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NATIONAL GEOGRAPHIC

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August 1981

PROFESSIONAL LOOTERS, simple farmers, and even leftist guerrillas in need of money for weapons are systematically plundering Guatemala's cultural heritage, in violation of national law.

One Maya scholar told me that more than a thousand ancient pots, many from unexcavated jungle ruins, reach the international art market monthly. A good one may fetch \$50,000 though the average is much less.

Many enter private collections. Responsible museums try not to deal in stolen artifacts, but some do, at times unknowingly, for pedigrees are not easy to determine.

Tombs in the Maya cave featured in this issue were ransacked not long before we arrived, destroying much of its archaeological value. A few months later a pot bearing glyphs sold at auction in New York; not spectacular, it brought a modest price. After the sale, a specialist familiar with the cave's unique glyphs identified the pot as being from the site.

Some scholars argue that our article will raise the pots' value. By publishing are we contributing to the very destruction we deplore? Possibly, but we hope that proper publicity could make stolen objects so "hot" and collecting them so socially unacceptable that plundering might become unprofitable.

Its supporters believe that the best hope of slowing traffic into this country is a bill now before Congress based on a UNESCO convention banning illicit commerce in cultural property. (Few major collecting countries have yet signed the convention.) The American Association of Dealers in Ancient, Oriental, and Primitive Art lobbies vigorously against the bill, believing each country should protect its own artworks and that international conventions are ineffective. Collectors argue that if the law is passed the business will simply go to other countries.

Opponents of looting have been pleased with the results of a bilateral treaty between the United States and Mexico that has slowed the traffic in monumental art, but the smuggling of smaller pots is booming.

Ironically, many of the objects sold for high prices aren't what they seem. Ingenious fakes, old pots with new designs, reproductions abound. Those who seek to profit may end up with a "pot in a poke," which serves them right. *Caveat emptor!*

Wilbur E. Garrett

EDITOR

Sharks Magnificent and Misunderstood 138

Amazing learning abilities, surprising mating practices, and extraordinary sensitivity to electric and magnetic fields are among recent discoveries about the ocean's most feared predators. Marine biologist Eugenie Clark and photographer David Doubilet explore their worldwide realm.

Molokai—Forgotten Hawaii 188

This small rural island "where the action isn't" is beginning to draw tourists and developers—and divide the people who live there. By Ethel A. Starbird, photographs by Richard A. Cooke III.

Maya Art Treasures Discovered in Cave 220

Recently revealed glyphs and paintings attract scholars to a Guatemalan cavern for new insights into the culture's golden age. Unfortunately, looters come too. Staff archaeologist George E. Stuart and Editor Wilbur E. Garrett report.

Finland's Capital Has Its Heart in the Country 237

Known globally for human-rights accords, Helsinki interlaces city skylines with rustic parklands for its half a million people. By Priit Vesilind and photographer Jodi Cobb.

The Untamed Yellowstone 257

Fishermen and farmers, industrialists and Indians battle over the dividing and possible damming of the waters of one of the nation's last remaining wild rivers. By Bill Richards, with photographs by Dean Krakel II.

COVER: A Maya ballplayer bounces a ball off a zigzag court wall in one of many 1,200-year-old paintings in a Guatemalan cave. Photograph by Wilbur E. Garrett.

SHARKS

Magnificent and Misunderstood

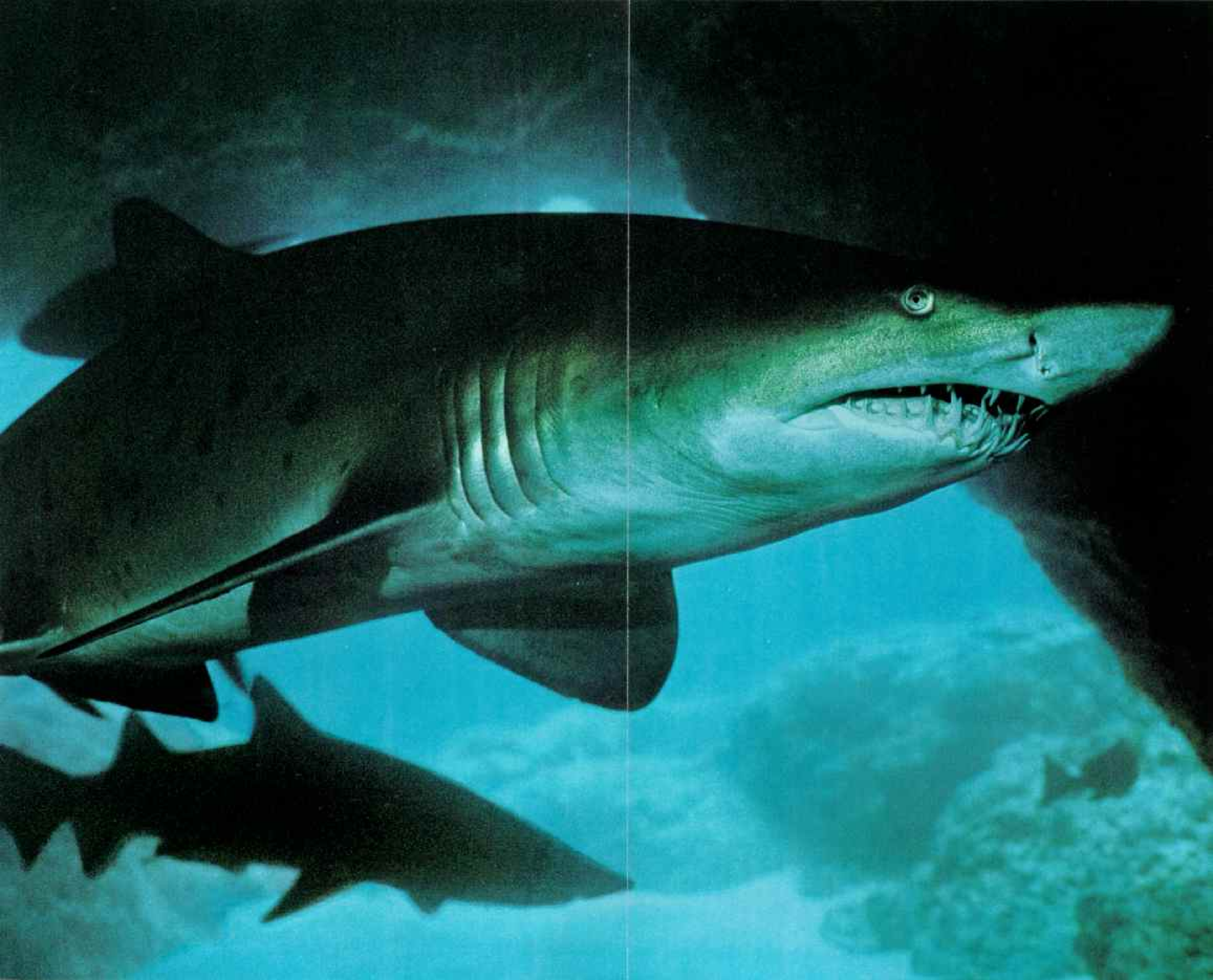
By EUGENIE CLARK

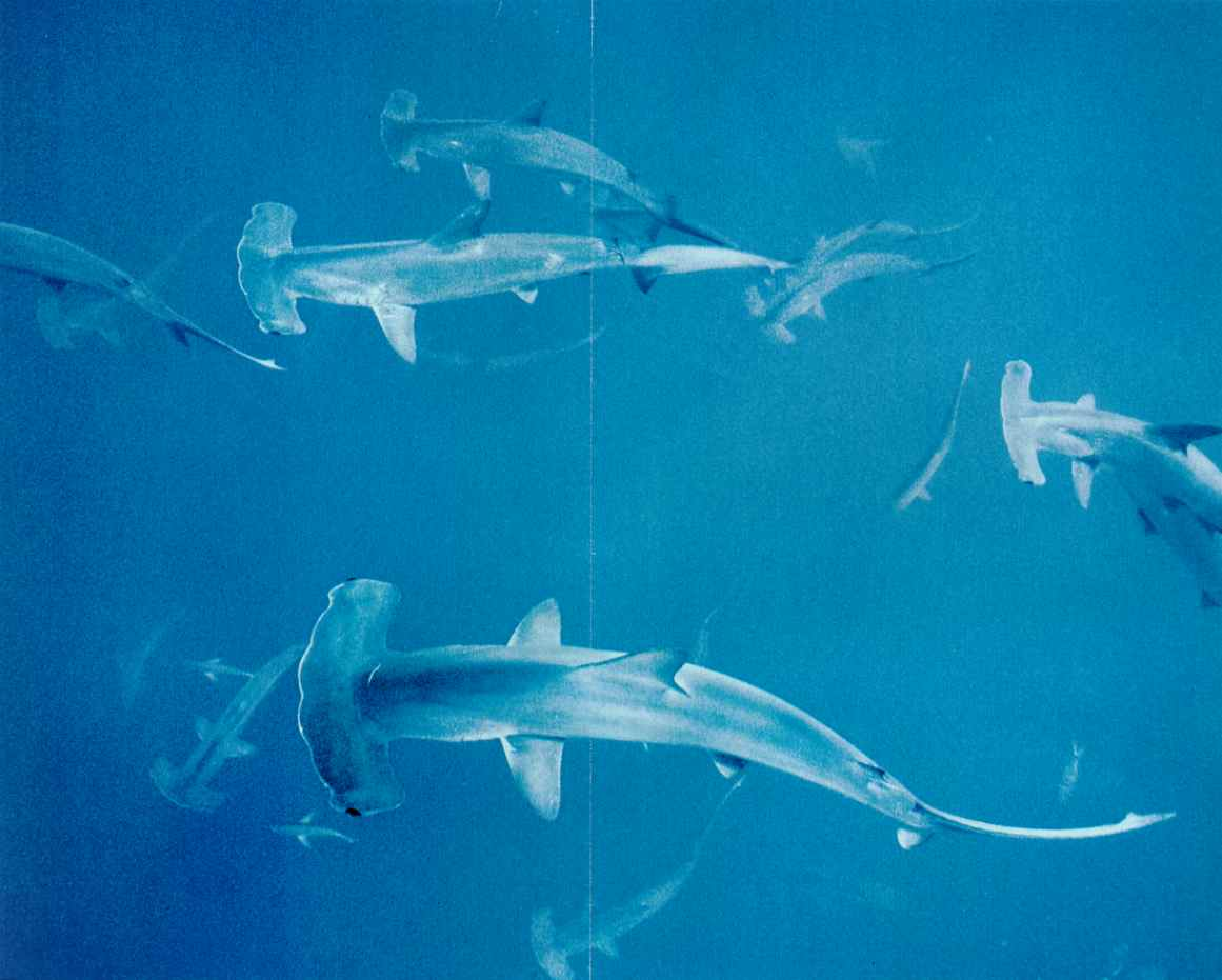
Photographs by
DAVID DOUBILET

Fearsome jaws stir the “man-eater” image. But a veteran shark researcher argues that it unfairly damns a large group of highly diverse animals. She reports new species, dramatic behavior, and a peerless sensing ability.

SAND TIGER SHARKS PROBE A CAVE OFF
JAPAN'S BONIN ISLANDS. GENUS *ODONTASPIS*.
LENGTH 8 FEET (2.4 METERS)











◀ *Enormous school of scalloped hammerhead sharks, nearly 250 all told, threads the Gulf of California (preceding pages). Dr. Kazuhiro Nakaya of Japan's Hokkaido University has found that the hammerhead has a specially developed muscle that allows up-and-down movement of the head, much like the elevator on an aircraft's tail.*

SPHYRNA LEWINI, 8 TO 13 FEET; FLIP NICKLES

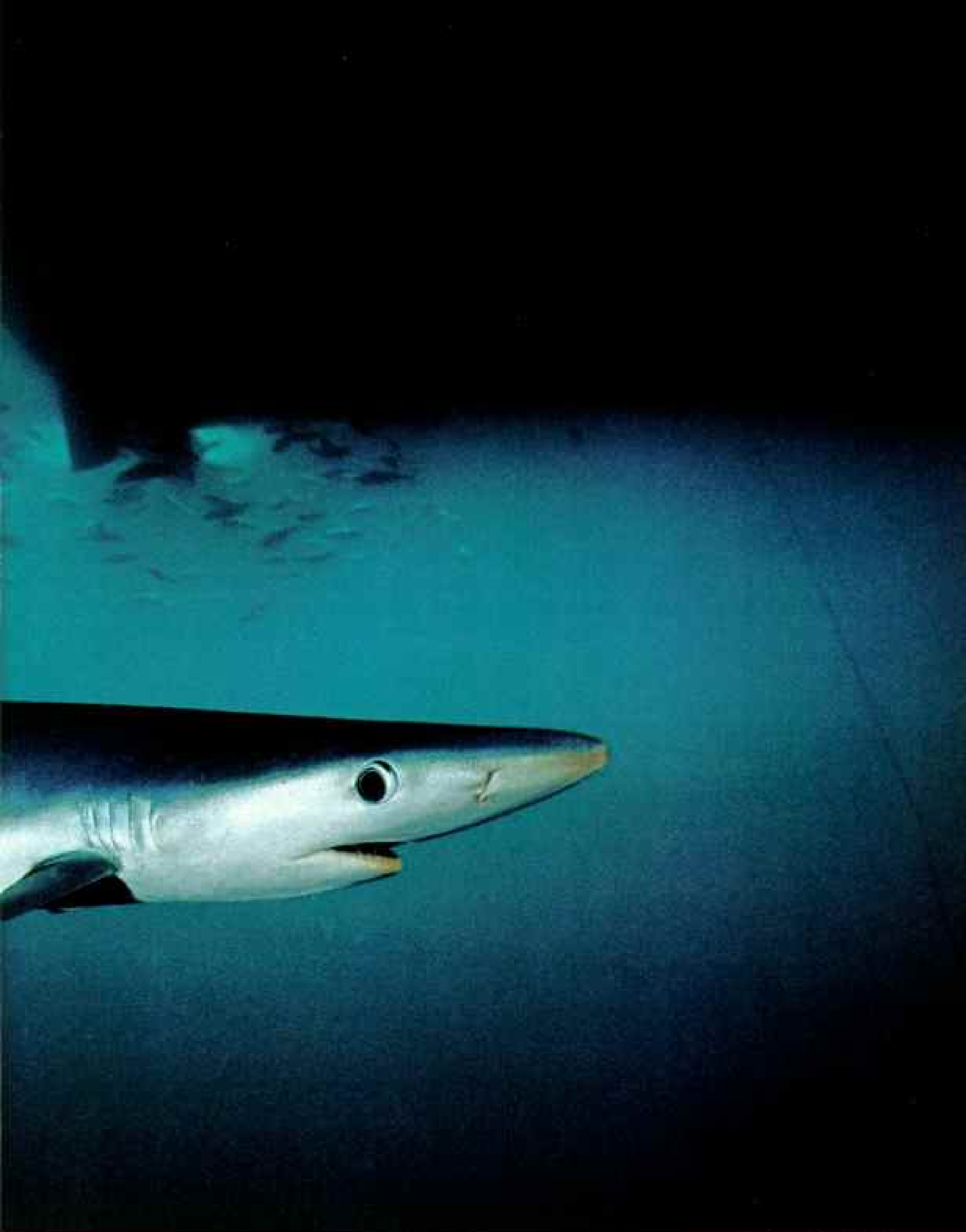


CAROLINERDON, CARCHARINUS, 1A, PFTT

"The one shark that fears nothing," says the author of the great white shark (above), charged with dozens of human attacks. Dr. Clark stresses, however, that the vast majority of sharks are unaggressive to people. Serious assaults worldwide number around 50 a year, with about ten fatalities.



Sharks can be beautiful, as the lithe contour of a blue shark demonstrates off San Diego. The hides of mature female blue sharks are more than twice as thick as those of males, probably as a protection against courtship bites. Females can store sperm for months after insemination, waiting for eggs to mature for



PRIONACE GLAUCA, 6 FEET

fertilization. While some sharks lay eggs, blue sharks give birth to live pups, as do about two-thirds of all sharks, estimated at nearly 350 species.

Among earth's oldest living creatures, sharks began to evolve more than 300 million years ago. Cartilage skeletons separate them from bony fishes.

THROUGH THE CRYSTAL SEA the monster came, heading directly toward us. The mouth was so wide that the four of us, a team of scuba divers, could have slipped right into it like a quartet of Jonahs.

No teeth were visible in the massive jaws. Inside the cavernous mouth several dozen remoras fluttered like black-and-white pennants in the ceaseless flow of water through the creature's gigantic filter-feeding system.

I imagined being trapped in that relentless tide and carried down into a black chamber awash with a mixture of krill and tiny fish. But before the monster reached us, it veered right, presenting a profile of the world's largest

fish—13 tons of flesh and cartilage known as a whale shark (pages 150-51).

In turning, the shark peered at me through one great dark eye rimmed with white. The eye seemed somehow benign, and I swam quickly to the creature's side, flipping upward. The shark's hide was like that of an elephant with the addition of white polka dots, each dot almost as large as my hand. I ducked around the massive pectoral fin that projected from the body like an aircraft wing and made my way to the great dorsal fin at the top.

The shark was swimming at about three knots now, too fast for me to keep up. My fellow divers had already drifted behind, and if I was to stay with the shark I had to find a handhold fast.

On a mature whale shark of this enormous size—35 or 40 feet long—there must be something to hang on to. Groping at the base of the dorsal fin along its trailing edge, I discovered a soft cavity like an armpit and promptly dug my fingers into it. Then we were off on a submarine voyage down the coast of Baja California.

The shark seemed to take no notice of me. But schools of small fish that swam about the dorsal fin came close and looked me over. The shark's skin was remarkably free of parasites, and I assumed that it must be cleaned by the small fish. This traveling

ecosystem I had joined was going at quite a clip, first breaking the surface, then planing down to about 40 feet.

Presently my right arm began to ache and my left hand developed a cramp. Realizing I couldn't hold on much longer, I pulled up my knees and sat astride the shark's great back like a jockey. The inner surface of my legs scraped against the shark's emery-board skin, later producing scabs I proudly showed off to my colleagues. I couldn't maintain the jockey stance either, so I lay on my belly and, protected by my diving jacket, slowly slid down the whale shark's back. I tried to straddle the rear dorsal fin, but that didn't work, and I suddenly found myself at the base of the immense tail.

Now, instead of being towed smoothly forward, I was swooshed from side to side. I tumbled off, catapulted by the whiplash movement of the tail, which came back and slapped me once. My scuba tank had already come loose, my face mask fell around my neck, and one flipper came off. I replaced the mask and got a last look at the shark as it began to dive.

It was obviously a female, for the pelvic fins had no claspers, the elongated extensions that serve male sharks both as penises and as grapples with which to hold the female alongside during mating. As the whale shark started down, I noticed that her pelvic fins were spread apart, exposing a slightly open cloaca rimmed with swollen flesh. Just in front of the cloaca was a peculiar bulge in her belly the shape and size of a suitcase. Was she about to lay the enormous black egg case with a single miniature spotted whale shark inside? Only one such egg case has ever been described in scientific literature.

"Better not follow her any deeper," I told myself. Reluctantly I surfaced, inflating my buoyancy vest and bobbing gently in the calm sea until my fellow divers picked me up in our charter boat.

THAT DAY off the southern tip of Baja California was as rewarding as any I have spent in my long study of sharks. Although I had seen and even dissected dead specimens of whale sharks, I had never swum with nor touched a live one. Unquestionably this is the leviathan of sharks, the largest among nearly 350 species now

SHARKS

Magnificent and Misunderstood

known to science. Only two other species—the basking shark and a recently discovered type called “megamouth”—are plankton feeders. All the rest are predators.

No creature on earth has a worse, and perhaps less deserved, reputation than the shark. During 26 years of research on sharks I have found them to be normally unaggressive and even timid toward man, with the sole exception of the great white shark. The vast majority are “chinless cowards,” as zoologist William Beebe called them, meaning that unless provoked or threatened they prefer to retreat rather than to challenge anything as large as man.

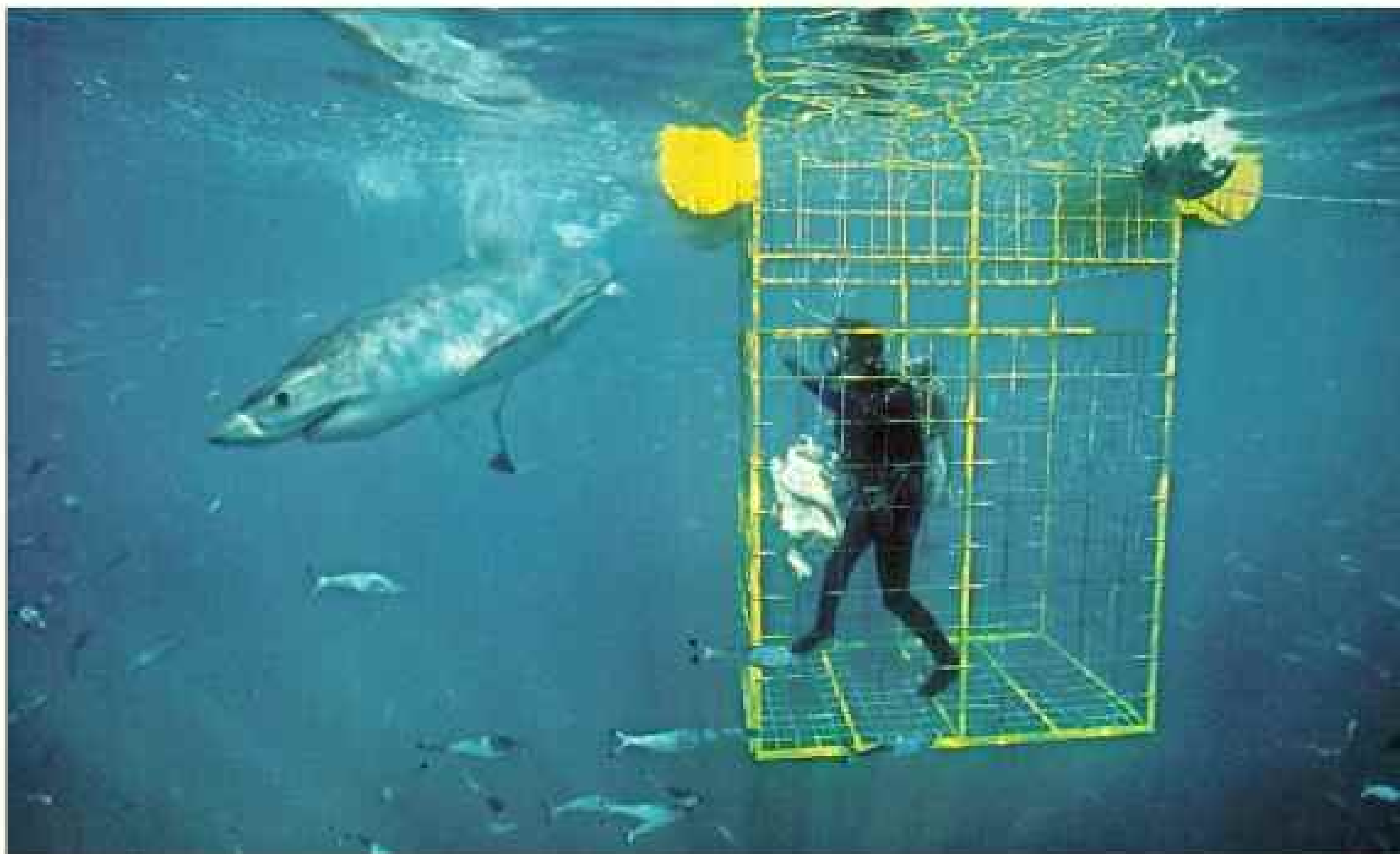
The objects of this interest have inhabited the seas in much the same form for more than 300 million years. Since his own appearance a mere two to three million years ago, man undoubtedly has been intrigued by sharks from the moment he first looked at

one and imagined what those jaws could do.

For the most part, normal shark diet consists of fishes, mollusks, and crustaceans. Few sharks actually hunt or feed on marine mammals, though as scavengers they will quickly rid the sea of the carcass of a whale or other large creature.

No shark normally feeds on man. Most shark attacks on humans are bite-and-release or slashing types of actions that suggest warnings rather than attempts to kill. We accept the fact that a dog growls or even bites a stranger if the latter invades its territory. Are the rare shark attacks on humans caused by similar invasion of what the shark considers *its* territory? Further, could a normally docile shark be more aggressive at certain times, as are sexually aroused male animals and females with young?

The last few years have produced exciting new knowledge (Continued on page 154)



In one of the high points of her 26 years of studying sharks, the author eyes a great white lured by bait to her antishark cage. For ten days she observed as many as five at once near Australia's Dangerous Reef, where “whitey” often feeds on sea lions.

As long as a city bus, a whale shark (following pages)—earth's largest fish—lumbers through Baja California waters. Dr. Clark, at right, found the benign plankton feeder to be female and pregnant, and caught a ride on her dorsal fin.

SHARKS BY DR. CLARK, 22 TO 42 FEET





"Pig shark" is one nickname, for obvious reasons, but this gargoyle leering from California algae is better known as the horn shark because of large spines on its two dorsal fins. The name of its genus, Heterodontus, means "different teeth." Each jaw has both cutting and crushing teeth to grind up sea urchins and mollusks.

Horn sharks package their young in augerlike egg capsules, an engineering wonder (below). Shown removed from its capsule, at right, the embryo is nurtured by a yolk sac for about a year. Females carefully deposit the capsules in rocky crevices. So effective is this protection from predators that scientists have literally had to "unscrew" them for collection.





HETERODONTIUS BRANCHII, 3 FEET

about sharks. Barely a decade ago there were only 250 accepted species; today that number has climbed by a hundred. Sharks are a great deal more sophisticated than we once thought, and we now know that they have a higher sensitivity to electric fields than any animal ever studied. They have also been shown to orient to earth's magnetic field. Sharks can match laboratory white rats in certain learning tests, and they have a surprisingly long retention span. Thus, they are hardly the primitive and senseless creatures that man has mistaken them for.

One of the newest and perhaps most bizarre discoveries is megamouth, the specimen with the outlandishly large mouth that was accidentally caught when it swallowed a U. S. Navy vessel's sea anchor off Hawaii in 1976 (opposite). An entirely new species that has yet to be named scientifically, megamouth is obviously a plankton feeder, yet it is also a deepwater fish. Since most plankton flourishes near the surface of the sea, how does megamouth find sufficient food to survive at great depths?

Unfortunately, the single specimen of megamouth was not preserved until 36 hours after it was caught, and deterioration had begun. But a curious layer of tissue in the fish's mouth seems to have luminescent capabilities, suggesting that megamouth lures deepwater planktonic organisms into the glowing cave of its wide-open mouth.

MY OWN INTEREST in sharks dates back to my childhood, when as a girl of nine I spent long hours in the New York Aquarium. I read everything I could on sharks and other fishes and became familiar with the aquarium's collection. On rainy days derelicts and panhandlers from the Battery took refuge in the aquarium,

The author: A famed biologist and professor of zoology at the University of Maryland, Dr. Clark has described her research with sharks and other unusual marine creatures in many GEOGRAPHIC articles. Sharks will be the subject of an upcoming National Geographic TV special in 1982.

and at their urging I began to tell them about the various specimens. Those men were among the most attentive audiences I have ever had, and I still attribute some of my life-long interest in sharks to them.

After receiving a doctorate in zoology at New York University in 1950, I helped to found the Cape Haze Marine Laboratory at Placida, Florida, in 1955. The laboratory has since moved to Sarasota and is now known as the Mote Marine Laboratory. Over the next 12 years, as director of the lab, I conducted experiments on shark behavior and learning capacity. Later I expanded my research to a worldwide study of sharks in their natural environment. Part of the latter research was supported by the National Geographic Society, and many of the findings have been published in the magazine.

Two years ago the Society commissioned me to report on the latest scientific discoveries about sharks and asked my good friend, underwater photographer David Doubilet, to illustrate the article. Baja California produced dramatic results; so did an old familiar area, the Red Sea.

We journeyed there to witness the mating frenzy of the gray reef shark, a bizarre courtship ritual that exists among a number of families of sharks, including requiem sharks, of which the gray reef is a member. With David and his wife, Anne, I dived at Ras Muhammad at the tip of the Sinai Peninsula. Here I had previously studied gray reef sharks as well as a curious "sharkproof" fish, a type of sole that exudes a toxic fluid that renders it inedible to sharks.

No such immunity surrounds the female gray reef shark at mating time. During our dives at Ras Muhammad we observed countless females that had been badly bitten by courting males. One female had been so severely mauled toward the rear of her body that I thought her tail might fall off. The attacks reminded me of a recent discovery by Harold Pratt at the National Marine Fisheries Service laboratory at Narragansett, Rhode Island. (Continued on page 160)

"Megamouth" is so unusual that it will create a new family, genus, and species when named. Preserved in Hawaii's Bishop Museum, the plankton feeder was hooked when it swallowed a vessel's sea anchor. Tissues in its mouth may have produced light that lured the deep-sea shrimp found in its stomach.

SHARK LARVAE, 14 FEET 7.5 INCHES



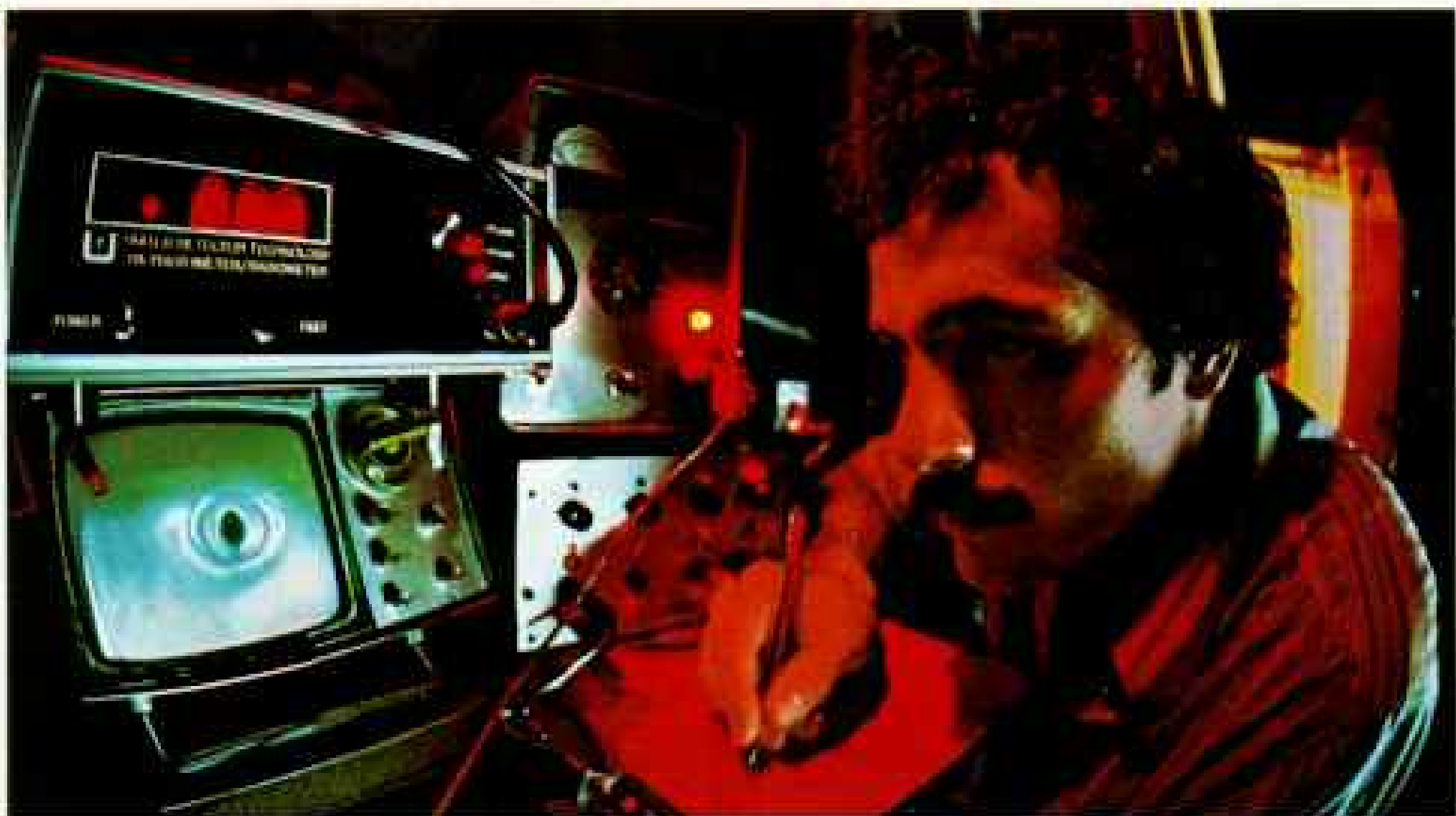


Focus on vision: With an underwater ophthalmoscope, Dr. Stanley L. Spielman of the University of Miami examines a lemon shark hooked off Bimini (above). His surprising diagnosis: The species is very farsighted and often develops cataracts. Mysteriously, while these sharks' visual acuity is poor, their sensitivity to light is slightly higher than man's. Graduate student Werner Finck (right) studies a videotape of a lemon shark conditioned to respond to different levels of light by blinking.

*Compiling an identification key to sharks' teeth, Dr. Gordon Hubbell (left), a Florida veterinarian, displays a four-inch fossil tooth of the great white shark's huge ancestor, *Carcharodon megalodon*.*

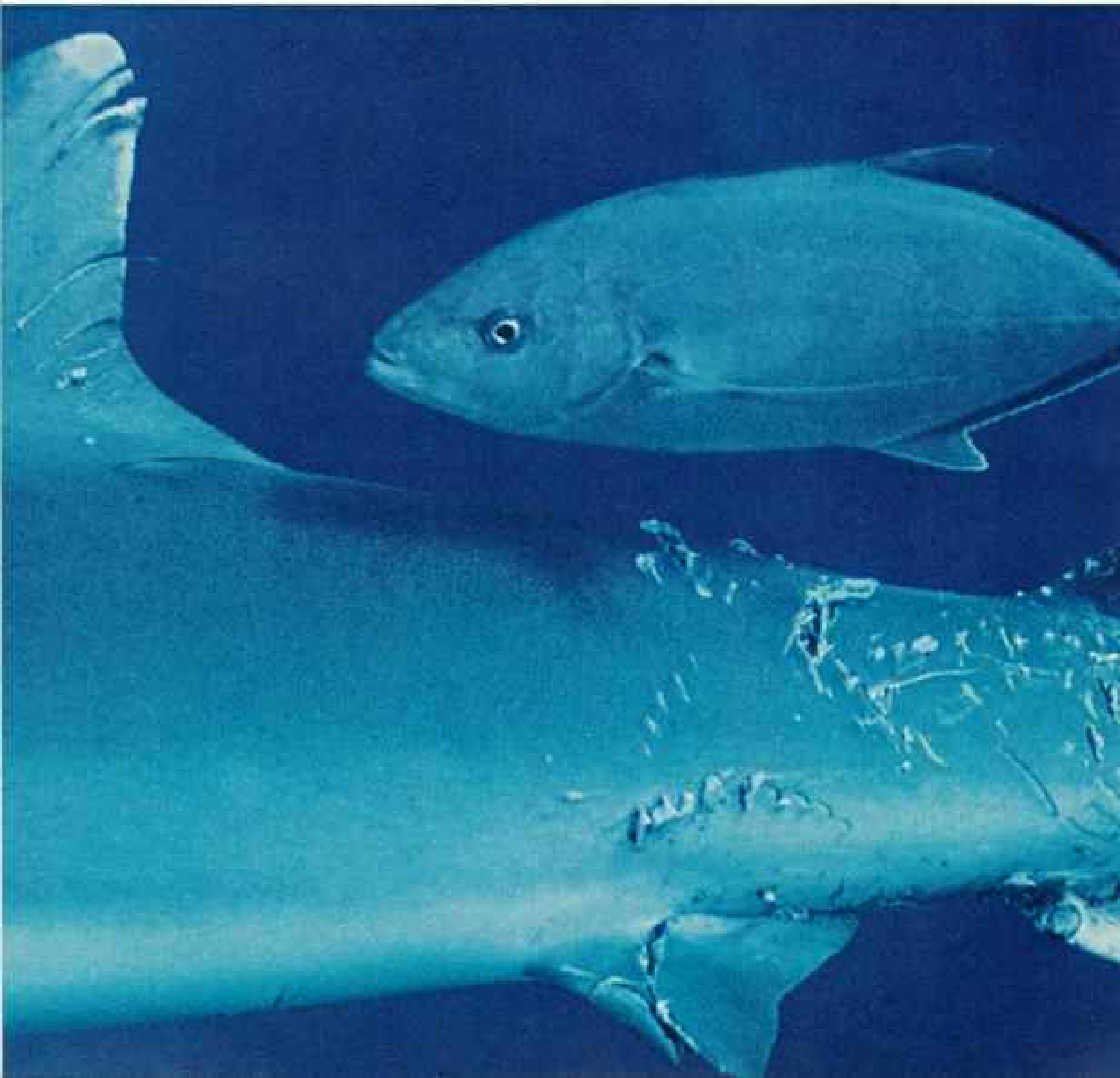


NEGAPTOR BREVIROSTRIS. 8 FEET. ALL BY FLIP RICKLIN





GENUS CARCHARHINUS, 8 FEET



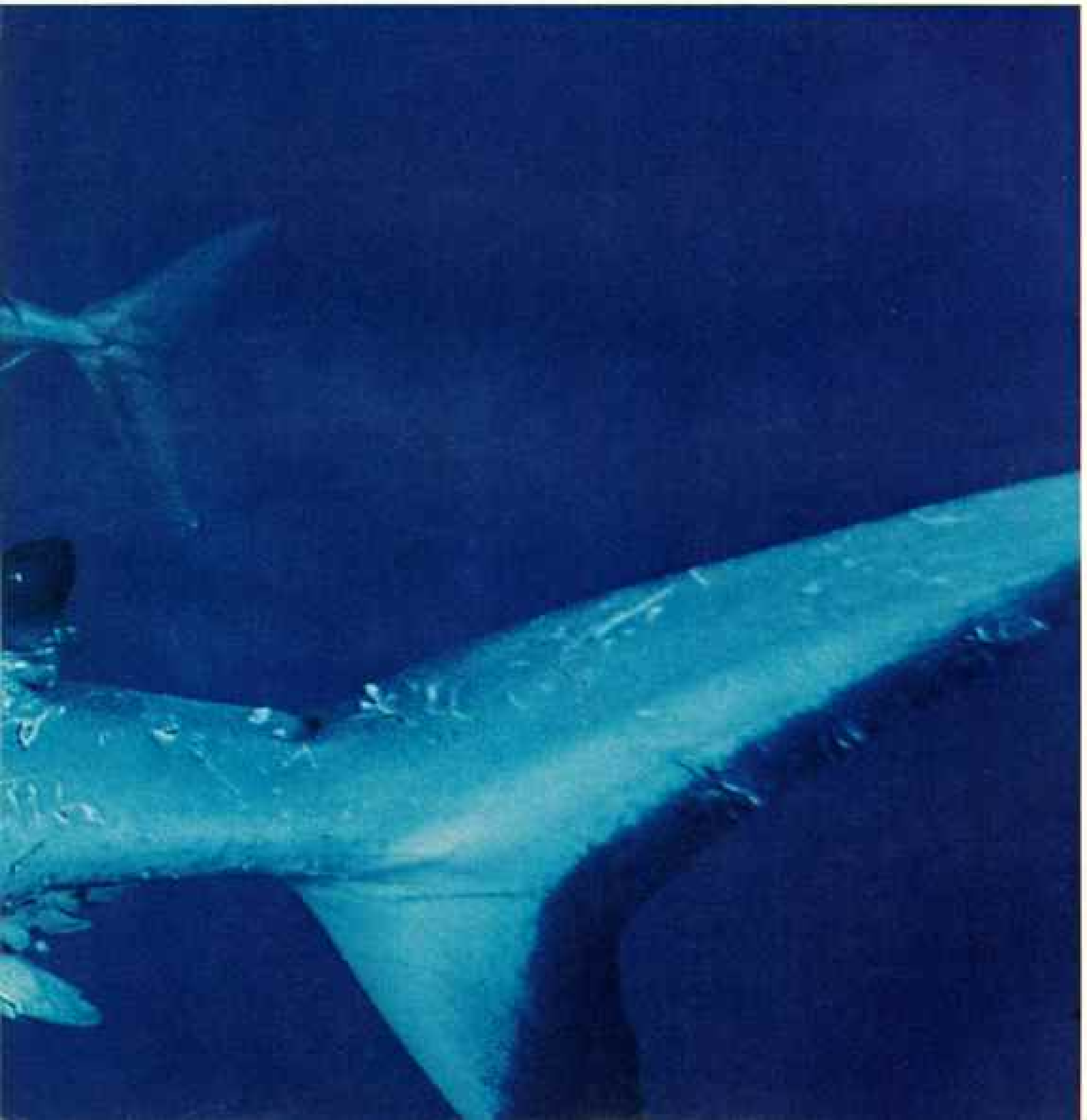
Violent courtship stirs the Red Sea. Bitten by a male, a female short-nosed gray reef shark shows gashes from dorsal to caudal fins (**below**); her companion, a large jack, may be riding her slipstream. In a unique photograph (**left**), a male moves in to attack an already wounded female.

The pattern begins when the sharks gather about 50 feet deep and mill slowly. Almost coyly, a female peels off alone. A male rushes her and bites her fins and flanks. After the attack the two then usually return to the group.

Here in 1974 the author and photographer were the first to document such courtship attacks. When they returned five years later, they saw one pair go a step beyond. After

biting a female, her suitor speeded up, wriggled over her back, then swam briefly along her right side. Though they were too far away to confirm actual mating, Dr. Clark believes it to be the first observation of this specific behavior by sharks.

She came to know individuals by their scar patterns. "What amazed me is how quickly they healed—in less than three weeks," she says. Such wounds, savage as they seem, are literally "love bites" compared to the damage that a truly hungry male could inflict. Israeli researcher Avi Baranes has found that the short-nosed gray reef shark, after nearly a year's gestation, gives birth to between six and eleven pups, each about two feet long.



(Continued from page 154) Mr. Pratt has found that the hide of a mature female blue shark—also a member of the requiem family—is more than twice as thick as that of a male blue shark of the same size, almost as though nature were giving the female added protection against her suitor's less than gentle advances.

At Ras Muhammad we quickly came to recognize individual female gray reef sharks by the pattern of wounds each one had. Only two females appeared unscathed. They were obviously pregnant from the season before and swam well removed from the other sharks. Whatever wounds they may have had from the year before were healed.

Eventually we witnessed a number of courtship attacks, and once David and I observed what appeared to be an initial step in mating. The attacks always occurred fast. A female swimming among a group of sharks would break away, almost as if inviting trouble. A male in the group would quickly oblige, rushing at her and biting her, often severely. Each would eventually return to the group.

In one case, however, a courting pair seemed to carry the process further. They were too deep for us to see clearly, but after biting the female, the male suddenly speeded up, crisscrossing her back, brushing his belly on her dorsal fin, then dropping to her right side and swimming there briefly, as a male guppy does during copulation. The two sharks quickly pulled apart, and I did not see the male extend his claspers. Even so, this is the only recorded observation of this behavior.

Large sharks were thought to mate belly to belly until 1959, when Dr. Dugald Brown, a physiologist doing research at the Cape Haze laboratory, made a discovery by pure chance. Returning to work late one night at the laboratory, Dr. Brown discovered a pair of nine-foot lemon sharks copulating in one of the outdoor pens. The pair were side by side, their bodies and tails plastered together and moving in synchrony. The sharks swam around the pen, looking, in the words of Dr. Brown, like a single monster with two heads. He watched for an hour then entered the lab to work, unaware of the rarity of what he had seen. Only later did he report the observation to me. I published his

account of the experience, to the interest of shark experts around the world.

We know from studies made by Harold Pratt at the marine laboratory in Narragansett that blue shark females—and many other female sharks—are capable of storing sperm for months after insemination, ready to fertilize eggs whenever they mature. Among several thousand sharks that I examined during the 12 years I directed shark research at Cape Haze, I often took smears from the reproductive tracts of female specimens. Once, after a female shark had been frozen for several months, a smear from her reproductive tract showed revived spermatozoa swimming around in the drop of seawater under my microscope.

ROUGHLY A THIRD of all sharks are egg layers; the rest are viviparous, that is, they give birth to live young. All female sharks have paired wombs, where the embryos may remain from a few months to two years.

The instant these embryo sharks are born, they are ready to begin feeding. The only time I was ever bitten by a shark was when I reached into the uterus of a live, 12-foot female tiger shark and pulled out a healthy baby hanging onto my fingers!

Some sharks start eating before they are even born. "Intrauterine cannibalism" was first discovered by Stewart Springer, then with the shark industries division of the Borden Company, who dissected a female sand tiger shark and found embryos with their stomachs full of eggs—they were eating their potential brothers and sisters.

Adult sand tiger sharks grow to ten feet and look more ferocious than most sharks, since their large daggerlike teeth hang out and they always keep their mouths open. David and Anne Doubilet and I met with three sand tiger sharks in a dark cave near Kitano Shima, a far-off corner of Japan's Bonin Islands.

It was scary at first. The sharks came slowly but directly toward us, like grinning vampires inviting us into their castle. But their initial curiosity passed. We stayed nearly two hours. We watched and photographed them, careful to make no sudden movements, barely flippering around. The sharks seemed to accept us in a languorous,

casual way. Neither my soft murmurings to them through my mouthpiece as I lay on the smooth white sand floor of their cave nor the flash from David's strobe light seemed to ruffle them.

Following our visit to Kitano Shima, the Doubilets and I studied sharks in more than a dozen locations in Japan. At Tsukiji, Tokyo's great central fish market, where tens of thousands of sharks are brought in each year for food, the most common type is the porbeagle shark. Porbeagle embryos also eat their siblings, as do thresher sharks. No one knows whether embryos of the great white shark—which is included with the sand tiger, the porbeagle, and the thresher in the group of sharks known as lamnoids—devour one another in the womb. The term lamnoid, incidentally, derives from the mythical Greek monster, Lamia, a horrible man-eating creature.

Most viviparous sharks bear from 6 to 12 young, but some, like hammerheads and tiger sharks, produce as many as 40 at a time. One tiger shark had a record 82 embryos inside her. If one embryo dies, the lot is not aborted. The dead embryo, mummified by

some natural method, is retained and finally stillborn along with its live siblings.

On one memorable dive with our colleague Koji Nakamura, David and Anne Doubilet and I explored a virtual undersea hatchery of a species known as the Japanese swell shark. Koji is a veteran diver and an outstanding underwater photographer whose still and motion-picture films are highly regarded around the world. We joined him on a deep dive in Izu Oceanic Park, some 75 miles southwest of Tokyo.

We reached bottom at 165 feet. The water was cold but crystal clear, and as I looked around, I imagined that the curtain had just risen on the snow scene from the *Nutcracker Suite*. The ocean floor was a thick forest of gorgonian corals, lifting their white, lavender, and pale pink branches above the dark, rocky bottom.

On this beautiful stage, dozens of rectangular, brown swell shark egg cases hung like Christmas decorations on the gorgonians and on delicate black corals twisted by currents into the shapes of bonsai trees.

The egg cases were covered with minute marine life that (Continued on page 169)



Dwarf from the depths is probably *Etmopterus lucifer*, nicknamed "devil shark" by Dr. Stewart Springer, an authority on this group of tiny sharks. It matures at about a foot. This pint-size predator was netted along with giant sakura shrimp near the bottom of Japan's Suruga Bay. Its enlarged eyes help it see in a dim world below 650 feet. Luminous photophores along its body cause its greenish glow, which may help these sharks stick together in a hunting pack to attack prey much larger than themselves, such as squid or octopus.



Ingenious security blanket, the egg capsule of the Japanese swell shark is a marvel of protective design. The palm-size capsules come with strings attached, which are wound around strands of coral (left), here 165 feet deep in Japanese waters. Hidden from predators and secure against buffeting currents, the embryo within (right)—about three months old and with tiny developing pectoral fins—feeds from its yolk sac. After about a year the capsule splits, and a newborn swell shark (below) leaves the nursery to hunt crustaceans and mollusks. As an adult, it will grow to about 3.5 feet in length.





CEPHALOSCYLLIUM ISABELLA, ROJI NAKAMURA, JAPAN UNDERWATER FILMS (BCCOW)



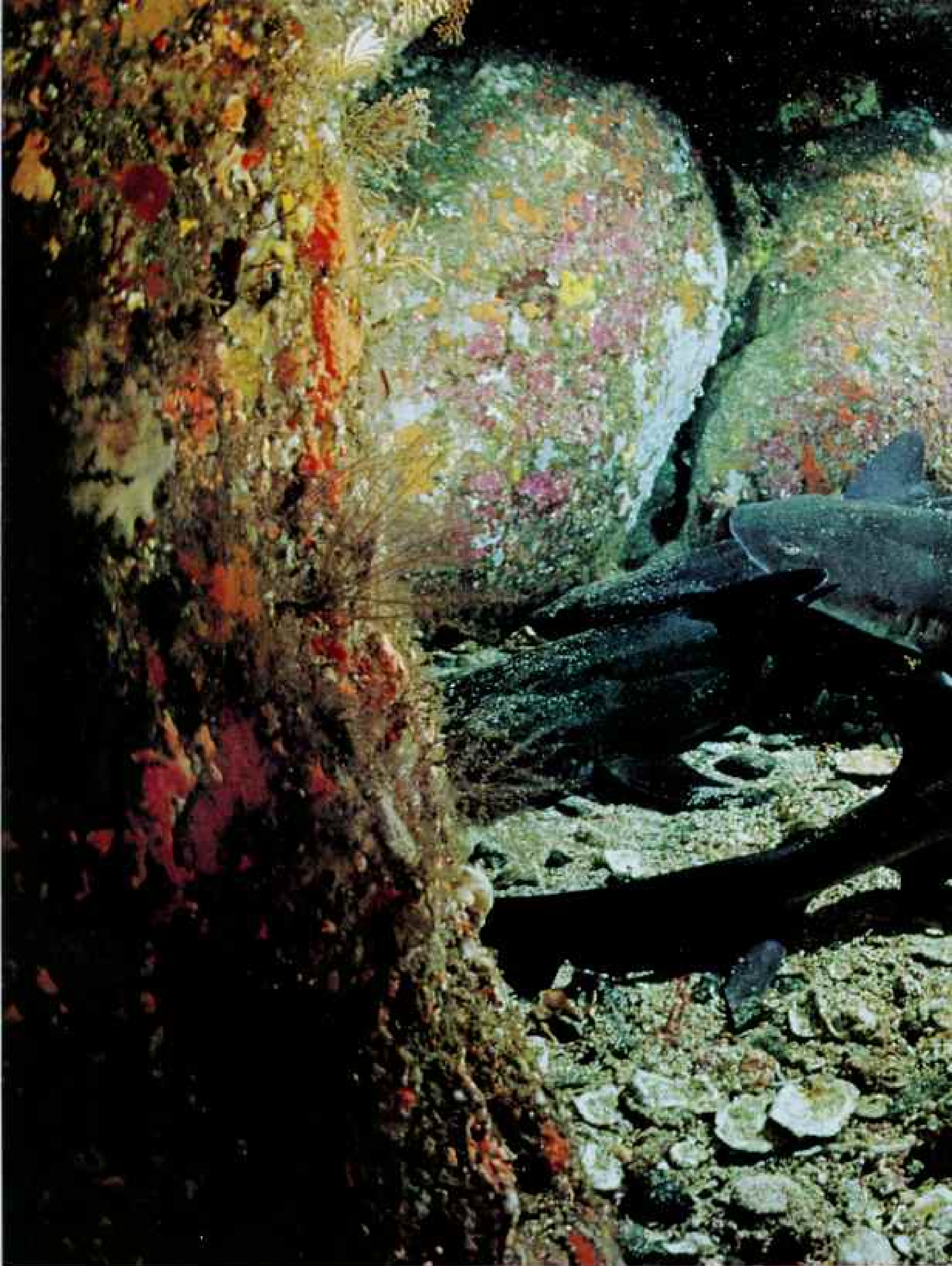


Beastly at close range, a laid-back California swell shark dozes amid anemone-like zoanthids. Rows of needle-sharp teeth move forward as those in front fall out.



ETMOPTERUS VENTRIOSUS, 3.3 FEET; FLIP HICLIN

A special fold of skin guards the eyes of the swell shark, named for its ability to inflate by gulping water or air, probably to wedge more tightly into a hiding place.



As if drugged in an opium den, sharks called "dochizame" recline torpidly in a cave of Japan's Izu Oceanic Park. Protection laws exclude sharks, zealously



TRIANGLE SCYLLIUM, 4 FEET

hunted for food in Japan. Such "sleeping" behavior, also studied by the author off Mexico, dispels the myth that all sharks must swim constantly or drown.



(Continued from page 161) produced clusters of purple, pink, and snowy white camouflage. Long tendrils from the corners of the egg cases had been twined and coiled around the branches of the gorgonians as the female swell sharks laid them. The cases were as secure as if they had been hung with clothespins on a wash line. Here the cases would remain for almost a year, the period required for baby swell sharks to hatch (pages 162-3).

Koji held a strong light behind an egg case. Inside, the inch-long embryo squirmed around on its big yolk sac. David scraped off the encrustations, and through the translucent wall of the case we could see the external gill filaments floating like two fans fashioned of feathers around the tiny embryo's head.

Perhaps more than any other people the Japanese have utilized shark products, not only for food but also for countless other purposes. According to one source, a substance known as squalene, derived from the livers of deep-sea sharks and having a low congealing point, was used by the Japanese in World War II as a lubricant for their Raiden interceptor aircraft. The Raiden operated in extreme low temperatures at high altitudes against American B-29 bombers toward the end of the Pacific war.

Today squalene is used for a variety of purposes, including the treatment of burns and as a base for such cosmetics as lipstick. I often wonder how many men realize that they kiss their wives or sweethearts through a film of shark-liver oil.

Recently squalene has been promoted as an effective treatment for both major and minor diseases. Thousands of Japanese pay the equivalent of nearly a dollar for a single capsule of products known by such names as Marine Gold (page 178). The manufacturers, and even some Japanese doctors, recommend two to nine capsules of squalene a day for treatment of virtually everything from constipation to cancer.

U. S. medical researchers acknowledge

that along with squalene, shark liver also contains a therapeutic substance known as coenzyme Q10, but they are extremely cautious about its potential effectiveness against cancer.

"We've experimented with coenzyme Q10 for years," says Dr. John Heller, director of the New England Institute, an interdisciplinary research center. "In some instances advanced cancer patients treated with coenzyme Q10 have improved, and that is encouraging. But if a case of cancer clears up spontaneously while the patient happens to be taking some pill, that could lead to dangerous conclusions."

DESPITE JAPAN'S leadership in aquaculture and marine conservation, the Japanese public seems unaware of the need to protect sharks. Having established more than a score of undersea parks, the country has passed stiff legislation against unrestricted spearfishing and collecting of live shells, lobsters, and other marine creatures. But no one in Japan will arrest you for killing sharks, a fact that troubles my friend Hajime Masuda.

Professor Masuda is a distinguished marine scientist, photographer, and teacher at Japan's Tokai University. He has also written more than a dozen books on Japanese marine life. One day at Izu Oceanic Park we dived together in a shallow area filled with "sleeping" sharks—sharks in a state of temporary lethargy such as I have observed and studied on several occasions in Mexico as well as Japan.

Here the sharks—a species known by the Japanese term *dochizame*—lay piled one on top of another like so many sleeping drunks (pages 166-7). They were so plentiful and oblivious that Professor Masuda caught one with his hands.

"Please don't reveal the location," he asked when we surfaced. "The weekend diving enthusiasts from Tokyo would catch every last shark and eat them up."

I knew what. (Continued on page 174)

Sharks go limp when inverted, a phenomenon that helps a researcher safely free a lemon shark after tagging its dorsal fin. Data on such marked lemon sharks (recaptured here in the Bahamas and in Florida), says Dr. Samuel H. Gruber, suggest that they grow slowly and take more than six years to mature.

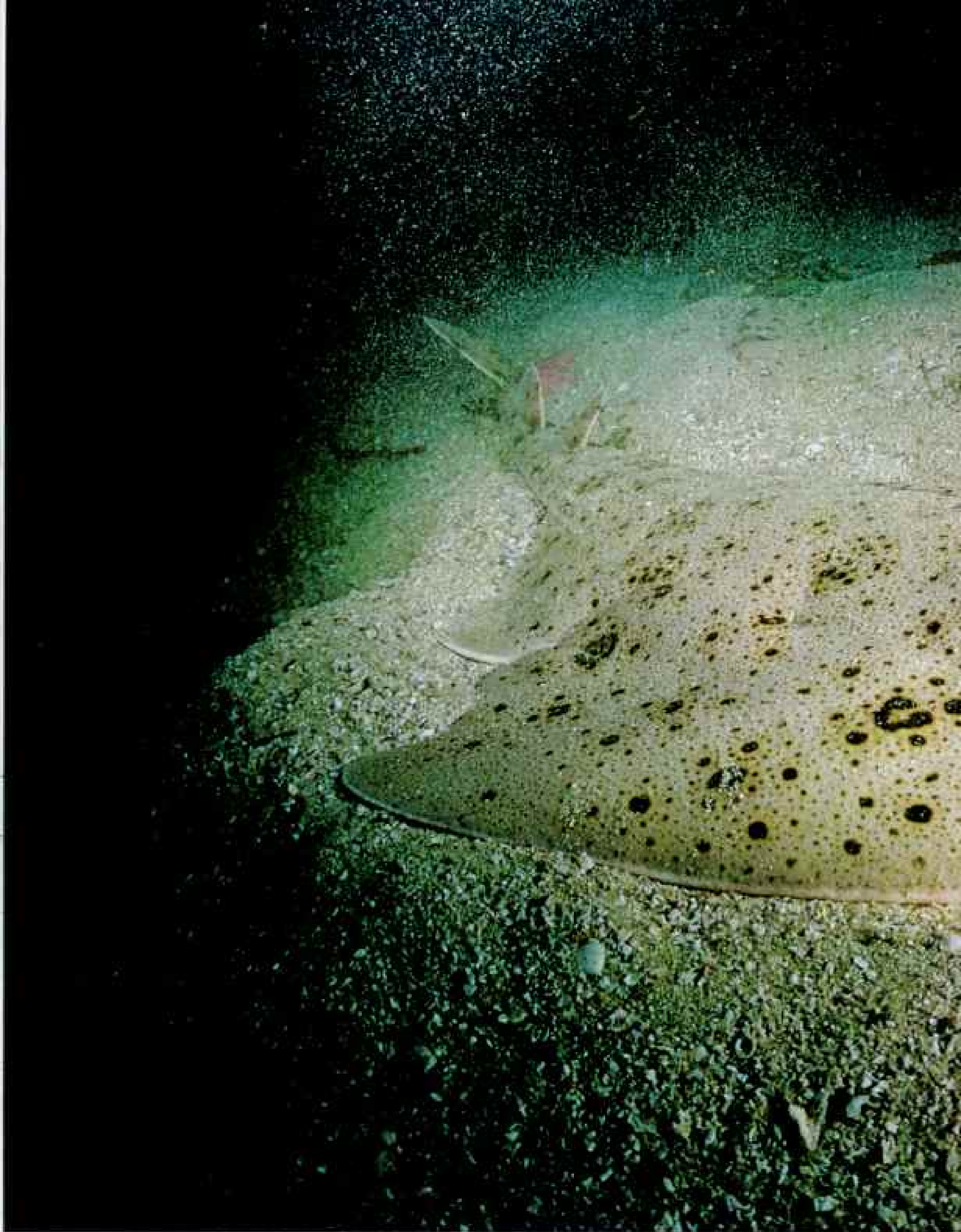




GRAY REEF SHARK, *CARCHARHINUS AMBLYRHINCHUS*; REEF WHITETIP SHARK, *TRIACHODON OBESUS*; ALL ABOUT 6 FEET

Writhing mass of gray reef and reef whitetip sharks in a feeding frenzy was triggered by bait wired to a coral head (left). A remote-control camera filmed the scene in the Coral Sea east of Australia. There, in an isolated incident, one gray reef shark, wolfing fish on a chain, appears to bite another accidentally (above).

Often thought to be set off by a single drop of blood, the storied frenzy may instead be incited by several stimuli, such as headshaking vibrations of the first shark to feed. How often, or even whether, such ravenous competition involves live natural prey is unknown. What is known about the gray reef shark includes its peculiar threat display—back arched, pectoral fins lowered, swimming motions greatly exaggerated—which clearly translates, “Watch out!”



Ghostly outline of a Pacific angel shark, a bottom feeder, blends into the ocean floor near California's Santa Catalina Island, dislodging an orange sea cucumber as it settles down. Angel sharks have lateral gill slits that reach beneath the



SQUATINA CALIFORNICA, 5 FEET

winglike pectoral fins, giving rise to their name. Rays, with which they are often confused, have gill slits on their undersides. Such close resemblances put sharks, skates, and rays in a subclass of fishes all their own: the elasmobranchs.

he meant. Several years earlier I had visited Takara Jima, an island northeast of Okinawa, to see a submarine cave where more than 40 reef whitetip sharks were reported to sleep. By the time I arrived, I found only two sharks risking a nap. Local fishermen told me how the islanders catch the sharks by slipping a lasso around their tails and hauling them to the surface.

"We never take all the sharks," a fisherman assured me. "We always leave one or two, so they will bring back their friends."

During a visit to the remote Bonin Islands north of Iwo Jima, the Doubilets and I encountered a far larger colony of reef whitetip sharks, more than a hundred by my count. In a small, shallow lagoon on one of the uninhabited islands we found a great many of the sharks lying in caves just beneath the surface. Others swam casually around our legs as we stood in crystal water up to our waists. I photographed dozens of sharks just by holding my camera below the surface and shooting as they passed.

Snorkeling in another part of the lagoon, we passed caves literally packed with sharks and other areas that had numbers of rays. All seemed content to live in the most heavily "shark-infested waters" I have ever seen, yet I wondered how long the haven would last once shark fishermen discovered it.

Like the residents of Takara Jima, many other islanders eat sharks but treat them with respect. Some fish for sharks by shaking coconut-shell rattles and singing traditional songs to lure the sharks alongside their canoes. There they capture them by hand for food or simply to demonstrate their courage. In the village of Vaitogi near the airport in Pago Pago, American Samoa, children sing to bring in a shark for tourists.

Although Pacific islanders are well aware of the danger of sharks, many parents normally allow their children to play in the water with them. They seem to have an awareness of sharks and shark behavior that corresponds in some ways to our hard-earned scientific knowledge.



Sensory wonder: Smooth dogfish held by Dr. Adrianus Kalmijn can detect an electric field 25 million times weaker than the faintest that man can feel—best electrical acuity of all animals. He tests the sharks both at sea and in a laboratory tank (right). Ignoring a stream of liquefied fish, a dogfish instead attacks an electric stimulus similar to that emitted by a buried flounder. Organs called the ampullae of Lorenzini receive signals through pores on sharks' heads, shown in a great white (above).

My early experiments with shark behavior at Cape Haze during the 1950s and '60s surprised a great many scientists—including, I must admit, myself. The experiments showed how easily nine-foot lemon sharks as well as smaller tiger, bull, and nurse sharks could be trained to push a target and ring a bell to get a reward of food. In a very short period of time sharks learned to distinguish between right and wrong targets, a skill they developed as quickly as laboratory white rats.

More recent studies of sharks' brains, sensory systems, and types of behavior contradict popular misconceptions of sharks as stupid, unpredictable eating machines, with nothing more than primitive brains and a good sense of smell.

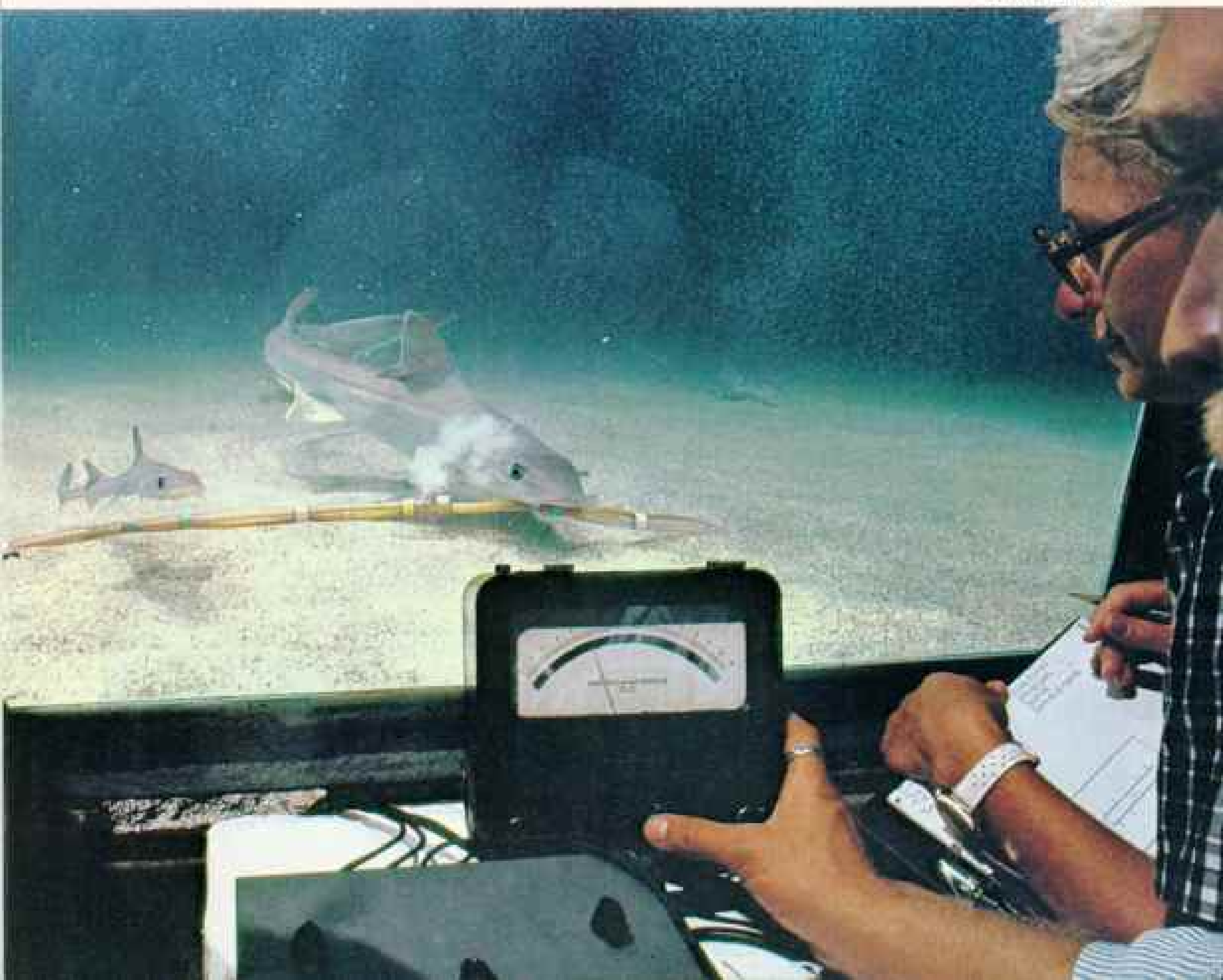
In fact sharks are as predictable as any animal—even one's spouse—if one takes the time to study and get to know them. Those of us who have had an opportunity to dive frequently with sharks do so almost with impunity, knowing that it is far safer to swim with

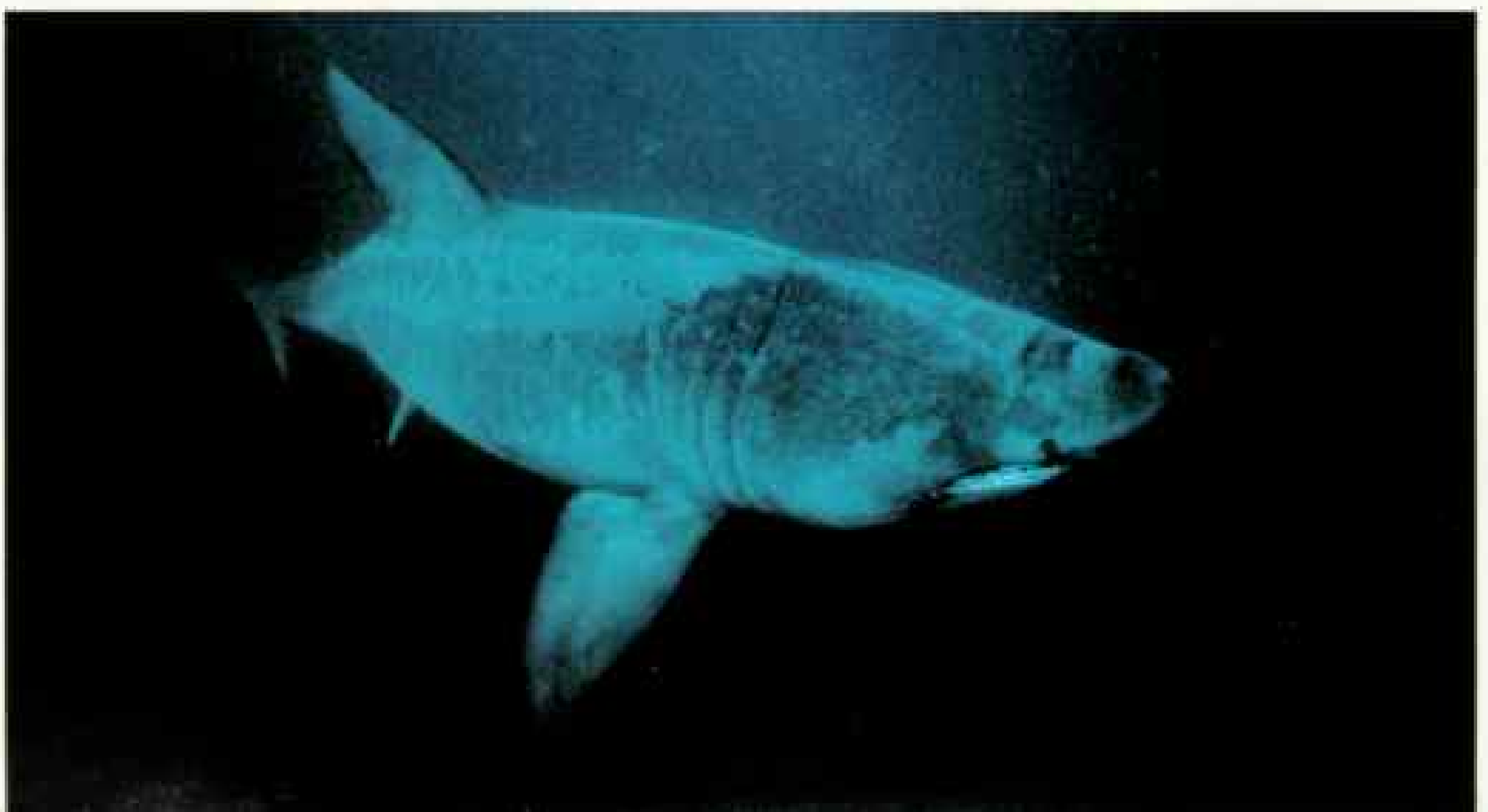
these animals than to drive on an average city street or highway.

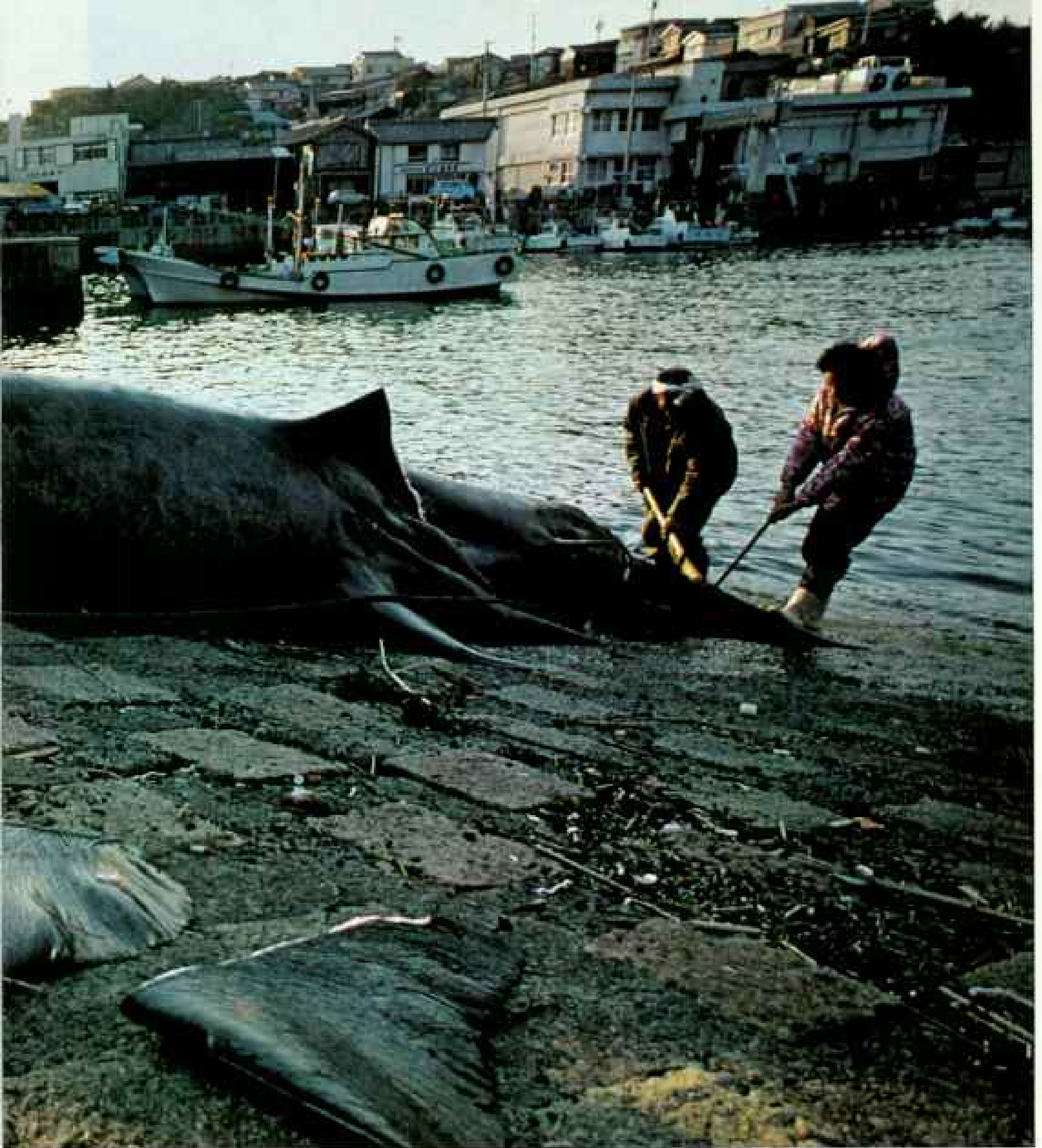
As for sensitivity, sharks appear to have one of the most remarkable detection systems in all of nature. Exciting research conducted by Dr. Adrianus Kalmijn at the Woods Hole Oceanographic Institution in Massachusetts and elsewhere has focused on electroreceptors in sharks, a series of sensory organs located in the head.

Supported by the U. S. Office of Naval Research, Dr. Kalmijn has shown that a shark known as the smooth dogfish can detect an electric field of less than five-thousandths of a microvolt per centimeter—an infinitesimal amount. This degree of sensitivity is the highest known in the animal kingdom and enables sharks—and their relatives, skates and rays—to locate hidden prey, such as flounder buried beneath the sand. It may also aid sharks in the process of daily movement as well as long-range migration, allowing them to orient themselves in the open sea electromagnetically,

MUSTELUS CANIS, 8 FEET







CETORHINUS MAXIMUS

A ton of meat and a dozen other products will be obtained from a 27-foot basking shark caught near the Japanese village of Nakiri (above). Its habit of lolling at the surface to strain plankton made it an easy target for fishermen's harpoons. Rarely seen in its own element, a basking shark looms off Long Island's Montauk Point (left).

Near Nakiri, a shrine sells amulets (right) that bear a prayer for protection against shark attack and are often carried by Japan's famed ama divers.





SALATINO LONHA, E. E. 1971



taking a fix from the earth's magnetic field.

Meanwhile, others are attempting to follow the shark's patterns of movement. Dr. Samuel Gruber at the University of Miami and Dr. Donald Nelson at California State University at Long Beach between them have tagged nearly 2,000 individual sharks, some with small ultrasonic transmitters that permit continuous tracking of their carriers.

Still other scientists have enlisted the shark's deadliest enemy in the cause of research. Jack Casey at the marine laboratory in Narragansett has persuaded sport and commercial fishermen to tag rather than kill sharks in order to study their migrations and growth rates. During the past 15 years in the course of this project, more than 30,000 sharks have been tagged.

THE MORE WE STUDY sharks, the more we realize that we have underestimated their capabilities. Dr. R. Glenn Northcutt of the University of Michigan at Ann Arbor has found that the ratio of brain weight to body weight in sharks is comparable to that in birds and mammals. Moreover, the shark's brain is capable not only of learning but also of retaining data for considerable periods of time.

In addition, sharks have demonstrated the process we call habituation; that is, they can learn to ignore stimuli such as sounds or other cues that eventually prove to have no meaning or reward.

It is difficult to define or measure intelligence even in our own species, and one cannot generalize about the intelligence of sharks. To begin with, there is no such thing as *the* shark. In any future attempts to farm or to utilize sharks on a large scale for food, oil, or other purposes, we must recognize that we are dealing with a group of animals,

Prime candidate for shark du jour, a pelagic species from Japanese waters (upper left) is transformed into a gourmet platter (far left). Its raw liver, in the small dish, yields a substance called squalene, processed into capsules (left) known as Marine Gold and widely touted in Japan as a panacea for everything from old age to cancer.

some of which are vastly different from others. The so-called cookie-cutter shark is a prime example.

Bearing the Latin name *Isistius brasiliensis*, the species for years puzzled both fishermen and scientists alike. From time to time commercial fishermen caught tunas, porpoises, whales, and even other sharks with small, round holes or scars on their bodies, as though made with an ice-cream scoop or a cookie cutter.

Eventually the culprit was identified—a foot-long pelagic shark with a circular mouth and rather feeble swimming ability. The evidence was conclusive: round chunks of tuna, squid, and porpoise meat contained in the shark's stomach.

But how could such a small, weak swimmer attack something so much larger and faster than itself? After careful study of fresh specimens Professor Everet C. Jones, now at Northeast Missouri State University, came up with the probable answer. *Isistius*, he believes, lies in wait in the open ocean and meets its monstrous prey head-on. As the two come together, *Isistius* takes a quick bite with razorlike teeth, hanging on briefly with its fleshy lips and a tongue that creates a vacuum. The flow of water past the victim swivels the diminutive shark around in a circular motion and pulls it free with a neat, cookie-shaped tuna or porpoise steak in its mouth.

The cookie-cutter shark, it seems, doesn't confine itself to live prey. Not long ago the U. S. Navy discovered that some of its nuclear submarines were returning from patrol with neat cuts in the neoprene shields of their sonar domes. Navy engineers must have had nightmare visions of unknown enemy weapons until the cookie-cutter shark was revealed as the villain.

At the other end of the spectrum from the cookie-cutter shark is the thresher shark, which uses its huge, elongated tail to herd fish into a tightly packed mass. Like nearly all other sharks, the thresher is equipped with a lifetime supply of teeth, each one quickly replaced when it falls out or works loose from the jaw. Studies of tooth replacement among young lemon sharks show that they can grow a new set of full-size teeth in little more than a week.

By contrast the three plankton feeders

among sharks have teeth smaller than a baby's fingernails. Occasionally the whale shark abandons its plankton diet and turns carnivorous in a bizarre feeding technique. Stewart Springer witnessed this technique from the deck of a research vessel in the Gulf of Mexico. A hundred or more whale sharks had come upon schools of feeding tuna and scattered themselves among them. Hanging vertically with their mouths open and heads at the surface, the sharks heaved themselves partially out of the water, then sank back, drawing cascades of baitfish and wriggling tuna into their cavernous maws. The process was repeated over and over again, as the whale sharks literally pumped tons of fishes into their bellies.

Though smaller than the whale shark, the

basking shark, *Cetorhinus maximus*, is commercially hunted, whereas the whale shark is not. A single mature basking shark may yield more than a ton of pink or white boneless meat. The term "basking" is a misnomer, for the fish does not sun itself on the surface. It feeds there, cruising at about two knots and passing an average of 1,650 tons of water an hour through its huge gill rakers, beautifully designed strainers that resemble a giant's eyelashes. These trap the minute plant and animal plankton on which the basking shark lives.

The basking shark's surface-feeding habits make it vulnerable to fishermen, especially the Japanese, who hunt it with harpoons in small boats. Akira Soga buys as much of the harvest as he can.



FLIP NICOLIN

Ageless fascination draws as many as 15,000 people a day to the Shark Encounter tank at Sea World near Orlando, Florida. Riding a belt through a tunnel, tourists become so engrossed that an attendant warns against stumbling at the end.

At 55, Mr. Soga manages a basking shark processing plant in his village of Nakiri on the Shima Peninsula. There I watched a 27-foot fish weighing roughly four tons being prepared for conversion into at least a dozen different products. First the fins were cut off to be dried for shark-fin soup, then the enormous liver was removed for extraction of squalene and other oils. The liver yielded 100 gallons of oil, nearly a hundred times the amount extracted from an ordinary deep-sea shark.

The meat, more than a ton of it, was cut from the huge, cartilaginous skeleton and boxed for smoking, frying, and mincing into fishburgers. Finally the skeleton itself was baked in a giant oven for processing into fertilizer and feed.

Inspecting a second basking shark at the plant, I found that its stomach was empty of plankton and that its gill rakers were missing. Probing beneath the tissue covering the cartilage that normally supports the huge strainers, I discovered a new set of gill rakers in the process of development but apparently ready to break through soon.

I was delighted, for the discovery supports the theory that basking sharks feed on the surface during the months when plankton is abundant, then shed their gill rakers and hibernate in the depths for the remainder of the year. This shark had presumably been harpooned shortly after it had migrated to the surface for the feeding season, since its stomach was empty and it was not quite ready to "bask."



Still scary in retirement, "Bruce," one of three mechanical sharks used in the film "Jaws," lurches toward visitors on a tram tour at Hollywood's Universal Studios. Huge carrotlike teeth have been substituted in case anyone misses the point.

FOR SHEER MYTH, mystery, and misinformation, few creatures can match the great white shark, *Carcharodon carcharias*. Countless books, films, and articles have been produced on "whitey," as Australians call the fish, but none of them quite captures the experience of meeting one close at hand. Rodney Fox is the man to arrange that.

I met him at Spencer Gulf in South Australia, where for the last 15 years Rodney has introduced scientists, filmmakers, writers, and photographers to great white sharks in

the area known as Dangerous Reef. Rodney agreed to take David and Anne and me aboard a charter boat equipped with submersible steel-and-mesh cages for observation and photography of great white sharks.

Some of my diving friends had warned me about the great white shark. "Wait till you meet him," they said. "He's a different kind of animal from the sharks you're always talking about protecting. You won't want to protect this one. You're in for the most dangerous experience you've ever had."

Rodney disagreed. "The experience of a



lifetime, maybe, but not the most dangerous one," he remarked as we headed south from Port Lincoln for Dangerous Reef. "Those cages look frail, but they do the job." He grinned cheerfully. "We haven't lost anybody yet."

One look at Rodney is enough to discourage the fainthearted; he has a massive scar down his left side where a great white shark attacked him in 1963 (below, right).

"I can't blame the shark," Rodney confesses. "I'd been in the water with great whites for years, and they never bothered

me as long as I stayed quiet while they were around. But that day I was spearfishing in a big competition. With lots of fish blood in the water, it must have been too much for the shark. I'm just lucky he only bit me and let go. If he'd bitten down and shaken me in the feeding technique, I wouldn't be here."

Although I have made hundreds of dives with sharks around the world, I was particularly excited at the thought of this one. The great white is the only shark that normally feeds on objects as large as humans. Dangerous Reef, in fact, is popular with



"I wasn't really afraid until I put down the camera and realized how close the teeth were," says photographer Doubilet of a great white attacking his cage. Australian diver Rodney Fox (above) displays a massive scar made by a great white. Closing the wound took 462 stitches after the shark hit Fox while he was spearfishing in 1963. Despite his injury, he decries those who kill great whites solely for their jaws, which can bring as much as \$1,000.

Fox survived because the shark bit once and let go—so common an occurrence that Dr. H. David Baldrige, who has analyzed the U. S. Navy's Shark Attack File, believes that 50 to 75 percent of all assaults are not motivated by hunger. More likely causes include a perceived threat.

great white sharks because of its resident colony of sea lions, a choice meal for the giant fish. Rodney has found that chumming around the reef with quantities of tuna, blood, and horsemeat sometimes attracts great whites to his boat.

"But the big fish are getting fewer," he told us sadly. "Nowadays people kill great whites just for their teeth and jaws. A set of jaws from a really big shark—say over 17 feet long—can go for as much as \$1,000. At that rate there won't be any big ones left."

The largest great white shark jaws on record are at Britain's Natural History Museum in London. A full-grown man can slip them over his shoulders with ample room to spare. Curator Alwyne Wheeler, a leading authority on sharks, showed me the jaws during a recent visit to London. Experts calculate that they came from a fish 20 feet long. Rodney believes that 25 feet is probably the maximum length for great whites, despite claims from some fishermen of seeing them as long as 30 feet.

The Doubilets and I were in luck. Within a day of Rodney's chumming, several great white sharks appeared in the waters around the boat, and David and I went overboard in cages side by side.

All my reading, movie viewing, and discussion with people who had seen great white sharks failed to prepare me for that first moment underwater with the giant fish. I suddenly found myself alone in the cage, with several sharks swimming around, bumping against the steel bars and mesh.

One fish came straight toward me with mouth so wide open I could see past the awesome teeth and peer down its gullet. Seconds later I saw and heard the massive jaws crunch down on the mesh as the tip of the shark's nose thrust through the space between the bars. I plastered myself against the opposite side of the cage, only to find another shark brushing along my back!

I glanced at David in the other cage, 10 or 12 feet away. As the sharks banged and thrust at the two cages, they were actually thrown together. I felt as helpless as I had in childhood days at Coney Island in the arena with the rubber-bumpered play cars. Our cages, however, didn't have rubber bumpers, and when they slammed together the noise and impact were considerable. At one

moment David's cage would come crashing against mine, and we'd catch glimpses of each other's wide-eyed expressions through our face masks. The next moment a shark would come charging between us and the cages would be knocked apart.

Even at the height of excitement when we had five sharks around us at one time, I was so exhilarated and full of wonder that I had no room for fear. The only time it got really spooky was when all the sharks would suddenly disappear into the green immensity of the sea. In the strange silence I kept turning slowly in my cage, wondering from which direction the next shark would reappear.

The banging and thrusting turned out to be only a small part of the shark's behavior. Most of the time they merely cruised by our cages, so streamlined, so graceful, so magnificent that I was completely awestruck by their beauty. Soon I no longer backed against the far side of the cage when a shark came at me, but aimed my camera in its face or down its throat if it swam head-on. At other times I reached through the bars and managed to stroke or pat a passing body.

WE SPENT ten days with the great white sharks, photographing, observing, and taking notes on the huge fish from our underwater cages. Despite the sharks' initial frenzy there were no really unprovoked attacks on us. Probably none of the fish would ever have come near us if Rodney hadn't been constantly pouring all that blood and offal into the water and hanging chunks of meat under the boat.

Often when I was in one of the cages, Rodney would dump another load of chum overboard, momentarily reducing the visibility to zero and making me wince at the blood-and-offal shampoo I was getting.

I frequently recalled William Beebe's description of sharks as "chinless cowards." Beebe knew, as do all experienced divers, that sharks are usually frightened off by objects as large as people. But nothing scares an excited great white shark. No amount of commotion, of people taking pictures or whooping and yelling, seems to affect the fish. It is the only shark that, when lured to a boat by bait, actually surfaces and seems to look the situation over.

During one of our last evenings aboard

the boat we were eating a late supper in the cabin when we heard a heavy thump at the stern. We investigated and found that a 14-foot great white shark had rammed the boat in the process of stealing a 50-pound bag of minced tuna meat that had been hanging well above water and dripping juice down into it. At length we turned in, hoping that the shark would stay around till morning for us to dive with.

We needn't have worried: The shark wouldn't leave us alone. All night long it kept thumping the stern, slapping the boat amidships with its tail, and actually lifting the 32-foot craft from below. I can still hear the heavy rasp of its skin against the hull and an occasional clank of metal as it encountered the anchor chain.

In the end I came ashore with different feelings from those predicted by my diving friends: I believe the great white shark should be protected, and that it would be a tragedy if such a magnificent animal vanished forever from the oceans of the world.

In 1945 Winston Churchill wryly announced: "You may rest assured that the British government is entirely opposed to sharks." Churchill probably didn't realize it, but he and his fellow members of Parliament frequently ate shark meat, one of the most common ingredients of England's beloved fish-and-chips.

In the effort to guard himself against sharks, man is killing them off at an alarming rate. Along Australian and South African coasts it is common to kill off the sharks in the area of bathing beaches by protecting those sections with underwater nets. The nets are highly effective: In Queensland, Australia, alone, more than 20,500 sharks of all kinds became entangled and died in such nets over a period of 16 years. Conservationists are even more alarmed by the fact that the nets also claimed 468 highly endangered dugongs, 317 porpoises, 2,654 sea turtles, and 10,889 rays. As for the 20,500 sharks, most of them would never go near a swimmer anyway.

When we consider the rarity of shark attacks among hundreds of millions of bathers each year, we should ask ourselves a moral question: Because we like to swim and dive in an environment unnatural to our species, is it right for us to kill off tens of thousands of



With raw power, a great white hurls itself from the sea while charging a baited line. These, the largest of all predatory sharks, inspire a favorite guessing game: How big? The current record stands at 21 feet for a specimen taken off Cuba in the mid-1940s. However, a serious challenger has surfaced. Experts await confirmation of a great white harpooned in the Azores and said to have measured a staggering 29 feet 3 inches.

harmless residents of that environment to ensure our peace of mind? We have invented many sports more hazardous than going into the sea. When we kill ourselves at these, we blame no one else and simply accept the risks. But when it comes to sharing the sea, we insist that sharks take all the risks.

Although many people still consider it ridiculous to protect sharks, Israel has taken the first pioneer step in that direction. The Israeli government's Nature Reserve Authority established a series of underwater preserves and parks along the eastern and southern coasts of the Sinai Peninsula. The aim is to protect the magnificent coral reefs along that coast, together with their inhabitants, including sharks.

As we become more familiar with sharks, the move to protect them may spread. Sharks can provide a major attraction in underwater parks, once divers learn that they can be approached and photographed with caution. Seen in their own environment, sharks are incredibly beautiful. The hammerhead, so grotesque when hooked or speared and hauled as a lifeless carcass aboard a boat, is a creature of matchless grace underwater.

Diving tours, now a worldwide business, are usually considered failures without at least one shark sighting. Nor does one need any longer to be a diver to become part of the sharks' environment. At Sea World in Orlando, Florida, nonswimmers can ride a belt through a transparent tunnel in the world's largest shark tank, viewing several species of sharks in-the-round (page 180).

In such ways we may come to appreciate and understand sharks, as we are coming to know other animals above and beneath the sea. With further research we may one day be able to predict sharks' behavior with great accuracy. When that day comes, I feel certain we will recognize that sharks present no threat to mankind.

I only hope the reverse will be true. □

Can the majesty of a great white give perspective to the terror sharks have elicited for so long? As one expert observes, "There are a great many more sharks eaten by people than there are people eaten by sharks."



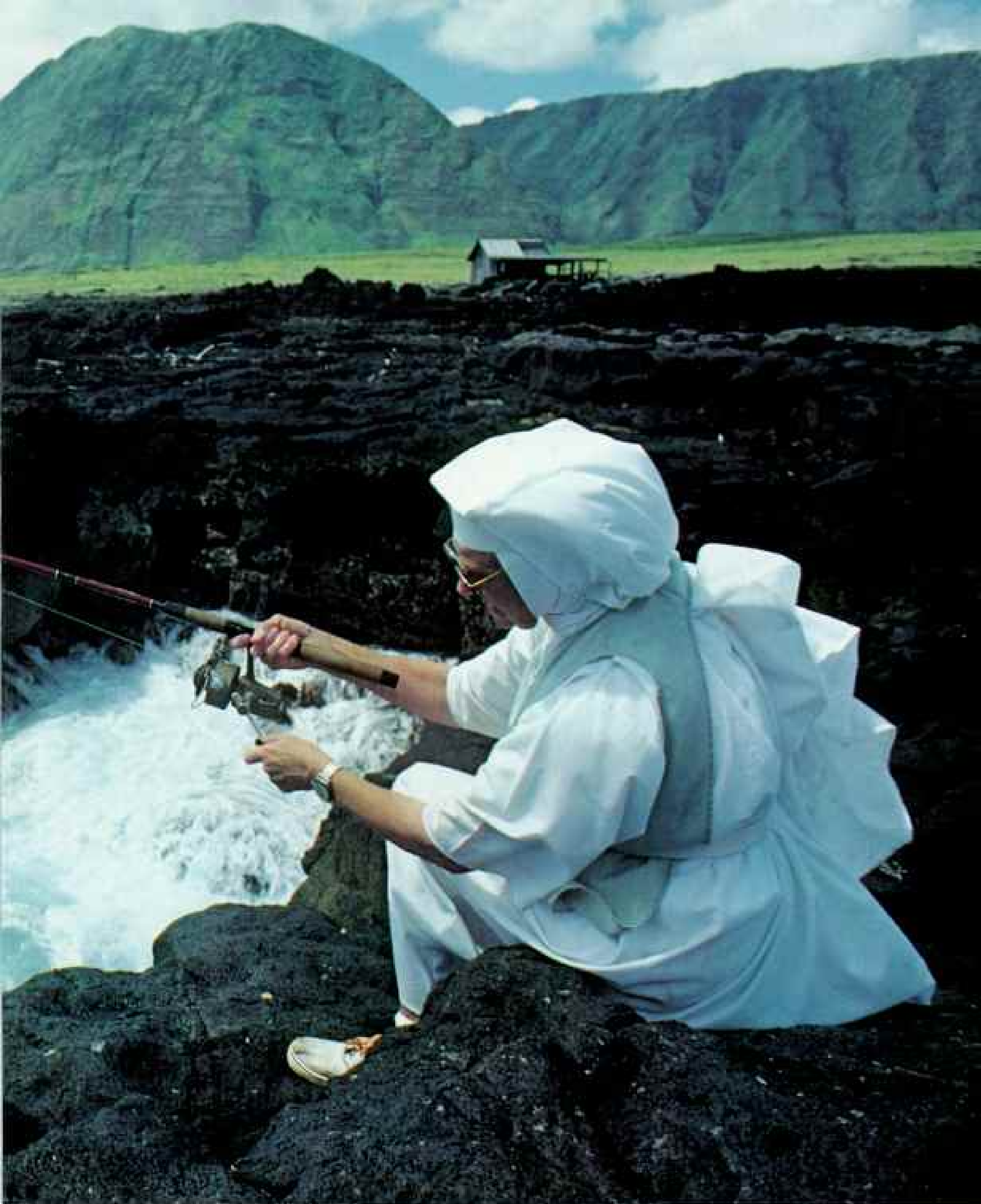




Molokai—Forgotten

By ETHEL A. STARBIRD NATIONAL GEOGRAPHIC SENIOR STAFF

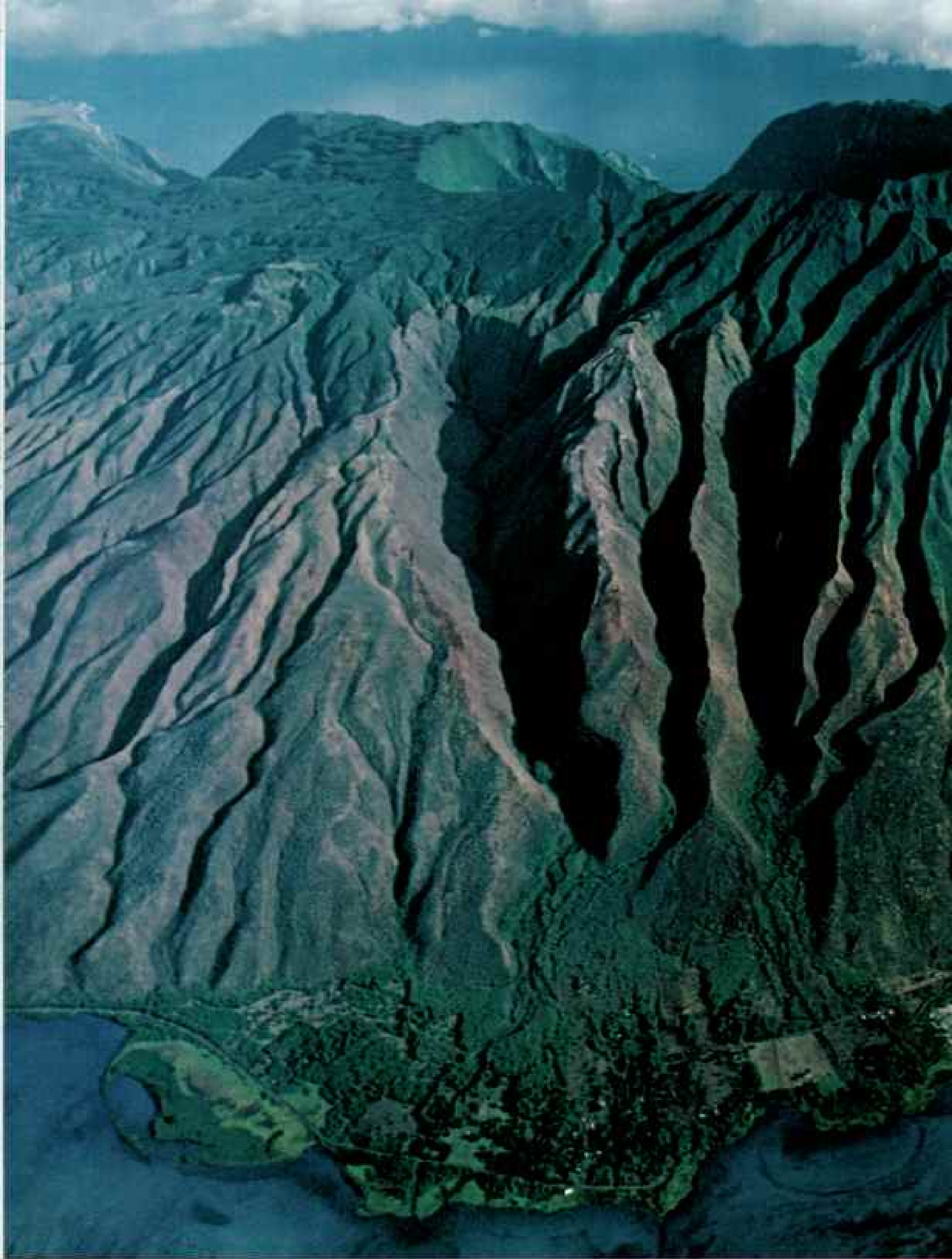
Photographs by RICHARD



Hawaii

A. COOKE III

Casting away care, Sister Richard Marie takes a day off near Molokai's leprosy hospital, where she has worked since 1960. Independent, resourceful, generous, she shares the best qualities of Hawaii's most unspoiled major island.



Like thirsty giants, the volcanic peaks of Molokai's eastern end steal rainfall from its flat, dry western end. Polynesians from the Marquesas Islands came to Hawaii about 1,200 years ago. They eventually settled on this island in numbers

National Geographic, August 1981



far greater than today's 6,000 population. The semicircular walls of coral and basalt seen in the shallow waters in the foreground enclose fishponds once used to capture and fatten mullet and other saltwater species for island royalty.





Beyond the furthest road a primeval world unfolds in the lush valleys of the northeastern coast. The chill waters of Kahiwa Falls (left) drop 1,750 feet to the sea in Hawaii's longest cascade. Deep in the island's forest reserve, spray from another waterfall (above) mingles with the scent of eucalyptus and wild ginger. Amaumau ferns (right, center) stand as tall as six feet.



For centuries, Molokai was revered as a place where religious rituals were performed by powerful kahuna, or priests. One of the most famous, Lanikaula, is said to be buried in a grove of kukui trees near the island's eastern tip (below right). To make lamp oil, Hawaiians traditionally took nuts from the kukui, now a symbol of Molokai.





A gift to the king, axis deer from the upper Ganges River were shipped in 1867 to Kamehameha V by Dr. William Hillebrand, a botanist of Hawaiian flora, then traveling in

National Geographic, August 1981



India. The deer multiplied rapidly, and they have been widely hunted over the years, along with goat, wild pig, pheasant, partridge, and other game birds.

Molokai

DANNY and Louise Kekahuna usually have their hands full—with the red soil of their native Molokai. With only one small outdated tractor, they work a 40-acre homestead on this moccasin-shaped island, which is anchored about midway in the major Hawaiian chain.

The day's hoeing and sowing were over. "Now we talk story." Which, in local language, means conversation on any subject.

Louise and I settled onto upended crates in their shady backyard. "I'm chop-suey Hawaiian; Danny's full-blooded. You have to be at least half Hawaiian to get a homestead. When we first moved in, he was working out, ranching. The Homes Commission say farm or forfeit—that's the law. We decided to stay."

Breaking and cultivating expanding fields of squashes and sweet potatoes can be a precarious pursuit. Barges may arrive late to pick up perishable produce for Honolulu, 50 miles away on neighboring Oahu. Without protective screens of wild cane or ironwood, boisterous trade winds can flatten a crop; a market glut may do the same to profits. And plant pests, finding the winterless weather as agreeable as humans do, munch and multiply year round.

To ease the strain of economic uncertainties—and for the pure pleasure of it—the Kekahunas, both in their early 50s, still reap the island's natural bounty as did their ancestors.

Together, we scooped sea salt from rocky pools above the reach of summer tides, plucked flowing manes of *limu*, edible seaweed, from south-shore shallows. With Louise, a patient teacher, I learned to select rapier-like *lauhala*, leaves from the pandanus tree, which she weaves into hats and mats and sells.

Danny needs no lessons on how to harvest the island's fish-rich reefs. "Spear squid, you quick bite between eyes where small brain is. You no kill fast, you maybe end up with a nose or ear full of squiggly arm." I opted to stay ashore and pick lauhala.

In the manner of Molokai people, the Kekahunas share. Neighbors had put a sack of onions on their boundary line; Danny would leave some surplus avocados and papayas in its place.

"That way, nothing go to waste. Everyone have at least a little taste of everything." Under this giveaway program, a mango I knew of changed hands four times.

Still more rural than most of Hawaii's other holdings,

Pure Hawaiian in origin and outlook, Rachel Naki tends taro patches today at 77 as she did as a child. The rootstock of the starchy taro plant is ground to make poi, for centuries a staple of the islanders. "In old days we eat mostly fish, poi, coffee, but all healthy people," she says. "We pick our own coffee—it just grow up." Hard work on the land has always been her way to express her love for God and for the island of Molokai.



Molokai with its 6,000 inhabitants remains a sparsely settled enclave of scenic inconsistencies. Born of the fiery outpourings from three long-extinct volcanoes, the little island—only 38 miles long and 10 miles wide—divides almost evenly between arid, prairie-like west and lush, mountainous east. Despite its wide-open spaces and chronic lack of rainfall, the west contains what few businesses exist here—ranching, resort real estate, pineapple plantations, and Kaunakakai, the only town.

Largest in terms of territory, 80-year-old Molokai Ranch still owns most of the west end—70,000 acres, more than half the island's usable land.

Formula for Survival: Diversity

"We're a corporation now; we'd have a tough time if we depended solely on cattle raising, though we're still running about 6,400 head. We've had to diversify."

As we jounced over dusty tracks that vein his domain, manager Aka Hodgins pointed out some of the new directions the old ranch has taken.

"Hay is doing well; we're selling about a thousand tons a month. Our abundance of axis deer and game birds has always attracted hunters. Now we're charging for shooting privileges, and we have more applicants than we can accommodate.

"Del Monte leases 3,500 acres from us for pineapple production. Dole did the same until 1976, when it closed out its Molokai operations. We're trying to find a new tenant for the vacated land, but we're having no trouble with takers for Mauna Loa, the company camp they built. There's a waiting list to rent the old housing units as we upgrade them."

Aka even found a use for a tract thorny enough to give a goat indigestion. He stocked it with wild African animals, creating Hawaii's first game park, a paying attraction for the tourist trade.

Molokai Ranch's most controversial decision was the sale of 6,700 prime acres to a mainland development company for house lots, condominiums, and a complete resort-hotel complex, the island's only one to date.

An old-timer expressed disgust: "You know who buying up alla Molokai? 'Uncle Kapu,' that who. Everywhere now you see his name." Indeed it has become prominent;



To soothe hard feelings after a well-fought women's softball tournament, Annette Dela Cruz sways into an impromptu hula for rival players. The good-natured aloha



Molokai



spirit has helped Molokai's varied ethnic groups live together over the years. Of the total population, 37 percent are Hawaiians, the largest proportion in the major islands.

Another 30 percent are Filipinos, and the rest are mainly Caucasians and Japanese. The 38-mile-long island, fifth largest in the chain, lies 25 miles east of Oahu.



many properties once freely crossed to reach common hunting and fishing grounds now bear signs reading *Kapu*. It's the Hawaiian word for "keep out."

The trend toward outside ownership and tourism, still in its infancy on Molokai, makes some natives restless, others openly hostile. Ripping off whatever they can from rental cars has become a popular sport; visitors have suffered violent, unprovoked attacks. Finding two-inch screws angled to puncture my front tires suggests a slow leak in the state's much touted aloha spirit.

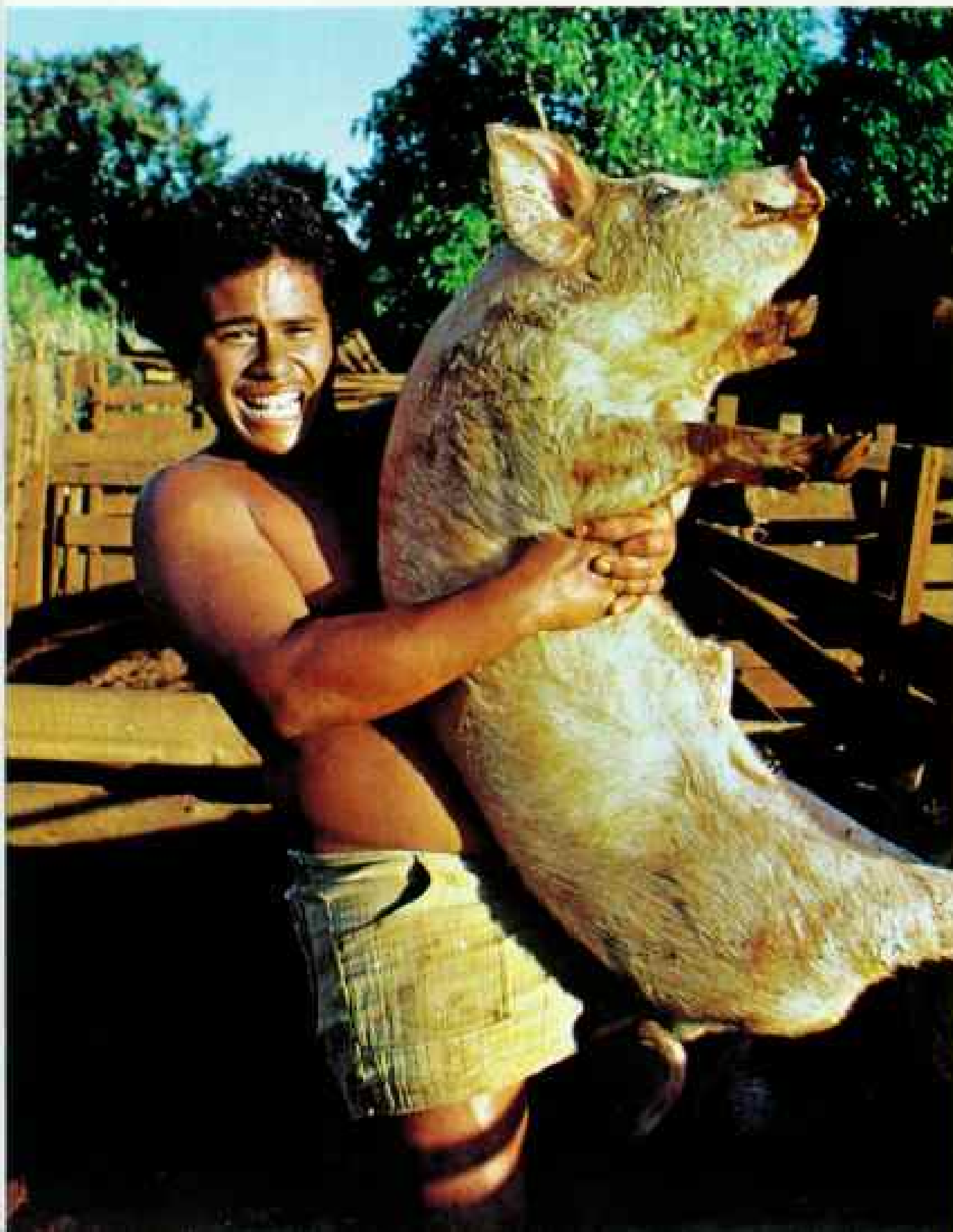
At least one preacher on the island has tailored his love-thy-neighbor sermon to the times: "Someone give you *pilikia*—trouble—turn the cheek. Do again, turn

other cheek. Third time, you on your own."

Prospects for the big boom many islanders fear seem a little overstated, even without a recent slackening in the tide of tourists to Hawaii. Except for that one remote development on former ranch property, shoreside hotels and condominiums now in place face a near-beachless sea, shoal lagoons often muddied by runoff, and shallows that won't wet a waist in a hundred-yard wade. Rare stretches of inviting sand and surf often hide tricky currents, treacherous undertows.

"My customers don't mind a bit," one hotel operator reported. "They only come here to start their tans. Once they're brown enough for a bikini, they're off to where the action is."

Pig out of its poke is returned by James Mawae, whose family holds one of the homesteads set aside by the government in 1920 for people at least half Hawaiian in ancestry. By law, owners must farm or forfeit these homesteads, but only about 20



One of Molokai's greatest attractions: It's where the action isn't.

Kaunakakai's main street—Ala Malama—is only three commercial blocks long. At peak hours it's about as crowded as the shoot-out scene in that classic Western *High Noon*. The setting, too, is similar: hot, treeless, fringed with false-fronted buildings and the vacant Kamoi Theater, where the last picture show played four years ago.

Among its businesses—predominantly Japanese—the two most enduring and endearing flourish at opposite ends of the street. Neither family establishment has changed much in its years of operation: 65 for the Kanemitsu Bakery, 42 for the Mid Nite Inn (which closes three hours earlier).

Dorothy Kanemitsu isn't much taller than the company-baked loaves she sells—about a thousand a day throughout the state.

"My father-in-law start with one item—Japanese cookie, like doughy bun with soybean filling. He try bread; it gooey too. My husband improve, same recipe today, no preservatives, all natural ingredients.

"We almost quit three years ago. Our doctor daughter in California say, 'You come here or you'll never get a rest.' We try, but my husband no like mainland. Bad weather. Not easy to go fishing like here. So we come back where we can relax." Working 12 hours a day.

Tourism has benefited the bakery, but it bothers Dorothy. "Hawaiian Islands such a

of 200 now actually work the land. Since 1927 when Del Monte began pineapple production, Kualapuu plantation (below) has been a key employer on the island, especially after Dole closed down its Molokai operation in 1976.





small place. If it grow and grow, soon like mainland; people see same thing as there. Molokai best stay like always, so in years to come children born will know how it was. This is a fragile island, so easily destroyed.

"If we keep what we have, I think more visitors come if only for a short time. Better that than building another Honolulu."

Art Kikukawa's restaurant, the Mid Nite Inn, began as modestly as the bakery—with a *saimin* stand his mother opened. Four nights a week, departing travelers would eat the zesty noodle dish while waiting until midnight to board the interisland steamer. Hence the name.

A strapping fellow who looks more suited to cattle ranges than kitchen ones, Art admits he has never liked cooking. But he must be doing something right; he's got about all the customers he can handle.

"They're mostly regulars, who don't want any changes. They kicked up an awful fuss when I put in new booths; the old ones were riddled with termites. They'd probably riot if I switched stoves. They're convinced the food would suffer if I cooked on anything but this old cast-iron relic."

Finding Art's place—where *saimin* is still a best-seller and prices remain reasonable—used to frustrate strangers. There was no sign. "The original one blew away in 1947. I liked the way the street looked without it."

Art shades his support of the status quo with a practical view of the future:

"We're bound to get a new shopping center, and it may well have a restaurant. I don't worry about competition; it keeps me on my toes. Those who grumble about growth are the ones who don't want to work. Create more jobs and they'll have to."

To reduce Molokai's present 8.4 percent unemployment rate—Hawaii's highest—expanded agriculture seems the logical alternative to tourism. There's one big hitch, though. The native population may be fiercely possessive about their land, but few want to cultivate more than an occasional household garden plot.

George Harada regrets the lack of interest in large-scale farming; even at present capacity, the Molokai Irrigation Project he supervises can provide enough water—at minimal cost to homesteaders—for another 14,000 agricultural acres.



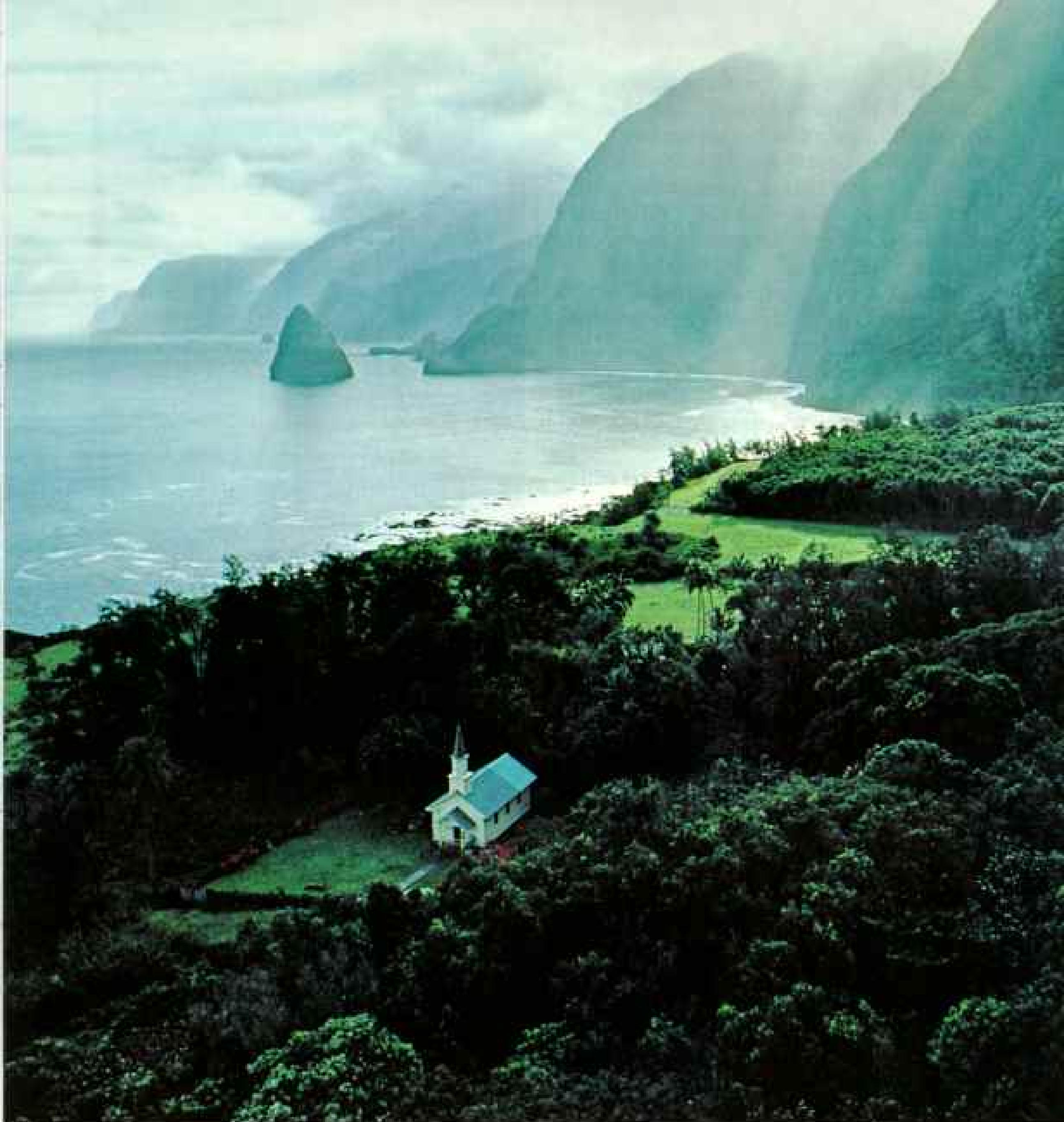
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Marching in step with land prices (top), an antigrowth sentiment is part of an evolving "Hawaiian consciousness" among some islanders, who resist resort projects and outside ownership of land historically Hawaiian. In June 1980, a grass roots group (facing page) successfully opposed plans by a California developer to build luxury condominiums near Pukoo, an old Hawaiian settlement. Resentment of wealthy strangers on Molokai may also be sharpened by the worst unemployment in the state.

Mixing old ways with new, Danny and Louise Kekahuna (above) cultivate sweet potatoes and squashes on their 40-acre homestead and collect natural sea salt and pandanus leaves.



"There's plenty of water; it's just in the wrong place—our windward coast, where almost nobody lives. Nearly 100 million gallons spill into the sea each day.

"To bring it to where it's needed in the usually dry central plains, we bored a five-mile-long tunnel into Waikolu Valley to tap the streamflow there. Took four years. Care to have a look?"

Our jeep gurgled through the carwide conduit, the water in the flume barely to the tire rims. "Designed to carry 21 million gallons

a day; doing less than a third that now."

The panorama from the far portal is ample payoff for an hour of dank and dark. Waterfalls, silvered with sunlight, jet from out-of-sight heights; dense forests shade gentler inclines with a dozen tones of green; wild ginger blossoms scent the air.

— Once out in the open, George turned the jeep around; the narrow passageway permitted only straight-ahead navigation. He grinned. "It'll be faster going out. After all, we've got the current with us."



Once banished because of their fearful disease, leprosy victims were put ashore to die at a colony established in 1866 at Kalawao, shown in this early photograph (above). Isolated by 2,000-foot cliffs, the windswept peninsula became a natural prison over the years for thousands of disfigured souls. Siloama Church (left), first built in 1871, marks the original site of the colony, later moved across the peninsula to Kalaupapa.

Touched by their suffering, Father Damien (right) served the outcasts for 16 years until 1889, when he too died of their disease.



DAMIEN MUSEUM AND ARCHIVES (ABOVE AND TOP)

Waikolu had shown me a small sample of Molokai's other world—the magnificent east end. From Kaunakakai to Halawa this half of the island erupts in a jumble of razor-backed ridges, corded slopes, and deep-cleft valleys. On the north side the volcanic landscape ends in fortress-like *pali*—cliffs—that plummet some 3,200 feet into an unruly surf. Here, frequent rains streak the rocks with myriad cascades, some exploding into wind-whipped mist and rainbows before they reach the sea.

Today this is a ghost coast, too rugged for any road to reach. Its few foot trails would slow a Sherpa, and even boatmen distrust its swells except in summer calms.

But its spectacular valleys—Waikolu, Pelekunu, Wailau, and Halawa—once sustained sizable settlements. Halawa, dead end for today's motorist, has a few hideaways occupied by the antiestablishment set; all earlier dwellings were washed away by a 36-foot tsunami in 1946 and not rebuilt.

No one knows who set foot on Hawaiian



soil first. But midway in the eighth century Polynesians from the Marquesas Islands began to populate the archipelago. They must have reached Molokai in large numbers: House foundations, rock walls, and *heiau*—temples—litter the landscape, even in places now barely accessible.

In 1833, when the newly arrived missionaries first counted, 6,000 people were living on the island, most of them on the east end. Apparently, until then, nothing had happened here to dilute their pure Polynesian lineage. Even Capt. James Cook, England's globe-girdling explorer, bypassed Molokai in 1778 when he became Hawaii's first known visitor from the Western world. So did all those whalers and sailors who followed in his wake.

Which may be why Molokai, of the state's six largest islands, retains the highest number of native Hawaiian people—37 percent.

Most still live as did their early forebears on the east end, though nowadays they favor the protected south shore.

The Nakis have been exposed to both east end exposures—north and south. Rachel, born in Pelekunu, spent the first 17 of her 77 years in Wailau, where she met and married Imu, 78. In those years he helped deliver mail to the valley's 300 residents, scaling the pali each week and walking 22 miles to bring the mail from Pukoo.

"Everything we need grow good there—wild pigs, goats, coffee, fish all aroun'. Papaya, mango, plenty *pili* grass for make house. Roots, leaves for med'cine. But mostly we raise taro for poi; it hard work, you got no time for sick."

When a flash flood (about 1915, as Rachel recalls) erased taro patches laboriously walled and terraced, the Wailau community began to dissolve. Nowadays only

Undaunted by his handicaps, John Kaona (left) fashions unusual dolphin-shaped jewelry (below right) from sandbox tree seeds in a workshop he built at the Kalaupapa colony.

Despite its centuries-old stigma, leprosy is rarely contagious. Thousands of people a year visit the colony, operated by the Hawaiian Department of Health, to find a cheerfulness expressed by patient Ed Kato on a rock message (above right).

No complete cure has been discovered for the most severe forms of leprosy, which is named Hansen's disease after the Norwegian physician who isolated the bacillus. But sulfone drugs used since the 1940s control the disease and prevent contagion so successfully that Kalaupapa's patients can come and go as they please. Yet many, now in their 60s, prefer to remain among friends in the quiet collection of well-kept cottages they have long known as home.



an occasional hunter or fisherman ventures into the valley.

Shifting to a south-side address, the Nakis are still doing what comes naturally—raising taro. And a flock of free-roaming chickens, a Molokai method of centipede control.

After 36 years under canvas, they moved into a new house and need no longer toil hard for a living. But it's a habit they don't intend to break. "Sit aroun', we dry up, we die. Stretch and bend, it keep us strong." Imu flexed his biceps, an impressive sight.

Rachel voiced disgust with a neighbor who, to curb through traffic, had strung a wire across the lane leading to the Nakis' taro terraces. "God no like greedy land. It all belong to Him; He expect us to take care of what He lend us."

Among the last of Molokai's taro growers, Imu and Rachel take care with a passion. No weed stands a chance amid their plants.

"Everybody want poi, but most too lazy to tend it. Soon no more taro, no more poi."

Most east enders do prefer other pursuits—like fighting further development, which they feel endangers their traditional lands and life-style. Many know what overbuilding has done to Honolulu; others see without leaving home the sky rises that now shadow Maui's once unblemished beaches.

Recognizing the need for more sophisticated weapons than talk, prayer, and demonstrations, leaders of the movement are fast learning how the law can be used for as well as against them. Already their educated efforts have paid off with one stunning victory—defeat of a large project planned for the Pukoo area.

Antidevelopment sentiment is fueled in part by a statewide drive among native Hawaiians to secure lands they feel are rightfully theirs by virtue of their ancestry.

Yet, historically, landownership among these islands was limited to a privileged few. For almost a thousand years, local *alii*—chiefs—controlled all property under a strict, often cruel feudal system. Kamehameha I put an end to their power when he annexed the islands and became king in 1810. The vast holdings of the *alii* passed to the monarchy, which during its century-long reign doled out large parcels to those who won royal favor.

Like American Charles R. Bishop. In 1875 he was granted half of what would become Molokai Ranch. His wife, Bernice Pauahi, last descendant of Kamehameha I, acquired the rest through inheritance. The complete 70,000-acre package sold in 1898 for \$251,000, the price of a condominium apartment there today.

Among the leftovers of the *alii* period is

a remarkably well-preserved chain of offshore fishponds looping along the south coast (pages 190-191). In these tidal corrals, expertly enclosed with snug-fitting stonework, early Polynesians raised fish, mostly mullet, to feed the ruling class.

Esidoro and Sifriana Pascua, an elderly Filipino couple, keep this ancient form of aquaculture alive—but they may give up soon. The pond they tend is being smothered by mangroves; rent for it has almost doubled in the past several years; their catch has dwindled to an occasional Samoan crab.

"Baby mullets still swim up channel from sea; for 30 years we put in pond to grow. Baby barracuda get in too and grow." Wading around to net mature food fish, Sifriana has suffered three serious barracuda bites—a painful memory that's taken the edge off her enthusiasm for the fishpond business.



The big time on Molokai is sleepy Kaunahakai's three-block-long business center, where master of ceremonies Butchie Dudoit introduces Moana's Dance Troupe (right) for a lively hula during Aloha Week. A celebration of things Hawaiian, the festivities take place each October. The false-fronted wooden buildings on the main thoroughfare (above) of this largest island settlement retain a Wild West charm—with an Oriental flavor lent by Japanese-American merchants.



 **BOBO'S
AUTO SERVICE**



"Once so many mullet they come when I whistle. A partner want to put in *tilapia*. We say no, a no-good fish, eat other fishes, taste muddy. Partner no good either; he dump in *tilapia* when we not here. To get rid, must poison whole pond, wait two years, start all over. Someone else maybe, not us."

These days Esidoro spends less time at the pond, more at "school," as Filipinos call their weekend social center, a back-street yard in Kualapuu's plantation community. There's a lot to learn there—if you can find the place. Nobody's going to volunteer the information.

Main attraction: Illegal chicken fights and games of chance that police tolerate as long as they're small scale and locally run. A patron named Joe approves the arrangement. "But just in case, the house takes a small cut. For possible fines or legal fees."

Pineapple Economy Slows Romance

Because pineapple growing is labor intensive and the last importation of field workers originated in the Philippines, 30 percent of Molokai's population belongs to that ethnic group. Recruited in their teens at wages that precluded the luxury of family life, many of its men remained bachelors until retirement. A lot have made up for lost time since, returning home, sometimes after a 30-year absence, to acquire young brides often pre-chosen by relatives or friends there.

Ponciano Raguindin made this pilgrimage five years ago when he was 65, his wife 20. "It's good to be married. New happiness for years I have left. Some make fun, call me the old man. Then how come I got three kids already?"

Fringe benefit of these May-December marriages: a pool of energetic young women eager for plantation jobs that many young males now spurn.

With some 300 employees at peak season, Del Monte is still Molokai's leading *luna*—boss. Manager Robert R. Kehler has no worries about a personnel shortage.

"Scientific and technical advances, changing practices, they're increasing faster than the labor supply is shrinking. New plantings are yielding three crops now instead of two, and we're converting rapidly to drip irrigation. So we can get along with fewer people."

By local measure Del Monte is a most impressive operation: 3,500 acres under production; 26,000 plants an acre; 60,000 tons of fruit a year for its Honolulu cannery.

While most Molokai people tend to congregate, as do Del Monte employees and retirees, in small communities or subdivisions, Joyce Kainoa (pages 216-17) has other tastes. A 34-year-old widow and the mother of six, she prefers the seclusion of an uninhabited north coast valley. To discourage strangers, only one helicopter pilot is cleared for landing; the hazards of her rock-strewn harbor hold curious boatmen at bay.

Despite this voluntary isolation, Joyce is a warm, outgoing woman deeply involved in preserving what's left of old Hawaii, securing landrights for native people, procuring legal aid for those in need. She has simply elected to re-create for her family the uncomplicated life-style of her Hawaiian antecedents, which is how she, too, was raised.

"For years I fished commercial, living summers in Wailau Valley to work these windward waters. Sure, the kids went with me; they knew what they were getting into when we moved here.

"There's too much hassle on the outside, too much dependency on nonessentials. After two years here, we're eating better than most, harvesting what nature provides—fishes, goats, pigs, fruits from the forest. But we never take more than we need."

The Kainoas and Joyce's friend Mike have given nature quite a nudge. Behind their bluff-top house, carefully sited for compatibility with its surroundings, one and a half acres of terraced gardens bear the bounty of their industry: taros, cabbages, corn, beans, potatoes, squashes, sugarcane, wheat for flour, bananas, avocados, figs.

"No chemicals. We don't know good bugs from bad bugs, so we don't fight them. We just grow enough for everybody."

Joyce occupies land to which she holds a title, but she has built her home without the necessary permits.

"If I waited for permits, we still wouldn't have a roof over our heads. We're more careful than regulations require about erosion, pollution, conservation, sanitation. After all, we're the victims if we mess up."

All the Kainoa youngsters respect and protect their environment, a lesson too few

learn at any age. And their unorthodox education is more meaningful in many ways than standard schoolroom fare.

"I teach them all I know—reading, writing, about plants and animals, about agriculture, about what lives in the sea. They know our fish, recognize which to avoid for safety's sake and when the ocean wants to be left alone.

"They've learned first aid and preventive medicine from a doctor friend of ours; also a lawyer who sometimes visits is giving them a continuing course in our legal system, vital knowledge for all Hawaiians who want to keep what little they have left. The kids know that they will be on the losing

end if they play hooky in this household."

So far, the family has suffered no major mishaps except the loss in a storm of their only transport—the scow and powerboat that brought them here. "God willed it. Maybe He thought that was too much luxury. Perhaps it was."

In an emergency the Kainoas must hike or swim for help. Afoot, it's about 20 miles over rough and tilted terrain to the nearest road. Usually the surf is even less inviting.

"Best head for Kālaupapa around the bend. Take off from our point and even if you're not a strong swimmer the current will sweep you straight to Waikolu Valley, which is a couple of miles away. The



Ancient and alternative life-styles join as Molly and Jade Brushfel exchange vows on the site of an old Hawaiian temple. Peggy Hau Ross, a kahuna, conducts the traditional Hawaiian wedding. The couple's week-old daughter, Olawa, in a gown cut from her mother's dress, attends in the arms of a friend. A handful of families has resettled the remote Halawa Valley, depopulated in 1946 by a 36-foot tsunami.

settlement is only a short walk beyond.”

In 1866 a pitiful band was cast ashore near the same spot, forever banished to empty, windswept Kalawao with only their waning strength to provide food and shelter to sustain their maimed bodies.

Thus Molokai received its first of many innocent outcasts whose only crime was contracting leprosy. Now known as Hansen’s disease (for the Norwegian doctor who in 1874 identified the microorganism that causes it), the disfiguring ailment was then uncontrollable and believed far more contagious than it really is.

The treatment in those early days varied little: Round up all the islands’ afflicted, adults and children alike; dump them at Kalawao without professional care; deprive them of their civil rights.

The settlement endured a painful record of hardship, lawlessness, and misery that was almost totally ignored by the outside world until the arrival in 1873 of Joseph de Veuster, a Belgian-born Roman Catholic priest known as Father Damien. Learning of the plight of Molokai’s forgotten exiles, he chose to spend the rest of his life serving their spiritual and physical needs. After 16 years

Too rough to ride on a windy October day, the surf boils onto Papohaku Beach, where a hotel chain has built Molokai’s only major resort complex. Stretching two



of extraordinary accomplishment, Father Damien contracted the disease himself and died at the age of 49.

Inspired by his martyrdom, other volunteers began to arrive under relaxed rules of nonpatient residency; more public and private funds started trickling in—never enough of either until very recent years. The first real hope for the afflicted emerged in 1945 when sulfone drugs proved effective in arresting most cases.

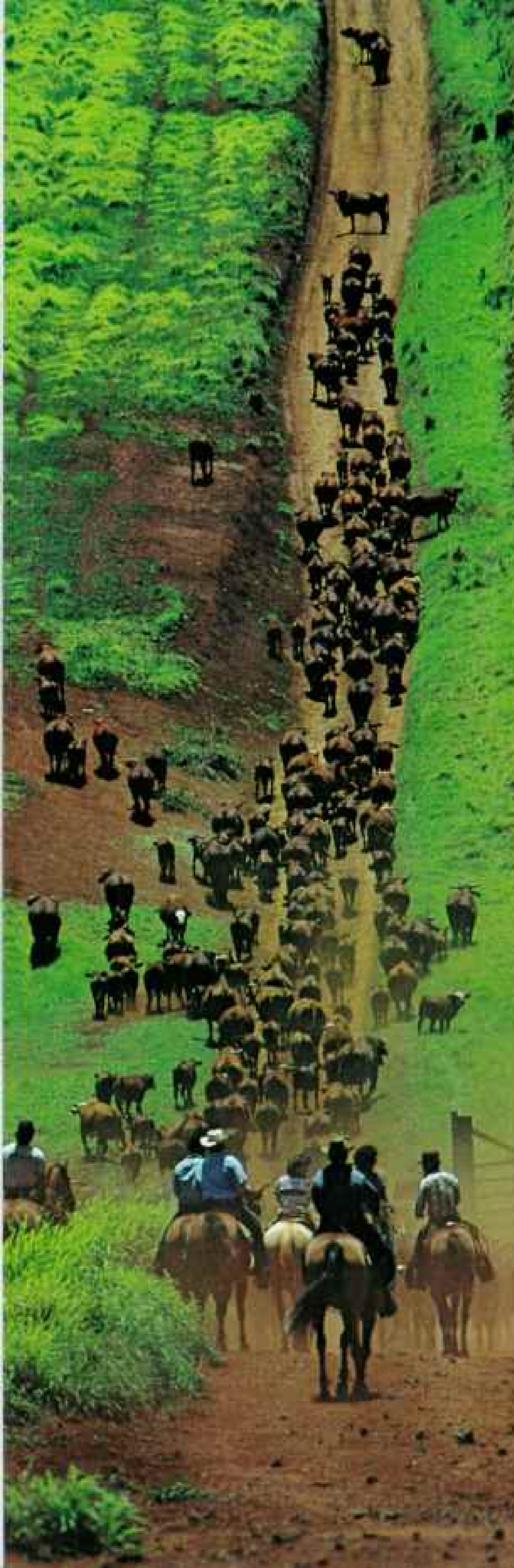
Today's scene is a far cry from those tragic years of neglect and suffering. The 118 remaining patients (admissions ceased in

1969) live in a neat cottage community called Kalaupapa, directly across the peninsula from the now deserted east side where Father Damien began and ended his labor of love. Residents enjoy all the amenities of this modern age, including regular air service connecting them to anywhere in the world. They may go and come as they please, leave forever if they wish. (New cases are treated as outpatients by a Honolulu clinic.)

Day visitors willing to respect the patients' privacy are welcome: Each year thousands descend *(Continued on page 218)*

miles along the western coast, the beach offers a haven to visitors seeking solitude. In the evening the lights of Oahu wink across the channel.

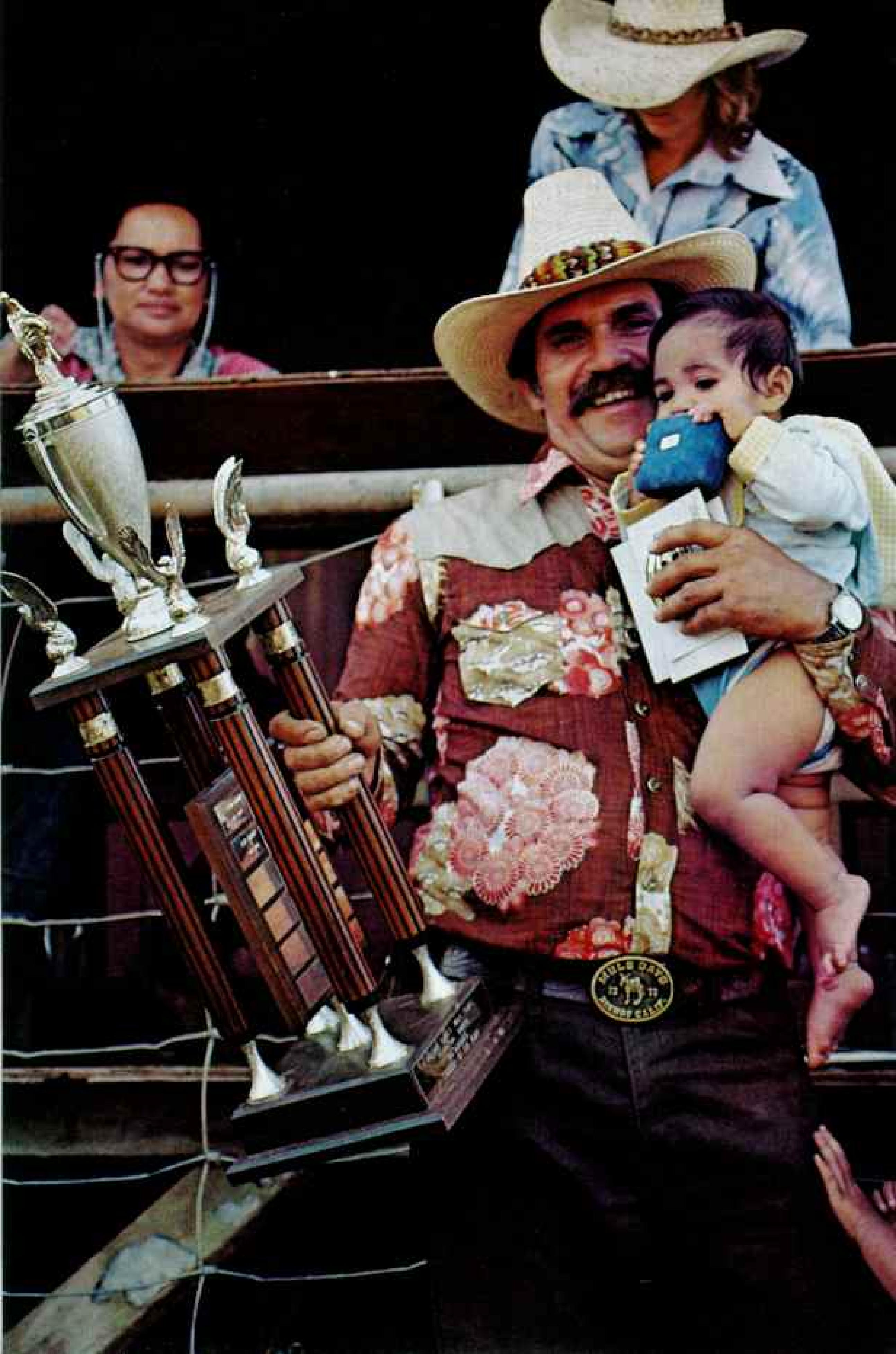




Cowboy of the Year Buzzy Sproat, here showing off his daughter and 1980 trophy (right), works at Tropical Rent-A-Mule when not competing in one of Molokai's frequent rodeos. As chief mule skinner, he guides visitors on muleback down a precipitous 3½-mile trail to Kalaupapa. Flagman Boy Negrillo (below), safeguarding the hats of several contestants, is a carpenter by trade. Regardless of profession, nearly everyone on the island shares a passion for the cowboy life.

Through clouds of red dust, the hands of 70,000-acre Molokai Ranch herd the first of 6,400 head of Santa Gertrudis cattle to new pastures on the main drive of the summer (left). Before the ranch was established in 1898, King Kamehameha V also raised cattle on this prairie-like west end.





Practicing what she teaches, defender of Hawaiian tradition Joyce Kainoa moved her family to an isolated northern peninsula (right) and revived old ways. She gives her children survival courses—from reading and writing to farming and fishing. At one session she reviews the meaning of Hawaiian place-names (below). At another (bottom) she shows how to relieve a sudden case of muscle spasms.





BRUNWEN JAMES

Like the Swiss Family Robinson, the Kainoas live by their wits. But unlike the characters of the Johann Wyss novel, who built ingenious contraptions for conveniences, the Kainoas seek to harmonize with their surroundings. As their Hawaiian ancestors did, they take pigs, goats, fish, and fruit from the forests. Their organic garden produces taros, sweet potatoes, sweet corn, and Irish potatoes. After a storm destroyed their boats last year, they decided not to replace them. So when visitors arrive by sea, Joyce ferries their belongings in a washtub (left). A friend stays with her children when Joyce periodically returns to the outside world to lobby for Hawaiian land rights and legal aid for the needy. Pursuing her dream of independence, she helps other Hawaiians find their way.

the three-and-a-half-mile cliff trail by mule-back or plane hop in from Honolulu to the peninsula's tiny airstrip.

Only the fortunate few make the airport run with Kenso Seki, who has spent 52 of his 70 years here. We traveled in style in his 1928 Model A Ford, its fenders filigreed by salt-air corrosion, its leaking radiator averaging a mile a gallon—of water.

As we rattled past the movie theater, I asked Kenso why, in writing the current attraction on the blackboard marquee, someone had included its rating: R. He grinned. "With us, you can't be too careful. After all, our average age is only 61."

Kenso is on the move as much as anyone at Kalaupapa. His living room is papered with pennants from the many places he's been—from San Francisco to the Kennedy Space Center, Mexico to Niagara Falls. He's saving now for an Australian tour.

"I don't mind visitors; it's one way for them to see they needn't be afraid. I would hate to have to leave here for good; it's the only home I know. But at the rate our numbers are going down, we may have to go one day. Upkeep will be too expensive for just a few."

Kenso needn't worry. Lifetime tenancy has recently been guaranteed by the state government, which operates the facility with federal funds. Concerned about what will happen after the last are gone, patients overwhelmingly supported legislation, which was passed in December 1980, to make the peninsula a national park.

Paul Harada, one of Kalaupapa's prime movers in this matter, applauds the act for preserving many of the present structures "as a memorial to what has happened here and will never happen again. I'm one of the last generation to be admitted; I don't want to hang around after the neighborhood is down to a handful. But I believe most of the buildings should remain where they are."

Paul is glad his case preceded the sulfone breakthrough. "My wife and I—she's a patient, too—have seen our prospects for a

long and full life advance dramatically. We've achieved a degree of normalcy we never expected back then. Kind of a deliverance, in a way."

Patients realize Hansen's disease is not the only enemy; their incidence of blindness and kidney failure is well above average. Yet in this peaceful setting of flowering shade trees, immaculate lawns, and gardens painstakingly tended by badly crippled hands, I sensed a general feeling of contentment, camaraderie; the oneness of a close family. As if everyone has taken to heart the message Ed Kato lettered on a streetside stone: Smile . . . It No Broke Your Face.

A Growing Future for Molokai?

Topside, as Kalaupapa residents refer to the rest of Molokai, the public mood is more difficult to diagnose. Certainly there's no oneness here over the one issue uppermost in every mind: to grow or not to grow.

Last of the state's major islands to be discovered by developers, Molokai has just begun making waves among speculators and those who think the nearest thing to earthly paradise (to say nothing of a foolproof investment) is to own a piece of Hawaii.

This sudden attention after years of being ignored frightens some, delights others.

Many of Hawaiian descent as well as other native-born Molokaians have joined Caucasian immigrants from the mainland and neighbor islands to form a substantial antibuilding bloc. Cerebral rather than combative in their efforts, they've made progress in staving off the megabuck invasion.

A splinter group seeks to do the same but through more militant means. Another faction frankly favors the input of outsiders to fatten the island's too lean economy.

A pretty standard stratification in many desirable spots these days.

Split as they may be over the expected onslaught by off-islanders, nothing will divide Molokai's people on their determination to preserve their identity, to control their destiny. Perhaps they're in time to do both. □

A world away from sophisticated society, Joyce Kainoa's son Sammy may well count the blessings of an untouched part of Molokai. But as pressures build to change the island, he may also wonder how long his home will remain as natural and unspoiled as a boy daydreaming on a rock.





Recently discovered inscriptions and paintings made 1,200 years ago in a remote cavern in Guatemala are a boon to scholars—but also a lure for thieves who already have

Maya Art Treasures

By GEORGE E. STUART NATIONAL GEOGRAPHIC STAFF ARCHAEOLOGIST



damaged some of the artworks with saws. Guards have been appointed to protect the art and writings, which name dates and notables of the Classic period.

Discovered in Cave

Photographs by WILBUR E. GARRETT EDITOR



Portal to hell in Maya religion, the cave's toothy mouth yawns over the National Geographic team exploring tumbled walls and tombs (facing page). Before this visit, looters had ransacked only the entrance, where author-archaeologist George E. Stuart examines polychrome bits of pottery (above). Countless unexplored ruins dot the remote Petén region. Jungle engulfs one new to scholars, a three-pyramid complex near the cave (below).



LIGHT FLARED from the scribe's torch of ocote pine, illuminating limestone walls deep in the cave. With strokes of a fine brush of animal hair, the Maya Indian carefully recorded his message in two columns of elegant hieroglyphs some 1,200 years ago.

Elsewhere in the gloomy chambers other artists occasionally added graffiti—pictures of games and musicians, more inscriptions, even erotica, a rarity among remains of the normally decorous Maya.

Then the last torch flickered out, and the inscriptions surrendered to the cave's dark and silent sanctuary—until one day last year, when two modern Maya farmers discovered its hidden recesses. Their electric torches brought to light an extraordinary archive—untouched and unknown for more than a millennium—that survives from the most brilliant age of Maya civilization.

When news of this discovery reached me through friends in Guatemala, I immediately sought the government's permission to fly to the site. I had reason for urgency.

Nowadays, as quickly as ruins are discovered in the haunts of the ancient Maya, they are menaced. Despite the best efforts of the Guatemalan government, swarms of looters seeking salable artifacts mutilate precious stonework with heavy tools and power saws. A carving sliced from a stela can bring the despoiler hundreds of dollars; in a New York or Zurich art gallery, it may fetch thousands. We were later to learn that our fears were justified.

A helicopter set us down at the remote farmstead of Emilio and Bernabé Pop, as close as we could get by air. Our small band included Wilbur E. Garrett, Editor of NATIONAL GEOGRAPHIC; John M. Keshishian, a Washington, D. C., surgeon interested in all things Maya; and my son David, who at 15 is an acknowledged expert at deciphering the Maya's complex hieroglyphic writing.

Mike DeVine, an American farming in Guatemala, had offered to lead us to the cave, known as Naj Tunich—"stone house," or "cave"—in Mopan, a local Maya tongue. We set out promptly from the Pops' thatch-roofed farmhouse.

Laden with cameras and flashlights, we filed along a muddy trail guarded by limestone outcrops and giant ceiba trees, held



Sacred signs in the nether regions

FIRST EXPLORED in the summer of 1980, Naj Tunich—“stone house,” or “cave,” in local Mopan Maya dialect—forks near where the first artworks were found in the Passage of Rites. Throughout the cave, prominent glyphs, figures, and natural features supplied titles for chambers and galleries where artists once worked by torchlight.

Many glyphs can only be partly deciphered. Others remain completely enigmatic. But milestone dates of the Maya calendar indicated by some

glyphs (bottom right) place them around the mid-eighth century A.D., peak of Classic Maya culture. Great temples arose, and large cities thrived in the now sparsely populated lowland of northern Guatemala (map).

In times of drought, watered caves like Naj Tunich are cenotes—natural wells—that often meant survival. Yet in the Maya universe, caves also reached into the realms of the dead. Thus they relate to both life and death—awesome themes reflected in Naj Tunich’s art.



TO WEST TERMINUS

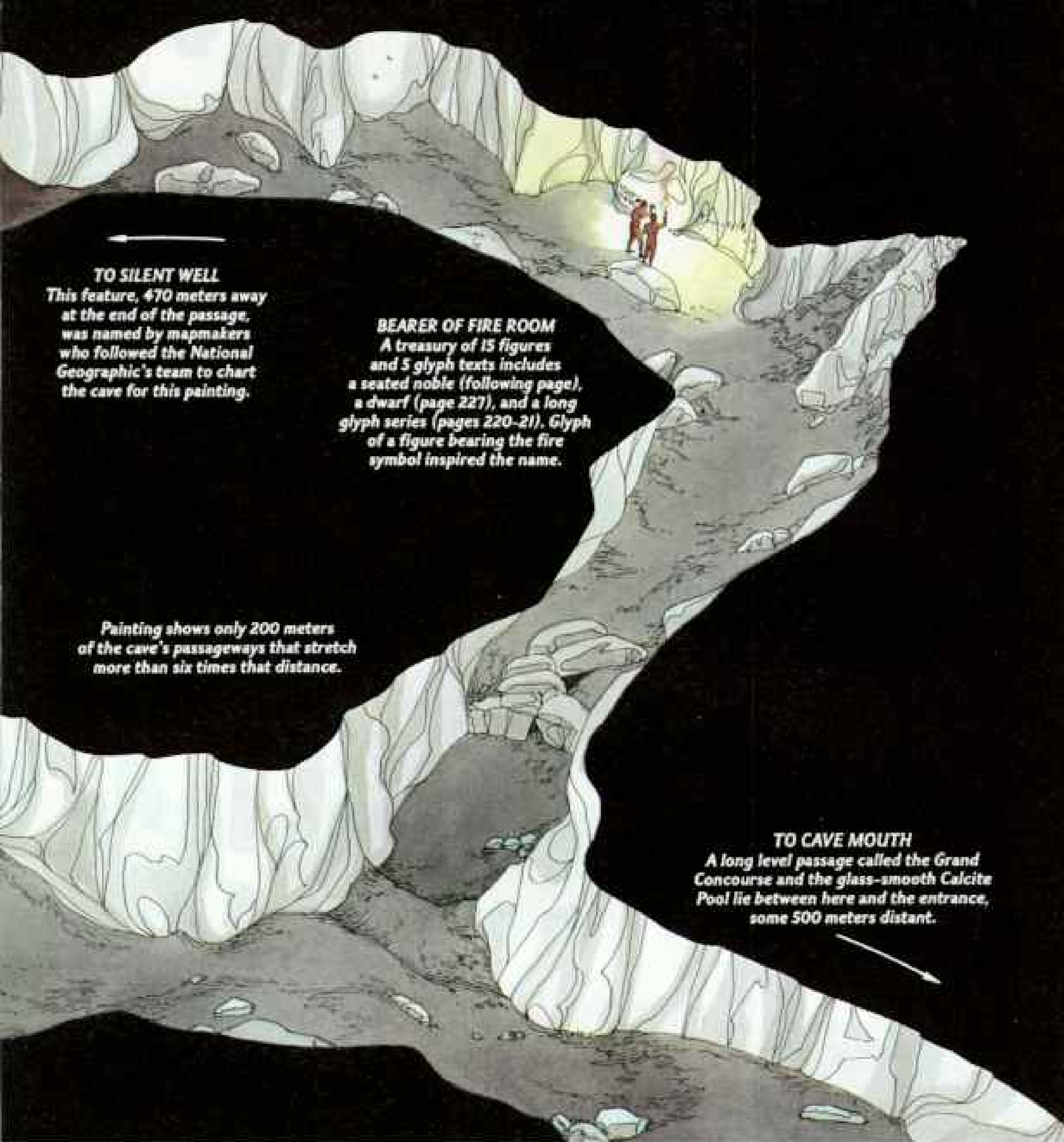
The Hall of Balam, named for the glyph interpreted as “jaguar,” and the Chamber of Crystal Columns (pages 230-31) form a double cul-de-sac 300 meters down the passage. En route lies the Hall of Musicians (page 233).

PASSAGE OF RITES

Artist at right paints a figure holding a bloodletting instrument (page 235). To his left, another works on a wide pillar that today displays 20 figures and 12 texts. Here a ballplayer and figure with conch are found (page 232), and four sexually explicit figures.



Obsessed with time, the Maya developed a complex and accurate calendar. This group of six glyphs (right) yields a precise date: December 18, A.D. 738. Interpretation begins with the bottom pair of calendrical symbols, marking a “period ending”—similar to the turn of a century in our system. This ending, known from other inscriptions, occurred on June 30, A.D. 741, by our reckoning. The central pair of glyphs, using dots and bars that represent ones



TO SILENT WELL

This feature, 470 meters away at the end of the passage, was named by mapmakers who followed the National Geographic's team to chart the cave for this painting.

BEARER OF FIRE ROOM
A treasury of 15 figures and 5 glyph texts includes a seated noble (following page), a dwarf (page 227), and a long glyph series (pages 220-21). Glyph of a figure bearing the fire symbol inspired the name.

Painting shows only 200 meters of the cave's passageways that stretch more than six times that distance.

TO CAVE MOUTH

A long level passage called the Grand Concourse and the glass-smooth Calcite Pool lie between here and the entrance, some 500 meters distant.

PAINTING BY WILLIAM H. BOND BASED ON SURVEY BY ERNESTO BARZA AND KAREN WITTE FOR THE NATIONAL SPELEOLOGICAL SOCIETY



DRAWING BY DAVID STUART

and fives, is a mathematical statement: 925 days. By subtracting that interval from the period-ending date, glyph readers determine the December date for the top pair of symbols, possibly the day the work was painted. Elsewhere in the cave, another date in the same scribe's handwriting falls just three days earlier. In addition to dates, other glyphs in this most advanced pre-Columbian writing system provide a record of royal names and events.



holy by the ancient Maya. Then a shout from Mike, "We're here!" We saw a thick limestone shelf and, beneath it, a huge black opening: Naj Tunich.

Slipping and sliding, we entered the cave, climbing down to a large and level clay floor. Fringed curtains of white stone hung from the distant ceiling.

Ahead, the penetrating half-light revealed a steep, boulder-strewn slope terraced with high flagstone walls, some partly collapsed. Near the base of the slope a sunbeam spotlighted a patch of color—a small pile of brightly painted pottery fragments.

"Looters," Mike declared. "Luckily they got no farther than this." The fragments appeared to be of the late Classic period, predating the tenth century A.D. The looters also had pried masonry walls apart to reveal rectangular cavities, probably tombs.

Though we had hardly penetrated the cave entrance, it was time to turn back; darkness already was falling along the jungle trail outside. Tomorrow we would see the hidden glyphs and paintings of the cave.

In the Heart of Classic Maya Land

Naj Tunich lies in a geographic region known as the Petén, centered in northern Guatemala. A jungle-clad lowland, it forms the heart of the Maya area (map, page 224).

Today this eastern part of the Petén is inhabited by several thousand Maya Indians, like Emilio and Bernabé Pop. The Pop family boasts the basic inventory of chickens, pigs, turkeys, and ducks, as well as a couple of mules. Their home, a structure of wooden poles and thatch with packed dirt floors, differs little from Maya houses of antiquity.

In this virtually trackless land Classic Maya civilization developed about the third century A.D., spawning great cities whose ruined mounds and temples still tower above the jungle. Across this vast lowland region sophisticated farmers held the jungle at bay and wrested crops from the thin soil. Those cities and farmers thrived until

around 900, the end of what we archaeologists term the Classic period.

Part of the history of this Classic period has survived, due largely to a long roster of rulers who left records on stone monuments and painted vases, naming their ancestors and noting reigns and conquests. The Naj Tunich inscriptions could provide still another context for that imperfect record.

Caves were of immense importance to the Maya, as they were to all people of ancient Mesoamerica. In the Maya view of their cosmos, the universe was basically a giant square of earth upon which men walked. At its center stood the giant tree of life, the sacred ceiba, or *yaxche*, whose foliage extended to the sky and whose roots reached into the underworld.

Xibalba, the Maya underworld, was a dread place inhabited by evil gods of death and sacrifice. The Maya believed caves to be entrances to this hell and all its associated evils. Like many items in the catalog of Mesoamerican culture, however, caves constituted a mixed blessing of opposites, for they often contained water—so precious to a civilization that had to survive through annual dry seasons and the caprice of drought. It was clear to David and me, from our knowledge of Maya literature and iconography, that the great cavern of Naj Tunich embodied the dread Xibalba.

Early the next day we were at the cave



Shaped in infancy, sloping skull of the Maya elite distinguishes a seated figure (left). A dwarf with a topknot (above) might belong to either the underworld or the heavens; dwarfs inhabit both realms in Maya myth. Dr. Stuart describes these and other figures as "some of the most beautiful examples of Maya art."

again. This time we pushed beyond the pottery and entrance walls and prepared our gear for the climb into the back chambers.

We descended through the upper level and soon found ourselves in a narrow tunnel festooned with stalactites. My straw hat was most useful here; the scrape of the brim warned of unseen formations before my head bumped them. We pushed on.

Ahead lay blackness. Mike's headlamp bobbed to the left and below as he descended along a convex ledge that hugged the wall of the room. Trying to catch up, I shoved my

tripod case forward, hoping it wouldn't fall into the darkness below. Soon I wished it would, so I could cling to the irregular wall. Just as the ledge vanished into nothingness, the flashlight—held firmly in my mouth—revealed a dark crack to the left, and I heard the voices of the others.

Negotiating the narrow slot, I reached the blessed lower level. Soon we were dancing through wet clay and around a pool of crystal-clear water.

A climb up a slick bank, and we were in a passageway large enough for a London bus. Soon it narrowed and forked. We took the left tunnel.

After many more twists and turns, and a scabble up a long dirt slope, suddenly John spotted an incredibly well-preserved inscription—two columns of glyphs, painstakingly painted with a delicate brush. We gathered before it in awe, standing in the very spot where the scribe stood perhaps 1,200 years ago.

Glyphs Pose a Challenge

"There's a date at the beginning," mused David, "an event . . . and some names . . . there's a date that has to be a period ending!" That would mark an important station on the Maya calendar.*

The Classic Maya considered the numbers and the days in their calendar as a procession of gods who marched along an eternal trail with no beginning and no end. There were stations along this trail—one for every day, others to mark the end of every epoch, or period. The Maya saw special significance in those involving numerical coincidences, much as we note with mental ceremony when our car odometer completes a "station" such as 100,000 miles.

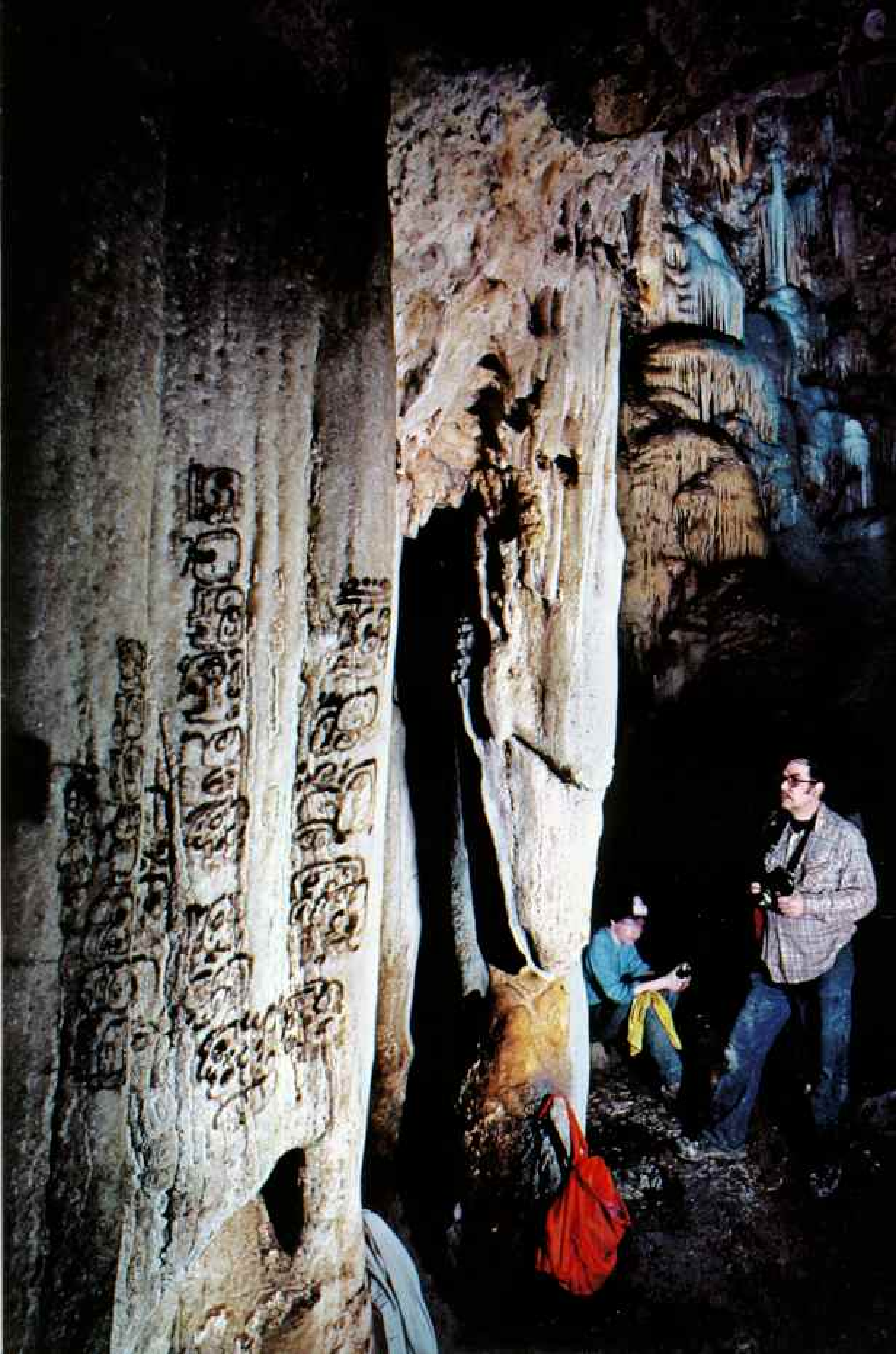
David may have spotted one of these stations among the two columns of glyphs. A quick reference to the Maya calendar tables he had brought enabled him tentatively to equate it to June 30, A.D. 741. This date is consistent with the pottery in the cave entrance, and the glyphs' general style is the same as that found elsewhere on vases of the period 600 to 900.

We continued our quest in the dark passageways. *(Continued on page 234)*

*See "The Maya: Riddle of the Glyphs," by George E. Stuart, in the December 1975 *GEOGRAPHIC*.



Resting in the underworld, George Stuart and his son David take a break in the Chamber of Crystal Columns (facing page). Maya farmer Bernabé Pop (above), here at home with his daughter, first discovered Naj Tunich while hunting with his father, Emilio, and accompanied the Geographic team on its trip to the site. He reported hearing voices in the cave. Says Dr. Stuart, "After he told me about it, I heard them too."





Greed took its toll of archaeological treasures as thieves wielding saws tried to cut away segments of the painted limestone stalactite only a few weeks after the Geographic team departed. First photographed in pristine condition last January (left, at far left), a section in the Chamber of Crystal Columns now bears deep saw marks at top and bottom (right). Luckily, the theft was not completed, for reasons still unknown. The damaged portion depicts a figure who stands beside a column of glyphs while watching a ball game—indicated by a kneeling ballplayer in full costume, the zigzag outline of a ball court's wall, and the large black smudge of the ball itself.

Word of the desecration reached Guatemalan officials through expatriate American Mike DeVine, who discovered the damage on a visit in March. He hiked nine hours to the nearest military base and returned to the cave with soldiers. Guatemala's Institute of Anthropology and History quickly appointed Bernabé Pop and a brother-in-law as custodians of the cave.

Across Central America, looters, some armed with automatic weapons, have been known to kill in pursuit of artifacts that bring fabulous prices at auctions in the United States and Europe. Plundered sites near Naj Tunich exhibit archaeological expertise on the part of the looters, who may have worked earlier as laborers on legal digs. Many of the region's Indians, however, feel a deep sense of responsibility to their cultural heritage.

DIEGO MOLINA (RIGHT)



ಶಿವಶಾಸ್ತ್ರ
ಶಿವಶಾಸ್ತ್ರ
ಶಿವಶಾಸ್ತ್ರ
ಶಿವಶಾಸ್ತ್ರ





DODDO MOLINA (ABOVE AND BELOW)



JOHN M. KESHISHIAN

Webs of mythical meaning surround many of the figures. A conch shell lying before a seated figure (facing page, top) carries associations with the sea—often a metaphor for the underworld—where the sun daily dies and is reborn. Shells, however, are also linked ritually to caves where fresh water is found, thus embodying the Maya life-death symbolism. At the column's center, a ballplayer wearing a straw hat, torso armor, jaguar skin, and kneepads faces a court wall and a ball topped with the symbol for the number nine, also the number of levels in the underworld. Legendary ball games pitted men and gods in contests involving death and rebirth, imbuing the sport with religious connotation. To the lower left of the player, a figure—drawn in a three-quarter profile, rare in Maya art—may be performing a religious act of genital mutilation. Vandals' scratches now deface the ballplayer's arm (left) and smear a drummer (above left) who, in procession with a piper (above), was photographed earlier undamaged.

(Continued from page 228) Behind the two-column inscription is a chamber we call the Hall of Balam, for one of its 67 hieroglyphs may be that word—Maya for “jaguar.” Like the other texts in Naj Tunich, this one contains phonetic elements that should prove priceless in further understanding the intricate mosaic of Maya script, a quarter of whose syllables still defy decipherment.

Nearby a convex crust of limestone was cracked like ice on a frozen river—probably the result of an earthquake. A new worry! We eased down through a hole into another chamber. Mike’s flashlight revealed pale curtains of stone that bore more glyphs and gave us a name for the room: Chamber of Crystal Columns.

Bernabé suddenly flung up a hand. “Sssh!” he hissed. “*Hay gente.*”

People? We strained our ears, but heard nothing. No intruders were approaching from the cave entrance, as Bernabé had fancied. Yet the danger was real enough. A small pyramid near his cornfield had recently been ransacked. And a band of 30 to 40 figures, some armed with automatic weapons, had been seen slipping through the brush. We knew that in Guatemala looters would not suffer discovery lightly—if captured, they face an eight-year prison term.

Getting To Know Ancient Scribes

Bill Garrett approached one of the columns and called out, “Drawings of human figures!” We gathered in the narrow passageway. There, in sketches barely a foot high, a ball game was in progress (page 231).

Brightly visible, one figure stood casually beside a column of glyphs, gazing. The object of his scrutiny was a stair-step pattern of black lines representing one side of a ball court. A black ball seemingly was bouncing from its surface. Facing the ball court and spectators, a player knelt in full regalia—headdress, kneepads, and chest padding.

More ritual than sport, the ball game gave ancient Mesoamerica one of its great distinctions. Played in a stone court with a hard rubber ball, the game provided an arena both real and mythical, in which kings played kings, kings played gods, gods played gods, and the losers were sometimes sacrificed. The lore of the ball game is permeated with celestial motifs—ancient tales

of the sun, the moon, and the planet Venus.

On our third and final day, before our strobe and flashlight batteries gave out, we explored two more rooms, one near the junction of Naj Tunich’s two main tunnels, the other down the dark passageway we had passed the day before. The first, to be called the Passage of Rites, bore several sexual scenes, seldom found in Maya art. Whether or not their creators intended it, these depictions possess a powerful shock effect.

Here, along with a host of glyphs, some other small sketches peopled the walls with figures diverse and often whimsical: a ballplayer in a straw hat; a small figure contemplating a conch shell; a bearded man in profile. Not far away we found three musicians playing instruments, including a drum. Just below them we saw a faded scene suddenly take shape—yet another ball game, this one involving a dwarf.

By now David was able to identify a sort of hieroglyphic “handwriting” that distinguished our more prolific cave painters. “I’d say at least three main scribes were involved,” he concluded.

Hot, dirty, and disheveled, we finally slogged back to the fork, and into the right tunnel, to the last gallery we would see. Its walls appeared almost pure white, while erosion had rounded the stone in strange curves that reminded me of a giant Henry Moore sculpture.

John’s flashlight, playing over the scene, picked out a long horizontal inscription done in elegant Classic-period calligraphy. Again there was no apparent pattern to help us decipher it on the spot.

But we did notice it included a rare figure glyph, a seated man bent against the weight of a tumpline holding the glyph for “fire” (page 220, at far left). We called this chamber the Bearer of Fire Room.

David pointed to a more finely rendered inscription that appeared near the great horizontal text. “It was done by the same artist whose work we saw in two other rooms,” he said. Here also were small figures, a seated dwarf, and delicate faces in profile. Some were unfinished, as if the painter had been practicing or doodling.

Paintings of dwarfs. And ball games. And conch shells. The cave setting itself. Slowly we perceived a glimmer of consistency

in the Naj Tunich mixture of motifs.

Dwarfs occur again and again in Classic Maya sculpture and vase painting. From our knowledge of Maya iconography, they appear to be connected with celestial gods. For example, at Yaxchilán, a major site to the west on the Mexican side of the Usumacinta River, dwarfs appear in a bas-relief as stars watching a ball game.

Perhaps in Naj Tunich they have the same role. At any rate, they form a link between ball game, underworld, and sky. In the cave of Naj Tunich, it may be that the Maya sought to memorialize the interrelated motifs of life, death, and the cosmos.

We are enormously grateful to Guatemalan officials for the privilege of visiting this remarkable Maya treasure, especially to Dr. Francis Polo Sifontes, general director of the country's Institute of Anthropology and History, and to Gen. Federico Fuentes C., who graciously provided us with an air force helicopter and pilot.

Bad weather delayed our helicopter flight back to the capital city for several days. David and I spent part of our wait trying to unravel the dates in the cave. Twice we identified the important date 3 Ahau 3 Mol—June 30, 741, by the correlation used by most Mayanists. If our assumptions are correct, it appears that the dates of Naj Tunich range from around 733 to 762.

Cave Painted When Tikal Flourished

These three decades mark the very height of Maya civilization. While scribes labored in Naj Tunich to paint their still mysterious records by the flickering light of ocote torches, the great Temple IV was being completed at the magnificent Maya metropolis of Tikal, about a hundred kilometers away. And artisans there were carving its massive wooden lintels with the same date 3 Ahau 3 Mol to honor a mysterious monarch we know only as Ruler B.

And, unknown to the Naj Tunich artists, their civilization as they knew it would last only a century or so longer. But their works—whatever they may mean—would endure for more than a thousand years.

Moved as I was at viewing these subterranean wonders, I feel a certain melancholy, too, that they came to light at all. For now they bear the curse of discovery.

Only two months after we had returned home, Mike DeVine phoned me from Guatemala. Our fears were realized: Others had penetrated the inner recesses and tried to slice off the intricate ball-court scene, leaving grievous scars.

The Guatemalan government moved swiftly to place Naj Tunich under armed guard. But there remains the sad certainty that elsewhere in the remote, brooding Petén, others are seeking—and perhaps finding and despoiling—similar treasures of the ancient Maya heritage. □



To nourish the gods, human blood was drawn, sometimes by piercing the penis with a sting ray spine or obsidian lancet. A figure holding a bloodletting instrument (above) may be preparing for the ritual. The meaning of this and other Naj Tunich paintings may never fully be known. But the newly discovered artworks, threatened both by time's erosion and by man's rapaciousness, may hold a key to the full rich tapestry of the Maya's lost grandeur.



FINLAND'S CAPITAL HAS ITS HEART IN THE COUNTRY

Helsinki

By PRIIT J. VESILIND

Photographs by JODI COBB

BOTH NATIONAL GEOGRAPHIC STAFF

THE SUN STARTS TO NIBBLE through the arctic winds in early spring. Daylight lingers into dinner hour, and there is an irresistible tug at the Helsinki soul to welcome the passing of winter.

On weekends solitary fishermen sit like toads on the still-frozen sea, their giant hole-drilling augers curling beside them. On the ice the people come and go, cross-country skiers and strollers, and young kickers of melting chunks of winter (following pages). They walk in pairs, arm in arm, or alone, just strolling in the healing sun, yet silently and almost magnetically apart, as if guided by a surrealist choreographer.

"Being on the ice," Helsinkians call the Sunday ritual, a celebration, really. But in this city of dignity and reserve, only a brief smile, a relaxed shoulder, and an occasional balloon hint at the holiday intent of it all.

The capital of Finland lies on the latitude of Anchorage, Alaska, and clings to a windswept outcropping of granite hillocks like a hand stretching into the Gulf of Finland. Half the metropolitan area's 737 square kilometers (284 square miles) are undisturbed shores, lakes, and forests. A broad swath of woods, Central Park, bisects the city north of the railroad station.

"Sometimes after work," a young draftsman told me, "I just strap on my skis at the door of my apartment house, and before me are ten kilometers of wooded trails."

Of the world's capitals, only Iceland's Reykjavík lies farther north, and in winter the elements press in on Helsinki as if reclaiming stolen property. By February the fingers of the peninsula are cemented into sea ice so thick that cars race on it. Deep snow muffles the streets, and on some still, foggy mornings, huge elk wander in from the surrounding forest.

You can easily walk to the walls of Suomenlinna, an 18th-century Swedish sea fortress built on four islands,



To defy and enjoy the rigors of an interminable winter is the challenge of life in Helsinki (facing page). Summer is but a brief, sweet interlude with long sunny days and strawberries at the market (above).



Islands of ice walkers, sitters, and skiers savor the longer light of early spring on one of Helsinki's harbors (above). Through the mist rises Suomenlinna, an 18th-century Swedish fortress built on four of the hundreds of granite islands that wreathe the city.

The Gulf of Finland, though locked in deep ice from February to April, provides year-round recreation for the outdoor-loving Finns. Fishermen like Erkki Markkanen (right), whose hole-drilling rig seems ill matched to his catch, hook perch and pike. Others make the holes larger and climb in themselves (left), as does this Helsinki matron taking a routine dip after a sauna off Lautta Island.

The ritual of the sauna, which sees Finns sitting in small rooms at more than 200°F and flicking each other with birch boughs, borders on a national obsession. Finland has as many saunas as cars—more than a million for a population of almost five million.





DRAWN BY JANE WOLFE; COMPILED BY JOHN R. TREMPER
NATIONAL GEOGRAPHIC ART DIVISION

and look back into South Harbor. The skyline of Helsinki is a layer of white, pastel, and ocher stone, 19th century in its scale and proportion. From here the old city fans orderly into the peninsula with blocks of six-story, gray-stone buildings shaped like boxcars, their spines dissecting the pale winter sunlight into a clean geometry of angles and planes. Darkness comes soon enough, at three in the afternoon, and gathers in thick layers. And people, as the poet and novelist Bo Carpelan notes, "hurry past like shadows. . . nothing but a feeling of disintegration and uncertainty, veering winds and a pale hope of spring."

The Daughter of the Baltic grew artificially on this somber landscape, by edict and decree, and thus slowly and grudgingly. In the 12th century, when Sweden colonized the Finnish hinterland in the name of Christianity and empire, there were no cities—only settlements and farmsteads of rough-hewn and stubborn free men. But Swedish King Gustav Vasa was determined to compete with the Hanseatic League port of Tallinn, Estonia.* In 1550 he simply ordered the burghers of four small Finnish towns to the sodden estuary of the Vantaa River. The misplaced settlement languished for 90 years before it was forcibly removed by another edict, six kilometers south to the edge of the sea itself.

Ruled by Swedish nobility for some 250 years and by the tsars as part of a grand

duchy of the Russian Empire for 100 more, Helsinki was essentially built by foreigners who considered the Finnish people rustics and hired hands.

Finland declared its independence during the Russian Revolution in 1917. Helsinki spread boldly along the coast and flared north like the bell of a trumpet.

TODAY SWEDISH is spoken by a 10 percent minority in the city, but the nation remains officially bilingual and subtly stamped by the past.

"Swedes are a civilized people," one young Finn told me. "That's what accounts for some of our inferiority feelings."

The core of true urbanites remains resolutely, though not snobbishly, Swedish. But many Finns, too, love the city for its brisk blend of architecture, fine arts, and fresh air. I found it a sensible, always honest, well-organized city, perhaps even chaste among the shopworn capitals of Europe—homogeneous in population, free of slums, and unencumbered by untidy pockets of corruption and sexual exploitation.

Still, Helsinki remains a city of people who would rather be somewhere else. Many of them live here as if Gustav Vasa still insisted on it. In their minds a city isn't home; home is the countryside of villages and farms to the north, the expanse of birch and

*See the author's April 1980 *GEOGRAPHIC* account of his return to Estonia, the land of his birth.

By royal decree in 1550, when Finland was a part of Sweden, the burghers of four small Finnish towns were uprooted and ordered to establish the seaport called Helsinki (map). Ruled by the Swedes and later by the Russian tsars, the town became the capital of independent Finland in 1917. Today's prosperous city of 484,000 remains a fulcrum between Scandinavia and the Soviet Union, fostering Finland's strong economic ties to both the West and the Eastern-bloc nations.

Grateful for their free society, Helsinkians have learned to treasure the simple beauties of life, such as this rose among potatoes at market.



pine and chill water. Just 40 percent of the city's inhabitants were actually born here.

Says my friend Oke Jokinen, who has lived in Helsinki for 32 years, "Everyone here has a silent wish: When I get my pension, by God, I'm going back home."

Helsinkians suffer from the natural shyness of people only lately accustomed to the closeness of urban life, a trait visitors often mistake for a lack of hospitality. They are a silent people—"silent in two languages"—as Bertolt Brecht once wrote. From the demands of a bitter climate they know innately that warmth is a luxury and must always be used sparingly.

When they talk, they're apt to be blunt, with a contempt for artifice, and slow to show emotion, but immensely patriotic, with an overriding respect for the privacy of others and an inner strength they call *sisu*.

Sometimes hospitality must be earned. Said Helsinki's mayor, Raimo Ilaskivi, a twinkle in his eyes, "We have had some trouble with tourists who disregard our traffic and parking laws, but some of our more conscientious citizens simply let the air out of their Mercedes-Benzes. That's a better kind of traffic ticket."

When large numbers of Finns migrated to Helsinki between 1950 and 1970, the city suffered a crisis of the spirit. More than 16,000 people a year, many of them rural poor displaced by mechanization of logging and farming, came southward to Helsinki.

The population almost doubled. Slablike apartment houses rose carelessly in the suburbs. Traffic fatalities soared.

By 1970 the growth had run its course, and city planners were actually caught short of people. They estimated that Helsinki's population would be 700,000 by 1980, but it plummeted instead—from 510,000 in 1970 to today's 484,000.

When I arrived last March, intelligent solutions had caught up with some elusive problems. "I want people to move back into the center of Helsinki," Mayor Ilaskivi told me. "They've been going to nearby cities like Vantaa and Espoo, and businesses have taken over their apartments. The central city has been turning into just an employment zone, and we can't let that happen."

CLOSE TO 900,000 people live in the ten-region metropolitan area of Helsinki, almost 20 percent of Finland's population. On coastal islands like Vartio, the wealthy live in resortlike splendor within the city limits. In the morning you can see businessmen in three-piece suits rowing to work. To the northeast, some government-subsidized suburban developments, like Jakomäki, are notable as crime areas.

The city owns 60 percent of the land and has a monopoly on building plans. In this highly structured society, all goes according to the master plan or not at all. The pragmatic master planners are fond of high-density



The world knocks at Helsinki's door for ships. The speciality in this city of frozen harbors is icebreakers. The bow of one is welded together at the shipbuilding division of Oy Wärtsilä Ab (above), Helsinki's largest private employer and world leader in icebreaker technology. The firm's most recent icebreakers each generate roughly 36,000 horsepower, enough to provide electricity for a city of 43,000.

Wärtsilä's yards lie next to the commercial center of Helsinki (right) in Western Harbor, one of five harbor areas on the coastline of islands and inlets that compose Finland's largest seaport.





solutions—apartments and town houses, and snugly fit gems of suburbia like Olari and the internationally acclaimed garden city of Tapiola. But it is no secret that the dream of nearly every Finn is a private, detached home of his own. Only 8 percent in Helsinki have fulfilled that dream, a level nevertheless high by European standards.

Lars Hedman, chief of city planning, plays the wet blanket in this drama. "It's just not practical," he said wistfully. He showed me what is practical—a master plan calling for a network of mini-cities to be built 16 to 24 kilometers out, intended to keep jobs and traffic out of the overloaded city center.

Since the middle 1970s, the exodus from the city center has been reversed. Special bus and tram lanes and electrification of trains into the city have turned traffic manageable, and the first branch of a subway should rumble in Helsinki next year.

HELSINKI'S most familiar sounds are the groan of winches, the creak of tightening hawsers, the cry of searching sea gulls. As envisioned by the kings of Sweden, Helsinki has become the center of trade in the eastern Baltic. By value more than half of Finland's imports—including oil, wheat, chemicals—funnel through the city's five harbors.

From the passenger terminal in South Harbor, the *Finnjet*, a 213-meter ferry operated by Finlines, powers tourists and their cars from Travemünde, near Hamburg, in 22 hours on engines similar to those designed for jet aircraft. The Estonian liner *Georg Ots* delivers "vodka tourists" to Tallinn almost daily; other liners specialize in quickie tours of Leningrad. Said Finlines official Matti Poijärvi dryly, "Some consider Leningrad the high point of their trip to Helsinki."

One cold March afternoon I took a cruise on the *Teuvo*, the city-owned icebreaker that keeps the harbors free of ice, at times as thick as two feet, thus permitting year-round commerce. Without it, and the fleet of nine oceangoing icebreakers, Helsinki would be virtually isolated in winter, for land routes to the west follow a frozen 1,770-kilometer loop around the Gulf of Bothnia.

Twenty vessels were stranded in the gulf that day, for Finland's Seamen's Union had gone on strike, shutting down the bulk of the

nation's shipping. It was getting dark, and a southeast wind was pressing ice against the coast. Even powerful ships were in trouble.

We made a cursory pass at the *Finnjet*, then rammed toward Suomenlinna fortress with a satisfying feeling of sanctioned destruction, like cracking and shattering an endless plane of mirrors.

"Will the strikers get their demands?" I asked *Teuvo* captain Iikka Stenberg.

"Sure!" he answered. "In these conditions they have the ice on their side."

With or without the elements, the workingman of Helsinki is no underdog, for the nation's labor force is one of the most highly organized in the world, almost 90 percent. Many Finns believe that SAK (Central Organization of Finnish Trade Unions) and the employers' association run the country; parliament only listens.

The largest nongovernmental payroll, 3,600, belongs to Oy Wärtsilä Ab, which has built more than half the world's icebreakers.

"We can't compete with low-cost-labor nations like Singapore or Korea for ordinary ships," said Wärtsilä's Göran Damström. "We have to concentrate on building ships that take high technology and expertise."

Mr. Damström showed me the dry-dock operation on the huge luxury liner *Nordic Prince*, which had just been lengthened by a new middle portion to add 44 percent more capacity. "It was like severing a body at the trunk," a technician said, "and connecting bones, veins, and nerve endings."

Helsinki's shipbuilding—one of the cornerstones of Finland's remarkably healthy economy—got its impetus from the reparations demands of the Soviet Union after World War II. It claimed hundreds of existing Finnish vessels, and asked for more. Much of the burden, or opportunity, fell to Wärtsilä. Last year the Russians contracted with Wärtsilä for six arctic ice-breaking freighters, a contract worth more than 1.2 billion marks (278 million dollars). In return comes a dependable flow of crude oil at a rate of 50 million barrels a year.

In postwar years, trade with the Russians has taken on the characteristics of a mother country (Finland) sending finished products to the colony (the Soviet Union), which sends back raw materials. Still, Finland's trade with the Russians is less than many

Westerners assume—20 percent of its exports and the same percentage of its imports.

The border with the Soviet Union, only 161 kilometers from Helsinki, is omnipresent; the harsh climate is limiting. Laws are rigid; rebellion is rare. Finns expect clearly defined boundaries.

Within these bounds, and perhaps because of them, the people have concentrated on improving the quality and the details of everyday life. A law requires all workers to have window light; traffic tickets are based on income level of the offender. Shoddiness and cheapness are not tolerated. Things—vending machines, toilets, telephones—work. Chinaware from the Arabia company, Fiskars scissors, woodenware from Aarikka, textiles by Marimekko are not only export products of elegant and functional design, but also aspects of a national consensus of taste, style, and mood. Motifs are rooted in the textures of the sea, the sculpture of ice, and the solidity of granite.

Wrote Swedish artist Tyra Lundgren: "The Finns possess . . . a primitive artistic instinct with which their creations are charged. It is a mysterious mixture of magic and the melancholy of the wilderness, of brilliant colors and drab greyness, heathenism, a yearning for beauty and tenacious strength."

FOR TOO MANY Helsinkians the melancholy of isolation and darkness has produced what some call "bad sisu," the intemperate use of alcohol.

"It's not really a problem of alcoholism," said Dr. Klaus Mäkelä of the Finnish Foundation for Alcohol Studies, "but a problem of disruptive drinking. The attitude of Finns toward alcohol is similar to the attitude of people in some countries toward taking drugs. The goal is to get intoxicated."

One Friday night I joined Senior Constable Bengt Lindholm and Sgt. Bjarne Eriksson for some practical experience, answering emergency calls in their Helsinki police cruiser. At 8:35 we got our first, a man named Suominen, 51, drunk and bleeding from the head in Harjutori Park.

"Ah, Suominen," said the young orderly at the emergency room, "where have you been? We haven't seen you for a while."

By nine o'clock we had been summoned

back to the same park to take away another offender, this time to the city drunk tank, where 10 television monitors keep a 24-hour vigil over 45 separate rooms.

"In the wintertime," said the sergeant, "some of them like to come here. It's warm, it's cozy to sleep. The police are watching over you. One homeless man will call up and say, 'There's a gentleman asleep on the park bench, and I can't wake him up.' Then he'll go lie on the bench and wait for us."

Through the hectic night almost every call had something to do with liquor. Take away demon drink, was the impression, and the yearly crime of Helsinki might fit inconspicuously into a bad week in a large American city. Handguns are rare. The city has only 10 to 12 homicides a year. And a list of all the stolen cars in Finland (about 30) is taped to the dashboard of the patrol car.

Helsinki has worked hard toward solving its drinking problems. One step was the opening of Kyläsaari Clinic in 1979, an asylum for homeless alcoholics (page 253).

Others find solace in the Siiloan Church, whose revival tent attracts 500 a night to hear the word of fundamental Christianity.

"I was a drug addict," witnessed one baby-faced young man. "My wife left me, and I was contemplating suicide. Now I'm a new man in Jesus."

A revival meeting in Finland is a little like flat beer—the substance is there, but the sparkle is missing. Yet the nasal monotone of the Siiloan preacher seemed to hypnotize the gathering. People nodded in the heat that smelled of canvas and closeness; some wept. Behind the preacher a row of earnest young guitarists made music for lost souls.

Not far from the tent a lone woman with gray hair and a gash of lipstick across her deeply lined face stood defiantly, thrusting literature at passersby. In her right hand a red flag bore the likeness of another prophet.

"Lenin is the light of the world," she said to an audience of one.

Among Helsinki's young, the old Marxist revolutionary has big competition from the late American actor James Dean, whose astonishingly large following of teenagers, called the *diinarit*, emulate what they think was the American tough guy of the 1950s. Many youths on the streets appear to be rebels without a cause—torn denim jacket,

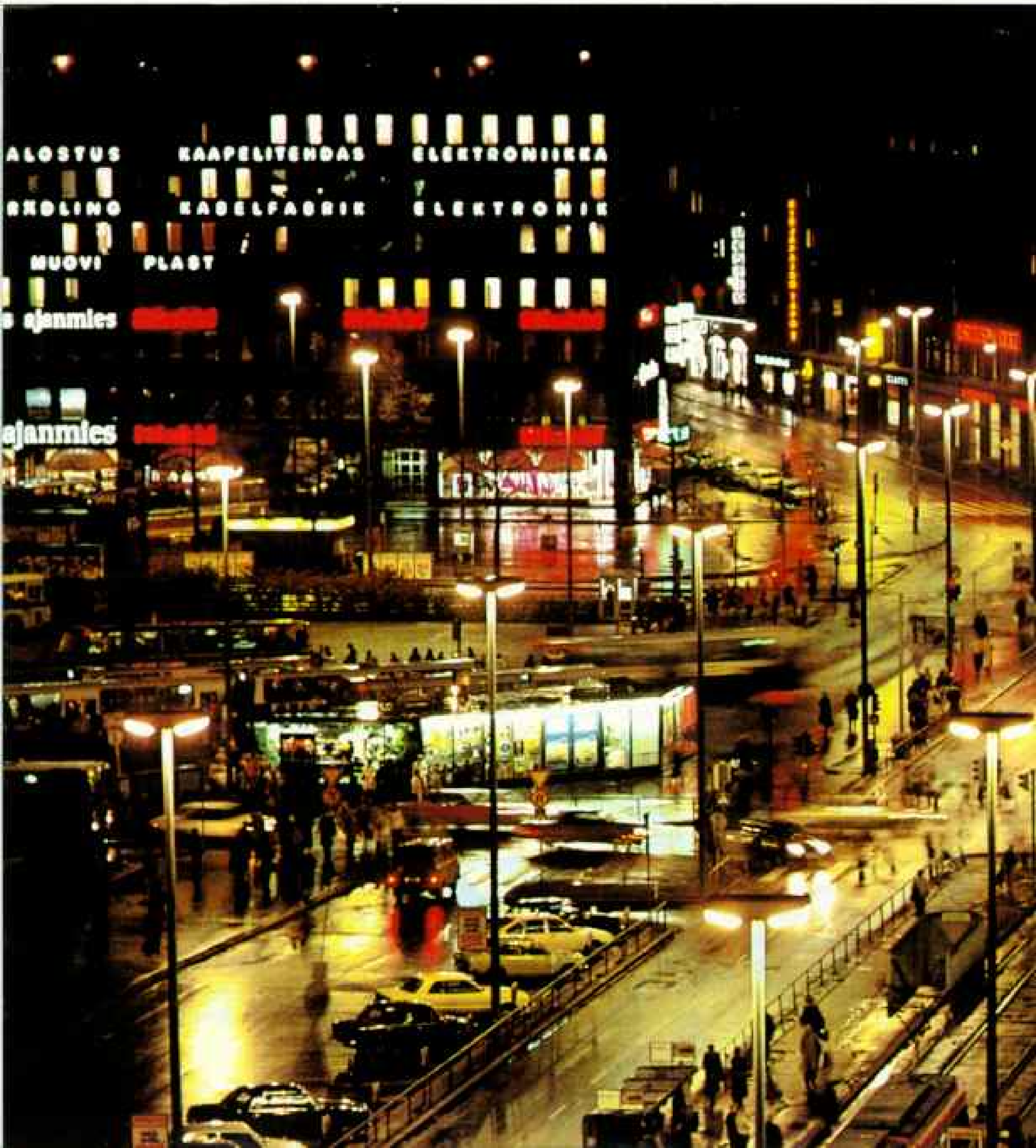
sewn-on Confederate flag, hair in a wavy *torttupää*, or cake head (page 249), pants pegged, menacing swagger. Trouble . . . except that the feeling persists that under each ducktail haircut lurks a streak of incurable Finnish wholesomeness.

In Helsinki the cure for any ill, the balm for any evil, is the sauna. It's hard to exaggerate the Finnish obsession with this ritualized heat bath, and the constant proselyting of its virtues to foreign visitors.

Why is it that a Helsinkian would rather sit naked in a sauna beside a total stranger

than say hello to him on the street? At the Sauna Seura (society) of Helsinki, President Dr. Harald Teir tried to explain. He told me of the idealism with which the sauna is taken, the tranquillity it generates; then he thrust me into an oven where half a dozen grinning retirees were beating themselves with birch branches in heat higher than 200°F.

"I had a friend here from Chicago," one of them recalled, "and after we sat up here in the top tier for five minutes, he looked at me and said, 'Seppo, if this is your pleasure, what is your punishment?'"



After a few minutes the gentlemen, still grinning, filed naked out the door, and lowered themselves into a 20-foot-wide hole in the frozen Gulf of Finland. I followed, cursing all rituals. But later we had salted herring and boiled potatoes with dill, a cold bottle of Karjala beer, and, as always, that sense of light-headed well-being.

The sauna mystique is endemic. Finnish President Urho Kekkonen often uses the sauna for international diplomacy, heated or otherwise, and much big business is conducted in this restful ambience.

"That's a problem for me," said Hilikka Tuominen, a bank officer. "I used to miss a lot of meetings. Next time, I'm going to demand they let me in!"

Hilikka, divorced and the mother of two small children, typifies several of the problems of Helsinki's workingwomen. Sixty-eight percent are in the work force, one of the world's highest percentages, but few of them reach prominent positions. The divorce rate is high, and women outnumber men by 55,000. In the short days of winter, life can be severely depressing.



Brighter and brighter shine the city lights, here glistening in an autumn rain (left). Larger and larger grow the conference and tourist crowds. Wetter and wetter get the light of heart at the annual Herring Festival at South Harbor (above), as they dance on a wooden platform under the Helsinki flag.



The heroes of youth range from Olympic champion runner Lasse Viren (top) to the late American actor James Dean, whose disciples, the diinarit, amuse themselves at the expense of a city policeman (facing page). A counter cult is the punkkarit—punks— (above), whose tastes run to bizarre haircuts and rock music played on a chain saw.

"What I hate," said Hilkka, "is going to work in the dark and coming home in the dark. Sometimes I just go dancing."

These "tea dances" are innocent affairs between working hours and evening. There is no disco music here, but a schmaltzy stage band squeezing out waltzes, tangos, and polka-like *humppas*. And on Thursdays at the Vanha-Maestro dance hall, the worm turns; it's ladies' choice night. The lines outside are prodigious.

HELSINKI remains basic and bourgeois compared to Stockholm and Copenhagen, but a certain cosmopolitanism is creeping in.

"Now we have everything," remarked Vuokko Tarpila, a young editor. "People are traveling more, and they have seen Paris and the café life of the Mediterranean. And we can get food items from Stockmann's [Helsinki's largest department store] that were not available before—like ginger from Malaysia and lobster from Canada."

With the extras of life has come a welcome rush of foreign tourists, 1,500,000 in 1979 compared to 500,000 in 1960.

"The character of Helsinki has changed very much in the past ten years," said former Mayor Teuvo Aura, the man credited for much of Helsinki's recent prosperity. "You see, heavy industry couldn't find enough places to build in Helsinki, so they moved out of the city. And we had to find some other way to get revenue. Now, especially in summer, Helsinki is an international town."

In the past decade Finland's strict political neutrality has brought both prestige and profit to the city. The spirit of Helsinki, a promise of more intellectual freedom for Eastern Europe, stems from the 35-nation Conference on Security and Cooperation in Europe (CSCE) of 1973-75. The Strategic Arms Limitation Talks (SALT) between the Soviet Union and the United States also began in Helsinki. More and more, the city is perceived as the Geneva of the North.

Such sobriquets delight city fathers, whose budgets count heavily on attracting international gatherings to Helsinki's growing conference facilities. Three patently international high-rise hotels, the Hesperia, the Inter-Continental, and the Presidentti, have been built near Finlandia Hall to meet







A midsummer's eve has just ended at the summer home of Ristomatti and Kristiina Ratia (left), heirs to the textile firm of Marimekko, one of Helsinki's best known exporters.

Heljä Liukko-Sundström (below), one of 14 artists at Arabia ceramics company, takes stock of a whimsical doll's head she has designed. At city hall

(above) Kimmo Kaivanto's digital sculpture "The Chain" is dedicated to friendship among the peoples of Europe.

The uncommonly high standards of exported Finnish design are simply the common standards at home, in a city where not only sculpture but also food, flowers, and the ordinary objects of life become objets d'art.



the demand for more space. Additional hotels are planned.

Visitors to Helsinki who expect to find a Soviet satellite are often chagrined to discover very little Soviet presence. There are only monuments from the days of the grand duchy, a few Russian restaurants, and the daily train from Moscow that caters mostly to Western diplomats on shopping sprees to Stockmann's or trips to the dentist. The only obvious Soviet connection is trade.

"I do business with Russians," said one Helsinki businessman, "despite my personal feelings about their system. We are here and can't do anything about it. We can't put Helsinki into the Caribbean or into Africa. And let's face it. We couldn't have the same high living standard without the Russians."

Yet the Communist Party of Finland is a part of Helsinki's everyday life instead of an outcast, because with the Social Democrats it controls the labor unions. Of 200 members of the Finnish Parliament, 35 are members of the Communist Party, which is split into moderate and radical-Stalinist factions. For now, the moderates work in surprising harmony with the multiparty system; the Stalinists say they refuse to work in a government whose capitalist system they are trying to overthrow.

"We are not gathering arms to attack," scoffed Anna-Liisa Hyvönen, a moderate Communist and former parliamentarian who is now Helsinki's deputy mayor for health service. "We are only trying to convince a majority that our line is correct."

Many Helsinkians are less troubled by Communists than by the term "Finlandization," coined to describe the relationship between Finland and the Soviet Union. In 1948 the two nations struck the Treaty of Friendship, Cooperation, and Mutual Assistance. It is not a military alliance.

"It hurts us," said Eero Asp, the director of Finnish Export Credit Ltd., "that people don't appreciate the fact that of all the countries to have achieved independence just after World War I, only Finland has remained a western democracy."

The prize of independence was hard won and bitterly defended in the Winter War of 1939-40, when Finnish troops fought the Soviet army to a standstill.

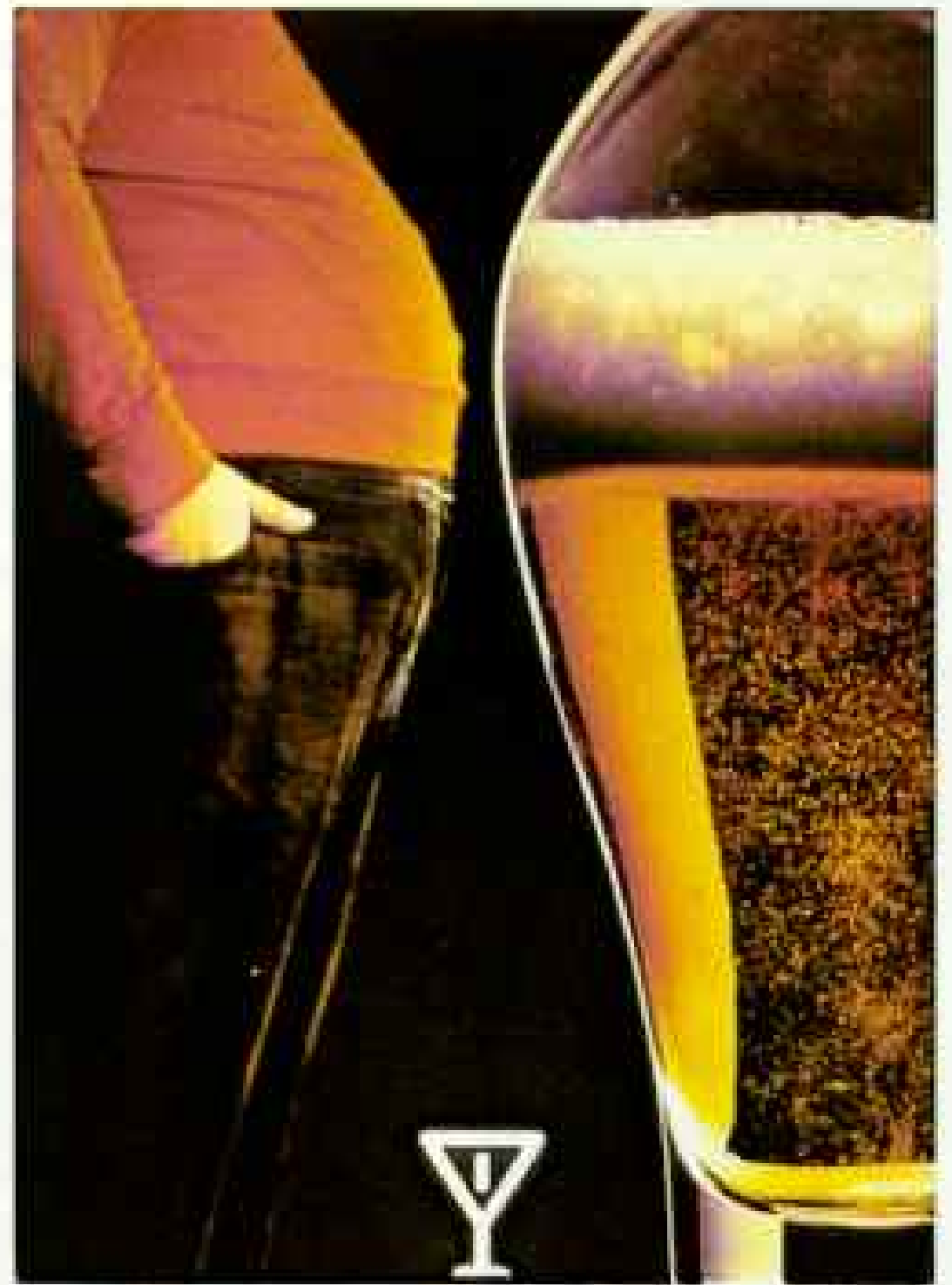
There are free speech and free elections

and a free press. Finnish television is seen and cherished in most of northern Estonia, now a republic of the U.S.S.R., and commentators do not hesitate to report on such volatile affairs as the Soviet invasion of Afghanistan. But they are presented in a carefully objective fashion. As Finnish historian Max Jakobson writes, "The Finns deny themselves the luxury of making emotionally satisfying gestures."

"If we bow West," one Helsinki pundit added, "we present our backsides to the East. We just can't afford to do that."

International books, newspapers, and magazines catering to every conceivable specialty and political persuasion choke the bookstores and newsstands; Helsinkians are among the best read people in the world.

They are among the most conservative of



"Our drinking habits are heavy," one recovered alcoholic told the author, "and rooted deep in our melancholy history. We drink not so often, but we drink to get drunk." The city fights that bane—55,000 arrests a year—with posters (above) and such asylums as Kyläsaari Clinic (right), where one of Helsinki's homeless men rests in an 85-bed dormitory.

audiences also, but knowledgeable and appreciative. Radio music often alternates between takes from, say, Isaac Stern and Bo Diddley, with each artist given the same humorless analytical introduction. Sports crowds clap politely rather than throw beer cans, but follow the subtleties of a track-and-field meet with attentive sophistication. Raucous chauvinism emerges only during the annual meet against Sweden, or an ice-hockey game against the Soviets.

On Midsummer Eve—celebrated the last Friday in June—on Seura Island a 60-foot-high bonfire announces the official beginning of summer in the city. There are folk dances in the amphitheater, gypsy fortune-tellers, and the sweet smell of birch fires and roasting *makkara*—sausage.

Then, from June through August, the city

virtually changes hands—tourists move in, residents move out to homes and cottages in the country. Commerce and businesses are staffed by grass widowers, those whose families have left. Life is a string of Sundays; streets lie calm and warm.

I asked my friend Jaakko Tahkolahti whether that yearly migration causes animosity between the city and country people.

“Oh, sometimes country people complain that their hospitality is being abused,” he said, “but that’s because the city dweller still feels that it is his *right* to come back.”

In mid-June the sun rises at 3 a. m., and by 5 the outdoor market at South Harbor shimmers with vitality under a swirl of sea gulls and arctic terns. Blond schoolgirls with braids and mocking eyes offer spring flowers, strawberries, cucumbers, cabbages,





and tiny new potatoes. In August four-inch-long crayfish, eaten with bread, butter, and dill, and frequent shots of Koskenkorva vodka are a specialty.

One sunny morning I took a bicycle ride along the shoreline of tall sea grass and piers with hundreds of small boats. In Sibelius Park, Japanese tourists crowded around Eila Hiltunen's sculpture of metal pipes that honors Finland's most famous composer, poking their heads inside the cylinders and tapping them (as all tourists must) to test the resonance.

Sails salted the horizon and a kayak stroked past, chased by a playful duck quacking with friendship. Sounds of laughing children floated on the breeze like the spangle of sunlight on the water, and from a seaside café came the whiff of fresh coffee.

If Helsinki could just stay itself—not too big, not too small; sophisticated but not jaded; livable; free . . . but with the years, the city presses in ever more. Diesel fumes and jackhammers and the alarming *hew-haw* of sirens dull the senses. The homeless suffer and abandon their dignity on park benches. At Carroll's Cheeseburgers on Mannerheim Street, the followers of James Dean order French fries. And trams, with their hard, painted shells and bristling antennas, rush by like angry, noisy beetles.

So the city Finn goes home to the soil, to the forests and chill waters that nourish him. Even if it's just for a weekend.

ON THE PORCH of the log cabin by the water's edge, Matti Kohva and I sat in the afterglow of a sauna. We had sailed on the lake in the brisk wind, and sunset ringed the western horizon of fragrant pine forests. But in the east, dark thunderclouds loomed.

Matti's wife, Irma, was cleaning fresh fish in the kitchen of the cabin, a hideaway many miles and many moods from their apartment in Helsinki.

"Looks as if we're in for some rain," I mused, worried that the weekend would be spoiled. Irma looked out of the open window, and a warm breeze blew back a stray wisp of blond hair.

"Yes," she said with the tough optimism that will be forever Finnish, "but it's not snowing." □



A layered look in street fashions (above) or in suburban apartments (facing page) speaks for a comfortable conformity of good taste and design. Helsinki is among the most homogeneous of Europe's capitals, with no significant minority groups or guest workers to complicate, or enrich, the society of Finns. Most land is city owned, a boon for urban planners whose talents have produced suburban models that are internationally emulated.



The Untamed Yellowstone

By BILL RICHARDS

Photographs by DEAN KRAKEL II

FAR BACK in the deepening shadows the haunting notes of a bugling bull elk suddenly lift above the trees, as clear and wild as the headwaters of the Yellowstone River flowing by my campsite. An elk's bugling is simply a phenomenon of the fall rutting season. But to me, as I traveled down the Yellowstone, the elk's cry, compounded of frustration and loneliness, seemed to epitomize the plight of this unique, untamed river.

Other rivers such as the Colorado, Columbia, and Missouri have been broken by man with chains of dams, locks, and muddy lakes. Now the 671-mile Yellowstone is the longest free-flowing river left in the United States outside of Alaska. A virgin target for dam builders, a source of conflicting demands from environmentalists, sportsmen, farmers, industries, and growing cities, the Yellowstone is a last troubled reminder of the way the rivers used to run.

Born in melting snowpacks high on Younts Peak in Wyoming, it carves its way north out of the wild Absaroka Range through Yellowstone National Park and spills onto Montana's plains. Above the city of Billings, halfway down its course, it is still fast and cold. Then gradually, it begins to

warm as it flattens into a prairie river flowing east. Just across the North Dakota border it meets the Missouri. At this confluence the Yellowstone is the larger of the two rivers, but it nevertheless loses its name to the Missouri (map, page 263).

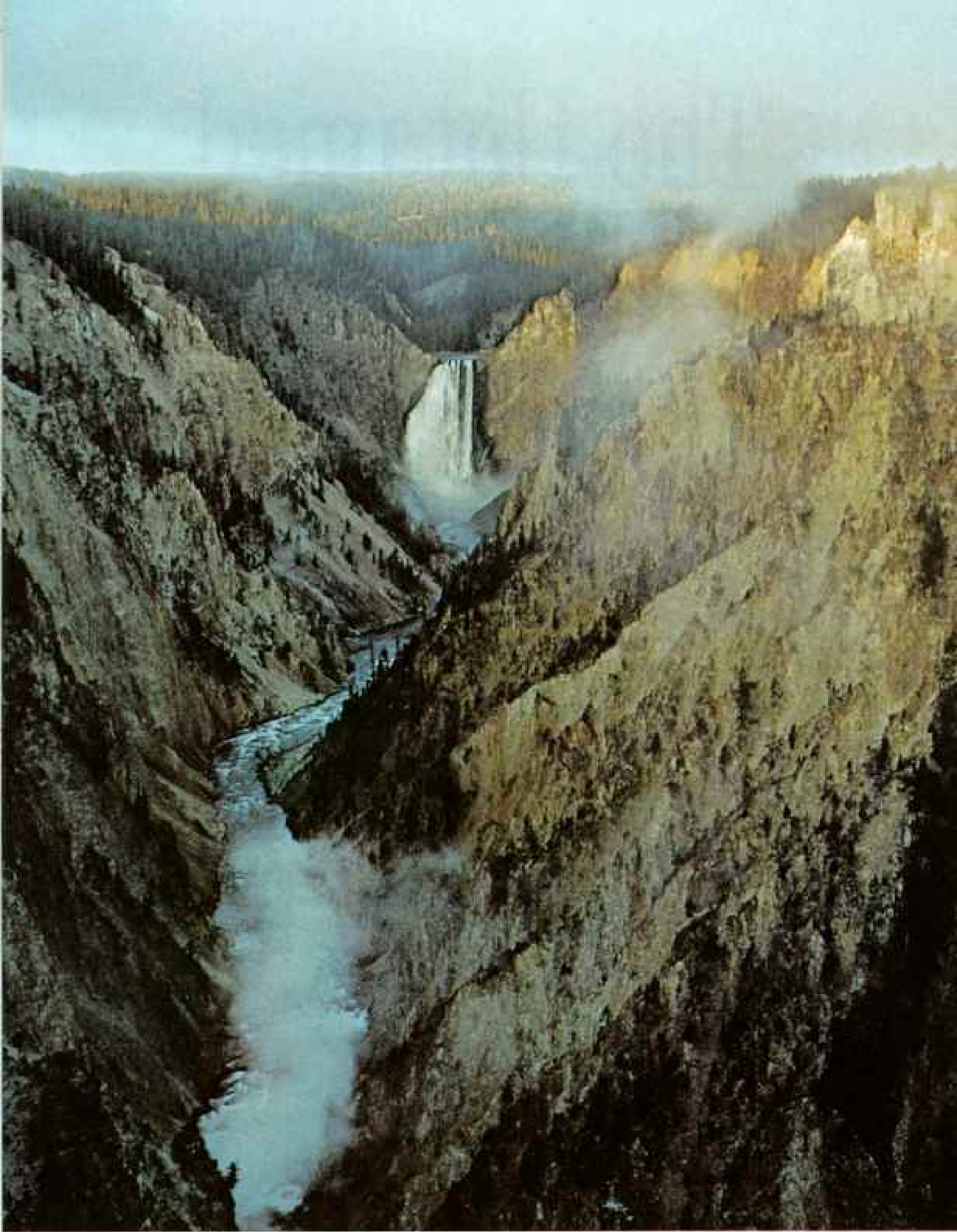
Along the way to that unfair end the Yellowstone leaves a string of natural wonders: the national park that bears its name; a lake, at 7,733 feet the largest high-altitude body of water on the continent; falls that drop 109 and 308 feet in a spectacular riverine two-step; and its own grand canyon.*

Mountain man Jim Bridger, one of the first to set eyes on the source of the Yellowstone, came away nearly 150 years ago with tales of a river that straddled the Continental Divide—a two-ocean waterway where trout could swim toward either the Atlantic or Pacific. For once Bridger, that weaver of campfire hyperbole, told the truth.

Not far from Younts Peak, the Continental Divide sits astride Two Ocean Pass, its flanks already covered with snow when I saw it in early October. The snow, when it melts, forms a high-altitude creek system running off in two directions—west to the

*A centennial salute to the nation's oldest national park appeared in the May 1972 GEOGRAPHIC.

Daybreak clouds dapple the Yellowstone River, where a bull moose wades for pondweeds in Yellowstone National Park. Rising in Wyoming's mountains, the stream courses 671 miles through that state, Montana, and North Dakota—the longest undammed river in the lower forty-eight states. But the question persists: Can increasing demand for its water be met without shackling one of the West's last major wild rivers?



With the earth-shaping fury that carved the Grand Canyon of the Yellowstone, the river chutes the golden chasm from the 308-foot Lower Falls. The world's first national park justly took its name in 1872 from the river that created such wonders.



Thomas Moran's watercolor sketch of the Lower Falls helped sway Congress to establish the park, but the landscapist rued his meager palette, reporting that "these beautiful tints were beyond the reach of human art."



Pacific and east to merge with the fledgling Yellowstone on its way to the Atlantic.

"You are about as far from a major road as anywhere you can go in the lower forty-eight states," said Yellowstone National Park ranger Bob Jackson after my arrival at Thorofare Ranger Station near the pass.

"And that's the way it ought to be," he added. "If it wasn't for the isolation, the grizzlies, and the general wildness of this place, the Yellowstone would be just another river full of people."

From June through October it is the task of Bob and park volunteer Evelyn Wyman to maintain a backcountry presence that helps keep poachers and illegal fishermen from crossing the park's rugged south border. Their headquarters, a two-room log cabin, has a two-way radio to keep them in touch with the outside world 32 miles away.

While Evelyn baked biscuits in the cabin's wood-burning range, I tried Bob's homemade outdoor shower—a 55-gallon drum mounted on a log scaffold and filled with water that had been "warming" in the afternoon sun. Bob laughed as I howled and danced under the frigid spray.

As the only semipermanent residents on the river's headwaters, Bob and Evelyn maintain a lonely vigil, traveling by horseback through the wild. A backpacking or outfitter party may pass through every few days during the busy summer season. As many as a thousand travelers venture into the area each year, but few make the full 32-mile trek to the ranger's cabin. Until late July the river is usually too high and boisterous with snowmelt to cross, even by horse.

Grizzlies and Tourists Don't Mix

And then there are the "griz." Some 200 to 400 grizzly bears roam Yellowstone Park and the surrounding wilderness, one of their last holdouts in the lower United States. Biologists aren't sure of how many grizzlies, but they are certain of one thing: "The more people in an area, the fewer grizzlies."

I noted several large, muddy bear-paw prints high on Jackson's reinforced cabin door. "We found them there when we packed in here last spring," Evelyn said. "We decided to leave them to discourage anyone from breaking in while we're gone."

That night Bob pulled out an old ranger's

logbook and thumbed back to a 1969 entry: "Went outside around ten o'clock last night to brush teeth, check stars etc . . . and almost ran into a (grizzly?) bear," a previous occupant of the cabin had written. "He snorted and blew and turned and left—I did same in opposite direction—only faster."

I was still thinking about that encounter as I hiked out of the backcountry a day later with photographer Dean Krakel II. The sky



Bath turns berth for the photographer's son, Dean (facing page), as he nods after a pack trip to the Yellowstone's headwaters in Wyoming's Absaroka Range.

The river enters the park near Thorofare Ranger Station, where a snack-minded horse judges visiting ranger Bob Mahn an easy touch (above). The station helps deter illegal fishing and hunting.

was a dazzling blue, the October weather unseasonably warm. Suddenly Dean halted and commanded "Freeze!" A grizzly—big even at a distance of several hundred yards—played along the riverbank.

An angry grizzly can sprint as fast as a quarter horse over short distances, and a running object is his instinctive target. So we edged—very slowly—into the trees. The grizzly missed us or chose to ignore us, and we were happy to leave him behind, undisputed lord in his own wild kingdom.

Eighty miles to the north, beyond the national park boundary, the Yellowstone tumbles out of the mountains into Montana's Paradise Valley. Its water is numbing cold, but that doesn't stop hundreds of fishermen from flocking here.

For Trout Fishermen, Paradise

"This is the mecca of trout fishing, better than almost anywhere else in the world," Jim Posewitz told me as we drifted in his johnboat, casting flies into pools. Along a ten-mile stretch we each landed a dozen rainbow, cutthroat, and brown trout. A catch like that was excitement enough, we decided, and tossed the trout back, including Jim's best, a three-pound rainbow.

Jim is employed by the Montana Department of Fish, Wildlife, and Parks. White-haired and usually puffing on a stained corn-cob pipe, he is an eloquent spokesman for the river. He has written, lectured, and lobbied across the state, opposing those who want to dam and drain the river's water for agriculture, for urban development, and, most recently, for Montana's coal industry.

Paradise Valley, besides being heaven for flycasters, is a natural wind funnel, narrowing at its mouth to a quarter-mile-wide gap named after the Burlington Northern Railroad's Allens Spur line. Cottonwoods in the gap tilt to the north because of the fierce prevailing wind. In Livingston, Montana, a few miles away, I heard residents refer to a 50-mile-an-hour blow as "breezy."

The 1,000-foot limestone cliffs that flank the gap make an almost ideal site for a dam. Since 1902 engineers have periodically suggested that a dam at Allens Spur could provide a dependable water supply for down-river users. One 380-foot-high dam there would provide enough water to irrigate

some 250,000 acres of dry Montana land and ensure a stable water supply for the massive coal development beginning to take place along Montana's eastern border.

"But it would also mean they'd flood 31 miles of irreplaceably beautiful valley behind that dam and kill off the kind of fishing you can't find anywhere else in this country," protested John Bailey.

John is a second-generation fly-fisher addict. In 1938 his father, Dan Bailey, left a career as a physicist in the East to open a shop in Livingston specializing in fly-fishing for Yellowstone trout. I stopped in to look over the Baileys' "Wall of Fame," actually four walls covered with hundreds of plaques depicting giant trout pulled from the Yellowstone and other area streams. To qualify, the fish must weigh more than four pounds. Under each is listed the name of the fisherman, the river, and the date of his catch.

In another room of the store I found Anna Patterson, an exuberant red-haired grandmother, twisting tiny bits of calf hair, chicken feathers, and peacock quills into an elaborate fly with a down-swept wing called a Royal Coachman Trude. Around the room another half a dozen women were quietly tying tiny creations. The Baileys' flytiers, all women, can produce more than 300 types.

"Do you ever go out on the river to test your newest fly?" I asked Anna.

"Oh, goodness no. I feel sorry for the poor fish. I could never kill one."

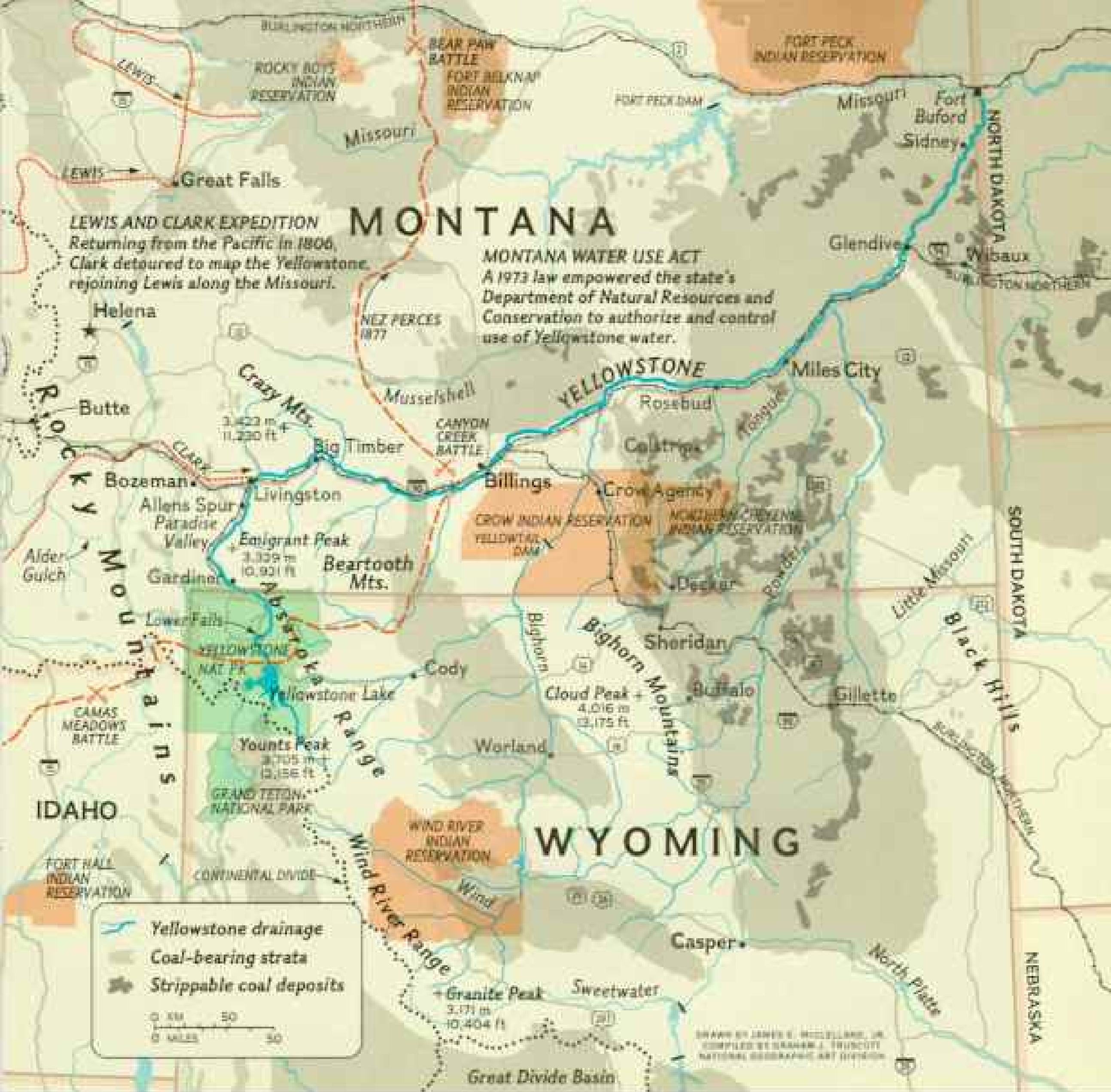
Modern Sourdough Vacuums River

It was just outside Livingston, behind a narrow gravel bar on a bend in the river, that Roy Kinne and I found gold (page 269).

At the bottom of the pan in Roy's hands two tiny flakes glittered in the gravel, and I felt my pulse quicken. He swished the slurry around looking for more. Roy's partner, Frank Fessenden, in a wet suit, paddled facedown in the cold Yellowstone, vacuuming its bottom with a long hose.

Gravel and water spurted through the other end of the hose into an eight-foot sluice box that floated next to a noisy engine mounted on inner tubes. The water and lighter gravel flowed back into the river, while heavier material, including my gold, settled to the bottom of the box.

There still is gold in the Yellowstone, Roy



Water politics run deep in the arid West. The battle of allocating water from the Yellowstone and its tributaries flared in the early 1970s when it became clear that energy companies would need massive quantities to develop Montana's coal deposits, the nation's largest. Ranchers and farmers feared loss of vital irrigation. Naturalists feared destruction of the river and its wildlife. In 1978 the state's health and wildlife departments won the right to keep more than half of the annual flow in the stream. Too much, some say. But river defenders counter that prudent use and alternatives to damming can provide water for all interests.



In dawn's solitude an angler in the park plays for one of the Yellowstone's most abundant species, cutthroat trout. For rainbows and browns, sportsmen go north to



Montana's Paradise Valley, where fishing groups have rallied against damming what some consider to be the finest trout stream in the country.

assured me. The river acts as its own sluice, catching flakes of the yellow metal in rocky cracks that seam the riverbed.

"We've been dredging for three years in our spare time, and we've found enough gold to just about pay for the gasoline to run the dredge," Roy said with a smile.

Since as far back as the 1860s, gold seekers have worked the upper Yellowstone Valley. In 1864 at Emigrant Gulch, above Livingston, prospector David Weaver recorded one discovery:

"Shorthill . . . brought up two shovelful of the sand and gravel. . . . And there in the bottom of the pan lay, unmistakably, the object of our long journey. There was perhaps a dollar's worth of gold in this first pan. I fancy I can hear yet the yell of delight which Shorthill gave. . . ."

It was not the big strike. That came the year before at Alder Gulch, 90 miles farther west on the Ruby River. But the Yellowstone miners set up a town near their claims. Unlike earlier settlements downriver that were built around military forts, this was an all-civilian enclave. The roistering community called Yellowstone City lasted two years. But before Indians drove them away, Yellowstone miners took out about \$30,000 in gold. At \$18 an ounce it was not bad work at the time. At hundreds of dollars an ounce nowadays, it is no wonder that gold fever has risen again along the Yellowstone.

Environmentalists are not altogether happy with this. They told me the gold dredges suck up fish eggs along with gravel from the river bottom, and the sediment they discharge adds an unnecessary burden to the Yellowstone. But Roy Kinne considers these objections spoilsport.

"Maybe there should be a limit on the number of gold dredges allowed to work on the river," Roy suggested. "But this is still such a big country. There ought to be room for a little bit of everything in it."

I followed the river east the next day along Interstate 90. The Yellowstone may still be undammed, but it is not untouched. It has

always been a natural highway. Once trappers followed Indian trails along its banks; now a railroad and the interstate are its constant companions for hundreds of miles.

I swung along the great bend in the river toward Big Timber, Montana, stopping for a while to sit along the riverbank with cattle rancher Franklin Grosfield. The cottonwoods glowed gold, and Frank's Herefords chewed contentedly. Grosfield is a fourth-generation rancher here, with 21,000 acres sprawling from the Yellowstone into the foothills of the lofty Crazy Mountains.

In an odd sort of way Frank Grosfield and my fishing companion Jim Posewitz have been a traveling team. When Jim showed up at a meeting to argue that more water ought to be left in the Yellowstone for fish and wildlife, Frank was usually on the agenda urging more water for irrigation.

Source of Life and Controversy

There is a touch of wry humor in Frank's voice when he talks about "the earthies," who he feels put wild creatures and a free-flowing river ahead of the needs of agriculture. "My aesthetic values are as good as anyone's," he said. "But a green field along the river bottom in the dry season, to me that's more beautiful than some slimy fish."

Water has always been a source of conflict along the Yellowstone, which is a lifeline for one-third of Montana's 787,000 residents. In 1973 the state legislature faced a future of even greater demands on the river's water: Synthetic-fuel plants proposed for eastern Montana coalfields would need billions of gallons year after year to convert coal into gas and liquid fuel. To establish an orderly system of water distribution, the legislature passed the 1973 Water Use Act.

When state officials began adding up requests for future water allocations from federal, state, local, and private interests, plus nearly 9,000 claims from existing river users, they totaled more than the river's average 8.8 million acre-foot annual flow. The situation seemed impossible. But in 1978

Dinner in hand, Montanan John Stillman pauses with a hunting companion, Chesapeake Bay retriever Hope, by a spring-fed creek on his ranch fronting the Yellowstone near Livingston. Migrating game birds soar the flyways over the Yellowstone, where the dynamics of a free-flowing river create island nesting sanctuaries.



Montana's Board of Natural Resources and Conservation settled two huge requests when it ordered that 5.5 million acre-feet of water be left in the Yellowstone for the sake of both good water quality and a stable habitat for fish and wildlife.

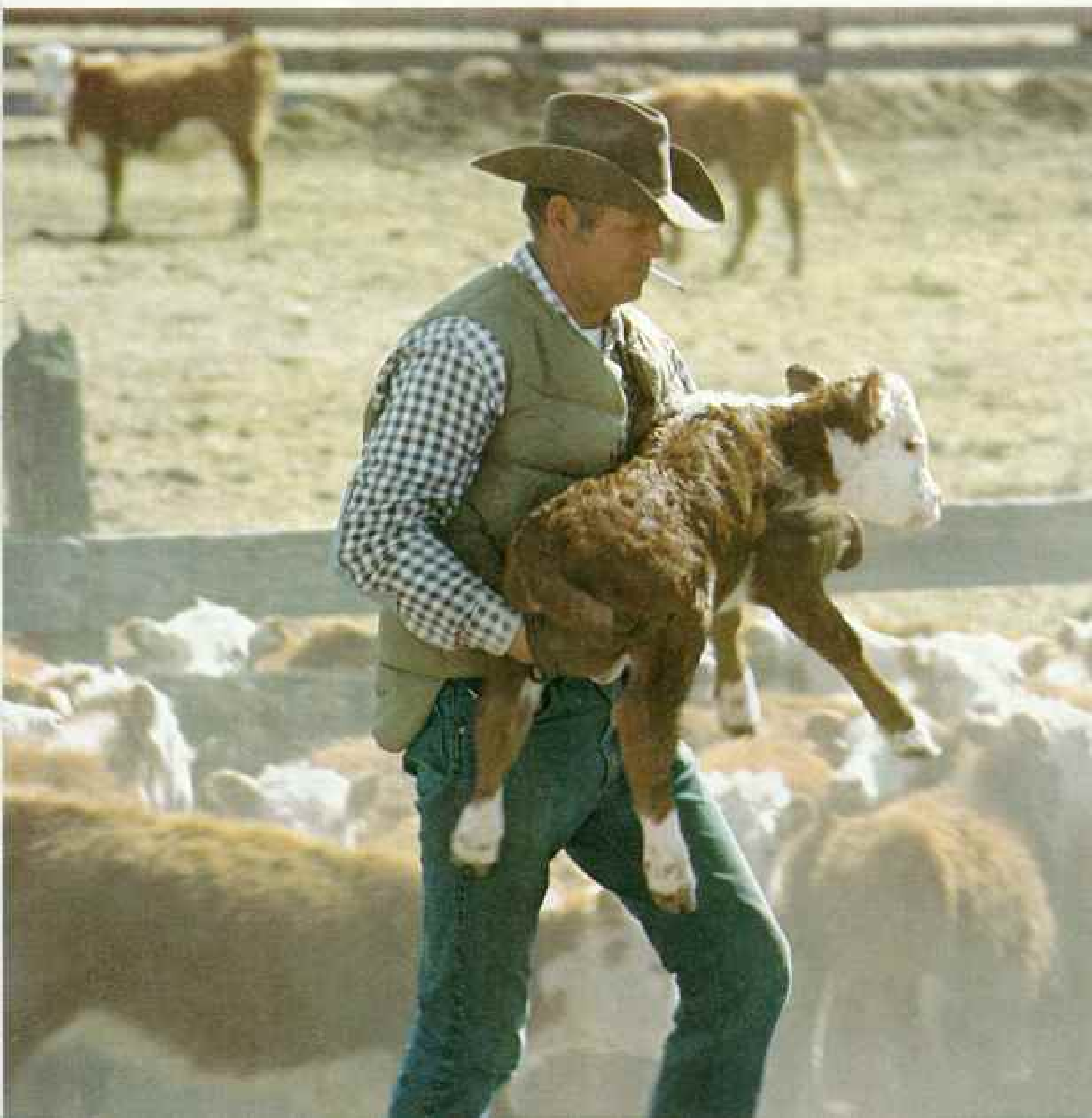
Montana officials have worked hard to accommodate everyone. And they have been bombarded with suggestions: Dam the river to catch the spring runoff, dam tributaries and divert spring runoff for storage, curtail growth, stop coal development. . . .

"I suppose the answer depends on which stump you're sitting on," rancher Frank Grosfield said, "but one thing never changes

in the West—control the water and you control the land."

Billings, Montana's largest city, is now a heavy user of Yellowstone water, but is even more absorbed in future energy development. Nearby in eastern Montana and Wyoming lie incredibly vast coal deposits, as well as gas, oil, and uranium.

From a distance Billings marks a clear change in the Yellowstone landscape (pages 270-71). New houses and trailers leapfrog through old sugar beet fields on the outskirts of this northern Rocky Mountain energy capital. The population is growing 3 percent each year, hovering around 100,000 now,



expected to hit 165,000 by the year 2000.

My first view of Billings was pleasantly impeded by the clusters of cottonwoods and willows along the riverbank. I was literally drifting into town, paddling a small inflatable yellow raft. Around me the Yellowstone was beginning to lose its mountain character, alternating between a few last, quick dashes around gravel bars and slow, deep turns under the remaining high buttes before the emptiness of the open plains. I beached my small craft on a bar in the middle of the river and stopped for a while to catch this change in mood.

Behind me the Beartooth Mountains

rose, framing the river valley in a distant frieze of snow and blue haze. Ahead I could make out white plumes of steam drifting off an oil refinery, a power plant, a sugar beet mill. A new glass hotel, 23 stories tall, caught the sun—"biggest building from here to Seattle," Montanans tell visitors.

A century ago buffalo herds grazed these banks and Indians moved across the buttes. In 1877 Chief Joseph and some 700 other weary and starving Nez Perces crossed this river not far from where I sat.* Those Nez Perces were headed north, to Canada, on an

*William Albert Allard told of the tragic march in "Chief Joseph," GEOGRAPHIC, March 1977.



"If it were paradise, everyone would be here," rancher Cleon Lesh (left) reasons when natural dry spells parch his land, watered by a tributary creek south of Miles City.

Only rain quenches eastern Montana's oil-rich safflowers, a profitable "dry" crop (right), here tested at the Agricultural Experiment Station at Sidney. But irrigation is crucial to the main harvest, sugar beets.

Dreaming of gold (below), weekend prospectors Frank Fessenden, left, and Roy Kinne find more fun than profit in their modest haul of Yellowstone flakes near Livingston.





In slow transformation to a prairie river, the icy Yellowstone meanders east of Billings past an Exxon oil refinery, one of three that have tapped the river since the



late 1940s. Waste-treatment lagoons installed for better pollution control of recycled water have rendered the river cleaner within the past decade.

ill-fated 1,700-mile flight from the white man. I wondered whether the Yellowstone seemed to them the peaceful, rippling river that I saw around me, or did it seem only a broad and ominous barrier to freedom?

One weekend each summer the Yellowstone above Billings is churned into a serpentine beer garden. Hundreds of craft, from old inner tubes to sleek, outboard-powered speedboats, take to the river to float and party. I passed no one on my rubber raft's mid-October journey through Billings, but just upstream of the Montana Power Company's Corette Power Plant a beaver stroked across my bow. When it saw me, it slapped the water with a surprising thwack of its tail and dived out of sight.

I returned to this section of the river later on foot with George Freeman, the chief of Billings' city-county planning department. The big coal-fired power plant hummed on one side of us, pulling in and returning 75 million gallons of river water a day, as the city's water plant nearby sucked in 35 million gallons. As Billings grows, this can be increased to 78 million gallons or more.

"The system on the river works fine for now," Mr. Freeman said. "But everybody wants more. People have to realize a free-flowing river is an uncertain resource. With a real dry year or two, it could end up a race to see who can get his bucket in first."

How long, I wondered, will someone be able to catch a brown trout or get a glimpse of a beaver on the Yellowstone just a mile from downtown Billings?

Indians Battle for Water Rights

For the white man the Yellowstone is a relatively new river. French fur traders arrived late in the 18th century and called the river *la Roche Jaune*—river of "the yellow rock." William Clark used the French name in his journal during a detour down the Yellowstone in 1806 on his famous trek with Meriwether Lewis to explore the vast new Louisiana Purchase for President Jefferson.

Historians still puzzle over the precise origin of the name because there is little yellow stone along the river. But Daniel Old Elk, a water commissioner for the Crow tribe, told me he knows where the French got their name. "It was a mistake," he explained. "In our language we always called it the Elk





"This ranching way of life is a precious thing," says Ellen Cotton (left, screened by a door). She runs a 3,500-acre spread—small by Montana standards—on Four-Mile Creek near Decker, site of a coal mine. In defense of the range, she fights to limit strip mining. "Ranchers are an endangered species out here," she says.

Raised to respect land and water, Spike Van Cleve (right), a fourth-generation Montana rancher, passes a heritage of self-reliance to grandson Rocco Carroccia (above), here with a ranch guest. "I'm an environmentalist with horse sense," says Spike, who irrigates his Big Timber ranch from Otter Creek. "You take what water God gives you, but we ranchers need our share before it's taken away for coal slurry, or to ensure that some fish live."





March snow saddles horses beside a barn on a ranch near Emigrant, Montana,



once used as a rest station by pioneer tourists bound for Yellowstone Park.

River. The words sound alike, and the French didn't understand Crow very well."

At one time the Crows owned most of the lower Yellowstone Valley as part of their 38.5-million-acre reservation. "Crow country is exactly in the right place," said their famous chief, Arapooish. But the treaties with Washington changed as the whites moved in. Today the reservation has been cut to 2.3 million acres and does not even border on the Yellowstone.

But Daniel Old Elk and his tribe may still hold a key to the future of the river. The Bighorn River, largest of the Yellowstone tributaries, flows through the Crow reservation. The tribe, backed by the U. S. Department of Justice, has gone to federal court to demand as much Bighorn water as it needs for future agriculture or coal development.

Any substantial withdrawal of water from the Bighorn's 2.5 million acre-foot streamflow would affect the quantity of water in the Yellowstone. If the Crows withdrew half the water in the Bighorn for their own use, about 14 percent of the water in the lower Yellowstone would disappear.

"What Flows Through Our Land Is Ours"

I got a graphic look at what could happen to the Bighorn someday when Old Elk took me to watch as federal engineers shut off the water in the big Yellowstone tributary for a day. The Interior Department's Water and Power Resources Service was closing its Yellowtail Dam on the river for six hours to check a concrete tailrace normally submerged below the dam. We watched as the Bighorn shrank within its hundred-yard-wide channel to one-fifth its usual size.

The engineers assured me the temporary shutdown was barely felt on the Yellowstone, 60 miles downstream. But what would happen to the Yellowstone if the Crows elected to divert massive amounts of water from the Bighorn permanently for future energy and agricultural projects?

"We have plans for using water from the

Bighorn someday," Old Elk said. "But we respect the rights of others downstream. We think there will be enough water to go around. What we are saying, though, is what flows through our land is ours."

By the time it reaches Miles City, Montana, the Yellowstone has completed four-fifths of its journey, and it is a confirmed prairie river. The tall bluffs and mountains that lined its upper reaches give over to open plains and stretches of jagged badlands red with the scoria of burned-out coal seams. It is the kind of land that once inspired a visiting military officer to proclaim, "It looks like hell with the fire out."



Winter stills the Yellowstone's trail of beauty and conflict 14 miles into North Dakota. Here the river, upper right, surrenders its name and water to the Missouri, now winding toward dawn.

The river, cloudy now with an accumulation of silt, weaves a lazy course through a maze of willow-covered islands. Incredibly, steamboat captains once maneuvered 200-foot stern-wheelers around these tight bends and random gravel bars.

The arrival of the Northern Pacific Railroad in 1881 brought an end to much of the steamboat traffic on the river, but in the steamboat's heyday in Miles City the riverbank was crowded with a line of such craft, loading huge piles of buffalo hides on deck. The *Yellowstone Journal*, the local newspaper, reported in 1880 that 30,000 hides were shipped from Miles City that spring and

summer. Most no doubt rode the June crest of the Yellowstone to the Missouri and on to "the states" and St. Louis.

The heyday didn't last long. Three years of frenetic killing all but wiped out the great northern buffalo herd. Today the river is empty, with no sign of the traffic that once made Miles City a major port for the inland Northwest. It would take more than a skillful navigator to make the trip to St. Louis today with four major Missouri River dams blocking the way.

Another kind of freight traffic now fills the lower valley of the Yellowstone. Six long coal trains rolled below me as rancher Keith



Stevens flew me along a 75-mile portion of the river near Miles City.

Black seams of lignite etch the banks of the Yellowstone here and lie buried beneath the prairie beyond. About 50 billion tons of strippable coal lie under eastern Montana, enough to supply dozens of plants producing synthetic gas or liquid fuel.

"We think that a realistic projection will be fewer than ten synthetic-fuel plants in this part of Montana by the year 2000," said energy expert Jack Adams. I had invited him and Gary Cheatham, both executives of Tenneco Inc., to go with Keith and me on our aerial tour of the coalfield.

Keith banked the Cessna 180, and the Tenneco men pointed out a wheat field below near the little farming town of Wibaux, Montana, where Tenneco plans to build a plant to convert Montana coal to synthetic gas. "We'd like to begin construction there by 1985," Gary said. "The plant will cost about 2.3 billion dollars and should produce 280 million cubic feet of synthetic gas daily from the coal we own nearby."

Too Many Needs, Not Enough River

Other energy giants such as Exxon, Gulf, Mobil, and Getty Oil also have coal holdings in the area. But so far Tenneco is the only company with water—a critical element in synthetic-fuel production. Tenneco estimates it will require at least 10,000 acre-feet of water annually to run its plant. The company beat the 1973 Montana limitation on new water users on the Yellowstone and has rights to take 80,650 acre-feet of water from the river if it wants to. Some of this it may want to sell to other energy developers.

But Tenneco's Wibaux site sits six miles outside the Yellowstone basin. Under the Yellowstone Compact—a 1951 interstate agreement signed by Montana, Wyoming, and North Dakota—all three states have to approve any diversion of water outside the basin. Tenneco has challenged this in court.

But, I asked, why doesn't the company

just shift its plant site a couple of wheat fields away from its coal mine to put it inside the river basin?

"It costs a lot more to move coal than it does to move water," Gary explained.

Environmentalists worry that Tenneco's challenge may have far-reaching effects on the Yellowstone. If Tenneco is successful, they fear a lot more water will be sold for use outside the basin. "That could disrupt Montana's attempts to establish its own system of allocating water within the state," argues University of Montana law professor Albert W. Stone, a water-law expert. "It certainly would mean more pressure to dam the river so the flow is evened out."

From the small windswept rise where I stood a few days later, it seemed hard to believe the Yellowstone is a river under siege. Below me the river coiled around one last gravel bar and was swept away by the Missouri, equally flat, equally deserted. The two rivers, joined now, disappeared eastward across the cold North Dakota prairie.

At this quiet confluence a line of small white crosses offered silent testimony to frontier times: "Norman Bartholomew, Pvt., U. S. Infantry, Nov. 3, 1871—inebriation . . . William H. Lee, Sept. 19, 1868—killed by Indians . . . Owl Headress, Feb. 8, 1870—beaten to death. . . ."

The tiny cemetery had served Fort Buford, a once bustling outpost on the fledgling nation's westernmost frontier. The cluster of small crosses—an isolated reminder of the perils of 19th-century expansion—was all but lost beneath the vast gray sky, the dead long forgotten.

Who knows how many others—plainsmen, painted warriors, nervous settlers—stood on this same spot and wondered about the future. They are gone now, those nameless ones, along with almost all trace of their endeavors. There will be others with new plans, new demands. But whatever happens, whatever the pressures, the land and the river will endure. □

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HELP! is a full-power, full-performance 40-channel CB radio. So you have all the access to the help you need, when you need it.



To use, simply put the magnetic antenna on the roof, plug the adapter into the cigarette lighter, and you're on the air.

If troubles nowhere in sight, neither is **HELP!** It stores neatly in its own compact case under the seat or in the trunk. You don't see it, nor does anyone else.

So the next time you and your family use the car, make sure **HELP!** is along for the ride.



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GOOD THINGS
TO LIFE.

GENERAL  ELECTRIC

For more information on **HELP!** (model no. 3-5900) write to: General Electric Co., EP, Bldg. 5, Rm. 139, Syracuse, NY 13221



The kind of color you get out of your camera depends on the kind of film you put into it.



That's why more people put Kodacolor II film into their cameras than any other film.

It makes colors so bright and so vibrant that they seem to have lives of their own.

So tell your story the way it was meant to be told. In color. On Kodacolor II film.

The more you care about color, the more you need Kodacolor II film.





MEMMET BIBER

Aphrodisias lives on through its art

CORNUCOPIA of art and architecture, the ancient city of Aphrodisias still pours out wealth after 20 years of excavation.

The Greco-Roman city in southwestern Turkey prospered from the first century B.C. to the sixth century A.D., mirroring the attributes of its patron goddess, Aphrodite: beauty, love, fertility, and life. The work of Aphrodisian sculptors, renowned across the Roman Empire, graced the city's grand theater, concert hall, baths, and one of the largest stadiums in the Roman world.

Treasures unearthed under the direction of Dr. Kenan T. Erim of New York University are now housed in the Aphrodisias Museum, built by the Turkish government and the National Geographic Society, a sponsor of the dig since 1966.

Chairman of the Society's Committee for Research and Exploration, Dr. Melvin M. Payne, at right, and Dr. Erim watch workmen clean a marble relief panel found in 1979, shortly after the museum's dedication.

Share such rebirth of cultures past; nominate a friend for Society membership below.

NATIONAL GEOGRAPHIC SOCIETY MEMBERSHIP

\$13.50 CALENDAR YEAR 1982 MEMBERSHIP DUES INCLUDE SUBSCRIPTION TO THE NATIONAL GEOGRAPHIC

ANNUAL DUES in the United States and throughout the world are \$13.50 U.S. funds or equivalent. To compensate for additional postage and handling for mailing magazine outside the U.S.A. and its outlying areas, please remit: for Canada, \$18.70 Canadian or \$15.50 U.S.; for all other countries, \$21.50 if paid in U.S. currency by U.S. bank draft or international money order. Eighty percent of dues is designated for magazine subscription. Annual membership begins with the January issue.

EIGHTEEN-MONTH MEMBERSHIP: Applicants who prefer delivery of their NATIONAL GEOGRAPHIC to start with the July 1981 instead of the January 1982 issue may upon request become members and receive the magazine for 18 months from July 1, 1981, through December 1982. Upon expiration, such memberships will be renewable annually on a calendar-year basis. For 18-month membership check here and remit: for U.S. and its outlying areas, \$19.25 U.S. funds or equivalent; for Canada, \$27.50 Canadian or \$22.80 U.S.; for all other countries, \$30.70 if paid in U.S. currency by U.S. bank draft or international money order.

Mail to: The Executive Vice President
National Geographic Society
Post Office Box 2895
Washington, D. C. 20013

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MY NAME PLEASE PRINT (MR., MRS., MISS, MS.)

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STREET

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00881

The Chairman and Council of the
United States First Day Cover Society
extend you a warm invitation to

Become a member of America's most prestigious organization — for collectors of the first editions of America's stamps.

THE CACHET

Museum-quality, *exclusive* works of art by leading artists, reproduced in vivid color and striking detail.

THE STAMP

Each commemorative stamp is issued by the U.S. Postal Service to honor a great person, event, place or other aspect of America's heritage.

THE POSTMARK AND CANCELLATION

The postmark records the date and location of the stamp's first day of issue; the cancellation further establishes the Cover's authenticity.

THE NARRATIVE

Printed on the back of each Fleetwood First Day Cover, this historical account brings the stamp's subject to life. You can never lose it, and it will add to the enjoyment and educational value of your collection.



Covers shown smaller than
actual size of 6 1/2 by 3 1/2 inches
(165mm by 92mm).

Few people realize the pleasure, the wealth of knowledge and the potential profit that can come from collecting official United States First Day Covers — the first editions of America's stamps.

Now, you have the opportunity to begin your own heirloom collection of these treasured collectors' items — simply by accepting this invitation to become a member of the U.S. First Day Cover Society.

UNIQUE AND DESIRABLE COLLECTIBLES

First Day Covers are sought after by astute collectors just as limited editions of works of art are prized by connoisseurs. And for good reason: of the millions — even billions — of stamps printed each year, only a very small fraction have "first edition" status.

The limited quantities produced, the exclusivity of each First Day Cover's original cachet art, the First Day of Issue cancellation and the beautiful stamps themselves make First Day Covers the most desirable way to collect our country's stamps.

WHAT IS A FIRST DAY COVER?

Before a stamp goes on sale at post offices across the country, it is introduced at just one post office designated by the U.S. Postal Service. The First Day of Issue cancellation and special postmark distinguish First Day Covers from all other covers (envelopes) bearing the same stamp. These limited editions become valued collectors' items, never to be duplicated.

THE SOCIETY PROVIDES THE BEST FIRST DAY COVERS AVAILABLE TODAY

First Day Covers issued by the U.S. First Day Cover Society are supplied by Fleetwood, America's oldest and largest creator of philatelic commemoratives.

Over the years, Fleetwood has produced hundreds of First Day Covers on an infinite variety of subjects. Their quality lithography, painstaking attention to detail, and uncompromising excellence in every respect ensure the greatest current and future value of your collection.

ENJOYABLE, CONVENIENT, INEXPENSIVE

Since the Society will send you each First Day Cover as the stamps are issued, collecting requires almost no effort. The Society also:

- Informs you of significant First Day Covers from other countries and provides you with the opportunity to acquire them.
- Offers a complete selection of past U.S. First Day Covers — at a 10% savings for your first six months of membership.

EXTRA BONUS

Display and protect your Covers in elegant hard-cover "book" form with this handsome Album. It is yours to keep if you remain a Society member for only 6 months. (Otherwise, you will be billed for its retail price of \$23.50.)



- Provides you with an official engraved certificate attesting to your election to membership. This handsome document is suitable for framing and may be displayed anywhere in your home or office.
- Gives you a membership card which grants you a personal tour, a free memento, and use of the Society's Clubroom when you visit the National First Day Cover Museum in Cheyenne, Wyoming.

All this for the modest cost of \$1.95 for each Cover bearing a 18¢ stamp (slightly more for stamps of higher value). This is indeed an extraordinary value, especially considering that it is not uncommon for First Day Covers to increase tenfold in value within a few years of their issue.

SATISFACTION GUARANTEED

Your satisfaction is unequivocally guaranteed. If you are not happy with your First Day Covers — for any reason — you may return them within ten days of receipt for a full refund or credit.

Take advantage of this unique opportunity to explore the world of First Day Cover collecting. Fill out the Membership Acceptance form today and mail it to: U.S. First Day Cover Society, National First Day Cover Museum, 1 Museum Station, Cheyenne, Wyoming 82008-0002.

MEMBERSHIP ACCEPTANCE



U.S. First Day Cover Society
National First Day Cover Museum
1 Museum Station
Cheyenne, Wyoming 82008-0002

D308

I accept this invitation to become a member of the United States First Day Cover Society. I will receive a First Day Cover for every U.S. commemorative. I will be invoiced only \$1.95 (for stamps up to 18¢), modestly more for higher values (Shipping and handling included.) If not satisfied with any shipment, I may return it within 10 days for full refund or credit, and resign my membership. I will pay as follows:

- DIRECTLY. Bill me with each shipment.
- BY CREDIT CARD. Bill my credit card account at the time of shipment, and mark my invoice accordingly.
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Signature _____
(All orders subject to acceptance by the Society)

Mr./Mrs./Miss _____
Please print clearly

Address _____

City _____

State _____ Zip _____

Your first shipment will be made within 6-8 weeks of receipt of application. U.S. First Day Cover Society®, Fleetwood® and associated emblems are registered trademarks. The Society is a division of Unicover Corporation.

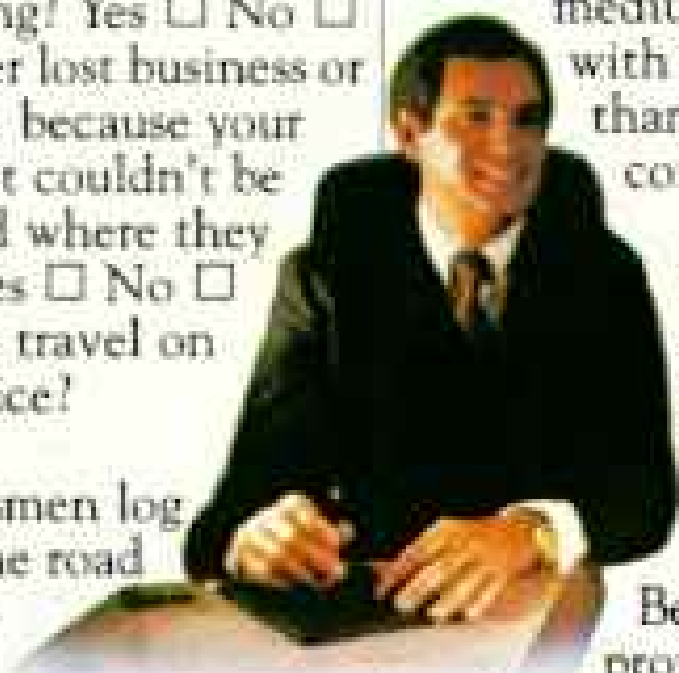
You may be in a position to justify an airplane and not even know it.

To find out, take this simple test.

1. Do you or your people travel several times a month? Yes No
2. Do you travel to, or come home to, destinations not well served by airlines? Yes No
3. Have you ever been out of town two days and a night for a two hour meeting? Yes No
4. Have you ever lost business or money, or both, because your top management couldn't be there, when and where they were needed? Yes No
5. Do you often travel on a moment's notice? Yes No
6. Do your salesmen log more time on the road than in selling? Yes No



The Beechcraft Bonanza A36TC can carry 6 people at speeds up to 246 mph.



can be there, when and where they're needed. And that's even more critical to small and medium sized companies, with fewer resources, than it is to large companies.

Our free Management Guide to Business Aviation shows that virtually any size company can, and has, used a Beechcraft to increase profitability and/or

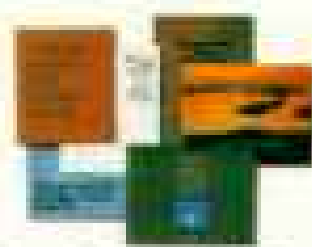
productivity. The size of your company isn't nearly as important as the size of your ambition. The Guide lays it all out in black and white, net dollars and capital recovery. And the more you travel, the more sense it makes.

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dealer makes owning an airplane so simple. He has a unique plan for managing many of the details for you. Maintenance, scheduling, upkeep, helping to find pilots, whatever you need. So all you get are the benefits.

Send for your free 1981 kit.

If you answered yes to any of the quiz questions, write us at Beech



Aircraft Corporation, Dept. AB, Wichita, KS 67201. We'll send you all you need to start thinking.

If you answered yes to all the questions, maybe you should call collect. 316-681-7072. Ask for Dick Schowalter, Jr.

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If you answered yes to any of the above questions, you'll have no trouble justifying a Beechcraft company airplane. To your accountants. Your board of directors. Or your stock holders. Because a Beechcraft means more efficient, more productive travel.

It means one of your most valuable resources, good people,

The Beechcraft Baron E55. A 6-seat twin that combines speed, fuel-efficiency and comfort. Up to 259 mph.





This photograph was taken in Saudi Arabia

Bet you didn't think Saudi Arabia looked like this.

Not all of it does, of course.

Some places in Saudi Arabia look like orange groves in Florida. Others look like mountains in Southern California. And *part* of Saudi Arabia looks like what most people think *all* of it looks like.

To us, Saudi Arabia looks like home. We're Aramco, the Arabian American Oil Company. There are 13,000 North Americans there with us. And sailboats aren't the only things that might surprise you about our lives there.

1. We're doing something important. Aramco produces more oil than any other company. Badly needed oil. Including about 15 percent of the oil the U.S. imports.

2. Aramco is working on some *incredibly* large energy projects. And on huge communications networks, electric utilities, and more.

3. Our people are glad to be in Saudi Arabia with Aramco. They came for excellent pay and professional challenge.

4. After 46 years in Saudi Arabia, Aramco is still growing fast. So is the number of interesting and rewarding jobs we offer.

5. There was a great sailing breeze until just before we took this picture, honest.

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The student attends high school in the local community for a year and learns about the American way of life, about our cultures and traditions.

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We provide the students. You provide the love.





Wildlife as Canon sees it: A photographic heritage for all generations.

When a work of creation is gone, there is no way to bring it back.

We can never bring back the Carolina parakeet or any of those birds and animals that have vanished forever from the face of the earth.

The Japanese crested ibis, an elegant bird that used to be found in Japan, Korea and parts of China, is in danger of going the way the last Carolina parakeet went. It lives under the spectre of total extinction.

Should it vanish forever, it would be very sad indeed. But sadder still would it be, were we to

be left with no records of it at all.

And that's where Canon comes in. With Canon, the Japanese crested ibis and all of wildlife can be recorded for posterity.

It would be a photographic heritage worthy to be handed down from generation to generation.



A-1 with FD 300mm f/2.8L

Japanese Crested Ibis

Genus: Nipponia
Species: nippon
Adult size: Approx. 80cm long
Adult weight: Approx. 1.2kg
Habitat: Japan, Korea and parts of China; now found only on Sado Island in Japan
Surviving number: Estimated 10 (5 in captivity, one in the wild in Japan, and the rest probably in the wild in Korea)

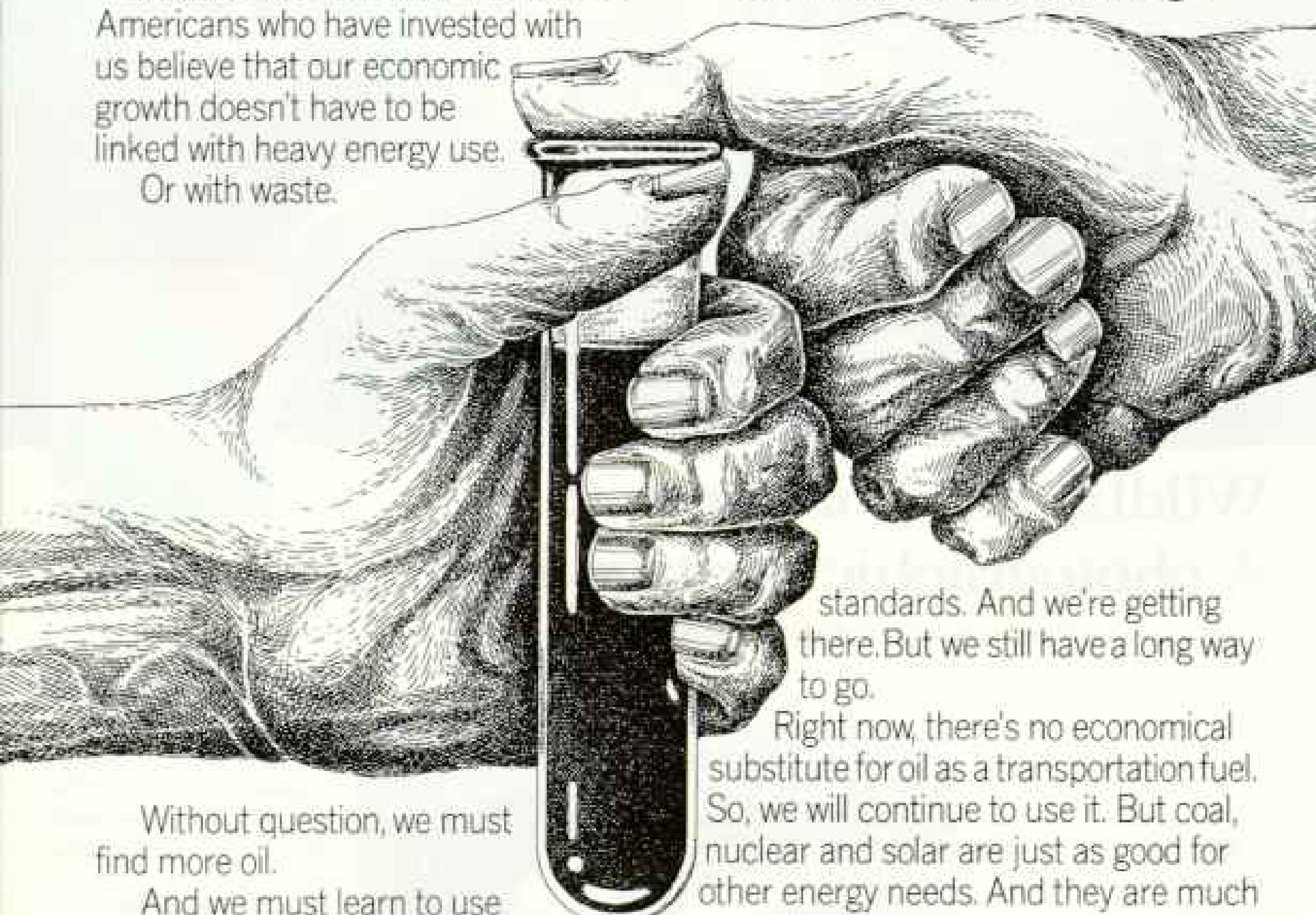
Canon
 Images for all time

**Some say the answer
is oil exploration.
Some say the answer
is conservation.
For once, everybody
is right.**

It is exploration. It is conservation. It is alternate energy sources. And it's more.

Atlantic Richfield and thousands of Americans who have invested with us believe that our economic growth doesn't have to be linked with heavy energy use.

Or with waste.



Without question, we must find more oil.

And we must learn to use the oil we have efficiently. So where do we start?

Scientists say there are billions of barrels of oil still undiscovered in the United States. We have the technology to find it.

Atlantic Richfield takes the prospect of domestic exploration seriously. And we've formed a separate company to

manage our broadened program.

Our new ARCO Exploration Company knows it will cost billions to find oil. But it's an investment our country can make because the money is available.

Even so, the most forceful domestic program won't be enough to meet the coming demand.

Nobody uses as much oil as America. Oil provides half of our energy needs. And half of that goes into transportation.

Smaller cars help. So do mileage

standards. And we're getting there. But we still have a long way to go.

Right now, there's no economical substitute for oil as a transportation fuel. So, we will continue to use it. But coal, nuclear and solar are just as good for other energy needs. And they are much more plentiful.

Energy is the issue of our time. The investment we make now will decide our future.

At least Atlantic Richfield thinks so.

There are no easy answers.

ARCO 
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House Dressing.

What more beautiful way is there to dress up a house than with Andersen® Perma-Shield® angle-bay windows.

Their crisp, classic lines bring an elegant touch to the most traditional lifestyle. And stay fashionably good looking year after year.

For over the windows' solid wood core lies a rigid vinyl sheath. It protects the wood inside from the weather outside. So you needn't worry about it chipping, flaking, peeling or blistering. Or worry about painting it every few years.



Of course, there's more to these angle-bay windows than their dressy good looks and everyday practicality.

Their snug-fitting design and double-pane insulating glass reduce energy costs. And help keep out drafts and keep in comfort.

Now what could be more beautiful than that?

Dress up your house with Perma-Shield angle-bay or bow windows in the size that suits it best. Your Andersen dealer can help. He's in the Yellow Pages under "Windows."

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Please send me more information on Andersen® windows and gliding doors. I plan to build remodel replace.
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Address _____

City _____

State _____ Zip _____

The beautiful way to save fuel®



Andersen Windowalls

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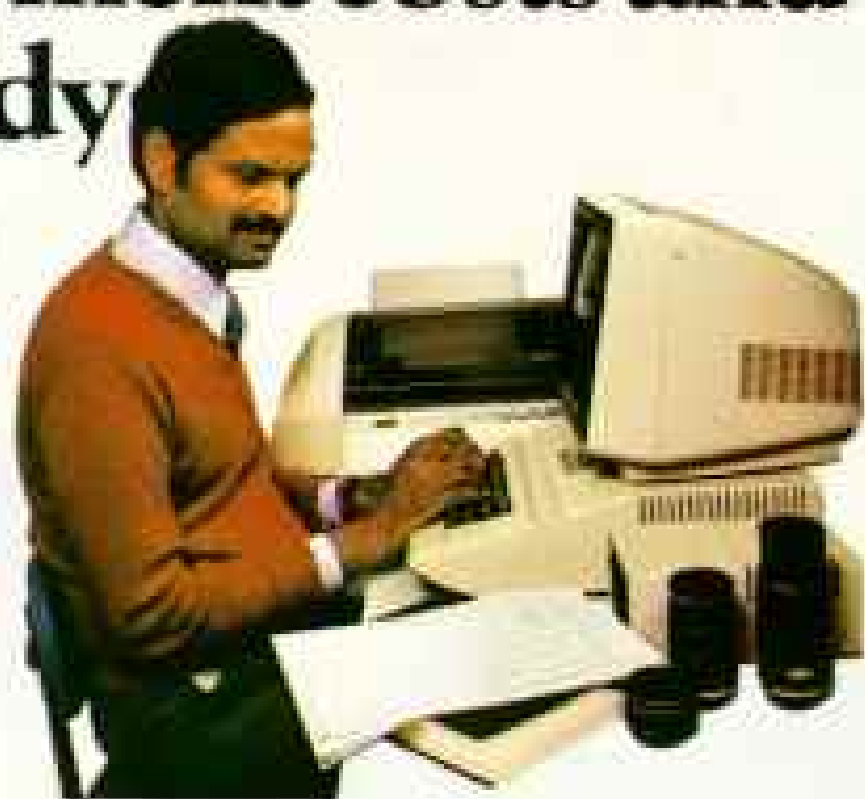
Reddy Chirra improves his vision with an Apple.

Reddy is an independent optical engineer who's helped build zoom lenses for some of the biggest names in photography.

Now, a zoom lens is a complicated bit of work—and prototypes cost a fortune. So big companies have used big



computers to cut development costs and improve quality. But Reddy is on his own. He's not a big company and renting time on a big computer is expensive. So he bought himself a small computer. An Apple Personal Computer.



Can an Apple actually match the capabilities of a \$1,000,000 machine? In two letters, no. But Reddy says it's powerful enough to help him choose from 250 different optical glasses and handle optical formulas with up to 80 variables.

So he's cut the time he has to spend on a big computer way, way down. And his productivity is way, way up.

That's what happened when we invented the personal computer. And that's why it's a good idea to spend some time with your authorized Apple dealer.

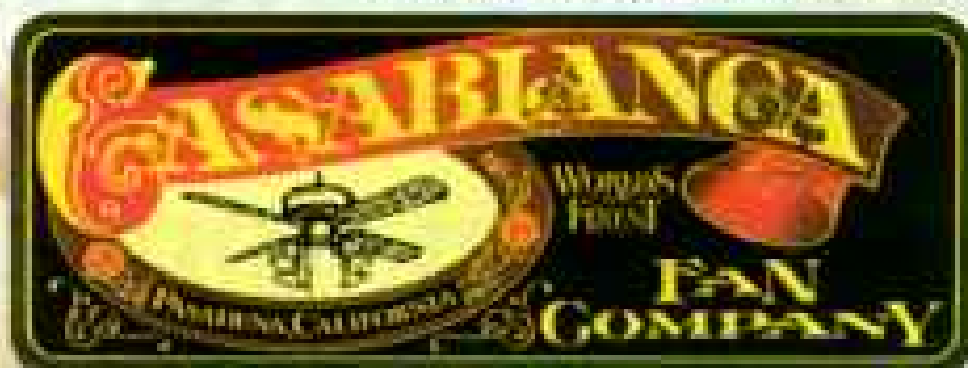
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The personal computer.



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You don't need elaborate equipment to use free solar energy to reduce your home's heating, cooling and lighting costs.

What you need is glass and windows, properly placed and designed.

For instance, a south-facing wall of PPG glass can collect the winter sun's heat and supplement a heating system.

And in the summer, when the sun is high in the sky, a roof overhang can shade south-facing glass and block out unwanted heat.

Of course, glass also provides a year-round source of free natural light, which not only brightens a room, but saves on electric lighting.

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If yours is a new home in a cold area, PPG *Twindow*[®] *Xi*[®] or other insulating glass can help control heating costs very effectively. In fact, heat loss through the glass is cut almost in half compared to single-pane glass. And storm windows can get similar results in existing homes.

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In warmer climates, PPG *Solarcool*[®] Bronze reflective glass or any of our tinted glasses blocks out heat and helps control air conditioning costs, too.

To learn more about using glass to save energy, talk to your architect or builder. And write for our free idea book, "Home Styles for the Eighties."

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INDUSTRIES

WE'RE EXXON

**We're Cindi Tate,
giving a deepwater
oil system a
leg to moor on.**

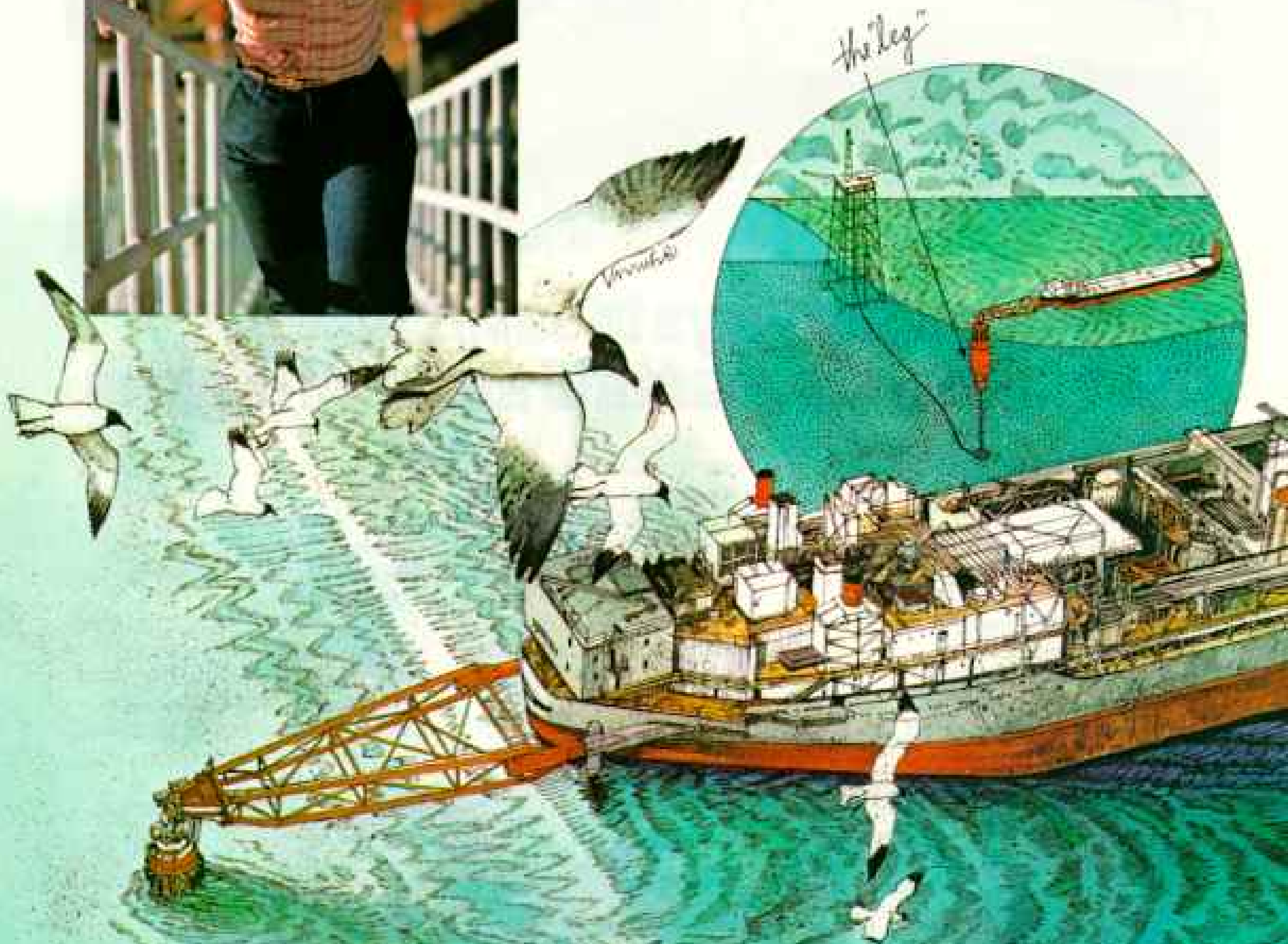


Civil engineer Cindi Tate has helped to boost America's crude oil supply by working on one of the biggest "legs" in the world.

The three-million-pound steel structure, pinned to the ocean floor and rising 500 feet to the surface, is an integral part of Exxon's new oil production system in California's Santa Barbara Channel. It serves as a pipeline to carry crude oil from underwater wells

to a storage vessel, and it holds the vessel in place.

Cindi Tate's engineering work on Exxon's giant sea leg has helped America take an important step forward in the production of offshore oil. Tate is just one of thousands of Exxon people who are extending America's reach for American energy.



We're more than 100,000 people working on energy.



Introducing Nutri-Grain. What the good earth gives, you get.



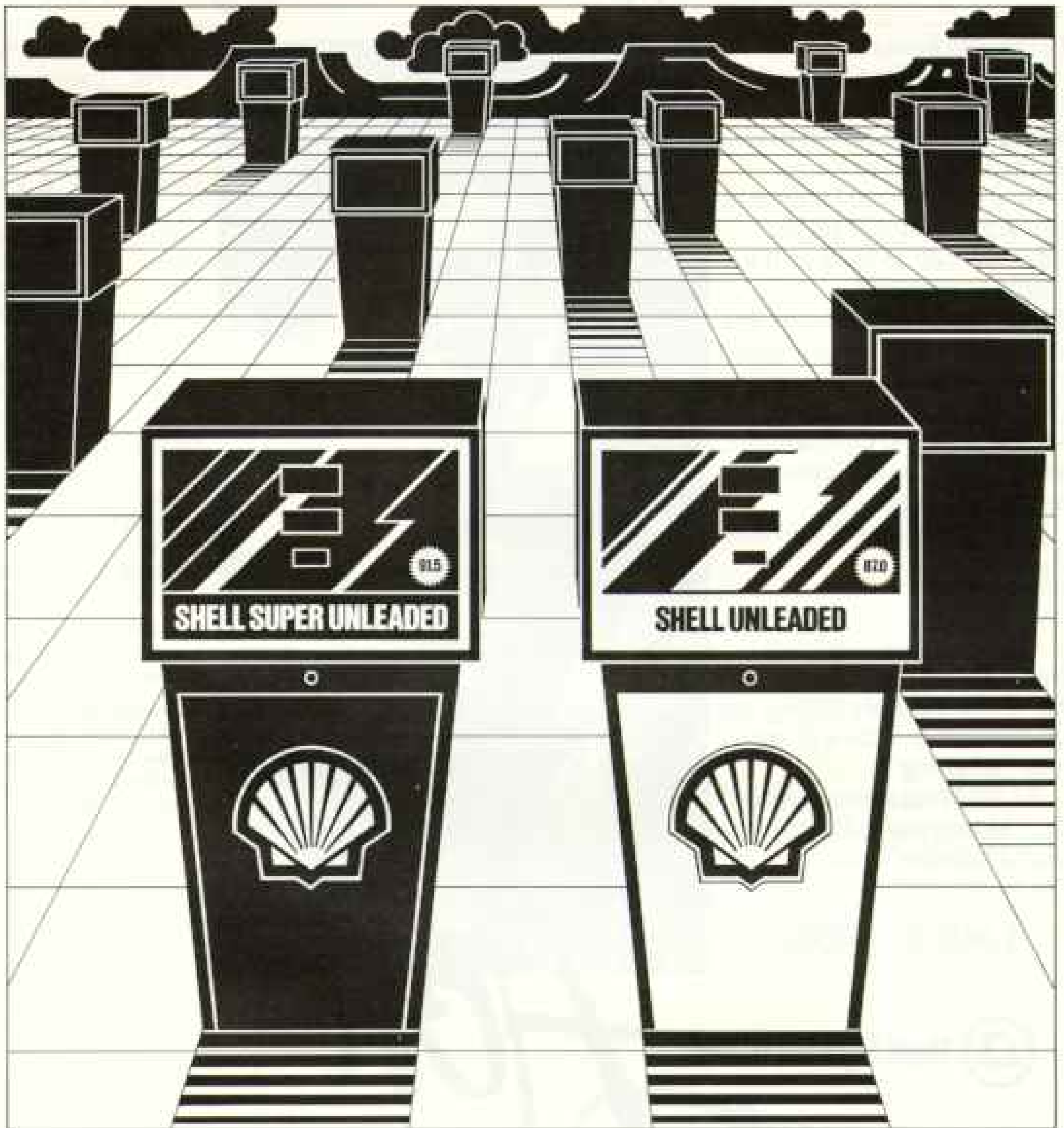
The first line of flaked, whole grain cereal with no sugar added.

Nutri-Grain™ is the first line of cereal flaked from the whole grain — the germ, the bran, everything — with no sugar added because the great whole grain taste needs no added sugar. Taste the whole grain difference in corn or wheat, barley or rye.

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Shell Super Unleaded Gasoline, in the red pump, is for cars that need a premium unleaded gasoline with extra octane. It can help keep those cars from knocking and running on. It helps prevent hesitation and stalling, too, because it's blended for good driveability.

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011 + 49 + 89 + LOCAL NUMBER

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\$4.95! What a nice surprise! Or... as they say in Germany, "Ach Du lieber!"

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Finland	6.15	4.95 B
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Ireland	4.65	3.60 B
Italy	6.15	4.95 B
Luxembourg	6.15	4.95 B
Monaco	6.15	— A
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Norway	6.15	4.95 B
Portugal	6.15	4.95 B
San Marino	6.15	4.95 B
Spain	6.15	4.95 B
Sweden	6.15	4.95 B
Switzerland	6.15	— A
United Kingdom	4.65	3.60 B
Vatican City	6.15	4.95 B

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The charge for each additional minute is 1/3 the initial 3-min. dial rate. Federal excise tax of 2% is added on all calls billed in the United States.

 Bell System

Ach Du lieber!

AALOHA



Hawaii. The weather. The beaches. The ocean. Nowhere else do they all come together in such a magical way. No wonder Hawaii is the number one vacation destination for so many people. It's only fitting, then, that the airline voted number one* can take you there. American. So call your Travel Agent. We're American Airlines. Doing what we do best.



*1979 independent mail survey of 37,495 Airline Passengers Association members with 11,531 responses.

All ceiling fans are not alike. Hunter is the Original. Since 1886. Whisper quiet. Cast iron housing. Real wood blades. Beautiful in its design integrity and simplicity without phony plastic frills. Beauty that's more than skin deep. Because it can cut cooling costs up to 40% by making a 78° room feel like 72°. In winter, it cuts heating costs by pulling warm air off the ceiling. And runs

on the power of a light bulb. A wide choice of models and finishes makes Hunter fit any decor. Send \$1 for 16-page color catalog. Dept. V1, Box 14775, Memphis, Tennessee 38114. Or phone 1-800-238-5358 for the name of your nearest dealer. Then put your Hunter Original Olde Tyme Ceiling Fan in your will. It's that good.

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SUPER SPORTS STAMPS



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Jamestown, NY 14701



for Holidays and
everyday for 40 years
1941-1981

Myth:

All freight carriers compete on an equal basis.

Fact:

Public subsidies for trucks and barges throw competition out of balance.

You, as an individual, pay part of the cost for everything shipped by truck or barge—whether you use it or not.

The public roads and highways—the rights-of-way for heavy trucks—are built and maintained primarily by money collected from drivers of passenger cars and light trucks. If a product travels by barge, it moves through locks and dams and over waterways built and maintained almost entirely with your tax dollars.

Nearly all of America's freight railroads build, maintain and pay taxes on their track and rights-of-way, and these costs are paid from dollars earned by the railroads. As a result, it costs the railroads 34¢ out of every dollar of revenue for track and rights-of-way, compared to the 5¢ paid by trucks and the .003¢ paid by barges, neither of which amounts to a fair share of costs.

All transportation has received government assistance at one time or another. The freight railroads, however, have reimbursed the government for most prior aid. Much of the current aid to some railroads is in the form of loans to be repaid with interest. On the other hand, trucks and barges have long received outright subsidies.

All forms of freight transportation should pay their full costs of doing business. When they do, the American people will receive the most economical transportation services—and a needless burden will be lifted from the motorist and taxpayer.

For more information, write: Competition, Dept. 5, Association of American Railroads, American Railroads Building, Washington, D.C. 20036.

Surprise:

Rights-of-way costs are heavy for America's freight railroads; motorists and taxpayers carry most of the burden for highways and waterways.





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HOW THE NEW *Cimarron*

BEATS THE IMPORTS AT THEIR OWN GAME.

	CIMARRON	AUDI 5000	BMW 300i	VOLVO GLE	SAAB 900i SEDAN
EPA MILEAGE RATINGS WITH STD. TRMS HWY EST. EPA EST. MPG*	42/26	33/19	36/25	25/16	33/21
FRONT-WHEEL DRIVE	STANDARD	STANDARD	NOT AVAILABLE	NOT AVAILABLE	STANDARD
POWER-ASSISTED RACK AND PINION STEERING	STANDARD	STANDARD	RACK AND PINION (ONLY)	STANDARD	STANDARD
FOUR-SPEED MANUAL INCLUDING OVERDRIVE	STANDARD	STANDARD 5-SPEED	STANDARD 5-SPEED	STANDARD	STANDARD 5-SPEED
TACHOMETER	STANDARD	EXTRA COST	STANDARD	STANDARD	STANDARD
EPA PASSENGER COMPARTMENT VOLUME	88 CU. FT.	76 CU. FT.	80 CU. FT.	85 CU. FT.	88 CU. FT.
ALUMINUM ALLOY WHEELS	STANDARD	EXTRA COST	EXTRA COST	STANDARD	STANDARD
AIR CONDITIONING	STANDARD	EXTRA COST	EXTRA COST	STANDARD	OPTIONAL EQUIPMENT
LEATHER WRAPPED STEERING WHEEL	STANDARD	NOT AVAILABLE	EXTRA COST	GRILLE INCLUDED OPTION	NOT AVAILABLE
LEATHER SEATING AREAS	STANDARD	EXTRA COST	NOT AVAILABLE	STANDARD	NOT AVAILABLE
MSRP**	\$12,131 (F.O.B.)	\$11,290 (F.O.B.)	\$11,109 (F.O.B.)	\$14,850 (F.O.B.)	\$12,700 (F.O.B.)

*Use estimated mpg for comparison. Your mileage may differ depending on speed, distance, weather. Actual highway mileage lower. Cadillacs are equipped with GM-built engines produced by various divisions. See your Cadillac dealer for details.

**Manufacturer's Suggested Retail Price including dealer prep, as of 3/31/81. Tax, license, destination charges and optional equipment additional. Destination charges vary by location and may affect this comparison. Level of standard equipment varies.

For years foreign car manufacturers have boasted about their gas mileage, standard features and interiors. But now, there's a car that beats the imports at their own game. Cimarron by Cadillac.

As the chart shows, Cimarron has features the imports have, plus Cadillac comfort and convenience, with reclining body-contoured bucket seats and perforated leather seating areas. Cimarron has front-wheel drive, just as the Cadillac Eldorado and Seville do. It comes with Cadillac's exclusively tuned, road-hugging touring suspension and a four-speed manual transmission including overdrive. What's more, Cimarron behaves like a civilized car should. Nimble . . . easy to maneuver . . . with a smooth, refined ride.

If you've been thinking about buying an import, it's time to re-think your decision. It's time for Cimarron.

Due to limited initial production, Cimarron is not available at all Cadillac dealers at this time.

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What makes OM-2 the ideal by which all compacts are measured? For one thing, the way it measures light. Its revolutionary OTF™ meter system reads precisely *where* no ordinary meter can—off the film itself. *When* no ordinary meter can—during the actual exposure.

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any f-stop—but at every f-stop. While a brilliant LED in the OM-2 finder shows when you can fire, then confirms exposure accuracy—another Olympus 'first.'

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For information, write:
Olympus, Woodbury, N.Y. 11797.
In Canada: W. Carsen Co. Ltd., Toronto.



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Kauai.

The Garden Isle. A dazzle of bougainvillea, poinsettia, jacaranda and plumeria.

Captain Cook made his first Hawaiian landing at Waimea. Today it's a colorful plantation town. Nearby is majestic Waimea Canyon.

Molokai.

An island of tranquility, from the emerald green cliffs guarding the northern shore to the camping



paradise of Waialeale Valley. There are more native

Hawaiians per capita on Molokai than anywhere else on earth. Maybe that's why it's called The Friendly Island.

Maui.

The tropical splendor of Hana, royal resort of Hawaiian kings. Sunrise over awesome Haleakala crater. Lahaina, once the whaling

capital of the world, now restored to the look of its 19th century heyday. The famed beaches of Wailea and Kaanapali. They're just a few of the marvels of Maui.

Hawaii.

The great volcanic peaks, Mauna Loa and Mauna Kea, tower



above this island of orchids (over 22,000 varieties!) and black sand beaches. Offshore is deep-sea fishing famous the world over.

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