhood. His address, *the USS North Carolina*.

He lives there with a couple of buddies, who wile away the summer months stroking in the river or sunning onshore.

Together, they are easily the best-known alligators in North Carolina, visible to the throng of tourists who pass over the decks of the battleship every year.

"That's where a lot of people see their one and only North Carolina alligator," says Alvin Braswell, curator of amphibians at the N.C. State Museum of Natural Sciences.

But unknown to many people, North Carolina is home to more than 1,000 alligators. It is the northernmost point along the East Coast where the cold-blooded reptiles will live.

"There are a lot more gators out there than people think there are," says Bobby Maddrey, a biologist for the N.C. Wildlife Resources Commission.

Most are not as celebrated or visible as Charlie. They are shy creatures content to lead lives of quiet anonymity.

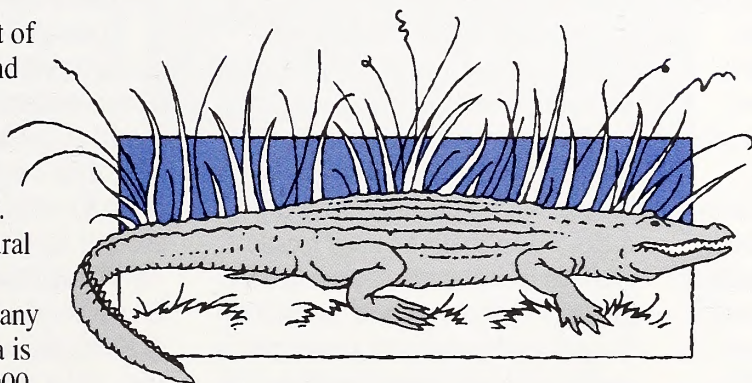
But as waterfront development takes off in North Carolina, as homes and golf courses edge into the alligators' habitat, they are being flushed out of hiding.

It's a phenomenon most easily tracked in phone calls to the Wildlife Resources Commission.

Maddrey says his office is fielding more questions than ever from people who have spotted an alligator sunning on their waterfront lawn or bobbing near the bank.

"Mostly people who haven't been living here long have the problems with them," he says. "They can't believe there's an alligator here. They move here from somewhere else, buy a house and the next thing they know they've got an alligator sunning in their yard."

The conflict is one that Tom Henson, also of the Wildlife Resources Commission, tries to cast in a



positive light. An alligator can be an asset, even a conversation piece, for a homeowner who respects rather than fears it, he says.

But too often, people want to live close to nature, "in the wild," until the wildlife gets into their backyard. Then they want it gone, says Henson, coastal non-game and endangered wildlife project leader for the Wildlife Resources Commission.

Alligators that pose no threat to their human neighbors can usually stay put, says Bobby Kaylor, wildlife technician for the Croatan National Forest.

They were there first.

The exceptions, however, are gators as large as 10 to 12 feet that have been pulled out of ponds at golf courses or drainage ditches.

Reptiles of this size are usually moved to more remote sites such as Alligator River off Albemarle Sound

or Gull Rock in Hyde County.

In the Croatan National Forest, the territorial gators have set up house-keeping in five lakes, where they can be seen nesting in the spring, Kaylor says.

Most of them stay hidden from view.

But as contact between humans and alligators heightens, experts offer some advice: leave the reptiles alone, don't venture at night into the water where they live and never feed them.

More stealthy than fast, alligators feed on frogs, snakes, fish, ducks, raccoons and even young deer at the water's edge. They'll also eat a pet if given the opportunity.

"To me, they're a creature of opportunity,"

Kaylor says. "If they can catch a dog, if they can catch a cat or raccoon, they'll get it."

Alligators are listed as a threatened species, which grants them protection from hunters in most states, including North Carolina. They average about 5 feet in length, but can grow to 12 feet in this state.

They have been sited 75 to 100 miles inland.

Braswell says North Carolina alligators have responded well to federal protection, even as construction intrudes into their habitat and the cold winters hold short their growing season.

The ultimate goal is for them to flourish enough to be removed from the list and hunted, as they have been in Florida and Louisiana, Braswell says. That would be a sure sign of a healthy population, he says.

Jeannie Faris

Shedding Beyond the Water's Edge

Crab shedding in North Carolina has come a long way. Used to be, most pre-molt crabs were held in sunken boats or floating trays offshore while crabbers waited for the critters to bust out.

Though operation was inexpensive, access was difficult, lighting was non-existent and rough wave action often interrupted the shedding process.

Fishermen eventually built onshore tanks on legs at a comfortable height for fishing the trays. They installed lights so they could work through the night. Water plumbed from a nearby creek or sound supplied a fresh flow to sustain the crabs.

Sea Grant marine agent and crab expert Wayne Wescott says a little more than 90 percent of crab shedders in the northeastern part of the state now use this flow-through method.

But not all coastal entrepreneurs have waterfront property. And the ones that do don't always have good water quality.

With new technology perfected by Wescott, folks who live along waterways clouded with silt can shed crabs simply by installing a swimming pool filter in their flow-through system. And through the science of closed, recirculating systems, inland coastal residents can shed crabs in their backyard.

"We could shed crabs on top of the Empire State Building if we wanted to," says Wescott, who has been shedding crabs for almost 40 years.

Of course, you need a body of water within reasonable distance from your shedding facility to ensure a healthy and abundant supply of crabs. But the technology improved by Sea Grant over the past few years has offered more North Carolinians a

piece of this \$12 million pie.

Most closed, recirculating systems use reservoirs, shedding trays, mechanical filters, biological filters, protein skimmers, pumps and plumbing to provide suitable water for crab shedding.

"We learned that if we used water over and over, we had to do two things," says Wescott. "We had to provide oxygen so that the crabs didn't suffocate, and we had to provide something to absorb crab waste, which is minimal since they're not eating much."

Crab waste produces ammonia, which is toxic to the creatures. Wescott determined that placing rocks, oyster shells or small plastic shells in the reservoir encouraged the growth of bacteria. These bacteria or "bugs," as Wescott calls them, feed on the ammonia, converting it to nitrite.

Another bug is introduced to feed on the nitrite, which can also be poisonous to the crabs. The nitrite is converted to nitrate, which is less toxic.

"Because it is a food supply for something, these things flourish, but they also must have oxygen to flourish and do their jobs," he says. Aeration in flow-through and closed systems reintroduces vital oxygen to the water.

Closed systems draw on a reservoir of seawater, real or simulated; groundwater; or other nonchlorinated water. The salinity should approximate that of the area from which the crabs are harvested.

But crabs can even be held in well water, provided the peelers used in the system were taken from waters of low salinity. Working with commercial shedders, Sea Grant developed

this system, which uses cool ground-water and heating elements to regulate water temperatures.

Because they are high-maintenance, closed systems are recommended only if there is no alternative. Wescott estimates that less than 3 percent of shedders in Dare County are using closed systems, and most are small operations.

"A closed system is the worst one possible, but it works," he says.

In the past decade, soft crab production in the state has jumped from a reported 88,000 pounds, valued at just under \$200,000, to more than 2 million pounds, worth about \$6 million. Yet demand still exceeds supply.

Wescott has opened another avenue for the industry along miles of previously unusable waterfront. Poor water quality has prevented shedding in areas where wind, rain, runoff and boat traffic cause excess turbidity.

Suspended materials in this water clog the gills of crabs held in shedding trays, causing high mortality.

After he installed a filter to keep sand out of his swimming pool, Wescott wondered if the same technology was applicable to shedding crabs in muddy water.

"So I got to talking with (Collington crab shedder) Murray Bridges, and he decided he'd try it," says Wescott. "It worked like a charm."

Use of a pool filter also prolongs the effective holding time of peelers in waters of marginal quality.

Sea Grant has developed several publications on these alternative shedding methods. For more information, see *The Bookstore*, page 25.

Carla B. Burgess

The Wolcotts: Curious About Crab Behavior

Just before the last molt of her lifetime, the female blue crab releases a chemical pheromone, something like a crustacean's Chanel No. 5, to attract a male crab to protect her.

The ritual is predictable and fairly well-understood.

But not so clear is how the male and sexually immature female crabs prepare to molt — how they choose the site to shuck off their own hard shell and wait naked until the new one hardens.

Do they seek out shallow, covered areas? And do they tend to shed in a particular area, perhaps raising the need to preserve that habitat?

These questions have been researched recently by Tom and Donna Wolcott, professors in the Marine, Earth and Atmospheric Sciences Department at N.C. State University.

Their study, funded through the UNC Sea Grant Program, compared the molting behavior of blue crabs in the Pamlico Sound to that of Chesapeake Bay crabs 250 miles north.

What they found were blue crabs tailoring their behavior to their surroundings.

Although blue crabs are equally vulnerable to predators in their freshly molted state, they were observed to seek out entirely different settings to shed.

Male crabs in North Carolina, unlike their Chesapeake Bay relatives, do not slip into shallow tidal creeks to shed, Tom Wolcott says. They instead hug the edge of the estuary in water 3 to 7 feet deep — about where the females molt.

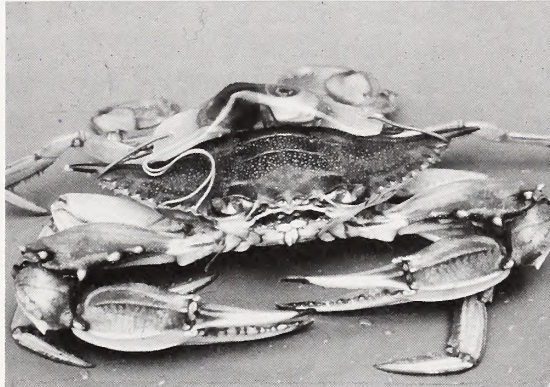
Security is not so much a concern for sexually mature females, who are protected by a male while they shed.

“There isn't anything spectacularly peculiar about the habitats they've selected for molting (in North

Carolina),” Wolcott says.

And because of their choice, there appears to be no shortage of molting areas for North Carolina crabs, he says.

But plot a map of molting sites in the Chesapeake Bay, and an entirely



different picture emerges. The males travel far up the salty creeks that branch off the sound, safe from predators. Molting females were not studied there.

Wolcott says he believes landscape is responsible for the different behaviors.

North Carolina tidal creeks, such as Pantego Creek off the Pamlico Sound, are wider and deeper than those off the Chesapeake Bay. So they offer soft crabs less cover and protection from predators — eels, pufferfish and oyster toadfish — that can follow them there.

These predators are not as likely to swim up the smaller tidal creeks such as Muddy Creek off the Chesapeake Bay.

The activity of individual crabs has been difficult to track in the past. But new technology has changed that. The Wolcotts and graduate research assistant Mike Shirley were able to monitor 40 to 50 crabs' travel patterns with tiny transmitters strapped to their backs.

From signals beamed off the estuarine floor, they tracked where and when the crabs molted, and what areas they had passed over.

The same technology is now being

used to discover how Chesapeake Bay crabs forage for food and what drives them to cannibalize their own.

“The main thrust of (this study) is to understand the estuarine ecology, because the blue crab is a dominant player,” Wolcott says. “But if people can figure out from that how many blue crabs there will be next year, great.”

Studies have shown crabs are sometimes their own worst enemies, preying on the smallest of their numbers. Prolonged cannibalism can damage a future supply of adult crabs.

In early summer, the Wolcotts will team up with students and other researchers to monitor the feeding habits, travel patterns and body language of crabs penned at the edge of the lower Chesapeake Bay.

The transmitters will tell when the crabs take a bite, what movements they make and how they interact over food.

A crab with pincers extended, for instance, is in the “threat display” pose and probably at odds with another crab.

The pens will be stocked with clams, a favorite food of the blue crab. But one pen may have a smaller clam patch and bigger crabs than the next to show the consequences of food supply on the survival of young blue crabs.

The Wolcotts are working on the project, funded by a three-year National Science Foundation grant, with the Smithsonian Environmental Research Center and the Virginia Institute of Marine Science.

But Wolcott says the molting research has shown that findings from the Chesapeake Bay cannot be directly applied to North Carolina's coast.

The study will, however, produce several hypotheses for future work.

Jeannie Faris

Dogfish 'N' Chips

Europe's hankering for fish 'n' chips has helped some North Carolina fishermen stay afloat in a season of slim pickins'.

Commercial fishermen around Oregon Inlet and off Cape Hatteras have found a market for spiny dogfish in England, Belgium and France. Once considered a royal nuisance, this abundant fish is growing in stature among Tar Heel watermen.

"Most of the time, they were just thrown overboard," says Eddie Midgett of Wanchese Fish Co. on Roanoke Island. "But now there's a market for them."

Coupled with french-fried potatoes, these members of the shark family make a tasty fish 'n' chips meal.

From October through early April, fishermen hauled in millions of pounds of dogfish. Midgett says in January alone, the fish house handled more than a million pounds. "And that was not our biggest month," he says.

Sea Grant agent Wayne Wescott says the catch brought 8 cents a pound.

Bountiful numbers of dogfish helped fishermen survive an otherwise puny finfish harvest. "It was the only ball game this winter," says Midgett.

Wanchese Fish Co. processed some of the fish on the premises and shipped other dogfish to Massachusetts to be cut and cleaned. Other processing was done by Murray Nixon in Edenton and International Seafood in Norfolk, Va.

The only fault fishermen can find with this creature now is its unsavory name.

"They're trying to get that changed," says Wescott, adding that locals have christened this ocean catch, "chipfish."

Musseling into Carolina Waters

If you use electricity or drink water, you should be concerned about the zebra

mussel's waterway voyage south toward North Carolina.

The tiny mollusk, a native of the Black and Caspian seas, was first sited in the Great Lakes four years ago.

Since then, it has traveled hundreds of miles through rivers and waterways, multiplying and clogging intake pipes for water systems and power plants.

And there's more.

As the barnacle-like mollusks colonize and encrust hard surfaces, they



have ruined boat engines, harmed native fisheries and littered beaches with smelly, sharp shells.

The costs are expected to reach billions of dollars.

Already, the zebra mussel has worked its way into the Chesapeake Bay, the Mississippi River and the Tennessee Valley Authority water system. Its forecasted arrival in North Carolina: one to two years.

The freshwater mollusk, as well as a related species able to tolerate low levels of salinity, is expected to settle in the rivers and brackish estuaries of the state.

Until then, there's little the state can do to slow the mussel's travel or to prevent it from settling here. Most preventive measures — heavy chlorination or retrofitting equipment — are impractical and expensive, says Jim

Murray, director of Sea Grant's Marine Advisory Service.

"Realistically, there's not a good way to deal with them right now," he says.

But researchers, industries and boaters can be ready, Murray says.

Beginning in June, Sea Grant is expected to launch an effort to systematically monitor state waterways, lakes and estuaries for the zebra mussel. It will encourage agencies and utility companies already studying these waters to watch for the mollusk.

The project is expected to be funded, in part, by a \$25,000 block of the \$3 million federal appropriation for zebra mussel research and education.

The bulk of this federal funding is earmarked for the Great Lakes states. But Mid-Atlantic and New England states are expected to win a share.

The effort in North Carolina, one of five Mid-Atlantic states, will also include preparedness education and training for industries that would be economically impacted by the mollusk.

These industries would include municipal water systems, waste treatment plants, pulp and paper mills, power companies and large-scale agricultural operations.

Experts project that the zebra mussel will spread to the south and west until it reaches a warm-water band running across the southern regions of California, Arizona, Texas and Florida.

The exotic mollusk was probably introduced to the Great Lakes in the mid-1980s through the discharge of ballast water from international ships. A native to seas straddling Europe and Asia, the zebra mussel hitchhiked through Europe where, after 200 years of infestation, no chemical toxicant has been developed that is not deadly to other aquatic life.

The zebra mussel is an elongated, fingernail-sized mollusk that can grow up to 2 inches. It is D-shaped with alternating bands of dark and light colors

and colonizes in layers on hard surfaces.

Report sitings of the mollusk — including location and quantity — to Sea Grant at 919/515-2454.

Tips for boat owners who find the zebra mussels on their hulls:

- Scrape and catch them in a bag, once or twice a month.
- When transporting a boat, drain all bilge water, live wells and bait buckets before leaving infested areas. Leftover bait should not be transported from infested waterways to uninfested waters.
- Thoroughly inspect the boat hull, outdrive, trim plates, trolling plates, prop guards, transducers, trailers and other parts exposed to infested waters. Hitchhiking mussels should be scraped.
- Anti-fouling paints may prevent them from attaching to boat hulls and outdrive units. But hull waxes do not appear to be effective.
- The use of chemicals such as chlorine and molluscicides by the general public could result in ecological harm, leading to even greater cleanup costs, and should be avoided.

“Return to the Sea” on Public TV

You don't have to be a Jacques Cousteau-type to enjoy the ocean.

That's the point of North Carolina Public Television's "Return to the Sea" series, a seven-part collection of half-hour programs scheduled to air this year.

The series will be shown in 40 states and Washington, D.C., on participating public television stations.

In North Carolina, an expanded package of 13 segments will run in the late summer or early fall. The seven-part series was aired last fall.

Filmmaker Bill Lovin and producer Jim Bramlett say the series sets out to demystify the ocean for non-divers who may see it as dangerous and intimidating.

Rather, the sea can be accessible to people with all appetites for adventure, from a walk on the beach or a snorkeling outing to a dive on a reef.

Part one, "A Day on the Reef," examines the coral reef ecosystem from dawn to dusk.

Part two, "Secrets of the Shark," explores a shark breeding zone off the North Carolina coast and displays footage of mantas and hammerheads off Cocos Island.

Part three, a two-part program, explores how fish sense their underwater environment in "Fish Senses," and how people experience it through underwater photography in "The Art of Underwater Photography."

Part four, "The Ocean at Night," examines the sights of night-diving. It also profiles the world's newest ocean, the Sea of Cortez.

Part five, "Graveyard of the Atlantic ... Graveyard of the Pacific," compares sunken World War II wrecks in both oceans, from the coast of North Carolina to the Truk Lagoon.

Part six, "People Who Make a Difference," profiles Norine Rouse, a long-time scuba instructor and guide. Also featured are Jill Robinson and Ted Bridus, two divers with disabilities.

Part seven, "The Reef at the End of the Road," examines the ecosystem of the Florida Keys and the dilemma of protecting America's most popular reefs. Also included is a look at the endangered manatee.

Lundie Spence, Sea Grant's marine education specialist, served as a consultant for the series.

Viewers should contact their local PBS station for broadcast dates and times.

Peddling the Homely Hagfish

It's slithery. It's slimy. It's revolting.

But the Atlantic hagfish, more commonly known as the slime eel, could be a boon to New England fishermen.

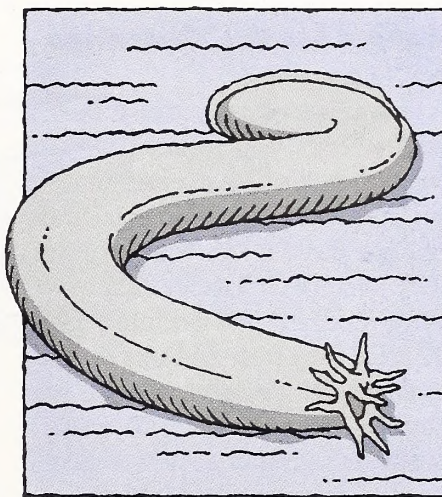
The University of New Hampshire Sea Grant Program is investigating the feasibility of harvesting the eels. The eels would be sold to South Korean

firms that produce eelskin wallets, boots, bags and other products.

Hagfish burrow into the mud at the bottom of the ocean. They grow about 2 feet long, develop teeth-like structures on their tongues and have a collection of tentacles on their snouts.

Eyeless, they depend on their sense of smell to find food. They feed on dead or helpless fish. And that's where they run afoul of fishermen.

When hagfish come upon a fish trapped in a gill net, they enter it through the mouth, gills or anus, then eat the fish from the inside out.



When the fisherman hauls in his net, he gets what appears to be a healthy catch. However, as soon as the fish hits the deck, one or more slime eels slither out and the fish collapses.

Hagfish secrete a slimy substance that, in addition to giving them their nickname, helps them get around and protects them from the digestive juices of their involuntary hosts.

Originally a minor food fishery in Korea, the hagfish fishery grew rapidly in the 1960s and '70s when the market for eelskin leather developed. In the 1980s, slime eel supplies in Korea and Japan diminished, and a fishery developed along the U.S. West Coast.

In current markets, West Coast fishermen are paid 30 to 40 cents a pound at the dock, a good price for such as slimy predator.

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.

Thanks for the Memories

Dear *Coastwatch*:

Just a short note to express how much we enjoy your publication *Coastwatch*. We have received this pamphlet since purchasing our home on the Outer Banks in '85. While so much of the information is totally distant to fishing styles and land lore here in Ohio (12 hours away from the Outer Banks), we thoroughly appreciate receiving your journal — especially during the winter months, as it gives us a vision to shoot for when we make plans for beach-combing in the spring, summer and fall as time permits.

Your staff does an outstanding job in making *Coastwatch* informative in layman's terms and professional in style. We particularly enjoy the helpful hints (i.e. weather, seafood awareness, construction, erosion trends, etc.). Keep up the good job!

**Daryl Huff,
Dalton, Ohio**

Thanks for the kind words and deep devotion. Coastwatch appreciates loyal readers like yourself, especially ones from outside the state. We were surprised to learn during our last reader survey that one-third of our subscribers are out-of-staters. Many of these folks are former North Carolinians who want to stay in touch with their homeland. Others are regular summer vacationers who like to stay abreast of their favorite

summer destination year-round. Whatever the case, Coastwatch says thanks for subscribing.

More About Shrimp Cages

Dear *Coastwatch*:

On page 20 of the November/December 1991 issue, you ran a letter from Billie Hayden, Cincinnati, Ohio, in regard to "Cagin' Shrimp."

The letter stirred my mental file of things I plan to do when I retire, somewhere around the year 2025. Locked away in there, somewhere, was an image of vertically suspended shrimp traps that had appeared in *National Fisherman* magazine some years ago. A quick note to, and response from, Susie Underwood, the librarian at *National Fisherman*, confirmed my memory.

I immediately pulled out my December 1984 copy of *National Fisherman* (I save everything of importance, including every *Coastwatch* since 1980) and copied the article, which I have enclosed here for your review.

You may wish to simply forward a copy to Mrs. Hayden. However, I believe *Coastwatch* readers would enjoy seeing a reprint in an upcoming issue, provided of course that you are able to obtain the necessary permission from *National Fisherman*.

If you do run a reprint, please mention special thanks to Ms. Underwood. The folks at *National Fisherman*, like *Coastwatch*, are great people.

Thanks for the opportunity to share this material.

**Cornelius Cummings,
Allentown, Pa.**

Thank you Mr. Cummings for all of your diligent research. We will forward a copy of the National Fisherman article to Mrs. Hayden and to anyone else who requests it. Unfortunately, we don't have the space to reprint the article, which was written by Duncan Amos, a Georgia

Sea Grant specialist. If you'd like a reprint of the article, write "Shrimp Cage," UNC Sea Grant, Box 8605, N.C. State University, Raleigh, NC 27695.

A Topical Discussion

Dear *Coastwatch*:

Thank you for the wonderful articles about the return of the brown pelicans. I've been vacationing on the Outer Banks (Currituck) for several years now, and I always enjoy seeing these funny, yet graceful, birds during walks along the beach. It's refreshing to read a story about a threatened/endangered species making a comeback as opposed to other species which continue to decline.

I also was very pleased with the series of articles about Currituck and its history. My family and I love the little town of Corolla, though I am a bit saddened every year to see the inevitable increase in development along the coast. In my delight at discovering Corolla and the Outer Banks, I guess I've become a bit selfish in wanting to keep it all to myself (I can only imagine how the natives must feel).

Might you have plans in the future for any articles on the lighthouses of the coast or the possibility of oil exploration by Mobil? Thank you again and keep up the good work.

**Meredith Zimmerman,
Washington, D.C.**

We're glad you are enjoying Coastwatch. We're keeping an eye on the oil exploration issue. As it is now, Congressman Walter B. Jones has introduced legislation to buy back the leases, and Mobil has indicated it would be willing to sell them. However, these actions are pending. We'll let you know what happens. As for lighthouses, we've had numerous requests for a Coastwatch on these coastal beacons. But because of the availability of several books on the lighthouses, we've never pursued the topic. We may, however, reconsider.

Blue crabs are big business in North Carolina. Whether you're crabbing for supper or your bread and butter, Sea Grant offers a host of publications on catching, shedding, selling, cooking and cleaning these crustaceans.

THE SECRET OF SOFT-SHELL CRABBING

The key to shedding the blue crab is understanding its biology. *A Guide to Soft Shell Crabbing* explains that and more. This 32-page illustrated manual offers instructions to the layman on identifying and handling peelers, which are pre-molt crabs. It describes methods for harvesting the critters, from crab trawls to trotlines to crab pots, and outlines the three basic designs for shedding systems. The guide also offers tips on marketing and freezing these crustaceans.

The cost is \$3. Ask for UNC-SG-84-01.

CRAFTING A CRAB TRAP

Blue crabs are an easy catch for coastal residents who have access to sounds and inlets. In warm weather, a crab pot can catch a dozen crabs in a matter of hours.

How to Build a Crab Pot describes a step-by-step procedure for fashioning one of these traps. You can find all of the supplies at most hardware stores.

This illustrated 14-page guide also lists a few rules and regulations for fishing with crab pots and the addresses you'll need to find out more. The cost is \$1.50. Ask for UNC-SG-80-03.

AN ALTERNATIVE TO CRAB POTS

In areas where peeler crabs move in large runs or waves, crab pounds can be very effective in catching these pre-molt crustaceans. *Building and Using Crab Pounds to Catch Peelers* is an illustrated four-page Blueprint. It details the construction and trial of one crab pound design used by Sea Grant staff and industry personnel during the



spring and summer of 1990. It's free. Just ask for UNC-SG-BP-91-01.

SHEDDING CRABS IN MUDDY WATERS

Until recently, thousands of miles of waterfront property were unusable for soft crab production because of poor, murky water. Turbid water clogs the gills of peelers held in shedding trays and causes high mortality.

Installation of a swimming pool filter in flow-through systems can facilitate crab shedding in murky or marginal waters.

Improved Flow-Through Shedding Using Sand Filtration describes how to construct a filtration system. This four-page Blueprint is free. Just ask for UNC-SG-BP-91-02.

SHEDDING CRABS IN WELL WATER

A temperature-controlled, well-water shedding system can eliminate

the problems of water quality and the need for proximity to brackish water.

This system uses cool groundwater and heating elements to regulate water temperatures. The system also reduces ammonia buildup because water continuously seeps from the reservoir and is replaced by fresh well water.

To learn more, send for *Shedding Soft Crabs in a Closed Well-Water System*. This four-page Blueprint is free. Just ask for UNC-SG-BP-88-01.

CRACKING INTO CRUSTACEANS

Want to know how to clean hard and soft-shell crabs? It's easy. Just send for *Cracking into Crustaceans*, a

colorful eight-panel brochure. It describes and demonstrates a step-by-step method for dressing live crabs, cleaning cooked hard crabs and cleaning soft shells. The brochure is 50 cents. Just ask for UNC-SG-88-01.

Ordering Information

When ordering Sea Grant publications, please use your mailing label from Coastwatch or the customer identification number that appears above your name. This will speed delivery. Also, be sure checks are made payable to Sea Grant, unless otherwise specified.

Send publication requests to: Publications, Sea Grant, Box 8605, N.C. State University, Raleigh, NC 27695. If you wish to order multiple copies or need further assistance, contact Carole Purser, distribution manager, at 919/515-2454.



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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 Beaufort by Scott Taylor.

Inside front cover photo of sailing on the Neuse River by Clay Nolen.



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Dear Readers,

This month, *Coastwatch* takes a look at tourism, a vital part of the coastal economy.

First, Jeannie Faris examines the pros and cons of this hospitable industry. Tourism is the backbone of many coastal county economies, yet it's not without costs to the environment and the local communities. She'll look at the issue from both sides.

Carla Burgess asks tourism directors in Dare, New Hanover and Carteret counties how they market their respective niches of the Tar Heel coast. They talk about the ways they target their advertising to attract more visitors, especially during the off-seasons of spring, fall and winter.

Then I tell you more about our coastal guests – who they are, where they come from, how long they stay and how they rate our bounty of beaches. Finally, I provide a rundown of some activities that can make a coastal visit more than just a week under the beach umbrella.

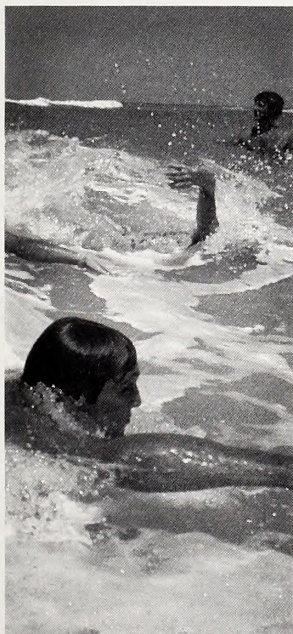
I hope you find the issue thought-provoking and informative. And I'd like to remind many of you that your subscription is expiring. You should have already received some renewal information. Please take the time to renew your subscription. We want to continue giving you the best information available about the North Carolina coast.

And we've got a deal for you. Just send us the name and address of a friend you think might be interested in *Coastwatch*, and we'll send him or her a complimentary copy of the magazine along with some subscription information. We'll send it just once, and we promise not to bother your friend again.

It's a way for us to introduce our magazine to potential new subscribers and a way for you to share a good thing with friends. Please take advantage of our offer.

See you next issue,
Kathy Hart

i n t h i s i s s u e



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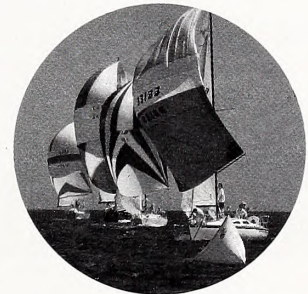
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Coastal Tourism: A Balancing Act

By Jeannie Faris

When W.A. Best was a boy, Atlantic Beach was little more than an isolated stretch of sand traveled at low tide by folks going from Morehead City to Salter Path.

Those days, however, are long behind him.

Today, the town of Atlantic Beach is a thick clutch of souvenir shops, airy beach homes, nightclubs, rides and restaurants settled at the base of the arching bridge to Morehead City.

To the east, the town is hemmed in by Fort Macon State Park. To the west, a live oak-lined corridor of hotels and condominiums, diners and bait shops stretches into Pine Knoll Shores.

The origins of Atlantic Beach were simple by today's standards. Though visitors had journeyed by boat to its pavilions since the 1880s, progress arrived with a bridge from the mainland in 1928 and a campaign to draw visitors with a casino and bathhouses.

This bustling seaside town, nourished on tourism, today hosts up to 30,000 people on a summer holiday weekend.

Carteret County — and its ribbon of barrier island beaches — has come of age as a vacation destination. It's the midpoint on a coastline 320 miles long and ripe for tourism harvest, from the Outer Banks north of Atlantic Beach to the southern beaches below.

Some say the growth and changes have been for the better. Tourism is the backbone of coastal economies. Where there had been few accommodations and no jobs, now there are both.

In Dare County alone, Outer Banks tourism drives the retail sales and services, which top \$500 million annually.

"Tourism is going to be here," says Louise Dollard, a Dare County commissioner from Southern Shores. "That's the only way this place makes money. So it's obviously going to continue."

Others, like Best, say the changes have been for the worse.

True, tourism has buoyed communities that otherwise would have relied on commercial fishing and boatbuilding for sustenance, says Todd Miller, executive director of the N.C. Coastal Federation.

But tourism is a double-edged sword, he says. There are real, and sometimes irreversible, costs to the environment.

Natural resources can be trampled underfoot in the rush for the tourism dollar. And coastal towns are occasionally pressed to provide water, sewer, police, lifeguards and garbage collection to the crowds who spill over their borders for summertime rest and recreation.

Some say the growth and changes have been for the better. Tourism is the backbone of coastal economies. Where there had been few accommodations and no jobs, now there are both.

"Too much. Too much," says Best, a Morehead City resident. "This island's going to sink."

Fancy floor plans and contemporary construction are replacing sand dunes and scrubby vegetation. And seasonal traffic overruns small towns like high waters in a flood, receding in the drier winter months.

But towns like Atlantic Beach and Pine Knoll Shores remain anchored to their past — their slower days and slower pace — by places and memories.

The faded yellow Iron Steamer pier and hotel advertises free fishing for families registered to a room. The old building hunkers down between the



modern facades of condominiums, stubbornly claiming its beachfront berth.

Best's worries, and his pining for days past, are not uncommon among folks who have watched North Carolina's coast develop through tourism. Their fear is that the beauty that attracts people to the beach will eventually be destroyed through unbridled growth.

"People come because of open space, fishing, swimming," says Miller. "In time, those things degrade and you put in swimming pools, amusement parks, all of which could be anywhere."

It wasn't long ago that many tourists heading south passed by the more rural, inaccessible North Carolina beaches for South Carolina and the sandy white beaches of south Florida. But no more.

The Tar Heel coast earned high marks in a national survey of 650 beaches that ranked North Carolina third behind Hawaii and Florida on the strength of its open, unpolluted and relatively undeveloped shoreline. The Outer Banks cinched the honor for the state, says author Stephen Leatherman, director of the Laboratory for Coastal Research at the University of Maryland.

Such an endorsement can only accelerate the catapulting rise of tourism as the state's top industry, observers say. The up-and-coming industry is expected to eclipse tobacco and textiles by the year 2000.

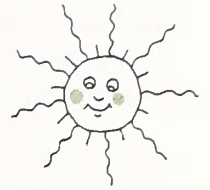
Bill McCaskill, owner of Whalebone Tackle in Nags Head, says he's watched his own business boom through tourism. It was a matter of being in the right place at the right time — his store fronts the Nags Head-Manteo Causeway at one of only two routes onto the Outer Banks.

But McCaskill has mixed emotions about the growth. He's frustrated at the traffic and declining water quality and waterfowl hunting.

"Money's good but I liked it better

before," he says. "I'm not going to complain about making more money. But I liked it better (before) for the hunting and fishing. There weren't as many people around.

"I wish it were back 30 years again. But you don't turn back the clock."



**MOTOR TO THE
PAGODA CASINO
ATLANTIC BEACH
MOREHEAD CITY
BATHING · MIDWAY · DANCING FREE**

**FOLLOW ROUTE 10 OVER BRIDGE TO THE SEA
THE ATLANTIC CITY OF THE SOUTH!**

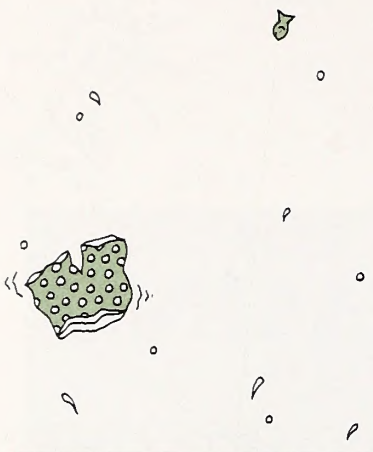
Early marketing efforts: Atlantic Beach touted the Pagoda Casino to tourists after the bridge from Morehead City was completed in 1928.

Many coastal residents are like McCaskill. They benefit directly or indirectly from the tourism dollars that support jobs and local businesses and bolster the tax base.

"A lot of natives don't look at it as an intrusion because they now have a

Continued





way of life that they could not have afforded had things been different," says Gwen White, spokeswoman for Dare County.

Even so, she concedes, many tourism jobs are low-paying hotel, restaurant and clerk jobs.

But tourism experts point out that the dollars invested in the North Carolina coast are largely from out-of-state and inland counties. The Outer Banks especially are a magnet for travelers from the North, who consider these beaches a mecca for fishing,



Riding breakers off the Crystal Coast.

Scott Taylor

surfing, windsurfing and hang gliding.

And the money these non-resident visitors spend keeps the tax millage low for locals while supporting schools and other infrastructure, says Gene O'Bleness, director of the Dare County Tourist Bureau.

On a sunny June afternoon, the parking lot at the Kitty Hawk Connection shopping center in Nags Head is packed with tags from Virginia, Pennsylvania, Florida, New Jersey, Maryland, West Virginia, Ohio, Delaware and Wisconsin.

North Carolina plates only dot the area.

The "First in Flight" tags are more conspicuous back at Pine Knoll Shores, just south of Atlantic Beach. There, Edna Moore and her husband

Leslie work the 6 a.m. to 2 p.m. shift at the Iron Steamer pier.

Edna says she enjoys the chance to meet out-of-towners, calling out to visitors to "help yourself" to a walk on the pier.

But this 46-year resident of Salter Path — the island's original community — says enough is enough. The island doesn't need any more change.

"I'd like it to stay the way it is," she says. "No more condos."

Outside, Morehead City native Helen Wilkins casts a shrimp-baited line into the water. She's on vacation from Wilson with her husband, and they're spending a week at the beach in their camper.

But tourism is a double-edged sword . . . there are real, and sometimes irreversible, costs to the environment.

Today, she's not having much luck with the fish. A few small catches are in her cooler. Mostly, she's pulling up stingrays.

With another on her hook — about 4 pounds, she estimates — Wilkins warns bystanders to stand clear of the ray's barbed tail.

And she laments the days when she could toss out a line and reel in one fish after another. Enough to fill a cooler on a good afternoon.

"Bites aren't as frequent as they were," she says.

Part of the problem, she suspects, are the changes that have taken place on the coast.

Experts agree that on-land demands are damaging water quality in some of our favorite vacation sites. As a consequence, locals and tourists are noticing some fish catches decrease, fewer migratory birds and a scarcity of certain seafood due to contamination.

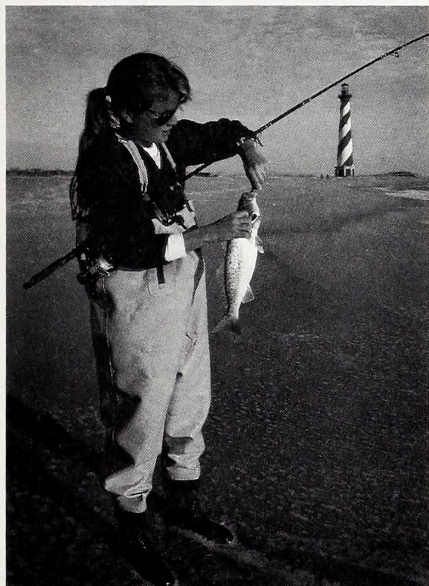


But diners at RV's restaurant in Nags Head may argue otherwise. Nourishing the body on seafood and the soul on a panoramic view of the Roanoke Sound, window-side visitors are communing with nature. A side-show of otters scrapping over food plays in the brackish water below the windows.

This natural beauty is what people come for, O'Bleness says.

The scenery in Dare County is shielded from runaway growth and development because 79 percent of the

Michael Haiminski



Surf fishing at Cape Hatteras, among the 12 most famous beaches in the nation.

land is locked up in federal and state reserves, he says. The remaining undeveloped property is subject to height and density restrictions.

Even so, Dare has grown faster than any other county in the state over the past decade. And with 150,000 visitors per week during peak season, O'Bleness estimates the county can handle up to 200,000.

In Atlantic Beach, most available land has already been built on, says Town Commissioner Tom Doe. But tourism-conscious property owners will probably be redeveloping parts of the town, he says, pointing to a brick retail store that recently replaced a group of trailers.

"I really don't see a whole lot of

change," he says.

On Ocracoke Island — home to 700 people, wild ponies and the legend of Blackbeard — limited land and growing outside interest in the village are creating a different quandary for residents. There, villagers are coping with soaring property taxes.

It's a trend experienced in many coastal communities, where speculation has hiked the value of land, but especially on the Outer Banks. And on reclusive Ocracoke Island, property taxes have leapt in recent years by 300 percent on average and up to 1,000 percent in some cases.

As a result, there's been a "Martha's Vineyardization" of Ocracoke, says Alton Ballance, an island native and Hyde County commissioner. Some families are faced with the prospect of pooling resources to keep land in their name, he says.

And slow to change, Ocracokers cast a wary eye toward the growth that is exploding on North Carolina's more accessible beaches. Even the tourists to this picturesque island are not immune.

"Over the past few years, more and more of our regular tourists have been lamenting the changes that have taken place," Ballance writes in his 1989 book *Ocracokers*. "Most are expressing serious concern that the island is becoming too much like the rest of the North Carolina coast."

Dollard, too, has seen this "drop the gate" attitude in Dare County's Outer Banks.

But Ken Stilley wants no part of that movement, even as tourism-related growth is driving him from his home just outside Duck.

Stilley is preparing to move because Highway 12, or Duck Road, buzzes with a steady flow of traffic just beyond his front yard. Consequently, his property value has fallen in recent years, he says.

His neighbors apparently have the same idea. All along Duck Road, "for sale" signs are staked out in yards.

Stilley says the sale was difficult in tough economic times, but he finally sold the four-bedroom home to a Maryland resident after dropping his asking price several times.

The tide of traffic will probably continue until a proposed bridge is built tying Corolla to the mainland, he says. Until then, Highway 12 is the only way to drive the northernmost reaches of the Outer Banks.

Experts agree that on-land demands are damaging water quality in some of our favorite vacation sites. As a consequence, locals and tourists are noticing some fish catches decrease, a scarcity of certain seafood due to contamination and fewer migratory birds.

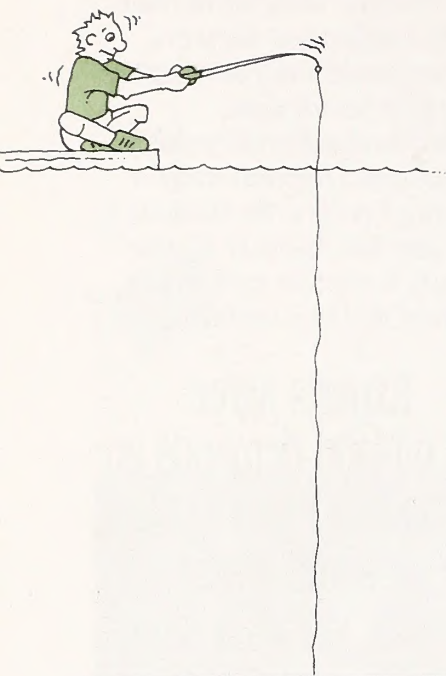
Currently, the Outer Banks in Dare County have only two bridges from the mainland. One, leading to Nags Head, is about to be expanded from two to four lanes in front of McCaskill's tackle shop. The other leads into Kitty Hawk.

Stilley says he will move to a quieter spot in Kill Devil Hills.

"Everybody feels the same way. They come in and they like it," he says. "It doesn't bother me. I'm not much of an environmentalist. Some development is good. I believe in controlled development."

The Outer Banks and coastal communities are unlike other towns in

Continued



many respects, but particularly because they can't grow physically to absorb change such as traffic, says Doe, the Atlantic Beach town commissioner. And that creates special problems.

In Wrightsville Beach, another popular coastal spot, traffic is clotting roads as "weekend warriors" and day visitors spin into town and seize up the precious few parking spaces, says William Hall, professor of economics at UNC-Wilmington and director of the Center for Business and Economic Services.

On a recent Sunday afternoon, Hall says he couldn't find a parking space after several passes on the island. Finally, he left his passengers and drove home.

Quality of life has suffered some

probably take care of itself," Hall says of the traffic. "People will find that it's difficult to go to Wrightsville Beach and that will put in a natural limit."

Roads are just one of the expanding needs that coastal communities have to plan for, according to a 1989 Legislative Research Commission report on tourism. Towns that enjoy rapid growth and success of tourism must host a burgeoning vacation population while keeping an eye toward protecting the environment.

The scenery, after all, is the number one reason that tourists travel to an area, and North Carolina typically is chosen as a destination because of the overwhelming beauty and variety of its scenery.

"But North Carolina can no longer afford to take that scenery for granted," the report says. "Environmental abuse is taking its toll and the

It wasn't long ago that many tourists heading south passed by the more rural, inaccessible North Carolina beaches for South Carolina and the sandy white beaches of south Florida. But no more.

state must act now to intensify its efforts to protect our natural habitat."

Otherwise, destruction of the state's scenery through neglect will result in the gradual loss of the tourism industry, the report warns.

The success of coastal tourism also rides on the services that most communities take for granted on a day-to-day basis.

In *Ocracokers*, Ballance writes, "If the lighthouse belongs to the past,

Steve Murray



Pier fishing is a favorite pastime of locals and visitors. Recreational fishing is one of the state's top tourism draws.

for Hall because it's not as easy to enjoy the exceptional coastal scenery that brought him to the area. But he says tourism has been a mixed blessing to Wrightsville Beach and Wilmington where retail sales are robust.

"I suspect the situation will

then the water tower belongs to the future”

Dare County responded to the summertime cry for water with a reverse-osmosis plant that can make the brackish groundwater from wells drinkable.

Sewer is another challenge on the coast, where most communities rely on septic systems and mini-treatment plants. Water quality is on ongoing concern.

Atlantic Beach is pursuing a plan

The Outer Banks especially are a magnet for travelers from the North, who consider these beaches a mecca for fishing, surfing, windsurfing and hang gliding.

to treat its sewage and pipe it 25 miles inland to Open Grounds Farm, where it would be used to irrigate crops. The idea is not without controversy, but it's preferable to ocean dumping, Miller says.

Garbage disposal poses some difficulty because the high coastal water table makes landfill sites hard to locate. Many coastal counties are discussing regional compacts for future sites.

Efforts to get visitors to recycle have met with some success because tourists from the North are accustomed to recycling, says White, Dare County spokeswoman. Many are required to recycle at home.

And Dare County is beefing up its emergency response system with an enhanced 911 system that will automatically identify the address of a caller. The county has found that tourists in trouble call for help

without knowing their address, White says.

“When tourists come here, to them the whole beach strand is Nags Head,” she says. “They don’t realize they may be in Duck or someplace else. They don’t know where they are. They just have a beach cottage number.”

lot of plastic things going on. No high-rises. So people can come and walk on the beach and enjoy themselves.”

Dollard moved from Fairfax, Va., to Southern Shores in 1972 after decades of vacationing along the Outer Banks. She and her husband had originally planned to retire in Florida, but it was “too plastic” there, she says.



Offshore racing with spinnakers aloft.

Scott Taylor

The bottom line in each community is striking that fragile balance between economy and ecology, Ballance says. North Carolina residents and visitors need to practice control and sacrifice.

“The history of the world is that man has destroyed the things that he loved,” he says.

To Dollard, Dare County commissioner, the answer lies in holding fast to the simple, family-oriented atmosphere of the Outer Banks. It means limiting construction and shopping centers to protect the environment and the small businessman who already struggles against a cyclical season.

“I think there’s more of the nature preserved down here,” says Dollard, a transplant from Virginia. “We don’t have boardwalks, and we don’t have a

North Carolinians don’t have to look as far south as Florida, or as far north as the New Jersey shores, to find examples of tourism-based growth gone in a direction they may not want to follow, Miller says.

Just south of the border, high-rise condos and hotels lining the Myrtle Beach “Grand Strand” invite comparisons to the Miami-to-Ft. Lauderdale corridor in south Florida, according to the national beach survey.

And even Hilton Head, S.C., has too much of a country club feel to suit folks like Miller. Most South Carolina islands now sport major golf courses.

“I saw a guy there walking down the beach carrying a golf club instead of a fishing rod,” Miller says. “You still see people on North Carolina shores carrying fishing rods.” ☺

By Carla B. Burgess

Aycock Brown knew every step of the tourism waltz. He knew the value of investing in tourism and reportedly loaned a dollar or two to visiting strangers. He claimed it always came back to him tenfold.

The Outer Banks' first true publicist, Brown knew the meaning of free ad copy. He sold the coast to big-city magazine and newspaper editors through photographs of choice channel bass, shipwrecks, banker ponies and scantily-clad women.

His suggestion of an impending hurricane lured a gaggle of reporters to the pinnacle of Jockey's Ridge. The storm never struck, but Brown's public relations machine did. The press left knowing that the Outer Banks were on the map.

If he were still alive, Brown would most likely be impressed with what he spawned.

Today, Dare County tourism officials tempt journalists to the seaside without the promise of a natural disaster. Twice a year, writers are treated to an all-expenses-paid romp in the sand and surf and a healthy dose of Southern hospitality.

It's a formula that never fails, says Gene O'Bleness, director of the Dare County Tourist Bureau. The metropolitan newspaper reporters pay homage to the barrier islands in Sunday travel sections across the country.

"The phones go off the hook on Monday," says O'Bleness.

Travel and tourism is the main contributor to Dare County's \$500 million economy. With the help of automated bridge counters, the county has estimated its annual number of visitors at 6.5 million. It ranks fourth among North Carolina's 100 counties in dollars spent on travel and tourism.

With 22,000 restaurant seats, 5,200 hotel and motel rooms, 14,000 cottages for rent and an estimated carrying capacity of 150,000, the

county stands to gain a lot from the advertising dollars it invests. Thanks to revenues generated by a 1 percent levy in the county's occupancy tax and a new 1 percent prepared meals tax, the

**With the stakes so high,
travel and tourism
has become more
sophisticated.
Tourist communities are
spending big dollars
to determine trends and
learning how to capitalize
on their knowledge.**

bureau will have about \$1.5 million to spend this year.

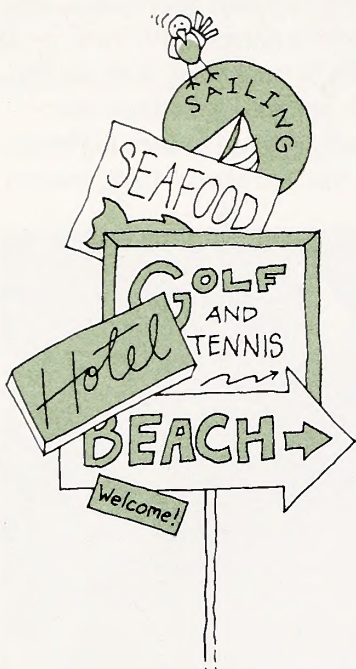
That's a far cry from the \$10,000 that fueled the bureau's operation in 1952, the year it incorporated.

"Throughout those early years, the tourist bureau lived from hand to mouth and did not have a prominent funding source," O'Bleness says. "Our basic budget up until last year was about \$200,000 — \$170,000 of which came through ABC sources."

With the stakes so high, travel and tourism has become more sophisticated. Tourist communities are spending big dollars to determine trends and learning how to capitalize on their knowledge.

"For every media dollar invested in advertising, we get \$5.28 in tax revenue from non-residents who visit the state," says Larry Gustke, associate professor of parks, recreation and tourism management at N.C. State University.

Dare and other coastal tourism meccas such as Carteret and New Hanover counties have abandoned the shotgun approach to advertising that scatters information to a general



Selling the Seaside Year- Round



audience, says Gustke.

Tourism representatives are marketing with rifles these days, gathering data about tourists and targeting their message to specific audiences.

"They are spending more energy to establish market profiles and preferences," he says.

Gustke's department contracts with travel and tourism agencies in North Carolina to conduct research and gather and interpret data on economic impacts of tourism. The information helps communities make better marketing decisions, tailor promotional materials and develop more effective strategies.

Another trend in coastal tourism is the heavy emphasis on promoting the shoulder seasons of spring and fall.

"In 1989 when I came here, the

promoting the shoulder seasons. The bureau spends 75 percent of its budget to sell the seashore in spring and fall. Residual impact of off-season advertising keeps vacationers coming in the summertime.

The other 25 percent is earmarked for special projects created by the impacts of the tourism industry. They could range from beach renourishment to a windsurfing museum, says O'Bleness.

"When we were able to capitalize on getting 1 percent of the occupancy tax and the new meals tax, that eliminated the difficulty in seeking national paid advertising," he says. "That put us in competition with other major areas like Myrtle Beach, Atlantic City and Ocean City."

O'Bleness says the bureau advertises in more than 20 regional

areas are also using occupancy taxes to fund promotion of the shoulder seasons. The Cape Fear Coast Convention and Visitors Bureau, which covers the town of Wilmington and the beaches of Carolina, Wrightsville and Kure, spends

The business and convention market is feeding travel and tourism industry in all coastal areas.

\$370,000 on its marketing efforts. President Jane Peterson estimates the economic impact of travel and tourism in the county at around \$200 million.

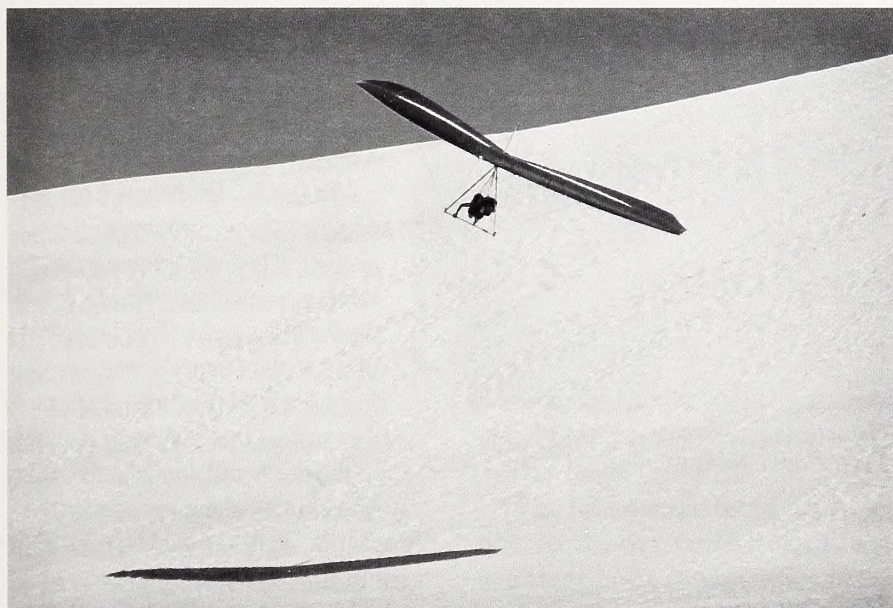
The board of the Carteret County Tourism Development Bureau gets 55 percent of the revenues generated by the county's 3 percent room tax, which translates to about \$650,000 to spend on promoting the Crystal Coast each year. Director of Tourism Carol Lohr estimates travel and tourism revenues at around \$150 million.

All three areas issue press releases and offer toll-free telephone numbers. Dare's tourist bureau has received more than 50,000 calls since installing its hotline the first of the year. Nearly 15,000 callers dialed the number in February alone.

New Hanover County even has a hotline just for Canadians. Because if tourism promoters have learned anything from research, it's that vacationers tend to travel north to see mountains and south to see the sea.

In March, the Cape Fear Coast Convention and Visitors Bureau promoted the first "Southern Lights" festival. Our Canadian neighbors to the north enjoyed folk, bluegrass and blues music at Wilmington's historic Thalian Hall; late-night downtown

Continued



Hang gliding at Jockey's Ridge.

Scott Taylor

vast majority of the state travel and tourism budget was spent promoting the traditional vacation seasons," says Dick Trammell, director of North Carolina's Division of Travel and Tourism. "Now instead of having feast and famine, you have a more balanced travel industry."

With its funding in order, the Dare County Tourist Bureau created a 13-member tourism board charged with

and national magazines, including *Southern Living*, *The Saturday Evening Post* and *Mature Outlook*. Response coupons help track who is using the ads. And callers who use the bureau's toll-free number are asked to supply their name, address, time of planned visit, any special interests and how they learned about the Dare County hotline.

Other North Carolina coastal

shopping; theater and nature expeditions.

"We took everything in the area that happened anyway and packaged it into a festival for Canadians," says Peterson.

O'Bleness says that in the fall, Canadians are among thousands of windsurfers who converge on a broad, shallow expanse of water in the hook of Hatteras Island dubbed the Canadian Hole.

The Outer Banks have long been revered for their fine surfing and sailing venues. But windsurfing, which is surging in popularity, has a different impact on the coastal economy, he says.

"With surfing you picture the blond kid on the surfboard curled underneath the wave," he says. "Windsurfers come in here with a BMW or a Mercedes with three or four beautiful sailboards on custom-built trailers. Each one of those sailboards would probably run two to three thousand dollars."

The Dare bureau is experimenting with cable television to reach these athletes, sportfishermen and other beach-bound travelers. A 30-minute magazine-style program about the Outer Banks aired on a sports-oriented cable channel with a viewing audience of 2 million, O'Bleness says. The program ran four times a week for two 13-week stints, one in the fall of 1990 and the other during spring 1991. The bureau bought the air time, and the channel, Home Team Sports, produced the shows.

The Travel News Network did five 90-second features that aired for a week during June 1991. The bureau tracked an overwhelming response to this televised exposure, says O'Bleness.

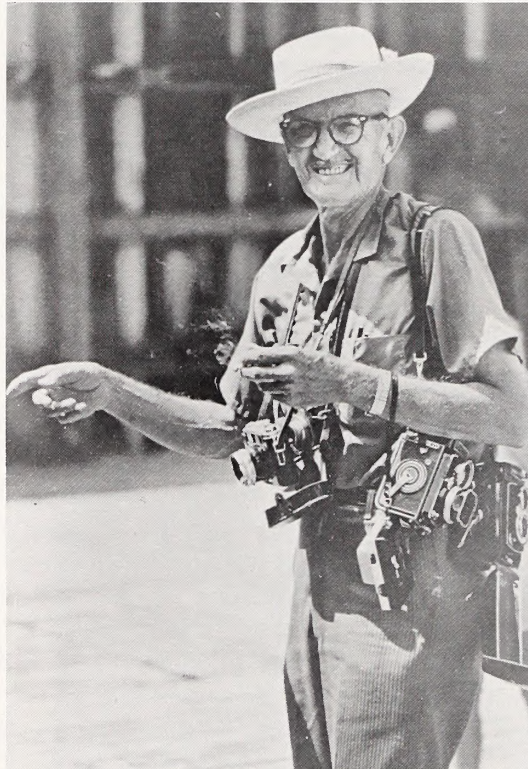
"We're looking all the time to find new ways to tell the story of the Outer Banks," he says.

Other target markets for coastal tourism are golfers, hang gliders,

families, business travel, conventions, senior citizens and nature lovers. One of the fastest growing markets is the tour group industry. Their participants have more "spendable income," says Lohr.

"We're aggressively going after the group tour market," she says. "It's been proven that when a motor coach spends the night in your area, it's going to leave behind \$3,000."

Photo courtesy of Outer Banks History Center



The late Aycock Brown, renowned Outer Banks publicist.

As an added incentive for group tours to choose the Crystal Coast, the bureau offers free "step-on guide service." With enough advance notice, Lohr and her assistants will dress up like pirates and provide point-to-point narration for historical hot spots.

Attractions such as the five-sided Civil War fortress at Fort Macon and the N.C. Maritime Museum are portals to the region's history.

Visitors learn "that Blackbeard really walked on our beaches and that soldiers really camped out around this building I'm sitting in today," she

says. "They'll remember us and learn what we have to offer here."

The bureau even offers hospitality training "for frontline help right on down to the janitors," says Lohr. "We bring in waiters and waitresses and tell them how to answer questions, how to avoid being negative, how to give accurate road directions, to always smile — the basic 'we're glad you're here' attitude."

Such emphasis has measurable results. Agreeable residents and a picture-postcard appeal rank among the top reasons tourists select the Tar Heel coast as a vacation destination, according to surveys.

Over the past five years, says Gustke, coastal tourism officials have begun to change their advertising strategy, flaunting the "scenery" and other perks as much as specific attractions.

"The image of North Carolina is that it's kind of rural, has beautiful scenery and very friendly people," he says.

Lohr says the beaches of Carteret are geographically distinct. They are oriented east to west, which is uncommon along the Atlantic coast. This layout protects the county's beaches from some of the more destructive storms that plague shorelines to the north and south, Lohr says.

The climate along the southern beaches is what sets the Cape Fear coast apart, Peterson says.

"Our weather in this little corner of North Carolina is a lot different," she says. "It's called the top of the subtropical. You see palm trees. Our rain comes in showers, and then it can be beautiful in the same day."

Divers, fishermen and sunbathers alike favor the region's balmy weather, she says.

Another asset to travel and tourism is the growing movie industry in New Hanover County. Peterson says the blockbuster thriller

"Cape Fear," starring Nick Nolte, Robert DeNiro and Jessica Lange, was a publicity dream come true.

"That's about the best marketing piece you could have," she says.

Natural history is a drawing card along all 320 miles of the Tar Heel coast.

"We're promoting ecotourism in which people can come down and go to the Cape Hatteras National Seashore and other sanctuaries like the Alligator River National Wildlife Refuge to canoe and to go bird-watching," says O'Bleness.

Promotional brochures advertise the Outer Banks as the "natural choice."

"We've always sold our environment — the air being clean, the water being clean and beaches being clean and uncrowded," says John Bone, executive vice president of the Outer Banks Chamber of Commerce.

"There's a lot of undeveloped oceanfront property, which makes this area very attractive," he says. "People can be in areas like Nags Head and Kill Devil Hills, where there a lot of things going on, and then drift off to Ocracoke and Hatteras and be relatively by yourself."

O'Bleness says the 90 miles of national seashore is his area's golden egg.

"You're always going to be able to drive to Whalebone and south and be as isolated as you want to be," he says.

And prudent zoning and planning along the northern Outer Banks has kept the beach from being striped with shadows of high-rise hotels and condominiums.

"We're not building a wall of buildings to block out the sun at two o'clock," O'Bleness says.

In fact, many folks to the north are fleeing cluttered beaches for southbound vacation destinations.

Studies have shown Dare County

that 40 percent of its tourist traffic comes from Virginia. Twenty percent comes from within North Carolina, and the remainder funnels from northeastern states such as Ohio, Pennsylvania, Maryland, New Jersey and New York, says Bone.

"The central coast and the southern coast have a strong North Carolina market and what I would

The Outer Banks' first true publicist, Aycock Brown knew the meaning of free ad copy. He sold the coast to big-city magazine and newspaper editors through photographs of choice channel bass, shipwrecks, banker ponies and scantily-clad women.

describe as a growing midwest market," says Trammell.

The business and convention market is feeding the travel and tourism industry in all coastal areas.

"We are seeking conventions and group meetings ranging from 25 to 400 or 450 people," says O'Bleness. "We had over 260 such groups last year."

A group of General Motors vice presidents rented 16 cottages for a northeast regional convention during a recent off-season month, he says.

In the summer, the cottage industry usually serves families with children on the traditional one- to two-week vacation.

"In larger cottages, 'cottage' is really a misnomer," he says of the million-dollar 12-bedroom homes that rent from \$3,000 to \$6,000 a week.

And of course there are cottages in the three-figure range for a homier vacation, he says.

"In the fall, we begin to see couples, childless families, senior citizens coming down with tour groups as well as independently, a lot of fishermen and a lot of golfers," he says.


Dispelling the seasonal image of beach communities is a challenge — both to tourists and to the employees in the industry who have become favorably accustomed to their irregular work lifestyle, says NCSU's Gustke.


But Dare County representatives say their area has already flowered into a 12-month industry. The "open-all-year list," once contained on two 8 1/2-by-11 sheets, is now a veritable encyclopedia, says Bone.

"In September and October, the beaches are still nice," says Bone. "We have a lot of people that come here at Thanksgiving for family reunions. A lot of people come here at Christmas."

About 212,000 visitors stopped by Dare County's three visitor centers during 1991. Studies have shown that 58 percent of those visitors will come again.

Dare County has an estimated \$500 million in gross retail sales receipts and 23,746 permanent residents, almost half of whom are employed by the travel and tourism industry.

"If you were to divide into \$500 million every man, woman and child, no matter what their age, they would have to spend in excess of \$24,000 each in a year," says O'Bleness. "That's a roundabout way of saying how much the tourism industry is really worth to us." 



Guess Who's Coming to Visit

By Kathy Hart

Like the dropping of the green flag at a NASCAR race, Memorial Day marks the rush of tourists to the North Carolina coast. Tourism officials estimate that millions of people vacation along our coastal shores year-round, with a majority making the trip between May and September.

Some seek the isolation of Ocracoke, others the homestyle beaches of Topsail, Sunset and Emerald Isle. They come to swing a club, cast a line, set a sail and hang ten. For some it's an annual pilgrimage to get away; for others, it's a chance to get together with family and friends.

They seek the beauty of the lighthouses, explore coastal fortresses and a battleship, educate themselves at aquariums and museums, and gorge themselves on plates heaped high with some of the best seafood the East Coast has to offer.

They pitch tents and rent rooms. Some seek the luxury of fancy condominiums and others want a home-away-from-home cottage with a porch, a good view and a rocking chair.

Whatever the reason, they come and they spend money — money vitally important to the coastal economy.

To find out more about our coastal guests — why they come, how much they spend, what they do and where they come from — the Office of Park and Tourism Research at N.C. State University periodically surveys travelers for the N.C. Division of Travel and Tourism. The last survey was performed in 1989.

Here's what they learned.

For North Carolinians, the southern coast, from Carteret County south, is the most popular tourist destination in the state. However, out-of-staters prefer the northern coast.

These preferences are a reflection of the road system and the desire of travelers to spend time on the sand rather than in the car, says Dick Trammell, director of the state's

Division of Travel and Tourism.

Two four-lane highways, Interstate 40 and U.S. 70, make travel to the state's central and southern beaches a faster, easier trip for North Carolinians, especially from cities such as Raleigh, Durham, Greensboro, Asheboro and Winston-Salem. From Raleigh, you can be on Wrightsville Beach in two-and-one-half hours and on Atlantic Beach in three.

But the Outer Banks aren't as accessible for Tar Heel vacationers. The trip from Raleigh to Nags Head takes four hours on a good day when traffic isn't congesting the two-lane highway that links our northern shores to mainland North Carolina.

However, the trip from Virginia to the Outer Banks is faster and along better roadways. So it's no wonder that Virginians flock to our northeast corner to sample the beauty of our beaches and to avoid the overdevelopment plaguing their own shores, Trammell says. Visitors from other northern states come too, particularly those along the Atlantic Seaboard.

By the same token, North Carolinians in the mountains and southern

Like the dropping
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foothills tend to head to South Carolina beaches for vacation.

Once they have sunk their toes in the sand, Tar Heel vacationers tend to stay longer than out-of-staters. Resident travelers stay an average of 6.5 nights at the coast; non-residents, 4.67 nights on northern shores and 4.91 nights at southern beaches.

Hotels, motels and resorts were



the most popular lodging choice for all seaside visitors, followed in most cases by cabins, condominiums and cottages.

When it comes to spending money, out-of-staters are freer with their pocketbooks. Non-resident visitors to

Banks in order of preference are the Wright Brothers Memorial, the lighthouses, the Cape Hatteras National Seashore, the N.C. Aquarium at Roanoke Island and "The Lost Colony" outdoor drama.



They seek the beauty of the lighthouses, explore coastal fortresses and a battleship, educate themselves at aquariums and museums, and gorge themselves on plates heaped high with some of the best seafood the East Coast has to offer.



Two-wheeling along the Tar Heel coast.

Jim Erickson

the northern coast spend an average of \$789 per trip; down south, they spend less: \$607. Frugal North Carolinians average spending only \$578 on their coastal vacations.

The top three expenditures in all cases were lodging, eating and drinking establishments, and food and supplies bought at stores.

Once they unfurl their towels and pop up the beach umbrellas, Tar Heel vacationers are inclined to stay put. More than 50 percent of the state's resident vacationers never visit an attraction such as the *USS North Carolina* or the Wright Brothers Memorial. And if they do venture away from the cottage, they tend to visit only one site.

Our out-of-state guests are more adventuresome. Twenty percent of those staying along the northern coast and 16 percent along the southern shores visit three to four attractions.

The most popular attractions for non-resident guests along the Outer

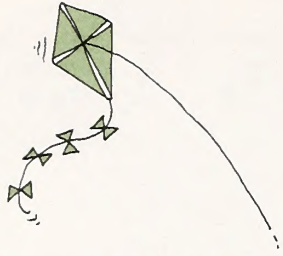
Southward, non-residents like to visit the Wright Brothers Memorial, the N.C. Aquariums at Bogue Banks and Fort Fisher, the *USS North Carolina*, the Cape Hatteras National Seashore, Fort Macon and the lighthouses. Obviously, these folks need a geography lesson because neither the Wright Brothers Memorial nor the Cape Hatteras National Seashore are located along our southern coast.

North Carolina natives prefer these attractions: the N.C. Aquariums, the *USS North Carolina*, Fort Fisher, Fort Macon, "The Lost Colony" outdoor drama and Tryon Palace.

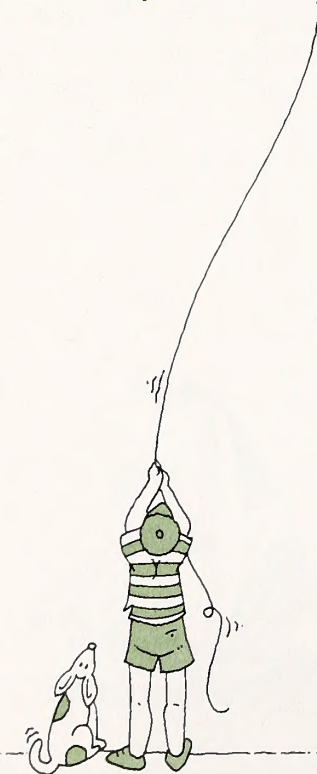
Of the non-natives who came to sit a spell along our northern shores, 81.5 percent were repeat guests, with 45.6 percent of these having visited one to five times in the last five years. Even more surprisingly, almost 10 percent said they had come calling to

Continued





Some seek the isolation of Ocracoke, others the homestyle beaches of Topsail, Sunset and Emerald Isle. They come to swing a club, cast a line, set a sail and hang ten. For some it's an annual pilgrimage to get away; for others, it's a chance to get together with family and friends.



the Outer Banks more than 16 times in the previous five years.

But from Morehead City south, the story is different. Only 17.3 percent of the out-of-staters who sampled our shores had visited before.

How do tourists rate our beaches as a vacation spot?

Non-residents gave the Outer Banks a rating of 4.31 — or B+ — on a scale of 1 to 5 where 1=F and 5=A.

They were most satisfied with the availability of tourist information, the friendliness of the people and the quality of service at tourist businesses. They were least happy with the quality of the highways, the cost of visiting the area and the quality of the eating and drinking establishments.

The aspects they liked best about our northern shores were the wonderful beaches, friendly people and the fact the area was clean and unspoiled.

Non-natives visiting our southern shores gave them a grade of B, or 4.13. In this region, non-residents were most pleased with the friendliness of the people, the availability of tourist information and the quality of service at tourist businesses. They gave their lowest ratings to the cost of their trip, the quality of restaurants and the quality of lodging.

Native North Carolinians, perhaps guilty of the grass-is-always-greener-on-the-other-side syndrome, were the most critical of our coast. They gave the shore a mark of 3.87, or B-.

Natives gave their best ratings to the friendliness of the people, the quality of the restaurants and the quality of the lodging. Their least favorable marks went to the quality of the highways, the attractiveness of roadside scenery and the cost of their visit.

And just who are these people rating our coast?

The non-resident visitors to the

Outer Banks normally travel in groups of 4.21 people, usually family, that are led by a male more than 30 years old who has at least finished high school and in many cases college.

The household income for the majority of these visitors exceeded \$30,000, with 32.7 percent in excess of \$50,000. Nearly 75 percent of the travelers were part of dual-income families, and they hailed largely from Virginia, Pennsylvania, Maryland, New York and Ohio.

Non-natives vacationing along our southern beaches come in groups of 3.4, usually family, that are also led by a male older than 30 who has finished high school.

The household income for the majority of these travelers surpassed \$30,000, with 31.9 percent exceeding \$50,000. Seventy percent of the respondents were part of two-income households.

Virginia, Florida, New York, Pennsylvania and Maryland were the states these southbound non-residents most frequently called home.

Tar Heel travel parties to the coast were again for the most part led by males over 30 who had received a high school or college education.

The majority of the household incomes topped \$30,000, with 33.5 maxing out at more than \$50,000.

Of these coastal resident visitors, 41.4 percent hailed from the Carolina heartland — an area that includes Durham, Raleigh, Wilson, Rocky Mount and Fayetteville. They were followed by folks who traveled from the northern foothills, 24.6 percent, and the southern foothills, 12.6 percent.

This snapshot of the North Carolina coastal tourist helps the state's Division of Travel and Tourism and local municipalities and county governments know their visitors better, target their advertisements and meet the needs of their guests. ☺

Anyone for Surfing, Sailing and Sea Kayaking?

By Kathy Hart

Tell anyone you're planning a coastal vacation, and they'll assume you are going to lie on the beach, play in the surf and pig out on plates of steaming seafood.

And there's nothing wrong with that. In fact, it's just what doctors order for work-weary people who need to escape the daily grind.

But for other folks, a day at the coast is a ticket to adventure. To heck with the beach towel, lounge chair and umbrella. They'd rather sail than sit or catch a curl rather than catch the rays.

Below is a list of "other" activities you can consider the next time you plan a seaside vacation.

golf — Ten years ago, only a handful of golf courses dotted our seaside. But now, more than 40 golf

courses, most south of Wilmington, beckon those men and women who spend hours swinging a club.

Not only are golf courses more abundant, they are also far above par, says Rocky Kurland of *Golf Magazine*.

"North Carolina has some of the best courses in the country," Kurland says. And many, he notes, are designed by top-name golf course architects.

Despite the abundance and excellence of our courses, Tar Heel coastal golf has until recently been a well-kept secret. Now, Dick Trammell, director of the state's Division of Travel and Tourism, is marketing North Carolina as a golf destination, creating competition for neighboring South Carolina.

The marketing efforts are paying off as more golfers from in the state and out are teeing up.

If you want to tee off on a top course in early spring and fall, plan ahead, Kurland says. Courses can be crowded and prime tee times taken during these choice seasons.

And golf can be a bargain in North Carolina. "You can easily get on a course for \$20 to \$30 on up," Kurland says. "That's an excellent price when you consider that it can cost more than \$200 to get on some courses in other areas of the country."

surf fishing — At the first hint of a northerly breeze in the fall, surf fishermen pack their off-road vehicles with coolers, waders, bait and tackle.

Jim Bahen, a Sea Grant Marine Advisory Service agent, says fall fishing is best because larger fish are moving to inshore areas to spawn. Along the Outer Banks, surf anglers line the shore from September through November as they cast for red drum and bluefish. Southward, surf fishermen hope to lure flounder and speckled trout to their lines.

Coastal hotels and motels often offer these avid anglers special

discount rates, and some municipalities allow the fishermen to drive on the beach.

But fall isn't the only time fishermen can cast a line in the surf. Anglers can also fill their coolers with catch in the spring. Then, young adult panfish, such as spot, croaker, whiting and flounder, are leaving their estuarine nurseries to face adulthood in the big ocean beyond.

If you're limited to summer surf fishing, Bahen advises dropping your line in the early morning or late afternoon when there are fewer swimmers to scare off the fish.

pier fishing — If you want an easy way to catch fish, there's nothing easier than dropping a line off the end of one of North Carolina's many coastal piers.

"You don't have to do much fancy casting or have much fancy equipment to pier fish," Bahen says. "And the good thing about a pier is it gives you access to different depths of water for catching different fish."

At the end of the pier, where water depths are 18 to 25 feet, anglers can drop a line for king mackerel, drum along the Outer Banks or shark in the winter.

Three-quarters of the way down the pier, you'll find fishermen jigging for Spanish mackerel in the early morning or late afternoon. At the halfway point, in water depths of 2 to 8 feet, anglers cast a bottom rig for spot, croaker, whiting and bluefish.

Most piers are accessible year-round, but many close their concession area or bait-and-tackle shop during the winter months.

charter fishing — Forget bluefish and croaker. Some recreational anglers are lured only by the fight of big game fish. If that's your lure for fishing, then you're game for North Carolina's charter boat fleet.

You can charter a boat into

Continued

offshore waters from locations all along the Carolina coast. From the Outer Banks, it's about 20 miles to the Gulf Stream, a northbound interstate highway for game fish such as blue marlin, white marlin, sailfish, swordfish, wahoo, dolphin and tuna.

A charter boat for six to this fishing heaven can cost more than \$700 a day and may require several months of advance planning if a particular boat and captain are sought.

From Morehead City south, the Gulf Stream is 40 to 50 miles offshore. Some charters go the distance, but many take advantage of inshore waters, ferrying their paying customers to locations where they can angle for Spanish and king mackerel, Bahen says.

A new type of charter industry is building along the coast, Bahen says. Smaller 20- to 28-foot charter boats are taking parties of two to four people for full days and half-days to fish inshore for drum, trout or Spanish mackerel. The cost for a half day of fishing fun is about \$125.

For those who don't mind fishing in mass, climb aboard one of several headboats that ply North Carolina's offshore waters. For \$20 or \$30, you can join 30 other anglers fishing for snapper, grouper or sea bass.

sailing — If you like the cool, quiet appeal of sailing, then the North Carolina coast is the place for you.

The state's coastal rivers, sounds and offshore waters offer a variety of sailing experiences for everyone from the beginning sailor to the experienced old salt, says Bill Lynn of Whitaker Creek Yacht Harbor in Oriental.

"North Carolina has an attractive climate, and the sailing is super steady because of the consistent winds," Lynn says.

Most sailors, he says, sail for the sake of the experience and not as means of getting from place to place. But for those who are destination-

bound, the state has a ready supply of marinas and public docks.

To learn to sail, enroll in one of two sailing schools located in Oriental, Lynn says. Oriental is the sailing mecca of North Carolina, but other towns — Beaufort, Belhaven, Elizabeth City, New Bern and Wrightsville Beach — cater to the sailing crowd too.

For sailors bitten by the racing bug, there are organized regattas. Or you can come to Oriental on a Sunday afternoon for what Lynn calls "beer can racing" that is rowdy, informal and lots of fun.

Don't let the lack of sailboat stop you from cruising the Carolina sounds. A boat of almost any size can be rented from a yacht harbor. You can even hire the services of captain if you don't know how to sail.

Summer isn't the only time to set sail in Tar Heel waters. Fall and spring offer milder temperatures and better breezes to catch your sails. Even winter, particularly along our southern shores, serves up enough 50- and 60-degree days to make sailing a year-round sport in North Carolina.

windsurfing — In spring and fall, there's a spot on the inside elbow of Hatteras Island that attracts Canadian windsurfers like kids to candy. In fact, the area has been named the Canadian Hole in honor of its popularity among our northern neighbors.

"The Canadians come here in droves," says Ralph Buxton of Kitty Hawk Sports. "They make up fifty percent of our windsurfing traffic in the spring and fall. Hatteras is the first warm water they can hit and get good winds."

Buxton says some days 200 to 300 windsurfers congregate at the Canadian Hole. They come because of the excellent windsurfing conditions and because they like to socialize while they're riding their boards.

But other areas along the Outer

Banks and the North Carolina coast offer conditions that are just as favorable for windsurfing, Buxton says.

"Oceanside, we have hundreds of miles of shoreline with wave conditions for real enthusiasts," Buxton says. "But most people prefer the sound. The water's warmer, especially in spring, and the sounds are shallow. That makes it easy to get back on if you fall off."

surfing — When it comes to catching a wave, the waves along North Carolina's Outer Banks are the ones to catch. The Outer Banks surf is famous along the East Coast for those folks, usually teenagers and young adults, who hang ten.

"It's the most consistent place to surf, particularly the area near the Rodanthe pier and the Cape Hatteras Lighthouse," says Ashley Long of Wave Riding Vehicles, a surf shop. "Here, you can find a rideable wave every day."

Long says surfers come from as far away as Florida and Maine to ride the waves. The best waves roll ashore in winter, Long says. Then surfers must don wet suits, booties, gloves and hoods to withstand the elements.

Long says the Outer Banks' reputation for surfing has spread by word of mouth and advertising by local surf shops. Good surfers know when surfing is at its best by listening to the weather report, but Long says surfers can also call ahead for a surf report.

Most surfers are just weekend visitors, and typically they camp, Long says. But those who travel from farther distances stay longer. Long says surfers make good tourists because they spend money in shops and restaurants. "Surfing is totally good for the tourism," he says.

hang gliding — If you ever wondered what it would be like to soar like a sea gull, then you'll probably

never come closer to that feeling than hang gliding. And there's no better place to learn this air-lifting sport than on the soft sands of Jockey's Ridge.

More than 10,000 people have learned to hang glide along the dune's gentle slopes, says Nancy McWilliams of Kitty Hawk Kites, the nation's largest hang gliding school. McWilliams says the high-flying school has taught people who range in age from 8 to 80 years old.

But there's one catch. You must weigh between 85 and 220 pounds, McWilliams says.

To take a beginner hang gliding lesson on the East Coast's largest sand dune will cost \$59 for three hours of instruction. Classes are taught year-round, and McWilliams says each class member will complete five short flights.

But don't think for a moment that beginners glide from the crest of the 150-foot tall dune. McWilliams says such heights are reserved for experienced hang gliders.

sea kayaking — Capitalizing on the 1990s ecotourism trend of going back to nature, sea kayaking takes the kayak out of white water and plunks it down in the rolling sea. Here, people can paddle along at a leisurely pace and enjoy the beauty of the coast, says Buxton, also an owner in Kitty Hawk Kayaks.

"Sea kayaking is to white-water kayaking what downhill skiing is to cross-country skiing," Buxton says. "There's more emphasis on endurance rather than speed."

Buxton compares sea kayaking to

backpacking on the water. It allows you to explore remote areas such as the Alligator River National Wildlife Refuge or Portsmouth Island and experience nature at close range.

Through Kitty Hawk Kayaks, Buxton teaches classes and offers guided tours of several natural areas along the Outer Banks.

diving — North Carolina's offshore waters are a wreck . . . after



Children enjoy a day at the beach.

Scott Taylor

wreck . . . after wreck. And these wrecks — for which we gained the notorious nickname "Graveyard of the Atlantic" — attract divers to explore the depths of the state's continental shelf.

Ninety percent of the people who dive off the Tar Heel coast do so specifically to see a wreck, mostly those sunk by the Germans during World War II, says Bill Thompson of Discovery Dive Shop in Beaufort.

During summer, water temperatures reach the low 80s and visibility in the water is 80 feet — conditions that are ideal for those willing to take the plunge. Thompson says that Discovery Dive Shop has seven charter boats that run divers to wreck locations located an hour to an hour and a half offshore in waters 50 to 100 feet deep.

The German submarine U-352 is the most popular dive spot, he says. And divers get the added treat of seeing many tropical and subtropical fish species from the nearby Gulf Stream.

bicycling — If you want to see the coast on two wheels instead of four, cycle during the spring or fall, says Mary Meletioui of the N.C. Office of Bicycle and Pedestrian Transportation.

These seasons offer less traffic, milder temperatures and fewer bugs for cyclists to contend with, she says. Her office has several coastal bicycle routes of varying lengths for cyclists.

One 300-mile route, named the Port of Call, takes cyclers from Calabash to Corapeake through Wilmington, New Bern, Bath and Edenton. Meletioui also has three long routes that loop

around Pamlico Sound.

And for those interested in shorter day trips, there are routes for Croatan National Forest, Beaufort and Onslow County.

Meletioui suggests biking along the coast during the morning before afternoon breezes increase, changing cycling from a labor of love to an agonizing fight against the wind. She says a casual cyclist can easily pedal 50 miles in a day.

If you want to cycle the Outer Banks, Meletioui recommends pedaling down N.C. 12 south of the Oregon Inlet bridge, preferably before or after the high-volume tourist months of June, July and August.

For more information about coastal bicycle routes, contact Meletioui's office at 919/733-2804. ☐

Getting Out of a Bind

Billions of pounds of plastics find their way into the aquatic and marine environment each year. The sources are many — from ships on the water to beach-goers along the shore.

The durability of plastic has boosted its popularity. But that staying power has caused countless deaths of coastal critters and aquatic animals around the world. Stray six-pack rings, plastic fishing line and other litter can bring untold suffering to the wildlife community.

Humans are able to use their hands and fingers to get out of a simple bind. Or we can ask for help from our friends and family. But animals are helpless when it comes to escaping entanglement in waterway litter.

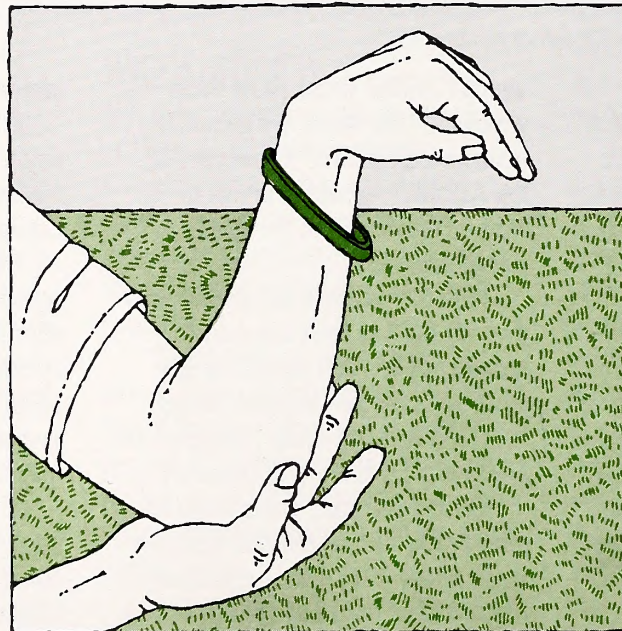
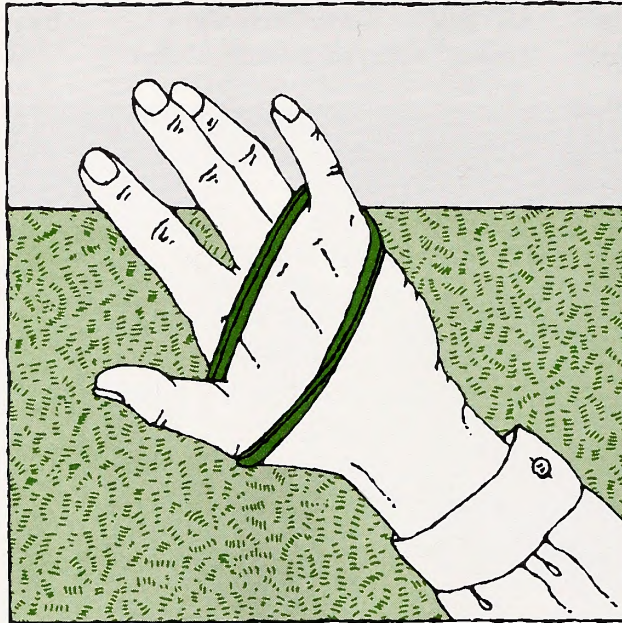
Here's a little exercise to help you understand the problem.

Pair up with a friend, family member or teacher and follow this procedure:

Have your partner put a rubber band around the back of your hand, catching the thumb and little forefinger. Try to remove the rubber band without using the free hand or your teeth or by rubbing it against something.

For a variation, pretend your hand and arm is a goose entangled in plastic. For example, your hand is the goose's head, your fingers its beak and your forearm its neck. Cup your elbow with your free hand. Have your partner wind the rubber

band around the goose's "beak" or around its "neck." Allow yourself only 30 seconds to get free.



Now trade places with your partner and repeat the activities.

Were you successful at untying yourself?

Imagine the animals that don't get free and starve, strangle or suffocate.

You can make a commitment to help keep our oceans, lakes and rivers clean. Be a role model for others. Never throw your trash into the water. And spread the message to others.

Questions For Thought

1. What plastics or other material could the rubber band represent in an aquatic setting?
2. How could an animal get into a situation in which plastics would entangle it?
3. What can you do to prevent animal entanglement?

Adapted from *Ripples: A Big Sweep Elementary Activity Guide*. To order, send \$1 for postage and handling to Sea Grant, Box 8605, N.C. State University, Raleigh, NC 27695.

*1. Fishing line, six-pack ring, plastic bag, packing straps.
2. By swimming into plastic accidentally; by trying to eat a plastic bag or the food inside it, etc.
3. Snip the loops of six-pack rings before throwing them away, never throw plastics into the water, volunteer for a waterway litter cleanup such as Big Sweep.*

Answers

Counting the Creatures

When it comes to completing an animal census, you can't very well leave a survey in the mailbox.

Instead, researchers James Parnell and William Webster trudged through marsh, muck and maritime



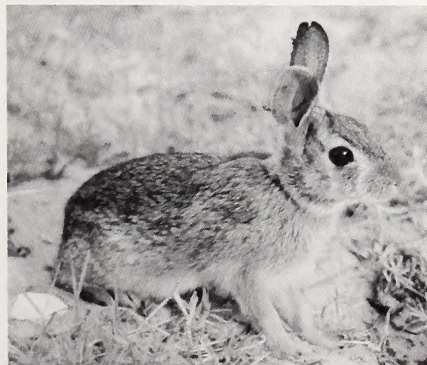
Brown Pelican

forests to count the birds and mammals that inhabit the Cape Hatteras National Seashore.

The research duo from the University of North Carolina at Wilmington sighted the creatures or looked for evidence — droppings or tracks — of their existence.

Now the inventory is complete and the census-takers are comparing their tallies with a count taken 35 years ago by N.C. State University zoologist Thomas Quay.

The results of the comparison were recently published in a book, *Birds and Mammals of the Cape*



Eastern Cottontail

Hatteras National Seashore: Thirty-Five Years of Change, published by the University of North Carolina Sea Grant Program and authored by Parnell, Webster and Quay.

In the late 1950s, Quay counted 243 species of birds and 22 species of mammals in the park. Parnell and Webster, however, found 363 species of birds and 27 species of mammals 35 years later.

The increase in bird species reflects the inclusion of more migratory birds, Parnell says. The Cape Hatteras National Seashore is situated along a major migratory bird route, and many species of birds briefly visit the national park but don't live there.



River Otter

Although the number of species sighted increased, the quantities of some species, such as the red-necked pheasant and southeastern shrew, declined, says Parnell.

Some declines can be attributed to changes in habitat. Few major storms have swept the Outer Banks during the past 30 years, resulting in fewer areas of sparse vegetation and more dense thickets and woodland.

Parnell says these habitat changes can, in turn, change the species of birds and mammals that find the national seashore an attractive place to live.

The 96-page book lists each species sighted and provides infor-



Laughing Gull

mation about its status from each census. The authors also discuss general habitat and animal trends that have occurred in the park during the past 35 years.

The color cover features a flock of sea gulls beside the Cape Hatteras Lighthouse. The book includes 22 photographs of seashore critters such as the eastern kingbird, brant, black skimmer, gray fox and river otter.

For a copy of *Birds and Mammals of the Cape Hatteras National Seashore*, write Sea Grant, Box 8605, N.C. State University, Raleigh, NC 27695. Ask for publication



Peregrine Falcon

number UNC-SG-92-01. Please enclose a check or money order for \$7 made payable to UNC Sea Grant.

Kathy Hart

A Flurry of Festivities

Commercial fishermen in Dare County decided 10 years ago the best way to sell folks on jetties was to invite them over for food and fellowship.

From this early strategy, the Wanchese Seafood Festival was born.

These days, the June event draws crowds numbering in the thousands to the area's commercial fishing center in an annual rite of summer.

The jetty has yet to be built, but the Wanchese festival has helped fishermen explain their vocation and the obstacles to making a living, says Rich Novak, a Sea Grant marine agent and recreation specialist.

It's also been a boon to the Wanchese economy, attracting visitors and their wallets to Roanoke Island with arts and crafts, music, boat tours of the Oregon Inlet and fresh seafood.

"These events are good for the tourism business," says Novak, an early organizer of the festival. "It's gotten to the point now, renters want to know when the festival is held so they can book a cottage."

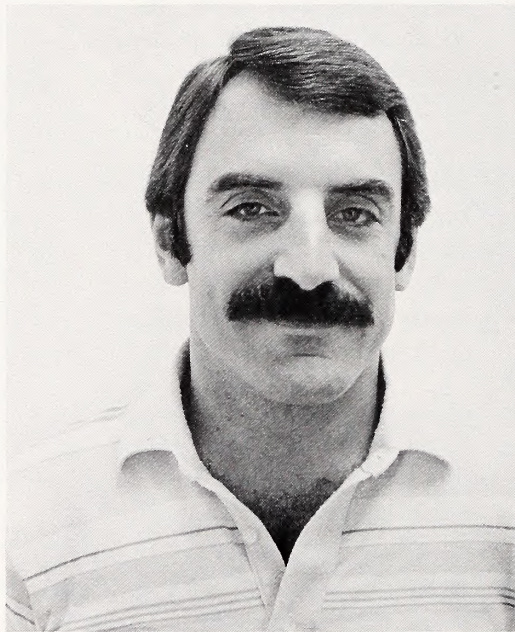
Other coastal events bearing Novak's fingerprints had similar beginnings. Engelhard has a May seafood festival and Ocracoke has a surf fishing tournament held in late April and early May. Dare County has a September triathlon that draws athletes from points all along the Eastern Seaboard. And Belhaven is hatching plans for a September crab festival.

Small coastal communities use these festivals as drawing cards to attract people who otherwise might not have visited. On the Outer Banks alone, a single vacation guide lists 61

year-round events and festivals.

Some — like the Wanchese Seafood Festival — have an underlying cause. Others simply aim to lengthen the tourist season and spotlight the community.

Either way, business gets a jump-



Rich Novak

Neil Caudle

start from the attractions.

Novak helps coastal communities get their event off the ground, putting the organizational foundation into place and spawning ideas for activities.

"There's a whole lot more work than people realize," he says.

From there, local organizers take over.

The Wanchese Seafood Festival started with a blessing of the fleet, a seafood meal and displays of trawling rigs. Organizers wanted folks to understand the plight of the commercial fisherman.

But especially, they wanted support for their controversial campaign to jetty the Oregon Inlet so it would be passable year-round. With the inlet

closed to commercial fishing boats, they must travel south to Hatteras Inlet or north to Virginia to trawl offshore.

In Engelhard, settled on the banks of the Pamlico Sound, the goals and expectations were less political. Organizers of the annual seafood festival wanted to unite the community in an event that would spotlight their local seafood trade.

"It's just a good time to be had," Novak says. "People come from all over the area. About 75 percent of Hyde County appears sometime in the day."

Novak has handed over the festival blueprint and made his customary shift from organizer to participant.

At last year's event, he judged a seafood cook-off and a beauty contest and served up 10 pounds of squid and 20 pounds of shark, breaded and fried in cubes. The samples of underutilized species — once a culinary curiosity — have become a hit with festival-goers.

And he's taken his planning expertise elsewhere.

In Belhaven — a town off the Pungo River — Novak is guiding plans to throw a Sept. 19 crab festival with seafood, tours of seafood processing houses, local arts and crafts, and a dance.

"We want to call attention to the town and hopefully to bring some people in to see it," says Susan Russ, a festival organizer.

"We want people to realize that we're here. If you're going to the Outer Banks from Greenville or Washington, you can bypass Belhaven. We want people to come into town and see what we have to offer."

Jeannie Faris

Sorting Through the Garbage

The list could be an inventory of the county landfill: tires and car parts, a rusted gas can, a refrigerator, a stove, a toilet bowl.

Unfortunately, it's not.

These items are just a sampling of the more than 210 tons of litter volunteers picked up from North Carolina waterways in last fall's First Citizens Bank Big Sweep '91.

Enough trash, collected in the course of four hours, to fill a fleet of 21 garbage trucks to capacity.

Organizers say the bulk of discarded appliances and furniture was hauled off inland lakes and waterways, where the cleanup hit full stride last year. There, volunteers found an electric motor, shopping carts, a mattress and car seat.

But there's more to the annual statewide cleanup than peculiar finds.

Bottles and cans left behind are no less of an eyesore. And plastic and discarded fishing line are deadly to aquatic wildlife that mistake them for food or become entangled.

It's this type of everyday garbage that continues to hold rank in the state's "dirty dozen," the 12 items most cited in the cleanup. On the coast, cigarette butts head the 1991 dirty dozen; inland, glass bottles.

The volume of trash collected statewide — 47 tons more than 1990 — is a rare measure of the hazards of our throwaway society.

But it's also a measure of the North Carolina effort, which rivaled cleanups in Texas, California and Florida in participation and shoreline miles scoured.

Close to 12,500 volunteers

scoured 400 miles of Tar Heel shoreline, from the southern mountains to the coastal plain to the beaches.

The inland and coastal cleanups combined netted 420,000 pounds of



Scott Taylor

litter, more than any other state. The heavy appliances and car parts played a role in driving up the reported weight of North Carolina's garbage, says Susan Bartholomew, First Citizens Bank Big Sweep executive director.

The jump in inland participation was also a factor.

"When we have more tons of garbage than anyone else, it's partly because our cleanup covers more area than just the beach," Bartholomew says.

Nationally, 129,900 volunteers picked up nearly 2.9 million pounds of trash from the shores of 31 states, Washington, D.C., and two territories.

In North Carolina, a profile of the 1991 statewide dirty dozen emerged from inland and coastal statistics. They were the items found most along waterways and coastlines: cigarettes, 95,057; glass drink bottles, 37,220; metal beverage cans, 31,905;

plastic drink bottles, 29,911; plastic food bags and wrappers, 23,053; plastic foam pieces, 22,578; paper pieces, 22,495; plastic pieces, 21,650; plastic foam cups, 17,498; plastic caps and lids, 14,984; glass pieces, 8,368; and plastic straws, 7,686.

The coastal and inland data show North Carolina volunteers gathered enough glass bottles, based on a 10-ounce average weight, to more than fill an 18-foot moving van.

They plucked enough metal cans from the water and shore to fill 737 grocery bags. The energy waste is equivalent to pouring out nearly 1,500 gallons of gasoline.

The plastic straws, placed end to end, could stretch from bow to stern of the *USS North Carolina* more than 6 1/2 times. Cigarette butts would cover more than two miles.

North Carolina led the nation in efforts to expand the cleanup inland. Data in these counties have been collected for only two years and don't yet provide enough information for spotting trends.

But individual inland cleanups have been taking place for years, and the illegal dumping is a long-standing problem, says Janie Wilson, coordinator for the Asheville/Buncombe County Keep America Beautiful.

"The attitude that it's OK to throw trash over the back of the mountain because nobody sees it is still in some people's minds," says Wilson, a Big Sweep coordinator. "I hear it's better than it used to be, but we've still got a long way to go."

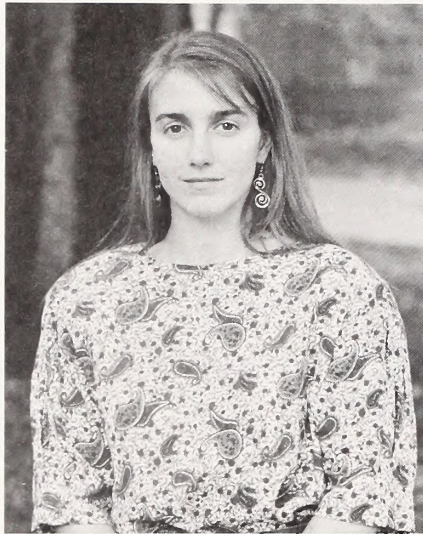
Jeannie Faris

New Water Quality Specialist

Water pollution is an ever-growing concern among people who love the coast. But water quality is also 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 responded to

Kathy Hart



Barbara Doll

these needs with a new full-time position for a water quality specialist.

Barbara Doll joins the Marine Advisory Service staff as water quality specialist on Aug. 17. She holds a master's degree in civil engineering from N.C. State University, with a focus on water resources and biology.

A native of Knotts Island in northern Currituck County, Doll will work with local decision-makers — county and municipal planners and policy-makers — on a range of water quality issues.

This staffing is particularly important because state and federal laws are passing more regulations onto local governments, which often lack the expertise and resources to come into compliance, says MAS Director Jim Murray.

Doll will help find economical solutions to water quality problems and develop a system for distributing useful university and agency research.

She also plans to emphasize the importance of regulations that protect coastal waters.

“Most people see the need in having good water quality,” Doll says. “And they’re more willing to help when they understand.”

A 1992 graduate, Doll also has a year of experience as a staff engineer for Westinghouse Environmental Geotechnical Services Inc., a Raleigh consulting firm. There, she worked on earthen dam designs and construction sites before entering graduate school.

Doll says her year in the engineering field convinced her to apply her degree toward water quality work.

It's easy to raise awareness of environmental problems, she says, but difficult to find answers. Engineers and scientists are equipped to do this.

Murray says the Sea Grant Advisory Board recently rated water quality as a top priority for advisory services. And, he says, a recent public opinion poll in the Albemarle-Pamlico region identified declining water quality as a pressing concern.

Debate on Drilling

The federal government believes oil and natural gas run deep off North Carolina's coast, but the odds that these energy sources will be mined in the coming decade remain uncertain.

Ultimately, Congress will decide the extent to which the oil and gas industry is allowed to develop offshore energy sources.

A 1991 report by the Minerals Management Service (MMS) says an untapped basin in the Atlantic Ocean, called the Carolina Trough, could yield up to 16 trillion cubic feet of natural gas and 690 million barrels of oil.

In May, the MMS released the proposed final five-year leasing program for 1992-1997. MMS is the Interior Department agency responsible for leasing areas offshore for oil and gas exploration.

If approved, the program would allow the industry to bid for the rights to explore and develop 250 Atlantic coast lease blocks, each about 9 miles square. The lease blocks are selected from among 916 that stretch from northern Delaware to Georgia. They include 438 tracts between 19 and 170 miles off the North Carolina coast.

But tapping into this resource may not be feasible now.

Given the continued controversy over the Mobil Oil Corp. leases off North Carolina — located north of the Carolina Trough — some officials doubt any company would risk bidding on the tracts. The Mobil leases are the subject of legislation that would direct the Interior Department to buy them back.

The current political climate, paired with concerns about the environmental impacts of offshore drilling and ready supplies of natural gas, will probably keep any exploratory drilling at bay for the next 10 years, says Kim Crawford, assistant director of the Outer Continental Shelf Office and executive director of the N.C. Ocean Affairs Council.

Also, there are onshore concerns about the potential impacts of a gas processing plant or oil refinery and pipelines on tourism in the coastal communities.

Although the trough does not include the Mobil lease blocks, which are north of Cape Hatteras, the oil and gas projections could have a bearing on the buyback debate.

Congress is wrangling with the issue in two energy bills, passed separately in the House and Senate. A House-Senate conference to resolve the differences is

expected to convene this summer.

The House bill calls for the buyback of Mobil's lease blocks off the North Carolina coast and imposes a moratorium on any new leasing and pre-leasing activities everywhere except in the Gulf of Mexico and most of Alaska until the year 2002.

The Senate bill contains no buyback provisions. It does, however, suspend offshore leasing activities in areas placed under moratorium by President Bush in 1990.

The buyback provisions and moratorium language are generally opposed by the petroleum industry and a number of key congressmen from oil- and gas-producing states.

Mobil wanted to drill the first test well off the North Carolina coast but has been unable to get federal permission because of opposition from the state and environmental groups. The company has since indicated, however, it has an interest in letting the federal government buy back the leases.

The company bought the tracts for \$300 million in the early 1980s, and the federal government now estimates their worth at about \$600 million. The buyback would occur at a time when some oil companies, including Mobil, are cutting their domestic exploration budgets, Crawford says.

Were the Mobil lease blocks to meet expectations, it would be the largest energy find off the U.S. coast since 9.6 billion barrels of oil and 25 trillion cubic feet of gas were found off Prudhoe Bay, Alaska, in 1968.

Petty Poses for Poster

NASCAR driver Richard Petty has posed for a First Citizens Bank Big Sweep poster aimed at recreational boaters and fishermen.

The poster features North Carolina's famous racecar driver wearing his trademark black hat and sunglasses. He's seated on a pier railing by the lake at his Randolph County home.

The poster, entitled "Don't Splash Your Trash," asks anglers and boaters not to throw their bait buckets, drink cups, cigarette butts or fishing line overboard. These items are among the most frequent kinds of trash picked up by volunteers during our annual cleanup of inland and coastal waters.

Petty agreed to pose for the poster because he has a special interest in clean waterways, says Anne Hice of the N.C. Wildlife Resources Commission. The NASCAR king also owns lakefront property at Badin Lake.

To receive a copy of the "Don't Splash Your Trash" poster, write First Citizens Bank Big Sweep, P.O. Box 550, Raleigh, N.C. 27602. Please enclose \$1 to defray the cost of postage.

First Citizens Bank Big Sweep '92

Join the First Citizens Bank Big Sweep '92 — the nation's largest statewide waterway litter cleanup on Sept. 19. To volunteer, call the MCI hotline at 1-800-27-SWEEP between 9 a.m. and 5 p.m. Monday through Friday. Volunteers will be standing by with a list of sites from all participating counties. Just tell them where you would like to pick up litter.

Or stop by a branch of First Citizens Bank after Aug. 20 for a brochure that lists the county coordinators.

First Citizens Bank Big Sweep makes a difference for North Carolina's waterways. Last year, 12,000 volunteers collected more than 210 tons of litter from the state's beaches, lakes, rivers and streams.

Volunteers not only remove litter, they learn a lesson. They get a four-hour crash course in the types of litter polluting our waterways.

As volunteers collect their debris they fill out data sheets. These data cards are very important. They allow Big Sweep organizers to determine trends and pinpoint sources of our litter.

Filling out the data card can be fun. As you pick up trash, designate one

person in your group to complete the card. As other members of the group bag litter, have them call out their trashy finds.

There are many ways to get involved in First Citizens Bank Big Sweep '92. Organize a group to clean your favorite waterway. Or be a site leader and coordinate your own cleanup. If you would like to become more involved, contact your county coordinator or Big Sweep Executive Director Susan Bartholomew using the hotline — 1-800-27-SWEEP.

You can support the cause and its educational efforts by purchasing a T-shirt. The theme "I've Had It Up To Here With Water Pollution" is displayed above a waterline. Below is a menagerie of brightly colored fish, turtles, frogs and other water critters. The T-shirt is 100 percent cotton, comes in one size only — extra large — and costs \$10. Send your orders to: Susan Bartholomew, First Citizens Bank Big Sweep, P.O. Box 550, Raleigh, NC 27602. Make checks payable to Big Sweep/KNCCB.

Big Sweep Wins Big

First Citizens Bank Big Sweep, the nation's largest statewide waterway litter cleanup, has won its fifth consecutive Take Pride in America award and will now be inducted into the Take Pride in America Hall of Fame.

Big Sweep's prestigious induction will be a first for North Carolina, and the cleanup will be only the fourth national inductee into the Hall of Fame. President Bush is expected to preside over the awards ceremony, which is scheduled to be held in July.

"We're extremely proud to have won such a prestigious national honor," says Susan Bartholomew, First Citizens Bank Big Sweep executive director. "And it's my hope that all the people who picked up litter on Big Sweep day will also feel a sense of accomplishment and realize that their efforts are being recognized nationally too."

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.

Ocean Waters Ripe for Rip Currents

Drowning has already claimed a few lives along the North Carolina coast this summer. Sea Grant agent Spencer Rogers says interest is piqued about rip currents, often to blame for beach drownings. We thought this would be a good time to answer any questions you might have about these potentially dangerous currents. With a little knowledge and caution, tragedies can be averted.

Often mistakenly called undertows, these strong currents can pull even experienced swimmers away from shore. Too often, the results are panic and drowning.

Rip currents are formed when water rushes out to sea in a narrow path. This happens when there is a break in a nearshore sandbar or the current is diverted by a groin, jetty or other barrier. Rip currents can extend 1,000 feet offshore, can reach 100 feet in width and can travel up to 3 mph. Some are present a few hours; others are permanent. Rip currents are more prevalent after storms, but can occur anytime.

Learn to identify the telltale signs of rip currents:

- A difference in water color (either murkier from sediments or darker from greater depth).
- A difference in the waves —

larger, choppiier waves in the rip current; smaller, calmer waves in front of the bar.

- Foam or objects moving steadily seaward.
- An offshore plume of turbid water past the sandbars.

A pair of polarized sunglasses cuts the glare and helps spot rip currents.

If you become caught in a rip current, don't panic. Don't swim against the current. Swim parallel to shore until you are out of the current. Rip currents are rarely more than 30 feet wide. If you can't break out of the current, float calmly until it dissipates, usually just beyond the breakers. Then swim diagonally to shore.

If you don't swim well, stay in wading depths and watch for sudden drop-offs.

Putting the Sting in Summer

Diane Allen, a *Coastwatch* reader in Fuquay-Varina, called us about an unusual abundance of jellyfish along



the Pamlico River in Aurora early in June. She and her waterskiing companions counted as many as 150 in a single swarm. Her brother sighted masses of the creatures on the Pungo River as well. Allen says locals expect to see many jellyfish toward the end of July and during August, but wondered about the untimely appearance of these stinging creatures.

We checked with Jess Hawkins,

district supervisor for the N.C. Division of Marine Fisheries in Washington, N.C. One reason for the multitude of jellyfish, he says, could be the high salinity in the estuary sustained by a dry early spring. As of mid-June, rain had not substantially depressed salinity levels, he says. Also, gusts of northeast winds blowing into Pamlico Sound pushed salt water up the Pamlico and adjoining tributaries. Combined, the direction of the winds and the high salinity produced just the right soup for these salt-seeking marine animals.

Mild Taste of Amberjack Alluring

Is amberjack edible? What about the parasites? How do you prepare it? Joyce Taylor, Sea Grant's seafood education specialist, was asked all of these questions by Dan Peruski, a caller from Kernersville.

Amberjack is certainly edible, Taylor says. They yield thick fillets that (when cooked) are white and mild tasting. Many anglers compare their taste to king mackerel, wahoo and cobia.

Yes, they can have worms, or parasites. But so do most fish, even grouper and trout. The parasites cannot be transmitted to humans, and they are usually confined to the tail. So simply cut off the tail and eat the shoulder, which contains most of the fish's meat.

Amberjack is excellent baked, charcoaled or broiled. Add a zippy seafood sauce or slow-cook the fish in a smoker.

For more information about this delectable fish, write for Sea Grant's underutilized species series that includes information about amberjack, sea robin, skates and rays, triggerfish, panfish, jack crevalle, sharks, sheepshead, bonito and croaker. Ask for UNC-SG-85-09 through 85-18. Please include \$1 to cover postage and handling.

Nobody knows seafood like Joyce Taylor, Sea Grant's seafood education specialist. In fact, *Taste Full*, a bimonthly food magazine published in Wilmington, recently proclaimed Taylor a seafood guru.

Taylor has committed much of her immense fish and shellfish knowledge to paper. Below is a list of publications that can help you increase your know-how about the fisherman's catch.

No-Salt Seafood

Shake the salt habit when you prepare a catch from the sea. Send for a copy of *No-Salt Seafood: All the Flavor Without the Salt*.

Joyce Taylor has developed 50 mouth-watering recipes for cooking fish and shellfish that are not seasoned with salt. Instead, Sea Grant's innovative seafood education specialist relies on herbs, spices, citrus fruits and wines to flavor snapper, shrimp, crabs and other ocean catches.

Taylor says these alternative seasonings provide just as much flavor as salt. And they are much more healthful, especially for people suffering from high blood pressure.

Here are a few recipe titles to whet your appetite: Lime-Marinated Snapper with Cilantro Butter, Baked Flounder with Sherry, Indonesian Grilled Shrimp and Clams Florentine.

For a copy of *No-Salt Seafood*, write Sea Grant. Ask for UNC-SG-89-07. The cost is \$3.50.

What's in Season?

When you're looking over fish and shellfish at the seafood counter, do you find yourself wondering what's in season and what's not?

Wonder no more. Send for Sea Grant's *Seafood Availability Poster*. This colorful, 17-by-23-inch poster charts the availability by month of

North Carolina's most popular fish and shellfish species.

Based on catch statistics from the N.C. Division of Marine Fisheries, the chart will help you determine whether you are likely to find clams in May or soft crabs in August.

For a copy, write Sea Grant. Ask for UNC-SG-84-04. The cost is \$2.

What's Fresh?

When it comes to buying quality seafood, you need to know what fresh seafood looks like and smells like.

To help you make that determination, Taylor has produced a brochure, *Hooked on Fresh Fish and Shellfish*. The pamphlet also includes information on market forms and serving amounts.

For a copy of this handy pamphlet, write Sea Grant. Ask for UNC-SG-85-08. The cost is 50 cents.

Flaky Fish

If you've eaten tuna salad, then you've eaten fish flakes. Fish flakes can be an economical way to create tasty spreads, appetizers, sandwiches, patties, casseroles and sauces.

To learn how to flake fish, send for Taylor's brochure, *Flaking Fish*. Ask for UNC-SG-87-05. The cost is 50 cents.

Picking, Shucking and Dressing

Taylor has developed three brochures designed to help consumers clean their catch.

Dressing Finfish illustrates step-by-step methods for cleaning fish.

Cracking into Crustaceans shows how to clean shrimp, hard crabs and soft crabs.

Breaking into Bivalves illustrates methods for shucking oysters, clams and scallops.

For copies of these brochures,

write Sea Grant. Ask for *Dressing Finfish*, UNC-SG-86-10; *Cracking into Crustaceans*, UNC-SG-88-01; and *Breaking into Bivalves*, UNC-SG-88-01. The cost: 50 cents each.

Storing the Catch

Catching fish doesn't end when you haul in that grouper or king mackerel. Anglers need to take care of their catch if they plan to serve their prize at dinner. If handled properly, fish and shellfish can be safely transported for long distances and retain their freshness.

To make sure you're doing all the right things to your catch, send for a copy of Taylor's *Bringing the Catch Home*. The cost is 50 cents.

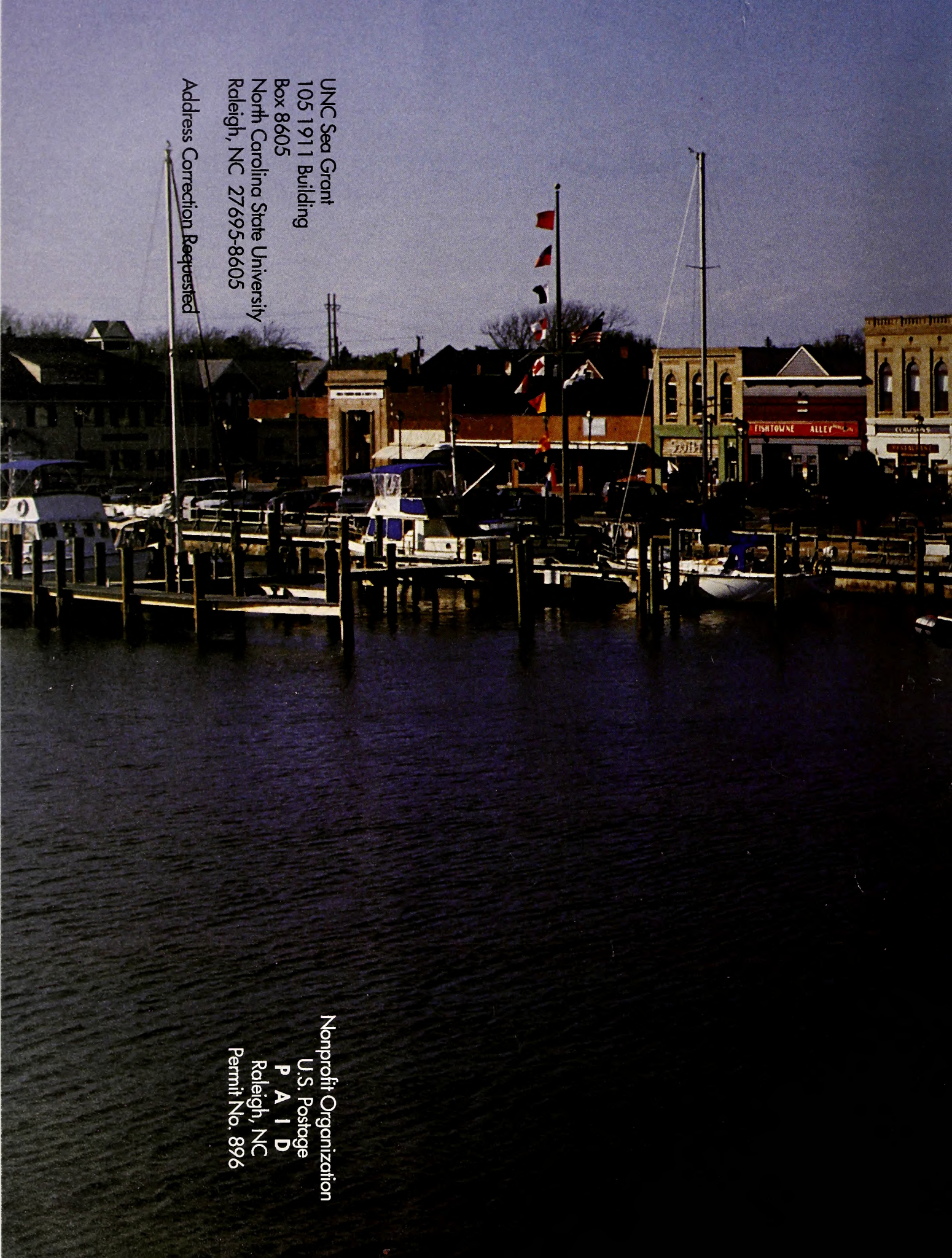
A Feast of Good Recipes

If you would like to receive regular installments of Taylor's seafood wisdom, then sign up for her bimonthly newsletter, *Mariner's Menu*. With each issue, Taylor focuses on a seafood preparation method or a particular species of fish or shellfish. Also included are six to 10 top-notch recipes that will have you eagerly awaiting the next issue.

Taylor will also be informing her readers about relevant seafood safety and quality issues. To subscribe to this free newsletter, write Sea Grant.

When ordering Sea Grant publications, be sure checks are made payable to Sea Grant unless otherwise specified.

Send all publication requests to: Publications, Sea Grant, Box 8605, N.C. State University, Raleigh, NC 27695. If you wish to order multiple copies or need further assistance, contact Carole Purser, publication distribution manager, at 919/515-2454.



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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 Indian artifacts by Scott Taylor.

Inside front cover photo of fog and trees by Karen Jurgensen.



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Dear Readers:

This month, *Coastwatch* focuses on Native Americans. These people have a long and rich history on the North Carolina coast that stretches back at least 14,000 years.

I delved into that history, tracing the Indians' existence along our shores from the final centuries of the last ice age to the time of European contact in the 1500s and 1600s. Sadly, the diseases introduced by European explorers killed the majority of Native Americans living in the Coastal Plain by the early 1700s. Today only small pockets of Native Americans remain in eastern North Carolina.

Jeannie Faris talked to archaeologists who are literally digging for information about Native Americans. At archaeological sites throughout the coast, state and university researchers are unearthing artifacts, burial sites and other remains that provide telling clues about Indian societies.

Freelance writer Sarah Friday talked with the present-day Waccamaw-Siouan Native Americans who live in Columbus and Bladen counties. These Indians are striving to reclaim and recover a heritage on the brink of disappearance.

To write this issue, we spent hours talking to researchers and archaeologists. We pored over books, reports and archaeological site information. When it came time to write, we assimilated the information as accurately as possible, crediting archaeologists for their theories and their work.

But more than anything, we wanted to be sensitive to the history of Native Americans. We wanted to tell their story factually so that readers could get a better understanding for these people and their way of life.

You may notice in this issue that we call America's true discoverers both Native Americans and Indians. Stanley Knick, director of the Native American Resource Center at Pembroke State University, advised us to use both. He said that some native people prefer to be called Indians; others elect to refer to themselves as Native Americans.

In reading these articles, we hope you gain a deeper understanding for the richness of early Native American culture. It's a heritage everyone should be proud of.

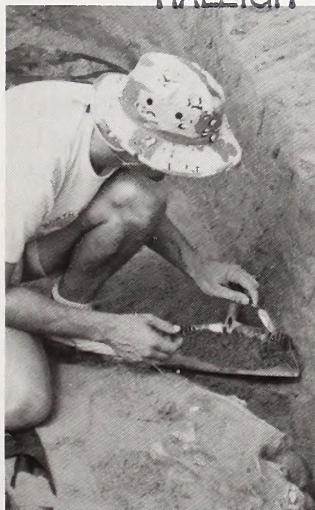
Until next issue,
Kathy Hart

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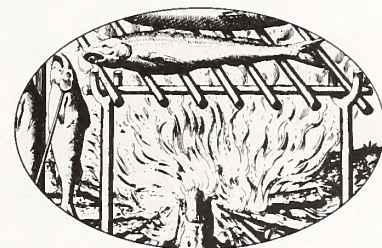
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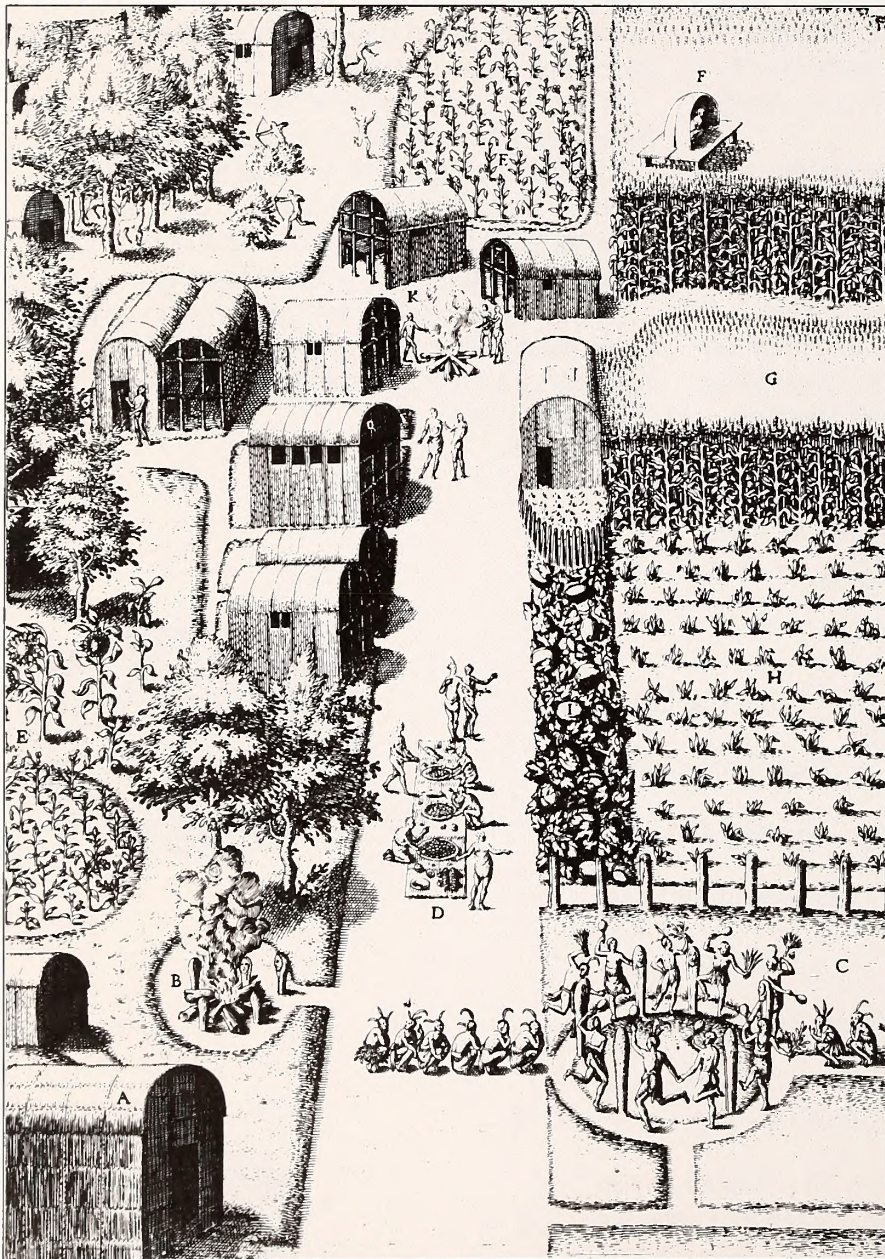


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FIRST ON THE LAND



By Kathy Hart

With much fanfare and hoopla, the United States will celebrate Christopher Columbus' discovery of America this fall. Although many historians now question that Columbus was the "first" European discoverer of this New World, we will nonetheless celebrate his voyage as the key event that opened the gate for European discovery and expansion.

But as sure as Columbus opened the door for Europe to come calling, he shut it on those who truly had the right to claim the forests and the plains, the rivers and the valleys as their own — the American Indians.

With the arrival of the Europeans came deadly diseases, guns that killed, a growing hunger to own the land and an attitude of superiority and conquest. Combined, these factors proved fatal to vast numbers of Native Americans, who numbered 50 to 60 million in North America at the time of European contact, says Stanley Knick, director of the Native American Resource Center at Pembroke State University.

Knick estimates that as many as 200,000 Indians representing three language families — the Algonkians, the Iroquoians and the Siouans — inhabited eastern North Carolina.

The Algonkians were part of a large population of Native Americans who lived along the coast and tidewater region from about the Neuse River in North Carolina to Canada.

The Iroquoians — mainly the Tuscaroras — inhabited the inland northern Coastal Plain. They were part of a larger Iroquoian-speaking group of nations that included the Cherokees and tribes near the Great Lakes.

The Siouans lived in the southern Coastal Plain from the Neuse River south. Their kinsmen also populated the Piedmont and other areas of South Carolina and perhaps Virginia.



For the most part, these Native Americans have been disregarded and unappreciated. Few people know of their history, their culture or even the tremendous contributions they have made to our society today.

Native Americans first inhabited the continent some 30,000 to 40,000 years ago. Scholars generally agree that these first Americans walked to North America from Asia. During the last ice age, when sea level dropped, a land bridge was exposed between Asia and Alaska along the Bering Strait.

Anthropologists have found distinct similarities in hair, skin color, blood type and teeth of Native Americans and the inhabitants of Siberia. For instance, Native Americans and northern Asians commonly have shovel-shaped front teeth that differ from other people.

The Indians gradually spread eastward and southward in small bands across North and South America. These early North Americans hunted large game — woolly mammoths, mastodons, giant deer, giant bison, elks and others.

David Phelps, an archaeologist at East Carolina University, estimates that Native Americans had been living in coastal North Carolina since 12,000 B.C., and perhaps longer.

The people of this era, 14,000 B.C. to about 8000 B.C., are called Paleo-Indians. Living in small groups, these Native Americans roamed their territories alongside herds of large and small game characteristic of the final centuries of the last ice age.

These people hunted with spears and had a survival toolbox that consisted of stone, bone, wood and skin implements.

“The most amazing tool was the atlatl, which was really a spear-thrower,” Knick says. “A spear-

thrower is a wooden stick with a hook on one end of it, which has a stone weight attached at the hooked end.

“You use that spear-thrower as an additional length of your arm, in

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essence, to propel the spear farther and faster,” Knick adds. “It’s a real technological leap into the future.”

Paleo-Indians roasted their food

over open fires or boiled it in pits lined with skins. They heated the water by dropping hot stones into it.

Phelps, who has specialized in unearthing clues about the Indians, has uncovered only limited artifacts from this era. The scarcity of remains can be explained by several factors.

First, time, weather and development destroyed all but a few stone artifacts. Secondly, many of the sites where these early Americans camped in coastal North Carolina are underwater today. This was the end of the last ice age, and sea level was much lower. The Indians tended to camp alongside rivers and streams. Subsequently, when the climate warmed and sea level rose, these sites and their artifacts were inundated.

Following the Paleo-Indian era came a period from about 8000 B.C. to 2000 B.C. or 1000 B.C. that archaeologists call the Archaic Period. During this time, the glaciers of the ice age receded, the climate warmed and subsequent changes occurred in plant and animal life.

Many of the large mammals present in the ice age became extinct. In North Carolina, the forests changed from those dominated by pine, birch and hemlock to woodlands mixed with oak and hickory.

As a result of these environmental changes, the Indians changed too. In the absence of large game, these skilled marksmen hunted deer, bears and rabbits. They also incorporated berries, nuts, grasses, tubers and flowers into their diet.

Native Americans of the Archaic Period curbed their wandering. Instead of constantly following herds of animals, they established seasonal camps to take advantage of the periodic abundance of certain foods.

Continued

“Increasingly diverse food resources required the Archaic people to make a much more diverse tool kit,” Knick says.

Just among stone tools, these native inhabitants were using spear points, a smaller dart point, choppers, scrapers, axes, adzes, grinding stones, nutting stones, borers and drills, Knick says. There were also numerous bone, shell and wood tools, but again, very few of these have survived.

In the late Archaic Period, soapstone cooking and storage vessels came into use. Since these Indians no longer constantly searched for food, they could manage the use of heavier utensils and spare more time for the development of tools and crafts.

At the beginning of the Woodland Period, between 2000 B.C. and 1000 B.C., Native Americans began to understand the concept of agriculture.

“Somebody realized those plants they had been gathering all along had little hard things in them,” Knick says. “If you saved those hard things and planted them in your yard, next year you wouldn’t have to go out and hunt for them.

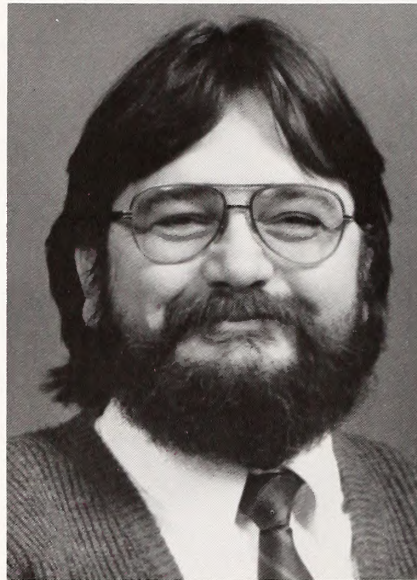
“This changes things forever,” Knick adds. “Once you have agriculture, then you rarely have to move again. You can have permanent villages, a larger population and much more cultural elaboration.”

Agriculture gradually evolved, and by the 1500s, North Carolina’s natives had developed a complex agricultural system. They were growing several kinds of beans, squash and corn as well as sunflowers, pumpkins, melons, sweet potatoes, tomatoes, chenopodium (a cousin of the spinach), gourds and tobacco.

Tobacco was grown for ceremonial and religious uses. Native North Carolinians smoked the dried tobacco

leaves in clay or stone pipes.

With the cultivation of crops, the Indians established permanent settlements that averaged 100 to 200 people



Stanley Knick

along the shores of rivers and streams. The waterways afforded the natives a means of travel and trade by canoe and rich alluvial soils for their crops.

Two other innovations marked the Woodland Period: pottery and the bow and arrow.

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Native Americans learned how to shape pottery from clay collected along river banks and stream beds. They mixed the clay with sand or crushed shell to prevent their pots from cracking when heated. To decorate these vessels, native women used fabric,

cord, carved paddles, netting, matting and methods such as incising and punctating.

The bow and arrow was developed during the early Woodland Period and gained widespread use. Native North Carolinians used the bow and arrow to hunt small game, protect themselves and occasionally attack their enemies.

The onset of agriculture signaled other changes in the Indians’ lifestyle, religious ideology and social structure.

By this time, Native American social structures were well-organized. The Algonkian societies were stratified, Phelps says. They had a ruling class, a nobility and commoners.

It is believed that the Siouans and Iroquoians were more egalitarian. These Indians were led by a council of tribal leaders. The councils acted democratically, and decisions were made by a consensus of the group.

Many of eastern North Carolina’s native societies were matrilineal.

Descent was traced along female lines, and children belonged to the mother’s clan, not the father’s. For example, the mother’s brother was responsible for the children’s education, and he acted as the spokesman for the family in tribal matters.

Often the decisions made by the male leadership had to receive the approval of the women. In Iroquoian society, the clan mothers chose the tribal chief. Among the Algonkian Croatans, a woman was serving as the hereditary ruler at the time of European contact, Phelps says.

“When the Europeans got here, the Indian women had a much higher status in their society than European women had in theirs,” Knick says.

The Native Americans of this era were also trading among themselves. Coastal Indians, having a ready supply of shells and other local products,

probably traded them for stone and copper.

Trade networks were extensive. Well-established overland trails made travel and trade from region to region relatively easy.

By the time of European contact, Tar Heel coastal Indians had evolved complex societies. They had developed distinctly different languages and were no more savage than the Europeans they were about to meet.

Technologically, some people would argue that the Europeans were more advanced than Native Americans because they had discovered metallurgy and thus could make metal weapons and tools.

But Knick argues that Indian cultures, because of their closeness to the environment and their ability to live in balance with nature, were superior to the more exploitative and destructive cultures of Europe.

And so it was when Columbus, in 1492, came ashore in the Bahamas, thinking he had found the islands off the Asian coast known as the Indies. He named the inhabitants he saw “Indians,” and for some unknown reason, the name stuck and was broadly applied to native inhabitants. Columbus died in 1506, thinking he had found Asia and never realizing he would go down in history as discovering the Americas.

During the next century, contact between Tar Heel natives and Europeans increased. First the Spanish tried to colonize along the Carolina coast. Then came the English.

In 1584, two English ships anchored along the Outer Banks. This marked the beginning of the Roanoke voyages that ended in 1590 when John White returned in search of the now-famed Lost Colony.

From these voyages and attempts

at colonization, we have the first written descriptions and drawings of North Carolina, its resources and its people. The chief chroniclers were John White, an artist and the governor of the Lost Colony, and Thomas Harriot, a scientist chosen to study the

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Indians and the natural resources.

Most early accounts describe the Carolina Algonkians, who spoke no less than 20 and perhaps as many as 100 versions of the Algonkian language.

The nobility lived in villages along

village, Phelps says.

Harriot says the Algonkian “longhouses” ranged in size from 18-by-36 feet to 36-by-72 feet and were “made of small poles, made fast at the tops in round form ... covered with barks and in some with artificial mats made of long rushes from the tops of the houses down to the ground.”

The Algonkians planted substantial tracts of land in corn, beans, squash and other sustenance vegetables and fruits. But the Native Americans also continued to gather nuts, berries, fruits and some roots.

When it came to hunting, Harriot writes that deer were an important and readily available year-round source of meat for the Indians. The Algonkians also shot bears, rabbits, opossums, raccoons, squirrels, skunks, muskrats and marsh rats. Harriot counted 28 “beasts” and 86 “fowl” likely to end up in an Algonkian stew.

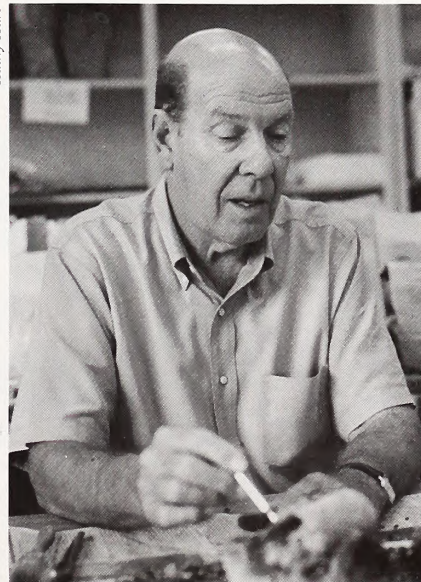
From White’s paintings and Harriot’s word, we also know that the Algonkians were proficient fishermen. They fished with weirs, hook-and-line, spears, and bows and arrows. The weirs drawn by White look much like the pound nets used by fishermen along the Carolina coast today.

Occasionally, the Indians trapped their catch in small pools and poisoned them, using a plant extract that killed the fish but left the flesh untainted.

In their religious beliefs, the Algonkians, like virtually all Indians, believed in a central creator. But they also had gods of nature such as the wind, sun and moon, and a form of ancestor worship, Phelps says.

Coastal Indians “were attuned to one creator, the four directions, the four corners of the year — the two equinoxes and two solstices — and the investing of spirits in things, which

Kathy Hart



David Phelps

coastal rivers such as the Chowan and the Pamlico. The more common people lived in smaller villages and farmsteads surrounding the main

Continued

anthropologists call animism,” Knick says.

Although we have some written and visual descriptions of the Algonkians, we really know very little of their daily existence, their rituals and their beliefs. We know even less of the Iroquoian-speaking Tuscaroras and still less of the Siouans.

Why is our knowledge of these Coastal Plain natives so limited?

Quite simply, most died before any written history could be recorded.

By the time the English arrived at Roanoke Island, vast numbers of Native Americans in North and South America had already died from diseases introduced by the Spanish.

Diseases such as smallpox, measles, typhus and influenza, that were endemic in Europe, became epidemic in America, Knick says. Native Americans had lived relatively isolated from other continents for hundreds of centuries, and they had no natural immunities to these diseases or any preventive cures.

English contact with North Carolina’s natives exposed them to the same pestilence.

“There were population reductions of 50 to 90 percent very rapidly,” Knick says. “With smallpox, five days is a typical course resulting in death.”

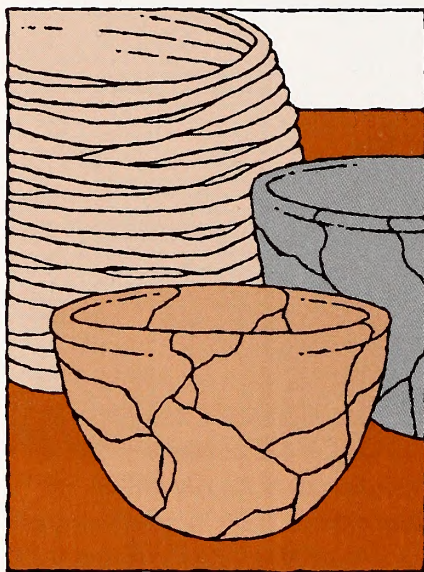
Harriot, writing of his travels in North Carolina, says every time he went to a new government to trade he noticed that people died when he left. Sometimes they would die in the tens and sometimes in the hundreds. And he wasn’t sure why they would die. It seems Harriot didn’t understand that he was the carrier.

John Lawson, an explorer, wrote that by 1705, 83 percent of the Indians within 200 miles of European settlements had died from epidemics.

“That’s why the unknown is greater than the known,” Knick says. “They

died before anyone got here to write anything about them down.”

As a result of the diseases, there are few, if any, modern descendants of the Carolina Algonkians. The Iroquoians and Siouans fared better. A small contingent of Tuscaroras live in Robeson County, and several present-



day tribes — the Waccamaws, the Lumbees, the Haliwa-Saponis and the Coharies — are thought to be Siouan descendants.

But what do these descendants know of their long-ago ancestors who farmed the Coastal Plain, who fished the brackish waters, who lived in

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harmony with nature? Sadly, many know very little.

“One of the things that changed Indian groups the most in early historical times was that it was bad to

be an Indian,” Phelps says. “Everyone looked down on you. The Indians, in order to survive, began to acculturate to European culture at a relatively rapid rate. In the process, the native culture went by the wayside.”

Archaeologists such as Phelps are literally digging into these Native Americans’ past at sites all over the Coastal Plain. These sites hold perhaps the only key to these Indians’ ancestors, traditions and ways of life.

Now the Waccamaws, the Lumbees and some remaining Tuscaroras are striving to learn more about their past and recapture some of the customs and culture of their early ancestors. Unfortunately, they have little information to draw upon.

“We stripped them of their culture and their heritage,” Phelps says. “In their attempts at trying to become Indian, they grasp at the image of the Plains Indians and other groups that survived. But these people were not farmers like eastern Indians. They were roving hunters with very simple societies. But that’s the public image of Native American culture. That’s where we get the dances and the powwows.

“It’s called the Pan-Indian movement,” Phelps says, “In fact, eastern Indians were twice as complex and had a very diverse, rich culture.”

But until researchers uncover more information about these Native Americans, the Lumbees and the Waccamaws may have to continue borrowing customs and rituals from their western kinsmen.

And the sad truth may be that no amount of artifacts and bones will ever tell the whole story.

Knick puts it like this: “After 500 years of what they have been subjected to, the miracle is — and I have said it a thousand times — the miracle is that there are any Indians here at all.” ❁

THANKS TO THE INDIANS

By Kathy Hart

Americans owe much to the native inhabitants whom Christopher Columbus mistakenly called “Indians.”

Had it not been for the complex agricultural methods developed by the Native Americans, many of the very foods that grace our tables and fill our bellies would not exist.

European crops simply would not grow in the new soils of the Americas. Oh sure, some would have eventually adapted, but by then thousands of colonists would have starved.

Instead, the Indians shared their foods and their agricultural knowledge with their invaders. Such sharing brought new food to the table and new farming methods to the fields.

Native Americans introduced the colonists to corn. Without this staple, the South would have been breadless because our climate was simply too wet and humid for European wheat to grow.

Corn was also easier for colonial cooks to use. It was easy to grind, and it was far easier and much faster to make cornmeal into corn bread than it was to make flour into bread. Wheat flour required a leavening ingredient — in this case yeast, because baking

powder was unavailable until after the Civil War.

This Indian favorite is still a favorite today, especially in the South, where as late as the 1930s the average Southern family consumed

sandwiches for lunch and a cold slice of watermelon on a hot summer day?

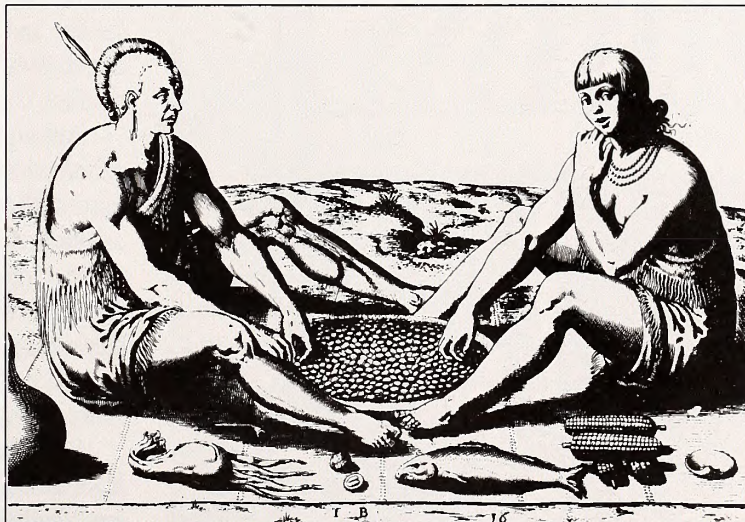
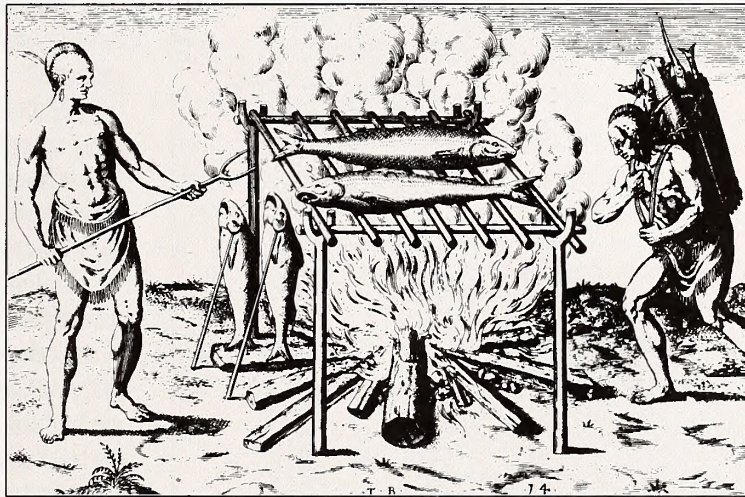
North Carolina’s prime cash crop, tobacco, was first cultivated by the Indians. Native Americans taught the colonists how to raise the leafy plant, dry it and, most importantly, how to smoke it using pipes.

Aside from foodstuffs, Native Americans also influenced our socio-political structure. The framers of the U.S. Constitution, impressed with the political structure of the Iroquoians, sought advice from these Native Americans. The Bill of Rights, which limits the absolute power of the government and ensures individual freedoms, was based on the Iroquoian belief of personal liberty.

Native American words pepper our language and mark places on our maps. The word “pocosin,” for instance, is an Algonkian word. Likewise, Hatteras, Manteo, Wanchese and Roanoke Island bear

Indian names. So do rivers such as the Chowan, the Neuse and the Pamlico.

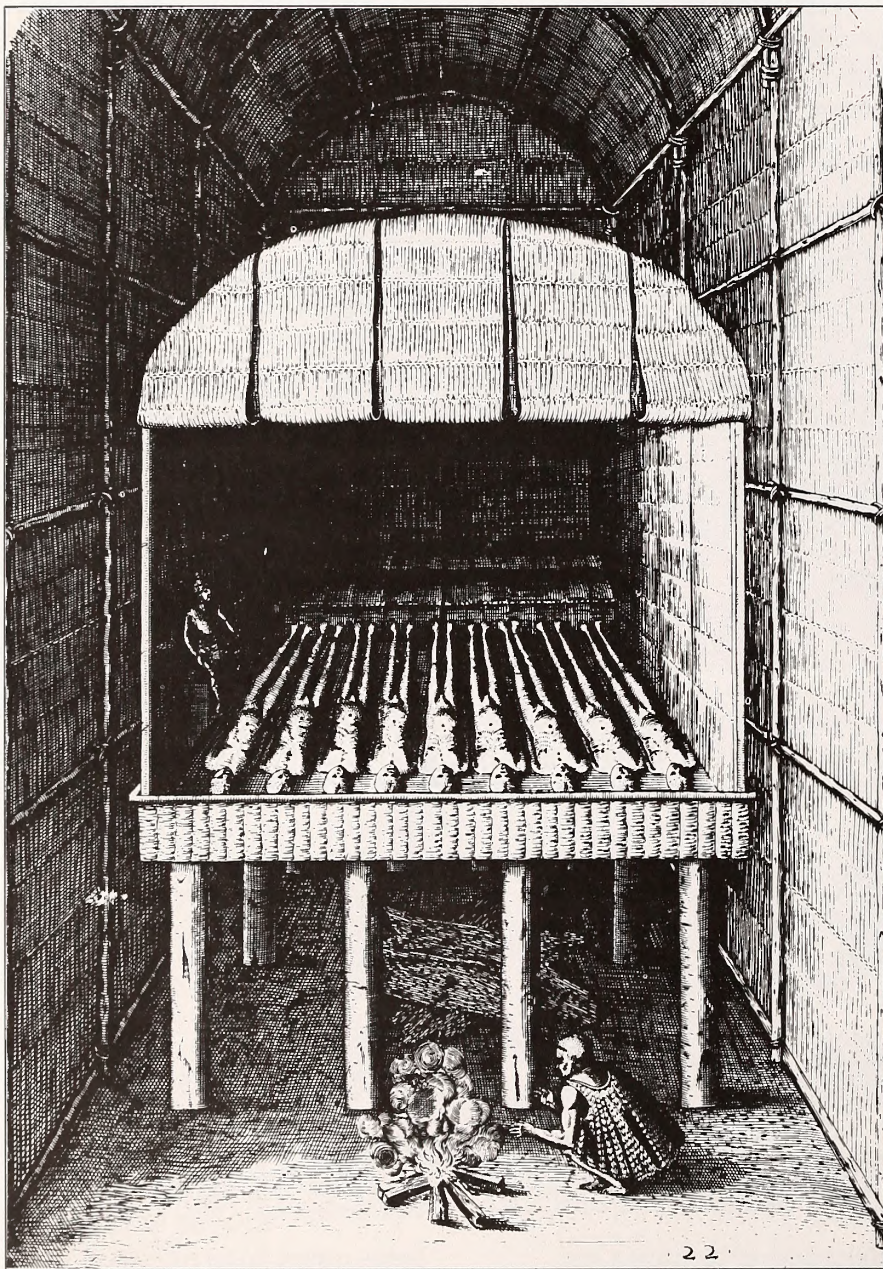
Now these things that were once Indian are so much a part of American culture that we don’t stop to think of their origins. But we should, and we should be thankful. 🍪



500 pounds of cornmeal a year.

Other vegetables introduced by Native Americans included pumpkins, various kinds of beans, squash, melons, sweet potatoes and tomatoes. Where would we be today without pumpkins at Halloween, tomato

READING THE EARTH



22

By Jeannie Faris

State archaeologist Mark Mathis dreads finding human burials when he excavates a prehistoric Native American site. He'd rather not unearth bones laid to rest centuries ago by societies that took great measures to honor their dead.

"We try to deal with it as reverently as possible," says Mathis, who works for the N.C. Office of State Archaeology. "We do (exhumations) because we have to, rather than see them destroyed."

But human burials are among the most revealing remnants of prehistoric Indian societies that left few clues and no written language to memorialize their way of life.

And increasingly, researchers find themselves running a losing race against the clock — against the eroding forces of nature, the farmers' plows and the bulldozers of developers — to find coastal Indian sites and salvage their contents before they are destroyed.

"Unfortunately, where the early settlers and Indians lived is where we like to live," Mathis says. "That's a conflict."

Among the dozens of burials exhumed in coastal North Carolina are mass collections of bones called ossuaries, a ceremonious mixing together of people who died over a span of time in a town or village. Common themes run throughout the excavated burials, but the differences are especially telling about a society.

Some ossuaries contain carefully placed, distinct bundles of bones. These are usually the remains of the noble or ruling class that had been scraped of flesh and stored in special charnel houses until the burial ceremony.

Still other graves are small pits containing a single body, possibly a commoner, with the knees flexed up to the chest in a fetal position.



These burials can tell experts whether a society was egalitarian or stratified into classes. They have yielded clues confirming early explorers' notes that leaders lived in the towns, while commoners scattered around the periphery. And they can unlock doors to understanding a society with details about the size of a population that lived centuries ago, what the inhabitants looked like, when they lived and what they ate.

From bones, for example, experts can determine the Indians' diets. At the Flynt site in Onslow County, little direct evidence of prehistoric crops has survived. But tests on bones showed the inhabitants ate corn, beans and other domesticated crops.

Archaeological sites are nothing less than cultural treasure chests, loaded with gems of knowledge about how Indians lived and died. And archaeology is a field of research perpetually in motion, turning over theories about prehistoric societies like trowels of dirt.

"What we're looking for is enough undisturbed remains to provide information about past settlement patterns, people, diets, environments, how they lived and how they died," Mathis says. "Who were they? That's the big question."

In spite of the possibilities, however, there has been only sluggish interest in excavating the Indian sites in coastal North Carolina.

David Phelps, an archaeologist at East Carolina University, says that until universities took interest in the 1970s, the Coastal Plain was the least known archaeological region of the state, received less professional attention and supported fewer projects than other regions.

Phelps is now coordinating an effort to reconstruct the lives of

Southern Algonkians from Delaware to North Carolina using clues from archaeology, physical anthropology, linguistics and ethnohistory.

Dale McCall, an anthropologist at

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the University of North Carolina at Wilmington, is one of 11 experts working on the project. A research geneticist, he is studying human skulls to characterize the Algonkian populations by appearance and to raise hypotheses about the differences or similarities he sees. The North Carolina Algonkians, for instance, had narrower heads and larger cheekbones than their northern neighbors, McCall says.

This holistic approach to Native American history, using experts from various disciplines, is a new one.

But the routine study of a non-European society's leftovers is a tedious process that is slow to kindle public passions, Phelps says. Interest heightens when an ossuary is unearthed, but only about 20 Native

American sites have been excavated on the coast.

Many are salvages to save a site in jeopardy, and they can raise compelling questions about how prehistoric Indians lived. But Phelps says the projects that provide the real cultural context for these salvages are ongoing excavations such as Neoheroke Fort and Jordan's Landing, both Tuscaroran sites in Greene and Bertie counties.

"Unfortunately, salvage operations are not the answer to the problem," he says. "Long-range planning and sufficient funding for excavation of key sites would reduce the need for quick salvage and produce more controlled information."

Even today, it is a little known fact that the Coastal Plain of North Carolina is scattered with these buried time capsules. Excavation of the sites, however, is crucial because the links to ancient coastal Indian societies have been so thoroughly severed.

Few vestiges of the original cultures remain, Phelps says. Even the languages that distinguished the Algonkian, Iroquoian and Siouan Indians of eastern North Carolina have vanished, although isolated words remain in the American vocabulary.

The only written accounts of coastal Native Americans' lives were provided by Europeans, who observed these societies through their own cultural biases. For the Algonkians, there were records from the voyages of Englishmen John White and Thomas Harriot. But for the Siouan and Iroquoian groups, there was not even that.

Surviving artifacts, however, speak volumes. With the care of surgeons, archaeologists use dental picks, wispy paintbrushes and sifters to unearth bones from burials, shards of crushed pottery, jewelry, stone and shell tools,

Continued

house patterns, food remains and weapons.

A detailed analysis of pottery and artifacts can tell if a population came into contact with others. Surface treatments and tempering of the durable pottery can mark a society's place on the historical timeline, and they hold up better than bones and shell, which decay on the surface and in acidic soil.

"The things (uncovered by excavations) are simply the leftovers that remain from a culture, and we find the things as people left them in their behavioral context," Phelps says.

No detail is too small.

Archaeologists begin with test excavations to learn what may lie in a site and at what depth. Then, they strip away the earth, each layer representing a different time of occupation.

In each of these layers, people have left things just as they were when they stopped their life there.

"We strip the layer away and lay bare everything that is there. House patterns, village ceremonial centers, cooking sheds, storage pits, burials, different structures for different purposes," Phelps says.

Even the soil is subject to inspection. Archaeologists read the land with their eyes and hands, able to see and feel where the earth had been dug into by ancient civilizations and later filled. Postholes sometimes still exist where a structure was built centuries ago.

From such finds, experts such as Phelps and Mathis hope to write the missing pages from Indians' cultural history. But the task is immense.

Archaeologists today must fill vast holes in history and reconcile countless mysteries and inconsistencies. Certainities are few and territorial boundaries appear to have been fluid, ebbing and flowing over the centuries.

Experts know, for instance, that Algonkians lived above the Carteret-Pamlico region bordering the Neuse River. But less certain is who lived

another scenario was in play: these were Iroquoian groups with Algonkian characteristics, Mathis says.

Unfortunately, there has not been enough research to distinguish between the remains of Algonkian and Iroquoian populations since they share a common ancestry. Both were robust and large, an inch taller than the average heights of modern-day Americans, Phelps says.

The smaller Siouan people are more easily recognized.

But whoever these people were, they apparently ceded the land to the Siouan groups, Mathis says. When, how or whether it was an assimilation of cultures remains uncertain.

The recently excavated Broad Reach site in Carteret County may help uproot the traditional theories about where the early Native American groups lived centuries ago. The Bogue Sound site may not have been Algonkian territory, as theorized, but perhaps Iroquoian, Mathis says.

Again, exhumed burials raised questions — the two Broad Reach ossuaries contained simple artifacts such

as turtle shells, clams, deer antlers and a cache of sharks' teeth. And this was not typical of Algonkian burial sites excavated elsewhere, which as a rule did not contain artifacts, Mathis says.

Both Siouan and Iroquoian societies, however, did bury artifacts. So, Mathis asks, was Broad Reach a unique Algonkian site or a different culture?

"We hope to tell from the Broad Reach site if they're pre-Algonkian. We do stand somewhere down the line to rewrite a very small page (of history) here, or maybe a paragraph."

On the whole, burial patterns of

Mark A. Mathis




State archaeologist John Clauser and volunteer Bill Jackson work at the Broad Reach excavation site in Carteret County.

below that region and when.

Maps from early European explorers in the 1500s and 1600s show the Neuse River as the boundary between the Algonkian territory and Siouan and Iroquoian territories.

But some evidence suggests that Algonkian speakers at one time occupied the coastline perhaps as far south as New Hanover County, Mathis says. A number of excavated southern coastal burials contain skeletal remains that appear physiologically more similar to Algonkians than Siouans.

It's also entirely possible that



coastal Algonkian Indians from Carteret to Currituck were common and were influenced by cultural tradition. The Iroquoian ossuaries were usually smaller than those of Algonkians, with two to 10 or 12 people per grave, and included artifacts. Comparisons with the coastal Siouan ossuaries are tentative because few have been excavated; but again, they appear to share similarities in the inclusion of artifacts and number of people buried.

Only about 29 ossuaries, ranging from two to 150 people in each, have been excavated in all of coastal North Carolina. The mass graves appeared in the region about 1,000 years ago, while evidence of flexed burials reaches back at least 2,000 years.

Archaeologists have learned that the ossuaries were usually the designated graves for the upper classes, the most important of whom were stripped to the bones after death. Their disassembled skeletons were stored in a charnel house in the village until burial during the “Festival of the Dead,” which may have been held on 10-year intervals from 800 through the early 1700s. The bones were either laid into the ossuaries in distinct, separate bundles or cast indiscriminately into a seeming sea of bones, depending on the size and shape of the pit.

Skulls excavated from nobility ossuaries at the Baum site in Currituck County bear the red iron oxide pigment from charnel house storage baskets, Phelps says. Archaeologists can distinguish the remains of charnel houses from regular homes because they contained an internal structure for treating and storing the bones.

Researchers derived information about burial treatment and the “Festival of the Dead” from the Great Lake Algonkians, the Hurons, who were observed by French Jesuit priests.

But the historical observations of the storage of the dead in Carolina Algonkian culture refer only to religious and political leaders. Statements about the common burials are absent or ambiguous.

Phelps says Algonkian burials hint at a more stratified society than those of the Iroquoians or Siouans, who probably operated on a tribal level.

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However, it’s apparent from the Hollowell site, where 40 people were buried, that even Algonkian ossuaries contained a demographic cross section of age and sex.

The Baum burials are perhaps coastal North Carolina’s best example of an ossuary complex that contained the upper crust of Algonkian society, Phelps says. Panther remains associated with nobility were found among the ossuaries, which accounted for five of the eight site burials. The remaining graves were single units, probably of commoners.

About 250 people have been exhumed at the Baum site, a presumed capital town in Currituck County.

Similarly, a recently discovered Broad Reach ossuary contained nine people who were probably of high

standing in their community, Mathis says. Their status can be calculated with some confidence, he says, because about eight tons of dirt were removed to create the mass grave, probably using large pottery shards as shovels.

So far, the site has yielded 15 burials for 29 people, from the early treatment of the dead to the final interment. Mathis believes this is a cross section of a fairly complete mortuary complex.

A second ossuary held the mixed, partial skeletons of six people and a cremation. Mathis says he’s not certain yet if these graves were from the same period, but it appears the ossuaries were for different classes.

“What this may mean is we’re looking at a different rank of people (in the second ossuary) and the fact that it was not necessary to have all the bones there, just a symbolic representation,” he says.

This was probably the case at the Flynt burial in Onslow County, which contained the jumbled bones of 150 people. It is most likely Algonkian, judging by its size, but well south of the then-assumed Algonkian territory.

Individuals represented in these ossuaries by only a sampling of his or her bones were probably not afforded the privilege of charnel house treatment. The families are thought to have kept their remains until the burial ceremony, and as a result, may have lost some of the bones over the years, Mathis says.

“But it didn’t matter. It’s the symbolism that counts,” he says.

The presiding chief or shaman at the “Festival of the Dead” may have ceremoniously stirred the bones of the mixed ossuaries before they were covered, he says.

The presence of long-exhumed

Continued

single burial pits would also suggest that some Native American families buried their deceased and came back later to rebury them in an ossuary.

“It appears that they were digging these pits up,” Mathis says. “Ultimately, it may have been that everybody was supposed to end up in an ossuary.”

Or, perhaps not. The coast is dotted with lone graves still holding flexed bones that may have been the final burial of commoners.

At this point, the questions about prehistoric Indians still outnumber the answers.

But archaeologists have learned so much from the burials because the bones are still in good condition. This fortune can be traced back to the Native Americans’ eating habits — not what they ate but what they discarded.

The mounds of discarded oyster and clam shells, called shell middens, leached calcium carbonate into the ground and fortified the bones buried nearby.

The process began thousands of years ago as Indians supplemented their diets with shellfish. The bivalves were a nutritional mainstay for both coastal settlers and the inlanders who trekked to the beach when food was scarce.

Over time, they amassed huge shell middens that probably lined the entire coast. Virtually all shell midden sites of more than one acre contain materials from the time of Christ up to at least 1400, Mathis says.

But beginning in the 18th and 19th centuries, farmers mined them for lime for their fields. By the 1920s and 1930s, highway builders borrowed from the

middens for road ballast.

The shell mounds, however, have survived to the extent that they can direct researchers to a potential archaeological site.

Researchers choose excavation sites by looking for the durable shells, ceramics and stone and by thinking about what the Indians needed to live, such as fresh water and food. They look also for elevation and soil type.

The 1440 date was drawn from radiocarbon dating on shell that had been burned to powder in a pit, an unusual finding in coastal North Carolina, Mathis says. Researchers found 30 to 40 pits that were probably perpetual cooking fires burning in front of homes, he says.

Using these clues, Mathis estimates 50 to 200 people lived there full-time.

Like the Baum and Broad Reach sites, most excavations in coastal North Carolina are reactive — responding to erosion or building plans. And Phelps and Mathis say research isn’t happening fast enough.

“I fear that if we don’t do something about it, I could all but guarantee in 20 to 30 years, (the sites) will be gone,” Mathis says.

The key is educating

people that the history of Native Americans is an important part of American history, Phelps says.

“The problem in America is that this isn’t our Euro-American history. This is somebody else’s history. And it’s very difficult to convince John Q. Public that the Native Americans are as good as he is,” Phelps says.

“We’re a can-do society. We think we don’t need to know the past. Yet these are people who had been adapting to the coast for 3,000 years. ... There’s a lot of information from archaeology that would apply, but we have this idea that modern technology can do anything. It doesn’t matter what people did in the past, which means that we’re not going to have a planet tomorrow.” 🌐

Mark A. Mathis



Volunteers Nathan Couch and Marco Brewer unearth a prehistoric hearth at the Broad Reach site.

Baum was excavated by Phelps after erosion on the Currituck Sound exposed the first of eight burials.

This is not unusual. Successive erosion and drowning of the shoreline through time has obliterated the coastal sites of early cultural stages, Phelps says. Even riverine sites in what was once the Coastal Plain are submerged beneath the estuaries.

The Broad Reach site, on the other hand, was excavated to save artifacts that would have been discarded in the development of a 75-slip marina.

Had the site not been salvaged, the losses would have included pottery from Indians who lived 2,000 years ago. The majority of artifacts collected near the shell midden, however, date to 900 and 1440.

EXCAVATING THE COAST

By Jeannie Faris

The archaeological study of prehistoric Indian settlements is still in its infancy in coastal North Carolina, where about 20 sites have been excavated. Following is a sample.

1. Baum ● A site north of Poplar Branch in Currituck County, excavated from 1973 to 1983. It was the possible capital for the Carolina Algonkian Poteskeet people. Maximum use of the site probably took place between 300 B.C. and 1650, though there is evidence of earlier occupation. Among the most compelling finds was a cemetery complex of five ossuaries significant to understanding the Carolina Algonkian mortuary and religious customs. The mass burials contained 30 to 60 men and women, ranging from newborn to old age.

2. Broad Reach ▲ A site near Swansboro in Carteret County, excavated in 1991 and 1992. The inhabitants may have been Algonkians or Iroquoians with Algonkian influence. Recovered

pottery dates back 2,000 years, with radiocarbon testing on other objects producing dates of 1158 and 1441, plus or minus 50 years. The site contained two ossuaries, perhaps for different classes of people.

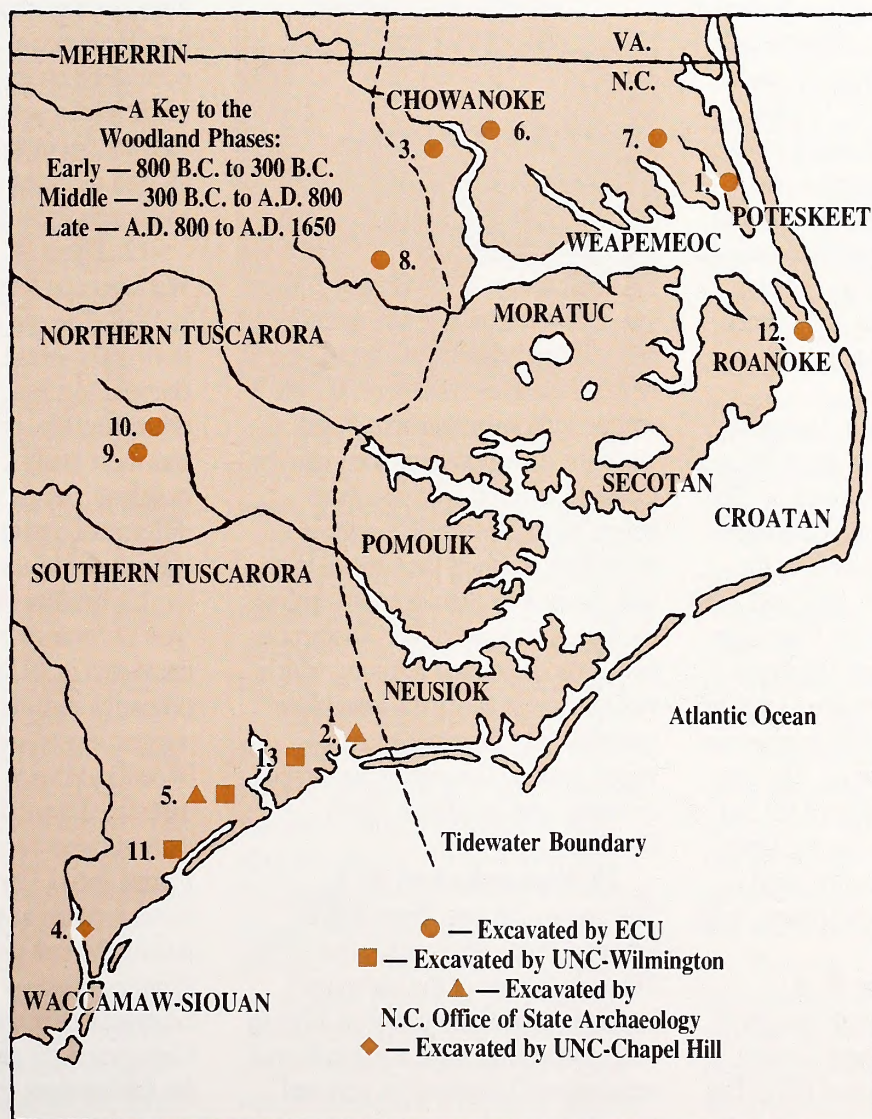
3. Chowanoke ● An Algonkian site on the west bank of the Chowan River, excavated from 1972 to 1984. Chowanoke was the capital town of the Carolina Algonkian society of the same name. Excavated features include

cooking pits — dating from 825 to 1650 — ceramics, storage and refuse pits, dog burials and a human burial from an earlier occupation. The agricultural lands lay to the west of town, which was the largest of the most politically powerful Carolina Algonkian society.


4. Cold Morning ◆ A Siouan site south of Wilmington in New Hanover County, excavated from 1977 to 1979. Ceramics date to the early and late

Woodland periods, but an ossuary for 16 people and a fetus appears to be late Woodland Period. Ceramics suggest this site was used over a long period of time, but it was probably not occupied by many people. No middens and almost no features were found. The ossuary was isolated and perhaps dug after the site was most intensively occupied. The people responsible probably lived elsewhere.

5. Flynt ▲ ■ An Algonkian site near Sneads Ferry in Onslow County, excavated from 1982 to 1987. The number of artifacts and rate of shell midden growth suggest that a



Continued



moderate-sized group lived there intermittently. The site was most heavily occupied from 800 to 1200 by people who stayed year-round as long as the soil was fertile — probably five to seven years. The salvage also yielded shell-tempered pottery associated with Algonkian-speakers and the crushed quartz-tempered wares of Iroquoian-speakers. The two styles were found widely across the site, indicating intensive trade, co-occupation or co-manufacture by the same group. An ossuary holding the remains of 150 people was unearthed.

6. Hollowell ● An Algonkian site in northern Chowan County, salvaged in 1975 during digging at a private home. The site was occupied from the middle Archaic Period (4500 B.C. to 3500 B.C.) through every prehistoric phase thereafter. Ceramics suggest it was a seasonal base camp or small village in the early and middle Woodland periods. An ossuary south of Cannon's Ferry held the bones of 40 men and women, bundled into nine separate family groups.

7. Indiantown ● An Algonkian site in Camden County on the north side of the Albemarle Sound, tested in 1983 and 1984. The Algonkian Weapemeoc society ended its history there as the Yeopim Indians between 1662 and 1750 after selling or being forced from their western lands. The society displayed a pattern of change comparable to that of the Chowanokes after 1650 in response to European colonial culture. The site adds significant knowledge of the last days of Carolina Algonkian existence. Individual burials exposed by sand mining are in the European pattern with various artifacts.

8. Jordan's Landing ● A Tuscaroran site on the north margin of the Roanoke River in Bertie County, excavated periodically since 1972. The

definitive late Woodland Tuscaroran community, this site was probably a typical 3-acre village. Cooking hearths and pits were widely distributed on the western and northern sides. Clustered on the southeastern side were 25 burials, including eight small ossuaries of two to six people each. Burials contained ceramics, marginella shell beads and other artifacts associated with status. Maize and beans were reclaimed from hearths, along with charred hickory nutshells, mussels and remains of various mammals.

THE SITE ADDS
SIGNIFICANT
KNOWLEDGE
OF THE
LAST DAYS
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ALGONKIAN
EXISTENCE.

9. Kearney ● A Greene County site uncovered on a family farm in 1992. It was probably a Siouan site with a Tuscaroran overlay. This site will provide answers about if and when the Tuscaroras intruded into the Coastal Plain and who was there before them. Researchers want to know how much of the Coastal Plain was claimed by Siouan groups before the Tuscaroras came. The Tuscaroras may have taken their territory, which would explain why they were bitter enemies. Five ossuaries were salvaged, making this one of the largest cemetery sites in eastern North Carolina.

10. Neoheroke Fort ● A Tuscaroran site near Snow Hill in Greene County, excavated since 1990. This was the site of the last major battle in the Tuscarora War of 1711 to 1713. Uncovered were a palisade wall, trenches and blockhouses, personal

belongings, structures inside the fort and ample evidence of stored food. This site contained artifacts from the final moments of life for the Indians who sought protection within the fort's walls. Excavations of the living areas are continuing.

11. Permuda Island ■ An Algonkian site in Onslow County, excavated from 1984 to 1985. It was occupied primarily during the middle and late Woodland periods by people who relied heavily on marine resources for food. Shell accumulations suggest small or intermittent occupations of the site, although the presence of an ossuary hints at some importance to the occupation. Evidence of houses suggests that occupation on the island was intended to last at least a season — probably late summer through early winter. Discoveries also included shell hoes for farming and conch shells for tools.

12. Tillett ● An Algonkian site in Wanchese on Roanoke Island, excavated in 1979. The site was probably occupied from 400 onward, as the environment changed to allow the population to live off marine life, primarily shellfish. This was most likely a seasonal settlement for mainland groups. Four burials suggest differential treatment of the dead in a class-stratified society.

13. Uniflite ■ An Algonkian site west of Swansboro in Onslow County, excavated in 1976 and 1977. Artifacts, primarily shell-tempered ceramics, suggest it was occupied during the late Woodland Period by small bands who assembled there in the late spring and early summer to exploit shellfish and marine foods. Excavations uncovered cultural debris and house patterns — among the first discovered on the North Carolina coast — that suggest a cultural continuity over a long span of time. Ceramics at the site provided guidelines for further work in the area. 🌀

WHERE TO DIG?

By Jeannie Faris

Archaeology is a science of precision in more than one way.

Scientists spend days, weeks, even months crouched over a hole in the ground searching for crumbling artifacts and subtleties in the soil.

But even before they reach this stage of an excavation, archaeologists have to choose where to dig. The expense and time required for these projects usually preclude the excavation of an entire site.

On the whole, experts are good at predicting where the remains of Indian societies are buried, archaeologist Mark Mathis says. But they need to more accurately target where the artifacts lie within the site, particularly a salvage that must be done quickly.

Prehistoric Native American settlements are large and complex, he says. And some archaeological digs are missing key finds in the living areas by focusing instead on the expansive shell middens, or refuse pits.

Mathis hopes that the Broad Reach excavation in eastern Carteret County will make his point. He is leading the dig there for the N.C. Office of State Archaeology.

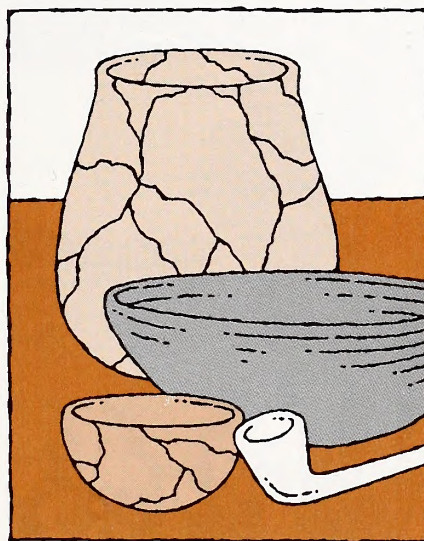
Archaeologists, of course, realize that Native Americans didn't live on shell middens. But the prevailing idea has been that prehistoric societies threw the most useful artifacts into the middens, and excavations should center there, he says. Digs farther from the midden core are thought to yield fewer cultural remnants.

Mathis, however, suggests the area immediately surrounding the midden was a processing area where Indians roasted or steamed the shellfish, then

shucked and dried the meats.

When they finished their work, much like modern societies do, they went home. And home was well beyond the processing area.

"One of the main things I've got to get out of here is to demonstrate that these are big sites, these are important



sites and there is information to gain from these," Mathis says. "We're not nearly harvesting that information."

But how these artifacts would be recovered and who would foot the bill remains to be seen. There first must be agreement that these finds are worth the cost to collect them, Mathis says.

David Phelps, an archaeologist at East Carolina University, says the problem would be best addressed with funding to launch a proactive, long-term excavation of key coastal sites.

Broad Reach, a 50-acre site with a 30-acre shell midden, is being salvaged to build a marina complex.

A small portion of the living area was excavated last year, when the top foot of topsoil, called the plow zone, was scraped from 7 1/2 acres. Mathis

says 426 features — from ossuaries to cooking pits — were uncovered.

"I was blown away because I knew there would be things out there, but not so much," he says. "They were everywhere."

These findings have also pointed up the shortcomings in the sampling system for potential archaeological finds. A 1987 soil survey using test holes indicated there would be little to find beyond the shell midden core.

But Mathis, who had noticed small shell pits, launched the 7 1/2-acre project with rewarding results.

This project shows that ineffective sampling is skewing the information being gathered about prehistoric societies, Mathis says. He's quick to point out, however, that the surveyors were not to blame — the sampling techniques are simply not working.

"It means that most of the work has been done on areas I call the processing area, where they harvested shellfish," Mathis says. "... So we haven't looked much at domestic sorts of things, the real people."

The Broad Reach excavation will continue this year on one-half acre that Mathis believes is the processing area. There, he expects to find cooking pits of a different kind than the hearths that marked the homes.

Over time, as the shell midden grew, the processing area and the living areas moved back. So Mathis has already uncovered "a lot of archaeological noise," including pits, soil stains and garbage at Broad Reach.

This year's work will further test his community model and determine whether Broad Reach is a unique site or a good example of what archaeology has been missing. ☺

A COMMUNITY REACHES BACK TO ITS ANCESTORS



By Sarah Friday Peters

The Wind speaks to those who will listen.

It whispers through the pines and dances on the water at Lake Waccamaw. It blows over scrubby flatlands and through the forests.

And it breathes cool comfort for a people struggling to find their past.

Chief Priscilla Jacobs of North Carolina's Waccamaw tribe first heard the Wind long ago. At 6, it beckoned her to Columbus County's ditches to dig clay for pots. No one had told her that hundreds of years ago, her ancestors had done the same.

"It's like there was always an instinct to do these things," she says.

Young Waccamaw drummers, too, hear the sounds that speak. "We don't teach them," the chief says. "There's just something in them that's able to come out."

Not everyone hears. But a time is coming when many will in North Carolina's surviving coastal Indian tribes — through renewed efforts to reclaim and recover a lost heritage.

Eastern North Carolina Indians such as the Haliwa-Saponis, the Coharies and the Lumbees have renewed the search by recording oral histories of elder members. Many have mastered traditions like beadwork and arrow-making to teach to the young.

"Each group has taken a different, in some cases overlapping, route," says Stanley Knick, director of the Native American Resource Center at Pembroke State University. "Each has its own qualities, its own flavor, its own local history."

"The people that have gone farthest along that route are the Waccamaws," he adds. "In that sense, they've gone a long way ahead of most of the other groups in terms of really trying to get in touch, through a scientific, systematic means, with their ancestry."



Today the Waccamaws of Columbus and Bladen counties celebrate a kind of cultural revolution with traditional craft workshops, an annual powwow, oral histories and a detailed research report that helps fit together missing pieces in an ancient puzzle.

As far as any kind of written history, language or songs, there are only a few things that the Waccamaws can put their hands on. "That's one of the biggest problems with the Waccamaws," says Brenda J. Moore, community developer for the N.C. Commission of Indian Affairs and a Waccamaw from Bolton.

And the Waccamaws are not alone.

By the early 1700s, most of the Indian tribes in what is now eastern North Carolina were killed or dispersed by war, disease and European settlement.

In the decades before, the Waccamaws, a Siouan tribe, hunted and traded peacefully by the waters of the Cape Fear and the lake and river they called Waccamaw. They migrated to fight in the Tuscarora War of 1711, then the Vocamas War near South Carolina in 1720.

After that war, the Waccamaws and the Cape Fears, another Siouan-speaking tribe, could not be found. Historians suggest that some may have assimilated with larger tribes such as the Catawbias of South Carolina or the Pee Dee Indians. Others may have fled back to their swampy homeland near Lake Waccamaw.

Cloistered from adversaries and white settlements, the Waccamaws kept quiet. For the next 160 years, few accounts except U.S. Census records tell the story of the survivors.

A resurgence in Indian heritage stirred in North Carolina's eastern

band of Waccamaws in the 1880s. By 1910, they had formed their first tribal council called the Wide Awake Indians. The struggle for education eluded them for several decades to follow. With few educated members to record the history, more traditions were lost.

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AND THROUGH
THE FORESTS.
AND IT BREATHES
COOL COMFORT
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STRUGGLING TO
FIND THEIR PAST.

Growing up, Brenda Moore felt the void.

"I feel like I'm just missing part of my heritage because those things weren't passed on. And I don't know the history, and I can't associate with it that well," she says. "There's an empty space."

From the day her twin sons were born 21 years ago, she vowed to change that.

"I want mine to learn as much book education as they can, and I want them to learn as much heritage-type education as possible," Moore says. "It's like part of you is missing that you never regain ... you never get back."

Other Waccamaw-Siouans in the communities of Buckhead, Ricefield and St. James share her conviction. A

regeneration of Indian heritage began in the 1960s.

The daughter of the tribal chief met the challenge with an idea.

"I realized we had lost our language, and I realized we were losing everything else unless we preserved it," says Chief Jacobs.

With help, she started an annual powwow to celebrate the past and bring together the community. The idea caught on. Last year, more than 4,000 people attended the 21st annual Waccamaw-Siouan Powwow, held the third weekend in October.

Indians young and old dance the Rain Dance, bless the ground, sing and parade a newfound heritage. A highlight is an elaborate regalia of tanned hides and suedes, colored feathers, bells, shells, bone breast-plates and beadwork.

The dances and the costumes mirror the Plains Indian culture. But Waccamaw traditions and pride shine through.

The tribe held its first powwow about 1970 on known tribal grounds at Lake Waccamaw. Such harvest gatherings are typical of their ancestors, tribal members say, as are many of the skins that dancers wear and the foods that they eat such as corn soup, venison and fish. More than that, though, the powwow evokes a rich community spirit.

"What you see when you go, this is Indian, this is Western," says Patricia Lerch, a cultural anthropologist at the University of North Carolina at Wilmington. "The people are involved. They make these costumes. They bead them. They work on the designs themselves. They become very personal. ... The entire community gets behind the kids as they weave in their own

Continued

personal identity.

"Participation in the powwow demonstrates a high level of commitment to Indian heritage and ancestry,"

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she says. "It provides a way for the tribal community to publicly demonstrate its own commitment to its Indian identity."

The struggle to reclaim the Waccamaws' lost heritage continued when the festival site at the lake was sold. In 1971, the International Paper Co. donated 5 acres to the Waccamaws for use as tribal grounds.

Again, Chief Jacobs heard the Wind. "I just knew the Spirit wanted that," she says.

That same year, the N.C. Commission of Indian Affairs officially recognized the Waccamaw-Siouans, entitling them to political and economic assistance. And community leaders founded the Waccamaw-Siouan Development Association to act as a conduit for community programs.

The association, a nonprofit program guided by an elected board,

took the lead in addressing area problems such as poverty and education. Yet a focus remained on reclaiming the tribe's cultural heritage. They began to sponsor the powwow, and in the late 1970s started a successful heritage project.

With a grant from the N.C. Humanities Council, the association held workshops so tribal members could learn the skills and techniques their ancestors used hundreds of years ago to make baskets, pottery and other items.

"We went back to nature and dug clay, and with natural tools we molded the clay into pottery," says Jackie Jacobs, WSDA's acting director, as she fingers a small, terracotta colored bowl. "Some really nice pieces came out of these workshops."

No archeological survey has been conducted in the region, but pottery and arrows are two artifacts that have been found. The findings substantiate the stories Chief Jacobs heard her grandparents tell of the Waccamaws burying their wares at the Cape Fear. They buried the pottery so they wouldn't have to carry it when they migrated to Lake Waccamaw, she recounts. They left behind another set at the lake when time came to move east again.

The lake offered a bounty of resources for Waccamaw ancestors, as well as for tribal members participating in the "cultural rediscovery" workshops. They used shells such as mussels for carving tools or shaping arrows and knives.

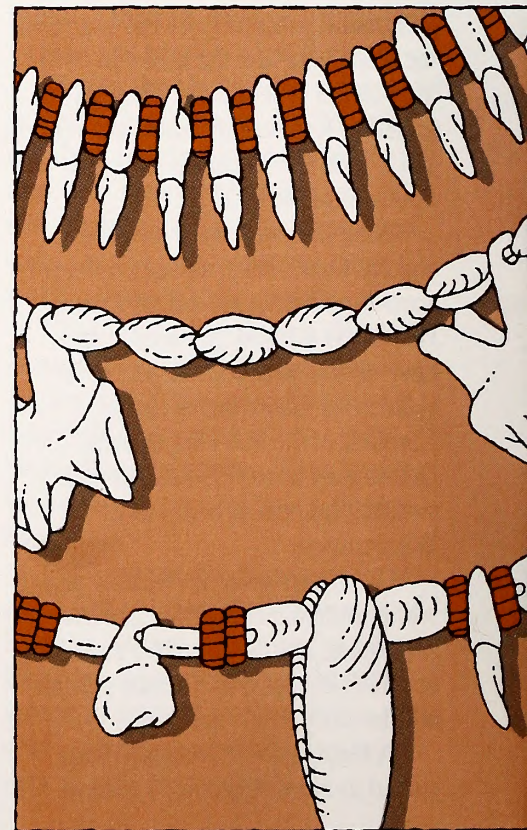
In other workshops, cattail reeds from the county's ditches were woven into beautiful baskets. Locally grown gourds became hand-crafted dippers and bowls.

Moore, Chief Jacobs and other tribal members continue to teach

children and others interested in learning the skills as an outreach project. Many of the items made by tribal members are marketed in the Wap-Ka-Hare Trading Post run by the association on the tribal grounds.

The workshops sparked a rejuvenation in the ancient crafts. The enthusiasm fostered plans for an interpretive center for archives, artifacts and education.

Tribal leaders and the WSDA recognized, though, that the Waccamaws needed to dig deeper to find their roots. In 1981, they hired Lerch of UNC-W to research their community and its history. At the time, the Waccamaws were looking at guidelines for petitioning the federal government to become a federally recognized tribe. The recognition, still elusive, would entitle them to services and programs of the U.S. Bureau of Indian Affairs.





As a cultural anthropologist, Lerch collected information about present-day members and their life histories to reconstruct a cohesive description of their group.

"It's always useful or helpful to have historical information or, if possible, prehistorical information," Lerch says. "But as a cultural anthropologist, I'm interested in what people say about what they do and in observing what they do."

From about 1982 to 1984, she logged hundreds of oral histories; dug into wills, deeds and other county records; scanned U.S. Census records; scouted grave sites; and read family Bibles. Her report showed a long history of the Waccamaws working and worshipping together as one people.

"I think that what they've gotten out of it," Lerch says, "is a greater sense of their own community and its

relationship with other communities. Oral traditions are strong there. They've always had a strong sense of who they are, but they have to deal with the outside world. I helped them support what they felt they already knew."

A drama written by tribal member Shirley Freeman around 1983 continues one of the tribe's most colorful oral traditions. "Over the Waters" tells the legend of Lake Waccamaw's formation by a giant fireball that fell from the sky. It explains the tribe's title as the People of the Fallen Star.

After a long run, the drama fizzled. But the WSDA obtained a grant from the N.C. Humanities Council to keep the legend living by converting the drama into a puppet show.

Through the generations, Waccamaws have passed down by words other traditions as simple as caning a chair bottom with cattail reeds to herbal remedies for colic. Religion thrives in the close-knit community of about 1,800 people because that's the way it's always been, members say.

"The religion has played a big part, and it really doesn't have to be any type of labeled religion," Moore says. "It's not a faith, it's just the Indian way. ... There's nothing that you do in this community that there's not a prayer."

Members fear that some traditions are slipping away as elder members die. Tribal elders such as Bertha Patrick and Joe L. Patrick still practice medicine the old way, with natural cures. And few know how to "talk the fire" out of a burn anymore like Vera Mitchell. A few of the crafts, too, may soon be lost.

"Things like this, the things we

do here, it's taught but it's not always handed down," Moore admits.

Yet hope endures.

"The youth are getting more

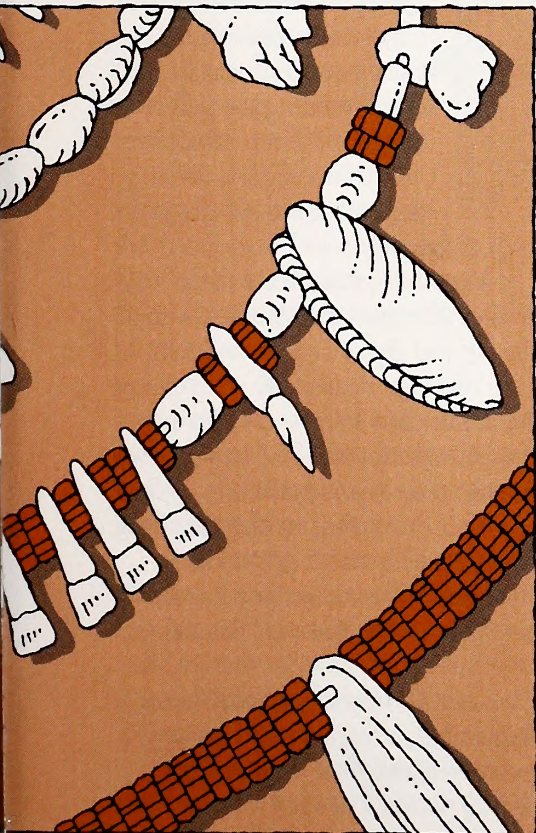
A DRAMA WRITTEN
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involved," Moore says. "It seems like the youth are getting more interested in their heritage, basically because of things like dancing, the workshops."

They want the powwows to be more authentic, reflecting the Waccamaws' true heritage, Chief Jacobs says. "They want things to be done the way they were hundreds of years ago. ... This generation is fighting for that. They don't want to forsake the cultural heritage for a dollar."

For her, it's a proud history worth preserving.

"My Indian heritage is something to be proud of, and I don't want to see it die out," she says. "To me, the Waccamaw tribe is special. ... We were on the coast. Lake Waccamaw, the legend — all of this just makes Waccamaw great." ❁



A Dig of a Different Sort

What could be more exciting than digging up a 2,000-year-old piece of pottery or a 5,000-year-old spear point? Nothing, say archaeologists.

Although archaeology — the study of past cultures — is exciting, it is not quite as adventurous as Indiana Jones makes out to be. It is hard work. And archaeologists must be very careful and very exacting when they dig into the past.

Since the Indians who lived along the Tar Heel coast had no written language that we know of, archaeologists must look for evidence of their societies in the layers of the earth.

They carefully plot the sites where they plan to dig. Then they take the earth away layer by layer. Each layer denotes a period in time. The deeper the archaeologists dig, the further back in time they go.

When archaeologists find an important artifact, they note how deep in the earth it is found, its exact location and its relation to other artifacts. Where an artifact is found is often as important as the artifact itself.

Archaeologists look for more subtle clues, too. They can tell where posts for houses once stood by locating the darkened earth that surrounded the post. They have also unearthed the pits where the Indians built their fires for cooking and the refuse piles, called middens, where they dumped their garbage.

And occasionally, archaeologists discover areas where these people buried their dead.

Like putting together a puzzle, archaeologists fit together information gathered at a dig site to get a picture of

a society's people, its culture and religious beliefs.

You and your friends can try your hand at archaeology with the assistance of a teacher, a Scout leader or a parent.

First gather these supplies: nails, string, several large boxes, sand, peat moss, paper, pencils, a yardstick, a shovel, a garden trowel, a bucket of

Gather a research team of three to five friends, and prepare a string grid over the site, using the nails. The resulting squares should be fairly large, about 1 foot square.

The team consists of a digger, measurer, recorder, cleaner and sorter. The digger is armed with a garden trowel; the measurer, a yardstick; the recorder, pencil and paper; the cleaner, a pan, paintbrush and bucket of water; and the sorter with pencil, paper and a box for storage.

The digger, measurer and recorder work together. The digger removes a thin layer of soil evenly, being careful not to damage any artifacts. The measurer gauges the depth of the excavation, which is noted by the recorder. When artifacts are found, the measurer determines each item's depth from the surface and its distance from each side of the grid. The recorder then writes these figures down and plots them on a paper



water, a pan and a paintbrush.

Then collect some artifacts of your culture that you don't mind burying. Consider these possibilities: a plastic spoon, a toy figurine (a Ninja Turtle, Batman, X-Man, etc.), a plastic plate, an empty can or bottle, a straw, a toy building block, an empty shampoo bottle, several paper clips, a small ball, an eraser, a pencil, a ballpoint pen and an old necklace or earrings.

Ask a teacher, Scout leader or parent to use a shovel to dig a 2-by-2 hole, 12 inches deep. Then ask this person to fill the hole with alternating layers of artifacts, soil, sand and peat moss. Now the "site" is ready for exploration.

map of the grid.

Next, the cleaner removes the artifact from the earth, brushes away the dirt and dips it into the water for final cleaning. Finally, the sorter places the artifact into a box and writes a detailed description of the item, noting its color, size and possible use.

After excavating the site, the young archaeologists should discuss their finds and analyze what they learned about the culture that used this site.

(This activity was taken from Coastal Beginnings, a teacher curriculum guide available from Sea Grant for \$3.50.)

Unexpected Connections

What do the mangroves of Costa Rica have in common with the saltwater marshes of North Carolina? More than you might think.

Lundie Spence, marine education specialist for UNC Sea Grant, says the threatened maritime shrubs are the tropical equivalent of our salt marshes. Both are sources of detritus or food for marine life, nursery grounds for juvenile fish and sediment sinks that build up the land.

"And like salt marshes, (the mangroves) have a bad reputation as a breeding ground for mosquitoes, full of scary animals and something to be removed in order to make way for development," Spence says.

This summer, Spence explored the parallels between the North Carolina environment and those in Costa Rica and Peru, where she taught marine ecology courses to American teachers and students.

The similarities she notes in mangroves and salt marshes — from their ecological roles to the threats they face — are among many examples of connections between North Carolina and the tropics.

In Peru, the clay soils in the Amazon Basin are strikingly similar to those in North Carolina. Both soils are derived from long-eroded mountains and both are poor in nutrients.

And like the Amazon Basin, North Carolina was once farmed in the slash-and-burn technique by Native Americans and early settlers, says Stan Buol, a tropical soils expert at N.C. State University.

Research and technology have provided new ways to maintain the soils

and nurture crops in North Carolina, but the tropics are still in a less sophisticated farming mode.

"We in North Carolina have nourished and protected and fertilized and cared for our soils, which costs money," Spence says. "And the rain forest destruction is pretty much related to the economy in those

ence a rain forest from a canopy walkway," she says.

The walkway, built in the treetops, allowed educators to join researchers up close to the array of virtually unexplored wildlife that lives in the rain forest canopy.

These teachers will report back to the program's designers how they used this experience into their K-12 classrooms. The program will be repeated in July 1993.

In Costa Rica, Spence and John Bort, an anthropologist at East Carolina University, teamed up to teach tropical marine ecology and cultural anthropology courses to 22 North Carolina undergraduates.

The June program, now in its 15th year, was founded by Bort and drew on the expertise of faculty and graduate students of the national

university in Heredia. Classes were supplemented with trips to several Pacific Coast sites, such as the Golfito fishing community near Panama, a national park near Quepos and a recreational beach called Playa Tamarindo.

The northwest coast of Costa Rica is experiencing the start of intense development pressure for recreational use. The students were able to see this for themselves, to sample the culture and to talk to residents about how the changes will affect their lives.

Educational experiences in natural habitats, whether in North Carolina or the tropics, provide a foundation for further learning and sharing with students, Spence says. As technology shrinks our planet, we are challenged to be more global in our educational perspectives.

Jeannie Faris

Marc Stranbo



Lundie Spence and American teachers explore tropical soils on the Rio Napo in Peru.

countries. So until they can provide fertilization for existing agricultural operations, they are being forced to expand into the rain forests."

In these ways, our hard-learned lessons and technology can be applied to problems in Central and South America. But more than that, we can make connections to the landscape of these countries and appreciate how our actions affect them, particularly as they posture to become tourist destinations.

Spence was a humid tropical soils instructor in Iquitos, Peru, at a July workshop for 90 American teachers who wanted hands-on training in the rain forest, using native guides and instructors.

"One of the highlights in this experience was that this was the first time teachers, or for that matter almost any other group, were able to experi-

Kudos to a Special Specialist

David Green, Sea Grant's seafood processing specialist, has won a 1992 Outstanding Extension Service Award from N.C. State University. He won the award based on his work with the North Carolina seafood industry, bringing to fish and shellfish processors the latest seafood research and the newest technological advances.

Green introduced Tar Heel seafood processors to cryogenic freezing, an innovative process that uses liquid carbon dioxide or liquid nitrogen to flash freeze a product in a matter of seconds. Quick freezing seafood using this technology makes for a better, higher quality thawed product for consumers.

Working on a grant from the National Coastal Resources Research and Development Institute, Green is using cryogenic freezing to solve several problems plaguing the blue crab industry.

In the summer when blue crabs are abundant, processors are hampered by an overabundance of crab, a shortage of labor to pick meat from the cooked crustaceans and low profit margins.

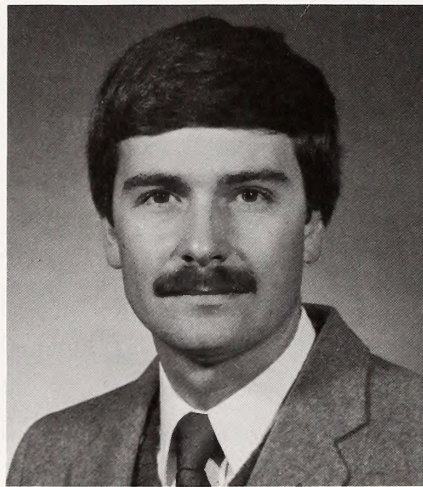
By using cryogenic freezing to flash freeze steam-cooked, in-shell crab cores, Green believes processors can store the frozen crustaceans at low temperatures, then thaw and handpick them later. Holding the crabs eliminates some of the seasonal glut, stabilizes labor needs and improves profit margins.

Now, Green is examining the freezing and handling process to ensure quality, adequate yields and safety.

In another crab processing project funded by the N.C. Pollution Prevention Program, Green evaluated brine recovery techniques for claw meat. Handpicking the meat from crab claws can be time-consuming and labor

intensive. Instead, processors prefer to recover the meat mechanically. But meat yields can be very low.

To solve the problem, Green worked with processors to improve recovery efficiency and reduce waste by using a brine flotation tank to recover claw meat. After the shell is cracked under a hammer mill, the claw is dropped into a stainless steel vat of brine. There, the meat floats to the surface for easy



David Green.

recovery and the denser shell sinks to the bottom of the vat for easy disposal.

By using the brine, processors can increase their efficiency by 10 percent and their profits by selling claw meat.

Three Sea Grant Publications Join the Winners' Circle

Three Sea Grant publications won Awards of Excellence from the Fourth Annual APEX '92 Awards for Publication Excellence.

Coastwatch garnered honors in the subscription magazines/journals category, while the Sea Grant publication catalog won in the catalog category. *Birds and Mammals of the Cape Hatteras National Seashore* was top dog among desktop-published, one-time publications.

This year, almost 3,600 entries were

submitted to APEX '92, which is sponsored by the editors of *Communications Manager*, a newsletter for publication managers and staff, and *Writing Concepts*, a newsletter for professional nonfiction writers and editors.

The APEX Awards are based on excellence in graphic design, editorial content and the ability to achieve overall communications excellence.

Experiment with Shellfish Netting Recruits Growers

For two years, UNC Sea Grant and Tipper Tie Inc. have been developing a system for growing oysters in a mesh netting that protects the shellfish from predators and appears to boost their growth rate.

Sea Grant Advisory Specialist Skip Kemp says many designs have been tested and dozens of materials have been evaluated in the Bogue Sound research sanctuary. The system has not been perfected, but it is ready for field testing and grower evaluations.

Kemp recruited interested aquaculturists to a series of September workshops for a hands-on role in stocking the oyster chubs, which are polyethylene mesh bags custom-made for the system. In exchange for their help, the growers took away oyster chubs to evaluate at their own sites.

The oyster chub grow-out system developed by Kemp is assembled on-shore and resembles a ladder floating on the surface of the water. Each step of the ladder is a tubular mesh bag containing the oysters and a float. The ends of the bags are clipped to two parallel ropes.

Kemp says oysters tend to grow rapidly at the water's surface where they have plenty of food and oxygen.

The oyster chub device, which may eventually be patented, gives the

shellfish a boost off the estuarine floor and may allow them to reach market size before they succumb to oyster diseases. This eventually may mean more quality shellfish at the market, Kemp says.

Market-sized oysters are anticipated 1 1/2 to 2 years after stocking, using the oyster chub system. The time to grow-out varies with oyster density and water quality.

Last year, Kemp cultivated 50,000 oysters in the nets, and he doubled that number this year. He also raises clams and scallops in the netting.

Tests are continuing to develop methods for reducing fouling of the materials.

Zebra Mussel Update

The irksome zebra mussel has not yet encroached into North Carolina's waterways and lakes, but UNC Sea Grant is gearing up for its inevitable arrival.

UNC Sea Grant has joined a regional pact of five Mid-Atlantic Sea Grant programs to plan in advance for the barnacle-like mollusk that has thoroughly encrusted boat hulls and water intake pipes in the Great Lakes.

The zebra mussel poses a multi-billion dollar threat to North America's industrial, agricultural and municipal water supplies, and it could become a costly nuisance for freshwater shipping, boating and fishing.

The regional effort was launched in August with a strategy session that featured the hard-learned lessons from Great Lakes experts.

In North Carolina, Sea Grant Water Quality Specialist Barbara Doll is working

with state agencies and industry to establish a monitoring system for the tiny, striped mollusks. This effort will be coordinated with public education programs, including a series of regional public service announcements for radio, informational fliers and a regional fact sheet.

North Carolina and Virginia will also co-host a regional conference in 1993 for large commercial and municipal water-users.

Lake Phelps Revelations

In 1982, fishermen casting a line in Lake Phelps began to hook more than a

good catch. Through the crystal clear waters of the state's second largest lake, fishermen began to spot Indian artifacts — stone objects and whole clay pots.

The discovery aroused the interest of archaeologist David Phelps, an authority on North Carolina's coastal Native Americans, and other state archaeologists. They began to remove the artifacts for examination, and in doing so made an unusual discovery — 30 dugout canoes.

The hollowed wooden vessels constitute the largest collection of canoes in the southeastern United States still in association with the sites where they were built and used.

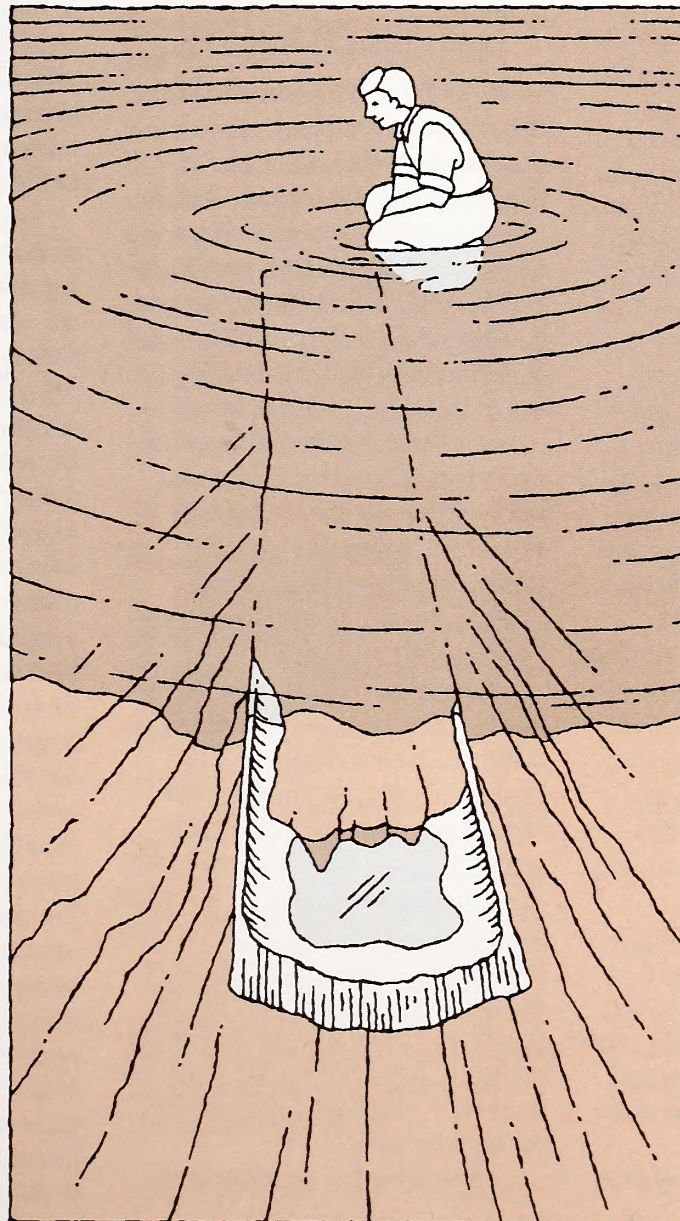
Some of the artifacts collected are as much as 11,000 years old.

The canoes, which are scattered along the northern and western shores of the lake, range in age from 2430 B.C. to 1400. Archaeologists have used radiocarbon dating to determine the canoes' ages.

Phelps and others are studying the shape, size and method of manufacture for the canoes. But he believes most were made by splitting a cypress log, then alternately burning and scraping the interior of the canoe until the desired shape and size were obtained.

Some of the canoes are only fragments; other are essentially intact, preserved by the acidic water and long burial in the lake sediments. The bow and stern formations on the canoes vary, and the length of the longest vessel is 37 feet.

Three of the canoes have been lifted from the lake and preserved. They are on display at Pettigrew State Park in Creswell.



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.

Renewing Coastwatch

I want you to know that I really love the *Coastwatch*. I look forward to getting it. It's extremely interesting. I love it, and I am sending a check for another year's subscription.

Tony E. Bone, Durham, N.C.

Thanks for the kind note on your subscription renewal form. We appreciate you and many of our other readers renewing your subscriptions. Beginning a magazine is a scary business. We weren't sure if we could attract enough subscribers to support our efforts. Luckily we did. Then it came time for most of you to renew your subscriptions. Again, we were nervous because we saw your renewals as a confirmation that you liked what you were reading and seeing in Coastwatch. Most of you have renewed, and many readers wrote nice notes of thanks and encouragement. We appreciate all of your comments, and we look forward to another year of providing you with information about our wonderful coast.

No More Coastwatch

I am sorry, but we'll no longer subscribe. I enjoyed *Coastwatch* over many years. Its few typed, stapled pages were vital, of meaningful content and often amateurish, but very much to the point.

The new *Coastwatch* I find of little

interest and minimal content — its conservation and ongoing consciousness replaced by glossy covers with emphasis on layout and format at the expense of content.

Who wants food recipes, especially a vegetarian like me? With the cost now for a subscription and the apparent move of *Coastwatch* into a popular press goal, I believe it is drifting into a waste of resources for catering to the masses and is fast losing the critical objective of its important original mission. I'm gone.

Sorry,

Lewis Clarke, Raleigh, N.C.

We're sorry to lose you too, Lewis. But there are a few things I have to say to refute your comments. First, Coastwatch was never typed, stapled and amateurish. As a newsletter, it was typeset, rarely stapled and professionally designed. In fact, the newsletter won several awards for its all-around professionalism — writing, editing, design, photography and printing.

As far as the content is concerned, we have added pages and tried even harder to provide our readers with meaningful content. We write our stories, then design the magazine. Consequently, the content dictates the design and not vice versa.

Many of the changes in the magazine are those requested by our readers. In our last survey, readers told us emphatically that they wanted more pages, more color and larger photographs. We have tried to accommodate those requests when possible. We added pages and a color cover. However, the inside pages, or guts, of the magazine are still printed in two colors just like the old newsletter. And the photographs are larger only when we don't write too much copy, which isn't often enough, our designer says.

I have served as the editor of the

newsletter and the magazine, and our focus at Sea Grant has not changed. We still strive to provide our readers with information that will help them make better decisions about the use of coastal resources.

Kathy Hart, Editor

Finfish Excluders

The phone has been ringing off the hook at the Sea Grant Marine Advisory Service offices as fishermen call to learn more about finfish excluder devices. Called a variety of names — Florida fish separators, snake eyes, fish shooters and BRDs — the finfish excluder devices will soon become a required part of shrimping in North Carolina waters when a new proclamation takes effect Oct. 2.

When fishermen call about the finfish excluders, Sea Grant Agent Jim Bahen has some answers. UNC Sea Grant was one of the first to research the use of finfish excluders, and Bahen began a pilot project this spring to test several designs. Commercial fishermen from Dare to Brunswick counties stepped forward to install the excluders in their nets and test the results. The devices, which come in a variety of sizes, shapes and configurations, are installed around a hole in the tailbag of a shrimp net, Bahen says. They allow finfish to escape while shrimp are pushed into the tailbag. So far, fishermen have told Bahen they like the excluders because they increase towing times, decrease culling and make for a better quality shrimp catch that isn't mashed into the tailbag by larger fish. As of Oct. 2, the N.C. Division of Marine Fisheries will begin requiring shrimpers to use the excluders in all state waters. To find out more about the regulations, contact the Division of Marine Fisheries at 919/726-7021. To learn more about making and installing fish excluder devices, contact Bahen at 919/458-5498.

An array of new publications are filling the shelves of Sea Grant's publication warehouse. Below are the descriptions of our new offerings.

New Aquatic Primer Makes a Splash

The Big Sweep Education Committee is making waves in primary education. *Splish Splash: A Big Sweep Aquatic Primer* is hot off the presses and making its way into school systems statewide.

The sequel to *Ripples: A Big Sweep Elementary Activity Guide*, a booklet geared toward the 9- to 11-year-old, *Splish Splash* aims its message at younger children. Designed for children in kindergarten through second grade, it is packed with activities about recycling, animal entanglement, plastics and other throwaways, and waterway cleanups. It includes word finds, stories, songs, puzzles, relay games and finger puppets.

The 44-page booklet is designed for use by a teacher or group leader, with worksheets that can be photocopied for the children.

The manual's cover features a colorful aquatic jungle, reproduced from a marker and watercolor drawing created by a young Cary artist. Amy Thorpe, 11, drew the picture while a fifth-grader at Morrisville Elementary.

Publication of the booklet was funded by the N.C. Wildlife Resources Commission, the N.C. Wildlife Federation and the Greensboro Jaycees.

If you would like a copy for your child's teacher or if you are a teacher or group leader — in a formal or non-formal setting — write for a free copy of *Splish Splash*. Please enclose \$1 per booklet for postage and handling. Make check or money order payable to Sea Grant.

Focus on Fishing

Catch up on the latest in fisheries management issues and research with *The Status of Fisheries: Proceedings from the N.C. Marine Recreational Fishing Forum*.

Forum speakers — from fisheries experts to anglers — offer up-to-date information about the status of fisheries and the environment, the economics of fisheries management, fisheries issues and resource conservation programs.

Among the speakers are Bill Hogarth, director of the N.C. Division of Marine Fisheries; B.J. Copeland, director of UNC Sea Grant; Kerry Smith and Jim Easley, economists at N.C. State University; Tony Fedler, corporate secretary for the Sport Fishing Institute in Washington, D.C.; Bob Mahood, executive director of the South Atlantic Fishery Management Council; Dick Brame, executive director of the N.C. Atlantic Coast Conservation Association; Jim Murray, director of the Marine Advisory Service for UNC Sea Grant; and Bo Nowell, president of the Raleigh Salt Water Sportfishing Club.

Copies of the proceedings cost \$3.50. Ask for UNC-SG-92-08.

Riparian Rights

Living on North Carolina's coastal rivers and sounds can offer many amenities — a pleasant view and easy access to the water — but which of these waterfront amenities are legally protected rights?

Walter Clark, coastal law specialist for UNC Sea Grant, has authored a guide for riparian landowners entitled *From Land to Water: The Waterfront Property Owner's Right of Access to Navigable Water*. The four-page Blueprint explains the legal rights of riparian landowners and the restrictions to safeguard the environment and private shellfish leases.

Clark says questions about riparian rights are arising more frequently as competition heightens for waterfront property and the use of adjacent public waters and submerged lands. It is becoming increasingly important for these landowners to know and understand their riparian rights, he says.

Just ask for *From Land to Water*. It's free.

Handling Seafood Wastes

Last fall, scientists from across the country gathered in Raleigh for the 1991 Seafood Environmental Summit organized by David Green, Sea Grant's seafood industry specialist.


The summit focused on environmental quality, pollution prevention and waste reduction in processing fishery products. Scientists and resource managers exchanged ideas about how the seafood processing industry could better handle its wastes and byproducts in the face of stricter enforcement of environmental regulations.

Now, the papers presented at that summit have been compiled into the *Proceedings of the 1991 Seafood Environmental Summit* and are available from Sea Grant for \$15. Ask for UNC-SG-92-06.

Ordering Information

When ordering Sea Grant publications, please write your name and address as clearly as possible. If there is a charge for a publication, be sure to enclose a check made payable to Sea Grant, unless otherwise specified.

Send publications requests to: Publications, Sea Grant, Box 8605, N.C. State University, Raleigh, N.C. 27695. If you wish to order multiple copies or need further assistance, contact Carole Purser, distribution manager, at 919/515-2454.



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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. 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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Inside front cover photo by Jim Strickland.

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Dear Readers,

Sit back and let *Coastwatch* launch you into orbit with the satellites. Invisible to us on Earth, these circling orbs take readings and measurements valuable to coastal research, management and fisheries technology.

First, Jeannie Faris explains how commercial and recreational fishermen use satellite technology to home in on their catch. These sensitive spheres can accurately detect ocean-surface temperatures from miles above the earth. The temperatures can then be charted and used by fishermen to pinpoint areas where certain species of fish live and feed.

Freelance writer Sarah Friday Peters explores how researchers use a satellite's bird's-eye view of the world to plot coastal land use. Using satellite spectral analysis, scientists can determine which areas are woodlands, wetlands and marshes, and which ones are dominated by highways, shopping centers and residential homes. In the future, planners and resource managers can use this information to strike a balance between maintaining natural

resources and planning for development.

Back on Earth, Carla Burgess reminds us of an old African-American Christmas custom called "John Kunner" that may be the foundation for a modern-day yuletide celebration in Rodanthe.

And I have one correction to make from our last issue about coastal Native Americans. In my story about the history of coastal Indians, I mentioned a tool called the atlatl, which was a spearthrower. I identified the tool with the Paleo-Indians (14,000 B.C. to 8000 B.C.). But Stanley Knick, director of the Native American Resource Center at Pembroke State University, called to say this device was invented in the Archaic Period (8000 B.C. to 2000 B.C. or 1000 B.C.). Thank you, Dr. Knick, for calling this to our attention.

Have a safe, happy holiday.

Until next issue,
Kathy Hart

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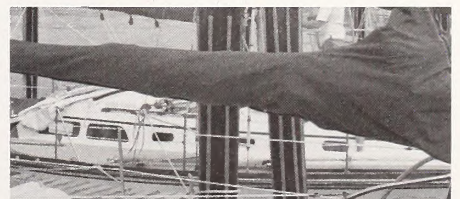
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SEARCHING OUT FISH

By Jeannie Faris

There's a fish tale behind the prizewinning blue marlin mounted on the wall at Motts Channel Seafood in Wrightsville Beach.

The 12-foot, battle-scarred billfish had been a veteran fighter. When the crew of *Myra's Choice* reeled it in after a 45-minute struggle, the bill of another marlin was found embedded in its flank as evidence of recent combat. Part of its own bill was missing.

But a footnote to this story is equally compelling.

This marlin was hooked with the guidance of a satellite orbiting 5 miles per second and 500 miles above the ocean. The satellite had directed *Myra's Choice* to a spot off Ocracoke Inlet, where Spanish mackerel bait lured the hungry 461-pound catch to one of six fishing hooks.

heralding an end to the days when North Carolina anglers motored around the ocean watching their temperature gauges in search of the Gulf Stream and its warm-water eddies.

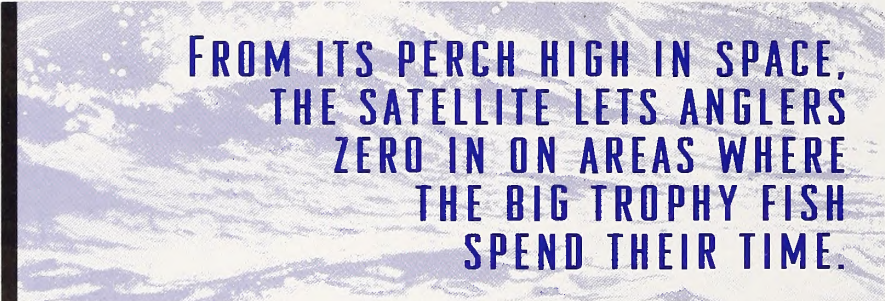
Waning, too, are the days when they had to watch for seawater color changes and trains of floating weeds to indicate possible feeding grounds.

Myra's Choice first mate Monty Martin says the blue marlin was hooked in relatively shallow water — only about 120 feet deep — where the crew might not otherwise have put out bait without the aid of a satellite chart purchased from a Florida company. The billfish placed third in the 1990 Big Rock Fishing Tournament, the state's largest contest.

"If you don't use (the chart), you're going out there blind," Martin says. "You don't have any place to start. And that's all it is, a place to start."

Sportfishermen like Martin number about 1 million in North Carolina, and they are the largest recreational users of sea-surface temperatures. They have the most to gain financially from huge tournament purses. But if marketed, the offshore images would probably hold interest for the general public — weekenders at the beach, boaters, surfers and armchair meteorologists, says Jim Murray, director of Sea Grant's Marine Advisory Service.

Already, a worldwide network of subscribers tap the ocean temperature readings from a pair of satellites owned by the National Oceanic and Atmospheric Administration (NOAA), a federal agency.



FROM ITS PERCH HIGH IN SPACE,
THE SATELLITE LETS ANGLERS
ZERO IN ON AREAS WHERE
THE BIG TROPHY FISH
SPEND THEIR TIME.

From its perch high in space, the satellite lets anglers zero in on areas where the big trophy fish spend their time. It does this by collecting ocean-surface temperatures, which are charted to show the warm, offshore waters associated with the Gulf Stream. Fishermen can then consult the charts to target a particular catch, such as the blue marlin in 80-degree water.

This high-tech fishing aid is

WITH SATELLITES



Sea-surface temperatures sampled from space are used to chart the warm Gulf Stream waters where fish congregate. Sportfishermen, among others, use the charts during tournaments to home in on prime fishing grounds.

The U.S. Navy and the National Weather Service are among the big-name clients.

But oceanographers are the time-honored patrons of this technology. In fact, outside of the U.S. Department of Defense, most of the nation's satellite technology has been advanced by researchers of ocean dynamics, says Len Pietrafesa, head of the Department of Marine, Earth and Atmospheric Sciences (MEAS) at N.C. State University.

That's not to say, though, that modern advances in satellite technology are limited to ocean research. Uses for these artificial moons have skyrocketed in the 34 years since Explorer 1, the first U.S. satellite, orbited Earth.

Environmental science — measuring the planet's vital signs — is a fast-emerging field for satellite technology. And it's gaining ground on the more established weather forecasting and national defense programs, particularly with the close of the Cold War.

Even NASA, the patriarch of space exploration, is stepping away from the manned space projects that defined it for decades to join the research pace toward environmental science.

Globally, a battery of satellites is used to monitor ozone depletion and the greenhouse effect. Through surveillance of ocean-surface temperatures, researchers are just now witnessing the onset of global

warming that, before the 1980s, was largely unnoticed. Satellites also assist in marine transportation, sea fog forecasting, and search-and-rescue of downed aircraft and ships in distress. They predict natural disasters and document the destruction of tropical forests.

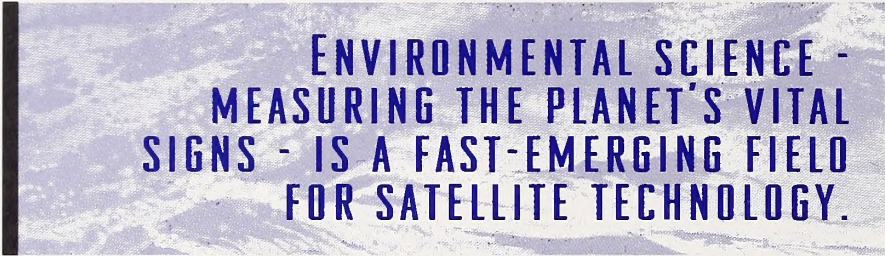
Closer to home, sea-surface temperatures gathered by satellite are used to track episodes of red tide that pollute shellfish, help predict flooding in the Pamlico and Albemarle sounds and monitor the movement of water laden with fish and shrimp larvae.

And fishermen like Martin rely on the electronic images to target their deep-sea bounty when thou-

Continued

sands of dollars in prize money are at stake in super-competitive billfish tournaments. Even the commercial fishermen who train their gear on king mackerel use the satellite-generated charts.

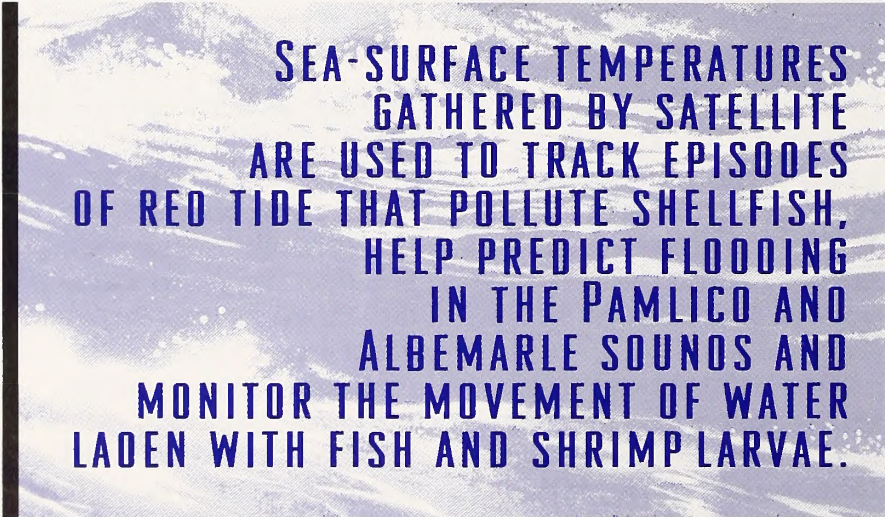
The measurements from space are astonishingly accurate — within 1/4 of a degree Fahrenheit —



**ENVIRONMENTAL SCIENCE -
MEASURING THE PLANET'S VITAL
SIGNS - IS A FAST-EMERGING FIELD
FOR SATELLITE TECHNOLOGY.**

considering the altitude and speed that the satellites travel. In 14 north-south orbits around the Earth, each of the two satellites scours the entire globe in a day.

Radiometers on board measure the ocean's emissions of thermal infrared radiation, which is a needle-fine gauge of water temperature, says Emanuele Böhm, a graduate research assistant in the MEAS department



**SEA-SURFACE TEMPERATURES
GATHERED BY SATELLITE
ARE USED TO TRACK EPISODES
OF RED TIDE THAT POLLUTE SHELLFISH,
HELP PREDICT FLOODING
IN THE PAMLICO AND
ALBEMARLE SOUNDS AND
MONITOR THE MOVEMENT OF WATER
LADEN WITH FISH AND SHRIMP LARVAE.**

and a doctoral candidate in physical oceanography.

With east-west sweeps that frisk a 1,550-mile stretch in one-sixth of a second, the satellites scan the earth in pixels — areas nearly 1 square mile. In the span of 24 hours, each satellite has recorded 1 billion pixels of sea-

surface, land and cloud-top temperatures.

The final product is not a photograph, but a profile of electronic data that can be charted onto maps showing water masses of different temperatures snaking through the world's oceans.

Off the North Carolina coast, the single most striking feature of these images — and the most significant to fishermen — is the Gulf Stream, a salty, 80-degree current shown in deep red, jetting north-northeast from Florida. The charts also show gradients of cooler water that ease shoreward from red to yellow to green to the cooler blue waters of the Labrador current dipping south past Virginia.

These images are critical because fish tend to congregate in nutrient-rich frontal zones where ocean waters of different temperatures and salinities meet but don't mix.

Also, the prizeworthy billfish follow the Gulf Stream, which has an inherent ability to meander. Warm fingers of the current twist away from its fringes to create prime fishing spots for marlin, wahoo, dolphin fish and king mackerel. And these areas shift with the Gulf Stream as it responds to winds, currents and storm patterns.

The satellite charts can help fishermen home in on these fishing grounds with an overlay of coordinates.

"A fisherman has a great advantage if he doesn't have to go running around the ocean with his hook out," Pietrafesa says. "If he can run around the ocean within an area (1 mile square), and he knows that those fish are going to be somewhere between, he has a big advantage. That's a great savings in fuel and time. And if you're a commercial fisherman, that's a real advantage."

The ability to sample sea-surface temperatures from space has existed

since 1972, when NOAA began its monitoring program. But it wasn't until 10 years later that the system was perfected to account for moisture in the atmosphere that distorted the measurements.

Supplying the fishermen with temperatures current enough to be useful was another barrier to marketing the technology.

Jim Bahen, a Sea Grant marine advisory specialist, has worked with fishermen since 1983 to track changes in the Gulf Stream's route past North Carolina. After a modest start using observations from several U.S. Coast Guard stations, Bahen today distributes a chart from the Environmental Weather Service in Miami. He mails the chart weekly to 120 fishermen and marinas with localized information on the width, speed and temperature of the Gulf Stream.

Fishermen, he says, were frustrated by the guesswork involved in finding the Gulf Stream before satellite aids.

"We'd always wondered where the Gulf Stream was," Bahen says. "We'd get on the radio and talk about it, but we really didn't know."

Today, angler interest in the charts is high, and it peaks at the start of spring with the first billfish tournaments. Gene Long, owner of Motts Channel Seafood, says the charts give anglers a leg up in high-stakes contests that cost from \$250 to \$600 to enter and run up expenses topping \$10,000 a week.

In addition to Bahen's efforts, private companies also peddle charts to fishermen showing the Gulf Stream and temperature gradients. But for anglers who want up-to-the-hour sea-surface temperatures, the MEAS department at NCSU is the only operation in North Carolina that can tap directly into the satellite data bank.

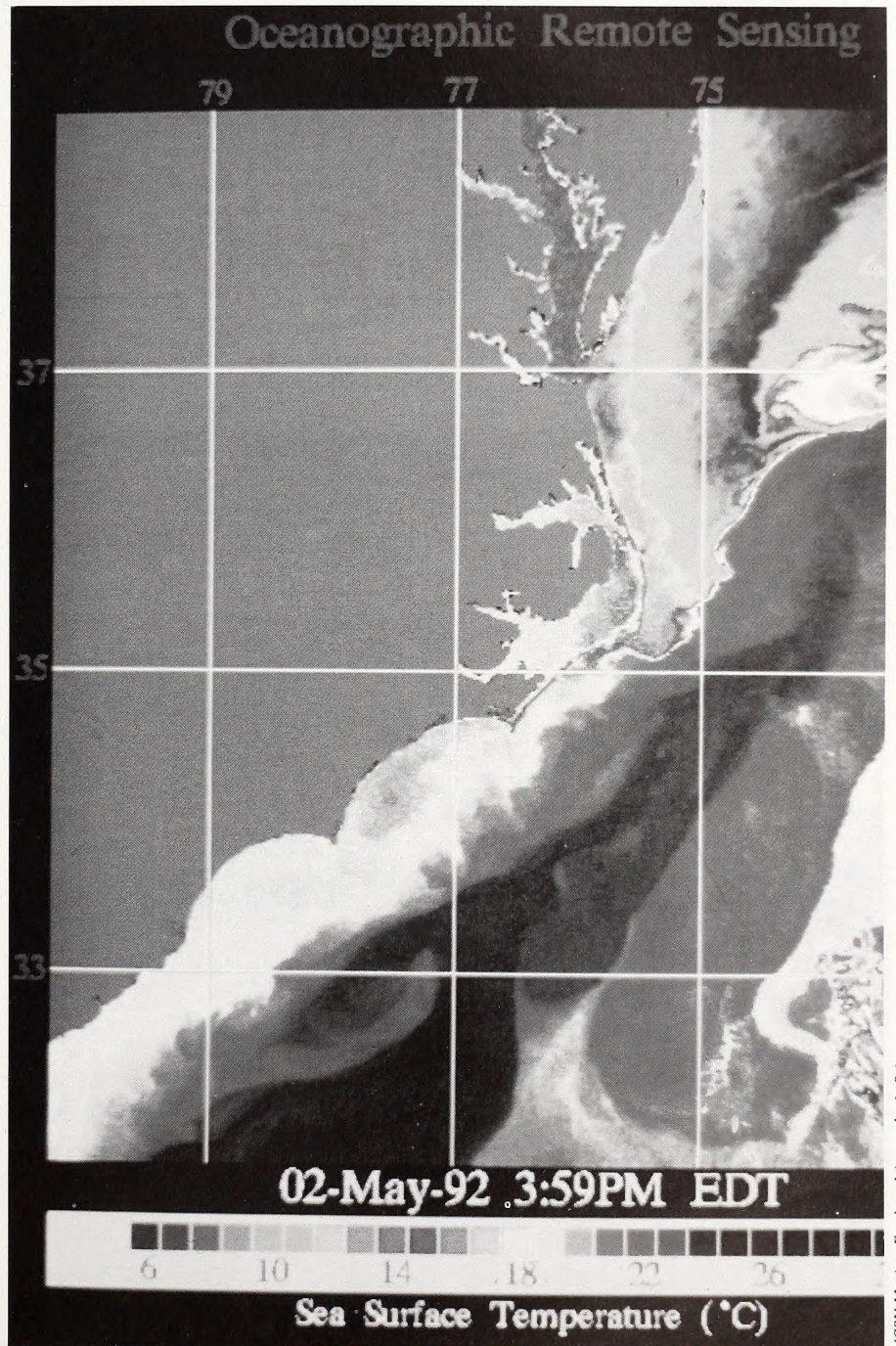
This fall, the university installed

equipment to access East Coast temperatures from Cuba to Nova Scotia as the satellites pass overhead two to three times a day. A system for marketing charts of North Carolina's offshore waters is still in the works. But Pietrafesa says he wants to place the late-breaking images into the

hands of subscribing fishermen by spring, possibly using a 900 number and faxes.

Such a system would cut down dramatically on the delays — sometimes as long as three days — that have been unavoidable in

Continued



Researchers at NCSU can chart the surface temperatures in North Carolina's offshore waters using satellite readings of thermal infrared radiation emitting from the ocean. This image was created from over 250,000 pixels of data.

NCSU Marine, Earth and Atmospheric Sciences

getting the same data from Florida, Böhm says.

Since the early 1980s, MEAS has gathered low-resolution images from the satellite and supplemented them with higher-resolution data through the Rosenstiel School of Marine and Atmospheric Sciences at the University of Miami.

Now, NCSU's accessing ability

makes it one of only six universities nationally that can collect ocean temperatures directly from the satellites. The data will be available to other North Carolina universities and state agencies, Pietrafesa says.

Robert Dennis, an oceanographer in NOAA's Office of Research and Applications, says the satellites are public domain and can be tapped

worldwide by anybody who has the proper equipment.

"One of the things about meteorological satellites is their data is not coded. It's not restricted information," Dennis says. "Anybody can sit there with a receiver and receive the satellite data."

The infrared technology, however, is not without drawbacks. It cannot see through clouds, which are common near the Gulf Stream where moisture is heavy in the air. And these satellites can only read the temperature on the skin of the ocean. Also, the gradients are nearly impossible to distinguish during summer months when coastal waters heat to about the same temperature as the Gulf Stream.

For these reasons, satellites have not replaced the more conventional instruments for measuring the ocean's vital signs, Böhm says. The tried-and-true methods are still the best gauges for temperature, salinity and speed of currents below the surface, which can tell researchers about the originating point of a water mass.

But satellites offer an overview — the big picture — for researchers to put their findings into context. And they are able to corroborate the findings of these conventional instruments, which are usually trailed at staggered depths from ships and sea buoys.

The technology has also let NCSU researchers test their models for the causes of natural phenomena such as red tide, which polluted shellfish off the North Carolina coast in 1987-88. The dinoflagellate, which originated on the west coast of Florida, washed ashore in a pocket of warm water that broke away from the Gulf Stream. It was carried by a combination of winds and currents that were tracked and plugged into a formula for predicting future episodes. The resulting



Jeannie Farris

A dish tracks the satellites as they orbit 500 miles overhead and taps into the East Coast data. Graduate research assistant Emanuele Böhm checks equipment on an NCSU campus rooftop.

model has been tested since 1987 to successfully predict that two outbreaks of the red tide would not reach North Carolina shores, Pietrafesa says.

Inland, the satellites have helped researchers understand the dynamics of coastal flooding, particularly in the Albemarle and Pamlico sounds where people need plenty of time to evacuate remote areas.

“When you have a storm in this area, how do you know when to evacuate?” Pietrafesa asks. “Who do you evacuate first? And is it really going to flood high enough to cause a problem anyway? If you don’t make the right forecast, then people can die. If you overforecast, you create panic.”

Pietrafesa says research, funded in part by Sea Grant, has shown how wind and tides move water in and through the sounds, and how acts of nature can flood the fragile estuarine systems. This effort is being touted as one of the best examples of cooperation between university researchers and forecasters for the National Weather Service to serve the public, he says.

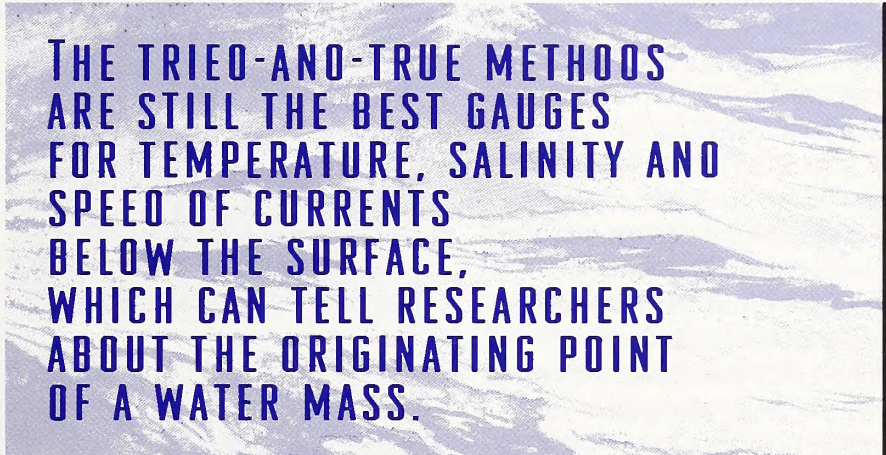
The satellite technology also has important fisheries applications because changes in the water play key roles in the natural fluctuations of fish stocks — their recruitment, distribution, abundance and vulnerability to harvesting.

Understanding the currents and sea-surface temperatures can help locate schools of tuna or salmon and can assist in tracking the movement of fish eggs and larvae that associate with certain kinds of water. Again, satellites are used to supplement field research.

Studies locally have shown that if Virginia waters are driving into Pamlico Sound with a northeast wind, then fish larvae enter the system through Oregon Inlet, Pietrafesa says. Under opposite wind conditions,

larvae enter through the Hatteras or Ocracoke inlets further south. And while the tide can carry them in and out of the sounds, a persistent wind will push them in and override the outward tidal pull.

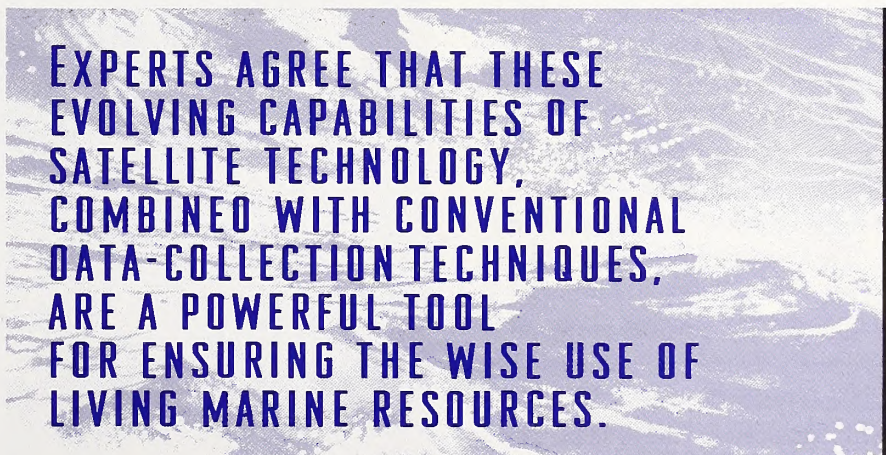
Experts agree that these evolving capabilities of satellite technology, combined with conventional data-collection techniques, are a powerful



THE TRIED-AND-TRUE METHODS ARE STILL THE BEST GAUGES FOR TEMPERATURE, SALINITY AND SPEED OF CURRENTS BELOW THE SURFACE, WHICH CAN TELL RESEARCHERS ABOUT THE ORIGINATING POINT OF A WATER MASS.

tool for ensuring the wise use of living marine resources.

“Ultimately, this (technology) is pointed toward understanding what the true energy balance of the earth is — if we are going to understand whether there’s going to be global warming or global cooling or where



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we are in the overall heating or cooling cycle of the earth,” Pietrafesa says. “We need to understand the present if we are going to understand what lies ahead.” ☼

By Sarah Friday Peters

Siamak Khorram can tell you the kinds of trees that grow on Bogue Banks without setting a foot in Carteret County. He can plot the wetlands around Manteo without seeing them and gauge how much pollution floats in the Tar-Pamlico River without ever taking a sample on the spot.

Khorram is no magician. But the director of the N.C. State University Computer Graphics Center is a wizard with satellite technology and the ways it can help us learn about our world.

Since 1972, the compact masses of mirrors and machines have launched a revolution in research. NASA's Landsat satellites, especially, tell us about Earth's resources. From 500 miles into space — the distance from Raleigh to New York City — satellites can survey North Carolina's coastline or focus in on a forest at Bogue Banks.

In the past few years, Khorram and his colleagues have used advanced satellite and computer technologies to take a closer look at the state's forests, wetlands and waters. At the coast, the researchers helped map vegetation, farms and other land in the Albemarle-Pamlico area. They devised a model for merging satellite data from different regions. And they're looking for ways to ensure that satellite image comparisons over time are accurate.

Their own timing couldn't be better.

Day by day, pressure grows on the coast's resources. As demand for land and water rises, so does the need to understand the systems that make up this fragile environment.

Satellites can help.

The photo-like images satellites create can give scientists a clearer picture of how riverine, oceanic and estuarine systems intertwine.

Looking Down on Coastal Resources

Researchers can use the data to count wetlands at the coast and map water quality, Khorram says. Land managers, in turn, can use the data to map, then select, the best sites for development or preservation.

"You want to be able to see as much of the earth as possible so that you can see how these systems interact," says John Brockhaus, a member of Khorram's research team.

The coast marks a transition zone to the ocean, says Sea Grant Director B.J. Copeland. "What happens in that band is so tremendously influenced by what happens beyond it, that being able to see it in total perspective is important.

"That's why this technology is



significant," he continues. "Because you're able to see things in some kind of big picture. That, then, enables you to make decisions in a more realistic context."

Getting that big picture, ironically, does not come from snapshots from outer space. Satellites like NASA's Landsat do not take photographs, as many believe. Instead, mirrors scan the earth's surface while detectors pick up electronic messages from different wavelengths of light. The satellite translates the messages into numbers and beams the digitized data back to Earth.

Landsat orbits Earth every 16 days, collecting data in 95-by-95-

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foot segments of land called pixels. One satellite scene includes millions of pixels and covers more than 100 square miles.

For their North Carolina research, Khorram and his colleagues buy satellite scenes on tape and feed the digitized data into computers that analyze and display it.

The first real pictures the researchers compose on screen look like color infrared photographs with splotches of red, green, white and blue. But satellites pick up and "see" much more detail.

On Earth, we see colors in everything around us. Green trees. Blue water. Red birds. Silver fish.

Colors are actually different wavelengths of light. Each object we see reflects its own signature combination of light on the spectrum. Colors make up the shorter waves. But the mechanical eyes of a satellite such as Landsat can sense longer infrared waves and a thermal, or heat-sensitive, one too.

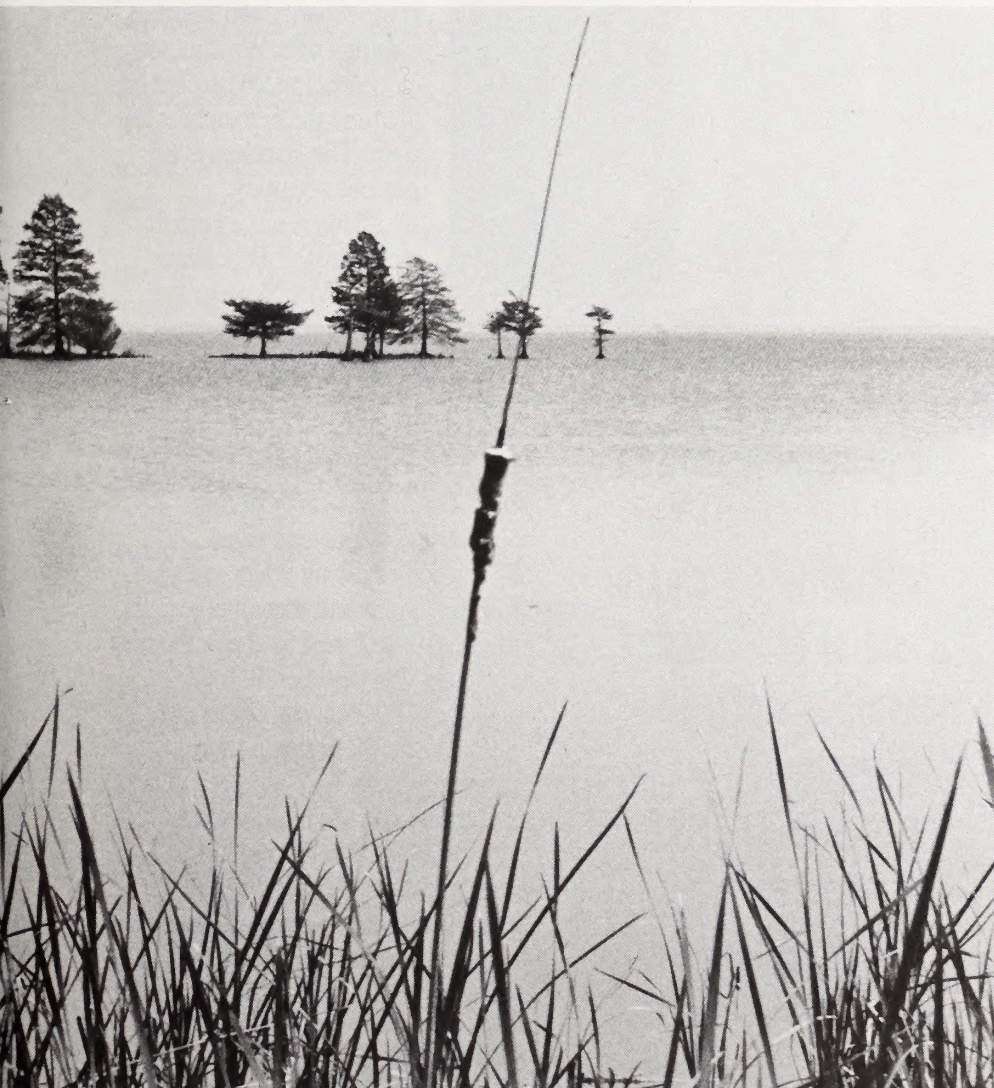
Although we see green pines, for example, Landsat reads light reflecting from the trees in the green, red, blue and infrared wavelength bands. Computers, in turn, can display most of these bands for scientists to study.

In 1990 and 1991, Khorram and his associates used this technology to lay a foundation for research in the Albemarle-Pamlico region.

One of the largest estuarine systems in the nation, the Albemarle-Pamlico watershed covers 23,000 square miles of eastern North Carolina. In the past 20 years, it has been plagued with declines in water quality and aquatic vegetation, and increases in algal blooms, turbidity, and fish and shellfish infections.

A comprehensive study to pinpoint the problems and outline better management plans began in the 1980s. But a big piece was

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C.R. Edgerton

missing from this environmental puzzle.

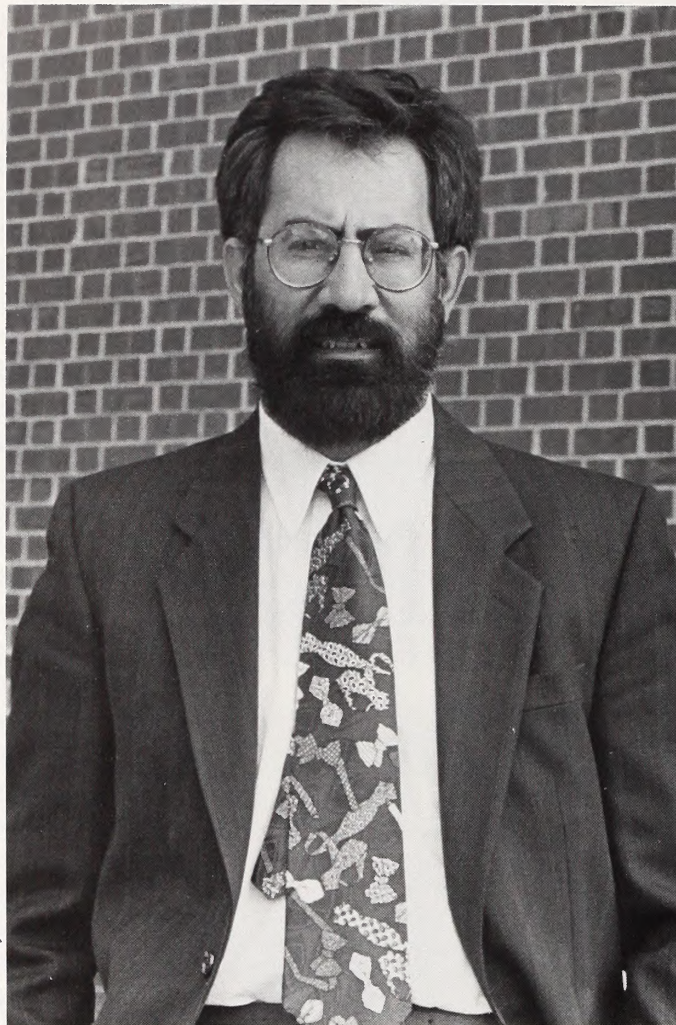
Researchers needed an up-to-date land-use and land-cover inventory, new maps and a land classification system to fill out their resource data base. The most cost-effective and practical way to get them, they decided, was with Landsat digital data.

Inventories had been done before, Copeland says, but Khorram and his team had the right machines and expertise to make this project work.

Khorram's team collected data for the study from five scenes by Landsat, taking care to match seasons, times and tides. Then, pixel by pixel, they studied how much light had bounced from the surface to the satellite and found patterns in the piecework. These patterns told them what kinds of vegetation, and in some cases land uses, were present in the Albemarle-Pamlico watershed. Buildings and barren farm fields reflected huge amounts of light, for instance. Deep, clear water absorbed light like a sponge.

From there, they developed 20 new categories for land use and land cover. The sharp eye of the satellite now could distinguish between pine forests and bottomland hardwoods, for example. And it could differentiate a low pocosin of wet, brushy land from a low marsh of cordgrasses and bulrushes. And Landsat could tell them something else.

The digitized spectral, or light-wave, data could be used by mapping experts to draw detailed land-use maps.



Siamak Khorram

The photo-like images satellites create can give scientists a clearer picture of how riverine, oceanic and estuarine systems intertwine. Researchers can use the data to count wetlands at the coast and map water quality.

If resource managers want to protect lowland forests, Copeland says, mapping via satellite can pinpoint these areas. Or, it can designate highways, farmlands, urban areas, wetlands and other land uses — pixel by pixel — in a context that managers may need to know.

The researchers verify their work by sampling their findings in the field. They match aerial photographs and county maps to the computer's images to identify plots of Atlantic white cedar and pocosins in Dare County, marshland in Hyde County and riverine swamps near Washington.

Eighty to 90 percent of the time the researchers are right. The standard is 85 percent accuracy.

"This is not a perfect technology," Brockhaus states. "You'll never get 100 percent accuracy. If we get 85 percent, we're very

happy, very happy."

Other than the sampling, the researchers do not need to visit the site. "That's the beauty of this technology," Copeland says.

Instead of taking water samples from one point and then another, or driving to one forest to check the tree types and then another 50 miles away, satellite data can fill in the spaces between, giving a more realistic picture.

"If you can see it all, you can begin to build that big picture," Copeland says. "Otherwise it's very difficult. If you've got to go down here and look at the edge of the Albemarle, then get in your car and drive up to look at the edge of the Chesapeake Bay, getting the big

picture's pretty tough."

The National Oceanic and Atmospheric Administration (NOAA) found that to be true.

Charged with managing the nation's wetlands, NOAA wants to find and map each marsh, bog and swamp from Onslow County, N.C., to Orange County, Calif. Such research will improve our understanding of coastal uplands, wetlands and seagrass beds and the ways they affect our marine resources. A more thorough data base will help decision-makers devise better protection policies.

For NOAA to find and map each U.S. wetland on its own would be expensive and time-consuming. Researchers such as Khorram and Brockhaus have been using satellite and other remotely sensed data to map coastal regions throughout the country. Linking their work, NOAA found, would be the best way to carry out its plan.

About two years ago, NOAA devised a wetlands mapping and monitoring project to develop a standard that can be used to assess coastal land cover and habitats nationwide.

A pilot project could tell NOAA if satellite-generated land cover images from two separate regions could be combined into one large image. But like two islands without a bridge, no one had a formula for joining the two data sets together.

Simply put, it was up to

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Clay Nolen

Khorram and his team to build that bridge.

At the same time Khorram and his associates were studying the Albemarle-Pamlico, researchers at the Oak Ridge Laboratory in Tennessee were investigating Virginia's Chesapeake Bay. Both studies used Landsat digitized data, and their boundary lines touched. So NOAA chose the two states to test its idea of merging regional wetland inventories.

"Even more remarkable was that the two studies took place about the same point in time," Brockhaus adds. The two research groups even had one Landsat scene taken on the same day in 1988.

"That's one of the reasons they did it," Brockhaus says. "They wanted to see how it would work in the best situation."

With support from UNC Sea Grant, Khorram, Brockhaus and their colleagues went to work.

One of the first steps was to merge the states' two different land-use classification systems.

Khorram's team combined some of its 20 categories for the Albemarle-Pamlico research to correspond with Oak Ridge's 14. Then they recoded their data and drew up one satellite-generated image of the North Carolina and Virginia coastlines.

The result is a vibrant paintbox picture of thousands of dots of color.

"Each color

Continued



Scott Taylor

means a different type of land cover,” Khorram says, pointing to a mass of white on the image. “These are all urban areas. This is the road coming down, I-95,” he says, tracing his finger along a thread of white. “Coming up here is the Washington, D.C., area. Coming down here, that’s Virginia Beach.” The wetlands show up nearby in different shades of green.

By piecing the regions together, the two teams proved other mapping projects could be linked using the methodologies they developed. The process, called “collective mosaicking,” joins one satellite map of thousands of dots of color to another map like pieces of a puzzle. A perfect match virtually erases the boundary lines between the two regions and creates that big picture scientists need.

Now Khorram and his colleagues are taking their coastal satellite research a step further, again with Sea Grant support from NOAA’s


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Coastal Ocean Program.

The North Carolina researchers can now detect changes in water and land uses over time. Khorram’s task is to find ways to ensure that can be done as accurately as possible.

“You take satellite [data] from 10 years ago, and you take satellite data from today and map the distribution of urban development, wetlands, agriculture, forestry, barren land ... things like that,” Khorram says. “By comparing them, you know what’s happened in the last 10 years.”

Satellites can also help detect coastline changes over time, he adds.

Satellite uses for future coastal research seem endless, the researchers say. For now, says Khorram, the technology provides a fast and cost-effective way to let governments, industries and citizens learn more about the sites that provide their livelihoods and resources, and about what’s right in their own backyards. 

The Legends of John Kunner and Old Buck

By *Carla B. Burgess*

John Kunner was dead.

His sheepskin-covered drums quieted. His contorted, gyrating dance stilled. His costume of colorful rags, feathers, sheep's bells and bulls' horns faded into dust.

Yes, many — including the *Journal of American Folklore*, community newspapers and some historians — believed that by the turn of the century this icon of African-American Christmas had slipped from our midst.

But Michael Luster was skeptical. In 1991, the Beaufort folklorist had

heard an elderly black woman recollect her childhood memories of the “John Kunners,” who painted their faces and donned fantastic costumes in which to haunt the streets at Christmastime, singing and dancing.

This venerable masquerade of African origin was a custom called John Kunner; its participants, John Kunners.

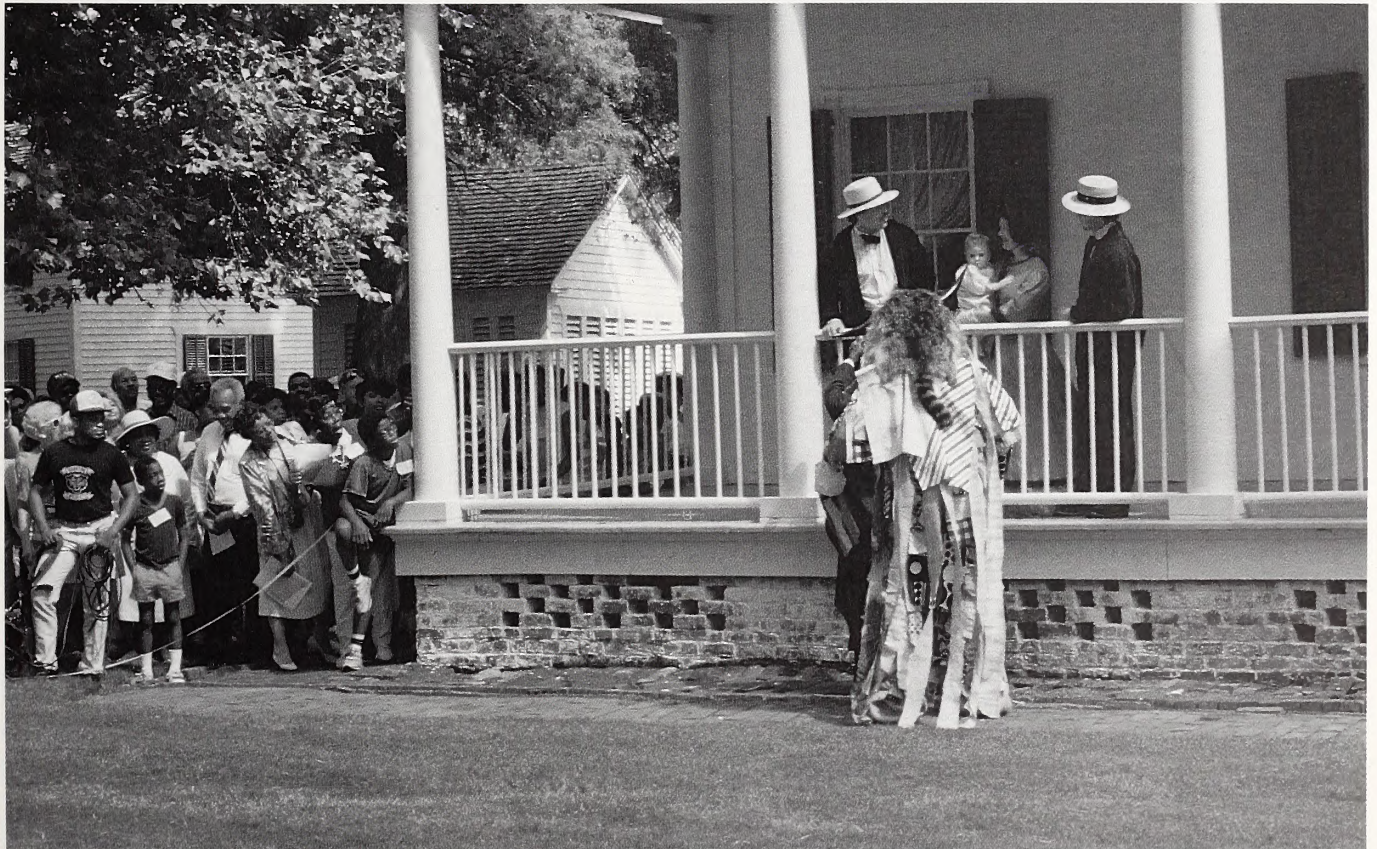
Luster went to back issues of the Beaufort newspaper, searching for signs of Kunner's life in the 20th century.

He cranked through every micro-filmed issue of the *Beaufort News*

between 1920 and 1950, and John Kunner managed to elude all but one report. On the next to the last day of 1937 was a morsel about Jack Chadwick, one of a parade of costumed black men, who was struck by a car, taken to the hospital, treated and released.

The news brief was lacking in context or description. But the presence of John Kunner — or John Canoe, John Coonah, Jonkonnu or any of the other names by which it has been identified — in that parade was unmistakable.

Continued



David W. Latham

The ragman and the “fancy dress” man collect coins from the plantation owner and his family during a re-enactment of the John Kunner celebration at Somerset Homecoming, a reunion of slave descendants, in 1988. Only during these Christmas festivities were Somerset slaves allowed on the lawn of Josiah Collins' Lake Phelps mansion.



Chuck Davis, outfitted in colorful rags, animal skins and horns, and carrying a stick of "seasoned wood," performs the John Kunner dance with another member of the African-American Dance Ensemble at Somerset Homecoming in 1988.

"If you take Halloween and Christmas caroling and mix them up, that's sort of what it was like," says Luster.

A custom brought to this country by slaves from West Africa and the West Indies, John Kunner was a stowaway that, mysteriously, flourished almost solely in the Old North State. Exceptions are a cousin of the celebration that died about 1860 in the southeastern Virginia town of Suffolk and an observance that thrives today in the Florida Keys.

"Like the islands of the Caribbean, North Carolina appears to have been a virtual island of Jonkonnu on the North American continent," wrote Elizabeth Fenn in a 1988 article in the *N.C. Historical Review*.

The celebration of John Kunner may have originated as a memorial to John Conny, an 18th century ruler on the Guinea coast. Harnett T. Kane,

author of the 1958-published *The Southern Christmas Book*, who referred to the ruler as "John Connu," described him as a flamboyant folk hero.

"In his name, groups of men have long gone about during Christmas season in 'fantastic manner, with cow horns ... masks and boars' tusks on their faces,'" Kane wrote.

The celebration may date to 1688, when a festival of dancing, singing and costumes accessorized with cows' tails was noted by Hans Sloane in Jamaica. John Kunner wasn't mentioned by name until 1774, when Edward Long's *History of Jamaica* describes the revelry led by "several tall robust fellows dressed up in grotesque habits." In Long's description, each masquerader is pursued by "a numerous crowd of drunken women, who refresh him frequently with a sup of aniseed-water, whilst he

dances at every door, bellowing out 'John Connu!' with great vehemence."

John Kunner is still observed in present-day Jamaica, although its personality and traits have changed somewhat.

On plantations in North Carolina in the 1800s, many black slaves were allowed to celebrate John Kunner and the uncharacteristic freedoms it afforded between Christmas and New Year's. During that week, they were given license to visit relatives at neighboring plantations and to roam the community, singing and dancing in exchange for coins and spirits.

The slaveowners hoped to gain in return "a placid and docile slave population that would labor with unquestioning obedience for the rest of the year," wrote Fenn.

In 1849, a Northern schoolteacher described a performance at a plantation in Bertie County, across the Chowan River from Edenton.

"The Negroes have a custom here of dressing one of their number at Christmas in as many rags as he can well carry," wrote George Higby

A custom brought to this country by slaves from West Africa and the West Indies, John Kunner was a stowaway that, mysteriously, flourished almost solely in the Old North State.

Throop. "He wears a mask too and sometimes a stuffed coonskin above it so arranged as to give him the appearance of being some seven or eight feet tall."

Musical instruments of "Kunnering" included "animals' bones, jew's harps, triangles and cows' horns," wrote Kane. The participants were predominantly men, but women and children often brought up the rear of the processional. The "ragman," or chief John Kunner, led the gala; the others dressed in "Sunday-go-to-meeting-suits" or donned women's clothing.

Though plenty has been written about John Kunner, its existence was downplayed or vaguely described in the media reports of its day. In the 1850s, the *Wilmington Daily Journal* labeled John Kunner "feeble," citing a lack of audience appreciation as a possible culprit. It continued after the abolition of slavery, but declined among blacks just before the turn of the century, possibly because of the racially motivated riots in Wilmington in 1898. Accounts in the early 1900s point to the tradition's later adoption by white youths in Wilmington.

With the exception of its 1937 accident report, Beaufort's "boosterish press" ignored the celebration taking place before them, wrote Luster in a 1991 eulogy, even though it appears that the water town harbored all that remained of the tradition in North America.

Meanwhile, the celebration of Old Christmas in the tiny, Outer Banks village of Rodanthe was thoroughly reported. The celebration there dates back to England's shift from the Julian to the Gregorian calendar in 1752, which moved the date of Christmas from Jan. 5 to Dec. 25.

"The news took awhile to reach outlying areas and was not warmly received by a lot of people," says

Wynn Dough, curator of the Outer Banks History Center, "especially out on the coastal fringe, far from the real centers of population."

The tradition of Old Christmas, which is still celebrated in Rodanthe to this day amid roasted oysters, music and dance, was once observed with a processional between the north and south ends of the community. The music spilled from fifes made with local reeds and drums crafted of home-tanned sheepskins, wrote Richard Walser in the *N.C. Folklore Journal*.

But the most consistent thread of Rodanthe's holiday was and is the appearance of "Old Buck" or, as Walser penned, "the wild bull of Trent Woods."

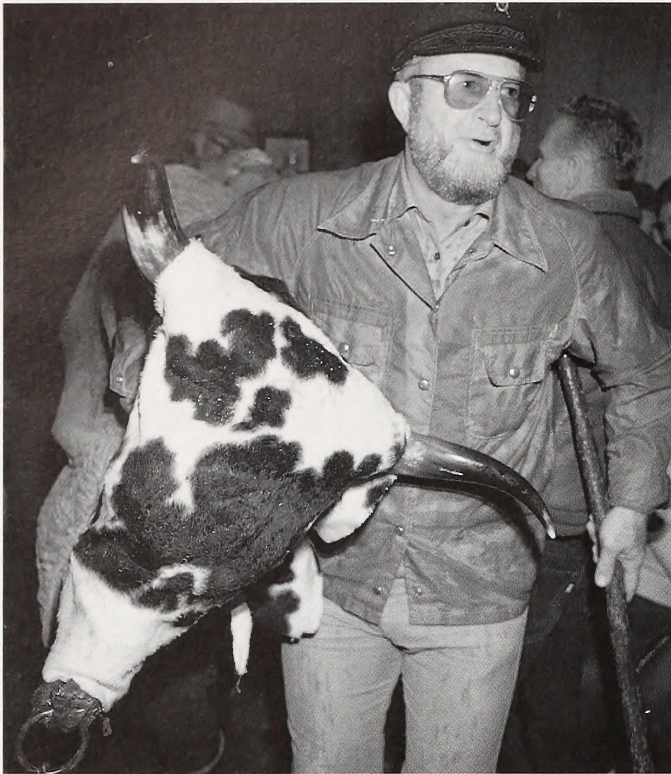
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On plantations in North Carolina in the 1800s, many black slaves were allowed to celebrate John Kunner and the uncharacteristic freedoms it afforded between Christmas and New Year's.

The African-American Dance Ensemble, performing as John Kunner musicians, beat drums and replicas of "gumba boxes," or wooden frames covered with tanned sheepskins.



David W. Latham



John Edgar Herbert Jr. leads "Old Buck," the wild bull of Trent Woods, during Old Christmas at Rodanthe in 1986.

With a roar like a Nor'easter, fiery nostrils and magnificent great horns, Old Buck emerged from the pine forests of Cape Hatteras each Old Christmas to inquire about misbehaved children, Walser wrote. The beast's mission was to annihilate Santa Claus through the misdeeds of children, but like Dr. Seuss's garlic-souled Grinch, he never succeeded. The young boys would buck and frolic and eventually shoo the impetuous steer away, saving the spirit of Christmas.

In Rodanthe's festival, an effigy of Old Buck — comprised of two men under a blanket, which is attached to a steer-like head with horns — cavorts and prances among the townspeople who gather in the old schoolhouse for a pageant of drumming and dancing.

Like the bovine costume, the legend of Old Buck has been passed down through generations of families. A story in *Sea Chest*, published by Cape Hatteras School in 1979, describes the flesh-and-

blood Old Buck as the lone survivor of a shipwreck off the Outer Banks. The black and white steer reportedly swam to the shores of this sandy seaside village. Buck is believed to have sired many offspring by local cows and to have been domesticated by the residents of Rodanthe. He was reportedly led through the village each year on Jan. 5. Some years later, old Buck wandered into Trent Woods and was killed by a hunter. But he was kept alive in future celebrations through his caricature.

The *Sea Chest* article, which recounts an oral history by the late John Herbert, a past keeper of Old Buck, includes tales of the townspeople going from house to house disguised in old clothes and stockings. "The women would dress up like men and the men as women," said Herbert. Other accounts of Old Christmas also describe minstrels performed by whites in painted faces.

Whether by design or accident,

John Kunner may have been immortalized in the lore of this Outer Banks community.

"Traditionally, in Rodanthe, you had groups of people wandering around the neighborhood, serenading anybody who would stand still for it," says Dough, adding that the head of a cow or steer was often part of the gleeful infantry. "The John Kunner celebration involved roaming bands of revelers making raucous music. It also involved a central figure with horns, in this case the ragman.

"The similarities between the older Rodanthe celebrations and John Canoe are kind of hard to miss," Dough says.

Luster concludes that like many American customs, celebrations such as Old Christmas at Rodanthe and John Kunner are owing to myriad roots, including English and African. Similarities between the customs of Rodanthe's festival and John Kunner are probably no coincidence. As with Buck, says Luster, "I suspect that its origins have nothing to do with a bull washing ashore.

The tradition of Old Christmas, which is still celebrated in Rodanthe to this day amid roasted oysters, music and dance, was once observed with a processional between the north and south ends of the community.

“Just like John Kunner is not a pure African tradition — first of all, Christmas isn’t an African holiday — (Old Christmas) draws on the European and the African,” he says. “All over the British Isles, people practice mumming at Christmastime, that is, people putting on costumes and going door to door.”

It was through a conversation with now-deceased Emma Chadwick that Luster recovered many precious strands about 20th century John Kunner in Beaufort. The rest was woven from the boyhood memories of some of the Menhaden Chanteymen — a group of African-American menhaden fishermen whose folk songs preserve their oceanborne heritage.

Jack Chadwick, the hapless John Kunner who collided with the car of that 1937 newspaper article, probably had the additional misfortune of arriving at the hospital in playful attire. Luster speculates that he was wearing makeup and a dress and carrying a purse at the time of his injury because that was his traditional role in the John Kunner pageant.

Through the Chanteymen’s recollections, a scene was conjured up for Luster of “six-foot-three-inch Willie Fulford, who wore a white spike-tailed coat and carried a walking cane.”

Buster Branche dressed like a clown, Pete Hyman pounded the bass drum, Charley Taylor rapped the snare. And there was an air of the gospel according to John Kunner.

“When they arrived at the next house, the drums would stop and Walter Joyner would step forward in some approximation of a preacher’s garb, clutching a catalog or other large book to serve as his mock Bible,” Luster wrote. “He would intone in preacherly cadences, ‘I’m taking my text from chapter two-twotie-two, ‘Dry Bones in the Valley, Biscuits in

the Oven and Molasses on the Table,’ and deliver his comic sermon to the congregational shouts of ‘That’s right. Tell it, Brother.’”

Sometimes the John Kunners and their entourage ventured beyond Beaufort, marching across the bridge to Morehead City or out to North River, a 17-mile trip there and back.

The Kunner faithful, which consisted mostly of menhaden fishermen, carried on the tradition through the latter years of the 1940s, until a marching band at the all-black Queen Street School debuted in 1948, perhaps stealing the thunder of the John Kunners and allowing the aging revelers a welcome retirement. The last of the gang passed away in 1989. ❁

Chuck Davis takes a respite from the John Kunner re-enactment at Somerset Homecoming in 1988. His costume was patterned after a description of Somerset “John Kunninger” by Dr. Edward Warren that fitted the “ragman” in strips of colorful cloth and a headdress of raccoon skin and ox horns.



David W. Latham

With a roar like a Nor'easter, fiery nostrils and magnificent great horns, Old Buck emerged from the pine forests of Cape Hatteras each Old Christmas to inquire about misbehaved children.

Crafting Coastal Plants Into Yuletide Trimmings

Give your home or beach cottage a natural touch when you decorate for the Christmas holidays. Use some of the plants that adorn your lawn when you begin your yuletide trimming.

Susan Ferguson, assistant horticulturist at Tryon Palace in New Bern, says any number of coastal plants, many of which are native, can be shaped into wreaths, arrangements, garlands and Christmas tree decorations.

Wax myrtle, an evergreen, is excellent for base greenery in arrangements or wreaths. It is adorned with gray-white berries and has a mild, pleasing fragrance.

For better effect when using wax myrtle, Ferguson suggests cutting away the new growth, or tuft of green stems, that extends beyond the berries.

Along the northern coast from Cape Hatteras to the Virginia line, bayberry makes an aromatic addition to holiday decorations. The semi-evergreen loses most of its leaves in the winter, leaving behind attractive, fruit-laden branches of whitish berries on the female plant, says Lundie Spence, Sea Grant's marine education specialist. The berries have long been used to scent candles.

Ferguson cautions against using wax myrtle or bayberry in decorations that will be jostled frequently, such as on doors, because the berries will fall off as the plant begins to dry.

If red is your accent color, then you can't beat the tried-and-true hollies for livening up the holiday home.

"The native hollies have various red and yellow berries," Ferguson says. "They're planted widely, and they fruited heavily this year."

Yaupon, an abundant native

coastal shrub, is a member of the holly family. It sports beautiful scarlet berries that hug close to the stem.

Nothing smells better during the holidays than the fresh essence of pine and cedar. And pine trees are as abundant along our coast as candles at Christmas.

The pine can be woven together to form a garland, used as a mantel topper or inserted in arrangements as base greenery. But if it's going to be



used indoors, it should be in water or a block of wet floral foam. Otherwise, it will yellow, Ferguson says.

Outdoors, the pine performs better because the air is usually cooler and carries more humidity.

Red cedar, abundant along the coast, can be used much like pine. It is adorned with a round, bluish-black nut that many people mistakenly call a berry.

JoAnne Powell of the N.C. Maritime Museum says she decorates her home with swags of mixed greenery tied together with a red bow. It's simple, but attractive, she says.

Grady Wheeler Jr., the Beaufort floral designer famous for dressing up Tryon Palace and the Governor's Mansion at Christmas, says he likes to

use the branches of the Chinese tallow tree for holiday arrangements.

Although the Chinese tallow is not native to North Carolina, some homeowners along the coast have added it to their gardens. It's distinctive because its seed pods burst open in late fall to look like popped popcorn.

Magnolia, camellia and boxwood foliage are also excellent for holiday decorating, Ferguson says. But magnolia stems must be kept in water, otherwise the leaves will curl up like cigarettes.

For a special party, cut a few lengths of greenbriar or catbriar vine. It's prickly, but its twiny appearance adds extra charm when woven around mirrors or at the base of the punch bowl or other arrangements. It only lasts a short time, Ferguson says, so save it for special occasions.

Or use ivy, Wheeler says. Just because ivy is used year-round doesn't mean it can't be a Christmas greenery too.

Don't forget the herb patch when it comes to decking the halls. Mint, rosemary and sage can be used to spice up holiday trimmings.

Once you have the base greenery in place, then it's time to dress things with splashes of color.

Pine cones, left natural or sprayed gold, can embellish a wreath or arrangement. In coastal North Carolina, pine cones come in a variety of shapes and sizes. The abundant long-leaf pine sports mammoth 12-inch-tall cones, Spence says. Loblolly pine cones are oval and 2 to 6 inches in length. The cone of pond pine is a tightly closed oval about 2 inches long, and the Virginia pine cone is small, round and open.

The fruits of two other common

coastal trees make excellent holiday adornments. Acorns and sweet gum balls can be used naturally, sprayed gold or coated with clear glitter for a snowy look.

If the birds haven't gorged themselves on the fruit, then snip a few berry-laden branches of the native American beautyberry bush for yuletide color, says Spence. The bright purple berries form tight clusters at regular intervals along bare branches.

And it wouldn't be Christmas without mistletoe, which grows abundantly in coastal North Carolina. The white-berried parasite attaches itself to the branches and trunks of flowering trees. The mistletoe can be added to adornments or hung above doorways to guarantee an ample supply of holiday kisses.

Wild grasses, natural or sprayed gold, silver or white, can add height to table or mantel arrangements or act as an earthy backdrop for a door swag.

The seed heads of flowers such as coneflowers or brown-eyed Susans make excellent natural adornments. And Wheeler says a variety of dried flowers — yarrow, baby's breath, larkspur, statice, strawflower and hydrangea, to name a few — will fit whatever color scheme you have in mind for the holidays.

Natural fruit — apples, oranges, pineapples, lemons, limes and grapefruit — can live up wreaths, swags and garlands. And so can nuts.

To give your holiday trimmings a distinctively coastal look, add seashells, says Wheeler. He's partial to creamy-gray oyster shells, but you

can use whatever you find along the beach. Wheeler trims the state symbol Christmas tree at the Governor's Mansion with Scotch bonnets, the state shell. Unfortunately, whole specimens of this lovely shell are hard to locate.

When collecting holiday greenery, use what is available in your own yard. Don't cut branches or berries



from other areas without permission of the landowner. And never take plants from public lands such as state and federal parks or national forests. This flora belongs to all of us.

Once you have assembled your branches, berries, cones and fruits, then it's time to condition them. Wheeler suggests crushing the ends of branches and stems before putting them in a bucket to drink a special solution of 1 gallon hot water, one can of Sprite (not diet) and 1/4 cup

bleach. Leave the cuttings in the mixture several hours.

Wheeler says this solution helps the plants hold their color and stay fresher in hot, dry winter homes.

Or you can try another method suggested by Ferguson. She assembles her wreaths and arrangements, then sprays them with clear acrylic floor wax to retard evaporation. Evergreens

last longer, and their leaves are shiny. However, do not spray the wax on berries or on citrus fruits such as lemons, limes or oranges because they will turn black.

For more decorating tips, Ferguson suggests you visit your local library or bookstore. If you would like your decorations to hearken back to times past, she has these suggestions: *The Southern Christmas Book* by Harnett T. Kane, *The Gift of Christmas Past: A Return to Victorian Traditions* by Sunny O'Neal and *The Christmas Tree Book* by Phillip V. Snyder.

For more modern decorating tips, browse the magazines at your local newsstand. *Southern Living*, *Woman's Day*, *Redbook* and countless other magazines offer how-to ideas for decking your halls.

To see how people in decades past celebrated Christmas in coastal North Carolina, visit Tryon Palace. The palace and nearby historic homes are decked in period decorations and tables are laden with traditional foods as they evoke the holiday spirit.

Tryon Palace will be adorned between Dec. 9 and 22. Please call ahead for tour times, group reservations and costs. The telephone number is 919/638-1560.

By Kathy Hart

Legal Precedents Loom in Lucas Case

In 1988, the hallowed halls of the U.S. Supreme Court probably seemed an unlikely forum for a lawsuit that cropped up when the S.C. Coastal Council barred David Lucas from building on two \$975,000 beachfront lots.

But the nation's highest court was exactly where *Lucas vs. S.C. Coastal Council* landed.

Now, four years later, the case continues to unfold, and it is pushing the bounds on existing laws. It pits property owners and their right to use their land as they please against regulatory agencies acting on the public's behalf to restrict uses of certain areas.

The verdict is still out, but the high court has indicated that Lucas should be entitled to compensation for the value of his property. The case has been remanded to the S.C. Supreme Court to determine whether construction on Lucas' property would violate the state's nuisance and property law.

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

But government intervention often chafes against our principles of freedom to do with our property as we please. And there has been a recent backlash against these regulations, Clark says.

The high court was trying to walk a safe line between these two interests.

The court realized there has to be some limit on how far government can go in regulating the use of property.

But at the same time, the court continued to see the need for regulation to respond to an increasing population and development of areas that could be impacted.

This conflict between individual rights and the public good has earned the *Lucas* case a large audience — landowners, land-use planners, environmentalists and local governments.

This case speaks to the larger issue of taking property — beachfront or not, Clark says.

"Whatever principle *Lucas* finally espouses could speak to other regulations," he says. "It could have a fairly far-reaching impact beyond just the oceanfront to wetlands and other land-use restrictions."

Some observers fear that a verdict in Lucas' favor will have a chilling effect on environmental regulation, making local governments reluctant to restrict land uses in ways to protect a natural resource or the public welfare.

Even now, as the case hangs in legal limbo, there is a degree of uncertainty.

"Until there is some clarity, the people who pass local ordinances or state laws might be a little bit nervous about the effects their rules have on property because they will worry about being sued," Clark says.

The roots of the case reach back to 1986. Lucas had purchased two lots on the Isle of Palms, where no permits to build were required from the S.C. Coastal Council.

But in 1988, the state enacted the Beachfront Management Act to preserve its 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 construction.

He filed suit against the Coastal Council, arguing that the act and its construction ban were a taking of his property without compensation. And because he was deprived of his property's entire value, he was due compensation regardless of whether the state had a legitimate reason for passing the act. A jury agreed and awarded him \$1.2 million.

The Coastal Council argued on appeal to the S.C. Supreme Court that a taking usually doesn't occur when a regulation is intended to prevent serious public harm. And the state's high court reversed the jury's award.

This exchange poised the U.S. Supreme Court to hear the case and possibly reshape government's authority to grant and deny landowners certain uses of their property.

In June, the court voted to remand the case to the S.C. Supreme Court to determine whether the state's nuisance and property law would prohibit Lucas' development plans. If not, he should be compensated for the land, the court has suggested.

Though the ruling was far from handing a decisive victory to either side, the case has the potential to shift the delicate balance between private property rights and regulating for the public good.

Sea Grant is making available a one-hour videotaped discussion of the case among a group of experts with extensive backgrounds in ocean and coastal policy, planning and land-use law. To order the videotape, send a check or money order for \$15 made payable to UNC Sea Grant, Box 8605, NCSU, Raleigh, NC 27695.

By Jeannie Faris

Tracking the Travels of *Trichodesmium*

A large, orange-brown slick was spotted in late October off Bogue and Shackleford banks and extended offshore to the Gulf Stream. The bloom's reddish color immediately set off alarms in coastal North Carolina, where fishermen and residents alike remember another reddish bloom that sent seafood sales plummeting.

Those reddish waters bore a toxic dinoflagellate called red tide.

But this year's coloration had nothing to do with that dinoflagellate.

Instead, this large surface slick was a harmless blue-green algae, known scientifically as *Trichodesmium*.

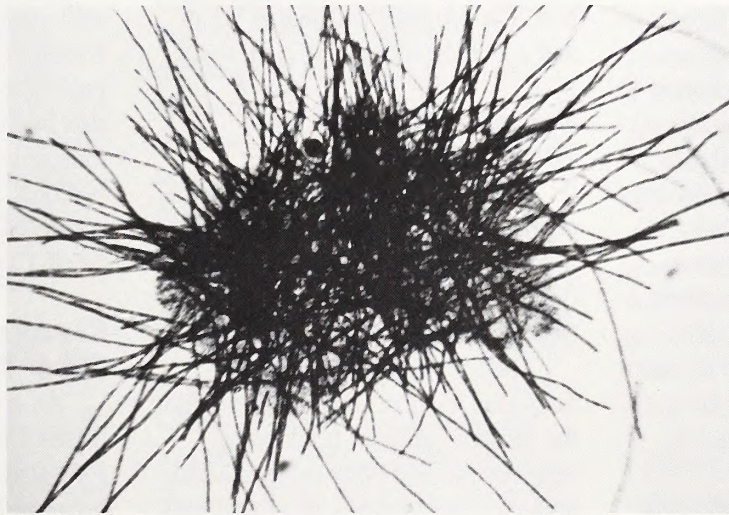
Hans Paerl, a Sea Grant researcher at the University of North Carolina Institute of Marine Sciences, says the slick stretched 30 to 40 miles, making it the largest *Trichodesmium* (pronounced trick-o-des-me-um) bloom that he has ever witnessed in Tar Heel coastal waters.

Trichodesmium is not toxic and did nothing more than color the water, Paerl says. The algae had a distinctive "earthy" smell, particularly in large concentrations.

Sea Grant's algae specialist says the bloom spun ashore on a Gulf Stream eddy, and its arrival was predictable. From the first of August to mid-November, the Gulf Stream hugs closer to the Tar Heel shoreline, and nearshore waters are at their warmest. Add extended periods of calm, dog-day-like weather to the

equation, and it's a perfect recipe for algal blooms, Paerl says.

Although the algae posed no threat to people, fish or shellfish, Paerl says *Trichodesmium* is worth some research. The tiny algae possess some scientifically interesting traits that might actually be a bonus to the



Low magnification picture of a puff-shaped radial colony of aggregated filaments of *Trichodesmium*.

productivity of the marine ecosystem.

Trichodesmium is capable of taking, or "fixing," nitrogen from the atmosphere and biochemically converting it to ammonia, a nutrient vital to its own growth and the growth of other marine organisms. This characteristic is uncommon, but Paerl is unsure how the nitrogen is transferred from the algae to the food chain.

The algae may be eaten directly by other organisms. Or, when the *Trichodesmium* die and break open, the nitrogen released into the ecosystem could be assimilated by other organisms and passed up the food chain.

Then again, bacteria that feed on the algae may be the transfer link between the nitrogen and the marine food web.

Right now, Paerl doesn't know how the nutrient transfer occurs, but he hopes that laboratory experiments will reveal some answers. His laboratory is one of only two in the world capable of culturing *Trichodesmium* outside of the natural environment.

As part of his Sea Grant project,

Paerl is also determining a pigment spectrum "fingerprint" on the *Trichodesmium* algae. By evaluating the type of algal pigment and concentration, Paerl may soon be able to pinpoint algal blooms by color, or spectral, analysis from a satellite orbiting Earth.

Next year, NASA plans to launch a SeaWiFS satellite, which will be capable of performing detailed spectral analyses.

Currently, Paerl is investigating the use of thermal infrared satellite technology for bloom detection. The *Trichodesmium* blooms are dense and reflect light in the infrared region of the spectrum, which means they can be detected from currently deployed satellites.

But Paerl believes the SeaWiFS satellite will do a better job of tracking *Trichodesmium* and other forms of algae and dinoflagellates such as red tide.

Now, researchers must spend hours sampling large stretches of water to characterize a bloom. Satellite detection could help scientists predict blooms and determine their movement and density without ever leaving the laboratory.

By Kathy Hart

Fishing Forum Scheduled

The second annual N.C. Marine Recreational Fishing Forum is scheduled for Feb. 6 in Raleigh, and organizers say the centerpiece of the one-day event will be a discussion of the pros and cons of a recreational fishing license.

Organizer Jim Murray, director of Sea Grant's Marine Advisory Service, says participants in the 1992 forum expressed a variety of concerns and opinions about a recreational license in North Carolina. Picking up on this theme, speakers next year will offer an overview of the issue, but Murray says the forum will take no positions.

He says fishery managers from three states that have the recreational fishing license — Florida, South Carolina and Virginia — will discuss their experiences. A panel of three supporters, three opponents and a legislator will also speak.

Among other scheduled speakers are Len Pietrafesa, head of the Department of Marine, Earth and Atmospheric Sciences at N.C. State University, who will discuss satellite technology and its uses for fisheries management; Bill Hogarth, director of the N.C. Division of Marine Fisheries, who will talk about the agency's highlights from 1992 and goals for 1993; Gene Huntsman, leader of the reef resources and coastal pelagics team at the Beaufort Laboratory of the National Marine Fisheries Service, who will discuss marine reserves; JoAnn Burkholder, an assistant professor of botany at NCSU, member of the N.C. Marine Fisheries Commission and Sea Grant researcher, who will talk about a newly discovered dinoflagellate that attacks and kills fish; Jerry Schill, director of the N.C. Fisheries Association and chairman of the habitat committee for the South

Atlantic Fishery Management Council, who will discuss the practice of harvesting the sargassum seaweed that supports juvenile fish and sea turtles.

To preregister, call Sea Grant's office at 919/515-2454 or write UNC Sea Grant, Box 8605, NCSU, Raleigh, NC 27695.

The forum will be held at the McKimmon Center on the NCSU campus. Registration will begin at 8 a.m. The program will start at 9 a.m. and conclude with a 6:30 p.m. social.

Spence Named to Museum Board

Lundie Spence, Sea Grant marine education specialist, has been named to a three-year term on the board of directors for the Friends of the N.C. State Museum of Natural Sciences.

The friends organization is dedicated to supporting and promoting the museum through fundraising, membership and other programs and activities that increase awareness and public support of the museum.

Appointed in August, Spence is no newcomer to the state's natural sciences museum.

As associate curator of education, Spence has conducted joint field trips for teachers in North Carolina and abroad and presented weekend programs for the public at the museum. She has collaborated with the education division of the museum since 1978.

As one of 54 board members, she says she looks forward to advancing the museum's role in science education and environmental understanding.

"I consider it an honor to work more closely with the museum," she says. "We have coordinated for years on educational programs. The staff and volunteers have always offered valuable services and programs."

The museum was founded in 1879

to preserve and advance North Carolina's natural heritage and to enhance the public's appreciation of the environment in ways that emphasize the state's biodiversity. It hosts more than 250,000 visitors annually, including 100,000 school children.

The friends want to celebrate North Carolina's heritage, but also to focus on the future. Collections and exhibits at the museum are constantly growing and changing. In December 1991, the friends celebrated the opening of a redesigned discovery room, funded in part by the SAS Institute Inc. The museum recently received a \$544,390 National Science Foundation grant for construction of a major new exhibit on North Carolina's freshwater wetlands.

Cleanup Collects 256 Tons of Debris

An army of volunteers fanned out across Tar Heel waterways on Sept. 19 for a statewide assault on litter. Four hours and 255.6 tons of litter later, their mission was accomplished.

Almost 12,000 volunteers participated in the First Citizens Bank Big Sweep, collecting everything from wigs and hairpieces to car parts and credit cards. Although unusual finds such as a 1947 Chevrolet at Masonboro Island and 26 pairs of underwear in Vance County kept volunteers chuckling, the amount of trash collected was no laughing matter.

The 255.6 tons bagged exceeded the 1991 total of 212 tons. The sixth annual event is the nation's largest statewide waterway litter cleanup.

Susan Bartholomew, the cleanup's executive director, says the addition of 50 to 60 new sites across the state explains the increased amount of litter collected. Overall, she says, county coordinators reported less trash this year at sites that had been cleaned during previous Big Sweeps.

"I think it's very encouraging that our county coordinators are commenting that some of their areas were much cleaner this year," she says. "I definitely think our message is seeping into people's minds and slowly changing their habits."

But like prior cleanups, the bulk of the litter collected continued to be items such as cigarette butts, plastic and glass drink bottles, metal cans and plastic pieces.

Unfortunately, volunteers also continued to find waterway dump sites where people had disposed of appliances, metal pieces, toys and tires.

Site coordinator Felicia Adams reported finding two refrigerators, four stoves, 30 water heaters, five washing machines, one newspaper rack, one metal drum, a television set and a set of metal shelves near the Neuse River bridge off Poole Road in Wake County.

At every site, volunteers tally the items collected on data cards provided by cleanup coordinators. The cards list more than 80 items — everything from egg cartons to diapers, from tires to 55-gallon drums, from fishing line to light bulbs — for volunteers to mark off.

On the flip side, the volunteers record the unusual. This year's list of surprises reads like items slated for a yard sale. They included: a vacuum cleaner, a swing set, a plastic Christmas tree, a dog house, high heel shoes, handcuffs, an ice cream freezer, a motorcycle, a pink stuffed pig and a set of bull horns.

Statewide, volunteers found three whole vehicles and enough car parts — mufflers, hubcaps, doors, batteries, gas tanks and windshields — to build several more. As for tires, volunteers pulled almost 1,500 of the rubber rings from the sand and mud of Tar Heel waters.

The First Citizens Bank Big Sweep '93 is scheduled for Sept. 18.

Kudos for Big Sweep

First Citizens Bank Big Sweep '92, which Sea Grant helped coordinate, won second place in the national America's Clean Water Awards Program sponsored by Keep America Beautiful. Big Sweep won its honors in the category of Cleanup/Restoration/Protection.

"The program's efforts to instill a sense of responsibility to protect national and local water quality were outstanding," writes KAB President Roger Powers. "The outstanding organization and success of a statewide waterway cleanup that involved thousands of volunteers in not only a cleanup effort, but an education effort about water quality and litter prevention, made your program stand apart from the others."

Big Sweep also became the recipient of the second annual Environmental Stewardship Award presented by the Chemical Industry Council of North Carolina (CICNC) and North Carolina Citizens for Business and Industry (NCCBI). CICNC and NCCBI present the award annually to recognize meritorious service in preserving North Carolina's natural resources.

Holiday Cooking

Most of us really enjoy the holiday spirit from Thanksgiving through Christmas. There's special warmth in the familiar sights, smells and festivities. And this is a traditional time to enjoy good food.

This year, why not replace or complement your holiday foods with fish and shellfish? Serve a festive spread for friends who drop in. Or use an edible shrimp tree for your centerpiece.

Below are two of several holiday recipes included in the Sept./Oct. issue of *Mariner's Menu*, the informative seafood newsletter written by Joyce Taylor, Sea Grant's seafood education specialist. For more festive seafood

dishes — crab-stuffed mushrooms, baked snapper with fennel, shrimp pilaf and oyster-mushroom stuffing — write Taylor for a copy of *Mariner's Menu*. Her address is: NCSU Seafood Laboratory, P.O. Box 1137, Morehead City, NC 28557. And while you are writing, why not subscribe to this free newsletter?

Festive Seafood Spread

1 pound backfin crab meat
1/2 pound cooked shrimp
1/2 cup mayonnaise
1/2 teaspoon freshly ground white pepper
1/8 teaspoon paprika
2 teaspoons chopped fresh parsley
1/4 teaspoon Tabasco sauce

Remove any cartilage or shell from crab meat. Chop shrimp coarsely. In medium bowl, combine crab, shrimp, mayonnaise, pepper, paprika, parsley and Tabasco. Chill well. Serve with assorted crackers. Makes about 3 cups. (Note: May also be heated over boiling water and served hot.)

Creamy Fish with Cranberry Sauce

1 pound skinless flounder
(or other lean) fillets
2 tablespoons margarine
2 tablespoons flour
1/2 teaspoon salt
1/2 teaspoon dried thyme
1/4 teaspoon freshly ground white pepper

1 cup milk
2 tablespoons dry sherry
1/2 can whole berry cranberry sauce
Melt margarine in medium skillet over medium heat. Stir in flour, salt, thyme and pepper. Gradually stir in milk and sherry. Cook, stirring constantly, until thick and smooth.

Cut fish into serving size pieces. Salt lightly. Add to mixture in skillet. Heat to boiling. Reduce heat to simmer. Cover and cook until fish flakes easily with a fork, about 10 minutes. Carefully lift fish onto platter. Spoon sauce over. Surround with cranberry sauce. Serves 4 to 6.

Coastwatch Needs More "Down Home" Style

I just finished reading your Sept./Oct. Back Talk page. There is a letter by Mr. Lewis Clarke about how your *Coastwatch* magazine has changed. I have noticed this myself, and I agree with him. Sitting next to me are issues that I have saved since January 1983 when *Coastwatch* was nothing more than a few pages. When Mr. Clarke stated that *Coastwatch* had an amateurish look to it, I think he really meant a "down home" look.

From my very first issue of *Coastwatch*, I liked the "down home" look that it had. It wasn't slick and had an unmistakable, friendly look to it. The look and the articles made me want to get in my car and explore my state.

One day a new, slick, colored publication came to my mailbox. It looked like a slick store-bought magazine. It was *Coastwatch*. What happened? Have you gained more readers with this new format? Was it necessary? You stated that the color cover was brought about by reader requests. I wasn't surveyed. You also said that *Coastwatch* has won awards for professionalism, writing, photography, design, etc. You seem to be geared toward award winning, not the "down home" readers who originally made your magazine what it is today. Your magazine now has a glossy, aimed-for-the-city look that I find blends in with all the other magazines that I receive. More than once, I have mistakenly picked up *Coastwatch* when I was reaching for my latest issue of *Wildlife in North Carolina*. *Coastwatch* and *Wildlife in North Carolina* once

complemented each other. Now they are almost the same.

Your new *Coastwatch* seems geared toward highly educated, young career-minded adults. Your look, readability, style and content has changed regardless of the fact that you think it hasn't.

I have no intention of stopping my subscription like Mr. Clarke, though I do agree with his criticism. Your magazine does not inspire me to travel North Carolina anymore; it is, however, about North Carolina, and that is the only thing that it has going for it. Please don't let *Coastwatch* start drifting from the North Carolina area or one more reader will be lost.

**Norman Scalise,
Winston-Salem, NC**

I'm sorry, Mr. Scalise, that you don't like our look and that we do not inspire you to explore the state. As for our look, let me say again that the magazine format was what our readers indicated they wanted. When we surveyed our "old" Coastwatch subscribers, they said they wanted more pages, more pictures and more color. They wanted a magazine. We polled every 50th person on our zip-coded mailing list of 21,000. Consequently, it was the "old" readers who mandated the change.

As for our down-home style, all I can say is that every story we write can't be about a nostalgic place such as Currituck or Ocracoke or include the reminiscences of an older person about days past. There are some very compelling issues facing coastal North Carolina, and we feel obliged to inform our readers about them. As a result, some of our recent

issues have been heavy on the information and light on folksiness. But that doesn't mean we ignore the real people who live along our coast. Don't forget meeting John Fussell, the bird man of Carteret County, and Russell Howell, the crabber who plied the White Oak River. And remember Floyd Pollock and Haywood Graham, the fellows who swapped stories of old Wilmington?

Again, let me say the mission of Sea Grant and Coastwatch is to provide information that people can use to make decisions about the use of coastal resources. Sometimes that means telling folks about the latest developments in the aquaculture industry or about using satellites to determine land uses. We're not a travel guide to coastal North Carolina, and we're not publishing just to win contests. But don't worry, the North Carolina coast will always be our subject matter.

Thanks for your comments. If you have specific story suggestions, we'd like to hear from you or anyone else who has ideas. The magazine is still changing, so we listen carefully to your comments and try to accommodate as many suggestions as possible.

Likes Coastwatch As Is

I don't understand folks like Lewis Clarke, who seem to want something free. *Coastwatch* is fine — interesting articles, well-written. The last issue, "North Carolina's First Inhabitants," was unusually good.

**Walter E. Diemer,
Lancaster, PA**

Jack Frost may be nipping at your nose now, but it'll be planting season before you know it. Sea Grant's coastal flora-and-fauna gardening guides make springy winter reading.

New Know-How On Checking Erosion

If you've got a problem with estuarine shoreline erosion, you'll find nearly everything you need to know in a new Sea Grant publication, *Shoreline Erosion Control Using Marsh Vegetation and Low-Cost Structures*.

This 20-page illustrated manual describes how to cultivate or transplant marsh vegetation for estuarine erosion control and how to fertilize and maintain it. The manual also illustrates placement and construction of an offshore breakwater, which combined with a planted marsh can protect precious shorelines.

The guide, written by Sea Grant researchers and N.C. State University professors Stephen Broome and Ernest Seneca and Sea Grant coastal engineering specialist Spencer Rogers, features up-to-date planting tips and advice on site suitability.

For a copy, write Sea Grant. The cost is \$2.50. Ask for publication number UNC-SG-92-12.

Bolstering Dunes With Vegetation

Dunes are fragile structures that require protection and maintenance to continue their normal function. Whether initiating formation of a new barrier dune or patching bare areas on an existing dune, selection of plant species is important.

Building and Stabilizing Coastal Dunes with Vegetation provides instructions on transplanting, fertilizing and maintaining dune grasses with detailed information on plant species.

The cost of this 20-page illustrated manual is \$1.50. Write for publication number UNC-SG-82-05.

Seaside Landscaping

Many new oceanside homeowners picture a dream cottage framed in a setting of luxuriant vegetation. But this vision of greenery can lure even the greenest thumb to disaster.

Seaside, the hinterland rules of plant selection, use and culture are subject to drastic revision. Many coastal nurseries are fully aware of these amendments. Their help with beach plantings can be invaluable. Nevertheless, many cottagers will decide to take on this job as a do-it-yourself project.

Seacoast Plants of the Carolinas for Conservation and Beautification offers the uninitiated an opportunity to accept these challenges.

This 206-page illustrated handbook details the use of native plants for landscaping and stabilizing coastal soils.

Copies are \$4.50 apiece. Write Sea Grant and ask for UNC-SG-73-06.

Seaside Sandy Anchors Are More Than Meets The Eye

Dunes are a beautiful backdrop to the roaring ocean. But the sandy mounds and the plants that stabilize them offer more than beauty.

They offer protection. They buffer inland areas from wind, waves, tides and storms.

Although sand makes the dune, vegetation holds it in place. And the plants that stabilize dunes have some special adaptive features that enable them to withstand the harsh beach environment.

To learn more about the ecology and biology of our coastal dunes, send for a copy of *A Guide To Ocean Dune*

Plants Common to North Carolina.

This 72-page guide will teach you about dune habitat and the plants — trees, shrubs, vines, herbs and grasses — that call this environment home. It contains more than 50 botanically accurate drawings of dune plants frequently found on Tar Heel beaches.

For a copy, write Sea Grant. Ask for UNC-SG-87-01. The price is \$4.50.

A Companion Piece: Salt Marsh Plants

As a companion to our dune plant guide, Sea Grant offers a smaller, but equally informative, *Guide to Salt Marsh Plants Common to North Carolina*.

This guide describes the plants that live in the brackish tidal waters of the salt marsh. Like their cousins on the dunes, salt marsh plants also have some special features that allow them to adapt to the tidal marshes.

To identify the marsh plants, this guide also includes botanically accurate drawings of more than 25 shrubs, vines, herbs and grasses.

For a copy, write Sea Grant. Ask for UNC-SG-81-04. The cost is \$2.

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