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South Carolina Wildlife

November–December 1980

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VOLUME 27, NUMBER 6

illustrations by Linda Laffitte

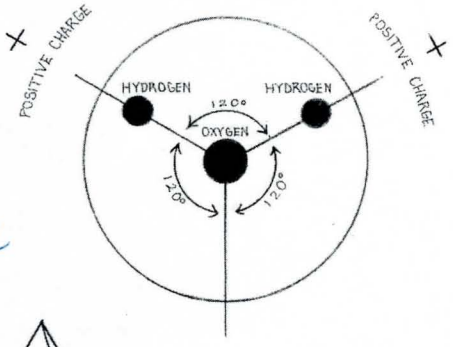
think SNOW

by john c. purvis

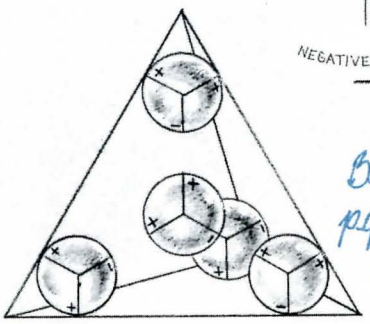
A little snow in South Carolina goes a long way. A few flakes can bring jammed telephone lines, stalled traffic and closed schools and businesses. But for most Carolinians, the sparkling white landscape, improvised sled rides, snowmen and snowball fights make the headaches seem small.

Snow is one of nature's most beautiful creations. It means different things to different people. Kids dream of a "white Christmas" or a day off from school. Adults become children again in snowball fights, sledding and snowman making.

In spite of the glamour we attach to this miracle of nature, few other events have caused more misery, more human suffering or disruption of the economy. It was the Russian snow, not their guns, that turned back Napoleon, an iceburg, not a torpedo, that sank the Titantic. As recently as February 1979, a snow and icestorm for a short time brought our way of living to a standstill.

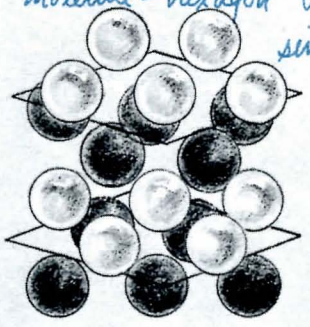


A water molecule

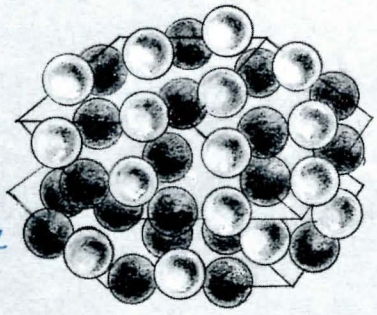


Basic pyramid structure of ice

When freezing temperatures slow the movement of water molecules, the positive pole of one attracts the negative pole of another. Because each molecule's three atoms are exactly 120 degrees apart, the molecules form a definite pyramid structure. This structure can be detected in the two layers of molecules forming a unit cell of ice. Each layer contains 10 molecules. Three unit cells form a 60 molecule - hexagon and represent the simplest possible crystal of ice.



Unit cell of ice



Three Unit cells joined — simplest possible ice crystal

What is snow? . . . a natural product of sublimation of moisture in the atmosphere, says the meteorologist. It is the result of water vapor freezing into ice crystals without passing through the raindrop stage.

Snow crystals take on a variety of forms and designs. They may appear individually as columns, bullets, needles and intricate six-rayed hexagonal plates. The most common forms are irregular with no symmetrical shape at all, yet all originate in the clouds and are made of water molecules.

"Snow is a unique example of a single chemical compound exhibiting great variation in crystal habit. . . . ice crystallizing in the free atmosphere is a great improvisor. Even though it creates distinguishable types of crystals within certain known conditions of vapor concentration and temperature, it achieves endless variation apparently on the spur of the moment and often by accident," Corydon Bell states in his book, "The Wonder of Snow."

Snowflakes range in size from a few millimeters to perhaps an inch or more across. At extremely low temperatures, snowflakes tend to be small, while at temperatures near freezing, they are larger.

"The fascination of snow crystals lies in their appealing beauty. . . . Yet all the beauty cannot be seen," Bell continues. "Within a single crystal there is an invisible masterpiece of construction that is achieved through the magic of nature's geometry, physics, and chemistry. . . ."

Bell states that an average-size snow crystal may contain 100 million or more water molecules, each with a diameter of about 10 billionths of an inch. Each molecule carries a positive charge on each of its two hydrogen atoms and a negative charge on its one oxygen atom. Within the molecule's ball shape, the electrical charges of these atoms line up at exactly 120 degrees apart. Water molecules move about in their liquid state, but under certain conditions of pressure and temperature, they begin to attract each other electrically, arranging themselves in definite three dimensional rows and ranks to form ice.

Because the atoms within each molecule and their electrical charges are 120 degrees from one another, molecules must join in a definite geometric pattern as negative poles of one are drawn to positive poles of others and vice versa. Thus, it seems, that all snow crystals would be uniform in appearance.

The diversity of crystal types apparently is caused by variations in the atmospheric conditions present within the clouds from which the crystals come. Changes in atmospheric pressure, humidity and temperature may vary from the top to the bottom of a cloud system and constantly change within the system.

"In a single snowfall lasting an hour and a half several types of snow may fall from the sky," Bell says. "For ten or fifteen minutes the clouds may send down nothing but curtains of stellar crystals. Then the stars will become mixed with a few plates and a goodly quantity of asymmetrical crystals. Toward the end of the storm, most of the snow may be slender needles, mingled with brief showers of bouncing graupel (snow crystals from a high, cold cloud which freeze the cloud moisture around them as they fall through a warm cloud).

"A snow crystal begins life as a microscopic germ of ice. The shape of the speck of dust, or nucleus, on which molecules of cloud vapor attach themselves to form the first ice, may well influence the form of the initial stage of the crystal. Over a period of perhaps fifteen minutes, under certain conditions of humidity and air temperature as water vapor continues to condense by sublimation of the germ, a snow crystal gradually takes on the shape of its first stage. This baby crystal is unbelievably small—from 8 to 9 thousandths of an inch in diameter. . . . The more regularly shaped of the tiny initial crystals may appear as hexagonal plates, sector plates, various stellar forms and even as minute capped columns. . . .

"The next 15 to 30 or more minutes are strenuous and decisive for the snow crystal as it floats, tumbles and falls through the storm cloud. The conditions of temperature and humidity this acrobat of the winter skies meets adds to its size, shape and design. . . .

"Finally the ice body of the snow crystal becomes too heavy for the vaporous net of the cloud and it joins the host of other migrants that are on their way to earth. . . . Like most snow crystals, it reaches the earth not quite perfect and somewhat travel-worn."

Sleet—more technically "ice pellets"—is sometimes confused with snow. Sleet results from raindrops freezing while falling; hence, they are little more than pellets of clear ice. The atmosphere processes producing ice pellets are different from the snow-forming process. With ice pellets, the cold air mass is not as deep so that the clouds are warmer. The precipitation, therefore, does not go through the sublimation stage as it forms.

Snowfall is measured both in the actual depth of snow accumulating and in equivalent liquid content. Depending on the type of snow, usually determined by the temperature, the liquid content of snow may vary greatly. Light fluffy snow may be as much as 20 times deeper than the melted equivalent. Heavy, wet snow may be as little as six times the depth of its equivalent water. A rough average is 10 to one ratio between snow and its water equivalent.

While some snow occurs in South Carolina each winter, major snowfalls are less frequent. Historically, snow occurrences are mentioned in early South Carolina literature, although an orderly record was not kept until 1888. Perhaps our most important snowfall occurred during the Revolutionary War when it figured prominently in an important defeat handed the Tories.

February 1899 will long be remembered in South Carolina as the year that the "bluebirds froze to death." A record winter storm in the middle of February produced snow depths of 10 to 14 inches over much of the state and was followed by the lowest temperatures of record. Subfreezing readings down to 11 degrees below zero were reported in Union and Aiken counties, with generally subzero minimum over most of the state, except the immediate coast. Dr. J. W. Earl of Holland, South Carolina, stated that old people were dying very fast with pneumonia and kindred diseases. A child was frozen to death in Statesboro near Columbia. It was stated that his parents left him in bed, covered too lightly, while they got up to build a fire. There was widespread destruction of farm animals and wildlife due to the cold weather accompanying this storm.

Several snowfalls during the winter of 1917-1918 were said to be a contributing factor to the large number of people that died from influenza or respiratory diseases during that period.

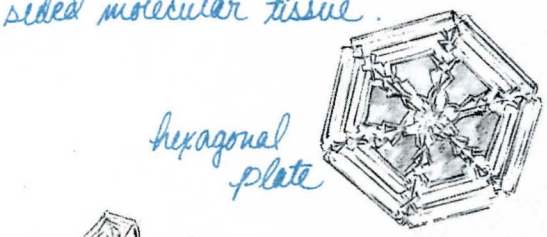
More recently, a record snowfall came in February 1973. Snow fell for approximately 24 hours, beginning in late afternoon on the ninth. The largest amounts fell parallel to the coast about 75 miles inland. Six northwestern counties were nearly snow free because the cyclone whose circulation brought the snow was considerably off the coast. A few places just northwest had no precipitation at all.

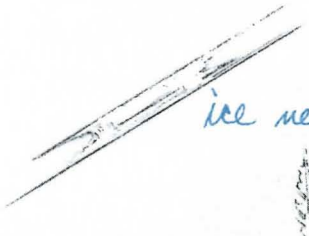
The previous record for a February snowfall in South Carolina was 21.8 inches at Caesar's Head mountain on February 15-16, 1969. February records in the non-mountainous part of the state were set at Smith's Mill in 1912 and again at Society Hill in 1914 at 18 inches.

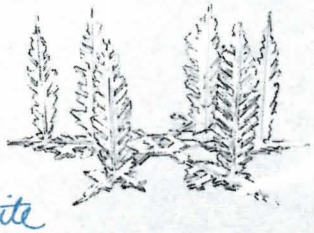
An area the size of five or six counties exceeded 18 inches in the 1973 snowfall. The coastal beaches, which rarely get snow, were covered by three to seven inches. It was truly the greatest snowfall for the central part of the state that has occurred during the 75-year period of record—not only for February, but for any winter month.

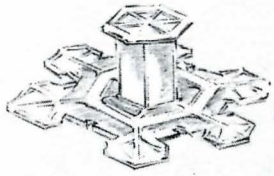
The Seven Snow Crystal Types

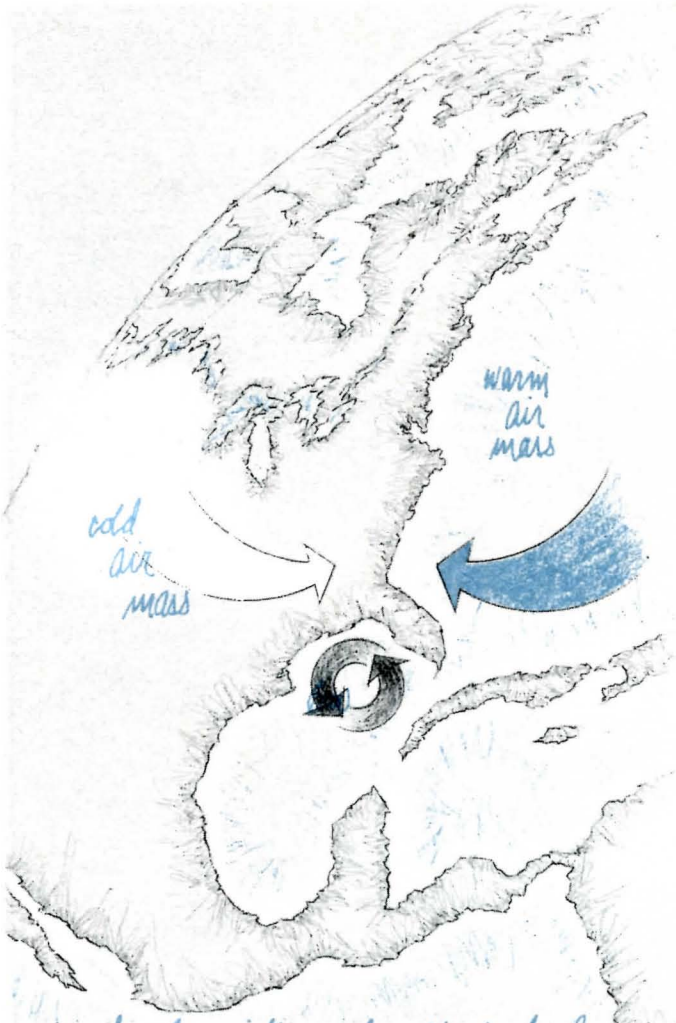
Hexagonal plates combine with stellar crystals to form exquisite spatial dendrites. Hexagonal plates also join with columns, forming capped columns. When we think of snow crystals, we don't think of ice needles and assymmetrical crystals, but they are the most common types. Beneath them all is the same six-sided molecular tissue.











In the winter, polar air in the far north grows heavier. A cold outbreak occurs when a mass of this air breaks away and plunges south. Meanwhile, the warm moist tropical air expands and rises. Where the tropical air meets the polar air, a counterclockwise swirl may develop, forming a center of low barometric pressure. For snow to fall in South Carolina, this low center must be sufficiently southern to keep enough polar air over the state, but close enough to produce precipitation.

About 30,000 tourists traveling to or from Florida were stranded on the state's highways. Many were rescued by helicopter and some by other vehicles. When the hotels and motels were filled, people were housed in armories, schools and churches. Farmers gave aid to travelers stranded near their homes and many had 50 to 60 unexpected guests. There were at least nine deaths directly attributed to the weather. Eight of these died from exposure to the snow and cold, and one child was killed by a falling carport.

The snow was accompanied by strong winds and followed by severe cold. Drifts of seven to eight feet could be found in some locations and all highways in the central part of the state were closed for two to four days. Tons of food and supplies were airlifted by helicopter to snowed-in families. At least 200 buildings collapsed, as did thousands of store awnings and carports. Many power and telephone poles and lines were downed, disrupting service. Damage to timber was not great due to the fact that there was very little freezing rain. The property damage and road damage, plus the cost of snow removal and rescue operations, has been estimated at close to $30 million.

Snowfall in South Carolina is best achieved by a low pressure system forming in the Gulf of Mexico and then moving east or northeast into the south Atlantic. However, this storm movement must bring the storm near enough to South Carolina to produce precipitation but a sufficient distance to the south to keep an ample supply of cold air over the Palmetto state.

Substantial snowfall has major impact on travel. Any road-icing condition is extremely hazardous, as most drivers and pedestrians understand. Snow sometimes will provide traction even over an ice layer, and, at temperatures just under freezing, traffic churns the snow into slush. But under certain conditions a road-ice condition not readily recognized may occur and set the winter stage for tragedy. Here, traffic melts the thin snow layer, which refreezes as ice and is polished by auto tires into a veritable skating rink. More light snow may obscure the layer of ice and lure unsuspecting drivers into mishaps—and pedestrians into overestimating how much control drivers have of their vehicles.

The large open bridges on interstate highways are particularly vulnerable, since ice and snow accumulate more readily on these areas. Once blocked, the interstate becomes a traffic trap.

The terms "watch" and "warning" are used for winter storms, as for other natural hazards. The watch alerts the public that a storm has formed and is approaching the area. People in the alerted area should keep listening for the latest advisories over radio and television, and begin to take precautionary measures. The warning means that a storm is imminent and immediate action should be taken to protect life and property.

Despite the misery and damage it sometimes brings, snow in South Carolina is usually a welcomed cause for celebration. A cult-like group of Carolinians throughout the state follow every cold front's approach and passage. Few can resist the wish for a white Christmas and a few inches of the fluffy stuff to brighten winter's calm.

Snow brings rides on cardboard, trash can lids and assorted makeshift sleds. Almost every house sports a snowman whose height depends more upon its builder's determination than upon the depth of the snowfall. Young and old gather about the fireplace to warm up with hot beverages before plunging back out into nature's white wonder. Too soon the miracle will be gone and we may have to wait another year or more before it will return.

John C. Purvis is meterologist in charge at the National Weather Service Forecast Office in Columbia, South Carolina.

In this mid-1900s photograph, the late Dr. Robert C. Lunz proudly displays two saltwater fish taken from his experimental ponds as part of his pioneering mariculture efforts.

Fort Johnson point facing Charleston Harbor houses one of the most modern marine research complexes on the Atlantic. Few would believe the beginnings came from one man's backyard experiments.

a center for the sea

by Pete Laurie

In the early 1940s G. Robert Lunz, a curator at the Charleston Museum, began experimenting with the cultivation of oysters in his backyard, which extended down to Wappoo Creek. His experiments caught the eye of H. Jermain Slocum, a wealthy patron of the museum. From this humble, casual beginning grew one of the largest and most sophisticated marine research centers on the East Coast.

Lunz was not the first to study the state's marine animals. Several well-known scientists, including Louis Agassiz, had traveled to Charleston to collect and examine marine life. A monograph on the jellyfish of Charleston Harbor, written by John McCrady in 1857, is still widely used by biologists throughout the world. These earliest workers were concerned primarily with describing animals and in determining their distribution.

Lunz was among the first to look for practical uses of South Carolina's marine animals. He saw the potential value of South Carolina's coastal resources and he saw that enhancing and developing these resources could greatly benefit the state. He started on a shoestring—a grant of $100 a year from the museum board of trustees—and he cleared the land himself at a site called Bear's Bluff on Wadmalaw Island. Soon he had a state grant, and eventually his program was incorporated into the South Carolina Wildlife Resources Department.

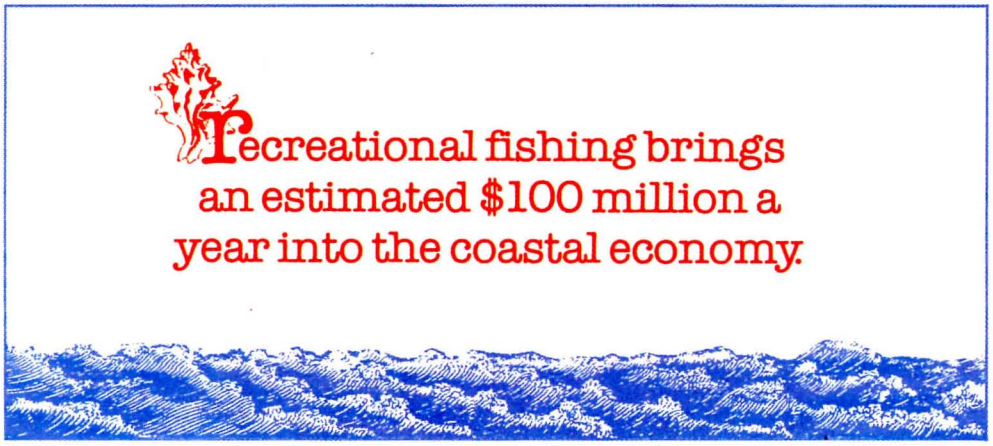
Unfortunately, Lunz was ahead of his time. Not until the late 1960s did the public develop a real interest in funding marine research and management programs. By that time Lunz's pioneering efforts had convinced a number of politicians that a well-organized, professionally executed marine program was vital to the state.

The year that Lunz died, 1969, was ironically the same year that the wildlife department was reorganized to include a Marine Resource Division, with a Marine Resources Center constructed at Fort Johnson on the Charleston Harbor.

In addition to the Marine Resources Division, the complex now includes the College of Charleston's Grice Marine Biological Laboratory, a National Marine Fisheries Service Seafood Technology Lab and an office of the U. S. Fish and Wildlife Service.

The Marine Resources Division is a mission-oriented organization looking for answers to immediate coastal problems, anticipating future problems, and compiling information on living coastal resources to be used for years. The division has a staff of 165, more than 60,000 square feet of modern research space and four large, modern research vessels.

One of the division's research vessels,



the *Anita,* was commissioned and built in 1962 under the supervision of Lunz himself. Lunz wanted a versatile research boat that could operate in shallow inshore waters. The keel and other vital parts were carved from oak trees at Bear's Bluff. Designed by a former employee, Gilbert Maggioni of Beaufort, the *Anita* continues to serve the state as a vital research platform.

Research and management activities are directed toward commercially important species, including shrimp, blue crabs, oysters, clams and finfish, as well as recreational species. Specific programs include general surveys of living resources, searches for and marketing of under-utilized species, mariculture experiments and enhanced saltwater fishing opportunities.

Recreational fishing brings an estimated $100 million a year into the coastal economy. Promoting and improving sport fishing is vital to the state tourism industry. A major thrust has been the establishment of 10 artificial reefs to concentrate fish and thus greatly improve offshore angler success. State recreation also has been aided by the establishment of more than 30 public shellfish grounds.

Under-utilized species, especially rock shrimp, calico scallops and whelks have been the subject of intense searches by scientists aboard the division's vessels. During the past few years of diminished white shrimp crops, shrimpers have benefited from rock shrimp beds located by Marine Resources biologists. A scallop bed discovered off Savannah in 1977 increased the value of the state's seafood landings by almost $1 million in 1978.

To enhance the value of untraditional seafood species, a marketing program was established to improve the local demand for catches such as rock shrimp. Work is also underway to find markets in other parts of the country and even overseas for marine animals that local fishermen ignore or throw back because no ready markets now exist.

Separate sections monitor populations and commercial catches of all major seafood species, including crustaceans, shellfish and finfish. Such efforts have helped provide the information necessary to achieve maximum economic benefit from these resources. Future use of these resources is now being planned and efforts are underway to coordinate management activities with neighboring states.

Traditionally, the state's commercial fishing effort has been either inshore or within the state's three-mile jurisdiction. However, fishermen are now paying greater attention to the potential of offshore fisheries. While these resources lie beyond state jurisdiction, the Marine Resources Division is interested in the maintenance and harvest of these species, which include snapper, grouper, swordfish, rock shrimp and calico scallops. These and other species will become more valuable to the state's fishing industry. Information being gathered on these offshore species will be vital to management plans now being developed by federal agencies and by the South Atlantic Fisheries Management Council, which represents Florida, Georgia and South and North Carolina.

Offshore studies have identified small live bottom areas where rocky outcrops provide solid points of attachment for corals, sponges and other organisms. Large bottom fishes, including snapper and grouper, inhabit these areas. Efforts are underway to determine the association of these commercial fish with such areas so that these habitats may be protected from possible degradation by offshore oil drilling and other activities.

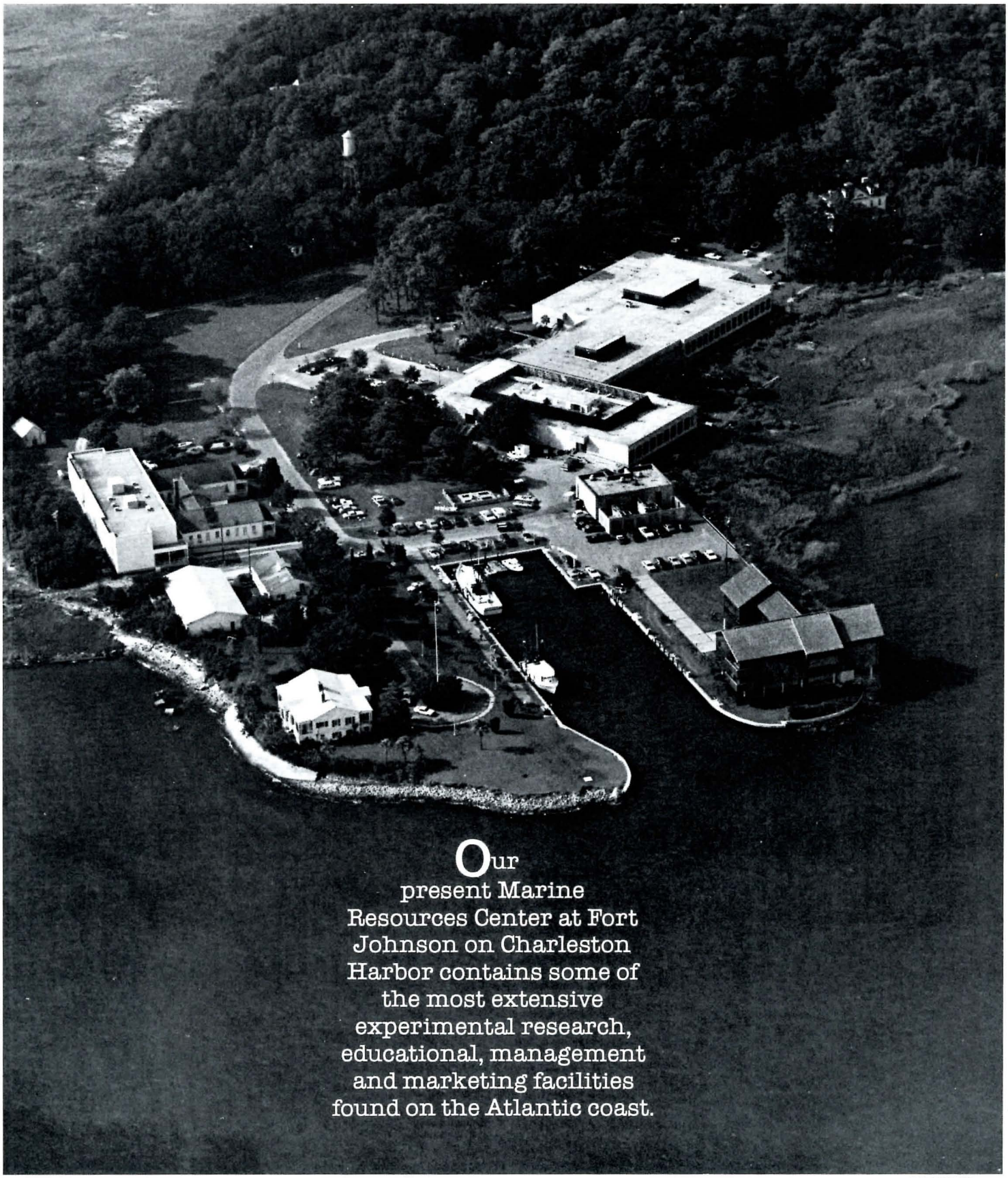
Protecting critical habitats is an important part of fisheries management. As more industry becomes established along the coast and human populations continue to shift toward the coast, more pres-

Bear's Bluff Laboratory, shown in this 1957 aerial photograph, was a forerunner for the modern research complex shown on page 26. These simple outbuildings (upper insert) were part of Dr. Lunz's first research complex at Bear's Bluff. The Anita (lower inset), a shallow water research vessel Lunz helped design and build, now docks at the modern Fort Johnson complex.

PHILLIP JONES

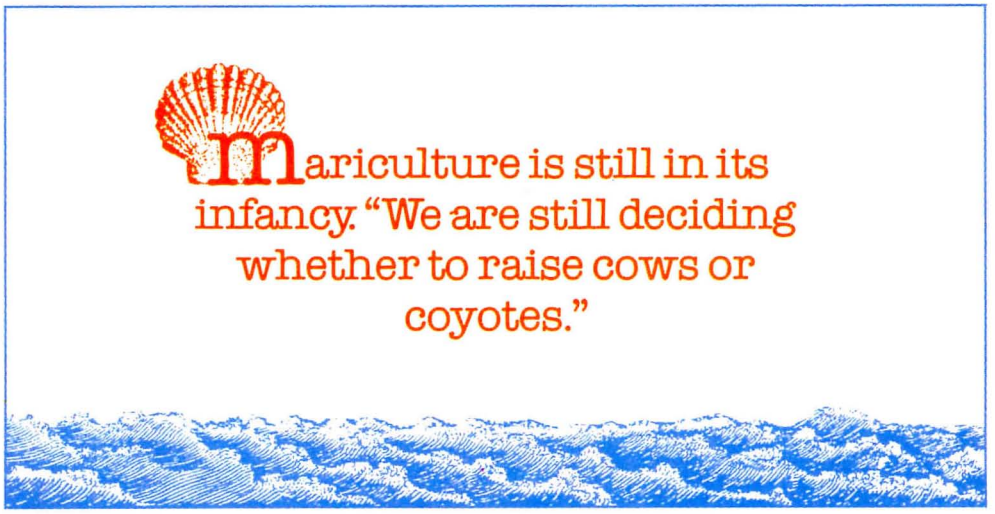
PETE LAURIE

GORDON H. BROWN



Our present Marine Resources Center at Fort Johnson on Charleston Harbor contains some of the most extensive experimental research, educational, management and marketing facilities found on the Atlantic coast.

JIM GOLLER



sure is applied to the natural habitats of fish, shellfish and other coastal organisms. Presently some 30 percent of the state's shellfish grounds are permanently closed due to water-borne bacteria and other pollutants. Identifying areas important to the life cycles of species and working with other agencies to protect these areas is one mission of the Marine Resources Division.

In addition to managing existing marine resources and searching for ways to utilize new resources, the Marine Resources Center has always had an interest in one of Lunz's pet projects: mariculture, the farming of the sea. South Carolina has a variety of attributes that make the state well-suited for mariculture. The temperate climate offers a relatively long growing season for many marine animals that could not be grown farther north. A larger number of coastal impoundments, built originally during the days of rice planting and maintained since the turn of the century for waterfowling, could in many cases be modified for mariculture activities.

Seafood ranks fourth highest in imported American goods. Since our coastal resources are finite and in many cases already utilized to their fullest, mariculture could enhance the use of existing resources and reduce American dependency on foreign imports. In the same way that hunting and gathering gave way to agriculture tens of thousands of years ago, fishing is expanding into the artificial rearing of marine and freshwater animals. All the advantages agriculture holds over gathering and hunting can carry over to mariculture without diminishing the role of commercial harvest of naturally existing fish populations.

Mariculture, however, is still in its infancy, still at the point of selecting the most easily and profitably cultivated animals. "We are still deciding whether to raise cows or coyotes" as one scientist put it. A number of animals that might be suitable for mariculture are now being studied, including oysters, clams, blue crabs, channel bass, sturgeon, hybrid bass, tilapia, Malaysian prawns, catfish and crayfish.

A large-scale mariculture center with numerous experimental ponds is now under construction at Victoria Bluff in Beaufort County. The center will serve as a Marine Resources Division field station where experimental results of laboratory work can be tested on a commercial scale.

In the future, the Marine Resources staff will continue in-depth studies of living marine resources and how they are influenced by physical and chemical factors. Alterations of wetlands and waterways will always be of concern, and the division will stand ready to react to immediate problems, such as oil spills and fish kills. Attention will be directed to developing new fishing techniques and improved methods and gear. Efforts in this area have already led to a self-culling crab trap, an experimental peeler crab trap, and, in conjunction with Clemson University, a prototype mechanical oyster picker.

With continued research and careful management, the state's marine resources will continue to increase in value, but the costs of research and management are soaring. The strides that have been made since Lunz's early beginnings are in part due to the public's willingness to fund such activities. Lunz, no doubt, would be amazed at what has developed from his backyard beginnings.


Maass