

COAST WATCH



EROSION—THE NEVER-ENDING BATTLE

WIND AND WAVES TAKE A BITE OUT OF BEACHES

The Bible warns people not to build a house upon the sand.

The seventh chapter of *Matthew* reads: "The rains came down, the floods rose, the winds blew and beat upon that house and it collapsed. And the wreck of it was complete."

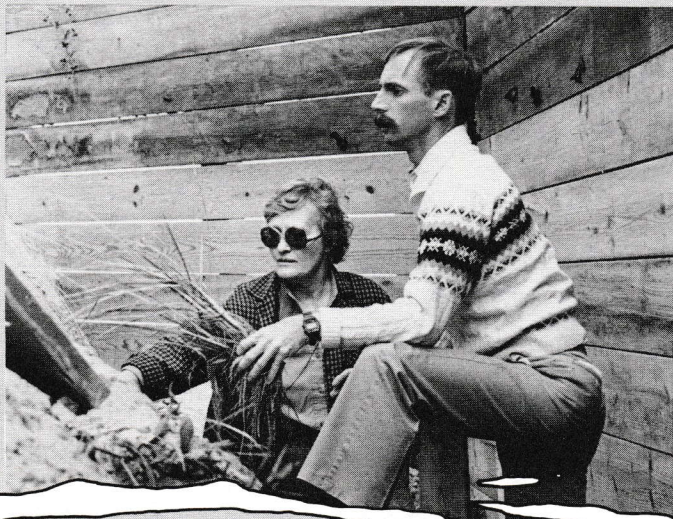
But people ignore this advice.

Lured by the beauty of the sea and the beach, people perch their houses and hotels near the ocean's sandy edge.

But on the first of January 1987 the rains did come, the ocean did rise and the winds did blow.

These forces beat upon the houses of coastal North Carolina. And one Long Beach residence collapsed; it was a complete wreck.

The Jan. 1 northeaster was a harsh reminder of this



Spencer Rogers

biblical parable. At Long, Kure, Carolina and Topsail beaches, the northeaster's lashing waves licked up vast quantities of beach sand, undermined the foundations of some houses and tore away the stairways, dune walks, porches and ground-floor walls of other ocean-front dwellings.

It was erosion at its worst.

Winter northeasters are notorious for hurling their erosive forces at the North Carolina coast. In fact, in recent years these storms have been more destructive than hurricanes, says Sea Grant researcher John Fisher, a civil engineer at N.C. State University.

As part of the Sea Grant research project, Fisher and another NCSU civil engineer, Margery Overton, are studying the effects of winter storms on dunes.

When the study is complete, the team will be able to plug information about a dune's size and a storm's intensity into a computer model and estimate the amount of dune erosion expected from a storm.

Fisher says dune erosion is based on several factors—the height of the tide, the magnitude of the waves, the size of the dune and the amount of dune vegetation.

The New Year's Day northeaster arrived on an astronomical high tide. The sun, moon and earth were aligned so that their gravitational effects combined to produce higher high tides and lower low tides.

Combine these high tides with a northeaster's strong onshore winds, which often clock in at 50 mph or more, and you get an eroding combination.

"Big winds make big waves, and big waves destroy dunes," Fisher says.

Erosion occurs as nature tries to strike a balance between water elevation, wave action and sand size, says Spencer Rogers, Sea Grant's coastal engineer.

by Kathy Hart

"You change one factor, such as the water elevation, and it's all out of equilibrium," he says. "The beach will then make adjustments to reach a balance."

During storms, waves suck beach and dune sand offshore and store it. After the storm, some of that sand will be restored to the beach. But other sand particles will be caught in longshore currents and carried parallel to the shoreline.

The result is usually a net loss of sand for the beach, Fisher says.

Besides their winds and waves, northeasters also possess an enduring quality. Rogers says these storms can park themselves off the North Carolina coast for days, battering the shoreline on high tide after high tide.

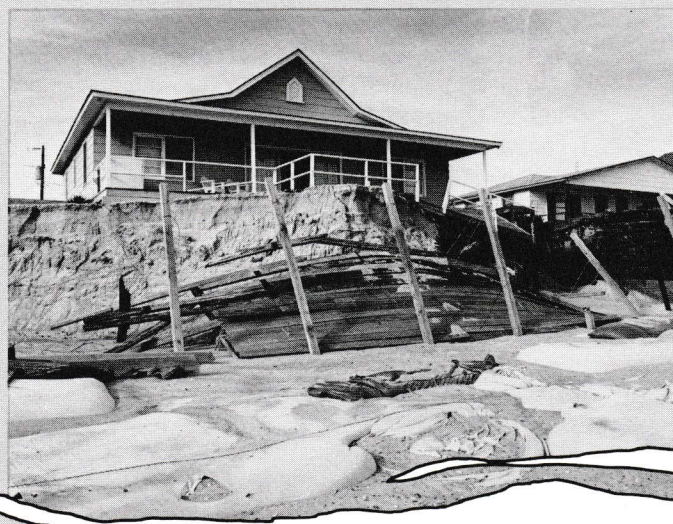
And exactly where these storms do the most damage depends on the orientation of the shoreline and the position of the storm.

The famous Ash Wednesday northeaster of the 1960s terrorized beach communities from the Outer Banks northward. But the two big storms of this northeaster season have wreaked havoc along the southeastern shore, particularly at Topsail and Long beaches.

Now many Topsail and Long beach homes, stripped of their dune protection, stand vulnerable to the next storm. To protect the homes, these communities have already begun beach nourishment and dune rebuilding projects (see story, page 5).

But these projects may only buy property owners a little extra time. These beaches will continue to erode, and storms such as northeasters and hurricanes often show where the erosion problems are most chronic, Rogers says.

Coastal resource managers estimate that the average



Photos by Scott Taylor

erosion rate for Tar Heel beaches is 2 to 3 feet each year.

Rogers says some areas are eroding at a faster rate; others, at a slower pace. And a few miles of the state's shoreline are actually building up, or accreting.

Scientists predict that the coast will continue to erode as long as sea level increases. Now sea level is rising at a rate of 6 to 12 inches each century.

But many scientists, including Fisher, expect that rate to increase.

Fisher says a combination of factors, including an increase in carbon dioxide levels and industrialization, will raise air and sea temperatures, melt portions of the polar ice caps and raise ocean levels.

"The rise in sea level is going to eventually magnify our erosion problems," Fisher says.

WHEN WINTER WINDS BLOW

by Kathy Hart

Meteorologists classify them as classic winter storms. Landlubbers know them as snow producers. But coastal folks call them as they feel them—"blows."

Whatever the name, northeasters are known along the East Coast as notorious winter troublemakers.

Along the southern coast, these low-pressure systems are laden with battering winds and rain. But as they sidle up the Eastern Seaboard, the rain often turns to snow—so much snow that occasionally it buries the nation's capital and halts air traffic from the Northeast.



Wayne Jones, a National Weather Service specialist, says there are three types of northeasters.

The first type moves from the Gulf of Mexico to the South Atlantic, typically close to Cape Hatteras. There, the storm draws strength from the warm waters of the Gulf Stream before hurling northward in a counter-clockwise swirl.

These systems are called Hatteras lows, and in 1984 a team of scientists assembled in North Carolina to study the formation of the storms. The \$7 million research program was funded by the National Science Foundation and the Office of Naval Research.

Another type of northeaster moves from the Great Lakes or the Ohio Valley to the southeastern coast where it intensifies and then tracks up the Atlantic Seaboard.

The third type of northeaster derives from a rare alignment of weather systems, Jones says. A strong high-pressure system in the Northwest combines with low pressure in the Southeast to make for strong northeast winds and higher high tides.

The early December northeaster that mauled Topsail Beach was of the third type, Jones says. But the New Year's Day storm was a typical Hatteras low.

Although the Jan. 1 storm caused a lot of coastal damage, Jones says the late January northeaster that dropped 8 to 20 inches of snow on western North Carolina was a more powerful storm.

The difference for coastal residents came in the tide levels. The Jan. 1 northeaster struck on an astronomical high tide; the latter storm did not.

Jones says the winter storm season, which typically lasts from fall to early spring, varies in its activeness from year to year. This year, an active southern jet stream has meant storm after storm has bombarded the East Coast.

EROSION REMEDIES

COASTAL COMMUNITIES STRUGGLE TO SAVE THEIR BEACHES

by Sarah Friday

Tony Caudle would just as soon forget last New Year's Eve.

While most of his friends partied up a storm, the Topsail Beach town manager prepared to fight one.

The rain, wind and waves from one of the worst northeasters of the decade threatened to wash his beach away.

And it did.

Topsail lost up to 60 feet of beach in some areas, and miles of dunes were flattened.

It was one more blow in the battle with erosion.

North Carolina's 320 miles of coastline face the problem daily.

In peril are millions of dollars of beachfront property and the state's coastal economy. Experts disagree on what can be done; some even ask if it's worth it.

"No matter what we do, it's not a permanent solution," Caudle says. The ocean continues to devour the shoreline like a giant with an insatiable appetite.

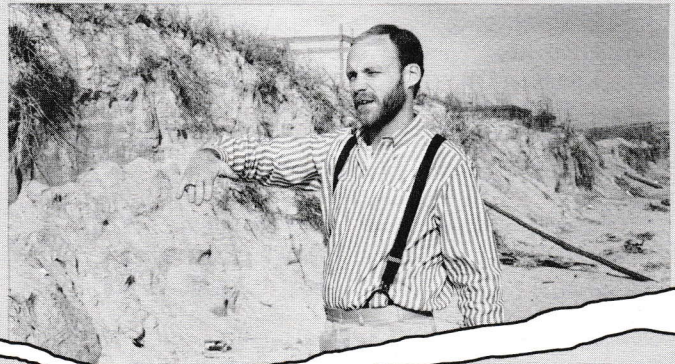
Three years ago, at the recommendation of Sea Grant's coastal engineer and Topsail's mayor, the town built dunes on the lowest end of the island to block the monster's bite.

The fortress worked during the first big northeaster in December. And just one section gave way Jan. 1.

Still, \$3 million worth of damages trouble the town.

But Topsail was just one of several beach communities that were hard hit by the storm. Damage estimates climbed to \$30 million for the North Carolina coast.

"Long-term erosion is a coastal problem we're going to have to deal with," says Spencer Rogers, Sea Grant's coastal engineer. "Erosion is not going to go away. It's not likely to be this bad every year, but it may be worse."



Tony Caudle

On the average, North Carolina loses 2 to 3 feet of beach each year.

If this trend continues, the N.C. Division of Coastal Management estimates 800 buildings will be destroyed or seriously damaged in 10 years. In 50 or 60 years, the number shoots to 4,900.

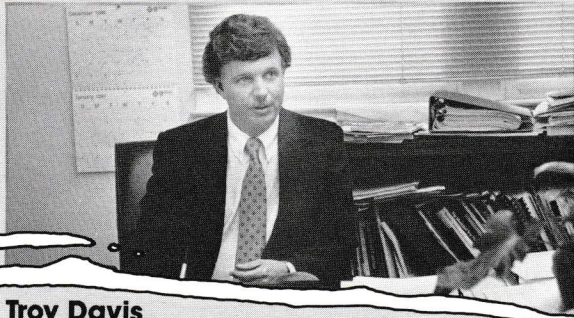
"It's something we're worried about constantly," Caudle says. "Before the storms, we had a moderate amount of beach we think the community enjoyed."

"Spencer (Rogers) says it will come back, that our beach will gradually reproduce itself," he says. "But I'm afraid if it doesn't come back we'll lose a lot of tourism dollars."

Tourism generates more than \$800 million in revenues in the 10 major tourist counties at the coast. New Hanover County alone collected \$178 million last year.

Fishing adds another \$200 million. And property owners contribute their own significant sums to the state's economy.

Continued



Troy Davis

The erosion threat keeps federal, state and local managers searching for ways to save North Carolina's beaches.

The state made one of its first moves in 1974 when it passed the Coastal Area Management Act.

Since 1979, new houses built near the beach must meet stringent setback standards. Regulations require homeowners to build behind a line 30 times the annual erosion rate. For larger buildings, it's 60 times the rate.

In addition, oceanfront property owners can no longer put up bulkheads, seawalls and revetments. Although these hardened structures sometimes help the immediate property, they often rob sand from the beaches on either side.

It's already happened in New Jersey. Little to no beach remains in towns such as Cape May and Asbury Park that erected bulkheads.

To help prevent such disasters, North Carolina aims its regulations at preserving beaches, not beach houses, says Dave Owens, director of the N.C. Division of Coastal Management.

The ultimate goal is "not to do anything in the short-term that will affect the long-term public use of the beach," he adds.

"In North Carolina, we have a tradition of high recreational use of our beaches," says Walter Clark, Sea Grant's coastal law specialist. "To allow this tradition to continue is to keep it in the public's hands."

The public owns the beach below the high-tide line in North Carolina. And in general, the dry sand beach above the line belongs to adjoining private property owners.

As the beach erodes, the high-tide line moves in and owners lose some of their private property, Clark says. In places with severe erosion, houses actually may be trespassing on the public's beach.

"The beach is always going to be there," Owens says. But the problem is the beach moves and development doesn't.

So the conflict between migration of ownership and public right continues. And it intensifies with increased development at the coast.

Many beachfront property owners think bulkheads and seawalls should be allowed. Or that federal flood insurance should help them pay to have their houses moved.

Not everyone agrees.

But, Owens says, "We still have some choices—the opportunity to protect our beaches and to use them in a reasonable fashion."

Spencer Rogers outlines the options in North Carolina.

Relocation

Historically, the most common effective erosion method for an individual homeowner has been to pick up a house and move it. The N.C. Coastal Resources Commission is urging local, state and federal management commissions to get involved in this.

Many residents have already moved. The cost varies, but averages \$15,000 (lot not included).

Beach Restoration or Renourishment

Rogers considers beach restoration the best long-term public structural solution. Huge volumes of sand are deposited in precise locations to build up the beach or restore it to its original state.

Restoration works well in low-erosion areas away from tidal inlets.

But it's expensive. And in high-erosion areas, the sand has to be replaced too often, Rogers says.

And most of the time, renourishment is "the treatment of the disease and not the cure," he adds.

Topsail Beach and Long Beach want to implement such projects, but the cost is prohibitive at \$1 million a mile. Most of the money towns have now for erosion control comes from a 3.5 percent N.C. accommodations tax.

Sand From Navigation Dredging

Sand often must be cleared from waterways in high-erosion areas like inlets. As sand is dredged, it can be pumped to eroded areas at little or no cost to the community.

Dredging projects are generally smaller and use less sand than renourishment projects.

But in some areas, it is not cost-effective. And often dredged sand is not coarse enough to build up the beach.

Temporary Erosion-Control Structures/Sandbags

When the foundation of a house is less than 20 feet away from the erosion scarp, residents can use sandbags. The 5-by-10, two-ton bags offer temporary help. But they often fail in severe storms. When bags are heavy and numerous, they can cause peripheral erosion.

Bulldozing

Most coastal towns use bulldozers to move sand to erosion-prone areas. Although bulldozing is relatively inexpensive, Rogers believes it is not effective.

"It just moves around the same sand that is already on the beach," he says.

Artificial Seaweed Or Similar Sandtraps

In theory, artificial seaweed acts as an underwater sand fence that builds sandbars. But tests in North Carolina, other states and Europe consistently have shown that it is ineffective in controlling wave-induced shoreline erosion.

Most of these options require a permit from the N.C. Division of Coastal Management. For more information, contact the division.

THE BACK PAGE

"The Back Page" is an update on Sea Grant activities — on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, NCSU, Box 8605, Raleigh, N.C. 27695-8605.



March is the beginning of crab-shedding season in North Carolina. It's a time for blue crabs to come out of their shells and for seafood lovers to savor the taste of these soft-bodied delicacies.

It's also a time when crabbers are busiest.

If you're thinking of starting a crab-shedding operation, you'll want to order *A Guide to Soft-Shell Crabbing*. Written by Wayne Wescott, Sea Grant's marine advisory agent in Mantoloking, the 32-page book is designed for the layman who is considering crab shedding. It includes sections on blue crab biology, identifying and handling "peelers," harvesting methods, shedding methods and more.

In addition to diagrams and illustrations, color photos depict the various stages of peelers. These photos enable the novice to recognize the subtle signs of a blue crab preparing to molt.

For a copy of *A Guide to Soft-Shell Crabbing*, write Sea Grant. Ask for UNC-SG-84-01. The cost is \$3.

Study a new marine environment without ever opening a book. Join Lundie Spence, Sea Grant's marine education specialist, for a teacher workshop in the Caribbean seaport of Belize.

July 4 to 11, participants can take a first-hand look at coral reefs, mangrove systems, grass flats and rain forests. And they can paddle a canoe, snorkel or swim in tropical waters.

The workshop, which is cospon-

sored by Sea Grant, is open to teachers from any state. The trip costs \$950 from Miami. For an application, write Spence at Sea Grant.



North Carolina's Albemarle / Pamlico Sound will be the national estuary of the month in April. In honor of the occasion, a group of politicians, state resource managers and scientists will speak to congressional staff members, national resource managers and the public about the Albemarle/Pamlico's importance.

The seminar will be held in the Herbert C. Hoover Building in Washington, D.C., April 9.

U.S. Rep. Walter B. Jones, chairman of the Committee on Merchant Marine and Fisheries; Secretary Thomas Rhodes of the N.C. Department of Natural Resources and Community Development; and Sea Grant Director B.J. Copeland will be among the featured speakers.

Others include William Hogarth, director of the N.C. Division of Marine Fisheries; John Costlow, chairman of the N.C. Marine Fisheries Commission; Michael Orbach, chairman of the N.C. Marine Science Council; Bud Cross of the National Marine Fisheries Service's Beaufort Laboratory; and Doug Rader, project director of the Albemarle/Pamlico Project.

Each month the Estuarine Program Office of the National Oceanic and Atmospheric Administration designates an estuary of the month.

For more information about the April seminar, contact Bud Cross at the National Marine Fisheries Service in Beaufort at 919/728-3595.

Seafood is a newcomer to the grocer's meat counter. And it presents some new and different marketing challenges for the retailer.

Initially, many consumers find seafood a little confusing because there are more species of fish and shellfish than other meats.

But a seafood counter attendant can use several marketing tools to alleviate the confusion.

One of those is a method Skip Kemp, Sea Grant's seafood marketing specialist, calls "seafood focus." Seafood focus is a continuous in-store promotion that features a precooked dish made from a particular species of fish or shellfish.

In Sea Grant's latest Blueprint, Kemp describes how to use the seafood focus to attract customers and increase sales. The Blueprint is designed primarily for grocers and seafood market retailers.

For a free copy, write Sea Grant. Ask for UNC-SG-BP-87-1.



Hard clam fishermen may have hit hard times in North Carolina. The recent increase in landings of this savory shellfish has triggered concern of potential overfishing. Fishery managers predict the problem will get worse unless a proper management policy is implemented.

To help decision makers understand the implications, three economists have compiled the report, *An Economic Analysis of a Potential Overfishing Problem: The N.C. Hard Clam Fishery*.

Yu-Mong Hsiao of Campbell University and Thomas Johnson and J.E. Easley Jr. of N.C. State University used 20 years of data to find that hard clams have not been overfished yet. But they did find that more fishermen and fishing resources are being used than are needed to generate maximum economic returns in the fishery.

For a copy of the report, write Sea Grant and ask for UNC-SG-86-11. The cost is \$3.50.

It takes more than a textbook for students to learn about the ocean.

That's why the Year of the Ocean Foundation recently funded a new resource guide for marine science teachers.

Continued on next page

Ocean Prospects: a high school teacher's guide to ocean-related topics lists curriculum guides, activities, books, films, periodicals and public and private organizations available to educators. Many of the materials are free.

Ocean Prospects also includes up-to-date information on the science, industry, recreation, careers, management and future of the ocean's resources.

For a copy of the 12-page booklet, send your name, address and \$1 to Sea Grant.

Doing a job well has its rewards.

Aug. 4 to 8, 20 high school students with winning aquatic science projects will travel to Rhode Island for the 1987 World of Water Awards.

World of Water recognizes students who have won state or regional science fairs exhibiting aquatic projects. Winners of the competition will be invited with their teachers to present their projects at the National Marine Educators

Association Conference at the University of Rhode Island at Kingston.

The group also will participate in activities related to modern marine science and learn about career opportunities.

Deadline for World of Water entries is May 1. For more information, write Vicki Clark, Mathematics and Science Center, 2401 Hartman Street, Richmond, Va. 23223.



Sea Grant Director B.J. Copeland and coastal law specialist Walter Clark will present papers at Coastal Zone '87, an international symposium on coastal and ocean management.

The symposium attracts about 1,500 decision-makers, professionals and citizens, representing over 30 countries.

Copeland will present a keynote address on the environmental problems of Albemarle and Pamlico

sounds. Clark will discuss water use zoning and its value in resolving coastal water use conflicts.

Coastal Zone '87 will be held May 26 to 29 in Seattle, Wash. The symposium is sponsored by the American Shore and Beach Preservation Association, the Coastal Zone Foundation, the National Oceanic and Atmospheric Administration and others.

For more information, contact Delores Clark, NOAA External Affairs, Rockville, Md. 20852. Or call 301/443-8031.

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