MAP SUPPLEMENT: "CLOSE-UP: CANADA"—QUEBEC/NEWFOUNDLAND

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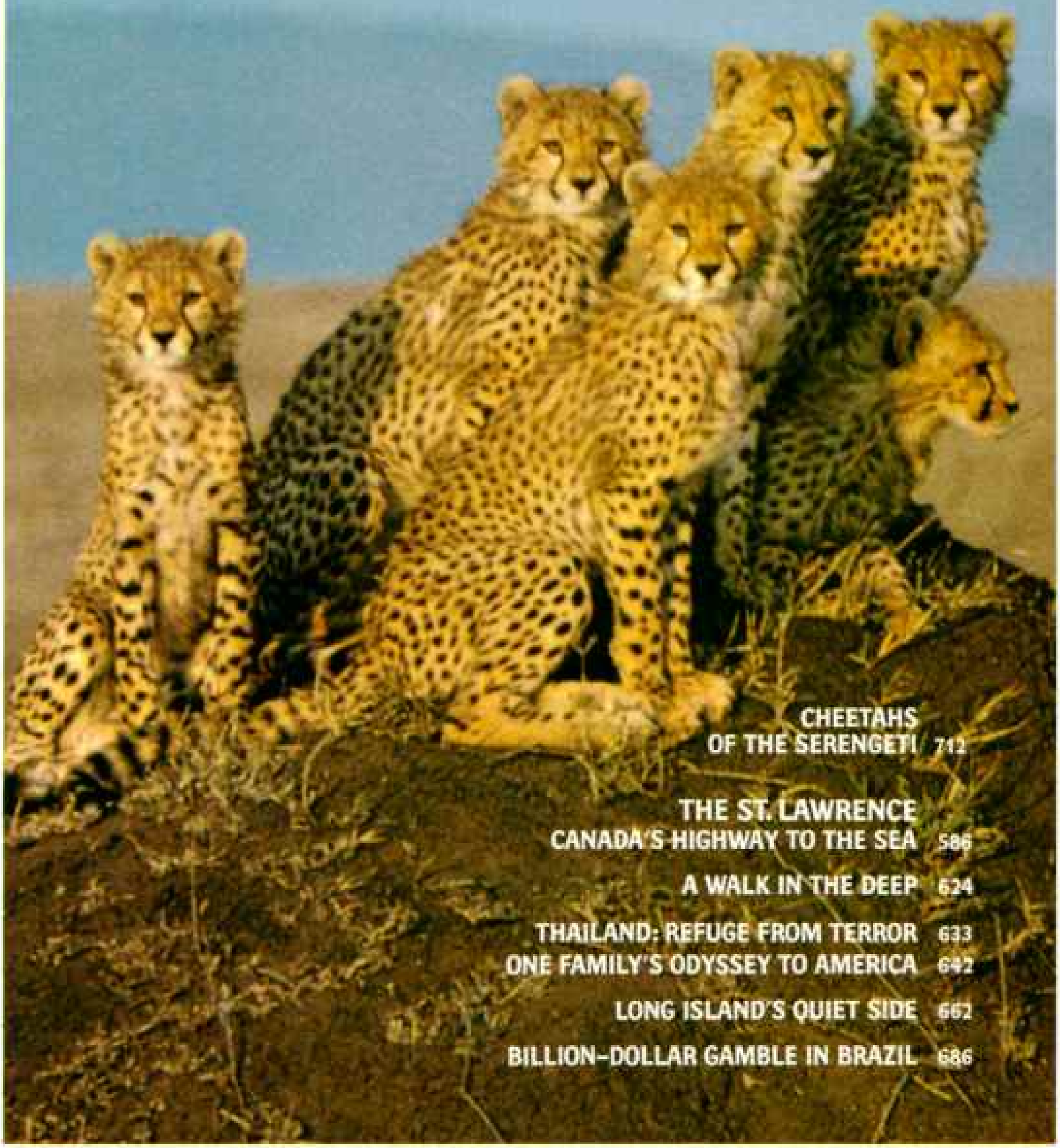
NATIONAL GEOGRAPHIC



OFFICIAL JOURNAL OF THE NATIONAL GEOGRAPHIC SOCIETY WASHINGTON, D.C.

ROBERT FROST's famous line "Good fences make good neighbors" is often quoted out of the context of his poem. Frost goes on to say that in some cases fences impair genuine neighborliness. The Berlin Wall is probably the most brazen and depressing example of such a fence.

The three largest nations that occupy the North American continent have not always had a peaceful coexistence. U. S. troops invaded Canada (when it was British) in 1813, and Mexico in 1846. But as borders go in the world, ours have been unusually stable and peaceful. And, some think, the relationships those borders symbolize have been usually neglected.

With much of the globe in various stages of chaos, the opportunities for a North American alliance seem more attractive than ever. In the U. S. Southwest, Mexican Americans grow in numbers and influence, finding north of the border the economic opportunity so often lacking south of it. This is a matter we will explore in the next issue. In Mexico itself the very large oil reserves are treated as the national treasure they are, a potential answer to the demographic challenge that may soon make Mexico City the world's most populous.

Canada has vast energy reserves in hydropower, tar sands, shale, and petroleum, and a northern wilderness that is one of the great natural parks remaining on the planet.

How could it not be to all these nations' interests to pursue closer economic and social cooperation? Yet, despite the tradition of our open border with Canada, economic dependence on the United States is an irritant in the north, and the Quebec question poses problems of statesmanship for the whole continent. For its part, Mexico deeply resents the border fence built last year and what it regards as the Yanquis' attitude of cultural superiority.

There is more to be gained than lost in any attempt at continental cooperation. Mexico need never suffer the anxiety of an Afghanistan, and the United States realizes the futility of any attempt to dictate Canada's national policies. But a coalition of interests for energy and social development, for economic unity and political integrity, seems long overdue and a goal well worth pursuing.

Gilbert M. Grosvenor

NATIONAL GEOGRAPHIC

THE NATIONAL GEOGRAPHIC MAGAZINE VOL. 157, NO. 5

May 1980

COVER: *Cheetah cubs find better survival chances in Tanzania's Serengeti National Park. Photograph by George and Lory Frame.*

The St. Lawrence River

First came Indian canoes, gliding with silent paddles on the broad stream. Then French bateaux arrived, and men who christened the river the St.-Laurent. Later British warships set their own imperial stamp on the waters. And today the commerce of two nations rides out to the sea from a continent's heart. But always, when the season darkens and nights fall sooner, there is the ice.

Photographs by BRUCE DALE
NATIONAL GEOGRAPHIC PHOTOGRAPHER

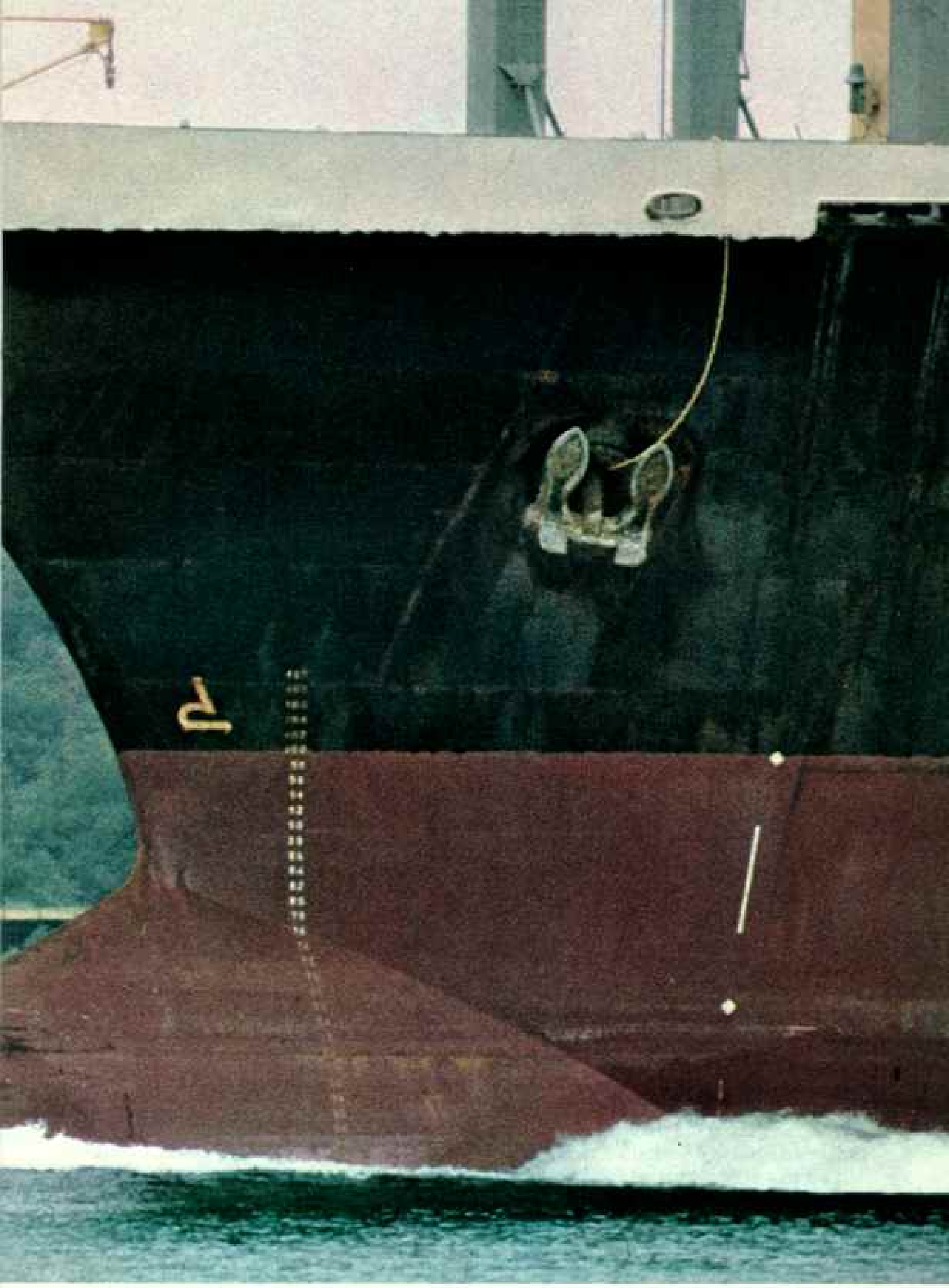
Sentinel spire of a Roman Catholic church stands watch over Pointe-Jaune

and a frozen eternity where the river melds with the Gulf of St. Lawrence.

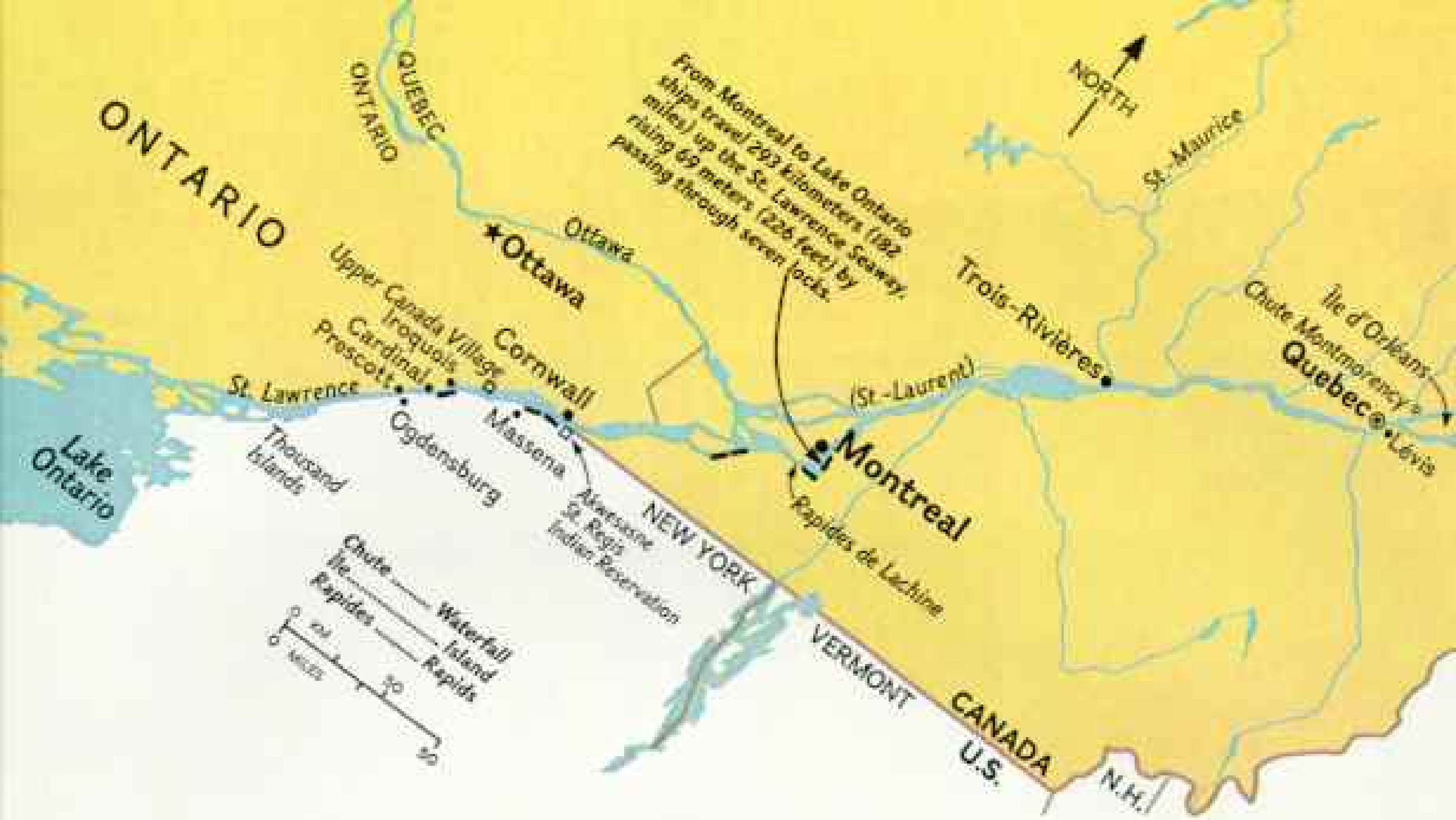
With logging hooks at port arms, woodcutters pause from work in the

forests that mean a livelihood for many who call themselves Québécois.

Oceangoing behemoth steams past a vacation cottage on



Just Room Enough, a postage-stamp scrap of land among the Thousand Islands.



Canada's Highway

THE TIDE RECEDES, and in multitudes that defy counting, white birds stab their beaks into mud that glistens brown and sleek, like a peeled, bruised peach. Virtually all the greater snow geese in the world are here, for fifty miles or more along the St. Lawrence River, gabbling in resonant discord as they feed upon aquatic plants. It is fall, and they are down from the north, but soon they will leave even this place to the snow that makes battlemented castles of the barns and to the ice that locks the deep, broad river in its grip.

Like a portent of that unfailing snow, the geese blanket the foreshore flats around Cap-Tourmente, just northeast of Quebec City, starting in early October. When the last one has journeyed from the eastern Arctic, they number two hundred thousand.

This has been a hurried fall, with colors flashing through the foliage and chilling winds raking the river before Halloween. Now, in late November, I watch the geese trail off to the south in the slated sky.

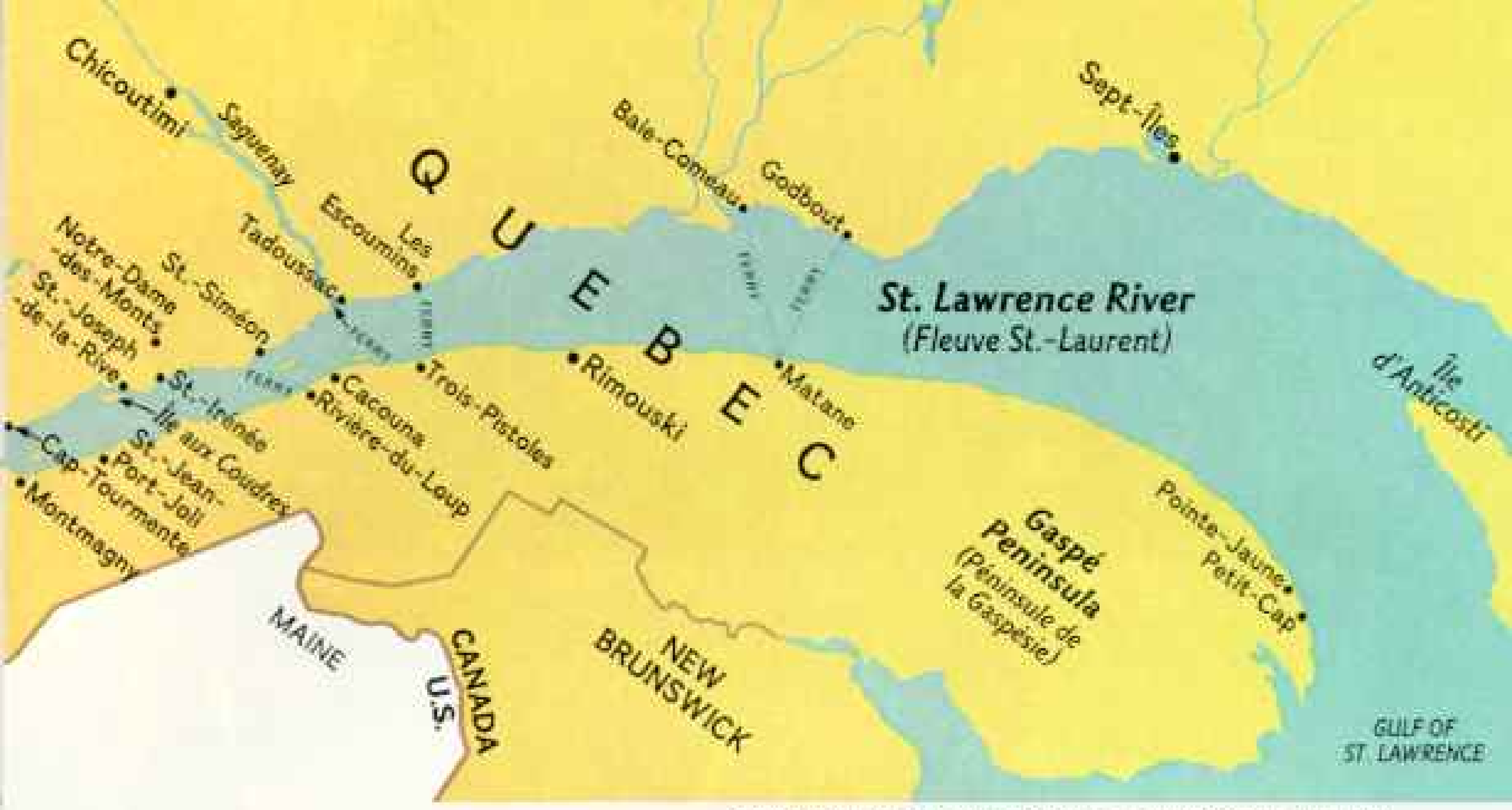
And I think:

This could be the year when the cycle of seasons finally fails, allowing the freeze to carry into August and beyond. But of course that will not happen. Just as certainly as cod spawn on the Grand Banks, there will come a day when the run of first melt splashes on the pale face of the land. Then too, the river ice will start to break up into brash remnants of the thick cover.

And the St. Lawrence will again course with the boldness and breadth that make it sceptered among rivers of North America.

When the geese have gone, the 750-mile-long waterway is crusted and captive, except along its downstream reach, where salt has intruded from the sea. These are days when darkness falls at four in the afternoon, and that is good in a way, for night softens the bleakness of it all—especially when the moon and stars set down enough cottony light to triumph over the threat of a blizzard-whipped tomorrow.

It comes out of Lake Ontario, this river with the arrogance of the sea, and ends in the Gulf of St. Lawrence. Along the way the river overlays about a hundred miles of the boundary between the United States and



DRAWN BY JAKE WOLFE, COMPILED BY DAVID B. WILLER NATIONAL GEOGRAPHIC ART DIVISION

to the Sea

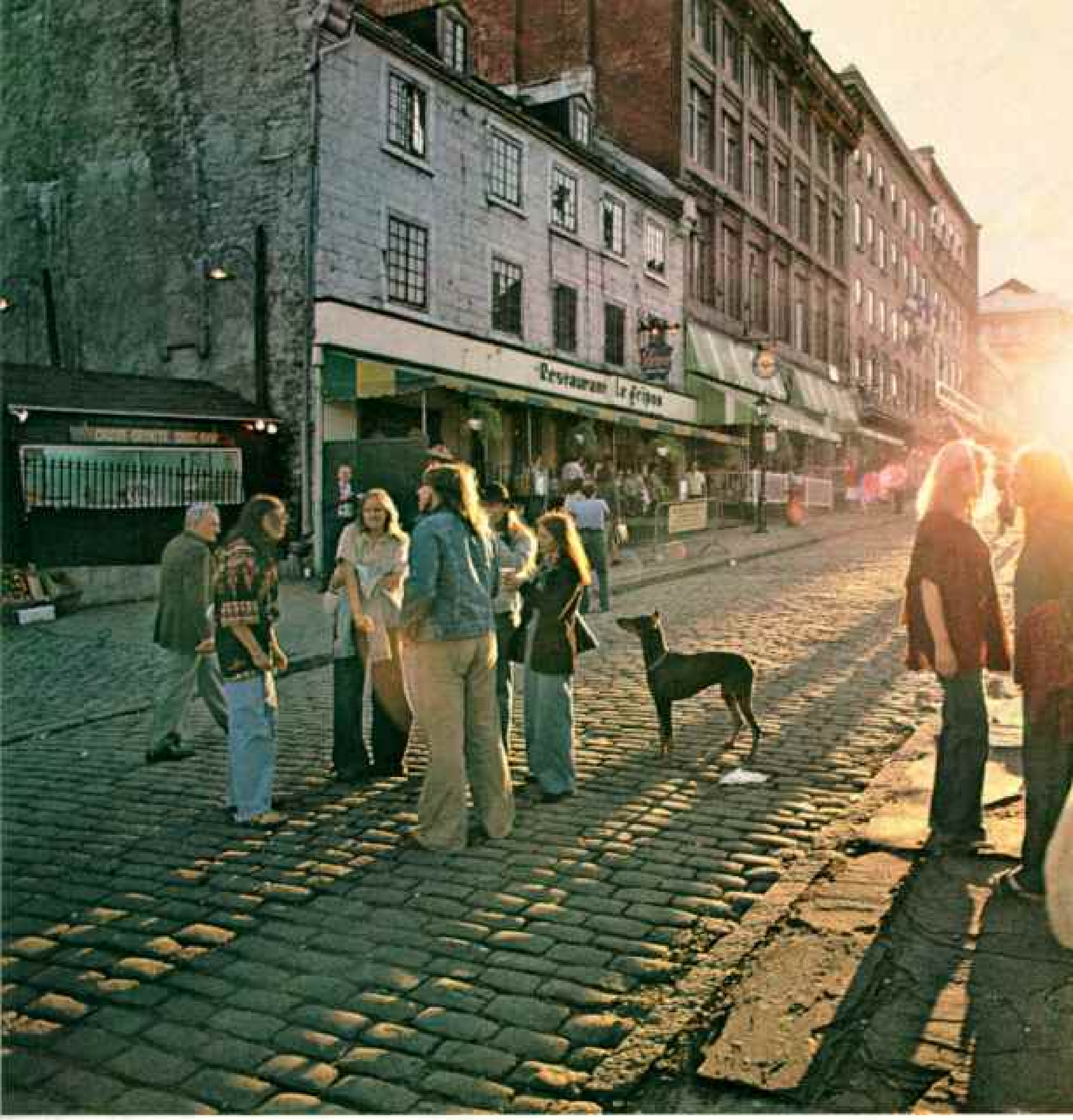
By WILLIAM S. ELLIS
NATIONAL GEOGRAPHIC SENIOR WRITER

Canada. There, it is the river of the Thousand Islands and the U. S. locks of the St. Lawrence Seaway. Pressing in on those shores are the English-speaking province of Ontario and the state of New York. Towns have such names as Cornwall and Prescott and Ogdensburg, and houses in lawny settings are invested with a flavor that hints of crocheted homilies on parlor walls.

Given this encounter with New York, the St. Lawrence, nonetheless, is a Canadian river—and above all, a *French*-Canadian river. Discoverers of the land followed the waters into the wilderness, and builders of the nation coupled their towns and cities to the shores, drawing life from the stream.

Most of the St. Lawrence falls in the embrace of Quebec, the French-speaking province where the thrust for separatism has left Canada divided along the lines of culture, language, and history. The river carries past the great island city of Montreal, then Quebec City, followed by a push over the hump of the Gaspé Peninsula before dumping into the gulf. (See **Close-Up: Canada—Quebec, Newfoundland**, a supplement to this issue.)

Half of water, *half of land, the Thousand Islands' mazy ways* ***(below)*** *mark the beginning of the river's 750-mile-long journey to the sea. Locks and channels of the St. Lawrence Seaway* ***(map)*** *operate in ice-free months. Below Montreal, icebreakers make navigation possible year round. Planners hope to extend seaway operations into winter—a move some experts believe could damage the upper river.*



In its middle reaches, in the town of Montmagny, I sought out Marcelle Bolduc, an artist who often paints snow geese. Her works are sometimes dark and somber, scenes with awful winds and skies ominous with approaching storms. But the hope and the miracle of bird migration are there in equal strength, and in the end, the paintings become celebrations of sweet brooding.

"The wind, the river, the geese—they are all my friends," she said in accented English. Born in Quebec, Mme Bolduc worked as a nurse in San Francisco before settling in Montmagny. Like nearly everyone in town, she is a French Canadian, and the river she loves is the St.-Laurent. Unlike other French Canadians today, she is tolerant of English spoken in her presence. That may be because her work—twenty paintings a year in the past two years—leaves little time to share the anger of so many Québécois.*

French is the first language of some six million Canadians. Most live close to the

*In the April 1977 GEOGRAPHIC, Peter T. White reported on the political turmoil that gave new impetus to the drive toward an independent Quebec.

Gallic ambience *warms the heart of Montreal's old town, a protected historic district of renovated fur traders' homes and riverfront warehouses that draw artisans and young people to a lively coffeehouse scene.*

river, in Montreal and Quebec City, and in the small shoreside towns where, in winter, the shuttered Dairy Queen stands as forlorn as anything on the face of the earth.

Reveling Amid Old World Charm

February, and it is foggy and bitterly cold. The annual Winter Carnival in Quebec City has just ended. As usual, hundreds of thousands watched parades, marveled at the artistic snow sculpture, drank something called Caribou out of hollow plastic canes, danced in the streets, and generally carried on in a manner designed to lift the spirit from the doldrums of winter in that venerable place (pages 608-609).

With all its fortress trappings—the loftiness of its perch, the ancient walls—Quebec holds the franchise for Old World charm in North America. Yet it is a stern city set against a backdrop of gray rock scarred by the wind, a city of narrow streets on which little sunlight falls, a churchy city raised on the solemnity of the Holy Mass.

There are few more inspiring views of the St. Lawrence than that from the heights of Quebec City. Some 300 feet below the Place d'Armes it flows past, seemingly in reverence. Indeed, the settlement founded here in 1608 by Samuel de Champlain remains the spiritual heart of a French-Canadian way of life molded in large measure by the presence of this great river.

"If you are from the States, I will speak English to you. If you are from Toronto, we will speak French or speak not at all."

He was a filmmaker, a slim, intense man filled with separatist zeal. Born in a village on the Gaspé, he could trace his family in North America back more than 250 years. He cast himself as a victim of injustice and discrimination, a French Canadian made to feel inferior for speaking the founding language of his country. His voice rose to a near shout, and as the fires of anger and nationalism roared up inside him, I sensed that no matter what happens in La Belle Province, Canada will never again be the same.

The wonder is that it took so long to come to this.

For many years French Canadians sustained their isolation by drawing strength from the bonds of religion and family. The church offered protection. It is still there, in every village, dominating all else with its size. But the role of the church has changed. French Canadians have left it in great numbers. The size of the family has diminished, so much so that the birthrate, fifty years ago

JODI COBB

Leading light *of Quebec cities, Montreal* ***(above)*** *ranks first in size, economic clout, and anxiety about the future. Separatist Parti Québécois leaders* ***(left)*** *rally support for independence for mostly French-speaking Quebec. Separatist emotions run high on June 24, Quebec's national day honoring patron St. Jean-Baptiste, and spill into the city's streets with impassioned waving of the provincial flag* ***(right)****.*

the highest in all Canada, is now one of the lowest. Something else had to replace the church and family as guardians of their culture. Today it is a fervent nationalistic spirit embodied in the slogan, "Masters in our own house."

Not long ago a French Canadian ordering something in the native language of Quebec Province might be told by an English-speaking clerk to "speak white." The reaction was not unpredictable, and some reacted extremely. In the 1960s and early '70s there was kidnapping and killing, and terrorism by bomb. But it was through orchestration of long-smoldering resentments that the Québécois became masters in their own house.

"I have never considered myself a Canadian in the broad sense," the filmmaker told me. "You have come to know Montreal and Quebec City, and I assume you also know English Canada. Have you eaten the superb food here and drunk the decent wines? Yes. And have you dined in a café in Regina, where a waitress wearing a starched handkerchief bouquet directs you to the salad bar with its bowl of wilted lettuce and brings you an overdone hamburger steak? A small matter, it is true, but I tell you that the gulf is too great, the cultural clashes too severe to hold Quebec together with the rest of Canada."

Indeed, a blunt-spoken former television personality named René Lévesque assumed office as premier of the province in 1976, vowing that Quebec must go its own way. Last June, with more than 1,800 delegates in attendance at a Parti Québécois convention, Lévesque laid out the details of a plan to seek sovereignty while maintaining economic association with the rest of Canada. The delegates overwhelmingly approved a provincial referendum, scheduled for this spring, on whether to pursue such a course.

Under the plan, an independent Quebec would continue to use the currency of Canada but would have its own central bank. There would be free movement of people and goods across the boundaries, but the Québécois would set their own policies in taxation, foreign affairs, and legislation.

René Lévesque is a short, balding man who is seldom without a cigarette in his hand. Having brought the drive for sovereignty this far, he stood before the delegates and said: "Two democratic societies that have so much in common will prove able to take up this challenge, and they will come out of this together; side by side, with an understanding, a frankness, and a renewed mutual respect, that is to say all the ingredients upon which can be established a true and lasting friendship."

Fine words, but, as Canadians are wont to say, fine words butter no turnips. Suppose English-speaking Canada rejects the

A high-speed portage climaxes

Trois-Rivière's annual canoe race, first staged in 1934, the town's tercentenary year.

"sovereignty association" scheme—what then? "We will have to go back to the people," Lévesque said, meaning they will likely be asked to reaffirm support for the government in a general election by year's end.

Seaway Operation in Question

As for the great river that is the aorta of Canadian commerce, the plan proposes that Canada, Quebec, and the U. S. will have to negotiate new agreements on operation of the St. Lawrence Seaway system. The seaway is now jointly administered by Canada and the United States. Of its 15 locks, 13 are maintained by Canada, four of them in Quebec.

Grain from the Prairie Provinces and the U. S. Midwest and ore from northern Quebec's rich lodes are moved on vessels that are raised or lowered hundreds of feet through the locks. More than 60 million tons of cargo were transported last year on the seaway.

Perched on a rocky throne, Quebec City commands the river from the strategic

heights where Samuel de Champlain founded the first permanent settlement in 1608.

Twenty years have now passed since President Dwight D. Eisenhower and Queen Elizabeth II of England officially dedicated the St. Lawrence Seaway, giving North America its fourth seacoast. It finally solved a problem encountered 445 years ago by French explorer Jacques Cartier.

As he followed the river, thinking it would take him to the Orient, Cartier was turned back by a piece of nasty water just west of where Montreal now sits. It is still there, and it is called the Lachine Rapids.

Through the years, canals were constructed to bypass the rapids. By the middle of the 19th century it was possible for a sailing vessel with a draft of no more than eight feet to navigate between Lake Erie and the Atlantic. By 1959 the present seaway system allowed passage of vessels up to 730 feet long, 76 feet wide, and drawing 26 feet.

Such are the approximate dimensions of present-day lakers—vessels specifically designed for navigation on the Great Lakes and the seaway. Putting a laker through the system allows scant margin for error, since the locks are but 36 feet longer than the ship, four feet wider, and four feet deeper.

Short of enlarging the locks, little can be done to relieve the shipping squeeze. However, there is one way to increase the tonnage and that, of course, is to extend the navigation season. Currently the seaway is closed from around mid-December to early April, and vessels can move upriver only as far as Montreal.

"The ultimate goal for the St. Lawrence River and the seaway would be a navigation season of 11 months, with the remaining month set aside for maintenance work," said Dennis Deuschl, a spokesman for the Saint Lawrence Seaway Development Corporation (the U. S. branch of the operation, which is under the Department of Transportation). "On the upper Great Lakes the goal is a 12-month season."

JODI COBB (FACING PAGE)

Edible advertising *invites passersby into Quebec's Restaurant au Parmesan* ***(facing page)****, reflecting the culinary accomplishments of the city. Even bundled against cold, its face is unmistakably that of New France* ***(above)****.*

Opponents Cite Environmental Risks

There is, however, a steady drumbeat of opposition to prolonging the seaway season. Each winter a number of ice booms are anchored in the river between Ogdensburg, New York, and Cardinal, an Ontario town ten miles away. These thirty-foot-long Douglas fir timbers serve to keep the ice cover stable, ensuring a steady flow of water to nearby hydroelectric plants. The utilities oppose winter navigation because they fear it would disrupt the flow.

A stronger objection has come from environmentalists, who claim that ship traffic in winter would have damaging effects on the ecology, fishery resources, and wildlife habitats along the St. Lawrence. One member of a group called Save the River Committee went so far as to claim: "Unless the courts or Congress kill the project, the fate of the mighty St. Lawrence will be sealed for all future generations."

Experiments have shown that the ice usually knits smoothly back together after the booms have been opened for the passage of a vessel. Along other parts of the seaway, where the ice is allowed to take its own shape, the winter scene is one of upheaval, of hummocks in battle like stags in rutting season. Along those stretches, icebreakers would be needed, as they often are now between Montreal and the gulf.

Aging Ship Still Cuts the Ice

Jacques Salem Vézina surveyed the ice—like shards of frosted glass—through a haze of blue smoke curling from his pipe. The vessel he commanded, the Canadian Coast Guard icebreaker *Simon Fraser*, sliced through the cover. We were twenty minutes out of Quebec City, moving upstream.

"We can handle ice as thick as about 14 inches," Captain Vézina said. Our mission that day was simply to push the ice around, to keep it loose. We would also service some of the 2,300 buoys used on the river between the gulf and Montreal.

In addition to the buoys, the Canadian Coast Guard operates more than two dozen lighthouses along the river. Still, disasters do occur on the St. Lawrence. "There was a bad one about 15 years ago," Captain Vézina recalled. "Two ships collided and 33 crewmen were killed."

And there was the *Empress of Ireland*. She was a liner of elegance, some 14,000 tons, the very best in the fleet of the Canadian Pacific line. On May 28, 1914, the *Empress* departed Quebec City bound for Liverpool with 1,500 persons aboard. Early the following morning she was steaming toward the sea through patches of fog, when another vessel suddenly loomed to starboard. The Norwegian collier *Storstad*, laden with 11,000 tons of coal, nearly sliced the *Empress* in half. More than a thousand people died as she sank in 125 feet of water not far from the city of Rimouski on the south shore of the St. Lawrence.

Portents of change, *skyscrapers hover over Quebec City's outskirts where suburbia shoulders into farmlands. Capital of Canada's largest province, the city grows and glows with economic health and burgeoning government.*

Thumbing their noses *at February's gloom, revelers fill the streets during Quebec City's Winter Carnival (**right**). Snowman Bonhomme Carnaval presides over costume balls, parades, winter sports, and the crowning of the carnival queen (**left**). Both residents and international teams create snow sculptures, such as this rendition of "Jaws" (**above**). "The fisherman is large because he does not fear the shark," says sculptor Lionel Faucher, known affectionately as Ti-Père, Little Father, here hosing down his creation.*

As the ice became thicker, the *Simon Fraser* began to buck a bit, riding up and then coming down with authority enough to break through. It is a proud vessel, one of great integrity, but old—a straggler in the field of ice-breaking technology. Last year, for example, a revolutionary new icebreaker tug plowed through thick ice on Lake Superior as air bubbles forced from holes in the vessel's hull acted like lubrication to speed passage. This new concept enables the craft to break ice as much as three feet thick.

Captain Vézina smiled when I asked about the computer-run ships. Behind him, his helmsman stood on a platform so that he could see over the large oaken wheel. Reflections danced in the wheelhouse as sunlight took inventory of the brass and copper pieces. He smiled again and offered no response to my question. None was needed.

There is tidal activity in the St. Lawrence several hundred miles upstream. Even at ebb tide, the shallowest part of the river between Quebec City and the gulf is more than forty feet deep—enough to cover countless shipwrecks through the centuries.

"I would estimate that there are 10,000 wrecks in the St. Lawrence," Marc Théorêt told me. Théorêt is a graduate student at the University of Montreal. His field is maritime history. In 1976 he and three other persons formed the Committee of Underwater Archaeology and History. So far, from archival research, they have turned up some 500 probable sinkings in the St. Lawrence, ranging from flat-bottomed bateaux to stately clippers. At least four vessels went down with cargoes of gold and silver worth between $600,000 and $1,000,000 each.

Théorêt told me of H.M.S. *Lowestoffe*, the first vessel to sail upriver following the fall of Quebec to the British in 1759. Many were waiting for the first vessel to appear, thereby revealing who would win the war. The appearance of the *Lowestoffe* signaled the end of New France. Ten days later the ship struck rocks and sank off the river's northern shore.

Even more intriguing to me was a Basque galleon. This vessel, according to Théorêt, was carrying whale oil. She was caught in a storm and sank in the gulf, close to the mouth of the St. Lawrence. What is most significant about the Basque ship is the date of its sinking—1565. Probably the Basques had come from Spain and France for whales and cod even before Cartier first sailed into the Gulf of St. Lawrence in 1534. Whether they came before Columbus is still a matter of speculation, as is much of the early history of the river. It has been written that French explorers encountered natives in Canada who spoke certain Basque words, including this response to the greeting, "How are you?": "*Apaizak obeto*—The priests are better off."

Toll Eases Government Cutbacks

Certainly the natives I encountered at one place along the river spoke no Basque. "You are on Indian land," I was told in the purest of English, "and we ask you to respect our tollgate."

They were the Mohawk and representatives of other tribes from throughout Canada. They had established their tollgate on the Seaway International Bridge between Cornwall, Ontario, and the United States. It was done to protest the Canadian Government's decision to cut back health services for Indians. Those crossing the bridge were asked to contribute a dollar.

The Akwesasne St. Regis Indian Reservation of the Mohawk nation spreads over some fifty islands in the St. Lawrence in addition to a part of the south shore. This unique geographic position causes many problems, Michael Mitchell said. "If I marry a Mohawk girl who lives across the river in the United States, the government is going to tell me that I married a non-Indian girl. A man from the other side who marries an Indian girl here is going to be told the same thing by the United States Government. All of that can affect our eligibility for benefits. When you fall in love, you don't check a list

Free-falling stream *never freezes where the Montmorency River takes a 274-foot plunge on its way to join the St. Lawrence. Frozen spray builds a smooth mound known as the Sugarloaf, drawing sledders and sliders from nearby Quebec City. More serious ice climbers tackle the escarpment beside the fall itself.*

to see if you can marry someone who lives on the same island so that we're both Ontarians, or Quebecers, or New Yorkers, or Americans, or Canadians."

Mitchell, in his early 30s, is director of the North American Indian Travelling College. The purpose of the college is to revitalize and promote North American Indian culture.

"We hear about Champlain founding Quebec City, and Jacques Cartier discovering this and that," Mitchell said. "But from our point of view, our people were sitting right here watching their ships go by.

"What I'm trying to teach is an Indian's need for a balanced lesson in life. The elders teach us that the blade of grass is alive, that the tree is alive, that they have spirits. The schools teach us something else. That's the type of balanced lesson every native child needs. Without it they move off the reservation and into the ghettos of the cities. They have an identity loss, a cultural suicide. But now they're slowly finding their way back."

Men on this reservation have gone off in times past to take high-paying jobs as steel- and ironworkers on the dizzy heights of

The river first tastes the sea below Île d'Orléans, foreground, where life remains

skyscrapers and bridges. Others worked in a factory on the reservation, making the finest lacrosse sticks in the world. The construction work is off, the factory is closed, and now there is high unemployment.

So they fish, and the elders among them refuse to heed the warnings about the dangers of eating the catches from the St. Lawrence. The children continue to splash in its polluted waters. "My own kids came home last summer with rashes and blotches after swimming in the river," Mitchell said. "The spirit of the St. Lawrence is sick."

A medical consultant to the Indians says he will not touch the fish. "And if we talk of spirits, I say you can cure the St. Lawrence when you cure the spirits of those who run the companies that are killing the river."

West of Cornwall and the Mohawk reservation, the St. Lawrence makes its link with the Great Lakes through country with a tumultuous history. Here, in the mid-18th century, raged the French and Indian War. And then the American Revolution, followed by the War of 1812. All of that musket smoke and the river tinged with blood, and

close to the land while shipping to and from upstream industrial ports bustles past. 613

JODI COBB

yet there was something right in the middle of it so beautiful that the Indians called it the Garden of the Great Spirit—the Thousand Islands.

They number closer to 2,000. Some are granite outcroppings no larger than a Volkswagen. Others cover hundreds of acres. On one island, called Heart, stands an unfinished castle. It was to have been a gift from George Boldt, manager of the Waldorf Astoria Hotel in New York City, to his wife. When she died, he abandoned construction.

Captains of industry and finance maintained elaborate summer places on the islands, but the legacy of the Thousand Islands has been not so much the grandeur of their past as their name on a salad dressing.

Icy Tide Delays Ferry

Whether jammed with islands or not, the St. Lawrence maintains its sense of bigness. Nothing, it seems, can dominate this stream—not the oceangoing ships that breast its currents, not the cities on its shores, not even the loose stitching of bridges that span it.

"What time is the next ferry?"

"I don't know. The last one was carried away by the ice five hours ago—it's still stuck out there."

Many miles and days downstream from the Thousand Islands, I had come to the point on the north shore where the St. Lawrence takes the flow of the Saguenay River. There the road ends, for there is no way to get across the intersection of the rivers except by ferry. For many years there has been talk of building a bridge, but it would be a difficult and expensive undertaking; the depth of the water is in the hundreds of feet, and tides run as high as a two-story house.

Monstrous slabs of greenish white ice were moving swiftly up the Saguenay. It was in this tidal push from the St. Lawrence that the ferry was caught. More than six hours passed before it reached the dock on the other side.

The drive up the Saguenay to the bridge at Chicoutimi, and then back down to Tadoussac on the other side of the river is not a pleasant journey in winter. Tadoussac, once a seasonal trading station, dates from the late 1500s. It is a small town, and when I arrived, it was a gallery of snow sculptures

True to the land, *farmer Abel Gauthier* ***(above)*** *follows the work that traditionally kept Quebec mostly rural. A surge toward the cities in recent decades, sparked in part by increased opportunities, has made urbanites of the majority of Québécois. Upstream in Ontario, a museum town called Upper Canada Village re-creates the life of the early 1800s in buildings removed from sites now drowned by the St. Lawrence Seaway. Poster in a printer's shop-window* ***(right)*** *refers to unrest that fomented uprisings in both Upper and Lower Canada, now respectively Ontario and Quebec—and to changes that led to confederation in 1867.*

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chiseled by 18 straight days of northwest wind. Robert Côté said it was cold but not as bad as the winter of 1939. "The wind never stopped then," he said.

Côté was born in 1897, in the house where he still lives with his sister, Charlotte. He worked in the post office in Tadoussac for fifty years. "I worked nights for 25 years, so I didn't have time to meet girls," he told me by way of explaining why he never married. But he did get a medal from the queen for his service with the post office.

We sat in his study, and looking out onto the St. Lawrence, he said, "Eleven thousand ships have passed by my window this year." He has seen collisions and ships on fire. He has seen the royal yacht *Britannia* pass by. He has seen schooners and whaling ships. He has seen whales.

There is no better place for whale-watching on the St. Lawrence than at Tadoussac. Belugas—small white whales—are attracted to the mouth of the Saguenay by rich marine life. At one time there were many whales in the St. Lawrence, but overhunting thinned the stocks to the point where sighting them today is cause for rejoicing. In the 1930s the government of Quebec Province put a bounty on belugas to placate fishermen, who claimed the mammals were responsible for declines in their catches of cod and other fish.

At Île aux Coudres, west of Tadoussac, belugas were once taken by means of a maze. Hundreds of tall saplings would be cut and placed six feet apart in the river, forming an enclosure shaped like a giant spiral. The trap was designed so that a whale would enter and swim toward the center. It would not attempt to escape through the pickets, and when the tide receded, the beluga would be left in a pool at the center of the spiral, an easy catch.

That has stopped now, as have so many of the old ways along the St. Lawrence. Only rarely is a horse used now to drag firewood out of the forests on the Gaspé. Rather, the buzz of the skimobile is the anthem to winter survival in the villages. No longer do a group of men labor all winter to construct a *goélette*, the 75-foot-long handcrafted fishing boat that was in service for many years on the St. Lawrence.

Today, in the pleasant little north-shore town of St.-Joseph-de-la-Rive, there are three old cargo vessels made of spruce, red oak, and pine. They are out of commission. I stood on the beach in a driving snowstorm to look at them, for ships long laid up cast the same kind of spell over me as railroad boxcars that rumble by, flashing teasing glimpses of lovers' initials penned in some wonderful place beyond the mountains. And the stories that the ships tell in silence: of wild gales, and nights pitched in blackness that presses against your eyes, and terrifying winds and spray, and reefs and shoals so narrowly averted.

Cargo Vessels Now Carry Memories

I walked into town and stopped an old man. "Can you tell me about those three ships?" I asked. And he replied. "I can. They're mine."

He said his name was Jaz Desgagné, and he had lived in St.-Joseph for all his 74 years.

"All three were built here," he said, "one in 1942, one in 1945, and the last in 1954. The timber for them would be cut in the winter and set aside through the following summer to dry. The building would start the second winter, with construction completed the next July. There are 200,000 feet of wood in each of them."

Jaz Desgagné invited me into his house, where he lighted a pipe and said that his father and grandfather had built the same kind of vessels. "I made my first boat trip on the St. Lawrence when I was 7 years old," he said. "By the time I was 12½, I was doing the navigating. I was a master at 18."

On one wall of the house hung a picture of the *Mont Sainte-Marie*, one of the vessels on the beach. It was taken when she was launched, all 130 feet decked out in bunting. "I built nine like her," he said. The *Mont*

Ethereal visitor *seems to vanish in Pier Cloutier's "La Dame Blanche," a wood-carving depiction of a magical lady who helped a poor family in French-Canadian legend. Cloutier lives and works in St.-Jean-Port-Joli, long a center for wood sculptors and now site of a school that teaches the craft to apprentices.*

CARY WOSINSKY

Sainte-Marie and the others were used to transport lumber and other cargo up and down the St. Lawrence.

"There were times when ice would collect on one side of the boat," Captain Desgagné said. "But instead of scraping it off, I'd just turn her around and let it collect on the other side. That put her back on even keel."

When he was told he had to move the three boats, Captain Desgagné, whose shipping business was not a small one, bought the waterfront property where they sit so he could keep them there. "I worked 35 years on boats like those, and they become part of you," he said. "In the summertime I often go down to the beach just to look at them."

It is just as well that the *Mont Sainte-Marie* is at rest, for she could not compete in the cargo trade on the river now. Massive shipments in massive ships is the order of business. At the city of Trois-Rivières, between Montreal and Quebec, the *Laurentian Forest* is at dockside, being loaded with rolls of newsprint. It is an operation dominated by a sense of bigness—bigness of ship, bigness of cargo, bigness of efficiency.

Nearby is a paper mill, one of three in Trois-Rivières, and that too brings its size to

bear on this area of the river country. The mill employs more than a thousand persons to produce 1,050 tons of newsprint daily.

Far downstream, at the city of Baie-Comeau, an even bigger plant turns out close to 450,000 tons a year. About 75 percent of the paper used to print the *New York Daily News* comes from here. In addition, shipments are made to many parts of the world, including China.

Softwoods, such as spruce and balsam, are cut in the vast forests above the river and floated down tributaries, or trucked, to mills on the St. Lawrence. At Baie-Comeau, the logs ride the final 11 miles to the plant in a troughlike flume of water.

Economic prosperity is changing the face of a portion of the north shore of the St. Lawrence, and Baie-Comeau sits in the center of it all. Along with the newsprint, aluminum is produced in the city. It is also a major transfer point for the shipment of grain. From massive storage elevators here as much as 3.5 million tons a year pours into oceangoing freighters.

Lakers bring the wheat and corn east through the seaway from U. S. and Canadian ports. Then they take on cargoes of iron ore that come down to Sept-Îles from the mineral-rich expanses of northern Quebec. Going either way, freighting either gift of the land, they are borne on the river that has been in good service to North America for hundreds of years.

Young River Stays on Course

North of Baie-Comeau, the river carries past Sept-Îles, and then forks to embrace Île d'Anticosti (it is said that there is no better salmon fishing in all the world than on this island). From there on, the St. Lawrence becomes the gulf. Because the Great Lakes act as a catch basin for scouring agents that would otherwise alter the course of the river through the granite of Quebec, the St. Lawrence has remained more or less where it was at the time of its creation.

As rivers go, the St. Lawrence is young. Its course follows that of a fault opened only 6,000 years ago. Prior to the birth of the river, the depression was flooded by the Champlain Sea, whose waters were later expelled by an uplifting of the continent.

From Lake Ontario to Quebec City, the St. Lawrence, under the influence of the Great Lakes, conducts itself as an orderly river, maintaining regularity of flow. Downstream from there to the mouth—where the ocean, at high tide, pours in more than 12 times the amount of water that flows

Push me-pull you contest *draws veteran woodsmen to St.-Irénée's carnival. Pulp and other forest products, along with grains, ores, metals, and manufactured goods, make up the lifeblood of river shipping.*

out at low tide—the St. Lawrence takes on a different character. It becomes big and boisterous, and its bottom drops off in places to more than a thousand feet.

As one of the world's greatest rivers, it is fitting that the St. Lawrence should carry on its back one of the world's greatest cities, Montreal.

It sits on a foot-shaped island thirty miles long and less than ten miles wide, and in the middle of it is a mountain called Royal. Three million people live in Greater Montreal; millions more throughout the world, having visited there, wish they could.

Two-Canada Controversy Rocks City

Montreal is a regal city, but beneath her robe of culture can be found the stretch marks of a nation pulling apart. The central city's population is decreasing, the school system is in trouble, and businesses are moving out. In no other place is the pain of Canada's ailments felt more than here.

Bill 101 is the legislation designating French as the official language of Quebec. This is what it says, in part: "Except as may be provided under this act or the regulations of the Office de la Langue Française, signs and posters and commercial advertising shall be solely in the official language."

One disturbing result of the language controversy is the flight of English-speaking residents from the province, and the closing of many schools under the administration of the Protestant School Board of Greater Montreal. Though Catholic schools are also losing students, enrollment in Protestant schools may decline by 50 percent within five years. What is left of the system may end up merging with the Montreal Catholic School Commission.

The driving force in the life of the province has always been centered around Montreal, but Quebec City, more and more, is siphoning off some of the action. What Montreal is not likely to forfeit is its role as one of the world's leading inland ports.

As far as general cargo is concerned, Montreal is the second largest port in Canada, after Vancouver. More tonnage is handled at Sept-Îles, but there it is limited to ore.

"There are only five berths at Sept-Îles, while here we have 134," Viateur Gendron, an official of the port, told me. "We also have four grain elevators, and we operate our own railway system."

Vessels from sixty countries call at Montreal, and 67 percent of the general cargo they bring and take out is containerized. Great liners of the world used to call here too, bringing as many as 200,000 passengers a year, but today only two passenger lines continue to use the port.

As the St. Lawrence is kept open in the winter from Montreal to the sea, the shipping here continues throughout the year, pumping more than 300 million dollars into the economy. Year-round navigation on the river downstream from Montreal dates back only to 1962, when icebreakers started to keep the channels clear. The master of the first ship from overseas to reach the city in the new year traditionally receives a walking stick with a gold knob.

Perhaps Montreal's importance to the Canadian economy is taken too lightly by those who maintain that Quebec could not stand alone, economically, as an independent nation. For example, on the east end of Sherbrooke Street, in an area of 4.5 square

CARY WOLINSKY (RIGHT)

***Shortstopped** on their migration from the Great Lakes to the Sargasso Sea, eels **(right)** will travel instead to Europe. Pollution closed the river to eel fishing in 1970, but now all seafood except some shellfish **(above)** is safe to eat.*

مرد دریا

miles, there stands the most concentrated oil-refining complex in Canada.

The six oil firms operating there—Gulf, British Petroleum, Fina, Shell, Imperial, and Texaco—process more than 500,000 barrels of crude oil each day. They employ thousands, and the combined payrolls and benefits amount to a hundred million dollars a year.

Of oil and economics and despair: It is cold, and because they don't have the $20 needed for a minimum home delivery of 25 gallons of stove oil, the poor of Montreal are moving through the icy streets, to and from the curbside machines that vend a quarter's worth of oil. They are filling buckets and jars and tins that once held lard. It is Dickensian. It is also a sinew in a great city's strength of character.

Elsewhere in Montreal, reservations are being made for dinner in some of the finest restaurants in the world. Down by the docks an old man is studying the faded lettering on an abandoned building, and though he can't make it out, this is what it says: The Edinburgh Roperie and Sailcloth Co. Manila Ropes, Proofed Canvas. Established 1756.

Certainly Canada would mourn the loss

Winter's overlay *blends land and river along the Gaspé Peninsula's shore, where kids play on a deep-frozen front-yard rink. But beneath the white mantle the St. Lawrence flows past with unabated power—a stream that knows no master.*

of Montreal to an independent Quebec, just as it would the loss of the great reach of the St. Lawrence through the province to the sea—the reach I followed as I left Montreal.

It takes time to drive out of Montreal on a winter day. The traffic is heavy, and the metal-eating slush that splashes on the windshield obscures the view of signs directing me to Highway 132. Finally, though, the high-rise buildings are behind me and the road is carrying past farms. Before the day is over, Quebec City is also behind, and so is Montmagny and St.-Jean-Port-Joli, a little town noted for its wood carvings (page 617).

And then, later, to Trois-Pistoles and across the river by ferry to Les Escoumins, where it is worth my while to linger. Champlain paid a visit to this place in 1603, but long before that the Basques, it is believed, had a station in the area, where they rendered oil from whales. It was in 1845 that Les Escoumins was established as a village.

It is good to walk around the town on a winter morning blessed with sunlight and feel the presence of the ghosts of history all around. There's no escape from them, not even in the hotel, where I stop for coffee.

The hotel building is as old as the village. It sits on a slight rise about 500 yards from the St. Lawrence. In the winter of 1864-65, the hotel sheltered four Confederate soldiers, who escaped into Quebec following a raid on St. Albans, Vermont. When the Civil War ended, the men sailed first to Halifax, then to France. All but one eventually returned home to Kentucky.

Time Wins the War Against Winter

On this north shore, and back on the other side where the St. Lawrence presses against the Gaspé, the people in the towns and villages, like the soldiers in the hotel, seem to be avoiding the outside. The war from which they have fled is with the harsh winter. Everything looks like slate—the sky, the river, the fields. Once again I am convinced that the siege will never lift, that winter will overlap winter.

The snow and ice melt, however, and spring returns to the St. Lawrence country with resurgent freshets and buds. Unjacketed, the river moves swiftly, churned to foam here and there by the ships' propellers moving through the reopened seaway.

And around Cap-Tourmente, the greater snow geese put down on the mud flats to rest and feed, and even—who knows?—to elect new point birds for the V-formations, before beating north to their nesting grounds in the wake of retreating winter. □

By SYLVIA A. EARLE

Photographs by
AL GIDDINGS and
CHUCK NICKLIN
SEA FILMS, INC.

A Walk in the Deep

CHUCK NICKLIN (ABOVE) AND AL GIDDINGS (FACING PAGE)

Inner-space suit *called Jim allowed the author* ***(above)*** *to explore the seafloor at 1,250 feet and ascend without decompression. Carried by submarine for a test walk* ***(opposite)****, Dr. Earle was first to use Jim for open-sea exploration.*

A RUSH OF BUBBLES cascades past my face like blue champagne as I descend into the depths of the sea. The translucent blueness around me seems to glow with its own light, like the deepest blue of a prism or the inner band of a rainbow.

Encased in a bizarre space-age diving suit, I stand strapped to the bow of a small research submarine like some ponderous figurehead. In the submarine behind me pilot Bohdan Bartko and team leader Al Giddings can observe me and maintain voice contact via a slender communications cable connected to the inside of my diving helmet.

By means of a simple control Al can disconnect the safety belt that holds me securely to the deck of the submarine. Plans call for him to release me when we reach the seafloor, allowing me to walk about at will.

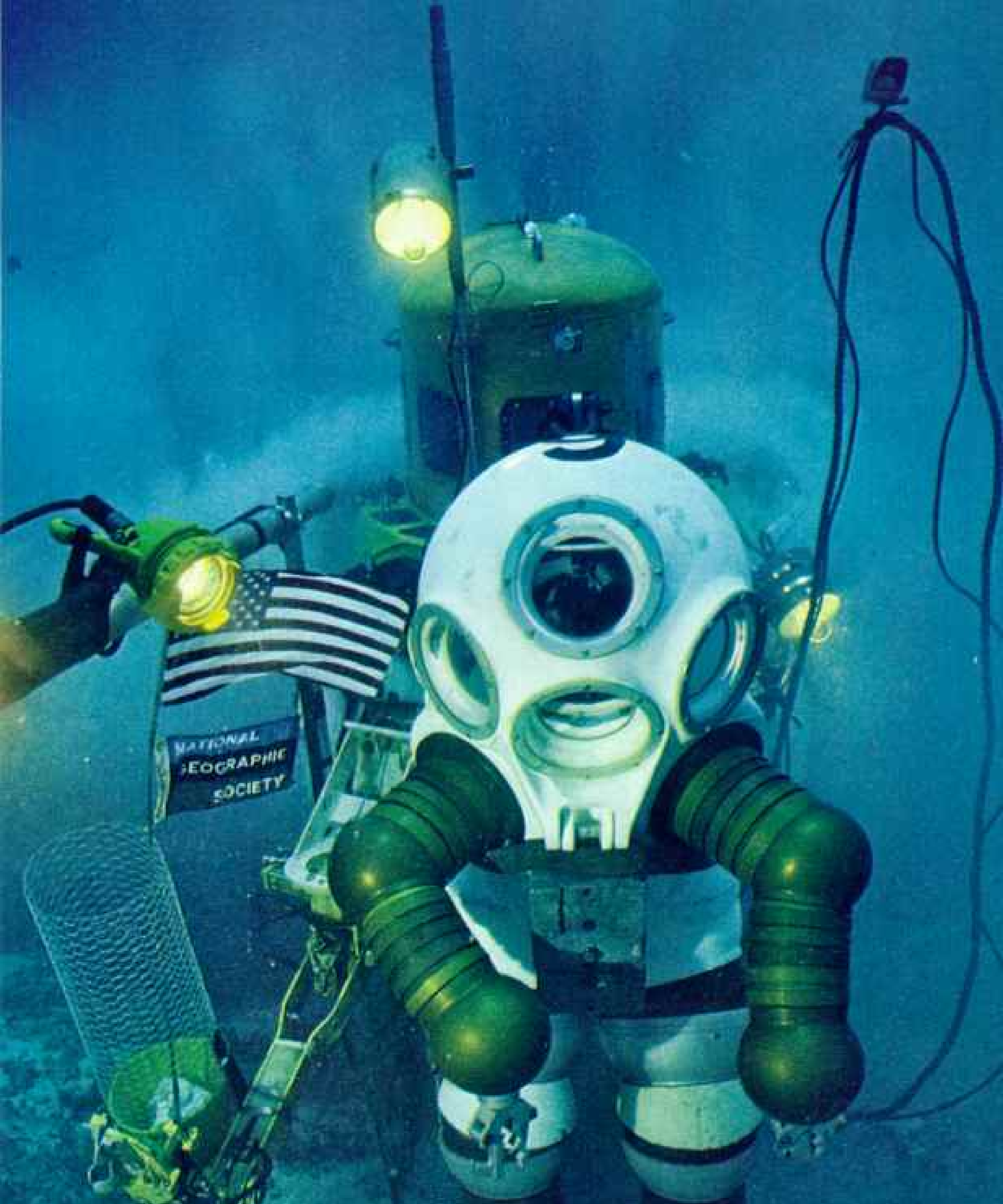
On the surface above us our technical advisor, Phil Nuytten, maintains radio contact with Al from a support ship. Phil is an executive of Oceaneering International, Inc., which owns the diving suit and has made it available for an experimental dive off Hawaii's island of Oahu.

Our goal is to test the suit—christened Jim after a pioneer diver, Jim Jarratt—as a tool for scientists. Until now Jim has been used primarily for commercial work such as submarine salvage and offshore oil operations, always with a tether to the surface. This dive will be the first open-ocean use of Jim for scientific research, and, for the first time, there will be no connection to the surface . . . only to the submarine.

"Five hundred feet, and still descending," Al's voice fills the dome surrounding my head. "How are you feeling?"

I want to answer, "Extraordinary! Fantastic!" But I respond with the dignity appropriate to a scientific experiment: "Fine, no problems," and the descent continues.

At the 740-foot level I mentally hold my breath. Here, on the previous day, we had been forced to cancel a dive when our communications system suddenly failed. A similar failure and cancellation had occurred earlier at 1,050 feet. But I relax as we glide smoothly past 800 feet, then 1,000. Al continues to report the increasing depth. Light from the *(Continued on page 628)*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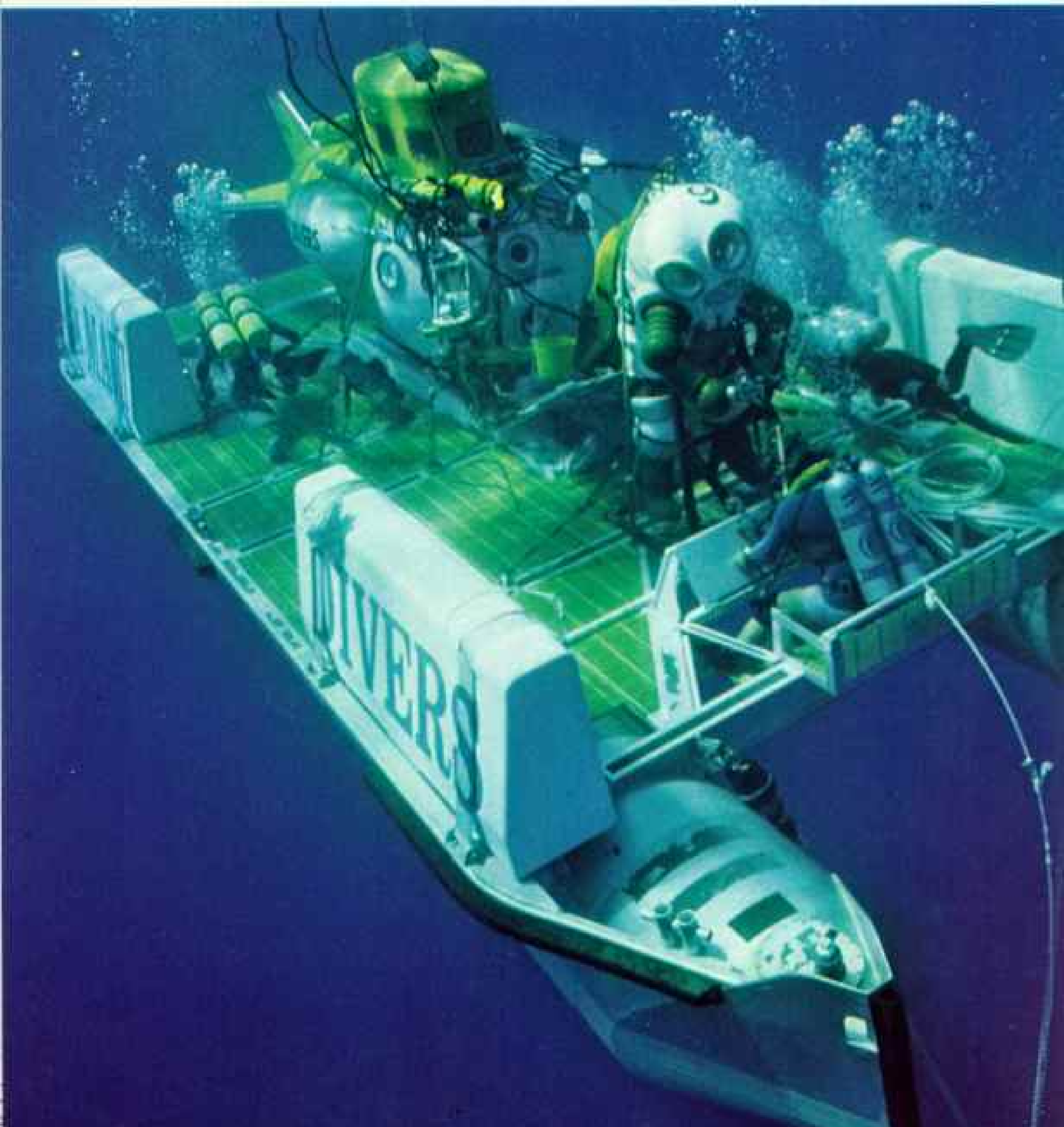

DIVERS

***Pacific waters** rush over Jim and the University of Hawaii's research submarine* Star II *(**left**) six miles off Oahu. Sixty feet below they will launch from a transport (**below left**) operated by Maui Divers, Inc. To increase Dr. Earle's freedom on the seafloor, the team took an unprecedented risk: For the first time Jim was used without direct connection to the surface. An 18-foot tether leashed Jim to* Star II *during the walk and hoisted Dr. Earle at ascent (**below right**). A communications wire twined around the tether allowed her to talk with* Star II*; a through-water radio linked Dr. Earle to the support ship* Holokai*. An ABC television special this month and a new National Geographic Special Publication,* Exploring the Deep Frontier*, document the dive.*

CHUCK NICKLIN (LEFT) AND PETE ROMANO (BELOW), SEA FILMS, INC.

CHUCK NICKLIN

Through the liquid jewel of open sea, Jim and Star II *descend a hundred feet*

surface gradually fades and the blue glow becomes blue-gray, then finally blue-black, and I am engulfed in near darkness.

Beyond my faceplate, clouds of tiny luminous creatures eddy and swirl like living constellations. I feel a sense of freedom in the eternal night that mantles the ocean realm—nearly three-quarters of the earth—at depths of a thousand feet.

In the faint light from the surface I suddenly glimpse a patchwork expanse beneath me and announce to Bob and Al: "I can see the bottom—we've made it."

At a depth of 1,150 feet the submarine gently touches down, and Bob switches on the submarine's lights. "Hang on for a while, Sylvia," Al advises. "Bob is going to try and find deeper water."

Step Into Lunar Landscape

We foresee no problem going to 1,500 feet, exceeding the present record of 1,440 attained by a salvage diver off the coast of Spain. But after a half-hour search for deeper water the submarine's limited air and power supply cause Bob to stop at 1,250 feet.

We land near a large, lacy sea fan amid a field of spiraling bioluminescent bamboo

per minute. A company of divers followed and photographed the action to 150 feet.

coral, dark-brown-and-white animals six to eight feet high that sprout from the seafloor like giant curled whiskers.

"Are you ready to take a walk?" Al asks over the communications line. Nothing in his voice betrays concern, though the step we are about to take is final. Once released from the submarine, I cannot climb back aboard and refasten the safety belt. Nor can Al or Bob swim out of the sub to help in an emergency. I can drop weights, if necessary, and rise to the surface independently. But if all goes well, the plan calls for me to be lifted off the bottom at the end of my walk by the line connecting Jim and the ascending submarine.

"Any time," I answer Al's query. The belt drops free. As I step down onto the ocean floor, I am aware that I am entering terrain in some respects similar to a lunar landscape. Both have a hauntingly similar appearance, and both, until quite recently, have been virtually inaccessible and unexplored. But there is a striking difference. Astronaut Michael Collins, who orbited above the moon's surface, observed: "I have seen the ultimate black of infinity in a stillness undisturbed by any living thing."

By contrast, in the dark infinity of the deep sea, there is an abundance of life. I meet an 18-inch-long shark with glowing green eyes swimming gracefully past only a few feet away. A lantern fish glides by with lights along its side, looking much like a miniature passenger liner. A dozen or so red, long-legged crabs cling to a sea fan swaying in the current, and a gray, silky-skinned eel undulates in and out of the submarine's circle of light.

Mainly, however, I concentrate on the bioluminescent spirals of bamboo coral. When touched, they do not simply flash or glow in the manner of most luminous creatures. Instead, they pulse for several minutes with rings of eerie blue light that move outward along the stalks of coral like tiny, incandescent doughnuts.

As I explore the bottom at the end of my 18-foot-long nylon tether, Al and Bob carefully follow me in the submarine, providing both light and communication. Slowly and carefully I make my way across the ocean floor.

One creature I encounter inspires a feeling of kinship. A small, pale-colored crab moves in front of me, lifting its legs in deliberate, mechanical fashion as it sidles toward the border between light and darkness.

"I think I know how you feel," I remark mentally to my small companion. For in much the same way I proceed across the ocean floor, slowly flexing my jointed legs and now and then opening and closing the pincerlike "hands" with which Jim is equipped. Accustomed to the suit by now, I feel as secure inside my metal armor as I imagine the crab must feel inside its living carapace.

Though it looks cumbersome, Jim weighs only about sixty pounds in water and allows remarkable freedom of movement. Special liquid-filled joints between the metal plates allow the suit to be used at depths as great as 2,000 feet. Inside, air pressure equal to that of sea level is maintained.

As a result, Jim-suit divers avoid extreme pressures that threaten other divers with the bends and often require long periods of decompression before returning to the surface. In addition, the suits are equipped with rebreathing devices that continually add oxygen and scrub carbon dioxide from the recycled air supply for as long as 48 hours.

AL GIDDINGS (LEFT) AND TERRY KIRBY

"Like walking on a moonless night," *says Dr. Earle of her two and a half hours at 1,250 feet. Photographed from* Star II ***(left)****, she grasps a piece of bamboo coral. Study of the luminescent species* ***(above)*** *was one goal of the pathfinding expedition.*

A Step Toward Knowledge

The suit is large enough for me to withdraw my hands from the metal arms to record my observations in a notebook. As I write down a few conclusions and numerous questions, I keep up a running conversation with Al. At twelve o'clock he announces, "You've been out there two and a half hours. It's nearly time to surface."

"You're kidding!" I respond. "It seems like twenty minutes." But Al is right, the time has sped away.

As I rise slowly from the seafloor, I reflect on the dive—the deepest solo exploration of its kind ever made, and the work of a team of highly talented people.

The average depth of the ocean is 10,000 feet, and the deepest place in it nearly seven miles down. Clearly we still have far to go and much to do, but on this day we have taken an exciting step. □

THAILAND

Refuge From Terror

By W. E. GARRETT
ASSOCIATE EDITOR

LIKE A CURTAIN dropping at the end of act one and never lifting, a shroud of secrecy closed around Vietnam, Laos, and Cambodia five years ago when the last American forces pulled out. Much of what the world knows about life there since comes from the faces and stories of the estimated one million refugees who risked their lives to flee.

At first they left for economic or political reasons, but now many speak of persecution, of tens of thousands of citizens sent to reeducation camps in Vietnam and Laos, of poison-gas attacks on Hmong mountain villagers, and of a mindless holocaust in Cambodia, a nation martyred to the twisted idealism of Pol Pot and his ideologist, Khieu Samphan, who set out to "purify" the revolution of foreign influences. Estimates of Cambodian deaths since 1975 vary according to the political prejudices of the source; they range from one to three million people. "Cambodia became an immense Auschwitz," former head of state Prince Norodom Sihanouk told me this spring.

Recently I traveled along Thailand's 1,400-mile border with Laos and Cambodia, or Kampuchea, as it is now called—haven to a growing flood of refugees. On the banks of the Mekong River near the town of Ban Pak Chom, I encountered 43 Hmong who had just escaped from Laos. For the first time in twenty years of knowing these stoic mountain people,* I saw them weep openly. Weeks in the jungle avoiding mined trails and patrols had drained them. One old woman clutched me impulsively and sobbed. Perhaps my presence assured her they had reached safety. Near us a man squatted beside his pack of meager possessions, his face strained with grief. During the escape his wife and six children had been killed by a Vietnamese patrol.

In the past year 40,000 Hmong, convinced

*See the author's "The Hmong of Laos: No Place to Run" in the January 1974 GEOGRAPHIC.

JOHN EVERINGHAM (FACING PAGE), AND W. E. GARRETT

Better jail *for a brief while than persecution at home. Fleeing Communist terror by the tens of thousands, Southeast Asians seek sanctuary in Thailand. Technically illegal immigrants, these Laotians* ***(left)*** *will be processed and interrogated before being sent to refugee camps.*

A Thai border policeman's drawing ***(above)*** *dramatizes his fear of Communist aggression from Vietnam, Laos, and Cambodia (Kampuchea).*

CHINA

After Vietnam's invasion of Kampuchea, Chinese troops staged a brief retaliatory invasion of Vietnam during February–March 1979.

More than a quarter of a million ethnic Chinese have fled Vietnam for refuge in China.

Nanning

Pingxiang

Red

TO MACAO

BURMA

Fighting between minority groups and the central Burmese Government creates a trickle of refugees into Thailand.

LAOS

Communist Pathet Lao and Vietnamese seek to subjugate those mountain-dwelling Hmong who fought for the U. S. Central Intelligence Agency during the Vietnam conflict.

Dien Bien Phu

Hanoi

Haiphong

VIETNAM

With troops already in Laos, the Vietnamese attacked Kampuchea and installed a puppet regime in Phnom Penh in January 1979. Pockets of Pol Pot's Khmer Rouge still hold out in western Kampuchea.

TO HONG KONG

Ban Houayxay

Mekong

Luang Prabang

Plain of Jars

Lung Cheng

Pa Hao

Ban Nam Chan

Vientiane

Paksane

Ban Don

Phayao

Nan

Ban Pak Cham

Chiang Khan

Chiang Mai

Mekong

Thakhek

Ban Vinai
46,000
REFUGEES

Nong Khai
45,000 REFUGEES

Udon Thani

Loei

Uttaradit

Salween

Hue

THAILAND

This traditional ally of the West faces threats of internal subversion by Communists and disorder as thousands of Laotians and Cambodians seek a haven from persecution.

Sukhothai

Ping

Ubon
46,000 REFUGEES

Pakse

Maulmein

Nakhon Ratchasima

From 300,000 to 500,000 homeless people awaiting entry into refugee camps still huddle on both sides of the Thai-Kampuchea border.

Khao-I-Dang
110,000 REFUGEES

Sa Kaeo
29,000
REFUGEES

Aranyaprathet

ANGKOR Ruins

Tonle Sap

KAMPUCHEA (CAMBODIA)

Famine ravages a land where, since 1975, an estimated one to three million Cambodians have died of disease, starvation, and the excesses of Pol Pot's Khmer Rouge.

Tavoy

Bangkok

Kamput
3,000 REFUGEES

Battambang

Mai Rut
3,000 REFUGEES

Phnom Penh

Mekong

Andaman Sea

Gulf of Thailand

■ REFUGEE CAMP

ROUTES OF REFUGEES

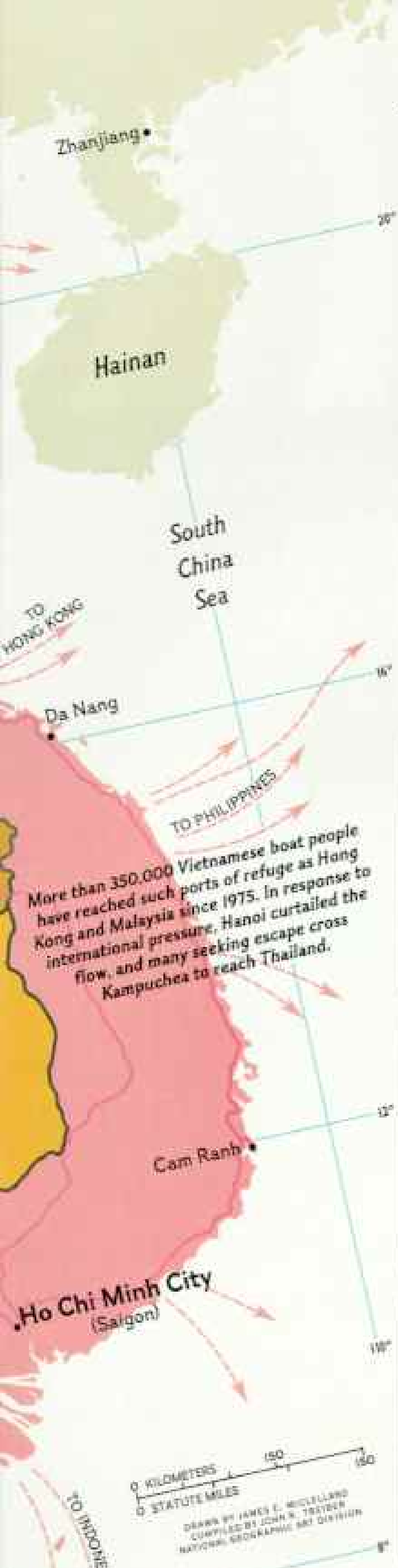
AREAS OF FIGHTING

Numbers of refugees in camps are based on U.N. figures as of January 22, 1980

TO THAILAND

TO MALAYSIA

The ebb and flow of empire and enmity



CHINESE DOMINATION The bitter roots of enmity in Southeast Asia reach back as far as III B.C., when the Chinese began a domination of the Vietnamese people of Annam—present-day northern Vietnam—that lasted a thousand years.

Athwart the trade route between India and China, prosperous Funan prevailed over the neighboring Hindu states of Champa and Chenla until the sixth century, when it was subjugated by the Khmer princes of Chenla.

KHMER HEGEMONY Rebellious Vietnamese of Annam finally shook off the Chinese yoke in the tenth century to become an independent state, and began forays against Champa to the south.

Separated from the aggressive Vietnamese by mountains, the Khmer expanded their empire of Kambuja to the north and west. At the glittering capital of Angkor, Khmer kings held court for scholars, religious leaders, and artists from India.

LAOTIAN EMERGENCE Moving southward, the Vietnamese crushed Champa in 1471, setting the stage for their eventual occupation of the Mekong Delta by 1800.

In decline after a century of building and expansion, the Khmer empire had already lost territory in the north to the emerging Laotian state of Lan Xang. But the major threat came from the energetic Siamese in the west. By 1600 Siam controlled Angkor, and the Khmer had moved their capital to Phnom Penh.

FRENCH PROTECTION Weakened and fragmented by conflict and civil war, Laos, Tonkin, Annam, Cochin China, and Cambodia fell under French protection in the 19th century.

By 1900 the colonial-minded French, using the tools of treaty and conquest, had turned protection into control. Treaties with the Siamese resulted in the drawing of the present-day boundaries of Laos and Cambodia.

VIET EXPANSION The seeds of protest against French rule, sown in 1930 with the formation of the Vietnamese Communist Party by Ho Chi Minh, flowered in 1954 with the final defeat of the French at Dien Bien Phu.

In 1975 the United States withdrew from two decades of confrontation with Vietnamese Communists, who continued their territorial expansion by invading Kampuchea and sending an estimated 40,000 troops into Laos.

Fleeing famine *and war in Cambodia, refugees streamed into Thailand in October 1979. A starving child (**left**) sipped nourishment at Sa Kaeo refugee camp. For others, bed was a mat in a field tent (**above**) or a concrete floor in a hospital in Aranyaprathet (**below**).*

Such images of human misery led to an international outpouring of aid. Housewives and executives left Bangkok to bathe the victims and give shots. Medical teams began arriving from other countries. More than 200 million dollars were pledged. The death rate at Sa Kaeo dropped as medicine and food arrived. But in Cambodia the tragedy is appalling; estimates vary from one to three million dead since 1975.

EDDIE ADAMS (LEFT) AND W. E. GARRETT

Bombed, gassed, *and relentlessly pursued by Communist troops, Hmong tribesmen from Laos arrive in Thailand after a two-month ordeal, capped by a perilous crossing of the Mekong River. Near Chiang Khan they board trucks to interrogation centers. One chief told a Western correspondent that his people "fight, work like buffalo, run, starve, and die—and no one knows."*

they had to flee or be killed, reached Thailand. Refugee officials estimate another 40,000 died trying.

Downriver some 60 miles, across from Vientiane, Laos, I sat at a riverside café one evening with my friend John Everingham, an Australian journalist. Eighteen months earlier he had swum to the Laotian side at this point, using scuba gear to avoid detection, and rescued his girl friend—now his wife—Keo. In two hours we saw the lights of only one car moving in the once bustling capital. John's estimates, based on Laotian Government reports and refugee accounts, indicate 60,000 Laotians (2 percent of the population) have been sent to reeducation camps. Some 200,000 others have fled to Thailand, half of them in the past two years.

At the nearby Nong Khai refugee camp we visited row after row of tin-roofed, bamboo-walled buildings housing 30,000 Laotians, more than in any Laotian city except Vientiane. For four months after her swim to freedom, Keo Everingham shared a 16-by-16-foot space in one of these buildings with 23 relatives. Eight who still lived there had hung plastic sheeting on the flimsy partitions to gain a semblance of privacy. To be alone, married couples borrowed a bachelor friend's cubicle by the hour.

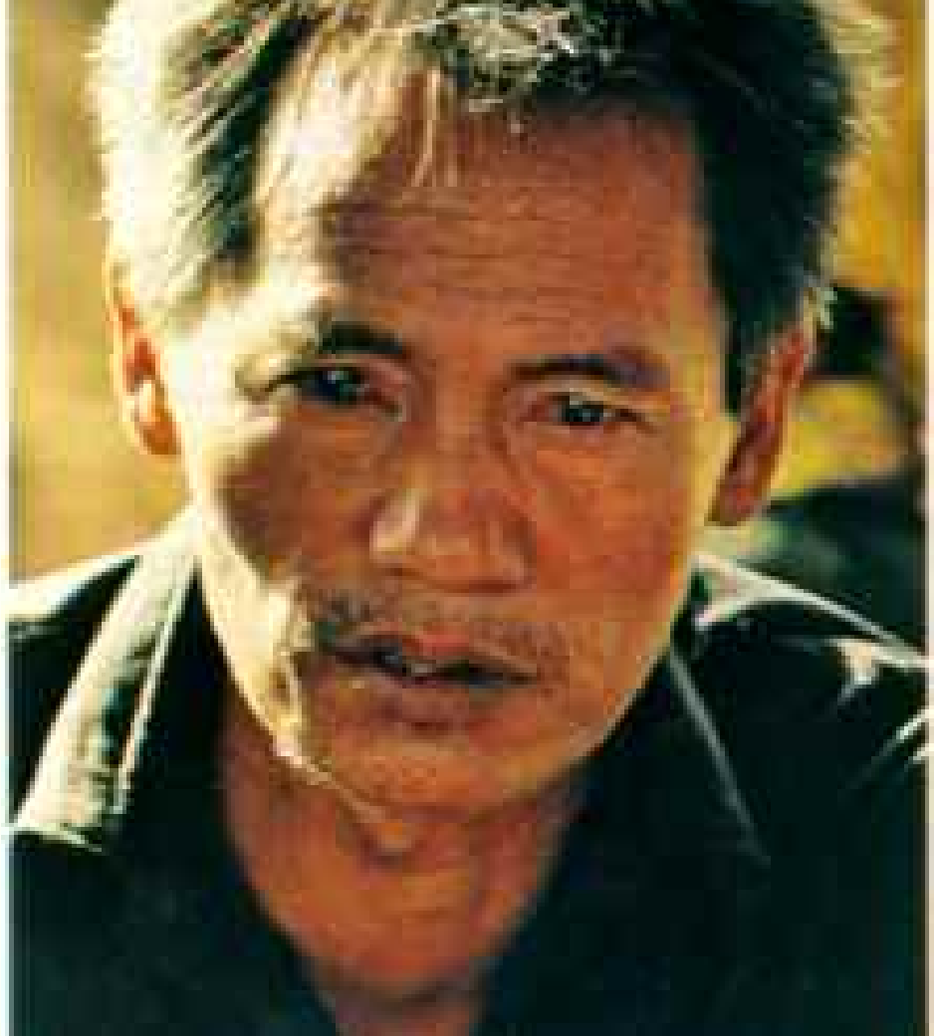
JOHN BERRINGHAM

Since the refugees could not leave the camps or hold jobs in Thailand, they sat in ever dwindling patience hoping for a miracle that would send them to the United States or another of the 35 countries accepting Southeast Asian refugees. For many, the invitation would never come.

After a three-hour taxi ride east from Bangkok, I visited the seven-day-old Sa Kaeo refugee camp near the Cambodian border. A six-foot-high barbed-wire fence confined 30,000 Cambodians on thirty acres of farmland. Englishman Mark Brown of the Office of the United Nations High Commissioner for Refugees was coordinating the work of local laborers, Thai soldiers, and volunteers to provide emergency shelter, food, water, and medical care. In large dirt-floored tents, makeshift hospitals treated hundreds of the most desperately ill. Thirty would die that day. Starvation compounded by a litany of diseases had ravaged the people until many seemingly were skeletons held together by a parchment of taut skin and a perverse refusal to die.

In one tent a nurse struggled to find a vein in the arm of an emaciated girl. Once found, the vein was so weakened that the intravenous fluid would not flow past the elbow. The girl watched passively with doelike eyes

W. E. GARRETT



With boys' faces *and men's hearts, Hmong guerrillas* **(above)** *escort their countrymen to safety in Thailand. Weapons cached on the Laos side of the Mekong await the return of these troops, who have vowed not to cut their hair until they have been victorious. They call themselves "Sky" soldiers, a Vietnam War term referring to Hmong armed by the U. S. Central Intelligence Agency.*

Numb with loss, a Hmong **(right)** *safe on Thai soil mourns his family, killed by a Vietnamese patrol during the escape.*

JOHN EVERINGHAM

that dominated a once beautiful face, eyes that seemed too large for her shrunken body and too old for her years—eyes that seemed beyond tears. Mine were not.

At Sa Kaeo I met Mey Kom Pot, a refugee with a degree from Canada's McGill University, who was fluent in English and French. Mey escaped months earlier and was now helping in the camp.

"On April 17, 1975, I was running the Banque de Commerce in Phnom Penh when the Communist Khmer Rouge took the city," he told me. "I turned the bank over to them and walked out of the city with all the other residents. I walked until May 9 when I was assigned to a rice farm."

The "walk" became a death march for thousands as the Khmer Rouge forcibly evacuated every city in Cambodia—of everyone, including the old and crippled. Hospital patients were pushed along the roads still in their beds. The move was the first in a radical scheme to restructure Cambodia into a virtual human anthill, where a peasant or agrarian economy would operate with no money, no cities, and no modern life as we know it. Nearly a million Cambodians judged not compatible with the new system

were slaughtered. There was one basic punishment for any suspected crime, past or present: immediate death.

Mey's education marked him an enemy, but for four years he slaved in the fields undetected by the killing squads. All friends and relatives gradually disappeared.

"Every time the cadres came past my field, my heart stopped; I thought I was next," Mey said. "The Pol Pot soldiers never killed people in front of us. They politely asked them to come. No one ever returned.

"I hate to admit it, but I'm alive today because our enemies, the Vietnamese, invaded, and I escaped in the confusion. We had been told that at the end of harvest all 'new people' [those who had not joined the revolution before April 1975] were to be killed. This was the worst form of genocide—Pol Pot was killing his own people. I hope I live to meet him face to face and ask 'Why?'"

Since 1969, U. S. and Cambodian Government bombing, Pol Pot extremism, and the Vietnamese invasion have decimated a once thriving agricultural economy. With only 10 percent of the normal rice plantings this year, continued famine is assured.

Now nearly half a million Cambodians huddle in camps along the Thai border. If Vietnam moves to eliminate them, the refugees will pour into Thailand, with a profound impact on the economy of that nation. Today these camps are fed by relief organizations, and an "ant army" of thousands of porters backpack and bicycle relief supplies into the Cambodian interior.

Since Vietnam curbed the exodus of dissidents by boat (William S. Ellis wrote of the boat people's impact on Hong Kong in the November 1979 GEOGRAPHIC), even Vietnamese are crossing Cambodia on foot to reach Thailand. The seemingly endless flow of refugees presents Thailand with staggering problems.

For the displaced of Southeast Asia, the outlook remains dark. Even by the most optimistic estimates no more than half the present refugee population will be resettled in the foreseeable future.

What's to become of the others? □

In the following photographic essay, John Everingham tells the story of one lucky family that made it out of the camps to a new life.

One Family's Odyssey to America

TEXT AND
PHOTOGRAPHS BY
JOHN EVERINGHAM

A MESSAGE from America brings the sadness of parting to one girl and a note of despair to her three friends. Chia Xiong, second from right and holding a letter from a cousin in Wisconsin, is spending her last day as a refugee from Laos in Thailand's Ban Vinai camp. Her friends may never leave. On the following day Chia and her family will journey from one world to another as they seek a new life in the United States.

To learn how it feels to become a new ingredient in the American melting pot, I will cross half the world with the Xiongs, from refugee camp to their new home in Wisconsin.

"A FEW YEARS AGO I never dreamed I would ever leave my village. Now I'm going to a strange country to live and die," Grandfather Xiong said thoughtfully on his last day in Ban Vinai camp. "But America will be good for my children. They say all children can go to school there."

There are even more compelling reasons for the Xiong family's eagerness to go to the United States. Behind them, in Laos, almost certain death awaits many of their people, the Hmong—mountain tribesmen from the jungle-crowned Laotian highlands. Winning acclaim during the Vietnam War as the United States' toughest, most dependable guerrilla fighters, those Hmong who resist the current regime are now hunted by Lao and Vietnamese Communist forces. Few other countries will accept the largely uneducated mountain people, and the refugee camp offers no future.

Nao Leng Xiong, 27 and the only member of the family with an education, is officially the family head. Along with his wife, Chay, and daughters Sheng, 4 years, and Chou, 17 months, Nao Leng must care for his aging parents, brother Vang, 15, and sisters Chia, 11, and Yer, 9. Here they share a meal in their refugee hut, not unlike their former home in northern Laos with its earthen floor, thatched roof, bamboo walls, and open-fire hearth.

Nao Leng won the right of entry into the United States because of his training as a teacher and knowledge of English. Having two cousins already settled in Wisconsin helped assure the Xiongs a new home.

W. E. GARRETT

NATIONAL GEOGRAPHIC ART DIVISION

RESILIENT and independent clans of warriors, the Hmong arrived in Southeast Asia little more than a century ago. They migrated from China, where centuries of persecution and expansion by the Han had slowly pushed them south. Nearly three million Hmong remain in China, but an estimated 300,000 now live in Laos and Thailand.

In their adopted countries they often find themselves unwelcome. Their slash-and-burn agriculture exhausts the soil, leaves wide expanses of valuable forest in ashes, and opens mountainsides to erosion.

"Our village in Laos was ideal. The mountains for rice fields were endless. There were big forests with game to hunt. Good streams. Bamboo. We never had to move far like other villages. Not until the Communists came." The nostalgia in Grandfather Xiong's voice was catching. I, too, spoke of my many years wandering between the Hmong villages that dot the Laotian highlands (***above left***).

His village was deep in the mountains, far from any roads. "In my lifetime only one Westerner ever came to our village," said Grandfather. "Like you, he carried two cameras."

What? It seemed we were total

strangers, but were we? Comparing notes, we realized that I was the two-camera foreigner whom he had invited in for rice back in 1971. It was his village, Ban Nam Chan, which I had photographed (***bottom left***). Now, almost nine years later, I had come again to tell the story of his people, this time in the refugee camp at Ban Vinai (***below***).

Remote, tranquil, and prosperous as I knew it in 1971, the Xiongs' village was doomed. Grandfather had seen many relatives join the guerrilla forces that were armed and advised by the U. S. Central Intelligence Agency to fight the Communist Vietnamese and Pathet Lao. Yet he still dreamed of peace, and sent Nao Leng to become the first family member to enter school. Nao Leng was only months short of his teacher's diploma when Communist forces swept through Laos to unopposed victory in mid-1975. He fled back to his mountain village, where he found chaos. With U. S. aid cut off, the guerrilla troops had disintegrated and fled. In November Pathet Lao soldiers executed 17 people in the Xiongs' district, accusing them of collaboration with the U. S. From the jungle, former guerrillas returned for revenge. In the seesawing battles, Nao Leng's brother-in-law was killed.

Reports of poison gas reached Thailand as early as 1974. In the following years tales of whole villages of men, women, and children collapsing into agonizing convulsions and vomiting blood before dying led to an investigation by a U. S. Army medical team. Their December 1979 report sparked a condemnation by the House of Representatives regarding "reliable evidence that lethal chemical agents have been used against the Hmong tribespeople in Laos . . . thousands have died in these attacks. . . ."

The time had come for the Xiongs to leave. Grandfather recalled their desperate flight: "When the government patrols were near, we moved only at night. We avoided trails and cut right through the jungle. An old American compass took us south."

The Xiongs' village split into two groups. Five weeks' trek brought the family and about 200 others to the last, terrifying test that cost so many Hmong their lives. In the dark of night they paddled crude lashings of bamboo across the Mekong River to Thailand and were free. The village's second contingent of 189, including Nao Leng's older sister and her children, has not been seen since.

MOTHER'S breast comforts baby Chou Xiong (***left***), who fears the probing stethoscope of Dr. Celeste L. Woodward of Baltimore, one of scores of American volunteers working in Thailand.

During one of the required personal interviews, part of the strict screening the U. S. Government prescribes for refugee immigrants, the grandparents were presented with an unanswerable question: When were you born? Only recently have some of the Hmong begun to keep track of birthdays. Nevertheless, the interviewer provided them with dates—for the record.

The Hmong revere education, and the camp offers many children like Yer Xiong (***top,*** at right) their first lessons. Though English is not taught formally, makeshift classes have sprung up in camp alleys. Children often greet foreigners with a crisp, "Hello. How are you today?"

Before the family departs, the incantations of a shaman entice spirits (the Hmong believe each person has three) to return and protect the travelers. Friends crowd round (***above***) to tie strings around the Xiongs' wrists, symbolically confining those protective spirits inside their bodies.

GOOD-BYE may mean forever when a refugee says it. Friends and relatives may never meet again. As the bus to Bangkok—the first step to freedom in the U. S.—stirred its dusty trail out of the camp one morning with the Xiongs aboard, they knew there was an unspoken "forever" behind the farewells.

The old Laotian adage about the hardy Hmong—"too tough to cry"—tumbled with the tears (***above***).

In the determined competition for acceptance into the U. S., refugees emphasize even the vaguest past contacts with Americans. But then, to the surprise of camp officials, as many as 30 percent of those accepted don't board the bus. When the final step confronts them, an interviewer explained, indecision often strikes. Some will not leave loved ones. Others prefer to return to Laos and fight. America becomes second choice.

For the Xiongs, the grueling 12-hour ride ends as the bus reaches the bright lights of Bangkok (***right***). Nao Leng, the only member of the family to have seen a big city before, explains the neon signs and large buildings to his wife.

ANTICIPATION SOURED long before the Xiongs boarded the jet airliner to cross the Pacific. Processing of their 150-refugee group began well before midnight. They were counted, checked, marched, bused, checked again and again, and left to wait for hours.

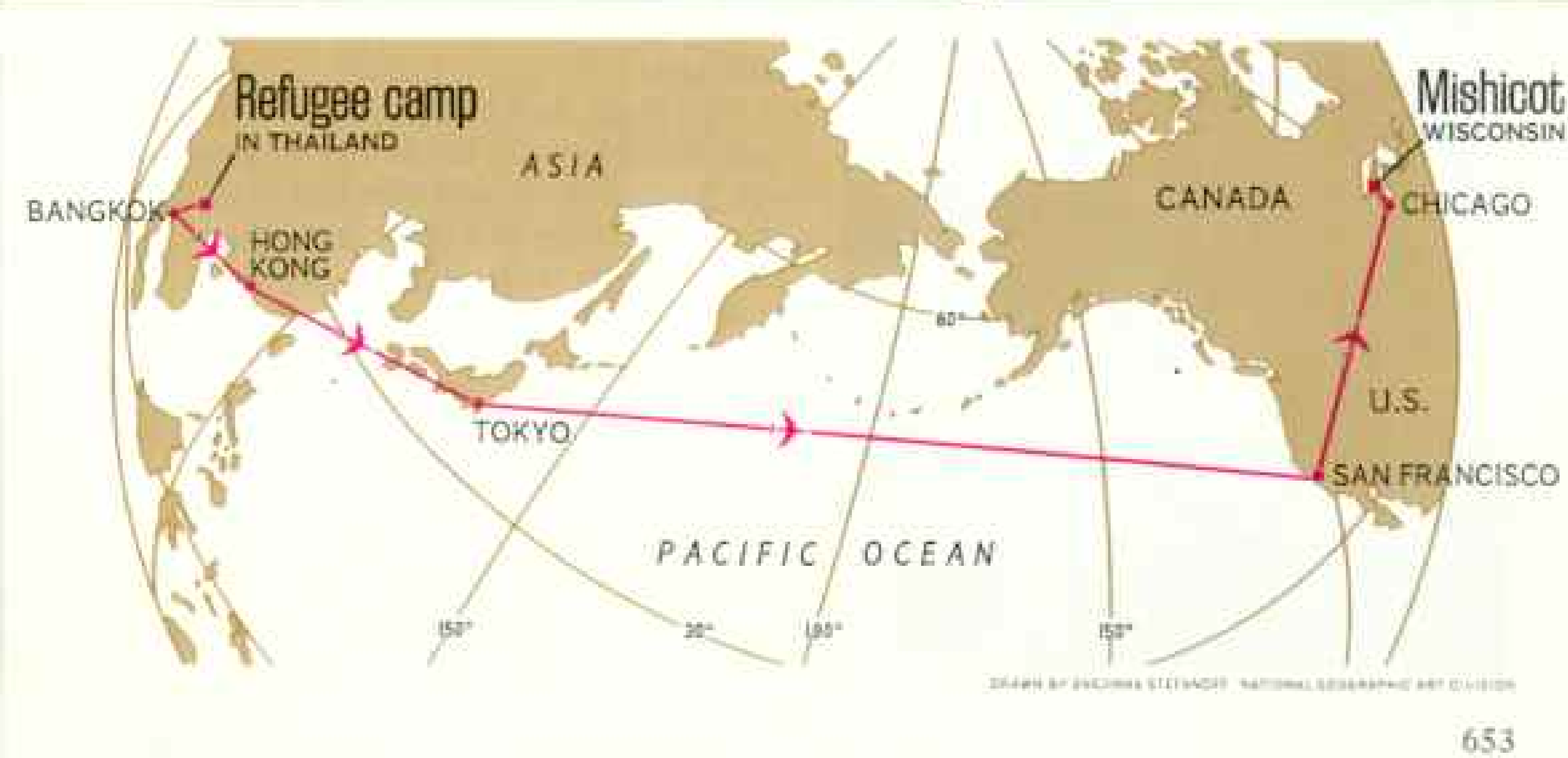
Dawn arrived, but their breakfast didn't. Regular passengers, checking in, gawked at Grandfather's black tribal costume and skullcap. Equally mystified by the marvels of his first airport, Grandfather stared right back in silence.

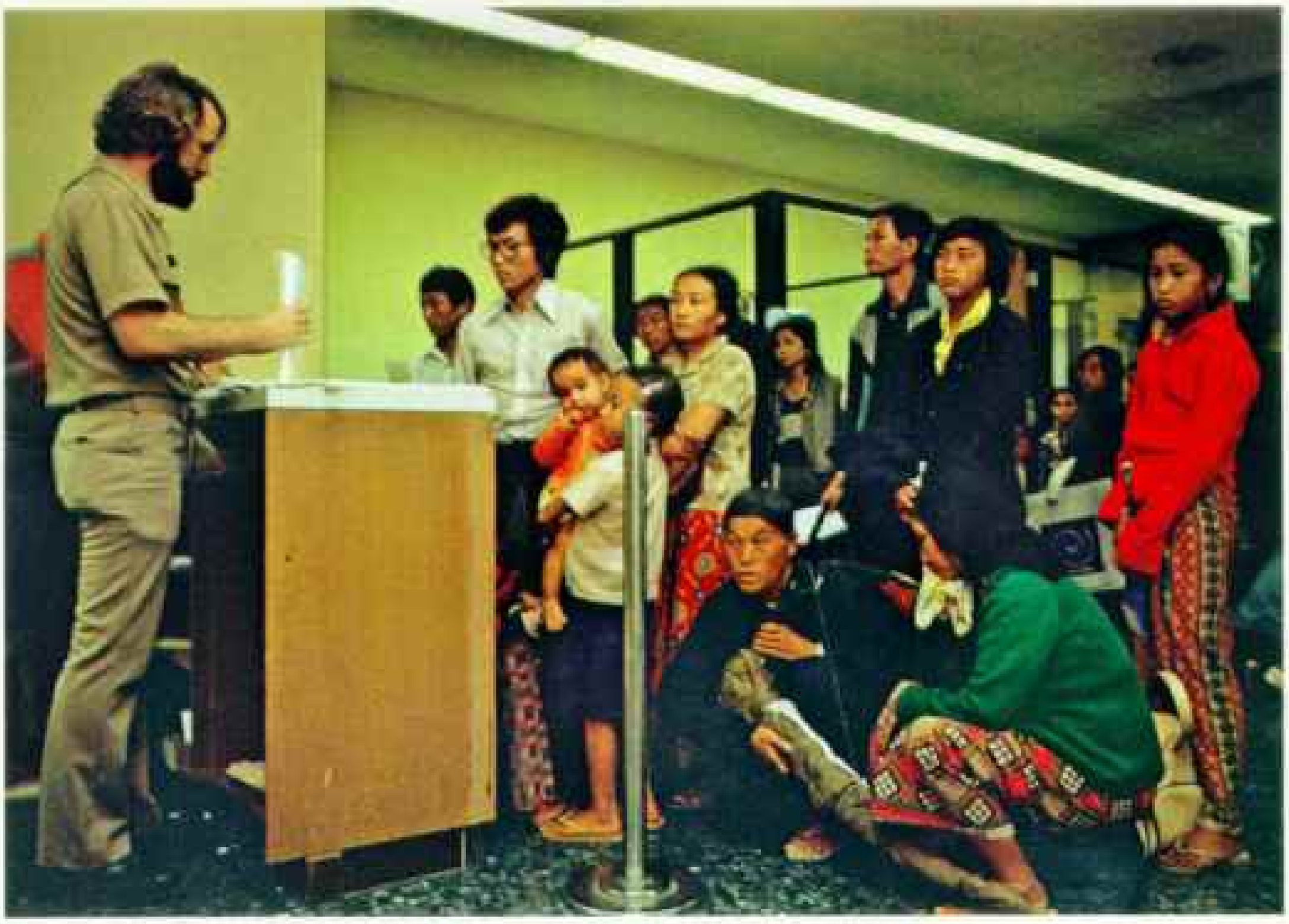
Disaster was narrowly averted when the Xiongs' group was discovered boarding the wrong aircraft. They had mistakenly joined another refugee contingent.

Tired and hungry, the Xiongs were finally belted into their seats in the big jet at midmorning. When the plane took off, Thailand's refugee burden was a little lighter. Then breakfast was served, and the Xiongs were elated.

The approach into Hong Kong, and the sight of the hills of China in the distance, thrilled Grandfather (***above***). "From childhood I've listened to fables of our ancestors in China," he told me. "But I never believed I'd see the homeland myself."

After a short flight to Tokyo the plane headed across the Pacific Ocean, and the weather turned foul. Most of the refugees, including the Xiongs, were soon airsick. Complained Grandfather, "In the air I feel drunk all the time." An unusually flustered flight attendant questioned other passengers. "Sir, are you going to be sick too? May I take your airsickness bag, if not?" It was a rough trip for everyone.


Refugee camp
IN THAILAND
ASIA
BANGKOK
HONG KONG
TOKYO
PACIFIC OCEAN
CANADA
Mishicot
WISCONSIN
CHICAGO
U.S.
SAN FRANCISCO
60°
150°
30°
90°
150°



LANDING in America brought the Xiongs just another three hours of waiting and processing at their first stop in San Francisco (***above***). Before health, immigration, and customs checks were complete, the elders had scant energy to stand.

They missed two flights to Chicago and were relieved to spend the night in motel rooms. There Grandmother slept atop the covers of her bed, while young Yer was delighted with her first doll (***left***).

The flight to Chicago and a five-hour drive brought the family to eastern Wisconsin. A road sign told them the name of their new home for the first time, "Mishicot, population 938." In front of the Holy Cross parish school, the pastor, Father Brouchoud, seized Nao Leng's hand, "Welcome! We've waited so long." Inside, a reception engulfed the family as their cousins from nearby Manitowoc, other Hmong, and local people crowded round (***right***).

"A REFUGEE needs a little more." Henry Gray, president of the Holy Cross Parish Council, the Xiongs' community sponsor, was talking about Midwest hospitality.

A Midwesterner's "little more" represented considerably more than the Xiongs had ever owned in Laos. The Roman Catholic parishioners had prepared a small two-story house out where the village of Mishicot fades into farmland. As the Xiongs stepped inside for the first time, it looked as if another family had stepped out just minutes earlier. The heat was on, a refrigerator brimmed with food, and beds stood made. In the closets hung winter clothes for each member of the family. Television, radio, and phone were connected.

A "little more" also included a warm welcome from the townspeople, as well as the Xiongs' introduction to frozen water (**below**) with a sled ride on a local pond. Winter perplexed Grandfather: "Strange, so strange. The trees are all dead wood. Everything is so white and so cold. It must be the clouds falling down."

It was the vision and energy of jovial, popular Father Brouchoud that sparked his parishioners to bring the Xiongs to Mishicot.

"It's so easy to take up a collection and ship it overseas," he told me, "but I believe Christ expects much more of us—to take in not just our own kind when in need, but all mankind.

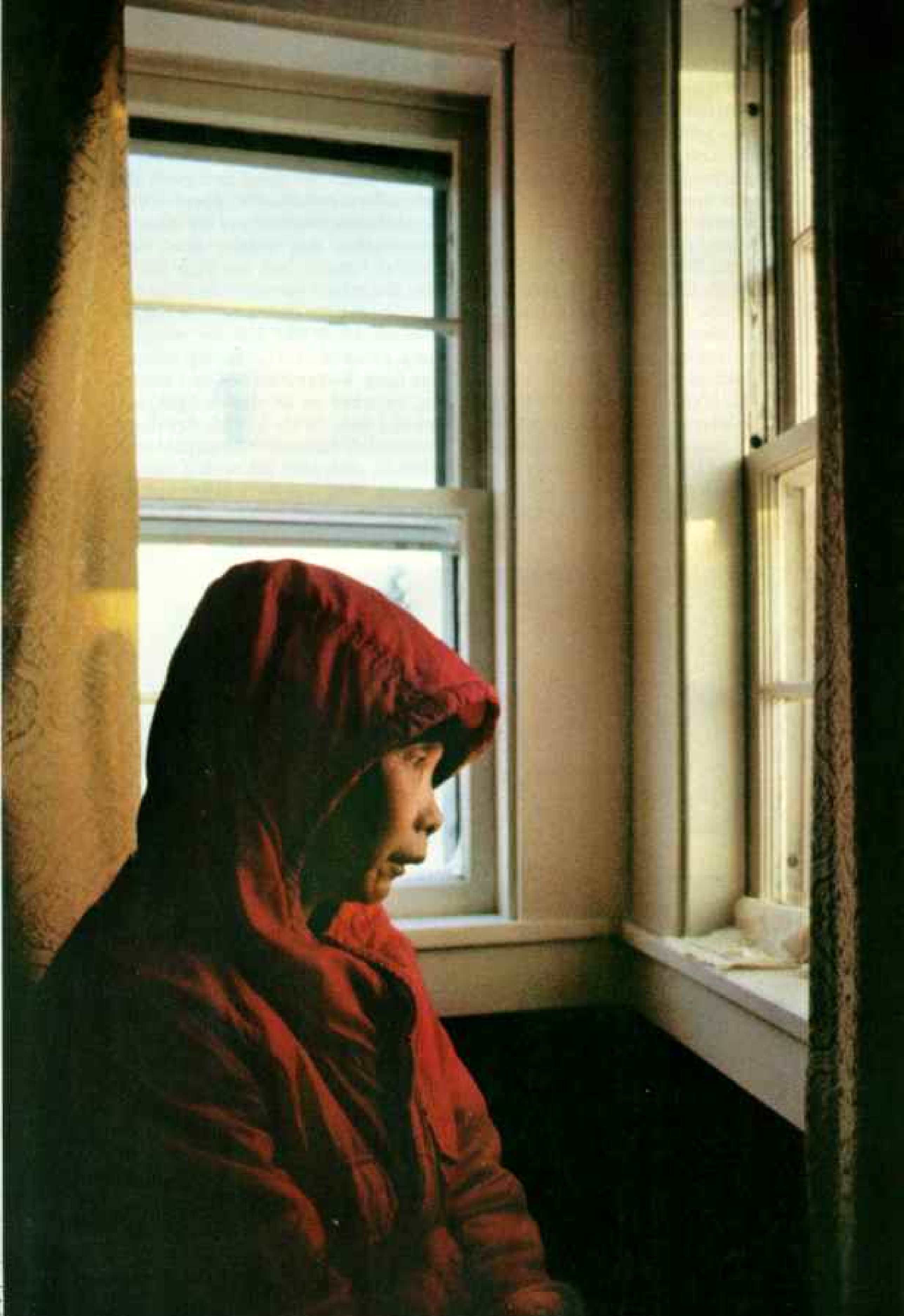
"There was some opposition to bringing refugees to this community," he went on. "Some protested—thought they would never get along

here. But for every one against, there were three people for it."

The parish council's appeal for support brought an overwhelming response. "Our people gave so much for the refugees," said Father Brouchoud, "that we could use but part of it. I would open my door and more things would just be stacked there."

Florenz Baugniet repaneled and repainted the little house with special affection—he had been born there 67 years before. Local women spent hours cleaning rooms and arranging the donated furniture. One donor, thinking of children born in the tropics and small cold feet, had a carpet laid. Tom Kennedy learned the Laubach method of language instruction in order to teach the Xiongs English. And a job, a local factory manager promised, would be held open two months for the head of the family.

The community's support buoyed the Xiongs' spirits as they faced the enormous transition into new routines. I found the speed and gusto of their efforts remarkable. Faced with the confusing labyrinths of the village supermarket, they quickly spied the familiar banana, but the high price gave immediate incentive for them to experiment with apples and other local produce. Until they left the refugee camp, no member of the family, except Nao Leng, had ever turned on a water tap, switched on an electric light, or locked a door. Yet in a single day they mastered all the modern household appliances, and were left with a single question. Why was there an oven pilot light that wouldn't go out?



CULTURE SHOCK hits hard. Void of expression and desire, Grandmother passed many days staring blankly at the forbidding icy world outside (***facing page***). Nothing could induce her to part with her parka, despite near-tropical heating inside the house. Chores like washing dishes (***bottom***) energized her briefly, but it was weeks before she began to recover. The other eight Xiongs adjusted quickly. Grandfather took curious delight in everything around him. Simple things were adventures—like

buying his first shoes (***above***), which even brought a rare smile to Grandmother's face.

Nao Leng went to work just ten days after arrival, operating woodworking machinery. "Easy," he said of the job. Bob Schenck (***top***) declared his new employee "a waste of talent on ordinary machinery," and promised better things for his future. In school Nao Leng's brother and sisters also excelled, amazing their teachers with their quickness. "We've never seen this kind of enthusiasm for study among our own kids," said school principal Hazel Eisenmann. "It's an excellent influence."

NEW COUNTRY, new home, new customs, new life. Taken half a world apart, two family portraits of the Xiongs point up in sharp contrast how their world has changed. The traditional costumes worn on their last day in the refugee camp (***top***) have been carefully packed away. And although their new Western clothes may seem strange and their winter surroundings bleak, life in Mishicot, Wisconsin, holds a springtime of promise.

The Xiongs are one of the lucky few among Hmong families. Few escaped intact. Files of hundreds approved for entry into the U. S. reveal a horrible scarcity of families complete with both parents and children. Tens of thousands of refugees have flooded the Thai camps since 1975, and more than half remain. The Xiongs' nine-month stay was brief.

A report released last January by the U. S. Department of Health, Education, and Welfare describes most of the newly arrived refugees as "living in marginal circumstances . . . in overcrowded, ghetto-like housing . . . receiving insufficient assistance, particularly with orientation, English language and employment training."

Knowledge of English was the reason one Hmong moved from Rhode Island to Wisconsin. "My sisters here can't speak it. They needed me badly."

Cultural orientation might have helped keep one love-struck Hmong youth out of a Chicago court. Kidnapping a prospective bride from her uncooperative parents is an age-old custom in Laos. But not in America, as this confused Romeo learned when he took a 13-year-old across state lines. The judge, noting lack of preparation for U. S. society, was lenient.

The refugees' problems are manifold, yet most are determined to rebuild their shattered lives. The HEW report quotes a mental-health counselor: "Overall, their resiliency is much more startling than their depression. They are doing much better than they should be, considering what they have been through. These people are survivors—they can do most anything."

As for the Xiongs, Nao Leng is bringing home paychecks, his wife has part-time work, and even Grandfather has been job hunting.

"Everything is so good for us here," said Nao Leng as he expressed gratitude for all Mishicot has given them, "and we have nothing to give at all."

Father Brouchoud disagrees. "It is really our people who have gained the most. All we have given is furniture and things. What we got back is more beautiful. This has forced us all to open our hearts as we've never done before. And we found love." □

Long Island's Quiet Side

By JANE SNOW
Photographs by SAM ABELL

AS A "BONACKER," Milt Miller belongs to the most exclusive society the fashionable East End has ever known. He and others like him, nicknamed after Acabonack Harbor, one of their favorite fishing spots for generations, are among the real first families here. They descend from English settlers who began moving onto the southeastern tip of New York's Long Island not long after the Pilgrims stepped ashore at Plymouth. The passing centuries have not erased the influence of their ancestors from their speech and attitudes.

Aloof with strangers like me as well as "not long in the mouth"—both Bonacker traits—Milt unbent a bit. "We farmed and fished to eat all our years, and traded for what else we needed. Lived by nature, and it's been pretty good to us. I've seen most of the world in the war, but a man's got all he wants right here around Acabonack Harbor—eeling and scalloping in winter, seining along the beach for stripers come spring. Just following the fish and the seasons."

The benevolent seas and shores that brought the Bonackers and kept them here have long attracted

Within sound of the sea, *partygoers gather at a charity benefit in Bridgehampton. The East End's quiet beach towns, long home to farmers and fishermen, have become favorites of writers, artists, and socialites.*

Rolling out of an elegant past, Ray Enstine's 1936 Packard convertible

an amazing amalgam of more worldly enthusiasts—the wealthy, creative, socially prominent, and seekers of solitude.

Albert Einstein spent summers on the East End years back, working (without knowing it) on a new theory of relativity, trying to master sailing a boat while reading at the same time. One of my friends recalls how this noble experiment ended:

"There was this fellow with flyaway hair, scudding along with his nose in a book. He forgot to tack, and capsized. A local lad rowed out and rescued the old man. 'How come,' the kid said, 'you're so dumb?' "

A lobster claw of land, the East End reaches boldly into the Atlantic, its pincers—the North and South Forks—ever poised to snap up its major offshore properties, Shelter and Gardiners Islands, and the blue tatter of Peconic Bay.

Bounded on three sides by a meandering 555-mile waterfront—longer than Oregon's coast—this final sixty miles of Long Island's lean body remains a bit too inaccessible to attract much industry or the Manhattan commuter. Yet its proximity to New York

sedan, one of 17 vintage cars in his private collection, cruises near Southampton.

City—less than 75 miles away—its superb stretches of broad beach, its perfect mating of land and sea, all have made it a mecca for some of the nation's best known names.

Fleeing the pressures of Manhattan, Lauren Bacall strides along the Amagansett beaches while Alistair Cooke golfs on the North Fork. Angier Biddle Duke, Anthony Drexel Duke, Gloria Vanderbilt, and Charlotte Ford are among the many second- and third-generation summer people; their predecessors began building palatial estates on the East End in the 1870s and '80s, when seaside vacations here became chic and the Long Island Rail Road extended service to the South Fork.

Gentled by the warmth of the Gulf Stream, little changed by the last century, the East End jealously guards its quiet world of the famous and the talented, the farmer and the fisherman.

Like countless others, I started on the East End as a weekender; later I became a full-time resident. Sailing in from Connecticut for the first time, I followed a course set long ago by turpentine gatherers, freebooter

Capt. William Kidd, world-girdling whalers, and pioneers from New England who came principally to farm.

The Yankee transplants found good crop climate and new surroundings much like their old ones: the glacial moraine that shaped Nantucket and Cape Cod, and waters rich in food fish. Since the East End was a part of Connecticut in the early days, in a way they never left home.

Their imprint endures in neat coastal villages, carefully cultivated fields that still cover 15 percent of the region's quarter-million acres, and taciturn men of the sea like Carl Darenberg, Jr., who talks in slow tempo of the fortunes of sportfishing.

"Been making out OK in summer, starving winters. Mostly I carry parties off Montauk Point, giving them a crack at some of the best waters north of Florida for white marlin, swordfish, white and mako sharks."

A magnificent 291-pound mako hung from the dock scales. "Feel it. Skin's like sandpaper. Old-time cabinetmakers used it to rub down furniture. Probably still work today, if anyone bothered."

Carl has seen sportfishing quadruple here since he began chartering in 1940. He's also seen a new challenger emerge in Montauk's unofficial white-shark sweepstakes, where the only prize is one of pride.

"Frank Mundus landed the last record breaker back in 1964: a 4,500-pound, 17½-foot monster. Made him quite a celebrity; some say he inspired that Quint character in Peter Benchley's novel *Jaws*.

"In 1978 Jimmy Sweetman harpooned one he figures ran 'most thirty feet, eye measured against his 40-foot boat. It got away, but there's still plenty out looking for it."

Fishermen like Carl and Jimmy navigate by Montauk Light. It has been signaling from the South Fork's easternmost headland since 1796. Then it stood almost 300 feet inland; today it hovers only 45 feet from the water, its margin of safety eaten away by wind, rain, and wave.

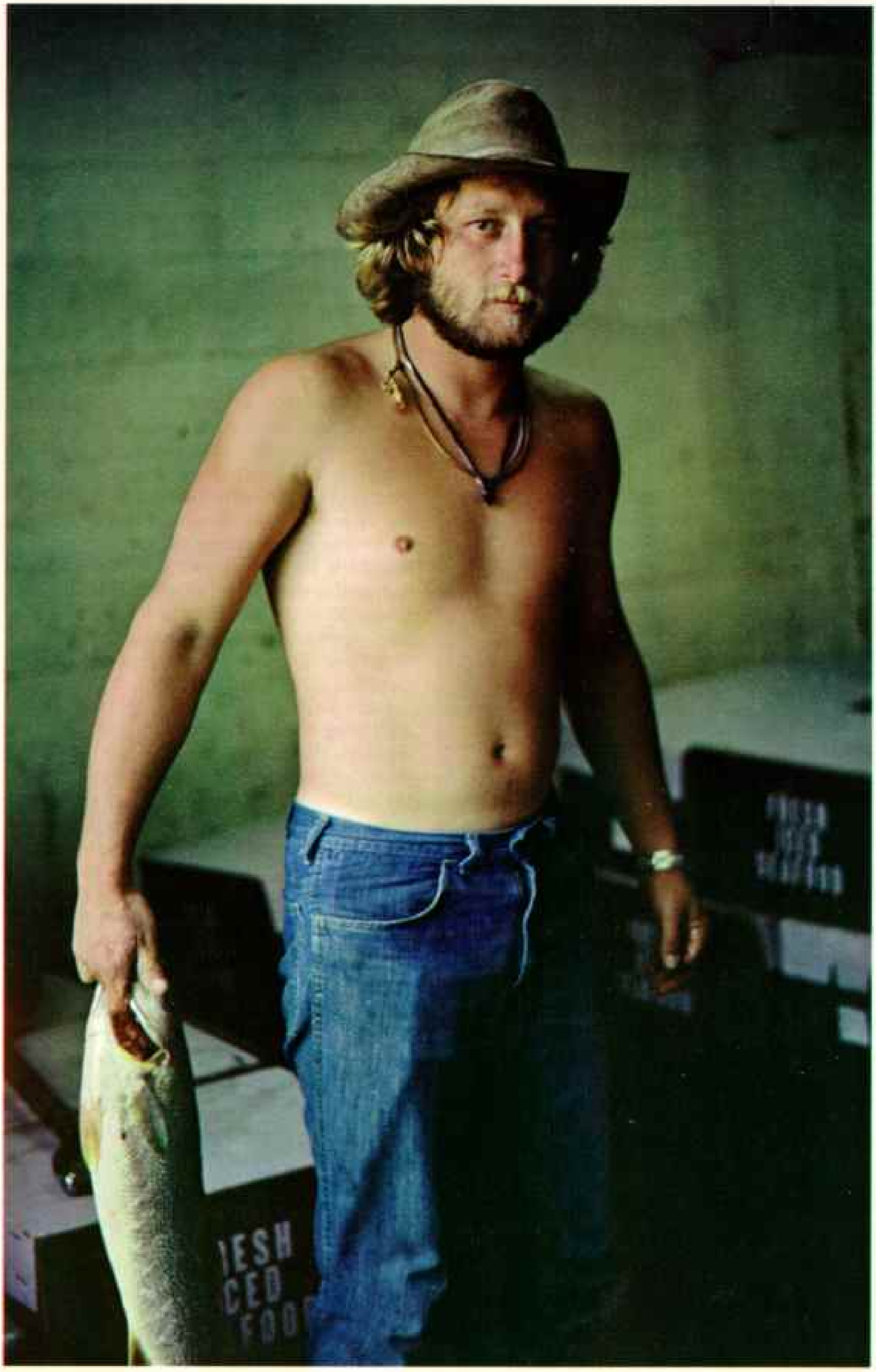
Giorgina Reid, a nimble and dedicated 70-year-old, has no intention of letting the Atlantic capture the remaining land. Skittering up and down the high embankment, she has helped the U. S. Coast Guard put in hundreds of terraces and plantings to stabilize the slope.

NATURAL FORCES continue to reshape the Montauk area, a bleakly beautiful ten-mile reach of crags, hills, scrub pines, and glacial kettle holes. But man's efforts to alter this scene have met with less success, except around the marinas. Things would have been different if, back in the twenties, plans of a promoter named Carl Fisher had worked out.

Having masterminded the Indianapolis Speedway and Miami Beach, Fisher tried to transform sleepy Montauk into a chic resort. When the stock market crashed in 1929, so did his dreams. But he had left his imprint on the one-story business center with an incongruous seven-story office building.

Fisher left one worthwhile legacy. He cut a channel into what was then landlocked

"It's potluck," *says Bill Leland* ***(left)*** *of haul seining, an East End fishing method requiring two pickup trucks. A net is set in the surf from a dory, and the trucks, some yards apart, winch it back to the beach. On a good haul a captain and his crew can catch as much as 10,000 pounds of bluefish, striped bass, or weakfish, one of which lands at an Amagansett market in the grip of Roy Wethy* ***(right)****.*


IESH
CED
FOO

RICHARD FERRY

Lake Montauk, leading to its development as a spacious and safe harbor for one of the East End's largest fishing fleets.

Relatively unspoiled Montauk, with its thick wet fogs and taste of salt, remains a magnetic sea gate to the "Hamptons," as the succession of villages—East Hampton, Bridgehampton, Southampton, and Westhampton—strung along the East End's ocean shore are called. Even before Fisher's grand design collapsed, the elite were gathering in the Hamptons.

Duplicating a pattern that was popularizing other East Coast playgrounds, the wealthy began summering on the South Fork in the 1870s, as artists and writers proclaimed its charms in paint and print. Among the early artists were Thomas Moran and William Merritt Chase. They were part of a group who called themselves the "Tilers," as they'd agreed to paint one tile a week apiece. Many of them had come from New York City to produce a series of illustrated articles for *Scribner's Monthly*, a magazine with considerable cultural influence. Working beside pond and pasture in their flowing ties and velvet knee breeches, they became a tourist attraction.

Later painters also found the East End appealing. Fleeing the congestion of the city while remaining close to their agents and their markets, finding the light and life-style conducive to their work and the cost of land within their means, they too began congregating on the South Fork. Through the years their numbers have included such distinguished artists as Dutch-born Willem de Kooning (pages 670-71) and the late Jackson Pollock.

Another artist, actor and playwright John Howard Payne, reputedly was born in East Hampton. In any event, villagers are sure the place inspired his lyrics for the all-time hit "Home, Sweet Home." To me, Capt. Samuel "Fishhook" Mulford has a greater claim to local renown. On a trip to London in 1716 to protest the royal whale tax, this ingenious native son sewed fishhooks in his pockets to snare purse snatchers.

The Hamptons galaxy with their satellite hamlets have welcomed many prominent persons. South Fork residents, past and present, include writers John Steinbeck, Saul Bellow, James Jones, Truman Capote,

National Geographic, May 1980

DRAWN BY ISAIAH BAIAH, COMPILED BY ROSS EWERDA, NATIONAL GEOGRAPHIC ART DIVISION

Winds of rebellion *blow on Long Island's rural eastern forks, where some residents urge a split with urbanized western Suffolk County. But the breeze gusts impartially on Long Island Sound (***facing page***), as racers sail to Block Island.*

Kurt Vonnegut, and playwright Edward Albee (page 671).

OLD-TIMER Cecelia Anderson, who was born and bred in the Southampton area, cherishes memories of the days when, as a young girl, she was a lady's maid.

"It used to be so lovely. Now there're all these new people coming out here in the summer. Most of the old-timers have passed away, and those who're left don't have so much help now. Maybe two instead of six or seven servants in those big houses, some with thirty or forty rooms.

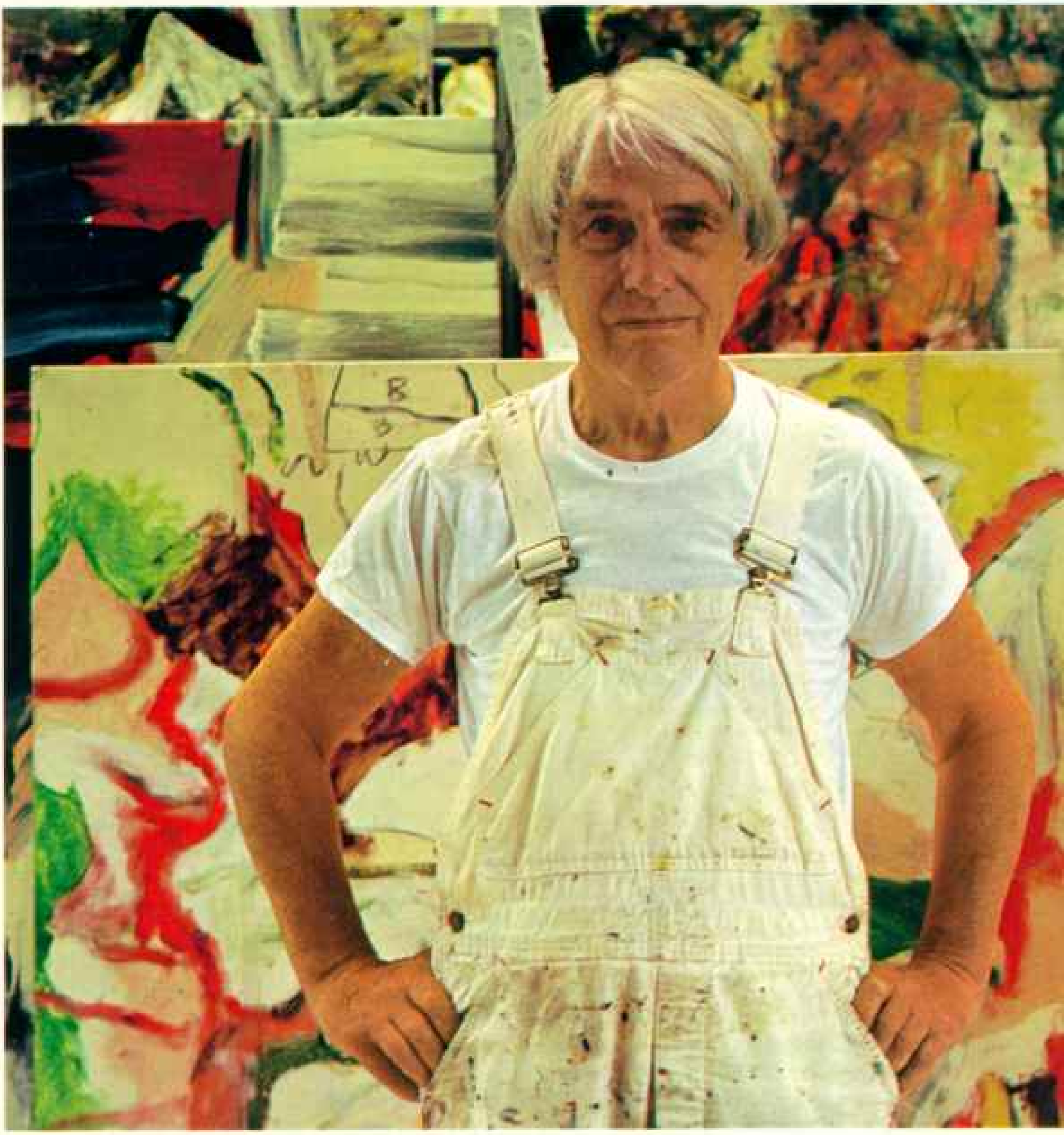
"But you can tell the nice people by the way they dress and the cars they drive. They're just different, that's all. Of course, I know most of them anyhow.

"They're still having the big parties, though, just like before, with great striped tents on their lawns and guests coming in from all over.

"Mrs. Murray—that's Charlotte Ford's grandmother—used to do her own shopping in Gristede's, our grocery store. But most of them had the help do the marketing. Now they even push their own carts, and in the supermarkets at that."

Back in the elegant Edwardian era, private railcars rolled in loaded with children, dogs, governesses, maids in long starched uniforms, and trunks enough for a dozen lorries. Now expensive contemporary-style houses are being built, and the tennis court has become the status symbol. Newcomers pay an astronomical price for a beachfront lot large enough to accommodate one.

Product of a lifetime of Southampton summers, automobile heiress and dress designer Charlotte Ford also enjoys playing tennis with her daughter, both at local clubs and on her own turf. "The Hamptons, people and property, have changed almost 100 percent in recent years," she told me. "But I'm still living on land that belonged to my



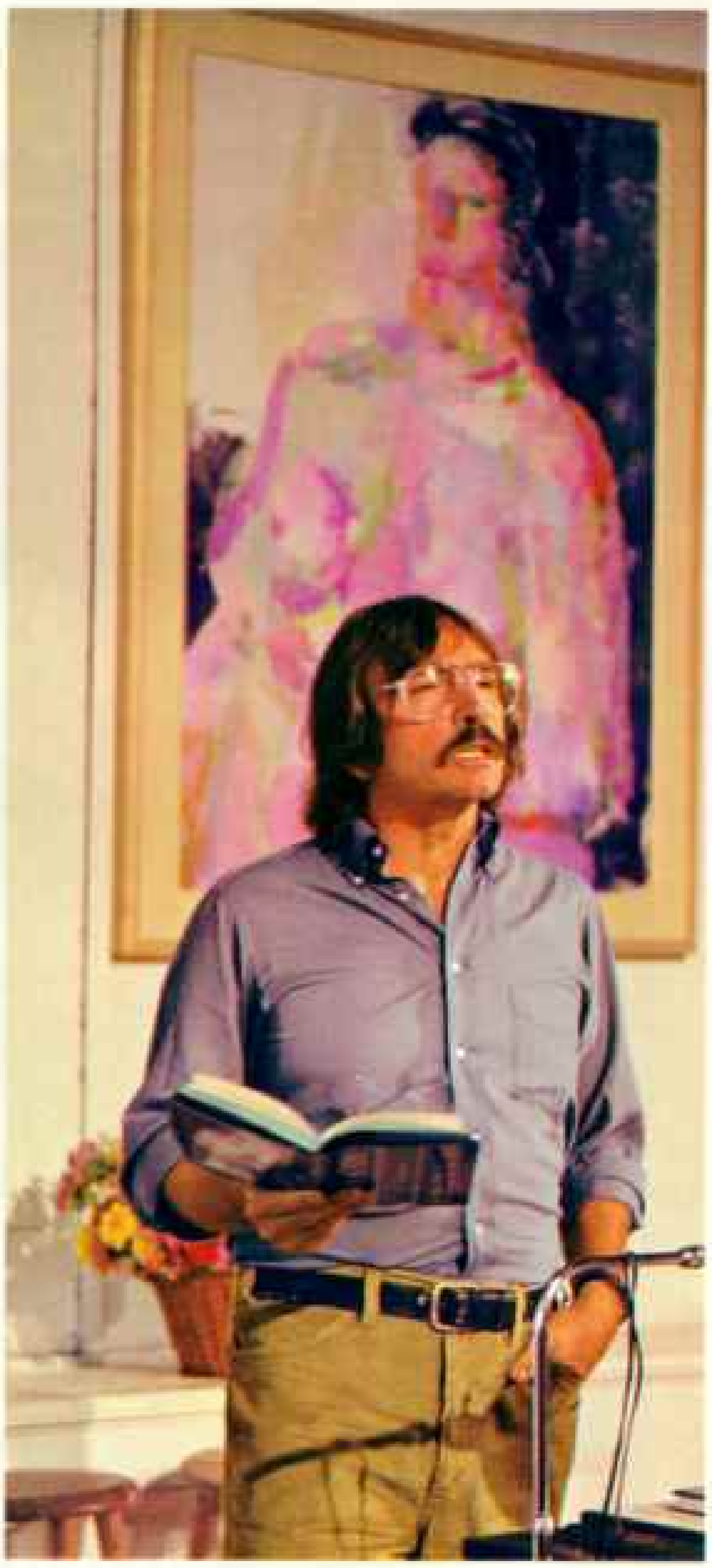
grandmother—the old Murray-McDonnell enclave. It had only two big houses then; both washed out to sea 12 years ago. Now ten others have replaced those two, and there's building all around. It's tough to say no to the prices being offered.

"I don't spend much time in town either. Summers, the streets are crawling with motorcyclists and backpackers sleeping all over the place. At least they haven't corrupted the sea yet or that gorgeous beach out there; there's no match for it anywhere—Portugal, Spain, Rio, Hawaii."

The beach indeed is a spectacular sight, almost an eighth of a mile wide in places and running along the south shore for a hundred miles, all the way to Coney Island.

Southampton's Bob Kennelly knows most of the East End stretch intimately. As the area's prime mover, he has jacked up and shifted to safer ground many a summer home endangered by dissolving dunes and the relentless sea.

Bob has also wrestled scores of historic buildings onto new sites. He explains: "A lot of people here have the money and urge to



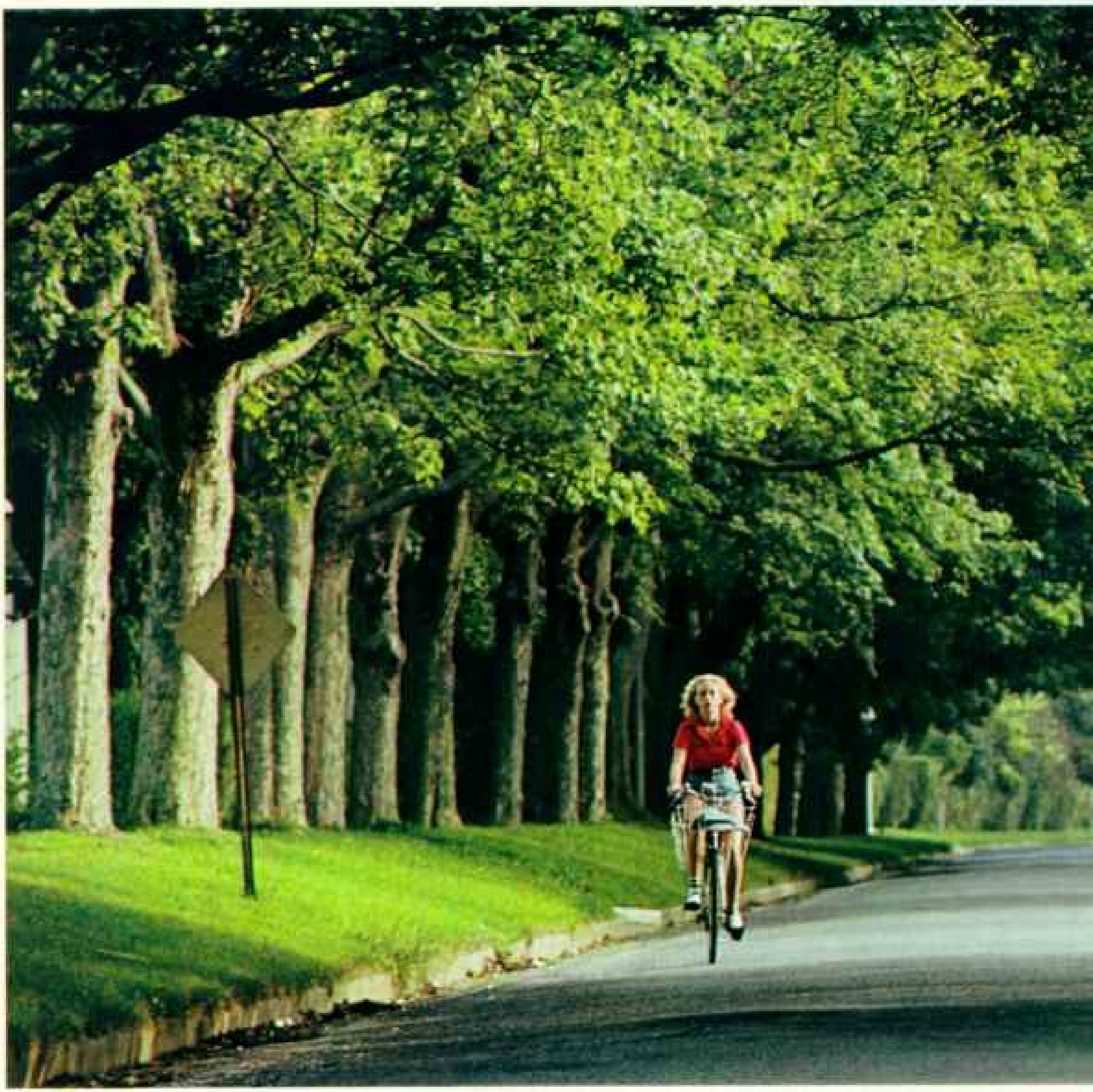
Seeking solitude *in remote villages, prominent artists and writers have colonized the South Fork. At Springs, Willem de Kooning, a pioneer of abstract expressionism, fills his studio with color (***above left***). And at Montauk, playwright Edward Albee, who reads from his Pulitzer prizewinning* Seascape *(***above***) at a Sag Harbor art museum, has set up a foundation for artists and writers in a former carriage house at his home.*

own and renovate something old. I can understand it; I live in a 19th-century farmhouse I hauled 35 miles from Baiting Hollow on the North Fork. In my 27 years on the job, I've moved at least one of just about everything: brooder houses, a rumrunner's shack, churches, fish markets, a fire station. I've even subdivided some of the big old houses horizontally, making two separate homes out of the first and second floors."

Many old structures were permanently removed when hurricanes struck this valuable, vulnerable strand. The worst roared

Advertisement for easy living, a doll named Sophie shares the porch of

a Sag Harbor boutique with owners Roxanne Allen, left, and Julie Snow.



Guardians of privacy, stately maples stripe Southampton's First Neck

through in 1938, giving the south shore a beating and washing away great swaths of dunes and dwellings. Hampton Howell, whose family was one of the founders of Southampton in 1640, remembers that hurricane as the deathblow to the serenity his village had always known.

"We'd had four, five days of rain, and the ground was mush," he said. "A hundred-mile-an-hour wind toppled our great old trees as if they were tenpins, blew out doors and windows. Walls exploded. Then the water came surging in—this giant wave. In some places the damage was weird. It cut a twenty-foot slice right out of the middle of what was then the Gill place and left a forty-foot cabin cruiser hole-high on the 14th green of a golf course.

"When it was all over, the barrier beach had been swept clean of 150 houses. Many of their owners never came back."

But other people replaced them, bringing a life-style as lavish but livelier than before. Today the beach bristles with clubs, condominiums, and expensive homes more cubist than conventional in design. Some of them perch on pilings for a tiptoe peek at the sea; others sport solar domes reminiscent of gun

RICHARD PERRY

Lane with shadows. Tall hedges shield residents from curious onlookers.

turrets on a World War II Flying Fortress.

The demand for East End property has spread beyond water-view acreage. Inland farmers are being enticed to sell out and cash in, threatening one of Long Island's most durable resources, its potatoes. Developers look longingly on potato land. The fringes of many fields, especially on the South Fork, already sprout crops of summer homes, and potato acreage shrinks with every season.

Nat Talmage, the 78-year-old squire of Friar's Head Farm on the North Fork, considers this trend injurious to the East End's delicate ecology, especially its supply of fresh water. "It is drawn almost entirely from underground reserves," he said. "If overpumping occurs because of increased need, saltwater contamination may result." Others blame contamination on industrial wastes, fertilizer runoff, and pesticides.

Potato farming is in the Talmage blood. Nat's grandfather started on the North Fork in 1882, after deciding that this land was more productive than the fields around Westhampton. Two years later he introduced the first mechanical potato-digger to Suffolk County. By hand, he had been getting as many as nine tons of potatoes an acre.

Currently the average is almost twice that.

"In my dad's day," said Nat, "Polish immigrants began moving in, mostly recruited right off the boat. We paid them around $15 a month, plus room and board. When their wives arrived, they joined their husbands in the fields. They've worked hard, and now their descendants own more than half the farmland out here."

The Talmage place has come down to Nat's son, John, who feels strongly about saving agricultural land. He helped devise an innovative conservation plan—first of its kind in the U. S. I asked John how it works.

"The county," he replied, "pays a farmer for his property's development rights—the difference between its value for agriculture and any other use. In return, the owner must keep the land rural. Even if no future generation should want to farm it, it must remain vacant."

To date, the Farmlands Preservation Program, adopted by Suffolk County in 1977, has purchased 3,400 acres of rights for 12 million dollars. Acquisition of some 15,000 acres, costing 55 million dollars, is authorized. Some nonparticipants claim that the county price is from $1,000 to $1,200 an acre below fair market value. Even so, many farmers have signed up.

The Talmages, first to sell their rights, were unhappy about the price the county paid. But they're convinced that it was the only way to forestall the land grab that threatens to eliminate much of the East End's open space.

Master of cuisine *Craig Claiborne, preparing for dinner at his Hands Creek home* ***(above)****, delights in the region's delicacies, from freshly picked corn and newly dug potatoes to Gardiners Bay oysters, Peconic Bay scallops, and Pekin ducks, such as this flock* ***(facing page)*** *near Eastport.*

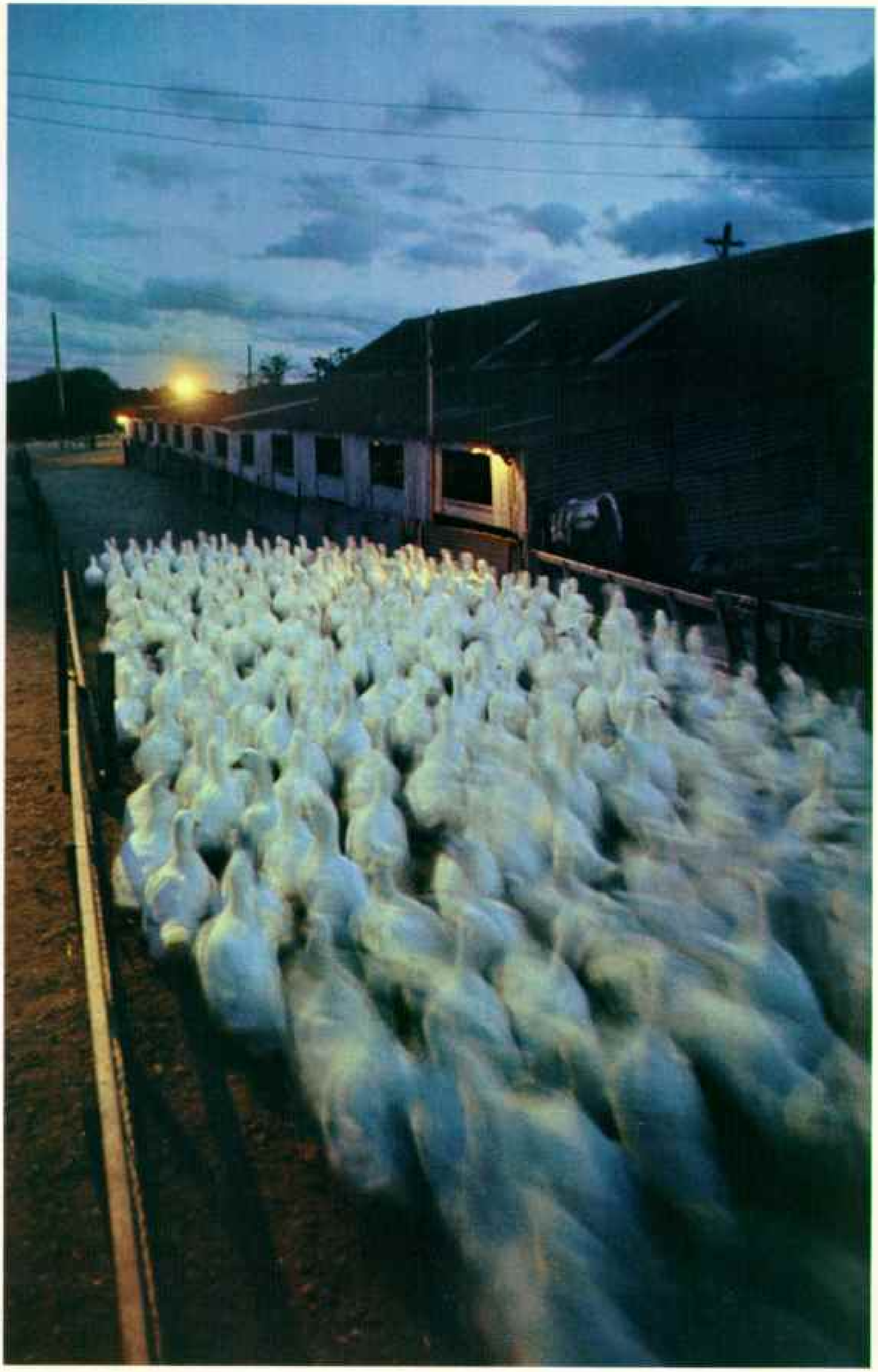
PRESSURE for land development is strong enough to be felt even by the long-established duck industry. Visiting the C and R Hatcheries in Westhampton and near Riverhead on the rural North Fork, I had difficulty envisioning homes rising on duck land. Over the years millions of ducklings have stripped away all vegetation here. Dunes of droppings overpower the scent of salt.

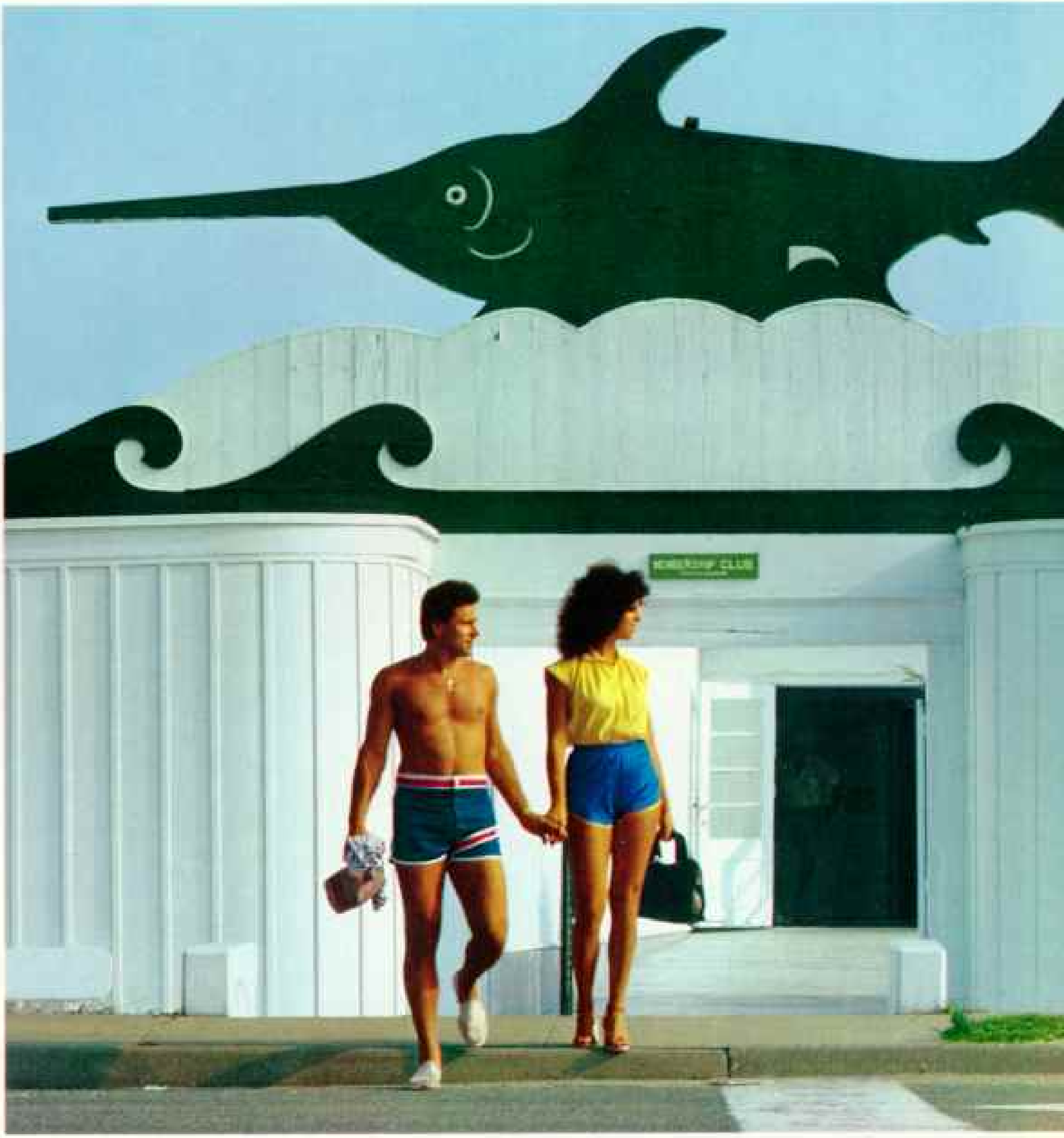
One pen billowed like a giant feather pillow as 1,000 ducks milled on a barren acre. "Those are layers, good producers for about two years," said stocky Ward Phillips. He and his brother John run breeding and marketing operations. Another brother, Bruce, handles the hatchery.

Howard, their father, oversees the operation. "Letting our ducks run loose," he says, "is the reason they're better than cage-bred ones raised in other places. And we've got the climate here they like; Long Island ducks grow up naturally, as they should. More succulent than most, well worth the premium of two or three cents more a pound people are willing to pay for them."

The Phillipses ship about 70,000 day-old ducklings a week to East End farmers. They, in turn, market more than five million young birds a year—one-third of the country's Pekin duck production.

All the ducks supposedly descend from seven brought into Riverhead from China





by a clipper captain around 1873. Now, in a neat turnabout, the East End is exporting ducks' feet to Hong Kong. Stuffed with crab meat or fish and deep fried, they are a delicacy to the Chinese.

"Not all the 25-million-dollar duck industry here is flesh and feet," Howard Phillips said. "Feathers and down bring $2.50 a pound; head and waste parts are ground into mink food. We scrape out the sheds daily and sell the waste; landscapers buy the 'straw manure' for fertilizer."

Less attractive to developers than the South Fork, the remote North Fork's long flat fields still roll away virtually undisturbed. In spring the newly turned earth lies beige and chocolate in the shadowing light of an afternoon sun. This is ancient farmland. When the first white man ventured onto Long Island to tap its pines for turpentine, peaceful Corchaug Indians had been cultivating patches of land along Peconic Bay for at least 600 years.

"Most of my friends don't even know where the North Fork is," declared journalist and television personality Alistair Cooke,

For members only, *beach clubs like this one in Westhampton Beach cater to cityfolk weekending at the "Hamptons." The area's 500-million-dollar resort business is its largest, generating seven times as much income as does agriculture.*

who has been escaping here for 45 years.

Cooke also enjoys another aspect of the North Fork. He vows that he eats better here than at home in New York City, because the vegetables and the fish are fresh. The farmer at the roadside stand, he says, even suggests that he refuse the morning's corn crop and come back at five for the freshly picked ears.

Cooke relishes the local fish. "There are six species of splendid eating fish to be found here: striped bass, bluefish, swordfish, weakfish, porgy—even the blowfish, which has a fillet down the backbone as firm as Dover sole."

The fishermen at Greenport, like the South Fork's Bonackers, take what the season brings, traveling as far as a hundred miles out to find it. Most fought to bring about the 1977 law prohibiting foreign boats from fishing closer than 200 miles offshore without a permit. Third-generation Greenporter William Pell III cites some benefits:

"Take butterfish. Before the distance limit, foreigners dragged wherever they wanted. They even scooped up spawners, grinding them up for meal. In 1976 we were getting 28 cents a pound for them at the dock. Now the foreigners are buying them from *us* at twice that.

"Foreigners now pay for the privilege of fishing inside United States waters—within our 200-mile zone. The U. S. collected 13 million dollars from them in permit fees and poundage charges last year. There's no way those fellows can cheat. We put National Marine Fisheries Service observers on their boats at their expense—a daily fee plus transportation.

"This has discouraged a lot of outsiders. We're beginning to get into the world market. Japanese, Poles, Spanish—they've got to buy from us now. A friend grossed $48,000 from his catch last year. Sea scallopers going out to the Georges Bank earn $30,000 to $50,000."

The fishing industry is bringing prosperity to the little village of Greenport and sprucing up its gingerbready Victorian houses. The recreational sailor also is making a substantial contribution.

BOATERS COME in increasing numbers—from city jobs and the leisure life—to enjoy stiff, steady breezes and clear, uncrowded waters. The East End, with its prevailing southwesterly winds, is one of the choice sailing spots along the Atlantic seaboard.

Past Orient Point the North Fork skips out to sea, island by island. At Plum Island the U. S. Department of Agriculture researches highly contagious animal diseases. At Great Gull Island, researchers from the American Museum of Natural History study tern reproduction. Fishers Island is a forbidding place, a sailor's nightmare in a storm, with sunken reefs, shoals, ledges, and vicious currents.

Plum Island's research work prohibits drop-ins. Few people reach Fishers either, for different reasons. It is legally part of the North Fork town of Southold, but its only ferry service runs to New London, Connecticut. The rocky, windswept enclave of wealthy part-timers and some 400 permanent residents has checked the tourist tide simply by providing few guest facilities.

A no-visitor policy prevails at privately owned Gardiners Island, sprawling across Gardiners Bay like some gigantic flounder,

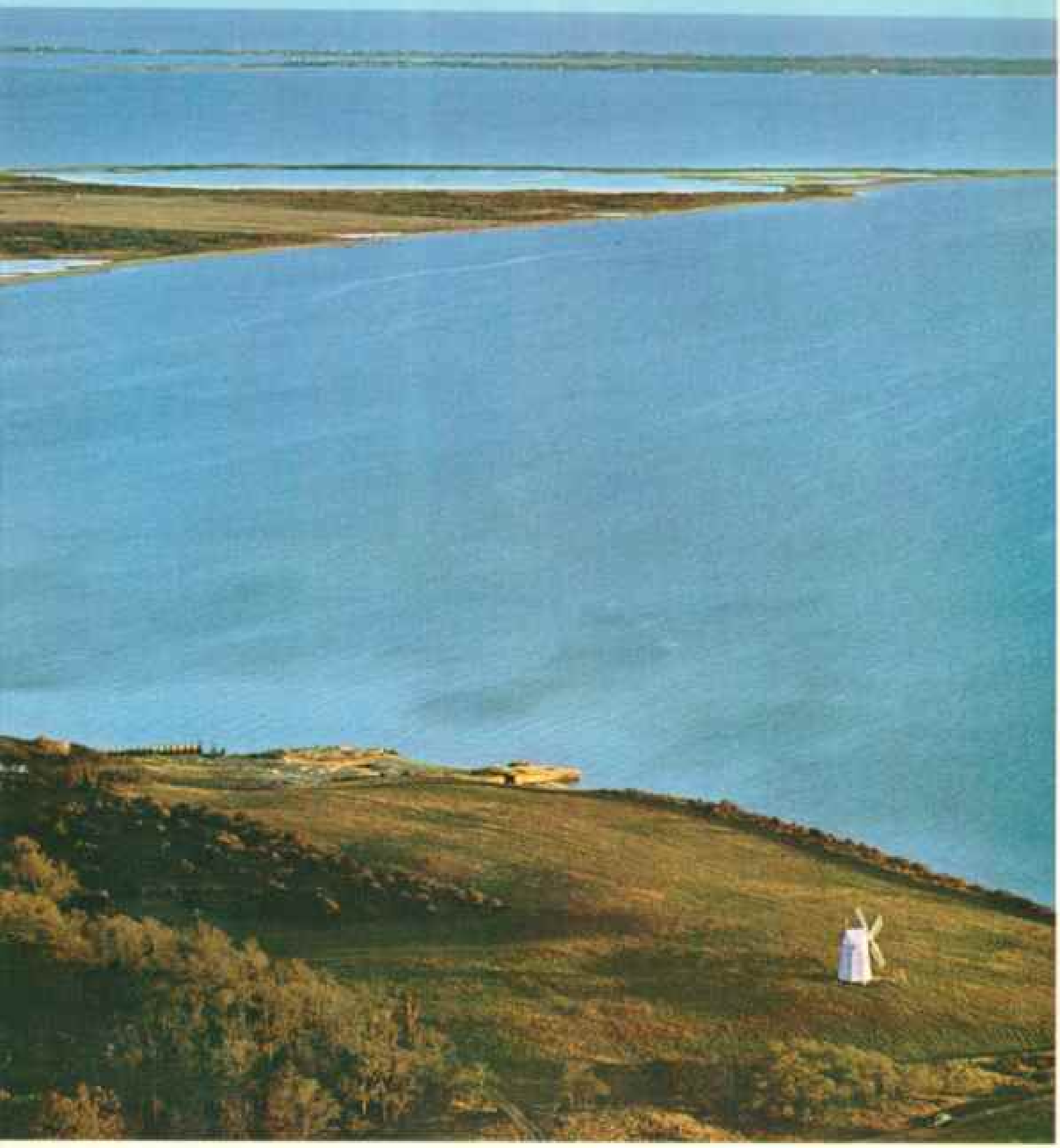
Lord of the manor *Robert Gardiner* ***(above)*** *rules a time capsule of nature and history: 3,300-acre Gardiners Island* ***(right)****. Acquired by his family in 1639, the island preserves acres of white oak, swamp maple, and wild grape. Turkey, deer, and osprey share the island with relics of Montauk Indians, a marker where Capt. William Kidd buried treasure, and this 1795 windmill, right.*

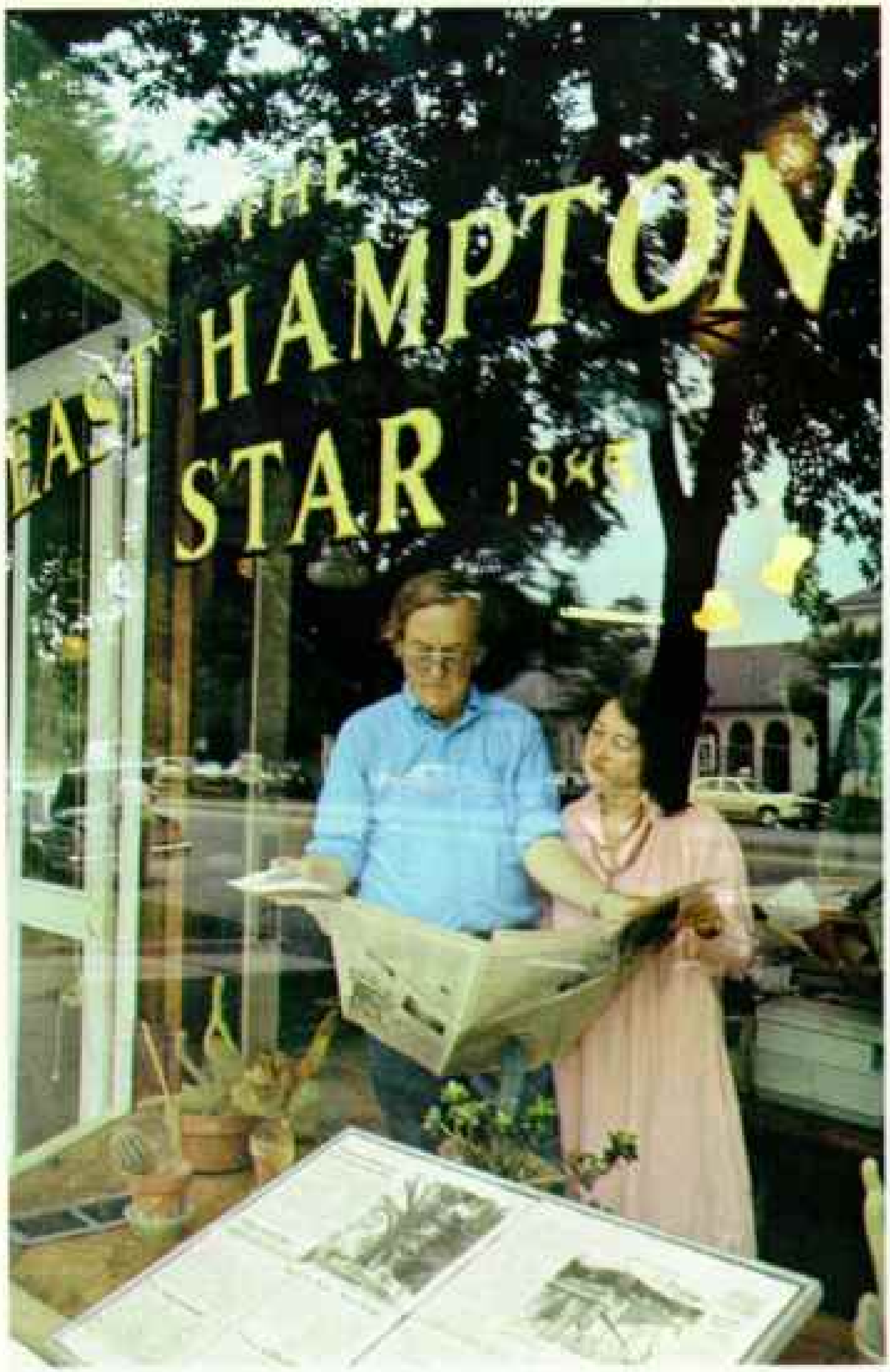
its tail a ribbon of sand (below). The place looks much as it did when Lion Gardiner, first English settler in what is now New York State, brought his Dutch bride, Mary, ashore in 1639.

A strapping six-footer, Lion bought the island's five square miles for "ten coats of trading cloth" and various sundries from Wyandanch, sachem of the Montauk Indians. Before he died, this lusty colonist set the village of East Hampton on a sure and prosperous course, gaining fame and fortune that still surround the Gardiner name.

Direct descendant Robert David Lion Gardiner (left), who lives in a baronial stone mansion in the village, occasionally refreshes himself with a visit to his ancestral island. At 68, childless, he and his sister are determined to preserve the family's fiefdom, now held in trust for a handful of heirs.

Fortunate are those who stroll with him through the island's magnificent forest, last





Window on the community *for 95 years, the* East Hampton Star *reflects local concern about environmental issues such as beach erosion and preservation of open space. Everett Rattray, who edited and published the paper until his death in January, inspects an issue* (**above**) *with his wife, Helen. His family is deeply rooted here. His grandfather's uncles hunted whales off Amagansett. And his grandmother carted beef broth to the Rough Riders, quarantined at Montauk in 1898 after duty in Cuba. At summer's end Southampton's Main Street slows to a stroll* (**upper right**).

remnant of the great woods that once graced Long Island. Its ancient white oaks, wild cherry, swamp maples, and birch provide haven for countless animals: wild turkey, plover, woodcock, hundreds of deer, and twenty-six pairs of osprey. Although the manor house dates back only three decades, the windmill, built in 1795, looks as ready to turn as it ever did.

WEST FROM GARDINERS, Shelter Island's towering white oaks shade 2,000 people on 11 square miles. Back in 1651, four merchants from Barbados in need of sturdy oak barrel staves gave eighty dollars' worth of muscovado sugar, or about one cent an acre, for this hilly bit of real estate.

A waterfront acre today brings $70,000.

No one I met on Shelter Island wants a bridge or further development. Residents tolerate the annual deer hunt only because it keeps the herd in check. Some deer retreat during open season to nearby North Haven, a spade-shaped peninsula once called Hog Neck. Here roistering sailors were jailed on boats during the heyday of Sag Harbor.

Between 1785 and 1875 whale oil and bone worth 25 million dollars sailed into port at Sag Harbor to be off-loaded on Long Wharf. Only New Bedford and Nantucket had larger fleets.

Sag Harbor was a seaman's town and still looks it. Affluent ship captains built Greek Revival and Federal homes; ships' chandlers and crewmen settled in simpler houses along crooked side streets. Their old dwellings are having their own revival as buyers bid up prices. Sag's fortunes fell with whaling's decline, and commercial fishermen now prefer facilities at Greenport or Montauk.

Most Bonackers, however, still haul their nets where they always have, along the South Fork beaches of their birth. But their time-honored practice may be in jeopardy. A powerful sportfishing lobby has been trying to put them out of the haul-seining business for years; similar efforts have succeeded in Massachusetts and Rhode Island. Perry Duryea, a lobster dealer who represented Montauk in the state legislature until he was defeated in his bid for the governorship last year, told me that there is room for both.

"Surf casters argue—wrongly—that our

haul seiners are ruining their fun," he said. "Yet sportsmen take substantial numbers of blues and bass out of these waters, and they're selling their overcatch in competition with the old-timers. In a sense, haul seiners are the last of a breed. I'll fight for them every inch of the way."

EMBATTLED East Enders face still another squeeze: Though they represent only 8 percent of Suffolk County's population, they pay—because of high property values—almost 20 percent of county taxes. Tax money, they maintain, goes primarily to the urbanized western areas of Suffolk. The decade-old movement swells among East Enders to secede from Suffolk and become Peconic County. PECONIC COUNTY NOW lapel buttons of 1969 are being worn again as separatists plan to approach the state legislature.

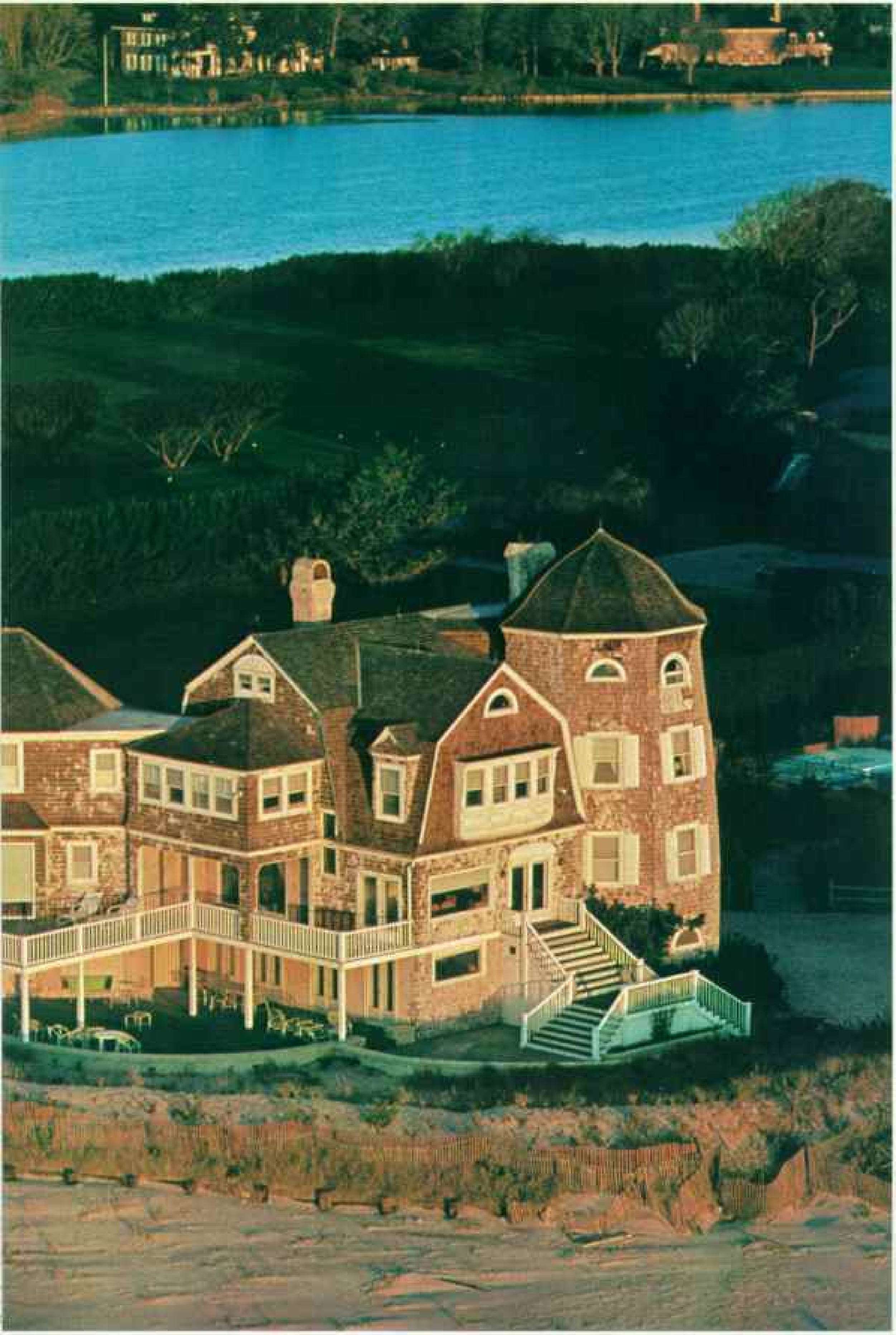
"We have nothing in common with the western end," said Everett Rattray, editor of the lively *East Hampton Star*. "On a clear day we can even see the smog line that separates us. We should concentrate our resources on our own particular problems. There was a lot of support for seceding a decade ago. It still makes good sense."

But I wonder. The East End's problems are highly competitive with one another. Many divergent interests are at work. The fisherman wants to protect his water; the farmer, his land. The rich seek their privacy; the artistic, a privileged environment. Often the preservation efforts of one conflict with those of another.

Standing beneath a dawn-streaked sky on a lonely strip of beach stretching toward Montauk, I watched a Bonacker and his wife labor with their huge nets, haul seining for stripers.

"Not many's fishing with their men these days," the woman confided to me. "But we like pulling together; it's the way things ought to be." □

Rambling along the beach *at Southampton, this 21-room summer house is not large by local standards. Its octagonal tower, right, recalls the windmills of 17th-century settlers who found prosperity in the soil and the sea.*



JARI: A Billion-

Launched by the resources and vision of one man, a paper-pulp mill assembled in Japan is towed halfway around the world. Taking shape in Brazil's wilderness, the daring, controversial experiment taps the Amazon Basin for fiber and food.

CRAIG VAN DER SAR

Dollar Gamble

TAKASHI YOSHIDA

TECHNOLOGY EMBARKS on a transoceanic adventure as one of the world's biggest seagoing tugs tows a paper-pulp factory through Japan's Inland Sea. The rudderless platform, three city blocks long and weighing 30,000 metric tons, is steered by smaller tugs (**above**). *In an industrial first, Ishikawajima-Harima Heavy Industries' Kure shipyards in Japan fabricated the pulp mill and a companion power plant on bargelike hulls. Too large to squeeze through the Panama Canal, the two mammoths sailed 15,500 miles* (**map**) *to Brazil's Jari River, a tributary of the Amazon. There they became centerpieces of Jari Florestal e Agropecudria Ltda., industrialist Daniel K. Ludwig's daring experiment in pulpwood and food production in former wilds. Meticulous weather forecasting and storm-resistant bracing brought the plants unscathed through the three-month voyage. Once installed on land, the two plants were carefully linked and readied for work* (**right**).

IN THE HOMESTRETCH, sixty miles from its jungle terminus, the power plant heads up the twisting Jari River. The pulp mill followed six days later.

*The mills were maneuvered into a holding lagoon (**right**), whose entrance was later diked and the water level raised. They were then floated into position above 3,700 pilings, at right, which were cut from rot-resistant massaranduba wood. Water pumped into the hulls lowered them onto the pilings. The dike was opened and the water was lowered to the original level, setting the stage for on-the-spot use of Amazon resources.*

Placement was so accurate that bolt holes in the plants lined up within three-eighths of an inch with those on equipment already installed at the site.

"We worked straight through for three days and nights," recalls construction manager Thomas Connor. "When the bolt holes aligned, we were jubilant. But we were just too tired to celebrate."

J. VON PRABUNATENICE (BELOW)

JARI: A massive technology transplant takes root in the Amazon jungle

ARTICLE AND PHOTOGRAPHS BY LOREN McINTYRE

FOR JOÃO MELO, the leviathan appeared without warning.

A Brazilian boy about 10 or 11, João was fishing from his dugout canoe in the Rio Jari one April day in 1978 when it happened.

The Jari is a dark tributary that splashes down from the remote Guiana Highlands over many waterfalls, grows wide and deep, and merges into the north channel of the Amazon before that mightiest of rivers reaches the sea. This is a land of primeval forest, rife from root to canopy with fecund plants and rapacious creatures.

At daybreak the air trembles with birdsongs like cellos and chimes played deep in a well. After midday heat has silenced the birds, cicadas assail the eardrums with an unwavering high-pitched buzz. Toward evening awesome thunderstorms shred leaves and limbs and uproot aging trunks.

As he had canoed on and bathed in the river all his life, I suppose João had an almost fetal awareness of the currents of the Jari. He sensed that day a pulsing of air and water perhaps long before you or I—riding in his canoe—would have felt the low-frequency throb of a massive propeller driven by a 22,000-horsepower marine diesel.

The boy looked up. Beyond an island in the river a silvery cluster of towers loomed above the forest crown and drew toward him. It was spooky, he later said to me.

Trailing his fishline, João paddled furiously for home—a stilt-legged hut on the shore. Big eyed and breathless, he told his mother, "A city is coming up the river!"

In truth, nothing so immense had ever entered the mouth of the Amazon, realm of

To clear the way *for new pulpwood-producing forest, Jari workers burn old native jungle (**above**), but only after culling usable trees. Later a pine seedling is tucked into its ash-enriched bed and nourished by the first seasonal rains (**facing page**).*

legendary monsters. The hulk that startled João weighed 66 million pounds and was drawn by one of the world's most powerful seagoing tugs. From a plane it looked less like a city in tow than a titan's tool chest: a steel box two and a half football fields in length, open at the top, with equipment standing twenty stories high.

It was destined to recover some of the sun's energy fallen on the Amazon Basin in years gone by. The monster would consume 2,000 tons of wood every day and render it into 55 megawatts of electricity—enough to supply a paper-pulp mill and the now and future cities to arise along the Jari.

The river bisects the 5,600-square-mile property of Jari Florestal e Agropecuária Ltda., a private company applying high technology to extract food and fiber from the Amazon Basin. One of Jari's bold experiments is using aircraft and advanced methods to convert floodplains into huge rice fields, growing food for Brazil and the world. More daring—and far more controversial—is the cutting down of luxuriant native forests to plant two or three species of fast-growing trees to be harvested for paper-pulp manufacture. With 250,000 acres already under cultivation, Jari is the world's largest tropical tree farm.

Critics contend that the Jari pulpwood plantations typify a mindless drive to destroy Brazil's great forests primeval, with worldwide repercussions. Erosion will clog streams, they say, and countless plants, animals, and Indians will die.

Some years ago a prominent Brazilian scientist predicted that the *hylaea*—the equatorial-rain-forest ecosystem of the Amazon Basin—would be mostly destroyed by A.D. 2000 at the present rate. Some scientists believe that about 50 percent of the heavy rain in Amazonia is generated by the release of moisture from the foliage of the forest itself, and that the loss of the jungle would cause shattering changes of climate.

Others maintain that the greenhouse effect of increasing atmospheric carbon dioxide from burning forests and fossil fuels will raise temperatures, melt polar ice, and the oceans then will inundate major cities.

For ten years, with such dire predictions in mind, I have been watching the Jari experiment and discussing it with ecologists. The arrival of Jari's fabulous factory was a high point of my experience.

Six days later came another. Flying above the Atlantic Ocean, a pilot and I sighted a small silver rectangle drawn by a tug with a brown Amazon tide in its teeth. It was another 66-million-pound treasure chest—this one containing the pulp mill.

At a cost of 269 million dollars, these two massive industrial complexes—power plant and pulp mill—had been assembled in Japan and towed for three months across the Philippine Sea and the Indian Ocean, around Africa, and across the Atlantic to South America (map, page 688).

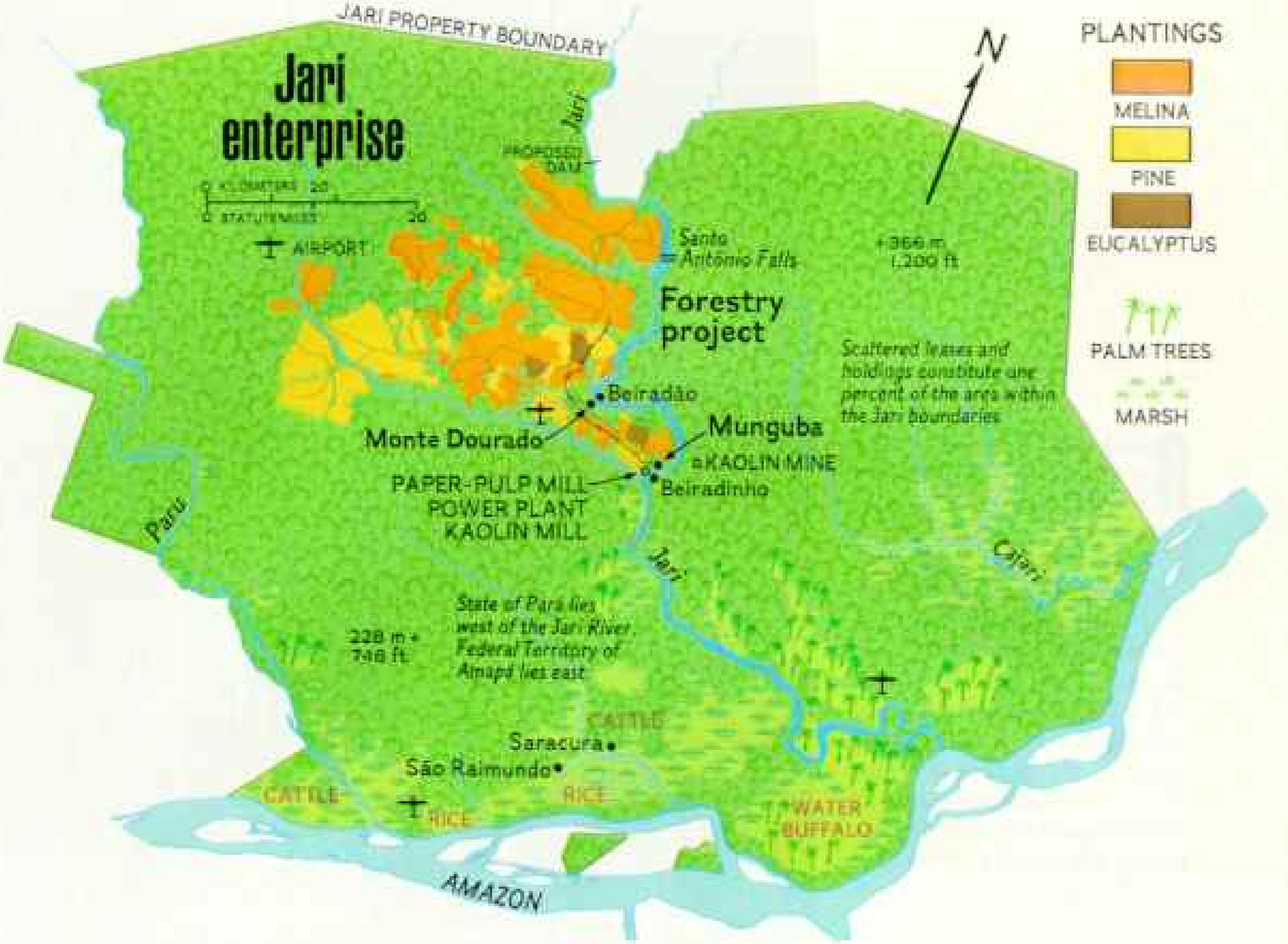
They entered a basin at the jungle's edge. There machine shops, warehouses, chemical plants, and a sawmill stood waiting at the terminus of a railroad and 2,800 miles of roads leading into Jari forests. The basin was diked and more water was pumped in to lift both vessels above the river. Then they were aligned on top of 3,700 rot-resistant wooden pilings, lowered into place, and coupled with catwalks and tubing. When all the water had been drained, the hulls were cut open and connected by conveyor belts and piping to the shore installations.

In 1979 the biggest factory ever to cross the sea, now fully land based, fired its boilers, and all the myriad pieces throughout Jari began to move together.

Enterprise Provides for 30,000

Today the mill produces almost 750 tons of bleached kraft pulp from plantation forests every 24 hours. "At dockside," said Jack Trescot, then manager at Jari, "that's worth more than $300,000 a day—enough to cover the cost of felling native forest, planting pulp trees, and providing for the 30,000 people who already live off this operation."

Half these people—staffers, technicians, service personnel, and families—live in new company towns. All but sixty are Brazilians. The foreigners are a United Nations—Canadians, Japanese, Finns, Peruvians, Indonesians, Americans, and Argentinians, to name a few. Largest town is the headquarters, Monte Dourado, thirty miles upriver from João's shoreside hut. Lumbermen, railroaders, scientists, and management people work in and out of hastily built offices dusty with the traffic of 700 vehicles.



The pulp factory lies about 15 miles downstream at the industrial site named Munguba, which didn't exist when I first visited Jari a decade ago. Neither did Beiradão (Big Place Alongside), a typical boomtown sprouting on stilts along the shore across the river from Monte Dourado (page 708). Beiradão is not supervised by the company but by the Amapá territorial government.

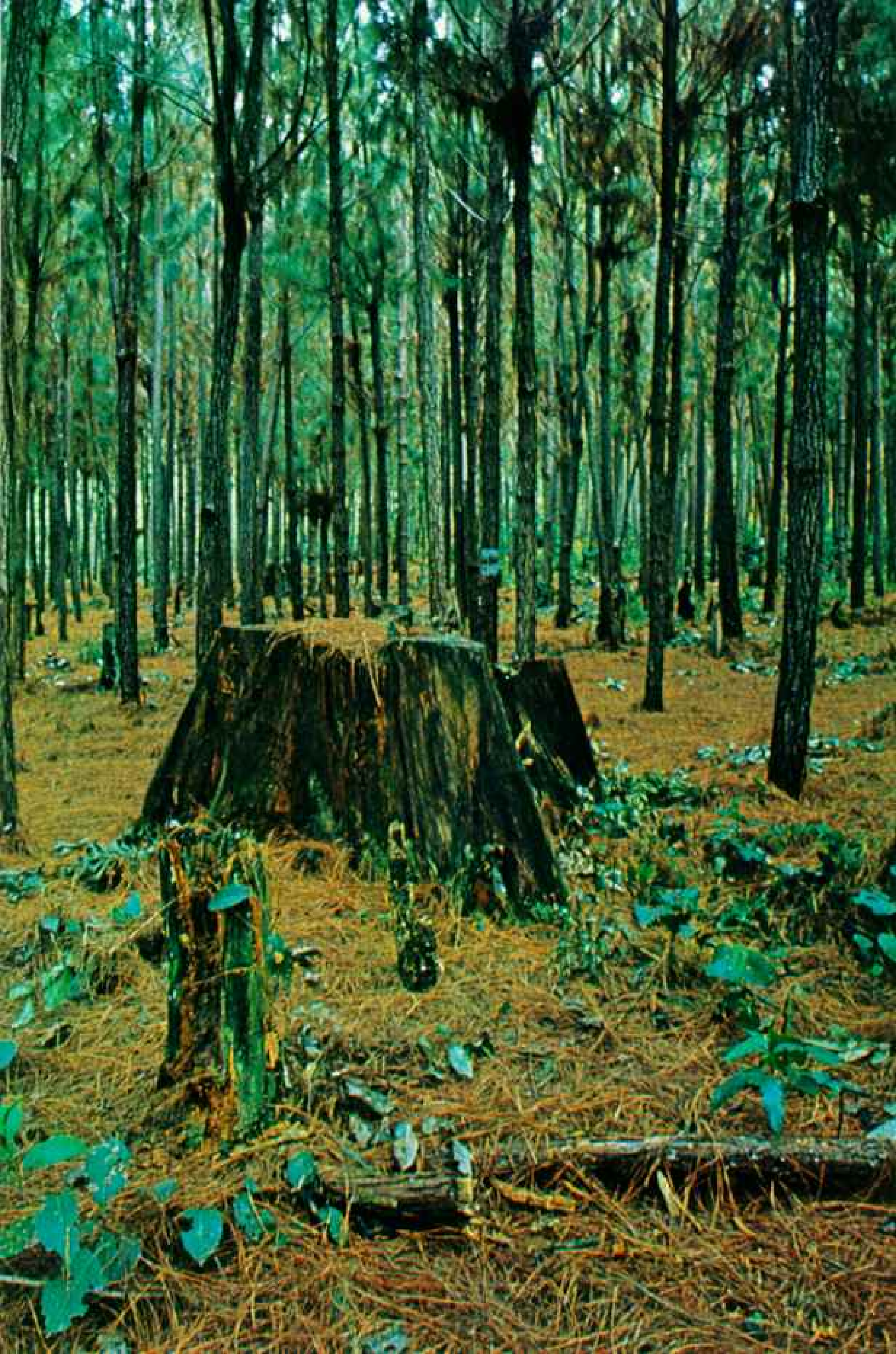
Few people—except hordes of children—think of Beiradão as home. But several thousand boat migrants drink, dance, work, pray, buy, sell, and catch a wink there. Some Jari technicians, with an itch to drink *cachaça* (Brazilian firewater) and do what they please of an evening, live in Beiradão. One explained, "I'm from Rio; I can't stand the soda-pop surroundings of Monte Dourado. It's too antiseptic . . . except when you're sick, and then of course you're glad that health care comes with the job."

Beiradão has no automobiles or roads; it is tied to Monte Dourado by 24-hour umbilical traffic of motorboats and canoes.

THE LEAFY REALM of Jari is marked by 2,800 miles of roads, a 26-mile-long railroad, three small airports, and experimental plantations with water buffalo, cattle, and rice fields that produce double crops. Thirty thousand people now inhabit the 3.5-million-acre domain. "It was almost like developing a country," recounts Daniel K. Ludwig. Caribbean pine, melina (Gmelina arborea), *and eucalyptus* (Eucalyptus deglupta), *all fast growing and suitable for pulpwood, cover 250,000 acres.*

RANKS of young pine stand among charred remnants of the native forest. A prickly blanket of pine needles deflects soil-eroding rain. As clearings cut and burned for such stands poke holes in the umbrellalike rain-forest canopy, ecologists fear that leveling Amazon jungles may upset carbon dioxide and moisture levels in the atmosphere and instigate climate changes. But Jari's experts say that they replace, not remove, trees and that the fast-growing pine and melina quickly form a new forest canopy.

Ecologists also caution against replacing native jungle with monoculture tree plantations. Jari foresters argue that the area involves only .03 percent of the Amazon jungle. Dr. Thomas Lovejoy, vice president for science at the World Wildlife Fund, admits the inevitability of some Amazon development in a resource-hungry world, but counters: "There is a likelihood that some unknown species never examined for man's use were destroyed in clearing the area. What worries me more is that Jari could be multiplied many times, especially in other more critical places, by people too ready to cut corners."



Three or four thousand Jari inhabitants live in jungle camps, sleeping in hammocks. Laborers recruited from riverbanks and arid lands in northeastern Brazil, they clear underbrush with machetes, and are taught to fell trees with chain saws (page 705) and even to operate heavy machinery.

"My contract is for three months," said one with a gesture to show how he'd signed with a thumbprint. "When I get paid off [perhaps $300], I'll rejoin my family in Maranhão State." He used to make a living there hunting wildfowl by canoe.

"Few ship over," said Don Hoppe, a Jari forester. "Labor is scarce because other projects south of the Amazon—railroads, iron mines, dams—draw workers away. The turnover rate of 200 percent a year for contract labor is horrendously costly."

Don and his wife, Heidi, both former members of the Peace Corps, help me find my way around a Jari profoundly changed from visit to visit.

On each visit I have met the latest director; I know eight of the more than twenty who have headed this project since its beginning 13 years ago. I quoted one in a NATIONAL GEOGRAPHIC article on the Amazon River. "This project," he said, "may cost 100 million dollars before it turns a nickel." Five years later I reported that 500 million dollars had been sunk into Jari (see issues of October 1972 and November 1977). Now the total approaches a billion dollars—but at least some nickels are being turned.

A Man in Tune With A.D. 2000

By now Jari may be the biggest one-man private-development project on earth. And one of the least understood.

Stories appear in the U. S. and Brazilian press about Jari's private army (there is none), enslaving Indians (there are no tribes or slaves on the property), and U. S. plans to populate Jari with "excess Negroes." I think such flights of imagination spring from Jari's inaccessibility to reporters, both Brazilian and foreign, and frustrated fascination with Jari's sole owner and operator, a private person who avoids interviews.

Daniel Keith Ludwig—D. K. to his intimates—was born June 24, 1897, in South Haven, Michigan (page 701). Slim, with an alert eye and a full head of hair, he swims an hour a day to alleviate an old back ailment caused by a shipboard explosion. (Jogging is stupid, he says; it jars the spine.) He is technologically oriented toward the year 2000, and I think he expects to get there, so long range are his interests.

Ludwig bought Jari when he was 70 for three million dollars, and has enjoyed Brazilian federal government support from the beginning. The fact that he has spent an average of $180,000 a day on the project for the past 13 years gives some idea of his wealth and the immensity of his commitment to Jari. Since Ludwig has no children, he plans to bequeath Jari's eventual profits to cancer research.

Ludwig started a shipping business at age 9 by salvaging a sunken boat. Forty years later he was pioneering supertankers and advancing supertanker technology. "Besides shipping," said Elmer Hann, onetime head of Ludwig's supertanker shipyard in Japan and later a director of Jari, "he's into mining, ranching, housing . . . oh, all sorts of investments in 15 countries. He got there by thinking twenty years ahead."

"I believe you must have luck in the world," the man known to be one of the richest in the world told me. He was chatting over lunch in his Beverly Hills home about his good fortune in the choice of a power plant for Jari.

"After several attempts we came up with a wood-burning plant that's a lulu! We save eight or ten million dollars a year by burning a resource that's replenished every day by solar energy. Brazil is short on fossil fuels; we could never get enough oil there to keep going. Pulp and paper use lots of energy; few industries in the U.S.A. use more."

Ludwig said he never rolls dice but that Jari is an exciting crap game, biggest in his career. "Back in the fifties I thought of floating a factory on a barge to an undeveloped region—such as a desalinization plant to make fresh water for an Arabian seaport. And I figured the world-communications explosion would cause a paper shortage by the 1980s. So twenty years ago I sent experts to search out fast-growing pulpwood trees. We hit on melina [*Gmelina arborea*], an Asian tree. It grew like crazy in Nigeria and Panama."

To put all of these ideas together and

become a major producer of food and fiber by the 1980s, Ludwig needed a piece of tropical forest and a floodplain, with access to the sea. He found Jari.

Only a few mixed-blood descendants of Indians, Portuguese colonists, and Negro slaves lived along this stretch of the Jari in those days. For centuries they had extracted Brazil nuts and rubber from the native jungle, ruled by a succession of petty dictators. The last of these, Col. José Júlio de Andrade, sold out in 1948 to Jari Commerce and Navigation Company, a small Portuguese trading firm that harvested Brazil nuts and raised some cattle and water buffalo. In 1967 Jari was acquired by Universe Tankships Inc., a Ludwig company.

Persistence Pays Off

I wondered at Ludwig's audacity years ago when I first met Clayton Posey, the knowledgeable forester who has supervised Jari's plantations from the beginning. Posey radiated confidence then, but seemed to have little idea whether, when, where, or how his melina groves, first planted in 1969, would be processed into paper. Henry Ford attempted to raise rubber trees in the Amazon Basin. Starting in 1927, Ford sank millions into developing plantations almost as big as Jari. He gave up in 1945.

Not Ludwig. When melina languished on sandy soil, he switched to Caribbean pine on a third of Jari's plantations.

A constant threat is damage from leaf-cutting ants and other plagues that might touch only a species here and there in the heterogeneous native forest but conceivably could wipe out his entire monoculture.

"Caterpillars did eat up a few acres of leaves one year," Posey told me, "but a virus—a natural disease—luckily destroyed them in turn. In addition, our experiments in cloning, pruning, fertilizing, and pest control are now paying off."

Ron Woessner, in charge of forestry research at Jari, showed me a seed of *Eucalyptus deglupta* as thin as a hair. "Would you believe it will grow to 18 feet high and 3 inches in diameter in 12 months? This eucalyptus may feed the power plant when we no longer cut native forest."

How do ecologists feel about converting jungle into tree farms?

"Frustrated," answered one of the Amazon's leading plant taxonomists, Dr. João Murça Pires, a Brazilian. In his laboratory at the famous Goeldi Museum in Belém—the skyscraper city at the mouth of the Amazon—he expressed a major concern of most tropical-forest specialists I consulted.

"We don't even know what we are destroying," he said. "We've identified less than half the species of the hylaea, an incredibly complex ecosystem that took millions of years to evolve. Perhaps some medical or nutritional keys to man's survival are hidden in that still mysterious gene pool, which is being obliterated bit by bit. I wish Amazon development might be slowed until we understand the ecology well enough to plan wisely."

As to Jari's own jungle, Manager of Forestry Operations Johan Zweede advised me that more than half of Ludwig's three and a half million acres will be kept virginal. As of mid-1980, he said, only 6 percent of Jari's native forest will have been cleared and replanted. "We expect to clear 10,000 acres a year," he went on, "until 500,000 acres are under tree cultivation."

I asked Clayton Posey whether melina forests produce as much of the oxygen we breathe as the original jungle. "Definitely more," he replied. "Young forests render more oxygen than they absorb. Old forests are essentially steady state. Decomposition on the forest floor uses up almost as much oxygen as the lofty biomass releases. I doubt that the Amazon forest supplies much atmospheric oxygen. Science now tends to credit the oceans as the main supply."

Ludwig presses hard for full use of native forest. Johan Zweede told me: "First we fell and extract good lumber trees. We utilize more than forty species at Jari for buildings and manufacture. But less than a dozen hardwoods are accepted abroad. If we can induce foreign buyers to order other Amazon hardwoods, all Brazil might profit."

Fuel is one of Amazonia's main forest resources, for wood will burn regardless of color, hardness, or size. "Many Jari species are useful only to fuel our power plant."

I interviewed the government official responsible for forest utilization at Jari. Dr. Clara Pandolfo, a widely respected authority on Amazon *(Continued on page 704)*

"I *ALWAYS WANTED to plant trees like rows of corn," says entrepreneur Daniel K. Ludwig (***above***), a publicity-shy, 82-year-old man who single-handedly formed and directs a colossal shipping empire. "Sometimes he just sits in his office and thinks twenty years down the road," an associate says. In the 1950s he foresaw a world paper shortage and began to look for the perfect pulpwood tree. His find: the fast-growing, disease-resistant melina (***left,*** *at upper right), planted across from cornlike rows of pine and adjacent to native rain forest.*

BOTH BY DAVID LOUIS GLADEN

*ON THE FIRST DAY of manufacturing bleached kraft pulp in April 1979, melina logs await processing (**above**). Bark stripped from the logs helps fuel the power plant, which also runs a sawmill and a mill that processes kaolin, a fine white clay used in ceramics and as a coating for paper.*

*In the spanking new paper-pulp mill's control room, technicians make a final check of production controls (**left**). The plant currently turns out close to 750 tons of bleached kraft pulp a day; most is exported to Europe and Japan.*

The second phase of the Jari plan calls for a paper mill, also barged in, and expansion of the pulp mill, additions that may pull the billion-dollar project out of the red. Jari profits will go to cancer research.

Recently Ludwig applied to the government of Brazil for approval of a hydroelectric dam project on the Jari River, a move that would hasten industrialization of the Amazon Basin area.

development, is director general of the Department of Natural Resources for the all-powerful SUDAM: Superintendency for Development of Amazonia. A cheerful, articulate Brazilian, Dr. Pandolfo received me in her spacious offices in Belém.

"We follow Jari's wood-fuel experiment closely," she began, "considering that Brazil already has wasted billions of dollars' worth of wood and trillions of Btu's by indiscriminate burning, while the cost of oil imports is ruining our economy."

I asked Dr. Pandolfo's opinion on the value of Ludwig's pine, melina, and eucalyptus plantations.

"I have few qualms about transforming jungle into monoculture tree crops. Jari involves only a fraction of one percent of the region under my supervision. And it is the most innovative of all current projects—some of which are frightful.

"It won't be tried on a larger scale until it proves viable. I hope Jari leads to the planting of trees on millions of acres of savanna in central Brazil."

A leading Amazon ecologist, Dr. Robert J. A. Goodland, agrees. Co-author of *Amazon Jungle: Green Hell to Red Desert?*, Dr. Goodland points out that to check leaching of nutrients from the soil, it is important to maintain the forest canopy. He believes melina does that better than annual crops. Dr. Goodland also rates tree plantations well above the ubiquitous cow pastures of Amazonia, which he believes are possibly the worst economic and biological trade-off for the original forest.

Shipboard Logs Sprout Leaves

Most Amazon forest nutrients are held in the biomass of leaf, limb, and roots, Johan Zweede told me. "These may be returned to otherwise deficient soil by oxidation, either by burning or by rotting, which is a longer process. The ashes are fertilizer worth about $275 an acre. When warm rains come early in the year, we plant seedlings in the ash-covered soil."

In 1976, before the pulp mill was built, Ludwig shipped 13,000 tons of Jari melina to Finland to make into pulp, then paper, as a test of its quality.

"Crossing the Equator," Johan said, "the deckload of tree trunks sprouted leaves. Hundreds of Finns came down to the docks to see the Amazon ship decked with greenery. Longshoremen refused to unload it until the cargo was inspected for snakes. Finally, papers made of melina were tried all over Europe and found good."

By that time, D. K. Ludwig had set up a worldwide systems approach for his Amazon project. The Japanese redesigned a pulp mill to tuck into a hull built as carefully as a ship. They filled it with machinery from Europe, Asia, and the U. S. Components were manufactured in 20 different Japanese shops, and transported to Kure, where cranes capable of lifting 1,200 tons dropped them into place.

The power plant and pulp mill were assembled in less than a year. Had they been built from scratch in the Amazon jungle, time and cost would have soared beyond the limits of practical planning. The implications are significant for other remote and developing areas, which could order intricate, high-cost plants and have them transported in, both on time and within their budgets.

I had supposed that cramming acres of pulp mill and 55 megawatts of power plant into steel hulls would create a bedlam of heat and noise. Cecil MacDonald, general manager, took me on an all-day walk through Munguba, site of the complex.

"As you see, it's cooler inside than out," he said. "It's clean, the noise level is normal, and there's lots of free space, as in a well designed kitchen. The plant observes the latest U. S. specifications for pollution control. You'll find dolphins sporting near the effluvium output in the river."

Few technicians were on duty. Most of the plant operates automatically, monitored from air-conditioned control centers.

The discovery of high-grade kaolin, a fine white clay used to coat paper with the gloss necessary in color printing, as well as for ceramics, cosmetics, and medicines, was another of Ludwig's lucky breaks. A kaolin mill alongside the pulp plant at Munguba already produces 190,000 tons a year from reserves underlying Jari property, both for export and for Brazilian markets. Now, expansion planning includes a possibility of a paper plant towed from Japan.

The tract also includes half a million acres of treeless Amazon floodplain suitable for

growing rice (pages 710-11). At Jari one day Ludwig told me: "By the mid-eighties I expect to help provide Brazil with rice enough to export."

Marvin Ragland, the Louisianian in charge of Jari's rice program, outlined the project. "We doctored up the *várzea*—floodplain—with canals and dikes and pumps," he said. "We sow by plane and harvest by machine, netting two crops a year, four tons an acre, high by world standards."

Ragland's assistant, my old friend Han Steenmeijer, a Dutchman from Indonesia, showed me the 10,000 acres now under cultivation—a vast extension of the single experimental paddy we had photographed from the air in 1972. Today's goal is 35,000 acres, producing 140,000 tons of rice a year.

Cristovão Lins, a young Brazilian in charge of livestock for Jari consumption, breeds cattle that graze in the upland pine plantations. "Jari is short of woodsmen for cutting back second-growth jungle that chokes out the pine," he said. "My cattle trample the weeds and feed on grasses sown among the pines."

Cristovão led me along Jari's swampy Amazon shore, where cowboys in canoes herd nearly 6,000 water buffalo. Milkers know cows by name, and buffalo respond individually when called. Cristovão said, "Few bugs bother them. They eat almost anything green, grow bigger and faster than cattle, and their milk yields 9 percent butterfat." It tasted delicious.

Environmentalists Assail Project

Controversy about Amazon development continues to flame. Three Brazilian congressional groups investigated Jari in 1979, the "International Year of the Amazon" declared by the government. The slogan "Save the Amazon, Save the World" caught on. In July, 5,000 scientists convened in northeastern Brazil to debate "dilemmas of scientific production in Brazil." They shouted down the Jari spokesman.

Daniel Keith Ludwig says he is somewhat puzzled by charges that he is wrecking the environment. As a man born in the 19th century, who has been a leader in America's technological revolution in the 20th, and who foresees a world of hunger and want in the 21st, he *(Continued on page 710)*

DAVID LOUIS GLOSS

NEW TOOLS, NEW TREES confront this mestizo melina cutter, one of 3,000 to 4,000 laborers recruited from impoverished sections of northeast Brazil. Most sling their hammocks under open-wall shelters in the jungle and earn $75 a month—high by Brazilian standards.

*THE COMPANY TOWN, named Monte Dourado, sprawls on the western side of the river (**following pages**); the boomtown of Beiradão fringes the opposite bank. Munguba, the industrial site, lies in the distance. For employees, Jari provides free medical care and schools, subsidized housing, and a supermarket that sells goods only slightly above cost.*

*SASSY BEIRADÃO—the unofficial, unsupervised offshoot of Jari—supplies fast, loose living for an assortment of transients and residents, including hundreds of Jari workers who just plain prefer its raucous style to the stiff order of Monte Dourado. Many make the daily cross-river commute by canoe, hitch up to a tree branch (**below**), and lock up by taking the paddle to the job.*

*On the main thoroughfare, a ramshackle boardwalk, two boys box playfully (**bottom**). The walk, jammed with a jumble of shops and scruffy bars that sell throat-searing cachaça by the belt or bottle, is peopled with adventurers, traders, and sidewalk croupiers who roll out a green-felt gaming board at the wink of a coin.*

*Downstream, at the quieter settlement of Beiradinho, María Socorro Pírez de Sousa does laundry in sight of the pulp and power plants (**right**).*

Fields of rice *fall to combines in former floodplain. Nearly a billion dollars backs Ludwig's dream of providing Brazil and the world with rice and pulp. But*

says that "only numbskulls would censure our use of .03 percent of the Amazon Basin to provide food and fiber for the future."

Ludwig disputes the phrase "surprisingly fragile ecosystem," which is frequently applied to descriptions of the Amazon jungle. He has always believed (along, perhaps, with many inhabitants of the region) the old saw that goes: "While you're clearing the jungle from your door, it's coming in the windows." "Hell's bells," he says, "I spend five million dollars a year just to whack down the wild growth that springs up among our planted trees!"

That great spectacle by the river, the Jari power plant, may lose some of its appetite for wood before it consumes even an infinitesimal fraction of the Amazon forest. Why?

"The Brazilian Government has just verbally approved a thousand-megawatt dam on the Jari," D. K. Ludwig confided to me. "When it is in operation, it will produce clean energy for us . . . hydroelectric . . . cheapest thing in the world once the steep building costs are paid off." Once again, I thought, that Ludwig luck!

The dam will rise upstream from Jari's Santo Antônio waterfall and will not submerge that natural park. Nowhere in the Amazon Basin have I discovered a lovelier place to photograph flowers, to shower under cascades springing out of black cliffs, to dive into waters pure enough to drink.

Tree Crop Replaces Jungle

Recently in a splendid pine plantation on a hill not far from Monte Dourado, I walked through even ranks of trees and paused to

more than money is at risk as human need balances with delicate questions of ecology. Time will tell if his vision and resources were put to good account.

rest on a mossy log. It was the charred and rotting trunk of a fallen giant of the "natural forest," as the jungle thereabouts is sometimes called. By implication, then, the pine forest is "unnatural." And indeed this forest seemed to be, for no snakes lurked beneath the log, no birds sang in the branches, and no insects buzzed in the still air.

The rite of death and renewal of life of the rain forest here—after millions of years—had burned into oblivion. A thick carpet of long brown needles covered the sandy soil and inhibited emergence of all but the most persistent of the vanquished vegetation.

I was sitting amid Ludwig's orderly trees, a crop spreading row on row. Soon woodsmen would lop them down, burn the brush, and return in the rain to stick into the sand and ashes whatever superseedling had just been cloned at the Jari nursery. I felt free of the apprehension one sometimes feels in the oppressive tropical rain forest, yet I missed the savagery.

I had to recognize, though, that harvests of pulp trees like these make possible the publication of the words I write and you read. Blame Johann Gutenberg and his printing press, if you must. The disappearance of broad belts of the age-old Jari jungle and the hurried life cycle of the new pulp forest are consequences of the information explosion, of today's world demand for paper, and of one man's scheme for meeting that demand on into the 21st century.

By then perhaps we'll know the winners—and losers—of D. K. Ludwig's biggest gamble, and the continuing debate it has inspired. □

Cheetahs: In a Race

THE CHEETAH DIED without resistance. With two companions he had entered the territory of three other male cheetahs and had been instantly attacked.

The victim's response surprised us, for he barely tried to defend himself. While his companions kept their distance, he was repeatedly savaged (pages 724-5).

From my Land Cruiser 15 yards away I could see the three attackers tear mouthfuls of fur from their opponent and hear the horrible cracking of his bones.

In half an hour it was over. The victim lay dead, scarcely a square inch of his hide untouched, and the two other invaders routed. Peace returned to the Serengeti Plain, East Africa's great natural wildlife region.

To me the fate of that one cheetah typifies the plight of his species. Cheetahs today are outnumbered by their enemies, they are largely defenseless, and, where unprotected, they are likely headed for extinction.

Slowly, inexorably, cheetahs have been exterminated from large portions of their former range in Africa and the Middle East. Once also plentiful in India, cheetahs have totally disappeared there, the victims of hunters and loss of habitat.

Only careful study and protection of remaining cheetah populations can ensure the species' survival. Research is vital, for in order to guarantee cheetahs' survival, one must know their habitat requirements, feeding habits, mating patterns, family structure, life expectancy—in short, every possible aspect of cheetah life.

Little was known about cheetah ecology and behavior in the wild when my wife, Lory, and I began our observations in 1973. At the same time we were studying African wild dogs in Tanzania's Serengeti National Park (map, page 717), we undertook research on cheetahs.

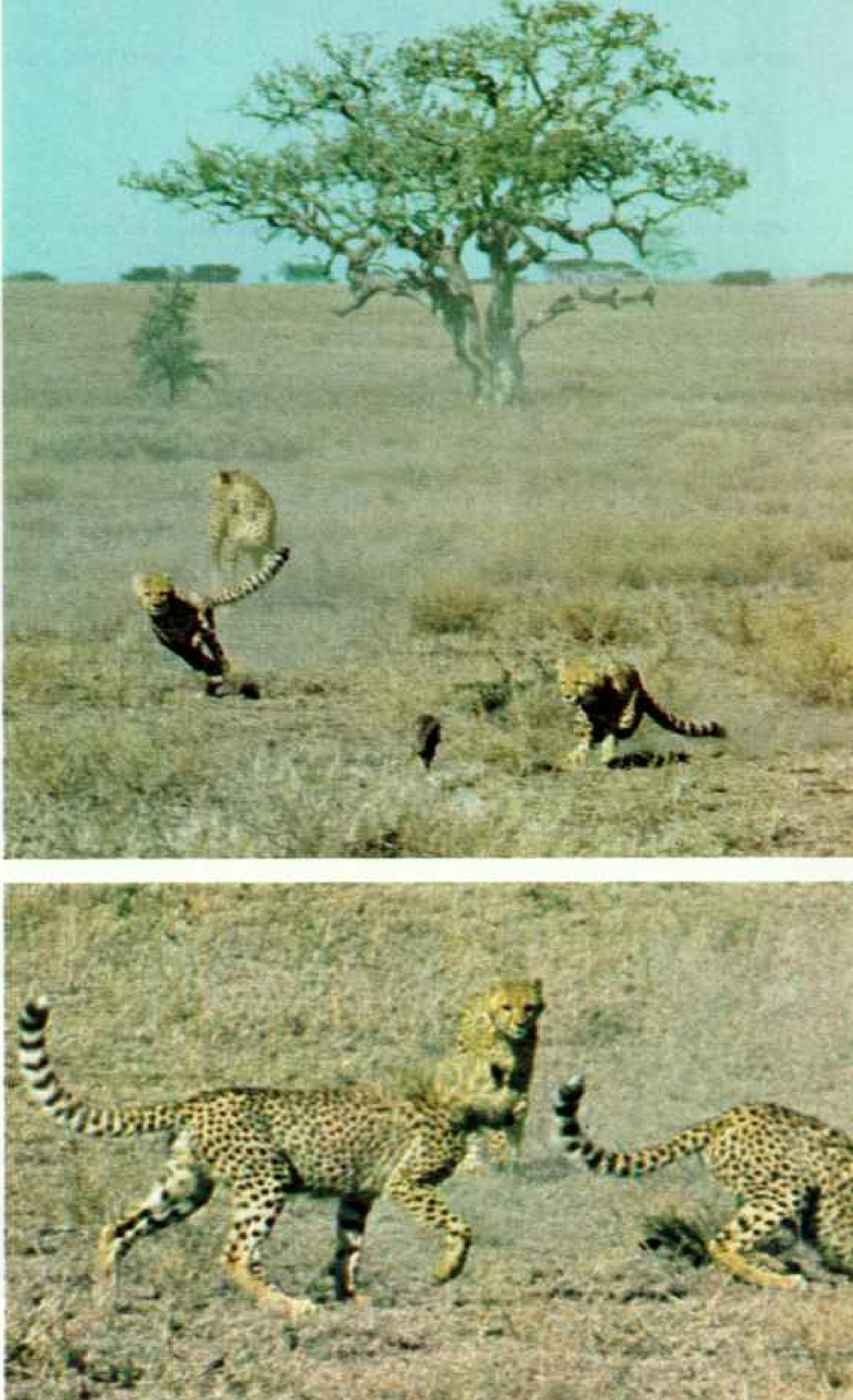
Our study extended over more than four

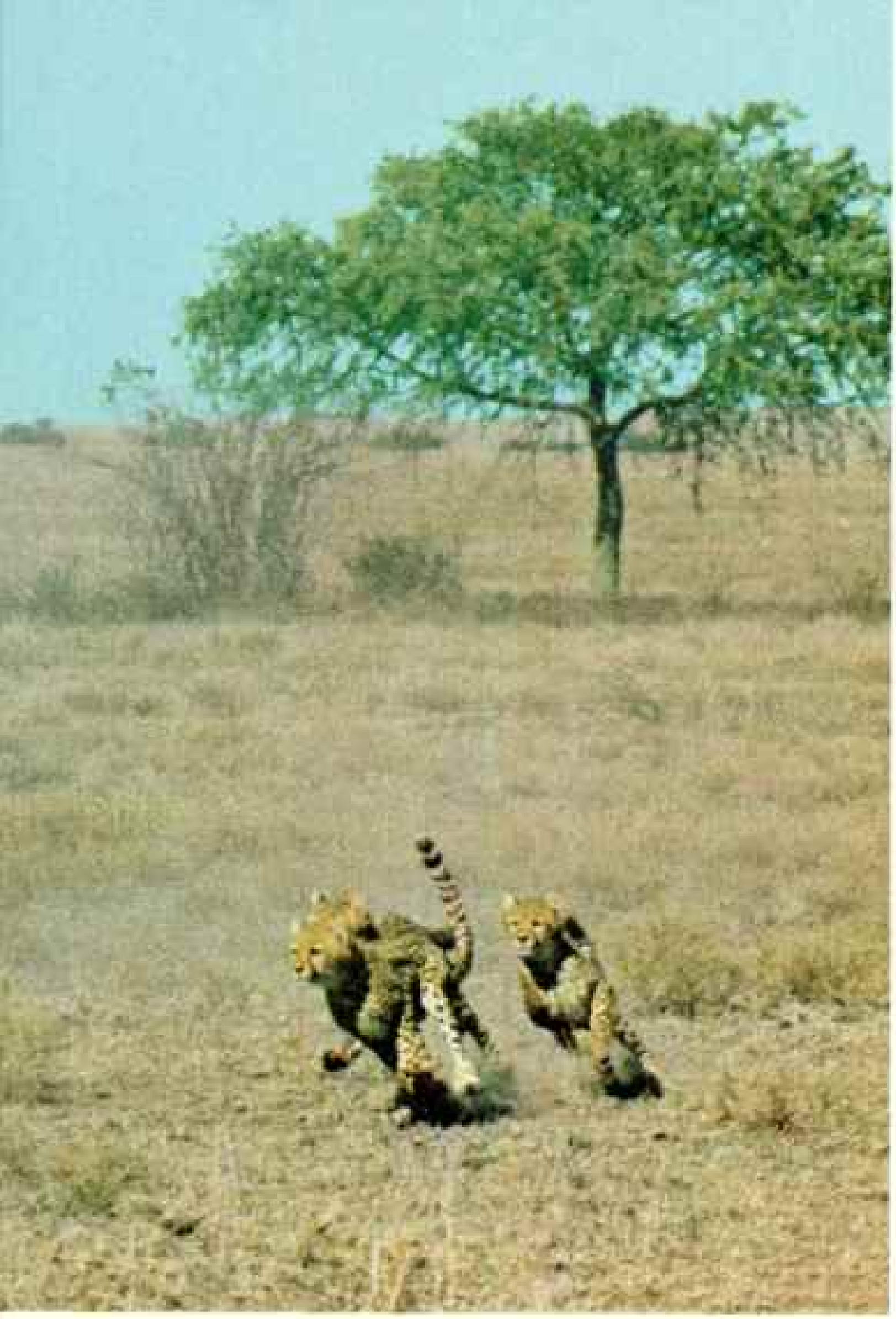
Secure in a Tanzania wildlife park, this

ARTICLE AND PHOTOGRAPHS BY GEORGE W. AND LORY HERBISON FRAME

for Survival

swiftest mammal eyes prey. Elsewhere encroaching civilization nips at its heels.

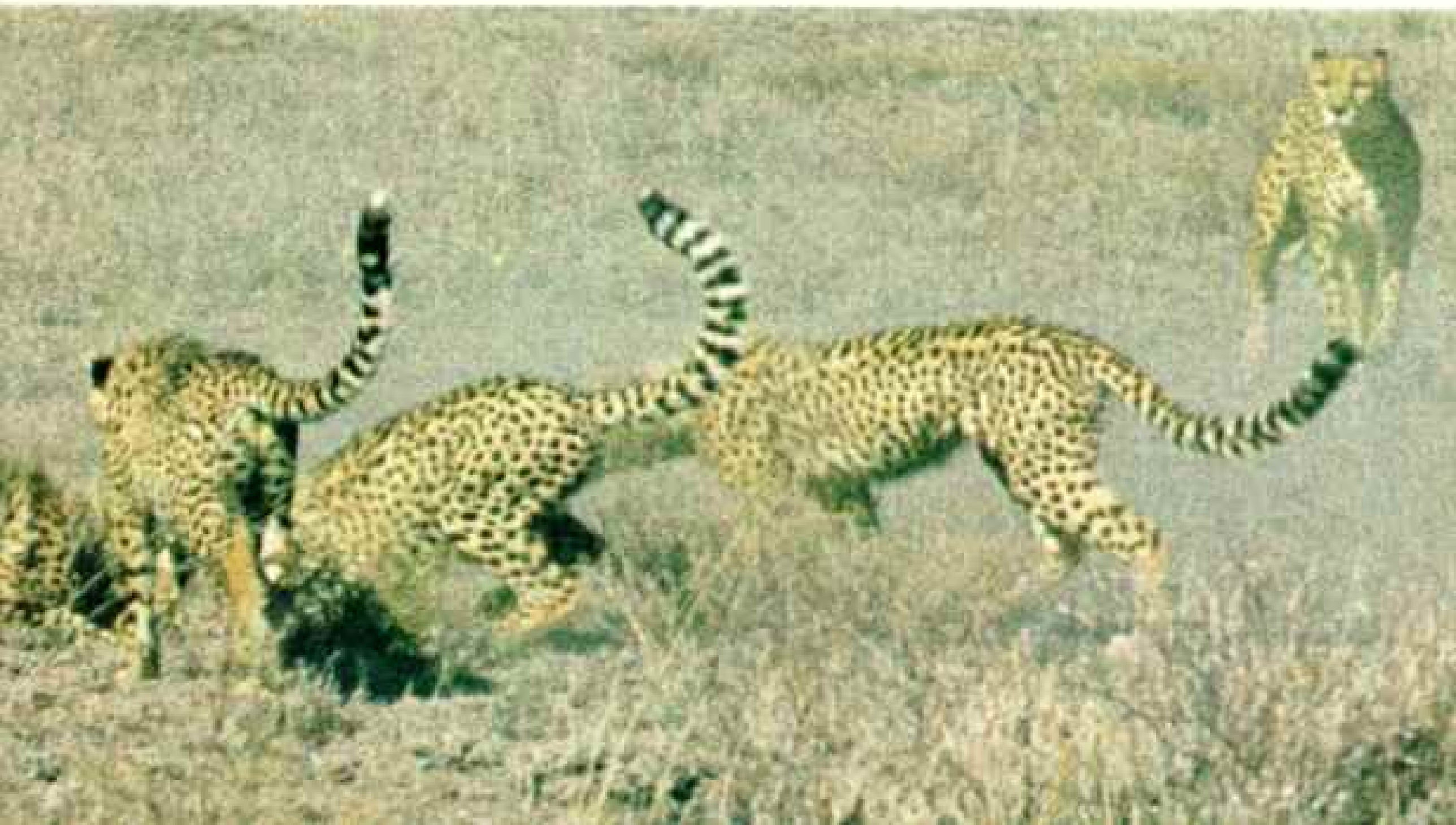




***A flurry of cheetahs**—cubs just 6 months old—converge on a hapless hare that they flushed in the Serengeti grasslands (**left**). Their mother (**below, far right**) looks on as the cubs finish off the quarry.*

On the chase, a cheetah can accelerate, in a brief burst, to a top speed of about seventy miles an hour; average speed is usually less than forty mph. Because even that pace can quickly cause overheating, the cheetah's hunting success depends on a careful stalk of the prey that culminates in a pursuit of only 200 to 300 yards.

Tracking cheetahs in the sprawling Serengeti National Park and its environs during a four-year study, the authors found them in surprising numbers—at least a thousand animals. But beyond such refuges the cheetah is losing its race with man, whose intrusive presence reduces its habitat and food supply and threatens its survival.



years and encompassed an area of 2,000 square miles in the Serengeti Plain and neighboring woodlands. Roughly speaking, the Serengeti forms the center of the cheetah's range, which stretches across Africa south of the Sahara and extends toward the Cape of Good Hope. The project helped form the basis of my doctoral dissertation at Utah State University.

Valuable support for the study came from African, American, and European institutions concerned with wildlife conservation. Among these, the Serengeti Research Institute provided us with a base of operations, and the East African Wildlife Society generously provided a Toyota Land Cruiser.

Despite our common devotion to the project, Lory and I occasionally differed in our approach to the subject. One morning on the Serengeti Plain we were studying a mother cheetah and her cubs through binoculars. Presently one of the female cubs climbed into the branches of a tree and became stranded some eight feet above the ground. The mother cheetah simply walked away as the cub frantically chirped in distress.

"Let's lend a hand," I suggested, but Lory shook her head. "That cub got herself up there, she'll get herself down," my wife assured me. Lory grew up in a household with pet cats, and she is an old hand at such minor crises. I, on the other hand, am a fire chief's son, and a cat in trouble still evokes memories of extension ladders and heroic rescues. After a while, the cub climbed down.

Our early observations refuted popular notions about cheetahs' hunting methods and their speed. Nearly every schoolchild learns that cheetahs are the world's fastest mammals, capable of sprinting at speeds as

Vehicle-wise *cats regard the park's population of cars and trucks as just part of a familiar landscape. Cubs appear to view themselves in a windshield* (**left**). *A hunting animal may even commandeer a roof to sight prey.*

Driving more than 50,000 miles throughout the Serengeti (**right**) *during their study, the authors found thorn-punctured tires an almost daily occurrence. Here George repairs yet another flat* (**below**).

high as seventy miles an hour. The *average* speed for most chases, however, is rarely more than forty miles an hour—still a crucial advantage over their favorite prey, the smaller types of antelope.

Despite their speed and killing efficiency, cheetahs are in the bottom ranks of large African predators. Among carnivores of the Serengeti, only the lowly jackal gives way to the cheetah. Lions, leopards, and even spotted hyenas not only challenge adult cheetahs for prey but also sometimes attack and devour their cubs.

After careful study Lory and I estimate that between half and three-quarters of all cheetah cubs in the Serengeti die before the age of 3 months. Those that survive reach sexual maturity around the age of 18 months, averaging 100 to 120 pounds in weight and standing roughly thirty inches high at the shoulder. Once past the critical three-month period, cheetahs in the wild may live as long as 12 or 14 years.

From the beginning of our study we kept detailed records on each cheetah we observed. In every case we snapped mug shots of the animals so that we could identify them later. We gave each one a name, borrowing from English, German, Swahili, and several other languages to accommodate a list that eventually grew to more than three hundred individuals representing four successive generations of cheetahs in the Serengeti.

The three male cheetahs whose killing of the intruder I had witnessed were known to Lory and me by the Swahili names we had given them—Tisa, Tatu, and Tano. Tatu and Tano were brothers who had teamed up with Tisa to establish a territory around the

Naabi Hill area in the middle of the Serengeti Plain.

To our knowledge, such a killing had been observed only once before. After much discussion Lory and I speculated that the intruder had hoped to join the resident males as a partner and had therefore chosen not to resist their challenge. If so, the choice had cost him his life.

Old Friend Reveals New Family

Such violence was rare in our day-to-day observations. Our subjects more often were females engaged in rearing cubs. Among those one of our favorites was Brigitta, a female (right) with a unique sickle-shaped scar across the top of her muzzle.

On our first encounter with Brigitta she had five nearly grown cubs with her. Thereafter she again became solitary, traveling and hunting on her own. After a time she disappeared, presumably to follow the herds of gazelles that migrate fifty miles or more across the Serengeti. One morning months later we were observing a female and her five new cubs through binoculars.

"Know her?" Lory asked.

"Not sure," I replied, studying the pattern of spots on the female's cheeks. I didn't recognize the pattern, and then my eye suddenly shifted to the animal's muzzle. There was the distinctive sickle-shaped scar.

"Brigitta!" I exclaimed, surveying the five silver-blue-and-black balls of fur gamboling along beside her. "So that's what she's been up to all these months."

Brigitta and her cubs proved ideal subjects for observation. Moving fairly slowly during the day and settling down together at night, the group offered excellent opportunities for round-the-clock study, a vital element in our research project.

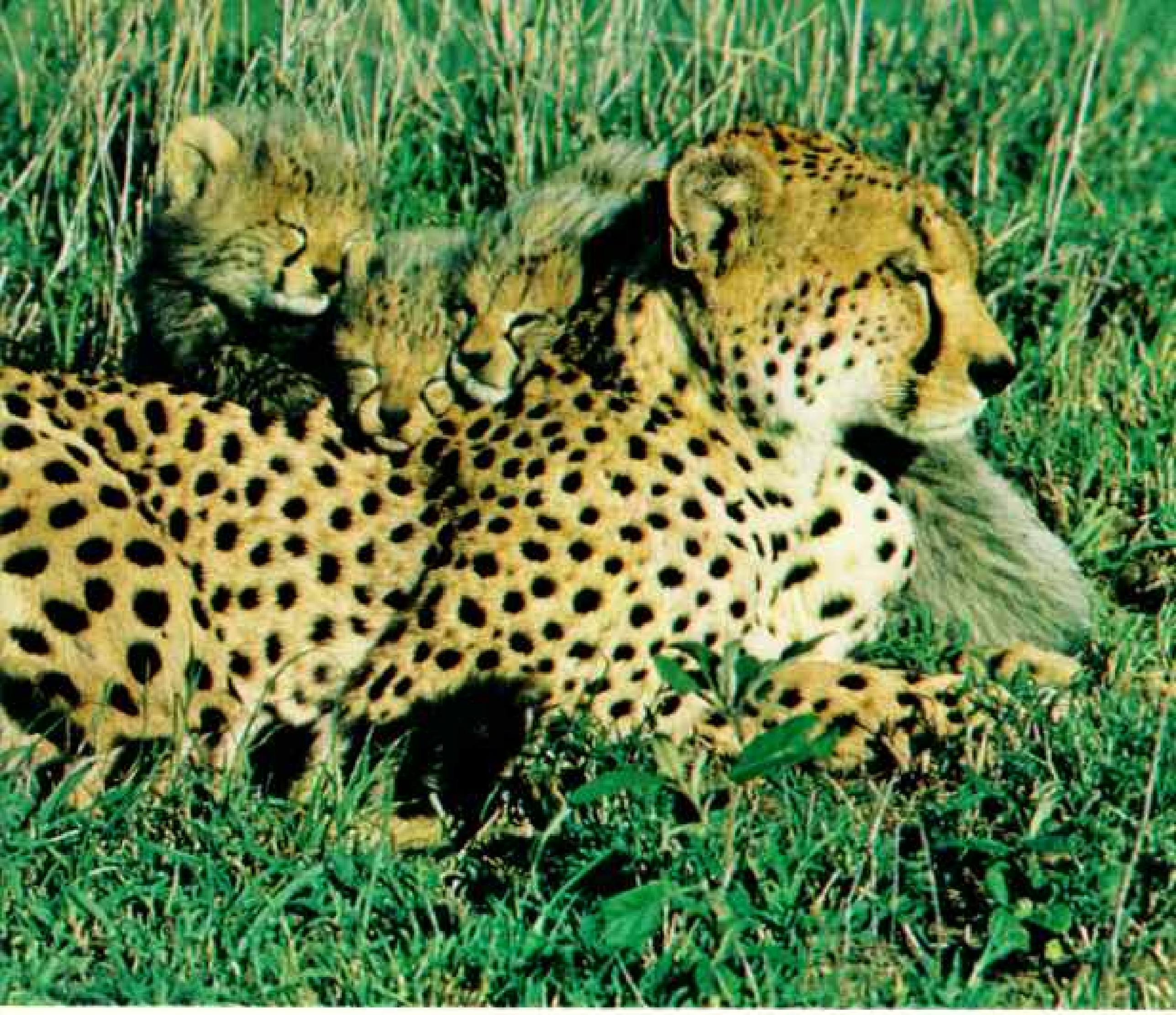
From the beginning we had determined to study cheetahs on a 24-hour basis, something no one had ever done over extended periods. We equipped the Land Cruiser with a mattress, portable stove, jerry cans of water, and an assortment of canned goods, so that we could remain in the field for as long as nine days at a time. Working shifts with binoculars and taking advantage of the bright East African moonlight, we were able to record nocturnal behavior (pages 722-3).

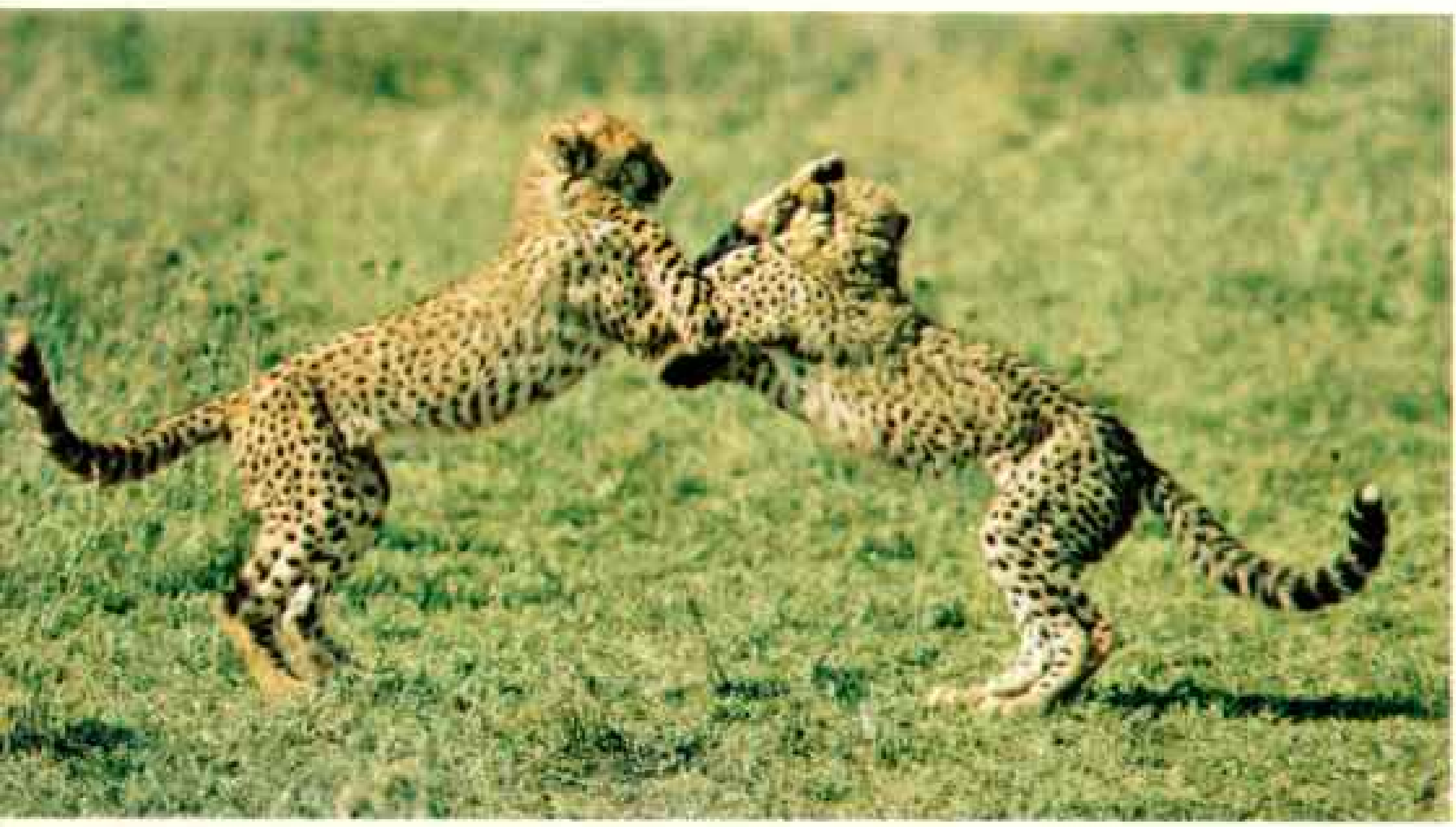
During the many weeks that followed our

Catnapping cubs *find mother's back a fine pillow for a noonday snooze (**above**). The mother, dubbed Brigitta, was one of more than three hundred cheetahs the authors grew to recognize from facial-spot patterns. Brigitta's cubs will wear their silver-blue mantles and blackish underside fur—visible on the animal at left—until they are about 10 weeks old. Scientists are as yet uncertain about the purpose of such distinctive markings.*

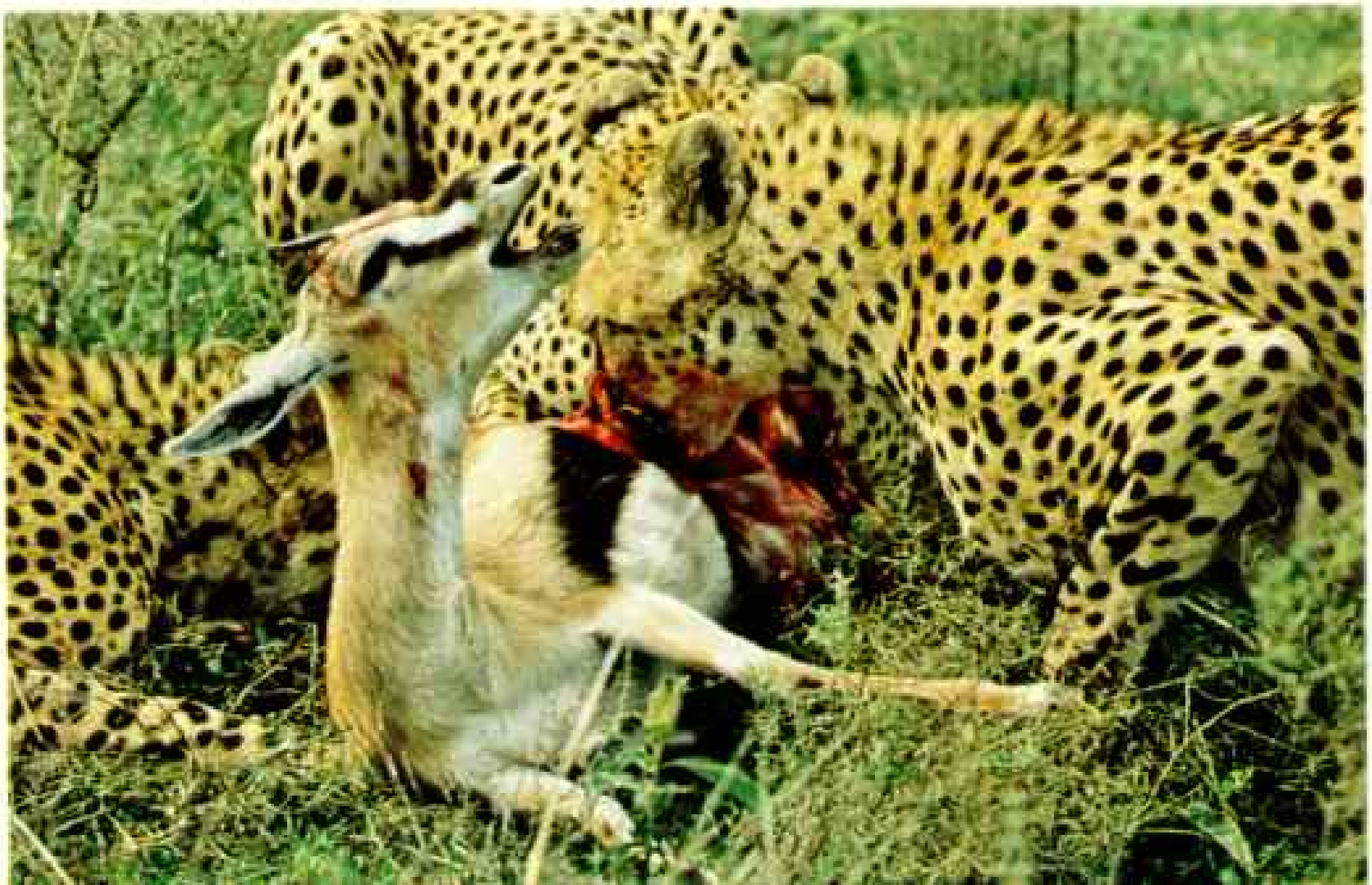
*At 4 months (**right**), cubs bear their mature coats and engage in the playful sparring familiar in cats of all kinds.*

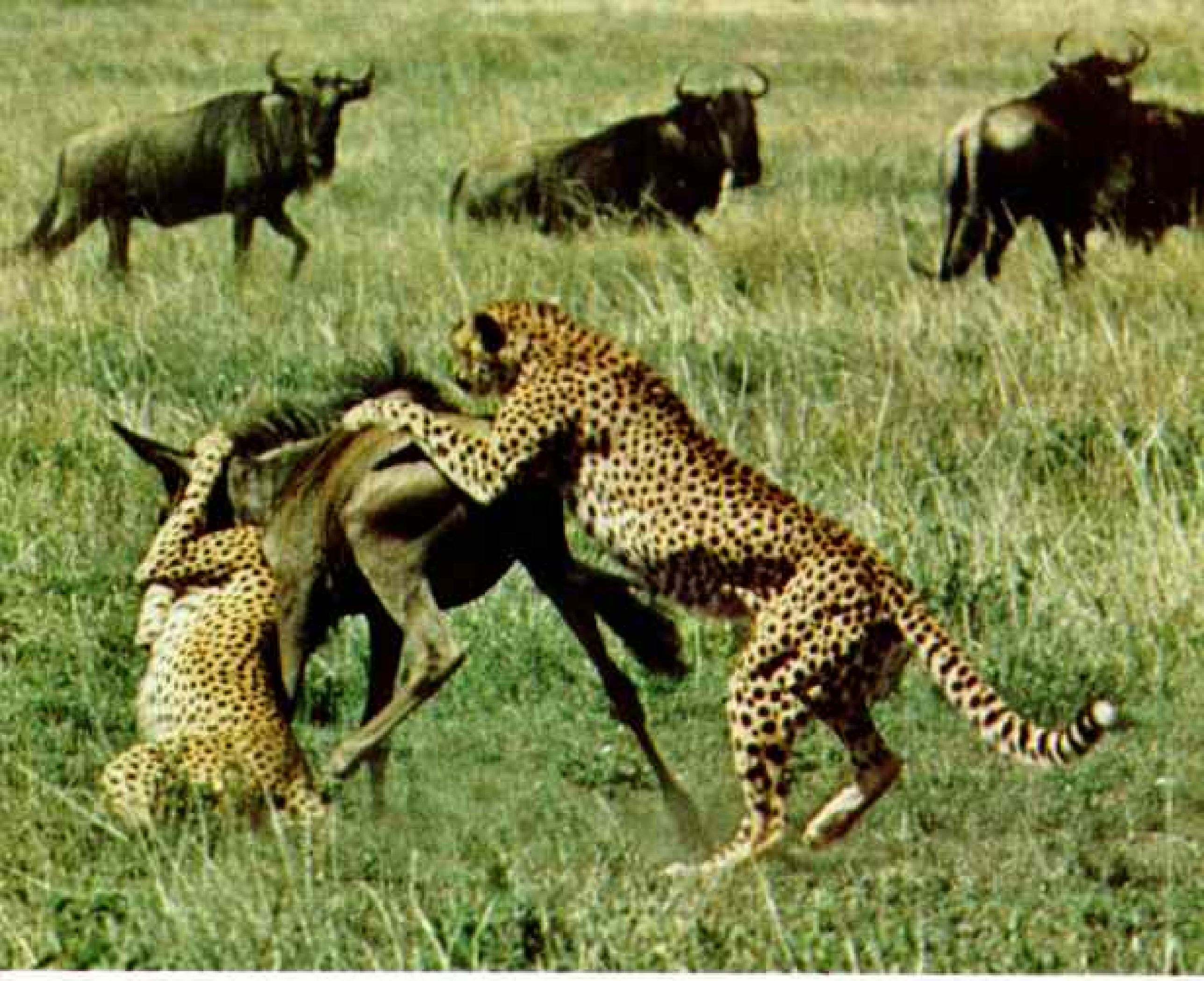
Cheetahs in areas frequented by tourists adapt to man's presence. Their morning hunts disrupted by sightseers, the Serengeti animals frequently kill during midday when people are at the lodge eating lunch.





Deadly teamwork *enables two males to down a yearling wildebeest (***above***). One cheetah grabs its haunches; the other lunges for the throat to inflict a suffocating bite, the standard method of dispatching a victim. Yet the animals sometimes kill in less efficient fashion. Immobilized, a Thomson's gazelle gasps as three hunters feed on its vitals (***below***).*





BOTH BY REINHARD KÜNKEL

reintroduction to Brigitta, Lory and I shared everyday life with her and her cubs. We watched her nurse the cubs, hunt, and share her kills with them.

After watching Brigitta hunt for several weeks, we concluded that a single Thomson's gazelle (left), an animal weighing roughly forty pounds, will sustain a mother cheetah and five small cubs for a day. Larger animals such as Grant's gazelles, wildebeests, hartebeests, and zebras require teamwork by two or more cheetahs to bring down (above). The usual method of killing is strangulation—the cheetah clamping its jaws onto the victim's windpipe.

When we had our second encounter with Brigitta as a parent, her new cubs were about 5 or 6 weeks old, and were beginning to follow their mother. Their fur was black, with silver mantling along the neck and spine. Although Brigitta still nursed the cubs, they were gradually being weaned. In following weeks they ate larger and larger portions of their mother's kills.

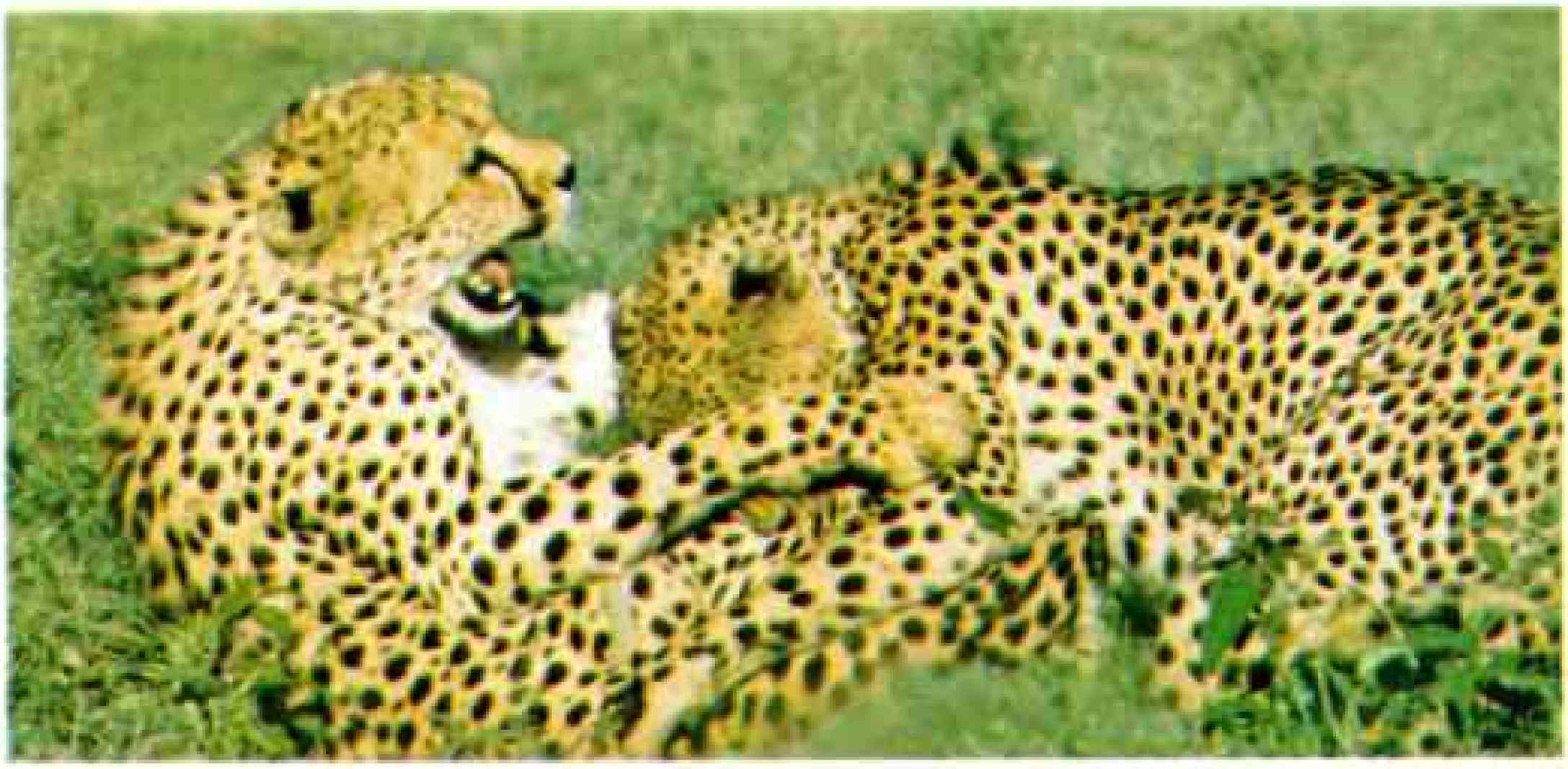
Occasionally during her travels Brigitta would climb into the branches of a thorn tree or to the top of a termite mound. She was searching for prey but often used the opportunity to mark the spot with urine or feces. Cheetahs space themselves out over relatively wide areas and use these scent marks on trees, bushes, and points of high ground to indicate their whereabouts or their territorial boundaries.

In time our study extended from one generation to succeeding ones. On a very hot afternoon in the fourth year of our study, one of Brigitta's daughters that we had named Tomoko suddenly appeared after a long absence. Tomoko emerged from a stand of high grass, her face blood smeared and her belly plainly full.

Cheetahs normally remain inactive during the heat of midday, so Lory and I,

Lovelorn Paka *sits attentively as morning breaks on the day after mating with Solitaire, who lolls on the grass. "Solitaire was merely tolerating him at this point," say*

the authors, first scientists to fully document wild cheetahs courting and mating. "When Paka fell asleep later in the day, she sneaked away, practically on tiptoe."



Leaping to the fray, *a male in defense of territory pounces on an intruder* ***(above)****. The attacker's cohort slinks in from the side. Curiously enough, the intruder lies submissively and does not try to fight back. "He was probably trying to be accepted into the group," say the authors.*

The assailants continue for twenty minutes, tearing out mouthfuls of fur and biting so savagely ***(left)*** *that the crunch of bone can be heard. Even when they stop to rest, the victim makes no attempt to flee. The denouement comes almost as an afterthought. One attacker ambles over and administers a choking, fatal bite.*

curious, drove closer to see why Tomoko was so active.

"She's nursing," Lory announced after a second look. "She seems swollen, and she's got dirt smudges around her nipples. She's obviously made a kill, and she's on her way back to her litter; maybe we can follow her and get a look at them."

For several miles Tomoko led us without a pause, finally stopping at Loliondo Kopjes, a scattering of huge boulders fringed with thornbushes. Here Tomoko began inspecting seemingly random bushes, glancing under each as she passed.

"Has she forgotten where she left the cubs?" Lory asked. "Or maybe she's checking for lions and hyenas?"

Neither, it seemed. Finally Tomoko paused and looked slowly around. She gave the soft churring noise of a female cheetah calling to her cubs, then vanished beneath a tangle of grass and thorn branches.

We waited in silence for half an hour. At length Tomoko emerged and stretched on her side in the grass. Five tiny balls of fur emerged from their hiding place and crawled toward her. When they reached her, they began nursing. Lory and I estimated the cubs' age at no more than 10 days.

Mother's Absence Brings Tragedy

For several weeks after that we followed Tomoko and her cubs, but kept a proper distance. With instinctive caution she moved her family to a new lair at least every other day, probably to hide them from predators. The technique worked, but only for a while. One day, with our colleague Reinhard "Leo" Künkel trailing her, Tomoko left the cubs for several hours in order to hunt. When Leo followed her home, the cubs had simply vanished. Although Tomoko searched a wide area around the lair for two whole days, no trace of the cubs remained. Most likely a hyena or lion had found them; such is the fragility of life in the Serengeti.

Unlike Tomoko's cubs, Jade's offspring survived the critical first three months and probably roam the Serengeti today as adults. Jade was a handsome mother with six cubs that we kept track of for 15 months.

Around the age of 10 weeks the cubs' black coloration and silver mantles began to give way to the adults' tawny fur and dark

spots. By the time Jade's cubs were a third grown, they were playing among themselves in ways increasingly suggestive of adult behavior. The play was so fast and varied that we couldn't watch and take notes at the same time. We finally had to concentrate on a single cub at a time, recording every possible detail on tape.

The most common type of play was stalking, chasing, and pouncing. The sequence bore close resemblance to actual hunting by adults. One cub would chase another to the point of capture, then swipe at its rump or hind leg with a paw in the same manner that an adult cheetah knocks its victim to the ground. Among cubs, however, the usual final stage was simply a wrestling match instead of the fatal strangling bite.

Jade was remarkably tolerant of the cubs' play, even when it was directed at her. Now and then a cub would rear up beside her as she walked, bracing its forepaws against her neck and vigorously chewing her nape. Often Jade merely continued to walk, forcing the cub to keep pace on its hind legs. Before long the attacker would weary of the effort.

Cub Rearing Is No Easy Task

Despite their growing independence, the cubs remained a constant burden on their mother. When Jade went on the hunt, the cubs tagged along, sometimes wrestling, pouncing, and snarling among themselves, frequently scaring off the quarry Jade had so painstakingly stalked.

Yet when Jade *did* make a kill and paused briefly to catch her breath, the cubs became a ravening mob, growling and shoving past their mother to get at the meat.

One fact we learned from our tracking of Jade and her cubs is that cheetahs can go long periods without water. Even in the hottest season the family regularly passed up water holes for four or five days at a time.

Jade and her cubs parted company when the young ones were 16 months old and

Panic erupted *at Seronera airport when travelers spied Solitaire sitting on a ramp. But the estrous female was just passing through, marking the spot—and other high points—with urine to broadcast her eligibility to prospective males.*

weighed roughly a hundred pounds each. At that stage young cheetahs are nearly full grown and are fairly competent hunters, though they still have much to learn. Perhaps partly for that reason littermates tend to remain together for at least several more months before going their separate ways.

As with many other mammal species, it is the males that disperse. We found that young female cheetahs continue to occupy virtually the same range as their mothers. In nearly every case the young males eventually emigrate, sometimes together, as did Tatu and Tano, to establish new territories.

Although male and female cheetahs are born in roughly equal numbers, we found that in the Serengeti adult females outnumber males. The reasons seem to be that young males are forced by the older, resident males to emigrate out of our study area into less favorable habitats. Some males are also killed in fights.

Curiously, although it is the males who emigrate, the females usually travel farther during the course of a year. Whereas a male's established territory encompasses 15 to 30 square miles, a female's range covers about 600 square miles. It is not uncommon when following migratory herds of gazelles for female cheetahs to travel more than forty miles.

The females are normally solitary creatures. The largest number of cheetahs we ever saw together in four years was nine—two mothers, with three and four cubs respectively. I suspect the females were young sisters who still had a sibling bond.

Perhaps the single most exciting observation in our four years of study involved the courtship and mating of cheetahs. The full sequence had never been studied in the wild, for cheetahs are not only solitary but also very secretive animals.

We had an indication that mating was soon to occur when we encountered Solitaire, another of Brigitta's grown daughters. Solitaire was clearly in estrus, for as she traveled, she paused to sniff at virtually every tree, bush, termite mound, and clump of grass she came to. In addition, she left urine marks at an unusually high rate—at least once every ten minutes.

Studies of mammals show that the urine of females in estrus contains hormones that advertise the condition to males. We knew it was only a matter of time before Solitaire's trail would be picked up by a prospective suitor, and we stayed close to her round the clock for five days.

Early on the morning of the sixth day a male we knew as Paka discovered Solitaire's scent marks. He broke into a fast walk, alternately yelping and emitting staccato purrs as he followed her trail. Shortly before sunrise Solitaire heard Paka's call and immediately trotted in his direction.

The moment the two animals saw each other Solitaire lay in the grass. Paka almost immediately mated with her, grasping the back of her neck in his mouth in typical cat fashion. The courtship ritual just before mating was surprisingly brief.

Afterward Solitaire rolled in the grass, groomed her legs and face, and seemed to ignore Paka. He growled and hissed whenever she moved, following her and sniffing the grass wherever she lay.

The pair rested through the day, mated again at dusk, and remained together until the next afternoon, when Solitaire cautiously crept away as Paka slept. The entire process was in marked contrast to those other large African cats, the lions, who mate frequently over a period of several days, sometimes as often as four times in an hour.

Preserves May Promise Only Haven

The major conclusion of our study is that the protected Serengeti cheetah population is doing well. Elsewhere in Africa, however, cheetahs are declining in number at a frightening rate. One survey jointly sponsored by two wildlife-conservation groups indicates that the cheetah population is being halved every decade. The reasons are simple: illegal hunting for pelts, encroachment on habitat by farms and settlements, loss of natural prey, and deliberate extermination.

Only in vast designated preserves such as the Serengeti National Park can the cheetah hope to survive. Lory and I estimate that there are at least a thousand cheetahs in the Serengeti, a living monument to the continuing efforts of Tanzania's government.

A similar conservation effort on the part of other African nations is the cheetahs', and our own, best hope. □

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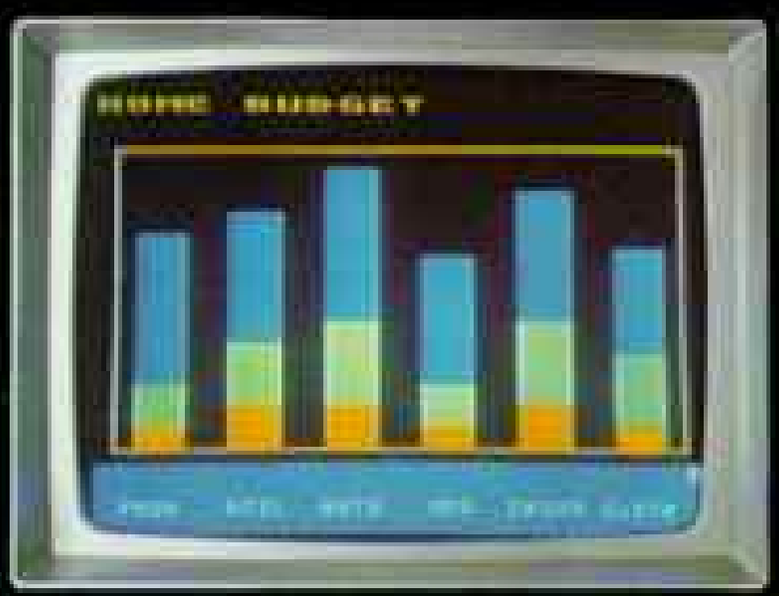

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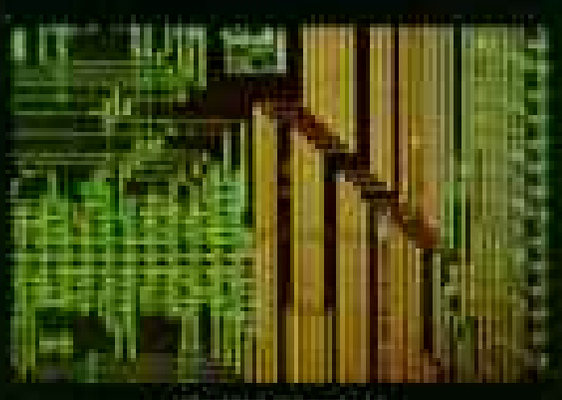

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The refugee plight: an inside view

CAPTURED by the Communist Pathet Lao and put on display in a small cage, John Everingham knows the plight of Southeast Asian refugees. Abruptly expelled from Laos as a "spy" in 1977, the Australian journalist returned to rescue his Laotian fiancée, Keo (**right**), now his wife. Wearing scuba gear with a dual mouthpiece, he swam the Mekong River and brought her to safety in Thailand, towing her as a lifeguard would, since Keo does not swim.

Starting on page 642, Everingham tells of one refugee family's resettlement in America. An introductory story by Associate Editor W. E. Garrett outlines the dimensions of the tragedy in Southeast Asia.

In 1973 both Garrett and Everingham were detained by the Pathet Lao in the village of Pak Hao, Laos. The blond Australian chats with his captor and a villager on the day of release (**below**).

Bring such first-person accounts to your friends by nominating them for membership below.

TOM MARLOWE (TOP) AND W. E. GARRETT

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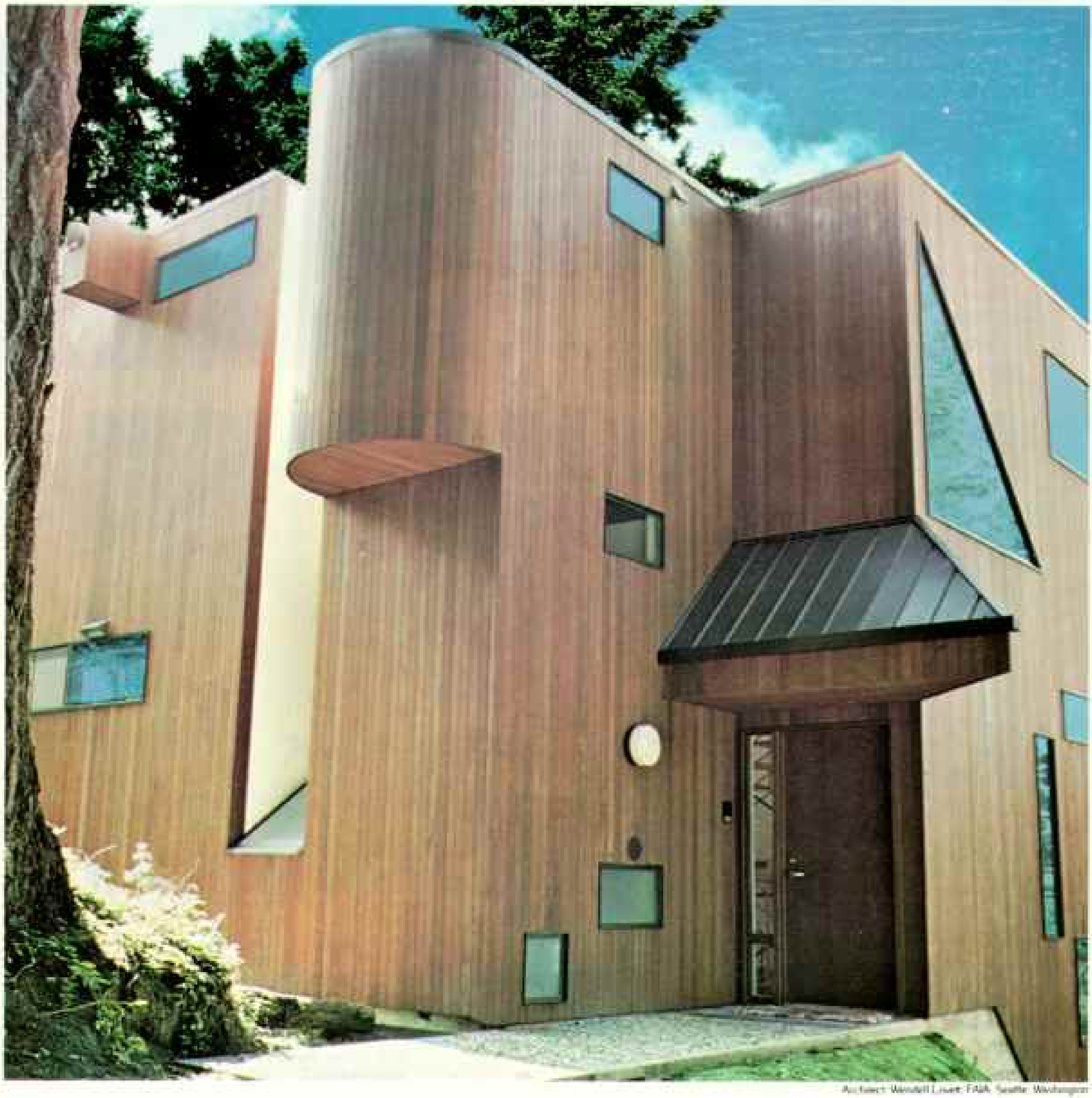

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The Parker arrow clip—so proud and distinctive—is your assurance of uncommon character and flawless performance. Recognized for its contemporary styling and traditional craftsmanship, a Parker pen offers elegance of form and unexcelled function.
A remembered gift, a cherished possession.

PARKER

At fine stores or write: The Parker Pen Company, Dept. J, Janesville, WI 53545

Partnership.
Twice the spirit to get things done.

It works in business insurance, too.

At Wausau Insurance, we believe it takes a partnership effort to make business insurance work for a living. When the policyholder works *with* us — with equal dedication — we have our best chance of preventing losses.

The preservation of life and health and property is the goal. And a reward in itself. But there's an *extra* reward for succeeding. And that's better control of what you have to *pay* for business insurance.

Because if you prevent losses, you can contain *costs*. We'll work hard to help you. But you have to shoulder *your* share of the responsibility. Partnership. Twice the spirit to get things done. That's the Wausau story on business insurance.

WAUSAU INSURANCE COMPANIES
Employers Insurance of Wausau

WAUSAU WORKS.℠

SMOKEHOUSE® ALMONDS

"ONE NIBBLE IS NEVER ENOUGH"™

You've settled down to do some reading. But there's that bowl of Smokehouse® Almonds. You reach for one handful, then another. That Smokehouse® flavor is so tantalizing, soon your hand is reaching and reaching, as if it had a mind of its own. Before you know it the bowl is empty. No wonder they say "One Nibble Is Never Enough."™

Smokehouse® Almonds are one of seven different snack almonds from the Almond People®

California Almond Growers Exchange P.O. Box 1768, Sacramento, CA 95808

One size fits all.

KRAFT

Our Pride. Your Joy.

Look at all you find when you look into this Sears Kenmore

Porcelain-on-steel liner

Power Miser saves up to 14% in energy

Ice and cold water dispensers

Textured steel hides smudges

25.0 cu. ft. frostless Lady Kenmore refrigerator, Model 69086/69096

Rollers for easy cleaning

Popular Features. Kenmore refrigerators offer a wide choice of features. Outside, you can find features like automatic ice and water dispensers that save you opening the freezer door and letting cold air escape. Inside, a feature like Sears Humidrawer® that helps keep a variety of foods fresh for up to eight days.

And remember, Sears service is only a phone call away.

Wide Selection. Choose from 29 models, 121 styles. Bottom freezers, top freezers, side-by-sides and compacts for office, den or apartment. Or family units like the 25.0 cu. ft. frostless Lady Kenmore shown here.

The 1980 Kenmore refrigerator line is an average 70% more energy efficient than our 1972 model line.*

Your choice of 29 models, 121 styles.

Available in most Sears retail stores and the catalog.

Kenmore. Solid as Sears

*The efficiency improvement, as measured by U.S. Dept. of Energy test procedures, is a weighted average based on production volumes for 1972 line and that projected for 1980 line

Myth:

Trucks move most efficiently on public highways.

Fact:

Railroads move trucks up to four times more efficiently.

Mile for mile and pound for pound, today's freight railroads are up to four times more fuel-efficient than big trucks. Shippers recognize this advantage. That's why piggybacking truck trailers and containers is the fastest-growing segment of the rail freight business.

But there's another consideration. While every wage-earner and manufacturer in America subsidizes our public highway system, trucks are destroying that vital system at an alarming rate.

Congress' watchdog, the General Accounting Office, said in a blistering July 1979 report: "Excessive truck weight is a major cause of highway damage. The rate of highway deterioration will slow down if excessively heavy trucks are kept off the highways…A five-axle tractor-trailer loaded to the current 80,000 pound federal weight limit…has the same impact on an interstate highway as at least 9,600 automobiles."

It is ironic that the American public is subsidizing the destruction of its own highways. It is also unnecessary, because a logical alternative already exists: This is the vast, fuel-efficient steel network that links every part of America: our modern freight railroads.

Railroads handle more than a third of the nation's inter-city freight and have the capacity to handle even more. Today, escalating highway repair costs and dwindling oil supplies make America's freight railroads more vital than ever.

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

Surprise:

America's freight railroads carried more than 3,000,000 piggyback truckloads last year —and never left a pothole.

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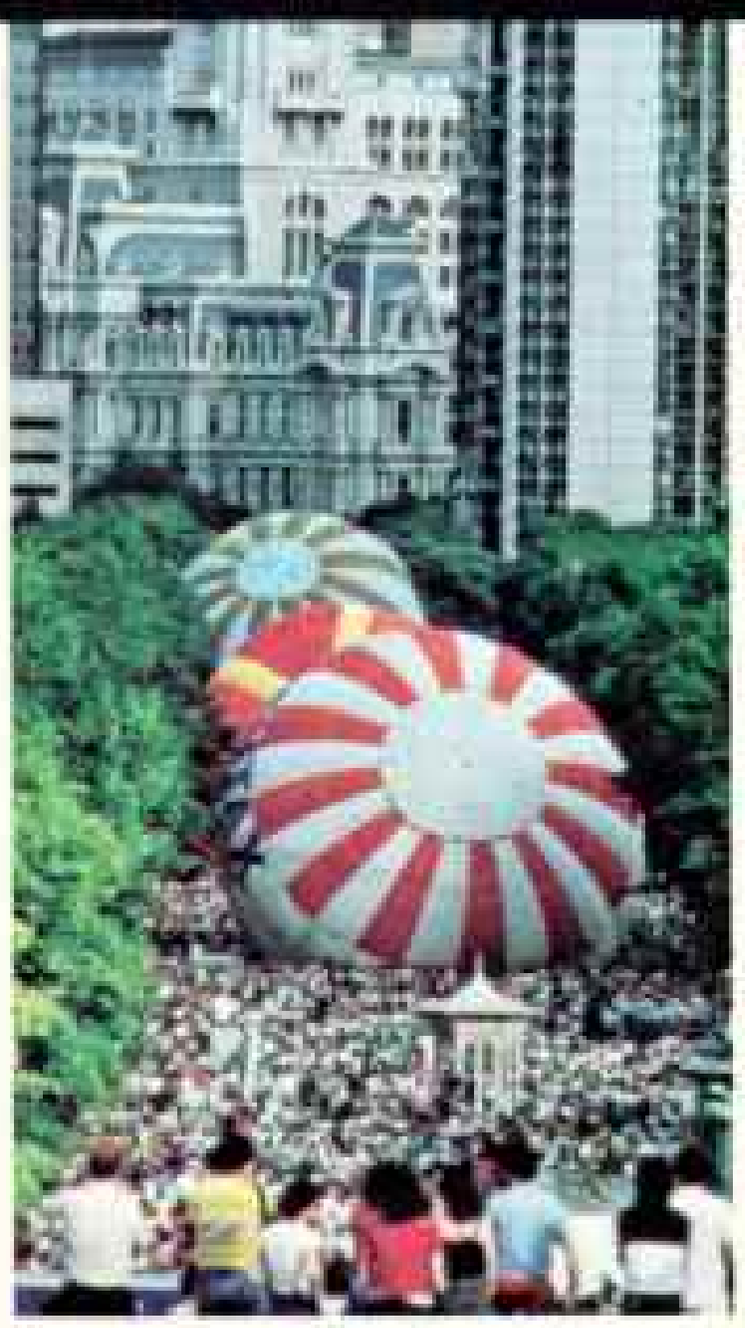
MEET A MUMMER. SPEND THE SUMMER. MAKE FRIENDS IN PHILADELPHIA.

There's a world of great things to see and do in our great city. The famous Mummers. 76 days of non-stop free summer events. Freedom Week — a one-of-a-kind 4th of July extravaganza. And history, entertainment, great food, friendly people and just plain fun. Come and enjoy. Come and make friends in Philadelphia.

For brochures and more information, consult your travel agent, send in the coupon or call Toll Free **800-241-8444.**



Philadelphia

Send to: Tourism Department, Philadelphia Convention & Visitors Bureau, 1525 John F. Kennedy Blvd., Phila. PA 19102

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59-5/80

"Environmental activists? At Bethlehem Steel, about 1,000 of them help clean up the air and water."

Dr. David M. Anderson, Corporate Director, Environmental Affairs

"The thousand people I'm talking about actively work at improving the environment.

About four hundred of them—scientists, engineers and technicians—develop, design and operate Bethlehem Steel's environmental control program.

And about six hundred of them—in our plants, mines and shipyards—monitor, maintain and repair the hundreds of pollution control facilities Bethlehem has installed.

We're proud of our accomplishments in cleaning up the air and water.

We've come a long way since 1946, when Bethlehem began its formal environmental control program. Today we're removing about 95 percent of the pollutants from our air emissions and water discharges.

Innovative technology and a lot of money help.

The equipment you see behind me is typical of the innovative technology needed to satisfy today's environmental standards.

It's called a 'one-spot' coke pushing emission control car. And right now it's helping to solve a pollution-control problem that's plagued us for years: capturing and cleaning the emissions produced when coke is pushed from a coke oven.

Our Bethlehem, Pa., plant was the first steel mill to operate this system. We're installing similar units at our coke ovens in Lackawanna, N.Y., and Sparrows Point, Md. Each of these units costs us more than $5 million."

Bethlehem's commitment: to do what is necessary to protect public health.

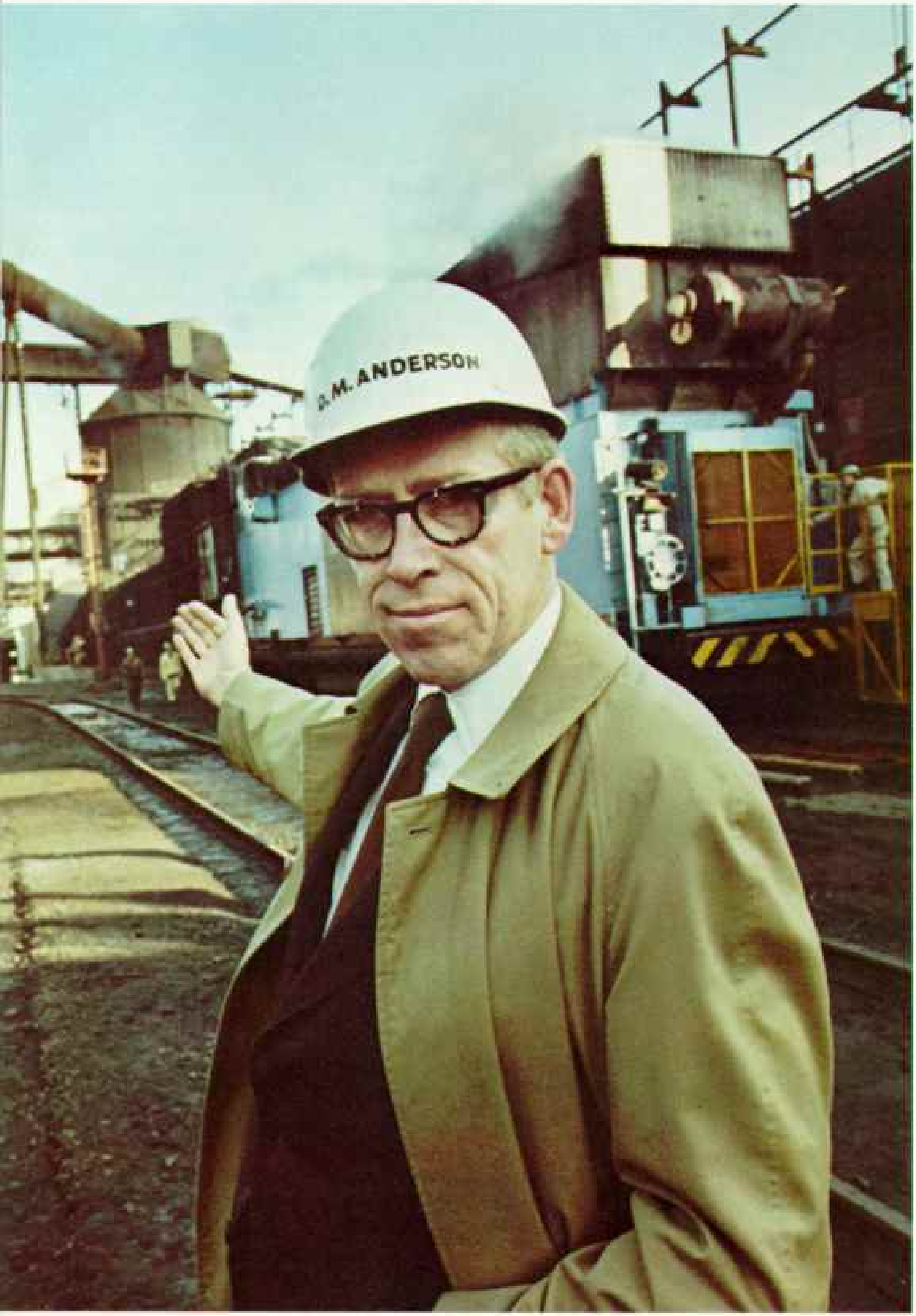
We've made substantial progress in controlling pollution, but we haven't finished the job. We've already spent $700 million for pollution control equipment and we may have to spend several hundred million more in the years ahead.

But we believe there's a limit. To require industry to "purify" the air and water beyond what is necessary to protect health does not make good economic or energy sense. A balance must be struck between an absolutely pure environment and a healthy environment, so that the economy of this nation has the opportunity to thrive.

Our position is clearly explained in our *Statement on Environmental Control.* If you would like a copy, write: Public Affairs Dept., Rm. 476 MT, Bethlehem Steel Corporation, Bethlehem, PA 18016.

Bethlehem

Coke, used in blast furnaces to produce iron, is made from coal baked in airtight ovens at temperatures up to 2000 F. The "one-spot" coke pushing emission control system is a mobile unit made up of a 33-foot-long coke receiving car and an 83-foot-long air pollution control car. As the coke is pushed from an oven into the receiving car, a high-pressure hot-water ejector creates a vacuum and evacuates and cleans the gases during the push. Evacuation continues as the system transports the coke to the quenching tower. These captured gases are cleaned by the scrubbing system in the control car before they are released into the atmosphere.


A.M. ANDERSON

The Pinellas Suncoast... For The Complete Florida Vacation

You'll find everything people come to Florida for right here on the glistening Pinellas Suncoast. From miles of soft sand beaches and warm tropical waters to exciting sports like fishing, sailing, water-skiing, golf and tennis. Come to the Pinellas Suncoast and you've come for it all.

Twenty-eight miles of beaches

Choose from eight very different resort communities on the Gulf of Mexico, each offering its own special brand of beach living from the cozy cottages of the Holiday Isles to the luxurious waterfront hotels along St. Pete Beach and Clearwater Beach.

Nearby, Mickey Mouse, Darkest Africa and much more.

Within 90 minutes of your Pinellas Suncoast vacation headquarters you'll find three-quarters of Florida's most famous attractions including the Walt Disney World® Vacation Kingdom and the Dark Continent, Busch Gardens, Tampa. Plus, many others right here on the Pinellas Suncoast.

It's all here and the Pinellas Suncoast is one of Florida's most accessible resort areas. So this year, make yours the complete Florida vacation — on the Pinellas Suncoast.

The Pinellas Suncoast.
Come for it all.

Tell me more about the Pinellas Suncoast.
☐ I'm enclosing $1 for the complete 32-page color guidebook to all the Pinellas Suncoast communities and attractions, and I'd like specific information on the community I have checked. I'm interested in:
☐ lodging ☐ campgrounds.
I'm planning my vacation for _____ (month)
I ☐ have ☐ have not visited the Pinellas Suncoast before.

☐ **Clearwater Beach** ☐ **Dunedin**
☐ **Holiday Isles** ☐ **Madeira Beach**
☐ **St. Petersburg** ☐ **Tarpon Springs**
☐ **St. Pete Beach**
☐ **Treasure Island**

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Clearwater, Florida 33520

109-5-80

Beauty that won't weather away.

The Andersen® Perma-Shield® casement window takes on the weather so you don't have to take on the window.

There's no worrying about it chipping, cracking, peeling or blistering. No worrying about painting it every few years either.

For over its solid wood core lies a rigid vinyl sheath. It protects the wood inside from the blazing sun, bitter cold and driving rain outside.

The wood core is also treated with a water-repellent preservative to resist decay, warping, insects and all the headaches that go with them.

And the window sash is *completely* enclosed in vinyl. So it's stronger and more sturdy. Easier for your family to open, close—live with.

The Perma-Shield casement is available in white or the earth color, Terratone. Both are virtually maintenance-free. If the rain doesn't clean them a damp sponge will.

With free time so precious, can you afford any other window?

Look up your Andersen dealer in the Yellow Pages under "Windows."

To: Andersen Corp., Box 12
Bayport, MN 55003

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 _____

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Andersen® Windowalls®

FIGHT BACK AGAINST SO-CALLED PLANNED OBSOLESCENCE

SCOUT® INTRODUCES THE WARRANTY PACKAGE IN

It seems like clockwork. Just when the repair bills start rolling in, you discover your car's warranty has run out. Call it planned obsolescence. Call it anything you want. At International Harvester, we call it disgraceful.

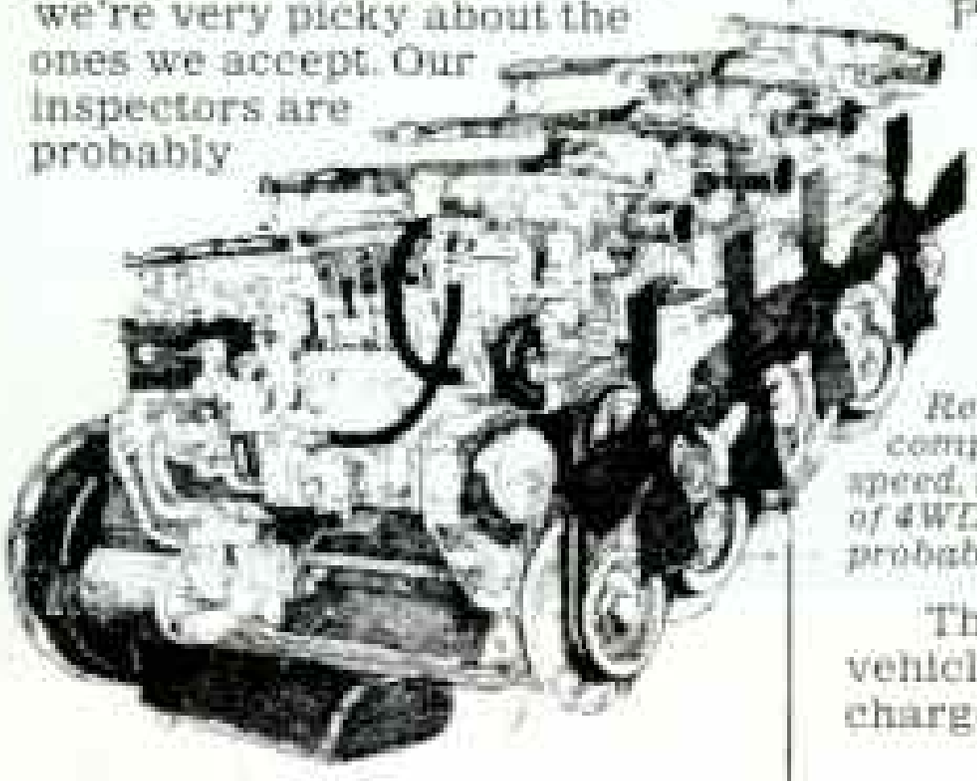
That's why for 1980 we proudly and confidently announce the longest engine and rust-through protection package in automotive history: 100,000 miles. Or 5 years. Clean and simple.

How to build a 100,000-mile engine warranty.

We build every one of our engines to last well beyond 100,000 miles. That's why we can make this promise: *During the first 100,000 miles, or 5 years (whichever comes first), International® Scout® will repair or replace without charge for parts or labor any part of the engine block and all internally-lubricated engine components which are defective.**

But it takes more than a good engine to back up a 100,000-mile warranty.

Testing. Unlike most car companies, we test every Scout engine both before and after it's put into the vehicle. And we're very picky about the ones we accept. Our inspectors are probably tougher on our engines than you'll ever be.



International Harvester Heritage. We've been building our own engines since 1908. In fact, one of our optional Scout engines is a first cousin to the power plant that goes in our 2½-ton trucks.

And every Scout engine is a 100,000-mile engine. From our gutsy, but economical, 196-cubic-inch four-cylinder to our hardworking, hard-playing 304-cubic-inch and 345-cubic-inch V-8's.

Our new turbo-diesel engine. Only one other in America.

The new Scout Turbo-D gives you all the economy and dependability of a diesel with startling acceleration. Power to pass.

Power to get through trouble. Extra power when you want it—and need it most.

Scout Turbo-D fuel economy:

22 EPA EST MPG 24 EST HWY MPG

Remember, use estimated mpg for comparison only. Mileage varies with speed, weather, trip length and your use of 4WD. Actual highway mileage will probably be less.

There is one other passenger vehicle in America with a turbo-charged diesel: the $30,000 Mercedes-Benz 300SD.

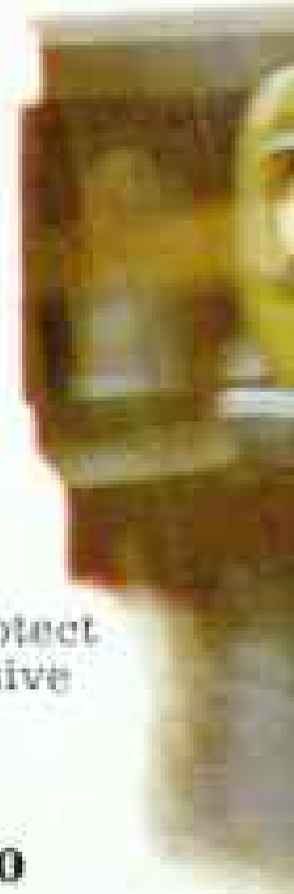
It's unfair to compare our engine to theirs however. Remember, the Scout Turbo-D has a 100,000-mile warranty vs. a warranty of only 24,000 miles for the Mercedes.

Our new rust warranty. Protection for the long haul. Drive an ordinary car a few years and you may discover that your rust warranty (if you have one at all) is no more solid than the fast-corroding body of your car. What do you do? You fight back with Scout. And our new 5-year rust-through protection plan.

Our new warranty gives you this honest promise: *During the first 100,000 miles, or 5 years (whichever comes first), International Scout will repair or replace any vehicle body component which suffers "perforation" due to corrosion without charge for parts or labor.**

Bill Roseberry is a steady hand behind our hot wax anti-rust treatment.

We treat every 1980 Scout with an extensive 4-step anti-rust process. We galvanize critical welding points. Dip Scout bodies to electrostatically coat all major body parts. Apply zinc-rich primer to hood, fender and windshield seams. Finally, we call on the steady hand of Bill Roseberry, who helps hand spray 325° "hot wax" on inner surfaces to protect them against corrosive road salt.



Quality and security go hand-in-hand.

The same built-in quality that is the backbone of our new warranties helps protect you and

*Warranties are non-transferable, and assume customer's proper care and maintenance. See your dealer for details.

LONGEST AND BEST AUTOMOTIVE HISTORY.

your family from things that push ordinary cars to their limits... and beyond. Like 1980-size potholes, flooded roads and hazardous winter driving. In a Scout you'll get a feeling of well-being you may never experience in a car.

It's a secure feeling of sitting in a vehicle that surrounds you with protective steel. Try and find a car that puts more steel between you and trouble than Scout.

In a Scout you sit higher than a car. A vantage point that lets you see the road ahead more clearly and avoid trouble more easily.

Then there's our selective 4-wheel drive. It gives you the option of easily shifting from economical 2-wheel drive to 4-wheel drive, for extra stability and traction when the road or the weather looks rough.

How to fight back.

Your International Scout dealer has just what you need to fight back against the compromise of ordinary car warranties and ordinary cars in general. The versatile Scout II® and the bigger, roomier Scout Traveler.®

Before you even consider buying an ordinary car, test drive a 1980 Scout. It's as easy as dialing 800-IH-SCOUT for your local dealer.

Dial Toll-Free **800·IH·SCOUT**
Illinois Residents 800-322-0821

INTERNATIONAL HARVESTER

FIGHT BACK WITH SCOUT.

Anything less is just a car.

In The Bahamas you can live like Robinson Crusoe.
Or the way he dreamed of living.

The endless islands with endless possibilities.

Some people dream of relaxing on a secluded island.
Others dream of more lavish surroundings.
In The Bahamas you can have either. Or both.
Create your own world at a quiet hideaway with miles of untouched beaches.
Or stay at an exciting resort where we'll pamper you in tropical style.
You see, with us you have a choice. To be alone on one of our endless islands, pampered by nature. Or be with others, pampered by us.
For reservations and information, call your travel agent or 800-327-0787.
In Florida 800-432-5594.

It's Better In The Bahamas

BaHaMas

The new Nikon EM

From the legend that is Nikon comes the new Nikon EM. A lightweight, automatic 35mm camera designed to make great pictures simpler and more foolproof than ever before. A camera that gives you beautiful pictures that are...

Sharp, and clear, automatically ... alive with rich colors and vivid detail, because the EM is precision-engineered by Nikon. Acclaimed by one of photography's foremost authorities for picture quality that rivals even professional Nikons. So it may surprise you to discover that...

For the cost of just an ordinary automatic single lens reflex, the extraordinary Nikon EM can be yours! At last, the joys of fine photography at an affordable price. And, from the very first roll, you'll find it's also easy to use, because...

Nikon's exclusive electronics automatically set the correct exposure! All you do is focus and shoot. There's even a unique audible warning signal that tells you if the light's not right. And to add more excitement...

The Nikon EM has its own low-cost accessories. A completely automatic flash. A dynamic lightweight motor drive for action sequences and automatic film advance. Superb Nikon Series E lenses for wide-angle and telephoto shots. Now the greatest name in photography can be yours. **Nikon EM. It's not just a camera. It's a Nikon.**

for pictures this sharp, this clear, automatically.

Nikon. Official 35mm Camera. 1980 Summer Olympic Games

The Gold Coins of Mexico.

Once you know the story behind them, you'll know why so many Americans are purchasing them.

For those who've considered buying gold bullion coins, The Gold Coins of Mexico offer a lot to consider.

The Gold Coins of Mexico are official restrikes of the government of Mexico, minted by the Casa de Moneda de Mexico, the oldest mint in the western hemisphere, established in 1535. Exclusively minted for the Mexican Federal Reserve Bank, Banco de Mexico, they have enjoyed a fine, world-wide reputation for many years.

Now, Americans who have made the decision to purchase gold coins have the opportunity to acquire The Gold Coins of Mexico in the United States at the following banks: Citibank, Swiss Bank Corporation and Republic National Bank of New York.

People who purchase them for the future, invest some thought in their past.

Long before the first gold coins were

Since financial portfolios come in all sizes, so do The Gold Coins of Mexico.

COINS SHOWN ACTUAL SIZE

2½ Peso "Hidalgo"
Pure gold content:
.0602 troy ozs.
(1.875 grams)
Diameter: 15.5mm

5 Peso "Hidalgo"
Pure gold content:
.1205 troy ozs.
(3.75 grams)
Diameter: 19mm

10 Peso "Hidalgo"
Pure gold content:
.2411 troy ozs.
(7.5 grams)
Diameter: 22.5mm

20 Peso "Azteca"
Pure gold content:
.4823 troy ozs.
(15 grams)
Diameter: 27.5mm

50 Peso "Centenario"
Pure gold content:
1.2057 troy ozs.
(37.5 grams)
Diameter: 37mm

minted in the New World, the Aztecs had already culled bits of the precious metal from the rich creeks and rivers of Mexico. While some of the gold was skillfully transformed into beautiful artifacts, gold bars and transparent feather quills filled with gold dust became common mediums of exchange. These were eventually replaced by the first Mexican-minted gold coins known as "cobs."

Once you understand the value of gold as an investment, you'll appreciate the value of The Gold Coins of Mexico.

Many people consider the value and purchasing power of gold as an alternative hedge against inflation. Of course, the decision to own gold is a highly personal one in which risks and advantages should be carefully considered in light of your specific financial and investment goals. For, as gold is a commodity, its value is subject to continual market fluctuations.

For those who have made the decision to purchase gold, The Gold Coins of Mexico provide the convenience, portability, and liquidity of owning gold in coin form, and offer alternative choices for purchases.

The Centenario.
More than an ounce of gold.

Mexico's 50 peso gold piece, more commonly known as the "Centenario," was originally minted in 1921 to celebrate the centennial of Mexico's independence. Boasting a high gold content of 1.2057 troy ounces, the "Centenario" is the heaviest of all high circulation gold bullion coins in the world. Like most other bullion coins, a simple calculation is required to determine its current value. Up-to-the-minute prices for any of The Gold Coins of Mexico are available by calling any of the toll-free numbers below.

Since financial portfolios come in all sizes, so do The Gold Coins of Mexico.

The Gold Coins of Mexico also offer you a variety of coins to purchase. The "Azteca," Mexico's 20 peso gold piece, for example, has a .4823 troy ounce gold content for investing on a smaller scale. The smaller "Hidalgo" coins, Mexico's 10, 5 and 2½ peso gold pieces, and the 2 peso gold coins make ideal gifts and can be used to create beautiful jewelry pieces for men and women.

The Gold Coins of Mexico. Among the most actively traded gold bullion coins throughout the world.

The Gold Coins of Mexico have become among the most popular gold bullion coins in the world. Due to the careful craftsmanship of Casa de Moneda de Mexico and the wide distribution of these coins, you can usually avoid the cost and delay of determining their authenticity upon resale. As with all gold coins, your purchase price includes a premium above the then current market price of gold bullion to cover minting and distribution. Purchases may be subject to state and local taxes. Call any of the following toll-free numbers for up-to-the-minute prices.

For additional literature, write: The Gold Coins of Mexico, Information Center, Grand Central Station, P.O. Box 1812, New York, New York 10017.

THE GOLD COINS OF MEXICO℠

The Gold Coins of Mexico are exclusively supplied to:

Citibank, N.A. 800-223-1080
N.Y. State call collect: 212-559-6041

Swiss Bank Corporation 800-221-9406
N.Y. State call collect: 212-938-3929

Republic National Bank of New York 800-223-0840
N.Y. State call collect: 212-930-6338

The Gold Coins of Mexico are also available at coin dealers plus selected banks throughout the country.

The Gold Coins of Mexico is a Service Mark of Banco de Mexico, Mexico City.

What kind of man owns his own computer?

Rather revolutionary, the whole idea of owning your own computer? Not if you're a diplomat, printer, scientist, inventor... or a kite designer, too. Today there's Apple Computer. It's designed to be a *personal* computer. To uncomplicate your life. And make you more effective.

It's a wise man who owns an Apple.

If your time means money, Apple can help you make more of it. In an age of specialists, the most successful specialists stay away from uncreative drudgery. That's where Apple comes in.

Apple is a real computer, right to the core. So just like big computers, it manages data, crunches numbers, keeps records, processes your information and prints reports. You concentrate on what you do best. And let Apple do the rest. Apple makes that easy with three programming languages—including Pascal—that let you be your own software expert.

Apple, the computer worth not waiting for.

Time waiting for access to your company's big mainframe is time wasted. What you need in your department—on *your* desk—is a computer that answers only to you...

Apple Computer. It's less expensive than timesharing. More dependable than distributed processing. Far more flexible than centralized EDP. And, at less than $2500 (as shown), downright affordable.

Visit your local computer store.

You can join the personal computer revolution by visiting the Apple dealer in your neighborhood. We'll give you his name when you call our toll free number **(800) 538-9696**. In California, **(800) 662-9238**.

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AWESOME

NEW DATSUN 280-ZX WITH T-BAR ROOF.

Turn it on and turn it loose. The very first Datsun Z-car with an open cockpit to the heavens! Just take off the two stowable roof panels and feel the rush of its fuel-injected fury. The shifting winds of every maneuver.

But the new T-bar "Z" is more than meets the sky. It moves you on burly radials. Flies you on a fully independent suspension.

Glides you with cruise control. Responds with 5 speeds and 4 power discs. Cradles you in optional genuine leather bucket seats. Surrounds you with the sound of 4-speaker stereo. Lays before you an eye-filling array of instrumentation including tachometer, time/date quartz clock, Computer Sensor System...

You always wanted to open up a "Z." Now is the time... to experience the ultimate definition of AWESOME. Available for purchase or lease at your Datsun dealer now.

DATSUN
WE ARE DRIVEN

Take the mileage and run...

443 MILES EST.* RANGE

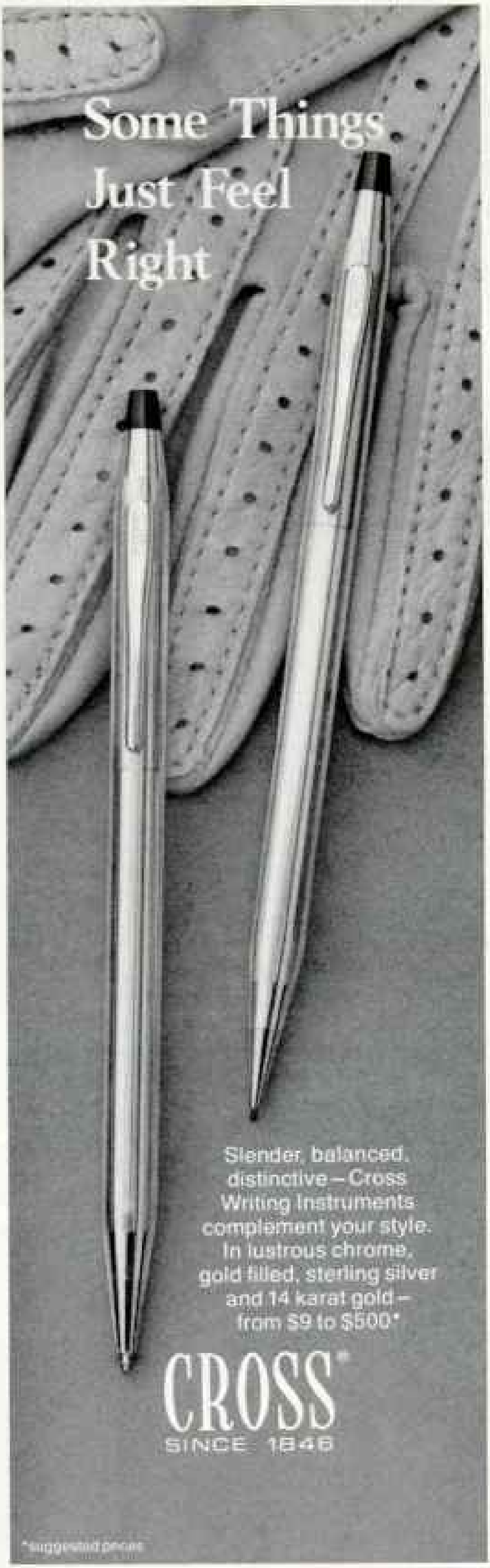
654 MILES EST. HWY. RANGE

21 EPA EST. MPG

31 HWY. EST. MPG

Projected 280-ZX ranges are based on EPA estimated MPG and highway MPG with five-speed transmission. Use estimated MPG for comparison. Your mileage and range may differ depending on speed, trip length and weather. Highway mileage will probably be lower than EPA highway MPG.
*California Range [422] 654. California Mileage [28] 31.

NISSAN



The American Cancer Society thanks you.

Your employees thank you.

Their families thank you.

You've become a life saver. Literally. For installing our Employee Education Program. For letting us supply free films, exhibits, speakers, pamphlets, posters, and articles for your company publications. For accepting our help in arranging "action" programs for your employees...for detection of colorectal cancer, instructions in breast cancer examination, for detection of cervical cancer via the Pap test. For simply understanding that if cancer is detected in its early stages, chances for cure are greatly increased. Thank you.

Hundreds of companies now have an American Cancer Society Employee Education Program. If yours isn't one of them, call us.

American Cancer Society
2,000,000 people fighting cancer.

THIS SPACE CONTRIBUTED AS A PUBLIC SERVICE

WHICH HAND HAS THE PENTAX CAMERA?

The one on the right holds the Pentax Auto 110, the only 110 SLR camera with interchangeable lenses.

But, if you guessed the one on the left, you weren't far off. It holds the optional wide-angle and telephoto lenses.

The purpose of this demonstration? To show how small and convenient a high quality, SLR camera system can be.

If you've ever missed a great photograph because you didn't feel like lugging a big camera around, you now know what to do. Just get your hands on a Pentax Auto 110.

THE PENTAX AUTO 110.

(Camera and lenses are actual size. If that's not remarkable enough, consider that it can also come with an optional autowinder and synchronized flash.)

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Educate your child at home with approved Calvert home study courses. Step-by-step teaching manual. Start anytime, transfer to other schools. Ideal for enrichment. Used by over 300,000 students. Non-profit. Write for catalog. Admits students of any race, color, national or ethnic origin.

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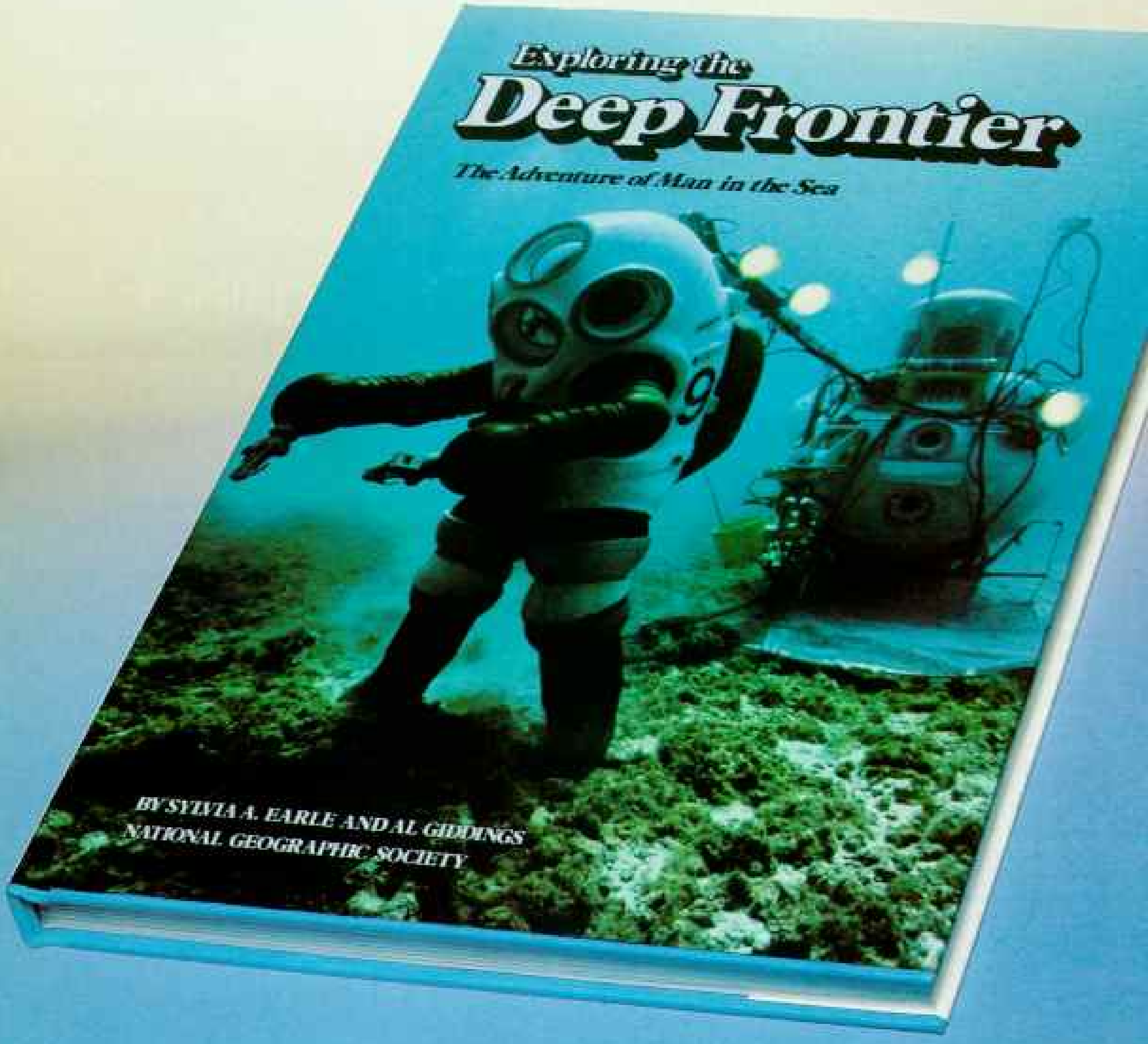

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