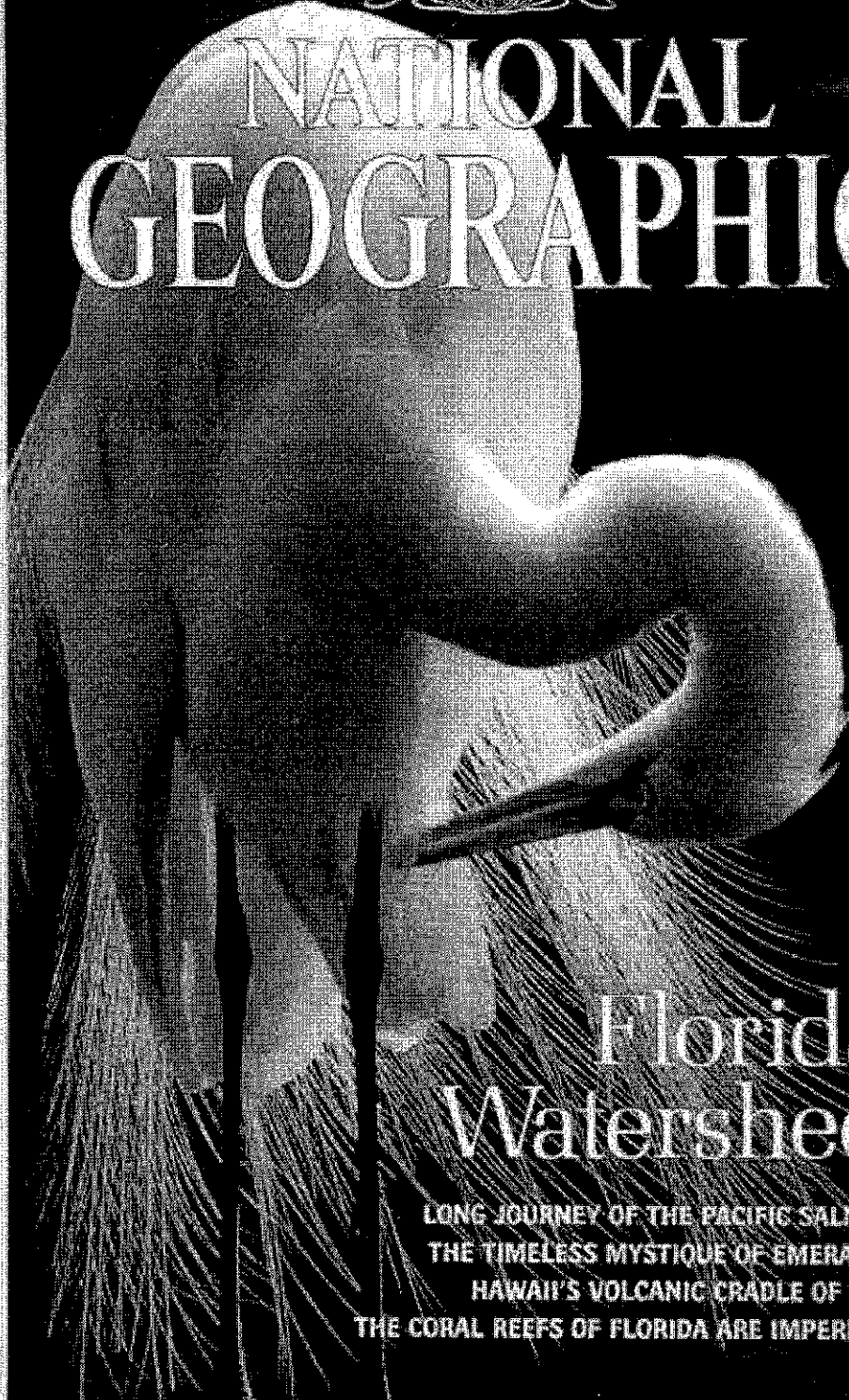


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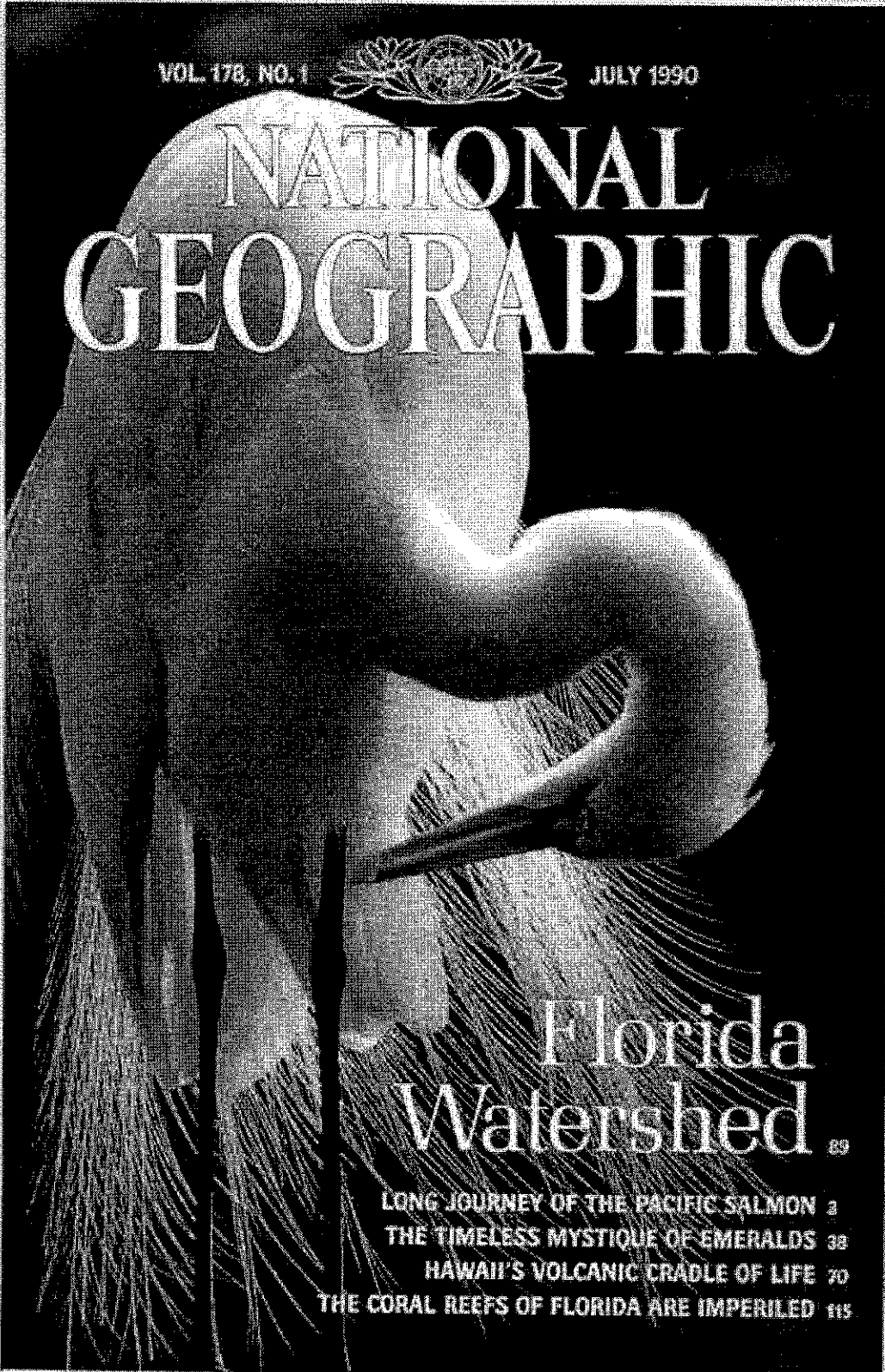
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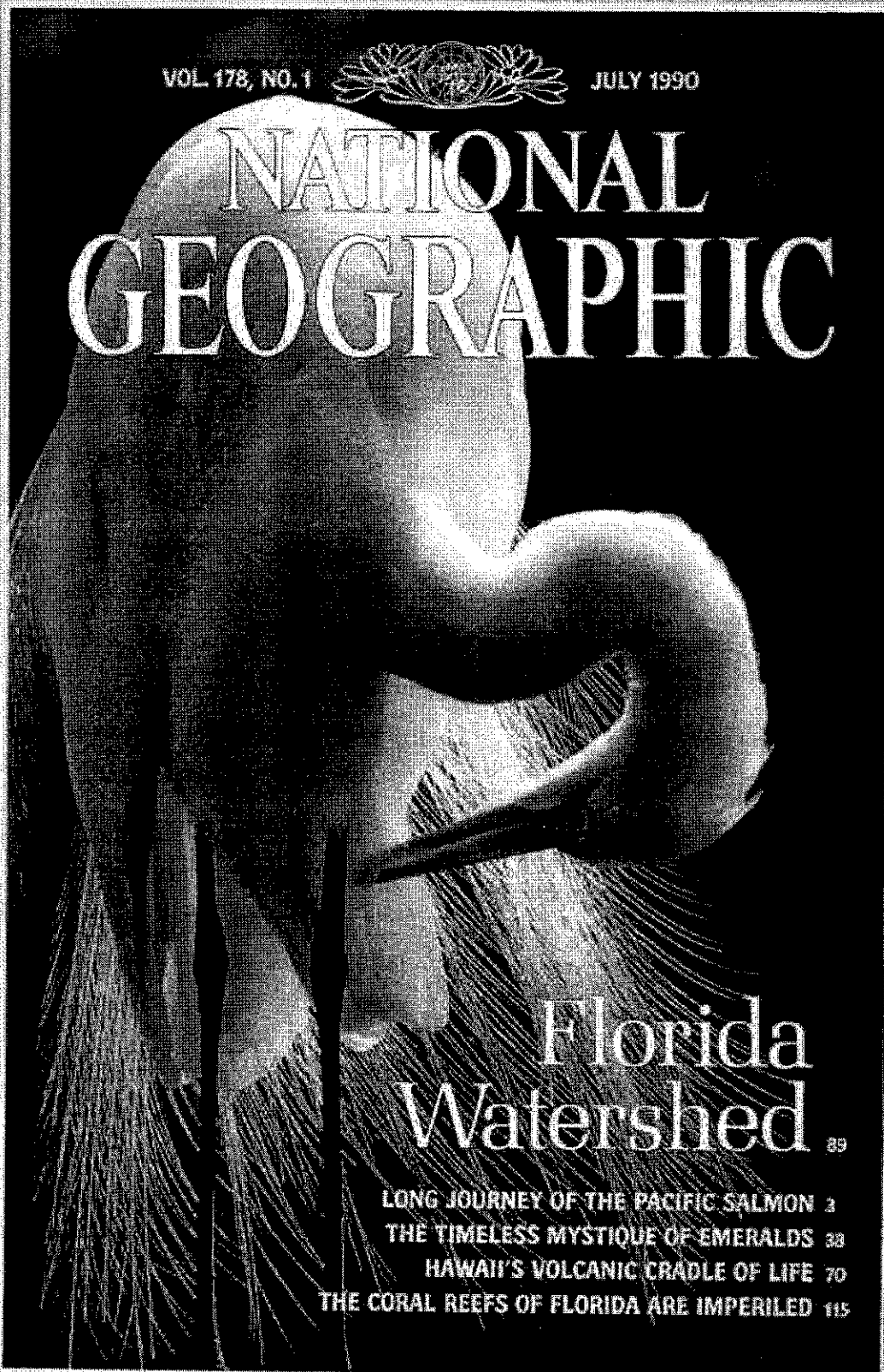
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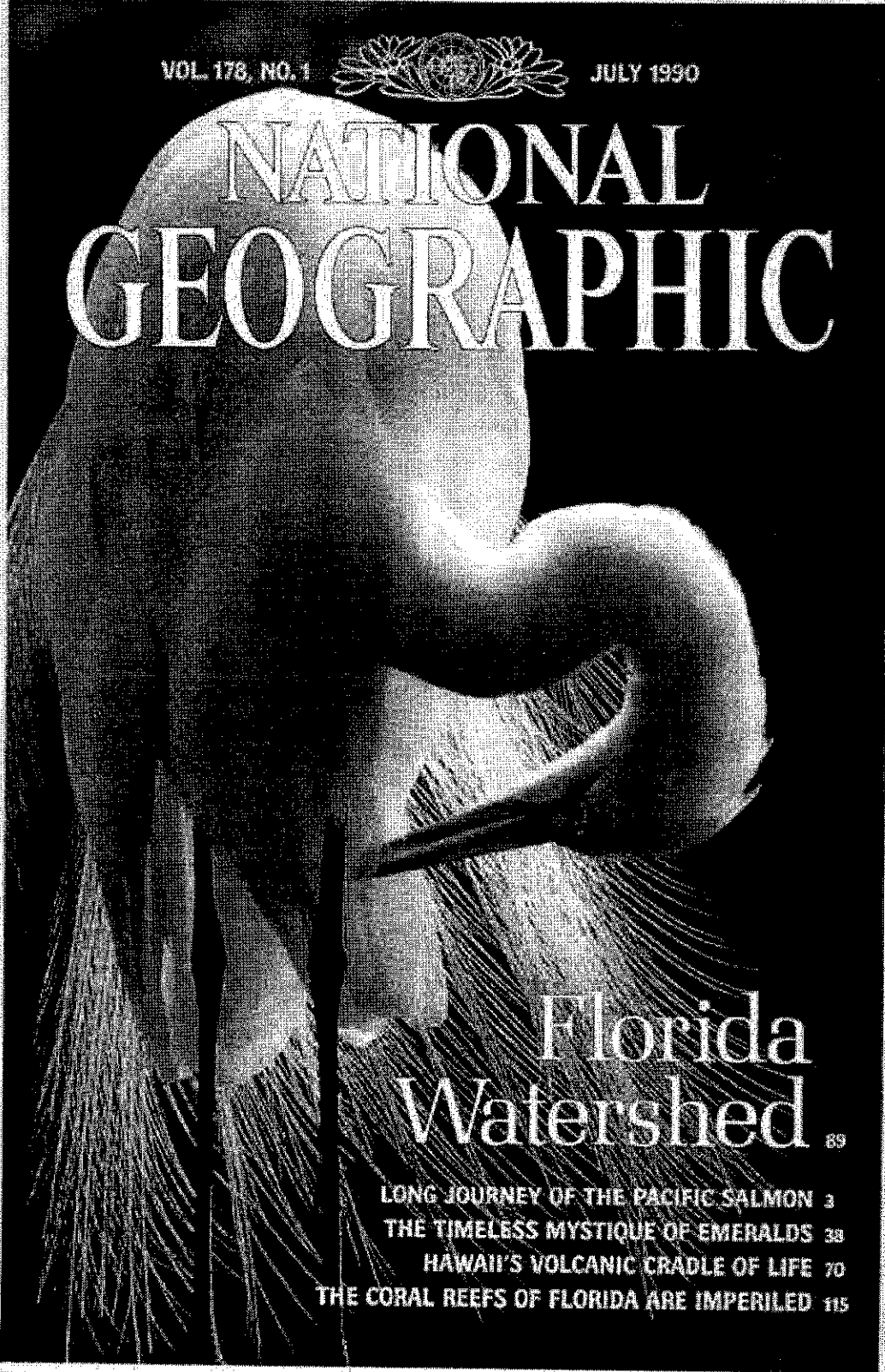
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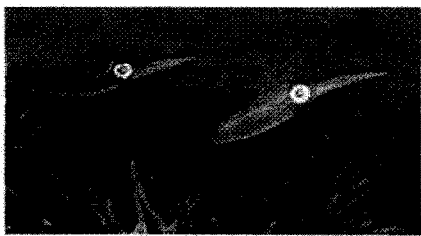
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MEMBER OF THE NATIONAL GEOGRAPHIC SOCIETY

The Following Pages Are Poor Quality



**Hammerhead shark** has a squam ranging to flesh, traveled with a couple of colossal white fish and as part of this party observed one of the "spiral" hammerheads.

**Porpoise squid**, common with the hammerhead porpoise. As night came a group of white fish swam with a few porpoises together in the darkness of a bay.

**White goats** and a porpoise nearby. A large white fish swam over the water. The white fish was a large white fish with the hammerhead swimming with the bay.

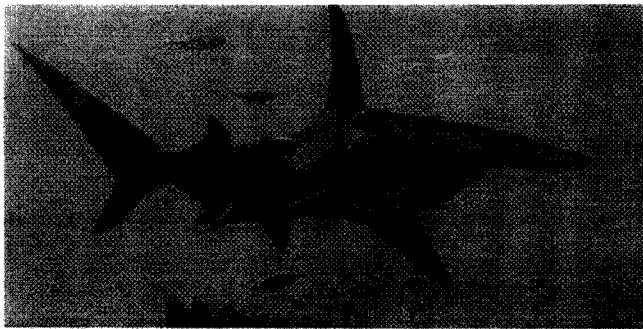
of a total vacuum and disappear in the 1/2 part of a minute.

A porpoise then swam very close to the water, waving a large white tail and swim the same. An in-flocking bay porpoise bates water with its white part, a row straight up. You have heard that hammerheads subvert attack man, but you have a sigh of relief when he is gone. A clever man may not keep a fish in a tank cage. An in-flocking fish that swims too close will find quick death in the water's surface to the page. He is no wonder to you, but over unless you try to dole out him from the cage.

Now a night glass and yellow fish attack your attention. Swimming close you watch a cart of fish hovering like a bump above a line of red. With constant head and small sharp teeth of fishes on the line of red.

You approach a very white or 200-200 ft, and one of the





**Hammerhead shark** (page 12) swims along the line travel with a smooth, gliding body. Its curved snout and the pointed upper jaw are the tip of the hammer.

**Popeyed squid** (page 13) has a long, thin, pointed beak and a large, bulbous eye. Its long, thin, pointed beak is the tip of the squid's mantle.

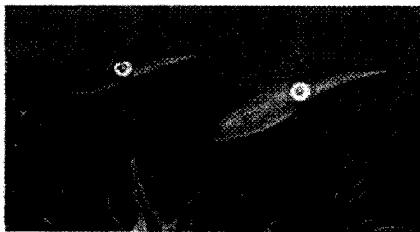
**White groins** (page 14) are a type of shark. They are the largest white sharks in the world. They are found in the Pacific Ocean, the Atlantic Ocean, and the Indian Ocean.

of a small, round, and sharp, in the front, glowing.

A pencil-like, long, thin, pointed beak, with a large, sharp, and curved snout. As a hammerhead shark swims, it uses its snout to feel for prey. You have to be very close to the shark to see it attack. You can't see it until it's right in front of you. A hammerhead shark's snout is very sharp. You can't see it until it's right in front of you. You can't see it until it's right in front of you. You can't see it until it's right in front of you.

Now a bright green and yellow, with a small, sharp, pointed beak. You can't see it until it's right in front of you. You can't see it until it's right in front of you. You can't see it until it's right in front of you.

You can't see it until it's right in front of you. You can't see it until it's right in front of you. You can't see it until it's right in front of you.



**Hammerhead shark** (Sphyrna tiburo) is a common species of shark found in the Atlantic and Gulf of Mexico. It is known for its distinctive T-shaped head, which is wider than it is tall.

**Porpoise squid** (Lycoteuthis californiana) is a small squid found in the Pacific Ocean. It is known for its unique shape, which is more rounded than that of other squid species.

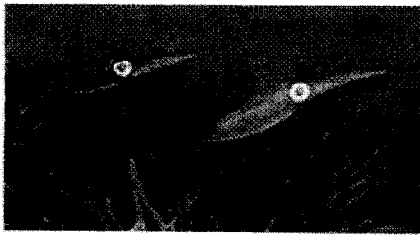
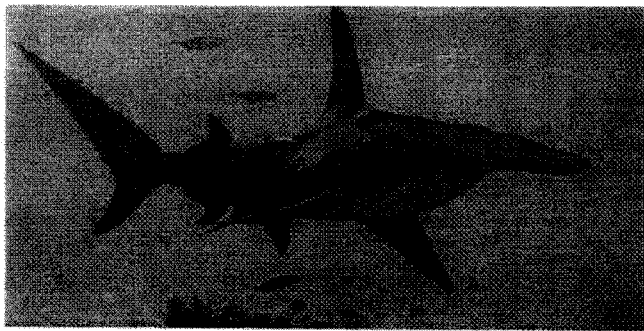
**White ground squid** (Lycoteuthis alba) is a small squid found in the Pacific Ocean. It is known for its white coloration, which is unusual for squid species.

of a great deal of water, especially in the surf, swimming.

A porpoise that stays too long, flutters wings, waves a huge dorsal fin, and spins the squid. As a diver, you should keep a close watch on your prey, as you cannot track it. As a hunter, you should be aware of your own attack time, but you have a soft, wet skin when it is gone. A squid is not out of your sight for a moment. As a diver, fish that swim too close will find your teeth on the side of your head in the past. If you are not sure, a few eyes will see the teeth and the squid from the top.

Now you might get a better idea of the squid's swimming. Swimmers come over you, and the fish hovering like a lamp above your head. Water is clear, but you can't see the teeth in the squid's mouth on the squid's side.

You approach a squid with a squid and a squid to



**Hammerhead shark** may be known for its sleek travel, with a smooth, yellowish-brown and white stripes that represent the top of the hammer.

**Peppery squid** come with the best name in the deep. As the name implies, they have a peppery taste. They are found in the deep, cold water.

**White goods** are a family of small, deep-sea fish. They are found in the deep, cold water. They are known for their white color.

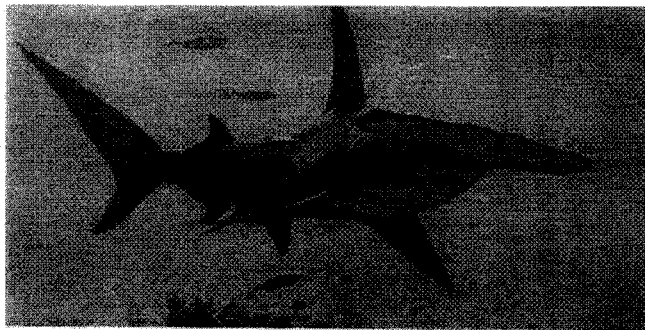
of a coral canyon, and disappeared in the instant gloaming.

A poroak-tan sting ray flaps jellylike wings, waves a huzzy whip tail, and skims the sand. As it glidingly berambles, bare, razor teeth also swing past. (I'm straight spiky!) You have heard that hammerhead can't attack man, but you have a high opinion when he is gone. A vicious moray eel keeps eel in a rock cave. You think it's fish that swims too close, but gunk them in the moray's curved teeth spines. He is no meek, to you, how you think you try to deal with him, you know.

Now a bright green and yellow fish with a long, narrow, swimming character, which is apparently hovering like a flump about a horizontal. With an oval head and small sharp teeth, it mingles on the living coral.

You approach a sea urchin, or sea urchin, out of the





**Hammerhead shark** (top) is a predator that travels with a group of conspecifics. The placement of this shark's eyes is at the tip of its hammer.

**Popeyed squid** (middle) may never have to be preyed on. An octopus with a similar eye placement probably cannot attack it because of the squid's speed.

**White squids** (left) are easy to catch because they are transparent. They avoid a predator's eyes by staying in the water column with their bodies.

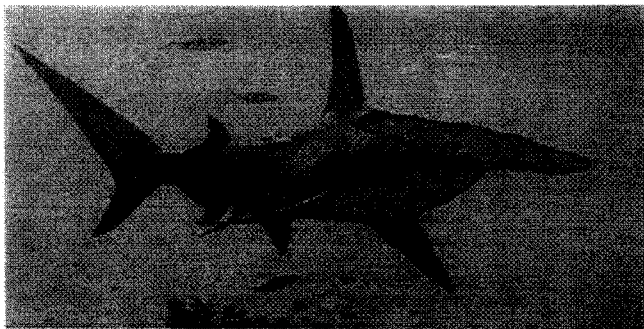
of a broad surface and disappear in the current, glowing

A pencil-thin sting ray has bat-like wings, a long, whip-like tail, and shares the same. An eel-like king snake guards holes near teeth and swims fast, almost straight (page 75). You have heard that hammerheads seldom attack man, but you never expect to believe what he is doing. A hammerhead will keep you in a rock's eye. Any hammerhead that swims too close will find itself dead in the man's eyes of teeth (page 77). There is no chance to see hammerheads, so they discharge their teeth in the air.

Now a bright green and yellow fish with its own own swimming class, you watch a pair of fish hovering like a little above a coral reef. With serrated back and small sharp teeth, it is able to eat the living coral.

Your approach is not white, so the hammerhead is of the





**Hammerhead shark** swims in search of its dark prey in a world of red and black. A few minutes of the night, one to the north of the equator.

**Porpoised squid** comes out at night to feed on the squid. An expert swimmer, it can move as fast as a shark.

**White grunts** add to the hammerhead's diet, and number of its prey. In the night, they are not as fast as the hammerhead's prey.

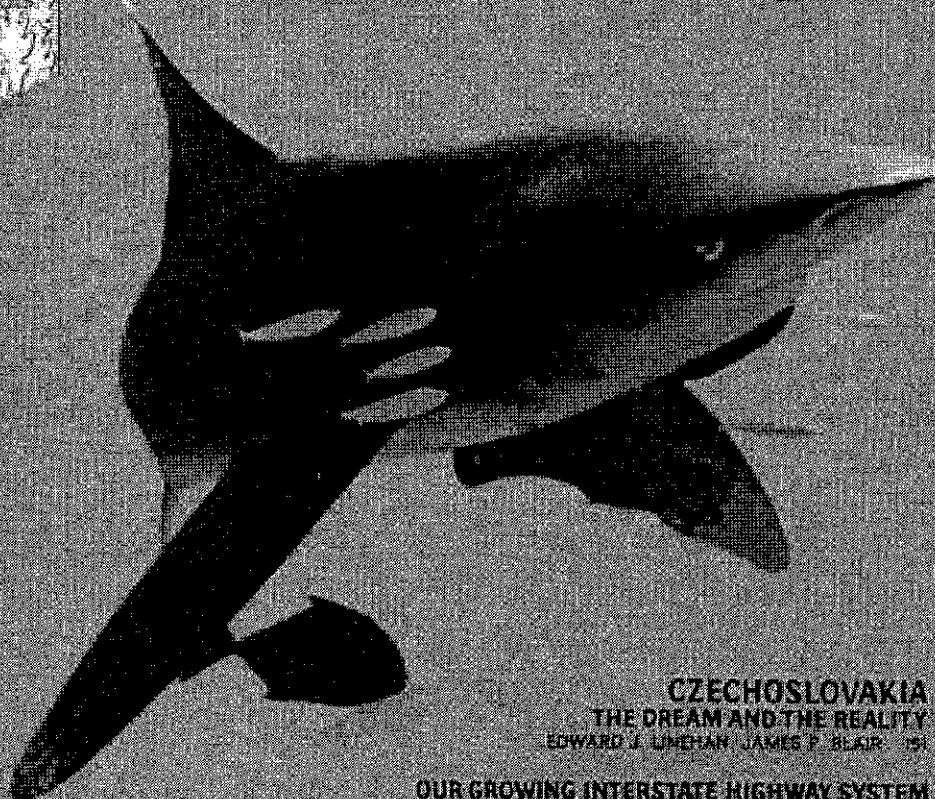
of a small, brown, and slippery, as the night begins.

A new denture, long, thin, sharp, and long, waves a hairs, white, and slits the sand. As both long and bar, include large teeth and a wide, flat, and straight space. You have heard that hammerhead's white, black, gray, but you never in light or night when he is gone. A few days, and he is in a new case. An expert swimmer that swims the sea, with long, thin, teeth in the night's curved teeth, open. He is no longer in the water, even, and is ready to do his job, his job.

Now a light blue and yellow fish attracts some. First, they swim, close, and watch a pattern, moving like a group, always in the water. With a white, black, and small, sharp teeth, in the night of the hammerhead.

And approach, and watch on the sand, and in the sea.

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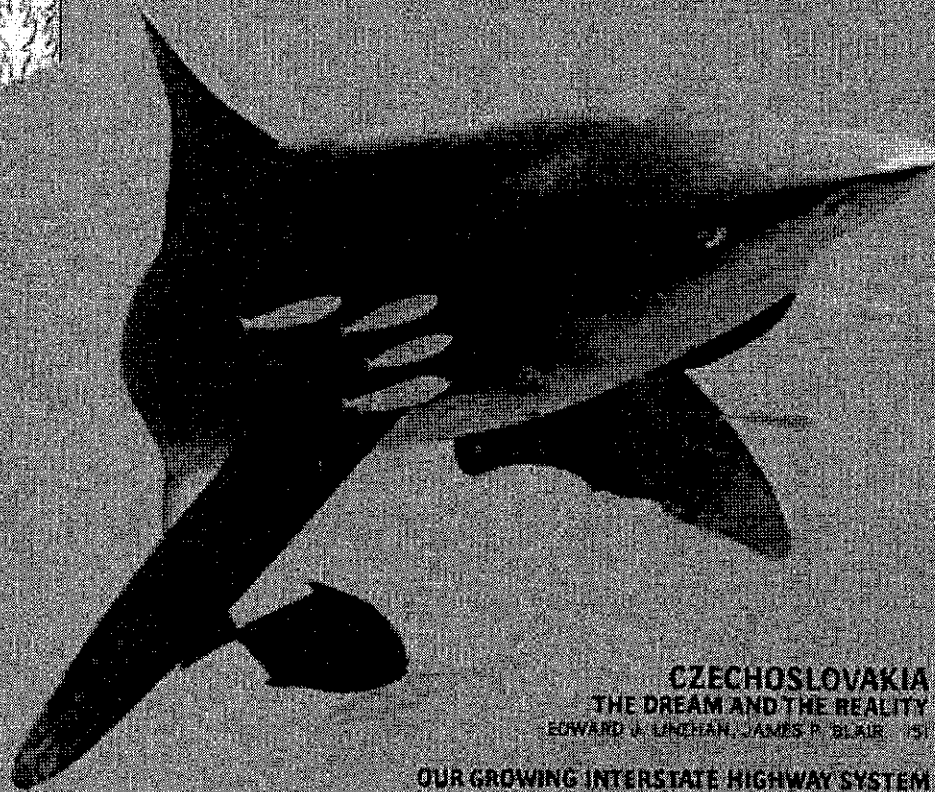
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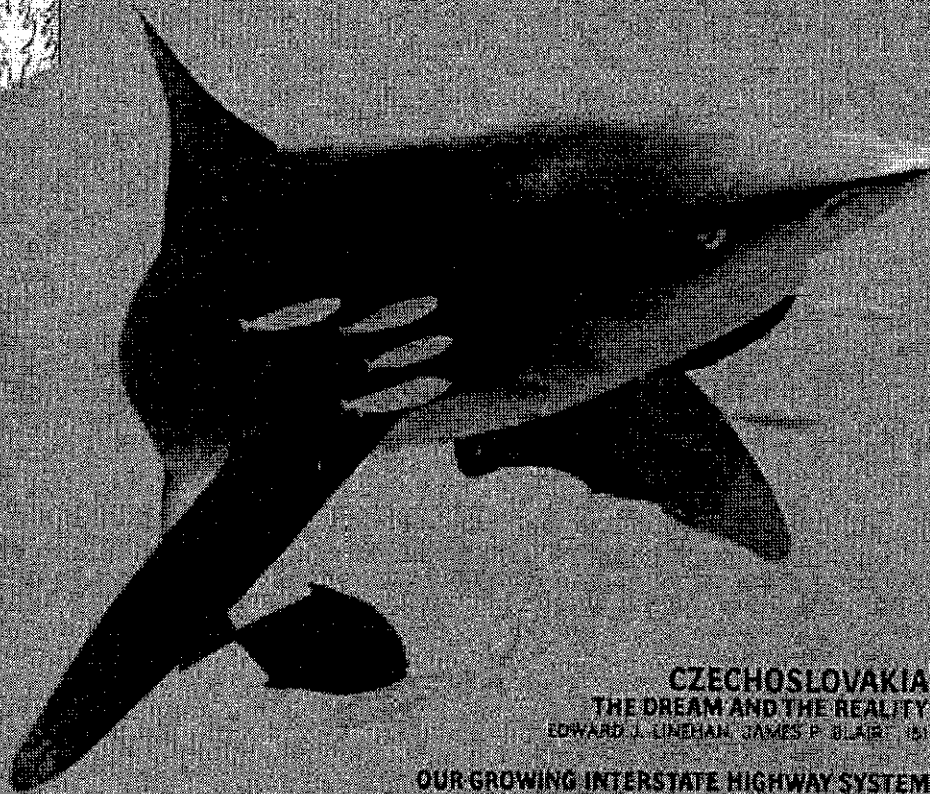
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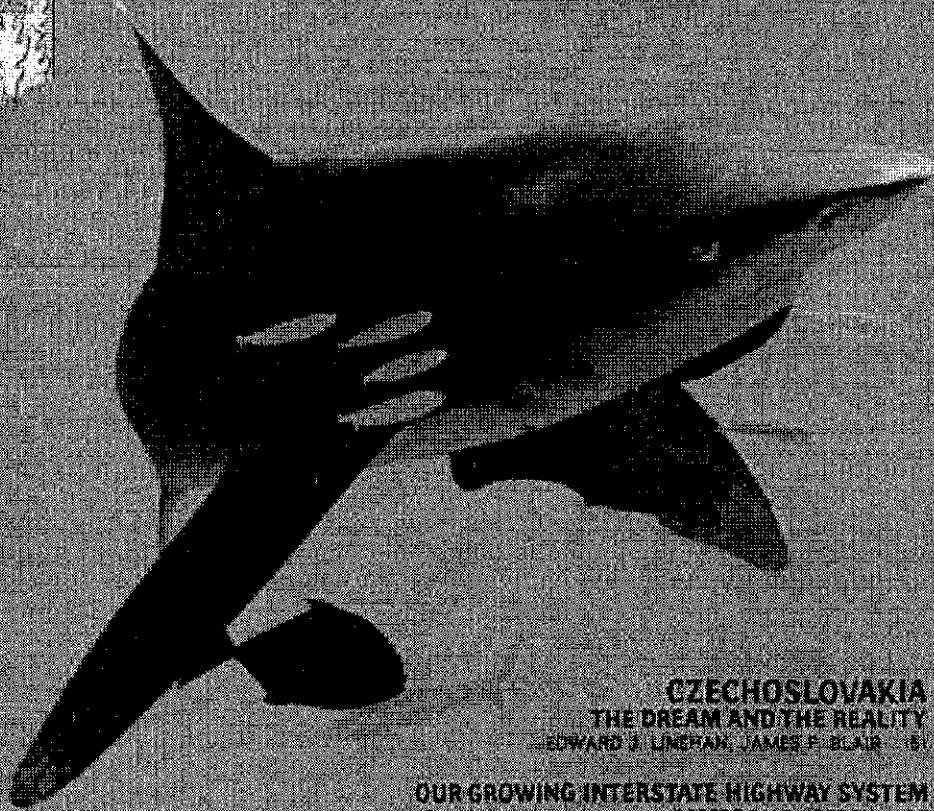
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# FLORIDA'S Coral Reefs Are Imperiled

By FRED WARD

BLACK STAR

Photographs by  
JERRY GREENBERG and FRED WARD

**W**HEN FLORIDA established John Pennkamp Coral Reef State Park off Key Largo in 1960, there was general rejoicing that this great American treasure would be preserved for future generations to enjoy. Less than a generation later many of the state's reefs are dying, not just in the park but throughout the keys. Some experts say the causes are part of a natural cycle, and widespread death is inevitable. Others say the causes are unknown, but the result is still inevitable. And others warn that we are actually killing our reefs.

I first dived the Florida Keys while I was a University of Florida student in the 1950s. Through 35 subsequent years of regular scuba trips and documentation (along with the amazing photographic coverage of the reefs by my lifelong diving buddy Jerry Greenberg), I have watched their steady deterioration. Corals are living organisms that have created the very structure of the reefs over thousands of years. Seeing them suffer is like living with a terminally ill family member whose doctors argue over symptoms while the



PHOTO BY JERRY GREENBERG

*In a troubled underwater world off Key Largo, a school of diving students swarms around the "Christ of the Deep" statue. Fouled waters and thoughtless visitors are destroying growths of coral (above), some of which took centuries to form.*

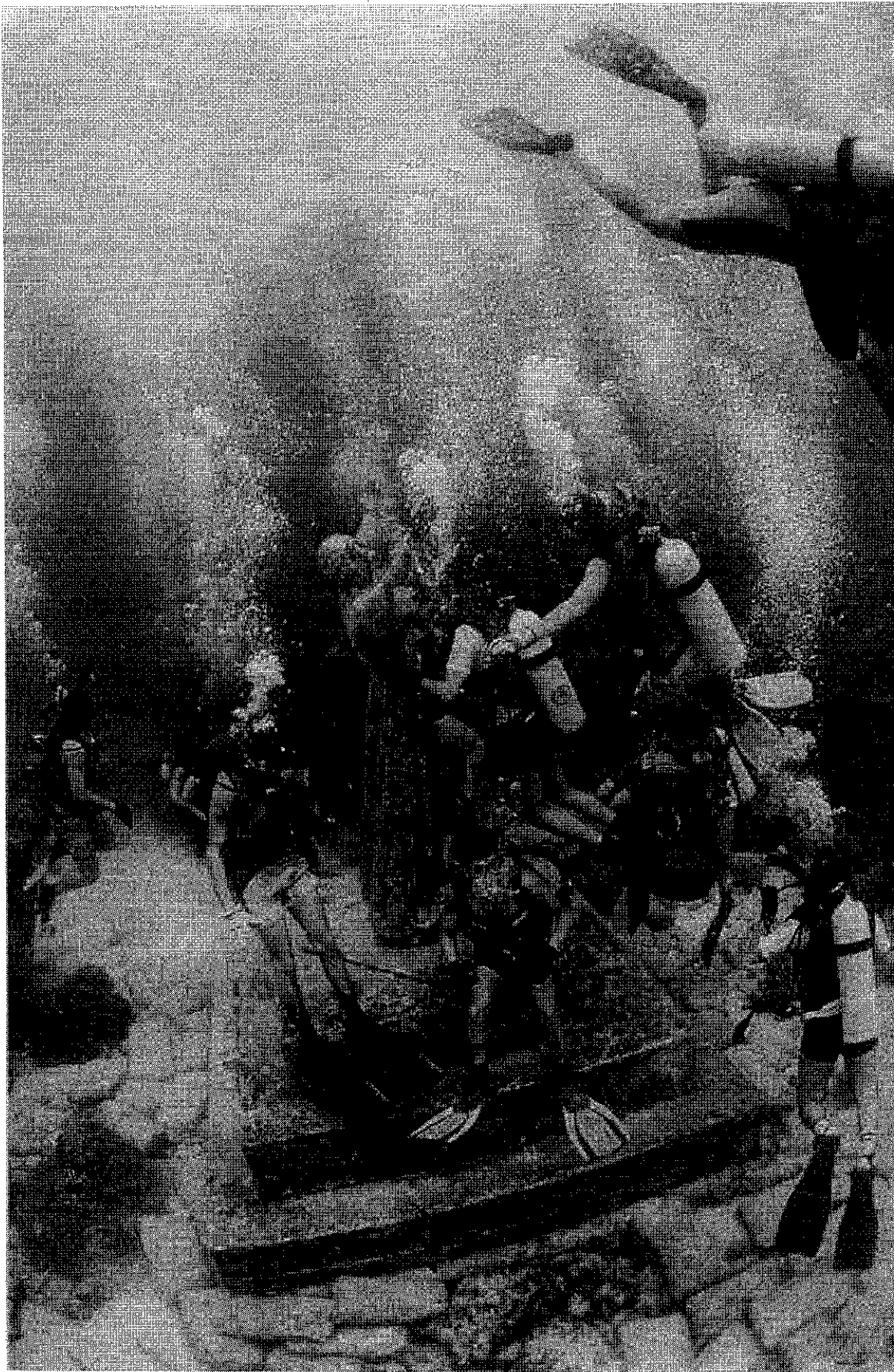
*Designed to protect an extensive reef system, John Pennkamp Coral Reef State Park and the adjacent Key Largo National Marine Sanctuary are being ruined by too much pollution and too many people.*

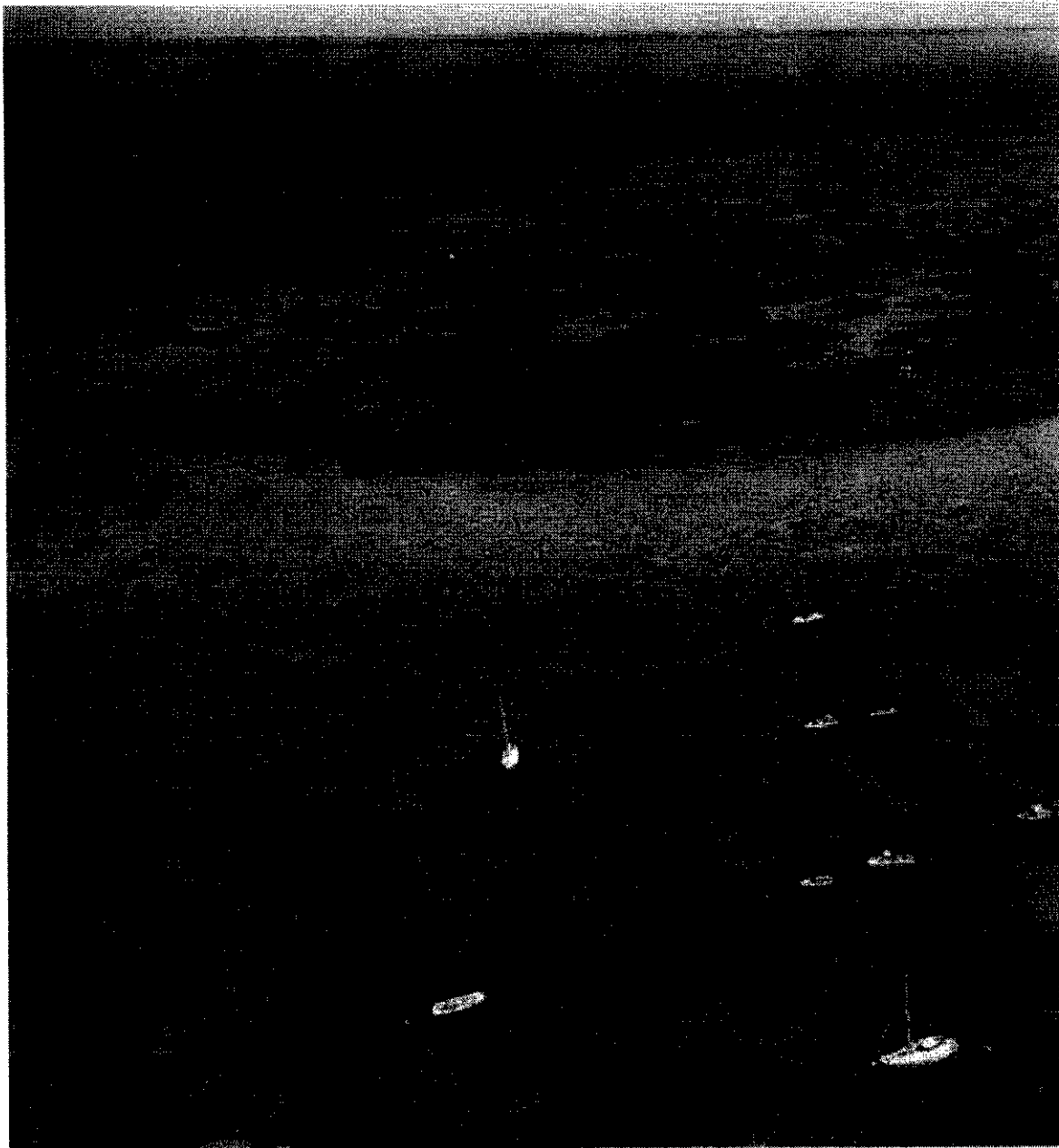
patient silently slips away.

There is magic in coral. In secret watery gardens, nature plays out her diverse drama for the swiftness alien to belief: birth and death, beauty and beast, competition and cooperation. What appears to be a large boulder that resembles a human brain is actually a colony of millions of creatures. Each tiny, seemingly independent polyp, taking in water and nutrients and exuding calcium carbonate (limestone), participates in forming a design specific to each species of coral.

Pennkamp is part of a reef ribbon, made possible by the warm flow of the passing Gulf Stream, that reaches from southwest of Key West almost to Miami.

Although most refer to the area along Key Largo as "Pennkamp," little-noted jurisdictional changes in 1974-75 dramatically altered the reefs' future. At that time the Federal government took control of all U. S. underwater areas beyond three miles to a depth of 300 feet. These actions diminished Pennkamp Park (administered by the Florida Department of Natural Resources) to the three





miles closest to shore and transferred the major reefs to the Key Largo National Marine Sanctuary (operated by the U. S. Department of Commerce).

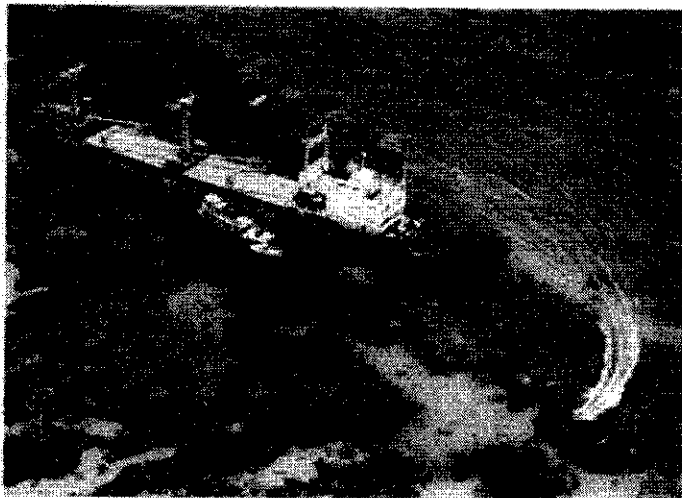
**R**ECENT YEARS in appearance, coral reefs are in truth exquisitely fragile, living within a very narrow range of conditions. Water temperature should remain above 70°F; Pennkamp

is at the cool edge of reef growth, and its waters dip into the sixties in winter. And the water must have few nutrients and even fewer toxins—Pennkamp has too many of both. In short, since the increase of development and tourism in the keys the odds are against Pennkamp's sensitive ecosystem.

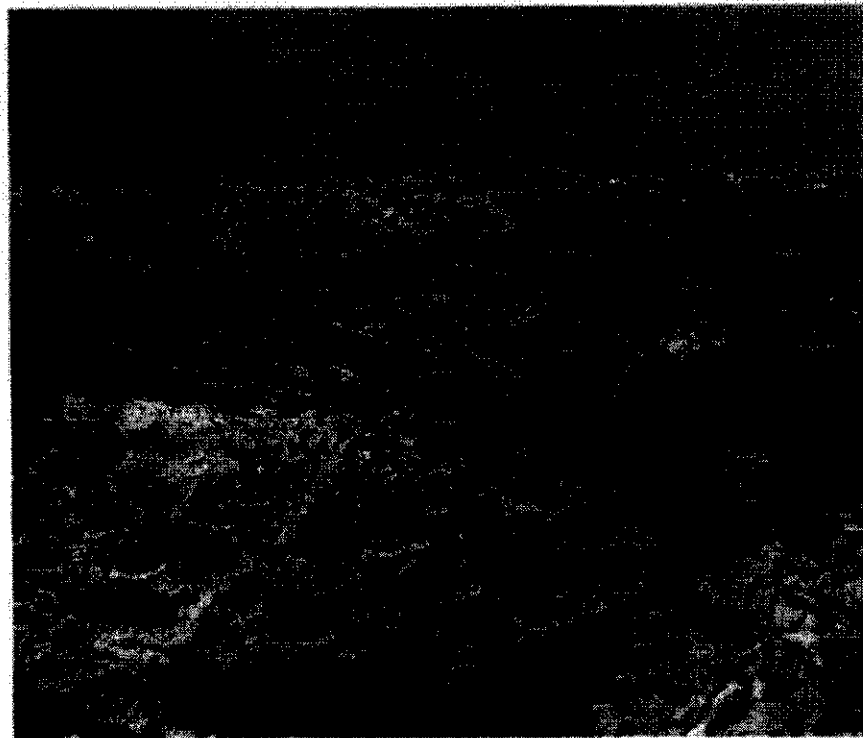
In the exciting days of 1950s sport diving we felt like pioneers, exploring a private

wonderland. After Jacques-Yves Cousteau co-invested the Aqua-Lung, the young and the daring suited up in relatively untested scuba outfits and raced toward this underwater frontier. No laws limited spearfishing or coral and shell collecting. Heedless divers speared tons of the most desirable game fish.

Massive publicity, not the least of which was a major  
*(Continued on page 123)*



*Buoys can be lifesavers for coral by discouraging anchoring directly on the reefs, once the cause of massive destruction. Some boats double up at Molasses Reef in the federal sanctuary (above), where 15 new buoys a year are planned. In 1984 the freighter Wellwood (left) plowed up several acres of coral and went aground. Part of the six-million-dollar fine helped finance habitat restoration.*

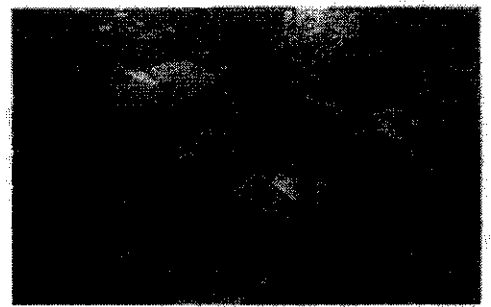
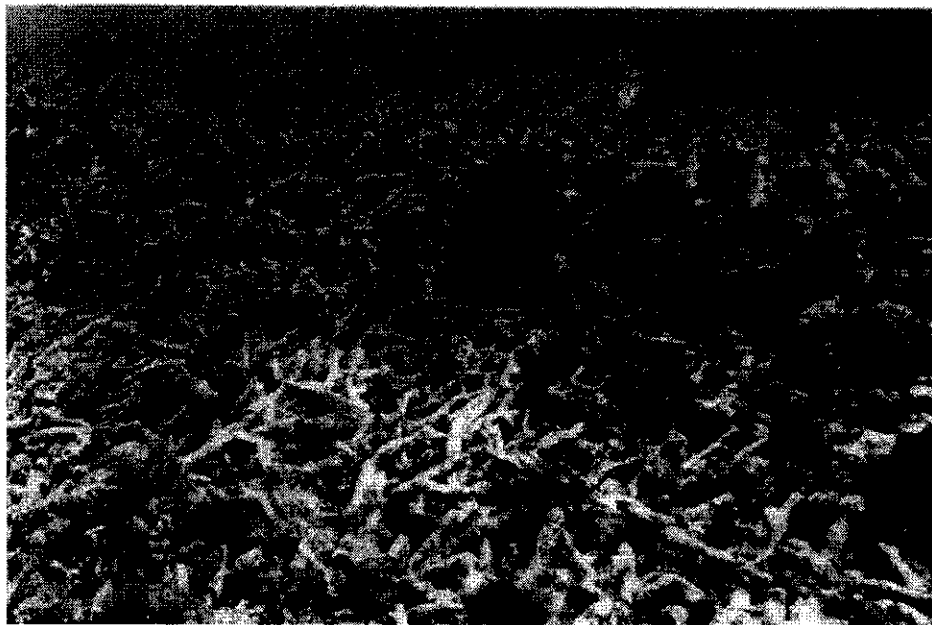


1960



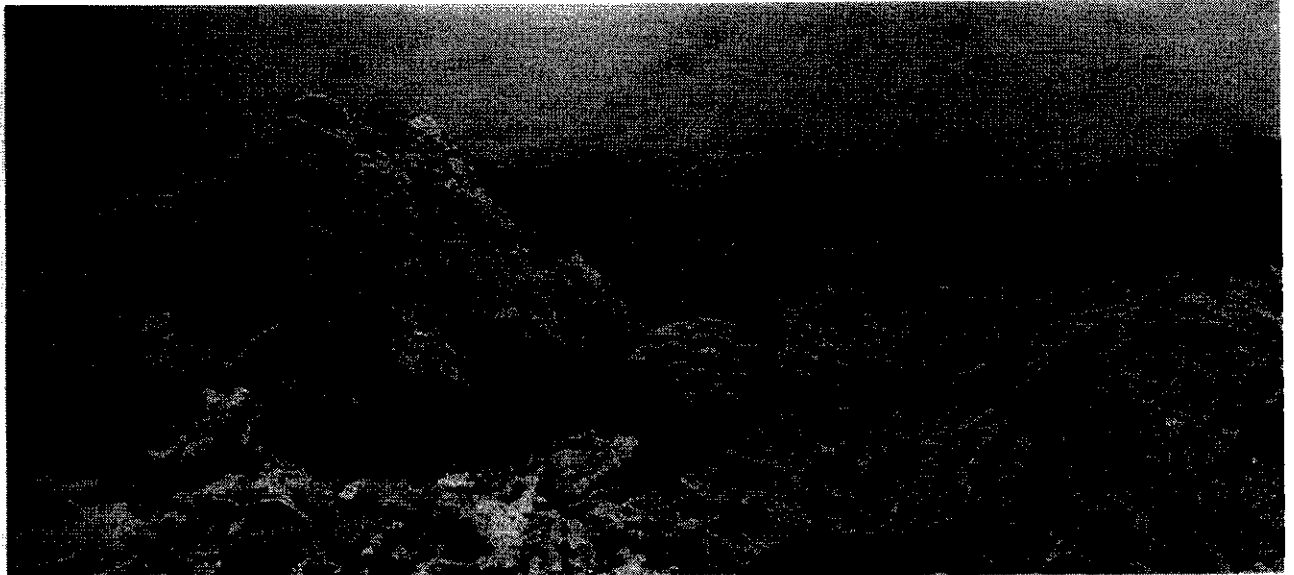
1989





A wondrous ocean unfolds in a panorama taken by ferry Greenberg at Carysfort Reef in 1960 (top). Golden branches of staghorn coral stand beside brain coral, at lower right. In the same region 29 years later, coral was reduced to a mass of stumps. To compare such areas, author Fred Ward (above) uses laminated old photographs.

made by living organisms, coral reefs are the handiwork of small marine animals called polyps, which reproduce asexually. After a polyp dies, it leaves behind deposits of calcium carbonate upon which live polyps build. When nutrient levels soar from such sources as human sewage and fertilizers washed from farmland, algae can overwhelm and smother the polyps.



1983

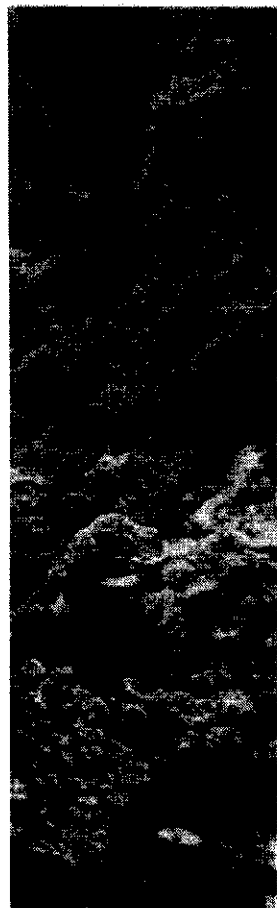


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(Continued from page 116)  
 article in NATIONAL GEOGRAPHIC magazine in 1962, prompted an almost instantaneous influx of boats and divers, putting new pressures on the underwater environment. A few divers might have caused little noticeable disruption, but safer, less expensive equipment and more leisure time helped popularize scuba diving.

Pennekamp, beautiful, accessible, and irresistible, became one of the most frequented diving destinations in the world, with nearly two million visitors a year (half of whom actually make it onto or into the water). The five most crowded reefs attract 5,000 people on an average day and double that on warm weekends.

Their boats pollute the water and everything in it with petroleum products and sewage. Incompetent operators crash into the reefs. They litter the sea with plastic foam cups, aluminum cans, glass, plastic bags, bottles, and miles of tangled fishing line. This debris does not go away—it is, for all practical purposes, indestructible.

Thousands of swimmers routinely bump, scrape, and step on coral. To a tired swimmer, standing on coral may seem as harmless as resting on a rock. But the slightest contact by a foot, boat shoe, dive tank, or swim fin can weaken a section of living reef. Algae then overcome damaged polyps. If only one person in a hundred scars or

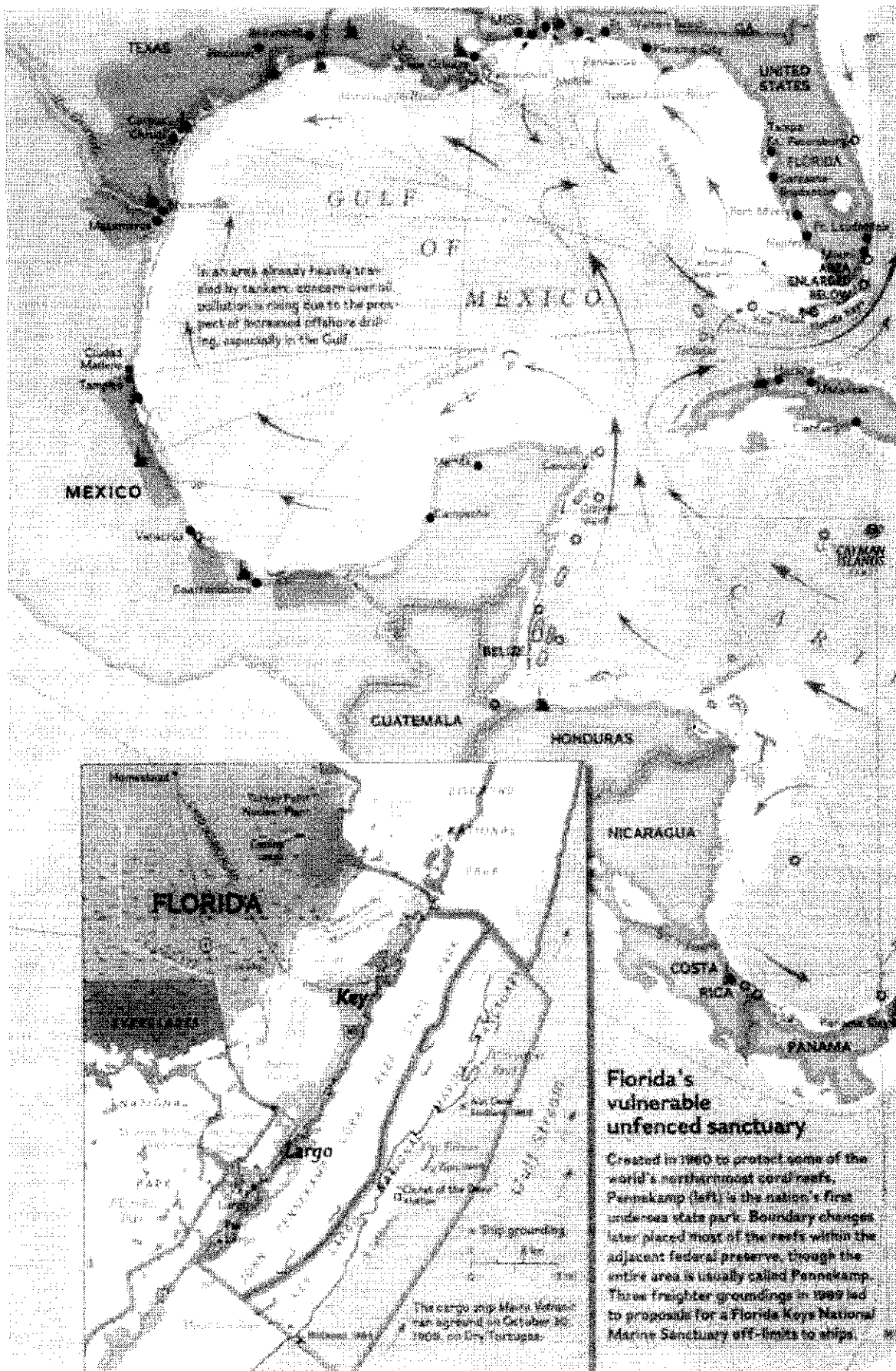
**Death can be shockingly swift in a coral reef that took some 6,000 years to grow. Thirty feet down in Molasses Reef, boulder coral (top, at left) and branches of elkhorn, at right, were suffering in 1983, but much of the area remained alive. Just six years later the boulder coral was seriously eroded, and the elkhorn had nearly succumbed.**

breaks off a piece of coral that took a century to grow, the cumulative devastation is enormous. Although spearing and specimen collecting are prohibited in the park, they continue illegally to this day.

**P**EOPLE PRESSURE makes money for Randy Pegrum, operator of the private park concession responsible for getting half of all the area's visitors onto the water. In his tiny dockside office he still worries about their impact. "The place is literally exploding," he says. "Over half the growth in the last 25 years has occurred in the past six. We're 'maxed out' every other weekend. Pennekamp has to close the gates because there's no more room for cars."

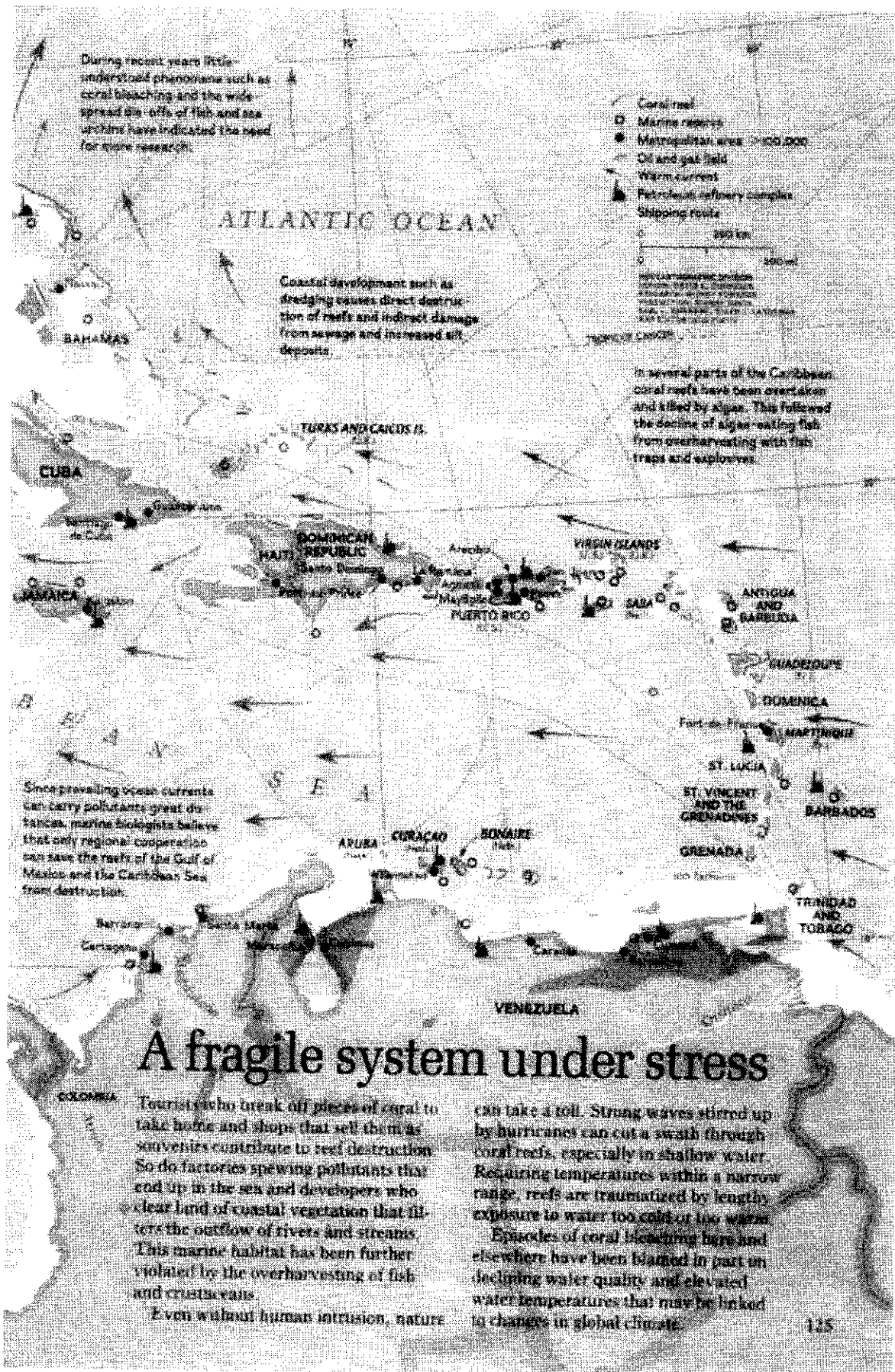
Parking-lot size seems a strange way to determine how many people get in. Carl Nielsen, then Pennekamp's energetic park manager (he has since changed jobs), agreed: "I'm not sure we want to bring in more visitors. We keep an annual list of 'destruction to natural features,' which includes boat groundings, mangrove damage, coral breakage, and boat-prop dredging. There was an increase of nearly 500 percent of such incidents between 1984 and 1986. We may soon be forced to close off parts of the reefs on a regular basis, to give them some breathing room to recover."

Fishing and diving, two main water sports in the keys, have conflicting goals. One enthusiast wants to catch what the other wants to see swim free. Killing major game animals is not allowed in other state or national parks, but the argument for prohibition falls on deaf ears when the issue is fishing; nearly every resident has a boat and rod. Anything that affects recreational or commercial fishing polarizes the keys.



**Florida's vulnerable unfenced sanctuary**

Created in 1960 to protect some of the world's northernmost coral reefs, Pennkamp (left) is the nation's first undersea state park. Boundary changes later placed most of the reefs within the adjacent federal preserve, though the entire area is usually called Pennkamp. Three freighter groundings in 1987 led to proposals for a Florida Keys National Marine Sanctuary off-limits to ships.



## A fragile system under stress

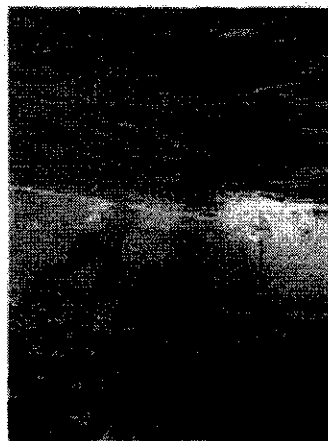
and the economy probably could not survive a substantial loss of fishing revenues. Yet in the absence of constraints, there may be no game fish in the future.

Hook-and-line saltwater fishing is still allowed in the 120 square miles of Pennecamp Park and the national marine sanctuary. The fish that are taken are often the scummiest, the biggest, and the best.

I asked Mike White, manager of the Key Largo National Marine Sanctuary, how the sanctuary and park justify letting people catch the very fish that two million visitors hope to see. He answered, "Our program is responsible for resource protection while encouraging multiple compatible uses. These requirements often conflict. I have another year to make a report on water use and to advise whether all the keys should become part of the national sanctuary system." Mike believes Florida would condone such an act had he watched the protest movement grow as treasure salvors, commercial lobstermen and fishermen, and tropical fish collectors organize to defeat any further attempt to federalize the reef tract.

Events, however, have overtaken Mike's study. After three freighters ran aground within 17 days last fall, Congressman Dante Fascell introduced legislation to designate all the reefs from Biscayne National Park to Dry Tortugas as the Florida Keys National Marine Sanctuary. "It doesn't take a congressman to see that the reefs are dying," Fascell told me. Florida's Senator Bill Graham has also introduced legislation.

Lobsters, tender to eat and difficult to protect, raise tensions to the breaking point. It is almost impossible to find a mature lobster at Pennecamp only a couple of weeks after the season opens. I was on the reefs



Divers' rest stop that appears to be bare rock (below) is actually an overturned stand of coral. Boaters who ran aground (left) were fined according to a formula that considers coral density, damage, recovery potential, and degree of negligence. Ignoring rules against touching the coral, divers paw through a dying stand of elkhorn in search of lobsters. In 1989 three persons caught with 399 lobsters were fined more than \$4,000 apiece for violating size and bag limits.



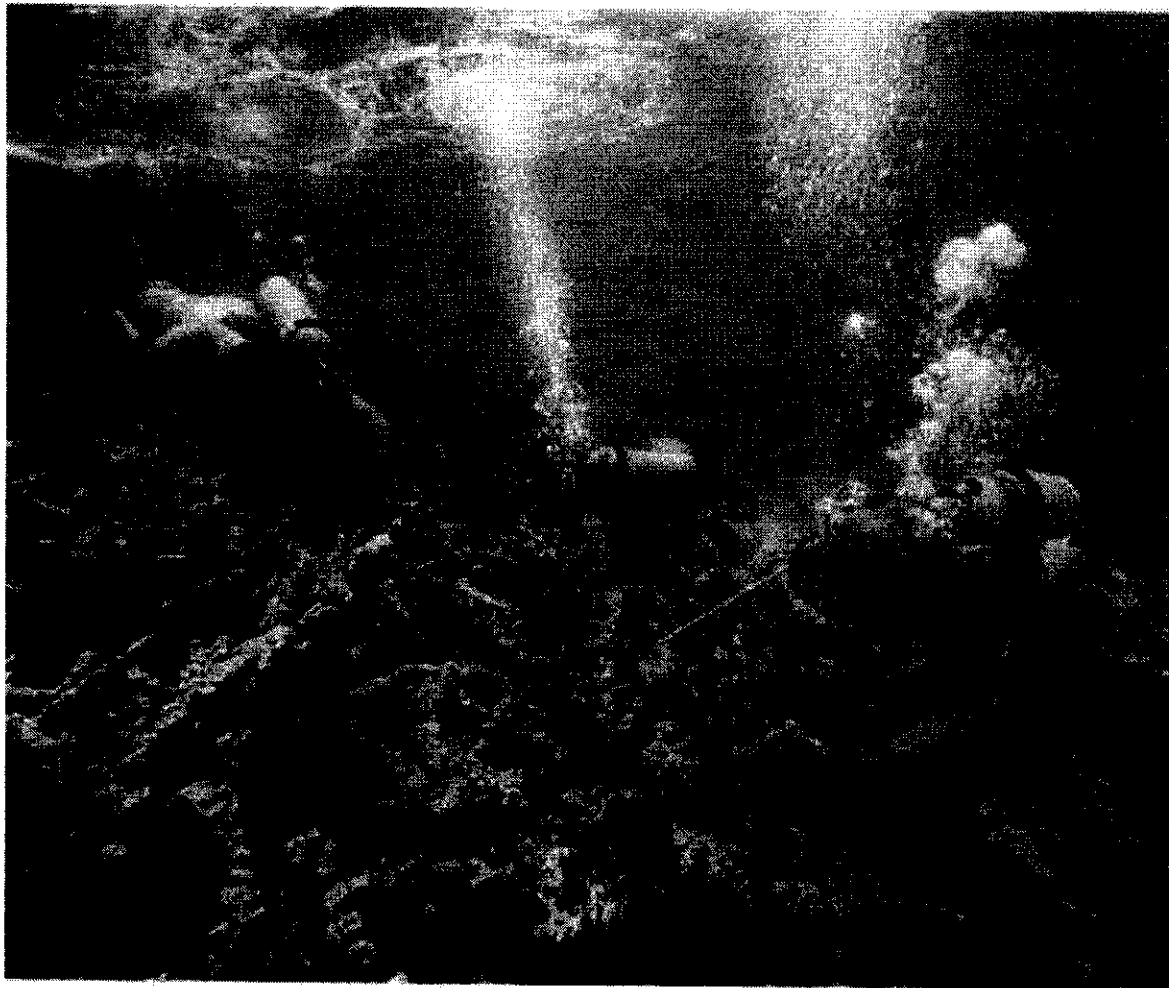
daily for six weeks and saw no more than half a dozen lobsters.

"Any person with a license can take a lobster a day or 14 per boat during the August 6 through March 31 season," says Mike White. "Some one with a boat can take 24 lobsters a day. And that's not the worst of it. Commercial lobster licenses are cheap in Florida, and there's no limit on the number of traps or lobsters taken."

During the summer two-day non-commercial "mini-season," locals say so many amateur lobstermen show up you can walk from boat to boat six miles out to the reefs without getting your feet wet.

A few days after the mini-season, Jerry Greenberg returned to finish photographing a particularly attractive stand of coral at Carysfort, near the sanctuary's northern border. Only a pile of paint-scarred coral fragments remained, silent testimony to careless boating.

**T**HE REEFERS' chief defenders are an unusual coalition of environmentalists and a few of the businessmen whose lives depend on having something alive on the reefs for people to see. One such is Captain Spencer Slate, gregarious owner of Atlantic Dive Center, who



AGI 87-10079 10/20/88

has been roundly criticized for continuing to hand-feed barracuda and moray eels even after a number of people have been bitten while imitating him. State has recently come down on the side of a fishing prohibition, saying, "Let's protect everything, lobsters and all. I want my guests to experience a living, beautiful reef."

But divers and fishermen alike do not threaten the reefs' survival. After 1980 Florida Keys development even outlasted neighboring mainland counties, which themselves had some of the highest growth rates in the country. Key Largo, the nearest island to the south, once

a rustic collection of trailer parks and weekend fishing shacks, has burgeoned into a development of homes, condos, and shopping centers straddling U. S. 1 and crowding the land between ocean and bay.

Carl Nielsen says, "Unplanned development is a continuing problem. Monroe County has no storm-water treatment facilities and no tertiary (or fully processed) sewage plants, which means that street runoff soaks right into the water and unprocessed sewage is dumped into the ground. Key West has the only city sewage-treatment plant in all the keys, and it opened just last year."

The cost of the keys use septic tanks, injection, and small local sewage plants operated by schools, apartment buildings, and shopping centers. The underlying limestone is as porous as a sieve. Anything dumped on the ground soon filters into the water table.

"A coral reef is only as healthy as the water around it," explains Florida regional biologist Bernice Skinner, who keeps some of the science hard data on Pensacola's water quality. A tiny woman who works in a cramped trailer, she appears even smaller among her crush of books and papers.

Putting over her computer

printsouts of the last decade, she explains. "There is a direct relationship between pollution and disease. Pollutants may lower the resistance of marine organisms. They irritate fish skin, creating a condition that allows bacteria to enter.

"Onshore pollution eventually reaches the park. Where else can I get clear one 26-month period I found water samples that exceeded the state standards for pesticides 67 different times and for planticides 65 times. I even found one PCB sample. Sediment samples collected six miles offshore in 1980 contained DDT. The chemicals people use on Key Largo end up in surrounding waters -- petroleum products, heavy metals, pesticides, herbicides, and fertilizers."

A surprising occurrence in 1988 awakened officials to another threat. Faced with heavy rains, south Florida's vegetable farmers petitioned to drain their fields by releasing water from Canal 111.

According to Renate Skinner, "Barnes Sound began to die -- the discharge of such a large amount of fresh water killed fish, grasses, anything that could not tolerate the sudden change in salinity. Then another unexpected thing happened. We had always assumed that the flow from Barnes Sound went north, into Biscayne Bay. However, after two months the decaying organic matter had flowed south through Jewfish Creek, into Blackwater Sound, through Marvin A. Adams Waterway, and into the park. Water samples from the organic slicks revealed high levels of several pesticides."

And if that's not enough pollution, a countercurrent between the shoreline and the Gulf Stream delivers runoff onto the reefs from Biscayne Bay and Greater Miami.

128

**P**ESTICIDES rain down from low-flying mosquito-control planes based in the Keys. Lois Ryan, director of the Monroe County Mosquito Control District, is emphatic that people couldn't and wouldn't stay in the keys without her operation. "We spray from planes, helicopters, and trucks twice a week during the wet season, whenever we get more than 20 mosquitoes landing on an inspector's arm in one minute.

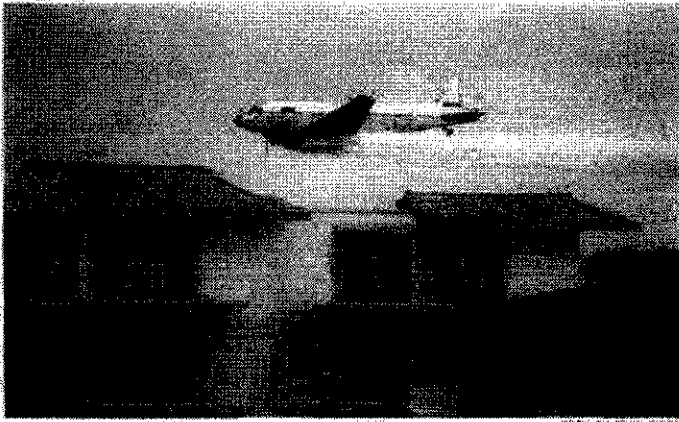
We use Naled, a pesticide, mixed 1 gallon to 100 gallons of diesel fuel. It's safe, and we perform an invaluable service."

Not everyone agrees that this program is safe or that Mosquito Control should have sole authority over when and where to spray. "Spraying kills larvae, not only of mosquitoes but also of a great many other insects," Mike White of the Key Largo National Marine Sanctuary says. "It's indiscriminate."

A local official lamented:







*Air raids on mosquitoes send fogs of petroleum-based pesticides over Key Largo twice a week during the wet season. The island's porous limestone substrate permits chemicals to filter into the water table and eventually into the ocean. Adding to the pollution, seepage from septic tanks increased in the 1970s with the building of the Port Largo subdivision (below).*

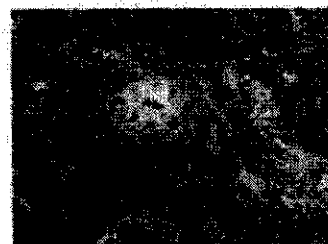
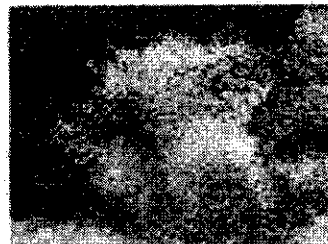
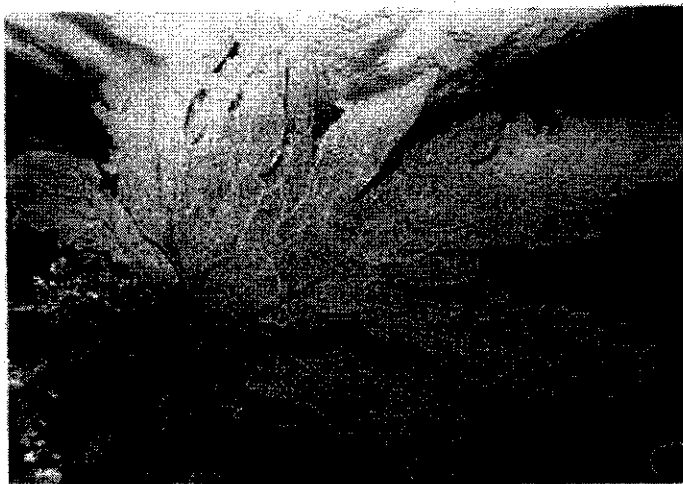


The ruddy glow of its branches reflects the health of a sea fan (right), which grows best in warm, clean water with a low nutrient level. A dying coral of the same species haunts the deep like a specter (facing page), perhaps the victim of parasites or polluted water.

Lifeless white limestone discolors a branch of elkhorn coral after the spread of white band disease (bottom left), whose cause remains a mystery. Produced by bacteria, black band disease, here infecting a star coral (center right), can kill a 200-year-old formation in two months. Experiments to stop the disease and treat infected coral so far have failed.

Known as golf ball coral, *Favia fragum* (bottom right) is smothered by algae, which then use the remains as a base for further growth.

Life on a reef is typically balanced, with a variety of corals coexisting with coral-eating parrotfish, algae, sea urchins, and damselfish. Normally corals have the ability to cleanse and heal themselves of disease and impact wounds. At Pennnekamp the reefs may no longer be able to withstand the stresses of their environment.



"There are almost no butterflies left where the county sprays. The number of birds has declined because their food is killed in the process of killing mosquitoes."

Carl Niebauer notes the county is supposed to quit oil the sprays as planes fly over the park or over water, but, he says, "We pick up those pesticides in our water samples. Anything that lands on Key Largo ends up in the park."

Once water quality declines, corals may not have the strength to recover from the

stresses of people, boats, storms, silt, chemicals. Anything can push them over the edge.

That fatal "anything" can come from almost anywhere. Richard Curry, resource management coordinator for Biscayne National Park, reports, "We pick up paper plants' residues from the Midwest brought down by the country's sewer, the Mississippi River, mixed in the Gulf of Mexico, and carried here by the Gulf Stream. Every product that people make is found around our reefs - including far too many nutrients."

Agricultural runoff, garbage, sewage, and thousands of products that humans discard have seriously raised the level of nutrients in the water around the keys.

"Nutrient loading could make the Florida Keys reef tract the first in the world to be killed by humans," says Brian Lapointe, water-quality expert with the Florida Keys Land & Sea Trust. Calling the keys an "ecosystem dysfunction," he notes, "Coral reefs thrive only in a low-nutrient environment. Pollution is pushing Florida's



TOP: SHOOTING THE LAST FRED WARD

reefs for, and their ability to survive. They may not recover.

Algae, which flourish in high-nutrient water, are the key problem. Relentless competitors, they can blanket an entire reef and smother living polyps. Lapsine has studied Caribbean reefs that turned algal in only weeks, the way a swimming pool greens overnight with algal "blooms."

Aggregating sea urchins, which might have helped save the reefs, suffered a Caribbean-wide die-off in 1983, possibly from a viral disease. The grazing

was intermittent. The keys lost an estimated 88 percent of their reef-growing sea urchins, just when they were needed most.

**I**N HEALTHY REEF SYSTEMS, Maybe not, but we need immediate and drastic actions. Man-made threats may well be the end of the reefs unless we change our ways. The area needs a master plan for dealing with water quality, fishing, boating, and visitors.

The reefs are credited with bringing in more than 50 million dollars a year to the upper keys.

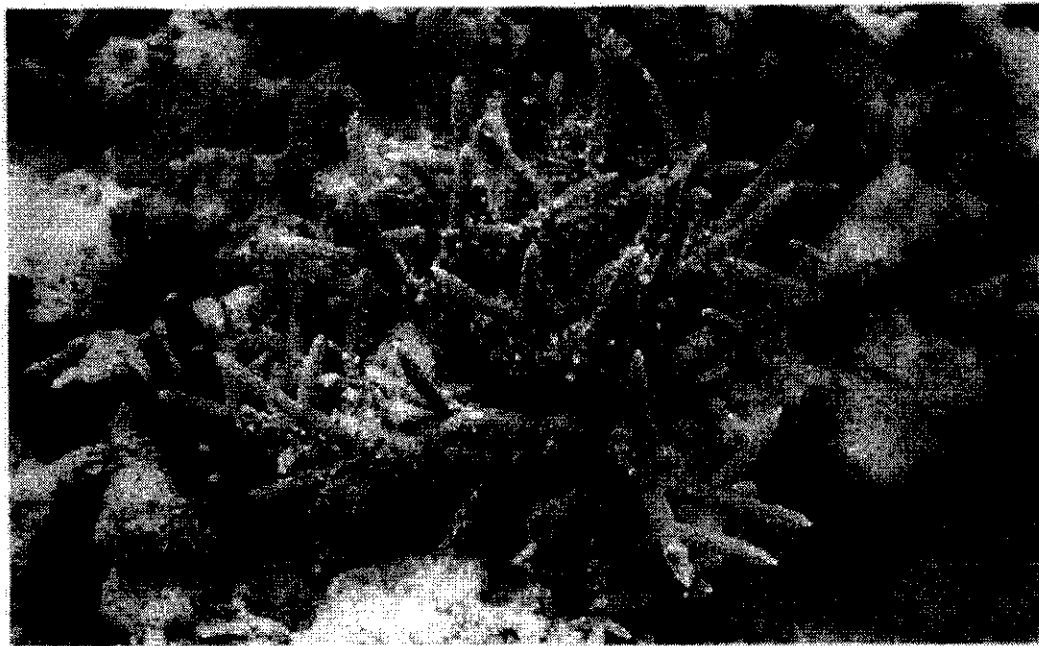
Restaurants, hotels, boat charters, and other shops all depend on that money. Logically, the owners of those businesses should be largely responsible for preserving the reefs. Instead, all too often, they bury their heads.

Rather than taking action, many plead that nothing negative be said to deter tourists, who continue coming in record numbers to enjoy the remaining beauty of the area. Ultimately, healthy reefs and healthy tourism are interdependent.

Saving the reefs means stepping the pollution. Lapsine



Small but feisty, a damselfish guards its turf (below). By picking at polyps, the fish kill patches to create algal towns (left). In defense, a "chimney" of new growth appears (above). If habitat is destroyed, the fish swarm to nearby reefs, where coral destruction is intensified.



says. "Clearing up key Lagoos and the other Florida Keys and putting them all onto sewage systems would be a major step in the right direction." Agricultural, boating, and industrial pollutants should be kept away from the reefs. Finally, fishing and lobstering should be banned in Frenckamp Park and the sanctuary.

As I photographed one swimmer from the top of a catfish, a concession snorkel boat, returning upstream, Kevin Pritch glanced below at nearly a hundred steel stockpiles, leaping onto one small patch of reef. We exchanged concerned looks.

"I make my living diving the boat, and I love it," said Kevin. "But the only way this

place will recover, if it even can, is to treat it like a real park . . . restrict activity in the fragile areas, and let it try to heal."

Kevin is probably right that some parts should be closed. But clearing up the water is the first priority. We will kill the coral reefs if we're not careful, by lowering their silent plight and leaving them to die. □

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## KEY LARGO CORAL REEF

# America's First Undersea Park

By CHARLES M. BROOKFIELD

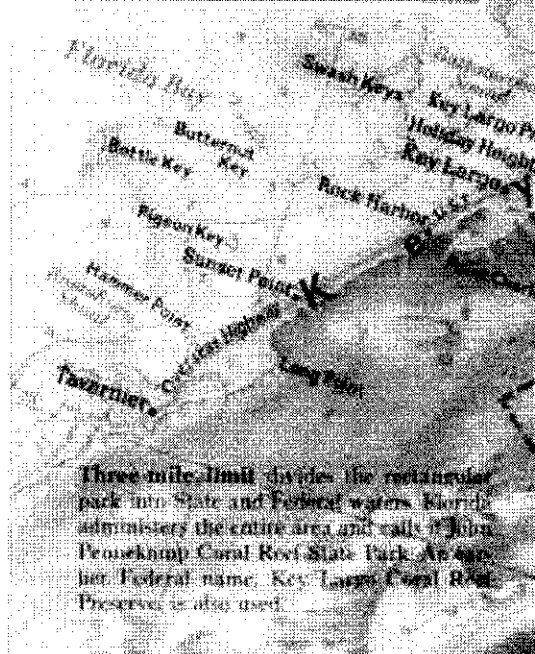
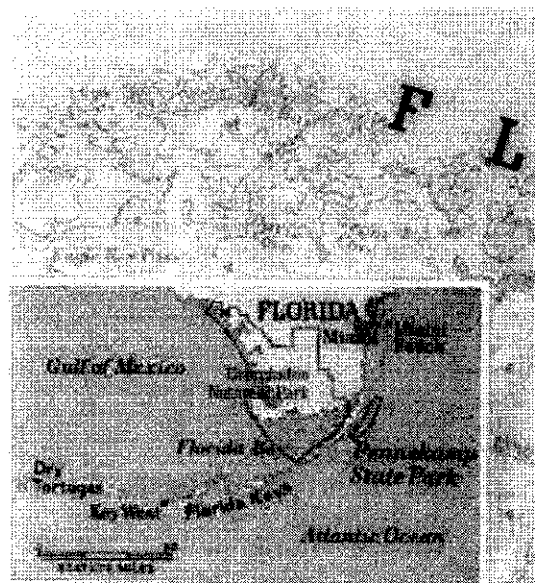
Photographs by JERRY GREENBERG

**A**LMOST within sight of the seaviewside palaces of Miami Beach, a pencil-thin chain of islands begins its 221-mile sweep southwest to the Dry Tortugas.

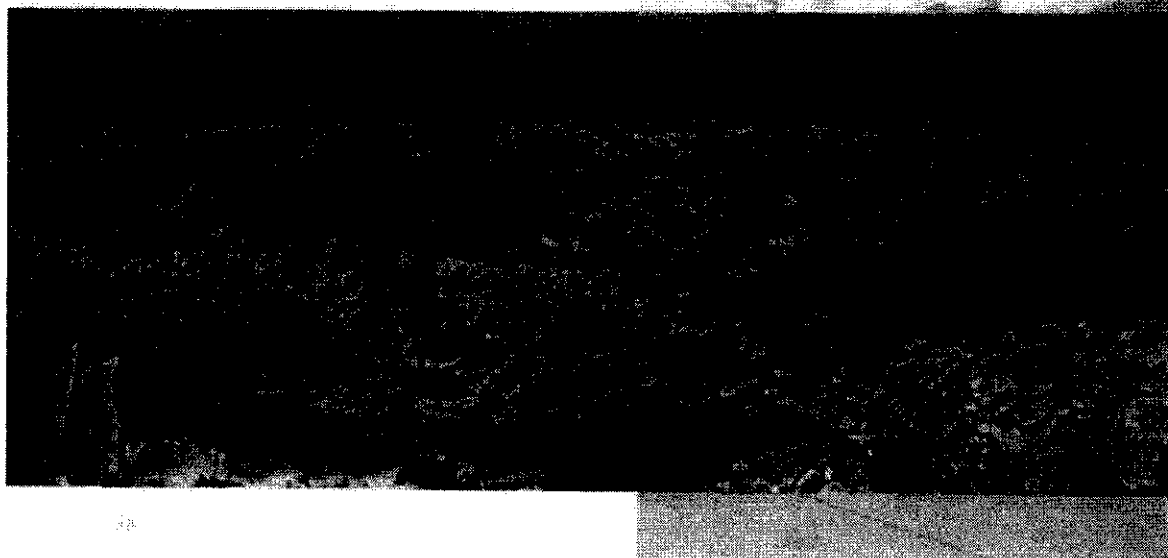
Just offshore, paralleling the semicircular curve of these Florida Keys, lies an undersea rampart of exquisite beauty—a living coral reef, the only one of its kind in United States continental waters. Brilliant tropical fish dart about its multicolored coral gardens. Part of the magnificent reef, a segment roughly 21 nautical miles long by 4 wide, off Key Largo, has been dedicated as America's first undersea park.

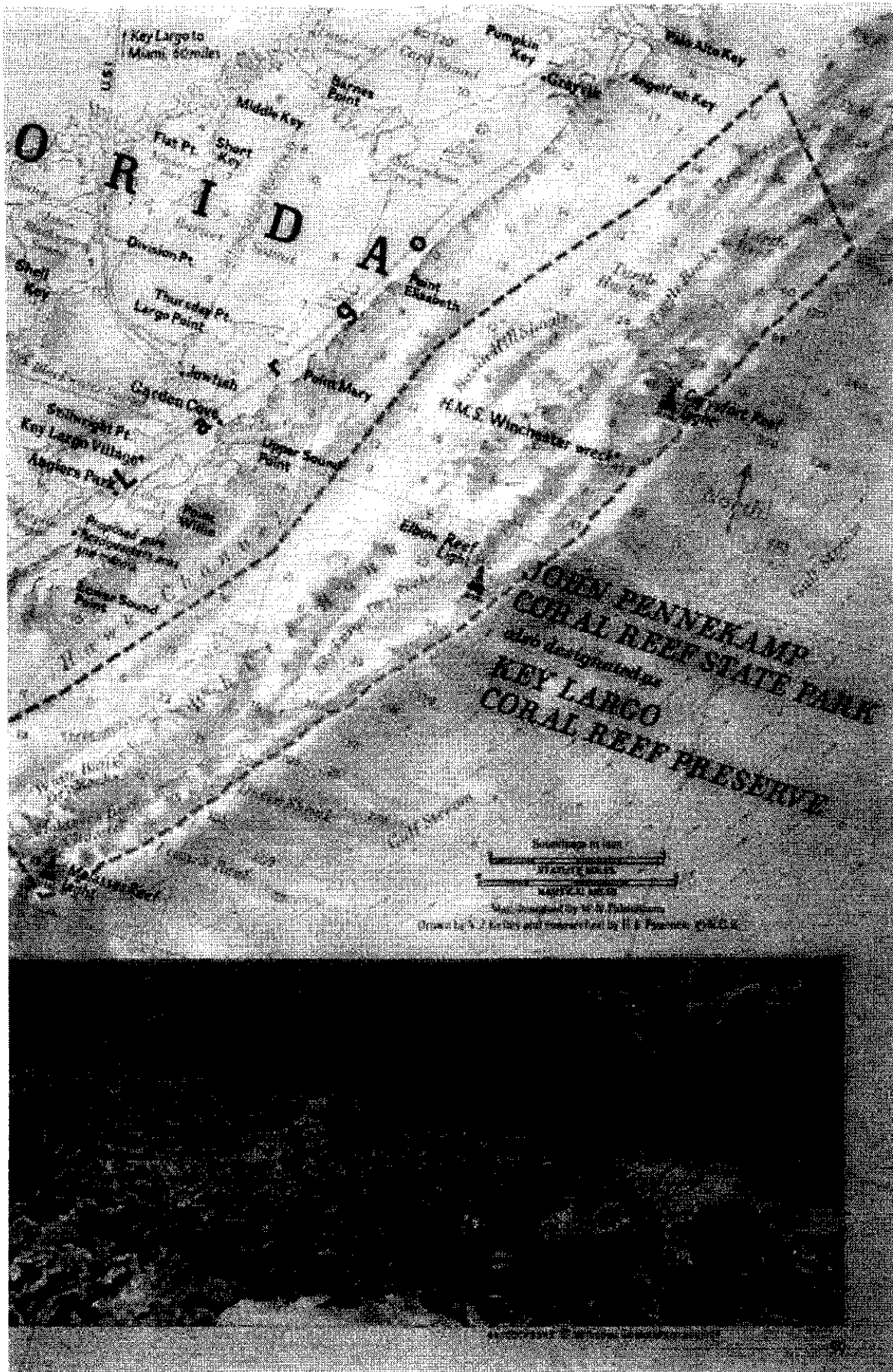
I know this reef intimately. For more than 50 years I have sailed its warm, clear waters and probed its shifting sands and bizarre formations in quest of sunken ships and their treasure of artifacts.

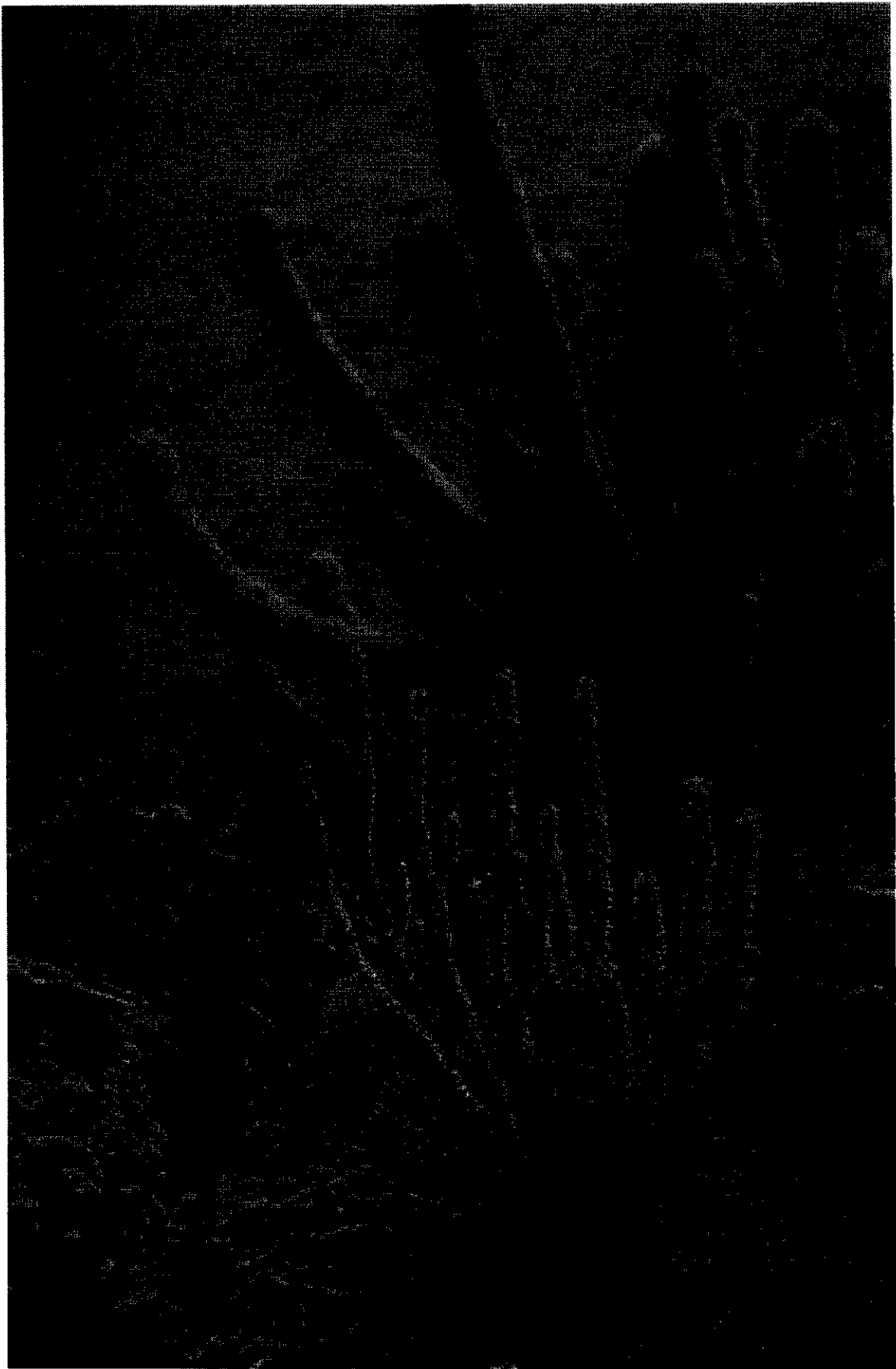
Snorkel diver (topposite, right) glides above brain coral into a fantastic underwater scene of gillbars and staghorns in the new preserve off Key Largo, Florida.



Three mile limit divides the rectangular park into State and Federal waters. Florida administers the entire area and calls it John Pennekamp Coral Reef State Park. An earlier Federal name, Key Largo Coral Reef Preserve is also used.









Here is a gallery of countless bronze sailing ships, Spanish galleons, English ironclad war, pirate vessels, and privateers foundered on the reef's hidden ledge. In the 19th century alone, several hundred vessels met death here, and the wrecking masters of Key West gleaned close to ten million dollars from salvage operations.

In today's salt-water preserve the boundaries are marked by buoys, and visitors eventually will ride glass-bottomed boats above the lovely coral gardens. Even now the more active visitors lasso on snail and storkel and bob face-down in gentle swells for a closer look at patchy reef fish. The most adventurous scuba on breathing units and descend to the beautiful coral world that underwater photographer Jerry Greerberg describes vividly on page 70 to 80.

#### Author Found Wreck of the Winchester

Heavy seas broke directly on the upper coral barrier, where the seaward edge of the reef comes up abruptly from the deeper waters of the Gulf Stream. Here, 13 years ago, I found the scattered remains of H.M.S. Winchester, which went down off Carysfort Reef, five miles east of Key Largo, in 1895.

A British ship of the line with 85 guns and a crew of 350, the square-rigged Winchester fought with the West India Squadron in the war with France, harrying parts of the French islands. Mission accomplished, she refueled at Jamaica, then set sail for England and home. Her voyage—that age-old plagues of the sea—began to lay her crew low. I did not

uncover this interesting fact until two years ago, when I learned that the Winchester's log had been saved. Writing in the Public Record Office in London, I obtained photostatic copies of the last few pages.

On September 13, 1895, the unhappy captain recorded that "... we had not above 7 men Well our Shipp increasing upon us by the water she made in the holds & we lost Distriute of all ability to pump it out our people being all dead and sick."

Ten days later a vicious gale struck the ship off the Florida Keys. With the crew helpless, only a few men able to stand, the Winchester broke her back on the reef.

Key Largo, the nearest land, was inhabited only by fierce Calusa Indians, notorious for practicing human sacrifice and keeping slaves. There was no thought of seeking refuge there. An accompanying vessel rescued eight men—the only survivors.

For 244 years Winchester's guns, some weighing more than two tons, lay five fathoms deep, while shipworms made a sieve of her rotten hull. By 1938, when we located the wreck and raised the cannon, the ship had disintegrated.

Eighteen months ago I paid a return visit to Winchester's grave. With an air lift and free-diving gear, I hoped to recover objects overlooked by previous expeditions. Finding favorable weather, we mechanically cranked cannon-

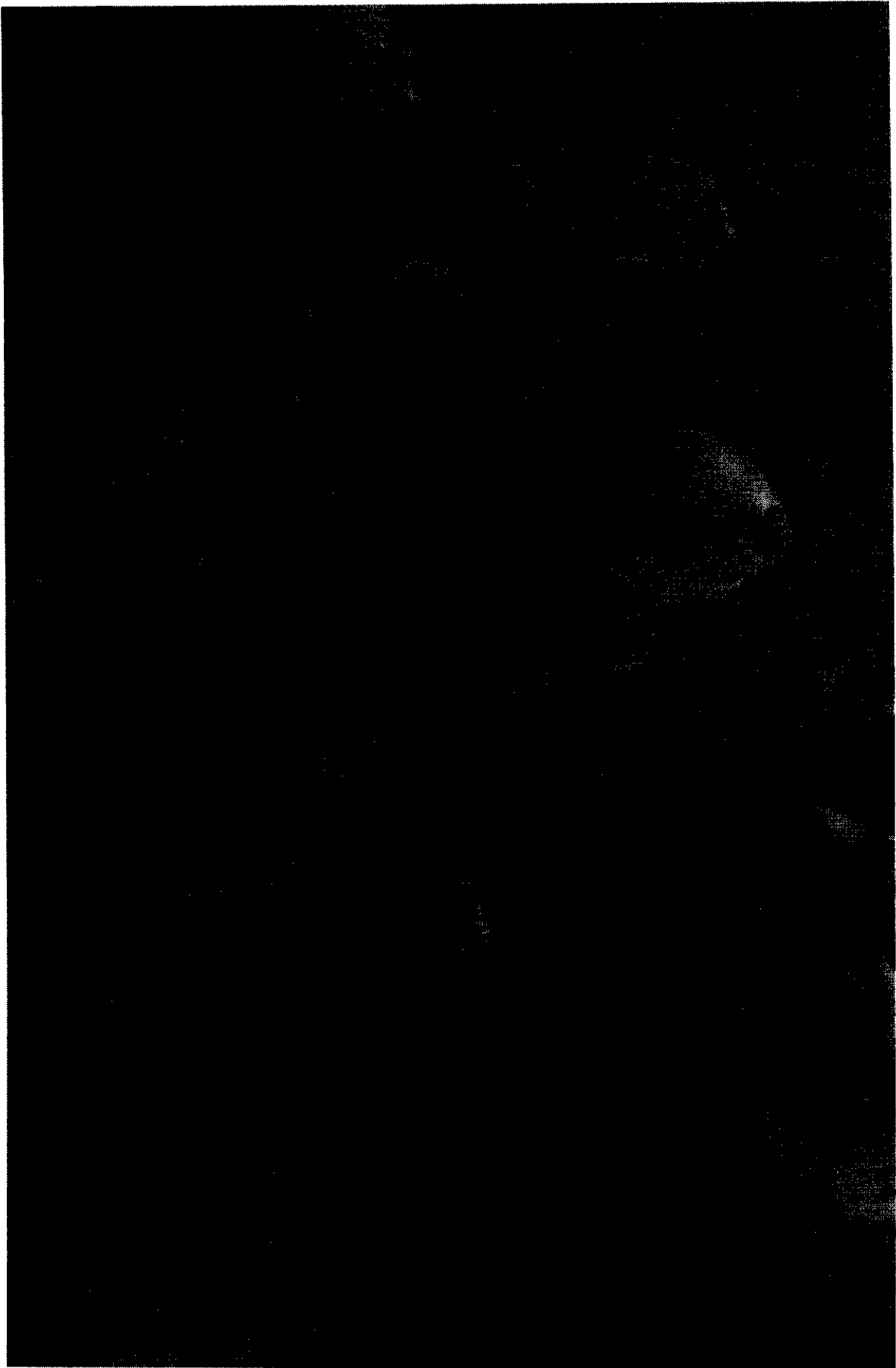
For a description of Winchester's last voyage and the discovery of its wreck, see "Florida's Hidden Silver Mystery of Shipwrecking" by Thomas M. Brinkfield, in the December 1991 National Geographic.

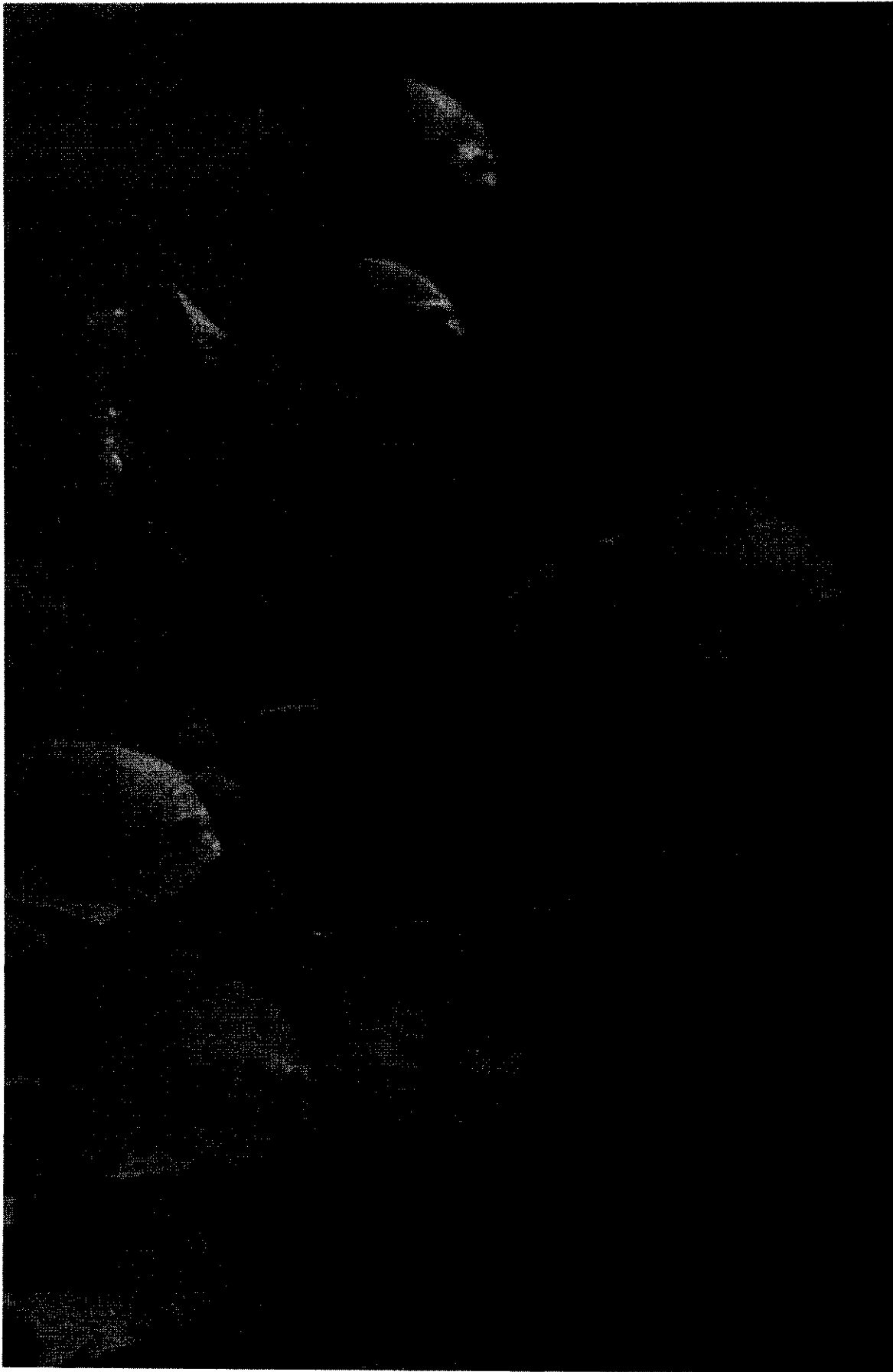
Giant sea whips, or sargassums, seem to float like seaweed in a current forest. Blue-striped green *Sargassum muticum* peeps past the smaller branches below.

Gold watch raised from H.M.S. Winchester, which went down off Carysfort Reef in 1895, shows the hours in Roman numerals and the minutes in Arabic. There's a bump of oak below the bezel in the dial's face in black and white. For 104 years the watch lay on the bottom, sandwiched between iron filings and rock ballast.

When he discovered the Winchester's grave in 1938, the author salvaged cannon, chronometers, a watch, two things, and a compass. It is recounted in the December, 1991 National Geographic. On a return trip 10 years later, this remarkable watch and a magnificent sundial were recovered.







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tools, hinges, spikes, and fittings wrought by 17th-century craftsmen.

One day young Charles H. Baker III papped to the surface with an object wedged in among the ship's ballast. A hammer blow revealed a pocket watch within the black mass. The watch's crystal was broken and its works were filled with grit and sand; but, miraculously, one of the brass wheels still turned on the pivot.

It seemed fitting that young Baker made the discovery. His father was with me when

**The Author:** Florida representative of the National Audubon Society, Charles M. Benckfeld also leads the State Park Board's Advisory Council on Florida Key Sites. A veteran captain of Key Largo's fleet, he found the remains of *H.L.S. Wesseler* there in 1959 (page 10). During World War II he was action in several theaters as an LST skipper.

we raised *Wesseler's* cannon, and the Baker skipper, *Mata Hari*, served as the mother ship of the latest expedition.

A second treasure raised from *Wesseler's* remains was a universal ring sundial, used by mariners in the 17th century.

#### Museum Will Exhibit Relics

Both watch and sundial will be exhibited in a museum which will be constructed in park headquarters on Largo Sound.

Generous citizens have donated 24 acres for exhibit buildings, docks, and launching ramp, and the Florida Legislature has appropriated \$25,000 for the center's development. From the mating, this bottomed boat will make art to the best.

Here soft-bedded coral polyps—tiny submarine empires that build protective cups of lime—dominate the warm waters of the



Half a billion billions of their limestone skeletons form the foundation of the reef; vast colonies of the living coral animals grow on the dead, enclosing a fantastically of strange forms.

Tourists who buy coral at roadside curio shops see only the bleached white skeletons of the once living colony. But a visitor to the reef may find his eye on living corals—the green, brown, and gold of stony corals, the blue, purple, and yellow of coral fans and plumes that sway with the current, the pastel fronds of twinning sea feathers and graceful coral stipes (page 66). Altogether, they form one of nature's grandest shows, a submerginal landscape of awesome beauty.

A project to safeguard this unique underwater world was discussed in a meeting of Florida conservationists in 1937. Dr. Gilbert L. Voss, of the University of Miami Institute

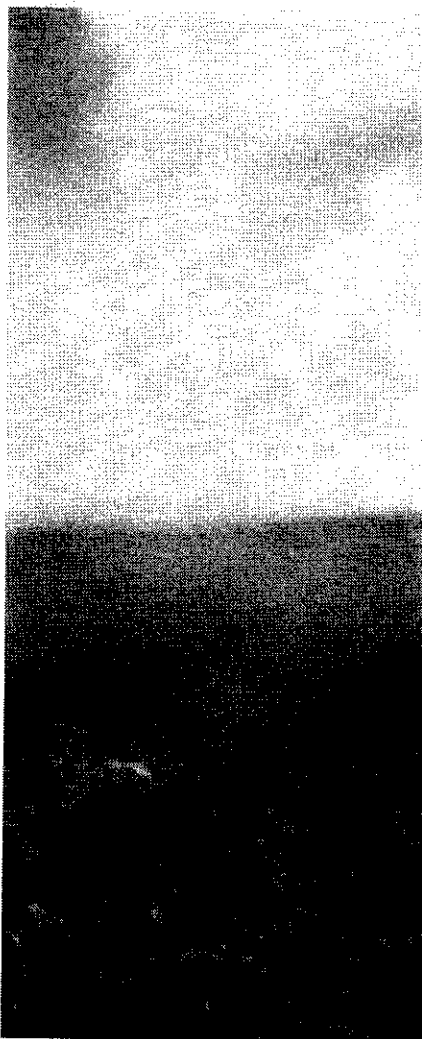
of Marine Science, warned that the gorgeous Florida reef might soon become a watery desert if steps were not taken to protect it.

His statement raised many an eyebrow. "What could destroy a reef?" he was asked. "Man," Dr. Voss replied.

**Coral From Reef Sold to Motorists**

Coral vandals were tearing the reef apart, using dynamite and rowboats. Bargesloads of corals, sponges, and the imposing queen conch shell were piled along the roadsides for sale to motorists. Fish collectors-raided the waters, and sportfishermen scubbed everything that swam or crawled.

Despoliation of the reef would have other consequences, Dr. Voss predicted. The coral gardens would be a haven for small tropical fish and a nursery ground for game fish. Without small fish to feed upon, the game fish



Water-loving Morays, members of a Miami diving club, leap into the Atlantic's gentle surf to observe Morays Reef to explore the sea floor with sharks, mackerel, and tin.

**Head in Air, Body in the Water, a Diver Prepares for an Inspection Tour of Coral Gardens**

Charles H. Boyer III clears his mask and breathing tube next to a boat Light. Rotation is such by water resistance has been about 27 percent. In the interior photograph, the camera was suspended in air and water like the famous fish of Central America when the blue of coral



**Bold white grunt** (*Hammelen-  
blauderi*) inspects a slice of sea-  
urchin held by Jerry Maude  
above a huge brain coral. Tiny  
bluehead wrasses (*Thalassoma  
bifasciatum*) hover near for left-  
overs. Many reef fish show little  
fear of humans.

### Mountains and Valleys Corrugate Brain Coral

Scum gully (*Echinotus acro-  
tus*) darts over the mass, ap-  
proximately three-quarters  
lens-like, at center right. Using  
finned ventral fins shaped like a  
sailboat's, this tiny fish perches  
on coral heads. Scum gully's  
patch resembles from the middle  
and bodies of acropora and  
other polynesian fish.

would go elsewhere. In Florida, where one  
out of four visitors comes for salt-water ang-  
ling, such a shift could be of grave concern.

Dr. Voss's plea spurred other activists  
into action. The Florida Board of Parks and  
Historic Monuments approved a 75-square-  
mile section—10 percent of the entire reef—as  
a permanent preserve. The National Audu-  
bon Society's staff in Miami encouraged  
Floridians to write to the governor and the  
United States Secretary of the Interior.

Because the park's suggested boundaries  
straddle the three-mile line that divides  
State and Federal waters, approval by both  
governments was needed.

Complications delayed the park's birth  
for three years, but in March 1960, President  
Eisenhower proclaimed the Key Largo Coral  
Reef Preserve. At dedication ceremonies the  
following December, Gov. Lewis Collins gave  
the preserve the name of John D. Pennsckamp,  
associate editor of the *Miami Herald* and  
an ardent conservationist. Thus the protect-  
ed area is known by two names, one chosen  
by the Federal Government, the other by  
Florida.

The pen has struck down the desperado  
and exalted those who would conserve.  
Governor Collins, aide of the editor who, in  
the press and in person, has fought more than  
10 years to preserve Florida's natural beauty.

To day the 10-mile stretch of sea in the pre-  
serve is dotted with clustered fishing boats  
trolling the surface and smaller craft of five  
divers floating at anchor. Fleets of flat bot-  
oms

formed clouds sail the horizon. Now and again  
sun birds fly from the armada and hur-  
ries across the sky, darkening the sea with  
its shadow.

Fish-hunting mammals ride the waves,  
and porpoises play leaping with whitecaps.  
A flying fish skirts the sea, and a loggerhead  
turtle pops up for air. Floats bobbing on the  
surface mark the lobster traps of commercial  
fishermen seeking the spiny lobster.

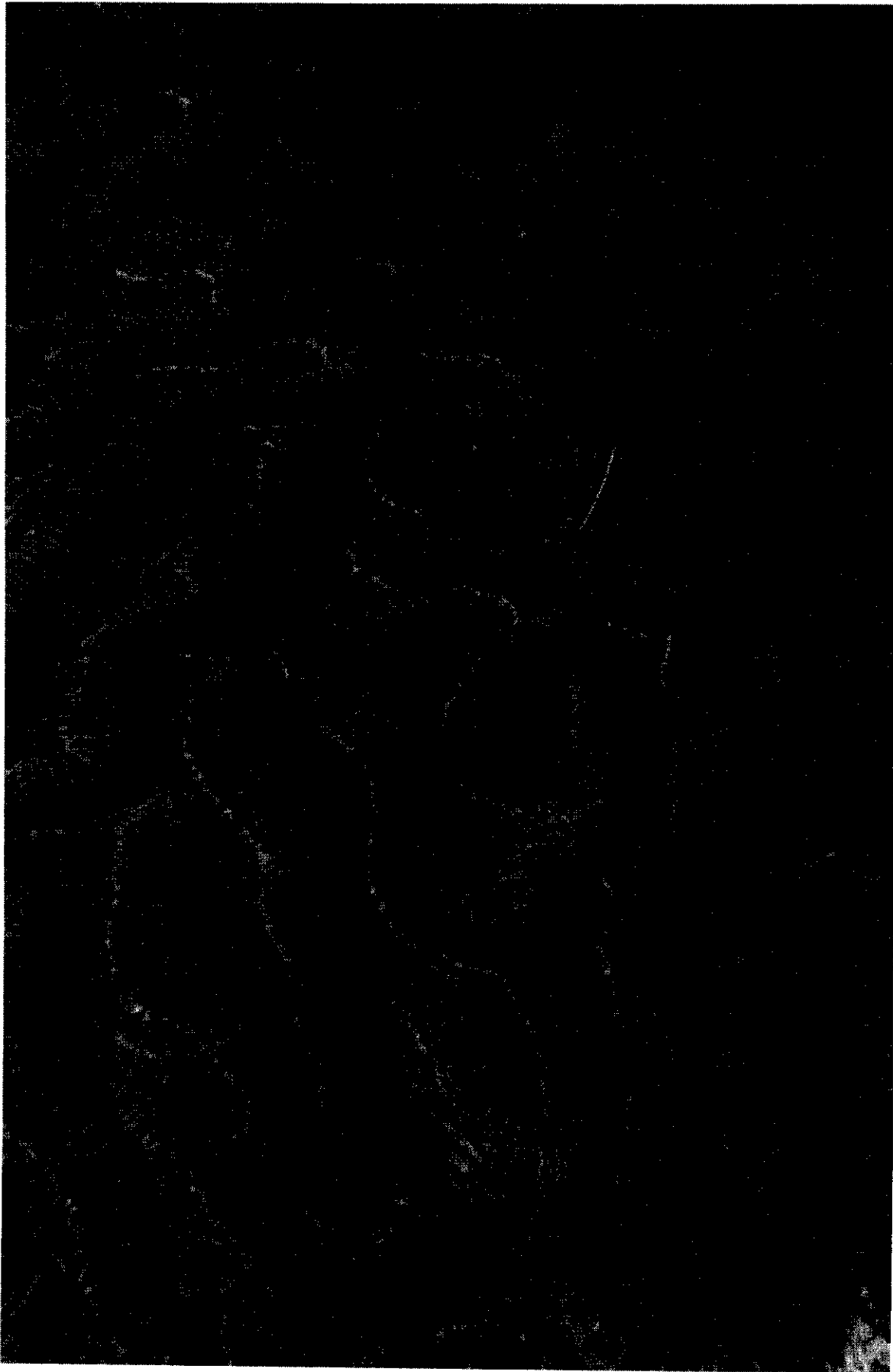
Park rules prohibit spearfishing, but some-  
top rod-and-reel fishing and lobstering, pro-  
vided the ocean floor suffers no damage.

### Reef a Center for Marine Research

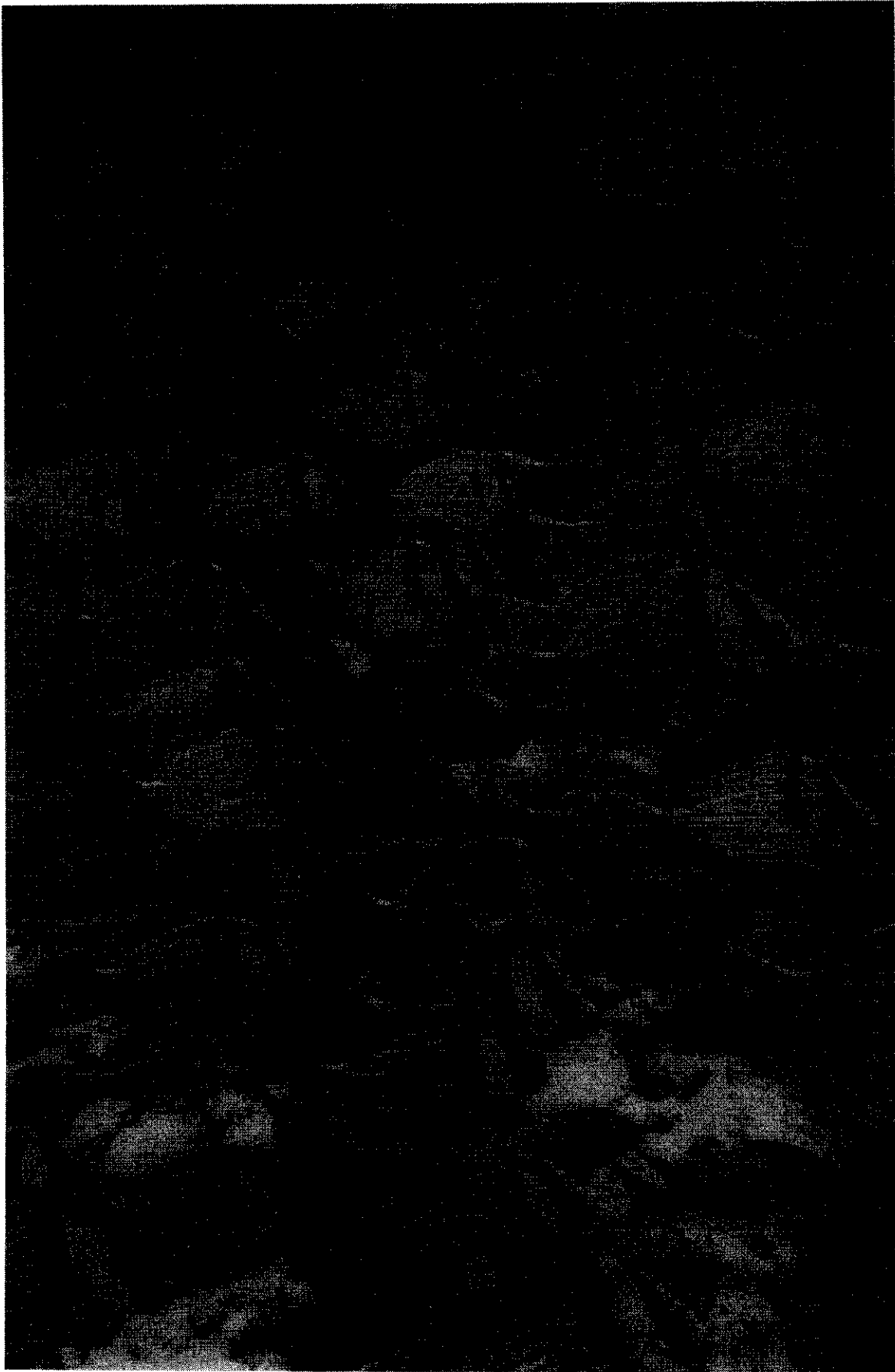
Marine biologists from all parts of the  
world work above and below the reef's sur-  
face. Dr. Voss and his associates at the Uni-  
versity of Miami's Institute of Marine Science  
are carrying on a three-year research project  
to determine how fast corals grow and the  
maximum life a reef can sustain. Aided for  
the past 10 years by the National Geographic  
Society, through its Committee for Research  
and Expedition, they are also studying the  
food-chain relationship between living plants  
and animals, and the movements of fish  
populations.

Other scientists are shedding new light on  
one of nature's most remarkable associations—  
the relationship between the coral polyps  
and herds of tiny plantlike cells that live  
within them.

Some of these microscopic cells contain  
chlorophyll, which tints the soft tissues of the



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and green." Others lend a golden-ligament color to their hosts. These cells benefit from the carbon dioxide and other wastes given off by coral organisms; in turn, they supply the polyps with oxygen. Symbiosis, or their mutually beneficial relationship, is known, stems from a Greek word meaning "to be together."

Close relatives of the true corals, milleporids, or stinging corals, also flourish on the reef. Their stinging cells, reaching human flesh, cause a burning sensation. Many of their colonies have distinctive shapes: brain-like, flat, or helmetlike (page 56).

Altogether, more than 60 different species of coral have been found in this temperate underwater preserve.

Other reservations in the West Indies and Florida include underscen groves, but the new preserve off Key Largo has a fully under-water lighthouse and tide-exposed rocks above break the surface. The three lighthouses straddling the seaward side of the reef—Carysfort (page 64), Elliott, and Molasses—all perch on their piles.

Carysfort, only 140-foot structure within the preserve, is manned by United States Coast Guard men. When I first visited it 35 years ago, the lighthouse service was in charge. Keepers then spent two months on the light for every 10 days on "honeymoon," their limit for shore leave.

I shall never forget my first night on Carysfort. I had gone out with two friends in my cabin cruiser. Munitions, work meat and vegetables for the keeper and his two assistants

#### Captain Johnson's Ghost Gains

At bedtime my companions and I settled on the lower deck of the light's dwelling, but I could not sleep. As I lay restless, a groan echoed through the lower deck.

"Did you hear that?" I asked.

My friends snored blissfully. I had just about convinced myself that my imagination was playing tricks when the moan was repeated, as if from a soul in torment.

Jumping up, I clattered the steps to the upper deck and circled the dark stairs to the prison, where Harry Babbs, one of the

"See How the sun shines late on the sea," is from A. E. Housman's "Introduction," February 1907.

#### Mixed Battalions of Porkfish and Grunts Maneuver in Class-order Drill

Organized by its yellow stripes and black bars, the porkfish (*Centrocyttus argenteus*) often travels with its relative, the white grunt. Like many reef fish, both species feed by sight. This school will disband when the members go foraging for food.

Photo courtesy of the author.

assistants, was standing with it at the lantern.

"Harry," I pointed, "have your eyes heard any funny noises down below?"

"Oh, sure," he said, "but we don't pay attention to 'em any more. It's only Captain Johnson, and he just comes around to see if all's well. He died out here on the light, you know. Must have been a great sinner; he groans so. Sometimes he rattles his chains."

Thus reassured—I use the word loosely—I went below and slept, groans or no groans.

Next morning I solved the mystery of the moans, I believe. Under the hot sun, the tower's iron walls expand; in the cool of darkness, they contract. Shrinking, they make sounds startlingly human. My theory may not be true, but I have clung to it ever since.

#### Seminole Ambrush Lightship Crew

Closest of the reef lighthouses, Carysfort was first lighted in 1854. But for more than a quarter of a century before that, a lightship had been stationed within the reef. Since the main source of supply for the crew was Key West, about 100 miles away, they cultivated vegetables in a little harbor they called Garden Cove, or near-by, Key Largo.

One fine day in 1847, Capt. John Wharton and three of his crew hoisted boats and headed for Key Largo to gather firewood. The Seminole Indians had been on the warpath in southern Florida for some time, but there had been no recent attacks on the Keys. It seemed safe enough to go ashore for a few hours.

But dark, frosty eyes watched from ambush as the boats beached. Without warning the Indians attacked, and the captain and one of his crew were killed. The two other men escaped with the boats.

In that earlier tragedy, when the warship *Whitbread's* keel struck Key Largo's coral barrier, the crew thought only of cruel rocks and surging seas. Crushing timbers were falling all about them, and the sea was rushing in through gaping holes in the ship's bottom. Soon the scalding waters brought merciful death.

No man aboard the ill-fated vessel could have dreamed that the treacherous reef possessed a rare beauty which man would one day deem worthy of preservation.

# Florida's Coral City

Article and photographs  
by JERRY GREENBERG

*Exploring the wonders of the reef,  
a diver finds another world and  
photographs its denizens in color*

**"B**UT THE SHARKS... aren't you afraid of the sharks?" This is a familiar question. My answer is "No," with some reservations.

When working under water, I regard sharks as the man in the jungle does the tiger, or the midtown pedestrian does the reckless driver. I know they are there; sometimes I see them. But I go out of my way to avoid them.

For more than 10 years, I have been diving

Lemon shark, 10 feet of malevolence, seizes



## ANNOUNCEMENT.

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THE "NATIONAL GEOGRAPHIC SOCIETY" has been organized "to increase and diffuse geographic knowledge," and the publication of a Magazine has been determined upon as one means of accomplishing these purposes.

It will contain memoirs, essays, notes, correspondence, reviews, etc., relating to Geographic matters. As it is not intended to be simply the organ of the Society, its pages will be open to all persons interested in Geography, in the hope that it may become a channel of intercommunication, stimulate geographic investigation and prove an acceptable medium for the publication of results.

The Magazine is to be edited by the Society. At present it will be issued at irregular intervals, but as the sources of information are extended the numbers will appear periodically.

The National Capital seems to be the natural and appropriate place for an association of this character, and the aim of the founders has been, therefore, to form a National rather than a local society.

As it is hoped to diffuse as well as to increase knowledge, due prominence will be given to the educational aspect of geographic matters, and efforts will be made to stimulate an interest in original sources of information.

In addition to organizing, holding regular fortnightly meetings for presenting scientific and popular communications, and entering upon the publication of a Magazine, considerable progress has been made in the preparation of a Physical Atlas of the United States.

The Society was organized in January, 1888, under the laws of the District of Columbia, and has at present an active membership of about two hundred persons. But there is no limitation to the number of members, and it will welcome both leaders and followers in geographic science, in order to better accomplish the objects of its organization.

October, 1888.

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Correspondence with the Society should be addressed to Mr. GEORGE KISSAN, Corresponding Secretary, No. 1318 Massachusetts Avenue, Washington, D. C.

THE  
NATIONAL GEOGRAPHIC MAGAZINE.

Vol. 1.

1888.

No. 1.

INTRODUCTORY ADDRESS.

BY THE PRESIDENT, MR. CLARENCE G. HUBBARD.

I AM NOT a scientific man, nor can I lay claim to any special knowledge that would entitle me to be called a "Geographer." I owe the honor of my election as President of the National Geographic Society simply to the fact that I am one of those who desire to further the prosecution of geographic research. I possess only the same general interest in the subject of geography that should be felt by every educated man.

By my election you notify the public that the membership of our Society will not be confined to professional geographers, but will include that large number who, like myself, desire to promote special researches by others, and to diffuse the knowledge so gained among men, so that we may all know more of the world upon which we live.

By the establishment of this Society we hope to bring together (1) the scattered workers of our country, and (2) the persons who desire to promote their researches. In union there is strength, and through the medium of a national organization, we may hope to promote geographic research in a manner that could not be accomplished by scattered individuals, or by local societies; we may also hope—through the same agency—to diffuse the results of geographic research over a wider area than would otherwise be possible.

## KEY LARGO CORAL REEF

# America's First Undersea Park

By CHARLES M. BROOKFIELD

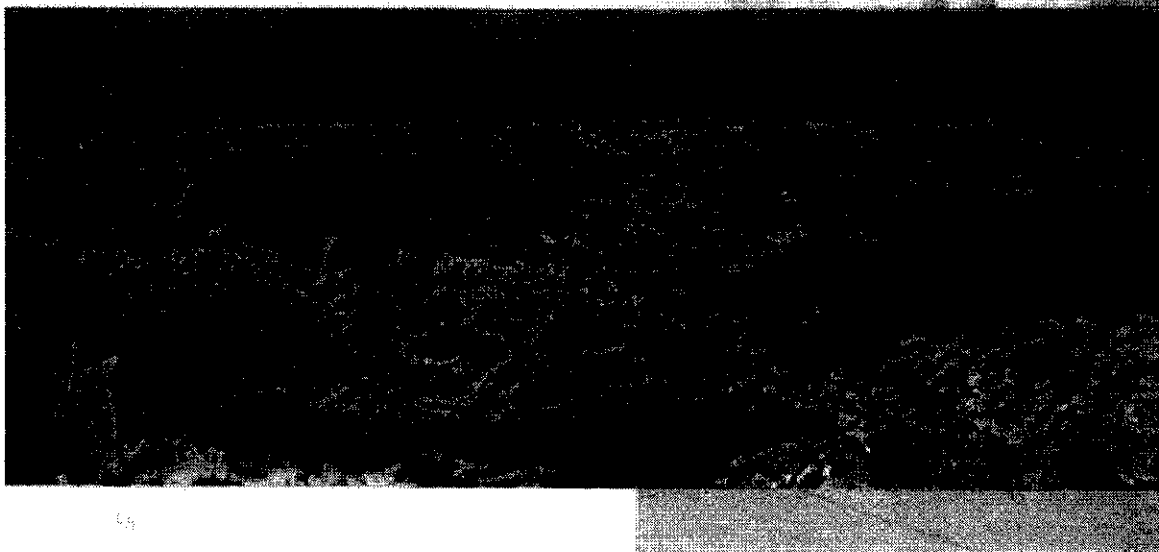
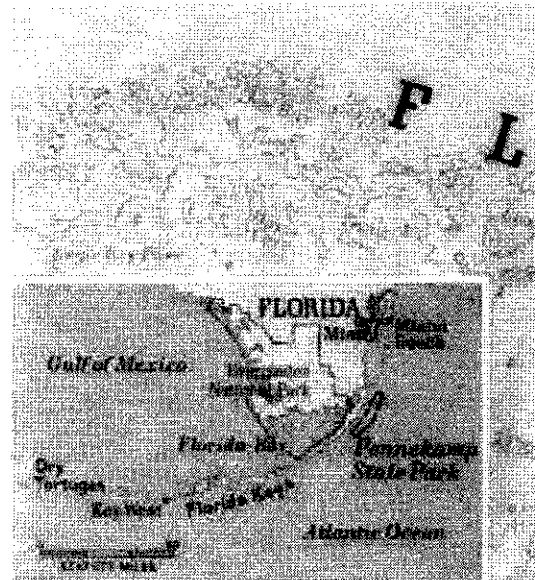
Photographs by JERRY GREENBERG

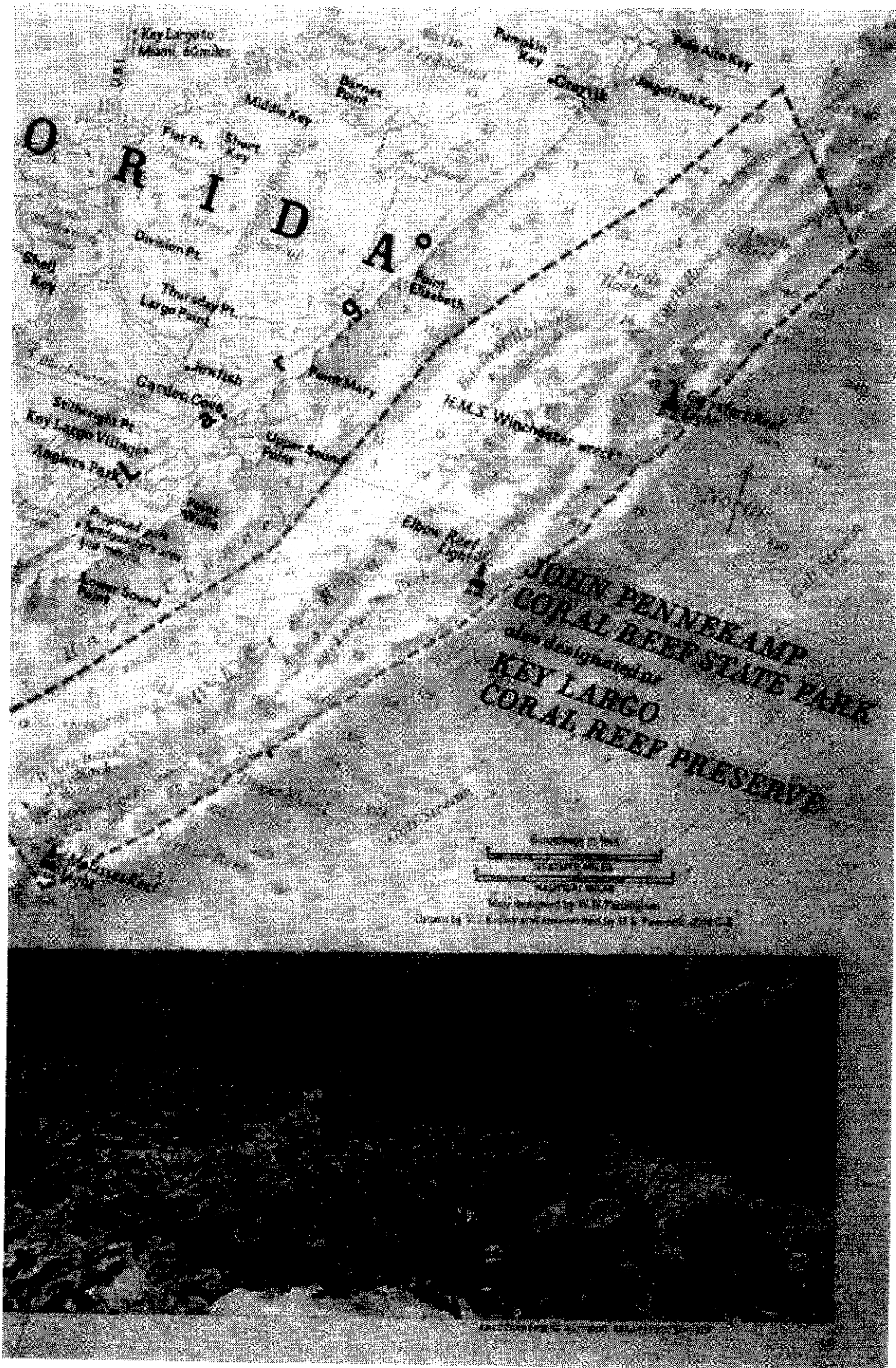
**A**LMOST within sight of the ocean-side palaces of Miami Beach, a pencil-thin chain of islands begins its 231-mile sweep southwest to the Dry Tortugas.

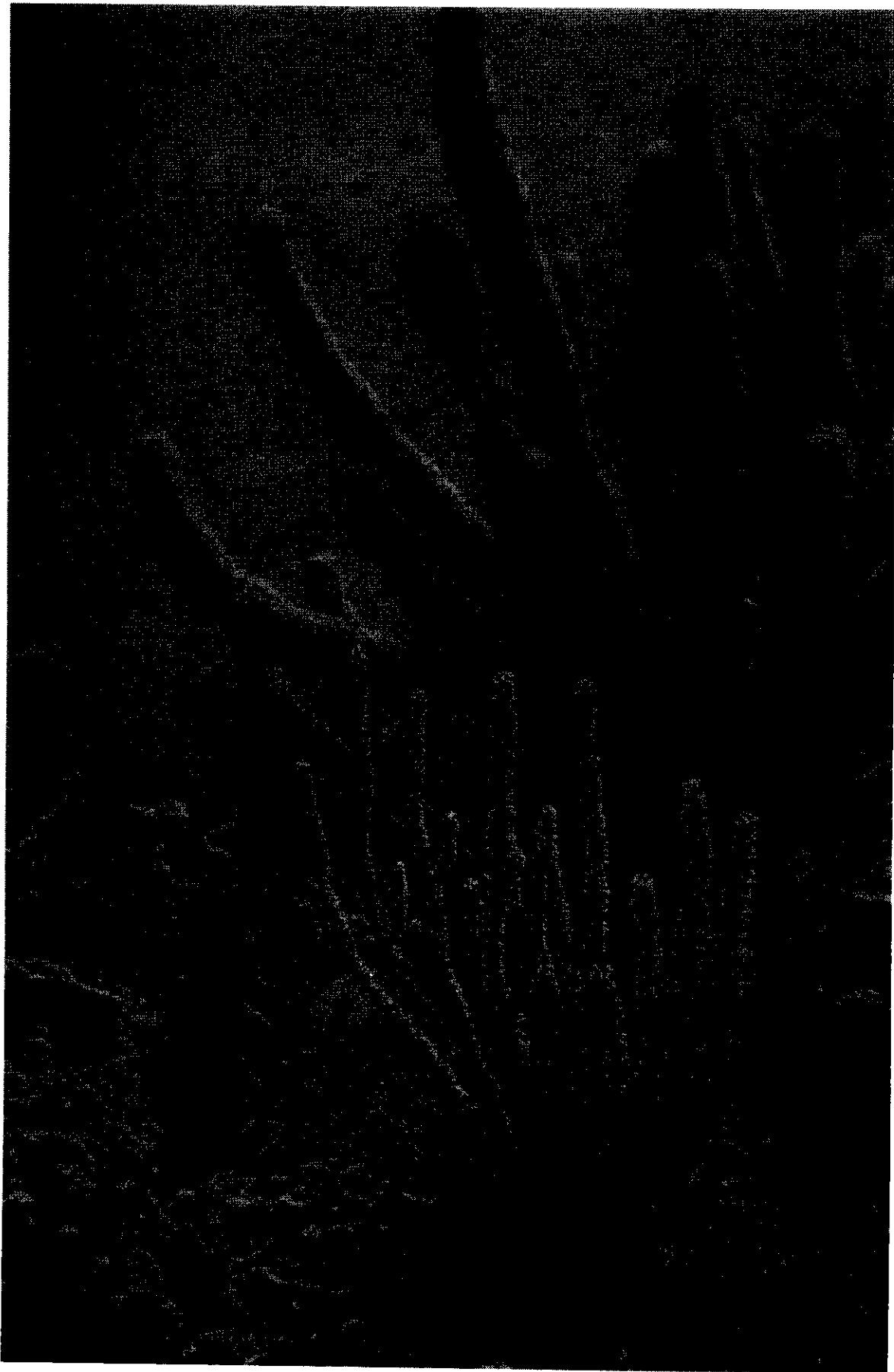
Just offshore, paralleling the scimitar curve of these Florida Keys, lies an undersea rampart of exquisite beauty—a living coral reef, the only one of its kind in United States continental waters. Brilliant tropical fish dart about its multicolored coral gardens. Part of the magnificent reef, a segment roughly 21 nautical miles long by 4 wide, off Key Largo, has been dedicated as America's first undersea park.

I know this reef intimately. For more than 50 years I have sailed its warm, clear waters and probed its shifting sands and bizarre formations in quest of sunken ships and their treasure of artifacts.

Snorkel diver opposite, right (clockwise above from coral) into a fantastic undersea arc of spherules and stalagmites in the best preserve off Key Largo, Florida.







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Here is a graveyard of countless slave sailing ships. Spanish galleons, English men-of-war, pirate vessels, and privateers foundered on the reef's hidden ledge. In the 19th century alone, several hundred vessels met death here, and the wrecking masters of Key West gleaned close to ten million dollars from salvage operations.

In today's salt-water preserve the boundaries are marked by buoys, and visitors eventually will dive glass-bottomed boats above the lovely coral gardens. Even now the more intrepid visitors lurch on masks and snorkels and bob face-down in gentle swells for a closer look at gnarly reef fish. The most adventurous strap on breathing units and descend to the beautiful coral world that underwater photographer Jerry Greenberg describes vividly on pages 73 to 84.

#### Author Found Wreck of the *Winchester*

Heavy seas break directly on the outer coral barrier, where the seaward edge of the reef catches up abruptly from the deeper waters of the Gulf Stream. Here, 23 years ago, I found the scattered remains of H.M.S. *Winchester*, which went down off Charleston Reef, five miles east of Key Largo, in 1875.\*

A British ship of the line with 60 guns and a crew of 350, the square-rigged *Winchester* fought with the West India Squadron in the war with France, harrying ports of the French Islands. Mission accomplished, she refueled at Jamaica, then set sail for England and home. But scurvy—that age-old plague of the sea—began to lay her crew low. I did not

uncover this interesting fact until two years ago, when I learned that the *Winchester's* log had been saved. Writing to the Public Record Office in London, I obtained photostatic copies of the last few pages.

On September 19, 1875, the unhappy captain recorded that "... we had not above 7 men Well our Ship increasing upon us by the water she made in the hold & we left Distrate of all ability to put it out our people being all dead and Sick ..."

Ten days later a vicious gale struck the ship off the Florida Keys. With the crew helpless, only a few men able to stand, the *Winchester* broke her back on the reef.

Key Largo, the nearest land, was inhabited only by fierce Calusa Indians, notorious for practicing human sacrifice and keeping slaves. There was no thought of seeking refuge there. An accompanying vessel rescued eight men—the only survivors.

For 23 years *Winchester's* guns, some weighing more than two tons, lay five fathoms deep, while shipworms made a sieve of her rotten hull. By 1900, when we located the wreck and raised the cannon, the ship had disintegrated.

Eighteen months ago I paid a return visit to *Winchester's* grave. With an air lift and free-diving gear, I hoped to recover objects overlooked by previous expeditions. Fortune favored us. We raised coral-encrusted cannons

\*For a description of *Winchester's* last voyage and the discovery of her wreck, see "Warship Cannon Sinks: Mystery of Sunk Ship," by Charles M. Henshew, in the December 1964 *NATIONAL GEOGRAPHIC*.

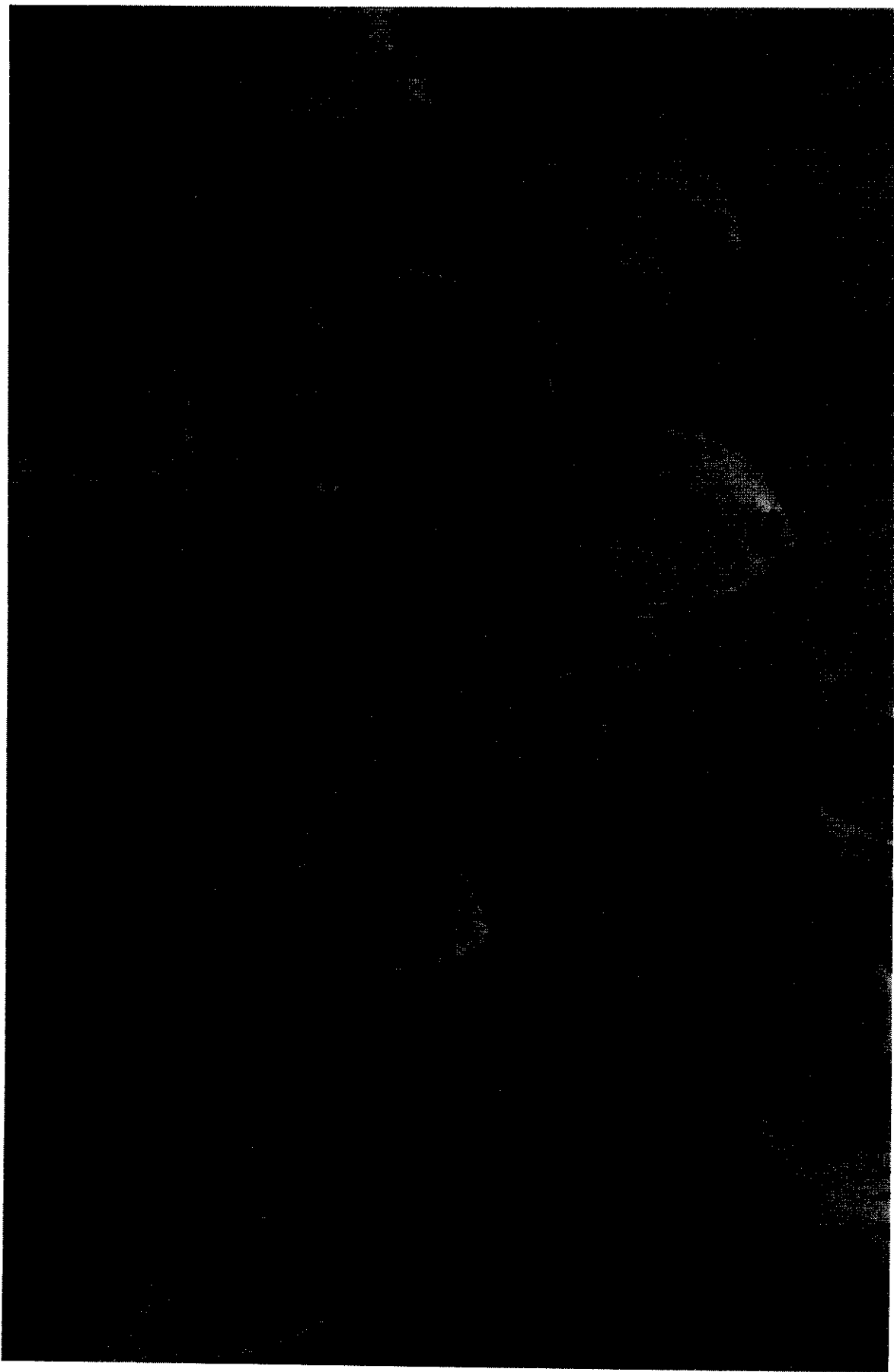
**Giant sea slugs**, or gastropods, bask in the sun like anguilles in a sandy lane. Their striped girths offer males a campsite and the females a theater box.

**Gold watch** raised from H.M.S. *Winchester*, which went down off Charleston Reef in 1875, shows the bones of Roman numerals and the minutes in Arabic. Here a lump of rock bears the imprint of the ship's logo in black and white. For 23 years the watch lay on the bottom, sandwiched between an iron fitting and rock ballast.

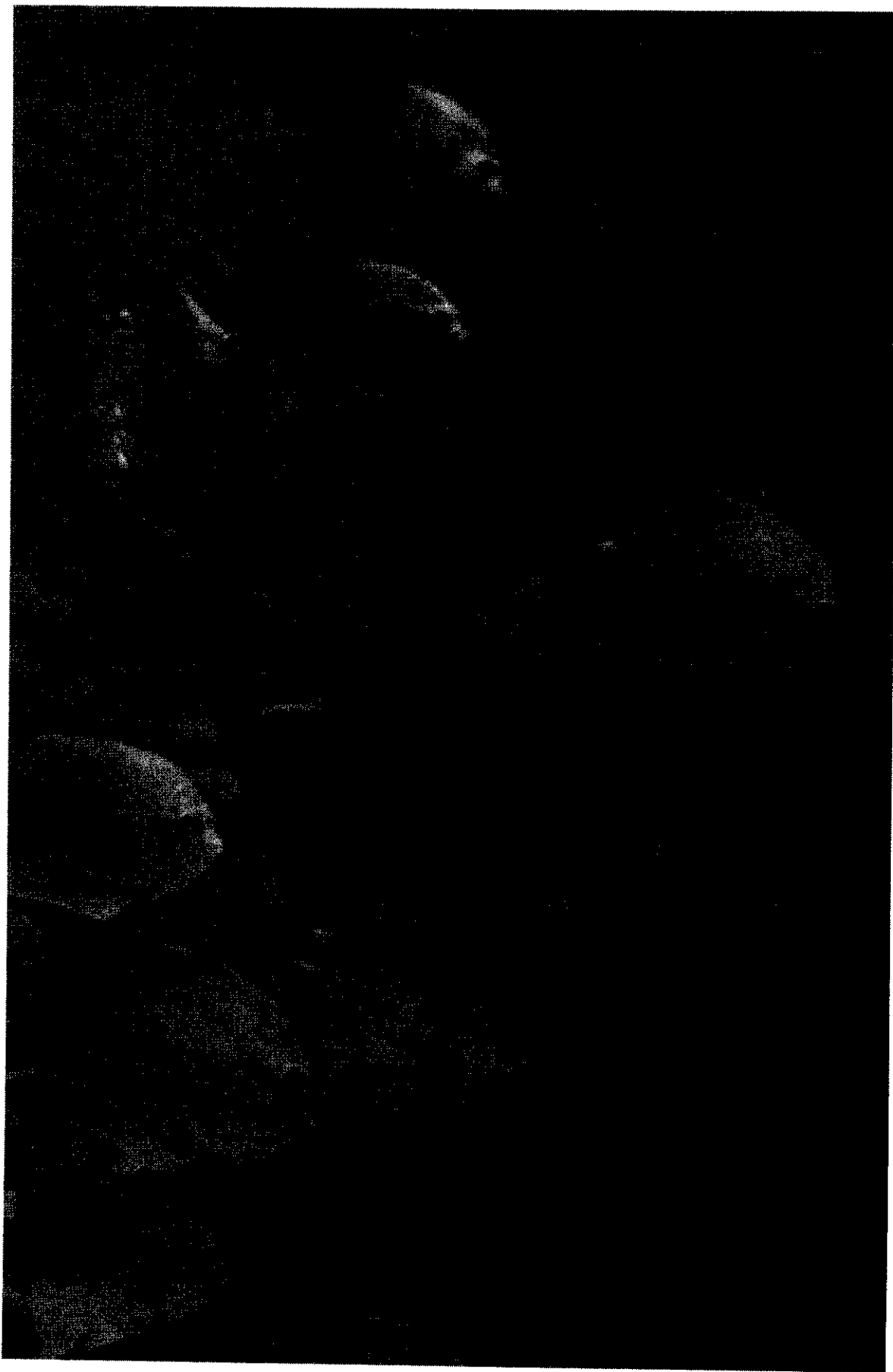
When we discovered the *Winchester's* grave in 1950, the antique salvaged cannon, cannonballs, wrought-iron fittings, and a brass ballast, as recorded in the log-entries, 1941 *NATIONAL GEOGRAPHIC*. On a return visit 20 years later this remarkable watch and accompanying shellfish were discovered.



REMARKABLE WATCH WAS DISCOVERED BY CHARLES M. HENSHAW IN 1970. IT WAS FOUND ON A CORAL REEF OFF KEY LARGO, FLORIDA.



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nails, hinges, spikes, and fittings wrought by 17th-century craftsmen.

One day, young Charles H. Baker III popped to the surface with an object wrapped in kumpe of the ship's hullast. A hammer blow revealed a metal watch within the black mass. The watch's crystal was broken and its works were filled with grit and sand, but, miraculously, one of the brass wheels still turned on the pivots.

It seemed fitting that young Baker made the discovery. His father was with me when

The Author Florida representative of the National Audubon Society, Charles M. Brasakoff, also heads the State Park Board—Advisory Council on Florida Key Sites. A representative of Key Largo's park, he found the remains of H.M.S. *Witchester* there in 1940. In 1941, during World War II, he was better informed of the area as an L-5 skipper.

recognized *Witchester's* position and the Baker ship, *Mara Ware*, served as the mother ship of the latest expedition.

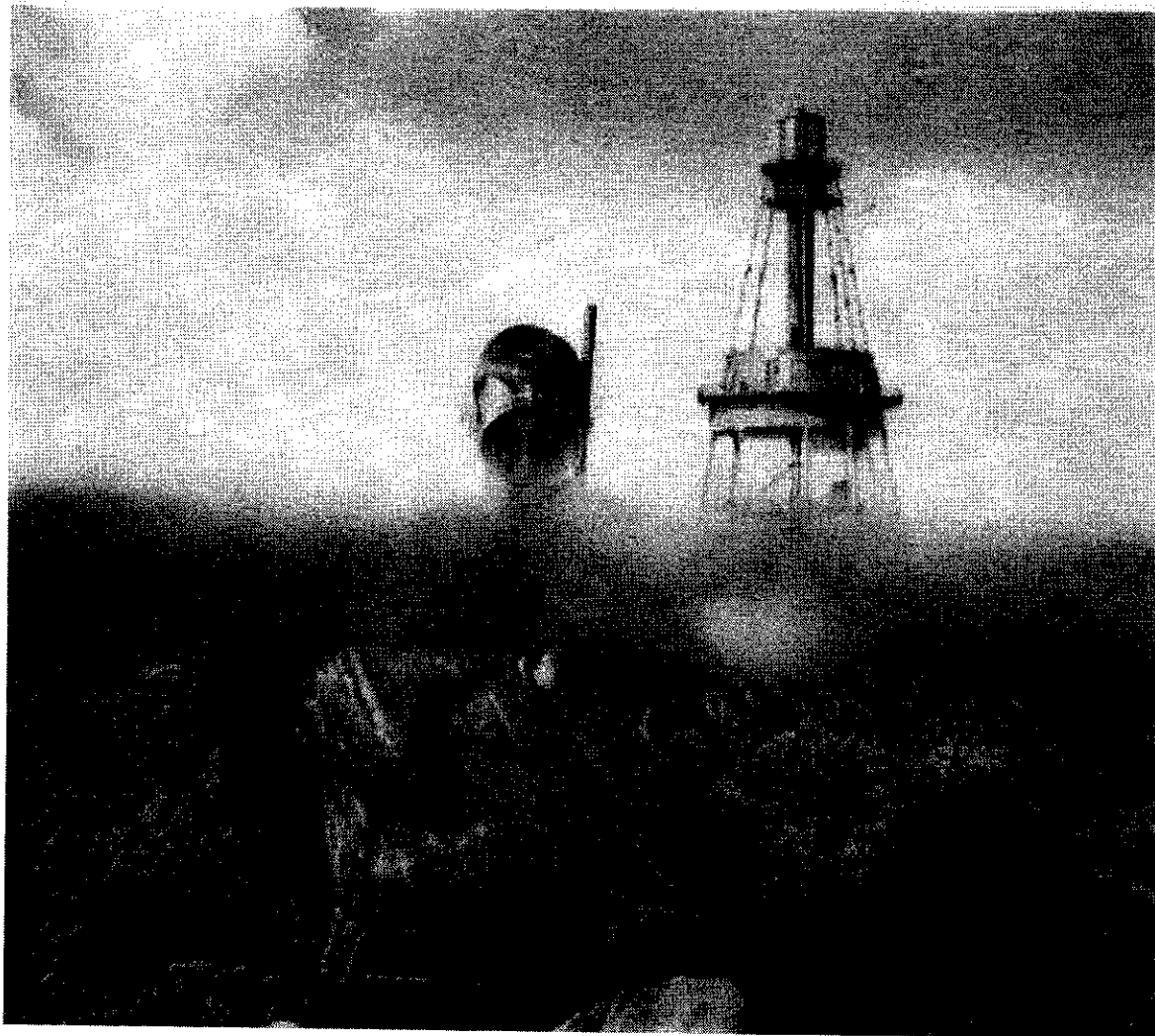
A second treasure raised from *Witchester's* remains was a metal oval ring sundial, used by mariners in the 17th century.

#### Museum Will Exhibit Belies

Both watch and sundial will be exhibited at a museum which will be constructed in park headquarters on Largo Sound.

Generous citizens have donated 74 acres for exhibit buildings, docks, and launching ramps, and the Florida Legislature has appropriated \$150,000 for the center's development. From the marina, glass-bottomed boats will cruise out to the reef.

Here soft-headed coral polyps—tiny animal-like creatures that build protective cups of lime—bloom in the warm waters of the



Gulf Stream. Billions of their limestone skeletons form the foundations of the reef, vast colonies of the living coral animals grow on the dead, fashioning a fantastically strange forms.

Tourists who buy coral in variable curio shops see only the bleached white skeletons of the once-living colony. But it is as if the reef may feast its eye on living colors—the green, brown, and rust of stony corals, the blue, purple, and yellow of coral fans and pillars that sway with the current, the pastel fronds of floating sea feathers and graceful sand shrimp and fish. Altogether, they form one of nature's grandest—how can we describe the landscape of an aquatic beauty.

A preservative to safeguard this unique underwater world was discussed at a meeting of Florida conservationists in 1957. Dr. Gilbert F. Voss, of the University of Miami's Institute

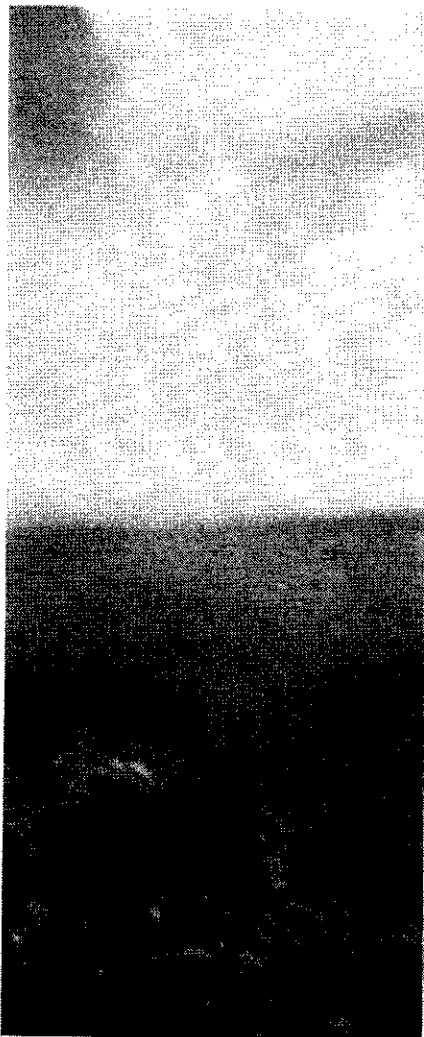
of Marine Science, warned that the magnificent Florida reef might soon become a watery desert if steps were not taken to protect it.

His statement raised many an eyebrow. "What could destroy a reef?" he was asked. "Man," Dr. Voss replied.

**Coral From Reef Sold to Motorists**

Curio vendors were tearing the reef apart, using dynamite and crowbars. Hundreds of corals, sponges, and the imposing queen conch shell were piled along the roadsides for sale to motorists. Fish collectors raided the waters, and sportfishermen snatched anything that swam or crawled.

Despoliation of the reef would have other consequences. Dr. Voss predicted. The coral gardens served as a haven for small tropical fish and divers around the game fish. Without small fish to feed upon, the game fish



Water-loving Morays, members of a Miami diving club, inspect the Atlantic's gentle waves above Molasca Reef to examine the sea fans with intricate, mesh-like arms.

**Head in Air, Body in the Water, a Diver Prepares for an Inspection Tour of Coral Gardens**

Charles H. Baker II dives into waves and breathes the first breath of light. Rotation of body in water magnifies his body about 25 percent. In this unusual photograph, the moment is captured simultaneously in air and water. Like the famous Arch of Central America, which has coral at its top.



**Bald white grunt** (*Hammulon phasianus*) inspects a piece of sea anemone held by Judy Murdie above a huge brain coral. Tiny bluehead wrasses (*Thalassoma bifasciatum*) hover near for leftovers. Many reef fish show little fear of humans.

### Mountains and Valleys Corrugate Brain Coral

Scrub gobies (*Elinoptera rubrocapa*) dart over the square top, presumably three-quarters life size at center crest. Upright based central fins shaped like a suction cup, that top fish perches on small heads. Scrub gobies which migrate from the roadside and borders of groupers and other predatory fish.

would be elsewhere in Florida, where one out of four visitors comes for salt-water angling, such a shift could be of major concern.

Dr. Vesely's plea spurred observations into action. The Florida Board of Parks and Historic Memorials approved a 23-square-mile section—10 percent of the entire reef—as a permanent preserve. The National Audubon Society's staff in Miami encouraged Vesely's to write to the governor and the United States Secretary of the Interior.

Because the park's suggested boundaries straddled the three-mile line that divides State and Federal waters, approval by both governments was needed.

Complications delayed the park's birth for three years, but in March, 1960, President Eisenhower proclaimed the Key Largo Coral Reef Preserve. At dedication ceremonies the following December Gov. Levey Collins gave the preserve the name of John D. Pennekamp, associate editor of the *Miami Herald* and an ardent conservationist. Thus the protected area is known by two names, one chosen by the Federal Government, the other by Florida.

"His pen has struck down the desperado and enthralled those who would conserve," Governor Collins said of the editor who, in the press and in person, has fought since then 10 years to preserve Florida's natural beauty.

Today the 10-mile stretch of sea in the preserve is dotted with chattered fishing boats trailing the surface and smaller craft of free divers floating at anchor. Fleets of Ray-bat-

toned clouds sail the horizon. Now and again one breaks away from the armada and scurries across the sky, darkening the sea with its shadow.

Fish-hunting excitement ride the waves, and porpoises play leaping with whitecaps. A dying fish skims the sea, and a loggerhead turtle pops up for air. Boats bobbing on the surface mark the lobster traps of commercial fishermen seeking the spiny lobster.

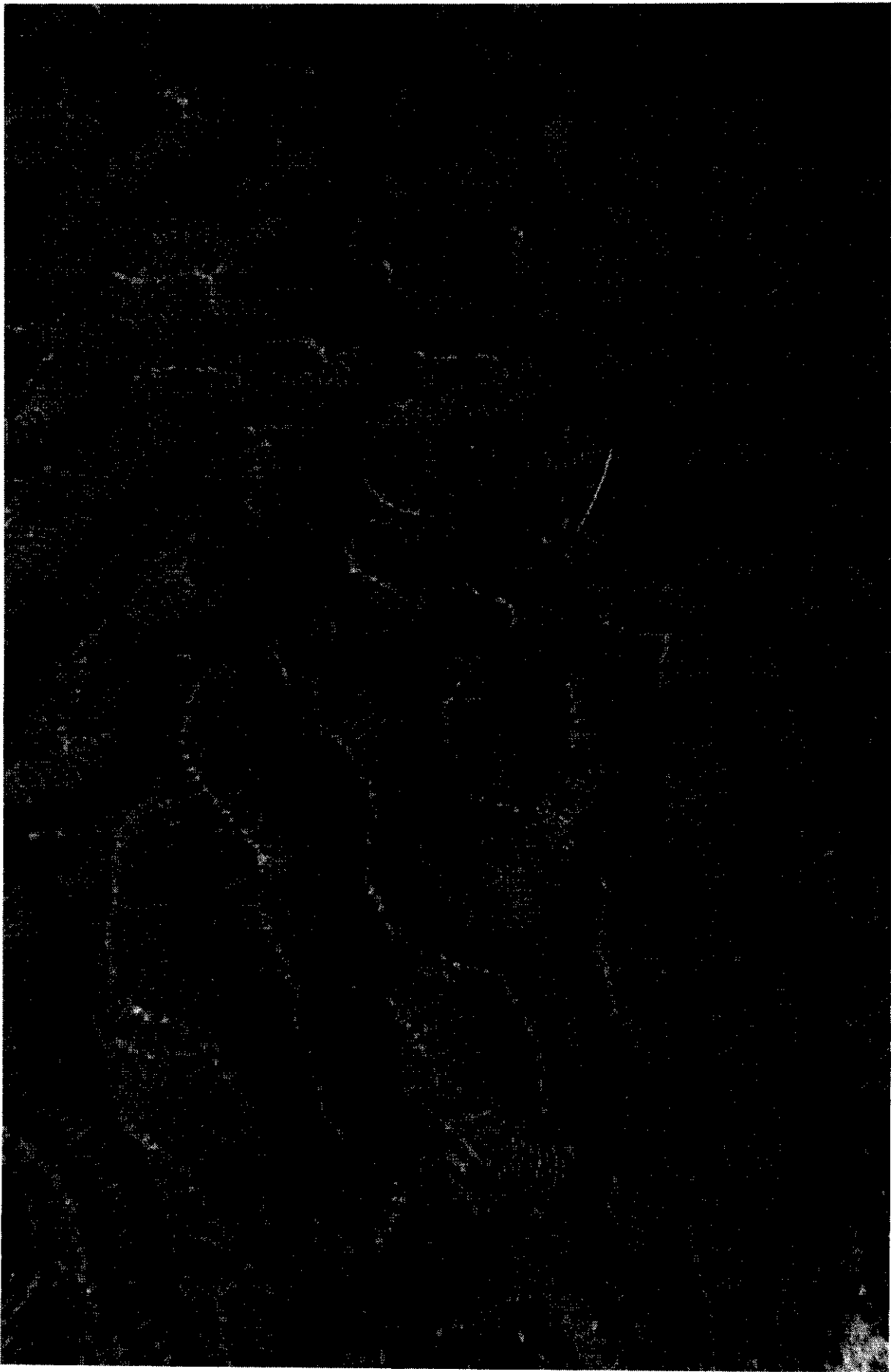
Park rules prohibit spearfishing, but some-thing rod-and-reel fishing and lobstering attended the ocean from surface to bottom.

### Reef a Center for Marine Research

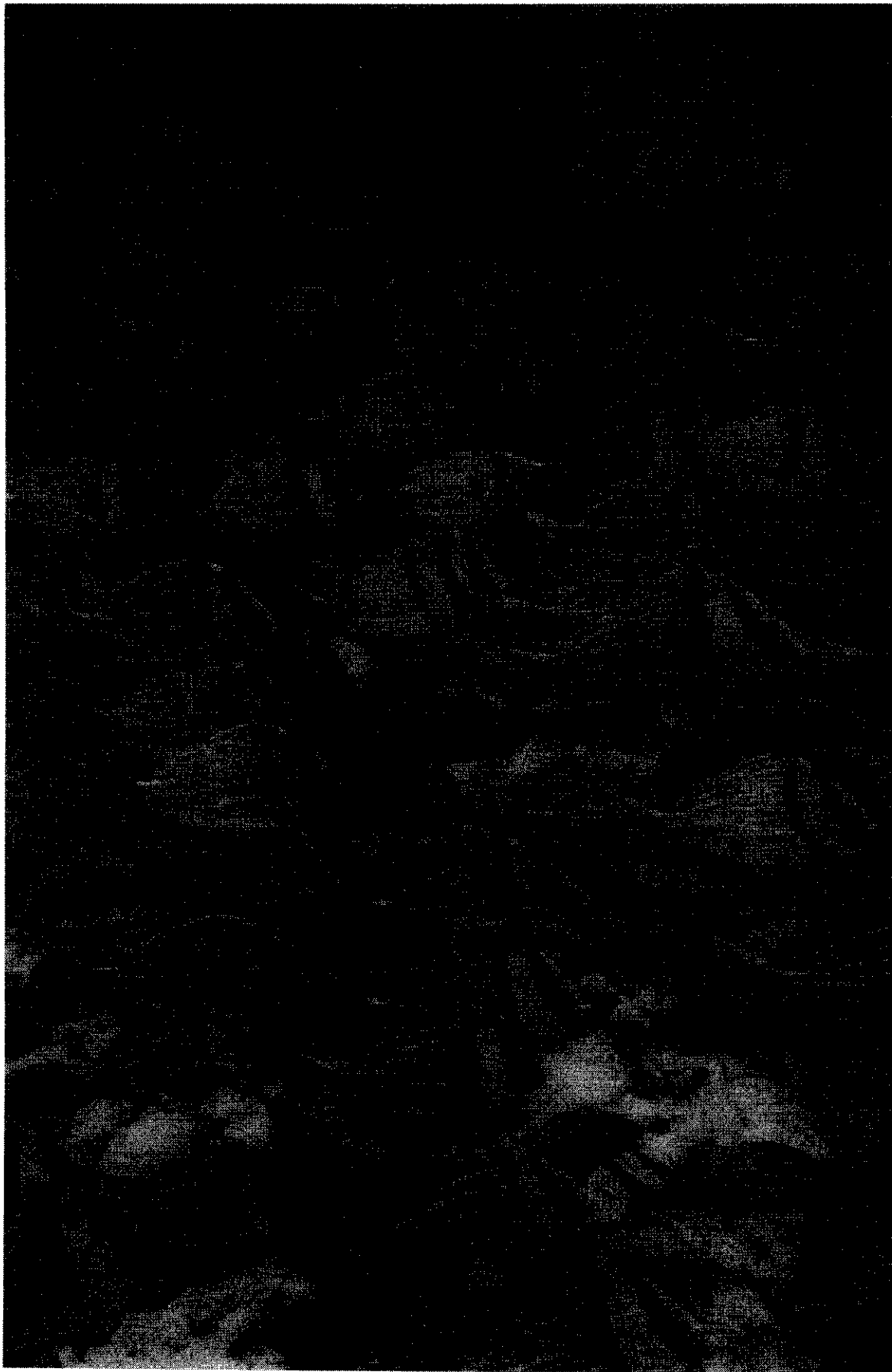
Marine biologists from all parts of the world work above and below the reef's waters. Dr. Vesely and his associates at the University of Miami's Institute of Marine Science are carrying on a three-year research project to determine how fast corals grow and the maximum life a reef can sustain. Aided for the past 10 years by the National Geographic Society through its Committee for Research and Exploration, they are also studying the food-chain relationship between living plants and animals, and the movements of fish populations.

Other scientists are shedding new light on one of nature's most remarkable associations—the relationship between the coral polyps and herds of tiny plantlike cells that live within them.

Some of these microscopic cells contain chlorophyll, which tints the soft tissue of the



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round green." Others had a golden-brown color out to their heads. Their cells, built from the carbon dioxide and other wastes given off by coral animals in turn, they simply use, judge with oxygen molecules, as their mutually beneficial relationship is known, stems from a Greek word meaning "living together."

Close relatives of the true corals, mille pores, or stinging corals, also flourish on the reef. Their stinging cells, containing potent heat, cause a burning sensation. Many of their colonies have a pattern which gives them the look of a flat, or rounded, sponge.

Altogether, more than 50 different species of coral have been found in this marine underwater preserve.

Other sea gardens in the West Indies and Florida include undersea oases, but the new preserve off Key Largo has a still under water Lighthouse and tide-exposed rocks above break the surface. The three lighthouses stand along the seaward side of the reef. Carysfort (gray limestone), Willow, and Molokini—all perched on granite.

Carysfort, with its natural structure within the preserve, is manned by United States Coast Guard men. When I first visited it 48 years ago, the Lighthouse Service was in charge. Keepers then spent two months on the light for every 30 days on "homeports" their term for shore leave.

I shall never forget my first night on Carysfort. I had come out with two boats on my cubic-meter *Molokini*, with meat and vegetable for the keeper and his two assistants.

#### Captain Johnson's Ghost Grains

At bedtime my companions and I settled on the lower deck of the light's dwelling, but I could not sleep. As I lay restless, a great shadowed through the lower deck.

"Did you hear that?" I asked.

My friends smiled skeptically. I had just about convinced myself that my imagination was playing tricks when the noise was repeated as if from a second direction.

Jumping up, I climbed the steps to the upper deck and reached the dark stair to the tower, where Harry Phillips, one of the

Keepers, took the light glass late in the night, by the light of a kerosene lamp, and reported to me.

#### Mixed Battalions of Peckfish and Grunts Maneuver in Class-order Drill

Distinguished by the yellow stripes and black bars, the peckfishes (*Pomacentrus*) migrate from station to station with its relative, the white grunts. Like many reef fish, both species feed by sight. This school will retreat when the corals begin to glow in the night.

Illustration by Robert R. Holt

keepers, was standing watch at the lantern.

"Harris," I pointed, "have you ever heard any funny noise down below?"

"Oh, sure," he said, "but we don't pay attention to 'em any more. It's only Captain Johnson, and he just comes around to see if it's well. He died out here on the light, you know. Must have been a great swimmer, he grunts so. Sometimes he rattles his chains."

That reassured. I use the word broadly—I went below and slept, grunts or no grunts.

Next morning I solved the mystery of the grunts. I helped. Under the hot sun, the towers from walls expand, in the cool of darkness they contract, shrinking, they make sounds startlingly human. My theory may not be true, but I have a right to it ever since.

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