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New and Authoritative—

The POISONOUS SNAKES *of the* NEW WORLD

By CLIFFORD H. POPE

Fellow of the New York Zoological Society;
Curator of Reptiles of the Chicago Natural History Museum

One of the most popular and useful publications the New York Zoological Society ever issued was "The Poisonous Serpents of the New World" by the late Dr. Raymond L. Ditmars. Thousands of copies were sold. Now that booklet is out of print, and Mr. Pope has prepared a new, and longer, text that will be extremely valuable to the layman who wants to know about the poisonous snakes of North America, Central America and South America.

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ALS

In his address [illegible] our Annual Meeting this year, Dr. [illegible] Director of the Medical Services of the Rockefeller [illegible] stated a vital creed. He said in part:

". . . . . must have spiritual and instinctive interest. Obviously it is preaching to the converted to urge deeper faith in the protection and study of this and have their being. . . . If we will search [illegible] beliefs that all creation is an open book of secrets [illegible] and for me the only chance [illegible] God through His works. . . . The knowledge [illegible] —offers more of value now and in the [illegible] humanity than any other science. No gift [illegible] to other costs possibly be equal to the gift [illegible]

Years ago a chemist — none other than [illegible] of Harvard University, expressed the same [illegible] words:

"The human race has more and greater [illegible] successful cultivation of the sciences which [illegible] from all the other sciences put together."

These are statements which we profoundly [illegible] inspiring when men eminent in other fields of [illegible] beliefs and express them so powerfully. When will [illegible] when everyone will not only accept the truth of these statements but actually begin to apply them in planning for a better civilization? Too bad if that day is too long delayed!

Fairfield Osborn

SHOP TALK

There is room in this [illegible] for everybody to [illegible] the Editor. [illegible] Editor — make [illegible] and if long [illegible] make room fre[illegible]

Hurrying to the [illegible] Committee has [illegible] of passage, this [illegible] Ground, to the Editor. It is his own personal Victory Garden and if nothing [illegible] up but weeds — well, maybe [illegible] weeds!

●

[illegible] a year ago Frank Rizzi laid [illegible] composing stick in our [illegible] shop and volunteered in [illegible] Corps. We heard vaguely he [illegible] to the West, learning to be a [illegible] on a Flying Fortress. Now [illegible] mail letter from Frank, [illegible] in Australia. He couldn't [illegible] much, except that he was doing [illegible] flying. "Our squad saw a [illegible] other night, and it [illegible] Children's Zoo," he [illegible] "Gosh! For the first time I [illegible] felt I were a long, long way [illegible] from home. Did the baby Kangaroo grow up, and is the Lamb still as fat as ever?"

●

Sidelight on Charles Cordier's [illegible] collection to collect Umbrella Birds: [illegible] one day he broke camp in the [illegible] interior of Costa Rica, he found on [illegible] his cot, under his sleeping bag, a [illegible] perfect-flat Coral Snake. "It must [illegible] have fallen out of the roof and I [illegible] sat on it in the night," Cordier [illegible] explained. "It was a nice little specimen, too."

●

Speaking of snakes, a keeper tossed a frozen Coral Snake on Dr. Goss's autopsy table the other day. "Dead on arrival," he reported. "I'll take a look at it after lunch," Goss said — but after lunch the Coral Snake was taking a look at him! It had thawed out and was ready to bite any and all comers.

BOOK NO. 1088

IN THIS ISSUE

"Explosion of Fins" — The Zebra Fish . . . . . COVER
The Umbrella Bird Comes to the Zoo . . . . . *Charles Cordier* 3
Fins . . . . . *Pictures* 11
Pride of the Antelope House . . . . . *Claude W. Leister* 15
Black Lace for the Gold Platyfish . . . . . *Myron Gordon* 18
Behind the Scenes: News and Notes 21

The first Umbrella Birds (*Cephalopterus ornatus glabricollis*) ever exhibited in a Zoological Garden. The[re] is a pair – the male, at the right, with his "umbrella" partly lowered, the top-knot-less female at the left. Several times a day, apparently when he is feeling particularly good, the male lowers and spreads his crest until it hides his eyes and most of his beak. The bare patch of skin on [his] throat can easily be seen; this is the airsack that the b[ird] inflates "to the size of a big tomato," according to collector Cordier, when making his strange booming noise. We have not yet heard the bird make the noise in captivity.

ZOOLOGICAL GARDEN CALCUTTA

Accn 570
dt. 15/12/42

The Umbrella Bird Co[illegible] Zoo

For the First Ti[illegible] Anywhere, We Exhibit One of [illegible] Curiosities of Central Amer[illegible] Avian Life

CHAR[illegible] ORDER
Collector for the [illegible]

ZOOLOGICAL GARDEN 07007

WHEN I left New York early in March of last year, three months after bringing back a collection of Colombian birds[1], at the top of my list of "wanted" specimens was a bird that apparently was to be found only in books of ornithology. No zoological garden, at any rate had ever managed to exhibit an Umbrella Bird (*Cephalopterus ornatus*), although one specimen lived for a time in a private aviary in England.

Costa Rica and western Panama was the habitat of the form known as *giabricollis*; all the books told that much. But they had little else to say that would be useful to a collector and I knew that if I managed to get out with even one Umbrella Bird, it would mean a great deal of hard work or else a great deal of extraordinary luck. As it turned out, it meant hard work.

My search for the Umbrella Bird started in San José with a search for information. In the first few days after my arrival I ferreted out all the retired field collectors whose work had helped M. A. Carriker, Jr., to compile his excellent volume on Costa Rican ornithology. I found one collector with many years of residence in the republic, and he was not encouraging when he told me that on his innumerable field trips he met *Cephalopterus* only once or twice. The other collectors said the same thing. At the little Museum of Natural History in San José I could get no information at all. Reference books simply stated that "The Umbrella Bird is to be found from sea level up to over 10,000 feet on the Atlantic side and is everywhere rare." Just that! So I got hold of a large-scale map and selected that portion of Costa Rica which looked most [illegible] with barely a suggestion of [illegible] Umbrella Bird, being [illegible] and consequently an easy [illegible] to hold its own in [illegible].

[illegible]ing inquiries and pack[illegible] the good fortune to meet a [illegible]e widow of the great Costa [illegible]gist Zeledon. And in the enormous [illegible] that covered the whole patio of her villa [illegible] of magnificent Costa Rican Quetzals, the male trailing behind in his flight a tail almost a yard long.

I admired the birds greatly and the proud proprietor of the aviary told me of her astonishing results in breeding these birds. She had actually obtained fully-grown youngsters from the pair.

As I was leaving the villa I remarked that the Bronx Zoo would certainly like to have that pair on exhibition, and then I got the unexpected reply:

Well, I am getting on in years and this place is too big and I shall have to give it up soon. You can have the birds. Come again some other time and tell me what you will pay for them."

Later we made a deal, the birds to become mine in case they should not try to breed. Fortunately for me, they did not, because the nesting log was not to their liking. And so that pair of Quetzals is now in the Zoological Park, adorning the Tropical American Rain Forest habitat cage.

[1] *Animal Kingdom*, Vol. XLV, No. 4, 1942.

On March 28, at 4 o'clock in the morning, the quest of the Umbrella Bird officially began. Our party consisted of myself, a young fellow whose boasts of being a great hunter and bird man had somehow ensnared me into hiring him, and another young fellow who was travelling in the same direction and who had invited us to stay at his cattle farm.

We piled our equipment and ourselves into two taxicabs and in the dark hours before dawn were whisked over excellent but narrow roads in a northwestern direction toward the great Central Plateau. Beyond the settlement of Zapote, at 6,000 feet, the usefulness of the mechanized equipment came to an end. We simply staked our things at the roadside and our helpers started discreet inquiries about getting sturdier and more reliable means of transportation—by which is meant Costa Rica's famed, often gaily painted and intricately ornamented, oxcart, the backbone of the country's transportation system.

Finally they located a prospect and from a distance I overhead the lengthy dickerings.

Proprietor of the oxcart: "Last time when I carried a load of 1,600 pounds to a place much closer, I was paid 15 colones (about $3)."

My helper: "For a load of only 400 pounds (a slight understatement) to a spot only half an hour further on (in strict fact, about 2 hours) we will pay you 10 colones."

Proprietor: "Yes, but think how much more I could get if the cart were fully loaded."

Helper: "All right, if you insist, we can make up a full load by piling on stones."

That rather silly argument clinched the deal.

After a descent of half an hour, a magnificent view began to unfold. Behind were depressingly naked and parched brown fields and pastures, but away down to the north and as far as the eye could reach was an immense expanse of land covered with dense, primitive forest except that part reaching from the foot of the slope we were on to the river San Carlos—some ten miles of flat country converted into pastures. To the left, the view was limited by the mountain chains of the continental divide, also densely wooded, with many rounded ridges projecting at right angles. From distance to distance some higher cone, some extinct volcano, stood out. Nowhere was there a sign of human habitation or traces of clearings, and it needed very little imagination to figure out how tough the going would be in exploring such country.

Late in the afternoon we reached the banks of the San Carlos and the tumbledown ranch-house, roofed with undulating zinc sheets, that was to be our headquarters for a while.

We started spreading the news to the few cattlehands and homesteaders living nearby of the wonderful opportunities offered by disclosing the whereabouts of the *Paroncillo*—the "little peacock"—a bird half the size of a vulture, with a big crest, all black, with a naked red throat from which hung a piglet's tail with four or five feathers on the end of it. Such was our description of *Cephalopterus ornatus glabricollis*.

We seemed to have stumbled into great luck. Everybody beamed, and knew the bird very well. A bit rare, perhaps, very hard to see, but turning up when one least expected it.

"Why, only the other day I shot one," one fellow told us.

"What day was that?"—eagerly.

"Well . . . let's see . . . I came here two and a half years ago. It was after the first crop of beans I harvested. Come to think of it, that was the first and last time I saw the *paroncillo*. But my brother who lives two days further north does practically nothing but hunt, and he knows the bird very well."

I have often thought about the eagerness of natives to tell strangers a pleasing story. To them, apparently, the whole quest makes no sense at all and they think it good to let the truth dawn on the stranger's mind by degrees. Besides, if he stays longer he is bound to spend some money—foreigners are simply rotten with it—and some of it may come their way.

The seeing of one bird becomes, in the telling, many. Seeing two birds transforms itself into a *manada*—a drove. And if there were more than two or three, why, there were simply as many as there are no-account women. . .

For the next fortnight I was busy combing that low-lying territory in all directions. I ranged as far north as the River Arenal some 25 miles distant, with the young man at whose ranch we were staying as my guide. As often as not he got lost.

One day, while jumping from an overhanging

For such a magnificently beautiful bird, the Quetzal (*Pharomacrus mocinno costaricensis*) has a singularly unfinished look about the head. Its blue-green-gold feathers are always tousled and in disarray. But its frowsiness can be forgiven, for there is no bird in the Americas that can equal the splendor of its back and particularly the long, trailing upper tail coverts that show so well in this picture. As our best-plumed specimen — with one tail covert almost 12 inches long — flits swiftly through the shadowy foliage of our Tropical American Rain Forest habitat cage, stray shafts of sunlight bring out the full iridescence of the feathers.

bank to the edge of a river below, one foot shot out from under me and I landed with my whole weight on the other leg doubled under me. I felt an exquisite pain, but soon after could walk almost as well as before. That happened early in the day and after lunch I was unable to get up for some time, but I finally managed to reach a brook where allegedly, only a few days before, two boys had met a pair of "little peacocks" and had chased them with bow and arrow, the birds flying from branch to branch, then from tree to tree, always keeping rather low.

But it was no use; I was unlucky and there was no seeing the birds. Unluckier still, after I explored the brook my leg hurt so that I could go no further.

I finally managed to get on a horse and a native offered to take me to an old woman who was wonderful at healing such things. I agreed readily enough. Already a fortnight had gone by without a trace of the Umbrella Bird; in another two weeks the heavy rains would start—and now this accident had happened to knock me out.

After a very painful two hours' ride I was delivered into the hands of an old, dark-skinned woman. She went to work on the leg with a little pot of grease—probably monkey fat—which she proceeded to knead and massage into my leg with the palms of her hands. Her reputation was justified. After half an hour I felt great relief and I could bring my mind back to *Cephalopterus*. I asked her if she knew the *paroncillo*.

Of course she did. It was very abundant around there.

"But my dear lady, are you sure we mean the same bird? You know, the black one, the size of a pigeon, with a bushy crest on its head and a little pigtail hanging from its throat?"

"Of course I know it," she insisted. "You should be here during the great storms in December. Then you would meet them on all the edges of the clearing making such a noise they almost make me crazy. There are positively so many it's hard to draw a breath in this place!"

She gasped for breath to show me how stuffy the clearing was when the Umbrella Birds came and her husband, not to be outdone, begged me when riding away to be sure to look for a depression on the left side of the trail, half an hour away.

"All the time I see them there, running 'round, scratching and generally misbehaving themselves on the ground," he assured me.

I thanked them profusely for this valuable information, bestowed a substantial tip for the very real relief the woman had given my leg, and left. Despite their protestations, they had been describing the Wood Partridge instead of the Umbrella Bird.

In the meantime the grapevine had travelled all over the country and some fellow well up in the mountains let it be known that he would guarantee my seeing Umbrella Birds within three days of exploring with him.

I decided to have a try and went into the mountains. The trip involved sleeping for three nights on an earth floor with a kitten and two pigs, and shifting nightly when the rain came through gaping holes in the roof. The showers were the forerunners of the heavy rains close at hand.

For the allotted three days I explored with the mountain man in the steep slopes of the continental divide and on the third day a native came running to tell us that he had seen an Umbrella Bird nearby only the day before.

That was all very well, but I wanted to see one. And then I came across a farmer, busily planting corn. After the usual exchange of greetings and an inquiry about my business in the neighborhood, he pointed to a tree far across the clearing.

"Last May," he said, "in that fruit tree I saw seven Crows." (In this part of the country, *paroncillo* had become Crow, *cuervo*, and in still another part it was called the Tapir Bird, *pajaro danta*.) "I shot four of them," he went on, "and good eating they are, too. But it is no use fooling around here now. Come back in May when the rain has well set in. Then you will hear them booming all over the place. All you have to do is follow the sound and you will find them."

This really sounded like a good lead. The farmer thought a little longer.

"But I will be blasted," he said, "if I don't remember that five hours from here, going up the trail and coming to a few dead orange trees, I see or hear the crows almost every time I go by. Why don't you go and see?"

For the first time my enthusiasm mounted. I

could feel in my bones that the farmer was right.

Twenty-four hours later, after I had found a horse and made enquiries about a base, I started for the dead orange trees, and found them. As for a base, there was a lone farmhouse set in the midst of rounded hills planted to grass for the cattle. On one side was a deep canyon and on the other steep slopes and heavily timbered ridges.

I was greeted by the man in charge and his numerous and curious family. Did they know the Crow?

"Why, man, you have come to just the right place," the cattleman told me. "When this farm was started I practically raised my family on the flesh of this bird. Nowadays they are much scarcer, but even so you come across one on the trail when you least expect it. At certain times you meet them in droves, seven or eight, even more, and at other times a pair only. They mostly feed in wild fruit trees, but you can also see them—especially when in pairs—catching grasshoppers and such insects and banging them against a branch to kill them."

After much bargaining I hired one of the man's sons as a guide and at 11 o'clock the next morning the boy pointed to a black bird in a medium-sized tree. The bird's back was turned to us but we worked nearer until it spotted us and flew off parallel to the trail. I just managed to see its crest. It was *Cephalopterus*, all right. There really was such a bird! For twenty-one days I had been on its trail relentlessly, and this was it.

The bird had alighted further down the trail and I worked near enough to make out that there were two of them, but they soon spotted me and made silently and swiftly off. They were genuine Umbrella Birds, but something about my calculations was wrong. They were not stupid: they were very much on the alert, and perched much too high to fit in with my plans.

The following day one of the boys took me across the canyon to the dead orange trees, the only signs left of a ranch gone back to the bush. There we heard two short, booming sounds, the second closely following the first.

The best way I know of reproducing these sounds is by blowing into the neck of a quart bottle.

A moment later two Umbrella Bird cocks came into view. One had three or four thin sticks five or six inches long, in its beak, and was being pursued by the other. They crossed the trail about ten feet above ground. By this time I was really excited and felt a strong hope of success. That bird was certainly nesting; it would be easy to capture it, I thought. Then a doubt came. What if the bird was only displaying? Later I found it was just that.

Nothing more could be seen that day, and for a week I made regular visits to the grove of dead orange trees, staying there all day. The trail back to the base camp was so bad that I had a shed of palm leaves put up under the oranges and I camped out there day and night. After a week of observation I discovered that four Umbrella Bird cocks had selected a heavily wooded ridge as their permanent abode. Each bird had from one to three branches where he could always be found except when feeding. The distance from the ground varied from 15 to about 30 feet at first, but the birds soon sensed my designs on them and kept to the higher branches.

It was well nigh impossible to surprise them. They would always discover me first. Studying this bird sneaking up to it and remaining motionless for hours under the punishment of a cloud of mosquitoes and horseflies took all the endurance and patience I could muster. Later the rains came and then for weeks I was wet and chilled, besides.

Here is an outline of the day's doings of our feathered curiosity:

Half an hour before it is completely daylight the bird greets the new day by his resounding boomings, first in the highest branches of the tallest trees. I think from this we can assume that he also passes the night as far away as possible from ground night-prowlers—cats, skunks and such, which must be his chief enemies.

After this early calling he makes a dive and alights on the lowest branch where he is accustomed to passing most of the daylight hours—figuratively speaking, his armchair. There he lets forth a further series of his calls and then in the twinkling of an eye he is again a hundred feet above ground, feeding on the fruit of the sloth tree which grows very tall in this area.

Having fortified himself, he notices his rivals, who are making a similar din. Wrathfully he

alights on his rival's trees, fifty to a hundred yards distant, and tries to chase them off, all the while giving out his calls. A third and a fourth bird or maybe more—to this day, I do not know how many—are attracted by the commotion, and join the chase. Black shapes flit back and forth, up and down, in the dim light. The noise is terrific. Twenty to thirty minutes later it is suddenly quiet. The birds have disappeared to feed on something more fanciful than the seeds of the sloth tree.

It is now around 6 o'clock. By 7 o'clock, the bird is back, very quiet, chockful of fruit, and he remains absolutely motionless for 40 minutes to an hour. From time to time he expels the pits of the fruit he is digesting. He feels contented, blows out the airsack on his throat and gives forth a long-drawn, low moooonh. Occasionally he notices a leaf, breaks it off, and after a time lets it fall. He goes off again to feed, this time darting through the tree top and vanishing in a straight rapid flight above the high trees. Usually, however, he flies between the trees with consummate skill and great speed, twisting and dodging turns, never touching an obstacle.

Between 9 and 10 o'clock, *Cephalopterus* is back again. He decides to visit his rival once more, but this time the fieryness of the contest is gone. Three, four birds are in a single tree chasing each other mildly. A few carry small dead sticks in their beaks and from time to time utter low chuckling sounds. Sometimes they quarrel and voice their protests with a throaty oooaaahh, repeated over and over.

Feeding and digesting take up the rest of the day. Sometimes late in the afternoon the bird will give another booming session. He has his days of activity and his days of comparative quiet—influenced by the weather, perhaps. I noticed that all of the Umbrella Birds behaved more or less the same way at the same time.

In order to produce his resounding call the bird fills out his airsack, which is bright scarlet to the size of a big tomato, the feather-tipped, fleshy wattle attached to the airsack becoming greatly extended and hanging down 3 or 4 inches. When the airsack is distended the boom is produced. Then he suddenly throws his head violently back, far back, and quickly forward again, expelling the air with a swishing sound closely resembling the spitting of a big cat. He immediately fills his airsack again and lets forth another boom, but now he expels the air without going through any contortion or sound. At a certain distance only the two resounding boom notes can be heard. But close at hand the spitting or swishing sound can easily bring panic to the ignorant traveller, who may flee from the "tiger" in fear of his life. No wonder this particular spot was reputed to harbor many jaguars.

There can be no doubt that the spot I had selected was a mating ground. Although I could never see a female together with the males, one specimen got caught in a pocket net I put up and is now here in the Zoological Park. A few weeks later another female almost hit my head while dashing through the undergrowth, almost in the same place. I have seen no nest with eggs or young, but had three nests pointed out to me as having been built by the Umbrella Bird. The native who pointed them out claimed to have found almost *Cephalopterus* nesting in just such a tree. The nests resembled oversize thrushes' nests. All were placed 4 to 6 feet from the ground between the trunk of a medium-sized tree and a branch.

From mid-April to mid-May, in July I met a party of three or four *Cephalopterus* occasionally feeding and soaring off in loose formation. The bird is mostly a fruit eater, but once I saw a male make a short flycatcher flight, alight on a branch with an enormous green caterpillar, and swallow it.

After having studied our bird for several days I was ready to attend to its capture. Full of confidence, I had set up pocket nets in strategic spots and soon had the thrill of seeing two males fall into them—and then the dispair of seeing them promptly back out again. Slowly the realization came to me that the Umbrella Bird was much too big for my nets. I placed practically invisible slings on his beloved branches—but they only made him shun the branches. Then I hit upon the idea of hanging, from a hook of thin wire, a few strings smeared with bird lime so that on alighting on his favorite perch the bird had to touch them. In the course of three weeks two specimens were caught that way, although one later escaped. Another flung himself into a pocket net where he did not expect to find it.

ZOOLOGICAL GARDEN CALCUTTA

This is one of the most remarkable still photographs of a Hummingbird we have ever seen. Made by David B. Eisendrath, Jr., formerly on the staff of The Newspaper PM and now with the Office of War Information, with a "speed-ray" camera shooting at 1/50,000th of a second, it shows a little Costa Rican Firethroat (*Panterpe insignis*) hovering in full wing-beat, *with the back of its wings turned forward*. This peculiarity of a Hummingbird's wing movements was first discovered some years ago when high-speed motion pictures were made. They showed that the wings beat at the rate of 60 strokes a second, and that they actually turn over on each back stroke.

Nets could only be used for an hour after dawn and the strings with bird lime had the drawback that insects immediately started getting caught in them, their buzzing making the trap too conspicuous. Furthermore the strings had to be put up with exasperating immediately after the bird had left for a long feed. Everything had to be in place and quiet before his return.

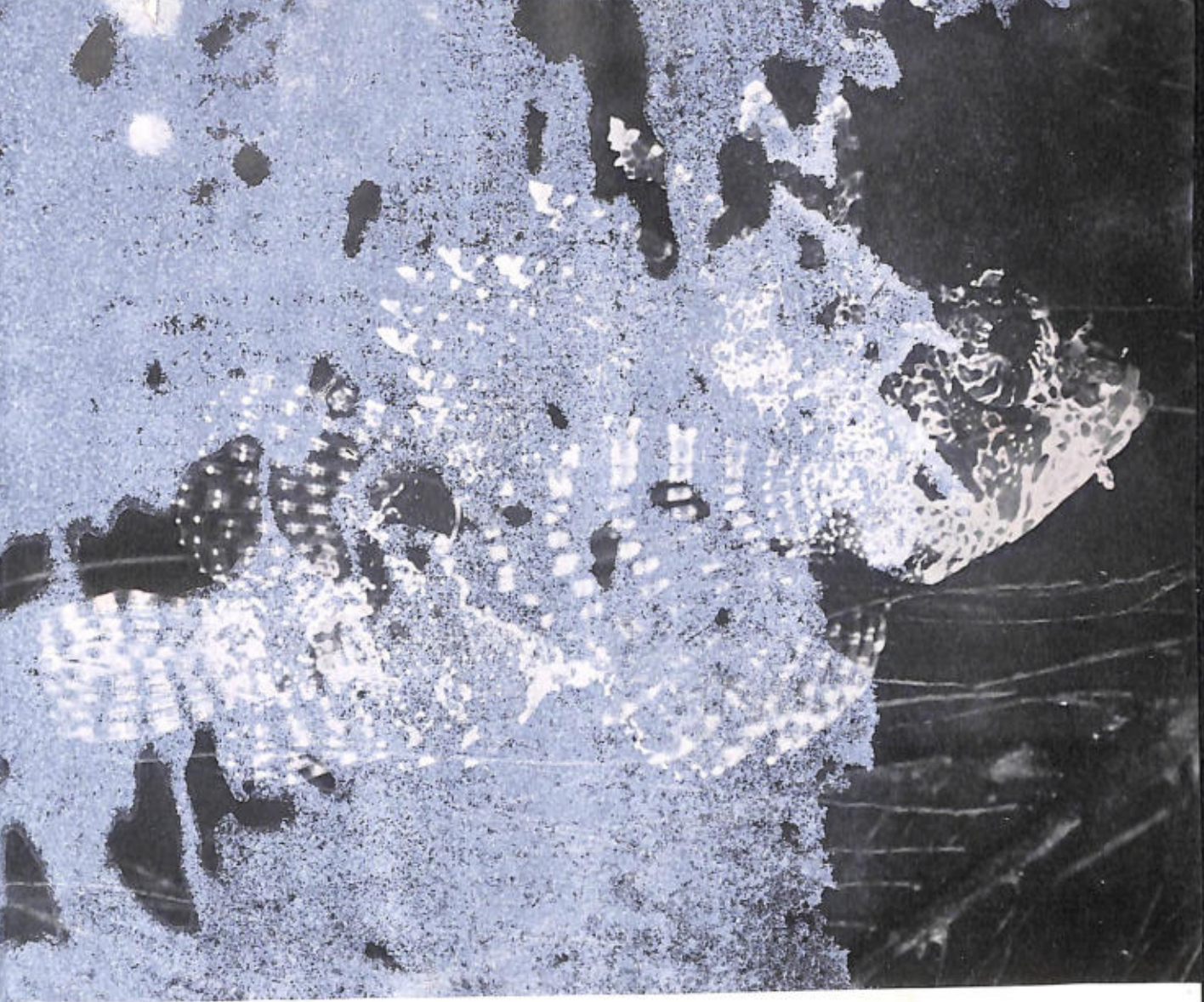
I had only [illegible] and then the rains set in. Life [illegible] thatched roof got to be a nightmare. Everything was damp. I had trouble making [illegible] stay more than a day or two, it was impossible to light a fire to prepare food and [illegible] the farmhouse an hour and a half away was often impassable. The problem of supplies became acute. Some days there would be no bananas for the birds, then no food would come through for myself.

By this time the rain was falling almost continuously and the moss-covered trees could never dried enough between showers to make it possible for my men to climb them with nets and strings. I had to give up. I figured it was around the twentieth of May, and it was no use staying. I ordered two pack animals to come early the next morning to help carry out the loads.

Late in the afternoon when dusk was coming on I was holding a male *Ephidoptera* in my arm with its wings tied with strips of adhesive tape when I noticed, high above, a black shape flitting from one tree to another. I kept watch-

[illegible]ss, dashing [illegible] most [illegible] times, and then I [illegible] [illegible] now, flitting about [illegible] and then [illegible] Umbrella Bird. Darkness [illegible] daybreak [illegible] [illegible] whole.

To [illegible] [illegible] [illegible] which [illegible] [illegible] [illegible]

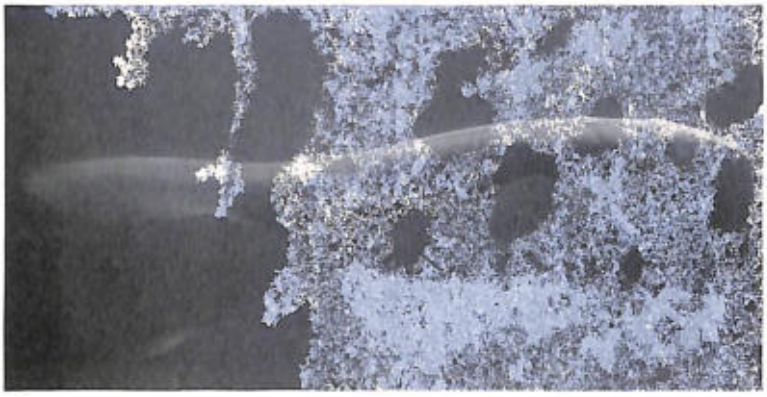


FINS

The fins of fishes are infinite in their variety and their function—although, strangely enough, comparatively few fishes depend upon their fins primarily for locomotion. Indeed, the fins can be removed from some fishes and they are able to swim and function perfectly well.

Ideally, a fish has five kinds of fins—Dorsal, Pectoral, Ventral, Anal and Caudal. Actually a very large proportion of fishes do not have all five kinds. Some—like the Scorpionfish, above—give the impression of having far more than five kinds. All flounces and furbelows, the Scorpionfish simply has a greatly exaggerated complement of fins—its Dorsal, for instance, has been broken up into multiple rays. But they all constitute one fin. Similarly, the Zebra Fish (on the cover of ANIMAL KINGDOM) has only the regular five kinds of fins—but all of them are broken up into rays.

AFRICAN LUNGFISH – Flabby filaments with no underlying bony structure are all that remain of the Pectoral fins. They are useless for swimming.



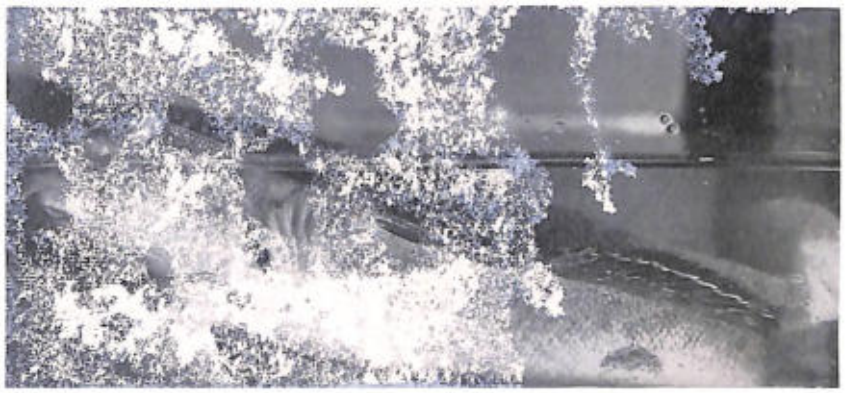
ELECTRIC EEL–Here, too, nothing remains but the tiny Pectoral fins and an enormously developed Anal fin which runs five-sixths of the length of the fish.

SHARK SUCKERS – One of the most curious developments among fishes is exhibited here, where the first Dorsal fin has moved forward and has become modified as a suction disk.

AQUARIUM-DERIVATIVE GOLDFISH – These "overdressed" fish have been specially bred for extreme development of fins, resulting in double Caudal fins and greatly enlarged Ventral and Anal fins.

TRIGGERFISH – The small first Dorsal fin has developed a strong spine and a trigger mechanism by which the fin can be erected and literally locked into place – a useful device when the fish wedges itself into a rocky crevice and resists dislodgement.

MUDSKIPPER – Spending much of its life out of water, chasing mosquitoes across a mudflat or up a mangrove root, this fish has a specialized development in its Pectoral fins – they are "jointed," and can be used very much like arms.



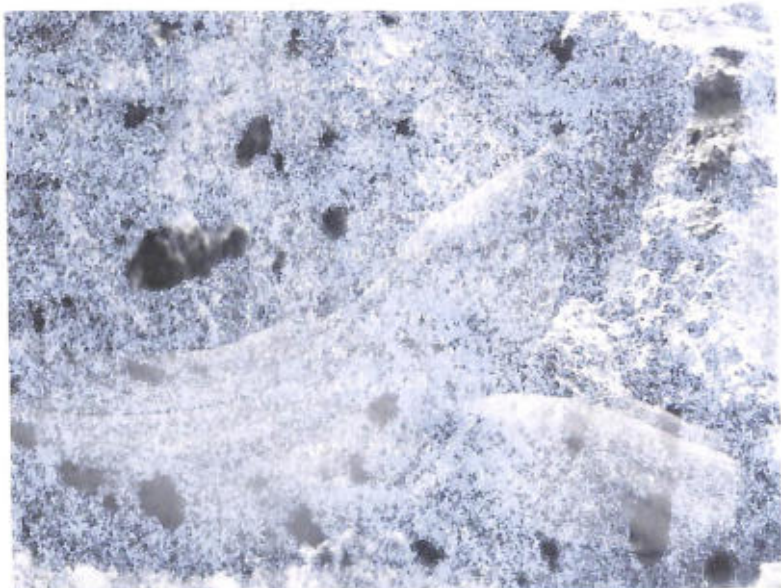
THREADFISH – The streamers would be remarkable fins indeed if they were fins, but actually they are merely elongations of the first rays of the Dorsal and Anal fins.

BUTTERFLYFISH – Here the rays of the Ventral fins are enormously elongated, but the fish takes its common name from the beautifully colored, butterfly-like Pectoral fins.

COW-NOSED RAYS – Deceptive is the word for the Cow-nosed Ray, for what might be taken for very superior fins are nothing but flattened extensions of the fish's body. The true fins have very little to do with the movement of the fish.

SEA DRAGON – One of the curious Seahorses seems to be liberally be-finned, but actually the appendages are only appendages, and the fins are the tiny "epaulette" near the head (Pectoral fin) and a small Dorsal fin at the beginning of the tail.

MORAYS – Just the reverse of the Electric Eel, the Moray has an extremely long Dorsal fin that runs the full length of the body. The other fins are small and non-functional.



Pride of the Antelope House

"Congo," the Okapi, and "Doreen," the Eland, Are Still Great Rarities But They Lead Uneventful Lives

CLAUDE W. LEISTER

A LITTLE MORE than seven years ago a young Okapi was born in the humid silence of the Belgian Congo. This little chap was destined to come to the Bronx Zoo, where he arrived on August 2, 1937, the first of his species to be exhibited in an American zoological garden. An account describing some of the happenings incidental to this trip and the reasons why the Okapi is such an interesting animal zoologically, appeared in the September-October BULLETIN for that year.

Five years with an Okapi! What have we learned about this little-known animal in that time? The answer is surprisingly little. But we have made a number of interesting observations, nevertheless.

"Congo" was born in October 1935. He is, therefore, seven years old and apparently fully adult. For the first three years after his arrival in New York he grew rapidly but slowed down to an almost imperceptible rate during the past year and a half. His height at the shoulder is now fifty-seven inches. We had expected him to become somewhat taller than this, since carefully measured specimens have exceeded six feet in height. It is possible however that growth will continue for some time to come, or he may not reach the known maximum height.

The horns, knobby little bumps on the forehead when he arrived are now about as thick as one's finger and two and one-half inches long. They are covered with a coarse-haired "velvet," except where the tips have been worn smooth and to the bone.

In captivity it has proved impossible to furnish an Okapi with the same food that he gets in the wild. Suitable substitutes must be found. To a certain extent, Congo had already been conditioned to "civilized" foods by the time he arrived in New York. Our own experimental work on his diet consisted of trying out new items from time to time and continuing or discarding those found acceptable or undesirable. Thus, at the present time, Congo receives a diet high in vitamin content and varied in its minerals, salts and vegetable materials. This is given in two feedings. He drinks about two quarts of water a day.

We are frequently asked if the Okapi is a "silent" animal like its relative, the Giraffe. Herbert Lang reported that one young Okapi calf, then held in the Belgian Congo, bleated like a sheep. Apparently, no one has ever heard an adult make any kind of a sound that could be regarded as vocal. We have paid close attention to Congo in this respect and we cannot say that he possesses a voice. However, he produces at least two characteristic sounds. One of these is a clucking noise, probably produced as we would make a similar sound with our tongue. He also grates his teeth with a loud, unpleasant crunching that can be heard all over the Antelope House. This seems to be a sign that he is hungry.

Congo's temperature requirements are not particularly critical. We had thought at first that our winter temperatures in the Antelope House would have to be revised upward in order to keep him warm enough. This has not been the case and he is apparently comfortable at our thermostat setting of 60°.

He shows a definite preference for the dark, humid days of summer over the bright sunshiny

"Doreen," the Bongo, was about 6 weeks old when this picture was taken and her horns were short spikes, giving little promise of the ultimate size they would attain.

Now that she has reached full adulthood, "Doreen" has acquired the proud carriage of her elders—still comparatively short, but twisted and sharply pointed.

ones. This seems to be logical, since the Okapi's native habitat is the shady depths of the equatorial rain forest. Thus, on glaring summer days he shows a reluctance to go out of doors and prefers the dark interior of the Antelope House. At other times his favorite spot is a dark and shaded corner of the outside corral.

Congo appears to be one of the most inoffensive animals we have ever had and, in fact, seems to be entirely lacking in offensive spirit. He is timid, apprehensive of change (to a lesser degree than might be expected of an animal that has changed so little for fifty million years), and in disposition portrays the very essence of the words meek and mild. He doesn't butt, bite or kick. When danger threatens in the wild, the Okapi's only hope for safety seems to lie in an instantaneous and apparently undirected rush for the nearest tangle of vegetation. This instinct is carried over into captivity, and he has no cause for alarm. Time and again Congo has been seen dozing [illegible] all quiet and serene [illegible]. Then there is a violent threshing of limbs in a frantic effort to get somewhere in no time at all. He is wide awake in a second or two and almost immediately subsides into his usual quiet self. Because of our hard, unyielding fences and walls, we have been afraid that Congo might injure himself in one of these nightmares. In fact, he at one time cut a gash in his shoulder upon hitting the fence and on another occasion, indoors, lost his footing completely and scrambled around on the floor to the consternation and dismay of his keeper. Fortunately, he was not injured.

In the September, 1957, BULLETIN, William Bridges told about the extreme antiquity of the Okapi and of the interesting fact that this animal

[illegible] ged but little from its ancestral type of fifty million years ago. There has been some question as to whether the Okapi has survived through this long period without change, as a study of the present-day animal would indicate, or, as suggested some years ago, that the Okapi was a "degenerate" Giraffe. A recent survey[1] of osteological material concerning the Giraffidae, both living and extinct seems to establish clearly that the Okapi "is a truly primitive giraffid, in many ways more primitive than the earliest of the fossil giraffes." It can, therefore, be truly referred to as a "living fossil," since it can be

is another highly prized exhibit, our Bongo, "Doreen." During the four years prior to the arrival of the Okapi, Doreen was undisputed queen of the Antelope House collection, but with the advent of Congo she was obliged to withdraw her claim of being the most strikingly colored and rarest animal in the group.

Like the Okapi, the Bongo is native to densely forested country. Thus the typical West African Bongo lives in practically the same type of forest, but Doreen, since she is a representative of the East African race, comes from a somewhat cooler region, especially since her kind is found only in mountain forests some thousands of feet above sea-level.[2]

Since the two animals, Okapi and Bongo, are both creatures of the deep forest we would expect them to be much alike in certain respects. This proves to be the case. In coloration, for instance, both are a shade of reddish-brown with an arrangement of white stripes, which perhaps have their purpose amid the light and shade of the forest.

Like Congo, Doreen is ordinarily a shy and inoffensive beast, but when up against a strange situation she doesn't rely upon flight for safety. She has a pair of horns and knows precisely what to do with them. On one occasion she made a lunge at a painter who had entered her corral, and scared

The Okapi's tongue is one of the most amazing things about this amazing animal. It seems endless, as if it could be protruded to any length to reach a succulent leaf. The animal can easily lick its own ears with its tongue. Here it is reaching for a spray of evergreen held high above its head.

very ideal as a surviving representative of the animal life of the Upper Miocene period.

Next door to the Okapi in the Antelope House

1. "The Relationships of the Okapi," by Edwin L. Colbert, Journal of Mammalogy, Vol. 24, No. 1, Feb. 1943, pp. 4-37.
2. See "Okapi," Natural History, March-April, 1943,

him half to death. But the last display signal that we now can read correctly. A constant "blinking" of her eyes means "Do not crowd me any further." If we pay attention to this, necessary work can be done about her quarters without danger.

Doreen shares Congo's dislike for bright, sunshiny days. Fitted for the darkness of the forest, their eyes are apparently unable, under the full glare of our summer sun,

It has been suggested that some of our troops now in Africa may have the opportunity to see the Okapi and the Lowland Gorilla in their native haunts. This is not likely to happen. It will be remembered that the Okapi inhabits a rather restricted strip of territory in the rain forest of the Belgian Congo and all of several hundred miles from the coast. It is not likely that the business of our troops will take them into such isolated and unhealthful regions.

The Mountain Gorilla inhabits a large area along the [illegible] French Cameroons mountorial [illegible] but it is supposed that [illegible] our troops could have a chance to see this animal. However, it is found only in one or two of dense tropical forests, where only a handful of white men have ever been seen and after a long and arduous search. Members of our Expeditionary Forces are not likely to see this animal alive.

Black Lace for the Gold Platyfish

The Costume of One of America's Most Popular Tropical Fish Was Created in the Laboratory of the Aquarium

MYRON GORDON

THIS STORY begins in a small stream hidden in the hot, mite-infested jungles of Mexico's southern state of Oaxaca and stops, for the present, in the tanks behind the counters of any pet shop in New York.

According to reports from the recent tropical fish exhibit held by the Aquarium Society of New York at the American Museum of Natural History, and from statements of sales from tropical fish dealers all over the United States and Canada, the golden wagtail platyfish, the favorite in a dazzling new costume, has climbed close to first place in the popular demand as a toy fish for the home aquarium. Yet only a few years ago, one of the grandparents of these colorful, home-bred and reared, aquarium fish was the wild, gray, undistinguished platyfish that abound by the thousands in the arroyos and lagoons of the southern states of Mexico.

Within a few fish generations, by a system of careful selection and scientific breeding, the olive drab body color of the wild platyfish has been transformed to bright gold; and each fin of the wild specimens which was colorless, has been darkened to produce the effect of an old fashioned black ribbed, lace fan. The sharp contrast of dull black on bright gold in the new golden wagtail platyfish is particularly appealing, for rarely is this striking color scheme seen in fishes.

The new wagtail platies are fine living examples of cordial Pan-American cooperation at its produce, for they are the direct result of crossing a wild Mexican platyfish with the domesticated goldplaty which was perfected in the United States.

With the consent of the Mexican Government and the generosity of the John Simon Guggenheim Memorial Foundation of New York, an expedition was organized with the cooperation of the New York Aquarium in 1939, for the purpose of studying the freshwater fishes of the Atlantic coastal rivers of Mexico. A book on this research is being prepared.

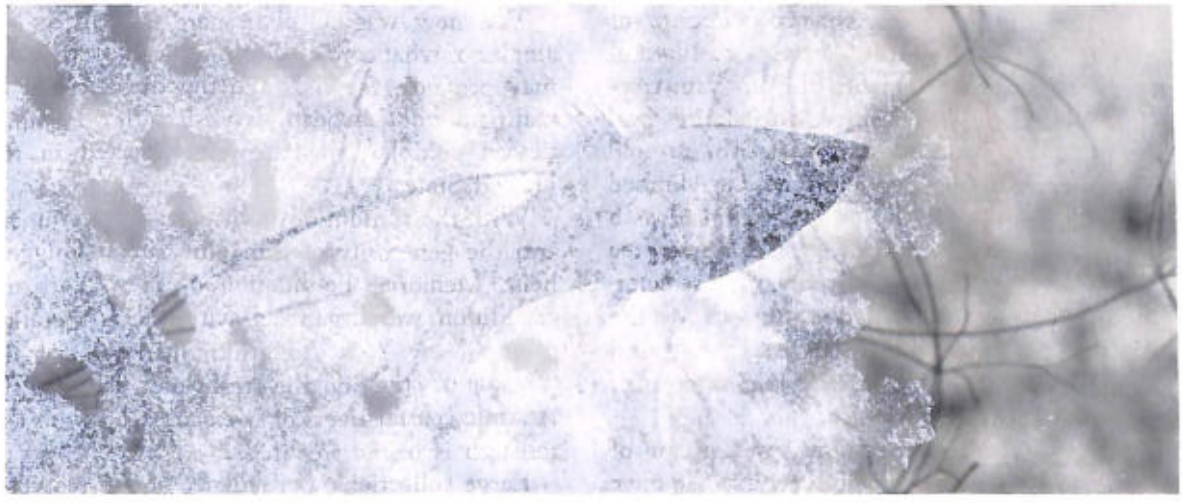
Large collections, particularly of the platyfish, were made for special studies which have been going on for many years in connection with the

Among 8,000 specimens of the southern Platyfish collected by Dr. Gordon were 135 different color types. This one, called "The Comet," was distinguished by a black line on the upper and lower margins of the tail.

problems of species origins and cancerous growths. Altogether, we collected more than 8,000 specimens and when they were classified, we found some 135 different color types among them. This proves, we believe, that the southern platyfish, *Platypoecilus maculatus*, is North America's most variable wild vertebrate with respect to color patterns. Yet in none of these patterns was there anything that remotely resembled the wagtails of today. Among them was a variety which was distinguished from others by a black line on the upper and lower margin of the tail. The rest of the tail was transparent, as were all the other fins. We called this color type "the comet." A number of these, together with a larger assortment of other types of platyfish, were shipped 4,000 miles north to our Aquarium laboratories.

The comet platy, at the Aquarium, was subjected to a routine breeding test to see whether its pattern was inherited or whether it was just a chance variation that occasionally appears and then disappears without leaving any living representative to carry on the type. The test was simple. A wild platy with the comet markings was mated with another platy without it. We found that their offspring all had the comet pattern; and when these offspring were mated together, they produced three fish with the comet pattern to every plain type. This indicated to us, clearly, that the comet was inherited.

Then a comet platy of our original wild stock was mated to the plain goldplaty, a strain that has been domesticated for a long time, the first of which appeared twenty years ago. When their



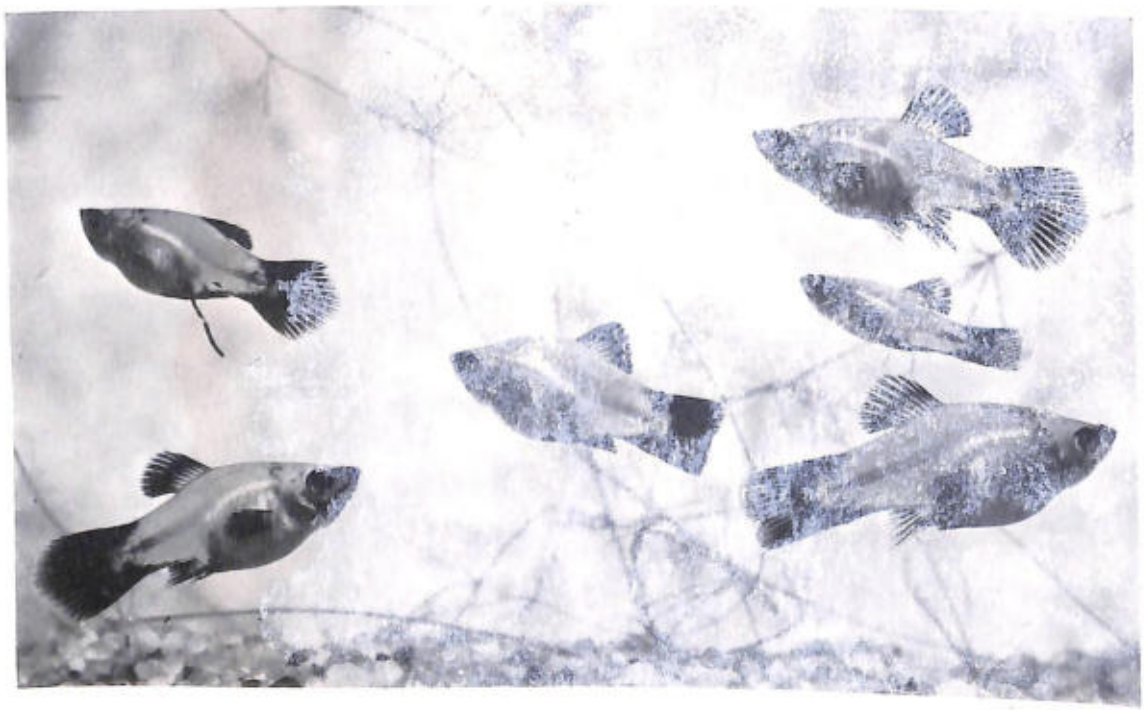
The plain Gold Platy, a strain that had been domesticated many years ago, was the second factor in the production of the dazzling creature that is a favorite in home aquaria. This fish was mated with the "Comet."

young were born, one could easily see that the gray body color of the wild platy was dominant, for all the young were gray. Later, as the gray hybrids developed, their tails became darker and darker. And when they were about half an inch long, the other fins darkened too. These were the first black wagtails, so named because of their wagging black tails.

Among our domesticated animals, the color scheme of the Siamese cat is comparable to that of the gray wagtail platyfish because its feet, tail and snout are so much darker than its body; so are, to a lesser degree, the dilute fawn breed of the Great Dane dog and the Hampshire Down sheep. But above all others, the Himalayan rabbit and the Giant Panda, with their strong contrast of jet black extremities on a snow-white body, appealed to us as being the most attractive. So we used them as models in choosing a somewhat similar costume for the fish.

Since we already had the gray wagtails, a plan to produce a black-finned and black-snouted goldplaty was easily worked out. All we had to do was to mate the gray wagtails to each other, or mate them back to the pure goldplaty. We did both. In the first instance, we obtained the anticipated golden wagtails once in about every seven young, or to be exact, nine in every sixty-four. In the second case, we obtained the predicted and desired type once in every eight offspring. Later, when these black-finned goldplaties were isolated and mated to each other, some bred true to type. Others produced a number of comets; these had the arrow-backs, indicating the wagtail's ancestor, as well as the white comet-marked platy.

The golden wagtails have turned out to be so popular that fish breeders have used them to improve other varieties. Thus, now you can buy red platies with black fins; even the related swordtail has been dressed up in black tails, gloves and socks. But the golden wagtail remains the key type and the most popular. Besides its sharply contrasting color scheme there is another feature, the peculiar markings of its head, which enhances its attractiveness. The upper and lower margins of its jaws are outlined in black and the black trim runs along the lower lines of its gill covers. It looks like a golden harlequin wearing a black mask. The golden wagtail is an amusing fish to watch in the aquarium. It has the rare trick of exciting one's sense of humor. It is just the kind of fish that aquarists are looking for these days.



The result of crossing the "Comet" and the Gold Platy was the Golden Wagtail Platyfish, resplendent in golden body and fins edged in black – a striking color scheme that is but rarely seen in fishes.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

EDUCATION MOVES AHEAD

A step toward a fuller realization of the Society's educational possibilities was taken last week when Dr. Leister was named Curator of the Department of Education, with Mr. Marcy as Associate under his direction.

Active work will be undertaken in expanding popular education in several directions, including increased services to the public schools, the preparation of low-cost pamphlets on animal life, the distribution of motion picture films, and the preparation of radio scripts.

While Dr. Leister will continue as Associate in the Mammal Department, he will have to give practically his entire time to the educational work.

Mr. Crandall has been named General Curator and will, in addition to his present duties in the Bird Department, handle the administration of the Mammal Department.

IT'S A DUCK WINTER

This winter, as usual, large flocks of wild ducks have visited the various lakes in the Zoological Park, their numbers guaranteeing at least enough open water to float them. About 1,000 Black Ducks, 300 Mallards, 100 Canada Geese and a scattering of rarer species were with us up to December 20. On that morning a sudden drop in temperature drove the thermometer to −3° F. congealing all nearby fresh waters as well as the margins of Long Island Sound and the East River. Many of the ducks that had been wintering there joined their compatriots in the only open water available, which happened to be ours. The most notable increase was in Black Ducks, of which we had at least 1,500. There were also a good number of Pintails and Baldpates, as well as both Greater and Lesser Scaup, a single magnificent American Golden-eye, and American and Hooded Mergansers.

For the first time since Lake Agassiz was dredged for cleaning purposes, about five years ago, the Mallards have this year reverted to a curious preference of long standing. At least 300 are segregated there, [illegible] no more than a scattering of Blacks. The l[illegible] have always preferred the Wild Fowl Po[illegible] where there are noticeably few Mallards.—L. S. C.

NEW MEMBERS OF THE SOCIETY

New members of the New York Zoological Society since last issue of this magazine are the following:

Life

Mrs. George F[illegible] Eugene Holman
[illegible]t Struthers

Sustaining

Dr. David Crockett Graham

Annual

Robert J. Caldwell
James McCosh Cecil
Miss Ethelwyn Doolittle
Mrs. Clara B. Havemeyer
Mrs. Mignon Lago
Roland Lindemann
Miss Elizabeth P. Martin
Roswell C. Otheman
Harry C. Perry
Mrs. Mildred Steele Woods

OLD-TIMER

In 1914, Col. Theodore Roosevelt led an expedition down the mysterious Brazilian river that for a long time went under the provocative name of the River of Doubt, and which the Brazilian Government later christened the Rio Teodoro or Rio Roosevelt in honor of the late President. Somewhere along the way a forty-pound tortoise was acquired and carried along by returning members of the expedition, eventually reaching the Zoological Park. Here it was identified as the South American tortoise, *Testudo tabulata*, a species which ranges widely through South American jungles, feeding on the fruits of jungle trees. Today, twenty-eight years later, the tortoise is still with us.

Soon after the arrival of this animal Dr. Ditmars, in a note published in the Zoological Society's BULLETIN, commented on the large size of the specimen and stated that it was evidently a very old example as the bright yellow markings normally found on the upper shell of this species were completely lacking. Mention was also made that the tortoise was contentedly browsing with

Memories of the ... in the spring of 1917 when the n... s as a workshop. Sixteen sewing m... ats for soldiers.

others of its k... gets warm milk bananas.

Through the ... we may be able munched its way ... leaves and banan... war and restricti... Klipspringer on number of ban... pected, they are steadily and at the present moment such c... nd on two previ- cies can exist only as a memory in the ... we have been unable to raise them this slowly cerebrating animal. Surpris... The present youngster seems to be enough, while it has remained in excellent h... n be expected and nurses regu- during the twenty-eight years, the tortoise ... larly. gained only eight ounces in weight!—J. T-V.

YOUNG ANIMALS

Gray Wallaby

During Christmas week a young Gray Wallaby — probably about three months old — put his head out of the maternal pouch for the first time. The world proved a harsh place, however, for the mother died early in December of a throat infection, and at present the baby is being

... rs of a young Klipspringer are relatively ... somewhat rabbit-like but more rounded. While resting in the back of his cage the baby's ears are usually cocked forward to catch the many strange sounds of the Zoo. At such times he looks so much like a rabbit that the Keepers refer to him as "Rabbit-ears."

Our pair of Klipspringers were extremely wild following their arrival two years ago. They have changed remarkably and are now one of the tamest of our animals. An elevated lookout has been provided in their outside corral. Here they

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fects in every depa[illegible]ment of its activity.

LETTER FROM A MEMBER

Visitors to the Zoological Park [illegible] numbered by millions — in itself [illegible] the Society's success in attracting [illegible] exhibits — but few concrete expressi[illegible] appreciation or understanding of t[illegible] purposes ever reach the ears of the [illegible]

Recently President Osborn [illegible] new member of the Zoological Socie[illegible] Eldridge of Albany, a letter which states so well the reaction that we hope our collections will produce in visitors, that we take great pleasure in reproducing parts of the letter here.

As a young man Mr. Eldridge lived on Long Island and from his father he gained a life long interest in animals and the out-of-doors.

"Marriage and the picking up of business again, left little opportunity of actively continuing that amateur interest," he wrote. "But as our children have gro[illegible] I must have recalled my own early introduction to nature and its wonders, for instinctively I have wanted to pass on that most valued aspect of [illegible] inheritance, even in [illegible]te of the vast change[illegible] that have come to limit its real enjoyment.

"[illegible] th[illegible] with uncertainties and [illegible] e[illegible] pl[illegible]e put off on the hope [illegible]n. That not being forthcoming [illegible]re appearing if anything [illegible]te, we decided to give [illegible] a [illegible]ence even though [illegible]d possibly [illegible]d their full grasp [illegible]. So follow[illegible] days spent [illegible] a [illegible] trout stream, we [illegible] and the next day [illegible] it was a return [illegible]ence. For the rest [illegible] first visit. The park was a glorious end of [illegible], and literally, until closing [illegible]d about, lost in admiration of [illegible]many wonders contained in that [illegible]s of the tremendous contribu-making to the enjoyment of the [illegible]sitors. For me it was a revelation. [illegible]eption of the strides made in the [illegible] animals. I was drawn back again and [illegible]frican Plains, or the Wapiti (I [illegible]s a boy one summer in Wyo-Okapi, or the Aquarium. Of course, [illegible]dren's Zoo was a delight, and again I [illegible] at the presentation. Even the absence [illegible]Rocking Stone Restaurant, my only recol-[illegible] from the past of a place to eat, was per-[illegible]ly compensated for in the discovery of the [illegible]. Coming out at last from the Heads and [illegible]s exhibit, I had to do something to record [illegible] whole family's appreciation for the unique [illegible] they had been enjoying. Therefore, my visit to the Administration Building and the taking out of membership. We continued on to see the Monkey Island and then the Farm-in-the-Zoo, the end of an outstanding experience and the beginning of what I hope may be a long interest and affection.

"Why should I bother you with this personal recital? I only feel that I must try to indicate the effect of something very close to your interests and attention on one person fortunately coming

under its influence. [illegible] confused
and many refuges are [illegible] But the
future can be bright if it [illegible] tain and
reenforce illustrations of the [illegible] ss of the
world and the permanence [illegible] wonders
to inspire and rekindle our [illegible] dge and
affections. I have enjoyed [illegible] ysis on
record and have to some [illegible] e started
repaying a debt which [illegible] never
completely repaid, the [illegible]
York Zoological Society.

PUBLICATIONS

THE AMATEUR SCIENTIST. [illegible] STEPHEN
W. W. Norton & Co., [illegible]ork, 1952.
16 photographs, $3.00

The amateur scientist is the successor of a long honorable tradition. Many [illegible]'s predecessors high rank in their fields, equaling and sometimes passing contemporary professionals. Now, the social changes and mechanical aids, most of an increasingly greater amount of spare [illegible] be devoted to cultural and intellectual pursuits those who, in this troubled world, avocations to some scientific work will into intimate contact with the complexities earth or of the lifeless aspects of the to have a better understanding of the necessary for living happily with their neighbors over.

Under any circumstance, the individual cation becomes a better citizen, and if his hobby, if it is a scientific one, contributes the world's knowledge so much the better. far as science is concerned, there is between the truth as determined by a by an amateur.

Mr. Thomas, who is Executive Secretary mittee on Education and Participation American Philosophical Society, has and interesting study of such matters people who become amateur scientists, employment, their equipment and hobbies in regard to their communities, and what ities offer them, as well as many other aspects of this inquiring and interesting group of citizens. obtain this data the author sent questionnaires a large number of members of scientific clubs and institutions in the Philadelphia region. His conclusions, therefore, are based upon a broad groundwork of information, and long, careful study of other aspects of amateurs in many fields of inquiry. As a consequence, we have in this book an ably correlated summary of what we know about modern day scientific avocations, and those who participate in them.

The obligation of the zoological park or museum or other institution to interest and assist the amateur in his chosen field is self-evident. The past record of help given to the non-professional is, as far as American

in[illegible] co[illegible]erned, an excellent one, and there is [illegible] t to that this record will not be surpassed in the future. Mr. Thomas gives us new ideas as to [illegible] its solutions may accomplish this.—J. T-V.

[illegible] AND LEMMINGS. By CHARLES ELTON. [illegible] Press, 1942. [illegible]

[illegible]d of Charles [illegible] he is in many ways [illegible] counterpart of [illegible]rles Darwin, and this [illegible]k, goes far to [illegible] such claims. By [illegible] main that *Voles, Mice and Lemmings* [illegible] Found influence on modes of [illegible] and ethics [illegible] the *Origin of Species* did, [illegible] in great scope, [illegible] qualities, generality [illegible] synthesis on [illegible] and practical importance [illegible] ably with Darwin's classic. [illegible] *Dynamics* is the subtitle of [illegible] is this aspect of animal life [illegible] the plagues of mice, lemmings or [illegible] have at times been veritable [illegible] astronomical [illegible] numbers of these pests devastating [illegible] crops, ruining orchards and [illegible] stored produce of all sorts. Following [illegible] superabundance come periods [illegible] the creature can be found. [illegible] has suddenly originate and to [illegible] more suddenly disappear. [illegible] plagues occur irregularly, but many [illegible] at regular intervals of from three to [illegible] ten years. This [illegible] cyclic behavior of populations of [illegible] has [illegible] Elton's principal concern for a [illegible] he has taken time to summarize [illegible] Several [illegible] have known [illegible] of this phenomenon. [illegible] his [illegible] has put [illegible] of his book to a brief review of what is known about mice and lemmings [illegible] of success and decline. The [illegible] population cycles is outlined. [illegible] explanations that superabundance [illegible] or other rare phenomena, [illegible] bring the enormous powers of [illegible] the small mammals and those [illegible] are and diverse which tend to [illegible] them, to the present time the [illegible] have in any predator prey or [illegible] the cycle itself, of course, [illegible] many outside influences. [illegible] he [illegible] Decline of Animal Populations at [illegible] set [illegible] in two chapters. The young, but [illegible]ant, organization was founded by Elton in 1932. [illegible] Society was instrumental in [illegible] bringing about the [illegible] in supporting some of its initial efforts. This financial aid is gratefully acknowledged [illegible] several places in the book.

The [illegible] half concerns the cycle of fur production in northern Canada and Labrador. The rhythmical fluctuations in amount of furs traded at the Moravian Missions and the posts of the Hudson's Bay Company provide the basic material. A surprisingly regular four year cycle is demonstrated. The gathering of these data entailed considerable bibliographic work, employing little known and generally unavailable references. In fact, the whole volume stands as a notable bibliographic achievement, for not only are commercial reports used, but invaluable lists of references to the French, German and particularly the Russian scientific literature are given. JAMES W. ATZ, U. S. [illegible].

ANIMAL KINGDOM

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In the Mail

As may well be imagined, the mail brings inquiries of infinite variety regarding animals, discoveries of our research staff, or the doings of the Society in general. A doctor writes in for the latest results gained from our neuro-physiological studies on the electric eel. A youngster reports a migrant bird and, describing it not too clearly, requests identification. A Government agency asks our opinion as to whether a parasitical condition common to a certain kind of fish disqualifies it for human consumption. An eminent lawyer, burning for the knowledge that elevates, seeks data regarding the characteristics of prehistoric elephants. Mixed up with the more serious mail comes a letter from a perturbed boy who informs us that his pet alligator "does not look so well this week" and requests immediate advice as to treatment. An ardent citizen, having just read the newspaper accounts of the new Aquarium plans, encloses a dollar bill to help meet its construction costs! A recent letter urges us to continue the African Plains method of exhibition – an exhortation that is scarcely needed. This letter reads in part, ". . . such freedom for animals would be one proof that humanity is worth and will get the freedom fought for and which is being paid for so dearly. We had to start with the Society for the Prevention of *Cruelty to Animals* before it was ever thought of for *Children!*"

Yes – there is generally something interesting in the mail.

Fairfield Osborn

IN THIS ISSUE

"False-face Insect" from Venezuela . . . . . COVER
Cashing Jungle Dividends
Part 1: General . . . . . *William Beebe* 27
Part 2: Specific . . . . . *Jocelyn Crane* 30
Portraits of Four Primates 35
Homing Pigeons in Peace and War . . . *Lee S. Crandall* 39
Newest Animal – the Kouprey . . . . *William Bridges* 43
Behind the Scenes: News and Notes 45

SHOP TALK

As this is being written, spring seems very far away. A wet, clinging snow is falling and a laborer with discouragement in every line of his sodden coat is trying to abolish the slush by pushing it into corners and along the margin of the pavement.

All week there has been a stream of newspaper reporters and photographers looking for "signs of spring in the Zoo." Even the reporters are disheartened today.

But the animals are sure. Spring is just around the corner. March snowstorms don't mean a thing. That moving speck over on the hillside, just at the edge of the catbriars – is it just another squirrel? Or . . . it's a cottontail rabbit. Looking for a likely site to build a snug nest, probably. Down in the old raccoon enclosure a pair of Canada geese are paddling around in the black water. They nest among the yellow willows every spring; just came back today to the old homestead.

For more than a week, now, flight robins have been hanging around the Dome Cage at the corner of the Bird House and making ingratiating noises that seem to mean a great deal to their fellow robins inside the Dome.

The peacock that always haunts the hillside near the Raven Aviary is up to his old tricks again – displaying alongside the ravens. It infuriates the male raven. He spreads his wings, squawks, hops up and down. If he could just get his beak on that swaggering. . . . It's a good thing our raven never learned to talk.

Fresh paint appeared on the fence around the Riding Animals Track yesterday. The pony boys were out in their shirt sleeves, raking the tanbark into furrows in the track. In the next office, somebody just now sneezed. Bless you! Spring is just around the corner.

Dr. Beebe (in the pit) and Mr. Fleming extract the night's catch from one of the many pits they dug in the jungle floor. Opossums, spiny rats, lizards, snakes, frogs and rare nocturnal insects tumble in and are collected on early-morning rounds. If left to themselves, the strongest captives devour the weaker, and the burrowers will, in time, tunnel to the surface and escape.

Cashing Jungle Dividends

How the Department of Tropical Research Obtains and Uses Its Specimens and Facts, Linking Field and Laboratory Studies

PART I: GENERAL

WILLIAM BEEBE

AN ACCOUNT of exactly how we go about getting facts and specimens in the jungle, and the subsequent methods of transmutation into scientific knowledge and publication has been asked for by our Editor. This is not an easy thing to do, for after forty-three expeditions many such actions and reactions cease to be conscious and enter the zone of instinct. Nevertheless, here is the tropical jungle with its challenge to us as Naturalists of a Zoological Society expedition, put in as few words as possible, dealing at most with only one or two out of hundreds of discoveries.

On our recent Venezuelan expedition the first time I stepped into a jungle trail I felt as if I had returned to an old home after twenty years of sailing over or diving into the open sea. For throughout preceding decades in British Guiana I had worked on life histories of jungle animals, and now I hoped to complete some of these.

When we entered the shade of this equatorial forest we left behind all the oil wells and pipes and comfortable camp of the Standard Company, and the last outlying thatched hut in its banana and cassava clearing was far away. Nothing of man remained except a narrow winding trail which finally led to the shore of the distant San Juan River, ending in a mudbank beloved of scarlet ibises, crocodiles and fiddler crabs. As I walked ahead I met the only human being who shared this wild region with me – a Venezuelan Indian carrying a dead agouti which he had stalked, and killed with his Alice-in-Wonderland gun. This was made of a length of gaspipe fastened to a rough-hewn stock with trigger and hammer consisting of two bits of wood released by the snapping of a pair of rubber elastics. "*Bueno,*" a quick smile and he padded out of sight.

To other men the source of livelihood is the stock market, or the purchase and resale of meat or cloth, jewelry or books, the ploughing and sowing of fields, or the extraction of milk and eggs from complacent domestic creatures. Here was my problem: From this silent expanse of giant trees, lianas, orchids and bamboos I must extract something which would satisfy my own intellectual curiosity, as well as trusting sponsors, fellow scientists, and those stayathomers who cannot travel but are eager to learn more of the wilderness life which shares this revolving planet with us.

The farmer must be alert for boll weevil or Japanese beetle, a broker worries about the effect of antipodal human activities on his stocks, the jeweler watches for thieves, while passing human fads may ruin a tailor or couturier. We are more fortunate, for four decades of experience have enabled us to relegate the so-called dangers of the jungle to subordinate attention. My daily five grains of quinine have already been taken, no thirst will tempt me to drink from the cool, clear, amoeba-filled streams, and avoidance of poisonous snakes and scorpions is automatic. Ticks and leeches are minor annoyances in this jungle, but nothing can be done about the hordes of bête rouge, until our blood sets up counter acting antibodies, when after a fortnight of grim

Tangled roots and the leafy litter of the forest floor – a typical hunting ground for the Department of Tropical Research in its work in the Venezuelan jungle. As Dr. Beebe commented: "We have only begun to solve many of the mysteries of the tropical jungle. The life which exists near, or on, or within the floor of the forest is a world in itself, with comedies and tragedies, and every creature striving with all its might to avoid danger, to find food and to perpetuate its race."

torment, all irritation will cease. We can now say that in the jungle our conscious mind is undisturbed by physical worry.

Our outfit consists of glasses, compass, gun, small net and snake bags, but our methods are far less simple than those of the old-fashioned collector. We are out for facts, for all possible knowledge of the living bird, lizard or frog, and yet these are useless without accurate identification. So we must choose when to cease observing and listening and when to shoot, unless we can return day after day and complete life histories on reliable sight identification.

Just as my oceanographic work benefitted enormously from such inventions as the bow pulpit and boom-walk[1], so here I must call to my aid other schemes than merely silent stalking. On a day when the jungle seems devoid of bird life I may suddenly feel a series of acute bites and find I have stepped into a marauding legion of army ants. Springing back and freeing myself of the furies, I plan to make use of these insects. I slowly encircle the hosts, until sooner or later, I hear a loud rustling and a medley of bird chirps and calls. Here is a golden opportunity, for all flightless animal life flees headlong from the vanguard of the ants; whereupon birds of many kinds find an unceasing supply of terrified insects, while I can observe the birds, and pick and choose at will.

A rare lizard, on this my first day, dashed over my shoe and his fear made him an easy capture. I watched three woodhewers, all new to me, all identical, so I shot one, and had to do a ballet tourjetée in order to salvage its body from the midst of the swirling mass, finding already a score of scouts of these blind demons on the plumage of the bird. The two remaining woodhewers were evidently a pair and divided their time between consumption of the rain of terrified manna and a hollow in a tall stub. I recorded their voice, expressing a half dozen emotions, unusual actions, incipient courtship and the effect of a threatening but futile power dive of a small hawk. The following day they were still there and I braved their wrath and investigated the hollow. Instead of a downy nestling I drew forth a protesting red and green tree snake with a significant bulge amidships. Subsequent investigation revealed, not an infant woodhewer but a most interesting nocturnal frog. I later found the nest of this pair of woodhewers in an adjoining tree, obtaining both an infertile egg and a nestling. Even here I was able to do more than to blow the egg and preserve the nestling in alcohol, for in the Park laboratory ultimate comparison of the syrinx or singing organ of the young bird with that of the adult gave me a hint of relationships which the organs of no two other species had furnished. Thus through previous knowledge of the army ant cosmos I was given a glimpse into the home life of *Xiphorhynchus susurrans jardinei*.

A paragraph or two in reverse brings us back to the tree snake and his last meal, and a desire to know what creatures came to life in the jungle at dusk and crept about on their occasions, both the leaf nibblers trembling at every sound, and carnivores smelling and feeling their way through the blackness toward living prey. One could spend an entire night here on the mossy floor without sensing anything more definite than a multitude of sounds and waves of scent; I know, for I have done it. Human muscles can keep quiet only so long, and the human body unceasingly gives forth a revealing odor, which to keen little nostrils is as potent as screams would be to sensitive ears.

Years ago in Ceylon I saw elephants and other animals trapped in pits and for many seasons I adapted this idea to lesser wild folk in Guiana. After my woodhewer plus tree snake plus frog incident, I returned with two husky natives complete with picks and shovels and with difficulty persuaded them to begin a series of pits, each a metre across and a metre deep, round, with vertical walls, and the excavated earth tossed far off over the jungle floor.

Pit Number One after twenty-four hours contained a motley array of creatures, a small lizard well on his way to becoming a snake, so tiny and almost useless were his legs; two of my nocturnal frogs which were so terrestrial that they were rather creepers than leapers, and only the tree snake can say what he was doing twenty feet up with one of these in his stomach; two other species of amphibians; a small spiny rat cowering in a scooped-out hollow in the pit, and

[1] *Bull. N. Y. Zool. Soc.*, Vol 28, July, 1925, pp. 88, 90.

lastly a rare mutillid, a large wingless wasp, gaudy in red and black fur and with nervous sting ready for action. Here was a cross section of lesser jungle night life, whose diurnal hiding places defy all search. Day after day we visited our many pits as a hunter runs his lines of traps. We could thus trace the increase and decline of various organisms as the months passed, their food, their relations to each other. Many thrived in spacious cages beneath our laboratory and contributed new facts to scientific knowledge.

And so our jungle was made to pay intellectual dividends and our collections the compound interest which is the endeavor in the field of all of us on the staff of the Department of Tropical Research who serve our mother institution, the New York Zoological Society.

In our studies of the evolution of life upon earth we detect slow but invariable progress. When we come to human beings we must admit that sometimes we find conditions which are stationary or retrogressive. Almost a century and a half ago, but only twenty-five miles from where I am writing in our laboratory at Caripito, Venezuela, Baron Alexander von Humboldt wrote the following: "I cannot too often repeat, that when the seas are infested with privateers, a traveller can be sure only of the object in his own possession." Most of the natural history collections which he shipped by sea were lost by privateer attacks of various nations. Now, in 1942, the same conditions existed and I had to keep by me, or send by airplane, all notes and the most precious specimens to avoid their loss by submarines.

PART II: SPECIFIC

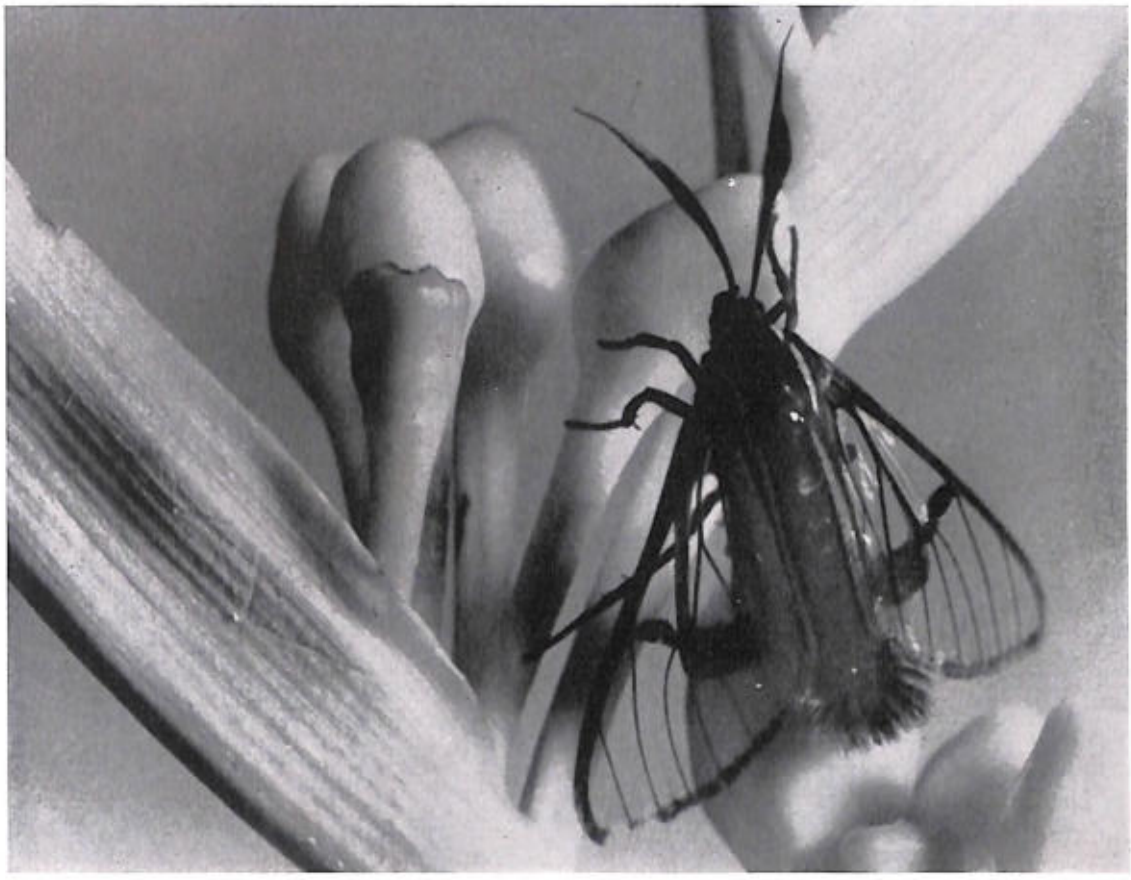
JOCELYN CRANE

Among the above-mentioned group of specimens which we kept always with us was a large tin can full of fiddler crabs, all tied up mummy-fashion in individual cheesecloth packets, along with labels giving catalogue numbers, localities and dates. At the last moment before leaving, to comply with plane regulations, we had drained off the preserving alcohol, taping the can up quickly so that the crabs would stay moist throughout the trip. I worried considerably over that taping: it must be secure, yet readily removable by customs inspectors, and as easily replaceable, and I was quite proud of the final result. Great was my chagrin when I arrived at the Miami airport, clutching that bulky tin, to find that our inspector – doubtless wanting his dinner as much as we craved ours – disclaimed all interest in a personal introduction to our highly valued but very dead crabs.

Weeks later, when the unpacking and preliminary sorting had been finished, we sat down at our desks, face to face with rows of preserving jars and little glass vials, all full of unsolved problems. My first task was to report on this same group of custom-scorned crabs, partly because their study is directly related to a similar one made last year on related Pacific fiddlers, and partly because, with their wide variety of structure, homes, habits and courtship displays, they are among the most interesting sources of light on our ultimate problem – the workings of evolution in this and all other biological fields.[2] The immediate steps to be taken were the relating of my notes on color and habits, made by watching the crabs living undisturbed on the swampy jungle edges of the San Juan and the Orinoco delta, to the anatomical observations that could be made only by careful dissection and comparison in the laboratory. The result of this synthesis of study, after due communion with reference books and related crabs from other parts of the world, would be that every Venezuelan fiddler could be identified, described if new to science, his way of life recorded, and eventually his proper place in world-wide fiddlerdom established.

When a satisfactory family tree of all the fiddlers, which is one of our present goals, is finally completed – a tree which takes into account not only their physical differences, but also their psychological relationships – then we shall have

[2] Systematics and the Origin of Species, by Ernst Mayr, p. 255.



These lovely tropical moths fly about in full sunshine. There are more than 2,000 species of this group, many of them mimic wasps, bees and other stinging insects. This one was common about the Venezuelan laboratory. Its wings are transparent and the body is covered with dense fur of scarlet and black. Scientifically it is *Dinia mena*.

solved another small but important section of the evolutionary puzzle. And, as in any proper crossword, patches which we work out correctly in this one part will give clues which may lead to the solving of sections far removed.

A quite unconscious example of all this was Edward, a greenish fiddler half an inch in height, who lived on a Venezuelan mud-flat down on the Orinoco delta. When I first saw him one August morning he was waving his large fiddling claw at an unimpressed adjacent female. Compared with some of his gaudy relatives, he wasn't much to look at: his claw was chiefly brownish, with only a wash of rose, and his back, although basically a lovely iridescent green, was covered except near his eyes, with mud which he never bothered to remove. Also, although he did his dance in front of a little half-domed shelter of mud, built above his hole, it was a poorly made affair compared with some I had seen, too thick for beauty and rough on the outside. Finally his display at first glance was nothing special, being only a vague beckoning underscored by a few half-hearted kicks of his walking legs. In fact his whole performance gave such an impression of comical ineptness and indecision that I named him on sight after Edward Everett Horton. (Until I could learn his scientific name in the laboratory, he had to have a field handle for practical use in notebooks, and "Edward," although highly unscientific, was certainly less cumbersome than some such title as "Green carapaced, brown-clawed, shelter-building, Group-5 *Uca*," and pleasanter and less confusing to use than a catalogue number).

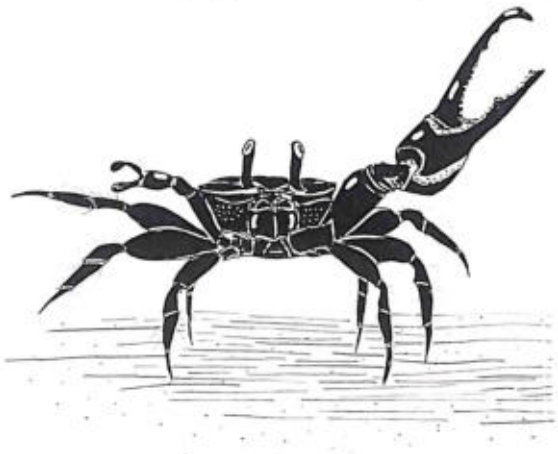
Edward, by whatever name, was of interest chiefly because I knew I had never seen him before, and because he added another shelter-

builder to my list. Soon, losing interest, I resumed my interrupted observation through the binoculars of another crab, a fine pearly fellow with polished apricot claw which he brandished with dramatic vigor, exactly like a great conductor at the climax of a symphony. Inevitably I dubbed him "Toscanini" and settled down for a morning's watching, between tropical downpours, of what was surely a new species.

Suddenly, however, dingy, bumbling little Edward, six inches away, claimed all my interest. A moment before, the female, who had hitherto paid him no attention whatever, but continued picking her dinner busily from the mud, stopped feeding, started watching her suitor, and finally sidled a few steps in his direction. That was the signal for Edward to speed up the tempo of his display and to add to it, at the end of every wave, a strong, triple rap of the elbow of his great crooked claw against the ground. "Rat-a-tat" went Edward in soundless vigor, and, after another beckoning wave, "Rat-a-tat." From that moment until, fifteen minutes later when he successfully persuaded the fascinated female to follow him down his hole, I never took my eyes off of them. Because in that rapping I recognized a clan-sign characteristic of a group of species quite different from the Shelter-builder group to which I had previously relegated Edward, and which I had hitherto watched only on the tropical beaches of the Pacific: Here was a crab at the mouth of an Atlantic, Venezuelan river which according to my theory, should be closely related to this Pacific group of Rappers. Yet he built a shelter like the members of the other clan! I could hardly wait to get him home and under a microscope.

So, on that November morning when I started our winter's scientific work, he was the first crab I took out of his vial of alcohol, from the cluster holding him and his brother Edwards. His field label read: "No. 42414" – meaning that he was the four hundred and fourteenth invertebrate with special notes taken on our 1942 expedition – and, "Pedernales, Venezuela, Aug. 24." He was duller than ever, and there were still traces of Orinoco mud clinging to him. So I scrubbed him gently in the sink, then settled down at last with microscope, powerful lamp, several books of references giving pictures, descriptions and keys to fiddler crabs, calipers, ruler and delicate forceps. The first necessity was to find out if he had a name other than our frivolous but convenient field soubriquet.

After tracing him through the available keys, it was obvious that he was a brand new species. In fact, no crab really closely related to him had ever been taken on the Atlantic coast. And when I examined such details of his anatomy as the tell-tale form of the serrations on his small feeding claws, counted the fifteen microscopic, spoon-tipped hairs that grew on the tip of a section of the mud-sifting apparatus far inside his mouth,



In Miss Crane's field notes, this particular fiddler crab was descriptively identified as "Toscanini."

and saw the shape and position of the minute arm near the end of his eighth-of-an-inch long abdominal appendage, it was clear that his closest known relative was a fiddler that lives some thirty-five hundred miles away up near the head of the Gulf of California.

Finally, with all the anatomical evidence in, it turned out as I had guessed on that jungle mud-flat three months before from his behavior alone: Although Edward's closest relatives were the Rappers of the Pacific coast, he was more primitive than any of them. Then it was time to bring out my field notes, labeled "Edward: No. 42414," which gave a description of the kind of mud he lived in, the surrounding plants, the salinity of the water which twice daily covered his hole, the dimensions of his clumsy little shelter, detailed notes made on his evanescent courtship colors while I watched him through binoculars, similiar notes on the colors of the

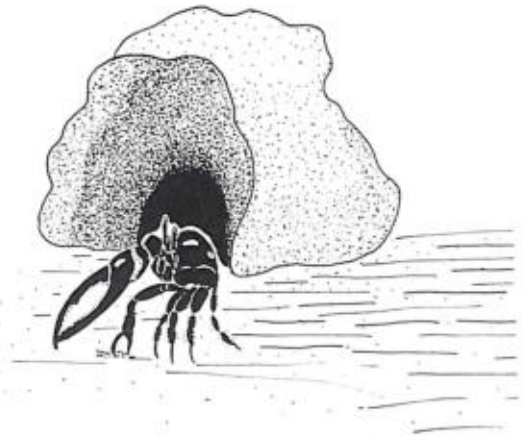
female, the description of his amateurish courtship display, the relative abundance of his kind compared to other species on the same beach, and whatever else I had been able to learn by watching him and his brothers through hours of observation. When these notes had been organized and typed, I compared them with similar notes I had already published on Edward's Pacific relatives.[3] Before writing the final description of his display, we studied the motion pictures made, between showers, of the crab's lazy dance.

From all of this data, combined with the now recorded details of his anatomy, it seemed evident not only that Edward was a primitive Rapper, but that this Atlantic fiddler was nearer the common ancestor of both the Shelter-builders and the Rappers than were his Pacific cousins. Those more highly evolved western Rappers wore brighter colors in display, were physically more specialized and had faster dances, of which rapping was a regular part, instead of being confined to the height of courting excitement. Added to this, the Atlantic crab built the shelter mentioned above, a custom characteristic of the other, more specialized fiddler group. It was a primitive shelter in comparison with the buildings of these higher crabs, but basically of typical form for all that.

So in Edward we had brought home not only a new species but – far more important – a true missing link, a crab living today which combined characteristics of two otherwise distinct groups of fiddler crabs. If we had not watched him fiddling and building his shelter down on the jungle shore we would never have guessed he was a Shelter-builder, for there was no anatomical hint of this habit. Hence we would never have known he *was* a missing link, which could give us a glimpse of fiddlerdom in the dim age when the Atlantic and Pacific were joined and there was no Panama.

In contrast to Edward, the flamboyant Toscanini, the neighboring crab of whom I expected such a lot, turned out to be merely a tropical subspecies of one of the most abundant of Atlantic fiddlers. The northern form scurries about on our own Long Island and Jersey shores, and was given the name of *Uca pugnax* – "the fighter" – by a New Haven professor way back in 1870. He now lives, in undistinguished obscurity, in a two-quart jar with several dozen identical companions.

Whereas Edward – dingy, unimpressive Edward – now has a special vial all to himself, with scarlet paint on his cork, showing that he is that pampered aristocrat of zoological collections, a Type Specimen – the one crab in all the thousands of his brethern upon which the original description of his species is based, and hence the standard for comparison by future zoologists who catch future generations of Edwards of dubious identity. On his label, with his catalogue number and the place he came from is his new name – *Uca* (CENSORED). (His specific name must be censored in this article, not because it might



And this is "Edward," now enshrined in a bottle of alcohol as "that pampered aristocrat – a Type Specimen."

give any conceivable aid and comfort to the enemy, but because Edward's official description will not be published until later, in the forthcoming number of *Zoologica*. Should his name be first published here in *Animal Kingdom*, the few incomplete details of his appearance, given here only for purposes of illustrating our methods of research, would constitute his Type Description, to the future confused distress of my fellow carcinologists, and the just heaping of anathema upon my head. Finally, the name might even descend to the lowest rounds of taxonomy, and be branded that nomenclatural strip-tease, a *nomen nudum*).

The above details of Edward's post-mortem career are presented here only because our editor

[3] *Zoologica*, Vol. 26, pp. 145-207, 1941.

thought our laboratory working methods might be of some general interest. Personally, I recommend instead that, with the first warm days of spring, you yourself hunt out the nearest quiet beach of muddy sand, sit there motionless awhile, and watch Edward's northern cousins emerge from their winter's hibernation, stretch in the sunshine, and then, very much alive once more, polish up their giant claws and start the summer's dancing.

Jungle taxi in Venezuela.

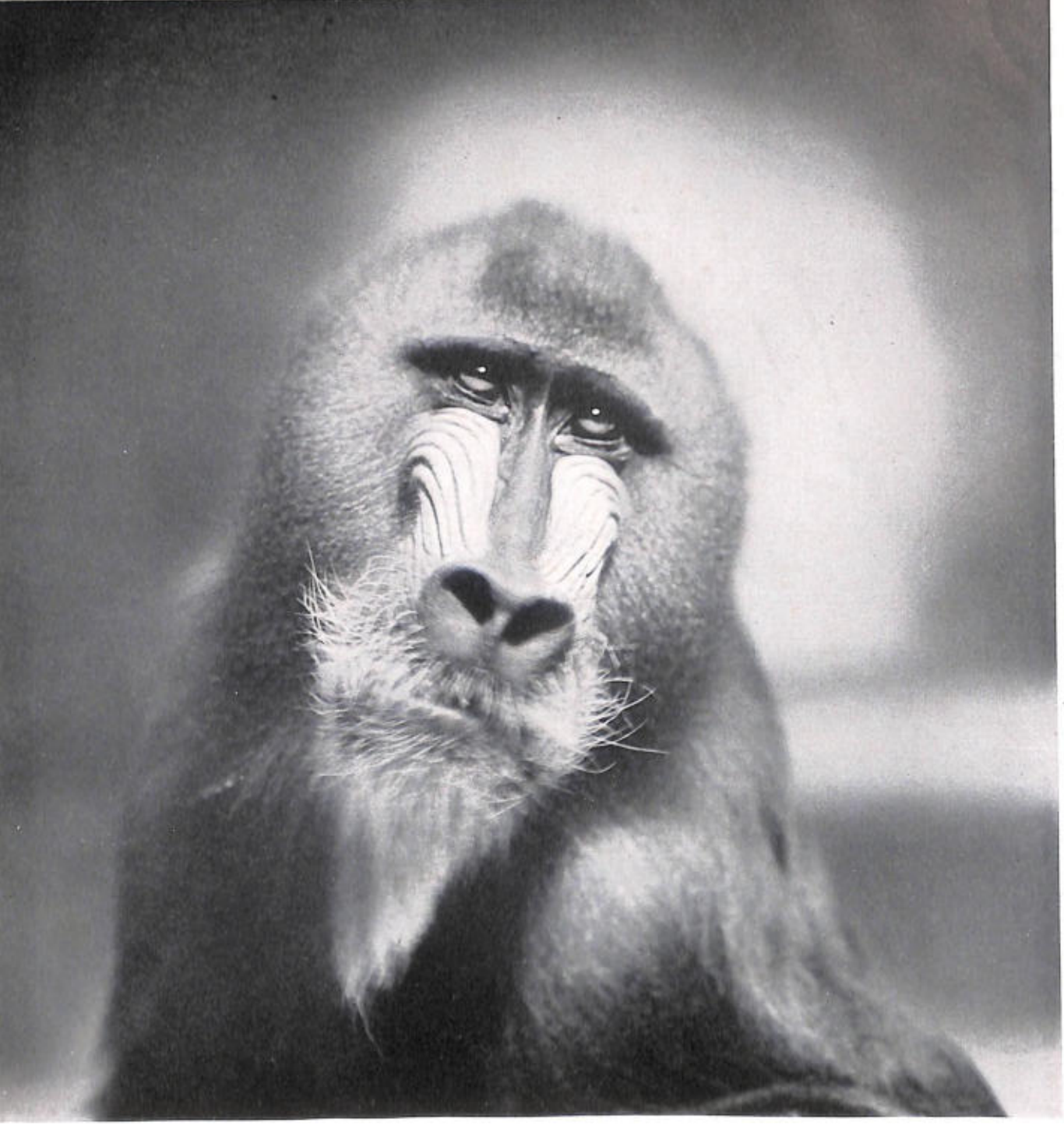
Urania and White Orchid

One of the loveliest of the flying creatures of the tropics is Urania. Here we see it perched on the flower of a rare white Venezuelan orchid. It is named for the Muse of the Stars and for a distant planet which we see only at night. Yet Solaria would be a better title for this insect, for it flies throughout the warm sunlight of the brightest days.

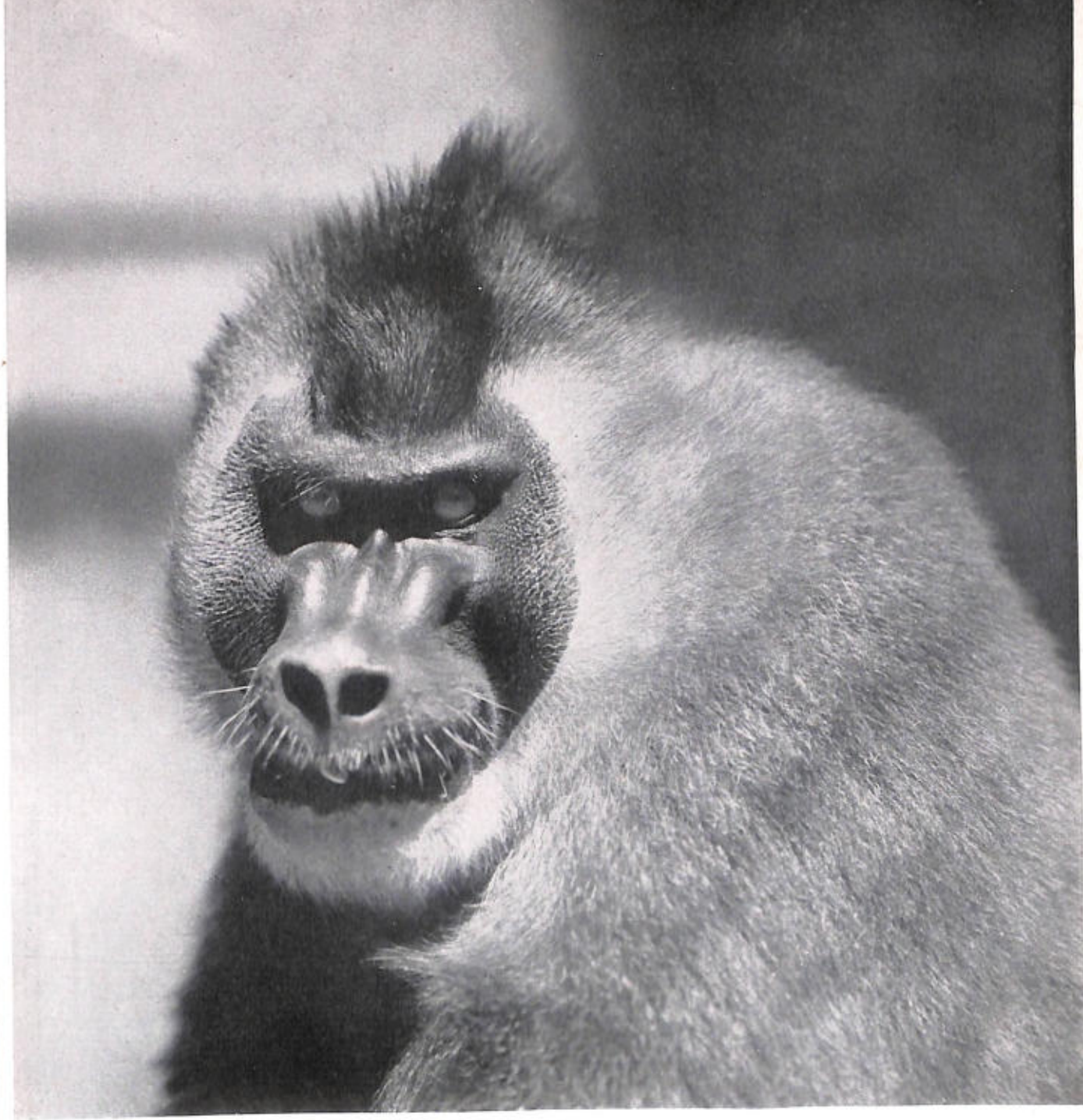
Etched against the jet black background of its wings are bands and stripes and rectangles of the most blazing iridescence, emerald green above, changing to turquoise blue beneath. On the hind wings and the long graceful tails these two colors blend and shift and merge in an exquisite riot of tints which defies human vocabulary. Strangest of all, this gorgeous butterfly is not a butterfly, but a moth, related to those fliers of the night clad usually in soft browns and blacks. Urania is a day-flying moth – so much science can tell us, but its grace and beauty are evident and belong to the eye of everyone who loves the colorful wild life of the tropics.

This moth has a constant migration extending over many months, of thousands upon thousands passing in a steady stream from southwest to northeast. If we are lost in the jungle without benefit of sun or compass, the movement of these splendid creatures passing us may safely be used as a directional guide.

This painting was made by George Swanson on the Society's Venezuelan Expedition and was used by Guillermo Zuloaga, Vice-President of the Standard Oil Company of Venezuela, as a cover for the company's magazine, *El Farol*. Doctor Zuloaga presented an extra edition for use in ANIMAL KINGDOM. He describes it as *"una de las más bellas mariposas del trópico, la Urania, buscando su alimento en el precioso cáliz de una orquisea."*



MANDRILL, a sad-eyed but ferocious fellow . . .



DRILL, a scowler even when asleep . . .

GICAL GARDEN
CALCUTTA

HAMADRYAS BABOON, sacred to the ancient Egyptians . . .

Homing Pigeons in Peace and War

Elaborate Training Enables This Specialized Breed to Travel Long Distances at Almost Incredible Speed

LEE S. CRANDALL

THAT HOMING PIGEONS are being used in the present war as message carriers is perhaps known to most persons. How extensive their use, and how valuable, in a war that according to one military commentator is distinguished from all others by use of the two-way radio, is something that we will not know until the conflict is ended and censorship is lifted from many phases of operations.

In the spring of 1942 the pigeoneers of the Signal Corps at Ft. Monmouth, New Jersey, captured space in newspapers all over the United States by stories of their extraordinary plans for developing an Army pigeon service. Many projects were mentioned, some practicable and others of a nature to make experts and amateurs alike raise their eyebrows. The Signal Corps' publicity department reached the peak of its ingenuity when it was announced that hawks were to be trained to strike down enemy pigeons. How the hawks were to be trained to distinguish between enemy and friendly pigeons was not disclosed.

But Homing Pigeons are being trained by the Army and presumably are being usefully employed. In England, at least, airplanes on certain types of duty routinely carry them and it can easily be imagined that the pilots would be grateful for their feathered message-carriers if their planes were forced down and their radio apparatus disabled. The military value of pigeons carried to extremely high altitudes by planes is less obvious, but experiments in high-altitude liberation have been made, and an ingenious pigeon-parachute has been devised by which the bird is enabled to drift gently down to an altitude where its wings can function properly—for at high levels the atmosphere is too rarefied for the bird's wings to get a sustaining "bite"—and at this functional level the parachute disengages and allows the pigeon to fly free.

Strangely enough, although we bred Homing Pigeons in the Zoological Park during the First World War and their exhibition attracted great interest, we have never published in the Society's magazine since World War I days any extensive notes on this most wonderful of all pigeon breeds. This article is an attempt to make up, in part, for that lack.

Not everyone, presumably, knows what a Homing Pigeon looks like—at least, how it is different from the common "clinkers" of the city streets and parks, and from the "Carrier Pigeon" with which it is so often confused.

Most persons think—and fairly enough, too—that the Carrier is the bird that flies with the messages. If it doesn't, why give it the name? It is because, in the old days, when messenger pigeons could not fly very far, almost any breed would do. The ancestors of the present Carriers were among these. Eventually the Carrier was developed for exhibition and soon became too valuable to risk at flying. For that matter, it would have been useless, for great, fleshy wattles were produced about the eyes and on the base of the bill, so that it would be quite unable to find its way about. But the name persisted, to everyone's confusion. Even the War Departments of the United States and Great Britain carry out the idea today, for the birds that are trained to carry war messages are known officially as Carrier

Pigeons – although they are really Homing Pigeons, plain and simple.

The Homing Pigeon does not look at all like the Carrier. Besides having overgrown wattles on eyes and beak, the Carrier stands much taller. The Homer is hardly more than medium-sized, not so very much larger than the common pigeons of the streets. But it is thicker and stronger in body, with a graceful taper toward the tail. The head, too, is heavier, with the beak wattle large enough to fill the space between the head and bill, giving the bird what is known as a "well filled face." There is also some enlargement of the eye wattle, or cere. These details perhaps seem hardly enough to distinguish one pigeon from another, but there is something about the Homer's manner and appearance that is more important; it looks, and carries itself, like a thoroughbred. Its lines are sharply drawn, its attitude is alert, there is a suggestion of coiled springs.

Homing Pigeons may be almost any color, as breeders pay little attention to this detail. They may run all the way from black to white, but most of them are blue, which is light slate, with two black bars across each wing; blue checker, which is the same thing with the slate of the wing covered with dark markings; or red checker, which is a mild brick color with light and dark wing markings. Sometimes there are white feathers in the wing and tail, or about the head and body. Pure white pigeons, or those with a great deal of white in the plumage, are not popular for flying because their worst enemies, the hawks, are likely to single out the light colored birds for attack.

To a pigeoneer, each bird is different from all others. Each has a distinct personality, for pigeons, and especially Homing Pigeons, differ in their mental make-up just as human beings do. Many pigeon breeders know the character of each bird as well as they know the colors of its feathers. One may be brave, another cowardly, one fierce, another gentle. All these points – and many others – are found in as many shades and variations as there are pigeons.

It is a common belief that a Homing Pigeon will go wherever it is sent, that the owner has only to whisper in the bird's ear! A few days spent with a Homing Pigeon fancier during the spring training season would quickly disabuse anyone of *that* idea. The training of Homing Pigeons is a long and complex business.

A pigeon flies only to its home; after all, that is why it got its name. One might suppose that constant practice would enable it to fly home straighter and with greater speed. Such is the case, and the object of the elaborate training.

Young Homing Pigeons, if allowed to fly freely about their lofts, will cover a distance of several miles in each direction, but never getting very far from home. When they are about three months old, the owner takes them perhaps five miles away and lets them go. Even though their own wanderings have taken them to the same spot before, they always circle a few times, going higher and higher, until they are certain of the right direction. Once this training is begun, it is continued at intervals of two or three days, at constantly increasing distances. If the birds are to be used for racing, training stops at about fifty miles, and they are sent directly into the first race, usually at seventy-five or one hundred miles. If the weather is favorable, pigeons of good breeding fly this without difficulty. Young bird racing usually ends in October, with three hundred miles, although even five hundred are sometimes flown. All through this racing period the contestants receive the very closest attention from their trainers. Their condition is watched constantly, and any that have lost weight are withheld from the daily flying exercises between the longer flights. They are fed carefully on the choicest grains, especially beans, peas and tares, which are known as makers of muscle. Race horses receive no better and no more skillful training than racing pigeons.

In following years when the young pigeons have become matured and have families of their own, racing is continued at greater distances. It begins in spring, usually about the first of May, and continues until July, when it is checked by hot weather and the beginning of molt. When pigeons are renewing the long feathers of the wings, they are too greatly handicapped for flying. Old bird racing begins at one hundred miles, continuing regularly to six hundred and one thousand, though special contests are sometimes arranged at longer distances.

The speed at which Homing Pigeons fly is

Homing pigeons in the loft of the Signal Corps at Fort Monmouth, New Jersey – an extraordinary photograph taken by David B. Eisendrath, Jr.

largely determined by weather conditions. They are likely to become completely lost in fog, are hampered by rain or head winds, may become exhausted if heat is extreme and do not like flying over mountains or wide expanses of water. What they like best is a fairly level course, with cool, clear weather and light following winds. Then they may fly at very high speeds. In 1900, an American pigeon flew one hundred miles at the rate of 2,511.87 yards—nearly a mile and a half – per minute. What was once the world record for 1,000 miles was made by a pigeon named "Bullet," owned in Fort Wayne, Indiana. Bullet flew this distance in one day and eleven hours, time out being allowed for hours of darkness, when pigeons do not fly. This time was not exceeded until 1927 when "Wayne Junior," again a Fort Wayne bird, beat it by a full hour. Such speed over long distances is not possible in Europe, because in countries where pigeon racing is practiced, courses cannot be found that are clear of tall mountains or wide water jumps.

As to how far a pigeon may be sent and still manage to get home, there is some doubt. There are tales of long flights over the ocean and of returns from distant South America. But since there was no official control in these cases, one may accept them as authentic, or not – always remembering that the owner, himself, may be mistaken.

However, proper races have been flown successfully to this country from Havana. This is the more extraordinary when it is remembered that pigeons have an aversion to crossing water.

One long distance record is officially established. This was made by a pigeon that flew from Denver, Colorado, to Springfield, Massachusetts, a distance of 1,689.44 miles. Twenty-two days and three hours were required, showing that the bird worked its way slowly along, stopping for food and water wherever it could find them. While the time certainly is not remarkable for speed, it is a striking example of the stamina and persistence of the Homing Pigeon.

It is sometimes difficult for the uninitiated to understand how there can be a real race between pigeons when the competing birds may be flying home to lofts miles apart, although they all start from the same point. It is all done in "yards per minute."

A surveyor establishes the distance from the point of liberation to each loft – and it is important to have the same surveyor make all the measurements, for otherwise there might be discrepancies. Each pigeon wears on one leg a narrow band of aluminum, bearing letters and numbers, placed there when it was six or seven days old. As the bird grows, the band will no longer pass over the toes, so that the mark is permanent. When pigeons are sent into a race, a numbered rubber band is placed on the other leg and the aluminum and the rubber numbers are recorded. Each owner has a special clock, so arranged that when a pigeon arrives the rubber band may be placed in it and the time recorded to the second. Figuring from the time of release, the clock shows how long the bird was in the air. Since the exact distance between the point of liberation and the loft has been established by survey, the average "yards per minute" is easily figured and the winner of the race can be determined.

All this talk of wonderful flights and dazzling speed naturally brings up the question: How do they do it? Most people who know little of Homing Pigeons, and even some who know a great deal, think that it is done by a mysterious "sense of direction." But even those fanciers who believe in this special "sense" do not rely on it when they prepare their favorites for racing. They train their birds by short, easy flights. They know well enough that even the very best pigeon cannot be relied upon to fly any great distance unless this is done. On the other hand, there is the fact that only the most carefully bred Homing Pigeons will go through this course of education. Pigeons of other breeds may find their way home from distances of a few miles. Half-bred Homing Pigeons have been known to fly one hundred miles. But this is an unusual feat and at greater distances such birds would almost certainly be lost. So, until this "mystery" is really solved, we shall have to satisfy ourselves by saying that, while the Homing Pigeon does seem to have some sort of ability missing in other pigeons, elaborate training is needed to develop it.

Newest Animal—the Kouprey

The Indo-Chinese Forest Ox Was Given a Scientific Name Only Six Years Ago and a Single Specimen Has Been Exhibited

WILLIAM BRIDGES

HAVE all the large animals of the world been discovered? More than forty years ago zoologists would have answered the question with a reasonably secure "Yes"—but then Sir Harry Johnston found the Okapi living in the Ituri Forest of the Belgian Congo.

In 1912 came Ouwen's published description of the Komodo monitor, the ten-foot "dragon lizard."

And as late as 1937 Prof. Achille Urbain was able to make known so large a creature as a wild ox, nor was it a mere race or form of some previously known species. *Bos (Bibos) sauveli*, known to the natives of Cambodia as the Kouprey, or Kouproh, was described as a full new species—even as belonging to a new genus.

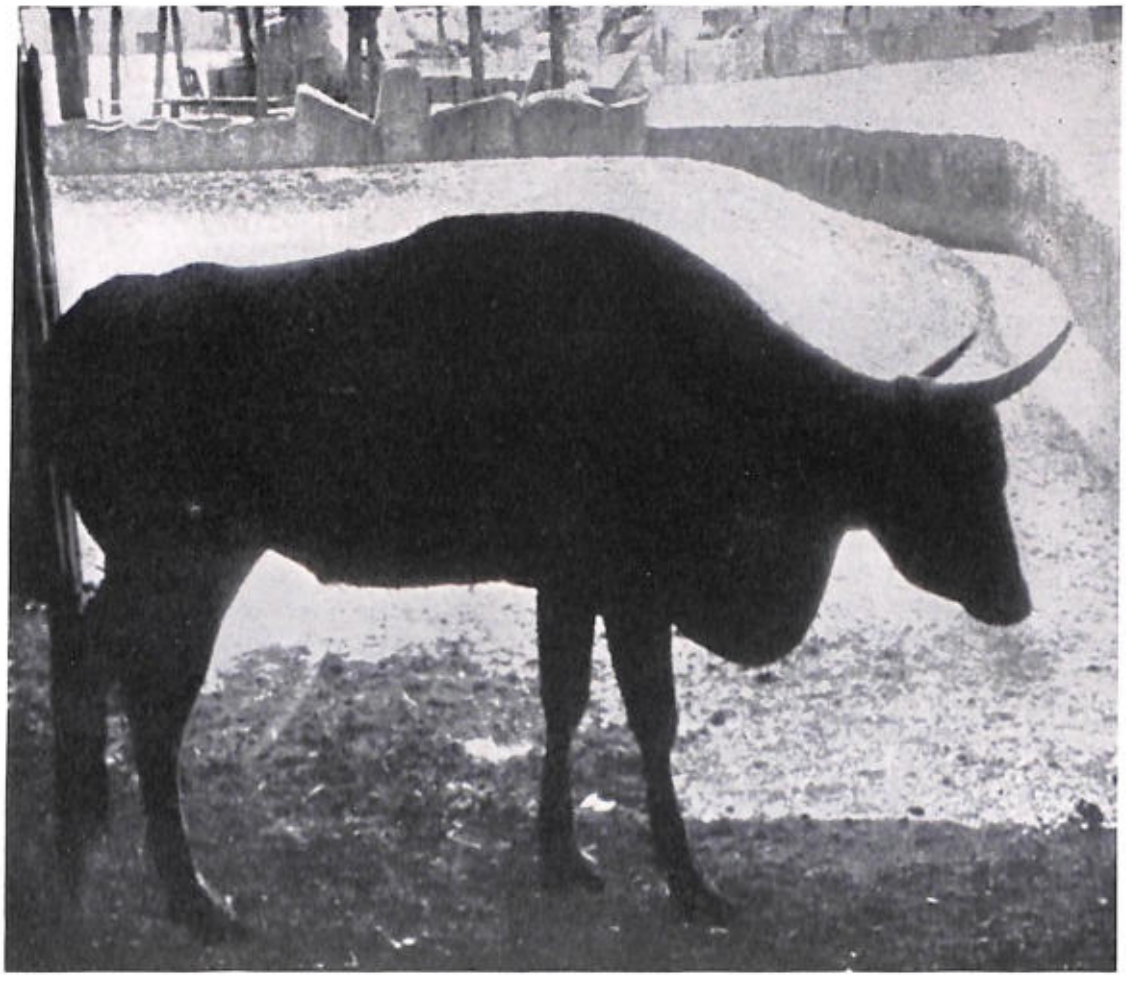
Only one specimen has been seen in captivity. In July of 1936 a young Kouprey was captured near Tchep in North Cambodia and was presented to the Vincennes Zoological Garden in Paris. There it lived peacefully, part of the time as companion to a young relative, the Gaur, until it was mysteriously poisoned in the spring of 1940. The photograph on the following page hardly does it justice but it is the only picture available and is reproduced from the elaborate paper on the Kouprey published as Vol. LIV, No. 6, of the Memoirs of the Museum of Comparative Zoology by Harold Jefferson Coolidge, Jr.

Captain Jean Delacour, who was the leader of the Indo-Chinese Expedition in 1938-1939 during which an adult Kouprey was collected, recalls that the young animal at Vincennes—about four years old at the time of its death—was placid enough when it arrived, but had begun to show an uncertain and dangerous temperament at the age of four years.

So recent is the discovery of the animal and so little field work has been done in Cambodia that almost nothing is known about the life history of the Kouprey and nothing, actually, about the cause of a curious and distinctive feature of the animal's horns. This is the ragged fraying of the horns near their tips. Mr. Coolidge comments that this "seems to be characteristic of the bulls although we know nothing as yet about the actual horn conditions in the cow Kouprey. The fraying is undoubtedly caused by some habit of the Kouprey which involves digging with or scraping the tips of the horns . . . It is a curious fact that extensive fraying of the horns is not to my knowledge associated with any other of the living Bovidae."

In size the Kouprey stands between the Gaur, largest of the world's wild cattle, and the Banting. Its coat of short, glossy hairs is blackish brown, the tail is long and bushy-tipped and the dewlap is unusually large.

Presumably the Kouprey has been known for a very long time to the natives of the Cambodian forests which are its only known home, but no printed reference was ever made to it until 1930 when a hunter-guide named Defosse referred to it in a pamphlet issued to attract sportsmen. Subsequently a few specimens were shot, but the species was not recorded in the scientific literature until 1937 when Prof. Urbain, director of the Vincennes Zoo, published a description of it and named it *Bos (Bibos) sauveli* in honor of Dr. Sauvel, the official veterinarian of North



A silhouette photograph of the only specimen of the Kouprey that has ever been exhibited alive—the 3½-year-old male that was for a time in the Vincennes Zoo in Paris. Not long after, the Kouprey was poisoned.

Cambodia who had shot a number of the animals and had made a series of measurements. It was Dr. Sauvel, incidentally, who captured the young Kouprey for the Vincennes Zoo.

Still later, in 1940, Mr. Coolidge made a thorough study of an adult specimen shot by M. François Edmond-Blanc of Captain Delacour's expedition and as a result decided that it was worthy of being placed in a new genus, which he called *Novibos*. Not all mammalogists are agreed, however, that the Kouprey deserves such distinction, and prefer to place it in the genus *Bibos* together with the Gaur and the Banting – certainly its near relatives and its neighbors in French Indo-China.

Perhaps the New York Zoological Park will someday have the good fortune to exhibit a Kouprey. However, the area known to be its home is remote and transportation is difficult. Nevertheless, one specimen *has* been brought out, so that the Vincennes Zoo was able to exhibit side by side this most primitive of the wild cattle as well as the related Gaur and Banting. After the war, who knows . . .?

One estimate places the possible number of living Kouprey at a thousand head, but since the limits of its range are not known and may well be greater than is now believed, it is to be hoped that this "newest animal" is not also one of the world's rarest.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

LONGEVITY OF BATS

The last of the Vampire Bats that have been an interesting feature of the collection for some years died several months ago, and a search of the accession cards shows that extraordinarily good longevity records were established for a few specimens. One bat lived for six years, three months and seventeen days.

Vampire bats which lived more than one year in captivity were the following:

Desmodus rotundus rotundus

ARRIVED	DIED
Sept. 1, 1934	Jan. 19, 1937
Sept. 10, 1934	Jan. 8, 1936
Sept. 10, 1934	Dec. 27, 1940

Desmodus rotundus murinus

Dec. 16, 1934	Aug. 15, 1938
Dec. 16, 1934	May 6, 1936
Dec. 16, 1934	Aug. 12, 1940
Sept. 20, 1941	Sept. 24, 1942

Food was no obstacle in the maintenance of the Vampires; they consumed only fresh blood, defibrinated, which could be obtained twice a week from a local slaughter house. Almost complete seclusion was found to be highly necessary, however, and the bats that survived over any considerable period were those which were never actually placed on exhibition, but were kept for study in a cage of their own in the feed room of the Reptile House. — W. Bridges.

NEW MEMBERS OF THE SOCIETY

New members of the New York Zoological Society since last issue of this magazine are the following:

Life

S. R. Lindboe

Annual

Mrs. Fred Gordon Blackstone
Dr. E. Burke
Harold H. Helm
Pvt. W. Clark Self
Mrs. Mary Stevens
Dr. Edwin G. Van Valex
Frederick Walz

Junior

Donald Sherwood Aiken
Kenneth Bobrowsky
Dorothy Carlson
Jules M. Crane, Jr.
Mary Schmid
Charlotte Scofield

CRISIS AT THE FARM

The manpower problem, much discussed nationally in recent weeks, struck home at the Farm-in-the-Zoo in March when Farmer Aaron White, who has been in charge of our rural exhibit since its opening last summer, was notified by his draft board that he would be inducted into the Army on April 15.

Attempts to find another farmer to replace Mr. White had come to nothing when the New York *Herald-Tribune* in mid-March printed a cleverly written story calling attention to the crisis. As a result, the Zoological Park was swamped with applications for the job during the next few days. Altogether Dr. Leonard J. Goss, who is in charge of the Farm, received 49 letters, interviewed 29 persons (including 12 women), and received literally scores of telephone applications.

One would-be farmer admitted that he was 84 years old but felt that he could still handle any farm job that came along. Another was a former taxicab driver, retired from service because he was losing his sight. One girl of 16 applied, stating as her qualifications that she had reared chickens in a back yard in Brooklyn. A woman claimed intimate experience with farm work for two years, but was rejected summarily when she said she milked a cow from the left side!

Dr. Goss eventually selected Mr. Joseph Kane, 46 years old, a retired New Hampshire farmer who had moved to Rockville Center, L. I., two years ago because his family wanted a taste of city life.

"We've all had enough of it and we want to get back to a place where there's a cow," Mr. Kane told Dr. Goss.

* * *

The Children's Zoo and the Farm-in-the-Zoo will open their gates for the new season on April 1.

* * *

Early spring brought some rare visitors to the

Wildfowl Pond and the Bronx River – several Goldeneyes, Greater and Lesser Scaup, Hooded Mergansers and American Mergansers.

THE GORILLAS GROW UP

Our two young Gorillas are beginning to grow out of the stage of harmless babyhood. Their strength has developed until thick plate glass is no longer safe under the pounding of their playful fists.

When the routine monthly weighing on March 1 revealed that Oka, the female, weighed 54 pounds and that Makoko was now 71 pounds, General Curator Crandall became alarmed about the indestructibility of the glass that separates the two animals. Both have a habit of pounding on it and bumping against it.

While the glass was being removed and a heavy wire screen set in its place, the male Gorilla explored a corner of the female's compartment, found a pane of glass that was not wire-reinforced, and promptly cracked it.

Then the female took up the pounding and broke a sheet of glass. Both animals were immediately locked up in shifting boxes while workmen installed wire screen guards in front of all glass. Visibility of the two animals is somewhat reduced, but their present quarters at the north end of the Lion House are only temporary and it is hoped that by early spring they can be transferred to their roomy new home in the renovated Primate House.

Makoko was inclined to be aggressive and distrustful of everyone when he first came to the Zoological Park on September 7, 1941. That attitude he has almost entirely lost, although he is still suspicious of the scales used to weigh him each month. Oka willingly climbs on the scales and sits still while her weight is being recorded; Makoko is afraid of the wabbling motion of the platform and cannot be induced to go near it. Keeper Reilly solved that small problem by taking Makoko on his back and standing on the scales himself, subsequently deducting his own weight.

RED FLAMINGOES

Our efforts to retain something of the brilliant scarlet natural to the plumage of the American Flamingo in the wild state, have involved us in a maze of comment and inquiry, varying from mere interest to actual suspicion. We have been covertly, even sometimes openly, accused of withholding scientific discoveries of cosmic value, or of secretly applying crimson dye to otherwise faded feathers.

Actually the truth lies short of both accusations. We have applied no dye, nor have we made any startling discoveries. On the other hand, we have succeeded in wintering our ten Flamingoes, of three species, in really superb condition, a feat which in itself is unparalleled in our experience. Moreover, when the birds emerge from winter quarters, somewhere about April 1, our three birds of the American form will carry a plumage of a brilliance never seen here before.

No secret formula is involved. The whole process has been purely empirical and just how the change has been accomplished, we still do not surely know. We only know that we used every food item known to us that might give the necessary oils and vitamins for the production of the coveted pigment, limited only by the rather peculiar and fastidious feeding habits of the birds.

During the winter their diet has included the following items: whole wheat, soft and white; dog biscuit; boiled rice; sweet peppers, grated fresh daily; raw carrots, finely ground; fresh shrimp; codliver oil and brewer's yeast. Somewhere in this list is hidden the unknown element which has given us at least a share of what we seek, and also the bloom of obvious well-being. Our Flamingoes may not be as brilliant as those of Andros Island, but they are definitely red and delightfully healthy. – L.S.C.

FORTHCOMING SPECIAL EXHIBITS

An interesting schedule of special exhibits has been arranged for the Heads and Horns Museum Gallery in the Zoological Park during the spring and summer.

On April 3 a series of colored photographs of animals, by Mr. S. Carleton Simonson of White Plains, will open and continue until late May.

Following the Simonson show, Dr. William Beebe will recreate some of the atmosphere of his recent Venezuelan expedition, by means of photographs and exhibits of the equipment carried on the trip.

The drama of flags against a March sky has been caught by Robert Coope in this photograph of Baird Court. At either end, the Zoological Society's banners; flanking the American flag are the flags of New York State and City.

"The exhibit will," Dr. Beebe explained, "attempt to answer some of the questions we are asked after we come back from a field trip — "What is the jungle really like? Is it as dangerous as we hear it is? How do you keep well? How do you find and catch your specimens? How do you watch them and take notes?"

Some of the answers to those questions are, of course, answered in this issue of ANIMAL KINGDOM, in "Cashing Jungle Dividends," the article by Dr. Beebe and Miss Crane.

Another exhibition already scheduled is one of news photographs of animals in the Zoological Park, taken over a period of several years by Arthur Sasse of International News Pictures, one of the most skillful news photographers in New York. This exhibition will begin July 3 and continue through August 15.

PUBLICATIONS OF INTEREST

HANDBOOK OF FROGS AND TOADS. The Frogs and Toads of the U. S. and Canada. By ANNA ALLEN WRIGHT and ALBERT HAZEN WRIGHT, Comstock Pub. Co. Inc., Ithaca, New York, 1942; xi-286 pp., 88 halftone plates, $3.00.

Twenty-five years ago at the Zoological Society's research station in British Guiana, I first became acquainted with the marvelous frogs and toads of the South American jungles and with one of Dr. Albert Hazen Wright's excellent batrachian papers. In the swamps and streams, on the jungle floor, and high among the forest trees about the laboratory were strange amphibians; harlequin frogs, *Dendrobates*, who carried their tadpoles on their backs from pool to pool whenever the dry season threatened to desiccate their childhood homes; Surinam toads, *Pipa*, whose females transport their tadpoles in pockets in the skin of their back, and dozens of other

colorful and astounding tree-frogs about whose life histories we could not even guess. Frogs' eggs and tadpoles were abundant and found in all sorts of surprising situations, and for guidance in absorbing the interesting batrachian activities that were all about us, we turned to Dr. Wright's "Life Histories of the Anura of Ithaca, New York", published in 1914, as a model of how a batrachian life history should be treated.

In the present volume, which is based on the similarly named 1933 edition, the Wrights have produced another model of a concise identificational and informational volume on frogs and toads. As a rule, each of the 98 species and subspecies of frogs and toads now recognized from the United States and Canada, are treated on two facing pages, each account containing common and scientific names; range and habitat; size and general appearance; structure; voice, breeding and transformations; plus field notes based on the authors' experiences and on accounts of other herpetological authors. A panel of photographs is given for most of the species, showing not only adults but eggs and growth stages whenever possible. Excellent keys to the genera and species, adequately explained by convincing diagrammatic figures, make the book easy to use, while a good bibliography is available for the student of local faunas. This is a volume to be recommended for the scientist or amateur student who is interested in the delightful, droll creatures of our swamps, streams, lakes, and fields that are known as frogs and toads. — J. Tee-Van.

THE BIRDS OF BRITAIN. By James Fisher. 48 pp., 12 illus. in color, 26 in black and white. William Collins, London, 1942.

As one who has always been just a little amused by the frequent reference in literature to "British birds," as if a whole avifauna were the exclusive possession of our ally (a typical specimen would be the John Bullfinch), I read Mr. Fisher's book with interest. He is one of the statistically-minded younger ornithologists, and reports that 33 of the 133 breeding resident birds of Britain are peculiar to the island. There are, it seems, truly British birds. I can smile no longer at the phrase.

"The Birds of Britain" is a handsome little book, well illustrated in color and black-and-white with plates taken mostly from the famous artist-ornithologists of the past. The text briefly summarizes the history of British birds, the changes taking place in the avifauna and the methods of observation that have contributed so importantly to a knowledge of British bird life. This volume is one of a series of books called "Britain in Pictures."— W. Bridges.

TRAIL OF THE MONEY BIRD, by Dillon Ripley. Harper & Brothers, New York and London, 1942. 305 pp., 18 illus., $3.50.

The "Money Bird" is the King Bird of Paradise and the "Trail" includes much of northern New Guinea and adjacent islands. Incidental are more than a few thousands of intervening miles that must be crossed and crossed again in such a journey.

Whether the "Money Bird" is so named because of its one-time value in the plumage trade or because of the shining disks at the tips of the two middle tail feathers, Mr. Ripley does not say. But he does say many other things, in a style so light and gay that the life of a naturalist-explorer seems filled with joy and fascination. Some of the experiences recounted must have taxed this young writer's ability to maintain a humorous approach but nevertheless he has succeeded in doing so. The book is readable and entertaining throughout, and is so strongly implanted with grains of information that it is definitely instructive as well.

A great deal of excellent natural history observation, usually artfully concealed, is contained in these pages and one, at least, astonished this reviewer. It is a reference to the "sickle-bill" which, by a process of deduction, may safely be taken as a form of *Epimachus*, a genus of large birds of paradise. At the close of its courtship display in a tall tree, the male was seen to make a "nose dive" for fully one hundred feet, check on spread wings and sail back to its perch high above the ground. Birds of paradise, for the most part, are not powerful fliers and the recording of such a performance is an achievement in itself.

The final chapter is devoted to a homeward journey around the Cape of Good Hope, with a varied collection of living specimens. Several of these creatures found a place in the New York Zoological Park and are still to be seen here. — L. S. Crandall.

ANIMAL KINGDOM

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The Cartoonists' Gorilla

Why should one of our well-known cartoonists pick on the Gorilla? The practice of using animals to characterize the lowest traits of human nature sometimes goes almost too far.

In a recent cartoon, dealing with the execution of American fliers by the Japanese, a Gorilla was used to represent the "murderers." The cartoonist may well be forgiven for his ignorance of the fact that these animals live only on a vegetarian diet and that they are quite harmless in their natural state either to man or to other animals, except when called upon to defend the members of their immediate family group. There is no intention here to glorify Gorillas, yet one pauses to wonder how long man must persist in keeping alive the shibboleths and superstitions of the dawn days of the human race. Or, are we humans attempting to justify our shortcomings by implying that they are due to our inheritance from nature?

As to the common belief that nature is a condition of "hunt or be hunted," "kill or be killed," it is a striking fact that when all of the larger and higher types of mammalian animals are considered, the carnivores, namely those who live upon the lives of others, are merely outliers among the great animal populations — a minority party indeed! In fact, it is estimated that the number of carnivores would not exceed one percent. of the total animal populations as they originally existed in Africa, or in North America — that is, before man decimated the wild life of these continents.

There is more that had perhaps better be left unsaid. In any case, we are not out to reform the cartoonists.

Fairfield Osborn

IN THIS ISSUE

Otter on the Alert . . . . . COVER
Apotheosis of the Zoo . . . . . *William Beebe* 50
Ten Ways of Helping Baby Birds . . . *Lee S. Crandall* 56
Alas, Poor Annie! . . . . . *William Bridges* 58
Portraits of Four Primates. II. 59
Before Montefiore Joash Sunshine . . *Claude W. Leister* 63
Behind the Scenes: News and Notes 71

SHOP TALK

Much against our inclinations, we have to say a good word for rain — to be exact, the rain that has been falling on the Zoo since (it seems) time immemorial. It was the cause of us getting the very superior picture of an otter that decorates the cover of this issue of ANIMAL KINGDOM.

When we proposed to Sam Dunton, our staff photographer, that he try making a series of shots of Emil Liers' otters just for the sake of a photographic record, his brow clouded and it looked as if Sam, too, was going to rain. The usual playing places of the otters, around Baird Court, were not suitable for the kind of pictures Sam had in mind.

But then he brightened. "All this rain," he said, "has made a fine swamp back there in the woods. Suppose I took the otters down there and got them in a natural habitat, sort of?"

So we said, "By all means, the swamp."

It was a good idea in one way, and in another it wasn't. Two hours later Sam came dripping back.

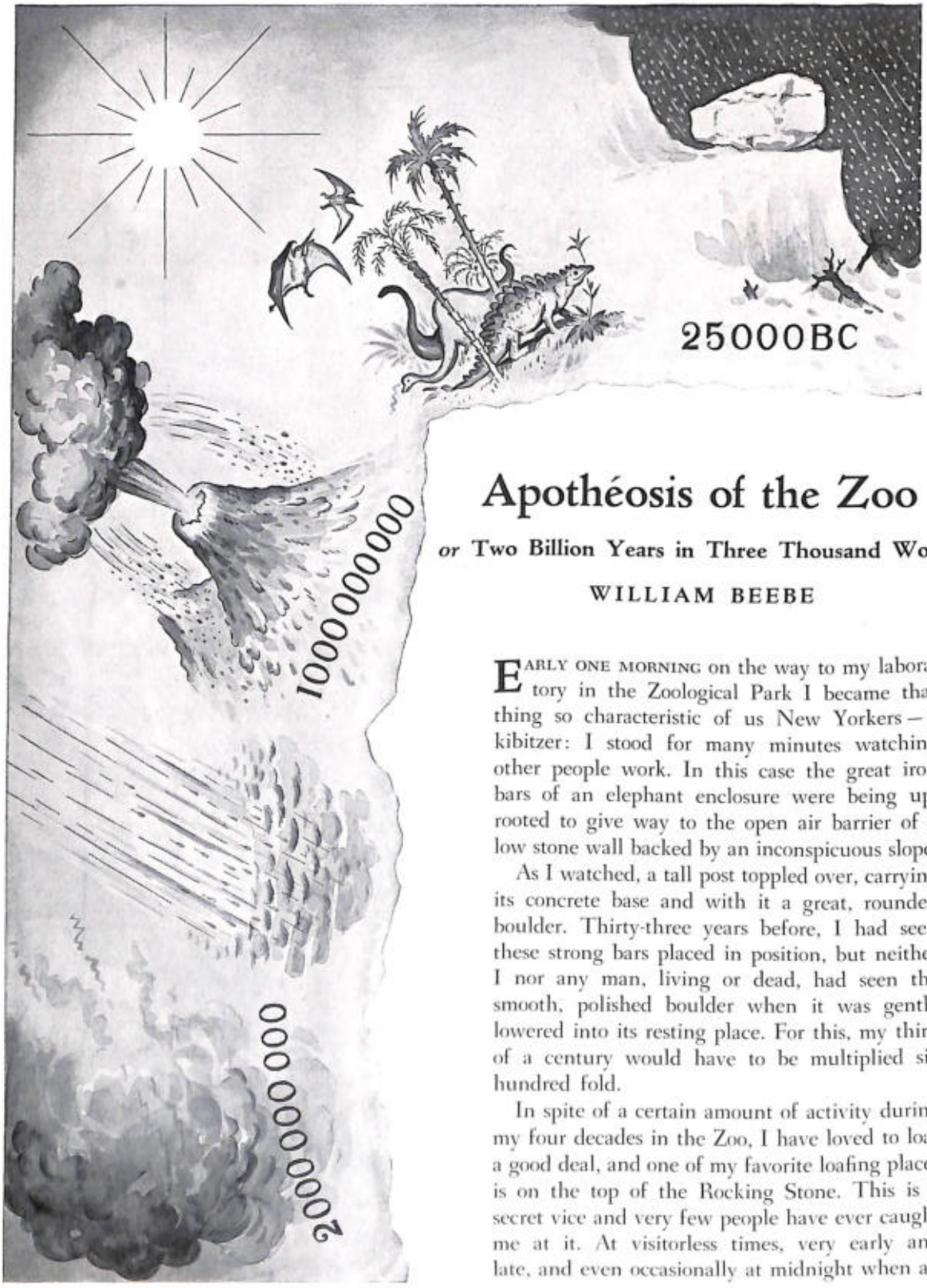
"On the way to the swamp," he said, "I found a honey of a rock ledge and posed one of the otters there. It's just the kind of a picture you want."

But what about the swamp?

"Oh, just as I thought, the rain made a fine swamp and the otters loved it," Sam explained. "I didn't get any pictures at the swamp, though. I fell in."

* * *

Anybody got a haywagon he wants to lend the Zoo for the summer? We've been running a "haywagon taxi" between the Zoo and the Farm-in-the-Zoo this summer on week-ends only, and people stand in line — hundreds of them — for a chance to get aboard. Another haywagon would be just dandy, but the species seems to be pretty near extinct around New York. — EDITOR.



Apothéosis of the Zoo

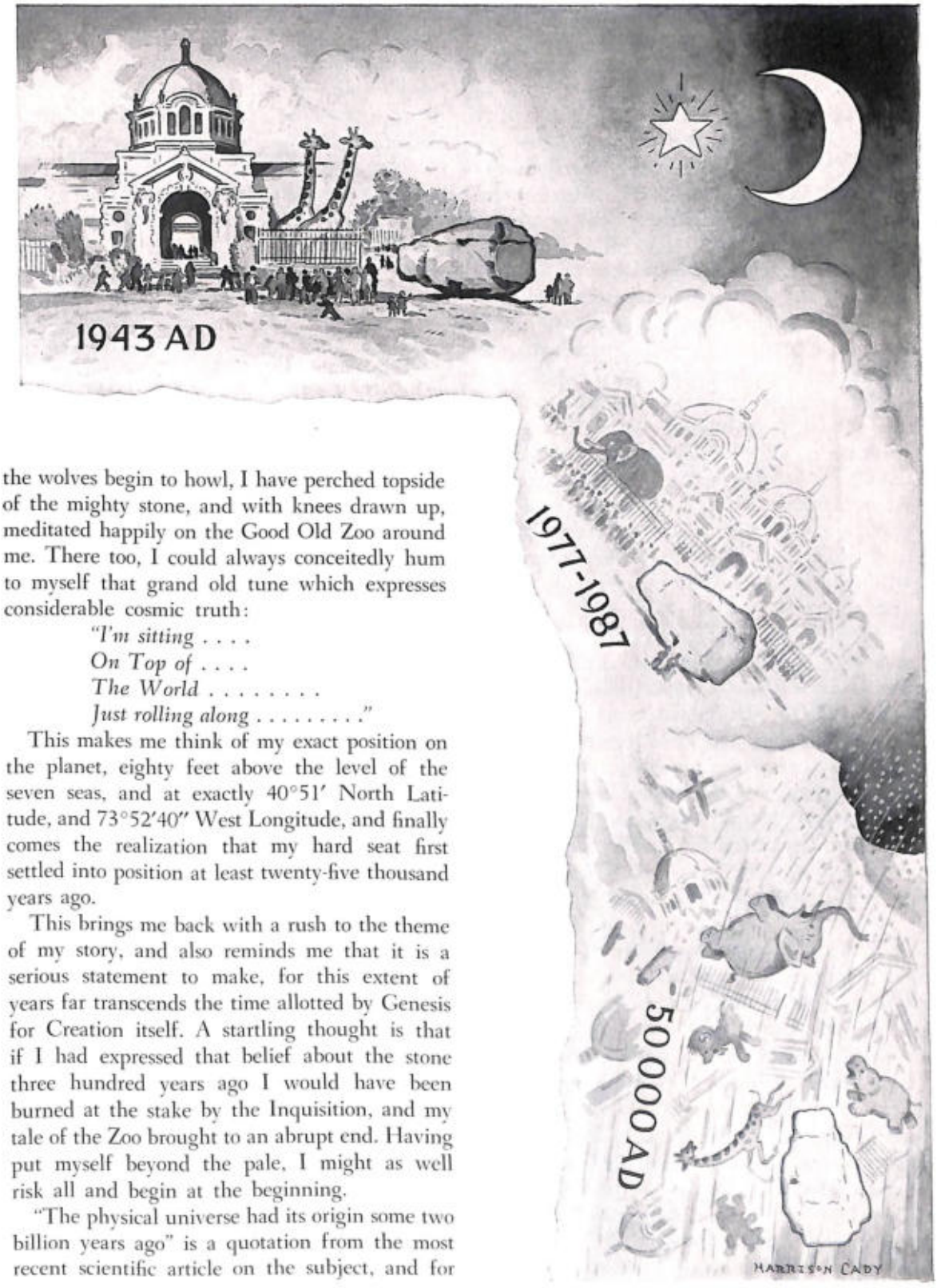
or Two Billion Years in Three Thousand Words

WILLIAM BEEBE

EARLY ONE MORNING on the way to my laboratory in the Zoological Park I became that thing so characteristic of us New Yorkers — a kibitzer: I stood for many minutes watching other people work. In this case the great iron bars of an elephant enclosure were being uprooted to give way to the open air barrier of a low stone wall backed by an inconspicuous slope.

As I watched, a tall post toppled over, carrying its concrete base and with it a great, rounded boulder. Thirty-three years before, I had seen these strong bars placed in position, but neither I nor any man, living or dead, had seen the smooth, polished boulder when it was gently lowered into its resting place. For this, my third of a century would have to be multiplied six hundred fold.

In spite of a certain amount of activity during my four decades in the Zoo, I have loved to loaf a good deal, and one of my favorite loafing places is on the top of the Rocking Stone. This is a secret vice and very few people have ever caught me at it. At visitorless times, very early and late, and even occasionally at midnight when all



the wolves begin to howl, I have perched topside of the mighty stone, and with knees drawn up, meditated happily on the Good Old Zoo around me. There too, I could always conceitedly hum to myself that grand old tune which expresses considerable cosmic truth:

"I'm sitting . . . .
On Top of . . . .
The World . . . . . .
Just rolling along . . . . . ."

This makes me think of my exact position on the planet, eighty feet above the level of the seven seas, and at exactly 40°51′ North Latitude, and 73°52′40″ West Longitude, and finally comes the realization that my hard seat first settled into position at least twenty-five thousand years ago.

This brings me back with a rush to the theme of my story, and also reminds me that it is a serious statement to make, for this extent of years far transcends the time allotted by Genesis for Creation itself. A startling thought is that if I had expressed that belief about the stone three hundred years ago I would have been burned at the stake by the Inquisition, and my tale of the Zoo brought to an abrupt end. Having put myself beyond the pale, I might as well risk all and begin at the beginning.

"The physical universe had its origin some two billion years ago" is a quotation from the most recent scientific article on the subject, and for

a completion of the sentence we may go back two thousand years in human history and quote an unknown author in the second verse of Genesis, "– and the earth was without form, and void." We have a silly, trite phrase that *Time is Money,* so when I ask you to consider what the Zoo looked like two billions of years ago, the American mind of 1943 is not wholly staggered, for every newspaper tells us of the spending of many times more dollars.

Any attempted definition of universe formation is outside of my humble thesis and beyond my ability. What would you expect of me in view of the fact that curved space permits the possibility of four hundred million nebulae, all whirling madly in a universe of finite volume but without boundaries! I even ignore the astronomer's naive classification of "Our Local Group" of a dozen isolated nebulae, and am satisfied with considering an infinitesimal portion of the minute speck of dust in our lonely stellar system – a speck, our earth, which at present we are so earnestly endeavoring to depopulate.

I have casually offered for your consideration a formless pre-world, yet we must admit that somewhere in space, even then, were the basic materials for a Zoo. Astronomy presents a vision of whirling, white-hot gas, composed of isolated elements. Cooling and concentration brought these lonely inorganisms into closer relation; gas thickened, began to boil, then to flow and hardened into rocks; hydrogen and oxygen flew together and made steam and water; carbon, oxygen and nitrogen became air. This is all so glib and so unreal as we wander about the Zoo today that I feel I must do something about that two billion. There is no denying that it is a heck of a time to separate us from all the days of the soft-boiled earth. So let us exchange past time for the present and think up a bit of modern magic.

We stand in the center of the Zoo on a gray, rocky outcrop, and box a forty-mile compass circle: Garrison, Bridgeport, Setauket, Asbury Park. Not very exciting and of interest chiefly to commuters whose trains may or may not arrive within the two-hour schedule. But there are other directions, so look up, and if the day is clear you can see much farther than forty miles. But there is no commuting and only the brave little meteorological balloons can bring us word from naked space: thinnest of thin air and the bitter cold of the "Wind that blows between the Worlds," ninety degrees or more below freezing. Finally we look down, and see nothing but our feet standing on the hard, rocky backbone of the Zoo. But geologists and physicists can provide mental vision and they assure us that forty miles down will bridge the two billion years; an inverted Asbury Park distance will bring us to a temperature of molten rock, twenty-five hundred degrees of heat, at which steel itself runs like water.

Still more magic is ours, for the very outcrops on which we stand are igneous, fire-formed gneiss, and when we realize that some of the rocks of our northeastern United States are the oldest on the whole planet, we know that we have conquered both time and space within our Zoo today.

We have now seen our aforesaid Zoo materialized, brought to a gentle simmer, and set aside to cool by the First Great Cosmic Cook, Chemist and Creator. For this we must allot the whole of the first billion years. Then begins Act II in the Drama of Creation. Just as the elements arranged themselves into air and water and earth, so somewhere, sometime, somehow, a new sublimated synthesis came to pass, and what we call Life was born.

We are now started on our second billion years, but our Zoo thesis does not require any detailed accounting eon by eon. Beginning with humble animal-plant blobs, we pass on through amoebas, sponges, corals, worms, starfish, clams, lobsters and spiders, bees and butterflies, fish, frogs, lizards, birds and mammals. Here again we do not need to go back through the billion years or to depend on fossils or even living creatures from far distant seas and lands. Within the confines of our Zoo's two hundred and sixty-one acres, there are today eleven out of the thirteen major groups of creatures living on the planet.[1] This is really a very remarkable thing, a Zoo within a Zoo, hundreds of species of wild animals, requiring no cages or special food or keepers. All eleven groups are on exhibition to any of us with sufficient curiosity.

[1] The only two missing groups are the marine phyla typified by comb-bearing jellies and by starfish.

Let us consider only three primitive lives — all to be found in our lakes or our river: a lowly Flagellate, a veritable mote of life, that whips itself about in the bottom slime, and may be so archaic, so dateless, that it simulates a plant in the daytime and an animal at night. Or the Amoeba, an immortal single cell, whose forebears appeared in the very womb of the world, and whose simple self typifies the stuff for the formation of all higher animals, including those of us who love to flatter ourselves that we "made" the Zoo. Lastly, marvel please, with me, at the lovely Volvox which rolls with dignity across our microscope stage, a dignity well deserved, for in its being it mirrors the early, many-celled organisms which were to culminate in sequoias and elephants. Volvox is also exciting, even at this late, sophisticated date, as adumbrating the beginning of sex.

Long after all birth pains of the Zoo were past, our pleasant plot continued to have an exciting time. More than once it was completely submerged, with the Atlantic breakers roaring high above its water-soaked granite. Another time it slowly reared itself up until it was far inland, while the neighboring Hudson River cut a magnificent gorge for itself a hundred miles out at sea. Bitter cold alternated with such blazing tropical heat that palms and cycads flourished on the shores of Greenland far to the north.

To lessen the strain on the time lobe of our human brain, let us forget billions and come down to a mere two hundred million years ago in the Zoo. Four miles away, at Fort Lee, Manhattan's Oldest Inhabitant lived at this time, a twelve-foot, weird, crocodile-like reptile with rows of terrible teeth. His bones were recently dug out of the Palisades, rather low down, for as yet no New Jersey volcano had built them up with outpourings of lava.

From now on a Zoo collector would have gone mad with joy anywhere in the United States or elsewhere, and what exhibits could be shown! Imagine the Flying Cage filled with dragonflies whose filmy wings stretched almost a yard across, or a flock of long-tailed, downy Archaeopteryx gliding from tree to wire, while diminutive dinosaurs, smaller than chickens, scampered gracefully about on their hind legs.

If a crate came to the Zoo containing a Pteranodon we would be at a loss where to put it — that naked, dragon-like flying reptile with a wing spread of twenty-four feet. And while we are at it, let us revel in a welter of imagination at finding a leathery-shelled egg as big as a football in that same crate! How easy to visualize the sea-lion rocks removed and a Brontosaurus swashing slowly about with head and neck reared twenty feet above the heads of the visitors.

In those early days the reptile department of the Zoo would dominate all others. There would be no bird house. Only a few small cages to accommodate loon- or tern-like feathered primitives with powerful teeth in their beaks. The aquarium would be large and varied, and a few giant amphibians would crawl about their enclosures. Our Botanical Garden neighbor would have a splendid showing of giant mosses and ferns, conifers and cycads, but not a single flowering plant.

Finally, the mammal department would be the least interesting of any in the Zoo, exhibiting a few, small, furry animals, looking like arboreal shrews. In the wild each was a veritable "Wee sleekit, cow'rin', tim'rous Beastie," creeping about at night on its search for insect food, in complete terror of its life from any reptile larger than an iguana. Far from being Lords of Creation, Makers of Zoos, we human beings, in this Mesozoic Era, were not even thought of. We would come along in due time thousands upon thousands of years hence, as the lineal descendants of these shrew-like, weakling, cockroach-eaters.

Having taken a long, humble breath after this last thought, we plunge again into the past. The present is hurrying toward us; less than a million years are left before we ourselves walk upon the stage, but rocks and mountains, fossils and crystals all provide a decipherable palimpsest. Four times, continents of ice push south, two of which drive across and overwhelm the Zoo. The last time, when the old stagnant ice finally softens and melts, it lowers into place stones, gravel and soil, and with these the smooth boulder in the elephant yard, and even our Rocking Stone, lowering it gently, delicately. It comes to rest exquisitely balanced, so that anyone can push against and sway its fifty tons, to and fro. Three times the ice sheets retreat, with long

seasons of great warmth following in their trail. We are now living at the beginning of the Fourth 'tween Ice Age Summer.

A veritable cavalcade of wonderful animals now lived in and around the Zoo, passing over the very rocks on which we stand, or within galloping, hopping or flying distance. This we know: walruses frolicked off Long Branch; giant beavers and bisons, huge ground sloths, hairy tapirs, out-sized peccaries and at least two species of sabre-tooth, stabbing tigers all lived at our gates, or within one hundred miles. Forest horses galloped as near as Throg's Neck, all-American steeds, unlike the immigrants of Cortez and today. Imperial mammoths, more than thirteen feet high, with tusks four yards in length, may have swung in herds past the Rocking Stone, but were seen by no living man here, although ancient cavemen of France fought them, and refrigerating Siberian glaciers spewed them forth, perfect in flesh and hair. The last mastodon which walked through our Zoo slipped into a peat bog three miles away, at Broadway and 141st Street, and died there.

When the last ice began to melt there came men of old, wading or canoeing across from Asia to Alaska, and then spreading over all the land, until we have the first record of them as Red Indians. Warriors and hunters from the Hackensacks, Tappans, Rockaways, Montauks, Navesinks and especially Mohicans and Manhattans hunted and fought in or near the Zoo, and probably spied out the land from atop the Rocking Stone.

Up to now, Time, to the Zoo, had been an illusion; merely successions of cold and heat, darkness and light, without name or classification. Then one day a symbolic number fixed by human mind arrived, significant, but almost laughable in its pettiness, a momentary full-stop lost in time and space – namely the third of September, 1609. Or if we wish to make the most of man-counting time, let us say that when this paper and print meet your eyes, a few more than one hundred and twenty thousand sunsets will have come and gone since a lonely Englishman leaned on the rail of his little shallop off Staten Island, and gazed toward the low, forested shore on which he was to land. Ten days later Henry Hudson sailed past within three miles of the Zoo.

Time, as we know it, now passed swiftly. There were fights between Indians, Dutch and Englishmen on or close to the Zoo. One of my very special treasures is an almost perfect Indian arrowhead which I picked up one spring, washed out of the side of the bank of the Bronx River near the falls in the Zoo. It is made of flint of a pale yellow color, unlike any type of stone in the vicinity of New York City.

On the twenty-third of October, 1776, a small band of patriots under Colonel Hand defeated a larger number of Hessians at Williams Bridge. Today, one hundred and sixty-seven years afterward, in several places in the Zoo, I see the sign *Air Raid Shelter,* a hint of the most recent conflict between the descendants of those same patriots and those same Germans.

Forty-four years ago, much of the Zoo was a wild tangle of undergrowth and forest, the buildings still in the stake-and-string stage of a boom town. The evolution from then until today has been smooth and unbroken under the leadership of Green, Morton, Osborn, Grant, Cross and Osborn *bis.*

But we may not draw breath, we cannot stop a moment in the present. As I write these words, they already become past. Next year will be 1944; six years more, 1950. On and on time goes. We can imagine unbelievable changes in our beloved little plot of ground. We have seen it in thought pass from cold cosmic space, on to gas and steam and boiling water; through fiery molten chemicals cooling to solid igneous rocks. The waters rise and engulf it, then sink; soil and air stabilize; life appears and evolves with no human eye to see. A superlative array of reptiles and mammals passes in review, with no cage to confine, no man to wonder. If we keep to the cosmic schedule, the inception and development of our present Zoo occupy only a fleeting second of geological time, conservatively, one forty millionth.

What of the future? As I write, let us suppose hundreds of thousands of years have already passed. It is in the dim, distant future, and my faltering human mind can be certain of only one ultimate happening.

Let us visualize it: I came into the Zoo a few weeks ago in a driving snowstorm. The

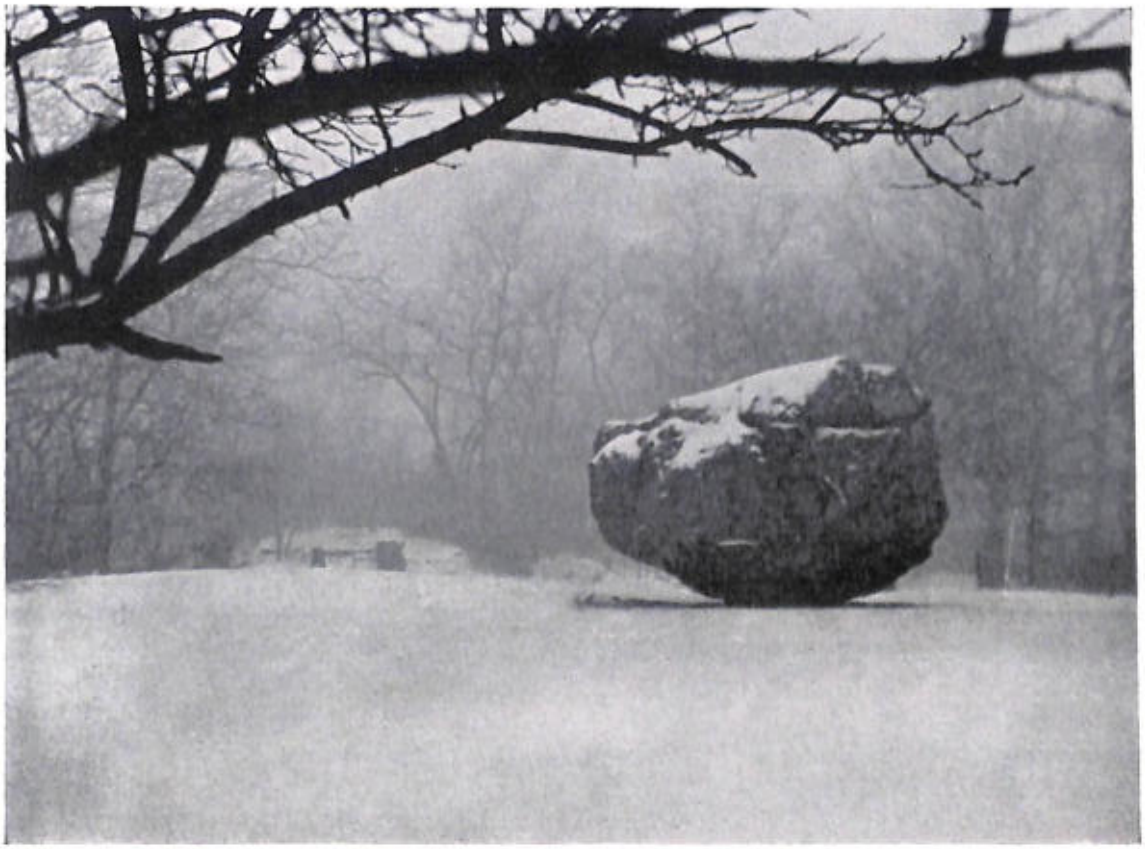
Rocking Stone was capped with white, and, all around, the ground was a foot deep in millions of snow crystals. My imagination can conceive the next day and the next and the next as of continued storm; frantic radio messages come from Canada of a slow-moving continent of ice, coming nearer and nearer, of never-ending snow. From along all ocean shores come reports of the slow sinking of the sea itself, leaving the beaches bare and frozen.

Ice Age Number Five is on its way!

All animals and human beings flee southward or perish. No man-made explosives or heating plants can do anything to stop the cataclysm for a moment. Soon come the last living creatures, polar bears whimpering with fear, snowy owls, muskoxen searching for a final bit of moss, walrus swimming down the coast. At last the enormous pale green ice front of cliff, perhaps a half or a full mile in height, crunches and grinds its way to the Zoo, just as it has done twice before. The houses, everything, crumble like clusters of twigs and pebbles. Last of all, if there could be any human eye to see, the age-old Rocking Stone itself is stirred, pushed from its bed, and like a great snowball rolls slowly southward in the fore-front of the glacier.

Time Marches On!

[Probably it is not necessary, but just the same I call our readers' special attention to the two drawings at the beginning of this fantasy. Harrison Cady made them; one of America's foremost illustrators took an hour off to contribute to the gaiety of Zoology.]



". . . the Rocking Stone was capped with white, and, all around, the ground was a foot deep in millions of snow crystals . . ."

Ten Ways of Helping Baby Birds

This Is the Time of Year When Boys with Shoeboxes Are Likely to Be Bearing Gifts to the Zoo

LEE S. CRANDALL

IF TWO BOYS and a shoebox come into the Zoological Park on a spring day, the chances are that the shoebox contains:

(1) A baby bird (or birds),
(2) A garter snake, or
(3) A turtle.

In the opinion of the Bird House staff, the box *always* contains baby birds, for dozens of fledglings are presented for care and feeding, or attention to injuries, every spring. The donations seldom are as complete, however, as one that came during the first week in May. Two boys from Yonkers arrived with a lard can containing a whole robin's nest and three baby robins not more than two days old. They explained that a neighbor had cut down a tree, not knowing there was a nest in it, and they had rescued the nest and its occupants. The Bird House staff accepted the gift—unenthusiastically, for feeding three voracious baby robins for a couple of weeks until they can feed themselves is a good-sized job. Nevertheless, there was nothing to do but to accept the responsibility. Otherwise the birds would have starved to death, for their parents would be unlikely to continue feeding them if the nest were taken back to the neighborhood of the original nest-tree.

The problem of what to do with baby birds that get into difficulties is one that perplexes hundreds of persons each spring, to judge from the telephone calls to the Bird Department. For their benefit we have compiled a list of hints on care and feeding.

But we ought to emphasize, however, that only emergency treatment should be given young birds because under New York state conservation laws it is illegal to harbor wild birds, with very few exceptions. The law states that they "shall not be taken or possessed at any time, dead or alive," except under special permit. At the State Conservation Department's information office at 80 Centre Street, New York City, it was said that it is all right for anyone finding a fledgling bird on the ground to put it back in a tree or nest, but that the Conservation Department should be informed if the bird were actually kept for feeding and treatment. The proper procedure would be for the person caring for the bird in New York State to write the circumstances to William G. Jacquemin, State Conservation Department, 80 Centre Street, New York City, whereupon the circumstances would be investigated by the department. The humanitarian would thereby be protected in case he was reported by someone as illegally keeping a wild bird.

Our ten best suggestions for temporary and emergency measures to keep very young birds from starving to death or being killed by cats and dogs are:

1. If a nest containing young birds is blown out of a tree, try to put it back in its original site. If the birds are very young, the mother will probably continue to feed them; if they are almost old enough to fly, they will probably refuse to stay in the nest. This is natural and nothing need be done about it.

2. If the nest is destroyed or helpless birds are found on the ground, they can be put in a substitute nest. This should be lined with something soft—cloth, cotton or dried grass roughly shaped into the form of a nest. The purpose of this is to give the young birds' feet something to push against; if placed on a hard,

Suburbanites are always worrying about "ferocious bluejays" swooping down to attack pedestrians who pass under their nests. Curator Crandall's advice is: Stay away from the nest or pay no attention to the fluttering birds.

flat surface their legs will spraddle and because of their rapid growth at this period will be likely to "set" in a spraddled position.

3. Young birds placed in a temporary nest should be covered with a cloth and kept warm, as they are used to being hovered by the mother and kept warm.

4. Baby birds must be fed at intervals of at least half an hour during the daytime. If they are very young they will open their mouths to be fed when their nest is jostled. Slightly older birds, getting on toward the flying stage, will be too frightened to open their mouths and their beaks will have to be opened by the fingers.

5. The proper method of feeding a very small bird is to push a bit of food into its open mouth by means of a smooth spatula or a pair of blunt forceps, or even by two small sticks held in "chopstick" fashion.

6. Small birds should never be given water from a medicine dropper. When they are old enough to sit on a perch, water can be offered them in a shallow dish. Small birds are quickly killed by water given them forcibly.

7. Proper food for baby robins, bluejays, orioles, catbirds and sparrows is:

Canned dog food.

Pellets made of bread crumbs and hard-boiled egg, moistened with cod-liver oil.

Bits of grapes, cherries, bananas or mealy apples.

Pieces of earthworms that have been "squeezed out."

Small pieces of scalded chopped meat.

8. Young birds that are able to fly only weakly and are in danger from cats and dogs while on the ground, may be placed in a tree out of harm's way. The parents will find them.

9. Birds assisted by their human friends should be turned loose at the very earliest moment, not

only because it is illegal to continue to keep them but because they will become unable to find food for themselves if they are accustomed to being fed by hand. Normally the parent birds teach the young to find food, and human assistance is no substitute for the bird's own efforts.

10. Suburbanites should not be afraid of baby birds and their parents. Each spring usually brings reports from nearby towns that "ferocious bluejays" are attacking people. Our advice is to stay away from the vicinity of bluejay nests or, if that is not possible because a nest is near a public walk, to pay no attention to the darting and fluttering of the birds. They won't hurt anybody.

Alas, Poor Annie!

WILLIAM BRIDGES

IT IS A fine point whether a penguin that has laid a fertile egg is any part a parent. That she is not wholly fulfilled, both nature and the popular idea agree; nature decrees an additional devotion of thirty-eight days of incubation. The popular idea is, "Let's see the chick!"

Alas! Annie, our romantic black-footed penguin, having fulfilled and more than fulfilled the requirements of nature, can still not satisfy public clamor. Annie will have no chick in 1943. Her first egg was a shaker.

As penquin lives go, hers has been a full one. At the very beginning of her career in the old Aquarium she assumed a leadership never successfully challenged. She was not found wanting when called upon to exemplify the athletic and the intellectual powers of her kind at the Zoological Society's building at the World's Fair. When other penguins hung fearfully back, appalled by thoughts of translation from dry duckboard to the aqueous element of the Penguin Pool, it was always Annie who made up their minds for them. When it came to diving, Annie's dive was always the best.

Until laterly she had no mate. Last winter a handsome Humboldt found favor in her eyes. But it was an ill-starred match; no sooner had she found a friend than a rival appeared. Her indignant mate felt obliged to kill him.

Annie's first egg was deposited on April 6 in a nest compounded of sticks, old fish heads, peanut shells and cellophane wrappers. She nested dutifully. Her egg was fertile. But somehow, some time, during those thirty-eight critical days it stopped developing.

Alas, poor Annie!

On the last day of her vigil, Annie devoted herself to her nest while other penguins gathered around as if to keep her company. Annie's Humboldt mate was restless; he is the bird in the upper right corner of the scene.

Portraits of Four Primates. II.

Spider Monkeys have a perpetual air of surprise, not only at the actions of the human beings who watch them but at each other and at themselves. Yet their surprise and puzzlement is seldom real; they are self-sufficient creatures and almost never at a loss for something to do next.

This portrait (one of the series of magnificent primate portraits in the Zoological Society's publication, "Monkey Faces"), is not quite such a perfect example of head-scratching bewilderment as it seems. Nothing ever seemed to worry this particular Spider Monkey. It was the photographer who had the worry of trying to get it to sit still long enough to have its picture taken.

WOOLLY SAPAJOU . . . haircut in the style of Mr. Pecksniff

YOUNG GORILLA . . . the beginning of a tantrum

Before Montefiore Joash Sunshine...

A Long Line of Ancestors Stretches Back from Domestic Cattle and Its Beginning Is Lost in the Mists of Antiquity

CLAUDE W. LEISTER

MONTEFIORE JOASH SUNSHINE is the name of a modern milk-producing machine. To a farmer, and to the visitors to the Farm-in-the-Zoo who cluster around her at evening milking time to watch fifteen quarts of milk rise foaming in the pail, she is a cow, a particularly fine specimen of the black-and-white Holstein-Friesian breed. But zoologically she is just a milk-producing monstrosity man has created out of the possibilities inherent in the ancient *Bos taurus* of Europe.

It is a long way back from Montefiore Joash Sunshine to the beginnings of her kind. Before Montefiore Joash Sunshine there were Osborndale Sir James Homestead, her sire, and Montefiore Miss DeKol Ona Fayne, her dam, and before *them*, there were four other pure-bred Holstein-Friesians, probably all endowed with equally fantastic registry names.

Their ancestors, too, were Holstein-Friesians and it might be possible to trace a direct line of descent back a hundred years or more. We know that the first cattle of that particular breed came to the United States in 1795 from Holland and Northern Germany, where the breed originated. But the record begins to fade out not long after it reaches Holland, just as it fades out for other domestic breeds of cattle when it has been pushed back a century or two to their countries of origin.

Just how little is definitely known about the beginnings of modern domestic livestock we at the Zoological Park began to appreciate last year when the Farm-in-the-Zoo was opened for the first time. The more scientifically-minded visitors, remembering the cow-like form of certain of the wild bovines in the Zoo itself, wanted to know whether our domestic cattle—Holsteins, Jerseys, Angus, Herefords—were related to the wild types.

To answer that simple and natural question is usually difficult and sometimes impossible, as far as linking specific wild and domestic types is concerned. This article will attempt to tell some of the reasons why.

* * *

The New World has had an insignificant part in the evolution of wild cattle and the formation of domestic races. The family Bovidae, including cattle, sheep, goats and antelopes, is of Old World origin and did not come to North America until the Pleistocene, something like 800,000 years ago, when forms of the musk ox, bison, mountain sheep and mountain goat entered the continent by way of the Bering land bridge. While these animals gradually extended their range south and east over the continent, and the musk ox, the earliest of the immigrants, was forced by succeeding glacial periods into territory south of the Ohio and Potomac, not a single species reached South America, leaving that country entirely without representatives of the family.

The North American Indian and the Eskimo were primarily hunters and lacked the incentive to attempt the domestication of the wild animals at hand. Certain Indian tribes doubtless half-tamed occasional bison calves but we know from our own later efforts that the domestication of this animal is virtually impossible. The musk ox is utterless hopeless in this respect.

The first domestic cattle in America were brought by Columbus, in 1493, on his second voyage. Our Texas longhorns date back to Spanish parent stock brought from Santo Domingo

The milk producing machine known as Montefiore Joash Sunshine is a registered Holstein-Friesian cow, and a particularly fine specimen of her breed. She was lent to the Farm-in-the-Zoo by the Holstein-Friesian Association of America as an example of a type that is extremely popular on New York State farms. She gives about 33 quarts a day.

to Vera Cruz, Mexico, in 1521. Outside of its historical connection with our southwest, this breed is particularly interesting because so many of these early animals were allowed to go feral that natural selection and reversion played a large part in producing the animal we know as the old time Texas longhorn. Good examples are rare today.

Early American settlers brought their favorite breeds of cattle, largely of English origin, along with them to the New World. The condition thus established has been maintained to the present day and practically all of our foundation stock has come from the British Isles and western Europe. There are no truly American breeds and our role in cattle breeding has consisted largely in improving existing breeds. The better known of these improvements, which are usually referred to as American breeds, are the polled Hereford, the polled shorthorn and the French-Canadian.

To place domestic cattle zoologically, we find that, according to Lydekker, they belong to the Taurine group of the Bovidae, which also includes the humped cattle of India and Africa. Other groups are the Bibovine, including the gaur, gayal and banting; the Bisontine, including the bisons and the yak; and the Bubaline, the buffaloes.

In gross appearance members of each group are much alike, except in size and color. The wild gaur of India and the Malay peninsula is an enormous animal sometimes exceeding six feet in height at the shoulder. The anoa or pigmy buffalo of the Celebes is slightly over three feet in height, the smallest of the species represented in the above groups.

Our beef and dairy cattle have been derived

chiefly from the European ox, *Bos taurus,* the Celtic shorthorn, *Bos longifrons,* of western Europe, and the zebu, *Bos indicus,* of India and Africa. In discussing the origin of modern breeds of cattle, this statement can be made with good authority. Further than that we can not go without wide investigation, for the problem is thoroughly entwined with the early history of man. The zebu is believed to have been domesticated as early as 4000 B.C. An extinct Indian ox, *Bos namadicus,* probably had a domesticated form in 8000 B.C. The wild ancestor of *Bos taurus,* the name given to European cattle, was *Bos primigenius,* the aurochs or ur, which existed until more recent, historic times. It is mentioned by Caesar and other Roman writers, and according to Herberstain (1550), a herd was preserved in the Polish forest of Jaktorowka, near Warsaw, where the last survivor is now known to have been killed in 1627. That date probably marks the extermination of the aurochs as a living species.

The aurochs was well distributed over all of Europe, from Great Britain to northern Asia and south to North Africa. It was a magnificent animal, the bulls being at least six feet high at the shoulders, with wide-sweeping horns, curving upward and slightly forward and inward near the tips. We are not certain as to its color, but apparently it was brownish-black in summer and grayish in the winter. In general appearance it was a high-shouldered ox, a great deal like the present-day gaur of India, a closely related species. The aurochs was a forest-dwelling animal

Courtesy Philadelphia Zoological Society

The zebu of India and Africa is believed to be one of the progenitors of our domestic cattle and in addition it has been domesticated, in its own right, for something like 6,000 years. This zebu family group at the Philadelphia Zoo illustrates their variation in color. The large hump is characteristic of the animal.

and must have been extremely common, for its fossil remains are numerous.

It has been said that the Chillingham cattle, the half-wild English park cattle of Northumberland, are direct descendants of the aurochs, or at least descendants of a breed derived from that species. Some investigators state, however, that they are the descendants of cattle brought in by the Romans. If that is true, the Chillinghams are much farther removed from the aurochs than has generally been supposed. In this connection the west highland cattle of Scotland were almost certainly untouched by this same admixture of foreign blood and today they doubtless differ only slightly from their ancient ancestors.

The zebu has been domesticated since prehistoric times and so many centuries have elapsed and so many breeds have been produced that today we can only guess as to its ancestry. The species apparently originated in Asia and has been spread by nomadic peoples to Europe, Africa and Madagascar. Because of its long domestication and wide geographic range there is great variation in the different breeds. Thus some have two humps and there may be either thirteen or fourteen ribs. The horns are usually rather small but reach enormous proportions in the Galla cattle of Africa.

Zebus, or Brahmans, as they are generally called in the United States, because of their general hardiness and disease-resistant qualities have been imported in considerable numbers during recent years to cross with our beef cattle. They are now used generally in South America for the same purpose.

While we can not definitely trace the ancestry of the zebu, some authorities believe that it was derived from the banting, a modern Malay species with several distinct races. At least two extinct species of wild oxen show an apparent relation to the banting and zebu, as evidenced by the shape of the skull and horn cores. This similarity may indicate descent from a common ancestor.

Another species domesticated in prehistoric times is the Celtic shorthorn, *Bos longifrons*, known to have inhabited most of western Europe. The Swiss lake dwellers had a breed of cattle believed to be this species. Other primitive peoples also kept this half wild ox and numerous remains have been found in bogs and kitchen middens from Great Britain to Italy. Its obvious association with early man, coupled with a lack of written record concerning that association, has focused considerable attention upon the animal. Earlier authorities believed it to be a domestic breed of the aurochs. But it possesses many characteristics of the humped cattle and recent investigators have pronounced it Asiatic in origin and closely related to that group. It is, therefore, allied to the banting and zebu. The Celtic shorthorn did not become extinct. In England it was still common in 200 A.D. at the time of the Roman occupation, and with but little change lives today in the Irish Kerry.

It will be seen that many bovine species, especially the aurochs, Celtic shorthorn and zebu, are inextricably involved in the ancestry of our present-day domestic cattle. Nomadic prehistoric Asiatic tribes were undoubtedly accompanied by humped cattle on their westward migrations. The blood of these eastern species became mixed with European breeds. Centuries later the extension of the Roman empire led to another great interchange and mixture of then-existing breeds. Thus, while it is relatively easy to establish the aurochs, Celtic shorthorn and zebu as the principal progenitors of our modern breeds of cattle, the hundreds of crosses involved and the numerous admixtures of different blood added over the years can never be determined. It is most interesting, however, to give consideration to our various species of present-day wild oxen and to try to determine what part they have played in the development of modern domestic breeds.

Despite the lack of definitely convincing evidence, we can be fairly certain as to the derivation of some of these breeds. The previously-mentioned Irish Kerry is most like the Celtic shorthorn, and the Jerseys and Guernseys, apparently, have likewise descended from that species. Holstein-Friesians and Normandys have descended from the aurochs, presumably by way of the European ox. Much is yet to be learned concerning the ancestry of the remaining three hundred-odd breeds of the world.

Members of the Bisontine group of the Bovidae have seldom, if ever, been used as domestic animals in America and representative forms can be found only on preserves and in zoos. The

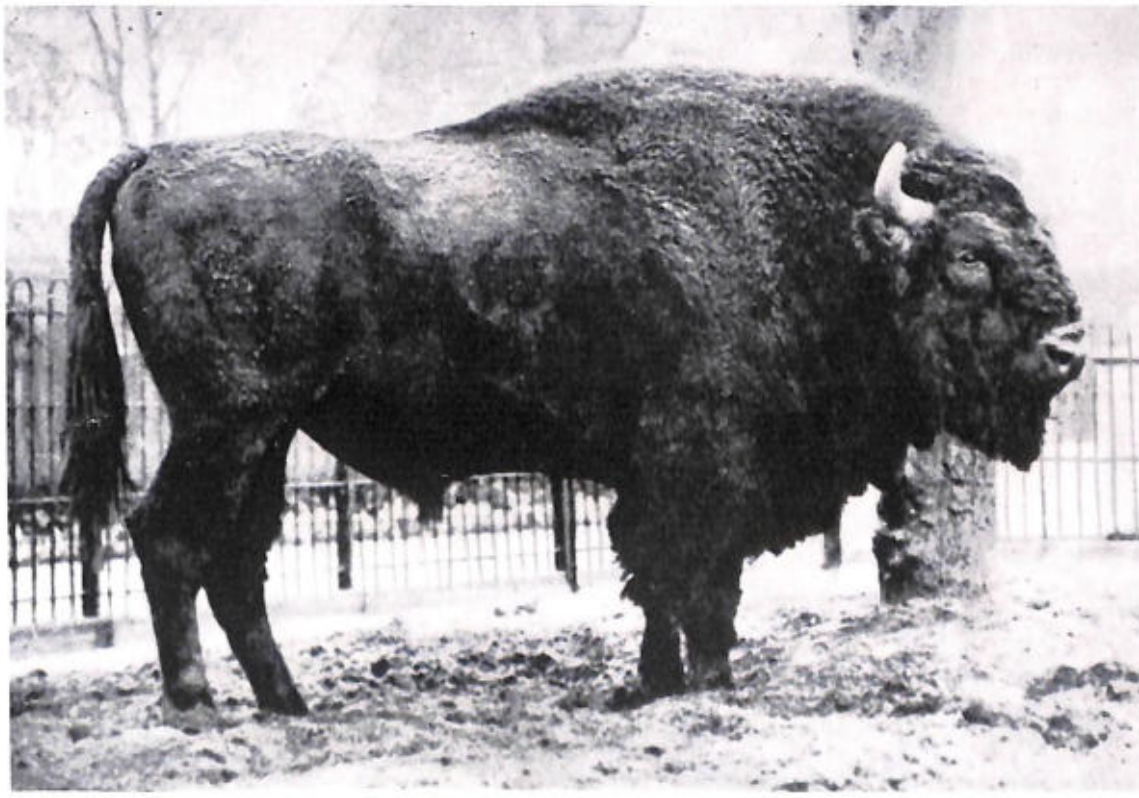
American bison was practically exterminated in the United States by 1900. Fears were held that it might become extinct, but timely action by the American Bison Society and the government so well preserved remaining animals that a steady increase was maintained for some years and today the supply is adequate for the areas suitable for the purpose.

The bison apparently lacks the temperament necessary for domestication but has a number of admirable qualities to recommend it for cross breeding with range cattle. While the flesh does not rival our beef breeds as to quality, the general hardiness of the species and its ability to ride out winter storms are generally lacking in domestic cattle. Bison-cattle hybrids have been called cattalos. To date all such cross-breeding experiments have met with indifferent success.

The European bison, *Bison bonasus,* is now on the extreme verge of extinction. During the First World War the scattered survivors of the species were greatly reduced in numbers. Only a few animals remained on preserves in England, Germany and the Polish national forest of Bialowitza, not far from the Jaktorowka forest, the last stronghold of the aurochs. The Polish herd was doubtless exterminated early in the present war, leaving only the animals in England and Germany.

The European bison is essentially a forest animal and in most respects is more like the wood bison of Canada than the typical species. Like the latter it has been unresponsive to all efforts toward its domestication. There seems to be little possibility of its having had any connection in producing European breeds of cattle.

The musk ox, *Ovibos moschatus,* is now confined to the Arctic regions of North America and Greenland. This animal shows a more or less puzzling relationship to the rest of the Bovidae. Some zoologists regard it as an arctic bison, others believe it to be allied to the rock antelope group.

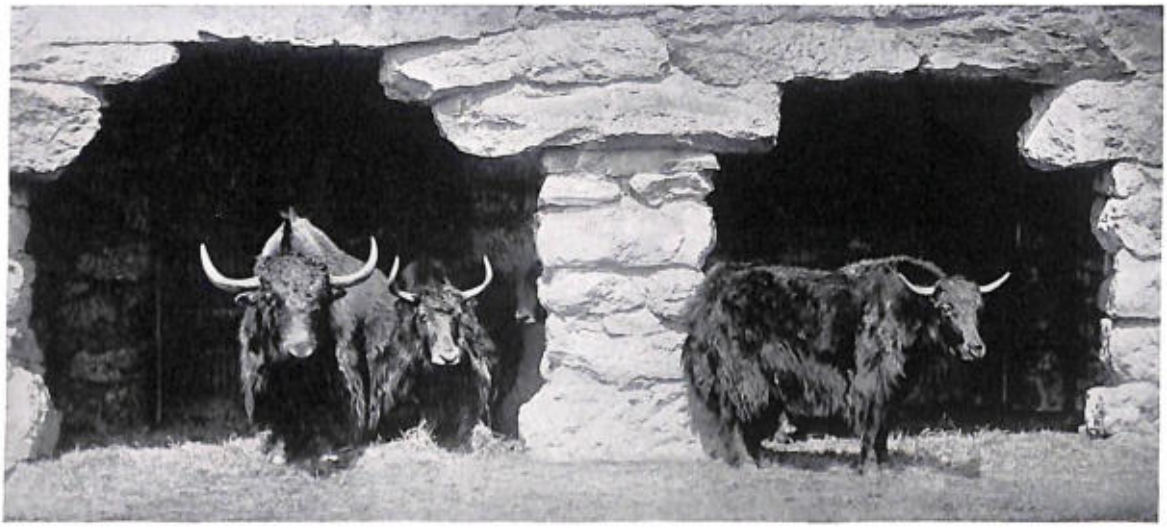


Courtesy Natural History Society and Zoological Society of London

The magnificent European bison has been as unresponsive to efforts toward its domestication as has been the American bison, and there seems little likelihood that it contributed anything to the development of European breeds of cattle. This specimen of the European bison is in the Duke of Bedford's great collection at Woburn Abbey.

It has never been domesticated and is stubborn and unresponsive in captivity.

Unlike the bisons, the yak, *Poëphagus grunniens,* from the highlands of central Asia, has definitely been domesticated. This long-haired bovine is native to the high plateau and mountainous region of central Asia, where the domestic form is all-important as a beast of burden and a source of wool. The wild yak is found at an elevation of 12,000-15,000 feet and does not thrive when taken to low altitudes. It is believed that none of the really wild animals have ever been exported to other countries but that even the best of these have come from semi-domesticated races. The wild bull yak is a striking animal, almost six feet high at the shoulder, brownish-black in color, with imposing horns and a draping fringe of long hair on the lower shoulders, flanks and thighs, extending almost to the ground. Some of the domesticated races are practically indistinguishable from the wild species. Others are distinctly smaller and occasionally include piebald and white individuals. The first black yaks to be brought into the United States were imported by the New York Zoological Society in 1913.



Although it has long been domesticated itself, the yak from the highlands of central Asia seems to have played no part in the creation of our modern breeds of cattle. They range in color from white through piebald to black. Back in 1913 the New York Zoological Society imported the first black yaks seen in the United States.

The Bibovine group of the family Bovidae is found only in the Oriental region. It includes the gaur, gayal and banting. All are large, handsome oxen and, with the exception of the banting, have a prominent ridge on the back which adds to their impressive appearance. They are dark brown to almost black in color and all have white or whitish "stockings." Calves are reddish-brown. It is probable that all three species are in some way involved in the ancestry of present-day domestic breeds.

The gaur, *Bibos gaurus,* from India and the Malay Peninsula, is in many ways the most impressive wild ox in the world, and one of these almost coal black bulls, standing over six feet high at the shoulders, encountered in his native forest, must afford a never-to-be-forgotten spectacle. The gaur is generally shy and inoffensive, but solitary bulls are sometimes vicious and closely pressed animals are apt to turn upon their pursuers. Thus gaur hunting is regarded as a dangerous sport. This is especially true of the Malay gaur or slading, which is larger than the typical species and has the reputation of being more truculent.

There seems to be no real evidence that the gaur has ever been domesticated and it has been said that the calves can not be raised in captivity. However, the first of the species ever to be brought to America was imported by the St. Louis

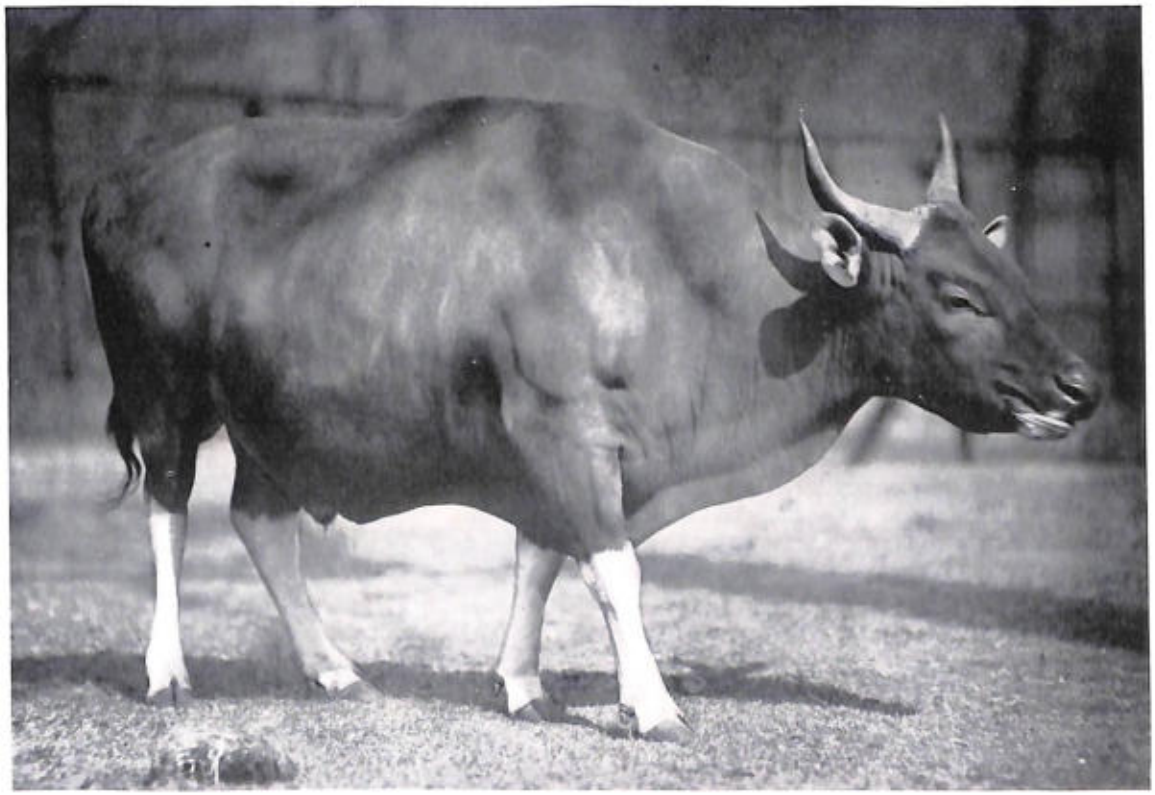
Zoo, where they have since bred on several occasions and the young are now well grown.

The gayal, *Bos frontalis,* from the hill districts of India, although it can be regarded as a species, is only half wild at the best, and at one time was believed to be a semi-domesticated race of the gaur. While much like the gaur in general appearance it is a smaller, more compactly-built animal with straighter horns. Our gayals at the Zoological Park have been placid and inoffensive. The mahogany-red calves have a short blackish stripe down the back and white stockings.

The third member of the Indo-Malay wild cattle triumvirate is the banting, *Bibos sondaicus.* It is well distributed over the eastern part of the Indian peninsula, the Malay countries, Java and Borneo. It is smaller and more slender than either gaur or gayal. There is more variation in color among its several races than we find between the latter species. Thus the bulls are black, except in the case of the Burmese banting where they are rufous fawn. Cows, instead of being brownish-black, are rufous. Calves are the customary reddish-brown with a dark back stripe.

The most recently-discovered species of the world's larger mammals is the kouprey, *Bos (Bibos) sauveli,* which was practically unknown scientifically until 1937, when it was first described. An account of this animal appears in the March-April 1943 number of ANIMAL KINGDOM. The kouprey is apparently closely related to the gaur and the banting. Almost nothing is known of its life history.

A plainly-evident close relation exists between gaur, gayal, and banting and all three species are said to interbreed where their ranges overlap. Largely for this reason many zoologists have regarded gayal and banting as forms of the gaur rather than distinct species. The group is apparently an ancient one and through the banting, especially, shows a relation to the zebu and, it is believed, the Celtic shorthorn. The gaur has been pointed out as being closely related to the



As a member of the Bibovine group, the gayal has perhaps had something to do with domestic breeds. It is, itself, only half wild and another member of the group, the banting, is supposed to be related to the zebu and to the Celtic shorthorn. The gayals we have exhibited at the Zoological Park have been placid and inoffensive.

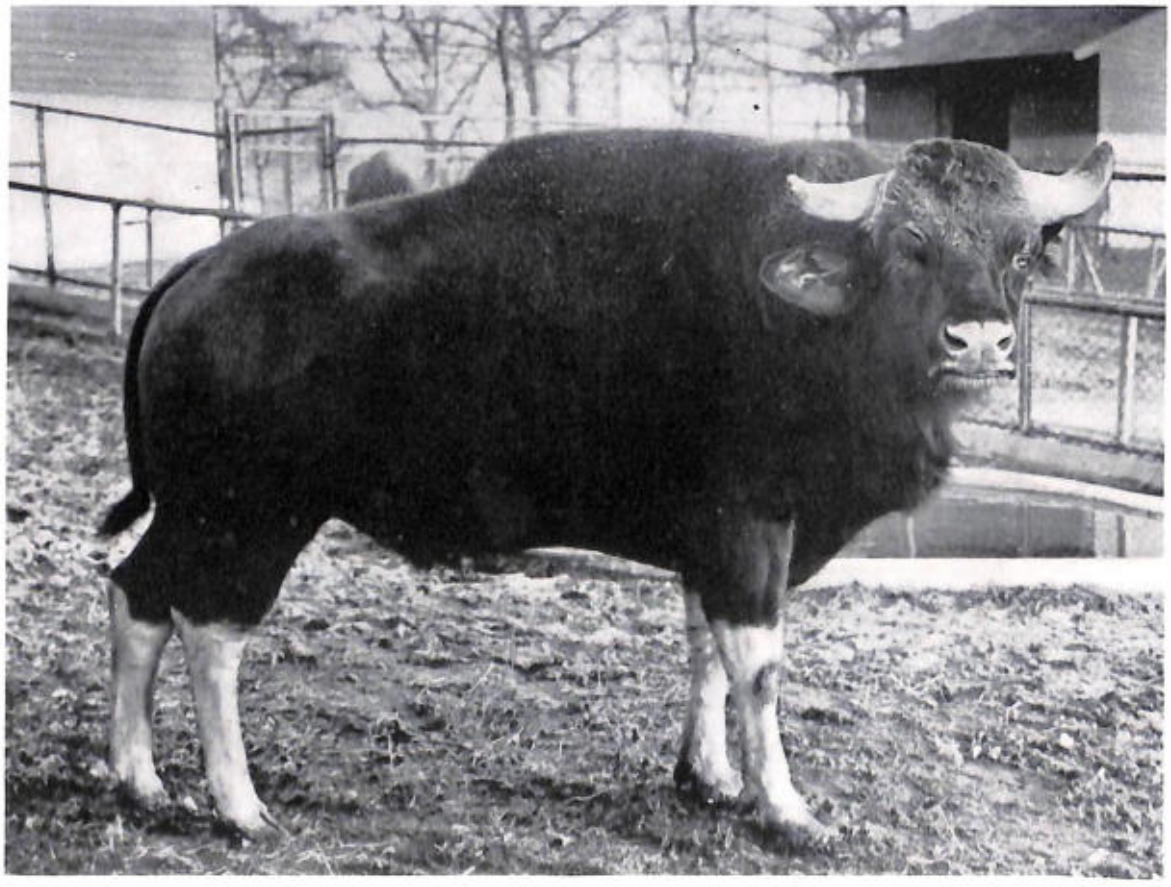
extinct aurochs. Thus it is possible that here in the Bibovine group we have the principal progenitors of all our modern breeds of cattle.

The Bubaline group of the Bovidae includes the buffaloes. The name buffalo is a misnomer as far as the American bison is concerned for the true buffaloes never reached North America and they are entirely Old World in distribution. As Lydekker points out, the African buffaloes are the most aberrent of the wild cattle, forming a distinct group and differing considerably from oriental species. They have never been domesticated. The best-known species is the Cape buffalo, *Syncerus caffer* from South and East Africa. Sportsmen generally agree that it is the world's most dangerous hoofed animal.

The Indian buffalo or water buffalo, *Bubalus bubalis,* is well distributed over the Oriental region. It has been domesticated since prehistoric times and is all-important to some of the Eastern peoples, since it furnishes not only meat and milk but serves as a draft animal and a beast of burden as well. In addition to the wild species, which is largely confined to India, a number of well-defined breeds are to be found from Egypt to the Philippines. It is now impossible to trace their origin.

The anoa or pygmy buffalo, *Anoa depressicornis,* from the Celebes, is the smallest of the Bovidae and therein lies its chief claim to fame. It has never been domesticated. Our anoas at the New York Zoological Park are pugnacious and untrustworthy.

The Bubalines do not breed with other bovids and therefore have no actual connection with the ancestry of domestic cattle.



Courtesy Philadelphia Zoological Society

The gaur, from India and the Malay Peninsula, is "in many ways the most impressive wild ox in the world," for the almost coal-black bulls stand more than six feet at the shoulder. As a relative of the extinct aurochs, it is possibly one of the principal progenitors of present-day breeds of domestic cattle. It belongs to the Bibovine group.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

BATHYSPHERE GOES TO WAR

Bathysphere, deep-sea Associate Diver of the Department of Tropical Research, after six busy years and thirty-three plunges far beneath the ocean off Bermuda, spent several seasons in exhibition; first in Chicago, next at the American Museum, and finally at the World's Fair. After this he went into seclusion at the Zoo, awaiting his next activity. Now he has been drafted and has marched proudly off to Washington and reported as a real Gob, V.A.S. (very able Seaman) in the United States Navy. Like most important draftees his mission is a very secret one, and all that his superior officer whispered to me was that "Bathysphere is to carry on secret underwater work relating directly to the prosecution of the war."

After the war, if he does not return to our Department at the Zoo with the stars and stripes of a full Admiral, he will at least have been instrumental in making things unpleasant undersea for the Germans and the Japs.—*Wm. Beebe.*

FARM DICTIONARY

Newest of our "publications" is a miniature Farm Dictionary, a sixteen-page booklet measuring 2¼ x 3 inches and defining some 75 terms commonly used on a farm. The need for such a dictionary (which not only defines terms but gives the correct pronunciation of some of them) was determined soon after the opening of the Farm-in-the-Zoo this spring. Visitors were heard to refer to a handsome Delaine Merino sheep as a "goat," and to talk learnedly of an "eewee"—meaning, of course, a ewe. The Farm Dictionary sells for 2 cents a copy over the counter. Or, rather, over the farm fence.

If any of our members order copies by mail, it is well to remember that postage is extra. A recent editorial about the Dictionary in the New York *Times* brought a flood of orders, each enclosing a 2-cent stamp. Postage (which we paid) was 3 cents!

NEW MEMBERS OF THE SOCIETY

New members of the New York Zoological Society since the last issue of this magazine are the following:

Life

Mrs. James C. Greenway — Lauder Greenway
George E. Ruppert

Annual

Louie A. Beard
Mrs. Louis Alexander Biddle
Henry A. Blum
Beverly Cory Chew
Mrs. W. Murray Crane
Frank L. Crocker
William F. Cutler
Mme. Elise de Souza Dantas
Colette d'Arville
Pierre David-Weill
William K. Dick
Mrs. H. Proctor Donnell
Sydney C. Erlanger
Edmund Esmond
Wilmer Price Fitch, M.D.
Mrs. Oliver Filley
William T. Graham
Jean Hallaure
Mrs. J. W. H. Hamilton
Elton Hoyt, 2nd
Walter Hoving
A. A. Hutchinson
J. Ford Johnson
Arshag Karagheusian
Miss Lucy M. Koenig
Capt. Charles H. Lockhart
Mrs. L. G. McMichael
Mrs. George Marshall
Countess Mercati
Clarence G. Michalis
Dr. Paul A. Naef
Miss Josephine Nocera
Ernest E. Nydem
Morgan J. O'Brien, Jr.
A. Perry Osborn
Edward John Paris
Miss Mary Ann Parker
Mrs. Harold I. Pratt
Mrs. Elsie Restell
Theodore M. Riehle
Lady Ribblesdale
W. S. S. Rodgers
Baron Robert Rothschild
Mrs. A. Seton
John L. Simpson
Donald Slesinger
H. E. Talbott
Mrs. Giorgio Uzielli
Dr. Robert Wallis
Miss Edith Wetmore
Sheldon Whitehouse

Junior

Audrey V. Bosworth
Francoise M. Bosworth
Michael Ardagh Cassidy
Gladys Gay Lipton
Michael Lipton
Laura Rockefeller

* * *

Three young Patagonian cavies, the first ever born in our collection, have emerged from their underground shelter and are visible almost every day in the old Prairie Dog enclosure.

* * *

Nesting time is with us again. The usual baby mallards and black ducks appeared on the Bronx River early in May but among the more exotic species, a white-necked crane is hovering a single egg in the Blackbuck Corral and a pair of mute swans are guarding three eggs on the Wildfowl Pond. It will be a brave intruder who violates their nest, for the natural truculence of the birds is greatly increased during nesting time.

* * *

At least two weeks later than usual, because of the cold and rainy spring, our collection of gibbons and spider monkeys have been liberated on Monkey Island in the Bronx River.

THE TIMID GORILLA

In the last issue of ANIMAL KINGDOM we mentioned Keeper Reilly's method of weighing Makoko, our male gorilla, who has developed a prejudice against the small bathroom scales used to weigh him and his companion, Oka. Keeper Reilly takes Makoko on his back, steps on the scales, and subsequently deducts his own weight. The process is pictured in the next column, in a photograph by H. Huber Clark.

* * *

More or less as an experiment a young alpaca, born last year, was introduced into the family of young and tame animals in the Children's Zoo this spring. After a period of shyness and timidity that lasted only about twenty-four hours, the alpaca has taken to children – and the food they proffer – with great enthusiasm.

PUBLICATIONS OF INTEREST

BIRDS AND MAN. By FRANK M. CHAPMAN. Guide Leaflet Series No. 115. American Museum of Natural History, New York, N. Y. 51 pp., 15 illus., 40 cents.

During recent decades, immense strides have been made in the public relations aspects of our museums and zoos. When we recall the dusty rows of badly "stuffed" birds and mammals that once were considered the last word and then inspect the marvelously realistic groups, prepared and lighted with infinite skill, that now fill entire halls in our modern institutions, they seem completely of different worlds – as of course they are.

Doctor Chapman's newest effort, "Birds and Man," is another step toward bringing sharper realization of our close relationship with nature and to impress the facts strongly on the minds of visitors at the American Museum of Natural History. The present booklet is designed as a guide to this series of superb exhibits. These are grouped as "Birds as Food," "Birds as Clothing and in Adornment," "Birds as Omens and Symbols, in Mythology and Tradition," "Birds as Emblems and Insignia," "Birds as Hieroglyphics," "Birds in Books," "Birds in Art," "Economic Ornithology" and "The Sentiment of Ornithology."

Doctor Chapman has put into these groups all the love and knowledge of his many years of study and research. We shall wait long for a finer exposition of "Birds and Man."–*Lee S. Crandall.*

ANIMAL KINGDOM

BULLETIN OF THE
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New Ways to Old Ends

Education has many facets. With this aphorism as a cue we are making a number of experiments this year on additional methods of spreading information to the public in the Zoological Park.

With the mid-season upon us we have grounds for encouragement regarding the success of some of the ideas that are being tried. The most promising is the use of a sound system at various points in the Park to give information about certain of the animal exhibits. So far installations have been made at the Sea Lion Pool, in the new Gorilla House, at the Elephant and Rhinoceros enclosures and at the Lion and Tiger exhibits. Another innovation is a series of pamphlets on animal life, of about 2,000-word length. There are being placed on sale at five cents apiece so that they may be within the reach of anybody's pocketbook. As a minor detail, the reopening of the Gorilla House provided the opportunity of trying out descriptive labels of a different type and larger size than those heretofore installed in any of our buildings.

So far these efforts are meeting with good response; particularly evident is the popularity of the sound system.

The crux of the matter is that only by constant experimentation will it be possible to develop the most effective methods of imparting information for which the public is obviously hungry.

Fairfield Osborn

IN THIS ISSUE

Green-lighted Firefly . . . . . *Sam Dunton* COVER
Bears and Their Curious Ways . . . . *Donald Marcy* 75
What We Have Learned About Blind Cave Fish . . . . *William Bridges* 82
Portraits of Four Primates. III. 83
"Lightning-bugs" . . . . . *Henry Fleming* 91
Behind the Scenes: News and Notes 96

SHOP TALK

Maybe somebody has made better pictures of a firefly by its own light than the ones in Henry Fleming's account of "Lightning-bugs" in this magazine, but we doubt it. Sam Dunton, staff photographer, made them.

* * *

Last time, in this space, we advertised for a spare haywagon to supplement our "haywagon taxi" to the Farm-in-the-Zoo. Nobody came through with an offer. Well, we'll try again. We want a dinnerbell for the Farm. To ring at milking time. Has anybody got a dinnerbell he isn't using? It will have a good home at the Farm-in-the Zoo.

* * *

Omniscient Grace Davall, assistant to the General Curator, opened the door and announced:

"It's happened!"

Around a Zoo, anything can happen, and usually does. So we said: "What now?"

"For blank number of years," said Grace, "I have answered letters from people who have moved to the country or have taken summer places. Thousands of letters. All wanting to know how to get rid of snakes on the farm. And now it's happened!"

"What's happened?"

"Today I got a letter from a man who's moved to a new summer place. He doesn't have any snakes, frogs or rabbits around his cottage. He wants to know how to attract them!"

* * *

Remember that in the previous issue we told the sad story of Annie, the Penguin, and her first egg – the egg that didn't hatch? Well, another pair of Penguins has just hatched two eggs, in the same enclosure. And Annie has been trying to steal the babies. She raided the nesting box a few hours after the first baby was hatched, but was driven off by the father. If she keeps it up, Annie will have to be moved. Kidnapping is a killing offense among Penguins. – EDITOR.

"Silver King" was the finest specimen of the polar bear we have ever exhibited. This portrait of the famous animal (captured by the Rainey Expedition) was made many years ago by Elwin R. Sanborn, and was called by Dr. Hornaday "the best picture ever taken of Silver King."

Bears and Their Curious Ways

The Gigantic Alaskan Species Has the Distinction of Being the Largest Carnivore in the World — More Than 1,500 Pounds

DONALD MARCY

THERE's something about a bear — Through the gates of the Zoological Park have passed, at one time or another, most of the strangest and rarest animals in the world. They come and they go; they have their days or weeks or months of public interest, and then they sink to the level of the familiar. But bears, somehow, seem to go on forever.

It happens that our bear dens are somewhat off the main track of visitor traffic. The dens themselves are old and unsightly, so much so that one of the very first post-war projects calls for their complete rebuilding. It makes no difference to visitors. Sooner or later in their wanderings around the Zoo they discover the bears and there a good proportion of them stick — charmed by the tireless antics of the lumbering creatures or perhaps by their sheer size and the power they express.

Whatever the reason for the public interest, it undeniably exists and it has long seemed to us that the bears — particularly the bears of North America, which we are almost sure to have always on exhibition — deserved attention in ANIMAL KINGDOM.

Our four North American species are, incidentally, well represented in the collection at the moment — the black bear in two color phases, the grizzly, the Alaska brown and the polar.

The smallest of the North American bears are the blacks, which range the forested regions from coast to coast. They manage to hold their own fairly well even in the long-populated eastern states, and a recent census of the U.S. Fish and Wildlife Service estimated there were about 3,300 of them in Pennsylvania, 1,400 in Maine, 1,000 in New York, 650 in New Hampshire and 400 in Vermont.

The average weight of a black bear is 200 to 300 pounds. The name "black" bear includes a variety of shades of brown and the common name of "cinnamon bear" is often given to the browner individuals. These sometimes occur in the same litter with really black cubs.

In the wild, black bears, as well as other bears, are shy and usually make a quick getaway at the approach of man, but when wounded, cornered or defending cubs, they are exceedingly dangerous. The senses of smell and hearing of bears are not particularly well developed — they are less effective than those of deer, for example — and the eyes are weak. However, their strength and intelligence seem to compensate for their undeveloped senses. A hunter once killed a bear which was totally blind from old and completely healed wounds, indicating that it had been able to exist for some time without the use of its eyes.

Although classed as carnivores, black bears and other bears are omnivorous feeders. They eat what they can find, depending on the season, and thrive on almost any food. Some of the articles on their bill of fare are berries, fruits, grass, acorns, nuts, honey, ants and other insects, fish, mice and ground squirrels. Large animals such as deer and cattle are sometimes killed and eaten, but such occurences are rare and are usually under the stress of extreme hunger.

Bears are often thought of as being slow, awkward animals, but actually they are well coordinated and finely balanced and can move swiftly if they wish; they are said to be able to run with the speed of a horse for a short distance.

Black bear cubs at play – two of the most active, inimitable clowns in the Zoological Park. Just out of their pool, they spar for position.

Like a couple of wary boxers, they break away and make quick feints with clumsy, swinging paws. Rough play, but not as dangerous as it looks.

The fun generally reaches a climax when one cub chases the other up a tree, with much huffing and puffing.

The fun's over – once at the top, they sniff a couple of times and back down, ready to start all over again.

The broad jump of a fleeing bear over a fallen tree was found to be eighteen feet. If not slowed down by excess fat, a black bear can run up a tree almost with the agility of a squirrel.

The temper of black bears is uncertain and treacherous, even toward other bears, and they usually live solitary lives. Males and females come together only during the mating season in June and July.

During the winter months their food supply is cut off and bears, like many other northern mammals, "den up" in a cave, hollow tree or under a log and spend the cold season sound asleep, living on the excess fat which the body has stored up during the late summer and early fall. It is during the long winter sleep, in mid-winter, that the two or three young are born to the female. The new-born cubs are tiny – about eight inches long and weighing nine to twelve ounces – and almost hairless. When one remembers that the mother may weigh around 300 pounds, the small size of the cubs is astonishing.

Grizzly bears are said by some naturalists to be the brightest and most intelligent of the North American bears. They are surely the most inveterate beggars; once they learn that a hungry look and an open mouth will induce visitors to toss them popcorn (or preferably sweet crackerjack) they will pose at the drop of a peanut.

When the cubs are two or three months old, the mother leads them out of the winter den and begins their education. She teaches them many things: how to turn over stones to find grubs, how to dig for roots and bulbs, how to catch mice, and how to climb trees when danger is near. Her orders are enforced by a sharp cuff with her paw which may send the little ones rolling, but if they are in danger she becomes a raging demon in their defense.

Not all of the time is spent on serious matters, however, for cubs are mischievous and frisky and like to play. In the Zoo, the playful antics of bear cubs never fail to attract a crowd of amused spectators. Dr. William T. Hornaday once wrote, in one of our publications, that although small cubs are very interesting, by the time they are a year old they become troublesome and dangerous. "Never buy a Black Bear cub in the belief that it can be kept for amusement and resold at a profit," he wrote, "but if thine enemy offend thee, present him with a Black Bear cub!"

The average weight of adult male grizzly bears is five hundred pounds, and of females, four hundred. Occasionally an old-timer will tip the scales at a thousand pounds or more. The color ranges from black or dark gray to brown and even light brown. Usually the tips of the hairs on the upper part of the body are gray or white, giving the grizzled appearance from which the

name is derived. "Silver tip" is another common name of the grizzly.

From the black bears they are further distinguished by their concave facial outline, straighter profile of the back, the broader and more massive head and the longer front claws.

The grizzly bears once roamed over North America from the Great Plains westward through the Rocky Mountains and into Canada, but now they are restricted mainly to the wilder parts of the Rockies. High, rolling uplands with both heavily wooded thickets and open meadows supply an abundance of food and cover, and it is in this type of habitat that they are most likely to be found. Breeding habits and hibernation are similar to those of the black bears.

The grizzlies are believed by many naturalists to be the most intelligent of the bears, and Dr. Hornaday claimed that they are the brightest of any North American mammal. They are peaceful and unaggressive except when wounded or protecting cubs, but in these cases – which might be called justified self-defense – their attack is terrifying in its swiftness and ferocity. The jumps of a wounded grizzly attacking a hunter were found to be fifteen feet long. The actual damage to the victim is done with the teeth and claws; there is apparently no foundation for the belief that bears "hug" their victims to death. Adult grizzlies, because of their size and the shape of their claws, cannot climb trees (though cubs can), and many a disarmed hunter's life has been saved by scrambling up a tree – but one must be quick!

In bear country, trees are often seen which have been deeply scratched by the claws and teeth of bears. Various explanations of these "bear trees" have been advanced by hunters and naturalists, but there is not complete agreement as to their meaning. It may be that the scratching of the bark of a tree by a bear is analagous to our leaving a calling card when we visit a friend.

The food of grizzlies is much the same as that of the black bears. Occasionally a "killer" will appear and cause great loss among domestic animals; one famous old grizzly is said to have killed one cow every other day during the active season for fifteen years (a total of more than 1,200 cows), one daily during the fourteenth season, and thirty-four during one ten-day period! A grizzly will often save food for future meals by digging a shallow depression in the ground, placing the animal in it, and covering it with dirt, leaves and sticks.

In the Alaskan region is found a group of giant bears which claim the distinction of being the largest carnivores in the world. These are the Alaska or big brown bears, and a full grown specimen may weigh in excess of 1,500 pounds. The color varies from dark to light brown, the claws are shorter than those of the grizzly, and the head is even broader and more massive. For many years sportsmen have been attracted by the great size and reputation for ferocity of the Alaska brown bears, and though many have been killed, their increased wariness and the remoteness of their habitat have kept them from extinction.

During hibernation, high up on a mountain side, two or three 1½-pound cubs are born. When the bears emerge from their winter dens in April they are weak and hungry and food is scarce. At first they feed like cows on green grass and alder twigs. Ripening salmon berries tide them over until the salmon run begins in June. During the summer they forage around for huckleberries, skunk cabbage roots, mice, squirrels, marmots and carrion.

In spite of their great size and strength, the Alaska brown bears living in the Zoo are generally even-tempered and trustworthy, and their keeper enters their cage daily to clean, armed only with a broom. In the wild, they are much like grizzlies – they will usually run away from a man if given the opportunity. But if cornered or wounded, they will attack with lightning speed and terrific ferocity.

How long Alaska browns live in the wild is not definitely known, but one of the Bronx Zoo's former specimens lived thirty-four years in the Zoo, and we have records of two others which lived twenty-eight and twenty-one years.

The latter was a 1,200 pounder named Ivan, a bear with strong personality and engaging habits. When the keeper throws loaves of bread to the bears, he uses a high, swinging arm motion in order to toss them over the nine-foot side of the cage. Ivan learned to stand up on his hind legs and move his huge arm with the same motion that the keeper used. He did this whenever the keeper approached with food, and there was no

"Ivan," a Peninsula Giant Bear (one of the brown bears) was the largest specimen we have ever exhibited. He stood nearly nine feet high and in his prime was estimated to weigh about 1,200 pounds. However, at his death in 1924 the animal's weight was found to be only 800 pounds. He had lived in the Zoological Park since 1903.

mistaking his meaning – he was begging, in his own sign language, for the keeper to hurry up and throw his food in the cage!

Ivan also developed a method of cracking large bones in order to obtain the marrow. He stood on his hind legs and balanced a large bone on the back of his forepaw, then tossed it high into the air. When it fell to the concrete floor of the cage it often cracked open. Sometimes it took a number of trials, but his patience was rewarded in the end.

One day the keeper walked into the den of Admiral, another of our big brown bears. He was wearing a new pair of white rubber boots instead of his usual black ones. Admiral immediately attacked him so savagely that the keeper had to make a quick dash for the door. Admiral would not permit the keeper to enter the cage until the rubber boots had been given a thorough coat of black paint!

Rivaling the Alaska brown bears in size, the polar bears of the icy north may often weigh in excess of 1,000 pounds. The beautiful white or yellowish-white coat which harmonizes with its snowy habitat, the small head, long neck, and wide flat paws with hair on their soles to prevent slipping, distinguish the polar bears from other members of the bear family. Most of them live permanently on the ice, sometimes hundreds of miles from land, and they seldom appear south of the southern border of pack ice. They are excellent swimmers and divers, and are said to be able to swim at a rate of six miles per hour.

With the approach of winter, males and barren females migrate far out toward the edge of the ice and remain active all winter, while pregnant females move inland to "den up" in holes in the snow which they dig themselves. Around the end of March the mother leads her three-month-old cubs out of the den in search of food. Her devotion to her cubs and her energy in protecting them are unmatched – she will even carry them on her back if they are tired, either in the water or on the ice. Sometimes a cub will grasp its mother's tail with its teeth while she is swimming and get a tow – which must present a very comical picture!

While polar bears rely upon seals, walrus and fish for a large part of their food, at times they are said to eat grass, seaweed, roots and lichens. Seton says they also feed on the carcasses of whales left by whalers, and on deer, foxes, birds, eggs, shrimps and mollusks.

In captivity polar bears are usually aggressive and their keeper never enters their cages until after they have been lured into the small "changing cages" with a piece of meat. They do not seem to mind the high temperatures of New York summers, and their large pool of water helps to keep them comfortable on hot days. One of our former specimens, an adult bear when received, spent nearly twenty-five years in the Zoo, while one in the London Zoo lived for thirty-three years and four months.

Bear skins are more or less in demand for making rugs and coats, and the British Army buys the finest skins to use in making the large hats for their Grenadier regiments. Their economic value has decreased in recent years because of reduced numbers, but as late as 1923-24 twenty-five thousand skins were taken for commercial purposes.

The flesh of bears is used for food, but they are not plentiful enough to make any real contribution to the world's meat supply. The edibility of the flesh seems to depend on the condition of the bear and the method of preparing it. Some individuals claim that it is delicious, while others say that it has a disagreeable flavor.

Besides serving as game for hunters, an aspect of their economic value which should not be overlooked is that of tourist amusement. The semi-tame bears in national park areas such as Yellowstone Park afford great entertainment every year for thousands of tourists, who would be disappointed if they were not "held up" by bears which have learned to stop cars and beg for food. But their potentialities must be properly respected and many tourists and campers have had reason to curse the bear tribe for wrecking their camping equipment in order to steal food.

To a limited degree bears may have a beneficial effect on forest growth by "planting" in new locations seeds which cling to their fur or pass uninjured through the digestive tract. In digging for mice, ground squirrels, ants and roots they tend to soften and cultivate the ground so that seeds have more chance of growing successfully. The tearing apart of rotten logs for the insects in them hastens the formation of humus.

When rodents are plentiful, bears help to control them.

Many individuals who know the bears well consider them the noblest of our North American carnivores. Their sagacity, courage and strength is such that man is the only enemy they deign to fear. Their harmlessness, their probable beneficial effect on the economy of the forests, and their general interest as one of the most characteristic of our large native mammals, renders them worthy of the most careful protection to insure the future security of this fascinating group.

What We Have Learned About Blind Cave Fish

After Three Years of Laboratory Experiment, the Aquarium's Mexican Specimens Still Raise Plenty of Problems

WILLIAM BRIDGES

EXACTLY three years ago I wrote in the society's magazine: "The Aquarium Cave Expedition to Mexico this spring will bear important scientific fruits in *Zoologica,* but it may be months or even years before the studies are completed."[1]

Now I think maybe I underestimated. I'm beginning to wonder whether these studies of the curious blind characin of the Mexican warm water caves are *ever* going to be completed. Perhaps by their very nature it is too much to expect them ever to be finished. In the past three years I have edited four papers on those blind fish for *Zoologica* (with the careful reading and re-reading that editing requires) and I have read at least once the three or four papers that have been published elsewhere. Besides, in preparation for the writing of this article, I spent many afternoons with Dr. C. M. Breder, Jr., the leader of the Aquarium's Mexican expedition, in the midst of his batteries of experimental tanks under the roof of the American Museum of Natural History. I read and re-read his summary of three years' work presented to the New York Academy of Sciences this spring.

I came out of it all with the firm impression that by learning one fact about those blind fish, Dr. Breder has merely unlocked a door that let a couple of even tougher problems come strolling in. Research is always like that.

But I should take time here to recapitulate the story of *Anoptichthys jordani* Hubbs & Innes for the sake of new readers of ANIMAL KINGDOM.

In brief, then, a scientific description of a new characin from Mexico – a blind, cave-dwelling little creature – was published in 1936 and four years later Dr. Breder's interest in it blossomed into an expedition to Pujal, San Luis Potosi, to study the fish in its natural surroundings. It was a neat, workmanlike, successful trip. In a little better than a month the blind fish cave, known locally as La Cueva Chica (the Little Cave) was explored from mouth to end, its pools and connecting streams were mapped, and as a grand climax, a series of fish ranging from the previously known eyeless forms right back through imperfectly-eyed forms to their eyed and pigmented relative, the common river fish *Astyanax mexicanus* (Philippi), was seined up, pickled or brought home alive.

It was the first time anybody had ever found such a series of blind, intermediate and eyed cave-dwellers.

Consider the implications of this discovery.

Until the spring of 1940 about a score of blind and whitish cave fishes were known from various parts of the world – all of them in a "pure" state; that is, while they might have eyed relatives on the outside, there was no living link to connect the eyed and the eyeless. The blind fish were, in effect, a race apart. Evidently the

(Continued on page 87)

[1] Bridges, W. The Blind Fish of La Cueva Chica. *Bulletin,* May-June, 1940, pp. 74-97.

Portraits of Four Primates. III.

A NATURALIST with considerable experience with primates once remarked that the Squirrel Monkey's face looked more like a little child's than any other monkey's he knew. He said it could look as innocent as a child, and smile like a child, and when it is afraid, its big eyes fill with tears.

The Indians of South America report that when a hard rain comes, numbers of these little monkeys will huddle close together with their tails twined about their necks. The ones that can't get in the group stand nearby and cry.

If the Wanderoo's tail showed in this picture, it would be apparent why it is often called the "Lion-tailed Monkey." The tail is fluffy and bushy and does indeed resemble a lion's.

Travelers say the Wanderoo is shy and wary in its native forests of western India, and will gladly avoid letting itself be seen by the natives or anyone journeying through.

Natives are generally very good at making pets of animals, but they are seldom able to train the Wanderoo.

Full of years and sadness is the Guereza—in appearance. As a matter of fact, even baby Guerezas look just as old and world-weary as this five-year-old specimen.

The long white fur on the back is highly decorative and Abyssinian soldiers used to hunt the animal for the sake of the fur, which ornamented their shields.

Wistfulness is not a characteristic of the Rhesus monkey, so it is all the more remarkable that the photographer managed to catch a fleeting expression of reverie on this one's face. For that matter, it is something of a feat to get a Rhesus to stand still long enough to have its picture taken.

In ordinary times, thousands of these monkeys are imported from India for research purposes. They are a favorite in some Zoos, too, for "monkey islands." One drawback is that while most monkeys are as afraid of water as a cat, the Rhesus seems to enjoy swimming.

blind cave-dwellers were derived – somehow – from the eyed fish outside the cave. No one could imagine any other source, but here, in the case of the Mexican cave characins, there was a living chain of intermediately-eyed fish to link the two populations. And there was the material for proving the assumption of relationship.

And furthermore, here for the first time were living fishes, living links, living bits of proof that could be taken into the laboratory to test the mechanism of *how* and perhaps even *why* they came into being.

That is what Dr. Breder has been doing, off and on, for the past three years, first in the laboratories at the old Aquarium in Battery Park and since the fall of 1941 in his quarters atop the American Museum of Natural History.

From its Mexican trip in 1940 the Aquarium brought home only a handful of living fishes – 13 of the cave-dwellers, mixed blind, intermediate and eyed forms, and 11 of their eyed relatives from the nearby Tampaon river – but they were enough to start the investigation rolling. Some of the completely eyeless fishes had been on exhibition at the Aquarium since 1936, and plenty more were available in a Florida hatchery where a breeding stock was being maintained. Several tank-bred blind fish have been acquired by Dr. Breder from this hatchery from time to time, and among his collection of hundreds of specimens, in all stages of eyelessness, he has some blind fish that are seven generations removed from the warm, dark waters of La Cueva Chica. But they are still blind.

Six major lines of investigation have been carried on more or less simultaneously and the simplest method of reporting what has been learned about the blind cave fish seems to be to take up each one in turn. Several of them are still in such an active state with findings still in the manuscript or laboratory notebook stage, that very little can be said about them yet.

I. *Reactions to Light*

From such simple experiments as the Aquarium party could make in the field there was no doubt about it – the blind fish were unmistakably blind.

"Even the brightest lights had no effect on them," I wrote in the BULLETIN in 1940. "How could they, when their eye structure was a mere jumble of ineffectual tissue? It was easy to test their unresponsiveness to light. Time and again we picked out an aimlessly-swimming fish and played the concentrated beam of an electric torch around it, ahead, behind, to the side and on it. The random cruising of the fish never changed. Whatever the course it had set as it slowly circled a small area of the pool, the presence or absence of light caused no deviation in its movements."

Well – that was admittedly an insufficient sort of experiment, and not at all conclusive. But the conclusion that the blind fish gave no response to light was based on something more substantial – the careful dissections of *Anoptichthys* eyes that Dr. Breder and Dr. E. B. Gresser of New York University had made before the collecting party left New York. They knew that while the fish's optic nerves left the brain and entered the eye sockets, they ended in mere capsules and never went on to form the complex eye structure necessary for even imperfect, vague sight.

It was a safe assumption that the fish could not see in the usual sense of the word, but did they have any sensitivity to light at all? Even if they went on aimlessly circling in the strong beams of the flashlights in La Cueva Chica, was it certain that they had no method of choosing between the blackness (and comparative security) of a cave, and the sunlight (and instant danger) of the open waters outside? The fishes' own safety and preservation would seem to demand some sort of a response to keep them in the warm darkness where they would be safe.

Obviously, there might be several other safeguarding "tropisms" at work, but a nicely-calculated experiment to determine their response to light and darkness seemed in order – just to make sure.

So Dr. Breder and Dr. Gresser set up what is called a "gradient trough" in the laboratory. In essence it was merely a long tank with one end open to the sunlight and the other end covered to simulate the darkness of a cave.

They found that the "blind" fish spent more time under the cover – in the dark end of the trough.

Those abortive eyes, those mere capsules actually buried in indifferent tissue where the eye should have been, were of some use, after all.

In this great battery of experimental tanks (only part of which are shown) Dr. Breder is carrying on some of his experiments with the Mexican blind cave fish at the American Museum of Natural History. The fish readily adapt themselves to life in quite small tanks.

They gave the "blind" fish a liking for the darkness in which they were found.

As I said earlier, finding out one thing about *Anoptichthys* only raises a couple of new questions.

Now, what use is light sensitivity to a cave-dwelling fish?

Well, it might play a part in keeping them in the cave where they were safe. Even if there was nothing else to prevent it, they would be inclined to turn back toward the shelter of the cave if they happened to get to the exit of the cave, where the cave waters flow into the Tampaon. Coming out of the underground stream, they would encounter the light of the open water and be turned back.

II. *Rections to Temperature and Water Flow*

A little way back I said there might be several "tropisms" at work to keep the blind fish in the safe shelter of their cave. Besides reactions to light, two more of these now have been demonstrated – the desire of the fish to swim upstream when there is even a very slight current, and a movement into warm water when there is a choice between temperatures as small as a degree and a half.

As a matter of fact, both the blind fish and the normally-eyed river fish react the same way to temperature and water flow.

These two facts suggest how the fish happened to go into the cave in the first place.

Both in the laboratory at the Museum and in a garden pool at his home Dr. Breder worked out details of these patterns of behavior. But before he discovered the compelling interest that temperature has for the fish, he was puzzled by their actions.

When he first placed blind and eyed fish in his garden pool (one end of which was covered to form a miniature cave), he had already demonstrated in the laboratory that the fish have a "negative photo-taxis" – that is, that they had a tendency to retreat from light.

It is easy to imagine his surprise, then, when fish that had been hiding in the "cave" end of his garden pool emerged into the bright sunshine during the heat of the day. When night came and both ends of the pool were almost equally

dark, the ghostly little fish crept back into the shelter of the cave!

What was happening, of course, was that the sun warmed the open water of the pool in the daytime and its temperature rose above that of the water covered by the roof of the "cave." The reaction against light was not strong enough to prevail against the attraction of warmth, and the fishes emerged. At night, the open water gave off its heat more rapidly than the "cave" water, and the fishes reacted in the same way as before – they moved toward the warmer water. Both eyed and blind fish reacted in this way.

Dr. Breder also discovered that a slight flow of water would make the fish – both blind and eyes – swim upstream. Even normal river fish, that had never experienced cave life, showed the same tendency to enter a simulated cave if there was a mild flow of water out of the darkness.

Thus, by these experiments, Dr. Breder had demonstrated two factors that could influence ordinary, eyed river fish to enter such a cave as La Cueva Chica, and to stay inside:

1. They prefer warm water as against water only a degree and a half cooler – and La Cueva Chica happens to be a warm-water cave, heated from beneath by magmatic layers close to the surface. It is true that at the time the Aquarium party visited La Cueva Chica, the temperatures inside were practically the same as those in the river, but at other seasons the cave waters would surely be the warmer.

2. They prefer to swim upstream – and the waters of La Cueva Chica flow out, underground, into the Tampaon River. Thus there is a constant outward flow that would act as a magnet on these sensitive fish.

These two factors, plus the light avoidance of the blind fish, should serve to make both kinds remain in caves such as this one.

III. *Other Senses of the Fishes*

When Dr. Breder undertook the investigation of the Mexican cave fishes, he hoped to get from them a better understanding of the evolutionary process that produced them. In particular, this seemed a good chance to study *behavior* and its role in evolution.

"As a matter of fact," he said at the beginning of his work, "ninety per cent of evolutionary study has been based on the study of form. But morphology – form – isn't all; it seems to me it is equally important, if you are studying a machine, to know what it does as well as what it is."

Some of the elements in the behavior of the fishes Dr. Breder could study in his own laboratory; others he asked specialists to work on. Dr. Daniel Merriman of the Bingham Oceanographic Laboratory undertook a study of the internal ear and the lateral line.

Dr. Merriman's studies are still going on and beyond the fact that he has discovered that the fish's ear is degenerate, it is not possible to report any of his findings here.

IV. *Taste and Smell*

A most laborious investigation of the tasting and smelling organs of the fish has been going on in Dr. Breder's laboratory for months and before the year is out should reach the stage of publication. Nothing more can be said now. The burden of this study has been carried by Miss Priscilla Rasquin, formerly of the American Museum, who is associated with Dr. Breder in this phase of the general problem.

V. *The Brain*

Dr. Ralph Meader of the Department of Human Relations of Yale University has in hand the task of studying the brain of these fishes but it will probably be a long time before his studies near an end. To date, many microscopic sections of the brains have been made. They are being studied.

VI. *Genetics*

Naturally, an important field for study is the one that involves the genetics of the cave and river fish. Fascinating as it is to study the behavior of an animal and to discover what it does and the rules by which it lives, the geneticist is the man who must be relied upon to figure out the "how" of the inheritance of its physical modifications.

More or less from the very beginning, a genetic study of the cave fish has been in progress and the end is a long, long way off.

As simply as I can state a complex situation, here is what probably has happened.

For untold generations the Tampaon river

has swarmed with the common little fish known scientifically as *Astyanax mexicanus*. (It has no common name). And it happens that this species naturally exhibits more variation in the size of its eyes than do most fishes.

Now, suppose that at some time perhaps many fish-generations ago some individual river fish found themselves at the point where the underground waters of La Cueva Chica boil out into the bed of the Tampaon river.

We know that even the fully-eyed river fish have no hesitation in entering darkness. The underground exit of the cave waters offered them darkness.

We know they have a disposition to swim upstream against a current. The outpouring waters offered such a current.

We know they will react toward warmer water – and the cave waters at certain seasons are warmer than the outside waters.

These factors would work together to inveigle any river fish into the cave. And once inside, the conditions of cave life – warm water and a current flowing outward – would conspire to keep the fish there.

Now, if we remember that the normal, eyed river fish have an hereditary predisposition to eye variations, it seems quite possible that occasionally some of them are hatched with really serious eye defects. Nobody fits baby fish with glasses; in the open water they die off quickly if their eyes are not up to the job of finding food and warning of enemies.

But in the complete darkness of a cave, eyes are not important at all. Predators are fewer, or handicapped by darkness to the same degree as weak-eyed or blind fish. And so, when a serious eye defect showed up among the fish in the cave, the merry complications of interbreeding tended to preserve it and even to extend it in the favorable cave environment.

That is where the geneticist comes in. It is his job to work out (if he can) the jumble of genes that produce all the variations in eye development that have been found in the waters of La Cueva Chica.

We know that the completely blind fish breed true. Cross a pair of blind cave fish and all the offspring are blind. That holds good even if they have been reared in full daylight; the offspring of seventh-generation-daylight-reared blind fish are just as blind as the original cave stock (as any geneticist would anticipate).

Possibly some of the intermediately-eyed fish found in the cave are the result of recent crosses between blind and eyed fish or maybe they are simply fish that represent steps in the evolution of the completely blind form. Dr. Breder would like to test these two ideas – and others – in his tanks, but there are difficulties. Other fish eat the eggs if they are deposited in a tank without planting, to make observation easy. If the eggs hatch in a planted tank, it is difficult to see the young, or they are eaten by other fishes.

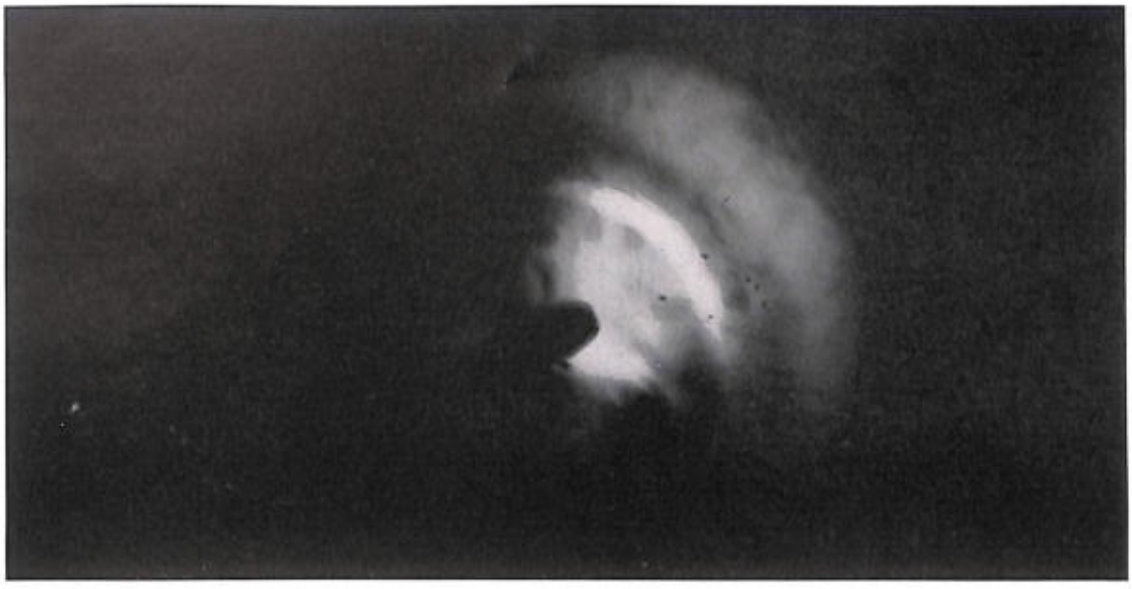
Ideally, of course, Dr. Breder would divide himself into three or four persons and sit beside his tanks day and night to see when spawning occurs, remove the other fish, and watch the young develop. He hasn't been able to do that yet.

Some way of making an isolated cross between a blind fish and a fully eyed fish, rescuing the eggs before their parents eat them, giving them the right conditions for hatching and then preserving the young until they can be counted and examined under a microscope is one of Dr. Breder's forthcoming tasks.

If he is successful, he will have a notebook full of genetic data that will certainly be the springboard for a whole new series of experiments and conjectures. That is why I think this investigation is probably never going to end!

* * *

Just as a footnote to this article, it should be mentioned that since the Aquarium expedition visited La Cueva Chica in 1940, other collectors have found another form of blind characin in the Cueva de los Sabinos, fifteen miles from La Cueva Chica. This fish has not yet been described in scientific literature. It has its own set of puzzles – no intermediate forms have been found – but living specimens have been brought to New York and are being studied. Maybe they will furnish some new answers to old puzzles and give an end to the main problem. But I doubt it. More likely, after the war there will have to be about six months of hard, slogging field work. More fishes – more data – and more puzzles.



Six flashes of the Green-lighted Firefly produced this striking photograph which silhouettes the abdomen of the beetle and shows the back-flare of the light. This is the first firefly picture made by Mr. Dunton.

"Lightning-bugs"

Five Species of Fireflies Are Most Commonly Seen in the Mid-Summer Fields in This Region

HENRY FLEMING

IF I WERE A painter instead of an entomologist, I should like to attempt an almost-impossible picture. I should like to paint a June night with fireflies.

Whistler might have done it. Indeed, he almost did in his Cremorne "Nocturnes." In the deep crepuscle, the glow of the chains of lanterns is very like the glimmering of enormous fireflies. But he chose a moment between dusk and night, and *my* picture would attempt to transfix the velvet blackness of an early summer night with a thousand winking, burning spots of green and yellow.

It would be sure to be misunderstood. It would be mistaken for an impression of an anti-aircraft barrage. Or a pilot's view of a faulty blackout.

No matter; I am not a painter, and my only purpose in evoking such a scene is to bring to my readers' minds the pictures we must all have stored away, of scented gardens and still fields all blossoming with the luminous, mobile flowers of the night, the familiar fireflies.

It is surprising how little we know about fireflies, and of that little how fractional is the information that is of general, as distinct from technical, interest. To know that fireflies are beetles, that they belong to the family Lampyridae and are related to the soldier beetles and that there are some fifty species of fireflies in the United States alone – in every State – is enough basic information to start one on a search through a mountain of books and isolated scientific papers. The hunt is almost as vain as swinging a collecting net with one's eyes shut.

As far as I can discover, there are no common names to differentiate the five species of fireflies most generally seen in this corner of the United States. All are known by the one shotgun term of "firefly" or "lightning-bug." It is an unfortunate lack, but the vast majority of all insects are under a similar disability, and it would be a brave entomologist who would attempt to do anything about it on a wholesale scale.

Nevertheless, since I hope in this article to lay down some simple rules by which the various species of fireflies can be differentiated, I am willing to attempt the naming of them. After all, these five species of lightning-bugs probably look less alike than the Dionne quintuplets did at birth, and yet Père and Mère Dionne faced the task of naming *them* and telling them apart!

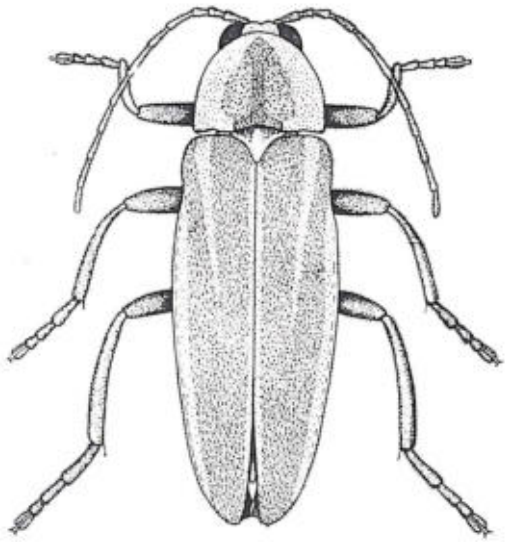
Solely for the purposes of this article (since I have no expectation that any considerable number of persons will ever want to pose as firefly experts), I list the five species under discussion, and give vernacular names by which I shall refer to them.

Scientific Name	Vernacular Name
Photuris pennsylvanica	Green-lighted Firefly
Photinus pyralis	Flashing Firefly
Photinus scintillans	Glowing Firefly
Photinus consanguinius	Double-flash Firefly
Photinus marginellus	Burning Firefly

For reasons that will become apparent when I discuss the light rhythms of these curious beetles, these vernacular names are not very satisfactory. They are simply an approximate expression of the color of firefly light, or of its flash-tempo. And these, especially the tempo, vary to a disheartening degree.

In this latitude fireflies make their appearance about the end of May and the beginning of June. As insect lives go, theirs are long; they flourish until the end of August. Before Labor Day the last light has been snuffed out, but the busy, purposeful summer has been well employed. Through the romantic medium of their flashing signal-lamps, the males and the females have found each other. On leaves, among grass roots, in minute cracks in the ground, the luminous eggs have been deposited and the complex mechanism that next summer, or the summer after, will populate the June world with fireflies is already in operation.

The glowing spheres that the female firefly deposits are, so far as we know, laid singly and not in clusters. The egg's feeble light is shed for only a few hours; then the fire is gone from its surface, but life has been stirring inside it. In three weeks or so the larva emerges from the egg – an undistinguished little worm, hard-shelled, often mistaken by Victory gardeners for the baleful wireworm.



After Hess

The Green-lighted Firefly (*Photuris pennsylvanica*) is by far the largest of the local species; note how its black head protrudes from the "shoulders."

The prime business of the grub is to eat and eat and eat again. To grow is its aim in life, and it must forage constantly among the snails, earthworms, grubs and such small deer of the grass-roots in order to put on size, even though the net result is only an added few millimeters of length. It is likely that the firefly grub lacks a sense of smell, for it seems to seek out its food by a constant casting about of its antennae. Once the delicate "feelers" make contact, the tiny creature lunges forward, mandibles opening and closing. They sink into the flesh of the victim and pour out a minute quantity of a poisonous brown fluid, which not only paralyzes the victim but liquifies the flesh so that the grub may feed more easily.

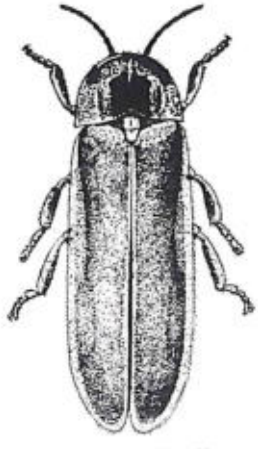
Apparently food is not too plentiful within range of the firefly larva's antennae, or else the creature has a low rate of growth, for it sometimes takes two seasons for it to get its full stature

of about one-quarter to three-quarters of an inch, depending on its species. Larvae hatched from the egg this summer may be ready for their next stage in life by the coming of cold weather this fall; on the other hand, they may have to hibernate and resume feeding next summer before preparing for their greatest change.

When the grub has fed its full, it creates a clay dome about itself and goes into a fretful sleep. The winter passes, the grub's form changes inside its capsule, and then comes the warm May evening or the scented June night when the shell cracks and the transformed grub soars upward, winged and flashing its species rhythm—a firefly.

* * *

When our hypothetical firefly of the preceding paragraph "soared upward," that fact of flight stamped it as likely to be a male. Both males and



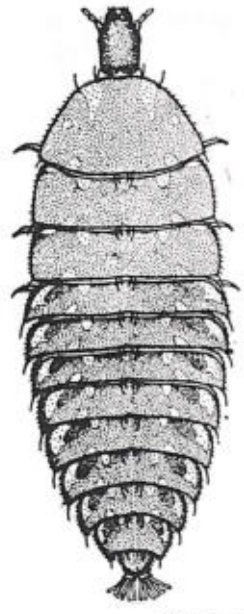
The Flashing Firefly (*Photinus pyralis*) is common in many areas and is next to the Green-lighted Firefly in size.

After Hess

females of the big Green-lighted Firefly take to the air; the females of the other common species all have wings but seldom or never use them, except the Glowing Firefly. The female of that species is wingless and completely earth-bound.

Although to our eyes it may seem that fireflies are almost always on the wing when their "day" begins at dusk, and that thus there is little chance for romance developing between the flying males and the grounded females, their lights serve to bring them together at a trysting place on a leaf, a stem or a blade of grass.

On her little perch at the tip of a blade of grass, the female winks with a feeble but definitely "come-hither" light. The bold flashing of an air-borne male within a few yards of her is



A typical firefly larva—in the stage when its chief purpose in life seems to be to eat and grow larger.

After Hess

enough to set her off and cause her light to blink. If the rhythm and tempo – or some other delicate factor of which we have but little knowledge – are those of his own species, the male may swoop down and investigate. Back and forth, one signaling and the other answering like a couple of destroyers searching each other out with blinker lights on a murky night, they exchange their messages of courtship. If all is satisfactory, the male alights and waves his antennae until he encounters the female. Then the flashing ceases and mating takes place.

It is sad to have to record that the female of the Green-lighted Firefly is a siren luring unsus-

Firefly pupa in its cell, awaiting transformation to its winged state.

After Hess

pecting males of other species to their death, but such is often the fact. The flash rhythm of the Green-lighted Firefly is so variable that it may on occasion happen to imitate that of most of the other species. Her signal may be answered by an amorous male of the Flashing Firefly or the

Double-flash Firefly, and the moment they encounter the female they find themselves seized by strong jaws and devoured. Incidentally, there is little other evidence of the food of fireflies; some investigators suspect that the males of our species eat minute portions of greenstuff.

Perhaps the most interesting and most puzzling of all firefly phenomena – besides, of course, the nature of the light itself – is their habit of flashing in unison.

It is not a frequent phenomenon locally. A few dozen observations have been reported elsewhere, but it is probably far commoner than published reports would indicate. The aftermath of a heavy thunderstorm seems to be a favorite time, when the air is heavy and damp and still with an unusually large number of fireflies hovering over a low meadow.

At one moment the meadow may be pitch black, a void, and at the next lit up by thousands of pin-point lights. The performance may cover the whole of a large field, or it may be of a rolling type, so that synchronous flashing starting at one end will proceed across the field like a wave. Off and on, off and on, the lights wink simultaneously for as long as five or six minutes.

So far there are several theories to explain what sets the lightning bugs off simultaneously, and why they stop when they do, but no one of them is entirely satisfactory. Incidentally, a Siamese firefly is said to synchronize for hours and to resume rhythmic flashing night after night. Our local fireflies are not that energetic. The Green-lighted Firefly keeps its lights going until almost dawn, but the others generally quit by eleven o'clock and seek rest under leaves or in the grass.

As I said a moment ago, the nature of the light of a firefly is one of the prime secrets of the insect world. Many thousands of words have been written about the cause, the method and the reason for the light, and to all intents and purposes naturalists are not much further along than they were in the beginning. It is, however, known that the light of a firefly is not wholly without heat, as was believed for a long time. The quantity produced is extremely minute but it can be registered by modern apparatus. Heat is, in one sense, wasted light and the firefly's efficiency as a light-producer is tremendous compared with the best man-made apparatus.

We know that the light-producing organs are on the underside of the firefly's abdomen, that there are two layers of tissue, one photogenic and the other a reflector. The light is the result of the oxidation of body wastes collected in the reflector layer. Apparently, oxygen and water and a photogenic protein are all that are necessary to produce firefly luminescence, but these seem to be consumed in such large quantities that they would not be very practicable on a commercial scale. What man lacks is the lightning-bug's "know how."

* * *

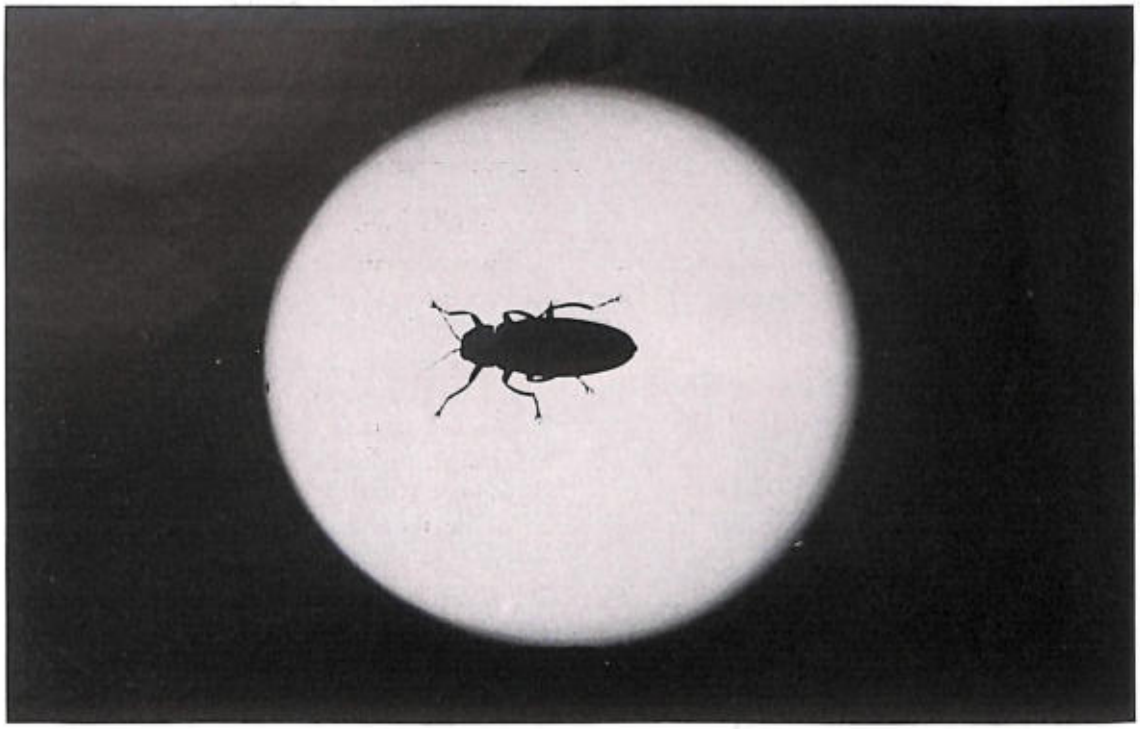
When I embarked on this article, I thought it would be interesting to work out a simple key by which the amateur could identify the common fireflies of this region. It would be interesting, all right, but almost impossible – at least to make a simple key.

However, since only five species are likely to be noticed around New York, a few hints at a beginning of separation of the various kinds can be given here and can be applied by anyone.

The Green-lighted Firefly is easily the largest of all our fireflies – half an inch long, or even more. Its light, both in the male and the female, is definitely greenish. Furthermore, if there is any question, and a specimen is in hand, one can see without the use of a magnifying glass that the head projects beyond the "shoulders" – the forward segment from which stem the two forward legs. In all our other local species, the "shoulders" (the prothorax) hides the head, looking at the firefly from above. To tell whether the head projects, wait until the firefly is at rest – not walking in one's hand.

The next largest firefly, and one that may at first glance be mistaken for the Green-lighted, is the Flashing Firefly. It is slightly smaller than the Green-lighted and its head is hidden. Besides, its light is yellowish, like that of the Glowing, the Double-flash and the Burning Firefly. The Flashing Firefly's head is thrust forward while it is walking, so that it resembles the Green-lighted Firefly, but it disappears when the beetle is at rest.

In solemn recognition of the fact that I am sticking my head in a noose, I am going to attempt a "flash chart" for the casual recognition of our five fireflies. No scentist would depend on



A particularly brilliant specimen of the Green-lighted Firefly produced this silhouette in six flashes. A round, curved reflector under the beetle concentrated its light and gave the image a circular effect.

such a crude device – but, then, no scientist would need to. He would have rows of specimens, microscopes and all the apparatus and technical keys necessary to make identification positive. The readers of this article are not likely to want to be so positive. It may add interest to a summer's evening in the country to try to separate the various flash-rhythms and to know that, probably, one has seen the Flashing Firefly, the Double-flash Firefly, or whatever it may be, at its evening's work.

Here, then, is the chart –

GREENISH-BLUE LIGHT

GREEN-LIGHTED FIREFLY

Male Signals: - - - or - - - - or - - - - - (Sometimes, for a reason we do not know, when the Green-lighted Firefly is circling a bush or tree, it will emit one long flash, holding it about twice the length of an ordinary short flash, like this: —
Female Signals: - or - - or - - -

YELLOWISH LIGHT

FLASHING FIREFLY

Male Signal: - (The signal of the female is presumably the same as that of the male).

GLOWING FIREFLY

Male Signal:.— (Female presumably the same).

DOUBLE-FLASH FIREFLY

Male Signal: - -
Female Signal: - -

BURNING FIREFLY

Male Signal: —
Female Signal: - —

The vernacular names I have arbitrarily given these fireflies are, it will be seen, based roughly on the characteristics of their lights. *Photinus scintillans,* for instance, I called the Glowing Firefly because its signal is a long glow of fire; *Photinus marginellus,* since its light also is long, I called the Burning Firefly to express the same idea. *Photinus pyralis,* quick and short in its rhythm, more nearly fulfills the name Flashing Firefly than some of the others.

I earnestly advise young entomologists to have recourse to their microscopes and formal keys if they want to make a career in the study of the Lampyridae. But for others whose aims are simply enjoyment, the "flash chart" may be the makings of an evening's amusement.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

NEW MEMBERS OF THE SOCIETY

New members of the New York Zoological Society since the last issue of this magazine are the following:

LIFE

Mrs. Kermit Roosevelt — Lewis S. Rosenstiel

ANNUAL

Henry B. Abrahams
Leon Balsam
William A. Bandler
David Bunim
Donald Angus Cameron
J. B. Deacon
M. L. Dreyfus
Elly Erdmann
Charles Frank
Crosby Gaige
Mrs. Richard Gambrill
Samuel Gates
Leo Gerngross
Herbert Haseltine
Max J. Halpern
Diana Hass
S. D. Hesse
Clarence H. Heyman
Ralph T. Heymsfeld
Adolph Hirsch
Duncan A. Holmes
Lester B. Jacobi
R. Lincoln Jordan
L. A. Heidel
Ralph C. Ketcham
Otto Kleppner
Alexandra Krastin
Marjorie Lane
J. L. Lehan
Edmund Lissberger
Mrs. George Marshall
W. J. Murray, Jr.
Fay Nash
Ernest E. Nyden
Jean Palmer
Richard Patterson
Ignatz Reiner
Mrs. Elsie Restell
Jerome Roth
Margot Schwarzhaupt
Milton B. Seasonwein
Mrs. W. D. Shackleton
I. J. Seskin
Frederick H. Warner
Theodore C. Wiehe

JUNIOR

Hartman J. Bittorf — Leo M. Spichler

"PETE" IS 40

"Pete," our two-and-a-quarter-ton hippopotamus, was 40 years old on July 13 and is the second oldest hippopotamus on record among the zoos of the world. The Paris Zoo in 1855 received a hippo that lived for 41 years, 7 months and 29 days. Pete's health and appetite are excellent and there seems to be no reason why he should not live to establish a new world's record.

The animal – our only hippopotamus, incidentally, in the whole history of the Zoological Park – was the seventh offspring of the famous "Mrs. Murphy," a hippopotamus in the Central Park menagerie. His father was "Calif," and the Central Park pair provided most of the hippos in American zoos in the past half-century. Pete was born on July 13, 1903, and came to the Bronx Zoo on July 14, 1906, the gift of the late Samuel Thorne. He cost $3,000, and was considered a bargain – as, indeed, he was. Few animal investments have paid such continuous dividends of interest and enjoyment.

WHITE-NECKED CRANE CHICK

Twenty years ago a pair of White-necked Cranes from Asia hatched an egg in the Zoological Park. That was the only record of successful breeding in the United States until this spring when our present pair laid an egg on May 17 and hatched it 32 days later, on June 20. The chick is strong and healthy, and may be seen in the Blackbuck Paddock.

While the cranes were sitting, two Barnacle Goose eggs were deposited in their nest by a Barnacle that has the run of the same paddock. Both eggs hatched – one under the cranes and the other under a mated Hutchins and Pink-footed Goose pair to which the second egg was given. The goslings are doing well, too.

PUBLICATIONS OF INTEREST

PICTURE BOOK OF INSECTS. By Albro T. Gaul. Lothrop, Lee & Shepard Co., New York, 1943. 40 pp., 42 illus., $1.50.

Picture Book of Insects will familiarize children in a general way with the field of insects. Mr. Gaul has selected some examples typical of those insects that a child is apt to see while walking through a city park or in the country. He has given a short account of the more interesting features of the insects' habits together with an identifying photograph.

"What is the difference between an insect and a bug? How does an insect grow?" These and other likely questions are answered in a lucid style entirely within the comprehension of a seven-year-old child.

Each insect, as the title implies, is illustrated by a large photograph. The pictures contain an excellent amount of detail and the child should have no difficulty in identifying the group to which his specimen belongs. A life-size silhouette has also been included as an aid.

This book is a particularly happy choice for it is so arranged that it will interest the child and stimulate him to further investigation of the subject as he grows older.– *Henry Fleming.*

ANIMAL KINGDOM

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Reversing the Order

While a Zoo is a place where people come to look at the animals, there exists, in every properly-run Zoo, a small group whose function it is, among other things, to look at the *people*. In other words, we members of the administrative organization who are doing everything we can to run our Zoological Park in bang-up fashion, know that we cannot accomplish this unless we constantly watch public reactions to discover what type of exhibits and what methods of exhibition technique have the most appeal and hold the most interest for our visitors. In effect we are conducting a friendly form of counter-espionage. We keep on learning new things and as long as we play this game actively ourselves, keeping our eyes wide open, we know we will be able to make a steady improvement in the great Zoological Park which is under our care.

One word as to the visitors of the year 1943 – already totalling some one and one-half million persons in number. It seems to us that it is the most lively, most interested, most, shall we say, "heads up" crowd that we have observed. We cannot tell just why we gain this impression. Perhaps it is that during this war period people have found a peculiar and extraordinary enjoyment in observing and studying the noble, curious and colorful living forms, each of which has its own place in the vast and inspiring scheme of Nature.

Fairfield Osborn

IN THIS ISSUE

Portrait of Old Nellie . . . . . *Sam Dunton* COVER
Night Life of the Bush Baby . . . . *Donald Marcy* 99
Quetzals *Do* Breed in Captivity . . . . *Charles Cordier* 104
Portraits of Four Primates. IV. 107
Our Zoo's Former Inhabitants . . . . *William Beebe* 111
Behind the Scenes: News and Notes 119

SHOP TALK

Ever since the last issue of ANIMAL KINGDOM *we have been pawing feverishly through the mail each morning, sure that this time somebody was going to write in and offer us the dinnerbell we have been trying to get for the Farm-in-the-Zoo.*

Just when we were beginning to think nobody cared, three dinnerbells materialized. One was brass, 4 inches across the mouth, and has a handle. We scorned it, politely but definitely.

The second dinnerbell was regulation size, all right, but its owner wanted $35 for it.

But the third bell! It's a beauty! Eighteen inches in diameter, with all the trimmings for hanging from a pole, and a voice that sounds like a hybrid between the Bare-throated Bellbird and the Abyssinian Wild Ass. It came all the way from the heart of Illinois, prepaid, with the compliments of Member Mary VanderPyl.

* * *

Two months ago President Osborn mentioned the new sound system being set up in the Zoo so we can give brief recorded talks about the animals. But he didn't tell about the shock the Education Department got the first time it tried out its Sea Lion record.

Waiting until about twenty persons had gathered to watch the Sea Lions, Dr. Leister put on his record and hurried out to hear the comments of the visitors. They seemed to be paying more attention to the animals than to the talk – and in the very middle of it they turned and walked away!

While he was pondering this complete failure of his efforts, the group of visitors broke into a flurry of finger movements.

They were all deaf mutes!

* * *

Our cover picture is Old Nellie, the Griffon Vulture, now 41 years in the Zoo. That's faithfulness for you! —EDITOR.

The tiny bush baby weighs only five and a half ounces and its long, fluffy tail balances it so perfectly that it seems as effortless as a piece of thistledown as it leaps six or eight feet from the floor of its cage to a perch.

Night Life of the Bush Baby

The Tiny Senegal Galago Becomes Active When the Sun Goes Down and Its Adaptation to Darkness Is Amazing

DONALD MARCY

ON THE OPPOSITE PAGE is a photograph of that tiny twig from the lemur branch of the primate tree, the galago or bush baby. Many readers will be surprised to learn that bush babies have been on exhibition in our Small Mammal House almost continuously for the past fourteen years, for their small size and nocturnal habits cause them to be passed unnoticed by most visitors; but those who are fortunate enough to have seen the little animals in action are astonished by their agility and enchanted by their appealing mannerisms.[1] Luckily there are ways to lure a bush baby out of its sleeping-box in daylight – we'll talk about that later!

One evening not long ago I decided to pay a visit to our galago. Arriving at the Small Mammal House as twilight was descending over the Zoo, I stationed myself immediately in front of its compartment and began my vigil. A furry ball in the sleeping-box, which is hung half-way up a tree near the center of the cage, showed that the little animal was still sound asleep, oblivious to the vague scratchings and rustlings issuing from nearby cages and to the occasional weird vocal concerts of the coyotes and foxes.

Presently there was a slight movement in the cage; the bush baby raised its head to look intently at me with great, unblinking eyes. Still staring and uttering a questioning, birdlike chirp, the little animal hopped to the door of the sleeping-box, paused while it surveyed me with its head swiveling, then jumped to the cage floor as lightly as a piece of down and ran forward on its hind legs. Satisfied that the intentions of its visiting relative were honorable, the bush baby accepted a moth from my fingers, ate it with evident satisfaction, and stretched in a manner which struck me as being not only unique but highly amusing as well. Standing on a small branch and grasping it tightly with its right hand and left foot, the *left* arm and *right* leg were stretched to their fullest extent—whereupon the process was repeated in reverse!

After yawning widely and grooming itself thoroughly, the tiny creature began leaping about the cage with amazing grace and agility – from the floor to the under side of the cage top six feet above, to the floor again, to the branches of the tree, then to the wire mesh side of the cage, and finally to the tray of food on the floor. The bush baby lapped a little milk with its long tongue, swallowed a few bites of fruit, and the aerial acrobatics began once more.

Though smaller than a chipmunk and weighing only five and one-half ounces, jumps of six or eight feet are matter of course for the little animal, even in the restricted space of its cage, and galagos have been seen to jump twenty feet diagonally downward. I tried to imagine a bush baby fleeing through the trees of its dark and lofty African home with a hungry owl in pursuit – the jumps must be prodigious indeed, with its life at stake!

I noticed that the bush baby quickly calculated the distance and direction to a new perch before leaping, and even when a backward or diagonal jump was involved could turn in full

[1] Since this article was prepared, the two specimens of the galago in our collection have both died — so it will not be possible for our Members to see the bush babies in action. However, Mr. Dunton's photographs are so interesting we hope they will be acceptable as a substitute.

flight so as to land on all fours facing its goal. Clinging to the cage front, head upward and back to the tree, the bush baby would launch itself backward and twist in midair, alighting on a branch in a horizontal position facing the back of the cage – having turned through 180 degrees on the horizontal axis and 90 degrees on the vertical axis!

Wishing to determine whether the nest-building habit of wild galagos would show itself in our specimen, I tore strips of paper from my notebook and thrust them into the cage. Sure enough, the strips were immediately picked up one at a time in its hands and transferred to its mouth. With quick hops the galago carried the fluttering strips to the sleeping-box, placed them in a corner, and fashioned the paper into a rough nest by bending and crumpling it dextrously with hands and mouth.

Darkness now forced my observations to cease for the time being, and as I prepared to leave I could faintly see the bush baby still jumping about with swiftness and precision – perfectly at home in a cage so dark that the little animal appeared to be nothing but a shadow without substance floating through space between perches invisible to me.

* * *

The thirty-odd species and subspecies of the genus *Galago* are all natives of Africa and a few of its adjacent islands. Varying from the size of a mouse to that of a cat, they are externally distinguishable from other lemuroids, some of which they closely resemble, by their large, almost naked ears. Our species, *Galago senegalensis moholi*, is an attractive form abundant in central and southern Africa. It is one of the smaller species, the head and body being only six and one-half inches long and the tail about two inches longer. Beautifully colored, the dense, fine fur is brownish-gray above and lighter below, the outer sides of the legs cream buff, and the cheeks and bridge of the nose light gray.

The enormous, bulging eyes are the most conspicuous feature of the rounded head. During the day the light brown iris covers most of the eye so that the pupil is a mere vertical slit, but at night the pupil is opened wide to permit a maximum of light to enter the eye. When seen at night by reflected light the eyes glow with an intense amber color, giving the impression that they belong to a much larger animal.

The retina of the vertebrate eye usually has two kinds of photoreceptive cells: cone cells, which are concerned with distinguishing color and light of high intensity, and rod cells, which perceive differences in light and dark and are highly sensitive to light of low intensity. The latter also perceive objects in motion. It is significant that the retina of the bush baby's eye *has rods but no cones*. The cornea – the transparent window at the front of the eye – is very large, constituting one-third of the entire eyeball, and the lens is likewise of great size. Knowing the structure of the bush baby's eye, we can understand the reason for its keen vision at night, and, recalling how our own eyes hurt when we emerge from a dark theater into sunlight, we can appreciate its avoidance of the bright light of day.

So large are the galago's eyes that they cannot be turned in their sockets by the eye muscles. The extreme mobility of the head itself compensates for this condition, however, and it does not appear to be a handicap. A galago constantly turns its head this way and that, twisting it around until the nose is directly over the midline of the back or swiveling it so far that one eye is directly above the other – or farther!

The large, membranous ears are constantly turning in various directions in response to the faintest sounds. An interesting peculiarity of the ears is that they may be pulled back flat against the head in alternate ridges and folds, probably as a means of protecting them from injury as the animal passes through dense foliage or through a small aperture. They are sometimes folded when a bush baby sleeps, and are said to be pulled back when it is fighting.

Although the muzzle is short and the nose small and pointed, the olfactory sense is well developed in the galago; unlike the monkey, it relies upon its nose rather than upon its hands for examining strange objects. This as well as the complete lack of facial expression emphasizes the fact that the bush babies are much nearer to the roots of the primate tree than the monkeys and apes.

As with all primates, including man, the bone structure of the forearm permits pronation and supination – that is, the hand may be rotated

The bush baby's hand has flat fingernails and almost bulbous fingertips. The friction pads on the palm, that aid in climbing, can be seen between two fingers.

freely. This is a condition that arboreal animals find particularly useful. The sturdy collar-bone, attached at one end to the breast-bone and at the other to the shoulder-blade, helps to give a solid foundation for the action of the forelimb — another characteristic common to climbing animals.

A bush baby's fingers are long and slender, the fourth being longest, and all have flat nails. The thumb is thicker than the other fingers and is opposable to them, although the index finger sometimes separates with the thumb and sometimes with the other fingers when a small branch is grasped. The tips of the fingers are expanded into friction discs which, with the pads on the palms, help to make the hand a most effective clinging device. The bush baby is the only animal known to increase the adhesive power of the hand and foot pads by moistening them with urine. Thus it is capable of clinging to smooth surfaces and can even climb up the edge of a pane of glass by grasping it between thumb and fingers and the "big toe" and its opposing digits.

Objects are grasped in the fingers without involving the palm of the hand or the thumb; the two outer segments of each finger are flexed while the proximal segments (next to the palm) remain in line with the palm. Hence the object is pressed between the two outer segments and the inner segments of the fingers. Picking up a pencil in your own fingers will make this easy to understand.

From the hind legs, which are twice as long as the forelegs and about an inch longer than the body itself, comes the power for the bush baby's spectacular leaps. The extreme length of the legs is obvious even in a sitting position when they are flexed with the knees high and far forward — so far forward, in fact, that they sometimes overlap the backwardly-projecting elbows. Much of the length of the leg comes from the foot, which has an overall length of more than

On the underside of the galago's foot the heavy pads on the palm and on the toes are quite visible. The claw on the second toe is used for grooming the soft fur.

two inches due to the elongation of two of the bones of the ankle, the calcaneum or heel-bone and the navicular, which lies above and slightly ahead of it. The great strength of the leg muscles and the elongation of the ankle results in a very powerful and efficient "throwing stick," capable of flinging the light-weight body over long distances with ease.

Widely separated from the four remaining toes, the hallux or "big toe" is sturdy and strong. The soles of the feet and the tips of the toes bear large friction pads, and all toes have flat nails except the second which is equipped with a claw, an efficient scratching tool used in grooming.

Probably the soft and fluffy nature of the fur helps to buoy up the light-weight body and decrease the impact of the landing after long jumps,

and the long, bushy tail is an important aid to balancing when the animal is perching, running, or jumping. A sleeping galago usually curls its tail around its feet and under the chin, and sometimes uses it to shield the eyes from light.

Although the bush baby ordinarily progresses in a series of jumps – spectacular when in a hurry – it frequently runs or walks on all fours along branches or on flat surfaces, and is also able to hop like a kangaroo on its hind legs or run upright on them for short distances, manlike.

In their natural habitat galagos spend the day sleeping in nests which they build of soft materials in hollow trees and other dark places. Often several are found snuggled close together in the same nest, and it is said they sometimes sleep continuously for several weeks during periods of drought when food is scarce. During the night they forage about in trees for fruit, insects, small birds and their eggs. Live prey is caught in the hands and transferred to the mouth, but fruit and similar food is first smelled, then picked up directly in the mouth. They are also said to eat gum arabic, produced by acacia trees, and from this habit they are sometimes called "gum animals."

In the Zoo our bush baby is fed apples, oranges and other fruit, as well as hamburger, insects and eggnog. Our bush baby seldom touches its food during the day, but apparently its love of insects is strong enough to overcome its abhorrence of light, for it may be lured out of its sleeping-box in daylight with a grasshopper or moth as bait. The animal may be awakened by tapping on the cage front, and the insect should be held up so that it may be seen. Usually the bait will be immediately grasped and eaten.

According to one story, which is repeated with misgivings, galagos may acquire a taste for alcoholic beverages if given the opportunity. It seems that a certain planter was disturbed at night by the loud, piercing cries of the little animals feeding in nearby trees. Unable to sleep, the exasperated fellow hurled a mug of ale on them. Quiet ensued while the bush babies carefully lapped the liquid from their fur, and apparently they spent the balance of the night in deep slumber. The next night, however, the din began once more, but seemed to come from twice as many throats. Finding that the same treatment was again effective, the planter always placed a bowl of ale under the trees and presumably slept soundly thereafter! So far, we know of no primatologist who has studied the effects of habitual drunkenness on the family life of the bush baby.

Tall as this story may seem, it is said that bush babies are sometimes captured by inducing intoxication with palm wine or fermented fruit juices. Their normal instinct to flee is inhibited and they would just as soon be caught as not.

The teeth of the bush baby are well adapted to its omnivorous diet. Sharply pointed cusps on the cheek-teeth break up the food which has been held or sheared by the action of the upper canines and the opposing first lower premolars. The lower canines are slender and lie close to the extremely fine incisors, which lean far forward and are pressed closely together. This tooth complex is an efficient scraper for cleaning the skin and fur and bush babies seldom go long without grooming themselves and their companions both with the incisors and with the tongue, for they are cleanly animals.

High-strung and sensitive, the bush baby responds to the faintest sounds and slightest quick movements with quivering ears and swiveling head. It is easily startled and its first reaction to any unexpected sound or movement is a quick hop away from the disturbance. Nevertheless the animal is exceedingly courageous, and while it will attack only on extreme provocation, it does not hesitate to leap upon and painfully bite the hand which, in its opinion, is becoming too familiar! The truth of this statement will be attested both by Zoo Photographer Sam Dunton, who made the accompanying photographs, and by myself, who assisted him.

The relations of galagos with one another are ordinarily most friendly, and apparently they seldom fight among themselves. At night, when it is most active, our bush baby appears to be much less nervous and high-strung than during the day and is monkey-like in its curiosity about strange objects.

Bush babies express their emotions by movements of the ears and head and by several different vocal sounds. Most of the time ours is silent, although it utters a soft chirping note when offered a choice tidbit of food, and when excited

gives a shrill chattering note. Extreme anger is expressed by a series of peculiar cough-snorts — impossible to describe, but sounding more than anything else like the noise emitted by an outboard motor which refuses to start because the gasoline tank is empty. Those who have heard bush babies in the jungle say that their voices are sometimes extremely loud and piercing and completely out of proportion to their small size.

Dr. Lowther has made a thorough study of a pair of bush babies and has described in detail the birth and development of their twins.[2] Born after a gestation period of four months, the young bush babies were about three inches long and were able to cling to surfaces or stand on all fours soon after birth. Although they clung to their mother when they were feeding, they never did so when she was moving about; when she wished to move them, she picked them up with her teeth and carried them one at a time.

At first the baby galagos spent much time in their nest. Within two weeks they were perceptibly larger and could walk about and even make little jumps of a few inches. Their development was rapid; at two months of age they were able to eat solid food along with their milk and had become quite sure of themselves in climbing and leaping. At the end of three months they stopped nursing and began capturing and eating moths.

From the first the mother took good care of her young, protesting when Dr. Lowther removed them from the nest for examination, and smelling and licking them when they were returned. The father also showed great solicitude for the babies.

So far, none of the bush babies which the Zoo has kept in the past have produced offspring; perhaps their quarters in the old Small Mammal House have not been entirely to their liking. Post-war plans include a new and improved building for small mammals, and when we secure a pair of bush babies they may find conditions suitable for rearing a family — let us hope so! At any rate, it is pleasing to imagine a family group of the tiny creatures hopping actively about a neat, spacious compartment illuminated during visiting hours by dim blue lamps, and taking their rest in artificial sunlight at night — when they would otherwise be wide awake.

[2] F. De L. Lowther, *Zoologica*, Vol. XXV, Part 4, Nos. 25-34, 1940.

This gives some idea of the size of the bush baby — it fits comfortably into the hand. It would bite that hand, too, if it weren't for the leather glove.

If Mother Nature, through her devious methods, decided to develop a new and perhaps better man-type, she would certainly pass over the bush baby as possible ancestral stock. "Sorry," she might say, "but you are already overspecialized, and I'll have to start with something much simpler than you!" *Were* the bush baby to evolve into a new form, it would probably have bigger eyes and ears, longer legs and ankles and — who knows — might be the champion jumper of all time!

Quetzals *Do* Breed in Captivity

The Zoological Society's Collector Brought Back from Costa Rica a Record of the Nesting of These Rare Birds

CHARLES CORDIER

[When Charles Cordier, the Zoological Society's collector of South American birds, returned from Costa Rica almost a year ago, he reported that he had copied the nesting records of a pair of Quetzals in the possession of Señora Amparo Zeledon. Since information about the nesting of these birds is almost non-existent, he consented to prepare an article on the matter for publication in ZOOLOGICA, the Society's technical journal. This has now been published, and the story is so interesting that it is reprinted here. Following Mr. Cordier's directions, a nesting log was set up where our Quetzals have access to it, but to date they have shown no interest in it as a possible nesting site. – EDITOR.]

IN MARCH, 1942, I had the good fortune to meet in San José, Costa Rica, Señora Amparo Zeledon, widow of the well-known ornithologist who died a few years ago.

At that time I was starting on a collecting trip having as its objective the capture of the Bare-necked Umbrella Bird (*Cephalopterus ornatus glabricollis*) and other rare birds for the New York Zoological Society.

It was with considerable elation that I noticed at Señora Zeledon's home a large, well-planted aviary, approximately 30x15x10 feet, in which was a pair of Costa Rican Quetzals, *Pharomachrus mocinno costaricensis*, in superb condition. The male trailed behind in its flight a pair of upper tail coverts nearly a yard long. Subsequently I was able to purchase this pair and the birds are now on exhibition in the New York Zoological Park, together with several other Quetzals.

The most interesting part of my discovery was that Señora Zeledon told me that the Quetzals had reared young successfully on two occasions and that she had made notes of these events at the time. She was kind enough to lend me her notes, which I have translated and reproduce herewith:

"We noticed the young bird peeping through the entrance hole on August 8, 1940, and on the 12th it left the nest.

"Both male and female were feeding it as long as it was confined to the nest, but once outside, only the mother cared for it, feeding it earthworms [Of all things! – Translator] in the morning, and fruit [By which is meant cut-up little plantains known locally as "guinea"–Translator]. On the 16th of the same month it fed itself for the first time. I suppose the birds started nesting at the end of June.

"The tree trunk in which they nested had been in the aviary for more than two years, exposed to the weather, before they showed any interest in it, the male preferring to enter a bigger, irregularly-shaped hole in the wall forming one side of the aviary. The female, however, would only reluctantly go near it, the entrance hole probably being too wide. Fortunately they decided on nesting in the tree trunk after two long years, the wood having become soft enough to be worked on by them.

"The male moulted at the end of August and lost its long tail coverts at the end of September.

"The plumage of the young bird at the moment it left the nest was uniform coffee-color, except the wing coverts which were green.

Although this is the nest of the Honduran form of the Quetzal, it is typical of that of the Costa Rican bird we hope will breed in the Zoological Park. Dr. V. Wolfgang von Hagen, who brought out the first live Quetzals in 1937, cut this nest apart to show that, contrary to legend, the nest has only one hole.

Photo Copyrighted by V. W. von Hagen

"Both parents had been kept for three years in the big aviary and previously for two years in a much smaller aviary in which they would get very wild as soon as approached. In the big enclosure they are quite steady and take no notice of visitors. The pair was composed of a young male and an adult female purchased from the natives.

"February, 1941: The male, already in good plumage, started to enter the nest in the middle of February and to clean it out, carrying loads of dust in his breast feathers which he would shake out, once outside. Both started uttering their calls and the female entered the nest some days later, mornings and afternoons. Both adults started chasing the young Quetzal from the vicinity of the nest and stayed continuously near it, even in March.

"On March 31, 1941, I noticed the female coming out of the nest to let the male get in. Shortly afterward the male came out and the female re-entered.

"April 19: Today I had the gardener trim the trees in the aviary and he noticed two young birds in the nest, maybe 8 days old.

"Five days later we found a dead young Quetzal on the ground. One side showed signs of having been injured. Possibly the birds got frightened when the gardener worked in the aviary and threw one of the nestlings out.

"The young Quetzal, reared the previous nesting season, is still being relentlessly persecuted by its parents. On Friday, May 2, they bit it almost to death. I took it out, did my best to cure it, but found it dead the following day. I had made the mistake of putting it back in the aviary. Even when it was lying dead on the ground, the female would swoop furiously down on it.

"On May 12, 1941, this season's young Quetzal could be seen at the nest hole. It left the nest on May 18, early in the morning. Male and female re-entered the empty nest several times that day."

On discussing the birds' performance, Señora Zeledon said she believed she knew why the Quetzals waited two years before nesting. She thought the wood in the tree trunk was too hard and they could not work it and shape it to their liking. In 1942 she had the old tree trunk replaced but no attempt at breeding was made, the wood probably again being too hard.

I measured the old trunk and found it to have a diameter of about 12 to 13 inches. The nesting hollow was approximately 9 inches in diameter. At the bottom was a shallow cup hollowed out, leaving a rim all around of a width of about 2 inches. The lower rim of the entrance hole, almost 5 inches in diameter, was about 6 inches from the rim of the cup.

Any future attempt at breeding should take into consideration the condition of the log, which should be so well rotted throughout that bits can be pried off with the fingernail, and should have an entrance hole and nesting cavity smaller than the measurements given above. The birds will accommodate it to their liking themselves. It would also be a good plan to wet the log thoroughly from the outside, with a hose, daily, to reproduce natural conditions.

Quetzals breed in cloud forests which are dripping wet almost the year around. While in Costa Rica I found two nests at an altitude of 4,000 feet. One was located deep in the cloud forest in a tree stump about 15 feet tall, so rotten that it swayed when a finger was pressed against it. The diameter of the stump was at most 9 inches, which goes to show that occasionally the Quetzal takes to cramped quarters. The entrance hole was about 12 feet from the ground. I caught the male, who was brooding inside, by walking noiselessly up to the nest and covering the hole with a butterfly net on a short pole. This was in the month of June.

The second nest was situated in an enormous tree trunk, charred by fire and standing in a clearing. The entrance hole was a good 20 feet from the ground. The native who climbed up to it risked his neck by doing so. The nest was deep. He brought up two eggs, the size of pigeon's eggs, uniformly blue in color. He replaced them but the birds abandoned the site. The natives said that they invariably do this when the eggs have been touched.

At first I thought the Quetzal lives in association with the great woodpecker, whose abandoned nest he would take over and accommodate to his liking, but later I was not so sure of this. Quetzals breed up to 10,000 feet and at the higher levels the big woodpecker is not found, being replaced by a medium-sized woodpecker, so that the Quetzal would have to accommodate a much smaller nest.

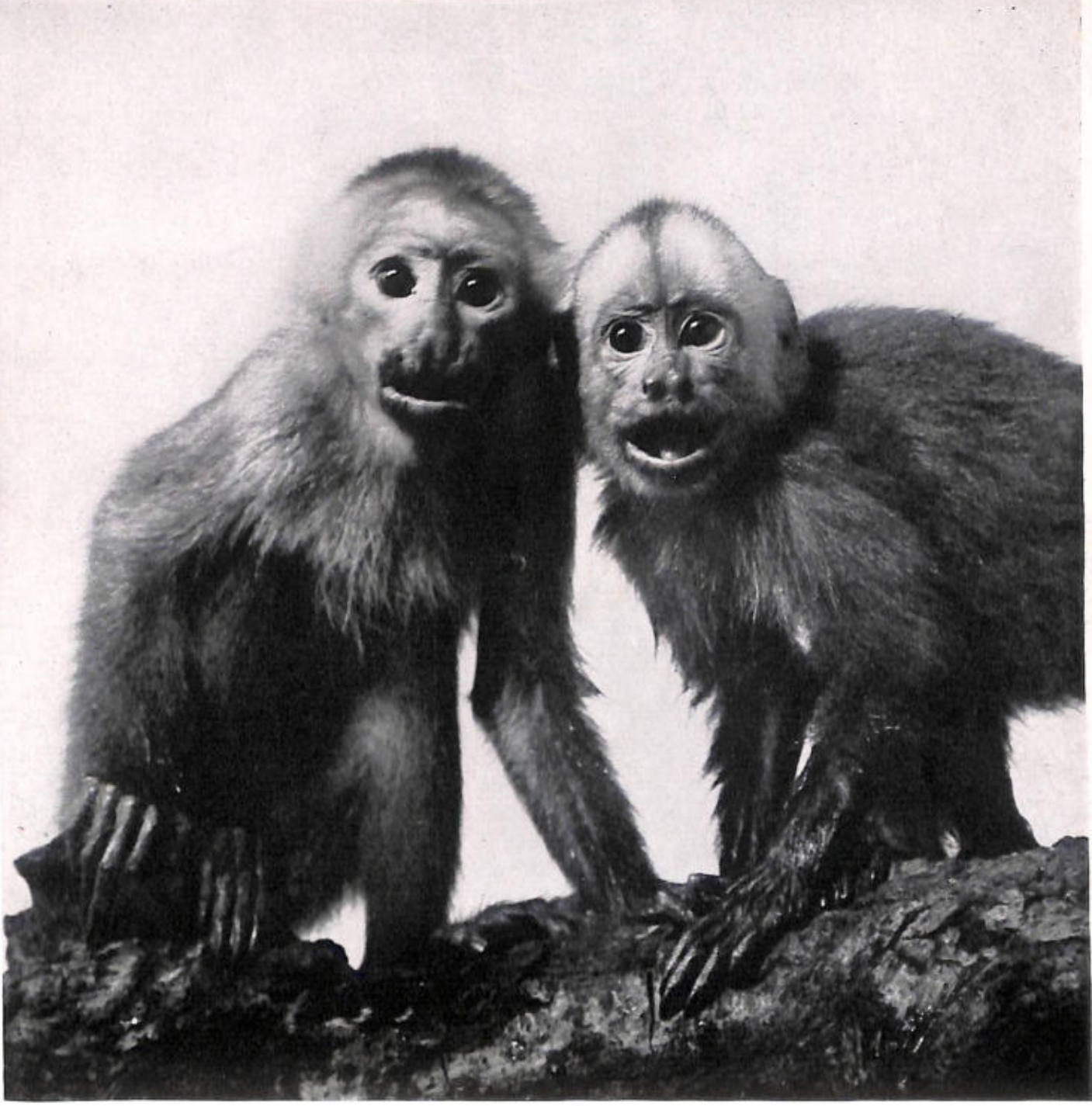
Despite the Quetzal's diminutive feet and short bill, he must be a good carpenter. I once observed in Guatemala a Red-bellied Trogon hollowing out, with feet and bill, an occupied termite nest, and these are quite hard.

Portraits of Four Primates. IV.

PENSIVE MOMENTS must come to all the anthropoids as they study the human faces peering at them, and the late Janet Penserosa – for many years our only Gorilla – was seen many times to assume this thoughtful pose.

With this series of Primate Portraits, we conclude the reprinting of the portraits in the Zoological Society's publication, "Monkey Faces."

Not only in facial expression but in habits does the Owl Monkey resemble its feathered namesake. It spends most of the daytime asleep in a hollow tree, and does not really wake up until night when it comes out to hunt for insects and fruits. This little fellow's home is in South America.



WHENEVER A SAPAJOU is frightened or angry about anything, he talks about it. These White-throated Sapajous apparently had never seen a camera before – and they didn't like it when they did see it. They chattered, screeched and screamed all the way through the process of having their picture taken.

As a rule Chimpanzees do not eat with forks and hold dainty napkins when they take their meals in the Zoo, but they are such excellent imitators that they can easily be trained to do so. The trouble is, the moment the keeper is not looking, the Chimpanzee is likely to put his mouth in the dish and scoop up fruit with his lips.

Our Zoo's Former Inhabitants

Four Mammals and a Bird that Were Driven from Our Grounds Long Before the Zoological Society Took Possession

WILLIAM BEEBE

WE HAVE ALREADY taken a brief and most imperfect glance[1] at our Zoo throughout a matter of two billion, fifty-one thousand, nine hundred and forty-three years, chiefly in the far distant past. A host of additional eras and beings are ready to materialize at the focusing of our curiosity and interest.

Remember, we live within a tiny speck of land, less than one one-hundred-and-twenty-thousandth of New York State. We, as the Zoological Society, have occupied this little area for only forty-four years, and we have been the means of a veritable Noah's Ark of amazing animals siphoning out of arctic and tropics, jungle and desert, out of the air, sea and land into our cages and ranges. Here they live happily, often much longer than their span of life in the wild. Even after death they continue to fulfill their destiny, either to be dissected and add to the sum of human knowledge, or to be reincarnated behind glass at the American Museum. There, through unwinking eyes, and with more permanent physiques of plaster and wire, they patiently watch generations of humans pass and repass before their cases.

Having recounted something of the far distant life of the Zoo which flapped and galloped millions of years ago, there remain the thousands of uncaged creatures, unnoticed organisms which today teem in the soil and bark, in our ponds and rivers. These will be paraded in good time. In these days, before travel becomes again easy and before the post-war spate of captive wild life sets in, it is appropriate to take renewed interest in the life around us. When the millions of our soldiers return from the ends of the earth our responsibilities will be far different. Our renewed animal collections must then be global and the information demanded by our antipodes conscious visitors will have to be encyclopedic.

I have chosen a quintet of American animals which had been driven from our Zoo before we took possession. Red Indians and our Dutch forebears knew them, killed them with arrows and blunderbusses, and served at least two of them piping hot in evening meals of the last century. Please meet them and enjoy their valedictory.

The Gray Wolf

I once heard a wolf howl at midnight in the heart of New York City. In fact night after night, almost exactly on the hour, as I wandered about the Zoological Park watching the nocturnal habits of the animals, the wolves would begin. The unholy yelpings of the coyotes instantly added their intermittent, irritating cachinnations, but through it all would arise the full-throated, terrifying, drawn-out ululations of the gray wolves. The last wild wolf known to have lived in the vicinity of New York City was killed one hundred and thirty-five years ago.

Wolves, like Indians, are one hundred percent American. Twenty to thirty million years ago, on what are now the Great Plains of Kansas and Nebraska in our middle-west, ancient lines of wolfish forms began experimenting. Some became long-tailed and slender like civet cats, others superficially resembled bears and hyaenas. Later, giant wolves appeared, as large as grizzly bears. But all these strains ran out in the course of time. Real bears and civet cats made good.

[1] ANIMAL KINGDOM, May, 1943, p. 50.

Finally about eight millions of years before today, there evolved an animal, which we call *Tomarctus,* which succeeded in life, and became the Nth great-grandfather of all wild dogs and wolves. Our own wolf appeared sometime in the last half million years, while side lines were still dying out. One of these was that of the dire wolves of California, who had so little sense that at least five hundred of them, one after the other, fell into and expired in glutinous asphalt lakes.

The gray wolf does not seem to have been especially dangerous to the Indians of New York and elsewhere. As long as human beings did not keep cattle and horses, the wolves were satisfied with their wild diet and let man alone. Only thirty-five years after the discovery of Manhattan by Henry Hudson, a Dutch resident of this city writes that the principal objection to keeping sheep in the colony was the number of wolves. From this time on, first Dutch and later English governments promulgated Act after Act for the destruction of these animals. One example will suffice:

About 1770 the following Order was issued: "Forasmuch as divers inhabitants of this colony have suffered many grevious losses in their stock, both of sheep and neat cattle, for the prevention of which and encouragement of those who shall destroy wolves in the said colony, and that the breed of wolves within the colony may be wholly rooted out and extinguished, be it enacted, etc., that in the County of Westchester there be paid twenty shillings for a grown wolf killed by a Christian, ten shillings for such a wolf killed by an Indian, and half that sum respectively for a whelp." In these days, the Indians would have formed a Redman's Union, and paraded up and down with birch bark placards, mottoing UNFAIR TO WOLF KILLERS! UNBOUNTYFUL RESTRICTIONS! The wolves more than held their own, and in 1776 the bounty was increased from thirty shillings to three pounds sterling.

The reaction of gray wolves to the advent of white men is rather complex and a direct result of their level of intelligence. When lambs and calves first appear in their hunting range, wolves find these so much easier prey than fawns and other wild creatures that they become a serious menace. They are soon thinned out by means of poison, traps and guns. Before long, however, there occurs a readjustment to these new dangers, and succeeding generations of cubs are taught to distrust anything tainted with the scent of human beings. At this point wolves begin to increase again, and only by the steady destruction of the forests and the spread of occupied land are they ultimately defeated. Among creatures of the wilderness the crow alone excells the wolf in matching its wits against those of man. If wolves were smaller, or had the power of flight, they would put up an amazingly stiff resistance.

The family life of a wolf is as perfect as in any other mammal. Wolves mate for life, share in hunting for their young, and seem to be able to equip their allotment of four to eight offspring as thoroughly mentally as they do physically. In winter, especially in isolated uninhabited regions, wolves hunt in packs, and exhibit great shrewdness in the use of their numbers to head off or tire out their prey. In general resource they are well ahead of any domestic dog.

We breed monstrosities of canines; flatten their poor faces, shorten their legs to mere stumps, give them hyperthyroid eyes, strip them naked as the dawn or embed them in such masses of hair that they can scarcely see; we can magic them to muff size or to giant boar hounds, make them permanent cowards or chronic fighters, waddlers or mile-a-minuters. Yet at the back of their sophisticated brains or what functions as such in their distorted skulls, even a Mexican hairless or a Scottie will often turn around and around before settling to sleep, to press down and smooth out the bed of leaves and sticks of some ancient, wolfish ancestor.

The Wood Bison of the Hudson

In the Palaeozoic Age of jokes there was one which was almost as ubiquitous as that of the

Mother-in-law. This was about the Englishman, who, visiting the United States for the first time, gets his rifle ready and asks to be ferried across the Hudson River to hunt bison on the New Jersey side. This serves to emphasize the unexpected truth that there was a time when, if we stood on the New York shore, furnished with a good field glass, we could have seen herds of American bison silhouetted against the sunset on the tops of the palisades.

Except for the south, the remains of bison almost box the compass around New York City; north-east, north, north-west, west and south-west; Cape Cod, Albany, Syracuse, Stroudsburg and Trenton. These were wood bison, like those living today in Canada, and their trails through the dense forests made man's journeys easier than they would otherwise have been. In 1773 the Pennsylvania bison numbered about twelve thousand, and the last one was killed in 1810 in Northumberland County. So if our Englishman's grandfather had travelled only one hundred and forty miles west of New York City he could have killed his bison.

Curiously enough, the first American bison to be seen by a Spaniard were in Montezuma's zoo in the Aztec capitol of Mexico, and the first observed by an Englishman were living wild in what was to become the capitol of the United States, in the District of Columbia. De Solis, who was with Cortez, writes: "But nothing was more surprising than the sight of the Bull of Mexico, a rare composite of several and divers animals; taking from the Camel the hump upon the shoulders; from the Lion, the flank dry and drawn up; the tail tufted, and the neck furnished with a long fringe in the manner of a mane; and from the Bull, the horns and the feet cloven. Outside of which, it imitates the ferocity of the last, in the vigour and the lightness with which it attacks."

Sir Samuel Argoll, in 1612 at the head of navigation of the Potomac, found "great stores of Cattle as big as Kine, of which the Indians that were my guides, killed a couple, which we found to be very good and wholesome meate, and very easie to be killed, in regard they are heavy, slow, and not so wild as other Beasts of the wildernesse."

These great, black wood bison which once stood on the Hackensack shore and gazed eastward across the Hudson toward the future metropolis, stood six feet high at the shoulder, were twelve feet long, and weighed as much as a full ton. The head in all-American bison is really of relatively normal size, as in ordinary cattle and oxen, but the great bushy hood, twelve inches long in the beard, gives the appearance of an unbalanced heaviness which is wholly belied by the quickness with which this mighty creature can spin around, ready for attack, almost in the space of its four hooves. Blizzards and bogs were the bison's worst natural hazards. In fact, before the coming of the white man, wolves and Indians were their only enemies. The latter valued them too highly to slaughter them except for immediate food and for the warm robes which their hides provided. Also it took exceedingly good hunting for a horseless brave to creep close enough for his stone-tipped arrow to be effective, and yet himself escape the charge of a wounded animal.

Wolves were an actual influence for fitness in the bison as a whole, canine vitamins of sorts. On the outskirts of every herd or lesser assemblage, invariably could be seen one or more gray wolves, squatted patiently, tongues lolling, eyes unwinking. It was watchful waiting carried to the ultimate degree. The effect was twofold: first, the bulls and cows were never wholly off guard, and young calves were kept on the safe side of the old folks. And secondly, when a cow

sickened, or a young bison injured itself, there was small chance of the weakening of the herd by any slowing down to the speed or even continued presence of the weakling. The keen wolfish eyes instantly spotted such a one, and sooner or later he was cut out and pulled down, while the strong, fit individuals continued to hold their own with deadly horn and hoof.

The European Wisent, etymologically the antecedent of our word Bison, is a larger, heavier-bodied animal, with considerably less mane on the fore parts. Caesar found them abundant in Belgium and Germany, but now only a pitiful remnant cling to the forests of the Caucasus, soon to go forever.

Historical times has known only our one member of the family of wild cattle in America, but it is a most noble member, and it is greatly to the credit of our conservationists that the bison – both plains and wood – are permanently preserved from extinction.

Reindeer

To children, especially in the memory of our own youth, it will be no news that caribou or reindeer once inhabited New York City. His was a poor childhood indeed, which cannot recall the "prancing and pawing of each little hoof." And while we may now correctly call the reindeer, *Rangifer caribou*, there was a time when we knew that there were only eight of these wonderful animals, all with never-to-be-forgotten names. In the words of their driver:

"Now, *Dasher!* now, *Dancer!*
now, *Prancer* and *Vixen!*
On, *Comet!* on *Cupid!*
on, *Donder* and *Blitzen!*"

What the yak is to the Tibetans and the Bactrian camel to the Mongolians, the reindeer is to the Lapps. And in recent years its usefulness as a domestic animal has been extended to the Indians and Esquimo of Alaska and Canada. This quality of complete adaptation to mankind is a very curious and unpredictable thing. A wild mallard duck becomes a puddle duck in two generations, while its very close relative, the black duck, remains forever wild; the Indian jungle-fowl and the rock pigeon, accept domestication with, I might say, open wings, while the Javan bird and closely related pigeons never relinquish their wildness. A moose or musk-ox can with difficulty be kept alive in captivity while a reindeer submits to man's care – drawing sledges, providing milk and breeding freely, where horses and cows would freeze to death in a week.

With one of the densest coats of fur and hair known, hooves which splay out into perfect bog trotters and snowshoes, and a digestion which prefers coarse moss, the reindeer is heaven-sent manna to the people of the North.

Our American caribou is very closely related, in fact, most certainly descended from the European reindeer, and the latter name can even more be appropriately used, than in the case of the American robin. No wild reindeer are now to be found in the United States or probably Alaska, but on the great barren grounds of Canada, untold thousands used to migrate south at the end of the short summer, to the pine forests where they could find the moss on which they fed. Early explorers describe the open landscape as darkened with them to the very horizon. In pioneer days of exploration, conservative estimates put the number at hundreds of thousands.

At the beginning of the last, or Fourth Glacial Period, migration on an infinitely greater scale took place. This time it was not to seek new pastures or to avoid plagues of mosquitoes, but an actual forced driving, slowly onward, by an immense, continent-wide glacier. Mastodons, musk-oxen, reindeer, all were driven south, as

inevitably as chips on a tidal wave. Myriads of the animals died, but many survived and found food and continued existence possible. In Connecticut, New York, Pennsylvania and New Jersey we know the reindeer lived and died throughout hundreds of years. Later, the survivors followed the retreating ice northward, on and on, to the ultimate land, scarcely four hundred miles from the Pole itself. Today we find the remains of reindeer — skulls, bones, antlers — in the clay and peat bogs, sometimes within fifteen miles of Greater New York City.

Again, past ages have made scientific fact of part of a child's beloved legend. The reindeer have been New Yorkers, whether chronologically, during the receding of the final glacier of the Pleistocene, or when "'Twas the night before Christmas."

Puma

In the more or less good old days, pumas or mountain lions were abundant throughout New England and New York. One hundred and eighty-odd years ago, within one hundred miles of Philadelphia, a county drive and shoot under the pretense of decimating varmints, slaughtered "41 Panthers, 109 Wolves, 112 Foxes, 114 Mountain Cats, 17 Black Bears, 1 White Bear (albino?), 2 Elk, 98 Deer, 111 Buffaloes, 3 Fishers, 1 Otter, 12 Gluttons, 3 Beavers and upwards of 500 smaller animals." And it is added that twice as many panthers escaped as were killed. The local Indians so resented this senseless killing of their staff of life that not long afterwards, they ambushed the leading hunter and slew him.

One authority reported that in New Jersey there were many more pumas than wild cats, and a leading conservationist tells of reliable rumors that stray animals still lived in the Adirondacks between the years 1900 and 1909. But the puma has gone forever from New York City and holds its numbers only in such distant places as Florida, Louisiana and the west.

In old New York the Dutch settlers believed in the mountain lion in a very realistic way, and when the Indians brought in the skins for sale they wondered at the absence of a mane, and why only lionesses were killed. Whereat the Indians, like their obliging descendants today everywhere in the wild, naively concocted the tale that the male lions lived in high mountains, many days' travel away, and were too active and fierce to be killed.

The degree to which any creature enters into the life of mankind is evinced by the number and character of its names. Mr. Seton has compiled the following list: Cougar, Puma, Panther, Painter, Catamount, Mountain Lion, Brown Tiger, Varmint, Sneak-Cat, Red Tiger, Silver Lion, Purple Feather, Deer-killer, Indian Devil, Mountain Devil, Mountain Demon, Mountain Screamer and King-cat. Of these names, more are devoted to the color and the voice than indicating that the puma was a dangerous animal. It fed, as a matter of fact, on every type of edible creature from grasshoppers to elk and buffalo, with a lamentable preference for the dainty flesh of young colts and calves when obtainable. But man and child seemed always immune from unprovoked attack.

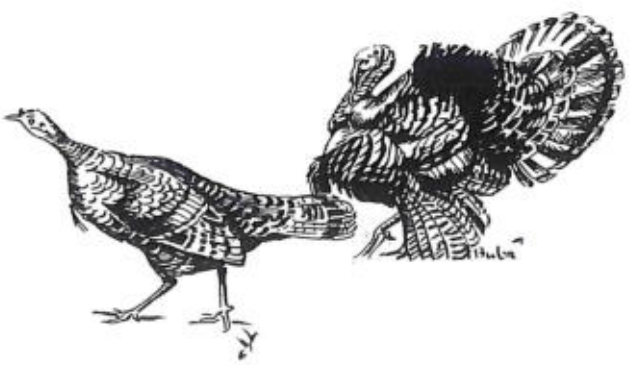
There has been much controversy about even the ability of a puma to scream or to utter any loud outcry. I once stood in front of a cage in the Bronx Zoo close on midnight, and watched the tawny gray inmate as it gave utterance to a loud, long-drawnout, quavering cry which seemed as if it would never stop, and epitomized the essence of wild nature. To imagine it, multiply the most awesome yowl of a back fence tommy by several times its amount of ominous, menacing, portentous, terrifying, appalling character, and you will realize what must now and then have frightened little Dutch babies fairly out of their

cradles as they lay shivering in their father's log cabins in the wilds of Westchester many, many years ago.

Wild Turkey

To the modern city dweller, the American turkey is typified by the crowded, bedraggled inhabitants of crates, bouncing along our streets, on their way to some killing station for turkeys. This is especially true of the season of Thanksgiving (for everyone except the unfortunate birds). Then again we see them suspended in long dismal lines in butcher shops, indecently naked, fulfilling Plato's definition of mankind, "Featherless Bipeds!" Even the casual kibitzer can tell that the birds in the crates are not wild turkeys, for if only a single, mussed tail feather remains, its broad tip will be seen to be white, and not, as in our splendid northern wild turkey, a rich rufous brown.

In the early 1600's turkeys were abundant everywhere on Manhattan and on Long Island, and their *gobble-obble-obble* must have often rung out on what was to become Fifth Avenue and the Battery. They held their own with the Indians, for their senses were keen, and their woodcraft far excelled that of the Redman. Even the blunderbusses of the Dutch could hardly have reached the roosting places in the tops of high trees. So they continued to live and thrive, with frequent nocturnal forays to cultivated corn fields.



Even before Henry Hudson sailed up the narrows, the northern wild turkey was described by the French explorer, Champlain. His testimony was as follows: "The savages, along all these coasts where we have been, say that other birds, which are very large, come along when their corn is ripe. They imitated for us their cry, which resembled that of the turkey. They showed us their feathers in several places with which they feather their arrows and which they put on their head for decoration, and also a kind of hair which they have under their throat like those we have in France, and they say that a red crest falls over the head."

The first official Thanksgiving, proclaimed by Governor Bradford of Massachusetts, was in 1621, and celebrated with the dedication to this feast of wild turkeys. Twenty years later, a writer in New Netherland says of Manhattan, "there were so many Turkies and Derr that they came to feed by the house and hog pens, and were taken by the Indians in such numbers that a deer or three turkies were sold for a loaf of bread or a knife, or even for a tobacco pipe, but now one commonly has to give for a good deer six or seven guilders."

There must have been a certain day when a marauding gobbler on our island heard a liquid challenge from the very door-yard of a Dutch farmhouse. He answered angrily and proudly. The two birds drew together, and in the moonlight a battle to the death was waged – the white-tailed against the brown-tailed. The latter won, we may be sure, for the tame bird had weakened and degenerated during his long domestication. His forefathers had been brought by the Spaniards, more than a century before, from Mexico, and had spread over Europe. Now he had again crossed the ocean, and met the wild bird of New England.

Today, in the 1940's, the wild turkey, like the crow, still pits his wits against man's deadly snares and guns, and still continues to hold his own in wild and isolated forests. Long may his electric, vocal thunder be heard – a sound which unites the past with the present.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

BLACK BABIES

Young cat animals of whatever sort are always great attractions for Zoological Park visitors but, like so many other good things, are not easily come by. Lion cubs we can sometimes manage, but they grow up so quickly that within a few months they are just more lions to swell an indisposable surplus. Tigers have never been successfully reared in the Zoological Park, although we are definitely ambitious in that respect and have hopes of final achievement.

Leopards are certainly as difficult to breed as are tigers and since Black Leopards have a reputation for extreme nervousness and ferocity, they would appear to be practically impossible as parents.

This makes it all the more astonishing that our pair of Black Leopards should have defied tradition last year by producing and rearing a fine black youngster. The parents remained together through the entire period and the father took a deep if passive interest in the youngster.

This year our model parents have presented us with a pair of babies, born on July 23 but not actually seen by us for at least a month afterward. Early in September the young leopards began making brief excursions from their inner nursery in the Lion House and we may expect them to furnish many hours of entertainment for our autumn visitors.— L. S. C.

THE PASSING OF ALICE

Old Alice, our oldest elephant, was quietly and painlessly put to sleep with an overdose of anaesthetic on August 27 after she was found helplessly lying in her stall for the second time in a week. A rheumatic hind leg gave way on her four days before and she was helped up by a derrick — the fourth time in three years that its services were required — but when she went down for the fifth time it was obvious that it was useless to prolong her life. Alice herself seemed to have given up, for she made no effort to rise or even to eat the delicacies which Dick Richards, her keeper for her entire life in the Zoo, pressed upon her.

The date of Alice's birth is uncertain, but Dr. Hornaday estimated it as 1893 when she came to the Zoo from Coney Island on September 3, 1908. She had lived at the Zoo for 34 years, 11 months and 24 days.

Her turbulent history during that time has been chronicled in the *Bulletin* and in *Animal Kingdom* many times, most recently in an article, "Twelve Elephants," in the issue of September-October, 1941.

The passing of Alice leaves us with two young Indian elephants and one of the African species. They are all good elephants. But there was only one Alice.

* * *

Frank Rizzi, printer of the Zoo's animal labels until he enlisted in the Army shortly after Pearl Harbor, has been awarded the Distinguished Flying Cross for more than 200 hours of operational flying in the New Guinea area.

* * *

The exhibition of Otters by Emil Liers of Winona, Minn., known as "the Otter Man," closed at the Zoological Park on September 12 after daily performances through the summer. The show was highly successful.

* * *

Our Patagonian Cavy exhibit in the old Prairie Dog enclosure is flourishing. Seven babies have been born since April 3, the latest pair on August 7.

NEW MEMBERS OF THE SOCIETY

New members of the New York Zoological Society since the last issue of this magazine are the following:

Life

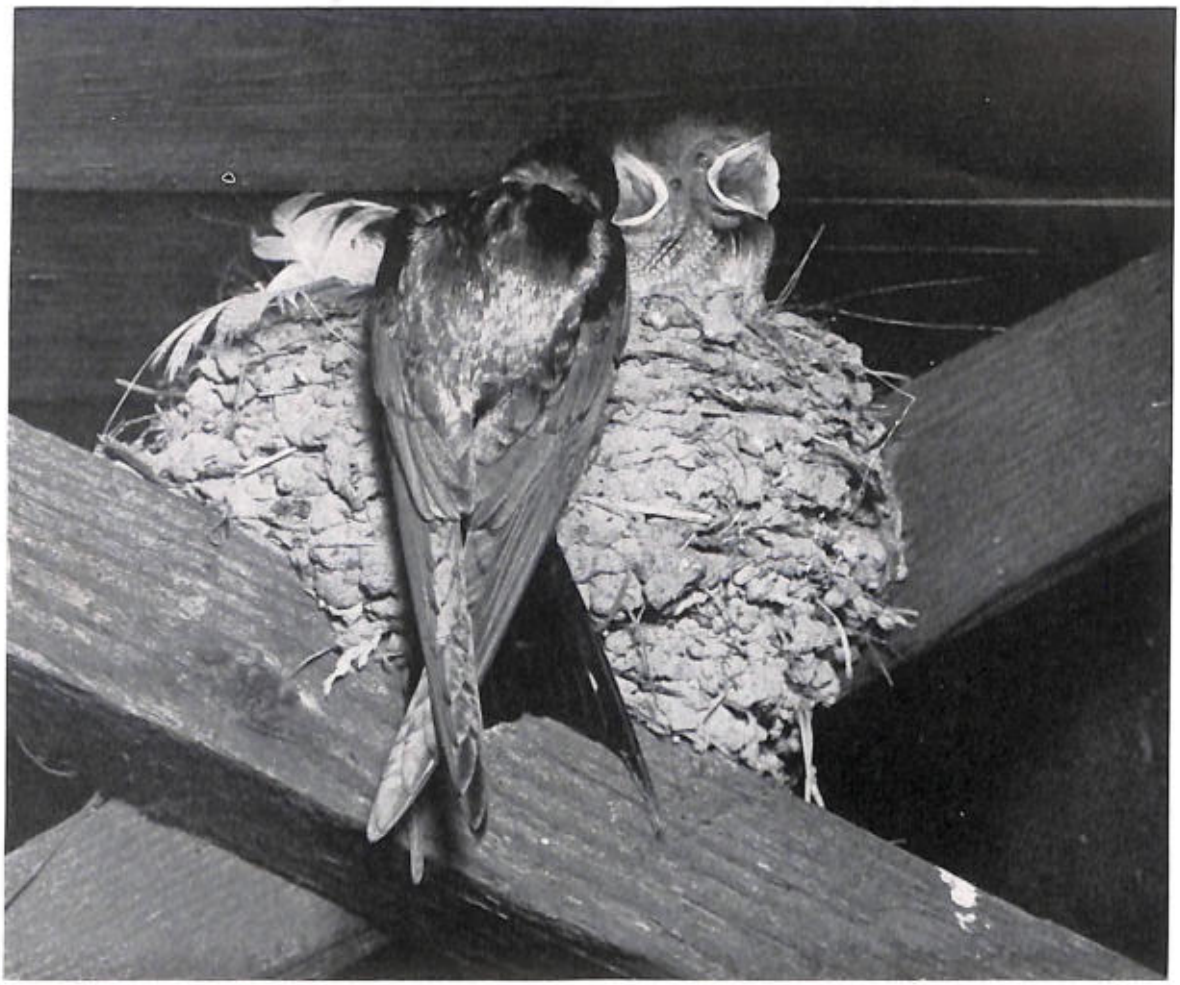
Arthur H. Samish

Annual

Corwin Black
Ruth M. Mueller
Rodolphe E. Rufenacht
Samson Selig

Junior

Frederick Cohen
Irwin Fridovich
Abraham Miller
Wendy Dawson Roth



Inside a busy garage, where trucks are coming and going all day long, is hardly the place one would expect a Barn Swallow to choose as a nesting place. Yet that is the latest home of two Swallows from the colony now apparently established in the Zoological Park. The brood was successfully reared in the garage this summer.

BARN SWALLOWS IN THE ZOO

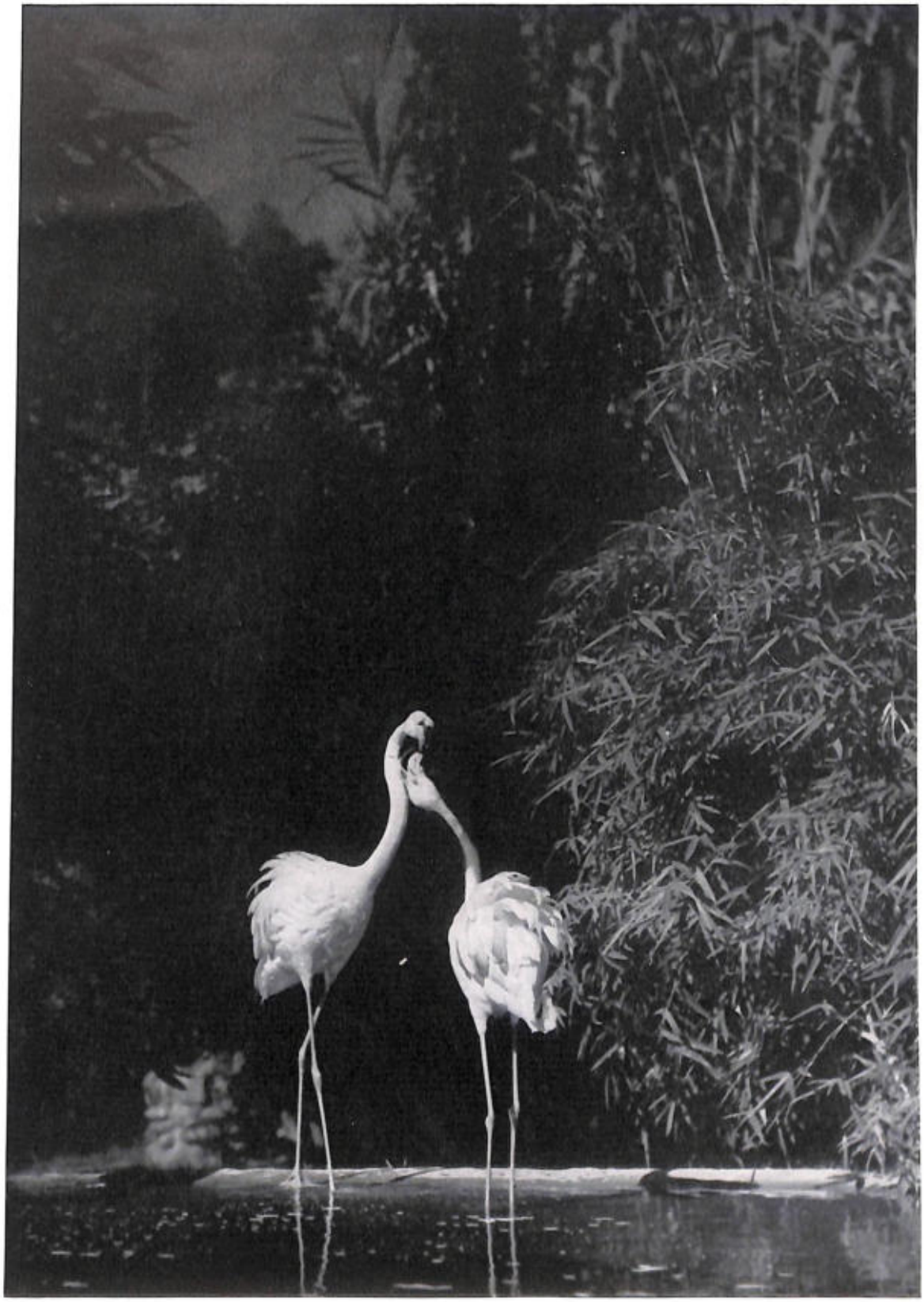
Photographs of young birds in the nest seem never to lose their intrinsic appeal. The picture at the top of this page has the added attraction of depicting one of our most beautiful and useful species, the Barn Swallow.

In the early days, Barn Swallows were missing from the environs of the Zoological Park but a stray pair finally settled under the eaves of the old Elk Shelter. This chance decision marked the beginning of a colony which spread to the Yak House and then to the garage in the Service Yard of the Zoo, where this photograph was made this summer. It was the first year the Swallows had nested in that part of the Zoological Park. — L. S. C.

A GREAT FLAMINGO PICTURE

If the amateur photographer needs any encouragement (most of them would be satisfied if they could just get film!) he can study the extraordinary photograph on the opposite page. It is the work of G. E. Kirkpatrick, a bus driver and camera enthusiast at the San Diego Zoo.

Mrs. Belle J. Benchley, through whose courtesy the picture is reproduced after it appeared on the cover of *The San Diego Zoonooz*, says that "it is one of those rare shots that patient photographers sometimes secure." Luck may have entered into the taking, also, but whether as a result of patience or luck, it is certainly one of the most graceful and striking Flamingo pictures we have ever seen.



A pair of Flamingoes "billing," as photographed at the San Diego, California, Zoo by G. E. Kirkpatrick. The photographer is an amateur who evidently has an eye for striking postures and composition of his pictures.

PUBLICATIONS OF INTEREST

EXTINCT AND VANISHING MAMMALS OF THE WESTERN HEMISPHERE. By Glover M. Allen. Published by the American Committee for International Wild Life Protection, 1942. 25 illustrations, 622+xv pages, $4.50.

This is a very important and lamentably significant volume of the result of lack of adequate conservation of wild life in past years. It is a thorough review of the field indicated in the title, and is divided into three sections; North America and the West Indies, South America, and Oceanic Mammals.

The text module is a sentence from Henry D. Thoreau; "Every creature is better alive than dead, men and moose and pine-trees, and he who understands it aright will rather preserve its life than destroy it." It is evident that insularity has been a dominant if indirect factor in causing rarity or extermination. About one hundred species of mammals are listed in the first section, of which more than sixty lived and died on the West India Islands. With the exception of ground sloths, these were, of course, small species.

The account of the decimation or actual extermination of such splendid creatures as wolves, pumas, caribou, prong-horns, mountain sheep, seals and whales makes a sorry chapter in the history of the coming of mankind to the New World. But this volume does a great deal toward the redemption of past sins, in its straightforward, unsentimentalized facts and figures, and should exert a wide influence in establishing a new and closer relationship, a better understanding (I use the mutual adverb advisedly) between ourselves and our fellow mammals on our planet.

This volume is an excellent piece of bookmaking as to paper and type, and an adequate bibliography and index provide a well rounded presentation. Except for the absence of the magnificent color plates, it is a worthy companion of Rothschild's "Extinct Birds." Allen's book is marked as Special Publication No. 11, of the American Committee. Interested readers would have appreciated a list of the preceding ten.

Especially is the work to be praised because of its appearance at a time such as this when the very life of institutions, states and nations hangs in the balance. It is a pity that the great naturalist author, Dr. Glover M. Allen, while he completed the manuscript, did not live to see his splendid volume in its published form.—*Wm. Beebe.*

MEETING THE MAMMALS. By Victor H. Cahalane. With 52 drawings in black and white by Walter A. Weber. The Macmillan Company, New York, 1943. 133 pp. $1.75.

The subject matter of this excellent little book is somewhat more restricted than the title might indicate, since it includes only such mammals as may be seen in National Parks and "Monuments," west of the Mississippi River. These, however, Mr. Cahalane has covered thoroughly well, in a style excellently suited to a popular handbook. Sixty-six of the most-likely-to-be-seen mammals are briefly described, as to characteristic habits and physical points of identification. Mr. Weber's drawings are very good, indeed, and add much to the attractiveness of the volume. Many readers will long for gasoline enough to make the obviously best use of such a book!—*L.S.Crandall.*

THE GRASSHOPPER BOOK. By Wilfrid S. Bronson. Harcourt, Brace and Co., New York, 1943. 127 pages, 35 illustrations by author. $1.75.

This is the best popular treatment of the subject that I have seen. It covers not only the grasshoppers, but also their kindred, from the roaches and walking-sticks to the crickets and katydids.

After commencing with a general survey of grasshoppers, Mr. Bronson describes the most important parts of the grasshopper anatomy as well as their functions; how they breathe, lay their eggs, jump and sing. Subsequently, since most of us want to have a name for what we see, he devotes a chapter to the various kinds of grasshoppers and to each of their relatives, the musical-winged katydids and crickets, the fleet roaches, the mimical walking-sticks and, as the author says, the "preying praying mantises." The accompanying semi-technical figures drawn with exactness and humor admirably clarify an already lucid text.

Those of us, man or boy, who are interested in nature and her ways will certainly welcome *The Grasshopper Book* with its informal and simple manner of introducing us to the ever present jumping and singing tribe of the insect world. —*Henry Fleming.*

ANIMAL KINGDOM

NEW YORK ZOOLOGICAL SOCIETY

VOLUME XLVI

JANUARY TO DECEMBER, 1943

NUMBERS 1–6

INSTRUCTIONS TO BINDER

The 4-page signature forming the first 2 and the last 2 pages of this issue may be inserted ahead of the cover of Vol. XLVI, No. 1, in binding the Volume.

ANIMAL KINGDOM

BULLETIN OF THE
NEW YORK ZOOLOGICAL SOCIETY

VOL. XLVI DECEMBER 1, 1943 No. 6

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The Pacific World

The text and illustrations of a book on the Pacific, to be entitled "The Pacific World," will shortly go to press. It will describe this vast ocean area, its islands, great and small, its animal life, its plant life and its native peoples. The book will contain a series of original graphic drawings, illustrations and charts. There is also to be published a series of handbooks on Mammals, Birds, Reptiles, Fishes, Insects, Marine Invertebrates, Plant Life and Native Peoples. One of the several purposes of these publications is to emphasize the conservation of the animal life of the Pacific Islands. The entire series is to be distributed in large quantities to our Armed Services. There will also be editions for distribution to the general public.

The Zoological Society is fortunate in its opportunity to play an active part in the preparation of these books in collaboration with seven other educational and scientific institutions.

Mention is made here of these publications not so much for the purpose of making an announcement but rather to confirm the policy which has so frequently been expressed here—namely, that the Zoological Society shall realize upon every possible opportunity which may come to it, of conveying to the general public information regarding the animal life of this world.

It is expected that "The Pacific World" and the supplementary handbooks will be available shortly after the turn of the year.

Fairfield Osborn

IN THIS ISSUE

Llama Family . . . . . *Sam Dunton* COVER
Two Healthy Baby Gorillas . . . . *Claude W. Leister* 123
Winter Get-together: Fish Aggregations . . . *Pictures* 129
Chipmunk Secrets . . . . . *Elsa G. Allen* 133
Behind the Scenes: News and Notes 141
Index to Volume XLVI 142

SHOP TALK

CHIPMUNKS may seem an odd subject to have as one's specialty, but they can be fascinating and there's plenty to learn about them. Elsa G. Allen, who writes "Chipmunk Secrets" in this issue, is the wife of Dr. A. A. Allen, professor of ornithology at Cornell University. She probably knows more about chipmunks than anyone else in the United States.

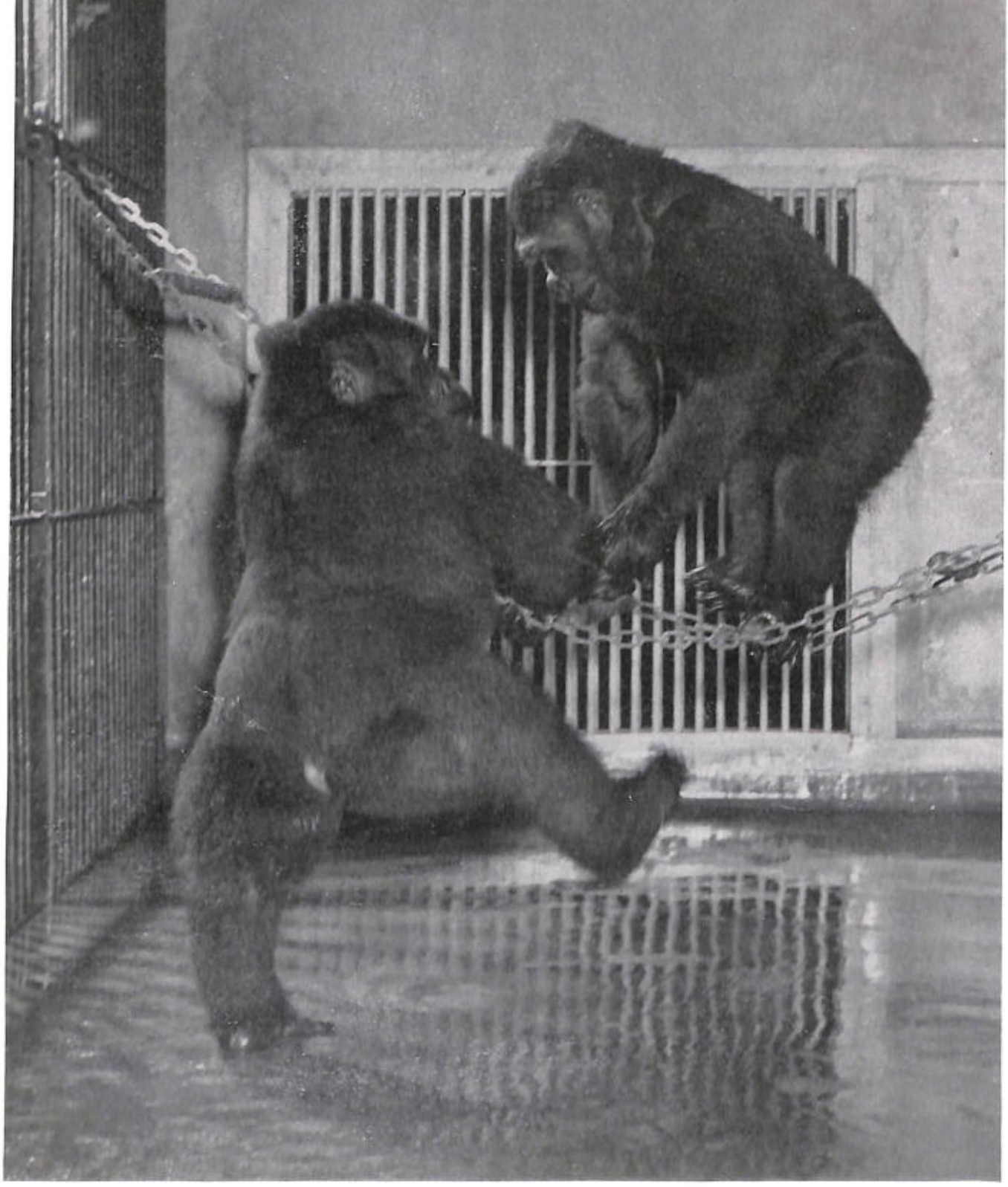
* * *

ANIMAL photography is an art—if, as we sometimes suspect, it isn't nine-tenths luck. If anyone doubts this, all he has to do is to step inside the Heads and Horns Museum Gallery any day this winter and take a good, careful look at the fifty-some-odd animal pictures made by Zoo staff photographers in the last twenty years.

* * *

GOOD stories lurk behind the animal pets service men bring home and give to the Zoo. Usually we don't hear the full story, but you can fill in the gaps yourself in the tale told us about a scrappy little Margay cat that came up from Brazil. According to the sailor who presented it, a friend of his went ashore one night in Bahia. Next morning he woke up in his own bunk aboard ship, with a Margay kitten curled up beside him. He didn't have any recollection of how he or the cat got there!

Another story we'd like to know more about concerns a pair of Flying Phalangers from New Guinea. Seems a sailor went ashore to look at the damage done during a recent battle. He heard a rustle in the top of a palm tree and got ready to shoot. Just before he fired, a terrified native came sliding down the tree trunk, holding something in his hand. It was the Phalangers—and he was so grateful to the American for not shooting first and investigating afterward that he gave him the little animals. They got to be a maintenance problem aboard ship, so now we have them. — THE EDITOR.



"Healthy" is exactly the word for our two baby Gorillas, for they eat voraciously, play strenuously and sleep soundly. Although they have separate compartments in the Gorilla House, they are permitted to play together for a few hours each day.

Two Healthy Baby Gorillas

Our Youngsters, Makoko and Oka, Are Growing So Strong That It Is a Problem to House Them Satisfactorily.

CLAUDE W. LEISTER

OUR YOUNG GORILLAS, Mokoko and Oka, are the Zoo's two problem children. They are growing so rapidly that it seems as if they are continually in need of larger and stronger quarters. Their first home, the Gorilla Room in the Lion House, lasted for less than two years. Growth was so rapid that glass and wire mesh could no longer withstand their rough and tumble tactics.

When the old Primate House was overhauled recently the needs of these two youngsters were so much in mind that the building has been renamed the Gorilla House. Here they now romp and play in roomy quarters, plentifully supplied with fresh air and separated from the visiting public by a glass barrier. A new and permanent home has been planned for them but its completion must await the end of this war.

Makoko and Oka arrived at the Zoological Park on September 7, 1941. Both were in good physical condition; in fact, they are the only really healthy gorillas ever received at the Park. Makoko, the male, weighed 28 pounds, and Oka, the female weighed 20. With fortunately few upsets they have been in excellent health ever since and each has shown a steady gain in size and weight. Makoko continues to be somewhat the heavier, at 88 pounds, while Oka weighs 71.

Makoko is an independent, rather suspicious youngster, about six years old, who takes nothing for granted and always insists upon working things out in his own way. He uncannily senses the arrival of "moving day" and at weighing time refuses to step on the scales but rather likes to go through this process while standing on his keeper's back.[1] Five-year old Oka, on the other hand, is a confiding little miss, always cheerful in disposition and as lovable as can be.

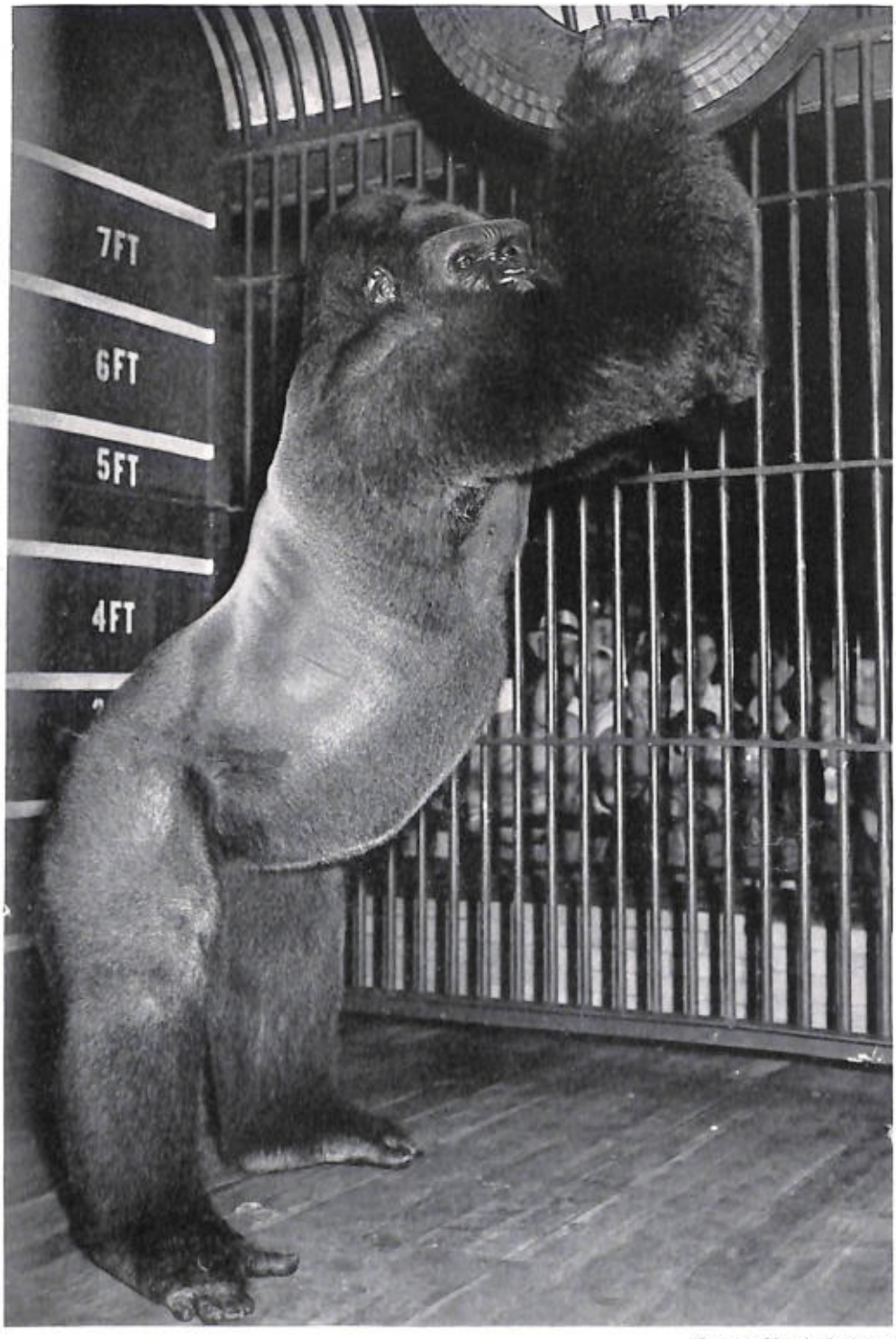
Both gorillas occasionally show an obstinate persistency apparently common to all of their kind. At such times Oka, because of her gentle disposition, can still be picked up and handled. But not so with Makoko. He quickly conveys the impression that while he may weigh only 80 pounds, he is all gorilla and that no one is to take any liberties with him.

Park visitors are entranced by the day-long acrobatics and the many human traits of our gorillas. Questions concerning these anthropoids are frequent and it is probable that they arouse more curiosity than any other of our Zoo inhabitants.

* * *

The gorilla was almost a legendary animal and practically nothing was known of this "king of the man-like apes" until the publication of Paul Du Chaillu's "Explorations and Adventures in Equatorial Africa" in 1861. His gorilla tales created a sensation, not only with the general public but among scientists as well. Many of Du Chaillu's observations have stood the test of time, although some of his stories, especially those portraying the gorilla as one of the most savage and ferocious animals in the world, were apparently inspired by native superstition and ignorance, and today are known to be largely untrue. At any rate, the gorilla emerged as a

[1] See the illustration in ANIMAL KINGDOM, May-June, 1943, page 72.



Courtesy Lincoln Park Zoo, Chicago

"Bushman," the famous Gorilla in the Lincoln Park Zoo in Chicago, is certainly one of the finest specimens in the zoos of the world. His recent weight of 515 pounds makes him second in size to Ngagi (638 pounds) in the San Diego Zoo. He is all muscle and there is very little fat on his powerful body, as this photograph shows. The scale of measurements on the wall indicate his impressive standing height. Even on all fours, he is about 4 ft. high.

remarkable personality and has gained in stature as we learned more about it during the ensuing years.

Two distinct geographical races of the gorilla are recognized and they are found only in two areas of Central Africa. The coast or lowland gorilla (*Gorilla gorilla gorilla*) inhabits an approximately five-hundred-mile-square area in the equatorial rain forests adjacent to the Gulf of Guinea. The home of the mountain gorilla (*Gorilla gorilla berengei*) is found more than five hundred miles to the east, just west of Lake Tanganyika, in the mountains along the eastern border of the Belgian Congo.

These two races are much alike in all respects and there is no single characteristic or anatomical feature that serves infallibly to tell them apart. In general, however, the mountain gorilla has a longer and heavier coat of hair, probably grows to a larger size and is more imposing in manner. There is still some confusion in identifying the different races, and characteristics supposed to be diagnostic for one have also been found in the other.

Following Du Chaillu, it was almost half a century before we began to add appreciably to our knowledge concerning the gorilla. Several zoologically-minded explorers penetrated the gorilla country. Specimens of both races were secured for museums. More and more life-history facts were discovered. A few baby gorillas were brought out into civilization but all of these died promptly, for we had not learned their requirements. As for the adults, to this day a mature gorilla has never been captured alive and only within the last decade have we been privileged to see fully-grown specimens—always youngsters that have grown up in captivity.

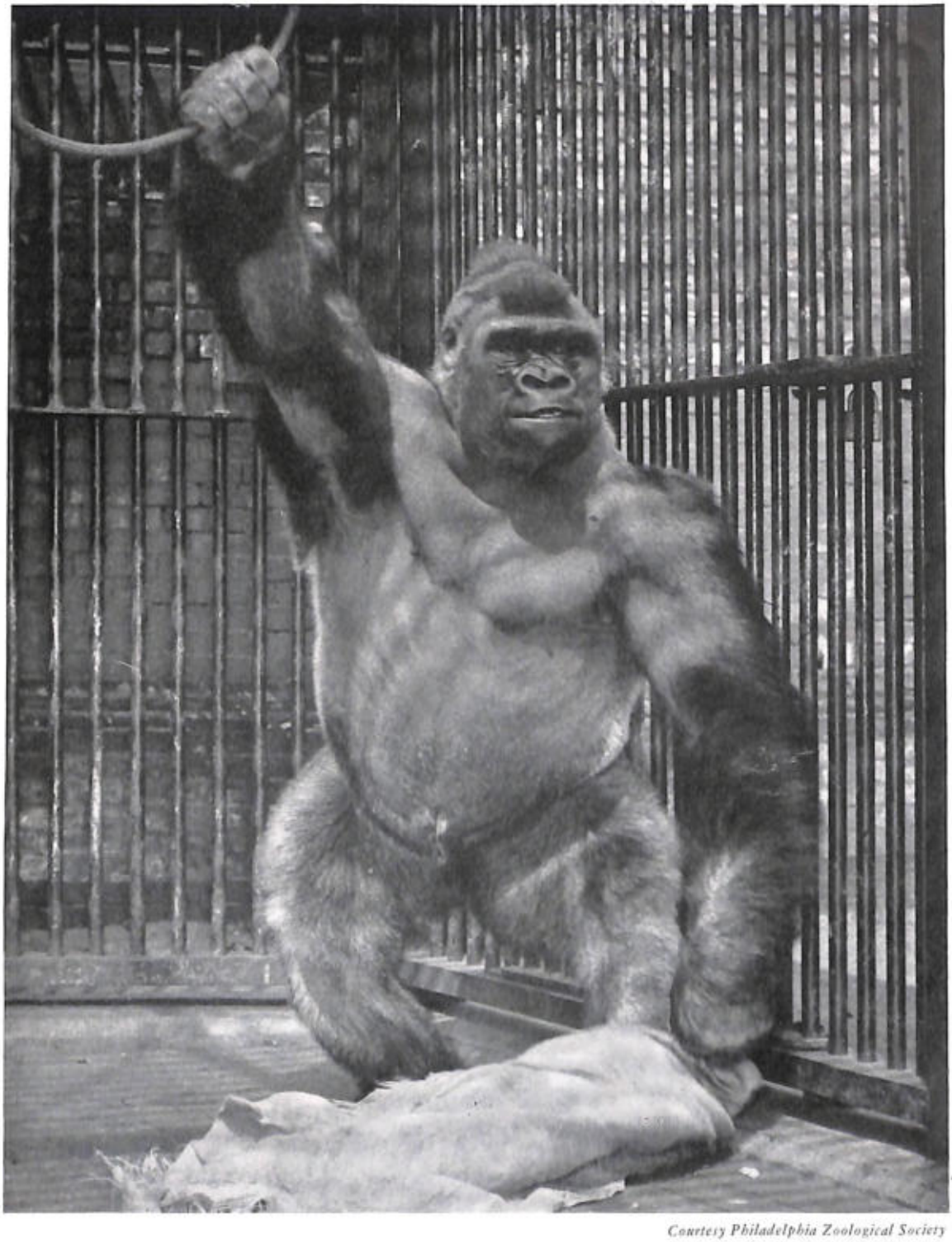
The first gorilla to come to America was obtained by an animal trainer in Boston in 1897 but apparently survived the voyage by only five days and was never exhibited.

The Zoological Park's first infant gorilla arrived in 1911, but she too was in poor condition and died twelve days later. Our second gorilla was Dinah, a three-year-old female coast gorilla from French West Africa. She lived for a few days over eleven months—the first gorilla to be exhibited in an American zoo. "Dinah" taught us a lot about the care of gorillas but we did not try again until 1928 with the arrival of "Janet Penserosa," a wizened little black-faced mite about 18 months old and weighing 17 pounds. Badly nourished and afflicted with a skin disease, she nevertheless responded to good treatment and survived to 1941. She was probably the most closely studied gorilla in America.

In the meantime other gorillas had arrived and gone to other zoos. Most of them survived. Experience had shown that it was useless to attempt to bring these great apes out of Africa without giving special attention to dietary and general sanitary conditions. Most of the youngsters brought to America were lost, not through lack of proper care here in this country, but because of previous exposure to unsanitary living conditions and infectious or contagious diseases.

Most primates, and gorillas especially, have little resistance to man's diseases, especially those of pulmonary origin. These, and disorders due to faulty diet, have accounted for the untimely deaths of most of our baby gorillas. At least two in this country have suffered and survived an attack of poliomyelitis, the dreaded infantile paralysis. Through better feeding methods, good sanitation, and a minimum of close association with humans, young gorillas now have a good chance of surviving to maturity.

Only a few years ago any zoo director's greatest ambition was to exhibit a gorilla. At this writing, there are no less than eighteen gorillas in America, varying in age from babies two years old to full-grown, adult animals of seventeen years. Ngagi, the 638-pound, seventeen-year-old gorilla of the San Diego Zoo, is the largest in America, an honor he acquired upon the death of his companion Mbongo after a short illness in 1942. Four other famous Zoo gorillas, are Bushman (perhaps the most magnificent of all), weight 515 pounds and 15 years old, at the Lincoln Park Zoo in Chicago; Massa, seventeen years old, weight 375 pounds, and Bamboo 15 years old, weight 435 pounds, both at the Philadelphia Zoo; all of these are males, but Susie of the Cincinnati Zoo holds her own at 400 pounds. Her age is seventeen. She has the added reputation of being the only "educated" gorilla in the country, for she has learned to ring a bell



Courtesy Philadelphia Zoological Society

The pride of the Philadelphia Zoo is "Massa," 17 years old and weighing 375 pounds. Massa is one of the best showmen in the Zoo; he loves to thump his chest and exhibit the "fierce" behavior that the public believes to be characteristic of Gorillas, and the gathering of a crowd is always a signal for him to begin his performances. This particular pose shows off well the magnificent chest development and powerful arms of a full-grown Gorilla.

for table service, and to use knife, fork and spoon in a ladylike manner.

The two best-known gorillas in America are the much publicized circus animals, Gargantua and Toto. Thirteen-year old Gargantua, the male, is said to tip the scales at 550 pounds and Toto's 400 pounds were acquired in only twelve years.

Toto was a spoiled young lady living among luxurious surroundings in Havana when she was acquired by the Ringling Bros. circus in 1941 for the wishful purpose of becoming Mrs. Gargantua. As yet a real mating has not been accomplished and, as a matter of fact, neither animal has shown any particular interest in the other. Until the day arrives when it can be said that love has come to Gargantua and Toto, the risks involved in putting them together are too great to be ignored. No one would appreciate the job of separating 900 pounds of fighting gorilla.

A most remarkable and almost unbelievable change takes place in gorillas between babyhood and maturity. The appealing, little, almost-human infants are about the same weight as a human baby at birth and give no indication of the hulking animals they may become in fifteen or sixteen years. Males are larger than females and are generally more temperamental and difficult to handle. However, as time goes on and we learn more and more about gorillas it is evident that each individual has his own distinct personality and must be treated accordingly. Our own Makoko and Oka are like many a human brother and sister—and just as unpredictable. But likes and dislikes, capabilities and accomplishments fall into a definite pattern for each.

Gorillas are vegetarians and in a wild state eat a variety of plants, bulbs, roots and fruits. Ngagi consumes approximately 30 pounds of carrots, potatoes, apples, bananas, etc., a day. Like most other gorillas in captivity, he is also given about a pound of chopped raw meat as a substitute for the occasional rodent, lizard or other small animal which we suppose would be eaten in the wild.

Despite their tremendous strength, gorillas are inoffensive animals. Ordinarily they are so shy that observers find considerable difficulty in getting more than momentary glimpses of them in their native forests as they roam about in search of food.

They are social animals. Generally they are found in small family groups or bands. Each band is under the domination of an old male, the acknowledged leader of his several females, subadult youngsters of both sexes and babies. When danger threatens, the old male usually stages a covering demonstration of rage and a "Don't-come - any - closer - unless - you - want - to - be-torn-to-pieces" act while the rest of the band escapes to the forest. Actually, gorillas are lords of the forest; their great strength is respected and no other animals, man excepted, molest them.

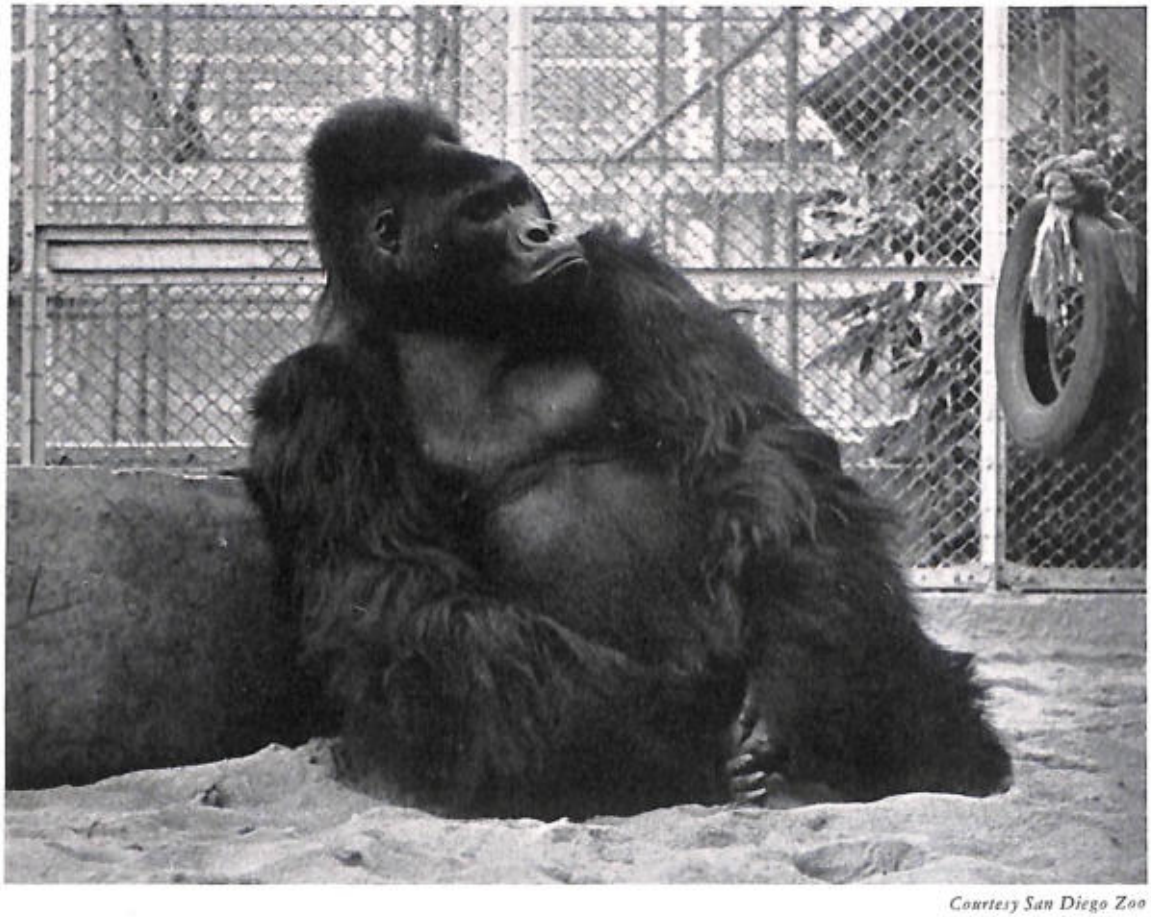
These roving gorilla bands spend the night wherever it overtakes them. They build sleeping nests of piled-up branches, sometimes in trees but usually on the ground. Next day the band moves on and the nests are never used again. Young gorillas are good climbers but adult males, probably because of their bulk, climb very seldom, if at all.

Zoo visitors will notice that gorillas are four-footed walkers, progressing in a stooped-over position with the body weight resting on the bent hands. This is their usual way of walking and thick callouses are worn on the knuckles. Young gorillas frequently walk erect in a very human fashion but habitually assume the stooped-over position as they grow older.

It is an interesting habit of gorillas to beat the chest or abdomen with their fists or hands. This is a means of expressing emotion and ranges from a rhythmic "stomach slapping," signifying happiness, to beating the chest in anger.

Gorillas when full grown are by far the largest of the three man-like apes—gorilla, orang-utan and chimpanzee. But the average zoo visitor easily confuses young gorillas with the chimpanzee and orang. The orang is readily disposed of by remembering that it has reddish-brown hair and yellowish-brown skin. The black-haired gorilla and chimpanzee are fairly similar but at any age the gorilla is the stockier animal and has relatively smaller ears.

Even experienced zoo men are awed by the stupendous size of the adult gorilla. The thick, stumpy legs support an enormous body with



Courtesy San Diego Zoo

The biggest Gorilla in any Zoo in the world is Ngagi, in the San Diego Zoo – 638 pounds. The high crest and the long hair on the arms are supposed to be characteristic of the mountain Gorilla. Despite his tremendous size, Ngagi is still comparatively gentle – although no keeper is able to enter his cage. This is a typical resting pose.

massive chest and tremendously developed forearms and hands. Fingers are short and thick, as big around as many a woman's wrist. All body measurements excel those of our largest and best-developed human beings and the strength of the gorilla is proportionally much greater, in fact unbelievably so.

Few instances are recorded that give us an indication of this great strength. But in Mrs. Hoyt's "Toto and I,",[2] it is related how Toto could, with ease, move parked cars by shoving them around and that "Once when she seemed annoyed because the station wagon was in her way, she took it by the rear axle with one hand and, though the brakes were set, and the entrance to the garage had a slight incline outwards, yanked the car out and with a quick thrust of her arm dashed it forward again into the garage wall, smashing the headlights."

Gorillas are not common in their native territory and the methods used heretofore in capturing young animals for exhibition have almost without exception resulted in the death of at least one adult gorilla, usually the infant's mother, and upon one excuse or another native hunters necessarily used in these expeditions have all too often managed to exterminate entire bands.

Conservation measures are necessary to assure a supply of gorillas lasting into the future. Probably, like our own American bison, they are doomed to become extinct in a wild state. It might be that the gorillas now in our zoos will come to be the foundation stock that will save these animals for future generations.

[2] Hoyt, A. Maria, Toto and I. J. B. Lippincott Co., Philadelphia, 1941.

ALL SET for winter. These Small-mouth Bass maintained the general form and relative position of their aggregation until warmer water in the springtime released them from the urge to cluster in a tight group.

Winter Get-together

Fish Aggregations

About this time of year, if one had the power to peer into the deeper holes of our northern fresh-water ponds and streams, many kinds of fish would be found at the beginning of their winter period of quiescence. In tight clusters or in looser but still cohesive groups, they have formed their winter aggregations and have begun to hibernate.

Not all northern fish hibernate—for example, the whitefish that is caught in large numbers through holes cut in ice. But many others give up the struggle to find food in ice-locked waters and are quickly chilled into inactivity. During this period their vital processes are reduced to a minimum and, in the Aquarium at least, they refuse food.

NO RULE – or, at any rate, no rule of fish behavior known to the Aquarium staff – was followed by these Golden Ides from central Europe when they formed the tight aggregation pictured on the left. Although they had gone through a normal hibernation the previous winter, they aggregated again in May and September following. Furthermore, they remained comparatively active and continued to feed. Why they did it, the Aquarium staff was never able to discover. Two sturgeons and two suckers which shared the tank with the Golden Ides, were greatly interested in the closely bunched fish and spent much time on the fringe of the aggregation.

IN THE DAYS when the New York Aquarium occupied its quarters at the Battery, some of the freshwater tanks were connected with the regular city water mains and consequently the temperature of the water rose and fell with the seasons. In late November or early December the temperature usually fell to the neighborhood of 40 degrees and the fishes that normally hibernated began to draw closer and closer together, and to discontinue feeding. The fish were generally in their typical winter aggregation by mid-December. If driven out of their grouping, the aggregation was reformed in an hour or two.

BLUEGILL SUNFISH demonstrate their winter aggregation in an experimental tank at the Aquarium. These fish were allowed to winter in a tank in which a series of strings were suspended to make visible the slight flow of the water. Hibernating fish head into flowing water, no matter how slight. In the background of this photograph, other fish can be seen faintly. Several of them are heading to the right, indicating that the current was flowing around the tank.

IT IS CURIOUS, but hibernating fish tend to keep the same relative position in the water all through the winter. The Bluegill Sunfish in the picture above were more or less held in position by the current in their tank so that in the late winter, at the end of their hibernation, they were scarcely a foot away from the position among the strings that they had assumed at the beginning of the winter.

In open streams, they may drift a few yards in the course of the winter. Occasionally at the Aquarium there were as many as three aggregations of the same kind of fish in one large tank, and invariably each kept its own position in relation to the others.

It is possible to keep normally hibernating fish from going into their winter rest period, simply by maintaining the temperature of the water at the summer level. Apparently they have their own, internal calendars – probably the shortening daylight – that tell them when it is time to hibernate, for if the water temperature is kept at summer height as the fall advances, the fish become sluggish and slow about eating. All through the winter they continue to eat, but with reduced appetite.

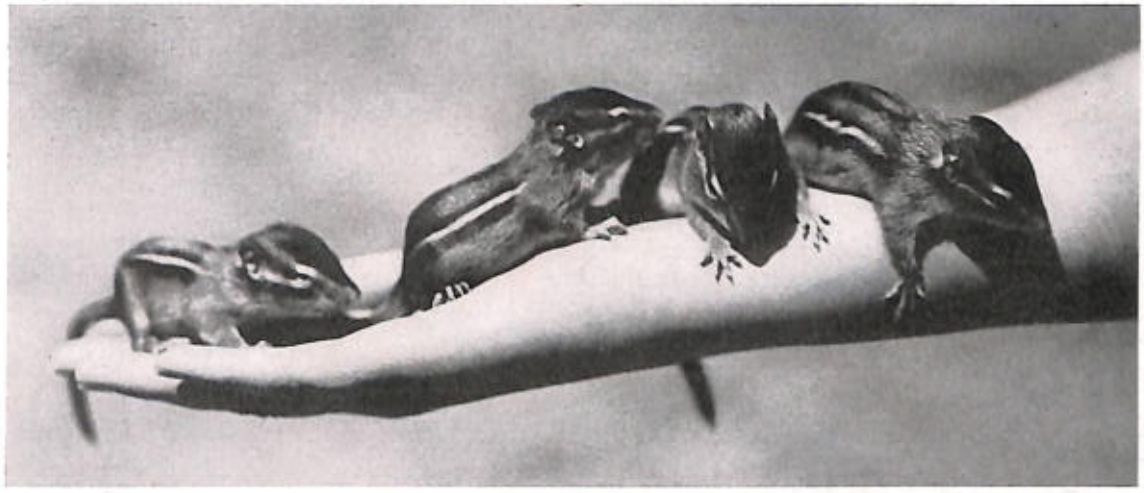
During the second winter of such treatment, their reluctance to forego hibernation has apparently been overcome, for they eat normally and move with their summertime activity. This elimination of the winter rest probably causes the fish to "live faster" and perhaps shortens their lives.

IN WATER that comes from more than one direction, an aggregation may twist and turn to face the sources of the streams, as these Mud Sunfish are doing.

WHEN LARGE COLLECTIONS of temperate freshwater fishes were kept at the Aquarium, the maintenance problem was simplified during the winter months by the fact that the greater part of the fishes were hibernating and did not have to be fed. Naturally, the Aquarium's food bills for this period were lower.

That fact used to cause eternal discussions with auditors of the Aquarium bills, who could not understand why the food requirements varied so much when the number of fishes to be fed stayed comparatively steady.

As a matter of fact, food requirements over a whole year would average about the same, whether fishes hibernated or not, for the hibernating species ate voraciously in the autumn to store up winter fat, and again in the spring when they came out of their torpor.



When they are about four weeks old, chipmunks can easily be tamed and it is then that they can become really good pets. Usually, though, they are still underground at this age. The eyes of these youngsters are opening.

Chipmunk Secrets

There Is Much that a Patient Investigator Can Learn About the Family Life of These Shy Creatures

ELSA G. ALLEN

SUMMER AFTER SUMMER the chipmunks had scampered around my door—friendly and tame enough to search my pockets for nuts but suspicious and shy when I stretched out a hand and asked for closer acquaintance. Family after family came to know they could always get a handout at the Allen's. We were running a veritable chipmunk farm but getting nothing out of it except the pleasure of feeding these darting, scurrying little creatures.

Their secretiveness was a challenge, as plain as if they had put it into words:

"All summer I have been living under your doorstep—and what do you know about me? I am here, and suddenly in the fall I am gone. You say I am hibernating. But did you ever see me when I am hibernating, or even where I hibernate?

"Have you ever seen me in my home, or even my home when I am not in it? People say I spend the winter in a hollow log. How would you like to live in a hollow log when the temperature drops below zero?

"You've never seen my children when they were really small, have you? Do you know they weigh so little that it takes ten newly born chipmunks to weigh an ounce? Of course you don't know that—and a lot of other things about me!"

There certainly was a lot I didn't know about chipmunks, but by means of trapping and marking and keeping wild chipmunks in captivity under various conditions I began slowly piecing together their life history. This is the story of some of my adventures with chipmunks.

* * *

Chip was sitting atop his favorite stump in the open, dry woods opposite my house on a fine fall morning when I started learning about him and

his kind. As I scrambled up the bank, trap in hand, he sat there giving his *cuk-cuk* call, his sleek fur pulled closely over his little body, his tiny ears very round, his black eyes very bright and his little hands pressed against his breast. But as I drew dangerously close, he uttered a sharp note of alarm and dove into his burrow. There were better things to do in life than sitting in the sunshine staring at human beings; there was fall housecleaning, for one thing.

Perhaps you will frown on his way of cleaning house; it may remind you of that lazy maid you had, once upon a time, who swept the dirt under the rug. But Chip could never be called lazy. For weeks he had been rushing supplies into his burrow. Back and forth he went to the duck pond, passing by way of the pheasant cages, to stuff his cheek pouches with grain. In the woods he paused sometimes for acorns; then down he went through his tunnel to unload it all in his underground pantry. He never stopped to think that every one of those seeds would have to be shucked before it would be eaten. What quantities of litter and refuse to be taken care of!

But Chip had an ingenious way of cleaning house to make room for fresh supplies. When he built his home he hollowed out a long tunnel for the express purpose of holding the refuse from his nest. When the nest gets uncomfortably full of nutshells, seed covers and the like, he pushes out this loose material, shoves it along with his nose toward the refuse or midden tunnel, turns about and scratches it along the passageway. He makes the dirt fly between his hind legs; then he turns around again and tamps it in securely with his skillful, fast-working paws. This makes a dark vein in the ground and if you ever have the ambition to dig out a chipmunk nest you will know you are "getting warm" when you come to such a dark plug in the earth. Somewhere nearby are the chipmunk's living quarters.

Many chipmunks were caught out of the burrow where on that fall morning I set my trap, a large catch-them-alive rat trap with a trip door in the center. Thirteen in all were taken and kept in a large bird cage in the house. Later they were moved to a large outdoor room. Could they all be members of a family? I had read that they seemed to spend the sleeping months in family groups. Audubon himself thought this, but if mine were one family they certainly had no love for each other, for one by one they dwindled, done to death by the ruthless persecution of their fellows. This, I learned, was surely the way *not* to keep chipmunks. At last only two were left, a male and a female, so I gave them the run of a large open air room with half-inch wire netting over the windows and a cement floor, and waited for spring.

* * *

Finally the winter broke. It was April and scattering snow patches lay under the spruce hedge though woolly hepaticas already pushed up their tiny heads and opened blue-violet eyes among dead wet oak leaves. I had noticed a chipmunk going in and out of a certain hole in one of the pheasant cages as early as March 20 and then on March 31 I caught her in a rat trap, gave her a short haircut in the middle of her back and turned her loose under the prosaic name of Female No. 24. The cutting of hair was a device for identifying her among all the other marked wild chipmunks I was watching.

It was time for her to have young, I thought, but I did not catch her again until April 24 when she entered a trap I had set nearby in the hope of determining whether or not her mate was occupying the same burrow. But unfortunately a passing rat entered the trap shortly after she did, and killed her. On close examination it seemed she might already have young for her tiny mammae were slightly more conspicuous and the fur around them seemed pressed down as if by tiny paws.

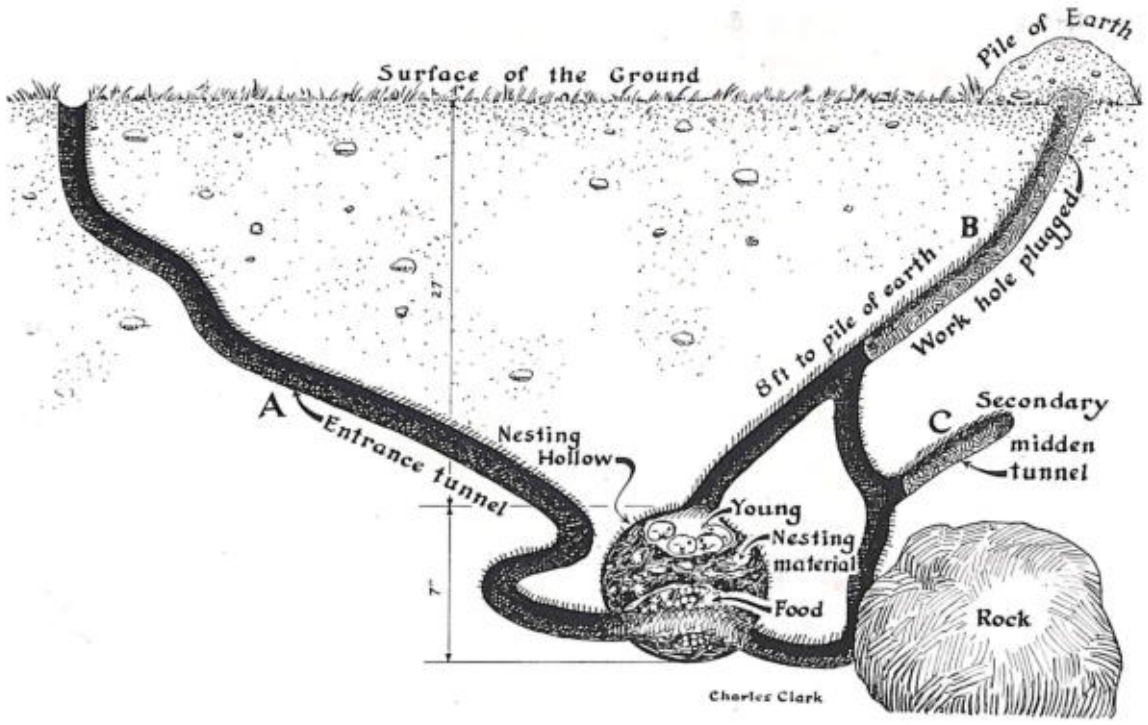
I looked at the unanswering ground with its neat round hole and wondered what lay beneath it. Then I realized the chipmunk's lifeless little form could still yield her secret. Dissection showed that she had had her young very recently, as I suspected, and these helpless little mites were probably lying dead in the nest several feet underground.

It was necessary to wait till the week-end before we had time to dig out the burrow. So two days later, on April 26, armed with pick and shovel, wires, rulers, notebooks and other paraphernalia, Doctor Allen and I undertook the job of finding the young.

The burrow was in a bank of light soil on the south side of the Glenside ravine. No effort had

Friendly – but secretive. Those three words reflect the character of the Eastern Chipmunk, *Tamias striatus lysteri*. This little fellow found a daily feast atop a stump near the Allen's home and in chipmunk fashion stuffed his cheek pouches and carried away great quantities of seeds and grain. The bulging of his cheeks is noticeable.

been made by the chipmunk to conceal the entrance, which lay inside a pheasant cage where there was scarcely a blade of grass to hide it. The calibre of the hole was 2 inches at the entrance, but at intervals during the digging the tunnel seemed to be narrower. It was difficult to be sure of this because the burrow constantly became plugged by the action of the shovel. The only way we could follow the tunnel was by means of a heavy, white, insulated wire held in the bur-



This is a diagrammatic section of the chipmunk burrow that Dr. and Mrs. Allen excavated. "A" is the entrance tunnel which the chipmunk uses for coming and going, and is constructed from the inside. "B" is the original tunnel, now mostly filled with shells of seeds. "C" is a supplementary chamber for the debris from the food supply.

row as far as it would go. We took careful note of all bends and turns and measured the number of inches in the direction in which it proceeded before turning again.

Roughly speaking, it was necessary to dig for eight feet, working down to a depth of about three feet, before any sign of a nest was found. The trend of the burrow was downward for two feet, with slight turns, then horizontal for eighteen inches. At a depth of two feet, the burrow still sloped downward for about twenty inches to a depth of twenty-eight inches below the surface.

Here it made a hairpin turn for a short distance, then sloped downward again, for from two to three feet it ran into a large rock, at the depth of thirty-four inches. By the time we had excavated to this point, we were very close to the nest—in fact we had bypassed it—but we did not realize it until we found one of the chipmunk's midden chambers filled with sunflower seed shells, cherry pits and miscellaneous débris. It appeared as a plug of dark loose material in the sandy yellow soil surrounding it, and proved to be the work tunnel leading up to a pile of earth under a small hemlock tree outside the pheasant cage.

The reason why there is no pile of earth near a chipmunk hole, where he is seen to enter it, has long been a mystery. The chipmunk is indeed a clever little beast, for after excavating his home he blocks the tunnel through which he has carried and shoved the earth, plugs it up, and then opens a new hole from within, many feet distant from the work hole. This then becomes the entrance tunnel. The discarded work tunnel, plugged for some inches with earth from within, is left as a repository for refuse from his nest.

But to return to the entrance tunnel which we were following. This went behind the nest, thus causing us to miss the nest cavity. After running against the large rock, it led into the work tunnel below the point where the plugging ceased. A strip of open tunnel twenty inches long continued downward from this juncture of the two tunnels and opened into the nest cavity. Here

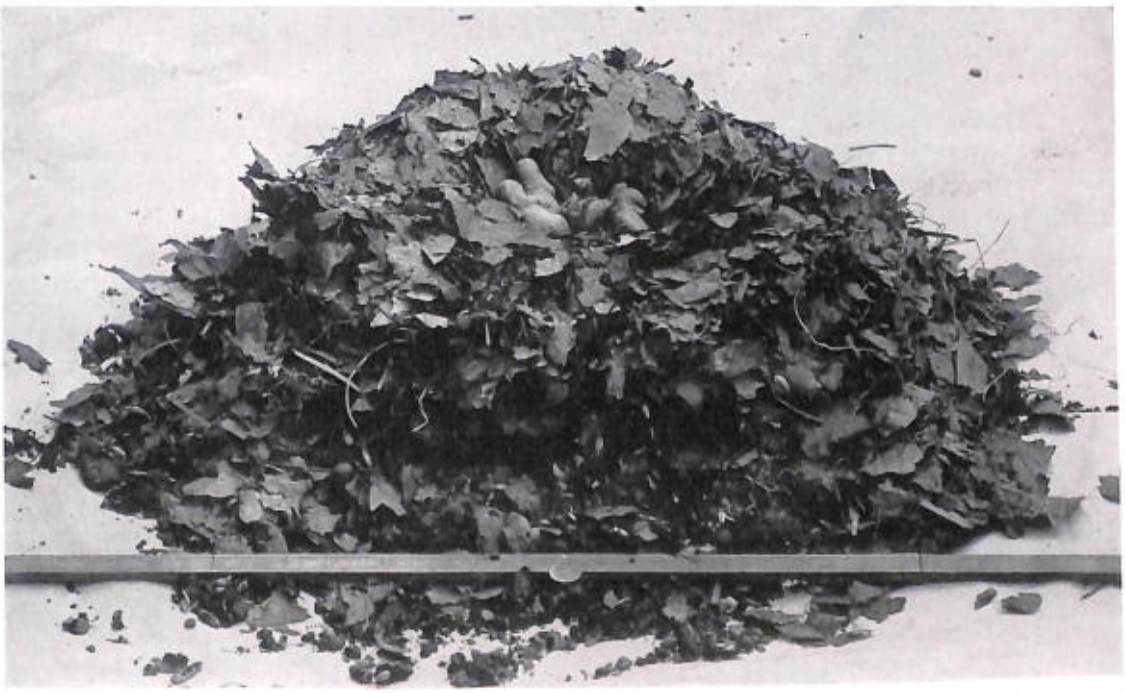
we found a large, spherical hollow which seemed about a foot in diameter. We had to proceed with great caution for fear of injuring the young with tools, so, reaching with fingertips through the last part of the tunnel into the nest, I felt dead leaves and then some small, cold objects. Four such were taken out—four gray and cold baby chipmunks. Knowing that the mother had been dead for two days, we assumed that the young had died, but to our amazement they were feebly moving in my hands. They were hurried to the kitchen, fed with diluted milk from a dropper, and soon they became more lively. These little orphans did not last long, however; two died very soon after being brought in; the other two lived for two and a half days.

The nest presented several surprises. The hollow was somewhat more than a foot in diameter and contained about two quarts of grain such as we scattered for our wild ducks and pheasants. On top of the grain was a great pile of broken leaves – vastly more than one would suppose could be contained in the nesting cavity. Some accounts of the chipmunk's nest tell of grass being used as nesting material and mention several food storage chambers, but in this case the nest was made entirely of leaves and all the food lay on the bottom of the hollow.

The hollow and all it contained were clean and dry, with the pleasant pungent odor of the earth, but in pulling out the contents with my bare hands I was not a little horrified to find my arms alive with small, creeping creatures called pseudoscorpions. The nest contained literally thousands of these arachnids. It likewise contained many small black beetles, some mites and two stapholinids. It may be interesting to entomologists to learn that this nest, though destroyed as a chipmunk home, yielded two species new to science. A large flea, *Neopsylla striata*, was described by M. A. Stewart while samples of the pseudoscorpions finally got to Vienna where they were described by Max Beier as *Hesperochernes tamiae* sp. nov.

* * *

The male and female—survivors of the thirteen I had trapped out of one burrow—spent the winter in a large, open air enclosure with a cement floor. Thus the chipmunks could not burrow out, and the room being about thirty feet long,



An almost unbelievable amount of dry leaves is packed into the nest of a chipmunk. This shows the pile removed from one nest, with your newborn young. Mrs. Allen found the leaves "alive" with small, creeping creatures called pseudoscorpions. Two species from the nest – a flea and a pseudoscorpion—were found to be new to science.

Tiny as a chipmunk is, it seems to have an almost unlimited capacity for stuffing its cheeks with food. Here are thirty-two beechnuts removed from the cheek pouches of one chipmunk.

they had ample space and felt comparatively unconfined. The little mammals shared the room with about twenty wild-trapped ruffed grouse. Since these birds were full-winged it was unwise to enter the room often and consequently the chipmunks also were largely undisturbed, except on the few occasions when I trapped them to examine them for signs of breeding. Nesting boxes and plenty of food were provided and although the weather became very cold—sometimes sub-zero—they never showed any signs of hibernating but spent much of the time sitting over the wide open windows. On April 15 as the female climbed the wire netting it was obvious she was heavy with young. I immediately removed her mate, fearing that he might do violence to the young, and all but one of the grouse were removed on April 23. Thus Madame Chipmunk had everything her own way. A three-foot tunnel was added to her box and it seemed to please her; a fine nest of leaves, straw, paper and grouse feathers, firmly bedded on a good peck of feed, was in readiness. On April 30 her nest showed signs of some last minute preparations and on May 1 five young were discovered in a secondary depression near the top of the box.

Four youngsters in my own family successfully kept me from visiting the young chipmunks until May 3 at 6 P.M. They were already silky to the touch and showed faint stripes in the skin. Their heads were disproportionately large and mouse-like and in a few days developed a covering of dense, reddish-brown, soft fur. Tiny white vibrissae were visible on the fifth day and the first sign of lower incisors appeared then as a tiny bump on the lower gum. These chipmunks were weighed and measured every few days for two months. The measurements of one at a week old were as follows:

Total length	77 mm.
Tail	25 mm.
Foot	13 mm.
Weight	12 gm.

Though completely helpless at this age, they were so active they could roll right off the weighing pan and they uttered faint squeaks which daily became stronger.

The mother stayed with them almost constantly until May 8 when she began spending quite a little time out of the nest. On June 14, when the young were about six weeks old, two of them were found to be using another box in which they had built a loose nest, but at dusk all were in the home nest with the mother.

Since these were apparently the first chipmunks ever raised in captivity, the mother seemed

to me too valuable to be allowed to settle down. There was much, much more to be learned about chipmunks. Therefore, the young were given a large cage of their own on July 3 so that she could proceed as normally as possible with her captive life. She was given an adult male companion on July 7 in the hope that she would breed again that summer, but unfortunately he escaped on July 9 through a hole caused by heavy rain.

This mother chipmunk spent her second winter in the open air room, again without hibernating, and maintained the good weight of 92 gm. In March she mated with a wild-trapped male and on April 18, early in the morning, she gave birth to six young—two males, and four females. The period of gestation was 31 days. From these young it was possible to obtain exact information on the development of the teeth[1] and many other notes on their growth and behavior which were not obtained from the first litter.

When the babies were three weeks old I put two of them in a small bathtub – something smooth being necessary to prevent them from climbing out. Although their eyes were not yet open, they ran around inquisitively and tried to sit up and wash their faces. They were still too weak, however, and fell over every time despite their persistent efforts.

Their eyes did not begin to open until the thirtieth day. It is at this very young age of about a month that they can be really tamed, but since they are normally underground at this time, few persons ever have the opportunity to attempt it. Bread soaked in milk is eagerly accepted and on this and other soft foods they grow rapidly and soon are gathering food in their pouches, like adults. I found that it is well to keep them somewhat hungry and that, unless they are handled considerably, they develop their inherent wildness. One chipmunk that we found when it was about a month old became completely tame, went freely in and out of the house and built a nest in an empty drawer in the study. Every night after it had gone to sleep the children picked it up and said goodnight to it!

The first family of chipmunks born in captivity. When they were only a week old, they were about 3 inches long and weighed a little less than half an ounce each. Here they are shown at the age of about two weeks. Their eyes are not yet open and they are still virtually helpless, but active and much inclined to utter baby squeaks.

* * *

The hibernation of the chipmunk is a phase of its life history that is difficult to understand, because it is so variable. Many experiments were carried out with captive animals, living under

[1] Allen, Elsa G. Habits and Life History of the Eastern Chipmunk. *N. Y. State Mus. Bull. No. 314*, pp. 52-53, 1938.

different conditions of temperature and light, in an effort to learn the controlling factors of this peculiar dormant life that chipmunks indulge in. I kept one in a glass cage in the kitchen during the winter so that her activities could be photographed. In this warm room temperature she never went into a completely torpid state, although she slept a great deal, ate and moved about with her eyes closed and was not in the least disturbed by strong light, voices or other noise.

Other chipmunks I kept in small cages in a dark, cool, damp room in the cellar, and these showed an increased tendency to hibernate. These animals were not allowed to have food in their cages, although they were fed from time to time. No. Eighteen, a wild female, spent a large part of the month of February in a heavy torpor, curled up in her cage. When picked up she could be rolled around like a ball without uncurling herself. In this state of hibernation the body temperature is much reduced, the animal becomes stiff and physiological functions are arrested for days and perhaps weeks. When rousing from hibernation the chipmunk trembles violently and may stagger or even roll completely over in a stiff, semi-curled-up position before waking. Unlike its dull cousin, the woodchuck, which sleeps profoundly all winter, the sprightly chipmunk frequently interrupts its hibernation to feast from its nest full of supplies, and in an open winter may even venture out of its burrow in late November. One hardy little steward was so captivated by the feed I put out for him that he gathered it daily until noon during November, despite the fact that snow lay on the ground and the temperature at twelve o'clock was 22° and only 18° in the morning when he began storing. On November 29, fresh snow and a chill wind sent him back to his cozy underground retreat with empty pouches.

And so, out of these and a great many other experiences with chipmunks, I have gained a few answers to the riddles that "Chip" propounds to me as he sits atop his favorite stump and cries *cuk-cuk* to tease me.

In order to observe a chipmunk in its winter sleep, Mrs. Allen supplied one with a comfortable nest in a glass cage in her kitchen, and this shows the little animal in a typical hibernating position in its bed of seeds and shells. At room temperature the chipmunk did not go into a completely torpid state, but it slept a great deal.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

THE GIRAFFE HAS A VOICE

The much-discussed and often debated question whether the giraffe has a voice is now settled as far as the staff of the Zoological Park is concerned. It does.

Late in October our female Reticulated Giraffe lay down in her stall in the Antelope House and subsequently was unable to rise. Veterinarian Goss inspected the animal and found it necessary to change her position to relieve the pressure of her body on her forelegs. As he did so, the giraffe uttered a loud, drawn-out "Mooooo." It was uttered only once—not repeated.

For the record: The Bronx Zoo's Reticulated Giraffe, *Giraffa camelopardalis reticulata,* positively uttered the sound "Mooooo" at 9:50 A.M. on October 25, 1943. Witness: Dr. Leonard J. Goss, D.V.M.!

As a matter of fact, it has been asserted by former Veterinarians in the Zoological Park that the giraffe was capable of making a sound, even though the animal does not possess vocal cords. For some years a section of a giraffe's throat, showing the cord-less larynx, was on exhibit in the anatomical museum of the Animal Hospital. Other Veterinarians agreed that the sound could not be modulated, but it is impossible now to determine whether they were speaking from theory or from experience. In any event, Dr. Goss is able to settle the matter.

NEW MEMBERS OF THE SOCIETY

New members of the New York Zoological Society since the last issue of this magazine are the following:

Annual

Baron de Zaylen
Luke Flanagan
Mrs. Jennie Lynne Kyle
William Lynch
Henrietta L. Seimers
John E. Tarrant
Mrs. Holland Thompson
John Wolff, Jr.

Junior

Joseph Sonnenfeld

IMPROVED EXHIBITS

Improvement of the interior of the Small Mammal House has been in progress for some time and the building was reopened late in November. A glass screen has been set in front of a battery of compartments for the smaller monkeys to protect them from the coughs and sneezes of the public, and the Clawless Otters have been given a habitat cage, with a deep tank so arranged that they can be seen swimming under water.

SUMMER'S END

After a most successful summer, the Farm-in-the-Zoo and the Children's Zoo closed for the winter on November 15.

Somewhat isolated as it is, and in this wartime summer visited by very few persons in automobiles, the Farm-in-the-Zoo nevertheless had the extraordinarily large number of 88,000 paid admissions. Test counts made during the summer indicate that an additional 40,000 service men and children were admitted free.

There were approximately 160,000 visitors to the Children's Zoo.

SERVICE MEN'S PETS

Starting in a small way, but with the prospect of enlarging the exhibit, we are making a special display of pet animals brought home by men in the armed services.

The collection already contains a Brown Lemur from Madagascar which a soldier bought in North Africa, a pair of Flying Phalangers from New Guinea which a member of the Pacific Armed Guard received as a present from a native, and a very young Margay cat brought back from Brazil by a sailor.

Not quite so exotic, but nevertheless included because they make an excellent exhibition pair, are two tame woodchucks that one young man had to dispose of when he was called into the Army.

Insofar as possible, the animals will be exhibited in the Small Mammal House, with special labels telling how they were acquired.

* * *

Two White-breasted Doves were hatched in the Bird House in late October, in the habitat cage known as the South American Jungle

Stream. They were the first of this rare Jamaican form we have managed to rear, although once or twice before the dove produced eggs.

PUBLICATIONS OF INTEREST

TAXIDERMY. By Leon L. Pray. The Macmillan Co., N. Y., 1943. 91 pp., 42 illus., $1.49.

Many of our best known naturalists first came into their chosen field through an early interest in the art of taxidermy. Thirty-five or forty years ago practically no information on this subject was available in published form. Many farm boys (this reviewer included) purchased a correspondence course in taxidermy, and birds and other animals were then mounted which still serve as somewhat nostalgic reminders of youthful days afield.

The author of TAXIDERMY has been a practical, working taxidermist through all the recent years which saw the modernization of this art. He worked and studied under Carl Akeley. The present wide use of borax instead of the poisonous arsenic for insect proofing is largely due to his research and advocacy.

Almost everyone engaged in Zoology or any of its allied studies must have a practical knowledge of taxidermy. For all such persons and for the hunter and the fisherman who want to preserve their trophies, Leon Pray's TAXIDERMY gives full and complete directions for mounting various types of animals.

To those of us who are frequently called upon for information concerning taxidermy, this little book is extremely welcome.—*C. W. Leister.*

THE BIRDS OF AMERICA. By John James Audubon. With a Foreword and descriptive captions by William Vogt. The Macmillan Co., New York, 1941. $4.95.

So many volumes have been written on the life and works of John James Audubon, and so widespread has been the destruction of his magnificent elephant folios for decorative purposes, that the fame of the great naturalist has been raised to the status of that of a national hero. Reproduction of the plates of birds in the now scarce and very valuable elephant folios would appear to be a logical sequence. However, an undertaking of such magnitude must have been approached with some trepidation, since the work would be both difficult and expensive. Public support of such a venture must always be a doubtful quantity but in this case, at least, the publishers' confidence in the general interest in birds appears to have been justified. First printed in 1937, at $12.50, a new edition is now off the press at the surprisingly low price of $4.95, a further indication of the success of the venture.

Appreciation of the difficulties involved in this undertaking must be based on the realization that the total of 435 full page color plates, originally contained in five unwieldy volumes, each measuring approximately 27½ x 39 inches, has now been condensed into a single volume of 9½ x 12½ inches. In addition to the illustration, each page carries a brief paragraph of salient facts relating to the bird figured, excellently done by William Vogt.

Any criticism of the reproduction of these plates must take into consideration the fact that the color in the original publication was applied by hand, so that there must be some variation in the many copies. While it is true that the color of some of the plates does not check well against that of the original set in the Zoological Society's library, it is still possible that it might be closer to others. Even though this disparity may sometimes be quite evident, the critic may be in some danger of appearing captious, for taken by and large, this volume is a magnificent achievement. — L. S. Crandall.

INDEX

Figures in **black type** indicate that the reference is, or includes, an illustration, map or diagram.

A

Allen, Elsa G., "Chipmunk Secrets," 133-140
Anoa, 64, 70
Anoa depressicornis, 70
Anoptichthys jordani, 82
Aquarium, New York, 129-132
Astyanax mexicanus, 82
Atz, James W., book review, "Voles, Mice and Lemmings," 24
Aurochs, 65

B

Baboon, Hamadryas, **38**
Baird Court, **47**
"Bamboo," Gorilla, 125

Banting, 43, 69
Bass, Small-mouth, **129**
Bathysphere, 71
Bats, Vampire, 45
Bear, Alaska Brown, 79, **80**
  Black, 75, **76, 77,** 78
  Grizzly, **78,** 79
  Peninsula Giant, **80**
  Polar, **74,** 81
Bears, 74-82
Beebe, Dr. William, 23, **26,** 46
  "Cashing Jungle Dividends," 26-30
  "Apothéosis of the Zoo," 50-55
  "Bathysphere Goes to War," 71
  "Our Zoo's Former Inhabitants," 111-116
  book review, "Extinct and Vanishing Mammals of the Western Hemisphere," 120
Beier, Max, 137
Bellbird, Three-pronged, 10
Benchley, Mrs. Belle J., 118
Bibos gaurus, 69
  sondaicus, 69
Birds, helping baby, 56-58
Bison bonasus, **67**
Bison, European, **67**
  Wood, **112,** 113, 114
Bluejay, **57**
Bongo, 15, **16**
Bos (Bibos) sauveli, 43, 69
  indicus, **65**
  longifrons, 65
  namadicus, 65
  primigenius, 65
  taurus, 65
Breder, Dr. C. M., Jr., 82, 87, **88**-90
Bridges, William, 16
  "Newest Animal—the Kouprey," 43-44
  "Longevity of Bats," 45
  book review, "The Birds of Britain," 48
  "Alas, Poor Annie!" 58
  "What We Have Learned About Blind Cave Fish," 82, 87-90
Bubalis bubalis, 70
Buffalo, Cape, 70
  Indian, 70
  pygmy, 70
  water, 70
Bush Baby, **98,** 99, 100, **101,** 102, **103**
"Bushman," Gorilla, **124,** 125
Butterflyfish, **13**

C

Cady, Harrison, 55
Carriker, M. A., Jr., 3
Cattle, Ancestors of Domestic, 63-70
  Chillingham, 66
  wild, 63-70
Cavy, Patagonian, born, 71, 117
Cephalopterus ornatus glabricollis, **2**-10, 104
Children's Zoo, 72
  attendance, at 141
Chimpanzee, **110**
Chipmunk, Eastern, 133-140
Cincinnati Zoo, 125
Clark, H. Huber, 72
"Comet" Platyfish, **19**
Coope, Robert, 47
Cordier, Charles, 1
  "The Umbrella Bird Comes to the Zoo," 2-10
  "Quetzals *Do* Breed in Captivity," 104-106
Crabs, Fiddler, 30-34
Crandall, Lee S., 21, 46
  "It's a Duck Winter," 21
  "Homing Pigeons in Peace and War," 39-42
  "Red Flamingoes," 46
  book review, "Trail of the Money Bird," 48
  "Ten Ways of Helping Baby Birds," 56-58
  book review, "Birds and Man," 72
  "Black Babies," 117
  "Barn Swallows in the Zoo," 118
  book review, "Meeting the Mammals," 120
  "The Birds of America," 142
Crane, Jocelyn, "Cashing Jungle Dividends," 30-34
Crane, White-necked, nesting, 71
  chick, 96

D

Davall, Grace, 73
Delacour, Capt. Jean, 43
Desmodus rotundus murinus, 45
  rotundus rotundus, 45
Dictionary, Farm, 71
"Dinah," Gorilla, 125
Dinia mena, **31**
Ditmars, Dr. R. L., 21
Dove, White-breasted, 141
Drill, **37**
Du Chaillu, Paul, 123
Ducks, in Zoo, 21, 45
Dunton, Sam, 49, 73, 91

E

Edmond-Blanc, François, 44
Eel, Electric, **12**
Eisendrath, David B., Jr., 9, 41
Eldridge, Harry, 23
Elephant, Alice, death of, 117
Exhibits, special, 46

F

Farm-in-the-Zoo, 45, 63, 71, 73, 97
  attendance at, 141
Fireflies, 91-95
  larva, **93**
  pupa, **93**
Firefly, Burning, 92
  Double-flash, 92
  Flashing, 92, **93**
  Glowing, 92
  Green-lighted, **Cover No. 4,** 91, **92, 95**
Fish Aggregations, **129-132**
Fish, Blind Cave, 82, 87-90
  experimental tanks, **88**
  newly discovered, 90
Flamingoes, 118, **119**
  effects of diet, 46
Fleming, Henry, **26,** 73
  "Lightning-bugs," 91-95
  book review, "Picture Book of Insects," 96
  "The Grasshopper Book," 120

G

Galago, **98,** 99, 100, **101,** 102, **103**
Galago senegalensis moholi, 98-103
"Gargantua," Gorilla, 127
Gaur, 43, 68, **70**
Gayal, **69**
Giraffa camelopardalis reticulata, 141
Giraffe, voice of, 141
Goldfish, Aquarium derivative, **12**
Goose, Barnacle, nesting, 96
  Hutchins X Pink-footed, nesting, 96
Gordon, Myron, "Black Lace for the Gold Platyfish," 18-20
Gorilla, 46, **72, 107**
  Bronx Zoo's, **122,** 123-128
  young, **62**
Gorilla gorilla gorilla, 125
  gorilla berengei, 125
Goss, Dr. Leonard J., 1, 45, 141
Gresser, Dr. E. B., 87
Guereza, **85**
Guggenheim, John Simon Memorial Foundation, 18

H

Hesperochernes tamiae, 137
Hippopotamus, birthday of, 96
Holstein-Friesian, **64**
Hoyt, A. Maria, 128
Hummingbird, Costa Rican Firethroat, **9**

I

Ide, Golden, **130**
Insect, False-face, from Venezuela, **Cover No. 2**

J

"Janet Penserosa," Gorilla, 125
Johnston, Sir Harry, 43

Jungle, Venezuelan, **28**
"river taxi," **34**

K

Kane, Joseph, 45
Kerry, Irish, 66
Kirkpatrick, G. E., 118
Klipspringer, 22
Kouprey, 43, **44,** 69

L

Lang, Herbert, 15
Leister, Dr. C. W., 21, 97
"Pride of the Antelope House," 15-18
"Young Animals," 22-23
"Before Montefiore Joash Sunshine," 63-70
"Two Healthy Baby Gorillas," 123-128
book review, "Taxidermy," 142
Lemur, Brown, 141
Leopard, Black, born, 117
Liers, Emil, 117
"Lightning-bugs," 91-95
Lincoln Park Zoo, 124, 125
Llama, **Cover No. 6**
Longhorn, Texas, 63
Lungfish, African, **12**

M

"Makoko," Gorilla, **122,** 123, 127
Mandrill, **36**
Marcy, Donald, 21
"Bears and Their Curious Ways," 74-82
"Night Life of the Bush Baby," 98-103
Margay, 141
"Massa," Gorilla, 125, **126**
"Mbongo," Gorilla, 125
Meader, Dr. Ralph, 89
Merriman, Dr. Daniel, 89
Monitor, Komodo, 43
Monkey, Japanese Red-faced, **61**
Owl, **108**
Rhesus, **86**
Spider, **59**
Squirrel, **83**
Moray, **14**
Moth, Tropical, **31**
Urania, 34, **opposite 34**
Mudspringer, **13**
Muskox, 67

N

Neopsylla striata, 137
"Ngagi," Gorilla, 125, 127, **128**

O

"Oka," Gorilla, **122,** 123, 127
Okapi, 15, **17,** 43
Orang-utan, **35**
Orchid, White, 34, **opposite 34**
Osborn, Fairfield, 23
"Goals," 1
"In the Mail," 25
"The Cartoonists' Gorilla," 49
"New Ways to Old Ends," 73
"Reversing the Order," 97
"The Pacific World," 121
Otter, **Cover No. 3,** 117
Clawless, 141
Ovibos moschatus, 67
Ox, European, 65

P

Panterpe insignis, **9**
Penguin, "Annie," **58,** 73
Phalanger, Flying, 141
Pharomachrus mocinno costaricensis, **5,** 104-106
Philadelphia Zoo, 125, 126
Photinus consanguineus, 92
marginellus, 92
pyralis, 92, **93**
scintillans, 92
Photurus pennsylvanica, **92, 95**
Pigeons, "Carrier," 39-42
Homing, 39-42
Platyfish, "Comet," **19**
Gold, **19**
Golden Wagtail, 18, **19, 20**
Platypoecilus maculatus, 19
Poephagus grunniens, **68**
Primates, Portraits of Four, **35-38, 59-62, 83-86, 107-110**
Pseudoscorpion, 137
Puma, **115,** 116

Q

Quetzal, Costa Rican, 3, **5,** 104, **105,** 106
Honduran, nest, **105**

R

Rasquin, Priscilla, 89
Ray, Cow-nosed, **14**
Red Cross, workshop in Zoo, **22**
Reilly, Keeper, **72**
Reindeer, **114,** 115
Rhesus, **86**
Ringling Bros. Circus, 127
Rizzi, Frank, 1, 117
Rocking Stone, **55**
Roosevelt, Col. Theodore, 21

S

San Diego Zoo, 118, 125, 128
Sanborn, Elwin R., 74
Sapajou, White-throated, **109**
woolly, **60**
Sasse, Arthur, 47
Scorpionfish, **11**
Seahorse, **14**
Service Men's Zoo, 141
Shark Sucker, **12**
Shorthorn, Celtic, 65
Simonson, S. Carleton, 46
Small Mammal House, Improvement of, 141
Snake, Coral, 1
Stewart, A. M., 137
Sucker, Shark, **12**
Sunfish, Bluegill, **131**
Mud, **132**
"Susie," Gorilla, 125
Swallows, Barn, **118**
Swan, White, nesting, 71
Swanson, George, 34
Syncerus caffer, 70

T

Tamias striatus lysteri, 133-140
Tee-Van, John, "Old-timer," 21-22
book review, "The Amateur Scientist," 24
"Handbook of Frogs and Toads," 47
Testudo tabulata, 21
Thorne, Samuel, 96
Threadfish, **13**
Tortoise, South American, 21
"Toto," Gorilla, 127
Triggerfish, **13**
Trogon, Red-bellied, 106
Turkey, Wild, **116**

U

Uca, 31
pugnax, 33
Umbrella Bird, **2**
Bare-necked, 104
Urania, moth, 34, **opposite 34**
Urbain, Prof. Achille, 43

V

VanderPyl, Mrs. John, 23
von Hagen, Dr. V. Wolfgang, **105**
Vulture, Griffon, "Old Nellie," **Cover No. 5,** 97

W

Wallaby, Gray, 22
Wanderoo, **84**
White, Farmer Aaron, 45
Wolf, Gray, 111, **112**
Woodchucks, 141

X

Xiphophorus susurrans jardinei, 29

Y

Yak, **68**

Z

Zebra Fish, **Cover No. 1**
Zebu, **65**
Zeledon, Ornithologist, 3
Señora Amparo, 104
Zoo, drawing of, **50, 51**
Zuloaga, Dr. Guillermo, 34

CONTENTS

No. 1. JANUARY – FEBRUARY

The Umbrella Bird Comes to the Zoo . . . . . *Charles Cordier* 3

Fins . . . . . *Pictures* 11

Pride of the Antelope House . . . . . *Claude W. Leister* 15

Black Lace for the Gold Platyfish . . . . . *Myron Gordon* 18

Behind the Scenes: News and Notes 21

No. 2. MARCH – APRIL

Cashing Jungle Dividends

Part 1: General . . . . . *William Beebe* 27

Part 2: Specific . . . . . *Jocelyn Crane* 30

Portraits of Four Primates . . . . . *Pictures* 35

Homing Pigeons in Peace and War . . . . . *Lee S. Crandall* 39

Newest Animal – the Kouprey . . . . . *William Bridges* 43

Behind the Scenes: News and Notes 45

No. 3. MAY – JUNE

Apotheosis of the Zoo . . . . . *William Beebe* 50

Ten Ways of Helping Baby Birds . . . . . *Lee S. Crandall* 56

Alas, Poor Annie! . . . . . *William Bridges* 58

Portraits of Four Primates. II. . . . . *Pictures* 59

Before Montefiore Joash Sunshine . . . . . *Claude W. Leister* 63

Behind the Scenes: News and Notes 71

No. 4. JULY – AUGUST

Bears and Their Curious Ways . . . . . *Donald Marcy* 75

What We Have Learned About Blind Cave Fish . . . *William Bridges* 82

Portraits of Four Primates. III. . . . . *Pictures* 83

"Lightning-bugs" . . . . . *Henry Fleming* 91

Behind the Scenes: News and Notes 96

No. 5. SEPTEMBER – OCTOBER

Night Life of the Bush Baby . . . . . *Donald Marcy* 99

Quetzals *Do* Breed in Captivity . . . . . *Charles Cordier* 104

Portraits of Four Primates. IV. . . . . *Pictures* 107

Our Zoo's Former Inhabitants . . . . . *William Beebe* 111

Behind the Scenes: News and Notes 119

No. 6. NOVEMBER – DECEMBER

Two Healthy Baby Gorillas . . . . . *Claude W. Leister* 123

Winter Get-Together: Fish Aggregations 129

Chipmunk Secrets . . . . . *Elsa G. Allen* 133

Behind the Scenes: News and Notes 141

Index to Volume XLVI 143

ANIMAL KINGDOM

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Post-Mortem

"Post-Mortem" is scarcely the appropriate word for a review of such a lively affair as our recent annual Members' Meeting. As a matter of fact, it is our hope that the recollection of the meeting will continue to live, for a while, at least, in the minds of those who attended it. For a reason that we ourselves do not quite grasp, the attendance was the largest that the Society has ever had on this occasion. Further, some of the matters reported there appear to have been of such general public interest that they were made the subject of editorials in several of the newspapers.

It seems evident that many people in these parlous and critical times turn with relief to Nature. Comment was made in a previous issue on an impression we gained at the Zoo this year, namely, that the public who came there seemed to be finding unusual enjoyment. This and the apparent success of the Members' Meeting are all of one pattern – with human affairs in such a pass, the works of Nature refresh and fortify. Come better days again, we need anticipate no lag; in fact, the carrying out of the we need anticipate no lag; in fact, the carrying out of the many many new developments now being planned for the future should assure ever-increasing public attention.

Fairfield Osborn

IN THIS ISSUE

Kissing Gouramis . . . . . *Sam Dunton* COVER
Those Bizarre Animals from Down Under . . *Donald Marcy* 3
Report from the Services . *Cpl. E. Chase & Pvt. R. Donahue* 9
Living in a Germ-free World . . . . . *William Bridges* 14
Nouns of Multitudes of Animals . . . . . *William Beebe* 17
London Zoo See It Through . . . . . *L. R. Brightwell* 18
Behind the Scenes: News and Notes 23

SHOP TALK

A MISCELLANY of Zoo news that doesn't seem to fit anywhere else:

** * * The Gray Fox in the Hospital is a gift. An Italian farmer brought him from upstate. Something had been killing his chickens, he set a trap, caught the fox.*

"He's in fine condition," says the Veterinarian. "What've you been feeding him?"

"He eat the sphagett–lotsa sphagett. Slop like for the pigs, too."

Sphagetti and garbage! The Vet says he never saw a better fox!

** * * See by the papers San Diego Zoo has lost Ngagi, its big Gorilla. Mbongo died in* 1942.

** * * Visitors can't figure out why we built only half a wall in the rhinoceros stalls–and such low walls, too. Well, they aren't walls, to begin with. Just low concrete barriers through the center of the stalls, with room at either end for the keeper to slip past in case the rhinos charge or try any funny business.*

** * * We've got a climbing elephant. One of our young Indians has a bad habit of pushing her trunk through the bars and swaying it in people's faces. So the engineer rigged up crossbars to limit her trunk. They made a fine ladder and she started climbing. Got three feet off the ground, too.*

** * * But that's nothing. We've got a biting rhinoceros. Rhinos don't bite –they attack with their horns. But Betsy, the big Indian rhino, is always trying to sneak up on her keeper and literally put the bite on him.*

** * * Two 3-foot alligators got into a fight the other day and a keeper separated them. He won't lose his thumb, but it was a close thing.*

** * * The panda babies are picking up weight again–the male touched* 179 *pounds last month, the female* 267 *pounds. Have to quit calling them "babies" pretty soon.*

** * * Prospective subscriber to* ANIMAL KINGDOM: *"Dear Sir," said his postcard. "Please send me all information about animals."*–EDITOR.

Those Bizarre

Captain Cook did *not* discover the Kangaroo, and Kangaroo babies are *not* born in the maternal pouch.

Truly a giant is the Great Red Kangaroo, for it is the height of a tall man—more than six feet—when it stands erect. This species is the largest of the 129 forms in the family, and its size is particularly impressive when it is compared with the Musk Kangaroo, which is scarcely larger than a rabbit. The barren interior plains of Australia are the home of the Giant Red.

Animals from Down Under

By DONALD MARCY

But there are many true and fascinating facts about this familiar yet ever-popular animal from the continent on the other side of the world.

PROBABLY NO ANIMAL has received more attention from cartoonists and humorists than the kangaroo, that bizarre animal from the Land Down Under—and all because kangaroo babies are fortunate enough to spend the early part of their lives in a fur-lined baby carriage!

To the majority of Zoo visitors, the pouch in which the young are carried is the most characteristic thing about kangaroos; indeed, zoologists have named the large and varied group to which they belong "marsupials," from the Latin *marsupium* (pouch).

A baby kangaroo is born in the usual manner of mammals, nearly always one at a time. Hardly more than an inch long and weighing about one three-thousandths of its mother's weight,* it is in a very premature state of development. The hind legs, eventually to become so long and powerful, are now little more than buds, and the tail is likewise small. The forelimbs, however, are well developed. They are equipped with claws by means of which the naked mite, resembling a little red grub, swims with an overhand stroke through a forest of hair into the mother's abdominal pouch. Here it fastens so tightly to a nipple that it is impossible to remove it without causing injury. In fact, it was long believed that the baby *grew* on the nipple, like fruit on a tree!

As the baby grows, its attachment becomes less strong, and in the Bronx Zoo when a two-months-old baby kangaroo was accidentally dislodged from the pouch it finally came loose after dangling for some time. The mother took no notice of the helpless infant, and it was necessary for the keepers to replace the baby in the pouch and force the nipple into its mouth. The baby suffered no ill effects and grew to maturity.

At first a baby kangaroo, though strong enough to have climbed into the pouch and fastened itself to a nipple, is not able to nurse. The mother forces milk down its throat by contractions of her abdominal muscles until the young marsupial develops the strength necessary to obtain milk by its own efforts.

By the time it is three or four months old or even older (the time varies in different species), the baby is covered with soft fur and pokes its head out of the pouch to look around and nibble grass while its mother feeds. Gradually "Joey," as it is called by Australians, learns to venture forth and hop along beside its mother, always sticking close to her in order to push its head into the pouch for a refreshing drink of milk or to dive headlong inside in response to the mother's soft, chirping danger signal.

There is no set time for young kangaroos to be born, as is the case in the deer family; they may appear at any time. In the southern part of Australia, however, they are usually born in April, remaining in the pouch during the cold months (June, July and August).

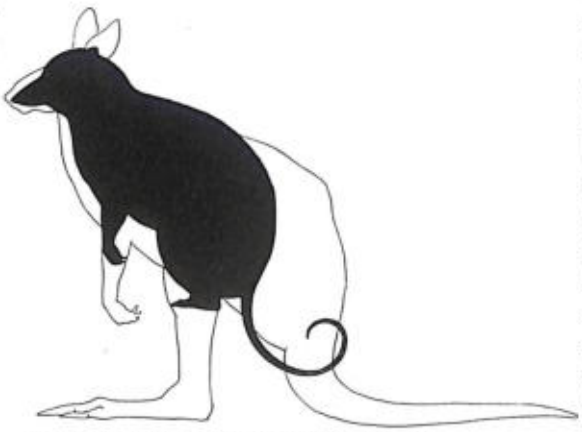
A description of a kangaroo is hardly necessary, for everyone is familiar with the small forelimbs, long, powerful hind legs and muscular tail. All are adaptations to its queer method of locomotion. Actually, the incongruity of the kangaroo's figure is not so much due to the small forelimbs as it is to the enormous enlargement of the entire posterior portion of the body. If the outline of a mammal of normal proportions such as an opossum is superimposed upon the outline of the kangaroo, the truth of this statement will be evident.

An interesting feature of the kangaroo is the

* For comparison: a new-born bear weighs approximately 1/400th of its mother's weight; a human baby 1/20th; and a porcupine, 1/12th.

peculiar development of the long, narrow hind feet. The first digit, corresponding to our "big toe," is completely missing; the second and third digits are extremely slender and are united by a common skin; the fourth digit is enormously enlarged; and the fifth is medium sized.

A kangaroo in a hurry progresses in a series of long, graceful hops upon the hind legs with the forelimbs folded and the heavy tail helping to maintain balance. Neither forefeet nor tail touch the ground. In full flight jumps of more than twenty-five feet are made, though at slower speeds the hops are short —about five feet. A group or "mob" of 'roos are said to present a stirring spectacle as they leap up and go bounding away from an intruder, the fleet females (does) leading and the old males or "boomers" bringing up the rear. Rocks, gullies and fences are cleared with ease and their speed and endurance are so great that dogs and even horses may be outdistanced.



Here the silhouette (solid black) of a common American marsupial, the Opossum, has been superimposed on an outline of a Kangaroo to test the author's contention that it is the enormous enlargement of the Kangaroo's posterior that gives it such an incongruous appearance. The forward portions correspond reasonably well with those of the "normal" opossum.

If actually brought to bay a courageous fight may be expected. Propped firmly by its strong tail, often with its back to a tree, a cornered kangaroo strikes out and scratches expertly with its forefeet and awaits a chance to deal a slashing blow with the spear-like claws of the hind feet. Though naturally timid and characteristically wearing a gentle expression, the kangaroo must be respected as a dangerous antagonist. And when an alarmed kangaroo begins to growl like a dog, it is well to take warning and make a judicious retreat!

Kangaroos are strong swimmers and have often been known to take to the water to escape pursuit; if attacked by a dog in the water, they sometimes grasp the dog with the forepaws and hold it under water until it drowns. It is said that a hard-pressed female will sometimes remove her Joey from her pouch to increase her chances for escape, returning when danger has passed.

Traveling slowly, as when grazing, a kangaroo lifts its hind legs clear of the ground and swings them forward together while the weight of the body is supported by the forelimbs and tail. The latter practically serves as a fifth leg and is constantly used as a prop when the animal is sitting on its hind legs or standing "on tip-toe" to obtain a better view of the surrounding country. When resting, a kangaroo often turns the tail forward between the legs and sits upon it.

During the day kangaroos usually lie up in a comfortable spot to rest, sleep and take dust-baths in circular holes in the ground. Sometimes the males amuse themselves by sparring and grappling with one another, displaying considerable natural skill. Now and then "boxing kangaroos" are exhibited on the stage, and one owner of such an animal sued the city of Minneapolis when his kangaroo died as the result of tail injuries received in an elevator. The owner claimed that he had taken great pains and had gone to much trouble and expense to train his animal in the noble art of boxing, and should therefore be paid well for his great loss. Mr. Harry Raven of the American Museum of Natural History, an expert on Australian animal life, was called as a witness and proved that kangaroos "box" even without training. The kangaroo owner lost his case.

It is popularly believed that the kangaroo first became known to civilized man when Captain Cook, who visited Australia in 1770, described an animal that jumped "like a Hare or Deer." Ac-

Weights up to 200 pounds have been recorded for the Gray Kangaroo, a species common in the open forest areas over most of the continent. This is a species very often seen in zoological parks.

tually the Dutch navigator Pelsart gave the first account of a kangaroo about 150 years earlier, in 1629. "We found large numbers of a species of cats," he wrote, "which are very strange creatures; they are about the size of a hare, head resembling the head of a civet-cat; the forepaws are very short, about the length of a finger, on which the animal has five small nails or fingers, resembling those of a monkey's forepaw. Its two hind legs, on the contrary, are upwards of half an ell [one ell equals 45 inches] in length, and it walks on these only, on the flat of the heavy part of the leg, so that it does not run fast. Its tail is very long, like that of a long-tailed monkey; if it eats, it sits on its hind legs, and clutches its food with its forepaws, just like a squirrel or monkey." The writer was evidently referring to one of the smaller kangaroos, or wallabies. Many years passed by before the complete story of these fascinating pouch-bearing mammals was brought to light.

We now know that marsupials are the dominant form of mammalian life in Australia and the adjacent islands. Furthermore, they are found nowhere else in the world except in South America and North America, where their role is a minor one. This is indeed a strange situation. How did it come about?

Although Australia is now separated from nearby islands and other continents by water, this condition did not always prevail. In fact, not only was Australia once connected by land to nearby islands and Asia, but there are evidences that it was joined to South America as well by way of the Antarctic. We know, too, that Asia was linked to North America in the Bering Sea region. Consequently it was possible for animals to pass freely from one continent to another.

It is believed that marsupials originated in the northern hemisphere and migrated to the southern land masses. When Australia was isolated from the rest of the world by water, its marsupials were left practically free of outside influences—free from the competition of other mammals which, as the ages rolled by, evolved into the many forms of higher, more efficiently organized animals we know today. The marsupials branched out independently of the higher

Several species of Kangaroos are agile climbers, so much so that they are known as Tree Kangaroos. This is Bennett's Tree Kangaroo, a form that we have often exhibited. The tops of cages and corrals must be covered, for otherwise the animals would climb out and leap for the nearest trees. The long, slender tail is a useful balancing appendage when the Kangaroo is feeding in the tree tops; it does not have grasping power, nor does the animal use it as a prop while on the ground as the other, ground-dwelling, Kangaroos use their tails.

Australia is a continent of vastly varied terrain, and almost every type of land—plains, forested areas, rocky hillsides—has one or more kinds of Kangaroos that find those particular conditions favorable. The Black-faced Kangaroo is a dweller in the densely thicketed areas. This, again, is a species that is generally to be found in the Zoo.

mammals to fill the various habitat niches. Thus, in Australia we find marsupials that live on the open plains like our more familiar grazing animals; marsupials that burrow in the ground like moles or gophers; marsupials that live in trees and resemble flying squirrels; still others that are carnivorous and resemble large dogs; and so on. The superficial resemblance of different kinds of marsupials to various higher mammals was immediately recognized by Australia's European immigrants, for they promptly named the animals "cats," "bears," "mice," etc., after the mammals with which they were familiar in the land of their birth.

In the western hemisphere the marsupials were not isolated from the higher mammals, met stiffer competition, and consequently form but an insignificant part of the animal life of North and South America.

The kangaroo family contains about 129 living species and sub-species, varying in size from the great red kangaroo dwelling on the interior plains, to the tiny musk kangaroo, no larger than a rabbit, which inhabits the tropical rain forests of Queensland. Typical kangaroos are large and have narrow feet. Among these, beside the great red kangaroo (which has an overall length of ten feet), are the gray kangaroo, weighing up to 200 pounds, found in the open forests over most of the continent; the black-faced kangaroo, dwelling in densely thicketed areas; and the shaggy wallaroo, which is most at home on rocky hillsides. These larger forms tend to be gregarious, frequently associating in mobs of a dozen or more.

The numerous species of smaller kangaroos or wallabies are less gregarious than the larger forms, usually being seen alone or in pairs. Their small size makes them good prey for the great wedge-tailed eagles, the introduced foxes and the dingoes; consequently they take advantage

of all available cover. The brush wallabies are at home in dense scrub jungle, while the agile rock wallabies are capable of passing over the roughest terrain at a good clip when pursued.

Up a tree is the last place you would expect to find a kangaroo, but one group of marsupials—the tree kangaroos—are perfectly at home high above the ground. Their adaptations to an arboreal existence include strong, sharp claws, roughened foot-pads, and forelimbs that are relatively longer than those of the "normal" kangaroos. Capable of ascending high trees to obtain food and escape pursuit, they often leap to the ground from a height of twenty feet, and it is claimed that one was seen to jump from the unbelievable height of sixty feet! In my opinion the tree from which this animal leaped was the *last* tree it climbed.

While kangaroos and wallabies are preyed upon by various carnivores, their most dangerous predator is man. Native Australian "black men" have always hunted them, not only for their flesh as food, but for the skins to make clothing, the leg-bones to make needles, and the tendons to make thread. White men with modern weapons annually hunt down vast numbers for "sport" and for their pelts, which yield fine fur and leather. In spite of this none of the species appears to be in danger of becoming extinct, although their numbers have been much reduced.

Our kangaroos are fed oats, carrots, potatoes, apples, cabbage and bread, a diet which apparently fulfills their needs as well as do the grasses and leaves of their native land. They usually eat sitting on their hind legs, propped up by the tail and holding the food in their forepaws. Even Emily Post could not criticize their table manners, for they eat in a quiet, leisurely fashion, often taking four hours to empty the tray.

Some of the smaller Kangaroos are known as Wallabies—a fact that often inspires visitors to say: "The label says it's a Wallaby, but it certainly looks like a Kangaroo!" This is a Black Swamp-wallaby, with its "Joey" in the pouch.

Report from the SERVICES

CPL. EARL CHASE ← BY → PVT. RALPH DONAHUE

[The three letters reproduced here have come from members of our Armed Forces in the Pacific—but at almost opposite ends of that vast area. Cpl. Earl Chase, formerly a keeper in the Reptile House at the Zoological Park, has been stationed in India for some months; Pvt. Ralph Donahue, a friend of Dr. William Beebe, is, as his letter indicates, "somewhere in the Aleutians."

[Both young men were keenly interested in animal life before they began their travels and both have been making good use of their eyes and their opportunities. So must thousands of others who have found themselves caught up by the war and set down in lands where "zoo animals" are familiar, everyday, backyard fauna. In these and other letters from service men that we have seen, there is a deep curiosity and a desire to know more about the animals and plants of their new surroundings, and it is for them that "The Pacific World," and its supplementary handbooks, mentioned by Mr. Osborn in our previous issue, are particularly intended.—EDITOR].

Cpl. Chase Wishes He Could Exhibit An Indian Pond in the Zoo

Somewhere in India
October 14, 1943

Dear Mr. Tee-Van:

Have you ever seen a frog that can hop for about 10 feet across open water? I see one almost every day. He is a large green frog and quite often, for no apparent reason, he starts jumping violently. This action brings him out on the surface and off he goes amid much splashing. He does it quickly, too; usually you see only the marks where he hit the water, about a foot apart, then the final ring where he plunged back in.

Another interesting little rascal I see almost every day is a tiny kingfisher. He sits up about four inches, is a deep blue-greenish color, with a light robin's egg blue running down the middle of his back. His long beak and a portion of his face are oxblood red. These are quite tame little fellows and allow me to approach within ten feet before they take off. I see them dive into the water and they always catch one of the tiny multi-colored fish that range the surface.

If I could transport one of these small ponds, its entire contents, and about ten feet of the surrounding soil with plants, back to New York, and with a wire cage around it, and set it in the Park, you would have a grand exhibit!

Imagine about eight varieties of tiny, highly colored fish, besides Elodea, hornwort, water hyacinth with a purple bloom and an eight-inch spike of flowers. Ten-inch lily pads, and six- to eight-inch red and white, or pink, water lilies. Lilies looking like giant amaryllis growing around the banks. Bamboo clusters—not small stems as in the Reptile House at the Zoo—but with six- to eight-inch butts. Tall coconut palms

Such a jungle pond as this Corporal Chase would like to transplant in the Zoological Park, although the actual pond he has been observing when he wrote his vivid description of Indian flora and fauna seems to have been even more luxuriant than the one shown here. Unfortunately, the New York climate does not lend itself to tropical pond planting.

loaded with fruit, betelnut palms in fruit, and many other tall and short varieties of palms which I do not know. Banyan trees with their many trunks, banana trees in bearing. Several varieties of duckweed on the water, large and small frogs and fish, land and water snakes, far more colorful than those of the United States.

In this transplanted pond exhibit, imagine many vines and creepers trailing from the trees, and often bearing beautiful flowers of all colors and sizes. Tiny kingfishers would be sitting on an old limb ready to snare a meal; possibly a mongoose sneaking around the edges. A basilisk running out from under a coconut husk to a safer retreat. Several skinks burrowing under rotten palm fronds. Snipe and herons wading around the edges and finally one house crow making a racket as he scratches on the ground, and a nice smelly, bare-necked vulture trying to maintain his balance on the top of a shade tree.

To make it look real, a big, black, skinny, water buffalo with a rope through his nostrils

should be somewhere in the water, with only his nose out, and a large bluish Brahma cow with a floppy hump, a dirty belly and legs, and an amazing lot of rib showing, should be munching grass near an eight-foot cactus in the background.

The natives say these places contain big, bad, cobras also, but I still have seen none. Oh, yes, beautiful, split-tailed, green swallows should whip across the pond occasionally and grab off a few insects, and the air immediately above the water must be filled with many species of dragon and damsel flies.

The old massive banyan tree really should have a few immense vines with large green, red and white leaves, climbing away up and threatening to choke it. A few air plants will have to adorn the branches, and every root cane must be filled with dancing crane flies.

There is much more, but I have no books or equipment with which to make identifications and even forget many names or how to spell them. It is really too bad to be among such material and just to look and, too often, forget.

Sincerely,

EARL

Pvt. Donahue Finds Plenty of Life in the Barren Aleutians

Somewhere in the Aleutians
October 18, 1943

Dear Dr. Beebe:

Received your letter of October 1st away out here in the Pacific Ocean. Instead of being in the South Pacific, I am just the opposite—out on the Aleutian chain.

At Kodiak, Alaska, we had some trees, but out here there is not a single shrub to be seen, much less a tree. There is, however, a dwarf tree-like plant[1] that grows in the deep moss of the tundra, its scanty leaves protruding through the foot-deep mossy carpet (two of its leaves, now frost nipped, are enclosed). The stalk is weak and grows from the soil, branching in several directions to enable its leaves to seek the light.

The entire island is covered with a variety of mosses that, in their collective capacity, makes for weary walking. At every step one's foot sinks down all the way from six inches to three times that. It's like trying to walk on a deep feather mattress.

There can be found, in most sections, three distinct varieties of moss. Enclosed you will find fragments of all three. The branchy brown one[2] grows in such compact bunches that mounds of it seem to be pushed upward in the middle, resembling large gopher hills, or Texas red ant mounds. Between these hummocks grows the green type,[3] often sporting wine-colored berries about the size of blackberries (specimen enclosed). Also enclosed is a sample of the gray moss[4] that competes for existence with the others.

There are certain swampy areas—though goodness knows the whole terrain is boggy — where acres of "Alaskan cotton" grows. These sections, now that fall has browned the supporting stems and grassy leaves, look as though a field of daisies were in bloom (from a distance away, of course).

From evidence found in the browned seedpods and dead stalks, lupines, monks' hood, fleabane, cinquefoil, wild geraniums, and terrestrial orchids bloom here, and it can well be imagined that the country is quite beautiful in the summer.

Went on a hike this morning—the first liberty I have had since taking over here, for weeks. I had been wondering what the place would be like away from the noise and rush of camp.

First I flushed a bird that I believe to have been a male ptarmigan.[5] As with the other creatures on the island, never before in contact with man's blood-lust of killing, this bird showed no fear of me. It merely ran ahead of me about five paces, sat down on its feathered legs and toes, and watched me with black beady eyes. Its underside was white; its back a greenish-brown, pencilled in white lines. Over each eye was a bright red crescent. I watched the creature for some minutes, then walked toward it to see it rise and fly in characteristic prairie-chicken-like flight. Later on this bird will be snow white except for

its eyes, beak, and part of its tail (if it is a ptarmigan).

Next I saw two great bald eagles[6] standing by the edge of one of the many shallow ponds (more about the ponds and their formation in a follow-up letter). First thought them to be men seated at the lake edge fishing, the whites of their heads appearing from the distance to be white faces. They let me get within 300 yards before they lifted their great wings and slowly went up the draw, like hunting redtails or marsh hawks. Before my hike was over I had counted 16 different eagles, fully a third in their adult plumage. (To settle a bet, is the Bald Eagle's head any less feathered when it's white than when it's brown? I contend that the color is the only difference).

While in a hideaway, watching the eagles, a falcon-like bird[7] came and hovered over my hiding place. It swung about in a great circle and came back to look five different times. Evidently it took me for some game. It was about the size of the sharp-shinned hawk at home, but was a brownish-gray, with darker tails, square ended and tipped with white.

Along the beach, among the water-ground boulders, dozens of small wrens[8] were seen. They seemed to be after some sort of beach insects under the rocks. The birds flushed before me as I walked, like grasshoppers from an early autumn Kansas alfalfa field. They were about the size and shape of the common house wren at home, yet were more the coloration of the Carolina wren, even to the white line over the eye.

There were to be found, too, many large sparrow-like birds,[9] brownish, with white spots over each eye, and on either side of their chins. They were shaped like the Harris sparrow at home. They sang short, sweet notes even when in the spray of the breakers.

Herring gulls[10] are not at all common here, but the ravens[11] are everywhere, taking the place of blackbirds at home. They come right into camp to pick up bits of garbage. I know of no birds that seem so to enjoy flying. Sometimes they actually do a complete side roll; often two of them in one downward swoop.

There are birds that come through here in small flocks that look something like the Java sparrow, but many times larger. They are stout birds[12] and their twitter and flight reminds me of that of the common bluebird. Their stout beaks are reddish and they have (some of them) a peculiar cheek hooding of a lighter hue, and on the buff bodies they have many spots and lines. They are about as erratic as cedar waxwings.

The only animals on the islands are Arctic blue foxes,[13] but there are hundreds of them. Being tame, they are not difficult to capture and when caught make no attempt to bite. Their fur is the softest, silkiest blue color imaginable. Sometimes the animals come out of their dens and bark at you as you go by.

It's all so charming, this finding the wild not wild, but it will be only a short time until man will show his superiority in blasting these trusting creatures, both bird and animal. Already the carcasses of eagles, ravens, seals and foxes are to be found—targets for thoughtless men with rifles.

More in a following letter.

Sincerely,

RALPH

Extracts from a Second Donahue Letter "Somewhere in the Aleutians"

October 31, 1943

Recently a member of this outfit, being obsessed with a yen for hunting, went out and brought in a female Mallard Duck,[14] two small Green-winged Teal[15] and a beautiful Blue Goose.[16] Its upper head and neck were white; the upper mandible pink, the lower black, as was its throat down to the smoke grey of its breast and underparts; its back was a blue grey with the longer feathers outlined in darker. Its webbed feet were orange yellow. It was two feet long and forty-four inches in wing spread. The crops contained seaweed, moss and grass.

About the surface of this island appear shallow lakes, really ponds, some forty acres in extent, many smaller, none more than eight feet in depth. The water is clear and sweet yet they have no visible inlet or outlet. Seepage through the tundra-covered soil seems the only explanation. I wondered what life, if any, lived in these peculiar bodies of water, and by digging a trench I emptied one small pond into a natural ravine that led into the sea.

As the water went down we found a nineteen-inch speckled trout and one ten inches long. The larger fish seemed a typical trout yet its lower jaw was upcurved like a "Humpie" in spawning season.[17] The small minnows varied in size from a half inch to three inches. They had backs of light brown, bellies of honey hue, and vertical lateral lines, large eyes and large pectoral fins.[18] Part of the fry had horns, two in number, about one-quarter of an inch long, extending outward and backward from just below their gills. On the back were three spines in the fin, and when captured they protested by blowing out their bodies until they seemed about to burst.[19]

Other creatures in the lake were small water bugs like those in my lily pond at home. Also sand-flea-like creatures. In digging the ditch we saw almost no signs of life, nothing but brown spiders, a few stink-bugs, and small slender millipedes.

While we are talking of soil and digging I might mention that an archaeological friend and I have been digging into some old kitchen middens and camp sites of ancient Aleut villages. We found tons of sea shells, sea urchin armor, fish, whale and seal bones and those of water fowl. Mixed in all this debris, we found objects of old Aleut art; ivory spear heads, barbed and polished bone instruments, whale oil lamps of stone and other articles.

RALPH

A Note by Dr. Beebe on the Aleutian Flora and Fauna

Names can be given with reasonable assurance to the specimens and to most of the descriptions of the plants and animals seen by Pvt. Donahue, so I have added a list of these. Dr. Ernst Mayr, Dr. H. A. Gleason and Dr. L. P. Schultz have helped with some of the knottier identifications.—W. BEEBE.

Footnote:

1. Some species of Arctic dwarf willow, *Salix*.
2. This Arctic moss is *Rhytidiadelphus loreus*.
3. Crowberry or Heathberry, *Empetrum nigrum*.

New York Botanical Garden

Across forbidding plains and hills like these Private Donahue probably made the hikes that resulted in his correspondence with Dr. Beebe. This particular scene is at Karluk, Alaska, near the beginning of the Aleutian chain of islands.

4. Reindeer "Moss" or more correctly Lichen, *Cladonia rangiferina.*
5. This is either the Kiska Rock Ptarmigan, *Lagopus mutus townsendi,* or the Attu bird, *L. m. evermanni.*
6. Northern Bald Eagle; *Haliæetus leucocephalus washingtoniensis.*
7. Probably the Western Pigeon Hawk, *Falco columbarius bendirei.*
8. Either the Kiska Winter Wren, *Troglodytes troglodytes kiskensis,* or the Attu bird, *T. t. meligerus,* according to which island is the source of the letter.
9. Aleutian Savanna Sparrow, *Passerculus s. sandwichensis.*
10. Siberian Herring Gull, *Larus argentatus vegae.*
11. Northern Raven, *Corvus corax principalis.*
12. Alaskan Lapland Longspur, *Calcarius lapponicus alascensis.*
13. A form of the Arctic Fox which does not turn white in winter, *Alopex lagopus beringensis.*
14. Mallard Duck, *Anas p. platyrhynchos.*
15. European Green-wing Teal, *Anas c. crecca.*
16. Emperor Goose, *Philacte canagica.*
17. Cutthroat Steelhead Trout, *Salmo clarkii.*
18. Cottus "Minnows," *Cottus aleuticus* (?).

LIVING in a Germ-free World

By WILLIAM BRIDGES

IT IS A COMMONPLACE of general knowledge that all life is surrounded by and pervaded by "germs." Anybody who doesn't know that elementary fact has only to read the advertisements of antiseptics in the subway. Only—it isn't completely, 100% true. There are exceptions.

In a few laboratories over the country living organisms, some of them as complex as fish, guineapigs and chickens, exist under absolutely sterile conditions. No bacteria on or in them, no fungi, no protozoa, no "germs." To all intents and purposes, they were sealed in a cellophane bag at birth and the contaminating world has been shut out ever since.

It is, as might be supposed, a peculiar sort of life and not at all what we human beings would be likely to choose for ourselves, even if it seemed to guarantee a sort of immortality. Writers of pseudo-science have sometimes dreamed of germ-free individuals able to live forever because no disease organisms could attack them. That sort of thing is all very well for those who like that sort of thing, but the fact is that freedom from micro-organisms does not mean freedom from death.

Not long ago Drs. Nigrelli and Gordon of the Aquarium staff visited the laboratories of Drs. James A. Baker and M. S. Ferguson of the Rockefeller Institute for Medical Research at Princeton, New Jersey, and were shown a series of milk bottles, each containing pair of vigorous little Mexican platyfish. One bottle seemed to have been skimped in the allocation of occupants; only one fish was swimming in the crystal-clear water.

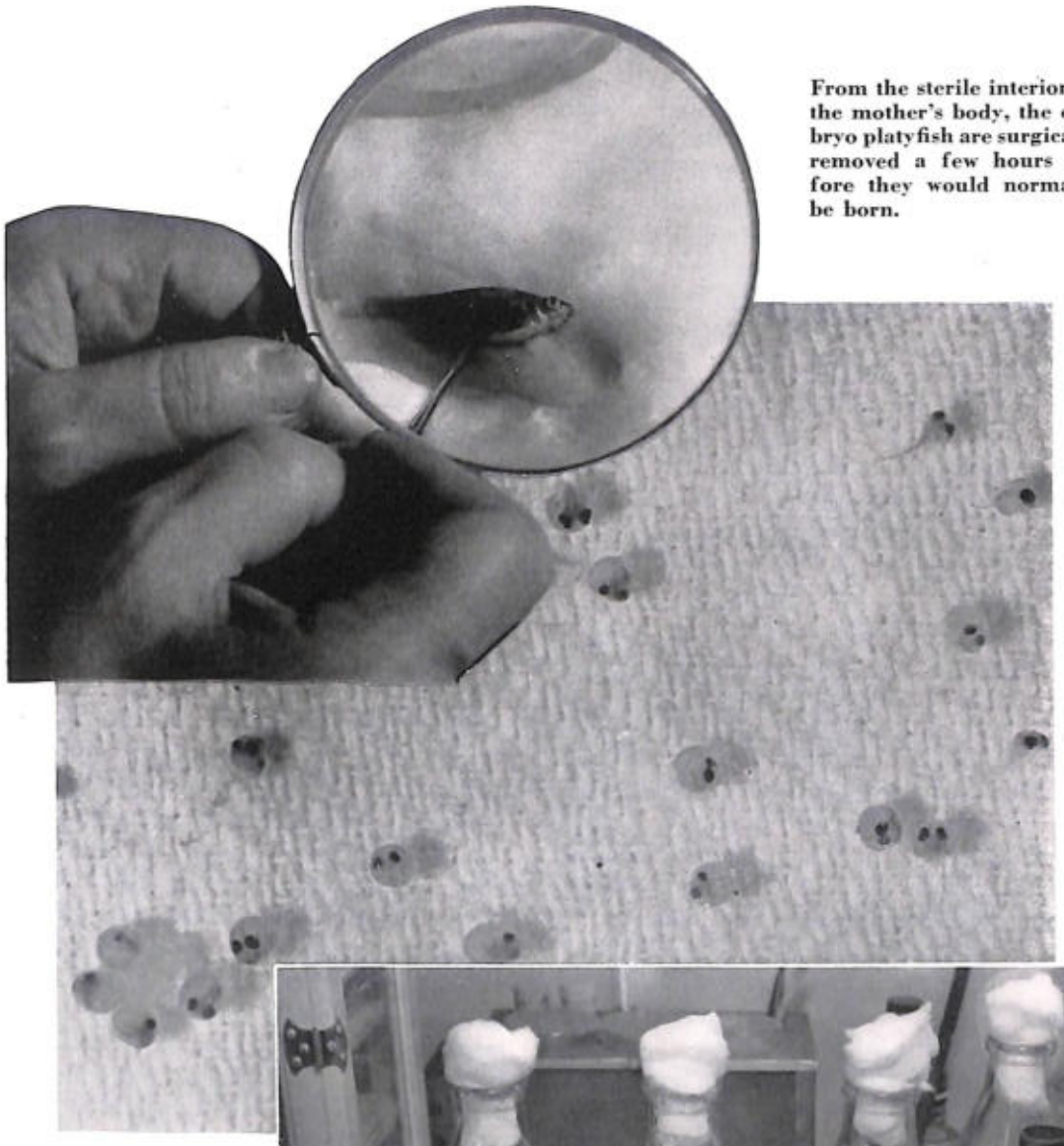
Then they saw a second one, bright-eyed and fresh but lying on its side in the bottom of the bottle. They called Dr. Baker's attention to it.

"One of your fish seems to be in trouble."

He glanced at the bottle. "Oh, that one. Yes, he died two weeks ago."

So they do die—but because of the perfect sterility of their surroundings and their own bodies, decomposition does not take place as it does in other organisms.

The interest of the Aquarium men in the technique of producing and maintaining animals under perfectly sterile conditions arises from a series of experiments undertaken in the Aquarium some time ago. Diet and nutrition are, obviously, of great importance in the maintenance of a collection of fishes and far less is known about the factors involved in fish nutrition than about the dietary problems of most other ani-



From the sterile interior of the mother's body, the embryo platyfish are surgically removed a few hours before they would normally be born.

ABOVE are some of the embryos in a dish of warm water, immediately after being removed. They are about twice life size; the globular mass is the yolk sac, and the black dots are the eyes.

RIGHT are the sterile milk bottles, the future axenic homes of the germ-free baby platyfish.

mals. They set out to learn what they could and very soon discovered that no positive results could be obtained as long as bacteria were present. Fishes could easily be kept in filtered pond water and fed doses of prepared food known to contain exact quantities of minerals, vitamins, salts and the like. But it was impossible to exercise an absolute control over the fishes' intake, because bacteria were present and under certain conditions they are known to have the power to create, or synthesize, vitamins out of material existing in pond water.

At this point the Aquarium's interests coincided with those of Dr. Baker, who had been working on fish tuberculosis. Some years ago Dr. Gordon had suggested the use of fish for tuberculosis studies and subsequently the Rockefeller men used these same fish—Mexican platys—for their experiments in sterile rearing, for they were hardy, easily obtained and brought forth living young.

Their discoveries were reported eventually in the *Proceedings of the Society for Experimental Biology and Medicine* (51: 112-119, 1942), in a paper entitled "Growth of the Platyfish (*Platypoecilus maculatus*) Free from Bacteria and other Microorganisms."

That explanatory phrase, "free from bacteria and other microorganisms," seemed unnecessarily cumbersome for daily use, so they sought the advice of Dr. A. G. Johnson of the Classics Department of Princeton University. Obligingly he created a new word for them: *axenic*. It filled the bill nicely: *a* means "without," or "free from," and *xenos* refers to "stranger" or "foreign life."

Drs. Baker and Ferguson did not need to wait until the baby platyfish were born in order to create an environment free from all contaminants. Embryo fish, like embryo mammals, are already in a sterile environment when they are in the mother's body. Consequently the research men developed a technique for performing a Caesarian operation under strictly aseptic conditions and removing the axenic babies a few days short of the normal four-week term of gestation. They were immediately placed in an "incubator" which was merely a covered glass dish of warm, oxygenated, sterilized water. Here the baby platys remained for several days until their yolk-sacs were absorbed, and then they were transferred to more commodious quarters in a series of sterile milk bottles, in sterilized water.

Eventually, of course, outside food had to be provided—and that food had to be sterile, too. Dried, prepared fish food that could be sterilized was part of the answer to the problem, but living food was desirable, and so as a supplement Drs. Baker and Ferguson began to use axenic nematode worms. These roundworms (*Neoaplectana glaseri*) were, incidentally, cultivated at the Rockefeller Institute for the control of the Japanese beetle; the worm parasitizes and kills the beetle.

The research men were able to rear the platyfish to an age of four months, by which time they had attained apparently mature size. But they failed to breed. They were, it seems, sterile in a double sense.

This sexual sterility has been a stumbling block to other scientists who have experimented with the maintenance of life under aseptic conditions. With some of the protozoa, with nematode worms, insects and crustaceans they have been able to rear and breed successive generations in a condition of axenia, but it is to be noted that all these animals were invertebrates. The story is different when it concerns creatures with backbones.

At the University of Notre Dame Dr. J. A. Reynier has tried to rear axenic guineapigs and chickens and has been fairly successful in bringing them to mature size, but he has failed to bring them to functional sexual maturity.

As a matter of fact, many scientists have insisted that life in the higher organisms, including man, is impossible without the right kind of intestinal microbes. Probably no one will ever attempt to rear a human baby under axenic conditions to find out. Anyway, there are still plenty of things to find out about axenic fish—and some of them Drs. Nigrelli and Gordon hope to discover in the Aquarium laboratory.

When Drs. Baker and Ferguson added living nematodes to the diet of their fish, they undoubtedly made a great improvement on the simpler diet of prepared, sterilized food. Nevertheless, it was inadequate to some of the needs of the fish, for they did not breed. It is possible that larger living quarters and more light should be given to the fish, for there may be psychological and physiological conditioning against repro-

duction in cramped and artificially lighted quarters.

If faulty diet is indeed one of the reasons why the axenic platyfish do not breed, the Aquarium men believe it will prove possible to approximate a normal, open-water diet by providing a chain of living food reared in pure cultures—in other words, feeding the axenic platys at all stages of their growth on axenic food appropriate to those stages – plus ordinary, sterilized dried fish food.

Very young fish should be given algae in fresh form. This could be done by preparing pure cultures of Chlorella or some other algae; it is possible to grow these in media composed entirely of inorganic chemicals so that all bacteria, fungi and protozoa are screened out.

At a later stage of the babies' growth it would be normal for them to feed on Daphnia, the familiar little organism of pond waters. Axenic Daphnia can be "fattened" on axenic Chlorella and made ready for the hungry mouths of the axenic platys. Algae-fed Daphnia *should* supply plenty of vitamins to the platys and—perhaps—bring them to sexual maturity.

Nouns of Multitudes of Animals

By WILLIAM BEEBE

In our Zoo we find carefully planned and executed labels which give us the names, both common and scientific, of every species of animal, bird, reptile and fish on exhibition. When several individual creatures, perhaps ten or twenty or more, are associated together we must find another name, and so we have come to speak of a herd of deer, a flock of birds or a school of fish.

When once we begin to think of such associations, curiosity prompts a search into past literature, and a very interesting thing comes to light: that one of the very first books ever printed in English contained a long and fascinating list of these nouns of multitude, some of them strange and obsolete, others still in use. The authoress was an English lady born about five hundred and fifty-six years ago. Dame Juliana Berners or Barnes wrote a good deal or all of *The Boke of St. Albans*, which dealt with hawking, hunting and heraldry, and was originally published in 1486, six years before Columbus discovered America. This volume was one of the first done in English, and was printed from an old, worn-out font of type discarded by Caxton. Ten years later, in London, it was reprinted from the same type, by a man with the delightful name of Wynkyn de Worde.

Dame Juliana spent her youth at court and became proficient at field sports, and later in life having retired from the world at Sopwell Nunnery, and finding plenty of leisure in the cloister after being raised to the position of prioress, she began writing of the sports of her younger days. In her volume we find the following list of names of aggregations of animals, or as Miladie Barnes penned it, "the companyes of bestys and foules."

A herd of swans, cranes, curlews and wrens; a nye of pheasants; a bevy of quails; a sedge of herons and bitterns; a sorde or suit of mallards; a muster of peacocks; a walk of snites (snipe); an exalting of larks; a charm of goldfinches; a flight of doves; an unkindness of ravens; a clattering of choughs; a dissimulation of birds; a bevy of conies; a couple of spaniels; a trip of hares; a gaggle of geese; a brood of hens; a badelyng of ducks; a covey of partridges; a spring of teals; a desert of lapwings; a fall of woodcocks; a congregation of plover; a covert of coots; a dole of turtles (doves); a tygendis of pies; a flight of swallows; a building of rooks; a murmuration of stares (starlings); a nest of rabbits.

Other Nouns of Multitude taken from other authors, are:

A mute of hounds; a pack of grouse; a school of whales; a rookery of penguins and seals; a shoal of mackerel and herring; a skulk of foxes; a skein of ducks; a swarm of bees and locusts; a host of sparrows; a watch of nightingales; a dopping of sheldrakes; a lepe of leopards; an herd of hartes and bucks; a bevy of roes; a sloth of bears; a singular of boars; a dryft of tame swine; a route of wolves; a harras of horses; a rag of colts; a stud of mares; a pace of asses; a team of oxen; a drove of kine; a flock of sheep; a tribe of goats; a cete of badgers; a richness of martens; a fesynes of ferrets; a huske or downe of hares; a clowder of cats; a kendel of kittens; a shrewdness of apes; a labour of moles; a litter of whelps; a cowardice of curs; a cast of hawks; a gang of elks; a troop of monkeys; a band of horses; a pack of wolves; a run of fish; a wisp of snipe; a pride of lions; a stand of plover; a hill of ruffs; a leash of bucks; a knob of pochards; a troop of kangaroos; a string of race horses; a sussuration of sparrows; a mumble of moles; and a pop of weasels!

London Zoo

Sees It Through

By L. R. BRIGHTWELL

FOREWORD BY JEAN DELACOUR

The London and the New York Zoological Societies have long been closely connected. I do not think that I can be contradicted if I venture to state that, when our Society was founded some fifty years ago, the men who drafted her by-laws were mainly inspired by those of the much older English sister institution. Moreover, a number of our first keepers came from London, bringing with them to America a tradition and an experience of capital value.

Quite unexpectedly, I am now contributing to the tightening of these old ties. The incredible circumstances of the last four years have compelled me to leave my old home, and my collections have been brutally destroyed. I have found a new haven in New York. Today, the collections of the Zoological Park have replaced, in the interest that I am taking in them, my own. For many years, also, I have been a member of the Council of the London Zoological Society, the only non-Britisher ever to hold such an enviable and honorable position. Thanks to the kindness of my colleagues, I retain it even today.

In his article, Mr. Brightwell is giving us an eye-witness account of the war-time London Zoo. Every one of his lines recalls to my memory some detail of those gardens which I knew as well as my own estate. To his thrilling picture I can add a few notes that, as a trustee, have come to me. Owing to the very dark days of 1941, financial problems of the deepest gravity were added to other anxieties of the London Zoo. Only the tenacity and farsightedness of the president, the Earl of Onslow, of the Treasurer, Major A. Pam, and of several of my colleagues, particularly Mr. Henry Maurice, the present president, Mr. Spedan Lewis and Mr. Alfred Ezra, joined to the generosity of some members, enabled the institution to survive. Since this difficult period, the position has been steadily improving. Mr. Brightwell gives us comforting figures of attendance to which I can add more recent news extracted from the Council Agenda for December 15, 1943, without, I hope, breaking its "private and confidential" character. The gate receipts of the London Zoo have increased by 30% over those of 1942. Once again these eminently satisfactory results show that Zoological Gardens retain their tremendous appeal to the public even under the most adverse circumstances.

A lesson perhaps may be drawn from such facts. It seems that by some unusual luck, the London Zoo and its country branch of Whipsnade have suffered comparatively little from the intense bombing. Practically no animals were killed. Now we hear that the Berlin Zoo has been very hard hit, many of its inmates having been killed, others let loose and slaughtered by the police, then eaten. The Berlin garden contained a strikingly fine collection. It is a matter of great regret to all naturalists and animal lovers to hear of its destruction, particularly of the distress of the innocent victims.

I cannot forget, however, that thousands of my own birds and park animals had been deliberately killed in June, 1940, by the German invaders, who first purposely bombed and machine-gunned

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them from the sky. Later on they shot them deliberately, introducing into this garden of Eden that was Clères savage dogs to hunt and kill defenceless creatures which for twenty years had been so fondly cared for by their English curator. I cannot, therefore, help seeing some sign of providential intervention in the fact that the London Zoo has survived many frightful attacks, while the Berlin garden seems to have been irremediably damaged.

London Zoo Was Ready for the Breaking of the Storm

AMERICAN VISITORS to the London Zoo (second oldest in the world) increase daily . . . and they miss the elephants.

We all miss the elephants, though apart from them the place has weathered over four years of global war better than many imagine. For accounts of the Zoo's baptism, at times a bath, of fire, are scrappy and conflicting; a jumble of fact and rumour. Here for the first time is a straight, and largely eye-witness account, of just what *did* take place.

On September 3, 1939, a year of uneasy speculation came to an end, and the Zoo awoke with the rest of us to stark realities. A rain of bombs was expected forthwith. Evacuation of persons and property went forward at high pressure. The Zoo in compliance with a Government order covering all places where people might congregate, closed. Every newssheet in the land announced the fact. It made a hot headline. Unfortunately they all . . . save the Field and Evening Standard . . . were too engrossed with other matters to announce the reopening a fortnight later. Some people *still* believe it shut!

I was privileged to come and go at will during the "black fortnight," when it always seemed to be Christmas, the only day of the year on which the Zoo closes. The local rats, normally in evidence only at night, swaggered about the deserted paths with reckless braggadocio; it was a hushed, uncanny place, but busy. The unrivalled collection of poisonous snakes was, rightly or wrongly, abolished. All glass houses save the Tortoise and Bird Houses were emptied, and the North Garden, giving onto a main road, was cleared and closed. Last touches were put to shelters and dugouts, the library of 100,000 volumes was spirited away underground, elephants and giant panda left for Whipsnade thirty-odd miles away, and nearly seventy-five percent. of the staff vanished in answer to the call-up. The chief librarian, the curator of mammals and birds, and the resident assistant superintendant had already retired on pension, and their posts could not be refilled; the curator of reptiles and fishes was summoned to the War Office. Dr. G. M. Vevers, with a handful of helpers from office and works departments, five overseers and a few head keepers, were left to face whatever was in store.

Battening down for the coming storm went on apace. The Children's Zoo closed, the extensive laboratories over the Reptile House became emergency offices, the art school a general repository, and a branch of the public services requisitioned two-thirds of the restaurant, with kitchens complete. The Monkey Hill, a large rockery, was cleared. The Aquarium, highlight of the Zoo and praised by King George Vth as "the finest show in London," was emptied of everything it contained, from the valuable manatees to the last drop of water. This was a heartbreaking business—apart from the sheer labour. The work devolved on Overseer Vinal, with only Keeper Skinner of the Tortoise House to help. All marine fishes, turtles etc. went to museums . . . or the frying pan. Cold and tropical fresh water exhibits, many hundreds of them, were quite miraculously tucked away in tubs, ponds, water carts—in anything that would hold them—and almost as many were taken over from the Brighton Aquarium, now an army depot. Also the precious sea water, brought at great cost from the Bay of Biscay, was run off into storage tanks (150,000 gals.), and is still serviceable. Under the Superintendant, ARP, Fire and First Aid Services were kept at a high level.

In 1940 the storm burst. Every approach to the Zoo had its quota of death and wholesale destruction. London was the City of Dreadful Night. For weeks on end Dr. Vevers and his little band of helpers worked, ate and slept with scarcely a change of clothes. Some hundreds of bombs fell upon the Zoo's thirty-five acres, densely crowded with buildings, paddocks and rockeries. Their detonations were largely drowned in the barrage and the crash of falling London. Early in the Blitz the North Gate disappeared, the Tropic

This poster, in black and white, appeared all over London when the Giant Panda returned from Whipsnade. All the newspapers announced the Zoo's closing, but few took the trouble to report its reopening!

and Rodent Houses became heaps of splintered glass, and a third of Monkey Hill, all steel girders and reinforced concrete, converted into rubble. Among scores of "incidents" may be mentioned the crashing of an incendiary bomb through the roof of the crowded Bird House, which is under the care of Overseer Jim Bailey (already known, I believe, to the New York Zoo). The bomb flared gaily on the floor of the central Tropical Finch cage, then skated through the wire, dashed once around the house, and then made its exit through a second cage and a door marked "Staff Only." And not even a feather was signed! That was a lively night, too, when a H.E. turned the Zebra House into matchwood and gave three of its highly strung inmates a chance—and they took it—to stampede down shop-lined Park Street, Camden Town. They came back, haltered,

quietly enough. Less lucky was a Barbary sheep on the Mappin Terrace, struck dead by a shell splinter. It was the London Zoo's only casualty, and received favorable notice in the restaurant.

By this time whole areas of London lay flattened. But, now prepared for anything, the Zoo's motto like London's was "business as usual." The bombing went on, but the animals, excusably nervy at first, soon became almost indifferent to mere noise. Even peaceful Whipsnade received several hundred bombs, but the Zoo's 800-acre country branch sustained only one loss, a young giraffe, from shell shock. Mr. Schorno, the Zoo's ingenious caterer, lavished all his skill on the giraffe, but it was deemed inferior to Barbary sheep.

With no desire to overstrain the national trumpet, the writer suggests that those who run the Zoo are, like other Londoners, tolerably resilient. A local humorist lost no time in placing a crude placard by the demolished North gate . . . ZOO NOW OPEN. News of the Zoo's resumed operation was crowded out of most newspapers by world happenings, so the Zoological Society's publicity officer, Mr. G. R. Doubleday, at once placarded tubes and buses with posters, miniatured by the paper famine, and commissioned a series of humorous lantern slides for display during the intermission at all the great Variety houses. He combined Zoo affairs with his duties as a part time instructor in the Air Training Corps, and inaugurated, as during the first World War, a series of Home Front Agricultural and Live Stock exhibitions specially designed to aid the thousands of small holders called into being by the war. Sponsored by H. M. Ministries of Agriculture and Information, and incorporating hundreds of clubs and societies, these exhibitions have attained gigantic proportions, overflowing the big central lawn that once saw the uncrating of the beasts previously kept for so long in the Tower of London. Nor was the Society's purely scientific side allowed to suffer. Even through the worst of the bombing, its rooms were at the disposal of the various societies accustomed to use them. Mr. Henry G. Maurice, the President, kept alive the Society for the Preservation of the Fauna of the Empire, and Colonel A. E. Hamerton, Prosector, with his assistants Messrs. Lawrence and Corbett, have continued daily their postmortem work, making many valuable contributions to veterinary science and general pathology. The Society's scientific publications continue under the care of the Hon. Secretary, Professor Sheffield A. Neave, C.M.G., O.B.E., M.A., D.Sc. All things considered, the temporary fall in Fellowships[1] was not severe.

A happy inspiration of the Blitz days was the adoption scheme, whereby admirers of any particular exhibit might give their regard practical expression by paying for its upkeep. As a result scarlet "Adopted for Duration" labels now give quite a touch of colour to the gardens on the darkest day. Another wartime innovation was the installment of "educational slot machines." It was argued that if animals might be fed by automatic devices, why not the human mind? Accordingly the writer, with Mr. Fraser Brunner of the British Museum staff [2] and Mr. J. Noble of Pathé Films, devised machines which for a small coin showed abyssal fishes and fireflies illuminated apparently by their natural light organs (an immediate appeal to a blacked-out city) and a cinema show which explained in cartoon form how the bird evolved wings, the horse its hoofs, the elephant its trunk, etc., etc. On busy days visitors queue up for "a penny a peep," and the revenue has been appreciable. For most of the year, also, the pleasure traffic (ponies, camels, llamas), the bar and the elephants are as busy as in peace time.

Few outsiders, however, can appreciate the difficulties which London's Zoo, happy though shabby, has had to face. New York, we hope, can still get some sub-tropic fruits by overland or air. London can get none worth mentioning. And the fish supply . . . anyone conversant with Zoo-keeping can picture how some exhibits are placed. Even so, such almost irreplaceable treasures as the giant panda, the okapi, the maned wolf, the Philippine monkey-eating eagle and the birds of paradise were never in better health. And history has not repeated itself in the Lion House. The first German bid for world ownership in 1914-18 brought the lions down to a diet of dogs which, served minus heads and hides, the public happily decided were rabbits. This war of petrol

[1] The London Zoo's normal Fellowship is about 8,000.

[2] Much of the National Natural History Museum's Collection has been hidden in a series of caves.

permits a normal lion diet of horse flesh, though amusingly enough Zoo lions were originally fed on prime beef!

As for the staff, despite the infiltration of one or two women and small boys, head keepers and overseers largely have to do their own housemaid and stable work in addition to their ordinary duties.

Just how the Zoo sank, and rose again, confronted by such terrific odds, may be fairly gathered from the following figures.

VISITORS

1938	1939	1940	1941	1942
1,816,012	1,707,443	631,671	502,966	1,344,568

ANIMALS EXHIBITED
(other than fishes or invertebrates)

3,801	3,624	2,932	1,574	1,752

These figures tell a tale indeed; still the struggle towards something like recovery is unmistakable. "Stay put" holidays plus a huge floating wartime population materially aid the gate. Another great step forward is the reinstatement of the Aquarium. The large cold freshwater hall is now pre-war, despite one bomb bursting on the premises, wrecking curator's office and vestibule. Steps are on foot to reopen the marine section though here the difficulties are greater. Our oldest, and headquarters, Fisheries Research Station suffered cruelly, her boats requisitioned, aquarium quite destroyed, director's house and private library demolished, and her laboratories largely wrecked. More than ever are the Zoo's dead animals in demand. Most go to reinstate the two hundred years old College of Surgeons museum, utterly destroyed in 1941. The Fire Brigade rears pigs amongst its ruins. Amazing indeed to think such witless havoc should be wrought by a nation that all but monopolised the animal trade and circus business, and blazed the trail for the modern zoo movement [3] which seeks to present animals without too apparent barriers!

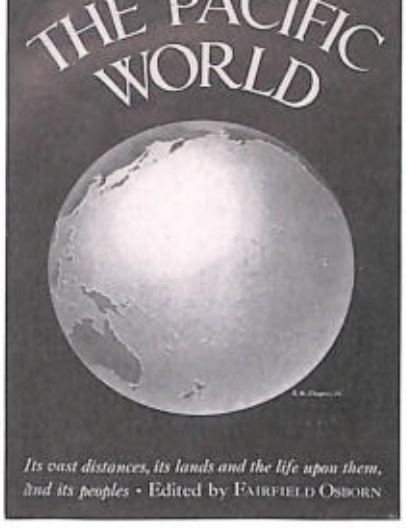
Our many country and provincial zoos have all ridden the storm with varying success; London, the centre of enemy hatred, could scarcely expect to escape the worst. She certainly received it.

To the staff and old habitués, her scars are all too apparent. Fuel and service economy, for example, have dictated an amount of "chumming in" that recalls the Zoo of 1842. Never before, in his Fellowship of thirty-eight years, has the writer seen bears, let alone a maned wolf and giant panda, under the same roof as the lions; or douroucoulis, galagos, ant-bears and fruit bats in the Reptile House. The domestic rabbit, by the way, holds a place of unprecedented importance in the national economy; probably about 40% of the population can for the time being be considered rabbit fans. At the Zoo almost every house, and even the Prosectorium, can show some rabbits, either in back quarters or quite openly in cages once occupied by much rarer exhibits. This reaches a grimly humorous climax in the Reptile House where chinchillas and havanahs may be seen placidly munching cabbage against gorgeous tropical backgrounds that once set off their arch-foes—snakes.[4] In summer the agricultural show features a long series of cages occupied each week by the star exhibits of a different rabbit club.

In the early part of the last century, Sir Stamford Raffles, founder of Singapore, set out from that port with a shipload of animals intended to form the nucleus of the London Zoo. Ship and cargo were burnt within sight of land, the crew and passengers escaping only with their lives. Wholly undaunted, Raffles, the ex-office boy turned empire builder, made a second attempt, and this time achieved his darling wish. One likes to think that incident was in some sort prophetic; that here once more history may repeat itself, and that our Zoo may indeed rise from her ashes, as has the great city that surrounds her, twice before!

[3] Carl Hagenbeck first devised the Terrace–with concealed moat–in preference to bars.

[4] The London Zoo, like all other menageries in this country, is at the moment almost wholly reliant on creatures born in the menageries to replace losses. Of late, however, soldiers on leave from Africa have presented Chamaeleons–favourite pets with our troops–as in the last war. A few regimental mascots also have been left with the Zoo for safe keeping.



GENESIS of a Book

FAIRFIELD OSBORN tells how "The Pacific World" came to be written and we offer a sample chapter and illustrations from the forthcoming book.

A SERIES OF BOOKS on the natural history of the Pacific is about to be published. How these happened to come into existence is a story of its own and illustrates the well-known fact that small incidents frequently give rise to considerable consequences.

The sequence of events runs something like this. About a year ago the Conservation Committee of the Zoological Society, in concert with the American Committee for International Wild Life Protection, came to realize that some pamphlets should be prepared for distribution to the Armed Services on the animal life on some of the Pacific islands where our troops were stationed. Childs Frick, Chairman of our Conservation Committee, and Harold Coolidge of the American Committee, had first propounded the idea. Everyone was aware that our men in the Armed Services, unless they were given a point of view regarding the desirability of preserving wild life on the islands on which they were stationed, would in all probability do a lot of random killing just for "target practice." As a consequence, a group meeting was held of a number of men of various scientific institutions to discuss ways and means of getting the pamphlets written. Everyone present realized that descriptive literature about the Pacific area was remarkable for its absence. Not only were there no popular books that would provide the reader with a good general idea of the physical characteristics of the Pacific, but, beyond that, books on the natural history and animal life of the area were few and far between and those that did exist specialized in detailed studies of only certain specific areas. As a consequence every man at this first meeting realized that a very unusual opportunity presented itself and that a considerably broader plan than that originally considered should be carried through.

It was therefore planned that the first book of the series, — which has since been titled "The Pacific World" — should be an overall and general description of the physical aspects of the Pacific, its vast distances, its lands, the life upon them, and its peoples, this first book to serve as a foundation-piece to a series of supplementary handbooks covering the following subjects:

Mammals
Birds
Reptiles and Amphibians
Fishes
Insects
Marine Invertebrates
Plant Life
Native Peoples

"The Pacific World" will be illustrated by a number of original color plates specially prepared for explanation of parts of the text itself. The book is designed upon the general premise that we Americans will do well to know more of the great area which lies to the west of our shores. This book has gone to press and should be ready for distribution during April. Work on the supplementary books is well along and they, in turn, will appear at intervals during this year.

Having in mind the fact that the primary pur-

pose of these publications was for their use by the very large numbers of American men and women serving their country in the Pacific, arrangements were happily concluded with Colonel Joseph I. Green, editor of *The Infantry Journal,* with the result that an initial printing of 100,000 copies of "The Pacific World" is to be made for the Armed Services and it has also been arranged that there shall be large editions of each of the handbooks. Thus, an extremely large volume of literature on the natural history of the Pacific area is about to be widely circulated.

In addition to all of this we found that there was a strong demand on the part of publishers for a popular edition for the general public, and arrangements were soon concluded with the W. W. Norton Company, which is handling this edition for general release.

No enterprise could be marked by a higher degree of unselfish collaboration then has existed in the preparation of this series of publications. The names of the men and of their institutions engaged in the preparation of "The Pacific World" are as follows:

American Geographical Society
John K. Wright

American Museum of Natural History
H. E. Anthony
W. H. Barton, Jr.
T. D. Carter
C. H. Curran
Childs Frick
W. K. Gregory
J. E. Hill
Frank E. Lutz
Ernst Mayr
Robert Cushman Murphy
John T. Nichols
Henry C. Raven
H. L. Shapiro
G. H. H. Tate
E. M. Weyer, Jr.
John T. Zimmer

Arnold Arboretum
E. D. Merrill

Blue Hill Meteorological Observatory
Charles F. Brooks

Carnegie Museum
Andrey Avinoff

Chicago Natural History Museum
Karl P. Schmidt

Museum of Comparative Zoology
Thomas Barbour
Arthur Loveridge

New York Zoological Society
William Beebe
Claude W. Leister
Ross Nigrelli
Fairfield Osborn

Smithsonian Institution
Alexander Wetmore

The table of contents of "The Pacific World" is as follows:

Foreword
The Pacific Is Before You – an Introduction
I The Ocean
II The Islands
III Climate, Winds, Currents and Tides
IV Discovery and Exploration
V The Native Peoples
VI Ocean Life
VII Stars Over Melanesia
VIII Island Life
Mammals and Birds
IX Island Life
Reptiles and Insects
X Island Life
Plants
Regional Descriptions:
XI Australia and New Zealand
XII Melanesia
New Guinea, New Britain, Bismarck Archipelago, Solomon Islands, New Hebrides, New Caledonia, Loyalty, and Fiji Islands
XIII East Indies
Borneo, Sumatra, Java, Celebes, Timor, The Lesser Sundas, Spice Islands (Moluccas)
XIV Philippines
Luzon, Cebu, Mindanao, Palawan
XV Micronesia
Palau, Caroline, Mariana, Marshall, Gilbert, and Ellice Islands
XVI Polynesia
Tonga, Samoa, Phoenix, Society, Marquesas, Cook, Hawaiian, Tuamotu, and Easter Islands
XVII Aleutians, Pribilofs, Galápagos
Fox, Andreanof, Rat, Kiska, Attu Islands; Pribilof Islands, Galápagos Islands
XVIII Formosa, Luchu, and Kurile Islands
XIX Japan
XX Tables and Factual Summaries

It is hoped that the broad variety of subjects dealt with in "The Pacific World" and the variation in the presentation of the subjects will interest many different kinds of readers.

There follows herewith an excerpt from the chapter descriptive of the origin and distribution of mammals on the islands of the Pacific, with a color plate and some of the line drawings which will accompany this chapter.

MAMMALS

ANYONE who has ever seen the long-nosed proboscis monkey of Borneo is not likely to forget him—he is like no other animal on earth. This uniqueness is probably the most fascinating feature about so many of the animals of islands. The curious crested kagu, a relative of the crane, found in New Caledonia, the flightless kiwi bird, and the tuatara lizard of New Zealand, the small and peculiar buffalo of the Philippines, the babirusa boar of Celebes—to cite a few random examples—are quite different from all other birds, reptiles, and animals, and are found nowhere else in the world but on those particular islands.

Why are many of the animals and plants on islands so extremely different from those on the mainland? Where did those unique forms of life come from? If their forebears originated on the continents, when and how did they reach the islands?

Answering the last question first, it is believed that the ancestors of *all* things living upon islands arrived accidentally from one or more of the continents or from some other island, itself first populated from the continents. The life of the continents is the source of all island life.

Since far back in geological time, occasional continental animals and plants have been carried through the air by storms or out to sea by flooded rivers. Of those strays, perhaps one in a thousand has been carried to some island alive and in a condition to reproduce its kinds. This slow but continuous process has brought about the colonization of islands, except in the case of islands that in the past were joined by land connections to the mainland.

Just as, on the continents, the multitudinous animal and plant life passed through a long, slow, intricate history of development of new forms, which by process of trial and error became adapted to fit the changing conditions about them, so, on islands, newly arrived animals evolved. Their shapes, colors and behavior became slowly modified, permitting their descendants at length to occupy many kinds of habitats to which the first arrival was unsuited.

Development of life on islands, once established, was in general a reproduction in miniature of the development of life on the continents. But island life steered its own course in complete independence. Islands thus became repositories of the species that colonized them, while on the continent that same species might be wiped out by more aggressive, competing species. In some cases colonizers found competition slight or negligible and consequently prospered. On the other hand their subsequent adaptation to local conditions was potentially dangerous, for they had lost much of their powers of accommodation, and relatively small changes in the conditions of the islands would threaten their extinction.

For the purpose of explaining the presence and the distribution of living animals on the islands

of the Pacific Ocean, the islands may be thought of in two ways: first, in relation to their geological history, and again, in relation to their geographical positions. Both systems of classification are helpful. But because the geological history explains most of the present-day puzzles in animal

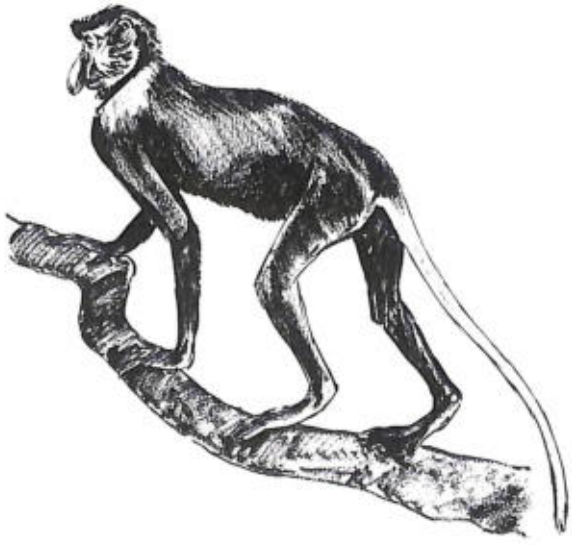
The prehensile-tailed cuscus is a slow-moving, nocturnal animal of the Australasian region.

distribution, it is generally preferred. Under geological classification, islands comprise two types—continental and oceanic. By definition, continental islands are those that rise from the continental shelves and actually form parts of the continents, separated from them only by shallow water. Oceanic islands are those that rise from the bed of the ocean and are separated from the continents by great depths of water; they may be only a few score miles from continental lands or several thousands of miles away.

The continental islands were connected with their respective continents during the last ice age, which ended about 30,000 years ago. In those times such an immense volume of water from the oceans was frozen in the polar icecaps that the ocean level is estimated to have been some 300 feet lower than it is today. The direct effects of this reduction of sea level were to reunite many of the continental islands to their parent continents and to make certain of the oceanic islands larger, at the same time reducing the widths of the deep straits or seas now dividing them from the continents. The former union of the continental islands with the mainland explains how the big mammals, like the rhinoceros or orangutan, reached such large islands of the western Pacific as Sumatra and Borneo.

The animal and plant assemblages that have contributed to the population of the continental islands of the Pacific are derived respectively from three principal sources—the temperate North American and north Asiatic regions, the warm southeast Asiatic or Malay region, and the Australian region. The mammals of the Australian region, vastly different from those of the rest of the world, are the special descendants of the survivors of that far-distant day when pouch-bearing animals were the common inhabitants of both America and Europe.

In the case of the oceanic islands, smaller mammals may have arrived by natural rafts—masses of trees and vegetation that were undermined by rivers and carried out into the ocean by winds and currents. Tree-living types of animals would be most easily transported in this way, although only one of such natural rafts out of perhaps thousands would reach another island. When the distances between islands were not too great, a number of the larger mammals undoubtedly



"Unforgettable" is the word for the curious proboscis monkey that is found on Borneo.

swam across the water barriers. Deer and various types of wild pigs are capable of doing this. Flying mammals, the bats, would be assisted by storms or strong winds to make a longer than usual flight. The more isolated islands, however,

might be successfully reached only once, or by a very limited number of mammals. Small populations are easily exterminated, and the animal life of an island may have formerly included species that were unable to persist. Large mammals are especially liable to this risk; on a small island their numbers are so limited that disease or an unfavorable year might destroy them, or in later times the human inhabitants might have killed them off. Naturally, large islands close to a continent were far more likely to receive such waifs than were tiny islands in the midst of the ocean. Furthermore, the larger islands offered a much wider choice of environment, and thus provided more frequently for the special requirements of different kinds of animals.

Tarsier of the Malayan region.

An interesting example of the workings of distribution is provided by the great mass of large and small islands collectively called the Indo-Australian Archipelago. This mass includes both continental and oceanic islands. The continental islands are Sumatra, Java, and Borneo and, as we should expect, their animal life is derived from tropical Asia and the Malay Peninsula.

The oceanic islands include the Philippines, Celebes, the Moluccas, and the Lesser Sunda Islands. It is held that the area occupied by these islands underwent great geological changes in prehistoric times, including upheavals and depressions, but there is no evidence that any land connection between these oceanic islands and the continent of Asia ever existed.

This particular area has been named "Wallacea," after the naturalist, Alfred Russell Wallace; and the line of the continental shelf—which runs west of these islands from between the islands of Bali and Lombok, north through the Strait of Macassar and through the Sulu Sea—is commonly known as "Wallace's Line." Wallace believed that this line indicates a boundary separating to a great extent the animals of Asia from those of Australia. Actually the region is, in a sense, a no man's land, its mammals being derived principally from Asia but to a very small extent from Australia.

The animal and plant life of Celebes is a case in point. This island lies only some eighty miles to the east of the continental island of Borneo (in the glacial period this distance was even shorter, reduced to approximately twenty-five miles) and more than seven hundred miles from Australia. Its mammals are predominantly of Asiatic origin. However, in parts of Celebes there are certain plants and animals so reminiscent and characteristic of Australia—the eucalyptus and nettle trees, the white cockatoo, and the cuscus, a pouch-bearing animal—that an untrained observer might think that he was in the forests of Queensland in Australia.

The nearness of the oceanic islands of Wallacea to the mainland and continental islands of Asia and Australia accounts for the profusion and variety of life dwelling on them, in comparison with the paucity of life on scattered groups of tiny islands in the mid-Pacific.

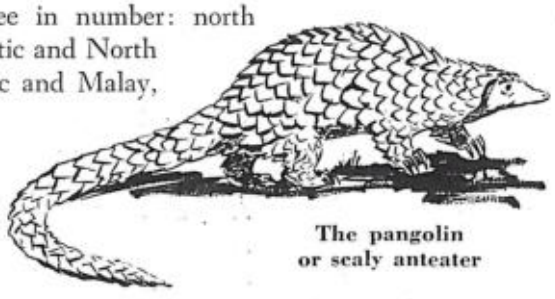
The animals and plants of any remote island are likely to be a random assortment derived from almost any part of the mainlands bordering the Pacific. In actual fact, Asia and Australia have in general contributed a much higher percentage of the animal and plant life of the oceanic islands than have the Americas. The only oceanic islands that have some mammals of American origin are the Hawaiian Islands and the Galápagos.

The process of differentiation on islands has been continuous. The species of one island became distinct from those of another, or on individual islands, mountain-living forms became separated from lowland races, and types preferring humid forests diverged from those inhabiting dry areas.

Animals that show greatest differences are believed to have descended from the earliest arrivals. Those which, on the contrary, are more like their mainland relatives are thought to have come later. The few animals and plants that are identical with those on the continents have without doubt been carried to the islands by man.

It has been shown that the fauna of continental islands is derived from the neighboring con-

tinents, that animals reached the oceanic islands by random drift from the continents, that larger oceanic islands nearer the continental sources received many more kinds of animals than smaller islands in mid-ocean, and that those continental sources are primarily three in number: north Temperate (northern Asiatic and North American), tropical Asiatic and Malay, and Australian. Central and South America contributed only to the faunas of the few islands relatively close to their coasts. The Galápagos Islands received their populations mainly from Central America.



The pangolin or scaly anteater

As stated in the opening paragraphs of this chapter the most compelling characteristic of island life resides in the remarkable difference of so many of the animals and birds and plants from those dwelling on the continents. It has been shown that islands have acted as places of refuge for many a species threatened with extinction and later wiped out by nature on the mainland. "Extinct as the dodo," is a common expression with an appalling sense of finality. It is fervently to be hoped that, so far as is humanly possible, those fascinating and irreplaceable island species may be preserved for posterity.

Man vs. Chimpanzee

AN EXPERIMENT to determine the bodily strength of chimpanzees was set up at the Yale Laboratories of Primate Biology and it appears that while adult men and adult male chimpanzees are "roughly equal in absolute pulling strength," the anthropoid apes would definitely have the better of it in a tug-of-war if they weighed as much as their human opponents.

In the experiments described by Glen Finch in the *Journal of Mammalogy*, four adult male chimpanzees and four adult men pulled as follows:

Subject	*Bodily Weight* lbs.	*Maximum Pull* lbs.
Man No. 1	190	525
Man No. 2	145	487
Man No. 3	145	450
Man No. 4	135	338
Chimpanzee No. 1	122	450
Chimpanzee No. 2	108	450
Chimpanzee No. 3	107	487
Chimpanzee No. 4	106	375

Four female chimpanzees were tested in the same experiments, but they proved to have less pulling strength than either the men or the male chimpanzees.

MAGNA CHARTA of the Birds

By WILLIAM BRIDGES

Back in 1913 Dr. Hornaday battled for a Tariff Act that would stop the traffic in feathers and plumes—and he took the birds off of women's hats.

NEARLY A THIRD of a century ago the New York Zoological Society was in the middle of a slam-bang fight to take wild birds off women's hats. The fashions of 1913 seem ridiculous and even pathetic now, but they were no laughing matter when David in the person of Dr. William T. Hornaday challenged the feather millinery Goliath. He started a fight that raged for months through the halls of Congress and across the platform of women's clubs.

Only the older members of the Society may remember the famous "Steam Roller Circular" that snatched victory out of defeat and a whole generation has grown up that takes the wild bird protective clause of the 1913 tariff act for granted — if, indeed, it knows there is such a thing.

But the machinery that Dr. Hornaday set in motion thirty-one years ago is still grinding away, moving so smoothly and quietly that only rarely does an attempted importation of feathers come to the attention of anyone outside the circle of the interested parties — the United States Appraiser's Office and the would-be importer. Just such a case occurred this winter and the Zoological Park was able to make a contribution to its tentative solution; the incident made us wonder what *has* happened since 1913 saw the writing of the Magna Charta of wild bird life all over the world.

It was around Christmas that a young man from the Appraiser's Stores came into the Zoological Park with a brown paper parcel. He unrolled it on General Curator Crandall's desk and spilled out half a dozen white and rainbow-tinted bird skins. They were down-skins from some duck-like bird, light and fluffy as powderpuffs — and, in fact, they were the raw materials from which American manufacturers expected to make that familiar implement of a woman's handbag. The gaudy colors of some of them came from dyes in which they had been dipped.

"These are samples of a bundle of skins that came into the United States from South America recently," the young man explained. "The importer claims they are goose skins, but we never saw any goose skins quite like these and we have an idea they might be swan skins. It makes all the difference, of course — goose skins are not from wild birds and can be admitted to the country, but swans are protected under the 1913 Tariff Act. What do you think about them?"

With the suspected skins was a down-skin known to be from a domestic goose and to the eye and the touch there was, indeed, a good deal of dissimilarity.

"We've made a microscopic examination and the goose down isn't the same as the down on these other skins," the government man went on. "What we'd like to do, is to get some known down from a swan and compare it, too."

As it happened, a whistling swan had died the day before and a quick telephone call revealed that the body was still in the icebox at the Zoo's Hospital, awaiting autopsy. Dr. Goss removed the skin, bundled it up for the young man and sent him away rejoicing.

Later we heard that our swan's down checked microscopically with the down of the "goose" skins from South America.

So the Federal Government *is* still on the job of keeping the feathers of wild birds out of the

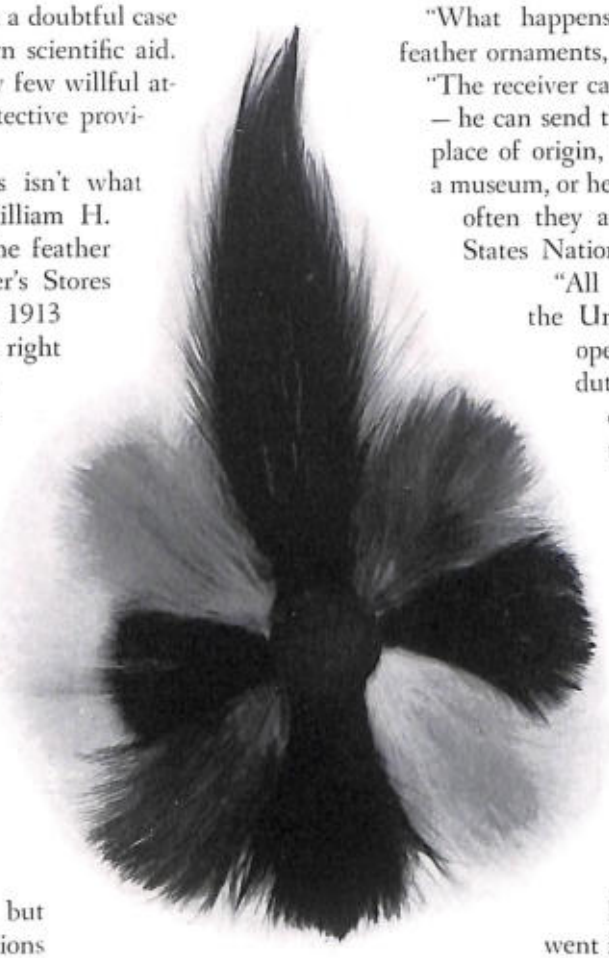
United States, and when a doubtful case arises it summons modern scientific aid.

Actually there are very few willful attempts to evade the protective provisions of the 1913 law.

"The feather business isn't what it used to be," said William H. Ehmann, in charge of the feather division at the Appraiser's Stores in Varick street. "The 1913 tariff knocked the bottom right out of the feather millinery industry that depended on wild bird feathers. Now there's no market for the vast majority of wild bird skins even if someone did try to slip them into the country. A woman wouldn't be caught at a dog-fight with a stuffed bird on her hat.

"Great quantities of feathers still come into the country, of course, but with certain legal exceptions they are almost all the feathers and skins of domestic birds. About the only wild bird cases we have are such things as native ornaments that tourists pick up in foreign countries, and commercial importations where the shipper claims the birds were domesticated—and we make him prove it, or else forbid the entry.

"A great many people don't understand that the source of the feathers doesn't make any difference as long as the birds are classed as wild by the law. Lots of native tribes in South America, the Pacific and so on, make beautiful feather head-dresses and ornaments and tourists used to buy them – I'm talking of the days before the war, naturally – and mail them home or bring them in with their baggage. They couldn't come in – even if they were fine enough to be called museum pieces."



This design of egret plumes was composed of variously-colored feathers in a shipment seized on the Mexican border after the Tariff Act went into effect.

"What happens to them – really fine feather ornaments, for example?"

"The receiver can do one of three things – he can send the feathers back to their place of origin, he can present them to a museum, or he can destroy them. Quite often they are given to the United States National Museum."

"All parcel post mail into the United States is routinely opened and examined for dutiable and forbidden merchandise and thus even the casual shipment of a single feather or skin is discovered. Men in the armed forces occasionally send home bright-colored feathers but most of them have learned that entry is forbidden and the practice is not general.

"All the feathers we have turned back since the 1913 tariff went into effect would make a mighty small pile against the feathers and skins that came in during one year at the height of the feather millinery period," Mr. Ehmann went on. "Wild bird skins used to come in literally by the ton. When they were shut off, the industry was hit hard and the feather dealers in Paris made a strong attempt to keep going with imitations of wild bird plumes, but the shape of hats changed late in the Twenties and the whole thing went out of fashion. You may remember those brimless hats, shaped like a bucket. There just wasn't much place for a spray of plumes or a stuffed bird – even imitation plumes.

"The Paris dealers tried hard, though. I remember they had a way of skinning down a peacock feather until it was a pretty good imitation of an aigrette plume. They made rooster tail feathers to look like Bird of Paradise plumes,

they printed white goose feathers to look like Silver Pheasant feathers, and somehow they managed to make a fairly authentic-looking goura crest out of goose feathers. All those imitations were legal, of course; no objection at all to bringing them in as long as it could be proved they were made from the feathers of domestic birds, and as long as the duty was paid.

"There was quite a while after 1913, before the fashion died out, when hats were loaded down with all sorts of imitation flowers and imitation wild-bird plumes. But then the cloche hat came in and even the imitations were washed up."

France is still — or was, before the war — the center of a big feather industry and great quantities of skins and feathers of domestic geese, especially, were shipped to this country. The skins of geese stripped of their guard feathers until only the down was left were used in making powderpuffs and the trimming on children's and dolls' dresses. French exporters customarily leave the neck of the bird as part of the skin and that fact, as well as the size of the skin, made it recognizable as from one of the domestic varieties of geese.

The clause in the Tariff Act of 1913 which saved countless species of wild birds from extermination was short but effective. It said:

> PROVIDED, that the importation of aigrettes, egret plumes or "osprey" plumes, and the feathers, quills, heads, wings, tails, skins or parts of skins, of wild birds, either raw or manufactured, and not for scientific or educational purposes, is hereby prohibited; but this provision shall not apply to the feathers or plumes of ostriches, or to the feathers of domestic fowls of any kind.

The feather exclusion provisions of the 1913 Tariff Act were directly responsible for the outlawing of such plumes as these—all skins of the Lesser Bird of Paradise. These particular skins were seized on the Mexican border in 1916 as a millinery trade importer was trying to smuggle them in.

That was the phraseology of the law as drawn up by Dr. Hornaday and bodily thrust into the Tariff Act despite the violent opposition of the feather millinery industry. Early in the hearings of the 69th Congress on the new tariff law, Dr. Hornaday for the Zoological Society and T. Gilbert Pearson for the National Association of Audubon Societies had appeared before the Ways and Means Committee of the House and had succeeded in getting their protective clause inserted unchanged in the House bill.

The feather trade, Dr. Hornaday wrote later, "had been caught napping." It made up for its carelessness when the tariff was debated in the Senate, however, and in a Senate sub-committee so amended the clause that it was valueless. It was then that Dr. Hornaday sat down and drafted the four-page blast: "The Steam Roller of the Feather Importers in the United States Senate."

He named names. He pinned responsibility for the defeat of protection on definite Senators and definite feather import firms.

"Who shall rule?" he concluded. "The 50,000,000 people who are interested, or the thirty importing feather dealers of New York?"

Twenty-four naturalists, editors, women's club leaders – all representing large blocks of the population – signed the "Steam Roller Circular."

The Senate passed the Tariff Bill with the Hornaday protective clause intact. And as Dr. Hornaday wrote in 1931, in "Thirty Years' War for Wild Life"– and as we have found today – the protection has been rigidly enforced ever since.

Nevertheless, there are certain loopholes; the 1913 Tariff Act, for instance, permitted the importation of wild bird feathers for use in making artificial fishing flies. Rhea feathers are permitted to enter, the law considering rheas both as wild and as domestic birds – although importers have to prove that their feathers came from domestic rheas. Both of these provisions are currently under attack by conservationists, particularly the National Association of Audubon Societies.

But by and large, Dr. Hornaday's great achievement still stands. Never again will a woman walk down Fifth Avenue with eight stuffed hummingbirds on her hat.

Speed of Animals

THE AUTOMOBILE and the airplane are constantly contributing to our knowledge of the speed of animals and some interesting figures are presented in recent issues of the *Journal of Mammalogy*. The speeds given here were clocked by automobile speedometer by Clarence Cottam and C. S. Williams of the U. S. Fish and Wildlife Service and are for distances of 50 yards to half a mile, over various types of terrain. The figures refer to miles per hour:

Elk, 45; Antelope, 45, 32; Black-tailed Jack Rabbit, 38, 30, 28, 27, 18; White-tailed Jack Rabbit, 34; Moose, 35; Coyote, 31; Buffalo, 30; Desert Bighorn, 30; Deer, 25.

Another Fish and Wildlife Service representative, R. Scott Zimmerman, clocked a coyote at a top speed of 43 miles an hour. Clarence A. Sooter of the same Service determined the maximum speed of a two-point buck mule deer as 35 miles an hour, of a doe and two fawns as 28 miles an hour, and of a coyote as 29 miles an hour.

Dr. Beebe Surveys the
MID-VISTAS of Zoo Life

While the Bronx Zoo's 250 acres were a mere part of the tangled wilderness, they saw the rise and fall of some weird and wonderful creatures.

By WILLIAM BEEBE

SOME MONTHS AGO we spoke of ancient creatures in the Zoo, and how we would have exhibited dinosaurs and plesiosaurs.[1] Then we reminisced of the wolves and bisons and turkeys when they were pre-Bronx suburbanites,[2] such a short time ago. In these days when our exhibits receive so few bird and animal refugees from Asia and Africa, it is worth while recalling mid-vistas of animal life in the past, in and around our Zoo, when our 250-odd acres were only an indefinite part of the surrounding forest. To do this I need not go beyond the time of man or almost man.

Just now it is rather a relief to leave the present conditions of life and death on our planet and think back almost two milleniums to the birth of the Prince of Peace; then three more when man was building Cheops, his most enduring monument; on another two thousand years and we find Babylonian cities already large and flourishing. Pass back twenty full thousand years from our day and even then man was drawing and coloring the wild creatures he knew, on the walls of his cave. In fact men of some sort must have seen and fled from almost all the creatures of which I am thinking. These beasts compel our interest, for like ourselves, they all once called home, this very place where we live today. It was home for them far longer than it has been for us.

The Broadway Mastodon

YEARS AGO I remember following a circus parade up Broadway. A half dozen elephants swung slowly along in their preoccupied, aloof manner, forever immersed in some proboscidian reverie. They passed the many blocks solidly built up with houses, and on uptown plodded by the vacant spaces of high, rounded glacier-worn rock. One elephant seemed to me immense – he must have been full eight feet in height. All had been brought from India and with dignity and gentleness submitted their lives to be dictated by their human masters.

Thousands of years before, on this very spot, all that was recognizable of my circus parade was the sunlight, sky and air, and the same glacier-scoured rock. Yet about this time (years and months and days not having been invented) another elephant had wandered up this way, along some pre-Broadway game trail – a strange elephant, what we now call a mastodon.

On this particular day he stepped to one side, perhaps to pluck at a branch of hemlock. He suddenly felt himself sinking into a bog. The more he struggled, the more he sank. And there he died. A few years ago when the Harlem ship canal was being cut, a workman found one of his ivory tusks. It lay beneath four feet of sod and

[1] ANIMAL KINGDOM, 46: 3, pp. 50-55
[2] ANIMAL KINGDOM, 46: 5, pp. 111-116

The "Broadway Mastodon" at home. In Greame Kelley's conception of the scene, the towering buildings are of course just a dream of things to come.

roots and twelve feet down at the bottom of the selfsame peat bog.

Very likely he was one of a herd of these great elephants, for in those olden days they were common hereabouts. The remains of more than one hundred have been found in New York State, some of them almost complete skeletons. Scallop fishermen have even brought the molar teeth of these beasts up from the bottom of the sea, sixty miles beyond Sandy Hook, showing that the great pachyderms wandered along the Hudson Gorge when it was still in the making.

The first unelephant-like thing we notice about our mastodon is his dense coat of dark reddish hair, showing him to be a camp follower of glaciers and a lover of ice and snow rather than of tropical jungles. Our only way to see a living creature even faintly mastodontian is to be on hand, in zoo or circus, at the birth of a baby elephant. The little chap is proportionately longer in body than his mother and is clothed in an astonishingly thick coat of hair, which, little by little, is shed and passes to the final resting place of the hairs of infant elephants. Finally there remains only a tuft of stiff, wire bristles on the end of his tail. The skull of a new young elephant also has more of a snout than that of his parents, and in this respect it distinctly reflects the elongate head of a mastodon.

A well-grown bull mastodon must have stood nine feet in height at the shoulder, and was quite fifteen feet long. The large teeth made possible the long life of these, as of living elephants, for an eater of grass exists only as long as its teeth. We know from fossil remains that these great mastodons suffered from teeth decay and from pyorrhea. The passing of tens of thousands of years does not diminish our sympathy for the pangs of toothache which must have emanated from a molar seven inches long, weighing perhaps twenty pounds!

One very interesting thing about mastodons was the presence of a small tusk at the tip of the lower jaw, sometimes one, sometimes a pair, reminiscent of a far distant ancestor which was furnished with four long tushes of equal size, the tips of each pair crossing the other far in front of the head. Examination of the remains of food packed between the giant fossil molars reveals a preference for the needles of hemlock and spruce rather than for the softer fodder of deciduous leaves. In fact, five bushels of crushed

twigs of these conifers have been found piled between the ribs of one fossil skeleton preserved in a peat bog. Mastodons were not wholly averse, however, to moss and marsh plants and even prehistoric blossoms.

Whether a mastodon trumpeted or squealed, what soft-bodied unfossilizable creatures he watched from day to day, what his new-born offspring looked like – these are forever lost to us, together with all the other mysteries of these cold old days, when wandering glaciers crept back and forth over the face of our land.

Sabre-Toothed Tiger

LONG AFTER DARK, on a night when the snow glistens in the moonlight, we may hear, at the edge of some wood close to New York, the long-drawn out squawl of a bay lynx, the largest wild cat left near our city. If we watch we may see the animal creep into the shadow of a fallen tree and perhaps leap upon a rabbit.

In days long past, in a warm interval between the eon-slow ebb and flow of glaciers, we might have seen in this very spot a mighty cat as large as a polar bear, mushing along on short but incredibly muscular legs. We know it today from its fossil bones as the sabre-toothed stabbing tiger, but probably instead of being striped it was dun or self-colored like our lynx. Strangely enough it was also lynx-like in possessing a very short tail, which by no possibility could be lashed from side to side as in living lions and tigers.

Its most remarkable characters were the two great canine teeth, eight and even nine inches in length, which hung down from the upper jaw, and gave it a most terrifying appearance. These were so conspicuous that they can be compared only with the long tusks of a walrus or the rapier-like fangs of a deep-sea viperfish. The lower jaw swung down and back to a full right angle, to give play to the brace of enamel blades.

In the sabre-tooth we have a super-feline, more powerful than any living tiger, short-legged, over-toothed and over-muscled. The enormous tusks would be of little use against small game such as rabbits or squirrels. But we can imagine this dawn tiger stalking a slow-moving, massive mammoth or a giant ground sloth, springing upon its prey and killing it with deep slashes of the long dagger fangs.

The great body and leg muscles together with the unusually large talons would ensure an un-

Courtesy American Museum of Natural History

The Sabre-toothed Tiger has a dramatic role in this scene at an ancient waterhole, as painted by Charles R. Knight. Against such adversaries as the gigantic ground sloths at the right, or the hulking mammoths in the background, the fangs and great strength of the killer would be most effective.

breakable grip on the back of the struggling prey, and the sabre-tooth also had the advantage of five toes and five claws on the hind feet, one more than any modern cat can boast. So far we are reasonably sure of the method of attack. But the abnormal size of the cutting teeth had, through the ages, caused a radical reduction in all the rest, so that there were only ten teeth in all, as compared with the thirty-odd of its ancestors. With such a feeble armature, any efficient biting off of pieces of flesh or chewing them would seem impossible, especially as the huge fangs must have constantly been in the way. So we must admit ignorance of the niceties of the feeding of the sabre-tooth.

Probably the specialized diet brought about by the equally unusual dentition resulted in the extinction of these ancient tigers. This seems reasonable from the fact that when the great elephants and sloths vanished from the earth, the sabre-tooths also disappeared. But in their heyday great numbers of sabre-tooths ranged from California and Pennsylvania south to the pampas of Argentina. We know that at least two species roamed the hills and valleys in Pleistocene times within one hundred miles of New York City.

The Manhattan Grubber

IT IS HARDLY FAIR to leave the comparative newcomers to New York without some reference to the Oldest Inhabitant.

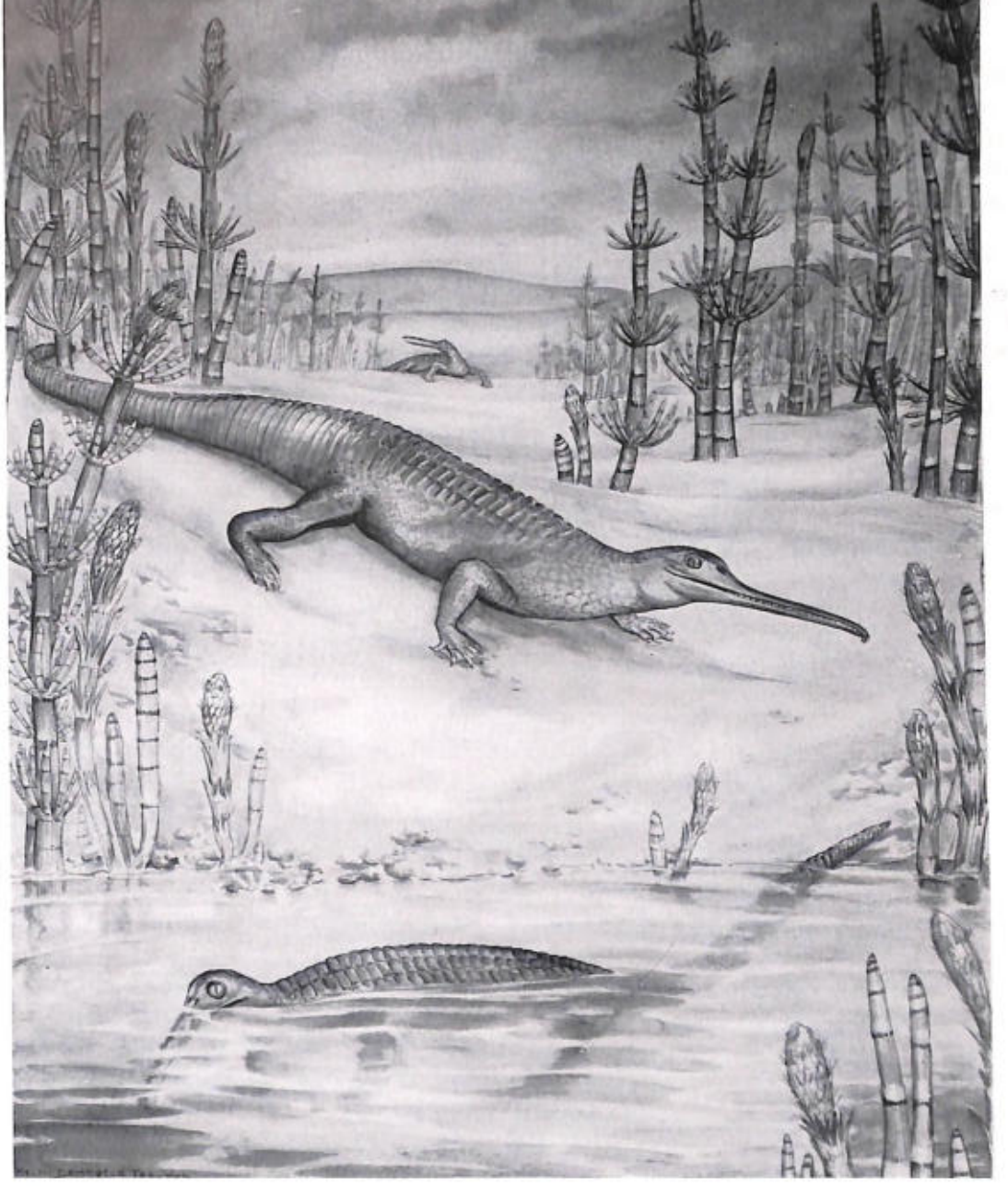
Let us take the ferry to Fort Lee and climb up to the top of the Palisades. The trains at our feet move heavily along like humble worm-like creatures, and microscopic bugs of automobiles crawl even more slowly. Tugs and larger ships creep back and forth over the waters of the Hudson, and occasionally a plane drifts down river, a tiny, gnat-like mote in the heavens. On the opposite bank is spread out a thin, frail crust of human habitations.

Before another hour of the future rushes upon us, becomes momentarily present, and eternally past, let us go in imagination back and back — ten, twenty, fifty, one hundred, two hundred million years. All human trace vanishes in an infinitesimal fraction of time; mammoths and stabbing tigers hardly less rapidly. Finally we sit up and look about us in what geologists call the Triassic Period. We are considerably lower on the Palisades than we were, for the lava on which we had been resting has not yet poured forth from its parent volcano. But the reddish sandy marl (which we can still see in the real today, halfway down the cliffs) is being formed on a sandy or muddy plain, dotted with scattered swamps and ponds, both here and across the river and beyond to the pre-Zoo.

Great ferns and horsetails are still in evidence but are giving way to the first dwarf conifers; the very beginnings of birds and mammals are in the making, the later ancestors of ours being replete with reptilian bar sinisters still conspicuous on their physical escutcheons. Of the life of this era within the hundred-mile circle around our city we know rather from foot-prints than actual fossil remains. We find the tracks of gigantic beings, slow and ponderous, to whose appearance we have no clue, and across them run tiny prints of hasty defenseless creatures, fleeing for their lives. We find the hieroglyphics of worms, but no hint of the makers.

A few years ago there occurred a great piece of scientific luck at this very Fort Lee. There was uncovered a jumble of bones, so well preserved and distinct from one another that there was evoked from them a reptile, twelve feet in length, a creature covered with large bony scutes, with an incredibly long, cruel snout, armed with serried teeth. At first sight he looked like a crocodile, especially one of the slender-snouted gavials, those terrors of the Ganges. This dramatic find was the first Triassic New Yorker, our Oldest Inhabitant.

He was christened *Rutiodon manhattanensis*, which, eased into the vernacular, means the Manhattan Grubber. In life the Grubber was essentially a sprawler and swimmer, but in one decisive way he differed from living crocodiles; his nostrils were placed far back near his eyes instead of being at the tip of the snout. The teeth at the very tip were elongated and curved, so that the whole jaw has been compared to an elongated pair of tongs with nippers at the end. This



The Manhattan Grubber was primarily a sprawler and a swimmer but it differed in one curious way from the modern crocodile which in many other respects it resembled—its nostrils were near the eyes, not at the end of the snout. Drawing by Helen Tee-Van.

little assemblage of characters shows that in the probable absence of large fish and other toothsome inhabitants of the swamps and ponds, the Grubber had to grub for a living. With his nostrils so far back, he could feel about and burrow in the muddy banks, and seize the giant worms and other life, without any hindrance to his breathing.

And so, almost at the very spot where we are sitting on the Palisades, opposite New York City, a hundred thousand times as long ago as the duration of our calendar, the Grubber lived and splashed and ate and fought.

We enter our little bug-automobile and return to the Zoo with varied thoughts and emotions, some of them decidedly humble.

Charles Haskins Townsend

By FAIRFIELD OSBORN

Some thoughts on the personality of the man who directed the Aquarium for 35 years. When he died, animal life lost a true and forthright friend.

DR. TOWNSEND was a man of strong and salty personality. He was short of stature, but tough and wiry. His face never lost the weather marks of his earlier long years at sea. His direct gaze was characteristic of a man who had spent much time in the open—eyes that had searched distances.

He was of that school of naturalists which, in this period of specialization, is too greatly diminished. He had no high regard for laboratory scientists. "Technical fellows," he called them—"too damn technical." He defined a naturalist, with warmth in his voice, as one who "finds and describes," while a scientist merely "takes and explains." In fact, he felt so strongly on this score that some of the staff who were doing important research work, much of it vital even to the successful operation of the Aquarium itself, had almost to do this work under cover. Yet he himself was wonderfully well informed and trained, having learned through the school of practical experience.

He was born at Parnassus, Pennsylvania, in 1859, the son of a minister. While still a school boy he decided "to go in for" natural history. At the age of twenty he took a job in Ward's Natural Science Establishment in Rochester and three years later became a junior on the staff of the Academy of Natural Sciences in Philadelphia, where he worked principally in ornithology. Through connections made at that time, he was appointed to the United States Fish Commission and sent to the salmon hatchery on the McCloud River, California. Three years later he participated in a survey trip up the Kowak River in Alaska, using the U.S.S. *Corwin* as a base. This Government expedition had much to do with establishing conservation measures for reindeer, which at that time were approaching extinction. Then came eleven years of ocean and coastal cruising aboard the U.S.S. *Albatross*. This experience proved a most fruitful one and led to his appointment in 1897 as Chief of the Division of Fisheries of the U.S. Fish Commission. During these years in Government service he had acted as Assistant Government Commissioner in salmon propagation and as a member of the Bering Sea Fur Seal Commission, in which activity he contributed to the eventual signing of an international agreement preventing the wanton slaughter of seals. In 1902 he joined the staff of the Zoological Society as Director of the Aquarium.

Dr. Townsend's career is so generally known and so many of his activities and accomplishments have been reported in the Society's publications over the years that it would seem of greater interest here to write of him more intimately.

The staff at the Aquarium used to call him "the old man" and he always referred to the men as "my boys." Like most men of strong personality, he had several idiosyncracies which added to the savor of his character. He abhorred seeing anything wasted. He was always saving pieces of string. His collecting and saving habit resulted in a great accumulation of all kinds of odds and ends in the attics of the Aquarium and of his home and barn in Westchester. He always took

At his desk in the Aquarium in Battery Park Dr. Townsend was never as much at home as in more active surroundings—on a field trip or aboard some sea-going vessel. There he really expanded.

keen satisfaction in the fact that at the end of the year he was able to turn back to the Society at least some money from the budget that had not been spent on Aquarium operations. The story runs that he used to keep an eye out of his tower window at the Aquarium and occasionally, when he spotted some lumber débris floating down the Hudson, would order the boys out in a boat to fetch it in. "Many mickles make a muckle," he used to say. His fondness for the sea was reflected in his everyday conversation with the men. At the Aquarium he gave his orders in nautical terms.

He took pride in the collecting sloop *Sea Horse*, which was built under his direction. He enjoyed inviting his many Navy friends aboard for collecting trips to Sandy Hook. Once when he had an Admiral friend of his aboard, a storm came up. The boat rolled and rocked so that the Admiral became violently seasick. Dr. Townsend stood on deck, taking the blow like a real old salt, smoking his little stogey cigar.

His knowledge and observations of aquatic birds resulted in his insistence that numbers of these be exhibited at the Aquarium. The odor of these collections in the poorly-ventilated old building did not deter him in the least—the public had to see them. If the stock ran low he would occasionally supplement it by fishing for sea gulls off Battery Park. The method was simple enough. A dulled hook baited with a piece of red flannel would be swung through the air by means of a long fishing pole. The sea gulls would dive and take the bait. He had an almost sentimental objection against clipping the flight feathers of a bird, to say nothing of pinioning one. He expected the men on the staff to make the bird so content in its new environment that it would not fly away, and threatened that if a bird were lost the man responsible must pay for it.

He was quite a good taxidermist and had a fine collection of bird skins which he had prepared

himself. A tortoise was once sent in to him for study and preparation. The carcass was stored in a basement room and after a couple of weeks he went down to look at it. On this particular day he was in a hurry to go to a Board of Trustees meeting but he wanted to do some work on the tortoise before he left. He asked Callahan, one of the men, to get the animal out on the table for him. The flesh was so decomposed that there was a frightful stench. Nevertheless, the Doctor insisted that the turtle be laid out on the table for him and as soon as this was done he began to dissect away. The odor was so bad that it overpowered Callahan. Dr. Townsend shoved one of his stogies in Callahan's mouth and said, "Here, this will fix you up." He worked for an hour or so, the whole room reeking, and then rushed off to the Board meeting.

Dr. Townsend often referred to the fact that he was able to change the Aquarium from "an over-sized bathroom to an Aquarium." He used to say that "we give the public the best show in the world for nothing." As a matter of fact, he was not far wrong, because during his 35-year tenure as Director of the Aquarium, it was visited by more than seventy-four million people and became known the country over as one of the five "musts" to see in New York.

The fact is that he worked miracles with the Aquarium from the day he took charge. In these days when we are planning great changes in the Zoological Park, together with a new Aquarium, it is too easy to forget what our predecessors accomplished. All kinds of innovations and methods of operation were installed under Dr. Townsend's direction and there is nothing truer than to say that we would not be in our present position without the knowledges which men like Dr. Townsend and Dr. Hornaday developed.

Dr. Townsend, alluding to the fact that his father wanted him to become a minister, semi-humorously claimed that he was a divinity student who went out for a one month trip on the S.S. *Albatross* and did not come back for eleven years.

Once Dr. Townsend got hold of a cause or an idea he never let go. His interests were wide-ranging. In 1928 he went to the Galápagos Islands and became captivated–there seems no other word – by the giant Galápagos tortoises. Their protection from then on became a passion with him. With great difficulty 115 of the animals were carried away and established in breeding stations through the South and Southwest, as well as at Bermuda. The continuation of these species became for him more than a crusade. The animals were uppermost in his thoughts. Meetings of the Board of Trustees for years were illuminated by his "Galápagos Tortoise Report," which was presented in considerable detail and with an immense amount of zeal and enthusiasm. The fact that the Board the year before had heard quite a similar report was entirely beside the point – the Galápagos tortoises had to be saved!

He was tireless in his researches on any subject that interested him. Probably no man knew more about whales than did he. His methods of study were practical and to the point. He prepared a voluminous amount of data on whales of various species and, in order to get his base material, waded slowly and meticulously through countless logbooks of early whaling vessels, which he found in the libraries of the former New England whaling centers. From the data accumulated he plotted charts indicating the distribution of these animals in the Atlantic and the Pacific Oceans. This information is even today the most complete of its kind.

Dr. Townsend was not afraid to consider and to seek for understanding of the entire realm of the living world and he had knowledge of a surprisingly large proportion of it. Although his reputation was built around fishes and other marine life, he really knew a great deal about mammals, birds and invertebrates. Despite his verbal sallies on the subject of "scientists," he published a large number of scientific articles, all written with great competency. His publications are marked by a faithful recording of observations keenly made, often accompanied by an historical slant that gives them both charm and value.

In thinking of Dr. Townsend, one realizes that an institution acquires its character from the men who through the years have worked in its interests. Dr. Townsend's personality, his knowledge and his methods are a part of the Society today and will continue indefinitely into the future.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

CHECKING UP ON JOEY

Authorities differ so considerably in their reports on the length of time between the birth of a baby kangaroo and its emergence from the maternal pouch that we have begun to make our own observations. Kangaroo babies of various species are a fairly regular occurrence in the collection and over a period of a few years we should be able to settle the matter to our own satisfaction, at least.

The present "Joey" under observation is a Walleroo-Euro hybrid. Thanks to the careful notes of Keeper James Rimmer, we know that 5 months and 11 days elapsed between the time the baby was born and the first occasion when it put its head out of the pouch. Several more weeks or even months may elapse before it actually gets out of the pouch. Keeper Rimmer will report the event when it occurs.

It may be found, as other species are brought under observation, that the period in the pouch varies from species to species.

THE PASSING OF OLD NELLIE

The death of an animal that has been in the collection a long time, even if its tenure has been quiet and undistinguished by any temperamental outburst, always leaves a keenly felt gap. We find ourselves in that position in regard to the passing of Nellie—Old Nellie, as she had come to be called, to set her apart from a Young Nellie—the Griffon Vulture who had the honor of being the oldest inhabitant of the Zoological Park.

Nellie was found dead in her winter home in the Ostrich House on the morning of February 19. She had come to the Zoo on August 23, 1902, and consequently had been with us 41 years, 5 months and 27 days, to set what is possibly a world's record for longevity. The best previous record as set down by Major S. S. Flower was some 37 years established by a Griffon Vulture in the Copenhagen Zoo.

Only last fall we had celebrated Old Nellie's forty-first birthday by spreading a picture of her head across the cover of ANIMAL KINGDOM. At that time she scarcely showed her age and we were able to remark that she looked good for many years more. Her chief disability in recent years had been a bad case of "bumblefoot," a swelling of her feet that incapacitated her for exhibition, since she developed the habit of sitting at the front of her cage with her unsightly feet stretched toward the public. In 1940 she was removed from exhibition and turned out in a large paddock in the southern part of the Zoo, and was removed to the Ostrich House each winter.

Young Nellie, her successor in the collection if not in our affections, came to us on January 8, 1925, and thus has accumulated 19 years toward Old Nellie's record.

A BARGAIN IN BOOKS

While taking inventory recently, the Publication Department discovered a number of copies of "The American Bison," by Martin S. Garretson, published by the Society, which had been warped and slightly damaged by damp. While they last they are offered to Members at 50 cents each. Send order, with payment, to Publication Office, Zoological Park, New York 60, N. Y. All copies sold "as is"— which means that we simply pick them off the shelf and mail them out, warps and all. Most copies are in reasonably good condition and they are a real bargain. Publication price was $2.50.

NEW MEMBERS OF THE SOCIETY

New members of the New York Zoological Society since the last issue of this magazine are the following:

Founders in Perpetuity
Dulaney Logan

Research Associate
Dr. C. M. Breder, Jr.

Annual

Harold C. Amos
Mrs. Elliott Averett
Miss M. Patricia Dunn
Fernando A. Rubio
Pierre Ruedin
Mrs. Alice B. Pioselli
Mrs. Paul M. Warburg

Three Tiger Cubs

By LEE S. CRANDALL

IN ANY well-organized collection, young animals are expected to be born and their appearance becomes more or less a matter of routine. Some, such as hardy range species, are cared for by their mothers with no particular attention from their keepers. Others are reared with variable degrees of difficulty but many are such problem children that they are not reared at all.

For us, at least, tigers have always been in the latter category. Never, in all our history, has a tiger cub been reared here. In fact, very few have been born. A search of our records reveals that up to 1943, only four infant tigers have been produced in the Zoological Park. In 1905 and again in 1915, single Bengal cubs were born, and in each instance died on the same day. In 1912, our beautiful pair of Siberians produced a litter of two, which met the same fate.

Dismal though this result may be, it is a fair cross-section of Zoo experience with tigers. For some reason, the long-haired Siberian form seems a little more reliable and the well-known pair in the National Zoological Park in Washington D.C., which reared six young over a period of several years, and the magnificent stock for which the Detroit Zoological Park is noted, come immediately to mind. Bengals are bred here and there, of course, but I must say that in my own experience, the only naturally-reared young of this form that I can recall seeing were in the chalk-pit den at Whipsnade, London Zoo's country establishment.

So when, in 1934, we bought a young female Bengal tiger from Henry Bartels, we made no effort to secure a mate for her. Through the vagaries of the animal market, it was 1941 before a male Bengal was obtained. Anteriorly, this is an extremely fine animal, very tall and with a beautifully molded head. Aft, however, he is definitely below par, rickets or an old injury having destroyed any early ambition he may have had to grow up with a straight back.

After the necessary period of rubbing noses through a wire partition, the two animals were allowed to occupy one of the large cages in the Lion House. Because of the physical imperfections of the male, there was no real expectation of breeding results so when, on January 19, 1943, a dead cub was found in the den, we were taken entirely by surprise.

Preparations were made for the arrival of the next litter and the animals were separated well in advance of the expected event. The gestation period for tigers is usually given as "90 to 110 days" and "Jenny" settled the question cleverly enough, for after exactly 100 days, faint squeakings were heard in her sleeping den.

Bengal tigers that will care for their young in captivity are rare and the only way to find out whether or not we had one, was to let Jenny try. And for four days she did her best, coming out of her box only to lap her milk and to drag in her bountiful allotment of raw horse meat. On the evening of the fourth day, the baby mewings were obviously growing weaker and next morning they had ceased altogether. Jenny was tricked into leaving the den, the sliding door was drawn and the den was entered from a passage below. A single emaciated cub was found, quite dead.

It looked then as though Jenny was not to be our pearl among tigers. By that time, she had been with us for nine years and must have been at least twelve years old, a point in the life cycle beyond which a tiger cannot be expected to improve. The animals were kept in separate cages while we pondered the situation. By late autumn, our plans had matured. We would place a nest box just in front of the inner door of the sleeping den, accessible only by the help of a 12-foot ladder. We would examine the cubs as soon as they had been born, without the necessity of entering the den, and remove all but one to be reared by hand. And we would prepare a pair of new cotton gloves, well scented with the essence of tiger, so that no odor of man would be left to disturb the mother.

The parents were reunited and in due time, early on the morning of February 8, 1944, infant squalls were heard again. And now for our plan. Everyone knows what usually happens to wonderful plans – only this one worked! Once Jenny had been coaxed out and locked out, the ladder was climbed, the door was opened, tiger-scented gloves lifted out two lovely, mewing cubs. Quickly, Dr. Goss determined them to be male and female, and after hasty consultation, we de-

The baby tigers were five weeks old when this photograph was taken in Mrs. Martini's home and it shows the size and agility of the youngsters—already so active that their play pen will not hold them.

cided to lift the male and leave the female with its mother.

Carefully wrapped in heated towels, the baby was rushed to our Hospital, where Dr. Goss found its weight to be two pounds eight ounces, and its length, from tip of nose to tip of tail, twenty inches. It was then taken to the nearby apartment home of Mrs. John ("Fred") Martini, wife of the efficient Keeper in charge of our Lion House. Mrs. Martini had already had a successful experience in rearing a lion cub and joyfully welcomed the baby tiger, which she promptly named "Raniganj."

Two hours later, Fred reported that he thought he could hear two tiny voices in the den. Following our routine with practised ease, we quickly

entered the inner chamber and found that a third cub had been born. Since the newcomer was a male, we this time took the female, leaving the last born to the mother. This cub weighed two pounds eleven ounces and had the same over-all measurements of twenty inches. Mrs. Martini named her "Dacca."

For the remainder of that day and two more, we watched the mother carefully, not daring to inspect the den for fear of disturbing her. On the evening of February 10, the cub's voice was obviously growing weaker and we determined that if there was no improvement by morning, we would remove it. Bright and early, Fred Martini began his vigil but by 9 A.M. had heard nothing. We then entered the den and found an emaciated little creature, cold and almost motionless. Without stopping for weighing, we rushed him to the only possible haven, Mrs. Martini's apartment. Jenny would be disconsolate for a day but there was just a chance to save the baby's life. Undismayed, Mrs. Martini called him "Rajpur" – just so he would not die unnamed – and laid him on a heating pad. Soon, he began to wriggle weakly; in two and one-half hours, he took his first meal. We found that while Rajpur adhered to the standard length of twenty inches, he was much stouter and heavier in bone than any of the others.

First food for the cubs consisted of one-third evaporated milk and two-thirds water, heated to body temperature. They took from two to three ounces at each feeding, every three hours, from 6 A.M. to midnight, drawing it vigorously through a rubber nipple. At first, they were kept together in a cardboard carton, carefully padded and covered, with the heating pad attached to one side so that there was no danger of overheating. Soon, however, it was found that the little mouths would attach themseves to anything they touched and because of the risk of injury, a box for each was provided. For short periods, under close surveillance, the cubs were allowed to crawl about in a padded play-pen.

Careful notes on progress were kept by Mrs. Martini and most of the following data were culled from her diary. When nine days old each cub weighed exactly four pounds. At fifteen days, Rajpur weighed 5 pounds 10 ounces, Raniganj, 5 pounds 8 ounces and little Dacca 5 pounds 4 ounces. On March 14, when the cubs were exactly five weeks old, they had achieved the following: Rajpur, 9 pounds 3 ounces; Raniganj, 7 pounds 6 ounces; Dacca, 8 pounds.

The eyes of tiger cubs are closed at birth, of course, and those of our babies opened at varying times. Dacca was first and separated one pair of lids in nine days, although the other eye did not open until four days later. Both little males opened one eye when eleven days old, and the other two days later. At five weeks, while definitely able to see, the eyes are still blue.

When ten days old, all three cubs were found to have their upper teeth just breaking through the gums. They were cross and irritable for two or three days but soon regained their good nature.

On the eighteenth day, all of the cubs gave evidence of digestive disturbance. This went on for several days and finally became so serious, at least in the case of little Raniganj, that we despaired of saving him. He became too weak to feed from the nipple and Mrs. Martini had to resort to a medicine dropper. In these desperate straits, Dr. Goss decided on desperate measures and injected 15 cc. of homologous feline distemper anti-serum, in lieu of a blood transfusion. Little Raniganj responded beyond expectations and within fifteen minutes was crawling in the play-pen, bawling for food. From that day, he has never looked back. A speck of bismuth here, a teaspoonful of lime water there, a mild increase of food all around, did equal wonders for the others. At five weeks, they are lovely and we believe now that Mrs. Martini will score another triumph.

Even at this tender age, the little tigers are remarkably different in temperament. Raniganj is definitely bad-tempered, squalling, biting and scratching whenever any infant wish is balked. Huge Rajpur is fat and indolent, willing to accept whatever comes – especially food! Little Dacca is happy, bright and friendly, though ready to defend herself against her larger brothers, as they romp in the play-pen. Can these apparent indications of forming character be expected to forecast adult natures? Let us hope that we shall know!

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Conservation and War

At this hour of climax of man's destruction of his fellow man, any words concerning conservation in general, or the preserving of wild animal life in particular, seem but as whispers in the wilderness, faint sounds and meaningless, lost in the whirlwind of human conflict. One could not expect, one can scarcely hope for kindliness in days so cruel.

It is worth recalling, perhaps, that conservation is of two elements – on the one hand practical, being the purposeful conserving of natural resources for man's own benefit; on the other hand, esthetic and moral, involving both the protection of the beauties of nature and the trusteeship of the heritages that nature has placed in man's hands.

Could it be that because of its moral aspect one is justified in hoping that conservation may not be lost to sight, even during these dread days? If so, it is because conservation may be thought of as a symbol – a symbol of kindliness which, denied for the moment as between man and man, can be extended to other living things, mute and without anger. These wild living things once destroyed will never appear again, but if protected, will, in the better days to come, be a continuing delight to us and to our children through all time.

Fairfield Osborn

IN THIS ISSUE

Prairie Dogs . . . . . COVER
The Birth of a Baby Platypus . . . . . *David Fleay* 51
A Short Account of Zoological Illustration . . . . . *Walter J. Wilwerding* 70
Behind the Scenes: News and Notes 78

"Corry," the baby platypus, at the age of sixteen weeks. At this time she was thirteen and a half inches long and four days after this picture was taken she entered the water for her first aquatic excursion. The baby is being held by the author, David Fleay, director Australia's platypus sanctuary.

The Birth of a BABY PLATYPUS

By DAVID FLEAY

Director of the Badger Creek Sanctuary, Healesville, Victoria, Australia

Here is the fascinating story of the first Ornithorhynchus ever to lay an egg and successfully hatch a youngster in captivity, told by the Director of Australia's famous sanctuary.

FOR NINE YEARS, three in the Melbourne Zoological Gardens and six at the Badger Creek Sanctuary, I have striven to bring about conditions conducive to the laying of eggs and successful rearing of young by our shy and temperamental duck-billed platypus. It was obvious that many interesting little details of intimate habits denied to Mr. Harry Burrell during his very thorough compilation of platypus lore could only be revealed when a truly domesticated "duckbill" consented to perform her duties as a mother.

In this 1943-44 season, after years of trial and error, high hopes, and great disappointments, Fortune really smiled, and Jill, wife of Jack, the platypus, made history by hatching and rearing a splendid female youngster.

Before proceeding I would like to acknowledge the debt owed in these investigations to Mr. Karl Byron Moore of Melbourne, a member of the enthusiastic Sanctuary Committee, who, knowing the tremendous expense involved in procuring the necessary quantity and variety of food for the pair of platypuses, has assisted financially each month throughout the difficult years of this war. In days when even our butcher's order had to be dropped in favour of using up ancient bony horses, it is doubtful whether the platypus experiment could have been carried on but for Mr. Byron Moore's very practical help.

There must also be remembered the steady conscientious assistance of my deputy, Mr. Cecil Milne, who has never spared himself in the many and varied duties involved in caring for the welfare of our Ornithorhynchus family. Mrs. Jemima Dunolly, too, last of the old aboriginal people at Coranderrk, supplied us consistently in all weathers for years with the important platypus food items until practically the day of her death in early January, 1944, at the reported age of 102.

In the *Victorian Naturalist,* Vol. LIX, No. 11, March, 1943, the ways of Jack and Jill, their places of capture and many vicissitudes, were described. On this day of commencing my further record (February 19, 1944) Jill has completed six years in captivity, and as she began her life in the Sanctuary at the nest-leaving stage, her age on this date is roughly, but fairly accurately, six years, three and a half months. This fact plus her bright, alert ways and excellent health, despite the constant demands of her youngster, are clear indications that the life of the platypus is a lengthy one.

Jack, whom we captured in Badger Creek a year later than Jill, as a half-grown youngster, is approximately the same age as his mate, and this big, richly-coated animal, 20½ inches in length and weighing 3¾ lbs., now has more than five years in a Platypussary to his credit.

With the object of providing a suitable small-scale "river bank," wherein Jill at her chosen time could excavate a breeding burrow, hard packed earth and logs had been arranged in an enclosed area at the western end of our Badger Creek Platypussary since early 1939. Variations

in the mode of entry to this section from wooden "tunnels" running to the swimming tank had to be devised from time to time, the excavated earth had to be carefully removed as Jill brought it out and the relations between the lady and her mate, who was almost double her weight, had to be most carefully watched.

With all our well intentioned architecture and experimentation with the all-important balanced diet, it seemed that only during the winter of 1943 were conditions brought to such a state that they met with Jill's unqualified approval.

Small, even for a female platypus, Jill measures 16¼ inches (average = 18"), weighing a bare 2 lbs. in her fattest condition, and her extraordinary tameness is largely due to the fact that, owing either to undernourishment or possibly to some accident having accounted for her mother, she left the nesting burrow at a very immature state—being then no more than 10 inches long, the smallest young platypus in the free state that I have ever seen. Compare this with her own youngster, which at the length of 13½ inches was still in the nesting burrow. Thus Jill's early impressionable weeks and months were our own, to instil into her the necessary trust and confidence. Little did Mr. Vince McCrohan of Healesville think, when he picked up the tiny and very weary Jill ambling down a hard mountain road three-quarters of a mile from water, that she would later create a stir even in wartime London.

The happy result of Jill's early education is that she has absolutely no fear of human beings, even when they crowd about her in hundreds, and unlike the general run of platypuses she is little inhibited by the traditional temperament. In fact, recently when I tied her in a bag to ascertain her weight, she resumed feeding immediately afterwards as if nothing had happened.

Jack, the male platypus who was captured after months of free life, became very quiet and accepts food by hand, but he has never been the friendly and frolicsome little pet that Jill is.

In the cases of both animals the success in breeding was not brought about by shutting them away and leaving them strictly alone. The daily exhibition with a general alternate day appearance of each (unless Jill happened to be hibernating) went on much as usual right until the famous October day when Jill actually gathered nesting material under the eyes of spectators and began to construct her nursery. Naturally, thereafter Jack had to represent the family at 3:30 p.m., each day, but even so Jill appeared on many occasions in succeeding weeks on daylight foraging excursions as I shall describe, and Jack was able to enjoy periods of well-earned rest.

Normally crepuscular and nocturnal, platypuses in Victorian streams are rarely seen during daytime unless flood waters are high, food is scarce, or females are engaged in caring for infant families. The usual thing is to find the animals slipping out into the streams during the evening light and swimming continuously up and down stream practically the whole night through.

Three years ago while engaged in procuring five pairs of platypuses for liberation in the streams of Kangaroo Island by the South Australian Government, it was particularly instructive at night to illuminate by means of a powerful spotlight the shallow rapids of such Healesville streams as the Watts River and Chum Creek, and observe the underwater "swim-past" of a number of otherwise unseen duckbills on their various lawful occasions.

The most usual indication of their presence when one is quietly sitting on a river bank at night is the sudden "splash-dive"—an almost double sound characteristic of the platypus alone. This alarm signal, like that of a rabbit or wallaby thump, conveys its meaning almost simultaneously to any other platypus in the vicinity.

In view of the typical nocturnal habits of the species, the behaviour of Jill, which has been most consistent over the past two seasons, is of exceptional interest. Jack, not being concerned with procuring food or preparing himself for incubatory duties, broke his nocturnal emergences on but a single occasion during the pairing month of October, 1943.

Skipping, then, the notes made over several past years I shall describe Jill's movements from the day they departed from normal in 1943, just as they did in the preceding year of 1942. In the winters of these two years, and, in fact, at odd times during those even before that, Jill had disappeared for periods of several days at a time

H. G. Wells visited the platypus sanctuary in 1939 and was so entranced by the little animals that he was allowed to hold Jill. Incidentally, destruction of the sanctuary by brush fires was narrowly averted two days later.

deep in her burrows. There is little doubt that these absences were stretches of hibernation or sleep during the coldest and bleakest periods of the year, and they may be in the case of the female animal part of the preparation for the incubation period to come. At such a time she pugged up or blocked up her camping chamber from its connection with the water. Jill is not the only platypus I have known to hibernate.

Harry Burrell ("The Platypus," page 164) says: "Although Bennett has made the suggestion that Ornithorhynchus hibernates, my investigations do not bear him out. In New England district of New South Wales, the pairing season commences in July which is the mid winter month on those cold highlands. The platypus lives an active life the whole year through." Bennett's statement read: "These creatures are seen in the Australian rivers at all seasons of the year, but are most abundant during the spring and summer months, and I think a question may arise whether they do not hibernate."

Robert Eadie ("The Life and Habits of the Platypus") recorded periods of hibernation during the months of June and July for his famous pet platypus "Splash," a male animal. There is no doubt whatever that in Victoria platypuses do hibernate for greater or lesser periods and my field observations agree exactly with those of Bennett. Unless a platypus in captivity has access to earthen burrows of its own construction it will not always hibernate, since it is possible that such periods of retirement, plus ensuing stretches of ravenous eating in the case of the female, are correlated (as suggested) with the nesting period. I have tabulated the following account of Jill's 1943 winter behaviour. The summary indicates the dates and periods of time, apart from ordinary nocturnal emergences, spent inside the burrowing bank with the animal "pugging" or sealing herself in – to use the mining term so appropriately adopted by Mr. Burrell.

Date Intervals.	Approximate Time Spent in Retirement.	Ensuing Feeding Period.
May 28, 1943.	One night and day—(24 hours).	Out at night.
May 31-June 1.	Two nights and a day. (36 hours.)	Out two succeeding days all day and sleeping at night.
June 4.	One day and night. (24 hours.)	Out all day.
June 7.	Two nights and a day. (36 hours.)	Out two succeeding days all day and sleeping at night.
June 12-June 19.	156 hours.	Emerged for half a day—12:30 p.m. until dark. Fed all next day, and for several days with nights in retirement.
June 24-June 26.	36 hours.	Fed all day for two days—away at night.
June 28-July 3.	120 hours.	Out all day for four days. Nights in retirement.
July 6-July 12.	132 hours.	Fed all day for five days. Away at night. Extra hungry.
July 17-July 21.	102 hours.	Emerged in early afternoon. Fed 6½ days consecutively. Away each night.
July 28-Aug. 2.	120 hours.	Emerged 4:30 p.m. Fed until well into night. Out in afternoons for several days and for several other whole days—away at night.
Aug. 8-Aug. 13.	120 hours.	Appeared 3 p.m. Fed into night. Out with little variation for seven days running. Away at night. Three more half days staying into night.
Aug. 25.	24 hours. Away during a day and night.	Out all day three days running. Away at night.
Aug. 29.	One night and day. (24 hours.)	Fed in daylight two following days. Away at night, emerging after midday in each case.
Sept. 1-Sept. 3.	92 hours.	Emerged 4 p.m. Out most of day for three following days. Away at night. 4th and 5th days out from 3:30 p.m. Away at night.
Sept. 10-Sept. 15.		Jill out each day all day, away sleeping at night.

Another interesting thing was the fact that from this period on, for the first time in 1943, the end of Jill's tail took on the bare and patchy appearance that so commonly develops each year. This, of course, was a direct result of using the tail in back-pushing soil to close off unwanted passages and working up blocks or pugs. On emerging from her various absences, Jill became definitely diurnal and could usually be seen feeding ravenously all day long. It was a common sight on such occasions to watch her working away in patches of mud below water with her ever-questing bill, and when on a good prospect, flailing hard with both "fore-paddles" in unison to stir up small delicacies from obscure crannies.

It will be noticed that the hibernation periods began towards the end of May and ended just before mid-September.

From September 15 onwards Jill gave no further indication of any periods of hibernation but her appearances in daytime continued more regularly than previously. With few exceptions she now appeared in the afternoon (from 3 p.m. onwards) and fed into the night.

In the 1942 season when no pairing was observed and evidently none took place, Jill's habits returned to normal in late October, and from the 23rd of that month onwards (the end of the mating season) she became once more a nocturnal creature sleeping by day and appearing at dusk to feed through the night.

The most interesting observations in this 1943 season, as in the preceding year at a corresponding time, lay in the prodigious Spring appetite displayed by the vigorous creature. Following her three months of on-and-off hibernation during the intervals of which she ate very heartily indeed, she now (from early September on) devoted herself to banqueting of a much more intense nature. From the time of her afternoon bow to the public (coming out of her own accord) until far into the night, she devoured grubs, yabbies (fresh-water crayfish), beetle larvae, worms and tadpoles with little pause, coming out each and every day. In view of the story yet

Jack, the father of the baby, is arriving at one of the landing stages in the platypus pool. This big fellow is twenty and a half inches long and weighs three and three-quarters pounds. He has well-developed venom spurs. Note the folded fore feet, with his weight resting on his knuckles. Jack is about the same age as Jill.

to be told, it will be seen that this performance was a preliminary "storing-up" in preparation for the domestic activities so close at hand.

Throughout all these months Jack had inhabited the same home and swimming pool as Jill, but he had not been permitted to enter her bank of earth. He showed no inclination to hibernate, did not come out to feed during daylight, and fed as usual throughout the nights. I am not inferring that the male platypus does not indulge in periods of winter hibernation. Jack has never done so but it must be remembered that he has not been permitted to excavate his own burrows. The adult male platypus is also far more difficult to observe in the wild state than the female, for these big "old men" are far more suspicious and retiring than the females.

In a long period of observing and capturing platypuses in various Victorian streams ranging from the Western district to Gippsland, I have only once managed to hoodwink a fine big fellow like Jack, whereas young males and immature and fully grown females are fairly easy game.

Returning, then, to the mid-September period of 1943 by which time Jill had ceased her bouts of hibernation, but still continued to feed by day, it happened on the 14th of that month, during an afternoon show featuring Jack (who had been brought from his "burrow" for display), that Jill slipped forth from her tunnels and began begging for special items of food. This she does by waving her beak jerkily above the water surface, and repeatedly emerging from underwater dives in the corner nearest the hand holding the food. Accordingly some beetle larvae were proffered and she reacted eagerly by clinging to the hand that approached her and levering its fingers apart with her bill.

After a few minutes it was noticed that Jack seized Jill's tail in a firm grip with his bill and the two animals swam slowly in a processional circle. The period between mid-September and mid-October was evidently the pairing season, and several instances of courting actions with the two animals swimming in a processional circle were noted during that time. Jill (as previously mentioned) continued her daylight feeding sessions, occasionally varying the procedure by appearances at night. Apart, however, from the rather interesting evidence of this play at courting, the first true act of mating was observed on October 11.

During the afternoon fairly heavy rain fell and at 3:30 p.m. both animals were in the water of their own accord – Jack, the male, of his own volition in broad daylight for the only time noted in his five years at the Sanctuary. In view of Mr. Harry Burrell's notes and theories on one use of the platypus spur as a means of holding the female during copulation (Burrell, Chapter 7), it is worth recording that during this act, when the animals were fast for nearly ten minutes, no spur grip was noted. A good deal of splashing and floundering about occurred, and in the first place the male animal doubled his body under while maintaining his grip on the female's tail with his bill. No further activities of this kind were noted.

Jill fed on ravenously each day, if anything coming out even earlier (about 1 p.m.). On October 18, it was decided to remove Jack and give him the run of a new Eastern section or wing of the Platypussary, which was shut off from Jill's Western quarters. Jill became more and more hungry. She was often seen now at 9 a.m., feeding continuously right through to 9 p.m., and for hours after that. Down she would dive time after time to weave her blind way about on the bottom, seeking palatable items, rising then to the surface for a leisurely chewing and continual bulging of her cheek pouches. I supplied her with duckweed and other aquatic plants, thinking that green vegetation might be in demand at this particular time, but all to no purpose.

On October 22 her actions were decidedly restless. She had for a week or more beforehand changed her entrance hole from the water to one leading out on the Northern side of the Platypussary and had excavated a fresh entrance-burrow high up in her burrowing bank. On this day she emerged at midday, disappeared again at 3 p.m., reappeared at 4 p.m., and again retired at 6 p.m. Possibly, in view of her further activities and the amount of earth thrown out, she was working on the nesting chamber at the burrow terminus.

Weighty support for this theory appeared on the following day (October 23). Jill was ready to build a nest! On that memorable occasion

quite a crowd was present and what a treat was afforded them! However, probably not one spectator realized the unique nature of the occasion. I happened to notice that Jill was not inclined to feed and she appeared to be more interested in making repeated snatches at a leaf fragment in the water. I gathered a handful of dry eucalypt leaves and dropped them in the water. Immediately the lively little animal seized upon them with her bill. With feverish energy she ducked her beak below and under her body, at the same time bending and tucking her tail forward so that the leaf became held in a neat tail grip almost identical with the mode employed by both nest-building ring-tailed 'possums and 'possum gliders of the genus *Petaurus*.

Again and again leaves were transferred below water to the grip of the tail, and as the bulk grew the platypus's hind feet were used to kick the bundle back into a more compact roll. It was a most amazing sight and I have often, figuratively speaking, kicked myself since for not taking photographs. All thought of food forgotten (which in a platypus of Jill's calibre was unprecedented), the little nest-builder swam towards her Northern burrow entrance again and again with her tightly-held leaf bundle, and scuttled inside. There was no hesitation. She had a job to do and she went straight to it. Through the wooden burrows and then up the burrowing bank she could be heard rustling along with her loads, and then in brief minutes out she came for more. From 3:30 p.m. until goodness knows what hour she worked a continuous "shuttle service." Food was disregarded entirely. We had provided a veritable floating raft of leaves.

I saw her a number of times during the evening, and when last inspected at half an hour past midnight she was still nest making! Leaf material was her object but wisps of grass in the water were also gathered. A second important habit revealed at this time, apart from the actual method of gathering and carrying material, was the fact that all of it was taken from the water. Wooden burrows through which Jill travelled contained leaves and grass but this was entirely by-passed. Even leaves dropped from her tail-bundles in the burrows were not picked up. All nesting material was chosen thoroughly wet *in the water*. This fact has definite significance. Burrell (page 180) quotes Kershaw as saying that mere exposure of platypus eggs to dry air produces denting in a few minutes. Mr. Burrell also suggests that it is the necessity for a moist atmosphere over the incubation period that is part of the reason for the pugging of the burrow.

Jill has shown that the nest itself is made originally entirely of thoroughly wet stuff and it can be imagined that leaves and other material collected by wild female platypuses would be in an even more thoroughly soaked state than those we threw in for Jill on the afternoon of October 23. The thickness of the nest in a platypus nesting chamber, plus its damp nature, and the pugging habit, would undoubtedly provide for some little time the moist atmosphere mentioned by Mr. Burrell.

The afternoon and night of October 23 saw the beginning and the completion of Jill's nest-building – a typical example of the restless nervous energy of our duck-billed oddity . The following day, October 24, she emerged at 3 p.m., with no further leaf-gathering ambitions, and chewed away continuously far into the night. This and the following day were the last two days before retirement. It should be understood that a very special diet had been accorded her for some time, consisting of prodigious quantities of beetle larvae, tadpoles, young yabbies and earthworms of several species.

Again, on October 25, Jill appeared – on this occasion at 10:30 a.m., to feed ravenously and continuously. On both these days she appeared shy and disinclined for any form of frolicking about, which was so frequently her custom when I paid her a visit. At dark on the 25th, after an all day feeding session, she retired. That was her final disappearance for the incubation period and it seems reasonable to assume that the first at least of her eggs (one or more in number) was laid during that night – for her period of preparation and feeding had ended, and now she was really down to business. It should be recalled at this point that just a fortnight had elapsed since the only observed instance of mating had occurred.

At the time of her withdrawal from public affairs, Jill was both fat and well. The number of pugs placed in the burrow, thus blocking the

Jack feeds from the author's hand while swimming in his tank. The bill of the male platypus is very large and wide, and its proportions are shown clearly. Jack has never become as friendly as has the younger-caught female, Jill.

brooding animal in her nesting chamber, could not, of course, be ascertained; but that she was in the habit of carrying out these activities was revealed later when finely worked dry earth (that, as Mr. Burrell remarks, slips through the fingers like flour) came to light along the course of the opened burrow.

Day after day passed by and night succeeded night with no sign of Jill. No food was touched and the water of her long swimming pool remained as clear as crystal. Imagine our excitement! I could feel it in my bones that at long last, after all the years of endeavour, luck had turned and Jill was curled up below ground in the peculiar upright ball so typical of her kind, while reposing in her lap were the precious eggs (one, two or three) comparable in size to those of a sparrow.

The earliest sign of a reappearance by Jill was evidence that during the early morning hours of October 31 she had pushed away grass arranged in the nesting burrow "doorway." She had defecated in the water but no food had been touched, nor was the water stirred up. The animal was not seen and evidently she had simply come in and out for the purpose of wetting her fur and defecation. This emergence was on the 6th night following five full days and nearly six nights of absence.

On the next occasion (November 1) Jill appeared at 2 p.m., when she stayed out for just half an hour. She appeared unusually timid. For the whole of this time she rolled and swam about in the water, making no definite attempt to feed but concentrating strongly on toilet scratching of her fur with her hind feet, combing her flanks and lower back. For the first occasion in the many times she had been watched at this process her combing extended into the abdominal region in what might be termed the pouch or mammary area. Perhaps this region was matted owing to the stickiness of the eggs when first laid; or again, perhaps the stimulus of developing milk glands caused Jill to scratch so continuously at this spot.

During the brief half hour of her outing she

kept her beak pointing anxiously towards her burrow entrance, and was never far from it. Her outing obviously had a threefold purpose:

(a) A wetting.
(b) Exercise.
(c) A cleansing of her fur.

Following her return she could plainly be heard scratching through and replacing pugs in her burrow. Her third outing took place during the early morning hours of November 3, some time between 1 a.m. and dawn. There was little, if any, evidence of feeding – and again the excursion was almost certainly a matter of defecation, fur wetting and brief exercise.

On account of the considerable loss of condition noticed in the animal over this period, as distinct from her appearance following winter absences, added to the forerunning preparatory period when she built up her reserves, I think it most unlikely that she passed into any state of torpidity or low body temperature peculiar to periods of hibernation. On the other hand Mr. Burrell ("The Platypus," page 182) writes: "I am convinced that during the three weeks or more which elapse between the laying of the eggs and the onset of lactation, the female not only does not leave the nest, but also passes into a condition of partial aestivation."

In order to convey some idea of the period of incubation, which must necessarily be somewhat uncertain though definitely much shorter than was supposed, tabulated observations are set out below.

No. and Date of Emergence.	Time Duration from Date of Retirement 7 p.m. X/25/43.	Time Spent Out and Notes on Behaviour.
1. X /31/43.	Five complete days and nearly six nights.	Out during early morning hours for extremely brief wetting of fur and defecation. No food eaten. Animal not seen.
2. XI/ 1/43.	Six and half days and seven nights.	Observed 2-2:30 p.m. Fur preening and considerable scratching at mammary area. Raising her body side on to reach this abdominal region. Exercise and fur wetting, "pointing" anxiously with beak at burrow entrance.
3. XI/ 3/43.	Eight days and nine nights.	Not seen. Out between times of 1 a.m. and dawn. Evidently same as before, wetting, preening, and defecation. Extremely small evidence of feeding.
4. XI/ 6/43.	Eleven days and twelve nights.	Seen 11-11:45 a.m. Looked a bit miserable. Feeding; ate a few small yabbies and earthworms. Exercising a lot. Up on landing board, concentrating on turning side on and continuously scratching mammary area with hind feet.
5. XI/ 7/43.	Twelve days, and thirteen nights.	Seen 5 p.m.-5:45 p.m. Swimming actively, feeding and again scratching mammary area while on landing board. "Waving" her bill anxiously at entrance of burrow as seen on previous occasions. Once she made up her mind there was no hesitation about returning.
6. XI/ 9/43.	Fourteen days, and fifteen nights.	Seen 12:30 p.m.-1:30 p.m. Same behaviour.
7. XI/10/43.	Fifteen days, and sixteen nights.	Seen 3:30 p.m.-6:30 p.m. Very little fur preening. Feeding very vigorously.
8. XI/11/43.	Sixteen days, and seventeen nights.	Seen 3:30 p.m.-6:30 p.m. Feeding hungrily whole time. Looked well though usually thick tail had now become strap-like.
9. XI/12/43.	Seventeen (really eighteen) days, and eighteen nights.	Seen 7 p.m.-10 p.m. Very hungry and lively. Feeding vigorously.
10. XI/13/43.	Actually nineteen days, and nineteen nights.	Seen 4 p.m.-8 p.m., behaviour similar to last.
11. XI/14/43.	Nearly twenty days, and twenty nights.	Seen 3 p.m.-6:30 p.m. Feeding vigorously. Much food consumed now.

In arriving at a fairly reliable, though naturally somewhat approximate, estimate of the incubation period which is my main purpose in listing the above table, it is as well to bear in mind Mr. Burrell's chapter on "Nursing Habits of the Platypus." Quoting from page 184, he says: "The most remarkable and mysterious feature about the baby platypus is that it is not suckled at all by the mother for some days after hatching for the very good reason that the maternal mammary glands are not yet actively functional. Investigations of this extraordinary phenomenon have advanced far enough to place the

Jill is particularly clever at pulling herself out of the water and extracting earthworms from between the author's fingers.

matter beyond doubt, etc. . . . The delayed lactation which I have observed may be due to the incomplete development of the necessary stimulus in the early young. How the young platypus is nourished in the meantime, I do not know."

From the notes in the table it will be observed that Jill concentrated on each of her early outings on an oft-repeated and entirely new habit of scratching vigorously at the area of the mammary glands. It was no mere preening, and probably may have been brought on by stimulus from within requiring a type of external massage. In other words, it is possible that the mother animal may stimulate herself in order to bring about the supply needed by the very tiny, helpless babes. Bearing this in mind and the fact that the mammary glands are not functional for several days after hatching, and the important observation by Caldwell that the egg of the Ornithorhynchus when ready to be laid contains an embryo already in approximately the same stage of development as a thirty-six-hour chick, it seems that Jill's activities indicate a very short incubation period.

The mere fact of a three-quarter-hour absence from the nest on November 6 (her fourth outing), her feeding on that date, and practically daily appearances for increasingly long periods

thereafter, are strong evidence that hatching had occurred at least several days previously. In view of the evidence set out it is not unreasonable to suggest that the longest possible period for egg hatching was ten days and the shortest perhaps slightly less than a week. It is of course quite possible that her first and even second excursions, brief as they were, took place before the hatching point had arrived, and had as their aim the bringing in of additional moisture.

Definite evidence of demands upon the mother's resources appeared from November 6 onwards when her mammary glands were evidently functioning. She began to feed vigorously and to appear regularly for longer periods. An interesting observation was the fact that the times between her outings became progressively shorter. No further scratching of the mammary area was noted after November 7, when the busy little animal spent her whole water periods in continuous feeding.

Carrying on with the tabulated and systematic summary of Jill's activities from the last listed date, the 14th of November we have the following:

Date.	Time Spent in Water.	Behaviour.
XI/15/43.	11:30 a.m.—3:15 p.m.	Fed vigorously.
XI/16/43.	12:30 p.m.—4:30 p.m.	Feeding very keenly on yabbies, worms, grubs.
XI/17/43.	11:30 a.m.—4 p.m.	Same as above.
XI/18/43. XI/19/43.	10:30 a.m.—4:30 p.m. 8:30 a.m.—2:30 p.m.	Jill now left baby or babies in nest for six-hour stretches and was with them for approximately 18 hours.
XI/20/43.	Out early morning hours—11:30 a.m.	Hours in nursery steadily decreasing.
XI/21/43.	Jill out during the night. Out again 5 p.m. onwards.	First time out twice in 24 hours.
XI/22/43.	Out 2 p.m. until dark.	Her appetite greater than ever.
XI/23/43.	Out early morning and all day until dark.	
XI/24/43.	11 a.m. until evening.	
XI/25/43.	12 noon, still out at 10 p.m.	Had been out ten hours continuously feeding and still going strong when last seen.
XI/26/43.	1 p.m. until far into night.	Condition of Jill herself vastly improved. No longer at all worried about nesting burrow. Resuming her old playful ways and leisurely combing herself on landing board at night.
XI/27/43.	Out 3 p.m.—most of night.	Exhibited to public.
XI/28/43.	Out 4 p.m.—onwards through night.	Exhibited to public.
XI/29/43.	Out 2:30 p.m. onwards through night.	Exhibited to public.
XI/30/43.	3:45 p.m. onwards through greater part of night.	Exhibited to public.

Jill had now reached her peak as far as maximum foraging periods were concerned — spending as long as fourteen consecutive hours in the water feeding, with very occasional visits to landing platforms for a little fur preening — while her baby (a single one, as we discovered later) was safely tucked away in its nesting chamber behind safety pugs in the passage way. However, in this process largely performed by the mother's tail, no further abrading of the stiff hair on its extremity — apart from that lost in the winter period — occurred.

With the coming of December Jill's excursions took more of a nocturnal turn. She appeared round about 7 p.m., and stayed all night. There was also evidence on December 2, that she had pulled grass from her wooden burrows into the water and then transferred it as fresh nesting material up the burrow to the nesting chamber. Wisps of wet grass were strewn over the water surface in all directions, and also about the entrance to her burrow. According to calculations about the incubation period, the single youngster (there is yet to be a thorough search of nest débris for egg shells) was now (Dec. 2, 1943) aged four weeks. Jill was very consistent in her outings, appearing each evening between 7 and 8 p.m. (E.D.S.T.) and leaving the youngster to its own devices in the nest all night. She was quite back to her normal outlook on life — gay and carefree in behaviour. Naturally, however, any shortage of food supply on a particular evening would cause her to emerge hours earlier

on the succeeding day to make up the leeway.

On the night of December 7 I caught her for an inspection, noting that her condition was comparatively fat while the abdominal mammary area showed the typical slight indentation with a median growth of rusty-red fur differentiating from the rest of the ventral surface. Domesticated and trusting as Jill is, she objected most strenuously to such indignities as this, so, although I made an attempt to express milk by squeezing the mammary area, I had to desist almost at once.

On December 13 a test feed was given to ascertain the quantity and weight of the assortment of items the little animal was now in the habit of devouring during her nightly banquets. The list included the wireworm larvae of click beetles, chafergrubs, stag beetle larvae, earthworms and land yabbies (burrowing cray fish). The youngster at this date was nearly five and a half weeks old.

It was found that Jill in this one night consumed a typical meal of the following items:

Worms (native species, larger than European earthworm): 400.

Grubs (mainly chafers): 338.

Yabbies: 38.

The total weight of all these items without soil of any kind was 28½ oz., or 1¾ lbs.! Considering Jill's mere 16¼ inches length and her body weight of an exact 2 lbs., when in her fattest condition, this test gives some idea of the amazing appetite of Ornithorhynchus – particularly during some phases of the nursing period. What a terrific time of it mother platypuses must have in their wild state! Little wonder (see later) that some baby animals leave the nesting burrow too soon. Naturally an animal weighing two pounds could not hold a meal of another 1¾ lbs., and it follows that the nursing platypus mother must assimilate the food as she swims and build up her milk supply to full capacity over the extremely long hours (up to 14) of continual foraging.

Energetic Jill actually found time away from her hours of busy mastication to drive into her nesting chamber from an old side burrow which she cleaned out. This was now used as an entrance passage while the original doorway up on the north side of the Platypussary was abandoned. From December 19 onwards with the youngster then approximately 6½ weeks old, there was a noticeable falling off of Jill's appetite. She ate few earthworms, and concentrated mainly on grubs and yabbies. This, together with the abandonment of her former mode of entrance to the nesting burrow, plus the fact that now for the first time since the pre-nesting period she had commenced working soil out of the old living burrows on the South side of the Platypussary, seemed to me, at the time, a very ominous state of affairs.

To make my worries worse a family of Swainson's Phascogales (large pouched mice) of insectivorous and occasionally carnivorous tastes, had taken to living in and about the Platypussary, and naturally I imagined that perhaps they had even tasted tender young platypus! Beyond a good appetite Jill gave few signs that she had any family responsibilities. She was to all intents and purposes an ordinary platypus citizen. As we discovered later, her labours on the Southern side of the Platypussary, when soil would occasionally be pushed back for 18 x 6 x 6 inches into wooden "burrows" connecting with the water, were devoted solely to the purpose of making pugs for yet a third route of daily egress from, and entrance to, the nesting chamber.

I could sometimes watch her at work blocking up the passages – a small creature of marvellous strength and industry. In view of later knowledge, the comparative falling off of Jill's appetite was probably connected with the stage of growth attained by the youngster. Mr. Burrell (page 189) remarks: "A rapid rate of growth in the early stages but such rapidity is explained by the fact that when once the young commence to suck, their appetites increase rapidly. The quantities of food found in their stomachs on dissection are surprising."

It is indeed very probable that once having attained a certain size, with fur beginning to make an appearance, the youngster enters a quiescent phase, requiring less nourishment than previously. In any event, it was true that leading up to the stage of five to six weeks, Jill's baby required a phenomenal amount of nourishment. However, in our general ignorance at the time of Jill's late December activities, or shall I say, lack of extra activities, time dragged and I

Samples of the food of the platypus—land yabbies (burrowing crayfish) and earthworms. During December of last year it was a common thing for Jill to devour one and three-quarters pounds of such food each night, although her own body weight was only two pounds. She fed voraciously to keep up her milk supply for the young platypus.

became an impatient and badly disappointed observer.

The days went by until the calendar registered January 3, which would make the inmate or inmates of the nursery at least 8½ weeks to 9 weeks of age. It seemed that Jill must have failed, particularly in view of Mr. Burrell's statement (page 188): "About six weeks after hatching the young will have reached a length of twelve inches . . . by this time their eyes are open, their fur is quarter of an inch in length, and they are able to crawl freely about the burrow."

In any case it now seemed that in the interests of finding some record of Jill's underground activities, the nesting burrow should be opened. With great care, then, we began this delicate operation on January 3, carefully removing the firm ground from the extreme back of the Platypussary so as to avoid as far as possible interference with any tunnels leading to the nesting chamber. High up near the passageway used during and after the incubation period, we found a deserted composite nest of grass and leaves. Possibly this was a nest from the previous year and we had not seen her carrying in the material.

In any case it did not improve our prospects. We dug on – not so carefully now, and found we were following a burrow that ran well below the surface on the Southern side of the burrowing bank. On its floor was a good deal of well-worked, bone-dry floury earth that tells of frequent working and pugging. Suddenly, in the bend of the burrow, dry leaves showed up, there was a shrill sustained growl of annoyance (like that of a broody hen) and Jill's beak and head poked out. To our delight (and horror also!) there bulged out, and was pushed out as Jill in her rage turned her back and began to throw out nesting material and earth to block out the daylight, a blind, fat, wrinkled babe with satiny, short fur, forming a very thin coat.

The baby creature had a tiny, stubby "milk bill" aptly likened by my assistant, Mr. Milne, to the beak of a Cape Barren goose. Here at last was actual proof that we had really bred the platypus. It seemed also that we had wrecked all our chances of complete success by unwittingly breaking in too soon. At eight and a half weeks this youngster was only nine inches long and entirely helpless – its only utterance a kiss-like sucking sound, and its only movement that instinctive lifting of a hind foot to go through the characteristic motions of scratching the fur on its flanks. On the ankles of its hind feet tiny spurs were visible.

A frantic few moments followed with the camera recording half a dozen hasty pictures. What would Jill do? She had already thrown out part of her nest and blocked the way by which we had disturbed her. We thought at the time that in with her was another infant, or perhaps two, but later observations proved the baby we photographed to be the only one. I scraped away her hastily-constructed "pug," and endeavoured to replace the baby. However, she persisted in her "back-shoving" and buried the baby with earth. I repeated the performance, got the baby fairly well in, and then built a "pug" of my own, so as to block it in. Then we fitted a hollow log over the spot and filled up with an overburden of earth and old bags.

As one can imagine, our feelings were very dubious. What good all the notes so far if Jill did not rear this little fellow? I called back that night after dark to see if Jill had pushed the baby out into the loose soil in the hollow log, and it was of some slight reassurance to find that she had not done so. Evidently she was in a considerable turmoil of mind over the event, for an hour after we had replaced the youngster in the burrow at midday, Jill appeared in the water in obvious agitation.

And hers was not the only disturbance of mind! We had staked everything on a successful issue with the platypus – even to almost ruinous expenditure from slender Sanctuary financial resources – in purchasing food that cost at least £1 a day, and in dry summer months 22/- to 25/-. It seemed that it was this season or never, and in spite of all, this season it was!

Following several weeks of doubt and worry, subsequent to January 3, it was found that Jill had re-established her quarters and maintained her youngster in spite of the general upheaval. Considering that this small mother animal is a member of such an exceptionally nervous species with probably no temperamental equal among the world's furred animals, no tribute to her mothercraft can be too high in view of her actions following the breaking-up of her home. Here, in the survival of her helpless youngster, is noteworthy evidence of a strong maternal instinct in the platypus – one reason, perhaps, why this ancient species has managed to survive and even thrive in modern days. Why, even a tame doe rabbit would probably have deserted her brood had her nest been interfered with as had Jill's!

For several days after the disturbance I could hear her towards evening through the walls of the dwelling, excavating passages and also pugging up the outlet near her entrance to the water, as she prepared for the night's feeding activities. Actually it was not for two days after the January 3 inspection that Jill got back into her normal habits of feeding. The night following the excavation of her nesting tunnel, she spent within the burrows, evidently keeping the youngster warm, for later inspections revealed that in thoroughly pugging up the original entrance that I had ruined, she pushed out her whole nest and much soil beside. Then she dug a new entrance and exit burrow to the nesting chamber on the side opposite to the original one which we had unwittingly destroyed. For weeks,

Mr. Fleay extracts "Corry," the baby platypus, from the nesting chamber. This shows a section of the interior of the burrowing bank at the rear of the Platypussary. Some of the leaves carried into the nesting chamber by Jill, as a bed for her baby, may be seen at the left of the little animal. Jill always protested a removal.

then, the youngster was entirely without bedding of any kind until, on the next inspection, I provided a new collection of leaves which Jill accepted quite gratefully.

On January 3 it was found that the youngster, whose sex at that time could not be determined, but which we now know by the disappearance of its spurs to be a female, had attained a length of nine inches and was blind and entirely helpless, with a very short growth of satiny fur at the age of eight and a half weeks.

Such observations and others to follow do not agree entirely with Mr. Burrell's notes on incubation and adolescence, but, as I mentioned previously, this is not surprising, for throughout his long and careful work resulting in the classic book on the platypus, Mr. Burrell did not have the good fortune to keep a breeding platypus where he could watch it. He had to make his estimates from laborious field study over long years, for which valuable work naturalists the world over, and I particularly, are grateful to him.

From mid-January onward, Jill's furry coat took on a very sorry appearance. This was partly due to the arrival of the moulting period. Each year in Southern Victoria, towards the end of January and the beginning of February, platypuses lose their old coats and rapidly grow new ones. Worn patches on tails are covered by a fresh growth of hair in a very short period, and it is no time before a platypus is clad in a new and glossy coat of superb fur.

Jill, with her domestic cares, was terribly "moth-eaten" and ragged, but extremely cheerful, with a streaky worn patch from shoulder to hip along the left side of her body. This was evidently due to some position adopted in the

burrow, or to some activity on the part of the baby. About the middle of February her new coat began to cover these marks of wear and tear.

Evening after evening when I arrived at the swimming tank before her advent in the water, her progress along burrows could be marked by careful listening. The digging and scrambling noises as Jill dug through the earth blocks in the burrows and pushed them back again after her were unmistakable. The fairly frequent dog-like shakings of her body to rid herself of loose earth during these operations sounded at close quarters like distant thunder.

The second inspection of the youngster (when all doubts as to its safety were dispelled) took place on the evening of January 26. It was obvious that by now the youngster should have made considerable progress, and since mid-January the mother's appetite had increased until she was demanding almost as much as she did in late December, 1943. On the evening of the second parade of the youngster, Jill had already journeyed into the water where she was "splash-diving" in mock alarm and rolling and twisting between submerging for food items.

Now aged eleven and three-quarter weeks, the youngster measured eleven inches in length, its fur had grown longer on the body regions but not on the tail. Little development of the short, stubby beak had occurred. Its eyes had not been long open, probably not more than four or five days, so that it could be reasonably assumed that the young creatures spend at least eleven weeks in a state of blindness. The striking thing in the absence of the mother on this occasion was the almost reptilian coldness of the baby.

Generally speaking, the little fellow was much less fat than when first seen – its tail now being more flat and platypus-like than the roly-poly sausage-like appendage noted on January 3. Also, though no longer blind, the young animal possessed no power of locomotion, and again went through the curious instinctive action of scratching at its flanks with its hind feet. When my wife held it, it pushed its short stubby beak down on the skin of her arm. Its only reaction to the disturbance was to growl shrilly when first touched in the burrow. In the absence of a nest – a situation that was soon remedied – dry earth from the floor of the chamber had caked into hard mud over the doubtless oft-wetted bill and nostrils of the baby. This was removed.

Jill's feeding periods were regularly from ten to twelve hours in extent, commencing toward evening and extending through the night. The evidence of various fecal deposits in the water (the pools being cleaned daily) indicated that as usual she masticated and assimilated food continuously throughout the nights in order to build up the all-important milk supply.

The third inspection of the baby was made easy by the fact that I had a bag "plug" in the back of the nesting chamber – this in turn being buried under a weight of soil, for it is very obvious that in some mysterious way a platypus senses the thickness of soil between itself and the surface. Jill evidently became more or less reconciled to these visits, for beyond a little shrill growling she was not unduly upset. The date of the third visit was February 8, with the baby now thirteen inches long, eyes quite bright and alert, and its age thirteen and three-quarter weeks, or slightly more than three months.

The youngster was three inches longer than had been Jill herself when picked up, six years ago, on February 19, 1938. On scraping away the soil immediately adjoining the leaves of the nesting chamber "bedding," when opening up for each of these inspections, it was extraordinary to feel the intense warmth that had emanated from the closely curled mother and baby. This in itself, even before sighting the animals, proved a certain indication that they were at home.

The baby was now a young platypus with a fairly straight though short bill, long and very handsome fur, and it was certainly a female, for the small spurs on the ankles of its hind feet had shrunk away to mere hard stubs. Remarkable to relate, the animal still did not show any sign of activity, remaining curled up in the typical platypus ball in the nest. When taken out, it seemed capable of only very slow movements – again tending to use its hind feet in the pathetic, useless and almost reflex scratching motion.

There was little doubt that it had not yet left the nest even to crawl about the burrows. On this occasion, while we had the baby out to secure a few photographs, the bag plug was not replaced in the hole. When we returned with the baby Jill had already sealed it up with soil

from within. She could not comprehend that the youngster was still outside!

Friday, February 18, was the date of a fourth visit to the baby Ornithorhynchus. Jill was now showing definite evidence of her new coat. The bare patch on her tail had grown over, and her general appearance was much more neat and tidy. The youngster now measured 13½ inches at fifteen weeks of age. Its fur was long and glossy, beak better developed, and now its powers of movement were much more pronounced. Jill seemed fonder than ever of her almost adolescent child, and refused to move out of the nesting chamber at all. Her mammary glands were obviously still functioning quite well, for she still stayed out all night consuming quantities of food as huge as the tested meal of December 13. Once again the baby's nostrils and upper beak were caked with hard mud. Attempts to express milk from Jill's mammary area were unavailing as, quite rightly, she objected most strenuously, and it would have done harm to have held her by force.

The fifth appearance of the young Ornithorhynchus was a notable one and took place on February 22, when it was aged just over sixteen weeks. On this celebrated occasion Herald Cinesound News Reel photographers came by arrangement and filmed the baby (not in the water of course) and both its parents. Jill rose to the occasion in a most spectacular fashion. The little fellow was noticeably active on this day, and when placed temporarily in a large tin filled with dry grass, it tried repeatedly to crawl out over the top. When replaced in the nest it crawled out of sight into the burrow, but a further peep that night revealed that the comfort-loving little creature had returned to curl up on its bed of dry leaves while poor Jill was out as usual hunting for its nourishment in the water.

On this occasion (February 22), when feeling for the baby in the nesting chamber, the youngster had grown to such a bulk that I almost confused it with its mother. Jill, by the way, put on in this instance a remarkable display of mock ferocity. Each time my questing fingers entered the burrow, she seized them in her rubbery beak and endeavoured to remove them from the nesting chamber. In fact, she literally "ran" me out of the burrow to the accompaniment of shrill growling.

There was now little doubt that the youngster could, if it wished, enter the water and eat adult food. Its weight was just half an ounce off one pound, and its length thirteen and a half inches. For the past fortnight Jill had made no attempts to pug or block off the burrows. There is apparently a definite relationship between the amount of food that it is possible for the mother animal to procure, and the particular time at which the youngsters depart to make their own way in the world.

Over the past six years I have noticed that a number of very undersized and miserable baby platypuses (Jill among them) have been discovered in all sorts of odd places in the Healesville district between the times of late January and mid-February. Some have been in a dying condition when caught. Two that we found in Lake Yumbunga, Chum Creek, Healesville, were so weak that they were picked out of the water by hand.

Evidently, then, unless something happens to the mother, or for reasons of a diminishing food supply, when the youngsters are forced to move out prematurely, they stay in the nursery for a long period (in this case 17 weeks) and when finally taking to the water at 13 to 14 inches in length, they are thoroughly well grown and able to care for themselves. In the case of Jill's baby, the mother herself lacked for very little in the way of food, and she had no distance to go and gather it, so that the youngster, itself the sole member of a family which in the wild state usually numbers two, enjoyed conditions of the very best. It left the tunnels for its first observed outing in the water at 5:15 p.m. (E.D.S.T.) on February 26, unattended by the mother, and immediately commenced feeding sparingly upon small yabbies, beetle larvae and other items of adult food. Its length was still 13½ inches, and its age corresponding to the length of time it had spent in the nest was seventeen weeks. Its weight at this time was 1 lb.

In fact, the date of its debut was just a day over four complete months since the famous October 25 when Jill retired to lay and commence her period of incubation. There is little doubt that for about sixteen weeks the young animal remained immobile in the nesting cham-

A closeup of "Corry," taken on the same day as the picture that is the frontispiece of this article. The beautiful glossy fur of the sixteen-weeks-old platypus is noticeable, as are the ear and eye openings.

ber, feeding from its mother during her presence at home, but otherwise curling up and spending its entire time asleep in the nesting chamber.

The excursions of the little fellow into the water, beginning in the late afternoon of February 26, by no means ushered in a new phase of independence, though doubtless many young platypuses, particularly those found wandering some distance from water, lose contact with their mothers at this stage, especially when the nesting burrow entrance is many feet from the water's edge up a steeply sloping bank. I recall that all the well grown young platypuses I have captured in Healesville streams during the month of March have been on the thin side, with strap-like-tails, which seems to indicate that the good condition of nest-leaving young is a prerequisite towards the difficult early stages of enforced independence.

The little lady's activities over succeeding days, to the date of having these notes typed, may be summarized as follows:

Date.	Time Spent in Water.	Activities of Young Animal and Mother.
1944 Feb. 26.	First outing 5:15 p.m. In before 8:45 p.m.	On each date the mother animal appeared in the vicinity at 7 p.m., eating all night through as she had done previously. During daylight she and baby were curled up together as usual in the nesting chamber. As usual Jill seized my fingers when I opened the bag plug in nest and endeavoured to "run" me out. This maternal solicitude, her continued enormous appetite, and the fact that the youngster ate only a small amount during its two or three hours abroad at night, indicated that she was still nourishing it on milk. The weaning period had evidently begun.
Feb. 27.	Out 7:15 p.m. In before 10 p.m.	
Feb. 28.	Out 7:15 p.m. In before 9 p.m.	
Feb. 29.	Out approx. 7:30 p.m. In 10:15 p.m.	
March 1.	Brought out for first public swim, 3:30 p.m. Not seen in evening.	

In the water at night Jill played with her daughter, swimming about it and nuzzling it with her bill, and once or twice she playfully pulled it off landing stages. There was no evidence that she masticated food for it, or foraged for it in any way. Both animals frequently splash-dived, Jill in mock alarm, but the youngster quite frightened on occasions. It was very clear that the fat, healthy little creature became both fatigued and very cold after a three-hour swim in the evenings of these early days.

Sure signs were a humping of her back, repeated attempts to scratch her flanks and back with the claws of her back feet. These symptoms foretold an early departure into the burrow. Jill was rather an unsympathetic mother on various occasions, and levered her tired offspring back into the water once or twice before it was able to retire, and then pushed her head after it into the tunnel as much as to say "What! So soon?" It will be interesting to find out how long her maternal solicitude continues. Apropos of this, it happened that on March 6, 1937, I dug out a platypus burrow in the banks of the Barwon River, South of Winchelsea, Victoria, and found there in a nest at a burrow terminus, a fine female animal with a young male duckbill practically the same size as herself. What he was doing in the nursery at that advanced stage has often puzzled me. It seemed probable that he was still tied to his mother's apron strings.

Finally it remains to give Jill's baby a name. Now that the youngster has ventured into the world, she becomes a personality. Probably by the time these observations are published the christening ceremony will be a thing of the past. The youngster is to be called "Corry," an abbreviation of "Coranderrk," – aboriginal term for "the creek of the Christmas Bush" (Prostanthera), which is actually the name of both the Sanctuary and adjoining forest lands through which runs Sylvan Badger Creek.

The Fox Maintains His Reputation

THREE WORKERS out on the tundra noticed a fox seated on its haunches some distance away. The men stopped work and coaxed the animal closer by tossing bits of ration biscuit. Shortly it was eating from the tips of the fingers on an outstretched hand. Now, the man who was doing the coaxing had ideas of capturing the fox for his pet and more than once made a grab for the animal with a heavily-gloved hand. But as quickly as he moved, just as quickly moved the fox, so it developed into a sort of game, the fox coming back each time. Then the men decided to make a snare of their combined bootlaces. They put the loop on the snow, put some biscuit in its center, and stood back holding the slip line. Up came the fox, but at the moment he started to cross the snare, he stopped and sat down just clear of it. After a minute, he raised up a paw and brought it down in a side swing that dragged the snare away from the bait. Without more ado, he grabbed the bait and jumped back.—*Ralph James Donahue*, CM 2/C (D-4), in a letter to Dr. William Beebe from Somewhere in the Aleutians.

An animal artist himself, Mr. Wilwerding takes a look at the drawings and paintings that have interpreted animal life to us in the past.

A Short Account of Zoological Illustration

By WALTER J. WILWERDING

THE ART OF DRAWING and painting pictures of animals is not new. Cavemen drew recognizable pictures of animals, and the ancient Egyptians painted birds and animals that are found in Africa today and may be readily identified in these early paintings. But it was not until after printing was invented that any serious attempt was made to describe animals and their habits, and illustrate these descriptions with pictures. As might be imagined, the first books on natural history were lacking both in authentic information and pictures that resembled the animals. There were unicorns with horns growing out of foreheads and, even when the artists learned that a rhinoceros did not look like a horse, that animal was shown with armor-plated sides studded with rivets.

Most of the earlier pictures of wild animals, from Africa, Asia and other parts remote from Europe, were drawn from imagination and inadequate descriptions of the beasts, brought home by travelers who had seen them in their native haunts.

Gradually, as strange animals were brought to Europe, artists began drawing and painting accurate pictures made from life. Rembrandt drew some very good pictures of camels and other animals that he saw in zoological collections. There were of course a number of good artists who painted domestic animals in the sixteenth, seventeenth and eighteenth centuries, but it was not until the nineteenth century that artists really seemed to take an interest in painting authentic pictures of wild animals. That century produced some of the outstanding animal artists of the world. Zoological collections had grown, living models were available and animal art flourished.

The naturalist-artist John James Audubon (1780-1851) was a pioneer in painting his subjects in the wilderness where he found them. Audubon was a hunter and pursued his work under conditions that would have tried the patience of any but one who possessed his zeal and courage. He truthfully painted the birds and animals that fell to his gun, working more in the tight, detailed manner of the scientific illustrator than for pictorial effect. His work was published in England in what is known as "the elephant folio," showing American birds in life or almost life size. This folio is now rare and very expensive.

In 1900, Audubon's animal illustrations were used in John Burroughs' book "Squirrels and other Fur-Bearers." Recently, the bird pictures from the elephant folio have been published in book form by the Macmillan Co., which was followed by another book showing his paintings of animals. Thus his work has been perpetuated and made available to all.

Interest in animals appears to have been at a high pitch during the nineteenth century, since

A wood engraving of "Bonnet Monkeys" by G. Mutzel, from "Animal and Bird in Picture and Word."

In 1890 Sir Samuel Baker's book "Wild Beasts and Their Ways" was published in London. He had a wide experience in hunting animals in Africa, America and Asia and the book is filled with accurate information obtained first-hand in the hunting field. The very good pictures were done by H. Dixon, and reproduced by the woodcut process.

Everyone is no doubt familiar with "Wood's Natural History." Just what this natural history was like in its original printing is difficult to say, but there were many reprints, mostly put out in cheap editions and apparently for young people. My own copy carries an 1898 copyright and was published by Conkey of Chicago. The pictures are in line and apparently chalk plates. Most of these are not bad in drawing, but are not signed. The book is without system and one turns the page describing a lion or other such animal and finds a snake or bird on the next page. Much of the text appears to begin in the middle of things, as if the information were plucked from longer descriptive matter. There were also smaller editions of "Wood's Natural History" and in some of these the work of Specht and other artists was used.

Many of the colored illustrations that appeared in early works of natural history were reproduced by the old stone lithography method, and this method produced beautiful results when handled properly. We recall a small album of animals that was printed by the Knapp Litho. Co. of New York, in 1900. It was called "Arbuckle's Album of Illustrated Natural History," which should bring a touch of nostalgia to older readers, for one obtained it by sending a certain number

Gronvold's illustration of "The Blue Wren" in Aviculture Magazine of 40 years ago is typical of his style as a technical illustrator.

"American Flamingo at Home," Andros Island, Bahamas, by Louis Agassiz Fuertes. Zoological Society collection.

"The California Condor at Home," Sierra Nevada Mountains, California, by R. Bruce Horsfall. Zoological Society collection.

"Polar Bear" from Kane Basin, a painting by Carl Rungius in the Zoological Society's collection.

"Lioness and Cub," by Charles R. Knight.

of wrappers from Arbuckle's coffee. There is no mention of the writer who furnished the natural history information that accompanied the pictures, nor are the pictures signed, but it is plain that the source for the pictures was Specht. No doubt the artists with the Knapp Litho. Co. copied the pictures from Specht's woodcuts and painted them in color. In most cases the colors are quite correct, but there is a dark brown snow leopard and a few other animals that are far from right in color. With the few exceptions among the fifty animals shown, this is a beautiful job of stone lithography. The colors in my own copy, obtained by the coffee wrapper process, are as good today as they were in 1900 when I first opened the album to gaze at the pictures with wondering eyes.

The use of halftone was coming more and more into usage in those days and woodcuts were going out. Something, too, happened to natural history writing. Ernest Seton Thompson, whose later work was signed Ernest Thompson Seton, brought out a number of books about animals in story form, illustrated with his own drawings done in pen and wash. Will Long also wrote a number of books describing his own experiences in the woods with animals, which were published by Harper and were beautifully illustrated by Copeland. Others followed the example set by these writers, and similar books, carrying animals through their experiences in story form, were written by Charles Roberts, Samuel Scoville, F. St. Mars, J. O. Curwood and others.

About this time the work by Charles Livingston Bull came into prominence and many of these story books about animals, and similar stories that appeared frequently in magazines, were illustrated by him. Much of this work came out in the period between 1910 and 1930, twenty golden years for animal illustrators that brought to fame not only the work of Charles Livingston Bull, but also that of Paul Bransom, Lynn Bogue Hunt, Bruce Horsfall and others who specialized in animal pictures. Photography was no competitor, for these were action stories about animals and no one has as yet found a way of posing wild animals so they can be photographed to illustrate an episode in a story. Yet, when we look at a colored motion picture like "Jungle Boy," we wonder whether it could not be accomplished, even though at a terrific cost.

The first indication that photography might prove a competitor for the animal artist in natural history illustration came in 1902. At that time, "The Living Animals of the World" was published by Dodd, Mead. It came out with a fanfare to tell the world that here was a book with no pictures that were drawn from an artist's imagination, no sir! these were actual photographs. The book was a disappointment then and still is. Some of the "actual photographs" of fish were made from badly stuffed specimens. Many of the illustrations do not show the birds and animals at their best. It looks like a collection of photographs that were picked up here, there and everywhere. It seemed sufficient that these were pictures of animals. How good they were, apparently did not matter. A number of colored illustrations are obviously from paintings, though purposely left unsigned. This is quite obvious in looking at the cassowary, lizards, indigo finches, waxbills, etc., all in color and all certainly by artists and not photographers.

In 1905, C. G. Schilling's book "With Flash-

"Woofover," by Paul Bransom, is from "Brownie the Beaver," by Allen Chaffee, published by the Milton Bradley Co.

light and Rifle" was published by Harper. It was the result of one of the first attempts to photograph animals in the wilds of Africa. He must have worked under trying conditions and with inadequate film, for most of the photographs are fuzzy and out of focus.

The work of Martin Johnson is too well known to need description. Suffice to say that he not only took good pictures of wild animals, but he seemed to have an uncanny sense for the picturesque and a great many of his photographs are unusually beautiful in pose and setting.

Despite the inroads of photography in natural history illustration, it will be difficult for photography, colored or otherwise, to compete with the fine work of men like G. E. Lodge, Archibald Thorburn, H. Gronvold, C. R. Knight and H. Jones, who illustrated W. Beebe's "Monograph of the Pheasants" published about twenty years ago, and the later condensed volume "Pheasants, Their Lives and Homes." These are something else than just pictures of birds. They show the birds at their finest, in their best pose and with beautiful backgrounds. The photographer might succeed in getting a picture of the bird, but the combination of showing the bird at its physical best, in a typical pose, and with good composition and pleasing background, is something that the camera will catch only rarely.

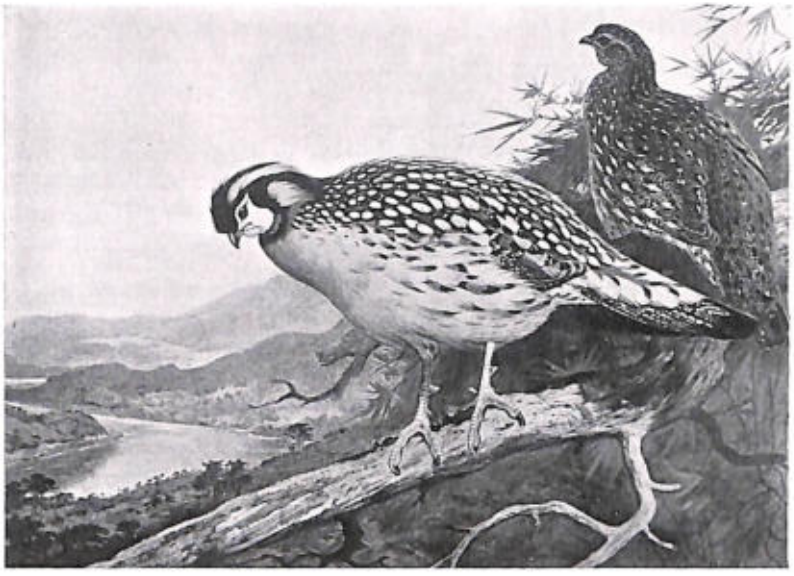
Charles Livingston Bull's style is well shown by this drawing of a Harpy Eagle, now owned by Dr. William Beebe.

One would have to go a long way to find a work on ornithology as beautifully illustrated as is "British Birds," in four volumes by Archibald Thorburn, published in 1931 by Longmans of London. Thorburn drew from the birds, and not from imagination. He is a master of pose, which can make or break a bird painting. In addition, his settings are beautiful and where he can he adds a few wild flowers to enhance the setting.

The work of Francis Lee Jaques is also outstanding, both in the field of bird and animal illustration. His bird pictures in Dr. Roberts' "Birds of Minnesota" are little masterpieces. Jaques, who for many years worked on habitat groups for the American Museum of Natural History, goes to considerable trouble to gather his material. He traveled to Newfoundland, Central America, the South Sea Islands, to the British Isles and Switzerland, as well as from north to south in our country, to prepare for his pictures. The result is authentic birds in authentic settings, not stiff and formal, as in many bird plates, but with proper composition, natural attitudes and settings that sing of the outdoors.

The late Louis Agassiz Fuertes was another zealous worker in the field of bird painting, whose illustrations filled many volumes. He too traveled far to obtain the specimens and proper setting for his pictures. South America, Mexico and Africa were fields for his brush, as well as many parts of our own country. He collected thousands of specimens and painted careful studies for reference in his finished paintings.

Carl Rungius is known as a painter of big game animals rather than as an illustrator, but his work has been used to illustrate articles and books on natural history. The wilds of Canada and our own country are his studio. There he



"Cabot's Tragopan," by Archibald Thorburn, from Dr. Beebe's "Monograph of the Pheasants."

has found his models and the authentic backgrounds in which he places his subjects.

Carl Rungius goes to the wilds because his models are rarely found in zoological gardens and he feels that his animals pose better in the wilds than in zoo paddocks. Also, he says that "the setting is practically as important as the animal itself."

Animal pictures as produced by Rungius, Kuhnert, Thorburn, Jaques, Bransom and other masters of this art will always stand by themselves. Photography will never replace these, since animal drawing and painting are not simply a matter of showing an animal in a picture. The artist deals with pose, composition, color harmony and proper accents. No mechanical device that was ever invented can take the place of the artist's ability to arrange a picture. The camera takes what is set before it and only that.

There is at present a crying need for some learned zoologist to write another great work on the natural history of the mammals of the world. Most of the great works mentioned have long been out of date and the information is inadequate, since the wilds of the world have long been opened to man and much more complete information is now available. You will look in vain in the works of Vogt, Brehm, Lydekker and others, who compiled their information in the 'eighties and 'nineties of the last century, for information about the Bongo, Okapi, Pygmy Hippopotamus and other beasts that were discovered after those natural histories were written. There is no mention of the Lesser Kudu and other well-known animals. Even much of the information given about animals that were known at that time is very meagre and there are many descriptions that end with, "Little is known about this animal in its natural habitat."

A work of this kind, well illustrated with colored pictures painted by outstanding animal artists and, perhaps, some of the good photographs that have been taken of animals in zoological gardens and in the wilds, by photographers who know their business, would do much to bring the natural history information of the mammals up-to-date. One who knows what he is writing about, and artists who know their animals, are needed. This combination should not be difficult to find these days.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

NEW MEMBERS OF THE SOCIETY

New members of the New York Zoological Society since the last issue of this magazine are the following:

Fellows

Dr. Arthur A. Allen
Dr. Alfred E. Emerson
Dr. Leonard J. Goss
Dr. W. A. Hagen
Dr. Daniel Merriman
Dr. David Nachmansohn
Dr. J. F. W. Pearson
Clifford Pope

Life

José Maria Sainz G.
Mrs. Mary VanderPyl

Annual

Donald Wilson Cragin
William A. Eldridge
Barney Figowitz
Mrs. Pearl Goldberg
Jack Lesser
Gustaf A. Nyden
Jack A. Saul
Dr. Ernst Schmerl
Riley Stanley
Harold D. Tompkins
W. O. Whitfield

"JUNGLE PEACE" GOES OVERSEAS

Dr. Beebe's book, "Jungle Peace," has just been republished by the Armed Services Editions in an edition of 75,000 copies for free distribution to the soldiers and sailors overseas. These special service editions are paper-bound, printed in clear type, measure 4 x 5½ inches, weigh less than 2½ ounces, and cost only 7 cents to manufacture.

The book originally was published by Henry Holt & Co. and has gone through twenty-one editions. It is concerned with the work of our Department of Tropical Research in British Guiana.

NEW TECHNICAL PAPERS

Published in *Zoologica*, the quarterly scientific journal of the New York Zoological Society, were the following papers:

New American Cerambycidae (Coleoptera) from British Guiana and Costa Rica. By W. S. Fisher.

Cerambycidae (Coleoptera) from Caripito, Venezuela. By W. S. Fisher.

The Metamorphosis of *Synodus foetens* (Linnaeus). By C. M. Breder, Jr.

A Revision of the Family Nectariniidae (Sunbirds). By Jean Delacour.

Two New Species of Fishes (Gymnotidae, Loricariidae) from Caripito, Venezuela. By Leonard P. Schultz.

A Melanotic Tumor in the Silverside, *Menidia beryllina peninsulae* (Good and Bean). By Ross F. Nigrelli and Myron Gordon

The papers were published in Vol. XXIX, Part 1, on May 10.

HARRY RAVEN

Afflicted with a variety of obscure tropical infections incurred in the course of his travels in remote parts of the world, Henry Cushier Raven, Curator of Comparative Anatomy at the American Museum of Natural History and Associate in Anatomy at the Zoological Park, died on April 5, 1944. On May 8 several hundreds of his relatives, friends and collaborators gathered at the Museum to honor his memory. Eight men of note, all from different though related fields of endeavor, spoke of "Harry," as he was usually known. All were in difficulties in the search for words. Not, however, the usual difficulties of encomium-hunters, who fumble for kind things to say of the departed. This time, the fumbling was a sincere acknowledgment of the impossibility of expressing the high regard in which Harry was held. Words of praise were spoken and the finest things one man could say of another were said. But unspoken thoughts, for which expression could not be found, remained in the minds of all.

Harry Raven would never have done for Hollywood. In fact, no one but a fellow explorer, without previous acquaintance would ever have judged him for what he was. Slender, of medium height, with quiet, self-effacing bearing, there was nothing of the accepted idea of an explorer about him. But there was a something in those clear blue eyes that keyed the character that lay behind them.

Just under 55 at the time of his death, Harry Raven had seen more of the world than most men see in greater spans. Australia, the East Indies, Africa, Asia and Greenland, all had been the scenes of his activities. Always willing to share his knowledge, Harry was the first thought for aid in the solving of knotty problems. All will regret that much of what he knew will never appear in print.—*Lee S. Crandall.*

RANIGANJ MEETS THE WORLD—ONE OF THE THREE BABY TIGERS NOW ON EXHIBITION IN THE ZOO

NEWS OF BERLIN ZOO

American newspapers some time ago reported that Allied airmen had heavily bombed the neighborhood of the Berlin Zoo but few details of the damage done were available. Apparently more was learned in London, for Captain Delacour has received from a friend on the London Zoo staff the following account published in a London newspaper:

No More Zoo

All plans for reopening the Berlin Zoo in the spring are now temporarily abandoned.

Professor Heckt, head of the zoo, announces that it is impossible so far to get new glass for the wrecked bird house and that new damage done to the zoo in the most recent raids would mean "entirely rebuilding the lion cages, the elephant house, the antelope house, and the snake house."

Heckt says an artificial mountain had been built out of rubble from the damage in previous raids and was to be used by various goats and other mountain animals that survived. The bombs last week knocked the artificial mountain down.

The only exhibits now in the zoo are a few squirrels, two or three rabbits, some porcupines, and two shell-shocked apes.

The principal occupants of Berlin Zoo, or what is left of it, are hundreds of rats. The number of rats in Berlin – meaning the four-legged ones – is rapidly increasing. Large quantities of rat poison are being distributed among the ruins, but the rats still scamper in droves across the city.

PUBLICATIONS OF INTEREST

LIFE WITH ALICE, Forty Years of Elephant Adventures. By DICK RICHARDS. 67 pages, 24 illustrations. Coward-McCann, Inc., New York, 1944. $2.00.

As far as I know, this is the first time any animal keeper in any Zoo has written a book about his experiences – for Author Dick Richards is *our* Dick Richards, keeper of our Elephant House, and his forty years of elephant adventures mostly were passed in the Bronx Zoo. Any other animal keepers who hanker to follow in his trail will do well to read his "Life with Alice" and model their tales accordingly, for this unpretentious account fairly shines with the essence of good keepership – a sympathetic, understanding, affectionate relationship between the man and his animals.

Dick Richards started his animal career as a circus man and began learning about elephants back in 1905, in the old Hippodrome. He made all the classic mistakes – tried to push an elephant into position, got his foot stepped on by the pachyderm, was caught in the middle of a stampede. But he learned about elephants.

Later he took a job at Coney Island as an elephant man and he tells the story of how he talked Dr. Hornaday and Dr. Blair into buying the troublesome Alice for the Bronx Zoo – with the sequel that when Alice wrecked our Reptile House, Dick was summoned to handle her, and stayed on at the Zoo.

That was in 1908 and the rest of Dick's forty years with elephants have revolved around Alice and our Elephant House. He tells the stories of all of Alice's escapades of those years and a few yarns about his other pets – particularly, Pete, the hippopotamus. The death of Alice last year was a hard blow to Dick. Young Judy occupies Alice's stall now and she is a good elephant . . . but she isn't Alice.

"Even as I feed her and do the things for her I did for so many years for Alice, I sometimes almost seem to hear Alice chirp at me, asking for her hose. Or, when someone shoves a pail across the floor, I seem almost to hear her shoving hers around. And I wish that I could feel her trunk in my pocket again, searching for something to eat.

"I'd give a dozen Judys, and almost anything else, I think, except, perhaps, old Pete, to feel Alice's trunk doing that once more."–W. B.

ANIMAL FACES. By R. MARLIN PERKINS. Foster & Stewart, Buffalo, N. Y., 93 pp., 84 photos. $1.50.

The author and photographer responsible for this little book of animal photographs was Curator of the Buffalo Zoological Gardens and formerly was Curator of Reptiles at the St. Louis Zoological Gardens. His long experience with wild animals has given him an excellent background for judging their emotions, disposition and character.

The introduction sets forth the author's contention that the facial expression of an animal gives a good clue as to what is going on in its mind and the amateur observer is told what to look for in attempting to "read the faces" of a number of different animals. The eighty-four portraits of mammals, birds and reptiles make an interesting collection. Of these the Chimpanzee provides the most enlightening series. But each and all of them give good opportunity for the study of animal character.–C. W. LEISTER.

ANIMAL KINGDOM

BULLETIN OF THE
NEW YORK ZOOLOGICAL SOCIETY

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Handsome Does As Handsome Is

Of all public institutions, a Zoo is no doubt the liveliest. It isn't just that the animals are all about. Somehow or other, barely a day goes by that something unexpected doesn't occur. Of course the animals are primarily accountable for this, for there is nothing dull about wild animals. They produce a constant succession of new situations, mostly minor ones, occasionally major ones. However, this is not intended to be of animals – but of people.

In this regard an agreeable and heartening thing happened this summer, at the reopening of the Reptile House. The interior had been renovated during the winter and this included a new treatment of the alligator pools. They had received general tidying up, new, tastefully planned rock work was built in, nice planting, in effect, just a general beautification. For ever so long these alligator pools at the end of a crowded Sunday were a sorry sight, floating with odds and ends of rubbish tossed in by an indifferent public, but on that first Sunday after the reopening, the near-miracle occurred. A great crowd filed through the building the whole day long but at closing time the pools were practically as clean and fresh as at the opening hour. "It's a 100% change," the headkeeper said later, "I don't quite understand it." He did, though, and so did everyone else. It is written, "A thing of beauty is a joy forever." All people will subscribe to that, but who would think that a big crowd, out for a day of recreation, would sense that – and live up to the sentiment! But they did that Sunday and they have ever since, not only at those pools but at other exhibits where the beauty that is nature's is most completely expressed.

It is a grand outlook for the Park's future development. Theoretically, when the whole place is keyed up to the highest pitch of perfectionism – which the post-war program promises and which somehow must be accomplished – there just won't be any litter at all for the Monday morning cleanup gang to cope with. All of which sounds like Utopia – which may be hard to reach even in a Zoo!

Fairfield Osborn

IN THIS ISSUE

Our Three Baby Tigers . . . . . *Sam Dunton* COVER
The Poisonous Snakes of the New World . . . . . *Clifford H. Pope* 83
Progress Report on "The Pacific World" Series . . . . *Fairfield Osborn* 91
The Cubs Are Growing Up . . . . . *Lee S. Crandall* 95
Yankee Naturalist in England . . . . . *Capt. William J. Hamilton, Jr.* 98
Capturing a Giant Anteater . . . . . *William H. Chippendale* 100
Behind the Scenes: News and Notes 104

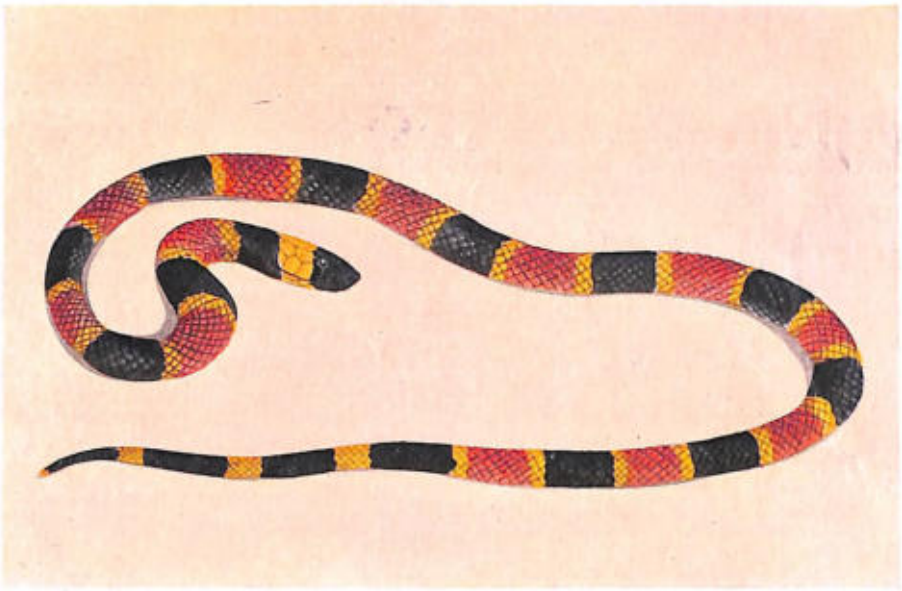


Fig. 1. Coral Snake, *Micrurus fulvius*. Range: Southeastern United States and eastern Mexico in lowlands. Average length: 28 inches. Poisonous.

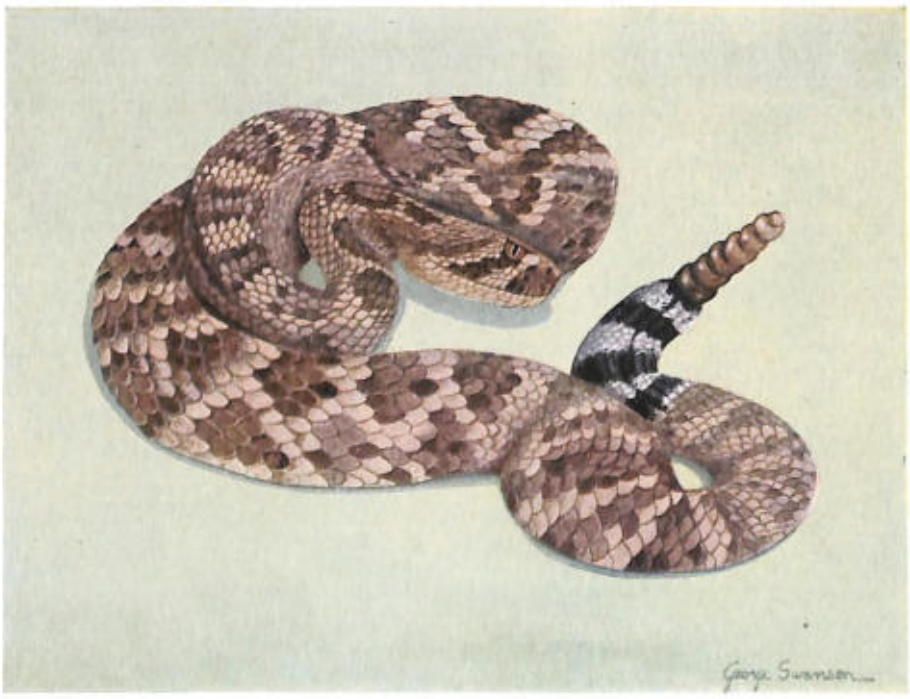


Fig. 2. Western Diamond-back Rattlesnake, *Crotalus atrox*. Range: Southwestern United States. Average length: Just under 5 feet. Highly dangerous.

The POISONOUS SNAKES of the NEW WORLD

Editor's Note

Early in June the Zoological Society published a 56-page booklet, "The Poisonous Snakes of the New World," by Mr. Pope. The subject is so timely, now that thousands of young Americans are coming into contact with raw nature for the first time — particularly the American tropics — that we plan to reprint the booklet in its entirety in three, or possibly four, successive issues of ANIMAL KINGDOM as a service to our Members and subscribers. The booklet is, of course, immediately available at 50 cents a copy, through the Publication Office, Zoological Park, New York 60, N. Y.

By CLIFFORD H. POPE

Fellow of the New York Zoological Society; Curator of Reptiles of the Chicago Natural History Museum

INTRODUCTION

Four groups of poisonous snakes are represented in the New World. In order of their importance as a menace to man they are:

Pit-vipers	about 75 species
Coral Snakes	about 50 species
Rear-fanged Snakes	few large, many small species
Sea-snakes	1 species

Only the pit-vipers and coral snakes will be discussed in detail, because they alone endanger human life.

The rear-fanged snakes have small, grooved poison-conducting teeth far back in the upper jaw that are readily brought into play only on objects actually taken into the mouth and chewed; in most of the species the mouth is small and the teeth are too short to inflict injury on man. These mildly poisonous reptiles closely resemble the innocuous species and learning to recognize them would be a major task requiring much concentration. Anyone familiar enough with snakes to want to handle them freely must learn to find the sharply enlarged grooved teeth at the rear of the upper jaw bone; most persons will give all snakes a wide berth and thus be in little or no danger from the species belonging to this third group.

The single New World sea-snake is found along the western tropical coasts of Mexico, Central, and South America approximately from 25° north to 5° south latitude. It is ordinarily between twenty-four and thirty-five inches long and has a tail flattened like the blade of an oar. The sides and belly are usually brown or yellow, or brown bordered with yellow. Although its venom is extremely potent, this marine reptile never attacks man and is not even feared by swimmers in waters where it abounds. About fifty additional species are found in the warm seas between Australia and southeastern Asia. The largest of these scarcely exceed nine feet in length, so they cannot be responsible for the myth of the gigantic sea serpent.

GENERAL ACCOUNT BY GROUPS

The Pit-Vipers

A belief is widespread that a poisonous snake can be distinguished from a harmless one at a glance by the thickness of its body and the width of its head. There is an element of truth in this belief since pit-vipers do have thick bodies and broad heads; but two facts make it useless

as a criterion, if not actually dangerous: coral snakes have slender bodies and narrow heads; innumerable harmless snakes are shaped like pit-vipers.

All pit-vipers have two unmistakable characteristics; a deep cavity in the side of the head below the line of eye and nostril, and a pair of hollow, movable fangs in the front of the upper jaw. Unfortunately, neither of these can be seen at a distance, but both can be readily found on a dead snake or on one pinned to the ground by any convenient object; an angle iron screwed to the end of a strong stick is a good weapon to keep handy in areas inhabited by many snakes, the length of the stick of course depending on the nerve of the owner and the size of the snakes. The proverbial forked stick is impractical because, unless the site of the encounter happens to have conveniently soft earth, a fork of different depth is needed for every size of snake. A snake cannot be easily moved about with a forked stick, whereas one can be either held down or dragged about with a properly mounted angle iron.

It may be maintained that the better practice is to kill all snakes without attempting to determine which are dangerous. In certain areas where harmless snakes are exceptionally abundant and poisonous ones uncommon, this will be impossible, and learning to distinguish between the dangerous and the harmless kinds will save time and nervous energy. Some skeptics may say facetiously that giving directions requiring close approach to a snake is like telling a person to find out whether a substance is poisonous by eating some of it. This objection can be countered quite as facetiously by replying that the close approach is necessary because poisonous snakes did not evolve a skull-and-cross-bones pattern along with their poison apparatus. After all the rattlesnake does have his rattle. Ordinary intelligence must be used in avoiding dangers of every kind and the menace of poisonous snakes is no exception. Upon arrival in a new area, anyone can form the habit of examining dead snakes and thus begin to train the mind to recognize patterns and correlate them with fang and pit, or lack of such. In time, the close examination will be no longer necessary. The task is no harder than learning traffic signals and lights.

The fangs are teeth constructed like hypodermic needles and are as sharp as the smallest sewing needles. Each one is fixed to a small, movable bone far forward on either side of the upper jaw (Figure 3). The identity of a fang is unmistakable if these facts are kept in mind: the fang is hollow, movable, and supported by a bone that bears no other teeth. The harmless snakes have in place of the fang a row of small, solid, non-movable teeth usually uniform in size. Occasionally two fangs will be found immediately adjacent to each other on one side in the pit-viper's mouth, a condition accounted for by the method of fang replacement (Figure 3). The fang-supporting bone has two sockets, one immediately next to the other, and into these sockets the newly developed fangs move alternately as the old fangs fall out. Thus a snake has a new fang in place a short time before the old one is actually shed. Careful dissection of the jaw will show a succession of fangs in various stages of development (Figure 3) imbedded in the soft tissue behind the supporting bone. The tips of the fangs develop first, the bases last.

The pit of a pit-viper is a complex sense organ having two cavities separated by a thin membrane richly supplied with nerves. The outer cavity is readily seen and freely open to the outside; the inner one is concealed and opens only by a tiny hole or pore just in front of the eye. The function of this organ long baffled scientists but recent experiments indicate that it enables pit-vipers to discriminate between nearby warm and cold objects. When an endless chain of light bulbs is moved in front of a pit-viper, it strikes more frequently at the warm than at the cold ones even though all the bulbs are wrapped so that they look alike. Presumably warm-blooded prey is more readily detected by snakes possessing a pit.

New World pit-vipers vary greatly in size, several species not reaching a length of three feet, others occasionally exceeding nine. All have the characteristic broad head commonly associated with poisonous snakes. Thick bodies are the rule that is not without exception. In temperament these reptiles vary not only from species to species but from individual to individual of the same species. Like other snakes, they do not have to coil to bite or strike but strike harder and farther from a coil just as a boxer

Fig. 3. Skull of a pit-viper (Bushmaster) showing functional as well as smaller reserve fangs. One of the two fangs on the right side of the skull is about to be shed.*

delivers his most dangerous punches from a fighting stance.

All are carnivorous and ordinarily feed on victims of their own poison rather than on carrion. Birds and small mammals make up the bulk of the food. In the New World, the young are born rather than hatched, with the sole exception of the bushmaster, a tropical species. Anyone who is not too timid may determine the method of reproduction of a dead snake by cutting the belly open: if a series of well-formed eggs is found, the snake cannot be a pit-viper unless it is the gigantic bushmaster which lays eggs three and a quarter inches long. To avoid confusing contents of the stomach with developing eggs, the cut should be made near the hind end of the body. At least one kind of pit-viper is found in every type of country from desert to tropical forest at altitudes from sea-level (or even below it) to 10,800 feet in the United States and to nearly 10,000 in South America. Most pit-vipers are terrestrial but some are aquatic and others arboreal.

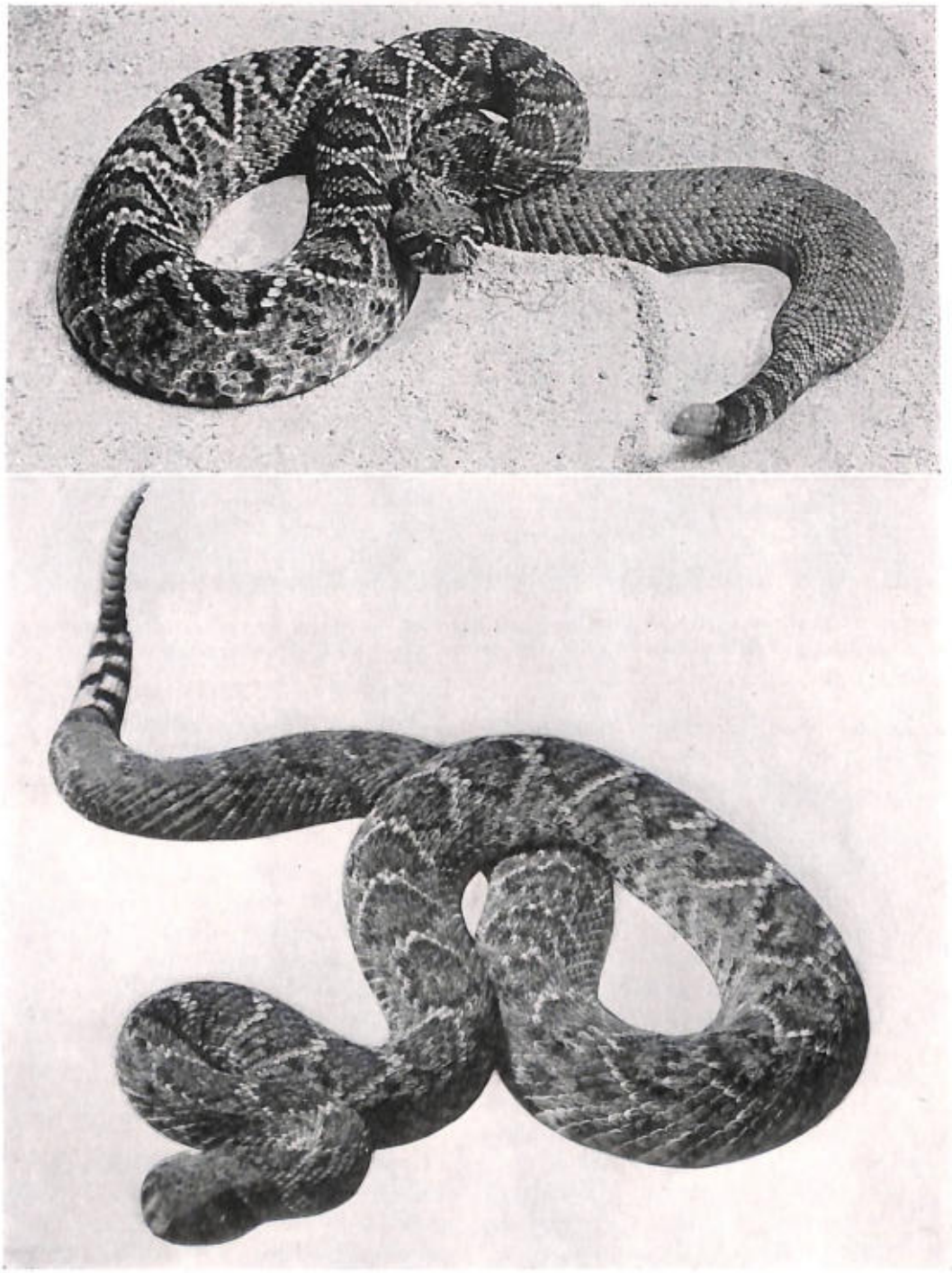
* Throughout this series of articles, the illustrations will be numbered consecutively, as they appear in the original booklet.

Pit-vipers are conveniently divided into two groups, one with a rattle on the end of the tail, the other without. Most of the pit-vipers without rattles are tropical reptiles about which little is known and the foregoing generalizations are all that can be wisely made. In contrast, the more homogeneous rattlesnakes (including neither arboreal nor aquatic kinds) have been so intensively studied by such herpetologists as Howard K. Gloyd and Laurence M. Klauber that certain facts can be stated about them as a whole.

The Rattlesnakes

(Pit-vipers with a Rattle)

In his monograph of the rattlesnakes, an exclusively American group of reptiles, Gloyd recognizes forty-five kinds (species and subspecies) and two have been described since the publication of his work in 1940. By disregarding the less clean-cut distinctions, the forty-seven may be reduced to twenty-seven full species, or obviously different kinds. The group range extends from extreme southern Canada southward to Uruguay. The center of differentiation is north-



Upper — **Fig. 4. Diamond-back Rattlesnake, *Crotalus adamanteus*. Range: Coastal strip of southeastern United States. Average length: Just over 5 feet. Highly dangerous.**

Lower — **Fig. 5. Western Diamond-back Rattlesnake, *Crotalus atrox*. Range: Southwestern United States. Average length: Just under 5 feet. Highly dangerous.**

ern Mexico and adjacent United States, and only in this area are many kinds found together. Over the remainder of the United States it is unusual for more than two species to live in any one region; nowhere in either Central or South America do two occur. Six of the fifteen species found in the United States are both described and illustrated below and seven additional ones are illustrated (Figures 13-20). The two remaining species are known only from the extreme southeastern corner of Arizona and never exceed two feet in length.

The diamond-back rattler (Figure 4) is not only the largest of the rattlers but the heaviest poisonous snake known; the relatively slender king cobra of the Asiatic region reaches a length of eighteen feet four inches and is several feet longer than any other venomous reptile. A large diamond-back may weigh more than fifteen pounds and reach a length of a little more than seven feet without the rattle which herpetologists never include in measurements of total length. It is often stated that this snake attains a length of more than eight feet. Such exaggerated statements rest on the fact that a fresh skin, even though it has been handled with utmost care, and without intentional stretching, is noticeably longer than the specimen from which it was taken. The western diamond-back (Figures 2, 5) is on the average a few inches shorter than the diamond-back and is the only other species that sometimes attains a length of seven feet. After these two come the banded (Figure 6), the tropical (Figure 30), the Mexican west-coast, and the Totonacan rattlesnakes, all growing to be more than five feet long, only the first, and that one but rarely, exceeding six. The average in contrast to the maximum length of the tropical rattlesnake exceeds that of the banded rattlesnake, so the former could be rated third.

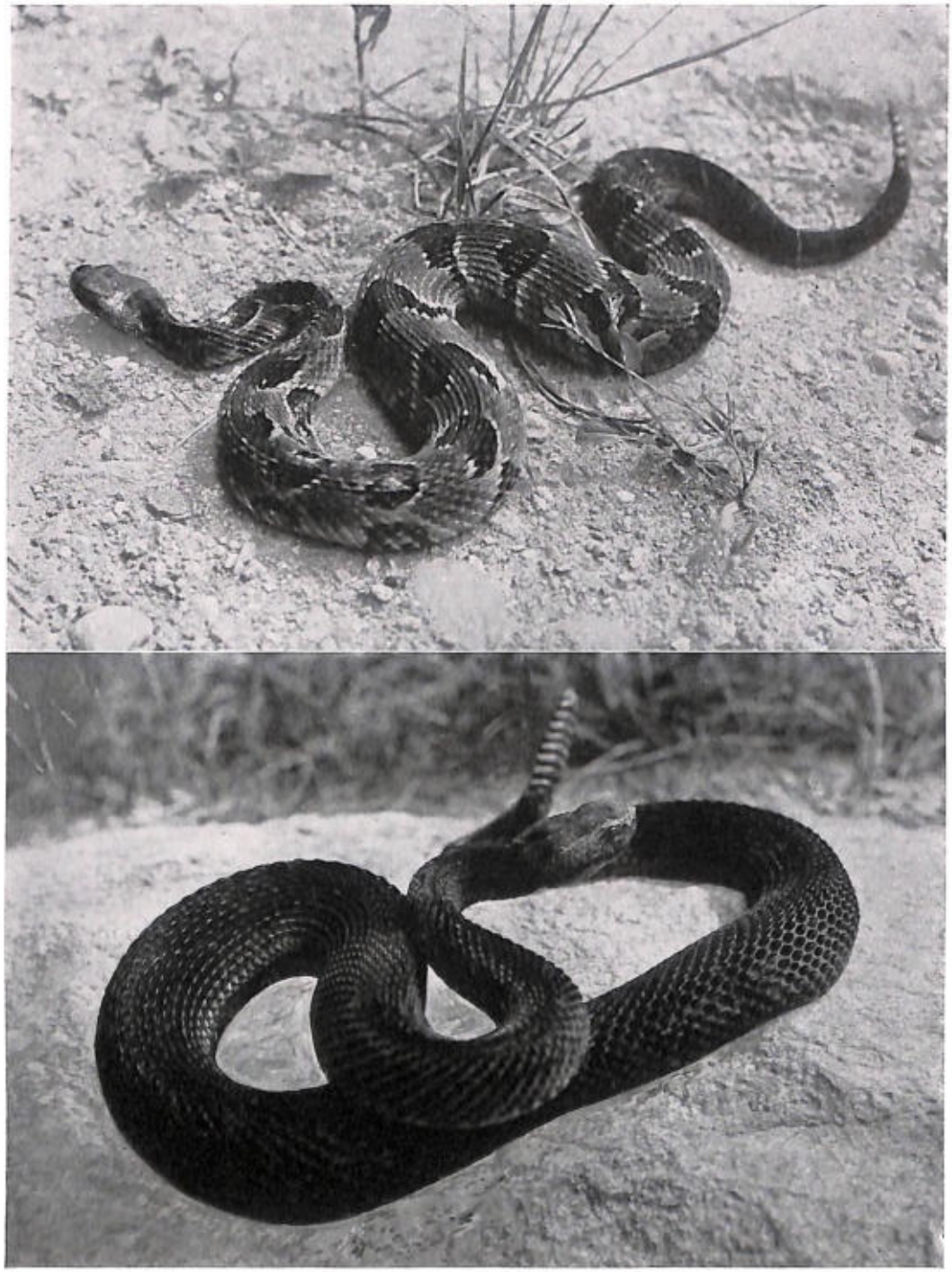
About a fourth of the rattlesnakes might be classed as small, that is, adults are commonly no more than two feet long; only two. Willard's and the Carolina pigmy, never attain even this length.

A Pacific rattlesnake (Figure 9) three years old is sexually mature, females of this age bearing their first broods. It is probable that the other temperate kinds develop about as rapidly. There is little information on longevity, but one rattlesnake lived fourteen years in captivity.

There is a widespread belief that the age of a rattlesnake can be told by counting the rattles or, more accurately, the segments of the rattle. The truth of the matter is that several segments, probably two to four, are added annually and, after about a dozen have accumulated, the terminal ones begin to break off. It is obvious, then, that the segment count at best gives evidence of four or five years of life, a minimum age that also can be judged by the body size. The shape of a rattle is more useful in age determination than is the segment count: the first segment is the narrowest, and each one on a growing snake is noticeably wider than those preceding it, the result being a rattle tapering to a point. After growth ceases, the segments are equal in width and the rattle, the early segments of which have been lost, no longer tapers. A segment is added at each change of skin.

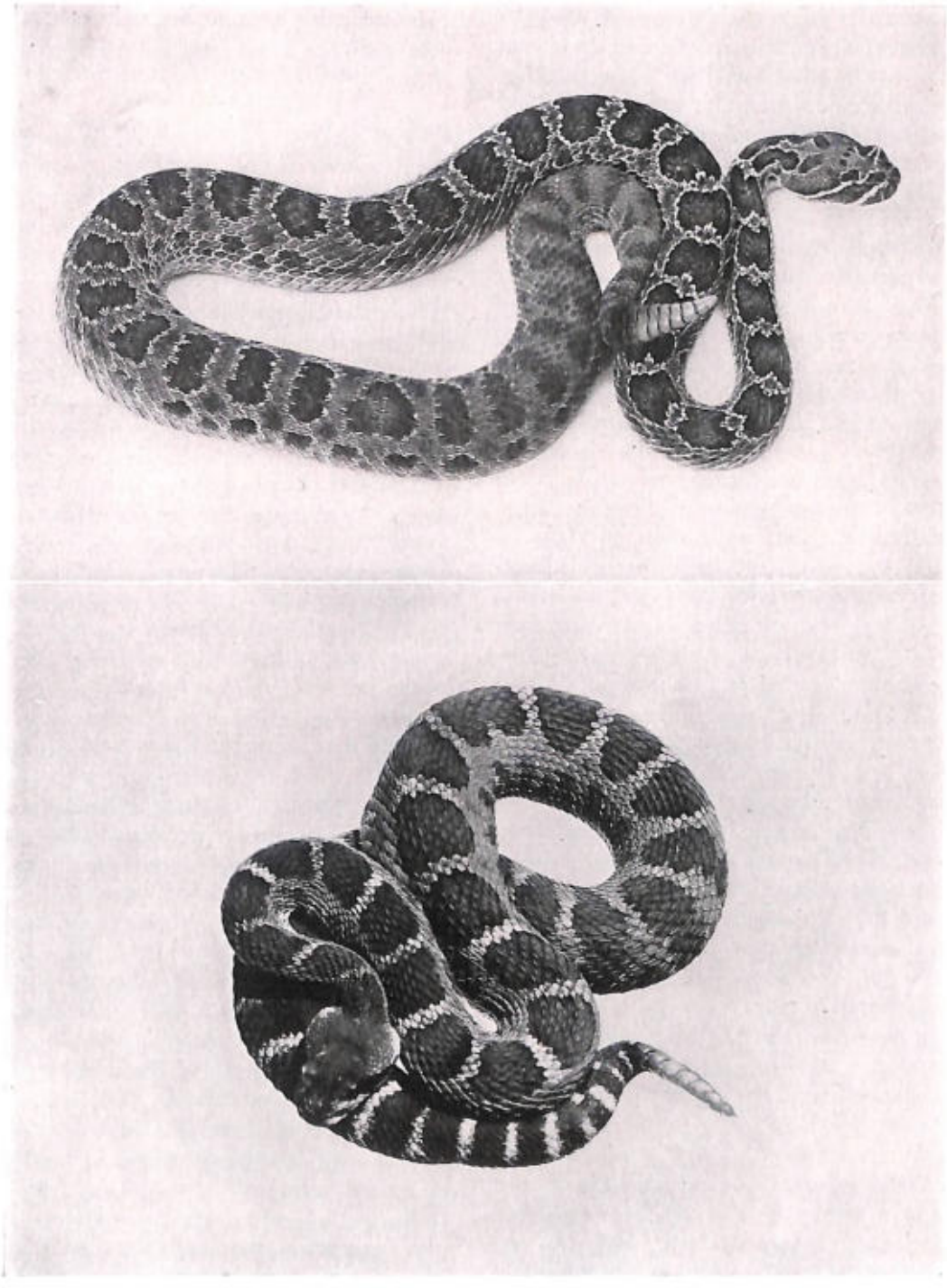
Most snakes vibrate the tail when annoyed and if dry vegetation happens to cover it a sound somewhat resembling that of the rattlesnake is produced. Thus harmless snakes are often mistaken for rattlesnakes. The speed of the rattle's vibration at 65° F. is forty-eight cycles per second and the sound, which is really a hiss, can be readily recognized by the experienced. This sound is useful to the snake; many animals, such as raccoons, weasels, and skunks, that attack harmless ones, or, like the bison, that might accidently trample them, are warned at a distance of the rattler's presence. The old theory that the rattle helped the sexes to foregather for mating is not tenable because snakes lack external ears and are known to be deaf to sound waves of the air. Vibrations of solid objects in contact with the snake are quickly perceived.

The rattlesnake has a gentleman's code of honor: it rattles before striking, whereas the copperhead delivers its blow like a coward without warning. This popular anthropomorphic dictum has an element of truth since most rattlers are nervous reptiles that rattle at the slightest annoyance and continue to do so minutes on end. In experimenting with numbers of them, Manning, who observed from behind a screen, found one individual that would sound its warning if he let so much as the tip of his finger come into its range of vision. In contrast to this, an occa-



Upper — **Fig. 6. Banded Rattlesnake, *Crotalus horridus*. Range: Eastern United States. Average length: 45 inches. Highly dangerous.**

Lower — **Fig. 7. Banded Rattlesnake, *Crotalus horridus*. This is an exceptionally black individual.**



Upper — **Fig. 8. Prairie Rattlesnake, *Crotalus viridis viridis*. Range: Great Plains region of the United States and extreme southern Canada. Average length: 3 feet. Highly dangerous.**

Lower — **Fig. 9. Pacific Rattlesnake, *Crotalus viridis oreganus*. Range: Pacific region from extreme southern Canada to northern Lower California. Average length: 3 feet. Highly dangerous.**

sional one even when encountered in the wilds, refuses to rattle until actually touched. Reptiles are cold-blooded and do not react quickly in cool weather, a fact that should be borne in mind during spring and autumn for it is then that any rattlesnake might be reluctant to rattle.

The method of reproduction is uniform, all the species bearing the young alive. The number varies from three or four to as many as twenty-four in a brood. Generally speaking, three groups of approximately equal size can be recognized: those that have, respectively, about five, ten, and fifteen young at a time. It has always been assumed that a female reproduces once a year, but recently evidence has been found that, in the northwestern part of this country, a brood is borne every alternate year. The new-born snakes shift for themselves, are well supplied with venom, and do not hesitate to use their fangs.

The feeding habits are similar to those of pit-vipers in general with small mammals forming the basis of the diet. Birds are sometimes taken; a few species eat lizards or amphibians.

No habit of our rattlesnakes has attracted so much attention as that of gathering in autumn at certain sites called "dens". These dens, always well known to the local populace, are often visited by bold persons who slaughter the sluggish snakes as they bask in the weak sun of Indian summer. In rugged, mountainous country hundreds of snakes may congregate on a southern slope before retiring for the winter into numerous deep crevices beneath boulders. Under such conditions they cannot be caught in numbers, but in more open country, where they are often forced to enter a few isolated crevices, trapping them in this manner is easy. In the early winter a stove-pipe is cemented into the mouth of a crevice so that it opens over a barrel. The snakes, upon emerging in the spring, fall into the barrel and of course cannot escape. This habit of hibernating en masse has not been thoroughly investigated, so no one knows whether the same snakes return year after year to a site and how far afield the inmates of a den wander through the summer. Many other interesting questions come to mind, for the study of snake behavior is yet in its infancy.

The Coral Snakes

Coral snakes are a real stumbling block to the inexperienced person who is learning to recognize poisonous snakes. This is because these deadly relatives of the cobras do not have the short, thick bodies and wide heads commonly associated with dangerousness in snakes. The brilliant cross-band combinations of coral snakes — black with red and yellow (or white) or black with red or yellow (or white) — are found on many common harmless kinds. Coral snakes have a pair of fixed fangs in the front of the upper jaw but these are so short and well concealed by the gums that only a careful examination under a lens will reveal them. Fortunately, there is a marked difference in defensive behavior between coral snakes and their so-called harmless "mimics": the former never raise the head and neck in an S-shaped loop to strike after the manner of the ordinary snake; instead of striking, they bite by jerky side swipes. Many individuals are reluctant to bite at all and persistently try to hide the head under a coil of the body.

Approximately fifty kinds of coral snakes are known, their range embracing all of tropical America. In the north, they reach the low coastal plain of our southern states; in the south, the Territory of Rio Negro, Argentina. All types of country are frequented by these secretive snakes that seldom wander abroad during daylight hours. The largest kind never does exceed five feet in length, and only rarely attains such a size. The chief items of the rather specialized diet are snakes and lizards. The first specimen of a certain kind of harmless snake that inhabits Florida was actually discovered in the stomach of a coral snake (Figures 1, 25). Presumably, all the species lay eggs; the reproductive processes have been investigated even less thoroughly than other aspects of the life history.

(To be continued)

Progress Report on "The Pacific World" Series

Prepared by FAIRFIELD OSBORN
Chairman of the Publication Committee

IT'S WONDERFUL what will happen when an idea catches hold and a number of men, under the impetus of a "group inspiration complex," really get moving to convert the idea into a reality.

This miracle of sorts is exemplified by the creative work being done on the series of books summarizing the natural history of the Pacific, now happily approaching its culmination.

The first general book of the series, "The Pacific World" has already been published, with an initial printing of 100,000 copies for the Armed Services and an edition of 10,000 copies for the civilian public. The book appears to be meeting with a very fine response indeed.

As we have already reported, eight supplementary books have been planned, each concerned with details of one phase of natural history. Each book presents a most difficult challenge to the authors, because of the vastness of the area to be covered and the variety of life and of physical conditions. Certainly the authors are rendering a valuable, and in many respects unique, service in preparing these books. Arrangements have been concluded for their publication for distribution to the Armed Services and negotiations are under way for the trade publication of the entire group. The names of the various authors and the state of preparation of each book, are:

MAMMALS OF THE PACIFIC WORLD

The authors of this book are Dr. George H. H. Tate, Dr. John Eric Hill, and Mr. T. Donald Carter of the Department of Mammals of the American Museum of Natural History. This book has been completed and the Armed Service edition is about to go to press. An edition for the public is also about to be printed.

PLANT LIFE OF THE PACIFIC WORLD

Dr. E. D. Merrill, Director of the Arnold Arboretum. The work is virtually completed.

NATIVE PEOPLES OF THE PACIFIC WORLD

Professor Felix M. Keesing, School of Humanities, Stanford University, has prepared this volume, now in its final stage of preparation.

REPTILES AND AMPHIBIANS OF THE PACIFIC WORLD

Mr. Arthur Loveridge, Curator of Reptiles, Museum of Comparative Zoology, is writing this book. To be completed by August.

INSECTS OF THE PACIFIC WORLD

Dr. Charles H. Curran, Associate Curator of the Department of Insects and Spiders of the American Museum of Natural History, is preparing this book. About two-thirds completed.

MARINE LIFE OF THE PACIFIC WORLD

The contents of this book fall into three sections, the authors of which are as follows:

Fishes – Mr. John T. Nichols, Curator of Recent Fishes, American Museum of Natural History.

Marine Invertebrates – Dr. George H. Childs, Scientific Assistant, Department of Invertebrates, American Museum of Natural History.

Mollusks – Dr. Paul Bartsch, Division of Invertebrates, United States National Museum.

This book is now in its early stages and it is hoped that it will be ready in late autumn.

BIRDS OF THE PACIFIC WORLD

This book will be written by Dr. Ernst Mayr of the Department of Birds of the American Museum of Natural History. Due to other pressing engagements of authorship, Dr. Mayr has as yet been unable to commence it but expects to start work on it shortly.

PHYSIOGEOGRAPHY OF THE PACIFIC WORLD

The idea that this book should be included as a part of the series took form only recently. Arrangements for its writing are now being made.

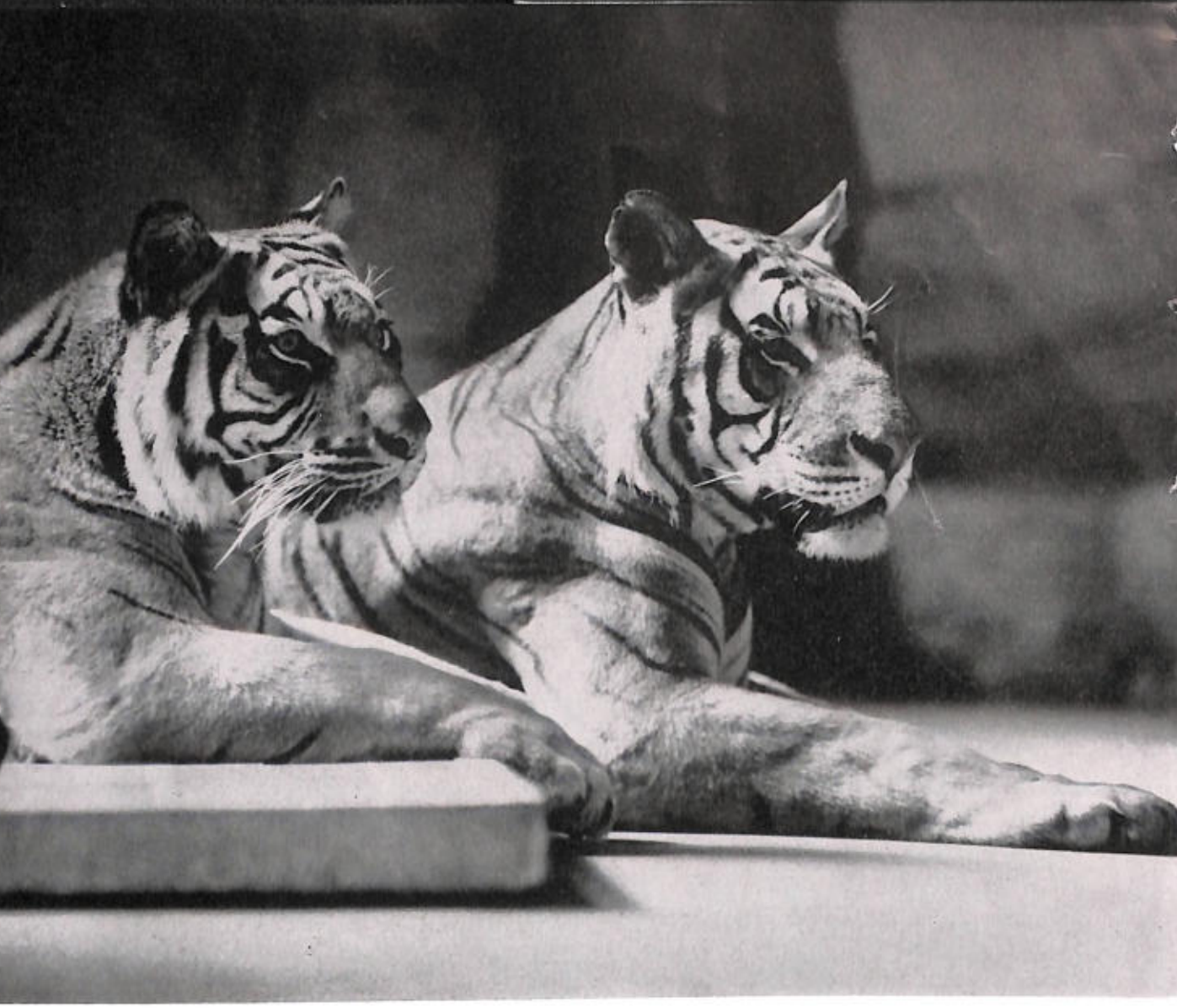
THE DISTRIBUTION OF REPRESENTATIVE MAMMALS FROM THREE CONTINENTAL SOURCES

Island Group	Representative Animals	Chief Sources of Animals	Remarks
NORTH TEMPERATE (NORTH ASIATIC AND NORTH AMERICAN)			
Kurile (continental) and Aleutian chain (continental) and partly oceanic)	Bears, weasels, wolverines, seals, rabbits, squirrels, field mice	North Asia and North America	The Aleutian Islands contain fewer species the farther they are from the continental mainland.
Japan (continental)	Raccoon dogs, foxes, deer, Japanese macaques, squirrels, shrews, moles	Temperate and sub-tropical Asia	Animals derived mainly from the temperate zone and to a limited degree from the cooler tropics.
TROPICAL ASIATIC AND MALAY			
Formosa (continental)	Hedgehogs, bears, martens, clouded leopards, muntjacs, sambars, macaques	Tropical Asia and North Asia	Mammals scarcely to be distinguished from those of Fukien Province, China.
Luchu chain (continental)	Hares, pigs, flying foxes, shrews, mice	Tropical Asia and North Asia	Animals far more limited in variety and number than those of Formosa.
Greater Sunda Islands (continental): Sumatra, Java, Borneo, Bali	Orangutan, sun bear, sambar deer, rhinoceroses, flying, tree and ground squirrels, brush-tailed and true porcupines, pangolin	Tropical Asia and Malay Peninsula	The present-day wonderfully rich animal life is thought to have been preceded by an even richer population, known from its fossil bones, which included mastodons, primitive hyenas, and saber-toothed tigers.
Wallacea (oceanic): Philippines, Celebes, Moluccas, Lesser Sunda Islands	Tamarau and anoa buffaloes, babirusa, sambars, phalangers (part)	Tropical Asia and Malay Peninsula, both ancient and recent colonists; and Australia-New Guinea	Some of the islands contain a few Australian animals in addition to representatives of many of the continental groups. All types become fewer the farther the island is from the continent of origin.

THE DISTRIBUTION OF REPRESENTATIVE MAMMALS FROM THREE CONTINENTAL SOURCES

Island Group	Representative Animals	Chief Sources of Animals	Remarks
AUSTRALIAN			
Australia, Tasmania, New Guinea (continental)	*Egg-laying forms*: Duck-billed platypuses, spiny anteaters *Pouch-bearing forms*: Marsupial moles, phalangers, kangaroos, wallabies, koalas, wombats, Tasmanian devils, thylacine wolves *Placental mammals*: Fruit bats and insectivorous bats, peculiar genera of rats and mice, dingoes	Extremely ancient to modern tropical Asia	The Australian continental group is noted for its two unique orders of primitive yet highly specialized animals: the monotremes which lay eggs and suckle their young, and the highly diversified marsupials which carry and nurse their young in pouches. During the ice age the Australian marsupials included many larger forms. Among these were kangaroos larger than the largest known today, giant phalangers with great shearing teeth, and wombats as large as tapirs.
Bismarck Arch.: New Britain, New Ireland; Solomon Islands (oceanic)	A small wallaby, cuscus phalangers, a bandicoot, flying foxes, insectivorous bats, peculiar rats	Australia-New Guinea	These islands support a restricted animal life.
New Zealand	Two kinds of insectivorous bats	Australia, ancient and recent	Excessively ancient and isolated islands.
MID-OCEAN ISLANDS			
Micronesia, Melanesia, Polynesia	Fruit bats, a few insectivorous bats	Life fragments from various of the foregoing, through a long space of geological time	The grouping of these islands according to their native peoples has little application in zoology. The only mammals that reached the remote oceanic islands without human aid were bats.

This concise presentation of the origin and distribution of mammalian life in the Pacific area was prepared by Dr. George H. H. Tate, Dr. John Eric Hill, and Mr. T. Donald Carter of the Department of Mammals of the American Museum of Natural History. It was published in "The Pacific World" in the chapter on mammals and has aroused a great deal of interest.



Prince and Jenny, the parents of our three Tiger cubs, are magnificent animals in point of exhibition —but complete failures as parents. It was because of Jenny's shortcomings in this respect that her babies had to be reared by Mrs. Fred Martini, wife of the Lion House keeper. This striking photograph is the work of an amateur, Mr. Alfred A. Alsleben of Woodhaven, N. Y., through whose kindness it is reproduced here.

Continuing the story of how we reared our baby Tigers, first in an apartment and now in the Zoo.

The Cubs Are Growing Up

By LEE S. CRANDALL

THE STORY of our three baby Tigers, Raniganj, Rajpur and Dacca, born on February 8, 1944, was carried to the age of five weeks in the issue of ANIMAL KINGDOM for March-April, 1944. Weighing less than three pounds each at birth, they ranged from 7 pounds 6 ounces to 9 pounds 3 ounces when we left them then. Fine and bouncing though they were, we knew that our troubles were by no means ended and that unknown perils lay ahead. Now, from our vantage point of eighteen weeks (June 13), with the largest cub weighing 29 pounds, we can calmly record events as they occurred. But this pleasant state of mind was only achieved after many anxious hours.

In order to avoid the risk of rickets, when the cubs were a month old ten drops of Vi-penta daily were added to the mixture of evaporated milk, water and lime-water. Later, dicalcium phosphate was added, as a further precaution.

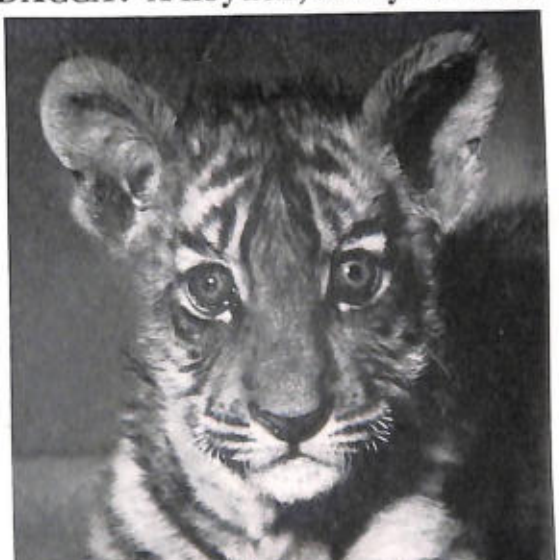
About the middle of March, one-half teaspoonful of liver juice was added to the diet, with no ill effect. The babies were walking unsteadily about Mrs. Martini's apartment by this time and quickly learned to scramble up to the soft cushions of couches and chairs. Then, too, they showed the first inclinations toward play, which rapidly developed into boisterous but harmless maulings of each other.

During all this time, we had constantly in mind the problems of teaching the cubs to lap and to eat meat. The first actual attempts to make them lap milk began on March 21, when

RAJPUR: Slow, fat, lazy . . .

RANIGANJ: Furtive? Or "sweet"?

DACCA: A hoyden, always sweet...



The baby Tigers were only one day old when this picture was taken and all three of them had been removed from the mother and turned over to Mrs. Martini. She started immediately on a methodical series of measurements and weight records, maintained while the babies were under her care.

the cubs were six weeks old, but no real success was achieved until two months later. Even then, they refused steadfastly, until the bottles were withheld for two or three days.

But the problem of how milk should best be taken was as nothing compared to the question of meat. Somewhere in the course of weeks, young Tigers must give up a liquid diet and turn to stouter viands. A mother Tiger solves the problem readily enough by dragging in a choice bit of entrails at just the right moment. But whatever tells the mother Tiger when that moment comes, failed entirely for us. So we could only fumble, not very cleverly. The cubs were nearly two months old when, on April 2, each received a tiny ball of raw chopped meat. They liked it very much but the effect was very bad. All became violently sick; poor Rajpur went into a coma, from which we thought he would never emerge. He finally became conscious but on the next day was stricken by a series of alarming convulsions. After this frightening experience, we were glad to allow the cubs to content themselves with the bottle.

A few days later, we resumed the attack by adding one-half ounce of meat juice to three ounces of milk, once daily, instead of liver. The cubs assimilated this so well that we had to put wire netting tops on their sleeping boxes, to keep them from climbing over the three foot sides as they gained strength.

The big day finally came on April 24, when the cubs were one day short of eleven weeks old. We give each one a piece of horse rib, with a trace of raw meat attached. At these they licked and nibbled until the bones were like polished ivory. It worked like a charm and from that moment the infants have never looked back.

Little by little, more and more meat was allowed to adhere to the bone. Soon, chopped meat was added. At eighteen weeks, each cub received the following, daily:

3 lbs. chopped meat
2/3 tin of evaporated milk, with an equal quantity of water
1¼ tablespoonful of cod liver oil
1½ tablespoonful of bone meal

At this time, weights were as follows: Raniganj and Rajpur (the two males), 29 pounds each; Dacca (the female), 28 pounds.

As the cubs progressed in size and strength, it became obvious that Mrs. Martini's home

could no longer contain them. A cage at the Lion House was furnished with a panelled glass front, to protect the cubs from well-intentioned food-throwers, and with a wooden floor and a curved background of pressed-board. On May 15, to the delight of our visitors, Mrs. Martini and her charges were moved, en masse, to the Zoological Park. Almost at once, they made themselves at home and the difficulties we had anticipated never materialized.

At the age of 4½ months, they are flat-backed and sturdy; the bandy legs of cubhood are straightening out beautifully.

Constantly, we are asked how long Mrs. Martini can safely enter their cage. At present, of course, there is no question. The cubs regard her as their mother, obeying her orders when they understand and accepting the mild cuffs she occasionally administers when something goes wrong. Who can tell when this will end, if it ever does? When the cubs approach maturity, Tiger natures may very well assert themselves. In any case, we shall expect to exercise every precaution.

In the first report on our cubs, then aged five weeks, we pointed out the beginnings of what appeared to be definite infant personalities. At 4½ months, these indications have been further developed. Raniganj remains furtive and unpleasant (a word Mrs. Martini is bound to resent — she says he is "sweet!"). Big-boned Rajpur is still slow, fat, lazy and good-natured and invariably cries for his foster-mother when he is left alone. "Little" Dacca remains the hoyden, always teasing her brothers to wake up and play, and always the leader in the rough-and-tumble that follows. If I had to call one "sweet," I think it would be Dacca.

It is hard to have to realize that our lovely striped babies are fast growing up to be Tigers, and that soon their gray eyes, now just turning yellow, will glow with the fierce light that denotes the nature within. Already, they must be fed separately, to avoid inevitable conflicts. Now, only Mrs. Martini and her husband can enter the cage in safety. Every day the time grows nearer when even they may no longer do so.

Rajpur on the prowl, at the age of eleven weeks. When Mrs. Martini saw him stalking across the apartment toward her, with this purposeful look in his eyes, she knew it was a good time to seek safety on a chair or a table. "He doesn't mean any harm," she explained, "but he plays a little rough sometimes!"

YANKEE NATURALIST in England

By CAPT. WILLIAM J. HAMILTON, JR.

Quiet observations of British wild life, set down by a Cornell University zoologist in the lull before the invasion.

THE SLOW DEVELOPMENT of agriculture and settlement has produced all those features that render simple rural beauty to the English countryside. Narrow, winding lanes which follow the contour of the land, the lovely little cress-choked ditches with their thick-bordered hedgerows, the elms, oaks, ashes and magnificent beech woods make each little hamlet different. The thatch-roofed brick, clay or strong oak-timbered farmhouses and stone churches, many of which go back to Saxon times, the gorse-clad commons and in the north the heath-covered moors overlooking the larger towns, all add a picturesqueness that is sadly lacking in many parts of the States.

Here in the land that nurtured Darwin and Wallace, everyone is an amateur naturalist. Every schoolboy knows his thirty birds and is tolerably familiar with the common plants and trees. This general interest is reflected on the shelves of the larger bookstores. Here one may find well-illustrated handbooks on such specialized subjects as beetles, the larvae of British butterflies and kindred fields. Such volumes would scarcely attract the amateur in America, yet in war-time England they command a good sale.

My first sight of the British Isles was through a porthole. Screaming kittiwakes, familiar herring gulls and those great sea vultures, the black-backed gulls, wheeled in the wake of busy smaller craft. Lush meadows were apparent in the distance. After we were settled in our new Army post, I had opportunity to become better acquainted with some of the birds. Most conspicuous of all is the ubiquitous black rook, counterpart of our own crow. The bare branches of giant oaks support the dilapidated old nests of these birds. In late winter these become more conspicuous as the rooks are busy adding twigs, mud, roots and straw. Rooks nest in colonies of five to thirty, some nests being so crowded that they appear to touch one another. The noisy youngsters keep up their incessant clamor from dawn to dusk. Associated with the rooks are the handsome and gregarious jackdaws, somewhat smaller and noisier. Their sable coats with shining gray napes glisten in the sun as they strut between the rows of new cabbage and sprouts. Their noisy chatter reminds one of the harbor gulls.

The English robin, or redbreast, is scarcely as large as a sparrow. His confiding nature makes him a welcome guest in every home in the kingdom. However cold and stormy, this pretty resident is sprightly and confiding, but pugnacious, other birds living in awe of him.

After mess, when other duties do not interfere, I walk through the paths of the post during the long evenings. Great wood pigeons tumble into the awakening ash, to fill their crops on the swelling buds. Much like our homing pigeon, they are somewhat larger, with a characteristic white half-moon splashing each side of the neck. The wild pigeon, incidentally, has lately risen to astonishing heights of price and popularity. Once hardly considered a bird, its cost could be counted in coppers. Today every London market bids for the bird and it has acquired the financial status of the pre-war grouse.

Along a narrow stream I startled a kingfisher. No larger than our bluebird, this living jet of color adds much to the charm of the waterways. Although its beauty creates a demand for the skin, the bird survives in our midst. Its greenish-blue back, cobalt rump and chestnut underparts strike a note of beauty long remembered.

In the early spring great flocks of lapwings flop heavily over the pastures and ploughed fields. By April they have paired, the male courting his bride in a wild, zigzag, frenzied flight. Far in the sky an unexpected song is heard. Above the roar of lumbering bombers returning from a mission, its changing tone reached me. Soon I could see powerful, quick-beating little wings as the skylark plummets to earth, and alights between rows of parked jeeps in a green pasture. I searched long for the nest, but without result.

At retreat formation one evening in late winter, I caught sight of a "white" bird flitting its solitary way on buoyant wings over the grassy fields adjoining the parade ground. As our formation was dismissed I temporarily forgot mess (my friends will find this hard to believe) and sought the lair of that cosmopolite, the barn owl. A short search soon revealed its retreat in the hollow trunk of a decadent elm. Later I filled a cigar box full of the pellets, undigested balls of fur and bones disgorged by all owls. When I spread these out on my cot and commenced to unravel the mystery of past Stygian feasts, my fellow officers had no end of sport with me. But as the pile of small skulls and bones grew, the joking turned to genuine interest; all too soon my frail cot was crowded with friends who insisted on lending a hand. Characteristic skulls of wood mice, bank voles, field and red-backed mice, rats and tiny shrews, with an occasional bird, were picked from the casts. Now I have a dozen assistants on my pellet hunts.

On our marches over the country, we see everywhere the evidence of rabbits, the same fearful pest that caused such widespread destruction in Australia. Every hedgerow is honeycombed with their burrows. Since the demands of war have temporarily removed many hunters and game keepers, these pests have increased enormously and levy a heavy tax on crops. Occasionally a big hare will start up from a ditch and race across the fields of sprouting grain. I looked in vain for evidence of the muskrat, which gained a foothold in England some years ago. It threatened great damage, but a successful campaign to eradicate it was undertaken and the last rat was trapped. The British have met with less success in their unfortunate introduction of our gray squirrel. In the States we look upon Bannertail as an asset, a handsome guest of our parks and cities and legitimate game in the country, causing little or no damage. Here in Britain it is an unmitigated pest, destroying fruit, killing young trees and girdling large branches. Such is the penalty of exotic introductions.

In the past few months I have seen more foxes than ever I did in the States. Every train ride produces a few, quietly sitting beside some marshy strip or thick hedgerow, in expectancy of a fat mouse. Anathema to young lambs, foxes are now hunted at every opportunity, but despite sporadic chases, they are said to be increasing.

As I write, the long spring evening has at length darkened. We have just put up our blackout shades. We are all tired, only a few hours in from maneuvers. Just a little while back I lay on a mossy bed, carpeted by blue violets and wild yellow primroses, eating a hot meal from our field kitchen. A chaffinch uttered its "pink, pink," while a large, slate-backed, bar-bellied bird, with bowing head and fanning tail, uttered its plaintive but famous "cuckoo." The countryside was at peace. At my elbow, a strip of soiled silver foil lay half hidden in the moss, dropped by some Jerry to counteract radar. Even in the still beech woods the evidence of war was at hand.

Capturing a GIANT ANTEATER

By WILLIAM H. CHIPPENDALE, C.M.Z.S. (London)

As the Indians remarked, it is easy enough to capture a mother and baby, but not so easy to turn the mother loose and keep only the baby.

THIS ARTICLE—reminiscences, really—has been compiled from my diaries ranging over a period of many extremely interesting and happy years spent among the Indians and animals of the Paraguayan Chaco, more commonly known to the general public as the battle ground of the late Paraguayan-Bolivian conflict.

If one takes a map of Paraguay, one will see that the river Paraguay divides the republic in half, roughly from north to south, the western half being the Chaco. Never has a river split a country into two more contrasting parts, the peoples, language, topography, trees, flowers—even the very grass and earth—being completely different. No towns or villages scar the "Gran Chaco" and it is today just as it has been since time immemorial—jungle, swamps, creeks, plains and palm-belts, unspoiled by the ruthless hand of civilization, home of nearly all South American sub-tropical fauna and dwelling place of nomad tribes of Indian hunters. The zone of my experiences is right on Capricorn's line and roughly in the center of the Chaco.

Some years ago I had received an urgent request for a pair of Giant Anteaters for the London Zoo as well as a request from an American Zoo, and as my usual well trained Indian boys were away after a Maned Wolf, I set about getting together an auxiliary gang of Indians who, although each was a born hunter, were not trained in catching live specimens for zoological collections. I strolled over to the Indian "tingma" (village), consisting of a few upright poles and a rough grass roof, and took my accustomed place on the ground in the circle of half-naked Lengua Indians. We squatted around a smoking termite nest (which keeps the mosquitoes and other pests at bay) while young maidens passed the carved communal pipe of strong, wild, green tobacco from mouth to mouth. In their own laconic language I explained what I wanted, and especially my desire to obtain not old and decrepit animals, but half-grown or baby specimens.

There was the usual ten-minute interval (for Lenguas have plenty of time and never rush things), during which we all smoked in moody silence. Then suddenly Hakuk Igyewa (Orphaned-by-the-Rattlesnake) cleared his throat, spat reflectively at the smoke fire, and said:

"I have considered your words, but am afraid that we will have many difficulties in capturing a young Nai-yim. For, although Nai-yims are not uncommon in our forests, females with their young are not so frequently seen.

"And furthermore," he added, "the young ones ride on the backs of their mothers, as you know, and the mothers me-oki (a Lengua word impossible to translate literally, but meaning, more or less: to-be-jealous-of-to-the-extent-of-dying-for) their offspring, and it is your wish that the mothers be not killed."

His voice trailed off into doubtful silence. "It is, indeed, my wish that the mother's life be spared," I replied, "and once you capture the mother and her young one, I am sure we will find some way of parting them.

"Tomorrow, then, you and your companions will start for the ant-hill country in the north to search the plains and forests for Nai-yims."

Six long weeks elapsed during which I heard news of the hunters only from the "chasquis" (runners) who came in from time to time with peccary and capybara skins. It appeared that the men were having great success with peccaries, capybaras and rheas, which they were also hunting for their daily meat, but had not come across even one Giant Anteater. Many Lesser Anteaters (*Tamandua tetradactyla*) they had found, however.

At the end of the sixth week, just as I was giving up the chase until the following dry season, Hakuk Igyewa himself silently appeared out of the forest path one morning and squatted on his haunches beside me.

"Thliyip nuk?" (Is it you?), said I, giving the Lengua salutation.

"Koo nuk," he grunted. "Artihe ikhim, meko koinaik marmigiyai. . . ." (It is I indeed; the sun is burning today and I don't think we shall have rain.)

We discussed the condition of the manioc root, the fatness of the peccaries this year, the scarcity of the "loloch" (lungfishes) in their muddy dens—in fact, all the small talk of the Chaco Indian. Then, after twenty minutes of gossip, he finally got down to the news.

"We have cornered a female Nai-yim with its young, and now await your orders; they are at the place of the-two-quebracho-trees-struck-by-lightning."

This spot I knew; it was about six miles away, through swampy country, and so I had horses saddled and Hakuk Igyewa and I set out.

At the two burnt quebracho trees, a score of hunters were squatting around a palm to which the female Anteater was tied by a plaited cowhide lasso around her middle. She was a fine animal, but furious, and a baby that I judged to be about two months old was clinging to her back in monkey fashion. It was taking the situation calmly enough—gazing at us with sleepy, disinterested, beady eyes.

As I approached the mother silently sat up on her long tail, in kangaroo style, and awaited me with her muscular arms wide open and her claws ready to enfold me. Her long snout was weaving from side to side. The baby, now in a vertical position, still held on tightly and obviously was not going to fall off so we could drag it away.

The time had now come for me to make good my reassuring words that "once you capture the mother and her young one, I am sure we will find some way of parting them." I went back to the boys and we sat down to plan our campaign.

To approach too near those claws would be courting death, for we have known a horse to be

A baby Giant Anteater usually rides on its mother's back in such a position that the dark streak on its shoulder and back forms a continuation of that marking on the mother's body. This baby was born while the mother was in shipment from South America to the Zoological Park.

Facially, at least, the Lesser Anteater or Tamandua bears a strong resemblance to the Giant Anteater. It spends most of its time in trees and prefers termites as a steady diet.

disembowelled by one stroke. We all pondered silently. Suddenly, seeing one of the hunters plaiting a broken thong in his bolas, I had an idea: why not use a bolas?

To digress for a moment, I expect most of my readers will know that a bolas is composed of three longish leather thongs at the ends of which are leather balls, generally about the size of an orange. One ball is grasped in the hand and the rest are twirled swiftly round the head and then let fly at the legs of the fleeing quarry. The thongs entwine themselves round the legs and the victim is swiftly brought down.

It proved to be much easier than I thought. Waiting until the Anteater was on all four legs again, Hakuk swiftly moved up, twirling his bolas. He judged the distance perfectly, the bolas snaked whizzing through the air to envelope the forelegs. The Nai-yim wobbled a moment, caught off balance, and then slowly toppled over on to her side, the baby meanwhile contentedly clutching its parent's thick mane. The Anteater now trumpeted shrilly and tore at the bolas with its back claws. The boys, however, swiftly got to work and trussed it up securely fore and aft. The baby was gently "unhooked" from its mother's back without any protests and sent home immediately with an Indian.

So far, so good. We now had our baby, and a beautiful specimen, too, *but* we also had an exceedingly angry mother trussed up and had to release her and then get out of her way—for these lumbering Anteaters can get along quite swiftly in that loping run of theirs. It was finally decided, after another council of war, that we would attach a 30-foot lasso round the forelegs, to be held at the extremity by two of the boys, while the back legs would be secured by another lasso with another two boys in the opposite direction. The lassos were duly fixed, both having

large and free-running slip knots, and the two sets of boys took up their positions at the ends of their respective ropes (incidentally I had picked out the swiftest runners, for obvious reasons). We sent the rest of the boys away to a safe distance and I then untied the original lashings round the legs, leaving only the lassos on, with the boys now pulling just hard enough to keep them tight. I mounted my horse and shouted to the hunters on the lassos to loosen up.

They shook their lassos in a snaking manner towards the Anteater, which loosened the slip knots, and then beat a retreat. The Nai-yim lay quite still for a minute or two. When she sensed that she was free again by the absence of the pressure of the lassos around her legs, she scrambled to her feet, stepped clumsily out of the nooses, shook herself, and—much to the disappointment of the boys, who were secretly looking forward to some fun—turned away from us and disappeared into the forest.

Upon reaching home I found that my wife had made up a bed for the baby Anteater in a thick sheepskin in a kerosene box on the kitchen floor. The baby was fast asleep and none the worse for its exciting day. The next morning we found "Aitkuk" ("Little One," as we called it) outside its sleeping can and busily licking up ants from the mud floor. The floor itself resembled a miniature battlefield, being pitted with excavations where an exploring claw had been searching for ants' nests. When it heard me it suddenly stopped and menacingly lifted one small but nevertheless businesslike claw in my direction. By picking it up swiftly by its back bristles, it was possible to examine the baby safely. I found it to be a fine young male, a trifle on the thin side. So Aitkuk became one of the family and commenced training and preparation for his forthcoming ocean trip, as is necessary before a long voyage.

At first we allowed him his natural food of ants and termites in abundance, water and his entire freedom within a large outside enclosure. Incidentally we observed that his favorite ant was the red "fire ant" and its eggs, and utter contentment could be seen in his pig-like eyes when he had his long snout buried right up to the eyes in a fire ants' nest. Seemingly he cared not at all for the hundreds of angry and disturbed tenants swarming all over his body and head, each one of which packed a bite like hot pincers—at least for human beings! The Lesser Anteater, on the other hand, seems to prefer a juicy termite nest.

During the three and a half months that Aitkuk was with us, we gradually lessened the ants, substituting fresh milk into which was mixed chopped hardboiled eggs and very finely chopped raw beef. All this "weaning" process was, of course, in preparation for the animal's long journey and subsequent life in the Zoo, for even the best ship's cooks and the largest of Zoos cannot possibly find sufficient ants to keep a healthy Giant Anteater satisfied and contented.

As time went on, too, we increased the number of hours each day that he was shut up in a strong wire cage, and by shipping day he was quite contented in it, and thriving on his substitute diet. I think he must have had as comfortable a trip to the Zoo as any Anteater ever did, for we heard later that he arrived in fine condition, full of fight. He got that from his mother, I expect.

FISH OR FISHES? Even professional ichthyologists often have to stop to think whether the plural of "fish" should be written "fish" or "fishes." The Aquarium's rule (and it's generally accepted) is this: "fish" is used as a collective plural when more than one fish of the same kind are meant – thus, two herrings are "two fish." But the plural is "fishes" when different species are involved – thus, "one herring and one mackerel" are "two fishes." Dead fish, though, are always just "fish," no matter how many kinds are referred to.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

MME. CHIANG AND THE PANDAS

Some months ago John Tee-Van, the Zoological Society's emissary to China in 1941 to bring back our two baby Giant Pandas, sent his yearly "progress report" on their health and behavior to Mme. Chiang Kai-shek and her sister, Mme. H. H. Kung.

It was through the good offices of Mme. Chiang and Mme. Kung that the babies were obtained for presentation, through the United China Relief, to the children of America.

Mr. Tee-Van reported that we were still undecided as to the sex of the animals, although we believe the smaller one is a male and the larger a female. Incidentally, there is a great disparity in their weights as they grow older; they were 62 pounds and 57 pounds, respectively, when they reached the Zoological Park. The male now weighs 196 pounds and the female 293 pounds.

Mme. Chiang's letter follows:

HEADQUARTERS OF THE GENERALISSIMO
CHINA

Chungking, Szechuan
April 7, 1944

Dear Mr. Tee-Van:

Thank you for sending me a progress report regarding the pandas. I am glad to hear that they are getting on so well, and I wish to congratulate you upon the way that they have reacted to the care and attention you have been giving them ever since they exchanged the privations and uncertainties of forest life in Szechuan for the amenities of Bronx Park.

The indeterminate sex problem that they present will, no doubt, resolve itself in time. From your description, the female seems to show pronounced male characteristics while the male is ladylike in his eating habits and avoirdupois.

It gives Madame Kung and myself great satisfaction to learn that the pandas continue to be such favorites with the children of America. Even with the formidable increase in weight, they must be still the engaging creatures they were in babyhood. I return their greetings and would like you to give them some special *bonne bouche* to mark the occasion.

With my personal regards,

Yours sincerely,
MAY-LING SOONG CHIANG
(Madame Chiang Kai-shek)

40 AND 34 YEARS!

Two valued members of the Zoological Park operating staff retired this summer after extraordinarily long periods of service.

Dan Schoonmaker, "boss" of the machine shop, retired on June 30 after 40 years and 20 days of work, and Miss Annie R. Newman, assistant in the Department of Publication and Photography, on July 7 after an even 34 years.

Dan had the reputation among the staff of being able to "fix anything or invent anything," when some intricate problem of mechanical housekeeping arose. Miss Newman was equally omniscient and ingenious in her own work and had a wide acquaintance among the older members of the Society, many of whom invariably dropped into call on her on Garden Party day each year.

Both will be – and are, daily – truly missed.

NEW MEMBERS OF THE SOCIETY

New members of the New York Zoological Society since the last issue of this magazine are the following:

ANNUAL

Colonel Walter A. Brown	Mrs. H. G. Hesse
Mrs. Hugh Bullock	Captain Raymond W. Lapham
Harry G. Collier	Norman J. Marsh
William P. Doelger	Mrs. Eric Maude
Alexis Doster	Mrs. Cornell Myers
Mrs. Ruth Grimes	Mrs. Nona Navin
Miss Marjorie M. Hensen	Mrs. M. Roessel

Mrs. Edgar Bauman

PROTECTING TRUMPETER SWANS

Captain Jean Delacour has been appointed as a Collaborator of the Wildlife Refuges Branch of the Fish and Wildlife Service and late in the spring made a six weeks' tour of the west where he advised on questions relating to the preservation and propagation of rare species of native birds.

An immediate problem is that of the Trumpeter Swan, the largest of all wildfowl, which is now so reduced in numbers that it is believed not more than two hundred birds survive. Their present refuge is in several high mountain lakes in Montana and Wyoming.

Captain Delacour, with Leo Laythe of the Fish and Wildlife Service, visited refuges in Montana, Utah, Wyoming and Idaho, and prepared a long-term program that includes the establishment of specific refuges and breeding facilities.

ANIMAL KINGDOM

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What About 2000 A.D.?

The mountain peaks do not change. Aloof and snow-crested, they look down upon the forested slopes, the foot-hills and the plains where there is life and where, therefore, everything is changing. Man being outside the ken of this page, what of the other animals? They continue to exist, though diminished beyond belief even within the last few decades. Yet they survive – elk in fair numbers, moose here and there, bighorn sheep on some of the distant ranges, and small bands of black-tail deer in the aspen groves. Bear still nose around the mountain cabins, and beaver, in isolated localities, work the streams. Waterfowl wing down to the mountain lakes at dusk or flock by thousands during migration time into their marshland sanctuaries. Yet the country, when compared with its condition, say, in 1900 – a little more than four decades ago – seems almost bare of animal life.

What of the future? What of another four or five decades of change? Will the end of this century write *finis* to the animal life of the great West? The outlook, though hopeful, is still uncertain. The question cannot yet be answered. The existing National Parks and established game refuges are sufficient in number and size to provide breeding and living space, though winter ranges are still not adequate. These areas, held in trust for the Nation, are well administered and provide the bulwark of hope for the future. But in the last analysis public opinion, in the years to come, will be the deciding factor – whether or not the majority of the people awake to the situation and, before it is too late, take action so that the life of these varied and wonderful animals may be permanently protected. Once they are destroyed they will never appear again on the face of this earth – no, not now, nor even in the milleniums to come.

Written while visiting the wild-life refuges and sanctuaries in Wyoming and Utah.

Fairfield Osborn

IN THIS ISSUE

Mute Swan . . . . . *Nicholas F. Delagi* COVER
Marine Cousins of the Bears . . . . . *Paul Bonnot* 107
The Poisonous Snakes of the New World, Part 2 . . . . *Clifford H. Pope* 111
How Baby Kangaroos Get Into the Pouch 121
Fish May Be Poisonous, Too . . . . . *Ross F. Nigrelli* 122
Behind the Scenes: News and Notes 125

Photograph by John Tee-Van

Sea lion rookeries are, at certain seasons, the congregating place of hundreds of animals. Here the young are born into a world of continual uproar—the barking of the adults, the breaking of waves, the screams of sea gulls and the bawling of lost pups. This rookery is on the San Benito Islands off the coast of Lower California.

MARINE COUSINS of the BEARS

On June 16 a sea lion pup was born in the Sea Lion Pool at the Zoological Park. Its adventures and mishaps as it learned to swim have so fascinated visitors to the Zoo that we thought an account of the life in the wild of these "marine cousins of the bears" would be interesting. Mr. Bonnot, who prepared the following article, has for many years worked for the preservation of the sea lions. In a later issue we expect to report on the weaning of "Benny," our active sea lion pup.

By PAUL BONNOT

Assistant, Bureau of Marine Fisheries, California Division of Fish and Game

THE ANCESTORS of all living organisms began their existence in an aquatic medium. Some of them, after reaching a high degree of specialization, remained there; many gradually moved ashore and became adapted to a terrestrial life. A few of these land forms, perhaps because of ecological advantages, have again reverted wholly or partially to an aquatic mode of life. In some remote geological era the ancestors of the sea lions, mammals closely related to the bears, began to go to sea. Anatomical modifications were of course necessary – legs became paddle-like flippers. The body temperature could not be maintained in a consistently cold medium by hair and fur alone and there was developed, just under the skin, a layer of tough, spongy tissue impregnated with oil. The present day sea lions are well adapted to their marine environment but they are still in the process of acclimation. Young sea lions must be born on land and they cannot swim at birth, but must be taught that very necessary accomplishment.

Sea lions can be distinguished from the true seals by their small external ears and their ability to turn the hind flippers under and forward for locomotion on land. They use the front flippers for swimming. The external ears of the true seals are merely holes in the side of the head; their rear flippers are used for swimming and cannot be turned forward. Seal pups can be born in the water and swim readily at birth.

On the Pacific coast of North America there are two species of sea lions: the Steller (*Eumetopias stelleri*), with a range from Bering Sea to southern California, and the black or California sea lion (*Zalophus californianus*), that is found from middle California to the southern end of Lower California. The Steller is the larger of the two, herd bulls weighing up to 2,000 pounds while cows go to 800 pounds. California bulls weigh about 1,000 pounds and cows 500. The Stellers are light gray when wet and gray or light brown when dry; the Californias chocolate brown to black when wet and ochre yellow or brown when dry. Stellers make a deep guttural roar while the Californias have a yelping bark and will sometimes howl.

The rookery is an essential feature in the life history of the sea lion. Rookeries will be found on isolated points of the mainland, sand and gravel beaches on large islands, or, more often, on a bare offshore rock. The first impression of a visitor to the rookery is one of sound. The steady muffled crash of breaking seas mingles with the growling roar of the sea lions to produce a diapason which seems to fill all surrounding space. The uproar ebbs and flows, swelling to a crescendo and dying away to allow an individual voice to break through; a cow bawling for a mislaid pup or a pup bleating for its lost mother.

At irregular intervals on the rookery site are the great herd bulls, defending their chosen areas and the cows they have collected, against poaching by other aspiring progenitors. On most rook-

eries, where they have been shot up, even the herd bulls have a wholesome respect for humans and will go overboard as soon as one appears. At some places, however, where they have not had much contact with man they will not only hold their ground but will actually pursue a human being. The animals are not concerned with sanitary considerations and the terrain is generally slippery with feces and salt spray; a situation not recommended for playing tag with a very spry, aggressive, 2,000-pound animal! It therefore behooves the visitor to respect their dignity and give them plenty of room.

Under normal conditions the bulls fight among themselves very little. If they are disturbed, however, many will stampede through territory claimed by another and savage duels are fought, sometimes until one or both contestants are dyed a dull pink from blood. In these encounters some aspirant to herd bull status may get an inferiority complex by being soundly thrashed and chased clear off the main rookery, but otherwise they seem to suffer few ill effects, as their hides are thick and salt water is a very fair disinfectant.

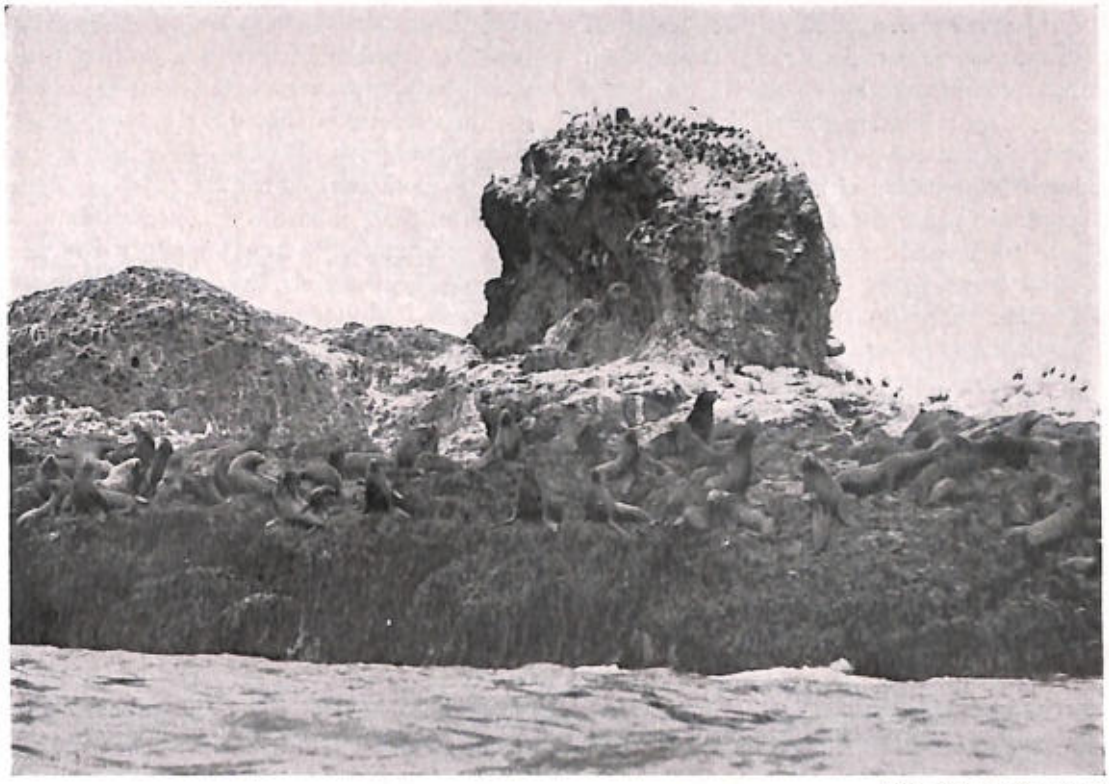
The sea lion population on any given coastal area is more or less stable and evenly distributed except during the breeding season when it is concentrated on the rookeries. During the rest of the year individuals and small groups move up and down the coast within their range, although there seem to be no definite mass migrations, except for the seasonal movements of the Steller bulls. These practically disappear from the southern part of their range after the breeding season, and spend their time on the coasts of northern Canada and Alaska. This is probably nature's method of adjusting the population to coincide with the available food supply. It is a curious phenomenon that fish can be found in abundance in the immediate vicinity of a sea lion rookery while they may be relatively scarce or absent at other places along the same coastal area.

A few of the animals may be found near the rookeries at all times but from the end of May until the first of September the whole sea lion population congregates on them. The bulls usually arrive first. They pick out a situation to their liking and as the cows arrive they are incorporated into the various harems. A few days after she lands on the rookery the cow has her pup and two or three days later she notifies her lord and master that she is ready to start all over again. The cows are pregnant practically all the time. After providing for the future the cow devotes herself to the maintenance and education of the current pup. Like most other young mammals, the pup drinks a great deal of milk, sleeps considerably, grows very fast and after a week or so begins paddling and splashing in tide pools and sheltered coves with its juvenile neighbors.

Most young mammals undergo a course of definite instruction from one or both of their parents in the fundamentals of adapting themselves to and obtaining a living from their environment. The sea lion pup, however, seems to acquire much of its education by its own imitative ability. Swimming is learned by splashing and paddling in tide pools and on shallow beaches. The first experimental attempts in deeper water are conspicuous by much jerky plunging and splashing. It is several months before the pups learn to coordinate their breathing and the smooth manipulation of the powerful front flippers necessary for successful submarine navigation.

Fish and other organisms are chased and caught; at first in much the same spirit that a puppy will pursue any smaller animal that will run. As the pup increases in size and appetite such captures are eaten to supplement the milk supply, which does not increase in the proportion demanded by the growing pup. The pup receives milk from its mother, however, to within a short time of the birth of the next brother or sister. It is not known whether there is a definite weaning procedure but the probabilities are that there is merely a progressive substitution of adult food for the natural nourishment of all infantile mammals.

The sea lion pup dwells in no Utopia. Its best (and only) friend is its mother. If it becomes lost and makes timid advances to a strange cow, it will probably be seized by the back of the neck and thrown a dozen feet. If the end of its flight is another strange cow it will usually receive another boost. When a couple of bellicose bulls are endeavoring to commit mayhem on each other, such an insignificant object as a pup does not merit consideration, and one that delays departing from that vicinity with great promptness will in all probability be stepped on – with generally unpleasant consequences for the pup.



Photograph by Paul Bonnot

Both California and Steller sea lions occupy this Piedras Blancas rookery off the California coast — the Californias taking the territory on the right and the Stellers on the left. There seems to be little fighting between the two species even though they appear to be rather cramped for space.

Although the sea lion finds protection and food in its chosen element, the sea enacts its toll. Many rookeries are so exposed that big seas wash over them during the winter storms. Occasionally an off-season storm during the breeding season will drown great numbers of pups not yet able to swim. But the adults seem to have few natural enemies besides man. A large shark will catch a medium-sized sea lion, although the large bulls seem to pay scant attention to them. The savage killer whales are feared by even the largest bulls and when the high dorsal fins of the *Orcas* appear, all the sea lions in the vicinity take to the shore. Diseases are never very apparent, possibly because a sick or diseased animal does not survive long. The littoral and sublittoral zones of the ocean, the areas inhabited by the sea lions, are not conducive to the development of weaklings. A minor injury, the slightest loss of vitality, and the individual is marked for a prompt and usually violent demise.

Sea lions are very intelligent animals and not such slaves to habit as their relations, the fur seals. Fur seals will return year after year to the rookery on which they were born, even in the face of persistent persecution. Sea lions will leave a rookery where they have been disturbed and sometimes move elsewhere for no apparent reason. They are easily trained to do a number of fairly complicated tricks. They are natural jugglers and will sometimes balance and play with a stone or piece of sea weed, evidently for amusement. The "trained seals" seen in zoos and circuses are nearly always California sea lion cows. Young Steller cows are occasionally exhibited but they are too large to be handled easily. The bulls of both species are also too large and, like many male animals, are too pugnatious to be managed. Nor are they as intelligent as the cows.

The present population of sea lions is only a small fraction of the great herds that once inhabited the Pacific coast. Vast numbers were killed a hundred years ago for the oil their blubber contained. As each animal contributed only a relatively small amount of oil, this type of exploitation was only profitable when large num-

bers of the animals were handled. The waste, of course, was tremendous, as only the oil was taken and the carcasses were left to rot. A few hides were sometimes utilized as glue stock.

During the last thirty or forty years the only commercial exploitation of the animals has been the activities of the trimming hunters. Trimmings are the genitals, whiskers and gall bladder of the full grown bulls. These were shipped to China where they found a ready market. The stiff bristle-like whiskers were used as cleaners for opium pipes, the gall bladders were incorporated in medical preparations and the genitals were dried, ground and sold as an aphrodisiac and rejuvenator of the aged. Considered merely a superstition based on the observed potency of the herd bulls, recent scientific studies of the origin and effects of hormones seem to indicate that perhaps the Chinese may have discovered a means by which impotent individuals could gratify their desire for sons.

In the matter of food, sea lions have a very catholic taste. They eat fish; sometimes commercially valuable ones, squid or any number of easily procured organisms. Periodically there are complaints by the fishing interests concerning their destructive propensities, but it has never been demonstrated that they do any extensive damage either to fish populations or to fishing gear. The tonnage of fish landed at Pacific coast ports by commercial fishermen during the last few years is so enormous that there is some basis for the contention that the sea lions, although no more numerous than they have been for years, may be more obvious because of their efforts to obtain a living from the depleted stocks of fish. The commercial fishing interests advocate destroying them entirely, "as they have no commercial value." Animals have been exterminated in the past, intentionally or accidently, with sometimes disastrous results. The sea lions may now be holding in check organisms of which we know little or nothing, on which it would be virtually impossible to impose man-made control.

The sea lions arouse the ire of a fisherman now and then by breaking his gear or stealing his fish and incur the displeasure of people who dislike any organism which they cannot profitably exploit. "If they're not good for anything, why not eliminate 'em?" is the attitude of these aggrieved individuals. But there are still a great many human beings who enjoy seeing an animal seeking "life, liberty and the pursuit of happiness" in the niche prepared for it by nature, and in the interests of these contemplative folk it is to be hoped that the commercial interests, fishing or otherwise, will not be able to force the extinction of one of our most interesting mammals.

Photograph by Dr. Wm. H. Bent

The slaughter of the sea lions is not something that happened long ago — it has been going on in recent years. These are carcasses on the San Benito rookery, within 5 years.

The POISONOUS SNAKES of the NEW WORLD. Part 2

By CLIFFORD H. POPE
Fellow of the New York Zoological Society; Curator of Reptiles of the Chicago Natural History Museum.

RECOGNITION AND DISTRIBUTION

Learning to recognize all the poisonous snakes of the New World is a task that few persons would need to undertake, but learning those of most localities is simple. Indeed, the greater part of North America, and part of South America, are free of dangerous kinds. It is obvious that much is to be gained by dividing the New World into regions and considering these separately. Many laymen do not grasp the significance of distribution; they think that an animal might suddenly decide to make a journey to almost any distant point. When I told a visitor to Chicago Natural History Museum that water moccasins are not found in the region of Chicago, he promptly replied, "I don't know of any law that would keep one from wandering up here if it felt like coming." He did not realize that inexorable natural laws do keep water moccasins far from Chicago. Even large soaring birds have their definite geographic ranges.

North America North of the United States

The only dangerous snakes found beyond our northern boundary are rattlesnakes, and these are confined to limited parts of extreme southern Canada:

Ontario: The Massasauga (Figure 12) occurs along the shores of Georgian Bay, Lake Huron, and Lake Erie but is rare or lacking in regions more than twenty miles from these bodies of water. It also is reported from the Lake Ontario shore as far east as Prince Edward County. Recently, a record for Cobalt, north of Lake Nipissing, has turned up, but this calls for confirmation.

The Banded Rattlesnake (Figure 6), although almost unknown in Canada, is occasionally met with in the narrow strip between the adjacent tips of Lake Ontario and Lake Erie, and may still exist on Point Pelee, the southern extremity of Ontario.

Alberta and Saskatchewan: The range of the Western Rattlesnake, prairie subspecies (Figure 8), extends across the Montana boundary into the southeastern corner of Alberta and the adjoining corner of Saskatchewan.

British Columbia: The Pacific Rattlesnake (Figure 9), a far western subspecies of this same kind, occurs in southern British Columbia throughout the region approximately bounded by the Fraser and Thompson Rivers and Okanagan Lake.

These rattlesnakes are described in the following section.

The United States

Once the distribution of our poisonous snakes is understood, their identification becomes simple, but certain basic facts must be committed to memory. Every poisonous snake found north (and west) of our southeastern lowlands is either a rattlesnake or a copperhead (Figures 21, 22) and therefore has a facial pit and large movable fangs. The northern limits of these lowlands are fairly well indicated on a map by drawing a line from Cape Charles, Virginia, to the midpoint of the Alabama-Georgia boundary, thence to the

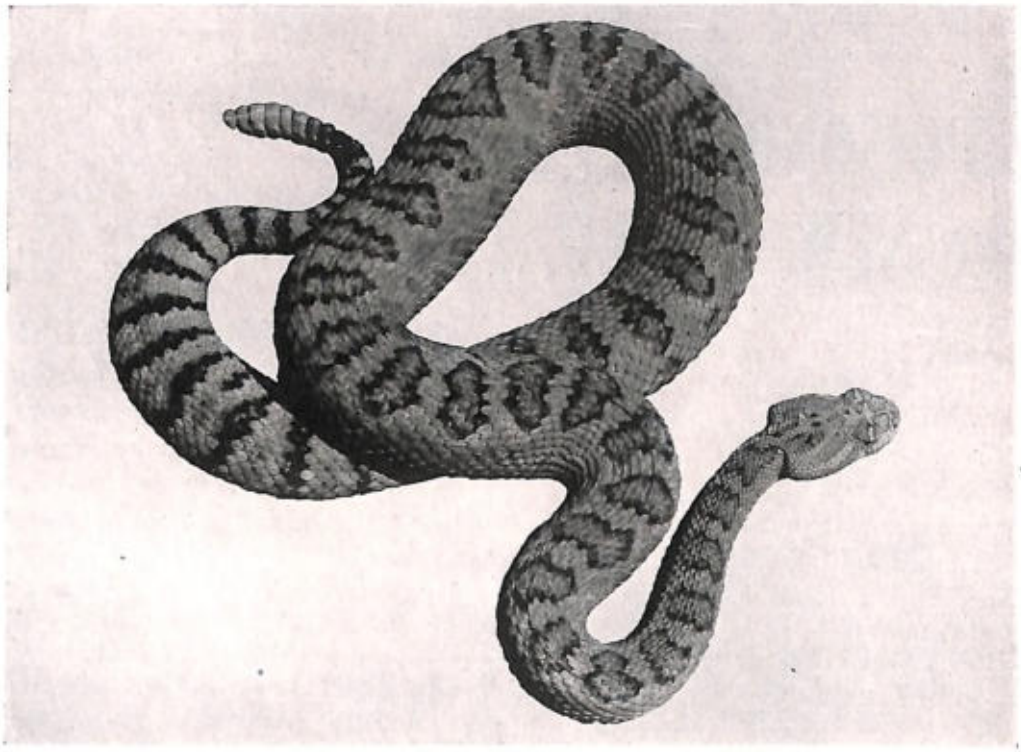


Fig. 10. Great Basin Rattlesnake, *Crotalus viridis lutosus*. Range: Great Basin of the United States. Average length: 38 inches. Highly dangerous.

center of the southern third of Illinois, and from there to the junction of the Pecos and Rio Grande Rivers, Texas. The Arizona coral snake (Figure 26), an exceedingly rare species found at altitudes below 5,000 feet in southern Arizona, is the only exception, but this reptile is distinguished at once from other Arizona snakes by a black snout and brilliant pattern of black, red, and white bands that completely encircle the body. It is never more than eighteen inches long. A description of it is given below.

The layman's problem is further simplified by the limited distribution of the copperhead, for this reptile does not range north of a line connecting the northeastern tip of Massachusetts with Pittsburgh and Pittsburgh with the extreme southeastern corner of Nebraska; nor west of one connecting this corner with the upper Rio Grande in Texas and passing just southeast of New Mexico. Thus the recognition of a poisonous snake in that vast part of our country lying north and west of the copperhead's range presents no problem at all, for one has only to look for a rattle.

Certain extensive areas are entirely free of poisonous reptiles, notably all of Maine except possibly the country adjacent to the middle sector of the New Hampshire boundary; Long Island, New York; the upper peninsula of Michigan and the northern third of Wisconsin; all of Minnesota except the territory lying along the Mississippi south of St. Paul; the coastal strip of Oregon, and the lowlands of western Washington.

The recognition of a poisonous snake in the southeastern lowlands delimited above is complicated by the presence there of our common coral snake (Figures 1, 25), and an additional pit-viper, the water moccasin (Figure 23). Rattlers not found beyond the lowlands also occur but these are recognized at once by their rattle.

With these fundamentals of distribution securely in mind a resident of any given area can quickly determine the maximum number of kinds of poisonous snakes that might occur near his home. For example, anyone in upper Michigan, northern Wisconsin, or Minnesota north

Upper — **Fig. 11. Southern Pigmy Rattlesnake, *Sistrurus miliarius*. Range: Southeastern United States. Average length: 19 or 20 inches. Bite not fatal to adults.**

Lower — **Fig. 12. Massasauga, *Sistrurus catenatus*. Range: North America from the region of the Great Lakes southwestward to the Rio Grande. Average length: 2 feet. Bite not fatal to adults.**

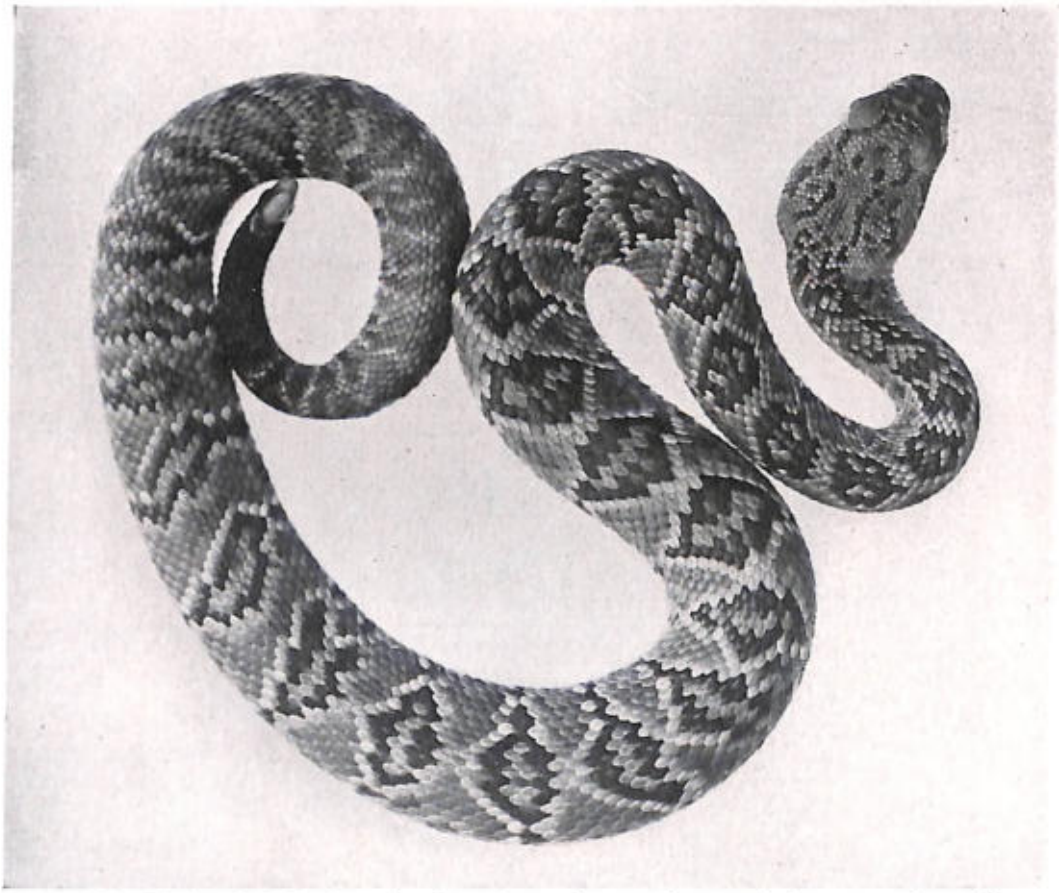


Fig. 13. Black-tailed Rattlesnake, *Crotalus molossus*. Range: Arizona, southern New Mexico, southwestern Texas and the highlands of Mexico. Average length: 40 inches. Highly dangerous.

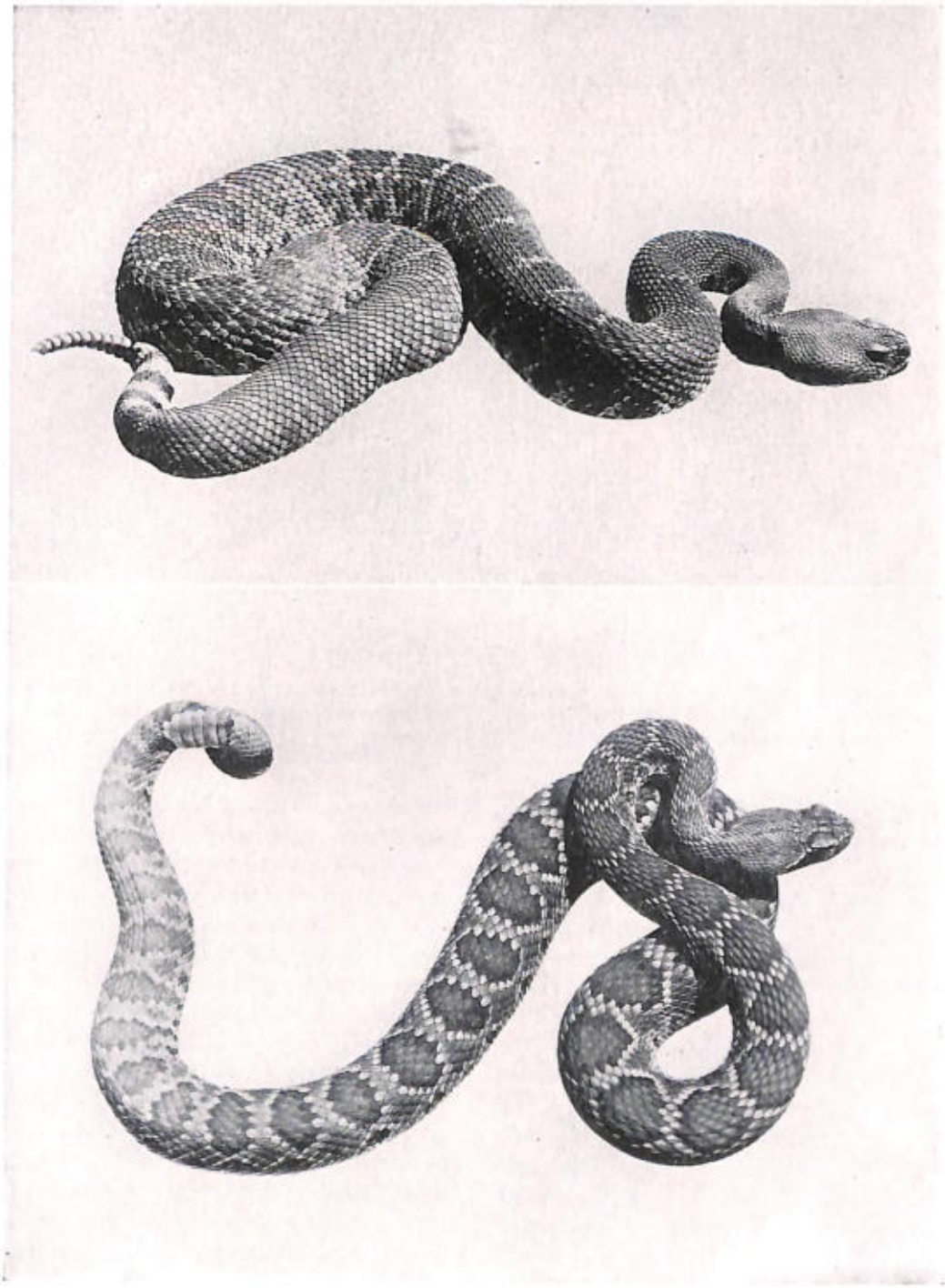
of the latitude of St. Paul would not have to consider the dangers of snake poisoning; one residing in southeastern Pennsylvania would have to recognize the copperhead (Figures 21, 22) and a rattlesnake; a Californian need concern himself only with the latter; a Mississippian with a rattler, the water moccasin, the copperhead, and a coral snake. The phrase "maximum number of kinds" is used advisedly because numerous areas of many square miles in the range of every snake do not happen to harbor individuals of the species. There are, for instance, extensive stretches of wild country in New Jersey entirely free of rattlesnakes even though these snakes are abundant to the north and south. Local museums and natural history societies are always glad to give specific information to the newcomer.

It is often stated that four "kinds" or "types" of poisonous snakes inhabit the United States, but such a statement is much like saying that there are (among others) four kinds or types of human beings: a Chinese, an Englishman, an African, and a New Yorker. Actually, our dangerous snakes fall into two types, the coral snakes (Elapidae) and the pit-vipers (Crotalidae). The former include only two species, whereas the latter are technically divided into two groups with rattles and one lacking this convenient character. The members of this rattle-less group are the copperhead (Figures 21, 22) and water moccasin (Figure 23). These facts may be concisely stated thus:

Coral snakes (Elapidae): Two unrelated species

Pit-vipers (Crotalidae):

1. Two groups of rattlesnakes (*Crotalus* and *Sistrurus*)
2. A rattle-less group made up of the closely allied water moccasin and copperhead (*Agkistrodon*)



Upper — Fig. 14. Red Diamond Rattlesnake, *Crotulus ruber*. Range: Extreme southwestern California and most of lower California. Average length: 45 inches. Highly dangerous.

Lower — Fig. 15. Mohave Rattlesnake, *Crotalus scutulatus*. Range: Deserts of extreme southern Nevada and adjacent areas, especially western and southern Arizona, southward through the highlands of Mexico; Texas south of New Mexico. Average length: 37 inches. Highly dangerous.

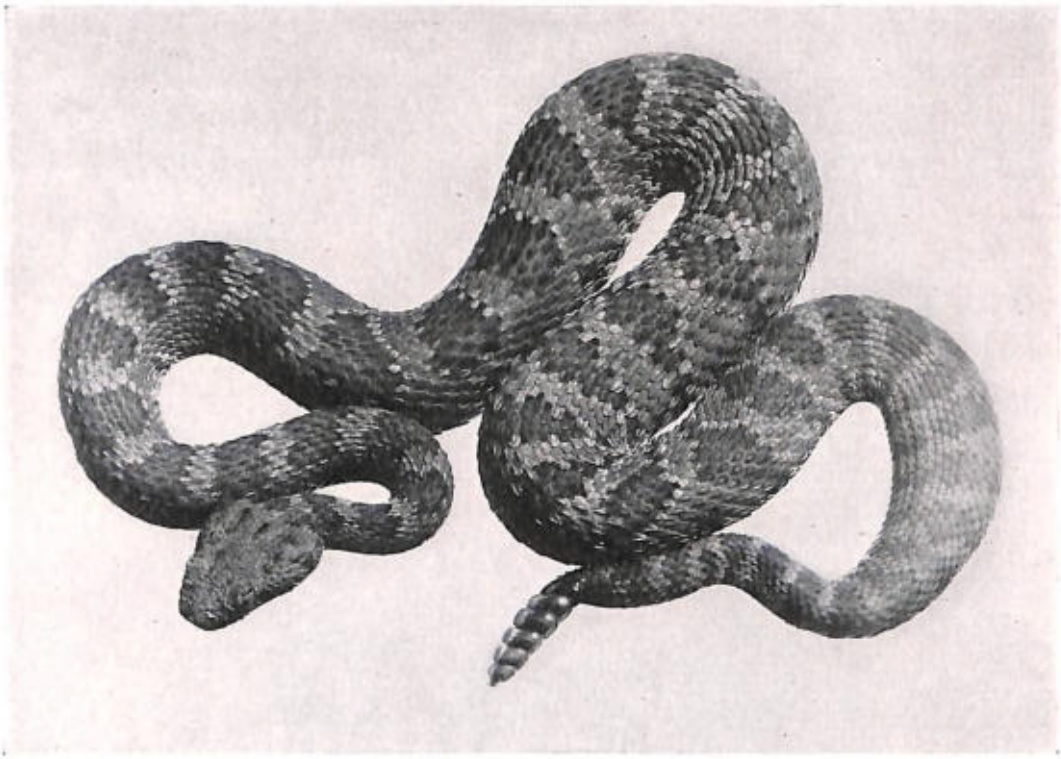


Fig. 16. Mitchell's Rattlesnake, *Crotalus mitchellii*. Range: Lower California northward through southern California to extreme southwestern Nevada; central and western Arizona. Average length: 33 inches. Highly dangerous.

In spite of their wide collective distribution, most of the species of rattlesnakes are confined to the region extending from central and northern Texas to the Pacific coast. Outside of this region one rarely if ever finds more than three kinds in a single area and one or two is the rule. Westward from Texas the number of kinds steadily increases until, in southern Arizona a climax is reached with no fewer than eleven species. Since identification of some of the southwestern rattlesnakes is extremely difficult, I shall not describe all of our fifteen species but only four large, well-known members of the major group (*Crotalus*), the two belonging to the minor one (*Sistrurus*), plus the two rattleless pit-vipers of the United States. In short, ten of our nineteen poisonous species are briefly characterized below. This includes every one found in the country's eastern half and northwestern quarter, and it might be remarked, the few that reach Canada as well.

Diamond-back Rattlesnake, *Crotalus adamanteus* (Figure 4). This highly dangerous reptile is not only the largest of all rattlesnakes but the heaviest poisonous snake known. The maximum length (excluding the rattle) is seven feet three inches, the average adult length just over five. It is confined to the coastal strip from Pamlico Sound, North Carolina, to the region in extreme eastern Louisiana north of Lake Pontchartrain; all of Florida is inhabited by it. The southern pigmy rattler (Figure 11) also occurs in the southeastern lowlands but is spotted and comparatively very small. The other large rattler of approximately the same region, the cane-brake rattlesnake, is banded (Figure 6) and does not inhabit peninsular Florida. The diamond-back's characteristic pattern of diamonds outlined in black and white amply distinguishes it; rural inhabitants of its range invariably recognize this reptile and give it a wide berth.

Palmetto flatwoods are the favorite haunt, but any low brush-covered country may be frequented. Although the diamond-back does not like swamps, it often lives in dry areas adjacent to water, and even swims occasionally. Some

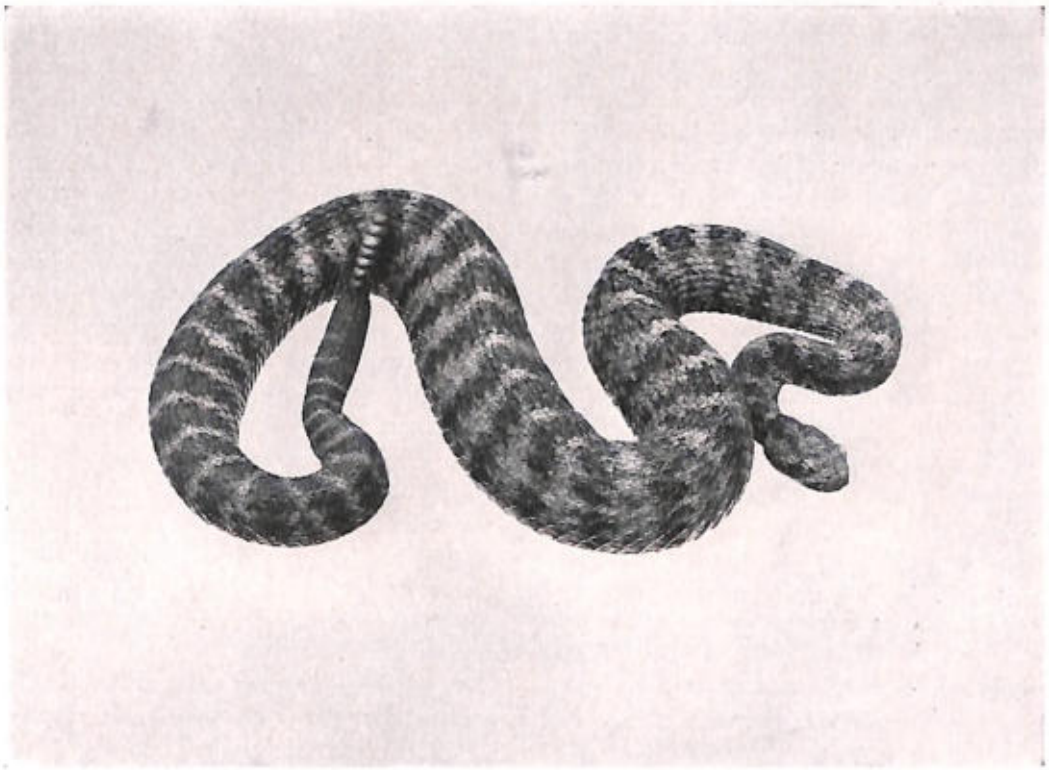


Fig. 17. Tiger Rattlesnake, *Crotalus tigris*. Range: A narrow strip of territory from the vicinity of Phoenix, Arizona, southward through the middle of Sonora, Mexico. Average length: 28 inches. Highly dangerous.

individuals rattle as soon as an intruder comes in sight, others refuse to do so until closely approached. Small mammals and birds are eaten, the former much the more frequently.

WESTERN DIAMOND-BACK RATTLESNAKE, *Crotalus atrox* (Figures 2, 5). There is little choice between this and the preceding species as a menace to man. Although the maximum recorded length of the western kind is two inches greater, its average length is five or six inches less; a more extensive distribution makes up for the smaller size. The range embraces the territory from central Missouri and Texas westward through the desert areas of southeastern California as far north as the southern tip of Nevada. The plains of extreme eastern Texas and the panhandle of that state are not inhabited, nor are the northernmost parts of Arizona and New Mexico. The range of this reptile, excepting central and eastern Texas, Oklahoma, and Missouri, is aptly styled the "rattlesnake belt" and in this belt identification of species becomes too difficult for the layman.

BANDED RATTLESNAKE, *Crotalus horridus* (Figures 6, 7). The distribution of this formidable reptile extends from the Atlantic coast (except peninsular Florida) to central Texas and eastern Kansas; in the northeast, it barely reaches Maine along the middle sector of its western boundary, and is found over at least the southern half of New Hampshire, most of Vermont and New York. West of Pennsylvania, its northern limits are in southern Ohio (excepting a colony at Catawba Cliffs of northern Ohio and on adjacent Lake Erie islands) and southern Indiana. From central and northwestern Illinois it follows the Mississippi valley northward to St. Paul, Minnesota. There are good records for the Baraboo Hills of southern Wisconsin.

Examination of thousands of specimens has shown that those from the southeastern lowlands are the larger and are different enough in color to be given a technical subspecific name (*atricaudatus*). This subspecies is usually known as the CANE-BRAKE RATTLESNAKE since it inhabits cane-brakes and other bottomlands. With maxi-

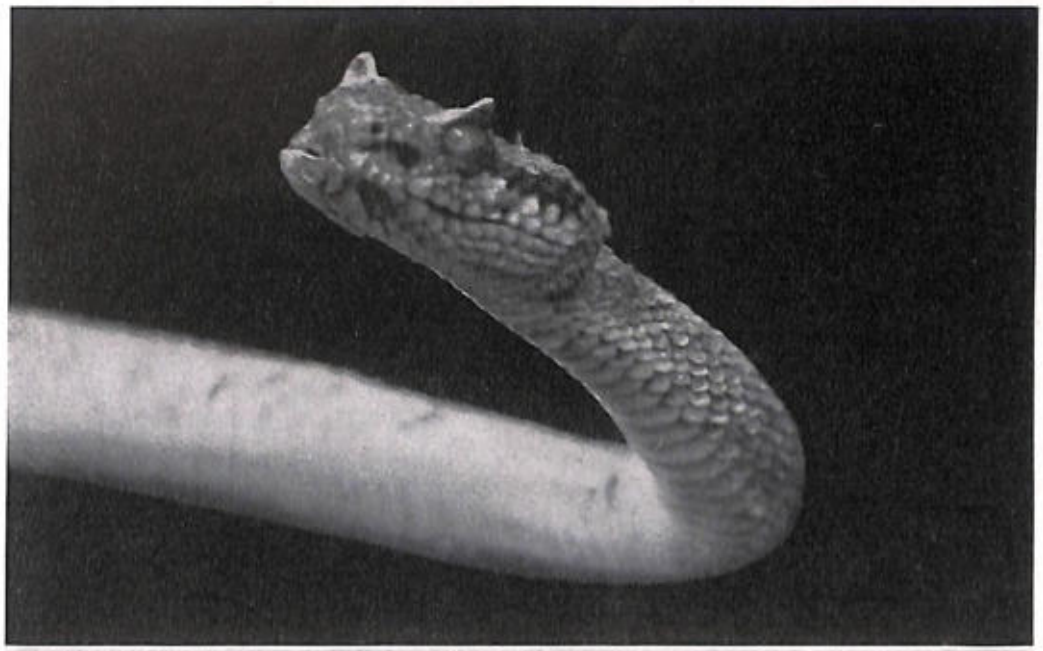
mum and average lengths of seventy-four and forty-eight inches, it ranks third in size among the rattlers of this country. The slightly smaller northern subspecies, often called the TIMBER RATTLESNAKE, frequents rugged, hilly country and even mountain forests. Because of its habit of hibernating in crevices of rocky ledges, it is associated with country in which such outcroppings are commonly seen. It is, nevertheless, encountered in wild upland river valleys far from rocky ledges, especially in the summer. In southern New Jersey, it even frequents flat, sparsely wooded pine barrens, and hibernates in wet sphagnum bogs.

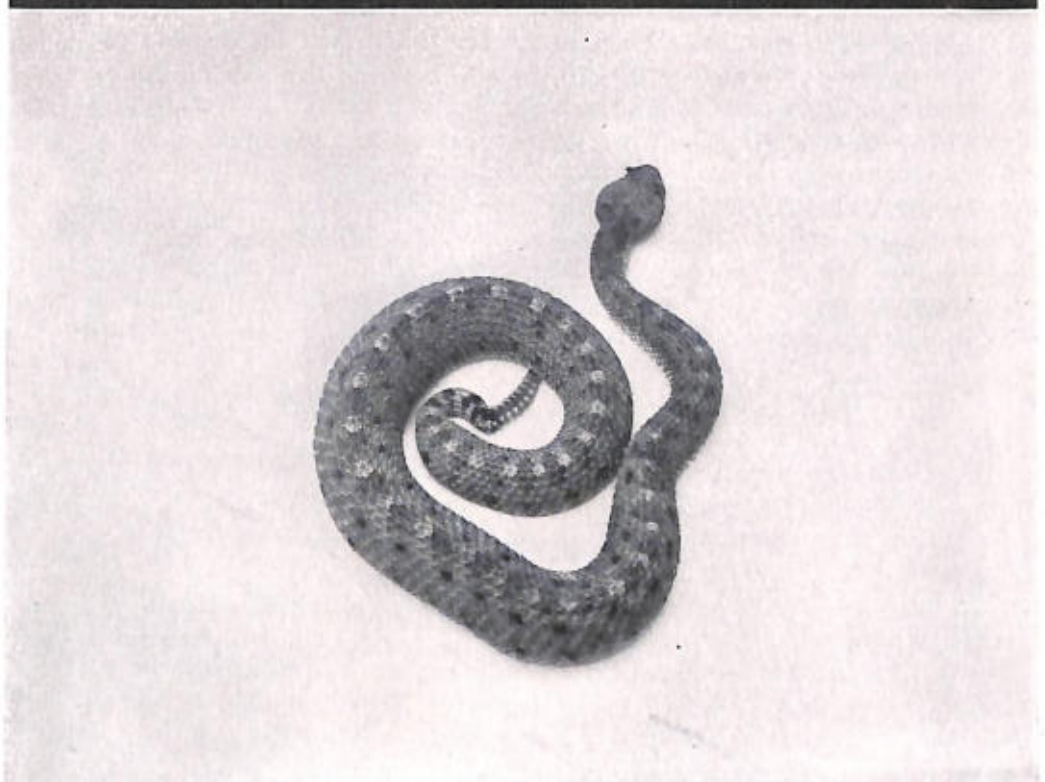
Bold, black bands distinguish it from the other rattlesnakes of its range. The colors are rich and variable, some northern individuals being so black that the bands do not stand out (Figure 7). The most conspicuous distinction between the northern timber and the southern cane-brake rattlers lies in the intensity of the stripe behind the eye which is usually obscure in the timber, strong in the cane-brake rattlesnake.

This is not a vicious reptile but its size makes its bite highly dangerous, and the inexperienced should approach it with extreme care. The food consists of a large percentage of small mammals, chiefly rodents, and a small percentage of birds.

WESTERN RATTLESNAKE, *Crotalus viridis* (Figures 8-10). A species highly variable in color and size occurs from the Pacific Ocean (except the coastal strip of Oregon and the lowlands of western Washington) eastward approximately to a line joining the centers of North Dakota and Texas. The variation is so great that six subspecific names have been given to the populations of as many areas. Since no other species occurs with this one over the whole northwestern quarter of the country, there is little need for descriptions of these subspecies. The three widely distributed ones, the prairie (Figure 8), the Great Basin (Figure 10), and the Pacific rattlesnakes (Figure 9), take their names from the regions they inhabit and attain approximately the same average size (three feet), the maximum length for any one of the three being five feet. The habitat varies with the different subspecies and so does the temperament. It is patent that any rattler attaining such dimensions must be classed as highly dangerous.

Fig. 18. Rock Rattlesnake, *Crotalus lepidus*. Range: Texas west of longitude 98° and south of latitude 31°; southwestern New Mexico and extreme southeastern Arizona; higher parts of the Mexican highlands southward to Jalisco. Average length: 22 inches. Highly dangerous.





Upper — Fig. 19. Horned Rattlesnake, *Crotalus cerastes*. The projecting scales above the eye that give rise to the term "horned" are clearly shown here. The peculiar form of locomotion is responsible for its other name, "Sidewinder."

Lower — Fig. 20. Horned Rattlesnake, *Crotalus cerastes*. Range: Extreme southwestern Utah westward to the Sierra Nevadas in southern California and southward into northeastern Lower California and northwestern Sonora, Mexico. Average length: 2 feet. Highly dangerous.

MASSASAUGA, *Sistrurus catenatus* (Figure 12). This is one of the three species that comprise the smaller group of rattlesnakes usually known as "pigmy" or "ground rattlers." These snakes carry a potent venom but their small size keeps them from being nearly as dangerous to life as are the larger rattlers. In other words, one of them would be approximately as dangerous as another rattler of equal size.

The massasauga attains a maximum length of three feet, an average of two feet. Its range extends from Ohio and the lower peninsula of Michigan southwestward to the Rio Grande but does not include any of Arkansas except the northwestern tip, nor that part of Texas lying east of the lower valley of the Brazos River. There is evidence of its occurrence in central and western New York and in Pennsylvania from the Allegheny River valley westward; also in the extreme southeastern corner of Arizona. Its boldly spotted pattern and small size readily distinguish it from the banded rattlesnake (Figure 6), the only other snake of the northeastern half of the massasauga's range having a rattle; in the southwest, it enters the "rattlesnake belt" and is easily confused with other species.

The massasauga frequents bogs, swamps, and similar poorly drained areas; during the summer it may move to adjoining drier situations. In the Chippewa language, massasauga means "great river-mouth." This fact is evidence that part of the original habitat was the swampy river-mouths of the Chippewa country. The food consists of mice, frogs, and, occasionally, snakes. In the northern states where the cooler climate keeps human feet and legs well covered the chance of the massasauga's short fangs reaching their goal is slight, but the barefoot southern boy or girl might be seriously poisoned by one of these snakes or its relative about to be considered.

SOUTHERN PIGMY RATTLESNAKE, *Sistrurus miliarius* (Figure 11). The average length of this, one of the smallest of rattlesnakes, is only nineteen or twenty inches, the maximum twenty-five and a half. It is boldly spotted somewhat like the massasauga.

The range includes all of South Carolina; the lowlands of North Carolina, Georgia, Florida, Alabama, and southwestern Tennessee. There are records only for southern Mississippi, but west of the Mississippi River, the distribution embraces Louisiana, central and eastern Texas, the southeastern half of Oklahoma, all of Arkansas, and southern Missouri. East of the Texas-Louisiana and Arkansas-Oklahoma borders no other small, spotted rattlesnakes occur, the two diamond-backs (Figures 2, 4, 5) and the banded rattlesnake (Figure 6) being amply distinct. Further west, the range somewhat overlaps those of the massasauga (Figure 12) and the western rattler (Figure 8), introducing complications of identification.

Will Sharks Attack Human Beings? Yes!

For many years there have been arguments about sharks: Will they, or will they not, attack human beings? The standard argument of the anti-shark-bites-man school has usually been that the attacker was not a shark, but some other fish, such as a barracuda.

In the "Journal of the American Medical Association" of July 22, 1944, the question seems to have been settled; at least one shark did attack – and kill – one man. The "Journal" reports the case of a sailor who went overboard on September 23, 1943, in a shallow cove about 75 feet off the north shore of Rey Island, Gulf of Panama, and was quickly attacked by a shark 6 or 7 feet long. No refuse had been dumped into the cove, and no sharks were seen before the sailor went over the side to inspect the ship's propellor.

The young man was horribly mangled by the bites and died seven hours later. The tips of two teeth were found among his injuries and were identified by John T. Nichols of the American Museum of Natural History as the teeth of the so-called man-eater shark, *Carcharodon carcharias;* in this identification Dr. C. M. Breder, Jr., at that time director of the New York Aquarium, concurred.

How Baby Kangaroos Get Into the Pouch

On November 16, 1940, a gray kangaroo was born in the Clifton Zoological Gardens at Bristol, England, and the actual birth and the progress of the inch-long baby toward the maternal pouch were watched. Through the years there has been so much speculation about kangaroo births, and the method by which the baby reaches the pouch where its development continues, that it was a piece of extraordinary good fortune that an observer was on hand to give evidence about the Bristol event.

In the latest number of the *Proceedings of the Zoological Society of London* received here, Dr. L. Harrison Matthews of the University of Bristol not only reports on the birth of the gray kangaroo but surveys previously published accounts of marsupial births.[1]

"Until recent years," he writes, "it was generally believed that the new-born marsupial, immediately after birth, was deposited in the maternal pouch by the mother, and that this deposition was effected by the dam using manus or lips, or by her propulsion or guidance of her offspring along the surface of her abdomen by means of her tongue. Since 1920, however, various observations have been published, showing that the new-born marsupial crawls into the pouch, receiving from its parent but a limited or indirect aid."

At the Clifton Zoological Gardens, as soon as the baby had been born the mother leaned forward and began licking her abdominal fur in a two-inch long path for the baby.

"When the latter had gained the top of this patch, another wet patch was prepared in continuity with the first, the process being repeated until the young one had climbed above the level of the marsupium, into which it then crawled. Between the spells of licking, the dam leaned well backward, keeping her anterior abdominal wall almost level.

"The infant was about an inch long; its hind limbs were crossed and flexed, and covered ventrally by the tail. Its eyes were closed, its mouth roundly open. It crawled by its forelimbs only, clawing its way by a sideways and downward thrust of these members. Soon after its arrival in the marsupium, it climbed to the rim thereof and fell out. It was replaced by the observer, and several hours later was found to be still unattached to the nipple. Several days later it had vanished. The dam was known to be an indifferent parent, and had previously lost partly-reared progeny."

After reviewing accounts of marsupial births published in recent years, Dr. Matthews states:

"These accounts of parturition in marsupials agree in stating that the neonatal marsupial crawls into the marsupium by its own efforts, and is not transferred thereto by the mother. The dam, indeed, appears indifferent to the fate of her offspring, of which she takes small notice. Should her young one miss the pouch, she makes no attempt to direct it thither; should it fall to the ground, she does not retrieve it. All observers agree that the sole assistance rendered by the female to the new-born, is, apart from the assumption of a particular posture, the preparation, by licking, of a moist track through the fur of the maternal abdominal wall from cloaca to marsupium."

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[1] Parturition in the Kangaroo. By L. Harrison Matthews, Department of Zoology, University of Bristol, *P.Z.S.*, Vol. 113 (1944), Series A, No. 10, pp. 117-120.

FISH May Be Poisonous, Too

By ROSS F. NIGRELLI

PEOPLE expect snakes to be poisonous. The few species that actually are venomous have been so well advertised that the whole tribe suffers suspicion. But fish, except in limited circles, are supposed to be entirely harmless. Nothing could be further from the facts – some fish are quite as venomous and as deadly as any snake.

It might seem that, since most of us do not go hiking or picnicking in the open ocean or among coral ledges, the poison fishes of the seas do not present much of a problem. Nevertheless, they do; commercial fishermen, who throw back about 7 out of 10 kinds of fish they catch, have to be well aware of the kinds of creatures it is safe to touch with the bare hands. Some rather important problems have been arising, too, in connection with the government's efforts to increase the food supply by popularizing species of fish not generally utilized. And the Army and the Navy have been very careful, in their instructions to service men how to find food if they are cast away, to point out the dangers that may exist in some brightly colored, appetizing-looking tropical fishes.

Soon after the beginning of the war the National Research Council undertook to find out which of the species ordinarily found in the nets of commercial fishermen, and usually thrown out, could be utilized as food. It has long been known that some, such as the sharks, grayfish (dog sharks or dogfish) and skates, could be eaten. As for some others, including the blowfishes (puffers, porcupinefish and rabbitfish), sea robins, rays and the like, there was some doubt about their edibility, for long tradition indicated that they were poisonous.

In our local waters, a fish that is caught in abundance from April until October is the Atlantic puffer, *Sphaeroides maculatus*. Epicureans

Food requirements of wartime, and the experience of service men, have made us aware of the venomous creatures of the sea.

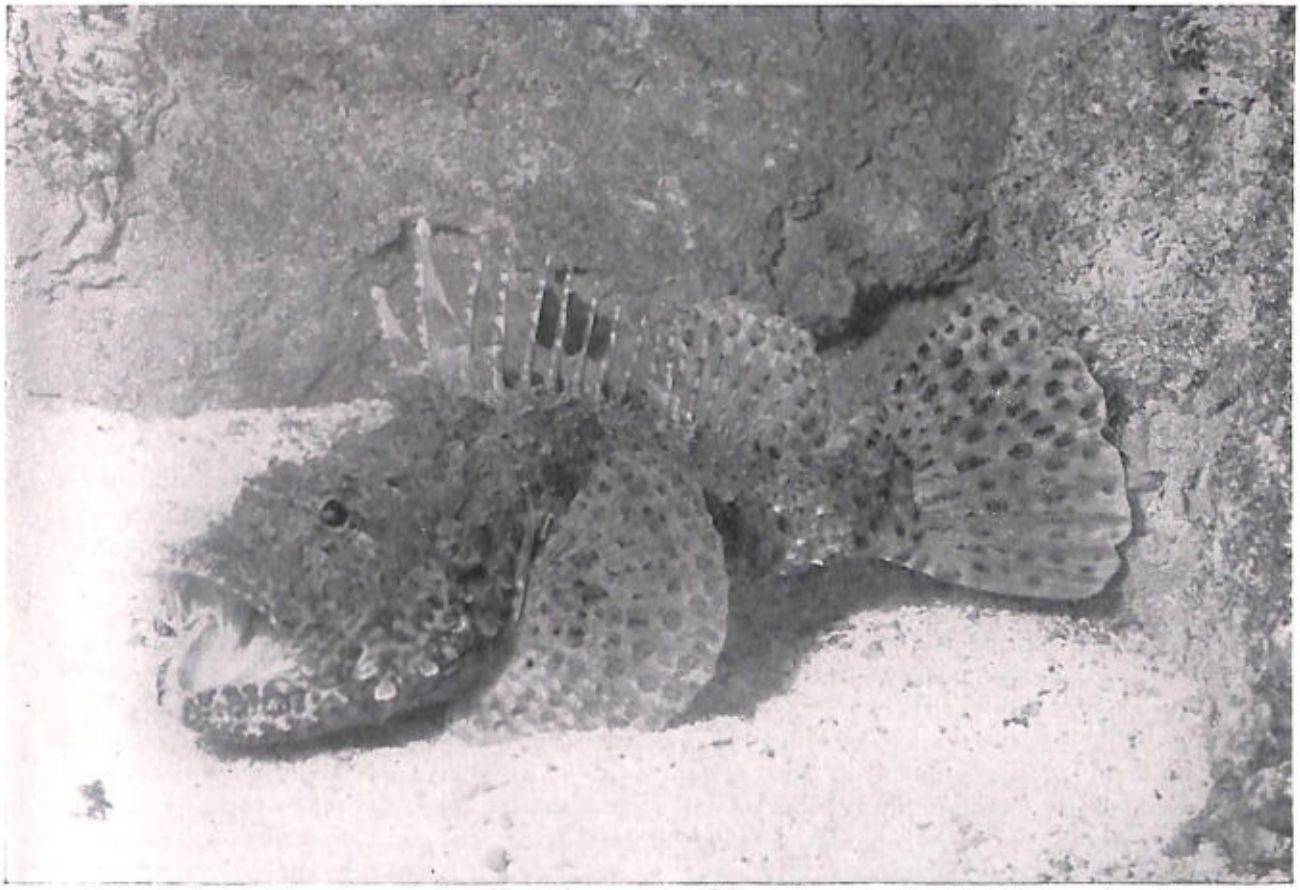
– the few that have tried it – say it is a real delicacy.

But the puffer has a bad reputation, because a long time ago it was said to be poisonous. Is there any real evidence for that tradition?

W. H. Yudkin of the Bingham Oceanographic Laboratory has been looking into the matter and has summarized the case of puffer, or tetrodon, poisoning, especially among the species of puffers found in other parts of the world. It seems that the viscera (especially the ovaries and liver) of the puffers are highly toxic and from them has been isolated a poison called "tetrodotoxin." Furthermore, it has been found that puffers caught in the late summer or early autumn are not poisonous – or at any rate that their toxic effects are greatly diminished. This decline in toxicity is apparently related to the condition of the ovaries, which at this part of the year are in a "spent" condition. The chemical nature of tetrodotoxin is not yet clearly understood, although its paralyzing effect on the nervous system is well known.

However, it is important to point out that there is no evidence that the *flesh* of any of the puffers, either the Atlantic species found around here or the members of the family in other parts of the world, is poisonous, and that only the viscera are suspect. From my own experience I can report that puffer meat is perfectly wholesome and in fact quite as tasty as others have stated it to be.

But there are many species of poisonous fishes that employ actual venom, and many cases of



A particularly ugly customer to handle is the scorpion fish, various species of which are found in the warm seas of the world. It secretes a poison under the skin of each of the dorsal spines. This specimen is the Madeira scorpion fish, *Sebastes maderensis*, often exhibited at the Aquarium.

poisoning have been reported. The *Bulletin* of the U. S. Army Medical Department as recently as last spring reported on fish poisoning among natives of the Marshall Islands – an area much in the daily news recently. In that Pacific area there are three groups that need to be watched: 1. those which poison by biting or stinging; 2. fish having definitely poisonous flesh; 3. fish having doubtfully poisonous flesh. In the first group are listed such wellknown venomous creatures as the morays, stonefish, toadfish, weeverfish, zebrafish, and so on. To this list might be added stingrays, scorpionfishes from other oceans of the world, and certain catfishes from North America.

Obviously one would do well to keep away from the morays in the Marshall Islands or elsewhere, for the Army publication remarks that they "have hollow teeth through which venom is injected into the wound. The venom is hemolytic and large doeses produce almost instantaneous death; smaller doses cause rapid, embarrassed respiration, violent cramps, and convulsions."

Dr. Charles M. Breder, Jr., former director of the New York Aquarium, pointed out in his "Field Book of Marine Fishes of the Atlantic Coast" that the Atlantic morays also reach large size and are greatly feared by fishermen. "Brought aboard a small skiff, it is an ugly customer" and can snip off a finger with ease. Nevertheless, the flesh of the morays is eaten with avidity in certain parts of the world – after throwing away the head which contains the poison apparatus, presumably.

Many species of scorpionfish, found in warm seas, secrete poison under the skin of each dorsal spine, the glands forming little bags full of a milky juice. The most fantastic – and one of the most dangerous – of this group is the beautiful black-and-white-striped zebrafish, or lion-

fish, of the tropical Pacific. Its pectoral fins are remarkably long and the needle-like spines are greatly to be dreaded. Specimens used to be exhibited with regularity at the Aquarium in Battery Park and fortunately no member of the staff ever had any serious encounters with the spines. However, a collector who brought fish to the Aquarium once accidentally stuck his hand on one of the spines and suffered terrific pain and swelling for many hours.

One scorpionfish that is dreaded by natives and fishermen is the black vohu, or nohu (*Emmydrichthys vulcanus*), that lives among lumps of lava along the shores of Tahiti and other Polynesian islands. Its spines are dangerous stinging instruments. So are the spines of the monstrous-looking scorpionfishes of the genus *Synanceia* – short, thickset, irregularly-formed fishes which can eject a highly toxic venom. Yet the flesh of all these poisonous fishes is perfectly good and sells readily in the native markets.

The most elaborate and perfect system of poison organs known among fishes are found in certain South American toadfishes. Two spines on the first dorsal fin and other spines on the gill coverings are the dangerous ones. They are like the hollow fangs of a poisonous snake, perforated at the base and at the tip. Since no definite glands are associated with the spines it is assumed that the poisonous fluid is secreted by the mucous membrane. The great ichthyologist Gunther, in his "Introduction to the Study of Fishes," pointed out that "the slightest pressure of the finger at the base of the spine caused the poison to jet a foot or more from the opening of the spine."

The toadfish or oysterfish (*Opsanus tau*), commonly found along our coast, has no poison spines but is reputedly poisonous nevertheless and persons have been made violently ill by eating it. The fish gives off tremendous amounts of mucous and the flesh has a disagreeable odor and taste.

The European weevers (*Trachinus draco* and *T. vipera*) are unpleasant members of the rogue's gallery of the sea through their habit of partly burying themselves in the sand in shallow water. Bathers sometimes step on their projecting poison-injecting spines, and get violent pains as a result. Nevertheless they are good eating and considerable numbers of the larger species, *T. draco*, used to be brought to the Paris market.

Fishermen the world over fear the stingrays, so-called because of the serrated spine they bear at the base of the whip-like tail. The tail itself is not particularly dangerous; the spine causes the trouble apparently through the surface mucous it introduces into the wound. To make matters worse, the spine is loosely set and sometimes pulls away and remains in the victim.

Even our fresh water streams are not free of poisonous fishes and many a New York state fisherman has reason to remember the diminutive catfishes known as Mad Toms. Their pectoral spines are equipped with poison sacs that produce very painful but not dangerous punctures.

As if it were not enough to find so many fish that are actively poisonous, it appears that individual wrasses and parrotfishes of the tropics, which ordinarily are quite non-poisonous, sometimes become toxic because they have been feeding on poisonous mussels, sea cucumbers and sea anemones.

The picture of fish life outside the range of the familiar, tried-and-true market fishes, is not as lethal as it might seem, however, for it is highly probable that at least some of the fishes that have a bad reputation in various parts of the world are not really poisonous, and that cases of human poisoning attributed to them are due actually to bacterial decomposition.

It would seem that in truth there are "as good fish in the sea as ever were caught" – for food – and that gourmets the world over might well continue with their experiments on new market fishes. As with snakes, the bad ones are really few and far between.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

TWO YOUNG AGOUTIS

Of all the mammals of tropical America, two groups are so common that few zoos, however unpretending, are without them. These are the Agoutis and the Coatis. Coatis are lively, interesting and vicious, so that they never fail to amuse visitors. But Agoutis are quiet and harmless, and look so much like out-sized guinea-pigs that they too often are passed by. Their soft coloring and graceful movements are appreciated only by the discriminating.

Common as Agoutis are in collections, they are not easily bred and in all the years our Zoological Park has exhibited them, less than half a dozen births have been recorded. Consequently, when a female Central American Agouti (*Dasyprocta punctata*) presented us with two lively youngsters, we were both pleased and proud. Agoutis are usully born in pairs, and come into the world with eyes open and legs prepared to move with amazing agility. The little animals are a great attraction to our visitors in the Small Mammal House, whom they constantly astound by their infantile abilities in running and leaping.—LEE S. CRANDALL.

46 BABY RATTLESNAKES

An extraordinarily large litter of Western Diamond-back Rattlesnakes was born in the Reptile House on September 8-9. A medium-sized female produced 46 young, of which 26 were alive.

Although there seem to be few records of the size of litters in *Crotalus atrox*, the average is certainly far fewer than 46. In their "Field Book of Snakes," Schmidt & Davis cite the average as "about 10," but state that occasionally "20 or more" are born at one time. Other herpetologists mention litters of 4 to 23.

The first young appeared about 3 o'clock on the afternoon of September 8 and only three had been born when the Reptile House staff departed for the night at 6:30 P.M. The following morning at 7:30 o'clock, 45 young snakes were on the floor of the cage, 26 alive and 19 dead. One other stillborn baby was in process of birth, but was not entirely dropped until mid-afternoon.

There was a noticeable change in the temperament of the female after the birth of the babies. Ever since she arrived from Texas in July, she had been quiet and tractable. The opening of the rear door of her cage never caused her to rattle and she could only be induced by vigorous poking with a snakestick to bestir herself and assume a defensive posture.

The morning after the birth of the babies, however, she was almost continually in a fighting coil and her rattle was in constant motion. Even the presence of visitors at the front of her cage caused her to face the glass and keep up a steady rattle. She did not seem to show any curiosity about or interest in the babies, most of which crawled into a distant corner of the cage and coiled up together. Occasionally an isolated baby would "rattle" its juvenile button in tune with its mother.—W. BRIDGES.

NEW MEMBERS OF THE SOCIETY

New members of the New York Zoological Society since the last issue of this magazine are the following:

Annual

Mrs. Arthur E. Lamb — Mrs. Anna N. Wanek

Fellow

Dr. John T. Zimmer

A RARE BABY CRANE

In all the history of the Zoological Park, up to 1944, only two young cranes, both of the same species, have been reared here. These two were White-necks, one in 1916, the other in 1943. Cranes of several other species – Demoiselles, Paradise and Sandhills – have nested here, but always unsuccessfully. These negative results are in accord with almost world-wide experience and lend weight to the impression that cranes are difficult to breed in captivity. Actually, this thought is only a half-truth, for once a young

Sticking close to its mother, the baby wattled crane explored every inch of its big corral. This photograph was taken a few days after the baby was hatched and was obtained under difficulties, for the male bird savagely resented interference and the photographer had to work from a stepladder.

crane has been hatched, its parents may be trusted to rear it, almost to a certainty. The real difficulties all come before the hatching of the young.

In the first place, cranes are finicky as to mates and the purchase of a male and a female by no means insures a breeding pair. Once this difficulty has been overcome, it is necessary to provide a secluded area, as large as possible, with enough grass and other cover to insure a supply of the earthworms, grubs and insects with which the parents feed their offspring. If it is hard to find a breeding pair of any kind of cranes, it is harder still to find an area, especially in a public park, where they may be expected to breed successfully.

The Wattled Crane, of eastern and southern Africa, is one of the very rarest of the group. Our first example was received in 1937 and we were pleased enough to find him a fine, tame young bird, in perfect condition. We never hoped to see another one but in 1940 a second bird arrived from Africa. This one was noticeably smaller than the first and it was fairly evident that we now had a pair.

The supposed male had become savage with maturity, as cranes are likely to do, and we kept the two in adjoining enclosures, to give them an opportunity to become acquainted. When the gate in the partition fence was finally left open, a battle immediately followed and the birds were separated with no little risk to life and limb. Actually, the better part of a year passed before we finally got them to live together in peace.

In the spring of 1943 the birds were liberated in the African Plains "Annex," an area of several acres, in company with assorted Zebras, Aoudads, Hartebeests, etc. Early in June two eggs were laid at the edge of a rainwater lagoon and our hopes were high. However, they were soon ended by a period of drought which left

the nest high and dry, so that the eggs were soon trampled under numerous hooves.

By the spring of 1944 the male crane had become so savage that we considered him unsafe in a mixed collection and the birds were placed by themselves in an adjoining corral measuring perhaps one hundred yards square. Here they were almost completely isolated from public view, but there was compensation in the likelihood of breeding. This worked out as we had hoped and on June 20 a single egg was laid. This was incubated closely and on July 26 a wobbly, reddish-brown chick emerged, establishing an incubation period of thirty-six days.

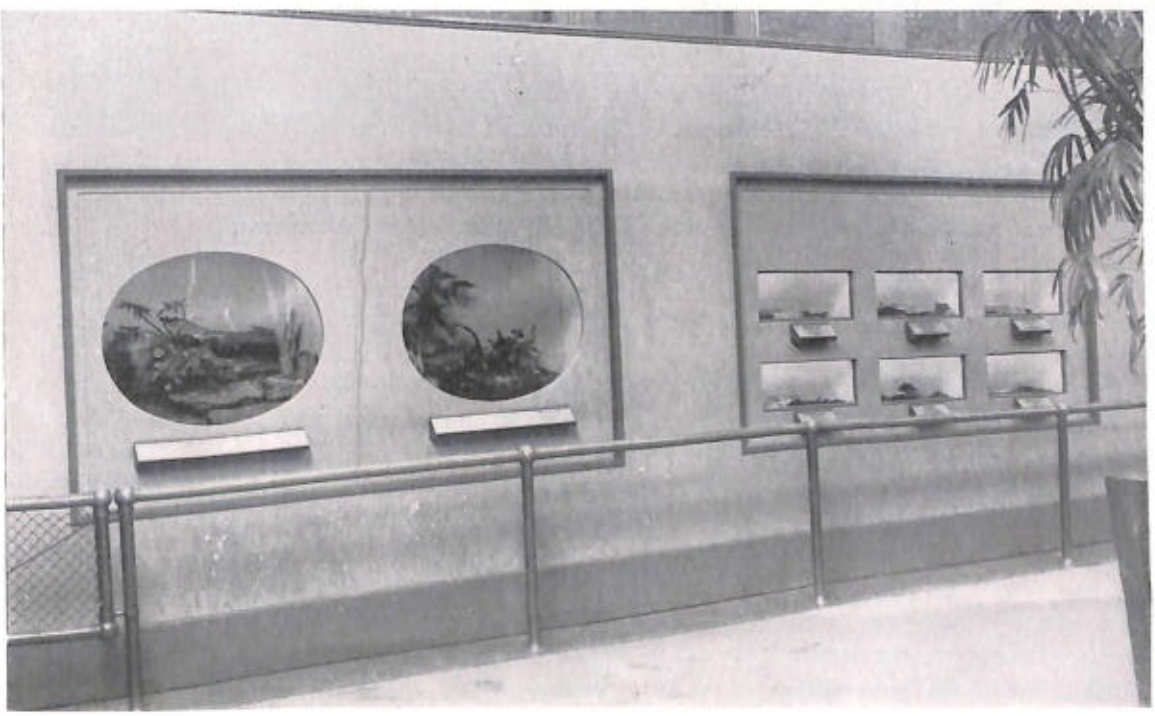
During their early lives, young cranes are fed entirely by the parents and during this period will pick up nothing for themselves. There was an abundance of natural food in the now overgrown enclosure and after the first few days, the chick began to come to the feeding place with the old birds, to receive choice morsels of raw fish, horse-meat and game food. At the age of two weeks the young bird was seen to feed for itself and from that time on, it has grown with amazing rapidity.

If this youngster is safely reared, as there is every reason to believe it will be, it appears, as least as far as published records go, that it will be the first of this rare species to be bred in captivity. The only previous record involving the species is that of a hybrid between a Wattled Crane and a "Canadian," reared in England in 1911.—LEE S. CRANDALL.

PUBLICATIONS OF INTEREST

GUIDE TO HIGHER AQUARIUM ANIMALS. By Edward T. Boardman. Cranbrook Institute of Science, Bloomfield Hills, Michigan. 107 pp., 58 illus. 1944. $2.00.

While this book is by no means perfect in its field and suffers somewhat from the smallness of its scope in relation to the size of the field, it is an extremely desirable step forward on a path unfortunately but badly marked. Increasing numbers of people try to keep local aquatic animals of one sort or another and are unable to find guides except, usually, highly technical and



"Utterly painless" is the way one snake-fearing visitor described a tour of the Reptile House after its exhibits were modernized this summer. These panels, setting off large cages decorated with plants and rocks, replace a series of small, bare box cages that used to line the wall.

Looking across the barnyard at the Farm-in-the-Zoo toward the pasture and the "little red barn" which houses the major part of the poultry exhibit. For most visitors the barnyard is probably the center of interest, for here the calves gambol and the poultry keeps up its cheerful noise.

specialized works whose very appearance scares off the novice.

Dr. Boardman's "Guide," although specifically directed at the aquatic fauna of the midwest, has sufficient range to be quite useful to the amateur naturalist in these parts, covering all the aquatic vertebrate groups and giving specific instructions for keeping many of the animals encountered hereabouts.

We regret that Dr. Boardman seems to approve, by indirection or omission, certain fallacies of long standing about the maintenance of an aquarium, but this is of minor importance compared with the basic value of the book as a whole.—C. W. COATES.

SHRUBS OF MICHIGAN. By Cecil Billington. Cranbrook Institute of Science, Bulletin No. 20, 1943. 249 pp., 161 figs. $2.50.

This book fulfills the purposes of the author "to awaken and stimulate an interest in the native flora and create a desire to know more about it," and at the same time gives a rather accurate picture of the distribution of the shrubs of Michigan as recorded in the various herbaria.

The distribution maps, indicating location by counties, are very good and the drawings of all the species included in the book are quite helpful in recognition of species.

Beginners will appreciate the explanation of the generic names and the glossary of the Latin specific terms used in the book. A key to the genera of Michigan shrubs is included.—N. M.

ANIMAL KINGDOM

NEW YORK ZOOLOGICAL SOCIETY

VOLUME XLVII
JANUARY TO DECEMBER, 1944
NUMBERS 1–6

INSTRUCTIONS TO BINDER

The 4-page signature forming the first 2 and the last 2 pages of this issue may be inserted ahead of the cover of Vol. XLVII, No. 1, in binding the volume.

ANIMAL KINGDOM

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A Place for the Natural Scientists

Some day political cabinets, forums for the planning of "brave new worlds" and other ways-and-means committees for human welfare, had better include in their number some natural scientists, more specifically a biologist, a zoologist, and an ecologist. Man and the lesser creatures of tnis earth have a good deal in common. Take the matter of "territorial rights." This problem is as old as the hills, has recurred all through man's history and exists in its most acute form at this very moment. In animal life, individual, family and even social-group disputes over the ownership of territories are indulged in – by gorillas and groundhogs, eagles and hummingbirds, and even little fishes.

There is nothing "unnatural" about all manner of living things fighting for the right to live in their own localities. In this respect the principal difference between human beings and the other animals is that the methods used by man to solve his territorial-rights problems seem somehow more illogical and desperate than those employed by most animal societies. What patterns have the latter followed? What answers have the instincts and lesser intelligences of animals evolved? Can man help himself by becoming more informed concerning them? In turn many various aspects come to mind – for example, among higher mammals the predators, or habitual killers, comprise probably less than 2% of the total populations in any given territory or continental area. Again, in the case of higher mammals combat within a species itself is "forbidden," except for the protection of family rights. The family is the basis of virtually all the more highly developed animal societies. What significance have such facts and countless others? Yes – it might be quite a good idea to make a place for the natural scientists.

Fairfield Osborn

IN THIS ISSUE

Portrait of a Chimpanzee . . . . . *Sam Dunton* COVER
Government Refuges Are Saving the Trumpeter Swan . . . *Jean Delacour* 131
The Ape Colony in Florida . . . . . *Henry W. Nissen* 137
The Poisonous Snakes of the New World. Part 3 . . . . *Clifford H. Pope* 143
Behind the Scenes: News and Notes 153
Index to Vol. XLVII 154

A. V. Hull Photo—U. S. Fish and Wildlife Service

In a little isle of tule reeds, a Trumpeter Swan incubates her eggs in the Red Rock Lakes National Wildlife Refuge in Montana.

Government Refuges Are SAVING THE TRUMPETER SWAN

By
JEAN DELACOUR

Ten years ago fewer than 60 birds survived in the United States; today the population has increased greatly.

THE GLORIFIED GEESE with long necks and short legs, which we call swans, have long stimulated man's interest and fancy, ever since the ancient Greeks made one an incarnation of Zeus, the King of the Gods. The largest of the seven existing species is a North American bird, the Trumpeter Swan. Unfortunately, it also is the only one which is threatened with extinction today.

The two swans of the southern hemisphere, the Australian Black and the South American Black-necked, are comparatively small and, of course, very distinct. So is the popular, semi-domesticated Mute Swan, which in a truly wild state is still found in eastern Europe and central Asia. The four remaining northern birds, however, are very similar in shape, color and habits, and are all so closely related that when more is known about their breeding distribution, they may be found to constitute only two species.

All are pure white birds. Unlike the Mute and Black Swans, they cannot raise their wings in anger, and they lack the black frontal knob of the former. They have a resounding, bugle-like voice, varying in intensity but of a similar general quality.

It is an interesting but by no means a unique fact that each of the two northern continental regions possesses two very similar forms of swans, differing mostly in size. The two Eurasian swans, the Whooper and the Bewick's, have a large yellow patch on the bill, in the former covering the basal two-thirds, in the latter only one-third, roughly speaking. The smallest of the American swans, the Whistler, usually shows a small yellow spot on the side of the upper mandible, near the forehead; but sometimes it has a pure black bill, which is the constant privilege of the Trumpeter. The latter bird is a good deal larger, as a rule, with a longer neck. But between a small Trumpeter and a large Whistler there are few obvious differences. The only safe characteristic in doubtful cases is the voice, deeper in the Trumpeter, shriller in the Whistler. If a doubtful bird is dissected, no mistake is possible, for the windpipe is dissimilar in the Trumpeter and in the Whistler; in the Trumpeter, it makes a vertical loop over a lump in the breast bone and emerges through a separate opening, which is lacking in the Whistler.

Trumpeters may attain a weight of 36 pounds, adult males averaging 30 pounds. Whistlers very rarely weigh 20 pounds, although individual variations are great. The average length of the wing of the five white swans will give some idea of their relative sizes:

Trumpeter	26.18 inches
Whooper	23.77 "
Mute	23.22 "
Whistler	21.65 "
Bewicks	20.70 "

Compared with their three highly migratory closest relatives, Trumpeters are rather sedentary birds, much like the Mute. They appear to travel only in search of food and open water. They breed as far south as they can and winter as far north as possible, while the Whoopers, Whistlers and Bewicks nest in the far North and accomplish long and regular winter journeys to the South.

These life habits have almost proved fatal to

K. F. Roahen Photo—U. S. Fish and Wildlife Service

This Red Rock Lakes area is typical of the region now being set aside as a refuge for the Trumpeter Swan. Two big and shallow lakes—actually little more than marshes — contain plenty of tule reeds for shelter and nesting material. Here, under protection, it is expected that the bird will thrive.

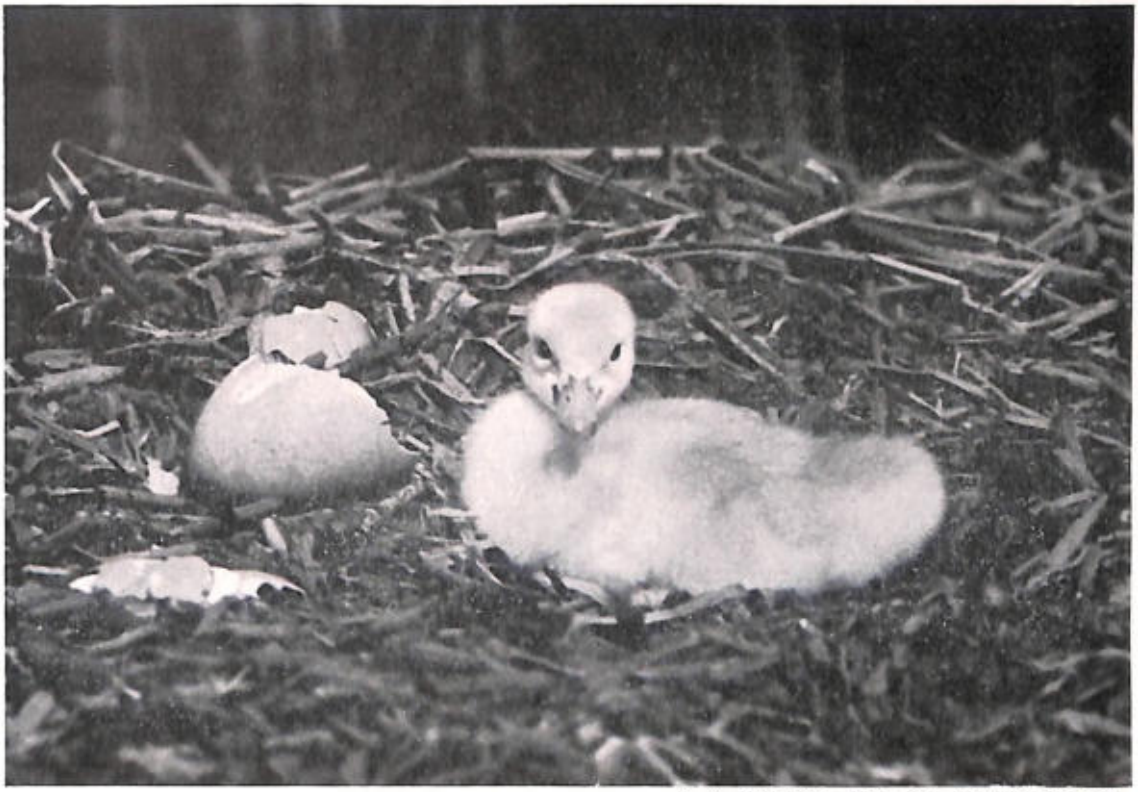
the Trumpeters. In former days they ranged all over central and western North America, from British Columbia to California, east to Manitoba, Minnesota, Iowa, Missouri, Arkansas and Colorado. At an earlier period they may have been even more widespread, as Dr. Alexander Wetmore of the Smithsonian Institution has identified bones from various deposits, from Maryland to the Mississippi Valley, and also from Florida in the Pleistocene remains. It seems, however, that most of the last century's records of Trumpeter Swans from the coast of California and on the Gulf of Mexico are inaccurate. They were probably based on black-billed Whistlers. In those days, all swans possessing a wholly black bill were called Trumpeters.

Because of their more or less sedentary habits, Trumpeters used to nest and to winter well within areas which became settled by man when the country was opened up. Consequently they were slaughtered quickly and easily, the more so since they usually fly low, within the gunner's reach. Whistling Swans still abound. They are much more wary, fly high and have so far enjoyed a good deal of security in their far northern breeding grounds.

Today, the Trumpeter is making its last stand in the wilds of British Columbia, in the protected areas of the Red Rock Lake Refuge (Montana), the Yellowstone National Park (Wyoming), and a few nearby localities. It has disappeared from all other parts of its former range.

About ten years ago, only a few hundred birds were supposed to remain in British Columbia, while in the United States fewer than 60 survived. Today the situation is already better, thanks to the establishment of the Red Rock Lake Refuge in 1935. The Trumpeter population has increased greatly in that part of Montana, and the Yellowstone colony has been holding its own.

A census made during the summer of 1944 indicates 169 adult and 62 young swans in the Red Rock Lake area, and 44 adult and 11 young



A. V. Hull Photo—U. S. Fish and Wildlife Service

A newly-hatched cygnet of the Trumpeter Swan in one of the Montana refuges. Oddly enough, the cygnets of these swans seem never to have been described scientifically, and Mr. Delacour has undertaken the preparation of notes on the young birds, as a result of his recent visits to the refuges.

in the Yellowstone. Although it remains difficult to count Canadian birds accurately, the estimated number of Trumpeters now in the Dominion is about 500.

In Montana and Wyoming, however, the increase has been slowed up or even stopped during recent years. Evidently the Red Rock Lakes are reaching their population limits. Several attempts to transplant birds in other refuges, at Jackson, Wyoming, and at Malheur Lake, Oregon, have been only partially successful, the majority of the released birds disappearing promptly. Out of ten birds introduced into the Elk Refuge at Jackson, only three have stayed since 1938 and for the first time a nest was built this year. Three eggs were laid, two cygnets hatched and one reared.

Evidently something more had to be done to save the species, to make certain that its existence can never again be threatened, whatever might happen in its present dangerously restricted strongholds. The fate of such an outstandingly interesting bird as the Trumpeter Swan has long occupied the anxious attention of naturalists in North America, and elsewhere. Emergency conservation measures, including strict protection and the establishment of sanctuaries, as mentioned before, have resulted. But they are hardly sufficient. A new line of action has therefore recently been proposed and adopted, thanks mostly to the initiative and energy of Mrs. C. N. Edge, Chairman of the Emergency Conservation Committee. From the satisfactory breeding results obtained in Europe over a long period (since 1873), notably by the late F. E. Blaauw in Holland, Mrs. Edge came to the conviction that the most practical way of increasing the number of Trumpeters was to multiply them under direct control. In March, 1943, she made a study of the question with the help of a veteran game breeder, Mr. R. Follett, and they both had several consultations with me on the subject. Needless to say, I was at once in complete agreement with them. It has long been my belief that a

large number of species of mammals and birds can be saved from extinction only through artificial propagation. Practically all the ruminants and many other mammals, the great majority of wildfowl, gamebirds, pigeons, parrakeets, a number of waders, particularly the cranes, and some other birds, can and should be maintained by the establishment in captivity, under suitable conditions and care, of an adequate breeding stock.

All the creatures which normally live in tropical or temperate countries, now densely inhabited by man, or on the way to be settled, are destined to disappear. Even the wildernesses of the Arctic and the Antarctic, of desert and mountains, long inviolate sanctuaries of many species, are now being easily penetrated. Protective regulations and the setting apart of refuges and national parks are, in many cases, an effective remedy. But too often they cannot be extensive enough to guarantee the future of many species, especially of birds which require vaster boundaries than the areas which can be possibly spared. Sad as it is to conservationists, the fact cannot be ignored that the incessant increase of the human population of the earth is bound to restrict further and further the habitat of wild animals, whose presence is incompatible with cultivation and exploitation. Ignorance of such truths has caused the disappearance of many fine forms of life the world over which easily could have been preserved in a captive state. To speak of North America only, it would not have been difficult to keep in confinement a suitable stock of Passenger Pigeons, Carolina Parrakeets, Heath Hens and Labrador Ducks. It will be the eternal regret of nature lovers that this was not done in time. On the other hand, the American Bison and the Elk are now safe under management which, in fact, is a form of captivity on very large ranges.

The project for the eventual establishment on various government refuges of an adequate number of captive breeding pairs of Trumpeter Swans was approved by Dr. Ira Gabrielson, Director of the Fish and Wildlife Service. The American

F. W. Onradnik Photo—U. S. Fish and Wildlife Service

The Malheur National Wildlife Refuge in Oregon is similar in physical characteristics to the Red Rock Lakes refuges. This particular area is now being used to settle young swans, and will be fenced.

Wildlife Institute, the American Committee for Wildlife Protection, the International Committee for Bird Preservation, the National Audubon Society, and the New York Zoological Society joined the Emergency Conservation Committee in recommending a captive-breeding project and in promising their support.

In the course of the last thirty years I have happened to gain some experience with the management of wildfowl, as about 90% of the existing wild species were kept and raised in large numbers on my waters at Clères, in Normandy. A more complete collection had never been gathered before in the world. For that reason the Fish and Wildlife Service authorities were good enough to ask me to act as an advisor and to supervise the project. I was therefore appointed a collaborator of the Service, the New York Zoological Society graciously consenting to lend my time to the Government when the necessity arises.

In such a capacity, I visited the Red Rock Lakes (Montana), Jackson (Wyoming), and Malheur Lake (Oregon) Refuges in May, 1944, in the company of Mr. Leo L. Laythe, the Regional Director. We were able to outline a general plan for action, and this was carried out during our subsequent visit in August and September.

The first idea had been to remove eggs from some of the swans' nests at Red Rock Lakes, to hatch them and to rear the cygnets under domestic fowls. But on the occasion of our first visit, we found that the Trumpeters were easily rearing their broods, which were out of the reach of predators on the numerous small islands of the shallow lakes, and that it was simpler to catch the wild-raised cygnets before they could fly.

Miles D. Pirnie Photo

The experiment of keeping Trumpeter Swans has been tried several times at the W. K. Kellogg Bird Sanctuary in Michigan, but with indifferent success. These three swans in the Kellogg Sanctuary were reared in Holland by the late F. E. Blaauw, who started breeding them as early as 1873.

A clutch of five eggs, however, had been taken before our arrival at Red Rock Lakes, and was already being incubated under bantam hens. These hens proved to be too small to cover them properly. In spite of this unfortunate start, two eggs were duly hatched and easily reared by Dr. Ward Sharp, the manager of the refuge, on a very simple diet of milk curd, chicken feed and green food. We had hopes that the robbed

pair of swans would nest again, but they refused to do so, and the only supposed advantage of taking eggs rather than catching cygnets was thus denied. On August 30 and 31 and on September 1, we caught 20 cygnets on the Red Rock Lakes. The operation was not difficult as all the broods had been carefully located in advance by Dr. Sharp, and it was easy to run down the birds in flat bottom boats. The captured cygnets joined the two hand-reared ones in a small enclosure, and at once they started feeding, showing no fear whatever.

The following days, all the young swans were transported to the Malheur Lake Refuge in eastern Oregon. The 700-mile journey was made by truck, with specially-built crates. After a day's rest in a small pen, the cygnets were pinioned and released in a cage enclosure, including a 3-acre pond fed by springs and free from ice the year 'round, which had been especially built for them. They will remain there until they reach their third year, when they will be separated in pairs and settled in breeding pens to be installed for them at the Malheur Lake and other government refuges offering adequate conditions of climate and protection, as well as permanent open water. We plan to catch other cygnets during the next few seasons until we have reached the total of breeding pairs we propose to establish. Their offspring will eventually be used to resettle favorable waters in the former range of the species.

Trumpeter Swans undoubtedly respond well to management and captivity if kept in suitable climate and surroundings. The hot summers of the eastern parts of the United States do not seem to agree with them and results in the New York Zoological Park and in the Kellogg Sanctuary in Michigan never were encouraging. In western Europe, however, they have done well. As early as 1873 broods were reared in the London Zoo, and in 1882 at the Jardin des Plantes in Paris, in very small pens under the continual disturbance of a large public. Ever since they bred regularly in several private parks. They figured in the Clères collection and the late F. E. Blaauw used to rear some every year in Holland.

The cooler parts of western North America, their native land, will no doubt prove more favorable still. It seems, therefore, fairly certain that a good number of breeding Trumpeter Swans will soon be established in captivity in the United States under public supervision. In my opinion this is the only safe method of insuring permanently the fate of this remarkable species, the largest of all wildfowl. The time was indeed running short for action.

R. S. Bach Photo

These four-weeks-old cygnets in the Red Rock Lakes Refuge were reared by a hen during the past summer, and are the first Trumpeter Swan cygnets to be brought up in captivity in the United States.

At Orange Park Dr. Robert M. Yerkes has brought to fulfillment his plans for a psychobiological laboratory for the study of man's nearest relatives.

The Yerkes Laboratories of Primate Biology are housed in a series of large and modern buildings at Orange Park, Florida. This is known as the Laboratory Building.

The APE COLONY in FLORIDA

By HENRY W. NISSEN

Yerkes Laboratories of Primate Biology

NEARLY THIRTY YEARS AGO a young Harvard professor published an article in the journal *Science*, in which he urged the establishment of a laboratory for the study of monkeys and apes. Most of our fundamental knowledge in biology and medicine, he pointed out, had come through the study of animals. But because of their relative scarcity and high cost, because practical information regarding care and breeding was lacking, and probably because of sheer inertia, the monkeys and apes had been neglected as materials of biological research. By virtue of their great similarity to man, Robert Mearns Yerkes argued, these subhuman primates should be more valuable than any lower form of animal life in helping to solve the problems of human biology. What observation and experiment showed to be true of an ape would obviously be more nearly applicable to man than a discovery made on a grossly divergent form of life such as a frog, guinea pig or cat. In the study of intelligent behavior and its underlying brain mechanisms, especially, the anthropoids should prove uniquely important; in respect to behavior, as well as in appearance, no other animals remind us so much of ourselves.

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World War I temporarily diverted scientific enterprise towards the solution of urgent practical problems. But in 1924 Yale University provided Dr. Yerkes with facilities for testing out the feasibility and value of using apes as laboratory animals. Four young chimpanzees were purchased and were housed in a converted barn-garage on Prospect Street in New Haven. The experiment was a success, and five years later, in 1930, a laboratory especially designed for primate research was established at Orange Park, Florida. Through gifts, by purchase, and by breeding, the colony grew rapidly, reaching a maximum of fifty-one chimpanzees a few years ago. Thus, after long years of planning, and at the cost of much effort in promoting and demonstrating the practicability of his vision, Dr. Yerkes brought to fulfillment his plans for a psychobiological laboratory in which man's nearest relatives, the monkeys and apes, provided the materials of research.

The Orange Park laboratory was set up both as a research center and as a breeding colony to provide apes for its own purposes and for the

Stages in the growth of a chimpanzee—Alpha, the mother, and Alf, her baby, immediately after birth.

needs of other research institutions. The few chimpanzees previously available to scientists were imported from Africa; their history was quite unknown, their ages could only be guessed at, and more often than not they were diseased and had received injuries incident to capture. The nucleus of the Florida colony was provided by the original four animals brought down from New Haven, by sixteen chimpanzees procured from Africa through the good offices of the Pasteur Institute, and by a gift of twelve apes from the collection of Mrs. Rosalie Abreu of Havana, Cuba. Further specimens were procured subsequently by gift or purchase, but for the past ten years the colony has been largely self-perpetuating.

In the first thirteen years of its existence more than fifty chimpanzees were born at the Florida laboratories, 27 males and 27 females. The first of these, Alpha, is already a mother of three youngsters whose grandfather (Alpha's father) is still a member of the colony. Ordinarily chimpanzees do not mature until about the age of twelve years, but Alpha was precocious and bore her first offspring when she was only nine years old. The gestation period of the chimpanzee is approximately eight calendar months. Labor is usually brief and apparently easy, although a few cases of prolonged and difficult labor have been observed. The chimpanzee mother is not always skillful in taking care of her first-born; she may hold the infant upside down or even allow it to be suspended by the umbilical cord. But she profits by this first experience, and her later-born youngsters are invariably well taken care of. The chimpanzee mother nurses her baby for over a year, often for the first two years of life. Rarely is she so modern as to allow the youngster any supplementary food before it is 8 or 10 months old. During the first year and a half mother and child are practically never separated, night or

The baby, Alf, at the age of two days.

day; the baby usually clings to the mother's abdomen and may later ride on her back. If the father ape has been caged with the female right through the period of pregnancy, he participates in the care and education of the offspring—increasingly so as the baby gets older. Observation made by the writer in Africa indicate that the male parent takes over responsibility in times of stress or difficulty: when a high tree is to be climbed, when a quick get-away from danger becomes necessary, or when the jump from one limb to the next is more than the female with a baby clinging to her can manage.

Some five years ago a special study of early chimpanzee development was begun.[1] In order to have these animals available for frequent testing and measurement, the babies were separated

[1] Supported in part by the Samuel S. Fels Fund.

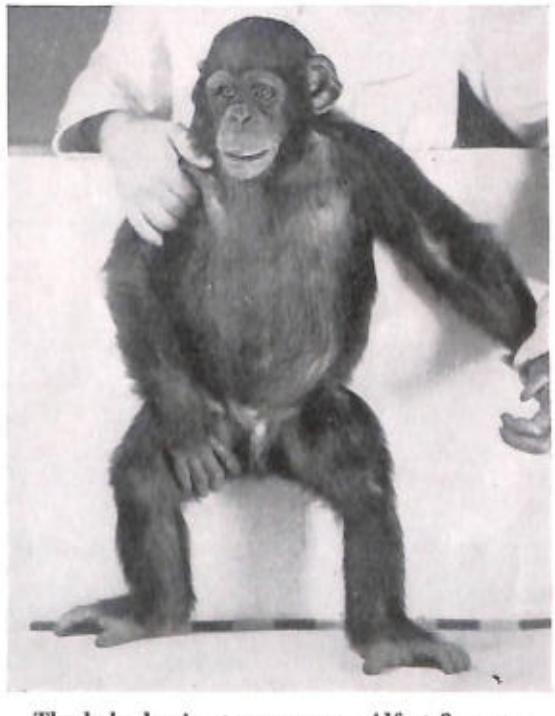
from their mothers a few hours after birth. They were raised under carefully controlled and standardized conditions, bottle fed, and diapered. These youngsters, sixteen of them so far, are weighed and examined for dental development every day, X-rayed and measured every month; records of temperature, respiration, pulse and activity are taken at frequent intervals; every few weeks they are tested for behavioral development in a series of situations standardized for the human infant by Dr. Arnold Gesell of Yale University; a day-to-day record is kept of illnesses and of all their responses to social and physical stimuli. Probably few human infants have had such complete records kept of their early development as these baby chimps.

It appears that the quantity and quality of our

Alf has now reached his first birthday.

formulae and feeding schedule are more adequate than the food provided by the chimpanzee mother. At any rate, the nursery infant increases its birth weight of four pounds to about sixteen pounds during the first year of life, whereas the mother-raised baby weighs only 10 pounds at the end of its first year. Youngsters captured in the African bush are much farther advanced in dentition than in weight and size when compared to our laboratory-reared infants. Although the time of tooth-eruption is not an accurate index of age, these facts indicate that the wild chimpanzee grows more slowly than do the chimpanzee natives of Florida.

Most of the nursery infants become habitual thumb suckers, whereas youngsters raised by their own mothers almost never suck their thumbs. There are probably two factors operative to produce this difference. The hands of the mother-reared baby are constantly occupied in holding on to the skin and hair of the parent; if it were to indulge in thumb sucking the security of its position would be jeopardized. The youngster in the crib does not have such a constant and vital occupation for its hands. The second factor is concerned with the circumstances that the nursery baby has to wait for the three hours prescribed by laboratory routine from one feeding to the next. If it becomes hungry in the meantime, the limbs thrash about and in the course of these movements a finger or toe may accidentally get into the mouth. Sucking responses are ready to be set off, and so the habit is gradually set up. The mother-raised infant, on the other hand, can eat whenever it is hungry—every hour or two; since the real thing is always available, there is no reason for seeking a substitute. Once the habit is established, in the nursery infant, thumb sucking may persist for many years, ap-



The baby begins to grow up—Alf at 3 years.

pearing whenever the animal is under tension and sometimes, apparently as a reaction to boredom, there being nothing better to do.

Any chimpanzee which has been captured in Africa where these animals construct a new sleeping nest every evening, will, when given access to a tree, revert to the custom even after years of no practice. Our nursery-reared chimpanzees, on the other hand, never construct nests, no matter how favorable the opportunity. Unlike birds, in whom nest-building is an instinct, this activity is evidently a cultural acquisition among chimpanzees; something that the younger generation learns from its elders. Where such educational opportunities are lacking, the custom drops out.

By human standards the chimpanzee is both intelligent and stupid. That is, in certain activities this ape manifests an almost human intelligence, far beyond the abilities of subprimate animals. In other types of problem, on the other hand, the solution of the chimpanzee is on a distinctly lower, animal level. As an example of intelligent behavior, the recent performance of an adult male in mastering a set of discrimination problems may be cited. These problems were so arranged that in any given choice the ape had to "bear in mind" five distinct factors: which of two objects was the correct one depended on its size, its shape, its color, and on the presence or absence of two further aspects of the situation. The following symbolic representation, which shows only a part of the problem (i.e., four factors, rather than five) mastered by the chimpanzee, may help to clarify the task involved. In each of the eight pairs of choices shown, the left-hand one is correct, the right-hand one is wrong:

$A_1\ B_1\ C_1\ D_1$ vs. $A_2\ B_1\ C_1\ D_1$
$A_2\ B_2\ C_1\ D_1$ vs. $A_1\ B_2\ C_1\ D_1$
$A_1\ B_2\ C_2\ D_1$ vs. $A_2\ B_2\ C_2\ D_1$
$A_2\ B_1\ C_2\ D_1$ vs. $A_1\ B_1\ C_2\ D_1$
$A_2\ B_1\ C_1\ D_2$ vs. $A_1\ B_1\ C_1\ D_2$
$A_1\ B_2\ C_1\ D_2$ vs. $A_2\ B_2\ C_1\ D_2$
$A_2\ B_2\ C_2\ D_2$ vs. $A_1\ B_2\ C_2\ D_2$
$A_1\ B_1\ C_2\ D_2$ vs. $A_2\ B_1\ C_2\ D_2$

Without the aid of paper and pencil, even the human mind finds difficulty in responding to five different and independent factors at the same time.

In what the psychologist calls "social intelligence" the chimpanzee is very keen indeed. This may be seen both in the relationship of chimpanzees to each other and to man. Wendy is one of our chief offenders in regard to jail-breaking. One of her principal pleasures in such escapes might seem to be the satisfaction derived from outwitting her captors, for, after a few hours of wandering in the nearby woods she is ready enough to return to her cage and, incidentally, to three free meals a day. Our cages are strongly built, so that it takes long, patient effort to produce an opening large enough for an ape to squeeze through. Wendy picks as inconspicuous a spot as possible and never works at her illegal occupation while people are about. There are indications (but here we are going beyond verified fact) that during her days of surreptitious activity, Wendy engages in various exhibitionistic antics intended to distract our attention away from the secret spot. It seems not improbable, also, that she completed all the tedious but not easily noticed work of untwisting the wire ends, before bending the wires back to form a conspicuous hole. Most of the jail-breaks occur at times (e.g., early evening) when there are few people around.

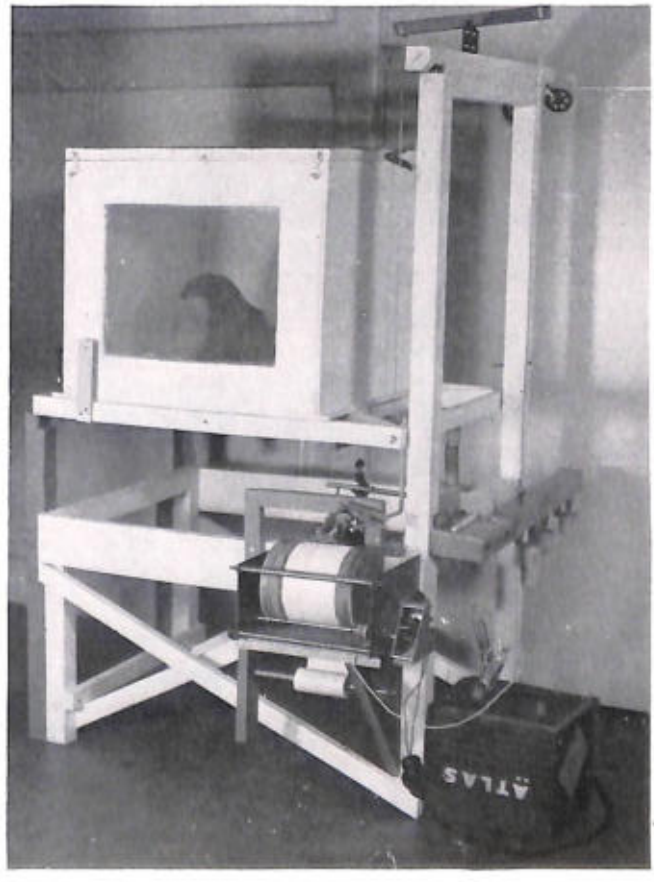
The chimpanzee is highly sensitive to the mood and attitude of his fellow primates. The question of who is to be boss among new cagemates is usually settled without an overt fight. The female "knows" that at certain phases of her sexual cycle she can take more liberties, can appropriate a greater share of the food from her male companion, than at other times. Sheer strength plays an important role in determining dominance and leadership, but it is by no means the only factor shaping the pattern of social relationships within a group of chimpanzees. Ingenuity, trickery, bribery and guile may become more effective than brute force. Some individuals are very successful in getting others to fight their battles or to assist them in a task requiring cooperation. The two cornerstones of social integration, a basic need for companionship and the intelligence to recognize the advantage of working together and of exchanging favors, are both discernible in the behavior of chimpanzees. The factors which make for companionship preferences are varied and subtle; certain individuals are much more sociable and popular than others. In this connection it is interesting to note that

(Left). Here the reactions of a young chimpanzee to various objects are being tested by a member of the Laboratories staff.

(Below). This apparatus, designed by Dr. Austin H. Riesen of the Laboratories staff, is used for measuring the activity rhythm of young chimpanzees.

these animals especially attached to, and dependent on, their human contacts often do not form close friendships with their fellow apes.

As examples of "stupid" behavior may be included most of the problems which man typically solves with the aid of language processes. Problems requiring counting, for instance, are very difficult for the chimpanzee. Habits in which the consequence of the response – reward or punishment – do not follow the performance immediately, are not easily learned. When the human child is spanked by his father at night for having stolen cookies that morning, we have some reasonable expectation of curing the child of stealing. The chimpanzee quickly proves his ability to distinguish red from green by consistently pushing against a green button and never against the red one – if green-pushing (but not red-pushing) is always rewarded *at once* by a raisin or other tid-bit. But we cannot tell the ape that he is now being rewarded for having pushed the green button, rather than the red one, five minutes ago. And apparently the animal cannot tell himself,



either; he has no bridge of symbols to close that time-gap between what he did a little while ago and what is happening now. (It should be pointed out, however, that if the ape is at once given a material token of reward – a poker chip, for instance, which later can be traded in for raisins – the habit thus indirectly rewarded will be learned quite easily). The chimpanzee has an excellent memory in the more common sense of that term, but naturally it cannot remember something that it has not yet learned. Many problems, easy for us, are impossible for the ape because it has such a limited capacity for dealing with objects and events not present to the senses. Although we cannot yet be sure what is the cart and what the horse – that is, whether language or the higher levels of intelligence came first – certain it is that together with language man acquired intellectual powers which set him far beyond his non-verbalizing relatives. From the lowest to the highest animals we find only gradual increases in intelligence. Then, suddenly, in passing from ape to man, we have a terrific forward leap. That great and abrupt gain is somehow related to the use of symbols, as seen most strikingly in language. In the primates, and particularly in the chimpanzee, we can discern the early glimmerings of symbolically mediated behavior, and by a careful study of this development we may hope to gain, eventually, some insight into the truly unique feature of human intelligence.

The work of the Orange Park laboratory can here be indicated only in its most general outlines. It is the only place – outside the jungles of Africa! – where chimpanzees are bred in any number. From time to time some of these animals are sent to other laboratories throughout the country for specific studies in medicine, in brain physiology, or in behavior. The present laboratory research program includes studies of growth and of factors which influence and control development; long-term investigations aimed at the description and analysis of behavior, with a constant search for the basic principles of laws of behavior; physiological studies of the relationship of the endocrine glands to normal and abnormal behavior; and, last but not least, experiments seeking to reveal the neurological processes and structures responsible for the various aspects of personality, emotional expression, drive and intellectual capacity. Pervading all these lines of inquiry is the problem of modifiability: which aspects of the total behavior pattern can be changed or influenced by environmental agencies, by training, teaching, experience, by drugs, diets, hormones, operations–and which are fixed immutably by the hereditary constitution of the organism? The purpose of all this may be summarized, briefly, as an attempt to gain deeper understanding, and thus greater control, of the living world in general and of man, the highest primate of them all, in particular.

In 1942 Professor Yerkes retired from the directorship of the Yale Laboratories of Primate Biology which were thereupon renamed the Yerkes Laboratories of Primate Biology in his honor. Harvard University joined Yale in sponsoring the enterprise and Dr. Karl S. Lashley, Professor of Neuropsychology, was named Director. World War II has indeed imposed heavy handicaps on research, but in this fortunate country of ours it has been possible to maintain this valuable colony of experimental animals and to continue, on a small sector at least, man's never-ending struggle towards greater knowledge and wisdom.

The POISONOUS SNAKES of the NEW WORLD. Part 3

By CLIFFORD H. POPE

Fellow of the New York Zoological Society; Curator of Reptiles of the Chicago Natural History Museum.

[This article is a portion of a booklet of the same title, previously published by the Zoological Society.]

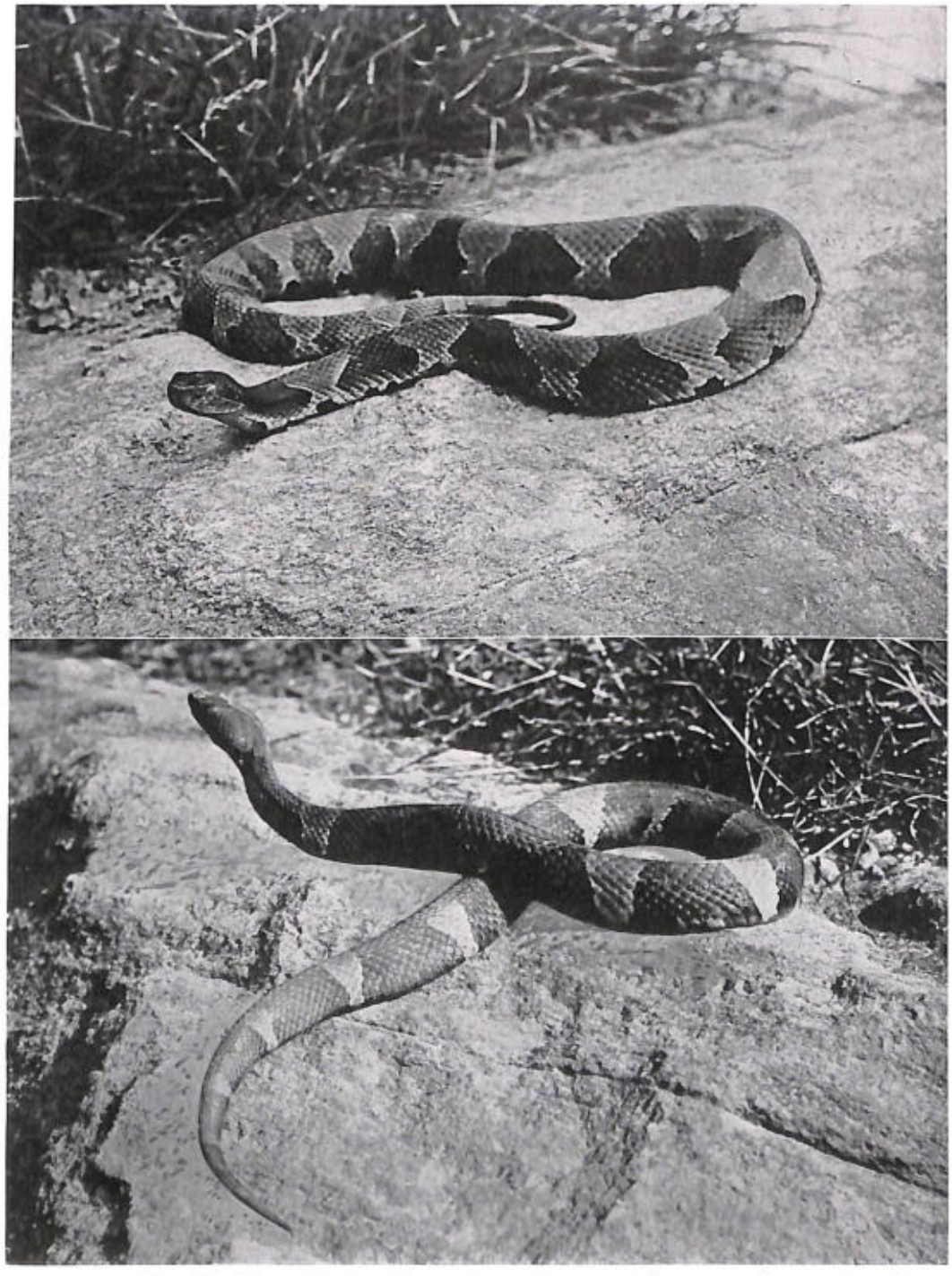
COPPERHEAD, *Agkistrodon mokeson* (Figures 21, 22). As already explained, this pit-viper is only found south of a line connecting the northeastern tip of Massachusetts with Pittsburgh and that city with the extreme southeastern corner of Nebraska; and east of one extending from this corner of Nebraska to the upper Rio Grande in Texas and passing just southeast of New Mexico. It is not known from peninsular Florida. The copperhead and water moccasin (Figure 23) are the sole pit-vipers without rattles that live in this whole southern and eastern segment of the United States, but the latter, as stated above as well as below and reiterated here for emphasis, is not found north of the lowlands.

The copperhead differs enough in pattern from one part of its range to another to have received four technical subspecific names. There is no necessity to describe these forms here as the only other snake with which any of the four can be confused is the water moccasin. When such a confusion threatens, certain facts may be helpful: the copperhead is terrestrial, inhabits extensive northern and western areas where the other species is not found, and the pattern of broad cross-bands has a predominantly coppery hue; the water moccasin is aquatic, lives only in the southern lowlands (including peninsular Florida where copperheads are unknown), and has a pattern of broad cross-bands largely brown, olive, and black. Old water moccasins tend to be dark, whereas the young are gaudily colored and much more easily confused with copperheads than are the adults.

The average copperhead is between thirty and thirty-six inches long although a length of more than fifty has been recorded. The species is not vicious. Like the banded rattlesnake, with which they often hibernate, copperheads have the reputation of preferring wooded mountainous country abounding in rocky ledges, but they actually frequent almost every type of rugged country.

WATER MOCCASIN, *Agkistrodon piscivorus* (Figure 23). Several harmless water snakes commonly called "water moccasins" are so consistently confused with this species, that the reptile man is all but driven to introduce the terms "true" and "false" moccasins. No matter how many people persist in calling harmless aquatic snakes from the elevated eastern parts of this country "water moccasins," the fact remains that the highly dangerous pit-viper of our southeastern lowlands, often known as the "cottonmouth," is the one reptile to which this name is properly applied. These lowlands, as already indicated, lie approximately south of a line extending from Cape Charles, Virginia, to the midpoint of the Alabama-Georgia boundary, thence to the center of the southern third of Illinois and from there to the junction of the Pecos and Rio Grande Rivers, Texas. Recent investigations have shown that the water moccasin is divisible into an eastern and western subspecies but the differences between these are hardly noticeable.

Almost any kind of a permanent aquatic situa-



Upper — Fig. 21. Copperhead, *Agkistrodon mokeson mokeson*, northern subspecies. Range: Eastern United States between the lowlands and the extreme north. Average length: 33 inches. Bite not fatal to adults.

Lower — Fig. 22. Copperhead, *Agkistrodon mokeson laticinctus*, broad-banded subspecies. Range: South-central Texas northward to southern Kansas. Average length: 33 inches. Bite not fatal to adults.

tion may attract this snake, although it is partial to ponds, lakes, and streams with wooded shores and banks. The average length is forty-two, the maximum sixty inches, so it is hardly necessary to say that this deadly reptile, which is not always inclined to retreat from man, should be let strictly alone.

Coral Snake, *Micrurus fulvius* (Figures 1, 25). Only inhabitants of our southeastern lowlands as approximately delimited under the foregoing account of the water moccasin need worry about the coral snake. Indeed, this species is unknown in Illinois because it does not range as far up the Mississippi valley as does the moccasin. The coral snake is one of three southern snakes that have areas of bright red, yellow, and black on the back. Since the other two are entirely harmless, much human nervous wear and tear can be avoided by learning to recognize them as innocuous. The rule is simple: look at the head as far back as the eyes and if it is red, discard all feeling of alarm because the coral snake has a black snout. If the head is hidden or missing, the identification still can be made because only the coral snake has wide alternating bands of black and red separated by narrow fillers of yellow, i.e. there is a yellow band for every black as well as for every red one, or twice as many yellow fillers as there are either red or black bands. In both of the other black, yellow, and red snakes the alternating bands (unequal in width) are red and yellow, the fillers, which happen to be wide, black. It is also well to remember that the colored areas of the coral snake are bands that completely encircle the body, a condition present in only one of the troublesome "mimics." In few snakes are back and belly patterns similar, so a widespread knowledge of the condition in the coral snake will save reptile life and human worry. Coral snakes vary enough from one part of the range to another to have received three subspecific names but these minor differences do not interfere with ready identification.

It has been stated that the coral snake does not coil and strike after the manner of so many harmless snakes, but this difference in behavior is more useful in the tropics where numerous kinds of coral snakes and their "mimics" abound, and learning pattern distinction becomes too involved.

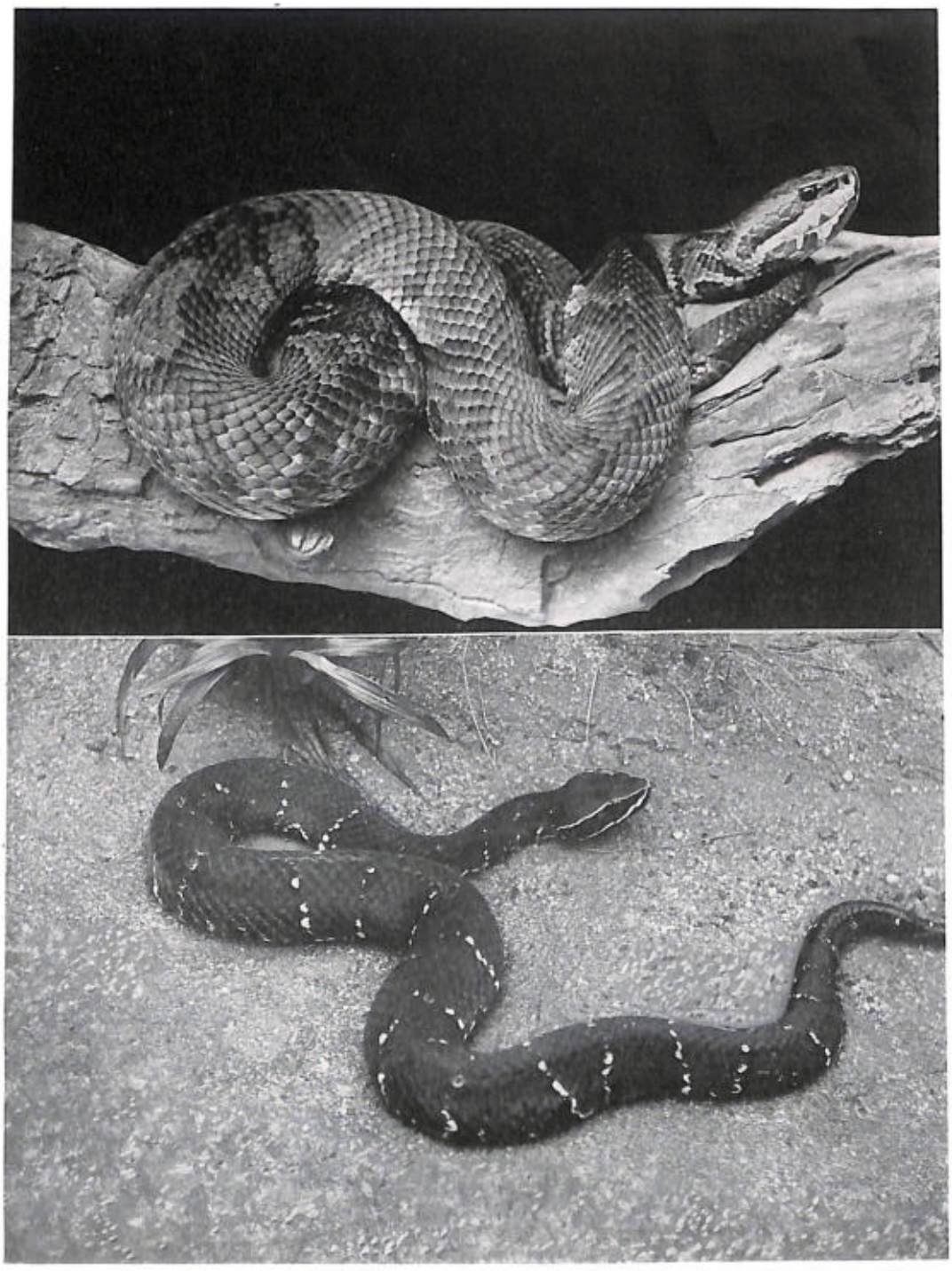
Our common coral snake reaches an extreme length of thirty-nine inches, but the average adult measures only twenty-eight. Individuals vary in temperament, some being indifferent even to rough handling, others biting viciously when molested. This fact, combined with realization that the venom is of great potency, will make any reasonable person treat these beautiful reptiles with due respect. On the other hand, their slender bodies, short fangs, and habit of remaining flat rather than rearing to strike keep them from being a menace to the well-shod hiker wearing long trousers.

Arizona Coral Snake, *Micruroides euryxanthus* (Figure 26). This rare species is confined to parts of southern Arizona with an altitude of less than 5,000 feet. It is small; no specimen measuring more than eighteen inches has ever been found. Presumably the venom is highly toxic. The color arrangement suggests that of the southeastern species (Figures 1, 25) but the fillers are wide and white, not narrow and yellow. A black snout distinguishes the Arizona coral snake from other brightly banded snakes of that state. It is interesting to note that, beginning with the snout, the color order of bands is black, yellow, black in the southeastern species; black, white, red in the other. One might say that on the body the black bands precede the red in the former, the red precede the black in the latter.

The Highlands of Mexico

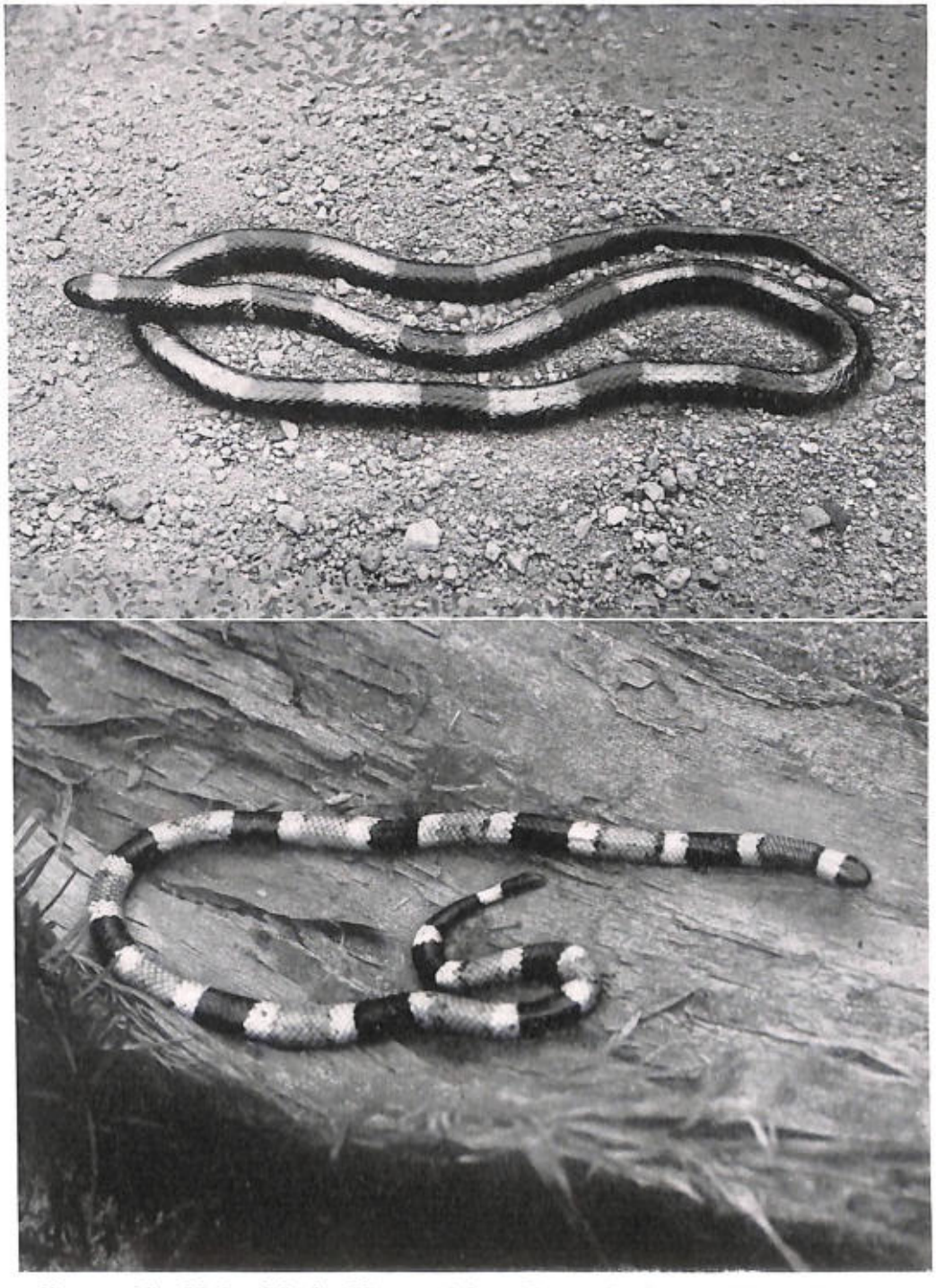
The Mexican highlands include Lower California and all of the plateau of Mexico north and west of a line connecting the city of Veracruz with the Gulf of Tehuantepec. This plateau, with the exception of its relatively low northeastern section just south of the Big Bend of the Rio Grande, stands 5,000 or more feet above sealevel. The low coastal strips (excluding those of Lower California) being inhabited largely by tropical animals, are considered with the next section.

The highlands of Mexico, actually a continuation of the "rattlesnake belt" of our own southwest, harbor not only all the species found in our border states but, toward the south, a few additional ones. Students of rattlesnakes believe that, during the course of evolution, these pit-vipers radiated from the north-central part of the Mexican plateau to become dispersed over North



Upper — Fig. 23. Water Moccasin, *Agkistrodon piscivorus*. Range: Lowlands of southeastern United States. Average length: 42 inches. Highly dangerous.

Lower — Fig. 24. Mexican Moccasin, *Agkistrodon bilineatus*. Range: Tropical Mexico to Nicaragua. Average length: Probably about 30 inches. Presumably very poisonous.



Upper — Fig. 25. Coral Snake, *Micrurus fulvius*. Range: Southeastern United States and eastern Mexico in lowlands. Average length: 28 inches. Poisonous.

Lower — Fig. 26. Arizona Coral Snake, *Micruroides euryxanthus*. Range: Southern Arizona and northern Mexico. Maximum length: 18 inches. Poisonous.

and South America. The other poisonous snakes of the plateau are found only in its extreme north across the international boundary from where they occur in the United States. They are: the water moccasin (Figure 23) in the Rio Grande valley below the Big Bend; the copperhead in the Big Bend region; the Arizona coral snake (Figure 26) in Sonora and possibly adjacent Chihuahua. Actual Mexican records for the first two do not exist, so the ranges in that country cannot be accurately delimited.

The West Indies and Trinidad

The Greater and all but two of the Lesser Antilles are devoid of poisonous snakes.

The fer-de-lance (Figure 32), a large and highly dangerous tropical pit-viper described in the section on tropical America, is found on Martinique and St. Lucia.

Trinidad, an elevation of the South American continental shelf, is surrounded by waters not more than 500 feet deep. As might be expected, its snakes are essentially the same as those of the adjacent mainland; pit-vipers, including the fer-de-lance and the bushmaster (described below next to the fer-de-lance), and coral snakes abound.

Tropical America

As here understood, tropical America is that part of the New World inhabited by a tropical fauna rather than the territory actually lying between the Tropics of Cancer and Capricorn. In Mexico, this fauna goes a little beyond the geographical tropics along the Mexican coasts to the valley of the Rio Grande on the Gulf side, to southern Sonora on the Pacific; in South America, the latitude (35° south) of the mouth of the Rio de la Plata marks the limits of the faunistic tropics.

The only parts of this vast area entirely devoid of poisonous snakes are the Andean highlands lying at an altitude of 10,000 feet or higher, and all of Chile. Peru west of this highland is inhabited by a relatively small number of dangerous species; two small pit-vipers without rattles and two coral snakes. Uruguay has, in addition to the tropical rattlesnake (Figure 30), two pit-vipers without rattles and two coral snakes. Both of the pit-vipers (Maximilian's and the urutu, Figure 36) and one of the coral snakes (*Micrurus frontalis*) are described below in the section on temperate South America. The other coral snake (*Micrurus corallinus*) has a black snout and an unmistakable pattern of red, yellow, and black markings in the form of rings that completely encircle the body, making the belly look essentially like the back. The black and red rings alternate, the red ones being two to three times as wide as the black and separated from them by yellow rings only half as wide as the black. Thus there are two yellow rings for every red and black one. The scales of the red areas are black-tipped. The average length is between twenty-four and twenty-eight inches, the maximum thirty-nine.

The groups of poisonous snakes found in tropical America are the same as those of northern temperate America: pit-vipers with and without rattles, and coral snakes. The relative numbers of tropical kinds by groups are the converse of what they are in the north: few species of rattlesnakes but many of rattle-less pit-vipers and coral snakes. The pit-vipers, as already explained in detail, are identified by their facial pit and large, movable fangs, but the coral snakes, about fifty in number, present a problem for they are variously banded with red, yellow (or white) and black; red and black; or yellow (or white) and black, combinations of color found on many harmless species. The only safe plan is to avoid all snakes with bodies completely encircled by bands of such colors (making their bellies look like their backs) unless, when annoyed, they throw the forebody into S-shaped loops, raise it, and strike after the manner of ordinary snakes. Descriptions of all the species would be useless and little or nothing is known about their habits.

In contrast to the coral snakes, the pit-vipers are readily distinguished as such, but identification by species presents an insurmountable problem for the layman since even reptile students name them with great difficulty. Some of the well known species are recognizable because of distinctive habits, coloration, or size, and these will be taken up one by one.

Tropical Rattlesnake, *Crotalus durissus* (Figure 30). A pair of parallel dark stripes extending along the neck is a characteristic of this, the only widely distributed rattlesnake of tropical America. The rattle is sufficient identification except in the two limited mainland areas where another species may occur with it. The "cas-

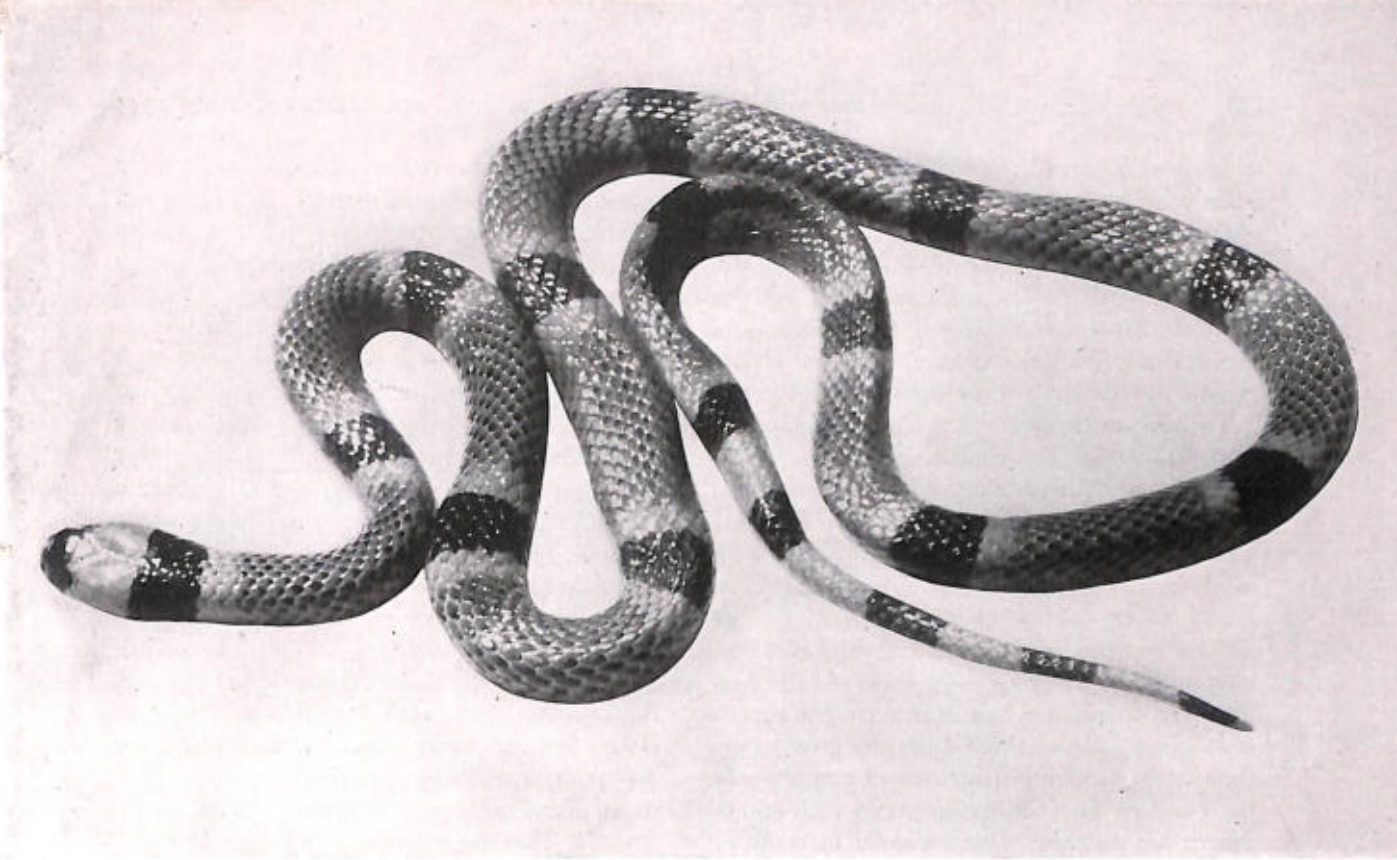


Fig. 27. Central American Coral Snake, *Micrurus nigrocinctus*. Range: Tropical Mexico to Panama. Average length: About 28 inches. Poisonous.

cabel," as the tropical rattler is called in Spanish, occurs in southern Mexico from central Michoacan (below the plateau) to about 32° south latitude in South America. There are no records for Panama, and the population to the north of this country differs enough from that of South America to have its own subspecific name; most of the differences are too slight to concern the layman. In spite of an extensive range, this snake is unknown in many parts of tropical America because it avoids the coastal plains and tropical rain forests, frequenting instead dry, hilly to mountainous districts devoid of heavy cover. For example, it has not been taken in the Amazon basin but there are numerous records for the highlands to the north and to the south of this wet, densely forested region.

Only two rattlesnakes, the diamond-backs of the United States (Figures 2, 4, 5), surpass cascabels of the northern and somewhat larger subspecies in average size, and the western diamond-back is but little larger. The average tropical rattler of North America is about fifty-seven inches long. The largest one on record measured sixty-six and three-quarters inches but longer ones doubtless exist as relatively few have been measured; in the tropics, preservation and transportation of big animals present difficulties. Size, an especially potent venom, and an aggressive disposition combine to make this the most dangerous of rattlesnakes. When surprised, it often strikes after a few clicks of the rattle have given scant warning, and the reach is higher than in other species. Prolonged annoyance will make a cascabel actually advance upon its tormentor, something that the northern rattlesnakes never do. The cascabel often bites before coiling.

Mexican West-coast Rattlesnake *Crotalus basiliscus*. This kind rivals its near relative, the tropical rattlesnake, in size and lives along the western coast of Mexico from central Sinaloa to central Oaxaca, the ranges overlapping from Michoacan to Oaxaca. The two may be distinguished at a glance: the west-coast species lacks the dark neck stripes of the cascabel. No other rattlesnakes occur in the Mexican lowlands occupied by these formidable giants. Little is known about the habits of the Mexican west-coast rattlesnake, which long was regarded as merely a subspecies of the tropical rattler.

Western Diamond-back Rattlesnake, *Cro-*

talus atrox (Figures 2, 5). This temperate species is included here because the southern extremity of its range extends into the tropical area for a short distance on both coasts of Mexico; on the west, nearly all of Sonora is inhabited; on the east, the entire state of Tamaulipas and seemingly the northern tip of Veracruz. An account of this gigantic reptile has already been given.

Totonacan Rattlesnake, *Crotalus totonacus*. The Totonacan rattlesnake is a rare reptile known only with certainty from Panaco Island lying about seventy-five miles south of Tampico, Veracruz. A specimen said to have come from southern Chiapas was received by the Staten Island Zoological Society in 1940, the year the species was first made known to science. The longest of the three individuals on record measures sixty-five and a half inches, so the species is large and presumably highly dangerous even though the captive just mentioned was astonishingly docile. Two additional species with limited ranges are described below chiefly to complete the list of rattlesnakes of the tropical region.

Aruba Rattlesnake, *Crotalus unicolor*. Aruba Island lying about twenty-five miles off the coast of Venezuela is the home of this species which is pale gray above, white beneath. The largest specimen on record was thirty-seven and a half inches long. A female exhibited by the Staten Island Zoological Society gave birth to twelve premature young.

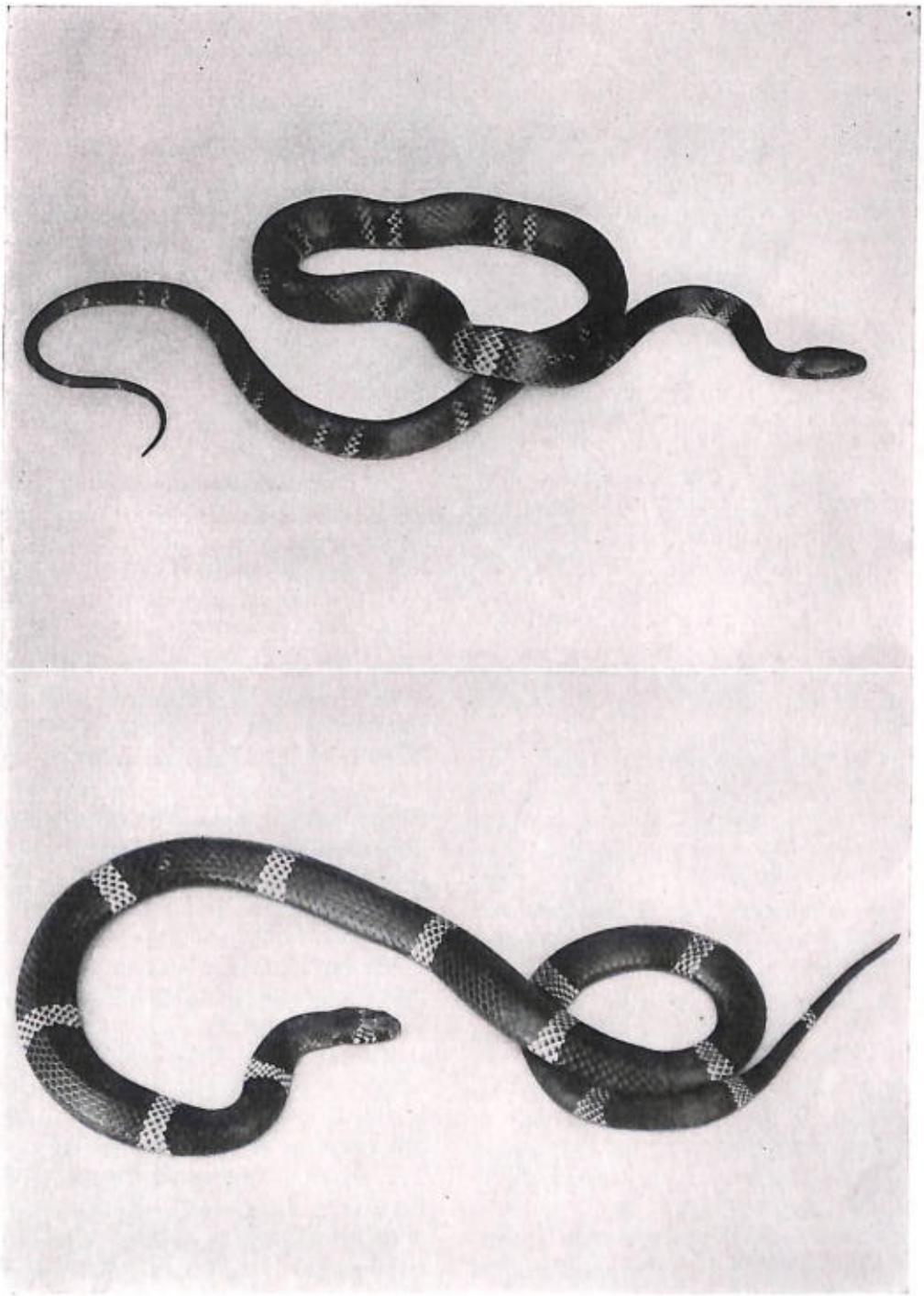
Uracoan Rattlesnake, *Crotalus vegrandis*. Two specimens from the State of Monagas, Venezuela, were given this name in 1940. They are smaller than their close relative, the tropical rattlesnake (Figure 30), and the blotches of the back are almost obliterated by numerous white-tipped scales.

Water Moccasin, *Agkistrodon piscivorus* (Figure 23). This snake may occur in the lower Rio Grande valley but it is not certainly recorded. It is described above in the section on the United States.

Mexican Moccasin, *Agkistrodon bilineatus* (Figure 24). Among the twelve rattle-less pit-vipers of Mexico's lowlands, this reptile stands out as the only one with a wide distribution along both coasts; it has been taken in southern Sonora on the west, and in the drainage of the Conchos River in the east. This river crosses northern Tamaulipas and is the first one south of the Rio Grande. The "cantil," as this species is often called, ranges southward to western Nicaragua. It is readily recognized by two white or yellow lines that begin on the snout; one extends through the eye and across the temple, the other along the upper lip. The wide brown or black cross-bands of the back are bordered with white spots that become obscure in the adult. Very little has been written on the habits of this aquatic snake which is known to reach a length of thirty-nine inches. Presumably it is highly dangerous; a horse bitten by one is said to have died in twenty minutes.

Bushmaster, *Lachesis muta* (Figure 31). Only two rattle-less pit-vipers of gigantic dimensions occur in Costa Rica, Panama, Colombia, Venezuela and the Guianas. The larger of these, the bushmaster, is said to attain a length of eleven feet and some inches but most adults are apparently from seven to nine feet long; measurements of a large series have yet to be recorded. The range extends from the low altitudes of both coasts of eastern Costa Rica southward through the Amazon lowlands, with its extreme limits along the Brazilian coast in the State of Bahia. The bushmaster frequents forests where it often hides in abandoned mammal burrows.

Recognition of adults should be easy enough if two facts are kept in mind: the skin, especially on the head, is rasp-like because the center of each scale is raised; the ground color is light brown of a more or less pinkish hue, the conspicuous black blotches of the back are wide in the middle, narrow on the sides. This pattern makes a bushmaster coiled on the forest floor anything but conspicuous. Some individuals seem to take advantage of this protective coloration and remain motionless until actually touched, others attempt to escape, or, if annoyed, strike viciously, even edging toward an intruder. The tail is vibrated and if the snake happens to be in dry vegetation, it may be mistaken for a rattlesnake. In spite of more than one long account, we still know little about the bushmaster's reproduction except the habit of laying eggs, which is of considerable interest because all other pit-vipers of the New World bear living young. The female coils about her clutch of about ten white eggs, each approximately three and a quarter inches long. Bushmasters are delicate snakes in



Upper — **Fig. 28. A harmless coral snake "mimic," *Oxyrhopus trigeminus*, recognized as innocuous by the fact that the areas of color are not continuous across the belly. This species is widely distributed in South America.**

Lower — **Fig. 29. Another harmless "mimic," *Erythrolamprus aesculapii*, in which the resemblance to a coral snake is striking because the areas of color form complete rings. Widely distributed in tropical America.**

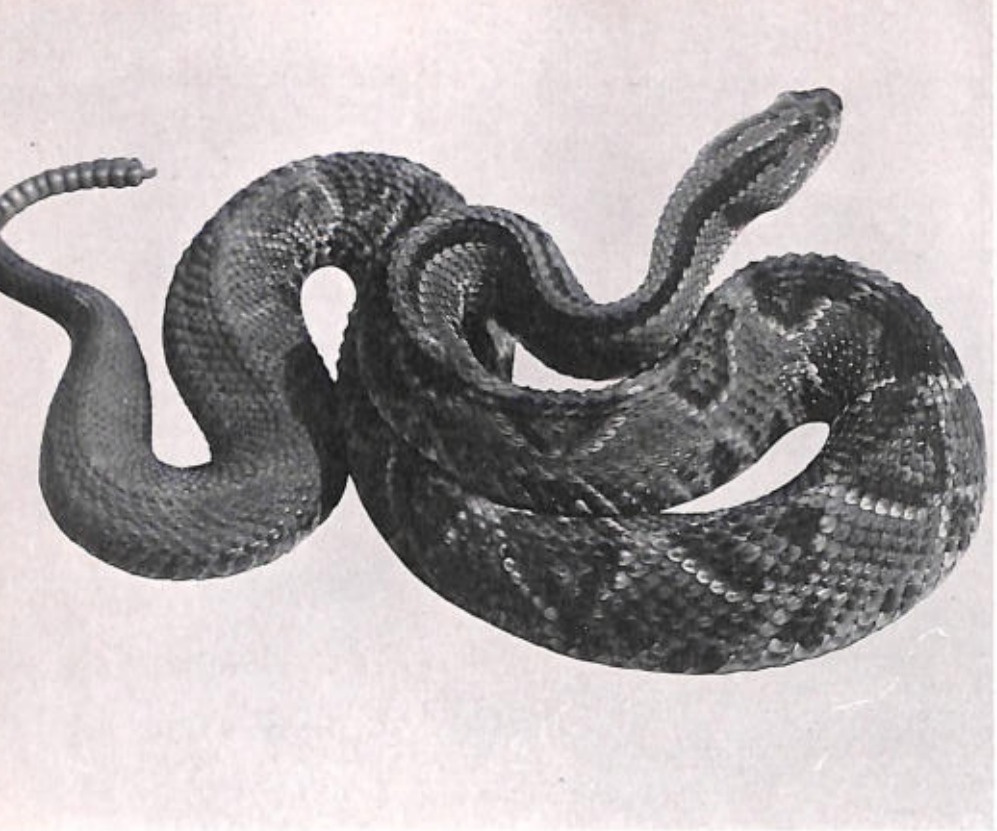


Fig. 30. Tropical Rattlesnake, *Crotalus durissus*. Range: Southern Mexico to Uruguay. Average length: About 57 inches in North, somewhat smaller in South America. Highly dangerous.

captivity and seldom find their way to zoological gardens.

FER-DE-LANCE, *Trimeresurus atrox* (Figure 32). The fer-de-lance, or BARBA AMARILLA, is the second of the two gigantic rattle-less pit-vipers found in Costa Rica, Panama, Colombia, Venezuela, and the Guianas. If we except the water moccasins already described, the fer-de-lance is the only gigantic pit-viper without a rattle that lives in Mexico at any altitude and in Central America above eastern Costa Rica where the bushmaster occurs. The Mexican moccasin (Figure 24) is hardly to be classed as gigantic, and the other water moccasin (Figure 23) is very rare in Mexico where its distribution is limited to the extremity along the Rio Grande.

The fer-de-lance ranges over nearly all of tropical America from eastern San Luis Potosi and perhaps southern Tamaulipas on the Atlantic side of Mexico and Guerrero on the Pacific to the State of Misiones in eastern Argentina (about 27° south latitude). Several other large and strikingly similar pit-vipers enter its territory south of the Amazon, so recognition there is difficult. Young individuals might readily be confused with various small species found north of the Amazon basin, but large ones could be mistaken only for the bushmaster (Figure 31). The skin of the fer-de-lance is not rasp-like and the pattern, in contrast to the clear-cut one of the bushmaster, is variable and complex, with light-edged blotches that are narrow or broken along the middle of the back, wide on the sides. The ground color varies from gray to brown or reddish-brown.

The size varies from place to place. On Trinidad, the maximum length is said to be about seventy-two inches, the average fifty-four to sixty; in Central America, specimens eight feet in length are not rare and there the average size may even approximate that of the bushmaster. Measurements of large series are not on record. The habitat is little restricted, the fer-de-lance frequenting wet as well as dry areas and forests as well as open country or even cultivated fields. In contrast to the bushmaster, it is a hardy captive that feeds readily and sometimes will reproduce in confinement. The diet consists chiefly of small mammals and an unknown but probably small percentage of birds.

(To be continued)

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

BIRDS FROM SOUTH AMERICA

Near the end of October, 1944, a consignment of western Colombian birds reached the New York market, by boat. In ordinary times, such an event would be of weekly, almost daily, occurrence. But nowadays it is almost epochal, for since the early days of the war civilian movement of live stock by water has been almost non-existent. From our point of view, therefore, this shipment marks a turning point. Already, there is talk of further arrivals from South America and from African ports. It seems quite likely that before another year has passed we shall be receiving replacements in some degree.

The present shipment is not of interest merely from its occurrence. Even among the floods of pre-war days, it still would have been notable, for it included a number of birds not previously seen here alive. The best of these were Toucans of sorts and their smaller relatives, the Barbets. Excellent specimens of each form were secured for our collections.

The only large Toucan was a Lesser Wagler's (*Ramphastos ambiguus abbreviatus*), a particularly fine representative of a rare and striking form. Next in size is a Gray-breasted Aracari (*Andigena hypoglaucus*), a sombrely-colored creature in dark green and bronze, with gray-blue breast and collar. It is of particular interest to us because none of the several blue-breasted members of this genus seems to have appeared previously in captivity. Of the attractive Green Toucanets (*Aulacorhynchus*), we have had a number of forms but the little Gray-throated (*A. cyanolaemus*) does not seem to have been imported before. It is a charmingly tame, hand-reared bird, with body feathers of bright green satin, set off by a blue-gray throat.

All of the several species of Barbets found in tropical America are exceedingly rare in collections and we are very fortunate to have been able, so far, to exhibit four different forms. We now add a fifth, the Toucan Barbet (*Semnornis rhamphastinus*), largest and most brightly colored of the group. This species first appeared in Europe in 1938 and has once before been imported into this country. The birds brought on the latter occasion, however, were in very poor condition and never left the importer's hands. The two we selected from the present shipment, however, are perfect and will soon be ready to grace one of our large planted aviaries.—Lee S. Crandall.

NEWS FROM LONDON ZOO

Through letters from friends in England, Mr. Delacour has learned that one flying bomb fell in the London Zoological Gardens during the summer, and several others landed in the vicinity. A good deal of damage was done to windows, doors and ceilings, and the bomb demolished the Hippopotamus-Giraffe House, one of the largest in the Zoo, the owl aviaries and the pheasantries, as well as a refreshment bar. All these structures will have to be rebuilt. No one was hurt and only two birds were killed. Some of the damage was repaired almost immediately and the animals were sheltered before cold weather. The Zoo continued open to the public all through the flying bomb raids.

After highly successful seasons, the Children's Zoo and the Farm-in-the-Zoo closed for the winter months on Sunday evening, November 12. The Children's Zoo will reopen on April 7, and the Farm on April 28.

Animal paintings, both in oils and water colors, by Charles Liedl will be exhibited in the Heads and Horns Museum Gallery from November 4 through January 1. Other work by the same artist was shown at the gallery in 1940.

NEW MEMBERS OF THE SOCIETY

New members of the Society since the last issue of this magazine are:

Annual

Irwin Rich — Henry Sleik

Mrs. Arthur A. Wacker

Life

Seabury C. Mastick

LEAF FISHES

Two of the curious South American Leaf Fishes (*Monocirrhus polyacanthus*) that look so much like dead leaves they can float within an inch of their unsuspecting prey have been put on exhibition in the Aquarium. They are the first specimens received here in ten years.

PUBLICATIONS OF INTEREST

THE BOOK OF NATURALISTS: An Anthology of the Best Natural History. 500 pp., 3 illus. Alfred A. Knopf, New York, 1944. $3.50.

Give Will Beebe a book and a bottle and you have a happy man. With such a set-up he is accustomed to make a few magical passes with microscope and typewriter, and come out with another book – about the insects, lizards, fish or invertebrates bottled on one of his expeditions – either in literal bottles or in his memory.

Just now he has modified the formula and has been making passes over a whole library of books. The result is, as usual, another book, a corking book, a book to make you want to sit down by a winter fire, with your own bottle, and drift and dream through the centuries of man's adventures in trying to understand just a little bit about his co-animals.

"The Book of Naturalists" is an anthology of lively and significant natural history ranging from Aristotle (b. 384 B.C.) to Rachel L. Carson (b. 1907 A.D.). We learn what the Abbot Theobaldus presumably believed in the XIth Century about the reactions of whales to fires lighted on their backs, Linnaeus's astonishing description of a cat as an animal that does not have fleas, we see Charles Darwin wandering entranced in a Brazilian jungle and industriously collecting specimens in the Galápagos; Huxley lecturing the workingmen of Norwich on the mysteries of a piece of chalk; Maeterlinck making vivid poetry of the intricate lives of bees; William Morton Wheeler's humor inspiring "The Termitodoxa, or Biology and Society."

Stefansson on Foxes, Owls and Polar Bears, Akeley on Elephants, Seton on the Sea Otter, Gerald Heard's imaginative "The Emergence of the Half-Men" in which he dramatizes the "inchoate beginnings of humanity," and generous pages from Chapman, Peattie, Miss Carson (on the strange odyssey of the Eel) represent only a few of the 45 naturalists in the anthology. All are prefaced by Dr. Beebe's editorial notes, appreciating the place of the writer in the great current of advancing knowledge.—W. BRIDGES.

INDEX

Figures in **black type** indicate that the reference is, or includes, an illustration, map or design.

A

Abreu, Mrs. Rosalie, 138
Agkistrodon bilineatus, **146**, 150
  mokeson, 143, **144**
    laticinctus, **144**
    mokeson, **144**
  piscivorus, 143, **146**, 150
Agouti, baby, Central American, 125
Aleutians, 11-14, 69
"Alice, Life with," book, 80
Alsleben, Alfred A., 94
American Committee for Wildlife Protection, 135
American Wildlife Institute, 135
Ancient animals, 37-41
Andigena hypoglaucus, 153
"Animal Faces," book, 80
Anteater, giant, 100, **101**-103
Artists, animal, 70-77
Aulacorhynchus, 153
  cyanolaemus, 153

B

Baker, Dr. James A., 14
"Barba amarilla," 152
Barbet, Toucan, 153
Beebe, Dr. William, 69, 154
  "Note on the Aleutian Flora and Fauna," 13, 14
  "Nouns of Multitudes of Animals," 17
  "Mid-Vistas of Zoo Life," 37-41
Beckmann, drawing by, **71**
Berlin Zoo, 18, 80
Blaauw, F. E., 133, 136
Blair, Dr. W. Reid, 80
Bonnot, Paul, "Marine Cousins of the Bears," 106-110
Bransom, Paul, drawing by, **75**
Breder, Dr. Charles M., Jr., **24**, 120, 123
Bridges, William, "Living in a Germ-free World," 14-17
  "Magna Charta of the Birds," 33-36
  "Life with Alice," book review, 80
  "46 Baby Rattlesnakes," 125
  review of "The Book of Naturalists," 154
Brightwell, L. R., "London Zoo Sees It Through," 18-22
Bristol Zoo, 121
Bull, Charles Livingston, drawing by, **76**
Burrell, Harry, 53
Bushmaster, 150
  Skull of, **85**

C

Carcharodon carcharias, 120
Chace, Cpl. Earl, "Report from the Services," **9**-11
Chimpanzee, 137-142, **Cover No. 6**
  strength of, 32
Chippendale, William H., "Capturing a Giant Anteater," 100-103
Clères, 19, 136

Clifton Zoological Gardens, 121
Coates, Christopher W., 24
"Guide to Higher Aquarium Animals," book review, 127, 128
Conservation laws, 33-36
Coolidge, Harold, 27
Copperhead, 143, **144**
Coral Snake, **82,** 145, **147**
Arizona, 145, **147**
Central American, **149**
mimic, **151**
Crandall, Lee S., 33
"Owls Are Moving Again," 23
"Three Tiger Cubs," 46-48
"Harry Raven," 78
"The Cubs Are Growing Up," 94-97
"A Rare Baby Crane," 125-127
"Birds from South America," 153
Crane, Demoiselle, 125
Paradise, 125
Sandhill, 125
Wattled, baby, 125-**126,** 127
White-neck, 125
Crotalus adamanteus, **86,** 116
atrox, **82, 86,** 117, 125 150
basiliscus, 149
cerastes, **119**
durissus, 148, **152**
horridus, **88,** 117
lepidus, **118**
mitchillii, **116**
molossus, **114**
ruber, **115**
scutulatus, **115**
tigris, **117**
totonacus, 150
unicolor, 150
vegrandis, 150
viridis, 118
lutosus, **112**
oreganus, **89**
viridis, **89**
Cuscus, **30**

D

Dasyprocta punctata, 125
Delacour, Jean, 104
Foreword to "London Zoo Sees It Through," 18, 19
"Government Refuges Are Saving the Trumpeter Swan," 130-136
Delagi, Nicholas F., photo by, **Cover No. 5**
Donahue, Pvt. Ralph, 69
"Report from the Services," **9,** 11-13
Doubleday, G. R., 21

E

Eadie, Robert, 53
Edge, Mrs. C. N., 133
Egret, plumes, **34**
Ehmann, William H., 34
Elephant, "climbing," 1
Emergency Conservation Committee, 133
Emmydrichthys vulcanus, 124
"Entomology, Outlines of," book review, 24
Erythrolamprus aesculapii, **151**
Eumetopias stelleri, 107
Extinct animals, 37-41
Ezra, Alfred, 18

F

Farm-in-the-Zoo, **128,** 153
Feathers, trade in, 33-36
Fer-de-lance, 152
Ferguson, Dr. W. S., 14
Fish and Wildlife Service, 134
"Fish" or "Fishes?" 103
Fish, poisonous, 122-124
Fleay, David, "The Birth of a Baby Platypus," 50-69
Fleming, Henry, review of "Outlines of Entomology," 24
Flower, Major S. S., 45
Follett, F., 133
Fox, 99
gray, 1
ingenuity of, 69
Frick, Childs, 27
Fuertes, Louis Agassiz, painting by, **74**

G

Gabrielson, Dr. Ira, 134
Gesell, Dr. Arnold, 139
Gibbon, **29**
Goose, domestic, skin of, 33
Gordon, Dr. Myron, 14, 24
Gorilla, 1
Goss, Dr. Leonard J., 46-48
Gourami, kissing, **Cover No. 1**
Green, Col. Joseph I., 28
Grönvold, drawing by, **73**
Grubber, Manhattan, 40, **41**

H

Hamerton, Col. A. E., 21
Hamilton, Captain William J., Jr., "Yankee Naturalist in England," 98-99
Harvard University, 142
Hornaday, Dr. William T., 33, 36, 80
Horsfall, R. Bruce, painting by, **74**

I

Illustrations, zoological, 70-77
India, 9-11

J

Jardin des Plantes, 136

K

Kai-shek, Mme. Chiang, 104
Kangaroo, 2-8
Bennett's tree, **6**
birth records of, 45
black-faced, **7**
gray, **5,** 121
great red, **2**
how babies get into pouch, 121
Karluk, Alaska, **13**
Kelley, Greame, drawing by, **38**
Kellogg Sanctuary, 136
Knight, Charles R., drawing by, **39, 74**
Kuhnert, Wilhelm, drawing by, **71**
Kung, Mme. H. H., 104

L

Lachesis muta, 150
Lashley, Dr. Karl S., 142
Laythe, Leo L., 135
Leaf Fishes, South American, 154
Leister, Claude W., review of "Animal Faces," 80
Leutemann, drawing by, **71**
Liedl, Charles, 153
London Zoo, 18-22, 153
Longevity, of griffon vulture, 45

M

Mad Tom, 124
Mammalogy, Journal of, 32, 36
Mammals, of Pacific area, **26**
Man, strength of, 32
Marcy, Donald, "Those Bizarre Animals from Down Under," 2-8
Martini, Mrs. Fred, 46, **47,** 48, 94-97
Massasauga, 111, **113,** 120
Mastodon, "Broadway," 37, **38,** 39
Maurice, Henry, 18, 21
Melbourne Zoological Gardens, 51
Meyerheim, drawing by, **71**
Micruroides euryxanthus, 145, **147**
Micrurus corallinus, 148
fulvius, **82,** 145, **147**
nigrocinctus, **149**
Moccasin, Mexican, **146,** 150
water, 143, **146,** 150
Monkey, proboscis, **30**
Monocirrhus polyacanthus, 154
Mullendore, Naomi, review of "Shrubs of Michigan," 126
Mutzel, G., drawing by, **73**

N

National Audubon Society, 135
Neave, Prof. Sheffield A., 21
"Nellie, Old," 45
Newman, Annie R., 104
New York Zoological Society, 135
Nigrelli, Dr. Ross F., 14, 24
"Fish May Be Poisonous, Too," 122-124
Nissen, Henry W., "The Ape Colony in Florida," 137-142
Ngagi, gorilla, 1

O

Onslow, Earl of, 18
Opossum, 23
Opsanus tau, 124
Ornithorhynchus, **50**-69
Osborn, Fairfield, "Dr. Breder Takes Post at Museum," 24
"Genesis of a Book," 27, 28
"Charles Haskins Townsend," 42-44
"Progress Report on 'The Pacific World' Series," 91-93
Owl, 23, 99
Pel's Fishing, **Cover No. 2**
Oxyrhopus trigeminus, **151**
Oysterfish, 124

P

"Pacific World, The," 9, 26-32, 91-93
Pam, Major A., 18
Panda, giant, **20,** 104
Pangolin, **32**
Paradise, bird of, plumage, 34, **35**
Park, Yellowstone National, 132
Perkins, R. Marlin, author of "Animal Faces," 80
Platyfish, Mexican, 14, **15**-17
Platypoecilus maculatus, 16
Platypus, **50**-69
Pope, Clifford H., "The Poisonous Snakes of the New World," 82-90
Part 2, 111-120
Part 3, 143-152
Prairie Dogs, **Cover No. 3**
Puffer, Atlantic, 122

R

Raccoon, 23
Ramphastos ambiguus abbreviatus, 153
Rattlesnake, Aruba, 150
banded, **88,** 111, 117
black-tailed, **114**
cane-brake, 117
diamond-back, **86,** 116
Great Basin, **112**
horned, **119**
Mexican west-coast, 149
Mitchell's, **116**
Mohave, **115**
Pacific, **89,** 111
prairie, **89**
red diamond, **115**
rock, **118**
southern pigmy, **113,** 120
tiger, **117**
timber, 118
Totonacan, 150
tropical, 148, **152**
Uracoan, 150
western, 111, 118
diamond-back, **82, 86,** 117, 150
babies, 125
Raven, Harry, 78
Refuge, elk, 133
Malheur Lake, 133, 136
Red Rock Lake, 132
wildlife, 130-136
Yellowstone National Park, 132
Reptile House, interior of, **127**
Rhinoceros, "biting," 1
Richards, Dick, author of "Life With Alice," 80
Rimmer, Keeper James, 45
Rungius, Carl, painting by, **74**
Rutiodon manhattanensis, 40, **41**

S

Sealion, California, 106-110
Piedras Blancas rookery, **109**
San Benito rookery, **106, 110**
Steller, 107
Sebastes maderensis, **123**
Schoonmaker, Dan, 104
Scorpion fish, **123**
Scott, George, 23
Semnornis rhamphastinus, 153
Shark, killer, 120
Sharp, Dr. Ward, 135
Sistrurus catenatus, **113,** 120
miliarius, **113,** 120
Snake, Arizona coral, 145, **147**
Central American coral, **149**
coral, **82,** 145, **147**
poisonous, 82-90, 111-120, 143-152
Specht, Friedrich, drawing by, **72**
Speed of animals, 36
Sphaeroides maculatus, 122
Staten Island Zoological Society, 150
"Steam Roller Circular," 36
Stingray, 124
Strength, man vs. chimpanzee, 32
Swan, Australian black, 131
Bewick's, 131
mute, **Cover No. 5,** 131
South American black-necked, 131
trumpeter, 104, **130-136**
whistler, 131
skin of, 33
whooper, 131

T

Tamandua tetradactyla, 101, **102**
Tariff Act of 1913, 33-36
Tarsier, **31**
Tee-Van, John, 104
Helen, drawing by, **41**
Tetrodotoxin, 122
Thorburn, Archibald, drawing by, **77**
Tiger cubs, **Cover No. 4**
in Zoo, 46, **47,** 48, **79,** 94, **95-97**
Tiger, sabre-toothed, **39,** 40
Siberian, 46
Toadfishes, 124
Toucan, Gray-breasted Aracari, 153
Lesser Wagler's, 153
Toucanet, Green, 153
Gray-throated, 153
Townsend, Charles Haskins, 42, **43,** 44
Trachinus draco, 124
vipera, 124
Trimeresurus atrox, 152

V

Vevers, Dr. G. M., 19
Vulture, griffon, 45
longevity of, 45

W

Wallaby, black swamp, **8**
Weever, 124
Wetmore, Dr. Alexander, 132
Wilwerding, Walter J., "A Short Account of Zoological Illustration," 70-77

Y

Yale University, 137
Yerkes, Robert Mearns, 137, 142

Z

Zalophus californianus, 106-110
Zoo, Berlin, 18, 80
Bristol, 121
Children's, closing, 153
London, 18-22, 153

CONTENTS

No. 1. JANUARY–FEBRUARY

Those Bizarre Animals from Down Under . . . . . *Donald Marcy* 3
Report from the Services . . . . *Cpl. Earl Chace and Pvt. Ralph Donahue* 9
Living in a Germ-free World . . . . . *William Bridges* 14
Nouns of Multitudes of Animals . . . . . *William Beebe* 17
London Zoo Sees It Through . . . . . *L. R. Brightwell* 18
Behind the Scenes: News and Notes 23

No. 2. MARCH–APRIL

Genesis of a Book . . . . . *Fairfield Osborn* 27
Magna Charta of the Birds . . . . . *William Bridges* 33
Mid-Vistas of Zoo Life . . . . . *William Beebe* 37
Charles Haskins Townsend . . . . . *Fairfield Osborn* 42
Behind the Scenes: News and Notes 45

No. 3. MAY–JUNE

The Birth of a Baby Platypus . . . . . *David Fleay* 51
A Short Account of Zoological Illustration . . . . . *Walter J. Wilwerding* 70
Behind the Scenes: News and Notes 78

No. 4. JULY–AUGUST

The Poisonous Snakes of the New World . . . . . *Clifford H. Pope* 83
Progress Report on "The Pacific World" Series . . . . . *Fairfield Osborn* 91
The Cubs Are Growing Up . . . . . *Lee S. Crandall* 95
Yankee Naturalist in England . . . . . *Capt. William J. Hamilton, Jr.* 98
Capturing a Giant Anteater . . . . . *William H. Chippendale* 100
Behind the Scenes: News and Notes 104

No. 5. SEPTEMBER–OCTOBER

Marine Cousins of the Bears . . . . . *Paul Bonnot* 107
The Poisonous Snakes of the New World. Part 2 . . . . *Clifford H. Pope* 111
How Baby Kangaroos Get Into the Pouch 121
Fish May Be Poisonous, Too . . . . . *Ross F. Nigrelli* 122
Behind the Scenes: News and Notes 125

No. 6. NOVEMBER–DECEMBER

Government Refuges Are Saving the Trumpeter Swan . . . *Jean Delacour* 131
The Ape Colony in Florida . . . . . *Henry W. Nissen* 137
The Poisonous Snakes of the New World. Part 3 . . . . *Clifford H. Pope* 143
Behind the Scenes: News and Notes 153
Index to Volume XLVII 154

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The Society and Conservation

Our thoughts regarding the Society's work in the field of conservation during the years immediately ahead are undergoing a considerable change. The impulses motivating us arise from a growing realization that emphasis must be placed to a greater degree than heretofore upon the preservation not only of wild animal life itself but at the same time upon the saving of natural habitat areas, namely, forests, soils and waterways, on which all animals, including man himself, are dependent. The velocity of destruction of these "living resources," not only in this country but in many parts of the earth, is infinitely greater than is generally realized. For example, continuance of the practice of burning or otherwise destroying forested areas in the sub-tropics and tropics, which results in soil erosion and the destruction of plant life, will bring about an inevitable diminishment, or even disappearance, of many present species of mammals and birds.

Historically, the Society's work in conservation has been pointed directly toward the preservation of species threatened with extinction, or toward the enactment of specific legislation protecting wild life. These activities must, of course, be energetically continued. At the same time it seems clear that the Society needs to broaden its program of conservation activities in order to contribute to a more general public recognition of what conservation means in its wider aspects. The essence of the whole matter is that wild animal life cannot exist unless its living places are preserved.

Fairfield Osborn

IN THIS ISSUE

New Guinea Short-headed Flying Phalanger . . . . . *Sam Dunton* COVER

Shopping for a Jungle . . . . . *Jocelyn Crane* 3
Foreword by Fairfield Osborn

The Oldest Zoological Park in North America . . . *Dr. Rafael Martin del Campo* 14
Translated by William Beebe

The Poisonous Snakes of the New World. Part 4 . . . . . *Clifford H. Pope* 17

Behind the Scenes: News and Notes 23

From the cloud-swept balconies of Rancho Grande, one looks down the winding road that cuts through the jungle toward Maracay, half an hour away. The road is concrete and therefore passable at all seasons.

SHOPPING FOR A JUNGLE

By JOCELYN CRANE
Research Zoologist of the Department of Tropical Research.

FOREWORD BY FAIRFIELD OSBORN

The last few weeks have been filled with the finest kind of news concerning the future plans of the Department of Tropical Research. First, a communication has just come from the Government of Venezuela that it welcomed the opportunity of making available to the Society a property known as Rancho Grande, situated west of Caracas. This property is on a mountain-top, 3,000 feet up, in the midst of the undisturbed jungle of a preserved national park.

Meanwhile, the officials of the Standard Oil Company of New Jersey and of the Creole Petroleum Corporation of Venezuela have on many recent occasions evinced their great interest in the idea that a permanent station should be established in Venezuela and now express their readiness to arrange for the transport of personnel and equipment and to meet the cost of maintaining the expedition.

The combination of support and interest coming simultaneously from a Government and from large industrial corporations is in itself a notable incident. Constructive developments of this nature rarely, if ever, occur by accident. In this case they stem back over a long period of time, even to the early years of Dr. Beebe's first field work in the British Guiana jungles.

Two years ago, it will be recalled, the Department was stationed in the jungle near Caripito. Subsequently, Dr. Beebe and Miss Crane, through lectures in the major cities of Venezuela, evoked widespread interest in the work that was being done. At that time the corporations mentioned above took an almost paternal interest in assisting the conduct of the work in numerous ways, and without their help the expedition would not have been possible. So successful was this entire project that it is only natural that it has now taken form in the manner described by Miss Crane in the accompanying article. To her goes great credit because, in the early part of 1944, she made a painstaking study of a number of possible locations for a permanent field station. It was an unusual sort of exploration trip, carried out with great thoroughness and care.

Rancho Grande is so ideally situated that it will provide the maximum of possibilities for fruitful results. Dr. Beebe and his staff will spend six months there during this year. Studies will include the conservation of wild life in the tropics and the habits of living creatures in the jungle. This will be the 45th Expedition of the Department. A series of lectures will be delivered by Dr. Beebe and his staff in the principal cities of Venezuela, Colombia and Ecuador. This project is the kind of work that will contribute, in the best possible sense, to better understanding between this country and the other republics of this hemisphere. Knowing the intensity and skill which Dr. Beebe and the members of his staff will use in pursuing their objectives, there is every reason to anticipate that this new venture will prove a highly important one in the annals of the Society.

Drawing by George Swanson

Rancho Grande stands in the center of the northern edge of Venezuela, in a crease of the southern slope of the coastal range. It was the first possible station site that Miss Crane visited, but she "shopped around" in many parts of Venezuela, Colombia and Ecuador, as indicated by the dotted lines.

ONE MORNING last spring the pilot of our small yellow plane pointed through the window at the jungle beneath and shouted in my ear, "Indians would get you there all right!" He wasn't smiling much and probably I wasn't either. A month before, that remark would have sounded like a worn joke to relieve a long flight. Now, after a week in Venezuela's southwest corner, I simply thought how nice it was that the Indians were at least several hundred feet away through lovely, empty air, and not waiting, complete with five-foot arrows, to ambush us in approved thriller fashion. Half-consciously, my ears began to take unashamed interest in the regularity of the motor's roar.

Bad Indians were only the latest unexpected addition to our long list of potential drawbacks of a jungle laboratory. When Dr. Beebe sent me to South America to find a suitable location for our next expedition's headquarters, the list of things we wanted in our jungle was, like the average Christmas list, longer than that of the things we did not want. Now, after a two months' intensive field course in the art of jungle-hunting, the undesirables had grown to include so many strange items, from tatucos to economical fever, that when I solemnly added the Indians they did not look in the least ridiculous.

In the beginning, the quest for a jungle had seemed relatively simple. Our old friends of the 1942 expedition, the Standard Oil of New Jersey and the Creole Petroleum Corporation, had invited us to come again to Venezuela. We could choose for a base any part of that wonderful country we wished, so long as it lay within the

agers in Manhattan, they will have quite similar mental pictures composed of equal parts trees, monkeys, vines, spiders and orchids all tied together with endless loops of boa constrictor. To them a jungle is a jungle. It is only when you are lucky enough to see a lot of different jungles that you learn there are as many different kinds as there are shoes or cars or fur coats or any other items of sensible everyday life. Also, jungles which are excellent from one zoological viewpoint are poor from another. And so, when I went shopping for a jungle, it turned out to be harder than choosing club-room slipcovers to please twenty members of the Ladies' Aid, or even than buying yourself a hat when you have a cold in the head and need a new permanent.

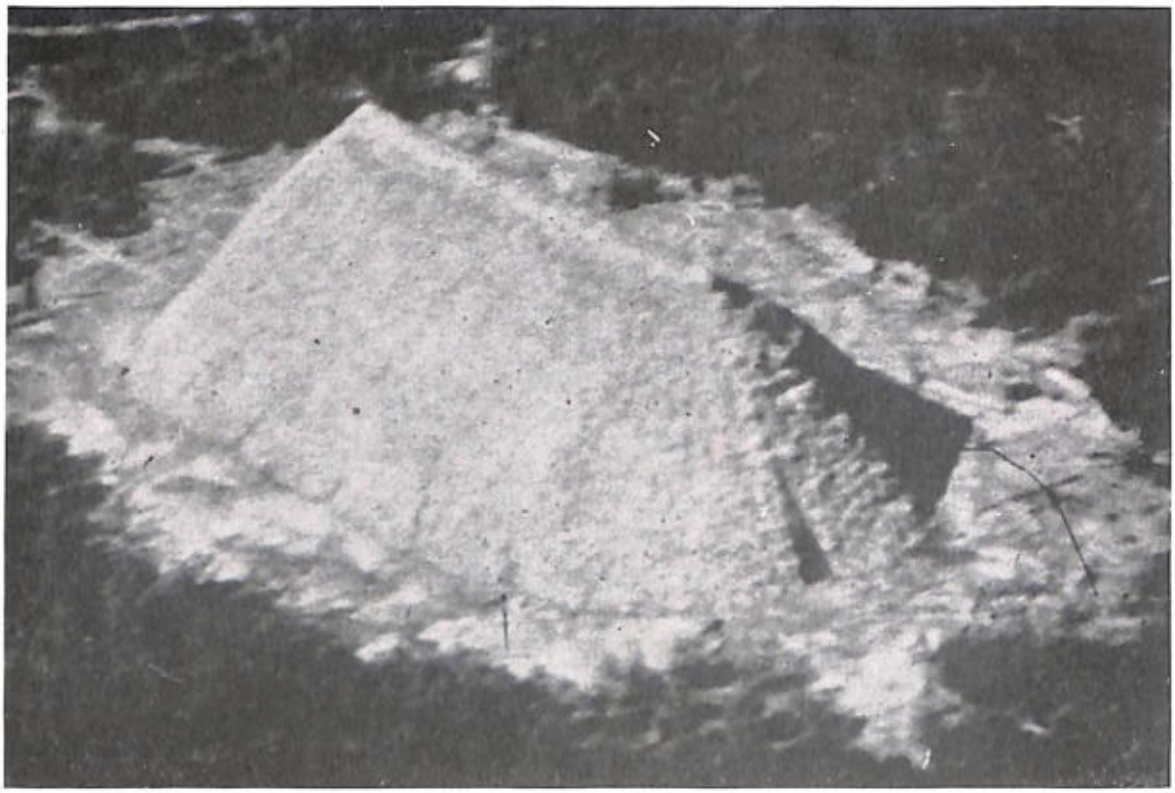
In the tropics, as in the north, such factors as rainfall, temperature, soil, drainage, altitude, wind-direction and nearness of lakes, mountains and seas all determine whether deserts or plains or forest exist. In addition, human ignorance can swiftly change a forest into arid, barren waste, good for neither farming nor pasture.

Among the tropical forests, which are loosely termed jungles, the combinations of these same climatic factors decide whether a given tract is formed by giant trees, always green, or smaller trees which lose their leaves during an annual drought, or stilt-legged trees with their feet in eternal swamp, or dwarf bamboo near a mountain top, or any of half a dozen other major jungle types. Those general kinds naturally govern the kind of animals that live there; a swamp-loving tapir would not prowl among the coastal cactus thickets any more than a polar bear would wallow in the Everglades.

The best of all possible jungles for our work is the kind typical of Kartabo in British Guiana, which Dr. Beebe chose as the site of the Zoological Society's first tropical research laboratory. Here is the queen of rain forests, with giant trees forming cathedral aisles, sparse undergrowth, and plentiful yet not excessive moisture through the year. But that kind of jungle is very rare anywhere, and particularly in Venezuela. Instead, the common variety is the seasonal sort we found in 1942 at Caripito, which is dry from January through April, with many trees as bare of leaves as an elm in December, and animal life almost as dormant as in our own winter woods. Later in the year, large parts of the same forest are soaked or flooded for months at a time. Understandably, fewer creatures are adapted to these violent annual extremes than to the equable conditions found in true rain forest. So we hoped to find a Venezuelan jungle more like the Kartabo region than that of Caripito.

We had heard high praise of the forest to the south of Lake Maracaibo, and thanks to Mr. Watson of the Caribbean Petroleum Company, the wells of which dot the area, I flew from one hospitable camp to another. In between times, I was guest of the Creole Corporation in Maracaibo, through the generous arrangements made by Mr. Proudfit, Dr. Zuloaga and Mr. Owens. From this comfortable base, I studied fiddler crabs and the trips around the lake were planned. Everyone—managers, engineers, geologists, their staffs and all their families—gave unstintingly of everything from companionship and advice to planes, cars and delicious jungle meals. Everywhere the story was the same: my hosts were kindliness itself, a house in any camp would have made a perfect laboratory, and the transportation of supplies would have been no great problem. The all-important jungle, however, was uniformly discouraging to zoologists who wished to settle down.

Caribbean's Casigua camp was typical. It sounded ideal, since it lay in wild forest down near the Colombian border, along a low ridge jutting north from the Andes. The land was still uninhabited, save for the rare oil camps and the adjacent Motilone Indians, those very literal savages whose well-guarded lands so effectively closed out civilization on the north and west. Finally, the rainfall up there in the hill country was well distributed through the year. In March, however, I found that the soil drained off moisture so rapidly that the surface dried out completely with every rainless spell, so that wild life appeared even more dormant than in the corresponding season at Caripito. When I stood alone in the forest one morning at dawn, instead of the wild chorus of toucans and parrots, monkeys and guans which a well-regulated jungle puts on as a daily show, there was only a bit of subdued chatter from a band of spider monkeys, far off. In mid-morning or mid-afternoon, the high tide of daylight insect activity, a



Flying over the Motilone Indian country, Miss Crane's plane dropped low over a clearing in the gray-green forest to give her a view of one of the communal huts of these Indian tribes. It was simply a law mound, oval in shape, of palm thatch, with two-foot-high entrance slits around its sides.

pitiful showing of butterflies fluttered in the glades, and an energetic two-hour hunt for jumpers—those most colorful and interesting of spiders—yielded only three of the big-eyed midgets. Doubtless in the rainy season creatures would crowd from mudholes and chrysalids, hollow trees and ancient logs, but for year-'round work we could surely find a more lively jungle than this.

I had high hopes of the flat delta lands below the camp, through which the Rio Tarra wound down to the Catatumbo. When I flew over this stretch just before landing at Casigua, the jungle. set off by circling skeins of startled egrets, looked perfect, even for our exacting tastes. It was completely green, without the frequent, barren boughs of tall deciduous trees which are among the tell-tale signs of dry-season jungle. Yet it lacked the superabundant palms and bright flashes of water which proclaimed perennial swamp. Both deciduous forest and palm swamp are abundant around the lake and equally bad for our work. Now I found that here in the lowland, as on the ridges, the land was disappointing. Top loam was almost absent; beneath the crackling leaves was only a whitish sandy clay which looked so poor that the merest window-box gardener would know better than to expect many plants to thrive in it. Insects were scarcer than ever, and I had just begun to think no more discouragement was possible when I crashed into a three-foot hole.

More careful wandering showed the soil riddled with these geological freaks, locally called tatucos. Although no one has been able to give me a literal translation of the name, it must certainly be a strong bit of indigenous profanity. Tatucos are anywhere from two to three feet deep and up to four by six across. A difference in color near the top shows the rainy season level of the water. Sometimes the pits connect with each other and sometimes they are separated by narrow ridges. In places it is easier to follow the ridges, leaping where possible; in others you sort of wade and jump, with an exhausting lack of rhythm, from the middle of one to the midst of

the next. A trail cut through this jungle would closely resemble a plan for a pretzel, and my idea of the perfect nightmare would be to chase a rare butterfly through a patch of tatuco forest.

Those pits warned me to use more caution in judging jungles from the air. The old Spaniards would have envied from their hearts my exploring technique, as they slogged these new-world forests, encased in armor which was vulnerable to mosquitoes and bête rouges and yet did not afford the luxury of scratching. Nevertheless, they could never have made my mistake of thinking a tatuco jungle a potential paradise.

Now that we were flying over the Indian country itself, I remembered the feeling of the afternoon before, as I struggled through the tatuco land. Palm leaves, falling and rattling in the dim stillness, had sounded far too much like stealthy steps. It is wonderful what proximity to wild Indians does to the imagination! Actually, the Motilones have not been known in the Casigua country for more than eight years. Yet, so well founded is their reputation for shooting on sight both Venezuelans and North Americans, that the least rumor of activity is sifted with respect. Too many people have lost friends with arrows through their chests, too many pilots have carried wounded oilmen to dubious recovery in the Maracaibo hospitals, for the Motilones to be a joke. All river launches, and all trucks traveling the Gulf Oil Company's road across the Colombian border, are well screened to guard against arrows. The Motilones appear, from our prejudiced, civilized viewpoint, to have just two graces: first, thanks to the oil which they smear on their bodies, their smell from afar is a useful warning; second, they are not William Tells, since their unpoisoned shafts usually go wide of the mark except when the range is short.

As we flew over their jungle, I hoped alternately that I would at least catch a whiff of a Motilone and that their jungle would prove *not* to be our prospective Eden. All the authorities said we would never be able to settle in their land. Even if we made camp, we would have to cut back the forest for yards and take an armed guard everywhere we went. Most important, we could never follow the same trails day after day, as is our custom, learning the roosting place of every butterfly and the hidden nests of tinamous and toucans, since the Indians' favorite method is to ambush unwary folk who pass the same way more than once or twice.

All at once we swung west, searching for one of the rare communal houses of the tribe. In the green haze of the jungle appeared a scattering of purple jacaranda trees in bloom, then some towering, golden pui, rising high over the gray-green forest like dandelions on a dew-drenched lawn. Suddenly, hundreds were in sight, with just enough sun to make the yellow shine, while all around the edges of the sky lay the morning mist.

At last we saw a small clearing. We banked steeply, dropped lower, then banked again and swooped so close that we could have counted the fringes on the palms. In the center was an oval, palm-thatched mound. Its only openings were a dozen slits, no more than two feet high, all

Trucks that use the roads and launches on the waterways in the Motilone Indian country are protected by heavy screens against the arrows of the Indians.

at ground level. The roof arched upward just above the slits, so that there were no proper walls. For once, here was a large building in the midst of a jungle, which I did not long to use for a laboratory!

As was to be expected, not a soul was in sight. Everywhere around were the shining golden pui and the violet jacaranda, all set in every shade of misty green, with the deeper, shining green of palms. It was unreal and enchanted, and like nothing so much as the Gingerbread House in the midst of a fairy-tale forest.

Minutes later I realized that the Motilone country, even minus Motilones, would not have been for us. The abundance of the puis and jacarandas, both deciduous trees indicating a strong dry season, were proof sufficient that our rain forest was not here. Although we were still jungle-less, I felt in the main relieved!

Much of the search for a jungle had nothing to do with jungles. There was, for instance, the night on the boat going to Bobures. Bobures is a tiny port in the southeast corner of Lake Maracaibo, which is the outlet for the great sugar plantation, Centrale Venezuela. Thanks to Dr. Pedro Paris and his nephew, Sr. Eugenio Paris, I was to be a guest of their plantation, since excellent jungle was rumored to lie just behind it at the foot of the Andes.

Nothing could have seemed farther from a forest wilderness than the little ferry boat which took me to Bobures. Most of the hundred passengers were typical, cheerful Venezuelans who were on their way home after a visit to their metropolis of Maracaibo. In addition, there were a few Goajira Indian women who, no relation to the Motilones, were amiable souls living to the northeast of Maracaibo. Why they were bound for Bobures, I never learned. They were a brilliant group, in gaudy, lace-trimmed printed gowns and with their faces painted with geometrical dot designs of henna and maroon. I reflected that, after all, their ideas of glamour did not differ so much from our own; it was simply that they put red on their noses as well as their mouths, while long dresses were worn all day long, on jaunts to town, instead of only at dinners and dances. Babies of all colors swarmed everywhere, but goats and kids, chickens, pigs and such lively passengers were confined tidily to the stern. There was no cabin, so for the all-night ride we sprawled comfortably in deck-chairs, protected from the brisk lake breeze by the upper deck and canvas dodgers. Everyone munched sweets interminably, unbothered by the pervading smell of ancient fish, and beat time to the ship's radio, which blared joropas, news and "Pistol-packin' Mama" with impartial enthusiasm.

Eventually, feeling as though I had been treated to a continuous vaudeville show, I climbed to the open upper deck, where, thanks to the chilliness, there was a great peace. Someone brought me a specially comfortable deck-chair, a blanket, coffee and crackers, and the jolly captain-owner came around for gossip of the States. Once he had visited New York for two weeks and admired, most of all, the Music Hall Rockettes and the Bronx Zoo. Long after he said goodnight and went below, five men around a table endlessly shuffled dominoes beneath a single shaded bulb, hissing soft *carambas* now and then. It was all dream-like and soothing, and the middle of Lake Maracaibo was a pleasant place to spend a night.

Our true rain forest paradise materialized south of Bobures, close against the Andes themselves. Here I rode horseback all one day through a picture-book jungle. Although it was the heart of the dry season, the soil was moist, showers reportedly came often, and yet the country was never flooded during the rains. All of these meteorological conditions were reflected in the plants and animals that lived there.

As we trotted toward it over the last of the plantation's pastures, the jungle rose before us like a wall. Suddenly bird cries swept out to us in a flood of sound so strong we could scarcely disentangle individual notes; guans, tinamous, toucans, antbirds and trogons all mingled indistinguishably, and only a bellbird's note soared above the din. By the time we had threaded our way through the great banana stand which fenced the forest itself, the performance was over, since it was then after nine.

The jungle lived up to its promise. Giant trees loomed within sight of each other, festooned with lianas and epiphytes of every kind. Philodendrons, those favorites of city apartments, climbed in such a lush growth that I thought with pity of our two little striving vines in the

laboratory in the Zoo, earnestly dosed with pellets and watered from a jug. Great brown morphos with bars of electric blue across the forewings were so common I could have caught a dozen. When we stopped to poke in fallen logs, enough assorted crawling things emerged to fill almost any invertebrate zoologist with joy. Orange sunbursts of Brownia, a strange flower that blazes from the trunk of its tree, seemed to glow in the greenness. Low paradise flowers grew here and there, lovely orange and purple blooms twice as big as those for which florists at home were asking several dollars. We could walk anywhere we wished, since underbrush was almost lacking and not a tatuco nor a spiny palm was anywhere in sight. By the streambeds we passed the tracks of peccaries and tapirs, jaguars and ocelots, and as we went farther toward the hills, the wonderful roar of howling monkeys grew ever stronger.

For a few hours I succeeded in closing my mind to the impossiblity of establishing our station here. Then reality won out: no permanent base could be built until well after the war's end, in spite of the hospitable offers of help from our friends of the Paris family. To do our work as we wished, we would have to set up housekeeping like our pioneer ancestors, beginning from scratch and with supplies carried by oxcart. We could only hope that this rare patch of rain forest would be saved intact for the future, and that it would not be necessary to sacrifice it to the gods of sugar or cattle or corn. Since it is the private property of the Centrale, there is hope it may continue to be saved.

Another locality which we hoped might prove suitable for our station was the jungle around the Yaracuy River, between Caracas and Maracaibo. Unfortunately, it turned out to be seasonal forest, exceedingly dry during part of the year and apt to be flooded at other seasons. Therefore, it would not be a good place for us,

Looking across Lake Valencia toward the range of mountains in which stands the new station of the Department of Tropical Research. The island-dotted lake itself is in view from the verandahs of the Rancho Grande, beyond the series of low ranges that may be seen in this photograph.

although Mr. and Mrs. Maxudian, who hold the lumbering rights in the region, gave me such a delightful weekend in their camp that I wished we might settle there.

Among other special memories was a handcar ride from the road's end to the sawmill, one ink-black midnight. By the time we had loaded ourselves and our gear on the car, I found myself perched on the very edge of the front, with my fingers clinging tightly to splinters. Most of the way was level, fortunately for my unpracticed balance, and only for a few wild moments were we careening downhill. We certainly were not actually going fast, but there in the blackness it felt as though we were tearing through space on a rocket. When I looked up and saw familiar old Orion overhead, he seemed wholly out of place.

Dry season jungle noises were disappointing. The forest creatures, thirsty to begin with, were doubtless quieted by our own racket, a rhythmic clackety-clack, accented tambourine-fashion by the jingle of the payroll, which banged back and forth in my tin crabbing pail. Once or twice when we clattered over a culvert, there rose the ringing notes of some frog, which died away behind like the lonesome sound of a crossing bell as a train tears past at night.

Smells, on the other hand, were more satisfactory. First there was the pungent whiff of cattle, punctuating the general scent of dusty grass, as we crossed the last pasture before the jungle walls of blackness shut us in. Then for a bit came an osmotic nomansland, between the fields and the forest depths. But soon, as the first of the frogs sang out, we were wrapped in the momentary rich odor of the mudhole where he lived. Then, so suddenly that I almost lost my balance, we met the acrid, invisible comet's tail of a bombardier beetle's path. Next came the faint muskiness of a comfortably distant skunk, only I knew the chances in this country were that the odor came, not from an animal, but from some jungle plant. A little later we swept through a wave of heavy jasmine fragrance, and at last, as a climax to our horizontal pousse-café of jungle smells, we stopped in the midst of exciting sawmill scents, where whiffs of fresh mahogany and cedro took the place of pine and oak and poplar in a carpenter's shop at home.

After visiting more than a dozen possible locations, it became evident that Rancho Grande was to be our paradise. I had studied it early in the trip, thanks to our good friends, the Phelps of Caracas. Hunting for our jungle had turned out much as shopping often does when you search for a special gift. You may find it within the first fifteen minutes, but you cannot take it happily until you have shopped all over town in the pouring rain. Nevertheless, when you do come back for your prize, you are delighted with it forever. So for weeks I had thrust from mind the pictures of the great half-finished hotel that stands high on the jungled slopes to the north of Maracay.

Now, after hundreds of miles of travel by plane and foot, dugout canoe, car and horse and train, there was no longer any doubt. Rancho Grande was *It*. The great building with its one finished corner and long verandah would make the most perfect of laboratories. Its setting is, for us, superlative, since it stands in the midst of the national forest reserve which the Venezuelan government has wisely established, guarding this one spot from the sadly common havoc of unplanned clearing.

In spite of its modernistic plan, the building has an old-fashioned personality all its own. With its naked metal beams, half-open rooms, rail-less stairways and eerie air of tropical decay, it should be a perfect haven for every lonesome ghost this side of the tropic of Cancer. But its finished corner should also be a refuge for scientists who love the tropics. From the verandahs, steep slopes, luxuriously jungled, rise on three sides, while to the south spreads a magnificent panorama of low ranges, the island-dotted lake of Valencia, and the whole, sun-splashed valley of Maracay. Late in the day, great clouds of mist come swirling with dramatic speed across the scene, shutting out the greens and blues and gold as quickly as a dark curtain is drawn across a stage. Just as swiftly the ghostly gray sweeps on, and once more you see for many miles.

A half-hour's ride on a cement road joins the Rancho to Maracay, which makes a bread-basket of unheard-of convenience for a jungle expedition. The same road continues past the building for an hour's drive over the pass to the arid coast. Thanks to this little-used highway, the range of

Here, on this broad veranda that will be screened against unwanted insects, the Department of Tropical Research will establish its laboratory in the finished corner of Rancho Grande. In all its history the Department has never before enjoyed laboratory floors of buff and henna tiles!

accessible study material varies from seashore life through cactus-haunting creatures to the secret fauna of the mist forests high up on the mountains.

Such wealth of variety is tempting enough to any ecologist, but even more satisfying is the abundance of life at the very door. On my visit, in the midst of the dry season when all was parched a mile down the road, the jungle about the Rancho was green and fresh. As I prowled along the adjacent trail, small live things scurried through the leaves and fluttered in the light that filtered to the path. Birds, frogs and crickets were all singing in their individual ways, and close by started the evening roar of howlers. The air was full of good ripe jungle smell, and I longed to settle down and go to work.

As I turned regretfully back to the verandah to make sketches and measurements against our possible return, I suddenly had a sort of cheerful premonition. Tables lined the balustrade, and heads bent over microscopes, notebooks and cages full of gaudy caterpillars and exotic-looking frogs. Typewriters clacked and a chair squeaked as someone pushed it back on the smooth hardness of the buff and henna tiles. Then the mirage faded, and only the cool tiles were real. I continued my notes contentedly: Here was our Lost World, rich with all the jungle life we wished; here were stout walls and a good road and accessible supplies; here was a healthy mountain, never flooded, never dry, and with not a Motilone nor tatuco anywhere about. Our castle in the air was found; we would return.

The Oldest Zoological Park In North America

By DR. RAFAEL MARTIN DEL CAMPO
(Done into English by WILLIAM BEEBE)

[In a recent number of the Annals of the Biological Institute of Mexico there is a most interesting article by Dr. Rafael Martin del Campo. entitled *El Mas Antiguo Parque Zoologico del America.*[1]

I have translated this rather freely into English and have condensed the long and often repetitious quotations from several of the conquistador chroniclers into a shorter and more succinct sequence. W. B.]

WE CAN AFFIRM without fear of being wrong that in olden times, in Tenochtitlan (what is now the city of Mexico), there existed a center of scientific learning, of naturalists and natural history lore, a focus of Aztec men who were well acquainted with the plants and animals of the whole of Mexico and indeed of all Central American countries. The extent and thoroughness of this ancient zoological culture is attested by an abundance of facts; for example, suitable native names for great numbers of plants and animals, names usually descriptive, or containing allusion to their qualities. So apt and wide-spread were these that many, more or less altered, have been preserved through numerous generations and today are incorporated in the vernacular and even in scientific nomenclature. Such are *xictomatl, ocelotl, tzapotl* and *quetzal.* Minute and precise descriptions of wild creatures were given by the natives centuries ago to the Spanish conquistadores and recorded by them. Today there still exist manuscripts, ceramics and sculptures with beautifully delineated creatures, sometimes realistic in the extreme, or when conventionalized, showing the intimate knowledge which must always underlie a successful burlesque or convention. When the organisms were most changed it was because of identification with the qualities of the particular gods to which the animals were dedicated.

Another proof of the extent of the naturistic knowledge of the Aztecs of Tenochtitlan was its wide-spread application to industry, food and medicine. Today the ignorant country peons still possess an unexpectedly wide recognition of the medicinal virtues of a host of plants, many of which have been confirmed by pharmacological proof. Finally we know that the Aztecs of this

[1] Anales del Instituto de Biologia de la Universidad Nacional de Mexico, Tomo XIV, 1943, pp. 635-643.

The headpiece of this article was drawn by George Swanson and all the human and animal figures were copied from Aztec codices and stelae.

fortunate region brought plants and animals from considerable distances in great numbers, and so studied their conditions of life that they continued to live and even to reproduce. So there came to arise in the great city of Tenochtitlan two things wholly new to the American continents, North and South, before the time of Columbus — a Botanical Garden and a Zoological Park.

Even in the days of the Romans there existed sporadic collections of animals for show or usually for exhibitions of combat in the arena, and in Europe in the fifteenth century there were bear pits and game estates. But there was nothing to compare with that astounding Zoological Park of the Emperor Montezuma, which so amazed the Spaniards when first they reached the metropolis of the Aztecs. In an annex of the palace of Tlacatecuhtli were many spacious buildings, each devoted to some class of plants or animals, all in lodgings suited to their wild ways of life, and the animals fed according to their requirements. In addition, careful medical attention was given to ailing creatures, and painstaking care lavished on those which reproduced themselves. These generalities together with many more detailed facts and minutiae have been preserved for us in the journals and chronicles of such reliable eye witnesses as Fray Juan de Torquemada, Diez del Castillo and Don Hernando Cortez himself.

Torquemada considers this mighty Zoo as one of the greatest proofs of the temporal power of the Emperor. Not far from his palace were great buildings and installations filled with dens and cages for ferocious wild beasts, also great aviaries for birds, with corridors supported by numerous columns of jasper, each column of a single stone. These corridors led down to a magnificent garden in which were spacious pools and ponds filled with birds which live in or near water. In one pond was a flock of birds with very long legs and all their bodies and wings scarlet, and the water around was covered with all kinds of ducks. The birds which waded and swam were of so many kinds that, as Cortez says, it seemed as if all the water birds which lived within 200 leagues around had assembled. They showed so many diverse forms and colors that this soldier author was lost in admiration, not having known there were so many and such beautiful birds in the whole world. Cortez tells us that the pools of salt water were for the sea birds, and those with sweet water for birds of rivers and lakes. All were emptied often, cleaned thoroughly and filled again through pipes, so the water was as clear as a mirror.

In dens of great size with strongly barred cages were collections of lions and tigers (pumas and jaguars), wolves, foxes and many small cats. For 300 leagues in all directions scarcely an animal existed which was not represented in this Zoo, living and often breeding. In a farther hall were royal eagles, goshawks and sparrowhawks, and elsewhere kites and vultures. These all had indoor places protected from the rain and sunny gardens where they could enjoy themselves.

The great *Toto-calli* or Bird House was a beautiful building, with a big patio, all with perches and floored with brilliant tiles like a chess-board, and in length a full 185 yards. Half was roofed, the other half open to the sky. The netting or mesh was of finest reeds or threads for lesser creatures, stout bars for greater. To each species was apportioned its exact food, whatever it ate when at liberty. To one prawns were given, to others fruits of shrubs or trees, corn or smaller grains, worms, flies, lizards, and fish to fish-eaters. Hundreds of pounds of live fish were used daily, which the birds themselves caught in the lagoon. Each day 500 fowls of various kinds were fed to the birds of prey.

Bernal Diaz contributes further details as to the food. To carnivorous mammals were given deer, dead and alive, fowls, little dogs and also the bodies of sacrificed Indians and of criminals. After the sacrifice in the temple the bodies of the victims were cut up with knives of flint, the hearts offered to the idols, the heads hung as trophies, and the remainder fed to the consecrated beasts of prey in the Zoo.

The soldier-author Diaz del Castillo gives us an actual catalogue of the contents of the various houses and exhibits. His list extends from the royal eagles, through large-bodied birds down to tiny creatures painted with many different colors; birds which look like the magpie of Spain called *Quezalas*, and others feathered in five brilliant hues, green, red, yellow, white and blue, of unknown names, and besides all these there were multitudes of beautiful parrots.

One large house was filled with many idols,

fierce gods and with them ravening beasts of prey, to keep them company. Also in the same accursed house were numbers of vipers, and other poisonous snakes which carry their venom in their rattling tails, the worst of all serpents. All these were kept in enormous earthenware containers in which they laid eggs and reared their young. In pools were crocodiles of wonderful size and great iguanas which are good for food, all of these creatures being provided with water or earth according to their requirements, and all kept in separate cages or receptacles.

Each division had its own labels and also its special name, which Torquemada has given us, such as *Toto-calli,* House of the Birds, and *Tecuan-calli,* Home of the Wild Beasts.

The personnel of the Zoo labored in great numbers, each man a specialist in his department, revealing an organization very similar to that of the best modern Zoological Park. For example, three hundred keepers were assigned to the birds. Some cleaned the pools and ponds, others caught insects and fish for food, others fed them, still others kept the birds free from lice and vermin and plucked out broken feathers, some were directed to receive and acclimatize new arrivals. Special men and women looked after nests and eggs, putting some of the latter under broody fowls, and caring for the newly hatched young birds. A considerable number of men did nothing but take care of ailing birds and animals, while a small army of hunters and collectors spent their time searching for new creatures.

The aims of this great zoological establishment set it far apart from any modern Zoo. In no sense was it primarily a public institution, although the Emperor, his Princes and their huge households of six hundred persons upward doubtless derived great pleasure from the collections of strange and beautiful living creatures. As we have seen, many snakes and fierce animals were consecrated to various gods and great numbers were sacrificed to their particular deities. We know that *Tezacatlipoca,* the chief of the gods, was personified by the jaguar, the spotted constellations on whose furry coat symbolized the starry night sky, the dwelling place of this god. Snakes entered into the personality of Quetzacoatl, ruler over earthly fertility.

A still less pleasant religious belief was the field of influence of the god *Xototl,* twin brother of the snake god, who presided at the birth of all human twins and monstrosities, and to whom the unfortunate albinos, hunchbacks and other human oddities on view in the Zoo, were sacred. However, we are in no position to criticize, when we recall the place at court held only a few generations ago, by dwarfs and deformed jesters.

In the second place, the Zoo of the Aztecs was a source of supply for untold numbers of beautiful feathers needed for the full-length robes of priests and warriors for which this nation was so famous. In this case, actual sacrifice or killing of the birds was not necessary; accurate timing and harmless methods of plucking provided an abundant supply of gorgeous feathers without harm to the original owners.

It was probably as an expression of his magnificence and power that the Zoo must have appealed primarily to Montezuma. Torquemada tells us that the Emperor, walking abroad with his retinue, and suddenly attracted by a hawk or heron flying past, would point to it and demand it. Such was the number and skill of his hunters that in a marvellously short time the individual bird he wished would be captured alive and brought to him.

In conclusion, the tragic end of Montezuma's great Zoological Park was as a victim of a war of conquest which, like the present conflict, was begun under the guise of civilization and redemption. Cortez "civilized" by the destruction of everything which stood for civilization and culture, and he "redeemed" the natives by exterminating or at least enslaving them. Cortez' own words are somewhat as follows: "In order to hurt the Aztecs more, that same day I ordered fire to be put to the great houses on the plaza . . . and all the other houses near by, smaller than the palace but cool and very beautiful, where Montezuma had his enormous collections of birds and animals. I regreted this but I decided to burn them all, because I knew the inhabitants would regret it still more."

[And so came to an end, on the thirteenth of August, 1521, or thereabouts, the splendid Zoological Park of the Aztecs, the first, and one of the greatest ever to be founded on the continents of the New World.]

The POISONOUS SNAKES of the NEW WORLD. Part 4

By CLIFFORD H. POPE
Fellow of the New York Zoological Society; Curator of Reptiles of the Chicago Natural History Museum.

[This article is a portion of a booklet of the same title, previously published by the Zoological Society.]

Temperate South America

The temperate region of South America, as explained above, is considered as beginning at the latitude of the mouth of the Rio de la Plata (35° south). Four kinds of poisonous snakes occur in this area, three pit-vipers without a rattle and one coral snake. These can be readily identified from the following descriptions.

Urutu, *Trimeresurus alternatus* (Figure 36). Few snakes are as beautifully marked as the urutu. A double series of dark-edged ᔓ -shaped blotches extends along the back, the open sides of the blotches facing away from the midline of the back. The brown of the ground color is lighter than that of the blotches. The characteristic pattern is subject to variations: the ends of the blotches may be cut off, or they may even join to form circles. In such cases, the design on the head will help; a light, ⅄ -shaped mark with the cross bar between the eyes and the branches of the Y on the back of the head.

The urutu is by far the largest of the three temperate pit-vipers, reaching an extreme length of sixty-six and a half inches; the average length has not been determined but it would probably be about forty inches. It ranges from the Territory of Rio Negro in Argentina northward over much of southern Brazil, reaching the States of Matto Grosso and Minas Geraes.

Maximilian's Pit-viper, *Trimeresurus neuwiedii meridionalis*. The pattern of this variable species strongly suggests that of the fer-de-lance. The ground color is red or brown and the large, dark blotches are narrow along the middle of the back, wide on the sides. A row of small spots extends along the side, two spots (on either side) being opposite each blotch. The subspecies *meridionalis* ranges widely over Argentina from the State of Buenos Aires and the Territory of La Pampa northward. Other subspecies, one of which is shown in Figure 37, are distributed over southern and eastern Brazil. Maximilian's pit-viper is medium in size, adults measuring two feet or thereabouts; the maximum length is approximately thirty-five inches.

Patagonian Pit-viper, *Trimeresurus ammodytoides*. The tip of the snout is distinctly turned up in this species, a characteristic that distinguishes it from the two preceding kinds. The ground color is brown; a row of darker brown or blackish blotches extends down the middle of the back and is paralleled on either side by two rows of spots similar in color. Adults are ordinarily from fifteen to eighteen inches long. This snake occurs only in Argentina where it is found from the Territory of Santa Cruz to the State of Tucumán. It does not inhabit the lowlands of the eastern states. No other poisonous reptile lives as far south.

Southern Coral Snake, *Macrurus frontalis*. This coral snake is recognized at a glance by its gaudy pattern of red, yellow, and black markings that completely encircle the body to make the belly look essentially like the back. Three black and two yellow rings form a set of five, all equal in width; each set is in turn separated by a wide ring of red. Thus the yellow of the pattern is in contact only with the black, the black only with

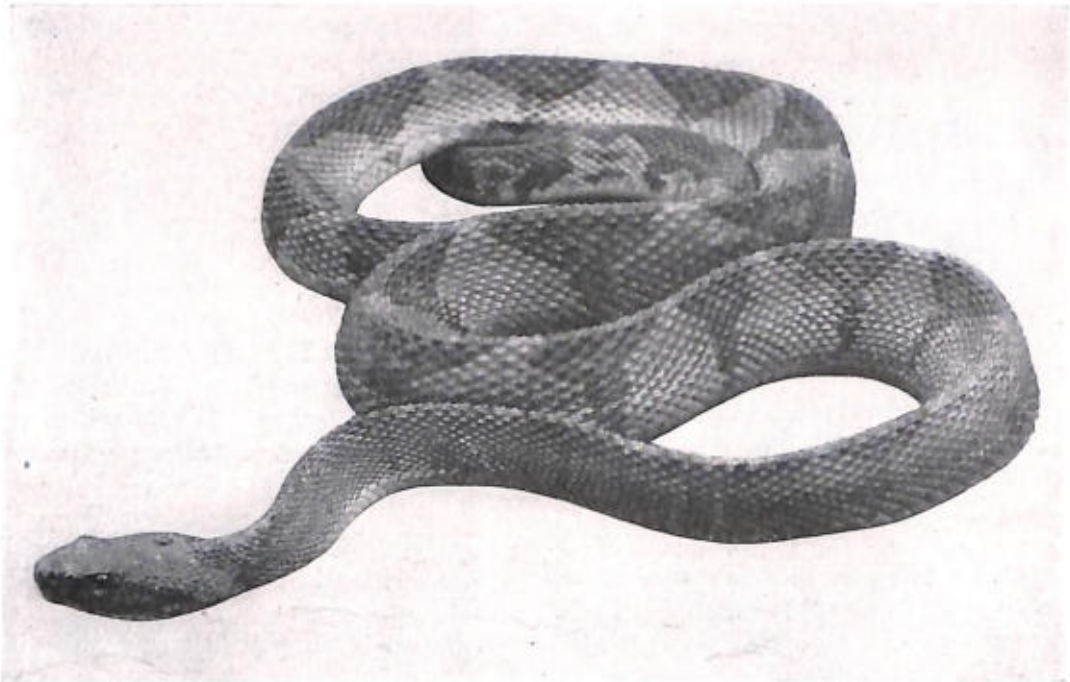


Fig. 31. Bushmaster, *Lachesis muta*. Range: Costa Rica to Brazil. Average length: About 8 feet. Highly dangerous.

the red. The patterns of few if any harmless snakes of Argentina's temperate fauna resemble this one closely enough to cause confusion. The species occurs from southern Brazil to the Territory of Rio Negro, Argentina, and attains a maximum length of forty-seven, an average one of about thirty inches.

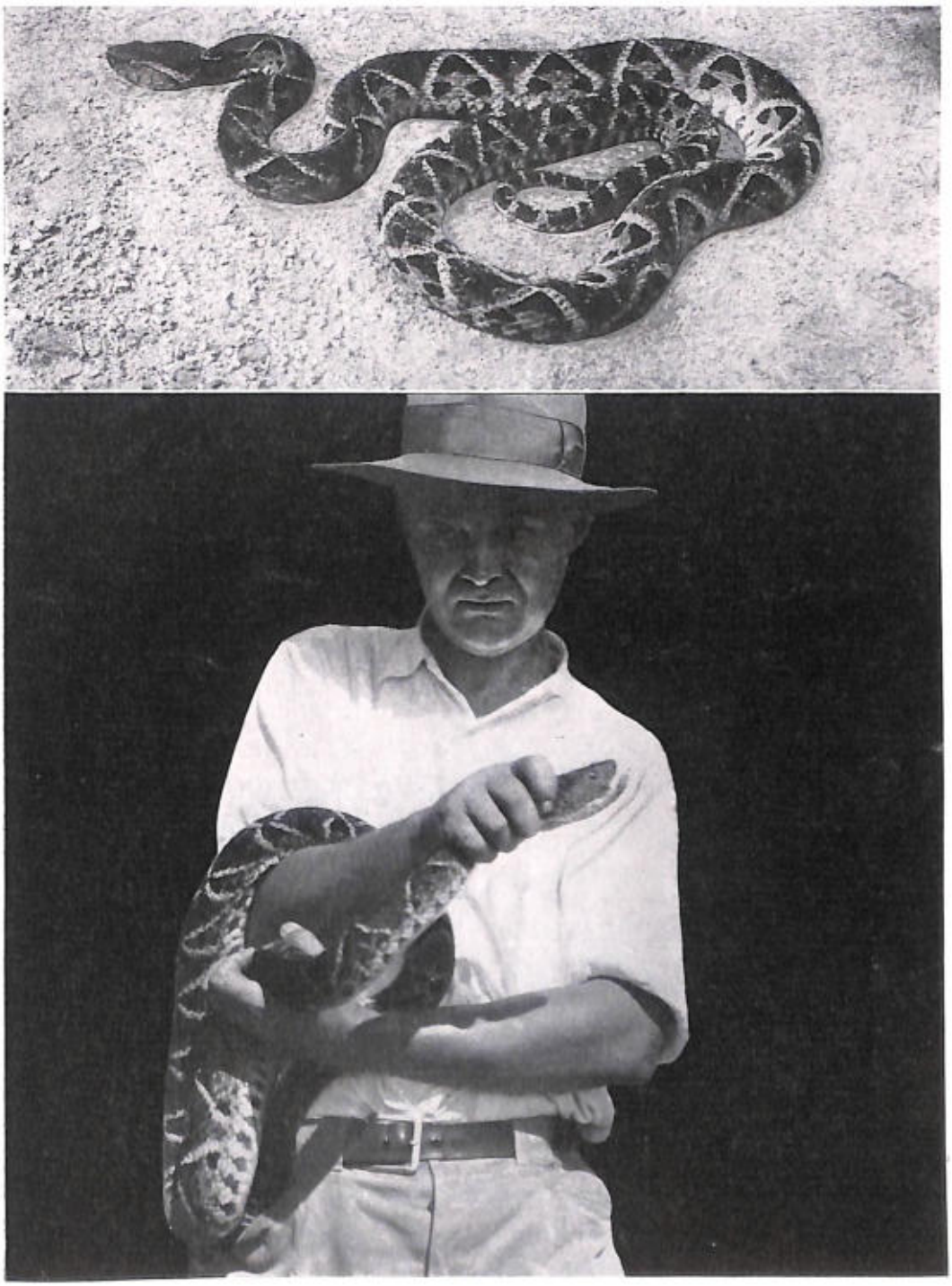
SNAKE POISONING AND ITS TREATMENT

Snake-bite and Snake Poisoning

The study of reptile populations is in its infancy so no one can say what percentage of the New World snakes alive today are poisonous; the available information strongly indicates that for every poisonous *individual* there are many harmless ones. It is well known that innocuous *species* greatly outnumber the poisonous ones; in the United States, for example, out of a total of one hundred and twenty-six, only nineteen are poisonous; there is every reason to think that the ratio would be approximately the same in the tropics. This does not mean that harmless snakes everywhere outnumber poisonous ones; certainly there are small areas where the reverse is true.

These comparisons in numbers are made to show how important is the distinction between being bitten by a snake and being poisoned by one. Since most harmless snakes are about as ready to bite as are venomous ones, the chances are always good that a victim who cannot tell one snake from another has been bitten by an innocuous species. Here emphasis is again placed on the importance of a little knowledge of snakes. Many a person merely pricked by the solid, needle-sharp teeth of a harmless species has suffered severely from shock or even from drastic remedial measures. No doubt the universal faith placed in large doses of alcohol is based on cases of bites by non-venomous reptiles "cured" in this time-honored manner. It is now well established that large doses of alcohol do much more harm than good.

The psychological aspect of snake-bite is extremely important. A person with a blind terror of snakes may become so helpless after an unpleasant experience with one that he or she is unable to act quickly enough to meet the requirements of the situation, which might call for agility in securing the culprit, or for steadiness and coolness in finding fang or pit after its



***Upper* — Fig. 32. Fer-de-lance, *Trimeresurus atrox*. Range: Tropical America. Average length: 5 feet or more (varies from place to place). Highly dangerous.**
***Lower* — Fig. 33. A fer-de-lance from Honduras, 100 inches long.**

slaughter. A person may look at a lethal weapon such as a loaded gun without emotion, but tremble with fear at the sight of a little snake. Even a poisonous reptile is no worse than the

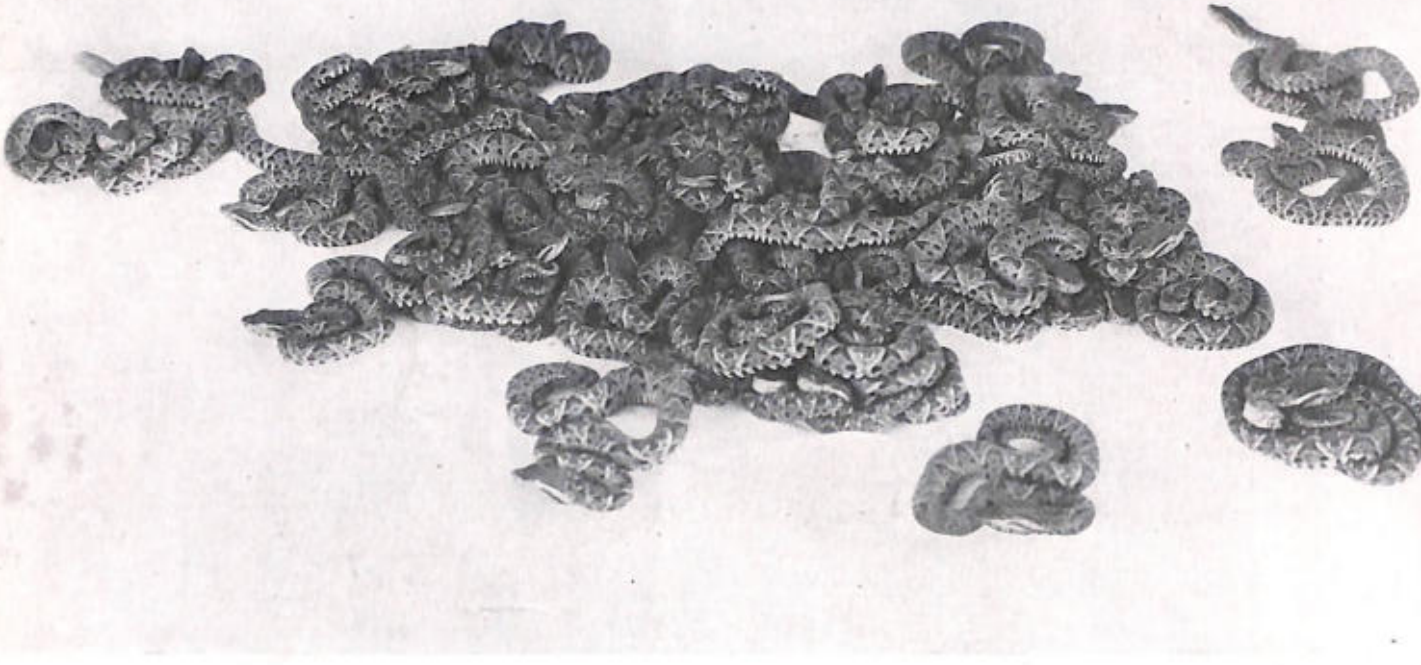


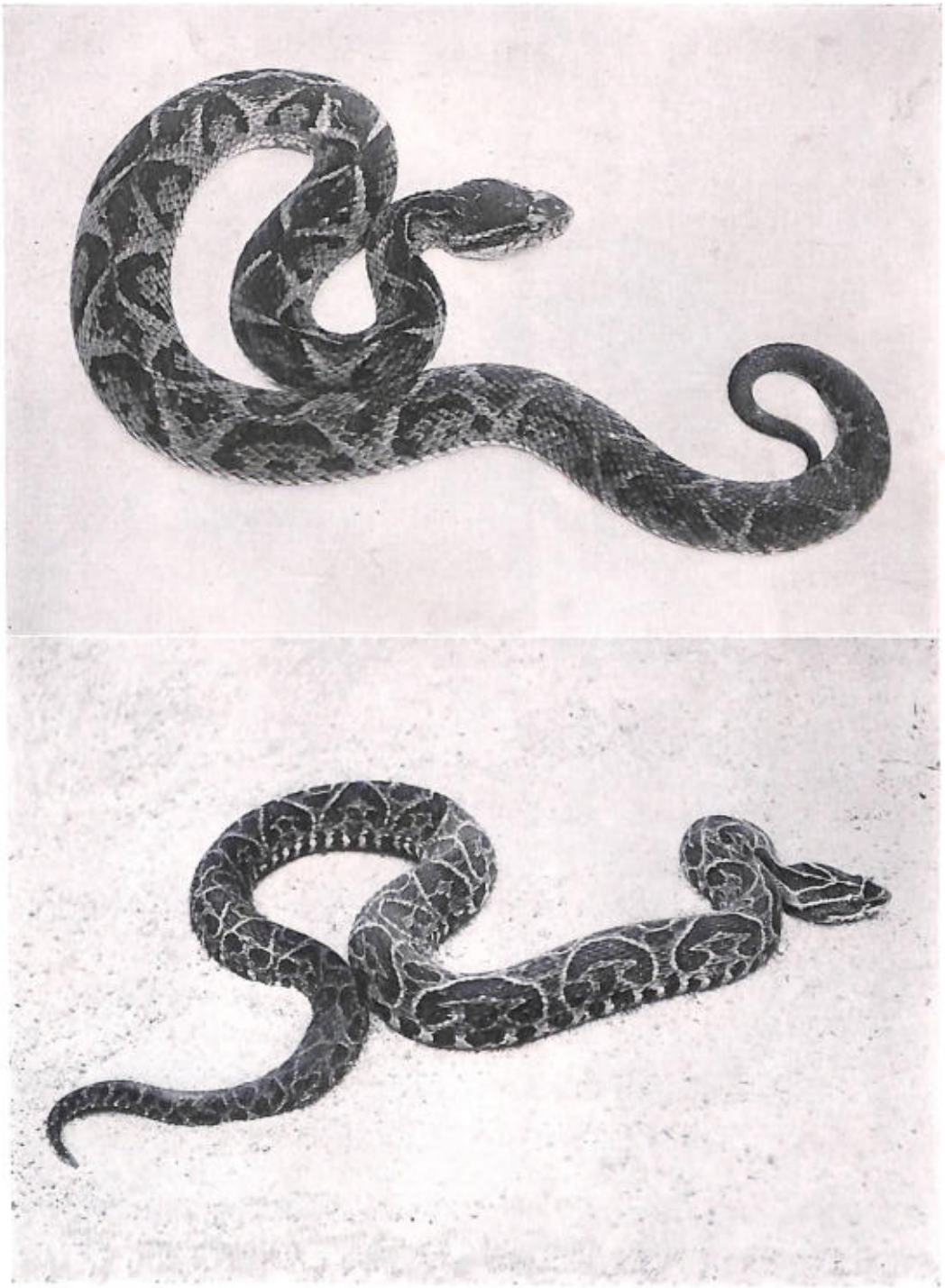
Fig. 34. This newly-born brood of fer-de-lances was made up of more than fifty individuals, each fully developed. Three broods from Honduras contained 64, 65 and 71 young. The offspring of a 6-foot female measured about 12 inches.

gun, and, if necessary, can be handled quite as safely. The fear of snakes is so deep-rooted in some persons that its eradication is all but impossible; in others the repeated handling of a harmless species rapidly dispels all feeling of dread. Sometimes the stumbling-block quickly turns into a stepping-stone and holding a snake becomes a pleasure. For most of us there is a thrill in the conquest of fear.

It is often said that the bite of a harmless snake differs strikingly in appearance from that of a poisonous one. The difference is not great enough to be relied on, but if certain facts are kept in mind, examination of the bitten place may help a decision; harmless snakes usually have four rows of needle-like teeth in the upper jaw and two in the lower, so a perfect bite would show impressions of all six rows; in poisonous species, the perfect bite would be like the other with the impression of the two outer rows of the upper jaw replaced by fang punctures, one hole on either side. Perfect bites are seldom accomplished, but it is safe to say that, if the upper jaw clearly made four parallel rows of tooth-pricks, the snake was harmless.

The Venom and its Effects

The venom is modified saliva that not only enables a snake to procure food but helps in its digestion as well; the defensive use of venom is secondary. All reptile venoms are complex proteins that defy full chemical analysis although a great deal is known about their effect on animal and even plant tissues. On this empirical basis, venoms may be divided into two types: one, the hacmotoxic or haemorrhagic, causes local congestion and swelling by damaging the blood cells and rupturing capillary walls; the other, the neurotoxic, attacks the sympathetic nerve centers controlling heart and lungs. Unfortunately for purposes of description, most venoms are not pure types but contain haemorrhagic as well as neurotoxic elements and are



Upper **— Fig. 35. Jararacussú, *Trimeresurus jararacussu*. A species of Argentina, Paraguay, Bolivia and southern Brazil easily confused with the fer-de-lance. Highly dangerous.**
Lower **— Fig. 36. Urutu, *Trimeresurus alternatus*. Range: Southern Brazil to Argentina. Average length: About 40 inches. Highly dangerous.**

properly classified only as predominantly one or the other. The matter is further complicated; the poison of the same species may vary noticeably from place to place.

Fig. 37. Maximilian's Pit-viper, *Trimeresurus neuwiedii*. Range: Brazil and Argentina. Average length: About 2 feet. Highly dangrous.

"What is the most poisonous snake on earth?" This is a popular reptile question — and none is more annoying. Asking a herpetologist this is like worrying a military man with, "What is the most dangerous gun made?" There are as many answers to the one of these as to the other. One kind of snake may have potent venom but short teeth and a docile nature; or it may even live in uninhabited country and never get a chance to bite a human being; another may have long fangs and big glands but weak venom; another might be neither well equipped nor inclined to inflict injury but frequent a habitat in which bare-legged laborers are forced to work and can scarcely avoid being bitten.

By leaving out certain complicating factors and only considering the three highly important ones it is possible to decide in a general way how dangerous any snake is. The three factors are: the efficiency of the species as a biter or injector (size and behavior of snake and length and structure of fangs); the amount of venom carried; its potency (measured usually in minimum lethal doses, one "M.L.D." being the smallest amount that will surely kill a given animal). A detailed discussion of the danger rating of New World poisonous snakes would only confuse the layman, but a few generalizations followed by some remarks about the species already discussed should prove helpful.

Coral Snakes: Few species have been studied but certainly all are inefficient biters and carry small quantities of a neurotoxic and very potent venom. A coral snake is not dangerous unless trod upon by a bare foot, or handled. Since the common species of the southeastern United States (Figures 1, 25) is well able to kill an adult human being, any kind that equals it in size should be regarded as deadly poisonous.

Rattlesnakes: All pit-vipers with rattles are

efficient biters, and all carry relatively large amounts of potent venom. The minimum lethal dose for man varies from species to species but any individual more than two feet long should be regarded as deadly. In the "rattlesnake belt" it is well to regard even smaller ones as deadly because of difficulties of identification; certain species of this area have especially toxic poisons. The venom of the tropical rattlesnake or cascabel (Figure 30) is remarkable in being predominantly neurotoxic instead of haemotoxic as in the other species of rattlesnakes investigated. The bite of this reptile is especially dangerous.

OTHER PIT-VIPERS: This category includes the numerous rattle-less pit-vipers of the genus *Trimeresurus* (or *Bothrops*), an almost entirely tropical group; the bushmaster (Figure 31); the two aquatic moccasins (Figures 23, 24); and the copperhead (Figures 21, 22). Broad generalizations cannot be made, the venoms of few of the tropical species having been investigated, but it is safe, as in the case of rattlesnakes, to regard all individuals more than two feet long as deadly, and to treat the others with great respect. In justice to the copperhead, it must be stated that its bite does not cause death in adult human beings unless complications develop. The pit-vipers, like the rattlesnakes, have a venom that is primarily haemotoxic.

(To be concluded)

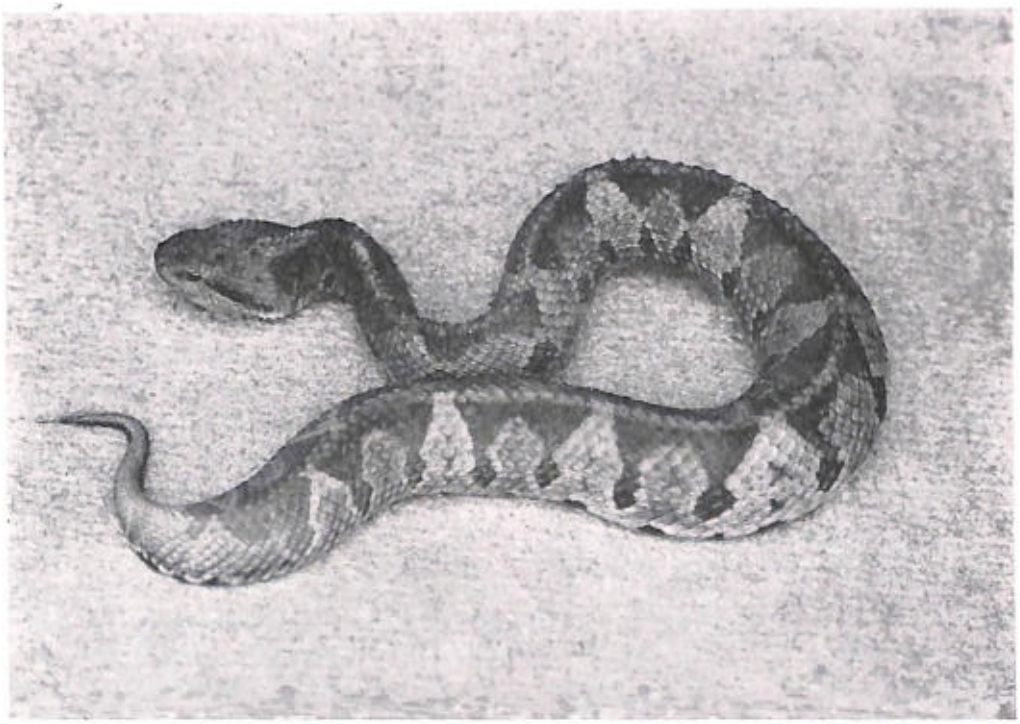


Fig. 38. Jumping Pit-viper, *Trimeresurus nummifer*. The strike of this bad-tempered snake is so vigorous that the whole body may be carried forward by it. The characteristic pattern and thick body help in identification. The species lives in Central America and tropical Mexico and its maximum length is 31½ inches.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

"PETE" IS THE DEAN NOW

The place of honor as the Bronx Zoo's oldest inhabitant is now held by "Pete," the Nile hippopotamus, born in Central Park Menagerie on July 13, 1903, and received here on July 14, 1906.

Pete acquired seniority on November 10, 1944, when "Old Jenny," an European pelican and up to then the oldest living specimen in the Zoo, succumbed to the excitement of being transferred to winter quarters after a summer of freedom on Cope Lake. Old Jenny was purchased from the firm of Louis Ruhe on April 20, 1904. Throughout her long life here she showed no signs of illness and evidently suffered, at the end, only from the inevitable encroachments of old age. Her established record with us of 40 years, 6 months and 21 days is exceeded, as far as we know, by only two others: 48 years, 9 months; and 41 years, 5 months, both in the famous old Zoo of Rotterdam.

Our hippopotamus seems likely to make an outstanding record, as the greatest longevity so far reported for the species is 41 years and Pete is well into his 42nd year with every indication of going on forever. As a matter of fact, all of the best records were made by females, so Pete has not only honored his sex but may go on to do something really good!—L. S. C.

NEW MEMBERS OF THE SOCIETY

New Members of the Society since the last issue of this magazine are:

Annual

Margaret T. Bohmert, Ph.D.
Pearl B. Boli
Florence A. Campbell
H. Huber Clark
Ferdinand Cochu
Rodney B. Cole
Charles Copeland
Mrs. Cheever Cowdin
Charles Crompton
George F. Fischer
Carl Edward Krummel
Raymond B. Haynes
Mrs. O. J. Lane
Benjamin Levi
Alan E. Leviton
Mrs. William F. MacDermott
Richard Dudley Miller
William Fellowes Morgan, Jr.
Maxim Smith
Dr. Charles B. Streck
John Swope
Sherman Thursby
Miss Nell Wardrop
M. J. Weisfeldt
Bernard Whitefield

A KANGAROO RECORD

On January 6, 1945, an aged Great Gray Kangaroo, coaxed by Keeper James Rimmer into living well beyond her normal time, lay down and breathed her last. We knew she was very old, since she was born here in 1927, but it was not until the records were searched that we realized a record may have been established. The oldest published record known for a Kangaroo of any species was established by a Red Kangaroo that lived in the National Zoological Park, Washington, D. C., for 16 years, 4 months and 3 days. Our Great Gray has certainly exceeded seventeen years, although by just how many months we shall never know, since no exact birth day is recorded.—L. S. C.

PUBLICATIONS OF INTEREST

BIRDS OF THE SOUTHWEST PACIFIC. By Ernst Mayr. The Macmillan Company, New York, 1945, pp. I-XIX—316. Three colored plates, 16 line cuts and map in end papers. Price $3.75.

Of all the questions that daily flood the staffs of the zoological institutions of this country, none can have caused more general embarrassment than the avalanche of requests for books about the animal life of the South Pacific, following the great increase of our armed forces in that area. Demands from Americans in Australia have actually given us pleasure, and we have been happy to recommend Cayley's excellent handbook, "What Bird Is That?" But soldiers, sailors and marines in the islands have just had to do without, for there has been no accessible publication that would help them.

"Birds of the Southwest Pacific" fills a gap that stretched from Tonga to Palau. It is a good book, done by the leading authority on the birds of the area. It will be a boon to many naturalists now in the South Pacific and to the hordes of bird-minded travellers who will swarm down on the islands once they have been cleared of the hateful invaders. Just how it will affect the service man is an open question. Dr. Mayr has reduced keys and descriptions to their simplest form but the plain fact remains that the speciation of birds is not a simple matter. It is there that the difficulty lies.—L. S. C.

ANIMAL KINGDOM

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Our New Department of Insects

Much has been written by philosophers as well as by naturalists about the similarity of some of the patterns of human society and those of bees, ants and termites. Many of these analogies may appear far-fetched – and yet, strangely enough, there *are* some startling likenesses in the social patterns of mankind and insects.

It is not because of these, however, that the Zoological Society is about to enter a new field of activity through the establishment of a Department of Insects. There are far more tangible reasons for doing so. Insects are much the most numerous of all living things on the face of this earth. While many kinds are harmful, others are not only beneficial but actually necessary to our existence. All in all, they affect man, for example, in health and in agriculture, more directly than any other forms of animal life. It is timely that we as a zoological society, having dealt with mammals, birds, reptiles and aquatic life, should now, as a part of our development plan for the future, establish a department for the exhibition and study of insects. Broad objectives are in mind for this new field of activity, including the eventual establishment of a major building in the zoo for the display of living collections of many varieties, native types as well as those from the sub-tropical and tropical regions of the earth. It is our aim that this department will become a center of study as well as of public information concerning this fascinating and important field of zoology.

Fairfield Osborn

IN THIS ISSUE

Nursery Class of 1944 Has Its Picture Taken . . . . . *Sam Dunton* COVER
News from the Nursery . . . . . *Lee S. Crandall* 27
Birds Among the Coconuts . . . . . *Major Richard T. Brice* 32
The Poisonous Snakes of the New World. Part 5 . . . . . *Clifford H. Pope* 44
It Died a Scarlet Ibis . . . . . *Hattie Ettinger* 48
The Humor and Myth of Linnaeus . . . . . *William Beebe* 51
Behind the Scenes: News and Notes 52

In the interests of accuracy, we must admit that Mrs. Fred Martini does not attempt to feed all three or even two of her charges at one time, as a general rule. One baby and one bottle are all she can handle.

ZOOLOGICAL GARDEN CALCUTTA

NEWS from the NURSERY

By LEE S. CRANDALL

Tiger and Lion cubs differ in temperament just as much as human babies do —and they keep their baby characteristics after they become adults, too.

BABIES in a Zoo aren't always planned, but when they are the plans are supposed to be made by the animal department. This time it was a little different. Animal men arranged the details, it is true, but the main idea stemmed from the Department of Publications, doubling as Publicity, which conceived the remarkable idea that if we only had a mixed family of both Tigers and Lions, it really could do something.

This idea was thought, at first, to be merely amusing, but very soon we began to realize that it should be taken more seriously. We had a pair of Tigers and a pair of Lions. What were we waiting for?

Well, we were waiting for a number of reasons. Prince, our male Tiger, had never been physically sound and was definitely waning. We were hoping that the coming of spring might improve his condition. Lions, within the last year, have been so plentiful that surplus young animals were not disposable, so that rearing them led only to unpleasant difficulties. On the other hand, our pair of Lions, Bruno and Lady, are superb individuals capable of producing outstanding young, but Bruno especially is approaching old age. It might be advisable to attempt rearing something from them before it was too late. Lady is an unusually nervous animal and we knew from bitter experience that she would not rear her cubs. Mrs. Fred Martini, the wife of the Lion House Keeper, who had been so successful with our three little Tigers last year, was our only hope. And if we were going to try two Lions, we might as well advance the Tigers a little and give the Department of Publications its chance.

In the first weeks of September, shift-doors were pulled and two pairs of happy animals were soon romping in the breeding cages. For some weeks all went well and then we noticed that the two females were becoming more deliberate in their play and were spending more time in the sleeping boxes. The males were coaxed back into their own quarters and the now expectant mothers were left to themselves.

The gestation period for both Lions and Tigers is about one hundred days, so that close approximation of the date of arrival of the cubs was possible, if not very probable. On Sunday, December 17, after just 103 days, hurried telephone calls from Head Keeper Schilling cut short the day of rest for the Veterinarian and the General Curator. Keeper Martini had detected infant squalls emanating from Jenny's inside box — Jenny being our Tigress. After waiting several hours in the hope that another small voice might be added to the one we could hear, we decided that the time for investigation had come.

Jenny would not leave the box for the fine piece of horse meat offered by her Keeper, but he finally tricked her by skillful manipulation of the amazing array of ropes that operates the numerous cage doors. This time we had planned no elaborate use of scented gloves, as we did when the three cubs were born last year. We meant to take whatever we found, for we knew that Jenny would lose her cubs if we left them with her but that Mrs. Martini would rear them if they were viable.

As soon as Jenny had been excluded, Fred entered the box and found little Ranee, cold,

hungry and squalling lustily. Dr. Goss pronounced her sound; so, carefully wrapping her in heated towels, we rushed her to Mrs. Martini's apartment. Here she was welcomed joyfully, weighed, measured and placed on a heating pad while her milk was warming. She was found to weigh 2 pounds and 12 ounces, an ounce more than her older sister Dacca at birth, and measured 20 inches from tip to tip, as did all three of the previous litter. As soon as Ranee was thoroughly warmed, she took 1¾ ounces of the standard mixture of one part evaporated milk and two parts water, from a rubber nipple. Set down on the floor, she actually stood up and even walked a step or two, using her hind legs with an ability the first lot did not acquire for weeks.

For the next day or two we listened hopefully at Jenny's cage, without reward. On the third day we again entered the nest, just to be sure. It was empty. Little Ranee was a singleton.

Leaving Mrs. Martini happily nursing her new charge, we began to concentrate on Lady. She obviously meant to oblige, and soon. It happened just as we were about to go to lunch, on December 22, after a period of 106 days. It seemed incredible that our little scheme should have come off to such perfection, but as we gathered at Lady's cage there was no denying that it was true. And more than one, this time.

We knew Lady's temper too well and promptly closed the building. After waiting as long as we dared, Fred began his campaign to coax Lady out. Far more nervous and reluctant than Jenny, she drew out the struggle for hours but it culminated successfully. Hastily, Fred entered the box and passed out three cold, wet and miserable cubs. Lady had never mothered them for an instant and one, a male, had somehow been so injured that he could not be saved. The two bedraggled little females were soon receiving the attentions of Mrs. Martini. She had been studying an atlas in a search for possible names for the cubs and was ready with two suggestions — Limpopo and Zambesi. Since it has become a tradition that Mrs. Martini is entitled to bestow names on the animals she rears for us, Limpopo and Zambesi it was — although somehow the cubs looked more like two out-sized, half-drowned kittens than like potential lionesses with such imposing names. Both cubs measured 21½ inches from tip to tip, but while Limpopo weighed 2 pounds 12 ounces, Zambesi made an even 3 pounds.

Miserable as they looked when we left them, morning brought a different story. We could hear them bawling even before Mrs. Martini opened the door of her apartment, and when we looked into their box, what a change! Their tawny coats bright and fluffy, their little bellies bulging with milk, they were crawling lustily over, under and around each other. It turned out that Mrs. Martini, despairing of gentler measures, had doused the cubs thoroughly in hot suds, rinsed them carefully and had put them in the oven to dry! It worked perfectly, but probably should not be noted as approved technique.

It was a joyful sight, but now came the time for final fruition of our plan. Carefully lifting little Ranee from her box, Mrs. Martini put her down between the Lions. Nothing would happen, of course — no reactions could be expected from these tiny, sightless creatures. But if eyes were not functioning, noses were, and Ranee began at once to sneeze and cough. At least, that is what we thought she was doing until we realized that she was really spitting in baby Tiger fury! And when one of the Lion cubs pushed clumsily against her, Ranee made a fumbling effort to strike with spreading claws. Limpopo and Zambesi were indifferent to the stranger and swarmed over her with as much enthusiasm as they showed for each other. It was a small matter, yet fully indicative of distinctions that became more definite as the cubs grew older.

Within an hour Ranee had become accustomed to her foster sisters and all three were curled up together, calmly sleeping. This acceptance quickly developed into strong attachment, at least on the part of Ranee, and she still cries pitifully if separated from them.

Both Lions opened one eye on the fifth day and the other on the next. Ranee opened one eye on the fifteenth day and both were fully open the one following. All grew rapidly and seemed to be more vigorous than average cubs. At two months weights were as follows: Ranee, 11 pounds 12 ounces; Limpopo, 11 pounds 4 ounces; Zambesi, 11 pounds 4 ounces.

Close observation of these cubs, from the day of their birth to the present age of two months

The laundry problem is a big one when there are three babies in the house. This is one week's supply.

A cooking utensil makes a practical receptacle for the cubs at weighing time—they can't scratch it.

Lion cubs are more active than Tigers, and delight in climbing, especially for a reward of milk.

Hand-reared and friendly though they are, our three young Tigers are creatures of the jungle and revert to jungle ways at any moment. This great, stalking cat is little Rajpur on the prowl in the big outdoor cage of the Lion House. At the time the photograph was made by H. Huber Clark, a Member of the Zoological Society, Rajpur weighed about 100 pounds. and was only about 7 months old.

(at the time of writing), has been illuminating. When we noted the temperamental differences between Rajpur, Raniganj and Dacca, and reported them in ANIMAL KINGDOM in the July-August issue of last year, we seemed just a little premature. Actually, however, these three older cubs are still entirely in character and have developed exactly as we rather dubiously suggested they might.

Now we can say, with more confidence, that little Ranee is a fourth Tiger personality, quite distinct from any of the others. Mrs. Martini still likes to call Dacca "sweet," but I prefer to call her mischievous. I yield, though, for Ranee – I admit that she is definitely sweet. She is also gentle, affectionate and shy, though not timid. She is strongly attached to the Lion cubs but she is rather like a small girl, tagging after two large and rather tough sisters. When she catches up with them she is soundly smacked for her trouble. But at the first opportunity she is off on a quest for more punishment.

Personality curves are as flat in Lion cubs as they are steep in Tigers. Rough, tough and active, young Lions fear nothing and as soon as their bleary baby eyes function sufficiently, will promptly bite the proffered hand of friendship. Their soft tawny coats and faint dark spots seem

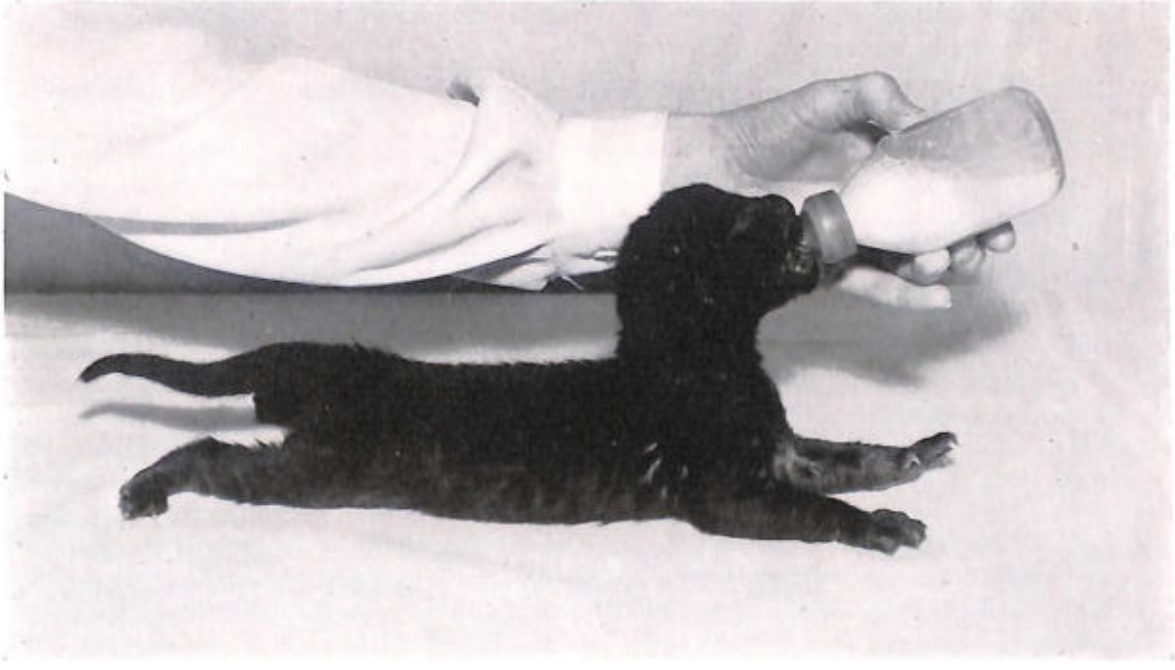
exactly alike and if one did not have a pinch more black on its tail-tip than the other, I am sure I could not distinguish them physically. And except that one is a trifle more savage than the other, I can detect no temperamental difference. What is more, I think any normal Lion cub would check with them, age for age.

Mrs. Martini insists that these small fiends are "sweet," although I notice she is always at hand for frequent rescues of the persistent Ranee. So now the Publication Department has what it wanted – though just how long we can keep the family tractable for photographers and reporters remains to be seen!

And a Black Leopard, Too

Two Lion cubs and a Tiger in the home would seem to be enough for most housewives. It must be that Mrs. Martini is a little different, for when the point of disposition of the young Black Leopards came up—provided there were any—she protested, almost tearfully, that she wanted them. We wanted her to have them, too, because of a rather curious point. Our Black Leopards are wonderful parents and share in rearing their young as much as such animals can. We may be sure their cubs will grow up—but then comes the hitch: at somewhere approaching a year, the father has had enough of them and for their own safety they must be removed. But then it turns out that they are so wild and shy that they cannot endure the separation from their parents. We felt that the only solution lay in bottle-rearing, so Mrs. Martini got her wish.

Ninety days is the period for Black Leopards and ninety days it was. That made it February 23 and on that day the sharp squalls of an infant Leopard were heard, emanating from the darkened sleeping box. After a brief but hectic struggle, we were able to enter and remove little Bagheera. His vital statistics were: sex, male; length, 14 inches; weight, 20 ounces. So far, foster-mother and child are thriving. And some day we may have that great rarity—a tame Black Leopard.



As if her apartment were not already crowded, with a Tiger and two Lion cubs, Mrs. Martini cheerfully took upon herself the duties of foster-mother to a baby Black Leopard. Its routine is like that of the other cubs at an early age—feedings every 3 hours around the clock.

BIRDS Among the Coconuts

By MAJOR RICHARD T. BRICE
with a gloss by LEE S. CRANDALL,
General Curator of the New York Zoological Park

This war has brought the amateur naturalists into their own. It has flung them down in a hundred odd corners of the world, with the result that many are in a position to make real contributions to our knowledge of the fauna of comparatively untouched areas.

An example is the author of this article. Major Brice, of Georgia, "didn't know one bird from another" when he was assigned to the Solomons. His hobby of bird-watching developed rapidly and his notes, uncertain as they are in some instances, help round out our picture of the bird life of those distant islands. General Curator Crandall has kindly consented to annotate Major Brice's account for the added interest of our Members and readers.— *Editor.*

BIRD WATCHING is a nice, convenient hobby because one can pursue it wherever one goes. However, it would have been better—yes, much better—had I taken it up in a civilized land first where I would have had the work of the masters to guide me. Trying to find the correct name of a bird that few people have seen and fewer have identified is no job for a beginner. When I started, however, I didn't know what I was getting into, and now I am too engrossed to stop. For many months I have been spending my spare time here on the Russell Islands trying to learn something of the birds and I have probably acquired as much knowledge of them as a trained observer would have gotten in a week, but I have had more fun at it.

Fortunately, there are others in this area engaged in the same pursuit, most of whom, unlike myself, have some previous experience, and by comparing notes and leaning on their better knowledge I have been able to obtain some confirmation (or usually corrections) for my identifications. First, there is Staff Sergeant George Greeley, who initiated me into the technique of bird observation. He is particularly interested in studying the shore birds, but has spent many Sunday afternoons with me hunting birds in the groves and the jungle. Along with Sergeant Greeley, there is First Sergeant John Griffin, an artist, who has drawn many of the birds for us. Our customary party for a bird trip is composed of "We" (Greeley, Griffin and myself), and sometimes a few hangers on. Pfc. William Beecher, a trained ornithologist working with one of our health units on Guadalcanal, has been my court of last resort on identifications. He has collected a great many specimens and has gone into identification from a true scientific angle. Unfortunately, since he is on another island, my visits with him have been few and far between, else I should not have stumbled around so much.

In the same organization with Beecher is Lt. J. E. Chattin, from whom I obtained the key to the avifauna of the Solomons that I have been using for the past month to check my previous ideas. Col. C. V. Widdy, many years a resident of the Solomons, very kindly devoted several hours to telling me about his interest—the introduction of insectivorous birds to combat pests in the coconut trees. Col. Widdy and Major F. R. Hewitt introduced a number of insect eaters into the area, but as far as the Colonel knows our only introduced bird on the Russells is the Indian Mynah. My own interest is entirely selfish: I watch the birds purely because it is a refreshing, objective hobby far removed from my business of getting on with the war. I make no claims to scientific study or the background required of the intelligent collector.

Drawing by Sergt. John Griffin

MYNAHS WERE NUMEROUS IN THE COCONUT GROVES, HUNTING INSECT PESTS.

The Russell Islands are located in 9° South Latitude, 159° East Longitude, which is about 20 miles west and a little north of Cape Esperance on Guadalcanal. Our islands cover an area roughly circular in shape and about twenty miles across. They are composed of two main islands, Banika and Pavuvu, surrounded by some thirty-odd smaller coral islands and a large number of tiny islets and reefs. The two large islands are both tops of almost submerged mountains which rise a thousand feet, more or less, out of the sea. On each of them the central mountain core of volcanic rock is surrounded by a fringing reef and a flat coral plain from fifty yards to a mile or more in width. It is on this plain that most of the large coconut plantations are located, although a few of the smaller islands have been cleared and planted. The interiors of Banika and Pavuvu and all the uncultivated islands are covered with the dense rain forests or jungle typical of the wet tropics. The weather here is ideal for this lush growth, the temperature seldom rising about 90 degrees or dropping below 75, and the rainfall averaging about 150 inches a year. Two-thirds of the rain falls from December to April, but even during the dry season three days without rain is unusual. Although we are below the Equator and our seasons should be reversed from those at home, the rains make our "summer" seem cooler than our "winter." For this reason there are more flowers from June to November, and most of the birds we have observed nesting do so during this season. Counting the ocean, we have four distinct types of terrain—sea, shore, coconut groves and jungle, each with its distinctive bird life, but this article deals only with the birds I have seen in and around the groves.

I found myself surrounded on all sides by the Indian Mynah (*Acridotheres tristis*). I had seen them before in New Caledonia, but I had learned them by their French name—Merle des Moloques—which they get from their habit of sitting on the backs of cows and horses, allegedly waiting for a nice fat horsefly. It was several months before I found out their English name, and then I was not too sure because I read an article referring to a "true Mynah bird," which set me to wondering whether ours is a "true" Mynah or some ubiquitous imposter. I still don't know what a "true" Mynah is, but anyway our Indian Mynahs are dark brown birds with yellow bills and feet and yellow elongated eyepatches that turn slightly down at the back, giving them a very cross look, like Mrs. Astor's horse. The Indian Mynahs were introduced here to eat bugs from the tops of the coconut trees, where they spend most of their time when not on the ground, and it is forbidden to shoot one. The birds are quite versatile in their feeding habits, because in addition to finding them pecking on the ground and foraging in the palms, I have seen groups of three or four methodically gleaning small bushes and mangrove stands. They are said to be a nuisance in Australia, which may account for the rigid prohibition against bringing them into the United States.

"Merle des Moluques" is one of the names applied to the Common Mynah, but it has nothing to do with the habits of the bird. The "Indian," or Common Mynah, is a "true" Mynah. Perhaps the article referred to the better-known Hill or "talking" Mynah as the "true Mynah."

The prohibition came a little late, for Common Mynahs were introduced on the West Coast of the U.S. before the regulation went into effect. As yet they have not spread far.

Although they are very numerous in the coconut groves, where they travel in flocks of ten to fifty, I have never found an Indian Mynah in the jungle. This gave rise to much conjecture as to where they roost and nest, particularly after I had examined the tops of dozens of freshly felled palms without finding a single bird's nest in one. In August I watched Mynahs carrying little bits of straw up into the coconuts, but even in September when a pair fussed about my doorstep for two weeks, flying off with bits of fluff, the nest continued to elude me. Occasionally I stopped writing long enough to rush out and stare after them, but to no avail. It wouldn't have been quite so much of a mystery if there weren't such a tremendous number of the birds, but there are literally thousands here and I couldn't find a nest. Now I know that I was looking for nests before their nesting season began. In the second week in October a friend arranged to have a native climb one of the trees where we had seen much activity, with the result that a nest with one egg was found. Unfortunately our knowledge of Pidgin is limited, so we could not obtain a coherent description of either the nest or the egg, but perhaps if we are patient this too shall be added unto us.

They may have changed their habits; in their regular range they nest from March to April, in holes in trees or cliffs, or even in open trees. Open-tree nests are big rough-domed affairs and the birds lay 3-6 blue eggs.

We have a Yellow-black Mynah (*Mino dumontii*), which is a jungle bird, and is as meticulous about not entering the palm groves as his cousin is about not leaving them. Just as the Indian Mynah was almost the first bird we learned in the groves, so this Mynah was among the first that we came to recognize in the jungle. We knew him initially by one of his calls and later by his brilliant orange bill, eyepatch, and legs. Eventually, we identified other of his calls, but if he is as multilingual as some of his relatives he may still be the source of any number of the more tantalizing jungle cries to which we can as yet ascribe no owner. The specimen which we collected had been eating some kind of yellow seeds but we don't know whether he was entirely herbivorous or not. One of the Doctors of the Army Hospital found a pair of these birds nesting in a hole about four feet up on a stump near the shore. Two fledglings with very little down to cover them hatched in April.

This is *Mino dumontii kreffti*, usually called Dumont's Mynah, a common jungle bird from the Solomons to New Guinea. "Frugivorous" is a better term than "herbivorous," for the bird is chiefly a fruit-eater. The yellow seeds were the remains of some fruit the bird had eaten. I brought 2 Dumont's Mynahs back from New Guinea in 1928. One was a good talker and used to startle visitors by calling "All out!" long before closing time in the Bird House.

After the Indian Mynahs, the Parrots are the next most numerous birds to be seen among the palms. Their gorgeous coloring and raucous voices

make them the most conspicuous birds we have and, being thus in the limelight, they are blamed for much more of the noise than they actually make. Although there is a profusion of big Parrots and little Parrots and Cockatoos and Parrakeets in the jungle, only two types are common in the groves. The one most frequently seen is an all scarlet fellow (*Eos cardinalus*) about the size and shape of a jay bird. It is called locally a Parrakeet, I think erroneously. The other one is a somewhat smaller bird (*Trichoglossus haemotodus*), mixed bright red and foliage green in color, with a noticeably shorter tail. Both types are gregarious as far as their own kind is concerned and are frequently seen in groups of four to fifty individuals. It is a matter of some regret to me that these striking birds are not better provided with common names—one hates to go around spouting poor Latin at so much beauty.

Eos cardinalis is properly a Lory, not a Parrakeet. *Trichoglossus haematodus* is a Lorikeet, but there are many forms and I don't know which form or forms are found in the Russells.

"Lory" and "Lorikeet" are the usual common names.

We occasionally see a White Cockatoo (*Cacatura ducorpsii*) or hear one squawking as he flies overhead, but they seldom light in the groves and more properly belong to the jungle where they are very common. They are as large as Crows and have the loudest and most raucous voices of all our Parrots. If these "Jay Birds" of the jungle discover you in an area where they resent your presence—which is almost any clearing—they may fly round and round over your head screeching at the top of their lungs and raising such a clatter that your intrusion is forthwith known. The Cockatoos I have seen are all white with milky blue eyes. I have read that the Sulphur-crested Cockatoo (*Cacatura galerita*, Lath.) is here and many travel books on this area expound upon the "cockatoos with yellow topknots," but it appears that this bird is more common in New Guinea than in the Solomons.

Ducorps's Cockatoo (*Cacatua ducorpsii*) is a better name than "White Cockatoo," for there are many white cockatoos in the southwest Pacific.

Don't believe all you read in travel books. The Sulphur-crested Cockatoo (*Cacatua galerita*) is not found in the Solomons. One form is in Australia, another in New Guinea.

To one who is accustomed to thinking of Parrots as more or less sedentary caged birds, it is a surprise to find that they are fast, strong flyers. They travel in straight flights with a continuous easy motion of the wings, never gliding like the Indian Mynahs or skimming like the Swallows. They are frequently seen traveling between islands which are a mile or more apart and at dusk small groups of three or four Parrots may be seen flying parallel to the shore at an elevation of a hundred feet or more in steady purposeful journey as though in a hurry to get home. This makes me think that they may wander far from their roosts during the day and that they probably return to the same area to roost each night. Both the Parrots and the Cockatoos are much prized by the soldiers as pets, and nearly every unit has at least one. They tame easily and there is much discussion about teaching them to talk. Col. Widdy says that all of them can be taught, but I have never heard one say any intelligible word.

It is a common Parrot habit to range widely for feeding—out at daybreak, back at dusk, generally flying in pairs in flocks that may number hundreds. Cockatoos are not very good talkers, but a soldier with plenty of time and patience might teach one a few words.

My next discovery was a bird about eighteen inches long which we called a White-headed Osprey. He is a stately, silent bird of prey, chestnut brown on the back and under parts, with pure white head, nape, neck and breast, and five primary feathers extending like fingers out beyond the tip of each wing. His identification gave us considerable trouble: Beecher called him a Brahminy Kite (*Haliastur indus*) from the beginning and someone else here called him a Sea Eagle, while locally he is simply referred to as a "fish hawk." We found a bird we thought was him described in "Birds of Tasmania" by Frank Mervyn Littler and identified as a White-headed Osprey (*Pandion haliaetus*) and then we were sure we had caught Beecher in a mistake, but just recently we have received a copy of a key to the birds of the Solomons, based on Dr. Ernst Mayr's work here before the war, and his description of

The bird, as described, is certainly a form of the Brahminy Kite. All the rest of the common names sound like "book" names to me.

Haliastur indus fits our bird better. Thus are we humbled before the learned. However, the key gives Mr. Haliastur a common name of Chestnut White Kite and Dr. Thomson in his "Birds of the Cape York Peninsula" calls this same bird a Red-backed Sea-eagle. I presume one has a right to give a local bird whatever name one pleases, so that a Fish Hawk here might be called a Kite somewhere else, but *Haliastur indus* is one and the same the world over, which illustrates the advantage of using the Latin names to compare notes, even if the common names do appeal much more to one's sense of the aesthetic.

Greeley once saw a Kite feeding on a Red Parrot, and I saw one flying with a rat in its talons. I have watched them searching for food over a clump of bushes, sailing round and round and back and forth with heads pointed down at right angles to the body. Even if they didn't turn out to be Ospreys, they do catch fish, as I frequently see them circling offshore, singly or in pairs, and once I saw one dive into the sea from a height of perhaps seventy-five feet, hitting the water with a splash that should have stunned him. I doubt that the Kite succeeds in capturing many of the other birds, for his flight, though graceful, is slow, and the smaller, faster birds with greater dexterity on the wing should have little trouble in eluding him. I have not been able to detect that the smaller birds hide when the Kite is about, and just yesterday I saw two Indian Mynahs flying after a Kite within six inches of his tail. When the noise of my jeep frightened them, they all three lit in the top of the same palm. On the edge of the jungle I have observed two magnificent Kites and three Cockatoos sitting peacefully on the same dead tree.

Kites will eat pretty nearly anything and are common scavengers in some areas. This is the first time I ever heard of a Kite diving for fish, though; I question the Major's identification in this case. If Kites catch other birds, it is probably a lucky accident.

Our largest and most magnificent bird of prey is a huge, all-brown Sea Eagle (*Haliaetus sanfordi*) with a wing spread of up to seven feet. He is reported to have attacked a small dog and to have been seen carrying off a kid from a flock of goats. Once when walking along the shore of a small island we saw two Kites and a Fish Hawk unite in an attack on one of these large birds, but with little or no results. For presuming to challenge the monarch, one of the Kites had four of the primary feathers pulled out of his left wing. It is said that a plantation manager once captured one of these Eagles and kept it in captivity and that all it would eat was fish, though how this ties in with the dog and kid stories isn't quite clear. Another story relates that one of the managers found the nest of a Sea Eagle in a tree. It appeared that the Eagle preferred his fish "high," because on coming back to his nest he would drop his fresh catch under the tree to ripen and occasionally pick up one of his older catches to eat. The manager was able to get considerable fresh fish of appreciable size by picking up a catch just as it was brought in.

It would have to be a mighty small kid if this Eagle carried it away. This seems to be part of the familiar legend of Eagles carrying off both goat and human "kids." Sea Eagles mostly eat fish or carrion, but on occasion will attack warm-blooded prey.

Of the two other birds of prey I have seen here, one is a beautifully trim Goshawk (*Accipiter albogularis*) with all white under parts and white "pantaloons" down to his knees. His head, nape, and back are usually solid blue-gray, but occasionally one is found black or dark brown in color. The first Goshawk I saw was sitting on top of our shower house one morning when I awoke and I thought he might be a nocturnal prowler, but the only other one I have seen was on the ground eating a lizard about noon of a bright day. When I disturbed him he flew up into a palm tree with his meal. Lastly, we have the Fish Hawk (*Pandion leucocephalus melvillensis*), a slightly smaller bird than the Brahminy Kite, with narrower pointed wings.

It is hard to say, without having the bird in hand, whether this is actually *albogularis*. Three very similar species of Goshawks are found there.

I don't know where Major Brice got this scientific name. The

Drawing by Sergt. John Griffin

COCKATOOS AND BRAHMINY KITES WERE FAMILIAR FEATURES OF THE LANDSCAPE.

He has light underparts that look a little bluish and I think he is either gray or blue on top but I have never seen one except from below.

One of our most interesting birds of the palm groves is a Kingfisher. I thought he was the Sacred Kingfisher (*Halcyon sanctus*), which is common in New Caledonia, but Beecher thinks that ours is different and that his name is *Halcyon chloris*, listed by Dr. Thomson as a "Mangrove Kingfisher." He is the only bird that habitually sits on the telephone wires, a ten minutes' drive along any road being sufficient to find at least one and more likely a pair. He is smaller than our common American Belted Kingfisher, and more closely resembles the Ringed Kingfisher of the southwestern states, except that he has a greenish-blue head and back (sometimes almost purple) and a rich buff collar and underparts. His typical Kingfisher's bill is unmistakable to the ornithologist, but to demonstrate my ignorance in such matters, I called him a Woodpecker when I first saw him (I understand we do not have any Woodpeckers here). Nevertheless, he seems to have given up fishing because he never frequents the shore or small streams. Instead he dotes on the little striped lizards which we have in profusion. It is said that he will catch one by the tail and carry it up to a telephone wire or a palm frond, where he hits it against anything handy to break off the tail, but I have never observed

bird is an Osprey and a form of *Pandion haliaetus*. It is more brown than either gray or blue on the back.

My money is on Major Brice's identification instead of Beecher's, if the bird is really buff underneath. That sounds like the Sacred Kingfisher. On the other hand, the Sacred is just a winter visitor from Australia, and the nesting bird is probably the Mangrove Kingfisher.

this. It is true that many of our lizards have stumps or are in the process of growing new tails, but this is not entirely due to the Kingfishers, for the lizards fight among themselves and I have watched a gecko break off and devour the tail of a skink. I think these Kingfishers nest in June here (the beginning of the dry season), because I saw several picking up bits of nesting material then. It was in June that I saw one Kingfisher feeding another, which might have been connected with mating or might have been a parent feeding an almost grown fledgling, but which in any event probably indicates nesting. This bird is an early riser, and stays up long after dark, its call having been heard at four o'clock in the morning and another time at ten o'clock at night.

Our other common Kingfisher, (*Halcyon saurophaga*) is snow white on the head and under parts with sky-blue back, tail and wings. In addition to being more colorful, he is nearly twice the size of his mangrove cousin, or about as big as the Belted Kingfisher in the States. I do not know his common name, but we call him the Shore Kingfisher. He is a true Kingfisher in habits as well as name, because he is only seen along the shore, usually in pairs, sitting patiently as all fishermen must. Although he fishes he is not above a choice lizard, for we found the remains of two skinks in the stomach of the one Greeley collected for a specimen. The calls of our two common Kingfishers are the same—a single slightly harsh note repeated several times —"treek, treek, treek"—except that the Shore Kingfisher's note is pitched a little higher than that of the Mangrove species. Also the Shore bird is less belligerent than the other, which seems continually to be warning some intruder away from his domain.

Good work! Reference books call it the "Beach Kingfisher."

In addition to the two Kingfishers already mentioned, we have another one which Beecher calls a "River Kingfisher." I have only seen him once and it may be that our lack of many fresh water streams on the Russells accounts for his comparative rarity here. The one I saw darted out of a mangrove thicket near a shallow beach where I was wading and flew perhaps a hundred feet along the sand before disappearing again into the bushes. I can only describe him as an enchanting flash of unbelievable blue seeming no larger than an English Sparrow.

There *is* a River Kingfisher, and it is blue above. But it is larger than an English Sparrow.

About the time that I began to feel reasonably familiar with most of the birds in the palm groves, I discovered a flock of glossy black birds about the size of the common Blackbirds at home. It was in May, and I thought I had discovered migratory visitors from Australia or New Zealand come up to "winter" with us, but after finding them in profusion in the jungle, I decided that my suspicions of migration are unfounded—they probably only "migrate" to and from the groves. The one Greeley collected had a greenish metallic sheen to the feathers on the nape of the neck and reddish-orange eyes. For months we knew this bird only as "the black bird with the orange eyes" and though we now know him to be the Social Starling (*Aplonis metallica*), he is still our "mystery bird" with two apparently distinct sets of habits. He is not a daily visitor to the groves and weeks may go by without my ever seeing one near my hut, but when they do come there will be from ten to twenty-five in a flock, all busily engaged in searching for insects, sometimes settling along the rib of a palm frond, all in a row close together and facing the same direction. In their gleaning outside the jungle they work in a group, descending upon the same tree or bush, twittering and chirping as they go, but in

I remember being confused in New Guinea myself, by 2 species of Starlings, and can sympathize with Major Brice. Five species of *Aplonis* are in the Solomons, as well as several subspecies. I never heard the name "Social Starling;" the Solomon Starlings are all called Glossy Starlings, of one kind or another.

addition to liking insects they are very fond of pecking the seeds from Elephant Ears.

In the jungle they seem to have quite a different character, spreading out over more territory and frequently traveling singly or in pairs with the other members of what might be a group dispersed in nearby trees. To add to the confusion, they have at least two distinct calls which they make very frequently in the jungle but which we seldom hear in the groves, and neither of which have we ever heard in the vicinity of their nesting trees.

The first bird nest I ever saw in the deep jungle belonged to a pair of these Starlings. It was a very neat conical affair, about four inches across at the top and tapering down to a sharp point. They had built it about twenty feet from the ground in the fork of a Philodendron vine where a branching tendril gave added support and two of the large leaves above provided some protection from the rain. We discovered the nest in July and the owners were working on it then, but although there were many other Starlings about and we watched carefully, we could find no other nests. Early in October we discovered a group of what we thought were new birds nesting in colonies in old dead trees. The nests were hanging, shapeless, masses of material, so closely resembling the air roots of the orchids and epiphytic ferns common on the jungle trees that we had to watch for some time to be sure they were nests. There was no resemblance between these nests and the nest structure we had previously observed, and nowhere near the dead trees did we hear the familiar calls—only chirpings and twitterings—but the specimen we collected was our old friend "the black bird with the orange eyes." Now we are again impaled upon the horns of a dilemma. Are we watching two birds so closely resembling each other that we can't distinguish them, or are we studying a dual and complicated personality in one species? Either theory would explain away our doubts, but only further observation will satisfy our curiosity.[1]

This could be any one of 3 species of Glossy Starling, but not the one the Major calls *metallica*; it is a colonial nester.

Here we have *metallica*; the colonial nester.

The dilemma can be resolved simply enough —they were watching 5 species of Glossy Starlings, all a good deal alike in appearance, but widely differing in nesting habits. I can't make anything of the footnote; maybe Beecher was kidding.

When they are about their nesting tree, the Starlings do considerable fluttering and milling around, never seeming to fly direct to their own nests. When they leave their nesting trees they fly fast and straight for perhaps a hundred yards and then stop to survey the landscape before proceeding. Likewise, when they return they alight in the same location and take a short look around before flying the home stretch. They appear to have certain approved places to stop for their reconnaissance, because we watched a continual stream of them lighting and taking off in a small tree, the top twigs of which had apparently been worn quite bare by the traffic. They always landed in the same tree, and never in the adjacent ones. That October is the nesting season we gathered from the number of birds flying in with small vines perhaps a foot long streaming out behind them.

Our nearest approach to the Hummingbirds on the Russells is the little Yellow-breasted Sunbird (*Cinnyris jugularis*). These tiny creatures, less than three inches long, are dull yellow on the back and brilliant yellow underneath, with a blue-black patch setting off the neck and throat of the males. They sup on nectar from the flowers and probably eat a few small insects. They seem as widely distributed as the Parrots, being equally at home in a planter's flower garden, the top of a palm tree, a mangrove swamp

ZOOLOGICAL GARDEN CALCUTTA.

[1] Since writing the above I have received a note from Beecher saying "You have just described a new species of red-eyed starling without the long tail feathers of *Aplonis metallica*. I call it *Aplonis brevicauda*." Maybe this is the answer.

or the densest part of the jungle. They fly rapidly with fast wings, but they do not "hum" or hover, and I doubt that they can fly backward like our hummingbirds at home. They seem quite unafraid of human beings, and will dart around among the flowers almost within reach.

Take another look, Major! Sunbirds can, and do, hover. But they can't fly backward. On the other hand, they can walk and jump, and Hummers can't.

These birds nest early in the "fall" for it was during the second week in April, before the rainy season had gone, that Greeley found a young Sunbird among the coconut-log seats of one of our fresh air theaters. The little fellow was apparently unable to fly so Greeley picked it up and took it into a nearby hospital tent where it astounded everyone by flying the length of the tent and perching on the frame.

It is supposed to be a mark of proficiency for an amateur to tell the Swifts from the Swallows, and certainly I am not proficient enough for this. I can only tell ours apart because they are different colors and have distinguishing habits. Our most common Swifts, which I call the "Blue Swifts" and are identified by Beecher as *Callocalia esculenta,* have dark glossy blue backs and light almost white throats and chests. They are most common in the interior of the groves and in the jungles where they occur in flocks of six to twelve, skimming about in search of insects which they must catch on the wing because they never seem to light. While resting on the bank of Tenaru River at the 'Canal, I watched one scoop a drink of water without so much as pausing in his flight (thus does nature soon forget the noise and turmoil of man's wars and battles). In the jungle I have watched groups of these birds encircling those trees which have the densest foliage and are most heavily encompassed in a mantle of vines, but just what was attracting them there I could not determine. That they must feed on only the smallest insects we learned from the infinitesimal throat of our specimen. It is possible that the small throat makes them harmless to larger insects, because several times we have seen these Swifts being chased by large moths or butterflies.

This is a Swiftlet, a kind of pigmy Swift, instead of a true Swift. *Esculenta* is one of several species that produce the edible nests of which the Chinese are supposed to be so fond.

The Blue Swifts nest in dusky caves or deep crevasses in the coral cliffs. During the third week in October I entered one of their nesting caves and found about a dozen small nests attached to the rock ceiling. There were undoubtedly more nests, for I estimated that at least fifty birds were flying in and out, but the cave narrowed to a slit farther back and I couldn't get all the way in. When the Swifts came out of their cave they flew rapidly away into the jungle, hardly pausing near the entrance to their home. Neither the entrance nor the floor of the cave were befouled with droppings, although there were some broken egg shells lying about.

Each nest was constructed separately and cemented to the rock by a clear hard substance which I presume to be saliva. The nest itself was made of fine grass moss and vine tendrils woven and cemented together in the form of a hollow hemisphere open on the side. The inside of the nest was barely larger than a golf ball and the two little white elongated eggs I found in one nest were lying near the open edge with hardly anything to keep them from rolling out. All the nests were very clean and free from droppings, but the birds probably harbor parasites, because I found a blond bedbug crawling around in one of the nests.

Here was a chance for Major Brice to sample that great "delicacy," birds' nest soup. But I wouldn't have cared to try it, either.

The other Swift we recognize here is an interesting bird nearly eleven inches long, mostly blue and white with a blue-black crown. I first described him as a huge swallow with long narrow crescent-shaped wings. Later Greeley

Drawing by Sergt. John Griffin

LIZARD-EATING KINGFISHERS WERE ALWAYS SITTING ON TELEPHONE WIRES.

observed several of them flying about in the deep twilight catching bugs around electric lights and we thought maybe they were Nighthawks. Only after we collected one and sent the description to Beecher did we get the answer: the Whiskered Tree Swift (*Hemiprocne mystacea*). The name is very fitting and proper because the bird has a most entrancing white moustache which must have come straight from a gay 'nineties saloon. Unfortunately the hirsute adornment is quite invisible when the bird is flying; his most obvious characteristic in the air, besides his wings, being a deep forked tail. Just to keep us guessing, the tail folds up into a single thin line and loses its forked appearance when the bird is at rest. Until we learned the secret of how it folds, we were much puzzled to know why our specimen didn't resemble the bird we saw flying, and we thought at first it was a different bird.

The only Swallows I recognize are *Hirundo tahitica*, which are well known throughout the Pacific area, though I don't know their common name. They are a usual sight along the shore and in the groves not too far inland and think nothing of flying out over the water to play about a ship half a mile or so from land. They seem a little bigger than the Blue Swifts, being about four inches long, and have a blue-brown back, an inconspicuous chestnut patch under the throat, a grayish chest, and an abdomen marked with a single

"Pacific Swallow" is the common name.

dark streak down the middle. Unlike the Blue Swifts, the Swallow frequently stops for rest and likes to sit on mangrove roots or on old stumps out in the water. He isn't as gregarious, either, and seems content in company with three or four of his own kind. In June a pair of these Swallows built a home and raised a family under the eaves of the Provost Marshal's office, seeming not to mind the soldiers being always about, although they would not approach their nest if anyone was within six feet of it. At such times they would light on a nearby wire and fidget till the intruder moved farther away. The nest, which rested on a beam, was about five inches across and open at the top, as a nest should be. The outside structure was all mud and the inside, which was big enough to almost completely conceal the setting bird, was lined with bits of soft downy material. This same nest was occupied again in October when I watched the mother carrying out pieces of brown mottled egg shells and feeding her babies.

As far as I know, the only game bird we have is the Black Duck (*Anas superciliosa*, Gmelin). This is a beautiful bird resembling our wild ducks in the United States so closely that it seems an incongruity among the palm trees. Somehow I have not been able to reconcile ducks and the tropics, and though I have seen them flying and have examined the specimen we collected, I still think there must be some mistake. We first heard reports of the ducks from the natives, but I, being a born skeptic, decided the natives didn't know a duck when they saw one. After that we got reports from other sources and when I saw three ducks swimming in a pool on a neighboring island I had to give in and admit that we have real live ducks.

A better name is the Gray Duck; a subspecies of *superciliosa* is in the islands. There are many Ducks in the tropics.

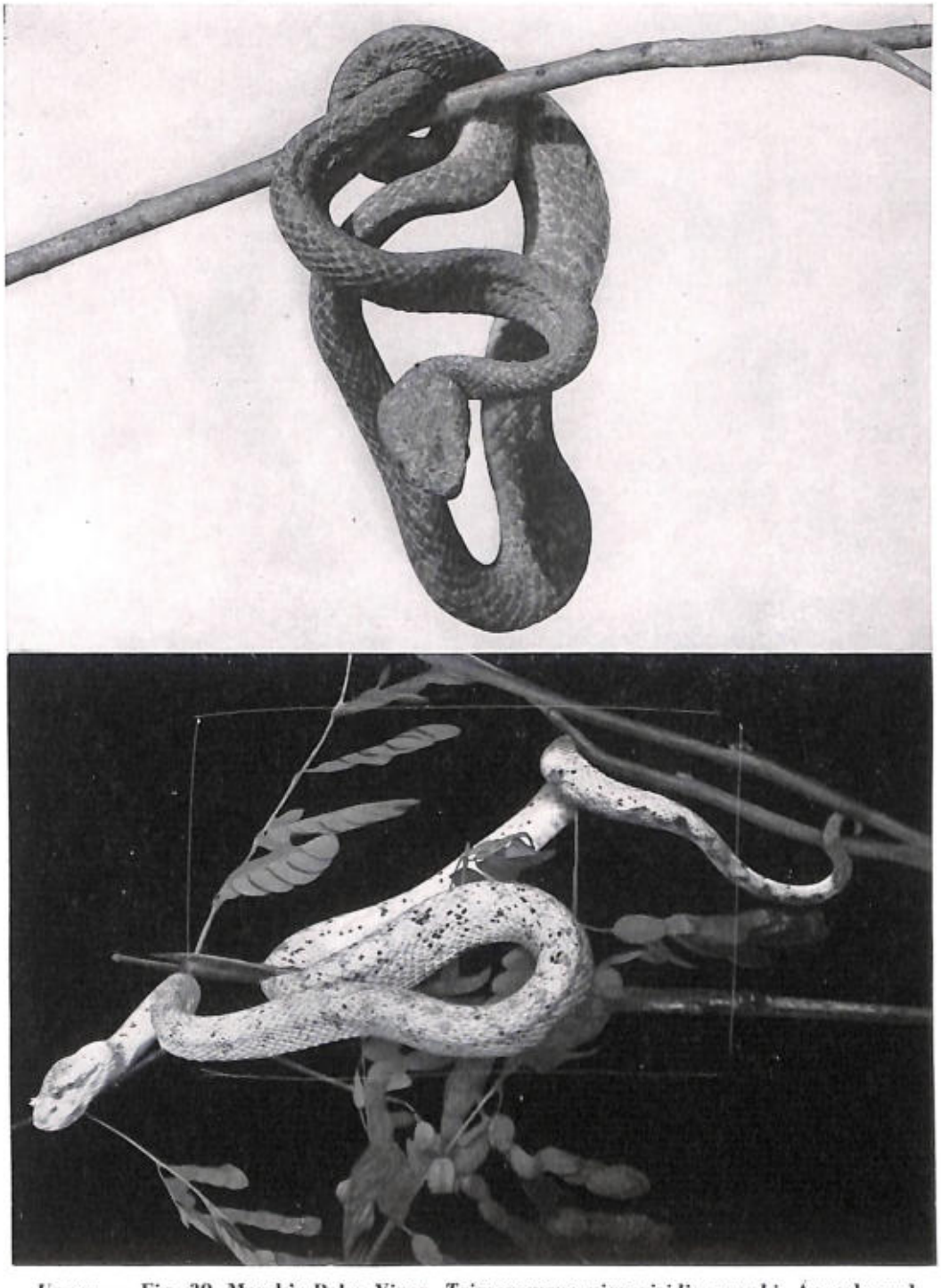
I have almost forgotten to mention our Gallinules (*Porphyrio melanotus*). Soon after I arrived on the Island I heard stories of a "wild chicken" to be seen in the groves just at the edge of the jungle, but it was several months before I finally saw one. They are the size and roughly the same shape as a frying-size roaster, except that the legs are noticeably longer for the body. Coloring is jet black on the upper parts with a deep blue breast and a white fluff under the tail, which is exposed from time to time when the birds walk, but not when they fly. Their most outstanding feature is a brilliant red beak and a pert little red tam-o-shanter set coyly just over the eyes. Greeley was the one who recognized this bird as the Gallinule, called locally a mud hen, and the identification was confirmed by a picture of the American species, identical except for color, which my mother clipped from the National Geographic Magazine for me.

More likely *Porphyrio porphyrio* than *P. melanotus*.

The name "wild chicken" is not a bad guess, because the bird is not too distantly related to the domestic fowl. It flies little, seldom over a hundred yards at a time, and lives most of its life on the ground. The young, which are hatched from August to October, are precocial—that is to say, they are born with fuzz like little chicks and can feed themselves. Several people have reported seeing a hen with chicks but by some quirk of poetic justice this sight has been denied "We." Fortunately for the Gallinule, it is not considered a table delicacy, some people complaining of its being tough, and others saying that it has a strong and slightly fishy taste. A few hardy souls occasionally boil one in soup, but the demand is not sufficient to threaten seriously the bird's existence. A far greater peril is the predilection of rats for eggs and young birds, and how the Gallinule protects its family from this danger is somewhat of a mystery.

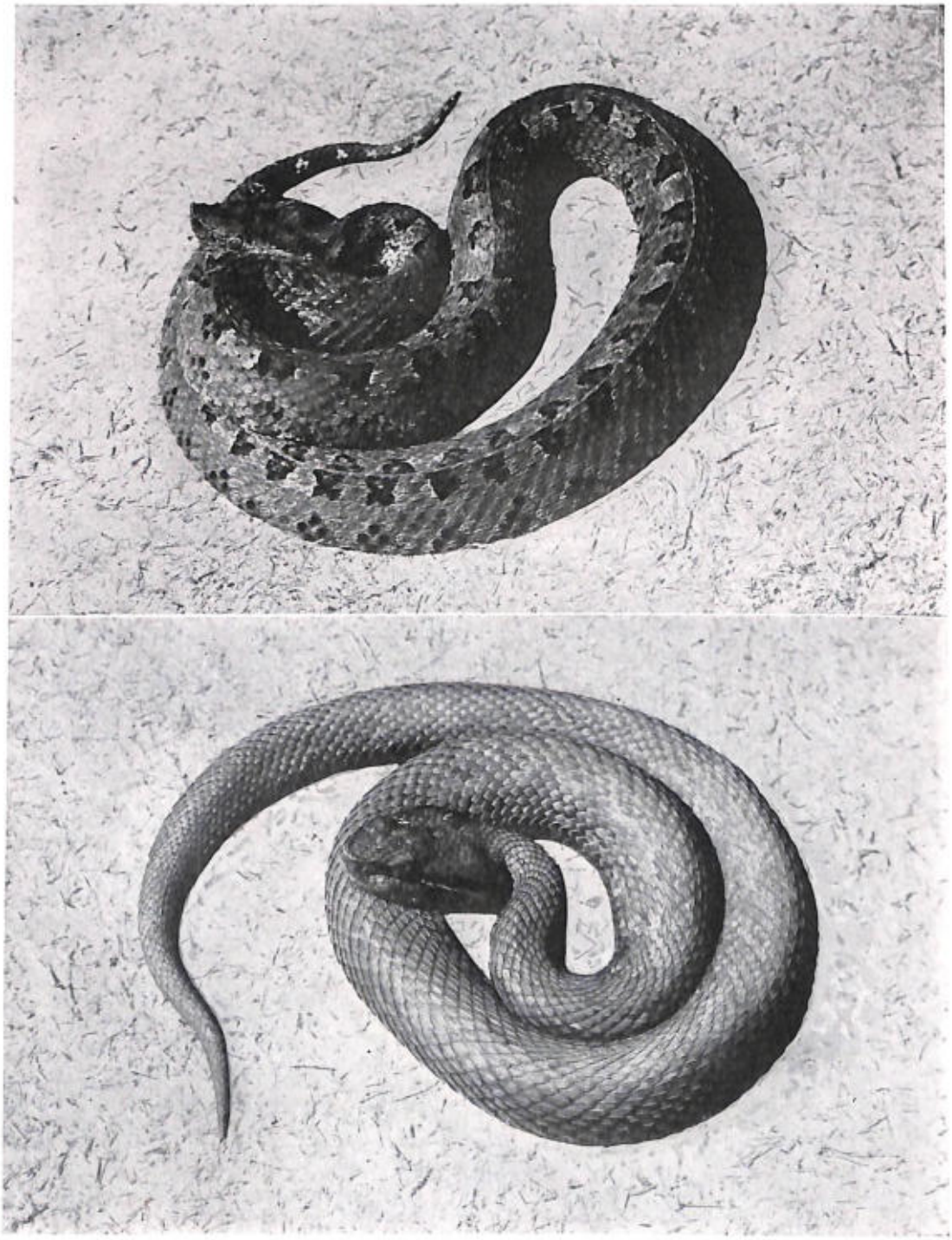
I wouldn't say it is related to domestic fowl, even distantly. It is actually a Rail.

Protection from rats is probably no problem to a Gallinule, for it can bite good and hard. It can even run across lily pads, without sinking, and a rat would have a hard time keeping up.



Upper — Fig. 39. March's Palm Viper, *Trimeresurus nigroviridis marchi.* An arboreal pit-viper of Hondurus, the bite of which is sometimes fatal. The adults are about 30 inches long and are green in color, but the juveniles are brown.

Lower — Fig. 40. Schlegel's Palm Viper, *Trimeresurus schlegelii.* This arboreal pit-viper occurs in northwestern South America as well as in Central America and is somewhat smaller than March's palm viper. The coloration is too variable to be useful in sight identification but the presence of erect, horn-like projections above the eye will help distinguish it.



Upper **— Fig. 41. Hognosed Pit-viper, *Trimeresurus nasutus*. Found in southern tropical Mexico, Central America and the humid coastal region of northwestern South America, this small species is characterized by an upturned snout.**

Lower **— Fig. 42. Godman's Pit-viper, *Trimeresurus godmani*. This is a small snake of Central America and extreme southeastern Mexico.**

2. Apply a tourniquet a short distance above the wound, that is, between it and the heart.

A necktie, a shoestring, or any strip of cloth can be used, but it should not be bound tightly; the object is to stop the flow of lymph without greatly retarding the circulation of blood. In the case of a bitten arm or leg, the tourniquet should be adjusted so that a finger can be forced between it and the skin.

3. After sterilizing the wound and a sharp instrument such as a knife or razor blade, make incisions at right angles across the fang puncture.

The depth of the cuts will, of course, vary with the size of the snake and the position of the bite; deep cutting into some parts of the body will cause excessive bleeding or do other serious damage. A cut not more than a quarter of an inch deep will suffice in most cases even though the bite of a five- or six-foot snake in a fleshy part of the body might call for one of double depth. If blood spurts from the wound because an artery has been accidentally severed, a hard object slipped under the tourniquet at a point over the artery will help stem the flow of blood. The cutting blade can be sterilized with the flame of a match.

4. Apply suction to the cuts.

If no mechanical means is available, use the mouth unless there are open sores in it; venom does not damage healthy mucous membrane and can even be swallowed.

5. As the swelling progresses, shift the tourniquet to a point just above it and continue to suck for about an hour, making many additional cuts at the base of the swollen area.

6. If antivenin is available, inject 5 ampouls (50 cc.) directly into the bite or area surrounding it and stop sucking for an hour.

Under all ordinary circumstances a doctor will now be on hand and the first-aid treatment ended. Sucking of the wound is often continued for as many as fifteen hours.

It was once thought that antivenin, the serum taken from immunized horses, had solved the snake-poisoning problem, but the work of Dr. Dudley Jackson and others has shown that mechanical removal of the venom by suction is, after all, the best method, especially for treatment of bites by the New World pit-vipers with their predominantly haemotoxic venoms. Outfits made up essentially of a sharp instrument, a tourniquet, a suction bulb, and an antiseptic are sold by many pharmacists in the United States for a small sum. Various types of antivenin with ample directions are on the market in several countries. Antivenin is expensive and must be used with caution because a large injection into a person who has received a mild bite may produce exceedingly unpleasant results.

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ZOOLOGICAL GARDEN CALCUTTA

ZOOLOGICAL GARDEN CALCUTTA

It Died a SCARLET Ibis

By HATTIE ETTINGER
Secretary to the Director, St. Louis Zoological Park

Two years ago the Bronx Zoo experimented with a special diet to restore color to certain birds. The St. Louis Zoo tried it, too—with additions—and here is what happened.

RECORDED on the December casualty list of the Garden is the death of our only scarlet ibis. Notable even in a period when the loss of each specimen is begrudged and we are filled with nostalgic longings for long-tailed birds of paradise and fairy bluebirds, this bird merits a special eulogy, for it died a *scarlet* ibis. On arrival in the fall of 1933, it was a scarlet ibis; but most of the years between it was a dingy gray-white.

One of three purchased from a New York dealer, on arrival at the Garden our ibis (*Guara rubra*) was in full adult plumage, scarlet from the tips of its long, down-curled bill to its toes, save for four black-tipped primary feathers. The three birds were exhibited in the open, planted patio of our Tropical Bird House. Seen against the lush green foliage, fronted by a pool of water, visitors were privileged to see a setting rivalling the beauty of the bird in its native haunts, the coast of South America from Venezuela to Brazil. Writers who have seen the scarlet ibis along the mud flats and against the mangrove forests have written that "the mangroves appear spattered with blood;" compared its coloring to rubies and to "rose-colored clouds lighted by the morning sun;" its flight to "jets of flame."

Like the coloring of the roseate flamingo and roseate spoonbill, all of which obtain their food industriously patrolling the mud flats, the coloring of the scarlet ibis was known to be an elusive thing, diminishing in intensity with each molt. This fact is noted all through the literature. It seemed apparent that food in captivity could not be expected to substitute for the tiny animal life responsible for the glowing pinks and reds of these three birds.

Not too much is known of the molts of the ibis in reaching the scarlet livery of adulthood. Hunters say three to four years are required. Neither is the time of molt of the adult bird known, but apparently it is slow and ill-defined. F. P. and A. P. Penard (1909) write of the bird as they observed it in Dutch Guiana: "—we have seen molting birds from January to December."

True to expectation, our three ibises molted from scarlet to rose to dingy white, and finally, our one remaining bird was relegated to our large Flight Cage where storks, cranes, gulls and other birds are exhibited. Although I knew there was an inconspicuous little gray-white bird in the Cage (the scarlet ibis measures about twenty-four inches from bill to tail, but appeared small in contrast with the tall storks and cranes), I did not associate it with the SCARLET IBIS (*Guara rubra*) which continued to appear each year on our census list until I took my first bird census in 1942, and did some checking. Each time thereafter that I saw the ibis, usually perched in a tree with its curved bill resting on its breast, I would pass by with a shake of the head. This bird was only a ghost of itself!

In the spring of 1943, George P. Vierheller, director of the Garden, read with great interest of Lee Crandall's dietary experiment with the three species of flamingoes at the New York Zoological Park, on which Mr. Crandall reported

St. Louis Zoo Photo

The Patio of the St. Louis Zoo's Tropical Bird House is famous—and deservedly so. Here, among luxuriant planting, without wire screens or glass barriers, many kinds of brilliant birds are at complete liberty. They recognize it as home, and never fly out. In this Patio the Scarlet Ibis was exhibited.

in the March-April issue of *Animal Kingdom*:

> "—we have succeeded in wintering our ten Flamingoes, of three species, in really superb condition, a feat which is itself unparalleled in our experience. Moreover, when the birds emerge from winter quarters, somewhere about April 1, our three birds of American form will carry a plumage of a brilliance never seen before.
>
> "No secret formula is involved. The whole process has been purely empirical and just how the change has been accomplished, we still do not surely know. We only know that we used every food item known to us that might give the necessary oils and vitamins for the production of the coveted pigment, limited only by the rather peculiar and fastidious feeding habits of the birds."

Mr. Crandall listed the following items included in the diet of New York's flamingoes: "whole wheat, soft and white; dog biscuit; boiled rice; sweet peppers, grated fresh daily; raw carrots, finely ground; fresh shrimp; codliver oil and brewer's yeast."

The yearly cycle of our flamingoes had been as follows: through the summer months, the birds foraged for themselves on our water fowl lakes. During the winter, spent in quarters at our large Flight Cage, their food had consisted of fish and whole-wheat bread. Various attempts had been made to prevent "fading." Fresh and dried shrimp had been given, but, at best, it had merely slowed down the seemingly inevitable loss of coloring. Our six roseate flamingoes (*Phoenicopterus ruber*), from the famous introduced nesting colony at Hialeah Race Track, near Miami, Florida, and presented to us by the Hialeah Association, and two Chilean flamingoes (*Phoenicopterus chilensis*) were already less intense in coloring after several years at the Garden.

Mr. Vierheller consulted with August Abendroth, head of our Tropical Bird House, who

welcomed the opportunity to work with the flamingoes. Plans were made to winter the birds in the wing of the Bird House, instead of their old winter quarters at the Cage, and all summer Gus waited impatiently for the birds to be brought into their new winter quarters, where it would be possible to segregate them and thus control their food.

The diet Gus worked out, based on Mr. Crandall's formula, consisted of the following: carrots, ground shrimp, sweet red pepper (when obtainable), prepared dog-food meal, cooked wheat, codliver oil and yeast. Two additions were made: dried Mexican flies, already in use at the Bird House in the feeding of soft-bill birds, and ground red beets, thrown in for luck and for color.

The new diet was started in October, 1943. Shortly afterwards, I remembered the scarlet ibis at the Bird Cage, and suggested that it also be given the same mix. The mix was faithfully given each day, in tubs of water to the flamingoes which normally obtain their food by straining it from water.

Within a few months, I was sure deeper colored feathers were beginning to appear in the plumages of the roseate flamingoes, particularly under the wings and about the head. Change in the Chilean flamingoes, smaller and less colorful birds, was a moot point. Mr. Vierheller and Gus, more cautious than I, persistently refused to commit themselves to an expression of opinion as to whether or not the coloring of the birds of either species was deeper. Finally, in February, Mr. Vierheller, with a twinkle in his eye, suggested that I run down to the Cage to see the ibis, which I had all but forgotten. Such a sight as greeted my eyes! Little tufts of *bright red feathers* were scattered through the bird's dingy gray-white plumage! Color was also beginning to appear in the legs, and the long, down-curved bill was a perky pink!

By early spring, the molt of the ibis was completed. Save for the black tips of the first four primaries and olive-drab scattered through the primaries and secondaries, the bird was scarlet from bill to toe. The roseate flamingoes, it was now unanimously agreed, were definitely deeper in color. While improvement in color was not so obvious in the Chilean flamingoes, it was probably slightly so, and, in addition, we had wintered our birds without a loss.

The scarlet ibis, with an explanatory sign, was placed on special exhibition to show its blossoming to our visitors.

The second molt of our flamingoes under the new regime is now completed, and the birds, both Chilean and roseate, are a beautiful sight, in deeper coloring than when they were originally received at the Garden. In addition, they are fine, plump birds.

Much to our regret, the ibis did not live for its second molt. Although we were disappointed, we realized the bird had been at the Garden eleven years. Since it was not less than four years old on arrival, it had lived to the ripe old age of fifteen years, and proved to the satisfaction of the staff here that this type of pigment coloring can not only be *retained* in captivity, but also can be *restored* when lost.

ZOOLOGICAL GARDEN CALCUTTA

The Humor and Myth of Linnaeus

By WILLIAM BEEBE

LET US SUPPOSE I am sitting in my library and that I crave something new and unread, something unexpected which contains a satisfying combination of interest, knowledge, science, humor and myth. I reach up and pull down a book at random. It turns out to be an old Latin Dictionary, a mere list of technical names, published exactly 186 years ago. Could any less promising volume be imagined? As well offer a list of colors to a blind person or an ephemeris to a coal miner.

But to a scientist miracles are not wholly alien things. The most unlikely place may magic a new discovery, and in dusty tomes of old, jewels are sometimes hidden.

However barren from a literary aspect our dictionary seems, it is the veritable bible of science, the original basic nomenclature, the foundation of all the language of the world's science. It is bound in rusty leather, the edges of the leaves are pink, it is the Tenth Edition of the world-famous *Systema Naturae* of Carl Linnaeus. Within its 823 pages are the names of all the animals known to the author, beginning with himself (and consequently ourselves), *Homo Sapiens*, and ending with that microscopic plant-animal, *Volvox polymorpho-mutabilis*.

The description of the various creatures are of varying length, as clear and diagnostic as they are short. Only recently I became aware that some of the beasts had appended a sentence or two of unexpected import. Five of these are the sole cause for this lengthy preamble, five delightful, improbable bits, translated from Carl's staccato, dignified Latin into English, and wholly satisfying my desire for the aforesaid interest, knowledge, science, humor and myth. As we read them and chuckle we suddenly perceive a very human side of Linnaeus, a new facet of the studious Swede: we realize that however inevitably accurate we must rate his nomenclature, he must have read and believed considerable of the true and the false of Pliny, Gesner and even John Mandeville, and we cherish the great man more than ever.

Vespertilio Vampyrus (Vampire Bat)

At night sucks in the blood of the sleeping, the combs of cocks and the juice of palm trees.

Trichechus Manatus (Manatee)

Lives in American seas. Eats vegetable matter; becomes tame; is delighted by music. Flesh edible.

Bradypus Tridactylus (Sloth)

Body very hairy, tenacious of life. Climbs easily; walks with difficulty and exceedingly slowly, turns its head as though in astonishment; call, an exciting senarius; noise frightful, tears plentiful.

Felis Catus (Cat)

Habits like allied forms, quiet, purrs (*ore molat*), erects tail; when roused is most agile, climbs, when angry emits an ambrosial odor; the lion of mice, she moves her tail when intent on prey; her eyes shine in the night, when she desires prey she devours it eagerly; makes love wretchedly with yowling and squabbling. Eats meat but disdains vegetables; in the next instant washes her face with her hand; when thrown from a high place, falls on her feet. Doesn't have fleas.

Camelus Dromedarius (Camel)

A second, chambered stomach for pure water providing for a long time in the thirsty desert. Carries burdens, makes haste slowly, when weary lies down on its breast.

(Adapted from *The Book of Naturalists, an Anthology of the Best Natural History*, by William Beebe, published by Alfred Knopf.)

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

The Department of Insects at The Zoological Park

By Fairfield Osborn

These brief lines constitute a preliminary announcement of a highly important development, namely, the establishment of a Department of Insects and the appointment of Mr. Brayton Eddy as its first Curator. In the next issue of Animal Kingdom a full report will be made of the activities and aims of this new department.

The Zoological Society considers itself fortunate to have obtained the services of Mr. Eddy, whose training and experience qualify him to an unusual degree for his future work with us. He was graduated from Brown University in 1921 and subsequently took special courses in entomology at Cornell University. He is the author of a large number of articles and the co-author of two books; he has lectured throughout the country on insects, water animals and wildlife conservation. Further, he has attained outstanding success in exhibiting large collections of living insects of various types in insect "zoos" near Providence, Rhode Island, and at Detroit, Michigan. Mr. Eddy is resigning his position as Administrator of the Division of Entomology and Plant Industry of the State of Rhode Island to join the staff of our Society. We extend to him the warmest of welcomes.

Début of the Cubs

As a footnote to General Curator Crandall's "News from the Nursery" in this issue of Animal Kingdom, we must report that on Thursday, March 22, the Tiger and two Lion cubs were formally introduced to the public. In the presence of Members of the Zoological Society, invited to the special pre-view, they were brought out of the apartment where they have been in the care of Mrs. Fred Martini since birth, and were given the freedom of a big and newly-rebuilt compartment in the Lion House.

Following the début, tea was served in the Members' Lounge in the Administration Building. The cubs were not invited to the tea—for the last two weeks before they left the Martini apartment they were so rambunctious that at times it was doubtful whether the Martini furniture would last until their new home in the Lion House was ready.

A Hummingbird Is Working On A Nest—and We're Hoping

Nobody has ever managed to breed Hummingbirds in captivity. But a Violet-eared Hummer from western Costa Rica is building a nest in the Main Bird House . . . her mate is most attentive . . . and we are wondering and hoping. After all, there has to be a first time for everything.

Although we had a pair of Violet-ears, they have been kept apart until recently, for Hummers are ferocious fighters and it is generally impossible to keep two of them in the same cage.

During the early spring the female was quartered temporarily in the New England Garden habitat cage. In the adjacent Desert Cage a nesting box and a handful of raffia had been hung up for the convenience of a pair of Zebra Finches, which proceeded to carry the raffia into the box. The first we knew of the Hummingbird's interest was when she found a tiny knothole in the back of the Zebra Finch nestbox and began pulling out strands of raffia.

In a short time she had laid the foundations of a nest of her own in the top of an evergreen in the New England Garden. The Bird House staff immediately matched her interest and began supplying choicer nesting materials—cotton, milkweed silk, dried moss and even a handful of spider webs.

Nestbuilding went on so energetically that Curator Crandall began to consider the possibility that the female was really serious. He inspected our male Violet-ear, found he had recovered from his moult, and ordered him introduced into the New England Garden.

It was done simply and easily, first by confining the male in a small cage hung on the Garden wall for a couple of days until both the male and the female became accustomed to each other. Then he was liberated. No fighting ensued; in fact, the two birds appeared to be quite friendly.

To date the male's contribution to the domestic scene is mostly one of morale—he sits on a perch and sings while the female busies herself around the nest. His song, incidentally, is surprisingly loud; a squeaky *chip-chip* that at times almost becomes a short melody. It can be heard all over the building, even above the calls and songs of much larger birds.

Up to now there are no eggs. Hummingbirds have nested rarely in other collections, and it may be that a nest is all we will get out of this experiment. But we're hoping for more.

Grand Opening: April 7

Bright and shining and the liveliest spot in the whole Zoo, the Children's Zoo will reopen for its fifth season on Saturday morning, April 7.

The big new feature this year will be a "Fish-bowl" for the younger visitors where, with the exercise of a little imagination, they can believe they are actually walking through the water with the bright-colored tropical fishes.

Although at the last minute—as well as currently through the season—other young or tame animals may be added to the Children's Zoo collection, the "line-up" for opening day will be as follows:

3 Black Lambs	Kittens
Sicilian Donkey and Foal	Rabbits
Angora Goats	Deacon, the Crow
3 White Goat Kids	Bantams
2 Skunks	White Rats
Top-knot Ducks	Pigeons
Miscellaneous Geese	Guinea Pigs
"Noah's Ark" Animals	Tame Squirrel

The Children's Zoo expects an excellent season, for its attendance has been building up each year. Last year it had 200,285 paid admissions, plus uncounted thousands of Service personnel.

As heretofore, adults will be admitted to the Children's Zoo only when accompanied by a child.

Farm-in-the-Zoo Will Open On April 28 This Year

Featuring the mechanical milking of our herd of cows, the Farm-in-the-Zoo will open for the summer season on Saturday, April 28. The variety and quantity of livestock will be considerably greater than in any previous year.

Through the cooperative interest of The De Laval Company, a complete mechanical milker unit is being installed in a new milking platform on the north side of the barn and both mechanical and hand milking will be demonstrated every afternoon.

Other new exhibits, including a series of dioramas of the handling of milk, prepared by the Borden Company for its display at the New York

(*continued on page* 55)

Lay *Not* Up for Yourself Treasures . . .

What becomes of the hundreds of thousands of peanuts that Squirrels have buried in the Bronx Zoo in the past 40 years?

Most of them have rotted—99% of them, probably. Food is plentiful and even though we human beings find it hard to stop eating peanuts once we start, Squirrels have better sense. They know when they've had enough. And they don't seem to care for buried peanuts when they can always beg a fresh-roasted one from passersby.

We *do* know what became of *one* buried peanut.

A stump-tailed Squirrel begged it from a complaisant visitor and carried it a few yards up the hillside. A few shoves of the snout, a scraping with the paws, a tidy patting, and the cache was secure.

But not quite—as an afterthought, the Squirrel dragged over a couple of oak leaves and laid them across the minute mound. It was a convincing touch of careless innocence. Stumptail scurried off to beg another peanut.

From the middle branches of the oak tree a Blue Jay witnessed the whole stratagem. Stumptail was still making mock-timid approaches to the enchanted visitor when the Jay dropped down on silent wings, brushed the leaves aside, made a few probes with his bill and flew off with the peanut.

That's what became of one buried peanut.

Now and then—in fact, quite often—Staff Photographer Sam Dunton turns in an animal picture that is so extraordinarily good that we like to use it in ANIMAL KINGDOM, even though it does not illustrate an article and there is no particular excuse for it other than the pictorial. This is one of those pictures—a young Sapajou now in the collection. The picture was made in the Zoo's photographic studio and the Sapajou was most cooperative; it took a pose and kept it all through the picture-taking instead of leaping for the entrancing overhead lighting fixtures, as we thoroughly expected it would do.

World's Fair, will be installed in the rotunda of the barn. A fuller report on the Farm's new exhibits will be made in a later issue of ANIMAL KINGDOM.

The haywagon "taxi" between the center of the Zoo and the Farm will operate this summer as usual. The haywagon has been presented to the Zoo by former State Senator Seabury C. Mastick of Pleasantville, a Life Member of the Zoological Society.

New Members of the Society

New members of the New York Zoological Society since the last issue of this magazine are the following:

Life

Dr. William S. Ladd

Annual

Board of Park Commissioners of South Bend, Indiana
Donald T. Carlisle — Lt. Col. Leigh M. Nisbet
Dr. Milton M. Ehrlich — S/Sgt. Willis C. Self
Mrs. J. Mitchell Hoyt — Mrs. Charles F. Slotter
Robert W. Tilney

A Pine Grosbeak Pays A Visit to the Zoo

The first Pine Grosbeak that General Curator Crandall has seen in the Zoo in the 37 years he has been on the staff was observed by accident late in the afternoon of January 19.

Mr. Crandall and his assistant, Miss Grace Davall, were leaving the Administration Building about 5:30 P.M. when they heard a twittering of birds in a low oak tree near the steps. The General Curator casually glanced up and saw that the noise was made by two or three Starlings and a few Juncoes and White-throat Sparrows. He went on a few steps and then something made him look back; his eye had registered some odd shapes among the little flock.

Five of the birds had unusually long tails and he could make out traces of red.

"What do you see in that tree?" he called to Miss Davall. Long association with the Bird Department has taught her what to look for and how to describe it.

"Pink on the breast," she exclaimed.

Crandall turned and dashed back toward his office to get his field glass.

Knowing too well that one perching bird is worth any number that have flown away, he quickly focussed through the window and brought a gray and yellow female Pine Grosbeak into plain view in a couple of seconds.

Another two or three seconds of steady viewing were all he had. With one accord the population of the whole tree took wing and flew away. But Crandall had made his identification.

More Nursery Notes

Annie, our always surprising Blackfoot Penguin, has found a new way to manifest her individuality.

Annie, it will be recalled, is the Penguin that stole sticks from another Penguin's nest and laid up a "hope chest" of building materials at a time when she had no mate; who finally got a mate and a suitor at the same time, with the result that her Humboldt mate killed the suitor; who laid her first egg in the spring of 1943 and refused to leave her nest when the egg proved a dud; who attempted to kidnap the offspring of another pair of Penguins and wrenched the flipper from the helpless baby; who—

But the saga of Annie grows too long. The latest report is that Annie still has not weaned her own first offspring, hatched in the spring of last year. Normally a young Penguin is feeding by itself after four or five months. Annie has made no attempts to wean her baby and even though he is a young giant, fully as large as herself, she still feeds him every day. Annie takes parenthood seriously.

* * *

We are entering the spring with two true baby Penguins and one—Annie's—that is only technically an infant. One Blackfoot Penguin was hatched early in March and the other came into the world last December. It is surprising that the December baby survived, having appeared so late in the season when the dangers of cold rains and snow are multiplied. However, it was well sheltered by its parents during the first critical two or three weeks, and is a vigorous and healthy youngster.

* * *

Two young Indian Blackbucks were born in early March and may be seen in the Blackbuck Enclosure. A third baby, slightly larger, belongs to Mary, an embarrassingly tame Blackbuck. It was born unseasonably on January 4 and because of the cold weather was removed immediately to a sheltered compartment in the Animal Hospital.

Two Central American Agoutis, sleek miniature editions of their mother, were born in the Small Mammal House on March 13.

PUBLICATIONS OF INTEREST

RAYMOND L. DITMARS: His Exciting Career With Reptiles, Animals and Insects. By L. N. Wood. Julian Messner, Inc., New York, 1944. 272 pp., 58 illus., $2.50.

In this sympathetic and very readable book, Laura Wood has given an account of the life of Raymond L. Ditmars that will surely serve as an inspiration for many a youth with a love for animals and a natural or imagined "way" with them. It is a fitting tribute to Doctor Ditmars, who all his life never begrudged the time to listen to the problems and the aspirations of budding naturalists and who gave generously of his knowledge and experience. I doubt that this was ever a conscious reflection of his own early struggles, but rather the expression of a kindly disposition and an innate desire to like and be liked.

The book opens with young Raymond at the age of eight, and even then evincing a lively interest in reptiles, much to the consternation of his parents and grandparents. His difficulties in overcoming the antipathy of his family to his "strange" hobbies are amusingly told; the family eventually capitulated, though, and became his staunch supporters. His school studies terminated at seventeen, when he was employed as an assistant in the Department of Entomology at the American Museum of Natural History, after which he worked for an optical company. This was followed by a short period as reporter on the New York Times and in 1899 he became associated with the newly founded New York Zoological Park. During the next forty-two years, through lectures, work at the Park and the publication of books and articles, he acquired international reputation. His vacation trips to the tropics always provided bright newspaper stories and several of these episodes are engagingly told. Many of the anecdotes described so vividly by Miss Wood are well known, while others reveal facets of his life that are less familiar.

It is with entirely pardonable pride that his family has furnished rather glamourized accounts of several episodes in Doctor Ditmars's life. Theirs was a very closely-knit group and "Pop" was ever their idol.

The selected bibliography would appear a little misleading and unnecessary in a book of this nature and a simple listing of Doctor Ditmars's own writings might have served the purpose more satisfactorily.—GRACE H. DAVALL

AMPHIBIANS AND REPTILES OF THE CHICAGO AREA. By Clifford H. Pope. Chicago Natural History Museum, 1944. Pp. 1-275, 12 plates, 50 figures; $1.75.

Field books confined to the animals of a state or "area" continue to be issued in considerable numbers, to the edification and joy of the increasing number who are interested in the animals of our fields, forests and streams. Clifford Pope, a Fellow of our Society and a former member of expeditions of the Department of Tropical Research and now Curator of Amphibians and Reptiles at the Chicago Natural History Museum, has produced a superlative handbook on the amphibians and reptiles of the Chicago area. Mr. Pope's facility in creating text easily assimilable by the interested amateur while at the same time completely accurate in its science, has resulted in a fascinating volume. Attractively bound in paper, with 12 plates, 50 figures and maps, it covers the salamanders, frogs, lizards, snakes and turtles of the "Chicago area," which includes counties of Illinois, Indiana, Michigan and Wisconsin, with an extreme range of 70 miles from Chicago. Fifty-two kinds of reptiles and amphibians live in this area, each of which can be determined through keys and recognition characters, while other sections under each species are devoted to the distinctions between the sexes, reproduction, habits, growth and age, food and feeding habits, enemies, economic importance, the animal in captivity, geographical distribution and occurrences within the Chicago area plus a reference or references to the most important published accounts of the species.

The habits of the amphibians and reptiles of the area treated in this volume are highly interesting and provocative and, as they are expressed by Mr. Pope, they provide a cordial and stimulating invitation to the people of the area surrounding the nation's second largest city as well as to others farther afield, to become better acquainted with the salamanders, frogs, toads, snakes and lizards that are often close to us, but because of our lack of knowledge as to where to look, unobserved.—J. TEE-VAN.

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Forest Destruction and Wildlife

Truth seems hard to come by. Rarely does it shine out like a beacon on a mountain-top—usually it is will-o'-the-wisping in a lower valley.

As a case in point, has the public got the facts concerning the destruction of the forests which are essential not only for wildlife preservation but also for balanced and adequate water supply and the needs of many basic industries? The air is filled with propaganda or, shall we say, with inspired or prejudiced information, in the form of magazine articles as well as motion picture films, prepared and sponsored by representatives of the commercial lumber interests. This material gains widespread circulation, is read or seen by large sections of the public that are led to conclude that all is well with our forests.

The facts concerning the forest situation are clearly presented in the last annual report of the Chief of the United States Forest Service. This report indicates that the rate of destruction, even making allowance for war demands, is far greater than the rate of replenishment and that the situation in regard to forest depletion is rapidly becoming more acute. Do these facts receive widespread circulation? Is the public as a whole informed regarding them? Not really. The potent machinery of propaganda is generally used by special groups seeking special purposes.

Occasionally the beacon flashes out—some government official makes a statement that draws general attention, or an authoritative article appears such as the recent one by William Vogt, Chief of the Conservation Section of the Pan American Union, telling of conditions in Central and South America where, in many republics, the velocity of destruction is even greater than it is in the United States. It reminds one in a way of the oncoming of war in Europe. Many people knew it was inevitable but no concerted action was taken to prevent it.

There are innumerable agencies, governmental and private, that have the facts and realize the seriousness of the situation but whose efforts in the matter of getting the truth over to the public are not coordinated and therefore not fully effective. These conservation forces naturally have their own varying objectives and could not be expected to forfeit anything of their own individualities. Nevertheless, there is one issue in which they should all join together, namely, informing the public concerning the crisis of the forests. This can be accomplished by the establishment of a central agency specialized in the technique of disseminating facts. The situation cannot be saved unless supported by organized public opinion. The Zoological Society is vitally interested because the present trend is a threat of the first magnitude to wildlife.

Fairfield Osborn

IN THIS ISSUE

"Petunia," Pet Skunk of the Children's Zoo *Sam Dunton* COVER

Four Years of Africa-in-the-Bronx *Lee S. Crandall* 59

The Subtlety of *Leucochloridium paradoxum* *Ross F. Nigrelli* 61

Insects Are Animals . . . . . *Brayton Eddy* 62

A Brilliant Flash – That's the Manakin's Display *Lee S. Crandall* 67

The Key to Question House . . *Grace Davall* 70

About Bull Snakes . . . . . *Earl Jackson* 75

Why Should I Join the Zoological Society? . . . 80

Problem of the Invisible Baby Fish *William Bridges* 82

Behind the Scenes: News and Notes 83

It might be in Africa—but actually this is a scene around the Water Hole in Africa-in-the-Bronx, where Chanler's Mountain Reedbucks, Bushbucks and Nyalas seem to live at peace with Lions.

Four Years of Africa-in-the-Bronx

By LEE S. CRANDALL

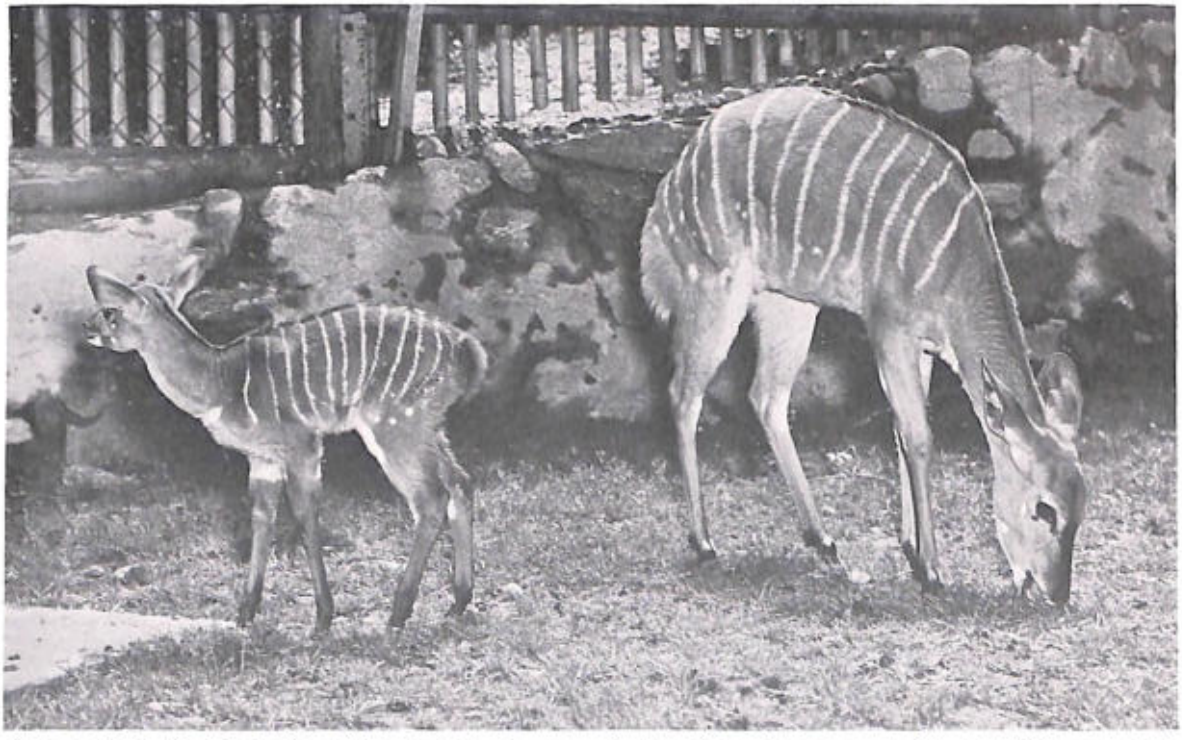
Looking back at our big Plains exhibit, it seems that most of the plans had to be modified—but the result is a magnificent, and workable, miniature Africa.

IN THE WORLD of Zoology, as in other spheres, few projects develop exactly as planned. When we opened our African Plains exhibit on May 5, 1941, we found ourselves abroad in a field of animal management entirely new to the Zoological Park. Never before, in the more than forty years of our existence, had we attempted mixed groups of mammals and birds on anything beyond a tiny scale. We had to feel our way and our most cautious groping could not save us from all of the many pitfalls that beset such a course. And yet, after four years of Africa-in-the-Bronx, we feel free to claim a real success. The area, carpeted with rich, strong grass, is certainly one of our best-liked and most popular exhibits. But for the members of the animal departments, there is a satisfaction even greater than obvious visitor enthusiasm. At last, we have developed a group of mammals and birds that will live together amicably, under reasonable control, that so far have reproduced their varied kinds beyond our expectations and that at the same time, yield an unsurpassed return in spectacular appeal and educational value. That this final happy outcome does not check exactly with our original plan is a matter of no consequence. We have had a great deal of priceless experience at no great cost and we are established, at last, on a perfectly sound and workable basis.

In the beginning, our ambition to accomplish the spectacle of the ages led us to include species that, for various reasons, were unsuitable.

The Zebras were the worst. The stallion was a callow yearling, too young, we thought, to be dangerous, and the two mares were staid old-timers from the Zebra House. From the very first day, the stallion proved himself a complete fiend. Ears back and teeth bared, he drove fiercely at first one companion, then another, and only the antelopes' fleetness of foot saved them from annihilation. Unable to accomplish his designs on Bushbuck or Lechwe, he set about systematically hunting down the Wart-hogs. These grotesque creatures had devoted the first few days of their liberation to digging a huge burrow in an embankment. By the time the Zebra had worked down to the level of such lowly prey, they had completed a dug-out that provided perfect safety. Having failed in several attempts to cut off the Wart-hogs as they dashed for cover, the Zebra developed the patience of a hungry Leopard and spent hours waiting for an opportunity to pounce on them as they cautiously emerged. Eventually, he actually succeeded in caving in a section of the burrow and doing the male Wart-hog a slight injury, from which he soon recovered. But it did result in the removal of all the Zebras, from which we had learned a number of things: male Zebras, once weaned, are likely not to be nice in mixed company; mature mares are not always to be trusted; Zebra feet are hard on small areas of turf, and anyway, they are too big for a miniature Africa! Incidentally, the recuperated Wart-hog and his mate were not long in finding themselves back in the Kangaroo House. The erstwhile invalid, rid of his Nemesis, soon developed an antipathy for anything that would run and pursued whatever it might be with ludicrous but determined agility. Moreover, a whole series of caves threatened a general collapse of the entire area.

The Elands, quiet enough after their ox-like fashion, made no trouble but we soon realized



The newest baby Nyala is a brightly-striped youngster that is gentle and unafraid, and will be a handsome addition to the African Plains when he is turned out with his mother. At present the baby and the mother are being exhibited in the feeding corral at the entrance to the Plains.

that their great bulk made them unsuitable. The splendid young Common Waterbuck, meanwhile, had been gaining rapidly in size and confidence and finally managed a transfer to the Antelope House by the simple expedient of chasing a too-trusting keeper into the Water Hole.

And so it went, our little colony rapidly diminishing and smaller. One evening, a small boy who had decided to take a short-cut across the Plains, had to be rescued from the cock Ostrich by a watchman passing on his rounds. That meant only female Ostriches in future. Then came the only real tragedy. In a ten-minute interval when no keeper was about, a lovely two-year-old male Nyala was killed, perhaps by his father, perhaps by a male Bushbuck, but most probably by a Cape Hartebeest. We never were quite certain, but at any rate we determined to risk no more accidents. The Hartebeest was removed to the "Plains Annex," a large enclosure just west of the Plains proper, where he behaves well with Zebra mare, Elands and elusive Aoudads. The male Bushbuck was confined to the shelter and the feeding corral.

Now only the male Nyala, a handsome and docile animal, is allowed the freedom of the Plains. With him run his original mate, a daughter of breeding age, a yearling female and two lovely white-striped babies. They are an affectionate and closely-knit family but are perfectly friendly with three female Bushbucks and two tiny youngsters, as well as two female Rooi Rheboks and a female White-eared Kob. Thus we have succeeded in establishing breeding herds of both Nyalas and Bushbucks and can swell their numbers as required by adding females of medium-sized and small species. Last year we added a yearling male Blesbok; this year, rather than risk him again, he will go to the Annex, along with larger game.

Birds in the group include a South African Ostrich (a hen), South African and West African Crowned Cranes, Paradise, European and Demoiselle Cranes, Crowned Guinea-fowl and a Marabou Stork. They cause no trouble and add just the right touch of color and movement required to give the scene a sense of reality.

Sam Dunton's superb photograph (the frontispiece of this article), made from the eastern edge of the Water Hole, points the necessity of men-

tion of the Lion Rock. This lies between the Plains proper and the Annex to the west and is separated from them by a well concealed moat, twenty feet wide and about eighteen feet deep. It is inhabited by three very fine adult male Lions, now about seven years old. Free from any disturbing feminine influence, they spend their days together in complete friendliness but at night they are housed and fed in separate compartments. Frequently they join in awe-inspiring choruses, sometimes so terrific that the Rock itself seems to shake. And yet the timid creatures of the Plains, which should be warned by some instinct that Lions are their natural enemies, pay little heed. Sometimes, when the dread vibrations seem to threaten ear-drums far less sensitive than theirs, they may deign to raise their heads and listen for a moment. But always they quickly return to their own affairs and leave the Lions to their fruitless uproar.

The Subtlety of Leucochloridium paradoxum

By ROSS F. NIGRELLI

Any practicing naturalist can astonish his friends with stories of complex life cycles and intricate food chains – Darwin's classic example of the relationship between cats and clover is a familiar example. But the parasitologists can tell the best stories, because some of their little animals will go to almost fabulous lengths to perpetuate their kind.

Take *Leucochloridium paradoxum*.

It is a minute parasite, a fluke, and its life fluctuates between a bird in a tree and a snail on the ground. Now admire the subtlety of its path.

Its reproduction begins in the intestine of a baby bird – a Sparrow, for example. The adult flukes lay vast numbers of eggs which pass out in the nestling's excrement and are thus strewn over bushes and on the ground.

Along come snails – many kinds – and feed upon the excrement. That is the end of the road for most of the eggs; they are simply eaten and digested. But in *one* kind of snail the eggs hatch into wriggling larvae and start their journey through the snail's body. They are pretty little things at this stage, even though they can only be seen under a microscope – striped green and white, with bright red tips.

These decorative mites burrow through the tissue of the snail and crowd into the tentacles. Such vast numbers of them jam into the delicate, extensible "feelers" of the snail that the tentacles are swollen and cannot be drawn back under the shell.

The skin of the snail's "horns" is stretched taut and thin and through its transparent sides the bright red tips and the green-and-white stripes of the parasites are clearly visible. They wriggle continuously and thus the tentacles seem to move and twinkle with ruby light.

What more likely to attract the attention of an adult Sparrow, perched on a limb and spying out the ground for its hungry nestlings?

The Sparrow flies down, the snail in alarm draws itself back into its protecting shell – and only the weaving, pulsating, tempting red tentacles remain exposed. The Sparrow nips them off.

If the Sparrow happens to be hungry itself, it may swallow the little bags full of parasites – in which case, again, it is the end of the road, for the strong digestive juices of an adult Sparrow destroy them.

But if it unselfishly carries them back to the nest and pops them into the mouths of its ravenous nestlings, the chain is complete; in the milder secretions of the nestlings' intestines, the larvae quickly develop into adults – which lay more eggs – which pass out in the excrement – which the right kind of snail eats – and the cycle is beginning all over again.

What happens to the snail who has been detentacled?

Nothing much; it simply grows new "horns," which fill up with parasites again, which another Sparrow nips off. And so *Leucochloridium paradoxum* continues to survive.

The paradox is that it has to be eaten in order to survive.

Insects Are ANIMALS

By BRAYTON EDDY

THE New York Zoological Society is pioneering when it undertakes to establish an Insect Department at the Zoological Park. There is no known precedent for it in this country. Sporadic attempts have been made by private individuals, public museums and government agencies to exhibit live insects, but these exhibits have lacked permanency and often they have lacked purpose. Only in London and Berlin before the war have any considerable number of insects competed with reptiles, birds and mammals for attention at a Zoological Park.

Which is rather strange, when you stop to think of it.

Here is a group of organisms that is so intimately connected with ourselves that we cannot escape them. They inhabit the air about our heads, the earth beneath our feet and the waters bounding the earth. They are found on the highest mountain peaks, within the darkest caves, and even 1,000 feet under Lake Superior. They survive in the mud of shallow hot springs which reach a temperature of 122° Fahrenheit, and frozen in icecaps of the far north. Only in mid-ocean are their numbers relatively sparse, yet they breed on floating vegetation in the midst of the Sargasso Sea.

Perhaps the unpleasant connotation of their name has kept them from being more extensively exhibited. Popularly they are known as "bugs," yet actually only a certain group of them belong in this classification. They are not mere bugs, creatures to be despised, enemies of ours that only delight in chewing up our trees, our furs and even ourselves. They are far more than that name implies. Their lives are crammed with amazing interest, charm and complexity. Their shapes are legion. They are animals in the truest sense of the word, dominant animals.

To many persons, insects are just "bugs," and bugs are something unpleasant. But our new Department has hopes of changing a good many of those mistaken ideas.

Insects may be thought of as standing astride the fulcrum of the animal kingdom, able to throw their weight in any direction. No other animal group, by pollinating plants and cultivating soil, contributes so much to the general welfare; yet no other group, through its competition for food and living space, demands quite so much in return. Insect lives are so enmeshed with other forms of life, both animal and plant, that their activities affect for good or ill the entire organic structure.

There are some commentators who claim that ultimately insects will inherit the earth. And they have a strong point to their argument. Numerically insects are already supreme. Over one million species have been named and new ones are being discovered almost daily. Already insect species are said to outnumber plant species two to one, and the odds are even greater when it comes to a comparison with other animals. Therefore the total known species of insects upon this earth is believed to be greater than the total known species of both plants and other animals.

But it is not alone in species that insects excel. Individuals within a species reach astonishing numbers. In favorable times there may be as many as 340 Aphids to a leaf on a tree bearing 100,000 leaves, or 15 Chinch Bugs to a plant in a wheat field growing one million plants to the acre. A queen Honeybee in good production form has been known to lay 3,000 eggs a day, whereas the potential increase of a Cabbage Aphis is almost unbelievable. Yet two eminent scientists have come to very much the same conclusion

Honeybees are a hobby of Brayton Eddy, our new Curator of Insects and Acting Curator of Reptiles. The purpose of this picture is to introduce Mr. Eddy to the membership of the Society; he is at the left in the photograph above, which shows him inspecting an apiary in Rhode Island.

regarding it. Although a single Cabbage Aphis weighs but little more than a milligram, its progeny in ten generations—provided they breed normally and all survive—can exceed the weight of the total population of China. And that statement was made before the war!

Granted that there are several arguments in favor of the supposition that insects will inherit the earth, nevertheless these arguments fail to recognize that insects are their own worst enemies. They are not united. They are divided against each other. Some 12% are said to be parasites, some 16% are predaceous – most of them being parasitic or predaceous upon their own kind. Add to these figures another 17% which are scavengers and the picture does not look so black for the human race.

The total number of insects which may be regarded as major pests are comparatively few. Perhaps a hundred fall in this category. The worst offenders come from abroad. Away from their natural enemies and in a region of specialized agriculture, they are capable of enormous damage. Although only about one-half of one percent. of all insect species are directly injurious to man or to his crops, nevertheless they cause an average crop loss in this country of approximately 10% each year.

One of the important functions of the new Department of Insects, as it operates at the Zoo-

A Monarch Butterfly resting on a thistle is a familiar sight in summer fields, and it will be one of the tasks of the Department of Insects to re-create such sights in Zoo exhibits. *L. M. Chace Photo*

logical Park, will be to help the general public to distinguish between insects which are destructive and those which are beneficial. The checks and balances of nature will be made demonstrable so that as individuals we will be less likely to work at cross-purposes. There are many native insects that aid in the policing of our gardens, and many others that have been imported by the Federal Government for our common good; but unless we recognize them and come to appreciate their value, we are likely to impose upon them an early and a violent death.

In the Insect House that has been planned for the post-war period, there is provision not only for the display of innumerable live insects but also, in separate wings of the building, for a few native vertebrates that feed upon them. Frogs and toads salamanders and small turtles, snakes, birds and mammals of a sort, constitute their natural controls. The assumption will be that if all glass fronts were removed, the insect population would have small chance for survival. It would have to run the gantlet of both vertebrate enemies and aggressive invertebrate enemies from within its own ranks.

Biological controls, as explained above, offer one means of curtailing insect populations. Their chief advantage lies in the fact that they operate continuously and at no added cost, but unfortunately they are not always effective. For this reason, and because biological controls of many insects are not yet known, it usually is necessary to employ some chemical for assured crop protection. Lead arsenate, rotenone, cryolite and many other products are in general use today, but a whole new world of organics and synthetics is being discovered that promises widespread hope for the future.

The emergence of the Seventeen-Year-Locusts in various parts of the country is a subject of perennial interest and the Department of Insects will be prepared to answer questions. *A.M.N.H. Photo*

Not only is it the intent of the Department of Insects to keep abreast of the times in the use of these newer materials, but also it plans to experiment with other materials as they appear and to attempt to find new uses for old reliables. The live insect displays will be a front for experimental activities of many kinds that will go on behind the scenes.

Since there will be many social insects on exhibit from time to time, opportunity for studies in animal behaviorism will be offered. It is hoped that a limited number of graduate students from nearby institutions will take advantage of the facilities provided and record the results of their findings in scientific journals.

Educationally the Department of Insects will function in many spheres. There will be chatty radio talks about insects on display, booklets giving information on insect control problems, and public meetings where related topics may be discussed. Although the department will not be staffed by specialists in particular fields of entomology, but rather by general entomologists, it will be prepared to identify the more common insects submitted to it. Since descriptions of specimens by letter or telephone are often misleading, actual specimens should be brought or mailed to the Administration Building and precautions taken to assure their arrival in good condition. Mailed specimens should be dead.

It will not be possible to examine real estate property to determine the cause of damages, nor actually to administer control measures. Inquirers will be referred to concerns that do this service.

Obviously the various aims and hopes of the new Department of Insects cannot be realized at once, or even after a considerable period of time. There is a staff to pick and a building to be

erected. Plans for the building have already been projected, but details necessary to an effective display of insects, to lighting and servicing cases, and to convenience in handling crowds cannot be worked out in a minute. They require careful study and experimentation to avoid unnecessary mistakes. The finished product must be as near perfect as is humanly possible.

The first subject for display was submitted on April 8. It consisted of two Black Widow Spiders that had been found on Long Island. To be sure, they were not insects, since their eight legs disqualified them, but the possession of deadly poison glands placed them in the nature of a major attraction. Because they are inclined to be cannibalistic, each spider was placed in a separate bottle and kept under observation. When they consumed the flies offered them for food, they were placed on public display—bottles and all—within a reptile case above the Tarantula exhibit. On April 12 a "blessed event" occurred in the form of a Black Widow egg capsule, which was spotlighted in a tight glass box against the time when the eggs would hatch, around May 6.

A Honeybee exhibit is planned for July in the Reptile House lobby, which at present is used as a turtle pen. Honeybees are not only an assured attraction, but also they are of great service to mankind. By their industry they make fruitful our orchards, berry patches and vegetable gardens; even during the destructive days of war they also serve, for they provide a natural sweet against the war-imposed sugar shortage; and they furnish wax to waterproof uniforms and speed our ammunition on its way to the enemy. Of all social insects, they alone are subject to easy manipulation.

It was intended that the bees should go outdoors to get their pollen and nectar, but this idea was changed when it was determined that honey plants were scarce in the Park and that ice cream in the hands of small youngsters might be taken in substitute. It is now intended to keep the bees confined within a glass observation hive where all their varied activities may be noted, allowing them access by an overhead route to a glassed-in garden spot at the opposite end of the lobby. Between hive and garden, space will be reserved for an exhibit of products which Honeybees have made possible.

The Honeybee exhibit will be a forerunner of what may be expected when the Insect House is completed. There are exciting times ahead. Live insects will constitute a majority of the public exhibits in the new structure, but it must be remembered that *back of the front* both research and experimentation of a very practical nature will be conducted.

The Fish that Can't Abide a Big Tank

FISH HAVE THEIR PECULIARITIES—their quirks of personality. For 13 years the New York Aquarium has struggled with the whims of a Velvet Cichlid (*Astronotus ocellatus*) that can't abide a big, roomy, comfortable tank.

As long as it can live in a tank 1 x 1 x 2 feet, the fish is happy and contented. Time after time, over the years, it has been given vastly bigger quarters, either alone or with other fish, and invariably it sulked, turned savage, fought its tankmates and refused to eat. Once it went five weeks without eating, until the Aquarium people gave in and put it back in its little tank.

The trouble is that tank size has a definitely limiting effect on the growth of fishes, and the midget tank is theoretically too small for a Velvet Cichlid that should reach a length of about 12 inches. Its growth will probably be stunted by its self-imposed confinement. It is 9 inches long now, and apparently has not increased for years.

A Brilliant FLASH— That's the Manakin's Display

By LEE S. CRANDALL

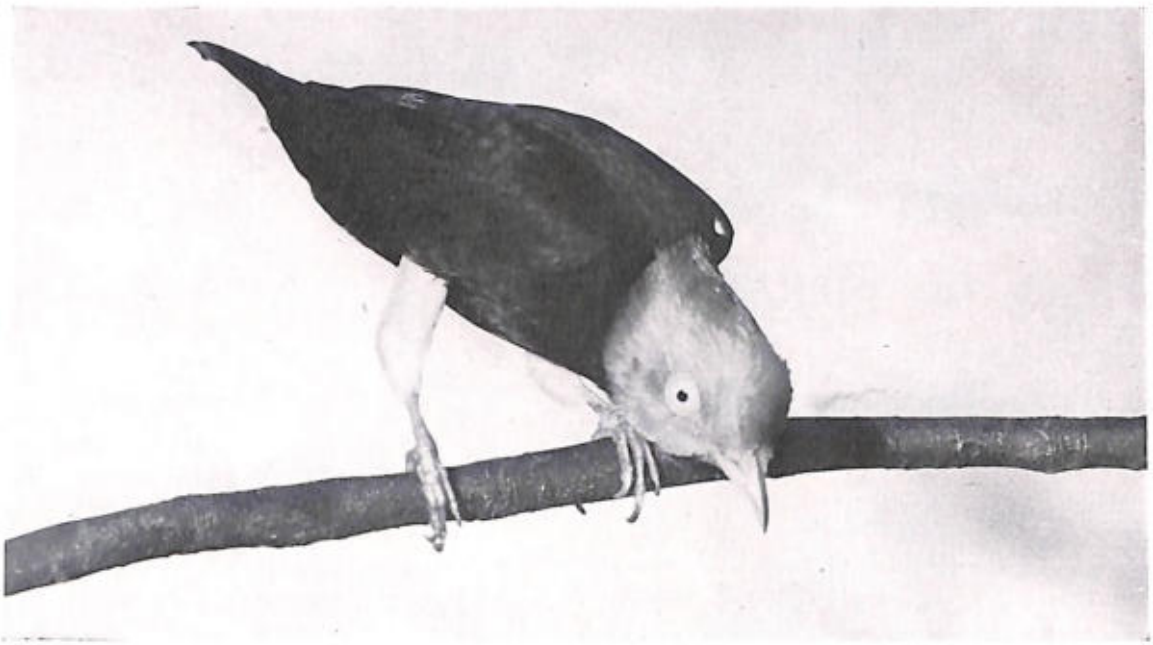
Thousands of visitors have viewed this colorful courtship but the most interested spectator of all is the somber-hued female. She is full of curiosity.

SIXTEEN YEARS AGO, Dr. Frank M. Chapman published a charming book called "My Tropical Air Castle." In it (pp. 175-7) appears a description of the courtship display of the Red-headed Manakin. In the Zoological Park, we call our birds the Yellow-thighed, for they came from western Costa Rica and represent a form of *Pipra mentalis* slightly different from the one found on Barro Colorado. In any case, we may certainly agree that the species is a particularly enchanting member of a lovely group. Doctor Chapman's account of the Manakin's antics is so fascinating that one feels certain that if the bird in the flesh could surely be seen, a trip to Panama would be justified indeed.

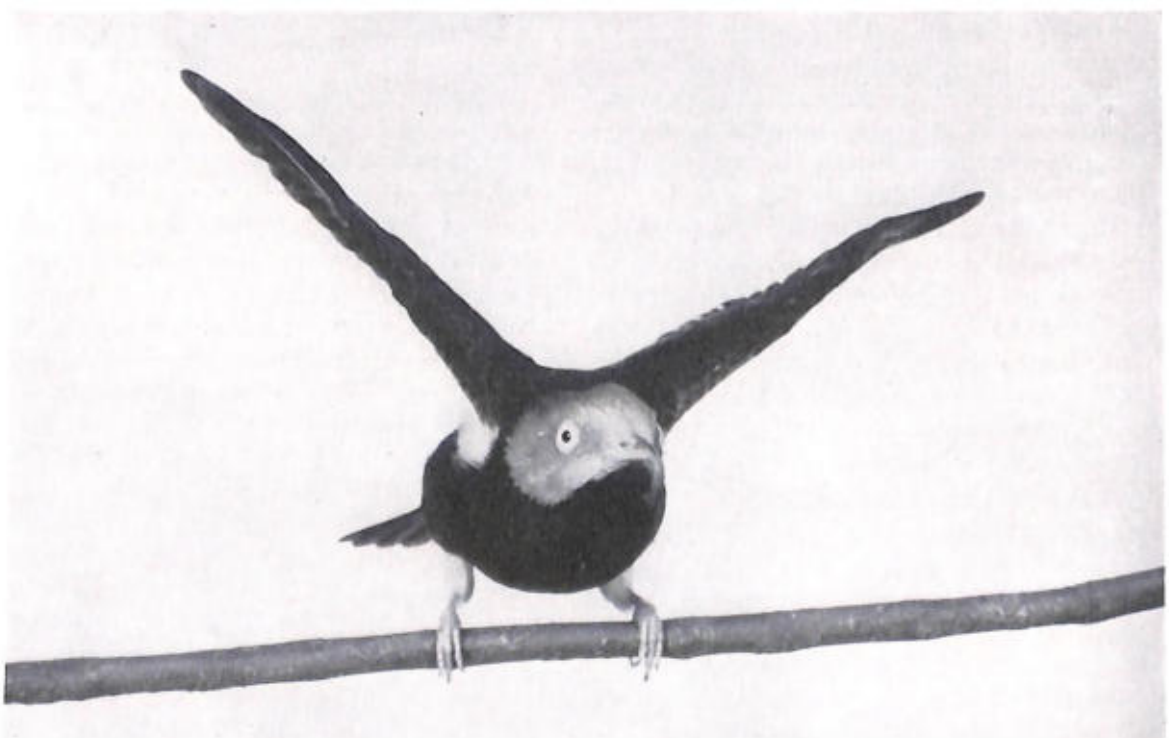
Yet, to the credit of our Bird House staff, it must be said that a visit there will bring the same reward. For in the glass-fronted aviary, in the Main Hall, which still houses hummingbirds, lives a pair of Yellow-thighed Manakins. The warm, humid atmosphere and dense tropical vegetation are ideally suited to Manakins and since these two were brought from western Costa Rica in 1942 by Charles Cordier, they have kept in perfect condition. A large printed label on a black and yellow pedestal calls attention to the marvel within. Thousands of visitors have seen what the label promises, though few of them have traversed the bush of Central America.

As you stand before the glass, you may well feel yourself transported to the jungles of Panama. Your attention is caught by a tiny black bird, touched with bits of scarlet and yellow. The cage is sound proof, so that you cannot hear the curious buzz of wings and the loud snapping sounds that accompany the movements of this brilliant creature. But the glass is clear and there is nothing to obstruct your vision.

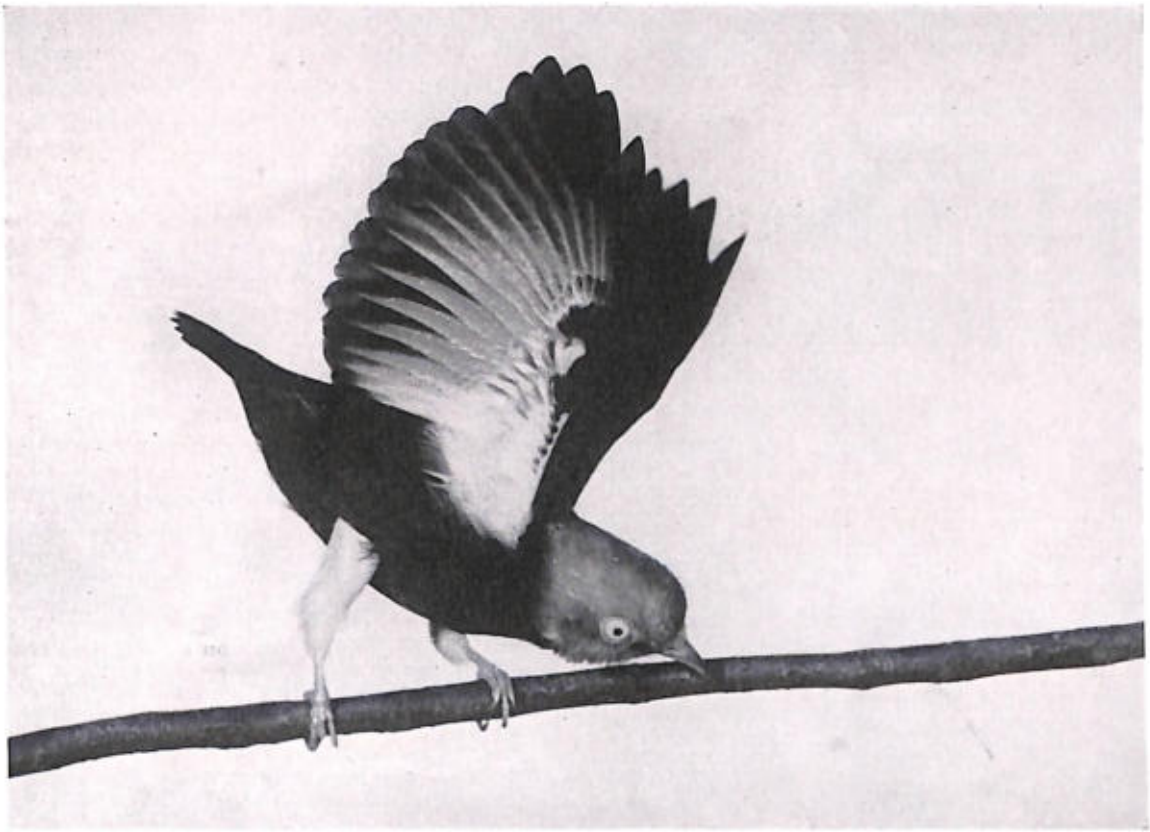
You see him sitting perfectly still on a thin, horizontal branch. His black, shiny body is stiff and taut, tilted well forward, with scarlet crown turned down. The legs are straight and rigid, yellow thighs exposed to the utmost. The stubby tail, almost ridiculous, is held upright. Long before you could read what is written here, there is a movement, fast as light. The little bird has reversed his position in a split second, turned his back and now is facing you again. You cannot believe what your eyes have barely seen, and to convince you, he repeats the process, perhaps five or six times. Now with a speed you cannot follow, he darts two feet away, freezes, then is back again, so fast you cannot tell whether he flew or leaped. Then begins the most curious phase of all. Holding his wings tight at first but later spreading them widely, he vibrates backward along the perch for a foot or more, leaps to his first position and then repeats. "Vibrates" is the proper word. The stiff little tail shakes jerkily as the golden thighs transmit the shock of tiny leaps. For while at first you cannot tell how it is done, you finally see that the movement is accomplished by a series of straight-legged jumps, so small and so very rapid that the little body seems to move in a perfectly straight line. The



At the beginning of his display, the Yellow-thighed Manakin sits perfectly still on a thin, horizontal branch. His black, shiny body is stiff and taut, tilted well forward, with the scarlet crown of the head turned well down. When he assumes that position he is ready for instant action.



Much too fast for the human eye to see, the Manakin goes into this stage of his display, in which he flexes his wings and flips back and forth on the perch, now facing the observer, now turning his back. These pictures were made at a camera speed of 1/1000th of a second to stop motion.



The most curious phase of the display is this, in which the Manakin "vibrates" backward along the perch for a foot or more, then leaps to his first position and repeats. The motion is accomplished by a series of straight-legged little jumps, all for a short distance and very rapid.

wings, usually spread at the end of the run, may very well aid the performer in keeping his balance.

Today as I watched, the female came to look on, too. She is a shy creature, dull green in color, with very large eyes. Perhaps it is these that give her a look of complete innocence. Certainly she was interested enough to cause her to move to the lower end of the display twig. But somehow she seemed motivated only by curiosity. Her great dark eyes were fixed on the bird she must have known to be her mate, but it was as though she could not imagine why he acted so strangely. When he jerked down the twig, she flinched as he neared the end of his run. When he darted back to his starting point, she obviously felt an impulse to follow, though she did not do so. Sometime she will act on that impulse. No one has ever bred a Manakin in captivity but there always has to be a first time.

The Key to Question House

By GRACE DAVALL

Can a kangaroo swim? Do animals ever get varicose veins? Do monkeys become bald? What are crocodile tears? How long is the tail of a hippopotamus? How can I teach my pet bear to skate? With questions like these, to the amount of several thousand each year, presented personally, by phone or by mail, monotony can scarcely find a place in the routine of the office of the General Curator at the New York Zoological Park. Undoubtedly the variety of questions cannot be duplicated elsewhere except, perhaps, in similar institutions.

It is not always possible to determine what elicits some of these queries and sometimes we might be inclined to doubt their importance or sincerity, but all are answered on their face value and probably there is some real reason behind each one. At least, we hope so. But why, we cannot help wonder, must somebody know whether or not turtle eggs bounce, or whether cats have tonsils? Finding the reason behind some queries often helps in the solution. A recent lengthy phone conversation could have been cut to a minimum had the caller stated his problem honestly at first. Instead, he made inquiry about the relationship of squirrels to the order Rodentia, on which point we attempted to enlighten him. Several minutes of conversation followed before we came to the realization that the gentleman had come into possession of a freshly killed squirrel and was endeavoring to dispel his own doubts about its edibility, considering that it was so closely related to rats. Perhaps that one should be charged to the war and the consequent meat shortage. To the war and cigarette scarcity we must also attribute a flood of calls from gullible individuals who have been beguiled into phoning RAymond 9-2090 on the promise that orders for Camels would be filled at that number.

Occasionally, though rarely, eccentrics phone or mail in questions or comments not entirely sensible, but as a rule they have the good grace to remail anonymous. A recent phone inquiry was a request for our opinion on how long it would take for a snake to digest a 500-pound pig. Since we knew of no snake large enough to attempt such a meal we declined to answer the question and the information seeker immediately capitulated and said he would settle for a 150 pound pig. He had merely been calling all around to note the reaction of various authorities!

It is obvious that our replies often settle wagers; the seriousness with which some questions are put would indicate possible loss of face in addition to financial involvement.

In recent months there has been a natural flood of letters from barracks, foxholes and government hospitals, to which we are happy to pay particular

Ask It and We'll Answer

In mid-June the Zoological Park will inaugurate Question House, a service that will attempt to give the best available answers to any question about animal life. The service will be free.

Question House will occupy an attractive room in the center of the Zoo.

We have no illusions about the magnitude of the job we are undertaking—but we are not entirely without experience. Miss Grace Davall, Assistant to the General Curator, has been answering animal questions for years. In this entertaining article she figuratively turns over the key to Question House to its new staff—at least, the key to some of the questions that interest the public.

attention. Sick or well, our men in Service always seem to find the time for discussions and arguments. Natural history subjects, which appear to take an important place, produce innumerable controversial points. In fact, quite a few Servicemen are regular correspondents. A query that frequently reaches us relates to the occurrence of lions in a small portion of Asia, as well as Africa, and the restriction of tigers to Asia. Relative strength of these two animals is often questioned, with a request for our opinion as to the outcome of an encounter between them. Longevity comes in for its share and to the remote corners of the world we send assurance that an elephant is old at fifty years, the best authentic record for a parrot is about fifty-five, and tortoises do *not* live to be five hundred years old—probably not even one hundred. The old favorite "Is a zebra white with black stripes or black with white stripes?" crops up frequently, also such sticklers as "How many mouse power would it take to make one horse power?" "How fast can an ant travel?" "Do horses have eye brows?" and "Why does a camel's breath smell?" Then, of course, there are the hundreds of requests for identification of mammals, birds and reptiles seen in remote places. Some are easy of solution, others may at least be run down to groups, but how to identify what amounts to a brown snake, two feet long or longer, seen "somewhere in the Pacific?"

Never a day passes that we do not receive visitors, phone calls and letters about pet animals. There is the owner of a parrot that suddenly begins to lay eggs, after masquerading for years under the name of "Davy" or "Dicky Boy." Or the woman who called excitedly on the phone to say that her turtle, recently acquired, had been lost in the apartment and where was the most logical place to look for it? Or still more on the humorous side, the call about a turtle that had fallen off the porch and soon afterward laid an egg, neither fact in itself particularly startling. But this person was quite certain that the turtle had been injured in the fall, had probably laid her egg prematurely and somewhere in the process had lost her maternal instinct. For no matter how often the owner put the egg under the turtle she refused to sit on it, and what *should* he do?

Queries about the everyday care of pet canaries, parrots, turtles, alligators, etc., including minor mishaps and illnesses, are routine affairs but there is a pleasant satisfaction associated with this phase of our work. Most people are very fond of their pets and are anxious to do everything in their power to care for them properly. Some are diffident in their approach; others, completely confident of sympathetic attention, regale us with endless tales about their particular pets. But the sincere gratitude of all is a pleasant reward for whatever efforts we might make in their behalf. The solicitousness of some pet owners, however, knows no bounds, as for instance the possessor of a Blue Racer that was not taking too kindly to captivity and handling. The amateur herpetologist wrote that he did not in the least mind being bitten by the snake but would we please assure him that no harm would come to his pet from these encounters? And there was the woman who called to tell us how she was taking the best possible care of her turtle but it did not seem to be responding properly. When she picked it up its limbs and head hung limp; was this a normal manifestation during winter hibernation? She finally admitted, quite reluctantly, that an increasingly unpleasant odor was associated with the creature. It is to be hoped that she followed our suggestion to deposit the turtle in the nearest incinerator at the earliest possible opportunity. Unfortunately, also, we were not able to be of much help to the pet chipmunk whose owner wrote that it was suffering from constant hiccoughs. The letter, coming from out of town, was delayed in reaching us and a week had elapsed between the date of writing and receipt at the Park. By that time, we felt certain that the chipmunk had either recovered or succumbed. And what could we have suggested, other than a sugar pap?

Strangely enough, our office has seasonal rushes. Spring brings us the oft-repeated query about deer shedding their antlers annually and summer brings every bit of snake lore out for an airing. Folks must constantly be assured that there are no poisonous water snakes in New England, that snakes do not swallow their young for

protection, do not steal milk from cows, "sting" with their tails or tongues, form hoops and propel themselves in this manner, ad infinitum. Then, of course, there is the frequent identification of all manner of wild creatures found on vacation jaunts in the country. Seasonal, indeed, is April Fool's Day, which would result in a hopeless jamming of our Park's switchboard were it not for the cooperation of the Telephone Company. All of our incoming calls on that day are covered by their special operators, equipped with lists of the Park's personnel – which do *not* include the names of Messrs. Fox, Wolf, Fish, Bear, etc.!

Spring also brings its baby bird problems. Many of these youngsters fall too early from the nest but some are fortunately found and kindly ministered to by human foster parents, who rear them past the critical feather-growing stage, then liberate them. One such little waif, a sparrow, was picked up by a business man. A complete novice in the art of bird-rearing, he called us concerning every minute detail of the baby's care. Hourly calls were followed by daily calls, the gentleman needlessly assuring us that the rearing of a baby bird was no trifling matter. After a week of this, the real and final worry developed: must the baby bird be taught to fly? He hadn't so much minded the early rising to care for and feed the little fellow, but darned if he would stand on a chair, flap his arms and jump off, just to teach it how to fly!

Rarely does a lunch hour pass, especially a rainy day lunch hour, without calls from office or factory groups. From them, probably more than from any other source, comes our year-round stand-by: what is the gestation period of elephants? The nine-year myth is so firmly imbedded in the minds of many people that it is hard to shift. So familiar are we with the question that we are able to anticipate it, no matter how subtle the approach, or how delicate. Our answer of twenty to twenty-two months has undoubtedly lost or won many a wager. Less helpful is our reply to the oft-repeated request, very often a lunch hour item, for a specific name for a female wolf. Our best and only suggestion, "she wolf," does not always appear to satisfy and those inquiring are left to their own devices to conjure up an appropriate name for some lusty lady under discussion.

Not all requests, of course, are made to satisfy personal whims. Social and economic subjects come in for a large share of attention. Sparrows in airplane hangars, gulls on airport runways, skunks under houses, squirrels in the attic and pigeons all around – these problems must be dealt with, each with its individual ramifications. And none is easy of complete solution. One downtown business house thought it had the pigeon problem well in hand, at least in theory. All the manager required was some fertile Pigeon Hawk eggs which he planned to put in the nests of pigeons that lived and roosted on the building. From there on, he figured that nature would take care of things.

Another inquirer, bent on preservation of pigeons rather than their destruction, asked about the practicability of repeated doses of epsom salts for his racing birds. He had read that Army sharpshooters take some just before combat to improve their vision; why wouldn't his birds benefit in like manner? As a matter of fact, such medication is a common practice among racing pigeon fanciers.

Rodents, snakes and all manner of insects harass many home owners. Most people attempt to overcome their problems before making inquiries and many call merely to ask for confirmation of some scheme they have in mind such as, for instance, the plan to feed poisoned blood to bedbugs, a pig to rid a field of snakes or a snake to rid a house of mice. One person making the last-mentioned inquiry laid his plans carefully; he asked from us an estimate of the cost of a snake, how often the snake would feed and how long it would take the snake to eat up its cost price in mice. Also on the cautious side was the woman whose home had been invaded by a snake. A four-page letter told of the distressing situation with maids leaving and the household in general uproar. The letter ended with an urgent appeal for help–but with the following restriction: "If there is any charge for this information, don't send it."

Certainly under the heading of economics comes the problem of a doctor from the Deep South. One of his patients took too literally his statement that he would accept his fees in "anything from kawn likker to rattlesnakes," and the doctor wanted to know the trade-in value of five big Diamond-backs in his possession.

Constantly besieged with multiplication problems of owners of rabbits, rats and mice, we still may sympathize with the rooming house owner whose tenant slipped out owing board but leaving behind four white rats which had made the gracious effort to repay for the hospitality offered them by producing progeny to the number of sixty. That was another matter of trade-in value, la[illegible]n which the rats should have been allowed a little so[illegible] more time to even the score.

Strange requests, too numerous to mention, are made each year. Some may be complied with easily, others with reservations or not at all. We did supply a few feathers from a white pheasant, although we lacked the faith of the recipient that they would help to cure his brother in Italy, suffering from some lingering malady. Nor could we be convinced that stork droppings would have the suggested desired results. An ounce of hippopotamus sweat we did not even attempt to gather, even though the person requesting it gave us the option of providing it dried or in a vinegar solution. Children often write in for pet animals – monkeys, baby bears, baby lions, donkeys or even Giant Pandas. One of the most appealing was from a youngster of six who confided that he had "some dollars" in his bank and would we please send him, at Christmas, a gorilla. But if we did not have a gorilla, then please a zebra, for to pull his wagon. He liked horses.

Under a psychological rather than an economic heading would be the offer of one man to allow himself to be bitten, for a price, by any poisonous snake. His claim to immunity was somewhat offset by his admission that, although bitten several hundred times by many kinds of poisonous snakes, to date he had lost *only* his left arm, three fingers on his right hand and one leg.

The problem of a "bird lover" who professed a keen interest and liking for all birds, but could not tolerate the cooing of pigeons, was also deposited on our doorstep. Since removal of the pigeons was not feasible, we could only suggest a personal adjustment, either mental or physical.

Prepared for almost any kind of question, we were nevertheless taken by surprise one day with "Do cows have tartar on their teeth?" A call to our Veterinarian confirmed our impression that they are not free of this dental problem but that they are not as subject to it as are carnivorous animals.

Giraffes and elephants are subjects of frequent discussion and dispute. Inquiries about giraffes are generally centered on their necks. Perhaps it is difficult for many people to believe that this very long member contains only the seven neck vertebrae found in most mammals and that the giraffe does not suffer more frequently or violently from sore throat than other animals. Nor is it entirely voiceless. The giraffe has a larynx and can expel air through it, making a low mooing sound, which it is unable to modify. And elephants are not really afraid of mice, although children's books and folk lore would have us believe this. The control of mice has always been a problem in our Elephant House and the pachyderms seem almost unaware of their presence, though there is little doubt that it would be inadvisable for a mouse to attempt to crawl up an elephant's trunk. Fascination by the legend that elephants in their last days travel to a common grave, prompts many people to call us for confirmation, or for information about the location of this elephant cemetery. Perhaps there is the lure of cornering the ivory market, should this mythical spot become a reality.

National or local word puzzle contests always produce a flurry of inquiries that sometimes attain avalanche proportions. A two-day check kept during one of these contests recently showed 256 calls and dozens of letters, begging for the name of one pictured mammal. Descriptions were so varied and included so many strange characteristics that we certainly doubted they could all be embodied in one animal. However, eventually the newspaper illustration of this creature was produced and it turned out to be the

Yapock, a tropical American water-opossum. Little wonder the average newspaper reader was unfamiliar with the species which, to our knowledge, has never been exhibited alive in any zoo.

We do not always please and satisfy. Quite recently a woman writer found it necessary to refer to some bird that sings only at night and she was quite certain the answer was the nightingale or the mockingbird. Calling for confirmation, she was angry and indignant when told that both species sing by day as well as night, and hung up expressing her displeasure at having "wasted her time trying to obtain information." All she had wanted was confirmation in error.

Occasionally, but rarely, we must confess to some loss of patience. We sympathize completely, for instance, with a free lance writer who may come or call, thinking it would be nice to do a story about storks. But it would be more considerate of him if he did a little preliminary research first instead of expecting to be supplied completely with all basic information as well as anecdotes to enliven his literary efforts. A few such appeals may be taken care of, but the world does seem remarkably full of free lance writers with sketchy ideas. Teachers, also, sometimes take short-cuts in making class room assignments in natural history. Recently three small boys came into the office for help on their school project, which was "The Evolution of Vertebrates." Questioning revealed that they were not entirely sure what they required but would like information on how birds, mammals and reptiles originated, how they now survive, what they feed on and how they live, and what are their chances for continued success. They were understanding when we explained that the subject could not possibly be contained in a term theme, no matter how briefly treated, and suggested that they ask their teacher to narrow down the assignment. That was on Saturday. On Tuesday they came back, all smiles. One had been assigned reptiles, the other birds and the third mammals!

Probably the pinnacle of information-seeking was reached in a letter from a student interested in monkeys. The questions in his letter were sensible, but *so* numerous. Surely he had covered the field. But he was taking no chances and finished his letter thus: "And please answer any questions I have left out."

One Day's Harvest of Questions

Just in case anyone has any lingering doubts about the variety of questions that flow into the Zoological Park by telephone, here is an actual list of the questions that were asked by telephone in the course of one day in May:

How many Kangaroos are there in the United States now?

How and what do you feed newly-hatched snails?

Where can I get a tame bull for use in a Mock Toreador show that will run all summer?

What is a Kangaroo's pouch lined with?

How often do Lions eat, in a wild state?

Do Ferrets have a keen sense of sight and smell?

Would Squirrels and Rats cross-breed?

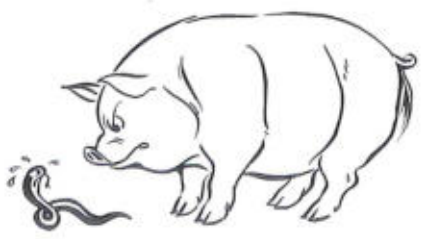
Are apes right-handed or left-handed?

When are Peacocks in full feather?

What is the longevity of Kangaroos?

Do Seahorses have any special or symbolic significance?

How can I tell the difference between frog's eggs and toad's eggs?



ABOUT BULL SNAKES

By EARL JACKSON
National Park Service

As I WAS DRIVING ALONG a country road in central Arizona one evening I met the largest bull snake I have ever seen—stretched squarely and typically across the road. For an instant my brain misdoubted the testimony of my eyes, for this snake seemed to be measured in yards instead of in feet – and, indeed, it proved to be somewhat more than my own length of six feet four inches, although not up to the recorded maximum of seven feet eight inches.

Now, I have a long-standing aversion to handling large snakes. I also have an aversion to running over them in an automobile, or to killing them in any other way. But I was in a hurry and this fine specimen of *Pituophis sayi affinis* had learned that a hard-packed roadway retains the sun's heat at night much longer than the adjacent loose earth. Since its body is lacking in thermostatic control, it is almost entirely dependent upon its surroundings for its body heat and it was reluctant to give up a warm berth across the road for the sake of a mere flivver.

There was nothing to it but to get out of the car and try to shoo the snake away. Very leisurely, it began to glide away – but *very* leisurely. I decided to give it a lift and incidentally to assist it far enough from the road so that it would not be likely to risk its neck crossing it again. I stepped quickly toward it and it reacted instantly, bridling and turning to assume the coiled defensive position, vibrating its tail and rudely sticking out its long tongue.

It seemed a good time for me to overcome my own timidity about big snakes so I waited a moment until it had calmed and had started crawling away. Then, using slow motion, I approached and placed my hand gently on its tail. According to pattern, it jerked its head angrily back, but not far enough to bite me. The touch disturbed the snake enough so that it decided to retreat in more haste. I again touched its tail, this time getting a gentle grip, and as its efforts to escape became more intense I worked my hands, one after the other, gently and slowly but firmly toward its equator. By this time I was near enough the head to reach out with my free hand and grasp the body snugly just behind the head. After only a moderate amount of struggling the bull snake became quite calm, and I let it coil around my arm. After a few moments of quiet handling I released its head, and found it as tractable as bull snakes are supposed to be.

The significant thing to me about carrying this snake away from the highway was that it was the first time I had been able to overcome my reluctance to handle a large snake – and to the snake it should have been of importance that I probably saved its life from the next truck or automobile that came along that road. For despite its beneficial habits and the fact that it is known to many people, the bull snake often meets death from automobiles. Motorists kill many purely by accident, along with other snakes that cross the road, but often I have seen a driver deliberately swerve his car to run over a bull snake. The reptile can move its head and the forward third of its body out of reach of an automobile wheel so quickly that the eye can scarcely register the motion, but the remainder of its body is not so agile and a speeding car that aims at the middle of the snake can easily do it in.

My next encounter with a bull snake was with a much smaller specimen under rather curious circumstances. It was in late May and my wife and I were walking across a sandy patch of dry

More than two yards of bull snake going peacefully about its business at the Montezuma Castle National Monument. Big as the snake is, it is of philosophic temperament and easily can be tamed —so much so that the snake is often used by "snake charmers" in their exhibitions. *E. Jackson Photo*

creek bed when we came upon a juvenile snake only 13 inches long; probably it would not have had its first birthday until some time in July. At this first meeting we saw only four inches of its body, for the rest of it was under the sand. It must have been wishing the other portion was hidden, too, for it was very securely held between the teeth of a 22-inch California king snake (*Lampropeltis getulus californiae*).

The desperate contortions of the king snake attracted our attention. He (I think "he" was a "he") was trying to gain traction so that he could pull his prey out of the sand. It was clear what had happened. The king snake had seen the baby bull snake in a little open space between the weeds and had pursued it. The baby beat a quick retreat but was not quite agile enough to keep its tail from being nabbed.

The aggressor, preferring the front end of a victim because of ease in overcoming and swallowing it, was loath to accept the tail, but apparently figured it was better than nothing. He held on, and the little bull snake, unable to drag its heavier enemy after it, went down. Not for nothing had a long line of burrowing ancestors given it a hard snout and the instinct to use it. It struggled until its head and one coil of its body were out of sight in the soft sand, then the muscular little frame pulled farther under by slow degrees, until it reached the stage at which we found it.

For fifteen minutes we watched the struggle. An inch was all the antagonists could gain, either way. The king snake was much stronger and heavier, but without even a blade of grass for his frantically groping tail to hang to, he was nearly helpless.

Each time the king snake lashed his body about, seeking traction, the bull snake crawled a little farther under the sand. Finally, in one desperate surge of energy, it pulled its imprisoned tail tip entirely under the surface, the enemy's head still hanging on. For several minutes more nothing was visible but the writhing king snake's body, from the neck back.

If you had your mouth open under the sand, even though it was stuffed with a hot dog, sand would get in and it would be mighty uncomfortable. The king snake finally had to turn loose and bring his head back to the surface. He lay

there for several minutes, the picture of complete exhaustion, restlessly working his jaws as if to get the dry sand out of his mouth, and having very little luck. Wondering how the bull baby was, we dug down about four inches and pulled it out. It seemed in perfect condition, and not distressed by the sand. We released it a short distance away, then carried the king snake to a pool of water in the creek, and gave him a bath which he didn't like at all, but which got the grit out of his teeth.

One investigator was fortunate enough to find a female bull snake in mid-May when she was about to lay her eggs.[1] She traversed about 100 yards of a field planted with squash and cucumber vines, pausing frequently to test the quality of the soil with her snout. She finally selected a spot by the side of a row of plants, where the soil was less loose and sandy and more favorable for the construction of a nest. Excavation began by loosening the soil with her head; she simply pushed it under the surface, throwing out the loose dirt, and brushed away loosened soil with her tail. A tunnel was finally constructed of sufficient length to conceal her entirely. She remained hidden until her eggs were laid, whereupon she closed the entrance and deserted the spot. Upon excavation, 10 eggs were found to occupy an enlargement of the tunnel six to eight inches below the surface, where they were stuck together in a single cluster.

Howard K. Gloyd reported finding burrows of pocket gophers which had been opened from the outside by bull snakes. The excavated earth was piled in concentric ridges. It is small wonder that bull snakes are such a menace to that clan.

Its weakness for rodent meat causes the bull snake lots of trouble, for it is often found with bad scars on its body, caused by the sharp teeth of rodents. Apparently the snake can capture these creatures in their tunnels. When attacking in a narrow space, instead of attempting to coil around the victim the reptile compresses it against one wall until it is crushed into submission, then swallows it head first. Small, weak victims are often swallowed alive. Larger prey, when not in a confined area, is killed by constriction first.

[1] "Variations and Relationships in the Snakes of the Genus Pituophis," by Olive Griffith Stull.

All six species and thirteen forms of bull snake have a similar and rather varied diet. The greater part of their food is small mammals, especially pocket gophers, rats, mice, ground squirrels, young rabbits, occasionally lizards, and even other snakes. One individual was actually reported as dining on a small rattlesnake. Unfortunately, like some humans, they cannot always stay on the path of virtue, and sometimes eat birds and eggs.

Herpetologists realize that bull snakes eat almost the same food as rattlesnakes. They are competitors, in some localities. If, within a given area, a number of one type is killed off, that diminution automatically allows room for the other species to become more numerous on the same food supply. Knowledge of this fact alone should cause many people, who otherwise thoughtlessly destroy all snakes, to save bull snakes.

Our friend *Pituophis* sometimes swallows eggs, but one must not get the idea that a bull snake is an egg epicure, for eggs are only one small part of its diet. Its real value, part of which can be measured in dollars and cents, is shown by such cases as the following:

One specimen five feet long, found dead on a road next to an alfalfa field at harvest time, contained 35 small mice. Grinnell, an eminent naturalist, cited the bull snake for its great value as a destroyer of pocket gophers and squirrels, and the Bronx Zoo's Dr. Ditmars stated that they are highly valuable for their control of several species of very injurious ground squirrels.

Experiments performed by Gloyd and others indicated that the average number of pocket gophers to an acre of alfalfa is about eight. A bull snake five feet long is able to destroy annually all those on an acre and a half, which amounts to a saving to the farmer of $3.75 a season. Other good observers say the bull snake is a much more effective ratter than most cats, and around the barn pays for itself many times over – unless, as sometimes happens, it gets to eating hen eggs or small chickens. Some California ranchers have enough faith in bull snakes to collect them and turn them loose in gopher burrows on their property.

I have often run across a bull snake crawling or loafing in a big rat nest. Being a thoroughly

logical reptile, it sees here an excellent shelter against possible enemies and the sun's heat, and a likely looking hash house. For it loves rats. This taste earns it many aches and pains, for a rat is an effective foe. For that matter, the snake also gets into grave difficulties with the rock squirrel (a bushy-tailed ground squirrel). On May 12, 1941, at about 10 A.M., three men were talking together near the parking area of Montezuma Castle National Monument, in central Arizona. Suddenly their attention was drawn by three squirrels making excited lunges into the tall weeds at the edge of the walkway, at the base of a steep bank. First one squirrel would dart down into the weeds, turn and dash madly up the bank, then another would lunge down and follow suit. The watchers started over to investigate, just as I arrived, and pointed out a five-foot bull snake in the weeds.

He was much the worse for wear and tear. Those four-footed villains had found him in this comparatively unprotected spot and ganged up on him. There were several large, bloody gashes on his body, from two or three of which blood was still oozing. He was so far spent that he offered very little hostility when I picked him up. Another half hour of attack and his career would have been over. I put him safely away in our snake box in the cool basement. Next morning, when he was released in a safer spot, he acted much livelier.

The bull snake moults, of course – all snakes do. I do not know how often this normally occurs. One authority thinks bull snakes have a fairly cyclical period of eating, fasting and moulting, about every 30 days. Another kept *Pituophis* in captivity for four months before it moulted, but of course these conditions were unnatural. It is easy to tell when a snake is about to shed. The coverings of its eyes grow dull and lusterless, and spots may occur in places on the body where the dead skin is pulling loose. Finally, when ready to shed, the snake seeks something rough to rub its head against, to loosen the skin from the lips. This done, it goes into a period of intense activity and violent muscular contraction and expansion, in order to separate the dead skin from the body. The creature seeks a place with a rough surface to catch the cast-off garment. Sometimes the skin comes off in one piece. The snake secretes a fluid which enables it the more easily to separate the dead skin from living tissue. One man watched a bull snake shed its skin in 35 minutes.

I was disappointed one day to be a few hours too late to witness a shedding. A garden hose was coiled rather loosely in the yard, and in and out and round about through the coils was the complete skin of a bull snake that must have been well over five feet long.

Bull snakes are widely spread in the United States, being found from sea level to several thousand feet elevation. Stull defines the range as Guatemala to Canada, including most of Mexico, and all of the United States west of the Mississippi, and east of the Mississippi in Wisconsin, Illinois, Indiana, Tennessee (?), and all the states of the Atlantic coast from Alabama to southeastern New York. You may find him called bull snake, pine snake or gopher snake; in Mexico he is known as the cencuate, or alicante; and in Lower California as the corallilo.

Despite its concealing pattern, the bull snake is inevitably conspicuous because of its size. Records of specimens seven feet eight inches long have been accepted by authorities as authentic, and longer specimens have probably been seen. Those from Arizona are by no means pygmies, as I realized one day when I saw a bull snake stretched across a doorstep, on its leisurely way around the building. The doorstep was exactly six feet long, and there were inches of snake hanging over at either end! It was not less than six feet six inches long, possibly six feet eight.

Earlier I mentioned having seen motorists deliberately try to run over bull snakes on the road. Ask a driver why he does such a thing and he will be likely to reply, "Heck, I thought it was a rattlesnake."

I have even seen farmer boys kill bull snakes – sometimes confusing them with rattlesnakes, but mostly, I fear, simply because they feel they should kill any snakes on sight. Apparently we human beings have a lot of suppressed murder down deep in our hearts, and it often comes out in the slaughter of snakes and other harmless creatures.

There is some reason for confusing a bull snake with a rattlesnake, because of resemblance

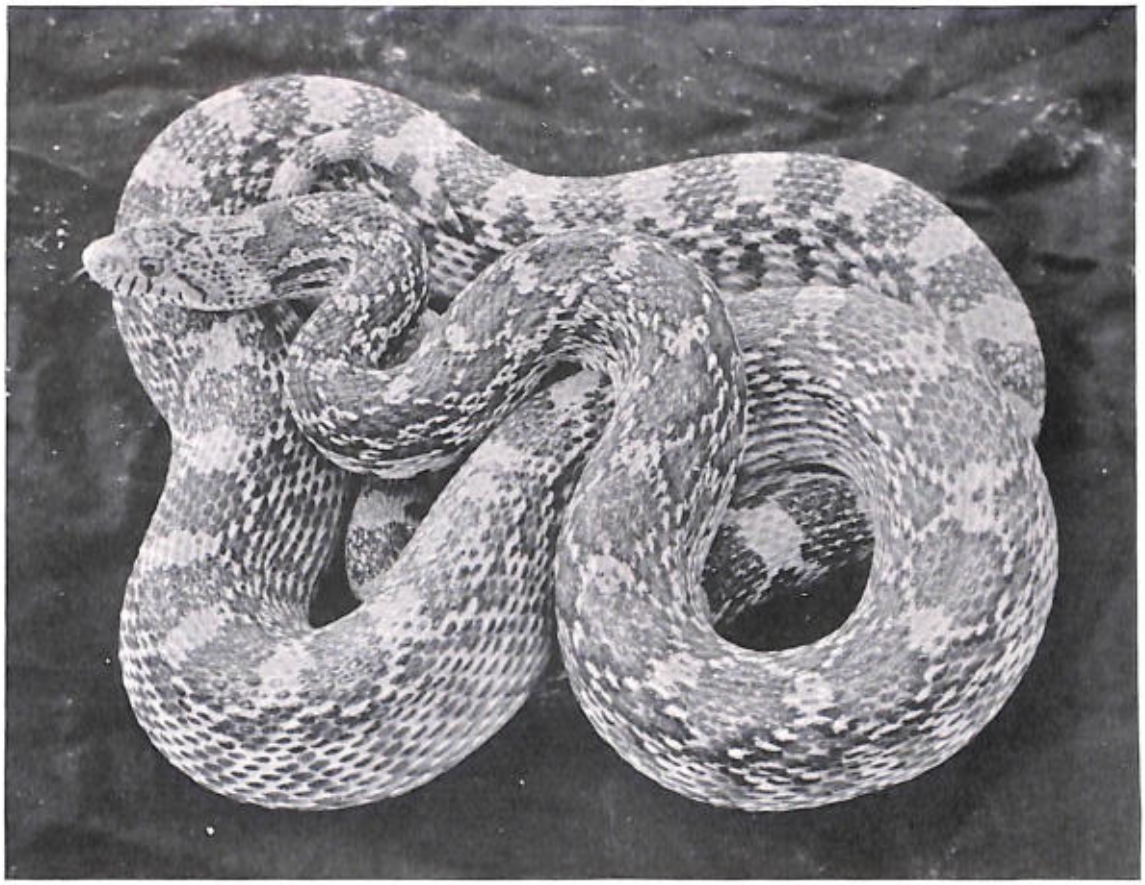


Photo Courtesy National Park Service

Bull snakes which have recently shed often appear lighter in color for a few days. Notice the tiny head, which is in strong contrast to the broad, arrow-shaped head of a rattlesnake. There is really very little excuse for confusing the two reptiles, although Mr. Jackson finds that such confusion does exist.

in color and length, but even at a distance it is easy to see numerous differences. For instance, a bull snake is streamlined from tip to tip; its head is so small and round that it is hard to tell where head leaves off and neck begins. The rattlesnake, on the other hand, has a broad, flattened head on a graceful, slender neck which is out of keeping with its chunky, heavy body. Compare a tap dancer to a heavyweight boxer and you see the difference between the two snakes. Besides, a bull snake has no rattles.

It must be admitted, however, that the bull snake's habits of mimicry cause it a lot of trouble. For it will often vibrate its tail so rapidly, when alarmed or irritated, that if it touches dry leaves or sticks it can easily suggest to a nervous watcher the sound of a rattlesnake. Besides, it has an awe-inspiring habit of hissing very loudly. To many people, any snake that "hisses" must be deadly poisonous! One writer described the hissing as being very loud and hollow-sounding, like distant thunder! Another observer said it bore a remote resemblance to the bellow of a bull – hence the common name.

The noise is made by the vibration of a small flap on the floor of the mouth immediately in front of the wind pipe. As the snake forcibly expels air from its lungs, this flap splits the blast and produces a sound audible for some little distance. The bull snake's blowing causes some people to call it the "Blow Snake."

In addition to huffing and puffing, our friend will really fight when necessary. He prefers to back up against some object, or to coil his body around a bush or stake. With this barrier to absorb his recoil, a full grown specimen can effectively defend himself by repeated savage blows against the attack of an ordinary dog.

Why Should I Join the Zoological Society?

PLEAS FOR NEW MEMBERS have gone to all those who support the New York Zoological Society, and the officers and staff are gratified by the quick and generous response which many have made. Yet, at a time when people are being requested to give substantial backing to so many worthy causes, the question, "Why should I join the Zoological Society?" may sometimes reasonably arise, and surely needs an answer.

Certainly the horror of recent news impresses all of us with our obligation to foster those relief agencies which deal directly with the vast problem of human misery arising from the war. Yet it must be admitted that to give all of our attention to these vital organizations is equivalent to spending all our means to patch the roof when an entirely new roof is indicated. If the world is to progress, if civilization is ever to be able to look itself in the face again, it is necessary for thoughtful people to take renewed interest in those forces that will teach man to live at better terms with himself. Greater means for man's study of his environment and his adjustment to it are necessary if a permanently peaceful world is ever to be established.

With proper modesty, the New York Zoological Society in its post-war plans is dedicated to just this end: the establishment and maintenance of means by which the general public and the student may increase their knowledge of the world in which they live, and may thereby find a more happy adjustment to it for themselves and for their children. New plans for the extension of animal exhibition by continental habitats, the new Department of Insects and the new Aquarium will round out an exhibition program of greater breadth and interest than has ever been attempted before. The proposed Conservation Exhibit will bring the problems of natural resource preservation forcefully to every citizen. Expansion of our resources for scientific research through our Scientific Advisory Council will make the Society an increasing force in the field of comparative medicine. The Society thus intends to equip itself as a complete foundation of zoological exposition and research as soon as possible after the war.

This is an ambitious program and its attainment is dependent upon many more items than blueprints, models and hope. It requires a far greater public support than the Society has ever had before. At its peak in the middle '20's the Society had a membership of some 2,400. In that period after the last war there was a decided upsurge in interest which may naturally be expected to occur again. During the depression years membership declined and for a long period there was no revival of interest. In the last five years this decline has been stemmed, and membership is increasing on a sharply upward line. New members during the first four months of

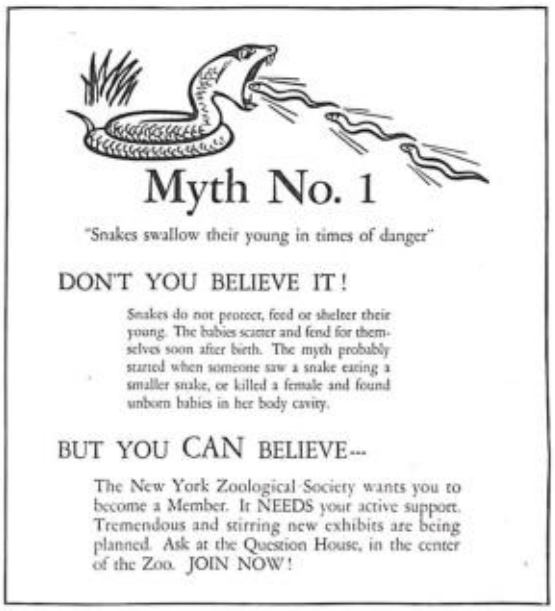
1945 exceed the total of new members for the previous year.

It is axiomatic that the more members the Society has, the greater can be the privileges conferred and the facilities supplied. The Society has never sought members for profit, and we return nearly the whole of the modest membership fee in the costs of the privileges now extended. With a greater membership, privileges can be increased, and it is our hope that this coming season we will be able to announce new facilities greatly enhancing the value of membership.

A new type of signs and bulletins within the Park will extend the Society's invitation to the public to join us in this campaign for what we hope will be the finest zoological foundation in human history. A list is being compiled of all persons who should have a direct interest in supporting one or another of our important new projects. These persons will be regularly informed of our desire for their membership. Present members and past members will be subjected to a modest but regular plea to give us their endorsement by sending us recruits. We expect to turn every stone in an effort to enlist the active support of all persons who have a basic interest in our future plans.

There are many people who would enjoy membership in the Society, but who do not realize their eligibility. Many people perhaps feel that membership is a matter of invitation or that they must qualify by some educational standard. Many more may not realize the fact that the Society is fundamental to the growth and development of the Park and its remarkable collections, and to the creation of the new Aquarium. Many of these would readily join if the sound aims of the Society were brought to their attention.

"Why should I join the Zoological Society?" is a question which is answered by the fact that only through a large and progressive membership can this fine goal of the Society be reached: the establishment of a zoological foundation that will make an important, continuing contribution to those sciences upon which man's future welfare must in large part rely. The moral support of a much larger and more representative part of our people is essential to our future needs.



"Myth" posters like this one, explaining the Society's membership aims, invite the public's eye.

Every member who recruits a new membership speeds the day when the New York Zoological Society will emerge into a new era of greater interest, influence and value for the post-war community. Every new member increases the possibility of our being able to advance the value of membership privileges for those already within our ranks.

Problem of the Invisible Baby Fish

By WILLIAM BRIDGES

So much publicity has been focussed on our Tiger, Lion and Black Leopard cubs that one group of babies has been overlooked – tropical fish that have been hatching in the Aquarium within a few yards of the popular cubs.

Not even the doting staff of the Aquarium could successfully maintain that fish fry are as appealing as tiger cubs, but the reactions evoked in a fish tank when eggs or fry are present *do* have a considerable public interest. The problem, as Curator Christopher Coates comments, is to explain what is going on and to point out the virtually invisible babies to the public.

Mr. Coates' current problem concerns a pair of Ruby Jewelfish (*Hemichromis bimaculatus*), freshwater cichlids from tropical Africa. Most of the time they are extremely unspectacular – olive-brown, dumpy-bodied little creatures about two inches long. They begin to justify their resplendent common name only when their breeding cycle starts, for then the male turns ruby red and the female takes on reddish overtones.

Many generations of the Jewelfish have been bred in the Aquarium and several specimens were on exhibition recently when one pair began to show the telltale coloring. They worked industriously on a square inch of rock in the bottom of their tank, cleaning it off as a respository of their eggs. The Aquarium staff did not see the actual spawning, but there was no doubt about the presence of the eggs, for the breeding pair defended their nest area fiercely and drove the other fish into the farthest corners of the tank.

Only his knowledge of Jewelfish habits told Curator Coates when the eggs had begun to hatch, for the fry are mere pinheads, about a sixteenth of an inch long, and much of the body and tail is transparent. Actually all that can be seen when they first hatch is a minute, animated black dot that represents the eyes of the fry.

The Ruby Jewelfish is an assiduous parent and its eggs—tiny white specks—are always well guarded.

When he saw, however, that the parents were making repeated trips to the egg site, picking something off with their mouths, and hastening to a shallow, spoon-shaped depression in the sand, Coates knew that the babies were hatching and that the parents were depositing them head down in the sand. By steady inspection, squinting along the floor of the sand, he could see a faint shimmering of the water above the sand – the baby tails were wriggling and were just barely visible as a mass effect.

In order to assist the parents and lessen the danger of other Jewelfish breaking through their guard and devouring the babies, Coates dipped out of the tank all the Jewelfish except the parents and their young.

And then for a few hours he was certain he had spoiled everything. The babies had disappeared. Coates figured that in the excitement of the other fish being removed, the parents had devoured their own young – a common, fright-induced reaction.

But the next day all was well – the parents had merely taken the babies into their own mouths for protection, and when the excitement had passed they were carefully re-deposited in the "nursery" in the sand.

For the first few days of their lives, after they have gained enough size to wriggle around the tank by themselves, the babies are carefully herded back to the "nursery" at night by their parents. But they grow rapidly and within a couple of weeks they are large enough to lead their own lives.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

The Garden Party is on June 14: Be Sure to Reserve the Date

The Zoological Park is traditionally—and usually actually—looking its best at the time of the Spring Garden Party. The party this year falls on Thursday, June 14, and a program and invitations will be sent to the entire membership about the time this issue of ANIMAL KINGDOM appears.

A number of new exhibits will be opened on Garden Party day—a slight indication of the vigor and activity of the Society even under wartime restrictions. It will be an excellent opportunity for Members to introduce interested friends to the work of the Society.

It's Baby Time Again

Looking back over the years, it seems that baby Zebras are by no means a novelty in the Zoological Park—yet each new one strikes the staff and visitors as the nicest of the whole series. That is particularly the case with little "Andy," born on May 15, for he is surely one of the strongest and healthiest of all the long line of Zebra colts.

Having had advance intimations that a colt might arrive any day, the keeper of the Zebra House prepared for the event by carpeting the expectant mother's stall with hay. His plans were not in accord with the mother's, however, for during the night she went outside into the hard and stony corral, and there the baby was born. It was very much on its feet, ambling in a stiff-legged fashion after its mother, when the keeper arrived early in the morning.

This is the first Zebra colt born in the Zoo in a little more than two years.

Far rarer is another recent birth—two baby Skunks that arrived on May 16. Skunks, certainly, are not rare in a state of nature, but they are unusual in a zoological park and our last previous record dates back to 1923. Mother and babies are doing well in the Small Mammal House but are not likely to be seen by visitors for several weeks, until the babies' eyes are open and they start following their mother.

Three Coyotes were born on May 6, two African Palm Civets on April 22 and four Raccoons on April 13. All are in the Small Mammal House.

New Members of the Society

New Members of the New York Zoological Society since the last issue of this magazine are the following:

LIFE

Hiram B. D. Blauvelt
Mrs. Suydam Cutting
Mrs. James W. Fesler
Joseph V. McMullan
Louis W. Maraventano, B.S.M.D.

ANNUAL

Albert Andriesse
William B. Baer
Mrs. William Foster Banks
Courtlandt D. Barnes
Mrs. Mildred Bello
Gordon William Berger
Peter Brandon
Carl W. Buchheister
Lt. D. Homer Buck, USMCR
Mrs. Walker G. Buckner
Harold R. Caffyn
Mrs. Joseph M. Cannon
Homer M. Clark
Henry Parsons Coolidge
J. T. Collidge
Baroness Alain deRothschild
Mrs. H. Laurence Dowd
C. Brayton Eddy
John Frederics
Mrs. L. Funke
Mrs. Frederick C. Gans
Frances B. Godwin
A. M. Gardiner
Miss Joan W. Greene
Waldo Grose
Albert Gubar
Chauncey J. Hamlin
Paul Hammond
Mrs. Alfred T. Hess
F. B. Hoffman
Mrs. Lytle Hull
Burton N. Johns
Leo B. Kagan
Dr. Barnett Kessler
Mrs. Homer Laughlin, Jr.
Richard W. Lawrence
H. T. Lindeberg
Louis Leu
James H. Lowell
Jesse J. Ludwig
Mrs. Henry J. Mali
G. W. C. McCarter
Walter Gordon Merritt
Mrs. Walter Gordon Merritt
Lt. Comdr. A. B. Miller, USNR
Sanford Miles
Miss Jane Moller
Wallace Murray Morse
Mrs. M. L. Neumoegen
Miss Charlotte Niles
Jules Pierre, M.D.
Eugene Henry Primoff
Thomas H. Powers
Mrs. Thomas H. Powers
Miss Florence Rand
William Rehwinkel
Ellis H. Robison
Miss Pauline L. Robinson
William A. Rockefeller
John Delafield Rudolph
Andre de Saint-Phalle
Robb Sagendorph
Mrs. Coster Salm
A. Schneider
William D. Scholle
Earle T. Shaw, Jr.
Stanley Simboni
Mrs. Walter C. Sinnigen
F. Morton Smith
Ruth Ferris Smith
Pfc. Leonard Stoller
Mrs. Edward F. Swift, Jr.
Miss Caroline E. Veatch
Dr. J. A. Vuilleumier
Miss Jane Watson
E. Sohier Welch
Francis C. Welch
Mrs. Bertram Wolff
Miss Helen M. Woodruff
Mrs. W. L. Wright

The Finest Songster

The Hermit Thrush has the reputation of being North America's finest songster. It is a matter of opinion, of course—some prefer the trill of the Wood Thrush, for example, and hold that the circumstances under which the Hermit Thrush is most frequently heard, at dusk in the deep woods, is a large part of its charm.

A Hermit Thrush is singing daily in the New

England Garden in our Bird House. Masked somewhat by the warblings of a hundred other birds in nearby exhibits, the song nevertheless can be heard plainly by anyone who stands close and concentrates. If one has never heard the Hermit Thrush sing, it is worth making a special trip to the Zoo in the next few weeks. This is one of the best singers we have ever had.

Concepcion Zoo Features Gifts from New York

After considerable negotiations, protracted because of the difficulties of arranging shipments in wartime, the New York Zoological Park sent 13 animals of 8 species to the Zoological Park at Concepcion, Chile, on December 5. We heard promptly from Director Carlos Junge that 11 of the 13 had arrived safely, and that only an Opossum and an Eastern Sparrow Hawk were lost en route.

La VOZ del Jardín ZOOLOGICO

No 27 - Concepción, Enero de 1945 - Parque Ecuador, frente a Lincoyán

UNA REMESA DE NUEVA YORK

Después de largas negociaciones con el Jardin Zoológico de Nueva York por fin nos fueron enviados en calidad de canje los siguientes ejemplares: 2 coyotes o lobos de las praderas, 2 ositos lavadores, 2 zorrillos o chingues de Norte America, 1 zaragüeyo o comadreja, 1 zorro gris, 1 bonito halcón, otro halconcito más, que resultó ser un simple cernícalo, casi identico a la especie chilena y 1 tortuga pescadora grande. Queremos dejar constancia de dos hechos: los 11 ejemplares nuevos son carnívoros, sin excepción alguna y con excepción del cernícalo, ninguna de estas especies existe en el Zoológico de Santiago.

LA ATENCION DURANTE EL VIAJE

La remesa anterior vino a bordo del «Lebus» desde Nueva York a Valparaíso. Durante este trayecto fue atendida por la tripulación del barco. En Valparaíso estuvo, cerca de dos semanas antes de poder seguir viaje. Ahí los ejemplares estuvieron unos pocos días a cargo del personal de la Aduana y después de un empleado de nuestro Zoológico, don Armando González, quien también los acompañó en el «Maipochoo hasta Ponce, cuidando cariñosamente a la valiosa remesa.

UN CAPATAZ ALTRUISTA

Por ciertos inconvenientes la remesa mencionada no pudo ser retirada inmediatamente de la Aduana de Valparaíso. Durante cuos días y luego contraria a ciertas informaciones de alguno diarios los ejemplares fueron atendidos con gran esmero por el Primer Capataz de la 2.ª Sección del Recinto Aduanero, don Leopoldo Zúñiga, quien además se negó a recibir propina alguna en pago de su sacrificio; un rasgo excepcional y muy laudable en el «Chile interesado y egoísta».

OTRAS NOVEDADES EN EL ZOOLOGICO

En el último tiempo nacieron en el recinto del Zoo 5 cuyes, 5 conejos, 2 ovinos, y 5 catitas de Australia. Se compraron 4 garcetas, 10 palomas mensajeras, 10 peces para acuarios. Obsequios hubieron los siguientes: 1 chunchu por don Ramón Labraña, 2 lagartos pintados, Urostrophus, por los señores Carlos Oliver Sch. y Enrique Romero, 4 culebras chicas, Fatchymenys, por los siguientes Sres. Orlando Varela, Avelino Alvarado, Manuel Roa y José Miguel Cid, además 1 rana verde por doña Emilia v. de Rodriguez. El Señor Armando Burcio P. le regaló al Zoológico 2 cosas de gran utilidad: 1 regio palomar y 1 saco de arvejilla, ¡Muchísimas gracias por tanta generosidad!

NO CURIOSIDAD, PERO SI "INTERES"

Abrevecemos a aquellos visitantes que vienen solamente a lo lejos al Zoo, recorriendolo con prisa, despachandolo en cinco minutos. Esos visitas solamente dejan siempre una mala impresión en el visitante y en la dirección del plantel. Aquellos vienen por pura curiosidad. En cambio queremos despertar en el público una profunda comprensión por la existencia, un verdadero interés por el progreso y un entendimiento intimo en la lucha cultural de nuestro Jardin Zoológico.

Now a copy of the Concepcion Zoo's publication, *La Voz del Jardin Zoologico,* has been received here and it features the announcement of the animals. All of them except one of the hawks was new to the Concepcion Zoo, it appears. The shipment (for the information of our Members whose Spanish is rusty) included 1 Gray Fox, 2 Coyotes, 2 Raccoons, 2 Opossums, 2 Skunks, 2 Eastern Sparrow Hawks, 1 Red-tailed Hawk and 1 Snapping Turtle – the latter an enormous, 42-pound specimen caught in Westchester County last summer.

Eventually we will receive a return gift of common Chilean animals from Director Junge. Several years ago a similar exchange produced a Chilean Wild Dog of a subspecies we had never before exhibited.

The Society Assists in Saving Wildlife Refuges in France

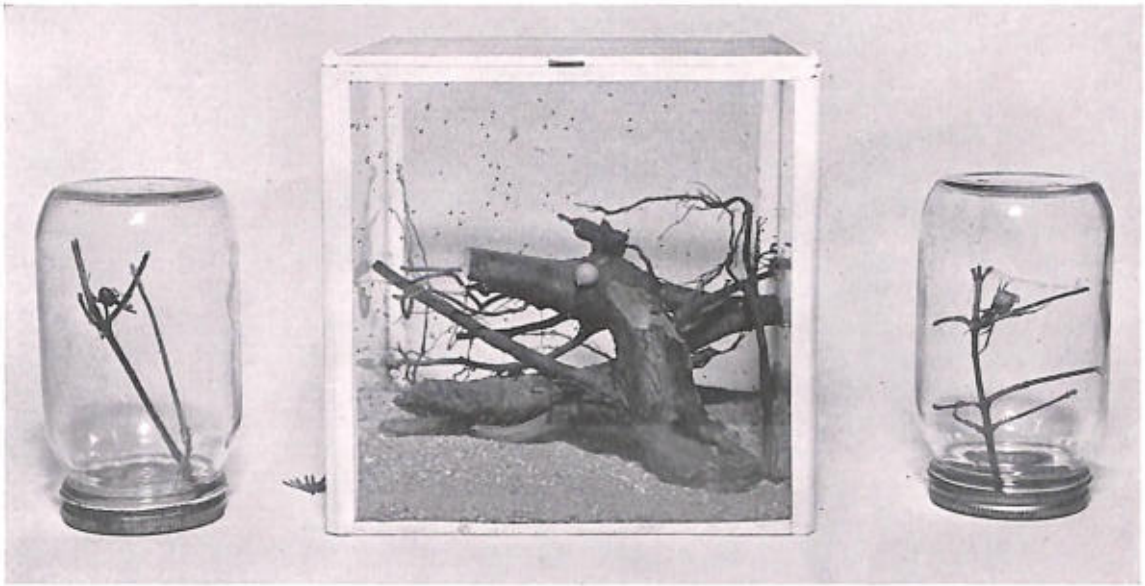
Shortly before the end of the war in Europe, Jean Delacour received a cable from Prof. F. Jolliot Curie, director of the National Center for Scientific Research of the French Government, asking for prompt help in staving off the threatened destruction of the great Camargue and Fontainebleau Biological Reserves in France. Prof. Curie reported that the Camargue reserve was scheduled to be used as a practice bombing site, while the forest of Fontainebleau was to be used as an artillery range.

On receipt of this disturbing news, President Osborn acted for the New York Zoological Society and for the American Committee for International Wild Life Protection, and explained the situation to Under Secretary of War Patterson.

His answer was quick and highly satisfactory; he stated that Allied Headquarters in France would undoubtedly do all it could to protect the reserves.

Following this assurance, Mr. Osborn received direct word from the Adjutant General that "Supreme Headquarters of the Allied Expeditionary Forces states that a practice bombing site in the French National Park in the Camargue is being moved. The question of artillery ranges in the forest of Fontainebleau is being investigated and corrective measures will be taken."

The Camargue reserve in southern France is a low, marshy and salty area abounding in bird life. It has a summer population of 10,000 to 15,000 Flamingoes and large colonies of Snowy Egrets, as well as great numbers of waterfowl, rare warblers and the like.



Set up too late for the photograph to be included in Curator Eddy's account of his plans for the new Department of Insects, this is the temporary Black Widow Spider exhibit in the Reptile House. Adult spiders are in the jars on the sides; the center cage contains hundreds of spiderlings.

Mamba, Cobra and Pythons Arrive from Africa

The first shipment of snakes from Africa in more than three years has been placed on exhibition in the Reptile House.

There is a vivid Green Mamba, deadliest of South African snakes, that can streak through the jungle at great speed in quest of mice, rats and birds. Its slim body and narrow head—six feet over-all—are admirably suited for this purpose. When it lies quietly on a tree limb amid green foliage, it can scarcely be seen.

Mambas are especially dangerous because they have needle-like fangs set at the very edge of the upper jaw. The slightest nip drives home the venom.

Also there is a Black Spitting Cobra, the very personification of impending death. Below its hood are red blotches. When disturbed it rears up its head in characteristic cobra fashion, spreads its neck region, looks straight ahead and without warning parts its lips, tosses back its head and ejects a double stream of venom for a distance of ten feet or more. Apparently it strives to hit the eyes of its victims, to blind them for the kill. A special, right-angled channel in the fangs, coupled with the posture of the snake, directs the poison not only outward but slightly upward.

Finally there are two powerful constrictors that have no poison glands: a young Rock Python and an adult Ball Python. Like most pythons they still possess outward evidence, a pair of horny spurs near the base of the tail, that their prehistoric ancestors were giant lizards with legs. The Ball Python can put on an act all its own. If frightened it will curl into a tight ball, hiding its head, and remain in that position even if tossed high in the air.

Only the Green Mamba has been exhibited at the Zoological Park within the past three years, and the last mamba died in early January, 1943. —Brayton Eddy.

The Death of Limpopo

We are extremely sorry to have to report the death on Monday, May 14, of little Limpopo, one of the two Lion cubs born on December 22. Death was caused by a sudden pneumonia which proved to be secondary to a necrotic lymph gland. Dr. Goss reported that the conditions from which the animal died were of spontaneous origin, unusual and unpredictable, and such matters as sanitation and management were not factors. The little Lion's companions appear to be in excellent health.

The Blue Goose Once More Tries to Nest Here

If the activities of predatory boys can be held in check only a little longer, we may be able to hatch the first Blue Goose in the history of the Zoological Park.

A pair of these birds has been nesting in a clump of iris near the Zebra House and the single egg that remains of a clutch of four should hatch about the time ANIMAL KINGDOM goes to press. The other eggs disappeared about 10 days before hatching time, presumably as a result of a raid by boys who had been throwing trash at the nesting bird. Her whole clutch of eggs was stolen last year the night before they were due to hatch. We are taking precautions this year.

The Blue Goose comes from the far north, and it was not until 1929 that anything was known about its nesting habits. In that year a representative of a Canadian Government department found a nest in southwest Baffin Island. The following year another wild nest was discovered in Southampton Island.

Until fairly recent years no one in this country had managed to breed either the Blue Goose or the closely related Snow Goose in captivity, but once the breeding was accomplished, captive-bred birds nested with fair frequency.

The extreme devotion of the gander and its incessant gabbling when anyone comes within sight probably—in the Zoo, at least—do more harm than good, for they serve to advertise the presence of the nest.

Now We Have a Plethora of Black Lambs

When the Children's Zoo opened for the first time, in the spring of 1941, the "Baa-baa Black Sheep" shelter actually housed a black lamb. It was so well received that we vowed we must always have one. Unfortunately, however, for two whole seasons, following the opening year, we were unable to find a successor. Finally someone, afflicted with a touch of genius, suggested Karakuls. What an idea! A coal black, curly-coated Karakul lamb would certainly take care of "Baa-baa Black Sheep." The best way to get one seemed to be the purchase of an expectant mother and this, after long negotiation and a considerable cash outlay, we did.

Now, an adult Karakul Sheep, especially a ewe no longer young, is not a thing of beauty. In fact, it is as ugly as sin. However, we consoled ourselves with visions of a dainty ebony lambling some time in the next spring. Then spring came and went, but brought no lamb. Desperately we searched, and at the last moment dropped on an incredibly beautiful little ram lamb, as black, crinkly and tame as we could have wished. The Children's Zoo christened him "Lambsy Divy," of course—that was 1944—and his friendliness and beauty delighted thousands of children during the summer.

When November came and the Children's Zoo had been closed for the season, we turned

Lambsy Divy, now grown to surprising size, into a field with the old Karakul ewe and three nondescript white ones, all old inhabitants. Later, the flock went to the Farm-in-the-Zoo for the winter. As spring drew near, it became obvious that our hopes were well founded. Early in March, Dr. Goss, under whose watchful eye the Farm flourishes, announced that one of the white ewes had blessed us—and Lambsy Divy—with twin black lambs. After that, they came thick

and fast. The Karakul ewe produced a kinky little ewe lamb, a white ewe came up with a singleton black and finally, the third white ewe found herself nursing another pair of inky twins! It summed up to six black lambs, one of them a pure Karakul. Try as we would, the Children's Zoo could not find room for more than four, so two still grace the Farm-in-the-Zoo. The whole black lamb experiment has, indeed, turned out almost too well – we have a plethora of blacks and would prefer some whites.

The explanation is simple, of course, for the black of the Karakul is genetically dominant to white and all the first cross lambs come black. But someone raised the question of how white sheep can produce occasional black lambs, as they are known to do. After debating this knotty point through several lunch hours, we referred it to Dr. Myron Gordon, the Aquarium geneticist. He ended the argument by explaining that the black of common sheep is recessive instead of dominant and so is bound to pop out now and then. A lucky thing for the Children's Zoo that Lambsy Divy isn't a common sheep!

—Lee S. Crandall.

Letter from Dr. Beebe Reports Delights of Rancho Grande

With typical enthusiasm, Dr. William Beebe reports the preliminary activities of the Department of Tropical Research at its new field station at Rancho Grande, Venezuela, in a letter to President Fairfield Osborn.

Later we hope that Dr. Beebe will write a series of articles for Animal Kingdom on the accomplishments of the station, but in the meantime his letter is evidence that things are going well. The letter was written in early April and extracts follow:

"Dear Fair:

"Perhaps the best thing at this stage will be to give you a résumé of the sequence of our days. We are still at the Hotel Jardin and will be for some time as the kitchen and other living arrangements have not yet been completed, although the engineers of the Creole Petroleum Corporation of Venezuela have already performed prodigies. We wake at the reveille of the aviation barracks and field a few hundred yards away. As we dress the sun comes up and the kiskadees yell their delight at the fact. The little snub-nosed bats settle down under our awnings and the day begins.

"After breakfast the car is waiting, and with our basket of lunch and whatever we brought down the night before, we go through town. Every house or store is a different color, every garden and grilled window individual. The stores are excellent and filled with everything we did not bring down with us. We whizz past the Zoo, with an amazing lot of animals, and unexpectedly well kept considering they have so little money. They will collect for us if we will send down surplus animals.

"Out past small sugarcane and orange groves and then suddenly into the real savanna, somewhat like our Arizona—chaparral, thorny acacias, agaves, with a characteristic and fascinating fauna – crested quail which scurry ahead of us, doves, etc. This is our Zone No. 1 which we have not touched as yet. At the 9th Kilometer stone we begin to curve and rise. The entire road is very wide, of level concrete, perfect for driving, but requiring skill in twisting around hairpin turns. For a long distance the savanna continues, and the first three ranges are high, old volcanic in shape, and barren except for the scanty flora I have mentioned. Up and up we go, leaving the black vultures and taking on turkey vultures soaring high in air.

"We are just beginning to lay the foundation of zonal study, numbering every fiftieth telephone pole in white, recording every significant change with altimeter, and temperature and humidity changes.

"The next range is rather abruptly different, Zone 2A, the deciduous seasonal forest. This is of tall trees, many of which have lost their leaves at this end of the dry season. Here tanagers and wholly new lizards and butterflies are apparent. Then on higher to Zone 2B, the semi-evergreen woods, and next, with a slowly increasing coolness in the air, the montane rain forest or jungle. This shows huge trees, lianas and epiphytes, gorgeous orchids, and is the typical tropical jungle. Finally after crossing half a dozen bridges and curving around breath-taking gorges we come in sight of Rancho Grande, into the final climax cloud jungle, which shows the most amazing mass of flowering trees, immense parasites cling-

ing to the trunks, and such mosses and lichens as only Walt Disney could devise. We wind around the last turn, passing by the building as we would circle an age-old castle, and the factotum Manuel opens the great gates (they should be a portcullis) and we are at our present home. We pass up the steps into the immense verandah, and turn into the finished part (thanks to Creole engineers), and the laboratory, red and white tiled floor, sixty feet long, thirty wide and the same height, with the entire front of glass. (See Jocelyn's illustration in A.K. but now fitted with all necessary tables, shelves, book cases and the 1001 gadgets.)[1]

"We look out over the jungle tree-tops except for six giants which rise high overhead, their trunks a mass of strange flowers. Lake Valencia 10 miles away with its islands and the surrounding mountains, some barren, others solid green, makes a sight most difficult to ignore in laboratory work. The day may be clear and sunny until 2 or 3 o'clock when between the two summit passes, out of the right side of our view, begin to pour forth wisps of fleeing cloud mist. This may be driven back but sooner or later it fills the valley, swirls past the windows and we are in the clouds. If we get chilly or wish to continue outdoors work we walk down the road a hundred yards or even around the corner of the valley behind the house and we are in full sunshine again and warmth. Nothing but 'Fantasia' ever had anything like it.

"Our myriad activities will wait for another letter. About 4 P.M. we are ready to start and we reverse our trail back. Fairly fast driving makes this 35 minutes to the hotel, but we usually are in and out of the car for specimens. A bathe, a rest and we have dinner, as well cooked as a New York one. The military band plays in the plaza for an hour, and we work in our rooms until midnight or so.

"Jocelyn chose well, and Rancho Grande is adapted for years of profitable work by us or someone. Please give our affection to all the gang. We wish they could be here to see and feel all the wonderful things which I cannot get into words."

Selah

WILL

[1] Shopping for a Jungle, by Jocelyn Crane. ANIMAL KINGDOM, Vol. 48, No. 1, 1945. Pp. 3-13.

No Baby Hummers

In the last issue of ANIMAL KINGDOM we reported that a Violet-eared Hummingbird from western Costa Rica was building a nest in the Main Bird House. We even expressed a faint hope that we might be the first to breed Hummers in captivity.

The hope has vanished. At least, as far as these Violet-eared Hummers are concerned, for the female died suddenly, and the autopsy showed that she was egg-bound, perhaps the first recorded instance in a Hummingbird of a condition that is unfortunately common in cagebirds.

PUBLICATIONS OF INTEREST

MAMMALS OF THE PACIFIC WORLD. By T. D. Carter, J. E. Hill & G. H. H. Tate. 227 pages, 69 illustrations. The Macmillan Company, New York, 1945. $3.00.

This is the first of the supplementary volumes on the fauna, flora, peoples and geography of the Pacific designed to follow the general, introductory book, "The Pacific World," published last year under the auspices of the American Committee for International Wild Life Protection and under the editorship of Fairfield Osborn. It represents the collaboration of three specialists in the Department of Mammals of the American Museum of Natural History.

Systematically working through the Orders of mammals found from the Aleutians to Australia, both on continental Asia and among the islands, the book devotes a more or less lengthy paragraph to the general characteristics of each Order and usually to each Family, then discusses individual species at appropriate length—from a page or two to a paragraph. Drawings illustrate representative species of most groups. Although technical terms have usually been avoided, there is a glossary of those that persisted. Of great usefulness not only to men in the Services but to the general student is an Alphabetical Index-Checklist of the Islands, listing the species known to be, or probably, on each island group. An intensely interesting section deals with the reasons why some kinds of mammals are found on one island group and not on another, how they became distributed through the vast Pacific area. There is a necessary plea for conservation of the wild life and, recognizing that Service men are likely to find themselves in areas but poorly known zoologically, some words on the collecting and study of specimens.

ANIMAL KINGDOM

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Question House

The new educational unit known as the Question House, that was opened in the Zoological Park in mid-June, has already proved itself a distinct success. As many as 1,500 people have visited it in a single day. From 50,000 to 100,000 people may be expected to use it in any given year – perhaps even a considerably greater number when its existence becomes more widely known and its reputation as a place where one can get accurate answers to questions concerning animal life becomes more firmly established.

As may be imagined, people come in with all sorts and varieties of questions. A few of them are pretty foolish, to be sure, but the great majority of questions are obviously evoked by a serious interest in zoology. Some of the questions are posers even for the trained staff in attendance. These are investigated either in consultation with the older members of the staff or through the library and are thereupon answered by mail. Requests for good reference books are numerous and as a consequence a group of standard books is now being prepared and these books will be available for sale.

The Question House is an innovation – the first of its kind in any zoological park. Already it is proving itself a success beyond all our hopes. There is really only one concern that we have regarding it, and this has to do with the great curiosity that people have concerning the other living things of this earth. Will the volume of inquiries as time goes on build up to such a degree that it will prove difficult for us to cope with it? We need not really concern ourselves on this score because this is just the kind of problem that our organization would welcome and be prepared to solve.

Fairfield Osborn

IN THIS ISSUE

Ancestor–the Gray Lag Goose . . . . . *Sam Dunton* COVER
(*See Page* 116)
The Farm-in-the-Zoo Appeals to City Folk . . . . . *Leonard J. Goss* 91
A Jungle Pigmy . . . . . *Paul Griswold Howes* 99
Multiple Uxoricide; or, the Two-inch Bluebeard . . *Christopher W. Coates* 103
"Live" Organizations Are the Most Fun . . . . . *Donald T. Carlisle* 104
The Jewel Room 106
The Umbrella Bird Is Not a Dull Fellow Any More . . . . *Lee S. Crandall* 109
People Are Curious About Insects . . . . . *Brayton Eddy* 113
Behind the Scenes: News and Notes 116

At milking time the Hired Man brings the cows in from the clover pasture.

The FARM-IN-THE-ZOO Appeals to City Folk

By LEONARD J. GOSS

It's a sample of that "little place in the country" so many of them talk about—forgetting that chores start at 3:30 A.M.

THE GIRL REPORTER, visiting the Farm-in-the-Zoo for the first time, was *not* a farmer's daughter. She perched on the "Sitting Fence" beside the pasture and chewed a straw in the best rural style as she interviewed Farmer Nelson Miller, but she gave herself away at last.

"Now, about that herd of lambs," she said, pointing to a dozen Horned Dorset Sheep dozing in the ash grove beyond the pasture, "when a lamb has a baby, what do you call the baby? Isn't there some special name, instead of just 'baby lamb'?"

"Right then I gave up," Farmer Miller told me later. "I was new to this job then, and while I liked the work fine, I kind of wondered to myself why the Bronx Zoo wanted to have a farm. It seemed to me everybody knew about farms and farm animals and they wouldn't be so interested in looking at cows and hogs and sheep and so on, like they would at an elephant, say. But when that city girl talked about a herd of lambs, and what you called a baby lamb, well, I gave up. I guess it's a mighty good thing we've got the Farm-in-the-Zoo."

This summer of 1945 the Farm-in-the-Zoo is four years old and Nelson Miller is in his second year as Farmer. All his doubts about the interest of "city folks" in farms and livestock have long since been resolved, for while some of the visitors to the Farm-in-the-Zoo are just as farmwise as Miller himself, it pleases even them to revisit familiar sights and sounds and smells.

It always irritates Miller when an affectedly fastidious visitor ("Some silly girl, all frilled up

The one time in the day when the old sow and her litter move rapidly and purposefully is feeding time, when the clanking of the milk pails gives warning that the Hired Man or the Farmer is approaching with a few gallons of skim milk, slop and grain. The trough licked clean, they usually go back to sleep.

in lace or something") holds handkerchief to nose while hurrying through the barn. He likes to recall the exclamation he overheard this summer as a sailor and a girl strolled through and stopped to watch him cleaning a stall.

"Boy!" the sailor said, drawing deep breaths, "I haven't smelled anything as good as this since I left Ohio!"

In fairness to the Farm's visitors, it must be said that the ultra nice ones who crinkle their noses at the pungent smells of livestock and pretend to object even to the sweet odors of hay and straw, are comparatively rare among the thousands who stroll through the barn on a summer Sunday afternoon. And in any case, the odors of sweating animals, of manure, of trampled hay, are usually at a bare minimum for a barn that houses sheep, horses and cows. Miller is a good farmer; he keeps a clean barn.

It seems humorous, now, that before the Farm-in-the-Zoo was opened in the summer of 1942, there was much debate among members of the Zoological Park staff whether it would be advisable to spray the interior of the barn with one of the odor-neutralizing preparations – possibly a pine-scented compound.

The Farmer-in-the-Zoo has been consulted many times by dreamy city dwellers who have always thought that some day . . . a little place in the country . . .

"It's a funny thing: they see all this livestock, and they see themselves in the middle of it, but

There is always something stirring in the barnyard where the ducks, geese and chickens carry on their multifarious activities. When the Farmer scatters grain, the pigeons come fluttering down from the roof of the barn and visitors gather around to enjoy the cooing and honking, quacking and cackling.

they don't seem to see any hard work," Miller says. He figures he has quashed many a dream by a casual remark that he'd "Better be getting along – been up since three-thirty, and still had a lot of chores to do."

"Since *three-thirty* o'clock?" The accents that float after him are usually shocked.

But it's true. Farmer Miller's day starts when the clock in his bedroom whirrs a muffled alarm – muffled because he hides it under his hat at night, so as not to awaken his wife when he arises to do the morning chores.

The Millers live in the snug five-room apartment on the second floor of the Farm wing adjoining the Poultry Room. At 3:30 A.M. seven days a week Miller is up before the dawn and after a cup of coffee left over from supper he snaps on the electric lights in the barn and prepares for the morning milking. This summer the Farm has three milkers – a Jersey, a Guernsey and a Milking Shorthorn. They are milked in public by a De Laval mechanical milker at 3:30, 4:00 and 4:30 o'clock each afternoon, and it is good farm practice to milk them as nearly at 12-hour intervals as possible – which means that Miller must clean the stalls and the cows, assemble the mechanical milking apparatus and draw the morning milk by 5 A.M. at the latest.

The early morning chores are a leisurely process and the mid-summer dawn is breaking in gray, watery light when Miller has washed the milking machine and put it away. He carries

pails of grain to the cows and the clanking of tin on concrete arouses the horses and sheep so that they, too, are stirring restlessly and making their low hunger-calls. Ginger, Blondie and Bullet, the Ayrshire and Holstein and Brown Swiss calves, begin bawling for their share of the freshly-drawn milk, and as Miller carries the pails through the barnyard, he is invariably a signal to the Poland China sow and her pigs to make their fastest move of the day – to the feed trough. Their grunts welcome the farmer when he fills their trough with slop, grain and fresh milk. Like a string of popping firecrackers, each move that he makes sets off another series of events; his trip to the hoglot brings out the chickens, ducks and turkeys to be fed and watered.

At this point in the day of the Farmer-in-the-Zoo, it is 6:15 A.M. and the "city farmers" who think they would like a little place in the country are just settling down for the last sweet hour or two of sleep. Farmer Miller knocks off work long enough to return to the apartment for a second cup of coffee – fresh, this time – with Mrs. Miller and for a hasty shave. There is still a lot of work to do before breakfast.

Back in the main barn he sweeps the floors in the public space and in the Poultry Room he dusts the battery chick brooders, the chick hovers and the incubator, mops the floors and fills the feed and water troughs. If he is spry, he has just put the mop away when the Farm bell tolls three times – Mrs. Miller has pulled the rope outside her kitchen window to tell him it is 7:30 o'clock and breakfast is ready.

The Hired Man comes to work at 8 o'clock – by subway. "Farm Helper" is John Gallagher's official title, but call him what you will his lot is not an enviable one on any farm anywhere. The hard work starts when he arrives.

The Farmer and the Hired Man pitch into the thorough cleaning of horse, cow and sheep stalls. They rake and sweep the ten poultry pens and yards at the Red Barn. The yards are pitted with dusting holes where the White-crested Black Polish, the Salmon Faverolles, the Golden Sebrights and the other fancy poultry have been enjoying themselves the day before; dust holes are inevitable and characteristic where chickens are kept, but they are not especially neat and Farmer Miller likes to keep a neat Farm.

Once the Red Barn and its showy breeds of poultry and pigeons have been tidied up, the Farmer and the Hired Man rake and sweep – yes, *sweep*–the Barnyard while the Rhode Island Reds, the Leghorns, Barred Rocks, Turkeys, Geese and Ducks scatter out of the way. The Farm-in-the-Zoo Barnyard is probably the only barnyard in the world that is swept every day and from a naturalistic farm standpoint it probably would be better if it were left alone from spring to fall. But, then, few real farm barnyards have 150,000 visitors during the summer, with all their attendant littering of paper, straw, leaves, sticks, stones and remnants of lunch.

If all has gone smoothly, Farmer Miller and Hired Man Gallagher are still breathing hard when the Hay Wagon rolls down the Farm Lane from the center of the Zoo a mile away, bringing its first load of anything from twenty to forty children, parents, teachers and schoolchildren. Far down the lane the Farmer can hear them chanting the words on the orange-and-black signposts along the road at intervals of a hundred feet, one line of the verse on each signboard:

"At the Zoo you saw a Gnu—"
"At the Farm you'll see an Ewe."
"If you think we cannot spell,"
"You can just go straight to—"

Here there is a long interval between the signs and the noise rises to a shrill peak of conjecture until the Hay Wagon makes the turn and the "snapper" on the last sign comes into view –

"The gate attendant—and ask for
A FARM DICTIONARY—2 cents!"

The advertisement of the Farm Dictionary whets the curiosity of visitors and already 20,000 of the 16-page miniature books have been sold, at 2 cents a copy, and a second edition is in press. It defines such common farm terms as sow, mare, pullet, squab, wether, ram, gee and haw, silo, haymow and so on – being careful to specify pronunciation in moot cases. School groups are among the most eager purchasers of the Farm Dictionary and the discussions and arguments it has settled are numberless. "You do so too milk a cow on the right side – it says so here!"

Incidentally, about 8,000 school children visit the Farm-in-the-Zoo each season; they are admitted free when accompanied by a teacher.

The busiest, if not the hardest, part of the Farmer's day begins when the Farm gates are

opened at 10 A.M. and visitors arrive. Whatever the chores left to be done, he talks and explains and answers questions as he works and he is usually surrounded by a crowd of interested spectators. Being the Farmer-in-the-Zoo is no job for a man who becomes nervous when people watch him work.

By 1 P.M. most of the school groups have opened their lunches in the picnic grove and are temporarily engaged with sandwiches, milk bought at the Farm's milk bar, and review of unfamiliar terms in the Farm Dictionary. Farmer Miller takes time out for his own lunch in his apartment while the Hired Man drops down, Hired Man fashion, in the shade of a tree in the Calf Lot to enjoy his own sandwich. It might be a summer noon on any farm in America – the Hired Man resting under a tree, the calves nibbling grass lazily, the Suffolk mare and her foal flicking at flies in the shade of the pasture grove and the tinkle of a sheep bell a little way off. Even the rumbling of a subway train on the elevated tracks half a mile away is somnolent, like the rushing of wind through the trees.

Farmer Miller likes his little flock of Horned Dorsets—the sheep that inspired a visitor to ask, "When a lamb has a baby, what do you call the baby?" Both sexes of Horned Dorsets have horns. The breed was developed hundreds of years ago in the British Isles, is used chiefly for the production of meat.

It takes a lot of milk to satisfy a growing calf, and after the final milking at 4:30 P.M. the Hired Man carries three pails, each almost full of skim milk, out to the Calf Lot and the youngsters race toward the fence. Visitors have to hurry if they want to watch; the milk disappears in three minutes.

Afternoon on the Farm-in-the-Zoo has its own pattern. The cows must be brought in from the deep clover pasture. The mare and colt race around the fence. Walks must be swept, eggs gathered, more questions answered, feed and hay thrown down from the barn loft, weeds pulled, grass cut around the walks, windows washed, the goat yard and house cleaned. The little jobs are endless.

Every few days a partial hatch comes off in one side of the electric incubator in the Poultry Room; every three weeks a full hatch comes out of the other side. The hatchings are "staggered," a few duck, chicken or guineafowl eggs at a time, so that there will be a frequent spectacle for the visitors. The opening of the incubator and the removal of the downy chicks is one of the great events at the Farm, and Farmer Miller tries to time each removal of the babies for mid-afternoon when the largest crowd is present. As a special treat, he allows the youngest visitors to touch a newly hatched chick.

"The way they look while they're reaching out their fingers, you know it's something they'll never forget," he says.

Over the incubator stands a "Hatching Clock," set to correspond with the timing of the full hatch. Each day the hand is moved forward one day, pointing to a cutout figure that shows the state of development of the embryo in the egg.

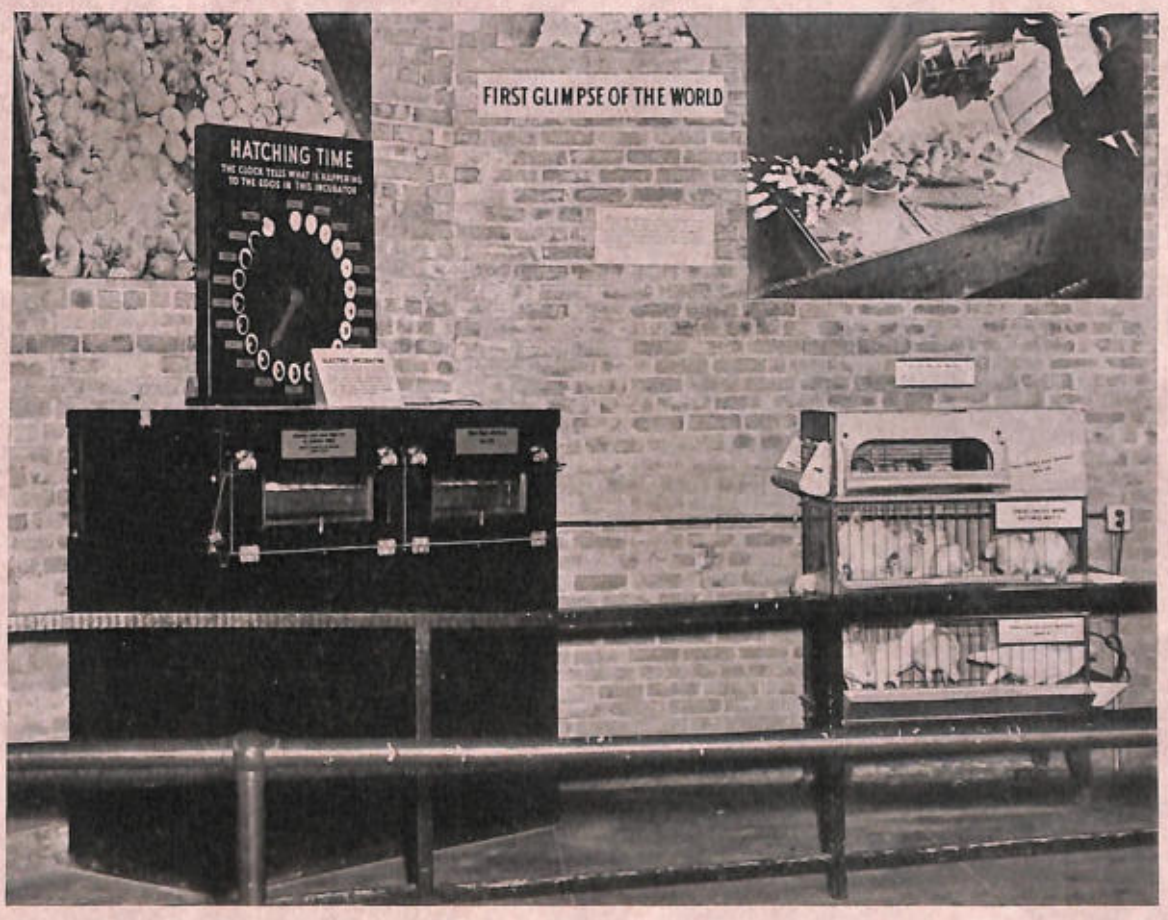
Elsewhere in the Poultry Room are the earlier products of the incubator – chicks, ducklings and guineafowl all the way from a day or so old to adults. The Farmer's appearance in the Poultry Room to sweep or supply feed and water is always a signal for the questions to start, and he could easily spend a good part of his day there. But there is a lot of other work to be done.

Three P.M. and time to feed the sheep and chickens, brush off the cows, get out the milking equipment and lead out the Guernsey to the milking platform in front of the barn. If these preparations have not already summoned every visitor within sight, the long-drawn-out calls to the livestock over the public address system above the milking platform quickly assemble everyone within hearing. The stock calls are on a phonograph record, especially made for the Farm-in-the-Zoo by an Indiana farmer, and they are the authentic calls that a midwestern farmer would use in calling his pigs, sheep, cows and horses from the fields. There follows a recorded talk on milk production and then the mechanical milking apparatus is started and one after another, at 15-minute intervals, the Guernsey, the Jersey and the Milking Shorthorn are relieved of their day's production. Between milkings, the milk is put through the De Laval separator on the platform and the crowd watches in fascinated interest while the cream pours from one spout and the skim milk foams out of another.

"What do you do with the milk?" is the inevitable question, and Farmer Miller has to explain that because the Farm-in-the-Zoo has no facilities for pasteurizing the milk, it cannot be used for human consumption and must be given to the calves and to the pigs.

After the afternoon milkings the visitors begin to drift away from the Farm and peace and quietness – of a kind – descend upon barn and pasture and yards. Farmer Miller cleans the stalls and beds down his stock for the night, brings in the calves and horses from the pasture, makes a start on cleaning up the day's débris. Supper is a hearty meal, and leisurely, with only a few small chores to do around the barn before bedtime.

And bedtime is strictly 9 o'clock. Farmer Mil-



The first and most fascinating object in the Poultry Room is the electric incubator and its Hatching Clock that tells, by means of a hand moved every day, what state of development the eggs inside the incubator have reached. All around the walls are brooder batteries and photomurals of egg production.

Beginning at 3:30 o'clock in the afternoon, at half-hourly intervals, the three cows are brought out to the milking platform and the mechanical milker goes to work. After each milking the whole milk is run through the separator in a glass case on the platform, while the crowd hungrily eyes the cream.

ler knows the alarm clock never fails to go off, and it is only forty winks until 3:30 A.M.

* * *

Owners of fine livestock have been most generous in lending outstanding examples of various breeds to the Farm-in-the-Zoo. Commercial companies, too, have been cooperative, the De Laval Separator Company installing the mechanical milker and cream separator that has proved of such great interest, and the Louden Machinery Company installing the stanchions used in the milking demonstrations.

Owners of livestock to whom we are indebted for the magnificent display this year are:

Warren Kinney, Lee's Hill Farm, New Vernon, N. J. Brown Swiss calf.

Rowe Metcalf, Judd's Bridge Farm, New Milford, Conn. Jersey cow.

Mr. and Mrs. Paul Moore, Hollow Hill Farm, Convent, N. J. Guernsey heifer.

Sheffield Farms Co., Inc., Pompton Plains, N. J. Guernsey cow.

Karchnar Bros., West Hazelton, Penn., and The Milking Shorthorn Society, Chicago, Ill. Milking Shorthorn cow and calf.

L. B. Wescott, Mulhocaway Farm, Clinton, N. J. Suffolk mare and colt.

John G. Enck, Maryland, N. Y. Sow and 6 pigs.

A JUNGLE PIGMY

By PAUL GRISWOLD HOWES

Curator of the Bruce Museum, Greenwich, Connecticut

IT WAS A strange turn of fate which one day guided me to a certain tiny nursery of a jungle pigmy. I wonder what strange force piloted me to this enriching reward in such a niche of the great Guiana forest, here to discover the home of so minute a creature? Among the great moras and purplehearts and a dozen others, towering into the tropical heaven of sunlight, trees from which a single seed would dwarf the nest of the tiny insect, it is a wonder that I found her at all.

It is a wasp of which I speak, the most diminutive creature of her kind that I have ever seen, a minute speck of life challenging the jungle and succeeding where far greater creatures fall from day to day, a personality whose nesting habits are as new as was the little insect herself. Science finally named her *Microstigmus guianensis* and here for the first time is her detailed life story.

For my own convenience, when making these studies within the jungle of British Guiana, I named her the Tiny Purse Wasp, which is at once descriptive of her house and self. I marvel at my diminutive friend who might rest in comfort upon the head of a pin! She is bright and colorful with a yellow glistening body, a dotted crown and large green eyes. Her expression—and all wasps are expressive — says plainly, "hurrah for me!" Her independence is indeed exaggerated by her very minuteness, yet she is friendly, to say the least. She comes and goes without paying the slightest attention to my huge bulk beside her nest, even though I occasionally turn up the leaf to which it is attached, and after many such rude interruptions on my part, she still toils unconcernedly within her nursery as it swings to and fro in the gentle forest breeze.

Paul G. Howes Photo

In the chlorophyll-tinted shade of a leaf, this tiny wasp, no bigger than a pin head, builds its gossamer nest and fashions it in the shape of a tiny purse.

In the depths of a jungle paradise I found her, building her purse-like home with golden thread. She had swung it from the underside of a sun-bathed leaf which formed a dome of gorgeous chlorophyll-tinted light above her. Suspended by a long stem of gossamer and bobbing in the slightly stirring air of the forest, it brushed my face as I walked beneath the emerald canopy and thus came the discovery.

After a time as I watched, the mite returned to her nest. She was all but invisible when resting upon it. How could such a minute thing as this know how to weave this nest, as elaborate in its details as the nest of many a

Paul G. Howes Photo

One type of nest, made of green lichen and opened to show collembolids at the left and a pupa of Microstigmus at the right. About eight times life size.

bird? I thought with reverence of this tiny living engine so completely at home in her huge surroundings. Above and in the heavy vegetation of the forest lurked a thousand dangers to its larger creatures. Even in my case, a hard-shelled fruit, a huge limb or even a tree might fall at any minute upon my vulnerable head. Again a Bushmaster might lie motionless until I trod upon it, or the hordes of careless Army Ants might suddenly surge my way and drive me off by their vicious advance.

But what of the tiny wasp? She apparently hears not, nor sees the dangers which beset the rest of us. At all times she is undismayed by her surroundings, oblivious to all save the importance of her coming family. She makes her little journeys, procures her thread and other building material from who knows where, sees her brood cells grow through her labors, provides them with strange food and lays her eggs, living her minute life and days perfectly synchronized into gigantic surroundings.

Far below her swinging home, lies the humid jungle floor, a deep, red-brown- and ocher-patterned blanket of fallen leaves, fruits and twigs, always so wet and deep as to be like a cushion under foot. Below this epidermis of dead but still undecayed vegetation lies the mould world, sheltering an association of tiny living things at once distinct from those in all the rest of the forest.

Upon the fallen leaves and in the moss, about the primitive ferns and fungi, laced in the lower strata of the jungle, dwell myriads of crawling things which bear a strange relation to our wasp. These creatures of which I speak belong to the most remote and primitive order of insects. Their bodies are more or less cylindrical and they range in color through all shades of honey yellow and amber, to brown, lavender and black. Each possesses six legs, a beak-like head, mere rudiments of eyes, but a marvelous catch and spring apparatus which sends the owner about in leaps if need be, each of which lands the jumper twenty or more times its length from the starting point.

Upon these collembolids our tiny wasp preys. Here we have the two extremes of insect life. The wasp, a member of the highest and most specialized order of insects which lives upon the earth today, and the collembolid, the most primitive, a wingless creature probably little changed from its ancestors of remote geological ages. Here are these two orders intimately related in one way, yet at almost exact opposite sides of the canyon, structurally.

Hunting among the leaves and moss, *Microstigmus* collects some fifty of her soft-bodied victims. Possibly she paralyzes them with her sting as do some larger Solitary Wasps, but on this point I am uncertain. At any rate the victims are collected, rolled into a ball at the nest and stored in one of the two or more pockets into which the nursery is divided. Upon the food mass in each cell a tiny egg is deposited, floating upon the mass of collembolid sardines.

In three days the egg hatches and the usual young or larval wasp, a white, footless grub, appears and commences at once to feed upon the accumulated provisions. In a week the

stores have completely vanished into the hungry young insect and a few days later the larva is transformed into a pupa or crysalis. It lies still in its cradle now until color and strength enter its frail body and it is a full two weeks before the perfect little wasp issues from the gossamer-bound birth chamber into the great jungle.

Some of the nests which I found in Guiana are greenish-gray and appear to be produced from tiny lichen shingles. Others are brown or golden yellow or orange, made from gossamer, hairs and who knows what, woven and fastened together with all the skill of Troupial or hang-bird. Always they float and bob at the ends of tiny threads made of the same material as the nest proper. Some of these supporting threads are more or less straight and of considerable length while others are curled into perfect spiral springs. In every case the nest is an object of fairylike beauty, the result of the tiny insect's great energy and care.

Here in the great South American forest where all events bring forcefully home to one the meaning of survival of the fittest, how does our pigmy succeed?

No larger wild creature appears to be en-

Collembolids or Spring-tails, on fungi. Their size can be compared with that of a white-headed pin at the right. These strange, primitive insects are used as food for young Microstigmus.

Paul G. Howes Photo

tirely safe in the jungle, and life for them is always uncertain. It hangs in the balance daily for most of the forest denizens and none may foresee what the next minute may unfold. Even the trees and other plant life fight perpetually, ever striving upward to the elixir of sunlight. Living upon the trees are parasites in thousands, plants which wind serpentine coils about their trunks, constricting and often strangling their benefactors who have supplied them with the means of reaching the sunny world of the forest top. Others whose seeds find a footing in damp crevices and hollows among the higher branches thus reach the light and drop their rope-like roots through the air to the forest floor below. On every side one is conscious of the struggle for life which goes endlessly on. Glancing at the gigantic tree trunks of the jungle, each representing a victory dearly won, we think again of this pigmy wasp and how it has succeeded.

The secret may lie in the minuteness of the insect. It fits easily into the niches of most dangers and escapes unharmed. If the insect is hunting upon the forest floor and a limb falls from directly above no harm results, for the natural roughness of the wood or bark offers plenty of cavities into which the minute wasp would fit with plenty of head room to spare. Likewise my great foot would not necessarily crush the pigmy, for there are too many openings in the leaves and debris also into which it would be pressed unhurt.

A falling nut, a mountain compared to *Microstigmus*, would simply brush her aside when in flight because of the air currents set up by its passage. Her all-but-weightless body would escape whereas the same nut might kill or injure me.

Microstigmus is apparently overlooked by enemies which might devour her, also, a fact which is evident when we realize how common are her nests and yet how few progeny she rears in each one of them.

It would appear, then, that some of the tiniest people of the jungle survive through their insignificance. What does a *Microstigmus* wasp care for a Jaguar, a Fer-de-lance, a malarial mosquito, falling trees or man? Many a human being would shake with fear and soon perish if left alone in a tropical forest unarmed. His size, his consciousness, his imagination and his fear of death would destroy him. Not so our tiny insect!

Paul G. Howes Photo

Still another type of Microstigmus nest—suggesting a number of species and a fascinating subject for some student of science to investigate fully.

Multiple Uxoricide; or, the Two-inch Bluebeard

By CHRISTOPHER W. COATES

This is not a mystery story – at least, not the usual mystery – for we know "who done it," when the deed was done, and how, and to whom. All we don't know is *why* the two-inches-long Ruby Jewelfish whose touching parental behavior was chronicled in the last issue of ANIMAL KINGDOM[1] should have killed three successive mates.

The marital and parental behavior of most of the family Cichlidae, to which the Jewelfish belongs, is usually exemplary and a model for humankind. The fish generally – one might almost say invariably – mate for life and produce brood after brood. It is true that they sometimes lapse into bad temper and when the waters are troubled the wise aquarist will provide some cover into which the vanquished fish can retire for a time.

Either sex may be the aggressor and either sex the winner in these altercations. But as a rule they are not serious or prolonged and if a mass of plants, a few rocks or some other refuge is available for a few minutes, the disturbance is soon forgotten and all is peace.

A number of these fish were spawned and grew up together in one of the reserve tanks of the Aquarium. At maturity they paired off and started to make homes of their own and raise families. The largest of these pairs, after raising two broods together quite amicably and successfully, were selected for exhibition and forthwith picked a site for their future nest, cleaned it scrupulously and deposited a mass of eggs.

With true Jewelfish devotion, both individuals started to tend to the hatching eggs and, when the young were hatched, both parents herded them about, the one foraging around for wanderers from the brood, the other remaining with the closely-knit group. These duties are interchangeable and are usually only onerous when other fishes are living in the same tank, in which case the outrider fish has not only to collect wandering sons and daughters but to keep the other fishes, regardless of size, at a safe distance from the main body of young. At feeding time each parent will dart off alone, take a mouthful of food and return immediately to relieve the home guard, which then darts away for its mouthful of food and returns to the brood to relieve its mate in turn. This business of sprinting for food, maintaining a constant survey over the disposition of the opposing forces, and taking quick nips at any which look as if they had designs on the babies, is continuous and constantly changing as each parent takes its mouthful of food. When all food is eaten, they return, without discrimination, to their respective duties.

In the case of our Bluebeard, however, after two or three days of domesticity under the constant surveillance of numerous visitors to the Aquarium, the male tired of it all and forthwith killed his mate. At the same time, he continued to guard her – and his – young with exacting care.

When the babies were old enough to leave the father, he was removed and given the run of a large tank in which there were a number of males and females. He immediately selected a second mate and spawned with her without mishap. His behavior was so "correct" that we put the pair on exhibition once more – whereupon they spawned again, still with the usual selectivity of site and enormous care of the young. Within a few days of the hatching, however, Bluebeard killed his new wife, and went right on attending scrupulously to the young.

Once more we gave him a choice of females, once more we put the pair on display. Once more they spawned, and the pattern was repeated:

[1] Problem of the Invisible Baby Fish. By William Bridges. *Animal Kingdom*, May-June, 1945, page 82.

spawning, assiduous care for a few days, and then the seemingly inevitable uxoricide.

In despair we removed the male from exhibition and provided a fresh mate. Two broods have been produced by the pair since then — both in the seclusion of the reserve tanks behind the exhibition panels of the Aquarium.

So far, both parents are enjoying all the blessings of a comfortable home, amicable relations with each other, and the worry and pleasures of raising a large family.

What is the solution of the mystery? Why the Jekyll-Hyde behavior? There is a reason, of course; there is a good and sufficient reason for everything that fishes do. But whatever it is, it must be determined by a thin, fine and to our senses impalpable difference of habitat. For the reserve tank in which uxoricide does *not* occur is identical in shape and size with the exhibition tank in which it *does;* the food is the same, heating and lighting similar. All conditions except exposure to public view are apparently uniform. Our two-inch Bluebeard, paradoxically, must be shy.

"Live" Organizations Are the Most Fun

By DONALD T. CARLISLE

Chairman, Membership Committee

WE ALL LIKE to belong to clubs, societies, associations that are progressing—with constructive, creative things taking place regularly and with undiminished enthusiasm for future accomplishments. All of us are asked today to support so many causes that have perforce a depressing undertone. It is, then, refreshing and enspiriting to find *one* organization that is not only alive to the present and the future but that has solely creative aims.

The New York Zoological Society is not patching up the results of any of our past mistakes. It is seeking primarily for knowledge that will make the world a better place in which to live.

This Society is "live" in two senses. First, we are progressing steadily toward a great goal even in the face of the restrictions of war. Secondly, in this work we deal with "live" things — mammals, birds, reptiles, fishes and insects — striving constantly not only to exhibit them under more and more natural and pleasing conditions, but also to learn more and more about them and their relationships to us and to each other. Also we are constantly working to protect them.

Take for example our proposed Conservation Unit which we hope to open shortly after the war. Where else than in a great zoological park can the lessons of conservation be taught so well as here with living models and "from the ground up"? Not only is this the best possible way of demonstrating conservation values, but here we do it in beautiful surroundings yet within the heart of our country's greatest population center. It should prove to be a model for similar demonstrations in every state in the Union.

The public response to our announcement of the new Department of Insects, described elsewhere in this issue, again shows the great latent public interest in the life about us and its bearing on our own problems.

The life of the Society goes on because it is based on Life itself — a constant, welling spring of experience for those who choose to drink from it.

It is gratifying that in our present effort to increase Society membership we are gaining many entirely new Members, and Members from the younger groups, but it is especially pleasing to us that many former Members who left us perhaps during the depression years are returning to the Society — presumably because our aims are so great, our new ways of doing things so fascinating.

We are grateful for the help of so many Members who have brought us new ones. But we still need the moral support of many more people who will understand and sympathize with our objectives for the years just ahead.

Our program for new memberships will continue throughout this year, and every new Member is a definite step towards making the Society the greatest zoological center yet known to man. If you cannot solicit members yourself, please send us the names of your good prospects. They will enjoy so much an association with a "live" organization — "live" in two ways.

These are the new Members of the New York Zoological Society since the last issue of ANIMAL KINGDOM—rather, the new Members reported before the forms of the magazine were closed ten days ago. By the time this issue is published the list will certainly be considerably longer.

Life

Lister Carlisle
P. H. B. Frelinghuysen
Gilbert C. Greenway 4th
Robert C. Hill
Arthur Roeder
Mrs. J. Watson Webb

Annual

William J. P. Aberg
E. G. Ackerman
George T. Adee
Alfred Reginald Allen
Lt. (jg) Wm. H. Amos, U.S.N.R.
David Asch
Rogers H. Bacon
C. Philip Barber
Floyd Barbour
Charles E. Bates
Mrs. Thomas T. Bear
Stanley D. Beard
Mrs. F. Wilder Bellamy
Russell Bengel
William Craig Berkson
D. H. Bierman
Dr. Alexander W. Blain
Lt. Anthony A. Bliss
Percy Thayer Blogg
James M. Boyles
Norman Brock
H. Clifford Brown
Dr. M. Vertner Brown
Robert E. Brown
Miss Andrea Bulson
Mrs. J. Randolph Burke
Miss Annie E. F. Bye
John B. Cabot
Mrs. C. A. Castleberry
Dr. McKeen Cattell
Stephan Chalner
Miss Cornelia Van A. Chapin
Paul H. Cheney
Saul C. Cohen
Richard Compton
Mrs. Richard Compton
Mrs. R. Constantian
H. J. Cook
Jarvis Cromwell
Mrs. Thayer Cumings
John W. Cutler
Anker N. D. Dalsgaard
Mrs. T. Clarence Davies
Joseph S. Derylo
Alvin Devereux
Alan Devoe
Frederick A. Dewey
Washington Dodge
Mrs. John W. Donaldson
Mrs. Tuckerman Draper
Mrs. Karl Eilers
Miss Catherine Elias
Major Temple Hornaday Fielding
Mrs. Dora Whitman Fluekiger
Leon S. Freeman
Mrs. Jefferson E. Fuller
R. L. Gabriel
Richard V. N. Gambrill
Gordon P. Gaver
Douglas Gibbons
Mrs. Frances E. Graham
Henry G. Gray
Mrs. L. M. Greer
Peter Grimm
H. P. Haldt
William Walker Hanna
Harold Hope Harding, Jr.
George T. Harrison
Dr. Caryl P. Haskins
Carr Heaney
Charles E. Heydt
Robert Hillyer
Philip Hoffeld
Mrs. James W. Holler, Jr.
Mrs. Frank Canfield Hollister
Thomas H. Howard
Mrs. Brooks Howe
Alfred O. Hoyt
George C. Hurdman
Mrs. O'Donnell Iselin
Mrs. Lily B. Javits
Mrs. J. E. Jeffery
Lawrence K. Jennings
Lane Jonap
Louis Paul Jonas
Miss Mary Jean Kempner
Laurence S. Kennedy
E. C. Ketcham
William G. King
Augustus S. Knight, M.D.
Mrs. John Knight
George C. Koch
Richard G. Kruger
Harry La Montagne
Charles C. Lawrence
Miss Gypsy Rose Lee
Mrs. Barent Lefferts
Bert Lytell
Mrs. Bertha Mack
Mrs. Clarence H. Mackay
Marilyn D. Marple
Charles C. Marshall
Mrs. Shelton E. Martin
Lt. Col. George C. Masters
Milton Matter
Mrs. Thomas McCance
Mrs. W. M. McKenzie
Richard Wakefield Miles
W. F. Morgan
Lawrence Morris
Edward A. Munger
Mrs. Margaret Neil
New York Color Slide Club
Douglas C. Orbison
Henry Paeper
Fredrick H. Parker
Mrs. H. H. S. Phillips, Jr.
Auguste R. Pottier
Dr. F. W. Proewig
Mrs Chester T. Reed
W. R. Reid
Stanley Resor
Grantland Rice
Mrs. Francis Rogers
Rev. Andrew Rogosh
Dr. Leslie A. Sandholzer
Mrs. R. W. Sayles
John Edward Schramm
Kerstin T. Schurman
Sec'y San Antonio Zoological Society
Mrs. R. W. Sexton
Jerry Shrewsbury
Miss Marion G. Sierman
John N. Staples
H. Lyman Stebbins
Roderick Stephens
Mrs. John A. Stevens
Thomas Sullivan
C. G. Symington
Miss Melita Taddiken
Howard L. Taylor
Thelma Teasdale
Hermann A. Thoenen
Rodman K. Tilt, Jr.
Mrs. Richard Trumble, Jr.
Miss Alma Trimmer
George W. Tucker
Richard George Van Gelder
Richard N. Vieth
Miss Edwyna Von Gal
Henry F. Wanger
J. Spencer Weed
Leonard D. Weil
Mrs. Caroline V. der W. Wiese
Ben Willis
Tate Woody
Will H. Yolen

The JEWEL ROOM

From the dark interior of the Jewel Room, visitors gaze into the brilliantly lighted and glass-fronted compartments where bright tropical birds flit among jungle foliage and flowers that often match the colors of the birds themselves.

Our jewels are tropical birds — the snippets of living light that actually glitter and glow with the fires of ruby and topaz, opal and aquamarine, sapphire and lapis lazuli until there is scarcely a precious stone that cannot be matched by some glinting color in these living jewels.

At last they have a setting, in the Bird House of the Zoological Park, that is worthy of their superlative beauty. Twenty brightly lighted compartments circle the darkened room in the southeast wing of the building; visitors stand in the darkness and watch the flashing wings, the glittering throats, the glowing bodies of the birds among the tropical foliage.

No small part of the beauty of the setting is lent by the artistry of Jean Delacour, who designed the rockwork and planting of the individual compartments.

▲ Rothschild's Myna is a slim and mostly snow-white bird that often displays in its leafy home.

In a green corner of jungle foliage, the Eastern Cock-of-the-Rock flaunts his beauty ▼

▲ The Yellow-fronted Green Tanager (left) is a foil for a tiny, lovely Blue-throated Calliste.

Many kinds of small and bright seed-eating birds inhabit the big compartment at the end ▼

The Umbrella Bird Is Not a Dull Fellow Any More

By LEE S. CRANDALL

WHEN CHARLES CORDIER arrived from Costa Rica on October 9, 1942, bringing with him, among other great rarities, three Bare-necked Umbrella Birds (*Cephalopterus ornatus glabricollis*), it seemed to us that the mere possession of such fabulous creatures was satisfaction enough. True, they were not beautiful—some realists have even gone so far as to name them "ugly"—and like all Cotingas, they were definitely dull. But in spite of all, they really were Umbrella Birds and if we could solve the problem of their long term requirements, they must reveal to us much that had been unknown. For only once before, as far as we can learn, has an Umbrella Bird been kept in captivity in either Europe or North America. According to a note by Frank Finn in *Avicultural Magazine* for October, 1909, this was a young bird owned in England by Mr. H. C. Molineaux, a private aviculturist. Nothing beyond the arrival of the bird is recorded.

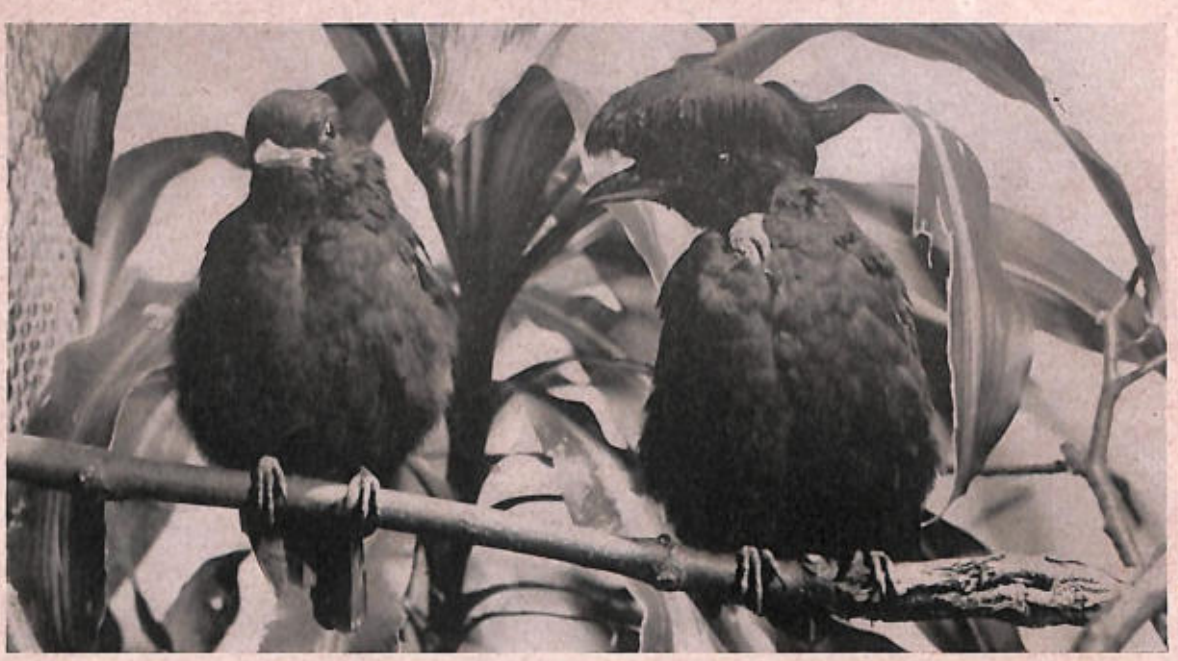
With nothing whatever to guide us, beyond Cordier's brief experience, we put the adult male and the female together in one cage and an immature male in another. The cages seemed large enough and both were planted with small palms for shelter. For a year, nothing in particular happened. All of the birds remained dull and quiet, and although we pointed them out frequently on personally-conducted tours, it was difficult to convince visitors that Umbrella Birds are something of special interest. Then we noticed that the young male was fading and in spite of all we could do, he became rapidly weaker until his death. A post mortem by Doctor Goss showed a necrotic mass of undeterminable nature in the thorax. This was better, at least, than malnutrition, and we were stimulated to greater efforts with the remaining pair.

We felt apologetic about this unexciting rarity—until conditions were just right and he began his extraordinary display.

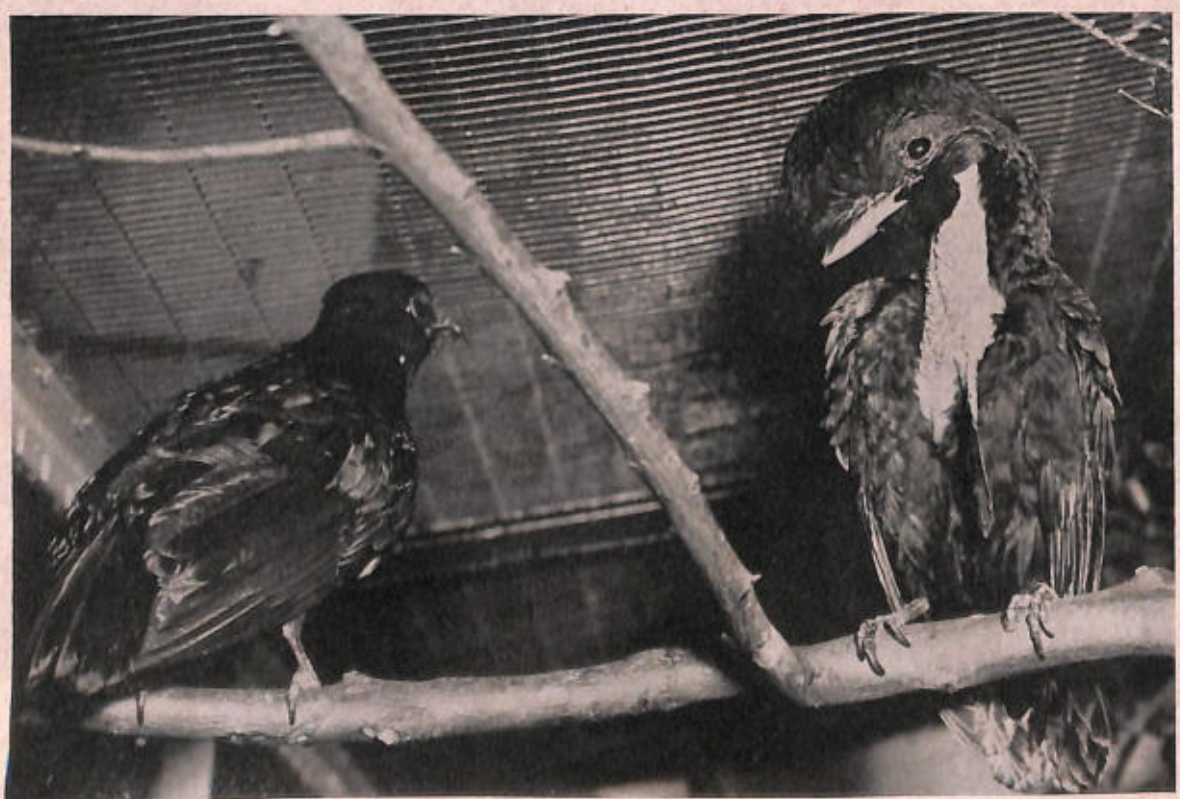
When the big planted cage in the south hall of the Bird House, known as the Tropical Rain Forest, was reconditioned in the autumn of 1944, we looked about for birds to people it. First of all, of course, we would try again with the Umbrella Birds. It just might suit them.

From the very first, the experiment was a success. The birds agreed perfectly, with no quarreling or interference. The Umbrella Birds liked it—we could see that from the beginning. And it was high time they found something they liked, for they were deep in moult and needed to settle down if they were to feather properly. They finished their change of plumage rapidly and soon began to look like real Umbrella Birds. Their black feathers were smooth and shining, their great dark eyes were bright. The "umbrella" of the male was rounded and full, and while sometimes it stood up stiff and straight in front like a well-cut pompadour, if often fell forward, so completely relaxed that it fully covered the great crow-like bill.

Winter passed, and with the first days of spring there were rumors that the Umbrella Bird was playing antics of a sort. I thought at once of Cordier's piece in ANIMAL KINGDOM for January-February, 1943—certainly one of the very best we have ever printed. He called it "The Um-



When the male Umbrella Bird (at right) is out of breeding condition, the bare, red throat area is greatly contracted and gives little promise of the enormous proportions it will bear later when inflated. This is the pair of Umbrella Birds, shortly after arrival and before they had really settled down.



The contrast with the photograph at the top of this page is apparent in this picture, made this spring when the Umbrella Bird was at the height of its display. Even the tiny, feather-tipped "pig tail" at the bottom of the throat area can be seen. The far less spectacular female Umbrella Bird is at the left.

At the peak of display. Here the male Umbrella Bird has inflated his air sac fully until it is "as large as a tomato," as Charles Cordier described it after seeing the display in the forests of Costa Rica. Even distended in this way, the bare skin remains bright red. The fleshy tassel near the lower part of the sac has grown from a three-quarter-inch spike of skin to a length of almost three inches, and when the bird moves his head from side to side rapidly, the tassel will gyrate like the pendulum of a runaway clock.

brella Bird Comes to the Zoo" and in it he reported, among other observations, concerning the courtship display of this little known species. I hunted out the piece and checked it with care. With some idea of what to expect, I began spending noon hours in front of the Tropical Rain Forest. And I had not long to wait. On March 30, 1945, to be exact, I witnessed the full spectacle. On subsequent numerous occasions, I was able to add a few minor details.

Since mid-winter, the bare skin on the throat of the male had been expanding and deepening the intensity of its scarlet. At the beginning of the display, this brilliant patch spread slightly, laterally, so that there was a sharp contrast against the deep black of head and neck. It was also extended downward, with a distension as large as a pigeon egg at the very bottom.

There are two distinct display forms. In the first, the bird turns his head forward and down, gasps, and distends his air sack to the size and shape of a scarlet goose egg, big end down. The fleshy tassel, tipped with scraggly feathers and ordinarily about three-quarters of an inch in length, is seen to have lengthened to quite three inches, although its diameter is hardly greater. Then the head is moved rapidly from side to side, making the tassel gyrate wildly, like a pendulum out of time with its clock. During this performance, the bird utters a soft "br-r-r-r," which I think Cordier refers to when he says it sounds like a distant jaguar. I suppose, in the forest, it might.

In the second form of display, the force of the expansion is forward rather than downward. There is the same pigeon's egg at the bottom to begin with, but this time the bird stands upright, his crest doing a tight pompadour. Suddenly, he snaps his head forward, dropping the spread umbrella so that the bill is entirely covered. He then jerks upright again and extends his air sac until he looks like a brilliant toy balloon and nearly as perfectly spherical. Now he throws his head sharply backward, making the tassel fly violently in and out, in the axis of his body. At the same time, he gives forth a loud "plunk"—which Cordier calls a "boom." After several of these violent convulsions, the air is expelled, with no sound.

It is pleasant to have so full a confirmation of what Cordier saw in the jungles of Costa Rica. And it is pleasant to know that the Umbrella Bird is far from being the dull creature we had thought him.

The three photographs on this page are extracts from a motion picture of the display of the Umbrella Bird, made by Staff Photographer Sam Dunton. Here the male begins to inflate his air sac.

A stage in upright display form, in which the lower end of the sac looks like "a scarlet goose egg."

A still later part of this same form of display. Note the long, thin, dependent tassel below the air sac.

PEOPLE Are Curious About INSECTS

By BRAYTON EDDY

THE SUREST WAY to become quickly and widely known is to offer a service that meets a public need, that solves a current problem while it is still in sharp focus. If there is any doubt about this statement, it can be verified by consulting the mailman and the telephone operator at the New York Zoological Park.

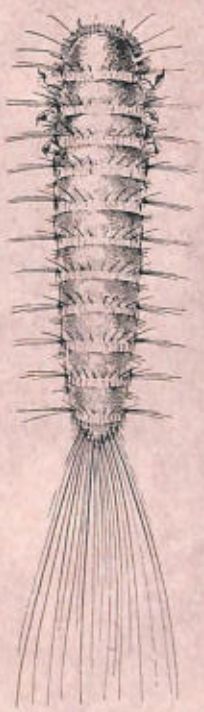
Scarcely a month has elapsed since the Department of Insects was established at the Administration Building, yet already one of its avowed functions is known in at least six states. No sooner did the press and radio announce that the Department would identify insects and furnish information on their control than the public sprang into action. The response was immediate and almost overwhelming. Dead insects arrived in pill boxes, small bottles, vials and typewriter ribbon tins. Most of the inquiries are answered by telephone or letter; but where a control problem is particularly involved, an office interview is encouraged.

The chief cause of public concern to date has been mistaken identity. It is assumed that an insect will accomplish the worst even though it sails under neutral or even friendly colors. The Elm Leaf Beetle[1] is a point in question. Several specimens have been received from eastern Pennsylvania with the notation that they were found in the house but that no exterminator had been able to decide what they were or how to get rid of them.

Elm Leaf Beetle.

In bottles and vials and pill bottles, by mail and by telephone, "bugs" and inquiries about them have been pouring in to the Society's new Department of Insects.

The reason is obvious. Elm Leaf Beetles are not a household pest. They do not eat indoors, but merely come indoors to hibernate. When the urge of spring is upon them, they fly to the nearest window in a frantic endeavor to escape. A vacuum cleaner or a dust pan and brush is a handy tool to dispose of them in this condition. Out-of-doors they are best controlled by applying an arsenical spray to both top and bottom side of elm foliage.



The Black Carpet Beetle (adult above) is sometimes confused with the Elm Leaf Beetle. The adult is said to feed on pollen. The larva (right) damages clothes, fur, and even eats feathers.

In the same mail with Elm Leaf Beetles have come Black Carpet Beetles[2] from New Jersey and elsewhere. Amateurs are very apt to confuse them with the Elm Leaf Beetles, although the Black Carpet Beetle is somewhat smaller and not marked with yellow. Black Carpet Beetles may get into houses by concealing themselves in floral pieces, especially spiraea blossoms, or by impartially alighting upon garments in public places. Whereas the adults are said to feed mostly on pollen and are readily attracted to light, their hairy, bushy-tailed, carrot-shaped offspring consume woollens, furs, and feathers and remain hidden. They even attack mounted insect specimens, as any ardent collector knows too well. Since they do not leave a trail of webbing over the object of their attack, after the manner of a Webbing Clothes Moth[3] larva, the first evidence that most people have of their presence is the observance of damaging holes.

The larvae of the Webbing Clothes Moth (various stages of development shown above) are comparatively easy to detect. They leave a trail of webbing.

Clothing frequently brushed and aired, or rugs and furniture in daily use, are seldom attacked by carpet beetles. Proper fumigation will kill the pests in all stages of development. Garments kept in cold storage at temperatures below 40° F. will not be consumed even though they are infested, and garments steam cleaned and then packed in tight paper bags will go unmolested. A small amount of lint in floor cracks, beneath mop boards and in heat convectors, however, is sufficient to maintain a vigorous colony of carpet beetles for an extended period. Often an unemptied carpet sweeper or vacuum cleaner bag is an innocent trouble breeder.

Many householders have been unduly alarmed by the sudden appearance of Indian Meal Moths[4] which resemble clothes moths. Both species wrap themselves with their wings when in repose, but the Indian Meal Moth alone has the outer half of its front wings decked with reddish-brown scales. The clothes moths are attracted to electric lights which their Indian kin seem to shun. Caterpillars of both the Webbing Clothes Moth and the Indian Meal Moth spin ropes of silk that reveal their presence to discerning observers, but the one does so upon fabrics whereas the other chooses stored foods — especially grain. Indian Meal Moths are best controlled in private dwellings by destroying all infested products and thoroughly cleaning floors and shelves.

Indian Meal Moth

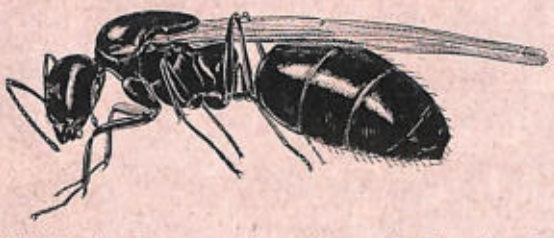
On two successive days a box of insects was received with the request that the sender be informed how to protect his property against them. The specimens were identified as Large Carpenter Bees[5] which are not unlike bumblebees, except that they lack a hairy abdomen and pollen baskets on their hind legs. Instead of nesting in the ground, they choose the hard way by gnawing tunnels into fence posts, trees and buildings. They are not averse to utilizing a deserted tunnel of last year's vintage or earlier. Like some species of bumblebees, they make a direct approach in gathering nectar by biting through deep flower goblets instead of diving into them.

The Large Carpenter Bee has puzzled many persons. It is seldom destructive, but it can sting badly.

In preparing a nest a Large Carpenter Bee may spend two days or more in gnawing across grain until its body disappears from sight, when it will sink a shaft down some twelve inches or more. This shaft it later divides with sawdust partitions into many chambers that rise one above the other. Each chamber is stocked with a mass of pollen and honey and an egg. In due time the eggs hatch, the food is consumed, and the adult bees gain their freedom.

Foresight is a major virtue of the parent carpenter bee since it provides admirably for the future of offspring which presumably it never sees.

Since Large Carpenter Bees are not colonial, they seldom are very destructive. But they can deliver a powerful sting. And they are persistent creatures, for once a tunnel is begun it is difficult to discourage them from its completion. They are not known to attack painted surfaces, although they will burrow into painted boards from behind.



This is the Carpenter Ant, often mistaken for the destructive Termite. The Ants merely nest in wood.

Of quite a different nature is the problem of Carpenter Ants[6] and Termites.[7] The latter are notoriously destructive to wooden buildings and the former can cause considerable damage. Too often their identification is confused, which leads to trouble when control measures are applied. Only last week a disagreement among so-called professionals was settled by recourse to this Department. One party claimed a certain building was being attacked by Termites, whereas the other party insisted they were Carpenter Ants. The price quoted for their control varied more than two hundred dollars. This was a serious matter. An examination of a submitted specimen proved beyond a doubt that Carpenter Ants were to blame, which saved someone a deal of money.

There is no real reason for confusing the two groups, provided one has recourse to a hand lens. Both have wingless workers and true males and females that are winged. Both are social creatures, living together in colonies, but there the analogy ends. Termites have no constricted waistline, their antennae are straight, and the wingless workers always stay out of sight unless disturbed, whereas ants have a decidedly constricted waistline, their antennae are elbowed, and the wingless workers do not hesitate to move about freely in the open. Termites eat the wood that they attack and therefore do not eject it from their burrows. Carpenter Ants, on the other hand, merely use the wood as a nesting site, which accounts for the sawdust heaps beneath the outside of their burrows.

The Termite, eater of wood.

Other insect specimens submitted for examination include longhorned beetles that had emerged from fireplace wood. Was it likely that they would lay their eggs in the house timbers? Since the house timbers nowadays are generally of spruce or pine and the beetles submitted were definitely partial to oak and hickory, this was not considered likely. Neither was it considered probable that American Dog Ticks[8] would spread Rocky Mountain fever in this locality, since the disease is of rare occurrence in New York.

Although the major task of the Insect Department at the New York Zoological Park is to plan an Insect House for erection in the post-war period, the insect identification and control service now being furnished is beating a well worn path to our door.

[1] *Galerucella xanthomelaena* Schrank.
[2] *Attagenus piceus* Oliv.
[3] *Tineola bisselliella* Hummel.
[4] *Plodia interpunctella* Hubner.
[5] *Xylocopa virginica* Drury.
[6] *Camponotus herculeanus pennsylvanicus* De G.
[7] *Reticulitermes flavipes* Kol.
[8] *Dermacentor variabilis* Say.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

Gray-lag—Ancestor of the Geese that Saved Rome

The origins of our numerous domesticated mammals and birds are the subject of constant speculation, turning up with remarkable frequency in our contacts with the question-asking public. Most of these origins, unfortunately, are so lost in obscurity that they are no longer discernible, and, at least in the case of most mammals, we have only speculation to guide us. Most birds, however, have either varied so little or have retained such obviously ancestral characters, that we are able to speak with more certainty.

The Gray-lag Goose (see the cover of this issue of ANIMAL KINGDOM), for instance, may safely be presumed to be the ancestral form from which our ordinary domestic breeds were derived. The Gray-lag breeds, or at least once bred, straight across northern Europe and Asia. Just which race of early humans first caught and tamed the downy goslings is difficult to say, for there are Egyptian records of domesticated geese that pre-date those of ancient Rome. But in any case, large flocks are said to have been driven to Rome each year from the northwest. These may have come only from suburban areas or, as seems more likely, they may have originated in barbaric lands that lay in that direction. There were both gray and white birds in these flocks, and from them must have come the famous white geese that are credited with having aroused the soldiery and saved the city from assault in 365 B.C.

At any rate, the fact remains that of the two principal domestic breeds today, one is brown, the other white. The great Toulouse, with unfattened ganders running to 25 pounds or more, is almost indistinguishable, as far as color goes, from the wild Gray-lag. The lovely snow-white Embden, with its pale blue eyes and almost equal bulk, must look not unlike those prized white birds of the ancient Empire.

Visitors to the Zoological Park interested in such matters can now see a Gray-lag in the lake just east of the Zebra House, and carry a mental image of the Farm-in-the-Zoo, where both Toulouse and Embden are shown.

— LEE S. CRANDALL

Pete's Birthday

Until a short time ago, we thought that "Pete," our elderly Hippopotamus, was certainly the oldest specimen of his kind in any zoological garden. Now it appears that he *may* be — his absolute right to the title is clouded by the uncertainties of the war.

Pete was 42 years old on July 13, thereby beating the best *published* record for Hippopotamus longevity, which was 41 years, 7 months and 29 days established by a specimen in the Paris Zoo in the last century.

Some time ago we received a communication from Major S. S. Flower, the British zoologist whose longevity records are frequently cited. He reported that there have been two long-lived Hippopotamuses in the Amsterdam Zoological Garden:

"Betty I, received in 1860, lived there for about 36 years.

"Betsy II was presented 29 March, 1898, when about 18 months old. The last time I saw her was 4 June, 1939, when she was about 42 years 8 months in age. Since then, unfortunately, we have no news from Amsterdam."

Major Flower pointed out in his letter that Pete holds the record for a male hippo.

It should shortly be possible to get further word from the Amsterdam Zoo, to determine whether Betsy II survived the war years. If she did, she still has a considerable advantage over Pete in the matter of age.

However, Pete's health and general well-being continue unexcelled, and he seems good for many more years.

The curiosity of Otters is notoriously great, and when our animals are not disporting themselves in their broad pool, or exploring every inch of their large yard, they like to stand up and stare right back at the visitors. A grassy bank hides the moat that confines the Otters to their pool and yard.

The "Otter Yard" Is Our Newest Exhibit

For the first time in the Zoological Park's history, we have a really superb place to exhibit Otters. The new "Otter Yard" on the site of the old Wild Turkey Range, in the center of the Zoological Park, was informally opened on July 7 when two fine young specimens of the northern Otter were given their liberty in the big pool and yard. They took to it instantly, explored the whole yard minutely and then settled down to playing in the broad pool.

Up to now they have not used their smooth slide into the pool; that "facility" was given them on the chance that they might take a liking to it and indulge in one of their most engaging habits. There is still a good chance that they will make use of the slide this winter when it is covered with ice.

Further planting of the Otter Yard remains to be done, but already it has proved that it is "workable" from a maintenance standpoint and that the Otters like it very much.

Capt. Hein Cited

Capt. Albert F. Hein, formerly a maintenance foreman in the Zoological Park before he entered the Army in February, 1942, has been cited for "meritorious achievement" for his work in Germany. The citation states that "during combat he resorted to ingenious innovations and expedients to restore radio and wire nets disrupted by the enemy action. By personally operating radios and switchboards during night periods Captain Hein has given his exhausted men a few additional hours of rest. He fearlessly exposed himself to direct enemy fire when his presence was required to supervise the communications network."

Plenty of Questions Are Asked at Question House

Since its opening to the public on Members' Day, June 14, Question House has been one of the busiest spots in the Zoological Park, with as many as 1,500 visitors on a single day. Not all of the 1,500 asked questions, fortunately!

In the first full month of operation, the attendants recorded 1,200 serious questions about animal life from visitors to the Zoological Park. Facetious or pointless questions have proved to be very few; it is obvious that most of the questioners want to know the "why" or "how" or "what" of some matter of zoological information, and the attendants have been able to give an immediate answer to the great majority of the questions. Those that require any considerable searching of reference books are answered by mail.

A series of wall paintings by Matthew Kalmenoff, illustrating longevity, size, gestation periods and myths about animals, have attracted many visitors and induce some of them to ask further questions.

Question House has already established itself as one of the most valuable of the educational services of the Zoological Society.

"Rainey Gate Aviary"

For some reason that is not entirely clear, the bronze trees in the Rainey Gate of the Zoological Park exert a fascination for birds and Robins, Sparrows and Starlings nest among their inflexible branches each spring. This year the Sparrows and Starlings preempted all the better nesting sites near the top, and a Robin was forced to build on the lower hinge of the outgoing gate, where she has reared three nestlings.

Mallards invariably explore the pachysandra beds near the gate and usually nest there. One

One or more attendants is always on duty in Question House, ready to talk to visitors who stroll in. Behind the counter is a shelf of reference books for quick consultation, and the staff is finding that it can answer an increasingly large proportion of questions offhand, for questions often recur.

brood of 14 ducklings hatched in mid-May and Gateman Ray Engle stopped all traffic at the gate for ten minutes while the ducklings crossed the road. They were halted for a time by the barrier of a curbstone too high for them to jump, but Mr. Engle and a police officer herded them along the curb to an off-branching road that led in the direction of Cope Lake. When last seen they were scrambling through a wire fence and heading for the water.

Dr. Dochez Honored

Dr. A. Raymond Dochez, a Fellow of the Zoological Society and a member of our Scientific Council, has been appointed to membership on a Research Board for National Security which will carry on in peacetime the work of two wartime groups, the National Defense Research Committee (NDRC) and the Office of Scientific Research and Development (OSRD).

The contributions of the NDRC and the OSRD toward the war effort "have been outstanding, nay, perhaps even deciding, factors in winning the war," the *Report* of the National Research Council states.

Dr. Dochez is Professor of Experimental Medicine and Surgery at the Columbia University Medical Center.

We Have Two of the Rarest Chicks in the World!

By LEE S. CRANDALL

Last year our pair of Wattled Cranes hatched the first young bird of this fine and stately species ever produced by captive birds. The great event occurred on July 26, 1944, so that at the end of October the youngster was only three months old. Since the Wattled Crane is a native of eastern and southern Africa we suppose that, like other African cranes, it is unable to endure low temperatures. Consequently, to avoid the risk of early November frosts, we had to put the little family indoors. From that day on, the youngster never seemed to thrive, and it finally died on November 25.

Young cranes grow at a remarkable rate, consuming immense quantities of food. For this reason they are notoriously "soft" and slip back with equal speed if the supply of food is reduced. For some reason not entirely clear to us, the young Wattled Crane never fed properly indoors, and to this we attribute his loss.

This year another youngster has been hatched, the required thirty-six days being completed on May 31. It therefore has an advantage of nearly two months over last year's bird, so that it will be much further advanced when cold weather comes. Also, the youngster is already being trained to feed from the receptacle it will use indoors.

* * *

Since 1939, pheasant breeders have been striving to preserve flocks of the many fine species established in captivity, with emphasis, of course, on the rarer kinds. One of the most-sought pheasants, since its introduction from Annam by Jean Delacour in 1923, is Rheinart's Argus, certainly the finest of this superb group.

The captive stock of this species, never very large, seems to have dwindled to whatever may remain in the London Zoo and the single pair in our own collection. These birds were presented to us in 1941 by Mr. Esmond B. Martin.

We have been unsuccessful in breeding from them until this year, when the female deposited her clutch of two eggs in a basket set under the shelter in the Phipps Aviary. On July 12 she brought off a single chick, which so far has grown well. It has the amusing habit of all Argus chicks of straining every muscle – and all its ingenuity – to remain under the protection of its mother's ample tail.

PUBLICATIONS OF INTEREST

"The Family Anatidae"

Something very important has happened in the scientific world (which is only another name for the world of truth), and this thing has been brought about through the efforts of two Fellows of our Zoological Society. Dr. Ernst Mayr and Captain Jean Delacour have published a paper in a mid-western ornithological magazine with the title "The Family Anatidae."[1]

[1] WILSON BULLETIN, Vol. 57, No. 1, March, 1945, pp. 1-55.

"So what?" the lay reader of ANIMAL KINGDOM may ask. Simply that for the first time in the study of evolution we are able to see the various forms of swans, geese and ducks more nearly as they have developed on the earth.

For decades we have been satisfied to shoot full-grown ducks, measure them, describe their patterns and colors, bills and feet, give them a name, label them and add sex, locality and date. More and more of their fellows join them in their museum drawer, each adding its mite of value. But each specimen represents only the external aspect of a momentary cross-section in the life of an individual duck. These birds have been known to live many years and from egg and duckling to death they have been concerned with a host of changes – physical, instinctive and emotional. They develop in an egg of definite size, shape, color and surface; as ducklings they wear a suit of down of characteristic pattern and color. They search for food in various places, and their wings, necks, legs and bills are fashioned in accordance. They call to one another in sundry quacks, honks, whistles or trumpetings, all different, all with receptive ears especially attuned. They instinctively differentiate friend and foe, and develop cunning methods of defense. When breeding time arrives voices change, vocabularies increase, courtships begin of flight, swimming, diving, posturing, which win mates, and the marriage lasts for a day, a season or a lifetime. They spend their life within a circumscribed area or they migrate thousands of miles.

In the smooth-plumaged, supine, duck skin, invaluable though it is, lying with its legs neatly crossed, these phenomena have no reality. Yet each one has its place as a factor of greater or less significance in the past and present interrelationships of all wild fowl. Mayr and Delacour for the first time have added these living, vital phases of life to the consideration of the epidermal characters of the preserved skin. They have brought about a unification of life and death and this is a very great innovation in the study of terrestrial evolution.

To those of us carrying on scientific work in the Department of Tropical Research in the Zoological Society this new departure is very heartening; it means a renewed vindication of the main objects of our expeditions, past, present and future, and reemphasizes the potential value of our hosts of photographs, paintings and ecological notes awaiting publication. The new treatment of the ducks is precisely what I and my staff are endeavoring to achieve in tropical lizards, certain families of birds, fiddler crabs and salticid spiders. And if such a thing were needed, all this would indicate the superlative worth of the observational and experimental researches on living animals of the proposed Science Center of the Zoological Society.

WILLIAM BEEBE

Rancho Grande Field Station,
Maracay, Venezuela.

JUDY AT THE ZOO. Story by Tom Maloney, Pictures by Jerry Cooke. 52 pp., 26 photographic illus. U.S. Camera Publishing Corp., New York, 1945. $1.00.

The best way to see the Children's Zoo is to visit it as a guest of an eager six-year-old. (Indeed, it is the *only* way, for adults are not admitted unless accompanied by a child.)

The author and the photographer of "Judy at the Zoo" found the perfect hostess for their visit. Judy, about six, all smiles and eagerness to pet every animal in sight, made the rounds of the Children's Zoo in the Bronx Zoo while the camera clicked, and the result is an entrancing picture-and-story record that carries Judy from her first approach to the Children's Zoo – handing her ticket personally to the uniformed attendant – to the breathless end where she says good-bye to Patches, the Llama, and goes out past Deacon, the Talking Crow.

As a souvenir of the Bronx Zoo's Children's Zoo, "Judy at the Zoo" is hard to beat and it will remind many youngsters of happy hours.

THEY ALL SAW IT. Photographs by Ylla, Words by Margaret Wise Brown. 32 pages, 15 photographs. Harper & Bros., New York, 1944. $1.50.

Ylla is one of the outstanding photographers of animals, with a reputation in the United States as great as that she enjoyed in Europe before the war. This large but thin book, half full-page photographs of animals, half one- or two-line text creating suspense as to what the animals saw that set them all agog, is a collection of some of her most striking photographs. It is an entertaining picture book for children and the only regrettable thing about it is that none of the pictures happened to have been taken in the Bronx Zoo, which her friends consider Ylla's second home!

ANIMAL KINGDOM

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The Purpose of This Society

The Zoological Society needs help. Somehow the opportunities that lie before it must be met. To help, you need to have but a single, simple conviction: that one of the worst things that can happen to human beings at this critical stage of civilization is to fail to receive a full share of the recreation, the understanding, the *vision* that come from Nature. The wonderful and diverse living things of this earth are the dynamic expressions of Nature's processes. In its broadest terms, the purpose of the Society is to bring this boon, this vision to the public—not only to the people of this great city, but to the nation, and, through publications, films and radio, even to the world at large.

Fairfield Osborn

IN THIS ISSUE

Osprey Coming Into Her Nest	*Eliot Porter*	COVER
The Significant Future of the Zoological Society	*Fairfield Osborn*	123
The Rare, the Strange, and the Beautiful	*William Bridges*	126
Perspective on the Zoological Society	*Jean Delacour*	135
Babies in the Zoo		138
Presenting – Bees and a Bee Tree	*Brayton Eddy*	141
Another Great Plan for This Society's Future	*Donald T. Carlisle*	146
"Let's Go to the Zoo!"		149
We Carry the Society Into the Jungle	*William Beebe*	152
Behind the Scenes: News and Notes		158

The African Plains as we plan the extension of this great exhibit will be a living, exciting panorama of birds and mammals of the continent.
From a painting by Matthew Kalmenoff

The Significant Future of the Zoological Society

By FAIRFIELD OSBORN
President of the New York Zoological Society

OUR INSTITUTION stands at the threshold of a period of resurgence and of far-reaching development. The opportunities that lie ahead are manifold and so significant that one is filled with a sense of faith and confidence that they will be met. There is no possibility, however, of meeting them unless those who believe in the purposes of the Society are prepared to provide financial support of an extremely substantial nature. This article provides a general description of the plans that have been made for the future and pleads for the support that will translate them into reality.

The founders of the Society were men of extraordinary outlook and foresight. For fifty years its original Charter has been fully adequate for all its purposes. This holds equally true today. Every plan and concept that we have for the future is related directly to the four great purposes for which the institution was created. They are as follows:

Management of public institutions designed to exhibit the animal life of this earth.
Popular education in zoology.
Scientific research.
Conservation of animal life and preservation of natural areas.

There follows a brief description of the major plans that await fulfillment, given in the order expressed above.

Zoological Park

During the war period extensive plans have been completed for the modernization and development of the Zoological Park. If these plans can be carried into effect the word "Zoo" will

Now is the time to act on the plans we have been making all through the war years. This is the first article of a series on our needs and opportunities.

hold entirely new implications, for the net result will be that the four great classes of land-living animals—mammals, birds, reptiles and insects—will be shown in the full beauty of environmental backgrounds and in the main according to their continental origins. At the present time a relatively small part of the Park comes up to the standard which we believe it should have. Fine as the original buildings are in their architectural design, and beautiful as are the Park terrain and foliage, the fact remains that the methods of exhibition both within the buildings themselves and in the outside areas have now become outmoded. It is true that within the last few years a series of improvements has been made. Two units exhibiting the animal life of Africa have come into existence. These have proved an outstanding success. Other improvements, not a few in number, have been made here and there; new techniques have been devised which have proved themselves practicable as well as beautiful and informative. But these efforts are at best merely preliminary and partial. They have fully justified our confidence in planning to adopt them generally. At the present time approximately 110 acres are developed for zoological display. Plans have been completed for the development of an additional 60 acres, carrying the Zoo itself over to the borders of Lake Agassiz, the Bronx River ravine and the beautiful lake that lies

below it. These plans involve the completion of *Africa* and the creation of an area for exhibition of the animals of North America as well as one for the animals of Eurasia. Ultimately it is hoped that we shall have areas for the animal life of South America as well as Australia. In view of the fact that the Park now has adequate and substantial buildings, future plans provide only for four large new buildings. One of these is for the exhibition of the anthropoid apes, another for a large central restaurant. In addition a new building for the smaller monkeys and mammals is badly needed and it is quite clear that we must have a building for the exhibition of insect life. The new Insect Department, the first of its kind in any Zoological Park, has already met with broad popular response. It is believed that a special building emphasizing the inter-relationships of insect and human life, will unquestionably prove one of the major drawing cards of the future Zoo.

The New Aquarium

It will be recalled that the old Aquarium at the Battery, managed by the Society for four decades, was closed in the Autumn of 1941 due to the encroachment of the proposed Brooklyn-Battery tunnel. Shortly thereafter at the request of the City government, the Society set about to prepare plans for a great new Aquarium. These plans have been completed. They are original and compelling. At the entrance to the building there will be presented a striking dioramic interpretation of the cycle of water and of the aquatic life that inhabits each successive area, namely mountain spring, up-land stream, pond, river and ocean. Large tanks giving the illusion of limitless space, will contain rays, sharks and mammoth sea turtles. There will be two vast outdoor tanks, some 70 feet long by 30 feet wide, with both over-water and under-water views which will contain large marine forms such as Stellar sea-lions, walruses, porpoises, seals, sea otters, together with some of the larger forms of marine birds. The plans further provide for two large exhibit areas with both over-water and under-water views of penguins: an air-conditioned enclosure for the King and Emperor penguins from the Antarctic and another for Humboldt penguins of the Pacific and the Blackfoot penguins from the South Atlantic. Adequate laboratory space is provided for research, an inherent and important activity of this institution.

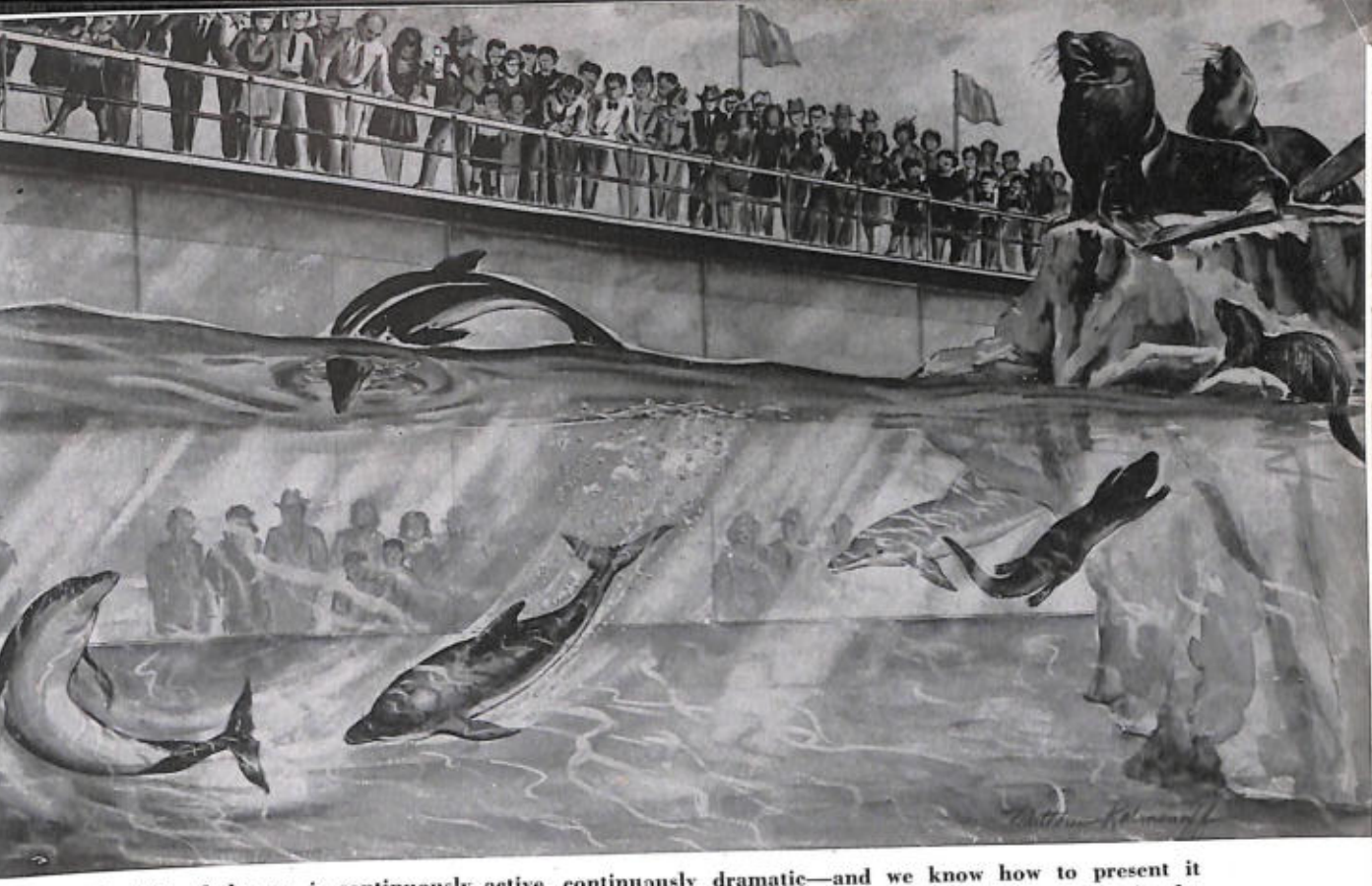
It is not credible that New York will have to go much longer without a great public Aquarium.

Popular Education in Zoology

The potentialities for the extension of the educational work of the Society are only limited by the amount of funds available for this purpose. In general these activities involve the distribution of educational material to the schools of the Greater City of New York and nearby communities, guided tours within the Zoological Park, the publication of books, the preparation of documentary films and the use of the radio. At the present time the Society has such limited funds that it is possible to meet only a fractional part of the opportunities which exist for work in education. The public is thirsty for information about animal life. This fact is brought home to us constantly, both in the Zoological Park itself and in the volume of demands from outside sources. The innovation initiated this Spring through the opening of the Question House, where a trained staff is in attendance to answer serious questions concerning animals, has already proved itself a very real success and substantiates the conviction that the Society should do far more than it is now able to do in the field of popular education.

Scientific Research

Last year a Scientific Advisory Council was formed for the purpose of developing plans for the extension and widening of the Society's work in this field. The men serving on this Council are among the nation's leading scientists associated with great universities, medical schools, or scientific foundations. They have reviewed the long and fruitful history of the Society in biological research and now subscribe to the opinion long held by our trustees and officers that the Society is faced with a great and unusual opportunity and that there should be established in or near the Zoological Park a Research Center where studies can be pursued in an organized manner by members of our own staff and where facilities can be made available for visiting research workers from other institutions. The fields



The life of the sea is continuously active, continuously dramatic—and we know how to present it effectively. This is a sketch by Matthew Kalmenoff of one of the two vast out-of-doors tanks in the new Aquarium as we now plan it. Visitors may observe both from above and below the waterline.

of comparative behavior, physiology, pathology, anatomy and parasitology are all advanced by the study of animal life. For many years the Hospital at the Zoological Park, as well as the Aquarium Laboratories, have kept complete vital statistics of the collections including full recordings of disease conditions and causes of death. Many medical schools, universities, colleges and individual scientists regularly call upon our staff for information or material. The time has now come for the coordination and extension of this vital work, to be organized under a competent directive head.

Within the year the Society's Tropical Research Department has concluded arrangements for the establishment of a biological research station in Venezuela. This is an event of substantial importance and it is greatly to be hoped that the Society may be able to carry this forward as a long-term project both for the work of its own staff and for the scientific men of other institutions.

Conservation

One of the most important purposes of the Society is the extension of popular understanding concerning the relationship of man with all other kinds of living things. Man is derived from Nature and though he has the caress of Divinity on his brow—and a touch of the devil—he is only "lord of the universe" to the degree that he realizes the need for his being a good trustee. The more his power increases, as indeed and in many ways unfortunately it has, the greater the need that he act in trust and protect the other living things of this earth, not for their benefit alone, but for the very continuing existence of man himself.

The Society from its earliest years has been a leader in the field of wildlife conservation. Today a new concept is forced upon us. It is based on the fact that the existence of all wild animal life depends upon the maintenance of the forests, soils and streams. These living resources are also the basis of the survival of man himself. The Society, while continuing its energetic support of the preservation of wildlife, needs at the same time to broaden its efforts in arousing public consciousness to the fateful destruction of living resources both here and in other parts of the world.

The Rare, the Strange, and the Beautiful

By WILLIAM BRIDGES

THE WORLD is still full of rare, strange, and beautiful animals that have never, or seldom, been seen in any Zoological garden. Rarities have come out of the wilderness at an accelerated rate in the last half-century – the Giant Panda is only the latest – but plenty are left. Indeed, the list of mammals alone could be extended to fill this page – all of them "snarks," as one Zoo director calls the prize animals of his collection.

Some day soon the world will settle down and then the New York Zoological Society intends to begin a systematic combing of the wild places. It is already thinking of sending its own expeditions to Malaysia, Indo-China, Africa. Transformation of the Zoological Park, as we are planning it, will give extraordinary opportunities for display. The Zoological Park is ripe for a great surge forward and if the "air age" is actually upon us, as newspapers and magazines give daily assurance, travel and collecting and transportation of animals will be simpler than ever before.

Here is an abbreviated list of mammal rarities we may reasonably hope some day to see in the New York Zoological Park. Almost all of them have been exhibited somewhere at least once, but they are authentic rarities for all that.

Aye-Aye
A primitive, Lemur-like Primate found only in Madagascar. Huge ears, long, bony middle finger, a big and bushy tail.

Pangolin
The Scaly Anteater of Africa and southeastern Asia. Six feet long, armor-plated in tough scales.

Maned Wolf
Neither distinctly maned nor a true Wolf, but a very rare carnivore of central South America.

Proboscis Monkey
A very long-nosed Monkey of Borneo, the most grotesque of all the Primates.

Royal Antelope
The smallest Antelope in the world—only about 10 inches high at the shoulders. Africa.

Tenrec
One of the odd insect-eaters of Madagascar; about 16 inches long; snarp-snouted.

Fossa
A night-prowling carnivore of Madagascar, catlike, long-tailed, slender-bodied.

Kouprey
A great Wild Ox of Indo-China, discovered only about 10 years ago, exhibited only once—in the Paris Zoo.

Takin
The big Goat-Antelope of the Himalayas.

Serow and Goral
Goat-like relatives of both the Goats and the Antelopes, from eastern and southeastern Asia.

Giant Forest Hog
Six feet long, the most spectacular of the wild swine. Forested highlands of Africa.

Yapok
The most beautiful of all the Opossums. A silky-haired, black-and-white Water Opossum of tropical America.

Silky Anteater
Hardly larger than a kitten, with long and silky hair, a prehensile tail. Tropical South America.

Leopard Seal
A gigantic, really fearsome, penguin-eating Seal of the Antarctic seas.

Elephant Seal
The largest of all the Seals—monsters more than 20 feet long, found in the southern seas.

Sumatran Rhinoceros
The smallest Rhinoceros, only about 8 feet long. Two-horned, hairy.

Marco Polo Sheep
One of the finest of the wild Sheep of the world, living high in the Himalayas.

These are a few – a very few, really – of the strange, the rare, and the beautiful animals we want and some day will have.

* * *

On the pages which follow are pictured a selection from the famous animal rarities that the New York Zoological Park has been privileged to exhibit, in the past or at the present time.

KOALA

Australia

Its black, pudgy nose, its bright little eyes and its soft, plushy, gray-brown fur make the Koala one of the most appealing animals in the world. Australians call it the "Native Bear," but it is not a Bear—actually it is a marsupial that zoologists have placed in a family all its own. It feeds only on certain kinds of eucalyptus leaves and therefore is hard to keep in captivity outside its native island continent.

HAITIAN SOLENODON

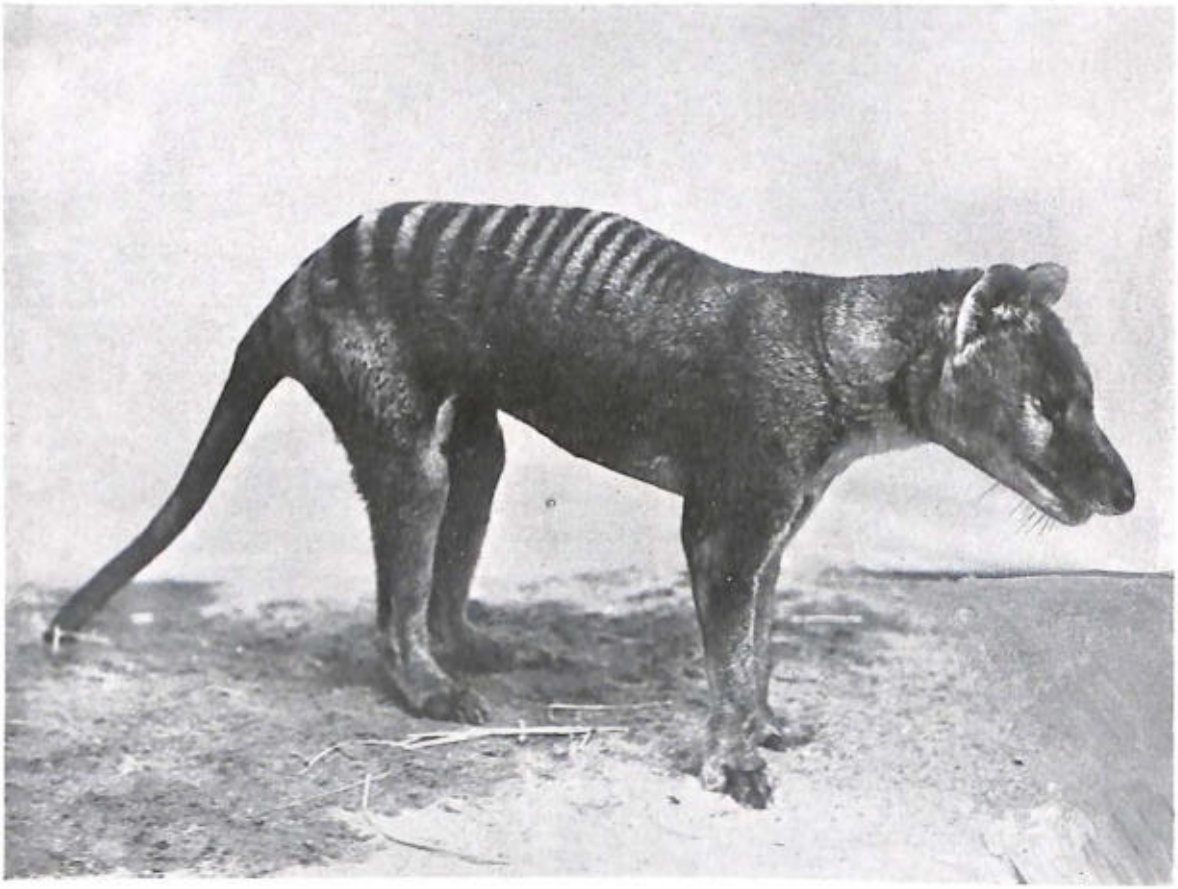
Haiti

Although it had been known to scientists for more than a hundred years, it was not until the early part of this century that the Haitian Solenodon was brought out for exhibition. It is classed as an insectivore, but its diet apparently includes vegetables, snakes and fruits. Its nearest relative is a form found on the island of Cuba—now almost or actually extinct.

OKAPI

Africa

The term "living fossil" is a loose one; nevertheless, the Okapi comes close to meeting the requirements. Its ancestors are supposed to have died out some 60,000,000 years ago, leaving it as a link between the distant past and the present-day Giraffe. Its home is in the thickest jungle areas of the Belgian Congo and the Okapi now living in the Zoological Park shows its shade-loving nature by avoiding sunlight.



THYLACINE

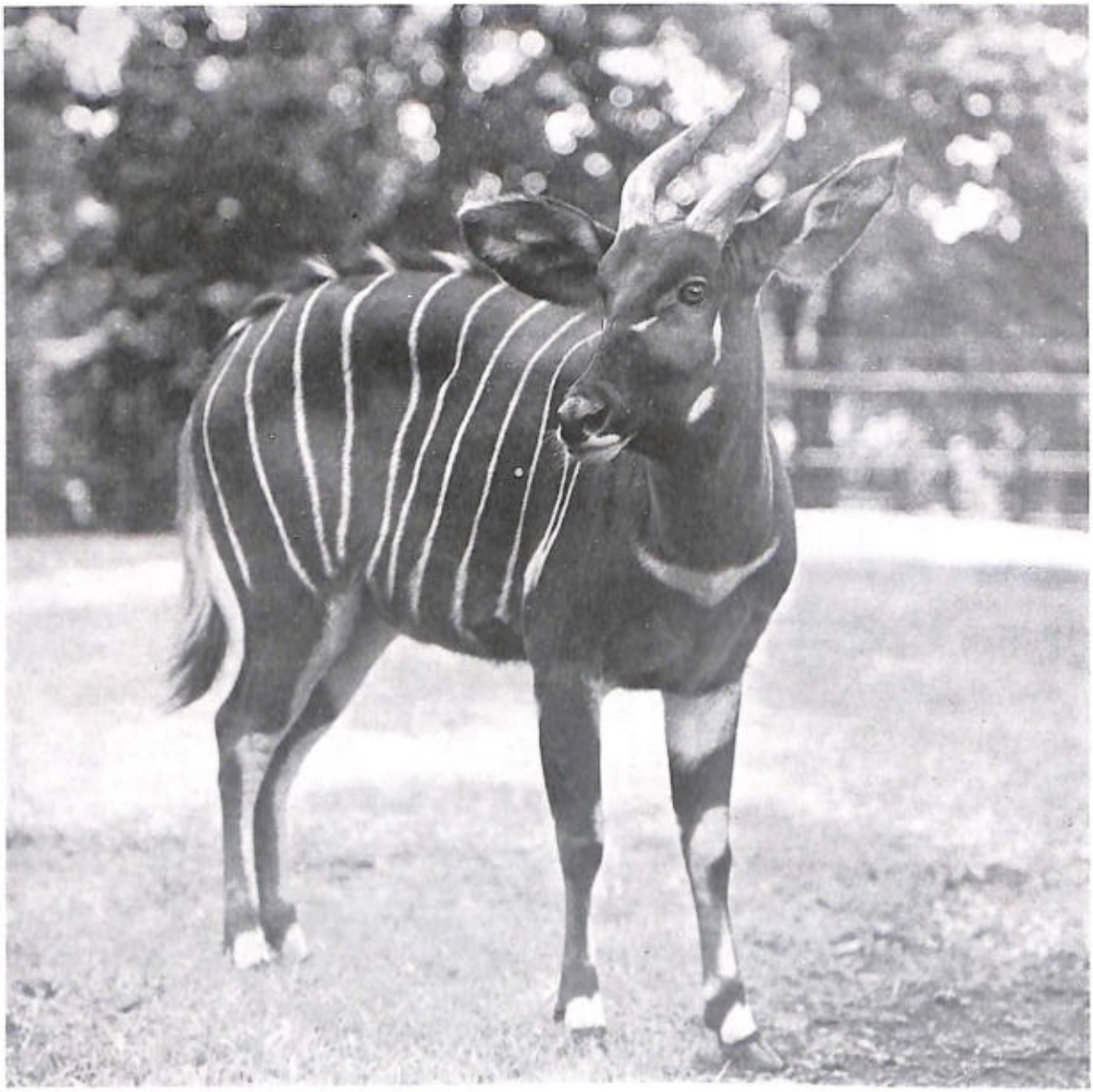
Tasmania

The bushmen of western Tasmania sometimes see, lurking in the dense forests or skulking through the underbrush, a dog-like, striped animal that they call a "Wolf" or a "Tiger" or a "Hyaena." Actually, the Thylacine is none of these. It is a marsupial, of course, and a carnivore; at one time it was fairly common, but because of its depredations against sheep, it has been exterminated over most of its old range.

DUCK-BILLED PLATYPUS

Australia and Tasmania

The first (and only) Platypus ever exhibited outside its native Australia and Tasmania came to the New York Zoological Park in 1922. It lived 34 days and thousands flocked to see this greatest of zoological rarities. It lays its eggs—usually two—in an underground nest, yet it is a mammal and nurses its young.



BONGO

Africa

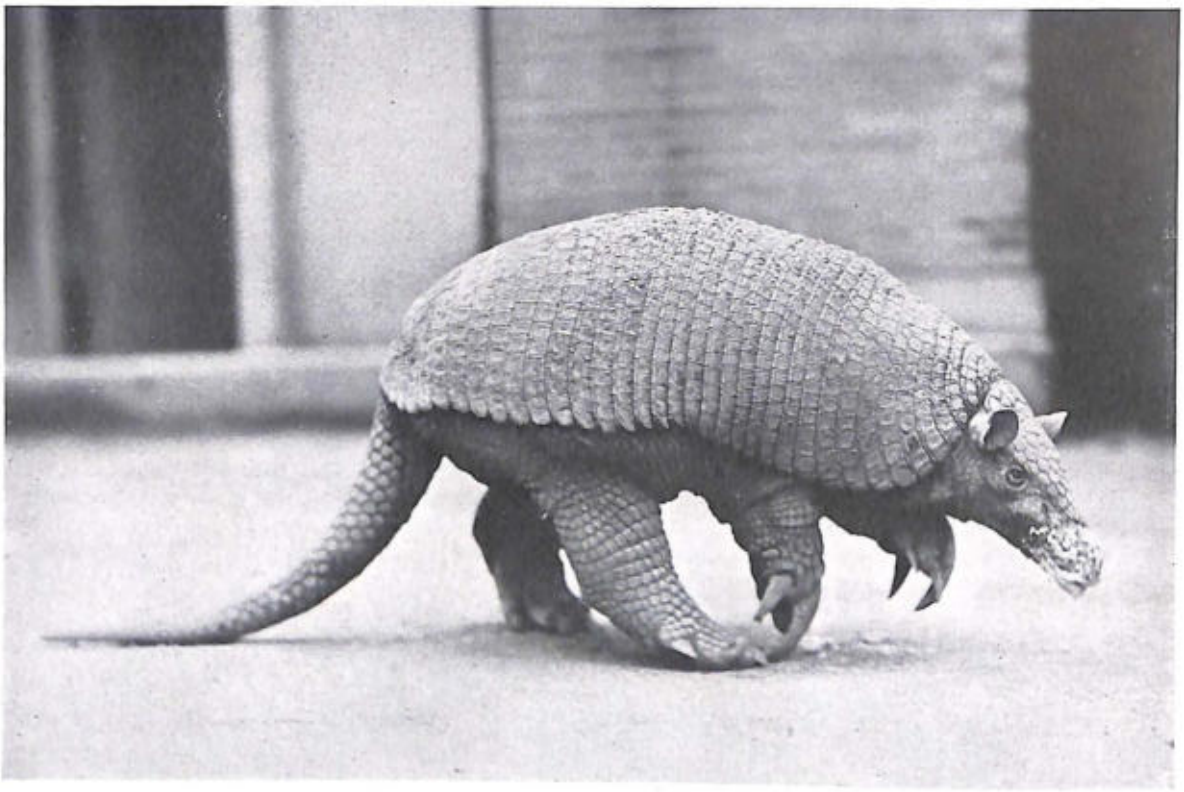
This is the handsomest of all the Antelopes, and one of the rarest. It comes from the dense, jungle region of Equatorial Africa and like the Okapi, another forest dweller, dislikes intense sunlight. The adult Bongo now living in the New York Zoological Park is the only one that has been exhibited in the United States.

H. Huber Clark Photo

GIANT PANDA

China

To a zoologist, all animals are interesting and important and, technically, there is little to choose between a small and inconspicuous Shrew and a large and showy Giraffe. But now and then some animal seems to have everything—popular appeal and rarity and a special scientific interest. Such is the Giant Panda, a "clown" as far as the public is concerned, a very rare animal that has been seen outside its native habitat only since 1936, and a curious creature that is Bear-like in some ways yet is closer to the Raccoons. The New York Zoological Park has two Giant Pandas.



GIANT ARMADILLO

South America

Animals that we call "giants" today are usually only the largest members of their group, and are "giants" merely in comparison with others of their kind. But the Giant Armadillo is so much larger than the familiar Nine-banded and Six-banded Armadillos—it is about a yard long, exclusive of tail—that it is truly gigantic. It was only about fifteen years ago that the first living specimens were brought out of the jungle.

Some interesting observations on the place we hold among the zoological institutions of the world.

PERSPECTIVE on the ZOOLOGICAL SOCIETY

Visitors crowd around the baby Black Leopard, learning new and exciting facts about animals.

By JEAN DELACOUR

I AM ONE of the few surviving representatives of a vanishing race—that of the private collectors of living animals. As such, I have had good opportunity to travel extensively over the world and the best of reasons to look observantly at the great public collections of animals in many countries. Nowhere—and I have seen most of the public zoological gardens on every continent—have I found another institution with the burning faith in the educational possibilities and in the scientific study of animal life, and the determination to bring its dreams to fruition, that the New York Zoological Society displays.

To establish my right to speak as positively as I do, I may perhaps be pardoned a reference to my qualifications. I was brought up in Paris in the heyday of the delightful Jardin d'Acclimatation. For many years I have been a Member of the Council of the Zoological Society of London. As an associate of the French National Museum of Natural History I have been active in the administration of the ancient Jardin des Plantes and the modern, moated Vincennes Zoo. I was adviser for the expansion of the Rome Zoo in the early Thirties. And, as I say, in the course of world travels to form my own unrivalled but ill-fated collections at Villers-Bretonneux and at Clères, between 1908 and 1940 I visited and studied most of the zoological institutions of the world.

I say it again: the New York Zoological Society is unique in its purposes, ideals and accomplishments.

Practically all zoological gardens, large and small, whether they are run by cities or states or belong to private societies, are purely and simply exhibitions of live animals, confined, as a rule, to mammals, birds and reptiles. Only a few have added insects and an aquarium to incorporate the water-world, or make any attempt at scientific research. Almost universally the efforts at education of visitors have consisted of labels on the exhibits—not always as accurate as could be desired and rarely really explicative.

The best of these institutions, notably the great Zoological Society of London, have attained fame by their scientific publications. The National Zoological Garden in Washington and the Paris Zoos, forming parts of great national establishments of natural history (the Smithsonian Institution and the Museum National d'Histoire Naturelle), have a special position, for in principle the available material and specimens are at the

disposal of specialists for study in different departments. Actually, the very hugeness of their scope has too often proved a hindrance to the smooth working of any such arrangement.

No such institutions, so far as I know, have tried consistently to promote zoological research, education and the preservation of natural resources by direct action.

In these fields, which make a Zoological Society so much more than a "zoo," the New York Zoological Society has always occupied a place of its own. Not by accident or circumstance, but by well-conceived design, since its debut fifty years ago it has combined with the first and all-important aim of exhibiting the best possible collections of animal life the vital corollaries of education, research and conservation.

In the Children's Zoo, contact between children and animals is direct and immediate. Here the wonder of living things unfolds.

My acquaintance with the actual work of the New York Zoological Society goes back not to its very inception, but to its early years, and I have seen and noted with satisfaction how it was willing—nay, anxious—to encourage its scientific staff and to provide means and time for observations and experiments. The crowded files of our scientific publication, *Zoologica*, constitute a monument to the activity of the Zoological Park and Aquarium personnel. Not only outstanding, but unique, is our Department of Tropical Research under Dr. William Beebe. Such names as Madi-

son Grant, Henry Fairfield Osborn, Frederic Walcott, Dr. William T. Hornaday and Dr. C. H. Townsend are inseparable from the accomplishments of the Zoological Society, are inseparable also from magnificent heroic efforts in conservation. Best of all, they were successful efforts—as how else could they be, with such men, such means and such ideals?

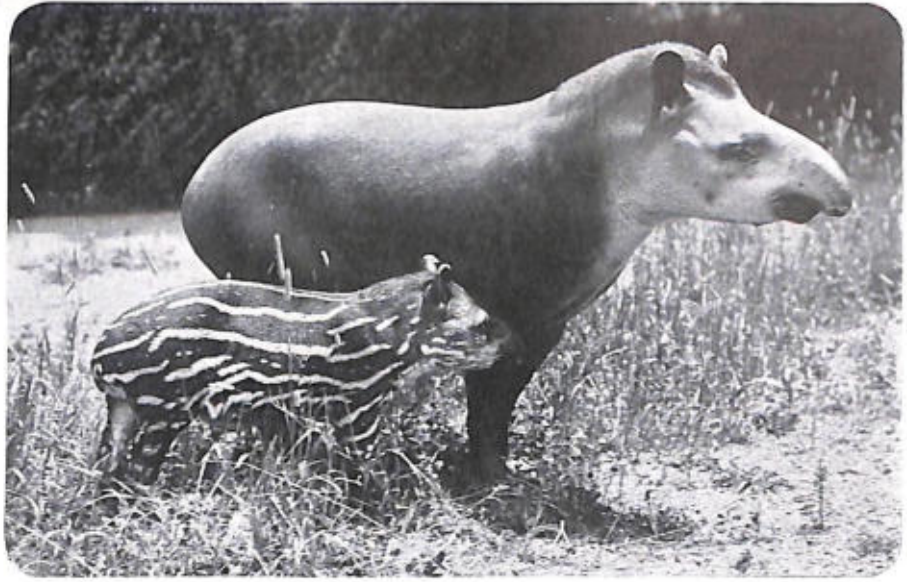
I do not say that all the vital ideas and constant seeking for solid accomplishment were in the past, either. Unless I am very much mistaken, the New York Zoological Society is the only institution of its kind that maintains a fully staffed Department of Education through which its ideas and ideals can be given directly to the public. Motion picture films, lantern slides, photographs, booklets, have been our standard outlet for years; recently our Question House has supplemented, even more directly, these functions and has proved to be a great success.

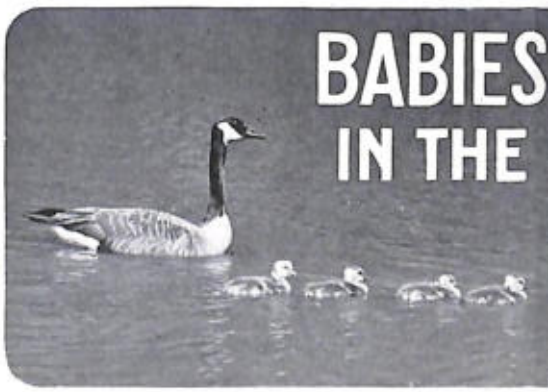
Elsewhere in this country and abroad I have seen other examples of displays of domestic animals and of special facilities for children; I have seen nowhere anything that approaches in attractiveness and effectiveness our Farm-in-the-Zoo and our Children's Zoo.

Today the guide book and descriptive labels in the Zoological Park are the best of their kind; they are an admitted standard for other zoological institutions. I am speaking not only of their physical appearance—although in this, too, we are pre-eminent—but of their content and informativeness. In the development of adequate labeling of living exhibits to identify, locate and, if you will, dramatize, each living creature in our collection, we have been encouraged by the receptive curiosity of our visitors. We have discovered that people—the man in the street—will read labels as long as 500 words. We know they want and appreciate information; we have studied them in the process of acquiring it from our exhibits. We *know* that an attractive habitat exhibit compels attention and creates an interest in descriptive labeling. We *know* our attractive and inexpensive booklets about animal life are wanted and appreciated. We *know* there is an avid thirst for the kind of information we are prepared and instituted to give, because every day we see examples of our beliefs in practice.

Yes, the New York Zoological Society is indeed a leader in these combined and inter-related fields of Living Zoology. No similar institution has done so much or so well—has felt the impetus to do so much. But progress must always be made. We want to do more, and better. Fortunately, we know how, and along what concrete, positive lines, progress can be made that will meet very real, very vital needs.

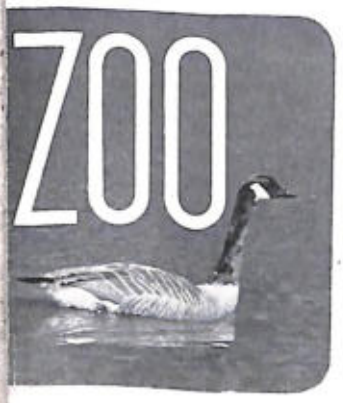
(RIGHT). Many baby animals are simply small editions of their parents. Not so in the case of the South American Tapir. There is no mistaking its babyhood stripes. (BELOW). Little Bagheera, our baby Black Leopard, appears almost wistful here—but actually she was simply contemplating a playful spring at the photographer, which took place a moment later. Hand-reared Bagheera is growing up with a friendly disposition.





(RIGHT). The Great Apes are remarkably "human" in their actions when they are quite small. This is Mike, the young Orang-utan, when he was given a new toy. He played with it for hours and exhausted all its possibilities as a plaything — although he never ceased to be surprised when it bounced and rolled back at him.

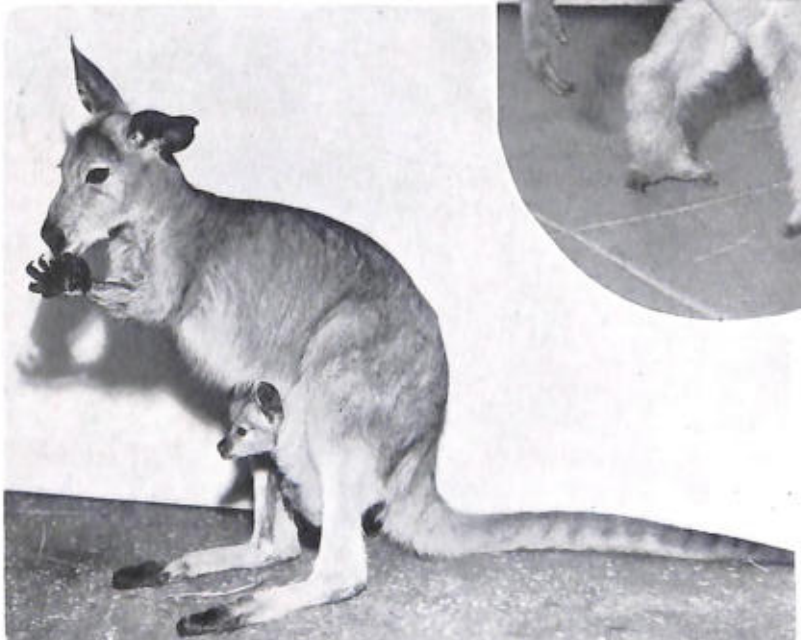
(LEFT). Baby Raccoons are appealing as they explore the great new world about them. A little timid in the beginning, one quick motion made them retreat, always returning for another look.



(ABOVE). A Sealion pup stays close to its mother when it is young. (LEFT). Rocky Mountain Goat and her frisky kid. (RIGHT). A baby Llama is an annual occurrence in the Zoological Park. A mother and baby.

(UPPER). Last year's little Tigers—now babies no longer, but huge creatures weighing more than 200 lbs. each. (BELOW). Keedah, a young Gibbon, in a bashful and yet inquisitive mood.

(ABOVE). Zebra colts are not a novelty nowadays, for one is born every year or two—but still they are among the most attractive of animal babies because of their clean, bold, black-and-white marks. (RIGHT). A great event at the Kangaroo House is the arrival of a baby — or, rather, the time when it begins to put its head out of the pouch. This is always several months after the birth of the baby. Then, for months more, it is in and out of the pouch daily.



Presenting—
BEES and a BEE TREE

By BRAYTON EDDY

Came a spring storm and the top of a great black oak crashed to the ground, carrying a swarm of angry bees—and a new exhibit.

THE TECHNIQUE of setting up an observation beehive, where the most intimate details of a honeybee organization can safely be noted and admired, is rather well-known. It involves the use of a special glass case and a few pounds of home-grown bees. But to bring in a 500-pound section of bee tree, with some 15,000 wild bees inside, and place it in a woodland scene within a display nook, is something else again. It involves certain unknowns which make the task both challenging and exciting.

Can the feat be accomplished without undue punishment of the persons concerned? Once accomplished, will the bees take kindly to the re-location of their home or will they resent it and move into more stable quarters? If they choose to remain, can they be persuaded to fly in a semi-circle and exit for food through a rear gap in the display nook or will they dash their heads against the public observation window directly in front of them? If they can be induced to wheel and go out-doors, will the bee pastures within an easy flight range of one mile yield sufficient nectar to meet the requirements of the colony? Finally—since a public exhibit is of no consequence unless it can be clearly viewed—will the bees permit a spotlight to be directed into the sanctity of their combs without becoming alarmed?

These questions can now be answered in the affirmative since the bee tree exhibit has been an accomplished fact for two months at the New

The log, as it fell, lay with the split side uppermost and with the comb and the whole colony of bees exposed to the weather. After sawing the upper part of the trunk nearly in two (the saw is visible in the picture), Curator Eddy undertook to remove the sticks and stones boys had thrown into the comb.

York Zoological Park. Bees are flying in and out of the Reptile House window just as if they had been doing so all their lives. Worker bees are building wax comb under the full glare of a spotlight with the same unconcern that veteran actors show on stage. Since the ways of bees are often unpredictable the curtain may have to be drawn at any moment, but present indications are that the drama will continue to unfold at least until cold weather.

In meeting the challenge to bring in a tree with live bees for public observation, certain fundamental bee urges have to be kept clearly in mind. Bees are attracted by light and repelled by smoke. This is important to remember. Bees do not desert their queen without good reason. Consequently, it is unnecessary to exert oneself catering to the whims of individual worker bees so long as royalty is satisfied. Bees return home at nightfall and cluster about their queen. An expedition, therefore, need not be dispatched over the countryside to round up scattered members, since, when darkness sets in, an entire colony can be captured en masse.

The story of the bee tree goes back to a warm day in June, 1944, when presumably a queen bee—overcrowded by her own fecundity and a mounting accumulation of honey and pollen stores—went forth from a man-made hive, probably somewhere in the nearby Bronx, in quest of space. No doubt she was accompanied by her older daughters, and some more young, for she would need help in establishing a new colony. They must have clustered for a time on a nearby limb, awaiting reports from scouts sent to reconnoiter; then they must have flown straight to a distant hollow located in the topmost section of a black oak tree. By coincidence, the oak tree happened to be growing on a woody ridge just east of Beaver Pond in the Zoological Park.

In early spring, 1945, there came a high wind which snapped off the hollow trunk some fifty feet from the ground and tossed it, loaded with comb and protesting bees, violently to earth. A large sliver of wood, torn from the face of the trunk as it fell, laid bare the occupied interior. It remained for a park policeman, searching the area for a lost child, to find the tree and report that he had discovered *hornets*.

But hornets are not plentiful in the spring . . .

About 9:30 o'clock in the evening all the bees were clustered on the comb and it was time to wrap netting over the aperture and prepare the trunk for travel. Just in front of the kneeling workman, the cardboard barrier across the lower end of the comb can be seen, securely wedged in with cotton.

not in New York. There was reason to be skeptical. Because hornets store no food to carry them through the winter, the entire colony perishes in the fall except for a lone queen mother, which survives by hibernating. Unlike bees, queen hornets must start from scratch each year without the aid of faithful daughters—and everyone knows it takes time to raise a family.

These were not hornets, but bees. There was no mistake about it. Their comb was made of wax, not paper. Great layers of it could plainly be seen through the wide gap in the hollow trunk stretched prone upon the ground. It was astonishing that the bees had managed to survive. Probably three weeks had elapsed since they were thrown from their lofty site in the old oak tree. Rains had come and flooded their combs, boys had tormented them with sticks and stones, yet they remained. Their tempers were somewhat aroused, but that was only to be expected.

When it became evident that the bees not only were holding their own, but actually increasing and making new comb, plans were laid for their capture. A section of the Reptile House lobby that backs up to a window leading out-of-doors was chosen to receive the exhibit. Through this window it was intended the bees should go in search for food; but if they refused, provision was made for keeping them alive on sugar syrup rations. The enclosure itself is approximately 500 cubic feet in area, with a curved backdrop, painted sunshine yellow, a large observation window and at the side a glass service door. Over the lobby window is a large reflector bulb to entice the bees out-doors early in the morning.

On August 3 this novel display nook was in readiness. Three o'clock in the afternoon was set aside for reporters and photographers to record the unique process of preparing a bee tree for night removal. First it was trimmed to size with a two-man saw, cutting the wood at a point where auger soundings showed there were no bees. The section must not be longer than seven feet, since that was the height of the nook. Then the Curator of Insects, disguised in the comic headdress of all good beekeepers and wielding a belching bee smoker, cleared brush from about the hollow trunk and extracted sticks and stones from its humming interior. Minor cracks in the rear armor were plugged with cotton to eliminate

one bee escape route, and a cardboard partition was installed to seal the end of the hollow. The afternoon's work was completed when a long strip of gauze was tacked to the top edge of the gap, in readiness to be lowered at night when all the bees were at home.

The night meeting was arranged for nine o'clock, the earliest hour of darkness. It was indeed an auspicious occasion. Animal keepers were present, maintenance men with tools and truck, photographers and gentlemen of the press. There were even two men from the Bronx County Beekeepers' Association, and a local dentist who cancelled all evening engagements to enjoy the fun. A total of twelve persons was on hand, and as it turned out everyone was needed.

It was a good quarter-mile from the place in the woods back of Beaver Pond, where the bee tree was discovered, to the Reptile House, but the journey was accomplished without mishap and the tree carried into its prepared display nook. Not a person was stung. Not a bee was crushed. The section was stood on end in a special well built in the floor to receive it. Jagged rocks, fungus-covered logs, dead leaves and other forest effects were strewn about to make a natural setting, to make it look as if the tree had grown in that position from a sapling.

The time was close to midnight and most of the volunteer helpers had gone home. But there was still the tree to unseal. The bees were wildly flying against the gauze curtain, trying to escape, which did not lend charm to the prospect. They could be left imprisoned until morning but that would only postpone the hour of reckoning. Meanwhile their tempers would not be improved.

Then came the answer to the problem. Bees are attracted to light. By holding a floodlight so that it shone down through the window in the false ceiling, the gauze was removed from the face of the gap in perfect safety. A stream of bees flew up over the heads of the crouched workmen, but without so much as looking their way.

Now that the bees were released, it remained

The hardest part of the whole job was shifting the massive section of tree trunk into the waiting truck — and, later, lifting it into the enclosure in the Reptile House lobby. Rain had soaked the rotting wood and it weighed at least 500 pounds, far more than estimated. However, there were many helpers.

Now that the bee tree is in place in its exhibit enclosure, it has justified all the time and effort its preparation required. A spotlight plays on the comb and the activities of the bees are fully visible. Pictures overhead show steps in preparation of the exhibit, and labels tell the fascinating story of bees.

to make certain they would fly outdoors in the morning and not forget to come back again. The entire plan of the display nook was directed to that end. Once the exhibit was safely in, all windows were blacked out except the one at the rear through which it was intended the bees should escape. The spotlight over the window was to aid them in finding it and was to be turned on early to start action.

For the first week the public was allowed to glimpse the exhibit through peekholes that did not admit too much distracting light. But as the bees became accustomed to flying in a semi-circle to go outdoors, lured there by the outside daylight, the blinders on the display windows were gradually removed until at the end of two weeks the full scene could be revealed.

On August 18 the final touch to the exhibit was added. Until then, although the wide gap in the bee tree was plainly visible, the wax combs within and the cluster of bees were not. But now a baby spotlight throws a warm glow over the area, revealing the geometrical design of the wax cells and the industry of the architects.

The story of the bee tree is told in pictures on the outside of the display nook, and there is a label which reads as follows:

HONEY BEES

Apis mellifera Linnaeus

ORIGIN IN EUROPE AND ASIA; DISTRIBUTION NOW UNIVERSAL

A honeybee colony is essentially feminine. One queen-mother lays all the eggs and her daughters do all the work. The males (drones) simply mope around home waiting for a marriage flight. They cannot even sting! The young daughters remain indoors acting as nurse-maids, ladies-in-waiting, construction engineers and honey storers. They even air-condition the home by fanning with their wings. The older daughters work outside gathering water, propolis and nectar.

A queen mother in full production can lay 3,000 eggs a day. She can even determine the sex of her offspring, laying female eggs in small cells and male eggs in larger ones. Worker-hood, however, is the result of arrested development due to a deficiency in diet.

The industry of honeybees makes fruitful our orchards and vegetable gardens. It provides wax to waterproof fabrics, to insulate electric wires, and to use in the manufacture of aeroplanes and cosmetics.

Another Great Plan for This Society's Future

By DONALD T. CARLISLE
Chairman, Membership Committee

"With the Zoological Society, this is a critical moment. The Executive Committee has been very heavily burdened, not only in planning for Park work, but in the difficult task of soliciting subscriptions for building operations. At this moment it needs the encouragement that the incoming of 2,000 new annual members would give. Leaving out of consideration the satisfaction which every public-spirited man feels in aiding a noble cause, will not the privileges of membership in the Zoological Society be worth to you and your family more than ten dollars per year? If you answer this question in the affirmative, please communicate with . . ."

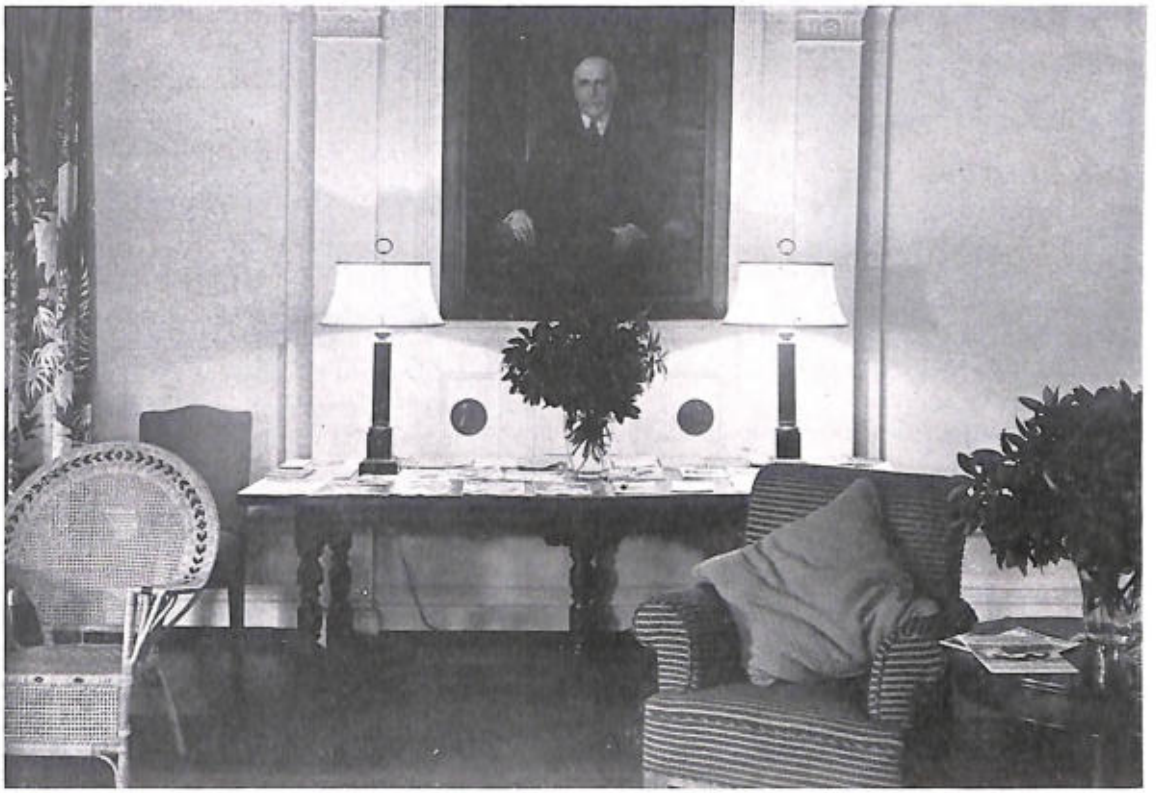
APPROPRIATE as these words are at this moment in the Society's history, they are not the expression of a new need. They appear in the editorial of the fourth number of this magazine over the initials of Dr. William T. Hornaday, and they went forth to the Society's membership in the month of May, 1900.

Back in that golden era familiarly known as the Gay Nineties, a small group of eminent New Yorkers went manfully to work to give expression to a great idea. They founded the New York Zoological Society, and in a relatively short time were able to open the gates of what was to become one of the world's greatest zoological parks.

The founding fathers perhaps built better than they knew. To begin with, they were granted the use of some 240 acres of land ideally suited to their purpose. This tract, situated in the then remote Bronx Park development, held grassy pasture land, fine trees, rugged outcroppings of rock and ample water supply—all necessary to display effectively a truly representative collection of the world's fauna. Their second great asset was sufficient funds. Due to the generous benevolence of the men who founded the Society, and with the financial support of the City, it was possible in a matter of a very few years to erect, equip and stock the buildings forming the nucleus of the Park today. This loyalty of the early membership enabled the Zoological Society to put itself in a ranking position among such institutions in exceedingly short order.

Perhaps, the Society's greatest asset in those early days was the ideas on which it was based—for its founders saw the organization not merely as the operator of a "zoo", but as the trustee for several causes of great general importance. The Society was to contribute to zoological research, it was to aid in both general public as well as highly specialized education, and it was to lend its weight to the great cause of wild life conservation. All these purposes were close to the hearts and minds of the men who formed the Society and without them it is doubtful if the land and funds on which the Park grew would have been so rapidly forthcoming.

Time has brought its changes to the Zoological Park as it does to everything else. The great tract of land is here to be sure, improved, if anything, in beauty. The purposes of the Society remain the same, but if the work of this organization is not only to maintain the pace of the earlier years, but also to realize on the many new opportunities which lie ahead, we must revert to the plea which



In the Members' Room at the Zoological Park, comfortable armchairs and the latest zoological publications await our Members. Cool and restful in summer, warm and cozy in the autumn days with a fire crackling on the hearth, it is a welcome resting place for visiting Members of the Zoological Society.

was made so earnestly and so successfully forty-five years ago. We need the encouragement of many new members. It was only by means of a large and enthusiastic membership that the Society's founders were able to create this great foundation in record time. It will be by the same means that the Society will fit itself for its new era of social usefulness now at hand.

Again the Society's Executive Committee and the Staff have been busily engaged in planning for the future. Many projects await execution. The collections, maintained so successfully throughout the war years, must be replenished. The new techniques of exhibition with which we have been experimenting must be expanded to include many new species. Our buildings, most of them nearly half a century old, require renovation or remodelling to fit them for new purposes. New buildings must be created. Above all there are the needs for greater means with which to enable our talented staff to pursue the scientific investigations which give a leading purpose to the whole enterprise, and further means must be found for expanding our great and growing educational and conservation activities.

This is a large work and an important one, for this Society must serve as a liaison between the great fields of biological science and the public or its true function will not have been performed.

Our Membership Campaign

In recent months we have sought new memberships. The response of present members to our appeals has been most gratifying. A number of members have been instrumental in bringing ten or more recruits to our ranks. In view of the fine program for the future, many former members who dropped out during the depression years are returning to the Society's rolls. Most pleasing to us however are the increasing memberships among young people, and the people from outside New York State whom we are welcoming almost daily. One new member out of every five lives far beyond the possibility of visiting us often.

Although membership has been increased by more than 40% since the first of the year, we are still far from the goal we seek.

We want at least to triple the membership of today, and it is to the interest of all present members to help us achieve this number. It takes only a simple arithmetical calculation to prove that the more members we have, the greater and better the privileges of membership become. We can hold more frequent membership meetings. Our publications can be increased in number and in value. Facilities reserved for members within the Park can be amplified.

It is our earnest desire to have our members visit us more often, become more familiar with what we are doing and what we plan to do. And in order that they will do so, we are hoping to be able to announce in the near future a number of things we plan to do for the comfort, convenience and interest of the membership.

This is not to be sure as "critical" a moment in the Society's history as was the spring of 1900 when Dr. Hornaday wrote the words with which this plea opens. Then means had to be found to make the Society's aims possible at all. Yet we do stand at a cross-roads today. Held up in progress by the necessities of war, we have been plotting our future course to fit us for becoming a truly greater new center of living natural history —not just a great Zoological Park or Aquarium, but an educational foundation and a laboratory. We cannot accomplish all we plan immediately, but the rate of our progress will relate definitely to the numbers and the enthusiasm of the Society's membership.

It is fitting again to quote the words which appeared in the Society's Magazine almost a half century ago:

"If you are already a member, pray send in the application of at least one other person."

New Members of the Zoological Society

Life

Mrs. G. B. Lambert

Annual

Ralph Arbus
Mrs. L. A. Atz
Robert E. Ball
Perkins Bass
Dr. F. L. Babbott
Dr. Catharine Bergen
Mrs. G. A. Berk
John Hartman Bittorf, (U.S.N.R.)
John C. Blick
Willard F. Boynton
Arthur P. Braaten
S. A. Christensen
Joseph M. Cudahy
Ernest B. Dane, Jr.
Clement L. Despard
Dr. Paul A. Eichorn
Alfred Ezra
Miss Agnes Fowler
Murray Friedman
Alfred Fritzsche
Mrs. Morgan Hamilton
Charles Hart
Mrs. Maxwell Hawkins
Bennett A. Johnson
Albert Koehl
Clara C. Lewis
J. Spedan Lewis
John Marshall
William D. McClure
George G. Moore, Jr.
Miss Margaret Osborn
A. E. Parsonnet, M. D.
E. Picket
Guido R. Rahr
Mrs. Mary B. Rogers
Walter G. Schneider
Thomas B. Scott, Jr.
Mrs. R. W. Sexton
Jesse Shanklin
Mrs. Louise Sherman
John L. Simon, M. D.
Mrs. C. F. Roe Slade
Mrs. Herman Dunlap Smith
E. W. Steiner
Charles Steinitz
Leo D. Sturgeon
Lawrence Tibbett
Emily Topp
E. S. Ward
Wildlife & Fish Dept.—
State of Louisiana
Richard S. Williams

ABOUT THE COVER ILLUSTRATION

The magnificent photograph of an Osprey descending to her nest, where a young bird is awaiting her arrival, is the work of Dr. Eliot Porter whose camera studies of birds are justly famous. This illustration is reproduced by the special permission of Dr. Porter.

Full house at the Fountain Circle parking field. This is one of three fields for automobiles.

Tractor trains are in daily operation between the Fountain Circle and the Boston Road Gate.

"LET'S GO TO THE ZOO!"

Since that gray autumn afternoon in 1899 when the New York Zoological Park was formally dedicated, 96,010,834 persons (up to the end of this August), have obeyed the well-nigh universal impulse to look at strange animals — specifically, the strange animals in the Bronx Zoo.

They come to stare, to wonder, to relax and to learn. They come for all the reasons that anyone can think of — and probably more besides. And they all have a good time in a variety of ways. The scenes on this and the two following pages are not meant to "prove" anything, or even to present a rounded picture of life in the Zoo on a typical summer Sunday afternoon. They're just a miscellany of people enjoying themselves — and animals having a good time, too!

People feed the animals, rules or no rules. So we sell smelts to be tossed to Sealions.

The best way to see the Zoo, if you are small, is to wheedle your Grandparents into a trip.

Interest in the stone Eagle from the old New York Postoffice is not always ornithological.

The younger generation is a thirsty generation, but there are plenty of watering places.

We inquired of this sailor, and learned that this was his first outing with his young son.

An instant later, the Children's Zoo goat began to chew — and things began to happen fast!

The Goldfish Bowl in the Children's Zoo was made for children, but parents can't resist.

It might be a woodland path, but actually it is the pony track in the heart of the Zoo.

The African Elephant puts out her trunk, and a crowd gathers to stuff it with crackerjack.

Every day except Monday the Haywagon Taxi plies between the Zoo and the Farm-in-the-Zoo.

Goats at the Farm-in-the-Zoo exercise a perpetual fascination for every human "kid."

Milking time at the Farm, and the visitors gather to watch the Farmer adjust the milker.

Causerie at the Penguin Pool — a familiar scene that visitors have photographed many times.

We like to think this earnest mother has absorbed our own enthusiasm for animal education.

Another proof that Grandparents are the best way to see the Zoo; reading the luncheon menu.

Slight accident — the baby Llama stepped on Mary's finger—and so Mary becomes a heroine.

If there is one scene more typical than another it is this — soldier, baby, mother, camera.

The appeal is the old one, of feeding the animals — they'll always know a Canada Goose.

When the Giant Pandas put on a show, a crowd gathers from nowhere seemingly in an instant.

The subway gate, and visitors are still pouring in for a healthy holiday visit to the Zoo.

We Carry the Society Into the Jungle

By WILLIAM BEEBE

Just back from our new Research Station in Venezuela, Dr. Beebe draws a parallel between the Society at home and in the field.

THE Department of Tropical Research of the New York Zoological Society is concerned with scientific investigation, both in the Zoological Park and on expeditions to all parts of the world. The department cannot yet lay claim to a half century of activity, for the first trip was made only forty-five years ago, in August, 1900.[1]

Since that date expeditions have averaged one each year. Geographically these have encircled the globe, including every continent and fifty-five degrees of latitude. Vertically they have extended from eighteen thousand feet above sea level in the Himalayas to a half mile beneath the surface of the ocean off Bermuda. Hundreds of living creatures have been collected and shipped back to our zoo, and more than seven hundred contributions have been published, of which nearly four hundred have appeared in the Society's publications, ZOOLOGICA and ANIMAL KINGDOM. For the past twenty-three years the results of the department's investigations have been presented at the Annual Meetings in the form of specimens, paintings and motion pictures.

As Mr. Osborn has mentioned in the present issue of ANIMAL KINGDOM, we have just returned from five months at Rancho Grande in Venezuela where a superb field laboratory has been established.[2]

It is too soon to present in detail the scientific and popular results, but there is one aspect of our work which is appropriate to this issue.

On page 123 Mr. Osborn has listed the four most important objects of the Zoological Society:

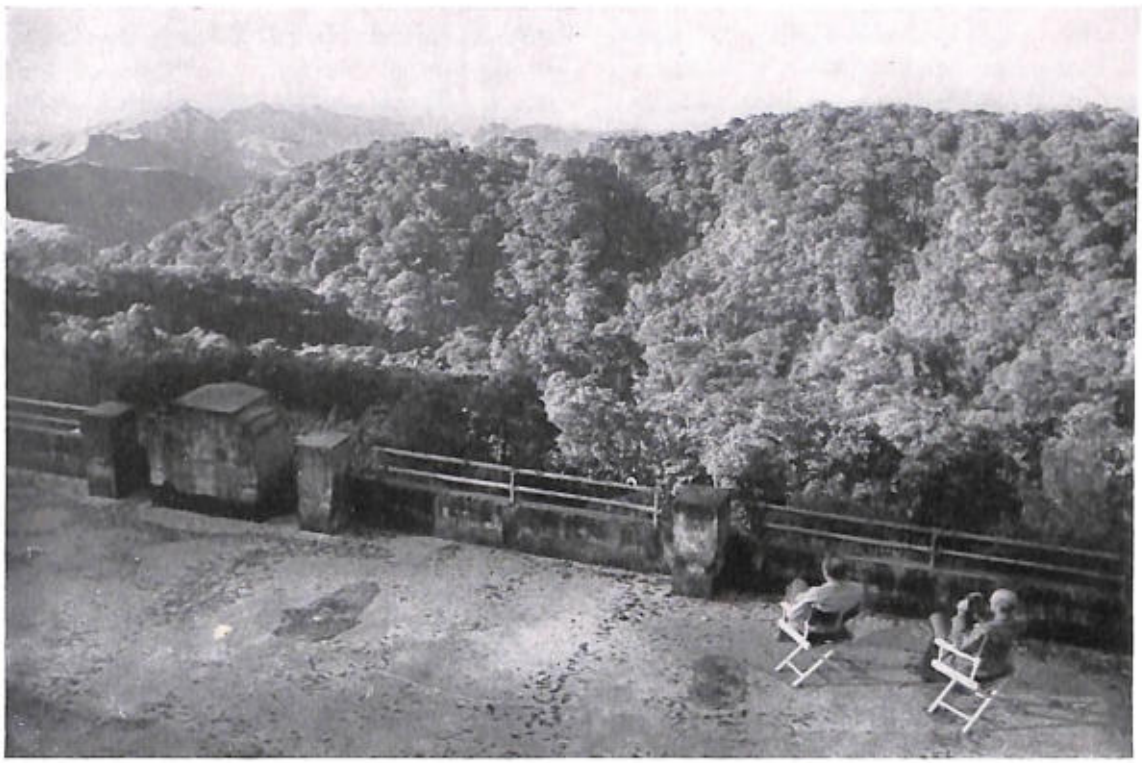
1. Management of public institutions designed to exhibit the animal life of this earth.
2. Popular education in zoology.
3. Scientific research.
4. Conservation of animal life and preservation of natural areas.

In our home laboratory in the heart of the Zoological Park in New York these objects are very real things, and their sustained development is evident every day both to the eye and to the ear. But what happens when our department packs up and transports itself bodily, both staff and elaborate outfit, thirty-five hundred miles to the south as the plane flies, coming to roost half a mile up in the heart of a magnificent, preserved cloud jungle? Do we temporarily shed Mr. Osborn's objects and evolve new ones, or what?

First, what about the management of public exhibits of living animals? Our concern in the zoo has always been with living creatures, and from our very first trip in the field our dominant interest has been rather with live organisms than great collections of dead ones. We crave privacy at our work so that our studies will not be interrupted, but in spite of this, when our vivaria and cages begin to fill up, word gets around and soon, from far and near, the vanguard of visitors appears and in courteous Spanish begs for a glimpse of the exciting reptiles, frogs and other

[1] For a general résumé of the department see Fairfield Osborn, "Scientific Odyssey," in *Animal Kingdom*, 1941, Vol. 44, No. 1.

[2] This expedition has received the generous support of the Venezuelan Government, the Creole Petroleum Corporation and the Standard Oil Company of New Jersey.



From the lofty, castellated roof of Rancho Grande, members of the Department of Tropical Research staff take one of their rare periods of rest and look out over a superb series of jungle-covered mountain ranges. Far in the distance, beyond the mountain ranges, they glimpse the blue water of Lake Valencia.

beasts in our collections. They know about these, for did not Manuel tell a cousin of his, who passed it on to an *amigo* of theirs, and here they are!

At the great half-finished, castle-like structure which is Rancho Grande we thought to be unusually free from these visitors, for less than an hour away by car is a very extensive zoo, with the pleasant name of Las Delicias, in which are contented lions, hippos, camels and other familiar animals, living happily with shade trees in place of heated buildings, and enjoying year-long sun and warm rains instead of ice and snow. But the Venezuelans seem more fond of their own native animal life, and as an important object of all our expeditions is to establish cordial relations with the people, one of us is always ready to play guide and host.

In the course of the past five months of this forty-fifth expedition we had hundreds of visitors, from the humblest ragged peon to high government officials and the archbishop of Caracas. The climax came at the official visit of one hundred and fifty members of the International Agricultural Congress. We had already given addresses at their meetings in Caracas and shown our color movies. On their mass visit to us we were unprepared for the enthusiastic interest shown by these delegates whose homes ranged from Maine and Montana to Chili and Argentina. We had prepared a duplicate of the jungle show which we put on in the Bronx Zoo last year: poisonous and harmless jungle animals and plants, the most beautiful from orchids to ten-inch moon moths, the largest and the smallest and the sheer magic of color change, courtships and strange habits.

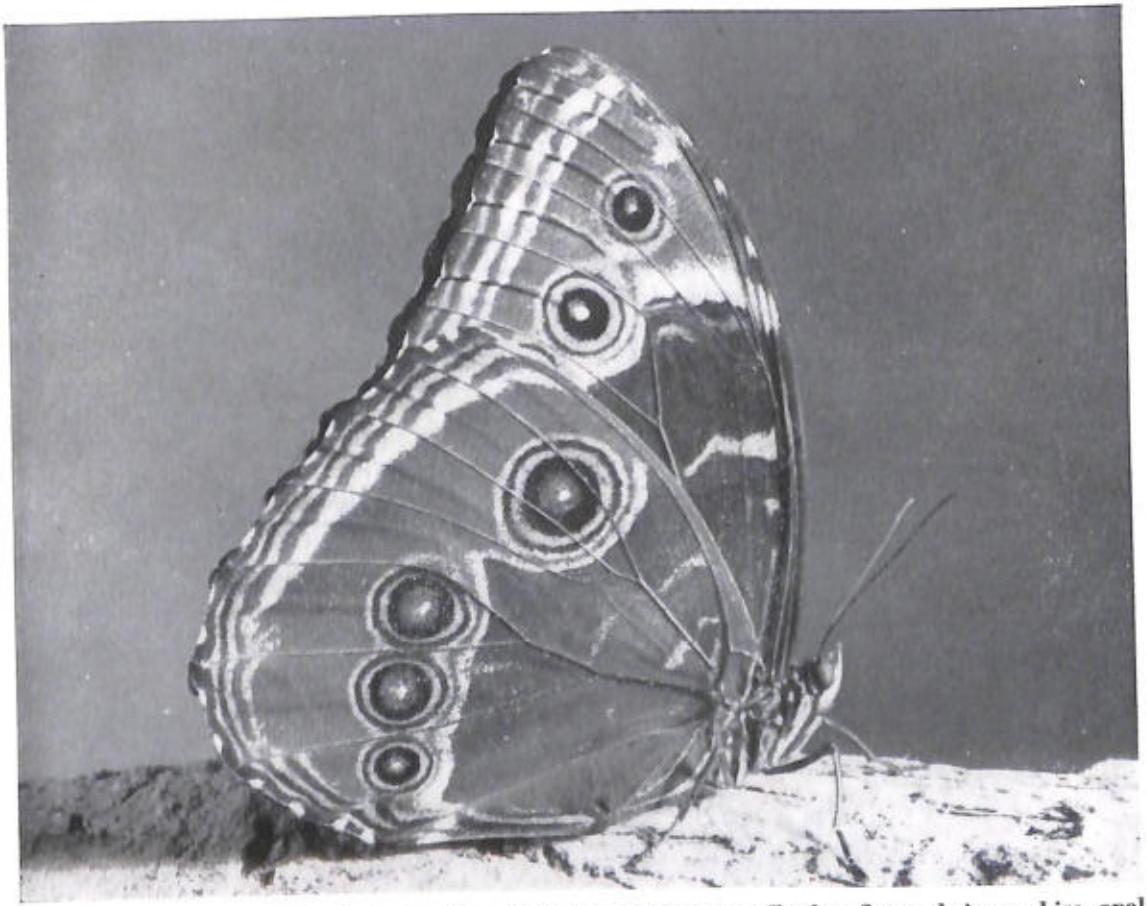
Many years ago in our northern zoo I trapped six mink which had depleted our flocks of geese and swans. In recent years wild carnivores have been less aggressive in the heart of New York City, but at Rancho Grande, so closely are we surrounded by primitive jungle that one night a jaguar broke down the door of a large cage and devoured or carried off a young aguti and a paca.

Closely connected with our jungle zoo comes

Mr. Osborn's second object, "Popular Education in Zoology," and this starts with our very first day. When the hunters and the road menders and a host of others learn our desires, wild creatures pour in, from eight-foot reptiles to tiny, exquisite and most rare insects. At first most of these are dead, and we have difficulty in demolishing widespread beliefs that every snake is very dangerous, *muy pica-pica!* After we demonstrate that most are harmless by letting them bite us, the number of incoming animals alive and in good health increases by about eighty per cent. We overhear our newly enlightened graduates of the college of truth proudly instructing their incredulous fellows, and so this and a score of other misconceptions begin to be dissipated.

Many of the native superstitions are so dramatic and striking that we are loath to discredit them, as for example: Giant boa constrictors are known to drape themselves in the boughs overhanging jungle paths along which men are accustomed to pass. When the unsuspecting victim is directly beneath, the dangling serpent emits a great, hissing poisonous breath producing instant unconsciousness. The boa then descends slowly and at its leisure enjoys its horrid feast!

In many cases I suspect that our converts render only lip service and I am quite certain that some of the picturesque beliefs are still going full strength. There is another phase to this. When asked how I broke my leg on the second day of my arrival at Rancho Grande, I rather gloss over the fact that it was by way of a heavy ladder and a man falling on me. Our missionary efforts would be vitiated by any revelation of the ladder superstition held by so many of my fellow countrymen!



On the wing, the great Morpho butterflies of Rancho Grande can afford to flaunt their sapphire, opalescent blues. As they flutter and glide through the broken sunlight in the jungle, there are few creatures as beautiful. But when they fold their wings and alight, they dare show only dull, confusing camouflage.

Education of our assistants was sheer joy, so quick and skilful were they not only in discovering and collecting rare creatures, but learning at once how to house and feed them. At one time Miss Crane had eighty-five small jars filled with healthy jumping spiders. These required just the right amount of humidity and the right kind and size of living prey. Yet Pedro could always be depended on for a daily supply of the requisite number of fruit flies collected from heaven - knows - where. On other tables were luminous lizards (so-called), marsupial frogs, carnivorous katydids, and coral and other snakes and lizards with their eggs. We soon had a zoo in full swing, within sight of wild orchids and soaring harpy eagles, and within sound of howling monkeys and unequalled melodies of jungle wrens.

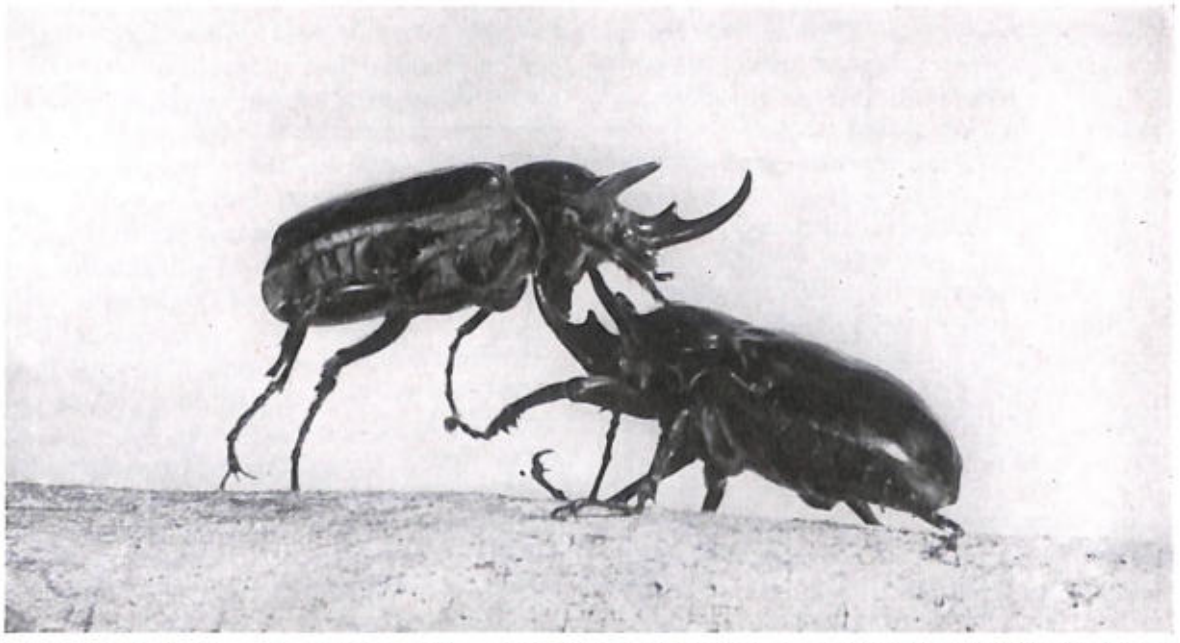
A splendid recent development of the Society's zoo is the introduction of backgrounds as natural as craftsmanship of artists and horticulturists will permit. In this respect we in the field amid tropical mountain forests are blessed of the gods. We can do little for the Zoological Park visitor except to strive to convey reality through photographs, paintings and words, in the hope that by the transmutation of imagination to imagination from one mind to another, by movies and two-dimensioned pigments and flat, black and white printed pages, we can accomplish one of two things: First, we can make the man who is forever city-bound by force of circumstance, after he has seen the great harlequin macaws in the zoo, go home and through the printed page continue to watch these birds beating across the high blue sky, two by two, like twin fragments of flying rainbows; then, following them to their nesting hole high up in a dead palm, watch them screeching affectionate nothings to their dishevelled, reptile-like twin offspring. Secondly, we can perhaps irritate and annoy the urbanite who is just sheer lazy, phlegmatic and ignorant, into desire and will to see the world of tropical wild life before he dies.

Scientific Research, object number three of Mr. Osborn, is number one of ours in the field, for it is actually the *raison d'être* of the whole department. Throughout forty-five expeditions the heart of our activities is the laboratory, and the story of these will sometime be worth the telling. One extreme was a transitory, one-night tent three and a half miles up among Tibetan mountains where we studied blood pheasants while outside a raging May blizzard battered the dwarf rhododendrons; others were the deserted gold-mine bungalow at Kartabo, and the converted saloon of a sumptuous yacht. Even the few cramped cubic feet in the sealed bathysphere swaying in the icy cold and blackness of undersea may be included in this list.

Here at Rancho Grande, thanks to our Creole friends, we work in a perfectly appointed great room, fifteen by sixty feet, with three hundred square feet of glass filling one whole side. Our view is comparable to a scene in Switzerland, the giant trees in the foreground tower twice as high as those in a New England forest, the orchids in sight of the laboratory challenge any fabulous Babylonian hanging gardens, and the songs which come through the windows are as lovely as I have heard in the tropics.

Within this framework of beauty our Rancho Grande laboratory affords every practical facility. One day in late May I look down the long expanse of tiled room and at the farthest end see George Swanson working at his color plates under perfect lighting conditions. When possible he holds frog or snake or flower in one hand and paints with the other. Dangerous creatures pose behind glass. At this moment he is drawing a frog which, except that it has a head and four legs, might be an exquisite bit of moss. When put down on the table it does not hop, but creeps away, a progression reminiscent of distant salamandrine relations. Henry Fleming at the next table works with mind and fingers over piles of beautiful moths which came to windows or roof the preceding night, drawn irresistibly by the glare of electric lights. One evening in a gentle drizzle we counted more than seven thousand on the laboratory windows. As I write this, Fleming gives vent to the curious utterance with which an entomologist announces some unexpected find. He brings to my desk a dull, bedraggled insect which instantly assumes an aura of sanctity, for it is the first of its family ever to be taken in Venezuela.

A bitter ejaculation arises from Jocelyn Crane at her table, as she pores over a dish containing two small spiders. Her pencil, poised to record



Like knights of old, the giant armored, spear-headed beetles of the tropics wage fierce battles for the favors of the smaller females. Here conflict between two large males has reached its miniature fury.

some new elaborate routine of courtship, writes instead, "Unpremeditated murder." The passionate arachnid suitor omitted some ameliorating phase of his amorous advance, and this neglect of ancestrally dictated courtship denies him fatherhood of some dozens of spiderlings, and substitutes sudden death and the humiliating destiny of unintentional immolation at a premarriage feast for "the female of the species." My own concern for the moment is with three birds which dashed against the lighted windows. Two are giant swifts with stomachs crammed with several thousand flying ants of a species not found near Rancho Grande. The third bird is a white-throated rail which, according to ornithological literature, should not occur nearer than the Pacific slope of Peru.

And so throughout our expeditions, we pile up fragments of knowledge, scientific details which, unimportant in themselves, will sooner or later fit into their place in some ultimate satisfying philosophy.

The last object of the Zoological Society listed on page 123 is Conservation of Animal Life and Preservation of Natural Areas. As true naturalists we cannot help being vitally interested in this theme, although many of our trips have been to places uninhabited and as yet unspoiled by man.

At Rancho Grande conservation holds a foremost place in our thoughts for several very good reasons. First, we are working in the heart of the National Park of Venezuela, where wild life is protected by law and in addition by the steepness of the slopes, which latter is a most efficient deterrent to poaching. Elsewhere I shall tell of the very apparent results of nine years of protection.

A wholly different aspect induced by the same abrupt declivities is the continual danger of landslides. Day after day in the rains we find our cement highway blocked by some great tree or piles of rocks and earth, all of which are quickly removed by hard working government road gangs. Even our own Rancho is not immune and scores of Australian casuarina trees, quick growing and with earth-gripping roots, are planted on all sides of our jungle castle. A floor in the rear of the building has buckled under pressure from the jungle, and we have received word of a still more recent shift. Visitors occasionally look down at the distant Lake Valencia and, with questionable humor, prophesy a future swift descent of Rancho, together

with laboratory and staff, to the lake. I can only counter with the remark that limnology has always held considerable interest for us.

So, in our case, Conservation, with a capital C, combines, with our wish to preserve the wild life about us, a very personal interest!

Reviewing the four objects listed by Fairfield Osborn, we realize that no matter to what great distances our expeditions take us, or how isolated our field activities, we still have the same bonds which knit us so closely to our Mother Society in New York.

In New York we now have a Question House where visitors ask and we try to answer. Elsewhere I always feel quite helpless when I sit between John Kieran and Frank Adams at "Information Please" and strive to search my soul for right answers. Never, however, does a human being, a naturalist, feel more ignorant and humble than in a jungle like that at Rancho Grande. This indeed is the world's original Question House where birds and beasts and insects themselves propound vital interrogations with every form, pattern, color, voice and action, and our poor brains grope for even the shadow of an answer. We come to think of all our fellow jungle beings as forming a Children's Zoo, while we onlookers, no matter how many degrees we boast, in spite of a more than half century of study, ourselves are children at this game. But whether we win or lose, it is the grandest game in the world.

The pets of the Department of Tropical Research always include a tame monkey, preferably the intelligent Capuchin, former slave of the itinerant organ-grinders. When the staff "pays him out" up a tree to get nuts, its only hope of success is to haul in the leash quickly and empty "Cappy's" cheek pouches.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

We Aid the San Francisco Zoo in Planning Development

By JOHN TEE-VAN

The staff of the Zoological Society was much pleased after the February visit to the Zoological Park of Mr. Lloyd E. Wilson, President of the Park Commission of the City of San Francisco, to receive a request asking if one of our staff members could come to San Francisco and review the San Francisco Zoological Garden with the idea of suggesting post-war changes and improvements in methods of operation. As a result I spent two and a half weeks during August in intensive observation of the Garden, and a report covering the results of the visit to San Francisco will be submitted to the Park Commission of that city in the near future.

San Francisco's Zoological Garden, although started in 1929 and thus a relative newcomer to the ranks of first-class zoos, stands high in accomplishment and interest. The Park, approximately 60 acres in extent, not all of which is developed, is situated in the southwest portion of the City, close to the ocean and in intimate contact with the rest of the City and nearby counties through wide and extensive parkways and motor roads.

During the years 1936 to 1940 the so-called new section of the San Francisco Zoo was completed under the supervision of the Federal Government. Within its confines is a large building for the big cats, on the south and west sides of which Lions and Tigers enjoy extensive moated enclosures; a large "Pachyderm" building for Elephants, Hippopotamus, Tapirs and Rhinoceroses; goose and duck ponds plus a series of excellent moated bear grottos, in one of which four young Grizzly Bears with their mother formed an unceasing source of amusement and merriment for large numbers of visitors. Completing this area is an exhibit devoted to Sealions where special shows of these active animals are given twice daily, and a large outdoor aquatic bird cage connected by an enormous open circular window with an interesting building that enables the public to observe through glass the birds that enter the inner exhibition quarters. The remaining older part of the Park is devoted to simple cages housing collections of birds, monkeys (including excellent Chimpanzees and Gibbons), Lions, Tigers, Pumas, Leopards and other cats, Giraffes, Camels, Zebras, Wallabies, Kangaroos, etc.

To those of us who have been operating parks during the war years and thus have a realization of the difficulties of securing sufficient and adequate help to do the necessary work, the maintenance of the San Francisco Zoo is astonishingly good. Walks, grounds, animal enclosures and little-seen service quarters were immaculately kept. The Director, Carey Baldwin, and the staff of the Garden deserve a great deal of commendation for their excellent work.

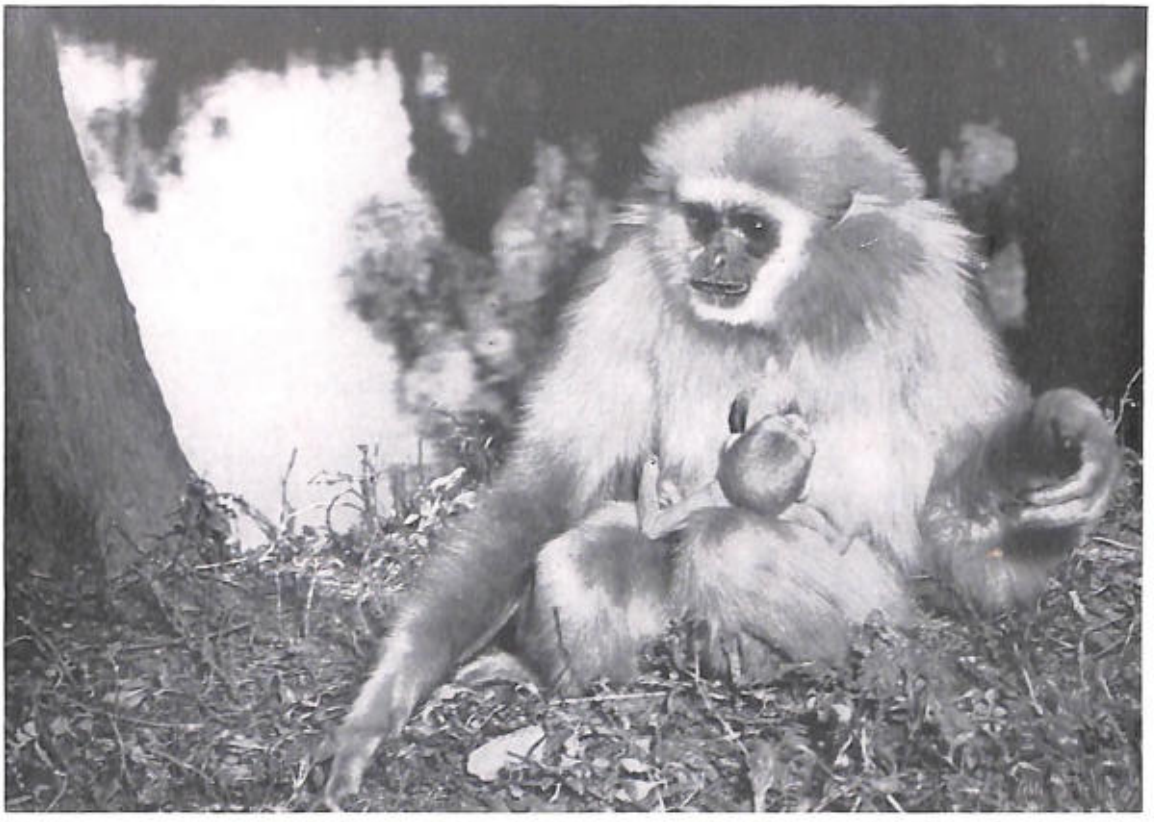
The future of the San Francisco Zoological Garden should be an exceedingly bright one. It starts off with a goodly proportion of its grounds well developed and in keeping with modern ideas of how animals should be displayed. It has sufficient space within which to expand; its closeness to a great port means that it can easily draw upon a large part of the world for its animals. Finally, it is served by a small but devoted and vigorous group of men who wish to see the Zoo completed and its services to the public increased.

Our First Baby Gibbon Is Born And Seems to Be Doing Well

By LEE S. CRANDALL

Gibbons are comparatively rare captives at any time, but since the last importation was made, in 1941, none whatever have been available. Consequently, when two White-handed Gibbons (*Hylobates lar*) were received, in September, 1942, from Mr. Hayden B. Harris, they were a welcome pair, indeed.

White-handed Gibbons are usually black in



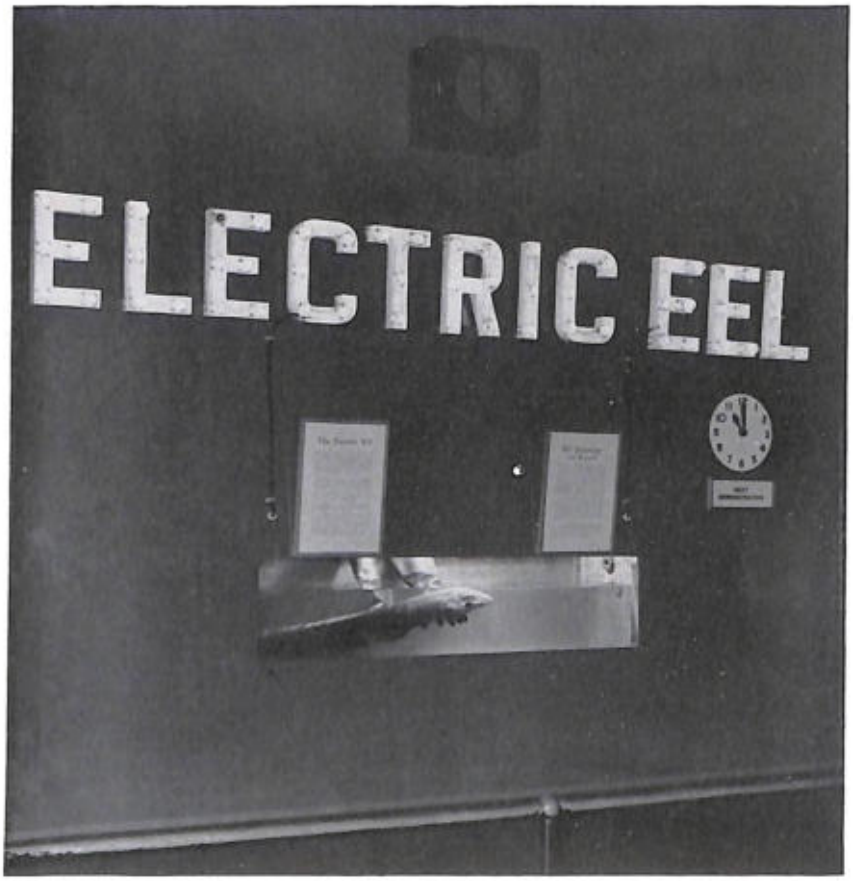
Two hours of coaxing went into the making of this picture of the White-handed Gibbon and her baby, taken three days after the birth of the baby. Before the birth, the mother showed very little timidity and willingly approached her keeper and photographers. Finally a bunch of grapes lured her down.

color, with white hands, feet, forehead and whiskers. Both of our animals, however, are a soft *café au lait*, a variation occurring frequently in the wild state.

During their first summer here, the new Gibbons lived in the wilds of Gibbon Island in peaceful companionship with a number of Spider Monkeys. Very soon, however, the Spiders learned that they could wade ashore through the two-foot depth and did so with enthusiasm, each carefully using one hand to hold the tip of its tail above water. So, for the past two summers, the Gibbons have had the Island to themselves. Winters have been passed in a large compartment in the Plains Lion House, where warmth, light and space for exercise were ample. Late in May of this year, when the Gibbons were being transferred to a shift-cage for their annual trip to the Island, there was some conjecture as to a possible increase in the family. After liberation, there was little opportunity for close observation, as the female, always a little more shy than her mate, usually remained high in the trees at feeding time.

We must confess, therefore, that we were almost completely surprised when, on the morning of September 10, keepers reported that a baby Gibbon had been born. There was a rush, of course, for Gibbon Island. Gathered on the rocks of the view area, we strained our eyes toward the tree-tops. Eventually, all had a fleeting view of the tiny body, wrapped tightly about its mother's middle. Later, the infant was seen to move upward and then to nurse.

Gibbons have been bred, rarely, before. But this is our first-born and the situation, we believe, is favorable. The parents are in perfect condition, living happily in almost complete freedom. When the approach of cold weather makes necessary their removal to winter quarters, the younster should be well established as one of the family circle.



Newest exhibit in the Aquarium is this working display of the electrical powers of the Electric Eel. At hourly intervals through the week, half-hourly on week-ends, attendants thrust rubber-gloved hands into the Eel's tank and disturb the fish, whereupon it sends out a series of discharges. These cause a loudspeaker above the tank to crackle, as with static, and then the flip of a switch sends the current into the electric lights in the panel, spelling out the words ELECTRIC EEL.

PUBLICATIONS OF INTEREST

NATIVE PEOPLES OF THE PACIFIC WORLD. By Felix M. Keesing. 144 pp., 71 illus. The Macmillan Company, New York, 1945. $3.00.

Now, when the problems of peace are upon us and it is increasingly important to understand the peoples of the Pacific world and their relations to each other and to us, it is most timely that "Native Peoples of the Pacific World" has appeared. It is the second of the supplementary volumes on the natural history and peoples of the Pacific that were designed to follow the introductory book, "The Pacific World," published last year under the auspices of the American Committee for International Wild Life Protection and under the editorship of Fairfield Osborn. The first supplement, "Mammals of the Pacific World," was published this spring.

Dr. Keesing is Professor of Anthropology at Stanford University and a recognized authority on the peoples of the Pacific. Indeed, he was called upon by the Government to train military personnel for service among the islands, and this book is an outgrowth of his very practical work with the Armed Services.

His point of view, as he discusses the physical groups of peoples, their languages, government, means of obtaining a livelihood, home conditions, social customs and religions, is emphasized both by implication and directly: ". . . the islanders are thoroughly human people. They have the same general needs and interests, the same problems and anxieties, as the man of New York or London."

It is too likely to be our naive belief that peoples who do not possess the blessings of electricity, indoor plumbing and plastics are not only benighted but miserable in their benightedness. Dr. Keesing makes it quite clear that in most of the affairs of daily life, there is little we of the mechanical civilizations can contribute to their lives: "In some respects the island peoples have already worked out about as good solutions as can be found for getting along satisfactorily in their island homes."

ANIMAL KINGDOM

NEW YORK ZOOLOGICAL SOCIETY

VOLUME XLVIII
JANUARY TO DECEMBER, 1945
NUMBERS 1–6

INSTRUCTIONS TO BINDER

The 4-page signature forming the first 2 and the last 2 pages of this issue may be inserted ahead of the cover of Vol. XLVIII, No. 1, in binding the volume.

ANIMAL KINGDOM

BULLETIN OF THE
NEW YORK ZOOLOGICAL SOCIETY

VOL. XLVIII DECEMBER 6, 1945 No. 6

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We Must Reverse the Tide

The tide is still running out. Forests are being depleted, soils and water sources are deteriorating. This is true not only in the United States but in many other parts of the world. If these primary natural resources continue to disappear, the gains that have been made in wildlife preservation will be forfeited. As for man himself, his world will become to an increasing degree a world of want.

How can such conditions be explained? Principally because there is no general understanding of the complete interdependence of plant life, animal life, water supply and soils. Great advances in knowledge concerning this complex subject have been made. A new science, known as Conservation, has come into existence.

The cure for the present critical situation must come through basic education and informed public opinion. As to basic education, the principles of Conservation should be integrated into the general curricula of our schools and colleges and not isolated as a "special course." The teaching of history would be illuminated by analyzing to what extent the exhaustion of living resources contributed to the fall of civilizations and to wars between nations. Courses in chemistry and engineering would be vitalized were they oriented to the needs of effective management of Nature's resources. By the same token, courses in biology would become far more purposeful if they provided a better understanding of the interrelationship of all living things.

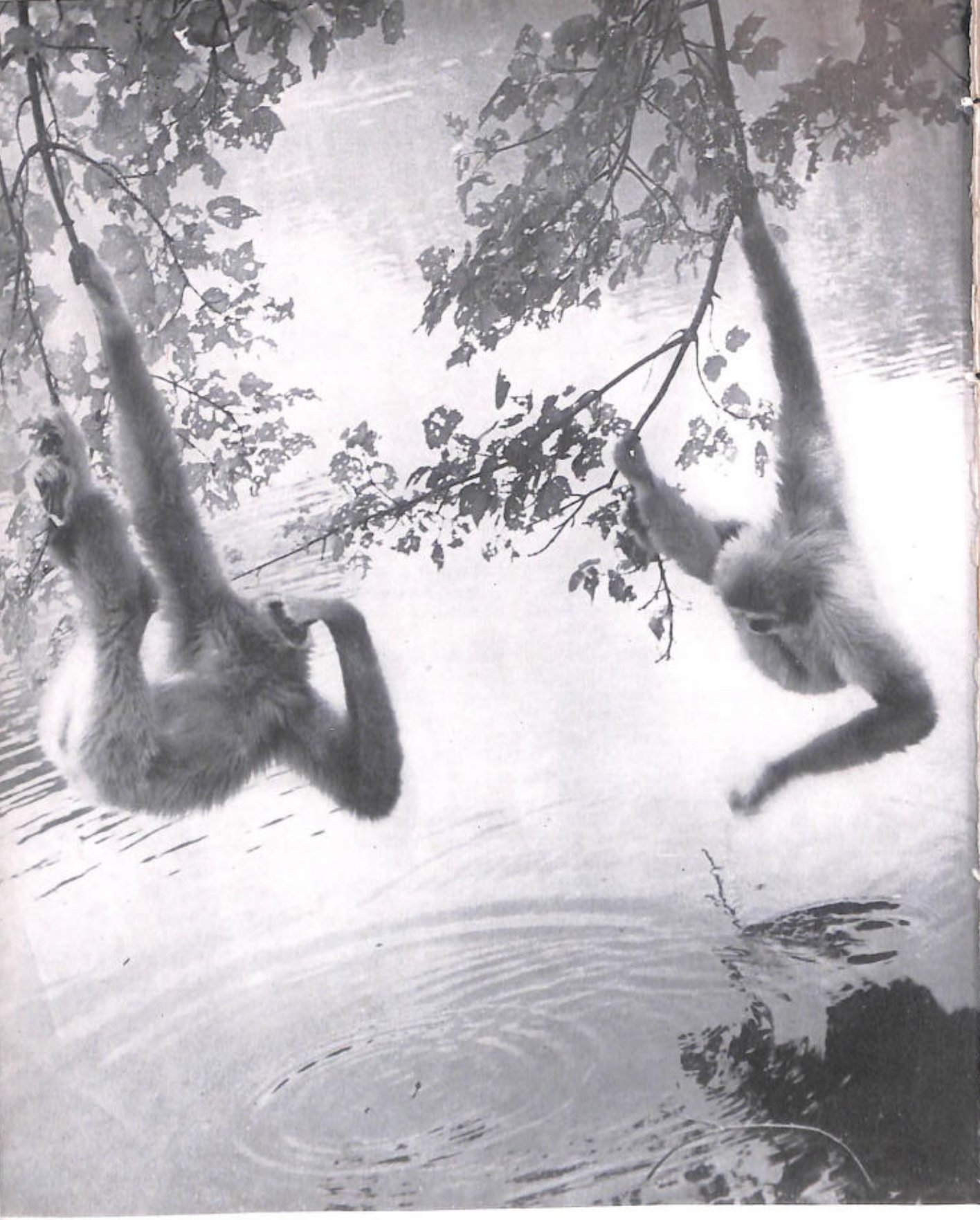
As to informed public opinion, the novel Wyoming project, described elsewhere in this issue, will, we believe, in addition to its great recreational values, contribute substantially to popular understanding of wildlife management and to the preservation of natural areas.

Conservation is no longer a "side show"—it is the "big tent" of human existence.

Fairfield Osborn

IN THIS ISSUE

Jungle Still-life . . . . . *George Alan Swanson* COVER
Family Affairs on Gibbon Island . . . . . *Lee S. Crandall* 165
The Zoological Society Is Going to Wyoming . . . . . *Fairfield Osborn* 168
Jungle Studio . . . . . *George Alan Swanson* 170
Insects in Winter . . . . . *Brayton Eddy* 176
A Swellfish Story . . . . . *Myron Gordon* 182
Behind the Scenes: News and Notes 187
You Can Make Christmas Last All Year 191
Index to Vol. XLVIII 193



The White-handed Gibbons Come Down for a Drink

This striking picture was taken on Gibbon Island by Lilo Hess and illustrates how Gibbons generally drink in the wild—by dipping water or sweeping hands through wet leaves.

Family Affairs on Gibbon Island

By LEE S. CRANDALL

Life in the treetops was full of harmony until Baby arrived—but now we must deal with a bad case of paternal jealousy.

SINCE THE BRIEF and somewhat breathless announcement in ANIMAL KINGDOM for September-October, 1945, that a baby White-handed Gibbon had been born on September 10, enough time has passed to permit a calmer and perhaps more coherent report. While it is true that Gibbons have been born and reared in captivity on several occasions, a birth is still a rare event. Moreover, we have never yet succeeded in rearing any anthropoid ape, perhaps because our installations, designed primarily for exhibition, are not always suited for breeding. Perhaps that is why we now are uncommonly eager for success.

Actually, no part of this cycle was completed in a confined exhibition area. Received at the Zoological Park in September, 1942, as the gift of Mr. Hayden B. Harris, the prospective parents were placed at once in a large spare cage at the African Plains Lion House. This building, while both warm and light, is not open to the public. Here the animals have the utmost seclusion during the winter months. Summers have been passed in the complete freedom of Gibbon Island, where the Gibbons' wonderful flying leaps from tree to tree can be readily viewed but where an expanse of approximately forty feet of the intervening waters of Lake Agassiz must give the animals a feeling of security. Not that they seemed to be in especial need of such protection, for through it all they have remained completely tame and docile. But no animal breeds in confinement unless all its needs are satisfied.

During the first summer or two, the Gibbons shared the island with a varied assortment of Spider Monkeys, with which they got on very well. However, drifting silt gradually raised the floor of the lake separating the island from the viewing area and the monkeys eventually found themselves able to wade ashore through water hardly two feet deep. It was amusing to see them inch gingerly along, clinging firmly with one hand to upraised tail. But it was definitely not amusing for a corps of Keepers to have to pursue them in and around parked cars and among troops of delighted visitors. So, as each monkey came ashore, its days of freedom ended; when the last one made the trip, the Gibbons had the island to themselves. For Gibbons, like other anthropoids, are not only unable to swim but are very careful not to place themselves in a position where they might have to try. Gibbons walk upright naturally and well, and ours could come ashore easily, but this they are unlikely ever to learn.

Ideal as the sylvan retreat of the island would seem for courtship, the actual mating must have taken place, unobserved, in the seclusion of winter quarters. Soon after the middle of May, 1945, when the temperature had risen sufficiently and foliage was enough advanced to provide needed protection, the Gibbons were removed to the island. The female seemed unusually plump and some mild speculations were made though we had no real confidence that they would materialize. Throughout the long summer, the Gibbons continued happy and active, amazing our visitors with their aerial agility and otherwise comporting themselves quite normally.

On September 10, then, there was intense excitement when Keeper Reilley reported that the female Gibbon appeared to be carrying a baby. Summoning such members of the staff as were within shouting distance, we rushed out to the viewing area. A few minutes' observation showed it to be true indeed: a tiny object was resting

Lilo Hess Photo

By the time the baby Gibbon was three weeks old, it had begun to take a real interest in the world around it, and especially in the friendly people who approached its mother and induced her to swing down from the trees to the ground. Earlier the baby had seemed to pay little attention to visitors on the island.

crosswise, low on the mother's abdomen, supported by her sharply flexed thighs.

Not knowing how the mother would react to closer investigation, we withdrew for the time, marveling at our good fortune. True, we could add nothing to our knowledge of the gestation period, which has been variously reported as seven and nine months. But it was a passing

regret, for more than all else we wanted to rear the baby. Later, we found that parenthood had had no effect on the charming gentleness our Gibbons have always exhibited and that the infant could be observed and even photographed without upsetting them in the least.

Both parents are of the golden brown, coffee-and-cream color phase sometimes found in the White-handed Gibbon. The white hands, feet and facial fringe are present, although, of course, not so sharply contrasted as in the more common black-bodied form. The infant showed, at birth, that it meant to follow the pattern of its parents, for its crown was well thatched with golden hair, with a scraggly mantle across its shoulders. Otherwise, it was quite naked, and the wrinkled skin of its tiny body and unbelievably attenuated arms was grayish-black.

On the day after its birth, the infant was seen to move upward, seek its mother's breast and nurse. Thereafter, it retained the upright position, its legs nearly encircling the mother's waist, while its arms clasped her firmly around the chest just below the armpits. While both fists and feet stoutly entwined themselves in the hair of the mother's luxurious coat, one has the impression that the pressure of the tiny limbs against the mother's body is a definite factor in maintaining the infant's position.

As September drew to a close, hasty plans were made for winter quarters. It was obvious that a family group of such interest must be made available to our visitors, if this were possible. Yet we had no means of knowing how the Gibbons would react, as they had never been fully exposed to close public view. Moreover, with breeding Gibbons in other collections, uniformly successful results had not been indicated. So, with some misgivings, we set about the preparation of a large cage in the unused northwestern section of the Primate House, behind a pressed-wood front with glassed viewing space.

When all was complete, even to explanatory labels, the Gibbons were coaxed into a shifting box and transferred to their new home. It was high time, for the date was October 6 and rapidly falling leaves indicated the near approach of cold weather.

Once they were installed, our fears for the Gibbons' behavior were quickly stilled. They might, themselves, have been born in this cage, so soon were they at home. Far from being upset by staring eyes, they came to the front and stared back, with interest.

By now, the infant's growth was plainly evident. The thin mantle of hair across its shoulders had crept downward, until its back was covered with golden down. This extended, on the limbs, to knees and elbows, on the outer surfaces, the remainder of the body being quite bare. While it still clung tightly to its mother, its interest in the world outside its furry haven was growing and in moments when its mother's attention was diverted by food or other matters, a tiny, tenuous arm and hand might be seen groping about for whatever might be within reach. Occasionally, the slender fingers would close on some small object which the mother, apparently unobservant, would instantly remove.

During the first week indoors, the father's conduct was exemplary. He displayed great interest in the infant, gazing at it fondly and even touching it gently. After the novelty had subsided, however, his activities took another tack. He wanted some attention for himself and his efforts to force his mate were, at first, both ludicrous and amusing. He would lie on his back, gently prodding her with his feet. She would endure it for a bit, then move away. When he snuggled up to her, presenting one shoulder, then the other, for much desired scratching, she remained indifferent. When he scratched it himself, to show what was wanted, she allowed her gaze to wander elsewhere. Then began a phase of increased fatherly interest in the infant, leading up to repeated attempts to touch it. Each time, when the extended hand touched the tiny body, the mother's hand was there to push his gently aside. Day by day, the father's evident jealousy and the mother's obvious anxiety grew. On October 21 the climax came when an observant Keeper intervened to interrupt the first real squabble, resulting from an apparently determined effort, on the part of the father, to drag the infant from its mother's embrace. He has languished since, in the confines of the shift cage, pathetically but safely barred from more than visual contact with his offspring. No doubt we shall relent, sooner or later, but any visits will definitely be made under surveillance. We are proud of our Gibbons, individually and as a family, but we mean to rear that baby.

The Zoological Society Is Going to Wyoming

By FAIRFIELD OSBORN
President of the New York Zoological Society

A GREAT PROJECT is in the making in which it falls to the happy lot of the Zoological Society to take an active leadership. Work is to be commenced next Spring, as soon as the frost leaves the ground, on the creation of a wildlife and conservation project in the beautiful high Wyoming valley known as Jackson Hole, bordered on the west by the majestic Tetons. In the words of Governor Hunt of Wyoming, in a statement issued by him on November 1, this plan provides for "the perpetuation of the State as a gathering point for naturalists and wildlife enthusiasts and an area for scientific study in wildlife conservation, propagation and management on a scale unparalleled in the nation."

We do not believe that the Governor has overstated the case. Our feeling is that the long-range possibilities are indeed very great and that the phrase "unparalleled in the nation" may come to be truly applied. Much depends upon the resourcefulness and vision of our institution in developing the program.

The first step provides for the creation of what may be described as a great game park. The purpose behind this is to provide an opportunity for the public to view the magnificent big game animals of the West. It seems axiomatic that people will take a far greater interest in preserving wildlife when they have an opportunity to see what they are being asked to preserve. Under present conditions very few visitors, except hunters, ever have the good fortune to catch sight of the superb forms of wildlife that inhabit the Rocky Mountain areas. The story is told of a bull moose that held up two hundred motor cars. The animal accomplished this one day by quietly feeding near the highway in the northern part of the Jackson Hole valley in full view of hundreds of car occupants who stopped to watch with delight the monarch having his morning browse. Such sights are a joy and a winter-memory. They stimulate an interest in the habits of wildlife and it is with this in mind that the first element of the Wyoming project will be created.

The plan for a display of the big game animals will be so arranged that they may be seen under entirely natural conditions. Areas have been selected extending along the east bank of the Snake River running southward from the outlet of Jackson Lake. This is a stretch of land a mile or more in extent, lying between the highway and the river. It is perfectly adapted to the purpose. Initially, three large areas will be made, the boundaries of which will be so designed and placed that they will be invisible. Elk, Moose and Mule Deer will inhabit the northerly area. The central area, which includes a long sage-brush flat running beside the river, will contain Bison. Pronghorn Antelopes and probably a few specimens of White-tail Deer will live in the southerly area. The numbers of animals of each species will be limited so that the areas will not be over-grazed or over-browsed. The scene is one of great beauty, with the blue of the Snake River in the foreground, the snow-crowned Tetons rising skyward in the distance.

As time goes on, it is hoped that plans can be worked out so that visitors to the area may get a view of Grizzly Bears and Black Bears. The difficulties of accomplishing this so that the animals may be seen in what are to all intents and purposes natural areas are not to be minimized, for if the showing of these great mammals – as well

Crandall Photo

The majestic range of the Grand Tetons thrusts skyward just west of Jackson Hole and forms a perpetually dramatic backdrop for the verdant valley. In the shadow of these great peaks the Zoological Society will help in the creation of a conservation ideal to inspire future generations of the American people.

as any of the others – gives the impression that they are confined under artificial conditions, the primary purpose of the program will be sacrificed. An effort will also be made to provide protected resting and feeding grounds for wildfowl.

As part of the initial project an information building will be established. This is to be a source-center of information concerning the habits, management and conservation of wildlife. It is hoped as time goes on that there may be presented in this unit methods used in fish propagation and the stocking of streams, including a model fish hatchery. This same unit can well be used for a forestry demonstration, explaining the critical need for preservation of our woodlands.

This entire program was made possible because of the farsightedness and support of Laurance S. Rockefeller, an officer of the Zoological Society. During the course of various trips to Jackson Hole Mr. Rockefeller envisaged the great desirability of such a plan. The land being made available for this project is part of an area purchased a number of years ago by Mr. Rockefeller's father. The State officials of Wyoming are collaborating actively in the preparation of these plans and the State Game Commissioner is prepared to provide representative groups of the various animals. The plan has received the warm endorsement of Mr. Harold L. Ickes, Secretary of the Interior, and Dr. Ira Gabrielson, Director of the Federal Fish and Wildlife Service, and it will be the purpose of the management to work in closest cooperation with the National Park Service, the Forest Service and other Government agencies.

From the point of view of the Zoological Society, we have certainly come upon a rare and wonderful opportunity. It will bring to our institution an intimacy with the wildlife conservation problems of the far West which could scarcely be gained in any other way. Such an opportunity comes, so to speak, only once in a lifetime and we certainly intend to do everything in our power to make the most of it.

A tropical rain forest is a state of mind. To a soldier it may be unmitigated hell. To a naturalist it is a zoo, a museum and a laboratory. To an artist it is pure fantasy.

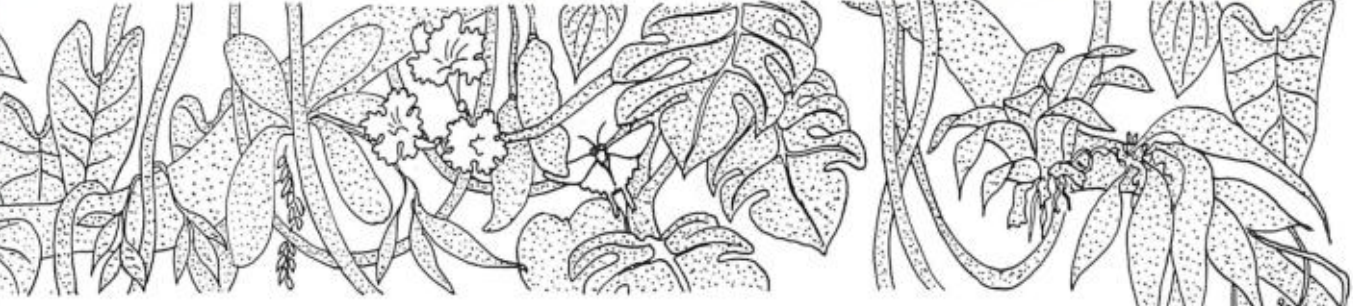
George Alan Swanson is staff artist for the Zoological Society's Department of Tropical Research and has recently returned from our new research station at Rancho Grande, Venezuela, the "enchanted castle" which the Creole Petroleum Corporation has fitted out for the needs of our research staff. We have had many articles in ANIMAL KINGDOM in which the jungle was seen through the eyes of naturalists; this is the first word-painting by an artist. — *Editor.*

A STUDIO in the jungle sounds silly. It sounds like a line from the Jabberwock. I suppose it's all because people think of a jungle as a place with a boa on every branch and a jaguar jumping from behind each bush, while studios, except those in Gautier, have divans and cocktails and pianos and casts of Praxiteles' Hermes. Anyway, I knew it sounded silly the minute I said it. It was during intermission at the Opera one night last winter when I announced to friends that I was going to paint in the jungle. I imagine I looked a bit ecstatic, and somehow Pelleas, martinis and the jungle didn't mix properly. One friend raised eyebrows, another winced and a third poked holes in the olive with a toothpick.

They all knew that I had been on other expeditions painting frogs and geckos and things, but I guess "jungle" meant cannibals and huge gaunt creatures waiting to spring out at one. At least my ideas were vaguely like that before I had seen bits of jungle in Costa Rica and other places. A barrage of questions came at me, all fortunately interrupted by the buzzer for the third act curtain.

Several weeks later I was in Caracas, Venezuela, with Dr. Beebe and other members of the staff of the Department of Tropical Research, waiting impatiently for equipment to arrive. On seven previous expeditions I had painted on desert islands filled with sea lions, in dry tropical forests with toucans and peccaries, and on coral reefs with angelfish and sea anemones, but I had never seen a real tropical rain forest before. I had my own idea of what one should look like, of course, and — I hate to admit it — boas and monkeys were on every tree. No cannibals, though.

My other trips with Dr. Beebe had ranged from the palm-fringed islet of Gorgonilla to the blue and gold Cape of San Lucas; from the watercolor land of Inez Bay to the San



Juan River in Venezuela with its scarlet ibises and crocodiles, but these were more or less just ordinary places. When we were finally established at Rancho Grande, I found that it was more than another place. It had a definite personality of its own. Situated thirty-five hundred feet up the Maritime Andes, surrounded by cloud forest, it takes on the slender mystery of a dream, particularly when in late afternoon it drapes its shoulders in mists and seems to hang suspended in mid-air like an enchanted castle of medieval legend.

The idea of my having a studio in such a place appealed to my sense of the dramatic, and while I found out later that there were no floating white ladies as tenuous as sea foam to roam its corridors on nights of full moon (as I had half expected), there *were* blue swallows and tanagers nesting in the walls, and at night red bats flittered in the halls after moths. Yellow-spotted snakes lived in the garden under the mango trees, frogs in the kitchen, lizards on the roof and spiders in every conceivable corner, so even though we owned no ghosts, we did possess the creatures usually thought of in connection with them. Perhaps we frightened the ghosts away. I shouldn't wonder, as the capture of any unusual animal was always attended by wild cries that echoed and re-echoed from the walls like the shrieks of so many maenads in the midst of dionysian revels – surely enough to send even the boldest ghost hurrying back to ghostland.

But all thoughts of a haunted studio vanished soon enough under a deluge of carnivorous grasshoppers with blue legs, emerald tree snakes and alabaster hylas with jade pop-eyes, and my brushes flew to record color before death made everything an uninspired gray and brown.

People who have never painted in the jungle may wonder how anyone goes about painting a boa or beetle. In most cases there is no way but to pick your animal up and start painting. This was rather difficult at first, as I, along with millions of others, thought things bit, or were slimy. In fact, everything was difficult at first; the problems that confronted me were such strange ones that I wanted to give up and study abstraction.

To begin with, I had been taught modern painting methods and techniques, and the idea of fin rays to count and measurements to make from snout to thorax never entered my mind. I had been used to thirty-by-forty canvases painted with a certain amount of daring, and allowing color to do what it pleased after it was applied. So, while my first few paintings were hardly done after the fashion of the Neo-Classicists, I *did* let watercolors mix themselves on the paper. My very first jungle painting was of a scarlet amphipod, which while I dare say it had a bit of charm, turned out to be an eyebrow-raiser resplendent in a dozen hues. The general color tended toward scarlet, but there were green and blue shadows and gold highlights, and countless legs and pleopods. From this disastrous experiment I learned that spines had to be measured, scales paid attention to, and that the fish or insect must actually look like itself. It was only after I realized this that things began to be fun, even when I was sketching the contents of tuna stomachs with a hundred squilla larvae and as many more squids and hatchet-fish.

And things didn't bite, and they weren't slimy! The only bite I ever had, besides bête rouge, was from a green lizard, but the skin wasn't even broken. Once I tied the tail of a tree snake into knots around a branch to make him stay put. Instead of biting, he just turned around to see what I was doing, and rested his head in my palm.

Before doing any painting, I had to have the specimens. Often these were brought to me by the other members of the party. Other times I went out and caught my own. In addition to the animals, I would collect background material to approximate as closely as possible the spot where the animals were found, and I would return to the laboratory with my haversack filled with fairy landscapes on bits of bark, *Enterolobium* seedpods like something in the window of a French confectioner, and twigs from mellow-trunked old trees with miniature forests of young ferns, mosses and seedling epiphytes. And beetles in cookie boxes, frogs wrapped in handkerchiefs wriggling in my pockets or a small pink-and-gray snake in a butterfly net.

Then would begin the all important job of getting everything painted before colors would fade, death overtake a specimen, or something escape and fly away. This was always an exciting time. Before my eyes, caterpillars would become pupae, unpainted chrysalids turn into wet-winged butterflies, orchids bloom themselves to death, cassias drop their

petals, gem beetles take fits and run around in circles, and an anesthetized lizard revive and lose itself in a confusion of paint pots, vials and dried leaves. But order would be quickly established and the agonizing matter of posing begin. This is the one problem that seems to have no permanent solution. You can't just kill the things and expect the drawings to look alive. There is always a great amount of fluttering, wiggling, crawling and carryings-on like temperamental prima-donnas on opening night.

Sometimes the only thing to do is to mesmerize your subject, and you sit there trying to look your model in the eye – a difficult feat in the case of multiple-eyed spiders. You have heard something vague somewhere that if you do this long enough, things happen; you don't quite know what. But the right kinds of things never do happen, so you have to experiment. Lizards and frogs are the easiest. You need just tickle their heads or sides with a paint brush and they freeze into immobility with the most starry-eyed expressions on their faces. On the other hand, snakes refuse to be tickled. The more you tickle them the more vivacious they become, the more they perform sambas, loops and lovers' knots.

But despite the complications and problems, which are certainly endless and never the same, the result is so worth while. You not only experience a wonderful feeling of elation at having overcome obstacles and emerged with something halfway decent, but you have the most amazing lessons in aesthetics continually before you – revelations of form, color and design that you are able to study at first hand.

The colors alone make all the theories I learned in school seem ridiculous. Analagous, triadic and monochromatic schemes become senseless when one sees pure hues mixed in undreamed-of combinations. I have seen a caterpillar that must have been the inspiration for Bakst's design of the chief eunuch in Scheherezade. I remember a small insect arrayed so fantastically in scarlet, jade, purple, turquoise and intoxicating magenta, in one primitive harmony so mad and daring, that the decor of Coq d'Or and Thamar seems pallid with the dust of years.

Membracids, those cobbolds and cluricauns of the insect world, (and perfect models, too), are crescents and trefoils reticulated with silver, or bearers of shields sequined with bronze, dull gold, and cool, dark viridian. Sometimes they seem textured like ancient glass, glittering beaten metals and all the jewels of fabulous Golconda. To attempt even to approach accuracy with man-made pigments when one's palette should be set with smouldering gems and minerals and stuff made of moths' wings, is futile. I could but hint at intricacies of pattern and design more finely wrought than the delicate silk tapestries of the Orient. As for those brilliant flashes like sunlight falling through shattered rubies, a few small spots of tempera put on with a two-haired brush must represent them. I could do no more.

Frequently, I would take my painting materials and establish an *al fresco* studio in the jungle itself, and there on a rock in the rain forest I found myself quite at home among giant trees bound with lianas, gripped by strangling figs and dripping with the roots of aroids. My favorite spot was quite near the road to Ocumare de la Costa – a moist grotto hung with delicate fern and lacy white begonias, where the larvae of fireflies glimmered like witch lanterns in the night, and a long gossamer waterfall sewn with paillettes of sunlight spilled over a cliff into a cool, green pool. These were the haunts of pale jade toucan

ets and short-tailed quetzals whose feathers shone like the wings of the Angel of the Revelation.

I would sit for hours sketching tiny plants and fallen leaves on the forest floor, or broad-leaved heliconias with their zig-zag inflorescences of flame and chartreuse and emerald, while around me wheeled brilliant birds—tanagers, orioles, manakins and callistes. The forest was filled with woodland voices – a bellbird clanging across the valley, jungle doves booming in thickets of thorny palm lianas, fat gold and purple wasps humming like spinning wheels and red howling monkeys delivering jeremaids from the top of Mt. Paraiso. A song like some latin chèvre-pied piping on a reed would be a small brown bird sitting on a rose-tinted spadix of an aroid blossom. Birds, colors, songs and the incessant whispering of the primeval forest giants merged into one glorious pastoral symphony. It was a temptation to dream away the hours and turn into a faun. But bugs and moths needed backgrounds, and it always seemed to be getting close to supper time, so the grotto would be left to the coatis, and I would wander home hoping to get there before the twilight fog reached the mountain pass, the Portachuelo.

Each day brought new marvels and their attendant problems. I jumped from spiny rats to impossible caterpillars, to tadpoles of golden froglets found in the wells of bromeliads. Brushes, inks, transparent watercolors, opaque watercolors, oils, sketch pads and slide rules were mixed up with yellow orchids, giant toads, hatching frogs' eggs in dishes, fresh jungle flowers in bottles and dead jungle flowers in jars, all in such startling confusion that I often wondered how I found the right thing at the proper moment. Little by little, however, paintings materialized out of the messes and the days slid by like a fantasy until it was time to pack once more and be off, leaving the green and violet velvety moths and incandescent gold beetles to resume their lives uninterrupted among the blossoms of the white ginger outside the window of my jungle studio.

Let's Take a Look at INSECTS IN WINTER

By BRAYTON EDDY

When the forests are bare and cold, what becomes of little creatures that sang and hummed and buzzed all summer long?

As THE cylinder of time revolves upon its giant axis it brings about many changes. It causes buds to blossom and develop into fruit. It clothes the naked twigs in green leaves, then splashes the leaves with gay colors before tossing them to earth. It drives the bullfrog into the mud, the rattlesnake into its den. It turns the songbird southward and gives the ermine a coat to match the snow. Screen doors give place to storm doors, garden tools to furnace tools. All these things time accomplishes for plant and vertebrate life . . . but what of insects? What of that great body of animal life which outruns all others in point of species?

It is this question which led to an expedition that late in October penetrated half a mile into the little-frequented section of Bronx Zoo east of Beaver Pond. Only last July that same region yielded a bee tree for exhibition at the Reptile House and later furnished specimens for inclusion in a growing insect collection. It is both woodland and meadowland, rocky ledge and sluggish stream – an undeveloped corner in the very center of the world's most populous city.

Last summer this region throbbed with ceaseless Lilliputian activity. The Praying Mantis was observed to feast in triumph upon the reluctant body of its mate. The Monarch Butterfly[1] emerged from its gold-pegged chrysalis to prepare itself for a long trek southward in company with its fellows. The digger wasp, nervous and excited, dragged its paralyzed prey beneath the ground to furnish unrationed meat for offspring it presumably never would see. The mosquitoes presented their bills, the yellow jackets their drills, and the crickets their raucous symphony until the cylinder of time made its scheduled round to winter.

Then all became silent, inactive, uncolorful. It was as if a magic wand had been waved to cast a spell over the entire scene. Where were the insects of yesterday? Did they follow the sun and disappear beyond the brink of the horizon? Did they bury themselves in the soft bosom of the earth to await the clarion call of a brighter day? Or did they, perchance, perish completely with the full circuit of the earth about the sun to rise again only by seeming spontaneous generation?

None of these alternatives which have plagued the mind of man since the beginning of time were found by our "expedition" to be completely true. Artfully concealed under rocks, beneath shedding bark, in the ground and on the trees were insects in various stages of development. Eggs, larvae, pupae, adults — but always dormant. Dormant not from choice, perhaps, but from necessity. Their blood, like summer oil in a motor car, thickens with the cold and makes it practically impossible for them to operate. Since they cannot change their blood, as we do our motor oil, and since unlike ourselves their blood contains no oxygen to give them warmth, they must wait for the heat of the sun to thin it out. They are cold-blooded animals, animals which assume the approximate temperature of the surrounding atmosphere. When it falls much below 45° Fahrenheit they become inactive, at the mercy of whatever delving sleuth chances to come their way.

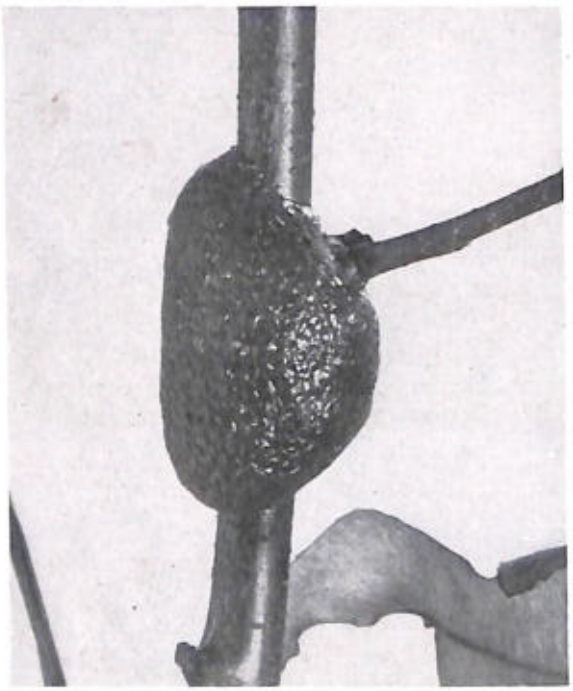
From the slender twigs of a hawthorn dangle many bobbin-shaped objects that might be withered leaves, if the tree were not otherwise bare. They hang like miniature Christmas decorations offset against the sky. They are small silk bags, ranging from an inch to an inch-and-a-half in length, decorated with shaggy bits of well-browned leaves. The smaller bags are invariably empty, but within the larger ones are the soft yellow seeds of a future generation.

The development of the Bagworm[2] is most fascinating to behold. Almost immediately upon hatching from its egg it proceeds to cover its nakedness. Not from an undue sense of modesty, to be sure, but rather from a desire for self-preservation. Being a caterpillar, unprovided with a hard shell, it would soon succumb to the insatiable appetite of its feathered foes if it did not take precautions against them.

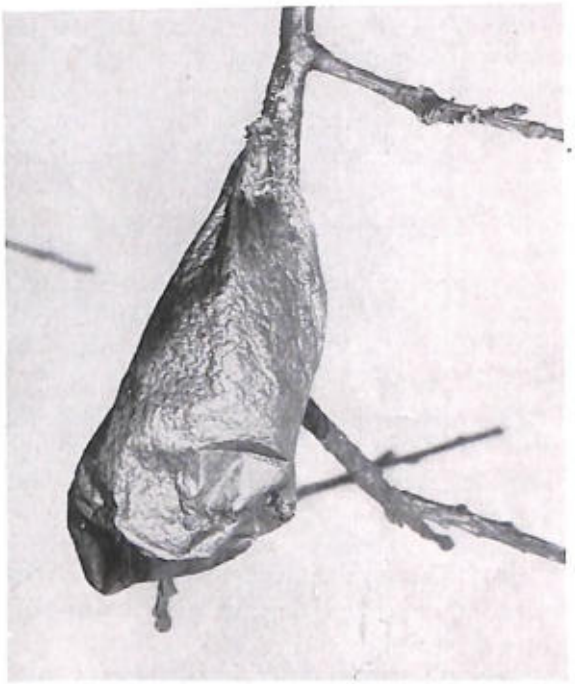
Straightway it crawls to the nearest leaf and, clinging by its front legs, with its tail in the air, deftly proceeds to weave a silken bag about itself. This bag is tough and the threads of it are exceedingly fine. In reality it is not a bag at this time, but rather a tube which bulges in the middle. The top is open to allow the head to emerge for feeding; likewise the bottom is open so that shed skins and waste may be discarded. The outside of the tube is decorated with bits of matching foliage to make it inconspicuous.

These are not seedpods, but cocoons of the Bagworm. Among the leaves they are inconspicuous; when the tree is bare, their toughness protects them.

When the Bagworm feels itself about to undergo a change, to convert into a helpless chrysalis, it chooses a solid support and lashes its tube in place. Usually the support is the twig of a host plant, of which there are many species besides the hawthorn. Instinctively it avoids attachment to a leaf, which inevitably would drop to earth in the fall and prove disastrous. The tube, now converted into a pendant bag, is given an extra lining of silk before the worm makes its final



More than 300 eggs of the Eastern Tent Caterpillar are in a tight, waterproof cluster around this wild cherry tree twig. The eggs will hatch next April.



The large, brown cocoon of the Cecropia moth is familiar to many persons who have tramped the woods in autumn. Inside is the mummy-like pupa.

moult. Should a bird even suspect there was a tempting morsel within, it would find it exceedingly difficult to peck a hole through this swinging object.

In three weeks the chrysalis works its way down into the bag and, if it is a male, makes its escape through the lower end as a moth with glassy wings. But if it is a female it has neither legs nor wings to escape with. It merely protrudes its memberless body for the mating, then retracts to lay its eggs within one end of its chrysalis case. There the eggs, protected by case and bag, withstand the rigors of winter while the mother drops to earth through the escape hole and perishes.

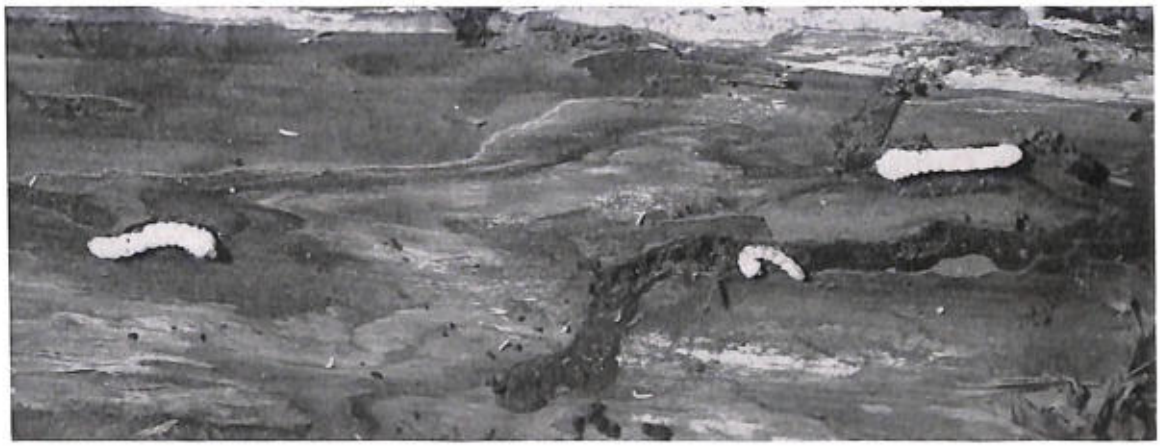
On the twig of a wild cherry tree, nearly shorn of its leaves by a recent frost, is a slight swelling almost the color of the bark. The swelling extends along the twig for about three-quarters of an inch and is rounded at either end. Close examination reveals that it is made up of tiny round eggs, more than three hundred of them, laid in a belt line about their support. A shiny coat of glandular shellac, applied by the parent moth, protects them against weather and no doubt against lesser enemies.

But man has come to recognize these egg masses as belonging to the brown-winged moth of the Eastern Tent Caterpillar.[3] Because these caterpillars make ugly spring nests high in small crotches of both apple and cherry trees, defoliating the limbs as they go, he has declared unmerciful war against them. Last spring many dozens of nests were clipped from the park trees and destroyed, but from mid-May through the winter to early April this insect exists only as a developing embryo in a sheltered huddle of eggs.

Attached to a stem of goldenrod is one of the most marvelous egg clusters of all time. And no wonder, for it is made by one of the most interesting and human-like of insects – the Praying Mantis. One species is native to this country, but two others were introduced from Europe and China because of their capacity to eliminate pests. It is believed to be the only insect that can turn its head without turning its body. When standing erect upon its four rear legs, holding its front ones alert for grasping, it reminds one of a wild horse rearing for action. The small triangular head with its lidless eyes follows every movement of friend, foe or shadow.

Any low-growing plant is likely to be chosen

Beneath the loose bark of a dead elm tree one may find the silk-cotton wad that protects the eggs of the Grass Spider. The female, here shown guarding her eggs, will not survive the cold of the winter, however.



Not all the tiny creatures of summer spend the cold months as eggs; these yellow grubs of the Elm Borer Beetle will pass the winter in this form among trails they have chewed under the loose bark of some log.

Dig into the soggy wood of a dead oak log and one is almost sure at this time of the year to turn up Horned Passalus Beetles that will scramble quickly out of sight in the tunnels they have chewed in the wood.

as an attachment for its eggs, and there may be more than a hundred in a cluster. The female mantis clings head down to a twig, stem or branch and pours them forth from the end of her body.

But eggs laid in a cluster should have protection against both storms and enemies. This the Praying Mantis provides and, unique among insects, it also seems to provide protection against extremes of temperature. Its nest, indeed, is built upon the modified principal of a thermos bottle only whereas the thermos bottle depends upon a dead air chamber between the glass interior and the metal exterior, the Praying Mantis utilizes a glandular secretion which it whips full of tiny air bubbles as it pours forth from the abdomen. On contact with the air, the walls of these bubbles soon harden to form a crust, not unlike the shell of an almond, beneath which the eggs lay hidden in comparative safety and seclusion. Sometimes these egg cases require as much as twenty-four hours to complete, but results have shown that the time was well spent.

Beneath the loose bark of a dead elm tree we find a medium-sized spider which one is accustomed to observe running over a doily web spread out upon the grass. Early morning dew makes the doily most conspicuous. At one end is a tunnel which leads downward for escape, and overhead is a net-work of fine threads to trip the unwary flier. Down will tumble a mosquito or a small moth onto the silk doily, like a trapeze performer that has missed the mark, and the alert Grass Spider[4] will rush forth from its frail tunnel to seize it.

The spider itself is truly not an insect, since it has eight legs instead of the qualifying six, but it is interesting to know where it spends the winter and how. On removing the bark from the elm tree, a cotton-like wad was disclosed upon which the spider rested. It had chosen its site wisely for it was well away from the grass plot where presumably its enemies would be lurking. Beneath the wad were tiny round globes, eggs like seed-pearls, which were held together by their sticky shells as well as by the covering fluff. Although the mother was found guarding the eggs when they were revealed, she will not survive the winter. Instead her prostrate body will be seen in the spring close by the seeds of her production.

But the animals of our concern do not spend the winter only as eggs. In the same log, half in the bark and half in the sapwood, were several yellow grubs streamlined from front to rear. Their black jaws must have been exceedingly strong for they had gnawed circuitous paths down a line set by the cambium. A trail of packed sawdust revealed their path before arriving at the socket-like depressions in which they were discovered.

These grubs were the offspring of a gray, black-spotted, Elm Borer Beetle[5] which attains a length of half an inch. Generally it matures in late May and deposits its eggs beneath the bark of trees either dead or near dying.

As we turn over a fallen log, another larval insect is revealed. Motorists are familiar with it, for like a hen, it seems forever desirous in the fall of crossing the road to get on the other side. Its hair resembles a pompadour clip – black at both ends but red in the middle. This is the Banded Woolly Bear[6] caterpillar which, having consumed its quota of plaintain and other fodder, seeks a shelter under logs and stones where it remains tightly curled against cold weather. In fact it is one of the very few caterpillars in New York which can boast of this accomplishment.

Some insects over-winter in the twilight zone between wingless caterpillar and winged moth. On the limb of a low cherry tree we find such an object. It is a large, brown cocoon which forms the sleeping bag of the famed Cecropia.[7] Within this bag is a mummy-like pupa, dark brown but bearing the imprint of the moth it will later become.

The bag itself is made by a caterpillar, some three inches long, whose back is decorated with ornate pegs like those from a cribbage board. It rears upon its hind pro-legs, using its front legs to draw forth the liquid silk from its modified salivary glands. Moving its body up and down, it slowly attaches loops of thread lengthwise of its support before beginning the outer scaffold of the cocoon proper. Within the outer cocoon is later constructed an inner cocoon with strands of fluffy silk acting as a buffer between. Only then does the maker shed its colorful caterpillar skin for the drab case of a pupa.

A survey of insects which over-winter as adults, often in clumps of weeds next to fence rows, shows a surprising number that attack

food plants. There is the Striped Cucumber Beetle,[8] the Asparagus Beetle,[9] the Mexican Bean Beetle,[10] the Squash Bug,[11] the Tarnished Plant Bug[12] and many others. They survive by reason of the fact that they conceal themselves under plant debris. But there is one over-wintering adult, a protector rather than a despoiler of plants, which seeks shelter in houses and hollow trees – the ladybeetle.

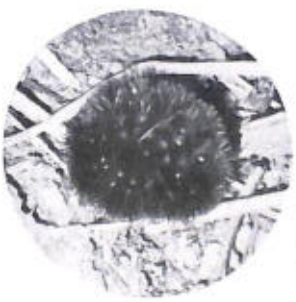
The Two-spotted Ladybeetle[13] is found behind a sliver of punky wood inside what might have been a bat roost, although if bats had been there it probably would have been eaten. Its size is pathetic, scarcely larger than a split pea, and its convex body is mahogany colored with one black polka dot on each wing. As a friend of man it holds front rank, since both in grub and adult stages it feeds upon herds of plant lice.

A pile of coarse sawdust at the base of a rotting oak log invites investigation. The bark is torn away, revealing large tunnels in the soggy wood beneath. These tunnels are quite unlike those made by the elm borer since they do not involve the underside of the bark but confine themselves principally to the heartwood. It is not long before a glossy black beetle, the size of one's thumb, its back ridged like corrugated iron, comes tumbling into view. It alerts its leafy antennae, then tries desperately to bury itself. When we pick it up between thumb and forefinger it makes a squeaky noise of protest by scraping hard areas on the upper surface of its abdomen against the lower surface of its wing covers.

Our "expedition" uncovered no fat grubs in the log, but there were several more Horned Passalus Beetles.[14] As soon as they were exposed they quickly tried to get out of sight and it was amazing how soon their clumsy bodies could disappear inside a log runway. Earlier in the year both adults and grubs may be found in the same enclosure, the grubs apparently depending upon their elders to break up the wood for them.

A strip of tar paper which evidently had lain on the ground for some time was raised and out jumped several female Field Crickets.[15] One can tell they are females because they pack – not a pistol – but a long, black sword-like ovipositor. And they cannot talk with their wings, the way their mates do so successfully, by drawing the sharp edge of one against the file-like vein of another. Their sole desire is to escape. No doubt they have already planted their winter eggs in the soil, but their own chances of surviving until spring are slim indeed.

1 Monarch Butterfly, *Danaus plexippus* (L.)
2 Bagworm, *Thyridopteryx ephemeraeformis* (Haw.)
3 Eastern Tent Caterpillar, *Malacosoma americana* (F.)
4 Grass Spider, *Agelena naevia* Walck.
5 Elm Borer Beetle, *Saperda tridentata* Oliv.
6 Banded Woolly Bear, *Isia isabella* (A & S.)
7 Cecropia Moth, *Samia cecropia* (L.)
8 Striped Cucumber Beetle, *Diabrotica vittata* (F.)
9 Asparagus Beetle, *Crioceris asparagi* (L.)
10 Mexican Bean Beetle, *Epilachna varivestis* Muls.
11 Squash Bug, *Anasa tristis* (DeG.)
12 Tarnished Plant Bug, *Lygus pratensis oblineatus* (Say)
13 Two-spotted Ladybeetle, *Adalia bipunctata* (L.)
14 Horned Passalus Beetle, *Passalus cornutus* Fab.
15 Field Cricket, *Gryllus assimilis* (F.)



Above — Banded Woolly Bear caterpillar as it rolls up. Right — wintering Crickets.

Above—Two-spotted Ladybeetle may be found hiding among rotting, punky wood.

A Swellfish Story

By MYRON GORDON

SINCE autumn, the frosty counters of the best fish shops in town have displayed, as they have for several seasons now, a new sea-food delicacy called "blowfish tails." Along the north Atlantic, fishermen know the blowfish under a long list of characteristic names: swellfish, balloonfish, globefish and puffer are samples. What surf-casters call them is unprintable, for the sport-fishermen have a strong and colorful way of expressing their low opinion of the puffer for stealing bait intended for fishes they hold in greater esteem. Salt-water anglers may be surprised to learn that these fish, so repugnant to them, have risen mightily and are now associated in the market places with the lordly salmon, the gamey striped bass, the handsome red snapper and the delicate pompano.

The debut of blowfish tails as respectable sea food has been part of a successful campaign of the government-sponsored National Research Council Committee for the Utilization of Marine Products together with the Connecticut State Board of Fisheries and Game, directed towards increasing the use of a number of so-called "trash" species heretofore neglected, little esteemed or purposely avoided in the great markets. Responsible authorities hesitated a bit before giving blowfish tails a clean bill of health because the common American species of the swellfish, *Spheroides maculatus*, belongs to the world-wide fish family known as the Tetraodontidae, the four-toothed beasts of the sea. Many of the members of this fish fraternity are notoriously poisonous, and this is particularly true of the tropical species, especially those of the seas around the West and East Indies.[1]

[1] Nigrelli, Ross F. "Fish May Be Poisonous, Too," ANIMAL KINGDOM, Sept.-Oct., 1944, page 122.

The pun in the title is intentional, for Puffer lore is full of entertaining stories about these poisonous but edible fish.

Biological chemists, in recent researches into the nature of poison of the puffer, have found by modern scientific methods what oriental sea-food chefs have known for centuries, that the toxic properties of the tetraodonts are concentrated in the visceral organs, the liver, the kidneys, the gall bladder, and in the genital glands, the ovaries and testes. The muscles are free of the toxin unless contaminated during the spoilage period between the catching and the eating of it. In tropical countries without proper refrigeration techniques, it is easy to see how the entire puffer might become permeated with the poison originating in some of the internal organs. The chemists had never analyzed this kind of poison before, and when they extracted it in final form they called it *tetraodontoxin*.

Pharmacologists, in testing the suspect organs of the puffer, found that the potency of the toxin varies with the seasons, being most virulent in the spring when the fish are preparing to spawn and during the breeding period. In tropical regions, lacking the definite seasonal changes, the puffers may always be dangerous. Fortunately, along the northeastern Atlantic seaboard, blowfish are taken in large and commercially profitable quantities only *after* their spawning season. The fish are processed immediately after being taken from the nets; nothing is saved except the tail muscle. Large quantities of blow fish tails have been marketed and eaten in the East, yet no cases of fish poisoning have been reported in this section. Blowfish tails are sweet,

delicate in taste, resembling in texture and flavor the white meat of the edible crab. They may be a nuisance on the end of the surf-caster's hook, but they are swell on the prongs of a dinner fork.

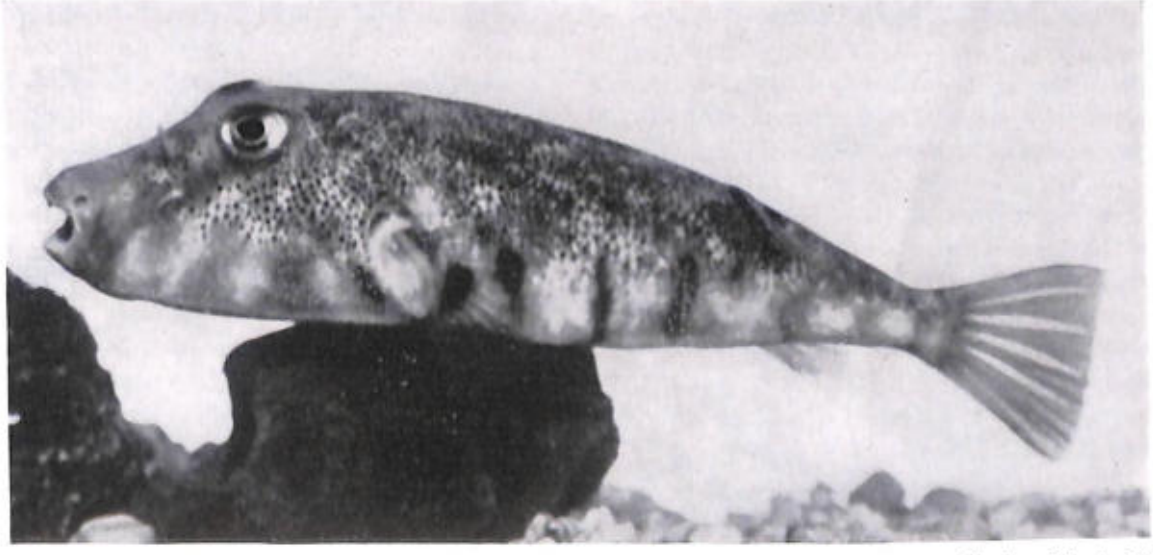
Up to the time our sea-food epicures spread the good news that blowfish tails make a delectable dish, the American swellfish were left pretty much to their own ways of life; yet it is not likely that their numbers in the sea will decrease, even if the demand from the shore-dinner trade should soar. Few fishes have so many physical advantages as they, and they make the most of their peculiar anatomies in a variety of tricks unmatched in the water wilderness.

Walter B. Savery of Wareham, Massachusetts, with his field glasses spotted an osprey diving for swellfish in about two feet of water on Little Harbor Flats. He saw the bird catch one and rise with it into the air. At that instant the fish started to inflate, and it swelled up so quickly that it was out of the hawk's talons before the bird could give that characteristic shake to its body that always follows its dive. Savery saw the fish-hawk strike successfully four times, and each time the swellfish puffed itself out of the bird's clutches. As the fish fell from a height of about ten feet, it seemed to bounce on the surface, float for an instant, deflate, and then sink out of sight.

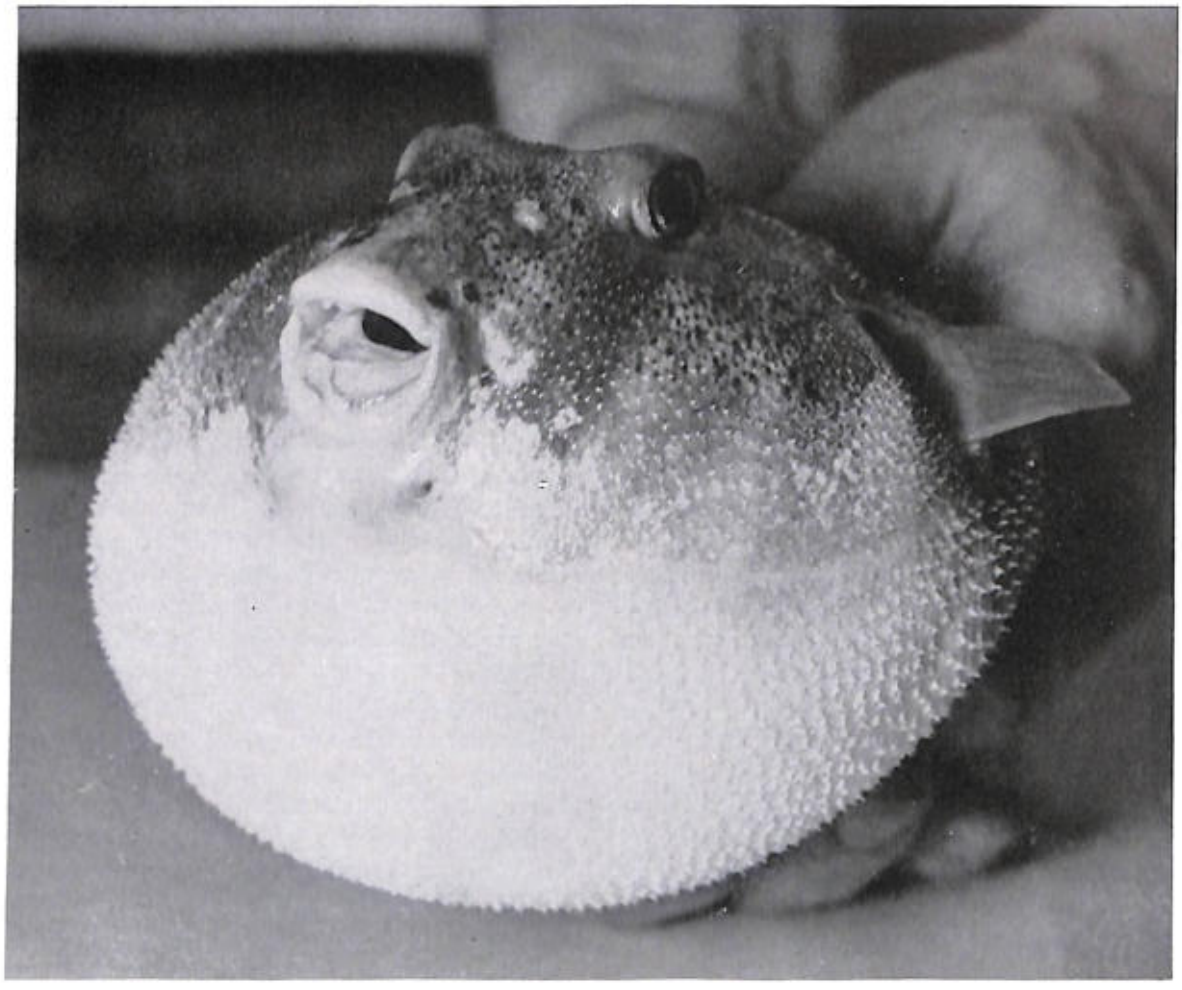
When, at the New York Aquarium, the late Director Charles H. Townsend placed a big, voracious scup, *Stenotomus,* in a tank with a dozen small puffers, the big fish attacked at once. Instantly the baby puffers, only two inches long, inflated themselves and became too large to swallow. The porgy could not get hold of its cue-ball-like opponents, but merely knocked them about.

William W. Welch of the United States Bureau of Fisheries and Charles M. Breder, with temporary laboratories at Atlantic City's Million Dollar Pier, discovered that puffers learn their trick of self-inflation early. During their studies of the fish's life habits along the New Jersey coast, the ichthyologists found that adult puffers spawn in June and July and that an eight-inch female deposits about 200,000 eggs, which form clusters and appear like honey in the comb. The eggs hatch in four to five days; the larvae are thin and transparent — little resembling their parents. Later, when they are a quarter of an inch long, they begin to show some of the tricks of their trade. Their bodies are extremely distensible, and when they inflate themselves they look like tiny balls about the size of peas. Fully swollen, their skins are literally turned inside-out and their eyes seem to pop out of their heads — all of which gives them a grotesque appearance, to say the least.

An eight-ounce swellfish — this is the usual weight of an adult — can swallow 40 ounces of



The common American species of the Swellfish (*Spheroides maculatus*) is a rather undistinguished citizen of the ocean when it is at rest. But it belongs to a family that is notoriously poisonous, especially in the tropics, and when it swells up—well, just turn the page and you will see what happens to it then!



The Swellfish really SWELLS! This one happens to be filled with air and is light enough to bounce if it were dropped on the pavement. In the water the Swellfish inflates itself with water, of course, and then it takes a predator with a sizeable mouth and a disregard for prickles to make a very hearty meal of it.

water during its puffing act. By a clever anatomic trick, the water by-passes its stomach and enters a sac of its body cavity.

Back in 1815 Dr. Samuel L. Mitchell, then Professor of Natural History at the University of New York, reported that puffers inhaled air with such vigor when lifted from the water that they could easily be heard, and that when fully inflated they were as hard as footballs and could be kicked about. He said he had seen them bounce from the surface of a rock against which they had been thrown.

Albert Eide Parr, now director of the American Museum of Natural History, in the early days of his biological career worked in the old New York Aquarium, where he watched the peculiar antics of the puffers. What puzzled him was the knowledge that although *Spheroides* has no ribs, and no ventral fins, and its soft pectoral fins are situated quite high up, the fish, when resting on the bottom manages to support its body weight from pressing down and interfering with the functions of its internal organs. Parr discovered that the puffer has a built-in, pontoon-like landing mechanism ingeniously contrived from its breastbones, which he calls "the post-clavicular apparatus." As the puffer sails down from a height to the loose coral sand, it spreads its two ski-shaped bones within its flabby belly wall and lands in an upright position.

After a vigorous run around, the puffer settles to the bottom and rests on its broad, rather flat belly. Its mouth remains partly open and its body heaves up and down as if it were out of

breath and trying to recover it quickly. As it lies there, stretched out, wide-eyed, mouth agape and heaving, it looks like a frightened baby calf freezing to the ground, hoping for the best.

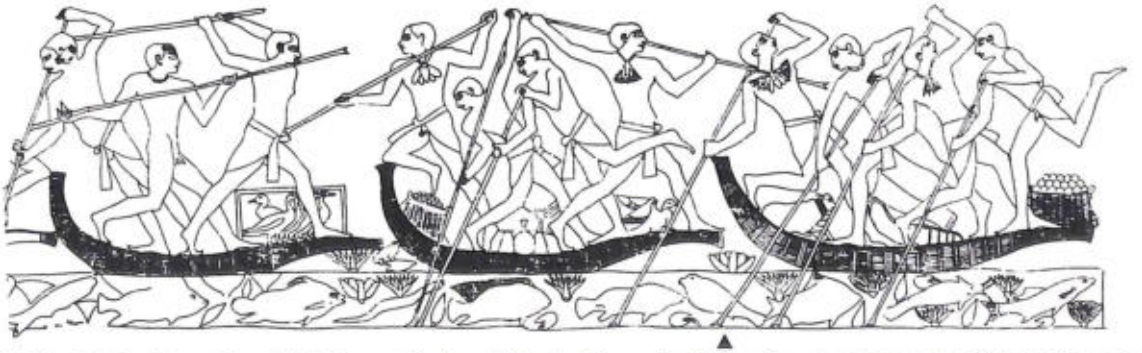
One day Parr noticed that just after *Spheroides* landed on the sand it pointed its head downward and with short, quick, energetic movements pushed itself partly into the sand. Then the half-hidden puffer immediately covered its exposed back by throwing sand on top of itself, using the long, flat bones of its postclavicular apparatus as shovels. This trick undoubtedly gives it the advantage of invisibility, which it may use either to surprise its prey or to hide from its enemies. But the puffers do not reckon with the human mind. Charles M. Breder says that the puffers in working themselves into position create two prominent ridges of sand over their backs, which diverge to the rear in a characteristic way. He says he can easily spot their secret hideouts in their natural habitat in water off the New Jersey seacoast. In working in the loose sand, the puffer's eyes are protected by semi-transparent eyelids, which serve them like eye-shields on a sandhog's helmet.

According to Breder, a group of tetraodont puffers will often gang up on a solitary blue crab. In attacking the decapod, the puffers aim their bites at the region just between its eyes, for it is here that its vital nerve ganglion lies; once this invertebrate "brain center" is hit, paralysis sets in. Both the crab and the fish "sense" the crucial importance of the area. The crab defends it with its powerful, pincer-like chelae, which hover in front of its eyes like a hockey goalie at his net.

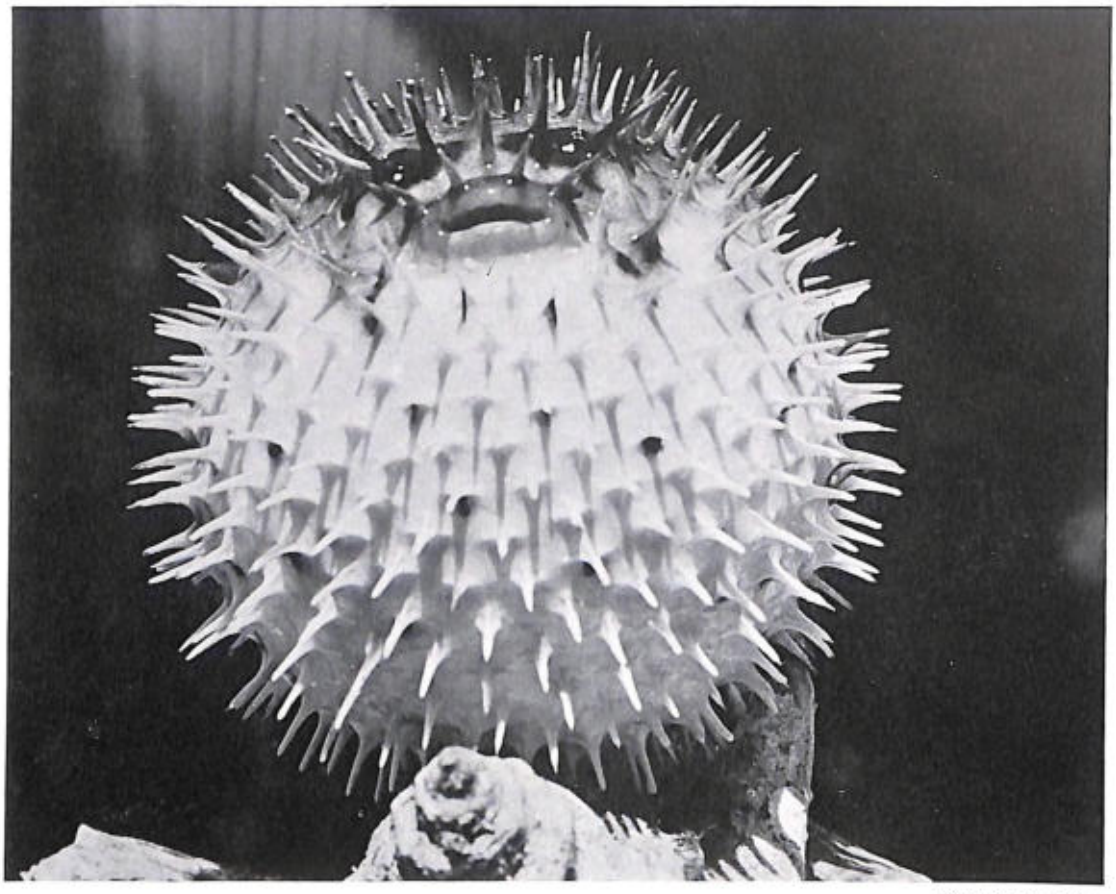
The fish seem to go into a huddle, then scatter, and make individual sallies at the crustacean, nipping it at the less well-protected areas. Once a puffer carelessly got within range, and the crab got in its lick by grabbing the fleshy lip of the aggressor with its powerful pincers. As the puffer violently shook its head to free itself, the brittle joints of the crab's claw-leg broke, making it vulnerable in the final battle maneuver. Another puffer closed in and with its powerful teeth crushed the crab's vital nerve center. Crab-meat was scattered all over the battle scene for a moment, and then everything was calm. Breder, in witnessing this strange war between the invertebrate and the vertebrates, was puzzled about the implications of this uneven struggle, saying, "The spectacle always suggests concerted action and the possession of more reasoning power than we have any right to assign to fish."

Most of the four-toothed puffers, the Tetraodontidae, are marine and are found in every sea. Traveling up the estuaries in India, Ceylon, Malay and Egypt, three species of tetraodonts are able to pass the tidal rivers and live in fresh-water streams.

An Egyptian species, *Tetraodon fahaka*, lives in the fresh waters of the Nile. The *fahaka* is a famous fish and one that must have had some important symbolic virtue, for it appears commonly in the mural paintings of the ancient Egyptians. Unmistakable likenesses of it are found in the fishing scenes drawn on the walls of the pyramids of Giza and Saqqara. The eastern half of the south wall of Ptah Hotep's tomb at Saqqara is decorated with an elaborate battle scene being fought on water. The pictures represent a cross section of the battle. Above the water line the battle royal goes on furiously. Below the water line, below the keels of the war vessels, as if in sharp contrast to the warlike scene above,



Ichthyologists have identified the puffed-up fish in this ancient Egyptian drawing as the Fahaka (arrow points to the fish), from the fresh waters of the Nile. The battle scene is carved on a tomb at Saqqara.



Myron Gordon Photo

Probably the most spectacular of the puffers is the Porcupine Fish, *Diodon hystrix*, that is armored with sharp and exceedingly disagreeable spines. In the water or in the air it can inflate in a very few seconds and it is a bold enemy indeed that will dare to attack this "hedgehog" of defense on its home grounds.

the artists painted a lovely scene of peaceful aquatic life. A partly inflated *fahaka* may be recognized easily among the aquatic creatures.

Tetraodon fluviatilis is the scientific name of the fresh-water puffer of India, and its name conveys the meaning that it is a four-toothed beast that has come from the river. It is a little fellow; the largest ones never get much larger than six inches. But in spite of its diminutive size it is a voracious and predatory fish.

Otto Thilo tells of the remarkable behavior of this globefish, or, as Thilo prefers to call it, *Kugelfische*. To avoid being swept downstream, it creeps through narrow openings between stones, or behind empty shells of snails which it has piled up, and swells out its body like a balloon. It is then so jammed in between stones that it remains just where it wants to be without effort.

The fresh-water puffer of India has recently been brought to America by an enterprising tropical-fish dealer, and these new fish immigrants are now quite popular in the home aquarium. They eat all kinds of fish food but prefer raw meat; they are inclined to be scrappy; they are too small to do much damage with their strong teeth when handled; they will go obligingly through the typical swelling antics of their tribe when lifted from the water and tickled under the chin. Aquarium-fish keepers are excited; they have discovered another parlor trick.

The porcupine fish, the two-toothed puffers, like their four-toothed relatives, do not rely solely on their inflationary trick for self preservation. They, too, have powerful jaws, which are equipped with a brace of chisel-like teeth. These two prominent dental outposts of defense have given them their technical family name of Diodontidae.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

The Trumpeter Swan Situation Continues Satisfactory

The plan for preserving the Trumpeter Swan worked out last year by the Fish and Wildlife Service authorities with the advice of Jean Delacour of the Zoological Society's staff is making satisfactory progress, Mr. Delacour was able to report after a late summer visit to the wildfowl refuges in Wyoming and Montana.

The swan situation on the Red Rock Lakes refuge area seems to be stationary, with about 170 birds wintering on the feeding grounds. Twenty cygnets hatched in 1945 were caught and successfully transported to the Malheur Lake refuge in Oregon, and it was found that 18 of the birds transported there from Red Rock Lakes last year were in perfect condition.

Mr. Delacour expects to pay another visit to the West next spring, at which time further refuges will be selected in Oregon, Idaho and Nevada. In these the cygnets hatched in 1946 will be established in the autumn.

"Expedition" in the Zoo

The "wilds" of the Zoological Park's own grounds continue to be a fruitful source of animals – witness the Alaskan Red Fox that was captured in the Zoo a year ago, the innumerable raccoons and opossums, owls and hawks that have been taken here in late years, and now the capture of a real rarity, a Colombian Red-bellied Squirrel (*Sciurus saltuensis bondae*).

The handsome squirrel, about the size of our familiar Gray Squirrel but brightly marked, was first noticed on the paths and in the shrubbery late in the summer. It appeared to be tame and a few efforts were made to capture it, but none of them succeeded until October 13 when Head Keeper George Scott of the Bird Department set out on an "expedition" with a pocketful of peanuts and a small hand-net – the latter carefully concealed behind his back.

He caught the squirrel on the second peanut.

We can only suppose that the squirrel had escaped from some private owner – or, possibly, had been brought back by a Service man and was liberated in the Zoological Park where it was sure to find enough to eat. It could not have withstood the rigors of a New York winter, however. Temporarily the squirrel is in the Lion House "nursery" under the care of Mrs. Fred Martini, wife of the Lion House keeper.

Citation for Keeper Hansen

Staff Sergeant Robert Hansen, now of the Army but lately (and in the future) of the Mammal Department keeper staff, has been given a citation for "heroic achievement in action against the enemy on 26 November, 1944, in France."

The citation states that when his isolated position was attacked by four enemy riflemen with automatic weapons, Sergt. Hansen disregarded the fact that he was outnumbered, killed the leader, and drove off the other attackers, thereby preventing a penetration of our lines.

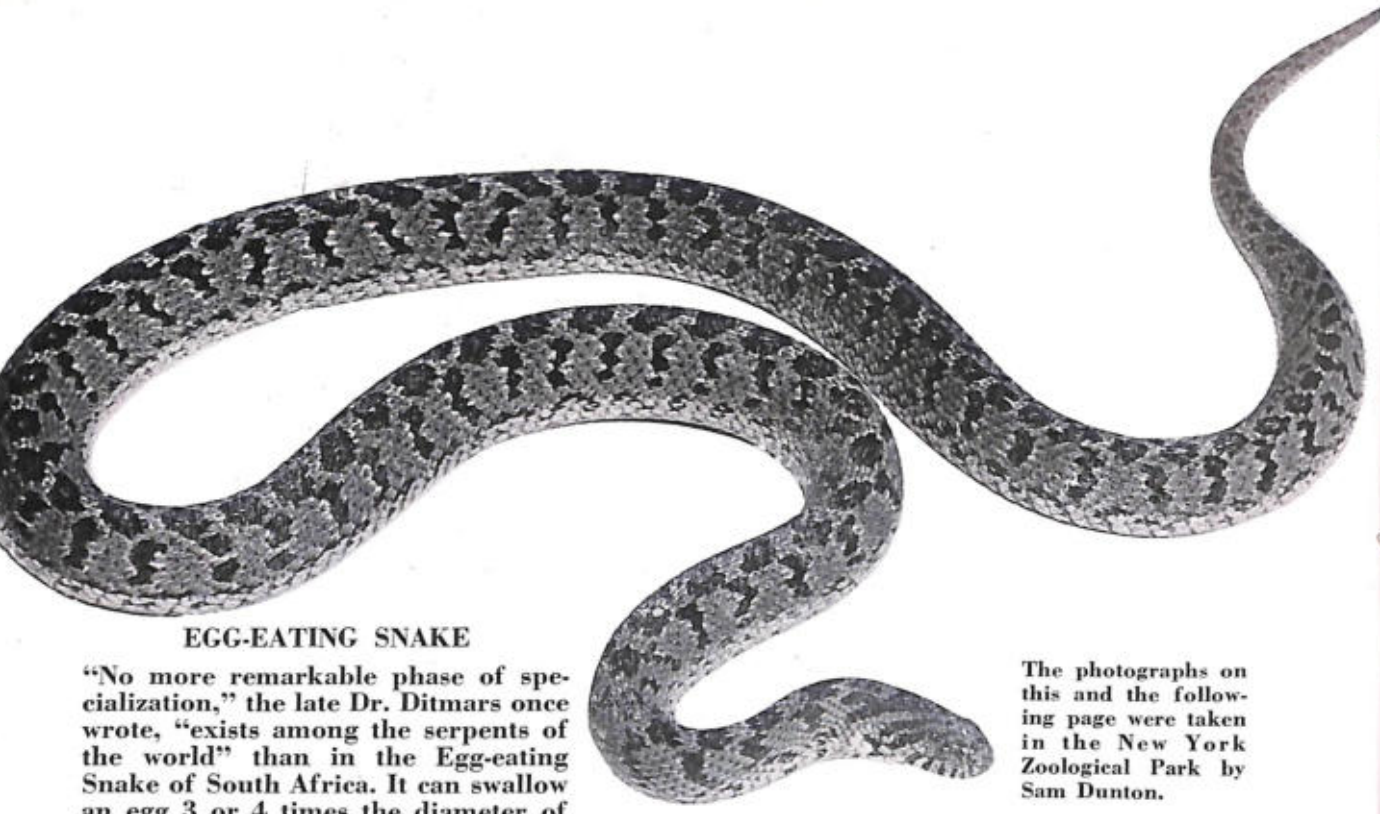
Sergt. Hansen is the husband of Mrs. Ruth Hansen of the Zoological Park's business office.

The Sealions Are Home Again

After about three weeks of exile in the Penguin Pool (during which time the Penguins suffered an exile of their own to Snake Island), our California Sealions are back home in their big pool on Baird Court. During the absence the underwater portions of the pool were given several coats of light blue paint, so that the swimming actions of the animals are quite visible even when they are several feet below the surface.

* * *

Newest publication of the Society is a large sheet of animal pictures, printed on one side only so the pictures can be cut out for scrapbooks, mounting on cardboard, and the like. The first Picture Sheet, which it is hoped will result in a series of sheets on the mammals, birds and reptiles of each continent, is called "Mammals of All Continents," and contains 37 pictures. It is for sale at 50 cents a sheet.



EGG-EATING SNAKE

"No more remarkable phase of specialization," the late Dr. Ditmars once wrote, "exists among the serpents of the world" than in the Egg-eating Snake of South Africa. It can swallow an egg 3 or 4 times the diameter of its head. This is *Dasypeltis scaber*.

The photographs on this and the following page were taken in the New York Zoological Park by Sam Dunton.

The Death of One Giant Panda

The death on October 4 of the smaller of our two Giant Pandas must, with regret, be recorded here.

Post-mortem examination revealed that it died of an acute intestinal inflammation which had produced peritonitis, the inflammation resulting in an obstruction prohibiting the passage of a bolus of bamboo.

The animal was found dead on the arrival of its keeper in the morning. It had been with us a little more than three years and nine months, having been secured in Chengtu, China, by Mr. Tee-Van as the gift of Mmes. Chiang and Kung.

On arrival at the Zoological Park on December 30, 1941, this particular specimen – supposed to be a male because it was larger and more aggressive than its companion – weighed 62.7 pounds. It weighed 201 pounds two days before its death, while its companion weighed 298 pounds. Autopsy confirmed a discovery of a few months ago that it was a female – as we still believe our remaining Giant Panda to be also.

Interestingly enough, the difference in weights between the two animals did not indicate that the smaller one was deficient in nutriment; it was relatively well-padded and even carried a small amount of fat. It had never been entirely normal since its baby days, having frequent periods of loss of appetite and weight.

Trouble in the Otter Eden

When two young female Florida Otters arrived by air on October 31, General Curator Crandall's only worry was whether the large male Canada Otter in the Otter Enclosure might resent them and kill them.

Instead, the playful females harried and chivvied the bewildered male until he had to be removed for his own protection. Now Mr. Crandall is trying to find him a mate of his own species and temperament.

PUBLICATIONS OF INTEREST

WILDWOOD WISDOM. By Ellsworth Jaeger. 491 pages, 193 plates. The Macmillan Company, New York, 1945. $2.95.

Although this reviewer never expects to have occasion to build a fire with a drill stick, cut out a buckskin hunting shirt or contrive an Ojibway drinking cup out of birchbark, he confesses himself positively fascinated by the "how-to-do-it" illustrations and the easy, informative text of "Wildwood Wisdom." Next to being a 14-year-old Boy Scout again, this is just about tops in armchair enjoyment of the out of doors.

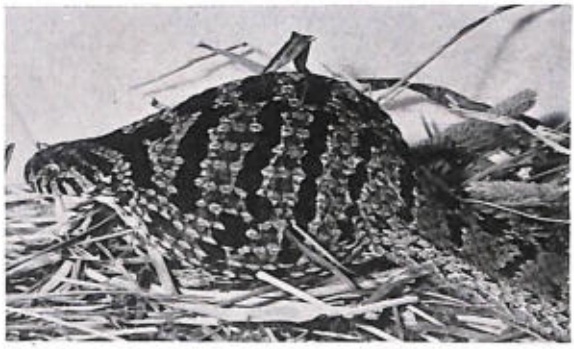
Mr. Jaeger is Curator of Education in the Buffalo Museum of Science, a very lively organization. Presumably he has tried out all the hundreds of ways of getting along in the wild that he describes so authoritatively, for he is reported to have spent many summers with the Indians in the United States and Canada.

1. Inspecting the "prey."

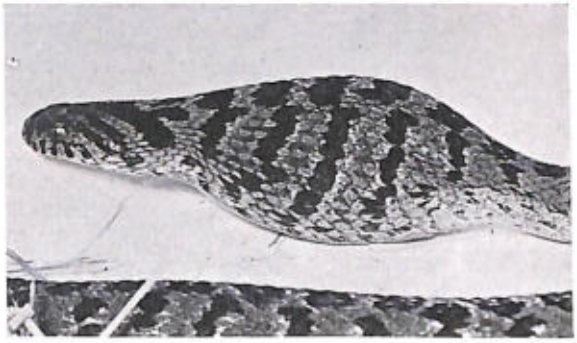
2. The jaws start to expand.

3. Almost half-way there.

4. On the home stretch.



5. The cutting processes start.



6. The egg has collapsed.

7. The shell is regurgitated.

8. What is left of the shell.

ANIMAL
KINGDOM

You Can Make Christmas Last All Year

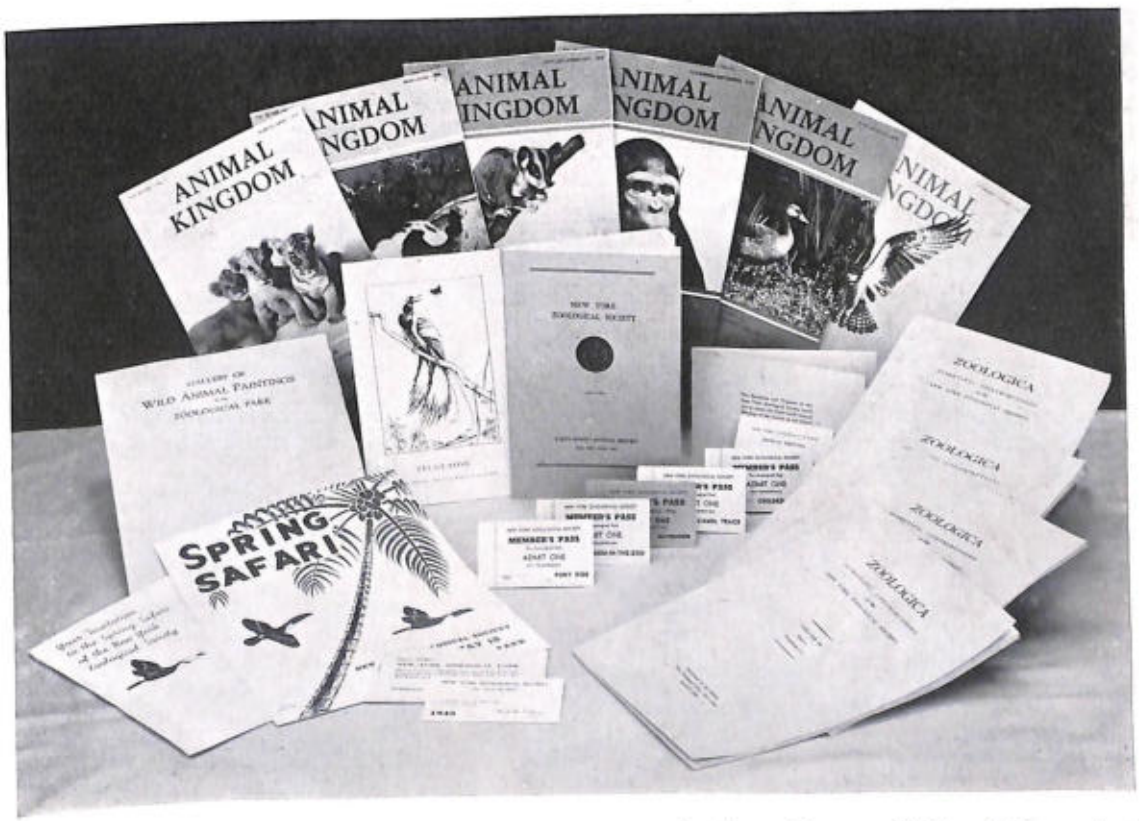
THIS WILL BE a merrier Christmas for most of us this season – the merriest in four long years. How can we make its spirit last?

The gift of a Membership in the New York Zoological Society continues all the way to December, 1946, and carries pleasure to the entire family of the recipient. A Membership is not only a lasting gift, but it is a different kind of present – an original, and thoughtful remembrance that brings entertainment and, at the same time, great beauty and instruction.

Think of Society Membership as a gift not only for children – ideal as it is for little people. So many older people will enjoy it, too. The invalid who loves nature but can no longer seek her will find satisfaction in the many publications which come with membership. Soldiers and sailors home from years in strange, out-of-the-way spots, will discover in membership a helpful means toward rehabilitation. Ex-service men and women throng the Park daily, and many are joining the Society.

Almost anyone you can think of will benefit from an association with the Society and its fine aims.

And such an easy present to purchase! No shopping, no fuss with ribbons and tissue paper! No worrying about delivery! All you need do is fill in the inserted form in this issue, mail with your cheque or money-order, and an appropriate announcement will go to each new member in time to slip into his Christmas stocking.



Here's What You Get

- Six animal-picture-packed issues of ANIMAL KINGDOM.
- A brochure of gravure reproductions of wild animal paintings
- Member's Card for free admission to the Zoo
- The Society's illustrated Annual Report
- A book of Guest Tickets to the Zoo
- Free tickets to Children's Zoo, animal rides, etc.
- Invitations to the Spring Garden Party at the Zoo
- Invitations to the Annual Meeting at the Waldorf-Astoria
- Zoologica, the technical quarterly (if you are a scientist)

These Are SOME of the New Members of the Zoological Society

Unfortunately, the forms of ANIMAL KINGDOM have to be closed almost two weeks before the magazine goes to press and it is impossible to insert the names of all the new members of the New York Zoological Society since the September-October issue. Members received too late for this issue will be reported in subsequent issues.

Life

Paul E. Geier
Walter S. Gifford
E. J. L. Hallstrom
Mrs. Paul Moore
John J. Raskob
Mrs. Beverly R. Robinson
William Jay Schieffelin, Jr.
Grant G. Simmons
Henry Trefflich
Mrs. Catherine B. Van Bomel

•

Annual

John C. Adams
Mrs. Ernest R. Adee
Alfred A. Alsleben
Alfred Angrist, M.D.
Percy Laurance Bailey, Jr.
Roger N. Baldwin
S. L. M. Barlow
Henry L. Beadel
George J. Beal
Sidney B. Becker
G. Campbell Becket
Herman Belth
Elliot S. Benedict
Irl. E. Bennett
Robert W. Bennett
Quincy Bent
William E. Bettridge
Frederick T. Bonham
Albert Greene Borden
Miss Lucrezia Bori
Helen E. Brice
Irving Burten
Sidney C. Carpenter
William M. Carpenter
Miss Susan Chase
Mrs. Knight D. Cheney
William H. Cole
J. Linzee Coolidge
R. N. Cranford
Percy L. Crosby
Thomas M. DeBevoise
J. William Decker
Miguel Alvarez del Toro
Anna George deMille
Adine D'Humy
John R. Dillon
Walter Douglas
Cecile de Rothschild
Irenee duPont
Lammot duPont
F. Eberstadt
George Gordon Edwards
Robert D. Elder
John S. Ellsworth, Sr.
Edith Helen Feild
Marion N. Fisher
Russell S. Fowler, M.D.
Mrs. L. J. Francke
Karl T. Frederick
Albert Fried
Mrs. Jane C. Frost
W. F. Fuerst
J. H. Gambrill, Jr .
Raymond E. Gates, Jr.
R. E. Gettys
Dr. Robert Good
Albert H. Gordon
Major Chapman Grant
Ralph W. Gwinn
N. Penrose Hallowell
Mrs. Hiram J. Hays
E. Newton Harvey
Dexter C. Hawkins
Elizabeth L. Hewins
Frederick W. Hinkle
Frithjof Holmboe
Mrs. Lydig Hoyt
Richard L. Hubbard
John E. N. Hume
Miss Victoria Ives
D. H. James
Mrs. Henry James
George E. Kahrs
William F. Keller
William L. Kleitz
Nada Kramar
A. D. Lane
Mrs. M. E. Leach
Henry M. Lester
Willy Levy
Jerome Lewine
Eugene P. Locke
Howard A. Loeb
Mrs. William E. Louttit
Samuel D. Lunt
David H. McAlpin, Jr.
Miss Lorna McAlpin
Mrs. George McAneny
Miss M. B. Montgomery
W. D. Nelson
Mrs. George Nichols
Robert C. O'Connor
B. C. Ohlandt
Ralph L. Phelps
Carl A. Pitha
Arthur Raphael
John H. Ray
Jack Raymon
Gordon S. Rentschler
C. P. Rhoads, M.D.
Mrs. W. W. Rindlaub
Louis Leonard Roman
Miss Thora Scott Ronalds
Charles C. Rumsey
Miss Elise E. Sage
Donald Stuart Sammis
William J. Schaldach
George L. Schrader
Robert R. Scofield
Frank A. Shailer
Moses Shapiro
Dorothy D. Sheldon
Francis M. Smith
Mrs. H. M. Spandau
Mrs. Elizabeth R. Starret
Mrs. H. B. Steffanson
Percy M. Stewart
A. C. Stimson
Mrs. Arthur Hays Sulzberger
Dr. Carl Fulton Sulzberger
Henry K. Svenson
Robert T. Swaine
Harold H. Swift
Walbridge S. Taft
J. Alden Talbot
John D. Thees
Max Tick
Ralph Van Buren
Domenick A. Vota
Miss Dorothy Wagstaff
Thomas J. Watson
Warren Weaver
Julius Weber
M. Weisbuch
Edwin L. Weisl, Sr.
Melzar M. Whittlesey
Walter J. Williams
F. G. Wood, Jr.
Ernest L. Woodward
Simon Zive

CONTENTS

No. 1. JANUARY–FEBRUARY

Shopping for a Jungle . . . . . *Jocelyn Crane* 3
Foreword by Fairfield Osborn
The Oldest Zoological Park in North America . *Dr. Rafael Martin del Campo* 14
Translated by William Beebe
The Poisonous Snakes of the New World. Part 4 . . . *Clifford H. Pope* 17
Behind the Scenes: News and Notes 23

No. 2. MARCH–APRIL

News from the Nursery . . . . . *Lee S. Crandall* 27
Birds Among the Coconuts . . . . . *Major Richard T. Brice* 32
The Poisonous Snakes of the New World. Part 5 . . . *Clifford H. Pope* 44
It Died a Scarlet Ibis . . . . . *Hattie Ettinger* 48
The Humor and Myth of Linnaeus . . . . . *William Beebe* 51
Behind the Scenes: News and Notes 52

No. 3. MAY–JUNE

Four Years of Africa-in-the-Bronx . . . . . *Lee S. Crandall* 59
The Subtlety of *Leucochloridium paradoxum* . . . . . *Ross F. Nigrelli* 61
Insects Are Animals . . . . . *Brayton Eddy* 62
A Brilliant Flash — That's the Manakin's Display . . . *Lee S. Crandall* 67
The Key to Question House . . . . . *Grace Davall* 70
About Bull Snakes . . . . . *Earl Jackson* 75
Why Should I Join the Zoological Society? 80
Problem of the Invisible Baby Fish . . . . . *William Bridges* 82
Behind the Scenes: News and Notes 83

No. 4. JULY–AUGUST

The Farm-in-the-Zoo Appeals to City Folk . . . . *Leonard J. Goss* 91
A Jungle Pigmy . . . . . *Paul Griswold Howes* 99
Multiple Uxoricide; or, the Two-inch Bluebeard . . *Christopher W. Coates* 103
"Live" Organizations Are the Most Fun . . . . . *Donald T. Carlisle* 104
The Jewel Room 106
The Umbrella Bird Is Not a Dull Fellow Any More . . . *Lee S. Crandall* 109
People Are Curious About Insects . . . . . *Brayton Eddy* 113
Behind the Scenes: News and Notes 116

No. 5. SEPTEMBER – OCTOBER

The Significant Future of the Zoological Society . . . *Fairfield Osborn* 123
The Rare, the Strange, and the Beautiful . . . . . *William Bridges* 126
Perspective on the Zoological Society . . . . . *Jean Delacour* 135
Babies in the Zoo 138
Presenting – Bees and a Bee Tree . . . . . *Brayton Eddy* 141
Another Great Plan for This Society's Future . . . . *Donald T. Carlisle* 146
"Let's Go to the Zoo!" 149
We Carry the Society Into the Jungle . . . . . *William Beebe* 152
Behind the Scenes: News and Notes 158

No. 6. NOVEMBER – DECEMBER

Family Affairs on Gibbon Island . . . . . *Lee S. Crandall* 165
The Zoological Society Is Going to Wyoming . . . . *Fairfield Osborn* 168
Jungle Studio . . . . . *George Alan Swanson* 170
Insects in Winter . . . . . *Brayton Eddy* 176
A Swellfish Story . . . . . *Myron Gordon* 182
Behind the Scenes: News and Notes 187
You Can Make Christmas Last All Year 191
Index to Vol. XLVIII 193