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Map Supplement of the Indian Ocean, Australia, New Zealand, and Malaysia

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THE NATIONAL GEOGRAPHIC MAGAZINE

So Oklahoma Grew Up

BY FREDERICK SIMPICH

WITH feathers in its hair, war-whooping Oklahoma still rode bareback when near-by Kansas and Texas already had English saddles, Paris hats, and Hamlet.

Little Rock, Dallas, even Denver, were big, busy towns that knew the taste of caviar and Havana cigars when coyotes still chased jack rabbits through what is now Oklahoma City. Today in this oil-scented State Capital fried rabbit is scarce at 50 cents a hind leg, and a furtive coyote in a cage soon draws a street crowd and a freckled girl who leaps from an Indiana car and cries, "Oh, ma! Come look at the wolf!"

In the Middle West of my youth we knew this near-by yet somewhat forbidden land vaguely as "Indian Territory." "If your foot slips," our elders said, "with the sheriff two jumps behind, scoot for the Territory!" Some did. In territorial days 65 U. S. deputy marshals were killed here trying to arrest outlaws and fugitives.

Up from this Territory each summer came Indian medicine shows. They've gone now, with bustles and buggy whips; but in their day they took the place of movies. Their painted Kickapoos would brandish their tomahawks at us boys and freeze our blood with their awful war whoops if we crowded too noisily about the mandolin-playing "doctor's" rostrum or heckled him in his harangue about the curative magic of "Kickapoo Indian Sagwah, good for man or beast" (page 286).

But why were neighbor States so long settled by whites when Oklahoma was yet held by Indians?

Ask Uncle Sam! First he brought here the Five Civilized Tribes—the Creeks, Cherokees, Chickasaws, Choctaws, and Florida Seminoles. That is, part of the Seminoles; the rest hid in the Everglades. In that swamp they still lurk when not shopping at Miami, and they are still technically at war with the United States.*

Later, with his soldiers, Uncle Sam rounded up many other tribes, mostly wild, and brought them here, too; but they didn't mix. He didn't know then that Cherokees and Creeks, for example, who liked to print books and plant corn, looked socially askance at Comanches and Apaches, who preferred scalps to seed catalogues.

Anyway, here they were, with Uncle Sam hoping to solve his Indian riddle in this one vast, Zionlike national home for red men. Why this plan failed is a curious story, too long and mixed up for any place in this article about the audacious, up-and-coming Oklahoma of 1941.

"Boomers" and "Sooners"

It is enough to say that homeseeking whites, when westward the course of empire took its way, clamored ever more loudly for homes in what is now Oklahoma. Again and again as "boomers," "sooners," and squatters, whites invaded the country, only to be ejected by puzzled American soldiers who felt the Army should protect whites from Indians and not vice versa. Cattlemen came, too, and leased open range from the Indians; many whites married squaws, were taken into a tribe, and thus gained property rights.

Railroads were built south from Missouri and Kansas across Oklahoma and down into Texas; and there were stations and towns in Oklahoma when it was still Indian country. You can see how Indian it was from their

* See "South Florida's Amazing Everglades," by John O'Reilly, NATIONAL GEOGRAPHIC MAGAZINE, January, 1940.

Photograph by R. Anthony Stewart

This Heroic Figure Depicts Woman's Place in the Conquest of Oklahoma

Stout of heart, grim, courageous, she braved the frontier to help her husband carve out a wilderness home. Known as the "Pioneer Woman," this bronze statue rises beside a boulevard near Ponca City. It was created by Bryant Baker.

Photograph by B. Anthony Stewart

In Such Prairie Schooners, Pioneers Conquered the Vast Western Plains

"Oklahoma or Bust!" says a motto on the canvas. That audacious spirit colonized this amazing State. This old wagon is preserved in the Frank Phillips historical collection on Woolaroc Ranch near Bartlesville (page 286).

many tribal names still on the map—Muskogee, Tahlequah, Oolagah, Chickasha, Waurika, Talihina, Tuskahoma, Okmulgee, Atoka, and so on into the night! (map, page 289).

Then came the first grand opening of free lands for whites.

Historic Hurdle Race for Homes

This spectacular "Run" of 1889 swept thousands of settlers into Oklahoma in a day. They swarmed like Israelites into a Promised Land. Uncle Sam was their Moses (page 279).

But they wasted no 40 years in any wilderness. Nor did they dawdle along after slow ox teams, in the manner of Oregon pioneers with banjos on their knees, singing "Oh, Susanna." Not they! Gambling for homes, they dashed into this Canaan on race horses or bounced over the hills in jolting buckboards and spring wagons, whipping their teams into a dead run; thousands more came in special excursion trains.

"I saw excited men jump from the windows of crowded coaches even before the train came to a stop," a railroad president told me, "and rush off to stake out claims in a cornfield that by noon next day was a busy tent city of 10,000 people. Drinking water cost as much as beer, and rivals shot it out over claim disputes."

Later on, still more free lands were drawn for by lottery, and otherwise opened to whites.

With an area about 8½ times the size of New Jersey, Oklahoma has some 54,500 oil wells and 35,000 dry holes with no oil in them. It has barefoot squaws who can cash fat checks, and other Indians, and part Indians, who gain prizes in painting and literature. It has huge refineries, pipe-line connections to the Atlantic Ocean, seas of yellow wheat, rolling ranges of bluestem grass dotted with fat, lazy kine—along with artists, orchestras, swanky clubs, and its quota of idle men and economic headaches (pp. 282, 298, 302, 314).

Photograph from Tulsa Daily World

Will Rogers Seems to Be Gazing Fondly at His Daughter Mary

She is the young lady looking up at the bronze figure, which she has just unveiled at Claremore. Jo Davidson, bearded sculptor, is seen in the lower left. At the microphone is Ernest W. Marland, who was Governor of Oklahoma when this picture was made on November 4, 1938. This bronze of the cowboy-humorist is like that in the Capitol at Washington, D. C.

What fantastic events have happened here in the short 33 years of this precocious State's turbulent life!

From the pell-mell, Monte Carlo manner of its settlement by whites to its poor Indians suddenly drenched in oily wealth, the bizarre case history of Oklahoma is unique in our annals.

Strange Turns of Fortune's Oily Wheel

This State had no youth. It mushroomed, instantly, from infancy to maturity; in fact, to premature senility in some regions of eroded farms and exhausted oil fields. In one lifetime people here saw the whole gamut of history from Indians chanting around campfires to prima donnas singing to clubwomen in air-cooled concert rooms.

Change was not only swifter here than in other States, but more spectacular, because of immigrant tidal waves and prodigious wealth from oil. I know one man who started life here driving a delivery wagon for a small store; now he owns a skyscraper and his own fancy stock farm.

Another showed me the 55-year-old white mule that he rode in the Run of 1889! He talks now more about this faithful beast than about all the wealth he has since accumulated (page 288).

"He wore a chef's cap and fried wieners in a tent," they told me of another pioneer. "Now he heads a big corporation."

Just here comes a note from our Editor-in-Chief, who as I write is motoring through the Southwest. "We drove our car *into* the hotel in Oklahoma City! Then to our air-conditioned room. A rose garden surrounds the hotel on three sides; next to the rose garden is a derrick, from which the hotel proprietor has taken $500,000 worth of oil! Three blocks away is the State Capitol with oil derricks crowded right up to its steps" (page 277, color; and page 292).

Sinking a "Slant Hole"

When they want to tap an oil pool that may lie under somebody's church or high school, they don't destroy the building; they don't even interfere with it. They simply commence drilling at some near-by point and sink a slant hole. They bend their well in any direction they wish.

This young State's gift to world knowledge of how to find and work oil fields, and its contribution of ingenious oil-drilling machinery that its exporters now scatter from Java to Baghdad, are alone enough to exalt it and give it a name. Away over in Persia (Iran), years ago, I saw Oklahoma well-shooters fighting fever and heat, dragging Oklahoma drilling machinery up the cholera-infested Karun River, using Oklahoma technique to open one of the world's richest fields.

Today top-hatted, white-tied Tulsa is called "the oil capital of the world" (pages 278 and 306, color). Foreign engineers and geologists are among the 200,000 guests who flock to its biennial International Petroleum Exposition; among other exciting events, a "hot papa" in an asbestos suit shoots out gas flares to show how real oil-well fires are extinguished with a charge of nitroglycerin!

These "hot papas" in fireproof pants walk about a fiery furnace as did Shadrach, Meshach, and Abednego; yet they seem a peculiarly American product. From Oklahoma they have been called to fields as far away as Romania to put out fires.

Small Wells Milked Daily, Like Cows

Oil made Oklahoma.

This State has yielded fabulous quantities of oil and oil wealth. In the Glenn Pool boom, I read, a cowman and a banker bought a lease for $700; without putting up another cent, they ran their holdings up till they sold out for $35,000,000!

Seminole was a typical boom town. In three weeks its population multiplied ten times. A story runs that coffee was 50 cents a cup, and that one man rented cot space in his hen house for $130 a month.

More is earned here from oil than from agriculture. At present 42 out of 77 counties are producing both oil and gas, and eight counties are producing natural gas but no oil.

Many of Oklahoma's early wells were "gushers," in the sense of being large producers, which flowed spectacularly over the top of the derrick. This was also true in the later development of the Oklahoma City pool. Now, the word "gusher" is used very loosely. To the layman it often means a well which comes in out of control and shoots into the air. In that sense, there are few if any gushers among Oklahoma wells today, because the industry has, as a whole, used precautions to bring in wells under control and with as little loss of oil and equipment as possible.

Furthermore, the output of all but the stripper wells (which are the little ones producing sometimes only a fraction of a barrel a day) is curtailed under proration, a method whereby production is limited in proportion to demand.

"The small wells are to farmers here what cows' teats are to Wisconsin dairymen," said Richard Lloyd Jones, owner of the Tulsa Tribune (page 305, color). "We milk them

Photograph by R. Anthony Rickert

Student Union Building, at State University in Norman, Is Center of Campus Life

This huge structure houses various student activities; it also includes a cafeteria, a large banquet hall, private dining rooms, the alumni offices, reception hall, and guest rooms. This seat of learning was opened to students in 1892.

every day, as if they were cows. Just as big dairy barons buy milk from men who own two or three cows, so big oil companies here buy from farm owners who pump a barrel or two of oil a day."

Enough oil has come from this State to load a train of tank cars stretching 163,726 miles, or six and a half times around the earth at the Equator. Oil pays half the State's taxes.

Oil pipe lines cover this State as wire fences cover Iowa—24,500 miles of them. But because they are underground, the public seldom sees these pipes and is unaware of their nation-wide extent, or that the net cost is billions. By switching from one pipe system to another, gasoline could flow from here to the Atlantic seaboard.

From 11 to 12 percent of all our natural gas comes from this State. Though not the largest in the State, Tulsa is a huge distributor. From it gas flows to more than 60 cities and towns and is much burned by glassmakers, cotton gins, light and power plants, smelters, steel mills, and oil refineries.

Story of Oil Seen from One Spot

"One of the few places in the world," they tell you, "where the entire cycle of oil, from well to motorcar, can be seen from one spot is the roof of Continental Oil Company's building in Ponca City, Oklahoma. There, six stories above the plains over which the Cherokee Strip pioneers once rushed in the wild scramble for new land, may be seen the entire story of petroleum: its discovery in the oil field, its transfer by pipe line to the refinery, its processing and manufacturing, its shipment to distributors throughout the world, executive administration of the entire cycle, and final delivery of the finished product to the consumer's motorcar" (opposite page).

Now let us meet some people here and go riding with them.

"My New York actor father came here in

This Ponca City Plant of the Continental Oil Company Includes Every Aspect of the Business Except a Producing Well

In the foreground is the company's office building; at lower right is a baseball diamond for employees; and above lies the "tank farm," holding millions of barrels of crude oil. Beside the Santa Fe Railway tracks (left) are loading racks for tank cars, stills, storage tanks, and smokestacks of powerhouses. Scattered about are operating units incident to the making of gasoline, fuel oils, and by-products. What you can't see, also, are miles of underground pipes (opposite page).

boom days, playing Shakespearean roles," said a musician. "But busy oil-well shooters then had no time for make-believe fights and stage murders of Macbeth or Hamlet. They had bad actors of their own! Oklahoma hills swarmed with real killers and conspirators. So papa took off his tights, pawned his sword and scenery, and went into the candy business.

"His timing was perfect. Oil was just making Indians rich; they had lots of fresh meat, but not enough gumdrops, horehounds, caramels, all-day suckers, butterscotch, and candy dogs—so papa went to town. He even quit reading Shakespeare himself and took to Wild West novels and the Indian sign language—that's what this country can do!"

They tell you of two other men, now rich and powerful, who got their start singing hymns at funerals.

In the 20-story Mayo Hotel at Tulsa, a Tribune reporter was talking to me when up stepped a trim, silver-topped man with whom the years had dealt gently.

"I heard them page you," he said. "I know you. I'm John Mayo. Years ago you rode horseback to Missouri country school with my brother Cass and me. We built this hotel. Cass is in the Mayo office building, up the street."

"Doc" Mundy—otherwise H. H. Mundy of Pawhuska—took a dental course, then turned cowboy. On some 23,000 acres of nutritious bluestem, he fattens herds brought up from Mexico and Texas.

"Here it takes only five acres of grass to feed a steer," said Mundy, "as against twenty or thirty in drier range country.

"Bovine tidal waves sweep from the south

every spring—cattle by endless trainloads. They graze here ninety days, put on maybe over 300 pounds apiece, then ride on to market. Some are regular tourists; they ride here from Mexico, then as far east as Buffalo or Rochester. That's getting plenty mileage out of a steer!

"Wolves bother us. I run 'em with greyhounds.

"That's Johnson," he said, pointing to a slim black dog (page 311). "He's killed over 300 prairie wolves, or coyotes. About seven years ago he got mutilated in a fight with a wolf; ever since, he's been getting even. Last week he chased a wolf into a pond, rushed right in, grabbed the wolf and swam ashore with him; then picked out a dry spot and killed his foe.

"A wolf can whip the average dog. Usually two of my greyhounds gang up on the enemy. They hate wolves; if they hear one howl out on the range in the middle of the night, they rush off into the dark and get him.

"How greyhounds can run! I timed mine with my Dodge; they made better than 34 miles an hour."

Four-footed Cowboy

"Doc" called a cowboy with a trained cow pony to show us how these horses work. Cutting a cow from the herd, the cowboy left his mount to work alone. Whichever way the cow started, the pony would head her off. Several times he turned her so quickly that she slipped and fell. Finally, exhausted, bewildered, the cow stood dead still and stared into the pony's face as if to say, "Well, just what is it you want me to do?" Thus the trained horse, without any guidance from his rider, had completely subdued the half-wild bovine.

Here, too, are the people God loves, as Lincoln said, because he made so many. Not everybody got rich. You see lots of "Joad" families, moving aimlessly in ramshackle rigs, camping beside creeks or water holes.

To one park in Oklahoma City old men come early. All day they play dominoes or casino. Sometimes they quarrel and throw the cards at each other; but always they come back, even in winter, bringing blankets to wrap their legs in (page 313).

"Some of them have been coming for years," said the playground superintendent. "Always they take the same seats, as regular as school children. At night their children or their grandchildren come to take them home."

"Sure I'm a barber," agreed a woman in Oklahoma City, as she skillfully stropped a razor and renewed her scraping on a sunburned cowboy's week-old stubble. "I own this shop, too. Men dress women's hair; turn about's fair play!" (Page 288.)

Living is cheap. Signs read: "Square meals, 15 cents, with meat, vegetables, salad, bread and butter, coffee, tea or milk." But just around the corner, at a good hotel, a prime steak is still $1.50.

In one gastronomic publicity prank, booster clubs served roast crow. "But it didn't catch on," they said. "Crows by millions plague us; they're a nuisance. In our fight on them we often bomb their roosts, setting off the charge with electric wires. After such a blitzkrieg, we haul off dead ones by the truckload" (page 293).

For 125 Years Men Have Swarmed Down "Texas Road"

Down into east Oklahoma, Route 69 parallels old Osage Trace, wilderness trail blazed by St. Louis fur traders soon after 1800. Later called the "Texas Road," this route, with the Santa Fe Trail,* became a path of empire. Its emigrant tide planted cities across the Southwest: Springfield, Joplin, Tulsa, Oklahoma City, Fort Worth, Dallas, Houston.

Over this road streamed homeseekers to settle Texas—sometimes 1,000 covered wagons in a week. Lanky, tobacco-chewing Missourians walked beside the creaking wagons popping their long whips over straining oxen's backs. Civil War regiments of the North and South, priests, explorers, freighters, fugitives from justice, herds of wild horses being driven north—all passed this way.

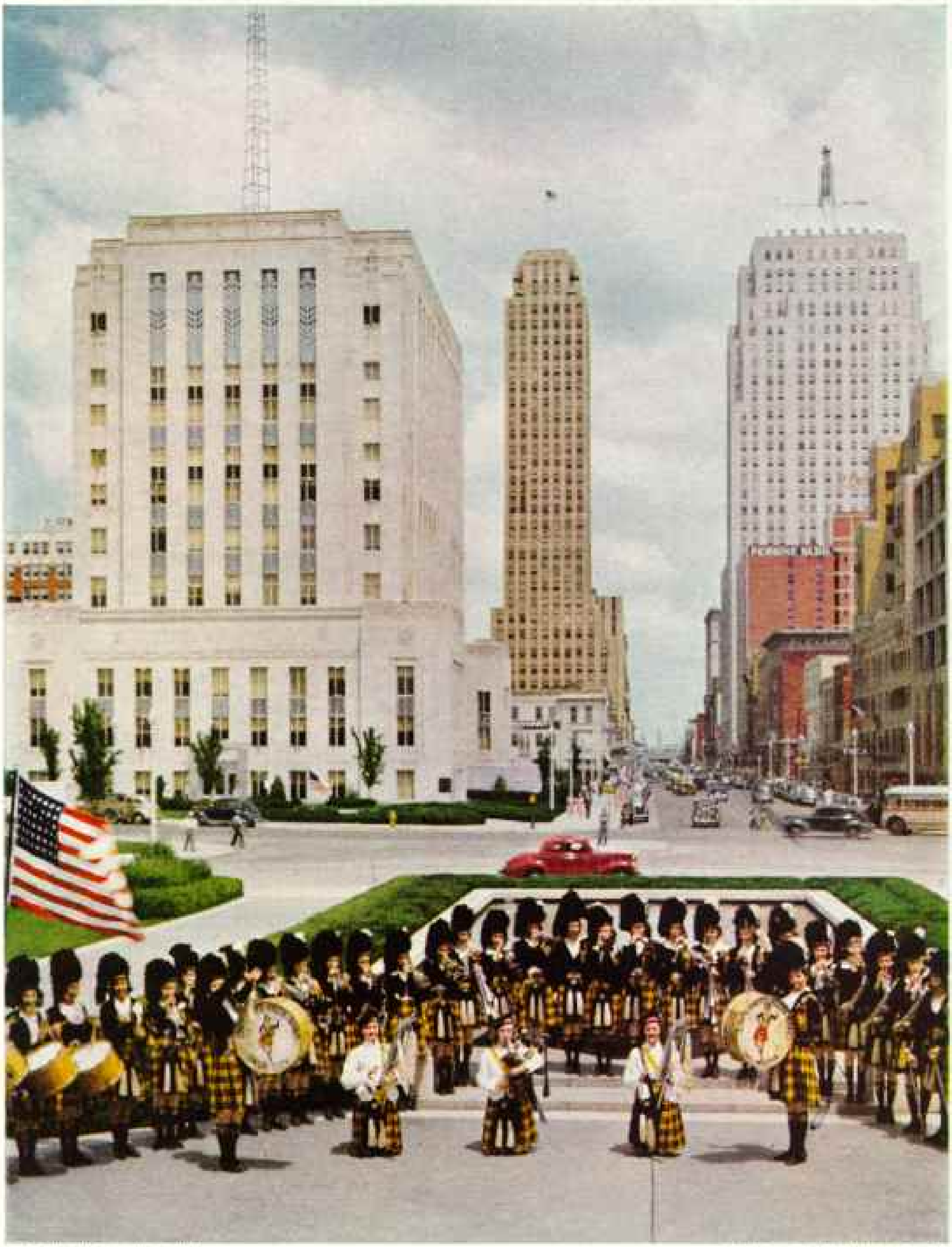
Today's smooth, high-speed roads show how Oklahoma has changed since Washington Irving used this route in 1832 and wrote his *Tour on the Prairies*.

Coming south, "69" leads past busy lead and zinc regions marked by miles of gray, wind-blown slag heaps. No earth scars made by man are more depressing. They look as if elephantine prairie dogs had burrowed long leagues of holes, big as railroad tunnels, then thrown up hills of powdery waste.

But when you lick fried chicken gravy from your fingers at bustling Miami, grown rich from lead and zinc, you can also imagine that the big prairie dogs dig up a lot of wealth along with all that slag!

"In recent years Oklahomans have written more than 2,000 books," says your companion. "The deeper into the State you get, the more writers you'll find (page 285). But right

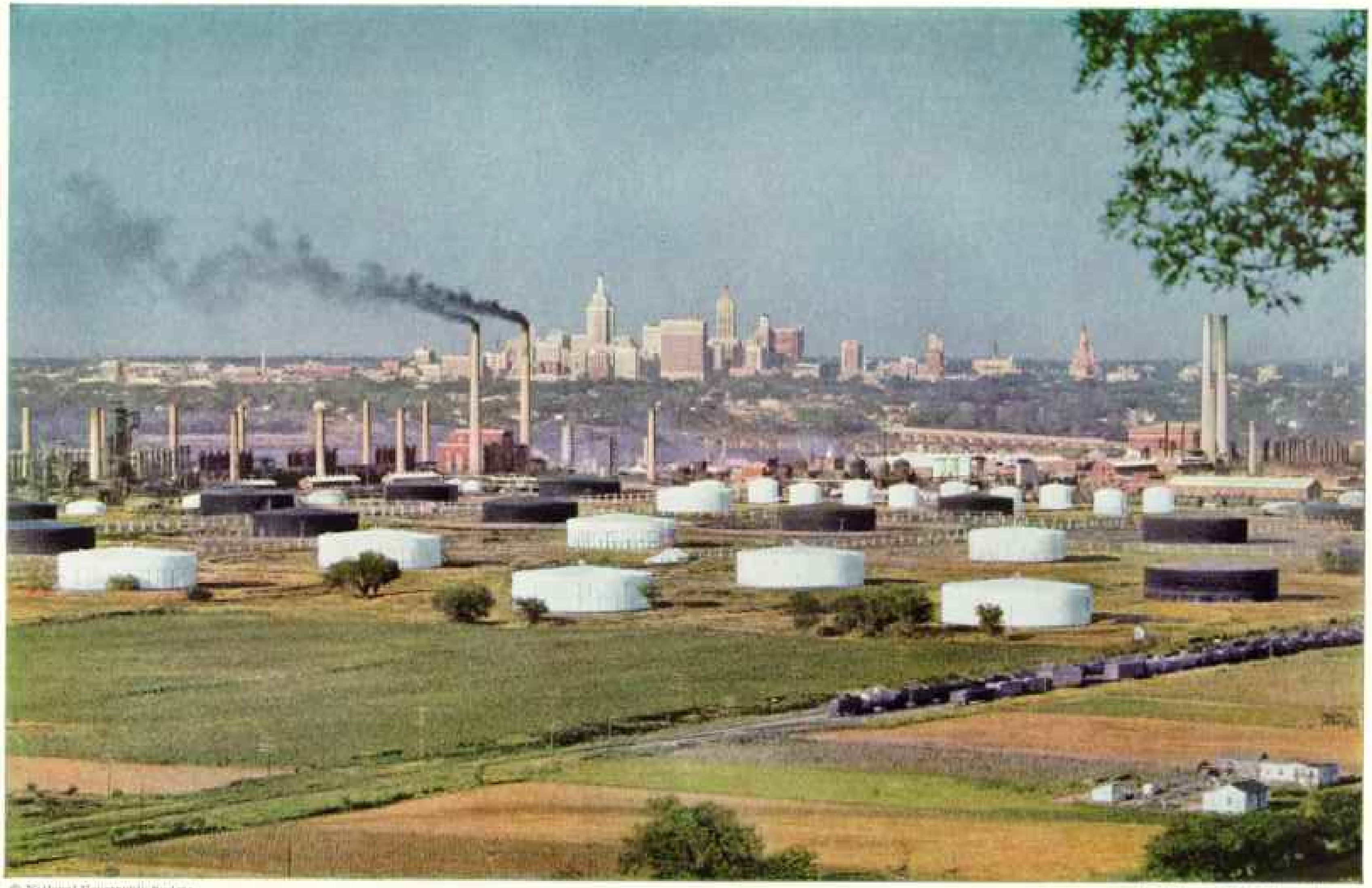
* See "Santa Fe Trail, Path to Empire," and "So Big Texas," by Frederick Simpich, National Geographic Magazine, August, 1929, and June, 1928, respectively.



 Kodachrome by B. Anthony Stewart

"Hoot, Mon! Hear the Pipes When We Play *The Campbells Are Comin'*"

Here the girls' Kiltie Band of Oklahoma City gives a concert in the Civic Center. In background is First National Bank (right); next, Ramsey Tower, and, at left, the Civic Center Building. Oil wells invade the very heart of this rich city, even almost touching the State Capitol.



Kodachrome by B. Anthony Stewart

This Tulsa Picture Tells the Dramatic Story of Colossal Achievement After a Young State Struck Oil

Coyotes chased jack rabbits here only a few years ago. Then came oil. From a "wide place in the road" Tulsa mushroomed to power and wealth. Now it's the world's oil capital. In the foreground is a Mid-Continent refinery.

Painting by Robert W. Lindneux

Settlers Rushed in to Stake Claims on Free Lands When Uncle Sam Opened the Oklahoma Country in 1889

Eyewitnesses say this scene of the "Oklahoma Run" is correct but for the man on the high bicycle—the ground was too rough for that. From Fido to patient ass, everybody hurries. One man wallops his galled horses while his wife clutches the seat. Gripping his rolled white flag, the rider at right is all set to jump off, when he reaches a likely spot, and stake his claim. In one day tens of thousands of settlers poured in.

Kodachrome by B. Anthony Stewart

"Look 'Em Over, Boys," Said the Radio Broadcaster, "They Can Ride Anything with Hair on Its Back!"

Neighbor States, Oklahoma and Arkansas, compete at Fort Smith to see whose cowgirls can ride, rope, and look the best. Perched on this corral fence is the Oklahoma team. At work on a real ranch, honest-to-goodness cowgirls wear old overalls, dusty boots, and slouch hats. But at rodeo shows they appear like mannequins in fashion parades.

Freckles Figures Her Chances to Win

With cool, calculating eyes, she takes her rival to pieces. "Her horse is faster—and her saddle's more showy. But my pinto knows all the tricks . . . and I'm quicker with the rope. We'll see."

Kodachromes by B. Anthony Stewart

Two Oklahoma Thoroughbreds

This brunette brought her mount to the State Fair Grounds at Oklahoma City to compete in a roping, riding, and bulldogging show. Some of America's finest horse-breeding farms are in this State.

Kodachrome by B. Anthony Stewart

Where Indians Shot Buffalo a Few Decades Ago, Seas of Yellow Wheat Ripen Now under Oklahoma Suns

This field lies near Chickasha, on the road south to Fort Sill, built to war on Indians. Past here went the millions of snorting, bawling cattle driven north from Texas to Kansas when Dodge City was the cow capital of the world and the West was wild.

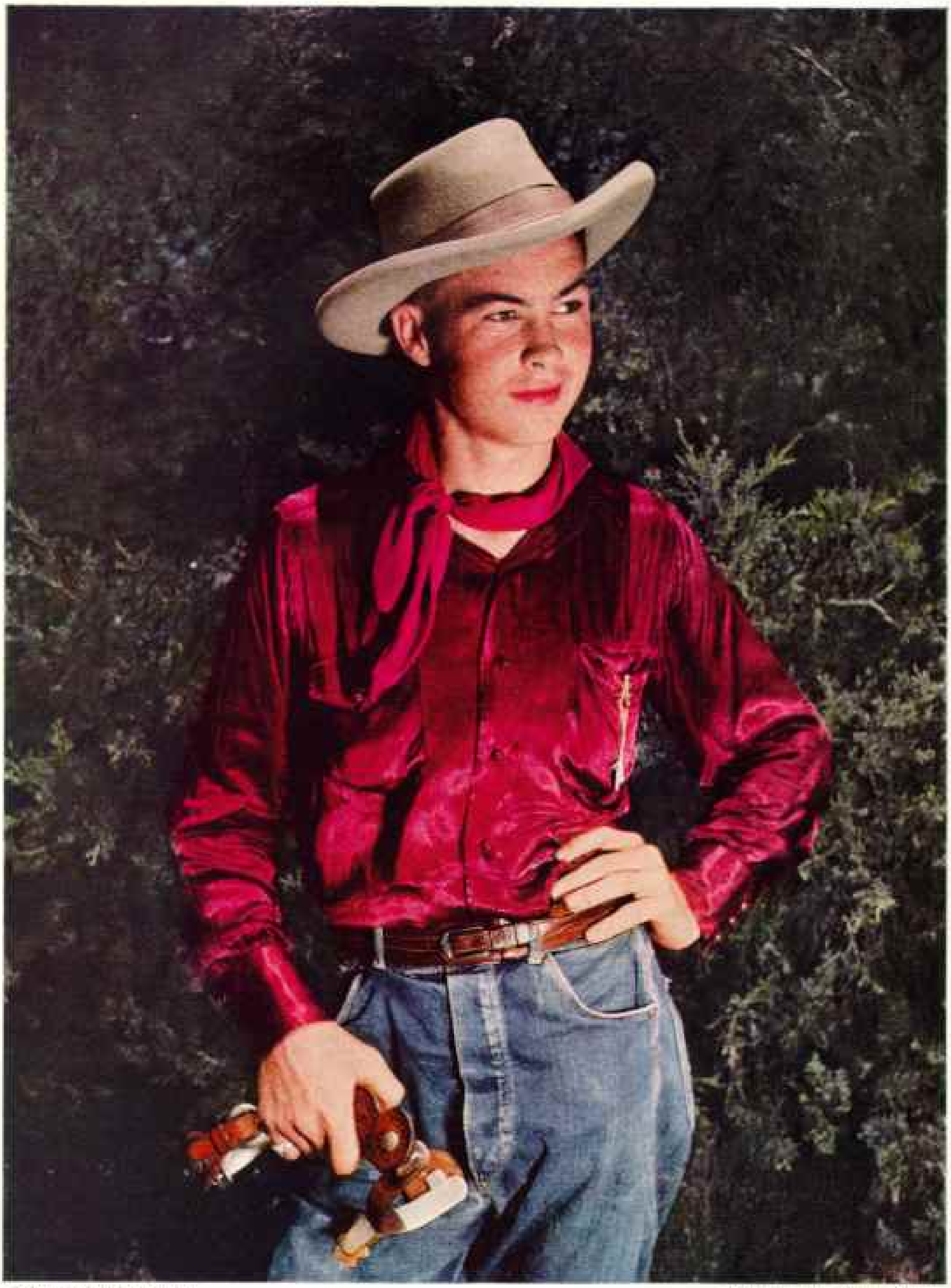
"Now Please Don't Dub This a 'Corny' Picture!"

So pleaded these guests at Frank Phillips' Woolaroc Ranch near Bartlesville, where he raises everything from mint beds to zebras.

Kodachromes by B. Anthony Stewart

The Quick and the Dead at Oklahoma University

With other University scientists she explored old Spiro Mound, from which came the odd god beside her and 100,000 pearls and other beads.



 Kodachrome by B. Anthony Stewart

Equine and Bovine Sartorial Effects Set the Style in Oklahoma

No real "buckaroo" ever roped a cow or branded a calf while wearing a silk shirt! But the whole West has gone cowboy mad; today more big hats, boots, and spurs are worn on dude ranches and in high school than ever were in ante-wire-fence days, when old-fashioned cowboys rode the range from Dodge City to Santa Barbara.

here at Vinita, in the Eastern Oklahoma Hospital, a patient wrote one of the most remarkable of all, *Behind the Door of Delusion.*"

To Vinita pleasure seekers swarm to swim, sail, and fish on the new lake created by Grand River dam, longest multiple-arch dam ever built—6,565 feet, including spillways.

It was dreamed of for fifty years, and the initial stages of the task are now complete—the construction of the 51-arch Pensacola Dam and the formation of a lake with a shore line of about 1,000 miles.

Graveyards had to be moved and a whole town evacuated, with roads, railways, and pipe lines all relocated and forests cut and hauled away. Now from the dam the State gets, Samsonlike, new-found electric strength. Two additional dams, at Markham Ferry and Fort Gibson, will complete this mighty hydroelectric project.

Near Pryor is Robbers Canyon, where men and boys still dig for gold coins reported buried here by the James boys after a bank robbery. They say Jesse James cut a rattlesnake on a stone, its head pointing to the treasure! Then he was killed, and nobody has ever been able to locate the snake rock.

On Grand River stands Salina, where Auguste Pierre Chouteau, French trader from St. Louis, lived with Rosalie, his Indian wife, and entertained Washington Irving. Springs near Salina are still as briny as when Osages made salt in huge iron kettles still scattered hereabouts.

Log Stockade Restored

Veer east from Route 69 near Mazie village, and you come to the site of old Union Mission, founded by men and women of the United Foreign Missionary Society of New York in 1821. Notes they kept afford vivid glimpses of Oklahoma's life 120 years ago.

Fort Gibson, over on Highway 62, is an old log stockade. As restored now by the Oklahoma Historical Society, it shows you exactly what these Indian forts were like. This one's importance in the conquest of the West is proved by the long list of officers who served here. To old files these are familiar names: Henry Dodge, S. W. Kearny, Braxton Bragg, Albert Sidney Johnston, J. E. B. Stuart, Kirby Smith, Pierce Butler, B. H. Grierson, Matthew Arbuckle (page 290).

Henry M. Stanley, later to meet Livingstone in Africa, passed this way writing early adventure articles.

From this old fort Jefferson Davis, then a lieutenant, left for Kentucky to marry the daughter of Zachary Taylor, against the latter's wishes.

As you cross Arkansas River Bridge on Highway 69, you can see where the Grand and Verdigris Rivers flow into this larger stream. Below here we turned off to Bacone Indian College. It was graduation day for Indian boys and girls. In caps and gowns they marched into chapel, proud and dignified. We heard them sing—a chorus of beautifully trained voices, yet wild, strong, emotional, hinting at old tribal chants (page 291).

Indian Artist Lectured at Oxford

In near-by Muskogee we talked with the noted Indian painter Acee Blue Eagle and watched him work on some murals. He was once called to England to lecture.

"I had lots of fun, especially with the students at Oxford," he said. "They insisted that I must always put on my feathers before I took the rostrum, so I'd look as they thought an Indian must look."

"How did you get your name?" I asked.

"When I was born, my father looked around and told my mother he saw a blue eagle.

" 'That's it,' she said.

"In our tongue, 'that's it' is *acee*. So I got my name: 'That's It! Blue Eagle.' "

All Tahlequah, former capital of the Cherokee Nation, was in uproar. More than 2,000 people milled around the streets, shouting and laughing over a greased pig contest (page 294). Shaved, greased, and set loose by stock raiser Shelton Lawrence, the slippery sow had bolted into an ice cream shop! There two boys grabbed her. Question for the judges: Which boy actually got the strangle hold that put the sow down for the count?

Here at Tahlequah Indians printed the first Oklahoma newspaper, the Cherokee Advocate, partly in English and partly in the "talking leaf" letters invented by Sequoyah (page 296). They say his alphabet was so simple—or the Cherokees so smart—that with it they could learn to read in a few weeks!

Oklahoma Swarms with Writers

Oklahoma's huge output of writing and printing has drawn much attention to the State (page 312).

White settlers rushing in brought presses and started papers. First they broke the sod, then they broke into print. Or, as a Tulsa editor said, "We brought in ink wells; then oil wells."

The *Handbook of Oklahoma Writers* covers 308 pages and lists hundreds of writers either native or sometime resident here. In literature, as in the science of petroleum geology, the State is precocious.

Photograph by B. Anthony Stewart

"Cures All Aches and Pains That Man Is Heir To; and It's only 50 Cents a Bottle!"

"Step right up, ladies and gentlemen, while the little girl on my right sings her song! Remember, your money back if you're not satisfied." "Little Doc Roberts" pitches his old-time medicine show on vacant lots in Oklahoma City suburbs.

Pulitzer prizes, Guggenheim Fellowships, Book-of-the-Month choices, and other awards have gone to local writers. Burton Rascoe, author and critic, started his writing career on the Shawnee Herald.

Lynn Riggs, of Cherokee blood, wrote *Green Grow the Lilacs* and other plays, and such screen dramas as *The Plainsman* and *The Garden of Allah* have felt his touch.

Throughout the American academic world both Grant Foreman and Edward Everett Dale stand high as authorities on Indian history.

Stanley Vestal's biographies of Kit Carson and Sitting Bull are authentic, colorful contributions to the unfolding annals of high adventure on the plains.

Zebras, Diamond-set Saddles, and Ruins

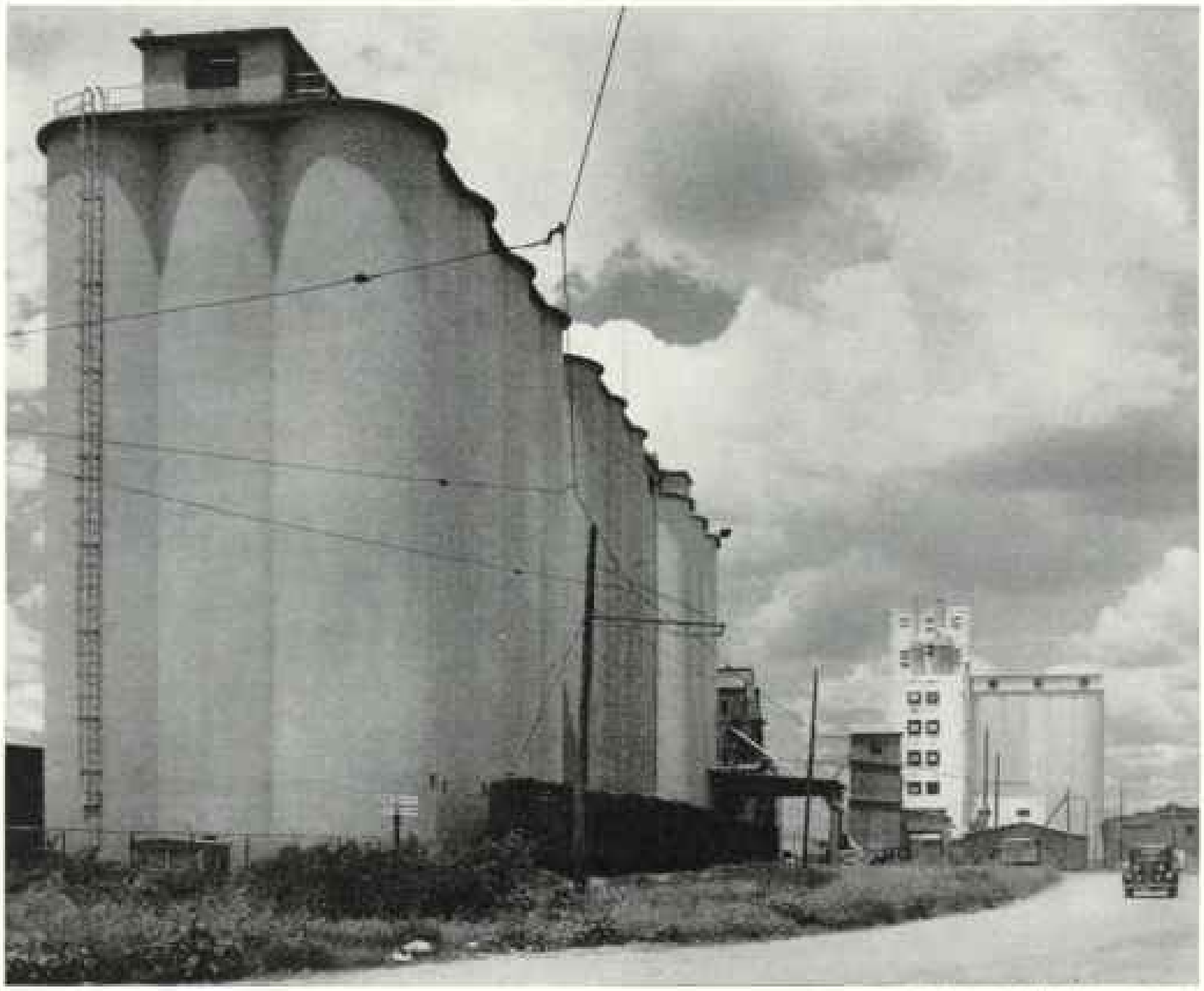
Students far and wide know the Frank Phillips Historical Collection in the University Library at Norman.

This rich mine of ancient documents, maps, rare books, woodcuts, and old photographs of early Oklahoma scenes represents the painstaking work of many years. You wonder how Mr. Phillips finds time to head the great petroleum company that bears his name and yet gratify his taste for history, archeology, and the personal management of a fancy livestock ranch.

Zebras frisk about this Woolaroc Ranch, near Bartlesville. Half-tame Canadian wild geese fly about its lakes. Peacocks, buffalo, elk, ostriches—they're all here. When Phillips himself comes out in the cool of the evening, from his tower in Bartlesville, and walks in this Garden of Eden, he says he feels like Adam.

"I've got 'em all here," he says, "two of every kind. If another Flood comes, all I'll have to do is build an ark!"

Unexpectedly, from a lonely hill road, you plunge suddenly into this spectacular ranch.



Photograph by H. Anthony Stewart

Giant Grain Elevators Tower Above Golden Wheatfields Near Enid

These elevators of the Great Plains are an original type of American architecture. In such enormous multiple cylinders enough wheat can be stored to feed a fair-sized city through many years of famine (page 300). After the grain is lifted to the top by conveyer, it is weighed and cleaned before storing.

Past huge effigies of painted Indians and decorated sheet-iron tepees, past big birds, real and cast iron, you come to the most astonishing feature of all—an art gallery hung with works of famous Western painters, and a museum with curiosities ranging from a miniature prehistoric village to the first theater program printed in Oklahoma (page 271).

"This old chuck wagon won first prize," says your host, "the year we held our Cow Thieves Reunion. This $10,000 show saddle was used in the 101 Ranch Wild West Show. Owned by Colonel Zack Miller of Ponca City, it is set with 166 diamonds, 120 sapphires, 14 rubies, and 4 garnets, and mounted with 15 pounds of gold and silver. Here's Pawnee Bill's portrait. This row of paintings is all Remingtons. . . ."

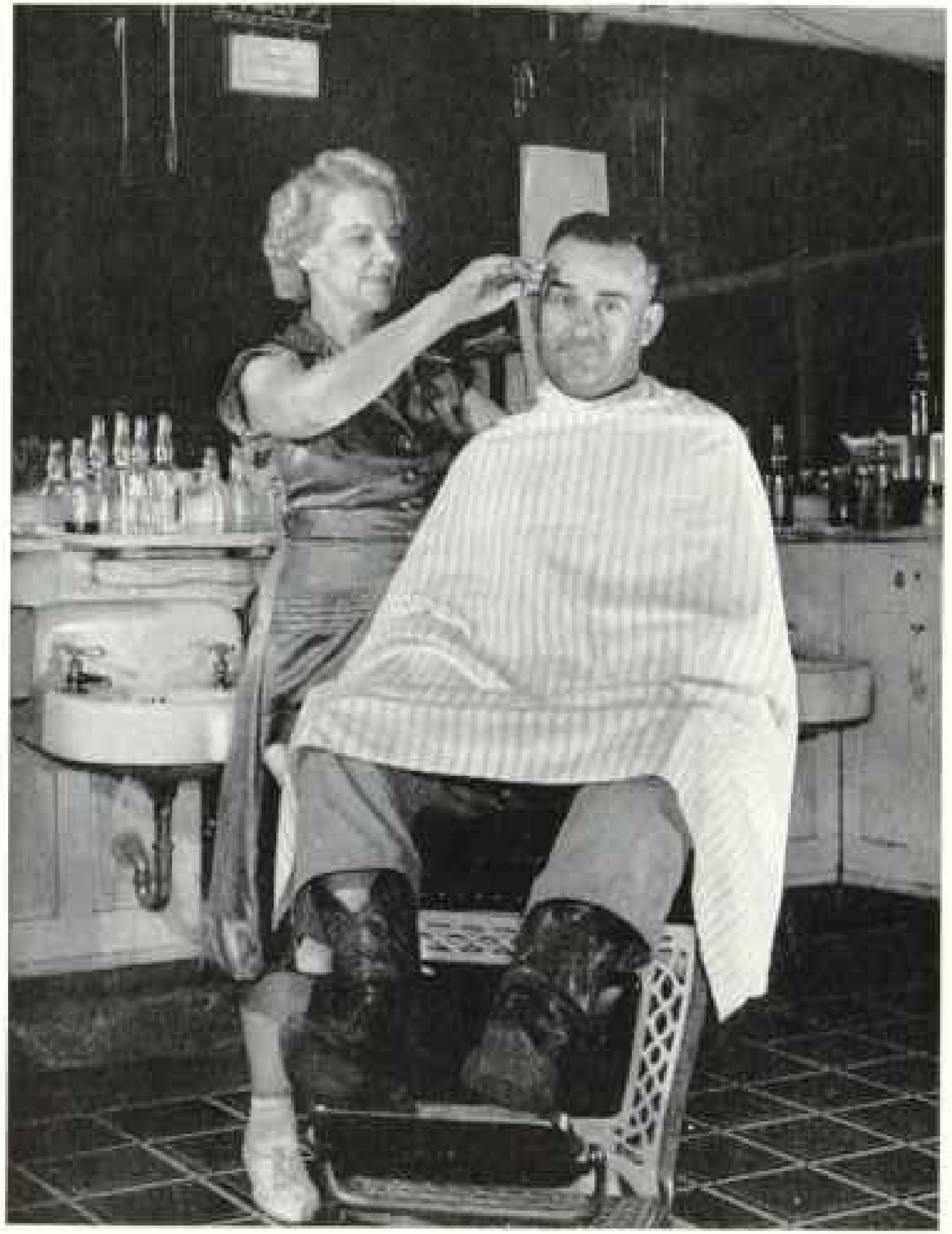
Here at the big ranch house, always lively with guests, you may hear anything from homemade limericks about Woolaroc zebras to tales of early Oklahoma outlaws' adventures, or news of the latest Indian mound excavations.

When we took interest in scientists as grave robbers, our host reached for the long-distance telephone. Then he said, "I fixed it for you. Go to Norman and talk to Dr. Forrest Clements; he teaches archeology at the University. His contributions to knowledge about our State long centuries ago are enormous. For Woolaroc Ranch Museum he built that model village that shows what life was like here before the Plains Indians came."

Mounds Yield Light on Ancient People

"People lived here long before the buffalo-hunting Indians came," Dr. Clements says. Yards of matched pearl beads dug from prehistoric Spiro Mound in LeFlore County are among the proofs (page 283, color).

Stone effigies of men, some lewd, some formed as large tobacco pipes, came also from this mound, along with weapons, ceremonial



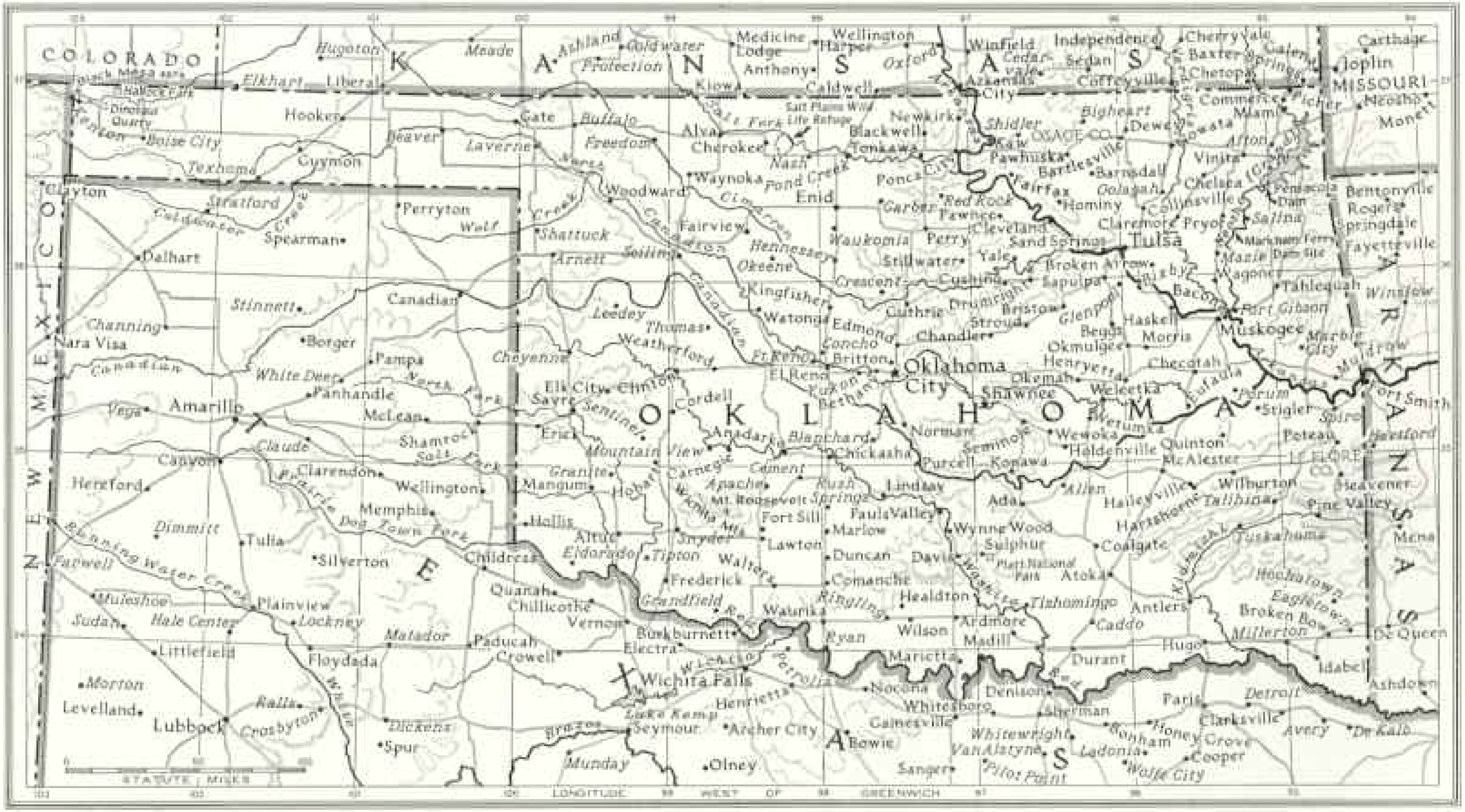
"Hold Still, Cowboy, or I Might Snip off An Ear!"

And he holds still! As a cowman who's marked many a calf ear, he knows it hurts! For years "Billy" has owned and run her own barber shop in Oklahoma City and has many regular customers among cattlemen. In this young, robust State, men and women may compete on equal terms.

Photographs by B. Anthony Stewart

For 55 Years This White Mule Has Watched the West Grow Up

In 1889, with the man beside him, he made the "Run" into Indian Territory. Since then they've seen Oklahoma change from a wilderness into a populous State. Time has brought wealth to the man, but neighbors say he still prizes the patient old mule.



From the Wooded Ozarks West to Empty Deserts, Oklahoma Includes Oil Fields, Cow Ranches, and Fertile Farms

Busy towns and cities, educational institutions, factories, refineries, and ranch homes dot the prairies now where Indian tribes were supreme only a few decades ago. At noon, April 22, 1889, when the Oklahoma Territory was thrown open to settlement, homeseekers by thousands rushed in—the first "run" of its kind in American history (page 279, color). Indescribable confusion ensued, until law and order could be established. For final proof of right to a free homestead, the settler had to show that he was first to claim it. On November 16, 1907, the State of Oklahoma was formed from Indian and Oklahoma Territories.

Photograph by L. E. Smith

Lacking Sawmills or Lumber, Many Pioneers Built Sod Houses with Dirt Floors

Hoops and canvas from this settler's covered wagon are piled by his "soddy," pictured in 1890. In hard times pioneers picked up and shipped buffalo bones to fertilizer and other factories to earn cash for food and clothes. A few Oklahoma soddies are still occupied.

Photograph by B. Anthony Stewart

This Replica, Near Muskogee, Stands on the Site of the Original Fort Gibson

With officers' quarters, barracks, mess hall, and deep well all enclosed by log stockade, it is a perfect example of an early western army post built for Indian defense. Names of some officers who served here, listed on placards, include Robert E. Lee, J. E. B. Stuart, Albert Sidney Johnston, and Kirby Smith (page 285).

Photograph by Hugh M. Davis

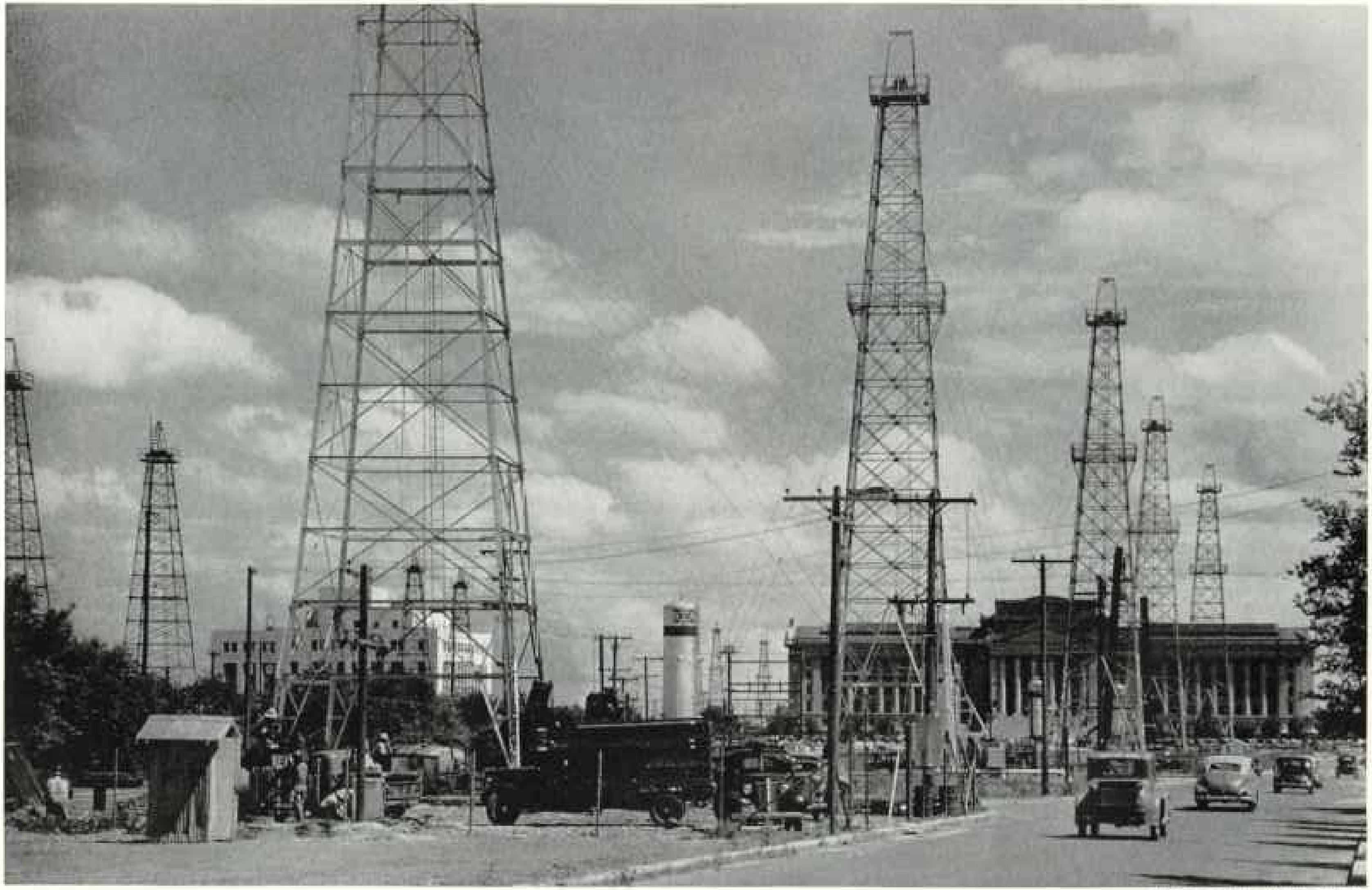
Children Watch Choctaws Take Fish by Stupefying Them with Poison Weed Juice

This is an old Indian trick. In Oklahoma cypress swamps, devil's-shoestrings, or goat's-rue, is used. Pounded on a log or stake, its juice runs down into the water and intoxicates fish. They soon float belly up and are easily caught. The chemical in the plant is used commercially in insect powder.

Photograph by R. Anthony Stewart

President B. D. Weeks of Bacone College Presents Diplomas to the Class of 1940

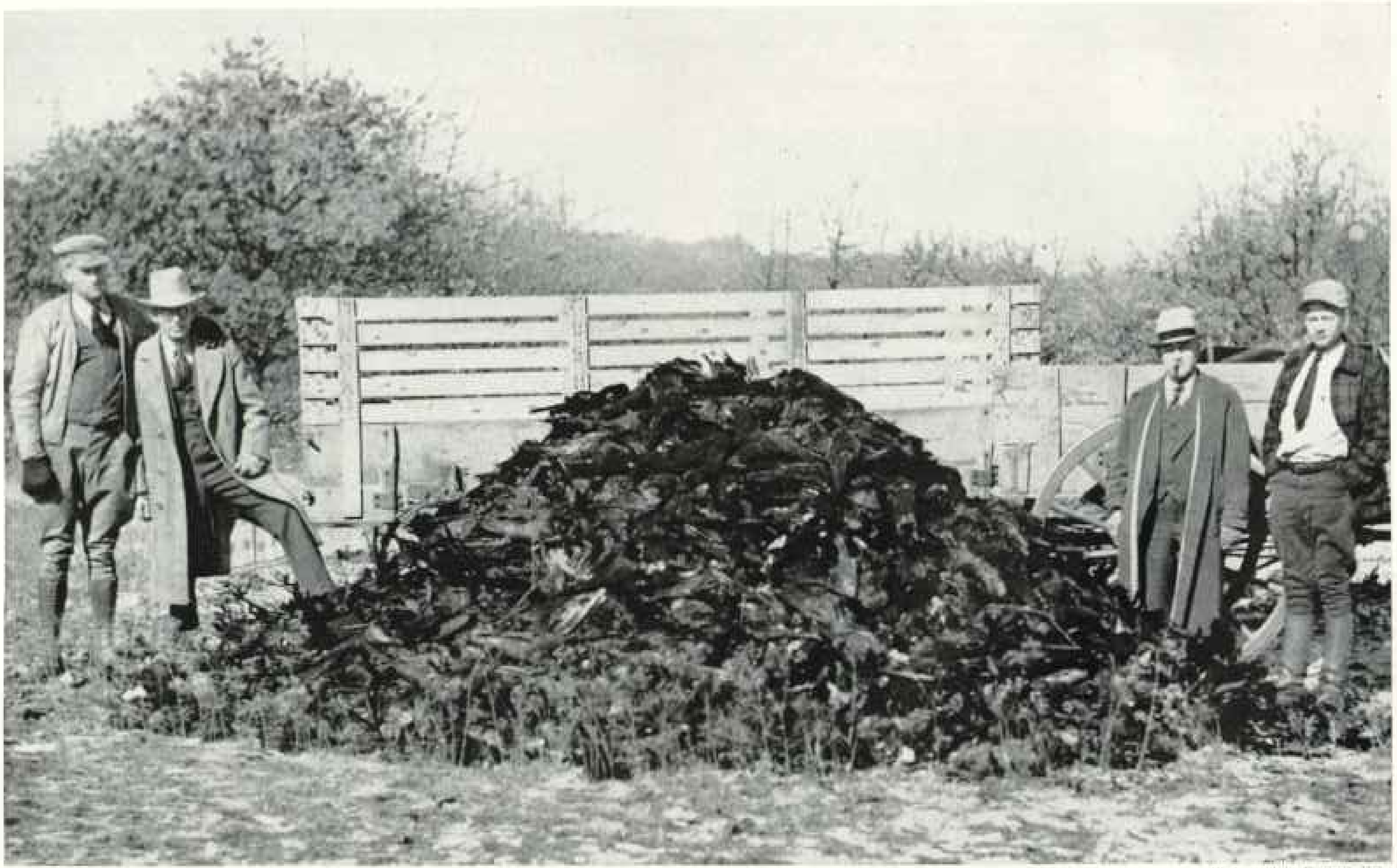
Founded 61 years ago, this school is exclusively for Indians (page 285). Nevertheless, former Secretary of War Patrick Hurley was graduated from it in 1903! The Bacone student body now represents 42 tribes from 14 States and Panama.



Photograph by B. Anthony Stewart

Derricks March into the Very Heart of Oklahoma City, Dominating Even the State Capitol Itself

Motorists riding down Lincoln Boulevard pass through a forest of steel towers. To avoid disturbing existing buildings and yet reach oil below them, eager man bores slant wells, "bending" the hole at an angle far from the perpendicular (page 273).



Photograph by Emily C. Hicks

State Game Rangers Kill Hundreds of Thousands of These Voracious Crows in Bomb Blasts

Midwest farmers dread the sight and raucous "caw" of the greedy birds, which destroy crops, gardens, eggs, and young chickens. Every winter, when the crows congregate in vast flocks, Oklahoma State officials go at night to their roosting places and festoon the trees with explosives, which are set off all at once. Often 15,000 to 20,000 birds are killed by a single blast.

Photograph by George L. Rinn

The Terrifying Approach of a Dust Storm at Hooker

It looks like smoke from an oil field fire, or even an awful cyclone. In a few minutes the town will be dark as midnight. Millions of tons of topsoil have been swept from western farms by these suffocating disasters.

Photograph from The College Studio

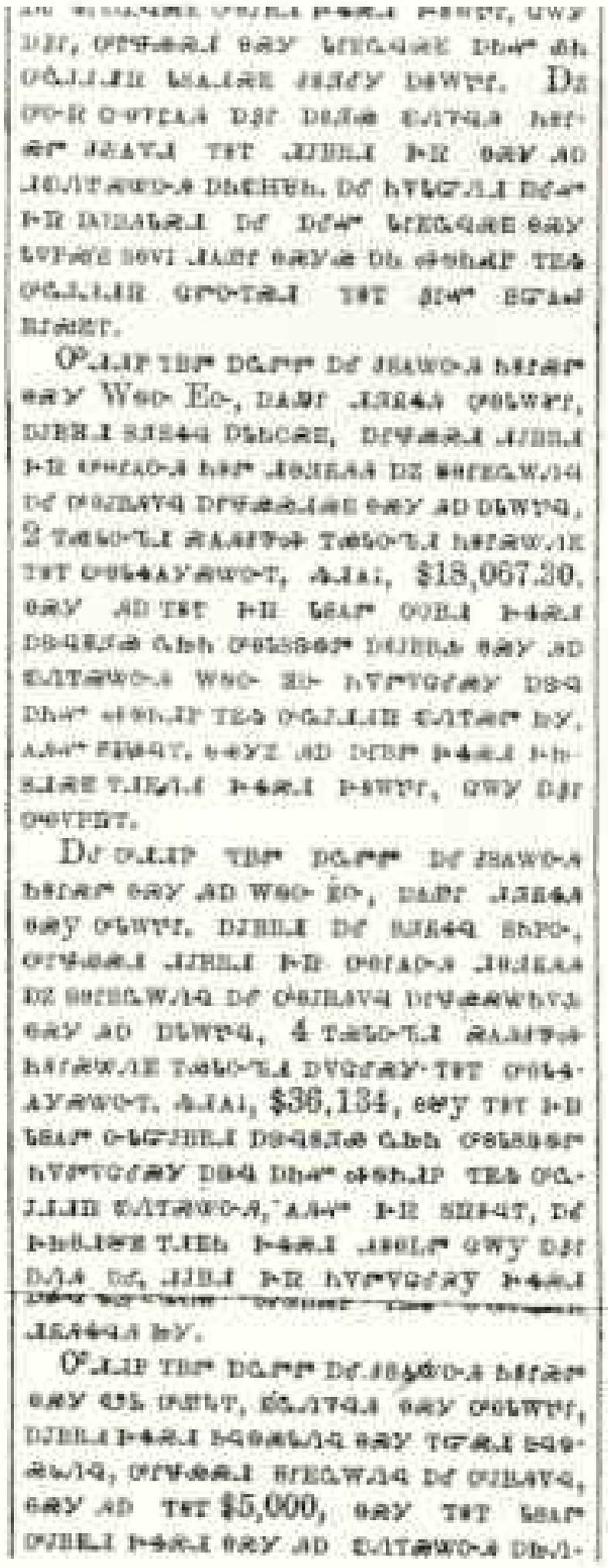
It Took the Whole Town to Catch This Greased Pig

Since pioneer days, "chasing the greased pig" has been popular sport at country fairs, picnics, and Fourth of July celebrations. Here a Tahlequah winner holds the exhausted sow in his lap!

Photograph by B. Anthony Stewart

How Many Americans Have Learned Music Singing in Church Choirs!

At Pawhuska this Presbyterian choir rehearses "a new song for next Sunday." All over this State, choir practice is an institution.



Photograph courtesy L. E. Huffman

Cherokees Learned to Read Their Language on the White Man's "Talking Leaves"

Sequoyah, half Cherokee, educated and aided by missionaries, invented an alphabet for his people, which enabled thousands of Cherokees to read and write in their native tongue. The excerpt above is from the Cherokee Advocate, which ceased publication some 40 years ago. The text, which here refers to a lawsuit, was printed in Sequoyah's alphabet and "ads" in English. Modern Cherokees seldom learn the symbols, preferring English.

masks, utensils, ornaments, pieces of reed mats, buffalo-hair cloth, and objects of copper.

Here, too, were decorated pottery, and carved shells that must have come from the Gulf of Mexico, inscribed with patterns that suggest Mayan art. One big tomb, apparently a chief's, means to Oklahoma archeologists what King Tut's meant to students of ancient Egyptian life.

From his discoveries here Dr. Clements has reconstructed a fascinating model village which vividly shows ancient scenes in Oklahoma.

"We know now that seven main prehistoric cultures are represented in Oklahoma," says Dr. Clements. "There are the Folsom culture (about 10,000 years ago), Basket Maker II, the closely related Ozark Bluff Dweller, the Pit House culture, Caddoan, and the two great basic patterns of the Mississippi Valley—the Woodland and the Mississippi.

"The problem of relation between Woodland and Mississippi culture patterns is very important in North American archeology. Our work in Oklahoma has shown that in this area, at least, the Woodland culture is older than the Mississippi.

"Most outstanding Oklahoma site has been the great Spiro earthwork, or so called 'Temple Mound.' This was a large burial mound which had been partially looted by commercial pothunters before its excavation by the University of Oklahoma, as part of a University-sponsored W. P. A. project.

"The structure contained an estimated 2,000 burials; nearly all were in groups which may have been sacrificial in character. Grave goods were abundant, yielding some of the most unusual artifacts so far found in the Mississippi Valley."

From East to West Across the State

It's over 600 miles by Route 64 across Oklahoma. Going west on it, you ride from the tree-clad Arkansas-Oklahoma line clear out to the desert marches of New Mexico. Here is a vivid cross section of the State, from the green Ozarks to the Dust Bowl.

Every road here holds its surprises. On "64," entering Oklahoma through Muldrow, you follow the historic "Trail of Tears" trod by weary Indians exiled here from other States.

Oolagah's Editor-Barber Got News Items and Ideas from His Customers

"Will Rogers grew up here and talked just like my other customers," says Bill Hoge. "I printed exactly what I heard 'em say, except no crime news, no raw jokes. Just hints on how to cut a boot off a cowpuncher's busted leg, or news on the latest roping contest, or when to set hens!"

Photographs by Elden Pyle

Bill Hoge Edited the Oolagah "Oozings" and Ran a Barber Shop All in One Room

In this corner, ye editor! His odd staff included special editors who wrote on hogs, dogs, goats, Indian squaws, whiteface calves, and chickens. Unfortunately the Oozings ceased publication in December, 1940, because, explained the editor, "the danged thing just wouldn't pay and I couldn't afford to carry it." Hoge also is mayor, trick roper, sign painter, and deputy sheriff of Oolagah!

This Farm Scene Represents a Complete Self-contained Agricultural Unit

Study its parts. It shows how independent a wise, energetic country man may be. It has house, barn, outhouses, cows, poultry, work horses, woodpile, storm cellar, grain bins, vegetable garden, etc.—a good example of diversified farming. Located near El Reno.

Photographs by B. Anthony Stewart

"On Your Toes, Lazybones!" Fort Sill's Physical Director Exercises Future Reserve Officers from State University

Photograph by Miller Studio

Tulsa's Municipal Airport Is Set on Main Lines of North-South and Transcontinental Travel

Swift silver ships of commercial lines and scores of private planes owned and flown by Oklahoma oil men and others call here. Since Army expansion began, training planes take off from here day and night. The Spartan School of Aeronautics, co-operating with the U. S. Army Air Corps, uses this field in training military flyers and aviation mechanics.

Sequoyah's old home stands just north of Muldrow. Near Eagletown Courthouse is the "Whipping Tree," where criminals were spread-eagled to get the lashes ordered as punishment.

On Greenleaf Mountain, beside this route, Cherokees still play their odd game of "stick ball." Each player has two sticks; on each stick is a small cup. The trick is to catch the ball and toss it against the goal, which is a wooden fish on top a high pole.

Belle Starr, Civil War courier for the Confederates and later Oklahoma's most notorious woman outlaw, is buried near the town of Porum, on the Canadian River bank. Friend of the James boys and the Youngers, she, too, finally died with her boots on. Her stone tomb shows a carved figure of her favorite horse.

Home of "Pawnee Bill"

Beyond Tulsa—and in Oklahoma all roads lead to Tulsa—you come to Pawnee, home of Major Gordon W. Lillie, otherwise the "Pawnee Bill" of Wild West show fame. He's too old now to bulldog a steer or bust a bronco; yet thousands flock to see his "old town," a reproduction of a frontier trading post, with its Indian council house and tepees.

When yet far from wheat-gorged Enid, you see its multiple-cylindered grain elevators towering above the prairie, like fantastic pagan temples of Babylonian pattern. Some Europeans say these giant Midwest wheat bins are the only style of architecture that is purely American. Enid stores and grinds enough wheat to make all the bread many a small European country could eat (page 287).

Between Nash and Cherokee you skirt the Great Salt Plains. On a hot day when we passed, fine salt blown in the wind looked like snow. From the sky this big salt flat looks like water; that illusion grounds so many wild fowl that Uncle Sam has made most of these plains a refuge.

South of Freedom are bat caves, where some guesses say more than ten million bats live. North of Gate, parallel with Horse Creek, is a mysterious old ditch. Nobody knows who dug it, or when.

For a lively day, stop at Guymon during its annual coyote hunt. After the hunt and big free barbecue, there's a "wild cow milking contest." They try to pick the wildest, "orneriest, kickingest cow that ever hooked a horse in the stomach." The winning cowboy is the man who, in the shortest time, can rope and throw the wild cow, tie her legs, and "get at least one drop of milk in a pop bottle."

You're in the Panhandle now, that three-county-long strip of "No Man's Land" that's tacked on the northwest end of Oklahoma. From 1847 to 1887, it had no government at all. During that period "Judge Colt was the Law and the Winchester rifle was Order." Then the "Territory of Cimarron" was formed, but never recognized by the United States Government.

In Hallock Park, near Boise City, tourists pitch camp now, to prowl over this once turbulent land and to marvel at the crude figures of mountain lions, beavers, and wolves carved on the cliffs by unknown, long-vanished artists.

From Dinosaur Quarry, northwest of Boise City, the University's School of Geology has taken tons of bones scattered there when prehistoric creatures roamed this land 125,000,000 years ago. From one quarry alone they took about 3,600 such bones. *Allosaurus, Diplodocus, Brontosaurus* and company, as well as the new *Saurophagus maximus* Stovall, largest Jurassic carnivore known at this time, were among those present. With such ponderous names, no wonder some of these creatures weighed around 15 tons and measured perhaps 60 or 70 feet from snout to tail—if any!

Black Mesa, off Route 64 northwest of Kenton, is formed by lava that flowed into Oklahoma from a New Mexico volcano. Its peak, 4,978 feet above sea level, is the highest point in Oklahoma. How different is this dry, Arizonalike colored mesa country from the almost tropical, swamplike verdure of southeast Oklahoma, with its egrets, water turkeys, wild ducks, and pileated woodpeckers!

More Things to See in Oklahoma

When the Government threw open the Kiowa-Comanche Reservation in 1901 and let the crowds draw free lands by lottery, El Reno's population jumped from 7,000 to more than 70,000 in twenty-four hours. Each year now this city celebrates Pioneer Day, re-enacting the wild scenes of that great gamble for free homes.

Fort Reno, which so often echoed to bugle calls as troopers galloped out to fight marauding Cheyennes, stands across the highway from El Reno. Here is one of Uncle Sam's largest remount stations, with several thousand horses, including pedigreed stallions.

To see some of the State's best Indian dancing, go north from Fort Reno to Concho, seat of the Cheyenne-Arapaho Agency. What graphic names for tribal swing steps—"The Owl," "The Rabbit," "The Kick Ball," "The Animal," "The Sun," and the "Sacred Arrow!"

From the agency school we saw Indian children visiting the near-by State Game Farm, where wild turkeys and quail are hatched.

Kodachrome by B. Anthony Stewart

What Indian Boys See in Their Dreams!

In this State are many families who claim kinship with Indians and are proud of that racial heritage. Here Miss Martyne Woods, of Choctaw descent, represents a tribal "princess." She was chosen as "Miss Oklahoma" in the 1940 Beauty Contest.

Kodachrome by B. Anthony Stewart

Bluestem Grasslands in Oklahoma's Osage Hills Carry Valuable Herds of High-grade Beef Cattle

These white-faced Herefords are drinking at a pond near Pawhuska. Forage here is so heavy and nourishing that ranchers can run one animal to every four or five acres, as against 20 or 30 acres of less favorable range. To conserve water, Oklahoma farmers have scraped out thousands of such ponds.

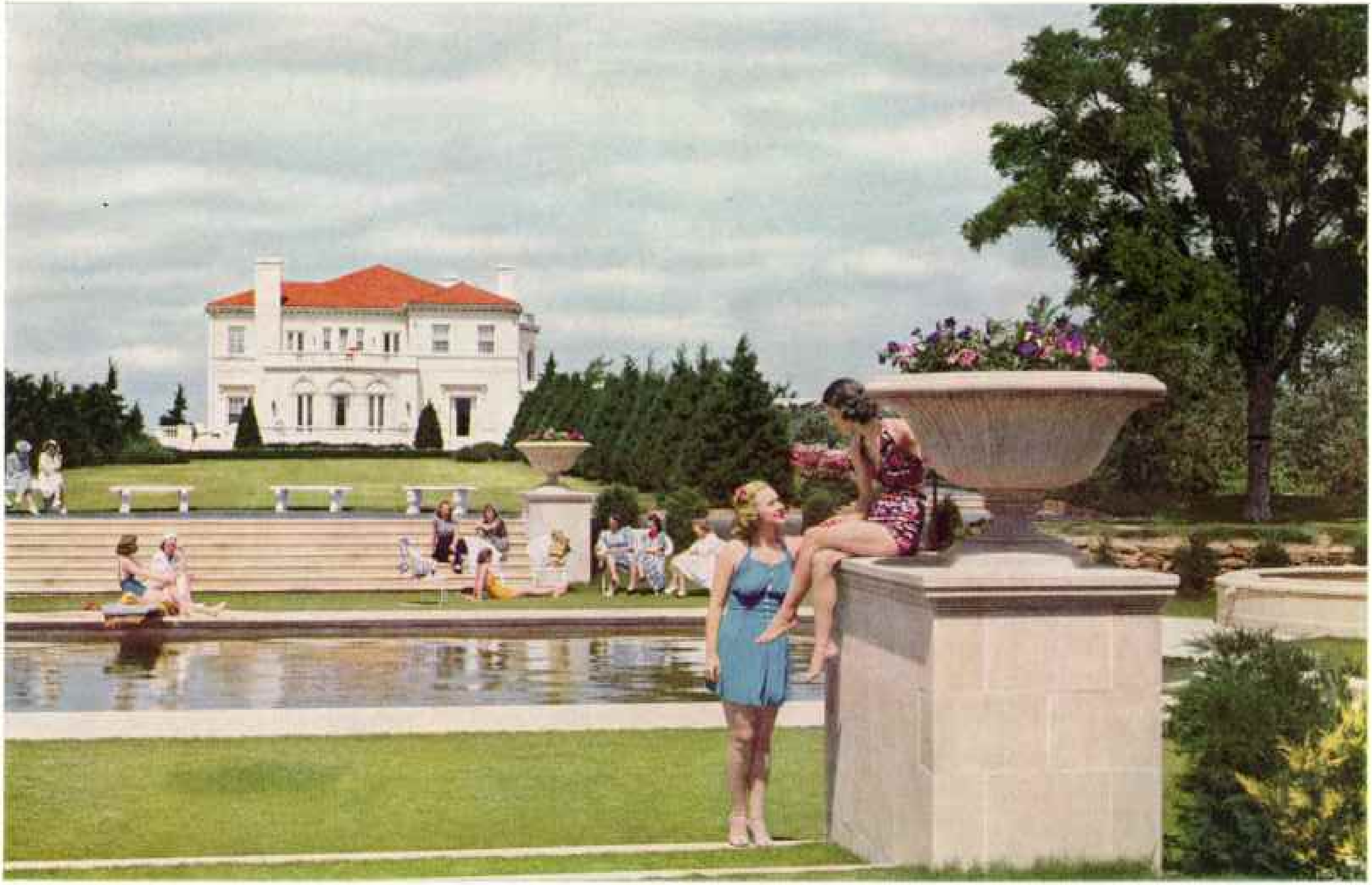
Some Osage Shawls Are Designed Like Early Indian Blankets

Oil enriched Pawhuska Osages, but also led to feuds and murders. Today's Osages like fine motorcars; some squaws wear silk shawls made in Paris, whose use takes the place of blanket and serape.

Kodachrome by R. Anthony Stewart

Otoe Bucks of Red Rock in Tribal Dress of Former Days

About one-third of United States Indians live in Oklahoma. Years ago, seeking to found a national home for red men, Uncle Sam's army moved widely scattered tribes to this region.



Kodachrome by B. Anthony Stewart

On the Outskirts of Oklahoma City Stands the Home of Frank Buttram, Geologist, Chemist, and Civic Leader

With what amazing rapidity this State matured! Many residents, still barely beyond middle age, remember when this region was a wilderness. In this home Buttram, born in the Chickasaw Nation, has collected some of the State's finest art treasures.

Kodachrome by B. Anthony Stewart

Tulsa Home of Editor Richard Lloyd Jones, Leader of Movement that Preserved Lincoln's Kentucky Birthplace as a National Park

Designed by the editor's cousin, architect Frank Lloyd Wright, this unique home is an Oklahoma show place. In its airy, openwork patterns, Wright, who designed Tokyo's Imperial Hotel and other buildings of note, sought an edifice suitable to Oklahoma's climate.

Kodachrome by B. Anthony Stewart

Southern Hills Country Club, at Tulsa, during the 1940 Trans-Mississippi Golf Tournament

Rolling, wooded hills that overlook green, fertile Arkansas River Valley afford an ideal terrain for a golf course. Skyscrapers of Tulsa rise in the far right background.

Kodachrome by B. Anthony Stewart

"One, Two, Three!" And Dewey High School's Cowgirl Band, of Pawhuska, Swings into a Sousa March

High school social phenomena of recent years, such bare-legged, white-booted drum majorettes add more "oomph" than "oompah." Maybe she's a passing fad; but just now no school parade is complete without a strutting, baton-juggling girl out front. Lately, one let her baton slip and broke her own nose.

Kodachrome by B. Anthony Stewart

Solomon's Temple Was No More Impressive than Tulsa's Boston Avenue Methodist Church

Despite rough-and-tumble oil booms, tumultuous Tulsa has more than 80 churches, and Sunday School classes which enroll more than 30,000 children. This church was designed by Dr. Adah M. Robinson.

One "electric hen" can "set" on 20,000 quail eggs! Young game birds are sent to farms all over Oklahoma.

Purest town in the State may be Bethany, just out of Oklahoma City. Founded by the Nazarene sect, it lives under strict city laws. It forbids all beauty parlors, pool halls, theaters, and the sale of tobacco or any form of liquor. You cannot even erect a billboard in the city limits which advertises any of these tabooed articles.

When Cameraman Stewart and I had been weeks in this State, I asked, "Tony, what strikes you?"

"Indian stuff," he said, "the no end of missions, schools, agencies, reservations, and the way these people scatter good paintings around."

Take Shawnee. In the art gallery at its St. Gregory's College you see the work of Pennell, Whistler, Rembrandt, and Murillo, as well as dozens of portraits and landscapes by Father Gerrer, one of the few American artists to paint a portrait of the Pope.

Then there's the Laura A. Clubb collection at tiny Kaw, a mere village east of Route 77 near the Kansas line.

Think of riding through lonely cow range or vast wheatfields and coming suddenly on an art gallery hung with magnificent works of Corot, Inness, Gainsborough, Joshua Reynolds, Thomas Moran, and many others—upward of 200 canvases in all, worth a king's ransom!

Bryant Baker's heroic bronze, "Pioneer Woman," stands just outside Ponca City, and is worth a hard day's ride to see (page 270).

On Black Gum Mountain, near Marble City in eastern Oklahoma, Cherokees each July hold their Sacred Fire services. Despite missionary efforts, these Indians cling to their own religion, which they say is very old. They invite whites to join this dance, because their deity likes converts to their tribal faith.

Why Jails Are "Bull Pens"

Do you know why jails are called "bull pens"? Listen to this Sooner explanation: Down in south Oklahoma, on Route 77, stands the city of Ardmore. Till oil was struck, this town was little more than a railroad water tank and the headquarters of the 700 Ranch.

When the boom came, a Federal court was set up here to give justice a chance to overtake the desperadoes. To hold all its prisoners, Ardmore built a log stockade, with a prison house in the center. This became known as the "bull pen," and the surrounding space the "run-around"—words now familiar to all wardens, prison guards, and jailbirds!

Walter H. Gant's Ardmore farms form one of this country's largest horse-breeding establishments. It specializes in the American saddle-bred horse, such as the Bourbon King, Rex McDonald, Rex Peavine, Jack Robbin Twigg, and Kalarama Rex strains. Horses bred here have been widely shown at American livestock fairs and have been sold to horsemen from New Jersey to California.

Over Chisholm Trail, when cows still walked to market, some 10,000,000 Texas longhorns were driven north across Oklahoma. Today Route 81, north and south, follows the once-mighty cowpath.

Chickasha, near Washita River, was a favorite camp site on the long trail, and many a vaquero and horse were drowned fording the Washita in flood times. Quit "81" at Chickasha, go southwest, and you come to Fort Sill and Lawton.

Heavy gunfire rocks the hills around Fort Sill, for here is Uncle Sam's center of advanced artillery training, with the largest concentration of field artillery in the country. With what incredible speed the great motor-drawn guns race across fields, splash through streams, and bounce over rough ground! Seeking pictures, Stewart and I could hardly keep up. From here General Sheridan and Custer waged Indian wars, and here Geronimo, dreaded Apache leader, died a prisoner.

Lawton Produces the Passion Play

Lawton certainly has turned over a new leaf. When 50,000 people rushed here to draw free building sites in the big 1901 land lottery, it was the paradise of gamblers, crooks, and grafters. In a few days it had 112 saloons! Now it hasn't any. But it has one of the finest residential sections of any city in the State and is year-round host to officers from near-by Fort Sill.

Lawton's outdoor Easter services, in near-by Wichita Mountains, draw crowds of more than 100,000.

Last year, with a cast of 3,000 Oklahoma actors and musicians, the Passion Play was staged. In a vast natural amphitheater that lies at the base of 1,800-foot Mount Roosevelt, an outdoor stage was set. It had representations of the Inn at Bethlehem, the Temple at Jerusalem, Pilate's Judgment Seat, the Garden of Gethsemane, and other familiar Holy City scenes.

With all its changing tableaux, its speeches, actions, and music, including the "Hallelujah" chorus and the Passion Choir's singing of "Christ Arose," it took three nights to give the play.

On the streets of Erie, Pennsylvania, a small

Photograph by R. Anthony Stewart

Man-made Lakes Turn Oklahoma Cowboys into Sea Scouts

This artificial reservoir, Lake Overholser, near Bethany, is fed by the North Canadian River and holds a storage supply of 17,000 acre feet of water. Bathing is prohibited, but sail and motorboat sports are popular.

Scotch-Irish boy once peddled papers. His name was Bill Skelly. Today he is W. G. Skelly of Tulsa, President of the Skelly Oil Company, of Mission Corporation, of Pacific Western Oil Company, and friend of newsboys! Not a one in Tulsa now but knows Bill Skelly, and very few that Skelly himself cannot call by their first names.

I asked him what Oklahoma has contributed to the world's knowledge of the oil business.

"Trained men, I would say, is her biggest contribution," he answered. "Most production and refinery men now busy in foreign fields learned the business here. The local Carter Oil Company, subsidiary of Standard Oil of New Jersey, has long been the training unit for Standard's foreign employees. Its laboratory and factory now being finished in Tulsa will make geophysical and precision instruments and train men to use them.

"Oklahoma is not only a training ground for skilled workers, geologists, and oil engineers; it is also a great workshop that makes every tool and every kind of machine needed in prospecting, drilling, and refining. These are sold to oil fields all over the world."

"Why do they call Tulsa the world oil capital?" I asked.

"Because more oil companies have headquarters here than in any other city. While

"Johnson," the Greyhound to Right, Has Revenged Himself on Hundreds of Coyotes

Mutilated by a wolf in a desperate fight, he has spent seven years getting even. Let a marauding coyote so much as howl anywhere on this ranch and, no matter how stormy the night, Johnson is up and after him. A scene near Pawhuska on Doc Mundy's estate (page 276).

Photographs by R. Anthony Stewart.

"Yes, Lady! I Know that Funny Sponge Tickles; but You Hold Still!"

Visitors flock to Platt National Park, south of Oklahoma City, to take mineral baths available to all.

Photograph by B. Anthony Stewart

University Press at Norman Publishes Many Books on Western History

The girl is designing a jacket for *Cherokee Cavaliers*, edited by Edward Everett Dale and G. L. Litton. This new volume, based largely on collected letters of pioneer families, traces years of Cherokee history (page 285).

some may have their main offices in New York, their operating offices are here. Policies may be dictated from New York, but exploration, drilling, production, and refining are handled here."

When the great Glenn Pool was opened twelve miles south of this city in 1905, Tulsa immediately offered every facility to oil men. It built hotels, laundries, and places to eat; it bridged the Arkansas, and it never raised prices!

From Wilderness to Skyscrapers

In skyscrapers resembling a bit of mid-Manhattan, Tulsa now houses 546 oil companies and operators (page 278, color). It has 140 drilling contractors, and 447 manufacturing concerns, of which 119 make nothing except equipment for the oil industry.

Tulsa has more engineers and technically trained men in its population than any other city in the country. One-tenth of the more than 2,200 members of the American Association of Petroleum Geologists live in Tulsa. A third of all seismograph and geophysical crews operating in oil fields throughout the world take their instructions from offices in Tulsa.

Shops here have developed types of equipment preferred everywhere in the world. The seismographic equipment used by Admiral Byrd on his second Antarctic expedition was made here, as was the winch for his famous snow buggy.

One Tulsa manufacturer not long ago closed an order with a foreign government for 200 portable drilling rigs.

Another sells pipe-line pumps all over the world. Pipe-line contractors in Tulsa have built some of the largest pipe lines in foreign countries. One Tulsa concern actually carried trucks and ditch-digging machines by airplane to inaccessible spots in a South American country where it was building a pipe line.

Tulsa has seen this country change from a wilderness to a metropolitan area. The city is so new that many people here well remember when its site was mostly open fields and a few Creek homes.

First white American civilian to set foot in Tulsa was Washington Irving. Today a monument rises to him here, in the city's beautiful Irving Place.

Tulsa doesn't always keep its mind on oil! Touched by the modern wand of progress, it

Photograph by B. Anthony Stewart

"Ah, Shucks! Can't Even Win with the Joker!"

To a public park in Oklahoma City come these old boys, day after day, to play cards and dominoes. On colder days they even bring blankets. Some are called for at nightfall by grandchildren in the family automobile (page 276).

built its own university. It enjoys the magnificent Philbrook Museum of Art, a vast park system; artificial lakes for recreation; good drinking water brought 55 miles from the Ozarks; and a quality of music seldom heard in many cities older and larger. From all over the State people flock here each year for the grand opera season, and Tulsa has given its full share of distinguished writers and journalists to the State.

Voted Oklahoma's Most Interesting Citizen —the Indian!

This State's name, which means "Red Man" or "Red Man's Home," is apt. Nearly a third of all United States Indians now live here. They represent some 30 tribes.

Andrew Jackson's 1830 Indian Removal Law meant that Indians forcibly colonized here should own the country, and that it should never form part of any State. But in time many whites came in. Disorder was grave, since there was no law except that of each tribe over its own people, and corrective steps were imperative.

Finally the tribes agreed to allotment of their lands among individuals, and the white man's social order began.

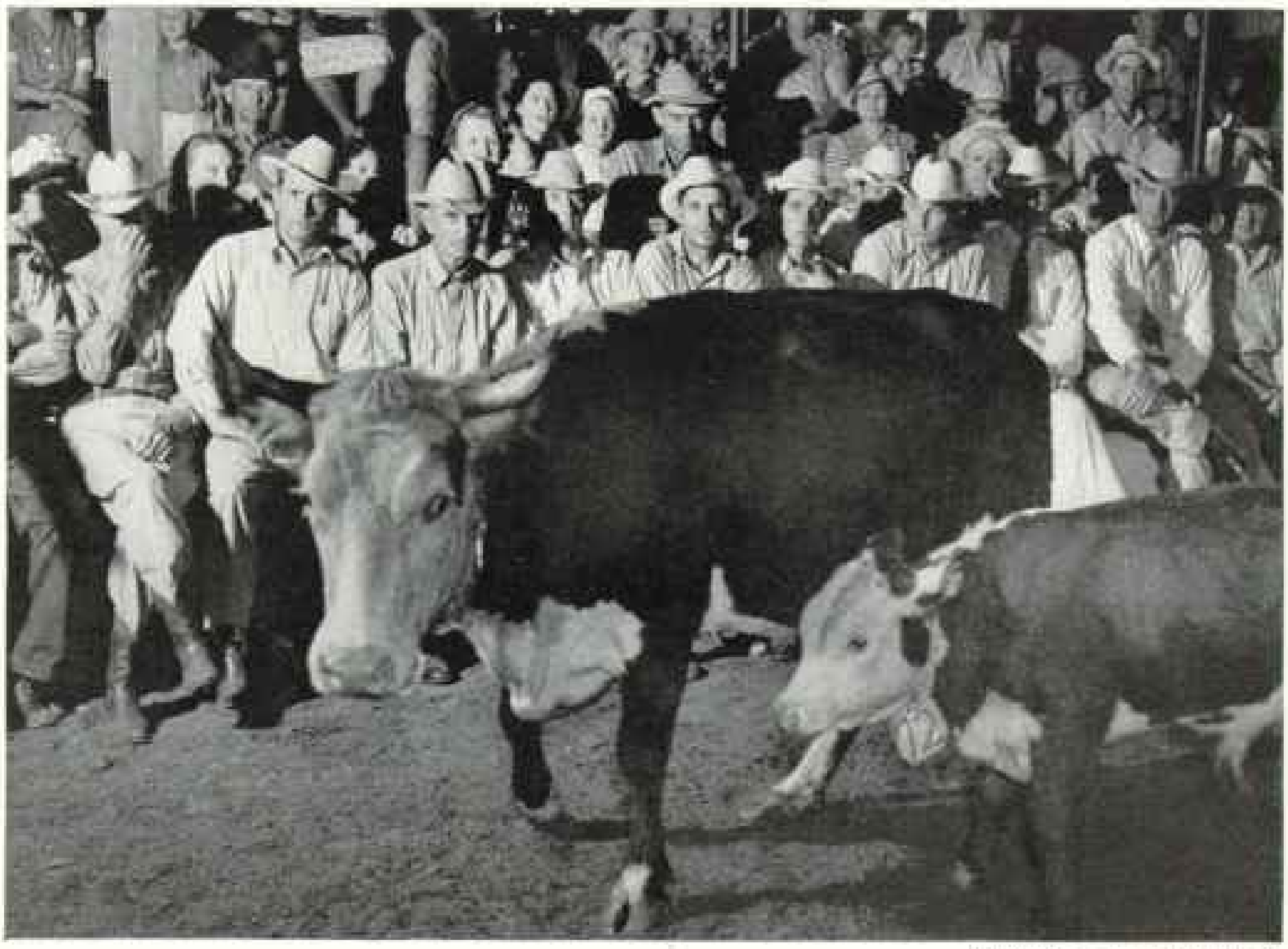
"After that, each Indian assumed a new character," says Grant Foreman, who came here 40 years ago with a Federal commission sent to solve tribal land problems.

"As the owner now of a farm in a region where white man's law was superseding the tribe's," says Dr. Foreman, "the Indian was suddenly forced to think and live differently, and to face new responsibilities."

In 1907 Oklahoma became a State, and the bewildered red men, as citizens, assumed still more new relations with the whites. Since statehood the status of Indians here has no parallel in our history.

Many full bloods were reluctant to accept land allotments because they saw in these the end of their old tribal ways of life. Hence, after most good land had been allotted, the Government arbitrarily assigned land to these hesitating full bloods. Much of it was hilly and poor.

But dramatically—and to the Indian's further confusion—oil was struck on these poor lands. As in some fairy tale, benighted Indians became at once rich—though still benighted! It was then we laughed at Indians who went to automobile shows and bought $12,000 hearses because they had so much



Photograph by St. Anthony Herald

Farmers and Their Wives Crowd Public Auction Sheds Hunting Bargains

At such community sales, livestock, vehicles, furniture, and even home-canned fruits may be offered. For a small commission, auctioneers thus conveniently bring buyer and seller together in a quick market.

shiny glass, and at squaws who lived barefooted in Waldorf suites.

But because full bloods are saved by law from selling their lands lest the unscrupulous exploit them, Uncle Sam makes oil leases for them and looks after their incomes.

The World's Richest Indians

To certain individuals in the Five Civilized Tribes, Uncle Sam has already paid, through his Indian Agency at Muskogee, more than $100,000,000! To the relatively few Osages, the Indian Agent at Pawhuska has paid more than $267,000,000, making them the world's richest Indians! (Page 303, color.)

Today's rich Indian, however, is learning the value of money and how to spend it wisely. With the rise of the new State, Indians, of course, had to abolish tribal rule, their schools, and some other institutions.

Ties of communal interest in lands and Indian laws, the holding of tribal councils for common good, are no more. Tribal interests that bound them together are relaxed or dissolved.

You see occasional signs of nostalgic longing for the old way of life in some surviving games, ceremonies, and dances, especially among the full bloods. But even in harvest-time dances, when they thank the Great Spirit for good crops and annual renewal of life, fewer and fewer young Indians participate.

Most significant result of all these social changes is that the Oklahoma Indians are in process of amalgamation with the whites.

Already, about 65 per cent of all "Indians" here are part white; many "whites" have Indian blood, but the trace is so slight as to be undiscernible. With the 27,000 full bloods of the Five Civilized Tribes, and the 10,000 or so of what were formerly called "Plains tribes" in western Oklahoma, the process will be slow, and the social result is as yet unpredictable.

Unique, however, Oklahoma now is among all States. Here only is the "Indian problem" being solved by intermarriage, and, at that, happily! This is the only State where a large share of the original Americans are merging their identity with an alien race, which must have its effect on the progeny of Indians and whites for generations to come.

Unknown New Guinea

Circumnavigating the World in a Flying Boat, American Scientists Discover a Valley of 60,000 People Never Before Seen by White Men

By Richard Archbold

With Illustrations from Photographs by the Archbold Expeditions

MY THIRD New Guinea Expedition was organized for a complete investigation of virtually unexplored north slopes of the Snow Mountains on the second largest island in the world.* How much more it was to accomplish I did not suspect as we took off from San Diego Bay on June 2, 1938, in the *Guba*, our twin-engined Consolidated Model 28 flying boat.

We were to discover in the interior of New Guinea a valley of some 60,000 people whose existence had not been recorded. Cutting sky trails over three oceans and three continents, we were to be the first to fly around the world nearest its greatest circumference, the Equator.

Our route was by way of Honolulu and Wake Island, skipping Midway, and thence to Hollandia, in Netherlands New Guinea.

Just after sunrise on June 10 we alighted on Humboldt Bay, where we were greeted by members of our expedition who had gone ahead. The trip had consumed eight days, but our flying time for the 7,236 statute miles had been only 50 hours and 4 minutes.

Fur-lined Suits Over the Equator

Save for a few thunderheads and a hail and snowstorm which forced us to put on fur-lined flying suits while crossing the Equator, the voyage had been uneventful. The *Guba's* flying range was 4,200 miles, and, thanks to the automatic pilot, we had had little to do except when the course was changed or we ran into heavy weather.

My scientific associates were Dr. A. L. Rand, assistant leader and ornithologist; L. J. Brass, botanist; and William B. Richardson, mammalogist. With me on the *Guba* were Russell R. Rogers, co-pilot; Lewis A. Yancey, navigator; Raymond E. Booth, radio operator; and Gerald D. Brown and Stephen Barrinka, flight engineers.

Brass, Richardson, and Harold G. Ramm, radio operator, had arrived in Hollandia on April 23, and Rand had joined them a month later. Through their efforts, living quarters, godowns, and a radio shack had already been established, and a ramp for the *Guba* was almost completed (page 317). They had injected into the sleepy village—permanent white population four persons—a spirit of activity and industry it had never before seen.

We planned to collect in areas on the northern slope of the Snow Mountains (Sneeuw Gebergte), between the summit of Mount Wilhelmina and the Idenburg River, establishing collecting camps at intervals of 2,000 feet (map, page 318).

Results obtained in that unknown region we hoped to connect with those of the Australian section and thus provide the basis for a comprehensive study of the flora and fauna of the entire island.

My three New Guinea expeditions were under the sponsorship of the American Museum of Natural History, New York City.

Wholeheartedly co-operating, the Netherlands Indies authorities gave us the assistance of Dr. L. J. Toxopeus, entomologist; Dr. E. Myer-Drees, forester; and an escort of 50 soldiers under command of Captain of the General Staff C. G. J. Teerink, Lieutenants V. J. E. M. Van Arcken and C. W. Schreuder, and Dr. R. Huls, medical officer interested in ethnology.

By June 17 the soldiers, their convict carriers, and 72 Dyaks brought from Borneo as additional carriers and collecting boys had arrived on the monthly steamer, increasing the personnel of our party to 195. The entire expedition, with food and camp-building material and scientific equipment, was flown in the *Guba* to the interior within 45 days. This feat, Captain Teerink informed me, was the largest-scale transport by airplane ever put on in the Netherlands Indies (page 327).

Our main inland base was to be on Lake Habbema, 11,342 feet above sea level and 175 miles southwest of Hollandia (page 319). Since no plane had ever landed on the lake and none had taken off from water at so high an altitude, we had to make sure that the *Guba* could lift herself there.

*Largest is Greenland. For other articles on New Guinea in the National Geographic Magazine, see "Into Primeval Papua by Seaplane," by E. W. Brandes, September, 1929, and "Pictorial Jaunt Through Papua," by Captain Frank Hurley, January, 1927.

Bananas Grow Tall on the Heights

A young plant that had not flowered, this specimen had a stem 22 feet long and 27 inches thick at the base. It was found at an altitude of 3,000 feet in the mountains near the Idenburg River camp. Dense vegetation reaches high in the New Guinea wilderness.

Our plans also called for the establishment of a camp on the Idenburg River and the cutting of a trail across country connecting it with Lake Habbema. Such a trail would serve as a means of retreat should some unforeseen accident put the *Guba* out of commission. Once on the Idenburg, which empties into the Mamberamo River, we could make our way to the coast in canoes.

We made our first reconnaissance flight on June 21, but clouds lying over the lowlands prevented us from getting a clear picture of what lay below. The next two flights, however, brought astonishing discoveries.

A Valley of 60,000 Population Seen for the First Time by White Men

Between the Idenburg and Lake Habbema we flew over an unmapped valley of the Balim River perhaps 10 miles wide by 40 miles long (pages 322-3).

From the number of gardens and stockaded villages composed of groups of round houses roofed with domes of grass thatch, we estimated the population to be at least 60,000. Subsequent meetings with many of the people convinced us that we were the first white men ever to penetrate their isolated domain (pages 326 and 329).

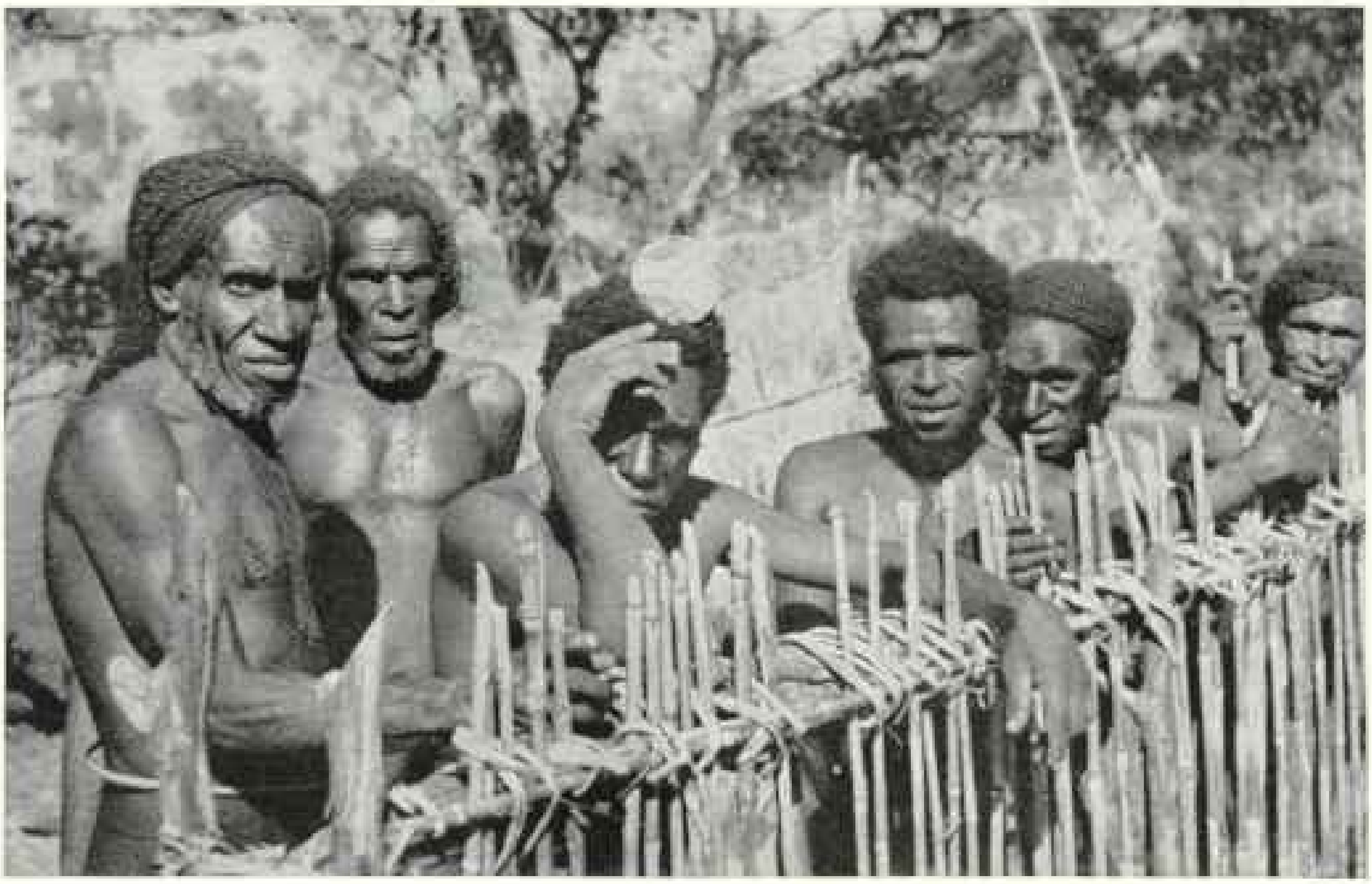
This Grand Valley, as we named it, lies to the north of the Snow Mountains, and its headwaters drain from the northern slopes of Mount Wilhelmina. However, the Balim River breaks through the central range of the Snow Mountains and flows away to the south coast of New Guinea instead of to the north, as one might suppose.

J. H. G. Kremer, on his way to the top of Mount Wilhelmina in 1921, had crossed the headwaters of the river, but he had been too far west to see the valley hidden behind range after range of wooded mountains.

From the air the gardens and ditches and native-built walls appeared like the farming country of Central Europe. Never in all my experience in New Guinea have I seen anything to compare with it.

Lake Habbema appeared beneath our plane, a placid brown body of water surrounded by high hills (pages 330-1).

To the south the snow-capped top of Mount Wilhelmina, one of the highest of the peaks in the Snow Mountains, looks

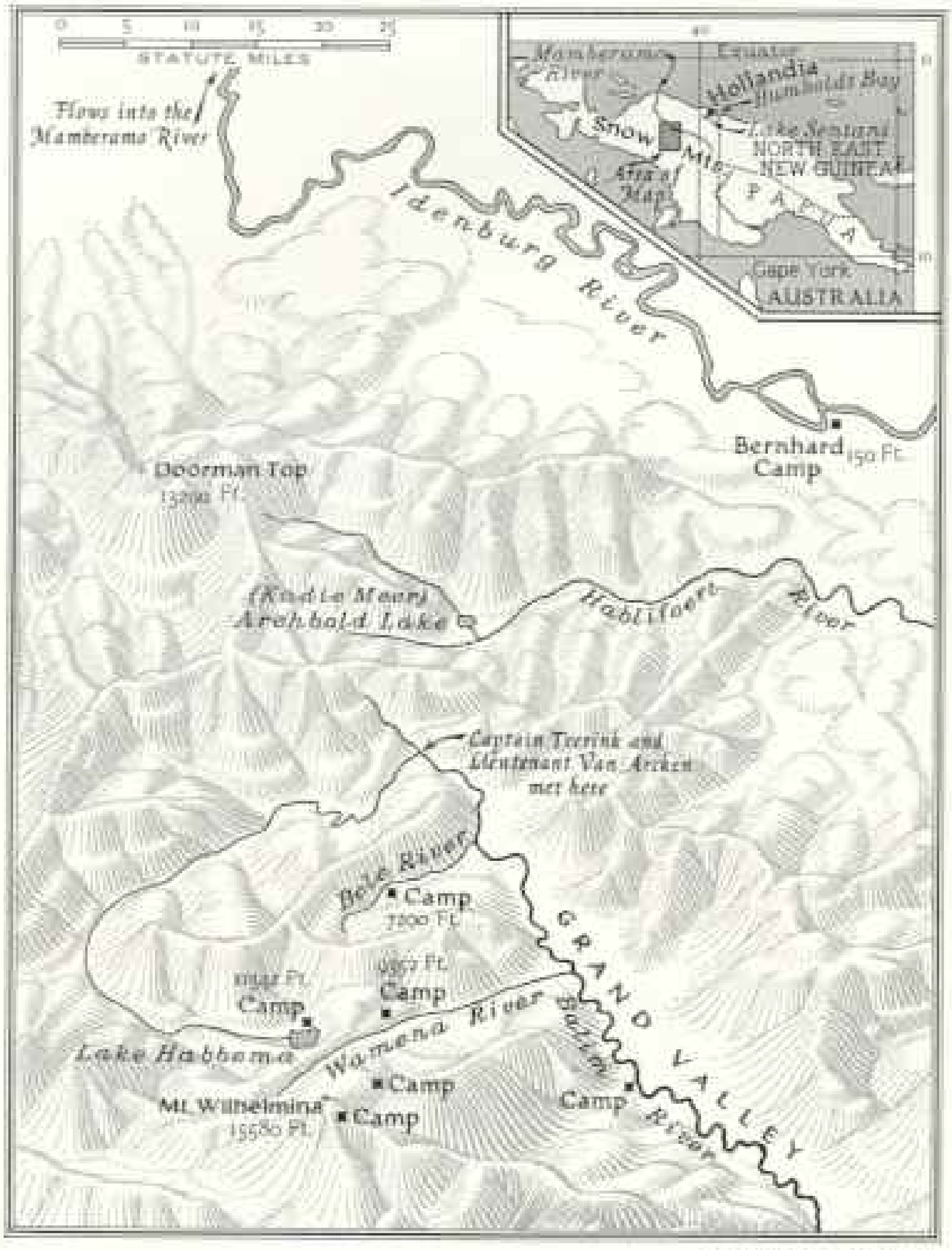


To Natives Peeking over the Fence, the Camp on the Balim Was a Show

One proudly wore the top of a fruit can as a head ornament. The day's labor in the gardens ended, the enclosure occupied by the white visitors became the neighborhood gathering place.

Advance Members of the Expedition Established the Coast Base at Hollandia

On the west shore of Humboldt Bay 100 natives were employed for more than two months on living accommodations, machine shops, and storehouses. The biggest undertaking was the construction of a ramp, 190 feet long and 20 feet wide, for use of the *Guba* (page 315).



Drawn by John J. Breton

In New Guinea's Snow Mountains the Grand Valley of the Balim Lay Hidden from White Men Until the *Guba* Flew Over It

From Hollandia (inset) the Archbold party moved to the interior by air and established 11 camps. The main inland base was named Bernhard in honor of the consort of the Netherlands Crown Princess. Highest station was on Mount Wilhelmina at an altitude of over two miles. Forestation is so heavy and terrain so rugged that earlier explorers passed on foot within a few miles of the most thickly populated area without suspecting the existence of a civilization there. Expeditions headed by F. W. Brandes and A. J. Marshall did most of their work in Australian territory in the eastern part of the island. Matthew W. Stirling explored a part of the Netherlands side, some 100 miles west of the section mapped here.—*Editor*.

down on it from a height of 15,580 feet (page 328).

Lake Named for Author

We circled the lake several times and ascertained that it is about 2½ miles long and 1¼ miles wide, sufficient area for landing and take-off. Although the populated valley of the Balim is only about 15 miles to the east, the lake showed no signs of permanent human habitation.

On the way back to Hollandia, we came across a lake about two-thirds of a mile long and a half mile wide lying 31 miles northeast of Habbema. This we learned was called Kadie Meer. It has since been officially designated as Archbold Lake by Netherlands geographic authorities (page 320).

Our Idenburg River camp site, only about 150 feet above sea level, offered no obstacles to the *Guba*. We made a trial landing there on the morning of June 28, sending scores of crocodiles scurrying from the shores into the water.

Before the day was over, Captain Teerink, Lieutenant Van Arcken, five soldiers, and three convict carriers, with food for three months, camp equipment, and a radio transmitting and receiving set, had been transported from Hollandia to the new camp. Since June 29 was the birthday anniversary of the husband of Juliana, Crown Princess of the Netherlands, the camp was given his name, Bernhard.

For ten days thereafter we made flights with men, supplies, and equipment for the construction of a permanent camp which was to serve not only for emergency purposes but also for collecting specimens. It was situated on the bank of the river, above which rose heavily wooded slopes of the mountains.

Dyaks were put to work building canoes. A garden was dug, and beans, corn, lettuce, and other vegetables for general use were

planted. Lieutenant Van Arcken even made a little flower garden.

All of us knew that the success or failure of the expedition hinged upon the landing and take-off from Lake Habbema, over two miles high. After careful study of aerial photographs we had made, Rogers, Yancey, Booth, Brown, and I set out from Hollandia early in the morning of July 15. We put aboard emergency supplies for two months, including rifles, pistols, ammunition, portable radio, and other equipment we might need in the event of disaster to the *Guba* or her failure to rise once she had landed on the lake.

Perilous Landing on a Mountain Lake

Since the minimum depth required for a safe landing was five feet, ropes of that length, attached at one end to a weight and at the other to a float, were dropped into the water. None of the floats remained above the surface. We came down.

Supplies Were Wafted to Parties on Foot in the Wilds

There were many places in the mountains of the interior where the *Guba* could not land. At Hollandia trials proved that the problem of maintaining explorers in such districts could be solved by use of cheap cotton parachutes, thrown away after use (page 324).

An awesome stillness settled upon us as we shut off the engines. I opened the afterhatch and looked about. Thin, firlike trees dotted the hillsides which frowned down on this strange bird of ours. We were on the top of little-known New Guinea and entirely dependent for safety upon the two motors of our ship. Were they to fail us, we should be lucky to get back to the coast alive.

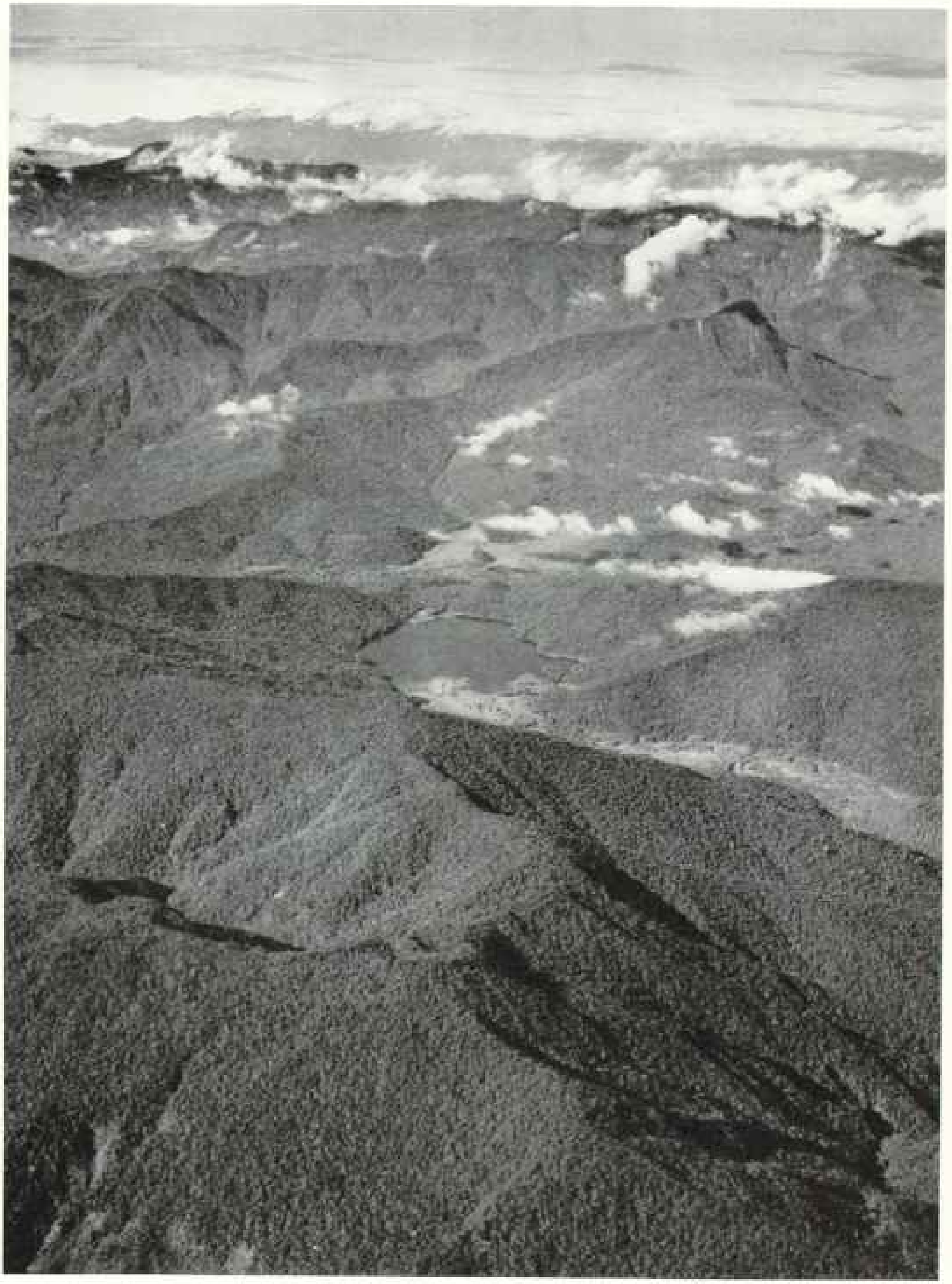
Booth and I put over our collapsible boat and ferried the radio and some of the emergency equipment ashore. There the two of us remained while the *Guba* made a trial take-off. Our purpose was not only to lighten the ship but to be in a position to help if anything unforeseen happened.

Now the moment for the crucial test came. Rogers started the motors, and their thunderous roar echoed and re-echoed through the hills. As the propellers beat against the thin air, I prayed that they would find enough in that high altitude to lift the ship.

Within a minute she was off the water, rose gracefully over the surrounding hills, made a wide circle over the lake, and came down.

Lake Habbema's first settlers—Teerink, Richardson, a sergeant, four soldiers, and a cook—were flown in on July 19 with a cargo of lumber, tents, radio, and a month's emergency rations. The rations were later increased to a three months' supply.

On that day we selected a site for the camp



Kadie Meer, Now Archbold Lake, Lies Hidden in Mountain Fastnesses

Here in the wilderness the *Guba* delivered stores to Van Arcken on his exploration patrol and landed again to fly the returning party to Bernhard Camp (page 324). It is easy to understand why earlier explorers, traveling on foot through these dense forests, passed near Grand Valley without suspecting its existence.

on the northwest side of the lake, put in a pier to be able to discharge cargo direct to the shore, set up a tent for the radio, and put it into operation.

On the ridges the forests were broken by yellowish grassy hollows, and on the slopes rhododendrons made brilliant splashes of red, yellow, and white. Traces of native nomads were in evidence in many places—paths, temporary shelters, and old and broken reed arrows. Often smoke from their fires could be seen in the distance.

By July 31, after a long series of transport flights to Habbema, during which we brought 105 men and more than 60,000 pounds of cargo in the *Cuba*, the camp was a complete, smoothly functioning settlement. We celebrated the day with speeches and a feast, offering toasts to Queen Wilhelmina and the President of the United States.

Two Natives Come to the Party

The occasion was made notable by a visit from two of the natives from the Grand Valley (page 326). Others had been seen near by shortly after the camp was opened, but these two willingly accompanied several of our Dyaks who were cutting wood in the forest.

One was evidently a man of some importance. The other, who was younger, perhaps a bodyguard, remained very much on the alert. They squatted on their haunches, their backs toward home, their bows and arrows handy, while we sat down on the camp side of them.

Aside from gourd "aprons," armlets, bracelets, and a coarse mesh net on the head of one, our visitors were naked. They had smeared themselves with charcoal, which gave their brown bodies a most unattractive appearance. The more important of the two men maintained a dignified mien and laughed only when we laughed.

We offered them small cowrie shells, cigarettes, sugar, dried fish, and other gifts. These were first accepted and then handed back, a gesture we interpreted as a sign of independence. The more important-looking man, however, took a few draws from Teerink's cigar.

The Airplane a Bird to the Natives

This done, he extracted from a capacious bag hung under his armpit a steel ax-head wrapped in bark and held out the prized object for our inspection. The bag was of string ornamented in yellow designs made from the fiber of orchid stems. Offered a new ax by Teerink, the guest refused to accept it. After a friendly 15-minute chat in sign language, our visitors shook hands all around and departed in an easterly direction.

Later we had many native visitors. Just what they thought of us was hard to ascertain, though they were obviously awed by our constant buzzing over their heads. Our prestige mounted even higher when they saw the great bird swoop down on the lake and all kinds of peculiar things being taken from its "innards" and stored away carefully on shore (page 330).

On August 1, Captain Teerink and a party of soldiers, carriers, and a radio operator set out to find the route across the Grand Valley to Camp Bernhard, from which Lieutenant Van Arcken and another party had started on July 25. The two groups were to meet on the Balim River at a point where a large tributary joined it from the northwest, a position previously determined by a study of aerial photographs.

Teerink's party, making its way through a dense, mossy forest, came next day to a large clearing laid out in neat gardens. There were several huts, and in front of one a man was romping with a child while his wife tended a fire near by. As soon as they saw Teerink's party, the woman and child vanished, but the man sat down, indicating that he was not greatly alarmed by the presence of the first white men ever to penetrate his valley.

He beckoned his visitors into the clearing and began to shout. From all sides men and boys appeared, crying, "Nap! Nap!"—a word of greeting which Teerink and his men zealously repeated. Handshaking followed all around, and the white visitors were led to a good camping spot near a swift little stream.

Handshaking as we practice it was fairly common among these people, but natives in some places greeted us by grasping our wrists. Others would join fingers with us and pull free with a snap.

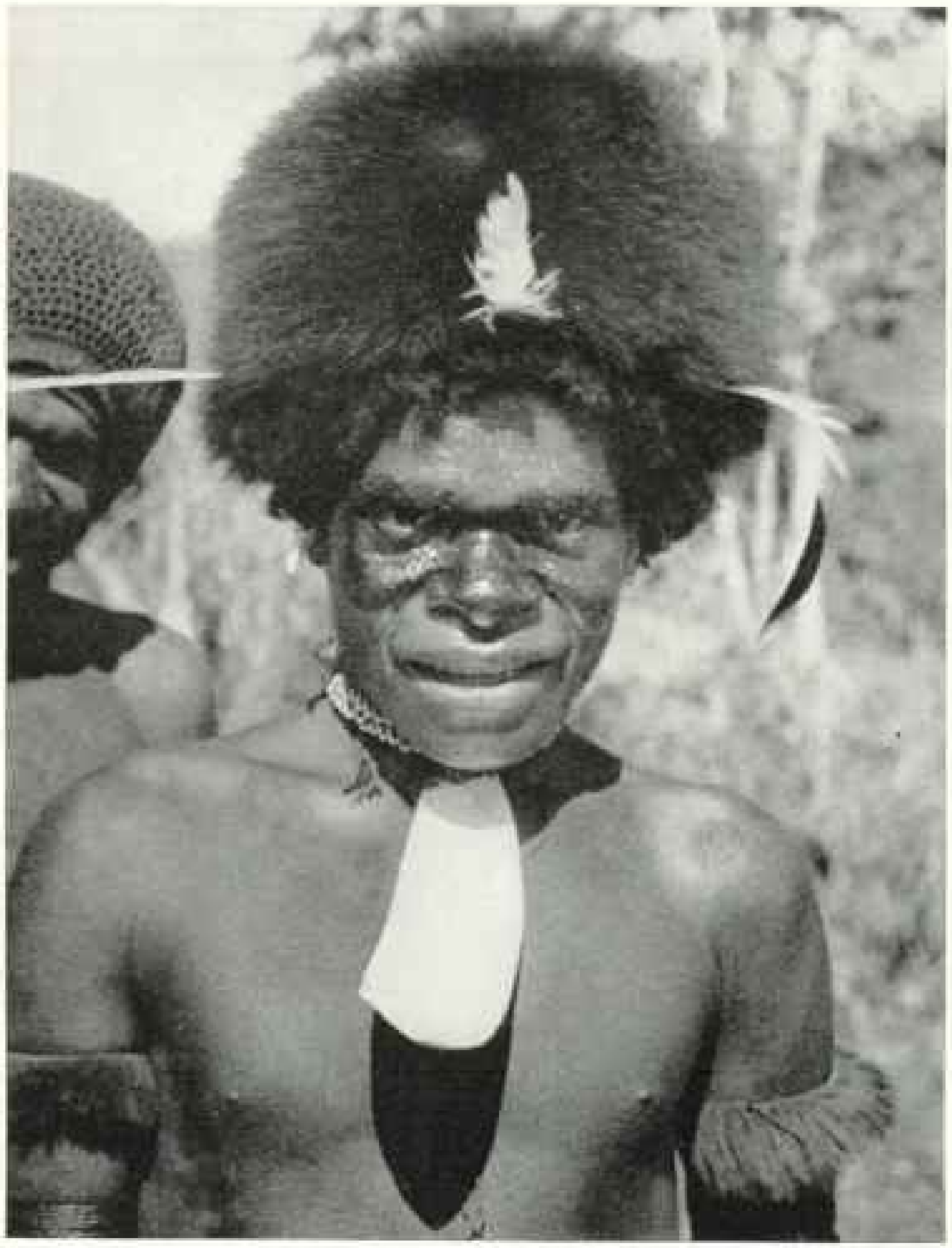
After setting up tents and a fence to keep the camp clear of a crowd whose curiosity had now overcome its timidity, Teerink and several members of his party took a dip in the stream. The natives gazed in amazement. Perhaps the practice of bathing was new to them. More probably the whiteness of the strangers' bare bodies excited their wonder.

Hospitality became a nuisance as Teerink broke camp the following day (page 332). The natives were utterly opposed to his departure and by sign language pleaded with him to remain. They made motions as if shooting with bows and arrows to tell him what kind of treatment he could expect of the people who lived in the country toward which he was headed.

When he ignored their warnings, about 300 of them followed him and his men, shouting and singing uproariously. This strange escort

Here the Archbold Expedition Found Some 60,000 People Living in a Vale Never Before Visited by White Men

The Grand Valley, as they named it, is thickly settled. As the party in the *Guba* flew over it, they saw many villages enclosed in stockades or walled with stones or mud in a patchwork of cultivated fields (pages 316, 329, 332, 333). From this unmapped land the Balim drops down a gorge in the Snow Mountains on the horizon.



What the Well-dressed Young Man Wore at Bele Camp

This dandy has a cuscus-fur headdress, fur and sennit armbands, and a shell breast ornament attached to a necklace of cowries. For the rest of his attire he is content with next to nothing (page 333).

kept pace with the explorers until midday; then several natives ran ahead of the party and placed twigs in the path. Failing to stop the march thus, they made a human barricade across the way, standing arm in arm, five men deep.

The situation was trying, but Teerink solved it by a few sharp words and black looks directed at those who seemed to be in authority. The crowd followed him for only a short distance after that. Apparently they had reached a boundary of some kind and feared to penetrate what probably was enemy territory.

The procedure was more or less similar in other villages through which Teerink passed. While annoying, overfriendliness was far easier to contend with than hostility.

Many scars from arrow wounds on the bodies of these people bear witness to warfare among them, but the location of some of the scars indicates that bravery is not one of their outstanding attributes. In settling personal quarrels, they aim their arrows at the legs.

Supplies Dropped by Parachute

On August 6 we replenished Teerink's supplies by attaching them to parachutes and dropping them from the *Guba* (page 319). He received everything but fuel and oil for the gasoline engine which generated power for his portable radio. The last two items floated off and could not be retrieved. Teerink, however, was master of the situation. He sacrificed his bottle of gin to fuel the engine and thus maintained radio communication!

The two parties arrived at the prescribed meeting place on August 14. A checkup of their journeys showed that, if the necessity arose, we could follow their path from Lake Habbema and reach Camp Bernhard in 16 days, an airline distance of 62 miles!

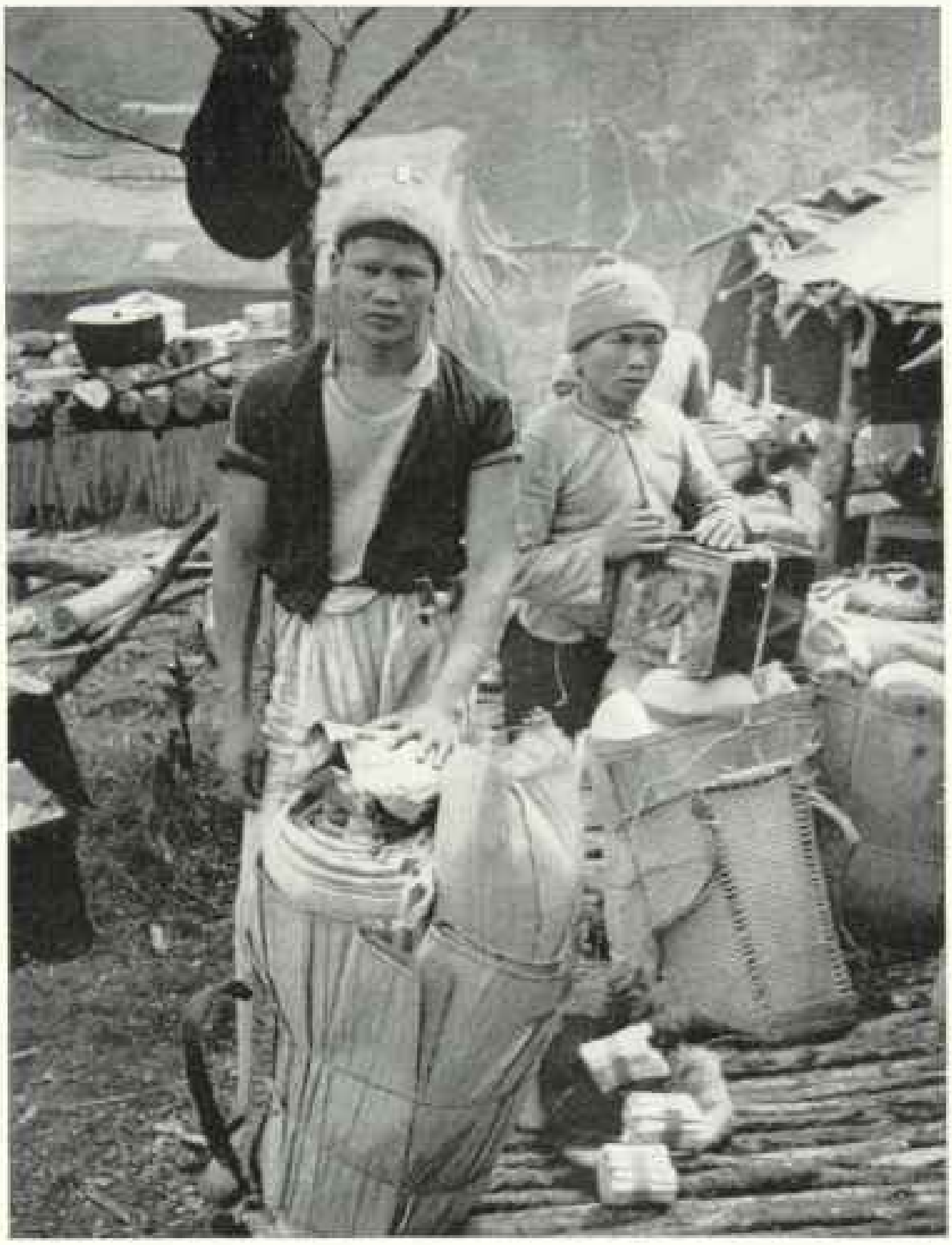
Van Arcken's journey was by far the more difficult because of the hilly terrain through which he had to cut his way. He, too, found the people he met friendly. In fact, he reported that the natives encountered on the first few days out of Camp Bernhard bore no wound scars. Evidently they were devoted to the arts of peace.

On August 19, according to arrangements made by radio, we put the *Guba* down on the Balim near the lower end of the Grand Valley and transported Teerink's party of 34 back to Lake Habbema in two trips. The next day we picked up Van Arcken's 24 men at Kadie

Lake and had them back at their starting place in short order.

Since a large and representative collection had been made in the vicinity of Habbema, we were now ready to begin work in the higher areas. On August 26 Captain Teerink and Dr. Rand left the lake to establish camps on the sides of Mount Wilhelmina, and by September 5 all of us were at work on its slopes. Our first camp was about five miles northeast of the peak and the other and higher one about 1½ miles south of east of the summit.

Here on the mountain we continued to run across natives. A party of seven, comprising two men, four boys, and a small girl, passed a night under a cliff near our first camp. Brass and Richardson first saw them on the other side of the valley, traveling slowly in the rain under long, peaked hoods of pandanus leaf. They set down their hoods and loads under the dry shelter of the cliff and by signs conveyed to us that they intended to sleep there, gesturing with the palm of the hand turned outward that we were to keep away.



For Back Packing 44 Pounds Was the Standard Load

Each Dyak arranged his own burden for the toilsome climbs on the Mount Wilhelmina trek. Equipment included a long knife slung at the belt and a waterproof palm-leaf mat which served by day as a covering for the bundle and by night as a tent roof.

About an hour later, one of the men paid a visit to our camp. Our scientists agreed that while he and his fellows were in all noticeable respects similar to those who had visited us at Lake Habbema, they appeared to belong to a different locality. Their word of greeting was *wai* instead of *nap*.

Finger Joints Sacrificed in Mourning

The visitor was minus two joints of the first and second fingers of the left hand—a mutilation general in the people we saw at Habbema. Upon questioning several, we learned that it is their custom to sacrifice a finger joint as a token of mourning for a close relative.

Scientific results of our work between Habbema and Mount Wilhelmina were eminently satisfactory, many unusual examples of flora and fauna being gathered.

Rand obtained several high-altitude birds of paradise, Snow Mountain grouse, warblers, finches, a small slate-colored flycatcher, a rock bird not found below 14,000 feet, pipits up to the edge of eternal snow, migrating snipe from Siberia, and many other important specimens.

The mammal collection obtained by Richardson included rats three feet long. Among the other specimens were bandicoots, mouse

Native Visitors at Lake Habbema Behold White Men for the First Time

In such attire, with a few sweet potatoes for food, and with bow and arrows, sometimes a spear, and nearly always a stone adz, these hardy people of the Grand Valley made long journeys over the frosty highlands. The man on the left wears a hairnet and a nose ornament of boar's tusk.

Dyaks, Crouching in the *Guba* with all Their Gear, Flew to Lake Habbema

What a contrast with old-time exploration, when men slashed their way through the jungles! With palm-leaf thatch (right) which the seaplane brought in, these carriers built themselves a comfortable house.

At Lake Habbema the *Guba* Performed Taxi Service

A long series of freighting flights to the interior set a record for aerial transportation in this part of New Guinea (page 315). Here soldiers of the Netherlands Indies escort with their supplies are ready to be flown to the Idenburg camp (page 338).

opossums, and aquatic rodents similar in appearance to diminutive muskrats.

Outstanding among the plants gathered by Brass were 25 species of rhododendrons, brilliant orchids growing in moss on the ground and on trees, and curious tree ferns which grew in open grassland and withstood frost and fire. Buttercups, daisies, gentians, and a host of little alpine flowers grew above timberline and extended down the treeless grass valleys to the altitude of Lake Habbema.

Toxopeus gathered six species of butterflies, moths which were abundant up to 12,465 feet, and flies existing on bare rocks above the limit of vegetation.

We also found crawfish in Lake Habbema, lizards up to timberline, and a snail at 14,000 feet.

Freezing Weather in Equatorial Forests

Back at Habbema on September 30, we were dismayed to see the lake six inches over its banks and to hear by radio that the Idenburg River was threatening to inundate Camp Bernhard (page 336).

The days were uncomfortably cold. Washing in the mornings called for breaking the ice in the basins, and a fire had to be kept going in the evenings—all this at a latitude of four degrees south of the Equator!

While Rand prepared a collection of grass, shrubs, tree trunks, and other material for a bird-habitat display now installed at the American Museum of Natural History, arrangements were completed to continue our work in lower altitudes.

Brass and Toxopeus set out toward the Grand Valley on October 8 and chose a campsite in the mossy forest at an altitude of 9,352 feet, 5½ miles northeast of Lake Habbema. Where trees had fallen as a result of dry rot, the natives had planted pandanus trees, the nuts of which, eaten raw or smoked, make up an important part of their food supply.

Through Mists like a Dantean Inferno a Dyak Plant Boy Crosses the Scree on Mount Wilhelmina

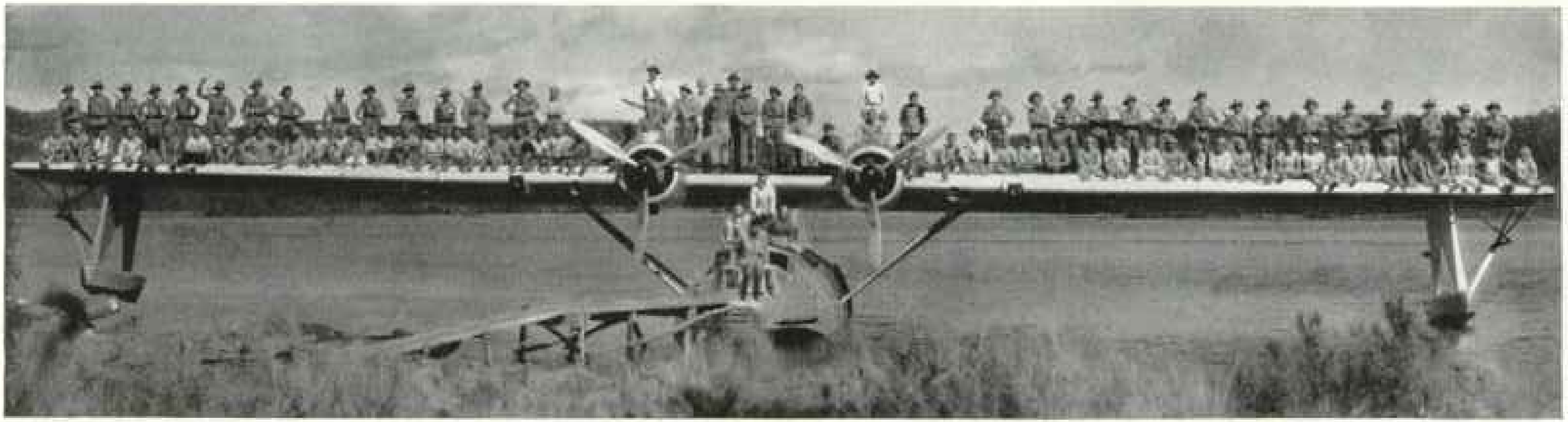
He is looking for botanical specimens at 13,000 feet, but bad weather hindered operations. Four members of the party attempted to climb the peak. After 13 days of hard going, the author and Dr. Rand reached a point about 650 feet below the summit. There they were blocked by a dangerous gorge.

An Amazing Farming Civilization Occupies Grand Valley in the Heart of Savage New Guinea

Upon landing, the explorers were astounded to find that this fencing and ditching and beautiful cultivation had been accomplished by a people working with stone tools and sharpened sticks. Sweet potatoes are the main crop; taro, spinach, cucumbers, and beans also are grown. Bananas and tobacco are found in the compounds (pages 332, 333).

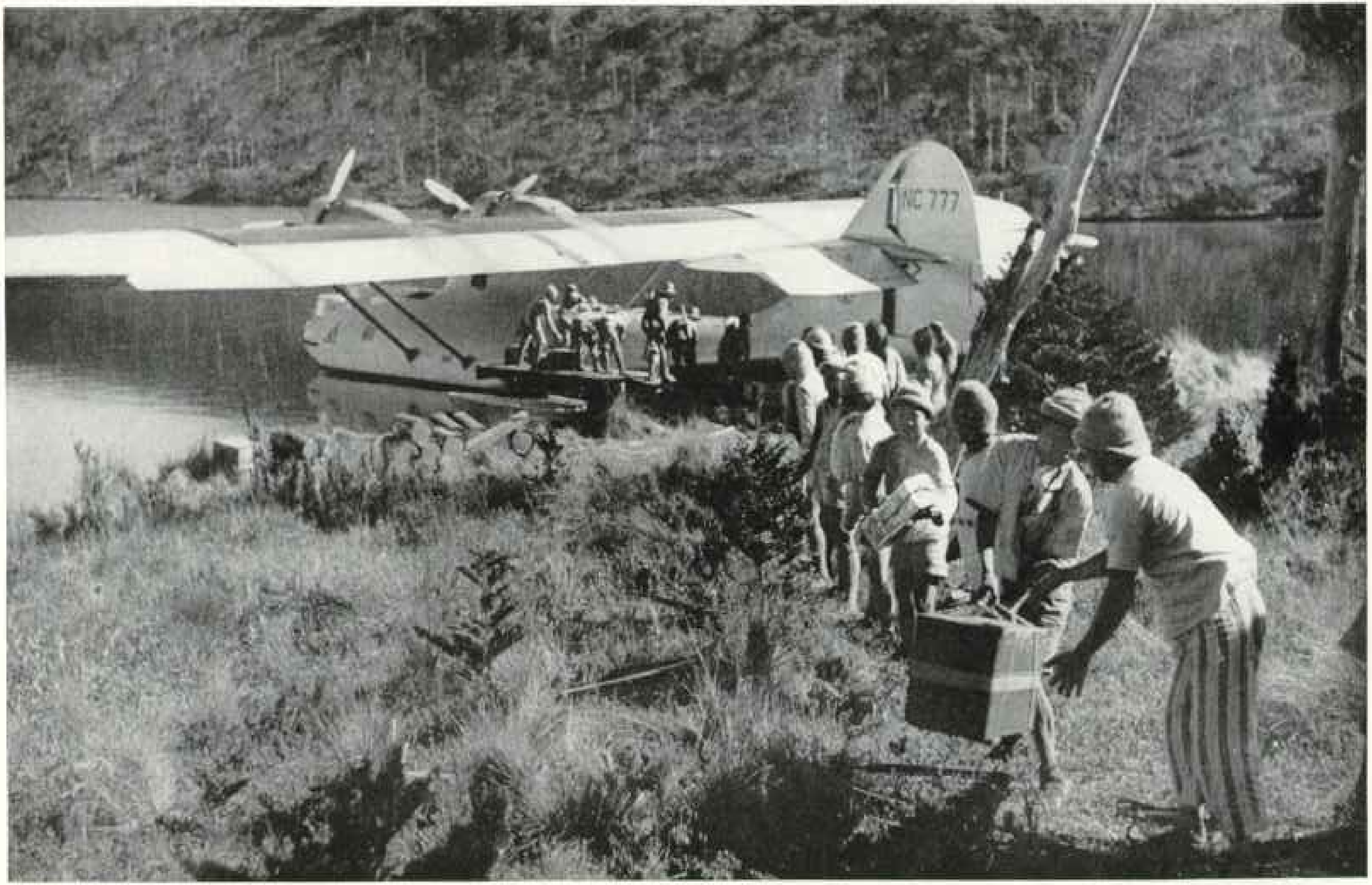
Natives Gazed in Wonder at the Strange Bird as It Unloaded Supplies from Its "Innards"—*Guba* at Anchor off Camp Bernhard

After its 31,116-mile flight around the globe, the big seaplane was sold to the British for war service.



The Entire Personnel at Lake Habbema, Posing on the *Guba*, Emphasizes the Enormous Strength of Its Wings

This PBY-3—patrol bomber built by Consolidated Aircraft—is of the type used in large numbers by the U. S. Navy. The latest model has four engines.



Cargo Comes Ashore from the *Guba* at Lake Habbema

After a trial had proved that the giant seaplane could land and take off at the altitude of 11,342 feet, regular flights were made to bring in personnel and supplies (page 319). The Dyak carriers, forming relay lines, unloaded the freight quickly by passing it from hand to hand.

Sometimes Captain Teerink Found Native Friendliness Embarrassing

Obligatory halts for a chat and a smoke made travel slow in the peaceful Bele Valley. There was always a committee of welcome in each village, and departure invariably occasioned lamentations (page 321).

We shipped some of the pandanus seeds by air express to the Coconut Grove Palmetum, in Coconut Grove, Florida. There they germinated but did not survive.

To build a camp, the party had to level a quarter of an acre of forest. Great care had to be taken in felling the trees in order to leave the pandanus uninjured.

At the very beginning of operations one of our Dyaks, careless of warnings not to damage the nut trees, hacked two of the stiltlike prop roots from a young tree. The owner was appeased with a cowrie shell.

Soon another pandanus was threatened by a big tree which was being cut down. All save one of the native onlookers gave permission for the cutting to proceed, but that one stood chattering excitedly, jabbing the butt of his spear into the ground.

Fearing trouble, Brass calmly walked up to him, took hold of his spear, and after an appreciative examination offered a cowrie shell for it. At sight of the shell, the native forgot his anger and parted with the weapon without hesitation. Our Dyaks felled the tree without doing any damage.

While temperamental at times, the natives as a whole remained friendly throughout our stay. Some offered themselves as carriers and helped bring supplies down from Lake Habbema in return for small cowrie shells.

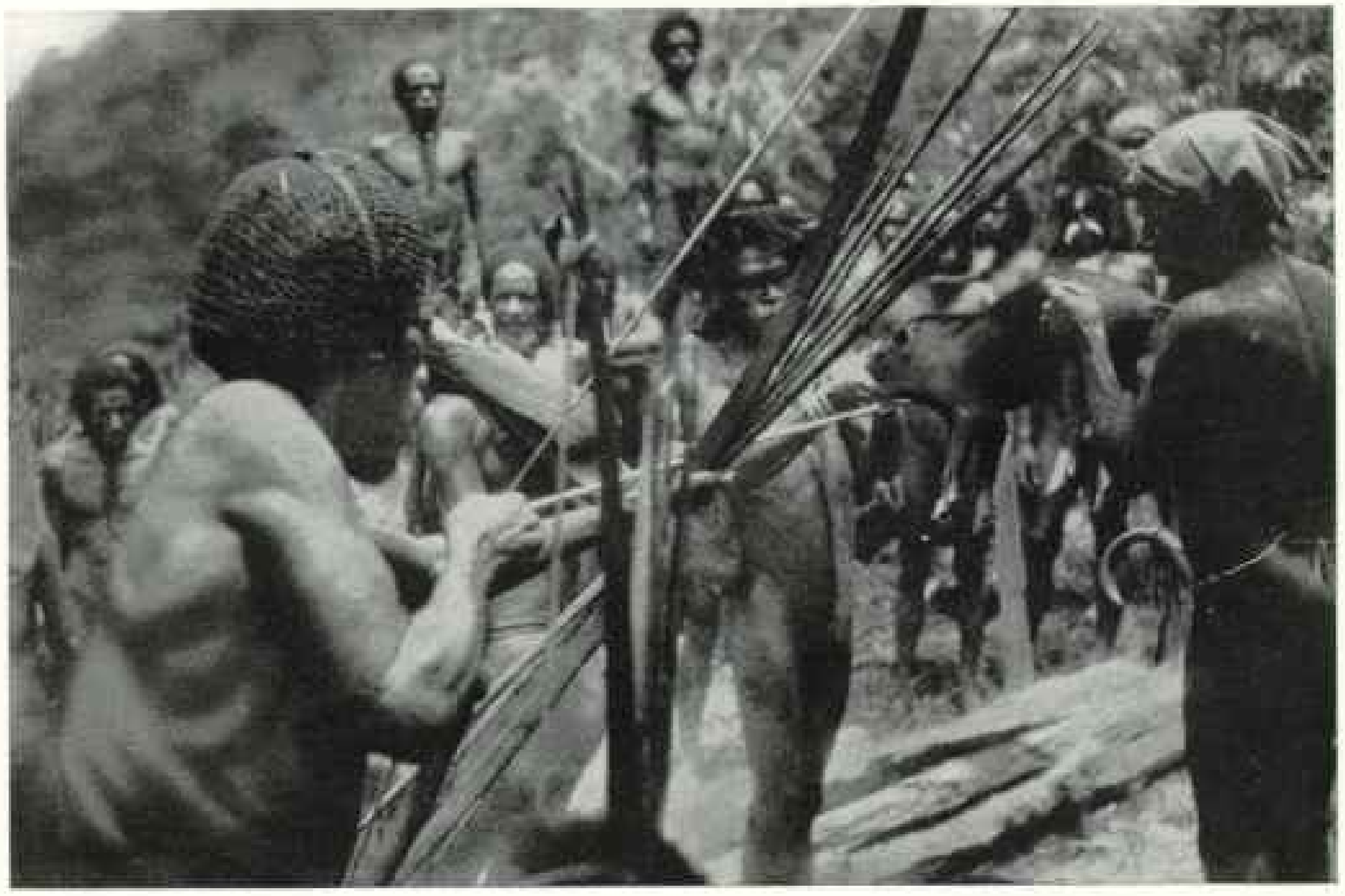
Others brought bananas, sweet potatoes, and often pigs to trade. As a medium of exchange, steel implements did not interest them so much as shells or mirrors. Apparently they regarded their crude stone instruments as far superior.

Natives Turn Collectors to Earn Shells

It did not take them long, however, to learn our major interests. Soon they were bringing in mammals, birds, and insects in return for shells. The butterfly hunters would wrap their catches in leaves and hand the little packages to Toxopeus, the entomologist. Many were worthless, however, because of rough handling.

Brass, our botanist, was the only one who did not get their assistance as collectors. It appears they could not understand what he or any other of these strange white men would want with flowers.

The more we saw of these people who had hewn down great stretches of forest, cleared the land of stumps and stones, and raised large crops, using only crude stone and wooden implements, the more amazed we grew at their simple culture. The agricultural pur-



Held by Snout and Flanks, a Pig Was Sacrificed for the Feast at the Bele

Convention prescribes death by an arrow through the lungs. The blood was saved for sprinkling rites which took place after the livers had been cooked by the elders and shared with the white men (page 336).

suits of natives I saw in other parts of New Guinea were the helter-skelter efforts of children compared with those of the inhabitants of the Grand Valley.

In their gardening, devoted primarily to sweet potatoes, some taro, bananas, and tobacco, they showed an understanding of the basic principles of erosion control and drainage. From the neat stone fences surrounding their carefully weeded fields it was easy to imagine that we were in New England rather than in an isolated valley of the last of Stone Age man (page 329).

Like the men, the few women were nude, except for a short skirt and a coarse net bag hung over the back from a band around the forehead. Dr. Huls, who succeeded in getting several of the natives to submit to ethnological measurements, found that their height ranged from 4 feet 8 inches to 5 feet 8½ inches. Nothing, however, could tempt them to submit to a blood test. They have a superstitious fear of giving anyone a particle of their bodies, even a bit of hair or a fingernail.

We found some evidence among them of ceremonial cannibalism, and Dr. Huls believes that, instead of burying their dead, they cremate the bodies.

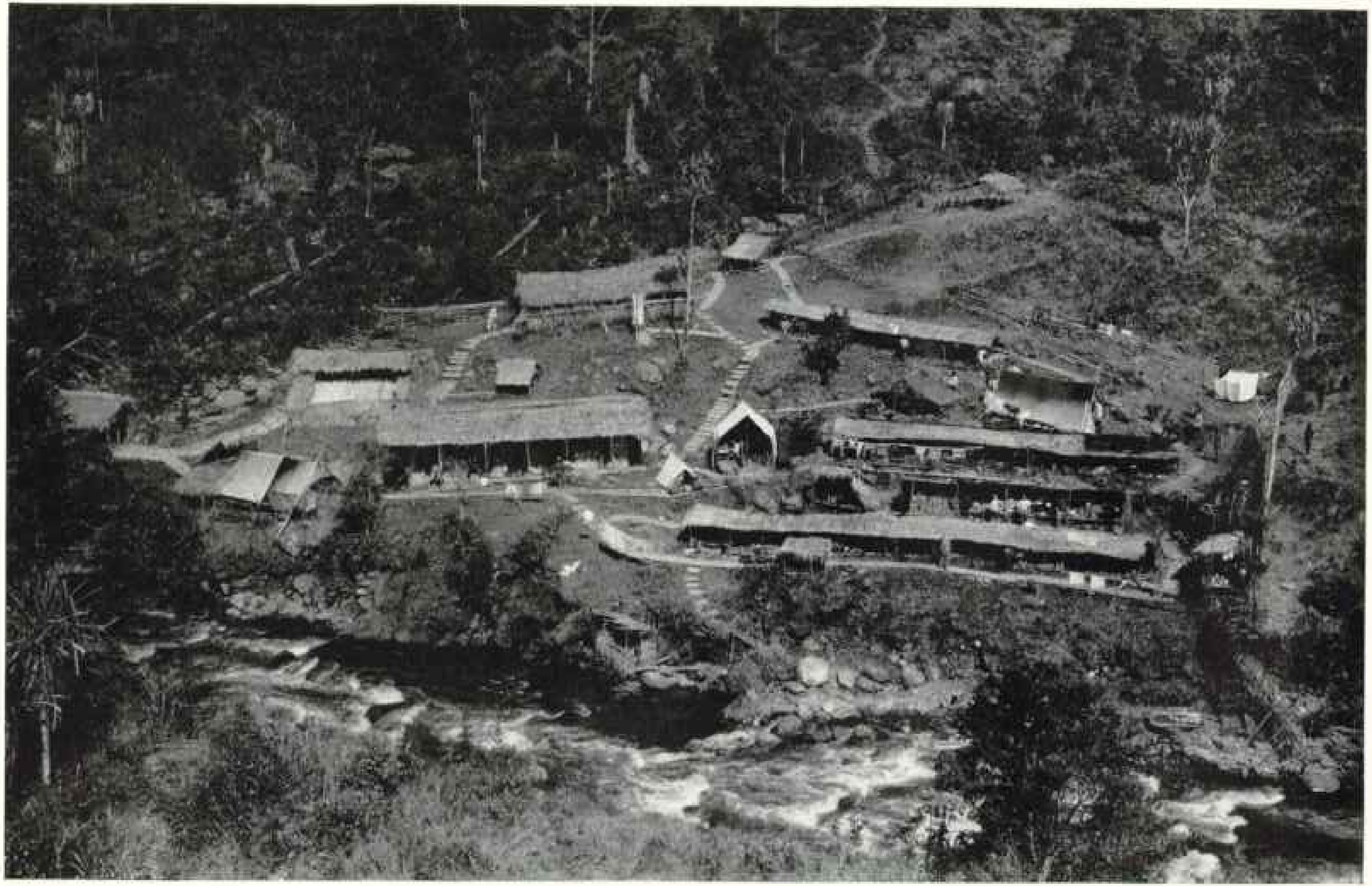
From the mossy forest we moved down to the south bank of the Bele River. The camp was at an approximate altitude of 7,200 feet, about 14 miles from Lake Habbema (p. 334).

White Man's Law in the Wilderness

To prevent the ever-curious natives from overrunning the camp, Teerink set up a simple form of government. He appointed two who appeared to be headmen as diplomatic agents, whose function was to handle transactions between the expedition and the natives.

He also delegated two younger men as policemen. These four officials were given white bands to wear around their heads as a mark of their exalted rank. They realized the distinction conferred upon them and for the most part performed their duties well.

One of the policemen, whom the soldiers nicknamed Beo, was able to call members of the expedition by name and showed a remarkable talent in pronouncing Dutch words, even those with the difficult "sch" sound. In addition, he was the only native who dared to eat rice and dried fish and seemed to appreciate coffee and tea. He never tired of lending our men a hand, and when he was not helping with the laundry he was bringing in firewood or performing other useful chores.



On the Bank of the Bele River an Orderly Camp Was Hewn from the Jungle

Staff quarters are on the left, soldiers' and carriers' on the right. Grass roofs were built over the tents, for after three months at high altitudes, the climate at 7,200 feet seemed uncomfortably hot. A fence kept natives from intruding (page 333). In the right background is a shelter where tribesmen traded.

Dyak Carriers Make a Risky Crossing of the Racing Wamena River

Steadying themselves by a rickety handrail, they picked their way through the deepest part on a tree felled so that it was jammed against submerged rocks by the force of the current. This stream is a tributary of the Balim, which rises on the northern slopes of Mount Wilhelmina (map, page 318).

On the day our scientists arrived at the Bele River camp, the natives staged a ceremonial dance and feast. It began at 10 o'clock in the morning with an hour of monotonous but sometimes melodious singing. Only the men raised their voices. The women remained silent. When several of our party joined in, the natives appeared delighted and sang with even more gusto.

Several young pigs were brought in and, while they were being slaughtered, fires were built. The natives insist that there is only one way to kill a pig. Two men hold the creature, one the hindquarters and the other the snout. It is then shot by an arrow from a distance of about four feet (page 333).

As the pigs were placed upon the fire, a witchlike woman with bow and arrow in hand sprang up and began to harangue the people in a screechy, vehement voice. When she ended her exhortation, the natives divided themselves into groups and began running to and fro, the men singing, the women, for the most part, silent. Again the weird mistress began her screeching, and this time the dancers performed in a ring.

Initiation into a New Guinea Tribe

Four hours later the pigs were carved, and the liver, apparently regarded as the choicest morsel, was given to our men. They got it down after a struggle and were then ceremoniously sprinkled with pig's blood. They were now full-fledged members of the tribe.

At another camp I went through a similar ceremony. Fortunately, the specialty there was baked sweet potato instead of pig's liver.

As our party left the Bele River to establish a camp on the Balim, 25 miles to the southeast, the older natives wept and wrung their hands, while the younger ones looted the camp of old clothes, buckets, bottles, and kerosene tins.

The route to the Balim site was through many more villages and across acres of highly cultivated fields. Here the natives seemed to take our party for granted. Some stood by and watched the long line of carriers file by, while others, digging in the gardens of rich black earth, did not even look up. In this part of the valley there were few fences, the gardens being surrounded by carefully dug trenches which served not only to drain the land but to keep out pigs.

The Balim camp was situated on a bank of the river in a grove of sighing casuarinas. Great fields stretched for miles with scarcely a remnant of the original forest remaining.

The natives here appeared to be more placid than those we had met before. Perhaps it was because they are more closely tied to the soil, having no new forest land to bring under crop. The stone and earth walls and their drainage systems of straight, clean-cut ditches are by far the finest I have seen anywhere in New Guinea.

These people were not only excellent agriculturists, but also ingenious engineers. Not far from where our party was encamped they had built a suspension bridge of large forest vines carrying a three-foot decking of split timber. I have counted 20 persons crossing it at one time.

The base at Lake Habbema was abandoned in November, and the *Guba* kept the expedition in supplies by alighting on the Balim. When enough had been brought in to last for several weeks, she was flown to Sydney, Australia, in command of Rogers, for supplies and for adjustment of the Sperry automatic pilot.

Collection results in the Habbema-Balim area were, in some respects, better than in the territory of Habbema-Mount Wilhelmina. Rand obtained a gray and yellow bowerbird, a new genus found in the mossy forest. He also found lories in the treetops, fantail flycatchers in the undergrowth, a new finch in the grassland, and a new nuthatch.

Mammals were more numerous in this area, and Richardson got large and small phalangers (New Guinea opossums), other queer marsupials, numerous rodents, etc.

Brass observed that, as elsewhere in the mountains of New Guinea, heavy population occurs at altitudes in which forests are dominated by oaks. The New Guinea oaks are large trees with evergreen leaves which might pass unrecognized as oaklike by the casual observer but for acorns which strew the ground beneath them.

The banks and streams of the Bele and the Balim Rivers also produced a rich collection of insects.

Floods Make Collecting Uncomfortable

The last four months of the expedition were devoted to collecting in a flooded area surrounding Camp Bernhard on the Idenburg River (page 330). There we encountered a very different type of native, a nomadic people who moved from place to place in dugouts. Their average height was about five feet. Instead of spears, they carried daggers made of cassowary bones. The presence of a few iron tools among them indicated either that they traded with tribes which had some contact with the coast, or that possibly they had obtained the implements from bird of paradise hunters long ago.

Unlike the Grand Valley people, they were plentifully supplied with dogs, medium-sized creatures which seemed to have lost the art of barking but made up for it by a highly perfected, most annoying bowl.

Continual rain hampered our party in the four camps on the Idenburg slopes until all were evacuated on May 9, 1939. Despite the handicaps and discomforts, our scientists achieved splendid results. Rand found a wide range of bird life between the mossy forests and the lowland forests. Among birds collected was a little parrot which digs holes in dead trees. Many migrants from Asia were found on the banks of the Idenburg.

Courtship of the Bird of Paradise

Most gratifying, however, was Rand's study of the courtship of the magnificent bird of paradise.

The male bird clears a space on the forest floor for his display. This he guards for months at a time, driving away other males and calling to attract females. Hidden in a little palm-thatched hut on the edge of these display grounds, Rand was able to watch the courtship of the birds without their suspecting his presence.

The male's plumes are used for two purposes: first, to intimidate and frighten away rival males; secondly, to arouse the female to accept him as her mate.

Marriage, however, in these brilliantly colored birds is of short duration. The female retires into the forest by herself to make her nest and raise her brood without assistance from the male. Philanderer that he is, he stays at his display ground throughout the breeding season.

Both Plants and Boots Were Dried on a Raft at Bernhard

Since the whole plain was flooded, the collectors had to slosh about in puddles while searching for specimens. They suffered discomfort from the dampness and, though it seems incredible at four degrees south of the Equator, from the cold weather as well.

Among the mammals collected by Richardson were flying foxes which hung in a large colony in the swamp forest at the edge of a lagoon; numerous New Guinea opossums, or cuscus, with orange and white markings, commonly seen at dusk in trees above flood water; a new rodent, related to the water rat, dwelling in the mossy forest far from the expected riparian habitat; and wild native pigs, the largest New Guinea mammals. These last added not only to the collection but also to the larder.

At the edge of the forest at Bernhard Camp, Brass found many conspicuous flowering trees and plants, the most brilliant the celebrated D'Albertis creeper with hanging festoons of

Dyaks Divide Their Rations Fairly and Without Quarreling

Throughout the trying months in the field, these willing workers from Borneo were good-natured. The issue of tobacco and dried fish at a mountain camp always meant a gala day for them.

large pealike flowers of a brilliant, fiery red. He also found the mossy forests of the mountain cloud belt extremely rich in beautiful ferns. In a gully near the camp at 6,000 feet he gathered more than 100 species.

As soon as the packing of collections from the last camps was completed for shipment, the exodus began. The Dyaks returned to Borneo, and the Netherlands contingent to Java. While our scientists and technicians left by steamer, the crew of the *Guba* and I flew her out of Hollandia to continue the flight westward around the world.

Decision to Fly Around the World

The decision to fly home by the longest way came about while the *Guba* was in Sydney for supplies.

For several years the Commonwealth of Australia and the British Government had been interested in a proposal made by Captain P. G. Taylor, associate of the late Sir Charles Kingsford-Smith,* to survey an aerial route across the Indian Ocean, which had never been flown by airplane. He believed that in event of war it would provide a valuable alternative to the England-Australia route by way of Singapore and Java.

The route he advocated was from Port Hedland, on the northwest coast of Australia, to Mombasa, Africa, by way of the Cocos, Chagos, and Seychelles Islands, thereby connecting with the Imperial Airways operating from Cairo to Capetown. Such a route to Australia would be over territory exclusively British or British-controlled.

As the situation in Europe became more acute, the Australian Government decided to make the survey. Taylor was commissioned to find a ship, but none suitable for so long a journey was available until the *Guba* arrived in Sydney. He proposed that we make the flight when the work of our expedition was completed in New Guinea.

Rogers, who was in command of the *Guba* at that time, wired the proposal to me in Hollandia. I accepted, with the proviso that the Commonwealth assume responsibility for fueling and provisioning and that it arrange for me to make biological collections in the islands on the route.

Such a route was not really very much out of our way, and the westward course would place prevailing winds at our advantage. It would also give us an opportunity to circle the

* See "Our Conquest of the Pacific," by Charles E. Kingsford-Smith and Charles T. P. Ulm, National Geographic Magazine, October, 1928.

Supplies for Bernhard Camp Were Unloaded from the *Guba*

Because of well-organized land and aerial transport, which ensured supplies at all times, the expedition achieved its objectives without the loss of a man or a case of serious illness.

globe near its greatest circumference and to pioneer in unflown skies. A new set of engines which had been sent from San Diego as spares was put into the *Guba*, and on May 12, 1939, we left Hollandia for Sydney, stopping en route at Port Moresby and Townsville and arriving on May 14.

Captain Taylor was put in charge of the Indian Ocean survey. This included the sounding of coral lagoons in the islands to determine their suitability for flying boats, and the collection of information likely to be of value in the establishment of air bases.

We took off from Rose Bay, the seaplane base at Sydney, on the afternoon of June 3 and reached Port Hedland the next morning after a nonstop flight across the continent. It turned bitter cold during the night, and even our fur-lined suits did not keep us comfortable. When the sun rose, the country beneath us looked most unfriendly and desolate. We saw no sign of habitation until we reached the coast and then only the collection of a few weather-beaten buildings called Port Hedland.

Blazing Air Trail over the Indian Ocean

Upon our arrival, we found a weather report from the Cocos indicating fairly good conditions, and after checking the gas remaining in the *Guba*—capacity 1,750 gallons—we added 1,400 gallons poured from 5-gallon tins and were off that evening on the first stage of the first flight over the Indian Ocean.

All went well until midnight, when rain and thick weather set in. At 2 A. M. we were within the vicinity of the islands but were unable to sight them because of poor visibility. We flew back and forth until daylight, but the sun did not brighten our prospects. The ceiling was 800 feet with 50 feet visibility in rain squalls.

Although we could talk to the radio operator at the Cocos, who said he heard us pass over the islands twice, we could not get a radio bearing. We had been in the air now for nearly 14 hours and could not continue to fly around indefinitely, particularly since the Cocos radio operator had informed us that the rain might continue for two or three days. Unwilling to take any more chances, we laid a course for Batavia, 800 miles away.

Two hours later, as my curiosity got the better of me, I sent a radio to the Cocos, inquiring about weather there. The reply was that the rain had stopped and that the sun was out in all its glory. But it was too late for us to turn back. Our gas was running low, and we continued to Batavia, where we

British Colonial Officials Royally Entertained the *Guba's* Crew at Port Victoria in the Seychelles

Photographs by Rodney C. Wood

Dots on Empty Ocean Are Sainte Anne, Mayenne, Round, and Cerf Seen from a Cinnamon Farm on Mahe Island, Seychelles

A Mixed Flotilla of Canoes Met the *Guba* off a Lake Sentani Village

Near the shore are circular fish traps into which the women dive to collect the catch. Seven thousand people live in pile dwellings and along the numerous bays.

arrived after being in the air for 23 hours and 30 minutes.

We left Batavia on June 7 and detoured from a straight course to fly over Christmas Island to see whether this island, which is rich in phosphate, could afford a harbor suitable for use by an airplane in an emergency. Such did not seem to be the case, however, and we flew on to Cocos.

The two atolls commonly referred to as Cocos are low-lying, and nothing of them shows above the sea except palm trees. The larger atoll is South Keeling; the smaller is properly known as North Keeling.

Remarkable Government on Cocos

Here in this tiny spot in the Indian Ocean at which ships seldom call, we were royally entertained (opposite page). We were put up at the barracks of the cable station operators and were also guests of the governor, whose great-grandfather, J. Clunies-Ross, took possession of the islands in 1827.*

The present governor, through strict but benevolent rule, keeps some 1,400 natives contented. He has insisted that their houses be spaced far apart and constructed with removable wall panels so that they may be thoroughly aired. The streets are cleanly swept.

A school for household hygiene has been introduced. By removing girls between the ages of 12 and 18 from the main village, so that their only contact with men is with those especially selected and trusted, he has broken the custom of child marriage. A small village on a neighboring island has been established for taking care of these girls.

Women do gardening and housework, while men labor in the copra fields, fish, and do special jobs, such as building boats and taking care of the governor's launch. The island has been made as self-sufficient as possible.

The men work at their regular jobs from sunrise to a little after noon. From then on, they may fish and may keep a fair proportion of what they catch. In this way they are able to obtain more food than is allotted to the family unit by the governor from the communal storehouse. When turtles are caught, they are put in a special compound and kept for banquets such as marriage ceremonies and the Christmas holiday, and for the Mohammedan New Year.

There is no money, but each family unit which does its job is properly maintained and is assured of the necessaries of life. Little food is produced on the island; much is imported. The governor is experimenting with a truck garden, and the produce is doled out to each family as it is available. In the regular allotment of food to the natives, meat is issued about once a week and fish twice a week.

While no money changes hands, there is a recognized value to certain foods and articles of clothing. Natives who have shown personal initiative and obtained credit for themselves, aside from their regular allotment, may use this credit for other foods and clothing at the storehouse.

For entertainment, there are supervised games, weddings, and holidays. Marriage is a matter of purchase. The husband gives the father of the bride a gift which is requested by the father. It is sometimes necessary for the governor to arbitrate matters of this kind when disputes as to the size of the gift arise.

The governor supplied me with two boys to help with collecting. My offer to take them on a flight was bashfully accepted. They were silent during the ride and displayed little emotion. Upon our departure, however, each of them presented me with an exquisitely worked tortoise-shell brooch.

Salvage from the *Emden*

The pin itself showed a lack of metal. Practically all the available supply of metal comes from pilgrimages during good weather to North Keeling, where the natives salvage it from the German ship *Emden*, beached there in the first World War. She was surprised by H. M. A. S. *Sydney* in the act of destroying the cable station.

We reached Diego Garcia in the Chagos on June 13 after a 14-hour flight and found that it offered even better seaplane facilities than the Cocos. For the comfort of airplane passengers, its one drawback is flies—houseflies, millions of them. Getting rid of them would merely be a matter of cleaning up the island.

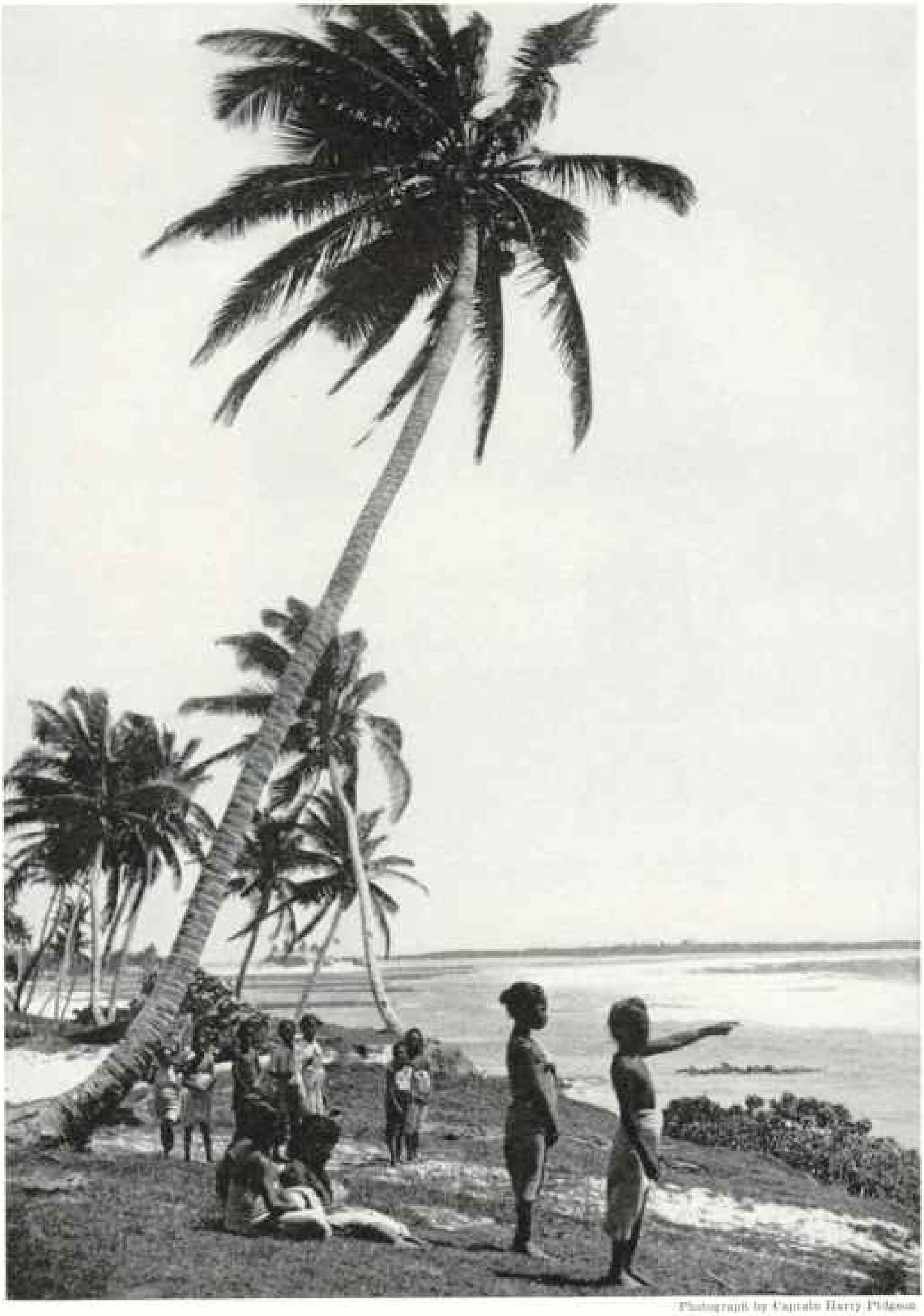
Here we enjoyed a delicious coconut-crab dinner. These crustaceans, as big as lobsters, can climb coconut trees and have pincer claws strong enough to break the shells of coconuts.

Mahe, in the Seychelles, was reached on June 16, and we were not long finding a suitable base for all types of flying boats.

Thus we had determined that three island groups in the Indian Ocean would make a chain connecting the east coast of Africa with the west coast of Australia. With the installation of radio and weather stations as well as landing facilities, these islands would offer not only an alternate route between Australia and England but a shorter one.

The Seychelles, especially since the decline

* See "At Home on the Oceans," by Edith Bauer Stout, National Geographic Magazine, July, 1930.



Photograph by Captain Harry Pidgeon

Happy Are the Natives Who Live on the Cocos Islands

Under the benevolent rule of Governor Ross, child marriage has been discontinued, and the people are healthy and carefree. Metal is salvaged from the German raider *Emden*, beached on a near-by reef in a losing battle with the Australian cruiser *Sydney* in the first World War (opposite page).

Photograph by Dr. Robert Randolph

In Mombasa Tribute Is Paid in Four Tongues to African Heroes

This monument in the capital of the Coast Province, Kenya, honors the native troops who fought in the first World War: the carriers, "hands and feet of the army"; and others who "died for King and Country."

in the price of spices, have become a residential mecca, particularly for retired British service officers (page 340). Their homes border the ocean, and it is a pleasure to motor through their well-kept grounds to see the curious trees. Many of these have been imported, although some, such as the double coconut, or coco de mer, are products of the islands.

Mountains Provide Air Conditioning

The center of the island is too steep and mountainous for habitation. However, these mountains lend beauty to the island and also insure a cool evening breeze. The weather cannot be called hot even during the rainy season. The only really warm weather is during the change of the monsoon period. The islands are too far north to get the terrific hurricanes that strike the Madagascar coast.

After being most hospitably entertained by the Governor of the Seychelles, we were off for Mombasa, where we arrived on June 21.

Captain Taylor left us there to return to Sydney by steamer with a complete report of the survey, while we prepared to make the first flight across Africa in a flying boat. Before taking off for Kisumu, on Lake Victoria, I received the following telegram from Prime Minister R. G. Menzies of Australia:

"The Commonwealth Government appreciates the part played by yourself and the crew of the *Guba* in the trans-Indian Ocean survey flight. Apart from the value of the survey flight, it has been a further example of what can be accomplished under difficult conditions by airmen of our two countries. Australia remembers the part played by your countrymen in Kingsford-Smith's Pacific crossing. Best wishes for the Atlantic crossing and a safe return home."

The exploration and investigation side of our work was over. Ahead of us was only the long journey home to be made as quickly as possible. Across Africa we roared to Kisumu, Coquilhatville, Lagos, and Dakar; across the Atlantic to St. Thomas and Floyd Bennett Field. From here we were taken to the World's Fair for a reception.

With our return to San Diego a few days later, we had completed the first aerial circumnavigation of the world nearest its greatest circumference.

Indian Ocean Map Spans Far East News Centers

STRATEGIC places and naval bases of the Orient are spotlighted on the National Geographic Society's new map of the Indian Ocean region, which reaches 1,100,000 members this month as a supplement to their Magazine.*

With insets of Suez, Singapore, Hong Kong, New Zealand, the Philippines, and Guam, this 10-color chart, 25½ by 32¾ inches, portrays the vast world "down under." It includes all of Australia, large portions of Asia and Africa, and some of the world's most productive and densely populated islands.

Within its boundaries is the area extending from Turkey and Soviet Russia to desolate Heard Island at the door of the Antarctic, from Tokyo to the Cape of Good Hope, and from the embattled Mediterranean to the tip of Tasmania.

Highest Peak and Deepest Ocean Spot

Here appear the earth's highest mountain and its deepest ocean hole. Off the Philippines in the Pacific lies Mindanao Deep, where the world's record sounding of 35,400 feet, or about 6.7 miles, has been taken, while 2,900 miles to the northwest soars majestic Mount Everest, 29,002 feet high, or nearly 5½ miles. Together they represent a 12-mile vertical span.

In this area are some of the world's last major unexplored places—and some of its most populous lands. The interior of the Arabian Peninsula, largest uncharted area outside the polar regions, has been crossed in recent years by white men, but has never been thoroughly investigated.

The comparative emptiness of this gigantic blind spot, or of Australia's arid central regions, differs sharply from the teeming populations of China, India, or Java. Striking, too, is the contrast between its dryness and the heavy rainfall of Cherra-Punji, India, second wettest known place in the world (426 inches annually). Waialeale Mountain, in the Hawaiian Islands, is wettest (460 inches).

For following dramatic developments, National Geographic Society members will find this supplement a complement to other recent Geographic maps (Atlantic, Pacific, Europe, etc.), which are now studded with colored pins on the walls of military and naval strategists and trade experts.

Thirty-three bases of seven navies—of the United States, Britain, Australia, Japan, France, Italy, and the Netherlands—are indicated by red anchors. Tiny black derricks mark the oil fields, sources of the vital fluid of battleship, airplane, and tank.

Historical highlights, shown in blue type, carry the map back to 1500 B. C. A temple wall inscription at ancient Thebes describes an Egyptian voyage of that period to the land of Punt, probably on the Indian Ocean coast of Africa in the region of Mombasa.

If you drove a stake straight down through the center of the earth from New York, Washington, or Kansas City, it would come out in the wide Indian Ocean. In surface miles, therefore, that tossing sea is more remote from the United States than any other ocean. Yet the map emphasizes that in trade and strategy this region is figuratively next door.

From Netherlands Indies and British Malaya come major United States supplies of rubber, tin, and quinine. Oil derricks bristle in the Indies, in Java, Sumatra, Borneo. Enormous quantities of their output go to Japan.

Here the American flag flies far from home, waving over sequestered Guam and the populous Philippines.

In this area lies a vital share of the worldwide British dominion, notably Australia, neighboring New Zealand, much of South Africa, and that human anthill, India.

Australia Completes Defense Highway

Like China with its Burma Road, Australia has a new defense highway, built for wartime need. A 600-mile stretch connecting the railheads of Alice Springs and Birdum, this Northern Territory road completes a rail-highway-rail route that provides for the first time a modern north-south transportation system across Australia.

Begun in September, 1940, with the promise of having the men home for Christmas, the project was completed in record time. It forms a lifeline to Darwin, a naval and Royal Australian Air Force base connected with Singapore's defense. Now Darwin could be supplied by land if control of Australia's coastal waters should be impaired.

For the British Empire the broad expanses of the Indian Ocean form a defense highway. Over its lonely sea lanes pass transports laden with fighting men from Australia, New Zealand, or India; merchant vessels bearing materials and food for beleaguered Britain; and the watchful warships of Britannia's Navy.

With the Mediterranean in the grip of war, Great Britain detours much traffic to the old

* Additional copies of the Indian Ocean map may be obtained by writing to the National Geographic Society, Washington, D. C. Prices in United States and Possessions, 50¢ on paper (unfolded); 75¢ mounted on linen. Outside of U. S. and Possessions, 75¢ on paper; $1 on linen—all remittances to be payable in U. S. funds. Postage is prepaid.

Photograph by Maynard Owen Williams

From Madagascar to Zamboanga, Outriggers Feel the Pulse of the Indian Ocean

Here at Manado, shipping center of northern Celebes, outrigger "taxis" are towed back from the Netherlands island steamer. Throughout this watery world—off Ceylon, in the Sulu Sea, among the Andaman or Comoro Islands—dugouts or canoes with straddle-hung floats ride the surge of southern seas.

route around the Cape of Good Hope and across the heart of the Indian Ocean. The detour is 4,422 nautical miles farther to Bombay than the Suez short cut.

In the present war German raiders have been reported in the Indian Ocean, where they operated in the first World War until British and Australian warships tracked them down (page 342).

In the Indian Ocean world-wide trade winds blow their strongest; mariners from early times have ridden these escalators of air.

Phoenician ships and the adventurous little craft of Europe's Age of Discovery; big, rich British East Indiamen and rakish pirates; tea clippers racing home from China; wool clippers carrying settlers to Australia and coming back laden with fleece; the wind-driven grain ships that even yet in peacetime sail out in ballast to the southern continent and then race home around the Horn—the Indian Ocean has known them all, from the earliest days of the saga of sail. Winds, currents, and typical storm tracks are shown here.

Varying in direction with changing seasons are the monsoon winds, which take their name from the Arabic word *mausim*, meaning season. When these winds go into reverse, fierce storms often occur—the dread typhoons.

Between the Equator and 30 degrees south blow the southeast trade winds, producers of the Equatorial Current. The calm belt which lies near the Tropic of Capricorn is here shown by its familiar name, the "Horse Latitudes." Also designated are the "Roaring Forties," the region of the fortieth parallel of south latitude, where winds blow steadily around the globe from west to east.

Time zones are outlined by white lines in the ocean's blue. They help emphasize how Asiatic are the Philippines, for Manila and Hong Kong are in the same time zone.

Brown contours marking out the sea floor topography emphasize that the Indian Ocean, like the Atlantic, has a central area of comparative shallowness. It extends from India toward Madagascar and has given rise to conjecture about a one-time Indian Ocean continent, such as the Atlantic's storied Atlantis.

This up-to-date map, created by National Geographic Society cartographers, is drawn on the Mercator projection designed 372 years ago by Gerardus Mercator, father of Dutch cartography. Today this network of straight parallels and meridians still is almost universally used for nautical charts.

Net Results from Oceania

Collecting Aquarium Specimens in Tropical Pacific Waters

By Walter H. Chute

Director Shedd Aquarium, Chicago, Illinois

"NO MORE Kikakápu for a while. The last lot is not standing up well. Half of them were dead this morning. We can use a few more Kihikihi, though."

The Shedd Aquarium's Hawaiian expedition was on location at Fort Armstrong in Honolulu, and I was on the dock talking to one of our local fishermen. He speaks excellent English, but knows the fishes only by their Hawaiian names, so that my conversation with him sounds like "pidgin" English.

We had journeyed to Hawaii to collect some of the 600 species of fishes known in these waters to add to the extensive exhibit of the Shedd Aquarium in Chicago.

That tongue-twister, "Humu Humu Nuku Nuku Apua'a," we had heard mentioned so frequently in the chorus of the popular song "My Little Grass Shack in Kealakekua, Hawaii" (page 367), and another favorite, "Kihikihi," so-called by the islanders because of its resemblance to the new moon (page 349), were some of the treasures we sought.

Also, we wanted to make for the National Geographic Magazine color photographs of these sparkling fishes fresh from their natural habitat before their brilliant coloring had faded in captivity. Some of the results of this work appear in the accompanying 24 illustrations in color.

Every Fish Name Has a Meaning

Hawaiians believe that the big erectile dorsal spine of the triggerfish group is used like a needle, and *humu humu* means "to sew." When taken out of the water, the triggerfishes grind their teeth together, making a grunting sound. *Nuku nuku* means "to grunt," and *apua'a* means "like a pig."

So, the next time you sing "Where the Humu Humu Nuku Nuku Apua'a Goes Swimming By," remember you are actually crooning "Where the fish that sews and grunts like a pig goes swimming by"!

The longest name of a Hawaiian fish, "Lauwiliwili Nukinuki Oioi," is given to one of the smallest of the butterflyfishes.

Because this little fish habitually swims in odd positions, sometimes head down, sometimes head up, and even occasionally upside down, Hawaiians say that it is *lauwiliwili*, (unpredictable). *Nukinuki* means "nose" or "chin" and *oi* means "long." Thus, Lauwiliwili Nukinuki Oioi means "an unpredictable fish with a long, long nose" (page 367, upper left).

One of the most delightful names given to a fish by the Hawaiians describes the little wrasse, *Cheilinus bimaculatus* (page 372). According to Hawaiian legend, this was the last fish created, and, when it had been completed, the Creator laid down his tools and rested. The natives call the fish simply "Pau," which in their language means "finished."

Many legends have sprung up among the Hawaiians about certain fishes. The "Aweoweo" (*Priacanthus cruentatus*), pelagic in habit, appears periodically in Hawaiian waters in large numbers (page 354). In the days of the Hawaiian kings it was believed that the appearance of these Red Bigeyes presaged the death of a member of the royal family.

"Malolo" is the Hawaiian name of the flying fish. The islanders say that when this fish jumps out of the water it sees the land and immediately turns, leading the other fishes away from danger.

With me were William H. Brunskill, assistant director; Max V. Mayer, chief collector; Loren Tutell, photographer; and Oliver G. Smith and Patrick J. Lally. At Honolulu the group separated, three staying with me to collect Hawaiian specimens and the others going on to Fiji for small coralfishes.

On our first collecting trip in 1933 we had attempted to hold the fishes in dock-moored floating boxes called "live cars." One night an oil-burning steamer pumped her bilges in the harbor. At the dock in the morning, we found heavy black oil floating on the top of each box and all the fish dead.

Since then we have solved our problem by keeping the specimens in tanks. The United States Army kindly helped us set up our outfit on the dock at Fort Armstrong, Quartermaster, Signal, and Medical Depot for the Territory. Sea water pumped into the fish tanks from six feet below the surface is clean and free from oil (page 361).

Fish Are Made to Feel at Home

After the unit had been set up and the water was running, we devoted several days to preparing the tanks for the fishes.

Wrasses like to burrow in the sand on the bottom. When put into a bare tank, they

crowd together and injure themselves trying to get under one another. Paradoxically, we more than double the capacity of a wrasse tank by putting into it six inches of sand.

Sand is also put in the tanks intended for "Moana" and "Kumu," the goatfishes. These habitually swim close to the bottom, and the sand prevents chafing (page 355).

Coralfishes are quarrelsome and, unless supplied with coral heads in which they can hide, the smaller and weaker are soon killed by the others. Coral used for this purpose must be thoroughly cleaned lest it pollute the water. We arranged for a supply to be waiting for us ahead of our arrival.

Morays are restless unless provided with rocks under which they can hide, and similar provisions have to be made for the rock skippers (pages 369 and 371). The rocks and corals are later used to decorate the Shedd Aquarium tanks. Butterflyfish, tangs, and triggerfishes are active in captivity and do not require any arrangement other than to keep each group in a separate tank.

This separation of the "sheep" from the "goats" is important. Until we learned the habits of the fishes, we lost many specimens through unfortunate mixing of species. Once a netful of about 25 small "Moana" was placed in a tank with several "A'awa," or Spot Wrasses (page 371). The A'awa had not bothered other small fishes in the tank, but apparently they like goatfish meat. We realized our mistake immediately, yet the wrasses worked so fast that we rescued alive only a few of the goatfishes.

Battle Royal in a Fish Tank

Even keeping fishes of the same species together was found inadvisable in the case of "Makimaki," the Poison Puffer (page 358). This fish possesses strong jaws armed with sharp teeth, which it does not hesitate to use.

When they were put into a tank by themselves a battle royal developed and we lost most of them. We accidentally learned later that they do not bother other fishes and that even the pugnacious triggers give them a wide berth. When we put one or two of these cannibals into each tank with the other fishes, we managed to keep them safe.

There is a little marine worm in Hawaii that builds for its home a white, calcareous, tubelike shell. Its microscopic larvae, floating through the water, were pumped into the tanks, where they settled and started to make their shells. Growth was so rapid that at the end of a month the shells had attained a length of an inch. They dotted the inside of the tanks and the corals (page 351).

Most of our Hawaiian fishes were caught by traps or by hook and line. Under the law, only native-born citizens may fish with traps; yet I know of only five trap fishermen around Honolulu. These use a rectangular trap, about 5 feet long, 3 feet wide, and 18 to 20 feet deep, made of chicken wire fastened to a frame of guava wood, which they believe is least affected by water.

There is a funnel at one end only, and no bait is used. The natives say baited traps catch nothing but morays! (Page 371.)

Traps, set in likely holes or along the edge of the reef, are not marked by buoys but by bearings from landmarks near by. They are pulled at slack tide. A waterglass (bucket with a glass bottom) is used to help find them, and if the water is not too deep they are hauled up with a gaff hook on the end of a pole. When set in deep water, they are retrieved by a grappling iron.

Joe Miot, one of our trap fishermen, is an American-born citizen, of Chinese and Hawaiian parentage, and combines the best traits of both races. His sturdy motor sampan of less than 30 feet in length is always spick-and-span, its deck scrubbed to shining cleanliness even at the end of a fishing trip.

Besides Joe, who fishes out of Honolulu, the Aquarium expedition engaged Wah Poon Tam, a Chinese trap fisherman at Kaneohe Bay on the other side of the island. All specimens captured by Wah Poon had to be hauled in tanks on the back seat of an automobile across Oahu's famous 16-mile Nuuanu Pali drive.

Most of the commercial fishing in Honolulu is controlled by foreign-born Japanese, who, not being United States citizens, are restricted to hand-line fishing. Because these hand liners often bring in fishes not commonly caught in traps, we also deal with them.

We often showed them Jordan and Evermann's *Fishes of Hawaii*, pointing out the picture of the fish and naming the price we would pay. The men held the fishes in small live cars until we were able to pick them up. Many triggerfishes, most of the wrasses, and nearly all the little hawkfishes and razorfishes were obtained in this manner.

Most of the smaller varieties, damselfishes (pomacentrids), small squirrels, gobies, and dwarf pterois, were collected by members of the expedition.

Pomacentrids (page 372) congregate around coral heads into which they disappear at the least sign of danger. To collect these fishes, we use native divers who work in water to depths of 20 feet.

Each man wears glasses, the wooden frames

Some Dandies with Odd Figures Go in for Loud Stripes

The Moorish Idol, Hawaiian name "Kihikihi" (center), is a favorite with artists. It is often confused with the Longfin Butterflyfish (left), which it closely resembles. On the right is a Bluestriped Butterflyfish.

 Natural Color Photographs by Walter H. Chute

Islanders Call the Gaudiest of These "Beautiful But Dumb"

One of the handsomest Hawaiian fishes is "Hinalea Lolo" (center), the second part of the name meaning "stupid." White specks on the Birdfish (left) and the Blue Parrotfish (right) are grains of sand.

Natural Color Photograph by Walter H. Chute

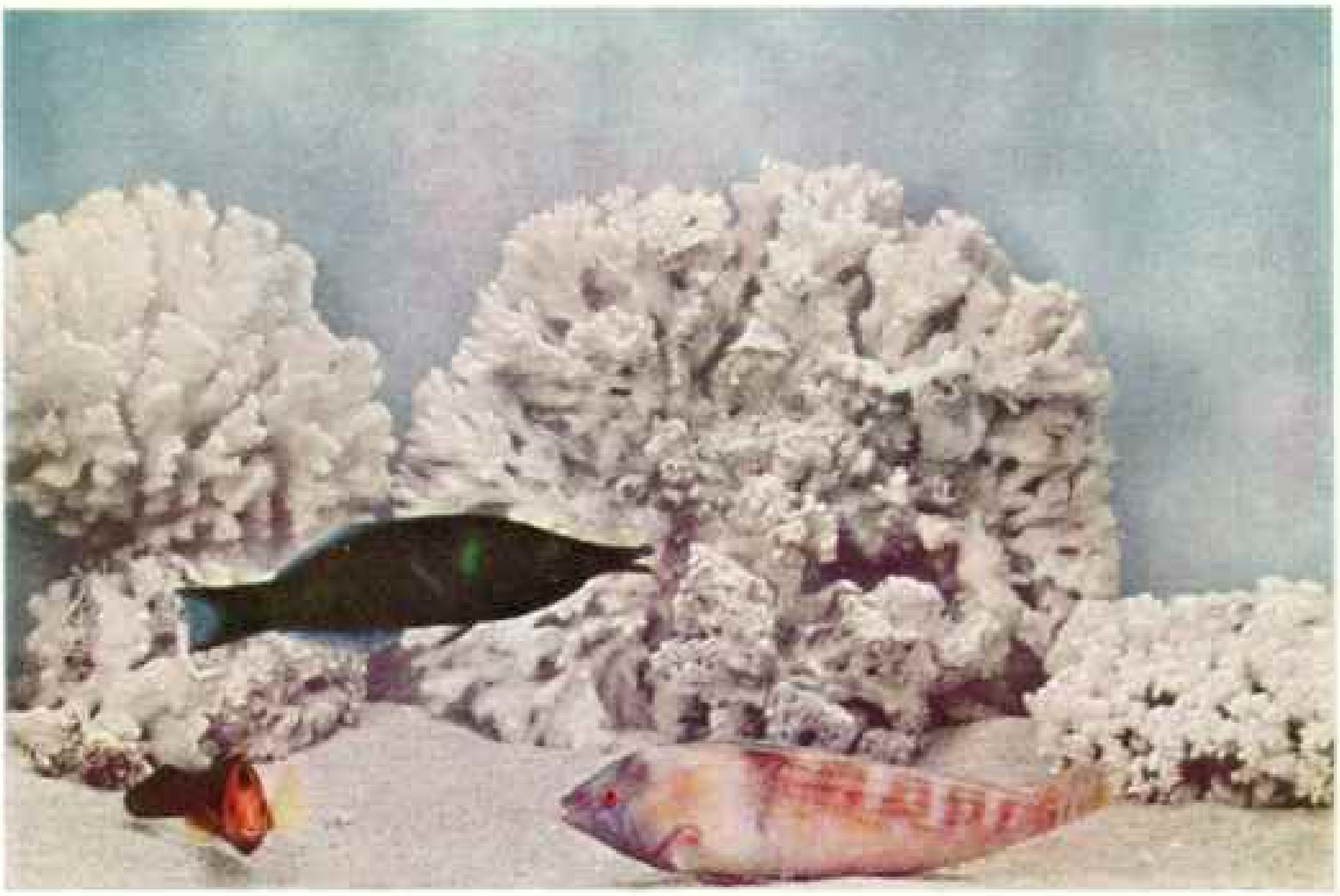
Dangerous as It Looks Is the Lionfish

The long spines on the dorsal fin are poisonous and can inflict serious wounds. Nevertheless, the spectacular *Pterois volitans*, also known as the Featherfish and Turkeyfish, makes a splendid aquarium denizen. In young specimens the pectoral fins are entire (page 365), but in adults the membranes separate between the rays, giving the featherlike appearance.

Natural Color Photograph by Walter H. Chute

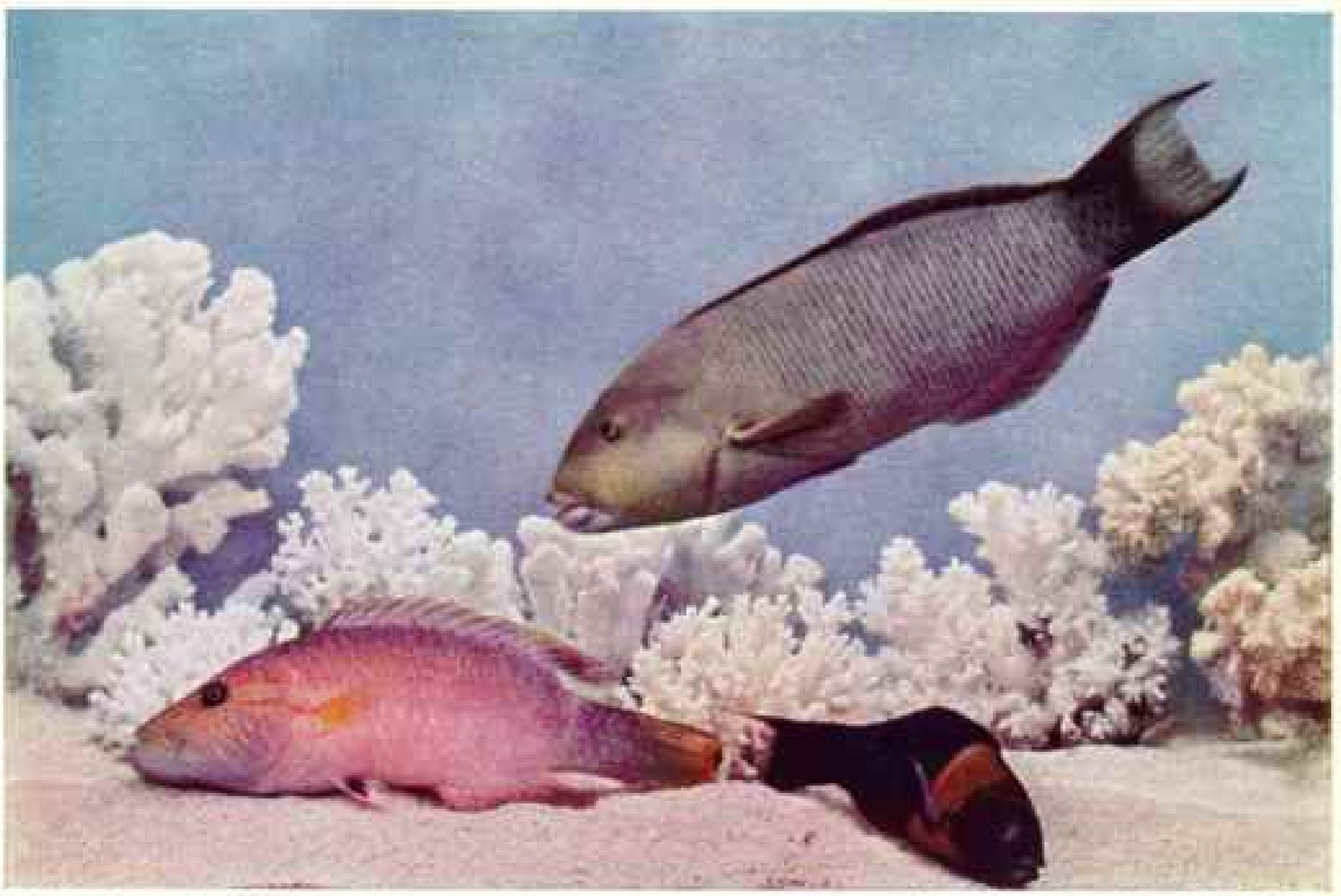
Polynesian Undersea Gardens Teem with "Butterflies"

Conspicuous because of their bright colors, these little fishes are seen everywhere on reefs and in harbors. They are called indiscriminately "Kīkakāpu" by Hawaiians. Hawaiian Butterflyfish (upper) has a wide range throughout the islands. Spot Diagonal Butterflyfish (center right) is common at Hawaii, but is replaced westward by Bar Diagonal Butterflyfish (center left). Little *Chaetodon trifasciatus* (lower), not plentiful anywhere, is probably the most beautiful of the group. White objects on the lava rock are calcareous tubes of a plumose worm.



Among the Wrasses Are Many Odd Fellows

The eccentric Green Birdfish (upper) has a long, narrow snout like the bill of a bird. The mouths of the Redlined Wrasse (left) and the Bluelined Wrasse are more typical of their family.



 Natural Color Photographs by Walter H. Chute

Not All Hawaiian Fishes Are Brightly Colored

The drab Gray Wrasse is abundant in Honolulu. Its smaller relative, the Saddle Wrasse (lower right), is even more plentiful. The "Pooû" (left) has not received an English common name.

The Plainest of the Three Is Best to Eat

Small and delicately colored is the Yelloweye Tang (left). The Orangespot Tang is strikingly marked. The Black Tang (center) is an important food fish which grows to large size.

 Natural Color Photographs by Walter H. Chute

Though Small, the Jaws of the Hawaiian Triggerfish Are Powerful

The Black Triggerfish (lower right) can bite a No. 3 fishhook in two. The fins of the Pinktail Triggerfish (upper) resemble ruching on milady's dress. The Whiteline Triggerfish (left) is armed with rows of tiny spines.

Natural Color Photograph by Walter H. Chute

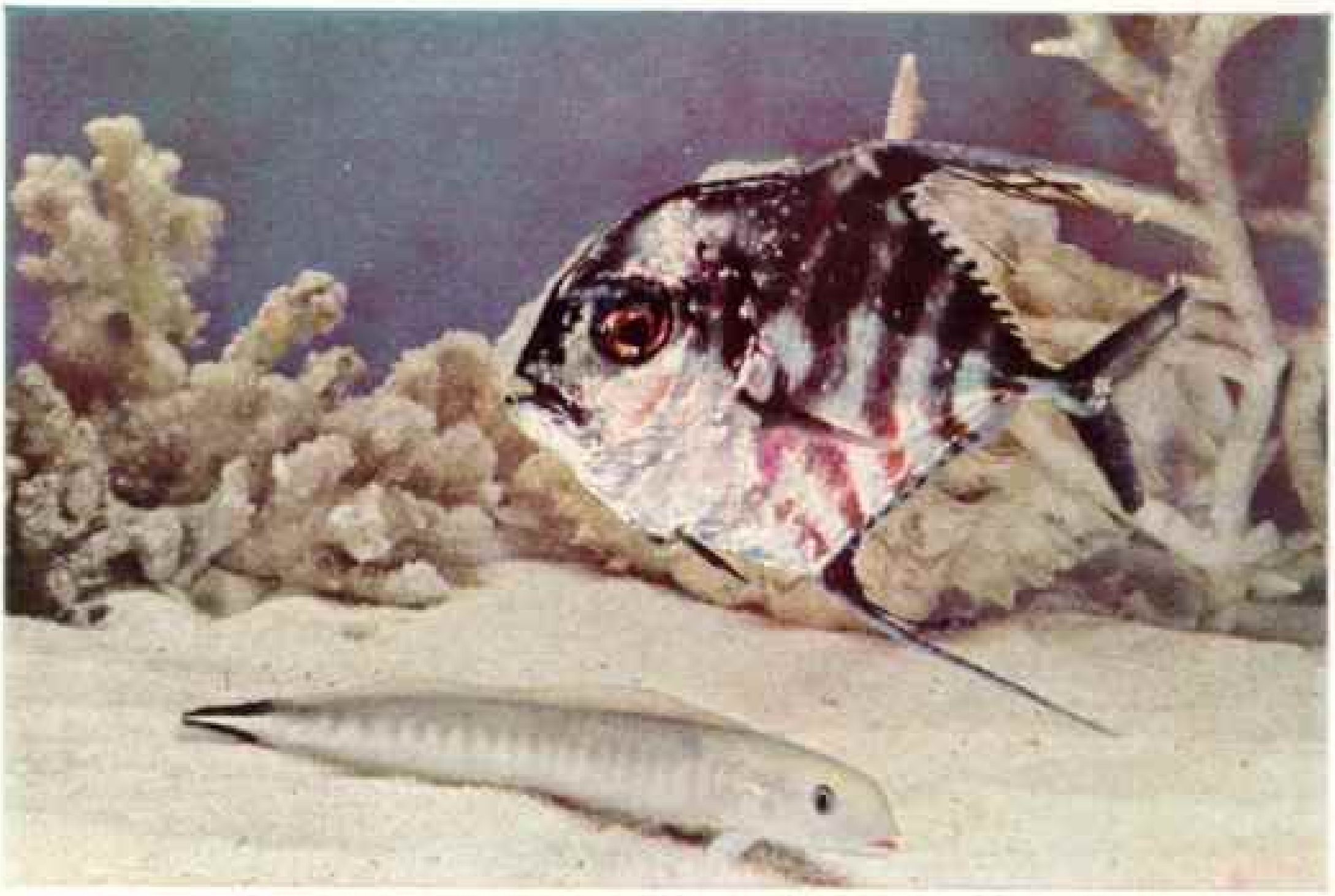
This Quartet of Table Delicacies Shows Nature's Versatility as an Artist

The "Uhu" (upper right) is one of the finest of Hawaiian food fishes. The striped Yellow Jack (center) is smaller and less abundant. The Red Bigeye (left) is known to the natives as "Aweoweo," the royal fish. The Common Scorpion (lower right) is an excellent example of camouflage.

Natural Color Photograph by Walter H. Chute

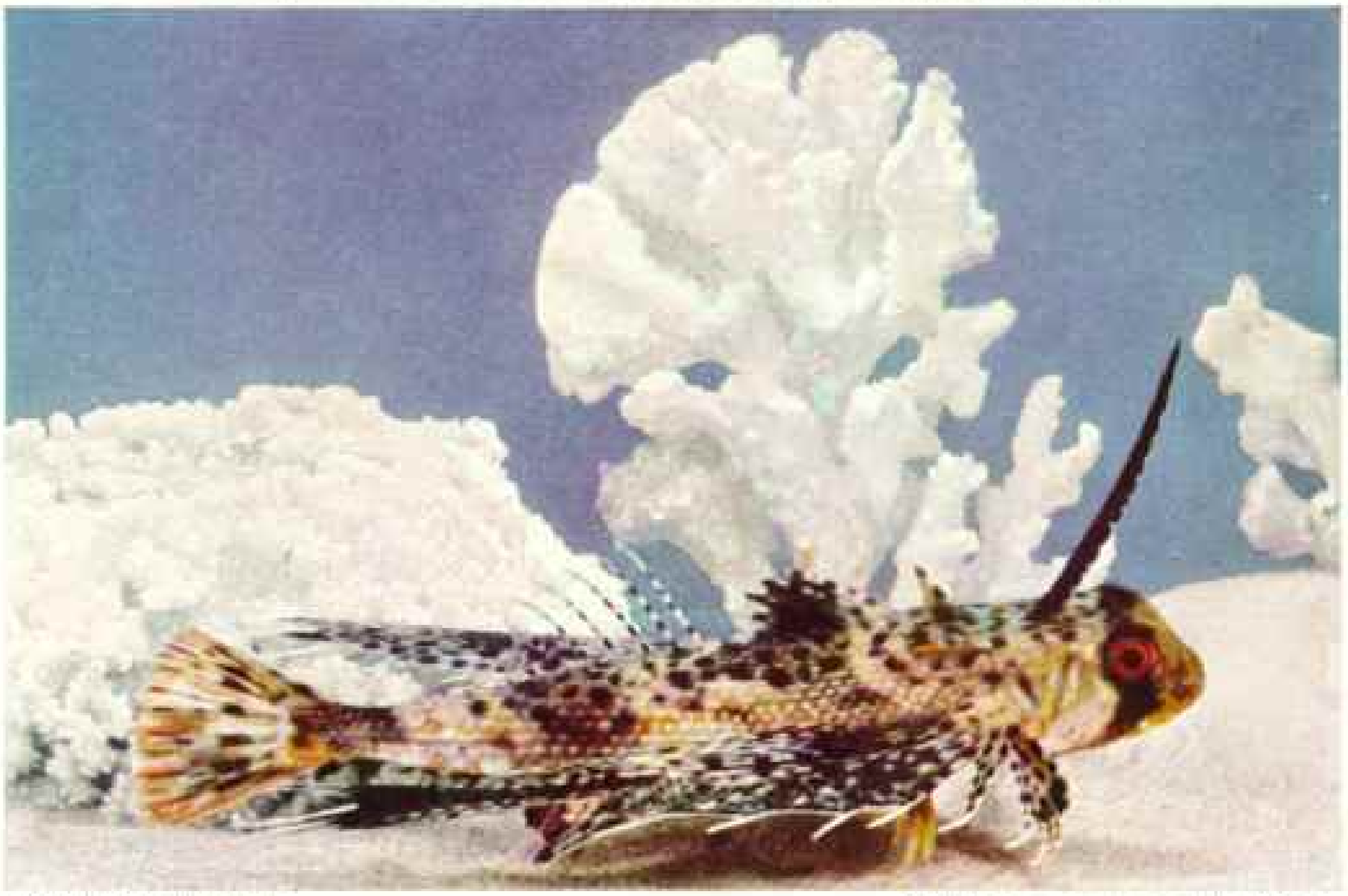
Some of the Most Brilliant Dressers Go into the Frying Pan

Sailfin Tangs (above) make showy aquarium specimens. The Yellowspot Goatfish (farthest left) is rather rare, but the Red Goatfish (left center) is commonly found in Hawaiian markets, where it is known as "Kumu." Both are excellent food fishes. Convict Tangs, wearing black stripes and called "Manini" by the islanders, abound on shallow reefs.



There Is Silver in the Sea

The Threadfish, or "Uhu Kihikihi," is one of the most attractive of the large family of jacks and pompanos. The graceful Sandfish is an almost exact duplicate of the Atlantic form.



 Natural Color Photographs by Walter H. Chute

Hawaiians Appropriately Dub This "Pina'okai," or Sea Dragon

The Flying Gurnard is so called because of its enormous winglike pectoral fins, although it cannot fly through the air.

of which he has carved to fit his own face. Before going into the water, he may rub the moist butt of a "smoke" on the lenses. The resulting thin film of oil prevents bubbles from forming.

In deep water the men dive headfirst, but in shallow water they invariably jump to prevent their heads from being cut on the coral. When a diver sees a school of fish go into a coral head, he plunges to the bottom and tries to pull the coral head free. If the first attempt fails, he dives a second time with a rope which he fastens around the coral so that the boys in the boat may pull it up.

Even when out of the water, the fishes wedge themselves so firmly between the branches of the coral that they cannot be shaken loose without injury. To get them, we have to break the coral apart with a hammer, piece by piece. We soon learned the advisability of wearing canvas gloves when working around coral, for the many tiny scratches received from its sharp points became infected from the slime with which it is covered when alive.

Other small fishes are obtained on the reef at low tide, usually in a one-man net, a short seine with a pole on each end. The fishes congregate around large rocks or masses of coral. One man lifts the rock and another slides the net under it so that the fishes are caught as they drop back into the water. If the rock is too heavy to lift, the net is set at one side and the fishes are chased into it with sticks or by hand.

While using the one-man net on the reef at Kaneohe one day, Lally felt something strike his leg just above his tennis shoe. Looking down, he saw a white moray (page 371). The moray, as a result of its error, is now living at the Shedd Aquarium, but the experience caused Lally never to go on a coral reef without tying his trouser legs tight around his ankles.

Tenderfoot Gets the Prize

Some of the smaller wrasses are caught by fishing with pieces of shrimp for bait in the white surf along rocky shores. When the water is quiet they seldom bite, for fisherman's luck is best when the foam from the breaking surf veils their view of the angler.

Tutell, whom we had been calling a *malihini* (newcomer or tenderfoot) because he had never been to Hawaii before, turned tables on our chafing by catching on a hand line a splendid "Hinalea A'awa" (page 371), the largest specimen captured by the expedition.

Rock skippers are caught on shore above the water line. When the tide goes out, stretches covered with black lava rock are dotted with small pools of shallow water. These pools are lined with a fine growth of algae on which the rock skippers like to browse.

From the ocean, which has here an average temperature of 76°, the fishes scramble over the rocks into pools heated by the blazing sun to temperatures of 110° to 120°; yet they suffer no harm from the sudden change. At sign of danger they dart into holes in the rocks. We catch them by holding nets in front of their hiding places and "tickling" them with little pieces of wire until they jump out (page 362).

Fish Catches Insects and Climbs Mangrove Roots

At Fiji is found the mud-springer, which leaves the water and congregates on the mud in the mangrove swamps at low tide. This queer fish is so active out of water that it is able to catch insects and actually climb up on the mangrove roots. Collectors chase the mud-springers into seines hung on stakes at one end of the swamp, but many escape before the nets can be rolled up. Rarely more than five or six are trapped out of a drive of hundreds.

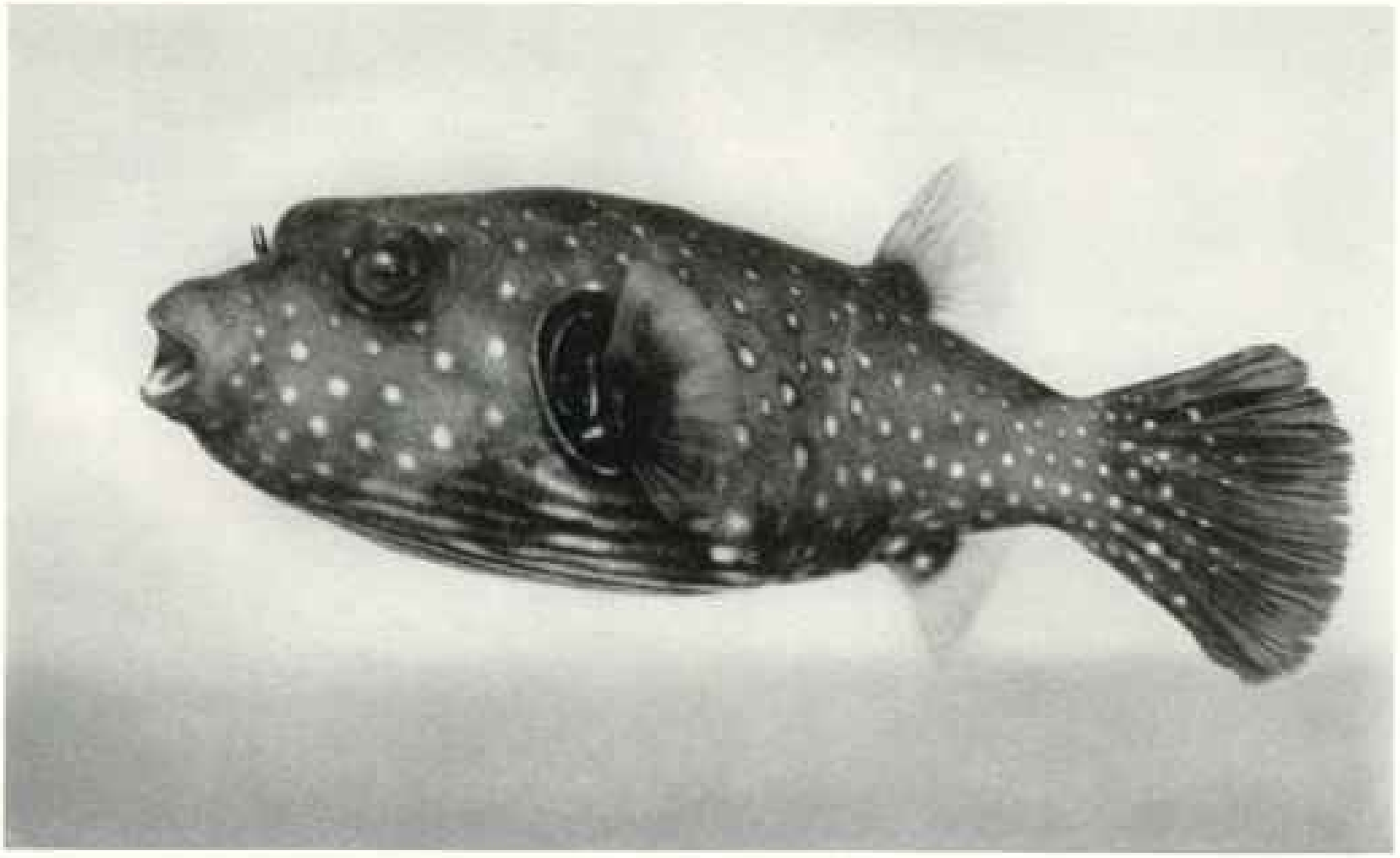
We try to get a few each of as many different species as possible. Regardless of how long one has been collecting, one never quite gets over the feeling of anticipation as each new lot is brought in. There is always the hope of adding one more species.

Very often rare varieties are discovered by accident. While holding the fishes in tanks on the dock at Honolulu, we feed them largely on "opai," a small live shrimp. These are gathered for us by Wah Poon at Kaneohe. One day we discovered in his catch some small specimens of *Microcanthus strigatus*, called "Stripey" in Australia, a fish that is more plentiful in the far-western Pacific than at Hawaii (page 358). Wah Poon had seen many of these at Kaneohe, but he had not bothered to bring us any, since we had not mentioned them.

In one of the pools connected with the Memorial Natatorium in Kapiolani Park there are two fine specimens of giant burrfish (*Chilomycterus affinis*). These fishes, so tame that they come to the surface to take food from the hands of picnickers, are probably among the most photographed in the world and would make splendid aquarium specimens. But we made no effort to acquire them, for we had no desire to incur the inevitable wrath of the entire population of Honolulu!

For many years tropical fresh-water fishes have been kept in glass tanks by fanciers.* Of late, efforts have been made to adapt small,

* See "Tropical Toy Fishes," by Ida Mellen, NATIONAL GEOGRAPHIC MAGAZINE, March, 1931, and "Tropical Fish Immigrants," by Walter H. Chute, January, 1934.



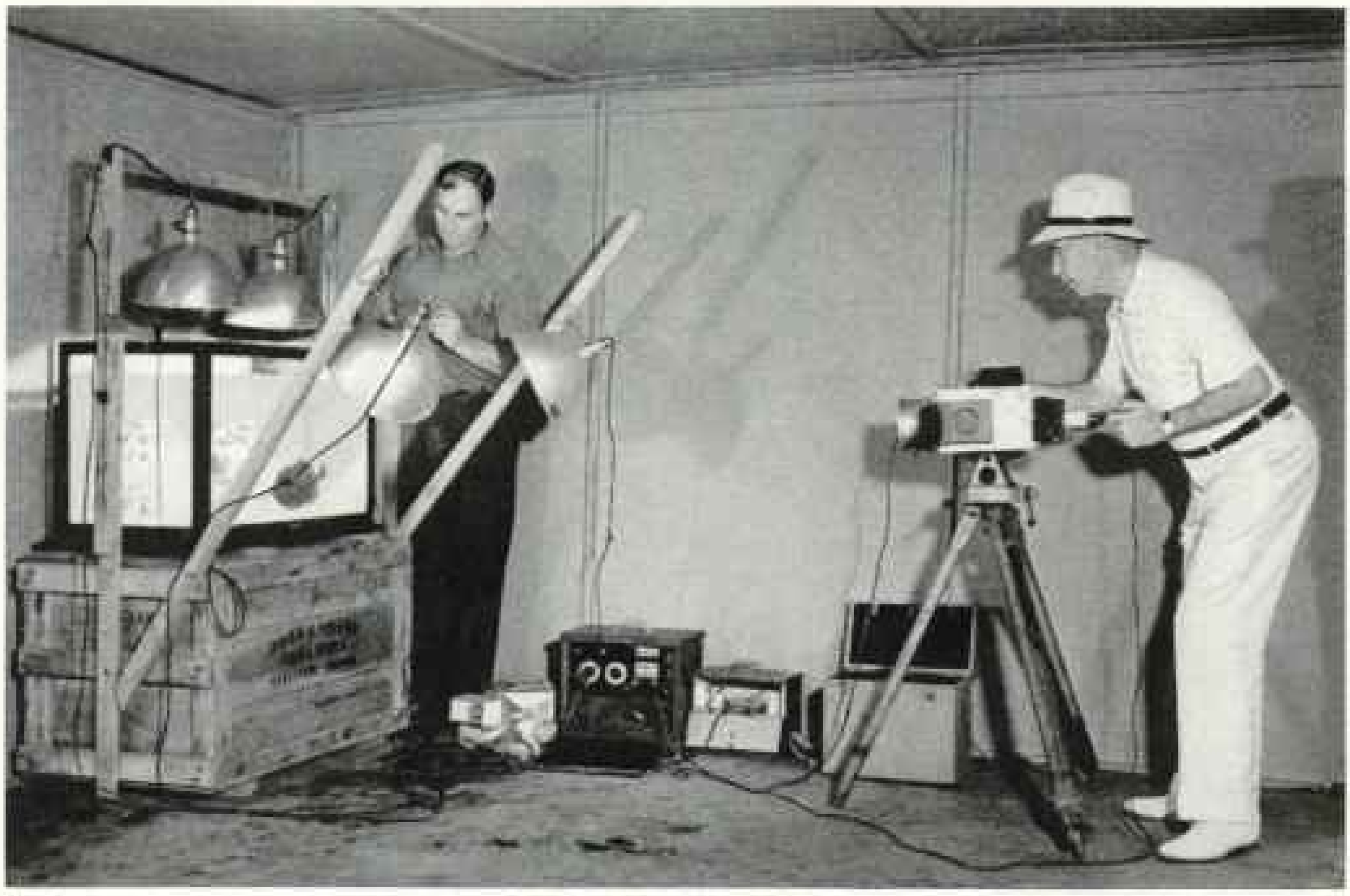
Hawaiians Call the Poison Puffer "Makimaki," or "Deadly Death"

Fishermen dislike its strong jaws and sharp teeth, capable of snapping flesh from an unwary hand. Poison Puffers stage battles royal among themselves, but do not bother other species of fish (page 348).

Photographs by Loren Tucker

This "Convict Fish" Lost Its Freedom in a Shrimp Net

Seldom found in Hawaiian waters, "Stripey" was discovered by accident in a catch of shrimp used as food for captive fishes. This butterflyfish (*Microcanthus strigatus*), abundant off the coast of Australia, the Philippines, and southern Japan, differs from the American convict fish, whose stripes are vertical.



Photograph by Loren Tuttell

The Author Shoots a Fish in Natural Color

In this boxlike studio, built around the photographic equipment, the accompanying color plates were made. The one-shot camera exposes three photographic plates simultaneously, one for each primary color. Max V. Mayer, expedition member, adjusts four photo-flash lamps. Radio apparatus in the center synchronizes flash bulbs and camera shutter (page 363).

highly colored marine fishes to similar home aquariums. Usually grouped under the general name "coralfish," they may be had occasionally from dealers in tropical fishes. Most of them come from the East Indies and other islands of the western Pacific, but many are native to Fiji and the surrounding islands. The bulk of the collections made at Fiji by the Shedd Aquarium consist of these small reef fishes.

Expedition headquarters were established at Suva in Fiji. The coral reef there is dead, having been killed by fresh water from a near-by river in time of flood. It is covered with large patches of branch coral in which literally thousands of small fishes make their home (page 369). The boys worked this reef with one-man nets and the near-by shores with seines, but most of the specimens were purchased from native fishermen.

The larger Fijian fishes are captured in a trap called a "fence net." This is built of bamboo interwoven with palm leaves and shaped like a figure 6, with the top of the 6 touching the shore and with the loop set in deep water. It is efficient only on the ebb tide. Fishes swimming along the shore with the current are stopped by the fence and work their way out into the loop, where they are caught as the tide falls.

For their fishing Fijians use outrigger canoes equipped with woven palm-leaf sails. Three or four men make up the crew. The fishes are brought to the collectors in square gasoline cans.

Much in demand is the blue damselfish, a pomacentrid, with a body of the deepest violet blue profusely sprinkled with pale sky-blue dots. It has a bright golden tail and anal fin. The collectors saw many on the reef at Suva, but were unable to catch any. Natives brought in a hundred or more, but all attempts to learn how these flashing fish were caught met with "No spik English."

Working shallow reefs close to shore, collectors are not likely to encounter sharks and other treacherous fishes; yet gathering small specimens has its dangers. One spectacular prize from Fiji, the Lionfish, *Pterois volitans* (page 350), must be handled with respect, for the long spines on its dorsal fin are poisonous and can inflict painful stings.

Another fish from Fiji is even more dangerous. One must be careful not to step on the Poison Toadfish (*Synanceja verrucosa*), which lies camouflaged among the rocks. It bristles with coarse, sharp spines that can pierce the

Photograph by Walter H. Chute

Surf Fishing on the Edge of the Reef: Hawaiian Coast

At low tide this reef is exposed most of the time, but occasionally a "big one" rolls in, as the high-water mark on Mayer's trousers shows. It is dangerous to move at such times, since some of the tide pools are ten feet deep and cannot be seen beneath swirling waters. All the collector can do is grab the pail, brace his feet, and wait for the breaker to subside.

Photograph by Loren Tuttell

Moving Day for the Expedition—Fishes Begin Their Long Journey to Chicago

Larger specimens are transferred from their tank unit to the commodious wells of a tuna fishing boat, which transports them to the steamer two miles away. The smaller fish make the journey in tanks and cans. On the way home in the steamer, 24-hour watch is kept over the valuable cargo (page 364).

Photograph by Lewis Tufell

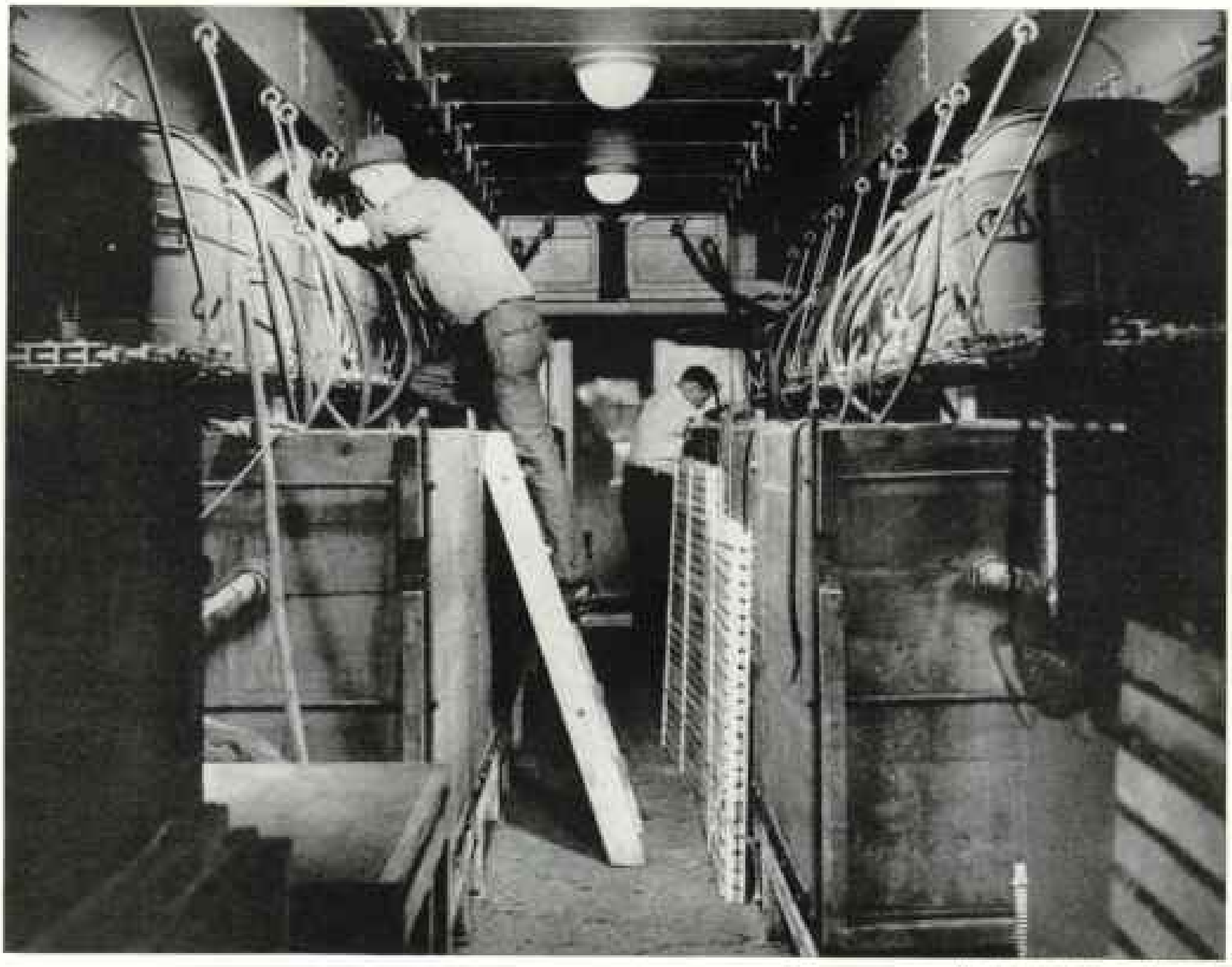
In Chicago, Shedd Aquarium Workers Unload the *Nautilus*

Wooden tanks, weighing a ton apiece with their burdens of water and fish, are carefully moved from the special car to the truck. The car has quarters for six men and is equipped with a galley (page 364).

Photograph by Walter H. Chute

When He Tickles the Hiding Rock Skipper, It Will Dart into the Net

The wary fish has taken refuge beneath a heavy rock in the pool. On hands and knees, the collector gently pokes about with a small piece of wire (page 357).



Photograph by Walter H. Chute

Pampered Aquarium Fishes Travel by Pullman

Tanks and cans take the place of berths in the *Nautilus*, Shedd Aquarium's railroad car, especially outfitted for the valuable specimens. This car met the expedition at Los Angeles, on the return from Hawaii. Water is circulated and compressed air is supplied through an intricate system of pipes and lines (page 364).

rubber soles of tennis shoes. These spines are supplied with a deadly venom. Natives stung by this fish sometimes die before they can be taken to the hospital at Suva.

Fishing among native Hawaiians usually is a family affair. Husband and wife and all sons and daughters old enough to work handle the big seine together. They set the net in a large circle and then, splashing the water in the center, frighten the fish into its coarse meshes. Each carries a cloth bag attached to his waist and, when he sees a fish caught in the net, he reaches down and places it in the bag.

Sometimes a native will come up with three fish, one in each hand and the third in his teeth. Small fish are eaten whole as quickly as they are caught, while the larger are taken ashore for later consumption. If an octopus is netted, its captor promptly dispatches it by biting its eyes out.

Octopuses are easily caught but difficult to keep in captivity, for they can escape through an astonishingly small crack. Frequently soldiers at Fort Armstrong would raise the cover of a tank to look at our collection. But when the octopuses started to crawl out, they usually dropped the lid and stepped back. After losing several good specimens, we finally nailed the covers down to keep the octopuses in and the soldiers out.

One of the petty officers at Fort Armstrong had several cats. To supply them with fresh fish, he set traps under the dock, baited with stale bread from the mess hall. Each evening he pulled the traps and fed the catch to his pets.

Patience Needed to Make Fish Portraits

One day he caught an exceptionally fine lot of "Pualu," or Black Tangs (page 353), which we coaxed him to sell to us. Later the plaints of the disappointed cats proved too much, so he went to market and bought them their fish dinner with the money we had just given him!

Photographing live fishes presents many difficulties not encountered with other natu-

ral-history subjects. Fishes cannot be posed easily; water cuts down the light so that exposures must be increased, and glass sides of tanks introduce troublesome reflections. Of course, natural-color photography increases these difficulties.

The pictures accompanying this article were taken with a one-shot camera, which exposes three photographic plates, one for each of the primary colors. Since the three negatives are exposed simultaneously, moving objects can be snapped at high speed to stop motion. A finished picture may be an enlargement of a tiny section of the negatives. For instance, in the original plates, the Lionfish (page 330) was little more than one inch long.

We solved the lighting problem with four photo-flash lamps. To exclude reflections and undesirable daylight, we built a funnel of black rubberized cloth, which was tied around the camera at one end and around the small aquarium at the other.

Gentle Hawaiian breezes wafting across Honolulu Harbor adopted this cloth funnel as a plaything, setting it billowing and flapping in spite of our best efforts to hold it down. After one particularly stiff gust nearly tossed camera and tripod overboard, we gave up and built a boxlike studio around our apparatus (page 359).

Fish Are Temperamental Posers

If we know the habits of the fishes in their natural surroundings, we can usually foretell their actions in the "studio." Some sulk at the bottom, others dash wildly about, according to their temperament. After a few minutes they usually settle down and try to hide.

Wrasses invariably burrow under the sand, and sometimes it is necessary to remove all the sand excepting a thin layer. After the first few minutes of fright, the butterflyfishes, tangs, and jacks swim back and forth in the upper part of the tank (see color pages). Little rock-clingers, or hawkfishes, settle gently down to a three-point landing on pieces of flat coral put into the tank for their benefit (page 372). Morays refuse to remain quiet until we give them a chunk of coral under which they can partly hide (pages 369 and 371), and the little pomacentrids gather around their coral head, some hiding among its branches.

Feeling secure behind its armament of poison spines, the Lionfish steals the spotlight, swimming boldly back and forth across the front of the aquarium.

None acts more strangely than the Black Triggerfish of page 353. When it wishes to rest on the reefs, it crowds into a hole in the coral and then secures itself in position by erecting and locking the large spine on its back.

Placed in the tank, this specimen swam close to the background coral, nestled on the sand, and attempted to lock itself in the coral by erecting its dorsal spine. Much to the fish's surprise, the spine, instead of catching in the coral, merely slid along a smooth, invisible surface—the pane of glass put in the tank to keep the fish in focus. The finny subject swam around in a circle, took another look at the coral, and tried all over again. Baffled by this partition, which it could feel but not see, the triggerfish repeated the performance at intervals all the time it was in the tank.

Bringing 'Em Back Alive Difficult

The long trip home to Chicago is trying for fish and collectors. Heavy tanks filled with water and fish must be carried to the ship and installed securely. Pipes must be connected for a continuous supply of water and a special air compressor installed to aerate the water when circulation is stopped (page 361).

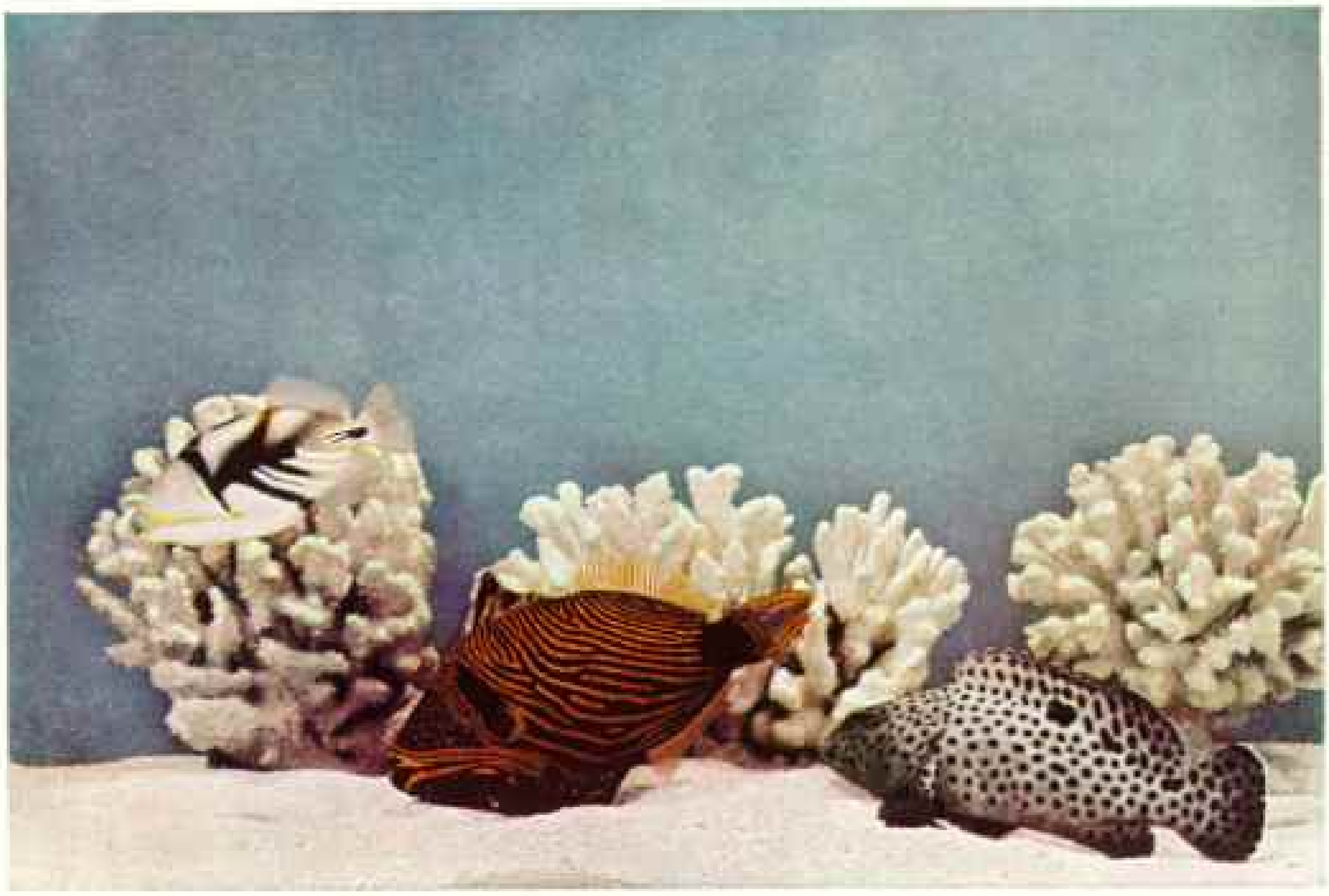
During the voyage across the Pacific to Los Angeles, we take turns night and day caring for the fishes. As the steamer approaches the California coast and enters the Northeast Drift Current, we keep a careful check on the temperature of the water, which becomes colder and colder. Finally it must be shut off lest the fish die. The captives are then kept alive by the aid of compressed air, which is passed through the water.

Upon arrival at Los Angeles, we transfer the whole outfit to the Shedd Aquarium's railroad fish car, the *Nautilus*. Living quarters for six men, including a galley, are provided in this traveling aquarium. The fish ride comfortably in their cans and wooden tanks, which are connected to permanent piping which circulates the water continuously. Overhead showers spray water into the tanks to provide aeration (page 363).

When the *Nautilus* reaches Chicago, the fish are trucked in their tanks and cans to the Shedd Aquarium, where they are acclimated before being placed on exhibition (page 362).

On our latest expedition we brought home 2,500 specimens and obtained as many as 207 distinct species. The average life of the fishes in captivity is approximately ten months, but there are still alive in the Aquarium specimens collected in 1937.

On our return to the Aquarium, colleagues greeted us with the atrocious old pun, "Hello! Hawaii?" and we answered with our newly acquired word for "finished"—"Pau."



Odd Patterns Mark Fishes at Fiji

Abundant there and occasionally taken at Hawaii is *Ballistapus aculeatus* (left). The Orangestriped Triggerfish (center) is found from Samoa south and westward. Brownspotted Grouper (right).

 Natural Color Photographs by Walter H. Chute

Poison Spines Make Brave Fishes

The little Lionfish (left), confident of its immunity from attack, swims boldly in the open (page 350). The much larger Bluespotted Niggerfish tries to hide in the shadow of a giant clamshell.

Natural Color Photograph by Walter H. Chute

A Rare Butterflyfish Joins Some Regular Inhabitants

From the southwestern Pacific comes *Hemitaurichthys zoster* (upper), nicknamed "dirty face" by the expedition. It is rarely caught at Hawaii. The Spotted Rockfish (left), the Longfin Razorfish (lower center), and the Red Squirrel (right) are common in Hawaiian waters.

Natural Color Photograph by Walter H. Chute

"Where the Humu Humu Nuku Nuku Apua'a Goes Swimming by"

This line from the popular song, "My Little Grass Shack in Kealakekua, Hawaii," mentions the Rectangular Triggerfish (lower left) by its Hawaiian name, which means "a fish that sews and grunts like a pig." The Longnose Butterflyfish (upper left) is freakish in both shape and markings. The Yellow Tang is pure lemon color all over except for the eyes and white caudal spines. The Whiteline Squirrelfish (right) is abundant in holes on rocky shores.

Dress Designers May Copy

The shape of the orange spot on Achilles Tang prompted collectors to call it "ace of diamonds." The Polkadot Wrasse has a perfect white dot on each scale.

Natural Color Photographs by Walter R. Chute

Sea Fans Are Used for Flitting, Not Flirting

The Fantail Filefish expands its tail at times until the front edges are at right angles to the body. The erectile spine on the back has a serrated edge.

Natural Color Photograph by Walter H. Chute

The Smaller Reef Fishes Make Good Aquarium Pets

Getting along well together here are Bluegreen Chromide (top), Banded Dascyllus (left center), Threestriped Coralfish (right center), Yellow Blenny (extreme left), Striped Apagon (lower center), and Clown Goby (lower right). A young Polkadot Moray hides in the coral (lower left).

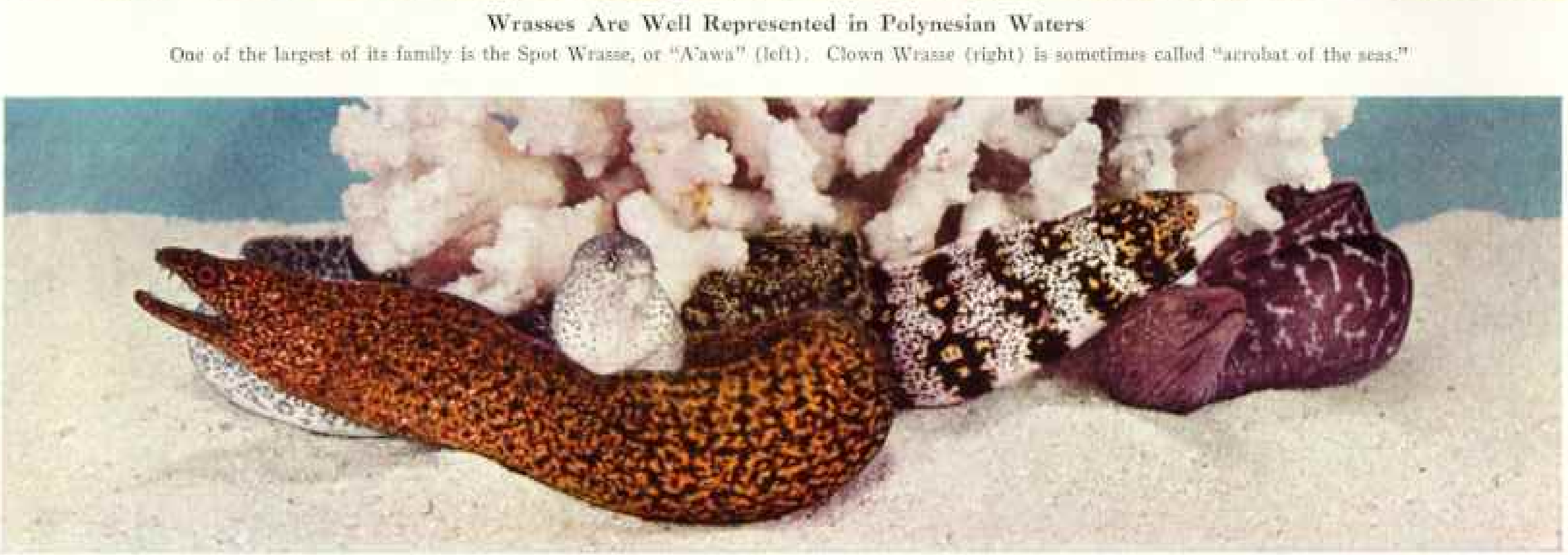
Natural Color Photograph by Walter H. Chute

Prominent Teeth Do Not Always Indicate a Fighter

"Hinalea Hilu" (left) is a peaceful fish. The protruding canines of this wrasse are used for catching and holding its food. "Umauma Lei" (right), a tang, is armed with two sharp spines on each side of the base of the tail, which it uses offensively.

Wrasses Are Well Represented in Polynesian Waters

One of the largest of its family is the Spot Wrasse, or "A'awa" (left). Clown Wrasse (right) is sometimes called "acrobat of the seas."



Natural Color Photographs by Walter H. Chute

Moray Eels, Vicious Guardians of Hawaiian Reefs, Are Dangerous to Handle

The two light fishes are both Spotted White Morays. The other two show different color phases of the Common Moray.

Finny Gems from the Coral Reefs Are Diminutive

Extreme delicacy marks the tiny "Pau," *Cheilinus bimaculatus* (upper). The Blackline Hawkfish (left center) grows larger than the Whiteline Hawkfish (left) and the Ringed Hawkfish (right).

 Natural Color Photographs by Walter R. Chute

Pomacentrids Abound Along South Pacific Rocky Shores

Jet-black fishes with a single white spot are the exclusively Hawaiian *Dascyllus albisella*. Spot Pomacentrid (upper right) is numerous in the tide pools, together with a close relative, the Sergeant Major (striped fishes, left). Potter's Pomacentrid (lower right) is rare.

Fighting Giants of the Humboldt

By David D. Duncan

With Illustrations from Photographs by the Author

FOR YEARS there have been records of tremendous swordfish being caught on rod and reel off the coast of Chile. Other and less substantiated reports told of huge-billed fish sighted at rare intervals and even brought up tangled in the lines of commercial fishermen off the shores of northern Peru.

To collect and study specimens of these fighting giants of the Humboldt Current, the American Museum of Natural History authorized our expedition, headed by Michael Lerner of New York. The Humboldt, a mighty ocean stream, flows northward from the Antarctic and pushes close to the west coast of South America before swinging west and losing itself in the outer Pacific (map, page 376).

As we stood on the wharf at Talara, Peru, shielding our eyes from the glaring equatorial sun and looking out beyond the bay into the stretches of the Pacific, the magnitude of our task struck home. What chance had we of even sighting a fin in this tremendous, little-known expanse of water, much less gaffing the giant and bringing it back to the laboratory?

Little did I suspect that not only the broadbill but also one of the most fearsome creatures of the sea, the giant Pacific squid, would be successfully caught with hook and line.

Seven Against Monsters of the Deep

We were seven: Michael and Helen Lerner, both experienced deep-sea anglers; Francesca LaMonte, Associate Curator of Ichthyology of the American Museum of Natural History; two seasoned Florida fishing captains, Bill Hatch and Douglas Osborne; Irving Hartley, ace movie cameraman; and the writer, who served as photographer and interpreter.

The quest began the morning after our arrival at Talara and continued for weeks with a routine nearly always the same. From dawn to dusk every day we combed the seemingly empty expanse of ocean.

Gentle and tranquil during the early-morning hours, the sea responded to the noontime change from an offshore to an inshore breeze by buffeting unmercifully our two 30-foot outrigged launches. Each day saw our little craft in some different part of the Pacific, all hands on topside and searching continually for the set of fins, one behind the other, which would mean that at last we had sighted a broadbill.

"But this is April; you have come too late," many of our new friends told us. "Now, if you could have got here earlier, say for the calm days of January. . . ."

Yes, we knew; we should have found fins cutting the surface in veritable regattas.

"Of course none of us has ever landed one of these swordfish, but the gringos are smart; so perhaps they will show us poor fishermen how it can be done."

The tone was courteous, but some hidden inflection made our captains stay out at sea longer than ever during the days that followed. They swore by Neptune to put a broadbill on the dock.

So went the days. And with them was born the thought that perhaps the reports of monstrous fins in the Humboldt were more fiction than fact. To be sure, we saw fins, plenty of them; but they were not sported by the right kind of fish.

False Alarms Dash Hopes

Our first alarm came one day as we were all settling down to our regular picnic-style lunch. The crash of feet on the roof overhead brought us to our knees.

"*Aleta, aleta!*" rang in our ears, as both the pilot and the lookout shouted at the same time.

Mike and Doug looked at me for translation.

"Fins!" I cried.

Off their knees and heading for the roof, they suddenly stopped short, for apologetically from above came the word *tiburón*, the one bit of Spanish they recognized—"shark."

Another time we were all on topside, saying nothing, but each concentrating on a given section of horizon. We were 40 miles from land. Suddenly, as one, we all turned to look at a slight movement on the surface several hundred feet off our bow. And even as we watched, a mammoth fin rose out of the depths, closely followed by a second, several *yards* off to the left.

"Ave Maria, the champion!" gasped Juan, our Peruvian. Yes, to be sure, it was the champion, the grunddaddy, the biggest of them all. But wait, what was that first fin doing?

"Look! It's bending, it's curling up, it just can't!"

Realization dawned simultaneously upon us all. We had intruded upon a giant manta ray in the privacy of its sunbath. Lolling upon the surface, the huge bat-shaped creature lifted one wingtip and then the other in lazy attempts to dislodge small parasitic remoras

Quickest Way to an Albatross's Heart Is through Its Stomach

The writer made friends with this one and thus escaped the dead calm that fell on the ship of Coleridge's ancient mariner, who shot with his crossbow the albatross "that made the wind to blow." Usually wild and aloof, the bird allowed itself to be fed until it was so gorged that it could not rise from the water. It seemed not to object even after being captured. Later it was released, still too lugy to fly. Members of this family range from the Bering Sea to the shores of Antarctica.

Beside the Broadbill Sword the Marlin Bill Is Dwarfed

Captains Hatch and Osborne match the two, showing the difference in size and shape. The larger weapon is flat, the smaller round and needlelike; hence the Spanish names *pez espada* (swordfish), and *pez aguja* (needlefish).

which were clinging to its body. Disappointment again descended upon us.

We fished far offshore, and we fished inshore, near the multihued, Grand Canyon-like mountain area on the mainland. Still we did not discover the secret of the broadbill's lair. We began to believe ourselves jinxed.

Then one afternoon, while I was lying on topside checking my camera lenses, as I had checked them a hundred times before, a movement far out over the water brought me suddenly alert. I thought I saw two fins moving in line. Eagerly I stared, my heart pounding; but no, that was only one. Just another shark, I thought disgustedly.

The Thrill of a Lifetime

I settled back. No, wait! What was that faint line following the first? In a second that first shark will have turned. There it is—*There it is.* The second fin was following the first. It was all one fish!

"Doug," I shouted down the cockpit where I knew Osborne would be sitting, as he had for days, optimistically preparing another bait.

"What it is, boy?" he drawled.

"Doug," I started again, fighting to control my excitement, "I've been watching something far out on the horizon."

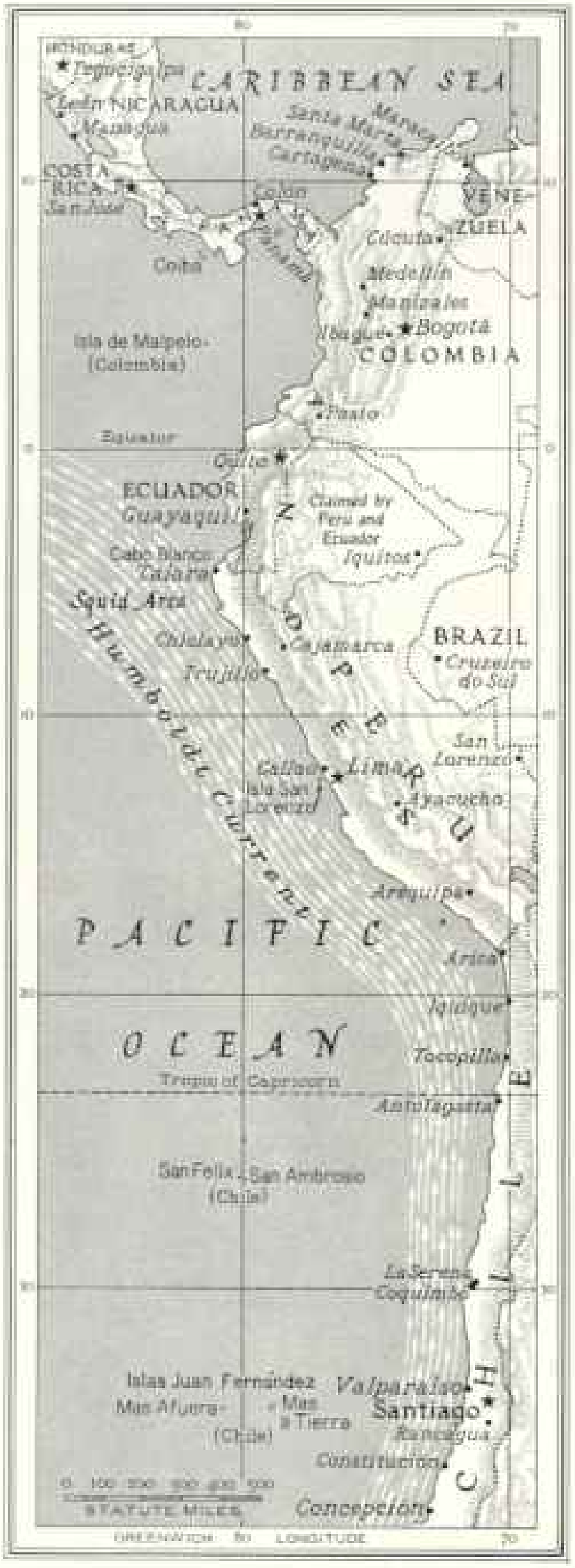
"Y-e-a-h?"

"Thought it was a shark for a minute; but Doug, it's not. It's a *broadbill.*" (Page 384.)

There was a crash, and I looked down to see where Juan had fallen from his siesta-hour perch on the bait box to land in the cockpit directly between Doug's flying legs. Juan had not understood my words, but there had been no mistaking the tone. Mike came running from the cabin where we thought he had been resting.

While Juan's shouted instructions to the pilot sent us skimming across the water, Mike got in the fighting chair to adjust rod and harness. Doug merely patted the big bait and watched the slowly circling set of fins which we were rapidly nearing. On topside, I looked first at the tremendous dorsal and tail fins, then down into the cockpit where the fishermen were preparing for battle.

Mike was seated in a chair which was little more than a backless, legless, wooden platform mounted on a short revolving pole and



An Ocean River Lures Anglers

In the chilly Humboldt Current off the Pacific coast of South America lurk the marlin, broadbill, and giant squid. Salt-water fishing is becoming popular among sportsmen of Peruvian and Chilean cities. Most of the adventures described in Mr. Duncan's article occurred near Talara and Cabo Blanco, Peru. Later the expedition moved south and made its headquarters at Tocopilla, Chile.

equipped with an adjustable footboard like those found on barber chairs.

On the front edge of the chair, directly between his knees, there was a swiveled socket into which the butt of the rod was placed. I was soon to learn that this merely held the base end of the rod and in no way relieved the angler of the strain in fighting a big fish.

It always seemed to my inexperience that in trying to boat fish of the size we saw, anything would have been fair. To hook into a fish which might outweigh the angler three or four times and to fight it on a thread of a line hour after hour, checking one terrific run after another, until legs, back, and arms quiver and jerk and grow numb under the inhuman strain, and then to lose the prize in the frenzy of its final run—well, that's fishing.

Preparations for Battle

It was clear that no such thoughts were entertained by the men below as the boat slowed down a few hundred feet from the fish. Mike, having finished his part of the preparations, leaned back to cast an experienced eye at the big scimitar-shaped fin cruising so aimlessly, it seemed, off our bow.

Doug, taking advantage of our reduced speed, slipped into the water his cherished bait with the two big hooks hidden in its belly. Then, stripping enough line from the 900-yard supply on the reel so that the bait would trail along on the surface about 80 feet off our stern, he snapped the line into the clothespin on the outrigger, binding it tight with an elastic to prevent its pulling out prematurely. The pin with its little burden was then pulled up to the tip of the outrigger, and we were ready to bait the swordfish.

Mike sat in the chair with the rod between his knees. The line ran from the rod tip to the clothespin on the far end of the outrigger, then straight back to the bait, which skipped merrily along on the surface. Doug stood beside the pilot motioning directions for approaching the fish. Juan knelt behind the fighting chair to be ready instantly from the time of the strike, to make sure that the angler and the chair were always kept pointing directly at the fish. Friction of a streaking line against a crooked rod tip has brought the freedom of many a fast-running broadbill.

All this time the swordfish lay slowly swimming on the surface, quite unmindful of the intense excitement it was creating. Circling first one way, then playfully scurrying back, it continually betrayed its presence by the towering set of fins cutting through the water.

Under Doug's skillful guidance the boat also began maneuvering in circles, keeping wide,

but always having the fish at the center (page 380). The broadbill cavorted on, one way, then another, continuing the funny little game it seemed to be playing. The bait hopped along behind the outrigger, apparently forgotten.

I noticed that we no longer circled, but were running downwind. The bait bounced along; it was going to pass directly in front of the fish's nose.

Just as it got ahead of the largest fin, we slowed ever so little. The bait sank and began to wobble slowly away. With a swish of its tail, the broadbill swirled and disappeared.

"Here he comes, here he comes!" sang Doug.

All eyes, strangely enough, were watching that little clothespin out on the tip of the outrigger. Excitement grew more intense as we continued our course straight across the sea.

A minute, two minutes passed. Our feeling of elation was transformed to one of worried concern.

The First Strike

Snap! For a second we stood dumb.

"Stop, stop! Line's down. Watch that drag. Stop!"

The boat literally skidded as the motor was reversed. No pressure had been put on that gossamer of line as its baited end sank out of sight. No sound came from below other than the low, nearly inaudible sound of the motor as we lay idling upon the sea.

Only the soft squeak of rubber-soled shoes on the roof tore the silence. Looking down, I saw little beads of perspiration glistening on Mike's forehead as he leaned over the rod, watching the reel in his hands.

Doug stood at one side, peering down at the line as it disappeared into the depths. His lips moved silently.

The low, scarcely audible sound of the motor had risen to a throbbing, head-filling roar; then slowly the line grew taut and the reel began to move. Slowly, very slowly at first, the cylinder of thread turned. Now in answer to some hidden power it began to whirl faster, and faster, and still faster, until in just seconds it was screaming in response to the terrific dynamo below.

In one jump Doug was at the wheel, sending us full throttle ahead. Mike came back hard on the rod. Again, and the reel still screeched as line ripped across its face. Once more, and at a quiet "Okay, Doug," we slowed to stop.

Our jinx was broken, and Mike Lerner was tied fast to a swordfish.

Knowingly, carefully, he touched the big reel to adjust the drag. There was now a giant fish

Mrs. Lerner Broke a World Record

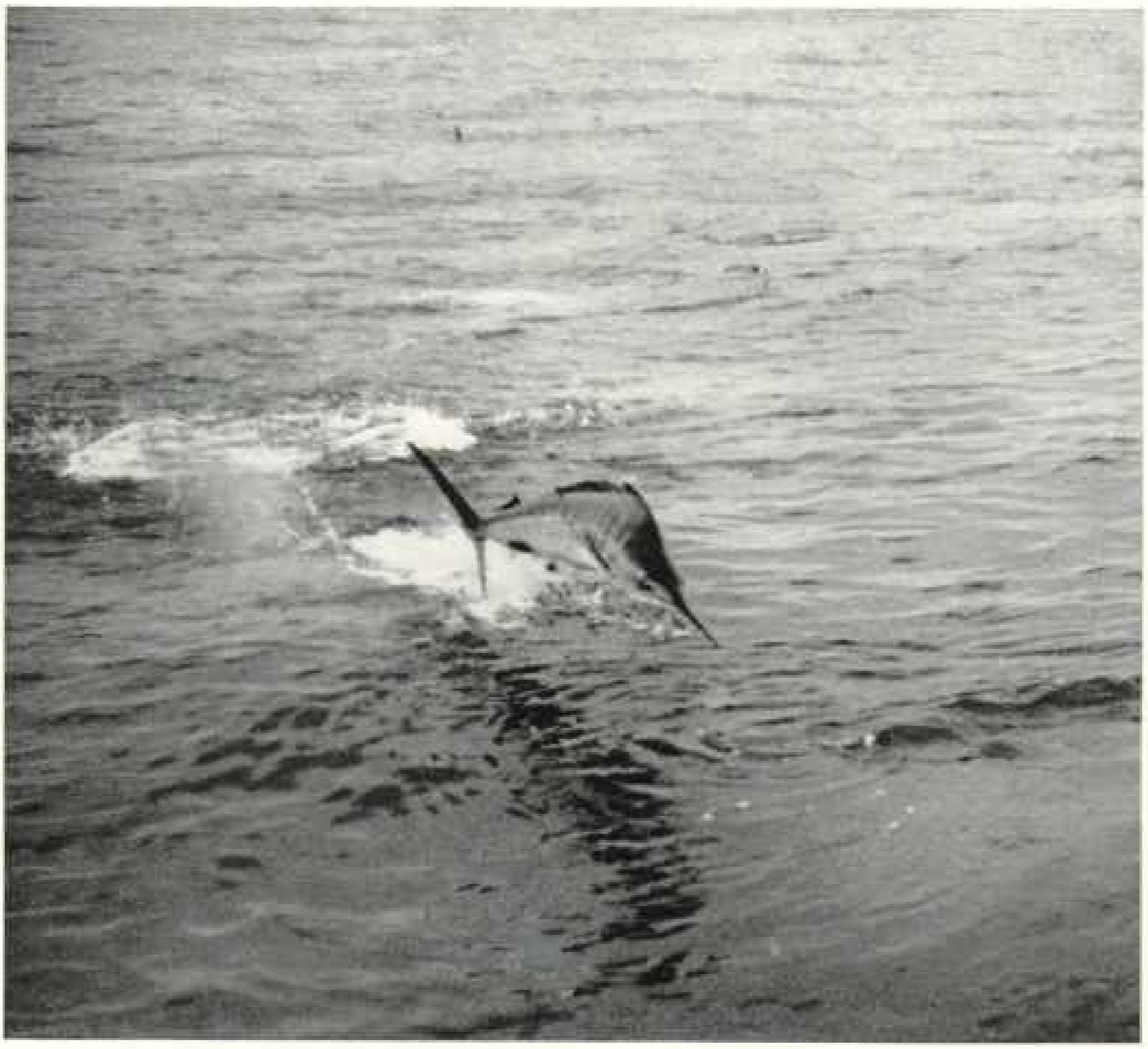
On December 24, 1940, the International Game Fish Association accepted as a new mark for women anglers this striped marlin, weight 403 pounds, which the wife of the expedition leader caught off Tocopilla, Chile, using a 39-thread line.

at the other end of a tenuous line paid out until its own weight was nearly enough to separate the strands. Almost a thousand feet had been stripped from the reel.

"Easy now. There! He's slowing down. He's turning. He's stopped!"

Looking up from the camera finder for a second, I saw that Doug still gazed at the line as if fascinated. Mike sat, panting now, still watching the reel, but beginning gently to turn the winding lever. Juan knelt behind the chair, keeping the line and rod tip straight.

One minute—two minutes—five—thirty—an hour went by. Everyone looked as at the start, only a little drawn. Now we knew that



Leaping Clear of the Water, the Marlin Hurls Itself toward the Boat

The line, unexpectedly slackened, lies in a loop on the surface as the big fish circles. To prevent disaster during such maneuvers, the angler must reel in rapidly and keep the pull steady.

the giant had been foul-hooked. In some way, in the strike, the 30 feet of wire leader had wrapped around his sword, his head, his body, or even his tail.

The swordfish was on the line, but in such a way that the hooks were dangling useless. Except for being a little puzzled, he was no more exhausted than when the fight began.

After an hour and a half we had seen the broadbill twice. Both times, by sheer strength and at the risk of breaking his tackle, Mike had forced him to the launch. But each time, just as the leader swivel neared the rod and Doug was about ready to grab the wire, the fish had seen the boat and with a swirling rush had torn away with another thousand feet of line, seemingly unaware that he was snared.

For Mike, however, the strain of recovering the line of each of those runs was carried through the rod and into the harness belt strapped around his waist.

At an hour and fifty minutes, instead of lying astern as it had been ever since the fish was hooked, the line started to go straight down. Down, down, down; 1,100, 1,200, 1,400, and finally 1,500 feet of line connected the angler to a fish that seemed to know no depth.

The rod bent dangerously time and again as the boat rolled in increasingly heavy seas; yet the fish refused to move. Fighting a fighter, as a fighter, Mike refused to give him a free spool to trick him into coming again to the surface.

Failure—After a Two-hour Struggle

The watch had just turned two hours when the launch rose upon a high sea, crashed into

Airplane and Submarine Meet on the Deep

The circling gull seems nearly as surprised as the wild-eyed marlin. Still trying to throw the hook, the fish "bulldogs" the bait from side to side.

the trough, then jerked up again on the following sea. The line lay limp.

Looking up with a half smile, Mike said simply, "That's fishing."

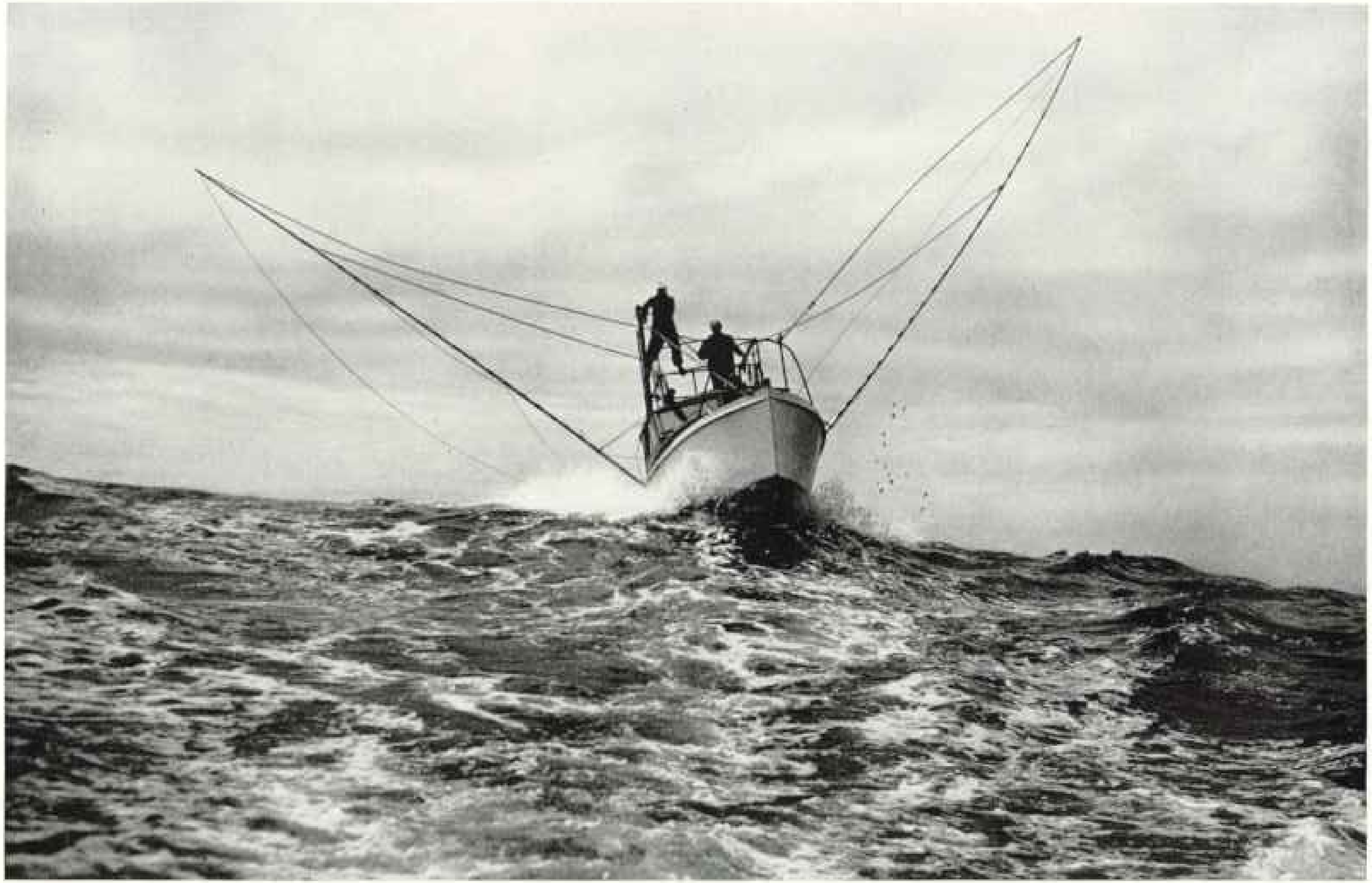
Slowly he reeled in the line. Another day was nearly done, and we started home.

In the days that followed, we worked northward along the Peruvian coast, from Talara toward the Ecuadorian border. Mike, having found one broadbill which he was sure was not a stray, believed that if we were to fish to the north, and miles from land, perhaps we might find an entire school of swordfish similar to those familiar off Nova Scotia.

Using Cabo Blanco as our base, we began again, fishing first north, then far, far offshore. Our search was fruitless. From morning until night we charted and followed courses in all directions, until with only another week of our allotted time remaining, it seemed that we should have to leave Peru empty-handed.

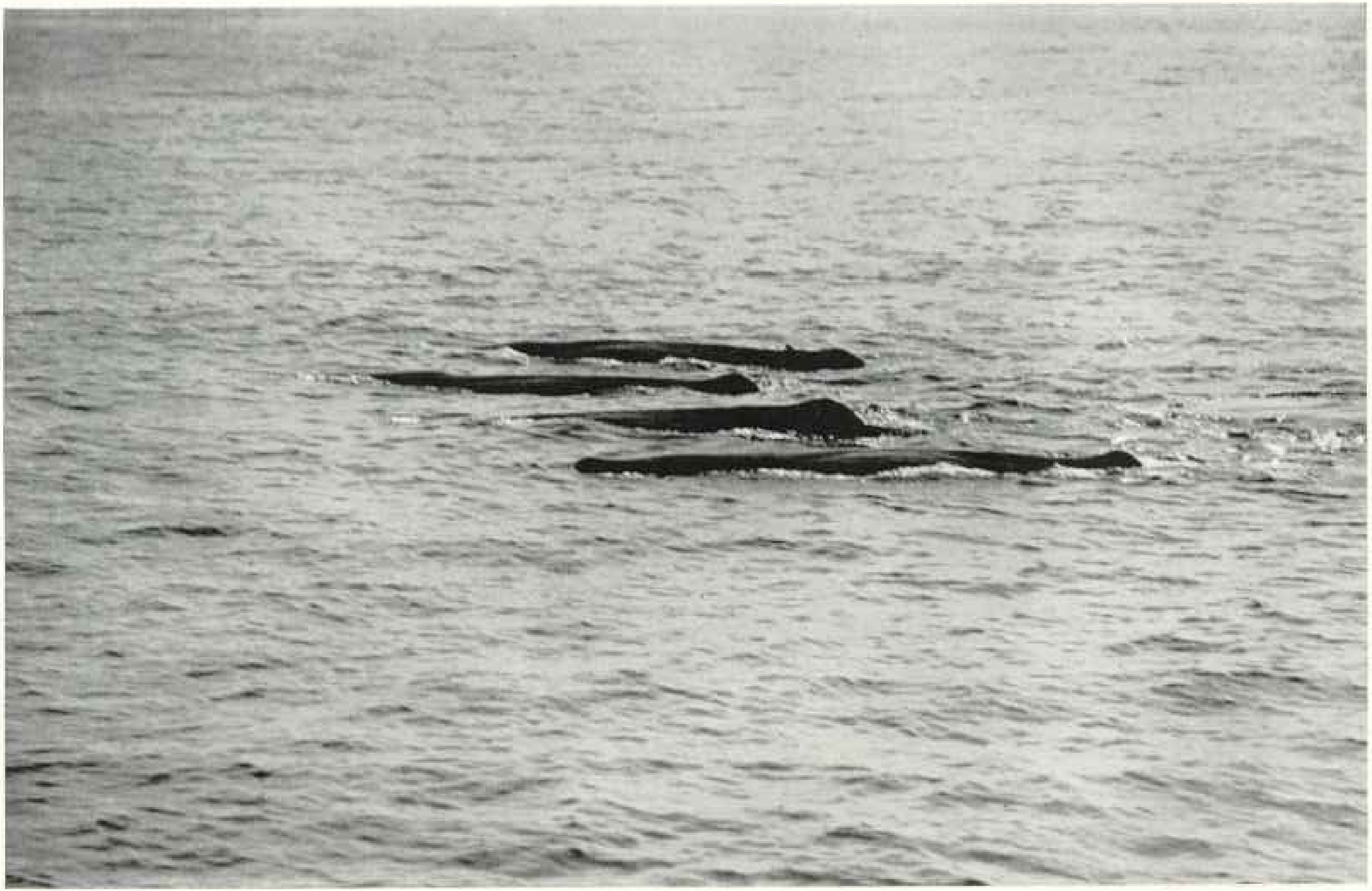
"If only we could see some bait," I heard Doug and Mike consoling each other, "we might have some idea of where to work; but the water is too warm and dirty in close where there are small fish. No broadbill would ever go there, and out here where the current is clear and cold, there isn't any bait. No wonder this place is Pacific—there's nothing in it!"

For lack of anything else to do, I translated the conversation for Juan. "Yes, it is true," he lamented. "Here where it is so beautiful there is nothing. Yet out only a little farther and more toward our neighbor," he sighed, and his dark eyes turned toward Ecuador, "there is so much. But," shaking his head as if to dispel some nightmarish memory, "those are the waters of the *jibia*."



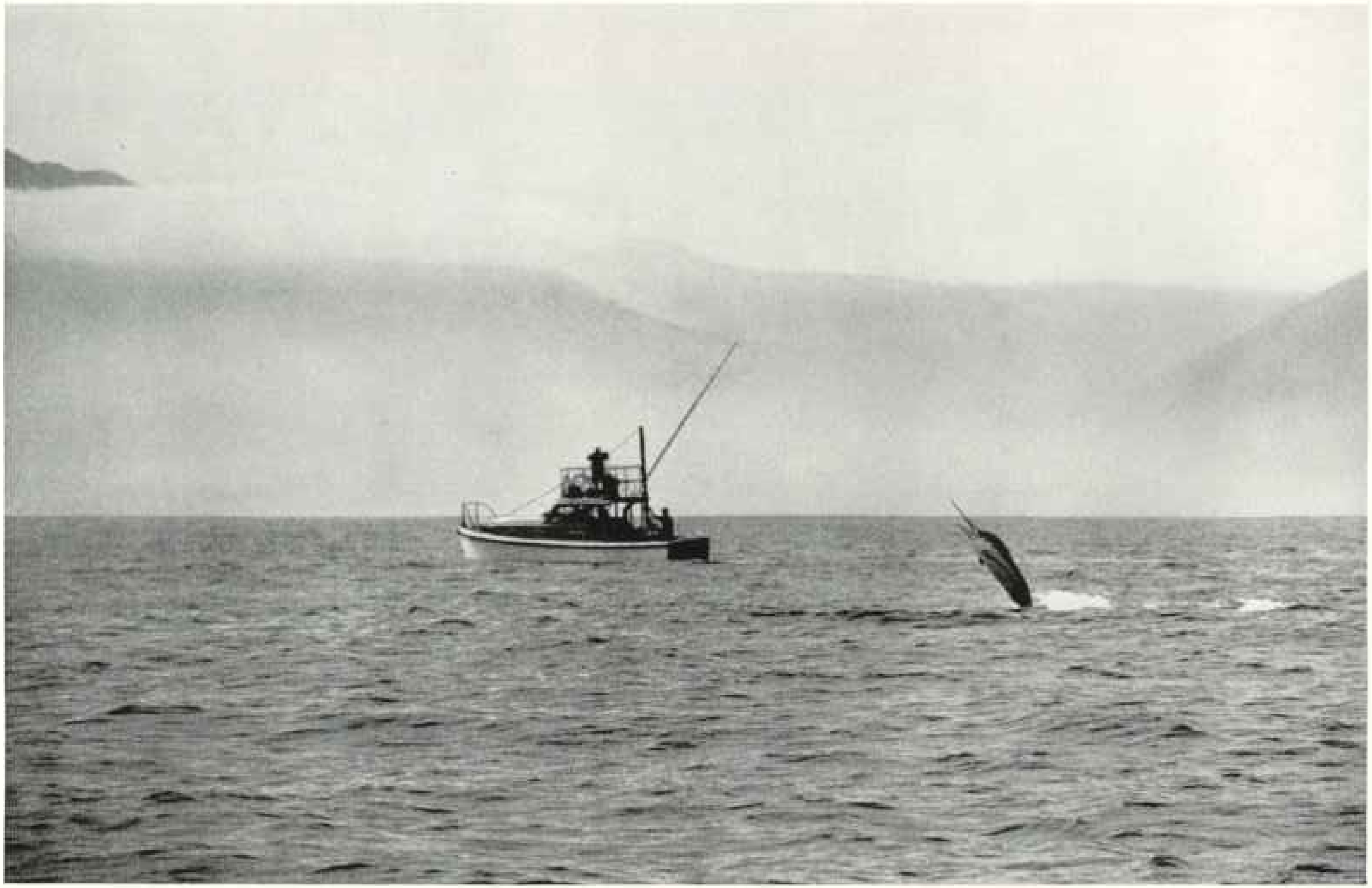
Fins Ahoy! The Launch Hurtles over the Waves in Pursuit of a Broadbill

Within a few hundred feet of the telltale sign, speed is retarded and the baited line is snapped into a clothespin on the tip end of the outrigger so that about 80 feet skips along behind the boat. Then the craft circles to present the line directly in front of the fish's bill (page 376).



Submarines Maneuvering? No, Only Peaceful Whales

They were unafraid, allowing the launch to follow them closely. One bobbed up, nose first, so close alongside that it would have been possible for one of the men to lean over and touch its head.



Tail Walking! Marlin and Boat Strive to Outmaneuver Each Other Off the Coast of Peru

Once the fish is on the hook, it may jump as many as 25 times, putting up a spectacular fight. Not only the angler who handles rod and reel but the captain of the launch must be alert lest the slender line be broken by a sudden jerk after it has fallen slack.

Every Beach Has an Avian Sanitation Corps—When Fish Are Cleaned, Vultures Gobble up Every Scrap

Occasionally huge condors come down from the Andes to eat their fill, but only after all the natives are gone. Both black and turkey vultures are in this group.

Two Fins Moving in Line Betray the Broadbill to the Lookout

Visible on calm days to distances sometimes exceeding a mile, the dorsal and caudal fins give the giant away as it lies circling upon the surface. The space between the two is often nearly six feet. The one in front always remains erect, while the tail sways slowly from side to side.

"Greyhounding," the Marlin Clears the Water in Low, Fast Jumps

Such action creates a large "belly" in the line, taxing the angler to the utmost to keep it from breaking. The thin strand would be snapped if suddenly jerked taut.

Though This Big One Did Not Get Away, It Was Hard to Bring Home

Michael Lerner and Douglas Osborne, together with all the natives, try to boat a giant broadbill in the waters of the Humboldt Current off Tocopilla, Chile. These swordfish are of world distribution. In recent years their flesh has become popular in sea-food markets of the United States.

"Mike! Doug! Come here quick!" I was so excited I could hardly speak. "Listen to this," and I went ahead to tell them of Juan's conversation and the jibia.

Mike was surprisingly self-possessed and not at all elated by the news. "There is only one thing we'd like to know," he said.

"Yes?" I was truly puzzled, for here they had the answer to everything.

"What is a jibia?"

"Squid! Squid, man! The very thing you have told me about so often, the favorite food of all swordfish."

A Warning of Demon Squid

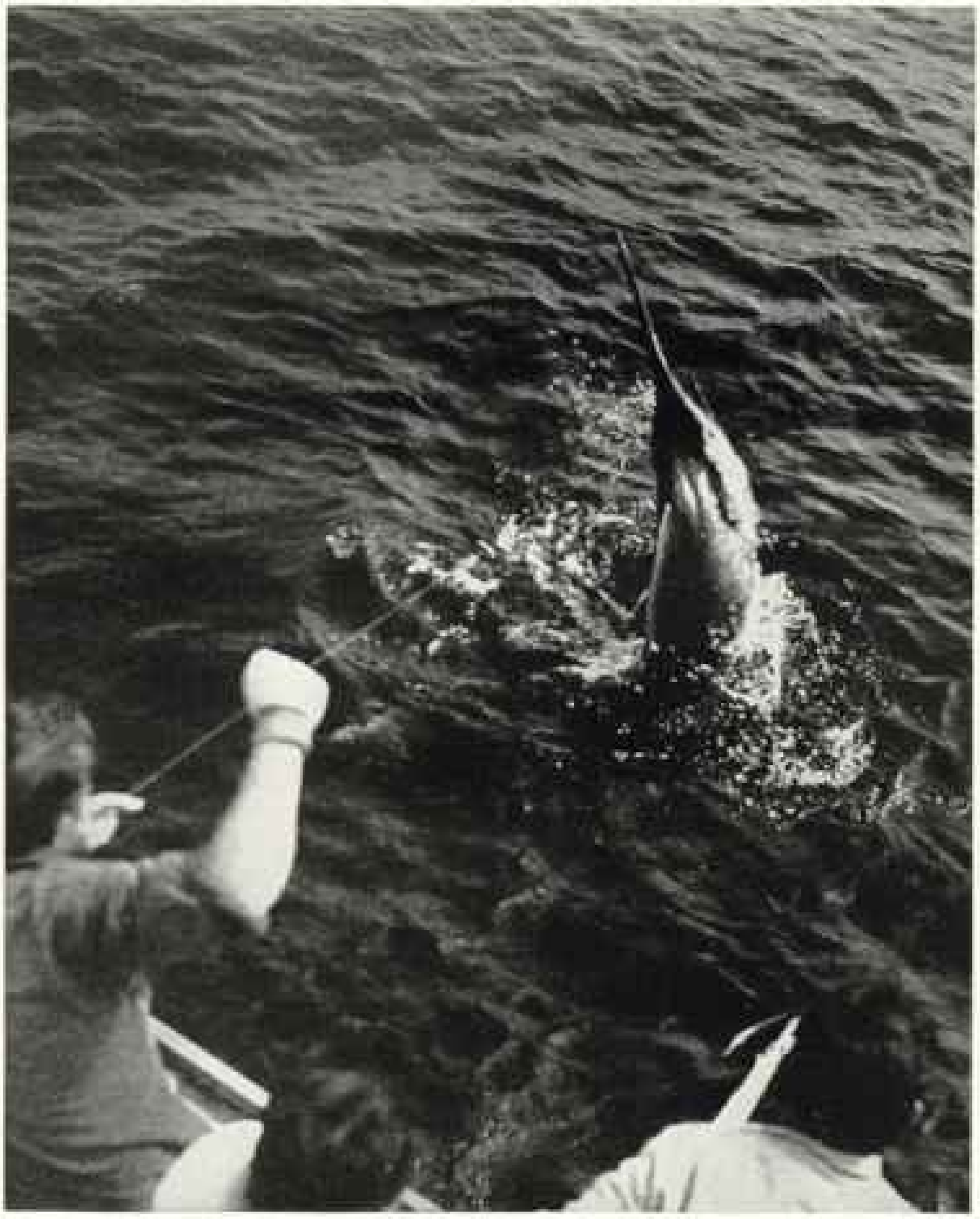
Here Juan clutched my arm, pulling me to one side. "You told them something funny, a joke, maybe? It is not the squid but the swordfish that we seek, no?

"But, by the holy saints, the gentlemen must be joking. These are not fish, or animal, but demon—I speak of squid. Now, surely we don't go.

"We do? Oh, why didn't I stay on the shore to work in the mines as my father, and his father's father! I can't make you understand.

"These are squid. They rise only at night to lie as ghosts upon the waves. They spit poison which burns, and is black. They have mouths, sharp and vile, surrounded by ten arms, all covered with suckers. They know no size, but are huge and horrible. Now, now that you know, we go back. No?"

It was then late afternoon, but with the thought of arriving before dark in the waters which seemed so fearsome to Juan, we gave the motor full throttle and headed north.



Journey's End!

As the captain takes the wire leader in his hand, the marlin jumps for the last time. A native boy stands by to gaff the fish as soon as it comes within reach. The third man will slip a rope around its tail and the fight is done.

Despite his well-intended warning, we were elated, for now at last we felt that we were going into an area where we might well expect to find swordfish.

"After all, a squid is just a squid," began Mike. "Juan can't be really afraid. He's just joking."

We had seen Juan dive overside to put the gaff into a harpooned manta, oblivious of the danger of shark-filled waters. One night he had piloted our little craft in and out of a driving sea, picking his way through the surf of a rock-strewn coast and coming to anchor in a tiny cove—all without a word.

It seemed ridiculous that this same man, displaying all of the earnestness of a friend and a guide, had exhausted every possibility of trying to keep us away from the very waters we sought.

"I have caught squid most all of my life," argued Doug, as if contesting Juan's resigned silence. "Some of 'em were big fellas, too, nearly three feet long."

In answer to the questioning glance Juan cast in my direction, I translated. For just a moment the worried look disappeared and a dry chuckle escaped his lips. No need for an interpreter there; we all knew we were in for a surprise.

Night found us still bearing north and offshore under Juan's unenthusiastic guidance. Not until almost midnight, when velvet darkness blanketed the sea, did he give the order to reduce speed and stop. I would have bet that it hurt him to do so, too, for his low conversation with the pilot told me that we were at last in the dreaded waters of the squid.

"Yes, señor," came his confirmation to my question regarding our arrival.

"But the water seems no different," I argued. "It looks just the same and as empty as that we've been searching all these weeks."

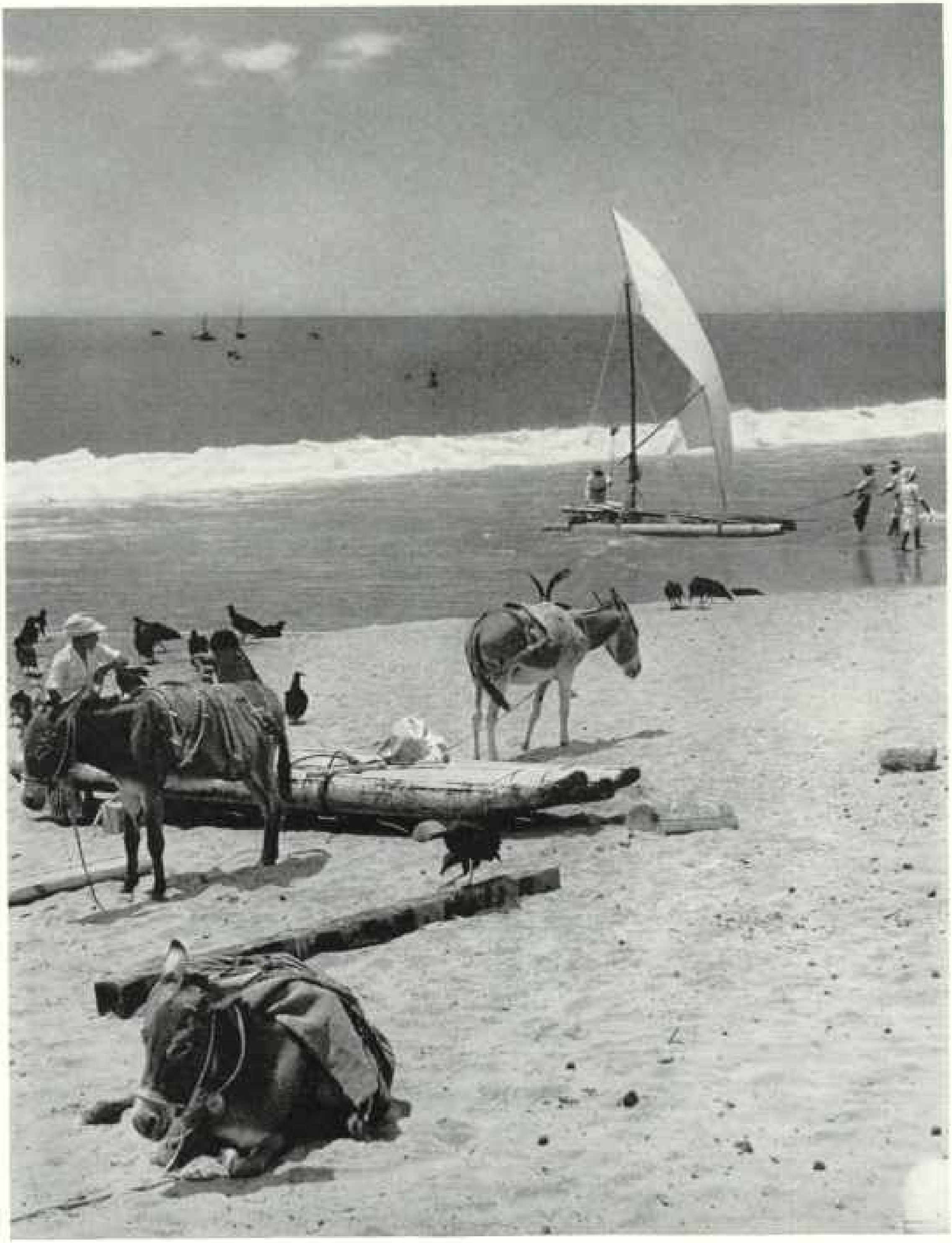
"Empty? Ah, but señor, allow me only to snuff the light which burns so brightly in the cabin. Now it is dark—dark as the cavern of night. There are no stars. Yet see; look out upon the water. We are not alone."

Following the command in his voice, I turned, attempting to pierce the mantle of the night, yet not knowing what I sought.

Midnight Magic in a Sea of Peril

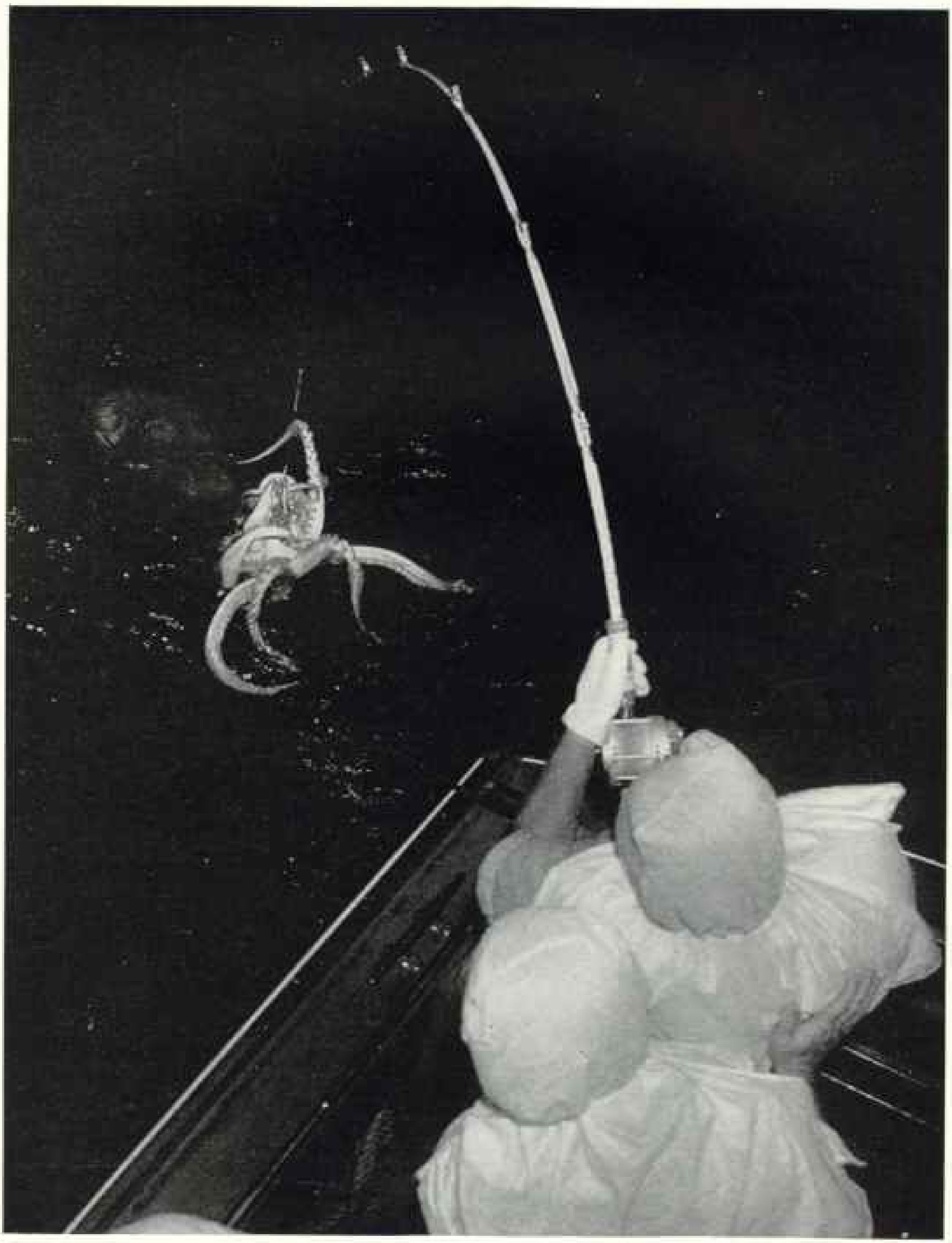
"But it is night! It is very dark. How do you expect me to—"

As I spoke, a great patch of water not twenty strokes from our side began to glow. Small and indistinct at first, the luminescence spread and became more intense until at last it seemed as if molten light were being poured



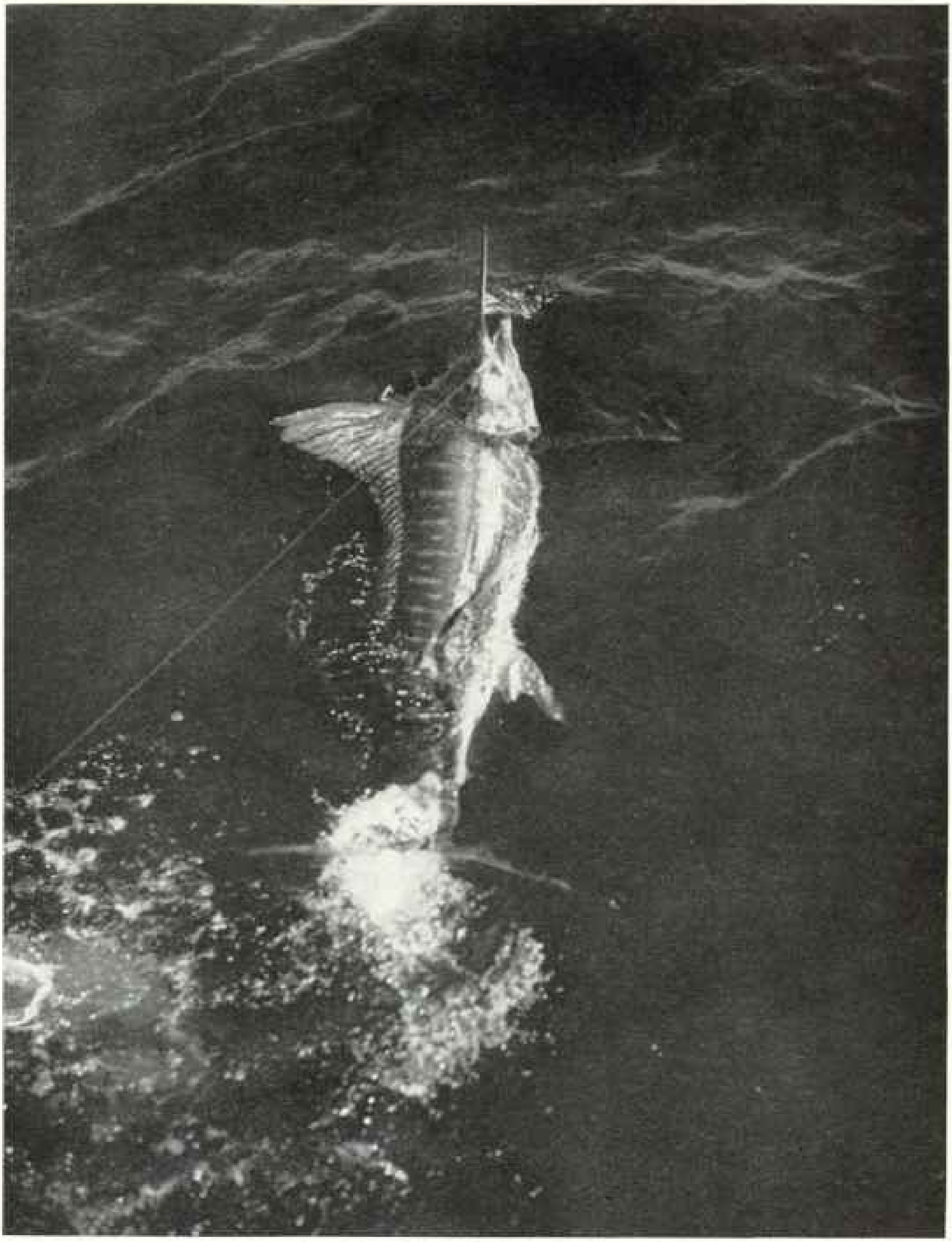
Burros Are the "Redeaps" at Cabo Blanco, Peru

Sent down from the houses, they wait near the water's edge until the men return and load fish in the slings thrown over their backs. Then, with no one accompanying them, the well-trained beasts go home. Women remove the packs and have dinner ready before their husbands arrive. As elsewhere along the Pacific coast of South America, there is no good anchorage close in; therefore, boats must anchor offshore. Fishermen sail far out on these balsa rafts. Returning, they skillfully steer their craft through the breakers up to the beach.



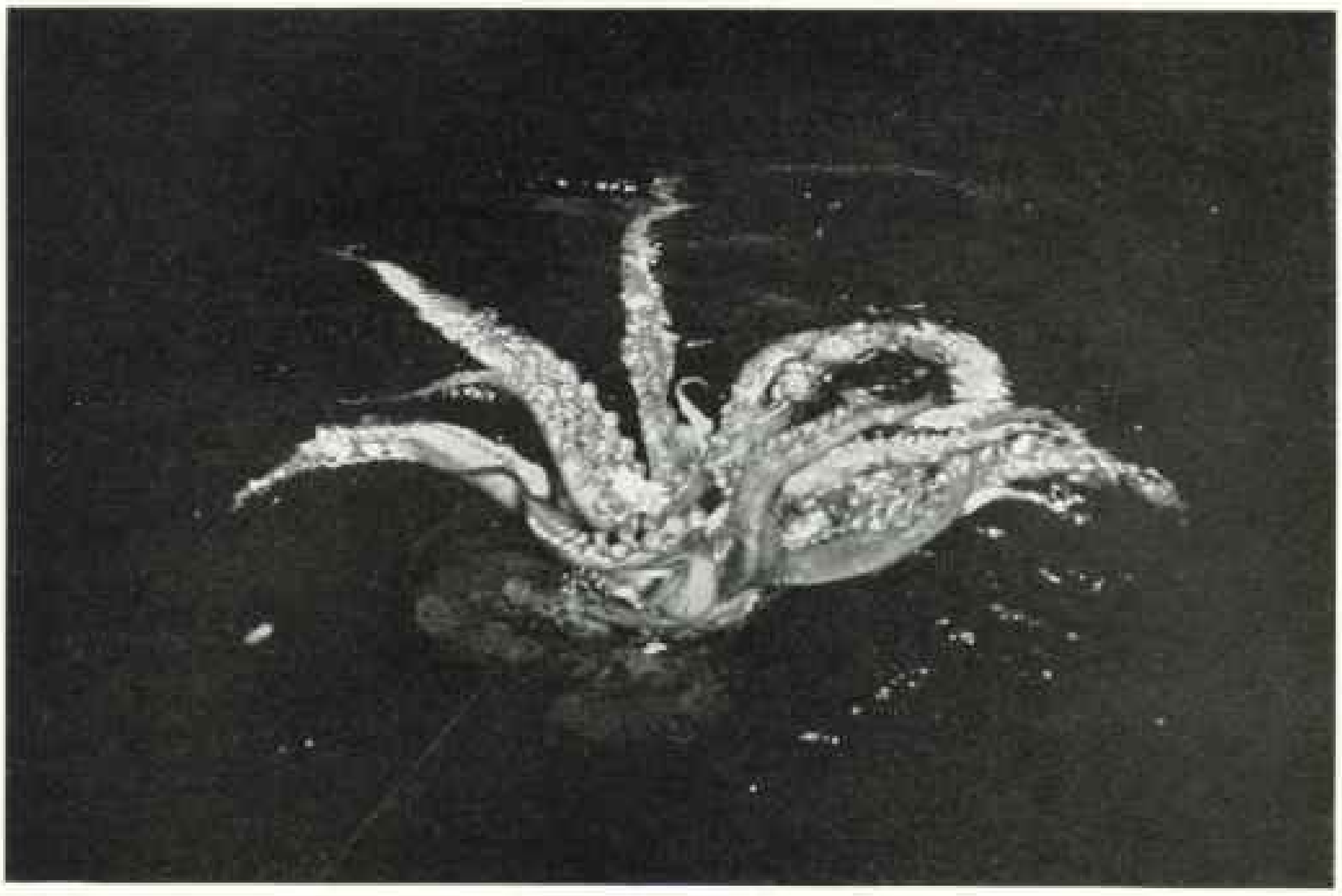
It Is the Squid's Nature to Fight Everything

As it is brought to the surface, it flails at the line with its tentacles and snaps viciously. Many of the fishing rigs were bitten in half despite their wire leaders of the toughest steel obtainable. A chain of hooks had to be used, for one or two proved futile. Dangerous as were the beaks and thrashing arms, they were not the only hazards. The anglers wore cloth masks made from pillow covers to protect their faces from the "ink" squirted at them by the giant squid (page 398).



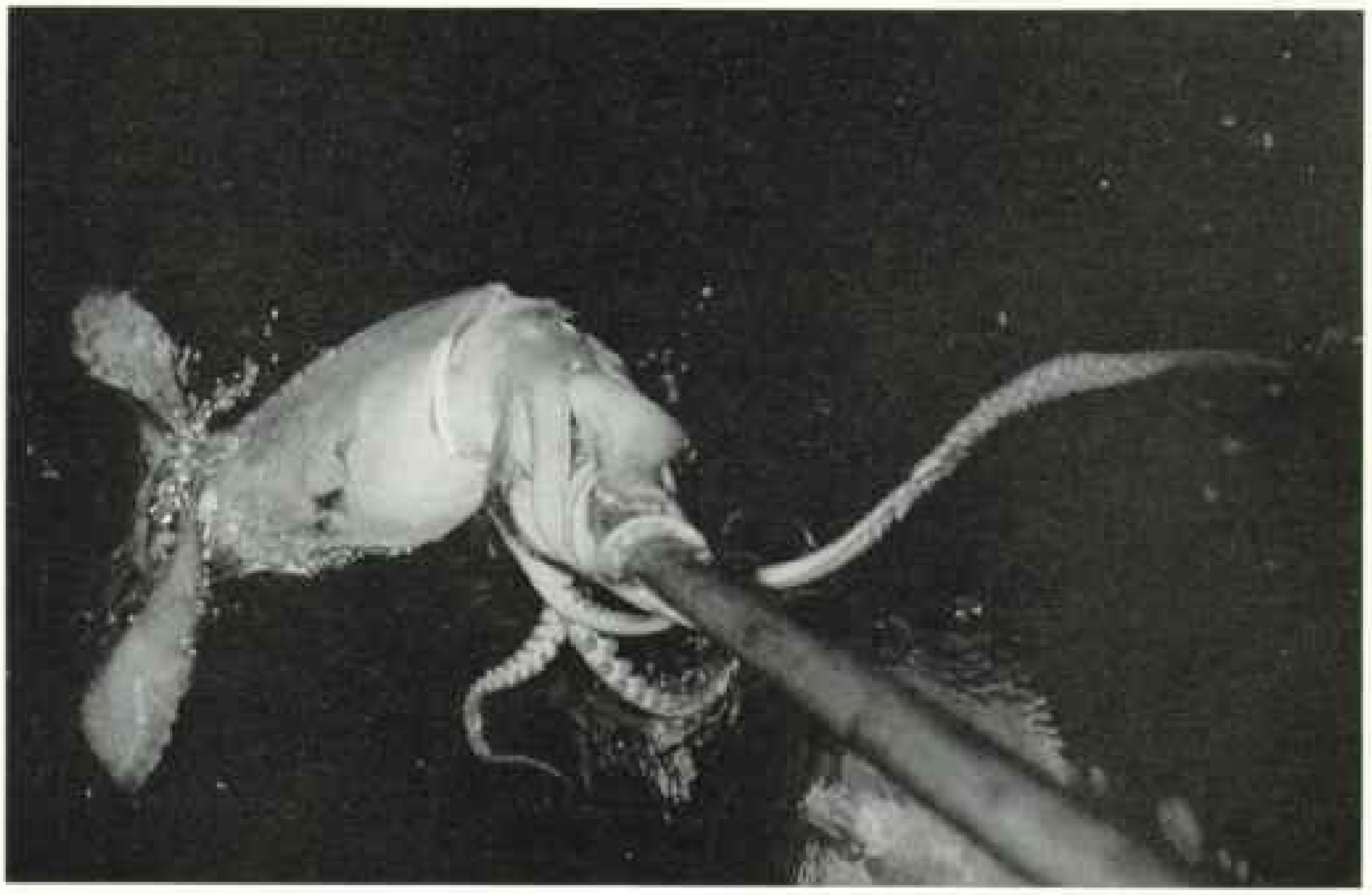
One Last Effort Before the Leap!

Completely submerged except for the tip of its bill, the marlin swirls up for its final fling. Stripes which show up clearly here soon disappear when the fish is landed. Anglers consider this one of the luckiest photographs ever made of the "acrobat of the sea." It caught the fish in extraordinarily clear water, revealing details of the action just before the jump. An instant later its huge body was clear of the surface. A few more runs, each feebler than the one preceding, and its game battle ended.



Coming up on the Hooks, the Giant Squid is a Fearsome Thing

Because the ocean off Peru is highly phosphorescent, the creature is visible as it shoots through the water, leaving a long meteorlike trail. The flashlight for this night picture blots out the luminescence.



Baleful the Eye and Vicious the Beak of the Gaffed Squid

With its ten tentacles wrapped around the pole, the monster grips tight and snaps big chunks out of the wood. One of its fellows (faintly visible lower right), darting tail first, is coming up to take a bite out of the captive. They are extremely cannibalistic (page 386).

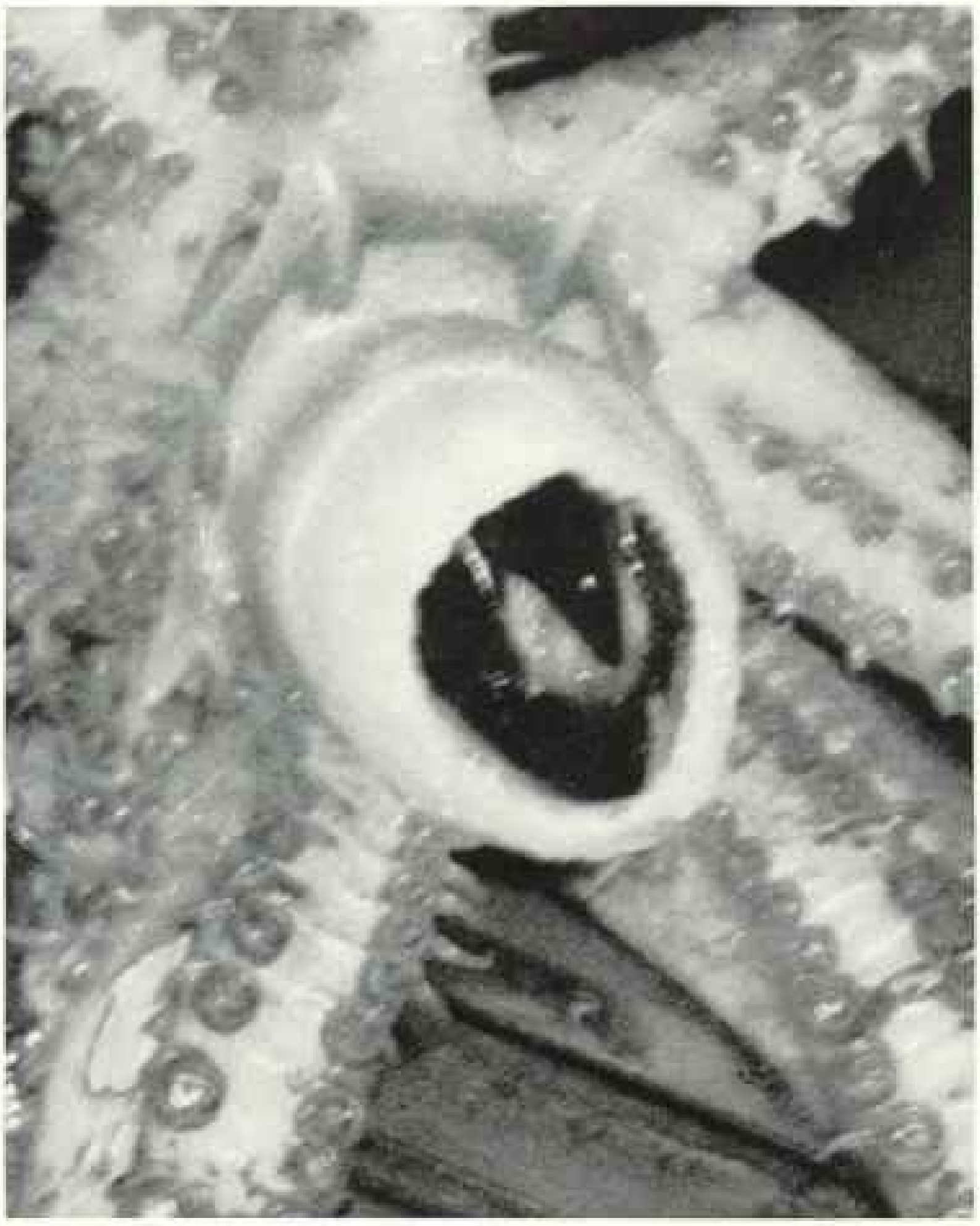
upon the waves. Sparks flew from its edge, only to fall dying into the abyss (opposite page).

Enthralled, I marveled at the beauty of this phosphorescence. It grew brighter and still brighter till suddenly it exploded. There, in the direct center of the unearthly halo, I saw an indefinable something which made me gasp.

The spasmodic flare of cigarettes at my side and a low, mocking laugh from behind told me that Mike, Doug, and Juan—all of us—had seen the same thing.

With a flick of his wrist which unquestionably said, "Now watch this," Juan then tossed a handful of fish-bait scraps overside. Standing by the rail, we followed their sinking flight by the little silvery bubbles of light in their wake.

Even as we watched, meteorlike streaks of light shot in from all sides; the blackness below glimmered. Then the very foundation of the ocean seemed to burst in the blinding flash of a terrific, but soundless explosion.



The Squid Is Armed with a Vicious, Parrotlike Beak

Powerful muscles open and close the dark-colored jaws in the center of the creature's head. With these the squid tears large chunks of flesh from its victim, which it swallows in quick gulps. But the beak is not its only weapon; each sucker disc on the ten tentacles is surrounded with a ring of horny teeth which assist in grasping the prey.

Darkness surged in again, and the tumbling pieces of bait were gone. Standing staring into the night, I recalled Juan's warning—"I speak of squid—not fish, or animal, but demon."

Mike was the first to regain speech. "Holy smoke! This place must be loaded with squid and saturated with phosphorus. What a combination! Why, I've been fishing for years, from Australia to Nova Scotia, from New Zealand to the Bahamas, but never in my life have I seen anything like that!"

Every scrap thrown overside sank from sight accompanied by a trailing streamer of fire, and no sooner did even the most insignificant morsel fall sparkling through the water than legions of squid rushed in from all directions to pounce upon it. Small wonder that the place was so feared by the native fishermen. Suppose a man should fall overboard!

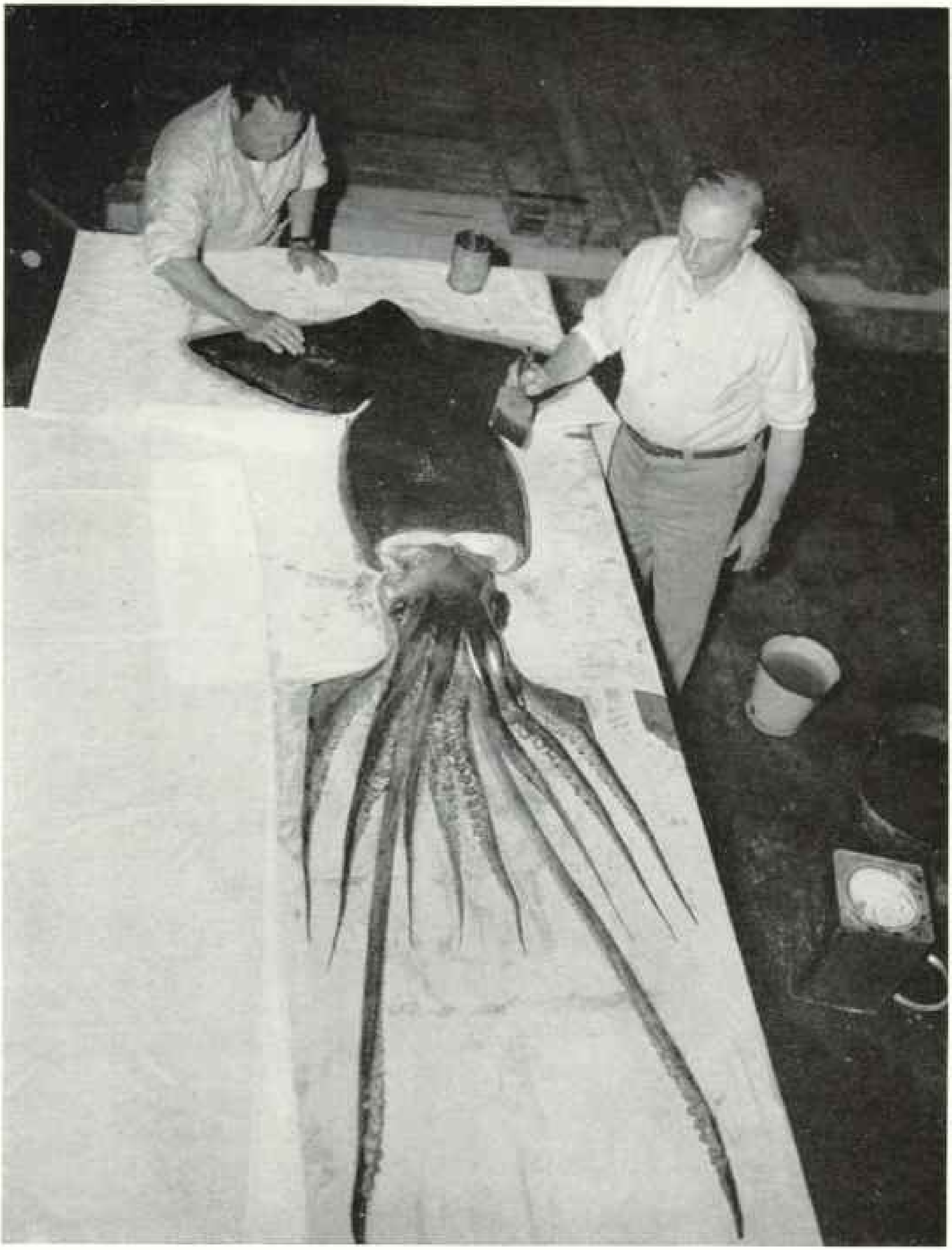
"Well, what are we waiting for?" This time it was Doug's voice that cut the silence and there was no mistaking his thought. He had already begun assembling tackle.

"But those things can't be taken on rod and reel! They never have been!"

Mike's answer, classifying the squid as "things," seemed a masterpiece of understatement.

Fishing for Demons at Night

"But we can sure try," he added. "After all, it seems they come up only at night. If



A Tough Customer Gets a Coat of Olive Oil

Thus a giant squid is treated before a plaster cast of it is made for the Museum. Note the eight short and two long tentacles, the muscular body, and the caudal fins spread out like the wings of a bat. The position of the specimen is that of a live one swimming. With arms trailing behind, the creature moves through the sea, driving itself along by jets of water ejected with incredible speed and force from pumping compartments in its baglike torso (page 395).

Michael Lerner Displays the First Giant Squid Taken on Rod and Reel

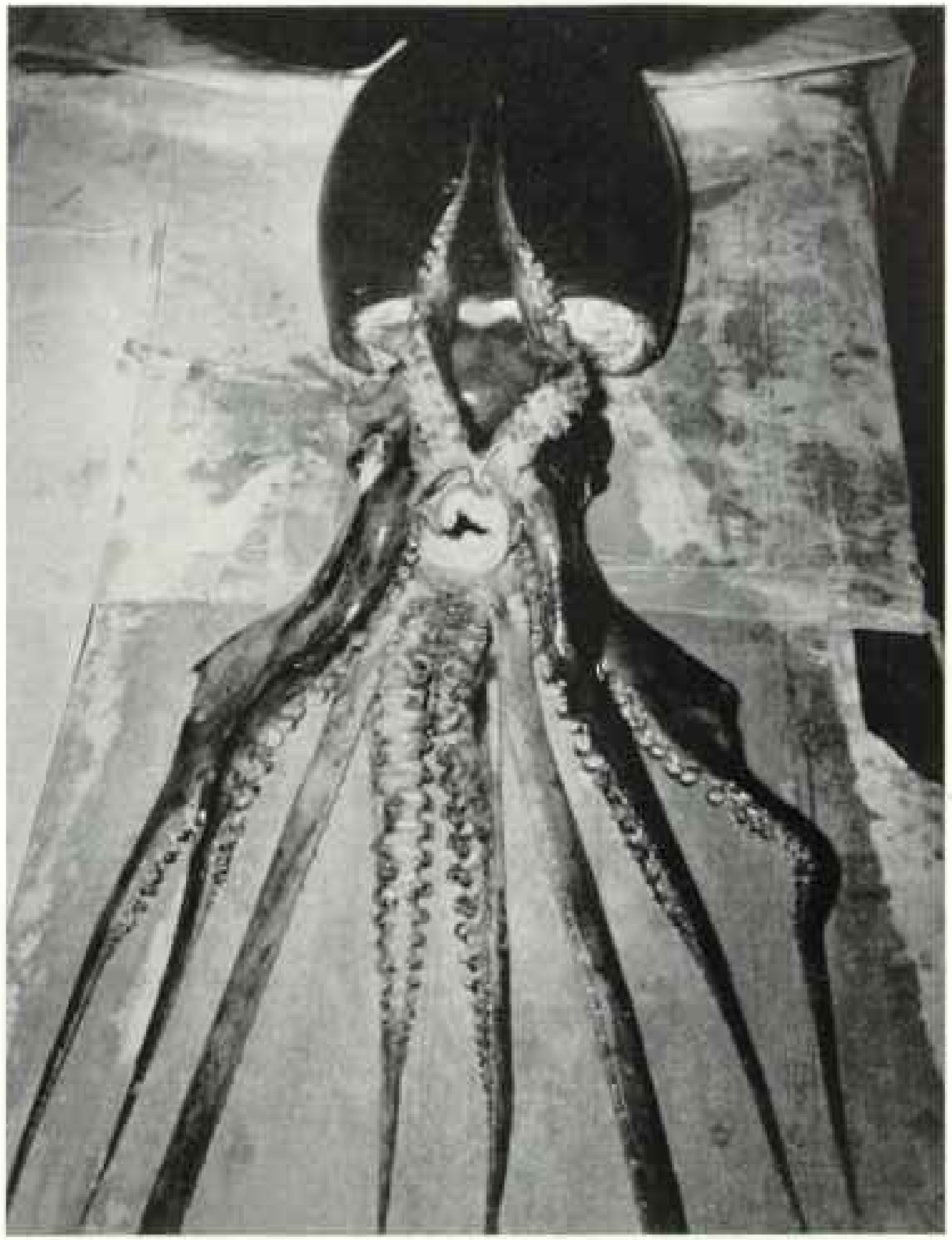
The smallest exceeds six feet in length, and the largest, which weighs more than a hundred pounds, measures nearly nine. The catch is shown on the dock at Cabo Blanco, Peru, where it was landed after a night of perilous adventure (page 400). Little wonder that the most intrepid of the natives fear these creatures and call them devils! The monsters eat anything that falls into the water, attacking all kinds of sea denizens, even whales. Their toothy tentacles enable them to cling to their prey while their beaks slash viciously.

Banners of Triumph Signal the End of a Perfect Day

One launch with one flag flying, and the other with two, each signifying a boated fish, motor back to headquarters of the expedition at Tocopilla, Chile.

The Squid's Body Is a Motor Bellows

By muscular contractions, jets of water are ejected to propel the creature backward at a terrific pace. Osborne holds the front edge up to show the pumping compartments. The ink sac is also located under this covering.



Not a Potted Cactus Upside Down, But a Squid, Head View

The teeth-crusted tentacles surround the beak, behind which the dreadful eyes are set. With the black, rubbery bellows of the body the creature propels itself rapidly backward or squirts out blinding torrents of inky fluid.

Where There Is a "Smoke Screen" of Birds, Bait Fish Usually Abound

The expedition quickly learned to drop nets for small fry in such places. Cormorants off Tocopilla, Chile, arising in such clouds from the water, sometimes nearly hide the nitrate vessels at anchor in the bay. These are among the best known of the guano birds of South America.

Cormorants Come in by Hundreds of Thousands to Roost upon San Lorenzo

The mounds are nests remaining from the previous mating season. This entire side of the island acquires a guano deposit nearly 18 inches deep during the two-year period between harvests. The fertilizer, garnered by the Peruvian Government, is offered first to domestic trade, and the surplus is exported.

Gaffing a Squid Is a Risky Gamble

As the catch is dragged into the boat, the parrotlike beak, at the center of the tentacles, is aiming directly at the camera. Any slip here might cost a careless fisherman a sizable section of his hands or arms.

we sleep now, we won't get a crack at them, anyway. Come on, let's go."

Using our broadbill tackle to fish for squid, we began one of the strangest adventures in the history of scientific collecting and deep-sea angling.*

All thought of sleep was forgotten. We fished shallow and fished deep, first with heavy tackle, then with light. We lost hooks and lost line. One hook unavailing, we tried two. Night passed and we had not caught a squid, but we had learned plenty about them—how they rise at night in untold thousands, how big they are, and how they squirt sepia-colored, ink-laden water for many yards.

After taking our bearings, to learn that we were nearly 70 miles offshore, we decided to go no farther but to work the area around us. Somewhat heavy-eyed, we started the motor and began our search anew.

It was our lucky day. No sooner had we climbed topside to be on the alert than we sighted a fin. Efforts to bait the fish were futile, but it really did not matter; for even as we gave up, exasperated by the brute which swam so provokingly near, yet would not even look at our offering, we saw another fin. By noon we had seen an even dozen broadbills, all very large.

Our hunch had hit the nail right on the head. The swordfish were in the area, but they were overstuffed with squid. Instead of rushing at our baits in orthodox broadbill fashion, they swam away in scornful disdain.

Just after lunch we sighted our thirteenth fin. Superstition held true that afternoon; number 13 was bad luck for the broadbill.

Circling, Doug presented a bait which wobbled right under the fish's sword. In an instant he was on the hook and less than an hour later he was in the boat.

Normally, such tremendous good fortune as boating a broadbill would have caused jubilation and the temporary suspension of all activities. But by this time we had only a few days remaining before we were to leave Peru to move down the coast to Chile.

Turning the swordfish over to Miss LaMonte in the laboratory, we shoved off again, headed for our newly discovered fishing grounds. Miss LaMonte found the specimen's stomach so full of squid that she marveled at its having

* See "Marauders of the Sea," by Roy Waldo Miner, National Geographic Magazine, August, 1935.

been able to swim, let alone show interest in our bait.

Once again it was nearly midnight before we cut the motor, to drift in over our favorite spot. Hurrying to the rail, we looked down into the water and drew back reassured. Long tracers of fire again ignited great submarine blasts of light, for the squid were still there. Chuckling, Mike appeared from the cabin carrying two packages which he had slipped aboard back in Cabo Blanco.

Mike Prepares a Surprise for the Squid

"Now for a little surprise party for these refugees from a nightmare," he crowed, and opened one to pull out a handful of pillowcases.

"Now the other," and he unwrapped the paper to lay upon the deck three of the most murderous-looking fishing rigs I had ever seen.

"We're going to use these pillowcases for squiddin'. We'll use them as helmets. With little eye-holes we'll be able to breathe and see; yet the ink from those devils won't get on our faces."

Hooked on the Gaff, the Squid Is a Nightmare from the Deep

Its ghastly eye stares, its round, rubbery body sags below, and its horrid arms dangle. This monster came in to snap at a smaller one which had taken the bait. Just as it grabbed its prey, Osborne gaffed it and landed both.

The scheme was perfect. The night before we had been hesitant about gaffing the squid for fear of being squirted in the face with a load of ink.

Used either as an offensive or defensive weapon, the ink is carried in the jacketlike body of the cephalopod, from where it can be shot into the water. We had found that the squid, when hooked and lying on the surface, could eject this sepia, together with water, under tremendous pressure, sufficiently far, in fact, to carry it over the side, past fisherman and photographer alike, to drench and stain the cabin of the boat. We had not been sure what effect the stuff would have if shot into our eyes, and had not cared to assume the role of guinea pig to find out.

"Sure, the helmets are a great idea, but these are even better." Mike indicated one of the rigs he had just unwrapped.

"You remember how we couldn't snag those squid on the one- and two-hook setups of our swordfish tackle? Well, this should turn the trick."

So it should, for instead of employing one or two large hooks such as were used for broadbill, the squid rig hung as a tassel, being composed of about a dozen smaller hooks. The leader about which the tassel clung was of the toughest steel wire obtainable.

"Now, when the squid takes one of the baited hooks into his beak, if only to snap it

off, we'll still have some chance of landing him. The other hooks should get tangled in at least one of his ten arms."

Our cutting eye-holes in the pillowcases and slipping into the helmets brought peals of laughter from Juan and the pilot. However, upon learning that they were to be somewhat protected, they were enthusiastic about the idea of dragging some of these all-ocean bogymen from the sea. Baiting up the hooks and dropping the line overside, we began to fish.

There was no waiting while one sat impatiently wondering what was going on below. It was actually a problem to get the hooks into the water fast enough so they would sink down through a stratum of little fellows to the depths where the giants prowled.

Many a Slip Between Hooking a Squid and Boating It

No sooner did the bait fall, amid its shower of phosphorescence, than the rod whipped and snapped as the line faded from the reel. Zipping first to the right, then to the left, it finally went straight down, only to lie limp and still.

Just as Mike began to reel in, the line came shooting back up, for the squid on the hook was being pursued by cannibalistic hordes of its own kind. Reaching the top and having no farther to go, it sizzled around for just a second. Those incredibly fast-moving streaks of fire closed in from all sides, the surface let go with another pyrotechnic display, and once again the line lay limp. This time Mike reeled it in. The super-tough wire leader had been bitten off just above the hooks.

"Whew!" Doug's exclamation was eloquent.

The next attempt proved more fruitful. The moment we dropped a new rig overside, the rod arched again as the line was yanked one way, then another. The reel howled. First it was full, then empty, then full, then empty again, for the squid below was eluding one gang of fiends only to run into another.

Finally it managed somehow to get to the surface unnoticed by the swarming others of its kind. For seconds it lay resting, shimmering in a widening and unescapable pool of phosphorescence; then, betrayed, off it fled again.

The end came unexpectedly.

A Living Horror from the Deep

Following the irresistible pressure of the rod, the squid rocketed through the water headed straight for the boat. At the instant when it seemed that a crash was inevitable, it saw the barrier and reversed its field to zoom away; but too late. Doug lunged down with the gaff, heaved back on the pole, and the squid came up alongside the rail.

Only then did we realize how grotesque and truly fearsome were these creatures we had been fighting. That first squid caught on rod and reel was a terrible thing. Stretched on the stern of the boat, it measured nearly 9 feet in length and weighed more than 100 pounds. One end supported ten armlike tentacles which were frightening to behold.

Nestled at the apex of these tentacles was a glistening beak, against the slashing attack of which few living things could survive. As if not already sufficiently ghastly, the creature was further endowed with two baleful, unblinking eyes, laterally placed behind the mouth. But that was just the head (pages 388, 390-3, 395, 398-9).

The body, connected by a little choked-appearing neck, was heavy and round, soft and rubbery, reminding us of an oversized water bag. At its end there were two flattened caudal fins used in steering its meteoric flights. The entire animal was cartilaginous and slimy.

Inquisitive, Doug prodded the jacketlike mantle of its body and found that it was separate from the vital inner organs. Opening at the front, just behind the head, there was a compartment which served a novel purpose.

Normally, as the creature lay in the ocean, this outer wall of the body pulsated to pump water into the jacketed area surrounding the organs. For locomotion the mantle was contracted by muscular action, expelling the water so forcefully that the squid was propelled through the sea with amazing velocity. Back under this mantle, too, was located the ink sac from which sepia could be thrown in times of stress.

On examining the tentacles, we found that the sucker discs were lined with a ring of calcareous teeth—formidable weapons themselves. Yet seemingly these discs held the prey only long enough for the onslaught of the beak.

When the sun next morning shed the light of reality upon what had been a ghostly, fantastic world, we stood for a moment in its warmth, then reeled in the line. Since this was our last day in Peruvian waters, we fished until dark and returned home with a flag flying, for Mike had taken another broadbill.

As we stood in the gloom of the pier measuring the fish for the laboratory, I sensed a melancholy regret creep over those of us who had spent so many sleepless nights far out at sea. True, we were heading south down the Humboldt where broadbill and marlin abound, but we were leaving the waters of the squid and our strangest adventure.

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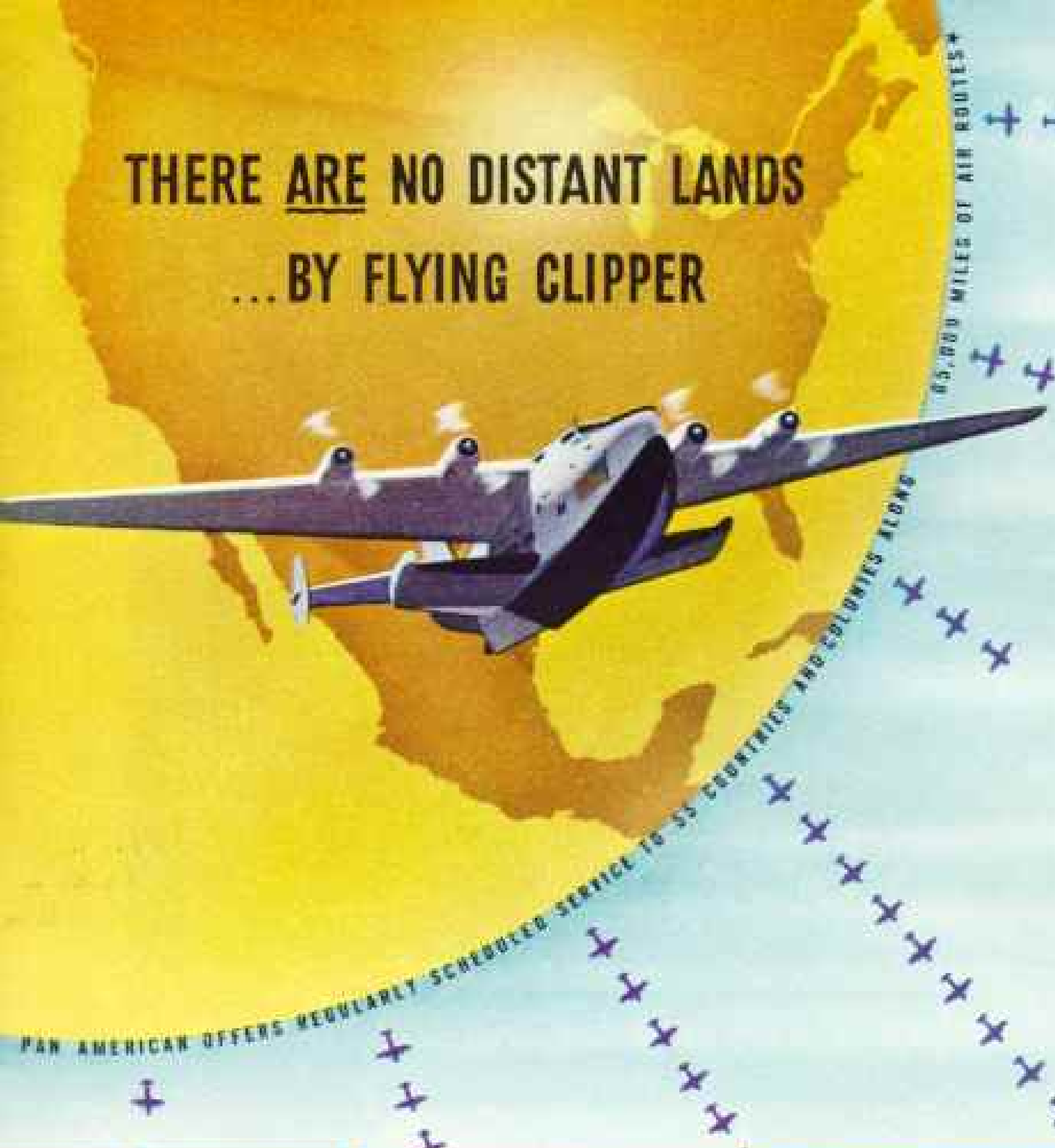

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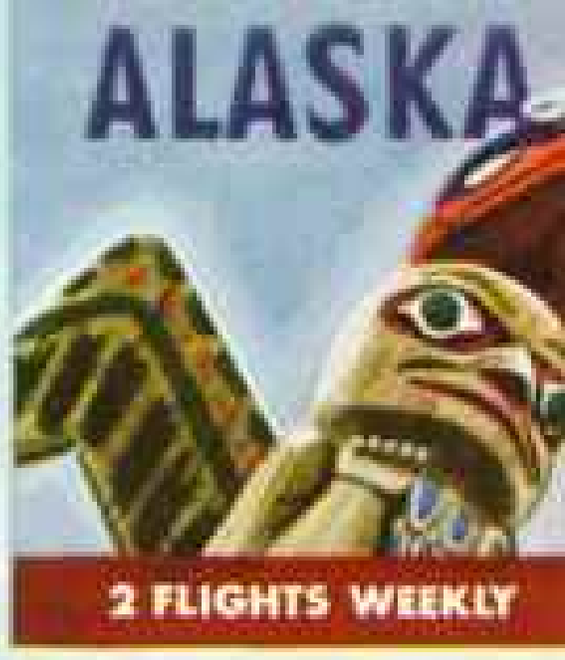

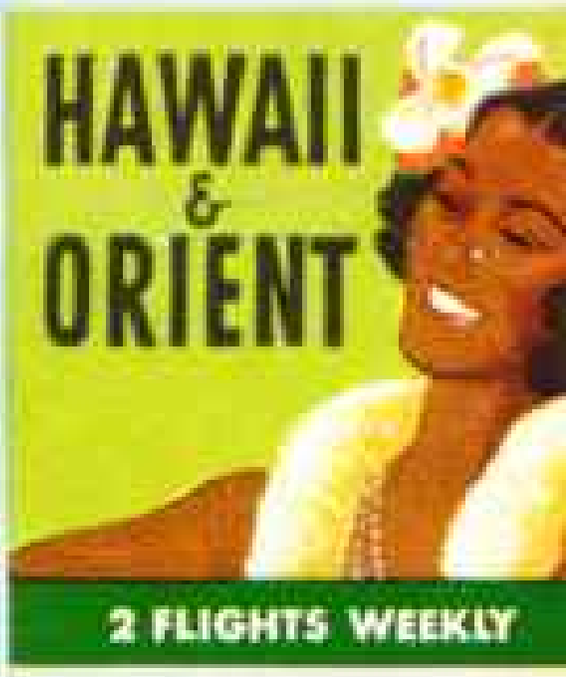

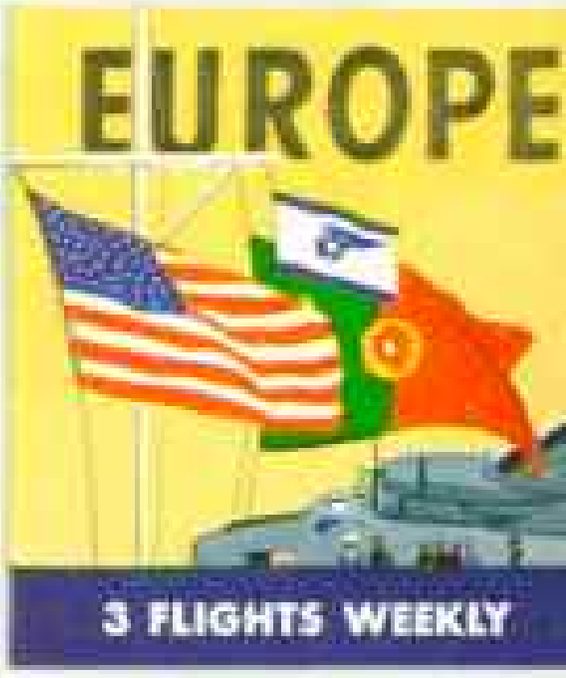

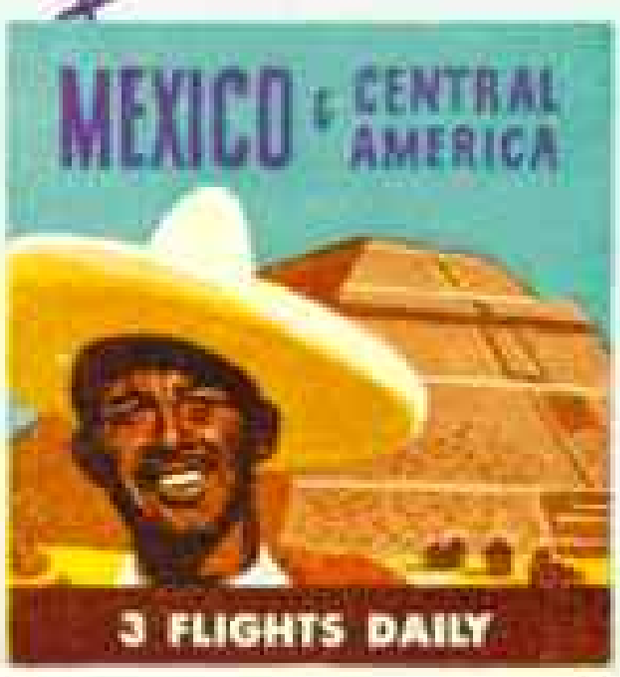

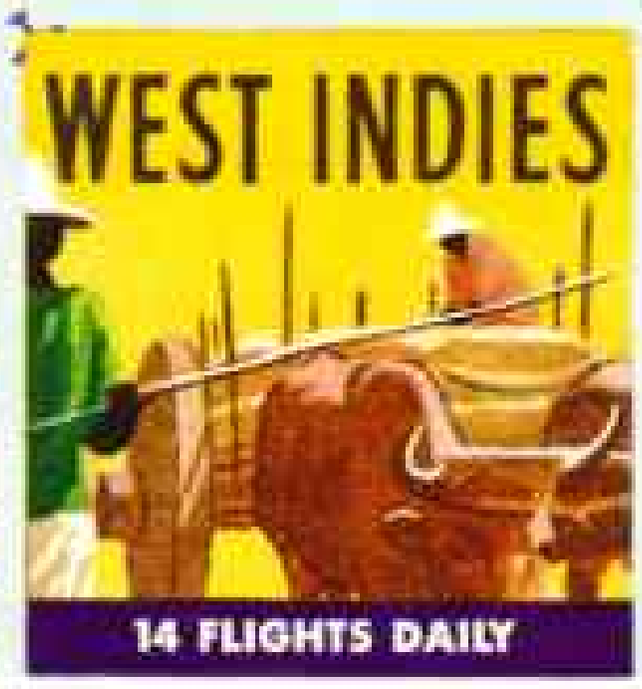

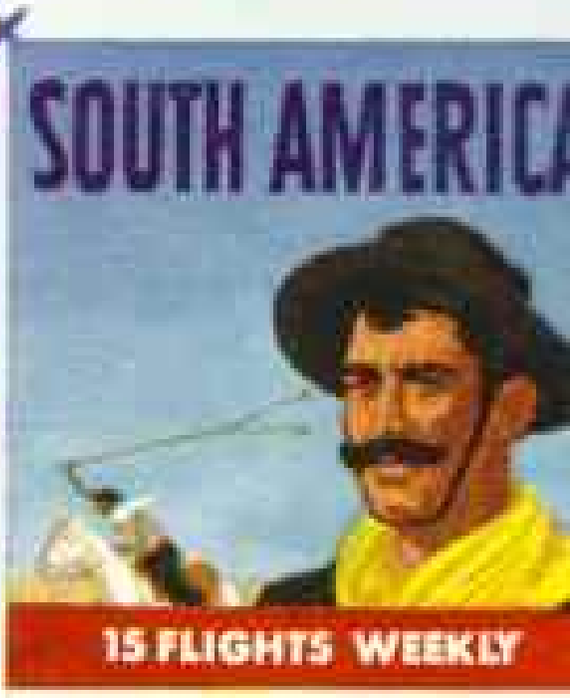

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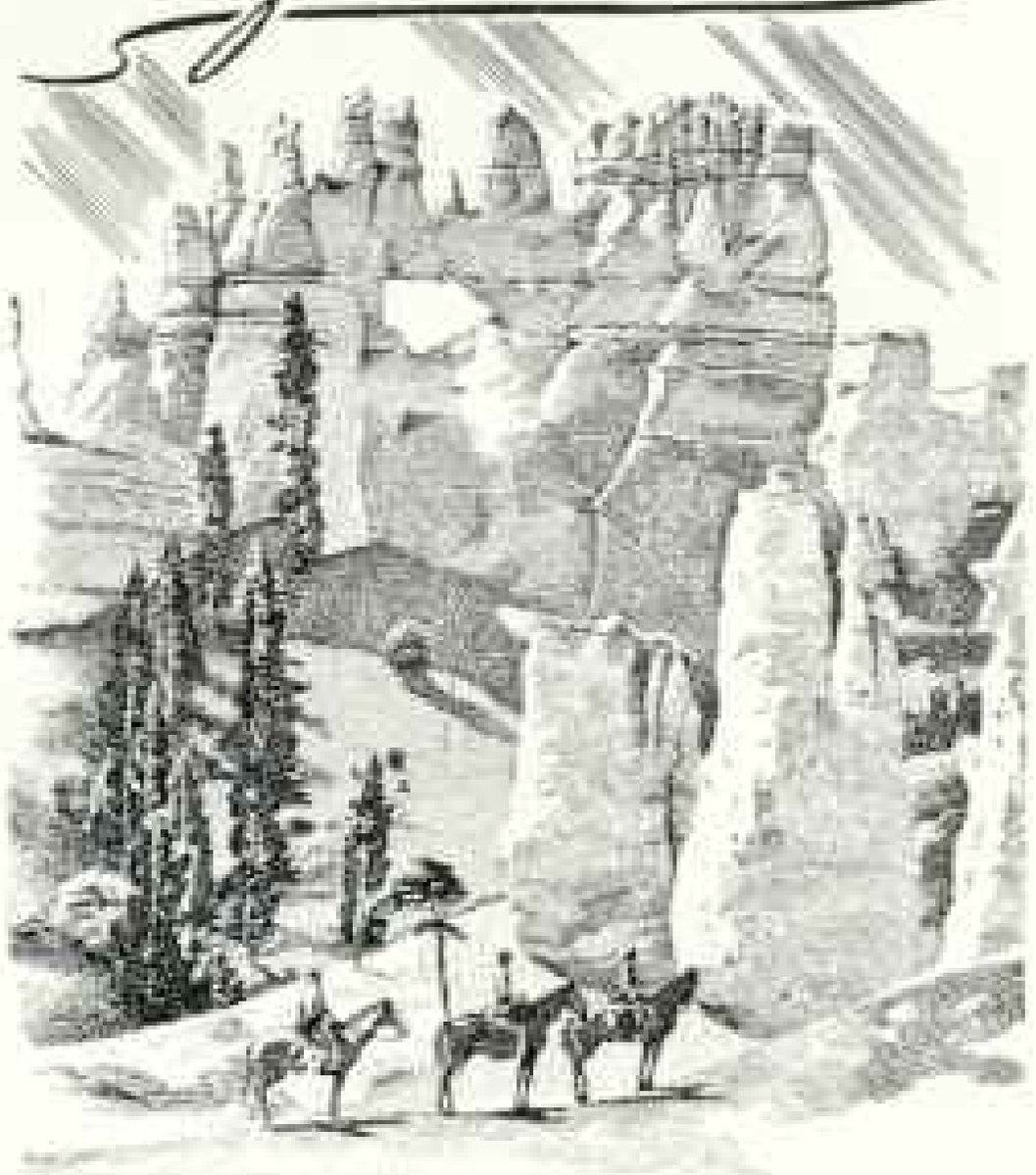

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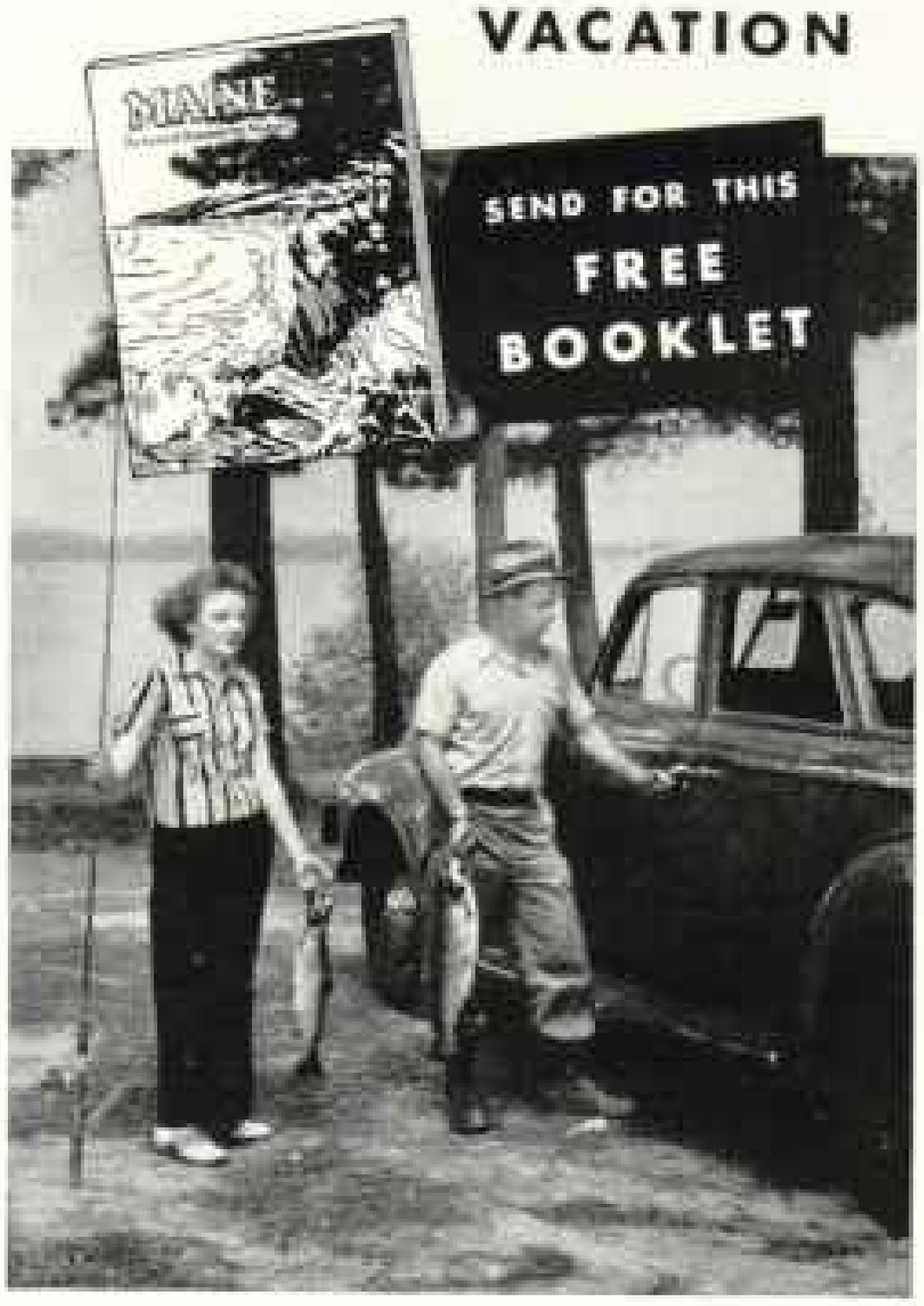

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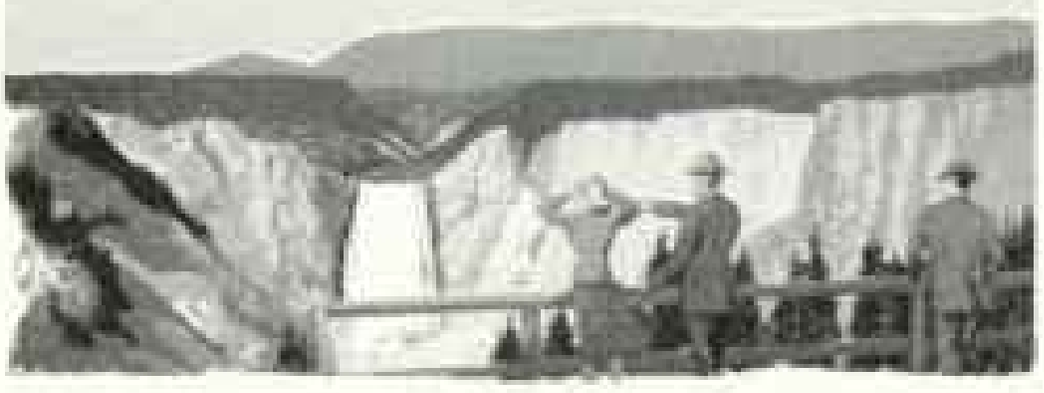

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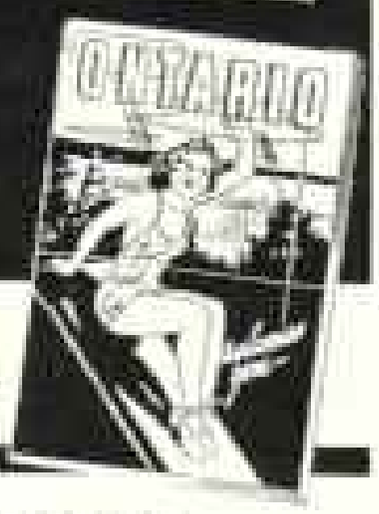

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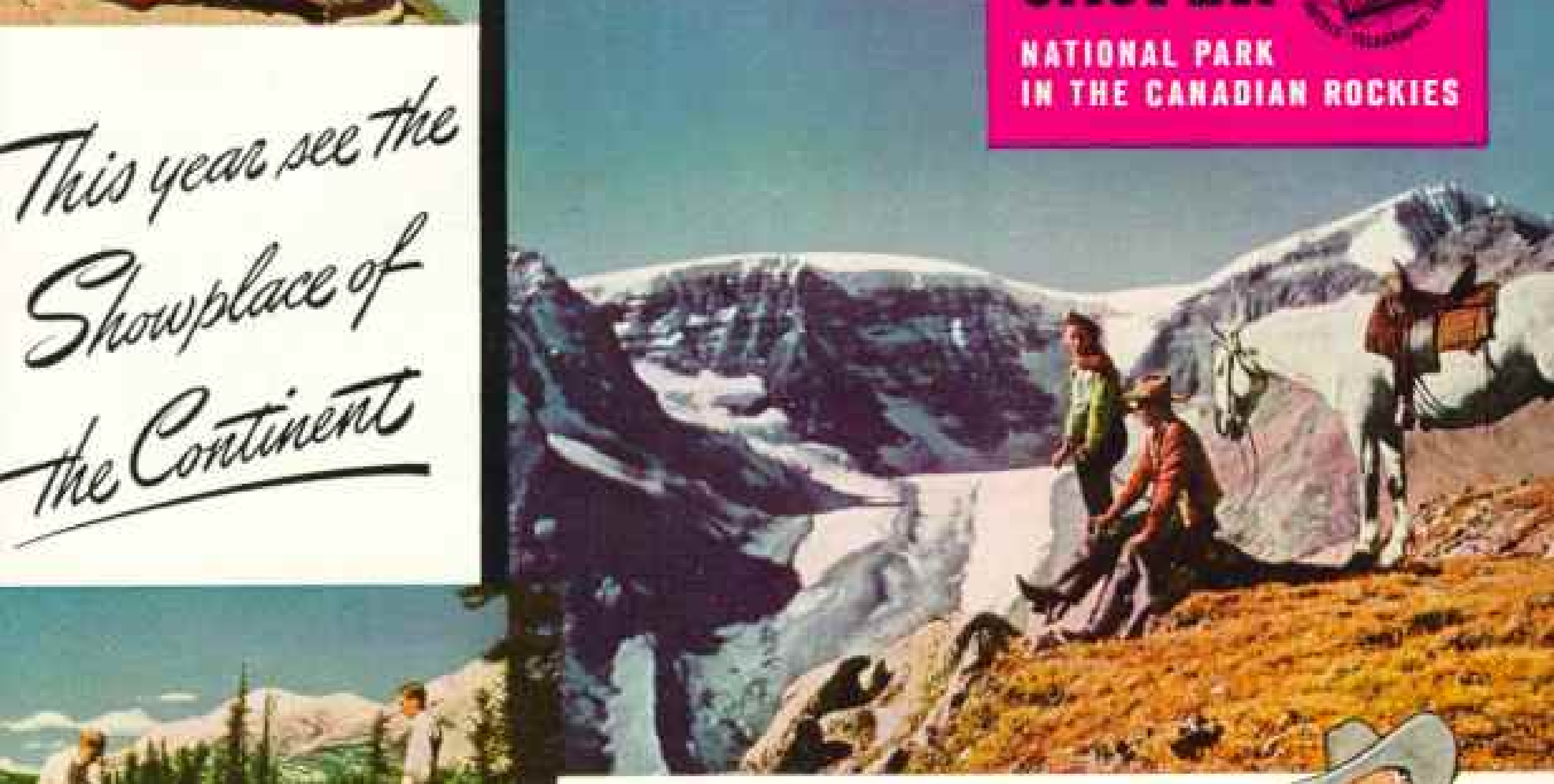

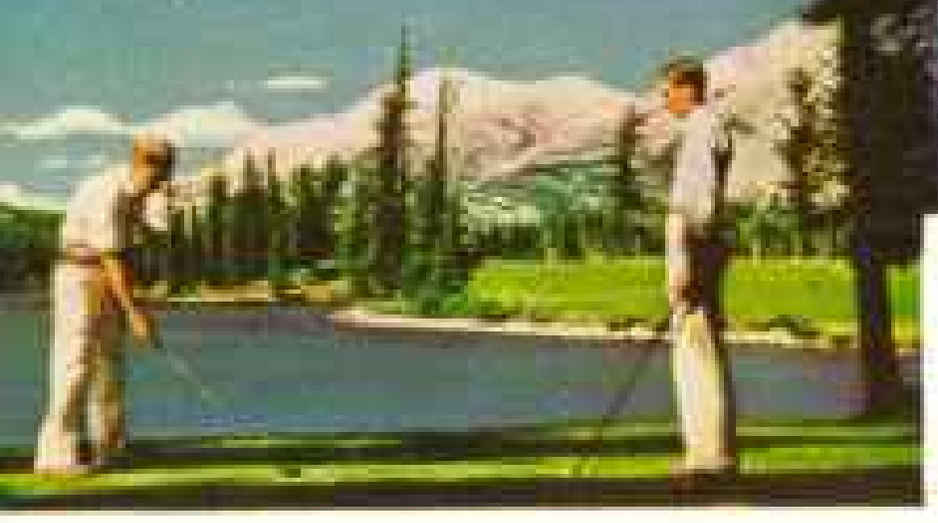

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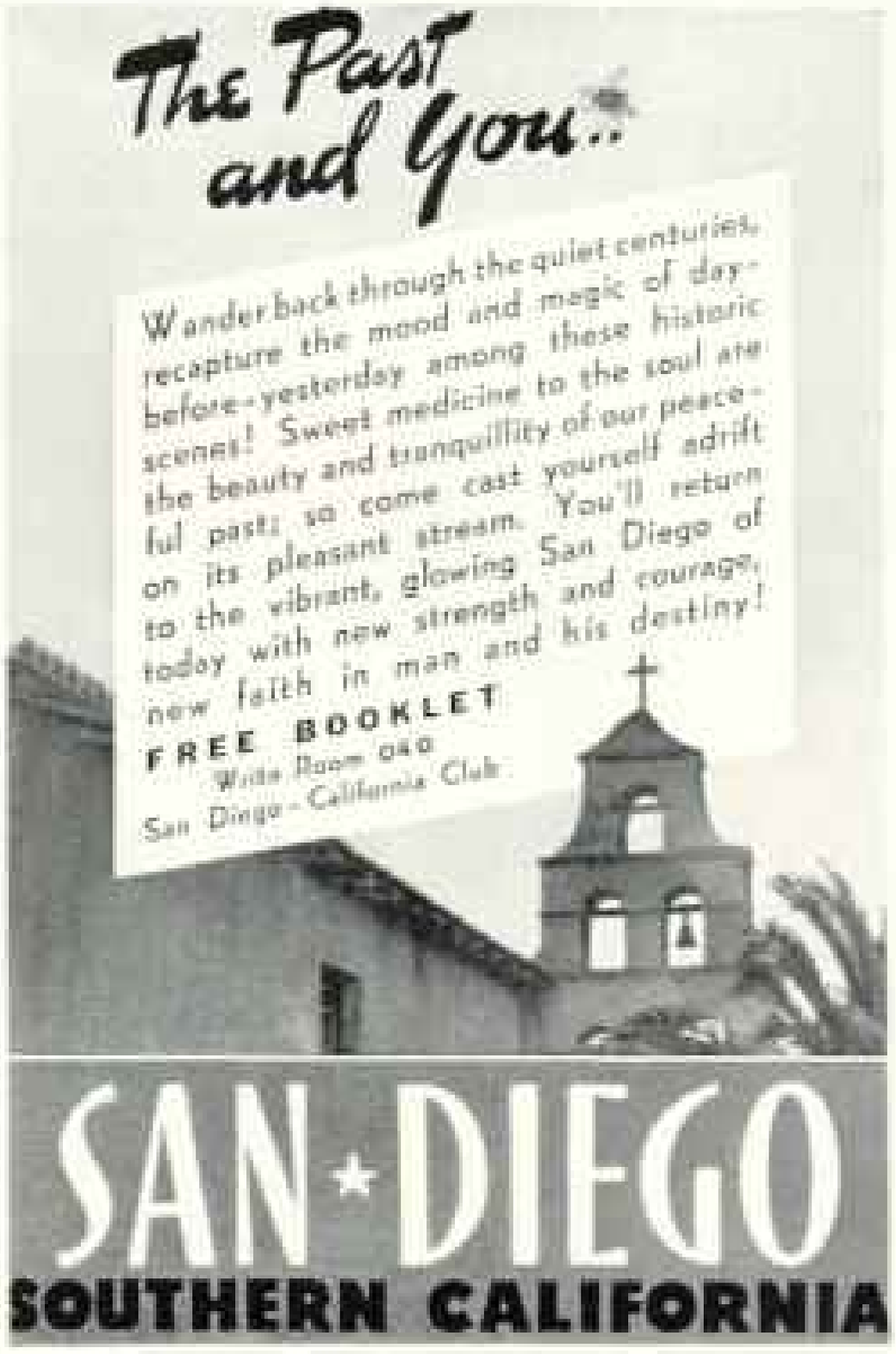

Where does he put it?

YOUNGSTERS, as they reach their teens, often develop an extraordinary capacity for food. Many a puzzled mother has said, "I don't know where he puts it!"

► It is important for parents to realize that in the majority of cases, such an appetite is normal and should be encouraged. One important exception, of course, is the child who shows a tendency to obesity —and in such a case a doctor should be consulted.

During the teen age, a normal child is exceptionally active. Each year he is adding 2 or 3 inches to his height and as much as 10 pounds or more to his weight. Therefore, a youngster has to eat a large amount. Too little food, or the wrong kind, can hinder normal development at this time just as truly as in infancy.

► Your doctor will tell you that an adolescent child's activities can be as strenuous as a manual laborer's—sometimes requiring from 50% to 75% more food than is needed by the average adult. That's why it may be perfectly proper for Junior to tuck away lots more dinner than his office-working Dad!

Three generous meals a day should include milk, cereals, vegetables, fruits, meat, and eggs—all so necessary for growth and good health. Furthermore, these meals should include wholesome desserts to satisfy the "sweet tooth" that boys and girls usually develop.

► This doesn't mean, of course, that the youngster should be free to gobble anything at any time. Simple, sensible snacks may be given to the child at appropriate times if they do not affect the child's appetite at regular meals. Good, satisfying foods like milk, bread and butter, and fruits are usually easy to keep on hand for the hungry young one.

In between times—right after school, for instance, but not too close to the next regular meal—such wholesome foods tend to discourage round-the-clock "nibbling."

To help you satisfy youthful appetites, and also to avoid one-sided or indigestible diets, Metropolitan offers a helpful, free leaflet, "When You Are In Your Teens." Write today to Dept. 341-N.

► "THE PROOF OF THE PUDDING"—a ten-minute, Technicolor movie on food and health—has just been released by the United States Public Health Service and the Metropolitan Life Insurance Company. When it is shown in your neighborhood, it will be worth your while to see it.

Why the Yucca Moth is a model parent

THIS NORTH AMERICAN MOTH, *Tegeticula alba*, which lives on the yucca plant, has a very ingenious method of providing for her offspring.

When time for egg-laying comes, this moth climbs deep into the flower of the yucca plant carrying a mass of pollen gathered from other yuccas.

Afterwards she carefully thrusts more pollen into the flower. By doing this, she makes sure that the plant is fertilized and that the yucca seeds will develop as her eggs are hatched. Regardless of what happens to her, there will be an ample supply of food for the children.

With the yucca moth, this is, of course, purely a matter of instinct. But it is an instance where lowly instinct can often teach a lesson to the human parent.

For, if you will just think about the people you've known, you will probably remember cases where something has happened to the head of the family and the children have been left completely without funds or inadequately provided for.

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● Drive West this summer! Oregon is only 13 hours from Yellowstone, 10 hours from San Francisco. Vacation costs here are surprisingly low. The average expenditure of motorists visiting Oregon last year was less than $3.75 a day a person.

See all of Oregon! Drive down the Old Oregon Trail and the Columbia River Highway to the sea. Drive America's most beautiful ocean highway that parallels 400 miles of free uncrowded beaches. Visit Crater Lake and the Oregon Caves in the National Parks system, the Hart Mountain antelope country, the entrancing lake regions of the Cascade and Wallowa Mountains, Mt. Hood, perpetually snow-clad—all these and hundreds of other scenic wonders easily accessible over superb highways. Send for State's booklet.

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3-41

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