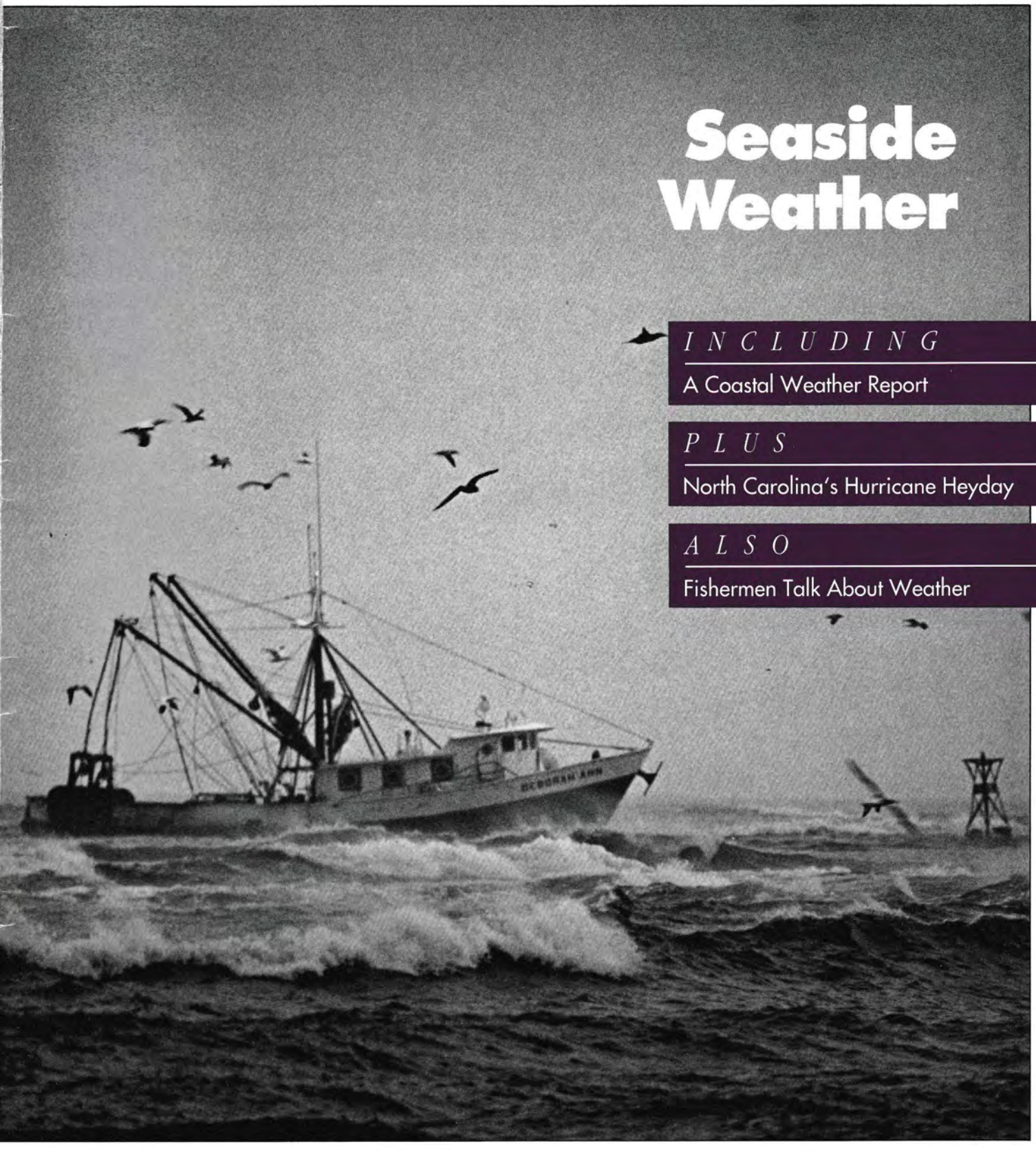
Coastwatch

UNC Sea Grant September/October 1991



Seaside Weather

INCLUDING

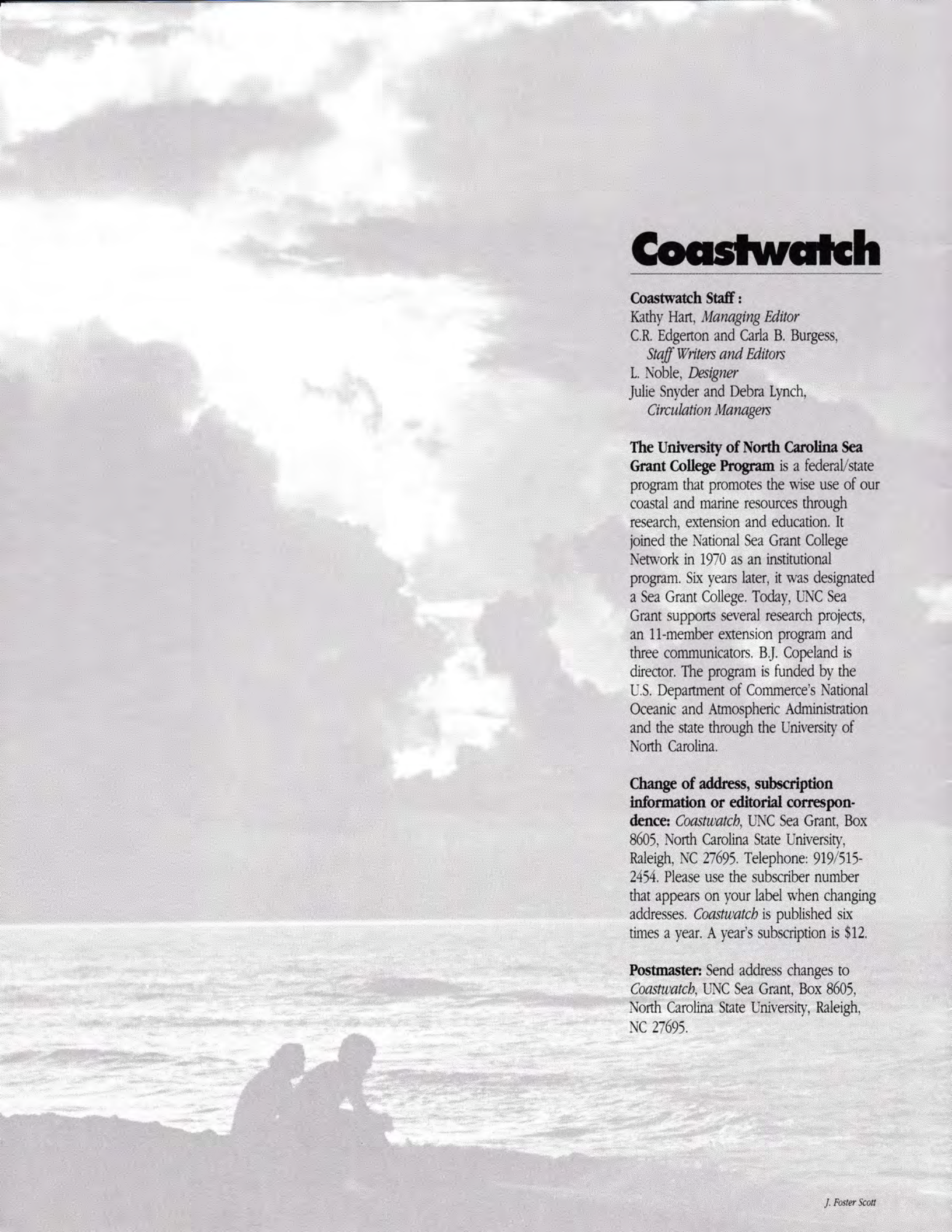
A Coastal Weather Report

PLUS

North Carolina's Hurricane Heyday

ALSO

Fishermen Talk About Weather



Coastwatch

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J. Foster Scott

From The Top

Dear Readers:

Welcome to the world of weather. This month, *Coastwatch* concentrates on the weather patterns and events that have, on occasion, literally shaped the North Carolina coastline.

In our first story, I'll tell you why the weather makes for more than just passing conversation along the Tar Heel coast. Waterspouts, northeasters and hurricanes can threaten the lives and property of those who live, work and play along our shoreline.

Then C.R. Edgerton will look back to the 1950s, when six hurricanes came to call on North Carolina within 13 months. These ladies, the most notorious of whom was called Hazel, wreaked havoc in coastal counties.

What effect does the weather have on recreational and commercial fishing? Carla Burgess got the scoop on the topic of weather and fishing from the experts themselves. And in talking to longtime coastal residents, Burgess got an earful of colorful weather sayings to pass along to you.

We hope you enjoy this issue.

See you next issue,
Kathy Hart

In This Issue

Winds, Rains and

By Kathy Hart

Put two people together anytime, anywhere and the conversation will always turn to the weather.

"Hot enough for ya?"

"Say, that was some storm we had last night."

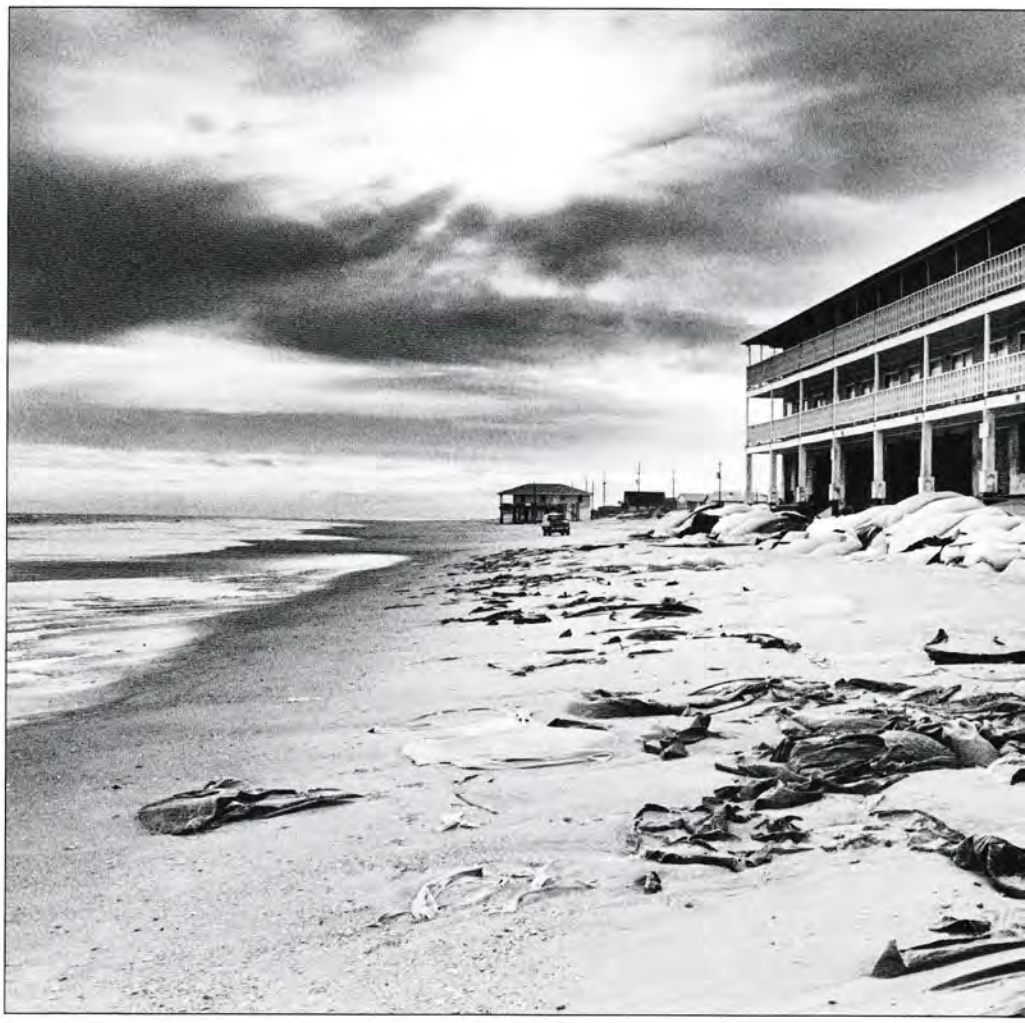
For landlubbers, weather talk is just a way to make idle conversation. Only on rare occasions does it affect their lives or their property.

But it's a different story along the coast.

Along this edge between the land and sea, the weather can take on an ominous, more life-threatening significance.

From June until November, the threat of hurricanes hangs over the heads of coastal folks like the impending dread of bad news. And as soon as the door is closed on hurricane season, it's time for nor'easters to come calling.

These active and sometimes violent coastal weather patterns are enough to keep forecasters hopping.



Summer Thunderstorms and Waterspouts

In the summer, the coast is subjected to what Al Hinn calls the "sea breeze effect." Hinn is a meteorologist at the National Weather Service's Wilmington office, and he's had 16 years experience forecasting coastal North Carolina weather.

During summer, the warm, moisture-laden sea breeze blows westerly from the ocean toward inland counties. About mid-day, the moisture starts to form swelling clouds over coastal counties.

By afternoon, the breeze has picked up speed, adding increasing amounts of moisture to the building clouds, which heighten to thunderstorm proportions. By evening, they often begin their march to the sea.

Those caught in their paths may experience thunder, lightning, heavy downpours and an occasional tornado. As a result of the mid-summer heat and humidity and the sea breeze effect, July is usually the wettest month of the year for these coastal counties.

During the night, the thunderstorms move offshore only to regenerate over the Gulf Stream. Hinn warns that evening hours nearshore and daybreak near the Gulf Stream are often dangerous times for offshore boaters and fishermen.

Occasionally the storms formed by the sea breeze effect or those associated with a passing cold front spawn water-

NOAA National Weather Service

A waterspout.

Along this edge between the land and sea, the weather can

Hurricanes

Scott Taylor

spouts, or tornadoes over water.

Waterspouts come in two types: those associated with severe thunderstorms and those that form in very instable atmospheric conditions in the fall.

Severe thunderstorm spouts often start over land as true tornadoes and then move over water. They come complete with sinister, snake-like funnels, enormous overhead clouds and a frenzied roar of rapidly rotating winds. Sometimes they whirl across the ocean's surface for more than an hour.

The cold-air spout forms only over water, developing as spiraling funnels from low clouds near the sea surface or from showers. They are usually small and last from two to 20 minutes.

Hinn says that waterspouts are most prevalent along the Tar Heel coast in the fall when very warm water temperatures contrast with cool air temperatures. The warm air rising off the water and the cool air descending from above can be set into a circular motion by the earth's rotation.

Waterspouts can be dangerous, Hinn says. Any boat caught in the twisting funnel can be torn apart by strong and shifting winds. If boaters spot a waterspout, they should determine its direction. Hinn says, and then move at right angles away from the whirling funnel.

Northeasters

From late winter until early spring, coastal residents anticipate the arrival of northeasters with the same dread they feel for the arrival of their least favorite relative.

Like the unwanted guest, these winter storms come on strong, stay too long and leave destruction in their wake.

Northeasters are counterclockwise rotating low-pressure systems that travel northward along the Atlantic Seaboard. They are frequently laden with battering winds, driving rain or snow, and lashing waves that can lick up vast quantities of beach sand.

Northeasters are notorious for hurling their erosive forces at the North Carolina coast. In fact, in recent years these storms have been more destructive and costly for our coastline than hurricanes.

Besides their winds and waves, northeasters also possess an enduring quality. These winter storms can park off the coast for days, battering the shoreline on high tide after high tide, says Spencer Rogers, Sea Grant's coastal engineer.

And 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 communities along the Outer Banks. But the New Year's Eve northeaster of 1987 wreaked havoc along the southeastern shore.

Three types of northeasters travel North Carolina's offshore waters.

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.

These systems are called Hatteras lows, and in the 1980s, a team of scientists assembled in North Carolina to study the formation of these famous storms.

Researchers from North Carolina State University's Department of Marine, Earth and Atmospheric Science played a major role in the study. And now their research is paying off in the design of models that will help forecasters predict the notorious winter troublemakers (see Field Notes, page 17).

Another type of northeaster forms when a strong low pressure system in the Great Lakes or the Ohio Valley transfers its energy to a developing low-pressure system along the Mid-Atlantic coast.

The third variety of these winter storms derives from a rare alignment of weather systems. A strong high-pressure system in the Northeast combines with low pressure in the Southeast to make for strong northeast winds, building waves, rough seas and higher high tides.

Northeaster activity along the Tar Heel coast varies and depends on the presence of an upper level trough of low pressure over the Southeast and the position of the polar and subtropical jet streams.

Hurricanes

From Currituck to Calabash, coastal populations are burgeoning. Most of the newcomers are true-blue landlubbers who never hung a gill net, cleaned a crab or experienced a hurricane.

take on an ominous, more life-threatening significance...

Continued on the next page

They don't know what it's like to look a Hazel or a Hugo in the eye; what it's like to be lashed by winds of 120 mph, battered by waves more than 15 feet tall or inundated by a storm tide that exceeds 12 feet; or what it's like to drive away from a home of possessions and memories knowing they might not be there tomorrow.

But this lack of experience with hurricanes isn't limited to North Carolina. All along the East and Gulf coasts, officials with the National Weather Service are working to educate the growing number of transplanted inlanders about the hazards of hurricanes.

In North Carolina, it isn't just new seaside residents who need an education. Many long-time coastal dwellers don't have much knowledge of these ferocious storms either.

Since the 1950s when Hazel and her sisters came calling (see story, page 6), hurricanes have shied away from the Tar Heel coast. During the last decade, Diana played tag with the southern coast in 1984, Gloria brushed by the Outer Banks in 1985, Hugo spread its fringe effects into Brunswick County in 1989 and Bob skirted by Cape Hatteras in 1991.

But Bob, Gloria and Diana certainly weren't in the same class of hurricanes as Hugo, Hazel and Camille. These catastrophic storms are among the 12 most costly and deadly storms of the century.

Hugo and Hazel were what the weather service classifies as Category 4 storms. Their winds ranged from 131 to 155 mph, and their storm tides, or surges, reached 13 to 18 feet.

Camille, which came ashore along the Gulf Coast in 1969, was one of only two Category 5 hurricanes to strike the United States this century. Her winds exceeded 155 mph, and the storm surge measured more than 19 feet.

If a storm of Camille's magnitude struck the Tar Heel coast, the majority of the barrier islands would be under several feet of water, says Rogers.

But luckily, storms that size don't occur often. During an average year, 12 tropical disturbances become tropical storms and receive the dubious distinction of receiving a name. Four of these storms will become hurricanes, and one of the four will become a Category 3 or higher storm, Hinn says.

Oddly enough, weather patterns in Africa may play a key role in affecting hurricane activity in the United States.

If rainfall amounts are above normal in Africa, then weather patterns favor the formation of tropical waves across the continent. These waves become imbedded in the westward-blowing tradewinds and, under certain conditions, intensify to become hurricanes in their trek between Africa and the Caribbean, Hinn says.

"By and large, most of the hurricanes that have struck North Carolina developed between the Leeward Islands and the Bahamas," Hinn says. "The exceptions were Hazel in 1954 and Donna in 1960."

Hinn adds that the Outer Banks are the most likely target for these tropical cyclones. Including Bob, 23 hurricanes have left their mark on the Outer Banks this century, but only nine have tangled with counties south of Carteret.

Hinn attributes the difference to the shape of the North Carolina coast. Because Cape Hatteras juts eastward into the Atlantic, it's more likely to be clipped by these northbound freight trains of atmospheric energy.

Although close calls by hurricanes such as Bob and Gloria are not to be scoffed at, they're nothing like a direct hit from a storm traveling perpendicular to the coastline, Hinn says.

Take Hugo for example. It struck the South Carolina coast head-on. And that means the storm's strongest sector, the right front quadrant, slammed ashore from Folly Beach to Brunswick County. Not surprisingly, these were the areas that sustained the most damage.

Hinn says the right front sector tends to be most severe because the energy from both the hurricane's forward and rotating motion are concentrated there. In contrast, the left front sector poses the least threat. The wind direction in this area is mostly offshore. That's why Bob's passage east, instead of west, of the Outer Banks meant good news.

NOAA / National Weather Service

NOAA airplanes fly into the eye of a hurricane.

A tropical storm becomes a hurricane when its maximum sustained winds exceed 74 mph. The winds blow in a counterclockwise spiral around a calm center — the eye of the hurricane.

The winds within this whirlwind spiral at a faster and faster rate as they near the hurricane's center of low pressure. The fastest winds, those within the wall cloud surrounding the eye, can easily gust to more than 200 mph.

Although a hurricane's winds are a force to be reckoned with, they are one of the least destructive aspects of these cyclones. It's the storm surge that causes the most damage to structures and nine out of the 10 deaths associated with hurricanes.

The storm surge is the rise in water level that occurs as the hurricane moves ashore. It does not include the waves that ride atop it.

If a storm of Camille's magnitude struck the Tar Heel coast, the majority of the

Arrows show where hurricanes have made landfall in the last 105 years.

This dome of water, which can exceed 15 feet, can submerge low-lying tidal areas. It can undermine houses by scouring away sand. And it can pull at walls, pilings and foundations, causing them to collapse.

Riding atop this surge are hurricane waves that can reach 15 feet in height.

But that's only half of it.

Water weighs about 1,700 pounds per cubic yard. Throw that weight against a building over and over, and you have a nature-made hammer that can demolish any structure not specifically designed to withstand such force.

And there's more.

Hurricanes can drop six or more inches of rain in a matter of hours over the areas they pass. The resulting floods can cause major property damage and loss of life even to inland areas miles from where the hurricane made landfall.

Diana, a rather mild Category 2 hurricane, pelted Wilmington with 15 1/2 inches of rain over three days in 1984, Hinn says. The one-two punch of heavy rains and strong winds uprooted trees that fell on houses, cars and other valuable possessions. By the time agricultural damage was added to property losses, Diana ran up bill of more than $70 million.

With so much to lose in property and life, it's easy to see why the weather service's National Hurricane Center in Miami has developed sophisticated equipment to track these killer storms.

The day has passed when a hurricane could develop and go unreported until it slammed ashore. Satellites, weather reconnaissance planes and radars track hurricanes from their conception to their landfall to their final dying gasp.

By using all the means at its disposal, the weather service attempts to predict the path of these erratic tropical cyclones and adequately warn coastal communities of impending danger.

Forecasters issue a hurricane watch when a storm may threaten an area within 36 hours. The area under the watch may be extensive since the location of the hurricane's landfall is uncertain. Residents in these areas should take preparatory action and stay abreast of the storm's progress.

A hurricane warning is issued when the cyclone is expected to strike within 24 hours. The area under a warning is smaller because forecasters can now narrow the possible location for landfall.

When warnings are posted, residents and visitors along the beachfront, in low-lying areas or in mobile homes should leave. If local and state officials ask for evacuation, everyone should go.

The weather warning system works. The death toll in the United States from hurricanes has decreased as the weather service's warning ability has improved.

But hurricane forecasters are worried that the time schedule for warnings and watches may not be enough to safely evacuate an ever-increasing population of coastal residents over bridges, roads and highways not designed to meet evacuation demands.

The alternative of offering greater lead times for evacuation is equally wrought with problems.

Long-range forecasting for the landfall of these great storms is still uncertain, despite improvements in technology. To give more time for evacuation would mean that hurricane warnings would have to apply to larger chunks of coastline — much of which may never feel the effects of the storm.

And forecasters know that the public will not continually evacuate when, in fact, no storm comes ashore.

That's not to mention the costs of hurricane preparation. Officials with the weather service estimate that advance preparation — boarding up homes, closing down businesses, losing sales and sending tourists home — can cost a coastal community millions of dollars.

With sums like that, coastal communities can't afford to prepare often.

So to avoid being compared to the boy who "cried wolf," the weather service is standing by its present system of hurricane watches and warnings. But they're striving harder to educate the public about the dangers these great storms pose.

And the education won't be a minute too late. Increased development and population growth have made the coastal sections of the United States more vulnerable to hurricanes than ever before.

barrier islands would be under several feet of water...

The Year

By C.R. Edgerton

Milton Berle was making us laugh.

Timmy and Lassie were making us cry.

And Carol, Edna, Hazel, Connie, Diane and Ione were destroying our coastline.

In the 13 months between Aug. 30, 1954 and Sept. 19, 1955, these six hurricanes struck on or near the North Carolina coast, leaving death and destruction in their wakes.

Never before or since has such a rapid succession of hurricanes hammered Tar Heel shores.

Merchants boarded windows, ripped the boards off, and boarded them again and again. Fishermen tied their boats down, loosened them and repeated the process. Tourists wondered if their vacation would be the next to be ruined by a storm from the sea.

Lifelong coastal residents had weathered many storms, but had never seen anything like this. They began to wonder just how long this pelting of their property would continue.

Nearly 40 years later, most of the six hurricanes have long been forgotten. At least one of them — the powerful Hazel — lives on in the memories of thousands of people who witnessed the most severe hurricane ever to punch the breath out of The Old North State.

There are theories — some credible, some based on pure conjecture. But most scientists will tell you that they aren't sure why such a large number of hurricanes made landfall in such a small area and in such a limited amount of time.

"Five years ago, I would have told you that this is all random, that hurricanes don't really have a pattern to them," says Joe Pelissier, deputy director of the National Weather Service office at Raleigh-Durham International Airport.

"But now, with all we know about hurricane data, I might say that hurricanes can be predicted to a certain degree," Pelissier says, adding that there are hurricane patterns that might be related to other meteorological events.

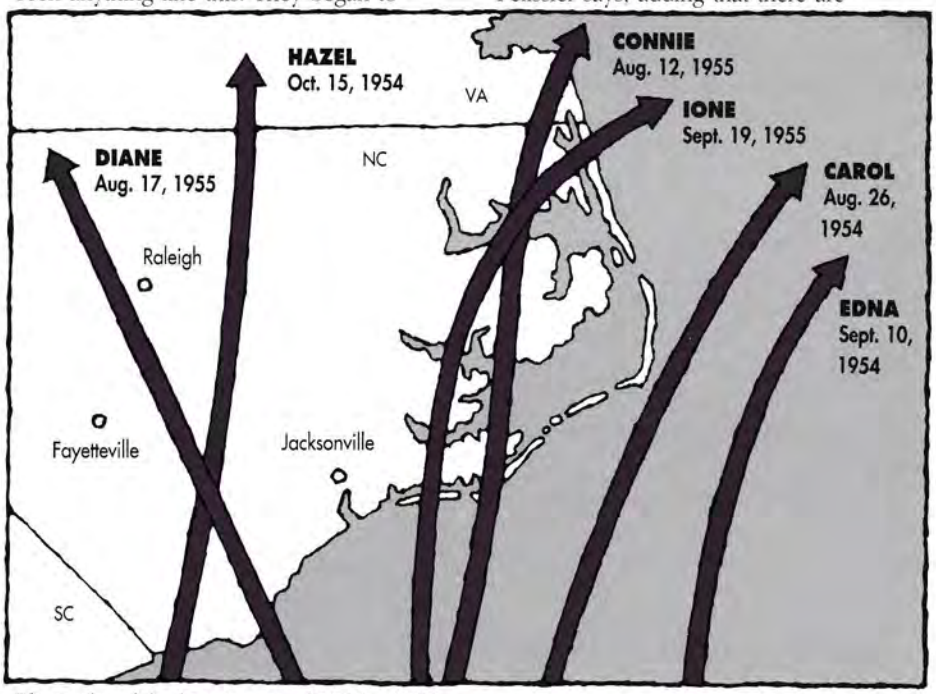
What Hazel left behind...

He points to the work of William Gray, a professor at Colorado State University. Over the last six years, Gray has developed statistical models based on certain weather-related events — the Pacific El Niño water-warming phenomenon, the amount of rainfall in Western Africa, biennial east-west winds above the equator and lowering of air pressure along with increased upper-atmospheric winds in the Caribbean Sea.

All these phenomena affect when and where hurricanes occur and the power they contain, Pelissier says.

"Some think it's a statistical fluke, but the evidence is convincing," he says.

A coupling of the data associated with the hurricanes of 1954-55 in North Carolina with the other weather phenomena in



The paths of the hurricanes of 1954 - 1955.

In the 13 months between Aug. 30, 1954 and Sept. 19, 1955, these six hurricanes struck

of the Hurricanes

Gray's prediction model might reveal clues to why six hurricanes slammed into North Carolina in 13 months.

"But people should remember, in meteorology ... you're rarely going to get anything that's exact," Pelissier says.

Here's a rundown of the six storms and the damage they caused:

Carol — Hurricane Carol formed in the Bahamas on Aug. 26, 1954 and brushed North Carolina just east of Cape Hatteras about 10 p.m. Aug. 30. Because the beaches were on the west side of the storm's counterclockwise winds, damage was not severe. Some crops were destroyed, and some houses and fishing piers were damaged.

At Cape Hatteras, where winds were measured at 90 to 100 mph, about 1,000 feet of highway was undermined. Folks along the Outer Banks cringed with empathy when they learned the next day that Carol had made landfall in the New England states, causing costly destruction and killing 60 people.

Edna — Only 15 days after the brush with Carol, Outer Bankers were told that yet another hurricane, this one named Edna, was traveling their way. Residents braced themselves again, but again they were spared as the great storm passed about 60 miles east of Cape Hatteras in the Atlantic. On Sept. 10, winds of about 70 mph were recorded at Cape Hatteras. Some crops were damaged, some piers were slapped, and a little more of the Outer Banks highway washed out. Again, New Englanders bore the major brunt of this hurricane.

Hazel — On Oct. 15, 1954, a storm unlike any other struck the North Carolina coast with a ferocity not seen before or since. Her name was Hazel, and even to mention her sends chills down the spines of those who survived her wrath.

The Caribbean Sea gave birth to Hazel in early October. In her 13-day life, she caused widespread damage from Haiti to Canada. In North Carolina, she created $100 million in damage (think what that would be in 1991 dollars), killed 19 people and injured 200 others. At least 30 Tar Heel counties reported damage to buildings.

Hazel struck the North Carolina coast near Shallotte around 10 p.m. on the 15th with sustained winds as high as 150 mph.

The following is excerpted from a report written last year by James D. Stevenson of the National Weather Service in Wilmington: "Wind-driven tides

Continued on the next page

on or near the North Carolina coast, leaving death and destruction in their wakes...

devastated the immediate oceanfront from the South Carolina line to Cape Lookout. All traces of civilization on that portion of the immediate waterfront between the state line and Cape Fear were practically annihilated."

Stevenson says the dune line, which in some cases was 20 feet tall, was washed away. So were the houses and cottages that had been built behind the dunes for protection.

In Long Beach, 352 of the town's 357 buildings were "washed into the sea." This story was repeated up the coast at Holden Beach, Carolina Beach and Wrightsville.

But the winds weren't the only problem. Storm surges and tides as high as 14 feet above normal were common. At the Holden Beach bridge, water measured a whopping 18 feet above normal. The Cape Fear River at Wilmington reached its highest point on record. That town suffered major damage and was without electricity for three days.

Hazel's destruction was not limited to coastal areas. After striking the shore, she bullied her way through North Carolina's heartland, destroying crops, homes, barns and buildings.

At Raleigh, she uprooted trees and caused thousands of dollars in damage. As far inland as Smithfield her winds were recorded at 90 to 100 mph.

After cutting a path into Virginia, she continued northward, pouring torrential rains in several states and flooding two Canadian provinces. She was last detected over Scandinavia where she finally fizzled.

Experts have called Hazel a freak, but other folks have labeled her a judgment from a higher power. She was a severe hurricane that jumped ashore in North Carolina on the exact date of the highest tide of the year — the full moon tide of October.

Locals call this the marsh hen tide because salt water rises in the marsh grasses, floating marsh birds above their protective cover and making them easy targets for hunters.

Connie — After several days of sloppy, sluggish movements in the Atlantic Ocean, Hurricane Connie slammed into

NOAA/ National Weather Service

Will it happen again? Will Tar Heel residents face a similar onslaught of hurricanes in the future?

• • • • • • •

the North Carolina coast on the morning of Aug. 12, 1955. Connie probably will be best remembered for the amount of water she dumped onto Tar Heel farmlands. Thousands of acres were flooded.

Because she was slow-moving, this storm caused pounding waves to eat away at the Carolina coastline from Southport to Nags Head. Beach erosion was estimated worse than that caused by Hazel 10 months earlier. The towns of Oriental, Belhaven, Plymouth and Elizabeth City received the brunt of Connie's winds and rains.

Diane — Coastal residents were in the process of estimating the cost of Connie when they heard the horrible news over radio: yet another hurricane, the fifth in 12 months, was churning in the Atlantic on a beeline to the North Carolina coast. Her name was Diane, and she was expected to strike land in the early morning hours of Aug. 17.

Diane made her appointment at Carolina Beach on schedule, bringing with her winds measuring 74 mph. Like her sister of a week earlier, Diane ferried walls of salt water inland, eating away at beaches and flooding already inundated farms. Crops that had managed to survive Connie's drenching were drowned by Diane's.

About 1,000 people were evacuated from low-lying areas, especially near sounds and rivers. In Belhaven, water was reported at 3 feet above street level in some stores. In New Bern's downtown district, the Neuse and Trent rivers swelled and carried waist-deep water into buildings.

Ione — For a little more than a month, residents of North Carolina's coastal counties had been walking in the mud and mire brought on by Connie and Diane. Then, on Sept. 19, 1955, Hurricane Ione made landfall at Salter Path, about 10 miles west of Morehead City.

Ione was a strong lady while swirling in the Atlantic, but quickly lost her gusto when she slammed into the beaches. But she brought a tremendous storm surge and another abundance of rain to our coast.

At New Bern, tides were reported to be more than 10 feet above normal, flooding at least 40 city blocks. Several hundred homes in the area were washed away.

Unlike Connie and Diane, Ione was a killer. Seven deaths were reported across the state, five from drowning and two from car accidents on rain-swollen roads.

In the 41-day period from the beginning of Connie to the end of Ione, unprecedented amounts of rain fell on North Carolina. At the National Weather Service substation at Hoffman Forest (near Maysville), almost 49 inches of rain were recorded.

Will it happen again? Will Tar Heel residents face a similar onslaught of hurricanes in the future?

The answer, says Joe Pelissier, lies not in the minds of men, but in the fickle imagination of Mother Nature.

"If conditions are right, a hurricane will form," he says. "And a hurricane doesn't know it's heading for a certain area; there's nothing that directs it to the North Carolina coast in particular.

"We can do a certain amount of general prediction of hurricanes now," he says. "But where it's going to land, that's anyone's guess."

In Long Beach, 352 of the town's 357 buildings were "washed into the sea."

An Ash Wednesday to Remember

The typical nor'easter's counterclockwise winds pound the coast as the storm travels northward.

By C.R. Edgerton

Well-known Outer Banker David Stick called it "a horrifying experience."

Aycock Brown, the self-styled promoter of the state's easternmost barrier islands, labeled it "The Ash Wednesday Storm."

Meterologists call it "The Great Atlantic Coast Storm of 1962."

Whatever you name it, the 60-hour northeaster that pounded the Atlantic Coast from March 7 to 9 in 1962 was one of the worst non-hurricane storms to ever bring its fury to the Tar Heel coast.

Stick, who was in charge of implementing Dare County's emergency disaster plan on the North Banks, reports that more than 500 miles of shoreline along the Mid-Atlantic states were affected by the storm. He says total structural damage was estimated at $234 million. About 1,800 dwellings were destroyed. Thousands more were heavily damaged.

The Ash Wednesday Storm was what meteorologists refer to as an extratropical cyclone. These storms have many of the same characteristics as a hurricane, but without the central warm air mass and the well-defined eye.

The primary problems associated with an extratropical cyclone are severe flooding and erosion, both of which were adundant during the Ash Wednesday Storm. The fury and power of this particular storm places it alongside many of the state's worst hurricanes.

To complicate matters, The Ash Wednesday Storm made landfall when the sun, moon and earth were aligned perfectly for one of the highest tides of the year.

Some of the footprints left in the sand by the Ash Wednesday Storm were:

— A 200-foot-wide inlet two miles north of Buxton (later filled in by the U.S. Army Corps of Engineers).

— Sinking of the Liberian tanker *Gem* about 100 miles southeast of Cape Hatteras. The ship split in half, and one crewman drowned.

— Total loss of the protective sand dune line from Kill Devil Hills to the Virginia line. Only the tallest dunes — such as Jockey's Ridge and Penny Hill — and those most inland were spared.

— Near record high tides of 8.2 feet (plus a storm surge of 3.6 feet) at Hatteras.

— Sustained winds of 60 mph recorded at Hatteras.

— Damage to hotels, motels, summer cottages, highways, piers and permanent residences estimated at $12 million.

Meterologists call it "The Great Atlantic Coast Storm of 1962."

The Fisherman's Angle

By Carla B. Burgess

The sun has been ambivalent on this late summer day. Tucked beneath a blanket of rain clouds the color of steel wool, it emerges now and then in a teasing gesture during my drive east to Roanoke Island.

No rain has fallen, but in the 90-degree humidity, I almost want to wring the damp air like a towel. At Manteo, the clouds give way to a tentative shower, bringing the eighth straight day of rain to this coastal community.

I couldn't have picked a better day to talk to fishermen about weather and fishing. With the rain of the past week fresh on their minds and their decks too, the charter boat captains at Oregon Inlet Fishing Center are chatty.

My final destination for the day, the fishing center is as full of activity as a kicked-in anthill. The charters are just returning from their day at sea, and the sprinkle of rain has subsided.

I maneuver through the center carefully, ducking around throngs of charter fishermen and tourists with cameras admiring the catches of the day. The fish line the dock neatly like pelagic tick marks: bulky tuna, blunt-headed yellowish dolphin and skinny Spanish mackerel.

If I expect complaints about the weather, I hear no cross words from the captain of *The Sportsman*.

"Sometimes the bad weather helps you fish," says Omie Tillett. Inside the cabin, the Wanchese native looks weathered himself. He sits on the bench and leans back, clasping his hands together on his lap and stretching his tan, bare feet.

"Pretty weather is good 'cause you don't lose no trips. But too much of one thing is not good for anything," he says in a soft voice. "It takes a change in the weather to bring the fish in.

"A northeaster helps, but then it might cut you out of a week's work," he says, shrugging.

"The rain doesn't bother us too much," he says. "We're 35 to 40 miles out, and the squalls just pass on through. You're not in it all day long."

Jim Schreier

Omie Tillett

Nearly 60 miles south, at the tip of Hatteras Island, Steve Hissey is not as forgiving. Four solid weeks of muggy, southwest winds have rendered small-boat offshore fishing in this neck of the woods "non-existent," he says. The co-owner of Pelican's Roost Tackle Shop in Hatteras is losing patience with Mother Nature.

"To me, the fish can feel the pressure changing. They feed better before a cold front and before a wind shift, but we've had nothing but rain the last week and a half," he says. "A southwest wind like this puts warm water on the beach and puts crabs in the surf. You can't keep bait on a line."

A customer in the store agrees. He's been fishing for flounder in the sound, using shrimp for bait. The only clamoring on his line today has come from calico crabs.

"I think the fish are confused because the weather's so confused," says Hissey, reaching for his ringing telephone. He looks up over his shoulder at his television, which is tuned to The Weather Channel.

"We got two more inches dumped on us today — I'm growing gills," he tells the caller. "I don't think we've weighed a citation pompano since you've been gone; the water's so awful."

It was a friend from Maryland, Hissey explains as he hangs up. He says he

Steve Hissey

Carla B. Burgess

on Weather and Fishing

receives nearly 3,000 calls each year about the weather and the fate of the fishing.

After all, fish are as picky about the weather — and about eating — as we are. Spanish mackerel like their water clean; rough winds and sloppy conditions in inshore waters don't make for pleasant dining.

However, Hissey says, you still have your bottom feeders — croaker, spot, mullet — if you can get to them. "If the wind blows too hard, the current is so strong you can't even fish for those; the grass blows in and tangles with the line."

Steve Murray

There's some irony to fishing, says Sea Grant agent Wayne Wescott of Manteo. "Northeasters blow our Gulf Stream in, and with that billfish, sailfish and blue marlin. It makes access to fishing better," he says.

"But on the other hand, if it's a northeast wind, it's probably going to be blowing too hard to go," Wescott says.

The fishing conditions desired at Hatteras or Oregon Inlet may be completely different from those sought at other points along North Carolina's scalloped-out coastline.

Fishermen farther south can do without the rain their northern neighbors are being served. But pass the southwesterly wind, please, says Capt. Billy Truitt of Oriental later in the week. Truitt and his wife, Lucille, have spent their lives crabbing, fishing and shrimping in the waters of the Neuse River and Pamlico Sound.

"This rain we're having right now is the worst thing you could have for a fisherman," he says. "What makes good fishing here is a light sou'wester and dry weather." When the Outer Bankers have a northeast wind, "their tide comes in here and floods us," he says.

As for rain in this area, the prescribed amount is "just enough to suit the farm," Truitt says. Too many showers will fill the Neuse River and Pamlico Sound with undesirable runoff.

In the long run, rain itself can have a profound effect on various fisheries.

An overly wet spring can be bad for shrimping; the decrease in salinity can send young shrimp out of the estuaries in search of saltier water, where predation is high. This wet August has increased the amount of coliform bacteria in runoff, Sea Grant agent Bob Hines says; fisheries planes are flying over Bogue Sound telling clam fishermen to stop harvesting.

No matter where you are, storm conditions — especially thunder and lightning — have their own way of making fish moody.

"Fish don't bite that good during or after a lightning storm," says Sea Grant marine agent Jim Bahen.

Capt. Eddie Haneman of Wilmington says fish know when to prepare for the tempest. "A lot of times the fish will feed right good, eating up for a storm," he says.

Even my dad has something to say on the subject. He's known fish to feed through all kinds of commotion.

"Some of the prettiest trout I have caught came off a northeaster," says Sam Burgess, describing a two-hour squall that

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"If you could figure it all out, you wouldn't be fishing for a living; you'd be a genius."

James Fletcher

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he and a buddy fished through on a Topsail Beach fishing pier. "The old pier just rocked; it rained; the wind blew."

Dad says he acquired a respectable mess of fish, and when the squall ended, the fishing did too. "When it left, the fish didn't bite another time. Not a nibble did they do," he says.

There's no set formula for weather and fishing. If there were, there probably wouldn't be fishermen who keep detailed logs of location, wind velocity and direction, barometric pressure and temperatures while they're out on the water.

Of all the folks I talked to, I think James Fletcher at Wanchese Fish Company said it best: "If you could figure it all out, you wouldn't be fishing for a living; you'd be a genius."

Of Bulls' Hides

By Carla B. Burgess

A sundog never fetched anything but a heap of bad weather.

So say Lucille and Billy Truitt of Oriental.

"We came from a long line of fishermen back in the 1700s, and they went by what the old Indians used to see," says Lucille. "A sundog, seeing two suns, means there's gonna be a sudden change — and we've seen a many of 'em."

Double suns and moons have long been seen as portents of bad weather. Even more feared are the lights of St. Elmo's fire dancing in a ship's rigging. Bloody sunrises don't sit well with sailors either, apparent in the saying, "Red sky at morning, sailors take warning. Red sky at night, sailors delight."

Throughout history, folks have set their beliefs and observations to rhyme, if not for poetic intent, then to make them easier to remember. Signs and sayings are woven tightly into the weather lore of fishermen and sailors.

And for people like the Truitts, who have fished the waters of the Neuse River

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When the glass falls low,
Prepare for a blow;
When it rises high,
Let your kites fly.

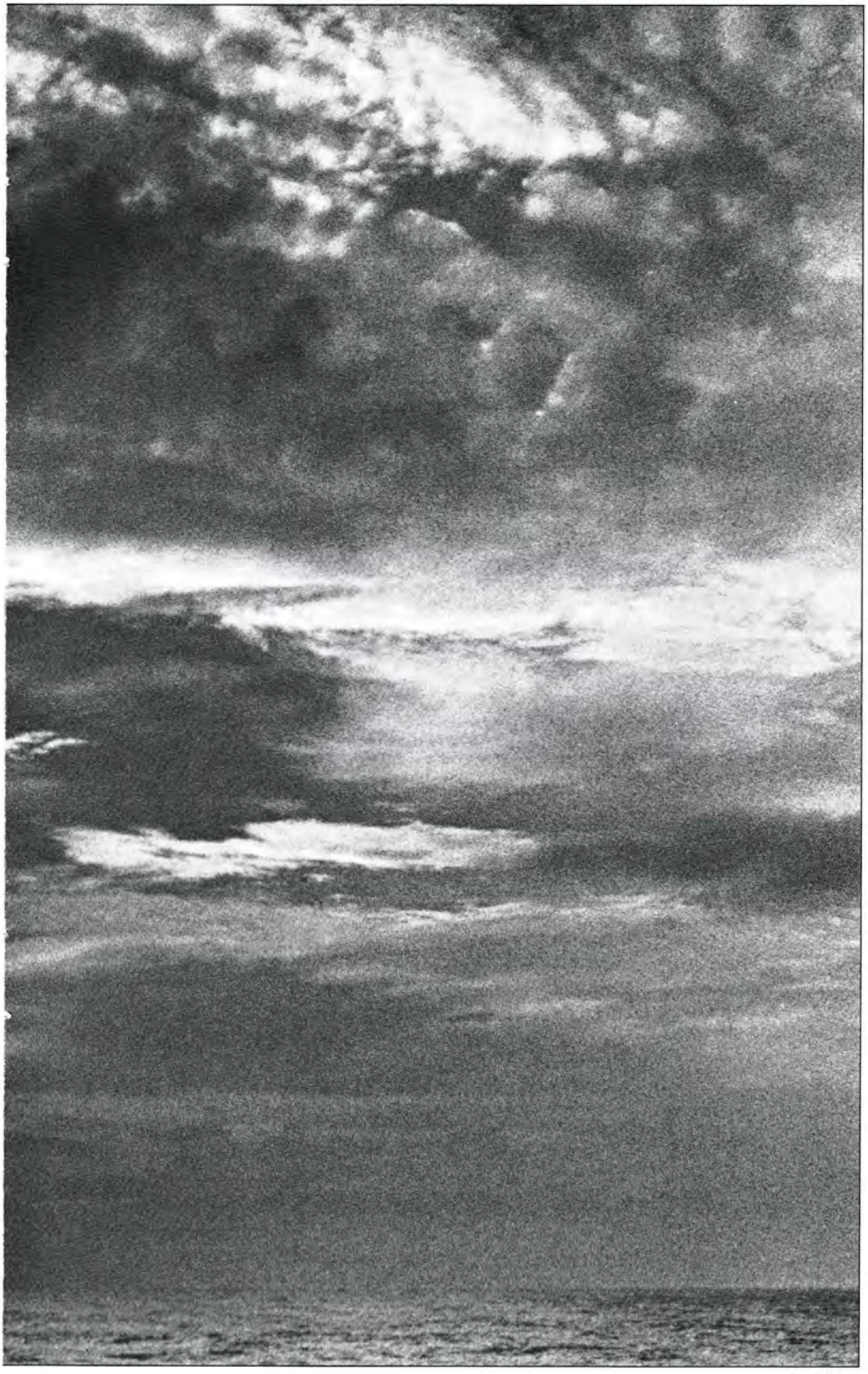
• • • • • • •

and Pamlico Sound most of their lives, they demand as much respect and attention as the local weather forecaster. Maybe more.

"A backing wind is no man's friend," says Arvin Midgett, who captains the charter boat *Miss Boo* out of Oregon Inlet. "I've known that saying all my life, and I've come to see the wisdom of it."

Counterclockwise winds almost always mean trouble — from colder air approaching to menacing hurricane winds. "If it (wind) comes from the northeast, back to the north, then from the northwest, why you look for another cold front coming through," says Midgett.

and Red Skies



Steve Murray

Wind can affect the fish as much as the people catching them.

"We have a saying here, 'wind out of the east, fishing least,'" says Jim Bahen, a Sea Grant agent based at Kure Beach and a fisherman himself. "Fishermen up around Carteret talk about a 'mullet blow,' a wind out of the northeast that makes the fish move.

"The fisherman who relies on it (the weather) year-round has got a pretty good handle on his own method of predicting," says Bahen.

Cloud formations, the direction of the wind, even the behavior of animals are telling signs.

"Gulls way high up means there's a front moving in," says Bahen. "Biting flies, the wind's gonna change.

"Back in the old days, people living on the coast didn't have the weather forecast. They had to rely on local knowledge," he says.

If Billy Truitt sees "bulls' hides" and "mares' tails" in the sky, he's going to cut his fishing trip short.

"If there's a bunch of clouds looking like buffalo running across the plains, it's gonna blow a gale that day," he says. His wife adds that you shouldn't let still waters fool you into thinking otherwise.

• • • • • • •

Rain on the flood,
Only a scud.
Rain on the ebb,
Sailors to bed.

• • • • • • •

"Even if it's pretty and slick calm, you might as well know," Lucille Truitt says. "We'll go up a creek and anchor somewhere."

Capt. Eddie Haneman of Wilmington agrees that streaking clouds, which are caused by the wind, should not be ignored.

"Mackerel skies and mares' tails make loftier ships carry little sails," he says.

Young Mariners

Coastal Adventures for Curious Minds

Breezing Through a Lesson in Weather

Wind is an important part of coastal weather conditions. At the beach or along the sound, wind affects work and play.

People who make their living on the water know that some winds are better than others for fishing and navigation. And of course, "blow boaters" and windsurfers depend on wind for their pleasure.

You don't need a fancy barometer or weather station information before you can learn about the weather. There's a lot you can find out just by feeling the wind and looking up at the sky.

A trip to the coast is a good time to learn.

The first thing you want to determine is from which direction the wind is blowing. After all, the source of the wind is what gives it its name. For example, a southwest wind is coming from the southwest, a northerly from the north, and so on.

Put your face into the wind, and turn your head so that you can feel, and maybe even hear, the wind equally in both ears. Once you sense a balance, your nose will be pointed toward the origin of the wind.

If you have trouble telling with your own nose, you might get some clues from sea birds perched atop pilings or standing on the beach. Which way are their beaks pointed? Gulls and terns usually face the wind. They don't like to have their feathers ruffled.

Once you've discovered the wind direction, notice its temperature. A southerly wind often brings warmth and humidity. Does the air seem almost tropical to you?

Winds out of the northeast are often cold. Hard northeasters sometimes bring fierce and lengthy storms.

Knowing the wind direction might help you decide where to tie up a boat or how to anchor it.

Carla B. Burgess

Wind velocity or speed is another helpful thing to know. Admiral Sir Francis Beaufort of the Royal Navy invented a handy scale for determining wind speeds by watching waves.

If you're riding across a bridge at the coast or standing on a fishing pier, you're in a good position to observe the waves.

If you see only small wavelets and no foam, this is "light air," which ranks "1" on the Beaufort scale. The speed of the wind is between 1 and 3 mph. A "moderate breeze," numbered "4" on the scale, will whip the waves into whitecaps. Winds are between 13 and 18 mph.

A "strong breeze," ranking "6" on the scale, brings winds 25 to 31 mph. You should see cresting waves and "wind streaks" on the surface of the water. A wind streak is a straight line of foam pushed ahead of a wave.

There are some winds that are different from the "big" weather pattern. One kind of "local" coastal wind is the sea breeze.

During the day, the land warms more quickly than the ocean. So in the afternoon, the warm air over the land rises, pulling in cooler air from over the ocean. This cool air moving toward the shore is called the sea breeze.

Have you noticed when you're at the beach, gnats and mosquitos tend to be worse at dawn and dusk? There's no sea breeze to carry them away from you.

If you're just learning to waterski, you might fare better in the morning or late afternoon, when the sea breeze isn't chopping up the waves. On the other hand, if you're a beginning sailor you might choose mid-afternoon for better wind in your sails.

Good luck in your weather adventures!

Carla B. Burgess

From Sound To Sea

Natural Wonders of the Coast

Way Down Upon the Scuppernong River

"He won't bite. And if he does, it won't hurt too much."

With those strange words of assurance, David Wojnowski of Elizabeth City maneuvered his canoe — with the reluctant help of his canoeing partner — next to a gum log jutting into the Scuppernong River.

On the log, a brown water snake sunned himself.

In one swift move, Wojnowski grabbed the reptile and threw him into a cloth bag in the bottom of the canoe. The slight wind carried the musty scent of the frightened snake downriver.

Later, Wojnowski showed the other members of the canoeing party his right hand. Blood trickled from a series of tiny wounds on his knuckles. He smiled.

"It was worth it to get a snake like that," he said, explaining that he would keep the snake alive and show it to his students.

Snakes included, the Scuppernong River is one of North Carolina's best kept secrets.

Quiet and unassuming, the river's dark pocosin waters flow from just north of Lake Phelps to Albemarle Sound.

There are few signs of man.

No littered shorelines. No trampled banks. No fire rings or newly-blazed trails.

Perhaps this pristine beauty is the reason Lundie Spence, Sea Grant's marine education specialist, chose the Scuppernong River as one leg in her recent Paddle-to-the-Sea project. The program was designed to give science and math teachers from the state's northern coastal counties a chance to experience coastal nature first hand. In turn, that knowledge will be passed along to their students.

Wojnowski was one of those teachers.

The five-day adventure traced the course of a single imaginary raindrop that fell into a freshwater lake (Lake Phelps), wiggled its way into the Scuppernong, flowed into the Albemarle Sound estuary, and finally came to rest in the warm waters of the Gulf Stream off North Carolina's Cape Hatteras.

C.R. Edgerton

The teachers discovered the unique characteristics of Lake Phelps, retracing the probable course of Indians who paddled dugout cypress canoes on the lake centuries ago. They studied the huge trees in one of North Carolina's last remaining stands of virgin timber.

On the Scuppernong, they took water samples, noted the river's bankside flora and fauna and paddled to one of the last stands of Atlantic white cedar on the East Coast.

In Roanoke Sound, the teachers waded in ankle-deep water, took more water samples, collected more plants and animals, and gained an appreciation for the myriad forms of life in the estuary.

Finally, aboard a headboat in Oregon Inlet, they learned of the raindrop's final earthbound destination. They discovered how the raindrop squeezes through the inlet to mix with the offshore waters, eventually evaporating and returning to the sky.

Why all the fuss over a tiny raindrop?

"If you look at our state, you won't find any watershed system that is more compact than the one we chose for Paddle-to-the-Sea," Spence says. "From lake to river to estuary to ocean, it's all there."

Spence says it's important for teachers to instruct their students in the fundamental truth that a watershed is not just one lake or one river or one stream.

"They need to teach that a watershed is a whole system and that a commitment to teaching about the watershed is a commitment to teaching about the system," she says.

C.R. Edgerton

Marine Advice

Extending Knowledge to the Coastal Community

Satellite Guides Fishermen to Their Catch

All offshore fishermen, recreational and commercial, know fishing is a hit or miss. Some days are good; other days you couldn't lure a fish to your line if you had the only bait on the Atlantic coast.

But what if you had a little help from above?

Not divine aid, mind you. But a satellite telling you where the fish are.

In an age when we use satellites to predict tomorrow's weather, to pinpoint Iraq's nuclear arsenal and to complete complicated communications connections, why not use these circling sensors to do a little fishing too?

Jim Bahen, Sea Grant's marine advisory agent at Ft. Fisher, thought the overhead orbs might be just what offshore fishermen needed to find the Gulf Stream. He knew that locating the meandering current of warm water often meant finding fish.

Pelagics such as marlin, wahoo, swordfish, dolphin and mackerel like the warmth of the Gulf Stream and rarely stray from the confines of its heated waters.

But finding this haven for fish can be tough.

"For a long time, people thought the Gulf Stream could always be found at the edge of the continental shelf," Bahen says. "But that just isn't true.

In reality, the warm-water current fluctuates in position, responding to the wind, current and storm patterns of the Atlantic. It can change location by several miles in just a few days time.

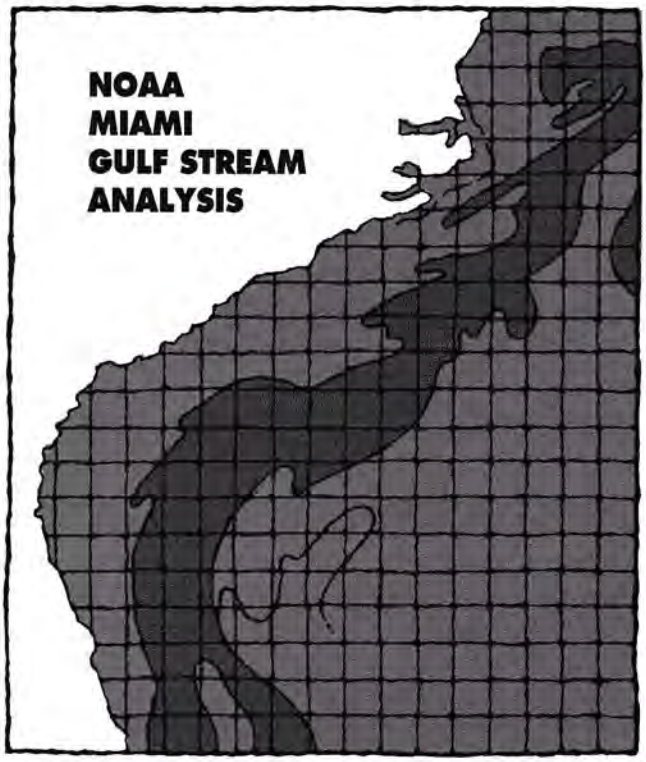
To find this wandering warmth, "fishermen used to spend a lot of time and fuel running around in the ocean looking at their temperature gauges," Bahen says.

But now Bahen has devised a system that can save commercial and recreational fishermen the search.

Several years ago, Bahen began talking to the folks at the National Oceanic and Atmospheric Administration's National Environmental Satellite Service in Miami. They received satellite images that allowed them to plot the Gulf Stream.

Using infrared photography, a circling satellite could differentiate the warmth of the Gulf Stream from the colder surrounding waters of the Atlantic Ocean.

Only during summer when the continental shelf waters are heated to nearly the same temperature as the Gulf Stream is detection of the current's position impossible. But most of the year, the current could be accurately plotted.



So Bahen decided to be the link between the readily available satellite information and the fishermen who needed it.

He began a service to send subscribers a weekly map charting the position of the Gulf Stream along the Eastern Seaboard. He charges $20 a year to cover the cost of postage, envelopes and photocopying.

The map arrives on Wednesday, and Nancy Martin, Bahen's assistant, sends it to a mailing list of about 100 people.

She also encloses other Gulf Stream information — its speed, its direction, its average temperature and its width at various points along the East Coast.

Bahen says the subscribers to the service are varied. Most are recreational or commercial fishermen.

Several recreational anglers subscribe just so they'll know the Gulf Stream's location during the lucrative billfish and mackerel fishing tournaments.

For other anglers, it's the location of the unusual formations — peninsulas and eddies — that form along the current's boundary that make Bahen's chart a good investment.

Often warm-water pelagics are trapped in these pockets, not daring to venture into colder waters. Therefore these areas become prime fishing areas that would go unnoticed without Bahen's chart.

If you would like more information about Bahen's Gulf Stream chart, call him at 919/458-5498. If you would like to subscribe, send $20 to: Gulf Stream Charts, Sea Grant, Box 130, Kure Beach, NC 28449. Make checks payable to Sea Grant.

Kathy Hart

Field Notes

Insights into Current Sea Grant Research

The Science of Offshore Weather Patterns

Gene Furr

If you could travel 30 miles east of Cape Hatteras on a cold January day and then shoot straight up about 15,000 feet, you'd see it.

You'd see warm, moist air rising off the Gulf Stream, like steam rising off a warm highway after a cool summer thunderstorm.

And if you looked west, toward the Appalachian Mountains, you'd see blue, cold air damming up in front of the mile-high range.

And, if you waited around long enough, you'd see a phenomenon unique to the Carolina coast: the formation of a major East Coast winter storm.

This event happens about 13 to 15 times every winter in the area over the ocean just east of Cape Hatteras.

These storms cause considerable headaches. Each year, they are responsible for millions of dollars in agricultural damage. And they are dangerous. In February 1989, the Presidents Day Storm paralyzed the East Coast with snow and ice. In April 1982, several people lost their lives when a Hatteras-formed storm dumped heavy snows in the Mid-Atlantic states.

Sea Grant researcher Len Pietrafesa, chairman of North Carolina State University's Department of Marine, Earth and Atmospheric Sciences, has teamed up with two other scientists — meteorology and oceanography professor Sethu Raman and graduate student Joe Cione — to study the formation of these winter storms.

Their research should lead to a better understanding of the storms and more reliable methods for correctly predicting when and where they will occur.

"We've been looking at these storms through satellite images since 1978," Pietrafesa says. "And we discovered that the events that occur off Cape Hatteras are unique in the world."

Raman agrees. He says a "freezing line" of low pressure air forms off the coasts of Virginia and the Carolinas when the Gulf Stream begins its annual winter migration toward the Outer Banks.

Northeast winds roll down from the New England states into this low pressure formation, combining with the warm air over the Gulf Stream and the dammed up cold air from the mountains.

"Nowhere in the world do you get this kind of heat flux," Raman says. Because of this, he says, these storms can sometimes form within the 12-hour span between weather balloon launchings.

"That's why these storms have been so unpredictable in the past," Pietrafesa says.

Now, however, with a better understanding of the upper atmospheric dynamics of such systems, predictions can be more accurate.

Pietrafesa says the more we know about these storms, the more we'll understand other processes that are affected by them — things like flooding, erosion, transport of sediments and fish spawning, the latter of which seems to occur more often just before these storms begin.

C.R.Edgerton

The Aft Deck

A Bulletin Board of Updates and Events

Know Your Regulations

The N.C. Department of Environment, Health and Natural Resources has published a guide to natural resource and environmental regulations. *The 1991 North Carolina Environmental Permit Directory* is a comprehensive introduction to environmental regulations and an overview of requirements governing the wise use and protection of the state's natural resources.

The directory can be used as a manual, or handbook, to guide businesses through the permit maze or as an educational primer for people interested in environmental protection.

The directory includes:

— a list of all state environmental and natural resource laws and their statutory citations;

— an informative grid that lists the environmental permits required for 40 businesses commonly operating in North Carolina;

— a series of frequently asked questions about permits;

— a list of permit processing times; and

— a list of permits by area and by agency.

Each permit summary includes a description of the type of project requiring this permit, the statutory authority, the administrative code citation, the requirements, process time, fees and contact information.

The directory also includes regulatory requirements of other state and federal agencies such as the N.C. Department of Cultural Resources and the U.S. Army Corps of Engineers.

It costs $5 and is available from: Department of Environment, Health and Natural Resources, Division of Planning and Assessment, P.O. Box 27687, Raleigh, NC 27611-7687.

Critical Coastal Concerns

The N.C. Division of Coastal Management needs the public's help in identifying the state's most critical coastal issues.

The 1990 reauthorization of the federal Coastal Zone Management Act created the Coastal Zone Enhancement Grants Program, which encourages achievement of coastal management goals. But to make the achievement of these goals responsive to public needs, the division needs your input.

Specifically, the division would like to know how you would rank the following objectives:

— protect, enhance or create coastal wetlands.

— prevent or reduce threats to life and property by controlling coastal development and redevelopment in hazard areas, and anticipate and manage the effects of sea level rise.

— increase public access.

— reduce marine debris.

— assess and manage the cumulative and secondary impacts of coastal growth and development.

— prepare and implement special area management plans.

— plan for the use of ocean resources.

— adopt procedures and policies for siting energy and government facilities and activities.

In addition to determining critical issues, the Division of Coastal Management is also seeking ideas on how to address these areas of concern.

With federal guidance and public input, the division will prepare a draft assessment. Public review and comments of the draft document will be accepted through the end of October.

Public forums to discuss the draft assessment are scheduled for Oct. 15 in Manteo at the N.C. Aquarium from 7 p.m. to 9 p.m., for Oct. 22 in Beaufort at the N.C. Maritime Museum from 7 p.m. to 9 p.m., and for Oct. 29 in Wilmington at the University of North Carolina at Wilmington (SB Building, Room 108) from 7 p.m. to 9 p.m.

If you have questions or comments about this procedure, contact Jim Wuenscher, N.C. Division of Coastal Management, P.O. Box 27687, Raleigh, NC 27611-7687. Or call 919/733-2293.

Fall Flora at the Shore

When the first cool air of fall finally pushes south, most people head westward to the mountains for a dose of seasonal beauty. But the coast also offers some spectacular examples of change.

Look first at the marshes, says Sea Grant marine education specialist Lundie Spence. Interspersed among the marsh grasses is the delicate sea lavender. Its fall bloom is a tiny purple flower.

Another plant, the short, segmented glasswort covers the salt barrens. Its finger-like projections turn flame red in fall as the cool breezes cause the plant's green chlorophyll pigment to break down.

The groundsel tree graces the marsh's upland side, and this time of year, fluffy white hairs bearing tiny fruits reveal the plant's other name — cottonbush. Some

local people also call it mullet bush, perhaps because its fruiting coincides with the fall mullet runs.

Around the dunes, seaside goldenrod is in its glory now, and camphorweed, a beautiful yellow aster, is dotting the back of the dunes. In the depressions between dune tops, purple muhly catches dew, and the five-petal marsh pink still blooms.

Wax myrtle, a common coastal shrub, sprouts clusters of small bluish berries that call out the season.

While observing the splendor of the flora, you'll likely see the fall migration of the monarch butterfly. These beautiful butterflies migrate from Canada to Florida and central Mexico. They stop for food, feeding on the nectar of fall flowers such as goldenrods and camphorweed.

North Carolina's barrier islands, especially sites near inlets, are excellent locations to watch for these migrating beauties.

Crazy About Crab

This has been the year of the blue crab for coastal fishermen. The clawed crustaceans have been as abundant as mosquitoes on a windless night.

If you favor the sweet, succulent meat of this shellfish, now's the time to feed your need.

Most folks buy crab meat that is already cooked, picked and ready to eat.

Picked crab meat is available in several forms, says Joyce Taylor, Sea Grant's seafood education specialist. The four most common are lump, backfin, special and claw.

Lump, or jumbo lump, comes from the large white lumps taken from the area adjacent to the backfin appendage. Backfin consists of some lumps plus the rest of the meat from the body.

Special, also called regular or flake, is the white meat without any lumps. Claw meat, often a brownish color, is used in recipes where a white appearance is not important.

Picked crab meat is also available in pasteurized form, which extends its storage life. Pasteurized crab meat may be kept unopened in the refrigerator for up to six months.

And you can buy canned crab meat, which needs no refrigeration as long as it is unopened.

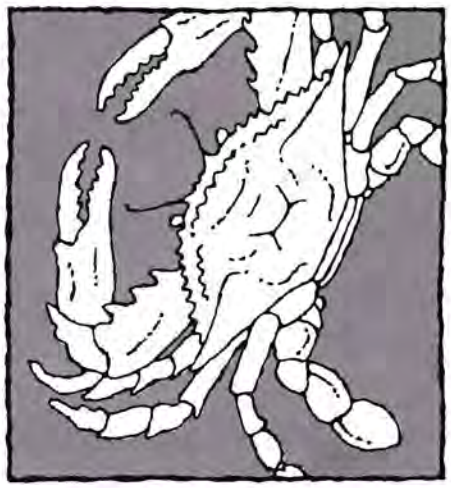
Before using picked crab meat, always examine it for shell fragments, Taylor says. And remember that picked crab meat has been cooked. When using it in recipes, be sure not to overcook it, she says. You'll usually need to cook it just long enough to heat it thoroughly.

For a crabby taste treat, Taylor suggests this recipe:

Crab Meat and Mushrooms in Wine Sauce

1 pound backfin crab meat
2 T. margarine
2 T. flour
1/2 cup milk
1/2 cup dry white wine
1/2 tsp. dry mustard
1/4 tsp. dried tarragon
1/2 tsp. salt
1/4 tsp. freshly ground white pepper
1/4 tsp. Tabasco sauce
1/4 pound sliced fresh mushrooms
3/4 cup dry bread crumbs
2 T. melted margarine

Melt 2 tablespoons margarine in large skillet over medium heat. Sauté mushrooms until tender. Blend in flour. Add milk, stirring constantly. Add wine, mustard, tarragon, salt, pepper and Tabasco. When heated, add crab meat and mushrooms. Place in lightly greased casserole. Sprinkle with bread crumbs and drizzle with melted margarine. Bake, uncovered, at 350 F for 30 minutes or until lightly browned and bubbly. Serves 4 to 6.



Oman Oasis

The Sultanate of Oman is an undiscovered Middle Eastern jewel.

Wide, sandy beaches and high, rugged mountains make Oman among the most beautiful of the arid countries of the Persian Gulf.

Walter Clark, Sea Grant's coastal and ocean law specialist, is working to make sure this oasis remains a viable environmental showcase.

Clark is one of a team of American, Canadian and German specialists whose ultimate goal is to write a set of rules and regulations that will protect Oman's coast from development brought on by an expected influx of tourism over the next few years.

Until recently, Oman was a closed country. Very few tourists were allowed in to witness her splendid shoreline beauty.

With the country's oil reserves expected to run out by the turn of the century, Oman's monarch, Sultan Quaboos Bin Said, wants to open the country to limited tourism.

But with people come problems.

The sultan is seeking ways to develop his country for tourism but leave the environment intact.

"It's called sustainable development," Clark says. "They want to allow development without destroying the resource that's attracting the development in the first place. They also want to preserve their cultural identity."

For Clark, it's an exciting adventure.

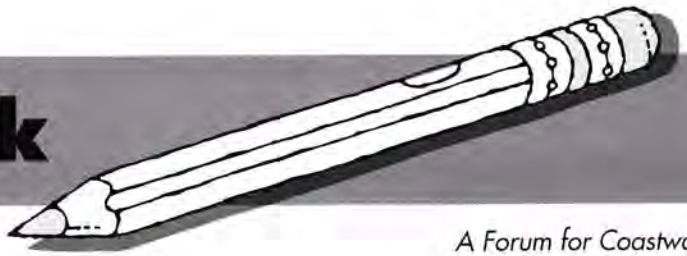
"We're going into a country that's relatively unspoiled," he says. "As a lawyer, to be involved with a project like this from the beginning is unique. We're usually trying to fix things after the fact."

Clark will interview government officials and look at information provided by a coastal engineer, a planner and a geomorphologist.

From that information, he will draft laws that will be reviewed by Oman's Ministry of Environment. From there, the laws are likely to become decrees of the sultan, and thus, law of the land.

The project is being sponsored by the United States Agency for International Development and administered by James Dobbin and Associates of Alexandria, Va.

Back Talk



A Forum for Coastwatch Readers

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

Shaking A Bad Image

Dear Editor,

I am a resident of Carolina Beach and have been so for five years now. I read with much dismay your article regarding the comparison of our beaches (May/June 1991). I must tell you that I am weary of writers and everyone else constantly comparing the two beaches of Wrightsville and Carolina. It is apparent that Wrightsville Beach is an affluent town. However, much money and time has been spent by the taxpayers of Carolina Beach to build up and beautify our beach.

This beach is growing, and many, many new residents are moving in here each year. These people are no different from the people who reside over in Wrightsville Beach. The residents of Carolina Beach have taken pride in the accomplishments that have been made here. There are many positive aspects to our beach and the boardwalk is not one of them. However, if you were to go to Johnnie Mercer's Pier in Wrightsville Beach, you would see the very same situation. Your glowing report of Wrightsville is wonderful, but I really feel like you did not give Carolina Beach a fair shake and the credit it deserves for building up and becoming the beautiful beach that it is today. We who live here are proud to call Carolina Beach "Our Town."

Arlene L. King, Carolina Beach, N.C.

Don't Kill Sharks and Rays Needlessly

Dear Editor,

I had to write you to request a correction in the Sharks and Rays at the Point article (Backtalk, May/June 1991). In your article you stated: "If you catch a ray, exercise caution and cut or clip off the tail." It should say: "If you catch a ray and plan to keep it to eat, exercise caution and cut or clip off the tail." Maybe you just don't realize how many fishermen cut off the tails of skates and rays and then throw them back into the water to suffer and most likely die.

Roxanne D. Dorman, Wrightsville Beach, N.C.

Pier Muncher is a Bore

Dear Editor,

I have an odd question for you on the maintenance of piers in salt water. I live in retirement at Topsail Beach on Banks Channel — great place!

Eight or nine years ago, I was told if I removed the growth and barnacles from my pier several times in the warm weather, I could prolong the life of the pilings. This year is the first year I physically couldn't clean them myself so I paid a man to do the pilings.

Now I'm told that cleaning does no good except where my boat might rub against them.

True or false? I had a lot of good exercise these last few years and wonder if I did any good!

Margaret L. Moore, Holly Ridge, N.C.

Outside of abrasion to your boat, you needn't worry about barnacles, says Sea Grant coastal engineer Spencer Rogers. Barnacles don't damage the wood; they just hang around on the outside.

The real culprits in damage to wooden pilings and decks are shipworms and limnoria. The shipworm is a relative of the clam. It doesn't eat wood, but bores into it, creating tunnels in which to live. You can see only the tiny hole where the earthworm-sized creature pokes its head from and feeds. The destructive mazes within the wood remain hidden.

The limnoria, which is kin to a shrimp, does eat wood. This 1/4-inch creature will even munch through creosote. Its snackings leave a trademark hourglass-shaped piling.

The only way to guard against these nuisances is by using properly treated lumber (chromated copper arsenic is recommended) during construction. Existing untreated pilings are completely vulnerable to these creatures, which have been known to destroy a pier in less than six months.

Highs and Lows, Ebbs and Flows

Dear Editor,

How do they calculate high and low tide times?

Eddie W. Scott, Mebane, N.C.

The variation of the tides is caused by the complex relationships between the earth, moon and sun. Although time tides vary widely from place to place, it is possible to predict high and low tides. Since tide times repeat themselves over the years, careful records of past tides aid in the prediction of current tides. The longer records are kept, the more accurate the prediction.

The Book Store

Publications to Enrich Your Coastal Library

Sea Grant has some fresh offerings. Several new and reprinted publications, on a variety of topics, are hot off the presses.

THE SCOOP ON DIOXIN

What is dioxin? Where does it come from? How much of the chemical is in posted waters? Is it safe to eat fish from some rivers?

You'll find the answers to these and other questions in *Dioxin: Sources, Health Risks, Alternatives*, a four-page fact sheet developed by UNC Sea Grant and the N.C. Cooperative Extension Service.

The fact sheet provides answers for some of the public's most frequently asked questions about dioxin.

This chemical is produced as a by-product of the bleaching process in papermaking and has been found in risky quantities in fish and sediments in some of North Carolina's coastal waters.

This paper describes dioxin, its health risks, and ways to assure safe eating of fish that may be contaminated with the chemical.

For a free copy, write Sea Grant. Ask for UNC-SG-FS-91-01.

ARTIFICIAL REEF MANAGEMENT

People who fish or dive among artificial reefs in ocean waters off North Carolina, Texas and Florida were surveyed in this paper, which offers suggestions for management of these resources.

The 59-page report, *User Views of Artificial Reef Management in the Southeast*, profiles artificial reef users and examines their general knowledge and use of artificial reefs. It also identifies their views on artificial reef administration, funding, siting, construction, information, evaluation, conflict experiences and acceptance of management restrictions.

For a copy, write Sea Grant. Ask for UNC-SG-91-03. The cost is $3.50.

HOW TO HANG A GILL NET

Along the East Coast, gill nets are among the most popular nets for both commercial and sport fishing. The versatile gill net can be used to catch a variety of fish — from trout to hake and flounder.

It can easily be staked, anchored, allowed to drift or pulled by a boat.

Making your own gill net is one easy way to cut down on fishing costs. *How to Hang a Gill Net* outlines steps for doing this, including tips on buying the supplies, hanging the net, and following regulations.

For a copy, write to Sea Grant. Ask for UNC-SG-79-03. The cost for this 16-page, illustrated booklet is $1.50.

PUBLICATIONS CATALOG

Sea Grant Publications has been reprinted and includes up-to-date listings of the books, booklets, brochures, posters and other materials published by our program.

Flip through our catalog, and choose from informative publications on coastal topics of interest to you — recreation, fishing and aquaculture, seafood, education and our changing coast.

The publication is free. For a copy, write Sea Grant. Ask for UNC-SG-91-04.

SUCCULENT SURIMI

The Japanese have been eating it for years, and now it's popular in America too. What is the dish that has gained international popularity?

Surimi. It's a fish paste made from Alaska pollock, and it's shaped into pseudo-seafood products such as crab flakes, crab legs and scallops.

Now Sea Grant researcher Tyre Lanier and the Technical Subcommittee of the Surimi Committe have standardized the procedure for evaluating the fish paste produced in the United States.

The procedure will allow surimi producers to accurately write reliable buyer-seller contracts, to ensure quality control and to predict the surimi's useability.

This standardization procedure is now available in a manual produced by Sea Grant and and the National Fisheries Institute.

For a copy of *A Manual of Standard Methods for Measuring and Specifying the Properties of Surimi*, write UNC Sea Grant. The cost is $6. Ask for UNC-SG-91-01.

THE CAPE HATTERAS LIGHTHOUSE

Since 1871 the Cape Hatteras lighthouse has been a welcome sight for sailors entering the treacherous region off North Carolina's Outer Banks known as the Graveyard of the Atlantic.

At 208 feet high, it is the tallest lighthouse in the country and has been called North Carolina's most famous landmark.

Through the years, it has withstood the ravages of humans and nature, but its fate is in question. In *Cape Hatteras Lighthouse: Sentinel of the Shoals*, Dawson Carr tells the story of the noble lighthouse and speculates on its precarious future.

For ordering information about this 144-page paperback, call the University of North Carolina Press at 919/966-3561.

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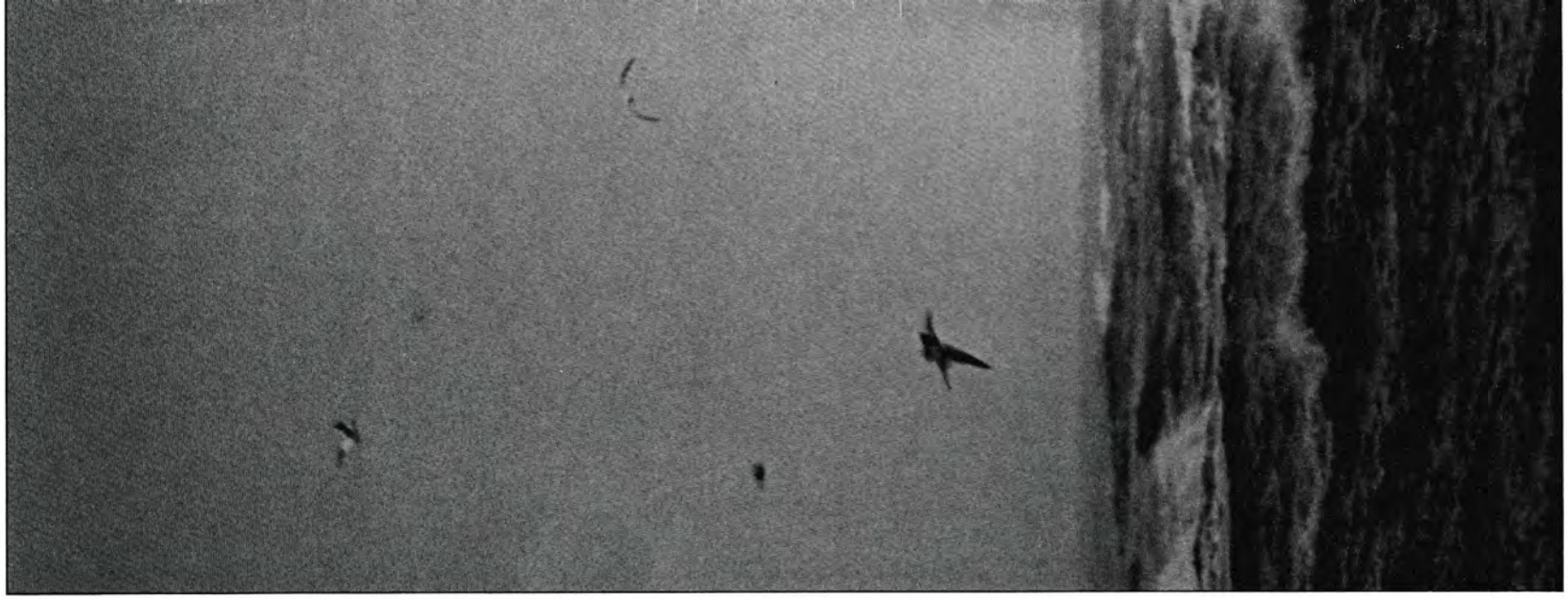

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