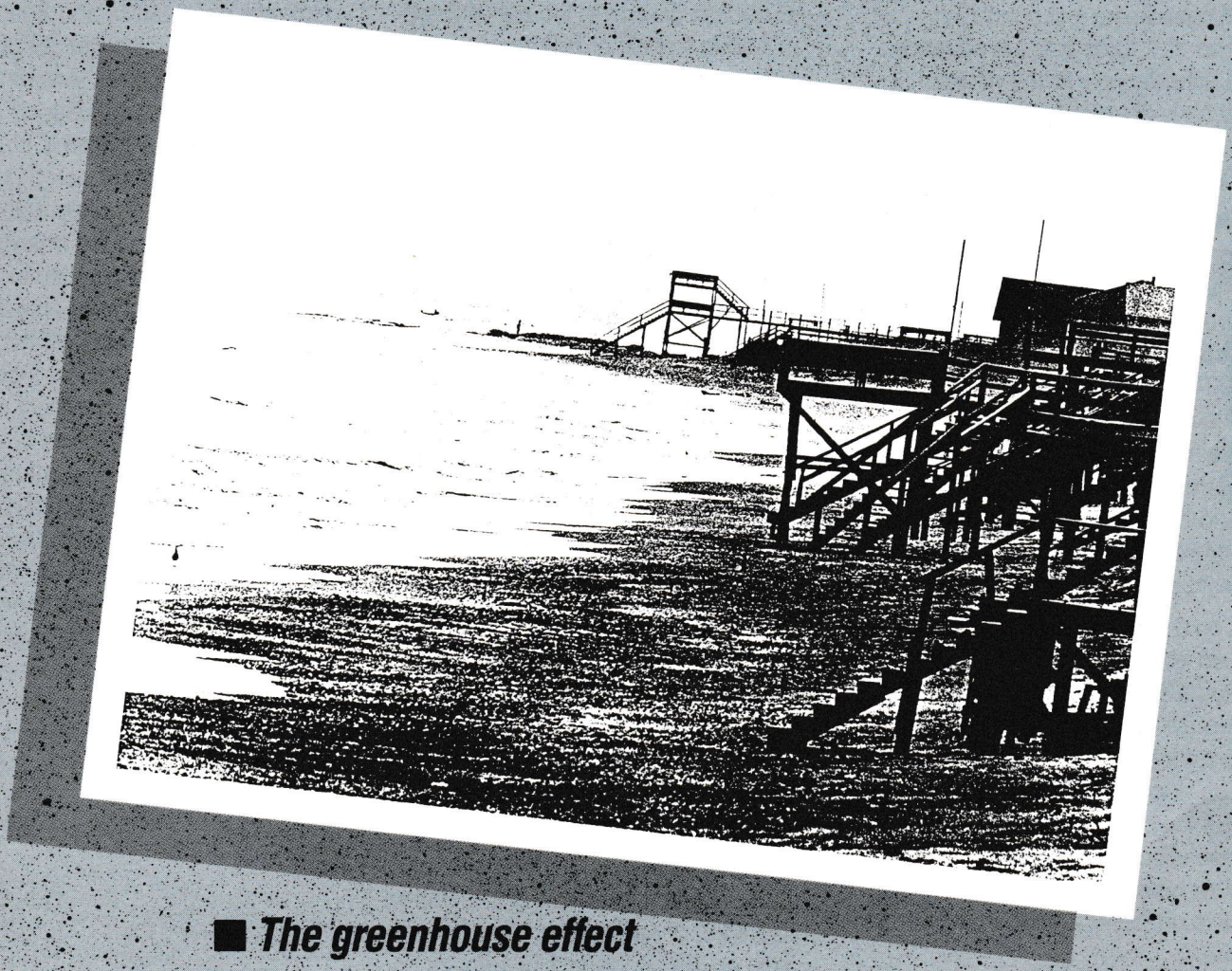
UNC Sea Grant August 1988

COASTWATCH

The heat is on



- The greenhouse effect
- Rising seas
- The North Carolina perspective

The greenhouse effect: Is it here?

BY NANCY DAVIS

Imagine the Earth as a giant laboratory.

In the past century, we've been conducting an experiment in our laboratory. We've burned massive amounts of coal and oil and pumped all the by-products into the sky.

We called our experiment the Industrial Revolution.

Now, the results of our revolutionary investigation are just coming in.

And as it turns out, the advances that ushered us into the modern age may have changed the world for mankind to come.

Consider the evidence:

- This year, 30 states had the driest spring in 50 years.
- This summer, the Midwest suffered through what may have been its worst drought since the dust bowl of 1934.
- The Earth's temperatures for the first five months of 1988 were the warmest on record.
- And if that's not enough, the four hottest years of the last century have been in the 1980s.

Could it be that the dreaded greenhouse effect is here?

Some scientists believe the evidence is mounting. Others are more cautious, suggesting the record heat may just be an aberration of weather patterns.

But they agree that if the greenhouse effect isn't already here, the record heat we're sweltering through now is probably a preview of things to come.

"The frightening thing is that 1988 is already known to be the hottest year in the recorded history of the earth," says Len Pietrafesa, a Sea Grant researcher and physical oceanographer at North Carolina State University. "This is a global phenomenon. You just can't ignore that."

The theory behind the greenhouse effect is simple.

Since the Industrial Revolution, the use of fossil fuels such as coal and oil, has dramatically increased the amount of carbon dioxide in the atmosphere.

Add to that other pollutants, such as methane, nitrous oxide and chlorofluorocarbons. The result is a collection of gases that blanket the Earth.

To make matters worse, we've chopped down much of the world's forests. And that just compounds the problem since plants help reduce the amount of carbon dioxide through photosynthesis.

The price we must pay for our automobiles, airplanes and smokestacks is life in a more intense greenhouse.

Under normal conditions, the rays of the sun warm the Earth, and Earth reradiates heat to the atmosphere. But some of the heat is retained in an opaque ceiling of gases around the globe. The ceiling acts as the glass roof of a greenhouse.

But the additional gases that we've dumped into the atmosphere are creating an even thicker ceiling of gases around us, trapping more heat in and allowing less heat to escape. Thus the greenhouse is getting hotter than it would otherwise.

The extreme example of the blanketing effect of carbon dioxide is Venus. With an atmosphere of 97 percent carbon dioxide, the planet absorbs 100 times the heat Earth absorbs.

Nobody expects the Earth to become another Venus. But according to estimates from the National Academy of Sciences, if the gases continue to build up around the Earth, we can expect a warming of 3 to 9 degrees Fahrenheit by the year 2050.

In testimony to a congressional committee, James E. Hansen of the National Aeronautics and Space Administration, said he was 99 percent certain that the current warming trend was caused by the buildup of gases in the atmosphere. Hansen is director of NASA's Institute for Space Studies.

If the greenhouse effect does take over, we can expect big changes.

The country's midsection will all but dry up. And the nation's breadbasket will shift north. Canada will become the biggest food producer in the world.

And the greenhouse effect will hit close to home. Paul Wilms, director of the N.C. Division of Environmental Management, predicts that by the year 2030, there will be a doubling of carbon dioxide levels in the atmosphere.

If that happens, temperatures in Raleigh would be higher than those of Dallas, Texas, today. Charlotte would be like Jacksonville, Fla. And the weather in the mountain city of Asheville would be more like that of Mexico City, Wilms

says in a paper he presented at a symposium in May.

And the Tar Heel coast? Well, it just won't be the same.

Wilms believes the most devastating greenhouse effect in North Carolina will be the accompanying rise in sea level. (See stories, pages 4 and 5.)

Warmer temperatures will cause polar ice caps to melt and will also warm the oceans, causing them to expand.

Unfortunately, experts say there is little we can do to hold back the impending greenhouse effect. Even if we stopped burning fossil fuels now, Wilms says, it wouldn't reverse the warming trend.

But that's no reason for complacency, he says. He believes we need to plan now for the possible effects of global warming. He advises reducing the burning of fossil fuels, replanting of forests and shifting agriculture to more heat-tolerant plant species.

"For the first time, we're seeing a phenomenon attributable to man's activities. . . and it may be irreversible," says Wilms.

The gases that we've dumped into the atmosphere are creating a blanket around the Earth. The blanket traps more heat in and allows less heat to escape.

Watching the water

BY NANCY DAVIS

Sea level has been rising for the past 17,000 to 18,000 years. It's part of a natural trend.

So what's new?

Plenty, says Stan Riggs, a geologist at East Carolina University.

Until now, we could attribute the steady rise to normal climatic changes that have occurred throughout the Earth's history.

But we've thrown another variable into the equation, Riggs says. And it's called the greenhouse effect.

Increased concentrations of carbon dioxide and other gases, the result of our burning massive amounts of fossil fuels over the last 150 years, are creating a warmer Earth.

Scientists say the higher temperatures, even if only a degree or two, will cause more melting of polar ice caps. And, as the ocean warms, it expands, causing an additional rise.

The result is an acceleration of an already rising sea level.

Riggs says the oceans have been rising at a rate of about one-half to three-quarters of a foot per century. And in the history of the world, sea level fluctuations are nothing unusual.

During one ice age, sea level was so low that much of the continental shelf was exposed. In warmer times, the polar ice caps melted and the oceans swelled. For example, about 5 million years ago the Atlantic Ocean reached slightly west of Wilson, Riggs says.

But the greenhouse effect adds a man-made twist to a natural phenomenon. So far, Riggs is hesitant to say whether we're already seeing a rise in sea level because of the greenhouse effect.

"This is all projection," he says. "From this point on, it goes into the realm of theory and models."

In the past few years, scientists have begun feeding data into mathematical equations to come up with estimates of if, when and how much sea level will rise.

Their science is still primitive. But preliminary projections don't look good.

For example, studies by the U.S. Environmental Protection Agency estimate that seas will rise between 4 and 7 feet by the year 2100. But some scientists predict the oceans could rise as much as 12 feet.

Riggs' projections are more conservative. He expects a 3-foot sea level rise along the coast within the next century.

But even with the most conservative estimates, the Tar Heel coast is in for big change, Riggs says.

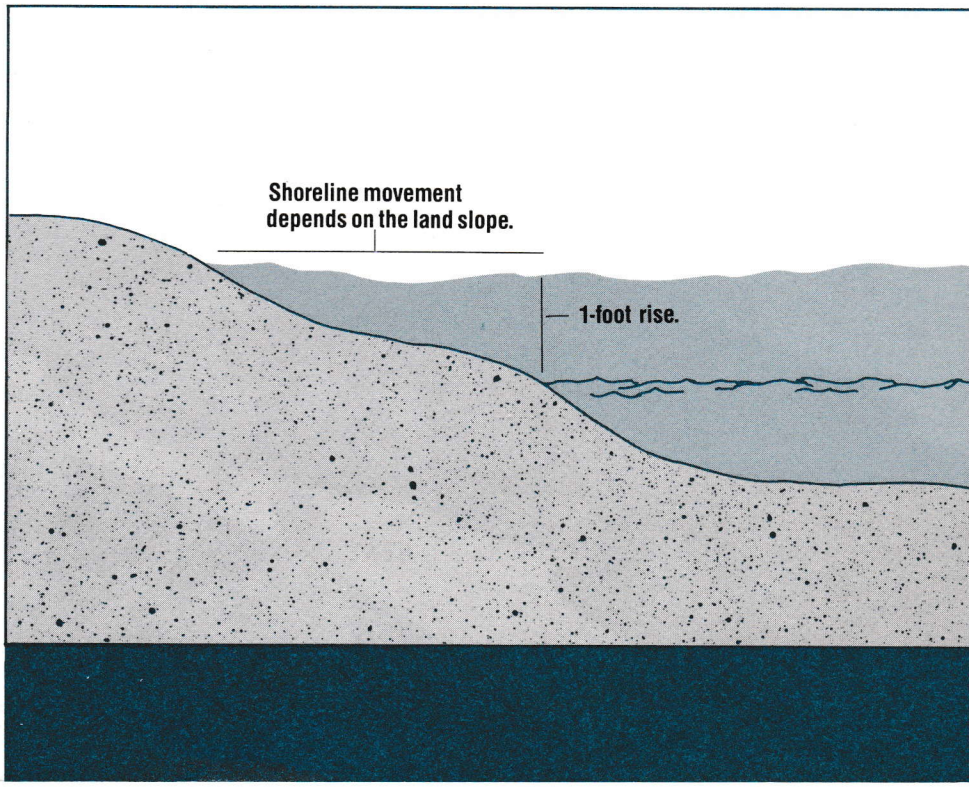
"North Carolina 400 years from now will have quite a different shape," Riggs says.

"This could have a significant impact on a state like North Carolina where a half a dozen of the coastal counties are just as flat as a pancake," he says.

Even a slight rise in the oceans could wreak havoc in coastal counties where much of the land is barely above sea level, says Len Pietrafesa, a physical oceanographer at North Carolina State University.

And just because sea level rises a foot, it doesn't mean it claims only a foot of land, he adds.

"The water level may be one foot higher, but that could mean in some places the movement of water could be as little as 1,000 feet inland or as much as 10,000 feet inland. And that's between one-fifth of a mile to 2 miles," Pietrafesa says. "Obviously that's not good."



North Carolina: A look ahead

BY SARAH FRIDAY

Paul Wilms, director of the N.C. Division of Environmental Management, has done some figuring to find out what might happen to coastal Carolina.

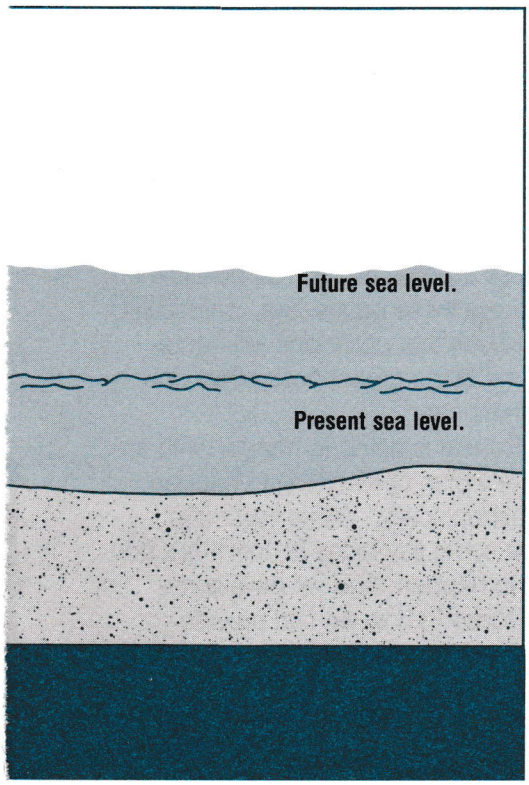
Using a 5-foot sea level rise as an example, he says 1.23 million acres in coastal North Carolina would be inundated, ranging from 6,000 acres in Chowan County to more than 260,000 acres in Hyde County.

Such a rise would disrupt nearly every aspect of life there, he says. (See story, this page.)

"This is an issue that can create mass hysteria," Pietrafesa says. "Property values at the coast could plummet."

Whether we'll see such changes in our lifetimes is anybody's guess, Pietrafesa says. He adds, "I'm a scientist. I never say I know until I really know."

Much of coastal Carolina is barely above sea level. Because of the gentle slope of the region, even a 1-foot sea level rise could claim many acres of land



Armor or retreat.

That's the choice people eventually will have to make at the coast if sea level rise continues, says Paul Wilms, director of North Carolina's Division of Environmental Management.

While scientists battle out the "when" of sea level rise, Wilms is studying the "where and how" for North Carolina.

He is part of a small clan of researchers and authorities who foresee major decisions for the state if the greenhouse theory becomes fact. As sea level rises, North Carolina's coastal farms, homes, bridges, wetlands and drinking water will be devastated, they say.

Others want to wait and see if it will happen at all.

Right now, eastern North Carolina lies like a long, flat road curving around the water's edge. The road makes up 320 miles of coastline and at least 3,000 miles of estuarine shoreline. And in 22 coastal counties, its elevations range from 100 feet above sea level to only a few feet.

If warming trends continue, Wilms estimates that 1.2 million acres of lowlands, swamps and marsh in North Carolina would be flooded with a 5-foot rise in sea level. Much more would be impacted.

Six counties at the coast would be hit the hardest, Wilms says. Three-fourths of the flooding would occur in Hyde (21 percent), Dare (17.5), Tyrrell (15.1), Carteret (7.5), Currituck (6.8) and Pamlico (4.8) counties.

There's no doubt sea level rise could cause significant environmental, economic and social impacts in North Carolina, Wilms says.

The environmental impacts of sea level rise are not bad, Wilms says. Nature has a way of bouncing back and adjusting to the changes. But the impacts on people pack a stronger punch.

As sea level inches up the back steps of an oceanfront home or fills in the pool of a beachside condominium complex, people will demand expensive sea walls, bulkheads, beach nourishment and other measures to save their investments.

"I'm convinced that the environmental impacts of mankind's response to sea level rise will be worse than the ecological impacts of the phenomenon itself," Wilms says.

"Vested interests will demand we have protectionist strategies," he says. "People who have built will demand it."

Eventually, each community must choose whether to build structures to hold back the sea or to retreat, Wilms says. Most likely they'll opt for protection in the short-term, he says, but they should have a long-term strategy to move back.

To Wilms, retreat is the only long-term solution.

His numbers suggest that 282,000 permanent residents in 18 of the 22 coastal counties would have to move if a 5-foot rise in sea level occurred. That's about 44 percent of the 1986 population for those counties.

Webb Fuller, Nags Head town manager, knows of the greenhouse theory and is aware of its possibilities, but he hasn't pulled out his bullhorn yet.

"Yes we're concerned about it." Yet, he adds, "There are a lot more pressing issues than to worry about some-

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A look ahead *continued*

thing that *may* happen in 2030."

"We're not doing anything about it. I don't think we can realistically do anything yet," Fuller says. "When we see more erosion, houses falling in, and more concrete research with rising sea level—it will then become an issue in the forefront."

Until then, we wait and speculate.

Along with flooding, expect the barrier islands to move west, and beach erosion and saltwater intrusion to increase, Wilms says. He figures 500 to 5,000 feet of beach would erode in North Carolina with the 5-foot rise.

Spencer Rogers anticipates other problems, too, with sea level rise.

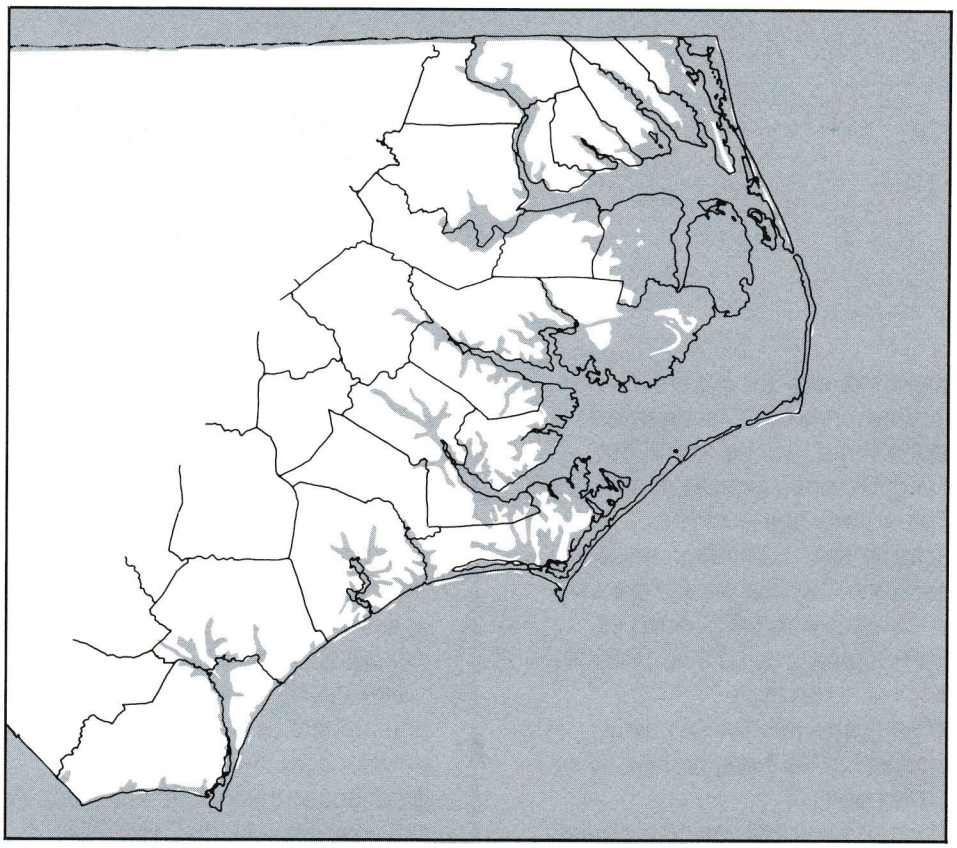
"One of the concerns is the effect on wetlands," says Sea Grant's coastal engineer. "Pamlico and Albemarle sound wetlands are seeing some of the highest erosion. As sea level rises, the wetlands will move into higher grounds. The area of the wetlands will go down," he adds.

With saltwater intrusion, the mixing zone—where the ocean and river meet—moves up the river. This could affect areas where communities draw fresh water and could change surface and groundwater levels, Rogers says. Plants and aquatic life accustomed to fresh water would likely be wiped out when the salt water moved in, he adds.

And it could mean a loss of thousands of acres of eastern North Carolina farmland.

Hyde County farmers have been battling the sea for decades. But in the past few years, an increasing portion of the county's farmland has been lost to saltwater intrusion.

About 60 to 70 percent of the county's farmers use tide gates or dikes to block salt water from flowing into ditches that drain most of their fields, says Daniel E. Smith, Hyde County's extension director. Without the gates, about half of the land would be useless.



Projected change in North Carolina's shoreline with a 5-foot rise in sea level

J.W. Spencer hesitates to blame the intrusion on the greenhouse effect. But like other Hyde County farmers, he can't deny sea level is rising.

"This greenhouse effect—if that's Mother Nature's course, you can't stop it," Spencer says. "You can slow it down, but you can't stop it."

But he adds, "Who's to say that the trend won't change. We can't predict it. Weathermen have a hard time predicting the weather one day to the next."

Fishermen, too, are watching the water. Wilms estimates that 65 percent of North Carolina's primary nursery areas will be lost with a 5-foot rise in sea level. Commercial fishing would be out, he says, but the industry may come back as new estuaries form.

Already, researchers in New Hanover County suspect sea level rise as a culprit in the death of gum and cypress trees along the northeast portion of the Cape Fear River.

One landowner there has watched tree after tree die as salt water pushes up the river. Researchers from the University of North Carolina at Wilmington and a team of specialists found that high salinity in the intrusive waters was the killer.

With the rise, sewage sytems, wastewater treatment plants, buildings, roadways, bridges, wharves and piers would need to be totally restructured, Wilms says. Disposal sites would become contaminated. And leeching of pollutants and toxics into groundwater and surface water would be enhanced by rising sea level.

Wilms would like to see the state devise a policy as soon as possible to address these issues. But, realistically, he knows that politicians will not respond to the greenhouse effect until it is imminent.

"Retreat is going to happen with an orderly plan or it's going to happen catastrophically," Wilms says. "We have some say today in how that's going to happen. And we have some say today in how we can provide short-term protection."

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.

The best deals in coastal real estate are not always the ones with the lowest price tags.

Most often, the best deals involve buyers and sellers who are informed of the risks, costs and regulations of owning coastal property.

To help buyers, sellers, developers and others weave through the maze of considerations, four state organizations will sponsor a series of workshops this fall.

Coastal Property Workshop: Planning, Constructing and Selling Barrier Island Real Estate will be held in four locations during September and October. (Details follow) It is sponsored by Sea Grant, N.C. Division of Coastal Management, N.C. Real Estate Commission and North Carolina State University's Department of Civil Engineering.

The all-day programs will help anyone interested in coastal property understand the environmental hazards, costs and ownership options involved in North Carolina. And they will take an in-depth look at the regulations that apply, such as building code standards, permit and condominium and time-share requirements.

Workshops will be held: Sept. 16, Raleigh, McKimmon Center; Sept. 30, Kill Devil Hills, Ramada Inn; Oct. 14, Morehead City, Crystal Coast Civic Center; and Oct. 21, Wrightsville Beach, The Blockade Runner.

Registration for each workshop begins at 7:30 a.m. Each runs from 8:30 a.m. to 5:30 p.m. The registration fee is $18 and is due one week before each workshop. Late registrants must pay an additional $5. The fee includes lunch, refreshments and workshop materials.

To register, call or write Brenda Miller, Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605. The number is 919/737-2454.

Sea Grant has published two more brochures in its seafood series. **Cracking into Crustaceans** (UNC-SG-88-01) provides illustrated instructions for cleaning shrimp, hard crabs and soft crabs. And **Breaking into Bivalves** (UNC-SG-88-02) gives illustrated methods for shucking oysters, clams and scallops.

The brochures were developed by Joyce Taylor, Sea Grant's seafood education specialist. Other brochures in the series include: **Hooked on Fresh Fish and Shellfish** (UNC-SG-85-08), which tells consumers how to choose fresh seafood; **Bringing the Catch Home** (UNC-SG-86-26), a guide for handling, preparing, transporting and storing fresh fish; **Dressing Finfish** (UNC-SG-86-10), an illustrated guide to cleaning the catch; and **Flaking Fish** (UNC-SG-87-05), which describes how to flake fish for use in other seafood dishes.

Each brochure is 50 cents. To order, write Sea Grant. Be sure to include the publication number for the brochures you are ordering.

Folks in Washington, D.C., feasted on fresh North Carolina seafood in May at the annual "Taste of the South."

The seafood, which was donated by the North Carolina seafood industry, was prepared by Joyce Taylor, Sea Grant's seafood education specialist. Jerry Schill, executive director for the N.C. Fisheries Association, presented the tasty treats to about 1,500 Capitol Hill staff members and young professionals with ties to Dixie.

At the Tar Heel table, they sampled North Carolina shrimp, crab claws, a seafood salad and a smoked fish spread.

Taste of the South is a fund-raiser for charities. This year, $25,000 was raised for The Lighthouse, a Louisiana-based educational enrichment center with a chapter in Charlotte.

If you fish in the state's northern coastal waters, Rich Novak could use your help. Novak, Sea Grant's marine recreation specialist, is working with the N.C. Division of Marine Fisheries to install a series of miniature artificial reefs in the waters off Oregon Inlet. And he wants recreational fishermen to let him know how they are working.

The reefs, called fish aggregating devices, are suspended in the water and serve to attract fish. They are installed in a series to form a trolling alley for recreational fishermen.

Novak will place one series of the devices about 7 miles southeast of Oregon Inlet. He believes that reef will attract king and Spanish mackerel.

Another series of the devices will be located about 35 miles southeast of Oregon Inlet. He believes that the reefs will attract king and Spanish mackerel.

If you're planning to fish in the area, Novak will trade you directions to the reefs for your catch data. Call him at 919/473-3937.

Discover the best of the beach at the fall conservation retreat sponsored by the N.C. Wildlife Federation Oct. 6 to 9.

The weekend retreat in Atlantic Beach combines fun activities with educational programs for adults and children. Learn to surfcast for a sea trout, grill a grouper or marvel at a marsh. Or listen to tales of folklore or a talk on coastal land management.

Classes will be held in the morning. Afternoons are free, then evenings

Continued on next page

offer stargazing, free time or social activities.

Field trips such as an offshore cruise or a trip to the N.C. Aquarium will also be available.

Group rates are $55 for doubles; $50, single at the Holiday Inn in Atlantic Beach. For reservations, call 919/726-2544. For more information on the retreat, write the Wildlife Federation at P.O. Box 10626, Raleigh, N.C. 27605. Or call 919/833-1923.

Coastwatch is published monthly except July and December by the University of North Carolina Sea Grant College Program, 105 1911 Building, Box 8605, North Carolina State University, Raleigh, N.C. 27695-8605. Vol. 15, No. 7, August 1988. Dr. B.J. Copeland, director. Kathy Hart, editor. Nancy Davis and Sarah Friday, staff writers.

Coastwatch is a free newsletter. If you'd like to be added to the mailing list, fill out this form and send it to Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605.

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