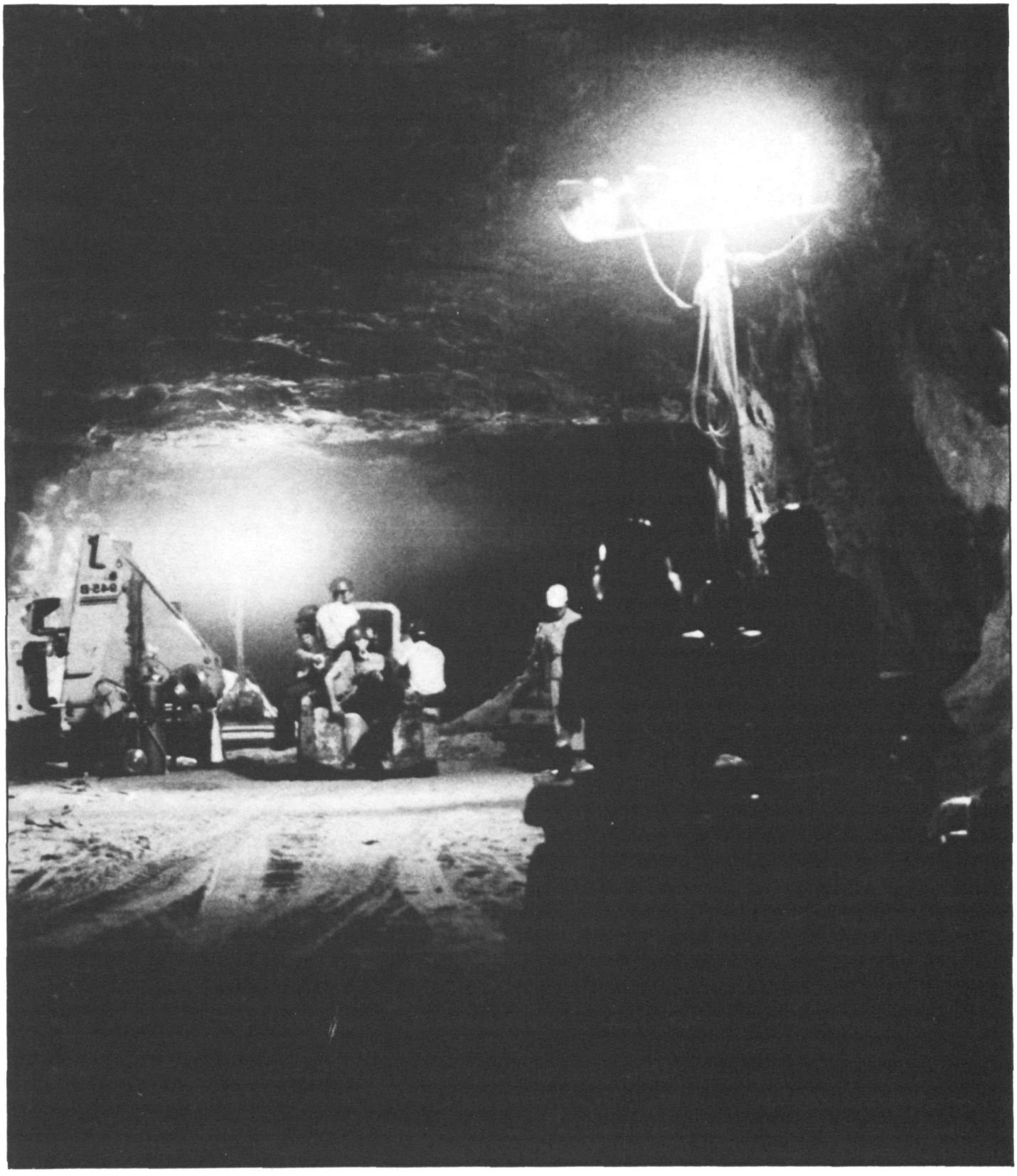
Volume 12, Number 3 Summer 1982

noaa



National Oceanic and Atmospheric Administration

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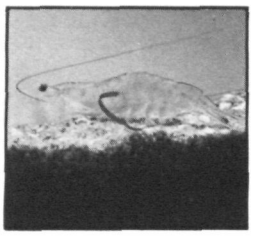
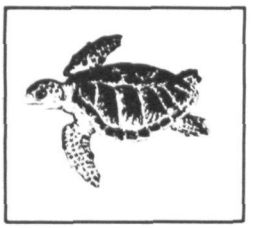
COVER: *Workers hollow out a salt dome beneath the Gulf of Mexico to make oil storage space. Where does the salt go? See the story beginning on page 4. (Credit: DOE)*



Story page 4

Story page 8

Story page 10



Story page 21

Newsline 3

Will We Make the Sea Too Salty? 4
Hollowing out undersea salt domes for the Strategic Oil Reserve.

Steering Clear of Bad Weather 8
In severe weather, your car can save you - or be your coffin.

Wintering Over at the South Pole 10
Nine months in a deep freeze is not just another assignment.

Lightning: Summer Superpower 12
Summertime, and the living can be downright dangerous.

Directions 14

Anatomy of a Tornado 16
Best look yet at the inner workings of a twister.

Weather, Climate, and Economics - the NOAA Nexus 17
Weather statistics as economic indicators.

Putting the Squeeze on Turtle Smugglers 21
A Federal crack-down helps the endangered Ridley.

Hurricane Hunting by the Numbers 22
Storm reconnaissance planes rely on a NOAA-developed computer.

Catch America—"It Worked!" 24
Teaching American consumers the seafood habit.

Seafare 26
Seafood with a touch of class.

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Newsline

Record Fish Revenues, Consumption

Americans ate more fish in 1981, and they also paid more for it. Estimated per capita consumption inched up to 13 pounds from 12.8 in 1980. The catch brought a record dockside value of $2.4 billion even though the volume fell to six billion pounds, lowest since 1977. Most valuable species was shrimp, worth more than $463 million at dockside, followed by salmon ($438 million), crabs ($297 million) and tuna ($206 million). The National Marine Fisheries Services reported also that the Nation's two fishing capitals are Kodiak, which had the highest-valued landings of any U.S. port; and Cameron, La., which led, as it has for 5 years, in volume of commercial landings. Meanwhile, the National Marine Fisheries Service revealed that U.S. fishermen also caught and delivered to foreign processing vessels 123 percent more fish from within the 200-mile conservation zone than in 1980, and sold it for 150 percent more money.

Population Center Takes A Hike

National Geodetic Survey surveyors Jerry Odum and Floyd Stewart have pinpointed the new location of the U.S. population center near DeSoto, Mo., approximately 40 miles southwest of St. Louis. It succeeds the 1970 center, which was in a farm field 50 miles east, near Mascoutah, Ill. Since 1790, when the first U.S. census was taken, the center has shifted about 750 miles west and 80 miles south of the first location, near Chestertown, Md. The location was established by the Census Bureau from more than 250,000 computer calculations, based on the decennial census. The Bureau's definition of the center (are you ready for this?): the point at which an imaginary, flat, weightless, rigid U.S. map would balance if 226,545,805 weights of identical value were placed on it to represent the location of each person counted on April 1, 1980.

Information Squeeze for EDIS

NOAA librarians have reduced information in 600 drawers, consuming 40 square feet of floor space, to a stack of microfilm less than an inch thick. The product is called a computer-output microform catalog and, true to tradition, has an acronym—COM. The encapsulated materials consist of holdings of 17 NOAA libraries in nine States and the District of Columbia. The new system catalogs acquisitions of the five Washington-area libraries for the 1972-82 decade, and of the others for varying times since 1976. It is completely updated every 2 months. Next step: make it available on line, so that users can have ready access through their computers.

The Lady Ellen Turns Straight

Rehabilitated in more ways than one, the former shrimper Lady Ellen commenced a new life on May 30 as the research vessel Seahawk, for the Southeastern Consortium for Underwater Research at the Univeristy of North Carolina, Wilmington. The 80-foot fish boat now has a four-person decompression chamber and a diving bell which, with other necessary refurbishing, cost NOAA $630,000 over a 2-year period. The Seahawk, ready for diving research, this summer will study artificial reefs, the effects of dragging over fish habitats, and Chesapeake Bay sediment transfer. The rest of the rehabilitation? It's occupational. Until she was seized on Feb. 5, 1978, the vessel ran marijuana.

New Urgency for Dumping Research

Where's the world's trash to go? As waste proliferates, and places to put it get harder to find, more of it probably will be going into the ocean. And this makes more research into ocean dumping an urgent matter, according to a National Marine Pollution Program Plan issued by NOAA. The plan also calls for more study of ocean dumping of dredged material and industrial waste, much of it toxic. It further recommends that some Outer Continental Shelf oil and gas leasing research be diverted from pre-lease environmental studies to post-lease monitoring. Other high-priority areas: spills of oil and hazardous materials, runoff, and fly ash. The plan, drawn up by the Interagency Committee on Ocean Pollution Research, Development, and Monitoring, will be coordinated by an interagency planning group.

NWS Gains Tornado Warning Time

New, automated techniques allowed the National Weather Service to provide a lifesaving warning time of up to 30 minutes last April 2, when 92 tornadoes slammed across 16 states. A sophisticated weather satellite display system at the National Severe Storms Forecast Center in Kansas City saved about 30 minutes of forecast time; automated transmission of weather watch information, another 15. At local weather stations, other automated equipment speeded the actual tornado warnings, so that people in their paths had 15 to 30 minutes to prepare. Normal time: about 5 minutes. The death toll was 28, all in areas where watches were issued. The saving of life, while impossible to compute, was substantial.

Outwitting the Rip Current

Oceanbound for your vacation? Ever hear of the rip current? If not, read this—it may save your life. Rip currents are strong, narrow outflows of water on some ocean beaches, and they can carry even a strong swimmer out to sea. Too powerful to fight head-on, they can be overcome simply by swimming parallel to the shore for perhaps 20 feet or so; then you can return to shore easily. An alternative: let the current carry you seaward until it dissipates, then get outside its pull and swim back. Either way, don't fight it, and don't panic. Happy swimming!

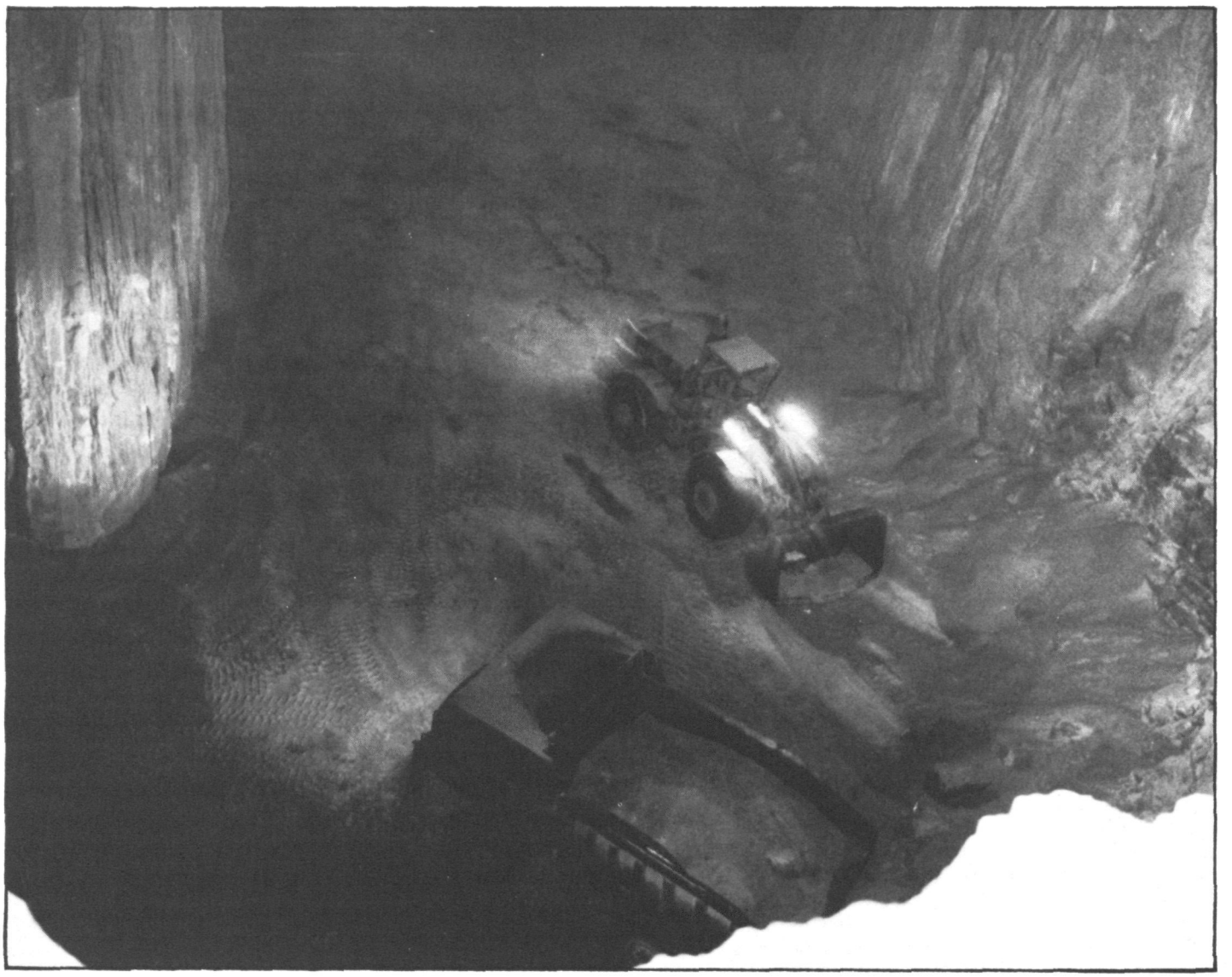
Fair Winner on the Ferrel

Karl A. Saxman, a 16-year-old from Los Alamos, N. Mex., was visiting scientist aboard the NOAA Ship Ferrel as she sailed from Norfolk on a hydrographic mission in June. The cruise, a tour of the Atlantic Marine Center, an engraved plaque, a citation, and a congratulatory letter from NOAA Administrator John V. Byrne were prizes for taking first in an Earth and Space Sciences catagory at the 33rd International Science and Engineering Fair held in Houston, Tex., in May. Saxman, who won the award for the second year in a row, planned and built a project called "The Earth's Future Climate: Computer Modeling of Climate Trends." Second and third place winners of the NOAA-sponsored awards were Johan Hedin of Umea, Sweden, and Joyanne V.M. Cobb of Fort Walton Beach, Fla. The winners were chosen from 525 finalists representing almost 300 affiliated fairs in the United States and overseas.

Scientists working to create the
National Strategic Petroleum Reserve ask NOAA:

Will We Make The Sea Too Salty?

Roland D. Paine



Credit: DOE

Weeks Island mining at the 800 foot level reveals an erie underground world of vast caverns crawling with bug-like earth moving equipment.

It was a monumental challenge: the agency was given 6 years to establish a National Strategic Petroleum Reserve. In just 6 years—by the end of 1982—it was to store at least a billion barrels of crude oil as a contingency supply against future oil embargoes, and do it in an environmentally safe manner.

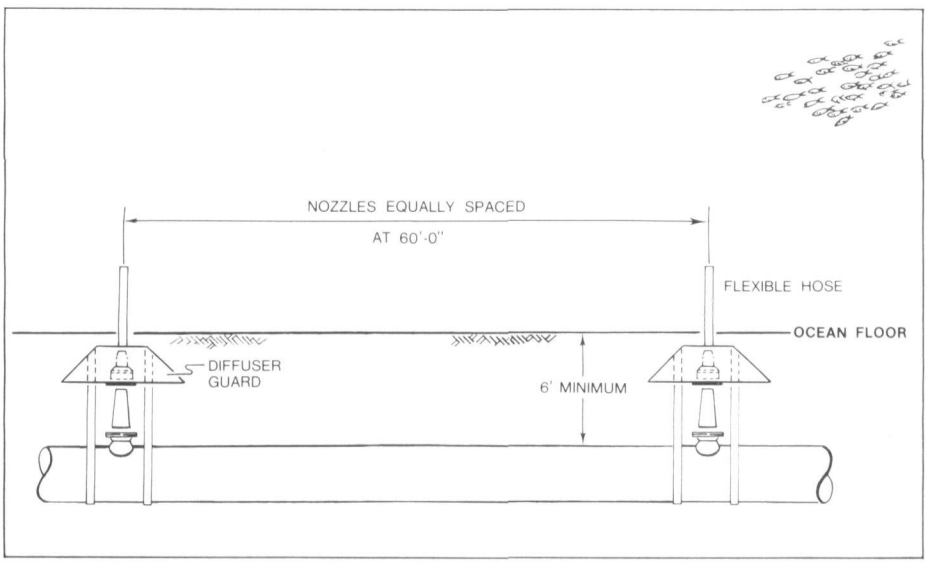
The charge was laid on the Federal Energy Administration, later the Department of Energy, in 1976. The energy agency studied available options and concluded that the most attractive appeared to be storage in underground salt dome cavities near existing petroleum distribution facilities along the Gulf of Mexico.

Problem: To make room for the petroleum, the salt domes would have to be hollowed out by solution mining technology—leaching with high pressure water. This would produce huge quantities of salt brine, 25 percent salt compared to normal seawater's 3.3 percent. For every barrel of oil to be stored, seven barrels of fresh water would be used to leach out the salt, and a place would have to be found for the resulting brine.

At first, injecting the brine into the water-bearing rock and gravel stratum at depths greater than 2,000 feet was considered, but great difficulty was experienced trying to inject it at the necessary rate and volume. The obvious answer seemed to be to dispose of it in the Gulf of Mexico. But environmental laws might prevent this. What effect would such a massive, though localized, discharge of salt brine have on the commer-

Credit: DOE

At Brian's Mound. a tanker offloads oil slated for the Seaway Pipeline which heads north across east Texas. At right is a diagram of the brine diffuser system.



cially important fishery resources of the area?

NOAA Steps In

Enter NOAA—specifically, the Environmental Data and Information Service, the National Marine Fisheries Service, and the National Ocean Survey.

Because of its capabilities in research and research applications, NOAA was asked by the Department of Energy to manage the environmental aspects of the brine discharge problem. The data service (EDIS) became NOAA's program manager as a result of its expertise in information storage, retrieval, and analysis.

To begin with, EDIS was asked to pull together all existing knowledge about the bathymetry, oceanography, meteorology, and biology of the area, summarize and analyze and categorize it, assess it, and then figure out how much, if any, brine could be safely pumped into shallow Gulf waters near the proposed oil storage sites. In conjunction with this, NOAA would help develop an on-site monitoring program that would evaluate actual impacts and compare them with model predictions.

Early Efforts

The first job was to provide site reports of meteorological and oceanographic data from information on hand. While this was underway in 1977, EDIS began working with the Massachusetts Institute of Technology to model the dynamics of brine diffusion.

"We also asked MIT to design a brine diffuser, an apparatus that would dispose of the brine into the Gulf in the most efficient, environmentally least harmful, way," said Capt. Charles Burroughs, the NOAA Corps officer who early on headed the project for EDIS. "They came up with a 36-inch diameter pipeline, buried about 6 feet under the floor of the Gulf, to transport the brine, Every 60 feet at the end of the 12-mile pipeline there would be a 3-inch diameter flexible diffuser nozzle, 52 altogether, protruding into the water above. The brine, pumped under pressure, would exit from these diffuser ports and disperse into the water column aided by variable longshore currents."

Which is just what happened when the system was built. "The system was designed to pump brine out of the ports at a rate fast enough to provide acceptable mixing in Gulf waters, and it worked," Burroughs said.

Project scientists sought to validate the MIT estimates of brine dispersion, refining their models to fit observed data. When the project began, for example, there were few ocean current measurements at the sites selected, so estimates were fed into the model. Later, Texas A&M University and the National Ocean Survey made on-site measurements that replaced the estimates.

The data service also contracted with the Naval Oceanographic Research and Development Activity at Bay Saint Louis, Miss., to establish a monitoring buoy over the diffuser. As part of this work NOAA's Data Buoy Office, also in Bay Saint Louis, installed meteorological and oceanographic equipment on offshore platforms in the vicinity of the diffuser.

To complement the fixed monitoring system, scientists from Texas A&M University conducted monitoring cruises to measure the brine plume around the diffuser sites, and took biological samples to see how the organisms—shrimp, fish, plankton, and bottom dweller—were affected.

Six sites were surveyed along the Texas and Louisiana coasts as possible brine discharge points. Named after the corresponding salt domes under consideration for petroleum storage, they were Bryan Mound and Big Hill off Texas, and Black Bayou, West Hackberry, Weeks Island, and Chacahoula off Louisiana. Bryan Mound was the first to go operational, in the spring of 1980. West Hackberry followed a year later.

Basic to the question of environmental acceptability., of course, was the possible effect on fisheries. Fishery resource assessment studies were begun by the Galveston laboratory of the National Marine Fisheries Service in 1978, and will conclude in September 1982.

Two currently active SPR storage sites—West Hackberry and Bryan Mound—have been studied, as were the proposed sites at Big Hill and Weeks Island.

Shrimpers Concerned

The assessments by the Fisheries Service were undertaken to respond to concerns voiced by the commercial shrimp industry, sport fishermen, and environmental organizations. They were to provide detailed information on possible impacts of brine discharge on brown and white shrimp and redfish during various stages of their life cycles, and to distinguish between the effects of natural and man-made influences, such as brine discharge.

Under the direction of Dr. Edward F. Klima, director of the Galveston laboratory, scientists from many organizations—the Federal Government, the States of Texas and Louisiana, universities, and private companies—undertook the work.

A comprehensive program of both laboratory and on-site studies was carried out:

- Samples of fish, fish eggs, larvae, bottom dwellers, and shrimp were taken and studied.
- Redfish, white shrimp, and brown shrimp in aquariums were subjected to ocean water, salt dome brine dissolved in river freshwater, and brine from artificial ocean salts dissolved in distilled water, and their behavior and reactions analyzed.
- Such analyses, plus historical data, were fed into sophisticated mathematical models to try to determine what might happen to the animals in their ocean world when brine is discharged.

Collecting Samples

Fishery scientists used three shrimp boats, ranging from 70 to 100 feet in length, to collect samples offshore. Captured shrimp were tagged with numbered plastic streamers, and returned to the ocean. When the shrimp tag was later recovered (from shrimp fishermen or managers of shrimp processing plants), scientists could determine from the release and recapture points the distance and speed of the shrimp's movement, and their growth rate.

Since 1979 some 331,000 white and brown shrimp have been tagged and released, and about 16,000 recaptured. This unusually high number of recaptures was achieved through a unique reward system developed by Dr. Klima and K. Neal Baxter of the Galveston laboratory—a computer lottery. About once every 2 months all recently returned tag numbers were put into a computer, and through a random number selection program, winning numbers were chosen. For each State, there were one $500, one $100, and six $50 rewards.

Spawning Studies

A search for shrimp spawning sites was investigated by capturing shrimp, determining if they were fertile females, and keeping those that were until they spawned. Samples of the eggs were counted to determine the average number released; all eggs were returned to the sea.

Scientists analyzed water samples for temperature, salinity, dissolved oxygen and pH (a measure of the hydrogen ions in the water) to see if some particular combination of these factors is preferred by shrimp for spawning. Bottom samples were analyzed for type and amount of sand, clay, and gravel, plus, chemical content. The latter was compared with chemicals found in shrimp ovaries. All these findings were combined and analyzed to see if fertile shrimp females preferred a particular area of the ocean for spawning.

"Our findings to date indicate that mature female shrimp do not prefer any specific spawning area," Dr. Klima said. "Instead, they may seek a certain depth in the water at a particular time of the year, with little or no regard to bottom type and within a slightly variable range of temperature, salinity, and pH."

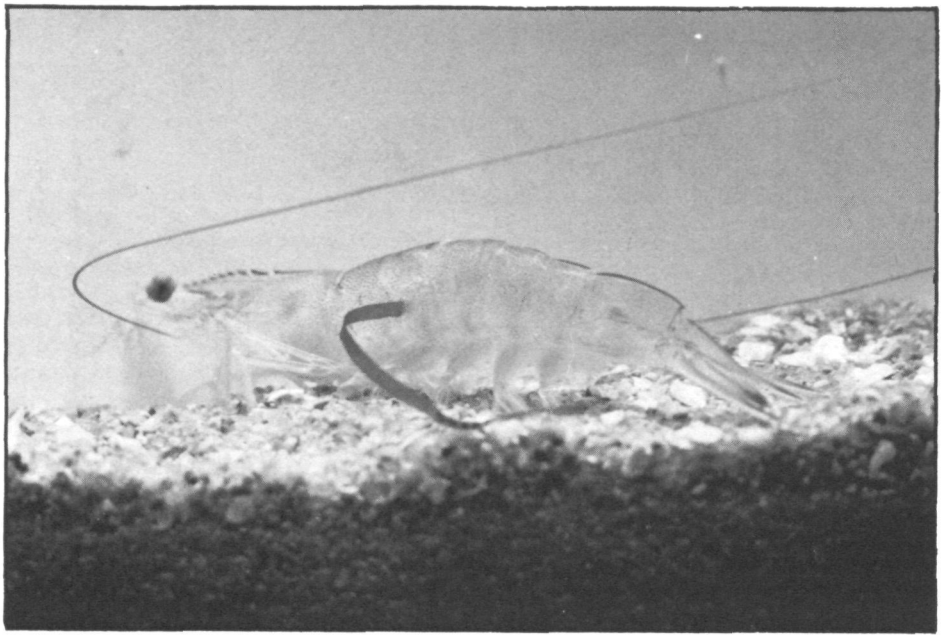
The tagging experiments showed that brown shrimp move from Texas toward Louisiana in the spring months, from Louisiana to Texas in the fall months, and toward the open ocean in the summer and winter months. All shrimp showed a net movement from east to west. An intensive survey of shrimp catch and fishing effort looked for any changes that might have been caused by brine disposal.

"So far," Dr. Klima said, "we have not found that the brine discharge diffuser sites have any effect on the movements or numbers of white and brown shrimp or redfish. Nor do we expect that our final research reports, due later this year, will show different results."

A Setback

Baseline oceanographic surveys of several of the sites were carried out from 1977 through 1980 by the National Ocean Survey. There were some interruptions, the biggest being tropical storm Debra, which struck the

A translucent shrimp shows off its NOAA tag. A unique reward system helped scientists track the creatures to study the effects of brine discharge.



Shrimp taggers, like these working for the National Marine Fishery Service's Galveston, Tex., laboratory, were kept busy collecting and tagging 331,000 shrimp over a 3-year period.

Louisiana coast August 28, 1978. Waves lashed by 55-mile-per-hour winds toppled subsurface platforms erected especially to support current meters in depths of 25 to 30 feet, and the meters were torn loose and embedded in the sea floor.

A total of $300,000 in instruments and equipment, containing information vital to the project, lay scattered about on or under the bottom. The Survey mounted a search and recovery effort using the NOAA ship Ferrel and two charter vessels.

Many Experts Shared Fishery Assessment Duties

In managing the environmental aspects of the brine discharge problem, NOAA sought the advice, assistance, and participation of many organizations and individuals—Federal, State, and local, academic, and private. Typical of this approach was the fishery assessment, which in addition to Federal agency researchers relied upon the work of scientists from the Texas Parks and Wildlife Department, the Louisiana Department of Wildlife and Fisheries, Texas A&M University, the University of Houston, the University of Rhode Island, Coastal Ecosystems Management Co., Energy Resources Co., Southwest Research Institute. LGL Ecological Research Associates, Inc., and Science Applications, Inc.

"Conditions at the Weeks Island site were especially severe," said Dr. Henry R. Frey, manager of the Survey's Strategic Petroleum Reserve Project and divemaster on the Ferrel. "Of the ten current meters there, only five were recovered—all found buried on the seafloor to a depth of a meter or more."

Fortunately, when the instruments were opened, their data tapes were intact. Invaluable oceanographic and meteorological information on conductivity, dissolved oxygen, air and water temperatures, water levels, and other data was obtained.

Along about the fall of 1980, all the data from the multiplicity of sources began to confirm to NOAA's project leaders the notion that whatever environmental effects might come from the brine discharges were likely to be subtle, rather than gross. There was certainly nothing to show that the brine was having a deleterious effect on the environment.

A Predictive Model

In the meantime the Environmental Protection Agency, which is charged with enforcing the environmental regulations on the petroleum reserve, was concerned with how to develop a predictive model that would forecast the impacts of that salty discharge.

So a private firm, Ecology Simulation Inc. (ESI), working under a NOAA contract, came up with an ecosystem model designed to answer EPA's question.

The little GEM (Gulf of Mexico Ecosystem Model) was designed to predict and assess the potential impacts of brine disposal on the fisheries in the neighborhood of the discharge sites.

GEM is divided into four submodels, which among them take into account everything relevant in the ocean ecosystem. The four are plankton (organisms that passively float or drift, such as fish eggs or jellyfish), nekton (organisms that swim independently of the current, from minnows to sharks), benthos (organisms that subsist on the sea floor, such as starfish and worms), and the organic complex (all the nonliving organic material in the water).

If this sounds like a tall order, it is. One of its problems is that nobody can gather enough data to verify everything in all the models. Nevertheless, major principles can be determined, and the effects of major perturbations can be traced.

The perturbation that DOE, EPA, and NOAA are primarily interested in, of course, is the influence of the massive salt discharges on the food web. So the model uses salinity as a driving force; it brings about changes and sees how the changes affect the whole system.

What does it show?

Changes Inconsequential

"It showed, for example, that an increase in the salinity may affect some species, while not affecting others," said Dr. Frederick Godshall, the present EDIS program manager for the project. In general it showed that at the level of salinity created by the MIT - designed diffuser and DOE discharge rates, the changes in the marine environment would be inconsequential and would not likely persist after brine disposal ceased.

It has definitely been established that there is more biological activity at the diffuser sites than elsewhere in the area. This might be caused by habitat alterations (because the diffuser area creates a brand new sheltered habitat), or by an increase in dissolved oxygen and nutrients, or for other reasons.

One intriguing graph produced by the model tracks the average autumn biomass of two types of animals—one being shrimps and blue crabs, lumped together as "demersal macrocrustaceans," and the other menhaden, anchovy, and mullet, or "pelagic planktivores"—and shows that as salinity increases from 30 to 42 parts per thousand, there is a very slight decrease in the population of the former, and a very slight increase in the population of the latter.

To put it another way, the net balance is slightly altered, but none of the organisms is at risk.

The National Strategic Petroleum Reserve hasn't yet met its goals for storing the oil, for many reasons including the fact that there were simply too many environmental unknowns. But as of April 1, 1982, there were 250 million barrels stored in the reserve, and the project is proceeding.

No major environmental problems have been uncovered by the research, or are foreseen by the models. None has been brought to light by the on-scene monitoring. If any do surface, the continuing monitoring program will flag them. In the meantime, the fishermen of the Gulf can continue their occupations with confidence that there is no evidence so far that this apparent threat is a real one. ■

Driver Beware

Steering Clear of Bad Weather

Don Witten

After most weather disasters, search and rescue teams locate victims, many of them drivers, who might have survived if they had known what to do when the severe weather struck.

You can increase your chances of surviving a weather-related disaster by planning for the event and being cautious when it happens. Your car may protect you, or it may prove your worst enemy, according to NOAA and the Federal Emergency Management Agency, which conduct extensive informational-educational campaigns aimed at increasing driver awareness of the threats of natural disasters.

As a starter, the experts say, drivers should become weather conscious, paying particular attention to the severe weather watches and warnings issued by the National Weather Service.

They should understand the safety precautions to be taken in a weather emergency as well as they know how to recover from a skid or how to parallel-park. Knowing when to stay with the car and when to leave it in a weather emergency is a driving skill as important as knowing how to steer. The driver's life may depend on either.

Here are the precautions recommended by NOAA and FEMA for motorists in various severe weather situations.

Lightning—Car Offers Protection

Lightning strikes the ground in the United States about 90 million times each year, mostly in the warmer months from April through October. On the average, lightning kills 109 people in this country and the property damage runs about $400 million.

Just how safe are you in a car during an electrical storm?

The value of being inside an enclosed metal vehicle during lightning was demonstrated tragically in Plainview, Tex., several years ago. Three people riding in the back of a pickup truck were killed by lightning while three other family members riding in the cab were unhurt.

No guarantees hold for lightning's behavior, but an all-metal car's skin usually bleeds off electrical charges, protecting occupants.

When it comes to hot weather, so often associated with electrical storms, drivers are cautioned never to leave anyone in a parked car during periods of high summer heat. Build-up of heat in a closed car can occur quickly and intensely. Children and pets can die from heat stroke in a matter of minutes when left in a closed car.

Hurricanes—Escape Early

Should you drive in a hurricane?

No, only to evacuate an area before the storm hits!

Coastal residents and visitors alike should know the best evacuation route before a storm forms. Both should plan to leave early if a hurricane threatens. It is a good idea to keep a full tank of gas in your car during the hurricane season.

August, September, and October are peak months for hurricanes, although the hurricane season runs from June 1 through November 30.

The driving force of hurricane winds is legend. Winds with speeds up to 200 miles an hour carry a deadly cargo of debris and knock down structures. But the real danger from a hurricane is its tides, or storm surge, which are responsible for nine out of ten hurricane victims. Hours before a hurricane strikes land, tides of as much as 25 feet above normal can sweep ashore near the area where the eye of the storm strikes. Low-lying escape routes can be flooded along a coastline area 50 miles wide.

In 1969, Pass Christian on Mississippi's coast was inundated by a 25-foot storm surge produced by Hurricane Camile. The bulldozing surge reduced an apartment building on the beach front there to its concrete foundation, killing 23 of the 25 people who remained despite warnings. One of the two survivors was washed ashore four miles down the beach.

Even though a hurricane weakens rapidly as it moves inland, the remnants of the storm can bring as much as a foot or more of rain to the area it crosses. Flash flooding and flooding can occur, posing a danger to drivers.

In June of 1972, the remains of Hurricane Agnes produced widespread and destructive flooding and flash flooding in Virginia, West Virginia, Pennsylvania, and New York. Deaths totaled 125 and the property damage was $3.45 million.

Floods—Deceptive Depths

Anually, flash floods kill 200 Americans and destroy $2 billion in property, based on statistics for the past ten years.

Drivers are cautioned never to attempt to drive around a road barrier through water which can rise rapidly and may be deeper than it appears. Roads can be eroded by flood waters and the missing sections might not be visible under the rushing water. Most cars float dangerously for at least a short while and they can be swept downstream during a flood.

If a car stalls in flood waters, the driver and his passengers should get out quickly and move to higher ground. Rising flood waters could sweep away a stalled car any moment.

Winter—Be Prepared

November through February brings severe winter weather to many parts of the United States. Winter storms kill 450 Americans on the average each year, more than the total dead each year from lightning, hurricanes, flash floods, and tornadoes combined.

The secret to a safer winter is to avoid driving in severe storms. If you are caught in a storm and your car becomes immobilized, stay in the vehicle and await rescue. Too many drivers have attempted to walk for help during a blizzard, only to become disoriented, lost, and frozen to death.

Trapped motorists who stand the best chance of survival are those prepared for the ordeal and those who use their heads. Before winter bears down on you, check your automobile for reliable operation, particularly the battery. Carry blankets, flares, high-energy foods, and other materials in your car to help you keep warm, visible, and alive should you be trapped in a storm.

Here are some survival hints if a storm traps you in your car:

- Turn on the engine for brief periods of time for heat, but always leave a downwind window open slightly to avoid deadly carbon monoxide poisoning. Make sure the exhaust pipe is clear of snow.
- Avoid overexertion and exposure from shoveling or pushing the car.
- Sleep only in shifts if there is more than one person in the car.

Tornadoes—Leave Your Car

By late winter, the tornado season begins in the central Gulf States and moves northwestward by March and April. In May, the peak month for tornadoes in the United States, these deadly storms occur in the Southern Plains. During the summer, the season moves north to the Upper Midwest and Great Lakes areas.

Tornadoes kill an average of 112 Americans each year, and annual property damage amounts to over $500 million. The most violent atmospheric phenomena and the most destructive over a small area, tornadoes pose a special threat to motorists. With winds that can exceed 300 miles an hour, these deadly storms can roll cars end-over-end or wrap them around a tree. During a tornado, your car is the least safe place to be. Drivers are cautioned never to try to outrun a tornado because of the maverick nature of these storms. Instead, they should abandon their vehicles for substantial shelter or lie flat on low ground with their arms over their head.

Despite adequate warnings, 45 people died and another 1,700 were injured when a massive tornado touched down near Witchita Falls, Texas, on April 10, 1979. More than half of the dead were killed in their vehicles while trying to outrun the gigantic twister—its mile-wide path of destruction was 60 miles long.

Knowing what to do and using your head is the best way for motorists to survive encounters with severe weather.

For the motorist faced with the threat of a tornado, a flash flood, a winter storm, deciding whether to stay in the vehicle or leave it may be a matter of life or death. Before reading the article, test yourself in each of the three situations at right. Stay or leave?

Credit: Lt. Wolfgang Lange

Clean but cold

Wintering Over at the South Pole

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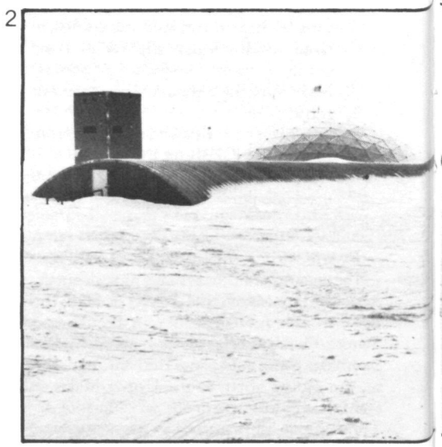

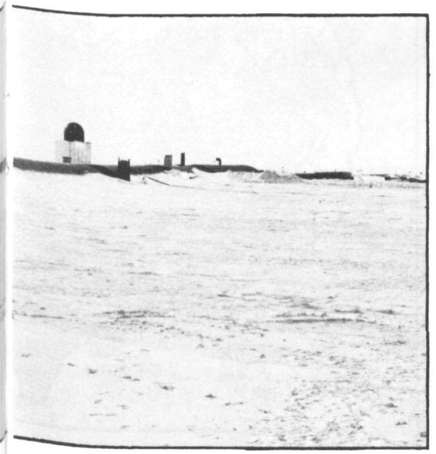

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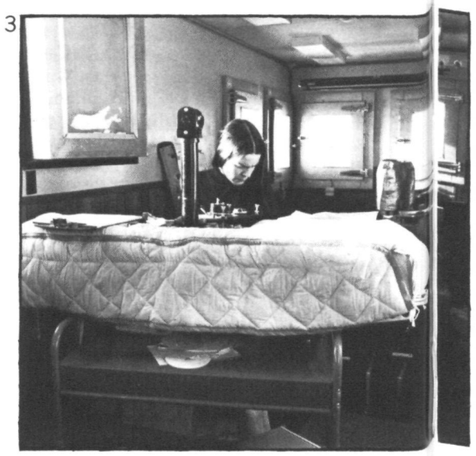

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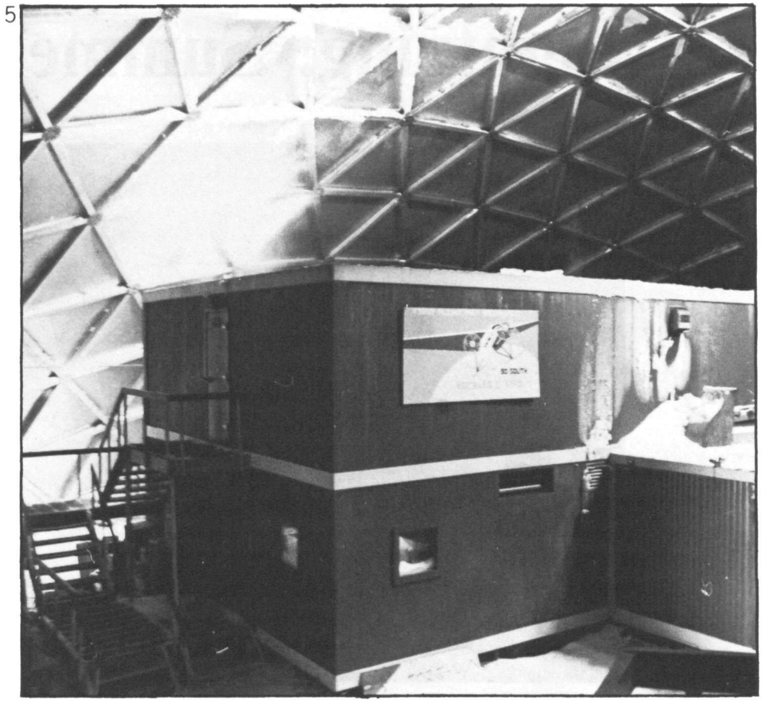

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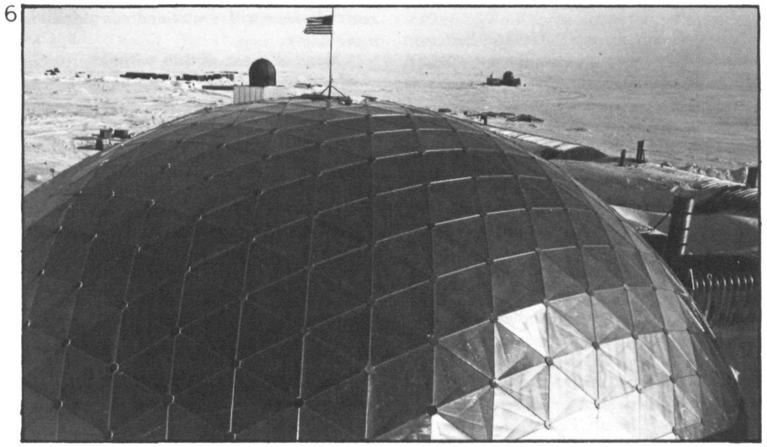


(1) Lt. McFee stands by the ceremonial pole where flags of the nations that signed the Antarctic Treaty are flown. As usual, the wind appears to be from the north. (2) Amundsen-Scott South Pole Station buildings include "fuel bladders," hospital facilities, power plant, and garage. The domed tower in the background is the balloon inflation shelter. The square tower at left housed the upper atmospheric laboratories and a lounge. (3) The clean air facility where Lt. McFee took daily measurements. The instrument shown measures total ozone. (4) The staff sits down to one meal from the 5-year supply of frozen and canned goods, dairy products, and such delicacies as lobster and Cornish hens. (5) Protected by an aluminum dome are the living quarters at top and the main science building. (6) The 60-foot high dome is 150 feet in diameter and houses the living quarters, science building, communications center, library, store, galley, and recreational facilities.

Rosalie A. Redmond

Lt. (j.g.) Cynthia McFee's new assignment is on the sunny slopes of Mauna Loa in Hawaii. It's a good place to live and work, and she'll be the envy of many other NOAA Corps officers.

In all fairness, she had it coming.

During her last assignment, in 1980-81, McFee wintered over at the South Pole, one of the coldest and most desolate spots on Earth. For 9 months she and 16 others were almost totally isolated from the rest of the world in a flat, featureless expanse of white where the temperature averages - 56°F.

Assigned to the Geophysical Monitoring for Climate Change Program of NOAA's Environmental Research Laboratories, McFee was the station chief of the remote GMCC at the Pole. Her job was to meaure atmospheric carbon dioxide, aerosols, ozone, and chlorofluorocarbons (like the ones found in refrigeration units) that exist in the air over Antarctica where human influences are negligible.

The station at the South Pole is one of four remote "clean-air" observatories run by NOAA to determine how atmospheric pollutants may be affecting the Earth's climate. The others are in American Samoa, Mauna Loa, Hawaii, and Barrow, Alaska. The same instruments are used at all stations to precisely monitor the pollutants over long periods of time.

Not all of the pollutants are the result of human activities; some are created by the Earth's biosphere, desert dust storms, or volcanic eruptions. But the increase in carbon dioxide, for example, that has been observed over the globe for the past 25 years is the result of the burning of fossil fuels, which in turn may be leading to global atmospheric warming via the greenhouse effect. Measurements such as those taken at the South Pole station must be made for many years before conclusions about long-term changes can be drawn.

McFee's stint at the South Pole lasted from November 1980 to November 1981. For 9 months, the weather is simply too terrible to permit flights in or out of the station, so McFee and the rest of the crew had no alternative but to stay. Not even in a medical emergency could a plane be called to evacuate the stricken person. Medical treatment was furnished by one doctor who ran a one-bed hospital, served as dentist, postmaster, and convenience store clerk.

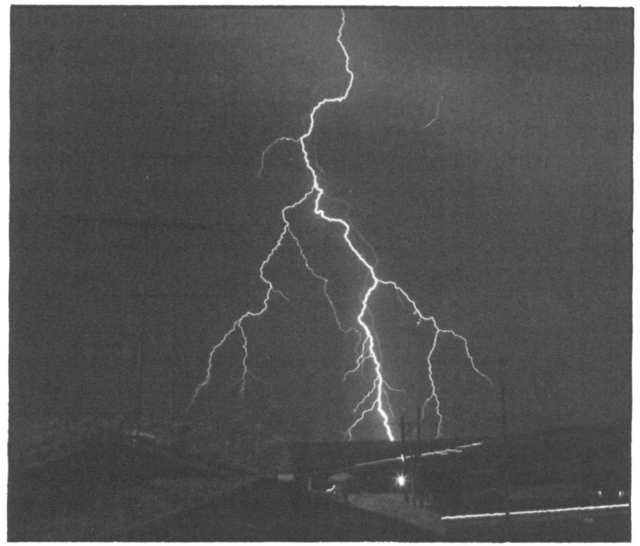
During off-duty hours, McFee and the others had movies, taped entertainment, a library, and a gym complete with jacuzzi. (The hot tub was constructed during the year McFee was there.)

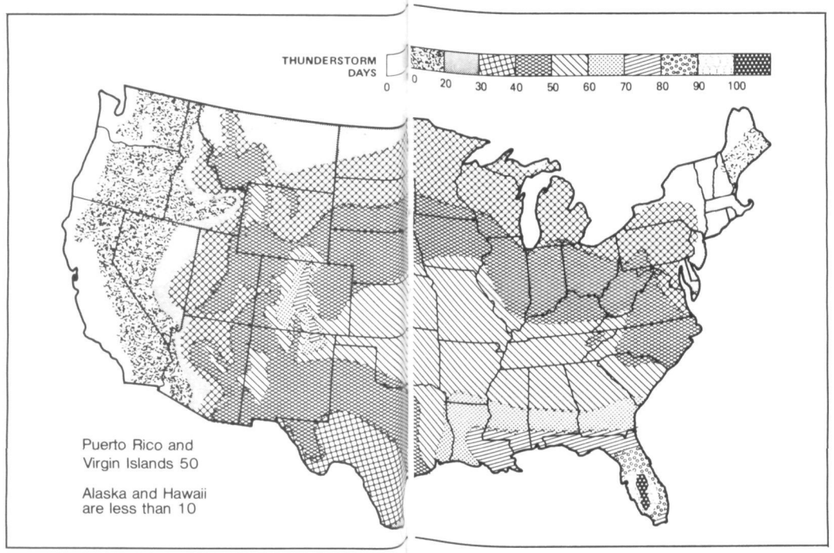
But for the most part, it was a long grind in a strangely insulated environment in which one walked outdoors only to find the sky was an aluminum dome 60 feet overhead and beyond the dome was a bleak, lifeless world of deadly cold.

Lt. McFee's going to enjoy Hawaii. ■

Lightning: Summer Superpower

Marne A. Friess





Thunderstorm days—the number of days each year on which at least one thunderstorm is observed—are indicated on the map above. Only areas on the west coast, Alaska, and Hawaii have less than 10.

Lightning—How To Protect Yourself

When a thunderstorm threatens, get inside a home or large building, or inside an all-metal (not convertible) vehicle.

Inside a home, avoid using the telephone, except for emergencies. Do not touch wiring or plumbing fixtures if possible.

If outside, with no time to reach a safe building or an automobile, follow these rules:

- Do not stand underneath a natural lightning rod such as a tall, isolated tree in an open area.
- Avoid projecting above the surrounding landscape, as you would do if you were standing on a hilltop, in an open field, on the beach, or fishing from a small boat.
- Get out of and away from open water.
- Get away from tractors and other metal farm equipment.
- Get off and away from motocycle, scooters, golf carts and bicycles. Put down golf clubs.
- Stay away from wire fences, clotheslines, metal pipes, rails and other metallic paths which could carry lightning to you from some distance away.
- Avoid standing in small isolated sheds or other small structures in open areas.
- In a forest, seek shelter in a low area under a thick growth of small trees. In open areas, go to a low place such as a ravine or valley.
- If you're hopelessly isolated in a level field or prairie and you feel your hair stand on end—indicating lightning is about to strike—drop to your knees and bend forward, putting your hands on your knees. Do not lie flat on the ground. ▪

Astronaut C. Gordon Fullerton successfully piloted the NASA space shuttle Columbia nearly four million miles around the Earth last March—without mishap. Two months later, Fullerton was flying a T-38 trainer plane from Houston to Cleveland, a 1,200 mile flight, when his plane was struck by lightning. Fortunately, there was little damage and no injury.

"There was just one big bang in the cockpit," the astronaut explained "The effect was as though a howitzer had been fired.

"The incident was a complete surprise," he said. "In all my 24 years of flying I thought I knew what lightning conditions looked like. The cloud formation just didn't indicate a thunderstorm."

Three days before Fullerton's plane was hit, 13-year old Peter Reynolds of Springfield, Va., was caught in a hailstorm on his way home from school with friends. The boys fled into the nearby woods to protect themselves from the icy pellets. Moments later, Reynolds and a schoolmate lay injured on the ground. Both had been struck by lightning.

"We didn't see any lightning, or hear anything," recalled Reynolds, who suffered severe chest burns. "But I felt the pain."

If statistical averages prove to be accurate for this year, over a hundred Americans will not be as fortunate as astronaut Fullerton and the young students. They will perish in explosive lightning discharges. Another 500 people will be injured and the toll in property damage will reach hundreds of millions of dollars.

Many of these victims will either ignore safety rules provided by the National Weather Service or they will be unaware of the true danger posed by lightning. Unfortunately, others will die by lightning because they will be caught in circumstances where there are no environmental clues.

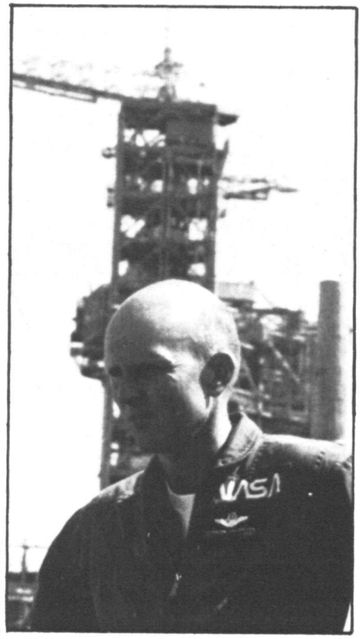
"Certainly, we are surprised at times with a lightning strike when we least expect it," explains Richard Coleman of NOAA's National Weather Service Warnings Program. "But for the most part an awareness of weather conditions favorable for lightning as well as a knowledge of the safety rules will lessen the chances of becoming a victim."

The risk of being struck by lightning is greater than most people realize. Fred Ostby, Director of NOAA's National Severe Storms Forecase Center in Kansa City, Mo., has estimated that 100,000 thunderstorms occur each year in this country. Some 1,800 thunderstorms are in progress over the Earth's surface at any given moment, generating approximately 100 lightning strikes per second.

The National Severe Storms Forecast Center monitors the Nation's weather and issues storm watches for the thunderstorms that threaten life and property. Warnings are issued locally by Weather Service field offices.

Though not confined to summer months, lightning is most common from May to September. Most lightning deaths and injuries occur in the afternoon and early evening when thunderstorm activity is at its peak.

An unpleasant surprise in the form of a lightning bolt awaited astronaut C. Gordon Fullerton a few months after his successful mission in the Columbia space shuttle in March. Fortunately he was uninjured.



Credit: NASA

Every State has its share of lightning, but some portions of the country are more vulnerable to lightning strikes than are others. Florida is most lightning prone with some regions of the State reporting 100 days of thunderstorm activity each year. The Rockies also are hard hit.

"Thunderstorms over the mountains are almost a daily occurrence," explains Maurice Pautz, chief meteorologist at the Weather Service field office in Denver, "We get more than 40 thunderstorms each summer season, with an abnormally high frequency of lightning."

Lightning injuries and fatalities are most common in Florida, where an average of 10 lightning deaths are reported yearly. Texas and the Gulf Coast states also have higher than average numbers of reported deaths and injuries.

Anyone involved in outdoor work or recreation, especially in large open fields or near the water, is more likely to be struck by lightning. Farmers, ranchers, golfers, members of the armed forces, spectators and participants at outdoor atheletic events, hikers, campers, and boaters are among those cited in a high risk category.

Lightning, statistically more deadly than tornadoes or hurricanes, has proven itself as a killer. During the 41-year period from 1940 to 1981, 7,583 Americans were killed by lightning. In 1981, 66 persons died from either being struck directly, or by conducting the current from a bolt.

Yet, despite the numbers, lightning doesn't attract much national attention, or respect. This is due in part to the scale on which fatalities occur. While hurricanes, tornados, and floods may kill hundreds of people and destroy millions of dollars in property in a single episode, lightning usually only causes one fatality at a time. And while lightning is known to cause extensive property damage, the singularity of incidents usually doesn't generate national news.

But with or without the headlines, lightning—the deadliest of severe weather conditions—is an unpredictable and underrated killer.

Scientists describe lightning as a gigantic natural spark that occurs when opposing electrical charges within a thundercloud, or between it and the earth, build up, attract, and discharge. When storm clouds gather, the wild turbulence inside them results in a separation of electrical charges. Negative charges usually accumulate in the lower part of the cloud, while positive charges build up in the upper part of the cloud and on the earth.

Lightning occurs when attraction between the opposite charges becomes strong enough to bridge the gap separating them, and to overcome the natural insulation air offers.

A typical lightning bolt, lasting only a millionth of a second, will pack a walloping 10 to 100 million volts of electrical energy, or about 3,000 kilowatts per second. This compares dramatically with the 2,000 to 3,000 kilowatts per month at 110 to 220 volts needed to run the average American home.

A cloud-to-ground lightning strike begins with a pilot leader, too faint to be visible advancing downward from the cloud to establish the path that the bolt will take. When the leader nears the ground, a heavily charged return strike shoots back up producing the brilliant flash. Thunder is caused by the rapid expansion of strongly heated air along the path of the bolt.

Lightning—the thunderbolt of mythology—was taken by early civilization to mean punishment or warning. The bolt represented a supernatural strength possessed by the gods to be used on mortals.

In the Middle Ages, it was customery to ring the bells in a church steeple to disperse thunder, which was thought to come from the rubbing together of clouds. This practice unfortunately led to the electrocution of hundreds of bell ringers. As late as 1735, the Parliment of Paris enforced an edict forbidding the practice after it had been determined that over the previous 33 years with 286 recorded lightning strikes, 103 unfortunate bell ringers had perished at the ends of their wet ropes.

Only in the 20th century have scientists begun to understand better the secrets of nature's fireworks. And as a result, we are learning more about how to survive lightning and how to cope with its inevitability. ▪

Directions

NOAA To Operate Landsat D Satellite;

NOAA will assume management responsibility for Landsat D—fourth spacecraft in the Landsat series—on January 31, 1983. Landsat data is used to help forecast crop yields, manage rangelands and forests, explore for minerals and petroleum, assess water quality, guage the effects of natural disasters, plan land use, and perform a host of other tasks.

NASA launched the spacecraft in July, and will check out the components, establish the precise orbit, and demonstrate that the system is fully operational before turning management over to NOAA.

Under the single manager approach that has been adopted, NOAA will then be responsible for controlling the spacecraft, scheduling the Landsat D sensors, processing and distributing the data from the operational sensor known as a multi-spectral scanner, and reproducing and distributing some of the data from an experimental sensor called a thematic mapper. NOAA's operational Landsat program is keyed to user orientation.

The Office of User Services of the National Earth Satellite Service (NESS) is establishing a Basic Data Set from the scanner, a type of instrument that has been used on previous Landsat spacecraft. The set will be established following collection and assessment of advice from a series of public meetings. Later this year NESS will publish a description of the set that will identify the scenes to be collected.

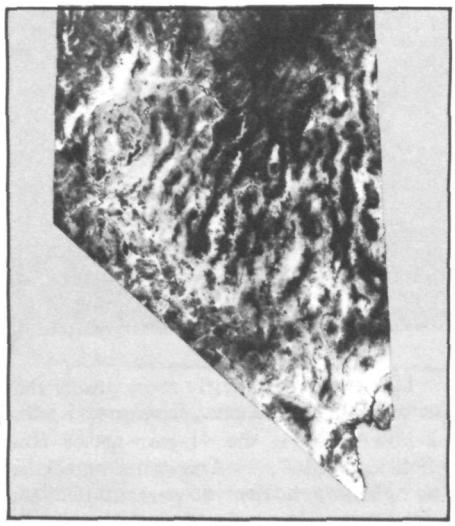
Because of limited capacity of the system, first priority will be given to observation of natural disaster and emergency events. Second priority will be given to customers willing to pay an additional fee for special acquisition services. Third priority will go to collection of Basic Data Set scenes.

Landsat users include private industry, State and local government units, and academic institutions, in addition to the Federal government.

To provide service to Landsat customers, NOAA has entered into an agremeent with the EROS Data Center of the Department of the Interior, at Sioux Falls, S. Dak. The EROS Data Center will continue to process Landsat data, as it has in the past, with NOAA assuming management of the Landsat data archive.

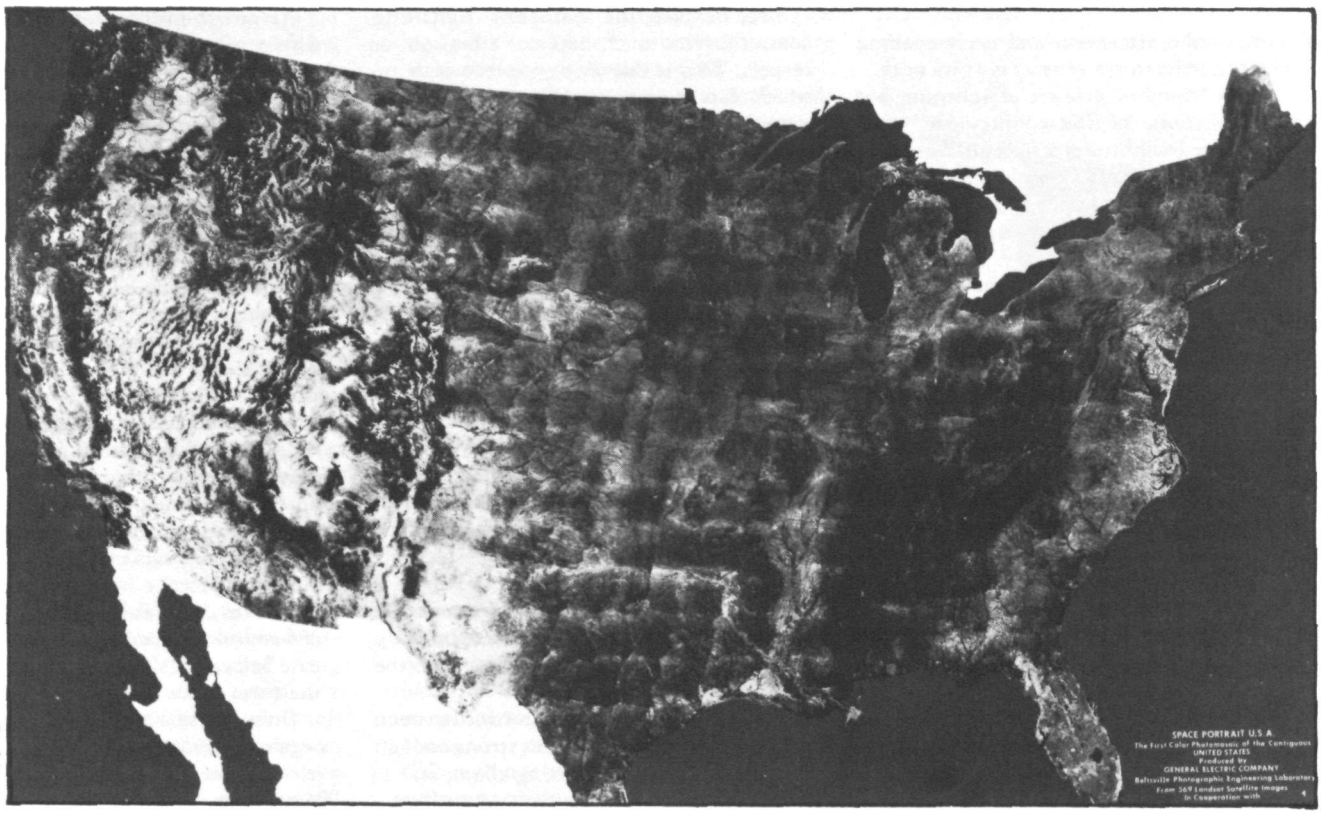
Information from Landsat is produced both as computer compatible tapes and as pictures (photographic imagery). Each Landsat scene covers an area of 115 x 115 miles.

The multispectral scanner acquires data simultaneously from four bands of the visible and near-infrared portions of the spec-



Credit: NASA

The versatility of Landsat is demonstrated in these photomosaics; one of the contiguous United States produced by General Electric from 569 images in cooperation with the National Geographic Society and NASA, the other, a cloud-free Nevada made from 24 images.



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Program To Be Keyed to User Needs

trum. False color composite photos are produced by combining several bands through filters onto color film.

The resulting pictures produce a great deal of useful data in color. Vegetation appears in various shades of red, depending upon species, stage of growth, and health of the plants. Cities and highways are blue. Water comes out in shades from white through light blue to black, depending upon depth, sediment load, and other characteristics.

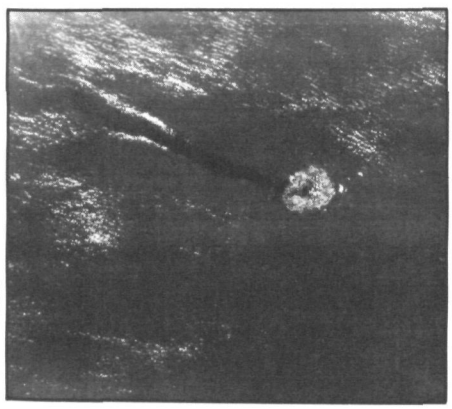
The thematic mapper produces information similar to that produced by the scanner, but in much greater detail. It will remain an experimental instrument until NASA has tested its specifications and validated its characteristics.

Current plans call for the mapper to become operational in January 1985. Design of the necessary operational ground system is underway. The satellite service anticipates that products from this new sensor will begin to trickle into the Landsat archive soon, and incresase as more handling hardware comes on line.

Landsat data has been useful in the Agricultural and Resources Inventory Surveys Through Aerospace Remote Sensing (AgRISTARS), a joint program of NOAA, NASA, the Departments of Agriculture and Interior, and the Agency for International Development. AgRISTARS seeks more objective and reliable production forecasts of wheat, barley, corn, soybeans, and rice, and better inventories of such U.S. renewable resources as water, forests, and rangeland.

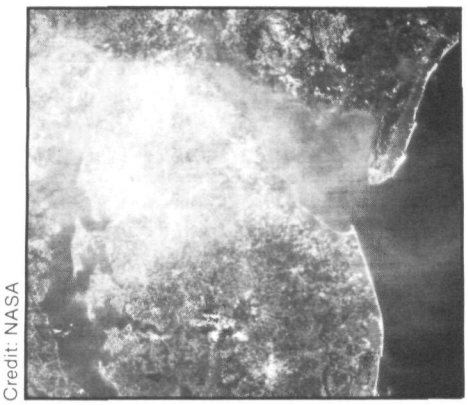
Cartography has benefited from Landsat data for many areas of the world where adequate topographic maps have never existed. Scientists have also used Landsat photos to identify erosion, river sediment loads, and the like.

NOAA was designated to manage all operational civilian remote sensing activities from space in November 1979, because of its experience in operating the National Environmental Satellite system, managing 24 environmental satellites since 1966. ■



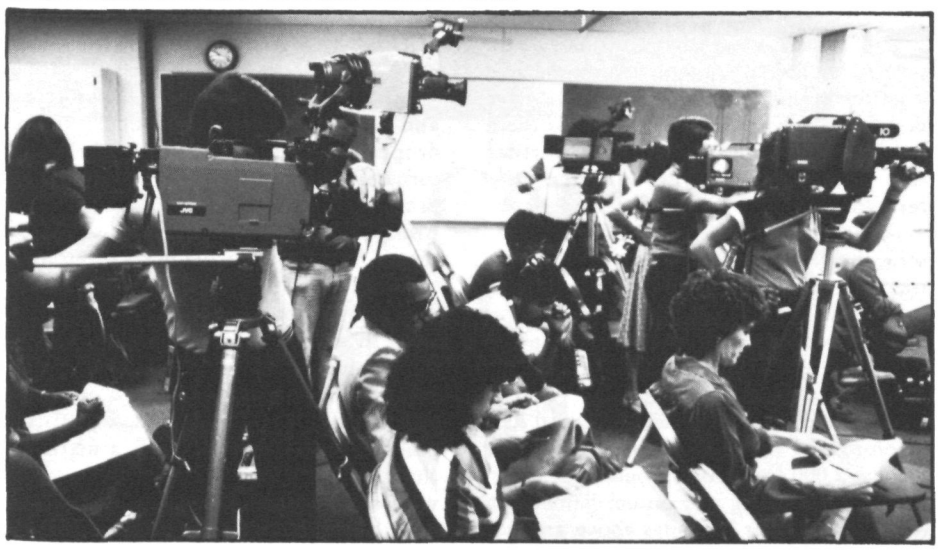
Credit: NASA

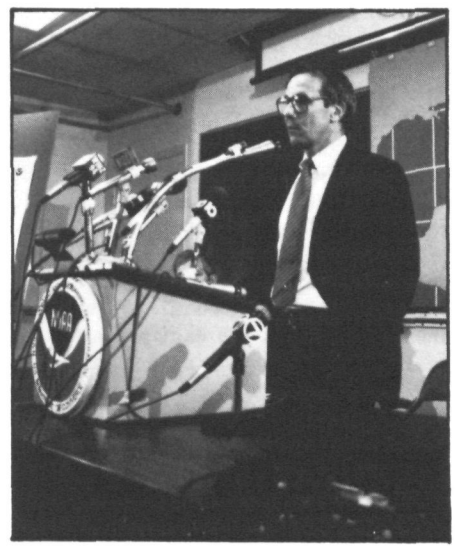
The satellite sees a plume of calm water for about 65 miles to the lee of a mountain on tiny Bawean Island in Indonesia, and a haze of dirty air over the Delmarva Peninsula from the Washington-Baltimore area to the west.



Credit: NASA

ON THE ROAD:





Administrator John V. Byrne faced the Miami media May 25 in a press conference opening the 1982 hurricane season. Dr. Byrne urged those in hurricane-susceptible places to be prepared to leave, to seek shelter in nearby bay areas, or to take cover in tall buildings removed from the shore, should a storm threaten. Eight days earlier, in Johnstown, Pa., he opened National Flash Flood Awareness Week with an appeal to those in the path of a flood to heed and obey National Weather Service warnings.

Anatomy of A Tornado

Louise Purrett-Carroll

Hundreds of tornadoes roar across the central United States each spring and summer. In some States and seasons, their appearance is almost routine. Each year a few earn a place in history because of the lives they take or the destruction they wreak—dubious distinctions.

A violent tornado in western Oklahoma last spring is earning another kind of distinction, not for its destructiveness, but because of what NOAA scientists are learning from it. Among other things, they have obtained from it the first radar measurements of the size and wind velocity of a violent tornado. They report that the tornado averaged half a mile wide and had winds of 196 miles an hour.

The tornado was the most powerful of at least five that developed from a late-afternoon storm on May 22 and plowed through farmland near Binger, Okla. Even by the awesome standards of tornadoes, it was an impressive specimen, bowling over cattle, farm combines, semi-trailer trucks and 12,000-gallon oil storage tanks along a track of destruction 14 miles long and over a mile wide.

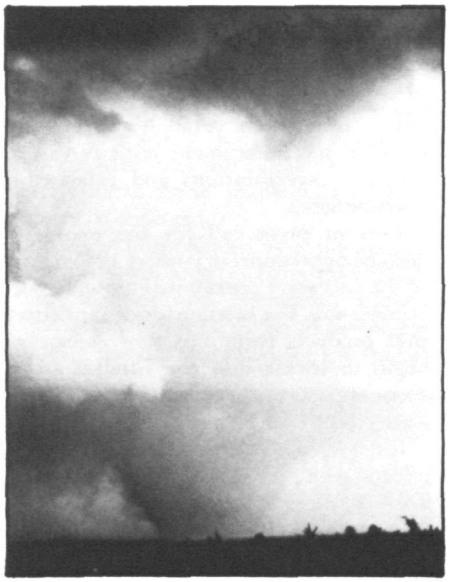
A Unique Opportunity

The tornado's immensity, plus the happenstance that it fell within range of the National Severe Storms Laboratory's powerful Doppler radar, allowed Don Burgess, Larry Hennington, and Dr. Dusan Zrnic of NOAA and Leslie Lemon of Sperry Corporation to make their unique measurements. The NOAA radar can measure not only the location but the velocity of distant moving objects, such as precipitation or debris carried by wind.

The velocity of winds in tornadoes has long been a subject of speculation and calculation, and stories of feats like driving straws through fenceposts and picking up 70-ton railroad cars have added to their fearsome reputation.

What scientists have been able to infer about tornado sizes and wind speeds has come from chance visual observations, measurements of the damage path, and, more recently, by filming a tornado and precisely measuring the movement of the objects picked up. Direct measurements within the tornado have been obviated by the tornado's very power, which has tended to destroy any weather instruments it hits.

Radar has added its own perspective on the destructive funnels. For years, the so-called "hook-echo," a hook-shaped pattern on the standard radar screen, has been associated with the large storm circulations that breed tornadoes, but the tornadoes themselves are rarely seen by radar. In the early 1970's, researchers at the NOAA laboratory discovered that at least the location of tornadoes could be revealed by Doppler radar because winds on the opposite sides of a funnel are travelling in opposite directions.



The Binger tornado at its mature stage was photographed at about the same time as scientists were making maximum wind measurements with Doppler radar.

Close-up of a Tornado

Last May, the NOAA scientists used the laboratory's radar first to pinpoint the tornado's position. They then switched to a special mode to scan that relatively small area with unusally high resolution. The high resolution, plus special radar displays developed at the laboratory, allowed them to obtain their measurements. The radar was designed by NOAA engineer Dale Sirmans and operated by Glen Anderson.

Scanning with the high-resolution pattern, the NOAA researchers were able, for the first time, to trace the outline of the tornado all the way from its base to the top of the clouds, a height of 7.5 miles. It was the greatest height to which a tornado has been detected by radar.

The radar revealed a funnel shaped like an elongated vase. It was about 3,000 feet wide at 2,000 feet above ground, got wider farther up, reaching a maximum diameter of over a mile about 2½ miles above ground, and then narrowed again. The tornado tilted at an angle of about 24 degrees from vertical and at right angles to the direction the parent storm was moving. A similar tilt had been observed in other tornadoes.

A 2-Mile Doughnut Hole

Finally, another first, the researchers discovered a "hole" in the radar echoes from precipitation in the storm cloud, surrounded by a doughnut of very strong echoes. This doughnut, averaging 2.2 miles in diameter, coincided exactly with the location of the tornado as revealed by the wind patterns.

The researchers suggest that, unlike the rest of the storm where updrafts produce condensation and precipitation, air within the funnel is sinking. So the interior of the funnel may be dry and clear. The scientists point out that both vortex theory and rare visual observations confirm this notion.

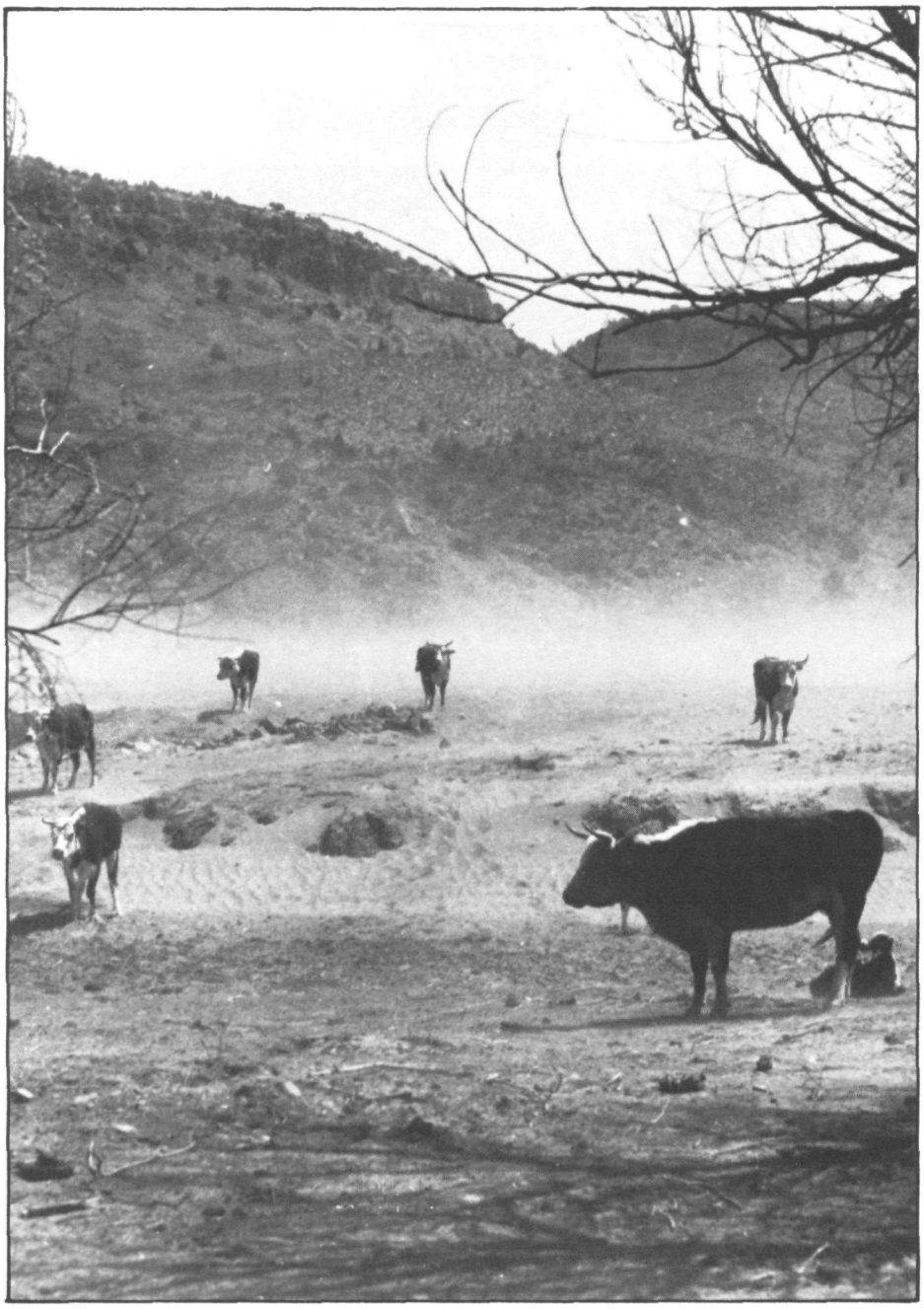
The discoveries that some tornadoes may extend to near the top of the cloud and may be clear in the center mean it might be possible to spot them from above. There have been a few reported observations, by satellites and high-flying aircraft, of swirling patterns, and even holes like the eye of a hurricane in the anvil tops of severe thunderstorm clouds.

The Binger tornado was also filmed by storm "intercept teams" dispatched in instrumented vans from the laboratory and the University of Oklahoma and guided by radio. And it was observed at close range by a portable weather station called TOTO.

TOTO—A Near Miss

TOTO (for totable tornado observatory), is a super-sturdy package of instruments designed to be placed in the path of tornadoes, make direct measurements within them, and survive to tell the tale. Designed and built by Alfred Bedard and Carl Ramzy of NOAA's Wave Propagation Laboratory, TOTO resembles a barrel with an antenna, and weighs about 400 pounds. It was dropped in the apparent path of the Binger tornado but the funnel veered suddenly and passed about a third of a mile from TOTO. Even so, TOTO got unusually closeup measurements showing wind gusts of up to 65 miles an hour. The nearby passage of the vortex also showed in TOTO's records as a drop in atmospheric pressure and a 50-degree shift in wind direction.

The findings, says Burgess, are not immediately transferrable to better tornado predictions. "It was, after all, a matter of chance that we obtained these observations, we don't know how often a feature like the echo hole occurs, as most weather radars are not sensitive enough to detect it anyway. But Doppler radars will eventually be used in operational forecasting, and meanwhile anything we learn about the tornado vortex, how it forms, and is organized, helps." ■



The effects of weather and climate on the land are felt throughout the economy. Agriculture is a particularly vulnerable industry when temperature and precipitation vary from the normal.

Weather, Climate, and Economics — the NOAA Nexus

Patrick Hughes

Last January was one of the most devastating winter months on record. It began with heavy snows across the Cascades and Rockies on New Year's Eve and ended in a fierce storm that savaged the country's midsection on January 31. Before the month was over, ice, snow, freezing temperatures, and chilling winds had made life miserable for millions of Americans from the Rockies to the East Coast and as far south as Florida. And it cost the country about $6 billion in direct dollar losses.

As bad as last January's weather was, however, it was not nearly as costly to the Nation as the winter of 1976-77, which caused direct losses of approximately $40 billion in today's dollars.

These included production losses in major U.S. industries, crop losses, transportation losses in rail and truck traffic and damage to roads and bridges, losses in retail sales, and losses resulting from increased energy consumption. A single snowstorm paralyzed rail operations in the Chicago area for more than one week, costing CONRAIL alone approximately $100 million.

During the winter, unemployment rose by about 2 million, the consumer price index took the largest 2-month jump (1.5 percent) in 3 years, the inflation rate rose, the number of business failures increased, and the U.S. balance of payments dropped by $1.4 billion.

Summing up the situation on February 2, 1977, Senator Hubert Humphrey said that "The weather report has become the latest addition to the list of economic indicators."

At the other end of the meteorological spectrum, the 1980 heat wave and drought cost the U.S. economy between $15 and $20 billion. The primary impacts occurred in crop and livestock losses in the Midwest, but secondary shocks later were felt by consumers who had to pay higher prices for bacon, beef, and poultry.

A few months later, in December 1980, cold weather in the Northeast (and increased competition) was blamed for falling revenues at Atlantic City gambling casinos.

That same winter, a series of severe storms drove New England fisherman from the water, causing a dramatic rise in seafood prices.

A little later, in March 1981, drought caused the Mississippi River to ebb, creating a severe shipping bottleneck that cost the Mississippi barge industry tens of millions of dollars. The Government spent millions more trying to keep the depleted Mississippi and its tributaries navigable.

Obviously, weather and climate have a heavy impact on the economy at all levels—National, regional, local, corporate, and consumer.

Weather vs. Climate

The economic effects of weather usually are local and short-term. Climatic impacts, on the other hand, are regional and relatively long-term, on the order of months and seasons and years.

Weather usually affects operating costs, such as the number of hours worked on an outdoor project. Climate affects capital investment decisions, such as the siting, design, and construction of an industrial complex.

In 1980, for example, Illinois lost a bid to have Nissan build a $300 million pickup truck plant in the State. Nissan decided to build in the South; one of the major reasons cited was climate. Similar decisions are reflected in recent relocations of domestic industries from northern to sunbelt States as energy costs have risen.

Because climatic data are used in making more costly capital investment decisions, while weather forecasts generally are used in less costly daily operating decisions, the potential dollar benefits of climate information can often exceed those of weather forecasts.

It is sometimes difficult to distinguish between the economic effects of weather and of climate. The construction industry, for example, is sensitive to both the seasonal impact of winter (climate) and to day-to-day weather changes.

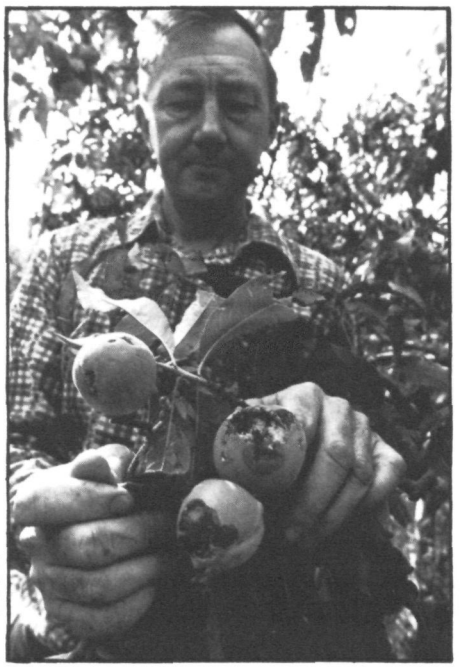
A 1965 study by the Travelers Research Center estimated that in 1964 the total dollar loss to the U.S. construction industry due to the elements ranged between $3 and $10 billion. Money spent on construction projects totalled $88 billion, more than 10 percent of the Gross National Product. Of this total, an estimated 45 percent ($39.7 billion) was spent in outdoor work or work involving perishable materials.

Beyond the Weather Forecast

There are meteorological products and services other than the familiar weather forecast than can be and are being used to assess, plan for, cope with, and save money on the vagaries of weather and climate. In the building industry, for example, structural design decisions involving billions of dollars a year are based on wind-force data and analyses whose costs range from a few dollars to a few thousand dollars.

In the energy field, heating and cooling demand obviously depends on the weather. Gas and electric companies use past temperature data to project demand, plan inventories, distribute products, and structure rates.

A single coastal storm can cause millions of dollars damage in a few hours. Roadways often are hard hit.



Credit: DOA

Peaches ripped apart by hail typify the vulnerability of agriculatural produce to severe weather. An entire crop can be ruined by a short-lived storm, or a moisture deficiency over several seasons.

In agriculture, the weather cycle and growing cycle are virtually synonymous. The farmer can't function without knowledge of the local climate. The Green Giant Company, for example, uses climatic data to determine when to plant vegetables.

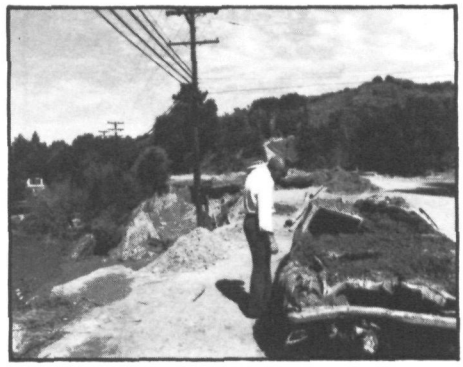
The weather cycle also impacts the general business cycle. Climatic information is used by business and industry to make critical choices concerning capital expenditures, production, and marketing. These applications, which turn climatic data into dollars, covering business activities ranging from the mundane to the sublime:

- Thermal underwear manufacturers, for example, use temperature data to schedule inventory shipments.
- Temperature data also are used by companies that lease portable toilets and are concerned about the chemical-water solution freezing.
- Supermarkets, dairies, and breweries like Anheuser-Busch use climatic data to manage and monitor their considerable energy consumption, as well as in the original design of their huge refrigeration heating, and cooling plants.
- Automobile manufacturers use precipitation data to study windshield wiper performance on passenger cars.
- Locomotive manufacturers use climatic data to determine the efficiency ratings of diesel engines.
- The Weyerhaeuser lumber company uses climatic data to plan, plant, and monitor the growth of seedlings.
- Raincoat manufacturers use precipitation data to plan sales campaigns.
- Piano manufacturers use temperature and humidity data to determine which glues to use.

Shasta Lake in California in 1976 during a rainless spell. All but the dark, tree-covered areas is usually under water.

Last winter ice kept these small fishing boats at dockside long after the season opened causing a serious loss of revenue.

A mudslide damaged houses, roadways, vehicles, and other property. Better site selection might have reduced losses.



- Boeing's Marine Division uses wind and wave data to design hydrofoil vessels.
- Travel agencies use climatic data to choose suitable sites for business meetings.
- The Bechtel Corporation converts climatic data into productivity measurements for construction workers building the Washington, D.C. subway system.
- And contractors use solar-radiation data to determine the light-fastness of pigments used in stained glass windows for churches.

These are but a few examples of the more than 35,000 business requests for climatic data and information answered annually by the National Climatic Center in Asheville, N.C., a major facility of NOAA's Environmental Data and Information Service (EDIS).

NOAA gathers global data about the atmosphere, oceans, Earth, space, and Sun to describe and predict the state of the physical environment. Other agencies, organizations, and individuals, both domestic and foreign, collect similar data for their particular purposes. Once the original collection purposes have been satisfied selected data flow to EDIS, which incorporates them into its national environmental data base.

From this data base, EDIS annually provides data products and services to 140,000 users in commerce, industry, agriculture, science and engineering, the general public, and Federal, State, and local governments. These products and services include assessments of the impact of weather and climatic variability on the National economy, on energy demand and development, and on global food supplies.

Weather and Climate Impact

Last year the EDIS Center for Environmental Assessment Services (CEAS) published its first annual assessment of the impact of weather and climate on the National economy. The report contains State and National direct dollar loss estimates in eight broad categories for each of the major anomalous atmospheric events that occurred in the United States in 1980. The categories covered are: (1) agriculture, (2) energy, (3) commerce, (4) quality of life, (5) transportation and communications, (6) construction, (7) government, and (8) recreation and services.

CEAS also issues a monthly impact assessment for both the United States and a biweekly evaluation for foreign countries, as well as annual domestic and foreign assessments and special or periodic reports on meteorological phenomena such as the past winter, the winter of 1976-77, and the 1980 heat wave and drought.

Energy Demand Projections

During the heating and cooling seasons, CEAS issues temperature-based, monthly and seasonal projections of energy demand for multistate regions of the country. These estimates are based on CEAS models and on National Weather Service forecast products and go the Department of Energy, to other Federal agencies, to industry, and to the news media for public dissemination. CEAS also provides National, regional, and State climatic statistics used to estimate actual heating and cooling energy consumption. These products are used to gage fuel needs and to ensure adequate reserves.

CEAS assessments of changes in consumer energy costs caused by weather and climate variations are used by the Department of Commerce's Bureau of Economic Analysis in calculating National income.

Planning, site selection, design, construction, and operation of energy facilities require assessments of local wind, temperature, atmospheric pressure, and storm statistics and frequencies. In support of National efforts to increase energy supplies, EDIS has provided special data products and services needed for development of the Alaska Pipeline, nuclear powerplants, offshore oil and gas drilling rigs, and supertanker ports. Proposed natural gas pipelines and synthetic fuels facilities will require similar products and services.

CEAS meteorologists have developed climate/crop-yield assessment models for major grain-exporting countries. These models provide some of the information the U.S. Department of Agriculture uses in making decisions on grain export policies that affect the Nation's balance of payments.

CEAS scientists also have developed subsistence climate/crop-yield models and assessment products for lesser-developed countries in the Caribbean, Africa, and South Asia. These are used by the Agency for International Development's Office for Foreign Disaster Assistance to provide early warnings of potential emergencies and to verify claims for relief assistance. The assessments also are used by foreign governments and by United Nations organizations to minimize the effects of grain-production failures around the world.

Economic Indicators

Weather and climate induced trends, peaks, and valleys abound in economic statistics. Because weather and climate events are outside the economic system, their effects are easier to measure than are those of other economic indicators.

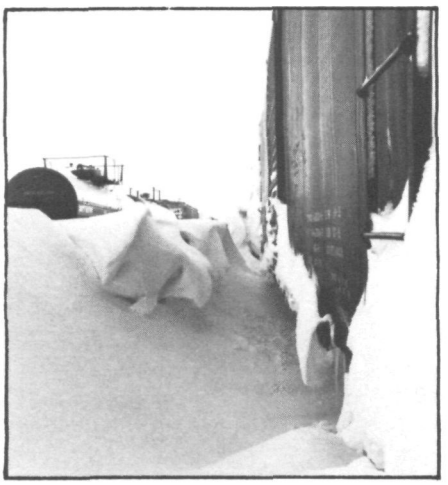
Meteorological data are available long before economic data. Traditional economic indicators usually take several weeks to compile; economic statistics take even longer, usually months and sometimes a year or more. Conversely, meteorological satellites and data collection systems provide global data within hours. These data can be combined with climatic data and converted almost immediately to economic assets. As a result, meteorological data-based assessments provide a unique early forecast of the economic impact of atmospheric events, a preview of economic data that do not yet exist.

The Federal Reserve Board recently asked EDIS to provide periodic data on the impact of weather on U.S. industrial productivity for use in preparing the Board's monthly industrial production index. ■

Credit: CONRAIL

Case In Point: The Railroads

W.J. Harris, Jr.
Vice President
Association of American Railroads



Credit: CONRAIL

Weather and climate conditions—precipitation, temperature, and even wind under extreme, but not rare, circumstances—can have a profound impact on the ability of the railroads to provide effective service.

Here are a few areas that suggest this impact. There are others, but from this variety it is apparent that precise information on weather and transient climate can be of assistance to the industry in planning its work and in dealing with its resources.*

Railroad Operations

Railroads were laid out in most parts of the United States in the latter part of the 19th century, when earth moving equipment was not extensively available. As railroads cannot surmount steep grades with long, heavy, and efficient trains, much of the system was laid adjacent to riverbeds and, in some instances, in the flood plains of those rivers. Today, when flooding occurs, railroad operations cease, and extensive rerouting is required. Bridges and rail sections are damaged. Substantial rebuilding costs and delays are incurred.

Both linehaul and terminal operations are profoundly affected by large amounts of snow. Railroads have massive investments in snow removal equipment. If heavy, and unexpected snow blankets a terminal area, substantial quantities of products delayed in delivery and enormous congestion results. Expensive emergency operations are required. The shippers, the consignees, and the railroads all are hurt.

Mud slides have been known to destroy sections of track. And railroads operating in mountainous terrain must, of necessity, try to anticipate rock slides, which can have a disastrous impact on the railroad.

Track Problems

The steel from which tracks are made has limited ductility which is even more limited under conditions of low temperature. Thus, early each winter there are a number of rail failures because of low temperatures.

Steel, as almost all materials, is also subject to expansion on heating and contraction on cooling. When rail is exposed to high ambient temperatures and the Sun, it can expand to the point that it becomes laterally unstable. Under these circumstances, rail may move away from its correct alignment by 5 or 10 feet either in a specific tight curve known as a Sun kink or with a substantial lateral displacement of the whole track structure. To reduce the effects at the end of rails, the industry has made extensive use of long assemblies of rail created by welding. These nearly quarter-mile segments are connected to each other by bolted attachments.

Rail-laying practices require that rail be laid only in a narrow range of temperatures intermediate between the lowest and the highest so as to minimize the relative temperature differential when the rail is heated and thus reduce the chance for Sun kinks.

Although some modest maintenance to keep the geometrical relationships necessary between the two rails can be achieved during the year, all major rebuilding and much of the major maintenance is done during the summer. It must be done after the gravel or broken stone laid in the railroad bed known as ballast is completely thawed and before the freeze-up of the ballast in the winter. It is much more difficult to maintain track during and immediately after periods of very heavy rain than when the track is reasonably dry. Accordingly, railroads have large crews and expensive equipment dedicated to making possible effective maintenance and rebuilding programs. The planning for the use of these crews and this equipment is profoundly affected by the weather of a particular maintenance season.

Railroad Traffic

Railroads carry a large quantity of coal. The need for coal is affected by the requirements for power and, to an increasing extent, for export. Export coal demands may be conditioned to some degree by requirements for power and heating overseas. Domestic power production is affected by weather requirements. Thus, a better knowledge of the relationship between climate and power requirements could lead to more definitive insights on how much coal is to be moved.

A second very important commodity or set of commodities for railroad operations is in the agricultural sector. The timing of the harvest and the extent of the harvest can have a profound affect on the requirements for cars to move grain, in particular. Thus, if railroads had better insight into these weather-related circumstances, car acquisitions, car maintenance, and car positioning could be improved.

Railroads move large quantities of agricultural chemicals, fertilizers. A better insight into the timing of requirements for fertilizers may also be conditioned to some extent by weather issues.

Railroads move large quantities of propane and other compressed, flammable gases. The requirements for propane also are conditioned by weather, particularly in the northeastern part of the United States, where propane may be used for heating as well as for other household purposes. Better insight into the interaction between weather and propane requirements could lead to a greater insight into the demands for propane and the timing of possible propane movements. ■

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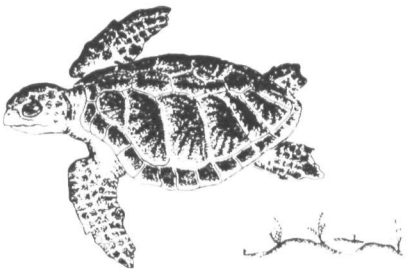
*Note

In partial response to some of the needs expressed by Dr. Harris, the EDIS Center for Environmental Assessment Services has developed an operational Railroad Trasnportation Index. It is designed to pinpoint temperature and precipitation anomalies along each segment of track on each of the rail networks which carry iron ore, food, transportation equipment, grain, and coal. The Index is featured in CEAS' monthly U.S. Climate Impact Assessment *report. In addition, CEAS scientists have nearly completed devlopment of a harvest (maturity) prediction product for major grains. One application would be in railroad planning for grain shipment.*

Patrick Hughes

Putting the Squeeze On Turtle Smugglers



Some 90 million years ago they began coming out of the sea and onto the beaches of the warmer waters of the Pacific, grotesque creatures thought to have evolved from the lizard family. Initially, purportedly, there were millions of them, turning the shoreline black as the females clawed themselves up the sandy beaches to lay their eggs.

In more recent years, since humans have been around to keep track of such events, the Pacific Ridley sea turtle has continued its ritual, on beaches from southern Japan to Baja California. But each year, it appears, they are fewer in number, and beaches which once were crowded with the 80 to 100 pound animals now, with only a half dozen exceptions, rarely see one.

In the eyes of the United States, Pacific Ridley sea turtles have been considered endangered since 1978., Their numbers are so few today, marine biologists have determined, that interfering with their normal life cycle—by killing them or stealing their eggs, for example—threatens to bring extinction to the species.

Imports Banned

Since Pacific Ridley sea turtles do not inhabit U.S. beaches or waters, the most this country can do to encourage efforts to save the species is to forbid the importation of Ridley turtle meat. Agents from a number of Federal organizations are empowered to assure that this restriction in trade is abided by; to police the inhibiting regulations by examining shipments into the United States from Mexico and other places.

There always are those ready to turn the desires of others into a profit for themselves, even if it means breaking a law or decimating a species. And any knowledgeable enforcement agent of NOAA's National Marine Fisheries Service will tell you there is a market in this Nation for smuggled Ridley turtle meat.

In the spring and summer of 1979, the market seemed to have had explosive growth, if the amount of illegal turtle meat seized at such diverse ports of entry as Brownsville, Tex., Miami, Fla., and Los Angeles, Calif., meant anything. And since all of the shipments were headed for Florida at the time of their interception, the market appeared to center around that State.

Charles M. Fuss, Jr., is the Special Agent-In-Charge of the Law Enforcement Division in the NMFS Southeast Region, headquartered in St. Petersburg, Fla. He knows, only too well, that before legal action can be brought against a person or an entity, a case must be built to substantiate the action. And if he had any doubts, the seizures in Brownsville, Miami and Los Angeles kicked off frantic months of investigations that saw agents painstakingly pulling together evidence that gradually indicated a massive smuggling operation stemming from a single source in Mexico.

A Sea Turtle Task Force

The apparent extent of the smuggling activity moved Fuss to request a coordination meeting involving his unit and personnel from the Interior Department's Fish and Wildlife Service and Treasury's U.S. Customs Service, both of which had been conducting investigations of their own. The result of the meeting was establishment of a Sea Turtle Task Force, coordinated by Fuss and manned by agents from all three agencies under the guidance of a special prosecutor appointed by the Justice Department.

Investigators fanned out from St. Petersburg: to Mexico, to attempt to identify the source of the illegal meat and those involved in its traffic; to San Juan, P.R., to trace the movement of 158 cases of turtle meat in cold storage there; to Los Angeles, where in October an additional 60 pounds of meat was found.

This was no cops and robbers effort of the kind seen on your TV screen; it was hours spent poring over shipping invoices, bank drafts, Mexican export permits, in an effort to find a common thread. It was interviews by the score with cooperative businessmen and with individuals whose past activities hinted at possible present involvement. It was frequent appearances by agents before grand juries to obtain subpoenas for additional invoices, cold storage records, bank records, and the like.

Agent Charles M. Fuss, Jr.

The investigations by task force members did not go unnoticed in the circle of conspirators. Word passed quickly that the heat was on, and for one individual in Brownsville, it was getting too hot. When NMFS agents routinely interviewed him in their search for leads, he began talking about the Brownsville connection with Mexico City, hoping for leniency. Shortly thereafter, in Mexico City, the customs attache at the U.S. Embassy obtained detailed admissions from a Mexican citizen involved in the export end. He identified the names and roles of various participants, how documents needed to ship the illegal meat out of Mexico were obtained, agreements among the exporters regarding the splitting of proceeds, the existence of bank accounts in Miami, cash flow techniques, and specific instances of violations.

Conspiracy Crumbles

The conspiracy was cracking, beginning to crumble.

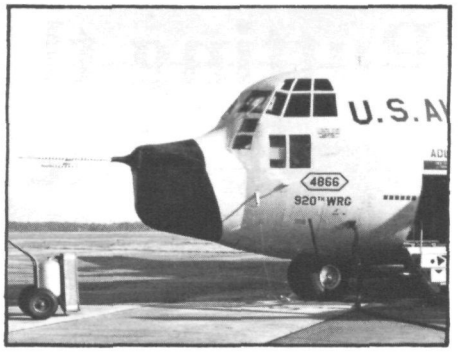
Armed with inside information, the NMFS, FWS and Customs agents pressed forward with renewed vigor, and late in July and early August of 1980 obtained indictments against four U.S. citizens, two Mexican nationals, five U.S. corporations, and four Mexican corporations. The indictments carefully detailed instances of alleged importation and/or smuggling of about 250,000 pounds of Pacific Ridley sea turtle meat into the U.S. from Mexico.

The largest prosecution ever undertaken by the U.S. Government for exploitation and smuggling of wildlife had begun.

As might be expected, the cases compiled against some of the defendants were air tight, while in other instances, in the opinion of a Federal judge hearing preliminary arguments, they were not sufficient for criminal prosecution. Significant fines and suspended jail sentences were levied against four persons and five corporations that the task force had firmly pinned against the wall, and civil charges have been filed against others who escaped conviction on criminal charges.

More significantly, in the opinion of Special Agent Fuss, the year-long investigation and resulting court proceedings may have brought about a reduction in the kill of endangered Pacific Ridley sea turtles by eliminating the U.S. market for meat and other products. ■

Hurricane Hunting by the Numbers



William J. Brennan

Forecasters at NOAA's National Hurricane Center are getting greater amounts of information this season from an Air Force Reserve hurricane hunting airplane, while the aircraft's hazardous task of flying into the giant storms has been made less perilous, both because of an airborne computer system developed at the Environmental Research Laboratories.

The new system performs many of the same functions as do centralized computer installations on NOAA's own research aircraft; the collection, recording, displaying, and transmitting by satellite weather-related data from an array of instruments either attached to the planes or, in some cases, dropped from them. But the new system is simpler to maintain and, perhaps more important, much less costly.

NOAA's two P-3 research planes were equipped with centralized computer systems in the mid-1970's to let them better perform a variety of atmospheric and oceanographic research missions. When these missions involved penetrating hurricanes, the P-3's provided operational data to the Hurricane Center.

Air Force Reconnaissance

But flying into hurricanes and sending back storm data to forecasters is not the primary duty of the NOAA planes. That assignment is handled by the Air Force Reserve's 920th Weather Reconnaissance Group at Keesler Air Force Base in Mississippi, and by several Air Force Weather Reconnaissance Squadrons. And while they are heavily instrumented to collect data required by hurricane forecasters, these "Storm Trackers" and "Hurricane Hunters" have relied largely on voice communications to transmit readings out of the storms and back to the relative calm of the National Hurricane Center.

Like it or not, there are some tasks computers can do better than humans, and the gathering, calculating, and transmitting of thousands of pieces of information from within a hurricane is one of them, as NOAA's airborne computers have shown since meeting their first hurricane out over the Carribbean in 1977. Information gathered by probes, sensors and other instruments is digested by the on-board centralized computer system, which then transmits the data via the GOES East satellite down to Wallops Island, Va., and then to the National Meteorological Center in Camp Springs, Md., and the National Hurricane Center in Goral Gables, Fla.

NOAA's centralized system was not the first, however. Responding to a Presidential directive in 1969, issued shortly after Hurricane Camille exploded ashore from the Gulf of Mexico and caused more than 250 deaths, the U.S. Air Force attempted to insure that weather reconnaissance aircraft had, as ordered, the best equipment available for future hurricane observations.

$50 Million Too Much

The problem was that the best equipment availble, installed in one reconnaissance plane, not only cost $14 million to obtain and install, but then ran up a half-million dollar maintenance cost in 1 year's time. Both its hardware and software were unbelievably complicated. Troubleshooting, maintenance, and repair required special equipment and special training of highly qualified personnel, or else, alternatively expensive factory repair. To equip the reconnaissance fleet would have required spending $50 million, which all agreed was too much.

By 1977, when NOAA's research planes were computer-equipped, the cost had come down. But the NOAA systems were too sophisticated—because of the research functions—for Air Force operational use, and still cost too much.

Until 1980, Air Force and NOAA planners were stymied, and frustrated. Each time a NOAA P-3 flew into a hurricane on a research flight, masses of helpful data poured back to hurricane forecaseters. But on the routine Air Force operational flights—if a flight into the eye of a hurricane ever can be considered routine—the high density of data desired by the National Hurricane Center just couldn't be provided without intense computer involvement.

Ironically, the break-through came from Boulder, Colo., a city nestled in the foothills of the Rocky Mountains which never has felt the ravages of a hurricane.

Microcomputers to the Rescue

Vernon J. Zurick, of the Environmental Research Laboratories' Weather Modification Program Office in Boulder, and Heinz Grote, at the time just retired from NOAA service there, had been following progress in the computer industry diligently, and when microcomputers appeared on the scene, low in price and small in size and weight, they saw the potential instantly. Why couldn't microcomputers solve the Hurricane Hunters' problem? Individual microcomputers, one for each sensor, could independently digest its sensor's data, format the gathered information, and hand it off to a central communications system. Grote quickly was returned to Government service as a re-hired annuitant, while Zurick pulled together a team of military, university, industry, and agency personnel. Cutting through red tape, the team, in just over a year's time, saw the concept converted into the hardware and software now installed aboard a 920th Weather Reconnaissance Group airplance for use in the 1982 hurricane season in an operational evaluation.

Relatively Simple Process

The process sounds simple. Each sensor on the airplane feeds the data it collects into its own microprocessor for coding, storage and display. The 17 microcomputers are tied into a data processor unit, which also is receiving information on the aircraft's position and flight-level wind data from an inertial navigation system. The data processor unit passes along processed information in coded message format to yet another instrument in the plane, the Aircraft Satellite Data Link. That instrument, at the same time, is receiving radioed data from omega dropwindsondes, instrument packages parachuted out of the plane to obtain pressure, temperature, and humidity readings down to the ocean surface. Every half hour, the collected mass of material is transmitted through the GOES satellite to Earth.

Without disputing the value of the immense quantity of data their aircraft makes available to hurricane forecasters, the flight crew of the Air Force C-130 carrying the new system can be forgiven if their interests perhaps are focussed more on what the system can do for them, personally. The ability of the microcomputers to display on board the airplane the data they are collecting and computing lets the flight crew meteorologists see what's happening in the vicinity of the plane as it occurs. Using this information, the pilot can guide the plane around areas of extreme and dangerous turbulence into, and out of, the eye of the

hurricane. Where a wrong turn could lead to deadly consequences, the new system is of immediate help to those who go in to test the fury of a storm.

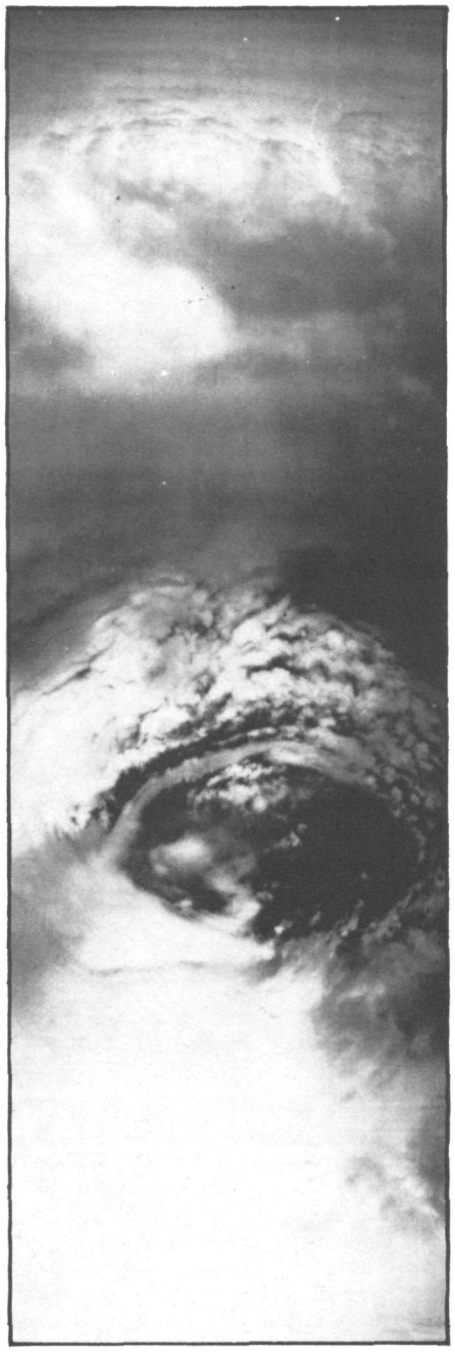
For the rest of us, relatively safer and a lot more comfortable on the ground, the impact of this computer package can be just as significant, especially if we live in a hurricane-prone area of the country. The goal of the improved equipment package, according to William S. Barney, Acting Federal Coordinator for Meteorological Services and Supporting Research, is to reduce the current landfall forecast error for Atlantic hurricanes 24 hours from shore from about 110 nautical miles to about 75 miles. In other words, to shrink the area of U.S. coastline that must activate expensive, life - disrupting procedures because it is believed that hurricane will come ashore nearby.

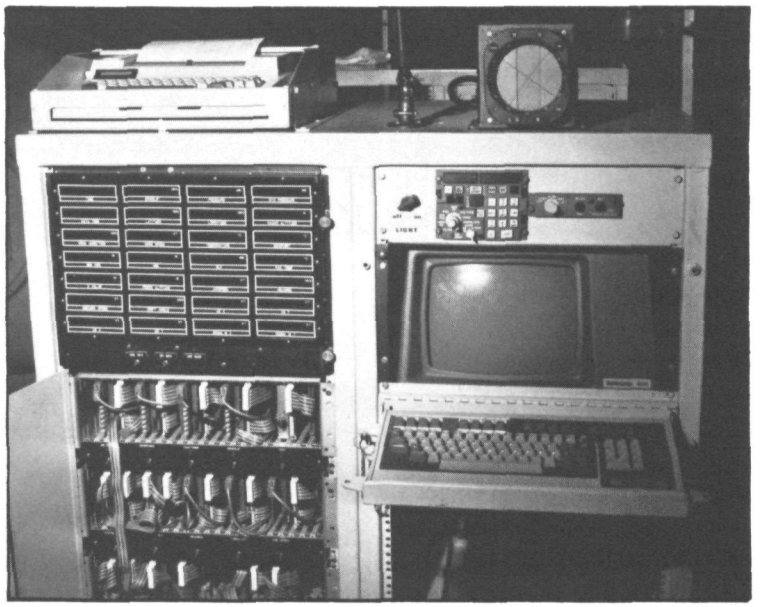
Hurricane Preparedness Savings

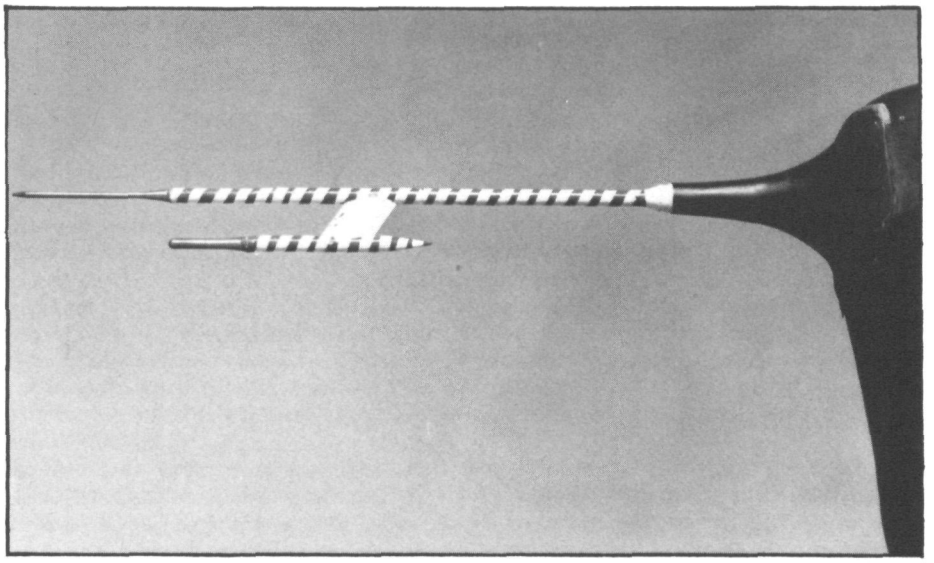
The cost of preparing for approaching hurricanes averages approximately $50 million a year at present, with communities along a 110-mile stretch of threatened coastline evacuating low-lying areas, closing down schools and industrial complexes, and the like. If the additional information provided by Zurick's microcomputer system permits forecasters to reduce the area under warning to about 75 miles of coast, an estimated $10 million a year in preparedness costs could be saved.

More importantly, as Dr. Neil Frank, Director of the National Hurricane Center, has pointed out many times, when an area has been warned that it may be struck by a hurricane off-shore and that fails to happen, the population is less likely to heed future warnings, possibly endangering their lives. The more accurate the Hurricane Center's landfall forecasts are, the more attention will be paid to them by people living in threatened areas.

Optimism is high the microcomputer system being flown into this season's hurricanes will bring the desired results. And if it does, it appears likely that within the next several years the entire reconnaissance fleet will be equipped with the system, providing maximum information on every hurricane that approaches U.S. shores. ■







Probing the heart of a hurricane, Air Force Reserve reconnaissance planes now are equipped with NOAA-developed airborne computer systems making their hazardous jobs safer and more efficient.

Catch America—'It Worked!'

Gerald D. Hill, Jr.

One of the most successful government/industry seafood marketing programs ever was conducted in 1981. "Catch America," the brainchild of Diane Boratyn, Acting Director of the National Marine Fisheries Services's Consumer Affairs Division, was designed to increase consumer awareness, availability, and consumption of quality domestic fish and seafood products.

"This intensive marketing effort was needed because people in the United States eat an average of only 13 pounds of seafood a year," said Boratyn. "This has not changed significantly over the past 10 years and is less than half the worldwide average.

"In addition, more than 50 percent of the seafood consumed in the nation is imported even though the United States controls about 15 percent of the world's supply of fishery products within its 200-mile conservation zone," she said.

This, then, was the problem that faced NOAA and the industry—how to get more people to eat more seafood.

"We felt we had to tell consumers about the wide variety of seafood available, its nutritional value, proper selection, and handling and preparation," said Boratyn.

Knowing that an effective campaign would require more resources than were available at the Fisheries Service, the Consumer Affairs Branch turned to industry and those organizations that supported it.

Unique Cooperation

The result, "Catch America," was a unique form of Government and industry cooperation to market products in the public and National interest. The National Marine Fisheries Service, National Fisheries Education and Research Foundation, the National Fisheries Institute, the Food Marketing Institute, and the several regional fisheries development foundations banded together in numerous joint actions to stimulate consumer awareness and demand for seafood products.

"Increasing consumer awareness and demand was well and good," said Boratyn, "but if the product is not available to the consumer, then more harm than good has been done."

Recognizing the need to insure supply, the Catch America program, working with representatives of individual firms, trade associations, and the fisheries development foundations, brought together all segments of the industry and retail sectors in a carefully orchestrated effort.

"We concentrated on 20 major metropolitan areas to increase demand and to supply additional amounts and varieties of seafood products," Boratyn said. "The program was designed to use and expand the existing State and regional marketing programs and distribution channels, to identify needs, and to move products from the harvester to the consumer."

Series of Events

The program was introduced to the public in May 1981 and involved a series of events and actions:

- Public service announcements and materials on the seafood industry and its products were prepared for use by television and radio.
- Regional home economists and other seafood specialists were placed on TV and radio programs in the 20 major markets to demonstrate seafood preparation, discuss products, and answer questions.
- Articles on how to buy and prepare seafood and recipes were prepared and placed in major magazines and newspapers.
- Informational materials were prepared and given to consumers when they bought seafood products.
- Regional seafood workshops and seminars for food retailers, wholesalers, brokers, processors, and other industry representatives were held in Atlanta, Boston, Chicago, Los Angeles, and Seattle.
- Research was conducted to determine consumer attitudes, consumption patterns, and market attributes of seafood products.

Did it work?

"Specific data on the program's impact on consumer awareness and product consumption takes about a year to gather," according to Boratyn. "However, we do know that retailers who took part in the program increased their sales by 12 percent during and immediately following the campaign period. This compares to an average National 9 percent retail increase during the same period." She added that efforts are being made to determine how much of the increase can be directly attributed to "Catch America".

"We know that Dominick's in Chicago sold 30,000 pounds of shrimp one weekend. Bell Stores in Buffalo upped their fish sales from 1,600 pounds to 6,000 pounds during their promotion," Boratyn said.

"It worked!" she said.

It is estimated that the program produced more than $6.5 million of free and credible media exposure for the industry reaching more than 140 million people.

A wealth of education and information material was provided. "Providing consumer information materials on identifying seafood species and product preparation is a service that is clearly beneficial to the public and, since the material is oriented toward domestic seafood, the service is in the National interest," Boratyn said.

The program did a great deal for the industry.

Raising the level of awareness of supermarket operators and personnel, grocery associations, seafood foundations, and food distribution trade groups concerning marketing quality seafood products had a positive and stimulating effect on sales," Boratyn said.

Over 3 million pieces of informational material were sent by the industry. By training retail personnel and providing consumers with informational material at the time of purchase, it is expected that there will be long-term changes in retail seafood marketing practices and consumer shopping behavior.

The "Catch America" program was the first National effort of its kind, thus it was a learning process. Improvements are being made in the marketing activities to strengthen the program. The improvements will focus on consumer education.

New Theme in 1982

"We will keep 'Catch America' as the trademark of the program," said Boratyn. "However, the new theme will be "Seafood USA—A Better Choice" and the campaign will be built around health, quality, and fitness of seafood which we will emphasize in our marketing efforts."

The regional foundations will, once again, coordinate the activities of the program in the major markets of 20 target cities. During January and February the foundations held meetings in these major markets for the local distributors, brokers, major food service operators and retailers, and set up local committees to develop funding for press parties, local space and time purchases, and literature distribution.

"The regional foundations will concentrate their efforts in the 20 target cities during the summer," said Boratyn. "Between May and October each of these cities will conduct an intensive two week program to emphasize the value of fishery products."

"Catch America" has increased the consumers interest in fishery products and probably even more important has shown what can be done with a strong cooperative government-industry program. ■

Diane Boratyn (top) goes over "Catch America" material and displays some of the campaign's promotional material. At home with a friend, she dons running shoes for her favorite activity.

At home and at work, Boratyn is as handy whipping up a tasty shrimp dish as she is at planning Phase II of "Catch America" with its theme "Seafood USA—A Better Choice."

Diane Boratyn, Catch America's Mentor

Few people would suspect that Diane Boratyn, the driving force behind a highly successful seafood marketing program, was a concert violinist.

She was a member of the Lake Forest, a Chicago suburb, symphony orchestra for a year before deciding that she didn't want to be in an orchestra for the rest of her life. "It's very difficult for a woman to compete with the Isaac Sterns of the world," she says. She now entertains herself playing the guitar.

"I have always loved the out-of-doors and wanted to get into a field that would give me the opportunity to be in the open."

She graduated from Southern Illinois University at Carbondale with a degree in community recreation administration in 1969.

During the '70's she moved to Indianapolis, Ind., and worked as a district supervisor and a program development coordinator for the city's Department of Parks and Recreation. In 1976 she was a technical assistance and research coordinator at the Georgetown University Academy in the Public Service in Indianapolis.

In 1977 she became director of the Tourism Development Division for Indiana and was responsible for tourism and market development for the State. She became Domestic Coordinator for the U.S. Travel Service in 1978.

Since coming to Washington, D.C., she has maintained her interest in doing things outdoors. She enjoys biking, skiing both downhill and cross country, horseback riding, racquet ball, and has been a runner for the past 2 years.

"I guess running is my favorite activity now," she says, "because it is something you can do by yourself and don't need a partner or any special equipment." She has run in three 10,000 meter races since coming to the Washington area.

Boratyn's greatest love is fishing. "I owe this to my dad who started taking me fishing for muskie and northerns way up in Wisconsin when I was 5 years old. I have a full line of fishing gear."

She is entranced with Maryland's Eastern Shore. "There are so many things to do, the people are great, and so is the fishing. I go every chance I get when the weather is nice."

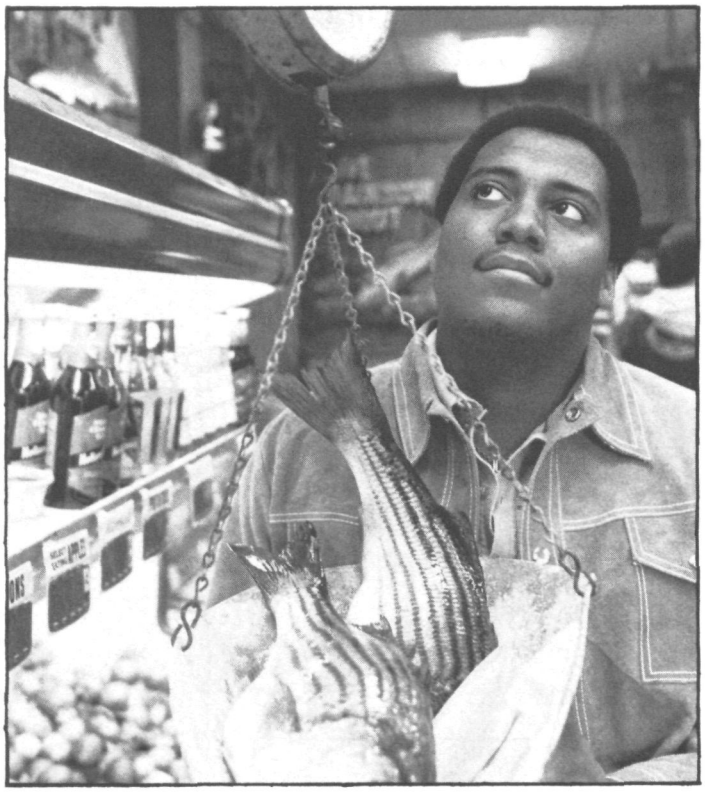
She also "dabbles" in art, working with acrylics, oils, charcoal, and pencils.

Her father was an engineer before he retired. "I think I must have inherited some of his skills," she said. This is apparent whenever she talks because she is constantly drawing flow charts and diagrams to illustrate her points.

It must have been fate that directed such an avid angler into a nationwide program promoting seafood. ■

Seafood With A Touch of Class

Carl Purcell



Suzanne Proctor (upper left) with the main course. At the market, some of the students were a bit squeamish (above), but Alan Lipscomb (upper right) had no problem picking and weighing the soon-to-be baked trout.

Back at school, students learned to make an attractive salad arrangement (left), as Ms Melvin showed Sandra Riley and Barbara Lewis how to peel shrimp; a tedious chore, but well worth the effort.

Mary Melvin, a home economics teacher at Wheaton (Md.) High School, believes that with the right training any high school student can become a gourmet cook. To prove her point, Ms Melvin had her students prepare an elaborate sit-down seafood dinner as a class project. The assignment included selecting the seafood at a local market, preparing it by following recipies, and finally consuming the "fruits" of their labor which included lobster, crab, scallops, shrimp, and stuffed sea trout.

The project started in a local seafood market where Ms Melvin explained the fine points of selecting fresh seafood and the students were able to pick the fish they would prepare and cook the following day. One young woman gingerly selected a live lobster with mixed feelings of appetite and remorse for the doomed shellfish.

It was fascinating to see some of the strapping football players delicately peel shrimp and bone fish in preparation for the meal. All of the students approached the project with enthusiasm, but the payoff was when the group of aspiring cooks sat down to a spread which would have done credit to the finest seafood restaurant.

Ms Melvin and her students invite Seafare readers to try some of their recipes. They come highly recommended by some fine Maryland chefs.

Baked Stuffed Sea Trout

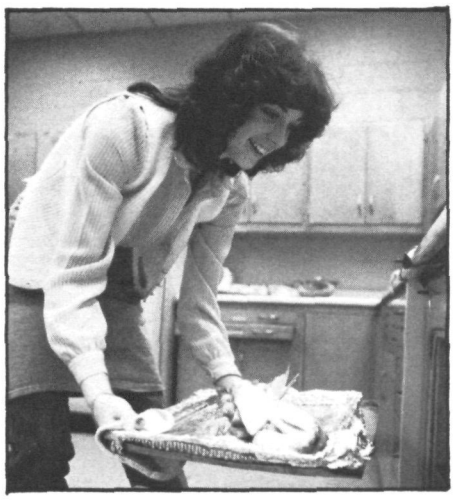
1 dressed sea trout (3 lbs.), fresh
Salt
Pepper
Bread stuffing
2 tablespoons melted fat or oil

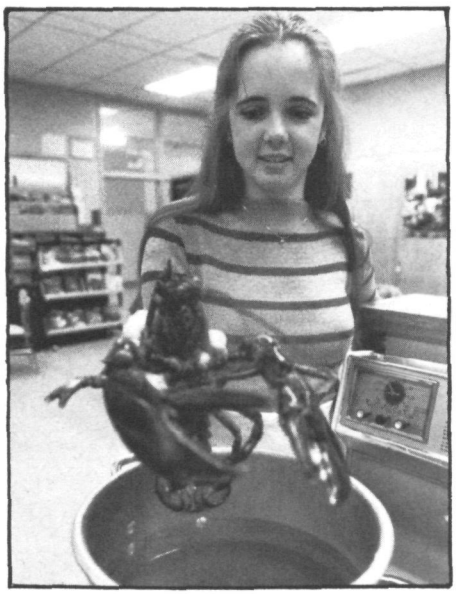
Clean, wash, and dry fish. Sprinkle inside with salt and pepper. Place fish on a well-greased bake-and-serve platter, 18x13 inches Stuff fish loosely. Brush fish with fat. Bake in a moderate oven, 350° F, for 45 to 60 minutes or until fish flakes easily when tested with a fork. Serves 6.

Bread Stuffing

½ cup chopped celery
¼ cup chopped onion
¼ cup butter or margarine, melted
1 quart dry bread cubes
1 egg, beaten
½ teaspoon sage
½ teaspoon salt
¼ teaspoon thyme
Dash pepper

Cook celery and onion in butter until





The somethin' in the oven was stuffed sea trout as Suzanne Proctor (top) began the real cooking. Meanwhile, Mary Powell (above) prepared to pop a lobster into a pot for its final dip.

It's ready! Ms Melvin (top foreground) posed briefly with her class and the results of their labors before they sat down to grade their own classwork. The students agreed the meal was an "A-plus" effort. The record is incomplete, though, as all evidence of the final exam disappeared.

tender. Combine all ingredients and mix well. Makes 3 cups stuffing.

Shrimp Paradise salad

¾ pound cooked, peeled, and cleaned shrimp
1 pineapple
2 oranges
1 avocado
1 tablespoon orange juice
Shrimp Paradise Salad Dressing

Chill shrimp. Cut pineapple in half lengthwise. Remove core and meat, reserving shell for serving. Dice pineapple. Peel and section oranges, reserving juice. Cut avocado in half lengthwise and remove seed. Peel and slice avocado. Sprinkle with orange juice to prevent discoloration. Combine pineapple, oranges, and avocado. Fill pineapple shells with fruit mixture. Arrange shrimp on top. Serve with Shrimp Paradise Salad Dressing. Serves 6.

Shrimp Paradise Salad Dressing

½ cup olive or salad oil
2 tablespoons lemon juice
2 tablespoons dry, white wine
1 teaspoon honey
½ teaspoon paprika
½ teaspoon salt

Combine all ingredients and shake well. Chill, Makes approximately ¾ cup dressing.

Seaman's Delight

1 pound can crabmeat
1 pound cooked scallops, coarsely diced
1 pound cooked shrimp, peeled, coarsely diced (fresh or frozen)
8 hard cooked eggs (dice 6, quarter 2 for garnish)
10 ounces frozen peas
1¼ cups finely diced green peppers
6 green onions, thinly sliced
1¼ cups finely diced celery
1½ cups mayonnaise
Salt and pepper to taste
9 large romaine leaves, tomato wedges, and egg quarters for garnish
Pimento

Remove any shell or cartilage from crabmeat leaving meat chunky. Dice cooked shrimp, scallops, eggs, celery, green onions, pimento, and green pepper. Mix all ingredients with cooked peas. Moisten all ingredients with mayonnaise. Serve in salad bowl lined with romaine leaves. Garnish with eggs and tomato wedges. Serves 6.

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