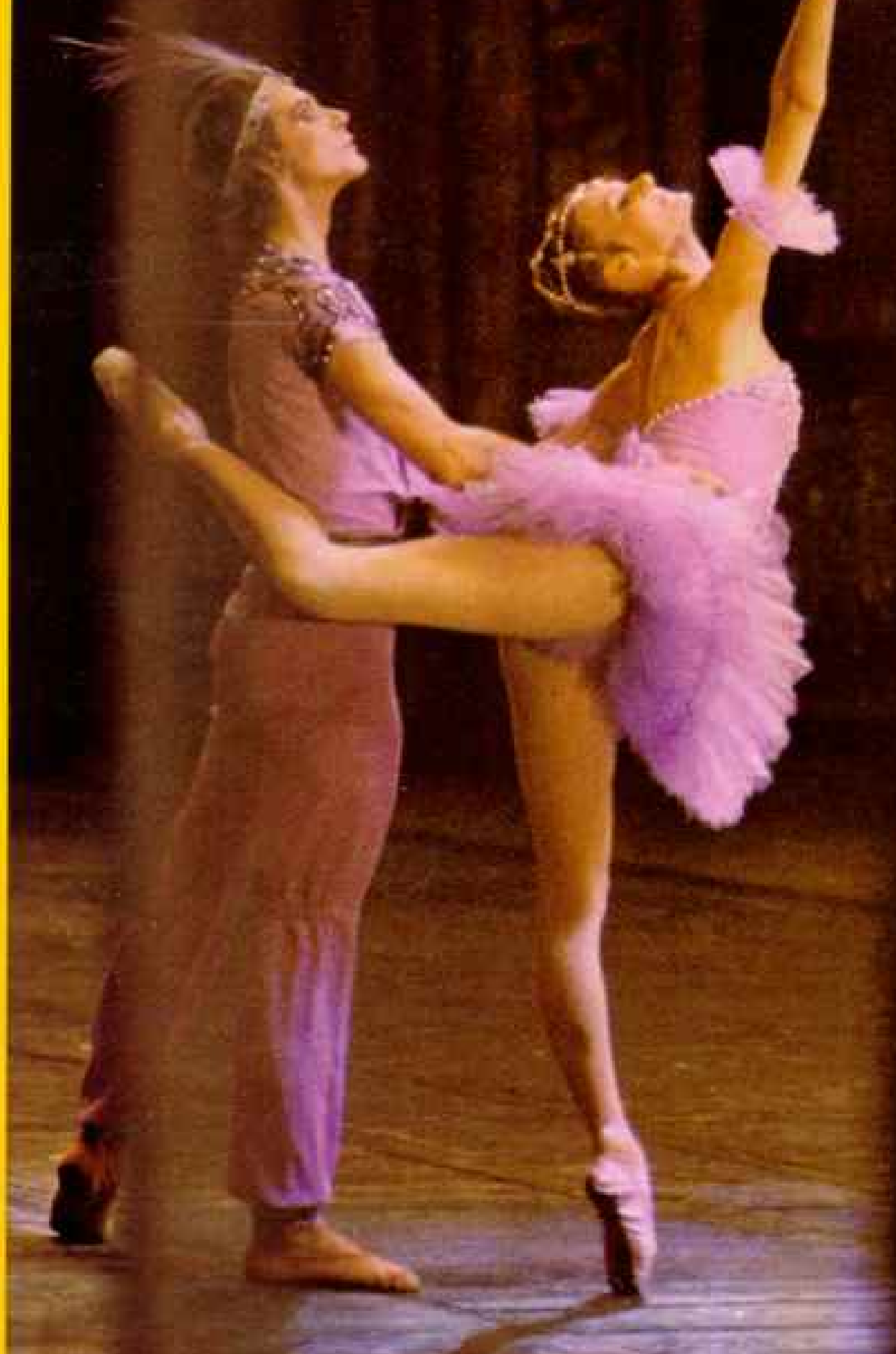


NATIONAL GEOGRAPHIC



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THIS YEAR your Society's journal turns a youthful 90. Its record of the events, peoples, and places of three generations represents a treasure for historians—and for our members. Perusing old NATIONAL GEOGRAPHICS is a pastime both educational and, we hope, uniquely moving.

It was 52 years ago that we published an 80-page article on the Soviet Union by "an Unbiased Correspondent," Junius B. Wood. His description of the Moscow of that day is a classic of vivid eyewitness reporting.

In 1977 staff writer John J. Putman and photographer Gordon Gahan paid our latest visit to Moscow. Communication about the Communist world remains as difficult, perhaps, as it was in 1926. Yet, as journalists committed to objective, impartial reporting of what we can report, we accept the opportunity to reflect our times, realizing that only history can tell the full story.

We often feel pressure to change that policy from those who would have journalism bear a message—their message. To some people, failure to denounce is the same as silent praise, and objective statement of fact amounts to advocacy—if fact fails to coincide with prejudice.

But these voices from distant right and far left only serve to remind us to steer a course that avoids those biased and dangerous extremes of mind. Last year's record increase in new Society members, coupled with a high renewal rate, seems ample proof our course is sound.

We will continue to travel the world unencumbered by ideology, to go along on a young man's walk across America, to peer into Loch Ness, and to fly to Mars and beyond. As the world goes its way, we will record it, accurately and clearly. This anniversary year is an appropriate time for us to reaffirm the principles that have served your Society so well.

Silvestro Brosens

REAFFIRMATION OF EDITORIAL POLICY

The mission of NATIONAL GEOGRAPHIC is to increase and diffuse geographic knowledge. Geography is defined in a broad sense: the description of land, sea, and universe; the inter-relationship of man with the flora and fauna of earth; and the historical, cultural, scientific, governmental, and social background of people.

The magazine strives to present timely, accurate, factual, objective material in an unbiased presentation. As times and tastes change, the magazine slowly evolves its style, format, and subject matter to reflect that change without altering the fundamental policies above.

Excellence of presentation—accuracy, technical superiority in printing and photo reproduction, and clarity of meaning—remain traditional goals against which each article is measured.

William W. Payne *Robert E. Doyle* *Silvestro Brosens*
CHAIRMAN OF THE BOARD PRESIDENT EDITOR

NATIONAL GEOGRAPHIC

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January 1978

Moscow and Its Treasures 2

City of tsar and commissar, centered on Red Square and the Kremlin with its fabulous trove of imperial art—the Soviet capital today holds many a surprise. John J. Putman and Gordon W. Gahan take a close look.

Zulu King Weds a Swazi Princess 47

Volkmar Wentzel records age-old rites that unite two powerful African peoples.

The Hudson:

"That River's Alive" 62

New York's historic waterway, befouled and strangling, flows cleaner than it has in decades. Alice J. Hall and Ted Spiegel report.

A Bad Time to Be a Crocodile 90

Rick Gore and Jonathan Blair explore firsthand the shrinking realm of those misunderstood, toothy survivors from the age of dinosaurs.

Hiking the Milford Track 117

Storm and scenic splendor punctuate the "walk of a lifetime" for Carolyn Bennett Patterson and Robert E. Gilka.

Flight of the Gossamer Condor 130

Man flies under his own power in a frail dragonfly of cardboard, piano wire, and plastic. Michael E. Long tells how it was done.

COVER: *Ballerina Alla Mikhailchenko wins in international competition at Moscow's Bolshoi Theater (page 45). By Gordon W. Gahan.*

The City Around Red Square MOSCOW

By JOHN J. PUTMAN

Photographs by GORDON W. GAHAN

BOTH NATIONAL GEOGRAPHIC STAFF

SOME GREAT CITIES remind me of old and enduring country houses: The steps are grooved by the passage of generations, and rooms are laden each with its special set of memories. Generations come and go, changes and additions are made; the house, or city, endures. In it we are ever mindful of the past, ever mindful that each generation, including our own, yields to another. Such a city is Moscow.

I was reminded of this each morning last summer by the view from my hotel room. To the south was a curve of the Moscow River, an artery of trade since the Middle Ages. Beside it rose the red brick walls of the Kremlin—which means “fortress”—designed by Italian architects in the late 15th century. The walls encompass the site of medieval settlement, enclose churches and palaces built by the tsars, and safeguard the seat of the Soviet government today.

Nearby spread the yellow plastered buildings and courtyards of the 19th century. Roofs

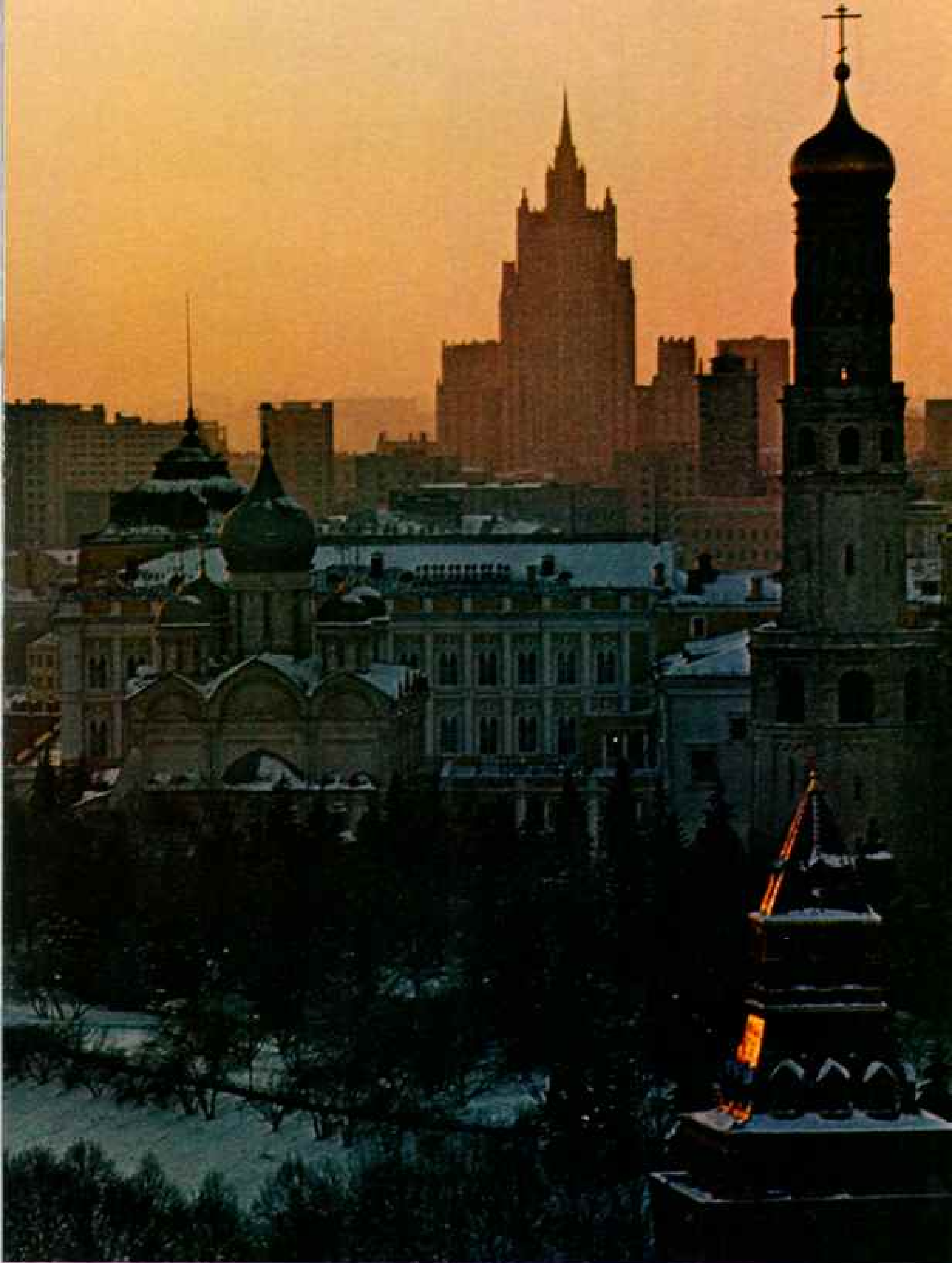
Winter brings out the gusto in Muscovites as they skate through 275-acre Gorky Park. Their clothes reflect a rising standard of living in the Soviet capital, blueprint for a model Communist city—though some privations imposed by the past still linger.







Bastion of rulers past and present, the Kremlin thrusts cupolas and towers from an enclave totaling 65 acres. Its museums of today include the Bell Tower of Ivan the



Great, at far right, and five-domed Archangel Cathedral, tomb for many tsars. Behind the cathedral lies part of the Grand Kremlin Palace, where the Supreme Soviet meets.

CENTRAL MOSCOW

0 KILOMETER
0 STATUTE MILE

Metro (subway) lines and stops in red.

DRAWN BY LES B. DEBARTH AND JOHN LUTHERS
COMPILED BY SHE PLATE
NATIONAL GEOGRAPHIC MAP DIVISION



EXHIBITION OF ECONOMIC ACHIEVEMENTS
Ostankino Palace (Museum of Serf Art)
ACADEMICIAN KOROLEV ST.
Ostankino Television Tower
PROSPECT MIKA
PROSPECT OF PEACE



1 BOLSHOI THEATER

SOKOLNIKI PARK

Petrovsky Palace (Air Force Engineering Academy)

Dynamo Stadium

Soviet Culture newspaper office
Pravda newspaper office

Sovetskaya Hotel

Soviet Armed Forces Museum

St. Trifon Church



2 ASSUMPTION CATHEDRAL (DORMITION CATHEDRAL)

Hippodrome

BYELORUSSIA STATION SQUARE

MOSCOW STATE UNIV. BOTANICAL GARDEN

KOMMUNAL'NOYE DORMITORSKOYE UBYE

Tchaikovsky Concert Hall
Izvestia newspaper office
Museum of the Revolution
Patriarch's Pond
Zoo

Novosti Press Agency

Petrovsky Monastery (Folk art exhibit)

Leningradskaya Hotel

Patriarchal Cathedral of the Episcopate

House of Architects
Soviet Writers Union
American Embassy

Institute of the U.S.A. and Canada

Ministry of Health

Committee for State Security (KGB)

Church of St. Nikita the Martyr

Trade center (under constr.)

Ukraina Hotel

Lenin Library

Pushkin Museum

British Embassy

Children's World

Moscow History and Reconstruction Museum

Prophet Elijah Church (Museum of Oriental Culture)



3 BELL TOWER OF IVAN THE GREAT

KUTUZOV PROSPECT

KIEV STATION SQUARE

Pushkin Museum

Moscow Outdoor Swimming Pool

Zachatievsky Convent

Church of the Mother of God, Joy of All Who Sorrow

Rossiya Hotel

Yauza River

Andronikov Monastery (Rublev Museum)

TAO ANSKY SQUARE



4 TRETYAKOV GALLERY

Church of St. Nicholas in Khamovniki

Church of Ivan the Warrior

Novospassky Monastery

Novodevichy Convent

LIZHNIKI SPORTS COMPLEX (1980 Olympics site)

Lenin Central Stadium

Academy of Sciences of the U.S.S.R.



5 DONSKOY MONASTERY (ARCHITECTURAL MUSEUM)

Krutitsky Monastery

Simonov Convent

LENIN HILLS
Moscow State University

LENIN PROSPECT

AVTOZAVODSKIY ST.

Likhachev Works (ZIL auto factory)



Cradle of Moscow, the Kremlin grew around the city's original 12th-century fort. Imperial rulers expanded the complex, which was commandeered by the Bolsheviks in November 1917.



Electric web of boulevards spins out behind Mayor Vladimir Promyslov, mapping a metropolis of 340 square miles and eight million people. Among his goals: checking population growth while easing a labor shortage by mechanizing more factory jobs.

were marked by iron railings to protect the men who shovel snow from them.

Farther off, to the west, soared the high-rise buildings of Kalinin Prospekt, modernistic slabs marching toward the city center like a column of robots.

On the horizon, atop the Lenin Hills, stood Moscow State University, 32 stories high, strangely Oriental in silhouette. Summer storms sometimes came from that direction, blanking out the hills, then moving closer, until rain beat against my window and umbrellas sprouted along Marx Prospekt below. At that moment, in my window, Moscow shrank again to its 19th-century dimensions.

I had, over the months, found favorite places. A shaded bench in the courtyard of the old Moscow university downtown; the Taynitsky Garden, just inside the Kremlin walls, so quiet that I could hear the thump of the volleyball as guards relaxed in a hidden spot; Patriarch's Pond, close by the Garden Ring with its linden trees and the tables where every afternoon the domino players gathered.

In winter there was Gorky Park, where the pathways were frozen over and you skated along under the trees to the sound of music. In summer there were the birch and pine forests around Arkhangelskoye, an old princely estate, where the Moscow River takes another great swing.

MY FEELING about the city had grown slowly, unexpectedly. I had come to Moscow to look into its remarkable growth and the changes over the past decade: 1.5 million more inhabitants—now about eight million in all—50,000 more autos, hundreds of new buildings, an improved standard of living. A master plan called for the city to develop further, to be by the year 2000 a model urban community.

And so it was, on a winter's day when snow frosted the shoulders of passersby, that I went to the stone-pilastered city hall to talk with Mayor Vladimir Promyslov (left).

He spoke proudly of recent achievements: "In only five years we built 600,000 new flats, and 2.4 million Muscovites moved into them. This five-year period will be the same, although construction will be more expensive."

He cited other projects under way: 225 million rubles' worth (about 300 million dollars) of buildings for the 1980 Olympics; a new



trade center on the Moscow River, rising with the assistance of U. S. firms; a 3,600-bed hotel being built by a French company.

And then the mayor, a short, soft-spoken man, turned to problems: "One is the shortage of working hands in every field, perhaps 150,000 to 180,000 total. We hope to overcome this by modernizing our plants. We don't want our population to grow at all."

To hold down growth, the mayor said, the city forbade the building of many new plants; certain existing factories would be moved elsewhere. (Moscow accounts for about 7 percent of industrial output in the U.S.S.R., leaning toward machine tools, motor vehicles, electronics, and precision instruments.)

Restrictions limit immigration: To get a residence permit, a newcomer must have a job, and his employer must state the need for him. Then comes the wait for a flat.

"If a young man falls in love with a girl from the country," the mayor said, "she may marry him and move here, of course. And a certain number of specialized workers are invited here each year."

MOSCOW'S RUSH-HOUR traffic fills downtown streets, but keeps moving. To avoid the snarls of other capitals, the mayor said, the city would double its 102-mile Metro system by the year 2000.

Below the city, as we talked, workmen were boring new passages—as they had been doing since 1932. The system was reaching out toward the new high-rise communities sprouting like mushrooms along the Moscow Ring Road, for it was on the outskirts, the mayor said, that Moscow was building its new housing. "The center of the city must be preserved as it is, for future generations."

I followed the Ring Road south to Troparovo, one of Moscow's typical satellite communities. On one side of a boulevard rose a giant complex: apartment buildings, schools, shopping center, sports field, a hotel. Trucks came and went.

Construction chief Abram Birger told me:

"Until 1975 we mostly built apartment complexes from 9 to 12 stories; now we are building them 16 stories and higher."

Eleven floors up, I watched warmly clothed workers bolting eight-ton floor panels and single prefabricated units that included kitchen, bathroom, and utility closet. It was bitter cold, but floodlights permitted three shifts to work around the clock.

From this perch I could look toward central Moscow, and in the other direction toward the forests. Then I saw, across the boulevard, the remains of the village this complex was replacing. I decided to visit it.

I was accompanied by Viktor Tagashov of the official Novosti Press Agency, which had arranged all meetings with government spokesmen and with people at work or school; otherwise I was free to talk informally with anyone. Viktor was often my interpreter.

The old village church had been closed for years, but artificial flowers marked the graveyard. A road led down toward what remained of the village: some 40 houses, their blue, green, and ocher paint faded. Here and there a leashed dog barked.

Anna Ivanovna, 51, with a round face and gold teeth, was gathering kindling when I hailed her. She lived with her husband, two sons, a daughter-in-law, and a baby.

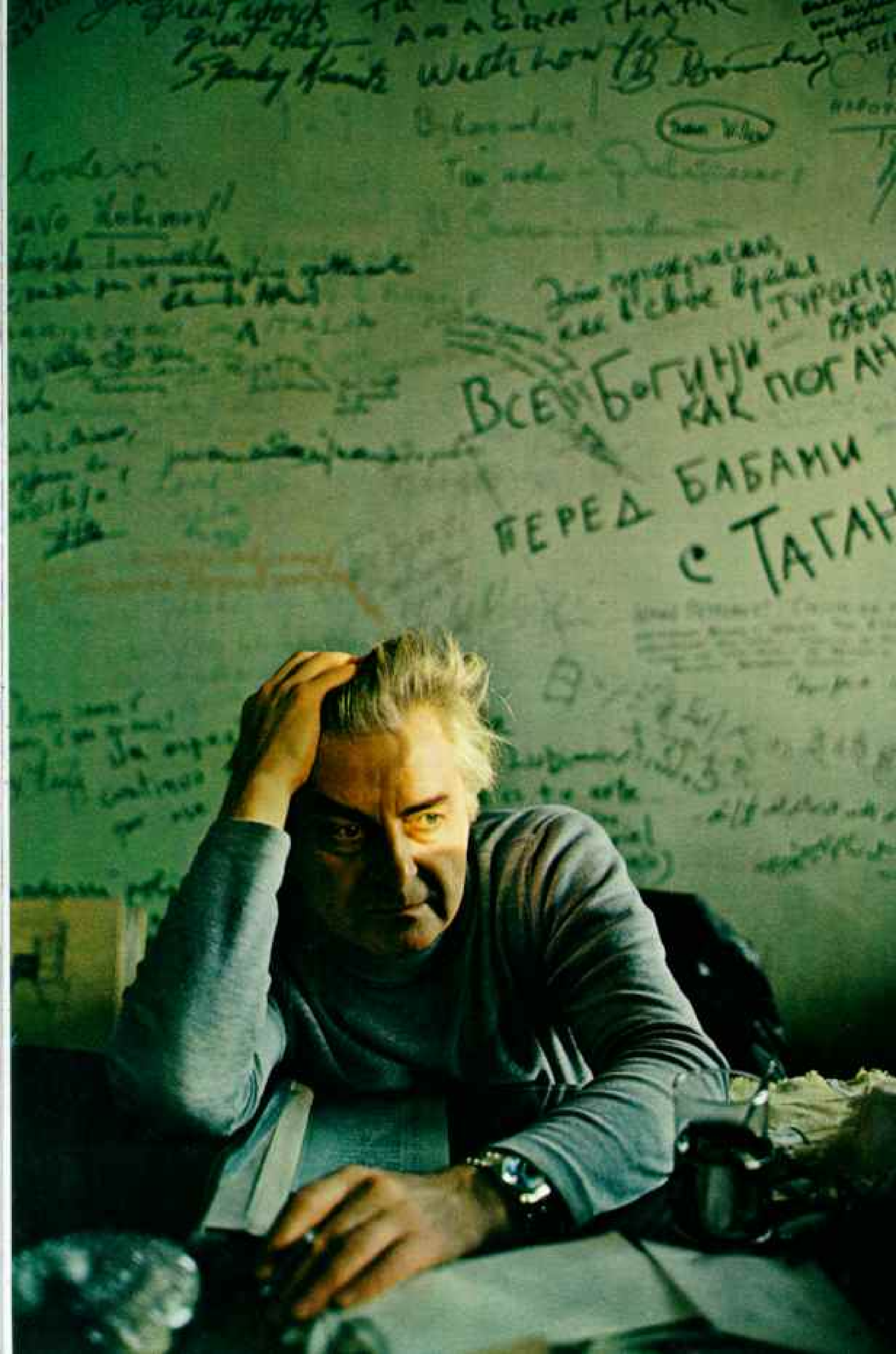
She had been born in this village, as had her mother. She talked of her childhood.

"I remember the village was more beautiful; at that time everyone looked after their houses. Each was painted a different color; each had different decorations.

"The cowherd came very early each morning blowing his horn; the housewives would take their cows down to him, and he would lead them to pasture. I remember the cherry trees. We would pick the cherries and put them under our shirts. The shirts would bulge and become stained, but we would pick more and more, and walk home eating cherries."

The cherry trees were gone now. "They stopped bearing fruit; in time the villagers cut them down." (Continued on page 15)

"If you want to change . . . you must change the inner soul." Gesturing passionately, poet Andrei Voznesensky explains his philosophy in the Soviet Writers' Union club. Muscovites pack auditoriums for Voznesensky's readings. His call to individuality and his satires of technology's dehumanization annoy some conservatives. A musical revue based on his works was shut down by government censors in 1970.



great day
Spunky Kants
Walter Now

New York

ВСЕМ БОГИНЫМ
КАК ПОГАН
ПЕРЕД
БАБАМИ
С ТАГАН

looker
also Kohnoff
best...
A...

Tyrants
Baba



Audiences gasped last year when director Yury Lyubimov (facing page) staged a long-banned Soviet novel, *The Master and Margarita*. It included a seminude scene and "the distortion of historical perspective," an official review rumbled—but the show went on. Celebrities' graffiti adorn the director's office wall. The avant-garde works of early-20th-century Soviet artists, ignored or suppressed and today worth millions, fill the flat of George Costakis (above). The Russian-born Greek has consigned most of his collection to the Tretyakov Gallery, where visitors now view only traditional art (left). He plans to emigrate to the West with the remainder.

Blue gray dusk of winter... the charm of an old neighborhood... laughter and the crack of hockey sticks in a park (following pages): To preserve such scenes and historical landmarks, nine Moscow districts are designated off limits to the wrecker's ball.







(Continued from page 9) Anna was looking forward to moving into a new flat: "In this house you must heat with a coal stove and fetch cold water from the standpipe. The flat will have running water." Some of her friends had already moved into a new building. "They said it should have come earlier, when they were younger."

IF MANY in Anna's generation feel that some niceties have come late, the newest generation may feel otherwise. For in Russia today the children are indulged and coddled and given great care. In winter the toddlers often travel on little sleds pulled by a parent. They are here, as elsewhere, the hope of the future, the remedy to past or present disappointments.

Moscow children enter the school system early; 80 percent of those between 2 and 6 are enrolled in the city's 2,149 kindergartens and nursery schools. Older children attend some 1,000 grammar and secondary schools, 65

schools for those with special difficulties, and scores of schools for specialized knowledge, such as science. An average of twenty new schools are built in the city each year.

When I visited the Board of Education, in the heart of the old city, Leonid Shilov told me: "We've had many changes in the past ten years. We want to improve labor education—teaching children to work, to give them a taste of different professions. We have changed all textbooks. The 'new math' has arrived. Physics has changed.

"Of course, ideology remains most important—students are exposed to ten years of Marxism-Leninism."

For artistically talented children there are special schools in music and other subjects. Among the memorable images of Moscow: the *babushkas*—grandmothers—sitting patiently in the lobbies of such schools, waiting to take their talented charges home.

But sports are the passion of Moscow's masses. At the Specialized Youth School for



Magic of the troika takes the icy edge off winter for Alexander Kozlov (left). He helps keep the tradition of the three-horse Russian sleigh alive in Moscow. Bells jingle as his team (above) carries well-bundled passengers through a snowscaped city park. "All my life I have worked with horses," he told the author. He harnesses the side horses so that their heads flare out when he tugs at the reins—"just for the beauty of it."

Gymnastics No. 1 (there are 172 such sports schools in the city), I got a look at how the Soviet Union's winners are developed (page 21). Twelve- and 13-year-old girls were practicing backflips on the balance beam and racing down a runway to flip over a bridge.

Head coach Igor Zhuravlev told me how the girls were selected. "Some are brought by their mothers. Some are recommended by school coaches. And some—well, we may see them on a jungle gym and invite them.

"Gymnastics is half a sport, half an art. There must be a feeling for the beautiful. That is why we always work to a piano accompaniment. It is very hard, and a gymnast must be brave. As for talent, a coach can tell only after three years of training."

As I left, I heard the *thump, thump, thump, thump* of running feet, the silence of the moment when a girl vaults over the bridge, then the *thump* of landing on the other side.

ONE DAY a Russian friend cautioned me: "You can joke about many things here, but not about World War II, when we lost so many, and not about Lenin. Lenin is not just our George Washington, he is like our George Washington and our Jesus Christ."

The image of the father of the revolution appears everywhere, in offices and schools, inside and outside buildings, in parks and railway stations. The expression is sometimes that of a kindly uncle, sometimes that of a stern father.

Once I browsed a bulletin board in the Bolshoi Theater. It was near the canteen where ballerinas in leg warmers and robes came for refreshments. The board held an illustrated story of Lenin: Lenin talking to little children, counseling the poor, confronting Pharisee-like critics; wandering alone in a snowy wilderness, and finally triumphant.

Thus his red granite tomb, in Red Square close by the Kremlin wall, has become for many Russians what Jerusalem's Holy Sepulcher was to medieval Europeans: a sacred place of pilgrimage. Every day you will find the long, slow-moving line of pilgrims there, coming up from Alexander Garden.

The winter day I join the line, it stretches back beyond the Kutafya Tower. We move along at a rhythmic shuffle, past the Monuments to the Hero Cities of World War II and the Tomb of the Unknown Soldier.

Now and then people break line to get a closer look at these monuments. A policeman with a megaphone orders, "Please stand back in line. . . . Return to the line."

A father with two young daughters protests, "But we are not from Moscow; we are here only one day!"

"All right, go ahead, but please be quick."

We make the right turn around the Kremlin wall and walk uphill into Red Square. Now people break from line to check packages and cameras in a locker room. Policemen scrutinize the line more carefully.

The people talk quietly now, in a hush; ahead the only sound is the steady drumbeat of feet—as pilgrims reach the tomb, they kick the snow from their shoes on a wooden platform. The men remove their hats.

We enter the tomb, moving quickly. Right turn, left turn, right turn; up steps, down steps. Then you are out. You recall the body, well lit in its glass coffin; two honor guards with bayonets; other guards watching. And you are back in the snow in Red Square.

I FOUND MYSELF drawn to the square late at night, when the snow scrapers sweep the cobblestones in a sort of mechanized ballet, and early in the morning, when the plump and jovial Kremlin cleaning women present their passes to trim, stern guards. But at any time it is fascinating, for Red Square is redolent with Russia's past.

On the white stone platform called Lobnoye Mesto (Place of the Brow), edicts of the early tsars were proclaimed, criminals were sentenced, and executions performed. Red Square was the central market of all Russia, not only of Moscow: Here you bought grain, hats, mead, wines, silver vessels; here you watched beggars, comedians, acrobats. This commerce survives today only in a few sellers of lottery tickets—plump women seated at tables, sheltered by umbrellas from winter's snow, summer's sun.

Here too are written bloody pages in Russia's history: battles with Tatars, Poles; Reds against Whites. Here was carried out the mass slaughter of aristocrats and their retainers under Ivan the Terrible, and the butchery of rebellious militia under Peter the Great. Peter ordered that ringleaders be broken on the wheel and left to die in agony; their bodies remained in the square for five months.



Glimpsed through a gate, Leonid Brezhnev (below), leader of the Soviet Communist Party, leaves the Kremlin last June after gaining the additional post of President of the Presidium of the Supreme Soviet. He replaced Nikolay Podgorny and thus became the first Soviet leader to head both state and party. Brezhnev enters a

hand-tooled ZIL limousine, flagship of the Soviet auto industry and worth about \$75,000. Moskvich subcompacts that sell for the equivalent of about \$9,000 ride an up-to-date assembly line (above), monitored by workers using French-made computers. Muscovites enjoy a growing romance with cars, though delivery can take as long as five years.





Efficiency earmarks a local election (right) as registrars distribute ballots at a precinct. There is only one candidate on the ballot for each office (middle), as in virtually all Soviet elections. A first-time voter gets a carnation (far right) after dropping his ballot into a box to signify approval.





Planning tomorrow's news today, the editorial board of *Pravda* (Truth) gathers for a morning meeting beneath a portrait of Karl Marx (left). The six-page daily, official voice of the party, claims a nationwide circulation of 11 million. It emphasizes ideology and economic achievements in front-page editorials and articles often prepared days in advance; crime and other "sensational" matters are seldom reported. However, *Pravda* and some of Moscow's thirty other papers often print general complaints from readers about inefficient bureaucracy and poor-quality goods and services. Reading posted for free perusal (above) includes *Komsomol Pravda*, a livelier "Truth" published by the Young Communist League, and *Soviet Sport*.





Another Olga Korbut? The famed Soviet gymnast trained in a special sports school like this one (facing page), where a student learns to add a ballerina's grace to her acrobatics. For Moscow's athletes, the pressure's on: The city will host the Olympics in 1980. Music school nourishes a gentler art, where young fingers master keyboard (above) and bow (top).

In Red Square I sometimes glimpsed the Soviet Union's present leaders: dark, bulky forms in the back of curtained ZIL limousines. They would race across the square toward the Kremlin's Spassky Gate. The twin traffic lights on the gate would blink green as the long car slid through, then return to red.

I WONDERED how these men saw the world. I knew that when they sought expert advice on the American mentality, they turned to the head of the Institute of the U.S.A. and Canada, Professor Georgy Arbatov.

Arbatov, husky and dark haired, his brow heavily creased, speaks softly but offers blunt opinions on Americans when asked.

"You know Americans have a Calvinist heritage, from Pilgrim times when they came to America to establish a new paradise, a new Jerusalem. This makes them think that they have opened an absolutely new page in history, a perfect one. And that they have a right to judge everyone by their standards and to teach them their ways."

Arbatov complained about the Western press. "You know we never had such a small number of people arrested or tried for political crimes as now. But there was never such a noisy campaign about them as there is now. I do not say that everything is perfect, but I think there is some kind of indecency in those writers who emphasize some deficiency or difficulties we have. I am not ashamed of these. We have had a very hard history. Our whole generation, they know what hunger is, real hunger.

"We experienced the war years, and just after the war, very difficult living conditions. Until 1958 I lived in Moscow in one room, sharing kitchen, toilet, and bathroom with 33 people, and this room, four by four meters. There: myself, my wife, my son, my mother-in-law. It was how everybody lived here.

"Actually this is the first time in our history when people get some luxuries of life. Maybe the houses are not perfectly built, but a majority of people now have flats for each family. Now more people are having cars too."

The treatment of political dissidents in Moscow could not be ignored. From time to time I heard reports of another person arrested. I was reminded of them when I happened to pass by Dzerzhinsky Square, where, across from the huge Children's World store,





Red Square explodes during May Day festivities. Special troops funnel



LEE HODDY, NOHOUTI PRESS AGENCY

marchers past the Kremlin and fancifully domed St. Basil's Cathedral.

stands the building of the Committee for State Security (KGB). The window curtains were always drawn, the doors closed.

THE AUDITORIUM in the House of Architects on Shchusev Street was packed. Six candles lit the stage. The poet gestured with one arm, his words not so much spoken as thrown:

*Yes, there is a Russian intelligentsia!
You thought not, but there is;
Not the indifferent mass,
But the conscience of the nation. . . .*

There was applause, then special requests and encores. Young women followed the poet backstage: "Please, your autograph, just on the ticket." "Tonight you were so wonderful—I could not believe you were so wonderful!"

Andrei Voznesensky is among those poets who in the 1960's brought fresh vigor to Russian poetry. His target: the inner man.

I talked with him a few nights later at the headquarters and club of the Soviet Writers' Union (page 8). There was excellent food, well served, the hum of conversation.

"Are poets free to write?" I asked. He replied elliptically:

"I can give you my own example. You have come across people here who praise me. But there are great numbers of people who are orthodox-minded, conservative. Mind you, I am talking now about poetry. I believe that poetry has a purpose—to fight for moral values, to fight for purity, for personality, against indoctrination. And since I said there was a fight, there must be opponents in the fight. Naturally, there are orthodox people who would want me to restrain myself.

"There are simple ways of trying to restrain me. If an orthodox man is an editor of a magazine, do you really expect him to publish my poems? Not on your life. Or take my recent Tchaikovsky Concert Hall reading. There was another manager before who would not dream of permitting my reading there."

The hand of orthodox man touches other arts in Moscow, I found. One day I went with friends to the atelier of an artist who was preparing for an exhibition of his works in Paris. His paintings depicted sea gulls, Arctic landscapes, fishing boats, a heroic logger.

He offered a bottle of beer, then ran out to the market. He

(Continued on page 34)

Imperial Russia's Glittering Legacy

A JEWEL-ENCRUSTED Easter egg, given by Tsar Nicholas II to his beloved wife, Alexandra, carries on its exterior the appealing portrait of the heir apparent, Alexis (right), as well as likenesses of their four daughters. The jade egg, created in 1908 in St. Petersburg under the direction of jeweler Carl Fabergé, is set with rubies and diamonds. It opens to reveal a colored gold model of the Alexander Palace, favorite home of the imperial family.

Such wondrous fancies, trappings of one of the world's most luxurious life-styles, fill gallery after gallery of the Kremlin Armory, now a museum. Planning the overthrow of the tsarist regime, revolutionaries considered that the riches rightfully belonged to the public. Upon their victory, the fabulous treasures became, by law, "property of the people," and are now displayed with great pride.







SYMBOLS of sovereignty, jeweled caps bespoke the power of Russian rulers. Most venerable, the Cap of Monomakh (above)—two pounds of gold, jewels, and sable—was used to crown tsars from 1498 to 1682. The Cap of Kazan (left) commemorates Ivan the Terrible's defeat of the Tatars of Kazan in 1552. A giant ruby supports a diamond cross on the Cap of Peter the Great (facing page), the tsar who opened Russia to the West in the early 18th century.



WITH HANDS of an artist and tools of a scientist, an expert (left) restores a fresco at the Kremlin's Assumption Cathedral (right), designed by an Italian in the 1470's but modeled after a 12th-century Russian house of worship. Here tsars were crowned and church leaders buried beneath the crosses of Orthodoxy. Even contemplative life in the cloisters was enriched, as an enameled gold chalice resplendent with jewels testifies (below). It was given in 1664 by a



noblewoman to the Kremlin's Chudov Monastery, which was dismantled after the Bolshevik Revolution.

From an ivory throne (left), Ivan the Terrible ruled 16th-century Russia with an iron hand, countering suspected opponents by killing them.

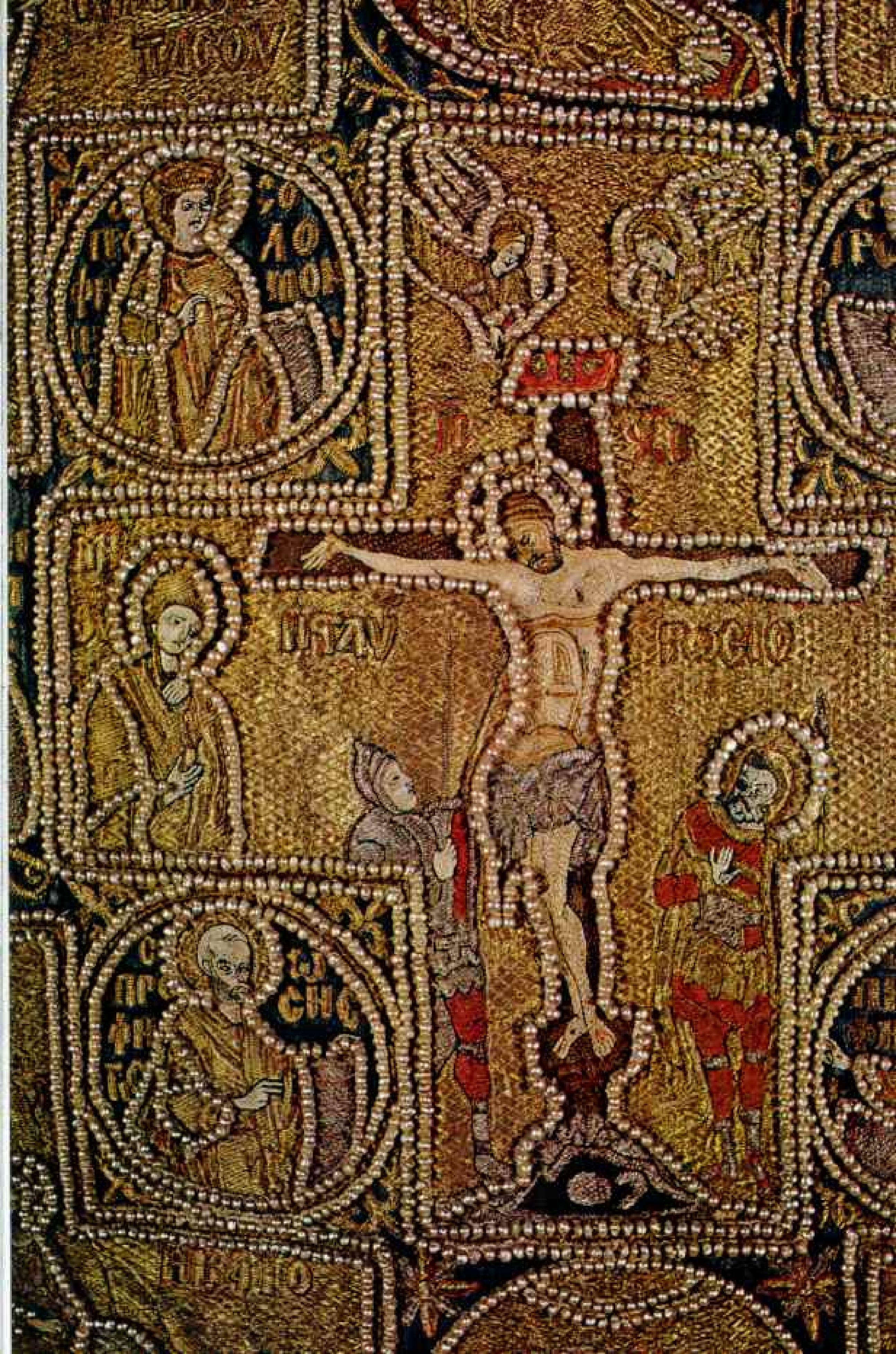


OUT OF THE EARTH in 1808 came this helmet, one of the Armory's oldest pieces, bearing the image of St. Michael. Scholars believe it belonged to a 13th-century Russian princeling, Yaroslav, who in a fight against his brother fled the field, casting aside helmet and armor. Yaroslav's son, Alexander Nevsky, made a more memorable bequest to history by inflicting a crushing defeat on invading Swedes in 1240.



EMBLEM OF POWER, the orb of Tsar Alexis, 1629-1676, is a blaze of jewels (left); the three middle bands alone contain 36 diamonds and 136 rubies. But the regalia of power went beyond those for state occasions. A runabout for Catherine the Great—an English-made carriage given her in 1795—flaunted an axle mounted with the carved and gilded figure of dragon-slaying St. George (right). Even as she rode, however, the fever of revolution was sweeping Europe.





ΙΗΣΟΥΣ

ΚΡΟΥΣΤΟΥ

ΜΑΡΙΑ

ΚΑΙ

ΙΩΑΝΝΗΣ

ΑΠΟΣΤΟΛΟΣ

Ο ΑΓΙΟΣ



STREAMS OF PEARLS flow around prophets, saints, and Christ in agony on an elaborate cassock (left) made for the leader of the Russian church during the early 15th century. Christ is risen on

the jeweled cover of a book of the Gospels (above). It was presented to the Annunciation Cathedral by Ivan the Terrible, who earnestly prayed for the victims he butchered—and they were many.

(Continued from page 24) returned with cucumbers, tomatoes, and two bottles of vodka. He sliced the cucumbers lengthwise, quartered the tomatoes, and sprinkled them with salt. We washed them down with vodka.

In time the talk turned to the role of women in inspiring artists. The painter walked across the room and pulled a large canvas from behind a stack of others.

The larger part of the painting depicted a voluptuous, reclining nude. "My wife," he said. Around her, like a garland, was the village of his boyhood, with its houses, its lake, its animals, his father leaning against a tree.

"It is not pornographic," the artist insisted. "Woman is the symbol of nature; of life itself." After a time he slipped the painting back behind the others.

IF THE STANDARD of living has improved for Muscovites, there is still concern over the quality of life. One of the official tools for confronting this problem is the newspaper *Soviet Culture*, with a circulation of 440,000. (Some 3,560 magazines and 30-odd newspapers are published in Moscow.)

Editor-in-chief Alexey Romanov spread a recent issue on his desk and explained: "A series of readers' letters about poor service in restaurants and shops led us to prepare this editorial, 'The Service of the Good Mood.' It cites examples of poor service that may spoil the good mood of the people."

The service in Moscow is sometimes good, sometimes fair, and—as the editorial suggested—often poor. But Muscovites pack the restaurants at night, especially those like the Uzbekistan, which features cuisine from that republic. The food is good, the music loud, the dancing spirited.

One hears few complaints about service in any of Moscow's 30 private-sector markets (one more is under construction). Here the radish woman scrubs each globular vegetable with a toothbrush, snips the stem with scissors, and keeps the whole red pile glistening with drops of water.

"Look at this lettuce," another cries, "what a good-looking salad it will make!" "Buy my cucumbers," still another exhorts.

The market smells of vegetables and flowers, and in one corner, the special aroma of the southern U.S.S.R.: dried apricots and melon seeds, walnuts, white and spotted beans, and peppers. A line quickly forms when a man opens a metal suitcase to reveal the biggest, reddest cherries of the season.

"In winter we have 550 people selling here, and in summer almost 1,000," the market director tells me. "Every citizen who has his own small plot of land has the right to sell. Most plots are in the countryside, of course."

Vendors must have their produce tested for health reasons, and they must pay a small daily fee for a stall. This market includes a hostel for vendors.

Moscow's regular food stores offered lower prices, crowding, and long lines. The Beryozka (Birch Tree) stores accepted hard foreign currency only, but stocked items not found in the other stores. And then there was the supermarket I stumbled onto one day: shopping carts, gleaming counters stacked with goods. I was stopped at the door: neither rubles nor hard currency accepted, only coupons.

A Russian said that the store was only for foreigners residing here. Foreign diplomats told me there were other stores for Russians who earned hard currency abroad, and for those in high positions.

I had begun to learn that life in Moscow is lived on several levels. A woman said: "We live two lives. A public one at work, a private one at home with our families and dearest friends." The second is closely guarded.

And I had begun to learn that things were not always as they seemed. At the elegant Tsentralny Restaurant on Gorky Street I was introduced to an "engineer technologist" who had developed a new technology for making *bliny* (pancakes). When they arrived with sour cream and red caviar ("less calories than the black"), I tasted not technology but haute cuisine.

Aura of a bazaar fills the arcades of GUM, largest state department store in the U.S.S.R. The emporium houses alcoves offering everything from appliances to zippers—when available. Every day an average of 350,000 shoppers flood the store, oftentimes Soviet tourists seeking goods scarce at home or eyeing unaffordable luxuries. "Moscow is downhill from all the Russias," a saying goes—thus the best flows into it.



Cold war on a housing shortage: Workers brave a bitter January to assemble prefab sections of an apartment complex (right). A sweeper clears snow from a wall section (below). A nationwide building boom began in 1956; in the past five years alone, 600,000 new flats have been completed and occupied by an average of four Muscovites each.



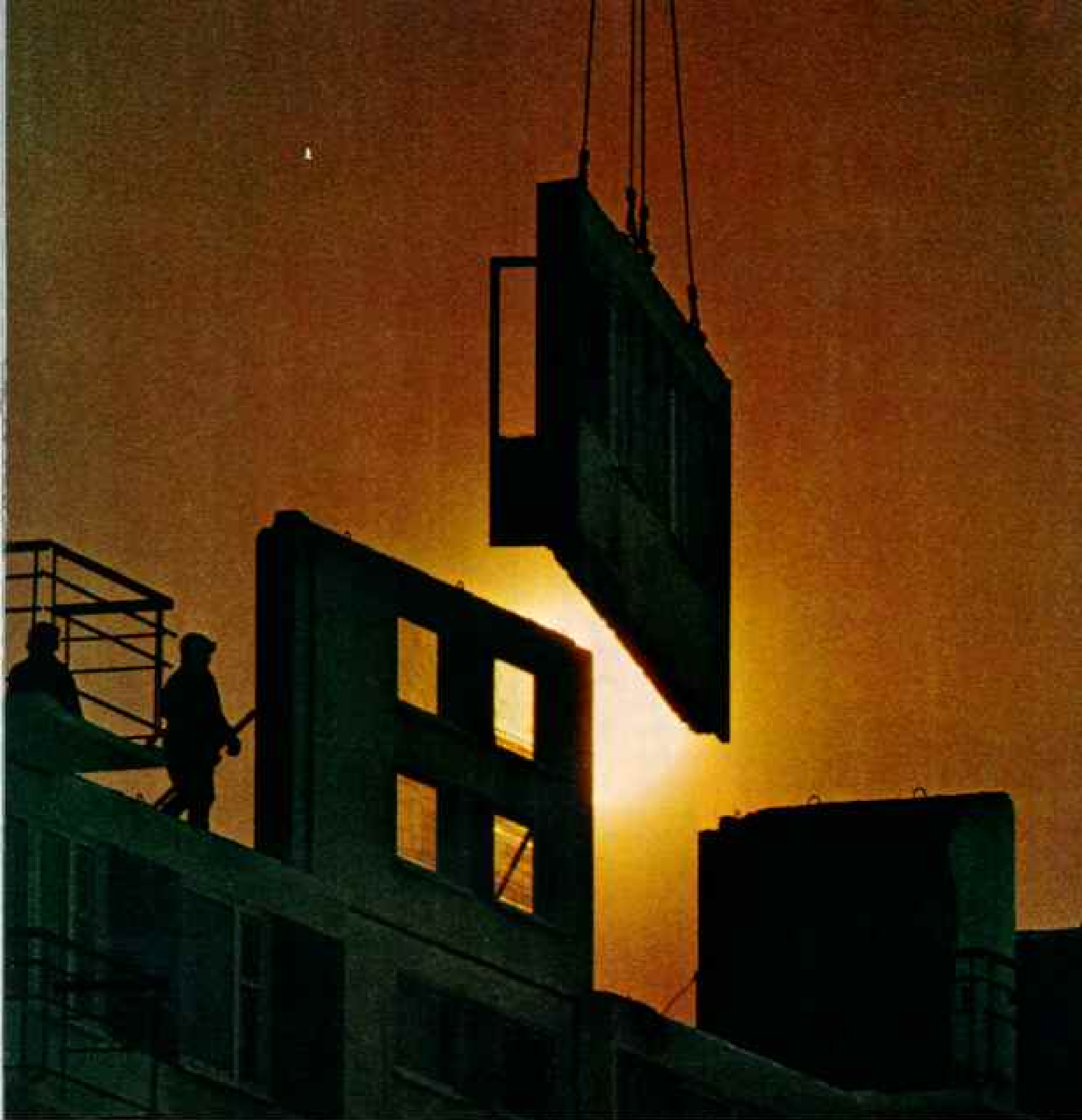
And the plump, middle-aged women who seem so dour as they guard the many doors, desks, and offices of Moscow have another side. Once, I tried on a sweater in a sports shop. One such plump woman, a customer, surveyed me amiably. "Too tight. It will shrink. Try a larger size." I did. "Yes, that's better," another volunteered.

Russians seem to prize their reputation as enigmatic. One night late while sharing a bottle of vodka, a young man confided: "You Americans will never understand us. To understand a Russian, you must *be* a Russian."

MORE SERIOUS for state planners than "The Service of the Good Mood" are two problems that came up during a talk with two Moscow State University geography students.

We sat over coffee in the small two-room dormitory flat of a married graduate student. The walls were decorated with color landscapes clipped from a Czech magazine.

The two students had just finished their examinations. Among the questions: "Under scientific progress, what are problems in a capitalist society and in a socialist society?"



What had they answered? "One problem in a capitalist society is unemployment; another the stratification of income—the classes become more and more differentiated."

And in a socialist state?

"The problem of our country now is the problem of labor productivity; it is evident that we are behind the United States in this. And also in the quality of goods produced."

Productivity. Quality. Longtime problems. One organization pledged to improving the situation is the All-Union Council of Scientific and Engineering Societies, which embraces

110,000 units and eight million members.

At its Moscow headquarters I talked with Deputy Director Nikolay Gritsenko. He told me the council was concentrating on mechanization in transport, loading, and control systems: "It would free two million workers for other tasks. Not only for economic reasons, but also for sociological ones: to make work a pleasure, not just labor."

A few days later I visited a piano factory on the city's outskirts. The popular Nocturne models were gliding along a wooden assembly line. Outside in the snow a West German van,

with special cushioned chassis and heated interior, was waiting to take a shipment west.

"We're doing well in exports," the director said. "The Dutch like the dark finish, the Spanish like the low price, and the Italians are just nice to do business with."

Inside, over vodka and smoked sturgeon, he talked on: "It is difficult to get workers. We advertise in newspapers, on the radio, and on billboards, but so do the other firms. We need 15 to 20 skilled mechanics; we've just bought a lot of West German equipment."

The director shook his head: "There's no rest for the director, what with the trade unions on one hand, the planners on the other." The vodka bottle was passed around again.

LLEFT MOSCOW that winter with certain memories: Of how icicles chopped from roofs fell with the sound of random cannonading; of how it was clear on the coldest days, and snowed when it warmed; and of how girls, caught in the bitter weather, would hold up one hand to shield their noses.

I would remember, too, the Moscow flats I had visited: A student's room in the old city, crowded with a bed, books, mementos, a tea-kettle; the spacious apartment of an artist, with paintings, music, Venetian-glass lamps, an excellent borscht prepared by a maid.

I would remember the crowd outside a bookstore late one night, waiting for morning, when the store would take orders for new editions of sought-after works.

And I would remember Alla, the young ballerina (page 45 and cover), rehearsing day after day to represent the Bolshoi in international competition. Her coach's words cut through the piano accompaniment time and again: "Alla, you *cannot* do it this way! You *must* not do it this way!"

And the woman on the Ost-West Express from Paris, the wife of a Soviet functionary in a Western capital. They moved in sophisticated circles, drove a Mercedes-Benz. Now, as she approached Moscow for a visit, she pressed her nose to the train window: "Look! A milkman with sled and horses! . . . Look! A birch forest! . . . Is it not beautiful?"

It was the end of April when I returned to Moscow. In the Lenin Hills the birches were greening; families lolled in the sun while children played. Excursion boats plied the river.

Red banners sprouted everywhere in the



Nourishing a fading past, gardeners tend small plots as their village and its abandoned church give ground to high-rise



apartments on Moscow's outskirts. Villagers, eager for modern conveniences, are rapidly moving into such complexes. So are families from the overcrowded residential areas downtown, where some still make do with one-room apartments.

city, and workers were stringing colored lights across the bridges. May Day was at hand. I arranged to observe this manifestation by walking with the Novosti Press Agency delegation and journalist Sasha Grigoriev.

The city is in its Sunday best; there are more neckties than I've seen before, and the hotel staff wears fresh uniforms. Beer and sandwich kiosks are everywhere.

Columns form in various parts of the city, ours near Komsomol (Young Communist) Square. Ahead of the Novosti float is *Pravda's*, and not far behind, the Bolshoi's. The floats depict smiling workers, Leonid Brezhnev, sputniks circling the globe. One proclaims: "Raise the Banner of Proletarian Internationalism Even Higher!"

ON GORKY STREET our column converges with others. The delegation of Moscow Watch Factory No. 2 draws alongside. We march on, past the Museum of the Revolution and Pushkin Square.

Few people watch from the street. Shop-girls step out in their white smocks and caps, some families peer from windows. Much of Moscow is in the parade—300,000 people—and many presumably watch it on TV.

I notice knots of soldiers, volunteer police with red armbands, military trucks blocking off side streets. Now we see the Kremlin towers and Red Square ahead (pages 22-23). Tension begins to build. Other great columns of marchers are coming from left and right on Marx Prospekt.

Along the way officials call out over public-address systems: "Long live the working class of the country, the living force in the body of Communism!" Cheers from marchers.

"Long live the collective farmers, builders of the country!" Cheers again.

"Long live the Soviet women!"—cheers—"active participants of Soviet life!" Cheers.

As we begin the climb into Red Square, soldiers and volunteer policemen stand shoulder to shoulder in long lines, looking into faces, watching arms and hands. I feel that I am being scrutinized by hundreds of eyes.

The square is a sea of marching columns, red balloons, banners, floats, and paper flowers. Atop Lenin's tomb I can see the Soviet Union's chief dignitaries, generals in uniforms, politicians in gray suits and fedoras.

Past St. Basil's, it is over. The columns disintegrate, the marchers head for parties.

IDID NOT KNOW IT, but that May Day marked one of the last official appearances of President of the Presidium Nikolay Podgorny, one of those distant gray-clad figures atop Lenin's tomb. The next time I would see the Soviet Union's leadership, he would be absent and his job given to another.

That was in June, when the Supreme Soviet—the national legislature—assembled in the Grand Kremlin Palace. The diplomatic corps and the international press were well represented. *Pravda* had announced that Mr. Podgorny was no longer a member of the Presidium, and there was speculation that Mr. Brezhnev, head of the Communist Party of the U.S.S.R., might now become president as well.

Sunlight filtered through curtains into the large assembly room; a statue of Lenin looked down over the proceedings.

The chairman of the meeting soon announced that Mr. Brezhnev had been nominated to the presidency.

"Now we must vote. All in favor raise their hands." Every hand went up.

"Now all opposed." No hands went up.

"All abstaining." No hands.

"Now may I introduce the General Secretary of the Communist Party of the U.S.S.R. and now the President of the Supreme Soviet."

Mr. Brezhnev, in a gray suit, thanked the deputies for the "great confidence voted in me," pointed out that it would not be easy to handle the burden of both jobs, but that "the will of the party and of the Soviet people has always been my first law." Applause.

To keep abreast of such affairs, many Muscovites turn to *Pravda*. The party newspaper has a circulation of 11 million. I attended the paper's daily editorial planning conference (pages 18-19). (Continued on page 44)

Student relishes a winter workout in a heated open-air pool, while an attendant paces like a muffled bear in the zero-degree cold. Bathers avoid the trauma of entry and exit by diving through a submerged opening that leads to warm dressing areas. Hardier swimmers, dubbed "walruses," often drift amid ice floes in the Moscow River.





Books appear in hands of Muscovites at the drop of an idle moment. The reading matter available is governed by an organization known as Glavlit. Anything published in the Soviet Union must bear its stamp of approval.

The delights of puppetry engross a tot in

his stroller (top), while a suburbanite takes to the fields near his apartment to soak up sun and knowledge (above). Magazines and paperbacks occupy riders on the city's 102-mile subway system, one of the world's finest. During rush hour, trains leave stations every 90 seconds.



A junior editor rose to report that that morning's last edition had been 20 minutes late; corrective steps had been taken. The discussion turned to Sunday's edition. The editor said: "The lead story will cover the elections to the local soviets. Page one will have a big photograph of the harvest in Turkmenistan and coverage of important national and international news. On page two, an article about the Day of the Doctors and a report on party organization in Byelorussia. We will also cover the work competition between the coal miners and coal processors." So it went, until *Pravda's* six pages were accounted for.

The chairman asked, "Does everybody agree?" All agreed. The meeting was over.

AFTERWARD I talked with Deputy Editor-in-Chief Ivan Vorozheykin, "a heavyweight physically and politically," one colleague said. I asked if *Pravda* had reported the fire at Moscow's Rossiya Hotel, which killed scores of persons.

"No. Really we pay very little attention to this kind of sensational information. We must husband the space in our newspaper. You see, we really need space for writing about our economic life, about the spiritual life.

"Our most popular material is the front-page editorial," he added, "a sort of beam in the sunshine of information; it directs attention to the most important information."

The "beam" for Sunday was the election of members of the local soviets, or councils. And so on Sunday I arranged to visit Precinct No. 4 in the Sverdlov region, in the old part of the city. Again there were banners and music, and many voters wore their best clothes.

The balloting was in a room in the Ministry of Health. There were flowers, a bust of Lenin, decorous and helpful officials. Vladimir Kondratiev, an employee of the ministry, said the precinct has 1,400 registered voters. "We expect 100 percent turnout. It is now only midmorning, and 50 percent have voted."

A voter entered, was welcomed, and made his way to a long table where registrars sat

(pages 18-19). The voter showed his identity card and was given two ballots. Each ballot bore one name: for city council, Mr. Anatoly V. Treushnikov, sponsored by the Ministry of the River Fleet; for local council, Mrs. Yelena L. Ivanova, sponsored by the workers in the canteen trust of the Sverdlov region.

The voter took his ballots, which were numbered, studied them for a moment, and then walked to the center of the room, where he carefully dropped them into the box. No marking was necessary.

At one end of the room stood two cubicles of polished wood. Voters who chose to vote "no," or to mark in another name, could repair there. During my stay none did.

How was it that only one name appeared on each ballot? Under the Soviet constitution every collective or trust has the right to propose a candidate, but in practice, Western observers say, the determination is made by the Communist Party, whose members predominate in the local organizations. The nomination of the party's choice—and no other—is thereby assured.

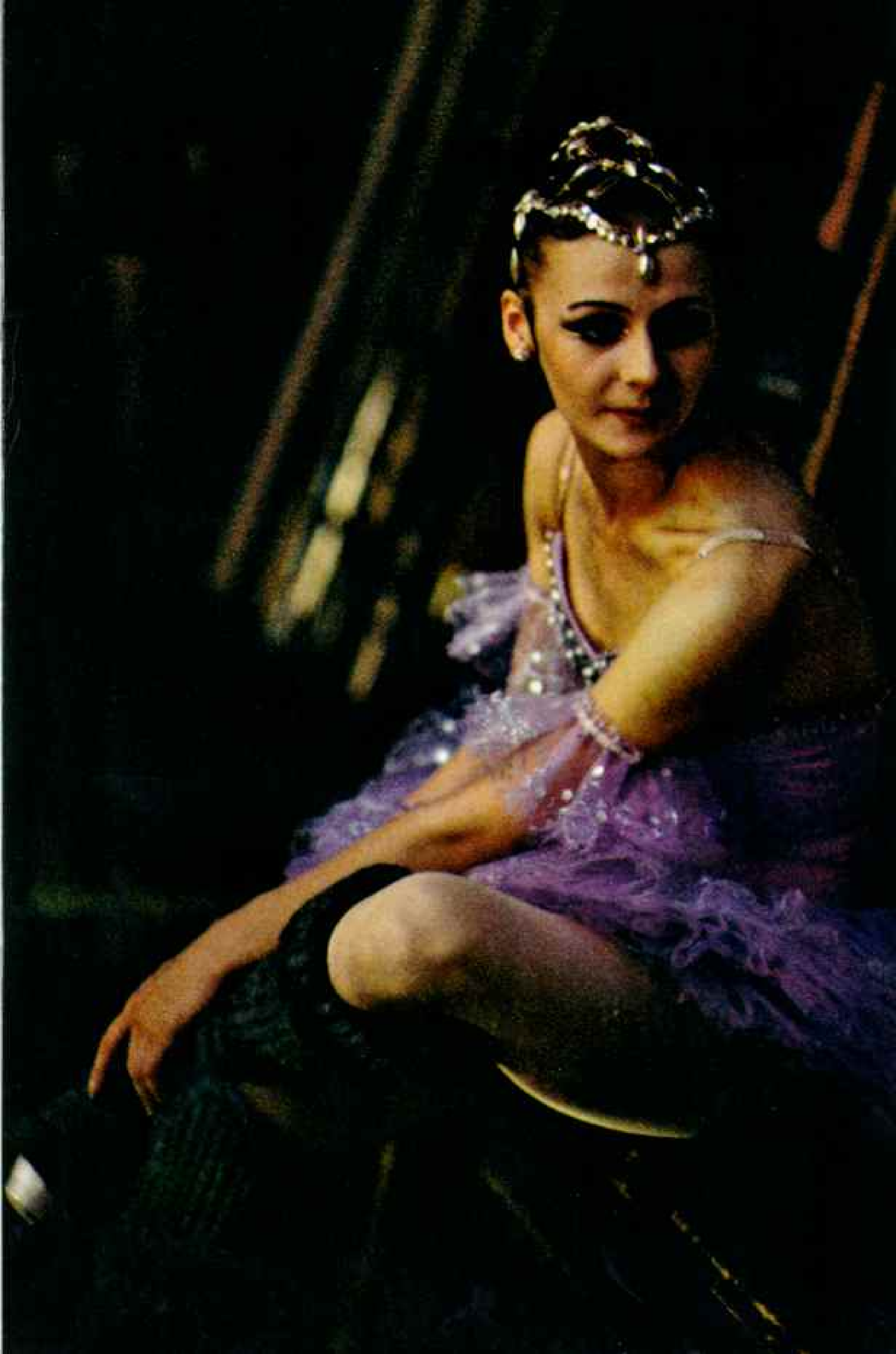
The results of the day's voting, Mr. Kondratiev said, would not be known until about 11 p.m., an hour after the polls closed, when all the ballots had been counted.

IT WAS SEPTEMBER when I left Moscow. The leaves were turning, and the sky seemed heavy with the promise of winter snows. At Sheremetyevo Airport the bus pulled up to the plane, and, as always, passengers stepped out one by one to be counted and scrutinized as they boarded.

Life had moved along since I had first arrived in the city: Alla the ballerina had won her gold medal; Andrei the poet was packing for a brief fellowship in the United States; some new apartment buildings had been completed, others begun.

The plane circled away from the city. Below, forests, fields, and villages stretched to the horizon. Then we were above the clouds, and the Soviet Union passed from view. □

Tense beauty waits in the wings: Alla Mikhalchenko prepares for the Third International Ballet Competition held last year in the famed Bolshoi Theater. A member of the Bolshoi's own corps de ballet, the 20-year-old ballerina captured a gold medal, one of three won by the Soviets, masters of the art. Perhaps she will join the ranks of Galina Ulanova and Maya Plisetskaya—touchstones of pride for Moscow and all the nation.







Zulu King Weds a Swazi Princess

TEXT AND PHOTOGRAPHS BY
VOLKMAR WENTZEL

FOREIGN EDITORIAL STAFF

THE SINGING reaches a crescendo of joy. Into the royal cattle enclosure of the Zulus dances a column of Swazi women. Leading the way, regal in her headdress of widow-bird feathers and cape of ox-tails, Princess Mantfombi (left) breaks into a radiant smile. Red wing feathers of the touraco around her forehead and a shining sword in the hand mark her as a daughter of King Sobhuza II of Swaziland. Twice the princess and her maidens circle the kraal, located near Nongoma, in KwaZulu, South Africa (map, following page). After each turn, as voices rise, the princess drives a spearlike assegai into the earth, thereby placing herself under the protection of her husband-to-be, Goodwill Zwelithini, King of the Zulus.

Not since the early 19th century had the Swazi and Zulu royal houses been united in marriage. The June 1977 wedding revived age-old rituals not yet surrendered to the rush of time, and it created family bonds between the traditionally powerful Zulus within South Africa and their politically independent Swazi neighbors to the north.

WEDDING ACTIVITIES begin in Swaziland with a public send-off for the princess in Siteki, her hometown, where local women present the bride with gifts to take to her new home. Holding a ceremonial knobkerrie—a club once used in warfare—the princess accepts a new suitcase (below, right) from a group carrying umbrellas as their identifying mark. The bride's father for his part received 200 head of cattle from the bridegroom's family.

Lobola—bride-price—consoles the father for the loss of his daughter and also legalizes the marriage and legitimates the children.

Reminders of the 20th century were rarely absent from the rites. Prince Gabheni, the Swazi king's son, and K. H. Dlamini, a government minister (below, left), arrived in pin-striped suits, and when *imbongis*—praise singers—announced the entrance of the bride, a band joined in with a number from



Broadway's *The Sound of Music*.

On Zulu Coronation Day in 1971, newly crowned King Zwelithini first met his Swazi guest and future bride. A ruler with limited powers, the 28-year-old monarch presides over some 280 clans, whose homeland, Kwa-Zulu, lies inside the Republic of South Africa. The Swazi royal family heads a landlocked nation to the north, which was granted independence by the British in 1968.

The couple became formally engaged in 1973, but the state wedding was delayed almost four years. Meanwhile, they built a palace and had two children. Because of her pedigree, Princess Mantfombi, 21, now becomes the "main wife" and her children the legitimate heirs of King Zwelithini, who has two other wives. In Swazi and Zulu societies, a king is encouraged to take brides from as many clans as possible as a means of knitting his people together.



SORROW comes as a prelude to happiness for the Swazi bride as she bids farewell to her family at Lobamba, home of the queen mother and spiritual capital of Swaziland. Bared to the waist as a sign of humility, the princess, with her royal sisters (right), dances for the king. In front of her, a sleeping mat, a wooden headrest, and a calabash holding beer symbolize the household she is moving to Kwa-Zulu. An ox's gallbladder is pinned to her hair to signify luck, and she grasps two assegais and a knife, indications that she is prepared to enter into another's clan. As the setting sun colors the Mdzimba Range, the bride's father, King Sobhuza (below), silently watches the slow-moving dance, which is accompanied by a haunting dirge.









STATUESQUE IN BEAUTY and composure, Princess Mantfombi (above) spends her wedding morning in KwaZulu being dressed by older Swazi women. At sunrise she had been ritually bathed in a stream and

anointed with ox gall. On a nearby hillside, young Swazi women put on their holiday best (left). More than a thousand Swazis journeyed from their country to the Zulu ceremonial grounds at Nongoma.



MOBILIZED for celebration, Swazi warriors launch a mock charge against the royal Zulu kraal.

The men will throw open the gates for the princess, an important part of the wedding rituals. Dancing women



follow, sweeping the bride across the threshold. Encounters between Swazis and Zulus were not always so mild.

The two peoples met in battle when tribal warfare convulsed southern Africa in the early 19th century.





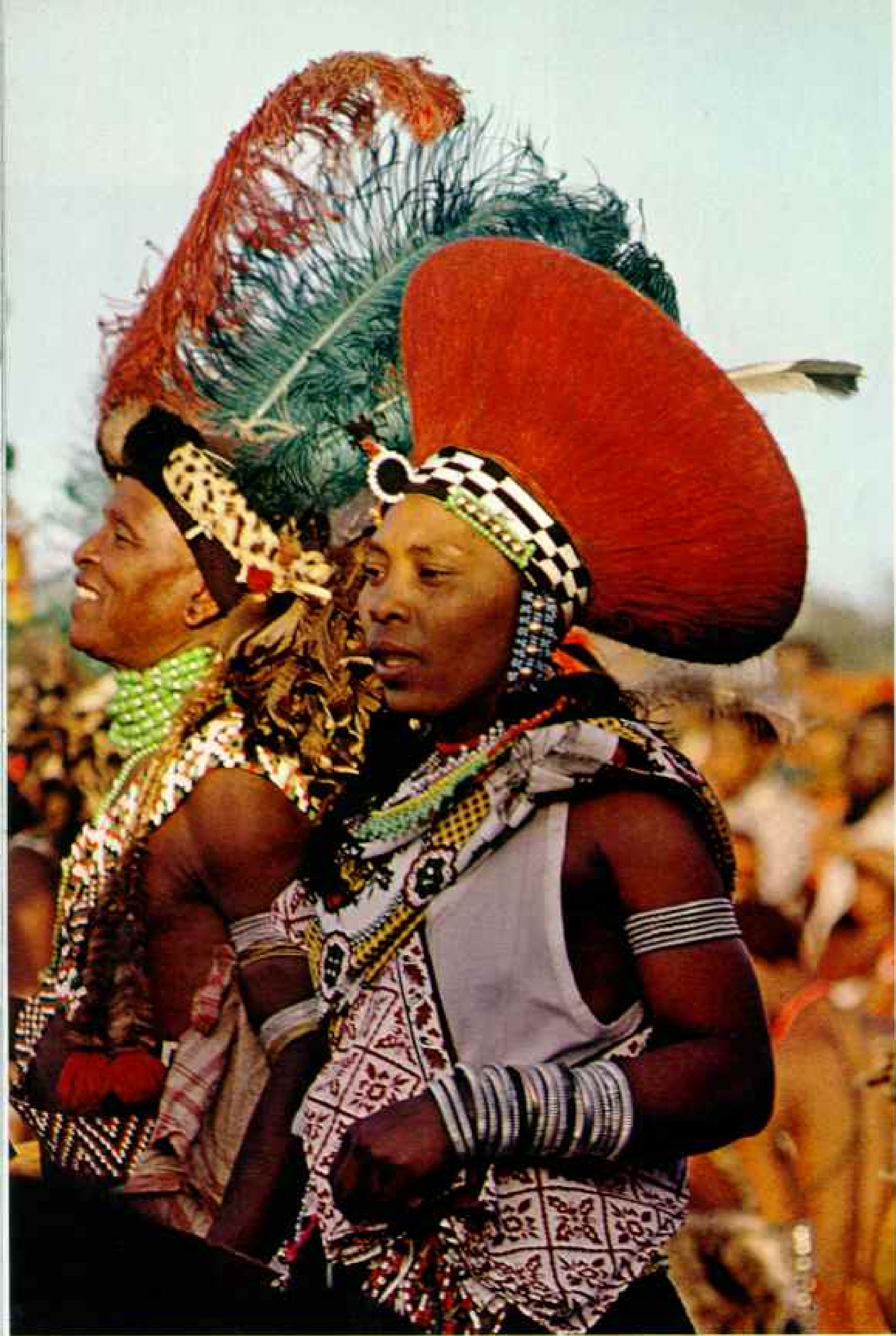
SYMBOLS OF ROYALTY accent the presence of King Zwelithini (above) as he joins two Swazi princesses in a wedding dance. His dress: a leopard-skin cloak, a necklace of lion claws, and a collar of wildcat tails.

On their wedding day the king first sees his bride when ceremonies shift to an outdoor arena. The Swazi retinue begins to dance for Zulu royalty and officials. Suddenly Princess Mantfombi emerges from a wave of chanting



women. Holding a sword high, she turns, and with flashing blade, points at the king, choosing him as her man. Feathers are then transferred from her headdress to his as a seal of tribal bonds. To complete civil rites, a policeman now asks the couple if they truly love each other.

Old and new ways also mix in the clothing style of a Zulu family (above), among the 25,000 people on hand to cheer the newlyweds (left).





REVELRY LIGHTS the faces of Zulu dancers (facing page) at the celebration that follows the wedding vows. Dyed ostrich plumes wave from the man's cap, while his partner wears a flaring wig. Arrayed



in ceremonial fighting garb, two Zulu elders (left) leave the dancing to others. Monkey-fur cap identifies one of the "mothers" of the bride, a close relative. Family asides pass between the wife and mother (top right) of Gatsha Buthelezi, chief minister of the Zulus. That none of this collage of faces and costumes may escape his eye, Prince Gabheni, now in traditional dress, records the scene with a movie camera.





SPIRIT OF FRIENDSHIP now exists between the Swazi and Zulu royal clans as Princess Mantfombi performs her duty of distributing gifts (above) to her new in-laws—all 94 of them. During this closing ceremony the bride again bares herself to the waist as a sign of respect. The string she wears announces her new married state. As she presents each object, she spills water from a pitcher, thus consecrating the offering. On this chilly day blankets prove the most popular gift, though

trills of appreciation also greet the handing out of sleeping mats and enamel pans. Because blankets convey a sense of warmth and closeness, they have evolved into emblems of goodwill for both Zulus and Swazis.

Later, at the palace, the handsome couple, relaxed and self-assured, sit for a formal photograph (right). Though their clothes are Western, their hearts owe allegiance to their ancestors and the proud heritage of their peoples, now bound by familial ties. □





Spring returns with its bounty—nets heavy with shad—for early-morning fishermen

The Hudson: “That River’s Alive”

By ALICE J. HALL NATIONAL GEOGRAPHIC STAFF
Photographs by TED SPIEGEL BLACK STAR



by the Tappan Zee Bridge. The news is good: The Hudson is getting cleaner.

IT WAS ONE of those sultry dog days of August, not peculiar to New York State. I was standing in a houseboat on the Hudson River 35 miles north of Wall Street, watching a trawl come in. Morning fog veiled the river in gray anonymity. But along shore I could make out fishermen baiting their hooks and optimistic sunbathers in bikinis arranging towels on seawalls.

On board the *Needham*, a floating research station of the Boyce Thompson Institute in Yonkers, estuarine expert William Dovel and his assistants looked expectantly at the taut line off the stern. Dovel had warned us there was no predicting what such a five-minute

sweep by a 35-foot-wide net might bring up.

"It's like dipping a tablespoon into roiling vegetable soup—a random sample."

With a groan the winch raised the bulging net overhead, and a stream of fish cascaded into waiting washtubs. This was no vegetable soup, but a gargantuan bouillabaisse.

A dozen hands reached into the wriggling mass, sorting out species.

"There's a striper . . . and a spot."

"Watch out for the . . ."

"Ow!"

" . . . crab pincers."

We identified juveniles of a dozen marine species, from bay anchovies to shad, plus

white perch, carp, and bluegills from upriver. I could see why Dovel calls the Hudson estuary one of the richest fish nurseries on the East Coast (painting, pages 66-7). A fifth of the striped bass caught in the North Atlantic, he estimates, grew up in the Hudson River.

The fishermen sum it up best when they say simply, "That river's alive." The good news surprises those who remember the Hudson of the 1960's, when it epitomized the nation's problems with water pollution.

Each summer, dissolved oxygen in the water around New York City sank toward zero. Upriver, sailboat hulls picked up oil-slick souvenirs left by tankers and barges. At the confluence of the Mohawk, a noxious blend of raw sewage and paper-mill wastes, dubbed the "Albany Pool," spread its stench every summer. Fish kills surfaced near power plants. A Presidential council called the river "an open sewer," and in an understandable burst of hyperbole, spoke of scavenging eels that attacked engineers taking water samples.

Such horror stories helped spur an environmental movement and federal legislation to "restore and maintain" all of America's waterways. Millions of dollars have since gone into Hudson cleanup alone, generating ongoing controversy about how clean a river should be. Clearly, the time has come for a progress report on this historic, scenic waterway.

River's Lower Half Driven by Tides

The Hudson is not a simple river. Large as it looms in the American mind, it is a midget in size, 306 miles long and 71st down the list of our rivers by length. Born in the pristine isolation of the Adirondacks, it exits into the Atlantic past New York City, one of the most densely populated metropolises in the world. (See "Close-Up: U.S.A."—The Northeast, a supplement to this issue.)

In the Hudson's oft turbulent upper half, a dozen dams impound 70 miles into gentle "lakes." In its lower half, the Hudson isn't a river at all but a tidal estuary, an arm of the sea. Powered by the lunar pulse, high tide arrives at Troy, 150 miles from the Atlantic, twice each day to lap the base of the federal

dam. At the adjacent lock, unwary boatmen occasionally tie up at sundown, only to be wrenched awake by stretching lines as the water drops nearly five feet on the ebb.

The Hudson's 13,370-square-mile watershed reaches into five states. Minor tributaries rise in Connecticut, Massachusetts, and Vermont. New Jersey claims 20 miles of shore. But basically the Hudson is New York's river.

Explorers, Artists, and Railroad Barons

It took three and a half centuries of progress in the Empire State to despoil the waterway, a gradual transition set in motion by an explorer and witnessed by some of America's favorite artists and authors.

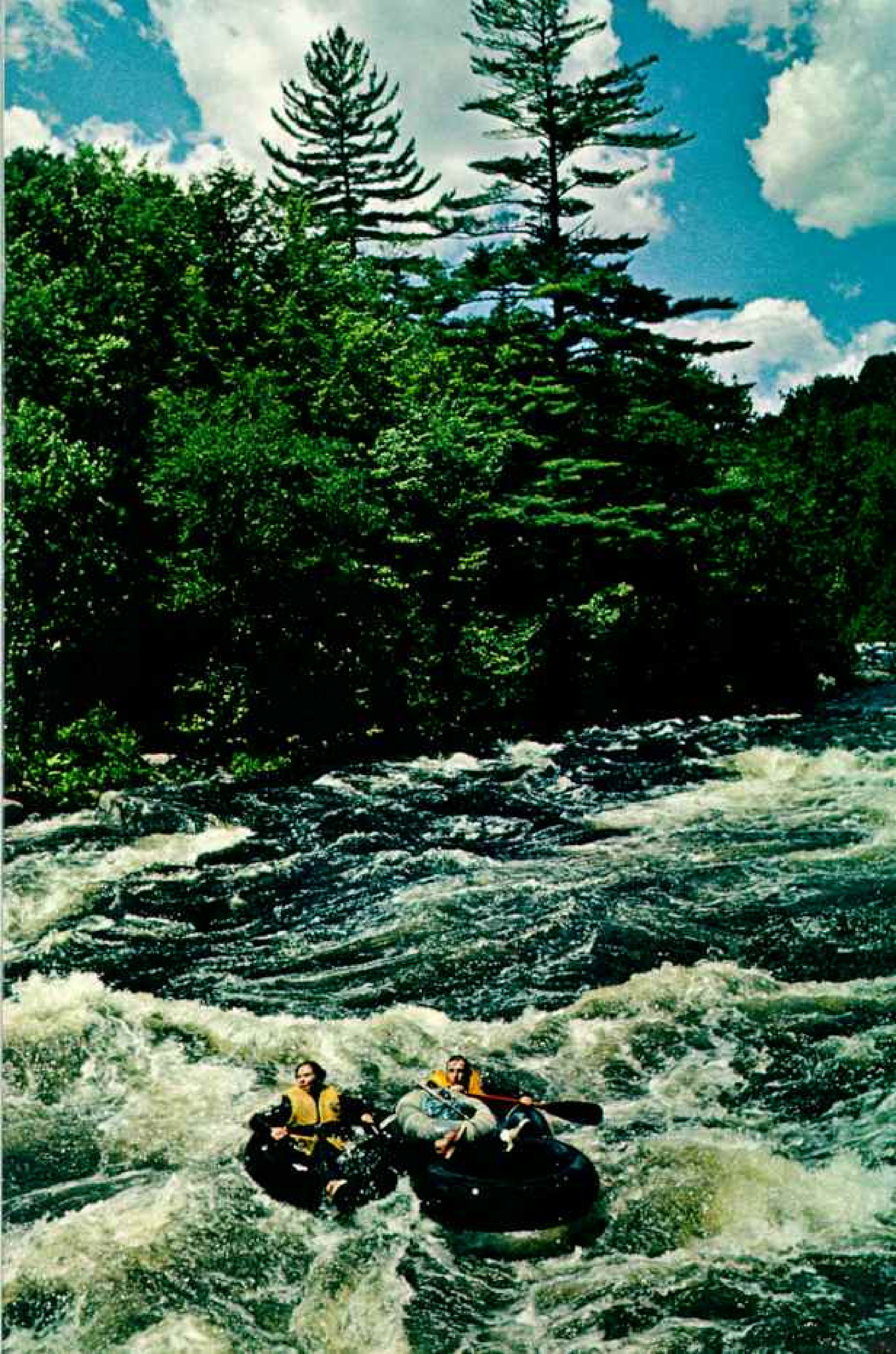
In the bright September of 1609, when Henry Hudson sailed his *Half Moon* to the present-day site of Albany, he was seeking a possible passage to the Orient. The English captain was only the first of a long line of explorers, sloop sailors, steamboat pilots, barge-men, dredgers, and Coast Guard officers who viewed the river solely as a highway.

The slow "civilizing" of the river was recorded by a succession of landscape artists, the Hudson River School of the mid-1800's. Thomas Cole, Asher B. Durand, Frederic E. Church, and Albert Bierstadt carted palettes into the open air to capture the play of light on water, the idyllic farms and vineyards, the shad fishermen, the forested slopes, and storms brooding over the Catskills. They painted a quarry here, a foundry there, a brick factory, an icehouse—miniature intrusions overwhelmed by the setting.

In the 1840's railroad magnates discovered the river and began a transformation felt today. Along both shores they built their tracks near the waterline, eventually corseting almost the entire estuary below Troy.

Washington Irving, then America's most popular writer, watched the rails arrive at Sunnyside, his Tarrytown estate (page 79). He had always sought inspiration along the river, savoring its "wildness and savage majesty." Protesting against the "iron monster," he balked at selling his waterfront. But eminent domain prevailed, and the rails came through.

Roller coaster gone wild, the upper Hudson rollicks clear and clean through Adirondack Park—giving two white-water enthusiasts a ride. In contrast, the past century turned the lower Hudson into an industrial drain and oil-fouled ship channel. Legislation and local activists have brought a dramatic turnaround in little more than a decade.



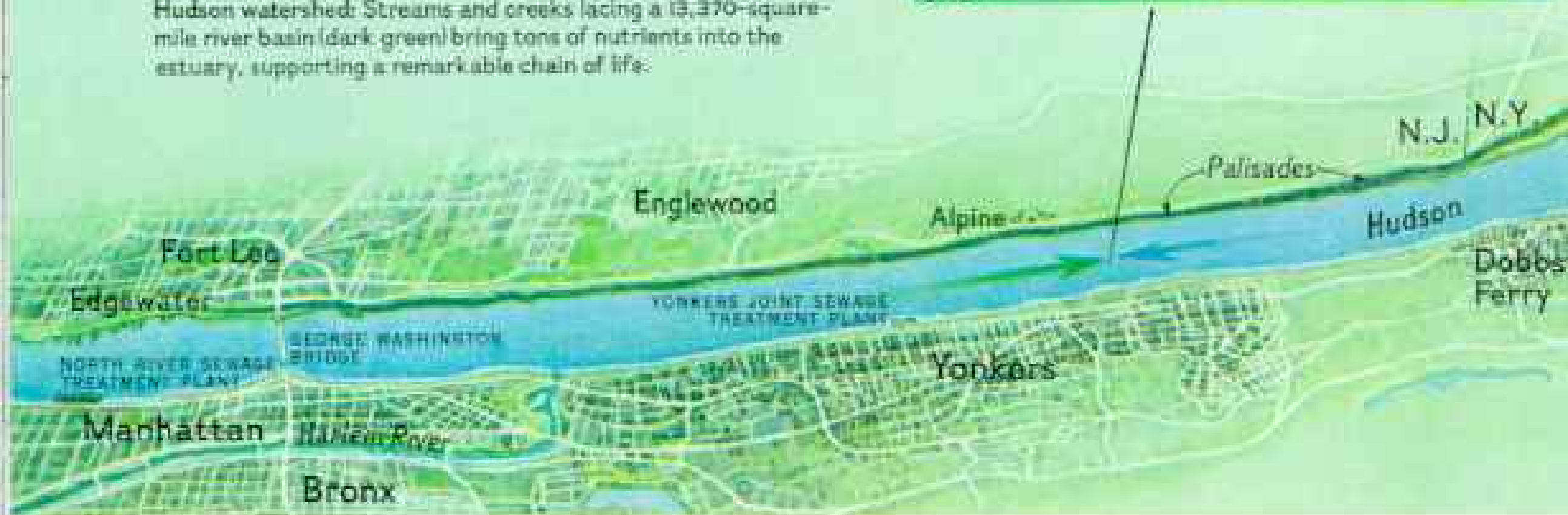
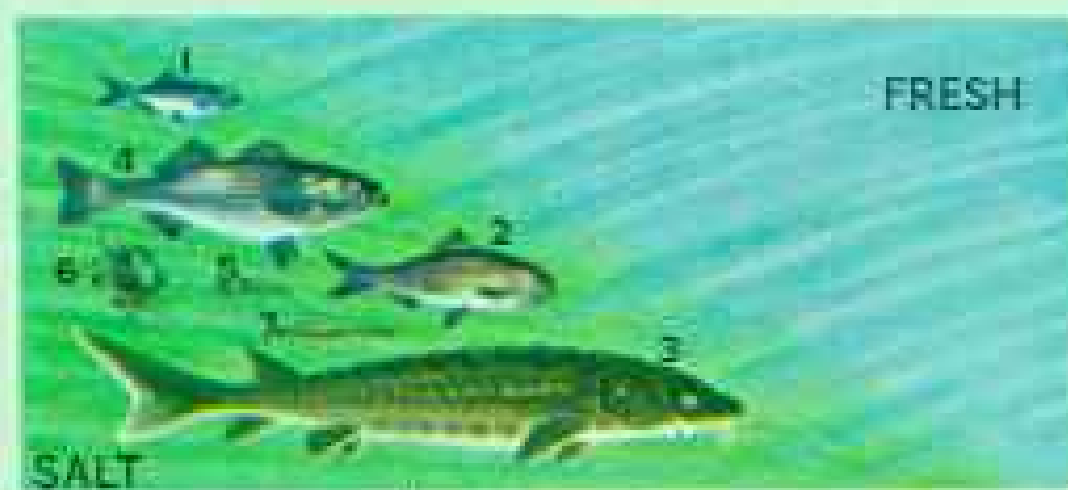


Hudson watershed: Streams and creeksacing a 13,370-square-mile river basin (dark green) bring tons of nutrients into the estuary, supporting a remarkable chain of life:

Hudson estuary

TIDAL TO TROY, saline to Newburgh, the lower Hudson boasts as rich and varied an aquatic environment as Chesapeake Bay, thanks to nature's timing. Some 20 marine species and 40 freshwater fish utilize it as a nursery. Yet as cities demand more space, more water, and more places to dump refuse, the lower Hudson is most affected.

SPRING. Upriver runoff (blue arrow) pushes the salt water down toward Yonkers. Marine species enter, blueback herring (1), followed by shad (2), sturgeon (3), and striped bass (4), race upriver to spawn and depart. Young menhaden (5), blue crabs (6) hatched in salt water, and baby eels (7) from the Sargasso Sea swim in to feed.



I sensed Irving's indignation during a visit to Sunnyside, a retreat as appealing as the character of Rip Van Winkle. Its shadowy glades seem haunted still by the ghosts of Ichabod Crane and the Headless Horseman.

On a grassy knoll Irving's "cocked hat" of a house, a comfortable stucco with eccentric gables and turrets, surveys his domain. Over the portico a gnarled wisteria planted by the author still twines. To the west spreads the Tappan Zee, the river's broad reach he loved. Not a hundred yards below the house gleam the rails he hated.

This day, amid the rattle-clatter-chug of work cars and cranes, a gang of men hammered rails, upgrading track for the arrival of high-speed trains to carry the commuters who move ever farther from Manhattan.

Industries Transform the Riverside

The scene could have been 1850, when the rails cut off Irving and all following generations from riverside strolls. The embankment arrowed across a cove south of his house, rendering a boat landing useless and eventually turning open water into marsh. With

SUMMER: Conditions in the Tappan Zee make it an ideal fish nursery. The mingling of salt and fresh water works to trap and suspend nutrients. Sunlight, warming this shallow bowl, promotes the growth of algae that are consumed by microscopic animals. These, in turn, provide food for larval and juvenile fish, which fall prey to adult bluefish (1), striped bass (2), and white perch (3). Bay anchovies (4), reproduce so rapidly and so abundantly that they could support a fishery.



FALL: Now at the juvenile stage, spring's hatch of shad (1), and bass (2), as well as three-to-five-year-old sturgeon (3), head to sea, but not the freshwater white perch (4).



WINTER: Salt water (green arrow) reaches farthest north and freshwater species move down toward its warmth. Catfish (1), yellow perch (2), carp (3), mature eels (4), and even introduced goldfish (5) mill sluggishly with young marine fish. In the dead of winter, ice can reach down to Tarrytown. A Coast Guard cutter keeps the ship lane open to Albany.

PAINTING BY DAVID MELTZER
BASED ON CONCEPTS BY WILLIAM L. DOVEL
COMPILED BY ROSS W. EMERSON
NATIONAL GEOGRAPHIC ART DIVISION

the railroad came noise, cinders, sparks, and water pollution. The rail yards at Harmon spewed waste oil into the river until halted by court order in 1969.

Manufacturers found the rail-river combination irresistible. By 1960 some 1,000 industrial sites, including four power plants, were overusing the river's capacity to dilute and assimilate wastes. Rarely did voices call for a halt; instead they warned "Swimmer, beware." Too many New Yorkers had relegated their river, in every sense, to the wrong side of the tracks.

As use turned to abuse, complaints grew louder.irate citizens banded into pressure groups. In 1966 the Hudson River Fishermen's Association resurrected the long-ignored Federal Refuse Act of 1899 against dumping in navigable waterways, and the government started suing individual plants.

Folksinger Pete Seeger, longtime resident of Beacon, worked the broader arena of public opinion. To draw people back to the river, he and other environmentalists built the *Clearwater*, a 106-foot replica of an 1800's Hudson River cargo sloop. Now its great gull wing of



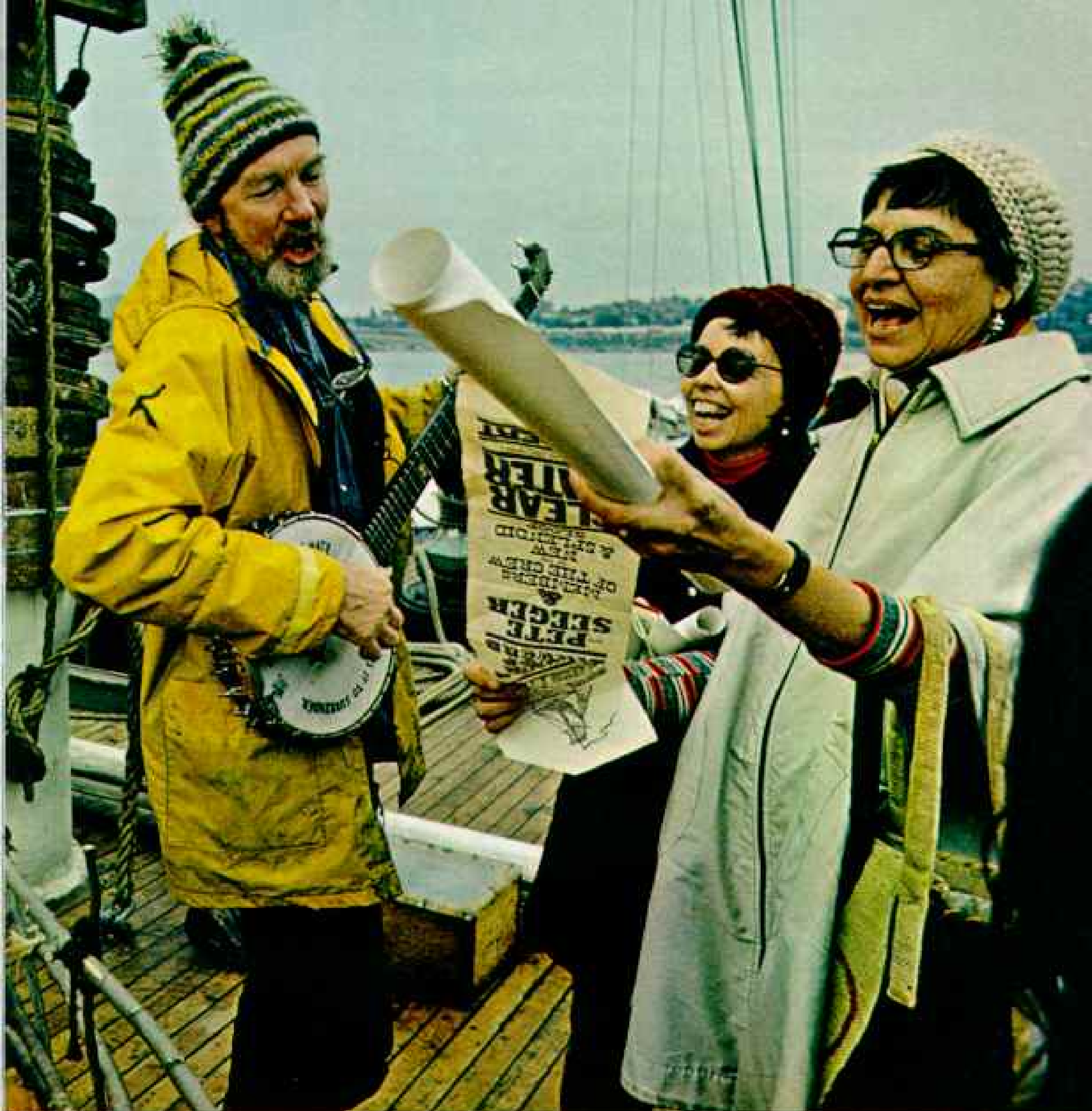
Giving voice to a silent river, folksinger Pete Seeger helped create an environmental group that built the sloop *Clearwater*. Shore-side festivals, such as a fall pumpkin sale (right), dramatize the river's plight and promise. With money raised, the organization cries foul against polluters and agencies that fail to regulate them. The *Clearwater* sails past the magnificent Palisades (above), scene of a victory for earlier conservationists who purchased the cliffs for a park just in time to keep them from being blasted down for building stone.



sail brings volunteer crews to riverside towns to spread the message.

Seeger often comes along, energizing every gathering with his gravelly-voiced songs (above). Then, slinging his banjo on his back, he proselytizes the earnest young people who crowd around him with the plea, "What can I do?"

Patently, he repeats the litany of citizen participation: "Get in touch with a local sloop club, or form one. Look for local water polluters. Write letters to representatives; sign petitions. Help your town open a waterfront park. Pick up the trash yourself."



Seeger does just that, early and late, at the Beacon park his club created on the site of an abandoned dump. "I should be retiring now," he confided to me. "But I'm more enthusiastic than ever about *Clearwater's* achievements, and I want to contribute more."

Storm Over Storm King

Hudson conservationists won an astonishing early victory when a handful of river people blocked plans of one of the nation's largest power companies. In 1962 Consolidated Edison announced its intention to cut 500 feet into a 1,355-foot mountain named Storm

King in the dramatic gorge of the Hudson Highlands. There a pumped-storage plant would raise river water to a mountaintop reservoir. At hours of peak power demand in New York City, water plummeting back into the river would generate electricity.

Nearby Cornwall-on-Hudson was pleased by the prospect of employment and a broader tax base. Residents of other towns were enraged. Frances Reese recalled the consternation of her neighbors as we relaxed on the porch of her home beside Wappinger Creek.

"We are not against progress or power plants. We just want them sited where they

will not damage irreplaceable resources.”

Mrs. Reese joined the Scenic Hudson Preservation Conference, an organization of 20,000 members that she now heads. Scenic Hudson, arguing the value of beauty as a public resource, won a landmark decision against ConEd in 1965. The case helped influence Congress to pass the National Environmental Policy Act of 1969, requiring federal agencies to evaluate the impact of any project—such as new power plants on the Hudson—before granting funds or license.

ConEd now proposes to build much of its Storm King facility underground, but Scenic Hudson still opposes, and hearings continue.

During those years of environmental battles, public opinion was building for state and federal action. In 1965 New Yorkers passed a billion-dollar bond issue to upgrade all sewage treatment to the secondary stage. Congress in 1972 passed the Water Pollution Control Act Amendments, setting nationwide standards for industrial discharges.

Approached step by step, the goal is zero discharge of pollutants into navigable waterways by 1985. Congress charged the Environmental Protection Agency with the difficult task of enforcement, a job since shared in New York with DEC—its Department of Environmental Conservation.

River Stages a Comeback

The new laws have achieved some striking results along the Hudson. Factories are carefully measuring water use and effluents; many are installing costly waste-treatment facilities; all must report their progress regularly to both EPA and DEC. Nine out of ten companies along the river say they met the first federal deadline this past July by installing “the best practicable control technology currently available.”

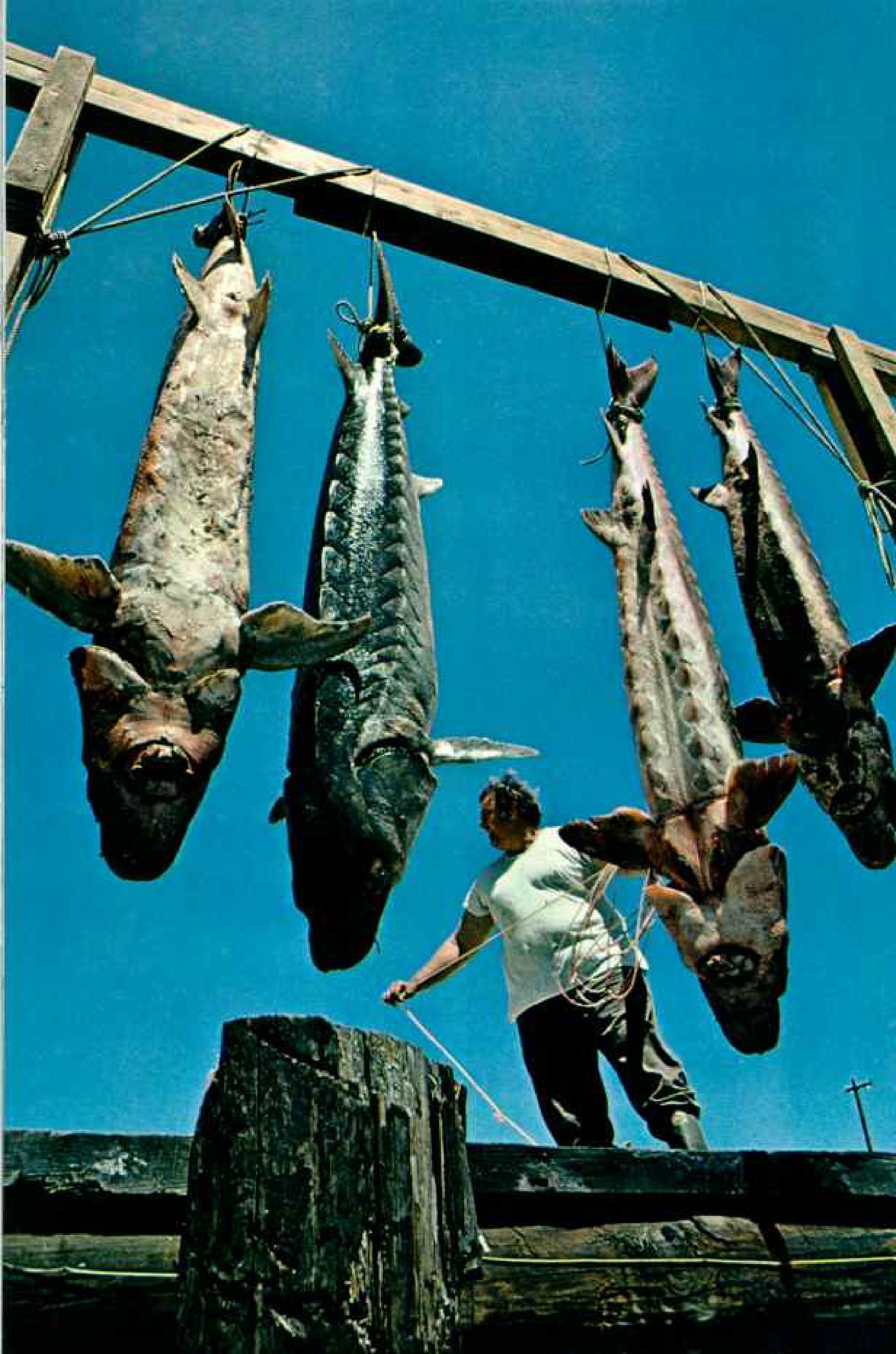
International Paper Company—once one of the worst polluters by its own admission—takes special pride in success.

“Ten years ago we didn’t even know what



HAND-COLORED PRINT FROM FRANK LESLIE'S ILLUSTRATED NEWSPAPER, AUGUST 4, 1878, BORGE THOMPSON INSTITUTE

Wrestling a 300-pound sturgeon into their scow, fishermen contributed to a flourishing industry just a century ago. At Hyde Park a caviar merchant cured the eggs on the spot and auctioned the veal-like meat. Overfished, the sturgeon seemed to disappear. Now Charlie White, who has “caught every kind of fish there is on the river,” sets extra-heavy nets off Verplanck. On Memorial Day at the Viking Boat Yard, he displays a two-day catch (right)—676 pounds of sturgeon.



was going into the river," IP mill manager Richard O'Brien admitted as I toured his plant at Corinth. I watched enormous logs of spruce, red pine, and poplar, trucked from within a hundred-mile radius, shoot down water-filled sluices and disappear into debarkers and grinders. More colossal equipment bleached, squeezed, dried, and ironed the high-quality publication paper. Clay, dyes, and titanium dioxide flowed into the vats, providing filler, color, and coating.

Residues used to go directly into the Hudson, together with 24 million gallons of waste

water daily. Now the mill has cut water use by nearly two-thirds and begun treating waste-laden water in its own three-million-dollar plant. Still, four thousand pounds of wood and clay particles, plus traces of chemicals, flow into the river every day. Mr. O'Brien adds: "It will cost another twenty million to reach zero discharge by 1985—if it can be done at all."

Is the river any cleaner? Weekend sailors think so. And the waiting list for slips in the river's sixty-odd marinas grows longer.

Swimmers agree, discovering as I did the



Floating trash truck, the Army Corps of Engineers' *Driftmaster* (above) scoops debris from New York Harbor. Cleanup is unending and complex. Junked cars headed for recycling are stored at riverside in Newburgh (right) near natural-gas tanks, creating this eyesore.



languid pleasure of floating on the current at refurbished beaches near Glens Falls, Kingston, Cold Spring, and Croton Point. I was forewarned about the murky water and muddy bottom by an angler. "Don't expect the Bahamas," he told me. "The current and tides keep sediments in suspension."

Fish Attest to Cleaner Water

Yes, the river's cleaner; say the Hudson's 55 commercial fishermen, their numbers sharply reduced since the 1930's by the changing economy, the river's dirty reputation, and

unpredictable catches. They point to the return of the delectable blue crab and to sizable hauls of shad.

It is the month-long spring run of silvery shad, racing for fresh water to spawn, that keeps these men in cash. Like harvesters awaiting ripening wheat, they set their nets in succession from south to north. First in line near the river's mouth, Ronnie Ingold of Edgewater, New Jersey, with half a dozen hired hands takes as much as 10,000 pounds of shad a day. Three weeks later, 100 miles upstream near the city of Hudson, Everett



Nack rows out drift nets to take his share.

While shad pay the bills, Atlantic sturgeon in the Hudson arouse the greatest interest and tell most about this complicated nursery. Sturgeon were living when today's continents drifted apart. A century ago they were netted by the hundreds off Hyde Park, where a professional caviar man salt-cured the roe, marketing it at ten dollars a barrel. Sturgeon meat, smoked or salted, became so common in the state capital that it was called "Albany beef." By 1900 too many fishermen meant not enough sturgeon to go around, and the industry died.

Tracking a River Monster

There were probably always some sturgeon in the river, believes Bill Dovel, who now conducts a pioneering two-year field study of the remarkable fish. One May morning I joined him on a sturgeon chase; before I knew it, a sturgeon was taking me for a ride.

Perched in fisherman Charlie White's 16-foot skiff, I stared down at a smooth gray body, five hefty feet of energy, lassoed to the bow. The head looked like the snout of a toothless crocodile, the mouth like a retracted vacuum-cleaner hose.

Charlie had netted the fish off Verplanck and was supposed to tow it to the *Needham*, anchored in mid-river. Instead, the sturgeon was towing us with undulating surges, and Charlie—all 200-plus pounds of him—was standing in the stern, laughing. Finally, he whipped his antique outboard into sputtering motion and delivered us to the vessel.

It took three men to wrestle the thrashing creature into a sling for weighing (76.5 pounds), measuring (67.5 inches), and sonic tagging. When the sturgeon was released, it carried a tiny sonic transmitter wired to its bony back plates. I twisted a receiver to locate the first bleeps. Listening was like riding on its back as it meandered in the area for hours.

Such tracking has helped Dovel write a scenario for spawning sturgeon. From May to July, ripe females follow smaller males up the river, swimming with the flood tide and

resting on the ebb. Reaching fresh water from Stony Point to Hyde Park, they spawn. The female "rubs out" one to three million eggs, a load weighing as much as fifty pounds. If even one-tenth of one percent survive the next five years, a thousand more adult sturgeon will range the Atlantic from Nantucket to Kitty Hawk.

While Dovel pursues sturgeon for science, Charlie White and Howard Jordan hunt them for cash (page 71)—and hope that someone will come along to revive the caviar industry. For now, they sell their catch at the Fulton Fish Market in Manhattan. There at dawn in a dimly lighted fish shed, I watched Steve Tatick butcher fish. His profits came from shad and flounder measured in tons. But as a favor, he would buy single sturgeon for resale to a Florida man who smoked it—to sell for \$12 a pound.

With the help of two other men, Tatick strung up a 171-pound sturgeon. In five mighty whacks, he beheaded it. Then with a neat slice, he opened the belly to gut it. Onlookers gasped. The two-foot cavity overflowed with gray black eggs. They weighed 34 pounds—and they went into the trash.

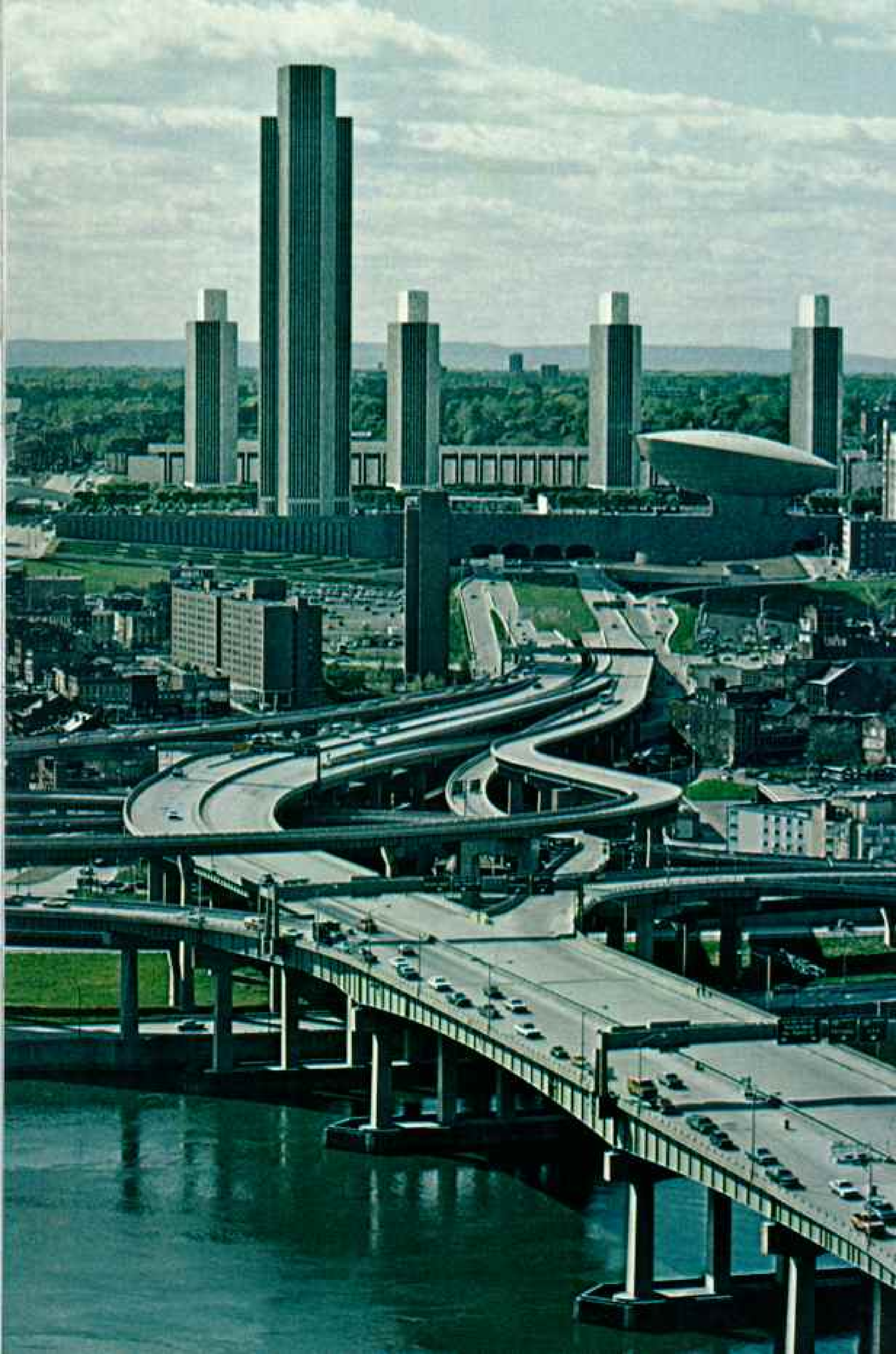
Caviar to Match the Caspian's

Uptown, in a plush office building, Arnold Hansen-Sturm, president of Romanoff Caviar, talked excitedly about reviving the Hudson caviar industry. "The river roe I've seen compares favorably with Iranian *sevruga*, which retails for \$13 to \$15 for a four-ounce jar."

Hansen-Sturm now imports 75,000 to 100,000 pounds of cured caviar from Iran annually to pack in his New Jersey plant. About the same amount was exported from U.S. rivers a hundred years ago.

But a businessman needs more than hope to launch a million-dollar enterprise. He needs state regulations to prevent overfishing. He needs the certainty of roe in large lots—say 3,000 pounds at a time, properly salt-cured from freshly caught fish. The eggs must meet exacting standards for quality and purity. For now, Hansen-Sturm pays for lab tests

Futuristic towers and ramparts of concrete flank the river at Albany, overwhelming the natural watercourse. The new billion-dollar Empire State Plaza, a 12-building state office center with saucer-shaped meeting hall, dominates the city. Downstream, the Port of Albany handles a million tons of cargo from ocean freighters annually.



that have proved Hudson roe to be free of most toxicants. He keeps an eye on Dovel's research, and he waits.

Meanwhile, what judgment does New York State pass on the health of its resource?

"The Hudson is definitely cleaner, but. . ." The chief of water monitoring at DEC, Ronald Maylath, spoke with some hesitation. "When pollution was at its worst in the early sixties, the water level was low, at near-drought stage; now we've had plenty of rain, and the Hudson has a much higher flow. Such variables make comparison difficult."

The river is cleaner in what the state measures: dissolved oxygen, bacteria, biochemical oxygen demand, and suspended solids. Until recently, no funds or staff existed to check routinely on toxic chemicals and heavy metals. Industry is still not required to monitor the

specific chemicals it may discharge directly into the river or through a city's sewers.

"It's what we don't test for that frightens me," Maylath shook his head. His nightmares became notorious reality in 1975, when a crisis arose over something called PCB.

Poisons of the Electrical Age

In 1929 chemists compounded PCB's—a family of polychlorinated biphenyls—as fire-resistant fluids to insulate transformers and capacitors, those electrical storage containers found on power poles and even in fluorescent lights. Their usefulness spread—from plastics to printing inks. In all industrial nations, PCB's have leached from discarded products into waterways, where they do not break down. Now traces show up everywhere from Arctic ice to human milk.

Nature's water purifier, a marsh converts wastes into elements of the food chain. But marshes, such as this one near Piermont (below), cannot assimilate persistent industrial poisons such as PCB's. The contaminants entered the river from dumps and with



An unprecedented PCB concentration—as much as 230 tons—lies in Hudson River sediments. From 1946 to 1976 General Electric, a principal user of PCB's, discharged them at the rate of 30 pounds a day with waste water from capacitor plants at Hudson Falls and Fort Edward. In 1973, GE's schedule for lowering its daily discharge to a few ounces was approved by DEC, and later by EPA.

Concern over PCB's was legitimate. In 1968 in Japan a machine leak of the compound into rice oil caused a tragic poisoning. The 1,500 victims of *yusho*, or oil disease, suffered skin lesions, swollen limbs, and eye and liver problems. Japan banned PCB's in 1972, and GE developed a substitute fluid for capacitors sold there.

In August 1975, then commissioner of DEC Ogden Reid learned of startling PCB readings

in Hudson fish—as high as 350 parts per million in the flesh of a rock bass. That was 70 times the federally established "safe" level of five parts per million for food fish. Astonished and angry, he appointed a state hearing mediator to fix GE's responsibility. He later banned commercial fishing on the river, though exempting shad, blue crab, and mature Atlantic sturgeon because of low traces in those marine species. Consumers were advised to eat no more than one river fish a week.

As months passed, I listened to Hudson fishermen grow increasingly bitter. After the spring shad run, they stood idle while great schools of striped bass ripped upriver to spawn. Many of the fish had passed Long Island, where no ban existed and where fishermen were reaping tons of them.

"They're the same fish," Howard Jordan

waste from plants at Hudson Falls and Fort Edward. Now New York studies how to rid the Hudson of PCB's, which show up in river fish; last winter, technicians lowered a core sampler through ice holes to collect riverbed sediments for monitoring (right).





Fortunes founded on railroading built lavish Hudson estates. Ironically, tracks along the shore cut owners off from easy access to their yachts. Frederick Vanderbilt, grandson of the titan of the New York Central, owned this country palace in Hyde Park (above), now a national historic site.

Lyndhurst, home of railroad magnate Jay Gould, overlooks the Tappan Zee at Tarrytown; a great-great-grandson, Kingdon Gould III, and his wife, Kristin (left), attend a party in the national trust mansion.

Nearby, the home Washington Irving called Sunnyside (right) captivates visitors with its enchanted air, a spell regularly broken by passing trains.





said. "Is there a gate at the Battery?" Others charged politics in Albany, saying, "We're just crumbs."

While the state attempted to keep PCB's off the dinner tables, some GE employees realized they had handled and inhaled the chemicals for years. Their union asked noted cancer researcher Dr. Irving J. Selikoff of New York City's Mount Sinai Medical Center to begin a long-range study. So far, he has found skin problems; other ailments that may be PCB-related are under investigation. He explains: "PCB's in trace amounts may not be immediately toxic. But like inhaling cigarette smoke and asbestos, ingesting PCB's over long periods might present a risk."

A River Clean Enough to Drink?

In 1976 the state mediator determined that GE had violated water quality standards. The firm has converted to a substitute that, it claims, will "virtually eliminate environmental risk," and has built a \$3,500,000 waste-treatment plant. In a negotiated settlement, GE paid \$4,000,000 toward research and river cleanup. DEC agreed to pay \$3,000,000, acknowledging its negligence in watchdogging. The unusually high settlement signals that industry and regulatory agencies may be held responsible for past mistakes.

In one way the PCB crisis actually pushed river cleanup a step ahead. It focused national attention on dangerous chemicals that, once loose in the environment, cannot be controlled. Congress last fall, after five years of debate, passed a Toxic Substances Control Act; now new chemicals suspected of being risks must undergo prior testing before they reach the marketplace. The act singles out PCB's for total ban by 1979.

But what of all the older, untested chemicals going into the river? PCB's are only the tip of the iceberg, the Environmental Defense Fund charges. It wants EPA and DEC to monitor much more rigorously.

How much cleaner should the river be? A lot cleaner, if many New Yorkers have their way. They are looking to it as a source of more drinking water. Reservoirs on tributaries supply millions of residents in the basin, but only 100,000 people in seven communities get their water directly from the Hudson.

The river could be a major source of supply for New York City and nearby counties, says

the Army Corps of Engineers. Anticipating a doubling of demand by the year 2020, it suggests withdrawing 400 million gallons a day from the 21 billion gallons that flow past Esopus during spring runoff, when the salt line lies far to the south. Such plans are subject to public scrutiny, and already opposition is gearing up. Won't the withdrawal pull the salt line north, upsetting natural balances? Won't the project ruin a scenic stretch of



Red-cheeked as their prizes, twins Jody and Robin Feder carry a fall treat from the J. R. Clarke & Son fruit farm near Milton. South of Rip Van Winkle Bridge (facing page), Greendale Farm raises apples, pears, grapes, and hay. River towns try to balance growth with guardianship of their "windows" on the water.

riverbank? What about the toxic chemicals in the water?

The town of Queensbury can answer the last question. The community of 18,500, which spreads like a nibbled doughnut around Glens Falls, drinks river water purified by the most modern plant on the Hudson.

"We Did It Ourselves"

In the 1960's complaints about water quality in deteriorating wells, about low pressure, hardness, and taste sent water experts scrambling. They drilled test wells and even considered tapping Lake George, ten miles away. With six other towns, Queensbury undertook a water study and sought federal and state aid. But water was running out; in 1971 the town on its own turned to the Hudson.

Now water superintendent Thomas Flaherty wins nothing but compliments about taste and quantity. Summertime bans on car washing and lawn sprinkling are in the past. The automated five-million-dollar plant can treat five million gallons a day. Chemical compounds and a granular activated-carbon filter cleanse the water of bacteria, heavy metals, and toxic chemicals. A tank larger than an Olympic swimming pool catches ten feet of sediment a year.

"We wanted to discharge it into the river where it came from," Flaherty chuckled. "But EPA wouldn't let us. Said *we'd* be polluting. So we truck to a landfill."

The restoration of the Hudson has meant more than nursing it back to health. It involves saving what is left of natural shore-

Families discover a river restored at Ulster Landing Park near the Kingston bridge.



lines and even restoring some that were lost.

Environmentalists' messages bombard local officials: Don't wipe out that marsh with landfill. Move the dump away from the shore. Buy some property from industry to give a spot of shore back to the people. Save those stretches of open land from suburban sprawl.

Preservationists are achieving that goal by bringing notable private estates into public use. In one of those curious quirks of history commonplace along the Hudson, they find themselves spiritual allies of the 19th-century magnates who landscaped only a central stage for their mansions, leaving acres of woodlands for privacy and view.

I recognized this phenomenon at Franklin Delano Roosevelt's home at Hyde Park with its mile-long trail to the river. On a bright

July morning I hiked the path through a grove that F.D.R. planted, past a pond where he taught his children to swim, under towering hemlocks, and over a tumbling brook. In a tidal pool near the shore, tiny blueback herring spawned days earlier were circling. Like F.D.R., I too had to cross the tracks to reach the Hudson.

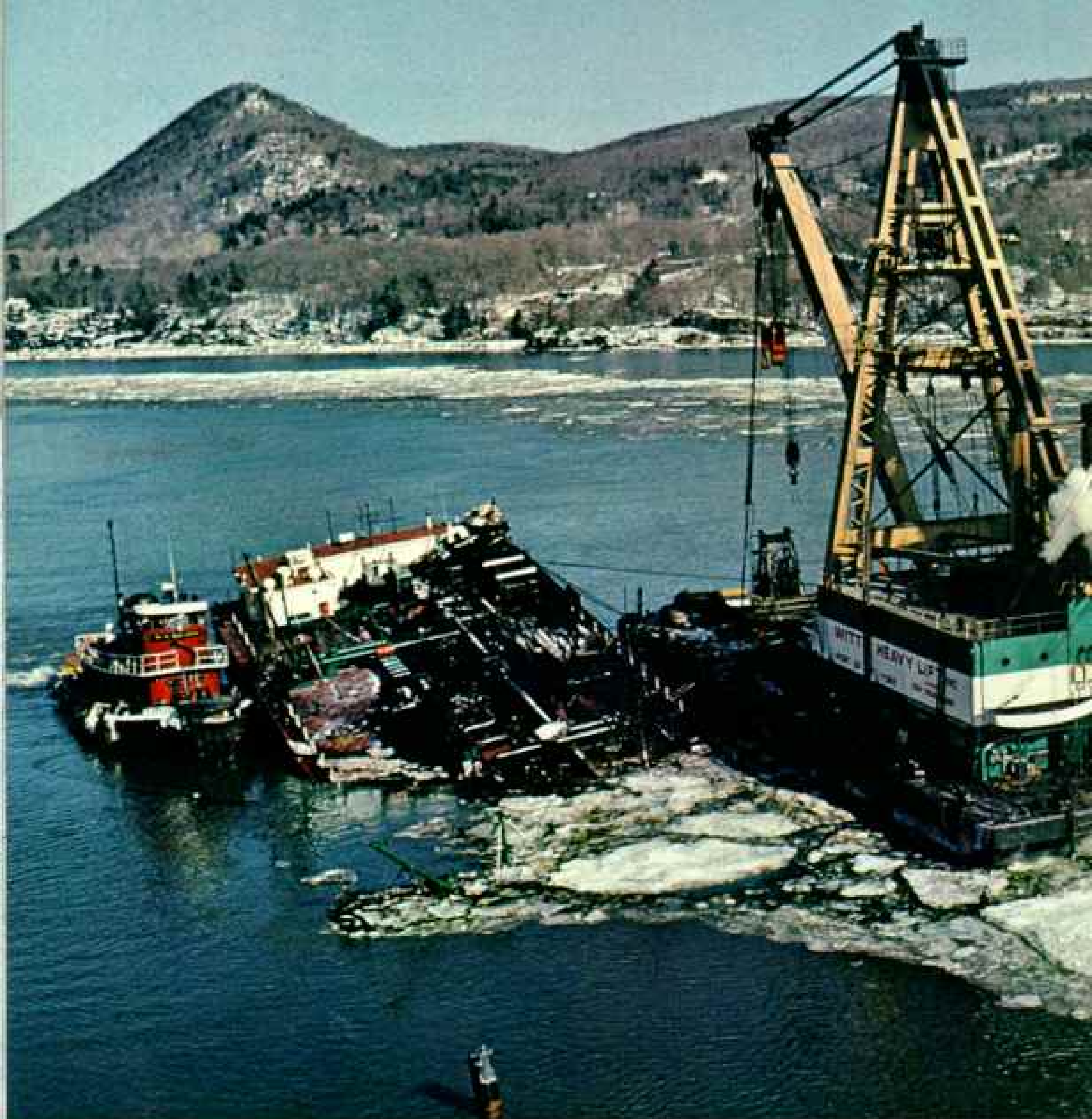
Private and public moneys open more such estates to the public every year. Olana, the Moorish mansion of artist Frederic Edwin Church, was destined for the auction block in 1966; today it is a state historic site. So is Clermont, a handsome seat of the Livingston family; there Robert Fulton, a protégé, docked his famed steamboat.

Octagon House in Irvington, an 1859 example of the mid-century fad for eight-sided

In 1973 Ulster County bought a former church camp to create the public park.

83





houses, depots, and even barns, belongs now to the National Trust for Historic Preservation. That organization will sell it with the proviso that new owners restore and maintain it intact.

An even more ambitious scheme fires a group called Hudson River Heritage. Members aim to protect 16 miles of riverfront near Rhinebeck. Winthrop Aldrich, an heir to an estate called Rokeby, believes the area's past makes all of it a national resource.

In 1783 Margaret Beekman Livingston divided her Dutchess County land, 25,000 acres,

among nine children. Aldrich's forebear was the first mistress of Rokeby. After William Astor, wealthiest man in America, married her daughter, he enlarged the original house to fifty rooms. Later, architect Stanford White "improved" the interior.

"For the Astors it was a summer retreat," Aldrich said. "Now even the tax assessors acknowledge it's a white elephant."

A state official of limited means, Aldrich wishes he had some of the Astor money to keep up the decaying mansion. Ceiling paint peels in a reception room hung with wallpaper



One mishap meant months of cleanup last February when the barge *Ethel H* struck Con Hook Rock, losing 420,000 gallons of oil destined for an upriver power plant. Directed by the Coast Guard, a derrick keeps the listing barge afloat (left) as pumps transfer remaining oil to another vessel. To attach underwater lines, Rick Hathaway (above) had to dive under the ice-and-oil-choked surface. Crews placed floating barriers around nearby marshes, steam-cleaned rocks, and scraped beaches for 70 miles to Long Island—a million-dollar job.

brought from Paris in 1811. Water stains, like a giant's tears, streak marbleized paneling. Aldrich and his family live in a portion of the main house, while renting out gardeners' and farmers' cottages and keeping the land in crops just to pay the taxes.

Some owners succumb to the temptation to sell off parcels of land to meet their tax bills. The whole area could thus disappear under a tide of housing developments if something isn't done, Aldrich believes. Hudson River Heritage seeks designation of the 16 miles as a national historic district. Owners may be

eligible for federal tax relief and rehabilitation grants in exchange for public use, such as hiking trails and house tours.

The Roman Catholic Church itself owns a number of estates, using them as seminaries, hospitals, schools, and nursing homes. One priest quipped, "I've heard the river called the Vatican Canal."

Recycling of properties is continuous. In a former Christian Brothers seminary near Rhinebeck, controversial Korean evangelist Sun Myung Moon trains converts. In the town of Hyde Park a onetime Jesuit seminary



shelters an organization with the intriguing initials CIA. That's what locals call the Culinary Institute of America, the Harvard for would-be chefs, maitre d's, and restaurateurs. I enjoyed Dutchess County apple pie in the Escoffier Room, a student-run dining room. The house wine—Benmarl—is bottled across the river.

Wines to Rival the Rhine's

There, near Marlboro, vintner Mark Miller makes his stand against urban sprawl with a showplace for rural renewal.

Never suited to large-scale agriculture, the Hudson's slopes nurture pastures, truck gardens, orchards, and vineyards. Some of America's earliest experiments in viticulture took place along the river. But crop problems and Prohibition pushed vintners into apple growing, and high taxes now pressure some farmers to sell to developers. One elderly viticulturist sold to the Millers.

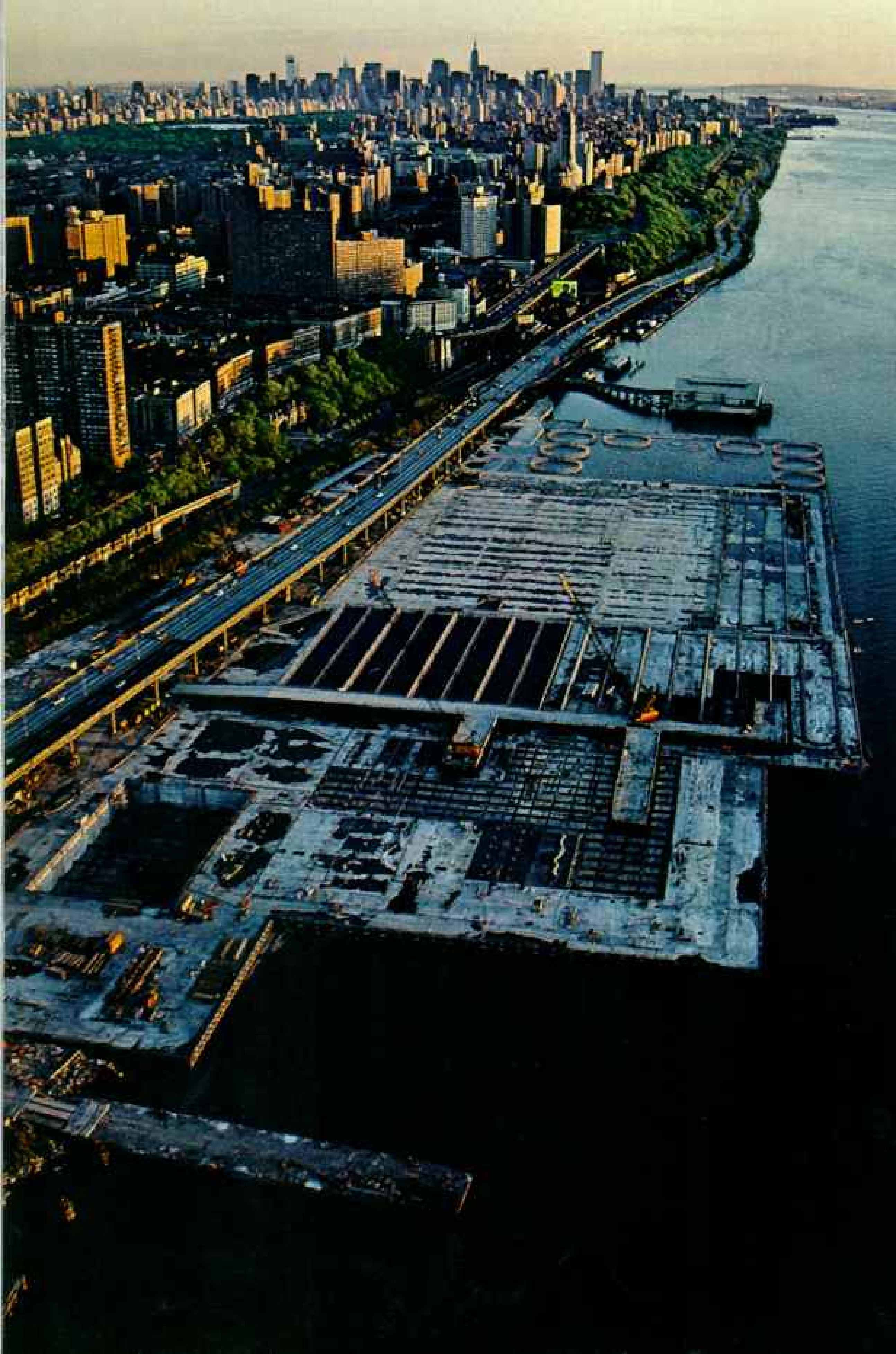
A retired magazine illustrator, Miller, his wife, and two grown sons began planting French hybrid grapes to test which were best suited to the mid-Hudson. From the hilltop home they designed, they overlook their own straitlaced vines and their neighbors' shaggy-branched apple trees to the river. The terraced hills and the soil resemble those of the Rhine Valley, and the quality of sunlight matches Rome's, Miller insists. "But it's the Hudson that's the key to our special climate, tempering the change from winter to spring."

To raise capital and share their enthusiasm, the Millers hit on an ingenious plan. They began a Société des Vignerons. Anyone

White plume in an infrared image shows that water used for cooling the Indian Point nuclear power plant (left) is warm when expelled. Whether or not this affects fish, the intake system is known to kill some fish, eggs, and larvae. EPA ordered closed-cycle cooling that would require construction of two 60-story towers, which the plant operator, Consolidated Edison, asserts are unnecessary, costly, and ugly. Hearings continue.

With no room on Manhattan, New York City builds a sewage plant in the Hudson (right) at 145th Street. Fiscal, political, and design problems delay completion to 1986, pushing the cost toward a billion dollars.

ENVIRONMENTAL PROTECTION AGENCY, LAS VEGAS LABORATORY (LEFT)



can become a *vigneron*, or winegrower, by purchasing a permanent right to two vines. Annual dues pay maintenance. In September, vigneronns arrive to help with harvest; in March they come to taste and select their bounty—12 bottles of wine.

In the tasting room, 28-year-old son Eric, the winemaster, savored a glowing libation and pronounced judgment: "As a young red, this Baco Noir was like strawberries. With aging, it's less fruity and more austere." I quickly signed on as a vigneron, staking my claim to the resurgent Hudson shore.

Realm of Spatterdock and Mummichogs

Estates and vineyards have supporters, but humble marshes have constituents too. A conference at Bard College in Annandale drew 25 marsh specialists, one for every 160 acres of tidal marsh on the Hudson. With self-taught naturalist and Bard instructor Erik Kiviat, I explored this domain by canoe.

We had to duck under a railroad bridge to enter Erik's special province, North Bay. It was a fitting approach, since probably half the Hudson marshes were formed after the railroad cut across creek mouths. Then sediments built up, and plants took root.

In the 350-acre confines of North Bay, rustling spatterdock and ten-foot cattails waved. Slow-moving, tide-carved rivulets snaked between mudbanks pocked with muskrat burrows. Ahead of the bow, silver flashed, like Lilliputian porpoises at play.

"Mummichogs," Erik identified a type of killifish. "They skip across the water when disturbed. They're an important link in the marsh chain."

Eroded nutrients from the land nourish algae and aquatic plants; killifish eat the plants; birds, fish, and snapping turtles relish the killifish. Thus the marshes, like the river shallows, serve as nutrient factories for the estuary. They are also stopovers for birds migrating along the Atlantic flyway.

Many marshes have been badly damaged by landfill, factory wastes, and poisons leaching from dumps, but not North Bay. Erik dipped up a floating seedling. "Golden club. That's a sensitive plant that has disappeared

from the Kingston Marsh, but flourishes here. It seems to be one signal—a canary in a coal mine—about the health of a marsh."

Each semester Erik turns the marsh into a living laboratory, passing on to the next generation of ecology students his concern for the natural world.

An even younger generation is being imbued with the river's legacy in an unlikely place—the Yonkers waterfront. There Carol O'Leary, of the recreation department, helped persuade the city—poor to the point of defaulting on its bonds—to back a summer boating program.

With hard-won funds she bought canoes and kayaks. For a site she leased a vacant Naval Reserve center. From the Yonkers Canoe Club next door came young people to serve as counselors. During four-week sessions thirty youngsters train in safe boating and come to treasure their river. Field trips take them to the marsh behind Constitution Island, to South Street Seaport Museum in Manhattan, and across the river to a sandy notch of shore at the base of the towering Palisades, below the town of Alpine.

Learning Firsthand About a River

I joined the youngsters for a camp-out at Alpine, their final fling of the season. The mile crossing was an easy paddle, leaving plenty of time before dark for hamburgers and hikes, marshmallows and storytelling. As I scrunched down in my sleeping bag on the sand, 9-year-old Rose Anne Noone didn't want me to miss a thing. "Look at the river now. It's so still. The wind is barely rippling the waves. In the morning it will all change."

Morning was a long time off, what with passing tugboats, Albany-bound freighters, wailing trains, even a light rain.

But as predicted, at sunrise the waves were high, the wind blew from the north, and the tide raced out to sea. The youngsters were undaunted; the Hudson was their territory now. In a small way they had joined the ranks of river lovers, the diligent officials, responsible industrialists, and dedicated environmentalists who care enough to help the Hudson on its road to recovery. □

Aquatic playground in the shadow of the World Trade Center, the Hudson hosts a Sunfish regatta, emblematic of New Yorkers' renewed enjoyment of their river.



A Bad Time to Be a Crocodile

Fearsome cradle holds newly hatched Nile crocs. Only recently have scientists documented parental care among the crocodylians, which are fast disappearing in the wild as man takes their hides and habitats. After gently scooping up her



By RICK GORE

NATIONAL GEOGRAPHIC STAFF

Photographs by

JONATHAN BLAIR

young, this female ferries them to a nearby pond nursery in a pouch that forms only after she hears her babies chirping.



They're not cuddly. They don't have big soulful eyes like seals. Most of the animals the world is concerned with are beautiful, or they tug at your heartstrings. Crocodiles have a pretty toothy leer. They eat dogs in Florida—sometimes even people. Who could love them?

—WAYNE KING, NEW YORK ZOOLOGICAL SOCIETY

CROCODILES are disappearing rapidly from the earth. In Niger a river swamp is drained to grow vegetables for Europe, and in three years its crocs are gone. In 1967 on Paris's Rue du Faubourg St-Honoré, a wealthy American pays \$7,500 for a portable bar covered with saltwater crocodile skin. Meanwhile adventurers shoot forty crocs a night out of the Liverpool River in northern Australia.

The crocodilians have been around for nearly 200 million years. There are 21 species of them, including the American alligator. They have seen continents shift and have persisted through the worst of many ice ages. Yet in just thirty years, massive hunting and habitat destruction have decimated every member of this ancient order, Crocodylia.

Although stringent laws have closed down most of the United States market, as many as two million crocodilian hides a year are still trafficked worldwide. Some experts warn that no crocodilian except the American alligator may survive in the wild much beyond century's end.

Others are less gloomy. Under pressure from wildlife groups, most nations have at least removed their crocodilians from the vermin category. Some are actually coming to value those crocs they have left.

Scientists, too, have begun to look carefully at crocodilians. This is difficult. Crocs live in isolated, unpleasant places. They disappear at the wink of a wading stork's eye. And they spend most of their time doing nothing. But when they do act, they are magnificent and, we are learning, deeply interesting.

Crocodiles survived while their close kin the dinosaurs died out. Croc brains are far more complex than those of other reptiles. They learn readily. Crocodile hearts are almost as advanced as those of birds and mammals. In fact, their closest living relatives are the warm-blooded birds. Many crocodilians even gather brush to build nests, as birds do.

Full-grown crocodilians range in size from three feet to more than 25, from a few pounds to more than a ton. We can only guess how long they live—some for perhaps a hundred years or more.

A few species prefer solitary lives, but most, we now know, have sophisticated social orders. Their grunts, hisses, chirps, and growls each carry specific messages. They also use a “body language” of back arching, bubble blowing, and other physical displays. Crocs may communicate underwater, too, through low-frequency warblings inaudible to us.

A big Nile croc is cunning enough to stalk a human, strong enough to bring down and dismember a water buffalo, yet gentle enough to crack open its own eggs to release its young.

Down-under Crocs in Trouble

It was the first of many crocodile days. I had flown into the Aboriginal settlement at Maningrida in northern Australia, two hundred miles east of Darwin, to attend a crocodile conference of the International Union for Conservation of Nature. Eleven croc specialists—a hefty percentage of the world’s total—had convened at a research station set up by the University of Sydney and the Northern Territory. The Maningrida team studies, and hopes to salvage, what’s left of Australia’s saltwater crocodiles.

The saltwater croc is the biggest and some say the most dangerous of crocodiles. Fishermen in Queensland once hauled in one that reportedly measured 33 feet. Historically they have ranged from India to Australia. They have been found at sea beyond Fiji, although, like most crocodiles, they dislike waves and prefer calm estuaries.

I went up one of those estuaries with graduate student Bill Magnusson. Bill needed to change film in a time-lapse camera he had set up over a crocodile nest he was studying. Bill’s legs were scarred with the tropical ulcers one picks up *(Continued on page 96)*

Fourteen feet of terror, a Nile crocodile prowls South Africa’s St. Lucia estuary research station. Although the species, which ranges over much of Africa, commonly preys on antelopes, Cape buffalo, and even man, crocs as a group subsist mainly on smaller fare, such as frogs, turtles, crabs, and fish.





○ AMERICAN ALLIGATOR



● CUBAN CROCODILE



● MUGGER CROCODILE



● ORINOCO CROCODILE



● MORELET'S CROCODILE



● AMERICAN CROCODILE



○ SMOOTH-FRONTED CAIMAN



● BLACK CAIMAN



● BROAD-SNOUDED CAIMAN



● COMMON CAIMAN



● WEST AFRICAN CROCODILE



- SAFE
- ◐ DECLINING
- ENDANGERED

ILLUSTRATION BY ROBERT S. MERRIS
NATIONAL GEOGRAPHIC ART DIVISION

The crocodilians' shrinking realm

SURVIVORS OF THE DINOSAUR AGE, the once flourishing order Crocodylia largely inhabits tropical and semitropical regions. Only 21 species and seven subspecies remain, 20 of which are shown above. They are divided into three families according to variations in skull, scales, and teeth—all adaptations to different habitats and diets.

Alligators and caimans form one family, their broad snouts useful for crushing and eating a variety of small animals, birds, and fish. Except for the critically endangered Chinese alligator, they inhabit the Americas.

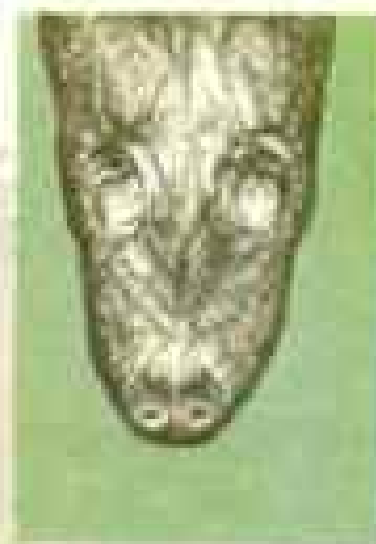
● GHARIAL (GAVIAL)



● SIAMESE CROCODILE



● CHINESE ALLIGATOR



● FALSE GHARIAL



○ NEW GUINEA CROCODILE

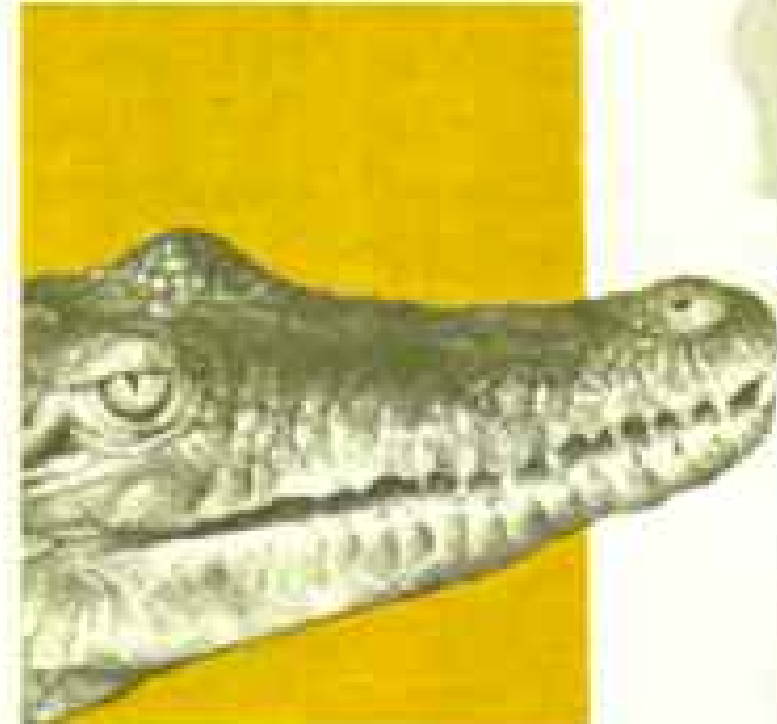
○ JOHNSON'S CROCODILE



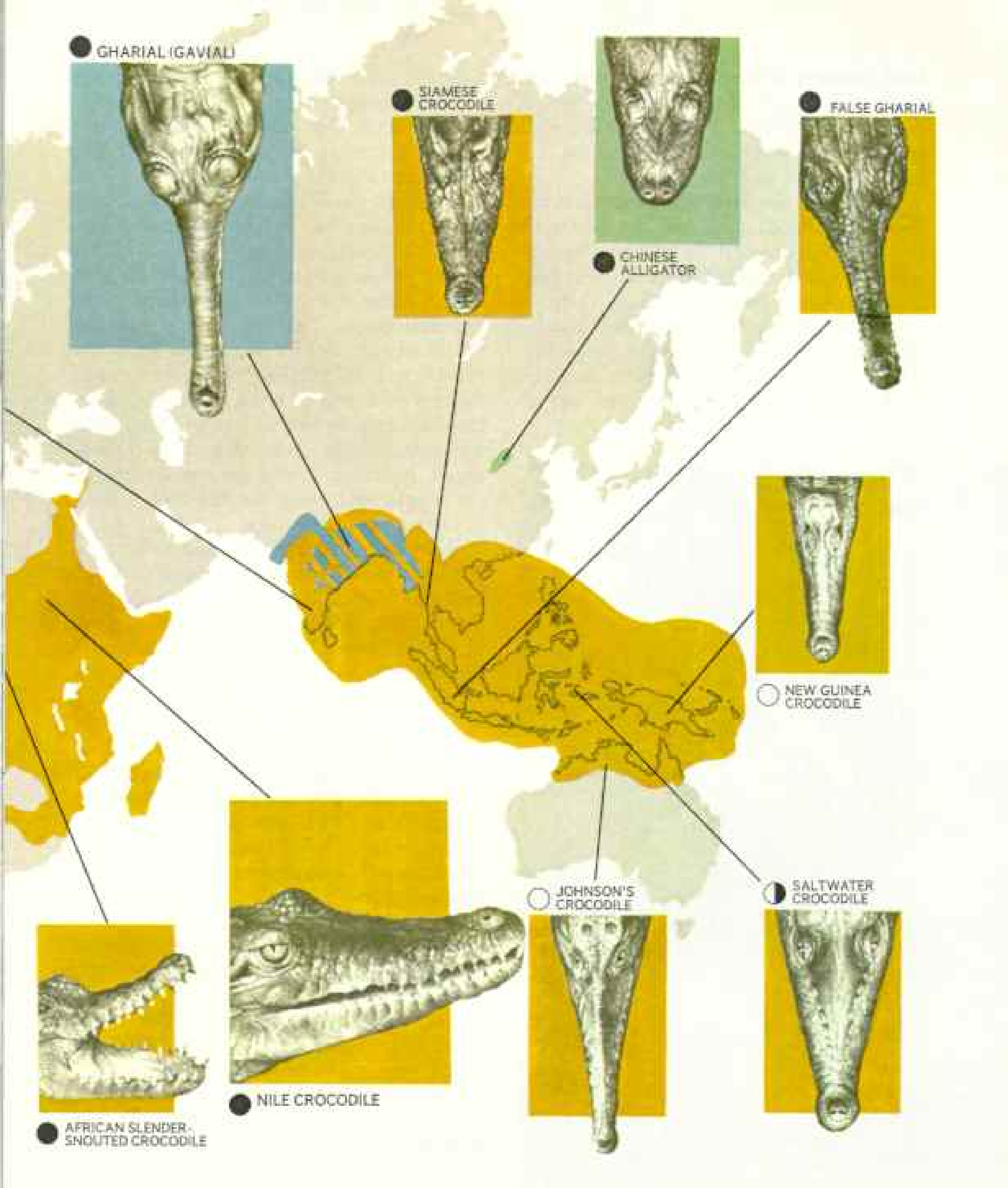
● SALTWATER CROCODILE



● NILE CROCODILE



● AFRICAN SLENDER-SNOUDED CROCODILE



South America's caimans, ranging from the 18-foot black to the three-foot smooth-fronted dwarf, are now the skin trade's main quarry.

One sure mark of the crocodile family: lower teeth are still exposed when jaws are closed. A few American crocs remain in southern Florida; aggressive Cuban crocs may still survive in Zapata Swamp. In Australia inaccessible billabongs shelter Johnson's croc, while in Papua New Guinea

dozens of farms rear reptiles captured in the wild. Some 11,000 Siamese crocs—possibly extinct in the wild—thrive on a breeding farm in Thailand. The wide distribution of relentlessly hunted Nile and saltwater species is their key to survival.

Best angler of all crocodilians is the sole surviving member of the third family, the long-nosed gharial, or gavial, of the Indian subcontinent. The false gharial of Malaysia is actually a croc.

from walking through the thick gray mud in the wet season. Professor Harry Messel, the project director, says too much time around stark and steamy Maningrida can rot the brain as well as the limbs.

We were on the river before dawn and motored deep into what seemed like the Devil's backyard. We beached the boat on a bank of quicksand and trudged through head-high saw grass into a dense melaleuca swamp.

"An old Aborigine named Dick and his son Oscar showed me this nest," said Bill. "Otherwise I never would have found it. To both Dick and Oscar the croc was an

ancestral totem, the spirit of their Dreaming.

"A few months later Oscar died suddenly. The medicine man told Dick they had betrayed the sanctity of the crocodile nest. His son's death was the croc's revenge."

Dick was warned to flee Maningrida, and did. Bill, regretful, but as an outsider immune to Aboriginal totems, continued his studies. When we reached the nest, we saw no sign of the mother. In the days before croc hunting, nesting females allowed nothing near their eggs. But survival of the shiest has ruled in recent years. Bill reloaded the camera, focused on a pile of brush containing sixty crocodile eggs, and we withdrew. The mother was undoubtedly close, masterfully camouflaged, watching. And if she has a spirit, as the Aborigines believe, she had every reason to be in a vindictive mood.

"Northern Australia once had millions of saltwater crocs. Today there are about 5,000," said Dr. Messel. "I thank God the government finally outlawed hide hunting. This place was like the Wild West of the 1850's. If I'd offered fifty cents for *your* skin, you wouldn't have lasted five minutes."

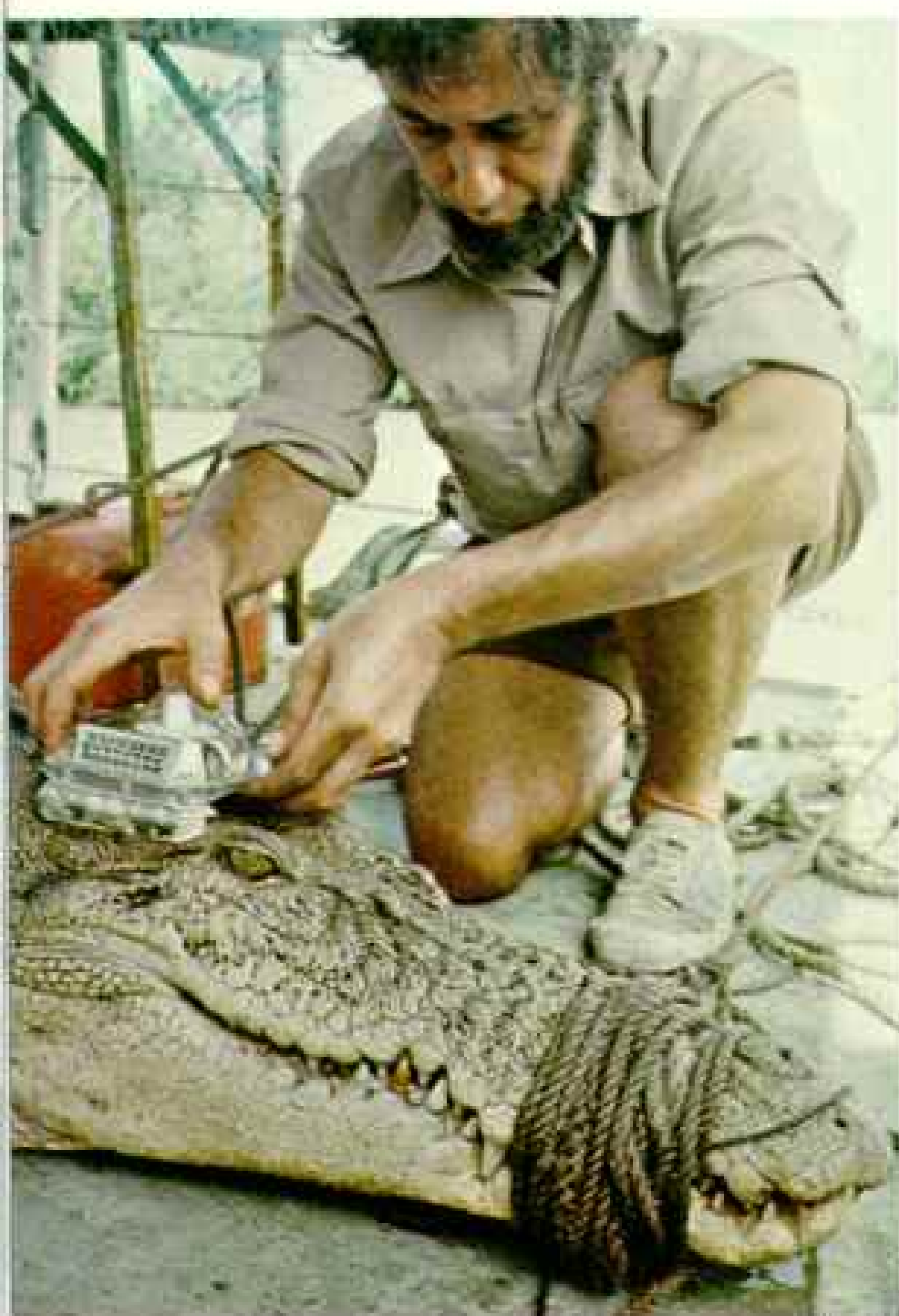
Some Have a Taste for Humans

The guns out of Darwin were quieted in 1972. But the pressure to hunt crocs could return. "Most people associate crocs with uncivilized places," said biologist Gordon Grigg. "And if a child is taken at a beach, say, it will become almost impossible to defend our efforts to conserve the crocs."

Wild saltwater croc tales abound. Hordes of crocs reportedly savaged nearly a thousand retreating Japanese soldiers in a Burmese swamp during World War II. In 1976 a news dispatch from Indonesia said crocs devoured 40 passengers of a sinking ferryboat.

The croc experts at Maningrida scoffed at these stories. Crocodiles prefer stealth and normally avoid both man and commotion. Nevertheless, crocodiles do occasionally eat people. No question. A few months earlier in Queensland, a young mine worker had been out pig hunting. A friend saw him strip for a swim. The next person to see him was a local police officer, who found his remains inside an 18-foot croc.

However, only three species—the saltwater croc, Africa's Nile crocodile, and the large American alligator, it now appears—can be



BILL GREEN

Tuning in for science, Michael Yerbury of Australia's University of Sydney adjusts a solar-powered radio transmitter attached to a saltwater crocodile's head with a special adhesive. Scientists track the wild croc's wide-ranging movements while testing the device, designed to send signals as far as a hundred miles.

considered man-killers. A few others, such as India's mugger crocodile, will attack if provoked, especially while nesting. Yet all are cursed with a stigma of primeval wickedness.

"O what a crocodilian world is this, Compos'd of treach'ries, and insnaring wiles!" bemoaned poet Francis Quarles in the 1600's.

"I avow . . . an active hatred of these brutes and a desire to kill them," wrote Winston Churchill on first seeing Nile crocs close up.

Are Crocs Good for Nothing?

In India, Rajasthani student Kamal Sharma was puzzled by my interest in the once ubiquitous mugger: "But, sir, they are of no use to the people!"

What good are crocs? As master predators, crocodiles help keep other animals, especially rough fishes, in check. Crocs also excrete the food they eat as nutrients other animals and plants can use. The American alligator has exceptional value. The water holes it digs keep the animals of Florida's Everglades alive during the dry season. But the question sparks debate even among those who want to save them. At Maningrida some specialists argued that crocs are a renewable resource.

"To save the crocodiles, we must commercialize them," said a state biologist from Louisiana, where annual alligator hunts and hide auctions are held. Only if they can make a profit from crocs, he thinks, will people protect them.

Others worry that a legal supply of crocodile skins will only stimulate more poaching.

"Why does an animal have to be useful?" argued Dr. Wayne King of the New York Zoological Society. "Besides, our only uses for crocodiles have been expensive trivia."

The crocodiles most commonly turned into "trivia" today are the caimans of South America, despite widespread laws forbidding their export. Brazil, Ecuador, and Venezuela officially protect their animals, but borders in Latin America leak badly. Along a main highway in French Guiana I saw trucks piled high with caiman skins—from swamps unknown—headed for Europe.

"On the day I left Colombia for Maningrida," said veteran crocodile biologist Federico Medem, "permission was given to export 290,000 caiman hides. There aren't that many adult caimans left in the country."

Moreover, in Latin America, as elsewhere,

half the hides rot before reaching a buyer.

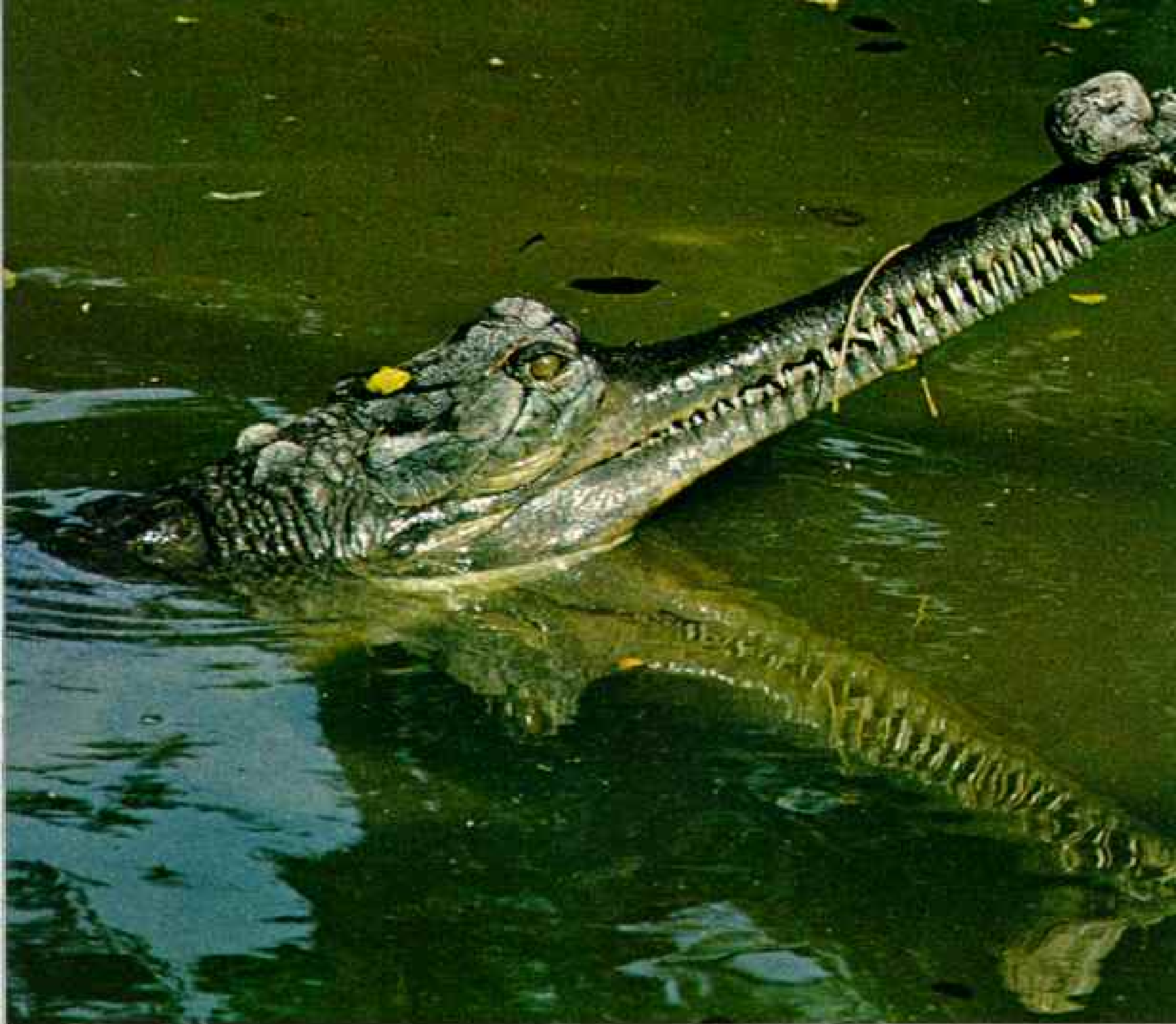
A few sizable populations of the common caiman remain. But the bigger black and broad-snouted caimans may soon join the ranks of critically endangered crocodilians. The Orinoco crocodile—about 280 left, maybe. The Siamese croc—11,000 left in a Bangkok farm, perhaps none in the wild. The Chinese alligator—no word in recent years on this only immediate kin of the American alligator; possibly extinct in the wild.

Gravely imperiled, too, has been the remarkable gharial, also known as the gavial, which until mid-century still flourished in the



BILL GREEN

Revered as a totem in parts of northern Australia, a saltwater crocodile prepares to eat a catfish in a contemporary Aboriginal bark painting. In ancient Egypt, wrote the Greek historian Herodotus, some dwellers along the Nile treated crocodiles "with every kindness," embalming and burying them in sacred tombs when they died.



cool Himalayan-fed rivers of the northern Indian subcontinent.

"I think we've lost the gharial," crocodile specialist Howard Campbell had told me before the Maningrida meeting.

India Moves to Save the Gharial

Some months later in India, I stood on a remote bluff overlooking the Girwa River near the Nepalese border. A quarter of a mile away on a sandbar basked three bulky green gharials. On the far shore lay a large female and a scattering of juveniles.

"You are looking at ten of the rarest and most elusive animals in the world," said Dr. Robert Bustard, technical adviser to a United Nations-assisted Government of India project to save the gharial.

Rare animals they were. Their large goggle eyes were raised and set back like a frog's.

Their long, narrow jaws, studded with more than a hundred slender teeth, resembled swordfish bills (above). Nature fashioned these thin jaws to slash through the water and snatch the fastest of fish. Often a gharial will throw its catch into the air to gulp it head-first. That way the gills don't snag the gullet.

Near the shore two gliding eyes broke the water surface. Slowly, like a dinosaur climbing out of a million-year sleep, an 18-foot male lumbered onto the sand. His short flippered legs strained for every inch of beachhead. These harmless phantoms of the river move poorly on land, and leave the water only to bask, mostly in the cool months.

As the big male emerged, we could make out a tuberosus lump on the end of his upper jaw. Even in this decade some biologists have argued that this *ghara* ("pot" in Hindi) was a myth. Not every mature gharial has this



PHOTO BY NARESH AND RAJESH KEDI



Rare pair of gharials touch snouts in India's Nandankanan Biological Park. This unusual photograph affirms the existence of the fleshy snout hump, the *ghara*, which appears on some adults. Gharas were inexplicably dismissed as mythical by some scientists as recently as 1971. One expert thinks the protuberance is used to resonate the animal's mating call.

Gharials reach imposing size—20 feet or more—and their jaws contain more than a hundred teeth. A hatchling frees itself (left) at Kukrail Crocodile Rehabilitation Center, where biologists hope to raise enough youngsters to restock protected wild areas.



extraordinary organ, and no one knows what it does. Dr. Bustard speculates that it serves to resonate mating calls.

Only about sixty wild adult gharials remain in India and perhaps forty in Nepal. Their demise began in the 19th century during the days of the *shikar*, or royal hunt. In Orissa, one maharaja reportedly shot a hundred gharials in one day for target practice.

However, most gharials have disappeared since the early 1950's, victims principally of dam building, hide hunting, and net fishing.

Fishermen everywhere tend to regard crocodiles as natural enemies, voracious competitors for their catch. Actually, crocodiles eat relatively little, usually taking their meals many days apart. They also tend to prey on rough, undesirable fish.

With no safe havens, it seemed that time had run out for the gharials. But suddenly at ten minutes to midnight, there is hope.

"Two years ago we used to laugh at crocodiles," said one district magistrate. "Now we cherish them. They are of international priority."

This change reflects not only concern for endangered species, but also an eye upon the rupee. There is money to be made from them—through crocodile farms.

Hungry Tribesmen Relish Eggs

In Uttar Pradesh I visited two state gharial breeding centers. Chief Wildlife Warden V. B. Singh showed me hundreds of babies being reared from eggs taken from the wild before hungry tribesmen found them. They



are being released into five new sanctuaries. When these are brimming with good-size gharials—in about five years—farming may begin. The mugger, also badly depleted, may be farmed even sooner.

From New Guinea to Japan, croc farming is a coming thing. Like sanctuaries, farms may save some species from extinction, but crocodiles have known more glorious days.

Ancient Egyptians put gold bracelets on the animals' legs. An elaborate city, Crocodilopolis, was built, legend had it, in honor of a crocodile. When the Greek geographer Strabo visited Crocodilopolis, he saw priests open the jaws of a basking holy croc and put in roasted meats and cakes, and pour in a pitcherful of wine mixed with honey.

I found nothing but ancient rubble and a

Teeth bared in rage, a 14-foot Nile croc at the St. Lucia refuge in South Africa slaps the water with his head (**above, left**), one of the ways big males express mood and territoriality. "After watching him for four months, I could almost sense when he'd do it," recalls photographer Blair, whose pictures are among the most remarkable ever made of crocodile behavior.

The big croc's aggressiveness grew as the time neared for his mate to lay eggs. Finally, he clamped his massive jaws on the tail of a trespassing ten-foot male (**above**) and dragged him from the pond. Weeks later, he killed and ate the interloper.

dead dog at Crocodilopolis, but nearby at Tebtynis, archeologists have unearthed thousands of crocodile graves. Each contains an embalmed crocodile family—male, female, and six young. The graves were dug perhaps by pilgrims to gain supernatural favor.

The Nile crocodile no longer abounds in Egypt, nor in much of Africa, for that matter. It is the classic crocodile, the one that cried crocodile tears and finished off Captain Hook in *Peter Pan*. No one studies its behavior more intensely than Tony Pooley of the Natal Parks Board in South Africa.

The Many Moods of Wolfgang

When I arrived at Tony's research ponds at St. Lucia estuary, Mary Crocodile had just laid her eggs. In another pond, Candy Crocodile, her belly swollen with eggs, was pacing her fenced-in compound, while her mate, the monstrous, evil-eyed, and thoroughly bad-tempered Wolfgang, was acting edgy.

Fourteen-foot-long Wolfgang—a seasoned scrapper perhaps 80 years old—had just chewed up and nearly killed a ten-foot male in the same compound. The wounded fellow's bites were festering, and one leg was broken; Candy's advanced pregnancy seemed to have driven Wolfgang to assert his territoriality.

Territory and ritual rule crocodilian lives. Tony has noticed in the wild, for instance, that one big male such as Wolfgang always dominates a river colony. He even controls who basks where on the beach. Any passing male must lift his head up out of the water and expose his throat, signaling submission, or else face the dominant male's full fury.

Most of the time Wolfgang simply lurked about his pond, sometimes submerged for half an hour or longer. He also basked boringly for hours with his jaws agape. But then as unpredictably as lightning, he would display himself in full saurian splendor. If upset, he would go (Continued on page 108)





Private lives are revealed in these unique photographs of breeding crocodiles. After weeks of courtship, a female yields to her mate, her head raised and jaws open to signal submission (above). About 40 days later, she deposits 40 to 80 brittle eggs in her nest (top), then covers them with dirt.

Sounds of the young hatching stimulate females to open their nests. While mama collects the brood in her jaws (left), papa stands guard. Youngsters are watched by the parents for about two months. Such behavior, observed at the St. Lucia station, confirms the active role both male and female play in protecting nests and young.



Playing for keeps, a year-old Nile crocodile snaps at an already punctured frog, a favorite meal.





Primeval horde basks beside Kenya's Lake Turkana, home of the world's largest remaining concentration of Nile crocodiles (left). By soaking up the sun, which glistens off their backs, the cold-blooded crocodiles raise their body temperature.

Itinerant fishermen, who have descended on the desolate lake in search of desperately needed food, now threaten its several thousand crocs, despite government protection. In addition to fish, they often haul in net-tearing giants (below), which they kill and discard. Although the quality of the hides is poor, poachers, many from Ethiopia, are also a perennial problem.

Few other predators—on rare occasions a lion or leopard, or an angered hippopotamus—pose a threat to adult crocs, but a veritable army of raiders takes a huge toll of eggs and young. They include the nest-robbing monitor lizard, mongooses and other small animals, and such wading birds as this six-foot-tall goliath heron (right) in Uganda, holding a young croc in its beak.



HUGH B. COTT



(Continued from page 102) under and boil the water with bubbles snorting from his nostrils. Or he might suddenly shoot half his body straight out of the pond and slap his head soundly against the water.

One day, after four parks board rangers strained to heave a culled dead antelope over his fence, Wolfgang lumbered out of the pond, picked the animal up in his jaws, and trotted it back to the water.

He gutted it first. Over the next two days, as hunger urged, he would twist off chunks, or grab a leg in his jaws, rear up, and slap the

carcass against the water to break off the limb. Then he would crush it and swallow.

Crocodiles cannot chew. They simply break, crunch, and gulp. They also swallow stones, which churn in their stomachs, grinding the food further. Their stomachs secrete powerful acids to help digest bones and cartilage. Remarkably, crocs will sometimes skin a tough-hided animal—a most delicate job for big jaws—before eating it. Occasionally, one croc will hold prey while a partner rolls over and over in the water to twist off a piece small enough to swallow.

Yet, for all their beastly behavior, crocodiles are devoted parents.

Mary Crocodile mated in early October. A month later, she dug a hole, dropped some 40 white eggs into it, covered them, and plopped down. When I returned some 80 days later, a much-thinner Mary had scarcely moved. Thanksgiving and Christmas had come and gone. Wolfgang had finally killed—and devoured—the young pretender in his pond.

Yet Mary sat squat atop her nest, having eaten but once, growling at whatever came near, and leaving guard only briefly to cool off during the hottest hours.

Yelps Signal Hatch Time

Mary turned out to be a problem mother. Ninety-five days—the maximum time viable eggs take to hatch—had passed. Normally baby crocs call from underground when hatching begins. These calls prompt the mother to dig the nest open.

There had been no peep, and Tony feared the eggs would rot. While an assistant lured Mary across the pond with fish, he scratched the surface, revealing several rotten eggs—but also one with a thrashing tail sticking out.

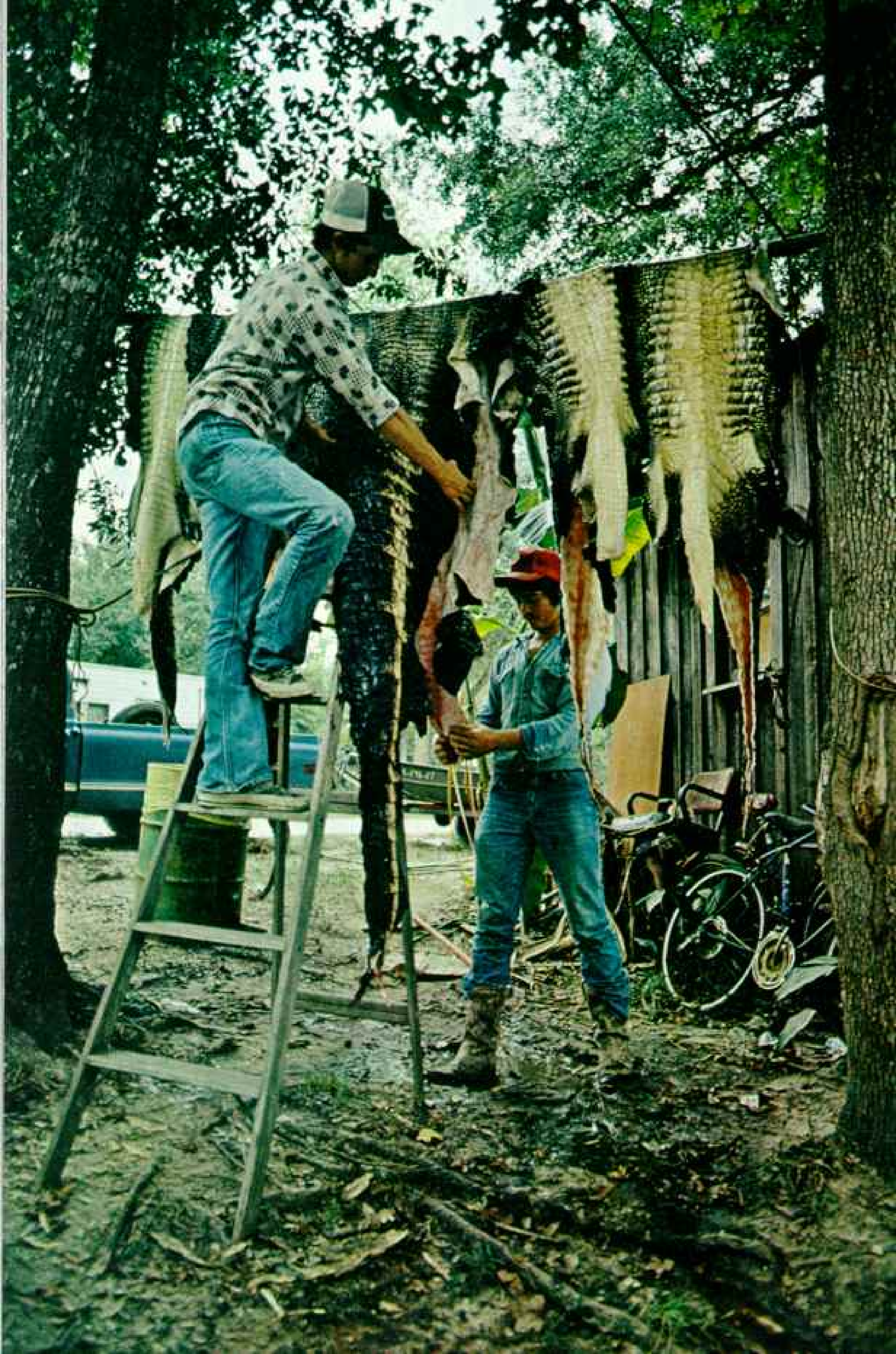
A very upset Mary charged back to her nest. Tony rolled in two ready-to-hatch eggs from a wild nest. One hatched and let out a yelp. Mary swooped the little croc up as if she were going to eat it. She didn't. Soon we could see the baby crawling about inside her jaws. Its yelping prompted her own babies to cry out. They hatched as she scraped open the nest, and she scooped them up one at a time.

When Mary had six babies in her mouth, she swam them across the pond to a site she had selected to be their nursery. Usually, Tony says, the female waits until all eggs are hatched so that none will be left defenseless.



BOTH BY CHARLES O'NEAR

Louisiana hide hunter Glenn Hebert shoots an American alligator (above), caught on a baited hook near Sweet Lake. The state's carefully controlled 1976 harvest permitted 4,500 gators to be taken in three parishes. Conservationists say that making marshes profitable has helped forestall drainage for cattle grazing and soybeans. Skins destined for a state-sanctioned auction dry near Sulphur (facing page).





Dog's best friend, plucky David Peters swam to the rescue after an alligator tried to attack his pup in a central Florida lake last July. When the reptile clamped down on David instead, other youngsters pulled him free and alerted wildlife officers, who shot the eight-footer (below). The animal's boldness had grown when local residents foolishly fed it food scraps.

Two months later a 6-year-old boy was killed by a Nile crocodile at the Miami Serpenterium.

As new construction continues to infringe on the state's half a million or more gators, conflicts between man and beast grow. Should alligators remain protected? According to a recent Florida Game and Fresh Water Fish Commission survey, residents remain sharply divided. Despite strong opposition from conservationists, the state probably will open a few wild areas in the future to test the wisdom of conducting commercial or sport harvests.



But Mary was a young mother, and we had obviously disturbed her.

Eventually Mary carried all the hatchlings to the nursery, where they learned to feed on frogs, fish, and insects. For two months Mary guarded them, fending off the many predators that would make a meal of her young.

Poachers Still Take a Toll

Nature makes life hard for a crocodile in Africa, but man has made it much worse. While most African governments have ended organized shooting, poaching continues.

Probably the greatest remaining concentration of crocs basks along Kenya's wild and fearsome Lake Turkana, formerly Lake Rudolf, which cuts through more than a hundred miles of desert and volcanic spewings two hours north of Nairobi by plane.

This is a madman's place, I thought, as wildlife-management consultant Ian Parker and I flew over the hot, desolate shore where crocs basked by the hundreds (page 106).

"In 1966 we estimated there were 12,000 crocs in Lake Turkana," he said. "Many have since been destroyed in defense of fishing interests. But the lake is remote and the land around it is basically worthless. Also, the crocs have bony growths in their belly skins that lower their value. If they're going to survive anywhere, it'll be here."

Since protection began in Kenya in the early 1950's, he added, crocs have come back well in some rivers. "They won't make it there though. Not with Kenya's population growing at 3.3 percent a year. The rivers will be dammed, and there'll be irrigation projects. Besides, a Nile croc in a river is a bloody bad thing for the people who live there." While Lake Turkana crocs seldom trouble humans, those in rivers kill several Kenyans every year.

Perhaps Africa's river crocs are especially aggressive because they are used to taking large mammals that come to the banks to drink. Kenyan paleontologist Richard Leakey reported being attacked once by big Omo River crocs while on a National Geographic Society expedition in Ethiopia. Crocs charged Leakey's boat, actually biting into the side.

"They either considered our boat to be a menace to their society, or the source of a tasty meal," recalled Leakey.

Most of those Omo River monsters are gone now. A game guide in Addis Ababa told me

that in recent years large expeditions financed by one French leather firm, Dofan, slaughtered countless crocs throughout Ethiopia.

In neighboring Sudan I talked to ecologist Asim el Moghraby. "We still had three crocodiles here in Khartoum until 1970," he said. "It was beautiful to watch them basking on the Nile. Somebody shot one. Another was caught in a net, and the last just disappeared."

Even in the great Sudd, where the White Nile turns into an impenetrable papyrus swamp the size of Iowa, hunting took a heavy toll before controls were imposed. Now the crocodile is about to confront progress. Digging begins soon on the Jonglei Canal, which will drain Sudd waters for irrigation. Sudan hopes to become the breadbasket of the Arab world. But once again, what may help people will destroy crocodiles.

France Unmatched for Elegant Hides

Returning home from Africa, I passed, as most crocodiles themselves do these days, through Paris. A hide tanned in France, I learned as I toured the leather factory of Hermès, the producer of the world's finest crocodile items, is the *crème de la crème*.

"In other countries they use the same raw products, the same chemicals and oils as we do in France," boasted tanner Pierre Grawitz. "But it's like your saying you are going to take a duck and some oranges and make Maxim's *canard à l'orange*. Hah! Just try it."

Undeniably, the lustrous merchandise at Hermès, the \$300 wallets and \$2,000 handbags, exudes elegance and fine workmanship. But few such items will pass U. S. Customs easily these days. Depending on the species, federal laws forbid or discourage the import or export of crocodilian goods.

Furthermore, most crocodilian commerce in this country was shut down in the early 1970's, when nine states—notably New York, heart of the leather fashion industry—forbade any trade in crocodile items.

Concern for our own once depleted crocodilian, the American alligator, inspired these laws. They worked, and today the alligator is out of danger. In fact, in Louisiana, gators have grown thicker than shrimp in a Cajun gumbo. In 1975 three parishes received an exemption from federal endangered species laws, and now each September hold a short gator season. The skins are sold at a special

auction to be tanned domestically and sold in those states where it is legal, mostly as boots.

I arrived at Ellis "Benck" Benckenstein's bayou-side backyard in Calcasieu Parish just after dark. At a picnic table beneath two naked light bulbs, Benck was scraping away the last remnants of flesh from a nine-foot gator hide. When the skin was clean, he rubbed it down with rock salt to preserve it for the auction and rolled it up.

"We're up to our ears in gators," said Benck's wife, Brenda, over lemonade. "Why, they stop traffic and even crawl onto the airport runway. We lost a dog to one, just out back. The kids can't swim in the bayou."

Alligators nearly vanished from these marshlands in the 1950's, when their skins were more fashionable than blue suede shoes.

"My daddy carpeted the insides of his old DeSoto with gator skins," said neighbor Mary Fay LeBlanc. "That was class!"

These days in Calcasieu Parish, however, nothing seems more prized than the succulent white meat from the gator's tail. Alligator flesh cannot be sold legally. But it is bartered, and few presents are as dearly given.

What Wine Goes With Gator?

A young gator hunter, Bruce Watts, brought some alligator he had spit-barbecued to Benck's. It tasted like a cross between fish and chicken. "I like gator any way," said Bruce. "Southern-fried or alligator jambalaya, but alligator spaghetti is hard to beat."

Most bayou gator hunters bait shark hooks with blackbirds and leave them dangling from bamboo poles just over the water. When a hooked gator is found, it is hauled in and shot. Louisiana hunters last year legally took some 4,500 hides, fetching as much as \$18 a foot at auction.

A few hundred miles away in Florida some 8,000 alligator complaints a year plague the Florida Game and Fresh Water Fish Commission. Particularly in central Florida, alligators—usually much too small to be dangerous—are popping up everywhere from laundry rooms to rose gardens, as more

and more people move into gator habitat.

Some now regard the alligators almost as mascots. Along Lake Alice on the University of Florida campus, students regularly toss them cookies and marshmallows. At Lake Mirror in downtown Lakeland, retiree Millard Fallis asked game and fish commission officer Floyd Buckhalter about Blinky, a one-eyed alligator that has prowled that lake for years. "Tell me if what I'm doing is wrong," said Fallis. "A couple of times Blinky has been lying on the shore here, and I've gone down and patted him."

Not a good idea, advised Buckhalter. "When you get people giving them names and calling them up by beating on pans, that's when they get dangerous. They lose their natural fear of humans."

Problem Animals Now Hunted

Alligator attacks have increased markedly. A teenage girl was killed swimming in a lake in 1973. A wildlife biologist was mauled by a 12-footer in the Oklawaha River in 1975.

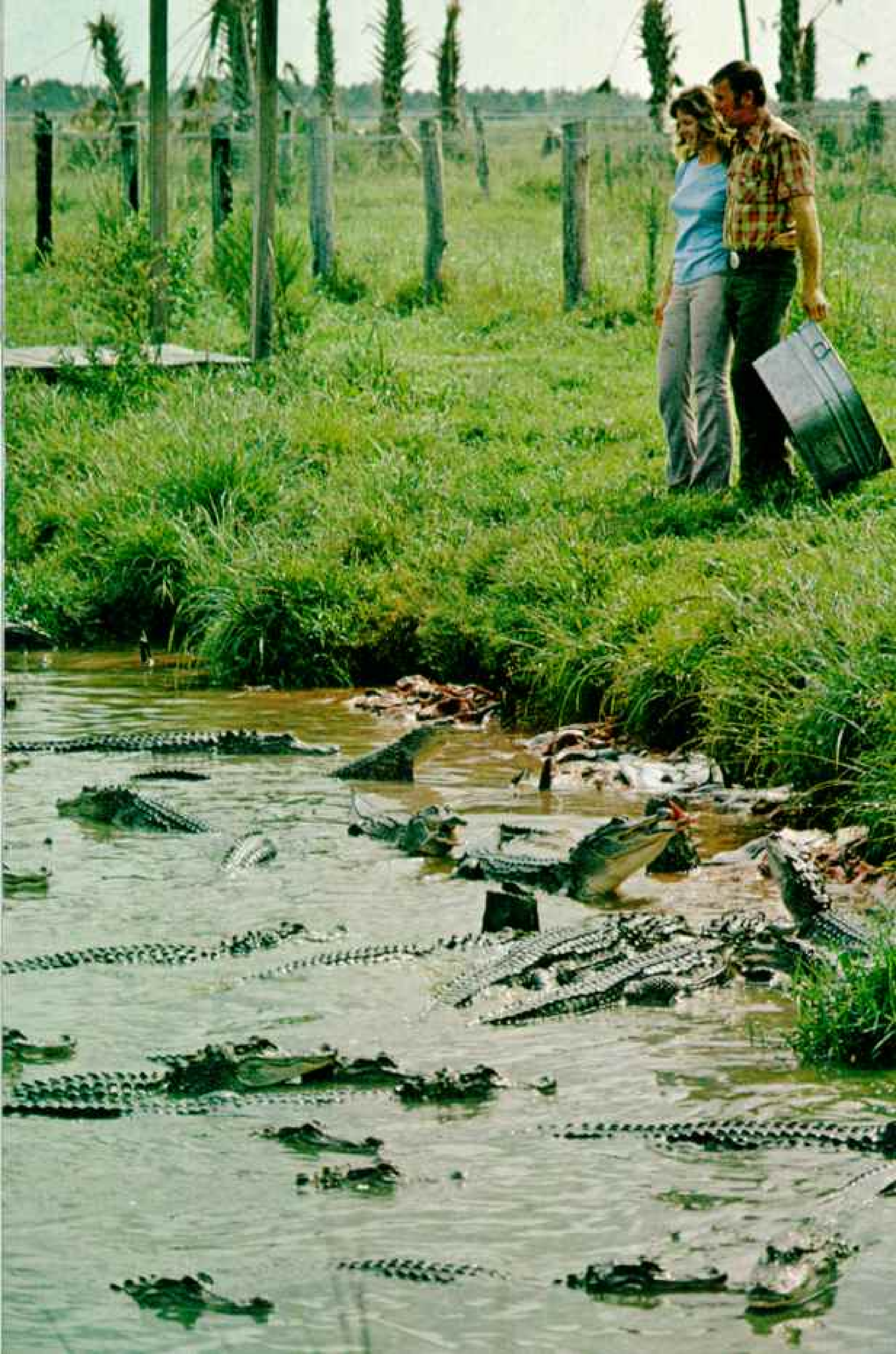
Although a swimmer in Florida is far more likely to drown than be attacked by an alligator, some big gators—eight feet and over—do need to be dealt with.

After the animal's endangered status was downgraded to threatened last January, the game and fish commission began an experimental program, sending former alligator hunters out to kill problem animals, then auctioning the hides. The first auction brought \$18.50 a foot for 592 gators. The hunters got 70 percent of the price. The commission views this as an economical way to control both alligators and costs.

The state would also like to hold alligator harvests, and recently decided to permit the sale of farmed animals. That decision pleases Ed Froehlich, one of several Floridians who have been learning how to raise gators in captivity on a gamble that the market would reopen. More than 2,000 gators now swish and scramble about the ponds and tanks on Ed's farm near West Palm Beach.

"It takes two hundred pounds of meat every

Handbags on the hoof feast at Ed and Francine Froehlich's alligator ranch near West Palm Beach, Florida. Their 2,500 gators gobble 3,000 pounds of meat and fish weekly. Under ideal conditions young alligators can convert each pound of food into half a pound of body weight. The Froehlichs hope to harvest 200 hides this year—and 1,000 by 1980.



Knee-deep in contraband, U. S. Fish and Wildlife Service inspector Sam Librandi (below, left) and the Bronx Zoo's Dr. Wayne King examine crocodile products confiscated at New York's John F. Kennedy International Airport. Though federal law permits the skins of five species to enter the U. S., nine states, including New York, prohibit any trade in crocodile products.



Daredevil swim allows photographer Jonathan Blair to come within ten feet of a 12-foot alligator (facing page) at Florida's Wakulla Springs. Though risky, Blair's dive nonetheless underscores wild gators' essential shyness toward humans. The resurgence of alligators in the United States reflects more than a decade of protection. Now other governments are working to save their crocodilians, amid fears that it may already be too late.

other day just to feed the little ones," he said. He and his wife, Francine, grind chicken necks, fish heads, and beef livers into chunks that their 1,600 baby gators can manage.

Frenzy erupted as the babies piled out of the water, crawling over each other, to shovel their little jaws into the meat. "Sometimes one will bite into another's leg, thinking it's meat, and twist it right off," said Francine.

We drove to a pond where Ed keeps most of his 150 breeders, large animals as long as 12 feet. "C'mon here," he yelled, and an armada of huge heads veered rapidly shoreward. Like tame dogs, they crawled out to grab fish from Francine's hand.

Now that skins are becoming available again, Ed says, "a hundred gator farms couldn't meet the demand."

Future Uncertain for Wild Crocodilians

The new availability of gator skins puts conservationists in a quandary. Many concede that a moderate, luxury-item hide trade would not hurt alligator populations. It might even encourage more nations to farm their crocodilians rather than deplete natural stocks.

The big worry is that the black market will get out of control again. Most biologists believe there will never be too many gators, that natural mechanisms, including cannibalism, will keep alligator numbers in harmony with the available habitat. "I'd like to see them managed as songbirds or herons are—for the sheer value of seeing them," said Everglades Park biologist Jim Kushlan.

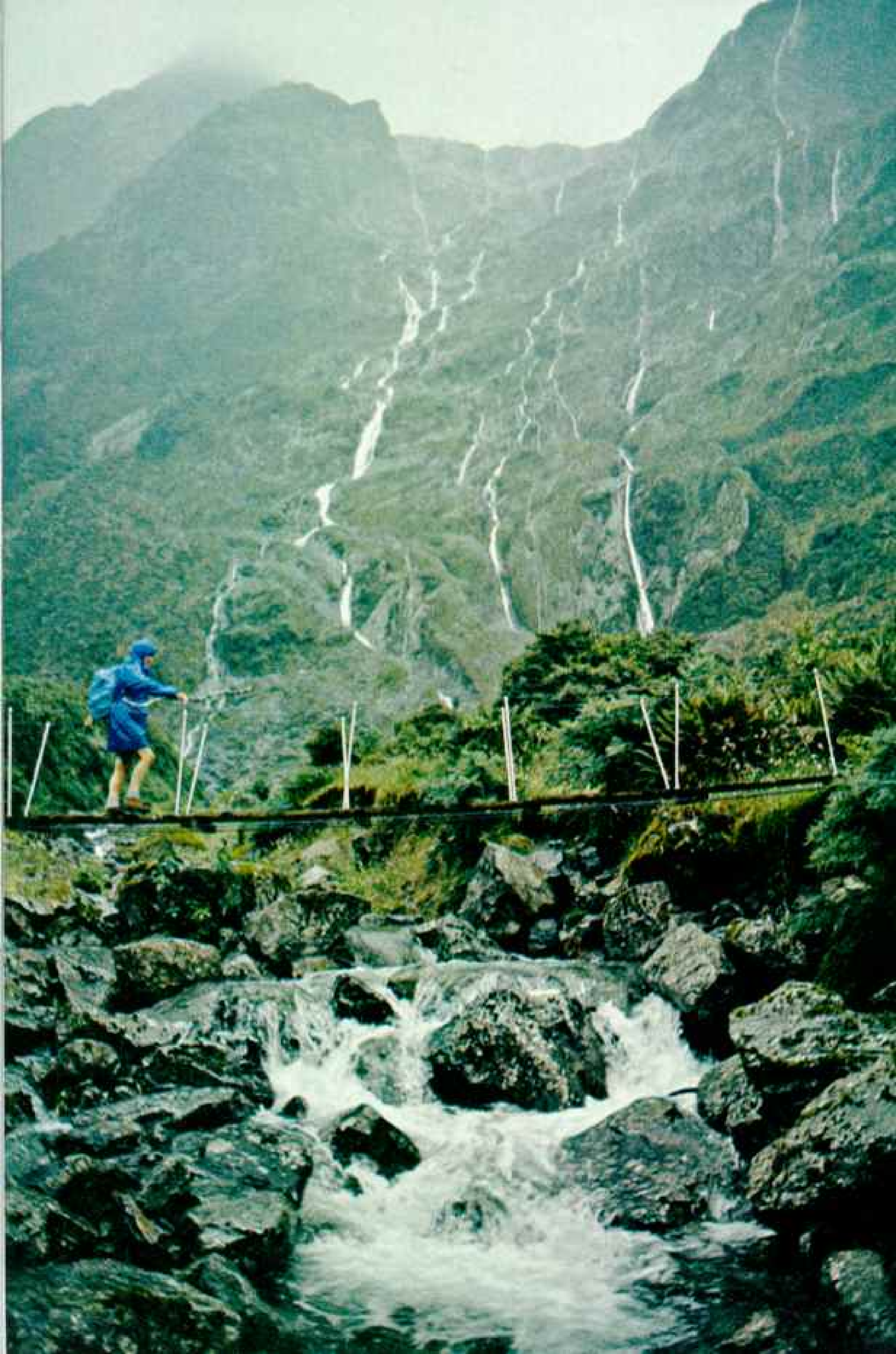
However managed, the alligator will survive. Its saltwater cousin, the shy American crocodile, will have a much harder time. A few pockets of American crocs remain in the Caribbean, but the small Florida population has been nearly wiped out, most recently by land development in the keys. Cars have run over several of the rare adult crocs near Key Largo. Only 11 known nesting females remain.

The future for most other crocodilians also remains bleak. As Bob Bustard said in India: "I would love to have crocodiles everywhere, but that's no more realistic than trying to put buffalo back into the wheat belt. All we can demand is a few viable and inalienable sanctuaries for each species in their natural range."

More likely we'll have farms.

All in all, were I a crocodile, I'd prefer another ice age. □





NEW ZEALAND'S MILFORD TRACK

“Walk of a Lifetime”

By CAROLYN BENNETT PATTERSON

Photographs by ROBERT E. GILKA

BOTH NATIONAL GEOGRAPHIC STAFF

THE WIND IS IN A RAGE, battering us with torrential rain and needle-sharp sleet. We move in painful slow motion across the saddle of Mackinnon Pass, stumbling, falling, then rising to stagger on.

After what seems forever, we reach the Pass Hut and burst into the cabin. Blessed shelter.

So this is the Milford Track? The famous “finest walk in the world”?

For nearly a century visitors to New Zealand have returned with stories of a spectacular 33-mile hiking trail that wends through the scenic wonders of South Island's Fiordland National Park (map, next page). The trail opens an unsurpassed feast of pure wilderness—lush rain forests, glacier-hung peaks, trout-filled rivers, and thunderous waterfalls. Lodges permit easy strolls of about ten miles a day, with side trips, for organized parties of no more than forty. The nature lovers' holiday takes less than a week.

The Milford Track lives up to all the superlatives—but we had to walk it twice to learn the truth.

Off we go, bound for Glade House—first of the lodges—near the north end of Lake Te Anau. We board the venerable launch *Tawera* and motor into waters frothy with whitecaps.

Steep, heavily wooded shores rise toward stone pinnacles. Here and there brilliant splotches of red, like paint, reveal the southern rata tree in summer bloom.

Passing the lake's Middle Fiord, *Tawera's* captain calls attention to a wild hanging valley that is a sanctuary of the takahe, a large flightless fowl once thought to be extinct but now numbering more than 200 birds.

Disembarking, we plunge into a rain forest of enormous beech-trees, whose branches and trunks wear heavy wet suits of green moss, and, in minutes, we warm to the welcome of Phil and Betty Turnbull, hutkeepers at Glade.

With photographer Bob Gilka and me are his wife, Jan, and my husband, Pat. We are introduced to our sleeping quarters, double-decker bunks in male and female dormitories; to our mess hall; and to our fellow hikers—a mixed crew, mostly from New Zealand, but also from Great Britain, West Germany, South Africa, Canada, Australia, and the United States.

Betty Turnbull at the piano livens things up with never-fail songs: “Amazing Grace,” “Home on the Range,” “Waltzing Matilda,” “Loch Lomond,” and “Silent Night”—the latter a month late but rendered with feeling.

Phil proclaims his conviction: “The Milford Track is *(Continued on page 121)*”

Quicksilver veins on a mountain's face, waterfalls spring to life during a storm along the Milford Track, a trail that draws hikers from all over the world. Here in New Zealand's Fiordland National Park, ice and water on the move have sculptured a realm whose rugged beauty is sometimes fraught with danger.



Elevations in meters (black) / feet (red)

Forest

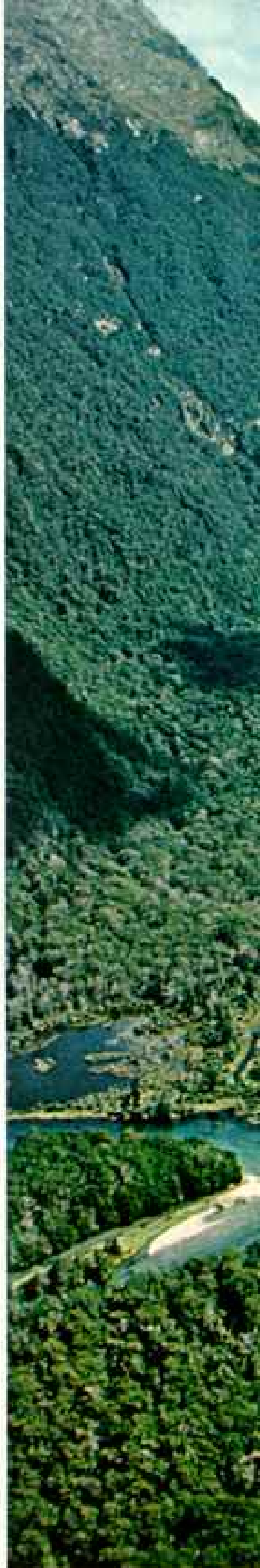


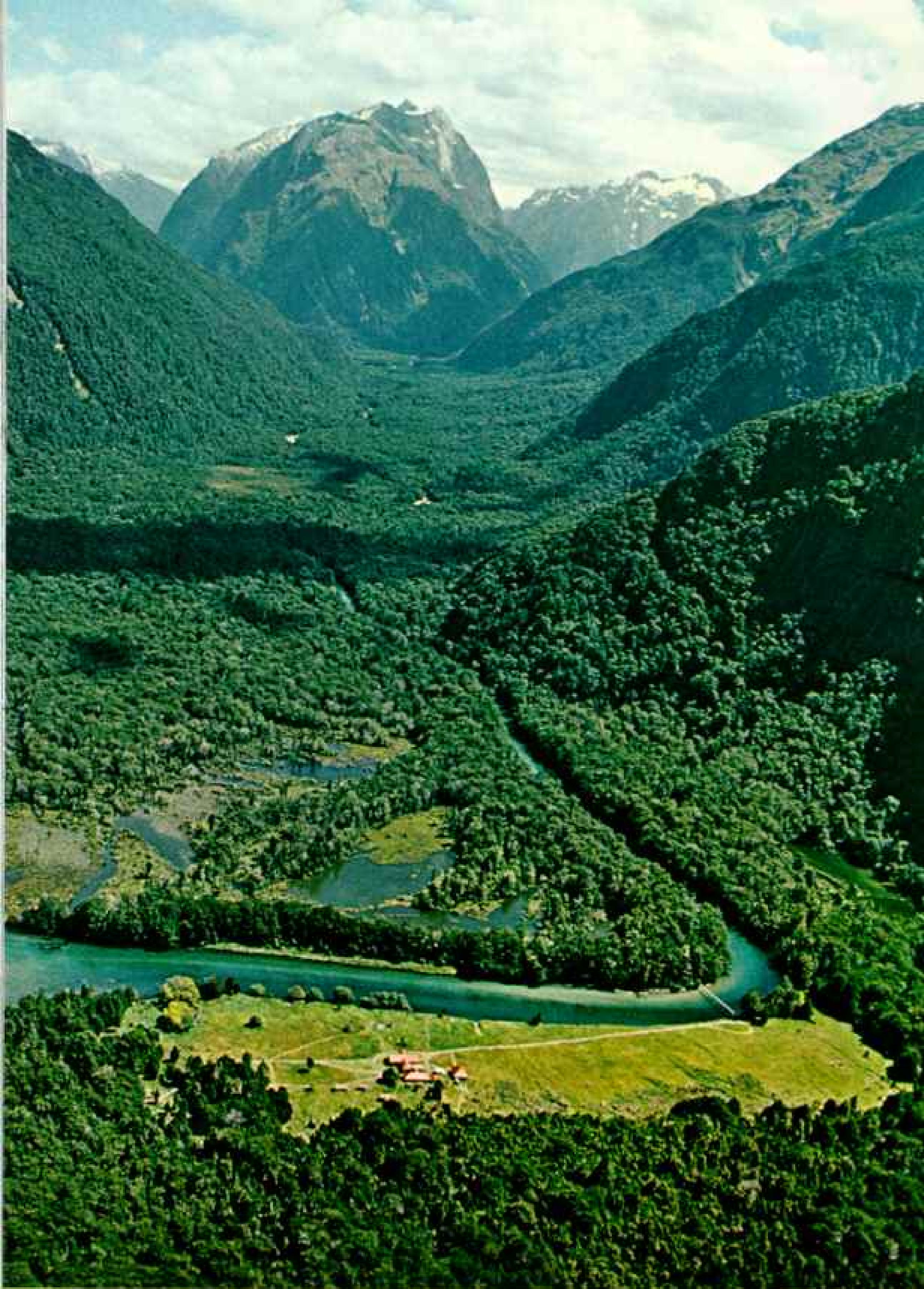
MAP BY GABRIEL BACCI
 COMPILED BY PATRICIA J. WARRISON
 NATIONAL GEOGRAPHIC ART DIVISION



Glacier-shaped and forest-draped, the Clinton valley beckons beyond Glade House (right), at the start of the 33-mile Milford Track (map). From here guided groups set off to explore the incomparable mountain wilderness and marvel at its distinctive birdlife; this enthusiastic party pauses even for a common New Zealand robin (below). Such groups find hot meals and overnight shelter in trail huts—Glade House, Pompolora, and Quintin. Mere shelters serve so-called freedom walkers, who carry their own food and bedding. The trek includes a visit to 1,904-foot Sutherland Falls, world's seventh highest. The Fiordland National Park limits the number of hikers, thus helping to preserve the wilderness.

For the author and her fellow hikers, the trek proved especially challenging when torrential rains, whipped by gales, spawned torrents that swept paths and bridges, threatening the safety of all.







Almost tame, a chicken-size weka—one of New Zealand's many flightless birds (above)—strolls among mountain buttercups atop MacKinnon Pass. Jervois Glacier gleams with year-round snow on the flank of nearby Mount Elliott.



JOHN MILLER (TOP); D. S. PETTINGILL, PHOTO RESEARCHERS, INC., (LEFT); SYDNEY KORA



Clown of the mountains, a kea (above) hovers over a party of trampers having lunch, awaiting the moment to swoop down and snatch sandwich scraps. At other times the bird acts the part of a hawk, soaring above the highest summits and earning a reputation for sometimes attacking sheep.

The bellbird (left) dines on the nectar of an exotic flower known as the "red-hot poker."

a place where people meet as strangers and part as friends." It is all good-natured and innocent, like the summer camps of my childhood in the 1930's. And we campers respond with laughter and relief that at least the human side of the adventure is easy.

Billeted at "The Cottage," we sit in candlelight before an open fire and, just as Phil had said, we shortly begin a friendship with a party of total strangers—a family from Lincoln College near Christchurch. Patrick and Frances Fox are walking with their sons, Ken, age 15, Harry, 17, and Tony, 21. Putting finishing touches to a hunting cap she has sewn for Pat, Frances says: "The boys are growing up so fast. We wanted this time together before they go their separate ways."

In the night I wake to rain, but it has a pleasing sound on the roof. So I drift into sleep again—undisturbed.

Wild Creatures Lack Usual Wariness

The morning appears bright in the Glade clearing, with the sun spotlighting the high mountains (pages 118-19). My backpack seems as light as my heart as I step across the swinging bridge over the Clinton River, spotting two of the brown trout that make it famous.

Instantly we are back in the eternal twilight of the rain forest, walking to the unceasing music of the river as it ripples over gray and white stones. Everything testifies to the bounty of abundant water: red, silver, black, and mountain beech-trees; gardens of ferns, many as tall as saplings; mosses and lichens in marvelous variety.

We have ten miles to go this day, and each milepost shows us a picture of a different native bird. We spy friendly little fantails, constantly spreading and fluttering their white tail feathers. A flightless weka joins us, as curious about us as we about it. While we eat lunch at Six Mile Inn we feed a kea, the parrot that seems to think it is a hawk, flying and living at great heights, enduring storms, but almost tame, even cheeky, when with people (left).

"It's like an Eden here," says guide Terry Inder. "With so few predators, the wildlife is accepting and trusting." For man, it is even better than Eden, since there are no venomous snakes or, indeed, any dangerous animals.

The trail begins to climb as the Clinton

broadcasts with ever louder roar. Soon we are out of the rain forest and crossing a glacier-leveled flat that opens up an extraordinary view. On either side the mountains vault to the sky. Their rock walls are spangled with waterfalls—wispy, silvery plumes that appear from the distance as fragile as feathers. One such fall, fed by a high creek that jumps off into space at the cliff top, created and refreshes Hidden Lake, where we stop only briefly, since the day has grown overcast and chill.

Nearing Pompolona Huts, goal of our first day's walk, we encounter another, more devastating result of moving water: a "river" of rocks, some as big as boxcars. They have poured down from the heights in a span as broad as a superhighway.

"We call this a 'slip,'" says my walking companion from Christchurch, George Gates, demonstrating the New Zealand penchant for understatement. What might have caused it? Perhaps one of the region's violent rainstorms; new storms continually add fresh stones and rearrange old ones.

I am among the last to make it to Pompolona Huts. I fall into bed immediately after dinner, troubled by the thought that my Washington, D.C., training for the track—a daily swim—hasn't been half good enough.

It begins to rain hard about midnight and continues through the night.

Storm Gets a Head Start

In the morning our timing is off. Pat is moving slowly and in some pain, having developed blisters. I am tired from the unaccustomed exertion of the day before and a restless night. Bob is repacking his camera gear and film to protect them against the steady rain. And Jan is waiting for us.

So we are the last to shove off from Pompolona, a serious error since the longer we delay, the longer the rain has to make critical changes along the trail.

Stepping off into the downpour, I recall a comment some wit has penned in Pompolona's guest book: "Up periscope!"

Immediately we see the handiwork of the nightlong rain. The stream alongside the hut—a mere trickle the day before—is now an angry river, and we move cautiously across its swinging bridge (page 116) before pushing, single file, up the narrow, rocky trail into the



rain forest. Everywhere there is the sound of rushing water: from the Clinton at full roar; from uncounted small streams and waterfalls that have been newly activated; from the ceaseless dripping of water from trees to ferns to moss-carpeted ground.

The trail steepens into a series of switchbacks, and I am uncomfortably aware that my pack is now heavy. It throws me off balance as I pick my way across water-slick rocks.

We have been climbing steadily, and suddenly we are out of the forest, in the open high country, above timberline. Looking back, we can see the plunging Clinton Canyon whence we have come; its walls are alive with new waterfalls born of the storm.

Looking up, we see our goal, the saddle of MacKinnon Pass between 6,080-foot Mount

Balloon and 5,850-foot Mount Hart. But here in the open a new and terrifying adversary has joined the rain. Wind! It strikes in gusts so strong that we must stop to wait them out. We fall, full face in the mud and rain, then rise and struggle on, finally onto the pass saddle and to its sheltering hut, where I am newly determined to stay until the storm is spent, even if it means overnight.

A Waterfall in Reverse

Most of our fellow walkers have come and gone. We dump packs, gulp hot tea, and wolf sandwiches. All the while, the wind outside is rising, and the hut's plywood sides rattle and buckle at each gust.

The radiophone rings, and we hear an urgent voice: "The barometer is falling. Wind



Clouds roil up from the valley, and mountain slopes thunder with waterfalls as poncho-clad hikers clamber across slippery rocks in a hanging garden of ferns. On the author's first walk, driving rain and wind almost stalled her and other hikers during the crossing of MacKinnon Pass. Suzanne White (above) helped guide the stragglers to shelter at Quintin Huts. Skies cleared for a second walk of the track, making for an experience of extraordinary beauty.

is up to 70 miles an hour. Leave the hut and come down the mountain as fast as possible."

At the urging of our guides, we struggle into wet ponchos and, opening the hut door, stagger into the icy blast. Jan, a woman of slight stature, is knocked flat. The danger of being blown off the pass by the wind is very real.

Fear comes to walk with us. We creep down past Mount Balloon until, at last, the slope at our back becomes a shield against the wind from one direction at least. It is then, during a pause to catch our breath, that we see, directly before us, the wonder of a lifetime.

At the lip of the Jervois Glacier, a thousand storm-triggered streams unite as a single mighty force that leaps into space with a monstrous surge from a 500-foot-high cliff.

But more. The gale, sweeping up from the valley, catches the water in the forward edge of the fall and *reverses* it, driving it back up sheer-sided Mount Elliott, up past the glacier, and on into the hovering clouds, where it is dumped anew as torrential rain.

As fantastic as is the sight, we must push on, for that very rain is making the going rougher by the minute. We must now wade rushing streams—near-waterfalls in themselves—holding to a rope barely anchored by Pat, Bob, and the guides.

At Crow's Nest, the radio crackles news that Roaring Burn, fed by waters from Jervois Glacier, is too swollen for us to ford. We shall have to detour by way of the longer Arthur's Track, which bridges the stream.

Now fantasy becomes reality. We plunge

almost vertically down a barely discernible track covered with small trees whose gnarled, slippery roots are bare from erosion. The way parallels a rain-swollen creek, furious with white water and thundering with waterfalls. We cling to a single wire, strung to prevent falling, perhaps into the torrent.

At this moment a miracle occurs. A beautiful young being in yellow slicker, with long braids swinging and eyes quiet and reassuring, appears on the trail. This angel—called by the human name of Suzanne White—pours life-sustaining hot soup. I am later told that she is a summer helper in the Quintin Huts kitchen, a student with a degree in geography, and that she volunteered to hike up to help us (page 123). But I know heavenly intervention when I see it.

One by one we straggle into Quintin, survivors of 12 hours of walking in a steady downpour and howling wind, over slippery rocks, flooded paths, amid crashes of thun-

der and flashes of lightning. Darkness is falling when I reach the final swinging bridge and cross on a walkway ankle-deep in swirling floodwaters. The windows of simple, rustic Quintin Huts, glowing with light, are a sight more welcome than a palace.

Concerning That Happy Little Stroll . . .

Cheers for each of us go up from our fellow hikers, whose early arrival has saved most of them from the brunt of the storm. Wet to the skin and bone cold, I nevertheless stop to make a speech.

"Any nation," I announce to the assembled group, "that considers the Milford Track a happy little holiday stroll must breed the strongest, most courageous people on earth. To New Zealand!" You could have heard the shouts up at MacKinnon Pass.

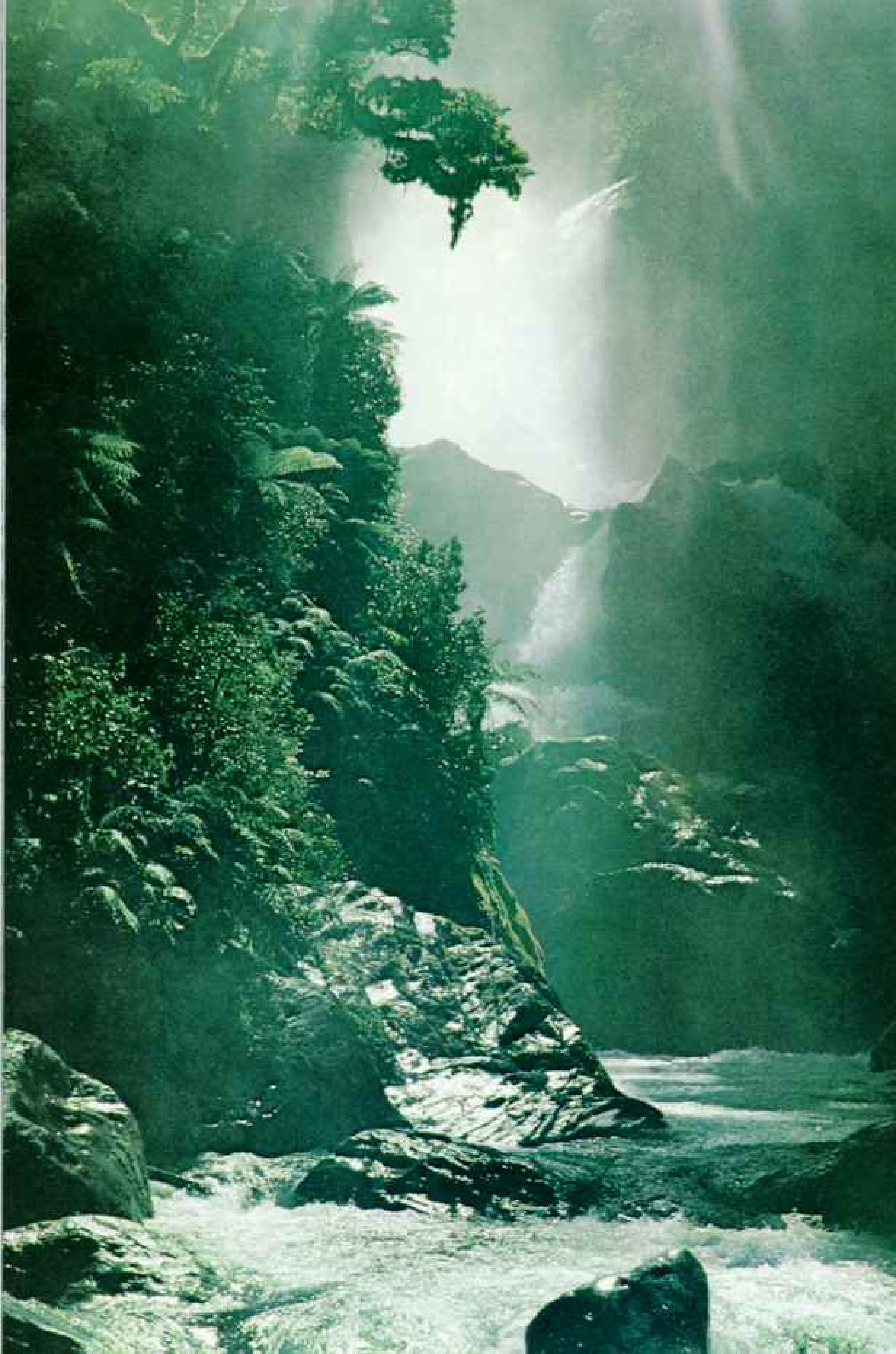
It is an evening of warmth, for the body and the soul.

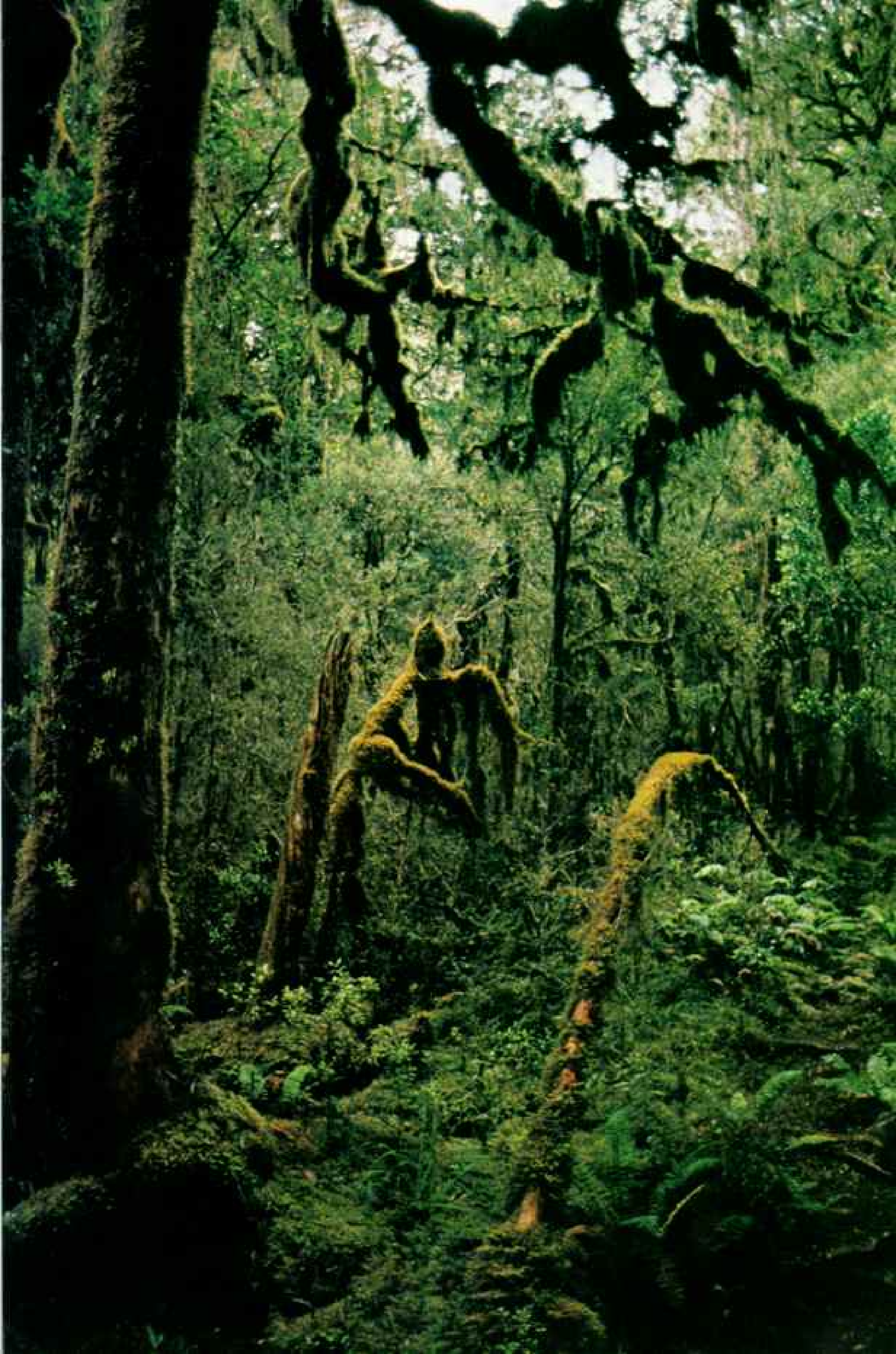
The original schedule had called for a hike



KENNETH CHILDREN, RIGHT

Struggling against high winds, Jan Gilka, at left, and the author leave MacKinnon Pass Hut as a guide secures the door. At Mackay Falls (right), reached on the last day of the trek, a shaft of sunlight signals that the elements are again at peace. When prospectors John Mackay and Donald Sutherland discovered the cataract in 1880, the toss of a coin gave it Mackay's name. The loser's name went to the next falls—much grander Sutherland.





the following day from Quintin to Sutherland Falls, the world's seventh highest. But with rain continuing, we choose to rest.

Our last day covers 13 miles of water-ravaged paths to Boatshed, Mackay Falls, Giant Gate Falls, and Sandfly Point, where a boat takes us to Milford Sound, beside the fiord of the same name (following pages).

With blisters making walking an agony, Pat boats down Lake Ada and catches an eight-pound brown trout. His prize turns up as a superb first course at dinner that night at the Milford Hotel.

The next morning we sail down Milford Sound to the Tasman Sea, in the thrall of the spectacular: Bowen Falls, gushing from cliff top to sound, generating power for the Milford Sound Hotel; soaring Mitre Peak and its neighbors, all black monoliths rising sheer from the water; and a colony of some twenty brown seals frolicking among the rocks.

Weather Does an About-face

Determined to walk the track again in the hope of good weather, we return to Te Anau and there learn the full scope of the storm we had endured. From the ten inches of rain that fell during that Sunday, 40-mile-long Lake Te Anau rose some three feet overall, while the wind whipped waves up to seven feet. And the same winds, sweeping on to Mount Cook, blew a hut off the mountain and killed four climbers huddled inside.

By helicopter we fly low over the Milford Track route, from Glade to Pompolona, to MacKinnon Pass, to Quintin, where we peel off for a sight we had missed on the ground.

Sitting in the copter's transparent bubble, we flutter above Lake Quill, a filled cup surrounded by high, bare, and rugged peaks. We follow the waters of Quill as they slip through a mere slit in the rock and plunge in three stages 1,904 feet to the valley, a leap of sheerest beauty known as Sutherland Falls.

Returning for our second hike, we are blessed with the kind of weather that confirms the track's reputation as the world's finest walk. For me it becomes the walk of a lifetime.

From Glade to Six Mile, Phil Turnbull gives us a lift in the jeep that carries supplies to Pompolona. He stops to show us the foundations of a cabin built by explorer Quintin MacKinnon, who discovered the pass in 1888

and helped open a track for visitors in 1889.

Afoot, we walk a path white with flowers of the ribbonwood—"like a bridal path of orange blossoms," Jan says—and thread a field of dandelions, purple clover, and Queen Anne's lace near Hidden Lake. There, under blue skies, we sun on the beach, fish for trout, and swim in tonic-cold water.

Uptrail, with clouds now a canopy, I sit alone by Lake Mintaro. It is a place made for dreams. The still, gray face of the lake haunted by mist. The enormous trees, hundreds of years old, with wisps of cloud entangled in their branches. The silence, broken only by silvery chimes of the bellbird's song.



Spry as a man half his age, William Anderson at 85 keeps building huts, cutting trails, and writing. His definitive history, *Milford Trails*, draws on his years as the Quintin hutmaster and trail foreman.

Upholstered in moss and lichens and carpeted with ferns (facing page), the trail alongside the Arthur River could serve as a setting for a fairy tale.



"A fine achievement," having "successfully completed the Milford Track walk... the experience of a lifetime," proclaims the certificate that guide Kenneth Chilton, right, awards to hiker George Gates of Christchurch. A real "beaut," New Zealanders say of the walk.

End of the trail, Milford Sound mirrors brooding giants, at whose feet brown seals play. Bowen Falls waves its white plume at the hardy, who walk in on the Milford Track, and at the hurried, who land on the airstrip near the Milford Hotel.



Shortly I push on, and within the half hour reach a swinging bridge and pause midway across it. Then, as if on signal, the clouds directly over my head part like a massive curtain and there, in a sky suddenly flooded with sunlight, hang Mounts Hart and Balloon.

Atop the pass, as Bob puts his cameras to work, Jan and I picnic beside Lake Stephen, feasting on views of Jervois Glacier (page 120), the Arthur and Green Valleys, and the distant Lady of the Snows, golden in the sun. Through binoculars we watch the figures of guides Ken Chilton and Jock McLean who, with Pompolona hutkeeper Buster Harker, climb the naked rock that forms Mount Hart's summit.

That night in the Pass Hut we dine on grilled steaks and vintage New Zealand wine,

the gift of a young friend and volunteer pack bearer, Richard Honey.

The cabin is aglow with candlelight and warm with the laughter of our overnight party that includes Ken Chilton and Zygmunt Kepka, a former foreman of the track. After dinner I put a waltz on my recorder and dance with Zyg, whose grace and verve reflect his Polish heritage.

The next evening, back again at Milford Sound, a few of us sail out across the night-shrouded sound for a visit with the stars, brighter and closer than I have ever seen them.

We talk, as people will at such poignant last moments together, of God and eternity. There is something about the Milford Track that makes us feel we have just had a special encounter with both. □



The Flight of the Gossamer Condor

By MICHAEL E. LONG
NATIONAL GEOGRAPHIC STAFF

WITH A NAME like that, it just had to fly. And the human-powered machine that looked like a cross between a dragonfly and a windmill did—hundreds of times. But could *Gossamer Condor's* pilot power the aircraft around a course that had frustrated aeronautical wizards from France to Japan?

Since 1959 human-powered flight enthusiasts had vied for a prize, now worth \$87,000, offered by British industrialist Henry Kremer for the first aircraft to complete a course set by the Royal Aeronautical Society: a figure eight around two pylons half a mile apart, clearing a ten-foot-high obstacle at start and finish. After many failures, some questioned whether the feat was possible, but still they tried. One contestant labeled the goal the "Mount Everest of the wind buffs."

On August 23, 1977, at the airport near Shafter, California, Everest was attained. Pedaling steadily, 24-year-old Bryan Allen, a former competitive bicyclist, spurred the *Condor*, 96 feet in wingspan but weighing only 70 pounds, around the course. He passed over the final obstacle with feet to spare. Four days later he repeated the climax of the flight for observers and photographers (right). ALBERT HOLTZMAN

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“Just the right amount of flimsy”

BUILD IT SIMPLE, fly it slow, decided designer Dr. Paul B. MacCready (right, standing behind fuselage), an aeronautical engineer and a former international soaring champion.

While most of his competitors spent many thousands of hours crafting elaborate airplanes that took months to fix after a crash, MacCready opted for a “quick, sloppy beast” built with “just the right amount of flimsy” to fly at around ten miles an hour.

Low-speed airfoil specialist Dr. Peter Lissaman, vice-president of AeroVironment Inc., MacCready’s Pasadena, California, engineering firm, installs a propeller on an early version of the *Condor* (upper left). Like a paperhanger working sideways, team member Jack Lambie helps cover the wing of the 12th and final aircraft with Mylar, a thin clear plastic (lower left).

With the leading edge of the wing made from corrugated cardboard, and piano wire and aluminum tubing serving as the main structural elements, refining the *Condor* was, as MacCready says, “no big deal.”

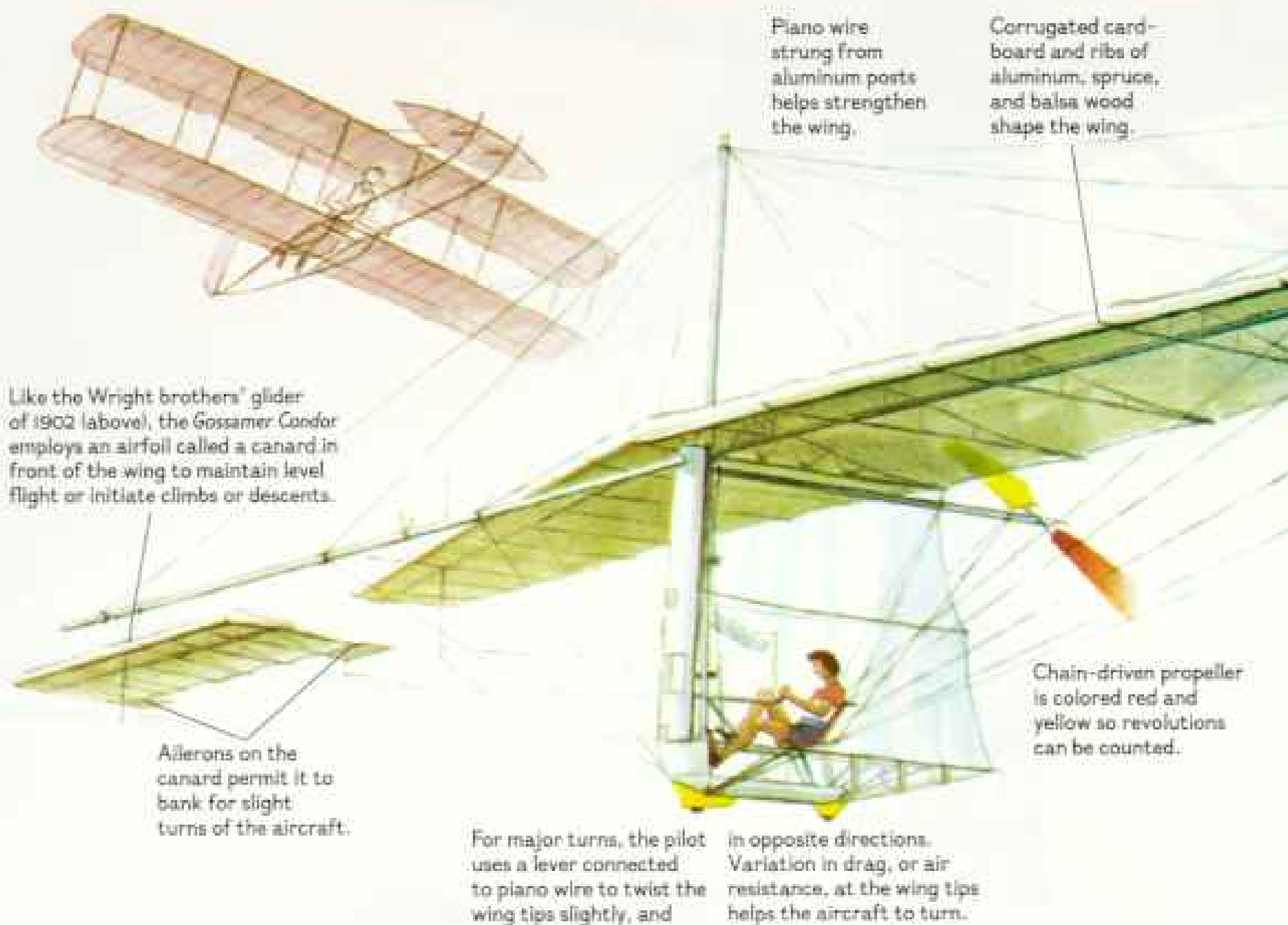
Nor was repairing it after numerous mishaps, actually an essential part of the testing program. “The only way we knew it wasn’t strong enough was if it broke,” says MacCready.

Exercise physiologist Dr. Joseph Mastropaolo (right, at controls) devised a training program to increase the power and stamina of the pilot, who at 135 pounds weighed nearly twice as much as the airplane.



JACK LAMBIE (UPPER); KAREN LAMBIE (LOWER); HERBERT BOLDAKY





For major turns, the pilot uses a lever connected to piano wire to twist the wing tips slightly, and in opposite directions. Variation in drag, or air resistance, at the wing tips helps the aircraft to turn.

Airborne at last on gossamer wings

IF WISHES WERE WINGS, earthlings would have flown under their own power long ago, for unassisted flight is one of man's ancient aspirations. In mythology Icarus (right) and his father, Daedalus, flew on feathered wings held together with wax. Ignoring his father, Icarus flew too near the sun; its heat melted the wax, and he fell into the sea. Daedalus, we are told, landed successfully.

In the 15th century Leonardo da Vinci drew plans for a man-powered vehicle. Venturesome Europeans later attempted soaring flight with a variety of paddles and feather- or cloth-covered wings, sometimes with fatal results. Perhaps the all-time record for intricacy goes to an unsuccessful English autogiro (lower right).

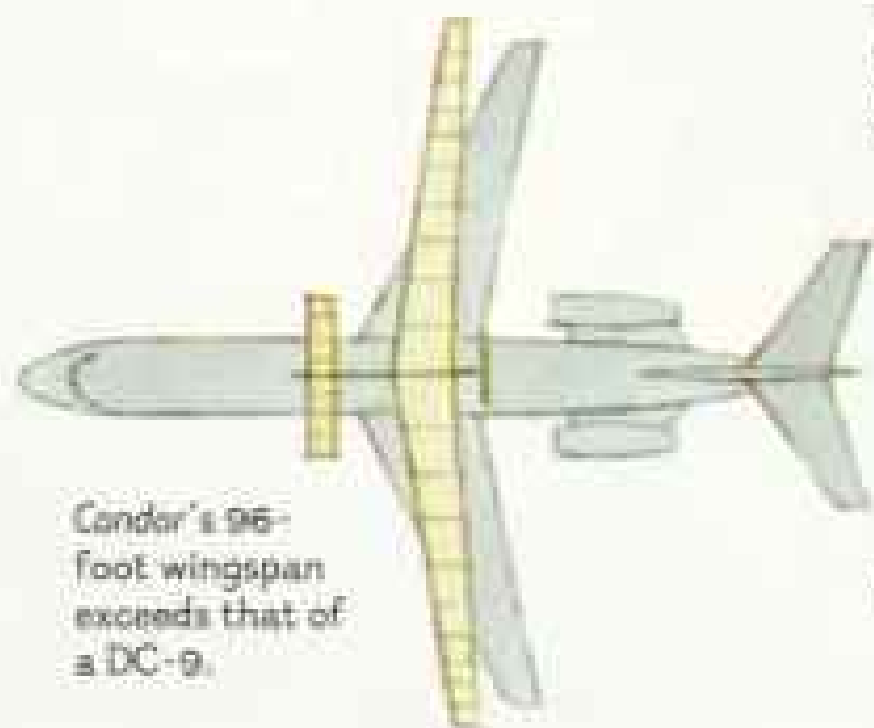
Lured by the dream as well as by the British prize, eminent aeronautical designers led teams that fabricated elegant aircraft (facing page).

As pilot-cyclists huffed and puffed, some of these aircraft flew for considerable distances, usually in a straight line. By manipulating a canard mounted on a pole in front of the wing for

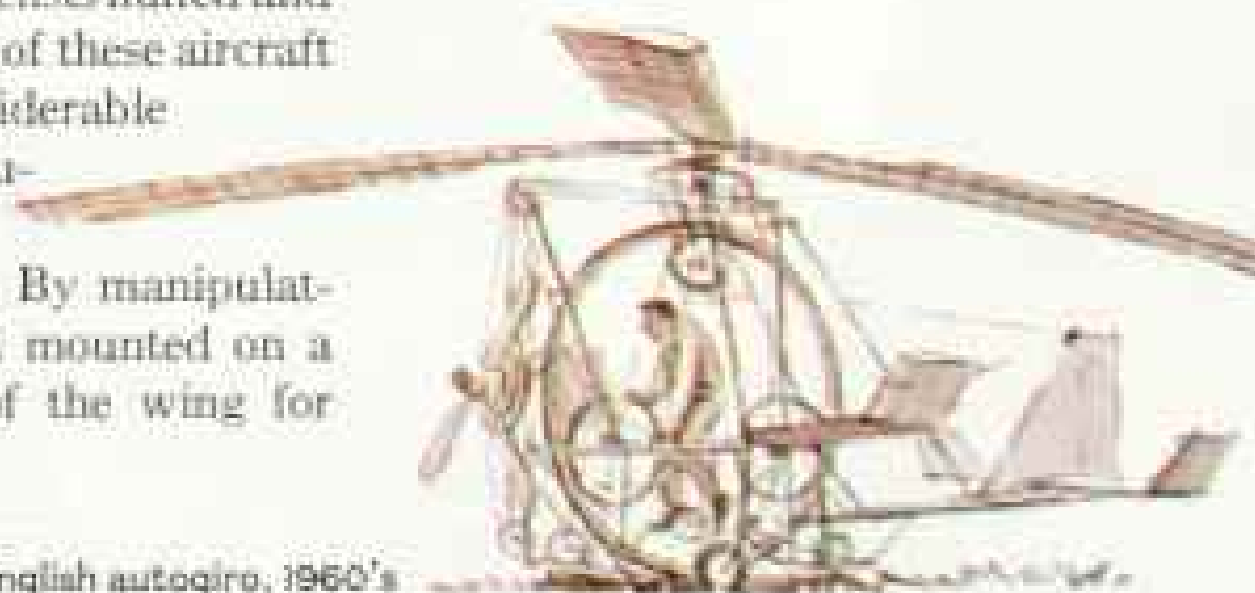


Icarus flew, for a while.

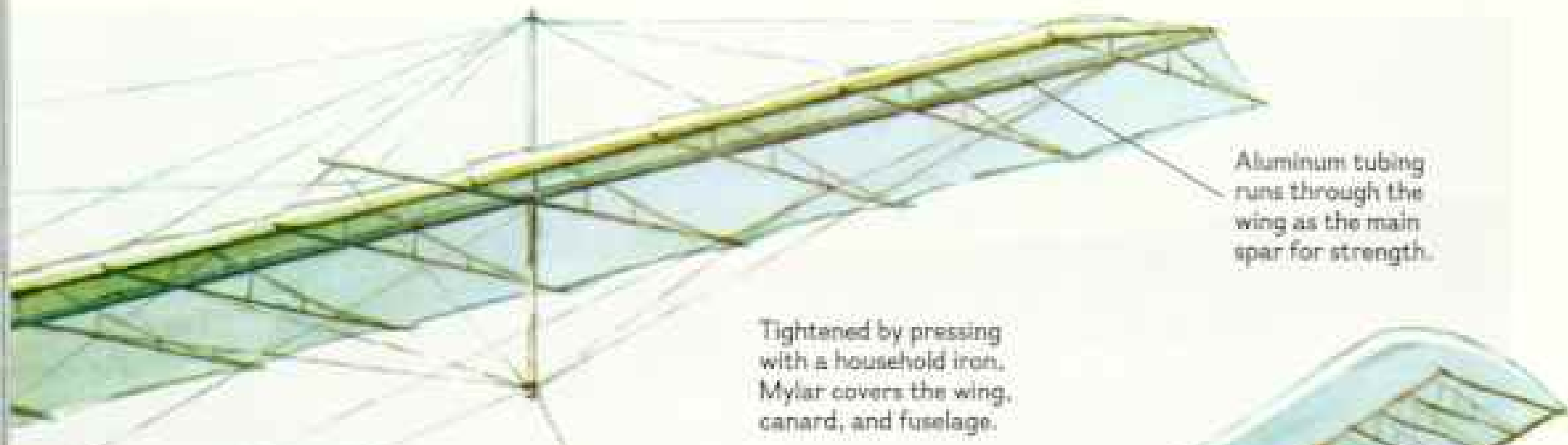
minor turns, and twisting the wing tips slightly for major ones, Paul MacCready solved the low-speed turning problem for *Gossamer Condor*, and his aircraft wafted into aviation history.



Condor's 96-foot wingspan exceeds that of a DC-9.



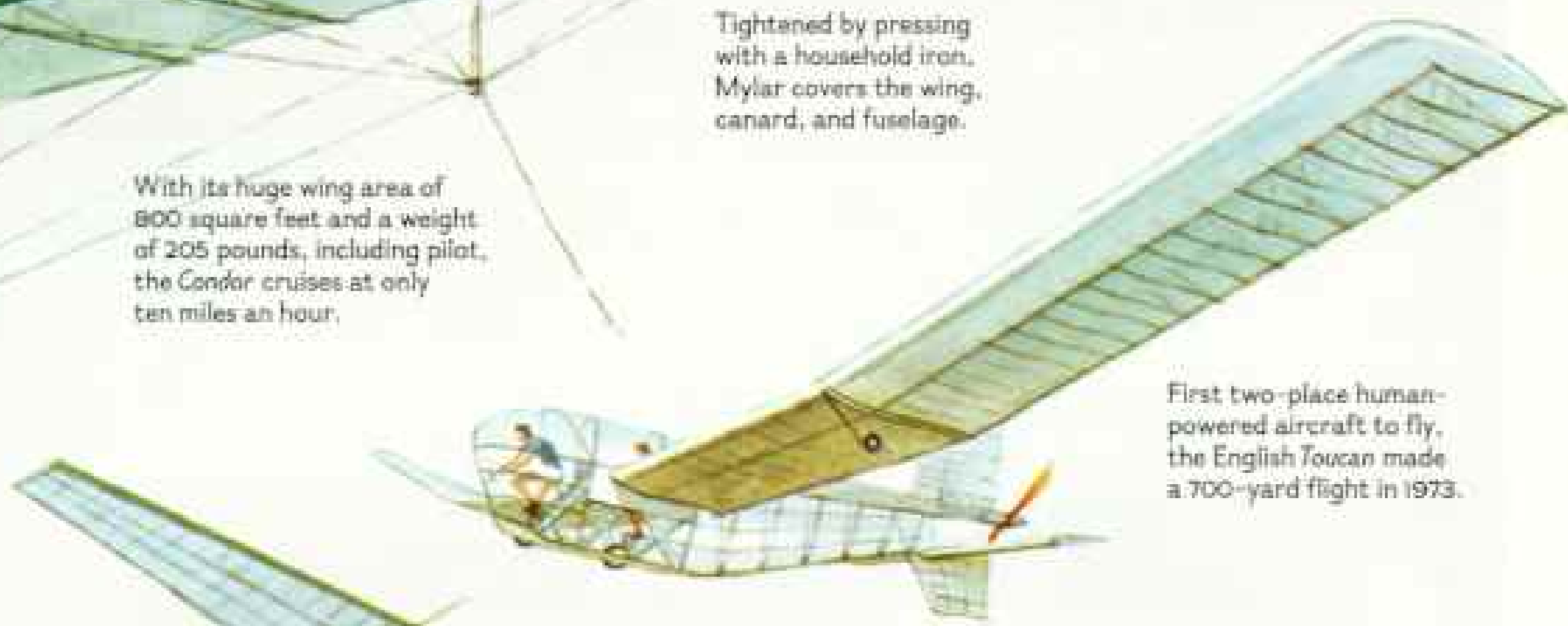
English autogiro, 1960's



Aluminum tubing runs through the wing as the main spar for strength.

Tightened by pressing with a household iron. Mylar covers the wing, canard, and fuselage.

With its huge wing area of 600 square feet and a weight of 205 pounds, including pilot, the Condor cruises at only ten miles an hour.



First two-place human-powered aircraft to fly, the English Toucan made a 700-yard flight in 1973.



Outrigger airfoils stabilized the slender 132-foot wing of the French Hurel Aviette, which flew 1,093 yards in 1974.



The Japanese Stork in 1977 achieved a straight-line flight of 1.3 miles.

The English Puffin flew 993 yards in 1962. Rebuilt after a crash as Puffin II (above), the aircraft crashed again and designers gave up.



“Hey, this is the day!” **P**EDALING determinedly,

Bryan Allen coaxes the *Condor* into the air to begin the historic flight (above). During preflight inspection moments before, MacCready demonstrated the aircraft's quick-repair capability by taping a hole in the wing (left). He also cut a hole in the nose to cool the pilot's legs.

Approaching the finish line (right), Allen experienced a combination of exhilaration and astonishment. “Hey, this is the day!” he thought.

The *Condor* covered the 1.15-mile course in 6 minutes 22½ seconds, a time that could have been matched on the ground by a dedicated jogger.






BURDST W. CLARKE (TOP AND LEFT); JUDY WAGNER







Gentle hands for an injured bird

“**L**IKE A Chinese New Year’s parade,” observed a team member as a crumpled *Condor* is carried back to the hangar at Shafter from a major crash four days after its victory flight. “After five of these you don’t really get hysterical about another one,” says MacCready (far left).

The *Condor* crashes with all the speed and impact of a falling handkerchief. “It seems to take forever,” says pilot Allen, who remains unscratched despite his mishaps. ALBERT HILGERT

Spin-off: better household fans?

SWEET THROB of success: After the flight MacCready takes Allen's pulse (below). Between them Vern Oldershaw, the *Condor's* structural engineer, beams the broad smile of victory. During the flight Allen generated nearly one-half horsepower, four times that of a weekend cyclist.

Here he takes a spin on a custom-built bike made by a friend (bottom). Allen trained for three months on a device that measured his muscle output.

What next for the *Gossamer Condor*? Practically speaking, not much—a breeze in excess of three miles an hour puts the fragile aircraft in immediate peril.

But MacCready points out that *Condor's* aerodynamic innovations could be used by soaring enthusiasts in ultralight sailplanes, gliding parachutes, and hang gliders. Of more significance, he adds, the knowledge gained from the characteristics of low-speed airfoils may help create more efficient household fans and wind-turbine blades, improved airflow through heating and cooling systems, perhaps even a better artificial heart pump. □



ROBERT W. CLARKE (ABOVE); JUDY MACCREADY



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Getting close to crocodiles

"MY HEART WAS POUNDING under my wet suit," recalled photographer Jonathan Blair after scuba diving in the home pond of a nine-foot American alligator (right) at Florida's Wakulla Springs. He used tape-recorded chirpings of recently hatched young to bring the creature within range. Blair and staff writer Rick Gore (above, right) logged a total of ten months of crocodile chasing in the U.S. and abroad for this month's NATIONAL GEOGRAPHIC report on the beleaguered animals (page 90). Blair's photographs are among the most remarkable ever made of crocodiles. Share such adventures; nominate a friend for Society membership.



BOTH BY ROBERT EWING III

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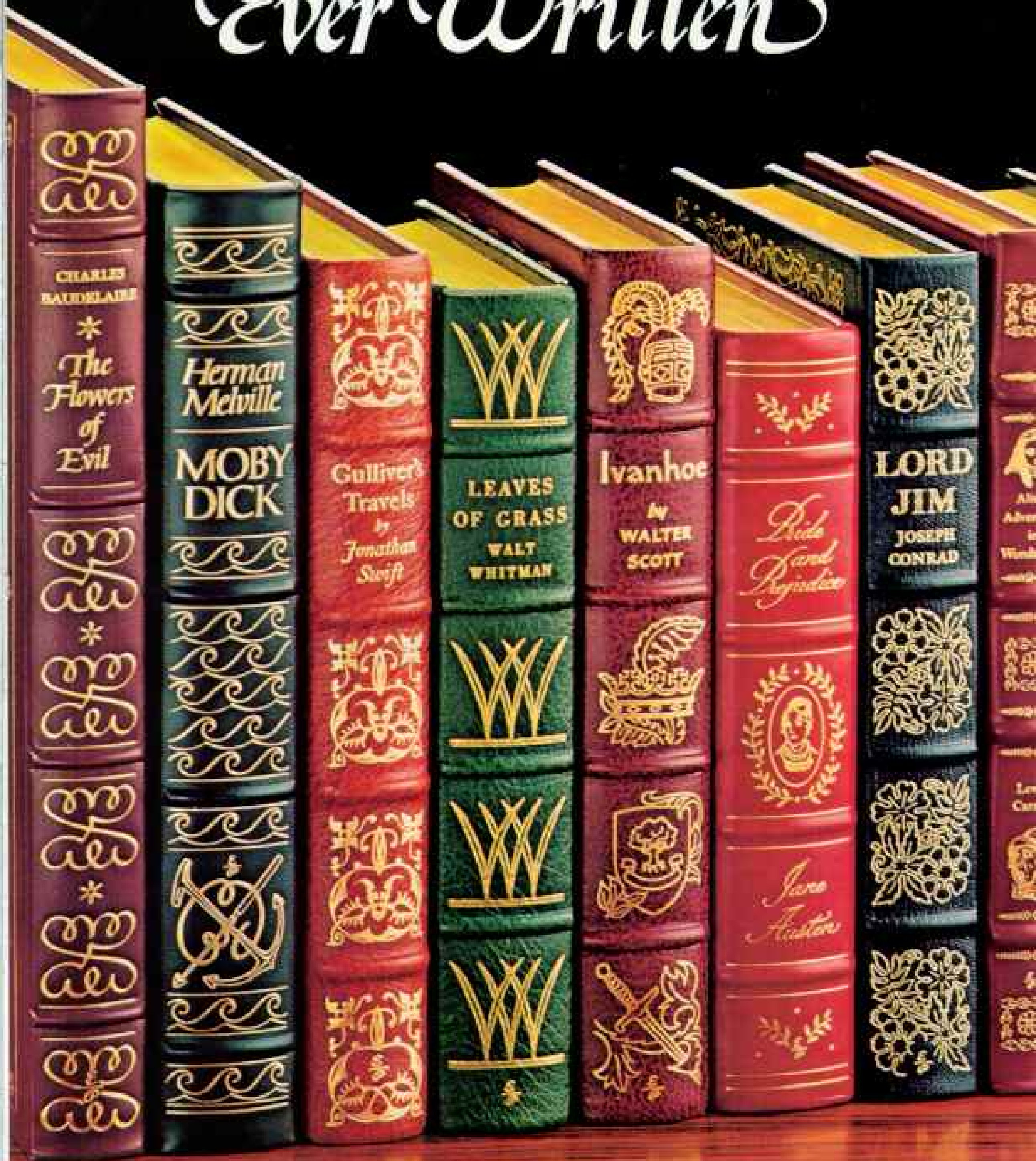
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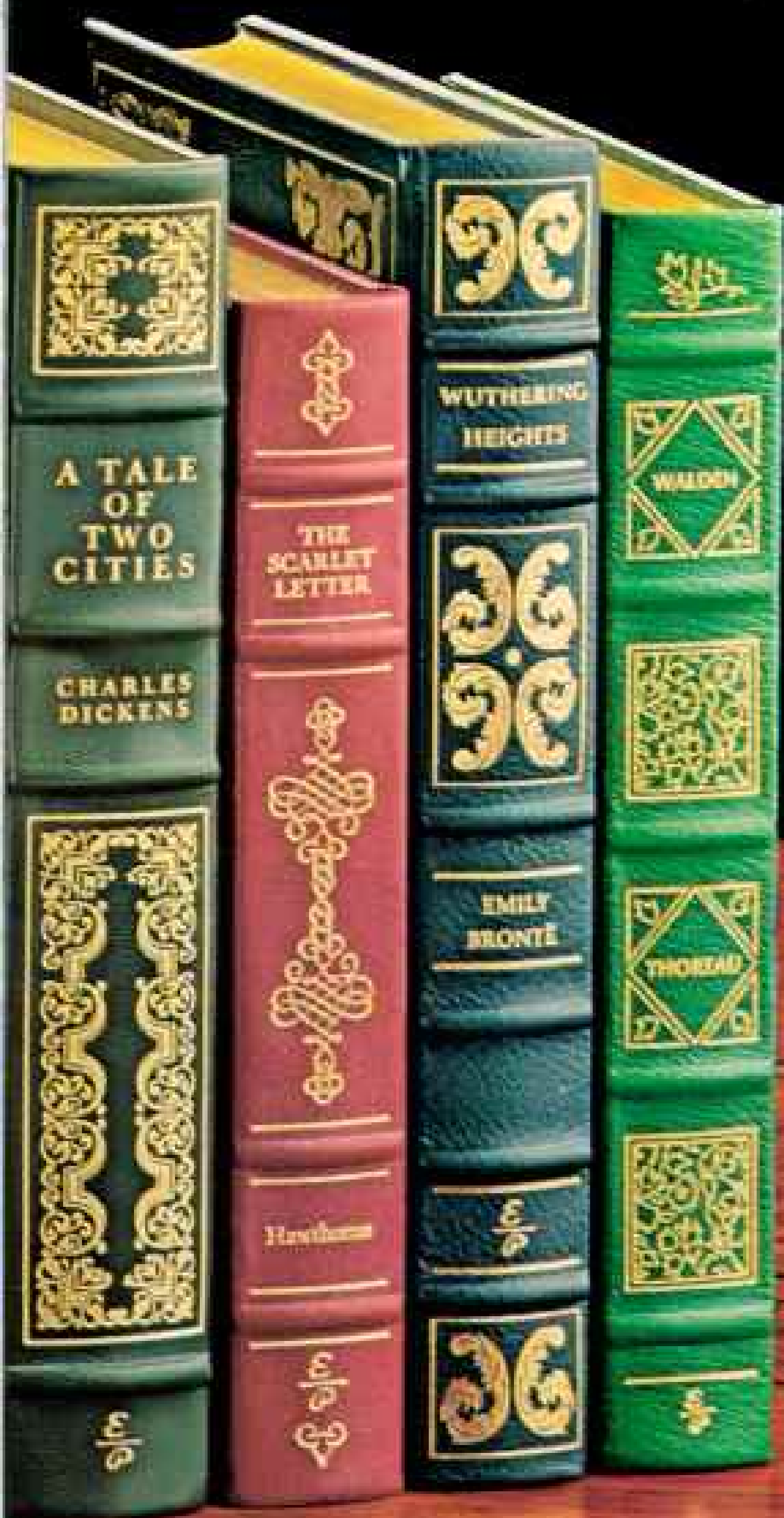
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Last night we got the bad news.

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Tuesday night my brother watched the same two hour movie on his TV set that we were watching in the living room. Not too smart. Thursday Mom ran an entire dish-washing cycle for three cups, two plates, a knife and three little spoons. That's a lot of electricity and hot water down the drain.

Dad drives twenty-eight miles back and forth to work. Alone. When two men he works with live right nearby. They could carpool and save about a thousand gallons of gas a year. And me. I'm guilty too. I went out and left the radio blaring in my room all Saturday morning. Dummy.

So last night at the dinner table we all agreed to do everything we could to conserve energy. Faster showers. Lower thermostats. Fuller cars. It's a fact that this country's using up energy faster than we produce it. I read where we may run out of oil – forever – in thirty years. Pretty scary. Unless every person in every house on every block does his part, the future looks pretty dim.

I'm getting more and more concerned about the future. Because that's where I'm going to be.

Atlantic Richfield Company believes that one of our national goals must be to make every American aware of the vital need to conserve energy. You can make it happen. Be an involved American. Consider the situation. Get involved.

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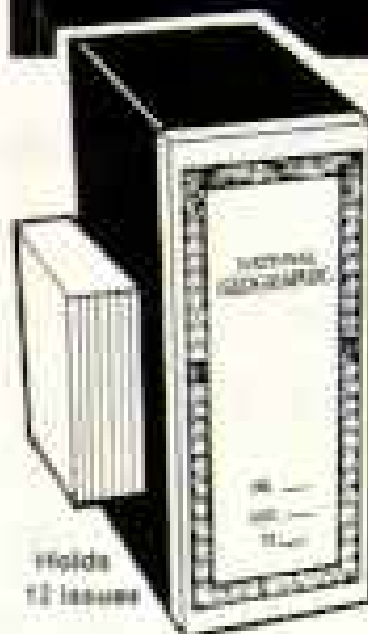
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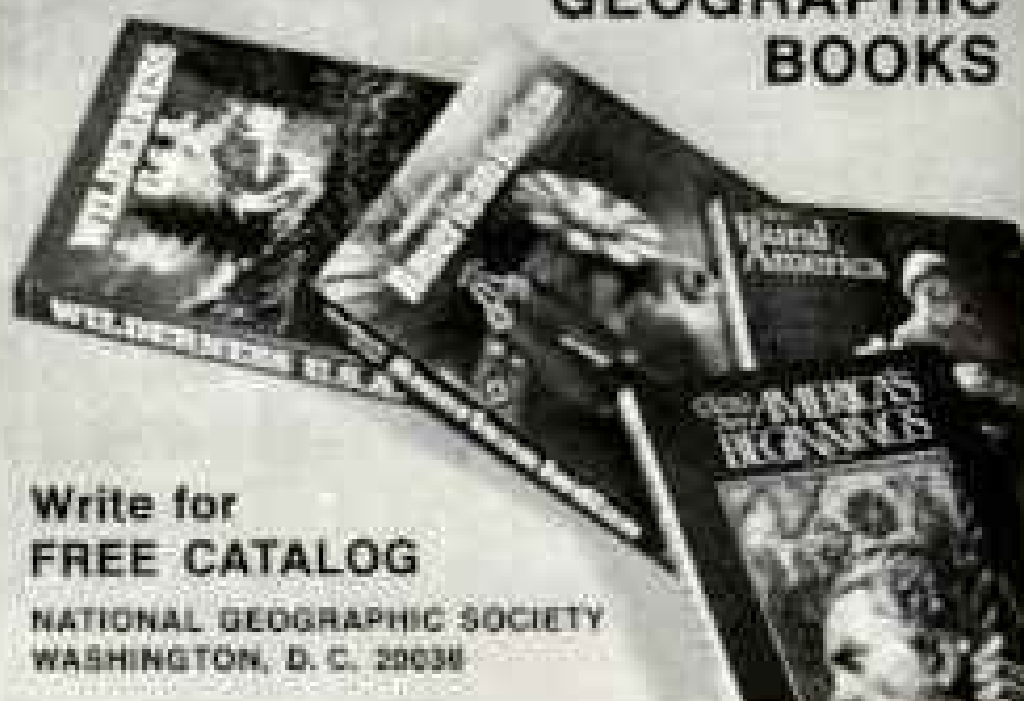
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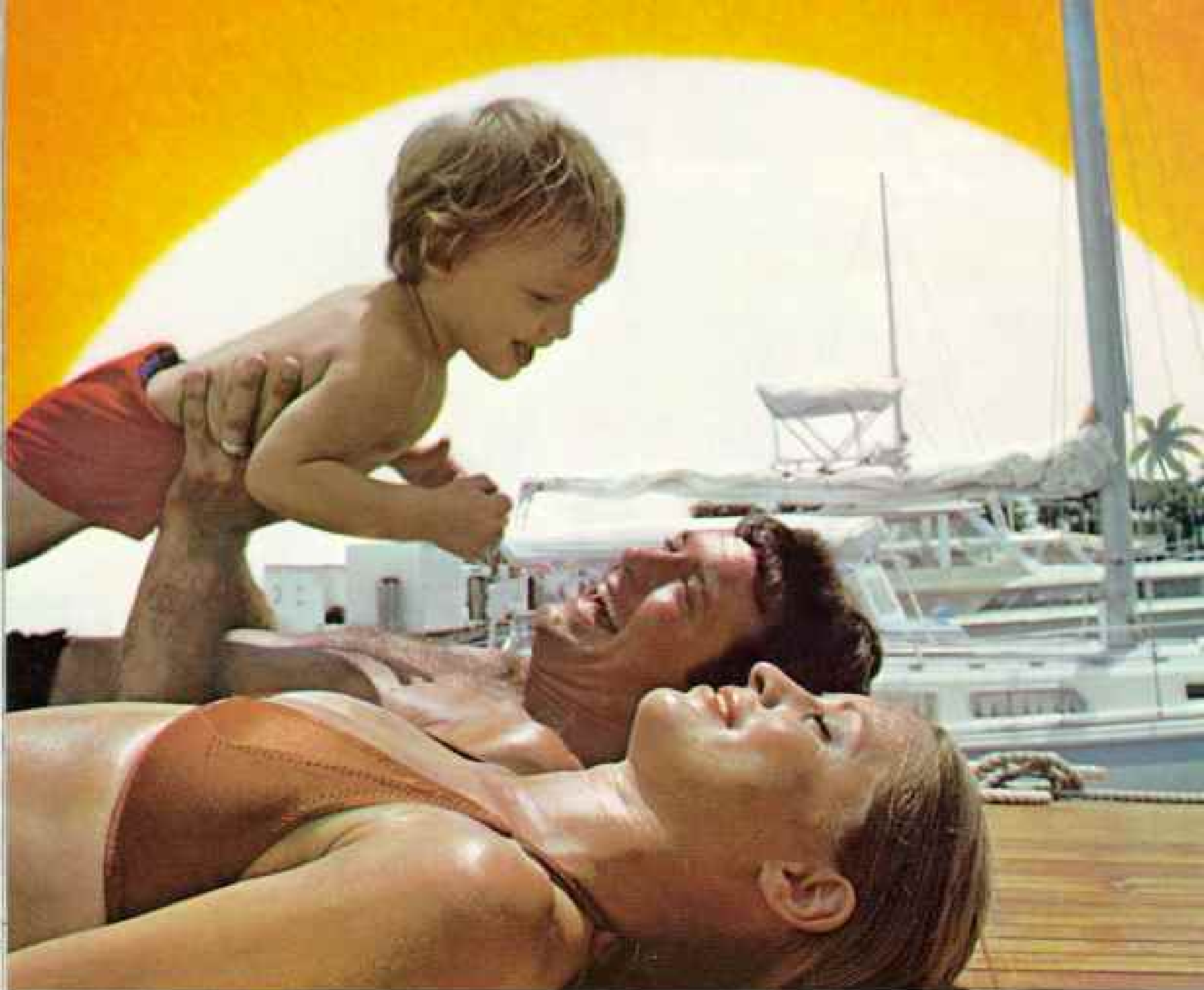


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In fact, according to the EPA, an Electra with standard 350-cu.-in. (5.7 litre) engine and automatic transmission got an estimated 22 mpg in the highway test, and 15 in the city, for a combined figure of 18 mpg. Remember, these are estimates. (The mileage you get may vary depending on how and where you drive, the car's condition and how it's equipped. And EPA estimates are lower in California.) Electra models are equipped with GM-built engines supplied by various divisions. See your dealer for details. Yet, for all its trim dimensions




Electra. 22 mpg highway. 15 mpg city; Another engineering marvel.

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But the dollars are frightening. Modernizing a plant to treat waste water for 100,000 people can run \$40 Million. And there's the continuing job of maintaining and running a facility which only controls "man-made" waste. When you talk erosion runoff, muddying our waters or total clean up, the whole job may be beyond economic feasibility.

Agreed, we can't use our waterways as open sewers. We must protect them from damaging levels of impurity. It can be done as proven by Oregon's Willamette, the Houston Ship Channel and elsewhere. But we must recognize a natural capacity of our waterways to carry on the purification work begun in modern treatment facilities. We must set, and work to, realistic guidelines for future, attainable clean water goals. Support your community in its efforts to keep our waterways clean.

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"There's more to being a chemist than just doing your science," says Terri. "Many things that look scientifically feasible may not be practical. It's sitting down with the chemical engineers and materials scientists to see if an idea is practical that makes my work intriguing and fun."

Off the job, Terri enjoys cycling, playing tennis, and swimming along the Jersey Shore with her husband, who is also an Exxon chemist.



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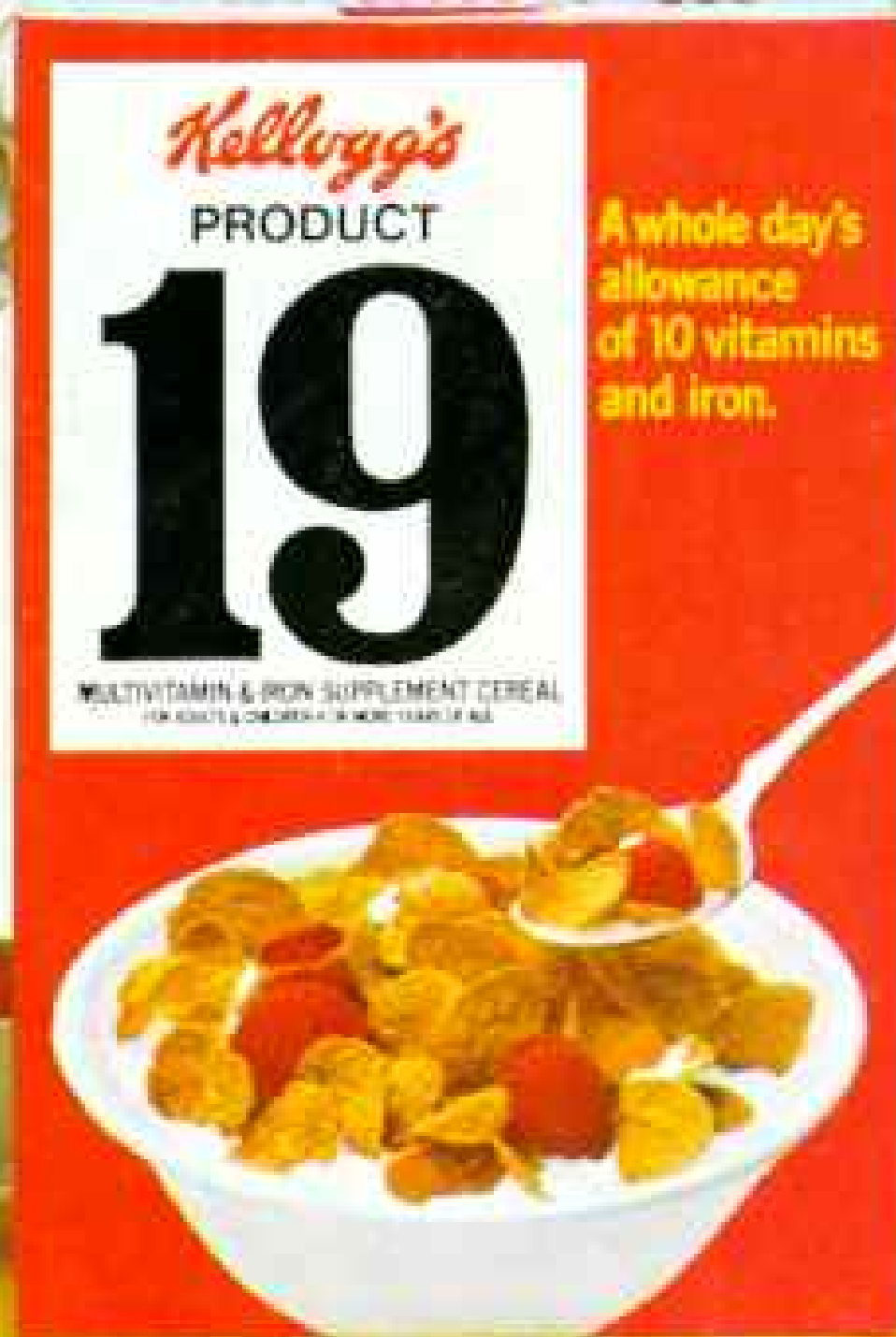
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My photographs... life's moments held suspended in time.

Special moments in life mean so much. You're sure you could never forget them. But, time moves inexorably forward, and even the most precious of moments fade into distant memories. Only photographs can keep them alive.

That's why photography has become so important to me. It lets me reach into the past and see it as it really was. It helps me preserve the present, which too soon becomes the past. But more important, I can capture the future, full of its surprises. Truly memorable photographs are simply beyond the capabilities of an ordinary camera.

I wanted a camera versatile enough for all those moments, built to last a lifetime and dependable enough never to let me down. I chose Nikon—the camera the pros depend on. I already knew Nikon was the best 35mm camera made, and when my dealer showed me the new, compact Nikon FM and how simple it was to operate, I knew it was the camera for me. And how right I was! My very first roll gave me sharp, perfectly exposed, color pictures.

Surprisingly, the Nikon FM costs very little more than an ordinary 35mm single lens reflex camera, yet it has all the feel and quality so traditional of Nikon. And, with all the interchangeable lenses and accessories that Nikon makes, there is just no limit to what I can do with my photography.

For details on the Nikon FM as well as a schedule for the traveling Nikon School of Photography, check your local Yellow Pages for the Nikon dealer nearest you. Or, write for Lit/Pak N-37 to Nikon Inc., Garden City, N.Y. 11530. Subsidiary of Ehrenreich Photo-Optical Indus., Inc. (In Canada: Anglophoto Ltd., P.Q.)

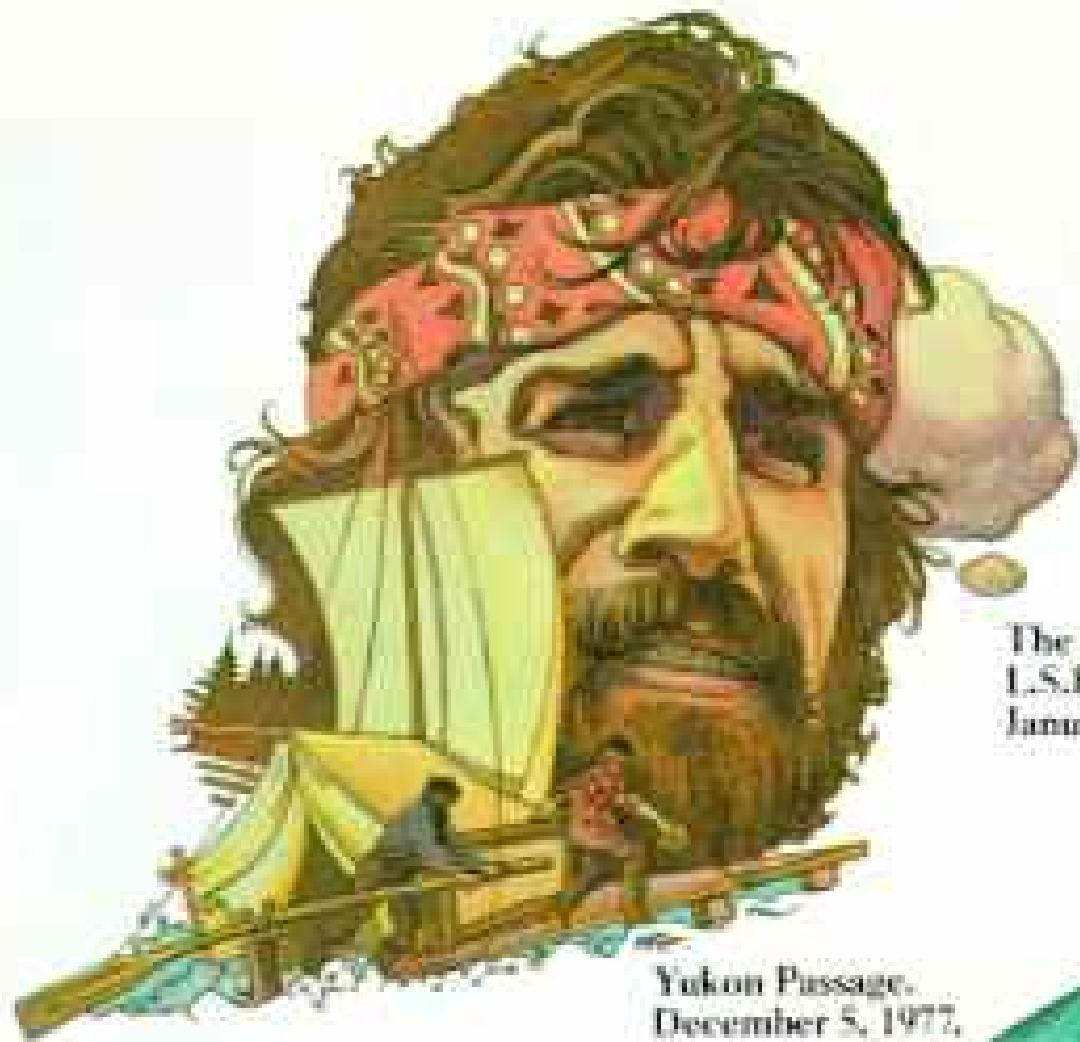
NIKON FM



© Nikon Inc., 1977

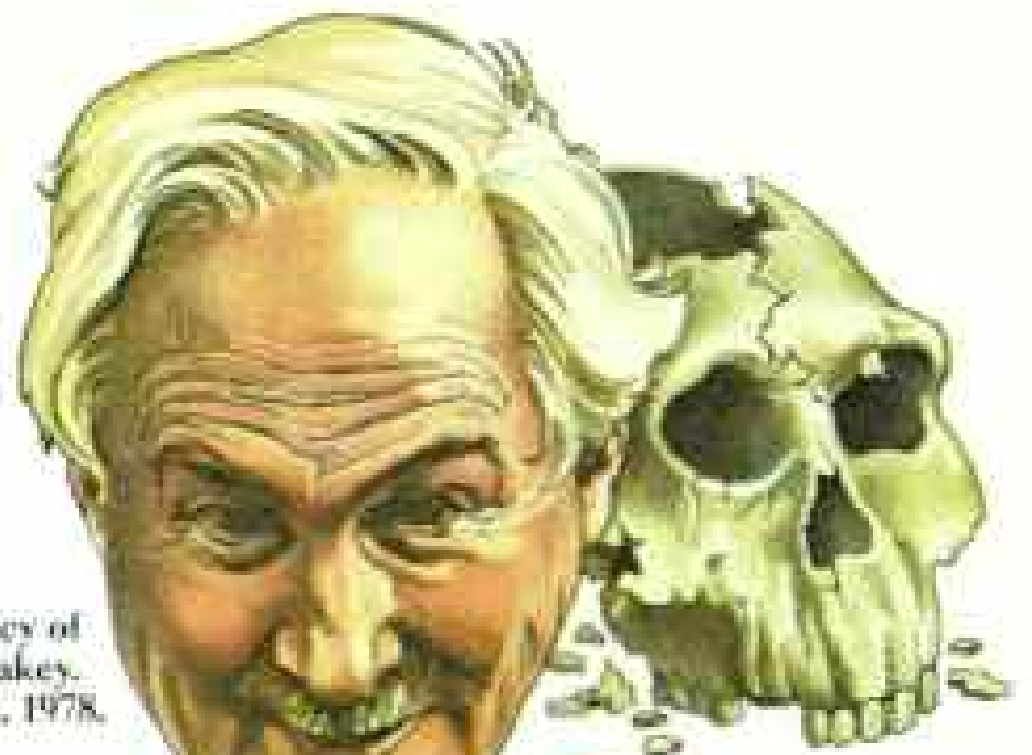


This year, it's a matter of survival.



Yukon Passage,
December 5, 1977.

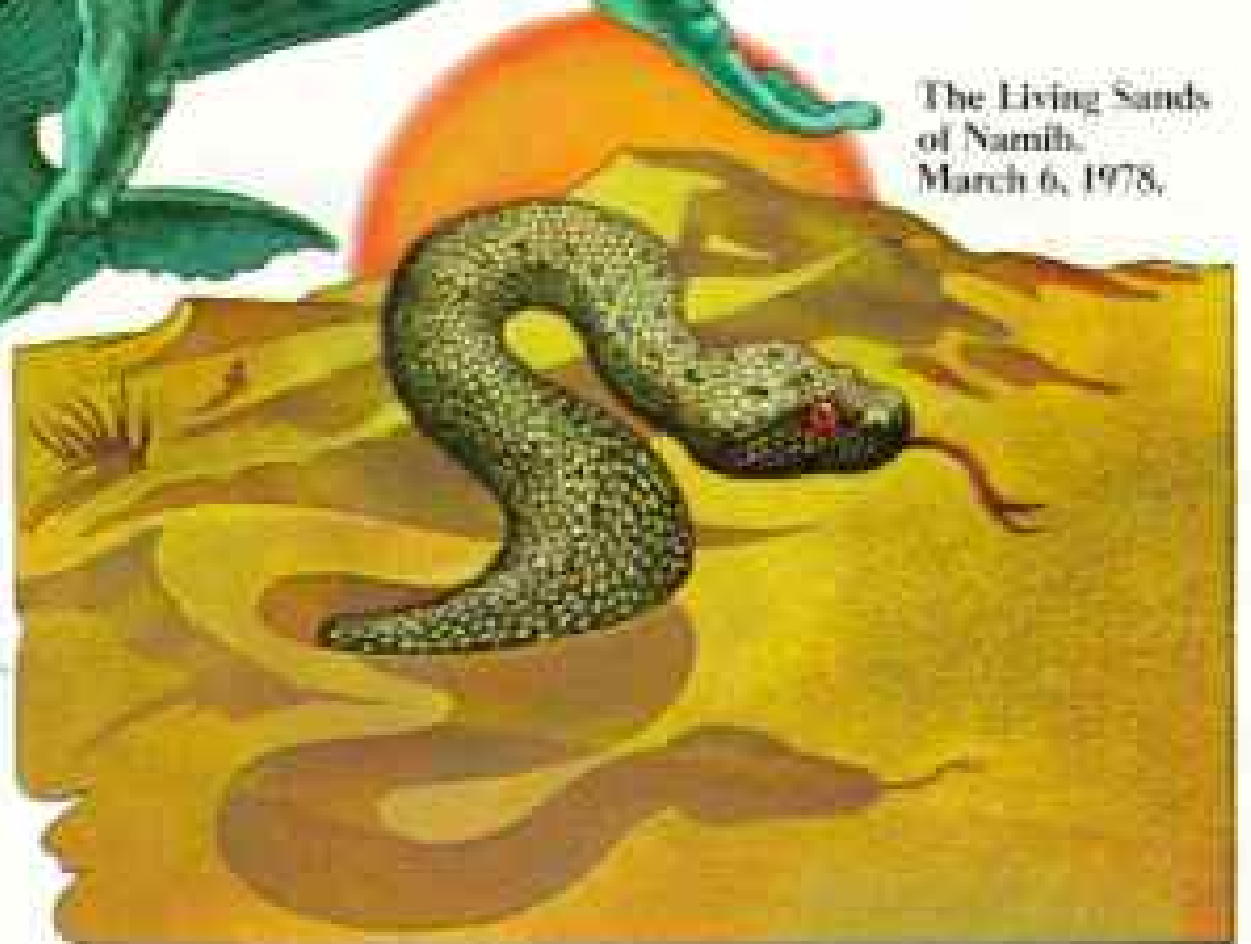
The Legacy of
L.S.B. Leakey,
January 9, 1978.



The Great Whales,
February 16, 1978.



The Living Sands
of Namib,
March 6, 1978.



The subject. Survival.

From the dawn of man to the endangered whale.

From the sand, wind, and scorching heat of the Namib Desert to the numbing, icy silence of the Yukon.

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Four exciting, American-made documentaries produced by the National Geographic Society and WQED/Pittsburgh.

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For the third thrilling season in a row. With two more years, eight more great shows to follow.

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