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# NOAA

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*COVER*

*Lightning . . . beautiful, awesome, deadly—a major weather hazard in many places and under many circumstances. Boaters beware! (Story p. 18)*

NOAA: Alan Moller

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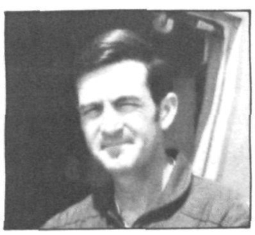

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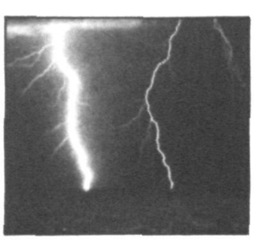

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# Hurricane Preparedness: A Team Effort

Thomas B. Owen
*Assistant Administrator for Oceanic and Atmospheric Services*

Many Americans will clearly remember 1979 as the year that the threat of hurricanes came alive again. Three hurricanes struck the U.S. coast last year, a sharp contrast to the average of one a year that reached the mainland during the 1970's.

As the 1980 hurricane season opens, there are still too many localities that are unprepared for the major hurricane that ultimately will strike a highly populated coastal area and perhaps cause a catastrophe, one which might largely be avoided.

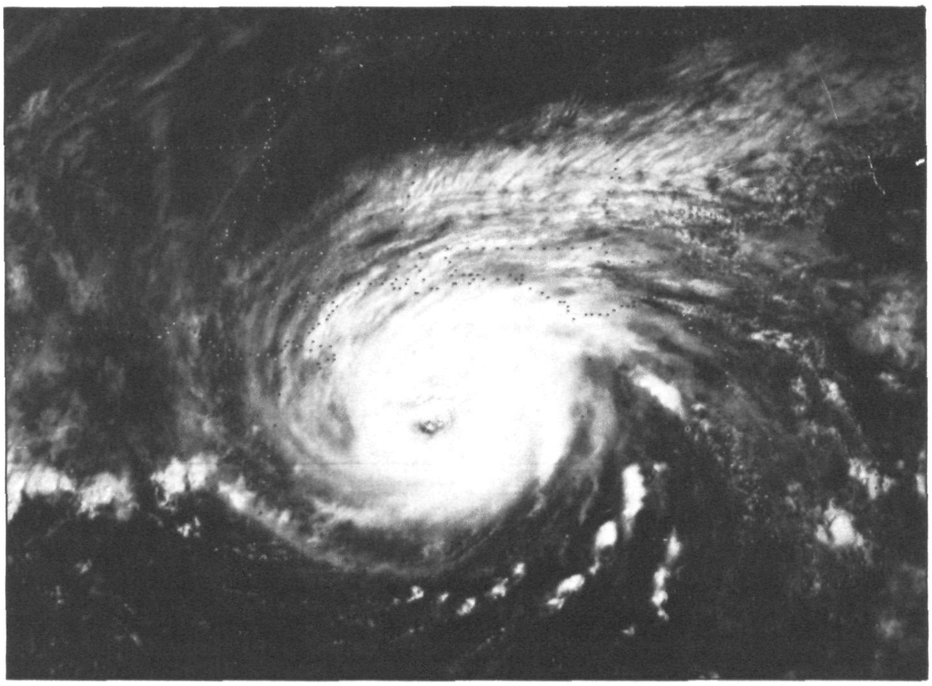
The excellent emergency planning on the local level, coupled with the excellent forecasts by NOAA's National Hurricane Center, kept last year's hurricane Frederic from being an even worse disaster than it was. At that, Frederic was the most costly hurricane in U.S. history, causing $2.3 billion in damage and leaving five persons dead.

There is no recognized periodic cycle for hurricanes. Although they do seem to come in bunches, both the number of hurricanes and their area of occurrence vary widely each year. The decade of the 1940's was characterized by major storms over the state of Florida, and the 1950's saw storms concentrated along the east coast. During the 1960's and most of the 1970's, the Gulf of Mexico received the brunt of the storms.

If last year's hurricanes are a precursor of things to come as some people suggest, we may be cycling back to what we saw in the 1940's or 1950's. If so, will the highly populated areas along the east coasts be prepared for storms that can cause major loss of life and extreme damage? Many such areas have untested or outdated evacuation plans. Coastal areas most vulnerable to hurricanes are the heavily populated communities that have sprung up on barrier reefs and along the seasides in low-lying areas. In some cases, they could be flooded hours before a hurricane makes landfall, blocking off vital automobile escape routes. The potential for a major hurricane disaster is there when transportation routes are not adequate to handle mass evacuation in a short time.

NOAA men and women have important roles to play in obviating such a disaster. At the very front line of defense are the meteorologists, the forecasters who keep Americans warned of impending danger. Their vital work is supplemented by regional and local contingency planning aided by the Coastal Hazards program, by Marine Advisory Service agents throughout coastal areas, and in many other ways. Two are touched on in this issue. Research scientists modeling hurricanes have been an important source of support for the frontline forecasters, trying to use the powerful tools of science to help improve forecasts; work carried on during hurricane Frederic illustrated the progress that has been made. Also well known and a reservoir of critically needed assistance when the going gets rough are the aircrews of the U.S. Air Force Reserve squadrons that fly hurricane weather reconnaissance, some of whom are National Weather Service meteorologists on Reserve duty.

As the hurricane season opens again, it is appropriate that we note such contributions to the massive team effort to prepare for and combat these terrible storms.



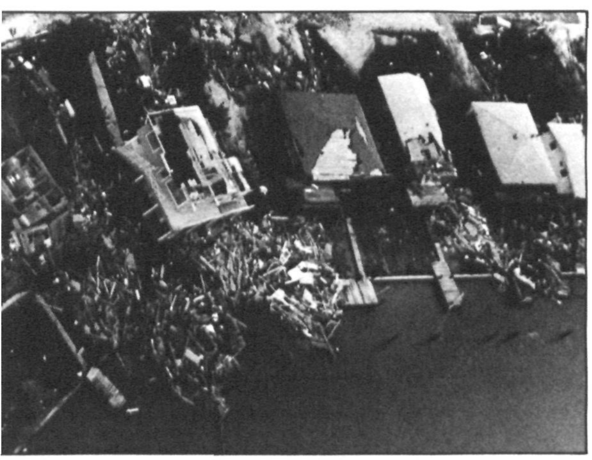
# Modelers help meteorologists

# FORECASTING FURIOUS FREDERIC

Joan Vandiver Frisch

*Before Frederic, the Alabama Gulf coast was a resort with excellent facilities for vacationers; immediately afterwards, it was a mass of rubble.*

*Ala. Bureau of Publicity and Info.*



*Mobile Press Register*

For days, NOAA meteorologists in Miami, Fla., had watched the frail, faltering hurricane called Frederic, drifting in the wake of David, a huge and horribly destructive storm. In the second week of September 1979, Frederic hovered over central Cuba, weak and wet, and not very interesting.

Then, as it slipped off the island into the warm waters to the west, it sputtered into the southeastern Gulf of Mexico and its untuned heat engine sprang to fresh life. Soon Frederic was a full-fledged hurricane again. And dangerous.

A hurricane bottled up in the Gulf must exit somewhere.

The physical merging of energy and wind and water that drove Frederic was paced by an intellectual and scientific confluence ashore. While forecasters at the National Hurricane Center in Miami focused on the storm, scientists one floor below at the National Hurricane and Experimental Meteorological Laboratory also turned their attention to Frederic. Their job is to study the internal dynamics of these terrible storms from the tropical atmosphere. In this 1979 season, forecasters and researchers were more closely bonded than usual through Project Hurricane Strike, an effort to use research results to improve hurricane forecasts. One vital element in this research program is a real-time data link (via NOAA geostationary satellite) between NOAA research aircraft in the storm and forecasters at the Center.

So, as Frederic poised in the Gulf, aircraft from NOAA's Miami-based Research Facilities Center took scientists into the storm, where they measured its forces and relayed data back to the forecasters.

Brian Jarvinen was one of the meteorologists on duty as Frederic moved within a few hundred miles of the Gulf Coast, and weather radars began to pick up the big bright spiral of the storm south of Pensacola, Fla. He was part of the confluence of operational science and basic research unfolding under the gathering emergency of Hurricane Frederic. At 6 p.m. on Tuesday, September 11, the Hurricane Center issued its first hurricane watch statement to the public. Jarvinen explains: "Once we knew the storm was aimed at the Gulf Coast, we could feed the information from the aircraft and the coastal radars into various computer models we use as guidance to help predict the track. Our first warning put the landfall somewhere between New Orleans, La., on the west and Panama City, Fla., on the east—about a 250-nautical-mile stretch of coast."

Although it was clear that Frederic was spinning toward Mobile, Ala., the forecasters' ability to predict Frederic's specific impact was dulled by the presence of Mobile Bay, a big, complex body of water that is neighbor to tens of thousands of people.

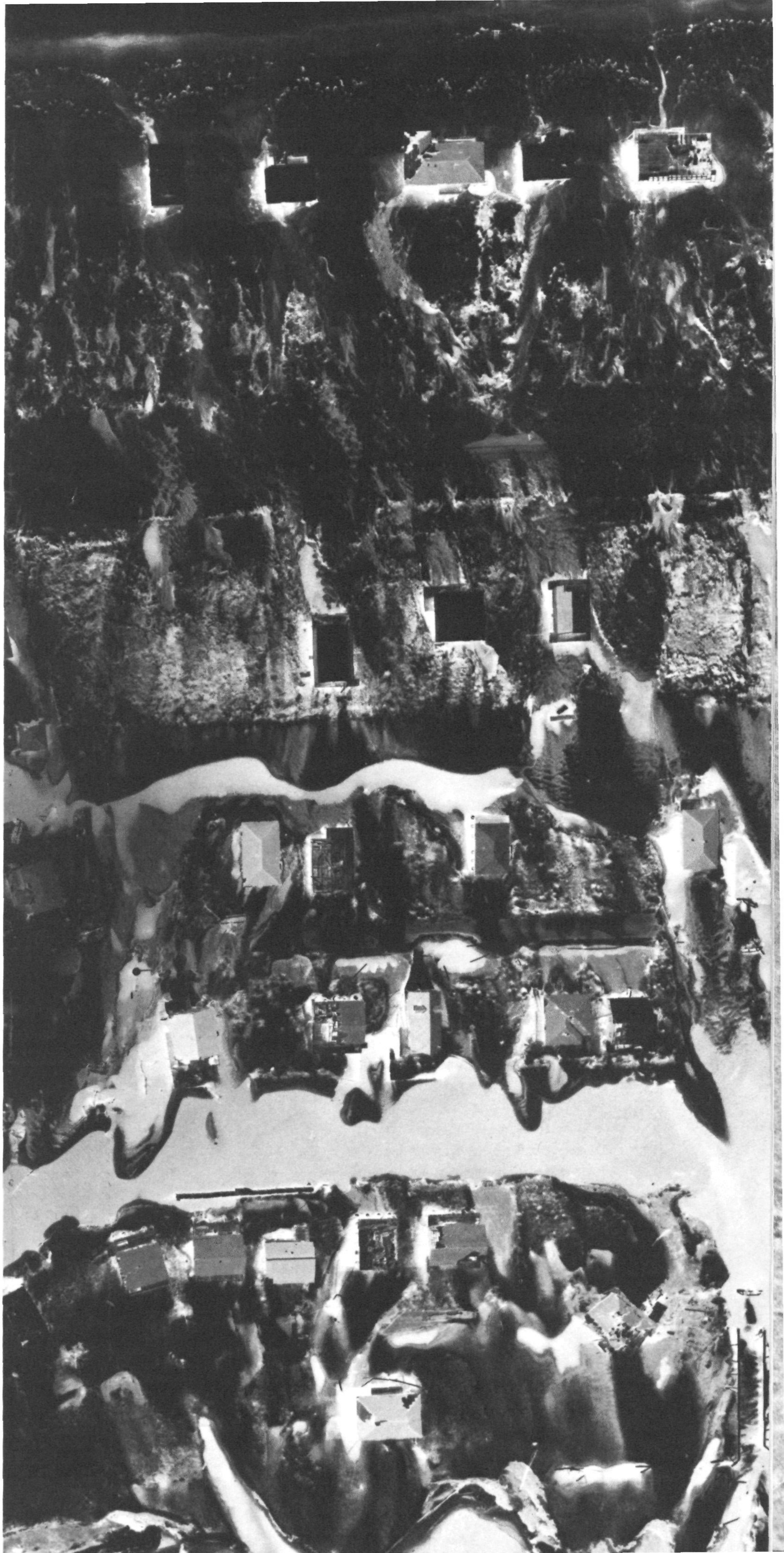
Storm surge, the general rise in sea level accompanying the big disturbances, is a hurricane's most lethal weapon. Wind may do much of the property damage, but water does the killing. The predictive tool at hand was an "open coast" computer model that visualized the coast as a solid line, without bays or estuaries—a coastline quite different from the intricate reality of the Mobile Bay shoreline.

At this juncture, the forecasters were able to reap a reward, a return on an investment they had decided to make in 1974. About that time Dr. Carlisle Thacker of the Atlantic Oceanographic and Meteorological Laboratories in Miami, had begun work on a computer model capable of visualizing an irregular coastline—a model that, rendered graphically, looks more like a stretched net of triangles than the usual rectangular grid of data points. The project focused on Mobile Bay, one of the largest and most complex embayments along the entire Gulf Coast.

In 1974, knowing the bay would have its hurricane sooner or later, the Hurricane Center had opted to provide Thacker such assistance as it could, in the person of Brian Jarvinen, assigned to the model-development task. The storm surge estuary model that evolved from this effort can fit the curvature of the coastline and its bays and estuaries, permitting a mathematical solution of the entire set of model equations, rather than just those pertaining to a straight coastline.

"Bays such as Mobile with high population densities make them the most vulnerable coastal areas, but they are also the most difficult to model," Thacker says. "Each bay has its own particular set of characteristics, including its specific irregularly shaped coastline and seafloor, which influence how water flows in and out of the estuary."

During the early morning hours of September 11, the forecasters at the Miami Hurricane Center ran the "open coast" model, developed by NOAA's National Weather Service, to estimate the deadly storm surge for the open coast. The computer's answer: the highest surge, 12 feet, would occur near Gulf Shores, Ala., 50 miles from Mobile. Based on high-water predictions for the outer coast, high water inside of Mobile Bay could reach 15 feet. Using these values as guidance, the 5 a.m. Hurricane Center forecast indicated that tides of 10 to 15 feet above normal could be expected on the outer coast and inside the populated bay.



*An aerial view of part of Mobile taken by NOAA photoplane, indicates the extent of damage felt by the Alabama city and shows the terrible effects of the storm surge.*

Thacker's "estuary model" was run several hours later to reaffirm the high water estimate and to give more details on tides in the bay.

At 6 a.m., Wednesday, September 12, Ray Barnes, meteorologist in charge of the NWS office in Mobile, made the following forecast: "Alabama and Mississippi coastal areas will be affected by 35 to 40 mile-per-hour winds around noon Wednesday. The wind will increase to about 60 miles per hour by 6 p.m. today, and to above hurricane force before midnight."

The local weather station also issued an evacuation statement for about 40 specific areas: "All mobile home residents or persons living in any structure that does not provide adequate protection should move to a substantial structure. Do not take these warnings and recommendations lightly. This is an extremely dangerous situation."

As a result, through the efforts of NOAA and the local Civil Defense, Red Cross, and State Patrol officials, 500,000 people were evacuated from the hurricane's path in Mississippi, northern Florida, and Alabama, including 100,000 from Mobile County.

When Frederic roared into Mobile Bay with winds from 100 to 145 miles per hour, its eye measured 50 miles long and 40 miles wide before hitting land. After Frederic had made landfall at Dauphin Island, 15 miles from Mobile, at 9:30 p.m., its eye began to compress as it moved northward, sweeping close to the west edge of the bay.

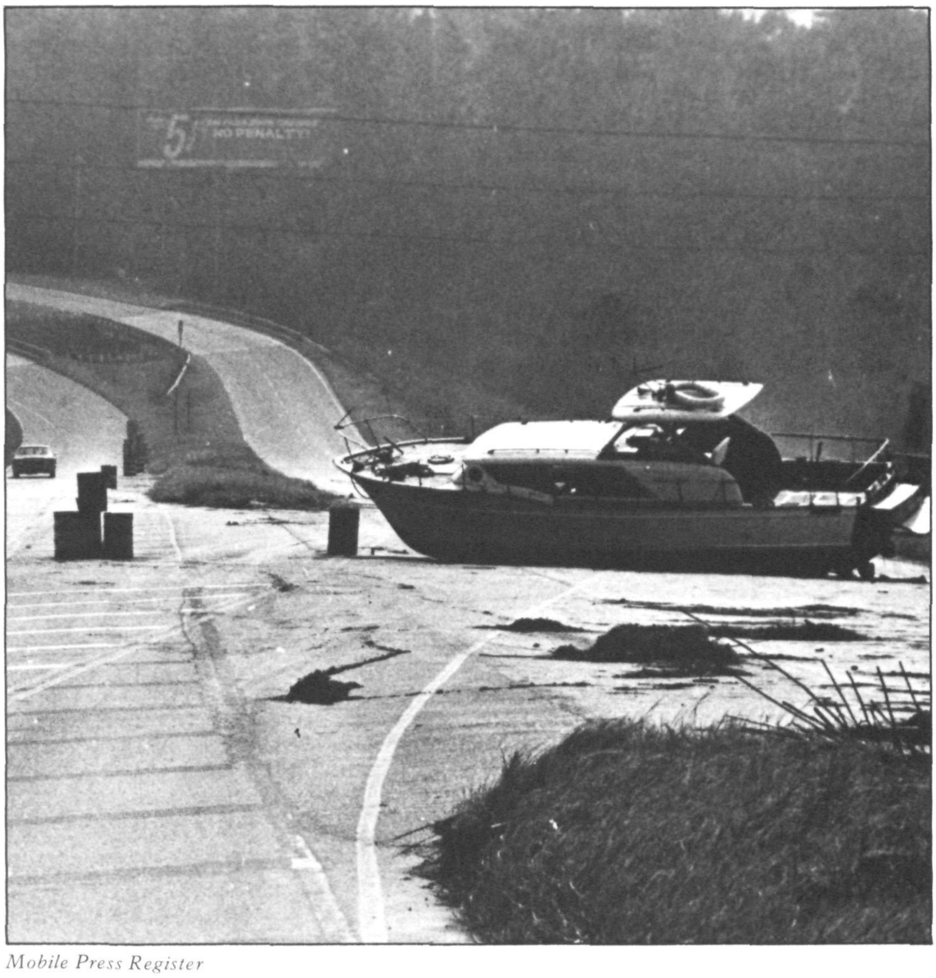
With high winds blowing in a counterclockwise direction, the hurricane first pumped water out of the bay. After the storm center had passed, the estuary filled up again, accompanied by wind-driven tides that slammed the shore as high as 12 feet above normal.

The gratifying performance of the model Thacker and Jarvinen had used—a model that, until Frederic began stalking Mobile, could not have been regarded as anything but an experimental research tool—pointed up the utility of that approach in predicting storm surges for America's ragged southern coasts.

Although models such as Mobile Bay's were designed to be used by forecasters, they may also provide an economical tool for land-use planners designing evacuation routes and for actuaries deciding on risks and rates for flood insurance.

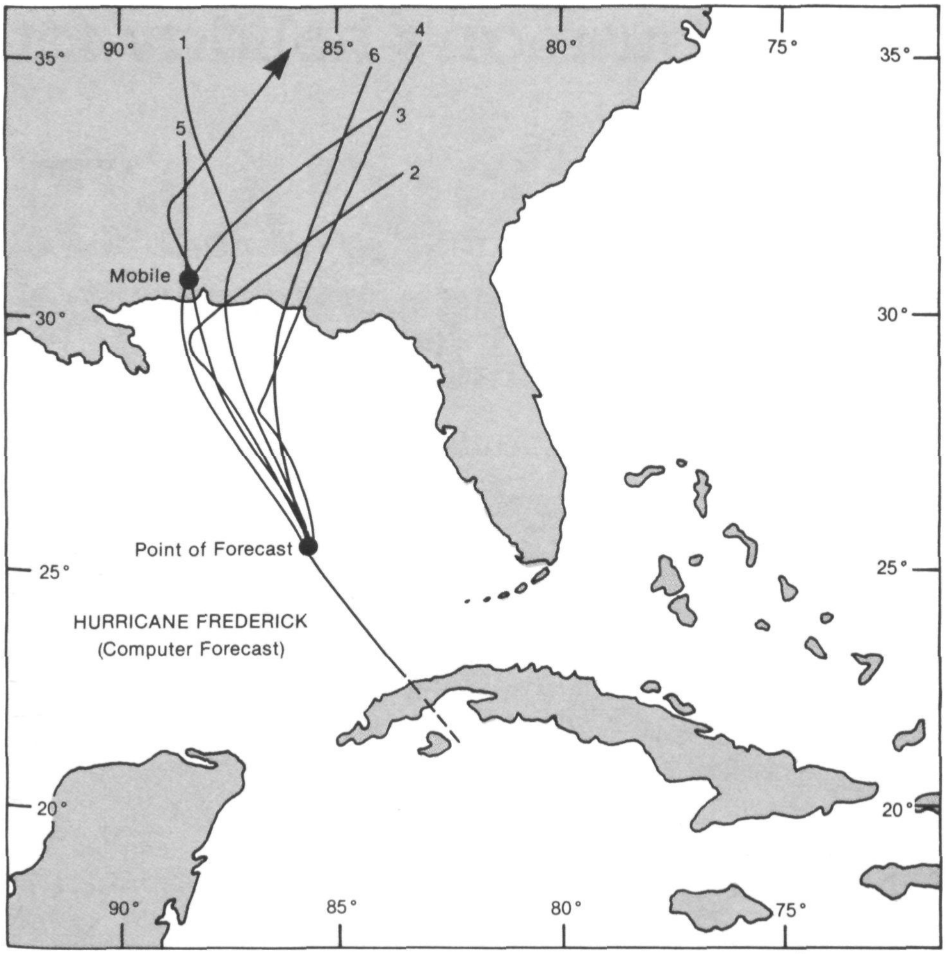
To adapt the model to each coastal area with varying shorelines and bathymetry (seafloor topography), the Miami scientists are assembling a computer catalog of specific geographic areas. This information is being taken from coastline charts produced by NOAA and plugged into the computer.

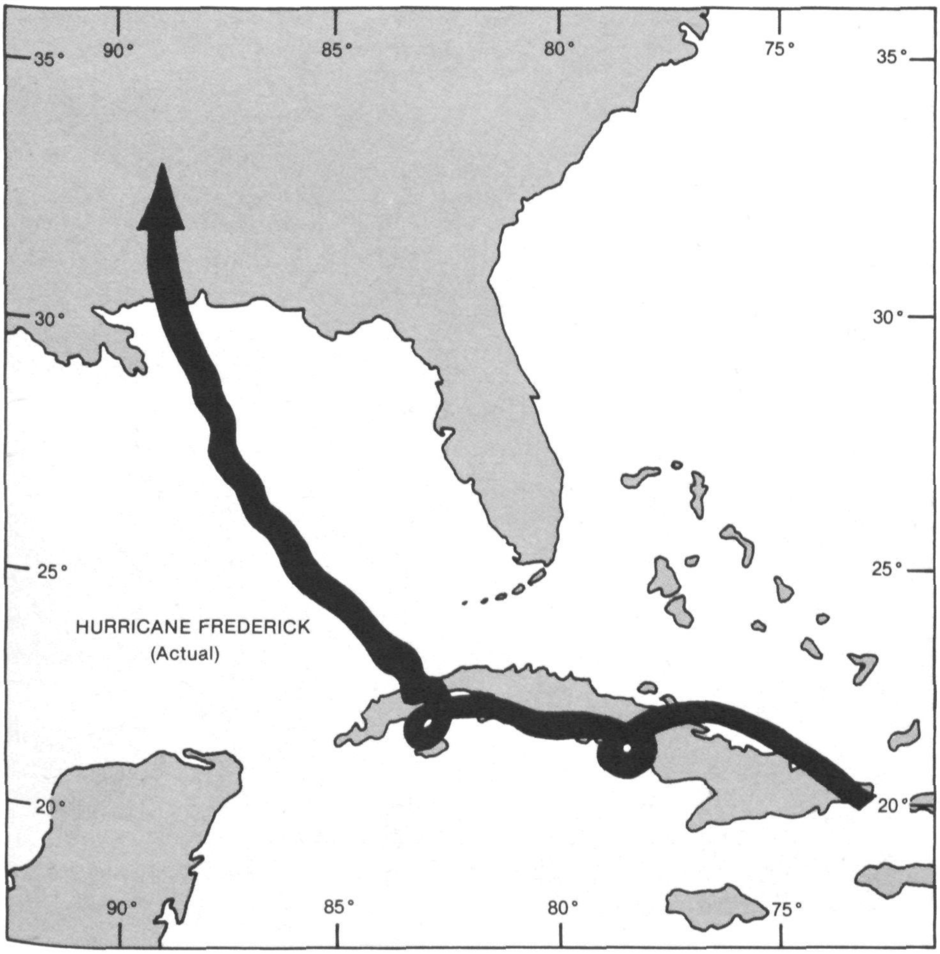
"One area under study is Long Island Sound, where a storm surge might flood the subway system of New York City," Thacker explains. "Rivers, such as the Hudson, can also affect storm surges in two ways. They provide channels for surges to propagate, so it is necessary to forecast the height of the surge along the rivers. And because the water can flow up the rivers, less water accumulates



*A cabin cruiser was left high and dry—perched precariously on the Mobile Bay Causeway after hurricane Frederic swept the city with winds of up to 145 miles per hour, and 12-foot storm surge.*

*Mobile Press Register*




within the bays, reducing the height of the surge around the bay."

Currently, NOAA scientists are preparing models for Biscayne Bay and Florida Bay near Key West.

According to Thacker, the Biscayne Bay area includes many homes built less than 5 feet above sea level. Florida Bay is important, he says, because of the burgeoning population in the Florida Keys. The only escape route to the mainland from Key West, for example, depends on an antiquated system of bridges, many in need of repair. And the height of the road above sea level could also be worrisome.

"If a hurricane similar to Frederic caused a 10-foot storm surge in that area, the Keys, like many other areas along the coastline, would be in real trouble," Thacker says. "That possibility makes our mission an urgent reality—a continuing effort to save lives from the devastating effects of hurricanes."

Last September, the timely application of a basic research tool may have saved scores of lives around Mobile Bay—another instance of an evolving trend, in which the unfinished products of basic research are needed to solve a difficult environmental problem.

*Top map shows course of Frederic across Cuba and northward, as charted at the time (dotted line, winds below hurricane force) and available to modelers. At point indicated, scientists obtained six possible tracks of the storm by using six statistical methods; the resulting forecast track (with arrow) represented a combination of the six. Bottom map shows the actual course of Frederic as computed later on the basis of full data, and confirms the accuracy of the prediction.*

It's busman's holiday for

# NOAA'S HURRICANE HUNTER RESERVISTS

*All photos courtesy Public Information Office, Keesler AFB.*

David G. Morris

*The author is known sometimes as David G. Morris, Hydrologist-in-Charge, National Weather Service River Forecast Center, Fort Worth, Texas, and sometimes as Major David G. Morris, USAFR, 920th Weather Reconnaissance Group, Keesler Air Force Base, Mississippi.*

***The eye of the hurricane is an excellent place to reflect upon the puniness of man and his works. If an adequate definition of humility is ever written, it is likely to be done from the eye of a hurricane.***

Edward R. Murrow

The late, great organist E. Power Biggs would practice all day long, and then in the evening for relaxation he would sometimes play the organ.

E. Power Biggs loved his work, and the world was the better for it.

There is a group of NOAA weather forecasters who also love their work, do it on the job and off, and maybe make the world a little better for it, too.

On the job, they hold such positions as meteorologist at the National Climatic Center, hydrologist at the Fort Worth River Forecast Center, lead forecaster in New Orleans.

Off the job, they are "weekend warriors," the largest part of the Air Force Reserve's Aerial Reconnaissance Weather Officer staff, and they fly missions ranging from routine data collection to hurricane hunting.

The more data weather forecasters have, the more accurate their predictions are likely to be. Aerial reconnaissance—a substantial portion of which is carried out by the Air Force Reserve—provides a vital part of this data. The NOAA civilian meteorologists bring to the Air Force weather recon program valuable skills that are applied to a multitude of weather-related programs.

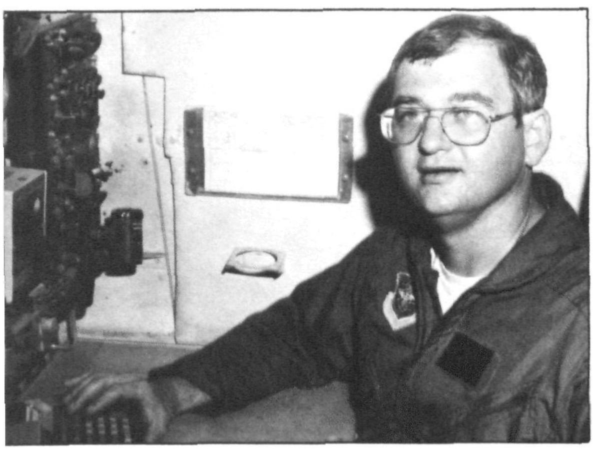
Hurricane hunting, for example. When the reservists fly into one of those fearsome storms, they have a major objective in mind—to locate the storm center, the eye, and measure all kinds of meteorological data. And radio it back to the National Weather Service, pronto. Those measurements are of utmost importance to, for example, NOAA's National Hurricane Center, which has the job of predicting the path and strength of the storm, and alerting the public to its dangers.

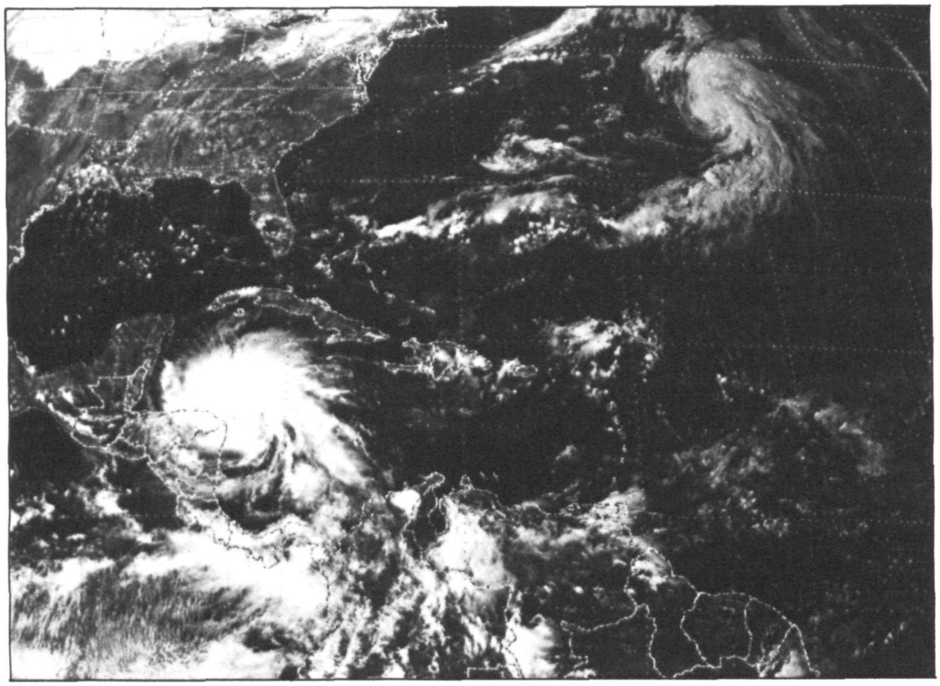
So last year a top-notch Air Force reserve outfit, the 920th Weather Reconnaissance Group, commanded by Col. Charles B. Coleman, III, tackled the two big hurricanes that hit the southeastern coast. The weekend warriors chalked up 100 flying hours between August 27 and September 6 on 10 flights into hurricane David, getting 24 position fixes on the eye. And in 154 flying hours between September 2 and September 14 they made 15 flights into hurricane Frederic and got 39 position fixes on its center vortex. National Weather Service reservists were the weather officers on 40 percent of those flights.

A hurricane flight is often more than just a bumpy ride. It can be a slam-bang, stomach-churning, spine-jarring, heaving, yawing, pounding nightmare of a ride, with pilots straining at the controls and meteorologists struggling to read their instruments. Penetration of the eyewall—that furious whirlpool of wind and water—puts the greatest stress on man and machine, with violent shear between eyewall and eye . . . and suddenly, calm.

"The first time I penetrated a hurricane, I wondered if the aircraft was going to hold up and if we were going to get through the wall cloud," said Capt. David McIntosh, a 920th meteorologist. "We did, of course—six times that night, in fact. After all the bumping and grinding, complete calm—suddenly everything just

*Author David Morris, USAFR, deplanes after training mission. On facing page, flight crew loads up at Keesler Air Force Base for storm reconnaissance mission.*





*An 815th air crew (top) returns from mission to get a close look at 1978 hurricane Greta, shown at top right in satellite view. New Orleans lead forecaster Julian E. Nevarez, a Lt. Col. in the Air Force Reserve, reads instruments (center) en route to storm; Oklahoma City meteorologist Nickey P. Jones—Capt., USAFR—is shown (bottom) at WC-130 weather officer's console.*

relaxed. I was left with a feeling of euphoria."

These are feelings that the fliers of the 920th share with the men and women of NOAA's own National Hurricane and Experimental Meteorology Laboratory and Research Flight Center, and with very few other human beings. A few inquisitive reporters like Ed Murrow, a few research scientists, and that's about all.

The missions of the Air Force reserve hurricane hunters and the NOAA hurricane hunters differ, but there is some overlap. The Air Force flights make measurements that contribute directly to the forecasts of the National Hurricane Center. The NOAA flights also contribute real-time useful information, but in addition are designed for research—to make possible a better understanding of the forces generated within these terrible storms, and perhaps help lessen their violence.

Within the 920th group, the NOAA reservists make up an important part of the 815th Weather Reconnaissance Squadron, the Storm Trackers, as they call themselves, also based at Keesler Air Force Base, Mississippi. The 815th, commanded by Lt. Col. J. B. Cobb, is the flying arm of the 920th. Their duty aircraft is one model of the C-130 *Hercules*, a trustworthy four-engine prop jet in use for everything from Navy resupply of the U.S. station at the South Pole to combat-support airlift. One of the three NOAA research aircraft is a C-130.

The WC-130's used by the Air Force reservists from NOAA carry two meteorological sensor systems. A horizontal system measures atmospheric data at the aircraft flight level, and a vertical system takes soundings between the plane and the sea surface below—10 kinds of measurements altogether, including sea surface temperature, atmospheric temperature, pressure, and others important to forecasters trying to figure out the probable paths of weather systems. The onboard meteorologists also make eyeball estimates of surface wind, clouds, icing rates, and other flight conditions.

The kind of data collected on any flight depends on the needs of the customer—for example, of the National Hurricane Center (NHC) when they are on a tropical cyclone (hurricane) flight. The on-board meteorologists radio their observations directly to a weather monitor, through an aeronautical station direct phone patch.

Air crew complement for a mission normally consists of a pilot (the commander of the aircraft), co-pilot, navigator, flight engineer, dropsonde operator, and meteorologist who frequently is a NOAA reservist.

One such NOAA reservist is Fred Foss. His regular job is as meteorologist with the Air Route Traffic Control Center near Denver, Colorado. When on active duty, he is Major Fred Foss, the only Air Force Reserve Weather Officer still flying weather recon who flew into the most violent storm in recent history, hurricane Camille in 1969. "The eye of Camille was so small," Foss said, "that

*Dr. Neil Frank, Director of the National Hurricane Center, discusses dropsonde instrument with a weather observer on board the Air Force WC-130.*

the plane couldn't turn sharply enough to stay inside. We went from violence to calm to violence without let-up. Camille was the only hurricane that really frightened me."

Foss has also been largely responsible for the development of software that permits on-board use of modern programmable calculators, greatly reducing operator error rate and increasing both the amount of data collected and the time available for in-flight quality control.

Last summer, while on a routine low-level tropical mission near the Leeward Islands, I discovered a storm that the National Hurricane Center promptly named Claudette. I followed Tropical Storm Claudette westward for a week, and when I was released from reserve duty on a Sunday, it was dissipating over Cuba.

Feeling confident that Claudette was no longer my problem, I went back to work at the River Forecast Center in Fort Worth. Surprise! Claudette had moved offshore during the night, strengthened, and was churning a path straight for Texas. By Tuesday the storm was dumping record rains along the coastal plains. The frantic pace in the airplane gave way to a frantic pace in the office, as we forecast devastating river crests for a multitude of streams.

It was with no regrets that I bid Claudette goodbye a couple of days later. That tumultuous "lady" had haunted me from her birth to her death.

Tropical cyclone reconnaissance takes up much of the flight time of the 815th "Storm Trackers" from May through October. Their job of picking apart the storm is vital to the formulation of forecasts and warnings to protect the public from the killer storms that sometimes devastate the highly populated U.S. coastal plains. In addition, the reservists fly flight patterns in each quadrant of the storm, at altitudes of 1,500 feet and 10,000 feet, to measure wind speeds and distribution, pressure, temperature, dew point—data that also help forecasters track the storm and predict its path and ferocity.

In the Atlantic, Caribbean, and Gulf, the reservists carry out 70 percent of the Air Force hurricane and tropical investigative missions; the active duty forces complete the other 30 percent.

Hurricane missions, however, are not the only jobs the NOAA reservists take on. In the mysterious world of Air Force terminology, the others are known as:

- *Volant Coast*, weather recon missions along the Atlantic Coast from November 1 to April 15 to help forecast the severe winter storms that often hit the east coast
- *Volant Met*, weather recon in data-sparse areas of interest to Air Force Global Weather Central
- *Volant Cross*, looking at weather in over-water refueling areas and routes for the deployment of large Tactical Air Command (TAC) fighter units
- *Wartime missions*, if need arises.

Volant Cross missions typically involve flights to Europe, giving NOAA meteorologists a chance to see a bit of the world. The author, for example, visited England, Spain, and the Azores during one five-day TAC support venture.

Volant Met missions flown each year in January out of McChord Air Force Base in Washington State are popular. Typically, an air crew will fly every other day, leaving time on alternate days to relax at nearby ski slopes. It's a welcome way to wind down after 10 or more hours flying a 300-millibar track over the North Pacific.

The NOAA reservists are products of long training, both as meteorologists and as Air Force officers. Their reserve duties are sometimes routine, sometimes adventuresome, but there is a payoff both to NOAA and to the reserves in enhanced meteorological skills that deliver a cost-effective service to the Nation. That's their work, on and off the job.

## NOAA's Weekend Warriors

Nine NOAA meteorologists who hold Air Force reserve commissions ranging from Second Lieutenant to Lieutenant Colonel fly with the 920th Weather Reconnaissance Group. They are John C. Bales, meteorologist, Air Route Traffic Control Center, Miami, Fla.; Robert O. Brines, Jr., meteorologist, National Climatic Center, Asheville, N.C.; Fred J. Foss, meteorologist, Air Route Traffic Control Center, Denver, Colo.; Andy Johnson, meteorologist, NOAA Data Buoy Office, Bay St. Louis, Miss.; Nickey P. Jones, meteorologist, Weather Service Forecast Office, Oklahoma City, Okla.; David G. Morris, hydrologist-in-charge, River Forecast Center, Fort Worth, Tex.; Julian E. Nevarez, lead forecaster, Weather Service Forecast Office, New Orleans, La.; James T. Skeen, Jr., meteorologist, Air Route Traffic Control Center, Kansas City, Mo.; and John L. White, meteorologist, Air Route Traffic Control Center, Minneapolis, Minn.

# FISHERMEN ENTER 4TH YEAR OF CONSERVATION

Right away American fishermen noticed a drop in the number of foreign fishing factories in their home waters, but only gradually did it hit them: there's no such thing as a free lunch.

The fishery resources off the United States are entering their fourth year of protection under the Fishery Conservation and Management Act (FCMA) of 1976. The Act, known popularly as the Two Hundred Mile Bill, was passed in September 1976 and came into force in March of 1977. It has profoundly changed the lives of many commercial fishermen. Their fishing activities are now being more closely controlled by new rules and regulations designed to insure abundant stocks of fish for generations to come.

FCMA has also given U.S. fishermen first preference to catch the enormous numbers of fish off our coasts—15 percent of the world's seafood supply. By bringing these fish under U.S. authority, the Act has opened the door to significant growth of the U.S. fishing industry.

Prior to FCMA, U.S. and foreign commercial fishermen went about their tasks relatively unencumbered by controls to guard against depletion of the resource. Foreign fleets were notorious for the large number and size of the vessels that regularly fished off the American coasts, and the methodical way that they harvested huge amounts of fish without regard to potential impacts. U.S. fishermen, fiercely independent and lacking significant financial resources, were sometimes shut out by these well-heeled foreign fleets.

Probably the most noticeable effect of the Act was the drop in the number of foreign vessels off the U.S. coast as soon as it went into force. Prior to 1977, as many as 2,500 foreign vessels fished here. Since 1977, fewer than 950 vessel permits have been issued each year.

The foreigners first came to the New England fishing grounds in 1961 in ships described as "ocean liners" by Boston fishermen who had never seen such large fishing vessels. The first to arrive were the Soviets with about 100 vessels. They returned the next year with about 1,000.

At first, the Americans were concerned with gear the foreigners were using, not the amount of fish they were taking. But in 1965, the Poles, the East Germans, and the Japanese joined the Russians. More than 200,000 metric tons of haddock were taken from Georges Bank and the fishery was almost wiped out. In the 1970's the Bulgarians, Romanians, and Spanish also entered the race. The foreign fishing vessel explosion soon spread to Alaska and the west coast of the United States.

The United States had some control over the catch of fish off its coasts through 23 agreements with various foreign countries, but these just didn't do the job. In 1976, the United States like other coastal countries around the world extended its control over its fishery resources to 200 nautical miles from its coasts.

The Act permits the United States to tell foreign fishermen how much fish they can catch, which species, and where they can catch it. To the chagrin of many domestic fishermen, it enables the U.S. Government to do the same to them.

The Act permits the United States to board foreign vessels while they are in the zone to inspect their records, catch, and gear. It allows the United States to put observers on board vessels for weeks and months at a time to observe their catches, gear, and methods.

Foreign vessels are permitted to catch some species of fish after it has been determined how much of a particular stock can be caught in any one year without harming the stock. Since, under the law, U.S. fishermen have first crack at all fish within the zone, the capability of the domestic fishermen to catch the

## *Open door to growth of an industry*

species is forecast, and any fish that remain to be caught may be allotted for foreign nations.

Before foreign nations may apply for fishing permits they must enter into a Governing International Fisheries Agreement (GIFA) with the United States. The agreement says, in effect, that the foreign country recognizes the 200-mile fishery economic zone that has been established and will abide by U.S. rules and regulations pertaining to the fishery.

The catch by foreign vessels off U.S. coasts since 1977 has dropped by more than a third. In 1976 foreign fishermen caught more than an estimated 2.6 million metric tons of fish within 200 miles of U.S. shores. The first year under the new law, fish allocations to foreign nations amounted to about 2.1 million metric tons, but they caught only 1.7 million metric tons. In 1978 and 1979, with allocations of 2 million and 2.1 million, respectively, they caught 1.8 million the first year, 1.6 million the second.

One sanction available against violators of the foreign fishing regulations is to seize the offending ship. In 1977, three foreign ships were seized, and the fines paid for their release totaled $589,000. In 1978, the number of seizures jumped to 11; fines totaled more than $679,000. In 1979, there were 14 seizures. Not all have yet been settled but $763,000 in fines had been collected by mid-February 1980, and two ships have been seized for violations.

Foreign fishermen are not permitted to catch their allocations free of charge. They must apply for permits for all their ships and must pay fees based on the size of each vessel and whether it catches fish, processes them, or is a support ship for the fishing operations. In addition, they are charged a poundage fee for allocations received. This fee varies with the species and is based on the price that the fish will bring at dockside. In 1977, the United States collected $10.9 million; in 1978, $12.7 million; and in 1979, $20.9 million. These fees paid by foreign countries go into the General Fund of the U.S. Treasury.

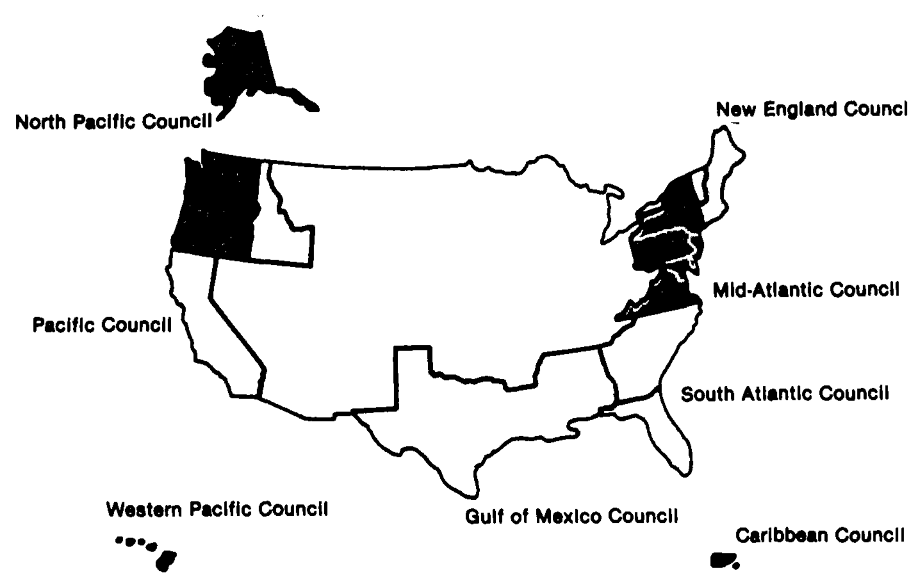
Foreign countries that do not catch their full allocation may request a refund based on the unused poundage. Refunds in 1977 and 1978 amounted to $3 million and $2.3 million, respectively.

Control of domestic and foreign fishermen and the mechanism established by the law to exert this control is the

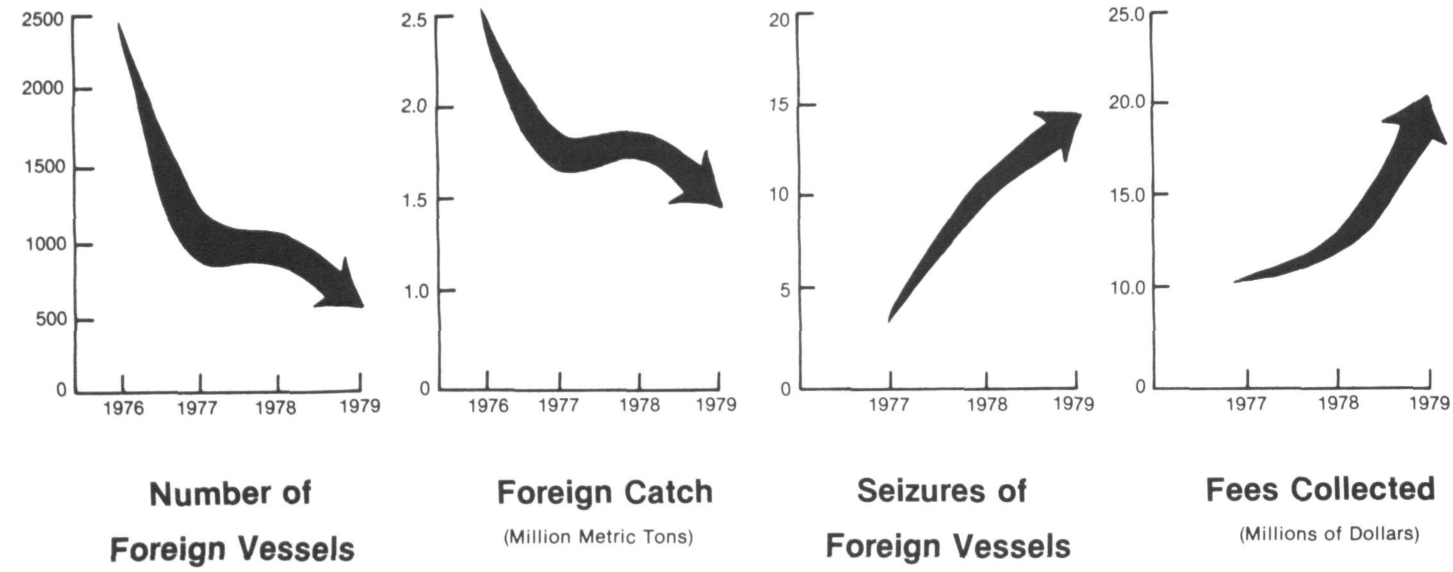
# No free lunch...

Gerald D. Hill, Jr.

*The cod end of a fishing trawl being unloaded on a foreign fishing vessel (opposite page). Catches of as much as 30,000 pounds have been recorded in one such trawl of several hours.*



## SOME RESULTS OF "200-MILE" LAW




result of one of the most far-reaching fishery conservation and management measures ever enacted by Congress.

The Act established a management system entirely different from anything previously adopted by the U.S. Government. It established eight regional Fishery Management Councils, which prepare management plans on the various species of fish found within their geographical areas of concern. Once adopted, they are enforced by regulations drawn up by the National Marine Fisheries Service and established by the Secretary of Commerce.

Councils have from seven to 19 members, depending on the number of states in the Council and the number of at-large members. Most members are selected by the Secretary of Commerce from lists of qualified individuals nominated by the State Governors. This method gives the Council an across-the-board representation of all interests—commercial and recreational fishermen, fish processors, conservationists, consumers, professional men and women, and representatives from academia.

By the end of 1979, fishery management plans regulating both foreign and domestic fishermen had been implemented, and another 60 were in various stages of preparation.

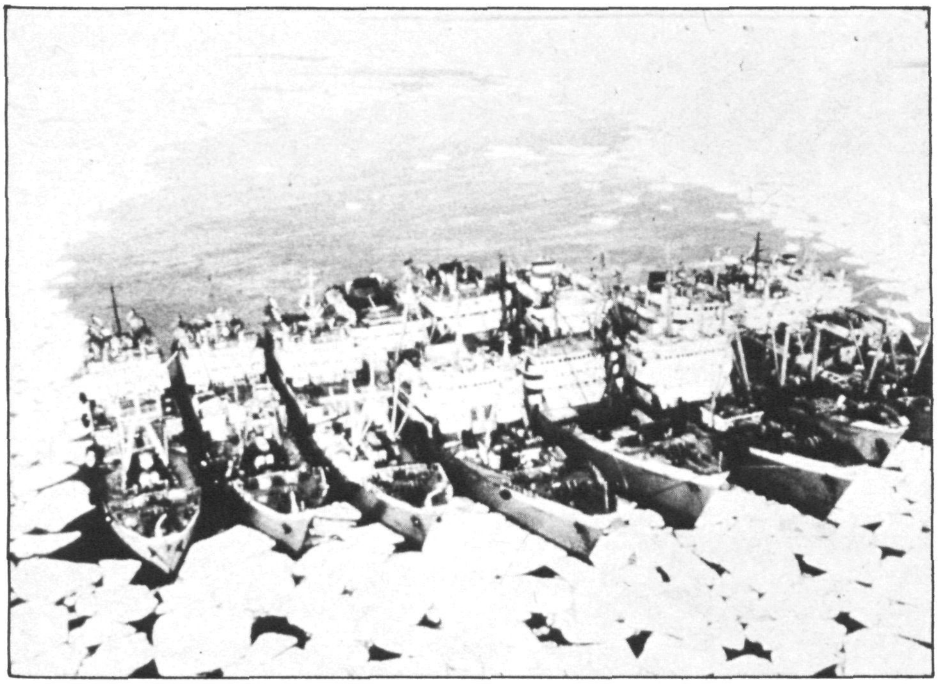
As with any new venture, there are difficulties. The Councils have had their share. A major problem has been educating people to the fact that the regulations apply to American fishermen too, not just to foreign fishermen. Many did not realize this and chose to ignore it when the bill was in Congress and when it became law.

As an example, one of the first management plans implemented controlled the domestic catch of cod, haddock, and yellowtail flounder off the New England coast. With the departure of the foreign fleets, which are prohibited from catching these bottomfish, U.S. fishermen caught them in great numbers.

Scientists, however, warned of drastic drops in the numbers in future years; and the Council placed restrictions on their catch. These scientists based their predictions on random samples taken off the coast which showed that most of the fish were of the same size and thus of the same age. There were not enough smaller

NOAA: J.M. Olson

*Scow loaded with sockeye salmon from Bristol Bay, Alaska—a rich prize off America's shores.*



*Foreign fishing vessels transferring their catch to transports frequently unload in the ice cap because of the stability of the sea.*

fish to indicate that sizeable amounts would be available in future years. The fishermen knew they were catching many more fish than previously, and often paid little heed to the uniform size factor. So the battle was joined.

With the great potential for developing fish resources within the 200-mile zone, interest has increased in boosting the U.S. fishing industry's capability to take part but this will involve improvements in catch techniques and processing methods and the development of new markets. Large investments will have to be made in vessels, processing facilities, product development, and market development.

Recognizing the industry's needs for investment and the sometimes hefty impediments that must be removed, the Congress increased the available funding for these activities. The money comes mainly from duties on imports of fishery products through the Saltonstall-Kennedy Act of 1954 which places no additional burden on U.S. taxpayers.

NOAA also provides support through existing programs, including organizing trade missions and trade fairs, investigating trade and tariff barriers to exports of fishery products, and increasing the amount of fish consumed through school lunch and military feeding programs.

The Act has had a number of unanticipated by-products. For example, a fund has been established to repay fishermen for ships and gear lost through no fault of their own or from losses caused by other vessels. Funds for this "insurance" come from an additional surcharge on the poundage quotas allotted to fishing within the U.S. 200-mile conservation zone.

The law also permits U.S. fishermen and companies to make agreements with foreign nations to catch species of fish not normally used by Americans and to sell them directly to foreign processing vessels. These joint ventures open a new market to them.

The Nation's exports of edible fishery products have more than doubled from 244 million pounds in 1976 to more than 553 million pounds in 1979. Their value has almost tripled, to more than $1 billion in 1979.

Despite the problems still connected with FCMA, few knowledgeable people will dispute the fact that it has been a boon to the U.S. fishing industry.

*Mending nets in the North Atlantic, to make best use of time at sea.*

I've seen lightning up close only once.

We were in a small daysailer tacking across the Rappahannock River when darkness appeared on the horizon, a tight curl of clouds sweeping down from the north. Before we could reach our destination a fist of wind knocked us on our beam ends, nearly capsizing the boat. I suggested docking at the first pier, but my friend decided to race the storm for home—a cozy cabin on a nearby creek.

The thunder was close as we hit the beach. Safe, we thought. While my friend stowed the sail, I bounded the few yards to the porch and waited. He ran in and we sank into rocking chairs to catch our breath. Then the lightning struck.

We had plenty of time to see it. A thick column of light materialized on the water where we had been sailing minutes before. Effervescent bubbles danced at its base, disappearing as soon as the flash ended. I don't remember hearing the sound of thunder at all.

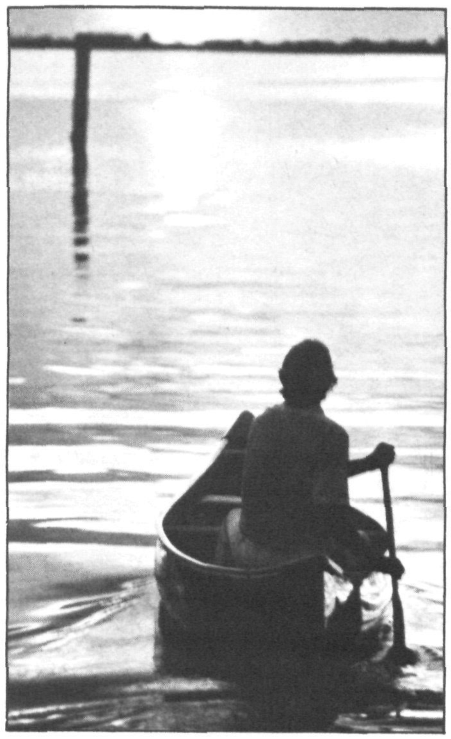
Tales abound around the Chesapeake of close calls with lightning, and the threat of lightning seems to increase as one heads down the Atlantic coast. Maine experiences only about 20 thunderstorm days a year compared with Maryland's 30 and Florida's whopping 100. Most thunderstorms occur on warm afternoons, but lightning can strike almost anytime, anywhere. Three days after Christmas 1978, lightning struck and killed a jockey working out at a Miami race track.

People involved in outdoor recreation should take special care when lightning threatens. Sailors, fishermen, swimmers, and golfers present prime targets. Of 2,054 people killed by lightning in the 20-year period 1950-1969, 494 were engaged in outdoor recreation, according to a NOAA study; 200 of them were on or near open water. This same study reports that 941 outdoor recreationists suffered injuries from lightning, 177 while on or near open water. Of these:

- 39 killed and 30 injured were fishing from a shore or bank;
- 33 fishermen in boats died, and 21 were injured;
- 30 other boaters died and 38 were injured;
- 9 swimmers died and 9 were injured.

Last summer my next door neighbor was struck by lightning while in a sailboat making its way through a nighttime thunderstorm. Sitting on his porch during another stormy evening, he recalled the experience:

"We were motoring into Eastern Bay after dark with lightning all around. I was in the cockpit, the tiller and a flashlight in one hand and my other hand on the lifelines. My brother, who was in the cockpit with me, says he suddenly saw me lit by a flash from the masthead. I felt a jolt run through the lifeline into my hand, and my flashlight seemed to jump overboard. For a long moment I



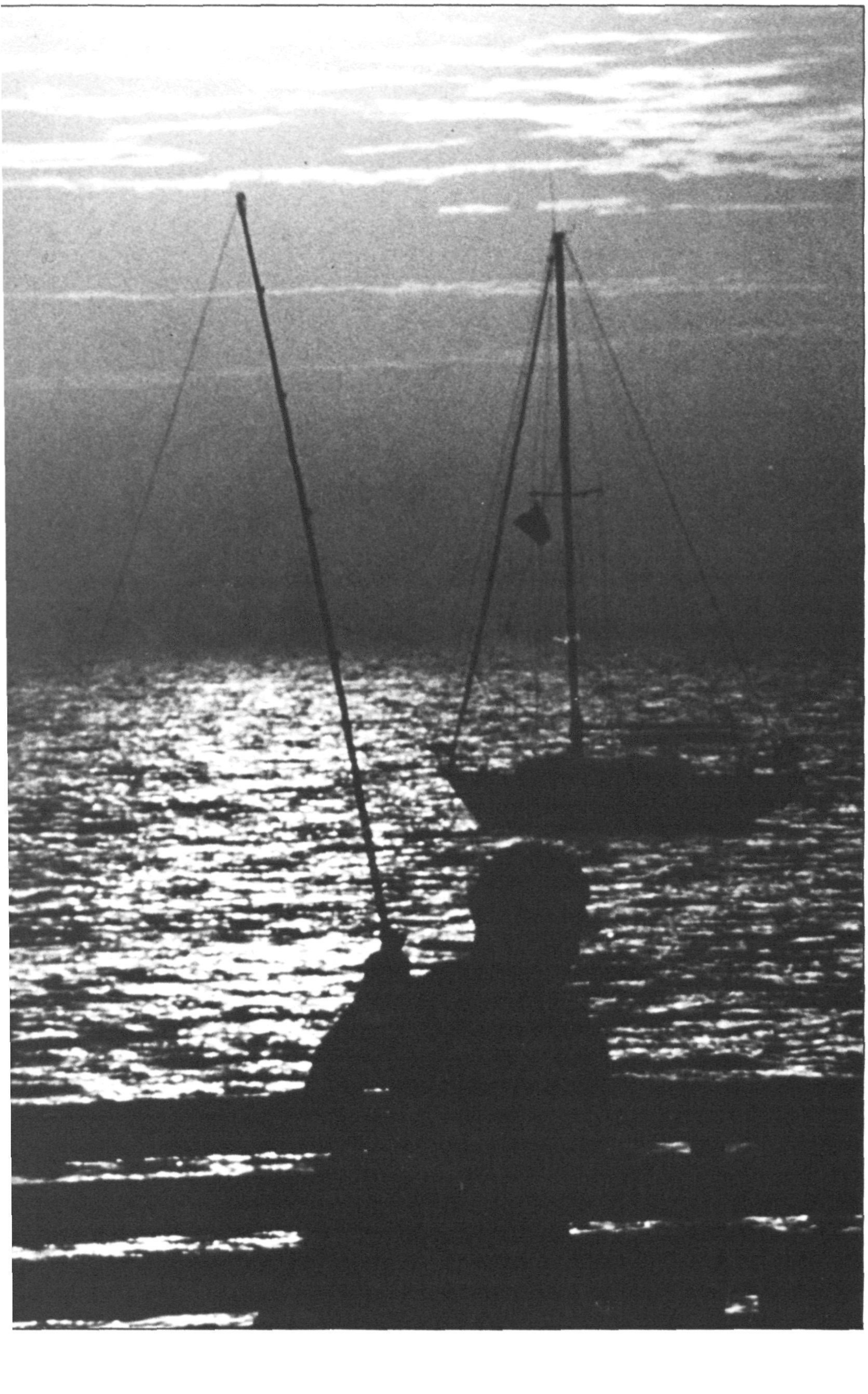
Bernard Brandt

## Boaters beware!

# DON'T TAKE LIGHTNING LIGHTLY

Jack Greer

*Jack Greer is a Communications Specialist with the University of Maryland Sea Grant Program*



was afraid to look at my hands—which, astonishingly, were not badly burned. My brother was staring at me—later he said he expected to see me fried.

"I called out to the others—luckily no one was hurt. The cabin was dark now, and with the running lights knocked out and the flashlight gone, I found it hard to get my bearings.

"The next morning we woke to find several inches of water in the cabin. A hose leading from the head through the hull had been punctured and was leaking. The VHF antenna was completely destroyed; fuses had been pulverized and electric wires burned.

"All in all," my neighbor concluded, "we were pretty lucky."

Bob Kocher, University of Maryland extension boating specialist, believes the plastic coating around the lifelines may have saved my neighbor's life.

Many lightning victims can be revived by quick mouth-to-mouth resuscitation or, if there is no pulse, by cardiopulmonary resuscitation. According to researcher Martin A. Uman, about two-thirds of the victims recover fully. These lucky ones were probably only close to a lightning strike, not hit directly.

A pattern emerges from lightning-death statistics. Outdoors is more dangerous than indoors. Farmers who stay in fields during storms invite disaster, and anyone seeking shelter beneath a tree gambles with his life. Indeed, the greatest number of people killed—12 to 15 percent of all lightning deaths—were standing under trees when they were hit.

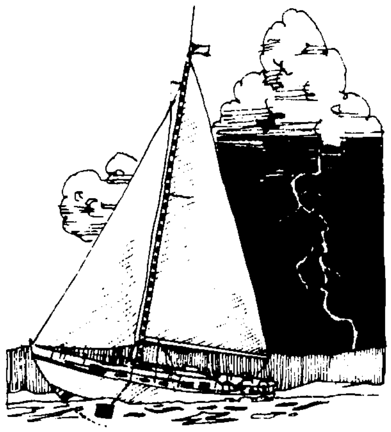
Clearly, lightning should not be treated lightly.

What is lightning and how can you protect yourself from it?

Lightning is nature's way of equalizing electrical charge differences between clouds and earth. It can leap from cloud to cloud, from cloud to earth, or from earth to cloud, carrying as much as 100 million volts of electricity. The discharge occurs as the flow breaks through the insulating air to dissipate through a ground: a tree, a boat,—or a person.

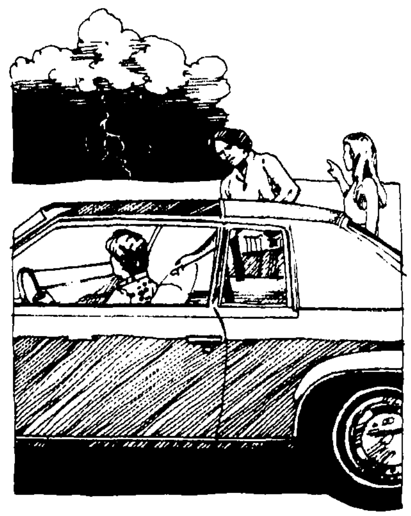
For protection in a boat, give lightning a ground. Boats made of steel, such as naval vessels, have a ground in their metal hulls but most small boats, made of nonconducting fiberglass or wood, block the lightning's easy access to water.

## GUARD AGAINST LIGHTNING



• *To ground your boat,* run a number 4 wire from a metal rod or antenna to a square foot of copper flashing dangled in the water or attached to the hull below the waterline. Be sure the rod is the tallest thing on board and the copper plate is always in the water.

• *When in a small boat,* try to get to shore. In a low-lying craft even a seated person could present the highest point in the boat's profile. Records show that lightning can strike outboard motors, sometimes killing their operators.



• *When on land,* get into a house, large building, or all-metal vehicle. No guarantees hold for lightning's behavior, but a car's metal skin usually bleeds off electrical charges, protecting its occupants. Lightning has killed people standing outside cars, leaving those inside unharmed.

• *When at home during a storm,* use the telephone only for emergencies. Telephone wires—especially rural lines—can carry high voltages.

• *If caught outside,* do not stand under a tree or near metal objects. Get off and away from bicycles, motorcycles, scooters, golf carts, or horses. Avoid wire fences, pipes, or rails—even clotheslines. Also avoid small isolated structures such as sheds or outhouses. In a forest, seek dense, low-lying trees or bushes; stay away from tall or lone-standing specimens.

• *If no shelter is near,* find a ravine or valley, but stay away from watersheds that could conduct electricity or become swollen streams. Remember, lightning can travel for yards through water or damp earth to claim its victims.

• *If in a group,* spread out. This will decrease the number of injuries should lightning strike. If you're tall, hunch down.

Small boats may also lack tall objects that could deflect lightning, and even boats that do have tall spars—such as sailboats—can run into problems if the spars are not properly grounded.

Lightning hitting an ungrounded boat could explode the mast, smash a hole through the hull, or cause death by electrocution. My neighbor, whose boat did not have a proper ground, realizes that he was lucky.

Lightning can fool you. It can precede storms, and it can follow them. It hits when you think you have time to move and it strikes when you are convinced danger has passed. At a little league game in Ames, Iowa, a lightning strike injured five youngsters after coaches had decided the storm was over.

My father-in-law, a physician, remembers that a lightning bolt caused one of the worst human calamities he has seen. Stationed near Washington, D.C. during World War II, he was on emergency room duty when seven soldiers were carried in, their dogtags charred, their socks and shoes burned. They had sought shelter beneath an isolated tree. None survived.

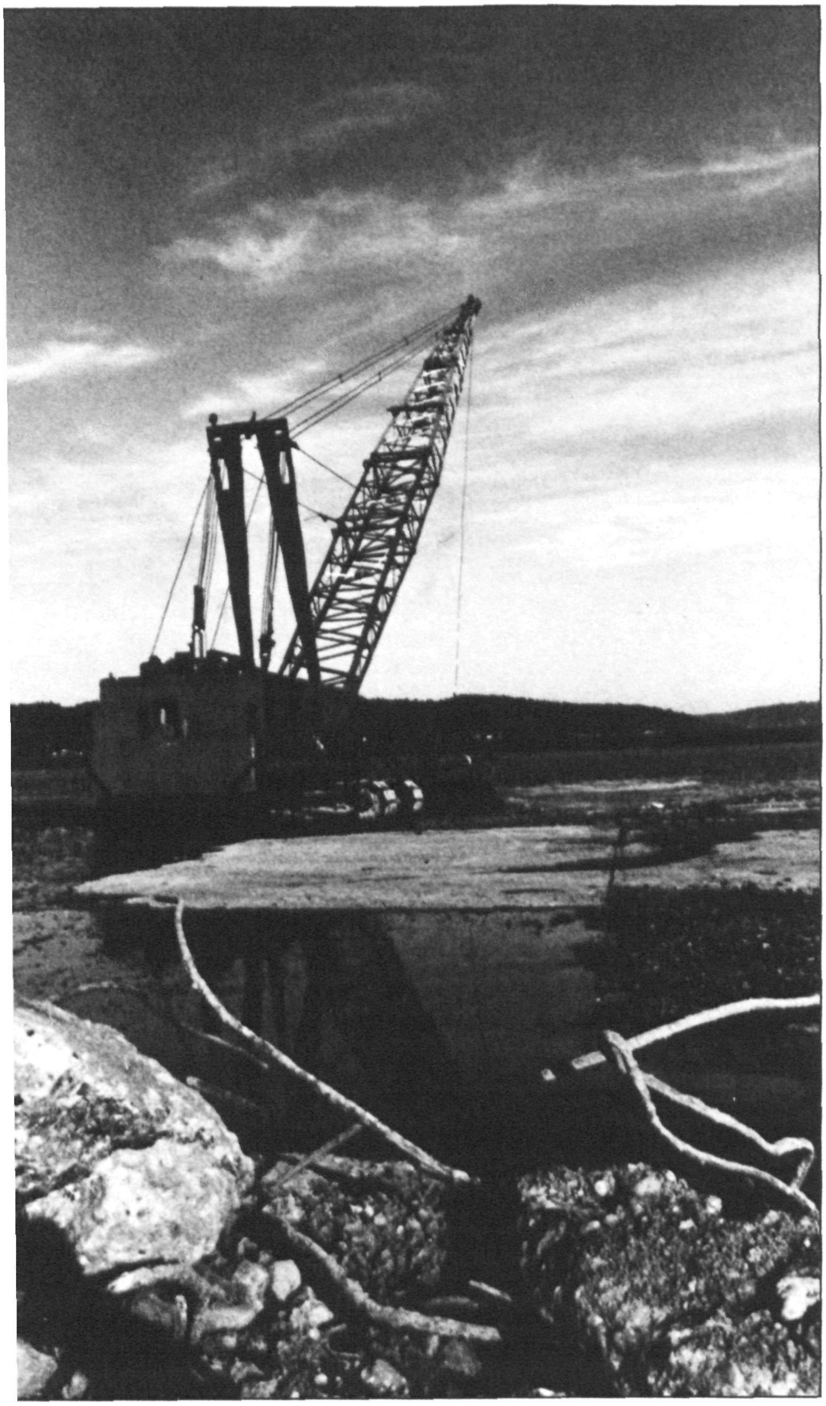
Contrary to conventional wisdom, lightning can strike the same place twice. It has struck the same person twice.

It could strike you.

If you are sailing before a storm and a quavering voice on board suggests a safe dockage, put in. The life you save may be your own.

# CITY-SCAPE

## NOAA's hometown, west



Seattle, Washington, as seen by a NOAA photoplane (opposite page), is home to the largest concentration of NOAA employees outside of the Washington, D.C. area—more than 1200 all told, working with the National Ocean Survey, the NOAA Corps, the National Weather Service and National Environmental Satellite Service, the Pacific Marine Environmental Laboratories, the Office of Marine Pollution Assessment and the Environmental Data and Information Service—with just about every component of NOAA. The Northwest Administrative Service Office is located on Lake Union (4 on the map) together with the National Marine Fisheries Service regional office, and just across Lake Union from the Pacific Marine Center (3); NOAA's new headquarters at Sand Point (1) on Lake Washington are now under construction.

The University of Washington (2), home of one of the Nation's top Sea Grant programs, is also site of the NMFS Northwest and Alaska Fisheries Laboratory—and NOAA visitors to the city, in addition to doing business at one or more of the above, will probably also take a look at the famous monorail (5) and Space Needle (6) remaining from the Seattle Sea Fair.

Progress on the Sand Point facility is illustrated at left, where a clamshell crane has removed about 420,000 cubic yards of material from the bottom of Lake Washington to prepare for construction of pier facilities. The Operations Building, no longer just skeleton, is nevertheless about 45 percent completed. NOAA's new home in hometown, west, is well under way.


1
2
3
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6

# A MATTER OF PRIDE

*John Roseborough*

Practical, up-to-date, ready for every occasion—the NOAA Corps uniforms in various combinations and permutations are appropriate for everything from ship handling in cold Alaskan waters to office work in semitropical Miami to flying or surveying or attending a fancy dress ball. Based on the traditional garb of seafaring officers, the uniforms are similar to those of the U.S. Navy and U.S. Public Health Service.

Dressiest of all is the Formal Dress with black tie, worn (far left, top) by R.Adm. Harley Nygren at the annual NOAA Corps dinner dance, as he chats with Lt. Marcella Bradley. For summer work in subtropical climes, Lt. (j.g.) Virginia Newell wears Tropical Khaki, Long, while Lt. (j.g.) Mike Henderson is in Tropical Khaki, Short.

Lt. (j.g.) Karen Cox and Lt. (j.g.) Mike Kretsch have selected (far left, bottom) Tropical Blue, Long, the uniform equivalent of a summer-weight business suit. The soft shoulder boards and light blue Air Force shirts are a NOAA Corps first. The Blue Overcoat worn by Lt. Cdr. Stewart McGee and Reefer worn by Lt. Don Rice (center photo) are working uniforms more suitable for colder weather, and for flying, the Aviation Coverall and U.S. Navy flyer's jacket with fur collar and blue work cap are just right for Lt. Cdr. Art Flior.

A practical option for rigorous field conditions where standard uniforms can get unduly soiled is the Working Coverall, worn by Lt. Cdr. Tom Ruszala, Lt. Maureen Kenny, and Lt. (j.g.) Newell.

Full Dress Blue was the uniform worn during a recent change of command ceremony at the Atlantic Marine Center in Norfolk by (l. to r.) Lt. Cdr. Max Ethridge, Ens. Frederico Diaz, Lt. Kenny, and Lt. Dennis Kuhl.

# Uniforms of the NOAA corps

John G. Stringer

# New buzz word is old hat to meteorologists

# 300 YEARS OF "NETWORKING"

Charles G. Thomas

Robert Fitzroy, commander of the *Beagle* on Charles Darwin's famous round-the-world voyage in the 1830's, was no mean scientist himself.

Lacking specialized education, Fitzroy was nonetheless a keen observer. Using a sailor's "weather eye" and a canny knowledge of the meaning of barometric pressure changes, he became a first-rate weather forecaster. In 1854, he was chosen head of the newly established Meteorological Department of the British Board of Trade.

Fitzroy was well known to English and Scottish fishermen as a practical meteorologist. It is said that an Aberdeen fisherman's wife mournfully exclaimed, on hearing of his death in 1865, "Now who's going to take care of our men?"

*History has assigned Robert Fitzroy, skipper of the Royal Navy ship* Beagle *on a three-year round-the-world surveying expedition, less fame than expedition member Charles Darwin, who collected the material that led to the landmark work* Origin of Species. *But Fitzroy later made his own vital contribution to science when he headed the British Meteorological Service at a critical period in the development of international cooperation in weather observing.*

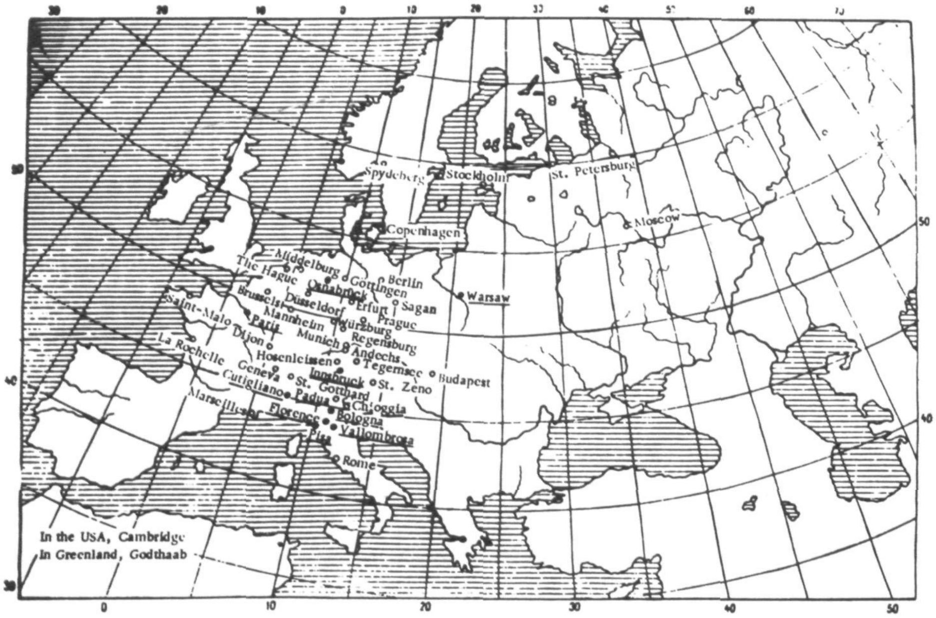
His work brought to a peak the art of predictions by a single observer armed with a barometer—a method used with fair success for the preceding two centuries to forecast, usually only a few hours in advance, the approach of stormy weather.

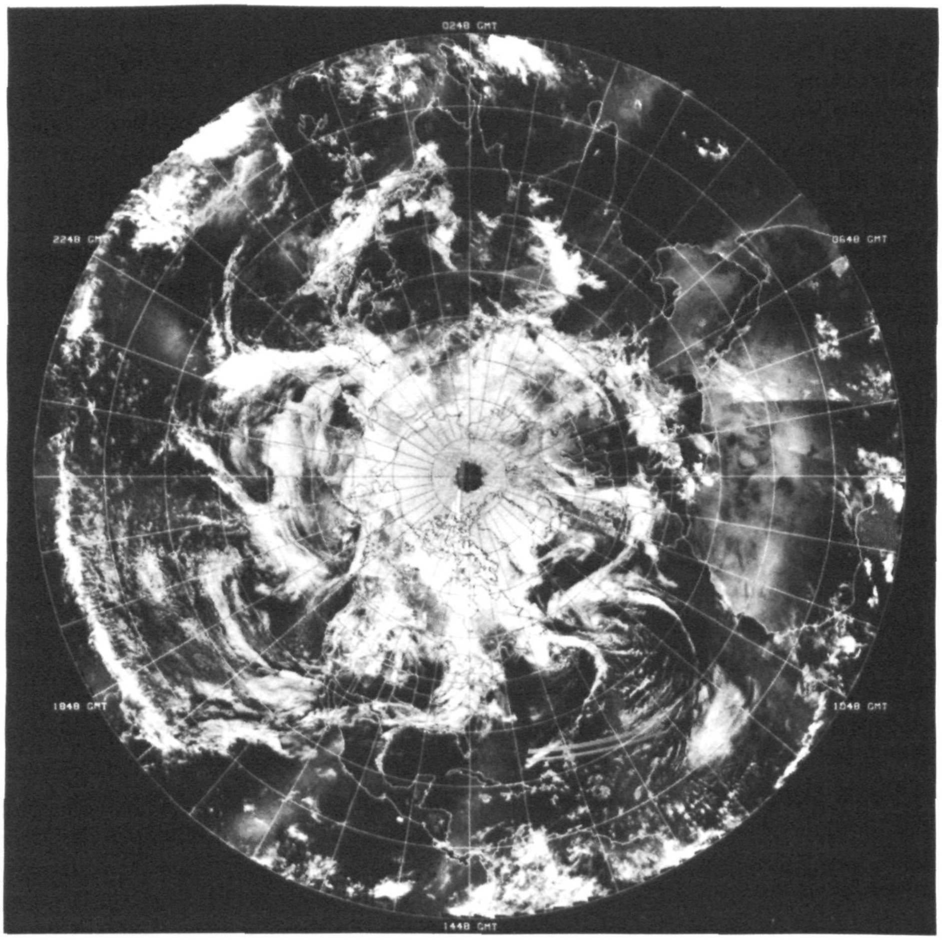
Near his life's end, Admiral Fitzroy and some contemporaries, searching for more scientific and improved means of predicting the weather, began preparing synoptic charts—charts that give an overall view of the weather at many points at a given time. It was an early but important step in the transition from basing forecasts on observations taken at a single point, to basing them on observations taken at dozens, hundreds, and eventually thousands of points.

Fitzroy's predecessors, including Benjamin Franklin, had deduced the motion of weather systems a hundred years earlier. But Franklin and his contemporaries had to rely on such uncertain evidence as newspaper accounts of storms and correspondence between friends.

The invention that revolutionized synoptic meteorology in Fitzroy's time was heralded in 1843 when Samuel Morse sent his famous message "What hath God wrought?" over a telegraph line between the Nation's capitol and nearby Baltimore, Md. The telegraph could transmit "real time" observations—a necessity for practical synoptic forecasting.

The idea of a "network" of weather stations, all reporting the weather at the same time, has been traced back to




*The earliest network of weather observing stations (top) was the Florentine network, dating from 1653, a scattering of observing posts in northern Italy and middle Europe. Today, observations are on a global scale, with some 3,800 surface stations sharing data and with satellite images such as that from NOAA-4 (below), a polar-orbiter, which were combined to make this photo of cloudiness over the entire northern hemisphere.*

Ferdinand II of Tuscany, in 1653. His Academy of Experimentation (Accademia del Cimento) established seven weather stations in northern Italy and four more at Paris, Warsaw, Innsbruck, and Osnabruck.

Records of the stations—known as the Florentine network—were made with great care at selected times each day. The temperature was taken from two thermometers, one facing north and one south. Barometric pressure, the state of the sky, wind direction, and other observations were written down in tables called "formulae."

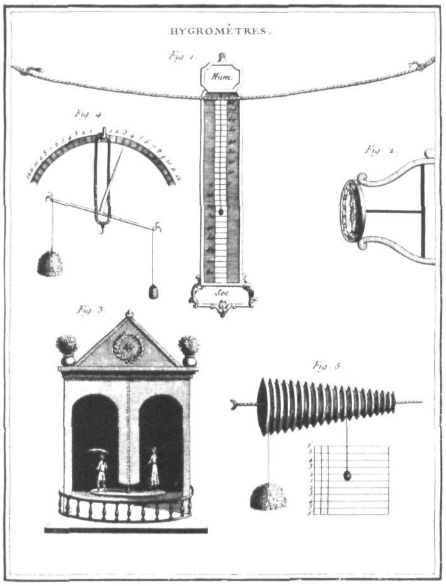
Other weather observing networks were set up over the next 200 years, but their data were useful to weather scientists only in a climatological sense. For instance, the first attempt at preparing a weather map as we know it today was made by H. W. Brandes in Leipzig in 1820, using data assembled by the Meteorological Society of Mannheim synoptic network 37 years earlier.

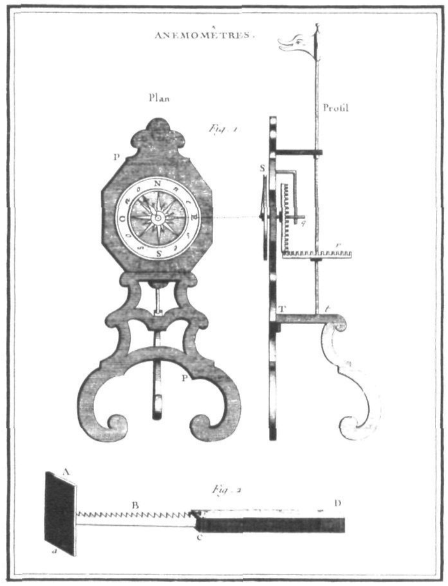
With the telegraph came regional, national, and global communications. Within 7 years of Morse's first message, the first synoptic weather maps based on telegraphic data were displayed publicly in Washington, D.C. Other nations quickly recognized the telegraph's potential in weather data collection.

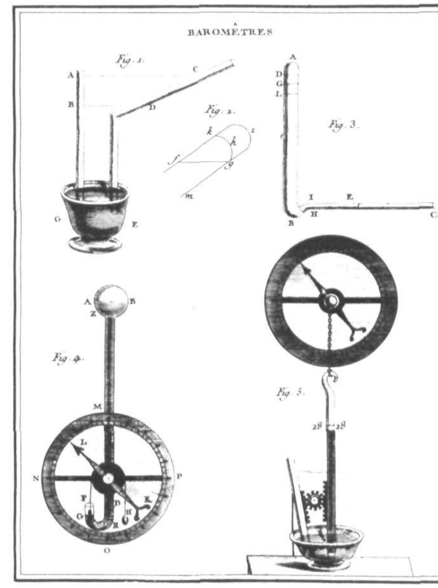
The world's first attempt at international "meteorological telegraphy" was stimulated, oddly enough, by a wartime catastrophe. The French fleet at Balaklava was virtually destroyed in November 1854 when a storm surprised the allied fleet during the Crimean War. The French Government suddenly recognized the strategic importance of telegraphic prediction of storms. Knowing that on the day before, the storm had been observed over the Mediterranean, the French Minister of War requested information on it from all the meteorologists and astronomers in Europe. From the more than 250 answers received, French scientists traced the path of the storm.

This feat so impressed Napoleon III that he approved a plan for a great meteorological network to warn mariners of impending storms. By 1855, 13 stations in France regularly telegraphed reports. Two years later St. Petersburg, Brussels, Beneva, Madrid, Turin, Rome, Vienna, and Lisbon were sending their observations as well.

Large scale international collaboration in meteorology began in 1853 (200 years after the establishment of the Florentine network) when seagoing nations met to




*Weather instruments—hygrometers, anemometers, barometers—from the earliest times up through Fitzroy's era in the early 19th century.*

draw up a program of oceanic weather observations to promote safety of life at sea.

At this First International Meteorological Conference, the illustrious American oceanographer Matthew Fontaine Maury, a lieutenant in the U.S. Navy, proposed that "The navies of all maritime nations should cooperate and make these meteorological observations in such a manner . . . that the system might be uniform" so that observations made on board any ship would be comparable. The leading seafaring nations accepted his proposal, and a worldwide oceanic weather observing network came into being.

To fill up the blank spaces in the fast growing worldwide synoptic weather map, only the land-based observing stations still had to be incorporated. The stage was set for formation of the International Meteorological Organization (1873) and its offshoot, the World Meteorological Organization (WMO) (1951).

Today, Oregon has as many stations as did the entire French network in 1855. A single satellite photo can show the weather over most of a hemisphere. Computers, performing complex mathematical gymnastics, predict the movement and changes in vast "parcels" of air, guiding forecasters concentrating on smaller scales.

Some 3,800 surface stations and 800 upper air stations around the globe report weather data to national or regional centers. The 144 member nations and six territories of the World Meteorological Organization (WMO) share the information. The weather services of the U.S.S.R. and China, transcending ideological barriers, report their local weather conditions four times a day, every day of the year.

All-out war has shut down some international weather data exchanges, but otherwise the importance of weather data has made it relatively invulnerable to the ups and downs of world tensions. Information exchange continued uninterrupted during the Cold War, was unabated by the non-recognition of the Peoples Republic of China, and was maintained throughout the Cuban missile crisis.

WMO's World Weather Watch, an outstanding example of international cooperation, is a vast network devoted to improving world weather services through regional and national data processing centers, a global telecommunication system, a global observing system and a meteorologist training program.

Another WMO venture, carried out cooperatively with the International Council of Scientific Unions, is the Global Atmospheric Research Program (GARP). In this enterprise the world's leading weather scientists jointly plan and conduct the largest and most complex peacetime scientific experiments ever attempted. It includes the GARP Atlantic Tropical Experiment (GATE), with its 100-day field phase in 1974, and the Global Weather Experiment, whose year-long observational phase has just ended.

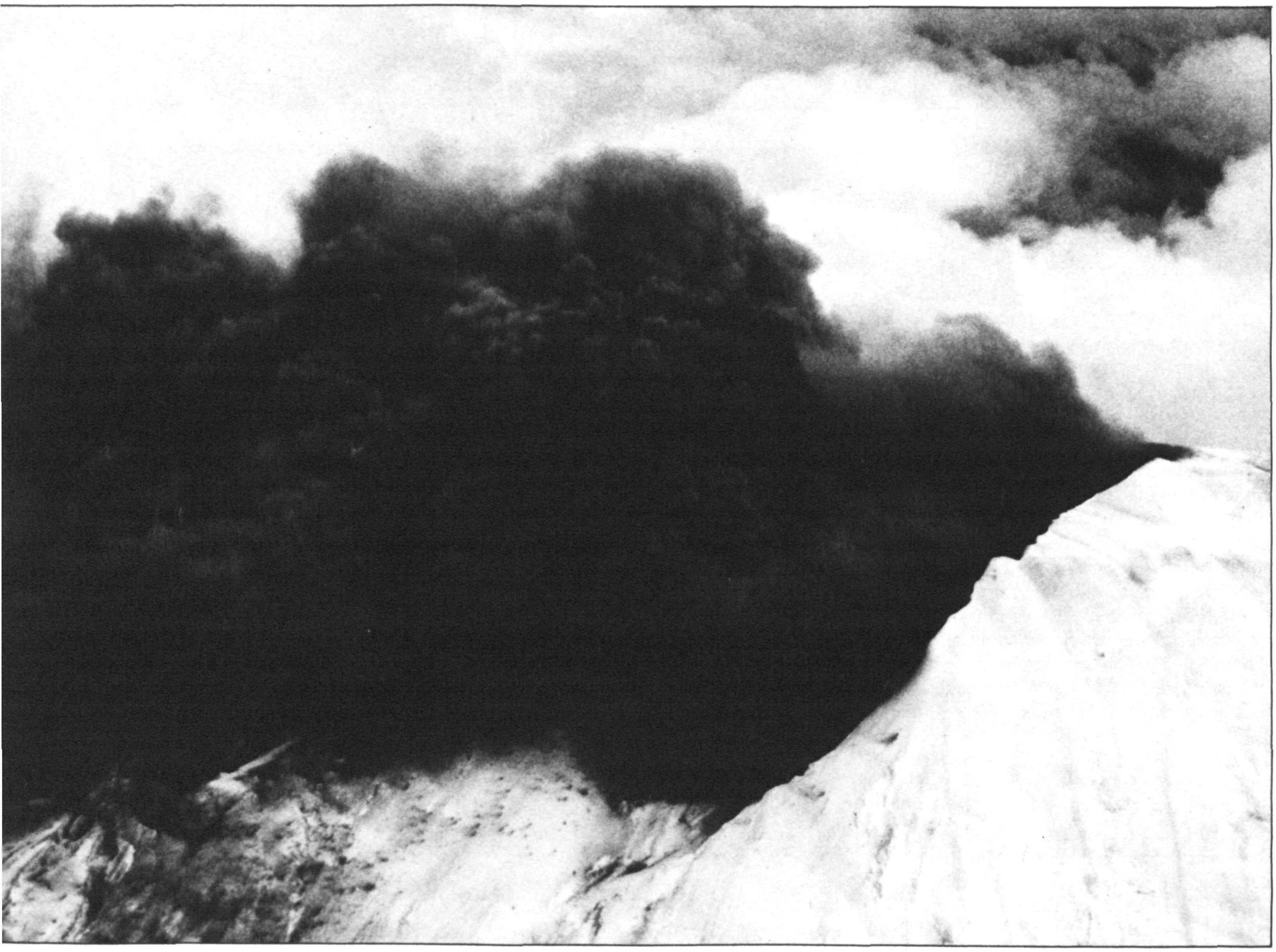
The Global Weather Experiment produced a major jump in worldwide observations. During a special observing period that lasted 2 months the 40,000 daily World Weather Watch observations were augmented by reports from countless ships, balloons, satellites, buoys, and aircraft. Much of the data was funneled into the Global Telecommunications Network and used by weather services around the world. All of it went to special processing centers where it is being converted to data sets and stored at World Data Center A, in Asheville, N.C., and World Data Center B, in Moscow, USSR.

All of this is a far cry from Grand Duke Ferdinand II's "formulae" in a period when scientific papers bore such titles as: 'The Tragic and Terrible Miraculous Account of the Appearance in Danzig and Its Surroundings of Eighteen Rainbows and Three Suns in the Middle of a Clear Day After Which a Host of Armies Was Seen in the Clouds at Night Together With Other Signs Causing the Sky to Open Up and Be Disturbed and Turn Loose a Rain of Blood."

Weather forecasting today, though based on observations much more trustworthy than those of the seventeenth century, is still not an exact science. According to one facetious suggestion, the elusive goal of a perfect forecast every day could be obtained by making observations of "everything, all the time, everywhere." A pipe dream? Maybe, but our overall view is getting better all the time.

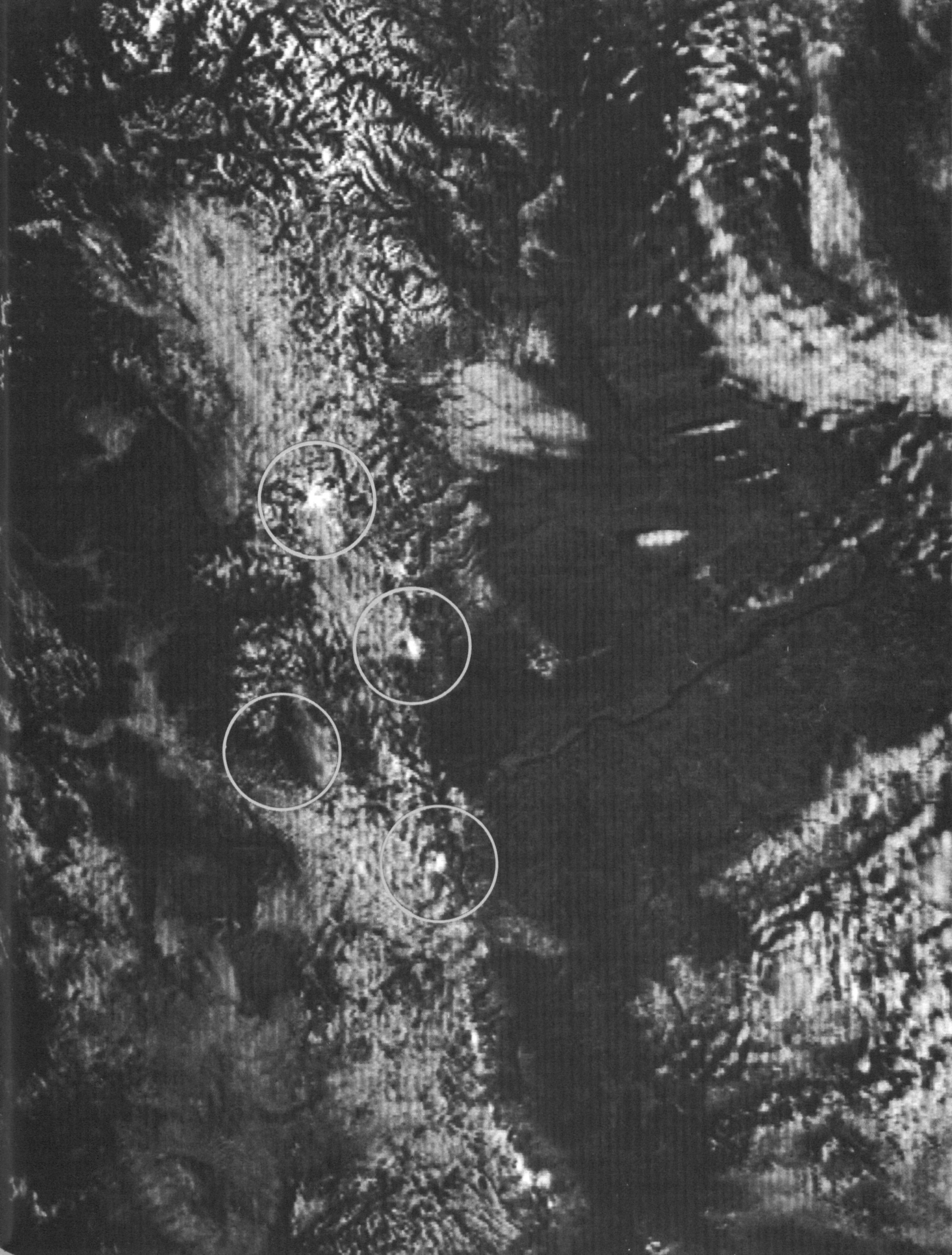
# VIEW FROM SPACE

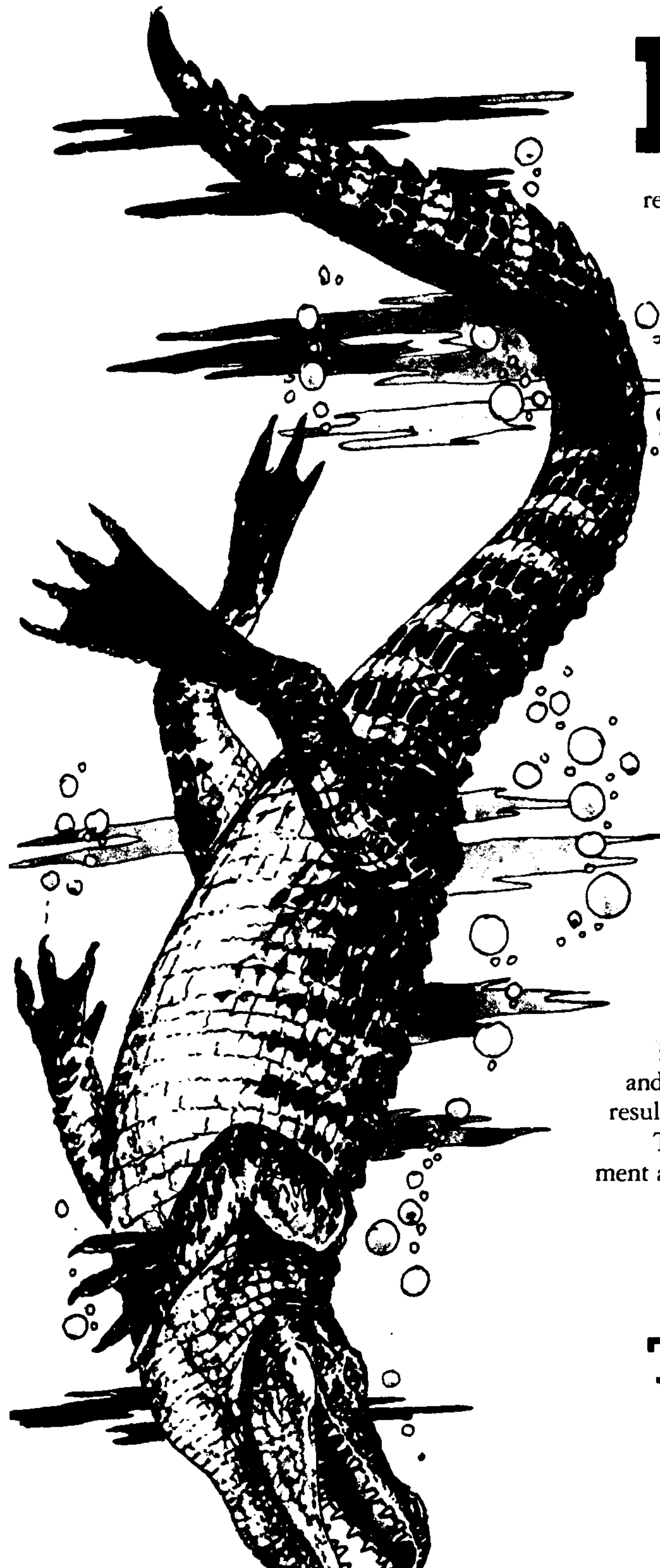
## Mt. St. Helens blows its top



The area over Mt. St. Helens in southwestern Washington is cloud covered most of the time, but just about an hour after a major burst of volcanic activity occurred on March 30, the NOAA-6 satellite passed overhead and got this imagery during a clear period. In the left center are three white patches that form the points of a large diamond; they are the snowy peaks of Mt. Rainier to the north, Mt. Hood to the south, and Mt. Adams to the right (east). Mt. St. Helens is the "point" to the left; its snowy top is obscured by the clouds of smoke from the volcanism.

Above, an eye-level view of the smoking crater of Mt. St. Helens, which is being monitored closely by NOAA meteorologists ready to help assess its effect on world climate.





L i'l Abner's lovable, highly edible shmoo tastes like any dish the diner fancies. Louisiana now has its own version of the shmoo: the not-so-lovable alligator.

A law passed in 1979 by the Louisiana legislature makes the retail sale of alligator meat legal. Among the many people in the State working to let people know about it is Sea Grant marine advisory agent Windell Curole of Houma.

Curole maintains that the utilization of alligator meat is what Cajuns call "lagniappe", a bonus in a 20-year-old state management plan that has brought the once seriously threatened species to dismaying abundance in Louisiana. The State's growing harvest of the animal, an endangered species in the rest of the Nation, prompted the alligator meat promotion. Present harvests are no accident; they are the culmination of a conservation program that began in 1958.

An open season seemed pretty remote back then. From legendary abundance (early writings are laced with superlatives; Audubon reported seeing "hundreds at a sight"), the amphibian had become almost extinct in most of its nine-state southeastern range by 1960. Primary reasons for the demise were overexploitation—a strong, profitable market for alligator hides has existed since the mid-1800's—and a loss of habitat due to encroachment of agriculture and industry.

In Louisiana, where the animal is regarded as an important commercial resource, in 1960 the legislature responded to the threat by passing protective laws regulating harvest. Finding the law inadequate, harvests were suspended entirely in 1963. Unfortunately, the demand for the hides was so strong that illegal harvests continued, and a substantial black market arose. According to alligator expert Ted Joanen of Louisiana's Department of Wildlife and Fisheries, the most important result of the 1970 Federal endangered species designation was in stopping the poaching.

"The alligator was never really endangered in Louisiana—we just no longer had huntable populations at the beginning of the sixties," Joanen said.

He and colleagues had already begun steps to correct the deficiency. Knowing that time and a sound management plan would likely restore the alligator to its former abundance in appropriate areas of the state, the Department of Wildlife and Fisheries launched an intensive long-range research program in 1958. Today, as a result of that research, the alligator has few secrets left.

Two of the most vital investigations were for management purposes. One, a movement and habitat study, pinpointed times when hunting would result in a harvest of only

## The gourmet's alligator, Part 1

# SUCCESS STORY IN LOUISIANA

males and non-breeding females. Another was an aerial nest count that showed female breeding populations to be roughly 5 percent of the total population.

While the data were accumulating, populations were making a steady comeback. In many coastal areas, as the alligator multiplied, other wildlife began to decline. The animals foraged into new territories, turning up in such urban areas as Baton Rouge and New Orleans.

Public satisfaction over the comeback changed to dismay: Two city policemen got out of their patrol car to remove a "log" from a flooded Baton Rouge street during a torrential downpour, only to find the six-foot obstruction had four legs and a mouth full of teeth. Swimming pools became occasional spots for the animal to assert its rights which few pool owners were willing to challenge. Wildlife and Fisheries personnel received more and more calls to remove the endangered species from areas where humans suddenly felt endangered.

In 1972, the Department of Wildlife and Fisheries held a carefully controlled two-week alligator harvest. The two parishes (counties) with the highest alligator populations were selected for the experiment. The brief season was so successful that others have been held each year since. Last year permits for 18,500 animals were issued (16,500 alligators were taken) during a 30-day period in September and October. The harvest allocation was 5 to 7 percent of the State's total alligator population. According to Joanen, lengthened hunting seasons have scarcely inhibited the burgeoning alligator population.

Increasing harvests have, however, created an unusual source of valuable animal protein. South Louisianians have relished the alligator as pink, finely textured meat for more than a hundred years. Hunters gave their meat to local residents, or, more often, lacking an organized commercial market, left it to rot in the marsh. In 1979 the State legislature tried to discourage such waste by making retail sale of the meat legal. The public remained cool to the idea.

Advisory agent Curole, a native of South Louisiana, was concerned about the waste. "Leaving an alligator to rot is like leaving a steer—you waste 50-80 pounds of perfectly good meat." Already working with alligator hunters on hunting, skinning, and curing techniques, Curole decided to include use of the meat in his public education efforts.

He pinpointed three major reasons why people were not using the meat: lack of awareness concerning the meat's availability and quality, financial risk to markets and restaurants handling the product, and lack of knowledge about cooking the meat.

Backed by the entire Terrebonne Parish Cooperative Extension staff in Houma, particularly Director Alfred Cooley and Home Economist Jean Picou, Curole initiated a "Festival of Alligator Cuisine." Its purpose was to acquaint the public, through the media and imaginative restaurateurs, with the fact that alligator is a wholesome, tasty meat. Both the press and restaurants were well represented at the lavish buffet of wine and alligator dishes.

Like the shmoo, alligator tastes like just about anything the chef wants it to: pork, chicken, beef, and a range of other, lesser known meats. Jean Picou developed seven recipes for the affair: half-inch thick chops baked with onions in a microwave oven; crisp catfish-looking alligator fried two ways; alligator sauce piquant; meat salad—a cross between tuna and chicken salad, and a favorite of the festival; highly seasoned deep-fried croquettes; and alligator smothered in both predictable and unpredictable Cajun seasonings.

The response was enthusiastic. In addition to coverage in State papers, at least one wire service carried the information to the Nation. An Australian newsman called Curole to ask whether the crocodile might also make good eating (Curole doesn't know!). By the end of the 30-day hunting season, restaurants scattered throughout coastal Louisiana were featuring alligator meat—some giving it co-billing with the ever-favorite fried chicken.

Curole terms his festival, and similar efforts by other alligator meat advocates, a satisfying success. "I believe the alligator will be established within another couple of years," he said. "By the end of the eighties, alligator will be as popular as Louisiana shrimp, crabs, crawfish, and oysters."

A long way to come indeed—from threatened status to re-established harvests to popular cuisine in just 25 years.

Sally Thompson Kuzenski

*Sally Thompson Kuzenski is an information specialist with the Louisiana State University Sea Grant Program.*

*Alligator meat indeed! Where can a cook get a supply of this versatile, tasty meat—a new resource for the people of Louisiana but hard to come by elsewhere.*

*Never fear. The recipes that follow, made available to NOAA readers by Windell A. Curole, fisheries specialist with the Terrebonne Parish Extension Service, are adaptable to any firm fish and to white meat such as lean pork chops. You might just find the tang of Cajun influence in them, too. A bit of creativity in the kitchen will convince you that those 'gators are more of a boon to humankind than anyone ever suspected.*

# The Gourmet's Alligator Part 2

### ALLIGATOR DIP

1/2 pound alligator meat
1/2 teaspoon liquid crab boil
1 teaspoon salt
1/2 lemon
2 tablespoons shallots
2 tablespoons celery
2 tablespoons green pepper
2 tablespoons chopped onion
1 tablespoon teriyaki sauce or soy sauce
2 tablespoons onion
2 tablespoons parsley
1 tablespoon sweet pickle relish
2 tablespoons mayonnaise
1 teaspoon mustard

Boil alligator meat in first 8 ingredients for 10 minutes, chop meat and vegetables used in boiling in food processor or blender. Add remaining ingredients and continue to mix well. Serve chilled with crackers.

### ALLIGATOR MEATBALLS

1 pound chopped alligator meat
1 egg
2 tablespoons finely chopped onions
2 tablespoons finely chopped celery
1 tablespoon finely chopped parsley
2 tablespoons chopped shallots
2 teaspoons lemon pepper
1/2 teaspoon salt
1/4 cup bread crumbs
Flour to dredge
1 cup cooking oil

Combine all ingredients, form into 1 inch balls. Allow to set for 1 hour. Dredge with flour and fry until brown. Serve hot.

### SMOTHERED ALLIGATOR

2 pounds alligator meat
1/4 cup cooking oil
2 onions finely chopped
1 bell pepper finely chopped
1/2 cup celery, finely chopped
1/4 cup finely chopped parsley
1/4 cup finely chopped shallots
1 bay leaf
1/4 teaspoon basil
Salt and pepper to taste

Sauté onions in oil until golden brown, add bell pepper, celery and sauté until tender, add meat and seasonings, simmer for 40 minutes, add parsley and shallots about 5 minutes before serving.

### MICROWAVED ALLIGATOR

2 alligator tail chops cut 1/2 inch thick
1 teaspoon Season-All
1 medium onion, sliced

Season alligator chops with season-all or lemon pepper.

Place in 1-1/2 quart dish and microwave on High for 5 minutes, uncovered. Arrange onion slices over chops, cover with plastic wrap and microwave on Simmer on 30% power for 20 minutes. Allow to stand 5 minutes before serving.

### FRIED ALLIGATOR

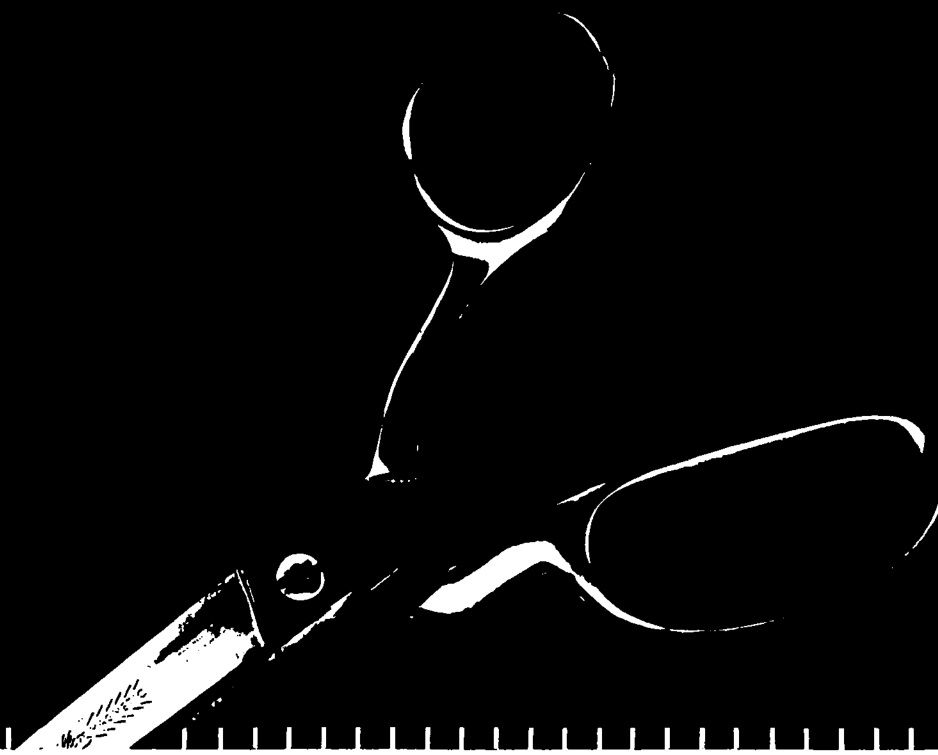
1 pound alligator meat
1 cup sherry
1 tablespoon lemon pepper
1 teaspoon season-all
1/4 cup lemon juice
1/2 cup Italian salad dressing
Flour to dredge
Cooking oil for frying

Marinate alligator meat in the first five ingredients for 2 hours. Drain and dredge with flour. Fry pieces for about 15 minutes turning often until brown. Drain and serve hot.

### FRIED ALLIGATOR

1 pound alligator meat sliced thin
1 12 ounce can beer
1/2 cup flour
1 teaspoon Season-All
1 teaspoon salt
1 teaspoon pepper
Corn Meal to dredge
Oil for frying

Coat alligator meat with batter and dredge with corn meal. Fry in hot oil for about 15 minutes, turning often until golden brown.



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