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# Coastwatch

NORTH CAROLINA SEA GRANT • WINTER 2004 • \$3.75



FINDING REFUGE



## Oysters: Past, Present and Future

For generations, warming up on chilly winter nights included sipping a steaming bowl of flavorful oyster stew. But in recent years, it has been less and less likely that the oysters were harvested from North Carolina waters.

Oysters are more than simply good eating, they also filter water – up to 50 gallons per day – and provide an important habitat for many other species of marine animals, finfish and shellfish.

North Carolina Sea Grant has various efforts focusing on native oyster stocks – funded through our core research program, national strategic research initiatives, minigrants and the Fishery Resource Grant Program, as well as through our extension and communications programs. Throughout 2004, we will share stories on various projects, including our first DVD, *The Amazing Oyster*.

Sea Grant is not alone in oyster restoration efforts in North Carolina. An overview of the issues will be offered at *An Encore for Oysters*, March 16-17 at the Crystal Coast Civic Center in Morehead City. The North Carolina Coastal Federation is organizing the conference with support from the U.S. Environmental Protection Agency and the Shellfish Sanitation Section of the N.C. Division of Environmental Health.

Speakers will include state and federal officials, university researchers and community groups involved in restoration efforts. The program will conclude with optional field trips. For more information, including registration fees and a complete agenda, contact the Coastal Federation at 800/232-6210 or go online to [www.nccoast.org](http://www.nccoast.org). North Carolina Sea Grant is one of many cosponsors for the event.

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In 2003, North Carolina Sea Grant chalked up a number of accomplishments. The long-awaited publication of *Mariner's Menu: 30 Years of Fresh Seafood Ideas*. The hiring of three new extension specialists, introduced on

Herman Lemkford



page 20. The selection of four Knauss fellows.

We also had a successful Program Assessment Team review. Our evaluation team included two members of the Sea Grant National Review Panel, one Sea Grant program director, and two additional experts in our research and outreach topics.

We kept them busy for their five-day visit, sharing many success stories. In many cases, we only scratched the surface.

The team gave us high marks for program leadership, our strategic planning process, and a “seamless” integration of our administration, research, extension, communications and education efforts. Other “highest performance” categories included contributions to science, technology, education and outreach, as well as our extensive range of partnerships.

In particular, they cited innovative partnerships such as FerryMon water quality sampling in the Pamlico Sound and the Coastal Plains Paddling Trails Initiative as “best management practices,” which could be models for other Sea Grant programs around the country.

The review team also offered a list of recommendations to improve our program, such as involving more high school students and undergraduates in Sea Grant efforts, as well as reaching out to previously underserved groups.

On behalf of North Carolina Sea Grant Director Ron Hodson, I would like to thank the more than 100 partners, researchers and graduate students who participated in one or more aspects of the review.

We expect our next national review in four years. Again, we will call upon those of you who have helped us bring Sea Grant goals into reality. But you don't have to wait four years.

Please drop me a line if you have an example of how Sea Grant's applied science and outreach programs have made a difference to North Carolina – and to you.

Katie Mosher, Managing Editor

### I N T H I S I S S U E

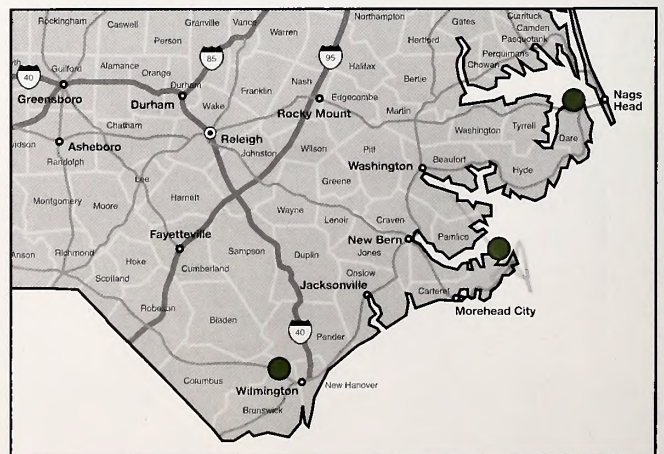
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Spencer Rogers □ Ken Taylor □ Scott Taylor

*North Carolina's diverse coast offers countless interesting subjects. The large dots on the locator map indicate story settings in this issue — including Dare, New Hanover and Carteret counties.*





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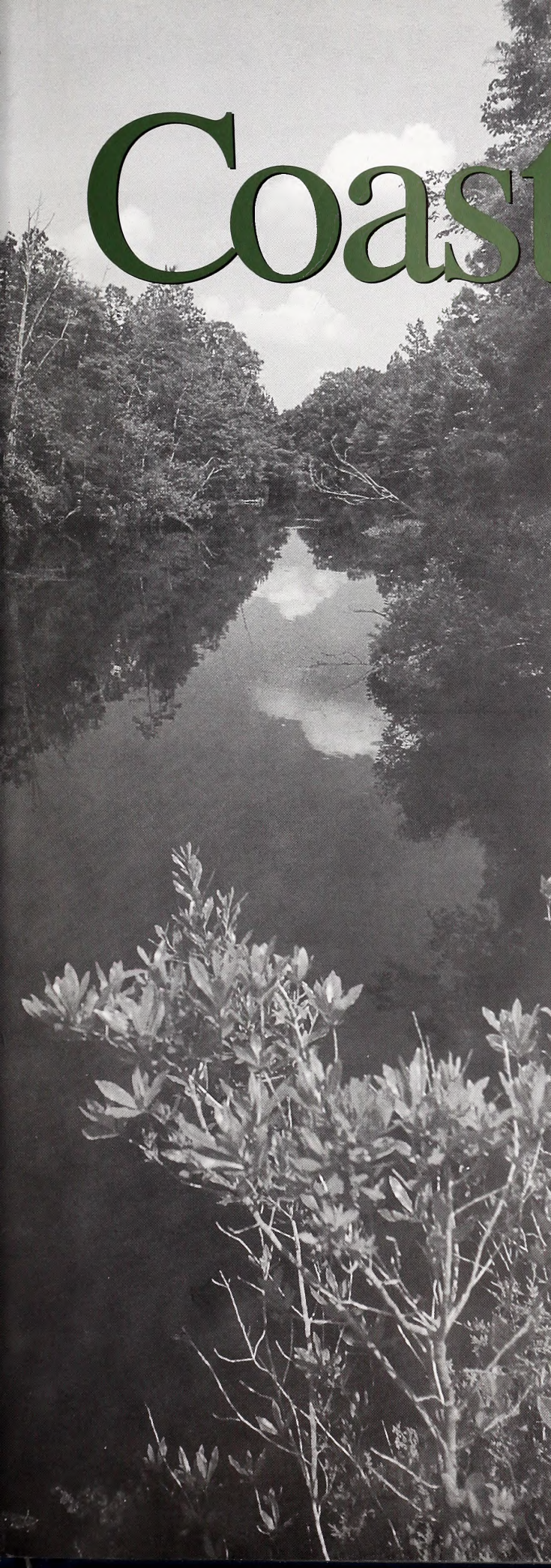
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# Coastwatch

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The North Carolina Sea Grant College Program is a federal/state program that promotes stewardship 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, North Carolina Sea Grant supports research projects, a 15-member extension program and a communications staff. Ron Hodson 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 and table of contents photos of the Alligator River Refuge by Ken Taylor.

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## COASTAL TIDINGS



Giant Salvinia, on the federal noxious weed list, has been inadvertently spread by water gardeners.

### Let the Buyer Beware

Internet shoppers need to be aware that some plants and seeds for sale as ornamentals to home gardens may be hazardous to the environment.

Many online vendors sell plants that appear on the federal noxious weed list — invasive species that choke out crops, gardens, forests and waterways.

Along with raising consumer awareness, researchers at the National Science Foundation's Center for Integrated Pest Management at North Carolina State University hope to nip the problem in the bud.

To halt the Internet sale of noxious weeds, center researchers, in partnership with the U.S. Department of Agriculture's Animal and Plant Health Inspection Service, are developing a computer program that searches for Web sites selling noxious weeds.

The search engine, called Agricultural Internet Monitoring System, will spot the sites, and notify vendors that they must stop selling illegal plants. Violators who refuse to comply will be prosecuted or fined.

Each year, state and federal agencies spend millions of dollars to fight invasive plant species, such as purple loosestrife, that chokes both fresh and saltwater wetlands and reduces wildlife habitat.

North Carolina Sea Grant, in collaboration with NC State, also has been in the forefront of the public awareness campaign. *A Field Guide to Invasive Aquatic and Wetland Plants* has been widely distributed through Sea Grant programs across the country. To order one, send a check for \$15 to North Carolina Sea Grant, NC State University, Campus Box 8605, Raleigh, NC 27695-8605. — P.S.

### In the Next Issue of *Coastwatch*

Travel with Ann Green to the famed Fulton Fish Market to learn how North Carolina seafood is transported from local docks to the world's dinner table. And Pam Smith introduces a trio of North Carolina coastkeepers who are helping to focus public attention on important coastal issues.



## Bulletin Highlights Horseshoe Crab

The American horseshoe crab, *Limulus polyphemus*, is scuttling through headlines once again with the University of Delaware Sea Grant College Program's colorful bulletin spotlighting the fame-stricken creature.

Titled, *The Horseshoe Crab: A Creature that Crawled Out of the Past*, this new bulletin comes as no surprise to fans of the unique critter — one that holds a pivotal role in various medical breakthroughs, such as the detection of bacteria in medical instruments and drugs.

Anything worth knowing about horseshoe crabs — anatomy, habitat and fun facts — is featured in the six-page publication. Educators will find such information useful for classroom activities, and instructions on using the bulletin to meet Delaware state and national science education standards are also included.

The horseshoe crab “has seen the mighty age of the dinosaurs come and go, has lived through numerous ice ages and natural disasters, and today serves as a keystone species in the ecology of the Delaware Bay,” says Bill Hall, education specialist for Delaware Sea Grant and author of the bulletin.

Request a free copy of the bulletin by writing the University of Delaware, Marine Public Education Office, 222 South Chapel Street, Room 103, Newark, Delaware 19716-3530, or emailing [MarineCom@udel.edu](mailto:MarineCom@udel.edu). Multiple copies also are available for a nominal charge. — LL



Delaware Sea Grant

## Artist Retreats in Columbia

Want to learn about traditional woodworking or outdoor pioneer skills?

These lessons will be taught at Cabin Fever Reliever III, an artist retreat, Jan. 29 to Feb. 1, at the Eastern 4-H Environmental Education Conference Center at Bull Bay, west of Columbia. The retreat is hosted by Pocasin Arts in Columbia.

A second retreat — Cabin Fever Reliever IV, which will focus on maritime art — will be held Feb. 26 to 29 at the 4-H Center. Artists can learn a variety of coastal art forms — from decoy carving and ancestral indigo dye techniques to Native American pottery and music of the sea.

Work-study scholarships are available. North Carolina public school certification



Courtesy of Pocasin Arts

Bill Fruit will demonstrate carving at the maritime retreat.

renewal credit is available for all studio concentrations.

To register and find out more information about studio concentrations and instructors, visit the Web: [www.pocasinarts.org](http://www.pocasinarts.org) or call 252/796-2787.

— A.G.

## Ocean Science Institute for Teachers

Along the southeastern seaboard between North Carolina and Florida, there are many learning opportunities for science educators — from research on sea turtles to phytoplankton in estuaries.

Middle and high school science teachers will be introduced to these topics and other cutting-edge ocean science research at the Second Annual Ocean Science Education Leadership Institute, June 25 to July 1. The institute, which is sponsored by the SouthEast Center for Ocean Sciences Education Excellence (COSEE), will be held at the University of Georgia Marine Education Center and Aquarium in Savannah. SouthEast COSEE is a partnership between North Carolina, South Carolina and Georgia Sea Grant programs, with support from the National Science Foundation, NOAA/Coastal Services Center, and NOAA/Ocean Explorations.

The institute's focus is to build a greater understanding of the South Atlantic Bight ecosystem between North Carolina and Florida. Topics include life on Gray Reef National Marine Sanctuary off the Georgia coast and the sea islands, including Sapelo Island National Estuarine Research Reserve. Teachers will receive curricular materials and resources. In addition, they will develop leadership skills.

Any middle or high school science teacher from North Carolina, South Carolina or Georgia can apply. Ten teachers and two alternates will be selected from each of the three states.

For information or an application, visit the Web: [www.seagrant.org/se-cosee/education.htm](http://www.seagrant.org/se-cosee/education.htm) or contact Margaret Olsen at [olsen@uga.edu](mailto:olsen@uga.edu).

— A.G.



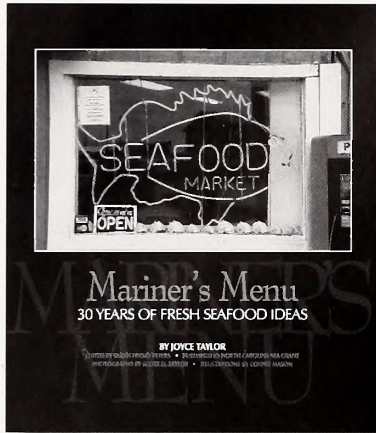
## Elizabeth City State Receives NOAA Funding

Elizabeth City State University will receive \$249,000 as part of a \$3.4 million NOAA Environmental Entrepreneurship Program — part of the agency's partnership with minority-serving institutions.

The awards will be distributed to 13 institutions to develop and enhance hands-on learning experiences for students in atmospher-

ic, environmental, oceanic sciences and remote sensing technologies.

Elizabeth City State will provide undergraduate students with instruction, hands-on training and research experiences in the study of protected species behavior. They will use remote sensing technologies in collaboration with NOAA programs. — P.S.



## Mariner's Menu Events Set

When cooking fish and seafood dishes, there are many methods — from a simple sauté to a generous grill.

Seafood lovers can try more than 160 original recipes in *Mariner's Menu: 30 years of Fresh Seafood Ideas*, a seafood resource book published recently by North Carolina Sea Grant. And they can get tips in person as author Joyce Taylor, retired Sea Grant seafood education specialist, makes several appearances.

Taylor will present sample dishes from the new book on Jan. 30 at 2 p.m., at the N.C. Maritime Museum in Beaufort. A book signing follows. The program also features music by Connie Mason, the book's illustrator. A \$5 donation to the museum is requested. For reservations, call 252/728-7317 or e-mail [maritime@ncmail.net](mailto:maritime@ncmail.net).

In late March, Taylor will be a guest chef at "CLASS: Culinary Lessons at A Southern Season." The school is on the second floor of the store in Chapel Hill's University Mall. Registration is required and a fee will be charged. For more information, call 919/929-7133 or e-mail [class@southernseason.com](mailto:class@southernseason.com).

To check for other book signings, go to the North Carolina Sea Grant calendar at [www.ncseagrant.org](http://www.ncseagrant.org).

— A.G.



Hybrid striped bass aquaculture shows economic promise in North Carolina.

## Aquaculture is Conference Focus

The North Carolina Aquaculture Development Conference is scheduled for Jan. 22-24 at the Sheraton Hotel, Atlantic Beach. The conference targets individuals interested in learning about getting started, as well as those actively engaged in the growing industry.

The three-day event is sponsored by the N.C. Department of Agriculture and Consumer Services and the N.C. Aquaculture Association. North Carolina Sea Grant is among the cosponsors.

Activities begin Thursday with self-guided tours of area demonstration sites. The

Friday schedule includes presentations and panel discussions by experts in the field.

Special interest workshops scheduled for Saturday will cover topics such as "How to Make Your Aquaculture Venture More Profitable," "Water Use and Algae Management" and "Advancements in Controlling Bird Predation."

The \$80 registration fee covers Friday lunch and the Aquafood Festival, featuring farm-raised products from the mountains to the coast.

To learn more about the conference, call Tom Ellis at 919/733-7125, or go online to [www.ncaquaculture.org](http://www.ncaquaculture.org). — P.S.





## Elizabeth II Marks 20th Anniversary

Manteo is celebrating a special anniversary. Twenty years ago, the *Elizabeth II* first sailed into Manteo's Festival Park. The ship is a replica of the historic vessel that brought the first English settlers to Roanoke Island in 1585.

*Elizabeth II* was commissioned and

built as part of the festivities surrounding America's 400th anniversary. The ship also helped launch a new era of historic tourism in North Carolina.

Today, when she is not moored at Festival Park, *Elizabeth II* travels up and down the Intracoastal Waterway. According to the N.C. Department of Cultural Resources, *Elizabeth II* is the only floating state historic site. Since its initial voyage in 1983, the ship has hosted 1.5 million visitors in Manteo and 20 other North Carolina coastal and river ports.

Festival Park, across from the Manteo waterfront, hosts other attractions that highlight Roanoke Island's place in the nation's history. It is open year-round. For information, call 252/475-1500. —P.S.

## Noted Speakers Set for Planet Ocean Seminars

Two nationally renowned speakers are set for the 2004 sessions of the Planet Ocean Seminar Series at the University of North Carolina at Wilmington's Center for Marine Science:

- **March 2, 6 p.m., Lora E. Fleming, "Harmful Algal Blooms and You: It's a Bloomin' Nuisance."** Fleming is the only board-certified occupational and environmental medicine physician in South Florida. She studies the health effects of aerosolized and red tide toxins on humans and other animals.

- **May 4, 6 p.m., Vice Admiral Conrad Lautenbacher, "NOAA's Ocean Sciences for the 21st Century."** Lautenbacher is the chief administrator of the National Oceanic and Atmospheric Administration. He oversees a number of agencies, including NOAA-Sea Grant, NOAA-Ocean Services and NOAA-Fisheries.

The Center for Marine Science is located at 1 Marvin Moss Lane, off Masonboro Loop Road, Wilmington. The Planet Ocean series is free and open to the public. However, due to limited seating capacity, reservations are required. For reservations, call 910/962-2300 after Feb. 1.

—P.S.

## Two Receive Highliner Awards

The North Carolina Fisheries Association recognized the lifelong contributions to commercial fishing made by two of its members. Each received the coveted Highliner Award during the annual Fish Baron's Ball.

Terry Pratt, of Bertie County, was cited for "his unselfish service to the commercial fishing families of North Carolina." Pratt is president of the Albemarle Fishermen's Association and attends countless fisheries-related meetings and hearings. He commercially fishes with gillnets and crabpots.

He is a former member of the North Carolina Sea Grant Outreach Advisory Board.

Dewey Hemilright, of Dare County, was recognized for his contributions to fishing families through his participation in the "Provider Pal" program. As a volunteer with the program, he shared his experiences in the commercial fishing business with middle school students in New York City. Owner and operator of the longline vessel

*Tarbaby*, he fishes out of Wanchese.

NCFA Chairman Billy Carl Tillett and President Jerry Schill presented the awards.

—P.S.





# Alligator River Refuge Comes Alive at Night



Ken Taylor

By Ann Green



Refuge  
Alligator River



Ken Taylor

It's almost dark as a white sport utility vehicle heads down Milltail Road, deep into the woods at the Alligator River National Wildlife Refuge.

At first, the road seems quiet and empty. The only sounds are the crunching of gravel and humming of insects.

But as soon as Kathy Whaley, the refuge's deputy manager, hops out of the vehicle and plays a tape recording of a screech owl, the forest comes alive with a night chorus.

First, a red wolf howls. Then the whine of the eastern screech owl echoes through the forest.

"Owls sound off because they are territorial," says Whaley. "I have seen them take over a bald eagle nest. They are very adaptive to nighttime and have large eyes. Their vision is good in thin lighting."

For almost three hours, Whaley leads visitors down moonlit roads. At one stop, the great horned owl hoots several times.

"It is fascinating hearing the sounds of the owls," says George Wisneskey of Oriental. "I have heard the screech owl before, but not known what it is."

#### OWL LESSON

To give the group an understanding of owls' eating habits, Whaley shows the tour group a pellet from a great horned owl that is leftover food that an owl can't digest. The pellet looks like a round or oval ball of fur with white bones sticking out.

"You can see teeth, skull and a foot," says Whaley. "Owls are 100 percent meat eaters. They eat moles and mice."

One of the last stops is Milltail Lake where the stars reflect on the lake. "The last stop was the best because it was such a beautiful night to see stars," says Barbara Carmen, a visitor from Chapel Hill.

The owl prowls is one of several field trips to the U.S. Fish & Wildlife Service (USFWS) refuge during the 2003 Wings Over Water, a celebration of wildlife and wildlands on the Outer Banks.

"Normally, the refuge isn't open at night," says Whaley. "This is a unique experience. You get to see and hear things never seen in the daytime. Besides the eastern

*Continued*



*Kathy Waley leads Wiggs Over Water participants on an owl patrol.*



*The American alligator can be found along the edge of refuge waters.*





screech owl, we have five other owl species in the refuge, including the eastern northern saw-whet owl, short-eared owl, barn owl, barred owl and great horned owl.”

### REMOTE REFUGE

To get to the refuge, follow U.S. 64 west from Manteo. A good access point is at Milltail Road about 5.6 miles past the new causeway over Croatan Sound. The Creef Cut Walking Trail and an informational kiosk are located at the site.

Aside from the U.S. Department of Defense’s Dare County bombing range, the 152,000-acre refuge covers an entire peninsula, bordered by the Alligator River to the west, the Albemarle Sound to the north and the Pamlico Sound to the east.

If you take any of the designated paths, the refuge is a wild, entangled place that is crossed by drainage ditches and gravel roads.

“The Alligator River National Wildlife Refuge offers some of the best wildlife observation opportunities in the area — although different than the opportunities on many refuges,” says Bonnie Strawser, wildlife interpretive specialist and volunteer coordinator at Alligator River/Pea Island National Wildlife refuges.

“Among the most popular activities are watching black bears, howling up red wolves and kayaking or canoeing,” she adds. “Birding is excellent, but it requires a bit more adventure and understanding of this type of habitat than birding in other places. It is not as easy as walking on North Pond Trail at the Pea Island National Wildlife Refuge.”

### RED WOLF HOWL

The refuge has gained recognition for reintroducing the endangered red wolf. Once found throughout the southeastern United States, along the eastern seaboard and west to Texas, the only wild red wolf population in existence today occurs in a rural five-county area on the Pamlico-Albemarle peninsula.

Due to habitat loss and predation control programs — where people trapped and shot wolves — the red wolf had been declared extinct in the wild in 1980. Through USFWS and captive breeding facilities across the country, the species has been saved.

After several generations of living and breeding the red wolf in captivity, four pairs were released on the refuge in 1987. The captive-born red wolves adapted successfully to the wild and now serve as the foundation for today’s wild population.

More than 100 red wolves now roam 1.5 million acres, including private lands as well as on three wildlife refuges.

While it is rare to catch a glimpse of these elusive predators, visitors to the refuge often have the opportunity to participate in “Howling Safaris” where they might hear the calls of the endangered wolves, says Whaley.

North Carolina State University scientists have begun tracking the red wolf with revolutionary technology. Researchers are studying how tiny, sensor-based computers can improve wildlife tracking. The information could prove enormously useful for the Red Wolf Recovery Program.

“Current tracking methods based solely on radio telemetry are expensive and provide limited data,” says Robert Fomaro, NC State computer science professor.

Although red wolves are endangered, very little is known about their pack dynamics. Because new, tiny sensors can track location, movement patterns and environmental conditions throughout the day, researchers believe this new information could shed some light on pack behavior.

“By placing these devices on wolf collars,” says Mark MacAllister of the N.C. Zoological Society, “we can find out who is hanging out with whom.”

### GATORS, BEARS AND BIRDS

The refuge is also home to the American alligator. Not long ago, the alligators were a threatened species. Now, they are back and growing in size.

The female alligator can lay up to 45 eggs and is a wonderful mother, usually staying around for a year for her young gators.

“We do have several alligators on the Alligator River National Wildlife Refuge, but they are normally shy creatures and are seldom seen,” says Whaley. “Occasionally, you can see one in the canals beside some of the roads. Alligators are not aggressive towards humans by nature.”

Unless they are around humans with food, or they are guarding a nest, alligators want to stay away from people. For the safety of visitors and the safety of the animal, never feed an alligator, Whaley warns.

More than 200 species of birds also spend a portion of their time here. Many neotropical migrants, such as prothonotary warblers, prairie warblers and red-eyed vireos make nests in the thick pocosin vegetation. Wood ducks and other cavity nesters seek shelter in old trees left by loggers.

Other endangered and threatened species include the American bald eagle, peregrine falcon and the red-cockaded woodpecker. The refuge also is home to one of the largest remaining concentrations of black bears along the mid-Atlantic coast.

“Recently, I have seen a bear every day that I have been out in the refuge,” says Whaley. “One bear broke into an intern’s cabin. We had to get bird seed and set a trap.” To teach the bear to avoid people, they also shot him with a rubber bullet, she adds.

The refuge has a number of census programs that monitor various wildlife populations — from neotropical migrant birds to the American alligator. The black bear population is monitored through track count surveys and the use of bait stations.

“We know we have enough bears that they are taking corn from waterfowl banding sites and getting killed by cars on the highway,” says refuge natural resource planner Bob Glennon. “When this study is finished in a few years, we will know what the population is relative to how many bears the habitat can support. Then the biological staff can determine if we need to control the population to maintain the health of the bears.”

The refuge staff also monitors red-cockaded woodpeckers and has inserted nest boxes into trees.

### VAST WETLANDS

Long ago, the area that now comprises the refuge was considered by most people to be a vast wasteland. Visitors to the Outer Banks made a special effort to complete their journeys before dark to avoid a breakdown in “no man’s land.”

*C o n t i n u e d*



The red wolf is now back in the wild, hunting and rearing young.



Because of its large size and density, the refuge is a haven for black bear.





In the late 1970s, biologists began to realize that many wetland communities were being destroyed at an alarming rate, including the pocosins or sponge-like wetlands that covered almost half this area. The functions of the pocosin impacted the quality of the environment in a big way — especially relating to diversity of wildlife and water quality.

Through a donation of 118,000 acres from the Prudential Life Insurance Company, the refuge was created in 1984.

Today, the refuge — which is spread over more than 152,000 acres — is one of the last large pocosin tracts in North Carolina. The pocosin habitats are characterized by deep organic soils resulting in peat deposits that can hold vast quantities of water.

“The Alligator River National Wildlife Refuge shows how the mainland of Dare County must have looked for hundreds of years,” says Terri Kirby Hathaway, North Carolina Sea Grant marine education specialist. “The plants, trees, animals and most everything is like it has been for decades. And now, with the reintroduction of the red wolf, it makes a wonderful ecosystem to explore and experience.”

Man’s biggest impact on the wetland habitats has been the long-term tendency to ditch and drain. Changing the hydrology of the entire system has impacted every part of the system, including species that were dependent on the original water regime.

To enhance water sheet flow through wetlands, culverts are being installed in key locations underneath roads.

The combination of culverts and water-control structures enable the refuge to maintain the habitat in a condition close to natural and still manage water levels in the soil with prescribed fire and other management techniques that require a dry soil surface, says Glennon.

In 1988, the U.S. Fish & Wildlife Service acquired 5,100 acres of farmlands within an area that offered a turn-key operation for waterfowl management. Currently, the area is divided into moist soil management units and agricultural lands farmed by cooperative farmers.

About 1,800 acres of farmland are diked and equipped with water-control structures and managed as moist soil units or managed wetlands. The management’s goal is to produce native annual plants with large crops of seeds that are eaten by the waterfowl. Each year, the plants reseed themselves.

Although management of these moist soil units focuses on waterfowl, numerous other wildlife species benefit. After the water is drained in the spring and late summer, migrating shorebirds are attracted to the insects in the mud flats.

The remaining 3,300 acres of farmland are actively farmed through a cooperative farming program. “In lieu of exchange of money, the farmers perform services for the refuge,” says Glennon.

“They may help pump water into or out of the moist soil units, disk or spray the units to remove unwanted vegetation, or plant additional crops for wildlife.” □

## take a tour

The Alligator River National Wildlife Refuge is open year-round. The best way to see the refuge is by boat. Visitors can launch canoes, kayaks or small motor boats from the south end of Buffalo City Road.

Four trails, totaling 15 miles, are marked to help guide visitors through remote waterways. There are also two fully handicapped-accessible walking trails.

The Creef Cut Wildlife Trail and Fishing Area is a half-mile, paved trail that leads to a 50-foot boardwalk with an observation platform that overlooks the Creef Moist Soil Unit and a 250-foot boardwalk over a freshwater marsh. During the winter months, you can see wildlife on the trail. You may catch a glimpse of black bears, woodpeckers and birds of prey.




For a walking tour of Milltail Creek, take the Sandy Ridge Wildlife Trail. It offers a 2,300-foot boardwalk and overlook to see the creek. The trail dead ends a half mile from its beginning and wanders through Atlantic white cedar stands and by beaver cuttings, wood duck boxes and prothonotary warbler nesting areas.

“The fall and spring are the best times to visit,” says Bonnie Strawser. “There are few biting insects, and migrating songbirds often fill the air with their melodic calls.”

The refuge offers wolf howlings and other programs throughout the year. For more information about the refuge, call 252/473-1131 or visit the Web: <http://alligatorriver.fws.gov> and follow the links to calendar of events.

— A.G.





*Hurricane Isabel cut a new 'inlet' through Hatteras Island, leaving residents of Hatteras Village stranded for a month. Engineers pushed N.C. 12 back into place to restore normalcy to the remote village.*

# Isabel





“There’s a price to pay for living in Paradise,” Jimmy Momis says philosophically.

Momis and his wife, Robin, paid dearly when Hurricane Isabel surged over the Core Banks barrier island, pushing Core Sound waters through their Sea Level home and clam hatchery business — its crop of 8 million seed clams just weeks away from harvesting. “When the storm tide surged, the beach went under and the surf came in,” says Willis.

In the wake of the storm, some 90 percent of the homes and businesses in the small Carteret County community were destroyed or damaged.

“It’s hard,” says Robin Momis. “But people here have been helpful and generous.”

a similar dilemma in Swan Quarter on the Pamlico Sound.

His shedding operation is pretty much a wash. “The building may be repairable, but the inside operation is gone. What Isabel did not wash away is ruined. ... I have no idea what amount of money it will take to get back in business,” Newman says.

To make matters worse, he adds, “I thought I was insured, but the wind insurance folks are arguing with the flood insurance folks.”

There is no federal grant money available to help rebuild — just small business loans. “Most folks here don’t see that as an alternative since they are

The United Methodist Disaster Response Program is operating in Swan Quarter. “We are here for the long term,” says site coordinator Tommy Gilbert. “There’s much more need here than folks across the state know about.”

Gilbert is coordinating all volunteer activities, including plans for a rebuilding program utilizing volunteer labor and donated materials.

“We’re here to fill in the gaps for those without insurance or other assistance,” he says. He expects the outreach program to remain for another 18 months.

“It’ll be a slow recovery. For Swan Quarter, Isabel was a lot worse than Hurricane Floyd,” says Brooks. “We just never expected what we got.”

## Makes History in North Carolina

By Pam Smith

The couple recently paid off their home mortgage, but had not renewed their flood insurance policy, which was tied to monthly mortgage and escrow payments.

So, after nearly 30 years, they are starting over from scratch. Natives of nearby Atlantic, they moved to Sea Level soon after they married, bought a home and made a life. Until about 10 years ago, Momis fished for a living.

“With two sons, I wanted to do something that meant being off the boat and at home with my family more,” he recalls.

That something was building a clam hatchery business — one of only a few producing seed clams for growers.

After 10 years, the business was beginning to pay off. But Isabel sent him back to square one. Gone is the clam nursery building and all the “stuff” that keeps the operation going — electrical and plumbing systems, meters, raceways and tanks.

Gone also is the crop of seed clams that would have sold for about \$160,000.

“A year’s worth of work was gone in a flash,” Momis says.

### Little or No Disaster Aid

Though aquaculture is covered under a new provision of a disaster-assistance program for agricultural products, Momis doesn’t expect to be compensated for his loss. The formula, he says, is complicated, and adjusters are not familiar with aquaculture “crop” values.

Still, he says, he’ll find a way to start over. At least Isabel had spared the clams he had planted in his leased bottom a year earlier.

Farther north, Dell Newman is experiencing

still in hock from Hurricane Floyd small business loans,” he explains.

Still, Newman considers himself lucky. His home was spared. “It’s a different story for my folks. They had more than two feet of standing water — the first time that happened in the 36 years they lived in that house.”

Some folks have cleaned out the muck as best they could and continue to live in their homes, because they have nowhere else to go, Newman says. Others, including some elderly Swan Quarter residents, have moved inland to live with relatives or in nursing homes.

Moving away is not an option. Like his father, Tommy Newman, he has fished all his life. Once a waterman, always a waterman, he says.

Margie Brooks, director of the Hyde County Chamber of Commerce, also has no intention of leaving in spite of the fact that her home, business and two vehicles were inundated.

Brooks was standing on her front porch when the eye passed. “I looked down the street and a six-foot wall of water was crashing along Main Street and all the way to U.S. 264. It ran through the old O.A. Peay School that we all thought was on high ground,” she recalls. “There was no high ground that day.”

In all, more than 400 homes and businesses were damaged or destroyed in Hyde County, she says. “While Ocracoke Island was spared, their economy is tied to tourist trade. And the island was pretty much closed for more than a month.”

Assistance is limited. Hyde County’s share of the North Carolina’s Hurricane Fund is \$33,000 — just enough to underwrite the needs of about 64 households, Brooks says.

“But good things are happening,” she adds.

### A View from the Sea

Ironically, just two months before Isabel unleashed her wrath, an array of instrumented buoys was deployed along the coasts of North and South Carolina. The pilot project known as the Carolinas Coastal Ocean Observing and Prediction System (Caro-COOPS) is funded by the National Oceanic and Atmospheric Administration.

Caro-COOPS could become part of an integrated national storm prediction system that enables emergency management officials to make crucial evacuation decisions, says Len Pietrafesa, project co-investigator from North Carolina State University.

When Isabel began to chum in the Atlantic and threatened the Carolinas as a massive Category 5 hurricane, the team of scientists from NC State, the University of North Carolina at Wilmington and the University of South Carolina were ready to put the system to the test.

Every two hours, data streams from the buoys’ submerged instruments bounce off a satellite and beam into laboratory computers — water temperature, salinity, wave activity and water height. In addition, an acoustic Doppler current profiler is used to detect shifts in the current’s direction and speed, critical to hurricane prediction and storm surge modeling.

Knowing what is going on near the ocean floor helps scientists understand how powerful the storm surge will be, Pietrafesa says.

For nearly a week before landfall, the team worked to collect and analyze the near-real time data. As the storm advanced, they developed “what-if” landfall scenarios — Myrtle Beach, Wilmington and Bogue Sound — for the National Weather Service.

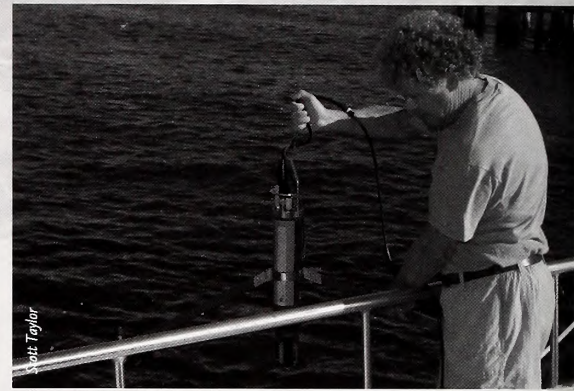
With the hurricane still more than 72 hours from landfall, the team narrowed the target to the

*Continued*





Jose Millins, The Carteret County News-Times



Scott Taylor



Scott Taylor

ABOVE: Hurricane Isabel destroyed Jimmy Morris' clam hatchery on the Core Sound at Sea Level. TOP RIGHT: Hans Paerl, UNC-CH Institute of Marine Sciences, takes post-hurricane water samples from the Pamlico Sound. BOTTOM RIGHT: Larry Crowder and students sample, sort and size fish during research cruises on the Pamlico days after Isabel. BOTTOM LEFT: Houses on Hatteras Island took a beating from the storm surge. BOTTOM RIGHT: Nacie Peele recalls storms from decades ago that came calling on Hatteras Village.

Cape Lookout area, Pietrafesa says.

To determine where and when the surge would hit, the scientists used the computing power of two different systems. One computer model even showed the potential for flooding along the Pamlico and Albemarle sounds as well as the Chesapeake Bay.

Isabel did exactly what their computer models predicted, Pietrafesa says.

In spite of the warnings of ocean and sound-side surge, many residents did not evacuate. Pietrafesa thinks that many let their guards down when Isabel was reclassified as a Category 2 as she approached land.

But with 105 miles per hour winds and a storm surge of 12 feet, a Category 2 storm packs a powerful punch. Swirling winds push ocean water toward the shore. The advancing surge combines with the normal tides to create the hurricane storm tide, which increases the mean water level. In addition, wind waves are superimposed on the storm tide — a condition that produced 25-foot waves along parts of the Outer Banks.

Isabel made landfall just after high tide. When the storm tide coincides with the normal high tides, the rise in water level can cause severe flooding in low-lying coastal areas.

Though hurricane season officially ended Dec. 1, university and weather service researchers continue to analyze ocean data from Hurricane Isa-

bel, factor in atmospheric influences, and attempt to understand the anatomy of a hurricane.

Hurricanes are a fact of life for North Carolina, Pietrafesa says. They draw energy from warm tropical ocean waters to power intense winds and ocean surges, he explains. And, more often than not, the warm Gulf Stream delivers the storm and all its destructive force to North Carolina's doorstep.

Some day, Pietrafesa says, prediction will be so precise that emergency managers will be able to narrow evacuation to city-block scale.

### Measuring the Damage

Meanwhile, other researchers are measuring the damage wrought by Hurricane Isabel as she cut a path through North Carolina, Virginia, Maryland and Pennsylvania. Before she finally blew herself out, she had claimed 54 lives and chalked up \$2 billion in property damage.

According to Spencer Rogers, North Carolina Sea Grant coastal erosion specialist, Hurricane Isabel will be the most documented hurricane ever.

"The state took the initiative and requested the Federal Emergency Management Agency to put together a Hurricane Isabel Rapid Response task force," he explains. "In the past, we did a good job in documenting individual case studies. But this was a chance to broaden post-storm evaluation to a community scale, looking at water, wave, erosion and wind."

Before the high-water marks dried, the team of scientists and coastal engineers spread out along the Outer Banks and sites on the Pamlico Sound to conduct a post-storm survey of damage to coastal buildings. Rogers was asked to help plan and implement the survey since he is familiar with the evolution of building codes over the past three decades.

North Carolina has the second oldest hurricane-resistant building code in the country, he explains. Since being implemented in the mid-1960s, it was reinforced by the N.C. Floodplain Management Program and Coastal Area Management Act.

"The survey was an opportunity to test the performance of existing building codes, and check to see if and under what conditions they are or aren't working," he says.

"In this storm, we clearly took a significant step backwards," Rogers says.

To his surprise, newer buildings experienced more damage than older ones. Since the late 1960s, typical beach homes have been built on deep piling foundations, with the lowest floor elevated. The open space accommodates parking and allows water to wash through during storm events.

More recently, there has been a shift to low-elevation building, with enclosed, under-the-house living space. Consequently, Spencer observed new oceanfront homes with bottom-story rooms pounded apart by 25-foot waves and storm surge.

Other data collected will be useful for resource



managers and policy makers, Rogers says. For example, measuring soundside and oceanside high-water marks will be useful as the state revises flood plain maps.

In addition, the new technical ability to predict hurricane progress five days out opened a window of opportunity for the U.S. Geological Survey to measure ground elevations of dunes before and after Isabel.

"The amount of detailed information collected is unprecedented," Spencer says.

## Gone Fishing

As hurricanes go, Isabel was unusually dry, dropping a mere 8 inches of rain at peak points along her path. Hurricane Floyd in 1999 deluged the coastal plain with 19 inches of relentless rain, freshening sounds and tidal creeks in the Pamlico-Albemarle Estuarine System, where water quality and habitat conditions were adversely affected for several months.

Isabel's winds barely had subsided when Sea Grant researchers were heading out to measure her impact on the water quality of the state's important fisheries nurseries.

Preliminary reports by Hans Paerl, of the University of North Carolina at Chapel Hill, are surprising. Paerl's post-Isabel studies show that the wet spring and summer months that preceded Hurricane Isabel delivered greater amounts of freshwater and nutrients to the systems than the hurricane did.

While Isabel may not have contributed acute water quality or habitat altering impacts, he underscores that she is one in a sequence of hurricanes that has struck with a "remarkable increase in frequency since 1996."

Increased tropical storms, nor'easters and hurricanes could have a cumulative environmental impact, he says, leaving estuaries and sounds in a state of disequilibrium.

Indications are that various levels of the food chain may take multiple years to recover from large and frequent disturbances.

Paerl stresses the need for long-term monitoring and assessment to detect trends, changes and the full range of natural and human impacts on the ecosystems.

FerryMon is one example of an innovative approach to monitoring water quality that Paerl and Duke University colleagues Joseph Ramus and Larry Crowder devised in response to Hurricane Floyd.

Since then, in cooperation with the N.C. Department of Transportation's Ferry Division, three ferries that traverse the Pamlico Sound and Neuse River are equipped with automated flow-through systems that sample near-surface water on a daily basis.

Crowder and his students were out on the Pamlico Sound looking for signs of troubled waters the day after Isabel passed. They constructed top-to-bottom water column profiles to detect fresh and saltwater stratification and signs of nutrient loading.

A second cruise 10 days later at a different sound location confirmed the good news: Freshwater input from Isabel was not an issue. There was no evidence of stratification or low oxygen levels that existed after Hurricane Floyd.

"The take-home message is that each hurricane differs in pathway, wind effect, and freshwater input," Crowder says. "There can be no generalization."

## Memories Linger

That may be so, but many North Carolinians who have weathered decades of hurricanes can't help pointing out similarities.

Nacie Peele, an 84-year-old resident of Hatteras Village, places Isabel in the same class as the 1933 hurricane. It, too, arrived on high tide and brought walls of water to the small fishing village.

"I was 13 at the time," he recalls. "Water came in the house, along with mud and other stuff. It was a real mess. A neighbor sat the storm out with us." He says the worst storm came in 1936. "It cut an inlet through the island," Peele adds matter-of-factly.

So, when Isabel carved a new inlet through the narrow stretch of the barrier island, cutting off Hatteras Village from the island, Peele was not surprised. Nor did he consider himself stranded until the inlet was filled and road rebuilt. "I was home, safe and dry. I'm a packrat, so I had plenty of food to wait it out."

The fifth-generation waterman is philosophical about life on the Outer Banks. "Seems we're always fighting nature in one way or the other," he says, recalling a string of hurricanes and nor'easters he has survived through the years.

Of course, he adds, the population on the Outer Banks in the old days was sparse. There were few homes and businesses to be washed away or buried with sand, as was the case with Isabel.

"They began to build on the beach in the 1950s. Durant Station Motel was the first one on the ocean beach. More were built after that. They all went down in Isabel. The whole works," he says. "I told my nephew that one day everyone may have to move off Hatteras Island."

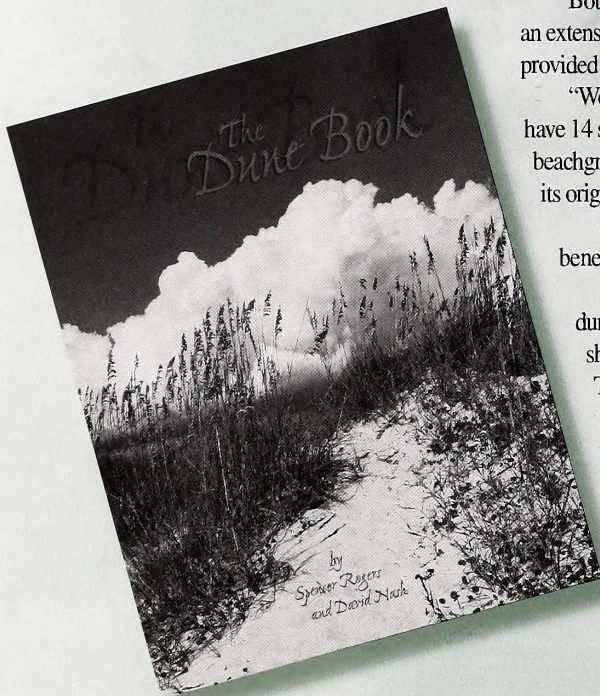
But until then, he is resolved to ride out whatever storms come his way. "There is no place in the world like the Outer Banks," he says. □





# DUNES: FRONTLINE FOR STORM PROTECTION

B y A n n G r e e n



When Hurricane Bertha hit Jenny Godwin's Emerald Isle beach house in 1996, it destroyed half of a sand dune and several small cedar trees.

Not long after that, Hurricane Fran destroyed the other half of the dune.

To rebuild the dune and add the proper vegetation, Godwin turned to Spencer Rogers of North Carolina Sea Grant and David Nash of N.C. Cooperative Extension for advice.

Both Rogers, a coastal construction and erosion specialist, and Nash, an extension agent in coastal management and commercial horticulture, provided information about dune planting and dune management practices.

"We started planting the dune six years ago," says Godwin. "Now we have 14 species of native plants on our dune — from sea oats and American beachgrass to bitter panicum and seaside goldenrod. The dune is now twice its original size. During Hurricane Isabel, we gained sand."

Along North Carolina's coast, the dune system provides many benefits — from serving as an animal habitat to storm protection.

In *The Dune Book*, Rogers and Nash describe the benefits of dunes as well as the best dune management practices along developed shorelines where people, buildings and roads are already in place.

The new book was a collaborative effort between North Carolina Sea Grant and N.C. Cooperative Extension.

"A principal benefit for anyone living near the shoreline is that a dune acts as a storage reservoir for sand," says Rogers.

"The larger the dune, the more time it takes to be eroded by the waves, and the more protection it provides to areas further landward. However, dunes do not provide protection from seasonal beach fluctuations, long-term erosion or inlet erosion — no matter how large the dune."



## HURRICANE ISABEL DAMAGE

When Hurricane Isabel hit the Outer Banks last fall, it caused widespread dune erosion.

Although detailed dune erosion analysis is incomplete, by eye about 20 to 50 feet of dune was lost north of Avon in Dare County, according to Rogers.

"The damage was light in areas where the buildings remained behind the dunes," adds Rogers. "Damage in this area was primarily caused by wave-induced erosion undermining piling-supported buildings and wave damage to underhouse enclosures."

"Dune erosion south of Avon was probably comparable to areas further north, but most buildings were located well landward of the wave-induced erosion," says Rogers. "With a few exceptions, most areas have dune grasses remaining seaward of the buildings. Buildings were more likely to be buried by overwash than undermined by wave-induced erosion."

In recent months, North Carolina Sea Grant and Cooperative Extension have been helping coastal municipalities and property owners to successfully restore dunes along the coast.

Workshops focus on the dynamics of the beach — dune systems, formation of dunes using native vegetation, and how to conserve and protect the dune ecosystem.

"Dunes are the first line of defense for homes, highways and other infrastructure during hurricanes and other storms along the North Carolina coast," says Nash. "Maintaining a healthy dune system is critical to the overall health of our coastal communities."

Before Isabel, Rogers and Nash provided dune expertise to a number

of coastal towns, including Emerald Isle where town officials and citizens planted 1,000 sea oats at the western and eastern access.

"The western access was particularly in need of dune plantings," says Alesia Sanderson, director of the Emerald Isle Parks and Recreation Department. "Now the dunes are more established and have more vegetation."

Since Oak Island began its dune vegetation program in 1998, town officials have planted more than one million dune plants.

The plants — including sea oats, bitter panicum, seabeach amaranth and seashore elders — are grown in the town's dune plant production greenhouse. The plants and new sand pumped on the beach in 2001 for the Sea Turtle Habitat Restoration Project and sand from the Wilmington dredging project in 2002 have helped to restore Oak Island's beaches and stabilize the dunes.

"We started with 90,000 plantings in the dune house," says Russ Morrison, a former Oak Island town employee. "We have had seven crops since then."

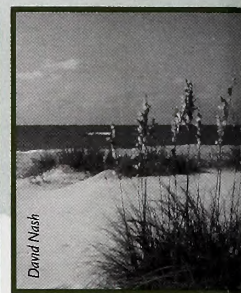
Every plant that was used in the turtle restoration project and other sand projects since Hurricane Floyd was grown in the greenhouse, adds Morrison.

Nash helped the town set up the greenhouse and secure seeds. A float germination system — similar to what is used for raising tobacco — was established to raise sea oats and other dune-building beach plants.

He praises the "town spirit" that spurred the innovative, cost-saving and sand-saving plant program. "The beach is a public trust, the only right thing to do is to preserve it," Nash adds.

*Continued*





CLOCKWISE FROM BOTTOM LEFT: This is an example of an on-grade walkway with railings. David Nash developed a float germination system for dune plants at Oak Island. Tina Pritchard was involved in the Oak Island dune project. A dune is covered with American beachgrass. New dunes form around sea oats.

### DUNE FEATURES

Ocean sand dunes are geologic features that are in a constant state of change — somewhere between building in elevation with wind-trapped sand and getting flattened in an extreme storm or hurricane.

Dunes are defined as an area landward of the active beach where dune grasses are dominant plants. It might be a classic dune shape that rises 40 feet in height and is covered with sea oats, a recent overwash terrace flattened by a hurricane where the buried sand grasses have yet to pop up through the new sand, or anywhere in between.

In addition to their aesthetic benefits, sand dunes and dune vegetation can provide substantial protection from storm-induced erosion. The larger the dune, the more time it takes to be eroded by the waves, and the more protection it provides to areas further landward.

If the dunes are large enough, the waves and storm surge are prevented from washing across the barrier island. Flooding may occur from the backside of the island but not directly from the ocean. “Even if the dune is breached and the shoreline is overwashed, the sand stored in the dunes and eroded by the storm reduces the incoming wave heights compared to areas without dunes,” says Rogers.

For these reasons, protecting the existing dunes and building larger dunes with dune vegetation are useful shoreline management practices.

“Remember that erosion has many causes,” says Rogers. “Determine what is causing your erosion before planting or building dunes.”

Areas subject to seasonal fluctuations are never good places for new dunes. In areas experiencing long-term or inlet erosion, planting vegetation or installing sand fencing is seldom recommended.

“Dune-building efforts should concentrate on areas well landward of the prestorm vegetation system,” says Rogers. “If you start too close to the water, you may lose your storm protection to chronic erosion before the big storm hits. However, if you have recently had a direct hit by a major hurricane and lost 50 to 100 feet of dune, you are likely to have a wide, recovering area on which to work.”

Faced with recent dune erosion, most people have a strong desire to return the dune to its previous location.

“However, that can be a mistake,” says Nash. “The two most common errors when building dunes are trying to stop long-term erosion and starting the dune too far seaward. If you avoid these mistakes, you will end up with a better dune. It is better to build a dune as far landward as possible.”

### DUNE VEGETATION

Only a few species of plants can adapt to the dunes closest to the ocean and beach — where there are high levels of salt spray, continuous wind, large amounts of wind-blown sand and other environmental factors.

Coastal dune plants must be able to survive in soils that are low in nutrients and moisture and have extreme fluctuations in temperature and ocean overwash. The vegetation aids in forming the dune and plays an important role in the coastal dune ecosystem.

“Dune vegetation is nature’s way to build and stabilize sand dunes,” says Nash. “Plants provide food and habitat for animals and birds while adding beauty to the coastal environment. Planting and protecting dune vegetation is one of the easiest and most important things we can do to conserve this valuable coastal resource.”

The typical vegetation zones from the ocean to the sound are: pioneer dune plants, grassland species, shrub thicket and maritime forest.

Climate is the primary factor limiting the geographic range of pioneer zone coastal plants species. Along the mid-Atlantic coast, the dunes between the Chesapeake Bay and Cape Lookout are the approximate transition zone for several species.

For example, sea oats prefer the warmer climate found south of this area and appear to be limited in their northern range by cold temperatures.

American beachgrass is the dominant pioneer zone species north of the transition zone, tending to die back when stressed by the hot, dry conditions found farther south. Both American beachgrass and sea oats are excellent sand trappers and dune stabilizers.

Since local plants take years to evolve, they are usually best adapted to the climate where they were first grown. For example, South Florida sea oats do not adapt as well in the cooler climate of North Carolina as they do in Florida, and American beachgrass from New Jersey is not well suited to North Carolina’s warmer climate.

“Therefore, it is always best to obtain dune plants from seeds or parent material originating as close as possible to the beach where they are planted,” says Nash. “When possible, acquire seedlings or transplants that were grown from seeds or cuttings originating within a 100-mile radius of your beach.”





CLOCKWISE FROM ABOVE: This is a well-established stand of bitter panicum. Seashore elder forms round, hummocky dunes. Saltmeadow cordgrass colonizes on a washed-over dune area. Rope fences are less expensive to install than wooden sand fences.

### PLANT SPECIES

The “signature” plants on North Carolina’s coastal dunes are sea oats (*Uniola paniculata*). As the name implies, the seed head has an oat-like appearance. The plant’s tall stems, with their seed heads blowing in the ocean breeze, are a favorite sight for coastal visitors and residents. Sea oats are aesthetically pleasing and also are important food sources for wildlife, including birds and other creatures that depend upon the dune ecosystem for their survival.

“Sea oats provide the best long-term stability for coastal dunes when planted in its native range, which includes the entire North Carolina coast,” says Nash.

American beachgrass (*Ammophila brevifolulata*), which is a cool-season perennial grass native to the north and mid-Atlantic coasts along the eastern seaboard, is also frequently seen along the North Carolina coast. Cape Hatteras is considered to be the approximate southern limit of its native range. Although American beachgrass is best adapted to the northern region of the mid-Atlantic coast, it has been planted extensively throughout the coastal areas of North and South Carolina to stabilize dunes.

A third type of dune plant is bitter panicum (*Panicum amarum*), which occurs naturally from New England to Mexico. Its stout stem and wide, blue-green leaves add unique color and texture to the dune environment.

“This plant works well in combination with other dune species and should be included in dune vegetation projects,” says Nash.

In back dune areas that have less windblown sand, saltmeadow cordgrass (*Spartina patens*) is highly adaptable. The slender-stemmed grass prefers moist sites but will grow in drier areas.

Seashore elder (*Iva imbricata*) is the only nongrass species recommended for trapping sand and stabilizing dunes in the pioneer zone along the North Carolina coast. This warm-season perennial has succulent leaves and woody stems. It is a very effective sand trapper.

“When planting dune grasses, be certain to plant at the correct depths,” says Nash. “Failure to plant deep enough is the main cause of the new plant death on the dunes.”

### DUNE PLANT COMMUNITIES

Native grasses and broadleaf plants stabilize pristine dune ecosystems, such as those found on the Cape Lookout National Seashore. Unfortunately, the dunes and plants in developed areas along the North Carolina coast are often destroyed by human impacts.

“Planting three or more of the pioneer zone species in a revegetation project will increase the long-term stabilization of the blowing sand and help the ecosystem recover more quickly,” says Nash.

“Once the foundation of the pioneer zone species is established, other annual and perennial plants adapted to the dune environment will establish naturally,” he adds. “As the dune system stabilizes and provides food and shelter, birds, animals and reptiles will return to the recreated habitat.”

Sand fences are usually not needed for dune building. Dune plants are just as effective and need little or no maintenance. However, sand fences can be useful in managing pedestrian and vehicular damage. When pedestrian traffic is heavy, try rope fences as a lower-cost and lower-maintenance alternative.

“Homeowners can protect dunes from pedestrian damage by choosing the appropriate accessway materials for local conditions,” says Rogers. “If the accessways are more than 3 feet lower than the adjacent dunes, look at modifying the accessways. Consider the walkways expendable but necessary to protect the dunes. Plan for future maintenance when the inevitable erosion occurs.”

Also don’t forget to check with your town hall about permits or the N.C. Division of Coastal Management at 919/733-2293, 888/4RCOAST; or [www.nccoastalmanagement.net](http://www.nccoastalmanagement.net).

“Planting dune vegetation does not require a permit,” says Rogers. “However, a permit may be required for other dune construction projects, including sand fences, dune walkways, vehicular ramps, removing vegetation, lowering dune vehicles, or moving any sand with heavy equipment.” □

To order The Dune Book, call 919/515-2454 or write: North Carolina Sea Grant, NCSU Box 8605, Raleigh, NC 27695-8605 and ask for UNC-SG-03-03. Single copies are \$5 or copies can be downloaded from the Web: [www.ncseagrant.org](http://www.ncseagrant.org) and click on products.



# New Faces at Sea Grant

By Pam Smith

It's a season of change for North Carolina Sea Grant. Three highly valued extension specialists — with combined service of nearly 75 years — are bidding farewell to Sea Grant.

Lundie Spence, marine education specialist, now heads the SouthEast Center for Ocean Science Education Excellence, serving North Carolina, South Carolina and Georgia; Jim Bahen, fisheries specialist in the Wilmington office, and Wayne "Smiley" Wescott, fisheries specialist in the Manteo office, are retiring.

"They will be missed," says Ronald G. Hodson, Sea Grant director. "It is difficult to calculate the cumulative impact they have had on advancing the Sea Grant mission over the years."

Hodson expresses confidence in the three new staff members who will step into their posts.

"They have not missed a beat in picking up where their predecessors left off. They bring a tremendous amount of talent and energy to Sea Grant," Hodson says.

The three new staff members are no strangers to the Sea Grant mission:

**Terri Kirby Hathaway** is taking on marine education duties, fresh from 18 years as education curator at the North Carolina Aquarium on Roanoke Island. She will be based in Manteo.

"I'm excited because I know what Lundie has done for and with Sea Grant, especially for teachers across the state and country."

Through the years, Hathaway collaborated with Spence on a number of projects, including Operation Pathfinder and Paddle to the Sea — field experiences for teachers interested in marine education.

At the aquarium, she was responsible for developing and conducting programs, supervising staff, writing and editing publications, developing budgets, and making presentations. But,

as her aquarium job grew more administrative, she became somewhat removed from working directly with teachers.

"My talents run in personal interaction, so I am excited about planning and conducting teacher workshops," Hathaway says.

She is interested in reaching out to elementary school teachers, pre-K through fifth grade. Elementary teacher preparation requires proficiency in teaching math and reading, she explains. However, they are expected to be strong in teaching all classroom subjects, and many feel ill-prepared to teach science.

"I want to provide the skills they need to be comfortable in teaching ocean science," Hathaway says.

She promises her teacher workshops will be strictly hands-on. "Learning is more effective if we can see, touch, hear and taste the subject," Hathaway says. She believes teachers are better prepared to teach marine science if they have an opportunity to become experiential "students."

First, though, she plans to conduct a statewide needs assessment to narrow down what the teachers need — and how Sea Grant can help. It's a huge task, but she won't have to start from scratch. She'll adapt survey instruments developed and implemented by Ohio and Delaware Sea Grant programs.

Hathaway already is well-connected to the Sea Grant National Marine Educators' Network and is familiar with its outreach success. She works closely with Virginia Sea Grant marine education

specialists and serves as the Atlantic regional coordinator for The Bridge. The online ocean science resource center is maintained by Virginia Sea Grant and funded by National Sea Grant.

Hathaway also is active in marine education at state, regional and national levels. She has held various leadership roles in the National



Scott Taylor



Michael Halmiski

TOP: Terri Kirby Hathaway is taking on marine education duties for Sea Grant. BOTTOM: Hathaway enjoys personal contact with folks curious about marine life.



*"I believe in what extension can do, and I'm excited about working with people who make a difference."*

— Sara Mirabilio



Marine Educators Association and now serves as secretary. She co-chaired the organization's 2003 national conference held in Wilmington.

Hathaway, a native of Wendell, holds a bachelor's degree in marine biology from the University of North Carolina at Wilmington and a master's in science education from East Carolina University.

**Sara Mirabilio**, who joins the Manteo office as a fisheries specialist, says she is energized to be part of a Sea Grant extension team that facilitates the transfer of research results to resource users and managers.

"I believe in what extension can do, and I'm excited about working with people who make a difference," says Mirabilio, citing state, regional and national impacts.

Her game plan involves connecting with members of the recreational and commercial fishing communities and encouraging them to plug into Sea Grant as a resource.

Early on, she hauled the Sea Grant display to the Hatteras Surf Fishing Tournament to meet hundreds of participants and re-enforce Sea Grant's ethical angling message.

She also met commercial fishers who attended Sea Grant informational meetings on the N.C. Fishery Resource Grants, which are funded

by the N.C. General Assembly and administered by Sea Grant.

To get in touch with state and regional fisheries issues, Mirabilio plans to attend N.C. Division of Marine Fisheries Commission meetings, as well as South Atlantic and Mid-Atlantic Fishery Management Councils meetings.

Though she considers herself a fisheries generalist, she is well-versed on national fisheries issues and policies. "If I don't know the answer, I know where to go for the right information," she says.

She became familiar with national strategic plans and federal processes as a program analyst for the chief scientist of the National Oceanic and Atmospheric Administration/National Ocean Service — the nation's principal advocate for ocean and coastal stewardship.

In that role, she participated on various interagency workgroups, including one drafting the ecosystem element for the U.S. Climate Change Science Program's Strategic Plan. She also helped develop a monitoring, modeling and research strategy to support a Mississippi River/Gulf of Mexico watershed nutrient reduction plan.

Mirabilio first arrived in Washington, D.C. as a 2002 John A. Knauss Marine Policy Fellow. Upon completing her master's degree in marine science at the Virginia Institute of Marine Science, she was selected as a fellow and assigned to the executive branch. She split her time between the NOAA Science Advisory Board and the Coastal American Partnership.

Mirabilio considers herself in the learning curve — in her Sea Grant role and in her profession. "It's a long road ahead," she says. "It's an ever-changing field. It's never boring."

Mirabilio, a New Jersey native, earned a bachelor's degree in marine science at Long Island University, Southampton College.

*Continued*



TOP: Sara Mirabilio joins the Manteo office as a fisheries specialist. BOTTOM: Mirabilio meets participants of the recreational fishing community at the Hatteras Surf Fishing Tournament.



## PEOPLE & PLACES

### M. Scott Baker, Jr.

joins the Wilmington team as a fisheries specialist. He comes with nine years of experience with marine fisheries along the Gulf of Mexico coast, where he has participated in an array of federal, state and university monitoring and research projects.

Baker is making the transition from research to outreach, learning the players — and the issues.

“I want to find a place where my background can best match what needs to be done,” he says.

For openers, he has applied for a position on the N.C. Division of Marine Fisheries Commission Shrimp Advisory Panel. The state will rely on the committee of scientists, commercial and recreational fishers, and environmental advocates to help develop a management plan for the important fishery.

In North Carolina, as in Louisiana, shrimpers are facing economic hardships from uncertain stock assessments as well as low market prices driven by global competition.

Baker's background also is well-suited for other North Carolina fisheries concerns.

As a research associate at Louisiana State University, he studied the age, growth and reproduction of adult marine fishes, including spotted seatrout, red drum, snapper and gag grouper — important commercial fisheries in the South Atlantic as well as the Gulf.

Baker spent time as an onboard observer of the red snapper commercial fishery to determine the number and fate of regulatory discards. Some commercial fishers would like to see minimum size limits lifted because of high catch-and-release mortality of deepwater fish, he says.

His prior work experience includes two

years with National Marine Fisheries Service's Panama City Laboratory, where he was responsible for at-sea and dockside sampling of recreational and commercially caught reef fish as part of an ongoing life history study.

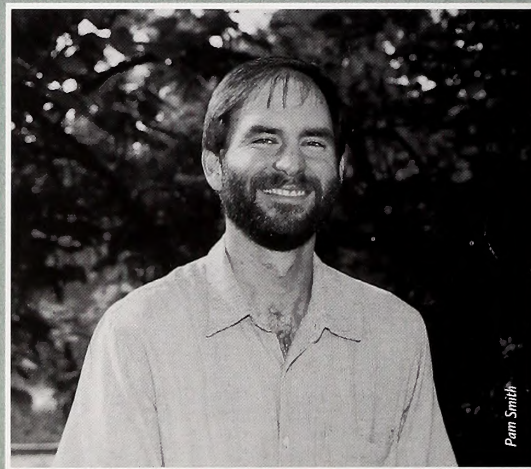
The size-age correlation is important to developing and implementing any fishery management plan. Success relies on educating constituents, and Baker plans to develop informational one-pagers that can deliver quick facts to commercial and recreational anglers alike.

In Louisiana, Baker earned a reputation for his ability to disseminate scientific results to the fishing community through publications, presentations and one-on-one discussions.

A native of Washington, N.C., Baker



ABOVE: Scott Baker, second from left, learns about an oyster research project being conducted by Troy Alphin, second from right, and students Josh Vinson and Joe Sonnier from the University of North Carolina at Wilmington. RIGHT: M. Scott Baker Jr. joins the Wilmington team.



earned his bachelor's degree in biology, with a minor in marine science at the University of North Carolina at Chapel Hill. He earned a master's in oceanography and coastal sciences, with a minor in statistics, from Louisiana State University.

To reach Sara Mirabilio or Terri Kirby Hathaway in Manteo, call 252/475-3663. To reach Scott Baker in Wilmington, call 910/962-2492. □



# Science Serving Our Coast — and Beyond

*New North Carolina Sea Grant Research Projects*

*By Katie Mosher • Photos by Scott Taylor*

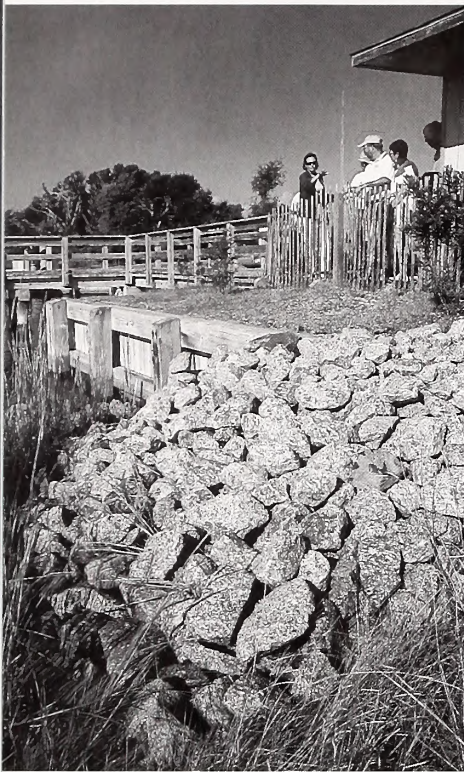


*“Each of our applied research projects addresses issues important to our coastal region.”*

*— Ronald G. Hodson, North Carolina Sea Grant Director*

*Continued*





LEFT: Erosion-control structures are common in the estuarine region, but what are their impacts on adjacent benthic communities?

MIDDLE: North Carolina Sea Grant research topics include a wide variety of water quality issues.

RIGHT: The economic impact of fisheries is the topic of a joint project with Wisconsin Sea Grant.

**F**inding new antibiotics in oysters. Evaluating impacts of erosion-control structures. Studying fecal contamination in estuarine and coastal waters. These are just a few of the 15 major research efforts to be funded by North Carolina Sea Grant in 2004.

"Each of our applied research projects addresses issues important to our coastal region," North Carolina Sea Grant Director Ronald G. Hodson says.

Selected after stringent scientific peer review, the 15 projects will be funded with a total of more than \$1 million in federal and state funding. The federal funding is through the National Sea Grant College Program, part of the National Oceanic and Atmospheric Administration in the U.S. Department of Commerce. Sea Grant also receives state funding from the N.C. General Assembly through the University of North Carolina system.

"The combination of projects reflects a spectrum of physical and social sciences," Hodson says.

One study will develop new models to de-

termine the economic impact of fisheries — and will be conducted in conjunction with a Sea Grant study in Wisconsin. "The Sea Grant network supports projects that draw upon expertise around the country to provide regional and national perspectives on particular issues," Hodson explains.

Another project will continue striped bass genetics research now underway. North Carolina Sea Grant conducted groundbreaking research on hybrid striped bass aquaculture, and continues to be a leader in the field.

A seafood science project looks at alternative production techniques. North Carolina Sea Grant has been a leader in surimi research and other production technologies.

Several topics involve important fisheries, such as flounder and red drum. Other projects look at water quality factors such as chlorophyll and mercury, and estuarine habitats important to coastal fisheries and economies.

One study will look at the impacts of new residents in coastal communities, while another looks at environmental impacts of beach nourishment.

The projects represent 26 researchers at four universities. More than a dozen graduate students will receive Sea Grant research assistant stipends, while many other undergraduate and graduate students also will be involved in the projects.

"Sea Grant not only funds some of the top scientists in the country, but also provides practical and theoretical training for the next generation of coastal researchers," Hodson adds.

#### Projects to be funded in 2004

- **Accelerated Genetic Improvement of Striped Bass: Molecular Biomarkers of Growth Performance;** Russell Borski and Craig V. Sullivan, North Carolina State University.
- **Improving Production Efficiency of Southern Flounder Growout: Evaluation of Monosex Populations;** Harry V. Daniels, Russell Borski and John Godwin, NC State.
- **Characterization of Novel Polypeptide Antibiotics from American Oyster;** Ed Noga, NC State.
- **Developing "Best Practices" for Coastal Communities Experiencing High Levels of Im-**





Patterned after Sea Grant's national Knauss Fellowship in marine policy, the N.C. Coastal Management Fellowship allows a graduate student to focus on planning and policy issues. In particular, this year's fellow, Lindsay Fullenkamp, is working on "smart growth" issues with additional funding from a partnership with the Environmental Protection Agency.

The N.C. Marine Fisheries Fellowship is a partnership with the N.C. Division of Marine Fisheries. A new fellow is expected later this year.

Sea Grant also funds "minigrant" projects each year. Recent projects have included rapid responses to determine hurricane impacts. Minigrant projects also may provide groundwork for major research projects, such as studies on gender changes in flounder.

Other recent minigrants have supported a documentary and book

on Snead's Ferry, as well as curricula for middle and high school science lessons.

North Carolina Sea Grant also encourages researchers here to compete for National Sea Grant initiatives funded by Congress. Current projects include oyster disease studies and ballast water technology research to limit introduction of invasive species.

The public likely is most familiar with North Carolina Sea Grant's nationally recognized outreach efforts that translate the latest science into information useful to user groups, educators, community leaders and others.

North Carolina Sea Grant's extension program includes specialists in fisheries, mariculture, seafood technology, coastal construction and erosion, marine education, law and policy, water quality, ecotourism and coastal communities.

The communications team produces not only *Coastwatch* magazine, but also several newsletters, as well as a mix of books, brochures, fact sheets and content for the Web site [www.ncseagrant.org](http://www.ncseagrant.org). □

migration; David Griffith and Jeffrey Johnson, East Carolina University.

- **Measuring Interrelated Demands for Commercially Caught Fish;** Matthew Holt, NC State.

- **Estimating Fishing and Natural Mortality Rates for Red Drum in North Carolina Estuaries Using a Combined Telemetry/Conventional Tag Approach;** Jeff Buckel and Joseph E. Hightower, NC State.

- **Estimating Direct and Indirect Effects of Hypoxia on Estuary-Dependent Fish;** Jim Rice and J. Kevin Craig, NC State.

- **Functional Evaluation of Fish Habitat Quality: Juvenile Southern Flounder;** John Miller, NC State.

- **An Alternate Approach to Improving Gel-Forming Ability of Seafood Muscle;** Tyre Lanier, NC State.

- **Constraints to Rapid Recovery of Habitat Function Following Beach Nourishment;** Charles Peterson, University of North Carolina at Chapel Hill.

- **Eutrophication and Trophic Transfer**

**in the Neuse River Estuary: Dynamics of Nutrients and Phytoplankton at the Chlorophyll a Maximum;** Hans Paerl and Michael F. Piehler, UNC-CH.

- **Effects of Erosion-Control Structures on Adjacent Benthic and Nektonic Communities;** Martin Posey and Troy Alphin, University of North Carolina at Wilmington.

- **Mercury in the Organic-Rich Cape Fear Estuary;** Stephen A. Skrabel, Robert Kieber and J.D. Willey, UNC-W.

- **Effects of Sediment Phosphorus Concentration on Fecal Pathogen Indicators in Estuarine Sediments;** Larry Cahoon and Mike Mallin, UNC-W.

- **F+ Coliphages as Source Tracking Viral Indicators of Fecal Contamination in Coastal Waters and Shellfish;** Mark Sobsey, UNC-CH.

#### Other Sea Grant Efforts

In addition to the major research projects, North Carolina Sea Grant funds a pair of state-based fellowships.



# Explorative Learning in Geologic Time

By Lilly Loughner • Photos by Scott Taylor

**F**ire ants. Quicksand. Black snakes. Rugged terrain. Dehydration. A bit of danger and fossil hunting wraps up a week-long National Marine Educators Association (NMEA) conference in Wilmington. The field trips share North Carolina's treasures — and offer a special farewell touch to bring the conference into perspective.

“What dangers might we expect out there?” is among many questions regarding the field trip to the Castle Hayne Quarry — one of several quarries in eastern North Carolina owned by Martin Marietta Materials. But this is the question that hushes the thrill seekers' bubbling anticipation of the fossil hunting to come.

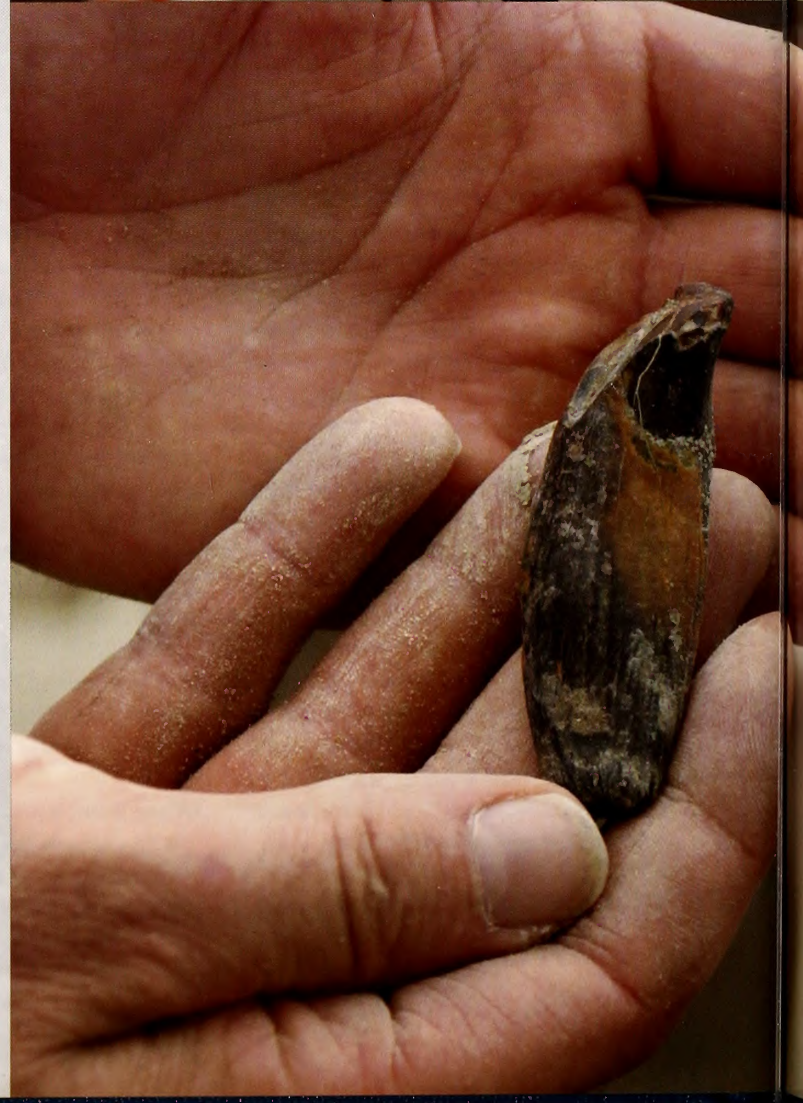
## In Preparation

The group huddles around fossil expert John Timmerman as he reveals examples of common fossils that will be found — and more importantly, the rare ones that they will be lucky to find. Eager as children, they lean faces toward the display case. Excitement rises as the fossils are passed from hand to hand.

The educators hail from North Carolina, South Carolina, Arizona, New York, Ohio and farther. “I think to dig fossils in North Carolina is a unique experience,” says Jim Palmer, a businessman and retired teacher from Arizona. “It's famous for its fossils and fossil sharks' teeth particularly,” as well as its variety of fossils.

Timmerman assures the group that findings of predominately echinoids, bryozoans and brachiopods from the Eocene Epoch will be common. Echinoids are commonly referred to as sea urchins, sea biscuits and sand dollars; brachiopods, as lamp shells; and bryozoans, as “moss animals” — living mostly in colonies of interconnected individuals.

*CLOCKWISE FROM TOP LEFT: • A chambered nautilus is unearthed in a rare condition — lacking its outer shell casing • Sand dollars are found in abundance in the Castle Hayne Quarry. • The first and only shark's tooth found during the trip. • The origins of this mystery tooth excites field trip experts. Could it be from a Pleistocene bear?*









## NATURALIST'S NOTEBOOK

"Pick up everything, because it gives you a much better idea of the fauna and life that is out there," Timmerman advises. "If you just look for sharks' teeth, you may be disappointed." The group will examine the entire ecology of the fossil record. Great diversity represents a rich, healthy ecosystem — and the Castle Hayne Quarry has some of the richest Eocene, bryozoan fauna in North America.

Timmerman also stresses how fragile these fossils are. "If the rock can be picked up and you find a beautiful nautilus in it, consider yourself lucky and leave it intact."

The chambered nautilus — a mollusk that uses its chambered shell as a sophisticated buoyancy system — and other larger fossils easily break apart, thus making them rare and sought after. Also, boulders are not to be overlooked, as rare fossils could be imbedded in them.

### For the Love of Fossils

To go through the trouble, there must be something compelling about fossils that draws people to hunt for hours — often returning empty-handed.

Some place fossils in the same category as art; indefinable. And Timmerman, who admires the structure and overall appearance of the fossils, enjoys comparing them to the modern shell.

To Susan Snyder, historian for the trip, fossil hunting is akin to Easter egg hunting.

"It's fascinating finding something that no one else has seen even though it's been there for millions of years," says Snyder. "I've collected things since second grade. I collect sand from around the world. Some people collect baseball cards; I collect fossils and shells."

### The Hunt

As the bus unloads, Judy Larrick, trip leader, suggests a rest before the hike through the rugged terrain. But the unanimous yell is "no." A tough crowd, armed with flat head screwdrivers and canvas tool belts, the educators prepare to scale the treacherous mountains of fossil and sediment for the find of a lifetime.

The group trudges up a wide dirt road to the first fossil site, waving to the driver of a giant bulldozer, the wheel taller than the average person.

Reaching a searchable destination, the hum of distant activities mingled with the buzzing of insects imbues the landscape with something of disaster and beauty combined. Mud and rock have been bulldozed and tossed aside for the excavation of deeper bedrock. Huge ravines are cut into the earth for the sake of gravel mining. The effect is awesome.

Water fills the pits, creating a scenic pond surrounded by previously nonexistent coastal mountains and valleys. Great walls of layered dirt serve as a life-sized, color-coded, geologic time scale.

Timmerman needs only to point toward the variations in color of the rock and sediment to explain the history of the fossils. The youngest and uppermost layer is brown clay that dates back to the Ice Age. The second layer — what the educators will be picking through — is Eocene epoch limestone.

The third and last layer is Cretaceous sediment, with the bedrock below the focus of the quarry miners. The fossil hunters have planned the



TOP TO BOTTOM: • Quarry workers expose a layer of Cretaceous Age rock.  
• John Timmerman provides guidance to Mary Beth Wilson, Andrew Wilson and Jim Palmer. • Meryl Kafka seeks insight into the origins of her find from Judy Larrick.

entire trip around the Eocene spoil, a quarry term for material that the miners discarded as waste.

### The Find

"Shark's tooth!" hollers Andrew Wilson, NMEA conference treasurer, and the group rushes to the find, taking visual notes in hopes of spotting a



## NATURALIST'S NOTEBOOK

Off to a great start and hoping for continued luck, Timmerman and Larrick decide to move the group to a solid Eocene deposit. More importantly, the site seems to be fresh.

"I almost hate to step in here. This is a really great site that hasn't been worked in a while," says Larrick. Such reservations are justified as the trip draws to a close, and the group is able to compare findings.

The riches are amazing. Timmerman has found a heavy boulder with a *Rapana* sp., or whelk, attached in near perfect condition.

Several more chambered nautilus have been found along with sand dollars, rare sea biscuits such as *Linthia wilmingtonensis*, heart urchins, an Ice Age bear tooth, and enough brachiopods, bryozoans and other Eocene fossils to satisfy every educator on the trip.

The day couldn't have turned out any better for collecting, with no other explanation than beginner's luck in an outstanding site. "Even when you become skilled at it, fossil hunting is 90 percent luck and 10 percent skill," says Timmerman.

Anyhow, Larrick reasons, "Whether you find them or not, you sort of lose yourself, commune with nature, and meditate."

### Taking Home More Than Fossils

While the educators enjoyed their fossil hunting, they did not forget why they were there: to share what they found with their students and professional peers.

Elaine McClure has taught fifth-grade science in South Carolina for 34 years and lives up to her belief that "teachers will collect anything." She maintains a corner in her classroom called Science Sizzlers, where she displays mystery objects related to science that the students research and identify.

"It's something to get them excited about science, and is a great motivation for research," says McClure. While she focuses this trip on searching for a chambered nautilus, McClure admits to having collected everything from cocoons and hornets' nests to seashells.

Many teachers swear by fossils as a teaching tool. Merryl Kafka, curator of education at the New York Aquarium, agrees that "kids are turned on by tangible evidence of ancient life." She incorporates ancient relics into her teaching, comparing fossils with a living marine collection to complete the geologic timeline — a complex concept for children and adults alike.

### For the Hobbyist

Fossils can be found on any North Carolina beach. Fossil trips, such as those sponsored by museums, aquariums and clubs, are the best way to be permitted into private sites, like quarries. The North Carolina Fossil Club schedules trips to PCS Phosphate mine in Aurora, among other locations. To get involved, go to [www.ncfossilclub.org](http://www.ncfossilclub.org).

Fossil hunters should always be equipped with a good reference book. Timmerman's books, coauthored by Richard Chandler, can be purchased by contacting the North Carolina Fossil Club, P.O. Box 13075, Research Triangle Park, N.C. 27709. They are titled: *Cretaceous and Paleogene Fossils of North Carolina: A Field Guide* and *Neogene Fossils of North Carolina*. □

TOP TO BOTTOM: • In their transport of quarried rock, miners create a landscape that entices fossil diggers. • NMEA members gather at UNC-W for an introduction from Timmerman (seated) on the art and science of fossil hunting. • Andrew Wilson examines a shark's tooth — an extremely desirable find.

similar specimen. According to Timmerman, sharks' teeth are pretty rare in Castle Hayne.

While the shark's tooth, from *Isurus preacursor* — an Eocene mako shark — is the first great find, a rare chambered nautilus, *Aturia* sp., immediately follows. The nautilus is preserved in a scarce condition in which the outer shell casing has disintegrated, leaving the fragile fossilized chambers behind.





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# Coastwatch

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SEAFOOD ON THE MOVE



## Best Wishes, Fond Farewells

The year 2004 opened with more changes for North Carolina Sea Grant. In late January, longtime fisheries specialist Wayne Wescott retired, while mariculture specialist Philip “Skip” Kemp moved to a new position at Carteret Community College.

A Dare County native, Wayne was given the name “Smiley” as a youth — and it has stuck for decades.

For two decades, he focused on fisheries in northeast North Carolina. He is likely best known for his work with the soft-shell crab industry. Today, our delicacy can be found on the menu at the finest restaurants around the country.

And the industry has boosted the economic opportunities in coastal North Carolina. In 2002, nearly 1.3 million pounds of peeler and soft-shell blue crabs were harvested in the state, valued at nearly \$3.8 million.

The green-stick tuna rig had been popular in Hawaii, but Wayne brought the idea to the tuna fleet off the Outer Banks. Now the rig’s colorful “bird” is a common sight.

In more recent years, Wayne’s publication highlighting a “keyholing” technique for finding clams has been quite popular. He offered workshops for residents and visitors alike looking to find sweet Carolina clams.

Wayne was honored by colleagues at the fall mid-Atlantic regional Sea Grant meeting.

Skip has studied shellfish aquaculture around the world, but he didn’t have to go far to find a new adventure. As CCC aquaculture program director, his experience is benefiting students that he has met while working at the Sea Grant office at the Center for Marine Science and Technology in Morehead City.



Wayne Wescott in early Sea Grant days.

He also runs the CCC shellfish hatchery, which soon will move to a new facility, as well as two research sanctuaries. His efforts include oyster restoration efforts with the Albemarle-Pamlico National Estuary Program. He hopes to reach out to schools and community groups.

In his 18 years with Sea Grant, Skip’s duties included mariculture and marketing. He worked closely with the N.C. Shellfish Growers Association and often led seminars at the annual Aquaculture Development Conference on topics such as the “chub” system of growing oysters off-bottom.

His marketing efforts included programs that highlighted the unique flavors of shellfish from different regions of the North Carolina coast.

A native of Wayne County, Skip says he got an early start in aquaculture — working with his father’s catfish operation.

On a closing note, I share the sad news of the death of former North Carolina Sea Grant specialist Rich Novak. Rich had been based at our Manteo office, but was known along our coast.

Although he moved to Florida Sea Grant about six years ago, he returned to North Carolina every winter to assist with the Tag-A-Giant program to track bluefin tuna. Rich, 56, apparently suffered a heart attack while on one of the tagging boats in late January. He had caught two tuna that day and had another on the line.

“People are saying he died doing what he loved,” wrote Michael Heller, editor of *Water Life* in Port Charlotte, Fla. “That’s true, but Rich loved all of life — there was so much left to do.”

Katie Mosher, Managing Editor

### I N T H I S I S S U E

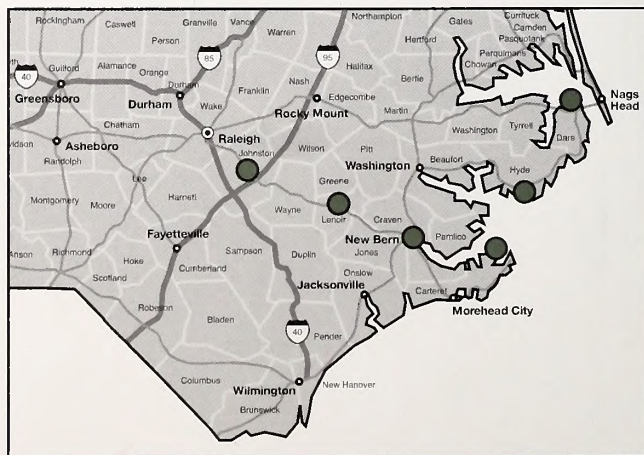
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North Carolina’s diverse coast offers countless interesting subjects. The large dots on the locator map indicate story settings in this issue — including Dare and Carteret counties, and towns along the Neuse River.





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# Coastwatch

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# Coastwatch

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The North Carolina Sea Grant College Program is a federal/state program that promotes stewardship 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, North Carolina Sea Grant supports research projects, a 15-member extension program and a communications staff. Ron Hodson 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. *Coastwatch* (ISSN 1068-784X) is published six times a year by the North Carolina Sea Grant College Program, North Carolina State University, Box 8605, Raleigh, North Carolina 27695-8605. Telephone: 919/515-2454. Fax: 919/515-7095. Subscriptions are \$15. E-mail: [katie\\_mosher@ncsu.edu](mailto:katie_mosher@ncsu.edu) World Wide Web address: <http://www.ncseagrant.org> Periodical Postage paid at Raleigh, N.C.

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Front cover photo of Wanchese crabs by Scott Taylor. Table of Contents photo of paver stones by Lilly Loughner.

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## COASTAL TIDINGS



Duke University's Marine Laboratory in Beaufort supports tuna-tagging research led by Barbara Block, center, of Stanford University.

### Tagging Tuna at Duke Marine Lab

Researchers at Duke University Marine Lab hope to establish a permanent large ocean fish-tagging program in the near future.

Now, Duke is the East Coast partner for Tag-a-Giant, a tuna research program headquartered at Stanford University. A team of Stanford scientists, led by Barbara Block, visit Duke each year to work with local charter boat owners to tag bluefin tuna.

The tags measure body temperature, water temperature, water depth and light sensitivity and enable scientists to track a tuna and know where and when it dives and eats. One tuna tagged in North Carolina was

tracked over a two-year migration that spanned ocean waters from Iceland to the Canary Islands.

Potentially, a Duke-led Tag-a-Giant program could figure in the lab's Pivers Island expansion project under way. Lab director Mike Orbach estimates that it would take \$1 million a year to run the program full time.

Such tagging programs provide valuable information for National Marine Fisheries Services and regional fishery management councils responsible for developing and enforcing fishery management plans for highly migratory species, such as tuna. -- P.S.

### In the Next Issue of *Coastwatch*

Travel with Jason Talley on board a North Carolina ferry destined for your favorite beach. And, Ann Green will explore new federal regulations for recreational anglers seeking highly migratory species, such as tuna and marlin.



## Rare Whale Excites Researchers



Courtesy of UNC-Wilmington

Researchers at UNC-Wilmington measure and evaluate a male dense beaked whale that washed ashore in January. The rare animal drew a crowd of spectators.

Early morning beachcombers stumbled upon much more than bits of shell and fossil on Jan. 28. They found a rare 14-foot whale.

The marine mammal, identified as a male dense beaked whale, was found washed ashore on a beach near Kure Beach. It was transported to the University of North Carolina at Wilmington, where scientists conducted a necropsy, or animal autopsy.

"It is a deep diver that feeds on organisms found in the deep ocean. This is an animal that is really out of its element, and can tell us about the deep ocean," says Ann Pabst, UNC-W professor of biological sciences.

The carcass was in good condition, and necropsy results revealed no apparent cause of death. Tissue samples were collected and sent, along with some body parts, to various universities and institutions for further study.

Dense beaked whale strandings are a rarity, as is research on the deep-water species. The *Wilmington Star-News* reported that over the past 200 years, only 47 dense beaked whales have been documented in the United States, with three adult males discovered in North Carolina. — L.L.

## Sailors' Decorative Carving on Display

During the 18th century, sailors on whaling ships often etched intricate designs on sperm whale teeth, an art known as scrimshaw.

They also crafted practical items like pie crimpers, needle holders and clothespins.

Examples of scrimshaw from a North Carolina collector are on display through April 18 at the N.C. Maritime Museum in Beaufort.

The collection includes a number of scenes etched on sperm whale teeth, including square-rigger sailing ships, whales and sailors or captains performing daily duties. A straight-edged razor, a bone letter opener, sewing and crocheting instruments, and a wooden box with 33 dominoes also are on display.



Courtesy of N.C. Maritime Museum

There is no admission charge to view the exhibit. For more information, call 252/728-7317; e-mail: [maritime@ncmail.net](mailto:maritime@ncmail.net).

Go online to: [www.ah.dcr.state.nc.us/sections/maritime/default.htm](http://www.ah.dcr.state.nc.us/sections/maritime/default.htm) and click on calendar of events. — A.G.

## Red-Cockaded Woodpecker Gets Help

Landowners in the coastal plain may be eligible for a grant from the N.C. Wildlife Resources Commission to help red-cockaded woodpeckers.

The commission will administer funds from a \$165,000 grant from the U.S. Fish & Wildlife Service (USFWS) to help landowners with habitat enhancement projects for the federally endangered species.

The red-cockaded woodpecker, once abundant in the southeastern states, has been on the endangered list since studies in the 1970s showed that the bird was headed for extinction. The USFWS estimates a total population of 12,500 over its entire range.

The decline has been attributed to the loss of southern pine forests, which the birds prefer for nestmaking. In North Carolina, the Croatan National Forest, Camp Lejeune Marine Corps Base and Holly Shelter Gamelands support some of the largest populations of the red-cockaded woodpecker in the coastal plain.

To qualify for a grant, landowners must be willing to sign a land management agreement and to share at least 25 percent of the cost of habitat improvements.

Those improvements might include planting longleaf pines, creating artificial cavities in trees, thinning pine stands, or planting native grasses and wildflowers.

Those interested in applying should call the N.C. Division of Wildlife Management at 919/733-7291. — P.S.





Courtesy of Kay Willis Collection

Ferries bring visitors to Cedar Island, a Down East community.

## New Down East Web Site

Want to take a virtual tour of Down East culture — from historic Portsmouth to the tiny fishing village of Cedar Island?

A new Web site developed by Core Sound Waterfowl Museum highlights photos, stories and facts from several Down East communities.

Funded through a grant from the N.C. Arts Council, the site showcases the cultural heritage of Down East communities, according to Karen Amspacher, director of the museum on Harkers Island.

From boat building to hunting with handcrafted decoys, the Down East communities bring you back in time.

To view the Website: click on [www.downeasttour.com](http://www.downeasttour.com). — A.G.



Courtesy of the Wilmington Star-News

The U.S. 17 Bypass near Wilmington took a new turn to save this centuries-old tree.

## Living History Saved

If trees could talk, one in New Hanover County might be saying, "Thank you."

The giant live oak tree was destined to be knocked down to make way for the U.S. 17 Wilmington Bypass project. But public outcry in 2000 sent the N.C. Department of Transportation (DOT) back to the drawing board to reroute an off-ramp and spare the tree.

Work on that section of the bypass, which includes the \$500,000 redesign, began early this year.

Now a large area surrounding the tree is fenced off to keep vehicles from damaging the

stately oak and its extensive root system.

The exact age of the tree is not known, but Mary Ann Metcalf, an urban forestry specialist with the N.C. Cooperative Extension Service, estimates that it is more than 450 years old.

The tree measures 80 1/2 inches around, and its canopy spreads more than 120 feet across.

John Farrow, supervisor of DOT's roadside environmental unit, told the *Wilmington Star-News* that "It felt good to be able to protect something that's older than the state of North Carolina." — P.S.



## Oriental Harbor to Host Boat Show

The first annual Oriental Harbor Boat Show and Festival is set for April 23-25. The event will feature power, sail and fishing vessels, both in and out of the water. Marine vendors also will highlight popular products.

The agenda boasts seafood cook-offs, fishing demonstrations, beach and bluegrass music and a coastal fashion show.

Oriental is located at the mouth of the Neuse River on the Intracoastal Waterway and is known as "The Sailing Capital of North Carolina" because it hosts dozens of sailing regattas each year.

For more information about the boat show, call 252/249-3783, or go online to [www.orientalharbor.com](http://www.orientalharbor.com). — P.S.



## NOAA Satellites Save Lives

In 2003, National Oceanic and Atmospheric Administration satellites, with sophisticated search and rescue technologies, brought 224 people to safety from dangerous situations.

That same year, the Personal Locator Beacon (PLB) debuted in the United States. Hand-held devices tested in Alaska, PLBs are credited with saving more than 200 lives since 1994.

NOAA officials say that PLB use opens the way for faster, more accurate search and rescue missions, especially for people who recreate in rugged, remote areas.

NOAA satellites, along with Russia's Cospas satellites, are part of an international Search and Rescue Satellite-Aided Tracking system called COSPAS-SARSAT. The system employs a cluster of satellites in geostationary and polar orbits to detect and locate distress signals from emergency beacons onboard aircraft and boats and from PLBs.

Since the system became operational in 1982, nearly 17,000 lives have been saved worldwide, including more than 4,600 in the United States.

— P.S.

## UNC-W Ocean Observing Program Receives \$1.2 Million

The University of North Carolina at Wilmington was awarded \$1.2 million for its Coastal Ocean Research and Monitoring Program.

The program provides an interdisciplinary science-based framework that supports public policy for coastal use, sustainable fisheries and improved coastal ocean ecosystem health.

UNC-W is one of 16 universities in 16 states receiving research grants from the National Oceanic and Atmospheric Administration's Coastal Services Center. The grants aim to promote the development or expansion of regional coastal ocean observation systems.

The Coastal Services Center provides integrated global leadership in the management of oceans.

— P.S.

## Save Those Oyster Shells for the Next Generation

A Down East oyster roast can give a heap of eating pleasure — and a heap of oyster shells.

The N.C. Division of Marine Fisheries (DMF) has launched the North Carolina Oyster Shell Recycling Program that targets two environmental challenges — creating habitat for future oyster stocks and unburdening local landfills.

Plans are under way to place special bins at landfills and designated drop off sites. The filled bins will be transported to DMF stockpile locations for aging. Aged shells that do not pose any threat of contamination will be placed on one of several DMF-sanctioned oyster restoration research sites.

By pooling shell resources, DMF officials say, researchers and scientists can construct large reefs in prime oyster growing areas to enhance oyster productivity — and provide hook and line

— fishing opportunities to the public.

Baby oysters begin life as free-floating organisms, and settle on hard surfaces. Their favorite and most productive place to grow is on other shells. A mound of oysters in brackish water attracts a multitude of marine organisms — and provides ideal grazing sites for native fisheries.

Civic clubs and businesses are encouraged to volunteer to help maintain collection sites.

Church groups, community organizations and individuals are urged to plan ahead for their next oyster roast. Contact DMF to arrange for a trailer to be transported to the roast to collect the shells.

For information, visit the DMF web site, [www.ncfisheries.net](http://www.ncfisheries.net) and click on shellfish recycling. Or contact Craig Hardy at [craig.hardy@ncmail](mailto:craig.hardy@ncmail) or 800/682-2632.

— P.S.



Stewards of the White Oak River Basin vow to clean up Sugarloaf Island — and keep it that way.

## Talking Trash on the White Oak

The Stewards of the White Oak River Basin are committed to cleaning up Sugarloaf Island, a city-owned sand spit across from downtown Morehead City.

Their first foray to the island yielded mounds of cans, bottles and other debris, which they transported to the mainland in an armada of canoes and kayaks.

Led by Elmer Eddy, the self-proclaimed "White Oak Trashman," a handful of stalwart stewards continue to brave wintry weather to carry out their pledge.

"There is 50 years of trash out there. It'll take a lot of work," says Eddy, who was profiled in the Early Summer 2003 edition of *Coastwatch*.

To continue their weekly effort, the stewards are seeking volunteers who have motorboats to help meet the ambitious goal of "cleaning up the whole White Oak River Basin, including Sugarloaf."

Those interested in volunteering should call Eddy at 910/389-4588, or e-mail him at [eeddy@ec.rr.com](mailto:eeddy@ec.rr.com).

— P.S.



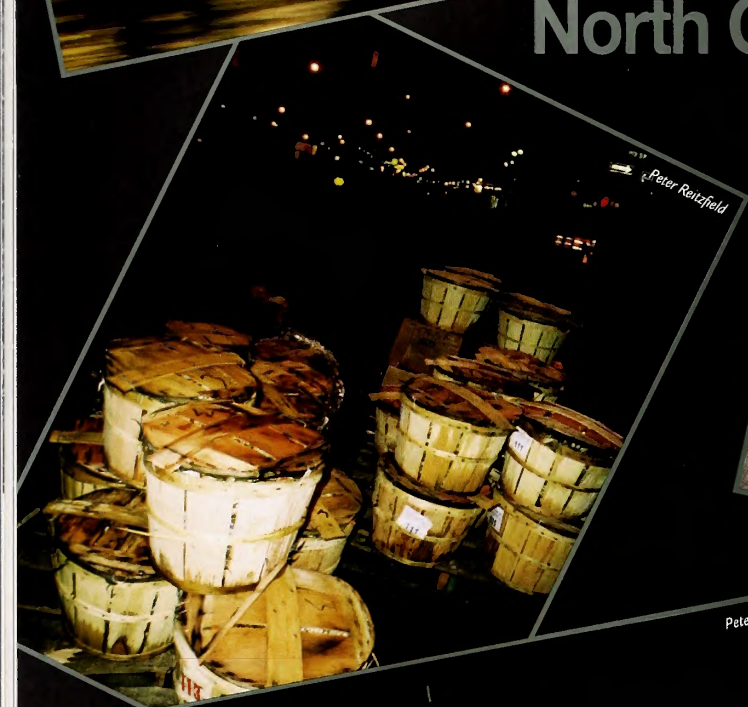


Peter Reitzfeld



Scott Taylor

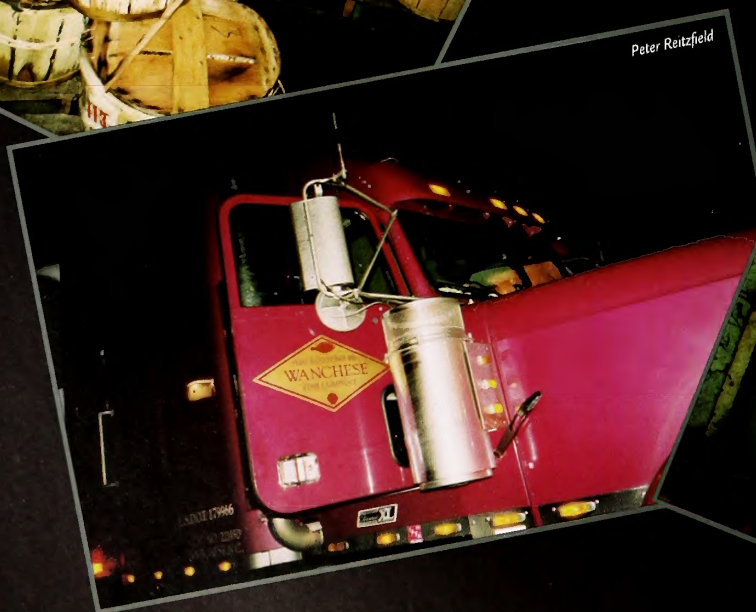
## North Carolina Seafood Shimmers



Peter Reitzfeld



Peter Reitzfeld



Peter Reitzfeld



Peter Reitzfeld

*CLOCKWISE, FROM TOP LEFT: Drivers on forklifts race around the Fulton Fish Market delivering seafood. Boats in the Wanchese harbor are an early stop for seafood that eventually is sold in New York City. A wide variety of seafood is sold at the Fulton market. Workers weigh each piece of fish on a scale. A Wanchese Fish Company truck stops at the market. Jimmy crabs are popular orders.*



From Coastal Waters to the World Market...

## Under Lights at Famed **FULTON FISH MARKET**

B Y A N N G R E E N

As Eric Voliva rolls a Wanchese Fish Company, Inc., truck into the streets of lower Manhattan, the sky is pitch black except for the lights of the Brooklyn Bridge and skyscrapers.

Voliva stops the mauve 18-wheeler at the entrance of the famed Fulton Fish Market. A supervisor, bundled in a dark jacket, waves for him to go ahead.

"Pull in straight," yells the man.

Immediately, Voliva maneuvers the truck behind another 18-wheeler. Then he rolls down the window and hands the supervisor 22 tickets for orders for North Carolina and Virginia seafood.

"This is real slow," says David Woolard, who shares driving with Voliva. "A lot of times, you have 10 to 12 trucks in line. Usually the forklifts are flying left and right. Most of the time, you can't stand here because you might get run over."

As soon as the truck in front moves, Voliva turns a corner and parks across from men huddled around wood crates burning in a metal barrel.

Although it seems slow to Woolard, there is still much activity at 1:45 a.m. Dealers with fish hooks on their shoulders bark orders. Men crack crates with hand axes. Drivers dart in and out with orange and black forklifts as if in a demolition derby.

As soon as Voliva parks the truck, both he and Woolard hop out and unlock the back. Immediately, a young man jumps into the trailer and begins moving pallets of oysters and jimmy crabs toward the front.

A man in a wool cap lifts one pallet of jimmy crabs from North Carolina waters onto the forklift and then speeds away to a wholesale dealer.

Within 30 minutes, the truck is unloaded and on its way to JFK Airport, a Brooklyn seafood market and then Boston.

For Voliva, the hustle and bustle of the Fulton Fish Market is a familiar site.

"I have made this trip several hundred times," he says. "Wanchese has four trucks. At least one or two trucks go to the Fulton Fish Market Sunday through Thursday."

As the largest fish market on the East Coast, the Fulton Fish Market is a key distributor for North Carolina seafood.

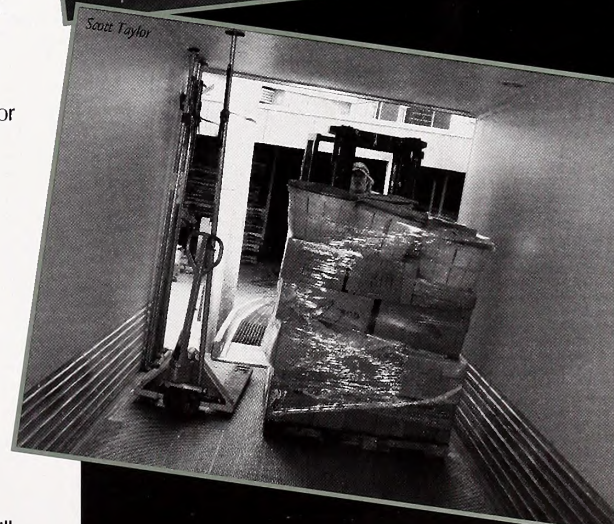
"I have been dealing with Wanchese Fish Company for 27 years," says Patty Duke of Caleb Haley & Co. LLC. "I get 10 to 15 percent of croaker, bluefish and mackerel from North Carolina."

### EARLY MORNING MARKET

The busiest time at the New York City market is from 2 a.m. until sunrise. "The real quality guys come early and buy before the market is established," says Capt. Bill Mieschberger, a New York restaurant supplier.

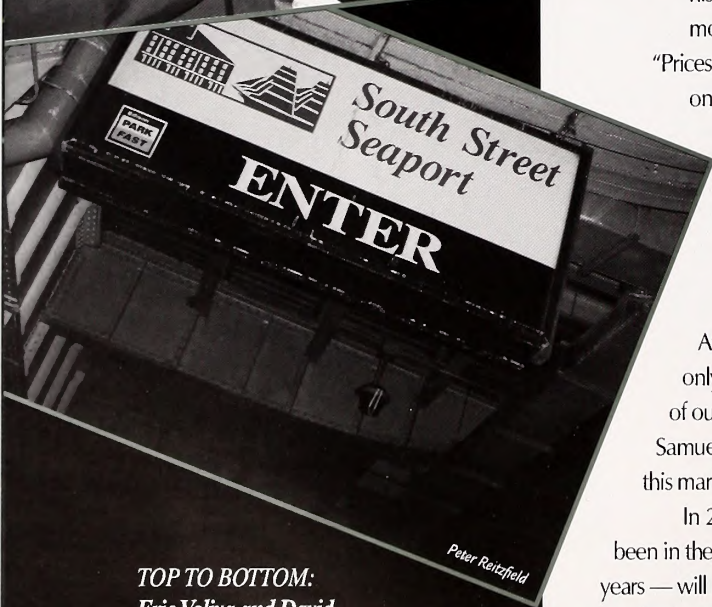
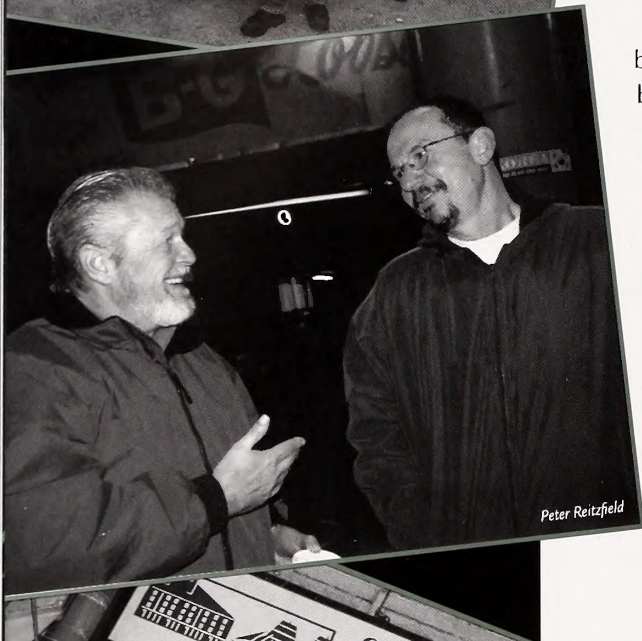
Most restaurant chefs or seafood dealers arrive in trucks. A few pedal their bikes through the open markets. While looking at the fish, customers have to side-step puddles of melted ice and

Continued



**TOP TO BOTTOM:** Max Brown checks his orders for seafood in the loading area at Wanchese Fish Company in Wanchese. The company delivers all types of seafood by truck to major markets along the East Coast. Jimmy crabs are loaded onto a truck for New York.





**TOP TO BOTTOM:**  
Eric Voliva and David Woolard of Wanchese Fish Company get ready for the long trip to the Fulton Fish Market. From left, Capt. Bill Mieschberger consults with Ken Gall of New York Sea Grant at the Fulton Fish Market. The famed market is in lower Manhattan near the Brooklyn Bridge.

dodge workers unpacking seafood.

At the Fulton market, buyers can choose seafood from more than 60 wholesale companies crowded into a four-square block. "I heard a billion dollars worth of fish are sold a year at this market," says Vinny Tatick, owner of Joseph H. Carter Co. Inc.

Carter and the other wholesale businesses are housed in two open-front buildings owned by the City of New York and individual brick buildings along South Street. Outside, fish brokers work in the market where fish from around the world are displayed on ice — from pink porgy and grouper to octopus and skate.

At Caleb Haley, a whole tuna that weighs more than 600 pounds shimmers under the lights. "This tuna will go to a sushi purveyor," says Duke.

After showing off the tuna, Duke holds up a swordfish for a customer. To see how much it weighs, he uses his hook to pick up the fish by the mouth and places it on a scale.

"Prices change every day and depend on the available supply of each

species and the relationship between the dealer and the buyer and the buyer's credit," says Ken Gall, New York Sea Grant seafood specialist.

Each market has a specialty. At Blue Ribbon Fish Co., they sell only saltwater fish. "Twenty percent of our fish is imported," says Dave Samuels. "Salmon is a big importer at this market."

In 2005, the market — which has been in the same location for more than 160 years — will move to the Hunts Point Food Distribution Center in the Bronx.

The New York City Economic Development Corporation is constructing a state-of-the-art, 285,000-square-foot facility with controlled access. The new facility will be more efficient and cut unloading time by 50 percent, according to city officials.

## GLOBAL MARKET FOR NORTH CAROLINA SEAFOOD

Besides the Fulton market, North Carolina seafood goes to markets and restaurants all over the United States and overseas.

"We have such a large variety of seafood that it goes all over the world," says William Small, seafood marketing specialist for the N.C. Department of Agriculture & Consumer Services.

"Some of the croaker go to Africa and Korea," adds Small. "Hybrid striped bass is sold in Toronto. Farm-raised catfish are shipped to Europe, Japan and even Africa."

The most lucrative North Carolina seafood is blue crab. In 2002, the total blue crab catch was valued at more than \$33 million, according to the N.C. Division of Marine Fisheries (DMF). North Carolina has consistently been a leading producer of blue crabs. In 1998 and 1999, North Carolina was the number one producer of blue crabs in the United States, harvesting more than 55 million pounds each of those years, according to Small.

Despite the high value of blue crab, the industry has been struggling since the 1990s. In less than five years, more than half of the state's processors have been forced to shut down, according to DMF.

The downturn in the blue crab industry can be attributed to a number of factors. Catches of crabs have dwindled in recent years. At the same time, an influx of less expensive, imported crabmeat has been nudging out the domestic market share.

In addition, lingering effects from a series of hurricanes altered estuarine habitats, and the crab supply further declined.

"We had an accelerated shift from domestic to imported products," says North Carolina Sea Grant researcher Dave Green, who heads North Carolina State University's Center for Marine Sciences and Technology in Morehead City. "We no longer can be commodity-based because we can't compete at the commodity level."

Green and Barry Nash, North Carolina Sea Grant seafood technology and marketing specialist, have been working with North Carolina seafood processors to develop value-added products,



which are processed to be different in form, taste and texture from the principal raw ingredients.

One of the successful products is Wanchese Fish Company's scallop medallion that is sold at the Fulton market. Developed through a N.C. Fishery Resource Grant, administered by Sea Grant, the medallion uses enzymatic cold-binding to create large scallops from smaller, less profitable ones.

#### NORTH CAROLINA MARKETING CAMPAIGN

To compete in a global market, the N.C. General Assembly began appropriating funds for seafood marketing in 1998. In the 2002-2003 fiscal year, \$200,000 was budgeted for seafood marketing.

For blue crab and other seafood, Small's office began a "Freshness from North Carolina Waters" (FFNCW) program. The FFNCW label may be applied only on North Carolina produced, processed or packed seafood products, according to the membership criteria.

"Our program is generic and focuses on all North Carolina seafood," says Small. "It will help fishermen and processors market their products by letting consumers know the products they are buying are top quality and locally harvested."

The campaign's goal is to create a positive image in the public's minds about all North Carolina seafood and aquaculture products through our "Freshness from North Carolina Waters" program, he adds.

Because of increased competition from Vietnam, China and Thailand in the shrimp industry, the 2003 Congress authorized \$17.5 million of disaster relief to the South Atlantic states. In North Carolina, Smith's program received \$600,000 to develop a 36-month shrimp marketing campaign to promote the virtues of fresh, local shrimp.

There really is a difference between foreign and North Carolina shrimp, says Small. "Our domestic, wild-caught shrimp are safe to eat, untainted, clean and have a firmer flesh that tastes better than the almost bland flavor of the

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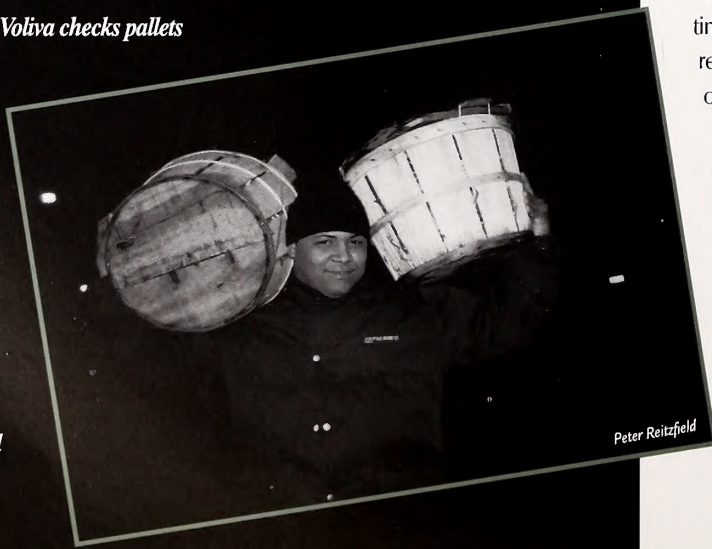


**TOP  
TO BOTTOM:**  
*A wide variety of seafood  
is sold at many wholesale compa-  
nies operating out of the Fulton Fish Market.  
The seafood arrives in pallets and then is unpacked and  
displayed for buyers. On most days, the market is buzzing with activity  
early in the morning.*





*TOP TO BOTTOM: Eric Voliva checks pallets of oysters and jummy crabs before unloading at the Fulton Fish Market. On a busy night, the drivers have to wait in line before unloading. Many of the market's wholesale dealers have been family-owned and operated for generations. Workers deliver orders throughout the night and early morning.*



imported product. We also are trying to increase awareness of the abundance and nutritional value of shrimp in North Carolina."

**TRUCK RIDE TO NEW YORK**

Five days a week, Wanchese Fish Company's trucks deliver seafood — caught from their boats and by other North Carolina companies — to locations across the East Coast.

On Sundays through Thursdays, the 18-wheelers leave from Wanchese Fish Company's office in a concrete building on the waterfront in the tiny community of Wanchese. The trucks go to Boston, Baltimore, Philadelphia and New York markets.

On a recent day, one man loaded crabmeat and hard crabs onto one truck and fish onto another with a forklift. The seafood is stored in a refrigerated section of the trailer.

"We freight everybody else's seafood," says Cruiser Midgett of Wanchese Fish Company. "We send at least five trucks a week to New York. Sometimes we send as many as 10 to 15. We are not packing as many fish as we used to because of more government regulations."

After the trucks are loaded, the drivers arrive. First, Voliva, a burly man dressed in a T-shirt and jeans, loads his quilt, cooler and pillow into the back of the cab — an efficiency apartment with curtains separating the driving section from bunks, tiny closets, a cubby hole wired for a T.V. and refrigerator. The front has a CB radio and a state-of-the art map tracking system.

A few minutes later, Woolard, a tall man with glasses, puts his belongings in the back. Woolard is one of eight Wanchese Fish drivers who transport seafood back and forth on the East Coast. Two pairs are husband and wife teams.

On the drive to New York, Voliva leaves the parking lot at the seafood company around 2 p.m. First, he heads down N.C. 345 past businesses and a long stretch of marsh. Then he turns and



crosses the causeway to Nags Heads and N.C. 158 west.

Voliva says hauling seafood is a “steady job, and you get 31 cents a mile when you go up, and extra for anything you take back.”

For Voliva, who has been driving a truck since 1984, the route is familiar — from a cluster of shopping centers in Kitty Hawk to the bumpy ride over the Wright Memorial Bridge on Currituck Sound.

“I like driving a truck because you get to see different things up and down the road,” he says. “I couldn’t stand being couped up in an office.”

As Voliva heads through the Great Dismal Swamp, the road narrows, and blackbirds flutter over the water that looks like a bowl of green pea soup.

“When I see a swarm of blackbirds, it reminds me of what my grandfather always told me — that cold weather was coming,” says Voliva. “My grandfather had a home on the Scuppernong River and took me out fishing.”

#### PICKUP POINT

The first stop is Quality Crab Company in Elizabeth City, where the drivers pick up some oysters. Then they head up the highway to Virginia. After going over a one-lane bridge in Suffolk County, Va., Voliva turns into Wanchese Fish Company’s new state-of-the-art, 180,000-square-foot facility, which has a large loading dock.

At the plant, the drivers, along with Wanchese Fish Company president Joey Daniels, load more seafood on the truck.

After the Virginia stop, the drivers don’t pick up or deliver any seafood until they get to New York.

“We don’t make any stops unless necessary,” says Voliva. “We try to get to the New York market as early as we can. The busiest nights are Sundays and Wednesdays because trucks come up from Florida. On Sundays, sometimes we leave at 7 a.m. out of Wanchese to be the first or second in line.”

At the Virginia plant, Woolard takes over the wheel. Voliva gets in the back, closes the curtains and takes a snooze on the bunk. “We split up

driving every three to five hours,” says Woolard.

As the sky begins to turn ink black, the drive becomes an endless stretch of dark open fields through Virginia and Maryland. Calls on the CB radio, along with bathroom and fast food stops, interrupt the monotony.

“Sometimes, you know the people on the radio,” says Woolard after getting a call. “You try to help one another.”

In Delaware, the refineries in Wilmington light up the night sky. Then Woolard stops in a service area for diesel fuel, and Voliva takes over the wheel.

Voliva says one of the drawbacks of the job is that it is “hard on my family.”

“Sometimes, you are on the road all week and don’t go home at all,” he says.

Truck drivers also have to deal with road rage from other drivers.

“You have to keep an eye on everything and everybody,” says Voliva. “I give people plenty of room. Just say ‘yes ma’am’ and ‘no ma’am’ to yourself. Let them cool off and go about their business.”

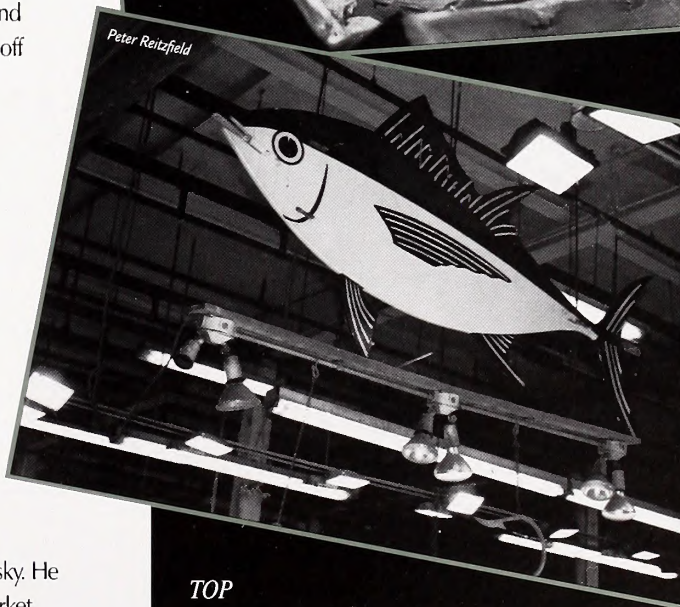
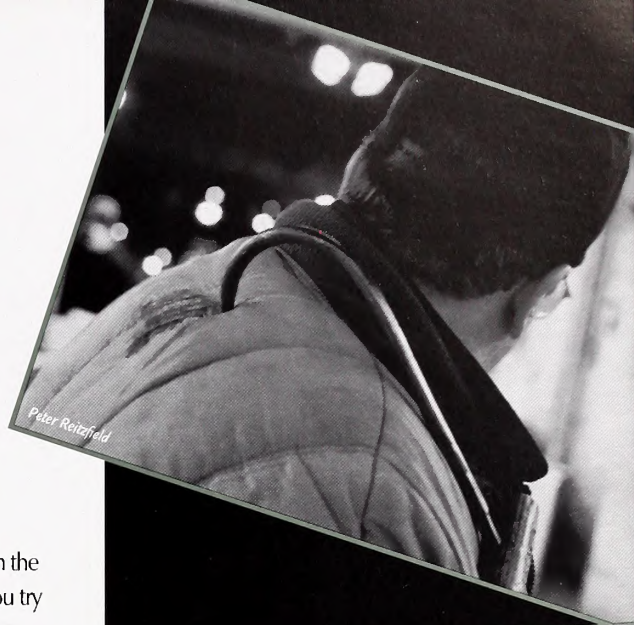
Along the New Jersey Turnpike, traffic picks up. As Voliva maneuvers onto the Queens Expressway, he says that a lot of drivers won’t drive into New York City.

“The scariest time is going into New York in the ice and snow,” says Voliva.

The ride gets bumpy when Voliva hits the Goethels, Bayonne and Verrazano bridges. Then the Manhattan skyline, including the Empire State Building and the Chrysler Building, illuminates the sky. He turns into a narrow street near the market.

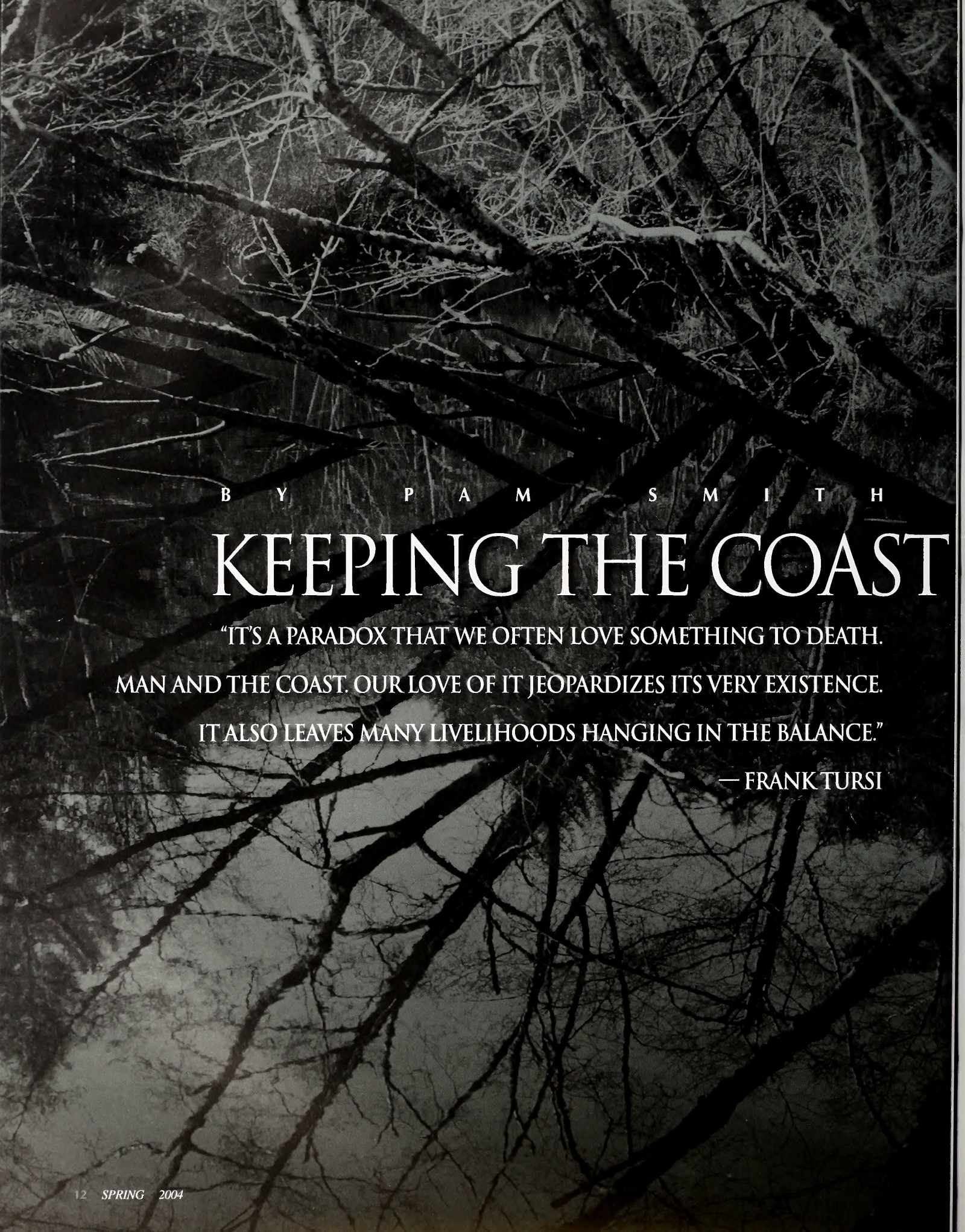
After making the trip hundreds of times, Voliva can deal with just about anything.

“Sometimes, people push you around at the market,” he says. “You have to not let them intimidate you. They use hard language, but don’t mean no harm.” □



**TOP  
TO BOTTOM:** Huge hooks are a common sight — even on shoulders. Buyers arrive early to get their pick of seafood that shimmers under the lights. A variety of seafood from all over the world is sold at the Fulton Fish Market — from flounder to octopus.





B Y P A M S M I T H

# KEEPING THE COAST

"IT'S A PARADOX THAT WE OFTEN LOVE SOMETHING TO DEATH.  
MAN AND THE COAST. OUR LOVE OF IT JEOPARDIZES ITS VERY EXISTENCE.  
IT ALSO LEAVES MANY LIVELIHOODS HANGING IN THE BALANCE."

— FRANK TURSI



These words preface a special report, "Our Coast: A Heritage Seeps Away," written nearly two decades ago for the *Winston-Salem Journal* by then environmental journalist Frank Tursi.

His 1988 series of articles was the result of a month-long journey following watermen, and talking with homeowners, shopkeepers, scientists, and state and county officials from Currituck Banks to Brunswick County.

In an era of fish kills, algal blooms and burgeoning coastal growth, Tursi set out "to find out what is happening on the coast, what rapid development is doing to fishermen... and to the fragile ecosystem."

Now, with development in some coastal counties approaching critical mass, Tursi continues to pursue answers to many of the same questions as a full-time environmental "guardian."

loss of wetlands and open space, and increased polluted stormwater runoff from paved surfaces — is degrading water quality, straining limited resources, and nudging out traditional coastal livelihoods.

In 2000, the federation was approved by the New York-based Waterkeeper Alliance to license three Coastkeepers, explains Todd Miller, executive director of NCCF, an environmental advocacy group with 8,000 members. The federation is the only Alliance-affiliated organization licensed to cover a state's entire coast.

"We always have maintained that North Carolina is excellent at designing environmental laws," Miller says. "The problem is its inability to fully implement and enforce them because of budget and staffing constraints."

That's where the Coastkeeper initiative

word. We're not there yet, but our Coastkeepers are gaining recognition in their geographic regions," Miller says.

"We are seeing an increase in compliance checks by regulating agencies as a direct result of reporting by keepers," he adds.

## TAILORED AGENDAS

To be effective, Coastkeepers must be part investigator, legal expert, lobbyist, teacher and public relations specialist, says Miller.

Above all, they must have outstanding communication skills.

That may explain how Ted Wilgis gets dozens of volunteers to respond to calls for help with a number of projects. The "invitations" urge volunteers to bring shovels, work gloves, buckets, old shoes and insect repellent.

# SECURE FOR THE FUTURE

Tursi is one of three Coastkeepers hired by the North Carolina Coastal Federation (NCCF) to preserve and protect coastal water quality and habitat.

As Cape Lookout Coastkeeper, Tursi's territory encompasses the central coast. Cape Fear Coastkeeper Ted Wilgis oversees the southeastern coast. And, Cape Hatteras Coastkeeper Jan DeBlieu covers the northeast coast.

Their job description is straightforward: Prevent pollution and habitat degradation; enhance the role of federal, state and local agencies — and relevant regulations — responsible for protecting the coast; and organize citizens to be a concerted voice for coastal resources.

Getting the job done is a bit more dicey. Describing the North Carolina coast is much like the old adage about the blind man describing an elephant — it depends on where you are standing.

From north to south, the geography is dominated by many different water features — ocean, sounds, bays, rivers and creeks; tidal marshes that sustain submerged sea grasses and aquatic life; wetlands that drain significant watersheds; and inlets that open and close at the mercy of severe seasonal storms.

All are shaped by nature and influenced by human activity.

Coastal urban sprawl — with its inherent

comes into play. Coastkeepers interact with university, state and federal scientists, and form partnerships with organizations that share water quality concerns.

More importantly, they recruit and train volunteers to become "extra eyes" for agencies.

## GLOBAL IN SCOPE

The addition of the three NCCF Coastkeepers raises the number of the Waterkeeper Alliance-sanctioned programs in the state to nine — second only to California.

The Waterkeeper Alliance was incorporated in 1999 as a way of unifying a number of grassroots keeper programs operating independently across the country. The Alliance now is the hub of a global network of 117 affiliates, all about one thing — protecting the integrity of waterways.

Many North Carolinians were introduced to the Waterkeeper program by Rick Dove, who served as Neuse Riverkeeper from 1993 to 2000. Much of his work focused on educating the public about the ailing Neuse River. During his tenure, his Riverkeeper activities were the topics of more than 4,000 news stories.

It was Dove who urged the NCCF to consider funding Coastkeeper positions.

"Rick Dove made 'Riverkeeper' a household

Wilgis became the federation's first Coastkeeper in 2001. Four years earlier, he arrived "on loan" to the federation from the Chesapeake Bay Foundation (CBF). His mission was to expand NCCF's environmental education programs based on CBF's hands-on stewardship model. The job became permanent.

So, when Wilgis moved into the Coastkeeper post, he already was familiar with the coastal landscape.

Among his current activities, Wilgis oversees the federation's oyster restoration efforts, in cooperation with the N.C. Division of Marine Fisheries. The projects are funded, in part, by NOAA and the National Fish and Wildlife Foundation.

So far, Wilgis and volunteers have shoveled and transported more than 6,000 bushels of oyster shells to construct six intertidal oyster reefs in licensed shellfish management and research sanctuary sites. In addition, they filled 2,000 mesh bags with oyster shells for setting with oyster larvae. Once the spat, or juvenile oysters, attached to the shells, the volunteers helped transfer the bags to "seed" the newly constructed reefs.

Backbreaking and labor-intensive, the results will be far-reaching, says Wilgis. Bringing back native oyster ecosystems for their habitat, water

*Continued*



quality and socio-economic benefits is a priority in North Carolina.

The federation is collaborating with North Carolina Sea Grant and scientists from several University of North Carolina campuses, who are seeking ways to reverse declining native oyster population trends.

Oyster diseases, harvest pressure and mechanical oyster-dredging practices that harm habitat are cited as contributing factors. But, water pollution is seen as the leading culprit.

Scientists are studying the ability of oysters — which filter 50 gallons of nutrient-rich water each day — to improve water quality in some troubled estuarine nurseries. If restoration efforts are successful, mature oysters growing on constructed habitat also will produce larvae for future oyster generations.

## AN OUNCE OF PREVENTION

Restoration is one side of the environmental integrity coin.

The flip side is pollution prevention and slowing the loss of coastal habitats. But, considering development pressures on the coast, it will take more than an ounce of prevention to stay the tide.

Sewer projects, subdivision and shopping center construction, stormwater permits, beach nourishment and inlet projects are on Wilgis' list of top concerns. He is closely monitoring development and roads that are being built along Howe Creek in New Hanover County. Wetland and stormwater rules were interpreted to allow a new high-density project to be built in the sensitive headwaters and wetlands of the creek.

Little more than a decade ago, Howe Creek was given the state's highest stream classification of "Outstanding Resource Waters." Now, it is permanently closed to shell fishing and is classified as "Impaired Waters."

Wilgis has implemented a water-quality monitoring and bacterial sampling regime at various runoff sites to track impacts on the troubled watershed. His goal is to identify potential violations for the N.C. Division of Water Quality and other regulatory agencies, in an effort to spur enforcement of clean water rules.

A core volunteer force is helping to carry the environmental message into the community and to policymakers responsible for protecting coastal resources.

"The next 10 years will determine the future of our coast and whether our grandchildren will be able to swim, eat oysters and experience the beauty of the coast," Wilgis says.



## VIGILANT VOLUNTEERS

Coastkeeper Tursi knows vigilant volunteers make a difference — especially if they are trained to identify likely illicit land disturbances and discharges, and are savvy about responsible government agencies and applicable laws and regulations.

A Carteret County couple who received the federation's 2003 Citizen Action Award proves the point. Working with Tursi, Bonnie and Lee Jones diligently recorded a developer's suspect activities — taking photos and water samples to document sediment and bacterial contamination in Bogue Sound. The state agreed, citing the developer for violating erosion-control laws.

Tursi envisions an extensive volunteer network that could function as a rapid-response team. Say a fish kill is detected in a creek. Trained volunteers could be summoned quickly to collect water samples and help track down contributing factors.

When Tursi became the federation's second Coastkeeper in 2002, it seemed to be a major career change. But, his communication skills are well suited for his new vocation. Moreover, he is familiar with the issues, the policies and the politics.

He says investigative reporting is similar to the detective work needed to research water quality issues. Often, it's knowing the right person to call and questions to ask.

As a Coastkeeper, though, he goes beyond reporting the facts. Now, he takes action to ensure the interest of water quality is served — such as blowing the whistle when someone appears to be out of compliance. Litigation, a last resort, is "one



*CLOCKWISE FROM TOP LEFT: Cape Lookout Coastkeeper Frank Tursi and Elmer Eddy take a break from White Oak River clean-up duties. • Cape Fear Coastkeeper Ted Wilgis, right, works with volunteers on oyster restoration. • Wilgis gathers water samples. • Wilgis hopes to recruit volunteers to be coastal advocates. • Cape Hatteras Coastkeeper Jan DeBlieu is the newest member of the team, but is no stranger to local issues. • Tursi went from environmental journalist to environmental guardian.*





Pam Smith

“We are dealing with the effects of development on the landscape and its consequences on coastal waters,” he explains.

The extent is driven by the amount of land disturbance and percent of hardened surfaces. “When you remove the land’s ability to filter water, stormwater rushes directly into streams, rivers and estuaries, along with all the stuff it picks up in its path,” he says.

The “stuff,” to some degree, depends on sediment and erosion controls in place.

“I could spend every day helping enforce sediment-control rules,” Tursi observes. “If there was just one site, it would be bad enough. But with dozens and even hundreds of sites, there is an enormous cumulative effect.”

Unfortunately, he adds, government agencies are overburdened and can’t keep pace with growth. “While agencies face personnel and budget cuts, the number of development permits are increasing,” he says. The result is any given agency’s diminished capacity to enforce rules.

#### FAULTY SYSTEMS

And, there are weak spots in the state’s environmental safeguards. Faulty or failing sewer systems are chronic sources of pollution in coastal waterways.

A recent investigation of state records by Tursi and Wilgis revealed that 60 sewer plants in the central and southern coastal counties had violated their discharge limits and were fined — some as many as dozens of times — by the N.C. Division of Water Quality.

Tursi and Wilgis have constructed a federation Web site where they post the most chronic violators who are cited, pay fines and are back to business-as-usual.

But, if the state is going to be successful in bringing back the oyster to historic population levels, it can’t be business-as-usual for any polluter, says Tursi.

“Oysters are a benchmark species, a symbol of water quality. We must promote smart growth, enforce sewer, stormwater runoff and sediment rules,” Tursi adds. “If we are successful in bringing back oysters, then other creatures will be healthier, including humans.”

#### NATURE’S NOTEBOOK

Many coastal problems stem from trying to change nature to conform to human purposes, such as filling in wetlands to create “buildable” real estate, says Cape Hatteras Coastkeeper Jan DeBlieu.

On the job one year, the newest Coastkeeper is a long-time resident of the region who has spent most of her professional life writing about the natural world. She moved to the Outer Banks in 1985 to write *Hatteras Journal*, an exploration of the ecology and people. It also was when she cut her grassroots activism teeth. She helped found LegaSea, a citizens group that successfully fought a proposal to drill for oil and natural gas off the Outer Banks.

As Coastkeeper, she parlays her knowledge of natural science with her understanding of policies to help monitor potentially destructive development projects along the northern coast, and to work with regulatory agencies to solve problems. She is building a Coastkeeper Corps of volunteers to help patrol her vast territory by boat, airplane, canoe and truck.

DeBlieu is working with the federation’s senior scientist, Tracy Skrabal, to establish “living shoreline” demonstration projects to protect estuarine shorelines from erosion. Skrabal has designed more than a dozen projects along the coast, including one at Festival Park in Manteo and at a residence in Columbia.

There is no dearth of regional issues. Some of them surfaced dramatically when Hurricane Isabel blew ashore last September. Isabel left broad sections of N.C. 12 under tons of sand — renewing discussion about a long-term solution to the recurring problem.

“Like most barrier islands along the coast, the Outer Banks are migrating westward; the erosion of their seaward shores is a natural process,” DeBlieu writes on her Coastkeeper Web page. “The continual maintenance of N.C. 12 is like drawing a line in the sand and telling the ocean that it can’t pass. It’s a contest of wills that humans are bound to lose.”

She describes beach renourishment as another “burning” issue. “The towns of Kitty Hawk, Kill Devil Hills and Nags Head are very anxious to begin beach renourishment, especially after the severe erosion caused by Hurricane Isabel.”

While funding is not a sure thing, the U.S. Army Corps of Engineers schedule calls for sand to be pumped onto the beaches in early 2005.

“Renourishment projects can be very effective. They also can turn into disasters, especially if the wrong kind of sediment is placed on the beaches. If we’re going to have renourishment here, one of my primary goals is to make sure it’s done carefully and wisely,” DeBlieu says. □

*To learn more about the North Carolina Coastal Federation and the Coastkeeper program, go on line to [www.nccoast.org](http://www.nccoast.org), and click on Coastkeeper. Or, call 252/393-8185.*



Courtesy N.C. Coastal Federation



Scott Taylor

tool in the box for extreme cases.”

After two years on the job, Tursi says there are few surprises. After all, he has been witness to a changing coast since his student days at East Carolina University and during his lengthy tenure as an environmental reporter.



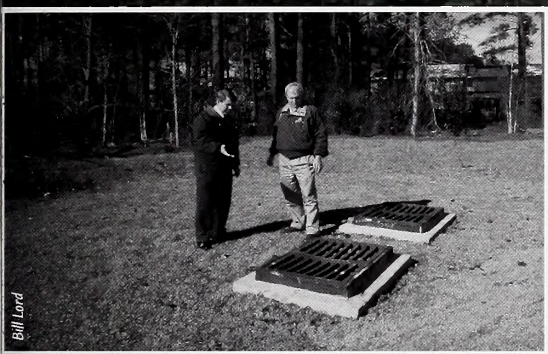


**THIS PAGE, CLOCKWISE FROM TOP LEFT:** *Sagittaria* sp. may be used in wetland construction due to its ability to handle typically wet conditions. • Bill Lord, area environmental agent, teaches Smithfield-Selma Senior High School students water quality testing techniques in their wetland classroom. • Educational signs are placed at demonstration sites. • Jonathan Smith, extension assistant, explains how to download data from the rain gauge at Smithfield-Selma Senior High School wetland, while Kenneth Bateman, county extension director, and teacher Martha Debeve, listen. • An example of fauna present in Smithfield's wetland classroom. • Upgraded stormwater pipes in River Bend help control the constant flow of water through the town. • After initial wetland construction, Bill Hunt and Bill Lord worked on minor adjustments through surveying techniques in Smithfield. • Beautiful blossoming wetland plants display the ability for a wetland to be visually pleasing. • Bill Hunt, stormwater specialist, examines plant growth atop the Neuseway Nature Center green roof in Kinston. • Kinston's Adkins Branch Stream Restoration should improve water quality, as the once straight, deeply eroded stream has been given back its curves.





Bill Lord



Bill Lord



Al Kish



Bill Lord

# SUCCESS STORIES FLOW ALONG THE NEUSE

By Lilly Loughner

The search for the cause of a series of fish kills in 1995 erupted in concern for the state of water quality in the Neuse River and its estuary. Nutrient loading, *Pfiesteria piscida* and other factors were linked to water degradation.

Studies rapidly evolved into action with the 1996 drafting of the Neuse River Nutrient Sensitive Waters Management Strategy. The "Neuse Rules" became the first basinwide strategy in the state.

It's been more than five years since the Environmental Management Commission put the rules into effect on Aug. 1, 1998. Goals calling for a 30 percent reduction in nitrogen loading by the year 2003 have been met, and the Neuse River seems to be showing improvement.

"The general tendency for total nitrogen data in the Neuse River and estuary is a slight downward trend over the past five years," says Ken Reckhow, director of the University of North Carolina Water Resources Research Institute.

There are various hypotheses as to why the decrease in nitrogen occurred, but as Reckhow points out, it is likely due to a number of factors rather than a single factor.

Committed to continual improvement, professionals pooled their knowledge at *Neuse River Basin: Five Years of Progress*, a conference focusing on stormwater management.

Stormwater is a nonpoint source of pollution — having no defined point of entry into the water system. As opposed to point source pollution — discharge from a pipe or ditch associated with a particular industry or source — nonpoint pollution is difficult to locate, regulate and manage.

Agriculture contributes the largest source of nitrogen. But, as development increases, urban stormwater issues need to be acknowledged as well, explains Barbara Doll, North Carolina Sea Grant water quality specialist.

"In the upper reach of the Neuse Basin, you have to do something about stormwater to have a positive effect," Doll says.

Large or medium municipalities with populations of 100,000 or more are already regulated under Phase I of the National Pollutant Discharge Elimination System Stormwater program. Phase II of the program builds upon Phase I by requiring smaller communities to be permitted.

In addition to the U.S. Environmental Protection Agency's Phase I and II rules, the Neuse stormwater rule — part of the Neuse Rules — targets 10 cities and five counties in the Neuse basin.

Affected areas, working in cooperation with the N.C. Division of Water Quality, have been required to develop a model stormwater plan to meet the objectives of the Neuse stormwater rule.

From there, local governments must devise stormwater management plans for their individual municipalities. These plans aim to meet a 30 percent nitrogen reduction goal for new developments through the use of best management practices (BMPs) and planning considerations, public education, identification and removal of illegal discharges, and identification of retrofit locations.

But what happens when local governments achieve more than is required?

Continued

**THIS PAGE, TOP TO BOTTOM:** A water lily offers beauty. • Kenneth Bateman speaks with Senior Bank Manager Ted Godwin about the bioretention area at K.S. Bank in Smithfield. • River Bend is nestled alongside the Trent River. • Smithfield-Selma Senior High School students remove litter from their outdoor classroom — later designing a net to trap the pesky trash.





Lilly Laughner



Lilly Laughner



Bill Lord



Bill Lord

**TOP TO BOTTOM:** River Bend Mayor John Kirkland and Town Manager Eric Pearson are pleased with their stormwater wetland demonstration. • This stormwater wetland in River Bend directs runoff from U.S. 17 toward water-loving vegetation. • This outlet weir at Smithfield-Selma Senior High School wetland is equipped to measure flow and temperature of water leaving the wetland. • The Smithfield demonstration wetland removes pollutants from runoff, slows discharge of stormwater, and can limit flooding and erosion downstream.

Travel downstream toward the mouth of the Neuse River. First, stop at the Town of Smithfield, which derives its drinking water from the Neuse. Then, float on to the City of Kinston, home to BMP pioneers. Finally, visit the Town of River Bend, where citizens are all too familiar with the word “floodplain.”

Come travel and experience success — success that pays tribute to the recent fifth anniversary of the Neuse Rules.

### Wet Feet in Smithfield

The fastest growing county in North Carolina — 47 percent of homes have been built within the last 10 years — Johnston County and specifically the City of Smithfield acknowledge the need for increased awareness of innovative solutions to water quality issues.

The Johnston County public utilities department had initiated a water reclamation program prior to the Neuse Rules, making an immediate, positive impact on the Neuse River. When the Neuse Rules came into debate and finally execution, extension activities at a local level became a priority.

Because the Neuse Rules were the first basinwide rules in North Carolina, farmers and municipal leaders alike initially met them with apprehension. “It was a change from the status quo. They thought it meant new regulations that would increase their cost of production. It was different, and it wasn’t production oriented,” explains Kenneth Bateman, county extension director in Johnston County.

Yet, Bateman facilitated education efforts and gave credibility to a project that would set the groundwork and spark interest in extension activities in Smithfield and elsewhere — the Smithfield-Selma Senior High School Stormwater Wetland.

An eyesore ditch filled with broken concrete, algae and trash was transformed into an attractive wetland to treat runoff, reduce downstream flooding, and serve as an outdoor classroom at both the high school and university levels.

Nearly 50 percent of the 26-acre high school campus drains water through the wetland — which removes pollutants, slows discharge of stormwater and can limit downstream effects such as flooding and erosion.

As NC State student Amy Lewis drew up site plans that contributed to her senior design project, the N.C. Division of Water Resources (DWR) funded the \$14,280 wetland.

And with the direction of Area Environmental Agent Bill Lord and the Neuse River Education Team — part of the N.C. Cooperative Extension Service (NCCES) — and the combined efforts of Johnston County, the Natural Resources Conservation Service, and the Town of Smithfield, the stormwater wetland demonstration has become the focus of three international tours. Moreover, its design is being adopted by the mainstream development community.

Not only is this outdoor classroom exceeding the educational expectations of the professionals involved in the project, but it’s also doing its job.

According to Lord, studies have shown a drastic reduction in nitrogen concentrations as well as temperature of the stormwater treated by the wetland.

Two underground storm drains provide almost continuous flow to the wetland. Three deep wells, fed by both stormwater and groundwater, stay wet even during dry periods. The goal is to disperse stormwater flow across the wetland in a thin sheet — encouraging contact of the water with vegetation and pollutant-removing microbes before flowing into the receiving stream.



Site data are analyzed at NC State through use of rain gauges, computerized monitoring of water level, flow and temperature, and water samples.

The project has not been without challenges, especially when “wetland” evoked images of a swamp — stagnant standing water full of mosquitoes and other health hazards.

But through careful management and maintenance of a very diverse ecosystem — manipulation of water level, control of invasive cattails and stocking of mosquito fish — the wetland came about without a single mosquito larvae being spotted by Lord.

Unexpected benefits have warmed public perception of wetlands. When Ellen Ennis started teaching at the high school four years ago, one environmental science class had only partial enrollment. Now there are eight classes, all full.

High school senior Drew Shumate visited the wetland a few times a week during his zoology class last semester. “It’s helped me learn more about what can go on and how much life is in one little area,” Shumate says.

Smithfield also has seen marked improvement in developments in the area, specifically through the installment of bioretention areas at K.S. Bank and Johnston Memorial Hospital.

“Generally it’s a nonevent for us,” says Ted Godwin, senior bank manager of K.S. Bank, regarding his experience with bioretention areas. And in the business of stormwater management, that’s exactly what professionals are seeking.

Bateman and Lord are ecstatic. The BMPs are installed in landscape that generally goes unnoticed. They work. Everybody’s happy.

### Kinstonians Know “Best”

A 1998 Urban Stormwater Management Conference, sponsored by NCCES Biological and Agricultural Engineering and North Carolina Sea Grant, spurred Kinston City officials into action.

“The pending rules we knew were coming, and we wanted to be able to show people that they weren’t as scary as they sounded. We also wanted the positive press in being proactive in order to counteract the negative press that was being received with regards to wastewater issues,” explains Scott Stevens, Kinston’s public services director.

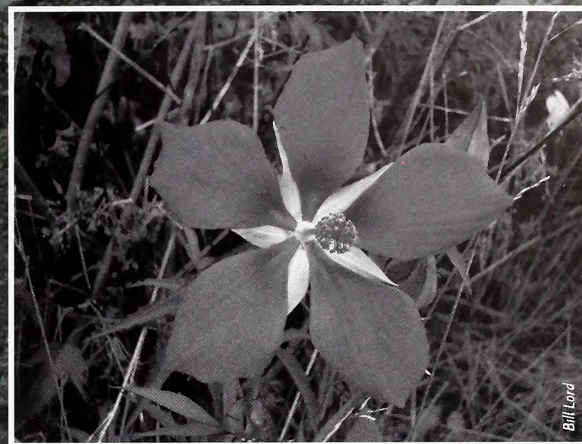
Compliance with the Neuse Rules has generated a mixed response from developers. As Kinston Water Resources Manager Stephen Miller explains, overall watershed policy has led many regional developers to expect stormwater regulations, while local developers are surprised that Kinston is affected.

Kinston emphasizes public education through the cable access channel, public hearings, brochures, and participation in the Cleanwater Education Partnership, which includes all governments that are required to meet the stormwater rules in the Neuse River Basin.

Public perception of standing stormwater is negative, but alternatives can be positive, Miller says. Bioretention areas are very popular because they lack a permanent water body and are less likely to attract mosquitoes and other nuisances, he adds.

Rain gardens are a type of bioretention area gaining favor because they give the developer design freedom. They can be landscaped to blend into the surrounding surface features or planted for quite the opposite effect — to serve as a functional aesthetic feature.

*C o n t i n u e d*



**TOP TO BOTTOM:** Rose mallow is another plant selection. • Smithfield is proud of this wetland’s capacity for public involvement and education. • This small rain garden in Kinston serves a huge, dual purpose — public demonstration and improvement of water quality. • Runoff flows from the surrounding high school campus into this Smithfield wetland demonstration.



Kinston installed the first rain garden in eastern North Carolina — at the Neuseway Nature Center in 1998. It was designed by NC State faculty and built by Kinston City crews for public demonstration.

The rain garden has proven to work. Runoff is directed into the garden from the rooftop of an adjacent building via piping. The garden consists of a depression landscaped with trees, shrubs and other water-tolerant plants, grass, and mulch overtop of sandy soil. The bowl shape of the rain garden is designed to hold the amount of water able to infiltrate and allow extra flow to run over the surrounding area.

Rain gardens are generally no more costly than traditional landscaping. Developers, such as East Carolina Mortgage in Kinston, have utilized them for control and treatment of runoff from parking lots and sidewalks.

Another successful BMP is a wetland retrofit on the Lenoir County Boat Ramp on U.S. 70. Construction of a boat ramp isolated an area that could collect and treat stormwater before re-entry into the Neuse.

Runoff from a parking lot flows down the boat ramp where it is then collected by a trench drain. The trench drain empties into a natural depression, or bowl-shaped area, that serves as a small wetland equipped to treat runoff. Water flows through the wetland and, once treated, drains through an outlet pipe into a ditch connected to the Neuse River.

The project was inexpensive. Costs amounted merely to the construction of the trench and the outlet pipe. Meanwhile Kinston gained the addition of a pocket wetland in an opportune and previously developed area.

Other innovative BMPs in place in Kinston are a permeable parking lot at the Alice Hannibal Building and a green roof in the Neuseway Nature Center.

The Adkin Branch Stream Restoration Project — the first phase of construction was completed in September 2003 by the N.C. Department of Transportation — and plans for a stormwater wetland at the Kinston Public Service Complex are current projects.

## Concrete Results in River Bend

River Bend literally is immersed in water quality issues.

The Trent River, a major tributary to the Neuse, borders the town to the south. There's a canal to the east, and one-third of the undeveloped land is located in the 100-year flood plain. This attractive residential community of approximately 3,000 is home to acres of wetland habitat.

Because of its small size, River Bend is unaffected directly by the Neuse stormwater rule and even the Phase II rules. Nevertheless, town leaders are proud of their proactive response to current environmental regulations and understand that they may be petitioned into the rules at a later date.

Their first step was to create a comprehensive plan with funding from a Coastal Area Management Act grant. This long-term plan, adopted in November 2000, is intended to serve as a living document that is updated frequently.

"The document is recognition that the town is a fragile wetland environment in need of protection," says John Kirkland, mayor of River Bend. With the comprehensive plan, River Bend has adopted a capital improvement plan and a town council action agenda to ensure that water quality endeavors are moving towards execution.

One of the town's first and most pressing needs was to increase the size of all storm pipes in the area, assisted by a Federal Emergency Management

Agency grant for mitigation of flood hazard. The larger pipes, complete with water-control structures, decrease flooding in the area and aid in water control.

Also, River Bend has installed a wetland demonstration site, a constructed wetland, a permeable parking lot, and various aesthetic and functional pond retrofits for treatment of stormwater runoff.

"River Bend approached the issue in a holistic sense. They really tried a lot of things," says NC State Biological and Agricultural Engineering Stormwater Specialist Bill Hunt.

The permeable parking lot at the town police station was a collaboration of the town, Hunt and the NCCES, DWR, and the Carteret Correctional Facility.

It was one of the first installations of a designed permeable pavement system in North Carolina — so new, components of this system were shipped from Maryland.

Composed of permeable interlocking concrete pavement laid by hand over sand, geotech fabric and more sand, the lot is expected to decrease creek erosion, runoff water temperatures, flooding, and pollutants caused by runoff from impervious surfaces.

Last summer, the lot contributed data to a larger study conducted across North Carolina and parts of Maryland to test the long-term effect of permeable pavement.

While alternative paving materials are not official BMPs, data collected from this lot, and others, may change their status in the future.

Through demonstration sites, pamphlets, town meetings, and continuation of a volunteer-based environment and waterways board, Kirkland plans to "get a greater percentage of citizens to understand the importance and need to comply to and understand the regulations."

The future creation of a half-mile nature walk in town also will enhance this understanding. The town owns 100 acres of wetlands and is devoted to leaving it in a natural state.

Policywise, officials are expecting to establish a maximum percentage of impervious surface for anyone planning to develop or modify existing property, says Town Manager Eric Pearson.

"We care very much that our stormwater is handled carefully and properly and are making good progress due to the guidance of our mayor and council."

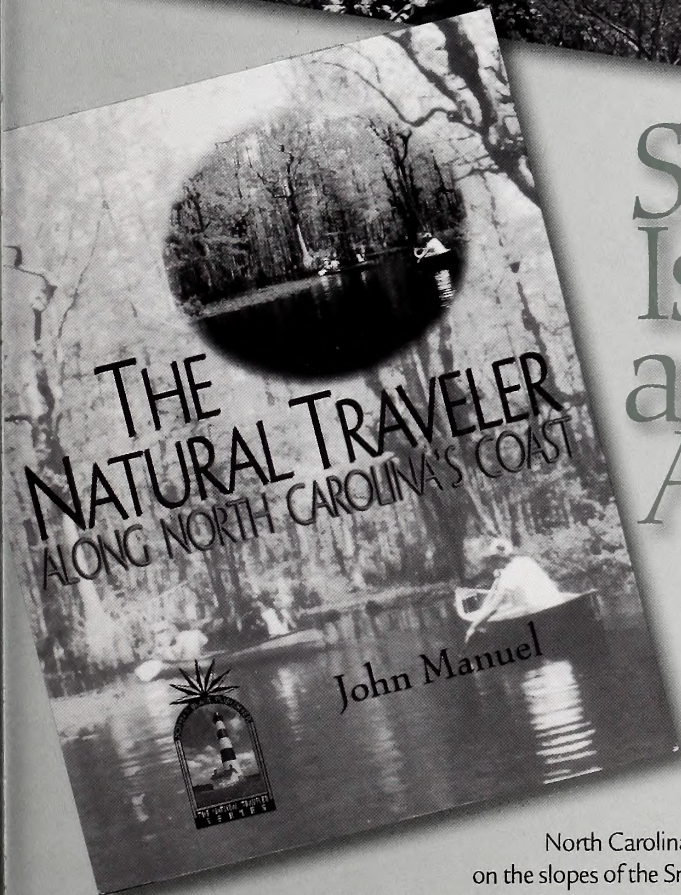
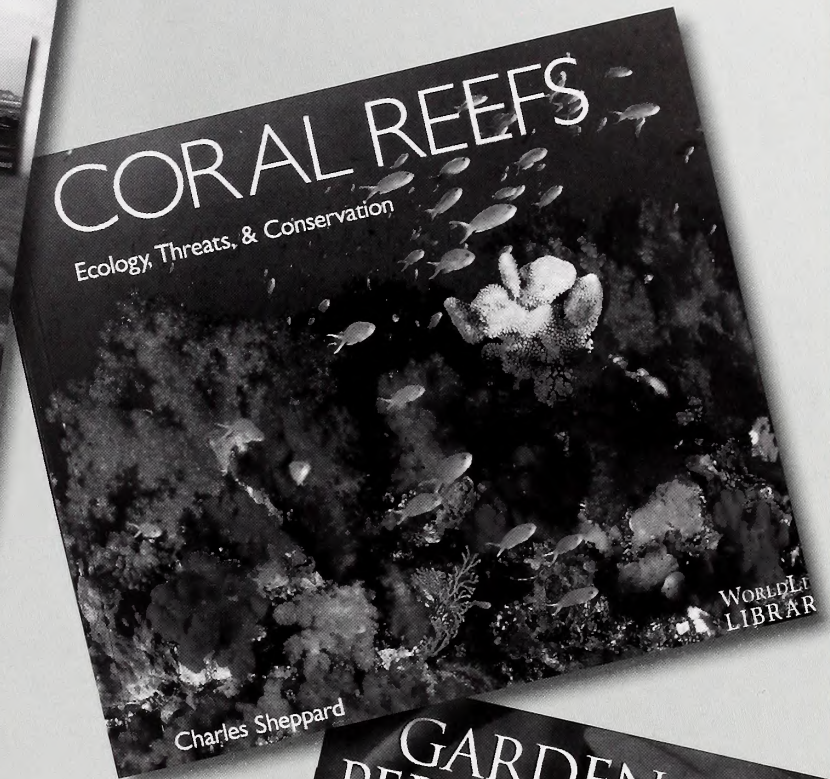
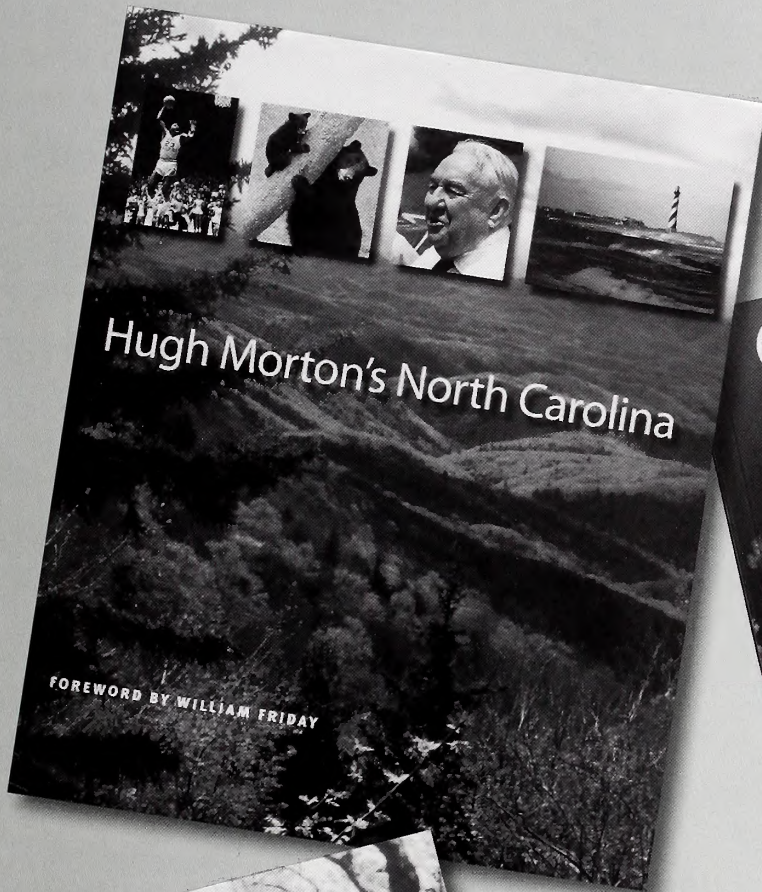
## A Basinwide Effort

Smithfield, Kinston and River Bend have contributed to the solution, but they are not alone in their efforts. "We have been successful in installing BMPs from Havelock to Durham and all the cities in between," says Hunt.

For information about stormwater management practices in the Neuse River Basin, go online to N.C. Cooperative Extension at [www.ces.ncsu.edu](http://www.ces.ncsu.edu), or the Neuse River Education Team at [www.neuse.ncsu.edu](http://www.neuse.ncsu.edu).

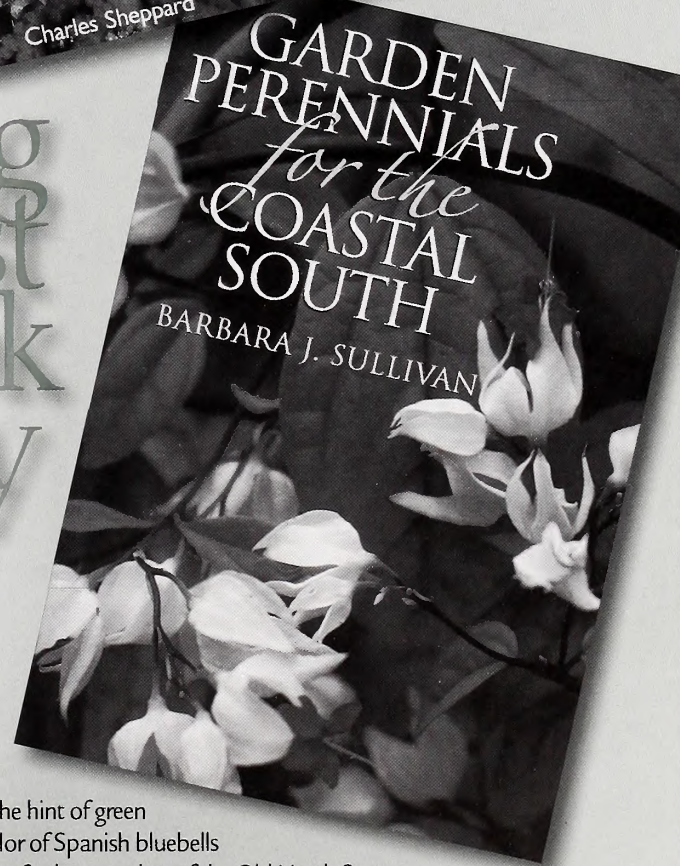
In Smithfield, contact Kenneth Bateman at 919/989-5380 or [ken\\_bateman@ncsu.edu](mailto:ken_bateman@ncsu.edu). In Kinston, contact Stephen Miller at 252/939-3287 or [steve.miller@ci.kinston.nc.us](mailto:steve.miller@ci.kinston.nc.us). In River Bend, contact John Kirkland at 252/638-3870 or [jkirkland@riverbendnc.org](mailto:jkirkland@riverbendnc.org). □





# Spring Is Just a Book Away

By Robin Sutton



All across North Carolina, life is budding. From the hint of green on the slopes of the Smokeys to the vibrant color of Spanish bluebells awakening in coastal gardens, we see the promise of new life in the farthest reaches of the Old North State. It's a time for planning, as we revive our senses through hiking expeditions or visions of bright perennials blossoming amidst the blue backdrop of sky or sea. Celebrate spring's arrival by delving into the pages of these four books that reveal the changing landscape.

Continued



## BOOK MARKET

• **HUGH MORTON'S NORTH CAROLINA**, by Hugh Morton. 2003. University of North Carolina Press, Chapel Hill, NC 27515-2288. 207 pages. Hardback, \$35. ISBN 0-8078-2832-7.

If you're looking for an up-close view of North Carolina's most celebrated scenes, browse through a copy of *Hugh Morton's North Carolina*. Without leaving your front porch rocker, you can view the state from the mountains to the coast — from the very best angles.

Before long, you'll be engaged in far more than a mere collection of photos. Morton's images and colloquial captions relate personal adventures that string together some of the most important events of 20th-century North Carolina.

One photo features former Sen. Jesse Helms and former Gov. Jim Hunt joined in cochairing the Save Cape Hatteras Lighthouse Committee, which raised more than \$500,000. "Perhaps folks thought that if they could work together, the cause must be a worthwhile one," Morton speculates.

Another coastal photo features then Gov. R. Gregg Cherry crowning movie actress Jacqueline White as queen of the first Azalea Festival at Wrightsville Beach in 1948. The crown was so elaborate, Morton says, that the confused governor placed it on the queen's head upside down.

Featuring images of Hurricane Hazel alongside legends such as Michael Jordan, Morton captures the gamut of North Carolina's natural phenomena. With a collection of more than 60 years of memories, Morton — president of Grandfather Mountain and recipient of the John Tyler Caldwell Award for the Humanities — appeals to all ages and varied interests. It's a book that evokes Tar Heel pride.

• **THE NATURAL TRAVELER ALONG NORTH CAROLINA'S COAST**, by John Manuel. 2003. John F. Blair, Publisher, Winston-Salem, NC 27103. 322 pages. Paperback, \$18.95. ISBN 0-89587-272-2.

For those ready to explore the season's new growth first-hand, John Manuel has written just the guide.

Hiking, fishing or sailing enthusiasts, will find the perfect spots — and what to do along the way. Anglers may want to refer to Manuel's chart,

"Fishing on the Outer Banks," listing the best times and locations for catching fish.

Visitors to downtown Wilmington will appreciate his detailed street map, highlighting pertinent tourist attractions. And readers with an affinity for wreck-diving may tune into Manuel's favorite spots for scoping out sunken ships.

Divided into four sections, the book leads off with a quick coastal history lesson that segues into three chapters featuring different geographic regions of North Carolina's coast: The Outer Banks, The Sound Country, and The Southern Coast.

For each region, Manuel features special attractions, from historic homes to state and national parks.

Leaving no stone unturned, he guides readers through a nature course, supplying information on wildlife such as the snow goose, the red-cockaded woodpecker and the red wolf.

And, if travelers work up an appetite while hang-gliding on Jockey's Ridge or decide to extend their visit on Bald Head Island an extra day, they should check out Manuel's selection of restaurants and lodgings to fit most any budget.

• **CORAL REEFS: ECOLOGY, THREATS & CONSERVATION**, by Charles Sheppard. 2002. Voyageur Press, Inc., Stillwater, MN 55082. 72 pages. Paperback, \$16.95. ISBN 0-89658-220-5.

Vibrant, diverse, aesthetically delicate, yet immensely sturdy — coral reefs are one of our waters' most exquisite hidden treasures. In his richly illustrated book, Sheppard gives readers a glimpse into the world of these powerful structures that have existed over 200 million years.

Though coral reefs are obviously resilient, Sheppard writes that in the span of one human lifetime, almost a third of our world's sparkling infrastructures have been killed due to abusive fishing practices in some countries, coastal development, water pollution and global warming.

Sheppard reminds readers that "People do not prosper when the environment around them fails."

By combining tales of his personal diving experience with stunning underwater photos that attest to the reefs' glory, Sheppard helps readers understand the history of these magnificent "giants" that are born of tiny, primitive polyps. He also shows

the vital role coral reefs play in global ecosystems — and the threats reefs face.

The author urges coastal lovers to take an active approach in saving these habitats that support numerous tropical marine communities.

Sheppard is full of hope for the future, believing strongly in the power of research and education. "Where both are done, the coastal people and the reef both become prime beneficiaries," he writes.

While this book focuses on reefs around the globe, it may entice readers to visit one of the state's aquariums to learn more about the rare corals that grow in deep waters off North Carolina's coast.

• **GARDEN PERENNIALS FOR THE COASTAL SOUTH**, by Barbara J. Sullivan. 2003. University of North Carolina Press, Chapel Hill, NC 27515-2288. 268 pages. Paperback, \$19.95. ISBN 0-8078-5473-5.

Sprinkling sound advice with gardening humor and sparkling pictures, Sullivan motivates the most brown-thumbed gardener to grab a pair of gloves and a shovel.

She buries any intimidation readers may have with the assurance that the coastal South has such a wide variety of choices in perennials, shrubs and trees that it's virtually impossible to unearth anything but a breathtaking garden.

By following her colorful zone maps, gardeners discover the temperatures certain perennials can tolerate based on their location.

Once gardeners choose the plants that best suit their yards, they can check out Sullivan's A-Z guide, listing cultivation requirements, growing habits, and other specifics for more than 1,000 varieties.

Sullivan also helps readers coordinate perennials with companion plants. "Perennials need company in the garden, whether it be mingling with ferns or sharing the glory with a beautiful wall of creeping fig," Sullivan notes.

She also draws attention to annuals such as vines, bulbs, herbs and groundcovers in a special chapter devoted to the garden's overall scheme.

Sullivan writes, "Spring is the only season that leads us to believe perfection is truly possible."

The bold, vivid photographs that blossom from the pages can be mirrored in readers' gardens — with guidance from this delightful gardening resource book. □



ABOVE: The diamond pattern on the Cape Lookout Lighthouse distinguishes it from other lighthouses.

# Cape Lookout Lighthouse Will Get Facelift

By Ann Green

As Madge Guthrie looks up at diamond patterns on the Cape Lookout Lighthouse, she recalls the lighthouse as a playhouse for youngsters on Core Banks.

"As a child, I would run up and down the stairs all day," says Guthrie, whose mother was the last teacher at the Lookout school. "There were 300 or 400 people living on the island until the '33 hurricane cut the island into two pieces, making Shackleford and Cape Lookout islands. It also destroyed the fertility of the land, bringing the final exodus from the Cape and the Banks."

Guthrie and others shared their memories at a transfer of the lighthouse from the U.S. Coast Guard to the National Park Service last year.

For years, the lighthouse has been a landmark to mariners, warning boaters of the treacherous 10-mile shoals extending off the Cape.

Superintendent Bob Vogel says that the park service plans to restore the lighthouse — which is located on Core Banks along Cape Lookout National Seashore near Beaufort — so that the public can go inside.

"The restoration process will take the support of the entire community and will undoubtedly take several years to complete," says Vogel. "Early estimates for the lighthouse restoration are \$1.5 to \$2 million. If you consider that the lighthouse was built in 1859, it is in remarkably good condition. The cast iron stairs need to be

made safer for visitors."

The nonprofit Friends of Cape Lookout National Seashore was formed to support the park service's efforts to preserve, restore and enhance the seashore that stretches from Portsmouth Village to Shackleford Banks.

One of the new group's first missions is to partner with the Outer Banks Lighthouse Society to gain support and funds for the renovation.

"The lighthouse is the symbol of the park," says Richard Meissner, spokesperson for the Friends of Cape Lookout National Seashore. "Certainly, there is a lot of public interest in having the lighthouse painted. She is a noble lady and needs tender-loving care."

*Continued*



## PEOPLE & PLACES

### Lighthouse History

In the late 1700s, the dangers of the shoals were compounded by the lack of any landmark that could be used for easy identification of the area. The land was so low that — even in the best weather — a ship might be on the shoals before the captain realized he was close to land.

In the early 1800s, Congress authorized construction of a lighthouse on Cape Lookout. Though it is not certain when construction began, the original lighthouse was completed and lit in 1812. The 96-foot high brick tower was eventually painted with red and white horizontal stripes.

The original lighthouse proved to be inadequate to protect passing ships, because the light was too low for mariners to view from the water.

In 1857, the government ordered a new and taller lighthouse to be built. An impressive 150 feet tall, the new lighthouse was the first of its kind built on the Outer Banks.

“The Cape Lookout Lighthouse was a prototype for the Cape Hatteras and Bodie lighthouses,” says Vogel.

The present structure was completed in 1859. Its red brick tower was sturdier and taller than the original structure of 1812. The lantern on the second tower contained a first-order Fresnel lens that displayed a fixed light that could be seen up to 18 miles offshore. Today, a pile of rubble is all that remains of the original 1812 lighthouse.

After the outbreak of the Civil War, retreating Confederate troops vandalized the tower and damaged the Fresnel lens, making the lighthouse useless to the Union ships after nightfall.

By 1872, new light towers at Cape Hatteras and Bodie Island were built. Since these two lighthouses looked the same as the Cape Lookout tower from a distance, officials decided to paint each one with a different daymark. The distinctive diamond pattern was painted on the Lookout tower in 1873.

For many years, a lighthouse keeper lived next door to the tower and tended to the day-to-day operations — from keeping the light clean and lit to clearing off the windows in bad weather. The keeper kept the light operating from 4 p.m. to a little after dawn.

“I used to carry the whale oil up for the lightkeeper, Mr. Van Willis, along with his son, Ray,” says David Yeomans who spent his childhood on the Cape. “It took four gallons of whale oil to keep the light burning through the night. Mr. Van would stand on the ground and hoist the whale oil up the lighthouse in a four-gallon can.

“When the oil came up, we would take it through the railing and then wait for Mr. Van and let him



Photos by Scott Taylor



put it where he wanted it,” adds Yeomans. “I have run up and down the stairs hundreds of times.”

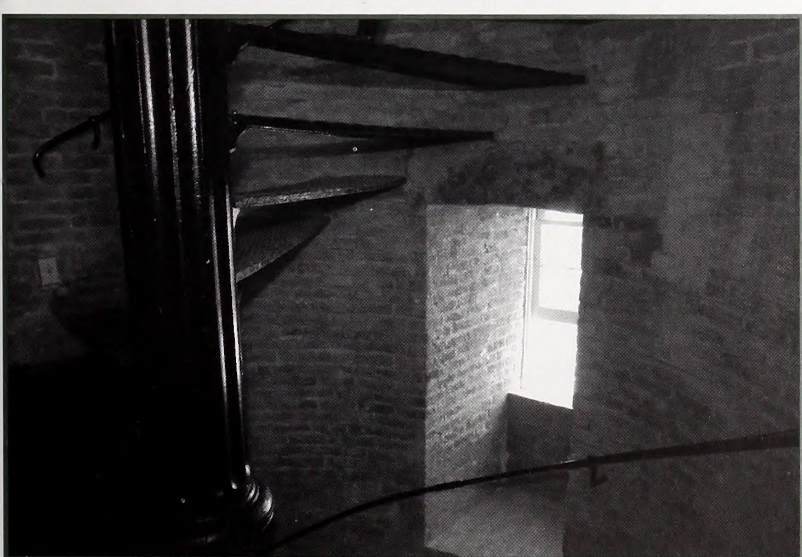
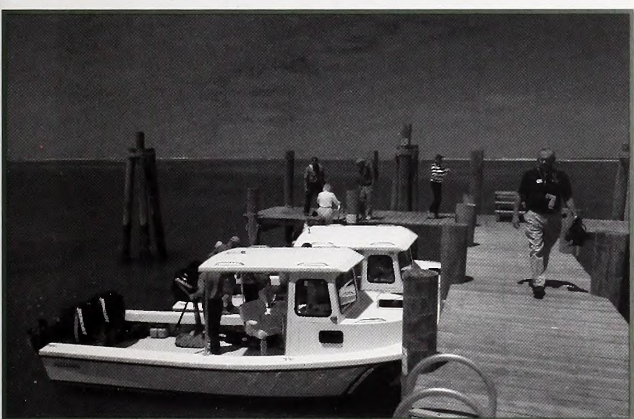
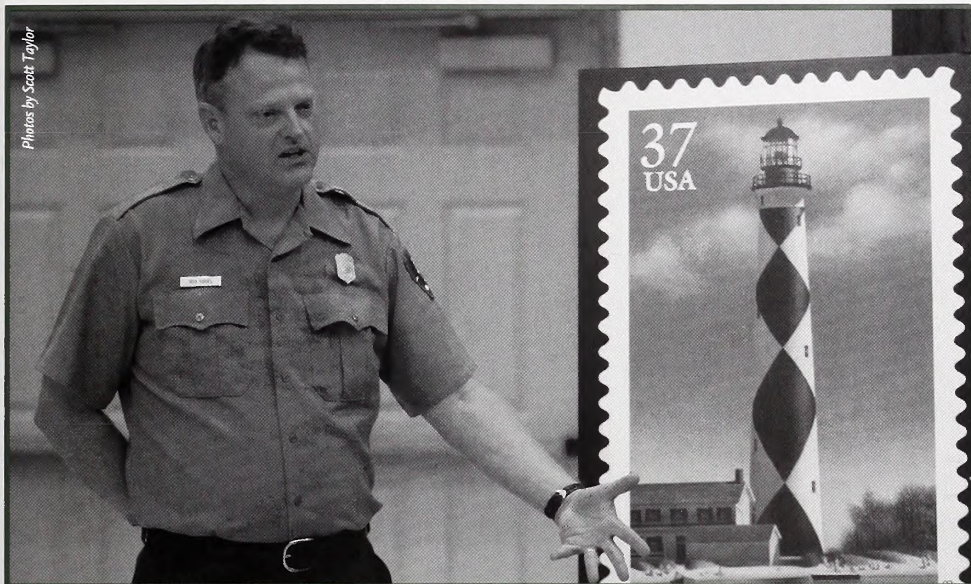
During World War II, the Cape was abuzz with military activity, and the lighthouse was shut down to protect U.S. Army troops. “There was a blackout on the island then,” says Guthrie. “They wouldn’t let us go on the Cape except during daylight.”

In 1950, the lighthouse was automated. Now, the light turns every 15 seconds.



TOP TO BOTTOM: Madge Guthrie played in the lighthouse as a child. David Yeomans and Margaret Ann Gillikin share their memories of growing up near the lighthouse. The view from the top of the lighthouse is spectacular.





TOP TO BOTTOM: Superintendent Bob Vogel participated in the transfer ceremony of the lighthouse from the U.S. Coast Guard to the National Park Service. To get to the lighthouse, folks go by private boat or ferry. Visitors must climb 201 steps to get to the top of the lighthouse.

### Modern Memories

During the transfer ceremony, visitors take a peek inside the old lighthouse. They climb up a circular cast iron staircase. Toward the top of the 201 steps, they must duck to maneuver through the area to reach the observation deck.

Once at the top, they can see all the way to Morehead City.

"This is a great view," says Vogel. "You get to see how shallow

the water is and how tricky the channel is to navigate. You also get a great sense of geography by looking at the natural cove called 'The Bite' and its

relationship to Shackleford Banks."

Along the Outer Banks, Cape Lookout lighthouse stories abound. Guthrie, who stayed in a little house on the Cape where lighthouse beams washed across her bedroom windows, likes to recount when her friend — the lighthouse keeper's daughter — was continually aggravated by a cat.

"So the girl took the cat and climbed to the top of the tower," says Guthrie. "She threw the cat all the way to the ground — and it landed on all four feet unharmed. I always figured that the cat had eight lives left."

One of Yeomans' favorite stories is about Billy Hancock, the fastest runner on Cape Lookout.

"In 1865, contractors were hired to tear down the old lighthouse at the Cape," he says. "After much calculation, the precise brick was located — that would topple the tower."

As Yeomans tells it, Billy was hired to strike the fateful blow to that one brick — and then run like crazy as the lighthouse fell.

### Lookout Logistics

The Cape Lookout Lighthouse can be viewed from Harkers Island, or visitors can take a private passenger ferry to South Core Banks near Bardens Inlet. The tower is open to the public only during special events.

The Cape Lookout Lighthouse Keepers' Quarters is open April 1 to Nov. 24. Exhibits focus on lighthouse history, early shipwrecks and rescues.

For a list of ferry services, call the Cape Lookout National Seashore at 252/728-2250. For more information about the lighthouse, visit: [www.nps.gov/calor](http://www.nps.gov/calor). □

### LIGHTHOUSE OPEN HOUSES

Want to look inside the Cape Lookout Lighthouse? Below are some open houses for the public:

- March 13 — Cape Lookout Seashore Anniversary
- June 12 — Cape Lookout Lighthouse Transfer Anniversary
- Aug. 7 — National Lighthouse Day
- Nov. 6 — Cape Lookout Lighthouse Anniversary.

For more information, call 252/728-2250, or visit the Web: [www.nps.gov/calor](http://www.nps.gov/calor).

— A. G.



A top-down view of a platter of oysters on ice with lemon wedges. The oysters are arranged in a circular pattern, with several lemon wedges interspersed among them. The background is a light blue surface, possibly a tray or a tablecloth. The oysters are fresh and glistening, with their shells open to reveal the meat inside. The lemon wedges are bright yellow and add a pop of color to the scene. The overall composition is clean and appetizing.

SEA  
SCIENCE

# Value-Added Products Boost Sales at Seafood Companies

By Ann Green • Photos by Scott Taylor





Inside a modern room at the top of Rose Bay Oyster Company headquarters, Connell Purvis pitches his newest product — a “lightly breaded and crisp” oyster wrapped in bacon.

“We don’t use bits and pieces of oysters,” says Purvis while standing near a window that overlooks Rose Bay in Swan Quarter. “We use a whole oyster for this product. Also, there is less than 10 percent breading. This will be our first bacon-wrapped oyster.”

The new product is just one item that Purvis showcases to Canadian seafood buyers on a

marketing trip sponsored by the N.C. Department of Agriculture and Consumer Services. Purvis also touts oyster stew made from his mama’s “old-fashioned recipe” and steamed oysters.

The bacon-wrapped oyster, which is a “value-added product,” will debut in March at the 2004 International Boston Seafood Show. Barry Nash, North Carolina Sea Grant seafood technology and marketing specialist, guided the development of the new seafood item.

Value-added products are processed to create new forms, flavors and textures from a variety of

raw ingredients. Nash says that “value,” in this context, means “using processing techniques, novel ingredients or packaging to enhance the health attributes, the sensory characteristics, or the shelf life of food.”

Traditionally, the Rose Bay Oyster product list consisted of seafood products to be used as ingredients, including fresh-shucked oysters.

“We are aggressively moving into value-added products,” says Purvis, general manager of Rose Bay Oyster Company. “This company has

*Continued*



## SEA SCIENCE

*CLOCKWISE FROM TOP LEFT: Bacon-wrapped oysters are a new value-added product to be distributed across the country. • Canadian seafood buyers toured Rose Bay Oyster Company. • The visitors sampled bacon-wrapped oysters, oyster stew and steamed oysters. • They also watched workers shucking oysters.*

been around for 75 years. We are at a real crossroads. If we don't come out with something now, we will be gone."

Of the three items showcased to Canadian buyers, the oyster seemed to be the most appealing. "Everybody likes bacon-wrapped items in the food industry," says Mark Tytel of Export Packers in Ontario. "It has added value to whole oysters. The hardest part will be educating consumers about the product."

### New Seafood Projects

At North Carolina seafood companies, more value-added projects are on the horizon.

For more than 18 months, Nash has been working with Sea Safari Ltd. and Carolina Seafood Ventures LLC to develop a line of products, including a devil crab, crayfish cake and crab cake. The process includes concept development, formulating the product, sensory testing, analyses for nutritional labeling, and shelf-life evaluations.

The value-added products were developed with funding from the North Carolina Fishery Resource Grant Program (FRG).

With the competition from foreign markets, creating prepared seafood offers more profit opportunities to domestic processors than selling seafood commodities, according to Nash.

"When creating new products for the food service industry, American seafood processors can identify trends and satisfy the needs of American consumers faster than foreigners," he adds.

In North Carolina, blue crabs are the most economically valuable fishery. However, landings

have declined, while imports of crabmeat have increased.

This combination has led to half of the state's crab processors shutting down in the last five years, according to the N.C. Division of Marine Fisheries.

To counteract the decline in the sale of North Carolina crabmeat, processors are turning to new products.

In 2000, Jimmy Johnson and his wife, Donna, sold their crab processing business in Washington because it had become too difficult to compete with imported products on a cost basis and virtually impossible to make a profit.

"It got to the point where you could not solely produce crabmeat and remain profitable," says Johnson, who then joined Sea Safari Ltd in Belhaven. "We had to sell the business or lose everything we had worked our whole lives for."

Johnson joined Raleigh marketing consultant Laura Ritter, Purvis and Nash in a product evaluation of several items, including a

spicy crayfish cake, at the sensory laboratory at North Carolina State University's Food Science Department.

"We can raise or lower the heat level to moderate the spiciness of this crayfish cake," says Nash.

For the lobster morsel, the tasters agree that it needs heavier breading.

The processors have chosen products that have the greatest probability for success in the marketplace, according to Purvis. "We looked at whether the price is compatible with other products," he adds. "We are specifically trying to identify niches for seafood."

Large food companies have many chicken and vegetable entrees but not many seafood items, says Purvis.

To better market the products, Carolina Seafood Ventures has hired a North Carolina-based food broker. "We are finalizing product development and trade programs and figuring out where to distribute the products," says Ritter.





**Variety, Flavor, Shelf Life**

FRG is a unique program that supports the development of value-added items. Funded by the North Carolina General Assembly and administered by North Carolina Sea Grant, the program helps people in the fishing and seafood industries to develop ideas for improving their businesses and the resources they depend upon.

Nash points to the success of Wanchese Fish Company, Inc. in developing the Scallop Medallion through a previous FRG project, using enzymatic cold-binding to create large scallops from smaller, less profitable ones.

The Sea Safari FRG began as a project to find out how textured vegetable proteins can add value to processed or cooked seafood, Nash says. He and Sarah Harris, Sea Safari's former director of research and development, proposed creating four new products: shrimp and crab appetizers, an inexpensive crab cake to target an economy market, and a higher priced crab cake to appeal to more affluent customers who shop online.

Results exceeded expectations. The company's list of value-added seafood grew from four to 26.

Nash also is helping Don and Doug Cross of Pamlico Packing Company in Vandemere to develop a line of seafood dips and salads that offers a 30-day refrigerated shelf life. The preservation system, which controls bacteria and growth, was developed through an FRG project.

Doug Cross says that he turned to value-added products when the raw seafood business began to fall off.

"I think value-added is the wave of the future," says Cross. "Consumers are looking for an easy way out at lunch or dinnertime."

Pamlico Packing's new line of 12 value-added products, including shrimp pasta salad, cajun crayfish pimento cheese and hot crabmeat dip, will debut this spring.

Nash also will use the new preservation system to help Jerry Smith, "Chef Dirt" of Dirt Enterprises, Inc. in Harbinger, to extend the shelf

life of devil crab, smoked salmon, shrimp, crab and tuna dips now sold in grocery stores along the Outer Banks. All the dips are made from fresh ingredients.

"The products now have a 14-day shelf life," says Smith. "I am getting ready to expand (the distribution of) the line to Washington, D.C., Virginia and Baltimore and need to lengthen the shelf life beyond two weeks."

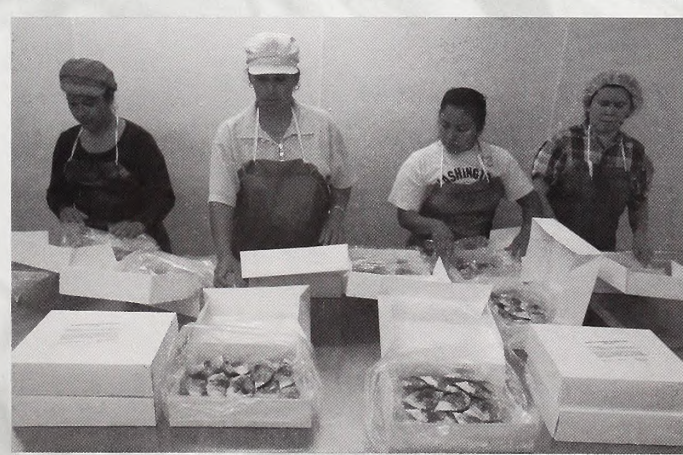
Nash's work includes items that compliment seafood. Recently, he helped Carteret County food entrepreneur Priscilla Livingston reformulate a line of vinegarettes that can be used on seafood and meats for the growing specialty foods market.

"Priscilla's sauces were formulated with costly ingredients such as olive oil," says Nash. "I worked with her on using lower-cost ingredients like canola oil that don't sacrifice product quality. Also, I used an emulsifier to prevent oil and vinegar separation, thereby enhancing the visual quality of her products. In addition, I helped her convert her recipes so that they could be batched,

cooked and packed on a mass-production basis."

Canadian seafood buyers who have traditionally bought N.C. seafood commodities say they foresee a bright future for a wide variety of value-added products.

"Value-added products are useful, especially for small restaurants and banquets," says Gus Nikoletsos of City Fish Market in Toronto. "In Canada, the banquet market is huge." □



CLOCKWISE FROM TOP LEFT: Barry Nash (center) has helped Sea Safari and other seafood companies develop value-added products. • One of Sea Safari's tasty products is a deviled crab. • Workers at Sea Safari package crab products. • Sarah Harris helped develop the crab cake and other products that are packaged at the plant in Belhaven.





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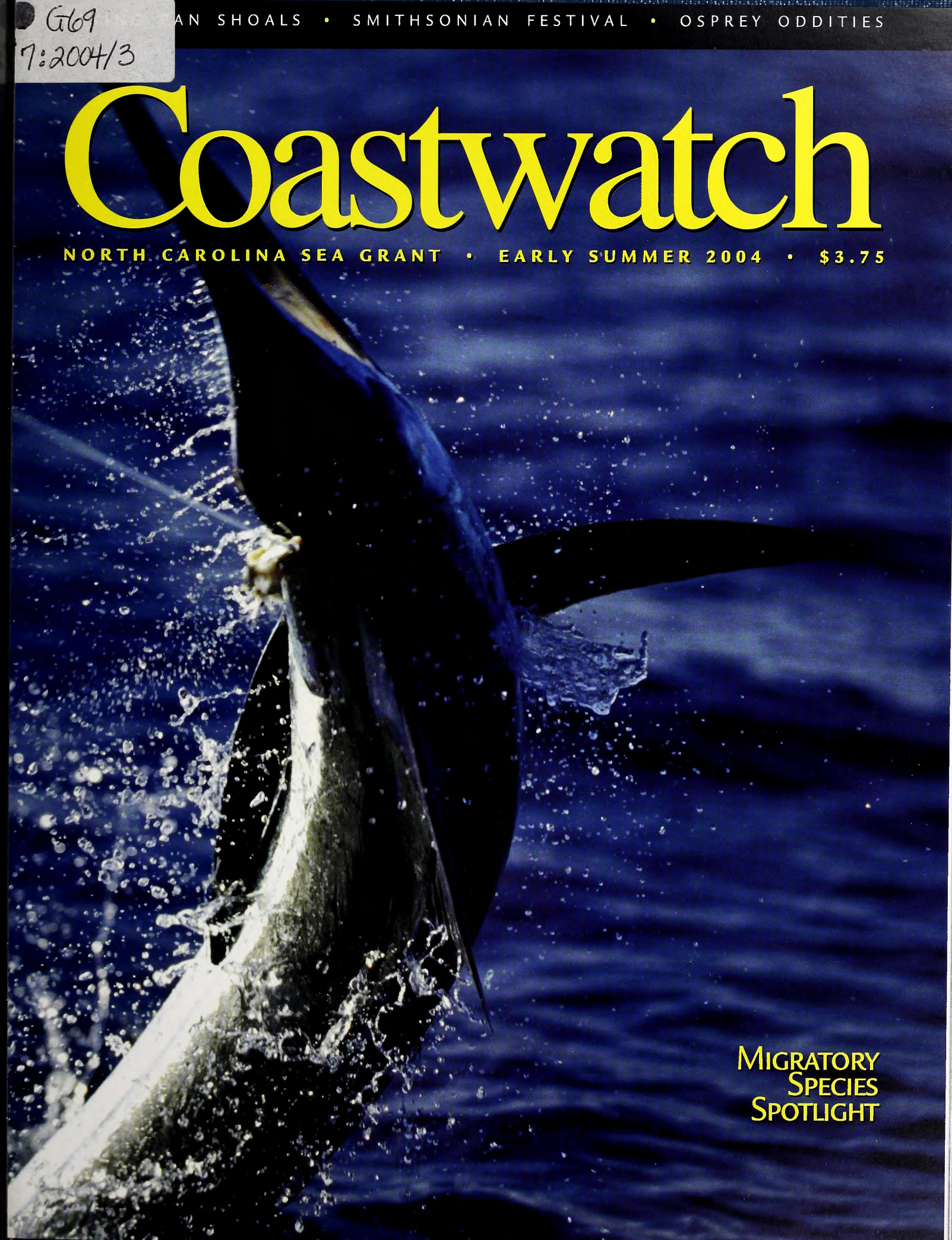


AN SHOALS • SMITHSONIAN FESTIVAL • OSPREY ODDITIES

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# Coastwatch

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MIGRATORY  
SPECIES  
SPOTLIGHT



## Partners in Beach Safety

As summer swings into full gear, millions will visit North Carolina beaches — and coastlines around the country — to enjoy the sun and surf.

This year's Beach Safety Week, beginning May 24, includes the launch of a new rip current safety awareness campaign developed through a National Oceanic and Atmospheric Administration (NOAA)/U.S. Lifesaving Association (USLA) partnership.

Watch local and national media that week for news stories and a new public service announcement featuring tips on how to "Break the Grip of the Rip." Also, new national signs, brochures and an updated Web site will give a consistent rip current safety message across the country.

NOAA partners are the Office of Oceanic and Atmospheric Research, which includes the National Sea Grant College Program; the Sea Grant Network of 30 programs around the country; the National Weather Service; and the National Ocean Service.

USLA, which represents thousands of lifeguards, provides training and certification programs — and USLA members make many beaches safer places to visit.

A combined NOAA-USLA safety campaign effort brings together the latest rip current research and forecasting efforts with outreach materials, on-the-beach education and, when necessary, rescues.

Countless additional partner agencies and groups will join the awareness efforts at the state and local level — including beach patrols, media, beach communities, chambers of commerce, hotel/motel associations, homeowner associations, schools and tourist bureaus.

Personally, I have witnessed similar successful rip current partnerships in North Carolina, from Currituck to Brunswick counties.



Herman Lemkford

For example, Wrightsville Beach was among the first towns to join a rip current sign effort led by Sea Grant and the Wilmington NWS office, which is a leader in rip current forecasting.

Efforts expanded as community leaders added beach flag warning information to new stickers for trash cans along the strand, and requested brochures for all hotel/motel rooms in the county. Soon, Wrightsville Beach hopes to have a full-time, year-round ocean rescue manager — selected through a national search announced through the USLA network.

I expect the national NOAA-USLA campaign to give added momentum to these and similar partnerships along the East, West and Gulf coasts and the Great Lakes.

In addition, I have had the honor of serving on the national NOAA-USLA rip current task force that has developed the new materials and is planning the national news conference to be held Monday, May 24.

I have worked with a dedicated team of professionals, whose focus on beach safety is unparalleled. These include our own Spencer Rogers, North Carolina Sea Grant's coastal erosion specialist who has worked on rip current safety topics for more than 25 years. He was among the organizers of a rip current science workshop in April.

Our efforts will be highlighted during Beach Safety Week 2004. The message, I hope, is one that will resound — and save lives — for years to come.

*Katie Mosher, Managing Editor*

*PS: Media, teachers, town officials and others interested in downlinking the UNC-TV satellite broadcast of the May 24 news conference should check for media advisories to be posted at [www.ncseagrant.org](http://www.ncseagrant.org).*

### I N T H I S I S S U E

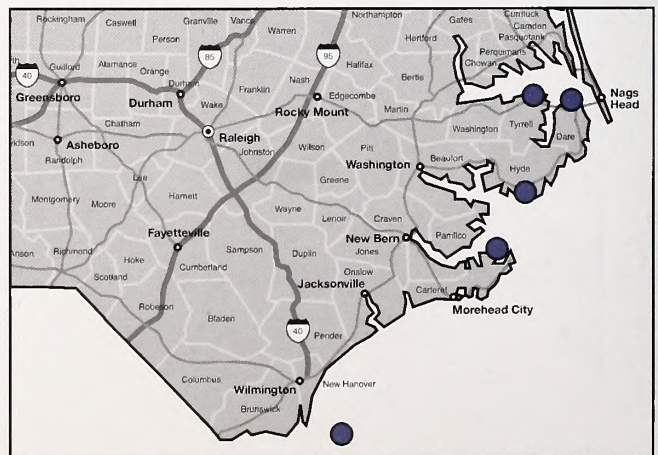
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*North Carolina's diverse coast offers countless interesting subjects. The large dots on the locator map indicate story settings in this issue — including Dare, Tyrell and Carteret counties, and Frying Pan Shoals.*







# Coastwatch

N.C. DOCUMENTS  
CLEARINGHOUSE

FEATURES

MAY 26 2004

COASTAL TIDINGS .....STATE LIBRARY OF NORTH CAROLINA  
RALEIGH

**FISHING THE DEEP-BLUE SEA:  
NEW FEDERAL PERMIT REQUIRED FOR  
HIGHLY MIGRATORY SPECIES**

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# Coastwatch

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The North Carolina Sea Grant College Program is a federal/state program that promotes stewardship 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, North Carolina Sea Grant supports research projects, a 15-member extension program and a communications staff. Ron Hodson 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. *Coastwatch* (ISSN 1068-784X) is published six times a year by the North Carolina Sea Grant College Program, North Carolina State University, Box 8605, Raleigh, North Carolina 27695-8605. Telephone: 919/515-2454. Fax: 919/515-7095. Subscriptions are \$15. E-mail: [katie\\_mosher@ncsu.edu](mailto:katie_mosher@ncsu.edu) World Wide Web address: <http://www.ncseagrant.org> Periodical Postage paid at Raleigh, N.C.

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Front cover photo of marlin by Scott Kerrigan. © Scott Kerrigan.com.  
Table of Contents photo of blue crabs by Michael Halminski.  
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## COASTAL TIDINGS

### Stop That Plant

Researchers are suggesting that *Vitex rotundifolia*, or beach vitex, could become the “kudzu of the beach.”

“Now is a good time to discourage its use in North Carolina before it becomes a problem,” says David Nash, N.C. Cooperative Extension coastal management specialist based in New Hanover County.

Beach vitex has been studied extensively in South Carolina, where scientists were alarmed by its invasive character. The plant, a fast-growing vine with purple flowers, was introduced in this country from Korea as a salt-resistant landscape plant.

But the aggressive plant often “escapes” into nearby dunes. And that, Nash says, could spell trouble for native sea oats, bitter panicum, seashore elder and sea beach amaranth.

The worst case scenario is beach vitex taking over frontal dunes and crowding out the native plants that do a much better job at trapping the blowing sand and building the dunes. Nash says he has seen beach vitex completely overtake the dune, crowding out native plants and potentially blocking turtle nesting. Moreover, the winter appearance, a mass of woody stems, is not attractive.

Though beach vitex is not widespread in North Carolina at this point, it has been spotted in Pender, New Hanover and Brunswick counties.

To learn more about noninvasive coastal landscape plants, contact Nash at 910/452-6393 or [danash@nhcgov.com](mailto:danash@nhcgov.com). To learn about appropriate dune plants, purchase *The Dune Book* (UNC-SG-03-03) by Nash and Sea Grant's Spencer Rogers. Send a check in the amount of \$5 to: North Carolina Sea Grant, North Carolina State University, Campus Box 8605, Raleigh, NC 27695-8605.

— P.S.



Photos by David Nash



*Beach vitex is a fast-growing vine with purple flowers. Its invasive nature could spell trouble for native dune plants.*

### In the Next Issue of *Coastwatch*

Ann Green travels with geologist Stan Riggs to Outer Banks' estuarine shorelines featured in a new North Carolina Sea Grant book. Writer Lilly Loughner and photographer Tasha Petty explain why Jacksonville's Wilson Bay project is a water quality model. And just in time for your beach trip — shrimp recipes from *Mariner's Menu*.



## COASTAL TIDINGS

### Come Fly with Me

The 22nd annual Rogallo Kite Festival soars June 10-12 at Jockey's Ridge State Park at Nags Head.

The festival honors Francis and Gertrude Rogallo, inventors of the flexible delta wing — an innovation that gave birth to hang gliding. In 1971, hang gliders utilizing the flexible wing design appeared in the world's first hang glider meet — marking a milestone in the evolution of nonpowered flight.

Their flexible wing design conforms with



wind flow, provides more stability than fixed surfaces, and enables maximum lift.

Like the Wright Brothers before them, the Rogallos tested their invention at the Outer Banks.

The family festival is free and open to the public. Sponsored by the Outer Banks Tourist Bureau and Kitty Hawk Kites, it will feature 100-foot specialty kites, kite-making and history exhibits.

For information, call 252/441-1719, ext. 208. Or, e-mail [jstein@kittyhawk.com](mailto:jstein@kittyhawk.com). —P.S.

### Discover 'The Amazing Oyster'

*The Amazing Oyster: A Keystone Species for the Health of Our Coast*, a North Carolina Sea Grant production, explores the past, present and future of the state's native oyster, *Crassostrea virginica*.

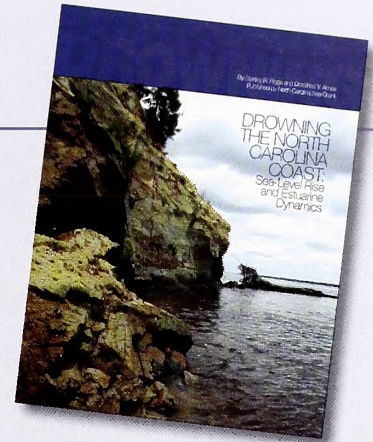
The documentary, in DVD format, was written and produced by Jason Talley, a former Sea Grant intern and recent graduate of North Carolina State University.

Talley visits oyster harvesters, researchers, government officials and coastal organizations to present a comprehensive view of the oyster's ecological, economic and cultural value.

The hour-long video can be played in its entirety or in individual interview segments — from an 87-year-old oysterman in Dare County to Sea Grant researchers looking for ways to restore the once-abundant bivalve.

Copies of the DVD, UNC-SG-04-01, may be purchased for \$10, including postage and handling. Checks only, no credit cards. Send checks to: North Carolina Sea Grant, North Carolina State University, Campus Box 8605, Raleigh, NC 27695-8605.

—P.S.



### New Book Focuses on Coastal Erosion

Along North Carolina's extensive estuarine shoreline, erosion is an ongoing natural process. While various methods are available to combat erosion and land loss, none are permanent solutions, and all have significant environmental trade-offs.

*Drowning the North Carolina Coast: Sea-Level Rise and Estuarine Dynamics*, by Stanley R. Riggs and Dorothea V. Ames, provides in-depth information about erosion rates along North Carolina's estuarine shoreline. Some of the sites include the Duck Field Research Facility and "Isabel Inlet" area in Dare County, the Lowlands in Pamlico County, Bay Hills in Beaufort County, and the Chowan River bluffs in Bertie County.

In the new North Carolina Sea Grant publication, the East Carolina University authors look at sea-level rise and its effect on shoreline change, as well as the dynamics of the estuarine system.

The 152-page book — with full-color photos and maps, along with comprehensive text, figures and tables — is a ready reference for property owners, government officials, community planners, resource managers and educators. The book was funded by grants from NOAA, the N.C. Division of Coastal Management and the Albemarle-Pamlico National Estuary Program.

Single copies are \$25. Credit cards are not accepted. To order a copy, ask for publication number UNC-SG-03-04 and send a check to: North Carolina Sea Grant, North Carolina State University, Campus Box 8605, Raleigh, NC 27695-8605. —A.G.



## Photo Exhibit

During the 1940s and 1950s, photographer Roger P. Meekins chronicled life on the Outer Banks — from square dancing in Hatteras to net mending in Stumpy Point.

Meekins' photos are on display through August at the Outer Banks History Center across from the Manteo waterfront at Roanoke Island Festival Park. "Aerial Views, Things in the News, The Beach of Yesteryear, and Past Happenings Here: Black and White Photographs by Roger P. Meekins" features 50 images of Dare County and the surrounding area.

Meekins, the eldest son of *The Coastland Times* founder D. Victor Meekins, was 15 when he began taking photos for the newspaper as well as at local weddings and events. Because there were no bridges over Oregon Inlet and the Croatan Sound, many of the images are aerial views.

For more information, call 252/473-2655 or e-mail [obhc@ncmail.net](mailto:obhc@ncmail.net). — A.G.

## A Call for Oyster Gardeners

The North Carolina Division of Marine Fisheries (DMF) is soliciting up to 50 participants for a pilot project that would allow them to grow oysters in bags or cages under private docks in approved coastal waters.

DMF will select applicants based on geographic distribution and suitability of waters. Only participants with docks located in waters approved or conditionally approved by the N.C. Office of Shellfish Sanitation will be allowed to participate in the project.

Docks located in waters permanently closed to shellfish harvest will not be considered due to health concerns.

For information, contact Craig Hardy at DMF headquarters in Morehead City at [craig.hardy@ncmail.net](mailto:craig.hardy@ncmail.net). Or call 800/682-2632 or 252/726-7021. — P.S.



*Surf fishing is synonymous with the Outer Banks. For more than a half-century, a sportfishing school has been offering know-how to novices and experts alike.*

## 52nd Annual Sportfishing School

Registration is open for the 52nd annual Sportfishing School, June 6-10, at Cape Hatteras. Sponsored by North Carolina State University's Office of Professional Development, the course includes classroom instruction, two fishing excursions on the Gulf Stream, surf fishing and social events.

The school is open to anyone interested in sportfishing regardless of age. A registered adult, however, must accompany persons under the age of 18.

Participants will learn about equipment, bait, big game fishing, surf fishing, slow trolling, and the use of circle hooks for ethical angling.

The instructors include recreational fishing experts Mac Currin and Joe Malat. For information, or to register, e-mail [continuingeducation@ncsu.edu](mailto:continuingeducation@ncsu.edu). Or call 919/515-2261. — P.S.

## Ocean Bowl Winners

Washington High School in Washington took top honors at the 2004 North Carolina Ocean Sciences Bowl at the University of North Carolina at Wilmington.

East Carteret High School in Beaufort placed second, and Williams High School in Burlington won third place.

More than 20 high schools participated in the academic competition, known as the Blue Heron Bowl, for high school students. The

bowl focuses on ocean-related science, technology, history and navigation.

The North Carolina winners competed in the National Ocean Sciences Bowl in April in Charleston, S.C.

The National Oceanic and Atmospheric Administration, the National Sea Grant Program and others support the N.C. bowl.

To find out more about Blue Heron Bowl, visit the Web: [www.uncwil.edu/cmsr/nosb/](http://www.uncwil.edu/cmsr/nosb/).

— A.G.



## Kate Ardizone Joins Sea Grant Team

Timing is everything. And, it's no coincidence that Kate Ardizone has joined North Carolina Sea Grant as water quality planning specialist when coastal communities are revising their land-use plans under new Coastal Area Management Act (CAMA) rules.



period by Sea Grant and the N.C. Department of Environment and Natural Resources' Division of Water Quality (DWQ).

Ardizone will consult with DWQ, as well as the N.C. Division of Coastal Management and N.C. Cooperative Extension Service to identify target

audiences for outreach and education efforts. When requested, she will assist in reviewing — or suggesting improvements to — water-quality components of land-use plans.

She also will help identify proposed water quality improvement projects that may be eligible for funding.

Ardizone maintains an office at North Carolina State University's Center for Marine Sciences and Technology in Morehead City. She can be reached at 252/222-6316 or [ardizonek@ncsu.edu](mailto:ardizonek@ncsu.edu).

— P.S.

The new rules, adopted by the Coastal Resources Commission (CRC) in 2002, address sustainable growth and development issues that link land use to coastal water quality. In particular, local governments must address nonpoint source pollution and its impact on water quality as part of long-range planning.

Ardizone will play a supporting role to local governments and citizens taking steps to comply with the CRC planning guidelines. Her position is being supported for a two-year

## Fullenkamp Elected TCS Secretary

Lindsay Fullenkamp, North Carolina Sea Grant coastal management fellow, has been elected to a two-year term as secretary of The Coastal Society (TCS).



TCS is an international organization that addresses emerging marine and coastal issues. Its 300-plus members include a diverse group of professionals representing academia, government, the nonprofit arena and the private sector.

Fullenkamp earned a master's degree from Duke University's School of the Environment and a bachelor's degree from the University of Dayton. As a coastal management fellow, she is working with Walter Clark, Sea Grant's coastal communities and policy specialist, to launch the Coastal Communities Initiative. She is developing a resource compendium for communities seeking information on land- and water-use planning,

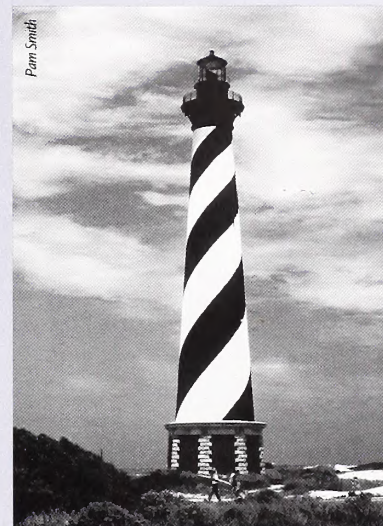
economic development and environmental protection.

Her TCS responsibilities include recording and distributing information regarding actions of the organization and its committees. She also is playing an important role in the planning and staging of the upcoming TCS 19th international conference, May 23-26, in Newport, R.I.

The theme of the biennial event is "Measure for Measure: How Do We Gauge Coastal Stewardship?" More than 80 presentations will address timely coastal governance, coastal land use, water quality and ecosystem-based management issues.

TCS, Fullenkamp says, puts members in touch with experts involved with the application of cutting-edge research in important areas of coastal policy and resource management.

— P.S.



*The Cape Hatteras Lighthouse attracts many visitors.*

## Nature and History Top Tourism Attractions

Nature and history topped the list of the most popular tourist attractions along the Outer Banks, according to a survey by *The Outer Banks Sentinel*, a newspaper published in Nags Head.

Pea Island Wildlife Refuge and the Cape Hatteras National Seashore tied for visitors' first choice. The 2.3 million visitor estimate is based on N.C. Department of Transportation traffic counts, the newspaper reports.

The Wright Brothers National Memorial took second place honors, with 714,371 visitors in 2003. Cape Hatteras, Bodie Island and Currituck Beach lighthouses ranked among the top 10 attractions.

In addition, the N.C. Aquarium on Roanoke Island and Roanoke Island Festival Park attracted visitors to their programs and educational exhibits.

The Lost Colony outdoor drama and the Graveyard of the Atlantic Museum complete the top 10 list.

— P.S.







*B y A n n G r e e n*

# FISHING THE DEEP-BLUE SEA

NEW FEDERAL PERMIT REQUIRED  
FOR HIGHLY MIGRATORY SPECIES

*YEARS AGO, Ernest Hemingway offered dramatic images  
of deep-sea fishing for blue marlin off the Florida Straits.*

*Today, recreational anglers not only love the thrill of the big catch,  
but also appreciate the value of big game fish conservation.*

"When fishing for marlin, you can sit around four or five hours and nothing happens," says John Graves, a recreational angler and chairman of the Virginia Institute of Marine Science's Department of Fish Science.

"Then in an instant, there can be complete pandemonium when fish tear into the bait," adds Graves. "Sometimes, it can take a couple of hours or more to pull a marlin in."

And as a member of a federal billfish advisory panel, Graves is helping to spread the word to private anglers that they are required by law to get a federal permit if they fish recreationally for highly migratory species, which include sharks, tunas, swordfish and billfishes.

Known as HMS, these fish are among the largest, fastest and pound-for-pound the most economically valuable creatures in the ocean. The permit is required whether anglers engage in catch-and-release fishing or land the fish.

Graves says HMS permits provide a good conservation measure for fish stocks that need to be rebuilt. "Requiring private boats to have permits and report their landings gives NOAA Fisheries a better way of estimating recreational

catches of big game fish species."

As their name implies, HMS swim throughout the world's oceans, and the stocks are shared by a number of fishing nations. They may spend different life stages or seasons in various habitats, moving up and down the coast, or from inshore to deep ocean waters.

Although these fish primarily live in the open ocean, the category also includes certain sharks that frequent closer waters for mating, pupping and nursery purposes.

Today, blue and white marlin are among the HMS prized by recreational anglers in the Atlantic, Gulf of Mexico and U.S. Caribbean.

"It is real exciting watching a marlin come up in bait spread behind the boat," says Pete Manuel, owner of the *Delta Dawn* charter boat in North Carolina. "When marlin get excited, they light up like a neon sign."

## *New HMS Permits/Landings*

The National Marine Fisheries Service, part of the National Oceanic and Atmospheric Administration (NOAA) and better known as NOAA Fisheries, works with other nations

through the International Commission for the Conservation of Atlantic Tuna (ICCAT).

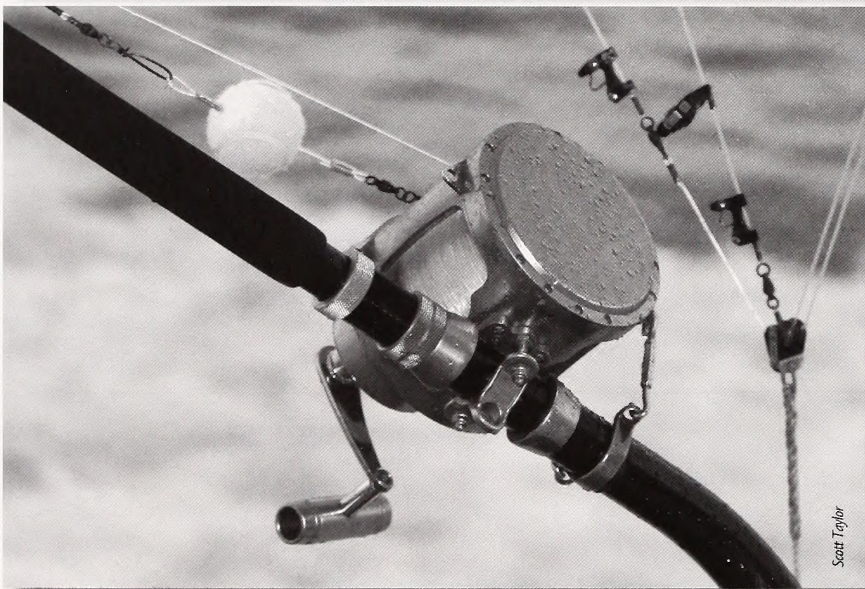
"Federal officials work to ensure that Americans get a fair share of international quotas," says Chris Rogers, chief of NOAA Fisheries' Atlantic Highly Migratory Species Management. "As a leading advocate for international environmental stewardship of big game fish, our country has a vested interest in making sure Americans do not overharvest the U.S. quota each year."

To ensure that quota is met but not exceeded, in 2003 NOAA Fisheries began requiring private anglers to get vessel permits to fish for regulated HMS in the Atlantic, Gulf and U.S. Caribbean waters. Previously, the permits were required only when fishing for tunas.

"With the growing popularity of sportfishing, this step was necessary to determine how many American citizens participate in HMS fisheries — essential information for negotiating international quotas that ultimately determine recreational catch allowances for the United States," adds Rogers.

*Continued*





TOP: A fishing party angles for tuna in deep waters off the N.C. coast.  
 BOTTOM: Recreational anglers can use only a rod and reel when fishing for billfish in the Atlantic.

The federal permit is required for private recreational boats that fish for Atlantic tunas, swordfish, sharks, blue and white marlin, sailfish and spearfish. It covers all passengers on board. A separate HMS permit covers charter and headboat customers.

"In general, sportfishermen are very serious about conservation," says Rogers. "Compliance with the permit and reporting requirement has been disappointingly low to date, so we are stepping up our outreach efforts to educate people about the new requirements and how compliance will ultimately help the recreational fishing community."

The new permit and reporting systems are designed to strengthen certainty in fisheries data. "The new systems will improve everyone's faith in the data used to set catch limits and establish other conservation needs," says Rogers.

To improve communication with the recreational fishery community, NOAA Fisheries and North Carolina Sea Grant recently held a workshop to discuss HMS fisheries permits, quotas and outreach to the recreational fishing community. Charter boat captains, billfish tournament directors and recreational anglers attended the workshop, to give NOAA Fisheries an "on the dock" perspective.

"NOAA Fisheries needs the cooperation of the recreational fishing community to rebuild highly migratory fisheries," says North Carolina Sea Grant Extension Director Jack Thigpen. "We can help to bring all sides together for an open discussion."

The landings data are used both for science and fisheries management, according to Bill Price, NOAA Fisheries' HMS national liaison to billfish tournaments. "The ultimate goal is improved stewardship of highly migratory species," says Price.

### Bluefin Tuna

Many recreational anglers are enticed by the thrill of catching a giant tuna that can weigh up to 1,000 pounds.

"You either need a stand-up harness or fighting chair when fishing for bluefin," says Capt. Donnie Lee of the Diamond Girl Sport Fishing Charter in Morehead City, N.C. "The fight for a bluefin can go on from 20 minutes up to more than four hours."

Managing the tuna fisheries is also a great challenge — and thus many quota decisions can be controversial. For example, in 2003-2004, NOAA Fisheries limited recreational bluefin tuna fishing in North Carolina, Virginia, South Carolina and Georgia to release only, a decision that frustrated many anglers in those states.

"The Atlantic bluefin tuna fishery poses management challenges because of the unpredictable migration pattern of the stock as it travels south each year," says Rogers. "In some years, the coastwide quota is reached before the tuna swim into South Atlantic waters."

Factors include ocean currents and weather patterns. "Sometimes the fish are too far offshore south of Virginia, forcing citizens of those states to travel north to participate in the fishery," he adds.

"This year, in an effort to help distribute fishing opportunities, NOAA Fisheries extended the HMS season from the end of December to the end of January."

In the past decade, North Carolina in particular has had an interest in the commercial and recreational bluefin quotas. Since the mid-1990s, giant bluefin tuna have concentrated near shipwrecks off Cape Hatteras and Cape Lookout National Seashores during winter months.

When quotas are available, the bluefin



fishery can extend the season for the charter and headboat industry, turning Hatteras and Morehead City into destinations for recreational anglers, says Louis Daniel, assistant to the director of the N.C. Division of Marine Fisheries (NCDMF).

“Fishing for bluefin tuna has become a world-class fishery because of the size of the fish caught,” adds Daniel, who also serves on a federal fisheries management council.

### Swordfish Limit

North Atlantic swordfish are showing promising signs of recovery just four years into a 10-year recovery program. However, much of the new stock consists of small juvenile fish that need continued protection.

NOAA Fisheries attributes the recovery to the conservation efforts of anglers and restrictive fishing limits placed on the commercial industry.

Federal regulators recently began limiting recreational swordfish catches to one per person, up to three per boat, per day. This applies to all recreational vessels, including charter and headboats fishing in federal waters of the Atlantic and Gulf of Mexico.

The retention limit is designed to discourage illegal sales as well as to ensure the protection of juvenile fish in nursery areas. In addition, there is a minimum size limit for recreational fisheries of 47 inches (whole fish) to protect juveniles.

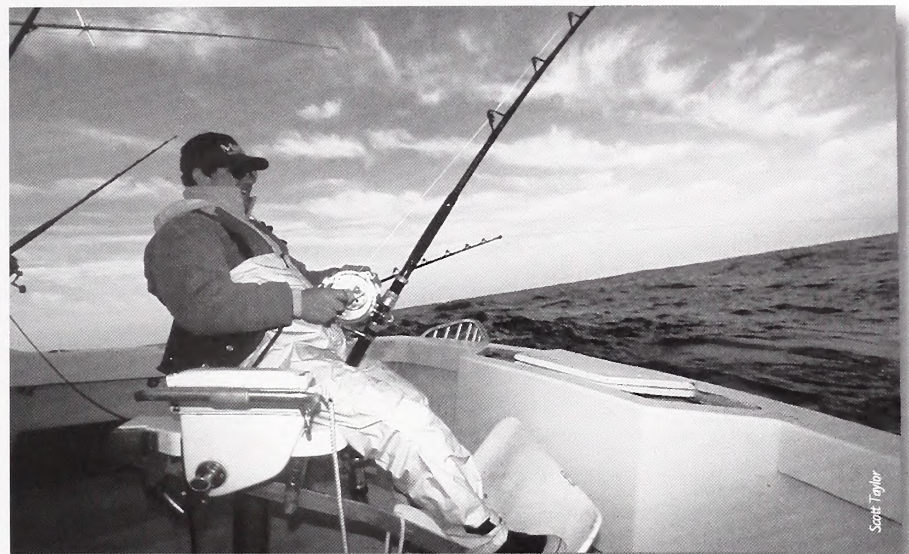
Capt. Kevin Kates of *Intrinsic Value* out of Pompano Beach, Fla., says the limits need to be enforced in order to sustain the swordfish fishery. “Before the new limits, a lot of swordfish were being killed,” he says.

Atlantic waters off Florida are one of the few places in the world where, on any given night, anglers get a chance to catch a swordfish, Kates adds. Depending on the night, a boat generally can catch one to three swordfish around the Pompano Beach area.

### Sharks

New regulations recently took effect for Atlantic, Gulf of Mexico and Caribbean shark fisheries, increasing recreational catch limits and defining recreational shark fishing gear as rod and reel and handlines.

Recreational anglers now may possess



TOP: Capt. Peter B. Wright angles for a bluefin tuna while sitting in a chair.  
BOTTOM: Fishing for bluefin tuna is popular during the winter months off Cape Hatteras and Cape Lookout National Seashores.

one shark per vessel per trip, with a minimum size limit of four and a half feet. In addition to this limit, sportfishers may take one bonnethead per person per trip with no minimum size limit and one Atlantic sharpnose per person per trip, with no minimum size limit.

“These recreational regulations complement a suite of new commercial fishing limits on sharks, including large cutbacks in annual quotas, gear restrictions, and a closure January through July each year off North Carolina to protect shark pupping grounds,” Rogers explains.

### Circle Hooks

To reduce the mortality of billfish and other HMS, many groups — including Sea Grant programs, NOAA Fisheries, fishing clubs and tournament boards — encourage the use of circle hooks in recreational fisheries.

For example, since the mid-1990s, NOAA Fisheries has supported training and outreach efforts in proper baiting and hooking techniques.

Anglers also are encouraged to use circle hooks in tournaments. In 2003, the Big Rock Marlin Tournament in Morehead City began giving additional release points for use of circle hooks.

*Continued*



"In the long-term, using circle hooks will enhance recreational fishing opportunities by maintaining healthy stocks," says Rogers.

"White marlin is on the 'species of concern' list, which serves to encourage conservation action and provide public notice that it may warrant future listing under the Endangered Species Act. We have to increase post-release survivability, or we could eventually see a halt to any fishing that has potential to catch one," he explains.

The principle behind the circle hook is simple. After the hook is swallowed, natural pressure applied to the line by the fish pulls the hook out of the stomach.

The unique hook shape causes the hook to slide towards the point of resistance and typically lodge in the jaw or corner of the fish's mouth. The actual curved shape of the hook keeps it from catching in the gut cavity or throat.

"We are doing a better job of educating blue-water fishermen about circle hooks," says retired North Carolina Sea Grant fisheries specialist Jim Bahen, who has conducted numerous circle hook workshops. "Research has shown that circle hooks reduce the mortality of released fish compared to deep hooking, where fish swallow bait."

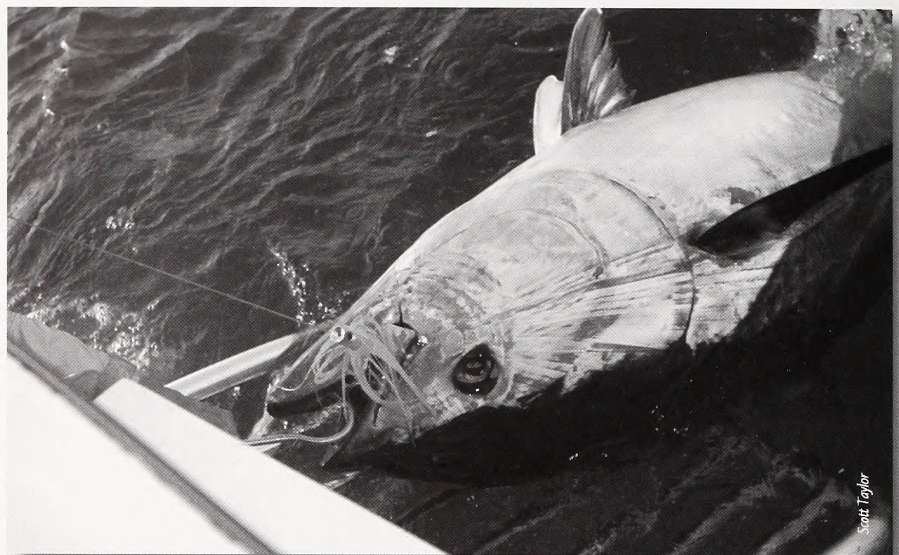
A 1999 NOAA Fisheries study found the rates of fishing success for billfish were comparable or higher for circle hooks compared to J-hooks. Circle hooks used on sailfish had hooking percentages — including fish hooked or fish bite — that were 1.83 times higher than J-hooks.

Eighty-five percent of sailfish were hooked in the corner of the mouth using circle hooks as compared to 27 percent for J-hooks. In addition, 46 percent of sailfish were deep hooked in the throat and stomach with J-hooks, compared to 2 percent with circle hooks.

### Billfish Tournaments

A popular activity for HMS anglers is participation in fishing tournaments. Anglers who participate in any of the tournaments offered throughout the Atlantic, Gulf of Mexico and Caribbean also can help in conservation of HMS.

"By getting the required angling permit — which is required even of catch-and-release fishing in tournaments — and making sure



Scott Taylor



Michael Palominski

TOP: A fishing crew pulls in a yellowfin tuna caught off Cape Hatteras.

BOTTOM: Proud anglers show off their yellowfin tuna on the dock at Hatteras Harbor Marina in North Carolina.

landings are reported through the tournament, participants will be helping to ensure a successful future for these popular and fun fishing competitions," says Rogers.

In the Atlantic, Gulf and Caribbean, recreational anglers annually compete in approximately 200 billfish tournaments registered with NOAA Fisheries.

For example, in North Carolina, seven billfish tournaments are included under North Carolina's Governor's Cup Billfish Conservation Series. Boaters and anglers accumulate points for billfish catches in participating tournaments to compete for the Governor's Cup.

There are a number of other large billfish tournaments along the Atlantic coast, such as the Hatteras Marlin Tournament and the Pirate's Cove Big Game Tournaments off the Outer Banks; the White Marlin Open in Ocean City, Md.; the Virginia Beach Red, White and Blue; the Florida Billfish Masters in Miami Beach; the Annual Silver Derby Sailfish in West Palm Beach; the NE Florida Marlin Association Blue Water in St. Augustine; the Annual Viking-Ocean Showdown in Cape May, N.J.; and the Open Atlantic Blue Marlin Tournament in the U.S. Virgin Islands.

Many of the charter boat operators go



from tournament to tournament along the East Coast and even to the Caribbean. Manuel, the *Delta Dawn* owner, has a house full of marlin trophies, including first place in the 2002 White Marlin Open for a 688-pound fish.

"I go to 10 to 12 marlin tournaments a year in Maryland, New Jersey, North Carolina, Virginia and South Carolina," says Manuel, president of the Winter Bluefin Association in North Carolina. "This year, I may go to Bermuda. I like the thrill of winning."

A large crowd usually gathers at billfish tournament weigh-ins.

Every night, at the White Marlin Open in Ocean City, 2,000 to 6,000 people watch the weigh-ins, says Jim Motsko, president of the White Marlin Open. "It's exciting. Few people ever get to see this kind of fish except at a tournament."

Billfish tournaments boost the economies in communities where they are held.

In 1999, Texas A&M University Professor Robert Ditton and North Carolina Sea Grant researchers conducted a survey on the economic impacts of the 1999 Pirates Cove Big Game Tournaments.

"We found that the tournament gave a significant boost to the Dare County economy," says Thigpen. "North Carolina residents who were not from Dare County and other nonresidents of North Carolina spent more than \$2.6 million in direct and indirect expenditures in Dare County."

As our nation's population grows and coastal tourism increases, it is "imperative that American citizens who fish recreationally partner with NOAA Fisheries and the coastal states to make certain we sustain our valuable fishery resources for the future," Rogers says.

"By obtaining an angling permit for HMS, reporting landings, and using circle hooks, anglers will help create enhanced fishing opportunities, which will generate greater economic benefits in the long term," he adds. "We want anglers to enjoy their fishing opportunities."

With those fishing opportunities come conservation responsibilities, Rogers says. "We ask anglers to help us by obtaining the HMS angling permit and reporting HMS landings." □

## GUIDE HIGHLIGHTS SHARKS, TUNAS AND BILLFISH

Want to identify a bluefin tuna in the water? How about a blue marlin or swordfish?

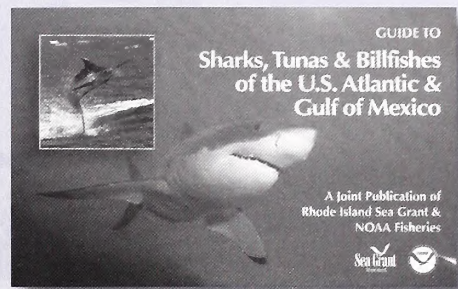
The distinguishing characteristics of these fish and other highly migratory species can be found in the new *Guide to Sharks, Tunas and Billfishes of the U.S. Atlantic & Gulf of Mexico*. The result of a partnership between Rhode Island Sea Grant and NOAA Fisheries, the guide features 44 of the sharks, tunas and billfishes commonly found in Atlantic and Gulf waters.

"We are very proud to be part of this project," says Chris Rogers, chief of NOAA Fisheries' Atlantic Highly Migratory Species Management. "The guide will help fishermen and fish dealers in their efforts to obey the laws, while at the same time supporting conservation efforts."

Developed for use in the field, the water-resistant guide highlights external features to expedite the identification of these fishes. It provides descriptions of physical features, diagnostic photographs and habitat information to help with species recognition.

The guide also includes information about reducing the risk of shark attack, as well as procedures for the protection, handling and release of entangled marine mammals and turtles.

The book is available for \$25 from Rhode Island Sea Grant, with discounts for bulk orders. To purchase the book, visit: [seagrant.gso.uri.edu](http://seagrant.gso.uri.edu), or call 401/874-6842. — A.G.



## NOAA FISHERIES CONTACTS ON HMS TOPICS

Recreational anglers who target highly migratory species can contact NOAA Fisheries if they have questions on new regulations.

"We are here to serve you, and it is important that anglers cooperate in return by getting the angling permit and reporting catches," says Chris Rogers of NOAA Fisheries.

"NOAA Fisheries is working to keep America within its agreed upon international catch quota by requiring private anglers to report their landings," he adds.

For recreational tuna, swordfish and shark fishing, anglers are allowed to use a rod and reel, which includes downriggers, or a handline. For billfish, only a rod and reel is allowed.

All blue or white marlin, swordfish or sailfish caught by private anglers in federal waters must be called in to a NOAA Fisheries hotline within 24 hours of landing — if the fish is killed and brought to shore.

Specific contacts include:

- In most Atlantic and Gulf states and the U.S. Caribbean, billfish and swordfish landings must be reported within 24 hours by calling 800/894-5528.
- In Maryland and North Carolina, vessel owners and/or captains should report their recreational billfish landings at state-operated facilities. For landings or additional information in Maryland, call 410/213-1531. In North Carolina, call 800/338-7804.
- Tournament operators should report all landings for tournament participants.
- Tuna landings also must be reported. Call 888/872-8862 or go online to [www.nmfspermits.com](http://www.nmfspermits.com).
- For more information about NOAA Fisheries' highly migratory species angling permits, call 888/872-8862 or visit: [www.nmfspermits.com](http://www.nmfspermits.com).
- For general information about highly migratory species, call 800/894-5528.
- NOAA Fisheries provides an online guide to help fishermen understand and comply with federal regulations. The guide is available at: [www.nmfs.noaa.gov/sfa/hms/2003\\_ComplianceGuide.pdf](http://www.nmfs.noaa.gov/sfa/hms/2003_ComplianceGuide.pdf).

Rogers adds that any questions also can be directed to the agency's public affairs office at 301/713-2370. — A.G.



# FRYING PAN SHOALS Light Tower Evokes Bygone Era

By Ann Green • Photos by Scott Taylor



*The Frying Pan Shoals Light Tower,  
located off Cape Fear, warned many ships over the years.*





While standing on a charter boat far out in the Atlantic, Mike Allen points to the 125-foot Frying Pan Shoals Light Tower that was once his home away from home.

"It is good to see her after 25 years," says Allen, who was one of the last U.S. Coast Guard crews to serve on the tower. "The antenna is where my room was. She has gotten older and rusted."

There have been other changes. Hurricanes washed away the tower's bulkhead, landing, and parts of the spiral staircase that Allen used to climb to the top, he recalls.

Not long after Allen served on the tower, it was automated. As a musical tribute, he wrote "The Lady" while still on duty.

During a charter trip on the *SS Winner Queen*, Allen sang and shared his memories of working on the tower — which transmitted signals to ships near low sandy areas or shoals. Carolina Ocean Studies, an educational tour group out of Carolina Beach, sponsored the trip.

The tower automation saddened Allen. "It was like taking out the soul of the tower," he adds. "There were times when people needed assistance on their boats, but couldn't be heard on shore. When there was a crew on the tower, you could at least relay a message."

The tower — along with the one at Diamond Shoals — will be dismantled in the near future because of advances in radio navigation.

"Light towers were like lighthouses in the water," says Bob Browning, Coast Guard chief historian. "They replaced light ships as an economic move and navigational aid. Since Frying Pan Shoals was a dangerous area and more than 20 miles out in the Atlantic, it was an important navigational point for mariners."

The dismantling of the tower is an ongoing project, says Dave Santos, media relations specialist in the Coast Guard's Atlantic area office. "The demolition project was still out for bids in March."

After the tower is dismantled, it will be used as an artificial reef that will be managed by the N.C. Division of Fisheries. The hard bottom provides an ideal habitat for marine life, including snapper, grouper and porgy.

"It is respectful and appropriate to give the tower a burial at sea," says Richard Cecelski, Carolina Ocean Studies director. "There has been a light ship or tower here since 1854, with the exception of three years during the Civil War and two years since World War II."

Valerie Dugan, a John T. Hoggard High School ocean science teacher in Wilmington, agrees.

"The tower is like a friend to me," says Dugan. "At least once a year, I take a trip out to see the tower."

Last fall, the Coast Guard announced it would not replace the weather instruments on the Frying Pan tower. Instead, the National Weather Service anchored a 3-meter discus buoy near the tower. The buoy transmits data on wind speed, water and air temperature, air pressure, dew point and wind direction to weather stations on shore. Its data are available online.

*Continued*



## LIGHTSHIP ERA

Before light towers, lightships were the sentinels of the ocean.

At least six lightships were in use off England's coast before the United States even ventured into the concept of lightships. The first U.S. "light boat" was launched in 1820 off Willoughby Split, Va., to aid Chesapeake Bay commerce, according to the Coast Guard Web site.

Four years later, a lightship was assigned to Diamond Shoals about 15 miles from the Cape Hatteras Lighthouse. This vessel was an extremely important marker for north-south coastal traffic.

However, it wasn't until 1860 that a station was established at Frying Pan Shoals nearly 17 miles south and east of Cape Fear. The last North Carolina lightship station was opened at Cape Lookout Shoals in 1905, 20.3 miles from Cape Lookout Lighthouse.

At one time, there was a fleet of more than 100 lightships maintained by the government. Lightships satisfied multiple requirements — from day beacons and light platforms at night, to sound signal stations in times of reduced visibility, and around-the-clock transmitters for electronic signals.

Ivey Gaskill of Southport served on the *Diamond Shoals* lightship for 18 months during the mid-1960s.

"The ship was 128 feet long and drew 15 feet of water," says Gaskill. "It was like being in an automatic washing machine. You were looking at water going round and round."

Time passed slowly on the lightships. When not on watch, crews watched westerns three or four times a week, according to Capt. David Melvin, who maintains the Lightship Sailor Association Web site.

"We would also enjoy the fresh taste of bread, milk and vegetables," says Melvin. But at the end of the two weeks, the food got old, he adds.

In addition to watching movies and eating, the crew did a lot of bottom fishing. They ate some of the fish and gave the rest away to party boats, according to Melvin. In return, the party boat would take the crew's stamped mail ashore. All in all, it was not an easy life, he adds.

The *Frying Pan* had a relief ship — aptly named the *Relief*. Life on the sister ship could be quite noisy, according to Joe Floyd of Wilmington, who served on the *Relief* during the 1950s.

"In foggy weather, we had two air-operated fog horns that could be heard 12 miles away," says Floyd. "I remember it running for 72 hours straight. The fog horns were so powerful that they would rattle objects on a desk and dishes in the galley. You would get little sleep."

## SHIPWRECKS, STORMS

There were a number of mishaps on lightships. Mankind caused the loss of the *Diamond Shoals Lightship #71* in 1918 off Cape Hatteras.

"A German submarine, provoked by the lightship's radio message warning of shipping, surfaced," according to Coast Guard reports. After allowing the 12-man crew to abandon the ship, the Germans sank it with shellfire. However, the lightship's "sacrifice was not in vain though, for more than 25 Allied ships had received its timely radio warning," wrote

historian Willard Flint.

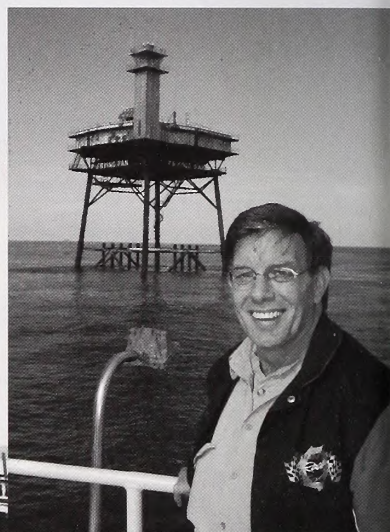
Sixteen years later, the British luxury liner *Olympic*, the sister ship to the *Titanic*, severed the lightship *Nantucket* in two, killing seven of the 11-man crew.

Lightship crews often endured nature's fury. For example, when the lights went out in bad weather, Floyd had to climb a 100-foot mast to replace the bulbs.



Courtesy of N.C. Office of Archives and History

CLOCKWISE FROM ABOVE: The Frying Pan Lightship operated out of Southport. Mike Allen was one of the last Coast Guard crews to serve on the Frying Pan Shoals Light Tower. Joe Floyd served on the Relief lightship during the 1950s. Passengers on the SS Winner Queen get a close-up view of the Frying Pan light tower. A new 3-meter disc buoy transmits data to weather stations onshore.



"We had a certain routine when climbing the ladder," says Floyd. "You would start on the bottom rung, wait for the ship to pitch forward, and climb as fast as you could. When the ship pitched backwards, you would hold on for dear life and then repeat the process up the mast."

Floyd also endured a couple of hurricanes, including Hazel and Diane. During Hazel in 1954, Floyd says that he and an engineman were the only ones who did not get sick.

"Everybody else was tied into the bunk," he says. "If you looked out any port hole, you would only see water. If you were in the wheel house or stock room, you would put your arms in the holes and legs around a stool."

Hurricane Diane that hit in 1955 caused more problems for the crew. "The seas broke up, and we lost the 8,000-pound main anchor and 5,000-pound spare anchor," says Floyd. "We ended up 130 miles south near South Carolina."



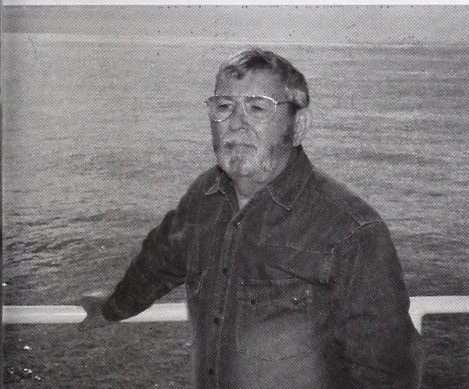
Duty on the lightships wasn't all hardships.

"You were able to eat better than any other branch of service," says Floyd. "We ordered food, and a cook prepared it. We had an open galley."

Some of the lightships, including #115 *Frying Pan*, have led remarkable lives.

While docked at an oyster cannery in the Chesapeake Bay, *Frying Pan* was abandoned and then sunk because of a broken pipe, according to the Lightship Frying Pan Web site. The lightship stayed underwater for three years before being raised by salvors. Instead of going to the scrap yard, she was raised, resold and towed to Manhattan's Pier 63 within the new Chelsea Waterside Park. *Frying Pan* is now being used for parties and special events.

"The owners left a lot of the encrusted interior," says Allen, who toured the boat. "It is kinda spooky to go on it. It is used as a nightclub."



## LIGHT TOWERS

To save on manpower and construction and maintenance costs, the Coast Guard began replacing the lightships in the 1960s with Texas-style light towers that looked like offshore oil platforms and navigational buoys.

In 1964, a light tower at Frying Pan Shoals was erected. Two years later, a similar structure was built at Diamond Shoals.

The Frying Pan light tower — which was automated in 1979 — was erected at the end of the shoals so ships could pick up radio signal and avoid them.

Allen, along with a crew of five, served on the Frying Pan light tower from 1977 to 78. They rotated between tower and land duty.

Crewmen served four weeks on the tower and two weeks off. They rode out to the tower on a 44-foot boat from the Oak Island Coast Guard Station, or on the 82-foot *Point Martin* out of Wrightsville Beach. On a few occasions, a helicopter would fly them out to the tower.

Pilings for the tower sank 200 feet through shell and sand to anchor it to the ocean bottom. Its legs extended from a depth of 50 feet underwater to the living deck 80 feet high over the water line.

"In the summer, you could see the bottom for 50 feet," says Allen. "The Gulf Stream would run under the tower. Every once in a while, you would see a turtle go by."

Allen also encountered birds that would fly into the tower at night, slamming into the windows. "One night, we found 138 birds that had rammed into the tower, and some had beat the feathers off their heads."

Allen says the scariest job was cleaning the windows. "You had to stand on a top rail to clean the glass," he says. "It was fine if you didn't look down."

Life at sea often brought unexpected requests, says Allen.

One time, he says, a tug with a 1,000-foot tow on a barge came by. "The ship was supposed to pull into Savannah, but had to stay out to sea due to adverse weather near the port," adds Allen. "They had elected to head up to the next port in New York. But because of missing the port in Savannah, they had run out of cigarettes and asked for help."

The light tower crew got together cigarettes that were double wrapped in plastic bags, tied to a couple of empty plastic milk jugs and dropped over the side, says Allen.

"The tug made three or four figure eights to try and recover the cigarettes but never got them," he adds.

When Allen had nothing to do, he would play with two cats named Bacon and Eggs.

"One time, I was looking out the engine room during a 45-mile-per-hour squall," he says. "One of the cats had climbed on the inside of the I-beam used for the hoist and was 90 feet over the water. The cat was standing on the narrow 1/2-inch ledge and looking around at the end of the hoist into the wind like a dog sticking his head out of the window of a pickup truck going down the highway."

To pass the time, Allen also would shoot pool in the small recreation room, watch television, or fish with a piece of hotdog as bait.

"One time, I caught a 20-pound bluefish and had to pull the fish up 80 feet from the water to the living quarters."

Allen plans to take another trip to the tower before it is demolished.

"I have a lot of good memories," he says. "I watched the sun come up a lot out here." □

To find weather data about Frying Pan Shoals, visit the Web: [www.ndbc.noaa.gov](http://www.ndbc.noaa.gov). For more information on lightships, click on: [www.uscg.mil/hq/gc/history](http://www.uscg.mil/hq/gc/history).

## TOWER TRIPS

This summer, Carolina Ocean Studies is offering several "farewell" trips to the Frying Pan Shoals tower aboard the *S.S. Winner Queen*, an 85-foot, 110-passenger catamaran. The excursion includes deep-sea fishing and discussions on the edge of the Gulf Stream. Tentative dates are: July 25 and Aug. 29. All trips are subject to weather.

For more information, call 910/458-7302.

— A.G.



MID-ATLANTIC MARITIME:

SMITHSONIAN  
FESTIVAL  
CELEBRATES  
COASTAL  
COMMUNITIES

BY ANN GREEN

When Harkers Island native Anthony Brooks began whittling and sanding his first duck decoy, he didn't want to use sophisticated techniques or power tools.

Instead, Brooks carved every inch of the decoy with a hatchet and other hand tools just like old-time carvers who worked in net houses in Stacy and Atlantic.

"I went to a lot of decoy shows and realized that the old Core Sound decoy was disappearing," says Brooks while carving a decoy at the Core Sound Waterfowl Museum on Harkers Island. "I didn't want the art to be lost forever. After two years and a lot of busted knuckles, I made my first decoy."

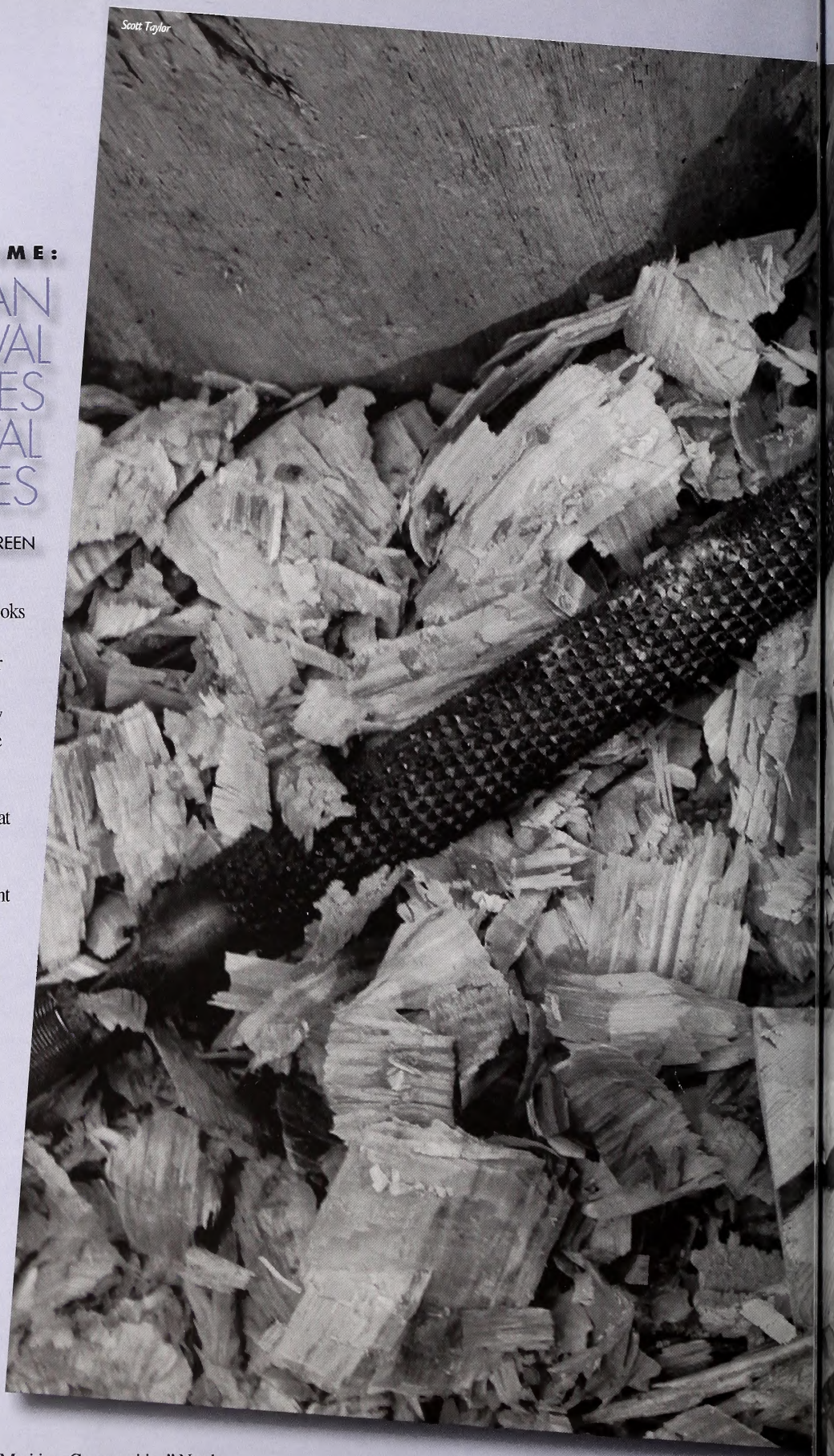
Since then, all of his decoys have been carved with hand tools — hatchet, sander and rasper. The body shapes and smooth contours combine for striking game birds and swans.

Brooks, who began making decoys four years ago, holds up a white swan that was made to look like a decoy from 100 years ago.

"It is not made to be pretty," he says. "Every now and then, you see a hatchet mark on one of my decoys."

However, they are functional, much like the old-time decoys that brought in game birds near hunters' boats, adds Brooks, who will demonstrate the old style of decoy carving at the Smithsonian Folklife Festival Program in Washington, D.C.

Decoy carvers from other mid-Atlantic regions also will be featured on the National Mall June 23-27 and June 30-July 4 in "Water Ways: The Past, Present and Future of Mid-Atlantic Maritime Communities." North Carolina Sea Grant will be partnering with other organizations to sponsor events and exhibits.



Continued

ABOVE: Anthony Brooks carves decoys with hand tools like old-time Down East carvers.

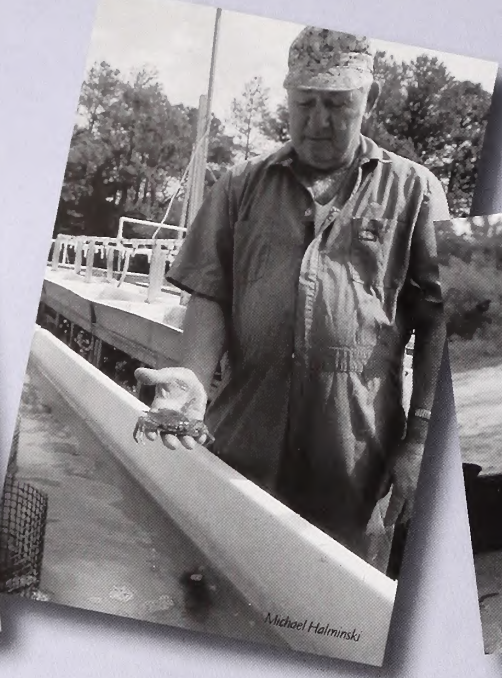








Scott Taylor



Michael Halmirski



Michael Halmirski

"We look for people who have a strong connection to the region, who have learned their maritime skills through their family or their community, and who can tell the story of the rich traditions found along the coast," says Betty Belanus, the festival's program curator.

### Core, Albemarle Sounds

The festival will bring together maritime workers and artisans from the mid-Atlantic region that stretches from Long Island, N.Y., to the Outer Banks, including the Core and Albemarle sounds.

"The Smithsonian Folklife Festival is a great opportunity to feature two regions of the state with strong living cultural traditions that are often overlooked by visitors and even residents of North Carolina," says Wayne Martin, N.C. Arts Council folklife director.

The Albemarle region, which includes Columbia in Tyrrell County and surrounding communities in northeastern North Carolina, is rich in timber, farming, hunting, fishing and trapping traditions.

"Hunting for such game as bear, deer and ducks is still popular in the coastal counties," says Chapel Hill folklorist Jill Hemming, who conducted a 1995 survey of northeastern North Carolina. "There used to be a good market for trappers, but that has fallen off in the last decade. People also pole fish in the canals and work on the water."

The Core Sound region stretches from Beaufort to Cedar Island through vast expanses of marshes and small communities. It also is comprised of the uninhabited Cape Lookout National Seashore, which includes Shackleford

and Core Banks. Because of the region's proximity to the Atlantic Ocean and Core Sound, boatbuilding, hunting, commercial fishing and decoy carving thrived.

### Herring and Shad Fisheries

In both the Albemarle and Core regions, people have worked the water for centuries.

When the first explorers arrived, they found the Chowan, Jamesville and Roanoke rivers teeming with shad and herring.

Later, commercial fisheries for shad and herring were established on several of the state's rivers.

To fish for shad, fishermen often used a shad boat, which is the official state boat of North Carolina. A replica of the *Tom Dixon*, which was built by the N.C. Maritime Museum's George Washington Creef Boat Shop in Manteo, where it is on display.

The shad boat was developed just after the Civil War by Creef or "Uncle Wash" who needed a stable boat for shallow waters around Roanoke Island.

"With simple tools — frame saws, handplanes, broad axe and adze — Uncle Wash began building his shad boats out of native cypress and white cedar," according to Connie Mason, N.C. Maritime Museum history specialist. "He usually worked on two boats at a time."

When his wife, Margaret, became ill in 1893, Creef lovingly fashioned two coffins, one for her and the other for himself, tucking them away in his shop's rafters, adds Mason, a folklorist.

The shad boat era ended in the 1930s when boats became too expensive to maintain.

However, they were widely used until the 1950s. Now, only a few boats are left.

### Crabbing, Shrimping

Blue crabs lie at the heart of North Carolina's entire fishing industry. Crabbers move their pots through the season as the crabs migrate across the estuary.

Both hard and soft crabs are a big industry in North Carolina. Soft crabs emerge when hard crabs go through a molting process called shedding.

At the festival, a North Carolina fisherman will demonstrate how to make a crab pot.

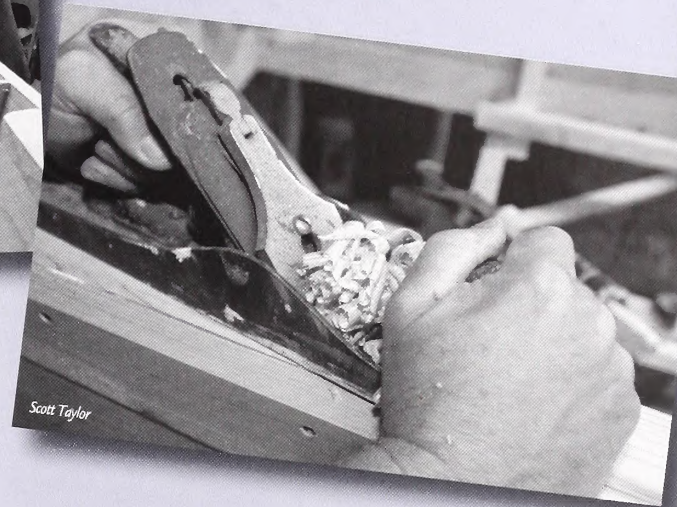
The Albemarle region has one of the most diverse and interesting crabbing cultures in the state, according to University of North Carolina at Chapel Hill researcher William Stott, who is compiling an oral history of crabbers.

"The Gallup, Daniels, Phillips, Perry and Tillett families — to name a few — are rich in tradition and knowledge," adds Stott, director of the Albemarle Ecological Field Site. "Many of these folks are smart, aggressive and adaptive — not unlike the prey, I suppose."

"Their knowledge of the water, robust work ethic and insights into markets and local ecology have been shaped by crabbing the Albemarle Sound, Alligator River, Kitty Hawk Bay, among other locations," he adds. "Also, individuals like Murray Bridges and Donald Dough pioneered soft shell crabbing in the state more than 30 years ago."

In addition, Stott says the waterman's culture in this region is ethnically diverse. "Though conflicts arise, the ways these men and women negotiate and fight out differences are





FROM FAR LEFT  
TO RIGHT:

Anthony Bracks  
carves a decay  
out of wood. •

Murray Bridges,

a veteran crab shedder, knows every telltale sign of an impending molt. • Willy  
Phillips checks out a blue crab catch from the Albemarle Sound. • Heber Guthrie  
and Jimmy Amspacher are keeping the Dawn East boatbuilding tradition alive. •  
Boatbuilding is an art and requires attention to detail.

part of the richness and legacy of crabbing in the Albemarle," he adds.

Oystering also was an important fishery on the Newport River and other bodies of water in coastal North Carolina.

In the early part of the 20th century, more fishermen in the Pamlico Sound and waters south of the sound turned to shrimping.

"Before that, old-timers used to swear at shrimp in Bogue Sound because they were not desirable to catch and got tangled in gill nets," says North Carolina Sea Grant fisheries specialist Bob Hines.

To catch the shrimp, fishermen use some type of trawl gear. With the otter trawl, they drag nets behind the boat. A skimmer trawl has nets on the side of the boat.

At the festival, Hines and a Carteret County shrimper will give a demonstration with a model trawler.

### Boatbuilding

In coastal North Carolina, including Harkers Island, many master craftsmen used native juniper to make boats.

For wooden workboats used by shrimpers and fishermen, the Harkers Island or Carolina design — which has a wooden hull and flared bow — is recognized along the coast.

Houston and Jamie Lewis, who work in a high-ceiling garage in Harkers Island, still use this design for their boats.

Brady Lewis was considered the island patriarch of boatbuilding. Lewis taught the craft to the late Julian Guthrie, who in turn became a legend in the business.

Guthrie often used ingenuity in his design.

In 1982, he built a 65-foot yacht around a piano. He also constructed three-masted sharpie schooners and sail skiffs. Throughout his life, Guthrie taught his trade to others, including his nephew, Heber Guthrie, and Jimmy Amspacher. Both men will be building a flat-bottom sail skiff at the Folklife Festival.

"Mr. Julian was a fine man," says Jimmy Amspacher. "He had the patience of Job. We were just young'uns. We could tear up more wood."

On a recent day, Guthrie and Amspacher were building a skiff out of juniper, pine and spruce in Guthrie's garage in Gloucester.

"It is built close to the old-time skiff," says Guthrie. "In the old days, boatbuilders would go in the woods and find a limb or stump so the grain would be a natural turn. Now, we buy the wood."

Amspacher says the skiff — which has a V-bottom and platform — was used for multiple purposes. The mast can be taken down, and the boat used for clamming, floundering or oystering.

"These boats were made to be used for a little bit of everything," he adds. "You could use it on Saturday or Sunday, or go to town in the boat. Before the bridge was built to Harkers Island, everybody went to Beaufort by boat."

Since it was hard to shove the skiff from Harkers Island to Beaufort, people added sails, according to Amspacher.

To build this boat, the men use a time-honored traditional called "rack of eye." It takes the eyes of an experienced boatbuilder rather than measured blueprints to see that a boat has the right dimensions and design.

"If you don't have the eye for building a skiff, you will mess up," says Amspacher.

### Festival History

Since 1967, the Smithsonian Folklife Festival has celebrated traditional cultures from across the United States and around the world. Over the years, it has brought together more than 16,000 musicians, artists, storytellers and others to the National Mall.

The Water Ways project grew out of the efforts of coastal communities and museums such as the Core Sound Waterfowl Museum, the Bayshore Discovery Center in New Jersey, and the Reedville Fisherman's Museum in Virginia.

Several years ago, Karen Amspacher, Core Sound museum director, visited Smith Island, an isolated fishing community in the Chesapeake Bay.

"We went on a mail boat into the harbor," says Amspacher. "It was so powerful coming in on the boat that I just started crying. It was like coming home."

"I realized immediately that these people were like us and shared the same traditions, the same history and the same issues for the future," she adds. "It is that shared heritage among all these communities that is the foundation for this folklife program."

After the Core Sound region was selected for the festival, Belanus asked Hemming, Martin and others to recommend another North Carolina coastal region to showcase at the festival.

They chose the Albemarle because of its strong traditions and distinct regional identity, according to Hemming.

"People still know each other in the local communities," she adds.

Also, Hemming says that the remoteness makes folks more self-reliant than in urban areas.

*Continued*





LEFT: Connie Mason's Down East music and storytelling is popular around Carteret County. •  
RIGHT: The guitar helps tell the stories of coastal North Carolina.

"People here learn to make something from nothing," she says. "People can do a lot themselves — from fixing lawn mowers to building boats. I met a guy who heated his house with a Honda engine."

### Juniper Project

In the mid-Atlantic region, artisans and fishermen used Atlantic white cedar or juniper for a variety of projects — from boats and houses to decoys and model boats. Stands of juniper are now rare.

At Kid's Coast, the festival will feature "7000 Juniper, An Art Action for the Millennium." Developed by Columbia's Pocosin Arts, the project focuses on the Atlantic white cedar reforestation efforts of Pocosin Lakes National Wildlife Refuge.

"Pocosin Arts wanted to develop an art education/environmental education project of millennial proportions," says Pocosin Arts Executive Director Feather Phillips. "Helping to restore the globally threatened pocosin ecosystem seemed an appropriate scale."

The project's centerpiece is the creation of the Millennium Forest at the Pocosin refuge, one mile south of Columbia in Tyrrell County. Teachers and students from the Tyrrell County Schools, local artists and others have planted 7,000 trees in concentric circles on a seven-acre field, once used as a farm, and buried hand-made clay millennium markers beneath each tree.

"This was a hands-on experience," says Phillips. "The children learned about culture, art history and the environment."

They will be leaving behind a legacy and

helping to ensure that juniper will be around in this maritime community for a long time to come," she adds.

Food was integral to maritime life in coastal North Carolina.

Some traditional Down East dishes include clam fritters, light bread biscuits (yeast rolls), oatmeal hurricane cake and collard dumplings. Yaupon tea was a popular drink.

The European settlers learned to drink Yaupon tea from the native coastal Indians who called it the "Black Drink."

"The tea was almost as thick as cough syrup," says Mason. "They used it as purgative to throw up and purify themselves for their ceremonies. Even its scientific name, *Ilex vomitoria*, alludes to this practice.

Yaupon tea was produced in two ways by the settlers — and never thickly brewed like the Indians — but made like we brew China tea today, says Mason. One early commercial yaupon tea operation on the Outer Banks dug a hole in the ground and lined it with thick wooden staves. The holes were layered with heated rocks and yaupon leaves until the hole was filled.

At home, people brewed yaupon tea in a large iron pot outdoors over an open fire or in their fireplace, stirring the leaves in the pot until they were dry or roasted. Then they would store the leaves.

Yaupon tea was used at the Edenton tea party, North Carolina's contribution to the Revolutionary War.

Mason will demonstrate how to brew yaupon tea at a folklife exhibit.

### Down East Music

Singing and storytelling were important in coastal communities.

While pulling the nets together on menhaden boats, men would sing shanties. The tradition stopped in the 1950s when fishermen began using hydraulic devices to pull in nets.

"Shanty music came from the sailing world," says Mason. "The men sang while they performed different jobs onboard, including raising the anchor or manning the bilge pumps. If the boat was leaking, the men increased the pace of the pumps by singing faster songs to keep ahead of the leaks in the ship's hull."

Mason will sing some shanties, as well as traditional songs, at the festival.

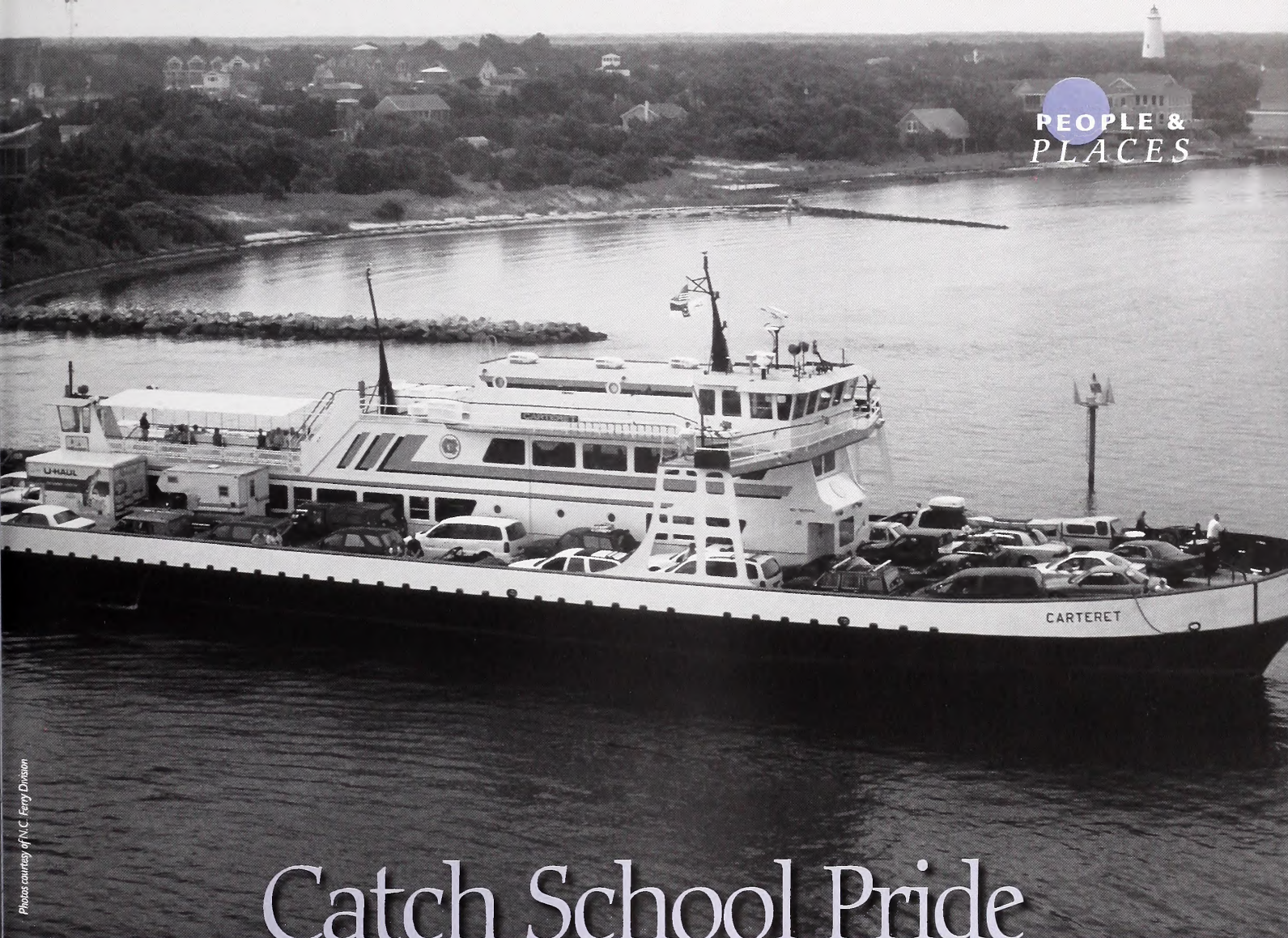
One of Mason's favorite tunes is "Marian's Song: On My Island Home" about Marian Gray Babb, last resident to leave Portsmouth Island. While conducting interviews with Babb, Mason says she learned about true island living.

Through the songs, stories and other traditions, Mason and others hope to take a little bit of Carteret County and eastern North Carolina to Washington, D.C.

"We always think of natural resources on the coast, but the cultural resources are often hidden," adds Mason. "At this festival, we will lift up the veil and help other people see what life is and was like here in the region around Core and Albemarle sounds." □

For more information about the festival, visit the Web: [www.folklife.si.edu/](http://www.folklife.si.edu/) and click on folklife festival or call, 202/275-1150.





# Catch School Pride with a Ferry Ride

By Jason Talley

**T**he North Carolina Department of Transportation Ferry Division paints their vessels with pride — school pride.

The Ferry Division's Customer Service Committee suggested that each ferry be painted with the color scheme of the 16 schools within the University of North Carolina System, and other private state universities and colleges.

A fleet of ferries — emblazoned with the school's colors and their logos or mascots — operate year-round to transport more than a million passengers across seven water routes and five bodies of water.

Born of geographic necessity, the state's sophisticated ferry system provides much more than a pleasant way for tourists to discover coastal North Carolina. Ferries are an integral

part of coastal culture and history, and continue to be the lifeline of many communities in the region.

Until the 1950s, when the state launched the N.C. Ferry Division, privately owned ferries linked isolated Outer Banks communities to mainland necessities. The state fleet has continued to expand to meet coastal needs.

Since 1962, ferries have provided transportation to Knotts Island youngsters attending mainland Currituck County schools.

The ferry system also plays a heroic role in times of natural disasters, such as hurricanes and floods. Vessels are moved into place to help evacuate stranded residents and to shuttle emergency workers, food, medicine and equipment to hard-hit areas.

Selected ferries also are floating research laboratories for scientists at Duke University Marine Lab, UNC-Chapel Hill Institute for Marine Sciences and the N.C. Department of Environment and Natural Resources. Known as "FerryMon," the project uses automated devices to monitor water quality along multiple daily runs over Neuse River and Pamlico Sound ferry routes.

The project, seeded with a grant from North Carolina Sea Grant, gets limited funding from state agencies. It has served as a model for real-time water quality modeling in other coastal states. For example, New York Sea Grant has a similar program to monitor the Long Island Sound.

Today, the Ferry Division is one of the largest state-owned and -operated in the nation — second only to Washington.

*Continued*





Riding a ferry evokes both state pride and school spirit. Check the list below to find your favorite school's ferry — and where it's running. For the 2004 schedule and other details about the N.C. Ferry Division go online to [www.ncferry.org](http://www.ncferry.org). Or, call 252/726-1380 or 800-By-FERRY. \*"M/V" stands for Motor Vessel

SCHOOL AFFILIATION	FERRY NAME*	CLASS	ROUTE
N. C. State	M/V Baum	Hatteras	Hatteras-Ocracoke
UNC-Chapel Hill	M/V Carteret	Sound	Cedar Is.-Ocracoke
East Carolina	M/V Cedar Island	Sound	Cedar Is.-Ocracoke
UNC-Wilmington	M/V Fort Fisher	River	Southport-Ft. Fisher
UNC-Pembroke	M/V Lupton	River	Minnesott-Cherry Br.
UNC-Charlotte	M/V Silver Lake	Sound	Cedar Is.-Ocracoke
UNC-Asheville	M/V Chicamacomico	Hatteras	Hatteras-Ocracoke
N.C. Central	M/V Ocracoke	Hatteras	Hatteras-Ocracoke
Elizabeth City State	M/V Kinnakeet	Hatteras	Hatteras-Ocracoke
Western Carolina	M/V Gov. Edward Hyde	Sound	Swan Q.-Ocracoke
Appalachian	M/V Frisco	Hatteras	Hatteras-Ocracoke
Winston-Salem State	M/V Stanford White	River	Hatteras-Ocracoke
N.C. School of the Arts	M/V Pamlico	Sound	Cedar Is.-Ocracoke
UNC-Greensboro	M/V Gov. James B. Hunt Jr.	River	Knotts Is.- Currituck
N.C. A&T	M/V Cape Point	Hatteras	Hatteras-Ocracoke
Fayetteville State	M/V Beaufort	River	Bayview-Aurora
Shaw	M/V Conrad Wirth	Hatteras	Hatteras-Ocracoke
Campbell	M/V Drinkwater	Hatteras	Hatteras-Ocracoke
Elon	M/V Herbert Bonner	Hatteras	Hatteras-Ocracoke
Duke	M/V Southport	River	Southport-Ft. Fisher
Wake Forest	M/V Neuse	River	Minnesott-Cherry Br.
Gardner-Webb	M/V Gov. Daniel Russell	River	Bayview-Aurora
Meredith	M/V Roanoke	Hatteras	Hatteras-Ocracoke



# N.C. Turtle Data Adding to Global Census

By Katie Mosher

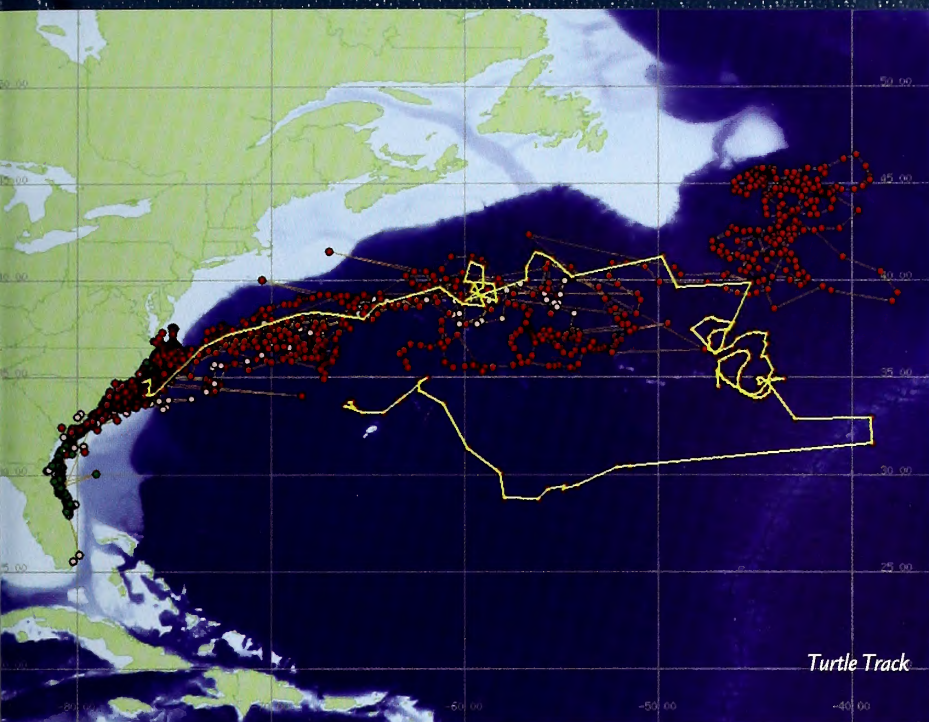
A Pamlico Sound turtle-tracking study is offering some surprising results — and the data sets have implications on the local, state, national and global levels.

The project is a “window into the lives and movements of sea turtles that we’ve never had before,” says Andrew Read of Duke University Marine Laboratory, who presented preliminary data at the 2004 meeting of the American Association for the Advancement of Science (AAAS).

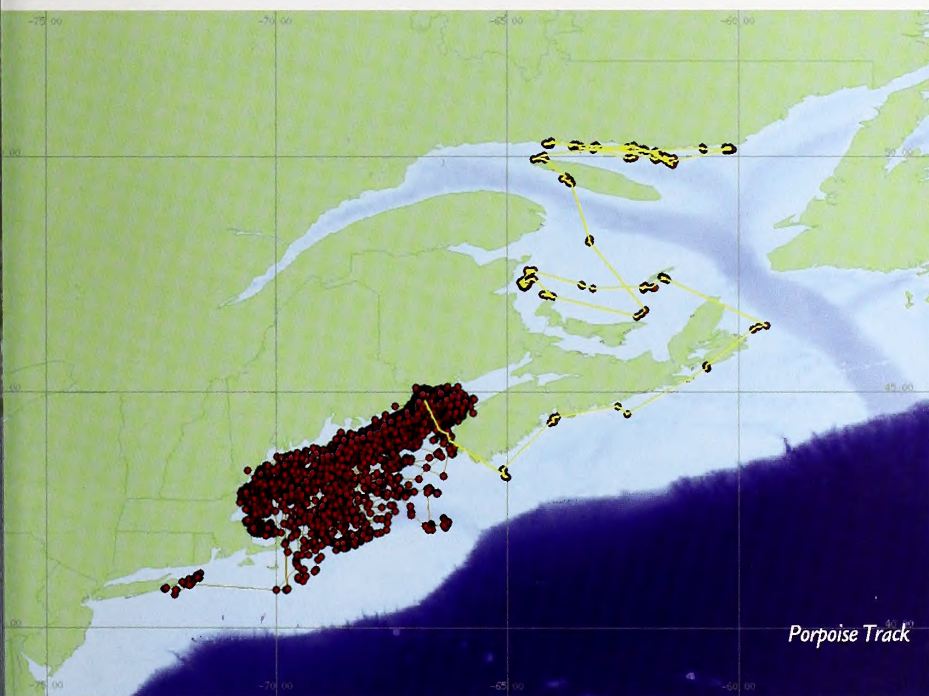
While Read says it is too early to draw firm conclusions, he was surprised by a group of turtles that headed to the open ocean — including one loggerhead tagged and released in September 2002 that went “half-way to Africa,” then turned back. By February 2004, it had traveled about 6,500 miles.

The turtle study is designed to determine movements of loggerheads and other turtles in an effort to reduce the number of turtles caught in flounder gill nets. The study is supported by the N.C. Fishery Resource Grant Program (FRG), which is funded by the N.C. General Assembly and administered by North Carolina Sea Grant.

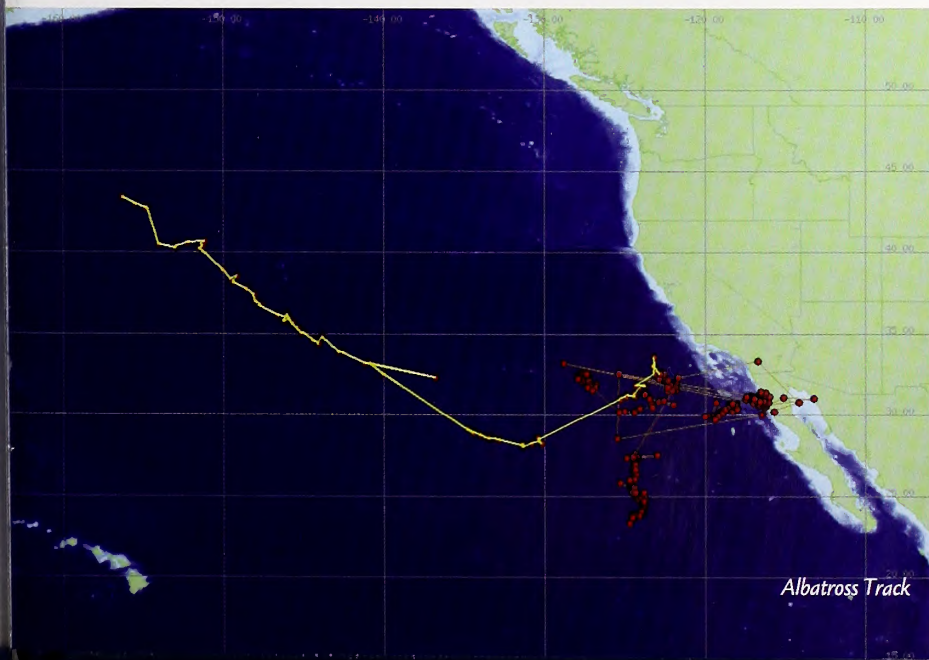
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Turtle Track



Porpoise Track



Albatross Track



In his AAAS presentation, Read cited the FRG turtle study as one of three examples that emphasize the need for cooperative efforts in gathering and presenting marine life data, so that global perspectives on marine animal movements are available to many audiences.

"The more that everybody has access to information, the better decisions can be made on all levels," Read says.

### Tracking Turtles

The FRG project has tracked 45 turtles — making it one of the largest single satellite tagging efforts for turtles anywhere in the world. The focus was to learn more about movements within Pamlico Sound and after the turtles leave the sound.

"Once they came into the sounds, we didn't think that they would go back out to sea," Read explains.

He and Duke doctoral student Catherine McClellan had expected that when the North Carolina sound waters turned cold in the winter, the turtles would travel through coastal waters south to Florida. Some individual turtles did head to Florida, but yet a third group stayed in North Carolina coastal waters.

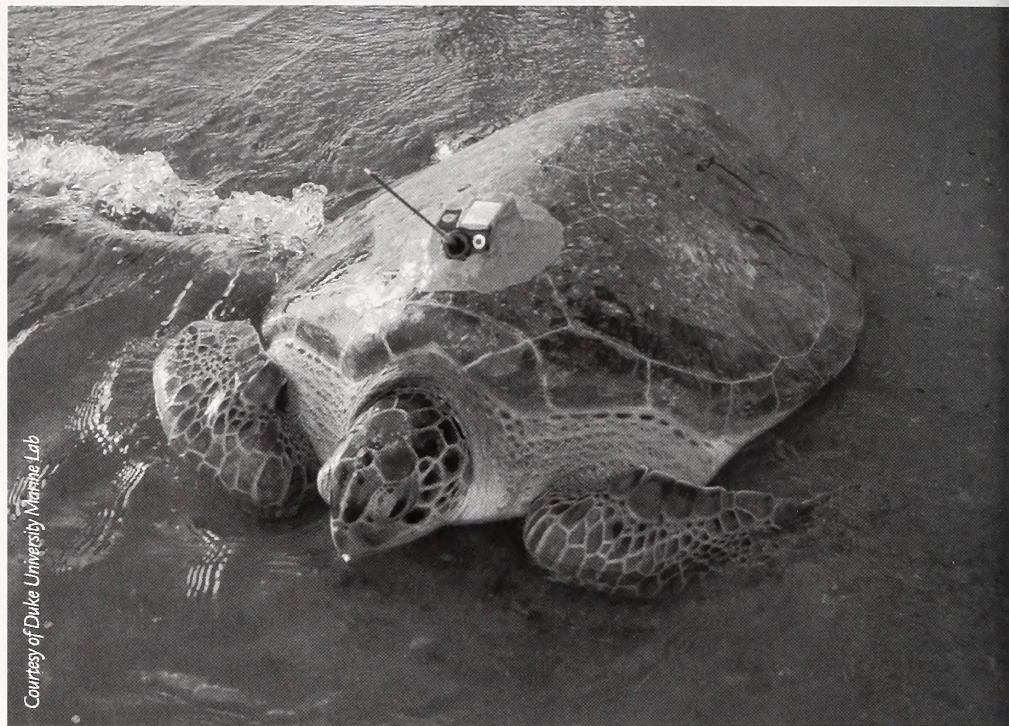
With the tracking data in hand, the researchers are focusing on the Pamlico Sound turtle/fishing interactions by overlaying two years of the turtle movements with flounder fishing efforts. They will add other data, such as water surface temperatures. "This is critical information to put into the management process," Read says.

Started in 1995, the FRG program supports research teams that combine expertise and skills from both the fishing and academic communities, explains Ronald G. Hodson, North Carolina Sea Grant director.

Read agrees that the grant program not only provides crucial funding, but also initiates new partnerships. "We have had some extraordinary relationships with fishermen, and we build on that."

Fisherman Bill Foster of Hatteras and Read proposed the tagging effort after the entire Pamlico Sound was closed to large-mesh gill nets from September to December each year because too many sea turtles were stranded. "Fishermen have nothing against the turtles," Foster explains.

Pound nets are allowed in the sound



because turtles that may become trapped would still be able to reach the surface to breathe. Thus McClellan worked with pound netters, including Michael Peele of Hatteras, to attach the transmitters to otherwise healthy turtles who had gotten caught in pound nets.

Peele sees his effort as not only personally rewarding, but also providing scientifically sound research that can help the fishing community. "It keeps us fishing," he says.

"I know the government has a priority on these turtles. If we want to fish, we have to learn how to stay away from them — and to release them alive."

When completed, the project's final report will be of great interest to the N.C. Division of Marine Fisheries (DMF) and the N.C. Marine Fisheries Commission. "It will help us refine our winter large-mesh and small-mesh flounder gill net fishery management," says David L. Taylor, a DMF representative on the FRG grants committee.

For example, the conclusions may define areas with little or no interactions, which could be considered to be opened to gill nets, Taylor explains. Or the study may identify specific trends — such as temperatures and weather patterns — that would signal the likelihood of interactions within a given season.

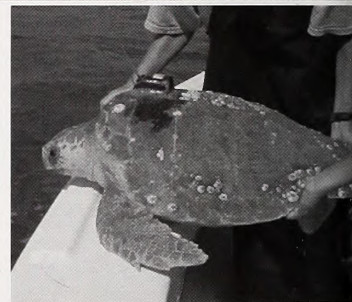
Whatever the results show, Taylor expects them to be accepted by many stakeholders.

*TOP TO BOTTOM:* Satellite transmitters help Fishery Resource Grant researchers track the movement of loggerhead turtles.

- Forty-five turtles were released back into the Pamlico

*Sound — and some headed out on grand adventures.*

- Catherine McClellan takes measurements and notes identifying features of turtles tagged in Pamlico Sound.



"When the fisherman is paired with the academic, we have had some good products that are useful for everyday management," he says.

"And, there is added credence when the data is presented to the fishing community because fishermen assisted in collecting it."

### Global Perspective

While the FRG project's primary goal is to deal with an important issue on the local and state levels, it also provides data for larger studies. The tracking information already is available online (<http://obis.env.duke.edu>). When complete, the final analysis regarding Pamlico Sound also will be available online.

The information may be used by a pound net or gill net fisher who wants to follow the turtle movements, and then use the trends to determine



placement of nets. State and federal regulators also will review the data and conclusions, as will interest groups weighing in on proposed regulations.

The data also has global impacts as it is added to a digital archive of the location and movement of sea turtles, marine mammals and seabirds around the world. Known as "Spatial Ecological Analysis of Megavertebrate Animal Populations," or SEAMAP, the project is based at

the Duke Marine Lab and is funded by the Sloan Foundation and the National Oceanographic Partnership Program.

SEAMAP is one component of an Internet data-sharing network called the Ocean Biogeographic Information System, or OBIS. In turn, OBIS is part of an even larger international Census of Marine Life project to track, collect and analyze information about all living sea animals.

OBIS studies highlighted in the AAAS

presentations included studies of porpoise and albatross movements, as well as Stanford University studies of giant bluefin tuna in the Pacific and the Tag-A-Giant tuna study in Atlantic waters off North Carolina.

One challenge is to bring together researchers from various disciplines. "You have an operational oceanography community that's developing a lot of satellite remote sensing data and models," says Patrick Halpin, a Duke researcher working on SEAMAP.

"We have to take a gigantic body of data developed from the physical scientists and communicate that to the biological scientists," explains Halpin, who focuses on geospatial technologies, such as geographic information systems (GIS) and satellite remote sensing.

The team must encourage separate communities of oceanographers and marine biologists to collect information in forms that are compatible for analysis and display. "By developing common analysis methods and seamless data sharing techniques, we hope to help maximize the utility of existing ocean data collection for better scientific understanding and more effective ocean resource management," Halpin says.

For example, computer tools to track tagged sea animals should be able to provide appropriate data frequency and resolution so that physical scientists can use the satellite information to follow how currents flow and sea temperatures change. Such correlations are important because sea temperatures and currents may strongly influence where animals move in the open water.

Another challenge is convincing scientists, who traditionally work alone, that this new way of doing research requires more cooperative interaction, Read says.

"Some people are enthusiastic and willing to share their data. Some are less enthusiastic, but once we persuade them, they are willing to share their data," he explains.

"Some people are waiting to see how the whole project works out before they commit to anything. And there are some who don't buy the entire approach and want to maintain a single investigator way of working," Read says.

"Our argument is that won't work any more because the scales at which we're working are too large." □



Courtesy of Duke University Marine Lab



# The Osprey:

## *A Conservation Success Story*

By Pam Smith

**A**s nests go, this one is no architectural masterpiece. It appears to have been built haphazardly by unskilled laborers. Sticks and twigs protrude beyond the platform that tops a 35-foot utility pole at the North Carolina Aquarium on Roanoke Island.

Still, looks can be deceiving. A pair of ospreys has called it home for more than two decades. And the nest — constructed of tightly woven materials — has withstood wind, weather, and a move to a new perch when the aquarium expanded in recent years.

Joe Malat, aquarium exhibit curator, marked March 2 on his calendar as the official “homecoming” and the return of activity in the nest for the 24th year.

Though ospreys mate for life and return each year to their established nest, it's not certain that this is the original nesting pair because they never were banded. The male, however, could be an offspring since young males return to their original nesting area to mate.

In any case, Malat says, the nesting ospreys create a lot of excitement among aquarium staff and visitors alike. Perhaps it's because people appreciate environmental good news.

Initially, a static exhibit told of the effects of the powerful pesticide DDT — Dichloro-diphenyl-trichloro-ethane — on ospreys' ability to reproduce.

*Continued*



*This awesome male called Wilmington home for several nesting seasons. Ospreys, known as sea hawks, return to the same nests year after year.*

Ken Blevins, Wilmington Star-News









Ken Blivins, Wilmington Star-News



Ken Blivins, Wilmington Star-News

Walker Golder

LEFT: Mother osprey tends to new chicks in the nest atop a tall pine overlooking the Intracoastal Waterway.  
RIGHT: These protective parents are wary of a photographer's visit in a cherry picker to capture a family portrait. A Web cam also documented their progress.

Scientists found that DDT introduced into the food chain and taken into the birds' systems was causing them to lay thin-shelled eggs that broke easily during laying or when sat upon by parent birds.

In fact, the brown pelican and bald eagle were driven to the edge of extinction. Populations of other fish-eating birds, including the osprey, were plummeting in many areas of the nation.

Since the use of DDT in the U.S. was banned in 1972, ospreys and many once-endangered birds have been increasing in numbers.

Now, the aquarium's living exhibit enables the public to witness the osprey's renaissance first hand. With the installation of a camera near the nest in 1995, images have been relayed to an aquarium monitor from first light of day until sunset. Soon, the images will be posted on the aquarium's Web site.

"It's a wonderful teaching tool," says Terri Kirby Hathaway, former aquarium education curator and now North Carolina Sea Grant marine education specialist. "I would tell the folks watching the monitor, 'That's live from Roanoke Island.' Their reaction was always one of surprise when they realized they could step out the nearby door and see the birds in the nest."

The video captures and records the lifestyle of the osprey, says Malat. For one thing, they are fastidious nestkeepers. To keep it pest-free, the birds sidle to the edge of the nest to "projectile

poop" — a fact Malat learned the hard way when he first mounted the camera too close to the nest.

And, Hathaway adds, "The ospreys have used some pretty odd building materials through the years — a fly swatter, a toilet brush, a surgical glove and an aquarium brochure have been woven into the nest, along with the more conventional twigs and moss."

Ospreys are the picture of a devoted family unit, Malat says. "Once the eggs hatch, the attention of the male and the female are focused on nurturing the chicks until they fledge. They remain together in the nest until fall migration."

Despite the "up close and personal" view of osprey family life, the birds are not named. "Nothing at the aquarium is named," Hathaway notes. "Latin names are used to remind visitors that these are wild animals and should be respected and protected as such."

#### ON THE REBOUND

Ospreys, *Pandion haliaetus*, provide a great wildlife conservation story, Hathaway says. "I don't know the exact counts, but anecdotally, there seems to be a lot more nesting along our coast."

Her observations are on target says Rob Bierregaard, a professor of biology at the University of North Carolina at Charlotte. Osprey populations in North Carolina are in good shape.

In fact, the osprey has made a remarkable recovery from the DDT era across the continent. Some 18,000 to 19,000 pairs have been documented in the lower 48 states, says Bierregaard, who has been studying the East Coast osprey since the 1960s.

Oddly, the osprey never made the federal endangered species list because dramatic population declines appeared to be regional rather than countrywide, he notes. For example, by the late 1960s, the documented nesting pairs of New England osprey between New York and Boston had plummeted from 1,200 to 100.

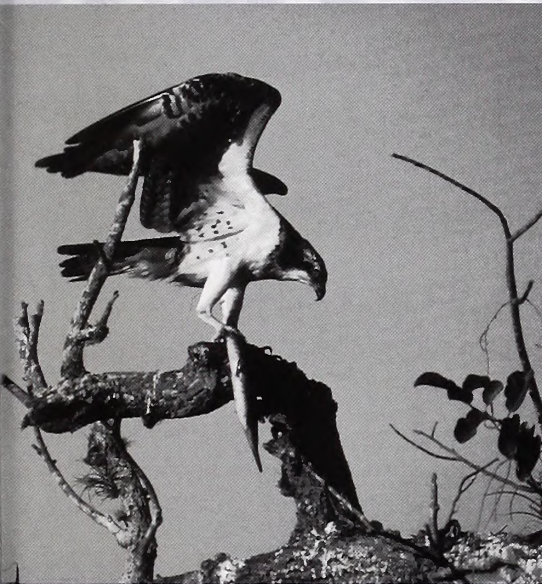
Scientists discovered that birds at the end of long food chains made the most dramatic population declines, because concentrations of DDT multiply up the food chain. The effects were not as devastating in areas where ospreys were at the end of a short food chain.

Now osprey populations are rebounding in New England — including Martha's Vineyard where Bierregaard began his ongoing studies. In 1969, he banded the last known nesting pair of ospreys. Since then, the island's ospreys have slowly recovered, with from 58 to 65 nesting pairs each season and an average of 1.2 successful fledges per nest.

#### OSPREY ODDITIES

Ospreys, he says, have a lot of evolutionary smarts. For example, male offspring return to nest close to where they were born. Females, on





*Ospreys have keen eyes for fishing and well-designed talons for holding on to their slippery catch.*

the other hand, wander significantly to mate. "This keeps the gene pool mixed up, something species 'know' to do in an evolutionary sense," Bierregaard explains.

Ospreys are highly specialized for fish eating. Their remarkable eyesight accommodates water refraction, enabling them to accurately target fish. When an osprey emerges with its catch, seemingly schooled in the laws of aerodynamics, it positions the fish headfirst in its talons for the flight to its nest. Its flexible outer toe and spiny bottom scales are designed to hold slippery fish.

While Bierregaard lauds the parenting skills of ospreys, he is quick to lay aside the notion that parent osprey "teach" the young to fish or fly.

"It's more like the parents are less interested in bringing food to nest," he observes. "Youngsters are on an allowance until they polish their skills. Besides, the parents don't have to teach the young to fish. Birds are wired to catch fish."

Shorter fall days probably trigger migration south.

"While they are inseparable during nesting, the family takes separate vacations. First momma, then dad, then baby. It's not clear why they don't travel together," he says.

The birds leap frog south along the migration path that brings them to a range from Florida to South America. For reasons

unknown, ospreys don't build nests or breed in the tropics. And, young birds instinctively know they are not going to breed for two years, and so remain in the tropics until their second birthday.

Ospreys are believed to live to the ripe old age of about 20, Bierregaard explains.

#### HOMEWARD BOUND

In the spring, the male osprey returns to the nesting ground ahead of his mate. A delay could result in an unexpected guest in the home nest. That was the case two seasons ago at Jim Teachey's Intracoastal Waterway lot near Wilmington.

A great horned owl had commandeered the osprey nest that Teachey — and the world — had been watching for two previous seasons thanks to a well-placed Web camera. Teachey's first reaction was to ask U.S. Fish and Wildlife Service officials how to get rid of the owl. "You don't," they warned. It's a federal offense to disturb an endangered bird. Besides it's a rarity to document the nesting and rearing habits of a great horned owl, they told Teachey.

And so, the Web camera enabled global visitors into the great horned owls' nest to watch the pair raise two chicks. Only one made it to fledge, Teachey reports.

The resident osprey — no match for the fiercest bird of prey — wisely did not contest the 2002 takeover. In 2003, though, the original osprey couple reclaimed their home nest. Of the three chicks that hatched, only one made it through to fledge.

Typically, Teachey's Web site gets about 40,000 hits each nesting season. He receives e-mails from people from Japan to the United Kingdom. "One touching message was from a bedridden woman in England. She thanked me for helping her 'go outdoors' to enjoy nature that she loves so much. She said it freed her. What can you say? That makes it all worthwhile," he recalls.

"It's a privilege to have this treasure in my own backyard, and to share what I enjoy so much with the people in my community and the world."

As of press time, no osprey has claimed the Teachey nest for the 2004 season. □

#### OSPREY ODDITIES

- **LATIN NAME:** *Pandion haliaetus*, from Greek, literally sea eagle
- **AKA:** fish hawk or sea hawk • **LENGTH:** 21-26 inches
- **WEIGHT:** 2.2-4 pounds • **WINGSPAN:** 59-67 inches
- **DESCRIPTION:** Dark back and wing with white on the top of head and extending from under the chin down the belly. Females have a dark "necklace." In flight, they are distinguished from the bald eagle by the white belly and the crooked wings with dark "wrist" patches.
- **NESTING:** Ospreys usually are territorial. In most places, their nests are scattered atop tall trees, power poles or channel markers. Where there are abundant fish and no predators, they can become colonial. Osprey lay an average of three eggs at intervals of one to three days. Incubation lasts 34-40 days, and is done by both sexes. Success rate varies from one to two chicks per clutch. Average fledgling at 48-59 days. Young remain dependent on the parents for another four to eight weeks, ending in fall migration, that is triggered by shortened days.
- **SOURCE:** Rob Bierregaard and Carolina Raptor Center: [www.carolinaraptorcenter.org](http://www.carolinaraptorcenter.org)

#### WEB SITES OF INTEREST:

- Rob Bierregaard's home page: [www.bioweb.uncc.edu/bierregaard/](http://www.bioweb.uncc.edu/bierregaard/)
- North Carolina Aquarium: [www.ncaquariums.com](http://www.ncaquariums.com)
- View nest at Jim Teachey's lot: <http://home.ec.rr.com/ospreynest/autoupdate.htm>
- Blackwater National Wildlife Refuge, Md.: [www.friendsofblackwater.org/osprey.html](http://www.friendsofblackwater.org/osprey.html)





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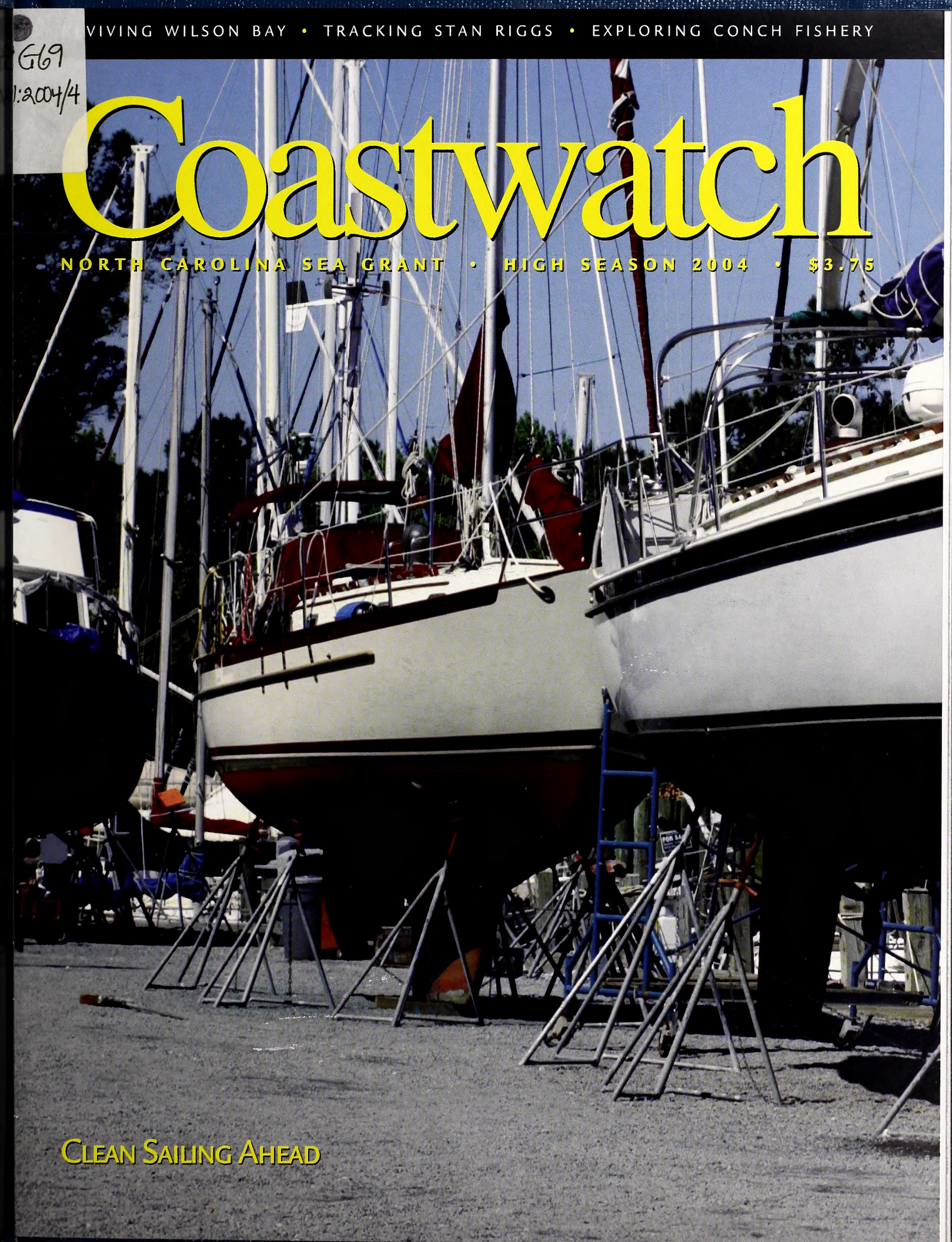


VIVING WILSON BAY • TRACKING STAN RIGGS • EXPLORING CONCH FISHERY

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# Coastwatch

NORTH CAROLINA SEA GRANT • HIGH SEASON 2004 • \$3.75



CLEAN SAILING AHEAD



## Lessons for a Lifetime

This summer, and for years to come, we hope that millions of coastal residents and beach visitors around the country will remember that they can “Break the Grip of the Rip.”

If caught in a rip current, they should: 1) remain calm; 2) swim across the current to calmer waters; and 3) then swim at an angle toward shore.

That lesson has stuck with Howard Marks of Virginia for nearly two decades. In 1985, he was caught in a rip current while vacationing in Avon. But before he got into the water, he had seen a rip current poster — and that quick read taught him the lesson of a lifetime.

North Carolina Sea Grant has a strong tradition of partnering with beach communities to promote beach safety. Spencer Rogers, our veteran coastal erosion specialist, recalls that shortly after he joined Sea Grant in 1978, he received a copy of a rip current safety poster from Dennis Regan, then a Sea Grant extension agent on the Outer Banks.

The Outer Banks beach patrols are still state leaders in ocean rescue — programs in Nags Head, Kitty Hawk and Kill Devil Hills have earned U.S. Lifesaving Association (USLA) advanced certification.

Other North Carolina programs are now looking to earn USLA certification, or in the case of Wrightsville Beach to move to advanced certification.

Our first Sea Grant poster has been updated over the years, and new products added. A video was developed in 1998 — an effort initiated by Dare County officials in partnership with Sea Grant and the National Parks Service. The video still is shown in water safety classes and on many cable access channels.

In more recent years, a Bogue Banks physician suggested a brochure



that he could share with his patients — and more than 50,000 have been distributed around the country. Topsail Island rescue officials requested a metal sign that would be more permanent than a poster — and now nearly 800 signs dot beach access points along our coast and three other states.

These North Carolina products were among the models considered by the national task force that convened last summer. In May, folks from around the country gathered in Wrightsville Beach to unveil the fruit of our labor.

The new national sign, brochure, Web site and public service announcement bring a consistent message — from North Carolina to Southern California, from Florida’s Panhandle to the Great Lakes.

The event marked a successful national partnership — one in which multiple agencies had to agree on phrasing and coordinate funding.

The event also highlighted the local partnerships that focus on beach safety. For the campaign launching, we had tremendous support from UNC-TV, Holiday Inn Sunspree Resort, Time Warner Cable, the Wrightsville Beach Chamber of Commerce, Mayor Avery Roberts and the Board of Aldermen, as well as the Wrightsville Beach Fire and Police Departments. Reid Hardy, past president of the chamber, served as our master of ceremonies for the event broadcast via satellite.

Their efforts — and more too numerous to name — are already paying off. A NOAA survey revealed 123 television news stories around the country focused on the campaign, reaching more than 15 million viewers.

And in the words of Reid Hardy: “If we save one life, it will be enough.”

*Katie Mosher, Managing Editor*

### I N T H I S I S S U E

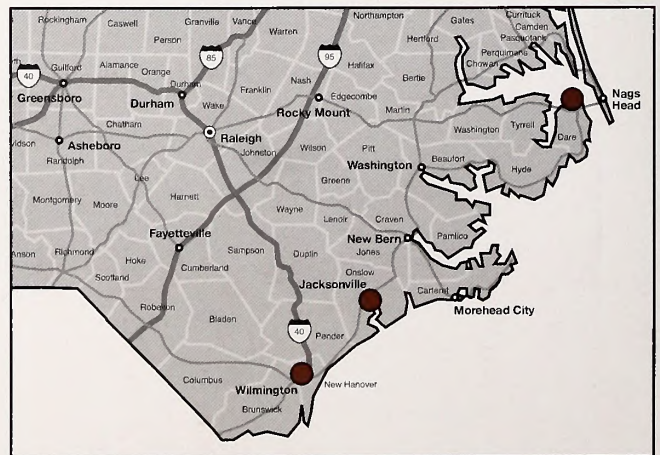
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*North Carolina’s diverse coast offers countless interesting subjects. The large dots on the locator map indicate story settings in this issue — including Manteo, Jacksonville and Wilmington.*





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# Coastwatch

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The North Carolina Sea Grant College Program is a federal/state program that promotes stewardship 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, North Carolina Sea Grant supports research projects, a 15-member extension program and a communications staff. Ron Hodson 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. *Coastwatch* (ISSN 1068-784X) is published six times a year by the North Carolina Sea Grant College Program, North Carolina State University, Box 8605, Raleigh, North Carolina 27695-8605. Telephone: 919/515-2454. Fax: 919/515-7095. Subscriptions are \$15. E-mail: [katie\\_mosher@ncsu.edu](mailto:katie_mosher@ncsu.edu) World Wide Web address: <http://www.ncseagrant.org> Periodical Postage paid at Raleigh, N.C.

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Cover photo of sleek sailboats by Scott Taylor.  
Table of Contents photo of oyster shells  
by Tasha Petty.  
Printed on recycled paper. ♻️

## COASTAL TIDINGS

### Break the Grip of the Rip

Summer beach visits should be memorable — and safe.

That's the goal of the "Break the Grip of the Rip" awareness campaign launched in May by the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Lifesaving Association (USLA).

"On average, more people die every year by rip currents than to shark attacks or weather-related deaths, such as tornadoes, lightning, hurricanes or flooding," retired Navy Vice Adm. Conrad C. Lautenbacher, NOAA administrator, said at a news conference in Wrightsville Beach.

The new national safety program builds upon earlier efforts by the National Weather Service (NWS) and the National Sea Grant Network, both part of NOAA, as well as USLA, which provides training and certification for open water lifeguards across the country.

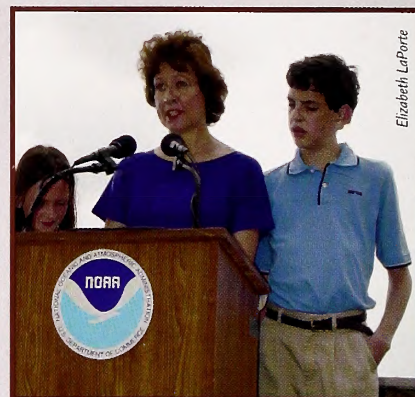
But the campaign includes a personal message as well.

"Teach your kids beach safety and how to act if they are in trouble in the water," said Sandee LaMotte whose husband, CNN bureau chief Larry LaMotte, died trying to save their son from a rip current in Florida last year.

Although their son was rescued, another good Samaritan lost his life in an attempt to save LaMotte's husband. "Eight families lost loved ones to rip currents on that day — and it did not need to happen."

To avoid future tragedies, beach visitors are encouraged to check daily rip current outlooks that are included in the NWS surf zone forecasts for coastal regions. Go to [www.ripcurrents.noaa.gov](http://www.ripcurrents.noaa.gov) and click on the outlook link to find forecasts for specific NWS offices.

The site also includes a wealth of information on rip currents, as well as links to



The LaMotte family — from left, Krysta, Sandee and Ryan — shared their tragic story.

download public service announcements in English and Spanish, and a national sign and a brochure designed by Michigan Sea Grant.

Awareness is important for even the best swimmers, as rip currents can move faster than an Olympic swimmer, according to Spencer Rogers, North Carolina Sea Grant coastal erosion specialist.

If you get caught in a rip, remember:

- Stay calm — don't fight the current.
- Escape by swimming across the current — in a direction following the shoreline.
- When free of the current, swim at an angle toward shore.

If you see someone else caught in a rip, get help from a lifeguard. Also yell instructions and throw something that floats. And, call 9-1-1.

"Rip currents are dangerous because they are invisible to the untrained eye and can happen without warning," said Chris Brewster, USLA president.

For more information on new products, contact Katie Mosher at 919/515-9069 or [katie\\_mosher@ncsu.edu](mailto:katie_mosher@ncsu.edu). — K.M.

### In the Next Issue of *Coastwatch*

Five years after Hurricane Floyd, Pam Smith looks at recovery in the coastal plain, while Lilly Loughner highlights books about the state's stormy history. Ann Green travels to the rural community of Alligator in Tyrrell County, where trapping has been a rich tradition. Also, readers learn how the Sea Grant mission translates to international efforts.



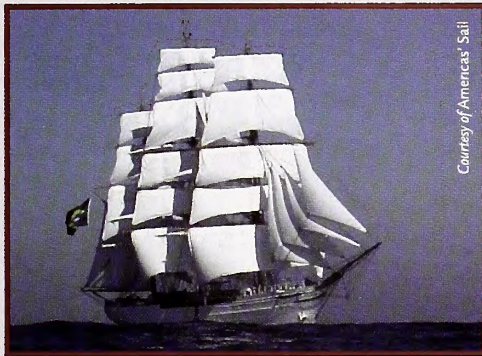
## COASTAL TIDINGS

### Tall Ships Coming to Beaufort

Beaufort will play host to the Pepsi Americas' Sail July 1-5, 2006.

Before arriving in Beaufort for the trophy presentation, the participating tall ships will have sailed along the South American coast in the Americas' Sail fourth competition of the year. The vessels competing in the event will be Class A and Class B tall ships.

The 2006 event will conclude in Beaufort because of a local connection: It's the home port of Horatio Sinbad, Captain of the *Meka II*. Sinbad was awarded the 2002 Americas' Sail trophy, after winning the tall ship Class B competition.



Tall ships will sail into Beaufort in 2006.

Courtesy of Americas' Sail

Minges Bottling Group of Ayden.

Some vessels that have competed in Americas' Sail in the past include: *Cisne Branco* from Brazil, *Simon Bolivar* from Venezuela, and *Eagle* — the U.S. Coast Guard flagship. Other American boats that have competed are *Compass Rose*, *Wolf* and *Mystic Whaler*, along with Sinbad's *Meka II*.

— R.R.

Americas' Sail was established in 1988 to give Class A and Class B tall ships an opportunity to compete in an international event that entertains worldwide sailing fans. The primary sponsor of the 2006 event is the

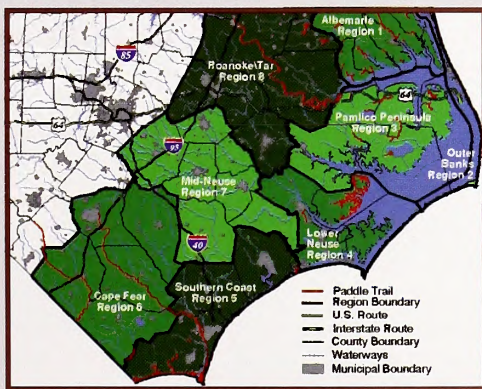
### New Carteret Paddle Trail Maps

Want to paddle by horses and sheep grazing on a Carteret County island, through a rambling salt marsh, or by beaver dams?

These diverse habitats are on Carteret County paddling trails featured on three new maps produced

by the Crystal Coast Canoe & Kayak Club. Two maps feature places to paddle in Western Carteret, including the White Oak River area, Bear Island, Bogue Sound and Newport River. The third map focuses on paddling trails in Central Carteret, including Morehead City, Beaufort and Harkers Island.

The color maps, produced in cooperation with the N.C. Division of Parks and Recreation, include driving directions to sites, as well as trail



Courtesy of Crystal Coast Canoe & Kayak Club

or vacation@sunnync.com. Also, N.C. Parks & Recreation, 127000 Bay Leaf Church Rd., Raleigh, NC 27614; 919/846-9991.

A more comprehensive N.C. Coastal Plains Paddle Trail Map is available online at [www.ncsu.edu/paddletrails/](http://www.ncsu.edu/paddletrails/). The regional map was coordinated by the N.C. Division of Parks and Recreation, North Carolina Sea Grant, and the Partnership for the Sounds.

— A. G.

difficulties and hazards.

To order the Carteret paddle trail maps, contact: Carteret County Tourism Development Authority, 3409 Arendell St., Morehead City, NC 28557; 252/726-8148;



Families of those being memorialized may take part in every step of the process, from dedication to placement.

### Eternal Reefs Memorial

"Sleeping with the fishes" has taken on a literal meaning with the introduction of artificial reefs that contain the cremated remains of loved ones. This summer, the Atlanta-based Eternal Reefs, Inc., will begin depositing artificial reefs off the coast of North Carolina, in collaboration with the N.C. Division of Marine Fisheries.

The reefs allow cremated remains to be a part of a living eco-habitat for fish, turtles and other sea life instead of in an urn on a shelf or mantle.

"As far as a final resting place, it's not just a memorial. It allows for a whole new ecological system to develop," says company founder and president Don Brawley.

The "memorial reefs" — an offshoot from the "reef ball" artificial reef system — are made from cast concrete mixed with cremated remains and are expected to last approximately 500 years, according to company spokesperson Amanda Leesburg.

The families of those being memorialized are encouraged to participate in every part of the process, from casting to dedication and placement. With a memorial certificate that identifies the exact location of the reef, it is easy to go back and visit.

"We had a woman who was 58, and she got a diving certificate just so she can dive on her son's reef," Leesburg says.

For more information visit [www.eternalreefs.com](http://www.eternalreefs.com) or call 888/423-7333. — T.P.



## N.C. Develops Wildlife Plan

What is being done about the robust redhorse or mole salamander — two North Carolina species of special concern?

The State Wildlife Grants (SWG) program, created by Congress in 2001 as a branch of the Conservation Trust Fund, provides federal funding to each state and territory to support cost-effective conservation with the goal of preventing wildlife from endangerment.

The grants call for statewide Comprehensive Wildlife Conservation Plans — due by October 2005.

North Carolina holds a \$1.7 million share of funding — out of \$80 million proposed for the 2005 budget — to be utilized by the N.C. Wildlife Resources Commission (WRC). Efforts must focus on the “species in greatest need of conservation.” Generally these are nongame species not supported by recreational fees and taxes.

Species review committees guided by WRC and composed of North Carolina wildlife experts helped to compile a list of more than 300 species.

The comprehensive wildlife plan is slated for completion by July 2005. Stakeholders will review the plan and provide input.

Funds from SWG have supported a variety of projects in North Carolina, including research on beach nesting birds. To find out more about the wildlife plan, visit WRC’s Web site at [www.wildlife.state.nc.us](http://www.wildlife.state.nc.us). Click on the link to Wildlife Species and Conservation and navigate to the N.C. Comprehensive Wildlife Conservation Plan page.

— L.L.

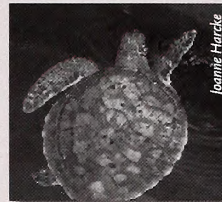
## Turtle Trails Project Studies Loggerheads

Researchers at the N.C. Aquarium at Roanoke Island — in collaboration with the Network for Endangered Sea Turtles (NEST), N.C. Wildlife Resources Commission and North Carolina State University’s College of Veterinary Medicine — are developing the Turtle Trails project to study the post-release movements of 14 juvenile loggerhead sea turtles treated for cold stunning.

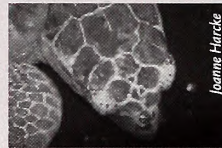
“We’ve been rehabilitating cold-stunned sea turtles for many years, but never knew whether our efforts were effective,” says Joanne Harcke, conservation and research coordinator for the Roanoke Island aquarium.

Some loggerhead sea turtles suffer from cold stunning, or extended hypothermia, along North Carolina’s coast each winter. While most juvenile loggerheads migrating to warmer waters have passed through North Carolina sounds by January, some stay for the winter.

These turtles may face trouble when



Joanne Harcke



Joanne Harcke



Dave Baker

water temperatures plummet, especially in the shallow sounds.

Scientists don’t know why some loggerheads suffer from cold stunning while others do not. Susceptible turtles become lethargic, float to the surface of the water and are found stranded on beaches. If properly cared for, these loggerheads are likely to recover and can be returned to the wild.

The NEST rehabilitation facility, based at the Roanoke Island aquarium, provides care and release for many affected loggerheads.

Rehabilitated turtles are tagged with satellite transmitters and released into coastal waters where their movements are followed and studied.

To view research logs, tracking maps, tag-and-release photos, and teaching activities, visit the new Turtle Trails site at [www.ncaquariums.com/turtletrails](http://www.ncaquariums.com/turtletrails).

— L.L.



Courtesy of NCCAT

## NCCAT Adds Ocracoke Campus

The former U.S. Coast Guard Station in Ocracoke is getting a facelift.

After a \$5 million renovation by the state of North Carolina, the historic structure will be used as an eastern outpost for the N.C. Center for the Advancement of Teaching (NCCAT).

The three-story facility will serve as a residential education center, where teachers at all levels can attend support seminars.

NCCAT has provided professional development seminars for teachers at locations throughout the state for almost 20 years. The center’s main campus in Cullowhee serves more than 6,000 North Carolina educators each year.

With a new facility, the center will be able to serve more teachers. To find out more about NCCAT, visit the Web: [www.nccat.org](http://www.nccat.org).

— A.G.



## Coastal Habitat Protection Plan to Debut

In the coming months, citizens across North Carolina will see and comment on the state's proposed Coastal Habitat Protection Plan (CHPP).

The draft document is the result of two years of work by the Intercommission Review Committee (IRC), charged by the N.C. Department of Environment and Natural Resources to devise strategies to protect and restore fish habitats for the long-term enhancement of coastal fisheries. The premise is that healthy habitats are the foundation of healthy fisheries.

The IRC is composed of members of the Marine Fisheries Commission, the Environmental Commission, and the Coastal Resources Commission.

The public is urged to attend input meetings that will begin at 7 p.m.:

- July 13, N.C. Aquarium on Roanoke Island, Manteo;
- July 14, Town Council Chambers, 500 South Broad St., Edenton;
- July 19, Quality Inn Ballroom, 701 North Marine Blvd. (U.S. 17), Jacksonville;



- July 21, East Carteret High School Auditorium, 3263 U.S. 70 East, Beaufort;
  - July 22, Craven County Court House, 411 Craven St., New Bern;
  - July 27, Brunswick County Commission Chambers, Building I, County Government Complex, Bolivia;
  - July 28, New Hanover County Northeast Regional Library, 1241 Military Cutoff Rd., Wilmington;
  - July 29, N.C. Estuarium, 223 East Water St., Washington;
  - Aug. 3, Charles Mack Citizens Center, 215 North Main St., Mooresville; and
  - Aug. 4, N.C. Museum of Natural Sciences, 11 West Jones St., Raleigh.
- For more information on ways to get involved, call the CHPP office at 252/726-7021 or 800/682-2632. Information is available on the Web at [www.ncfisheries.net](http://www.ncfisheries.net). Questions and comments may be sent to [chpps@ncmail.net](mailto:chpps@ncmail.net). — P.S.

## Restoration Projects Abound in Onslow

Water quality is a major coastal issue that just keeps growing. Onslow County has initiated two new cleanup projects funded by the National Oceanic and Atmospheric Administration's (NOAA) Community-based Restoration Program.

Chaney Creek is Jacksonville's largest subbasin and a priority for cleanup. The restoration proposal calls for salt marsh and submerged aquatic vegetation restoration, and the creation of oyster reef. Mussels and clams will filter pollutants.

The city is applying the concept used in Wilson Bay upstream, says Pat Donovan-Potts, field coordinator for the Jacksonville water quality initiative. NOAA is awarding \$137,493 to the city for the project.

A similar effort to restore fishery habitat in Stump Sound by the North Carolina Coastal Federation will receive \$114,188 from NOAA. North Carolina Sea Grant, the Division of Marine Fisheries and J&B AquaFoods also will offer in-kind contributions to meet the \$230,000 total cost of the project.

Four acres of oyster habitat will be created in Stump Sound, where a salt marsh will be restored. Also, a community outreach program will explain the value of oysters to water quality.

The Stump Sound and Chaney Creek strategies spouted from a larger water quality initiative in Onslow County. Turn to page 6 to learn about Jacksonville's Wilson Bay project.

— L.L.



Sandra Harris and Walter Clark took division honors.

## Sea Grant in the Winners' Circle

Two Sea Grant staffers stepped into the winners' circle at recent North Carolina State University Awards for Excellence ceremonies.

Taking honors for the NC State Division of Research and Graduate Studies were Sandra Harris, public information assistant, and Walter Clark, coastal communities and policy specialist. Todd Marcks, from the department of graduate studies, also was honored for outstanding service.

The trio received recognition plaques and checks from John Gilligan, associate provost for Research and Graduate Studies. The division winners advanced to university-wide competition.

Harris was cited for her contributions to the university throughout her 24 years of service. At Sea Grant, her duties bridge administration and communication and include distribution of *Coastwatch*, newsletters, news releases and dozens of Sea Grant publications.

Clark, who has been with Sea Grant since 1984, was praised for being a prolific ambassador for NC State and Sea Grant. He has forged partnerships with universities, state and federal agencies — and nations. He recently has taken the lead to establish research ties with the North African countries of Morocco, Algeria and Tunisia.

His achievements also earned Clark the 2004 Outstanding Extension Award from the university. — P.S.







*"We wanted to create this place,  
make it a celebration of the river."*

— Jay Levine

*"You're privileged to live on the coast,  
but with privilege comes responsibility."*

— Pat Donovan-Potts

## From Students to Sturgeon: WILSON BAY REVIVED

B y L i l l y L o u g h n e r

A wavering line of children — mucking through a path in the marsh to collect critters for a lesson in marine biology — mirrors nearby reeds swaying in the wind. The 9-foot stalks of marsh grass are vibrant with rustled chatter. They form a coastal jungle around the young group.

The group's leader, Pat Donovan-Potts, is a marine biologist, teacher, role model and friend.

Donovan-Potts makes sure the children do not stray from the well-beaten path. She aims to teach, while ultimately conserving the resources that aid the learning process — resources such as the swaying grass, the mucky wetland bottom, the darting fish and the quietly lapping waters of Wilson Bay.

### SWIMMING IN SLUDGE

It wasn't long ago that Jacksonville's faulty wastewater treatment plant poured layers of sewage sludge over all life in the 126-acre bottom of Wilson Bay. Built in the 1940s, the treatment plant was unable to keep up with population growth and ran out of compliance.

The plant's 27-foot biotower — designed to remove bacteria, nutrients and chemicals from the city's sewage sludge — was an engineering failure.

As a result, the nutrients, chemicals and bacteria — particularly fecal coliform — were not adequately removed from the sludge. Fecal coliform are bacteria found living in colonies within the guts of warm-blooded animals, where the bacteria aid in digestion.

Partially treated at best, the sludge was then discharged into the bay.

Shellfish sanitation officials in the N.C. Department of Environment and Natural Resources (DENR) closed the bay to recreational and commercial uses for 10 years because of high levels of fecal coliform.

When a water body contains high fecal levels, humans should avoid direct contact. Fecal bacteria are not only harmful disease carriers, but also are an indication of other pathogenic bacteria that render swimming, boating and harvesting of fish or shellfish a danger to public health.

Excessive nutrient loading also triggered eutrophication, the process where excessive aquatic plant growth depletes dissolved oxygen in the water. If this natural process is accelerated by human activity, it may lead to algal blooms, low dissolved oxygen levels and fish kills.

In addition to the treatment plant, various other sources may have contributed to the bay's degraded water quality, including flooded hog farms, trash dumped along the shoreline and pollutants carried in stormwater.

The New River, which feeds Wilson Bay, was deemed one of the worst rivers in the state by the N.C. Division of Water Quality (DWQ) in 1991. The bay alone was described as "ecologically dead" and "nutrient sensitive."

*Continued*



## A CLEANUP INITIATIVE

In the early 1990s, the Jacksonville City Council decided to upgrade to a new land application plant built farther inland. This waste treatment plant, one of three in the U.S., cost \$50 million to build and irrigates 6,300 acres of forested pine plantation.

The old treatment plant officially closed in March 1998. With its closing, "The people wanted to see an effective reclaimed use of the riverfront and river," says Glenn Hargett, Jacksonville community affairs director.

"You don't hear local government use the words 'moral responsibility' very often. There was a clear public will to reclaim the river, and the city felt a moral responsibility to clean up Wilson Bay."

A series of community summits drew more than 1,000 people looking for ways to revive the bay. The city consulted Jay Levine, a researcher with North Carolina State University's College of Veterinary Medicine. He saw potential in the dilapidated buildings and wastewater tanks.

"Between the tanks and the large biotower, there were the makings for a huge aquarium," says Levine. Also, the industrial features of the treatment plant face a magnificent view of the bay.

Levine's idea quickly took root — and continues to grow into the educational center named Sturgeon City.

Eventually, the converted wastewater facility will be used to raise short-nosed sturgeon that could be released into the bay. The biotower will treat the fish waste. And the huge wastewater tanks will be divided into smaller viewing tanks.

Levine's early vision for Sturgeon City was "to fill the area with yellow school buses." But two obstacles were apparent: the stench-filled bay and the neglected area surrounding it.

The Wilson Bay Initiative (WBI) began



Photos by John Allhouse

*CLOCKWISE, TOP LEFT: Donning waders, students collect water quality samples. Students learn to dissect squid at the Sturgeon City Student Leadership Development Institute. There's much to see in the freshwater lily pond at Sturgeon City. Here students take temperature readings and get an up-close look at mosquito fish through the viewfinder. Students and volunteers of the Student Leadership Development Institute at Sturgeon City gather trash along the perimeter of Wilson Bay.*

as a comprehensive proposal submitted in 1997 by Levine, Donovan-Potts and the City of Jacksonville to the N.C. Clean Water Management Trust Fund (CWMTF).

The proposal included stormwater management and efforts "to clean up the bay and upper portions of the river through a new process called bioremediation — utilizing shellfish to filter water of toxicities and organics," says Donovan-Potts.

Donovan-Potts began collecting baseline data for the project in 1997. CWMTF awarded a \$572,000 grant to WBI in 1999.

### IDENTIFYING PROBLEMS

In addition to the bacteria and pollutants in the bay, other potential problems had to be defined before Donovan-Potts could formulate a plan of action to revive the bay.

For instance, no dissolved oxygen was found within Wilson Bay. A healthy bay requires 5 mg or more per liter.

Also, rather than an aerobic sand habitat

bubbling with life, a soft anaerobic mud — largely composed of sludge — blanketed the bay bottom. In fact, the accumulation created an 8-foot wall between the bay and the deeper channel. The wall pushed the natural flow of water away from the bay, decreasing the circulation of water and oxygen.

To make matters worse, freshwater intrusion from stormwater events caused salinity levels to drop. In an estuarine ecosystem, saltwater is key to survival.

With such poor conditions, the diversified bay-bottom organisms that should have been present — clams, oysters, crabs, shrimp and worms — had died off long ago.

And without bottom life, fish can't survive. "We didn't have a diverse finfish community because there was nothing to feed on," Donovan-Potts explains.

These factors weighed so heavily on the bay's ecology that NC State researchers predicted an extremely slow recovery — one that could take decades.



## LIVING FILTERS

The initiative to counteract the contamination in the bay began with millions of innovative solutions — oysters.

Oysters possess amazing filtering capacities, as one adult oyster can filter approximately

the bay. There also was a high incidence of petroleum byproducts — carcinogens that pose dangers from long-term exposure.

Thousands of ribbed mussels and clams were placed among the oysters because each of these shellfish targets a different food source.

in mesh bags. Spat start at 20 mm and can grow to 120 mm. And, the tiny oysters are cheap — just \$18 per thousand.

Reviving the bay also required boosting oxygen levels. Five aerating devices were placed in the bay to pull oxygenated water from the surface and force it towards the oxygen-depleted bay bottom. The hope is to pull flow in from the New River and restore the natural hydrology of the bay.

Once the aerators no longer are needed in Wilson Bay, they will be moved to other restoration projects.

Meanwhile, five hydrolabs in Wilson Bay monitor water quality every 15 minutes.

The oysters are monitored from 15 study areas where samples are collected, analyzed and replaced by Jacksonville staff, students and volunteers.

The project was well documented and can be duplicated in any municipality, says Donovan-Potts.

*The New River, which feeds Wilson Bay, was deemed one of the worst rivers in the state by the N.C. Division of Water Quality in 1991. The bay alone was described as “ecologically dead” and “nutrient sensitive.”*

## LIFE RETURNS

Expectations at the beginning were modest. “The elected officials thought this was a wonderful way to clean up the bay. The scientists told us that this would jump-start the process,” says Hargett. “Both scientists and elected officials were pleasantly surprised that there were some successes as soon as there were.”

Successes included return of migrating birds, marsh crabs, blue crabs and various species of fish.

“The flounder have come back. We’ve been catching croaker, spot, mullet, menhaden,” says Tami Dubois, water quality technician for the City of Jacksonville.

Since the closing of the wastewater treatment plant, implementation of the bivalve planting, and initiation of stormwater management measures, the bay’s water quality has

*Continued*

10 gallons of water over 24 hours, according to Donovan-Potts. And because the bay contains 101 usable acres of water, the amount of oysters needed to filter the entire bay would have to be substantial.

In this case, three million oysters were placed within the bay over a four-year period. That adds up to at least 30 million gallons of water being filtered each day.

The main concern was to filter the immediate danger of *E. coli* and other bacteria from

Oysters feed on heavy organics and contaminants. Ribbed mussels eat phytoplankton. Clams feed on bacteria.

Because “oysters have the greater filtering capabilities,” they were used the most, according to Donovan-Potts.

Valued for research purposes only, the oysters cannot be eaten and may be contaminated with the same pollutants they filter.

Juvenile oysters, known as spat, were placed throughout the water column of the bay



Photos by Tasha Petty

LEFT: Pat Donovan-Potts is careful to lead students only on the beaten path through the marsh grass. Conservation is key to Sturgeon City. RIGHT: Ron Pearson makes preparations for wildflower plantings at the new Sturgeon City Park.



rebounded, according to a CWMTF report. Hydrocarbons in sediments decreased nearly 70 percent, total nitrogen has been reduced, and fecal coliform levels have been significantly reduced.

Donovan-Potts says that the project also succeeded in restoring dissolved oxygen levels in Wilson Bay from zero to near normal levels.

As a result, the WBI has maintained a bottom community since Spring 2001 and has achieved a higher diversity of fish and waterfowl.

"We reopened the river and the bay to recreational and commercial uses in 2001 — what was closed for 10 years we reopened in two," she says.

*Students gain hands-on experience through activities — ranging from wetlands restoration to water quality monitoring and even leadership development. In time, many become volunteer teachers.*

The synergy of the Wilson Bay project has attracted about \$6 million dollars in grants from various sources.

Both Hargett and Donovan-Potts attest that much of the overwhelming response reflected in funding, community participation and local media attention can be attributed to the undeniable success of the project.

However, before there were successes with WBI, the city and its many partners took a science-based leap of faith. "You have to believe in the possibility," says Donovan-Potts.

An extra \$4.2 million from the U.S. Army Corps of Engineers will help keep the bay clean in the future by focusing on wetland restoration and stormwater management in the area.

"We're addressing stormwater runoff from all of the neighborhoods that border Wilson Bay and this portion of the river," says Donovan-Potts. Twenty-seven projects in these neighborhoods will filter, reroute and change stormwater flow through use of bioswales, rain gardens and

other options to filter the water before it makes its way to the bay or river.

Donovan-Potts was hired as the field coordinator for the Jacksonville water quality initiative along with technician Dubois. Their duties are ever increasing as the WBI continues to grow and spawn new projects.

"The lessons learned in Wilson Bay's

we'd like to see them return," says Donovan-Potts. However, because this species is endangered, a full return is unlikely, she adds.

But it's not just about the symbolic sturgeon. Donovan-Potts hopes that, if anything, her students will take home the message that "with privilege comes responsibility."

This sense of stewardship is encouraged



Photos by Tasha Petty

*LEFT: Oysters and other bivalves provide filtration as part of the Wilson Bay restoration.*

*RIGHT: The view of a growing Wilson Bay from the 27-foot biotower will remain a steadfast feature of Sturgeon City post construction.*

rapid recovery should encourage restoration projects around the state," adds North Carolina Sea Grant Director Ronald Hodson.

#### **STURGEON CITY VISION**

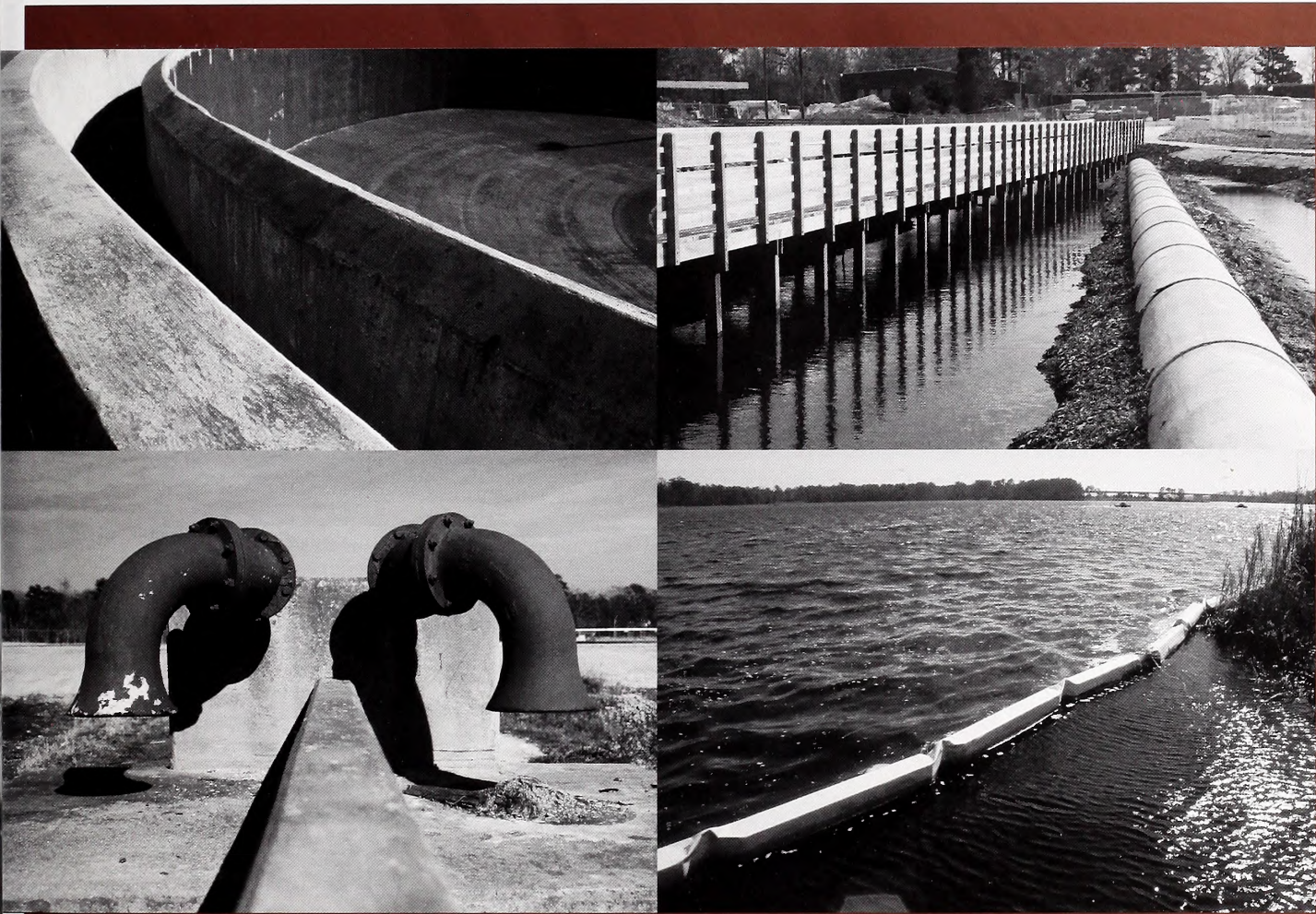
Sturgeons are the ghosts of Wilson Bay. Once swimming right up to the shore to feed, sturgeons now are nonexistent in the New River and endangered throughout their range.

"Sturgeons are indigenous to the river, and

after school, on weekends and over summer through an array of environmental educational programs — Wilson Bay Keepers, Science Explorers and seven Sturgeon City Institutes. Students gain hands-on experience through activities, ranging from wetlands restoration to water quality monitoring and even leadership development. In time, many become volunteer teachers.

Kira Alsop, an eighth grader recruited





Photos by Tasha Petty

*CLOCKWISE, TOP LEFT: The old wastewater tanks are designed to hold 1.7 million gallons of water. • Remnant industrial features remind visitors of both the human folly and success attached to the bay. • Now the Wilson Bay appears as calm and beautiful as it must have been decades ago. • Pipes once used by the old wastewater plant have been idle since 1998.*

from Jacksonville Commons Middle School, is a regular at Sturgeon City.

Sitting in the lab at Sturgeon City, holding an oyster in one hand and a permanent marker in the other, Alsop pauses for a moment to explain her task. “We check for mortality, growth and whether or not they’ve reproduced.” She marks the oysters by number in order to keep record of the oysters in her measuring sample.

Alsop’s partner for the day, Stephen Clark, an eighth grader from New Bridge Middle School, chimes in to explain the process. “Every site has a different set of oysters with the same numbering system and the same numbers in the bags. We clean, dry, take measurements, renumber, and put them back in the bay.”

Both students enjoy different aspects of the program, from working in the wetlands to

studying hydrolabs, which are little labs in a tube.

The combined response from students, grant institutions, researchers and volunteers in the community supports Levine’s philosophy: “It’s possible to pursue both economic development and environmental stewardship.”

Thus, designs for Sturgeon City will reflect that industry and nature can coexist. “We are going to leave the industrial look to the place as a constant reminder to not let history repeat itself,” Donovan-Potts explains.

A butterfly garden, outdoor amphitheater, gazebo-style picnic area, playground and nature walk are just a few ideas for the facility.

When Wilson Bay reaches full recovery and Sturgeon City grows within a watchful eye of the reborn bay, it is hoped that there will be a constant stream of people of all ages walking

through the center eager to learn.

They will walk from building to building, hushed by tanks flowing with sharks, skates, rays and sturgeon. Engaged and challenged by educators, they will learn the history of Sturgeon City and Wilson Bay. □

**Get Informed to Get Involved**

- To learn more about Wilson Bay, visit the Web at [www.sturgeoncitiy.org](http://www.sturgeoncitiy.org).
- To volunteer or enroll in a Sturgeon City Institute this summer, call Jeanne Stanley at 910/938-6452.
- To learn more about oysters, order Sea Grant’s new DVD: The Amazing Oyster: A Keystone Species for the Health of Our Coast. Call 919/515-9101.





# STAN RIGGS: GEOLOGIST PAINTS VIVID PICTURE OF NORTH CAROLINA'S DYNAMIC SHORELINES

BY ANN GREEN

The brownish-green water from Roanoke Sound in Nags Head hits the heavily rip-rapped shoreline as North Carolina Sea Grant researcher Stan Riggs stands on a large concrete slab.

With the help of a large megaphone, Riggs' voice booms across the estuarine shoreline while he points to a house perched on stilts in the sound.

"You see the house out in the sound," says Riggs to N.C. Coastal Geology Research Cooperative field trip participants. "Even though there is rip rap on the shore, it is still eroding here as indicated by the difference between the 1997 and 2003 photographs."

"From 1932 to '73, the erosion rate was more than five feet a year," adds Riggs, an East Carolina University distinguished research professor. "Since then, the shoreline has been armored with broken concrete slabs, but the rip rap is at best a temporary fix and not a permanent solution."



Rugged and energetic, Riggs has recorded erosion rates along North Carolina's 4,000 miles of estuarine shoreline for more than 30 years. To gather the data, he has trekked across soggy swamps, muddy marshes and hot, bare beaches.

"Stan is unique," says David Mallinson, a former student of Riggs and ECU assistant geology professor. "He is so insightful and full of knowledge. He hasn't slowed down mentally or physically in 20 years."

Last year, after Hurricane Isabel, Riggs and his research team measured the erosion rate of the sediment bluffs along the Chowan River. During the storm, a surge of up to eight feet occurred within large portions of North Carolina's estuarine system. Along the Chowan River, there were estimated 80 mph sustained winds and gusts up to 95 mph, according to Riggs.

"After Hurricane Isabel passed over the Chowan River, there was up to 80 feet of shoreline recession along portions of Chowan River bluffs," he adds.

#### New Sea Grant Book

The bluff along the Chowan River is featured in the new North Carolina Sea Grant publication *Drowning The North Carolina Coast: Sea-Level Rise and Estuarine Dynamics*, written by Riggs and ECU Research Associate Dorothea V. Ames. The book builds upon Sea Grant's *Sound-front Series: Shoreline Erosion in North Carolina Estuaries* by Riggs.

In the new book, the authors provide in-depth information about erosion processes and rates along North Carolina's northeastern estuarine shoreline.

"We put the science of the estuarine system into a framework that could be understood by the public and coastal managers," says Riggs. "Our estuarine system is an incredible resource that represents North Carolina's natural capital. We must manage this coastal system as a nonrenewable natural and extremely dynamic resource if we hope to preserve it both for the short- and long-term future utilization and development of the state."

Riggs began tracking shoreline erosion rates for the state's coastal system in the 1970s

with funding from North Carolina Sea Grant.


"This was a progressive idea for Sea Grant to fund such a study, prior to severe development pressure," says Riggs. "At the time, not many people were interested in erosion rates along estuarine shorelines."

Since then, Riggs and his colleagues have gathered data on short- and long-term erosion rates along the state's estuarine shoreline. Recently, they consolidated the data for the book that can be used as ready reference for property owners, coastal managers, government officials, community planners, resource managers and educators.

"While much attention has been focused on the natural resources affecting the ocean shorelines, little has been directed to the forces acting on the estuarine shoreline, which is an equally vital resource," says Charles Jones, director of the N.C. Division of Coastal Management.

"We are excited about the prospect of using Dr. Riggs' research to further our understanding of these processes," adds Jones. "I feel it is in the Division of Coastal Management's interest to support studies and research in this area so that a better understanding can be applied in the development of coastal management and policies."

*Continued*



AFTER HURRICANE ISABEL PASSED OVER THE CHOWAN RIVER, UP TO 80 FEET OF SHORELINE RECEDED ALONG THE RIVER BLUFFS.



## Early Years

Riggs grew up in Green Bay, Wis., close to the Chequamegon-Nicolet National Forest. "As early as I can remember, I had a canoe paddle in my hand or rode my bike and explored the waters and shores of the Green Bay and Fox rivers," he says.

"I never knew a time when I wasn't interested in geology, biology and the natural history of what was around me," adds Riggs. "When I was out on a lake or river, the whole business of water and its dynamics fascinated me."

So Riggs pursued a major in geology while at Beloit College. As a freshman, he helped to organize a geologic field trip to the Appalachian Mountains in North Carolina.

"This was my introduction to North Carolina," he says. "I clearly remember the Spruce Pine pegmatites and the Webster olivine ring dike, both world-class rock structures."

The Appalachian Mountains were "warm, green and friendly compared to the raw, rugged and hostile Rocky Mountains," recalls Riggs. "I thought then that North Carolina would be an awesome place to live."

Riggs pursued a master's in geology from Dartmouth College and then a doctorate in geology from the University of Montana.

After working in Alaska, New Mexico, Colorado and Florida, Riggs moved to Raleigh in 1964. Three years later, he relocated to ECU in Greenville, where he helped to start new geology and marine science programs.

During the late 1960s and early 1970s, Riggs lived on the Outer Banks and taught an interdisciplinary geology and biology program, "ECU by the Sea," for senior geology and biology majors.

As part of the course, Riggs and his students conducted "soggy-groggies" or intensive field studies from Maine to Florida. To learn about coastal system dynamics, they spent days on the hot sand at Jockey's Ridge — where they studied how the winds erode and deposit sand — and monitored the impacts of nor'easters and hurricanes on North Carolina beaches and inlets.

## United Nations Project

From the late 1970s to early 1990s, Riggs conducted extensive studies on various types of mineral resources around the world.

As part of this effort, he served as co-director of a United Nations project involving resource utilization in developing countries. One of the program's workshops was held at ECU, where

Riggs brought together geologists from more than 40 countries.

"Stan helped geologists provide resources for people in developing countries," says Scott Snyder, senior associate dean of ECU's Thomas Harriot College of Arts and Sciences.

Because of his coastal work and worldwide resource project, Riggs received the O. Max Gardner Award in 1983. The Board of Governors of the University of North Carolina System gives the award annually to a faculty member who has made "the greatest contribution to the welfare of the human race."

Riggs also has conducted extensive studies on the geologic framework and sediment dynamics associated with the North Carolina continental shelf and its rock hard bottoms. His work has provided critical information about potential sediment supplies for the barrier islands, as well as habitat data for marine ecosystems and associated fisheries.

Presently, Riggs is spearheading the ECU/U.S. Geological Survey (USGS)/N.C. Geological Survey (NCGS) Coastal Geology Cooperative Research Program that focuses on the geomorphic and ecologic dynamics and evolution of the northern Outer Banks and associated estuarine system.

This summer, Riggs and a team of researchers and graduate students are doing field work in the southern Pamlico and Core sounds, the Neuse and Pamlico rivers, the barrier islands from Ocracoke to Cape Lookout and the nearshore continental shelf.

Throughout his career, Riggs has spent a lot of time educating teachers and other public groups about the dynamics of North Carolina's coastal system. Riggs' workshops are a favorite with science educators.

Teri Kirby Hathaway, North Carolina Sea Grant marine education specialist, says that she has learned so much from Riggs over the years. When Riggs led a marine education field trip in the summer of 2000 to sites in eastern North Carolina hit by Hurricane Floyd, Hathaway says that the group was exhausted by the end of the afternoon.

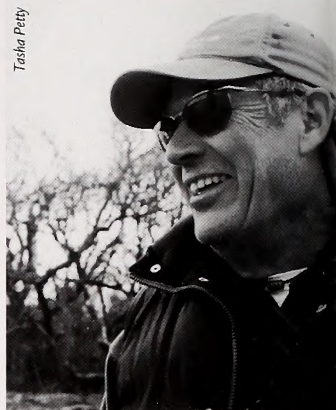
"But Stan kept yelling: 'Come on, let's get going. We're burning daylight,'" Hathaway recalls.

Marine educator Lundie Spence, who also has coordinated numerous field trips with Riggs,

TOP: Stan Riggs is known for his extensive field trips along the Outer Banks.

BOTTOM: Co-author Dorothea Ames, right, accompanies Riggs as he explains soundfront shoreline erosion rates.

Tasha Petty



Tasha Petty



says that he brings the North Carolina islands to life by helping people visualize their dynamic and mobile nature.

"Stan makes people laugh with the joy of wind carrying sand," adds Spence, director of the SouthEast Center for Ocean Sciences Education Excellence.

## Field Trip

On a recent field trip for ECU/USGS/NCGS geologists, Riggs welcomes participants while standing on the estuarine shoreline at Jockey's Ridge State Park in Nags Head.

"I hope you enjoy the stops and get a flavor of North Carolina's barrier island system," he says.

In the years before the Civil War, Riggs says Nags Head residents lived primarily within the maritime forest of Nags Head Woods.

Gradually, after the war, they began to move out of the woods to Old Nags Head along the estuarine shoreline and sell the ocean shoreline to vacationers, according to Riggs. "The 1932 map shows the recently paved coastal Hwy. 12 and the large Jockey's Ridge and Seven Sisters dune fields," he adds, holding up photos showing changes over seven decades. "Also notice the few oceanfront





Tasha Petty



Tasha Petty

Once Jockey's Ridge became a state park, the human forces from large numbers of visitors — in concert with extensive development and vegetation growth around the park — began to tear down the dune, says Riggs. "Over the years, Jockey's Ridge has shrunk in size from 156 feet in the 1950s to less than 90 feet high today," he adds.

### Erosion at South Nags Head

After leaving Jockey's Ridge, Riggs, dressed in jeans, a green jacket covered with a work vest, tennis shoes and baseball hat, leads the group for more than 12 hours to various sound and beach sites. He takes a break from lecturing only when traveling between stops.

At South Nags Head, Riggs walks at a brisk pace down the beach past homes that have been condemned because major beach erosion

has exposed or eliminated septic systems.

"Years ago, when this area was first developed, houses were built way back from the ocean," he says. "But the very high rates of shoreline erosion along this segment quickly encroached upon them and began taking out the oceanfront houses.

"At South Nags Head, the erosion rate is up to 20 feet a year," says Riggs. "This caused the second and third row homes to systematically become oceanfront homes."

Throughout the rest of the field trip, Riggs, who often sounds like an evangelist giving a sermon, keeps the group's attention by using colorful anecdotes about the barrier island.

Toward the end of the trip, Riggs' enthusiasm doesn't wane as he climbs more than 200 steps in the Cape Hatteras Lighthouse.

Standing at the top of the lighthouse that overlooks the beach and woods, he describes the ocean and estuarine dynamics maintaining the barrier islands. He points out the classic beach ridge sequences that make up the landmass of Buxton Woods.

"This area has the highest ocean wave energy along the entire East Coast," says Riggs. "In addition, there is a very large estuarine sea, known as Pamlico Sound, that works along the back side of the barrier island."

Riggs' last stop is at Hatteras Village, where Hurricane Isabel cut an inlet 1,700 feet wide and

up to 28 feet deep, in a weak segment of the barrier island in September 2003. The U.S. Army Corps of Engineers then filled the inlet with sand dredged from the Hatteras Inlet channel and rebuilt the barrier-dune ridge. The state rebuilt N.C. 12.

As the sun is setting at the former site of Isabel's inlet, Riggs leads a group along the beach. He points out the large peat blocks that are the size of a wheel barrel.

"This peat formed in the marsh about 200 years ago when the Hatteras Island shoreline was about five football fields seaward of the present location," he says. "The rapid recession of this shoreline has moved the beach over the former marsh, causing the peat to crop out in the low-tide surf zone, where it has eroded during storms."

Further down the beach, Riggs holds up an aerial photo of Isabel's inlet shortly after it opened and took out a portion of N.C. 12. "If you walk back into the marsh," he says, "you will see large pieces of pavement from the old road."

Riggs says that about 25 miles of N.C. 12 has "hot spots" that were either damaged or destroyed by Hurricane Isabel and will continue to be threatened by future storms.

"In response to storms such as Hurricane Isabel, the state of North Carolina must put the science on the table before major decisions are made concerning the long-term maintenance of Hwy. 12, as well as future management decisions concerning new inlets," he says. "Sea level will continue to rise. Storms will continue to directly impact our barrier islands."

"The question is: can and will we learn to live with the dynamic nature of barrier islands — or will we destroy the barriers while attempting to stabilize the islands to protect our economic investments?" says Riggs. □

*The research presented in Drowning the North Carolina Coast was funded by North Carolina Sea Grant, U.S. Geological Survey, East Carolina University, National Park Service, U.S. Fish & Wildlife Service and Environmental Defense. The book was published with grants from the National Oceanic & Atmospheric Administration, the N.C. Division of Coastal Management and the Albemarle-Pamlico National Estuary Program.*

*Single copies of the book are \$25. To order a copy of the book, refer to publication UNC-SG-03-04 and send a check to: North Carolina Sea Grant, NC State University, Box 8605, Raleigh, NC 27695-8605. Order forms are available from [www.ncseagrant.org](http://www.ncseagrant.org).*

*TOP: Riggs often stops along South Nags Head to discuss beaches that have been sandbagged because of extensive erosion. MIDDLE: Riggs' field trips often reveal the dramatic dynamics of the North Carolina coast.*

*BOTTOM: Riggs' new book, published by*

*North Carolina Sea Grant, provides in-depth information about the state's estuarine erosion rates.*

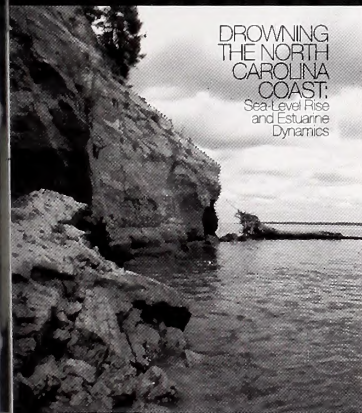
houses along a very wide ocean beach."

In the late 1930s, the government built barrier-dune ridges to prevent overwash and encourage other development, says Riggs, gazing at the group with his gray-blue eyes.

"By 1999, you can see coastal N.C. 12 is very close to the ocean, and all of the old houses have been moved back significantly and are now up against the highway," he adds. "The Seven Sisters Dune Field also has been totally developed by 1999."

By Benji R. Ross and Dorothy V. Ames  
Published by North Carolina Sea Grant

**DROWNING  
THE NORTH  
CAROLINA  
COAST:**  
Sea Level Rise  
and Estuarine  
Dynamics





# Clean Marinas Make Good Neighbors

*By Pam Smith*







At Mile Marker 182 on the Intracoastal Waterway, Oriental is one of those rare places on the North Carolina coast that seems unchanged by time. Through the years, it has remained true to its water-based genesis.

The village overlooks a wide stretch of the Neuse River near the entrance to the Pamlico Sound. Eight deepwater creeks outline the village and flow into the river.

Founded in 1872, its early residents fished, processed and shipped seafood, along with produce and lumber from area farms and timber operations. Oriental was a vital link for steamships hauling goods between Norfolk and New Bern.

The steamships are long gone. Commerce has shifted over time. Nevertheless, commercial fishing boats and a seafood processing plant still occupy the heart of Oriental's waterfront.

The water provides a new income source: recreational boating. In fact, Oriental bills itself as "The Sailing Capital of the Carolinas."

While the population holds steady at just under 900, the latest count puts the number of sail boats in and around Oriental at any one time at more than 2,000.

New businesses have emerged to cater to the transient and resident sailors, from ship stores to gift shops, restaurants and bed-and-breakfast inns.

Over the past two decades, many people have come to sail — some stayed. The locals like to say that the "come here's" don't change

the town, but rather, the town changes them: Slows them down. Exposes them to coastal hospitality that may take them by surprise — like the woman on Hodges Street who hangs clippers on the rose bush in her front yard

and invites folks strolling by to help themselves to a fragrant, perfect bloom.

There's a genuine neighborly feel to the place.

### CLEAN MARINAS, GOOD NEIGHBORS

In a place that boasts thousand of sailboats, hundreds of recreational fishing boats and a host of commercial vessels, it's little wonder that marinas and traditional marine trades thrive.

Business is good, but being a good neighbor is a top priority for Bob Deaton. He and his brother, John, own and operate Deaton Yacht Service Inc. on Whittaker Creek. Their two-acre operation is tucked into a residential waterfront neighborhood at the north end of the village.

Deaton's was the first marina in the state to receive the Clean Marina designation from the N.C. Marine Trades Services and the N.C. Division of Coastal Management (DCM).

Flying the Clean Marina flag signals neighbors that they are safeguarding the environ-

ment, especially the quality of water — a shared community resource.

To qualify, marina operators must demonstrate that they voluntarily employ best management and operation techniques that go above and beyond regulatory requirements, explains Mike Lopazanski, DCM coastal and policy analyst.

"The Clean Marina Program is a national program that was adopted by North Carolina in 2000," Lopazanski says. Unfortunately, budget and personnel cuts limited outreach efforts and only eight marinas in the coastal area fly the flag.

In the coming months, he plans to introduce the Clean Marina mission to more marina operators. For starters, Lopazanski is collaborating with the N.C. National Estuarine Research Reserve education staff to conduct workshops. The N.C. Coastal Nonpoint Source Pollution Program is funding the workshops.

Also on tap is the distribution of a newly published "Best Management Practices Manual for North Carolina Marinas" that was prepared by the N.C. Marine Trades Services for DCM.

The take-home message of the effort is: protect coastal waters.

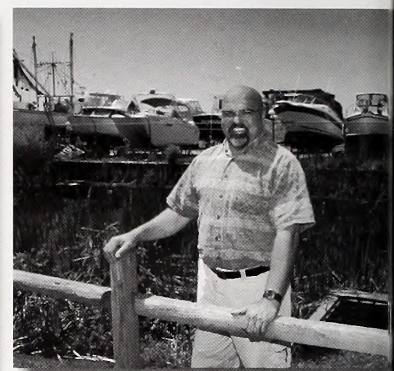
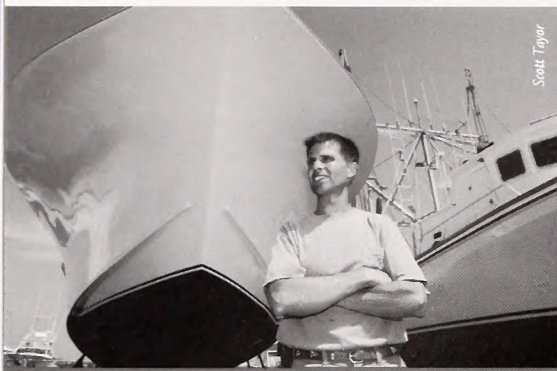
"Marina operators know the benefits to their business, their community and the environment. Beyond that, the Clean Marina program is a way to show boaters how they can minimize their

*Continued*



CLOCKWISE FROM FAR LEFT: The Clean Marina flag flies over marina operations that take extra care in protecting the environment. ♦ Recreation boating is growing in popularity. ♦ Bob and John Deaton, of Deaton Yacht Service in Oriental, were the first in the state to earn the Clean Marina designation. ♦ Marina operators post reminders to foster a clean environment. ♦ Pat Webster, aboard Warrior Woman, is happy to live on board while her boat is repaired by the Deaton team.





negative impacts on the marine environment," Lopazanski says.

Current Clean Marina operations, he adds, are models for other operators and boaters.

## SHOW AND TELL

In some coastal states — including Texas, New York and Florida — Sea Grant programs are the lead agencies for the Clean Marina program. Here, North Carolina Sea Grant is playing a support role. Barbara Doll, Sea Grant water quality specialist, is working with Bill Hunt from North Carolina State University to develop a Clean Marina demonstration site to highlight a number of best management practices.

"Hopefully, things will get rolling by the early fall," Doll says. "We also will conduct workshops to help marina operators learn how to design water protection measures into a marina project."

Walter Clark, Sea Grant coastal community and policy specialist, is working on a project that could have broader implications.

"I am working with Gloria Putnam from the N.C. Coastal Nonpoint Source Program to look at the state's marina policy — from the very definition of marina to the complex permit process."

The marina development process begins with a permit application to DCM, but it involves 14 other state and federal agencies, each with various mandates and objectives when it comes to marinas, Clark says.

Often, just the legal definition of a marina can cause confusion. A marina is defined by DCM as any publicly or privately owned dock, basin or wet boat storage facility constructed to accommodate more than 10 boats, and providing any of the following services: permanent or transient docking spaces, dry storage, fueling facilities, haulout facilities and repair services.

"We hope to examine the process and develop recommendations that would clarify the state's marina permit and management process while protecting our natural resources," Clark says.

Now is a good time to take a long look at

marina policies, Lopazanski says.

"The number of applications for marina permits has held at a steady 10 to 15 each year. However, we also have seen a large number of 'nonmarinas' — multislip docking facilities with less than 10 slips," he says.

"This is where you get into questions regarding what has the least environmental impact — individual docks associated with single family houses or community marina/docks that serve a larger residential area."

The heart of the issue is considering the cumulative environmental impacts of any proposed marina.

"The demonstration project," Lopazanski adds, "will show how upfront planning can go a long way towards the protection of coastal water quality."

## PRIDE AND PRACTICE

For his part, Bob Deaton says he feels great to have been the first Clean Marina in the state — a fact noted with pride on the company Web site.

"When we received the checklist, I looked at it and realized that we were almost there," he says. "We set a goal that was easy to achieve without a lot of extra effort and expense. We already were doing our best to protect the water as a matter of company policy."

Deaton chats as he heads toward the haul-out ramp at the end of the dock. He wants to check the status of emergency repairs on a boat that ran aground overnight at low tide.

Deaton Yacht Service is a TowBoat US provider, covering the region from the Neuse River to Ocracoke.

"We're like AAA only on the water. It can get pretty exciting," he says. "Last week, a fishing boat strayed into the military bombing range. The Coast Guard removed the people according to the rules. And we towed the boat out of the restricted area. It could be dangerous considering there are some unexploded bombs on the bottom of the sound."

Deaton stops to give a progress update to Pat Webster, who sailed from Manteo to have work done on her hurricane-damaged boat, *Warrior Woman*.

"I had to wait for a break in the weather to sail," Webster explains. The work will take several weeks to complete. She and her black lab will live on board for the duration. But she doesn't mind.

"I feel safe and I love this marina — and Oriental," she adds.

Down the line, dock repair is in progress. With timbers pulled away, a backhoe scoops dirt and loads it onto the bed of a dump truck. The goal is to prevent sediment from escaping into the water. "It's all about reducing impact," Deaton says.

He points out other Clean Marina practices that protect the water: grass buffers to catch run off from the paved areas; a vacuum system for dust generated by sanding; tarps under hauled out boats; a pump-out station and sewage holding tank for boaters; waste oil containment tank; barrels for used paint products; a parts wash collection center.

A licensed waste-management company collects all hazardous products for disposal, he explains.

"Water is our lifeline. It's to our advantage to be the best environmental stewards possible. It's just good for business and it's good for fish," Deaton insists.

## ATTITUDE IS KEY

A fierce spring windstorm shredded the Clean Marina flag at Town Creek Marina in Beaufort. Owner-operator Chuck Tulevech was quick to call DCM for a replacement. He's proud to display the flag that lets customers know that his business exceeds required measures to protect the environment.

"Our clients tend to be more conscious than ever before, and they don't mind adhering to our strict rules," Tulevech says. "Attitude and education are key."

His four-acre marina straddles Town Creek





and Gallants Channel, about 1.5 miles from the Beaufort Inlet. With 88 slips, the marina provides waste pump-out service; showers and laundromat; fish cleaning stations; dockside water and power connections; a ship's store; and a full array of haulout repair and dry storage services. Marina services help clients obey the rules.

It's a symbiotic relationship — clients who spend a lot of money on their boats don't want to jeopardize their investment in a nasty boat yard or wet slip.

"We are all connected to and by the Neuse River, and it's our shared responsibility to protect it," Tulevech points out. "We just want to do things right."

One obvious "right" measure is an elaborate on-site stormwater filtration system, designed to catch hazardous material from repair operations — sanding dust, antifouling paints, engine overhaul byproducts, oils, fuel, fiberglass materials. An aeration device keeps the 6-foot-deep lagoon from becoming a stagnant mosquito-breeding pond.

"The nature of our business is messy," he notes. To further protect water quality, the messiest jobs are done at a satellite facility away from the waterfront.

Tulevech, a transplant from Port Jefferson, N.Y., purchased the marina in 1996 and recruited his younger brother, Steve, away from academic life to serve as vice president of operations.

Steve Tulevech is a marine biologist who taught and helped develop the marine resource management program at Richard Stockton College of New Jersey.

"A lot of people do business with Town Creek Marina because of the clean appearance of our operation," says the younger Tulevech. "They don't necessarily see our attention to detail, such as using waste filters to absorb oil or gasoline. But they do understand the hazards associated with runoff."

There are industry challenges, such as protecting the environment from antifouling marine paints. He is testing a water-based bottom paint that will eliminate water and air contamination. "It will be good news all around if it works," says Steve Tulevech.

#### A HIDDEN TREASURE

When Skip Fry purchased the Wilmington Marine Center in 1987, it was a diamond in the rough — a far cry from the model Clean Marina it is today.

at that. Fry purposely dug a basin on high ground to create an enclosed marina — a "hurricane hole" — that would be a safe harbor on the often stormy coast. His plan works. From Bertha to Isabel, no boat in his marina has been scratched.

Seeking the Clean Marina designation was not a stretch for Fry, one-time president of the Cape Fear River Watch.

"Conservation is a pervasive concept, from tarps under boats being serviced to impervious surfaces, and contracts to remove all waste products," Fry says. "The marina was designed so that all runoff flows away from the water body."

Fry also designed the overall marine operation according to function. The marina shares the waterside address with Baker Marine Sales and Service. Across River Road — well away from the water basin — Fry sited an industrial area that is home to DeMann Marine Power, Industrial and Marine Fabricating and Welding, Cape Fear Yacht Works, O.E. DuRant Ship Chandlers and Sound Marine.

Ken Trapagnier, who has been a "live aboard" at the marina since last August, appreciates the degrees of separation.

The former deputy fire chief from New Orleans retired early to enjoy life on board his 46-foot boat, *In Dreams*.

"I really didn't know about the Clean Marina Program until recently," he says. "But I always look for a clean environment. I have been to some places in the Caribbean that could definitely use stricter regulations to protect the water quality."

Trapagnier will set sail in late summer for his next adventure at sea. He plans to return to the Wilmington Marine Center in the future because, he says, he appreciates the high standards of the Clean Marina program.

Fry runs a tight ship and is a self-proclaimed tough landlord — one who enforces strict rules that protect the environment.

"Our industry is predicated upon clean water," Fry says matter-of-factly. "Without clean water, we have nothing." □



CLOCKWISE FROM FAR LEFT: Steve Tulevech, vice president of Town Creek Marina in Beaufort, says attention to details helps achieve Clean Marina goals. ♦ Boaters are attracted to Town Creek Marina by its array of services — and its appearance. ♦ Chuck Tulevech, president of Town Creek Marina, stands beside the stormwater filtration pond that keeps the surrounding water bodies clean. ♦ Full-scale boat service sites require extra effort to protect water quality. ♦ Wilmington Marine Center dockmaster Miles MacQueen, owner Skip Fry, and site manager Debra J. Napp say the Clean Marina program sets high standards for marinas. ♦ The center is a hidden treasure not far from the Wilmington port.



# A Fishery for All Seasons

By Pam Smith



LEFT TO RIGHT: Elaine Logothetis displays the traditional wooden conch pot and a typical wire crab pot. • Octopus provided a lucrative bycatch during the FRG study. • While the horseshoe crab is said to be the favored conch bait elsewhere, the FRG demonstrated effective alternatives.

**Y**ou can have your conch and eat it too," says Dave Beresoff, a Brunswick County commercial fisher.

That's one conclusion he drew from a N.C. Fishery Resource Grant (FRG) project he completed with Elaine Logothetis, a marine biologist with the N.C. Aquarium at Fort Fisher.

The two set out to explore the feasibility of a viable conch fishery in southeast North Carolina. Could conch become an alternative target fishery during the months other traditional fisheries are less active?

From October 2002 through March 2003, they caught conch — and a few other surprises.

"I'm convinced that I can make a day's pay setting conch pots in winter," Beresoff happily reports.

Conch has become a general term used to describe various large, spiral-shelled gastropods. The whelk, a close cousin, is the predominant edible mollusk in North Carolina waters.

During the study, the researchers captured a total of 13,876 conch — about 45 percent of their overall catch. The predominant species caught was channeled whelk (*Busycotypus cancellatus*), with some knobbed whelk (*Busycon carica*).

For their FRG study, Beresoff and Logothetis used both wooden lathe conch pots and

wire crab pots to compare effectiveness. They placed the pots offshore, behind the breaking surf, at ocean depths from 15 to 30 feet.

Beresoff and Logothetis were more successful with wire crab pots than with traditional wooden conch pots; they caught the most conch in February and March; and they caught the largest individual animals in the fall.

They used a variety of "opportunistic bait," that is, whatever was readily available — from menhaden to rays, fish heads and dead crabs.

"The more pungent the bait, the better," Logothetis reports. Whelk, a predator, uses its well-trained nose, or proboscis, to seek out smelly prey.

Tom Likos, a local crabber, was on board as "baitmaster," Logothetis says. He helped keep track of the type of bait that was used, the type of trap, and each location. He also pinpointed areas where he historically caught whelk in his crab pots during the winter months.

The bait issue also is important because scientific literature indicates that horseshoe crab is the preferred conch bait. But, with declining horseshoe crab populations, the research team was happy to demonstrate the effectiveness of alternative baits.

## Catching a break

The bycatch is even more interesting. "When we began the project, we worried that bycatch might be a problem," Beresoff recalls with amusement.

But, when the economic value of the bycatch — blue crab, stone crab *and* octopus — exceeds the target species, it's an enviable problem, he concedes.

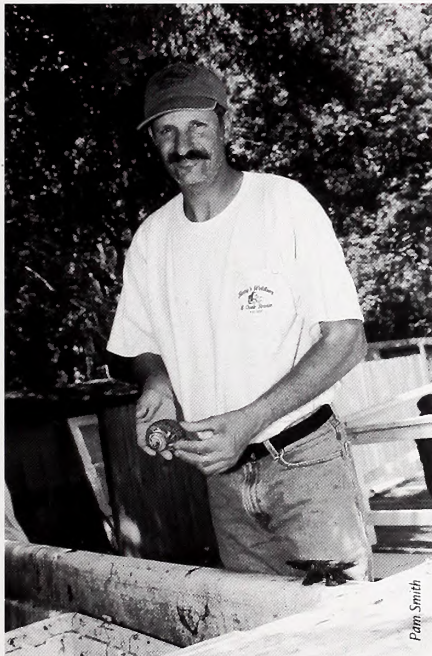
In fact, the dollar and weight of marketable bycatch landed surpassed that of conch in every month except December, they report.

Landing blue crab in the ocean during winter months is a significant break, Beresoff says. Ocean waters remain open to crabbing year-round, according to the state's Blue Crab Management Plan, even when inland waters close for a brief period during January.

"Marketing to the year-round blue crab trade — in addition to the healthy conch market — is a huge economic benefit," Logothetis adds.



All whelks are carnivores and scavengers, and use their noses to find burrowing clams — or bait used in crab or conch pots. They force apart bivalves with a strong foot and aperture lip. Or, they may chip away the shell of the prey until it is possible to insert their mouths to feed on the mollusk inside.



Pam Smith



Dave Beresoff



Elaine Logothetis

LEFT TO RIGHT: Dave Beresoff, a Brunswick County commercial fisher, says FRG projects help find real world answers to pressing needs. • On board the fishing boat, Logothetis measures and records each catch. • The results suggest a viable fishery during slow seasons.

And, documenting the presence of blue crab in ocean waters during winter months sheds light on the life history of the prized crustacean. Currently, the N.C. Division of Marine Fisheries (DMF) is conducting a crab-tagging study of female blue crabs to determine staging areas, migration routes, timing and habitat of the female crab.

Since the conch study ended, Beresoff has caught a number of DMF-tagged crabs offshore. “This says they do migrate into ocean waters,” he points out.

To help assess the offshore population of blue crab, Logothetis and Beresoff will take the study a step further. They will tag females trapped offshore to learn if they return to inland waters — and if so, where they go. A grant from the N.C. Blue Crab Research Program will fund their continuing effort.

Their conch study also had another surprising finding. When they set lines — 20 pots over

1,000 feet of troll line — the pots stayed in place, even in heavy weather. This suggests that troll pot lines could help solve the “ghost crab pot” problem.

Ghost pots are single crab pots that break loose from their buoys and potentially foul other fishing gear, stray into boating lanes, or become environmental trash.

### Sea science

Conchs and whelks are related as shelled gastropods, Logothetis explains.

Whelks are in the family *Melongenidae*, while true conchs are in the family *Strombidae*.

All whelks are carnivores and scavengers, and use their noses to find burrowing clams — or bait used in crab or conch pots. They force apart bivalves with a strong foot and aperture lip. Or, they may chip away the shell of the prey until it is possible to insert their mouths to feed on the mollusk inside.

On the other hand, true conchs are herbivores that feed on algae. Their typical flared lip would prevent them from exhibiting carnivorous behavior.

The Queen Conch of tropical fame does not come as far north as North Carolina waters. They are protected in the Florida Keys and parts of the Caribbean due to overharvesting. In some

places, conch farms provide the sweet meat for commercial consumption — the main ingredient of stew and fritters.

Though whelks are not a protected species, many states do have commercial and recreational landing /harvesting restrictions.

Currently, North Carolina recreational anglers are limited to 10 per day per person, or not exceeding 20 per day per vessel. However, our state has no commercial harvest restrictions for whelk, nor is there a fishery management plan in place. Should one be considered, further studies will be needed to document male/female distribution, growth rates and life history, Logothetis says.

### Fishing-boat science

The conch study is not the first FRG project Beresoff has initiated. He previously has worked with scientists to study fishing gear and red drum protection.

Beresoff provides project ideas, field knowledge and equipment, while the scientists climb on board to collect samples or test gear and record data. Together, the strange boat fellows analyze and report findings that often prove economically valuable to the fishing community.

The North Carolina General Assembly

*Continued*





Elaine Logothetis



Pam Smith

TOP: The whelk follows its nose into the pot, intent upon eating some smelly morsel placed as bait.  
BOTTOM: Once the meal is finished, the shell can be recycled as a mini flower pot.

created the FRG program in 1994 to help protect and enhance the state's fishery heritage. The Blue Crab Research Program was added in 2000 to focus exclusively on that fishery.

The idea behind the programs — funded by the General Assembly and administered by North Carolina Sea Grant — is to match traditional knowledge with research methodology to find workable ways to improve or protect limited marine resources.

Beresoff and Logothetis agree that the key to the success of these state-supported research programs is the marriage of science and commercial fishing.

"There is no way a marine biologist can simulate what fishers know about the water,

where the fish are, where to lower the nets or traps. The projects produce solid information that can be used in developing or revising fishery management plans," Logothetis says.

The collaborative projects also enable fishers to become involved in decision making. "They understand the data because it comes from them," she adds.

"In other words, scientists help document our truths," Beresoff comments. "Programs such as the FRG help others view the reality of our business."

Projects also are learning vehicles for participants.

"All the projects are different," says Logothetis, who also is doing the scientific work for an FRG shrimp study. "Each one provides an opportunity to grow as a scientist. There are things to learn out on the water that you can't duplicate in a laboratory."

In turn, Beresoff is acquiring a taste for scientific inquiry. "One thing leads to another. For every answer, there is another question to pursue," he says.

### The payoff

When Beresoff and Logothetis began the FRG conch project, they were focusing on boosting the year-round livelihoods of commercial fishers in North Carolina. New and alternative fisheries and markets often are sought to sustain commercial fishing families.

Conch pot fishing from Massachusetts to Virginia yielded \$11 to \$15 million in 1999, they say. In Georgia, the conch fishery is one of the most productive mollusk fisheries. And, South Carolina shrimpers fish for conch using trawls after the shrimp season.

In North Carolina, a small conch fishery is lucrative in Dare County during December and January.

Conch was once a profitable bycatch from flounder trawls in the southeastern counties. But, conch fishing disappeared in the region during the 1980s when flounder trawling ceased due to the increase in flounder size limits.

Beresoff plans to continue polishing his conch fishing techniques — and the prospects for a sustainable fishery along the Brunswick County coast.

Logothetis believes there still is a profitable market for these edible snails that are known as "squngili" in Italian markets.

Conch may not provide a full-time fishery, but conch plus bycatch could add up to a profitable winter activity — having your conch and eating it too, as Beresoff puts it.

"All in all, it was a successful FRG experiment. The idea is to make money during the typically slow season, and we showed it could be done," Beresoff concludes. □

For information about the FRG program, go to [www.ncseagrant.org](http://www.ncseagrant.org), and click on research.

### CHANNELED WHELK

Phylum: Mollusca

Class: Gastropod

Order: Neogastropoda (new snails)

Family: Melongenidae

Genus: Busycotypus

Species: canaliculatum

- This large univalve can grow to 8 inches. It is pear-shaped, with an elevated, conical spire and a broad body whorl that narrows into a long, slender, curved canal.
- Grayish to yellow-white in color, covered with a gray periostracum bearing minute hairs; its aperture is yellow.
- It is found on sandy bottoms, often traveling just below the surface, plowing through the sand with its strong, grey foot.
- Its range is from Cape Cod, Mass., to northern Florida; was introduced into San Francisco Bay.
- Strings of egg cases can hold up to 100 tiny shells.
- Indians once used beads cut from the whorls around the axis of the shell as ornaments and money.
- These whelk are mostly are "right-handed," or dextral, meaning the shell coils to the right. Hold the shell with the opening facing you. If the opening is on the right side of the shell, it is dextral.





Courtesy of Roanoke Island Festival Park

Climb on board the Elizabeth II in Shallowbag Bay at Roanoke Island Festival Park for high adventure.

# Roanoke Island Festival: Every Day is an Event

By Pam Smith

Every day is an event at Roanoke Island Festival Park — a 27-acre island neatly packed with history, culture, art and nature — just a footbridge away from the quaint Manteo waterfront.

The park's promotional brochure invites visitors to "Celebrate Roanoke Island's unique place in history as the site of the first English settlements in the Americas."

From 1584-1587, the island was the

stopping off place for Sir Walter Raleigh's New World voyages for Queen Elizabeth I.

The sea delivered the first chapter of American history and figures prominently in retelling the story of sacrifice, hardship and discovery.

Visitors to the Festival Park become part of living history when they climb onto the *Elizabeth II* sailing ship moored in Shallowbag Bay. The square-rigger was launched in 1984 as

the centerpiece of America's 400th Anniversary celebration. Once onboard, visitors encounter 16th-century sailors who tell tales of adventure on the high seas and close calls with loot-seeking pirates.

Guests stroll into a replica of a working English settlement and discover the meaning of self-reliance.

Carpenters, blacksmiths and soldiers from the era greet visitors and chat about life at the

*Continued*



## PEOPLE & PLACES

fort and demonstrate what it means to rely on natural resources for food and shelter. Soldiers are ever watchful for a surprise attack from Spaniards, in spite of the seemingly remote settlement island location.

Without the protection of Algonquian Indian Chief Manteo, their lives would be in greater peril from hostile natives.

Being part of the drama gives visitors a greater sense of history, says Scott Stroh, Festival Park's executive director.

The biggest draw for the park may be the view of the *Elizabeth II* from the Manteo waterfront. "It's a wonderful symbol of our state and our country's history," he says.

Once in the park, though, visitors are surprised at how many things there are to "do" — not just to see or to observe.

"Everything here is predicated on the fun of hands-on learning. You help raise the sails on the ship, navigate with 16th-century technology, or put on authentic clothing and experience history," Stroh says.

Even the Roanoke Adventure Museum is an interactive presentation of 400 years of Outer Banks history. "It's a play-and-learn experience for all our visitors," says Stroh.



Julia LeDoux, Outer Banks Festival

### More in store

Another surprise, Stroh adds, is the scope of experiences — performing and cultural arts, nature trails, archival and research facilities.

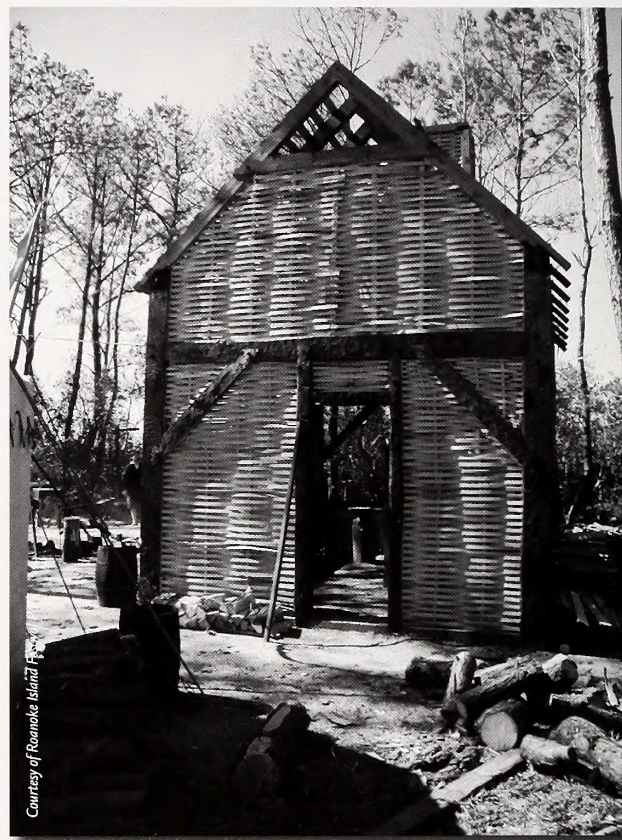
Park visitors can relax in a theater to view *The Legend of Two Paths*, a film depicting the history of Roanoke Island from the point of view of the Algonquians.

The Outdoor Pavilion provides the summer venue for N.C. School of the Arts students to ply their talents. Their "illuminations" — a series of afternoon and evening performances of drama, music, dance and film — runs through July 31, Tuesdays through Saturdays. Picnics are welcome.

In addition, the 2004 Summer Children's Performance Series runs from June 29 through July 30, Tuesdays through Fridays. The morning editions feature professional productions with kids in mind.

Visual art lovers are not short-changed at the park, Stroh notes. The Art Gallery hosts year-round, monthly changing exhibits by renowned artists. A display from the North Carolina Penland School of Crafts reminds visitors that Gov. Easley has designated 2004 as "The Year of North Carolina Crafts."

The park's calendar is filled with special



Courtesy of Roanoke Island Festival Park

events. Some recall the nation's maritime beginnings: The North Carolina Maritime Museum will present a junior sailing program as well as sail training and boat handling.

And for guests with a passion for shopping, the museum store offers books, gifts, toys, jewelry and nautical-themed goods for visitors who want to carry away a reminder of America's roots.

All told, the Roanoke Island Festival Park has carved a niche in North Carolina's heritage and cultural tourism industry. More than 110,000 people visited the park in the 2003 season — in spite of an unusually wet summer and Hurricane Isabel's rampage through the Outer Banks.

### Heritage tourism

The Roanoke Island Festival Park is one of many historical sites supported by the N.C. Division of Cultural Resources that figures in the state's economic picture.

According to the Travel Industry Association of America (TIAA), heritage and cultural tourism is the fastest-growing segment of the



tourism and travel industry. In fact, 81 percent of adults who traveled in 2003 were “historic/cultural travelers.” The association survey reveals that these visitors spend an average of \$623 per trip.

That bodes well for the tourism and travel industry in North Carolina — the sixth most visited state in the nation. TIAA figures also show that about 200,000 people are employed in the travel and tourism industry across the state.

Heritage and cultural tourism is travel that is motivated by a desire to experience the authentic natural, historic or cultural resources of a community or region, explains Jack Thigpen, North Carolina Sea Grant extension director and tourism specialist.

Many coastal communities such as Manteo on Roanoke Island are showcasing their historic pride, he says. The area is unique in the number and variety of heritage and cultural attractions, Thigpen says.

### So little time

While its proximity to the Outer Banks beaches makes the island a logical side trip, it is becoming a destination in its own right.

Pedestrian friendly, Manteo invites leisurely strolls along tree-lined sidewalks or boardwalks along the waterfront. Visitors may safely walk, jog or bike along the multi-use pedestrian path that runs the length of the island along U.S. 64.

A single day is not enough time to take in Roanoke Island Festival Park and nearby Manteo attractions that include:

- The N.C. Aquarium on Roanoke Island, open year-round, explores the watery environment of the Outer Banks and the Graveyard of the Atlantic — the first obstacle to New World exploration;
- The North Carolina Maritime Museum, open year-round, celebrates the age-old art of boat building;

### Want to go?

Roanoke Island Festival Park is open daily from February through December. (*Elizabeth II* sails to Manns Harbor for haul out and maintenance during January.) Admission to the park is \$8 for adults, \$5 for students ages six to 17, and free to children five and under. Admission is good for two consecutive days.

Special school group rates are available at discounted prices. And, a Festival Park Web site [www.roanokeisland.com](http://www.roanokeisland.com) offers teachers a way to prepare a class for the experience, or to follow up the visit.

Visitors also may choose a Roanoke Island Attractions Pass or Queen’s Pass at up to 25 percent off admission prices to the island’s many attractions. Valid through Dec. 31, the Attractions Pass offers one-time admission to the Roanoke Island

Festival Park, the N.C. Aquarium on Roanoke Island and The Elizabethan Gardens for \$17 for adults and \$8.25 for youth ages five to 17.

The Queen’s Pass adds to the combination with a ticket to *The Lost Colony* outdoor drama and costs \$31 for adults and \$15.25 for youth ages five to 17.

Membership in “Friends of Elizabeth II” offers a season pass and free admission to many scheduled programs, a subscription to the park’s newsletter, and discounts at the Museum Store. □

Visit the Roanoke Island Festival Park online at [www.roanokeisland.com](http://www.roanokeisland.com). Or call 252/475-1500 for further information.



ABOVE: John Wright, portrayed by Chris Roberts, works at the settlement site, while Brian Seitel, as Rys Courtney, dreams of the settlers’ new life.

TOP LEFT: The blacksmith shop is the latest completed building in the English settlement replica.

BOTTOM LEFT: Chris Woodson, in character as William Beale, stokes his fire in the blacksmith shop.

- *The Lost Colony*, the historical outdoor drama that runs June through August, depicts the attempt to establish the first English-speaking colony in the New World;

- The Elizabethan Gardens, open year-round, was created by the Garden Club of North Carolina in memory of the first English colonists;

- The Outer Banks History Center, a manuscript repository, operates year-round by the N.C. Division of Archives and history; and

- Fort Raleigh National Historic Site, open year-round, features a museum, exhibits, interpretive talks, and a film entitled *The Freedom Trail*.



# Shrimp

## A Favorite Catch

By Joyce Taylor

Ask most people to name their favorite seafood, and chances are they'll answer "shrimp." This tasty crustacean is the most popular seafood in the nation.

But this has not always been the case. Until the late 1920s, fishermen thought of shrimp as pests that fouled their nets and they threw them aside. John Maiolo, a retired sociology professor from East Carolina University reports: "North Carolina fishermen were paid about three cents a pound for their catches. Others were paid five cents a bucket to head them."

Back then, people often called shrimp "bugs." Many of the Nutrition Leaders remember calling them that, and pitching them back in the water when caught. Even today, many fishers going out after the valuable catch will say that they are "going bugging."

Brown, pink and white shrimp, "local" to us, are found along the southeast U.S. coast and in the Gulf of Mexico. Shrimpers catch these favorites in large mesh nets. Many of the shrimp you buy in restaurants and supermarkets are imported from Asian countries. And many of them are cultivated in ponds, which makes a steady supply available. Shrimp are low in calories and fat, and high in protein. They contain a moderate amount of cholesterol, depending on the species.

Markets price shrimp according to size, based on the number of headless shrimp per pound. Counts are not always uniform, but generally jumbo shrimp contain about 21 to 25 per pound; large, 31 to 40; medium, 41 to 50; and small, 51 to 60. You will see some labeled "jumbo" and "colossal." There are no official standards for labeling the sizes, and different markets may use different terms.

Generally, shrimp drop one count in shelling and another in cooking. After peeling and cooking, raw, headless shrimp will yield about three-fourths their weight.

I'm often asked if it's more economical to buy shrimp with the heads on. To determine this, you need to calculate what the headed price is. If heads-on shrimp are below 40 count, divide the price by .63. If they are above 40 count, divide by .55. For example, if large shrimp with heads on

*Continued*







MARINER'S  
MENU



## MARINER'S MENU

are \$5 per pound, divide \$5 by .63. The answer is \$7.94. If this is less than the market price for headed shrimp, it is a better buy.

Use smaller shrimp for casseroles, salads, sandwiches and in spreads and dips. Medium shrimp make good additions in soups and some entrees, such as shrimp creole. They also can be steamed or grilled. Use large shrimp for grilling, steaming and other entrees where size matters.

Fresh shrimp smell like sea water. There should be no off-odors, mustiness or chemical smells. Occasionally shrimp will smell and taste like iodine. This is not related to spoilage and is not harmful, but makes them unacceptable for eating. Certain organisms on which shrimp sometimes feed can cause this iodine effect. If you buy shrimp that smell this way, return them to your market for a refund or replacement.

When shopping for shrimp, look for those that are firm and not slippery.

Beware of shrimp that are bright pink or red. They have a "cooked" appearance due to not being properly iced.

Look for uniform size and shrimp that don't have defects such as black spots, yellowing or a bleached appearance and check for extraneous material such as legs or shell fragments.

Shrimp may be peeled before or after cooking. If they are boiled, steamed or precooked for a recipe, they are much more flavorful if cooked in the shells. If you don't believe this, give it a try. You'll be surprised!

Shrimp must be headed and peeled; deveining them is optional. People often ask if it's necessary. In many shrimp, the "sand vein," as it is commonly called, is small and can be left. It is not necessary to remove it to clean the shrimp, since most of the digestive organs are in the head and thorax and are removed when the shrimp is headed. If the vein is large, it may be gritty and you'll want to remove it. And dishes such as shrimp cocktail, salads and soups are more aesthetically pleasing if the vein is removed.

When precooking for further use in a recipe, shrimp should be cooked in salted or seasoned water.

To cook 1 pound, combine 1 quart of water and 1/2 teaspoon salt in a medium saucepan.

Bring to a boil. Add shrimp. Simmer until pink and tender, about 3 to 5 minutes, depending on the size of the shrimp. Pour into a colander to drain.

You can add celery leaves, lemon slices, a bay leaf or other favorite seasonings to the water. If you do, boil about 10 minutes before adding shrimp. This will allow the flavors to blend. Also, most markets and stores have seasoning mixes. Some of them such as Old Bay, are quite good.

If you're hungry for a *Carolina Shrimp Boil*, don't be intimidated by the recipe. You can easily cook it for two or even one. I've done it many times — and it works!

### Shrimp Newburg

- 1 pound cooked small shrimp, peeled
- 6 tablespoons margarine or butter
- 2 tablespoons flour
- 1/2 teaspoon salt
- 1/8 teaspoon nutmeg
- 1/16 teaspoon cayenne pepper
- 2 cups light cream
- 2 egg yolks, beaten
- 2 tablespoons dry sherry
- 4 slices bread, toasted and cut into points

Cook shrimp in salted or seasoned water.

Melt margarine in medium saucepan over medium heat. Blend in flour. Add salt, nutmeg and cayenne. Add cream gradually, stirring constantly. Cook, stirring constantly, until thick and smooth. In small bowl, stir a little sauce into the beaten egg yolks. Add back to sauce slowly, stirring. Add shrimp and continue to cook until heated thoroughly. Remove from heat and add sherry. Serve on toast points. Serves 4.

### Savory Baked Shrimp

- 1 pound cooked small shrimp, peeled
- 3 tablespoons vegetable oil
- 1 tablespoon finely chopped green onion
- 1/2 teaspoon pressed garlic
- 1 tablespoon chopped fresh parsley
- 1/4 teaspoon savory
- 1 1/2 tablespoons fresh lemon juice
- 1/4 cup dry bread crumbs
- 1 tablespoon freshly grated Parmesan cheese
- 2 tablespoons dry white wine

Heat oil in small saucepan over medium heat. Saute onion and garlic until tender. Add parsley, savory, lemon juice, crumbs and cheese.

Arrange shrimp in lightly greased medium baking dish. Sprinkle crumb mixture over top. Pour wine over this. Bake at 350 F until heated through and lightly browned, about 10 to 15 minutes. Serves 3 to 4.

### Shrimp Scampi

- 1 pound large shrimp, peeled
- 1/2 teaspoon Worcestershire sauce
- 1/4 teaspoon salt
- 1/8 teaspoon freshly ground white pepper
- 1 teaspoon paprika
- 1/4 cup margarine or butter
- 1/3 cup finely chopped green onion, including tops
- 2 tablespoons softened margarine or butter
- 1 teaspoon pressed garlic
- 2 teaspoons finely chopped fresh parsley
- 1/2 cup dry white wine
- cooked rice (optional)

Cook rice according to package directions.

In medium bowl, toss shrimp with Worcestershire. Combine salt, pepper and paprika and sprinkle on shrimp. Melt 1/4 cup margarine in large skillet over medium heat. Add green onion and shrimp. Cook until shrimp are browned, about 5 to 6 minutes, turning once. Stir in softened margarine, garlic, parsley and wine. Simmer 3 to 4 minutes. Serve with rice, if desired. (You'll enjoy it with rice — the broth is delicious.) Serves 3 to 4.

### Carolina Shrimp Boil

- 8 pounds large unpeeled shrimp
- 8 quarts water
- 8 rounded tablespoons Old Bay Seasoning (more to taste)
- 30 small new potatoes (or larger ones, halved or quartered)
- 5 large onions, halved
- 15 ears of corn, shucked and cut into thirds

In a large cooker, bring water to rolling boil. Add seasoning. Add potatoes and onions. Continue to boil until potatoes are almost done, about 10 minutes. Add corn and cook until done, about 3 minutes. Add shrimp and cook



until done, about 3 to 5 minutes. Drain and serve. Serves 12 to 15.

*Note: Many people like to shake additional Old Bay over the food after draining it. Also, you can add smoked sausage to the pot. Cut into pieces about 1 1/2-inches long and add after the potatoes. Other seafood seasonings can be used for flavor. Follow package instructions for amounts and cooking methods.*

### Shrimp Salad

- 1 pound cooked small shrimp
- 2 tablespoons fresh lemon juice
- 1/2 cup finely chopped celery
- 2 hard-cooked eggs, chopped
- 1/2 cup mayonnaise
- 1/8 teaspoon Tabasco sauce
- 1/8 teaspoon freshly ground white pepper
- lettuce
- tomato wedges

Cook shrimp in salted or seasoned water. Peel and devein.

Mix shrimp with lemon juice. Add celery,

eggs, mayonnaise, Tabasco and pepper. Mix well. Chill thoroughly. Serve on lettuce leaves. Garnish with tomato wedges. Serves 3 to 4.

### Shrimp au Gratin

- 1 pound small or medium shrimp
- salt
- 2 tablespoons margarine or butter
- 1/2 cup soft bread crumbs combined with 3 tablespoons melted margarine or butter
- 1/3 cup freshly grated medium cheddar cheese

Make sauce and keep warm.

Lightly salt shrimp. In medium saucepan, melt margarine over medium heat. Add shrimp and sauté lightly, about 2 minutes. Remove shrimp with slotted spoon.

Add shrimp to sauce mixture and mix well. Pour into greased casserole dish. Sprinkle top with crumb mixture and cheese. Bake at 400 F until lightly browned and bubbly, about 20 minutes. Allow to stand 10 minutes before serving. Serves 3 to 4.

Sauce:

- 3 tablespoons margarine or butter
- 3 tablespoons finely chopped green onion
- 3 tablespoons flour
- 1 cup light cream
- 1/2 teaspoon salt
- 1/4 teaspoon freshly ground white pepper
- 1/8 teaspoon nutmeg
- 1 teaspoon fresh lemon juice

In medium saucepan, melt margarine over medium heat. Lightly sauté onion. Stir in flour. Add cream gradually, stirring constantly, and cook over low heat until thickened. Add salt, pepper, nutmeg and lemon juice. □

**Excerpted from *Mariner's Menu: 30 Years of Fresh Seafood Ideas.***

**To order a copy of *Mariner's Menu, UNC-SG-03-02*, visit the Web: [www.ncseagrant.org](http://www.ncseagrant.org) and download an order form. Send the form and a check for \$25 to: North Carolina Sea Grant, NC State University, Box 8605, Raleigh, NC 27695-8605.**

### Heading, Peeling and Deveining Shrimp

1. Hold a shrimp in one hand. With your thumb behind its head, push the head off. Be sure to push just the head so that you do not lose any meat.

2. If using a deveiner, insert it at the head end just above the vein.

3. Push through to the tail and remove the shell. This removes the vein at the same time. Rinse shrimp well under cold running water.

4. If you prefer to use a paring knife, shell shrimp with your fingers or knife. To

remove the vein, use the knife. Rinse well under cold, running water.

*Note: When cooking shrimp in their shells, first head them. After cooking, peel and devein them. To maintain flavor, do not rinse shrimp after cooking.*



1.



3.



2.



4.





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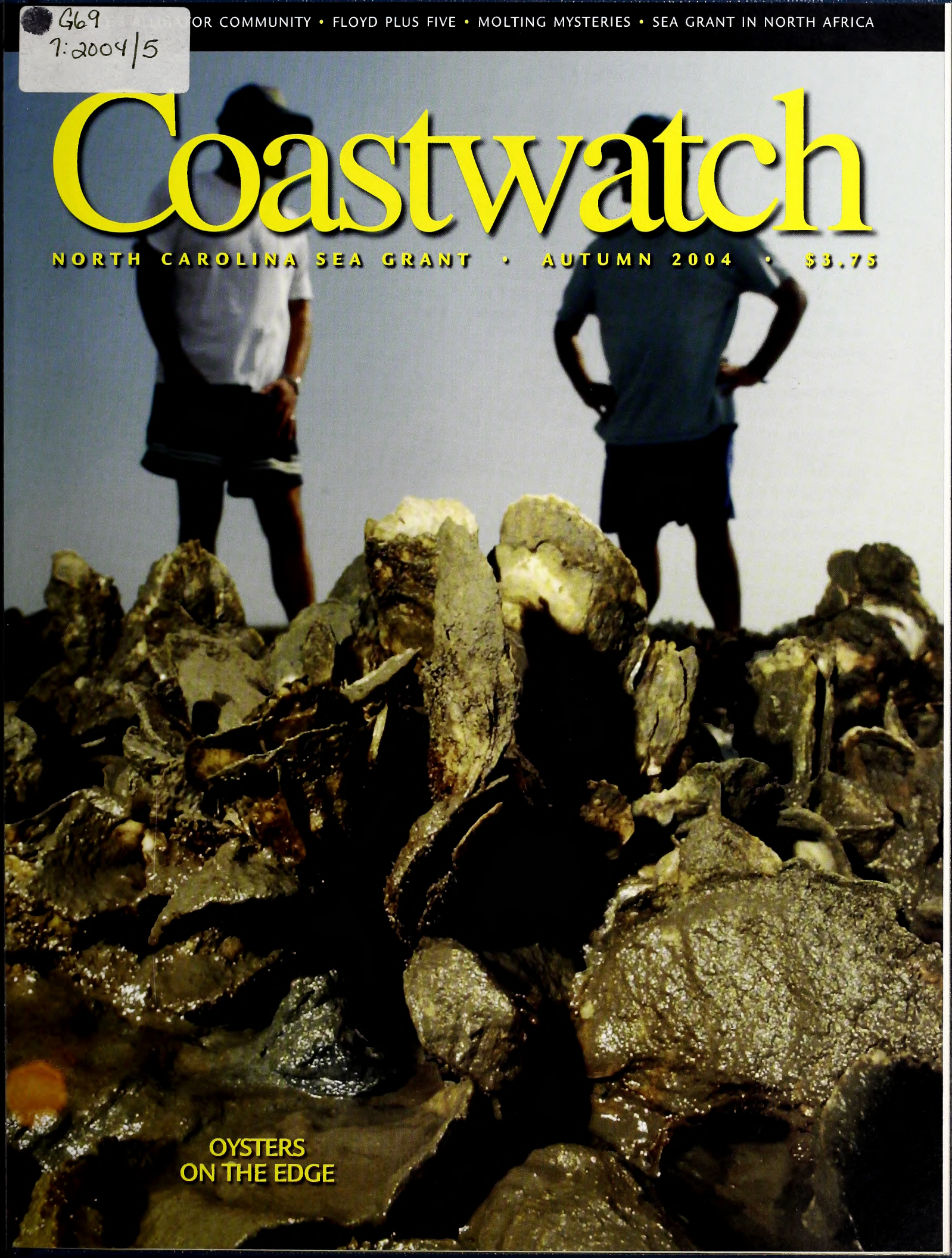


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# Coastwatch

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OYSTERS  
ON THE EDGE



## Memories of Hazel

This fall, we'll be marking anniversaries: one month since Hurricane Alex, one year since Isabel, five years since Floyd, and eight years since Fran.

And come Oct. 15, it will be 50 years since Hurricane Hazel — a benchmark by which recent storms still are measured. Hazel left 19 people dead in North Carolina. More than 600 lives were lost from Haiti to Canada.

Thirty North Carolina counties were devastated — 15,000 homes and structures were destroyed and nearly 40,000 damaged, with total losses set at \$136 million in 1954 dollars. Hazel affected inland towns, such as Wallace, Wilson, Raleigh and Henderson.

But those who survived the storm's landfall in Brunswick County have stories that became legend. Veteran *Coastwatch* readers will recall the story of then 17-year-old Connie Ledgett of Southport, but it is one worth repeating.

Connie had married Jerry Helms on Oct. 9, 1954. The couple honeymooned at her family's beach cottage in Long Beach, which had only 500 or so dwellings on the entire island.

During a midweek trip back to Whiteville, they heard news reports of a storm in the Bahamas but thought nothing of going back to the beach on Oct. 14. "We didn't have TV and the Weather Channel and satellites," she explains.

Overnight, the wind picked up. Rain pelted the cottage's tin roof. By dawn, the couple began battening things down. While packing her precious 45s and record player, she looked out. Normally, high dunes blocked views of the ocean from her third-row cottage. "I could see the ocean billowing above the sand dunes. This was the first time that I knew we were in trouble," she recalls.

By the time they got the car to the access road, the water was already up to the fenders. And the family's Army surplus jeep wouldn't crank. "The only thing for us to do was to start walking to higher ground."

The water was waist high as they reached a corner house with an upstairs apartment. They climbed the outside stairs, broke in, and found towels to dry off. Chaos surrounded them. "Smaller frame houses would float like boats. Cement block houses were the first to go — the mortar melted."

Twice, breakers shifted oncoming structures, sending them parallel to — rather than into — the couple's enclave. But they could feel the water under their floor. "We tried to come up with some lifesaving measures," she recalls.

They noted that furniture was floating, but their first choice, a chest of drawers, blew out the window. Next, they pulled a mattress off a bed and rolled it to fit through the window. A flannel blanket became a rope to link the couple. She climbed aboard the mattress, and Jerry hung on, swimming beside it.

A breaker broke off a piece of siding that became his raft as he held a corner of the mattress in his lap. "We were at the mercy of the storm," she says.

They rode toward Davis Creek, where they spent the remainder of the storm in the branches of oak trees. Finally the sun broke through. As water receded, they climbed down. But they still had to cross the creek to get to the mainland — with Jerry swimming and pulling Connie behind with a 2x4.

The beach had been flattened and the road pulled out in chunks, but she was most amazed at the sight of her mother and step-dad who had come through the storm from Whiteville. "When she saw us, she fainted," Connie recalls.

In the ensuing days, the couple talked with many reporters. Connie even was interviewed on Wilmington's Channel 6, which was in its first year on the air.

With the 50th anniversary approaching, she is again telling her story, with this moral: Property has limited value. Get yourself out of the storm.

Watch for Connie's story in documentaries this fall on WRAL and *The Weather Channel*.

*Katie Mosher, Managing Editor*

### I N T H I S I S S U E

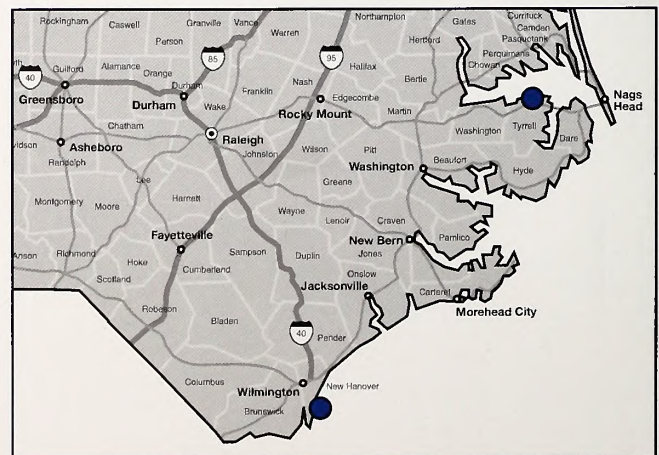
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*North Carolina's diverse coast offers countless interesting subjects. The large dots on the locator map indicate story settings in this issue — including Tyrrell and New Hanover counties.*





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# Coastwatch

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# Coastwatch

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The North Carolina Sea Grant College Program is a federal/state program that promotes stewardship 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, North Carolina Sea Grant supports research projects, a 15-member extension program and a communications staff. Ron Hodson 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. *Coastwatch* (ISSN 1068-784X) is published six times a year by the North Carolina Sea Grant College Program, North Carolina State University, Box 8605, Raleigh, North Carolina 27695-8605. Telephone: 919/515-2454. Fax: 919/515-7095. Subscriptions are \$15. E-mail: [katie\\_mosher@ncsu.edu](mailto:katie_mosher@ncsu.edu) World Wide Web address: <http://www.ncseagrant.org> Periodical Postage paid at Raleigh, N.C.

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Table of Contents photo of crabs  
by Scott Taylor.

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## COASTAL TIDINGS

### NC Sea Grant Among Nation's Best

North Carolina Sea Grant is among the top Sea Grant programs across the country, according to the National Sea Grant College Program (NSGCP). The Category 1 ranking cites "highest level of performance."

The North Carolina program "is a leader locally, regionally and nationally," NSGCP Director Ronald Baird wrote in a recent report. "The program is very successful at integrating research, education, extension and communications elements across projects," he added. The ranking places North Carolina Sea Grant in line to receive national merit funding.

"There are many outstanding Sea Grant programs across the country, so it is an honor to be ranked among the very best," said North Carolina Sea Grant Director Ronald G. Hodson. "The rating highlights our focus on coastal topics important to North Carolina, the region and the nation — providing scientifically sound information to the public in effective formats and understandable terms."

Sea Grant is a federal/state partnership that receives funding from Congress through the National Oceanic and Atmospheric Administration, as well as an appropriation from the North Carolina General Assembly. The program headquarters are at North Carolina State University, with offices in Manteo, Morehead City and Wilmington. Nationally, 32 programs are in coastal and Great Lakes states.

A Program Assessment Team, organized by the National Sea Grant Review Panel, visited North Carolina last fall. The evaluators noted



the effectiveness of the program's Outreach Advisory Board, as well as an in-state review of research preproposals and an out-of-state review of final research proposals.

"An impressive array of diverse user groups routinely participates in and benefits from NCSG programming, including policy makers, community organizations, business leaders, property owners, visitors to the N.C. coast, educators and members of the media."

National leadership of the Seafood Science and Technology Theme Team and rip current education efforts also were cited, as was legislative support for the Fishery Resource Grant and Blue Crab Research programs.

The review team focused on program results — underscoring the Sea Grant mission of applied research and subsequent outreach. "The impacts seen in coastal processes, beach nourishment and salt marsh enhancement, shellfish growout, creating value-added seafood products, adoption of coastal construction techniques into building codes, urban stormwater runoff reduction due to stream restoration, and in many areas of aquaculture are particularly noteworthy," the report stated.

Other examples of outstanding efforts cited were: breakthroughs in surimi and tuna processing; culture processes for hybrid striped bass and flounder; workshops for real estate agents and brokers; training of coastal businesses in marketing for coastal paddlers and birders; and training seafood producers in seafood safety.

— K.M.

### In the Next Issue of *Coastwatch*

As the holidays focus on family and tradition, Kathleen Angione introduces Muzel Bryant, who, at age 100, is one of Ocracoke's most cherished residents. And readers will join Pam Smith on a holiday tour of North Carolina's southern coast. Meanwhile, Ann Green explores shrimping with skimmer trawls and the more traditional otter trawls.



## Seafood Festival Oct. 1-3

Mark your calendars for the 18th annual North Carolina Seafood Festival, Oct. 1-3, on the Morehead City waterfront.

The festival is a fun-filled way to learn about the importance of seafood to the economy and culture of the state.

The event features arts and crafts, port and ship tours, street dances, fireworks and unique sporting events — including a flounder fling.

Look for North Carolina Sea Grant in the education tent, along with dozens of organizations presenting hands-on, seafood-related exhibits. The Yesterday & Today Education

exhibits will be open Saturday and Sunday, from 10 a.m. to 5 p.m.

Festival activities get under way on Friday at 5 p.m. The street fair — featuring entertainment on three stages, rides, and more than 100 food, arts and crafts vendors — runs to 9 p.m. both Friday and Saturday, and from 10 a.m. to 5 p.m. Sunday.

Proceeds of the event will help establish a scholarship program for young people pursuing education in seafood-related industries.

For the complete list of activities, go online to [www.ncseafoodfestival.org](http://www.ncseafoodfestival.org). — P.S.

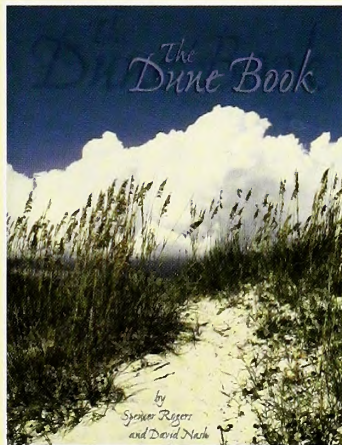
## The Dune Book Wins APEX Grand Award

North Carolina Sea Grant's educational campaign on sand dunes took top honors in APEX 2004, a national publication awards program. The campaign — focusing on *The Dune Book* and related outreach efforts — won one of only 100 Grand Awards conferred among the nearly 5,500 entries.

APEX judges also recognized North Carolina Sea Grant's online site, [www.ncseagrant.org](http://www.ncseagrant.org), and *Coastwatch* magazine.

*The Dune Book* was written by Spencer Rogers, North Carolina Sea Grant coastal erosion specialist, and David Nash of N.C. Cooperative Extension. "Superbly designed, extremely well-thought out campaign offers a wealth of well-written, beautiful and interesting features and resource material. One comes away from reading this material with a clear understanding of and appreciation for the role of dunes in protecting against storm-induced erosion," the judges wrote.

Sea Grant communicator Ann Green edited the book, which was designed by Kathy McKee of Raleigh, illustrated by David Williams of Raleigh and printed by Theo Davis Sons of Zebulon. The



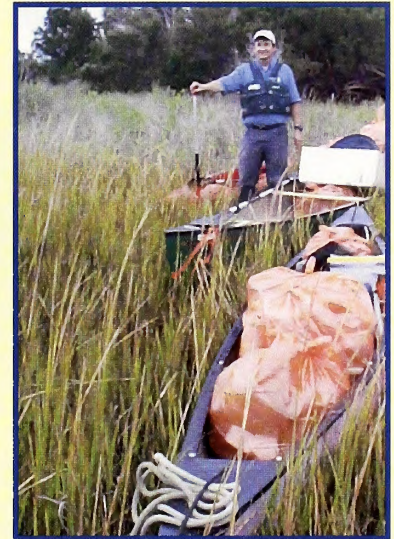
campaign also included news releases and media coverage; workshops led by Rogers and Nash; and other distribution efforts.

The North Carolina Sea Grant Web site received an APEX Award of Excellence for "most improved Web and intranet sites."

The site was updated in 2003 under the leadership of Tammy Sumner, assistant director

for finance and information systems, who handles technical aspects; and Katie Mosher, communications director, who oversees content. Capstrat of Raleigh provided site programming and design services. "Our goal was to develop a robust site that offered the user an engaging look at our program," Sumner says.

*Coastwatch*, North Carolina Sea Grant's hallmark publication, also received an Award of Excellence. Mosher is managing editor, while Green and Sea Grant communicator Pam Smith are senior editors, and Sandra Harris is distribution manager. Linda J. Noble of Raleigh is the designer for *Coastwatch*, which is printed by Theo Davis Sons. — K.M.



Courtesy of North Carolina Big Sweep

## Big Sweep Moves to October

North Carolina Big Sweep — the annual statewide waterway cleanup — is scheduled for Saturday, Oct. 2.

The volunteer effort traditionally has been held on the third Saturday in September. But Hurricane Isabel in 2003 caused officials to consider moving the cleanup to a less hurricane-prone time. Since 1950, North Carolina has been hit with eight hurricanes in August, 15 in September and two in October.

Big Sweep was founded as Beach Sweep in 1987 by Lundie Spence, then North Carolina Sea Grant marine education specialist. The initial band of 1,000 volunteers swept coastal counties to collect more than 14 tons of debris. In 1989, the effort expanded inland and became Big Sweep. Last year, a volunteer force of more than 190,000 gathered seven million pounds of trash littering North Carolina watersheds from the mountains to the coast.

For a complete list of local Big Sweep activities and county coordinators, go to [www.ncbigssweep.org](http://www.ncbigssweep.org). Organizers in Carteret County have scheduled Big Sweep for Oct. 9 to avoid conflict with the N.C. Seafood Festival. — P.S.



## New Sea Slug Identified



### Smithsonian Festival Features NC Coast

This summer, North Carolina Sea Grant staff, as well as maritime workers from the Core and Albemarle sound regions, were at center stage on the National Mall.

As part of the 2004 Smithsonian Folklife Festival in Washington, D.C., North Carolina Sea Grant Fisheries Specialist Bob Hines and Carteret County shrimper Bradley Styron offered in a shrimp trawl exhibit. Also, University of North Carolina at Chapel Hill researcher William Stott and Mary Ellen Cox, a crabpot maker in Hyde County, showcased North Carolina's rich crabbing culture. Sea Grant sponsored these four participants.

In addition, Jack Thigpen, North Carolina Sea Grant extension director, and Mid-Atlantic Sea Grant representatives offered in a panel discussion on "Coastal Development & Values." National Sea Grant Outreach Director Jim Murray served as moderator.

The exhibits and panel were part of "Water Ways: The Past, Present and Future of Mid-Atlantic Maritime Communities."

"The Smithsonian Festival was a great way to feature North Carolina's rich maritime traditions in both the Core and Albemarle sound regions," says Thigpen.

"Maritime culture, such as the long history in sport fishing and commercial fishing, are an important component of North Carolina's coastal economy," he adds. "Visitors come to North Carolina to discover its natural beauty and wildlife. Its visitors support an increasing number of heritage and ecotourism businesses." — A.G.

While diving on the Hardees tanker shipwreck near Cape Lookout last year, scuba enthusiast Sandy Smith of Pennsylvania spotted an odd, yellowish blob.

"I knew it was a nudibranch," says Smith. "But it was a type I've never seen before."

It turns out she wasn't alone. This nudibranch had never been seen alive in the western Atlantic.

Nudibranchs, or sea slugs, are related to marine snails.

But thanks to evolution, sea slugs no longer have external shells like most of their mollusk cousins. Researchers know precious little about these delicately shaped and colorful animals, and Smith's find would prove an exciting discovery.

She snapped a few photos of the unusual creature and contacted Bill Rudman, an Australian research scientist and founder of the



Smith's photo of the butterfinger nudibranch won second place in the underwater close-up category of the North Carolina Aquarium's 2003 underwater photo contest.

Entries for the 2004 contest must be postmarked by Dec. 31, 2004. For more information, visit [www.ncaquariums.com](http://www.ncaquariums.com) and click on the News & Events link.

animal and never been reported again," explains Rudman.

Because *Polycera chilluna* had never been documented as a living animal here, Smith was allowed to give it a common name.

She chose "butterfinger nudibranch." Why? "It had yellow appendages that looked like a hand to me," says Smith. — K.A.

## Mumfest to Feature Flowers and Boats

New Bern's 24th annual Mumfest, Oct. 9 and 10, will have a new attraction this year — a boat-building contest.

Teams of two to four people can try their hands at constructing a wooden rowing dinghy. For \$350, teams will receive a kit of pre-cut marine plywood. They will have two days to transform the 40-piece kit into a working 8-foot dinghy at workstations under a large tent at the center of Union Point Park.

Teams will showcase their finished products in a flotilla on Oct. 10.

Festival-goers traditionally enjoy the Tryon Palace colorful gardens, which are open free to

the public for Mumfest, and boats of all sizes at the Sheraton docks and Union Point Park.

Dick Mushet and Frank Bruno of New Bern designed a prototype of the dinghy, based on the N.C. Maritime Museum's build-a-boat project model. They configured a square-stern boat that seats one adult and one child — and rows easily, according to the designers. The prototype is on display at the Middle Street Post Office.

Team members must be at least eight years old. Scholarships are available for interested nonprofit groups.

For information, call 252/638-5781 or e-mail [swissbear@swissbear.org](mailto:swissbear@swissbear.org). — P.S.



## Coastal Business Specialist Joins Sea Grant

Brian Efland has joined North Carolina Sea Grant as a coastal business specialist. "The post will enable Sea Grant to provide a link to the latest economic research and business models at a time of shifting coastal economies," says Ronald G. Hodson, Sea Grant director.

"The coastal business climate provides opportunities and challenges as new businesses emerge, and traditional fishing and seafood industries find themselves part of the global marketplace," Hodson says.

Efland, who will be based at the Center for Marine Sciences and Technology in Morehead City, holds a bachelor's degree from North Carolina State University and a master's degree in business management from Appalachian State University. He has held managerial positions in the financial and insurance sectors.

And, he places high value on his other "advanced degrees." Efland earned a captain's license at the U.S. Coast Guard Sea School in Charleston, S.C. He also holds a commercial fishing license and is a certified scuba diver.

Efland has participated in the National Marine Fisheries Service's bluefin tuna tag-and-release program in North Carolina waters. He also took part in the South Carolina Department of Natural Resources' red drum research tagging program.

In short, he says, his passion for the coast drives his desire to help balance the economics and ecology of coastal North Carolina.

"I am interested in delivering research results to people who will benefit most from many aspects of Sea Grant's work," Efland says.

To contact Efland, call 252/222-6314, or [brian\\_efland@ncsu.edu](mailto:brian_efland@ncsu.edu). — P.S.

## Angione Selected Science Communications Fellow

Kathleen E. Angione of Holly Springs has been selected as the first Science Communications Fellow for North Carolina Sea Grant and the North Carolina State University Department of English.

In the one-year fellowship, Angione will develop communications products for the N.C. Fishery Resource Grant Program and the N.C. Blue Crab Research Program. The two programs, funded by the N.C. General Assembly and administered by Sea Grant, highlight fishery and habitat topics that are important, not only along the North Carolina coast, but across the state in terms of economic and environmental value.

She also will teach one undergraduate science communications class at NC State during the 2004-2005 fellowship year.

A Queens, N.Y., native, Angione holds a bachelor's degree in environmental policy from Eckerd College and a master's in technical communication from NC State. This year, she received an NC State University Outstanding Teaching Assistant Award.

Angione, who is an avid sea kayaker, has a lifelong interest in marine science issues. As a child, she spent summers on the Maine coast. As part of the Sound to Sea Environmental Education Program in Salter Path, she taught hands-on coastal ecology classes to school groups.

The Sea Grant Science Communications Fellowship will be available next year pending available funds. The application process for the 2005-2006 fellowship will be announced in the fall. For more information, contact Katie Mosher, North Carolina Sea Grant communications director, at 919/515-9069, [katie\\_mosher@ncsu.edu](mailto:katie_mosher@ncsu.edu); or Cat Warren, associate professor, NC State English Department, 919/515-4105, [cwarren@unity.ncsu.edu](mailto:cwarren@unity.ncsu.edu).



Brian Efland



Connie Mason



Kathleen Angione



Tammy Sumner

## Mason Receives Folklore Award

For a number of years, Connie Mason has entertained audiences by sharing the history and lore of coastal North Carolina.

Recently, Mason was honored for her music and storytelling with the 2004 Brown-Hudson Folklore Award. Each year, the N.C. Folklore Society recognizes people who have contributed in a special way to the appreciation of North Carolina folk life. Past recipients include blues player Richard "Big Boy" Henry, folk singers Doc and Merle Watson, Harkers Island model builder James Allen Rose and playwright Paul Green.

A native of Carteret County, Mason is the collections manager/historian of the N.C. Maritime Museum. Her illustrations are featured in *Mariner's Menu: 30 Years of Fresh Seafood Ideas*, written by Joyce Taylor and published by North Carolina Sea Grant.

— A.G.

## Summer Earns Honor

Tammy Sumner, North Carolina Sea Grant assistant director for finance and information systems, earned the Certified Research Administrator designation from the National Research Administrators Certification Council. The certification represents the highest level of professional achievement in the field of research administration.

Individuals must pass a comprehensive exam related to research and sponsored program management, and must reapply for certification every five years.

Sumner also serves as Sea Grant's webmaster. The Onslow County native joined Sea Grant in 1994, and previously worked in the North Carolina State University Office of Contracts and Grants.

— P.S.







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Ken Blems/Wilmington Star-News





ALPHIN, LEFT, AND MARTIN POSEY, BOTH OF UNC-WILMINGTON, TAKE SAMPLES AT THE OYSTER REEF RESEARCH SITE.

Ken Blevins/Wilmington Star-News

They found that more aquatic species used patchy reefs — each of which were more than five meters in diameter and had channels between them — than a large continuous area of shells, according to Posey.

While the use of multiple patch reefs is beneficial in oyster habitat restoration, fragmentation — the loss of oyster coverage through degradation, burial of reefs and mortality of oysters — is not useful, according to Alphin, a UNC-W senior research associate.

“When you look at habitat loss throughout the state, increased pollution has caused

private organizations, state and federal agencies and researchers to restore oyster habitats and protect water quality,” says Wilgis. “You can’t restore oysters without improving habitat and water quality.”

In light of the research findings, Sea Grant scientists also are working with the U.S. Army Corps of Engineers and others to initiate an oyster restoration project in the Lower Cape Fear River system. And the study can be applied to intertidal reef restoration in South Carolina and Florida, adds Posey.

DMF will use the data for cultch planting

fragmentation of oyster reefs,” Alphin adds. “In fact, some reefs have become so fragmented that they may no longer function.”

## OYSTER RESTORATION PROJECTS

Using the study results, Posey and Alphin are working closely with the N.C. Coastal Federation on site selection, reef design and the sizing of oyster reefs on a number of coastal projects, including the one at Hewlett’s Creek that feeds into Masonboro Sound.

“Martin and Troy recommended four small reefs instead of one large one at our Hewlett’s Creek site so that there would be good water flow between the reefs and also to increase the space for habitat niches,” says Ted Wilgis, N.C. Coastal Federation’s Cape Fear coastkeeper.

“This project is part of an increasing effort by a diverse coalition of

of hard materials like shells and limestone on man-made oyster beds, according to Craig Hardy, DMF Resource Enhancement Section chief. The cultch serves as a substrate for new spat set — the initial attachment of oyster larvae that spawn from June through August.

Baby oysters begin their lives as highly mobile plankton. After the first three weeks, oysters become permanently attached to solid surfaces.

During the summer months, DMF plants shells and rocks to provide additional habitat for larval oysters and clams. Large vessels transport the cultch out to designated sites. The shells are either dumped from a front-end loader or sprayed off the boat deck with a high-power hose. About 500,000 bushels of cultch material are planted annually.

“The Sea Grant research will provide guidance in the way that cultch is deployed in shallow waters from Cedar Island to South Carolina,” says Hardy. “In the past, cultch has been placed on the bottom during the summer to provide additional oyster habitat. We relied on the natural spawn to provide the spat set.”

Scientists have made great strides in moving oyster restoration forward — from research on better placement of sanctuaries to the understanding of needed geometry of the mounds — according to Sara Mirabilio, North Carolina Sea Grant fisheries specialist.

However, Mirabilio says the research will be of limited value unless everyone — from private citizens to restaurant owners — helps to conserve another important natural resource: oyster shells. “Baby oysters settle on oyster shells better than on any other substrate,” she adds.

She cites DMF’s Web site, “One individual may not be able to create a sizable reef, but by pooling our resources, researchers and scientists can construct large reefs in prime oyster-growing areas, enhancing oyster productivity and providing hook- and-line fishing opportunities for the public.”

## NATIVE OYSTER

The Eastern oyster (*Crassostrea virginicus*) provides many ecological and environmental benefits, including filtering the water. The species also contributes to turbidity reduction and the removal of particles in the water column. With





Ken Blevins/Wilmington Star-News

THE INTERTIDAL REEFS WERE BUILT WITH VARYING SHAPES AND COMPLEXITIES.

less turbidity, more light is transmitted through the water, expanding areas of submerged aquatic vegetation (SAV), an important nursery habitat for a variety of species.

“The health of North Carolina’s oyster populations is a good indicator of the overall health of our estuaries; all prudent measures should be taken to ensure a viable oyster resource,” according to a DMF report.

In North Carolina, oysters are found from the extreme southeastern end of the Albemarle Sound near the northern end of Roanoke Island southward through the Croatan, Roanoke and Pamlico sounds to the estuaries of the southern part of the state to the South Carolina border.

Since before recorded history, the oyster has been an important source of food in coastal North Carolina. When the first Europeans arrived, they were amazed at the number of oysters found.

The Carolina oyster industry hit its ascent in the 1880s, when Baltimore companies built larger canneries in coastal towns. Schooners from outside North Carolina introduced oyster dredges and longer, sturdier tongs into the local oyster industry. Despite later attempts to restrict dredging, most of the damage to oyster beds already had occurred by 1910, according to DMF.

In the 1960s, ecological changes began affecting oyster harvests. Harmful intrusions — disease and polluted waters, combined with other factors — have tainted the once prolific resource.

In recent years, there has been a decline in

the number of leases for oysters. In 2003, the state issued 273 leases in comparison to 294 in 1993, according to DMF. The highest density of leases is on the Newport River in Carteret County and Stump Sound in Onslow and Pender counties, according to Hardy.

#### OYSTER DISEASE

Since the late 1980s, Dermo (*Perkinsus marinus*) has been responsible for major oyster kills in North Carolina. Harmless to humans, the parasite wears down oysters over many months, killing them before they reach a harvestable size.

The disease first hit the Pamlico Sound in the early 1990s, explains Hardy.

“Since then, it has spread up and down the coast,” he adds. “Dermo seems to be driven more by climatic and salinity-driven issues. From the late 1980s to 2002, North Carolina had drought conditions that provided warm, dry winters, where the water temperature didn’t drop, and the salinity was high. Dermo, like oysters, thrives in medium salinity water.”

There also have been isolated incidents of MSX — a parasite that typically thrives in cooler waters north of North Carolina.

A combination of environmental factors has forced the closing of many oyster beds. Of 1.43 million acres of North Carolina salt water suitable for shellfishing, more than 365,000 acres have been closed for shellfish due to pollution, according to Hardy.

To address the oyster crisis, DMF adopted

an oyster management plan in August 2001.

“We are in the process of incorporating recommendations,” says Hardy. DMF staff members have identified areas where only hand-harvest methods will be allowed to provide protection from the effects of mechanical harvest gear, he adds.

“Hand-harvest gear usually does not damage undersized oysters that must be returned to the bottom, where they were caught, nor the structural integrity of the reef system or oyster rock, to the degree that mechanical methods do,” Hardy explains.

In recent years, research on oyster disease has gained momentum.

Through funding from the National Sea Grant College Program, Charles “Pete” Peterson, of the UNC-Chapel Hill Institute for Marine Sciences, and Sean Powers, now of the Dauphin Island Sea Lab in Alabama, are studying the influence of local small-scale variations of landscape setting on Dermo and Eastern oysters.

“A lot of native oysters in North Carolina have been lost to disease in the last 20 or more years,” says Peterson. “We hope this research will help the oyster industry get back on their feet.”

In previous Sea Grant studies, Peterson examined the influence of large-scale environmental factors on oyster disease, including salinity and temperature. The scientists found that there were lower incidences and less severity

*Continued*





Ken Blewins/Wilmington Star-News



Scott Taylor



Ken Blewins/Wilmington Star-News

TOP: HEATHER HARWELL, OF UNC-WILMINGTON, PARTICIPATES IN THE FIELD RESEARCH. MIDDLE: CHARLES "PETE" PETERSON OF UNC-CHAPEL HILL INSTITUTE FOR MARINE SCIENCES IS LOOKING AT THE ROLE OF OYSTER SANCTUARIES IN DISEASE RESPONSE. BOTTOM: RUSS BARBOUR AND THOMAS MOLESKY HEAD TO THE UNC-W RESEARCH SITE.

of Dermo among oysters on the tall reefs than on one-meter reefs degraded by mechanical harvesting.

#### NEW STUDY

The new National Sea Grant Program study addresses a number of local, small-scale variations in the environment, including water depth, reef orientation, water flow through the reef and the ability of water to transport oyster larvae.

Understanding the relationship between these small-scale effects and oyster disease could aid in oyster reef restoration in areas known to have high disease levels, Peterson says.

The sampling areas include oyster sanctuaries at Wanchese in Dare County, the Pamlico River estuary, the Neuse River estuary, and Cedar Island Bay, Middle Marsh and Bogue Sound, all in Carteret County. "These reefs bring 10 years of history," says Peterson.

In the Neuse River estuary, the researchers will use historical data on oxygen, temperature and salinity from the MODMON Interdisciplinary Research Project on water quality. The monitoring project is funded by the N.C. Department of Environment and Natural Resources and the UNC Water Resources Research Institute.

In the mid-1990s, Peterson and his colleagues compared the topography of oyster reefs in the Neuse River to an 1880 survey. Through the Sea Grant study, researchers found that vertical structure of reefs had declined in height because of dredging for oysters.

"Specifically, the study showed that oysters located on elevated reefs were above the low-oxygen water mass," says Peterson. "By being above this water layer, oyster survivorship and growth was high."

In another Sea Grant-supported study, Peterson and his colleagues compared oyster sanctuaries that were not harvested for up to 10 years and adjacent harvested oyster reefs. The researchers found the proportion of oysters with some levels of Dermo infection and the severity of infection were lower in reefs closed to harvest than in harvested reefs.

Peterson says the new project will provide a valuable and unique database to assess the success of oyster restoration in North Carolina.

"The project will focus on oyster restora-



tion in North Carolina over the last 20 years and help determine which reefs have survived and why,” says Powers, a former postdoctoral researcher at the Institute for Marine Sciences. “Any effort to restore oyster populations must consider how the disease dynamics will influence the survivorship and growth of oysters in a specific area and develop strategies to overcome disease-related problems.”

Now, the only strategies used to combat oyster disease in native populations include the early harvest of small mature oysters and the selection of areas for oyster transplant or restoration that are at least 0.4 kilometers from other infected beds, according to Peterson. Also, managers and fishers can monitor beds infected with Dermo to determine when harvesting is necessary.

Hardy says the Sea Grant study will help guide the DMF oyster restoration in deep subtidal areas, particularly in the Pamlico Sound and Neuse River.

“THE DEGRADED CONDITION OF THE STATE’S ESTUARIES AND THE DECLINE OF THE OYSTER POPULATION OVER THE LAST 10 TO 15 YEARS HAS HEIGHTENED THE AWARENESS OF THE IMPORTANCE OF OYSTERS — NOT ONLY AS A SEAFOOD PRODUCT FOR HARVEST, BUT ALSO AS A VERY IMPORTANT LINK IN A HEALTHY, PRODUCTIVE ECOSYSTEM.”

— CRAIG HARDY

“The degraded condition of the state’s estuaries and the decline of the oyster population over the last 10 to 15 years has heightened the awareness of the importance of oysters — not only as a seafood product for harvest, but also as a very important link in a healthy, productive ecosystem,” he explains.

“The value of oysters in increasing

habitat through reef construction and providing additional areas for SAV and the water quality benefits provided by filter feeding may equal or exceed their value as a seafood product,” adds Hardy.

Because the decline of the oyster stock and degradation of the estuaries over the last 100 years resulted from many factors, Hardy says the rebuilding of the oyster stock — along with the restoration of oyster habitats and estuarine function — will take many years.

To revive the oyster fishery, a variety of issues needs to be addressed, including harvesting and management of reefs.

“Oyster restoration cannot be successful without responsible development, farming and forestry practices, wastewater treatment and stormwater runoff controls,” Hardy adds.

“In short, we have to address all the factors that have contributed to the decline in order to be successful in restoration.” □

THIS CRAB WAS FOUND IN A NATURAL OYSTER BED THAT IS INCLUDED IN THE STUDY.

Ken Blevins/Wilmington Star-News







BAILEY'S

OFF PREMISE  
BEVERAGES

PLEASE PUT MONEY  
FOR ICE IN BOX

LIVE



## ALLIGATOR COMMUNITY RICH IN HUNTING, FISHING TRADITIONS

By Ann Green • Photos by Michael Halminski

While standing in a rain-soaked yard in the rural community of Alligator in Tyrrell County, Ray Sykes springs open a rusted trap used by his dad to capture raccoons.

"My dad and I would trap 'coons and whatnots," says Sykes. "During the season, we would trap every day. My old man, daddy could hunt, trap and kill 'em. He did not use bait. He just hunted them. Back in the old days, you'd get three 'coons on a good day. It was best when it was dark, and the moon was not shining."

Before the fur man came, Syke's late father, Lonnie Frank Sykes, would stretch the hide of a raccoon or muskrat on a long cypress board.

"You would get \$5 or \$6 for each coon in the early 1970s and \$35 for otter," says Sykes. "The last few years, there hasn't been much price on fur."

For many years, trapping thrived in the undeveloped swamps and woodlands of the Alligator community — just off U.S. 64 between Columbia and Manteo.

When the hunting season was over, many residents turned to better-known coastal occupations — fishing, farming and forestry.

By the 1980s, trapping for a living began to dwindle in Alligator — which includes the tiny communities of Fort Landing, Pot Licker, Pledger Landing and Goat Neck as well as the Alligator Marina. However, many residents still hunt recreationally for bears, raccoons and deer.

When 'coon hunting, Sykes carries a lantern, chains, ropes and a machete that he uses to help him mark the trails.

"I never burn a bright light but just use a lantern," he says. "I don't use a compass. As I go through the woods, I make a glance or mark with a

machete on a tree. When I get in deep, I build a fire if it is cold."

When hunting deer, Sykes goes with friends and neighbors to the Big Buck Hunting Club that leases property on the Palmetto Peartree Reserve from the Conservation Fund.

Holding up a steel hunter flag that alerts others when deer hunting, Sykes says that some members also run fox. "We have hunt masters who have lived and trapped on the land before and tell newcomers what to expect about water levels and other things," he adds.

One of the hunt masters is Chatman Bryant of Goat Neck. "As an old hunter, I love to hear dogs run and bay," says Bryant.

Bryant also likes to show off a handgun that he uses to kill bear.

"I killed many a bear with this gun," says Bryant, who is retired from the N.C. Department of Transportation. "I do bear hunting off at Buffalo. When hunting bear, you get them in the corn field at night."

### STRONG FISHING TRADITION

Because of Alligator's proximity to the Alligator River and Albemarle Sound, the tiny community has a rich fishing culture.

In the winter, people would set gill nets in the "little Alligator" — where the mouth of the Alligator River, Alligator Creek and Albemarle Sound join together — when herring were running, says Alligator native Syble Knotts.

"People would catch herring and then salt them up and can the roe," she adds.

As the herring began to dwindle, more people turned to crabbing.

William Stott, who is compiling an oral history of crabbers in the



Albemarle Sound, says there are some very successful crabbers in Alligator. Stott's project is funded by the Blue Crab Research Program administered by North Carolina Sea Grant.

"Some crabbers also set eel pots and even do some striped bass net fishing," adds Stott. "Some of the Alligator watermen I know — like Willy Phillips, and Purnell and David Gallup — are smart, hard-working professionals. They are adaptive and innovative. I am deeply impressed by their work ethic, their intelligence and their good humor and spirit."

A few in the Alligator community work the water full-time. Others, like Sykes, fish part-time. In front of his home, Sykes keeps some of his fishing gear, including crab pots, eel and catfish pots.

"I crab in the Alligator River," says Sykes, who also works in construction. "The last two to three seasons, I have bought pots and put in escape rings. I have 300 to 400 pots in the Alligator River."

In his many years of fishing and hunting in the swamps, Sykes says that he has never seen an alligator. However, others have spotted gators

during the summer at East Lake, Whipping Creek and the canal at the Alligator Marina near the Alligator River Bridge.

"There is an alligator in Second Creek about two miles away from the marina, and it is about 16 feet long," says Wanda Pritchett, co-owner of the Alligator Marina. "The ones up on Milltail Creek are not that big."

#### COMMUNITY HISTORY

With only a small concentration of American alligators in the community, there are two theories of how the community got its name, according to Morris Pritchett, co-owner of the Alligator Marina.

"Some say it is because of the shape of the Alligator River," he says while pointing to the river on a North Carolina map. "You see, the river turn is the tail, and the feet and head are at the top."

The second theory is that years ago there was a large concentration of American gators near the swamps and marshes, adds Wanda Pritchett.

*Continued*

**FACING PAGE: BAILEY'S STORE IS A HUB FOR THE RESIDENTS OF THE ALLIGATOR COMMUNITY. THIS PAGE, CLOCKWISE FROM TOP LEFT: COLON BAILEY GOT STARTED IN BUSINESS BY SELLING SWEET POTATOES AND FISH FROM A TRUCK. • RAY SYKES SHOWS HUNTING RELICS. • RESIDENTS GATHER IN BAILEY'S STORE TO CATCH UP ON NEWS. • BAILEY'S STORE IS THE ONLY LOCAL OPTION FOR GROCERIES.**







**LEFT: CHATMAN BRYANT IS A HUNT MASTER WHO KNOWS WHERE TO FIND BEARS IN SEASON. RIGHT: A SIGN NEAR THE MARINA WARNS DRIVERS OF BEARS IN THE AREA ALONG U.S. 64.**

Although Native Americans inhabited parts of Tyrrell County in the 1500s, there is no recorded mention of the Alligator community until the 1800s when new homes appeared, according to *Bridging Generations through Tyrrell County Memories* by Virginia C. Haire, Lillian D. Hill, Madge L. Van Horne and Gwen A. White.

“Gum Neck, Alligator, and other communities near the water grew,” according to the publication.

From the late 1800s through the 1950s, many in the Alligator community rotated how they made a living by the season, according to Al Hollis, who grew up in Fort Landing.

“In the fall, everyone participated in the hog killings,” says Hollis. “The men started the preparations around 5 a.m.,” he explains. “Then the men would cut up the meat. The women would wrap the meat in wax paper. People came from all over the community and helped.”

The highlight was the big dinner that culminated the raising of hogs, he adds.

When leaves began falling from trees, women would get together and rake yards, according to Hollis. And along the great shoals of the Alligator River, men would set their nets.

“There would be four or five groups at a time, and they would cook fish,” adds Hollis. “This is how they fed the family.”

During the winter, Hollis says his family tended to the livestock, and his grandfather trapped bears and racoons.

When spring arrived, the family got the fields ready to plant. “During the summers, we worked from sunup to sundown in the Irish potato fields,” says Hollis. “There would be a crew of 80 to 100 digging potatoes by hand.”

Because of the vast stretches of forests, many in Alligator also worked at lumber mills until the early 1940s.

Hollis remembers his father’s stories about working at a sawmill. After the workers cut the timber, they would take it to the edge of the Alligator River, then float the lumber on a skidder to the mill, he says.

When lumbering, farming, trapping and fishing began to dwindle, Alligator residents looked for jobs outside the county, or moved to other communities, says Hollis.

“Fort Landing used to be a big neighborhood in the late ’50s,” he says. “When I was a child, there were about 50 families. Now, we have about 20 families.”

He estimates that two-thirds of the people who stayed now go to work at the beach in Dare County, about 40 miles from Columbia.

“The other third farm or do other things,” adds Hollis.

#### **ALLIGATOR TOUR**

The Alligator community starts at the marina on the Alligator River off U.S. 64, where a large replica of the Cape Hatteras lighthouse welcomes visitors.

“Our business is mostly transients traveling the Intracoastal Waterway,” says Wanda Pritchett.

Boaters come from as far away as Africa, England, Switzerland and Canada. They go inside the marina and shop for alligator and lighthouse souvenirs or order a tasty crab cake or fish sandwich. During the peak seasons, they can sample a full-course meal in the back restaurant.

“Some people make the migration every year,” says Wanda Pritchett. “Some make it every three years. It is fun to see some of the same people, and we miss the deceased. One of our favorite captains got killed. It is interesting to see people as they get older.”

To get to the rest of the Alligator community, turn right out of the marina onto U.S. 64 heading west. Follow the highway for about five miles along hardwood swamps and marshes toward Columbia.

When approaching Old U.S. 64, turn right onto a two-way flat road that leads to the north side of the Alligator community. The first landmark is St. John’s Baptist Church, a small, unmarked white church with a steel bell. Across the road is a group of mobile homes. Further down, muddy marshes extend along both sides of the road for miles.

After a long open space, there is a sign that reads: Captain Neill’s Seafood. On the dock, a large number of crab pots are stacked up.

The road continues past a large plowed field and more homes. Then a narrow bridge crosses over Alligator Creek. At the end of the creek more homes are erected on stilts. Knotts lived on the creek as a child with her grandparents.

“We had to take a boat to go everywhere,” says Knotts. “When I went to school, I went on the boat to Fort Landing and then took a bus to school.”





**LEFT: MORRIS AND WANDA PRITCHETT ENJOY MEETING THE CAPTAINS WHO STOP AT THE MARINA. RIGHT: WESLEY CHAPEL IS THE OLDEST CHURCH IN THE ALLIGATOR COMMUNITY.**

### COMMUNITY STORE

The bridge welcomes visitors to the south side of Alligator. Bailey's South Side Store — the community's only grocery store — sits on the left. On the outside, there are two small signs. One is for "Burning Permits." The other says: "Live Bait, Minnows, Crickets."

Inside a small wood-paneled room, the owner, Colon Bailey, stands behind a plywood counter and greets customers with a friendly smile.

"I got started selling sweet potatoes and fish out of the back of a truck," says Bailey. "Then I built the 8 x 8 building from scratch."

The store is a throwback to a bygone era when country stores sold a variety of items — from home remedies and white potatoes to chewing tobacco and Irish whiskey. On one shelf, there is a bottle of Black Draught Laxative. Nearby is a cake of Colgate's Octagon Soap, lye soap that was used to wash clothes in generations past.

The live crickets — which sell for \$3 a tube and are used by bass fishermen — are kept in a box at Bailey's house next door.

The store reflects the strong hunting tradition in Alligator. On the far end of the room, a deer is mounted on the wall. On the opposite end, a large black bear stares at customers.

"I killed that bear in 1994," says Bailey. "It weighed 538 pounds and was 12 3/4 years old. You can tell how old a bear is by its teeth."

The busiest days at Bailey's are Saturday and Sunday.

On a recent Sunday afternoon, local folks begin arriving around noon. First, Bailey's brother, Donnie Bailey, pulls in front of the store on the gravel road in his pickup truck, gets out and then scoops up some ice. "This is my home," says Donnie Bailey. "I am getting ice for sea mullet and bluefish caught at Avon Pier."

A sign near the ice still reminds customers to place money in the box.

"I had ice on an honor system for awhile," says Colin Bailey. "But people didn't pay. But I still let them put money in the box for vegetables that are on the table in July and August."

Several more men wander inside and gather around the counter, where they swap hunting and fishing stories. Bailey calls most customers by their nickname or CB radio name. As the Rev. Royce Reynolds walks in, Bailey says, "Hey Mr. Roe."

"I come in here often," says Reynolds, the minister at the Sound Side Free Will Baptist Church. "I come to see if Colon's been deer hunting."

The biggest news around the counter these days is that a volunteer fire department is going up on the north side of the community. "I am going to be a captain," says Bailey.

With the closing of Foodway grocery store in Columbia, Bailey also will be restocking his store as a full grocery until a Food Lion opens in Columbia, he says.

### FORT LANDING, GOAT NECK

Head back out of Bailey's, turn left on Newfoundland Road and pass a group of trailers and a water tower. Turn right onto Fort Landing Road, and several small homes and a large aluminum building appear.

After passing a gray barn, turn into a long driveway that leads to a tan farmhouse owned by Hollis and built around 1795.

When he was a child, Hollis says that locals would argue over who was best — folks on the north or south side of Alligator.

Head down the road from the old house and pass an unoccupied home and Pledger Landing Road. Turn left onto Pledger Landing to get to Goat Neck, where there are a number of homes and churches.

Or, keep straight on Fort Landing and pass the oldest church in Alligator — the white-framed Wesley Methodist Chapel that has a small congregation. "It used to be packed when we had revivals," says Hollis.

A ferry landing at the end of the road was used until World II to carry people and freight across the "little Alligator" to the Alligator River and then to the East Lake landing.

Although many natives have left Alligator, they return from near and far for holidays and family reunions.

On July Fourth, everyone gathers at Bailey's for a big cookout. "We cook a little bit of everything from pig and bear to deer," says Knotts. "It is a really good time."

Every Memorial Day weekend, the Sykes gather for a reunion.

"We all descend on the original homestead," says Janice Sykes in an oral history for the North Carolina Coastal Folklife Survey, conducted in 1997 by Jill Hemming.

"And we do the memorial service at the graveyard. We pay homage to the descendants that have gone on before us. And we do this in celebration of our family and where we came from." □





# “Floyd was a MONSTER,”

recalls veteran meteorologist Steve Harned. For the first time in his forecasting career that spanned more than three decades, he was scared. “I knew we were looking at a catastrophic event.”

It’s been five years since Hurricane Floyd flooded the state’s coastal plain with misery, but for Harned and thousands of North Carolinians, memories of the 1999 storm are razor sharp.

“It’s the only weather system in my career that actually frightened me,” says Harned, then meteorologist-in-charge of the National Weather Service Forecast Office (NWS) in Raleigh — the office responsible for weather and river flood forecasting for the state.

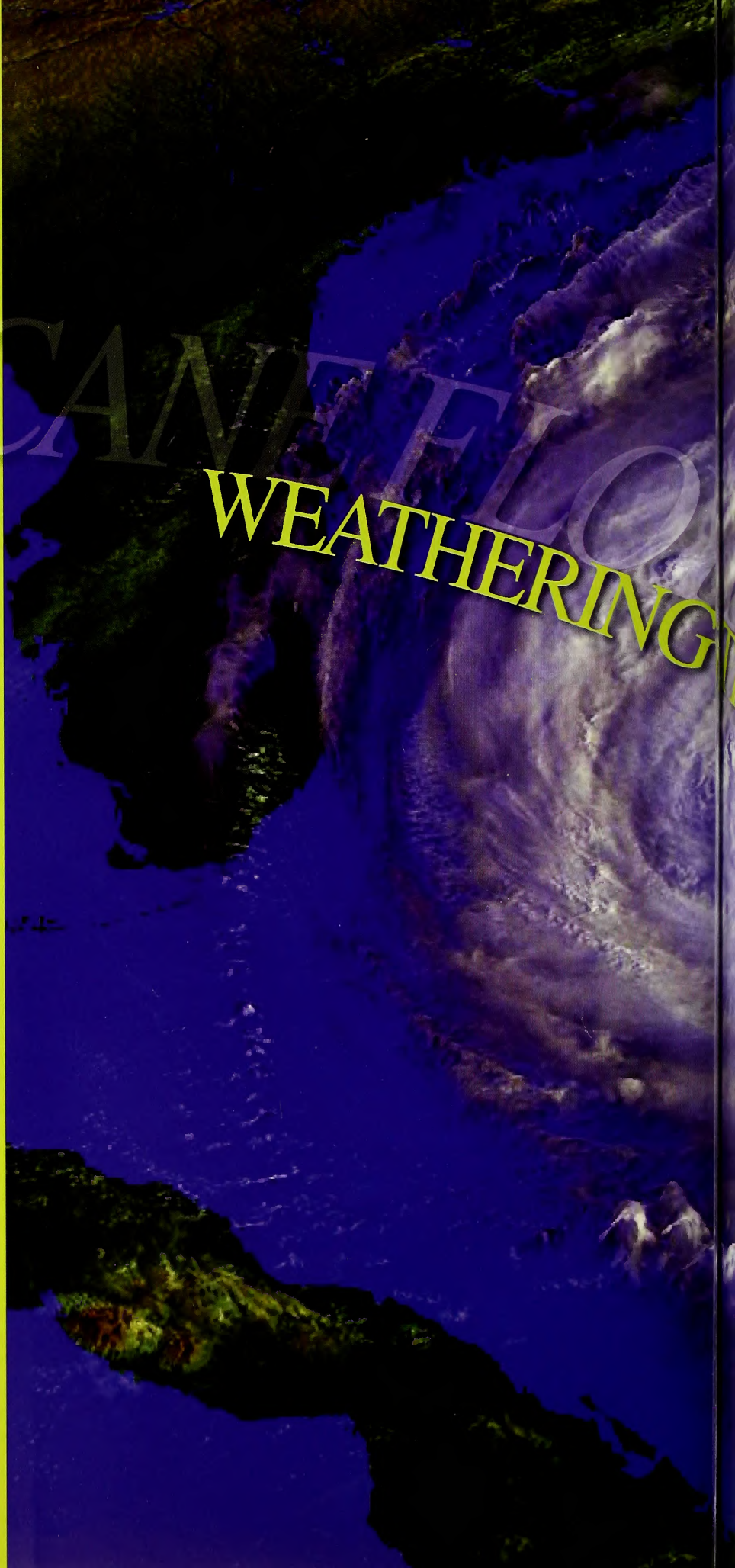
Until he retired in July 2004 with 36 years of service in the National Oceanic and Atmospheric Administration (NOAA), Harned worked to improve flood forecasting — and communicating timely, understandable warnings to the public.

In the weeks, days and hours before Hurricane Floyd struck the coast, a network of NWS meteorologists tracked the giant storm along its Atlantic course — from birth as a tropical depression in waters west of Africa on Sept. 2 to maturity as a Category 4 hurricane roiling toward the U.S. mainland by Sept. 13. Weather scientists churned out hundreds of computer models to match the storm’s idiosyncrasies and predict where it might come ashore.

“Millions evacuated coastal areas along Florida, Georgia and South Carolina in anticipation of a totally destructive landfall,” Harned points out. “Its size and its winds were immense.”

Floyd came within 110 miles of Florida’s Cape Canaveral — then shifted its course to take dead aim at North Carolina.

*Continued*





A satellite image of Hurricane Floyd, showing a well-defined eye and a dense, swirling cloud structure. The colors range from dark blue to bright white, indicating varying cloud heights and densities. The storm is viewed from an oblique angle, showing its curved structure.

**THE STORM:**  
*Five Years After Floyd*

BY PAM SMITH

*Hurricane Floyd, as seen by satellite on Sept. 14, 1999, two days before it made landfall in North Carolina. Data from NOAA GOES satellite. Image produced by Dennis Chesters, Laboratory for Atmospheres, NASA Goddard Space Flight Center.*





**LEFT TO RIGHT:** Steve Harned, a veteran meteorologist with the National Weather Service, says Hurricane Floyd is an icon for the dangers of inland flooding associated with tropical storms. • Hurricane Floyd — among a cluster of hurricanes that targeted North Carolina in the 1990s — left a trail of destruction five years ago.

“The day before Floyd made landfall at Cape Fear, dry air circulated to the south side of Floyd, choking down its power from a Category 4 to a Category 2. But, it had a long way to go to wind down, and its tank was full,” Harned continues. “We knew when it hit, something terrible would come of it.”

Before the first band of rain pelted North Carolina, the Raleigh NWS office and the NWS River Forecast Center in Atlanta issued flood warnings. “We were advising county managers and emergency management officials to be proactive and move people out of harm’s way.”

Hundreds evacuated to high ground. Those who chose to ride out the downgraded storm didn’t understand that a Category 2 still is a dangerous storm, Harned says.

At 2:30 a.m. on Sept. 16, Floyd came ashore near Topsail Beach with sustained winds near 100 mph, gusts up to 122 mph, and a 10-foot storm surge. The oceanfront took the first losses in terms of beach erosion, structure damage and dune loss.

But much of Floyd’s impact was yet to be felt. Rain — torrential rain — inundated low-lying communities across the coastal plain all the way to Interstate 95. Wilmington, alone, measured nearly 20 inches of rain in a 12-hour period.

Extreme amounts of rain continued to fall through the day as the hurricane tracked over North Carolina and Virginia. In less than 24 hours, North Carolinians began reeling from Floyd’s watery blow.

## A centennial EVENT

“We had forecast a 100-year flood event,” Harned says. “But for some areas of North Carolina, it was a 500-year flood event.”

Floyd could not have come at a worse time for North Carolina, he points out. Earlier in September, Hurricane Dennis — the summer drought breaker — dumped heavy rains from the coast to the Piedmont. Dennis saturated the land, pushed water tables higher all across the state, filled rivers, tributaries and sounds to flood levels — and set the stage for the disastrous visit by Hurricane Floyd.

“When Floyd came ashore, it became a rain machine over the coastal plain. The rivers and sounds already were full, and the water had nowhere to go,” Harned explains.

“When the weather cleared after Floyd, we rented a plane to assess the extent of the storm. As Wilson came into view, it took my breath away. The Tar River, which crested 24 feet above flood stage, was four or five miles wide and moving on a sheet downhill toward Greenville.”

He called the NWS Atlanta River Flood Center, reporting the scene with disbelief. “Get this into a model,” he told colleagues.

“It was daunting to calculate the impact on the people and the environment by such a major weather event,” he says.

There’s frustration in Harned’s voice when

he recounts one hard lesson learned from Hurricane Floyd: “We learned that we have excellent, on-target forecasting capabilities, but we had antiquated methods of getting out the message that inland flooding is a serious threat.”

## New forecasting TECHNOLOGIES

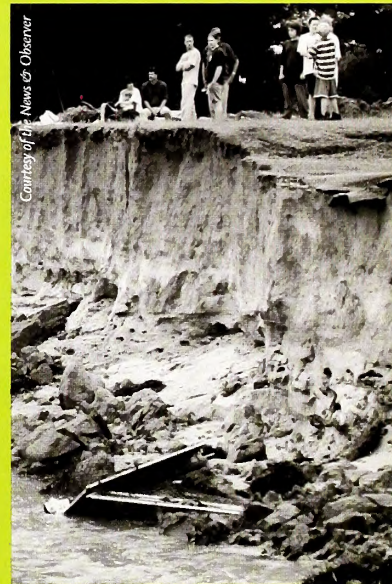
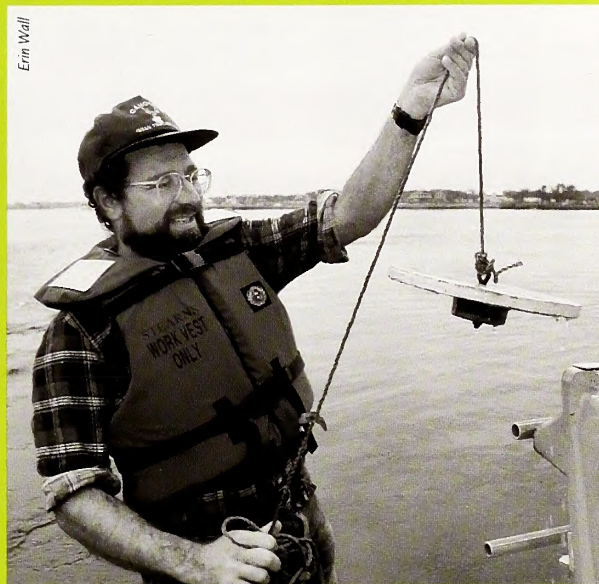
Since Floyd, Harned has partnered with several NOAA agencies, the Federal Emergency Management Administration (FEMA), the state of North Carolina and the U.S. Geological Survey (USGS) to develop a more effective means of delivering flood warning information to the public, emergency management leaders and other government officials.

A collaborative demonstration project, under the umbrella of the NWS Advanced Hydrologic Prediction Service initiative, models the Tar River basin. The pilot project combines data from USGS stream gauging stations with the rain estimates to forecast flood potential. The information is shown graphically on an animated river map that can be accessed online at [www.csc.noaa.gov/hc/flood](http://www.csc.noaa.gov/hc/flood).

This new approach, which was successfully tested when Hurricane Isabel came ashore in 2003, holds enormous promise for emergency managers, Harned says.

Other new technologies are now in place along North Carolina’s coast to enhance NWS meteorologists’ predictive powers — and ultimately save lives.





**LEFT TO RIGHT:** *The National Guard assisted in the rescue of flood-stranded communities in the wake of the hurricane. • Larry Cahoon of UNC-Wilmington was part of a cadre of scientists who initiated an unprecedented surge of research targeting the environmental status of coastal waters. • Dams, roadways and bridges were no match for Hurricane Floyd's rampaging floodwaters.*

Isabel was a successful “test case” for an array of instrumented buoys deployed along the coasts of North and South Carolina. The NOAA-funded Carolinas Coastal Ocean Observing and Prediction System (Caro-COOPS), is part of a national storm prediction system. It enables emergency management officials to make critical evacuation decisions based on information from the buoys’ submerged instruments.

In April, NOAA installed a solar-powered device, known as the Sutron Expert, at the Johnny Mercer Pier at Wrightsville Beach. It is designed to measure tides, wind speed, wind direction, water temperature and barometric pressure to help assess potential for storm surge and coastal flooding. Data is transmitted every six minutes to a satellite that feeds information to NWS and is posted online at [www.tidesonline.com](http://www.tidesonline.com).

## Making a COMEBACK

In the days following Hurricane Floyd, H. David Bruton, then N.C. Secretary of Health and Human Services, assessed the disaster this way: “Nothing since the Civil War has been as destructive to families here... The recovery process will be much longer than the water-going-down process.”

Floyd was the deadliest and most costly hurricane in the United States since Agnes in 1972, according to NWS. In North Carolina, 35

deaths, most from drowning, were attributed to Floyd. Damage estimates approached \$3 billion.

Most roads east of I-95 were flooded, bridges washed out, dams failed, water treatment plants swamped, water supplies cut off, and a half million people were without electricity. Farm crops and livestock were wiped out, commercial and recreational fishing idled, and most tourists went home.

Entire towns, including Princeville, disappeared under water. But the human spirit endures, says Samuel Knight, Princeville’s interim town manager and planning and zoning officer.

“On the morning that Floyd came and went, by 5 a.m. water was standing in Town Hall – and rising,” Knight recalls. “With the dike failing, we knew it was time to evacuate the entire town of 2,200, most of whom are senior citizens.”

By the end of the day, the traffic light at the corner of Mutual and Main was the only visible sign of the town’s presence. “For ten days, all we saw were treetops,” Knight says. “Our people lost everything. More than 750 homes and dozens of businesses were gone.”

The governor’s disaster proclamation freed up federal funds that provided travel trailers for suddenly homeless residents.

The decision whether to accept a federal buy-out program to relocate, or rebuild Princeville in place, was a difficult one. “First, how do you relocate more than 700 households?” he asks rhetorically. “Second, how do you restore a sense of history and pride of place?”

Citizens of Princeville, who take great pride in the fact that theirs was the first town in North Carolina to be incorporated by freed slaves, voted to stay on the land and accept FEMA’s one-time offer. Five years later, Knight says, the dike is rebuilt and most citizens are back home.

“Floyd was a blessing in disguise,” Knight says. “Historic Princeville is no secret any more.”

More than 26,000 volunteers from as far away as the Soviet Union and Korea have helped Princeville emerge from the muddy waters. And, when Prince the Entertainer visited the town to celebrate Princeville Heritage Day last year, he donated \$1 million to help with the rebuilding process.

“Our citizens are now comfortable and happy in centrally heated and air-conditioned homes. They are pretty content — except when it rains. Then, I get calls,” Knight says with an understanding smile.

## Resilient RESOURCES

The major hurricane activity of the 1990s was a catalyst for unprecedented research targeting the environmental status of the vital Albemarle-Pamlico Estuarine System — the largest lagoonal estuary in the United States. Scientists from universities and state and federal agencies focused on the cumulative effects of a decade of powerful storms, including Hurricane Fran in 1996 and Hurricanes

*Continued*





**LEFT TO RIGHT:** Samuel Knight, Princeville's interim town manager, says the town has risen from the floodwaters with new resolve and pride in its history. • Bonnie Baynor, right, helps Troy Ball load crab pots onto his boat near Washington's Broad Creek. • Guy Sawyer says crab harvests have been down in the Belhaven area since Hurricane Floyd.

Dennis, Floyd and Irene in 1999.

In 2004, a team of North Carolina State University scientists and collaborators from several North Carolina universities and government agencies reported their findings to the American Academy of Sciences.

"The overall story we see is of estuarine resilience to impacts from these types of major storms," says JoAnn Burkholder, director of the NC State Center for Applied Aquatic Ecology, and the paper's lead author.

The study indicates that water quality, numbers and health of most of the area's shellfish and finfish — and the overall health of the surveyed water systems — appear to be returning to normal.

The storms also may have displaced undesirable organisms, such as the toxic alga *Pfiesteria*, linked to massive fish kills in the 1990s. The authors theorize that the organisms could have been pushed to areas of the estuary that are less conducive to growth.

While commercial catches of shrimp or bivalve mollusks, such as clams and scallops, apparently haven't suffered long-term effects from the storms, blue crab numbers remain depressed.

Sea Grant researcher David Eggleston, who co-authored the paper, attributes the decline to the crabs' interaction with and migration response to the floodwaters — and the overfishing of the mass-migrating crabs. Additionally, Eggleston says, "The floodwaters rushing through inlets may have impeded the crabs' post-larval migration from the ocean to estuarine nursery habitats."

## Proof in THE CATCH

N.C. Division of Marine Fisheries (DMF) officials also are interested in learning about the cumulative impact of the 1999 hurricane season on the people who rely on those same waters for their livelihoods.

"A DMF survey is designed to learn how hurricanes impacted peoples' ability to get back on the water and fish," explains Brian Chevront, manager of the DMF social economics program. "We also want to find out whether assistance programs helped people get back on their feet and back in business."

Analysis of the survey is not complete, but Chevront has observed that a lot of fishers lost gear or had damage to their boats. Some shellfish leaseholders reported that the bottoms were entirely covered over by sediment or destroyed completely. However, some commercial crabbers saw a bounty of landings in the weeks after Floyd as crabs headed to high-salinity waters.

That was not the case for Guy Sawyer, whose family has dropped crab pots into the Pungo River for generations. Hurricane Floyd was a turning point, he says. "Floyd was in my house and in my folks' house," he recalls. "I never have seen anything like it, and I have been on the water all my life."

Three-foot waves energized the otherwise flat waters of Slades Creek, where Sawyer maintains his boats, dock and gear at the edge of family-owned land. Many of the crab pots he thought to be safely stored were washed away.

"It was weeks before I could get back on the water, and then there was a lot of debris floating around," he says.

With crab catches down since 2000, Sawyer turned to fishing for flounder and puppy drum to supplement his income.

He has replaced all his lost pots and is optimistic about filling them with abundant catches this season. It's a way of life he doesn't plan to swap, in spite of all the uncertainties.

For his part, Bonnie Baynor, a part-time fisher from Washington, doesn't plan to give up his day job. He is a 39-year veteran of Weyerhaeuser.

When Floyd hit, he and other crabbers along Nannie Smith's Gut, one of many ditches off Broad Creek, pulled up equipment and didn't go back on the water until the following spring.

Baynor points to a small, rental house he owns. "It was elevated after Hazel, but Floyd still took the duct work out from under it, along with crab pots I pulled from the water."

The incoming surge that swamped the small finger of land was bad. But the worst was yet to come. "Floodwaters from Tarboro, Washington, Greenville and all rushed through to get to the Pamlico Sound," he recalls.

It was an awesome sight and proof that no hurricane should be taken for granted, he says. When the storm warning flags fly, Baynor has this advice for fellow watermen: "Get off the river and put into a safe place." ■

### Hurricane Floyd Impacts in North Carolina

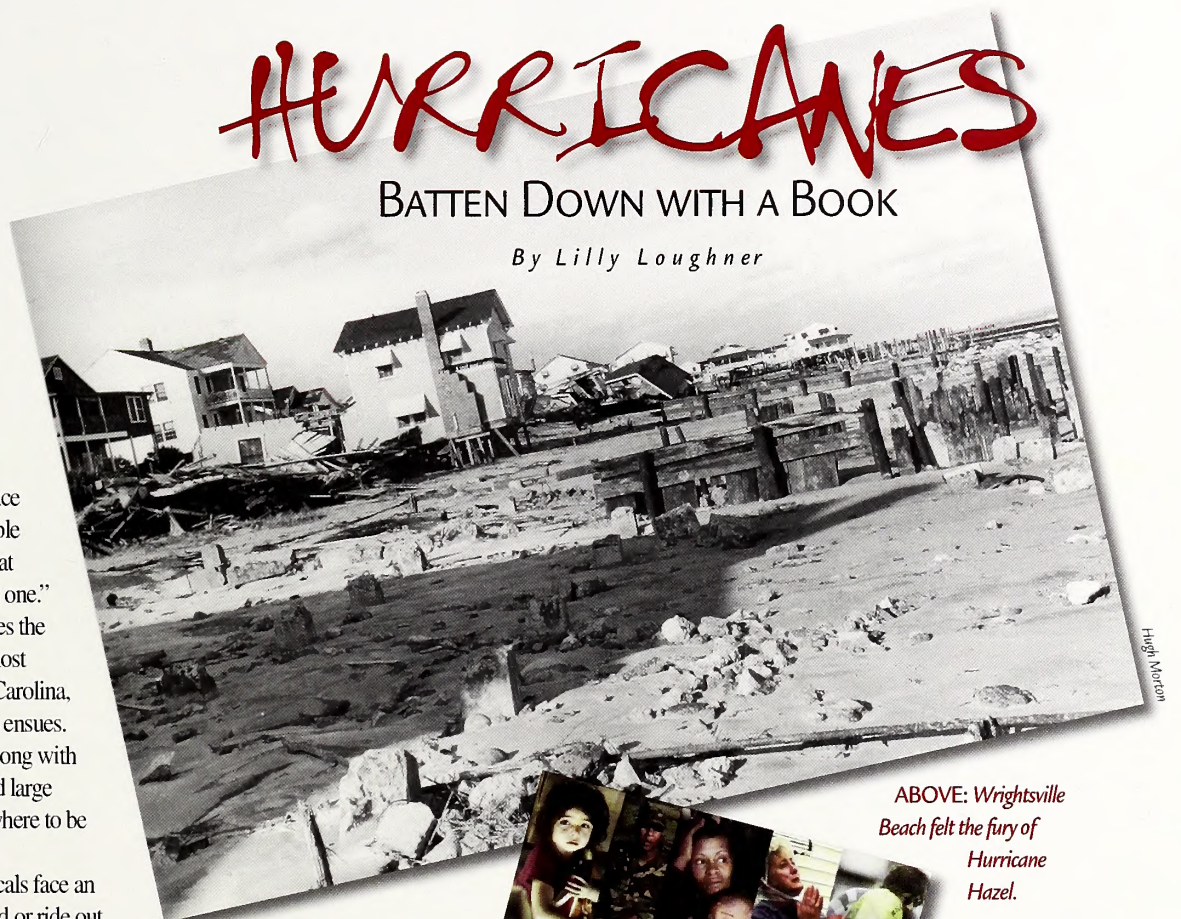
- 35 deaths
- \$3 billion in damages
- 7,000 homes destroyed
- 17,000 homes deemed uninhabitable
- 56,000 homes damaged
- 10,000 people in temporary shelters
- 1,500 rescues



# HURRICANES

## BATTEN DOWN WITH A BOOK

By Lilly Loughner



Hugh Morrison

ABOVE: Wrightsville Beach felt the fury of Hurricane Hazel.

The buzz starts when a meteorologist points out a white, swirling storm cloud on the radar far off in the Atlantic. As the weeks go by, the cloud takes a powerful form and achieves hurricane-naming status.

Soon, students become hurricane-trackers in their science classes, and folks start to grumble with talk of “funny feelings” that this hurricane could be “the big one.”

Once the storm approaches the United States and takes the almost predictable turn toward North Carolina, a mad dash to the grocery store ensues. Suddenly, bread and milk — along with masking tape, bottled water and large squares of plywood — are nowhere to be found along the coast.

Throughout the chaos, locals face an important decision: travel inland or ride out the storm one more time.

With some of the most deadly hurricanes having occurred in the fall, the onslaught of hurricane season 2004 — and the anniversaries of several major storms — sets the mood for good books on hurricanes.

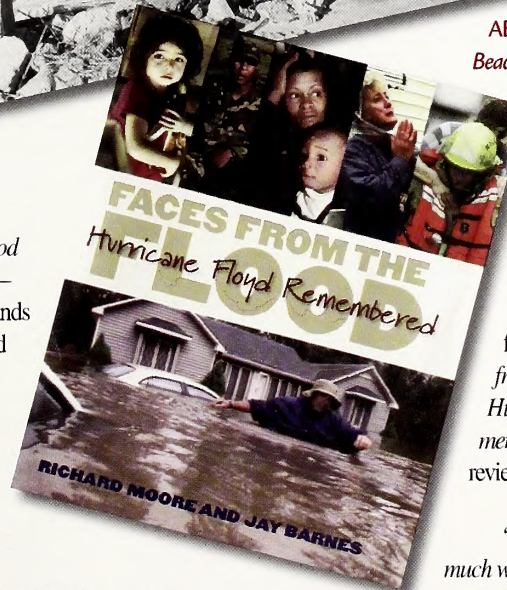
• **FACES FROM THE FLOOD: HURRICANE FLOYD REMEMBERED,** by Richard Moore and Jay Barnes. 2004. University of North Carolina Press, Chapel Hill, NC 27515-2288. 225 pages. Hardback, \$29.95. ISBN 0-8078-2861-0.

This book is about residents of North Carolina — from Oak Island to Kinston, Rocky Mount and Greenville — who maintain an undying connection to Hurricane Floyd and resulting flooding in September 1999.

The book is dedicated to the 52 people who lost their lives. But mere descriptions will never express the devastation that, through news coverage and charity efforts, bound affected communities to people across the country.

*Faces from the Flood* offers an intimate view — small slices of the thousands of personal stories behind the hurricane. Authors Richard Moore and Jay Barnes elicit amazing stories from folks who explain that they did what any good person would do.

Rocky Mount resident Kurt Barnes fits such a description. Forced to swim through his flooded neighborhood toward high ground, Barnes couldn't forget his neighbors in need. He located a motorboat and steered through torrents of rising water, compounded by high winds and rain — ultimately rescuing 18 people stranded on various rooftops, attics and porches. His bravery earned him the 2000 Governor's Award for Heroism.



The following excerpts of personal stories featured in *Faces from the Flood: Hurricane Floyd Remembered* need little review or introduction.

“What scared me so much was the mother with her three-month-old newborn baby. She walked around to get in the boat, and I said, ‘Let me have that baby.’ She handed the baby to me. We had no lifejacket for that baby, but I had a blanket. So just as she walked around, I’m trying to hold that baby, hold that boat, and get her in the boat, she walked right off that porch. The water was so deep, she didn’t know where the porch ended. She just

Continued



walked right off it. Well, when she did, she went out of sight. So I'm holding the boat, holding that baby, and I reached down in that water as far as I could with my other hand, and I felt her hair. She had a head full of hair. So I got a-hold of her hair and pulled her back up, and "Sssppppppitttttt!!!" She blew that water out. She was so glad somebody got that hair that she didn't know what to do." — Kurt Barnes, water maintenance worker in Rocky Mount.

"...people found out what flood damage does to treasured memories and keepsakes. When you have wind damage, you may have a tree on your house, maybe some water leaks in, and you may ruin some sheetrock or a piece of furniture. But when your home is flooded, you lose it all." — Richard Moore, secretary of the N.C. Department of Crime Control and Public Safety during Hurricane Floyd, and now North Carolina state treasurer.

"It was nice to have people who cared, but who also had been through disasters enough to help us understand that we were going to get through this, too. ...The National Guard, the Coast Guard, and others from the military were really the same way. They were lifting coffins out of the water with great respect, and very sensitive to the fact that someone loved the person in this coffin. I think we all saw another side of the military that was there. I'm very emotional about all of this." — Diane Lefiles, Edgecombe County Schools.

"For us there was no other story. And there was no sense in acting like there was. It seemed odd when we did try to get back to normal. You would be amazed how a young reporter whose job is to cover City Hall rises to the occasion in something like this. And I hesitate to use the word, but there were little acts of heroism all through the newsroom and all through the coverage. Folks that just thought nothing of doing the best work of their lives." — Bob Williams, *The News and Observer*, Raleigh.

"And the thing that haunts me about this is that if I hadn't felt his arm, I wouldn't have felt so

bad about this. But I felt his arm. And when you feel a guy's arm, you feel like, 'Okay, I've got some control of this situation. I can get this guy out.' They do it on 'Baywatch' and all these programs on TV all the time. They just pull the guy out, do CPR, and boom — we can pull this guy back to life. And man, it's just a happy conclusion. But it's not that way in reality. It's not that way at all." — Ed Maness, North Carolina Highway Patrol.

"When I got down there the cattle were mooing, and the river was rising, and I sat there and listened. The intensity of their mooing increased, and by seven o'clock in the morning, maybe, they were all bawling. Just this chaotic bawling. Then by about seven-fifteen, they were all quiet. And I knew then that the world was not at peace, even though the river itself was very peaceful." — Stan Riggs, East Carolina University geologist and North Carolina Sea Grant researcher.

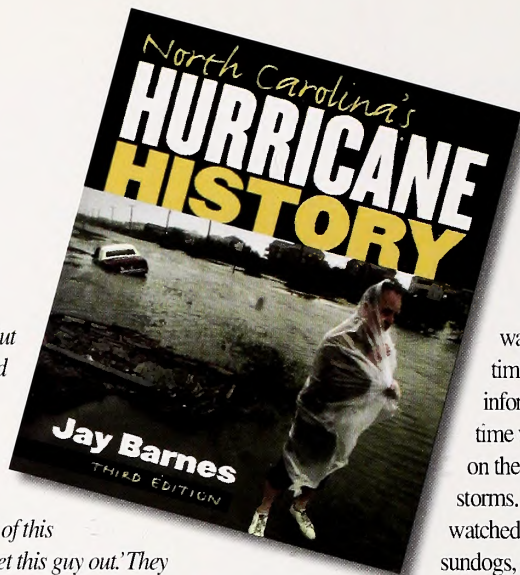
• **NORTH CAROLINA'S HURRICANE HISTORY THIRD EDITION**, by Jay Barnes. 2001. University of North Carolina Press, Chapel Hill, NC 27515-2288. 319 pages. Paperback, \$19.95. ISBN 0-8078-4969-3.

North Carolina has weathered a far-reaching storm history, with hurricanes recorded since the 1500s. Author Jay Barnes pieces together this hurricane timeline through sometimes scattered and sparse documentation, including personal stories, pictures from the National Weather Service, newspaper reports, historical publications and letters.

Barnes begins by describing the "birth of a hurricane" — giving a crash course in the science of a hurricane storm.

"Rivers of air in the atmosphere push and steer tropical storms and hurricanes. Low-level trade winds and high-altitude steering currents join to guide the storms on what are sometimes erratic courses," writes Barnes, who also is director of the N.C. Aquarium at Pine Knoll Shores.

Although today's advanced forecasts and



warning systems provide timely, accurate hurricane information, there was once a time when coastal residents relied on the spoken lore of coming storms. "Sailors and islanders watched the skies for double moons, sundogs, and the scarlet aura of a summer sunrise," writes Barnes.

Repeated devastation and the deaths of thousands of unwarned coastal residents lead to the establishment of the U.S. Weather Bureau in 1890. Technological advances and flights by "hurricane hunters" — the first aircraft reconnaissance flight occurred in 1943 — brought steady improvements in hurricane forecasting.

Primed with bits of the history and science behind the menacing storms, Barnes delivers readers into the gripping realities of those hurricanes unnamed but chronicled by year, as well as those whose naming — Hazel (1954), Hugo (1989), Fran (1996), Floyd (1999) — continues to ring symbolically in the ears of their survivors.

Barnes describes hurricanes dating back to 1524 when Italian adventurer Giovanni da Verrazano sailed along the North Carolina coast. Readers also learn how the Carolina region achieved the nickname "hurricane alley" after seven hurricanes churned into North Carolina waters in the mid-1950s, including the infamous Hazel.

Arriving on Oct. 15, 1954, Hazel's eye swept close to the North Carolina/South Carolina border and passed north through Raleigh and into Virginia — bringing record winds up to 140 mph.

Marking the most recent addition to "The Modern Era" of hurricanes, Barnes does not overlook Floyd, the "ominous rainmaker" and "monstrous flood producer...recognized as the greatest disaster in North Carolina history."

Barnes provides a lengthy summary of the entire catastrophe that starts with the frantic concerns of forecasters working around the clock and continues month by month through the disaster, the amazing rescue effort, the aftermath and the struggle to rebuild entire communities.

"How North Carolina rebuilds after Floyd will have a profound influence on what happens in the next great hurricane," writes Barnes. □



By Kathleen Angione

**A** male blue crab placed in a shedding system senses a female nearby who is ready to mate. The male's biological instincts are torn: he must molt, but he stands no chance of mating without his shell. Ultimately, the urge to mate prevails, and he channels his energy into delaying his shed. But this extra stress seems to be too much, and he dies before successfully breeding with the female.

# EXPLORING THE MYSTERIES OF MOLTING

As far-fetched as this lustful tale of invertebrate procreation may sound, at least one research project has documented higher mortality rates among male blue crabs in co-ed shedding systems — but so far nobody knows exactly why.

“Male crabs can control their molt a little bit,” says Dell Newman, of Newman Seafood in Swan Quarter. “The bigger males will try to breed instead of shed.”

Newman and researcher Juan Chaves of North Carolina State University received an N.C. Fishery Resource Grant to study whether separating male and female blue crabs into different shedding systems affected male molting time and mortality.

Newman explains that males in his shedding system often start “cradle-carrying” a female, a precursory behavior to mating. He and Chaves found that although separating the sexes didn't affect male molting time, it did reduce mortality.

But, perhaps more importantly, the “delay molt to mate” theory is a reminder that molting is actually a far more intriguing process than many people think. In fact, most folks — even the most discriminating seafood connoisseurs — usually don't think about molting at all.

*Continued*



MALE BLUE CRABS:  
ROOM TO GROW?

Shortly after molting and rehardening, blue crabs — especially males — have little muscle tissue and are called “white bellies” because of their clean, white abdomens.

But harvesting these crabs can create waste within the blue crab fishery, says Marc Turano, the blue crab specialist for North Carolina Sea Grant.

“Crabbers earn little money for white bellies,” he explains, referring to a white belly’s lack of tissue, or meat. “And picking houses lose money attempting to get a few pounds of meat from many pounds of crabs.”

For the last few years, research funded by the North Carolina Blue Crab Research Program (BCRP) and Fishery Resource Grant Program (FRG) has focused on reducing waste in the fishery and maximizing blue crab harvests. The programs are funded by the N.C. General Assembly and administered by North Carolina Sea Grant.

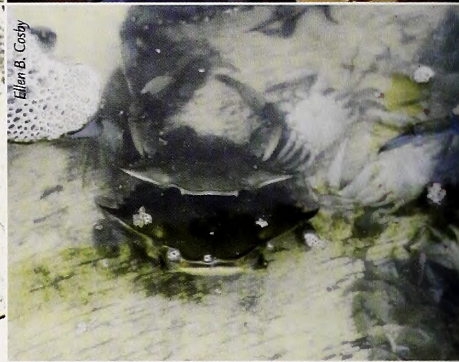
One solution would be a release and recapture program that culls white bellies from the catch and returns them to the water. Simple as it sounds, culling would be difficult to implement, says Turano.

Legally, a culling program would need distinct criteria for harvest. Economically, crab dealers would have to accept only the meatiest crabs, and crabbers would have to forgo larger daily catches for the long-term benefit of the fishery.

Another option is to hold white bellies in shedding systems until they develop into more profitable crabs. Three BCRP studies examined this “growout” technique and found it might be profitable for crabbers with existing shedding systems.

But growout entrepreneurs beware: the way white bellies are handled may affect their survival.

Because white bellies are still relatively soft, their shells are easily punctured. A 2001 FRG study by David Eggleston and Juan Chaves, both of NC State, found that survival rates of peeler crabs — which experience molting stressors similar to white bellies — were much higher if the crabs were carefully handled, stored on ice and covered with wet burlap during transport. □ — K.A.



CLOCKWISE FROM TOP LEFT: Barry Nash and Greg Bolton of the NC State University Seafood Lab examine a crab catch. • Dell Newman of Swan Quarter conducts research at his blue crab shedding operation. • A molting crab backs out of its shell. • A mature female, or “sook” displaying the telltale U-shape on her abdomen.

And that’s a shame; especially considering the process has all the elements of a compelling drama — a dangerous task, lurking enemies, suspense and yes, even deception.

SEABED STRUGGLES

As an invertebrate, a blue crab literally bears a burden on its back. Lacking a spinal column, its skeleton forms as a hard shell outside the body. As its internal tissue grows, a crab is periodically forced to shed its exoskeleton — a process known as molting.

Before molting, a blue crab undergoes a premolt, or “peeler” stage. The crab releases a hormone that prompts a layer of cells underneath the shell to separate. These cells produce enzymes to dissolve the existing shell, as a softer shell develops beneath.

As the chemicals in the old shell dissolve, the crab reabsorbs and stores the inorganic salts. Once the developing shell is complete, the crab faces a difficult and — especially if it’s an older

crab — potentially life-threatening task: removing its muscle mass from its own exoskeleton.

As the molting or “busting” stage begins, the crab looks for a hiding place. Shedding will ravage the crab’s energy, making it weak and vulnerable to a variety of predators, including fish, sharks, turtles and other blue crabs.

After hunkering down in the sandy bottom, the crab absorbs water and swells its tissues. Soon, like a slow-motion crustacean version of the Incredible Hulk, the old shell begins to fracture and bust open as a larger and seemingly more imposing crab backs out.

Although its new shell is about one-third larger, the crab’s size is deceptive. Instead of bulging muscles that expand within the shell, the crab continues pumping water into its tissues. For the next six hours, the crab will inflate its new exoskeleton with nothing more than sea water.

The immediate postmolt, or





Ellen B. Crosby

*Sponge crabs display a series of egg development. Each number represents the day of development. The sponge color changes as the yellow yolk is absorbed by the embryos.*

“soft crab” stage, has made blue crabs famous. Often referred to as “soft shells,” the sweet, white meat from these crabs is a seafood delicacy recognized throughout the world. Popularity is not without its price, however; the ubiquity of the “soft shell” moniker has caused many to mistake soft crabs for a separate species.

For the next two to four days, the crab draws on the inorganic salts stored during the premolt stage to harden its new armor. Finally, the crab begins replacing the water in its tissues with muscle-building protein.

The crab will live in its roomy new exoskeleton for a while, but in 14 to 50 days — depending on the crab’s size — the shell will become too snug. Then the whole process will begin again.

Besides being a high-stakes benthic drama, blue crab molting might also find its niche in reality television — radical makeovers that result in newer, more fit and desirable individuals. □

## FEMALE BLUE CRABS: MOLTING, MATING AND MANAGEMENT

### MOLTING

Throughout their lifetimes, immature female crabs, or “sallies,” and male crabs, known as “jimmies,” will molt approximately 21 to 23 times, says Steve Rebach, associate director of North Carolina Sea Grant.

Larger adults molt less frequently than smaller juveniles, notes Dan Rittschof, a blue crab researcher from Duke University. As adults get bigger, it takes more energy to produce muscle, he explains.

### MATING

A sally has a distinctive triangle shape on her abdomen, but the triangle will turn dark purple when she reaches sexual maturity and undergoes one final molt.

After this last molt, she emerges with a U-shape on her abdomen. She is now a “sook,” or sexually mature female, and most of her energy will be directed toward egg production.

As for her male counterparts, Rittschof says they probably also stop molting at some point, “but there are no massive morphological changes like females,” he explains.

A sook will mate almost immediately after her final molt, while her shell is still soft. Although a sook only mates once, she internally stores packets of sperm to fertilize multiple egg clutches throughout her lifetime. After fertilization, she carries the eggs for two weeks until they hatch.

### MANAGEMENT

Despite extensive research on blue crab molting and mating, female migration patterns remain somewhat mysterious, says Rittschof.

Through an N.C. Blue Crab Research Grant, Rittschof is conducting a four-year field study near Beaufort Inlet regarding female blue crab migration patterns and reproductive potential.

In late spring, females carrying fertilized eggs — known as sponge crabs — ride outgoing tides from low-salinity estuarine waters to high-salinity ocean waters, where they release their eggs.

People used to think that sponge crabs had one clutch and died, but that isn’t true, explains Rittschof.

A female in North Carolina waters can have up to five clutches during the May to September spawning season, he says. And if they don’t get caught up in crab pots or eaten by predators, females can live and spawn for another two or three years.

As for migration patterns, Rittschof’s research has debunked some myths about female blue crabs.

“The existing lore is that crabs go to the ocean, have their clutches and go home,” he says.

But Rittschof’s tag-and-recapture data, coupled with offshore recapture data from 2002, suggests that a substantial number of females live offshore for extended periods.

“Crabs that spawned in the fall don’t die, but I don’t know where they go,” he says.

Rittschof has marked 12,000 female crabs near Beaufort Inlet, and although he believes some returned to estuaries after spawning season, none have returned to the estuary where they were tagged.

“The crabs don’t know where the estuary and the ocean are,” he says. “They ride the tide.” □

— K.A.



# Sea Grant in North Africa

By Pam Smith

**H**istorians refer to the North African nations of Algeria, Morocco and Tunisia collectively as “The Maghreb” — in Arabic, “the setting sun.”

But for Walter Clark, The Maghreb is a horizon illuminated by possibilities.

Clark, North Carolina Sea Grant coastal communities and policy specialist, is spearheading an effort that would extend Sea Grant’s research, education and outreach model to those North African countries.

The effort would link university and scientific communities on both sides of the ocean.

*The Grand Mosque in Casablanca is a tribute to the late Moroccan King Hassan II.*

Photo courtesy of Tingis Magazine, Gourad Media Group



The vision for this ambitious plan began to take shape in the fall of 2003 during an interagency, fact-finding mission to the Maghreb nations led by the U.S. State Department.

Clark represented the National Oceanic and Atmospheric Administration (NOAA) — the parent agency of the National Sea Grant College Program. The group also included representatives from the U.S. Department of Energy and the National Science Foundation.

“The purpose of the trip was to identify common areas of interest with the hope of laying the foundation for long-term partnerships,” Clark explains.

The visiting team held more than 50 meetings in 10 days at various government ministries, universities and research facilities.

While researchers in all three nations are engaged in various fields of science and technology, few are engaged in applied research

— that is, matching research results with specific economic or social needs or goals.

“One of Sea Grant’s greatest strengths, is its ability to link university scientists and educators to outreach professionals who serve as conduits of information and knowledge to ‘users’ — business and industry, government and non-government organizations, and other educational institutions,” says Ronald G. Hodson, North Carolina Sea Grant director.

Representatives from each country expressed particular interest in the Sea Grant model for addressing vital coastal issues, says Clark.

Collaboration, he suggests, could focus on watershed management, integrated coastal management, water quality improvement, fisheries management and aquaculture development — well-proven Sea Grant areas of expertise that foster both economic growth and sustainable marine resources.

#### EXPANDING HORIZONS

Clark has proposed a multi-million dollar program to support long-term collaboration among scientists from the U.S. and the North African countries — and to extend the reach of an ongoing State Department initiative.

“It’s part of the administration’s program to foster collegiality and peace in the greater Mid-East region,” says Bob Senseney, the State Department senior advisor who led the fall 2003 mission. He is attached to the Bureau of Oceans and International Environmental and Scientific Affairs, Office of Science and Technology Cooperation.

Senseney explains that the U.S.-Middle East Partnerships Initiative (MEPI) was launched by the administration in 2002 to expand economic, political and educational opportunities for some 80 million people in that region — and to bolster relationships among partnering nations.

*Continued*





## LEGAL TIDES

For his part, Senseney has been helping to pave the way for partnerships to form and flourish. Already, the Morocco Research Institute is working with its sister-lab, the Lawrence Livermore National Research Laboratory in California.

“We are looking to cultivate new ground for a broader scale of collaboration in a wide range of scientific fields,” he says.

There is a particular interest in Sea Grant’s expertise in coastal zone management, he says.

“Science and technology will strengthen ties between our country and each of the three countries — and among those countries — collaboratively and collectively,” says Senseney.

If approved, Clark’s competitive grant-based program would be funded by MEPI and administered by NOAA Research International Activities Office in collaboration with National Sea Grant and North Carolina Sea Grant. The proposal still is wending its way through government channels, and funding is far from being a “done deal.”

Nevertheless, Algerian Embassy officials responded by naming Clark an Embassy Science Fellow. Building on the dialogue that began with the 2003 mission, the fellowship could mean an extended return trip to Algeria for Clark. This would provide time to forge research partnerships.

Ultimately, Clark would establish a cooperative extension network to deliver research results to users and to facilitate the transfer of research results into university curricula.

To achieve a positive outcome, Clark is calling on his past experience in the region to navigate its complex culture. In 1991, Clark headed up a United States Agency for International Development sustainable development initiative in the Sultanate of Oman. He helped develop a policy framework that would enable the expansion of tourism while protecting the coastal environment.

### A MELTING POT

Novelists and screenwriters portray the North Africa region as a world of mystery and intrigue, perhaps best captured in the screen classic, *Casablanca*. In fact, it is a world whose character is shaped by history and colored by its varied cultures.

Algeria, Morocco and Tunisia are on the western edge of the Arab world — with portals to the Mediterranean Sea and Atlantic Ocean. Scholars point out that this region lies on the boundaries of modern and ancient, Christian and Muslim, Oriental and Occidental traditions.

The silver screen image notwithstanding, Casablanca is a modern Moroccan city with wide boulevards and French-influenced architecture.

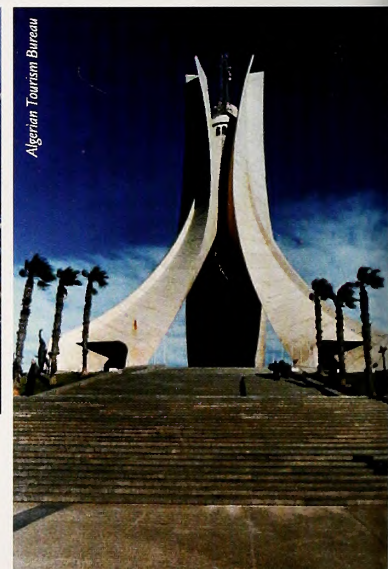
And, its Grand Mosque is just that — grand, Clark says. Built to honor the late Moroccan King Hassan II, it was meant to be the greatest mosque in the modern Arab world. The mosque sits at the edge of the Atlantic and, appears to float over water. From the pinnacle of the minaret, a laser beam that points toward Mecca can be seen from more than 30 miles away.



Daniel Kim



Tunisian Tourism Bureau



Algerian Tourism Bureau

Casablanca as well as Rabat, the capital city, are portraits of contrast: old and new, rich and poor, he adds.

Morocco, which won its independence from France in 1962, is strategically located on the Strait of Gibraltar that connects the Atlantic Ocean and the Mediterranean Sea.

The team identified a set of environmental issues to target — in line with the nation’s commitment to sustainable development. Moroccan Princess Lalla Hasna, addressing the Foundation for Environmental Education recently,

iterated her nation’s resolve to tackle water quality and waste treatment concerns, as well as desertification — the loss of productive land to arid conditions resulting from management or climate change.

In Tunisia, probably more for “local color” than real intrigue, Clark actually had to knock three times on the door of a Kasbah restaurant — The Hideaway. Tunis, he says, is a city of



BRIDGES OF KNOWLEDGE

Conflict, distrust and even intrigue might be expected to spill over from the melting pot of Maghreb cultures.

While there is some political unrest and saber rattling over borders, there is a growing sense of harmony at the scientific level, Senseney notes.

For example, there is ongoing discussion about pollution monitoring across borders.

The 2003 visit was highlighted by openness among members of the scientific community, admission of need, and willingness to collaborate.

In June 2004, the United States and Tunisia signed a formal, 10-year science and technology agreement that will pave the way for collaboration on an array of issues. Similar formal arrangements are in the works with Algeria and Morocco.

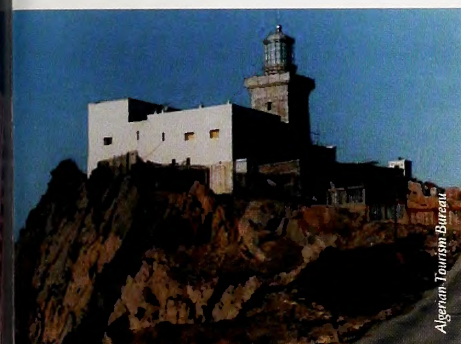
Scientific discussions and progress could help foster collaborative relations on the political level as well, or at least provide a structure for communication, Senseney says.

"It takes vision for people to look at the big picture and then take step by step, one piece at a time," he adds. "Partnerships are vital to bringing together individuals who may not have an opportunity to talk and learn from each other."

Clark agrees. He sees an opportunity to bring together top researchers to advance scientific, economic and political objectives.

"For everyone who collaborates, it's an opportunity to learn about each others' culture, way of thinking and from each other when it comes to dealing with coastal issues. We all will benefit from partnerships that we forge," Clark concludes. □

To learn more about The Maghreb countries, go online to *The CIA World Fact Book 2002* at [www.cia.gov/cia/publications/factbook](http://www.cia.gov/cia/publications/factbook).



Algerian Tourism Bureau



Tunisian Tourism Bureau



Trigis Magazine, Gourai Media Group

*CLOCKWISE FROM TOP LEFT: Walter Clark is heading up a global outreach initiative for North Carolina Sea Grant. • A lighthouse warns sailors away from Algeria's rocky coast. • Tunisia is attempting to lure tourists to its Mediterranean coast. • A colorful market at Marrakech in Morocco offers a bounty of goods. • Algeria exhibits a contrast of old and new architectural styles. • This Tunisian port holds economic promise for the North African nation.*

contrasts of color and sound. Members of the mission explored colorful markets along ancient alleys and cobblestone streets.

Located on the Mediterranean coast, Tunisia won its independence from France in 1956. It is characterized by only 18 percent arable land, mountains in the north, a hot dry central plain, and the desert in the south.

Its environmental concerns include limited natural freshwater resources, deforestation and desertification.

Algeria, three times larger than the state

of Texas, is located on the Mediterranean Sea. Because of civil unrest, the visitors traveled in armored vehicles and were kept under tight security. Instability has delayed the country's economic development.

"When you fly over the coast, it seems rugged and rocky. Everything seems crammed into the coastal margin," Clark observes.

With few environmental laws in place, pollution is a critical issue, he says. "We found the people to be kind and generous and eager to collaborate."





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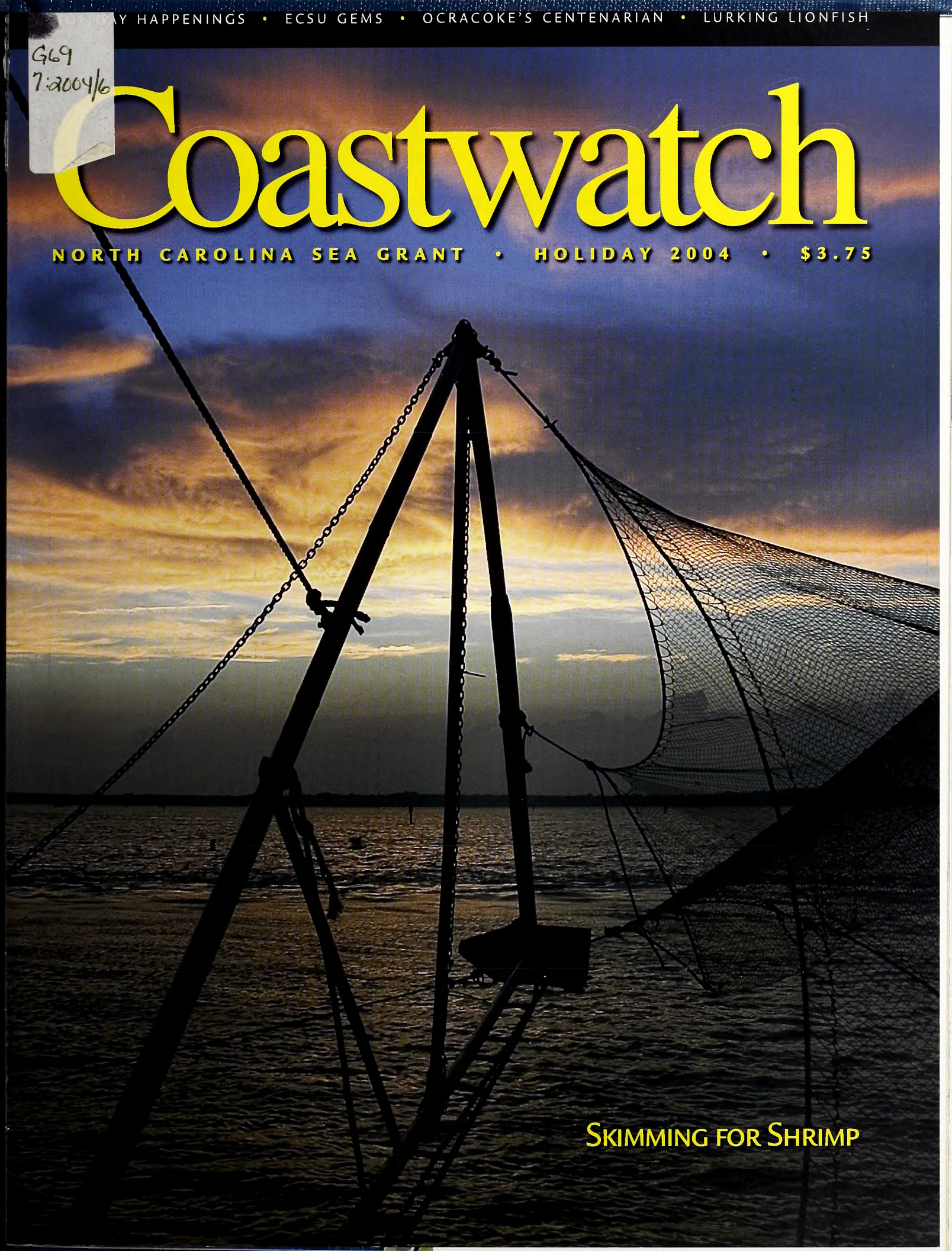


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# Coastwatch

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SKIMMING FOR SHRIMP



## Resolutions for the New Year

With the holiday season upon us, it soon will be time to make New Year's Resolutions.

As you list your own resolutions, you may want to consider the following environmentally conscious actions identified by the N.C. Coastal Federation in its 2004 *State of the Coast* report.

**Reduce, reuse, recycle:** Buy products that feature reusable, recyclable or reduced packaging to save the energy required to make new containers. Also, by recycling all of your home's waste newsprint, cardboard, glass and metal, you can reduce carbon dioxide emissions by 850 pounds annually.

**Consider a fuel-smart car:** When buying a car, purchase a fuel-efficient vehicle — one that gets more miles to the gallon than your current vehicle.

**Give your car a day off:** Consider transportation alternatives such as mass transit, carpooling, bicycling and telecommuting. By leaving your car at home two days a week, you can reduce carbon dioxide emissions by 1,590 pounds a year. When you do drive, keep your car tuned up and its tires properly inflated to save on fuel costs.

**Tune up your home to save dollars:** Your house is responsible for more air pollution and carbon dioxide emissions than the average car. Insulate your home and caulk windows and doors. Potential savings in carbon-dioxide emissions: 2,480 pounds a year. Buy energy-efficient appliances. A high-efficiency refrigerator, for instance, will reduce carbon dioxide emissions by 220 pounds a year. A washing machine that uses water and energy efficiently will reduce emissions by 440 pounds a year.

**Go solar:** Install a solar thermal system in your home to help provide your hot water and reduce your carbon dioxide emissions by about 720 pounds annually. Encourage your utility to do its part. Many local utility companies offer energy from clean sources (landfill gas recovery, high-efficiency natural gas-fired power plants, or renewables such as solar and wind).

**Buy green power:** Green power is electricity that is generated from renewable sources such as solar, wind, geothermal or biomass. Although the cost may be slightly higher, you'll know that you're buying power from an environmentally friendly energy source.

**Get involved at work:** Your company can save money by joining EPA programs such as Energy Star Buildings and Waste Wi\$e recycling programs, and by buying office equipment with the Energy Star label.

**Plant trees:** Trees absorb carbon dioxide from the air. Join family members, neighbors, environmental groups or community service groups in planting trees in your yard, along roadways, at schools, and in parks.

**Educate yourself:** There are many good books and Web sites that will help you learn about global warming. (Go to [www.nccoast.org](http://www.nccoast.org) for sample sites.)

**Educate others:** Encourage others to take these practical, energy-saving steps that save money while protecting the environment.

Taking any of these actions can make a difference.

\*\*\*

In closing, I note the passing of Llewellyn Salter Lewis of Davis, who died in October at age 93.

I met "Miss Lue" more than a dozen years ago, when I interviewed her and coworkers in the picking room at Luther Lewis and Son. She took on the task of teaching me the fine art of picking crab. I am not known for fine motor skills — and thus my pace was "hours per pound" rather than pounds per hour.

Several years before I joined Sea Grant, *Coastwatch* published my account of Miss Lue's picking lessons. I easily recall her smile and Down East brogue as she explained just how to keep lump meat in one piece.

But she also taught me much more. She shared stories of family, community and the value of honest work along the North Carolina coast — lessons that I use to this day.

Katie Mosher, Managing Editor

## I N T H I S I S S U E

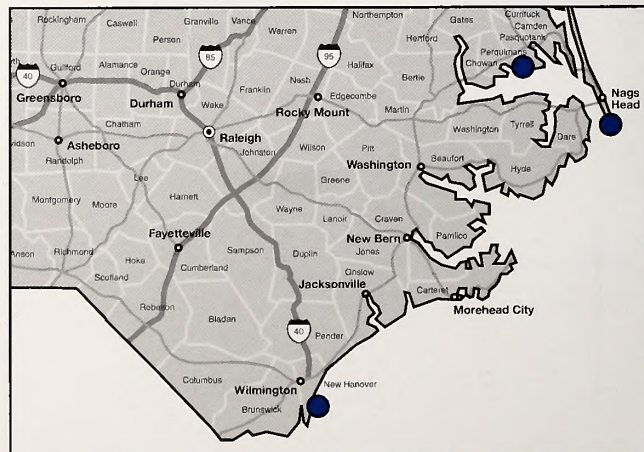
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James Morris □ Tim Runyan □ Jeff Scovil □ Pam Smith □ Scott Taylor

North Carolina's diverse coast offers countless interesting subjects. The large dots on the locator map indicate story settings in this issue — including Ocracoke, Elizabeth City and the Cape Fear Coast.





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# Coastwatch

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# Coastwatch

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The North Carolina Sea Grant College Program is a federal/state program that promotes stewardship 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, North Carolina Sea Grant supports research projects, a 15-member extension program and a communications staff. Ron Hodson 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. *Coastwatch* (ISSN 1068-784X) is published six times a year by the North Carolina Sea Grant College Program, North Carolina State University, Box 8605, Raleigh, North Carolina 27695-8605. Telephone: 919/515-2454. Fax: 919/515-7095. Subscriptions are \$15. E-mail: [katie\\_mosher@ncsu.edu](mailto:katie_mosher@ncsu.edu) World Wide Web address: <http://www.ncseagrant.org> Periodical Postage paid at Raleigh, N.C.

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## COASTAL TIDINGS

### Fishery Resource Grants and Blue Crab Research Grants Awarded for 2004

This year, more than 20 research projects will be funded through the N.C. Fishery Resource Grant Program (FRG) and the Blue Crab Research Program (BCRP). The projects will explore topics ranging from the ecological effects of shrimp trawling in the shallow waters of southeastern North Carolina to documenting the cultural history of crabbing in Albemarle Sound.

Sponsored by the N.C. General Assembly and administered by North Carolina Sea Grant, the FRG and Blue Crab programs support cooperative research based on ideas from the fishing community. Where appropriate, the program helps to partner persons in the industry with academic researchers to ensure useful results for both fishers and fishery managers.

Some of the 2004 FRG projects include:



developing an oyster shell-recycling program among seafood restaurants to help restore oyster habitat; studying bottlenose dolphin interaction and behavior with Spanish mackerel gillnets; and determining prey types and sizes preferred by Atlantic bluefin tuna wintering off the North Carolina coast.

Projects funded by the BCRP are equally diverse, including topics such as

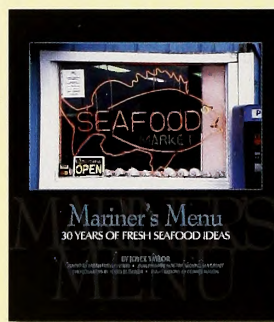
using pheromones from male blue crabs as bait; assessing the condition of fish and turtle bycatch generated during the spring blue crab harvest; and testing sponge crab excluder devices on crab pots.

For more information on specific FRG and BCRP projects, visit North Carolina Sea Grant online at [www.ncseagrant.org](http://www.ncseagrant.org) and click on research areas. — K.A.

## Holiday Gifts from Sea Grant

Let North Carolina Sea Grant help with holiday gift-giving ideas:

- For cooks on your list, consider *Mariner's Menu: 30 Years of Fresh Seafood Ideas*, by Joyce Taylor, \$25.
- A subscription to *Coastwatch* is a gift that keeps giving for a full year, \$15.



• *Sea Shells of North Carolina* is a hit with year-round beachcombers, \$12.

Send requests and checks to North Carolina Sea Grant, NC State University, Box 8605, Raleigh, NC 27695-8605. Or call 919/515-9101.

— P.S.

## In the Next Issue of *Coastwatch*

North Carolina's future oyster restoration efforts are being guided by the past. Join Kathleen Angione as she explores how combining historic maps with today's satellite and sonar imaging technology helps restore native oysters. Pam Smith goes beyond the jargon to explain how coastal communities utilize "smart growth" methods. And Ryan Reynolds takes readers aboard the *Periauger*, a replica of a colonial-era cargo vessel.



## Civil War Submarine Search Begins

In August, researchers began searching for secrets of a Civil War marvel — the submarine *USS Alligator* — off North Carolina's coast.

Launched in 1862, the *Alligator* was the U.S. Navy's first submarine, but it was lost in stormy conditions off Cape Hatteras in 1863.

Now, scientists with the National Oceanic and Atmospheric Administration, the Office of Naval Research and East Carolina University are searching for the *Alligator*.

Based on Ocracoke Island, the search



was launched from the Navy's 108-foot survey ship, YP-679, also known as the Afloat Lab.

"It is like finding a Wright Brothers' airplane. If one were ever lost," says Tim Runyan, director of

ECU's Maritime Studies Program.

Researchers used a side-scan sonar that transmitted images to the lab and a magnometer to scan the ocean floor to detect metal.

To find out more about the submarine, visit the Web: [www.sanctuaries.noaa.gov/alligator](http://www.sanctuaries.noaa.gov/alligator) or [www.nauticus.org/MHCalligator.htm](http://www.nauticus.org/MHCalligator.htm) — A.G.

## Antibiotics from Fish May Fight Diseases

Peptides previously isolated from hybrid striped bass may have implications for controlling certain viral diseases in fish as well as in humans, according to research results published recently in *Virology*.

"The peptides were highly inhibitory to channel catfish virus, as well as certain amphibian viruses," says Ed Noga, the study's co-investigator and North Carolina Sea Grant researcher at the North Carolina State University College of Veterinary Medicine.

The peptide antibiotics or "piscidins" originally were isolated from mast cells — a highly common, tissue immune cell found in fish and other vertebrates, including humans.

"The results suggest that piscidins may be an important defense for fish against viral infections, which are among the most serious diseases in aquaculture. They also have the potential to fight viral infections in humans, particularly the herpes viruses."

V. Gregory Chinchar of the University of Mississippi Medical Center led the study. In addition to Noga, co-investigators were Umaporn Silphaduang, a former NC State veterinary medicine graduate student; Locke Bryan of the University of Mississippi Medical Center;

David Wade of Rutgers University; and Louise Rollins-Smith of Vanderbilt University Medical Center.

Earlier work by other researchers found that viruses can be sensitive to other types of antimicrobial peptides besides piscidins, according to Noga.

This new study expands the range of target compounds that may help protect against such diseases.

In an earlier North Carolina Sea Grant study, researchers found that piscidins possessed potent broad-spectrum antibacterial activity, which included activity against multi-antibiotic resistant fish and human pathogens. That was the first time that researchers had isolated a peptide antibiotic from mast cells of any animals.

"The next step is to determine the specific role that piscidins play in defending fish against viral infections, as well as finding out if piscidins can effectively treat viral disease in an animal model," Noga says.

The study was funded by North Carolina Sea Grant, the National Science Foundation and the U.S. Department of Agriculture.

— A.G.

## Oceans Centers Planned

The National Oceanic and Atmospheric Administration (NOAA) and its partners have created three new research centers for lakes, oceans and human health.

The centers will be in South Carolina, Michigan and Washington.

At the South Carolina center in the Hollings Marine Lab in Charleston, researchers will address fundamental questions about the quality and safety of coastal waters and seafood. They also will develop new biotechnological methods to enhance NOAA's ability to identify and characterize chemical and microbial threats to marine ecosystems and humans.

Another center will be at the Great Lakes Environmental Research Laboratory in Ann Arbor, Mich., where scientists will develop technology for predicting the formation of toxic algal blooms, beach closings and water quality in the Great Lakes basin. One of the center's partners is the NOAA Beaufort Laboratory.

Researchers at the third center in the Northwest Fisheries Science Center in Seattle will investigate infectious diseases, biotoxins and chemicals that affect human health through seafood.

To learn more about the new centers, visit the Web: [www.ogp.noaa.gov/mpe/ohi](http://www.ogp.noaa.gov/mpe/ohi).

— A.G.



## Spectacular Gems, Minerals at Museum

In North Carolina, geologic diversity has created spectacular treasures — from emeralds and rubies to sapphires and gold.

A large collection of stones and minerals from an anonymous donor is on display through June 12, 2005, at the N.C. Museum of Natural Sciences in downtown Raleigh.

“Treasures Unearthed: North Carolina’s Spectacular Gems & Minerals” also features a hands-on learning lab, where visitors can use



scientific equipment to identify rocks and minerals, just as geologists do.

In addition, a portion of an 111-pound meteorite that fell in 1934 in Pitt County near Farmville will be on display. A meteorite is a rock, usually composed of metals and other minerals, that falls through the Earth’s atmosphere

from outer space.

To learn more about the exhibit, visit the Web: [www.naturalsciences.org](http://www.naturalsciences.org). — A.G.

## Some N.C. Fish Stocks Improving

Good news from N. C. Division of Marine Fisheries (DMF): North Carolina’s coastal and ocean fisheries continue to show signs of improvement. In September, DMF upgraded the status of Atlantic croaker and monkfish.

Croaker, a popular commercial and recreational fish, moved from “concerned” to “viable.” Monkfish, a commercially harvested ocean fish, moved from “overfished” to “recovering.”

DMF’s annual stock status report evaluates the health of the state’s most important coastal

fisheries. It spotlights successes and areas of concern.

The long-term goal is to have all 40 of the state’s major species move to “viable” or “recovering” categories, according to Louis Daniel, DMF scientist. To date, 18 stocks are in these classifications.

Eight are listed as “concerned,” another eight are “overfished,” and six are listed as “unknown.”

The N.C. Marine Fisheries Commission uses the annual DMF report to develop Fishery Management Plans. — P.S.

## Aquaculture Conference Feb. 10-12

The North Carolina Aquaculture Development Conference will be held Feb. 10-12 at the Atlantic Beach Sheraton.

The program includes farm tours, workshops and presentations designed to help start-up businesses or to enhance established fresh and saltwater operations.

Bill Springer, publisher of *SeaFood Business*, will deliver the luncheon keynote address, “Aquaculture’s Place in the Seafood Market.”

North Carolina Sea Grant specialists will participate in the annual event, giving updates on finfish and shellfish aquaculture research and marketing opportunities.

Sea Grant-funded aquaculture projects

at North Carolina State University and the University of North Carolina at Wilmington will be highlighted. Projects supported by the N.C. Fishery Resource Grant Program also will be featured.

“There is a tremendous opportunity for the aquaculture industry to meet the growing demand for seafood,” says Ronald G. Hodson, Sea Grant director. Hodson is recognized internationally for advancing methods for the aquaculture of hybrid striped bass.

For additional information, or to register, contact Matt Parker, N.C. Department of Agriculture and Consumer Services, at 252/633-1477. Or, go online to [www.ncaquaculture.org](http://www.ncaquaculture.org).

— P.S.

Courtesy Avery Research Center



## N.C. Teachers Attend Coastal Legacy Workshop

This summer, two North Carolina educators connected South Carolina’s Low Country culture to coastal science — from rice cultivation to basketmaking from the Gullah/Geechee tradition.

Amy Beal of Cary and Monica Franklin of Raleigh attended the SouthEast Center for Ocean Sciences Education Excellence (COSEE) Coastal Legacy Workshop based in Charleston.

The workshop supported SouthEast COSEE’s commitment to increase access to ocean research for under-represented groups and increase diversity in the ocean sciences. The retention of African influence on language, crafts and technology in the 18th- to 19th-century rice industry still influences the coast from Wilmington N.C., to Jacksonville, Fl.

Coastal Legacy teachers will test new activities and resources in their classroom curricula. One of the workshop’s goals was to increase interest and understanding in coastal management, wetlands and coastal development.

Workshop instructors included Lundie Spence, SouthEast COSEE director and former North Carolina Sea Grant marine education specialist, and Carrie Thomas, Southeast COSEE research specialist and NC State University visiting faculty.

SouthEast COSEE serves North Carolina, South Carolina and Georgia, with the state Sea Grant programs as strong partners.

For more information on future COSEE programs, visit the Web: [www.seagrant.org/se-cosee](http://www.seagrant.org/se-cosee).

— A.G.



## U.S. Seafood Consumption Rising

Americans ate an astounding 4.7 billion pounds of seafood in 2003 — an average of 16.3 pounds per person. That's a 0.7-pound, or 4 percent, increase over the 2002 average.

The figures were released in September in the National Oceanic and Atmospheric Administration (NOAA) annual report "Fisheries of the United States."

Of the total seafood consumed, a record 11.4 pounds per person were fresh and frozen finfish and shellfish. Shrimp topped that category, with an average of four pounds consumed per person, according to the National Marine Fisheries Service (NOAA Fisheries).

Americans also ate an average of 4.6 pounds of canned fish, mostly tuna, in 2003 — a 0.3-pound increase from the previous year.

This extends the continued upward trend of seafood consumption in the United States in recent years. The U.S. Departments of Health and Human Services and Agriculture are recommending that Americans double their intake of fish to two servings per week as part of a heart-healthy diet.

"Along with the latest news from NOAA that fish populations are rebuilding, we have plenty of reasons to incorporate more fish into our diets," says Bill Hogarth, director of NOAA Fisheries. — P.S.



## Shellfish Farm Plays Role in Oyster Restoration

On the surface, aquaculture and shellfish restoration may not appear to have much in common. But in the waters of Stump Sound, one shellfish farm has proven it can help boost the declining natural population of *Crassostrea virginica*, the Eastern oyster.

Jim Swartzenberg, owner of J&B Aquafood in Jacksonville, had been stocking his 37-acre lease with juvenile Eastern oysters from Louisiana for several years when he had a revelation: "If you could tell the difference between Louisiana and Stump Sound oysters, we could see whether cultured oysters in a lease would propagate and add to the overall population."

Oysters from North Carolina and Louisiana are both classified as Eastern oyster species, but each group maintains a distinct genetic profile.

Swartzenberg partnered with Ami Wilbur, a geneticist at the University of North Carolina at Wilmington, and they obtained a N.C. Fishery Resource Grant to test his hypothesis.

They discovered the Louisiana stock

successfully reproduce and spread — about 1 percent of oysters in the natural beds around Swartzenberg's lease fits the genetic profile of Louisiana stock. An additional survey of reefs throughout the state yielded no significant evidence that the Louisiana stock occurs naturally in North Carolina.

The study shows aquaculture benefits shellfish restoration, says Wilbur. As the farm-raised oysters reproduce, "the genes they carry are being put into our wild population," she explains. And some scientists are hopeful that Louisiana oysters may be more tolerant of Dermo, a microscopic parasite that kills oysters when they reach reproductive age.

Swartzenberg admits leases have been controversial among coastal communities, but prefers to focus on the positive. Even if an area has a lease, Swartzenberg says, it can still be used for boating and fishing. But more importantly, "it's still productive," he adds. "That's the benefit to the public — producing oysters." — K.A.

## New Seafood Products Debut

A new line of seafood appetizers — bacon-wrapped oysters, scallops, shrimp and tilapia — were introduced this fall by Southern Farm of Bailey.

The product line is the result of a push to identify niche markets for domestic seafood, says Connell Purvis, Southern Farm's director of sales and marketing. The

appetizers will be featured on the menus of fine restaurants and country clubs.

For several years, Purvis worked with North Carolina Sea Grant and the North Carolina State University Seafood Lab to develop value-added seafood products for retail and institutional markets.

Their efforts resulted in the introduction of several seafood entrees in 2003 with the help of two N.C. Fishery Resource Grants — one for product development and one for marketing.

The appetizer venture — a spin-off of the entrée project — takes business collaboration to a new level, says Barry Nash, Sea Grant's seafood technology and marketing specialist.

Rose Bay of Swan Quarter provides the oysters. Pamlico Packing of Vandemere supplies local shrimp. Scallops come from North Carolina and Virginia waters. Southern Farm supplies the smoked bacon and tilapia, and prepares the products. Sharin Foods of High Point handles the marketing. Southern Foods of Greensboro distributes the products.

"And, it's supported by the 'Freshness from North Carolina Waters' marketing campaign," Nash adds. "Southern Farm's appetizers have all the ingredients for success in the institutional food arena — products that start with fresh domestic seafood, surpass quality standards and exceed taste expectations."

— P.S.









## SHRIMP: No Small Catch

HARVESTS FEATURE  
SKIMMER, OTTER TRAWLS

By Ann Green

**A**s Bob Hines adjusts a miniature green net on the side of a skimmer trawl model, he explains how commercial shrimpers can tell when they come upon a bounty of white shrimp.

"White shrimp are very active," says Hines, a North Carolina Sea Grant fisheries specialist who introduced the skimmer gear in the state. "As the net moves forward through the water, the shrimp jump from the water, marking their presence."

Because the top of a skimmer net extends above the water surface, it is able to contain the shrimp, Hines explains to a crowd gathering around an exhibit on the National Mall in Washington, D.C. The North Carolina Sea Grant shrimp trawl exhibit was part of "Water Ways: Charting a Future for Mid-Atlantic Maritime Communities" at the 2004 Smithsonian Folklife Festival.

Last summer's festival featured the rich culture and traditions of maritime workers from coastal communities, including the Core and Albemarle sound regions.

"I come to the festival every year," says Larry Rockwell of Upperville, Va. "I came to this exhibit because I am fascinated with the technology of boats."

While several visitors look on, shrimper Bradley Styron of Cedar Island and Hines explain that as shrimp are caught in the tail bag, shrimpers pull in the catch and sort it on a culling table.

Skimmer trawls — in which nets are mounted on frames attached to the sides of the boat — often are preferred in shallow waters along the North Carolina coast, adds Hines.

*Continued*



In deeper water, shrimpers use otter trawls that are attached to vessels by towlines extending to otter doors. The towlines are attached to outriggers or to the stern of the vessel, and the nets are dragged through the water. The doors spread the nets behind the boat, allowing shrimp to enter.

“One advantage of the skimmer trawl over the otter trawl is that you can leave the mouth of the nets in the water and continue fishing while pulling up the tailbag with the catch,” explains Hines. “With an otter trawl, the nets come out of the water when the catch is brought in.”

Built by Steve Lewis of Harkers Island, the model skimmer and otter trawls help showcase North Carolina’s shrimping tradition to visitors from around the world.

“North Carolina has a long history of shrimping, dating to the early days of the 20th century, when the commercial fishery began here and became centered in the area around Southport,” says Hines.

Since he was a young man, Styron has been trawling in Pamlico and Core sounds.

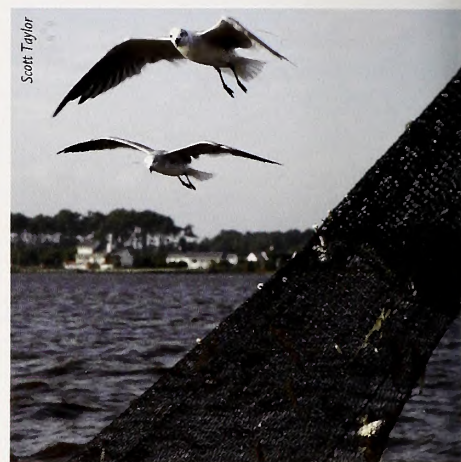
“Most of my life, I have been a commercial fisherman,” says Styron, owner of Quality Seafood in Cedar Island and member of the N.C. Marine Fisheries Commission.

Styron and his crew not only shrimp but also clam and harvest other species, he adds. “I own three trawlers but won’t be shrimping this year because of cheap prices.”

When the season is good, otter trawlers line up like a wagon train in Pamlico and Core sounds, according to Styron’s wife, Debbie.

## SHRIMP SPECIES

In North Carolina, commercial and recreational shrimpers use trawls to catch three species of shrimp. The brown shrimp — or *Farfantepenaeus aztecus* — prefer peat and muddy bottoms but also are found on sand, silt, or clay mixed with shell and rock fragments. The species is more active in open waters at night than in the daytime. The harvesting season is in late summer and fall, usually from July to November.



TOP: Skimmer trawls often fish near each other in North Carolina waters. BOTTOM LEFT: Bob Hines and Bradley Styron set up a model trawler at the Smithsonian Folklife Festival in Washington, D.C. BOTTOM RIGHT: Skimmer trawls are used in shallow waters along the state’s central coast.

Pink shrimp, known as spotted — or *Farfantepenaeus duorum* — also are active at night and burrow into the bottom during the day. Commercial shrimpers harvest this species from April to June.

White shrimp, commonly called green-tailed — or *Litopenaeus setiferus* — prefer soft muddy bottoms, with the highest abundances in areas of extensive brackish marshes. Commercial shrimpers catch white shrimp from August to November.

In North Carolina, otter trawls are the predominant gear used by commercial shrimpers along the state’s entire coast, especially in deep waters.

From 1994 to 2003, 93 percent of the commercial shrimp harvest in North Carolina was caught with otter trawls, compared to 4 percent with skimmer trawls and 3 percent with channel nets, according to the N.C. Division of Marine Fisheries (DMF).

The skimmer trawl primarily is used in shallow waters in Carteret, Onslow and Pender counties.

Recreational shrimpers also use otter

trawls to harvest catch. However, the size is restricted to 26 feet, according to Rich Carpenter, DMF district manager.

In a DMF survey, Carpenter found that recreational gear license holders harvested about 101,325 pounds in 2002 and 47,500 pounds in 2003.

“Recreational shrimpers take about 1 percent of the total shrimp harvest in North Carolina,” he says.

## SKIMMER TRAWL INTRODUCTION

In 1989, a *National Fisherman* article about a Louisiana shrimp trawl — the skimmer — caught the attention of two Carteret County shrimpers, Clinton Willis and Craig Schreck.

The two approached Hines, asking how to obtain the gear and test it in North Carolina.

In June of 1990, Hines, along with Willis and John Weeks, who then taught marine vocations at East Carteret High School, traveled to Buras, La., to test the waters with Gulf shrimpers.

“These two local fishermen were interested in the gear, so we went to Louisiana to try it,” says Hines.





ABOVE: Don Weeks has been fishing with the skimmer trawl for 12 years.

After the skimmer trawl was successfully tested and introduced in North Carolina, it became a popular form of gear in shallow waters.

Don Weeks of Morehead City has been using the skimmer trawl in the Newport River for 12 years. During the white and brown shrimp season, Weeks keeps his trawler moored in the middle of the Newport.

“Eighty-five to 90 percent of the time, I go shrimping at night,” says Weeks. “Most of the time, I start at 8 p.m. and don’t stop until 4 or 5 in the morning.”

In the early 1990s, Hines led a North Carolina Sea Grant study on the skimmer trawl when it was introduced in state waters. With assistance from the Gulf and South Atlantic Fisheries Development Foundation, John Weeks built a set of skimmer trawls and tried them aboard the school’s small work skiff.

“He found good results on white shrimp,” says Hines.

In a larger-scale study supported by the National Marine Fisheries Services (NMFS or NOAA Fisheries), Sea Grant researchers compared shrimp catch between skimmer and otter trawls.

Researchers found that the skimmer trawl was very effective in catching white shrimp in the North and Newport rivers in

Carteret County, according to North Carolina Sea Grant’s publication *The Skimmer Trawl In North Carolina Estuaries*.

“Paul Biermann and I built the first commercial-scale skimmers on his boat, the *Frankie and Al*,” says Hines. “In the study, we fished the skimmers alongside the conventional otter trawl rig *Capt. Will*, owned by Clinton Willis,” adds Hines.

More than 23 percent of the total biomass collected by the skimmer trawl was white shrimp — a higher average than with other gear, according to the Sea Grant publication.

“In general, they found the skimmer trawl caught less bycatch per minute than the otter trawl,” the researchers wrote. They also found skimmer trawl bycatch for white shrimp was more likely to survive than otter trawl bycatch.

However, the otter trawl was more effective with brown shrimp.

### NEW NOAA STUDY

NOAA Fisheries’ Southeast Fisheries Science Center recently began conducting a research study of the framed-net shrimp fisheries in the waters of Louisiana and North Carolina.

The gear includes the skimmer trawl and butterfly nets that are used by commercial shrimpers in Louisiana. The difference between

skimmer trawls and butterfly nets is that the skimmer has no frame on the bottom part of the opening, while the butterfly net has a square frame that completely encircles the mouth opening of the net. Neither has doors like those found on otter trawl gear.

The butterfly net is usually fished in the current much like a channel net used in North Carolina.

Federal and state laws require shrimp trawls to have bycatch reduction devices — which allow small fish to escape from the net before reaching the tail bags. Federal law also requires shrimpers to use turtle excluder devices.

The new study is designed to evaluate the effects of increased use of skimmer trawls by commercial shrimpers, according to Jim Nance, chief of fisheries management at the Southeast Fisheries Science Center’s Galveston Laboratory.

“We want to assess the catch and bycatch from that fishery,” adds Nance. “Skimmer trawling may be more efficient because you use less fuel.”

For the skimmer trawl study, observers will be placed aboard vessels to record vessel and gear characteristics as well as catch and effort data by season and area.

“The study is voluntary,” says Nance. “This particular study will be completed by next year, but additional funding may allow us to go beyond that date.”

NOAA has been gathering data on the otter trawl since the early 1990s, when researchers tested the amount of bycatch caught in the southeastern United States.

Results showed that in the Gulf and South Atlantic shrimp fisheries, about 51 percent of the catch by weight was composed of finfish, according to a NOAA Fisheries report. In addition, the researchers found that 18 percent of the catch was made up of commercial shrimp species, 13 percent by noncommercial shrimp crustaceans and 18 percent by noncrustacean invertebrates.

### SHRIMP HISTORY

Historically, a wide variety of gear has been used to harvest shrimp.

Native Americans caught shrimp for subsistence using dip nets, seines and weirs.

*Continued*



They also used traps made from leaves and cord from plant fibers, possibly extracted from bear grass and palmettos, according to *Hard Times* and *a Nickel A Bucket: The Struggle and Survival in North Carolina's Shrimp Industry* by John Maiolo.

Just prior to World War I, two developments — a new Southport cannery and the adoption of the otter trawl — stimulated a dramatic growth in the shrimping industry, according to *Hard Times*.

“The otter trawl revolutionized shrimp fishing and replaced the long-haul seine that could only be used in shallow waters,” writes Maiolo, now an East Carolina University professor emeritus. “The efficient otter trawl could be used either inshore or in deep water, needed few men to operate it, and yielded a greater production per unit of effort.”

During the late 1920s, Brunswick County's monopoly of shrimping fisheries began to erode as interested shrimpers from Carteret County arrived to learn how to catch the crustaceans.

However, Maiolo adds that commercial shrimping did not take off until after 1933 — when production steadily increased from 338,000 pounds in 1931 to more than 2.5 million in 1934.

“For a long time, shrimp were considered pests,” says Hines. “Southport was the first area for commercial shrimping in North Carolina.”

In *Hard Times*, Maiolo describes the editor of the Southport *State Port Pilot* recalling his first months there in the mid-1930s: “Living on the waterfront, his sleep was ‘rudley shattered by the discordant sound of many noisy gasoline engines’ as the trawlers moored along the docks in the harbor prepared to leave in the early morning.”

As more people began shrimping, a unique method of harvesting called “channel netting” developed near Harkers Island in the 1930s.

Since then, this form of fishing has undergone numerous modifications.



TOP: Don Weeks empties a net. BOTTOM LEFT: Weeks sorts through the shrimp and bycatch. BOTTOM RIGHT: Shrimp are put in separate buckets and then iced down.

“The modern version is set on the stern end of the boat, with ends of the staffs running across the board and resting up the gunwales,” writes Maiolo, a former North Carolina Sea Grant researcher.

As the ebb tide begins to run, the captain locates the edge of the channel or bank, usually with a long pole, and then marks the edge with a buoy, he adds.

“Then, making allowances for anchor line and bridge length, the fisherman throws one of the anchors overboard and sets it firmly,” according to the book. “The net is then pulled off the stern so that approximately one-third of it will extend off the bank and into the channel.”

Following World War II, the shrimping industry began to emerge as one of the state's most important fisheries.

By 1953, shrimp production in North Carolina climbed to more than 14 million pounds, according to Maiolo. Throughout the 1950s and 1960s, larger vessels that stayed

longer at sea were introduced.

The 1980s brought large harvests for shrimpers. “In 1985, I caught more than 1,500 pounds of shrimp in one night on the Pamlico Sound,” says Styron.

## TRAWLING RESTRICTIONS

For a number of years, shrimp trawling has been restricted in designated nursery areas in North Carolina.

“These are the most sensitive areas to bottom-disturbing fishing gear,” says Carpenter. “Also, these are areas where very young fish, crab and shrimp develop.”

Some recreational fishing associations want more trawl restrictions for commercial shrimpers.

“We would like to see less destructive gear used in inland waters like the sounds,” says Doug Roberts, board member of Coastal Conservation Association (CCA), North Carolina.



Scott Taylor



ABOVE: A captain sets shrimp trawl nets in the water.

CCA prefers that shrimpers use skimmer trawls over otter trawls, which Roberts argues drag the bottom and damage nursery areas for finfish.

“We need to do everything possible to reduce finfish bycatch,” he adds. “The skimmer trawl seems to minimize bycatch.”

Because of the controversy over shrimp trawling and decline in price due to foreign imports and other factors, DMF moved up the date for the state’s first shrimp management plan. The division expects to have the plan completed in 2005, according to Carpenter.

“The plan will examine all aspects of

shrimping in North Carolina, including bycatch, impacts on habitats, economics, gears and practices utilized in the state,” he adds. □

*For up-to-date information on turtle excluder devices and bycatch reduction devices for commercial shrimpers, visit Louisiana Sea Grant’s fisheries Web site: [www.seagrantfish.lsu.edu/management](http://www.seagrantfish.lsu.edu/management) and click on “gear.”*

*For more information on the North Carolina’s shrimp management plan, contact the N.C. Division of Marine Fisheries, [www.ncfisheries.net](http://www.ncfisheries.net) or 800/682-2632.*

## CORE SOUND WATERFOWL WEEKEND

Shrimping demonstrations and other coastal North Carolina presentations at the 2004 Smithsonian Folklife Festival will be recreated at the Core Sound Waterfowl Weekend Dec. 4-5.

Organizers from the Core Sound Waterfowl Museum on Harkers Island in Carteret County also expect to host representatives from Maryland and Virginia coastal communities who participated in the national festival.

The Waterfowl Weekend includes a dessert reception on Friday evening, Dec. 3 at the museum. PCS Phosphate is the lead sponsor of the Educational Tent, which will be open Saturday, Dec. 4, from 9 a.m. to 5 p.m.; and Sunday, Dec. 5, from 10 a.m. to 4 p.m.

For more information, go online to [www.coresound.com](http://www.coresound.com). Or, call the museum at 252/728-1500.

## NEW BOOK ON SHRIMPING INDUSTRY

Along North Carolina’s coast, the shrimping industry has a rich heritage — from the early years in Southport to current economic issues.

In *Hard Times* and *a Nickel a Bucket*, John Maiolo highlights the state’s shrimping history as well as local customs and regulations. Named to honor the African American women who headed the shrimp in

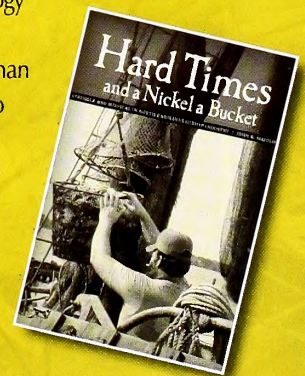
the 1930s for a “nickel a bucket,” the book also includes historical trends and harvest-technology changes.

For more than 25 years, Maiolo and colleagues at East Carolina University researched the state’s shrimping industry. North Carolina Sea Grant provided early support for the project.

“Our work in the late seventies and early eighties was the first attempt in North Carolina to understand the social and economic organization of the shrimp fishery — the fishermen, their communities and communication networks, the processing and marketing organizations, and the resource-management structure itself,” writes Maiolo.

To order a copy of the book, contact Chapel Hill Press, 919/942-8393 or [publisher@chapelhillpress.com](mailto:publisher@chapelhillpress.com).

—A.G.





## HOLIDAY SPIRITS AT HIGH TIDE ALONG THE CAPE FEAR COAST



Pam Smith

By Pam Smith

Excited laughter echoes through the main hall of Poplar Grove. The stately Greek Revival plantation house on the fringe of Wilmington is dressed for the holidays and filled with the aroma of mulled cider and sweet cakes.

It's how the Foy sisters — Mary Frances, Abbey and Theresa — remember the holidays in their historic homeplace.

"We were born and raised on the plantation, and we all married from this house," recalls Mary Frances Foy Sanders, the youngest of the trio of octogenarians.

"At Christmas, the house was filled with laughter, and there were lots of parties," Abbey Foy Anger adds. "We square danced in the front and back parlors."

The sisters remember simple holidays — a cedar tree cut from their land and decorated with handmade ornaments, wreaths on doors, greenery with red bows on the black walnut banister lining the steep stairway, and scores of visitors.

"We never would get many toys. Perhaps a baby doll. We treasured the apples and nuts in our stockings," recalls Theresa Foy Hall.

Memories flow as the sisters greet visitors at the annual holiday open house, sponsored by the Historic Poplar Grove Foundation.

Scheduled this year for **Sunday, Dec. 5** from noon until 5 p.m., the event is free and open to the public. The nonprofit foundation, which now owns and manages the homestead, draws from the plantation's historic records — and especially from the sisters' vivid memories — to recreate the festive holiday atmosphere.

The dining room table is set with the family china and crystal. A typical holiday meal might have been cured ham and oysters smoked in a pit of burning marsh grass, the sisters say.



## FAMILY TIES

Holiday visitors encounter reminders of the Foy's historic tie to Poplar Grove — the family Bible, deed box, photographs, unique pieces of family furniture, linens, wedding dresses and christening gowns.

Until 1971, when the family sold the mansion and 16 acres of land, generations of Foy's lived and worked on the plantation that James Foy, Jr. purchased in 1795. Its 628 acres included 64 slaves, a mansion on Futch Creek,

The ingenious Foy designed the wooden columns to conceal gutters and downspouts that delivered water to a cistern on the north side of the house. The collected water was used for bathing and laundry. Drinking water was pumped from the well.

Poplar Grove prospered until the Civil War, when Union armies commandeered, destroyed or damaged the family's property, including beehives, food stores, mules and horses. Legend has it that family members saved one swayback

Childless, the couple left Poplar Grove to their nephew, Robert L. Foy Sr., whom they adopted when he was about 11 years old. He would guide the plantation into modern times and through the dark Depression era.

While times were difficult, Robert L. Foy Sr. and his wife, Elizabeth Abbey Foy, managed to indulge their daughters and son, Robert L. Foy Jr.

"We were out in the boonocks. Electricity wasn't installed until 1937 — and there was

practically nothing between here and Wilmington," says daughter Abbey Foy Anger. "Dad was in the lumber business and built a guest house on the sound with a bathroom, kitchen and bedroom. Guests who came to Poplar Grove for parties stayed there. Or, when summer nights were too hot in the big house, we would sleep out on the porch of the sound house."

Today, the mansion and outbuildings — a kitchen, smokehouse, country store, weaving, blacksmith and basket shops, and a tenant house — serve as a museum complex. But, the Foy sisters and their brother, also an octogenarian, remain connected to Poplar Grove. Each of them

has a home on their ancestral land between the mansion and Topsail Sound.

The nonprofit Poplar Grove Foundation guards this jewel of southern coastal living through research, preservation of the property and artifacts, and the interpretation of a 19th-century plantation community.

Poplar Grove Plantation is located at 10200 U.S. 17 North in the Scott's Hill area of Wilmington. It is open to the public nearly year-round, Monday through Saturday from 9 a.m. to 5 p.m. and Sunday from noon until 5 p.m. It is closed Easter and Thanksgiving, and between Christmas and the first Monday in February. A nominal fee, waived for the holiday open house, helps with the foundation's preservation efforts.

For information about individual or group tours, call 910/686-9518 or go online to [www.poplargrove.com](http://www.poplargrove.com).



*CLOCKWISE FROM TOP: Poplar Grove Plantation is 'dressed' for the holidays. • Docent Vicki Blacet places traditional ornaments on one of the mansion trees. • Mary Frances Foy Sanders, Abbey Foy Anger and Theresa Foy Hall have fond memories of growing up at Poplar Grove.*

and "the banks," now called Figure Eight Island.

When the original manor house was destroyed by fire, James Mumford Foy — believed to be the first man to raise peanuts on a large scale in North Carolina — rebuilt the family mansion at its present location in 1850. Most of the building materials came from the plantation — from brick for 12 fireplaces and chimneys to the heart pine for interior and exterior construction.

horse from the occupying troops by hiding it in a bedroom and "warning" soldiers not to open the sealed room where a dying relative was quarantined with a deadly disease.

After the war, James T. Foy and his wife, Sara Eleanor (Nora) Dozier Foy, restored the plantation to sound economic footing thanks to successful peanut cash crops. They would play important roles in Wilmington's post-war days.

James T. Foy was influential in bringing the Wilmington, Onslow and East Carolina Railway to foster regional prosperity. Nora Foy became postmistress, distributing mail to customers on the front porch through a window of the "morning room," which served as the plantation's business office.



## FESTIVAL FEATURES TREES

The holiday season along the Cape Fear Coast is filled with events families can enjoy for a day, a weekend, or even a weeklong excursion to the Southeast coast.

Visitors are certain to get into the spirit of the season upon seeing more than 100 lavishly decorated trees featured at the 22nd Annual Festival of Trees, **Nov. 27 through Dec. 5** at the Hilton Wilmington Riverside.

The event is presented by Friends of the Lower Cape Fear Hospice and Life Care Center. Last year's festival raised more than \$100,000 to support the local hospice program.

The trees, wreaths, gingerbread houses and general décor will carry out the "Christmas on the Cape" theme, says Bidgie Sue of Leland, 2004 festival chairperson.

"The Cape Fear River is the tie that binds us together," she says.

The work of local artist Robert Clark is the inspiration for murals being prepared as backdrops to the festival's holiday boutique, café, children's activity center and entertainment stage. Festival-goers should recognize familiar scenes, including the Wilmington waterfront, historic homes and Old Baldy lighthouse on Bald Head Island.

The festival is a community-wide event, drawing support from local civic groups, businesses, artists, schools and residents. Sue estimates that more than 1,000 volunteers work nearly year-round to make the weeklong event a success.

That may be a modest estimate once you multiply each festival tree by the number of people in the sponsoring organization or business. Now add the number of school and civic groups that will provide refreshments and entertainment each day of the festival. Next, figure in the army of Friends and staff members from the Lower Cape Fear Hospice who volunteer to work countless hours during the event.

"It's big. It's something the community anticipates. We actually got started last March," Sue explains. "There are about 50 committees with varying numbers of members — and the numbers grow from there."

This year, construction crews have been working on sets and murals in the New Hanover County Administration Building. The space has glass walls, thus preparations have been very much in the public eye, Sue points out.

All the prep work culminates before the



LEFT: *Something is fishy about this tree from the 2003 festival.* RIGHT: *Butterflies make their holiday visit to Wilmington. Trees this year will carry out a 'Christmas on the Cape' theme.*



## HOLIDAY NOSTALGIA: OLD WILMINGTON BY CANDLELIGHT

For holiday nostalgia, port city visitors have enjoyed Old Wilmington by Candlelight for more than three decades. The tour provides a chance to see some of Wilmington's privately owned historic homes decked out in their holiday finest.

Stroll streets lined with luminaria **Saturday, Dec. 4**, from 4 to 8 p.m., and **Sunday, Dec. 5**, from 2 to 6 p.m. Sponsored by the Lower Cape Fear Historical Society, the event will feature two dozen homes and churches, all within walking distance of each other.

In addition, Salvation Army Headquarters at 223 South Third St. will feature an antique doll exhibit prepared by the Women's Auxiliary.

Visitors may stop for refreshments at Latimer House, the society's headquarters, at 126 South Third St.

The tour showcases preservation efforts and is a way to get the public excited about local history. It also is a major fundraiser for the society. Proceeds from the \$25 tickets benefit the society's community preservation and education efforts.

For information call 910/762-0492 or go online to [www.latimerhouse.org](http://www.latimerhouse.org).



volunteers digest their Thanksgiving dinners. The trees are delivered to the Hilton Thursday afternoon, and Friends volunteers swing into action to put the infrastructure in place, and to allocate space for the tree teams.

"I can't say enough for the generosity of the Hilton. They pretty much give over the entire hotel public and conference space to us. It's a wonderful venue," Sue remarks.

Friday morning dawns with a flurry of decorating. By evening, the Hilton is transformed into a winter wonderland.

The finishing touches must be in place

Friday evening — in time for a 6 p.m. gala opening and silent auction that will benefit the Lower Cape Fear Hospice and Life Care Center. Tickets for the gala are \$50 per person.

The Festival of Trees opens to the public at the Hilton on Saturday, Nov. 27. Admission for the festival is \$10. It is open weekdays from 9 a.m. to 9 p.m. and weekends from 10 a.m. to 9 p.m. The festival closes on Sunday, Dec. 5, at 7 p.m.

For information, go online to [www.hospiceandlifecarecenter.org](http://www.hospiceandlifecarecenter.org).



Courtesy N.C. Division of Tourism, Film & Sports Development

## HOLIDAY LIGHTS ARE DEEP-ROOTED TRADITION

Another Cape Fear holiday tradition has equally deep roots — quite literally. Since 1928, a giant gnarled live oak tree, thought to be between 400 and 450 years old, has been the focal point of Wilmington's annual tree lighting ceremony. The tree, billed as The World's Largest Living Christmas Tree, stands about 75 feet tall, with a limb spread of more than 100 ft.

The 2004 lighting is set for **Friday, Dec. 10**, from 6 to 8 p.m. at Hilton Park, U.S. 117 and Castle Hayne Road.

The tradition began with a contest. The late J.E. L. "Hi Buddy" Wade, then mayor, asked school children to submit nominations for an official Wilmington Municipal Christmas Tree. A boy and girl each received a silver dollar for nomi-

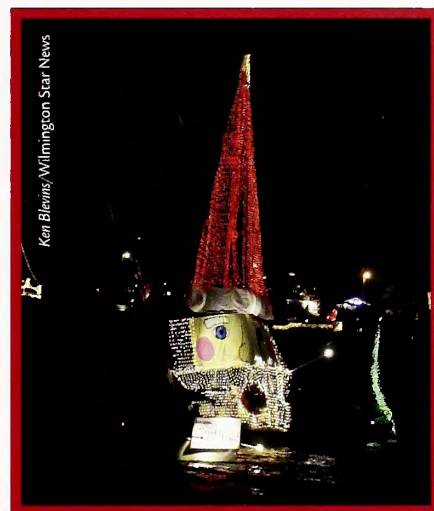
nating the stately live oak that overlooks the Cape Fear River. It quickly became the city's holiday icon.

"It's the symbol of the holiday spirit," says Tammy Skinner, a spokesperson for Wilmington's Department of Parks, Recreation and Downtown Services.

Firemen first decorated the tree using about 750 lights. Today, the tree features 7,000 lights and 2 miles of industrial wiring.

Only World War II prevented the lighting of the tree since the tradition began, says Skinner.

For information about this year's event, which includes entertainment and family activities, contact Skinner at 910/341-4602.



Ken Blasius/Wilmington Star-News

ABOVE: What's a holiday parade without Santa?

## HOLIDAY HAPPENINGS ALONG THE CAPE FEAR COAST

- **Holiday Festival in the Park, Saturday, Nov. 27, 10 a.m.** The party begins at Wrightsville Beach Municipal Park with food, music and fun for the whole family.

- **North Carolina Holiday Flotilla at Wrightsville Beach, Saturday, Nov. 27, 7 p.m.** Enjoy the nautical essence of the holiday with the parade of illuminated boats along the Intracoastal Waterway. The light and music show begins at the Wrightsville Beach drawbridge and floats along Motts and Banks channels. The event culminates at 7:30 p.m. with a fireworks show choreographed to a medley of holiday music. It's all free and open to the public. For information, go online to [www.ncholidayflotilla.org](http://www.ncholidayflotilla.org).

- **Carolina Beach Island of Lights Christmas Parade, Friday, Dec. 3, 7 p.m.** The electric nighttime parade features floats, bands, clowns, horses — and Santa. Parade travels along Lake Park Boulevard from Atlanta Avenue to Federal Point Shopping Center.

- **Carolina Beach Island of Lights Holiday Flotilla, Saturday, Dec. 4, 7 p.m.** Fishing boats and pleasure crafts display their holiday spirit from Snows Cut to Carolina Beach Boat Basin — and back.

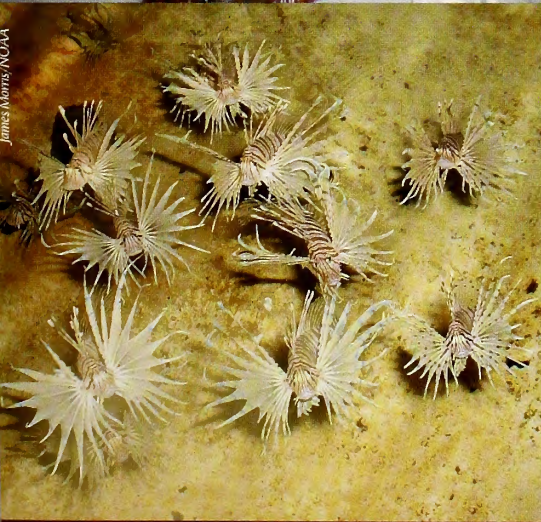
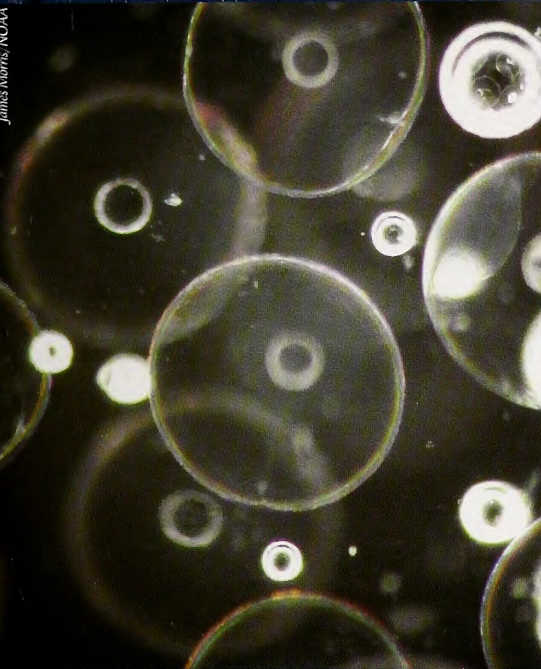
- **Carolina Beach Island of Lights Tour of Homes, Saturday, Dec. 11, 4 - 9 p.m.** Visit area homes to enjoy holiday decorations and southern hospitality. The \$10 fee includes a map for the self-guided tour. For Island of Lights information, go online to [www.islandoflights.com](http://www.islandoflights.com).





TOP LEFT: Divers find lionfish along crevices and ledges of hardbottom habitats and shipwrecks. TOP RIGHT: Christine Addison dissects a lionfish onboard the R/V Cape Fear. MIDDLE LEFT: Christine Addison preserves the egg sac of a female lionfish specimen that was ready to spawn. The egg sacs contain up to 20,000 eggs. MIDDLE RIGHT: This lionfish specimen swallowed three small reef fish whole before being captured by NURC divers. BOTTOM LEFT: A lab dissection of a juvenile lionfish exposes gonads for further analysis. BOTTOM RIGHT: Can you find the two egg balls floating alongside the lionfish? Adult lionfish spawn in the rearing tank at the Center for Coastal Fisheries and Habitat Research in Beaufort.





# DIVING FOR LIONFISH

By Lilly Loughner

“Divers are ready. Dive, dive, dive.”

On this signal, researchers disappear from the rear of the *RV Cape Fear* several times a day into choppy blue water. They descend 120 to 140 feet in search of lionfish.

The *Cape Fear* rocks 49 miles off Wilmington near the sunken dredge *Porta Allegra* — or what divers call the “Lobster Wreck.” With its many ledges, *Porta Allegra* is a favorite hangout for lionfish.

“I think we are going to find out that they are very prolific,” says Paula Whitfield, marine biologist at the Center for Coastal Fisheries and Habitat Research, a National Oceanic and Atmospheric Administration (NOAA) lab in Beaufort.

Whitfield and her crew carry spears and specimen bags in expectation of a large catch of the invasive creature native to Pacific waters. The scientists lead the first Atlantic study on lionfish, a joint project by NOAA’s National Undersea Research Center (NURC) at the University of North Carolina at Wilmington, and the National Centers of Coastal Ocean Science.

## IDENTIFYING A NEW INVASIVE THREAT

Recent newspaper and online headlines sound like sci-fi thrillers. “Waters posing possible health threat.” “Toxic lionfish spotted off North Carolina.” “Lionfish could turn up off Delaware Coast.” Although a popular fish for marine aquariums, lionfish released in the Atlantic threaten local ecosystems and pose dangers to divers and fisherman.

The lionfish is the first marine invasive fish known to have established itself in Atlantic waters, according to Whitfield. So far, only *Pterois volitans* specimens have been identified, but genetic studies continue.

In the meantime, Whitfield says the lionfish is becoming the poster child for marine invasive species, already having been named “invasive species of the month” in June 2004 by the National Invasive Species Council.

“This fish has everything going for it — it

has venomous spines, it eats everything, and to top it off, it has these eggs that free float,” Whitfield says of the fish that has few known predators.

Fleshy tentacles, fanning pectoral fins and elongated dorsal spines protrude from this fish in an exotic array of armor dressed in maroon, red and white warning colors. If lionfish spines are touched by humans, they may cause an extremely painful sting, resulting in swelling and in rare cases paralysis.

Also, the lionfish is near the top of the food chain, at least in its native range. This voracious predator stalks deep waters for shrimp, fish and small crab, wielding expanded pectoral fins strategically to corner prey until one sudden, debilitating bite prepares the meal to be swallowed whole.

To spawn, the lionfish releases a floating “mucous balloon of eggs” that drifts within the water column. In the Atlantic, the eggs and larvae likely are transported by Gulf Stream flow, which disperses the population and exacerbates the lionfish invasion, according to the National Invasive Species Council.

In addition, the lionfish seems to adapt easily to warm waters across the globe. The native range of the lionfish spans the subtropical and tropical reef waters of the Pacific and Indian oceans, and the Red Sea. Along the East Coast, water temperature appears to be the only factor limiting distribution, Whitfield says.

Divers’ reports indicate that lionfish existed in the early 1990s off the Florida coast — after unsubstantiated reports cited the release of six lionfish during Hurricane Andrew into Biscayne Bay in 1992. However, lionfish were not officially reported in the Atlantic until August 2000, when divers spotted them off North Carolina.

Since then, adult lionfish as long as 17 inches have been observed and caught from Florida to Cape Hatteras, usually on wrecks and natural hardbottom at depths of 85 to 300 feet. In warmer seasons, juvenile lionfish are reported as far north as New York and as far east as Bermuda.

Scientists will never be sure exactly how

*Continued*

TOP: Tiny lionfish eggs appear larger under a microscope. True egg diameter is less than one millimeter. MIDDLE: Researchers display their catch on deck of the *R/V Cape Fear*. BOTTOM: These hungry juveniles are part of a study to identify the age of maturation for lionfish.





Ken Blawie/Wilmington Star-News



Doug Keating/NOAA NURC



Doug Keating/NOAA NURC

TOP TO BOTTOM: The R/V Cape Fear arrives at the study site, Porta Allegra, where research divers hunt for lionfish. • Divers pause to decompress before they head to the surface. • Paula Whitfield shows equipment used in a 30-minute dive.

lionfish were introduced to Atlantic waters. Nevertheless, all evidence points to aquarium release, whether accidental or intentional, as the likely source.

Other common sources of invasive species transportation are considered unlikely. “We really don’t think it’s ballast water,” says Whitfield, who knows of no reports of lionfish in water carried in the hulls of shipping vessels for ballast.

### SIGHTINGS SPAWN STUDIES

Reports from divers and recreational fishers now help researchers map the current distribution of the lionfish.

Since the summer 2000 sightings, reports of lionfish have probably tripled, says Whitfield, who maintains a Web site that tracks public sightings of the creature.

Also, scientists examining sites proposed for Marine Protected Areas (MPAs) found lionfish in natural hardbottoms and reefs located off South Carolina, North Carolina, Georgia and Florida, according to Andy David, research fishery biologist for the National Marine Fisheries Service.

David encountered 15 lionfish during the course of the NOAA-funded cruise last spring. Relying on ROV equipment provided by NURC at UNC-W, David gathered data beyond normal diving depths — where lionfish are seen in habitats up to 300 feet deep.

“They were seen in each of the five areas which have been proposed by the South Atlantic Fishery Management Council as MPAs,” David says.

Increased lionfish sightings by the public and scientists stress the need to know more about this invasive species. Thus, NOAA is conducting both laboratory and field studies on the lionfish.

Last summer, Whitfield and her team visited 22 different sites within Onslow Bay, ranging from 35 to 100 miles from Masonboro Inlet near the NURC facility.

By increasing understanding of the current status and risk posed by the lionfish invasion, the study is designed to predict the effect of lionfish on native fish communities.

The research goals are threefold: to establish population data for comparison in future studies; to characterize and examine what role lionfish play in their habitat; and to predict the distribution.

“Basically, what niches are they filling in

this habitat?” asks Whitfield. These “eco-roles” will be characterized through information gathered about the lionfish diet, its rank in the food chain and its reproductive status.

“We know they are predators. We don’t know exactly what they are preying on,” says Whitfield. “There is very little known about even the most basic life history of lionfish. We’re basically starting from scratch.”

North Carolina is cited as the northern limit for winter populations of lionfish due to the warm Gulf Stream influence. To determine the ultimate distribution, scientists need temperature information from the ocean bottom and knowledge of thermal tolerance of lionfish.

“We really don’t have a lot to compare this particular invasion with,” Whitfield says.

The deep ocean is an open system with a constant flux of organisms. In more closed systems, such as a lake, invasive species can be devastating. “There’s a lot less known about marine invaders in general,” Whitfield says of efforts to determine effects on ocean ecosystems.

The study continues through the winter, with a focus on tagging the lionfish to increase the geographic range of the research being done off North Carolina.

### ABOARD THE RESEARCH VESSEL

In the ocean, lionfish are sedentary and easy to approach, even docile, when spear-wielding divers are not aggravating them. “They mind their own business and try to avoid you,” explains Jay Styron, a NURC diver aboard the *Cape Fear*.

Nevertheless, lionfish are dangerous predators — and stalking them with spears can be unsafe, even for research divers.

When Styron felt a lionfish spine puncture his wrist while bagging his specimens, there wasn’t much he could do.

“Underwater I saw him pumping his hand, and I kept asking him ‘Are you all right? Are you all right?’” Whitfield recalls.

Unlike a jellyfish sting, the pain is deeper, “almost like a muscle bruise,” Styron says. To ease the pain, Styron covered his hand in heated water. “It’s an occupational hazard,” he says. “You just go down with the realization that you might be stung.”

Lionfish stings outside of aquariums are fairly rare, however, and Styron thinks he’s among the first stung by wild lionfish in U.S. Atlantic waters.



Surfacing with the lionfish creates another range of dangers — this time for the lionfish, according to Morgan Bailey, a safety diver with NURC. As divers transport a live lionfish from the high-pressure environment of the ocean bottom to low-pressure surface waters, the fish's swim bladder expands.

Normally the swim bladder helps a lionfish control buoyancy. But when brought up by divers, the lionfish is incapacitated by the pressure change — reaching the surface resembling a spiny balloon.

"We use the hypodermic syringe to vent their swim bladders," Bailey says, explaining the decompression process.

After each 30-minute dive, researchers surface with up to 28 lionfish. The NOAA crew has seen lionfish at 19 different sites and has gathered a total of 155 lionfish specimens, more than five times the initial goal for the study.

"We're starting to wish for less," says Whitfield, who must dissect the lionfish following each dive, a task often lasting until midnight.

With no capabilities for freezing fish onboard the *Cape Fear*, researchers must dissect the specimens quickly to preserve gonads and stomach organs.

The simple act of cutting open one lionfish reveals a world of questions that, through future research, will soon render the basic life history of the lionfish in Atlantic waters.

The dissection exposes female gonads, a sac filled with up to 20,000 tiny, pelagic, or free-floating, eggs from a female ready to spawn. "Now we know that they are also spawning off of North Carolina," says Whitfield, holding the gel-like mass of eggs.

Inside the gut, Whitfield finds three small reef fish that have been swallowed whole — these fish will be identified back at the Center for Coastal Fisheries and Habitat Research in Beaufort.

"Their bellies are full of fish, and they have a lot of meat on their bones, so they're healthy," Whitfield explains.

## EVALUATING ECOLOGICAL IMPACTS

The sheer numbers of lionfish found, and the fact that juvenile and egg-bearing lionfish are among the samples, indicates eradication may be impossible. If further studies by Whitfield locate wintering populations of lionfish, "thoughts

of eradication should be replaced by serious management consideration," according to an assessment by the NURC crew.

"They're more prevalent than expected, and they're here to stay," says Doug Kesling, mission coordinator with NURC in Wilmington.

Species of high commercial value, such as snapper and grouper, may be at risk as lionfish feed on the same food sources and compete for the same habitat. Also, lionfish could prey on the young of important commercial fish that use "live bottom" reefs as nursery grounds, NOAA reports.

As Whitfield and her crew gather wild specimens in the field, NOAA researchers back in Beaufort are developing techniques to successfully spawn and rear lionfish in the laboratory.

Supplied with a fresh batch of Whitfield's wild-caught lionfish, researchers perform cutting-edge laboratory studies on the reproductive biology of lionfish.

James Morris, biologist with NOAA and doctoral student at North Carolina State University, is developing a model to forecast potential lionfish population growth in Atlantic waters.

Morris is studying both captive and wild-caught lionfish to establish basic information on lionfish reproduction, such as estimates of the number of eggs a female lionfish produces.

"These experiments have given us insight into the reproductive strategy of lionfish. This is new information that has never been documented before," says Morris.

Morris also is conducting feeding experiments to determine if there are any potential lionfish predators in the western Atlantic. "This question is important as the many factors that limit population growth are relatively unknown for lionfish," Morris says. Experiments also will help scientists find out what exactly the lionfish prefers to eat.

By forecasting the rate of population growth over time, scientists can assess the ecological impact of the lionfish invasion.

The data gathered by NOAA researchers will eventually help answer pressing questions about how lionfish interact with other fish species, like snapper and grouper.

For now, "What we see in the lab will definitely supplement what we see in the field," says Morris. □

## A DIVING DISCOVERY

Upon diving 130 feet to explore ghostly wreckage off the coast of North Carolina, Trish Boyer couldn't believe her eyes: "I thought, 'this can't be'."

Boyer had launched from the *Atlantis IV*, based in Atlantic Beach, to explore the stern section of the wreck of the *Naeco*, 40 miles offshore. On Aug. 10, 2000, in the midst of colorful sea anemones growing from the sunken tanker, Boyer, a visiting diver from Delaware, was credited as the first person to spot a Pacific lionfish off North Carolina.

Familiar with the lionfish and its colorful warning signs, Boyer knew not to touch. She had been planning a diving trip to Pacific waters and had done her homework — reading-up on fish native to the Pacific, especially the fish to avoid.

More surprised than frightened to see a lionfish near North Carolina, Boyer informed Renate Eichinger of Atlantis Charters. Eichinger was skeptical at first, but soon realized that there's no mistaking a lionfish's distinct markings.

Eichinger handed Boyer a disposable underwater camera — and the photos made national headlines. "Clearly this was the first of a chain of substantial events — it was terribly exciting," says Boyer.

Now, divers expect to see lionfish inhabiting North Carolina's shipwrecks. "It was kind of a little learning curve in believing that they're there — but now they're everywhere," says Eichinger.

Visit Atlantis Charters at [www.atlantischarters.net](http://www.atlantischarters.net), click on "Diving." — L. L.

## INVADING THE WEB

For more information on lionfish, visit [www.uncw.edu/nurc/](http://www.uncw.edu/nurc/). Go to "What's New" at the bottom of the page and click on the lionfish link to virtually board the *R/V Cape Fear* and check out the crew's daily research log.

To report sightings, go to <http://shrimp.ccfhrb.noaa.gov/lionfish/>. Or contact Paula Whitfield at 252/728-8714, [paula.whitfield@noaa.gov](mailto:paula.whitfield@noaa.gov).

## SEE FOR YOURSELF

The North Carolina Aquarium at Roanoke Island has lionfish on exhibit. The Fort Fisher and Pine Knoll Shores aquariums expect to have new exhibits with lionfish in 2006. For more information on the aquariums, go online to [www.ncaquariums.com](http://www.ncaquariums.com).



B y K a t h l e e n A n g i o n e

## CELEBRATING A CENTURY:

# The Life of Muzel Bryant

Vacationers on Ocracoke Island, lured by its pristine coastline and rich maritime culture, seldom notice the tiny, quiet woman who, at 100, is one of the island's most cherished and unique residents. On most days, friends and neighbors passing by her house will look for her sitting in her recliner, positioned just right to see through the storm door. A woman of kind heart and few words, she always returns a wave hello.

Meet Muzel Bryant, whose lineage on Ocracoke goes back to the Civil War. While history books were chronicling the resolve of the postwar American spirit, equally passionate and entrepreneurial African American families, such as the Bryants, often were left out of the story.

Muzel is a rare link to that near-forgotten past. "She's a treasure in Outer Banks history," says Walt Wolfram, a sociolinguist from North Carolina State University. Wolfram has studied Muzel's speech and her life for a decade. "She's the last living African American who was born and still lives on Ocracoke."

The first African Americans arrived on the Outer Banks during the early 1700s as slaves brought from Virginia and Maryland, according to Wolfram. By the Civil War, coastal North Carolina had a significant slave population, and more than 100 slaves lived on Ocracoke.

After the war ended in 1865, all of



TOP LEFT: Muzel Bryant, age 11 (1915). TOP RIGHT: Muzel, age 25 (1929). ABOVE: Today, at age 100, Muzel is one of Ocracoke's most cherished residents and an important link to Outer Banks history.

Ocracoke's former slaves left the island. The only two African Americans to move from the mainland to Ocracoke were Muzel's grandparents, Harkus and Winnie Blount.

No one knows why the couple chose the island, but there is some speculation that Winnie's former owner occasionally visited Ocracoke, according to Alton Ballance, a Bryant family friend. Ballance is the author of *Ocracokers*, a definitive work on the island's culture and history.

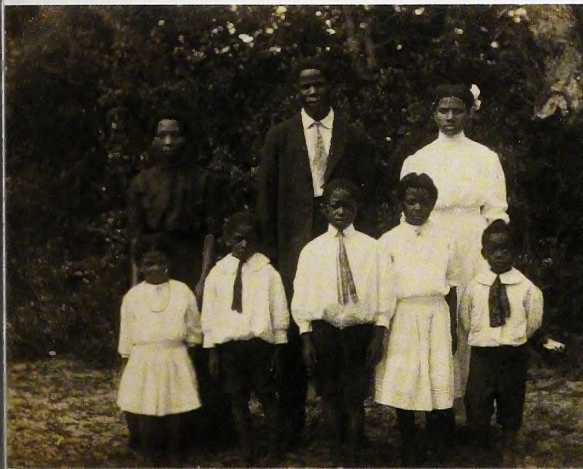
Like many island men, Harkus earned a living as a carpenter and a boat builder, while Winnie worked as a domestic. Few written

details about their life exist, but it was likely difficult. Of the couple's 12 children, only two — Annie Laura and Elsie Jane — lived to adulthood.

Elsie Jane married Leonard Bryant near the turn of the 20th century, and they chose to stay on Ocracoke. Between 1902 and 1924, they had nine children, including Muzel. She was born on March 12, 1904 — only 39 years after slavery ended and 50 years before the civil rights movement began.

"The connection over the century is just amazing," says Julie Howard, Muzel's friend and former next-door neighbor.





“As a small child, she remembered people sitting around talking about people that tried to fly,” says Muzel’s caretaker, Kenny Ballance, referring to the Wright brothers’ flight over Kitty Hawk in 1903.

Despite the astounding changes in technology, world politics and culture during her lifetime, Muzel takes things in stride. “Well,” she admits with a shrug, “there have been a lot of changes.”

### JUST LIKE FAMILY?

Growing up, the Bryant children may have seemed like any other group

celebrated Muzel’s 100th birthday last March, the party was held at the same school she and her siblings could not attend.

As Wolfram learned more about Muzel’s life on the island, he uncovered other, more subtle examples of those social boundaries.

At one time the island had a dance hall, he says, describing it as a simple wooden room with a record player and a few metal chairs. “When we asked Muzel if she used to go to the dance hall, she said she did,” he reports. “However, when we asked her if she liked to dance, she said she didn’t know because she had never gone in; instead, she stayed outside,

watching the others through the window.”

Those kind of educational and social boundaries, coupled with the isolation of island life, may explain why many of Muzel’s siblings left Ocracoke.

All of the Bryants’ nine children, except Muzel, Mildred and Julius, settled on the mainland, either in North Carolina or in northern states.

The youngest, John Thomas, moved to Elkin and was a chauffeur for the Reynolds family, of tobacco fame. Two of Muzel’s brothers, Lewis and Jeffrey, worked

for the U.S. Army Corps of Engineers, and her oldest brother, Artis, joined the Merchant Marines.

Muzel’s sisters were equally ambitious. Mildred worked in Washington, N.C., and Baltimore for nearly 15 years, returning to the island in the early 1940s. Mamie moved to Connecticut and later taught school in New York City, where she still lives with her daughter. Annie Laura lived in Washington, N.C., where she may have received some schooling, according to Alton Ballance in

*Continued*



TOP: Back row, from left: Muzel’s parents, Elsie Jane and Leonard with family friend. Front Row, from left: Muzel’s sister Mildred, brothers Lewis and Artis, Muzel and cousin. MIDDLE, LEFT TO RIGHT: Muzel’s sister Mamie, brother Artis, sister Annie Laura, and Muzel’s son Charles, who was born in 1925 and died in 1988. LEFT: Leonard Bryant, a sexton at the Methodist church, appears here with Ocracoke resident Doris Garrish.

of siblings as they played by the shore and “mommucked” their elders, a local term meaning “to irritate or bother.” And although many in the community felt they accepted the Bryants “just like family,” Wolfram discovered that certain social boundaries once existed between Muzel’s family and other Ocracokers.

“They didn’t go to school with the regular kids,” Howard says. “But the white kids their age would teach them.”

“And Mu’ was always very proud of the fact that she could read,” she adds.

Ironically, when the community





Ocracokers. She has since moved to a nursing home in Swan Quarter.

For most of her life, Muzel stayed on Ocracoke. She began working as a domestic at age 14, and her employers eventually included historic Ocracoke families such as the O'Neals, the Brags and the Ballances.

She never married, and she only changed her career and location once: During her late teens she worked for relatives in a restaurant in Philadelphia. She returned to the island at age 20, and has lived there ever since.

### A SPECIAL CONNECTION

Today, Muzel lives a quiet retiree's life with her 50-year-old caretaker, Kenny Ballance. His father worked alongside Lewis Bryant, one of Muzel's brothers, in the U.S. Army Corps of Engineers, and Muzel and her sister Mildred looked after Kenny Ballance and his siblings, Alton and Kathy.

Ballance and others on Ocracoke remember Mildred as the more outgoing and talkative of the two sisters. "She taught us to Charleston," he says, recalling dance lessons. "She was like a mother to us."

Although more shy than her younger sister, Muzel's presence was still felt among the community. She was known for her daily walks along the unpaved, sandy road near her house.

"We used to say she'd lurk in the bushes," Howard remembers with a smile. The road didn't have a shoulder, she explains, and Muzel had to walk at the edge, often obscured by overgrown bushes and tall oak trees.

"She used to walk up and down the street and watch who was coming," Howard recalls. People often stopped their cars or came out of

their houses to chat with her.

Howard remembers one particular gentleman who regularly came down the road to talk with Muzel. "We used to kid and say, 'oh, he's courtin' Muzel!'" says Howard. And many mornings, another neighbor would leave a newspaper in Muzel's driveway for her to read.

"She kept a real close connection to everybody, just by her presence out there," observes Howard.

But occasionally Muzel's walks turned more adventurous, remembers Ballance.

"I looked one day, and she was going down the road in an old weapons carrier!" he says.

Ballance and his friend were headed to the post office when they spotted Muzel cruising down the street. "I said... 'Wasn't that Muze that just went by in that old Army weapons carrier?'"

The owner of the vehicle, an employee at the old Coast Guard station, had seen Muzel walking along the road. "He stopped and put her in there ... and the two of them were going up the road!" says Ballance.

These days, Muzel doesn't go out walking as much. Shortly after Mildred died in 1995 at age 87, Muzel moved out of her family's house and in with Ballance. Given his family's history with the Bryants, taking care of Muzel seems only natural.



TOP: A traditional island road, similar to where Muzel would take her daily walks. BOTTOM, LEFT TO RIGHT: Winnie Blount, Muzel's grandmother, was a former slave. She died in 1925, and was believed to be about 100 years old. Elsie Jane and Leonard Bryant, Muzel's parents. They died in 1964 and 1960, respectively.





ABOVE: Kenny Ballance and Muzel Bryant. "When she was in her 80s, she was taking care of 90-year-olds," he says.

"It's been a struggle, ain't it Mu'?" he asks her playfully. "You having to look after me?" She chuckles and nods in agreement.

Muzel possesses a certain quiet politeness that seems rooted in a different era. She may ask a new visitor where he or she is from, or if they like the island. But that's about it. She only offers her thoughts when asked.

Even those who know her well won't catch her complaining about aching hips, stiff joints or the music kids listen to today. She exudes a calm happiness, one that accepts her age but refuses to let go of her character and self-sufficiency.

"You would never know she's about the house," says Ballance. "She's no problem at all."

Even as floodwaters seeped through their floorboards during Hurricane Alex in August, Muzel looked after herself when Ballance, who works for the National Park Service, got caught at work. "I couldn't get home — the tide came in so quick, and she was here through the whole hurricane by herself," he says.

## A NEW CENTURY

As Muzel's 101st birthday approaches this March, she is in better shape than many people decades younger. Her body is healthy, her mind is sound, and her cholesterol is lower than Ballance's — a fact he indignantly admits.

Her daily routine isn't much different than most senior citizens. After a bowl of Rice Krispies and a glass of orange juice, she enjoys reading the morning paper. "She looks to see if she or I are in the obituary column," Ballance quips. "If we're not, then the day goes on!"

When Muzel sits in her recliner or out on the porch, neighbors and friends offer greetings as they walk down the street. She sits up slightly and squints through her large, round glasses. Once she recognizes the passerby, she smiles and raises her small hand in a delicate wave.

During the rest of the day she likes to read, watch television and take naps, according to Ballance. And on Saturday nights, Muzel tunes into "The Lawrence Welk Show," courtesy of cable television. "Seven o'clock, like clockwork," says Ballance. "Don't miss it."

But the secret to Muzel's long life probably has more to do with her flexible spirit and sense of fun than her daily routine.

Next to her armchair sits a small shelf with dozens of brightly colored stuffed animals. "I have a lot of toys," Muzel says, motioning to her collection on the shelf. Near her feet sits Babe, a stout, brindle bulldog that Muzel says keeps her company during the day.

And Muzel hasn't forgotten how to have a good time: After her 100th birthday party, she celebrated with the crowd at the famous Howard's Pub until almost 2 a.m.

She simply outlasts people, notes Ballance.

"She's outlived everyone on O'cock!" ▣

## LINGUISTIC LESSONS

Although Muzel Bryant isn't one to chat the day away, she has made valuable contributions to linguistic research, says Walt Wolfram, a sociolinguistic researcher from North Carolina State University.

"Her speech has been very important in terms of our understanding of the development of African American English," he says.

An expert in African American dialects, Wolfram began studying the speech of Outer Banks residents nearly a decade ago. He soon saw a unique opportunity in Muzel Bryant, Ocracoke's sole African American resident.

Because Muzel rarely had contact with mainland African Americans, Wolfram wondered if her speech matched other Ocracokers, who, after centuries of physical and cultural separation from the mainland, had developed a distinct dialect known as the "Ocracoke Brogue." He discovered that her speech contained some elements of the local dialect, but it also reflected features unique to African American Vernacular English.

"To be perfectly honest," he reports, "this is not what we expected." A person's speech often assimilates to neighboring groups in certain syntactical ways, he explains, but Muzel's speech did not match this pattern.

Wolfram's interest in Muzel eventually went beyond dialect, however, as he saw her extraordinary connection to Outer Banks history. Earlier this year, one of Wolfram's graduate students, Andrew Grimes, began filming a documentary about Muzel. Grimes directed and produced the film, which chronicles her life through stories from friends and family, and features her 100th birthday celebration.

"We're doing this video as a preservation memento," says Wolfram. "We're interested in celebrating her life."

To order a video, visit [www.talkingnc.com](http://www.talkingnc.com) to fill out an order form. Cost is \$12, plus \$2 shipping and handling.



# At War in the Wetlands

By Pam Smith

There's a war being waged in wetlands.

The enemy — *Phragmites australis* — appears innocuous enough at first glance: With blue-green leaves and cane-like stems topped with purplish plumes, the tall marsh plants curtsy and dance in the breeze.

But the aesthetic deception ends at their "feet." These moisture-loving rhizomes and fibrous roots not only anchor the plant in place, but also branch out to reproduce exponentially. Even the smallest rhizome fragment can float away to regenerate itself in a new locale.

In just one growing season, dense growths can crowd out native vegetation and wildlife habitat — threatening entire aquatic ecosystems. *Phragmites australis* is particularly aggressive in low-salinity marshes and in wetland areas where salinity levels are lowered by human-induced changes.

LEFT: Kyle Hall is in full battle gear as he combats the spread of *Phragmites australis* in Kitty Hawk Woods Reserve.



Courtesy Kitty Hawk Woods Reserve



It's little wonder that fast-growing coastal North Carolina is a primary battlefield — and that state resource managers are raising a battle cry to halt the invasion.

Michele Droszcz, of the N.C. Coastal Reserve, says that combatting *Phragmites australis* requires a variety of strategies:

- recognizing the enemy;
- understanding its potential environmental impact;
- developing methods to eradicate or control its colonization in the coastal region; and
- finding resources to win the war.

Droszcz is site manager at Kitty Hawk Woods and Currituck Banks reserves in the northernmost reach of the coast. She is leading a research and outreach effort to deliver valuable information about *Phragmites australis* to the public, developers, resource managers and government agencies.

With the help of a grant from the Albemarle-Pamlico National Estuary Program (APNEP), Droszcz is partnering on a variety of fronts with staff from APNEP, the Rachel Carson Estuarine Research Reserve and N.C. Cooperative Extension.

A 2004 summer workshop drew participation from public and private sectors to learn the latest scientific data on *Phragmites australis*, to share experiences from the field, and to create an information-sharing network. A forthcoming brochure will target coastal landowners with identification and management tips.

The APNEP grant also is underwriting research at Kitty Hawk Woods to determine which weapons and strategies are most effective against the growing menace.

### Knowing the Enemy

Technically, *Phragmites australis* is not a new arrival to the plant realm in North Carolina, nor in North America for that matter.

"*Phragmites australis* likely was a minor component in North American wetlands for thousands of years," according to Alexander Krings, curator of the North Carolina State University Herbarium. "We know this from the accounts in floras from the 1800s and 1900s."

Floras are treatises on plants of a particular area or period. Such literature describes *Phragmites australis*, as "occasional," "not common," and "rare to occasional" in ponds and marshes from Canada to New Jersey.

Yet, by the 1960s, it had been recorded in nearly all U.S. states — and widespread enough in New England to be considered a "nuisance" in coastal and inland areas.

"Early speculations for the change included environmental and genetic causes, and raised questions as to whether habitat changes might be responsible," Krings says.

Certainly, he notes, the expansion of *Phragmites australis* parallels the loss of wetlands in this country. Between the 1780s and the 1980s, 53 percent of all tidal and nontidal wetlands in the United States were altered, filled or destroyed, according to scientific literature.

Still, scientists were stymied by the shift from peaceful coexistence of *Phragmites australis* to its "take-no-prisoners" dominance in wetlands.

Genetic studies would reveal some answers. Yale researcher Kristen Salstonstall collected leaf samples from 1997 to 2001 throughout the plant's North American and European range.

For genetic comparisons, she extracted DNA from fresh samples as well as historic herbarium specimens. When possible, fresh samples were collected from the same localities as herbarium specimens.

Her study shows that a non-native strain of *Phragmites australis* is responsible for the spread of the nuisance aquatic plant since the 1960s.

In a paper published by the National Academy of Science in 2002, "Cryptic Invasion by a Non-native Genotype of the Common Reed, *Phragmites australis*, into North America," Salstonstall writes:

*Results indicate that an introduction has occurred, and the introduced type has displaced native types as well as expanded to regions previously not known to have Phragmites australis.*

In fact, she concludes, native types of *Phragmites australis* have disappeared from New England — and may be threatened in other parts of North America.

*Continued*



*Phragmites australis*  
Common reed

Illustration provided by  
IFAS, Center for Aquatic  
Plants, University of  
Florida, Gainesville, 1996.



# NATURALIST'S NOTEBOOK

## Finding Solutions

The “cryptic invasion” discovery provides a scientific explanation of the aggressive characteristics of *Phragmites australis* in recent decades. But, resource managers are left with the daunting challenge to find effective and efficient counter attack methods.

The Kitty Hawk Woods research is a beginning volley.

“Some resource managers dealing with hundreds of acres of *Phragmites australis* have great resources to map and combat its spread,” Droszcz explains.

For example, many National Wildlife Refuges employ aerial spraying with a glyphosate herbicide late in the growing season, followed by prescribed burning or removal of dead stalks.

However, wide-scale spraying is not an option at reserves such as Kitty Hawk Woods because of the possible negative effects on environmentally important nontarget plants.

Instead, the APNEP-funded study is taking a smaller-scale approach, Droszcz explains. As a first step, Elizabeth Noble, director of the Remote Sensing Lab at Elizabeth City State University, helped map patches of *Phragmites australis* in Kitty Hawk Woods using Global Information System (GIS) technology.

As high-tech as it sounds, someone still must physically walk the marshes to locate the patches and send the positioning signals to the satellite using a hand-held device, Noble explains. Subsequently, the data is downloaded to a computer to overlay on available topographic maps with the same coordinates.

“It was no walk in the park for the student intern,” asserts Kyle Hall, the Elizabeth City State GIS technician working with Droszcz on the project.

Hall searched the scientific literature to learn about the various control methods being used in both large- and small-scale situations.

“There never has been a side-by-side comparison study done before as far as we can tell,” he notes.

For the study, he constructed a total of six 30' x 30' sections in dense patches of *Phragmites australis* to test six different control approaches:

- cut and burn;

- cut once at the beginning of the growing season;
- cut monthly to knee-height;
- mash down and cut below water level to “drown” canes;
- cut to the ground and cover with plastic to cut off sunlight needed for photosynthesis; and,
- cut and spray with aquatic herbicide.

“Some of the literature mention chopping the rhizomes, but we did not use this method because of the danger that pieces could float away and colonize in other areas,” Hall says.

So far, the monthly, multiple-cut approach is looking good, and the drowning is promising, he reports. Though the grant support has ended, Droszcz and Hall will continue the study through another growing season.

## Preserving Diversity

Nearby at The Nature Conservancy's Nags Head Woods, Aaron McCall also is combating *Phragmites* in patch-by-patch skirmishes. The machete had been his weapon of choice until recently when he switched to a gas-powered hedge trimmer.

For now, he is concentrating efforts in freshwater ponds filled with diverse aquatic species — including a rare water violet.

“You have to choose your battles,” says McCall, who has tried varied control methods from the cut-spray-remove thatch approach to the cut-and-drown approach.

“I haven't attacked a patch of *Phragmites* at the edge of the marsh (on the sound side), where it is acting as a buffer from wind and wave erosion. Removing it may cause more harm than good,” he explains.

Patches of the invasive aquatic plant were first detected in the pristine maritime forest about seven years ago. McCall has been on the front lines there for more than five years.

The Kitty Hawk Woods' staff has been waging the battle for about that long. “All control methods are labor intense and require diligent monitoring,” says Hall.

But with biodiversity of coastal wetlands, shallow sounds and productive estuaries from Corolla to Calabash at stake, finding a way to win the battle is an imperative. ■



**TOP TO BOTTOM:** *Phragmites australis* can overtake a marsh in a single growing season.

• The invasive plant's gnarly rhizomes branch out to reproduce exponentially. • Aaron McCall is combating *Phragmites* in patch-by-patch skirmishes at Nags Head Woods.

## For Further Information

• To order free copies of the APNEP-funded brochure, *Removing Phragmites, the Invasive Weed*, e-mail Michele Droszcz at [michele.droszcz@ncmail.net](mailto:michele.droszcz@ncmail.net).

• To order a copy of the North Carolina Sea Grant publication, *Invasive Aquatic and Wetland Plants Field Guide* (UNC-SG-01-15), send a check for \$15 to North Carolina Sea Grant, NC State University, Box 8605, Raleigh, NC 27695-8605.

Straatford Key

Straatford Key

Courtesy Nags Head Woods



# Marine Science Hands-On

*Elizabeth City State  
Expands Program*

*By Ann Green • Photos by Michael Halminski*

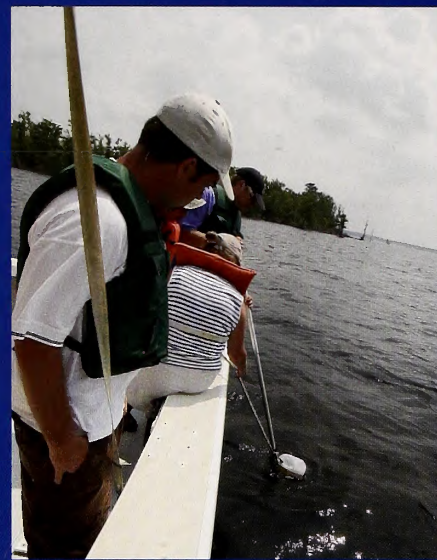
**A**s the *RV Hawk* stops in the middle of the Pasquotank River, Elizabeth City State University marine scientist Kathleen Fischer leans over the boat's edge and scoops up some dark brown water.

"We are getting water samples because the water contains tannic acid from the Dismal Swamp," says Fischer.

*Continued*







FROM LEFT: Kathleen Fischer, Francisco San Juan and ECSU student Matthew Woolard take a trial run on the R/V Hawk. ECSU student Sean Hankinson looks down at the Pasquotank River.

High amounts of acid can affect the concentration of dissolved metals that can, in turn, harm organisms that live in the river, she adds.

The sampling is part of a test run of the new Elizabeth City State University research vessel. Last spring, the National Marine Sanctuaries transferred the 29-foot vessel to Elizabeth City State. The Sanctuaries program is part of the National Oceanic and Atmospheric Administration (NOAA).

The ECSU Department of Geological, Environmental and Marine Sciences (GEMS) will use the vessel for habitat mapping and monitoring, as well as restoration research in waters of northeastern North Carolina and southeastern Virginia.

"We want to do more estuarine and wetland research," says Francisco San Juan, GEMS department chair. "The boat will help us with the research and allow undergraduate students to get first-hand experience conducting research. We also are trying to increase enrollment in the department."

### Skills Training

In 2000, ECSU began offering the Marine Environmental Science major with four enrolled students. Four years later, the program has increased enrollment to 19 students.

"At ECSU, there is a strong emphasis beyond book learning," says Fischer. "We are training undergraduates to get jobs in the state or federal government. They can work as technicians or go on to graduate school."

As part of the program, students master basic navigational skills, including tying knots, taking samples and learning about safety

issues. They also are conducting research on the boat and in the Dismal Swamp, where they use a half-mile boardwalk with an elevated observational deck.

"I have been fishing since I was 10," says ECSU freshman Sean Hankinson of Elizabeth City. "I wanted to study and be on the water — and also be close to home."

A water quality study involves the Pasquotank River and Albemarle and Currituck sounds.

"A lot of water quality research has been done in the Pamlico Sound," says Fischer. "Baseline information on water quality also is needed in northeastern North Carolina and in coastal Virginia, just to the north of the North Carolina state line."

Researchers are looking at agricultural pesticides in the watershed, as well as effluents or solids released by the reverse osmosis plant on the Pasquotank River. The plant pumps groundwater and then removes suspended and dissolved solids.

"We are looking for any traces of water that is saltier than the river water," says Fischer. "If the effluent water forms a pool or plume within the river water, then fish, plants and other organisms may avoid or not be able to live in those areas of the river."

### NOAA Support

Through the NOAA Environmental Entrepreneurship Program, ECSU is providing support to officials developing North Carolina's Coastal Habitat Protection Plan (CHPP), including using remote sensory technology to conduct research on wetlands, submerged aquatic vegetation (SAV) and water quality.

The entrepreneurship program awards grants to minority-serving institutions to help them attract underrepresented students in advanced academic study and to foster job opportunities in the NOAA-related sciences.

ECSU's partners in the habitat mapping project include the U.S. Fish & Wildlife Service (FWS), the Albemarle-Pamlico National Estuary Program and the N.C. Department of Environment and Natural Resources (DENR).

"It is a good program," says ECSU senior Reginald Bazemore of Windsor. "I have an overwhelming interest in the water."

Students are mapping and monitoring SAV habitats in Albemarle and Currituck sounds, Kitty Hawk Bay and Buzzard Bay, as well as in Back Bay in Virginia. SAV species include wild celery, redhead grass and widgeon grass.

SAV is a critical habitat for fish and shellfish, including red drum, speckled trout, scallops, clams and blue crabs. Fischer says that SAV needs clear water so that sunshine can reach the plants.

"With disturbance of the shoreline, you see increased turbidity," says Fischer. "The amount and health of SAV is a good indicator of water quality."

The data will be analyzed at the ECSU remote sensing lab, where aerial photography and spatial technologies such as Global Positioning Systems (GPS) and satellite imagery are being used to identify critical fish habitats in the Albemarle Sound and the Chowan River basin.

To give students a first-hand look at SAV, instructors took them in a blimp along the northern shore of the Albemarle Sound.





Woolard, Elizabeth Noble and Hankinson prepare to take water samples. • Noble and San Juan spend many hours aboard the vessel. • Fischer helps to dock the R/V Hawk.

“The students took several digital photographs that showed SAV beds in various locations along northern Albemarle Sound shorelines,” says Elizabeth Noble, director of the ECSU Remote Sensing Lab.

Preliminary results in Currituck Sound show that the most extensive SAV beds are in and around protected areas such as the Currituck National Wildlife Refuge, she adds.

State and federal officials will use the data in conjunction with the CHPP and other natural resources planning initiatives. CHPP — which will be presented to the N.C. General Assembly in the 2005 session — will provide protection for a variety of habitats, including wetlands, spawning and nursery areas.

### Salt Marsh Restoration

ECSU researchers also partnered with the NOAA Center for Coastal Fisheries and Habitat Research in Beaufort to monitor salt marsh restoration sites on the Newport River estuary in Carteret County. Built by the N.C. Coastal Federation, the sites incorporated stone sills and marsh plantings that serve as a natural buffer against wave energy.

“This was interesting work,” says Bazemore. “I had to count and measure a couple of thousand fish, including mullet, pinfish and spot.”

After sampling the restored salt marshes, the team found that finfish, crabs and shrimp frequently utilized the marshes where marsh grass had begun to colonize.

At the Kitty Hawks Woods Estuarine Research Reserve, students are monitoring the colonization of the invasive reed *Phragmites*

*australis* that grows along roadsides, ditches and dredged areas and forms dense stands that invade wetland communities.

“*Phragmites* is a hardy, aggressive colonizer and is challenging to eradicate,” says Noble. “Our students are assisting with different techniques to eradicate invasive species, including burning, flooding and spraying with a herbicide. We have found that sometimes a combination of methods work.”

A few miles from the reserve, students also used GPS to conduct vegetation surveys on the effect of development in several zones in Southern Shores. The areas included the fore dune — where sand accumulates above the high tide line — as well as sandy flats behind the fore dune, high dunes behind dune swales, a maritime forest and a marsh.

“The practice of clear-cutting lots is increasing, and native vegetation is being replaced by non-native landscaping that requires more water and fertilizer,” according to Heather Allen, a recent ECSU graduate who worked on the study.

### Vegetation Survey

Southern Shores residents realized that preserving native vegetation would help keep the town aesthetically pleasing, adds Allen.

To determine how the town’s landowners had used the property, students set up the following categories: unimproved lots that had not been built on and had natural growth; clear-cut lots with significant cleared vegetation; non-native lots with less than 40 percent native vegetation; and native lots that had a house and a lot of native vegetation.

From December 2003 to January 2004, the ECSU students found 614 unimproved lots, 477 non-native lots, 41 clear-cut lots and 1,766 native lots.

This baseline data will help the town of Southern Shores educate residents on the importance and ecological value of native vegetation to their community, says Noble. Also, the information can be used for future planning efforts, ensuring that the town preserves and protects as much vegetation as possible, she adds.

In the future, GEMS students will continue studying various aspects of the estuarine system in the Albemarle region, including invasive plant species. They also will collaborate with the University of North Carolina Coastal Studies Institute in Manteo.

To boost enrollment, the department is planning community outreach and science teacher training, says San Juan. A new degree program in earth and environmental sciences, with a minor in secondary education, also is proposed.

To expand students’ opportunities beyond graduation, Noble says they will continue to engage students in hands-on experiences in marine sciences and coastal ecology.

“The use of remotely sensed data and spatial technologies is an integral part of this effort,” she adds. ■

To find out more about the ECSU Department of Geological, Environmental and Marine Sciences, visit the Web: [www.ecsu.edu](http://www.ecsu.edu) and follow the links to academic programs. Or call 252/335-3375.





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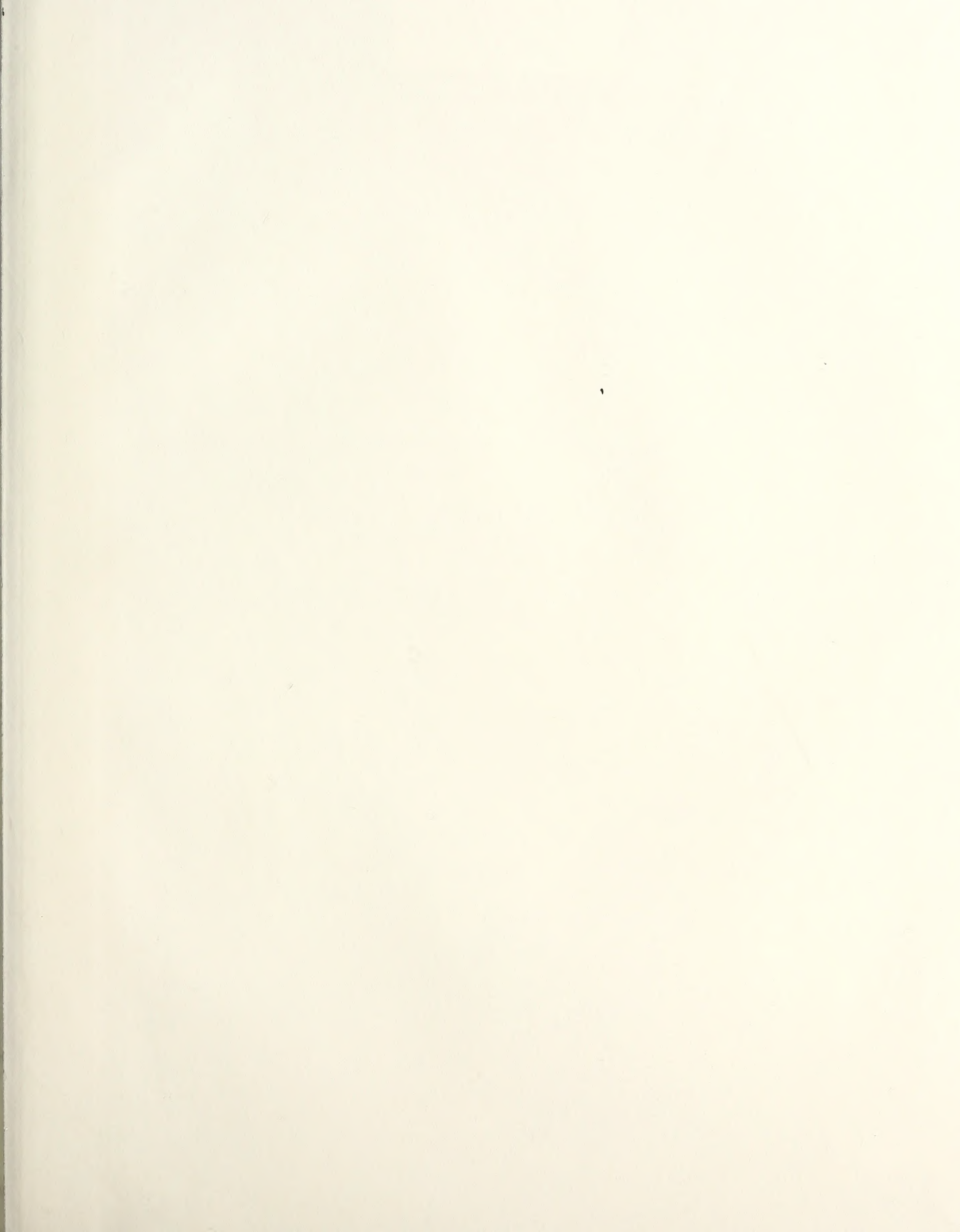














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