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SILKY ANT-EATER
"At a touch, the little creature assumes a most remarkable attitude"

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A SILKY EATER OF ANTS

By WILLIAM BEEBE.

THREE million years ago a perfectly good white ant lived on the earth. His fossilized remains have been so well preserved that there is no doubt of his presence and activity in that dim, distant past. Together with many of his fellows, he left the impression of his body in the mud of that far off time, and since then the mud has hardened to stone, been buried under thousands of centuries of other mud and stone, and at last split open by inquisitive scientists and the ant impressions recognized from their striking resemblance to their rather distant relatives living on the topmost stratum of the earth today. Hence my right to the adjective "white" in referring to fossils, an adjective of considerable importance, as it indicates that these insects are not really ants at all, and removes them from Soloman's entomological advice, in identity although not in unworthiness. For white ants or termites are related much more closely to dragonflies than to ordinary ants. Though today they have developed a marvellously intricate social life, yet they and their relatives trace their lineage back with almost no change in structure an unthinkably longer time than man and his immediate forebears have taken to evolve.

I have devoted this whole paragraph to the white ant because of the importance of his relation to my subject from quite another viewpoint—a rather unkind one—that of the food which he, and his billions of brethren, scattered over all the face of the world, furnish to hosts of animals, birds, reptiles and ant-eaters in particular. True ants, Soloman's kind, which make slaves and wage wars, are devoured by many creatures, but these insects are all flavored more or less strongly with formic acid, and must be an acquired taste. White ants or termites, on the other hand, are, by all insect-eaters and some others, considered a universal panacea for hunger, and I have seen fishes leaping for them, lizards risking dangers from hawk and man, dogs, cats and Bornean squirrels snapping up the winged hosts, while they furnish by far the larger proportion of food of pheasants and many other birds. The little Malayan bear has been recorded several times as clawing apart their nests and feeding upon these insects, although the amount of debris which must be included, makes this an exceedingly adulterated diet.

Termites are today so important an article of diet on the earth, that certain animals have been developed with this sole means of nourishment in view. I have already related something of the scaly ant-eater of Borneo.* In South America, where these insects are exceedingly abundant, there are three animals set apart from all others in structure and mode of life, to which the ants are actually *la raison d'etre*. They would probably become extinct or at least hard pressed for food were the supply of termites and ants to fail for a few weeks.

Some of the white ants build their nests in trees, others are content with lowlier positions; some of the nests are large and extremely hard, some are smaller and less cement-like, while still lesser structures are not lacking which offer but little resistance to outside force. Like the various sizes of big and little bears, we find

*Zool. Soc. Bull. XVII. No. 5, p. 1,141.



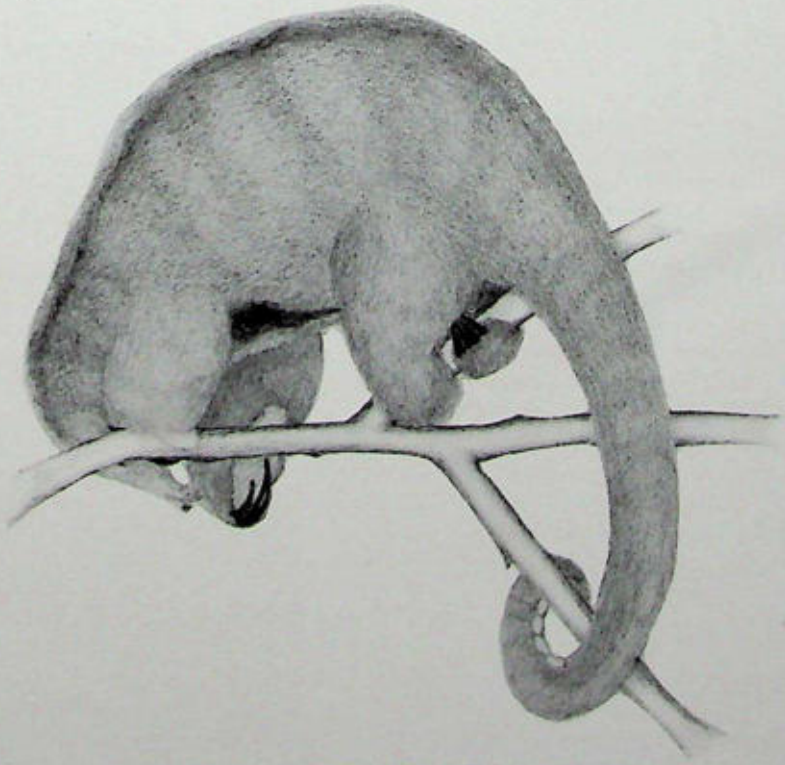
"HAVING OBTAINED A FIRM GRIP WITH BOTH HIND FEET, THE LITTLE CREATURE BENDS FORWARD"

three types of ant-eaters adapted to the varied building sites and the durability of the ant nests.

These three animals whose forms and activities have been moulded upon a single article of diet are the Great Ant-eater or Ant-bear, (*Myrmecophaga jubata*), the Lesser Ant-eater or Tamandua, (*Tamandua tetradactyla*), and the Little Silky Ant-eater, (*Cyclopes didactylus*). It is said that the latter occasionally feeds on the larvae of ants and wasps, but this has not been confirmed. All three are found about our tropical research station in British Guiana and all have now been represented by living specimens in the Zoological Park. Perhaps the best known is the largest, which is by no means innocuous, although its diet is of so humble a character. No man, single-handed, could overcome an ant-bear, so strong are its muscles and so effective its claws. The last one observed in our vicinity was killed at the Penal Settlement by Mr. Frere, which from nose to tail-tip measured exactly eight feet. This species is wholly terrestrial and is occasionally to be seen making its way through the jungle or along the Indian trails, or, as I have twice observed it, swimming wide rivers and creeks. The head, and the long hair of the back and tail project above the water, and the creature makes surprisingly good time.

The tamandua or lesser ant-eater is less frequently seen and always in trees. Last year one was discovered rolled up in a ball resting in a low crotch. He was picked out and we kept him alive.

The Pygmy or Silky Ant-eater is by far the rarest of its family. There are few specimens in museums and not one has been brought alive to a northern zoological garden. In July, a year ago, as I paddled along a jungle creek I saw my first Silky Ant-eater. It was an overcast, late afternoon and the little creature had begun her hunting early, climbing



"NOSE AND ALL FOUR FEET COME TOGETHER"



"NO MATTER HOW MUCH HE IS TEASED, NOT A SOUND ESCAPES HIM"

slowly along a branch overhead. I was quite certain of her sex, for I could distinctly see a young ant-eater clinging to her fur, half beneath and half to one side. I had no gun, so could only watch her through my glasses and curse the horde of stinging ants which made any ascent of the tree impossible.

A boviander gold miner was descending the lower Cuyuni rapids late in September of the present year, when an unexpected eddy swung his boat toward shore, and it crashed into some bushes. When he had pushed out again into the still water below, several small boughs remained on board. On one of these was a round ball of fur, which, when poked, turned toward the man with such a comical, supplicating gesture that he laughed and allowed the small creature to remain.

When the Penal Settlement was reached I lifted the little ant-eater carefully and received the same ludicrous salaam. This was the first living captive specimen of which I ever had heard, so I devoted myself to making him comfortable, both outside and in.

His external wants were simple in the extreme—in comparison those of Omar were complex, with only the bough in common, and this to sit upon and not under. He was happy in a cubic foot of space throughout the day, and unless disturbed never moved from the spot he had chosen at dawn. No circle plotted by mathematician could be rounder than this small being when engaged in passing the useless hours from dawn to dusk. For him the sun is a wholly useless member of the planetary system, light is an evil thing, day something to be forgotten in sleep.

Having obtained a firm grip with both hind feet upon a branch, the little creature bends forward and down, until nose and all four feet come together. Then the long prehensile tail curls around, so evenly that without unwinding it, one cannot tell on which side it starts or ends. It is always curled from the right side around in front of the feet, behind the left leg.

From here on, the bare, pinkish-red tail-grip forms a tiny cup between the feet, in which the sensitive little nose is safely buried. The palms of the forefeet are pressed together, which brings the inbent, twin claws of those limbs close above the face, thus effectively shielding all the delicate parts of the body.

Homer describes the Cyclopes of old as gigantic troglodytes, cannibals with a single eye, living a pastoral life in the far west, ignorant of law and order, and fearing neither gods nor



"HE TURNED WITH A SUPPLICATING GESTURE"



"HE ENGENDERS A FEELING OF PERFECT BALANCE AND SURENESS OF FOOTHOLD"

men. With our modern little spherical *Cyclopes* we can find no parallel, except as to the final phrase. But though more prosaically arboreal, insectivorous, *et avec deux yeux*, yet the Silky Ant-eater is not an unworthy namesake.

At a touch, at a trembling of the branch, the little creature straightens up and assumes a most remarkable attitude. The tail takes a tight grip about the branch. Both arms are raised in front of the face, the red soles and the bright pink muzzle showing as three strange bits of brilliant color. The claws are laid along the snout back of the tip, and this weird posture brings to the imagination thoughts of some strange gnome performing an equally strange religious rite, or an eery dwarf going through the movements of some unknown, silent dance.

Thus swaying from side to side, in slow inexplicable rhythm, the little ant-eater awaits further attack on the part of his disturber. At the least touch on the upraised palms or the snout, both limbs are brought down as quick as a flash, and one has to be on the alert to avoid getting a vicious slash from the strong claws which, like stilettos, shoot forth from the line of the snout.

If the disturbance is severe, the creature puts its whole back and body into the blow and the claws come down on the branch or anything which intervenes with most surprising force.

My assistant incautiously received a slight scratch from such a stroke, and required two weeks' treatment to avoid blood poisoning. Although thus quiescently awaiting attack, the Silky Ant-eater is far from being unarmed, even in addition to his claws. His thirty-two ribs are widened and flattened until they form a veritable box of bone, and with the dense, matted coat of fur, must offer an almost perfect protection to an attacking snake, small owl or carnivore. Though concealed beneath a camouflage of fur, yet the ribs protect the vital organs as completely as the external plates of the scaly ant-eater or the armadillo.

The color of the fur on the body of this ant-eater is, in general, a grizzled buffy grey, the hairs being long, dense, and with a silvery gloss. On the head and legs and tail this becomes a cold grey. A narrow blackish-brown line on the crown broadens suddenly on the neck and back, narrowing and dying out on the lower back.

These colors and patterns are emphasized on



SKIN OF GREAT ANT-EATER
The animal measured exactly eight feet from nose to tail-tip.

the under surface, and, added to the rosy spots of color of the soles and muzzle, give it an undescribably strange aspect. The sides below are yellowish buff, while toward the center this color changes to whitish grey. Down the full length of the body in sharp contrast with the surrounding hues extends a broad black line, of even width, except where it widens out on the throat. This sturdy little erect column of grey, yellow and black fur, apparently faceless, topped by a triangle of red, is like nothing else in the world, and when at a tap on the branch it suddenly arises from a mass of green leaves, all efforts at similes or exact descriptions are hopeless.

His eyes are black, prominent and mouselike. When open wide they are quite round, but more often they are mere slits or are closed. Strangely enough the latter is the case at the moment of expected attack, the ant-eater preferring to shelter his eyes with the claws, and to trust to reacting to the slightest touch, rather than to be forewarned by sight. With all his strangeness he is but a tiny beast, not more than fifteen inches in length, of which more than half is tail.

In walking, the two pairs of feet are used in very different ways. The front feet are remarkably modified, with the third toe developed at the expense of all the others, and armed with a large stout claw. The second finger has a small slender claw but the remainder do not appear above the skin. When walking on a flat surface, the two claws are bent inward and the foot rests upon a great pad of flesh, a sort of globular palm, which bulges like a boxing glove on the outer side of the hand. On a branch, however, the claws are slipped over and the branch rests in the hollow of the front, flat part of the palm, the claws forming one side, and the inner side of the boxing glove the other.

The hind feet are interesting in a wholly different fashion, but even more efficient as organs of climbing. Their grip is chameleon-like, zygodactyl, the sole being much extended heelwards, and very mobile, so that any irregularity is seized, chameleon wise, with the four nearly equal claws grasping one side and the pliant, muscular sole and heel, the other. The great sole cushion is supported by an exaggerated heel bone, and a large, made-to-order, sesamoid ossicle.

The ant-eater depends almost exclusively on the grip of the hind feet and tail, seldom releasing more than one at a time. These have such power that, without effort he can rise slowly to full height, or lean sideways almost horizontally from the branch with no other support.

All his movements are slow and deliberate. He engenders a feeling of unusual strength, perfect balance and sureness of foothold. When walking slowly down one branch, if he can reach even a single leaf of another, he clasps it firmly and draws it toward him; then carefully steps, one foot at a time, upon it, keeping his tail hold until the last. No matter how much he is teased, or annoyed, or shaken or left alone, no sound, not even sigh or hiss escapes him.

His strange appearance and posturing have caused many strange legends to arise among the natives, one of which is that he is the author of the caprimulgine cry which echoes through the jungles at night, like the cry of a lost soul—Poor-me-one-oh-oh. His senses seem extremely dull, and he pays no attention to a threatening hand or stick swung a few inches from his eyes.

If I sit or stand quietly, he climbs slowly and painstakingly, all over me, showing not the slightest fear, nor the knowledge that I am a living creature. But the least tremor of the branch not wind-born, and he stiffens, ready, if the disturbance should increase, to rise into the weird upright column, with hands raised in a salaam of preparedness.

My Silky Ant-eater was wholly nocturnal, and remained rolled up all day. It is probable that this fact makes his claws more of a defense against danger, than sapping tools, for at night the hosts of termites stream forth, sometimes unprotected, more often beneath the flimsiest of earthen tunnels, which need but a touch to expose the hurrying hosts within. I placed a half broken termite nest at his disposal, but he paid little attention to it and ate but few of the inhabitants. He thrived on two small saucers of egg and milk each day, leaning over the saucer, with forelimbs partly raised or on the ground. He took the liquid with rapid darts of his long worm-like tongue, occasionally getting his whole mouth immersed, which made him choke a bit.

Even more than the tamandua, the Silky Ant-eater is structurally specialized for an arboreal life, his hind feet being preeminently fitted for climbing. His large collar bone and the unusual breadth and size of his ribs emphasize his arboreal character. But he is quite at home on the ground, even more so than his near relative. Once my specimen escaped from his box and walked easily and with considerable speed around five rooms looking for an exit to the jungle. At last we found and rounded him up as he was making for the one open door.

The written accounts of this creature show

almost a total ignorance of his actions in life. Illustrations which show him upside down, slothlike, and with a short rounded snout are wholly at fault. He never suffers the inverted position for a longer time than it takes to clamber topside again. As to his snout, it is quite long and slender, with a curious Roman break in it, which with his usual half-shut eyes conveyed an air of peevish aloofness which was very characteristic and amusing.

When given the run of a large packing case, he was constantly making his way over the branches and twigs, occasionally taking a few laps at his milk and egg. When the first hint of dawn appeared, he chose a small calibred crotch, or the crossing place of two twigs, secured a firm grip with both hind feet, one facing front, the other backward, bowed into a perfect sphere, and gave himself up to the luxury of Cyclopean day-dreams.

TROOPS OF CHIMPANZEES, ON OPEN PLAINS.

A LETTER OF THRILLING INTEREST FROM MR. R. L. GARNER.

Fernan Vaz, Gabon,
Congo Francais, October 1, 1917.

Dear Mr. Hornaday:

Your letter of June 18 came about the 20th of August, and found me camped in a tent on the south bank of Lake Ntyonga, an arm of Lake Fernan Vaz, about four hours by canoe, north-east of Omboué, where the post is located.

I have an ideal place here for our purposes and if I had designed it myself, I doubt if I could have done it so well as nature has. I am building a new house here to shelter myself and comrades from the approaching rains that are now beginning. My new abode is on the margin of the lake on the edge of a great plain stretching miles away to the southward and extending about the same distance east and west.

The plain (or plains) is traversed by wide belts of forest which afford asylum to vast numbers of antelope, buffalo, chimpanzees, monkeys and birds of countless kinds and numbers. On the opposite side of the lake about a mile away is a boundless forest, one of the favorite resorts of the gorilla and the home of herds of elephants.

During all my experiences in Africa, throughout twenty-five years of travel and sojourn in the heart of the habitat of the chimpanzee, I have seen here what I never saw before, and that is schools of chimps playing out on the open plain, and crossing the plain in full view, a distance of nearly half a mile, and within three hundred yards of a dozen natives at work on my house.

One day a school of ten passed over the plain in full view and the younger ones were gambolling like human "kids." Another day three adults came within less than two hundred yards of us and seemed intensely curious to learn what we were doing. Another day two mothers, each carrying a baby, one on her back and the other with the babe under her arm, clinging to her side.

Yesterday a big, stoical-looking fellow passed within two hundred yards of us, and seemed quite indifferent to the presence of my fourteen crewboys, cook, houseboy and myself. More than a dozen times within the last few weeks, from one to ten crossed from bush to bush, and rarely showed the least timidity.

I am preparing to entertain them next year in my garden, where I shall try to have a bountiful supply of sugar cane and pineapples for them to steal. I have postively forbidden any of my people disturbing them in any way, by chasing, yelling or otherwise, as I want to see how near I can come to taming them in a wild state. Not that I expect, in any sense, to tame them as they are tamed in captivity; but to get them so that they can be closely approached, studied and photographed in the open.

No doubt after the war closes there will be a rush for such animals to restock the decimated gardens of Europe, but the supply will be greatly restricted because of the new and stringent regulations of the chase in these colonies. I am truly glad of them, because in the past anybody could go out and slaughter whole bands of animals for $1.50 a year. Now, the sporting license is $1,000, and the commercial license $200, and there are many restrictions on them. For example, the chimps enjoy absolute protection under all licenses, and it is almost as great a penalty to kill one as it is to kill a man. The maribou and several other kinds of birds are absolutely immune, and hence the reckless slaughter that formerly prevailed is now much reduced.

Just at this moment five maribou are feeding on the plain, three of them about sixty yards away. They seem to be utterly indifferent to the presence of a score of people, nineteen of them trying to persuade the twentieth man to shoot one of those stately birds to feed a multitude of ebony-colored gluttons.

Here they come! At this moment seven chimps are crossing the plain, and now that they

are about half way across four more are just in sight, following in their wake. I am utterly amazed at the conduct of these apes, and it is to me certainly a new phase of their life.

I insist that Mr. Aschemeier, my taxidermist companion, will not shoot at anything near our domicile. A mile has always been my limit, and I have always observed the rule myself except for game birds. I can't bear to have my animal neighbors murdered, and they seem to know that, for I long had three schools of monkeys that made their home in the bush around my clearing and often came to my fruit rack, within ten yards of the house, and stole bananas.

For four years, two ibises nested in a tree just in front of my house, and mixed with my chickens in the yard. Three schools of chimps boarded on me for over four years, and three or four antelope used to come three or four times a week to eat manioc in my garden. Three pairs of mocking-birds (?) nested for several years in a palm that stood within ten yards of my door. In fact, I have always guarded my wild neighbors; and they seem to realize it.

Here I have the finest Zoo Park possible, and I shall try to keep it stocked. But I don't know how long it will be my home.

Five times today I have seen chimps crossing the open plains near us, in groups of eleven, five, three, one and two, counting the first two groups as one, because they were all in sight at one time.

Yours very truly,

R. L. Garner.

SOUTH AMERICAN FROGS.

By Richard Deckert

IN THE amphibian collection of the Reptile House are several large specimens of the five fingered frogs, a species common in northern South America, where they take the place that the bullfrog occupies in the United States.

These creatures are not true frogs, belonging to the family *Cystignathidae*, which is more closely related to the toads and tree-toads. The determining characters, however, are purely internal, therefore we will speak of these animals as frogs, especially since they resemble our true frogs in appearance.

The specific name, *Leptodactylus pendactylus* means slender-fingered five-fingered, and is given this frog on account of the possession by the males of a spur on the inside of the hand, in addition to the regular four fingers. The color above is rich chocolate brown, with darker cross bands and marblings. The concealed part of the thigh is brilliant crimson, the sides of the body lemon or whitish yellow, and the throat and abdomen are pale gray with purplish marblings. A black band extends from the tip of the snout through the nostril and eye, curving over the ear-drum and ending at the insertion of the arm.

The eye is large and prominent. The lower half of the iris is black, and the upper half a beautiful pale bronze tint. The skin is smooth, moist, and when handled, very slippery, owing to a strong and acrid secretion. This secretion has a very peculiar odor, is intensely bitter to the taste, and serves perhaps, as a protection against some of the frog's enemies. On the sides of the body are several rows of large glands, some round and some oval in shape. The head is very large, and the mouth is unusually wide, even for a frog. There are no webs on the feet and the fingers and toes are long and slender for a frog of five and one-half inches head and body length.

The habits of this species are terrestrial and nocturnal. In their terrarium, they sit bunched together in the darkest corner during the day, but at night they are quite active, continuously making the rounds of their cage by means of short leaps.

Although shy creatures, they do not jump upon being touched, but at first squat close to the ground with head lowered, hissing loudly with every breath. When continually annoyed, one specimen raises itself on its limbs as high as possible, and with body slanted toward the intruder, tries to rid itself of its tormentor by butting vigorously. In this position the brilliant crimson of the inner sides of the thighs appear like fresh blood flowing from a wound.

When taken up suddenly, one of our specimens will utter a series of loud, piercing cries, like a kitten in acute pain. These cries are produced with the mouth wide open, whereas the regular calls of frogs and toads are made with the mouth closed.

Among the many species of amphibians observed by the writer at the Reptile House, none can approach this one in quickness of movement.

When food, which consists of roaches, grasshoppers, frogs, toads and sometimes mice, is introduced into the vivarium, the frog seems at first not to pay the slightest attention, but should the unsuspecting victim, either toad or insect, venture too near, it will be pounced upon and devoured with startling rapidity.

ZOOLOGICAL SOCIETY BULLETIN

Departments:

Mammals
W. T. Hornaday.

Aquarium
C. H. Townsend.

Birds
William Beebe.
Lee S. Crandall.

Reptiles
Raymond L. Ditmars.

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Elwin R. Sanborn,
Editor and Official Photographer

Vol. XXI No. 1 JANUARY, 1918

RESOLUTION REGARDING MIGRATORY BIRD TREATY

At the Annual Meeting of the Zoological Society, held on January 8, 1918, the following resolution was adopted:

Whereas, the Congress of the United States invited the Government of the Dominion of Canada to enter into an international treaty for the protection of North American migratory birds from the destruction which rapidly has been exterminating many valuable species, and

Whereas, the Government of Canada, despite the distractions of her participation in a great war, promptly accepted the proposal of our Congress and diligently and forcefully carried it into complete effect; now therefore be it

Resolved, that the New York Zoological Society hereby respectfully directs the attention of the President of the United States and the House of Representatives to the disquieting fact that the American enabling act to provide regulations for the enforcement by the United States of the aforesaid treaty has not yet passed the lower house of Congress, and that immediate action is necessary in order to keep faith with Canada, to avoid affronting a friendly nation, and at the same time to place our migratory birds on the basis of protection that long has been desired for them by the people of the United States.

WHAT ABOUT THE AMERICAN-CANADIAN BIRD TREATY?

Our enabling act for the international treaty for the protection of all migratory birds, fully negotiated in 1916 between the United States and Canada, is at last making progress in the lower house of Congress. On January 15 the House Committee on Foreign Relations formally reported the enabling-act bill to the House.

We proposed that treaty to Canada. Unhindered by her heroic part in the war, Canada promptly accepted our overture, gave the matter diligent attention, and finally ratified the treaty, down to the last detail. Canada already has passed her enabling act into statute law.

Our Senate has passed our enabling act, but the House of Representatives has not acted.

Of two things, however, we all may be absolutely sure. Canada is watching to see what we are going to do with our end of the treaty that we invited her to negotiate; and if for any reason our House of Representatives fails to pass that enabling act, it will be to Canada a slap in the face and a first-class affront! Let us make no mistake about that. Great nations are not supposed to trifle with international treaties.

Unquestionably the situation depends on the lower House of Congress. Will that body defeat our own treaty, or not? "War measures" will not be accepted by anybody as an excuse for neglect or failure on our part. Canada has shown us that even in the midst of a terribly exacting and exhausting war she was able to pass a bird-treaty bill, and secure for it the necessary concurrence of a large group of provincial governments, all of whom were busy with war troubles of their own.

Again it seems to be a case of the spring-shooters of Missouri against the American nation. And what will the House of Representatives do about it? W. T. H.

WILD LIFE LOSES A CHAMPION

The passing of an ideal champion of wild life is a loss to the country at large. Three years ago the game situation in New Mexico was in a well-nigh hopeless condition. At that time there stepped into the arena, as the champion of the remaining game, Miles W. Burford, and a few other men like him. They resolved that the situation should be saved, partly for the benefit of the present, and partly for the benefit of posterity.

The result of their work has proven to be an object lesson of such illuminating power that it shines afar; and what has been done in New Mexico has been a great source of encouragement to the wild life defenders of other western and southwestern states.

Miles W. Burford, first president of the New Mexico Game Protective Association, died at his home near Silver City on November 8; but he has helped to make history.

In March, 1916, there was organized the New Mexico State Game Protective Association, with Mr. Burford as its president. In quick succession eight local organizations, with an aggregate membership of over 1,000, and each member soi-



MILES W. BURFORD

emnly pledged to a common platform of principles and action, sprang into existence almost in a day. New Mexico was transformed.

Miles Burford, facing the state with a thousand men at his call, was the same vigorous, genial and generous young Burford who eight years before "tied into" Silver City, riding alone. Looking neither to the right nor to the left, he promptly attempted the accomplishment of the impossible. A true sportsman, and also a true cattleman, he won his way by demanding, in the name of the people, the protection of their heritage of wild life. Out of a clear sky, politely but firmly, he demanded of the political powers the appointment of a non-political state game warden, to be selected on a basis of fitness only, by the Game Protective Association.

The politicians laughed in his face. The job-hunters gasped in astonishment. The bystanders smiled and made wise remarks about "theorists" and "fanatics." But the loyal thousand members of the Association stuck, and stood by with their votes in their pockets, while the newspapers found much good copy in a situation so novel in politics-ridden New Mexico.

The cause of progress won. New Mexico has today a real game warden, backed by every sportsman in the state. The man who deliberately violates the law, be he of humble estate or the landed nobility of politics, steps up and pays in full view of the applauding public. The man who ignorantly violates the law is bombarded with publicity and educational material in a manner equally effective.

While the wild life of New Mexico is yet far from being saved, its ultimate preservation is at least well within the bounds of possibility. Miles W. Burford did these things; and while doing them died. His fight is over, but his work is not. The flaming spirit that gave out courage and enthusiam in life will live forever. The slogan in New Mexico is "Remember Burford and Carry On!" W. T. H.

GAME PROTECTION NOTES

From the N. Y. *Sun*.

Under a new law Colorado permits land owners and tenants to capture or kill pheasants destroying crops, provided a permit is first obtained from the Game Commissioner.

Iowa has closed the season on Hungarian partridges and ring-necked pheasants except in four counties, and on quail until 1920.

Idaho has shortened the grouse season by one month, turtle doves two months and a half, deer two weeks, and reduced bag limits generally.

Arkansas by a new law protects does, turkey hens, prairie chickens, grouse and woodcock until 1922.

By a new statute California permits civil war veterans to hunt free of charge.

By regulation Alaska has prohibited the killing of deer on Hinchinbrook and Montague Islands, in Prince William Sound, before August 1, 1919.

It is unlawful, according to a new statute in Michigan, while hunting, to skin or otherwise destroy the identity of any bird.

California now includes the black-tailed jackrabbit as a predatory animal.

Utah has prohibited the hunting of quail, sage hen, grouse and dove.

Florida has shortened the deer and game season by ten days.

Ohio has added the bob white to the list of protected game birds.

Wisconsin has established close seasons on partridge (ruffed grouse), spruce hens, prairie chickens and pinnated and sharp-tailed grouse until 1919.



THE BEAR SKINS AND THE CUB

In Wisconsin automobiles may be seized when it is believed they contain game illegally in possession.

California now prohibits the sale of aigrettes, birds of paradise and goura or numidi.

Wyoming has added six new game preserves to its total, making eleven in all.

Indiana is giving greater protection to the squirrel.

BEHAVIOR OF WILD GRIZZLY CUBS.*

Contributed By a Member of the Zoological Society.

LAST May when I was out bear hunting in the Rocky Mountains, one of our party shot a female grizzly with three cubs. We had no dogs, as they are not allowed in bear hunting in Wyoming, so the cubs escaped. We skinned the mother and left the carcass lying where she fell, hoping the cubs would return on that account, but though we visited it every day, we found no trace of them for about three weeks.

Then the warm weather came and the carcass ripened and the three little cubs returned to feed upon it. We tried to rope them several times, but they were so very small and so very quick and the trees so dense that this proved futile, but we eventually caught one in a trap made out of a box. He was quite fierce, but after his paws were tied together and a stick and rope put through his mouth for a gag, he became fairly docile.

He traveled quietly on the back of a horse for several hours until, as we reached camp, he started squealing and struggling violently, and upon being released, made a dash, pulling after him the men who were holding him towards the four bear hides we had strung on a rope near the tents. Still crying, he jumped upon that of his mother, and clung to it with his teeth and claws so firmly that we could only remove him eventually by hitting him gently but decidedly over the head with a stick.

About a week later we caught one of the other cubs, a little female, and exactly the same performance was repeated. We kept them in camp about two weeks, and their only happy moments were when clinging contentedly to, or cuddled up upon, their mother's hide,—the hide of the mother they had eaten with so much pleasure and appetite,—where they would spend quiet, peaceful hours every day. As soon as taken away, they would cry and fight, even when taken half a mile from the camp so that we could sleep at night, and no amount of food and kindness were ever able to tame them. We endeav-

*The most interesting feature of this unusual instance of bear behavior is the failure of the two cubs to recognize the dead body of their mother, and their keenness in recognizing her furry coat.—*Ed.*



THE GRIZZLY CUB CLINGING TO ITS MOTHER'S HIDE.

ored many times to make them pay some attention to the other bear hides we had, but with no success whatever.

WHERE OUR BIRDS COME FROM.

By LEE S. CRANDALL.

BIRDS are so widely dispersed over the surface of the earth that barren indeed is the spot without avian life. The great gift of flight has carried them to the farthest corners of the globe. Perfect plasticity of form and habit have allowed adaptation to a multitude of changing conditions. From Arctic to Antarctic, birds have fitted themselves to every conceivable type of environment. Every land, however inhospitable, has its share of the 20,000 forms of feathered life.

The study of the geographical distribution of life on the earth has led to the recognition of well defined areas, distinguished by the character of their fauna. Six main life zones, corresponding in general to the continental bodies, have been separated. Each has numerous subdivisions but for our purpose, the six will suffice.

Briefly, North America forms the Nearctic Region; southern Mexico, the West Indies and South America, the Neotropical. Europe, northern Africa are included in the Palaearctic Region, while southern Asia and the neighboring islands are known as the Oriental. Arabia and Africa south of the tropic of Cancer are assigned to the Ethiopian Region; Australia, New Guinea and the East Indies to the Australian.

The sequence of these regions in point of numbers of species represented in our collection is interesting. It depends in some degree on the number of forms indigenous to the zone under consideration, but chiefly on their accessibility. The 802 species of birds now living in the Zoological Park are grouped as follows: Neotropical, 237; Nearctic, 162; Australian, 118; Ethiopian, 84; Palaearctic, 81; Oriental, 78. Forty-two species either are cosmopolitan or range extensively through more than one region, so that they may not fairly be assigned to one.

The order of the first two probably would obtain under normal conditions, the greater abundance of species in South America more than balancing propinquity in the north. Since the beginning of the world war Europe, Africa and the Orient have been almost entirely cut off, and most of the species which still represent them have been in our possession three years or more. The position of the Australian area is abnormally high, the same factors which have interrupted our supply in some cases having had the reverse effect in this. The trade in Australian birds has been diverted from Europe to America and there is no doubt that New York now has the finest collection of Australian fauna ever gathered by a single institution outside that country.

The maps which accompany this article give a diagrammatic idea of the broad geographical area represented in the collection. The origins of 379 typical species are designated. As far as possible, sedentary forms have been chosen. When widely dispersed or strongly migratory birds have been used, a point approximating the center of their breeding grounds has been indicated. The object has been to emphasize extent of distribution rather than the numerical precedence of the various regions.

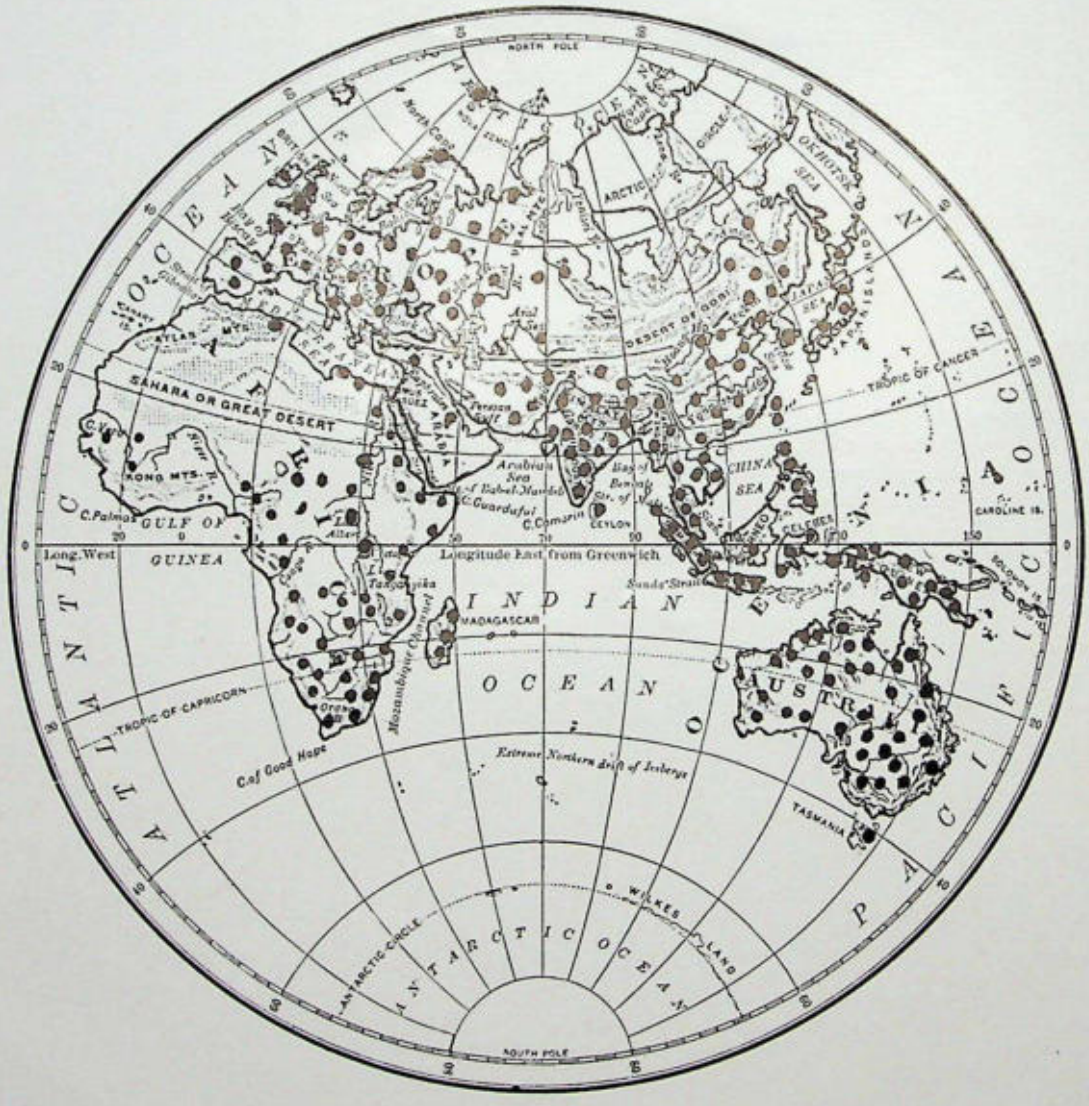
Every extreme of habitat has contributed its mite. The ice fields of the far north, the dripping jungles of the tropics, the giant peaks and the seas of many lands, have been skillfully searched.

The gathering of such a company is a herculean task. A group of tiny finches, a brilliant bird of Paradise, a flock of penguins, each could tell a tale of adventure and romance that would enthrall the listener. One may get a hint of



HOW THE WORLD HAS CONTRIBUTED TO THE

Without an ocular demonstration, few persons can realize how much of the habitable globe is represented by the 813 species of birds now on exhibition in the Zoological Park. As an aid to the understanding, Mr. Lee S. Crandall, Assistant Curator of Birds, has marked on a map of the world, as shown above, the localities represented by about 379 important species. All of these are now living in our collections and enjoying life. The Large Bird House is nothing less than an avian treasure-house, and the happiness of this feathered throng from far distant lands is quite evident from the strange mixture of song. While it is impossible to show the names of these selected species, they appear on our reference map, which holds all the keys to this exhibit.



LIVE BIRD COLLECTIONS OF THE ZOOLOGICAL PARK.

It is unnecessary to suggest to the careful observer the amount of human effort, and also avian endurance, that has been involved in gathering all these birds, and hundreds more, from near and from far, caring for them in their infancy, and transporting them, without starvation, to their present home. Nor do we need to suggest the quality or the quantity of the skill and industry that is required of the staff of the bird department, to take this cosmopolitan assemblage of appetites and wants, and enable these 2799 specimens to live together in this one spot. It is believed that all the efforts represented on this map of the world, and by the birds not indicated thereon, will be appreciated by the public.

W. T. H.

this from the descriptive labels on the cages. New Caledonia, Formosa, Pegu and Patagonia are good material for castles in Spain. But for full realization of the meaning of these names, one must visit the wharves and docks and the shops of the great importers, where come the men to whom New Caledonia and Formosa are not mere words on a label.

That brilliant if diminutive Gouldian finch, gravely wheezing his ludicrous song, represents the climax of the effort of a succession of human minds and hands. Some Australian bushman has spent weeks in the lonely scrub of the northwest, keeping vigil at the only water hole for miles about. At last, a single pull of the net-rope has enmeshed dozens of gaudy mites. Then the gruelling trip back to the outposts of civilization, where the catch is turned over to the local dealer. After a long trip at sea, in charge of the agent of an American or European trader, comes the arrival at New York, San Francisco or "somewhere in Europe." Here the birds are resorted and reshipped to the many retailers who distribute them among the final owners.

In India, much the same system prevails, except that the trapping is done by natives. In the neighborhood of Bombay and Calcutta, professional bird-catchers ply their trade. The great markets of these cities have many bird stalls, each well supplied with potential songsters. Farther north, collecting is more casual, and less skillfully done, so that few birds reach us from that region.

The course followed in Africa is a middle one. Here the collector is usually in quest of the mammals which abound, and to him birds are of small consequence. Such as he does get are obtained quite by chance from natives, as the caravans are passing. There are, however, a few dealers who gather birds from the native catchers and dispose of them to traveling agents.

The South American method is quite different. Here are no proper trappers, skilled in their art. Although the Neotropical Region boasts of far more species of birds than any other, its possibilities are almost entirely undeveloped. In the public markets of most of the larger cities, birds of a few common kinds are generally to be seen. Occasionally one finds a man, usually a Portuguese, who conducts a sort of zoological clearing station. But for his wares he depends on more or less nomadic Indians, who bring their hand-reared pets from the interior. The only birds commonly trapped are the smaller finches and tanagers, which are caught in some numbers, as occasion demands, by small boys.

This region has been exploited chiefly by American dealers whose stock in trade consists of parrots and monkeys. Few uncommon or delicate birds reach us from this source. By means of our own expeditions and the permanently established Tropical Research Station, we have done much to overcome these obstacles. The latter, especially, has brought us many rarities. But not until the dealers who control the market have acquired more of both skill and initiative, will the zoological treasures of the great southern continent fully be opened to us.

LABEL MAKING IN THE FIELD.

By William Beebe

WHEN one has reached some remote field of research in tropical jungles or elsewhere, at the cost of considerable expense and many days of travel, every moment is of scientific worth. Foresight should have so arranged that all possible details and preparations are already provided for, so that in the field every activity of body and mind may be concentrated on the work in hand.

Labels are one of the time-consuming necessities that sometimes can not be planned in advance, especially in those cases where places, dates and other minutiae are incapable of prediction. I have spent many weary and thoroughly begrudged hours in writing series of labels, whose items I could not have forseen.



TYPEWRITTEN LABELS REDUCED BY PHOTOGRAPHY

Proper spacing of the typed matter—before photographing—is important. In this instance, the space between the columns was 1¾ inches, and the horizontal spaces were 5-16 of an inch. To facilitate cutting apart, dotted lines could be made through the horizontal spaces on the copy.

Assuming that the scientist has an ordinary photographic outfit, I can suggest a method of fulfilling all the requirements of label duplication in the field, no matter how intricate or localized may be the data. This method is to

print with clearness, or, much better, to typewrite a sheet of the required labels, and to reduce these on a photographic plate to any convenient size. Then by printing on ordinary unglazed paper or making common blue-prints, any desired number are available within the hour or two necessary for making the fixed, dried prints.

It is so simple a matter that I would hesitate to record it, were it not that my memory is still very vivid of the times I wearily wrote labels by the hour on many expeditions, before this solution occurred to me and was put into practice, instantly and successfully.

ANT PESTS AND ANT-EATING ANIMALS

By S. P. VERNER.

From the Panama *Star and Herald*

THE ant-eaters are close kin to the sloths, but they live on the ground also, whereas the sloths live on trees. The ant-eating animals comprise the great or maned ant-eater, (*Myrmecophaga jubata*); the lesser ant-eater, or tamandua (*Tamandua tetradactylus*); the two-toed ant-eater, (*Cyclopes didactylus*); the armadillos; the pangolins; and the aard-varks. These six groups of animals are usually all classed under the order of the edentates, although they differ widely from one another in many respects. The ant-eaters and the armadillos are Central and South American animals; the pangolins and the aard-varks are Afro-Asiatic.

The main point of interest common to these animals presented for consideration here is the fact that they devour ants, and that they may possibly be put to a useful economic purpose because of that fact.

The extent to which farming and gardening in Panama is handicapped by the presence of certain species of ants is a fact well known to everybody who has had the least experience in the matter. The difficulty of getting rid of the insects within the limits of the expense that could be borne is almost unbelieveable unless one has tried it. The main reason for it lies in the marvellously intelligent routine habits of the ants. They have their central fortress, which is their home, food warehouse, nest, queen's palace, all in one; and from this center they have their long marching lines of workers and soldiers moving along in a continuous circuit to the trees or shrubs which they attack, and back again to their base; this being so continuous a movement that if one followed up the line outside of the nest in the ground and mashed them all, there would still be immense numbers of them in the subterranean galleries and chambers; while if the latter were blown up, and the lines left outside, there would be a sufficient number left outside for them to go off and start a new colony. Moreover, the minute a disturbance starts they scatter round so that it is almost impossible to get them all. They are extremely suspicious and wary; it is almost impossible to poison them, or to get them on sticky substances, or to trap them; while the usually prescribed use of carbon bisulphide has not been either completely efficacious or cheap enough to meet the requirements.

Of course it is possible for men to beat ants. By using dynamite, or the wholesome application of poisonous liquids or gas, or even by persevering digging and killing, they can be eliminated, but to get rid of a single well-developed colony by any or all of these methods would cost not less than ten or fifteen dollars, sometimes much more. Some of these colonies honey-comb the ground over an area of a hundred square yards and to a depth of two yards, thus requiring the excavation of two hundred cubic yards of earth to get rid of the nest.

The damage they can do is amazing. A colony has been known to strip an avocado tree in a day; another to destroy a hundred hills of yam-vines in the same time. Any kind of produce which they like cannot be raised near the nests; and their tastes are unfortunately very much like man's

The possibility of using the ant-eating animals to combat these pests is therefore interesting. I am not aware that it has ever been done, and do not know how such an experiment would work out in practice. But ant-eaters would feed themselves on the work; they are known to tear the hardest and toughest nests all to pieces to get at the larvae, and in this way they also expose and probably destroy the queens. They could be harnessed so as not to interfere with their working powers, and as they also eat other insects they could be kept at little expense when not eating the ants, though there are ants enough here to keep a good many busy all the time.

All this at least would warrant the capture and preservation of any ant-eater found here. Armadillos are fairly common, and all three of the ant-eaters are found in Central America.

ITEMS OF INTEREST

Zoological Park

Army and Navy Mascots.—Owing to a government ruling that no large animal mascots may accompany our soldiers on army transports during the voyage to France, the Park has become a sanctuary for several army and navy pets. One of these mascots is a particularly interesting white-tailed deer of a variety that never previously has been on exhibition at the Park. This fine, young male specimen was captured near the United States-Mexican boundary, and was presented to the Society by the 1st Troop United States Military Police, through Sergeant Charles L. Bajart, Jr. This troop is now quartered at Camp Upton, Long Island. Other mascots that are on exhibition include three black and cinnamon bear cubs. Two black bears were presented by Sergeant Skinner, of the Sunset Division, U. S. A., through Mr. John Hays Hammond, President of the Rocky Mountain Club, New York City. Young bears appear to be favored mascots.

Snake-Bite Serum.—Since establishing a base at the Park for the distribution of anti-venomous serum, we have had a number of calls for this valuable antidote for snake-bite, and so far as we can learn, all the cases treated have resulted in complete cures. The Society recently sent a large number of tubes of serum to army medical posts along the United States-Mexican boundary. These tubes were produced specifically in the Brazilian government laboratory at Sao Paulo, by Dr. Vital Brazil, for the treatment of rattlesnake bite.

While comparatively few cases of bites of wild poisonous snakes in the United States are reported, accidents are rather frequent from the careless handling of captive specimens. The majority of these cases occur in traveling shows. Our last assignment of serum went to the Harlem Hospital, in this City, where a young man was suffering from a wound on the thumb, produced by a large Texas rattlesnake. The injection of the serum brought speedy improvement, and the patient was soon discharged.

Persistent Zero Weather.—The month of December, 1917, has broken all weather bureau records of the past forty years for persistent cold. Four cold waves — each of particularly long duration — covered a period of fully two-thirds of the month. Between these spells of intense cold, severe snow storms prevailed, greatly increasing the severity of existing winter conditions. Temperatures below zero on the 29th, 30th and 31st were unprecedented in the history of the Park. On the night of the 30th, our thermometers registered between 12 and 14 degrees below zero. Under those conditions practically all the hydrants supplying drinking troughs in the animal ranges were frozen. The few hydrants that continued running, accumulated immense and fantastic mounds of ice, and the keepers assigned to outside work toiled throughout the day chopping away the ice and carrying water to the animals.

Throughout the cold period, the animals continued in splendid condition, and the only casualty among the mammals was a very young fawn axis deer that wandered out of its stall and died of exposure. We discovered several guinea fowl that had sought shelter in nooks along the buffalo shed, were frozen to death. Despite the activity of the great flock of ducks and geese in the Wild-Fowl Pond, this large stretch of water closed to such a small area that hundreds of birds were forced to take refuge in an opening not more than twenty feet in diameter.

Record of Events.—A motion picture series has been prepared at the Park showing certain activities here during the present strenuous year. These pictures were exhibited at the Annual Dinner of the Board of Managers given by Mr. Geo. F. Baker on the evening of December 27, and also formed part of the program at the Annual Meeting of the Society at the Waldorf-Astoria on Tuesday, January 8. The series of events illustrated, included the ceremonies attending the raising of the large national flag on Baird Court early last April. This flag was the gift of the officers of the Zoological Park Staff. The event was attended by a mobilization of the Boy Scouts to the number of over a thousand.

The war farming activities in the Park during the year, and the planting of the elk range, wild-horse range, ball fields and other areas with corn, cabbage, carrots, mangles, sunflowers and other needed products were shown. There were several scenes illustrating the midsummer utilization of the crops, the use of one of the elephants in delivering hay, and the training of the Park rifle company. There were interesting views of the target range with squads of our men practicing with the Springfield rifle, the large and flourishing Red Cross working base at the Lion House, and a number of the Park animals.

Our Service Flag.—A large service flag now hangs in the Reptile House, and its field contains nine stars.

Dr. W. Reid Blair, Veterinarian of the Park, has received a major's commission and is on active duty at Camp Lee, Petersburg, Va. Innes Hartley, Research Assistant of the Society's Tropical Research Station at Kalacoon, joined the Officers' Training Camp at Plattsburg, New York, early in the year. He received a 2d lieutenant's commission, and recently has been promoted to 1st lieutenant, attached to the 302d Ammunition Train, and is stationed at Camp Upton, Long Island.

Curator William Beebe, of the Bird Department, enrolled with the French Aviation Service that came to the United States to instruct our aviators, and after much technical work began the instruction of United States volunteers. Among the men under his instruction, twelve are now in France in the flying corps. During his instruction work, Mr. Beebe experienced a fall and received severe injury to his wrist, making it necessary to discontinue active work for some months. During his recuperation he is abroad on an observation trip.

The Park stock-accountant, Cyril J. Newman, has enlisted in the Navy, and is now on active duty in the transport service as a yeoman.

Howard Engeholm, of the Bird Department, is acting corporal of Co. K, 325th Infantry, at Camp Gordon, Atlanta, Ga. T. Donald Carter, likewise of the Bird Department, is an acting corporal in Co. 13, 4th Battalion, 157th Depot Brigade, also stationed at Camp Gordon. Edward Reuter, a gateman, is a private in the 307th Infantry at Camp Upton, Long Island, and Frank Doyle, of the Forestry Department, is with the American Expeditionary Forces, in France.

The excellence of the training and discipline of the Park Rifle Company, which is officially connected with the New York Police Department, is well exemplified by the recognition accorded the men of the Company who have joined the colors. Those not already commissioned have been advanced in the ranks, and one of them has received orders to prepare for examination for a commission. The location of some of our men cannot be determined at present.

Liberty Bond Subscribers.—The members of the Park staff—officers, keepers and other workers—have subscribed liberally to both issues of Liberty Bonds. The sum of seven thousand dollars was subscribed to the first issue, and four thousand dollars to the second issue; making a total of eleven thousand dollars from our force. This amount was raised to sixteen thousand by subscribing five thousand dollars that had accumulated in the Pension Fund. The Society has extended aid to its employees in purchasing government bonds by arranging for payments in installments. Our employees are also purchasing War Saving Stamps.

War-time Feeding.—War conditions have created radical changes in feeding the animals. Coarse corn bread has proven a very successful product, and we are cooking large batches of it daily. This bread is made in square loaves of about two and a half feet square by four inches thick. Some of the animals prefer it to any other food—and this is particularly marked among the bears. We are now drawing heavily upon the stock of vegetables raised during our farming operations.

Park Collections Normal.—With the close of 1917, our census of the collections reveals interesting and satisfactory conditions. The total number of species of mammals listed at the close of the year is 204, which is a very superficial drop of but three species below the total recorded at the close of 1916, and the total number of mammal specimens at the close of the past year (610) was within seventeen of the total of the previous year. These are gratifying conditions, in the face of the practical extinction of the world's animal market. The Bird and Reptile Departments show a similar condition.

The Kangaroo Collection.—With substantial additions by births to the collection of kangaroos and wallabies, our series of these interesting and characteristic Australian animals becomes probably the largest and most elaborate series ever exhibited in the United States. And Mr. Ellis Joseph, who furnished the collection, states in a letter that it is the equal of the one at Melbourne, Australia. The collection now contains forty-one specimens representing sixteen species. One entire side of the Small Deer House is occupied by these animals. The immature specimens are especially interesting to our visitors.

An Aviator Goat.—One of the most interesting of the animal mascots deposited by the 98th Aerial Squadron, is a goat, with long, lustrous jet black hair. For years we have maintained an adamantine rule against the exhibition of domestic animals, but the members of the Squadron were soon to leave for France, and they pleaded so earnestly for their pet, on the grounds that he was particularly famous, that



DOMINICA—THE HOME OF THE IMPERIAL PARROT

an exception to the rule was made. This goat has traveled over 500 miles in trial trips of fast United States flying machines, and, from accounts, appeared to heartily enjoy such experiences.

A SECOND IMPERIAL PARROT.

By William Beebe

FIVE years ago the Zoological Society added a live Imperial Parrot to its collection of birds, and of the details of this valuable accession I have already written.* Since then, this extremely beautiful and rare bird has remained unique, until last summer when we were able to secure a second specimen, a male in full plumage, and bring it safely to the Zoological Park. To this the way was paved by correspondence with the Hon. A. M. Mahaffy, Administrator of Dominica. On my way south to the Research Station in British Guiana, I visited Government House, and through the interest and kindness of Mr. Mahaffy was able to arrange for a pair of birds to be ready when I passed north again. In this interval the female escaped so that I was able to obtain only a single bird. It was exceedingly tame, at once adapted itself to life on shipboard, and is now in good health and on exhibition in the Park.

I was interested to learn from Mr. Mahaffy that the bird laws on the island were being enforced rigorously, and that the Imperial Parrot, while still restricted to a small area in the central range of mountains, was holding its own. On a recent trip which he had made around the island he had seen and heard a number of these birds, and was convinced, for the present at least, that their perpetuation is assured.

Dominica is a worthy island to be the last earthly home of such a splendid parrot. No other of the West Indies quite impresses one with such tropical luxurience as Dominica. The view from the steamer passing close to shore is magnificent—a constant succession of tumbled mountains and ravines, completely covered with the densest, most lush growth of vegetation, come swirling down the valleys from the high peaks, showing as dense, streaming, pale-blue mist or as oblique lines of rain, yield humidity, to which, suspended or precipitated, the luxuriance of the tropical plant life is due.

*Zool. Soc. Bull. XVI. No. 51, May, 1912, p. 868.

ZOOLOGICAL SOCIETY BULLETIN

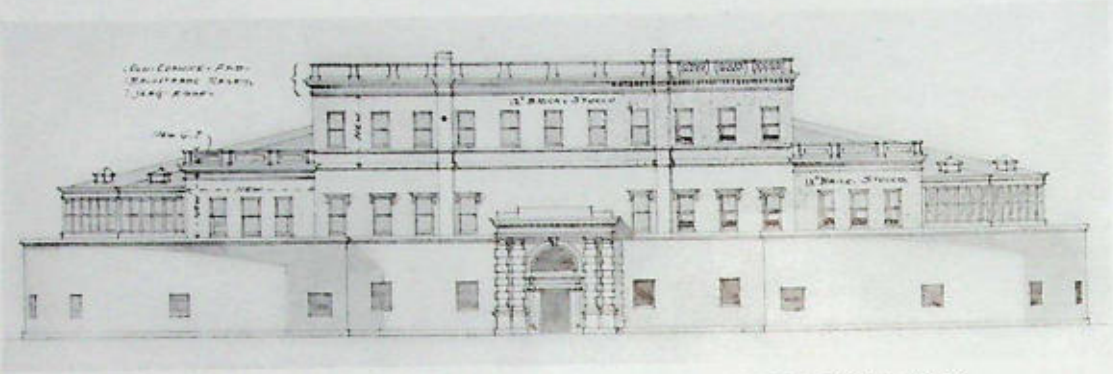
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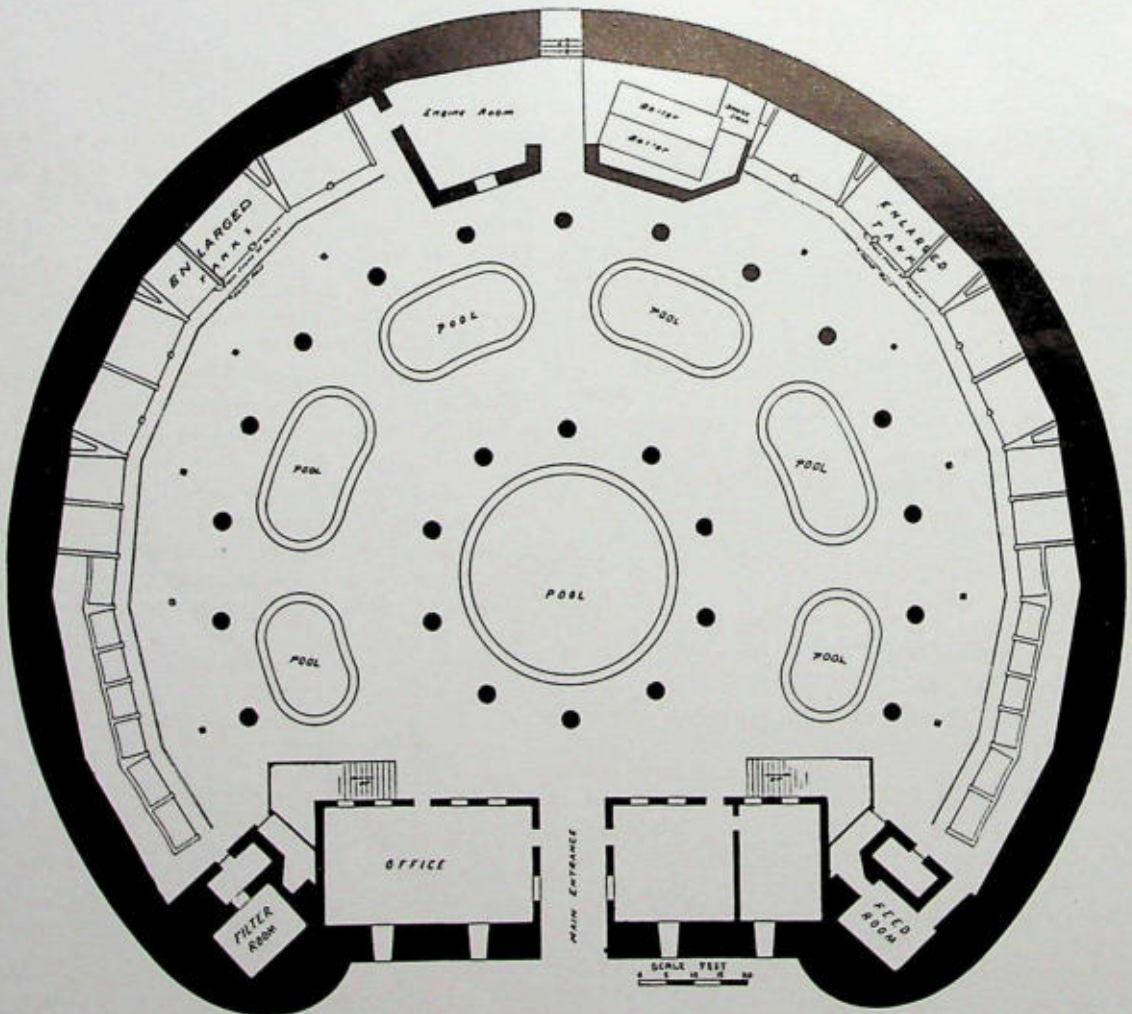
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Old Doors of the Aquarium ..... *Cover*



FRONT ELEVATION OF THE AQUARIUM SHOWING PROPOSED THIRD STORY

This addition is made necessary by the removal of the machinery from the rear to the front of the building



GROUND PLAN OF THE AQUARIUM SHOWING POSITION OF BOILER AND PUMP ROOMS

It is proposed to remove the entire mechanical department from the rear, to the basement of the front of the building. The space now occupied by engines and boilers would, in case of their removal, be available for exhibits.

ZOOLOGICAL SOCIETY BULLETIN

Published by the New York Zoological Society

VOL. XXI MARCH, 1918 NUMBER 2

IS THE AQUARIUM TO HAVE A SQUARE DEAL?

THE Director of the Aquarium cannot refrain from expressing once more his regret at the repeated failures to secure long needed improvement of the building. During a few days of each month wet coal has to be shovelled into the furnaces by firemen wearing rubber boots and standing knee deep in water. The sea has always invaded the fireroom floor and the underground pipe galleries during new moon tides. This almost impossible condition has been tolerated under constant protest.

The Aquarium needs to have its mechanical department removed to the unused basement at the front of the building where it can be protected during high tides. The installation of the machinery at the front of the Aquarium will render necessary the creation of a third story. The space vacated by pumps and boilers can be made available for exhibits to good advantage.

During the high tides one of the pumps becomes entirely submerged and ceases to operate, and the steam heat is cut off from the entire building until the tide falls; a serious matter in cold weather. The coal storage space is so limited that the Aquarium always has had to depend on two deliveries each week. This winter we are operating on the precarious basis of *daily* coal deliveries. If these should cease for forty-eight hours, the Aquarium would lose its collections, and be put out of business until next summer.

The high tide of January 15 invaded the fireroom, flooded the ash pits under the boilers, and covered the day's coal supply completely. It almost covered the iron wheelbarrow from which wet coal was shoveled into the furnaces; in fact, the water was so deep, that the rubber hip-boots worn by the fireman were not high enough to protect him, and he was forced to abandon his duties for an hour.

The return pump was submerged and stopped, so that heat was cut off the entire building all the forenoon.

For evidence that the above described drawbacks have not been overstated, the reader is invited to study the accompanying photographs which were made in the fireroom of the Aquarium on January 15, 1918.

If more evidence would be of interest, the following letter from the Architect of the Park Department is submitted. Mr. Kraus saw the fireroom when it was flooded on October 24, 1917:

CITY OF NEW YORK—DEPARTMENT OF PARKS.

Boroughs of Manhattan and Richmond.
Municipal Building, 10th Floor.

Cabot Ward, *Commissioner.*

October 24th, 1917.

Mr. C. H. Townsend, *Director,*
New York Aquarium, New York.

DEAR SIR:

I visited the boiler room in the Aquarium this afternoon to see the conditions there during a high tide.

I entirely agree with you that the present conditions are intolerable. The boiler room is cramped and the coal storage space very limited.

Having seen the fireman in rubber boots shovelling wet coal into the furnaces, with the ash pits, at the same time, half filled with water, I must congratulate you on having been able to successfully



Photographed by L. L. Moubray

FIRE ROOM, NEW YORK AQUARIUM
Flooded at high tide.

operate your mechanical department all these years with such handicaps.

You can count on me for such assistance as I can render in your endeavors to convince the City authorities of the urgent need of a change in the location of the machinery department as described in your recent report.

Very truly yours,
(Signed) JAROS KRAUS, *Architect.*

The wretched and unsanitary conditions that exist in the Aquarium building are of long standing. The Director is on record as having protested many times during the past fifteen years against the official neglect that has ignored conditions which would not be tolerated in any other City building.

The Aquarium had 1,595,118 visitors during the past year, and this attendance was lower than usual. It would seem that a museum patronized by the public to such an extent should be put on a safe and sanitary basis without further argument.

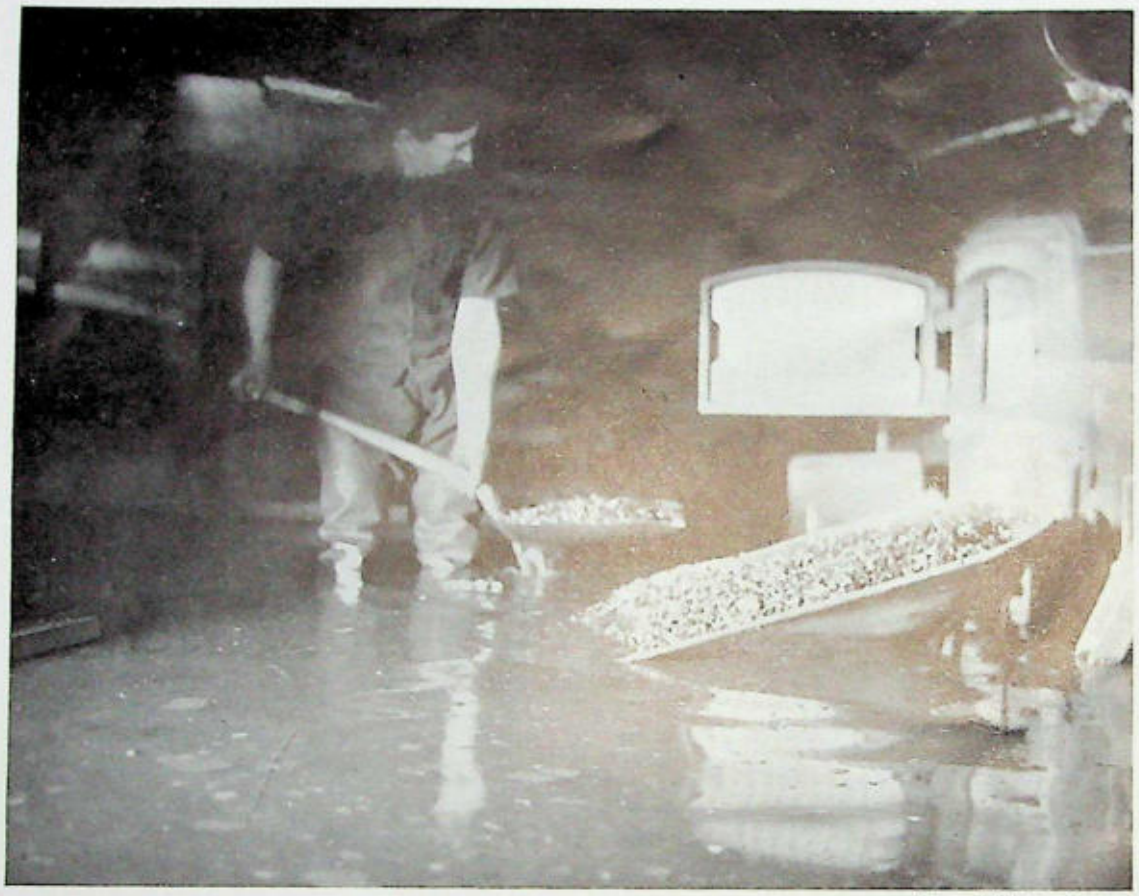
THE CLIMBING MUSSEL
(*Mytilus edulis*)

By IDA M. MELLEN

Illustration from a pen drawing by author

THE sea mussel is not a home-body like the oyster, which settles in one spot for life; nor is it a great traveler. It does not use its foot to plow through the bottom mud, as do the fresh-water mussels, as it is a less active species. Rather, it prefers to gather with its friends upon the ledges or wharves at low water mark, where, holding fast to its moorings, it may feel the rocking of the sea and benefit by the rise and fall of the tides. If satisfied with the spot selected, the sea mussel remains an indefinite tenant. If food or other conditions turn out unfavorably, it moves on.

The sea mussel has not sufficient strength in its small foot to support it against the sweep of the waves, nor even to permit it to walk without assistance. But its foot is quite equal to both



Photographed by L. L. Mowbray

FIRE ROOM, NEW YORK AQUARIUM
Flooded at high tide.

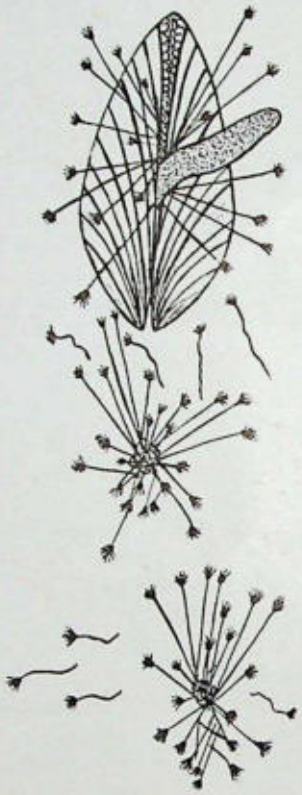
emergencies in the possession of a means for manufacturing what might be called provisional hands and arms. It is advisedly that we say the mussel's *foot* is equal to the emergencies, since its brains are under its foot and the foot is therefore as good as a head. Indeed, rather better than some heads.

In the end of the foot is a byssogenous cavity containing a byssus gland whose function it is to secrete slender threads of conchiolin called byssus threads which become hard and tough on contact with the water. Each thread may be likened to a long white arm with an open hand at the end. The arm remains attached to the base of the foot and can be broken off; but the hand, once fixed, adheres permanently to the spot.

When the animal wishes to change its position, it puts out its foot and extrudes numerous provisional hands and arms, or byssus threads, which it attaches to the nearest objects upon either side of it, as well as before and behind, drawing them taut as far ahead as it can reach, in order that it may pull itself forward by means of their support. The old threads are abandoned with each change of its moorings and the threads in actual use may number seventy-five or more. On glass, the sea mussel's tracks appear to the best advantage.

The illustration shows the track of one as it traveled up the glass in a tank of sea water, searching, no doubt, for low water mark. It spent some days in the ascent, but after climbing eight inches, desisted and dropped to the bottom, resuming the ascent a week later. Other, smaller mussels in the same tank, climbed patiently till they reached the surface, which necessitated a journey of nearly twelve inches, and settled there.

They all stop occasionally when traveling, sometimes for several days at a time, perhaps to rest or manufacture new byssus material, or both. They have a preference for attachment to shells. One young specimen fixed itself to



THE CLIMBING SEA-MUSSEL
Three of the positions that the mussel held during its ascent are shown

a mud snail, and at the time of this writing is still traveling without exertion on its part—but has not yet reached its desired destination at the top of the water.* The shells they generally cling to are those of their own species, and bunches of mussels may be seen almost anywhere along the shore attached to the rocks and spiles and ends of wharves—one might almost say, holding hands.

The food of the sea mussel consists of microscopic organisms and bits of floating matter that drift to it.

Until recent years mussels have not been considered palatable in this country, though they have long been used extensively for food in Europe, and are cultivated in "parks" in France, where stakes are driven in the mud and the intervening spaces filled in with wicker work for their accommodation. Clinging together in clusters in these enclosures, they are said to be gathered like grapes from a trellis.

*For twenty-four hours the mud snail remained in one spot, an inch from the surface; but the mussel did not alight.

SALT WATER AQUARIA IN THE HOME

By Ida M. Mellen

THE peculiar beauty and charm of animal and plant life in the sea arouses in our minds a natural craving to enjoy it close at hand. This is comparatively an easy task for residents of the coast, who may collect plants and animals for themselves and procure plenty of sea water; but for the inland aquarist it is a matter requiring more delicate care and closer concentration.

Salt water, with the animals and plants, can be shipped inland from the coast. Formulas for the preparation of artificial sea water have been devised, but we do not know of anyone who has succeeded with them.

That salts in water are not subject to evaporation, is illustrated by the eternal salinity of the seas, whose evaporation is replenished by water from the rivers that constantly flow into them; and though they acquire some additional salt from the rivers, their loss of that substance is so small that the new salt acquired really adds to their salinity. It is therefore quite practicable to compensate the loss through evaporation in the salt water aquarium with fresh water from the faucet once a week, and a watering can is very good for the purpose.

It is 75 years since the first salt water balanced aquarium was established in England, and many experimenters have been at work in the field since that time; but to secure a perfect balance of marine animals and plants, it is still difficult to suggest an infallible rule. As with fresh-water forms, the animals depend largely upon the oxygen thrown off by the plants, while the plants absorb the carbonic acid gas exhaled by the animals. The aquaria having capacities measured by the gallon are more satisfactory than those holding only quarts. There is small danger from an excess of plants, but too much animal life is certain to prove fatal.

All-glass aquaria are the best for salt water, and are the only kind used at the New York Aquarium for small marine balanced aquaria.

Marine collections of the happy family order are successfully maintained at the Aquarium in eight-gallon jars, with two kinds of plants and as many as eleven forms of animal life. The plants are the red alga (*Soleria chordalis*), sometimes attaching itself to rocks and again living free at the bottom, and the green sea-lettuce (*Ulva latissima*) buoyed with bits of cork to cover two-thirds of the surface and allowed to hang down ten inches from the top



BALANCED SALT WATER AQUARIUM

on the side of the jar nearest the light. The animals are:

Northern white coral (colonies ranging in size from 2 to 6 inches in diameter);
Brown anemones (3 or 4);
White anemones (3 or 4);
Tunicates (*Molgula*) (3 or 4);
Killifishes, 2 inches long (2 or 3);
Variegated minnows, 2 in. long (2 or 3);
Prawns, 1¼ inches long (2 or 3);
Young eels, 3 or 4 inches long (1 or 2);
Mud snails (*Nassa obsoleta*) (1 to 12);
Oyster (1);
Little-neck clam (*Venus mercenaria*) (1).

Warning has been given to the beginner by some aquarists to limit his animals, one to the gallon of water. It can be seen from the list just given that a gallon will accommodate more than one animal—even more than four—but in experiments with marine aquaria too much moderation cannot be urged at the start.

Sea-lettuce is absolutely essential for the balanced aquarium. Other plants may be used with it, as the red alga called flame weed (*Grinella americana*), and dead, sun-dried hydroids such as *Sertularia argentea* and *S. pinnata*, make good ornamental effects.

Other animals that can be confined successfully in balanced aquaria are small mussels—say a quarter of an inch in length, rock barnacles, annelids (especially the tube dwellers), and very small crabs. Large crabs tear the plants and catch the fishes, but small mud and spider crabs, of one-half inch or so in diameter, are not only interesting (crabs being truly comical animals) but desirable, as they pick up scraps from the bottom. The small hermit crabs are especially good scavengers.

It is well to place an inch or two of fine pebbles, white sand, or bird gravel on the bottom of the jar, and a few stones must be added for the attachment of anemones and for the crabs to hide under. Care must be taken to wash the sand thoroughly. Bird gravel is very dirty and will ruin the aquarium if put in before cleansing.

Hermit crabs should be provided with empty shells of a suitable size so that when they outgrow the home they are living in and go house-hunting for a larger one, the new tenement will be at hand. They are pugnacious, and two will fight hard for the possession of a desired shell.

Little-neck clams and oysters, whose siphons are always busy, are valuable as clarifiers.

Snails that consume vegetation should be avoided. The periwinkles do not thrive as well in standing water, but no balanced aquarium is complete without a few mud snails (*Nassa obsoleta*). They do not harm the vegetation appreciably, preferring animal food, and besides being excellent scavengers, are always interesting to observe as they move about with their inquisitive siphons traveling a little ahead like an advance agent.

Young specimens of starfishes may be kept. They live on mollusks, however, and a supply of the mud snails is necessary for them. It would not be possible to keep an oyster, clam, or any other mollusk alive in the jar with a starfish, and at best the starfishes are not long-lived in captivity.

Probably the most attractive of all small fishes is the sea horse; and the general desire to own one is so great that people even inquire if they could not keep one in the same jar with their goldfishes! The little creature is difficult to provide for, except with running sea water and salt water *Gammarus*—the minute shrimp that infests the sea-lettuce. Some aquarists have succeeded in maintaining sea horses for a number of months in balanced aquaria by feeding them with fresh chopped prawn on the end of a stick, which the little fish soon grows tame enough to take.

A New York dealer in aquaria and aquarium supplies, who sells sea horses, tells us that he feeds them on daphnia — the common

water flea of the ponds—by taking the sea horses out of the salt water and the daphnia out of the fresh water, and putting them all into brackish water one-third salt and two-thirds fresh. Within an hour the sea horses are replaced in salt water, and this process he repeats each day. Fresh-water shrimps are a welcome substitute for the salt water variety, and will live several hours in sea water.

During a shortage of *Gammarus,* we have succeeded in enticing some of the sea horses to eat the fresh water worm *Tubifex,* which will live for half an hour in salt water, and some were also coaxed to partake of enchytrae. One of the Chicago department stores maintains an aquarium and has succeeded in keeping five sea horses alive since last summer by feeding them on the new-born young of small, fresh-water viviparous fishes. These little tropical fishes are well known to aquarists, and include Guppyi or rainbow fish, Helleri or swordtails, Gambusia, etc.

Other fishes, also crabs and prawns, annoy the sea horses, but it is possible to keep anemones, barnacles, oysters and clams in the same jar with them.

The salt water aquarium requires strong light, but should have very little direct sunlight, —none in the summer and not over an hour or two a day in winter. The most useful cover is one made of glass of the same diameter as the jar, with bits of cork glued to its edges at several places in such wise as to allow it, when set on the jar, to rest on the corks a quarter of an inch above the top of the aquarium. Such a cover prevents the escape of crabs, snails, etc., retards evaporation, and keeps out dust.

Animals in all balanced aquaria at the New York Aquarium are fed three times a week with macerated clam. Care is taken to drop small pieces from the end of a stick or long wooden forceps upon the tentacles of the corals and anemones, which then may be seen to carry the food to their mouths. All food not eaten within a few hours in carefully siphoned off with a glass tube.

For the inland aquarium, dried shrimp, desiccated cod fish after the salt has been soaked out of it, fresh-water mussels, or fresh fish, finely chopped, would serve. Fresh fish, however, is oily, and even an expert aquarist must take unusual care in using it.

A bit of wood fastened at the end of a stick and covered with felt or cheesecloth, is useful to clean the inside of the glass. In the matter of impurities in the water, an ounce of prevention is worth many a pound of cure; particularly in the inland marine aquarium. The speedy removal of dying plants and dead animals is very essential. For this, a long wooden forceps is a convenient tool. Some aquarists advocate a bit of charcoal placed under the rocks as a clarifier.

During a succession of gray days, the water may be aerated by lifting out a dipper full at a time and letting it fall back from a height of several inches. When the sand appears dirty, it is well to siphon off the bottom with a rubber tube until about four inches of the water have been drawn. This can be used again by filtering through four or five thicknesses of cheesecloth, or letting it seep through a sponge placed in the bottom hole of a watering can. The same method may be employed if the water appears a trifle cloudy.

What is only difficult, may appear to the novice impossible. He must not be discouraged if his first efforts fail, however, but remember that "Patience and perseverance overcome all obstacles," and, as a wise lady once remarked, the only difference between the difficult and the impossible is that the impossible takes a little longer time.

SPEARING SALMON FROM A SHADED BOOTH

By C. H. Townsend

A METHOD of fishing to be seen, probably, nowhere else, is that practised by the Wintun or Digger Indians of the McCloud River in northern California.

When the salmon run begins in this mountain tributary of the Sacramento, three hundred miles from the sea, the Indians erect booths of branches and green leaves overhanging the water, through the half open bottom of which they strike salmon with the spear. The booth or bower is shaped like a conical tent and is high enough to accommodate a standing man, while the long shaft of the spear projects through the leafy top.

The booth is supported on a framework of poles set firmly in the bank, its rim in close contact with the surface of the water, the bottom being without floor except for a mere shelf close to the bank on which the spearman stands.

It is erected over a shallow pool or eddy just below a rapid or riffle where the upward moving salmon are likely to pause before rushing into more rapid water.



BOOTH FOR SALMON SPEARING
Built of branches and leaves by the Indians of McCloud River, California
From a photograph made by C. H. Townsend in 1888

Being heavily shaded so that the light within is dim, while the water beneath is well illuminated by the light of day, the spearman can strike to good advantage. The spear used by the Wintun has a detachable barb, which is secured to the shaft by a stout cord, permitting enough play to prevent the heavy fish from tearing out the barb or breaking the shaft. With an Indian constantly on watch in a shelter of this kind, a good many salmon can be secured in the course of a day.

In all our explorations of salmon waters in the region inhabited by the Wintun tribe, we observed this form of fishing employed only on the McCloud.

The photograph was made on a bend of the river, just above the government salmon hatchery at Baird.

THE SEA HORSE OF THE BLACK SEA

By L. L. Mowbray

In the summer of 1905 it was my good fortune to spend several months along the coast of the Crimea, with headquarters at the navy yard in Sebastopol.

The docks about this locality are covered with marine life. Between the rise and fall of the tide the area exposed is covered with mussels (*Mytilus*), algae, and tube worms (*Serpula*). Below low tide mark there are hydroids and polyzoans in abundance. Among these the sea horse feeds and can be found in considerable numbers. It is a small species, not more than three inches in length, and of a bright yellow color.

One day while leaning over the rail watching them feeding, I determined to catch some. Having no dip net, I took a boat hook and twisted a piece of wire round the end to form a loop six or eight inches long and three or four wide. When the loop of wire was placed near one of the sea horses, it would in most cases coil its tail around the wire and allow itself to be drawn to the surface of the water, rarely releasing its hold. In this way I succeeded in capturing many specimens, and secured the same species also about the shores of Balaklava and in the tide pools around Cape Khersones.

Dried sea horses are frequently to be seen for sale on the streets of Sebastopol.

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Elwin R. Sanborn,
Editor and Official Photographer

Vol. XXI No. 2 MARCH, 1918

THE MOST REMARKABLE FISHING-NET KNOWN—THE SPIDER'S WEB NET

By E. W. Gudger, *Professor of Biology, State Normal College, Greensboro, N. C.*

LOUIS BECKE, author of many interesting books on the life and customs of the South Sea islanders and on the habits of the fauna found therein, in one of these books, 'Neath Austral Skies (London, 1909), tells the following interesting story: He says that many years ago he was discussing the customs, habits, and manner of life of the inhabitants of western Polynesia with Dr. J. S. Kubary, a German naturalist and traveler of high standing. They were at the time traversing a path through the mountains of Ponapé, one of the islands of the Caroline Archipelago, lying northwest of New Guinea.

It was early in the morning and spiders' webs with the dew on them were found everywhere. They were very large, so much so that occasionally one of them would obstruct the path of the travelers, and would have to be broken through with a stick. The size, strength, and beauty of these webs were so extraordinary as to attract Becke's attention, and he spoke to Kubary of them. However, the German assured him that these were nothing compared to those which he had heard were to be found in the vicinity of Astrolabe Bay on the northeastern coast of that strange island-continent, Papua or New Guinea.

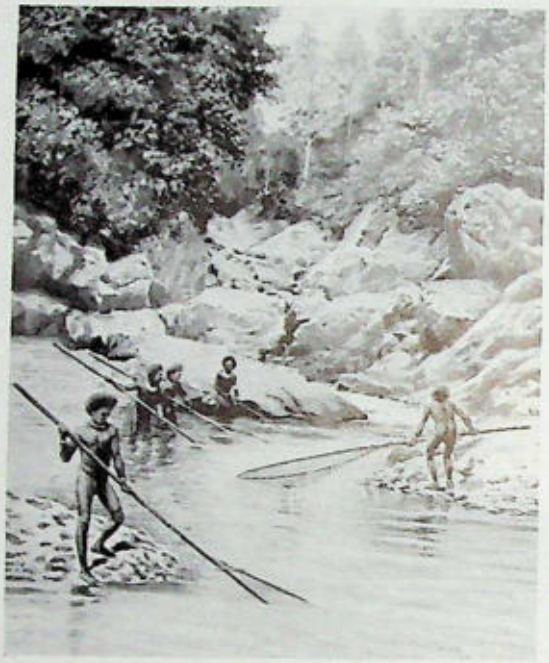
Kubary told his companion that he had read in either a letter or a publication by the distinguished Russian naturalist, Baron Nicolai Miklucho-Maclay, the statement that the mountain-dwelling tribes about Astrolabe Bay used similar spider-web nets for catching fish in their mountain streams.

Now Miklucho-Maclay was a scientist of high standing, especially in ichthyology, a traveler of wide acquaintance among the savage cannibals of New Guinea and the South Sea Islands, and had for some time resided among the tribes inhabiting the shores of Astrolabe Bay.

Whether or not the Baron had actually seen the natives use the large spider-webs for catching fish, Kubary could not say; but he certainly believed that the former had grounds for making the statement. Kubary's own notion was that the natives somehow or other were able to remove the nets whole and uninjured from the branches of the trees between which they had been spun, and having fastened them with proper supports across the narrow streams, drove the fish into them.

Becke next relates that years later, in a conversation with Sir John Robertson, Premier of New South Wales and father-in-law of Miklucho-Maclay, he spoke of the death of the latter from fever in New Guinea, and expressed great regret that the loss of the collections, journals, etc., of the naturalist probably made it impossible ever to trace down the spider-web fish-net story. Sir John, however, laughed at the story and expressed his belief that his son-in-law was simply playing on the credulity of the German. I have had careful search made of all the works available in the Library of Congress of both Kubary and Miklucho-Maclay, but with barren results so far as finding anything confirmatory of this interesting story.

However, from another source we now come to a most important confirmation of the spider-web fish-net story. During the past summer while at work in the American Museum of Natural History, New York City, on the Bibliography of Fishes, under the editorship of Dr. Bashford Dean and Dr. Charles R. Eastman, I examined a considerable number of books of travel to get fish references. Among these was one entitled Two Years Among New Guinea Cannibals: a Naturalist's Sojourn Among the Aborigines of Unexplored New Guinea (London, 1906). The author is Mr. E. A. Pratt, a natural history collector of standing, and Gill Memorialist, 1891, of the Royal Geographical Society of Great Britain. Mr. Pratt spent two years in New Guinea, mainly among the aborigines in the vicinity of Yule Bay on the southeast coast where he collected insects and birds-of-paradise. This book gives an interesting



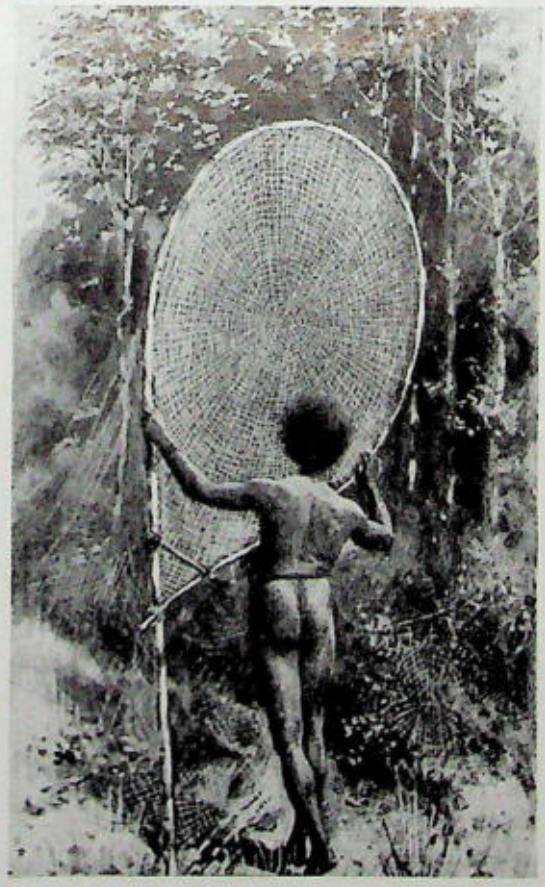
NEW GUINEA NATIVES FISHING
Reproduced from Two Years Among New Guinea Cannibals.

account of his experiences during this time. On pages 266 and 267 is found the following remarkable account of fishing with the spider-web nets. The accompanying figures are reproductions of Mr. Pratt's plates:

"One of the greatest curiosities that I noted during my stay in New Guinea was the spiders' web fishing-net. In the forest at this point (Waley, near Yule Bay), huge spiders' webs, six feet in diameter, abounded. These were woven in a large mesh, varying from one inch square at the outside of the web to about one-eighth inch at the centre. The web was most substantial, and had great resisting power, a fact of which the natives were not slow to avail themselves, for they have pressed into the service of man this spider, which is about the size of a small hazel-nut, with hairy, dark-brown legs, spreading to about two inches. This diligent creature they have beguiled into weaving their fishing-nets. At the place where the webs are thickest they set up long bamboos, bent over in a loop at the end. In a very short time the spider weaves a web on this most convenient frame, and the Papuan has his fishing-net ready to his hand.

"He goes down to the stream and uses it with great dexterity to catch fish of about one pound in weight, neither the water nor the fish sufficing to break the mesh. The usual practice is to stand on a rock in backwater where there is an eddy. There they watch for a fish, and then dexterously dip it up and throw it on to the bank. Several men would set up bamboos so as to have nets ready all together, and would then arrange little fishing parties. It seemed to me that the substance of the web resisted water as readily as a duck's back."

Since writing the above, a third brief reference to the spider's-web fish-net has come to light. In 1913, Captain C. G. Rawling, a fellow of the Royal Society of Great Britain, published in London a work bearing the title "The Land of the New Guinea Pygmies. An Account of the Story of a Pioneer Journey of Exploration into the Heart of New Guinea." His explorations were done in Dutch New Guinea, on the southern side of the western end of the island beginning in 1910 and covering about a year and a half. On page 289 is found this interesting statement:



NEW GUINEA NATIVE AND HIS SPIDER-WEB NET
Reproduced from Two Years Among New Guinea Cannibals.

"The bushes round the camp (at the village at Atabo on the coast) contained large numbers of an immense spider; I do not know its name, but it is well known in other parts of New Guinea. They have soft balloon-like bodies, and spin a web of great strength. It has been commonly stated that these webs are utilized by the natives as fishing-nets, and that large fish are secured, but I am afraid that this is an unsubstantiated yarn. Nevertheless, it is a fact that the children do take the webs off entire by slipping a ring of cane below, and that in them they will carry fish the size of sprats."

THE SARGASSUM FISH.

CALLED MARBLED ANGLER AND TOADFISH.
Pterophryne histrio.

By L. L. MOWBRAY

THIS fish, without doubt, is one of the most interesting and curious of fishes, and can be classed as a true subject of Aeolus, for it has no definite line of migration, is purely pelagic, and is dependent upon the course of drift of the sargassum weed. It is most abundant in tropical and sub-tropical seas, but has been taken on the coast of Norway.

When it leaves the Strait of Florida and is cast into the Atlantic clinging to the air vesicles of a floating mass of sargassum—that may measure anywhere from the size of a man's hat to several miles in length and breadth—it is at the mercy of the winds and currents. The strong west and northwest winds drive large beds of the weed easterly out of the Gulf Stream off Cape Hatteras and between the latitudes of 20° and 40° north, where there is almost always an abundance of weed to be found.

The little fish makes these floating beds of weed its whole world. Its color matches that of the weed, it feeds on the many forms of crustacea that live in the weed—principally shrimp, and there it builds its nest, fastening its eggs to the fronds by silk-like threads.



THE SARGASSUM FISH
Sometimes called Marbled Angler and Toadfish.

Peter O'Phryne, as the fish is jokingly called by naturalists, is almost helpless without a mass of weed to cling to, being a very poor swimmer and dependent upon its hand-like pectorals for grasping and for darting at its prey. Holding fast to the weed, it dangles its little fishing rod, that nature has so cleverly set over its gaping mouth and whose quivering movement attracts passing animals. As they attempt to nibble at the natural bait the rod is thrown back and the fisher strikes with lightning speed.

If the Sargassum fish is placed in a jar of water, it will settle to the bottom, resting on ventral and pectoral fins. In this position the pectorals are turned forward. The fish changes its position only occasionally, resting for hours at a time, motionless. If fishing is not good in one direction, it will turn around and fish as long facing the other way.

When a shrimp is dropped into the jar with the fish it will start quivering its bait. There seems to be something magnetic about it, as it does not take long to get the shrimp interested.

I have taken hundreds of these fish in the course of many years' collecting in the Bermuda Islands. In size one finds them ranging from three-quarters of an inch to four and a half inches in length, the average size being from two to three inches.

Like other anglers, they lose their bait at times, or have their fishing rod broken, and it is by no means rare to find one with the bait missing from the end of its rod, or the rod broken off at various lengths.

As previously stated, the sargassum fish is entirely pelagic, and when found along the shores it is there because it has followed some mass of floating weed. Another fish that looks to the untrained eye to be the same, but is found on careful examination to be of another genus, is the Marbled Angler (*Antennarius scaber*), which lives on rocky shores and about coral reefs. It can be recognized by its rough skin, the skin of the sargassum fish being smooth.

THE COMMON SNAILS.

Their Relation to Balanced Aquaria.

By Ida M. Mellen

Illustrations from Sea-Shore Life and pen drawings by author.

BALANCED aquaria, whether of salt or fresh water, are never quite satisfactory without snails; and most snails, especially very active varieties, are so attractive that no one who observes them closely can help developing some interest in them.

The snails are members of that group of molluscs called gasteropods, which are characterized by an unsymmetrical body, a well-developed head, and a one-piece or univalve shell which is readily distinguished from the double or bivalve shells of clams and oysters.

The amount of oxygen in the water is supposed to determine the growth of the shell.

Snails differ in habits and structure. Some (principally the land and fresh-water species) have lungs, while others (mostly the marine forms) breathe with gills. There are certain kinds which die very soon if they become dry, and others, after spending years in a naturalist's cabinet, apparently dead, have been known to resume activities when placed in water. Some are separately sexed, while others are not. Most snails lay eggs, but a few bring forth their young alive. The hard shell of certain species, provided with a horny door or operculum with which the animal closes the shell's opening after retreating within, serves as a protection against enemies; others, with thin, doorless shells, are defenseless and fall easy prey to aquatic insects, beetles and fishes.

Shells are subject to erosion from the action of chemical and mechanical stimuli upon the prismatic layer.

The tongue of the snail, also called a lingual ribbon, is set with even rows of minute teeth, only the forward sets of which are used. As these wear down, the rows behind, which are continually being formed, move forward on their membrane, and by this process of constant renewal the snail is always in possession of a serviceable rasping apparatus. This is drawn back and forth over a plant leaf or other edible substance, scraping and comminuting it preparatory to swallowing.

The eyes are generally situated at the base of the tentacles.

Snails possess some powers of regeneration even in the shell; and a hole cut in the shell of a common pond snail was observed to heal completely in six weeks.

Salt Water Snails.—The Periwinkle (*Littorina littorea*), though prettily shaped, is not hardy in balanced aquaria, nor particularly to be desired because of its preference for a vegetable diet, which is inimical to the aquatic plants. If one lives near the seashore, however, he may keep periwinkles in his aquarium for a few months by feeding them with sea lettuce, which they will eat fresh or partly decayed. If provision is made for them to crawl up out of the water, they will do so, clinging to a stick or stone for hours as though waiting for the tide to rise.

The Seaweed and Salt Marsh Snails (*Littorina palliata* and *Melampus bidentatus*) are also vegetarians, and fishes prey upon the latter.

The Oyster Drill (*Urosalpinx*) is a handsome little shell and will survive for some time, but as the presence of an oyster or clam is highly desirable for clarification in the salt water balanced aquarium and this small carpenter will bore his way through either, it is obvious that the helpless giants must not be placed at the mercy of the Lilliputian. In truth, no other molluscs, even small ones, can be maintained with the oyster drill, which is a thorough cannibal.

Other seashore snails, such as the Rock Snail (*Purpura lapillus*), whose natural food is barnacles, have proved fairly hardy in the home aquarium, but experiments to date point to the conclusion that the best of all salt water snails for this purpose is the mud snail.

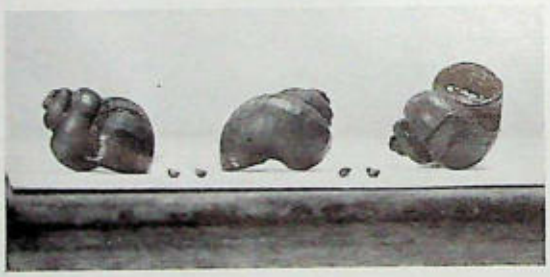
The Mud Snail (*Nassa obsoleta*) is found in all parts of the world. On the Atlantic coast, from Massachusetts to Florida, it is the commonest of small molluscs, darkening the rocks and infesting mud flats and tide pools.

When adult it moves only on solid surfaces, though the young hang by the foot to the surface of the water after the manner of fresh-water snails. Miss Dimon, who has made special studies of this species, thinks it effects locomo-



Left: OYSTER DRILL; *Center:* SEAWEED SNAIL. *Right:* PERRIWINKLE

tion by the extrusion of mucus, "affording a semi-solid rod against which to push." This is probably the method of locomotion of many snails. However, considerable difference of opinion exists on this point, some observers maintaining that snails move by muscular contraction and relaxation of the foot, other theories variously holding that they effect locomotion by means of a blood flow to the foot tissues; by peristaltic contraction of the foot in undulatory waves; by action of the cilia on the foot and not by motion of the foot itself, etc.



POTOMAC SNAILS

The mud snail requires considerable oxygen. Its siphon supplies the gills with oxygen from the water when submerged, while, when left dry at low tide, air is inhaled through the siphon and life sustained as long as there is some water remaining in the mantle cavity. Moisture is necessary to its existence, and it dies much sooner when deprived of it than when prevented from rising to the surface for air. Indeed, it is a burrower, and will bury itself in the mud and remain quiescent for a considerable period.



ROCK SNAILS

The sexes are separate but there are no external distinguishing marks. Under natural conditions eggs are laid during the warm months. In small aquaria they appear at all seasons on the sides of the tank or attached to the sea-lettuce. The egg capsules, shaped like miniature urns, are dirty white, semi-translucent, and may contain as many as seventy-five ova. The young hatch as invisible, free-swimming veligers, and, for several days prior to leaving the egg, the cilia of their large "ears," under magnification, can be observed already in rapid vibration. The shell is only partly formed at hatching, but a couple of weeks' growth completes it, and the tiny creature now having lost its means of locomotion, no longer swims, but, snail-like, crawls on its large foot.

Typical of snails, this species is a scavenger. It takes food only under water. It will eat algae and sea-lettuce but does little damage to the plant life of the home aquarium. Its favorite food is fresh meat in the shape of other molluscs, worms, shrimps, crabs and dead fish, and it will assiduously clean up all the scraps from the aquarium, only the eel surpassing it in scavenging ability. For a slow-moving animal, burdened with a shell uncommonly heavy in a mollusc of its size, it is extremely voracious. It is recorded that several together have been observed to capture a clam-worm (*Nereis*) and devour it alive, though we suspect that the worm must have been caught napping.

The mud snail is nearly black. The upper surface of its foot is heavily pigmented, and the under or crawling surface is pale gray. The shell is marked with deep, brownish grooves, and is so much subject to erosion that some specimens are worn away to the innermost layer. When full grown it measures about an inch in length. The operculum is small, only partly closing the opening of the shell when the body is withdrawn.

The animal often carries around a pretty little roof garden of waving green algae, and occasional specimens are so densely overgrown with the fringe-like plant *Enteromorpha*, that at first glance they might be mistaken for sea mice.

The species is unique in the possession of a long inquisitive siphon that can be turned in any direction, and which, traveling on before

like an elephant's trunk, tells its owner the nature of the object it is approaching.

Small aquarium fishes do not molest it, and next to the minnows, eels and shrimps in activity, the mud snail, without which no salt water balanced aquarium can be complete, serves as a useful and interesting pet.

Fresh Water Snails.—There are numerous species of American fresh-water snails, and most of them are preyed upon, either in the young or adult stage, by fishes. One of the few that attains a length greater than one inch, is said to avenge all the others by attacking and devouring little fishes.

The two species most commonly used in our balanced aquaria come from other shores: the Red Ramshorn of Europe and the large brown Japanese Snail.

The commonest of American fresh water snails are the Pond Snail (*Lymnaea*), its near relative *Physa*, the little fresh water limpet, *Ancylus*, the coiled shells called ramshorns, and the Potomac snail.

The horn-colored fresh-water limpet, or river limpet (*Ancylus*), is a very small, sluggish and almost flat snail. It is a lung breather and has been observed to spend an entire winter out of water. It is hardly above a quarter of an inch long, and desirable only in an aquarium for animals smaller than fishes, since the latter will prey upon it.

Physa is one of the species credited with resisting dessication. It is a spiral snail with no operculum and a thin shell easily crushed in a fish's jaws; and most species of the pond snail answer the same description, being thin-shelled and doorless like *Physa*, slightly longer and more pointed. One species of the pond snail, however, found in northern New England (especially in Vermont) and called the Niagara snail (*Lymnaea stagnalis*), grows to be two inches in length and is large enough to be kept with goldfishes. But it has the reputation of capturing little fishes such as sticklebacks, also small salamanders; and it will attack the plants if not provided with special food, such as lettuce.

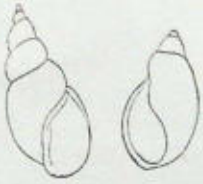
The common pond snail is the most interesting of fresh-water snails, a pulmonate—that is to say, an air breather, having a lung and no gills. Crawling upside down, at the surface, on its broad, flat foot, it imbibes air so audibly that even small specimens can be heard sucking it in, and feeds on floating vegetable and animal substances. Drawing small edible objects to its foot, which is provided with threads of fine cilia, whose action attracts like a magnet, it curls the foot so as to hold the food substances thus captured, and carries the repast below to be devoured under water. It can drop to the bottom or rise to the top in an instant, and all feats of



FRESH-WATER LIMPET

aquatic motion are familiar to it except that it cannot swim through the water like a fish.

Its most interesting performance is the manner in which it ascends from the bottom on a string of mucus extruded before it as it rises,



Left: POND SNAIL: *Right:* PHYSA

Physa is a near relative of the Pond Snail. When held in the same position, one shell opens to right and the other to the left.

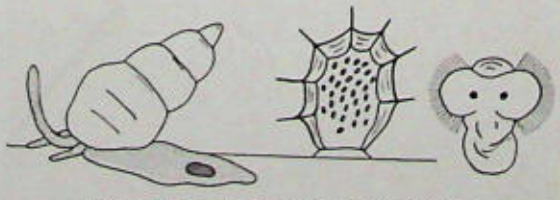
later descending upon the same string. These mucus strings are invisible unless they remain long enough to gather a covering of silt, but their presence is easily detected by passing a stick over or under the suspended animal.



RED RAMSHORN SNAIL AND YOUNG

The young—much enlarged—shown marked difference in shape of shell and size of eye and syphon.

The pond snail is omnivorous, feeding largely on vegetable substances, but refusing nothing that is edible. A defunct comrade is soon cleaned out of its shell, and no scraps left by the fishes will escape the snail's attention. It is



MUD SNAIL, EGG CASE AND YOUNG

Egg case and young much enlarged

hermaphroditic, both sexes being present in each individual, but the eggs are cross-fertilized. The eggs number from seventy to one hundred, according to the species, are laid in horse-shoe shaped masses of gelatin attached to plants or to the sides of the aquarium, and hatch in two or three weeks.

The ramshorn shells are of a very ancient type, being found in fossil remains of great antiquity. They are of numerous species, the commonest being the brown *Planorbis*, a clumsy snail measuring scarcely more than half an inch in diameter. It lays about eighteen yellow eggs in gelatin and does well with little fishes such as shiners, banded minnows and dace. It often carries on its back a menagerie as well as a roof garden, colonies of protozoa and rotifers, water bears and other minute animals. Specimens are said to have become active after being without water for four months.

There is a ramshorn shell (*Planorbis magnificus*) indigenous to certain streams of North Carolina, that is the giant of its type in this country, some specimens measuring one and three-eighths inches in diameter. It is called the Cape Fear River Snail. It has been observed chiefly for scientific data, has eyes when young which later degenerate and, becoming covered with cuticle, render the adult sightless. It is probable that the rarity of this large shell will prohibit its general introduction into home aquaria, although, as its name indicates, it is a magnificent snail.

The European Red Ramshorn (*Planorbis corneus rubra*) originally introduced from Germany and numbers of which are now bred in America, is the ramshorn shell most commonly used in home aquaria; a handsome, active snail an inch and a quarter in diameter, ruby bodied and ruby-shelled when young, the shell becoming striated with brown and black as its size increases. It is also called Copenhagen, Coral, and Red Post Horn Snail, and occasionally Trumpet Snail. It breathes by means of a lung, often visiting the surface for air, and manages its shell more dexterously and gracefully than the American *Planorbis*, never giving the impression that it labors under an embarrassing weight. This is partly due to the advantage of having a longer body to control both the foot and the shell. Like most pulmonate shells (lung breathers) it is hermaphroditic and cross-fertilization takes place. The pink eggs, numbering from ten to forty-five, are enclosed in an ovate mass of gelatin attached to the stems of plants.

The eyes and the siphon (which is at the side of the shell, behind the body) are enormous in newly hatched specimens, and the shell at birth is thimble-shaped and shows no convolutions, the color being dirty yellow with faint touches of pink. The baby snail just out of the egg is barely visible to the naked eye, but begins activities at once, and can travel an inch in five minutes.

The eggs are preyed upon by microscopic animals of various sorts, but given a clean aquarium, a little lettuce and scraps of meat or fish, with chalk, gypsum, ground coral, plaster of paris or cuttlefish to provide lime for the growing shells, and the red snail will breed rapidly. It is desirable to place only full grown specimens with fish, the younger ones being likely to fall prey to their finny companions. The red color is, speaking eugenically, a recessive trait, and is lost if the snail is bred with our native, sombre-hued ramshorns.

The Potomac Snail (*Viviparus viviparus*, formerly *Paludina*) and the Japanese Snail (*Viviparus malleatus*) have the fault of becoming somewhat dormant in the winter, moving about only on the milder days or when the sun is upon them. The Potomac Snail, whose shell measures an inch and a half in length, is generally more sluggish than the larger Japanese variety, which is over two inches long. This sluggishness is so dominant a quality that those who have interbred them record the resulting progeny as sluggish and short-lived as the Potomac Snail. The males of both species have one tentacle shorter than the other, while those of the female are of even length.

Both the Potomac and Japanese Snails are ovoviviparous, the eggs being retained within the mother's shell till they hatch. The young shells are hard enough at birth to protect them from small aquarium fishes. It is believed that the female of the Japanese snail after once mating, remains fertile the remainder of her life. Both species have remarkably small appetites, yet help to clarify the aquarium, and are of an ideal size to be kept with goldfish. They are gill breathers, not needing to rise to the surface for air, and have a horny operculum for the complete closure of the shell.

The dark brown shell of the Japanese Snail often presents a fuzzy green aspect, because of the dense growth of minute plants with which it is overgrown.

The only fertile specimen the present writer has observed, produced fourteen young in seven days and then rested. At birth the Japanese

Snail is larger than the Potomac, and is an exquisite creature, of a delicate gray tint with slender brown tentacles and a single brown band in the translucent shell.

A European snail now bred in this country and to some extent used in home aquaria, is the Transparent African Snail, also called African Paper-Shelled Snail (*Lymnaea auricularia*). It has a light, horn-color shell, over an inch in length, and a spotted brown body. The eggs and young are preyed upon by fishes, and only adult specimens are therefore desirable for aquaria. It is a short-lived, rapidly-breeding species and an excellent scavenger. In shape the shell is similar to that of the common pond snail, except that the opening is much larger, giving it the popular name of Ear Shell. It has a broad body whorl, and depressed spire.

The Four Horned Snail (*Ampullaria gigas*) from South America is a vegetable feeder and destroys plants indiscriminately. It is large, like the Japanese snail, and has the peculiar habit of laying its eggs above the water in such a position that when the young snails hatch they may drop into the water immediately. Another snail of the same family, *Ampullaria pinei*, from Florida, grows over three inches long. These snails are attractive and a study of their habits will afford many pleasant and profitable hours; but if one wishes snails only to act as scavengers in his aquaria, the most desirable are those which will not attack the plants except to keep the fine plant growth cleaned off the glass, and will consume the scraps left by the fishes.

The best fresh-water snails for this purpose that are readily procurable, are the European red ramshorn, the Japanese snail, and—when it is not asleep—the Potomac, common in nearly all our ponds and lakes. Of these the last two are the cleanest, but the red ramshorn is the best scavenger, though necessarily requiring more care, and will survive several years in captivity. More than one variety of snail is not amiss in an aquarium, since tastes differ even among snails.

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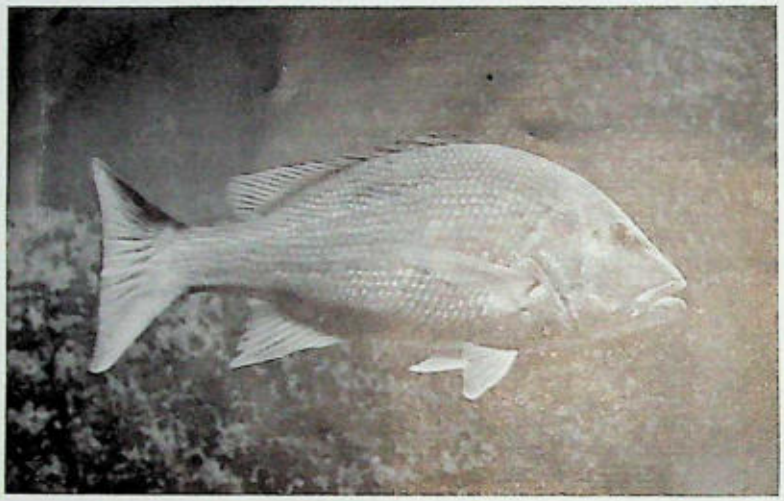
RAINBOW AND STEELHEAD TROUTS

Both Now Called Salmo irideus

By C. H. TOWNSEND.

NATURALISTS for some time have been of the opinion that these two trouts were identical. The steelhead is merely a rainbow trout that enters salt or brackish waters and has acquired the anadromous habit. As a result it becomes much changed, having a larger size when it re-enters the rivers, and a more salmon-like appearance. While the rainbow trouts of our Pacific coast states vary somewhat according to the streams they inhabit, the sea-run steelhead, wherever taken, remains uniform in appearance and ranges farther north, entering streams in southeast Alaska.

The writer has seen freshly captured steelheads at the McCloud River hatchery on the



RED SNAPPER

Sacramento, three hundred miles from the sea, the appearance of which was very different from rainbows taken at the same point.

It is now known that the so-called steelheads introduced with remarkable success by the Bureau of Fisheries into Lake Superior, are recognizable as rainbow trouts when they enter the streams. Moreover, the young rainbows artificially propagated in streams flowing into Lake Michigan, acquire to some degree the appearance of steelheads.

The appearance of trouts is affected by the waters they frequent, and this probably accounts for such changes in coloration as take place when the rainbow moves from streams into large lakes. As rainbows were introduced into streams tributary to Lake Michigan before the first so-called steelheads were introduced into Lake Superior, the presence of fishes resembling steelheads in Lake Michigan cannot well be explained otherwise.

ITEMS OF INTEREST

By C. H. Townsend

A Large Octopus.—Dr. W. H. Dall the veteran curator of Mollusks in the U. S. National Museum, recently visited the Aquarium. While looking at a photograph of an octopus, he gave an account of one he saw captured in Alaska in 1880.

It was observed in shallow water in the harbor of Unalaska, and was soon harpooned and taken on board the Coast Survey vessel of which Dr. Dall was then in charge. When hung by the body from the main boom over the stern, the relaxed arms touched the surface of the water from a height of sixteen feet. This means that if measured across the outspread arms the distance would have been more than thirty-two feet.

Ancient Doors of the Aquarium.—These doors, like the building itself, are over one hundred years old, and are of considerable interest to visitors. They are, in fact, the doors of a fort—West Battery, as the building was first called—and were constructed to withstand almost any force except the cannon shot of that period.

Today they seem as out of place in New York as though they belonged to the Tower of London. It is not unlikely, however, that some other forts in the country have doors like them.

The great doors of the Aquarium are each twelve feet high, five feet wide, and seven inches thick. They are constructed of three layers of heavy cross planking, thickly studded with bolts, the heads of which are over two inches in diameter, all riveted on the inside. The bolts on each door are in twelve vertical rows, with thirty-two in each row, a total of 768 bolts, five inches apart, for both doors.

The hinges, three to each door, are proportionately massive. The small sentry, or postern door cut in one of the large doors, is fifty-seven inches high and twenty-one inches wide, with a ponderous lock, the key to which must have been three times the size of the key to the Bastile, that Lafayette presented to Washington and is now exhibited at Mount Vernon.

The large doors were fastened with heavy timbers, the ends of which were let into the masonry at each side.

More Large Exhibition Tanks.—The work of enlarging the glass-fronted tanks at the Aquarium has been carried on until more than half of the ground-floor series have been extended to a depth of twelve feet back from the glass.

Most of these tanks have been rebuilt by the employes of the Aquarium, and all of them with material charged to the regular maintenance fund, without extra cost to the City for construction.

The extent of this work may be seen by a glance at the ground plan of the building on page 1580 of this BULLETIN.

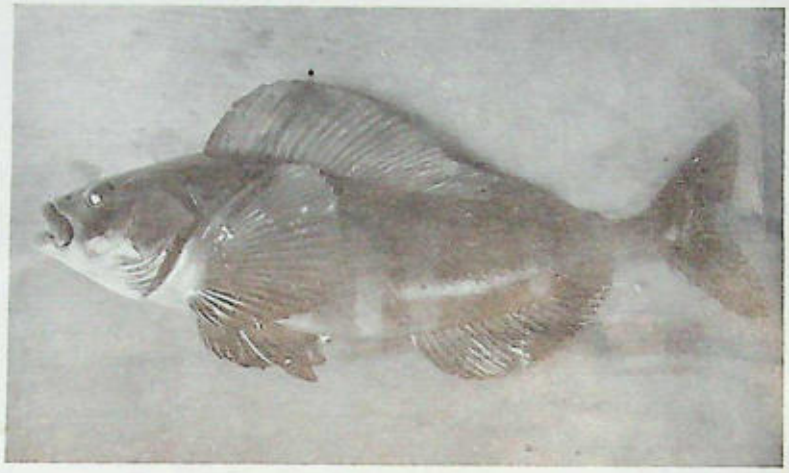
The enlargement of the exhibition tanks constitutes the most pronounced improvement made in the Aquarium during recent years, and the increased swimming space afforded has been directly beneficial to their living occupants.

Attendance.—The total number of persons who visited the New York Aquarium in 1917 was 1,595,118, an increase over the preceding year of 95,451.

Fuel saving at the Aquarium.—In compliance with the orders of the Fuel Administrator, the Aquarium was closed to visitors on January 18 to 22 inclusive. It was also closed on the Monday following. Steam heat was cut off all parts of the building, leaving it about as cold as a barn with the roof off. Just enough steam was generated to keep the pumps going and warm the water for tropical species that would otherwise have been lost. The engineer states that there was a saving in coal of about fifty per cent. The employes were on duty and kept warm by engaging in vigorous house-cleaning.

Bird Visitors at Sea.—Most of the land birds that alight on vessels at sea, do so for the purpose of resting. But some water birds, in no way under the necessity of finding a dry perch, often make themselves quite at home on a vessel cruising near their nesting rocks. This is a common trait of the various species of gannets (Sula) called boobies. During the investigations of the U. S. Fisheries Steamship *Albatross* in the Gulf of California, boobies often rested on the rigging of the vessel, especially when the vessel was working about the rocky islets where they breed in great numbers. There is little reason to believe the booby the stupid fowl sailors have always credited it with being, since many birds unaccustomed to the presence of man are quite fearless.

The writer made the accompanying photograph on the deck of the *Albatross,* while clouds of black smoke from the funnel drifted past the boobies perched on the main boom without disturbing them in the least, and the sailors were able to catch some of them with their hands.



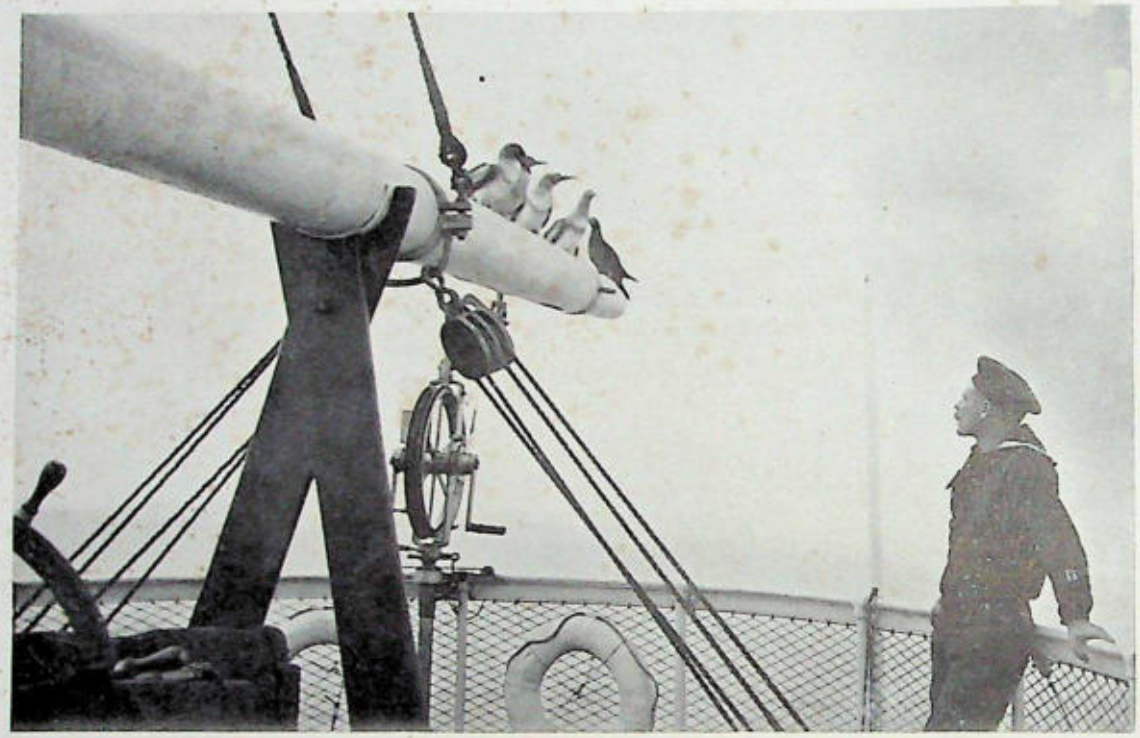
ATKA-FISH OR ATKA MACKEREL

The Atka-fish.—The Atka-fish (*Pleurogrammus monopterygius*) is usually called Atka Mackerel in the Aleutian Islands, because when salted it tastes much like salt mackerel. It has long been the custom of traders among the islands of western Alaska to salt small quantities of the fish for local use. As it is abundant and easily caught there is reason to believe that it will eventually be taken in sufficient quantities to be of considerable commercial importance.

It is indeed one of the little used species recommended by the U. S. Fisheries Bureau as a valuable addition to the national food supply, but the Aleutian Islands, lying about two thousand miles northwestward from California, have not yet been brought within the regular sea routes of commerce.

While cruising with the Fisheries Steamship *Albatross* among the Aleutians, the writer had excellent sport with the Atka-fish and found it fine eating, both fresh and salted. It is of great importance to the natives of those islands. It is found throughout the Aleutian Chain but is probably most abundant about Atka Island. The Atka-fish is a handsome species, yellowish gray in color, with black cross bars. It reaches a length of eighteen inches, and a weight of three or four pounds.

The Red Snapper.—The Aquarium recently lost a specimen of the red snapper (*Neomaenis aya*) that had lived in one of the tanks for two and a half years. The red snapper is the most important tropical fish that comes to our markets, and the most valuable food-fish of its genus, reaching a length of two and a half feet and a weight of twenty pounds. In 1903 thir-



BOOBIES ON THE ALBATROSS' MAIN BOOM

The birds were quite fearless; heeding neither the drifting smoke from the funnel nor the presence of the sailors.

teen million pounds, worth $400,000, were landed in ports of the Gulf States alone. (Later statistics are not at hand.) The red snapper is caught in rather deep water, large numbers being taken on fishing grounds off the west coast of Florida. The center of the red snapper fishery is Pensacola, where there are many vessels engaged in the taking of this fish. The catch is made in the Gulf of Mexico and on the Campeche Bank of Yucatan. It is marketed in all eastern cities as far as Chicago.

The red snapper is found from Long Island to Brazil but is very rare north of Hatteras and merely accidental in New York waters. It lives well in captivity, and the beautiful rose red color of the fish makes it one of the most attractive exhibits of the Aquarium.

Whale Meat as Food.—It is many years since the writer ate whale meat on board a whale ship at Port Clarence, just below Bering Strait. The lapse of time is too great for recollection as to its flavor, but it proved to be quite edible, like the seal meat we had eaten previously at the Pribilof Islands. Pickled whale skin was also set before us by the hospitable whaler.

About one thousand whales are taken yearly at shore whaling stations along the coasts of North America. There is no reason why the meat of the whale should not be utilized. It has always been saved for food at Japanese whaling stations. The creation of refrigerating plants at such stations is entirely practicable and hundreds of tons of wholesome meat hitherto converted into fertilizer should undoubtedly be made available as food for a country now suffering from a general meat shortage.

Porpoises, which are merely small whales, have long been used for food. The species known as blackfish is used in the Faroe Islands where porpoises have always been taken in large numbers. The white whale has always been used for food in arctic regions especially in Hudson Bay and Greenland waters.

Five years ago the porpoise fishery at Hatteras, North Carolina, supplied to a New York firm several hundred pounds of porpoise meat, which was mixed with five per cent. of pork and made into sausage. It was sold through the regular channels as first class sausage, and consumers were unaware that it was made of porpoise meat.

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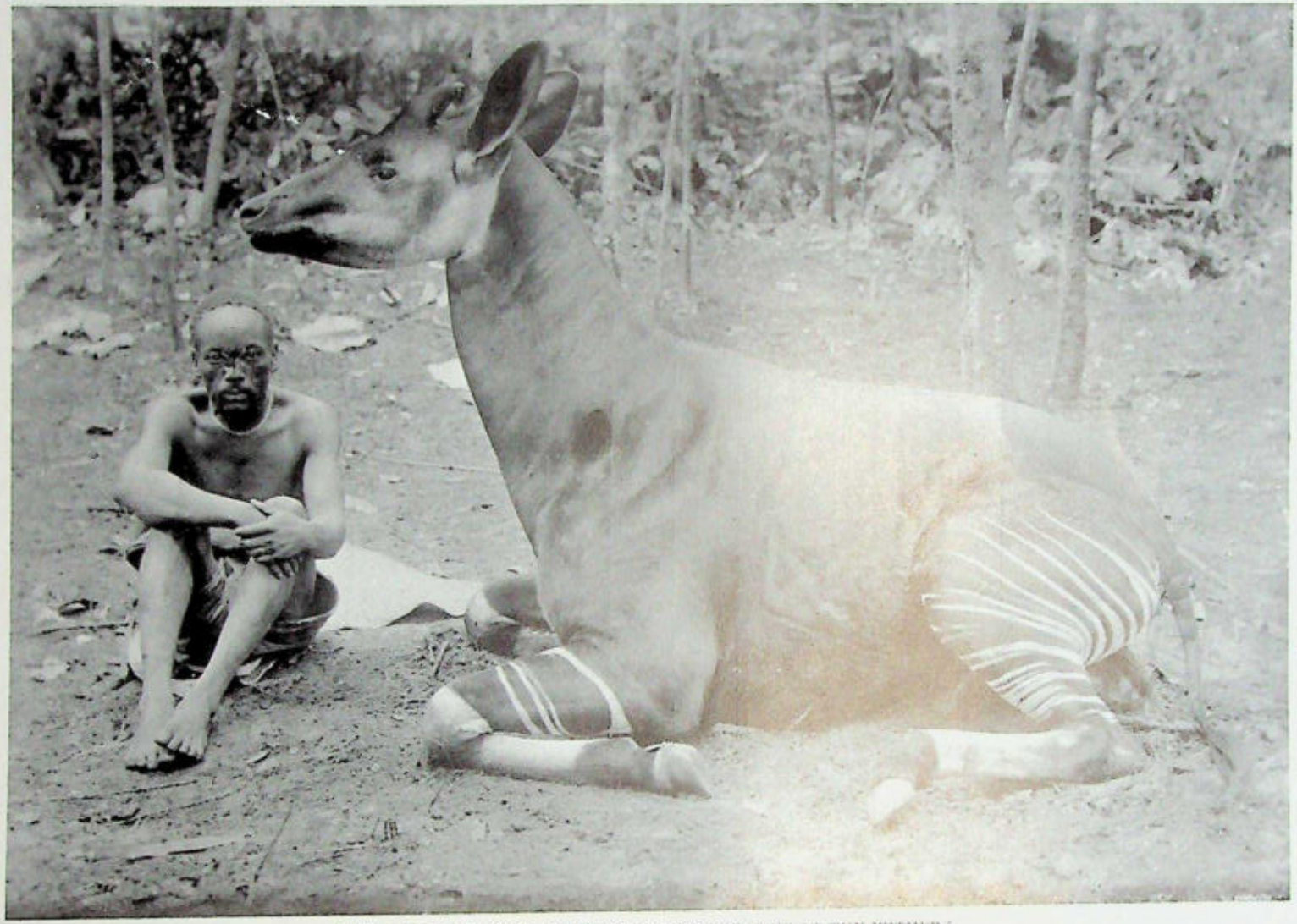
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Young Okapi ..... *Cover*



A RECORD BULL OKAPI, STANDING OVER FIVE FEET AT THE WITHERS

This magnificent specimen will be the main feature of the habitat group to be installed later in the African Hall of the American Museum of Natural History, where it now is temporarily on exhibition. The small eyes and delicate deer-like head and muzzle show none of its giraffine characters, and the lips are not in the least prehensile as has generally been stated. Ahawe sits at the feet of his long-sought quarry.

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IN QUEST OF THE RARE OKAPI

By HERBERT LANG

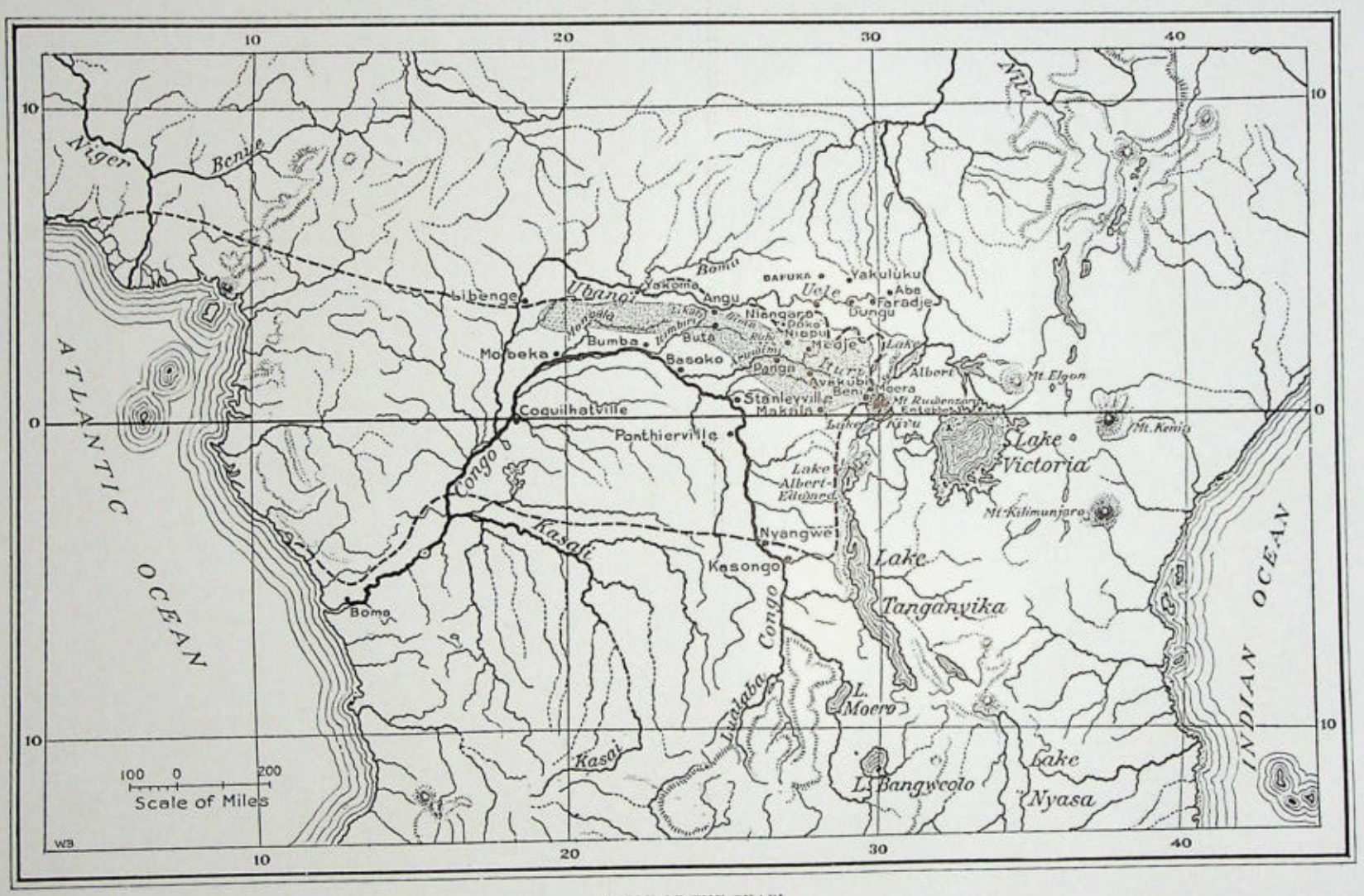
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ON the first of January, 1907, I had the pleasure of turning over to Dr. Hornaday the rarest New Year surprise any mortal has yet received, a little bull black rhinoceros, just arrived on the Steamship *Cedric*. It was a fitting contribution to a Director who, in a few years of strenuous effort, had succeeded in making the New York Zoological Park as renowned, if not more so, than those, many decades old, of Europe. The late Mr. Richard Tjader, quick to seize the splendid opportunity, had purchased the little fellow in Mombasa for the New York Zoological Society, and I had gladly taken care of him all the way from British East Africa. This husky orphan gave a most affectionate greeting to the Director and even after so memorable an ocean journey was in such perfect health that I needed no further recommendation for a similar undertaking.

Two years later, in the spring of 1909, Professor Henry Fairfield Osborn, President of the American Museum of Natural History and the New York Zoological Society, had elaborated the far-sighted plans of the Congo Expedition of which I had the honor to be in charge, with Mr. James P. Chapin, now a Lieutenant in service in France, as my sole companion. At this time I again saw Dr. Hornaday. His unbounded ambition was seething anew, and trusting my ability to care for animals, he saw the chance of securing at least two of the rarest and most interesting mammals, the famous Okapi and white Rhinoceros, neither of which had ever left the African continent alive. Dozens of other rare animals that would be the pride of any zoological garden were on his list of desiderata. This expedition was to proceed to Central Africa, to the northeastern Belgian Congo, a region most promising for a systematic zoological survey. Up to that time it had been considered impracticable to carry on in this unhealthy country any prolonged zoological exploration, and Schweinfurth, Emin Pasha, Stanley, Junker, Casati, Alexander, and Schubotz had passed through these territories with no attempt to make extended collections. The Congo Expedition, however, was organized and equipped to camp for years where others had spent but a few days or months, and the absolute soundness of such a hazardous project was proved by our signal success. We set out from New York in May, 1909, and returned with fifty-four tons of collections in November, 1915, without having had a single accident, nor did we lose a day through illness. Working from 1,200 to 2,000 miles inland, we succeeded in attaining results far beyond expectation. In five years of uninterrupted field work more than 38,000 natives were recruited to carry the 1,287 burdens of sixty pounds each, since in these districts the porters proceed only short distances and return at once to their villages, when the packs are shouldered by others. In spite of the careless treatment of the loads by such savages and the difficulties of preservation in a moist and hot climate all collections reached the Museum in perfect condition.

One of the main objects of the Congo Expedition was to realize the wish of President Osborn to obtain for the American public materials for a habitat group of the Okapi before the progress of civilization should make this im-



RANGE OF THE OKAPI

The shaded area represents the haunts of the Okapi, some seven hundred miles from east to west, about one hundred and forty miles from north to south, in the hilly regions of the head waters of the northeastern affluents of the Congo. The heavy broken line shows the extent of the West African rain forest, from the shores of the Atlantic Ocean to the Ruwenzori Mountains



A TRAP SET IN AN OKAPI TRAIL.
An Okapi stepping into this noose is caught by the foot, and, hobbling on three legs, is beaten to death.

possible. The Belgian Colonial administration generously seconded the efforts of the Museum's party by granting the necessary privileges, and it was our great ambition to procure a few rare mammals for the New York Zoological Park; and even when the collections increased to such an extent as to make it impossible for us to care for live animals we still hoped to the last moment to bring home the first live Okapi.

Let me briefly outline the history of the discovery of the Okapi. In 1890 Stanley gave the first positive clue to the existence of the Okapi in the Ituri forests, the northeastern part of the great West African rain forests. Stanley referred to it as a "donkey" called "atti," which feeds on leaves. In traveling through the greater part of the range of the Okapi in 1888, as commander of the Emin Pasha Relief Expedition, he lost through famine, fever and attack by hostile natives four hundred of his six hundred and forty Zanzibari porters. His thrilling account established a dreadful fame for the haunts of the Okapi, but apparently no attention was paid to the few words appended to his "In Darkest Africa." Stuhlmann, traveling in the Semliki Forest in 1891, actually saw a part of the striped hide and mistook it for that of a Zebra, as Junker had in 1883 in passing through the Mangbetu country. But in 1901, eleven years later, Sir Harry Johnston, the gifted explorer and colonial administrator, then High Commissioner of Uganda, through persistent efforts, succeeded in securing a few strips of the striped hide of Stanley's "donkey"-like animal, and, recognizing their importance, at once sent them to the British Museum. London scientists, misled by the stripes, announced the discovery of a new species of forest zebra. This was a tempting problem for so enthusiastic a naturalist as Sir Harry Johnston, always wide awake to the opportunity for discovery. He organized an expedition, and, in the company of Pygmies, soon camped near the trails of the animal he sought. His time being limited, his followers ill and disgruntled, and seeing that the quarry he followed in vain had cloven hoofs and might prove to be only a forest eland, he abandoned the immediate realization of his hope. Nevertheless his diplomacy triumphed. He met Mr. Erikson, a Scandinavian officer in the service of the Congo Free State stationed at Beni, who was well acquainted with the Okapi through its meat and skin, which the natives often brought to his post, and who gladly promised to send a skin and skeleton to the High Commissioner's residence at Entebbe, Uganda. Indeed a few months later Sir Harry could study the coveted remains at leisure. It was a pleasant surprise for him that the "donkey"-like animal called "O-api" by the natives proved to be an epoch making discovery. Far from being a horse or an antelope, as expected, it claimed as its nearest relative the giraffe. It was one of the survivors of the giraffine group, such as the Paleotragus and Helladotherium, flourishing in southern Asia and Europe during Miocene ages, several million years ago. The Okapi had found a safe retreat in the heart of Africa, in the gloom of the Congo forests. Some of these ancestors differed vitally from each other in size and form, and the Okapi too has practically no external resemblance to the giraffe. To the layman this much heralded affinity seems puzzling because in size, proportions and color the Okapi looks more like a mule. The two



THE CAREFULLY CONCEALED TRAP
A circular hole about a foot wide and eight inches deep is covered with pieces of bark beneath which rests the release.



APOSHO, THE SKILLFUL OKAPI TRAPPER

Aposho was sixty years of age and had slain over a hundred Okapi without coming to grief. The twisted ropes on his arms were supposed to propitiate the bad spirits attendant upon each successful killing.

stumpy, skin-covered horns on the top of the head, present only in the male, and the tuft of long bristles tipping the tail are the only external counterparts common to both.

A big Okapi stands but five feet on the slightly raised withers, and the short, heavy neck carries a delicately modeled, deer-like head. The glossy brown and purplish black of the body is set off by the conspicuous white stripes and bands on the limbs. The zebra-like pattern on the buttocks, suggestive of shafts of light, has been said to help in concealment, but this would be of little use in the gloom of the Congo forest, and an acute sense of hearing is a far better protection.

After traveling up the river to Stanleyville, twelve hundred miles inland, and after marching with a caravan of two hundred porters for twenty-one days across the forests to the northeast, we reached Avakubi and later arrived at Medje, a nine day journey to the northwest, where we made our headquarters. We followed the advice of Lieutenant E. Boyton, a Scandinavian in Belgian service who commanded this post, and proceeded southward to Banda's territory with only twenty-five porters. By reducing our caravan and employing as carriers natives from the villages we intended to visit we eliminated the possibility of antagonizing them by heavy and unnecessary demands on their food supply.

The evening we arrived at Banda's village his men were drying Okapi meat over the fire. At six the next morning Banda appeared with the dried portions from the limbs, all they preserve, as the rest of the hide is generally eaten. We were at last sure of being in Okapi country though in view of past events and prevailing conditions it was not surprising that our reception was tempered with suspicion. Their women and children dared not venture forth unaccompanied by men armed with poisoned arrows, ready for action. Here in 1903, Thornton, an American in Belgian service, with over fifty of his soldiers and porters, was killed and eaten, and the caravans of other officers had frequently been the targets for poisoned arrows shot from ambush. Desperate fighting ensued, lasting more than three years, and the Belgian Government finally forced the abolition of cannibalism.

The Government had given instructions that we were to be provided with a dozen armed soldiers, whose presence, in our opinion, was unfortunate. We were alarmed to see the suspicious natives leaving their village, retreating to huts in many far away parts of the forest where they have plantations, the easiest way for them to escape trouble. To us their going meant the defeat of our hope of ever securing Okapi. We therefore sent the soldiers back to the garrison, a step we had no reason to regret, as our success proved. To the black man it was a new and strange experience to see white men at work. Daily the natives flocked in from neighboring villages to see "Banda's white men." For a long time I thought myself very popular; many waited for hours to shake my hand. They stroked my arms and joyfully grinned "Nyama mingi! Nyama nzuri!" (Lots of meat! very tender meat!) Later on an explanation of their interest gave me a cold chill. However, they good naturedly added that they would not kill us for they would have to send every bit of meat to the great chiefs, for white men eat much salt and taste far better than their own kinsmen. This had been the fate of Thornton.

After many lengthy palavers I finally succeeded in overcoming their superstitions. I soon had stationed in their camps in the forest



TRUE TO LIFE AND IN ITS NATIVE ENVIRONMENT
This is an exceptionally fine study of a still fresh Okapi bull. The horns, here unusually long and slender, vary individually.

our native assistants, and finally, as news of the Okapi arrived, I ran out day by day, crossed swamps and rivers as they themselves did, slept in the forest, and joined their hunting parties even in the dead of night. I had but two porters with me, one for my camera and the other for my necessary camp outfit, an equipment so meager that a Belgian officer laughingly called it "the tablet-form outfit." This gave us a reputation with the natives and our absolute fairness with them secured their confidence.

Having walked more than a thousand miles in the tracks of the Okapi, I unhesitatingly state that a great wariness and nocturnal habits efficiently protect it from being successfully stalked by white men. Those who can rightfully claim to have seen a living Okapi, or shot one, have been so favored quite accidentally. During the day it rests, but sometimes moves when storms rage and falling leaves and branchlets drown the usual noises. The Okapi is a typical browser, feeding generally by night, often while rambling with a companion. The female invariably takes the lead, her ears alert for the slightest suspicious sound. Towards morning they leave the hills and move in the direction of the swampy regions, with dense, almost impenetrable thickets. The clear brooks, often flowing over beds of firm, white sand, are thus frequented, and, when shallow, are used by natives as paths and followed for miles by the Okapi. As the sun rises they return to the hills, and, without seeking shade or concealment, rest wherever they happen to be, apparently never twice in the same place. They spend by far the greater portion of time in the higher and drier parts of the forest where trees are taller and more scattered. The undergrowth here is open, permitting porters with their loads to pass without much trouble, and the ground is covered with only a thin layer of dry leaves and sticks since numerous colonies of termites rapidly transform dead vegetable matter into soil which is washed away by the torrential rains. So remarkably regular are their habits that the natives picturesquely state that each pair of Okapi has its own village. Trails, leading to one of the numerous brooks, are sometimes a foot or more wide and have given rise to stories of large herds. The truth is that in their northern range, during a dry season of several months, tracks made daily by one or two Okapi remain unchanged, and due to the moisture in these swamps, retain their original freshness.

Though food is abundant, the Okapi, wherever it stops, clears the bushes of all foliage within reach, often breaking saplings and branches down, much as giant elands do, and in these attempts tears off from the tip of the horn the covering of hairy skin. It has been suggested that the distribution of the Okapi coincides with that of the broad-leaved, marantaceous marsh plant, phrynium, the tender shoots of which are used as fodder for the mules of officials. However, we know that the food plants of the Okapi are a few common species of trees and bushes, and so are safe in concluding that



OKAPI TRACK IN SOFT GROUND
Many travelers claimed that the Okapi inhabits swamps, yet the small, well worn, cloven hoofs alone would prove the general hardness of the trails frequented.



AWAITING THE PHOTOGRAPHER'S PLEASURE

This confident pose does not reveal the ambling gait, for the Okapi, like the giraffe and camel, moves the legs of one side simultaneously.

its restricted range does not depend upon phrynium or any other plant. In fact, the flora of the West African rain forest is so uniform over its entire extent that it could hardly influence the distribution of so large a ruminant. Our long experience and numerous inquiries prompt us to say that the range of the Okapi is limited by physiographical conditions; any extended swampy area, with its inextricable vegetation, would completely bar the Okapi, and thus we find it only in the undulating drier portions of the northeastern rain forest.

The question how it happens that so large an animal so long escaped discovery by science is easily answered. While it is true that exploration and civilization made such rapid advance that the term "dark continent" practically became obsolete during the last decade of the nineteenth century, the Okapi, in true hermit fashion, had secured the only retreat that white men would respect, a country that he was forced to acknowledge as the most unhealthy in the world. It inhabits a narrow strip some seven hundred miles long and hardly one hundred and forty miles wide, about seven hundred miles from either coast, the forests of the hilly sections of the many small affluents of the northeastern tributaries of the Congo River. The only region where it has yet been recorded is in the Belgian Congo, west of the Ruwenzori, across a portion of the Ituri and Uele districts to the Ubangi River, though it has been maintained that it occurs also in Uganda. While the Okapi was not unknown to the officers of the Congo Free State at the posts in the Ituri and Uele, they had more vital interests than studies in natural history. Communications with other posts and Europe were in a precarious condition. They had to battle with hostile natives whom they forced to abolish cannibalism. Stations had to be built and roads cleared through tropical forest. They endeavored to establish a feeling of general security. Even the wild, roving Pygmies learned to exchange the prod-



THE YOUNG OWNER OF THE TYPICAL STRIPES
When walking he held his head even lower than shown here.

ucts of their chase for salt, tobacco, knives and other articles of value to them. Some of the officers and the native soldiery had enjoyed eating the flesh of the Okapi some ten years before its discovery by science. It furnished excellent meat, and excepting the elephant and buffalo, was the biggest game. The striped portions of the hide decorated their chairs and soldiers used straps of it as bandoleers for their guns.

Whoever penetrated here was, so to speak, "on the wing," and wings beat doubly fast across these inhospitable regions. The numerous sportsmen who had visited nearly all parts of Africa found no attraction in these forests. Indeed the many pale, haggard faces that emerged from the western half of equatorial Africa were no incentive to pleasure-seeking people. The immensity of the wilderness is appalling; for over eighteen hundred miles without a break it stretches more than half way across the continent, from the coast of Guinea to the Ruwenzori. In spite of tropical luxuriance, it is one of the most dismal spots on the face of the globe, for the torrid sun burns above miles of leafy expanse, and the unflagging heat of about one hundred degrees day and night, renders the moist atmosphere unbearable. Over the whole area storms of tropical violence thunder and rage almost daily. Here natives have become cannibals, and the graves of thousands of white men are merely a remembrance of where youthful energy and adventures came to a sudden end.

What a difference in the eastern half, where Africa's three largest snow-capped mountains greet the rising sun far above the equatorial mists. Delightful valleys of exuberant green, miles of park-like stretches, far extending plains and lakes, large and small, compose the beautiful landscape. Here lies the sportsman's paradise. Large herds of antelope have found a land of plenty, zebras in immense troops, buffalos and elephants by the hundreds shift aimlessly and unhampered across the vast expanses,



THE AWKWARD AGE. ALL LEGS AND FEET

Though not annoyed by sunshine, he preferred the shade. Toward evening he became restless and walked about, but when gently stroked settled down peacefully, sleeping with his head on the breast of his guardian, with whom he shared the hut.

It is an open country where companionship is developed to its highest degree, where stampeding herds are followed by bands of lions, where swarms of yawling hyenas give their gruesome concerts and flocks of vultures circle far above it all, awaiting their share of the spoils.

But in the West African rain forest travelers move on the beaten track, and even the hunter rarely hears more than the noises of escaping animals. Only the elephant, buffalo or wild boar allows of approach. The sombre green of the vegetation accentuates the general monotony, and few escape the oppressing gloom of the rainy hours or days with a sun overcast by dense vapors. Here and there a few score monkeys frolic together under the large green canopies. Unlike the vast herds of antelopes roaming the plains, those of the forest await the silence of night to steal about singly or in pairs. Strength, speed and endurance are replaced by stealth and rapid dodging from thicket to thicket. Even the otherwise gregarious buffalos occur here in bands of only three to five, and elephants in troops of a dozen or so generally follow the trails worn by generations of their kind. The giant carnivores and carrion feeders would starve here; only leopards, ambushed in trees, succeed in securing prey. Dead animal matter is chiefly disposed of by millions of tiny ants. The vulturine eagle, Gypohierax, is compelled to satisfy its wants by picking oily pulp from the palm nuts, as many of the smaller carnivora, the genet and mongoose, that also consume plantains. The larger civet adds corncobs to this peculiar vegetable diet.

The habitat of the Okapi, however, is not as uniform as might be expected, at places so open that, could it be observed during its nocturnal rambles, it might be seen at a hundred yards, or, again, so dense that it could find sufficient cover at arm's length. The Okapi's one great enemy is man. The wariness of the game is but an added stimulus to the cunning Pygmy hunter who, like the Okapi, claims the forest jungle as his home. A quarry so large provides coveted meat for days of feasting. The more powerful Bantu negro, living in villages and owning plantations, with a craving for meat that had made

him a cannibal, also trapped the Okapi in well-concealed snares and pitfalls, and the Pygmy would gladly exchange the product of his chase for vegetables. These negroes were capable of artistic appreciation and used the quaintly striped portions of the hide with its white, brown and purplish-black markings for adornment, especially belts. So highly were they prized that in some regions to sit upon a skin or wear portions of it became the privilege of chieftains and their families. In fact its value, as a means of gaining the favor of important chiefs, increased so considerably in districts beyond its range that the hide of each limb was eagerly accepted as the price for a woman. Tales of the Okapi are so interwoven with mysticism that to those wearing portions of it, the many marvelous qualities of the Okapi were willingly credited, especially its cunning in eluding enemies and the power of retaliating upon those who slaughtered it without due ceremony. Had not whole villages been wiped out by the spirit of the "O-api" when a reckless hunter had failed to take proper precautions? Let but the head of the dying Okapi touch the ground and earth receives the curse that may annihilate the negligent one, his near relatives, and even any one stepping thereafter in the tracks it had left the day it perished. The Medje never dare kill outright those caught in traps, but make elaborate arrangements so that the head of the Okapi, during its last moments, will rest upon a cushion of leaves or branches. Its elusiveness works on the imagination of the native and intensifies the mystery surrounding it. Should an Okapi by any chance suddenly bolt out of the bushes, an uninitiated Okapi hunter returns home at once, for this is a warning not to proceed. Marvelous stories about the Okapi provide welcome entertainment for the family circle and friends long after the dying embers have ceased to offer protection against the chill humidity of the night.

Okapi are caught by various methods in use over the greater part of Africa, but are of such a nervous temperament that they invariably kill themselves, and I am certain that only calves can be taken alive. Strong nets, in sections, are hung loosely from the trees, barring the trails of the Okapi whose whereabouts are previously known to the hunters. So rapidly are they driven towards the nets by small dogs with wooden clappers and followed by men shouting at the top of their lungs that they usually try to break through. But the net instantly falls, completely entangling them, when they are quickly dispatched by natives in ambush. This, however, calls for hundreds of drivers and only powerful chiefs can afford to catch big game in this manner. Pitfalls ten feet long, eight feet deep, but less than three feet wide near the surface also claim many victims. The smooth sides form a wedge-shaped hole in which the captive's body is suspended, and sometimes spikes, projecting from the bottom, pierce the body and cause sudden death. These pits are treacherously covered with sticks and leaves, a perfect imitation of the trail in which they are usually dug.

The third method requires far more skill and a greater knowledge of habits, but is more in use with professional Okapi hunters. Aposho, an old Medje trapper who used this method, had to his credit at least a hundred Okapi, boasting that he had killed at least two or three every year, even from his boyhood, and in later years, when meat became scarcer, as many as ten. I finally gained his confidence and repeatedly assisted in setting his traps. He and his friend Bope had divided the region between them. Each had some thirty or forty traps, which were visited about once in four days. He was considered by the others a great medicine man endowed with the power to direct Okapi to his traps. On finding a suitable spot, he carefully investigated, poking his knife into the trail to find a foundation for the snare. To make doubly sure he consulted his instrument of augury, and if the auspices were favorable he and his helpers were busy for the next hour. A circular hole about a foot wide and eight inches deep was dug in the ground and by that time the upper branches had been stripped from a strong, flexible sapling, to the top of which a thirty- to forty-foot strand of rattan about three-fourths of an inch thick was fastened. A specially prepared and consecrated noose was tied above the bulging root of the rattan. The combined effort of three men was needed to pull the rattan down to the release actuating the crossbar, upon which narrow pieces of bark were so arranged that pressure at any point released the noose. Thus an Okapi stepping within the fatal circle was usually caught by the ankle, and, hobbling on three legs, could not move far. So skillfully are these traps set that it takes an astute observer to discover them. Before leaving, Aposho hummed his imprecations and all joined him in yelling and dancing. All traces of their presence were effaced for a distance of several hundred yards. The places selected for these traps are narrow trails walled in by heavy vegetation by which the Okapi regularly goes down across the swamp to the crystal clear brook. On first hearing of this method I thought I might see one alive, but luck was against me and I only

saw one in its last throes. It had jumped from the trail into a deep pocket of mud and only the head was visible.

When caught, the noble beast is often disgracefully beaten to death with clubs; the skull and even other bones are shattered. Superstition does not allow the use of spears, arrows or knives. I saw nineteen of these carcasses, that putrefy quickly in the tropical climate, which for the natives only heightens their tastiness. It would be dangerous for anyone staying in these regions to interfere with their methods of hunting. I myself nearly came to grief for remonstrating with natives who were about to put an old woman to death to propitiate the evil spirits. Hunting results had become so bad that she had been accused of bewitching both hunters and traps. In pleading for her I appeased their wrath by assuring them that my own medicine was strong enough to banish all witchcraft, on condition that the traps should be changed. My advice was taken, results proved most gratifying, and the delay saved her life, though she had faced the ordeal as a matter of necessity.

The general belief is that the Okapi is one of the shyest of creatures, but my experiences prove that it would peacefully live in the immediate neighborhood of villages if it were not killed at once. Apparently unfrightened, two Okapi habitually roamed near a village situated in the midst of the forest and inhabited by a few old people whose duty it was to maintain communication by gong with a far distant son of an Azande chief.

Since the Belgian government has undertaken to stamp out cannibalism, hunger for meat has driven these negroes to seek the game of the forest. No longer able to supply their occasional feasts by raids on adjoining villages, so large and inoffensive an animal as the Okapi is a tempting prize. Though hunting Okapi is legally forbidden, many chiefs have stationed in special camps hunters, who are forbidden by superstition to eat Okapi meat. In course of time one section after another is thus depleted of the Okapi. Some years ago the great Mangbetu chief, Zebandra, with the aid of eight hundred drivers, caught eleven within a week. An Azande showed me twenty-two pitfalls in which nine Okapi had perished, not to mention a number of others that had fallen to his gun which he loaded with self-hammered plugs.

My wish to observe the Okapi in its mystic haunts, to listen to its frantic rush into deeper wilderness, was often looked upon by Okapi hunters as the veil for a desire to find in these forests some product even more valuable than rubber. They care little to see the Okapi, each series of tracks gives them information as certain as if the Okapi were in plain view. Indeed a fresh trail possesses all the stimulating factors of the certainty of success and offers the thrills and emotions of a great novel. But for the white man the physical and mental strain in the moist heat and monotonous gloom of the forest detracts from the pleasure. The tangled vegetation forces one to stoop, the gnarly roots, stumps, and creepers impede one's progress, and after miles of tripping and slipping in the narrow trails or dragging oneself through the muddy, steaming swamps it is a welcome change to walk in the firm sandy bed of the shallow meandering brooks.

One day my hopes to see a live Okapi were well nigh realized. Throughout the night a storm had raged and the rumbling of the far-distant thunder could still be heard. The tree-tops never emerged from the vapors that enveloped all in their drizzling mist, and gusts of wind scattered showers of raindrops. In ten miles we had crossed seventeen streamlets and their adjoining swamps and had reached the higher lying portion with its more open forest, the real haunts of the Okapi.

The whistle of the oriole was the signal directing our guide and we soon followed fresh Okapi tracks. Forest boar and sitatunga had passed in the early morning, and near one brook a troop of bongo had stopped. Our two Okapi traveled together throughout the day, but late in the afternoon, when it started to rain, had separated. Here was our chance, for all minor noises were drowned by the falling drops. Trusted Amadu kept on the move; the others were far behind when we finally drew near to the Okapi. In the last hour we had covered not more than thirty yards. Under the cover of heavy vegetation we had crept along a fallen giant tree and had come to a column of driver ants that ended our hopes, for, attacked by them, we both moved when within less than fifteen feet of the Okapi. Its peculiar odor was still in our nostrils and the swishing of its tail and stamping of its feet in our ears when our coveted prize bolted. On our return to the camp at midnight we found that our companions had remained in the forest.

In the Uele we could not think of capturing live animals, distances and lack of time would have foiled any such enterprise, but on leaving for the Ituri we met an old friend, Commandant M. Siffer, who offered invaluable advice. At Poko a letter from President Osborn, extending his generous congratulations, reached us



BULL OKAPI TRAPPED IN THE ITURI FOREST

One step within the fatal circle of the trap unfailingly delivers this noble game into the power of the savages, for the rattan rope, as here shown, holds it by the foot.

just in time to encourage me to hasten arrangements for the completion of the survey in the forest regions. Through the assistance of Akenge, a powerful Azande chief, I hoped to fill in the gaps in the collections. He was going on one of his annual hunting trips on which the natives procured stores of meat for the sultan's larder. Four days to the south we arrived at the village of his son, Abawe, who, according to Azande custom, left at once, abandoning wives, children, and all he owned to his father, as a sign of his reverence. On this great occasion gongs signalled throughout the night, asking, not for able hunters, but that "all cowards should stay at home!" Akenge himself was leader and every headman had reason to show the effects of this influence. Prowess and courage among the warfaring Azande were stepping stones to fame. Abawe was the most renowned hunter in the region, making many contributions to our collections of rare animals during the two months we spent with him. But finally, at Akenge's return to his residence, I proceeded southward to the neighborhood of Niapu. Late in the evening his messenger, a boy of ten, sneaked up to me, whispering, "The sultan is going. Do you want to see him?" I had hardly assented when Akenge stood before me. He had waited under cover of darkness to hear my reply with his own ears. His time of going was set by augury, and he had come to bid good-bye. Like the "King of Beasts," he traveled through the forest on roads untrodden. Neither darkness nor jungle could stop him. This venerable chief of savages had a gentleman's pride and was worried not to have been able to make good his promise to help capture a young Okapi.

"The day the child of the Okapi is born, I shall know, and so will you," he said proudly. "My gifts will travel on the road to your village



IN THE FIELD. PORTERS WITH THEIR LOADS NEAR THE SHELTER HUT

One of our temporary laboratories in a Medje village edging the uninhabited forest where the Okapi still lingers. Terrific heat and an abundant rainfall make living under tents ruinous to health. Shelter huts, covered with large leaves securely tied down, are erected within less than forty-eight hours.

the very day my hands can stroke the Okapi," was my joyous and encouraging reply. Six weeks later, in Makere territory, I was informed that Abawe, who was to capture the Okapi calf, had left his forty wives, and, accompanied by three men, was camping only twenty miles to the north of our camp. Whatever my doubts at this message, I knew what a careful hunter Abawe was. It was Akenge's boast that at least one son, among some seventy children, could catch alive any animal in these forests. Akenge had undoubtedly posted many natives to observe Okapi trails, but in the eyes of the natives occult powers were brought to bear.

Abawe had been in camp but five days and it seemed utter foolishness when his messenger boldly announced, "The young Okapi will be caught tomorrow." His instructions would not allow him to speak further. At all events there was a chance to see, if not an Okapi, woodcraft unsurpassed. Before daybreak Abawe had left alone. He had eaten nothing the previous night nor that morning for fear of touching something a woman had put a hand upon, as this might have broken the charm. His merciless rigor alone brought success and all superstition with which he surrounded himself was mere chaff appealing to the mysticism of the negro mind, though sometimes he himself gave the impression of believing in it. By noon the party was to meet him. It was a clear day, the sun had passed its zenith when he finally appeared. There was a deadly silence. At intervals only could one hear the customary noises of birds or insects. Stopping at the top of a hill, he sent two men by a circuitous route down to the brook, where the Okapi usually crossed. Within half an hour one of them returned. "The Okapi has not passed!" Mbansa had remained near the crossing to signal. Abawe concluded that it was on the hill and had proceeded cautiously only a hundred yards when he stopped. There was a terrific crash but he stood still, patiently listening for the signal which was promptly answered. "The calf is not with her!" The mother Okapi had bolted at less than three yards from him. The deep-cut tracks later revealed the mighty leaps she had taken. He had promised his father to capture the calf alive, he cared nothing for the mother, and so scrutinized only the smaller tracks on the hard, well-worn trail. There, right at the place where the frightened mother had decamped, stood another owner of the typical stripes, hidden in the bushes, apparently with no other object in life than to await her return. This looked so like the rehearsal of a performance that evidently Abawe had spent the last few days in useful observation and had not trusted luck alone.

Holding the calf in his arms as firmly as if it were a struggling lion, he called desperately for lianas with which to bind it. All hands were ready, for that was big game! But everyone had to laugh. The terrible beast had no other desire than to lick the face of its captor and to suck the fingers held out to him. It was as tame as a lamb and enjoyed being patted and stroked. Abawe thought it had been bewitched so he would receive no presents from the white man for catching a thing tamer than any goat. All cheered him and a dance was held on the very spot, during which the young Okapi peacefully settled in the shade. To the negroes it was disappointing to see that calf, the young of a creature believed to be one of the shyest in the world, stand unafraid among them, especially in view of the fact that it was a week old, able to run and jump, and walk as fast as any man. Had it not bleated from time to time like a sheep and walked about in quest of its mother, even by the following day one might have thought it belonged to the little boy whom it liked to follow. A most endearing creature, it was the pet of all, though few dared to touch it.

Within four days my store of eight cans of condensed milk had given out, and it was a severe shock when my messengers returned from Poko and Medje, six and seven days distant, without a new supply. Low water prevented steamers from proceeding as far as usual up the Ubangi and Aruwimi rivers, with a resulting scarcity of provisions from Europe in all the posts of the eastern Uele and Ituri that year. I tried a mixture of rice flour and water, but the calf became so weak that ten days later I lost all hope of saving him. It was a sad disappointment, yet more than ever I was convinced that under proper conditions Okapi could be brought to civilized countries. This happened in late November and perhaps with the enormous task on our hands of overhauling and packing our large collections we might have lost the little fellow later, especially as delays and difficulties due to the European war might have made its transport impossible.

I sent salt, pipes, tobacco, matches, heavy anklets, brass tags, perfume and scented soap, gifts most welcome to Akenge. A fortnight thereafter his chief medicine man arrived, entrusted with two magic whistles from a famous set, mere hollowed pieces of wood decorated with polished iron rings, a token of his friendship. I had my choice; one if blown by the

ZOOLOGICAL SOCIETY BULLETIN

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Lee S. Crandall.

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Elwin R. Sanborn,
Editor and Official Photographer

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rightful owner was supposed to kill his enemies and the other to make many friends. I chose the latter, and was assured it was one of the most cherished heirlooms of this branch of the Azande dynasty and to which these cannibals ascribed Akenge's great influence. Now it is inconspicuous among 3,800 other pieces of the Congo ethnographical collection in The American Museum.

Perhaps when times are more settled, generous gifts may enable the New York Zoological Society to send an expedition of its own, and thus The New York Zoological Park may have the honor of being the first to secure alive the rarest and most interesting of large African ruminants. Of course in these far-off, unhealthy regions it needs the enthusiasm of morally and physically strong men, who, properly equipped and burdened with no other problems, can offer unceasingly their sympathetic care to captives passing from Africa to America under the trying conditions of changes in nutrition and climate. There are no obstacles that patient and intelligent management could not overcome.

ACKNOWLEDGMENT

The beautiful pencil drawings illustrating Mr. Beebe's "A Silky Eater of Ants" in the January, 1918, Bulletin were made by Miss Isabel Cooper. The credit was omitted through a typographical error.—*Editor.*

ANIMAL LIFE AT THE FRONT

By William Beebe

No stranger association ever existed than that of animal life at the front, as I was able to observe it on various sectors during the past winter. First of all, there is the rather delicate personal viewpoint, familiar to most of the poilus themselves, which ranges from lice and fleas through bluebottles to rats. After that comes the important economic phase, with our friends, the dogs and horses, and our acquaintances, the canaries and homing pigeons, playing their admirable parts. Finally there is the abstract, naturalistic consideration of the wild life which has become wonted to the *bruit* of the terrible struggle, and will find it strange when at last silence settles over those wasted deserts and tortured landscapes. I shall refer chiefly to this last aspect of wild life.

Under an intensive barrage or bombardment, almost every form of human activity ceases, in the area about the front lines. The sole exceptions are the aviators who, by their command of the three planes of space, are able to rise above effective fire from Archies, or if contour flying at low heights can, by sheer speed, avoid danger from machine guns and rifles. Considering the war zone as a whole, much the same thing is true of feral animal life, birds and bluebottles, and other creatures of flight being most in evidence. In spite of the months and years of constant noise and flames, gases and dangers, wild birds have shown an astounding disregard of these supreme efforts of mankind. They soar and volplane, they seek their food, quarrel with one another, carry on their courtship, mate and rear families in close proximity to the actual fighting and exploding shells. In fact, their numbers have increased near ruined villages, where they nest in the shattered houses, and in cathedrals still smoking from devastating bombardments. Besides this increased nesting facility, and the immunity from disturbance by man, thanks to his preoccupation with his fellow beings, there is a less pleasant reason for the great numbers of insect-eating birds, which live and thrive in this region. The terrible conditions of sanitation and the numbers of unburied dead in many of the sectors result in a plague of flies, mostly great bluebottles, and these in turn attract the birds—martins, swallows, swifts and others which find an abundance of food in these hosts of insects.

The intricacies of animal action and reaction can be traced in many ways. In one sector I observed a very great number of scavenger rats —even more than the usual hordes which tear through the dugouts, and shatter the nerves of the pickets by rustling the dried grass in No Man's Land. And correlated with this increase of rodents was an abnormal number of large birds of prey. I saw them perched on the splintered stubs of trees, on the raw ruins of farmhouses and villages, and even on an abandoned tank, which had settled in a hole stern-foremost.

with the front reared high in air. A large hawk, almost as light colored as a gyrfalcon, was perched on the topmost pedal of one of the caterpillar treads, and suddenly I saw it leap into the air, fall over in a most undignified way, catch itself and fly off at full speed. A hollow sound from the interior explained the cause, a sniper having taken up his station there. The noise of his rifle in the hollow tank must have been as terrifying as it was unexpected to the hawk perched just outside.

My introduction to bird life at the front, came when I was several thousand feet up, and repassing the front line trenches. I was looking down through my glasses following the undulations, the sudden twists and salients of these inconspicuous frontiers of barbarism and civilization, when a tiny black speck crossed my field, above the pale grey of low-lying vapor. I took it at first for a trick of tired vision, until it came again from the opposite direction. A quick twist of finger and thumb and the zigzag trenches blurred from focus and the black spot became distinct and vibrant—a skylark hovering at an amazing height, doubtless in full song. I looked at the compass and down through the crossed hair lines, and realized that it was a German skylark and that I was over temporary Bocheland.

Few aeroplane pilots or observers recall memories of engine trouble without a shudder, and yet twice I have had most remarkable experiences as a result of missing cylinders. The last time I was forced to land in an isolated district of northern France, and was salvaged by an officer whom I had last met in the hinterland of India. He motored me on my way toward the front and promised several surprises, the first of which was fulfilled almost at once. We stopped beyond a little bridge and walked a short distance into a French forest. Within a few minutes we heard a wolf howl, a sound which in modern Europe I had supposed was confined to the wilds of Russia. In several places in France wolves have since been reported, hunger driving them down from the more isolated regions where their race still survives.

Near Verdun, late one evening, when I was looking over the ghastly desert back of Douamont—a land of slime-filled shell holes, with half-fallen wooden crosses and the flapping remains of old camouflage as the only relief from mud, I was surprised to see a fox creep across a line of irregular mounds which once had been a cozy, picturesque village.

Back of the lines, in the most miserable marshes and swamps, herons stood disconsolate, mudhens crept about, and ducks slithered down into the grassy water. In the centre of the fields, small covies of partridges cowered, or fed timorously; blackbirds called softly in the evening, between the boom and the kr-rump of distant guns. Whether seen from train, motor or aeroplane, the dominant bird-life of France, at least in winter seemed to be the flocks of rooks and crows, feeding in the fields or drifting in their curious massed flight through the air. Rooks were the birds most frequently encountered in mid-air. In late afternoon, I once found myself among fifteen or twenty of these birds at a height of forty-five hundred feet. I had not seen them until I was close, and they too were evidently surprised, as before I could dip and pass beneath and beyond them, several had been thrown wholly out of control by the suction of the propeller blades, rolling helplessly over and over, and only catching themselves when beyond the vibrations of this aerial maelstrom. There was certainly opportunity for gossip in one rookery of France that night, concerning the adventure which befell a mile above the earth.

The trim magpies of France, singly or in pairs, will always be associated with the ruined villages, the long straight roads lined with poplars, and the winter tilling of the fields. Their nests were difficult to distinguish from the bunches of mistletoe swung among the leafless branches, and they too were making themselves at home among the fresh ruins of farm-houses and erstwhile village streets.

I once lay flat in a trench looking up at a small wood, where a steady stream of machine gun bullets was hissing past, showering down a continuous rain of twigs, splinters and occasionally sprigs of mistletoe. Every five minutes a shell of some kind or another would rip off a branch, or bury itself in the earth; if a dud, to die with a single thud, or if fulfilling its destiny to explode and send a shower of roots, mold and splinters in every direction. If twenty sportsmen were seated in this small patch of woodland, shooting continuously and regardless of direction, the noise and disturbance could not have been greater, yet a party of three great titmice, a small woodpecker, a jay and a pair of wood pigeons came now and then within my field of vision, on the alert, obviously disturbed, but showing no inclination to cease feeding and escape at headlong speed, which would have been the instant reaction of any birds unused to this volcanic part of the world.

In the Tuileries Gardens in Paris, at midnight, at the height of the January raid, I saw



A BARRAGE OF HAIL STONES
A typical storm of hail in the Himalaya Mountains.

groups of wood pigeons sleeping peacefully through the excitement—heedless of the noise of planes and star-shells, shrapnel and mitrailleuse, sirens and bugles.

One of many interesting instances of birds close to the lines is that of the swans at Ypres. A chateau still nearer the Boche lines had been under intermittent fire literally for years. The building itself gradually became a mass of ruins, the woods were torn and splintered and the great moat became little more than a half-filled ditch. Yet a pair of swans continued to live here month after month, through gas shells which made masks absolutely necessary for a half hour at a time. Every soldier hereabouts knew of the birds, and the Anzacs especially never tired of feeding them. Their ultimate fate I never learned, but the marvel of their continued existence under such terrible conditions of gas, shrapnel and shell fragments will forever remain a mystery.

One of my last memories of the trenches had to do with a wild bird. Early one morning I was leaning against the soft mud of the back of the trench looking up at the strange sight of blue sky overhead, with half a dozen Nieuports and Spads swooping and rolling as if they felt the exhilaration of the crisp air in their canvas skins and spruce skeletons. Three poilus were near me, idly looking up, when suddenly all ducked and doubled over, then looked sheepishly at me and laughed. I saw the cause, but did not know enough, or rather stupidly knew too much, to follow suit. A house sparrow, or as we call it, an English sparrow, had flown up and over the parapet and alighted on the heaped sandbags piled at the back, and its sudden appearance was a close imitation of a hand-thrown grenade. I had had little experience with such missiles, but from my life work, I reacted instantly to the sight of the bird and did not give it a second glance. So there was no incentive to flinch as I should certainly have done, had I known what it might have been. To the soldiers, experienced in this sunken warfare, the appearance of any object from that direction meant death; but to me it was only a male house sparrow, still in the veiled winter plumage.

A KASHMIR BARRAGE OF HAIL

By William Beebe

Illustrations from photographs by the author.

IN battle we use such similes as, a storm of bullets, a rain of shells, but the strength of this comparison lies usually in the thoughtless acceptance of the figure of speech, rather than in any actual similarity. Once or twice in my life I have experienced natural storms which, in intensity and power of destruction, equalled any temporary hell which man, with the aid of gas or high explosive, has been able to achieve.

A month ago in Trafalgar Square, London, where there was literally a hail of shrapnel from the British anti-aircraft guns, there came to mind the most terrible hail-storm I have ever experienced, on the border-land between Garhwal and Kashmir, in the western Himalayas.

I was camped in a wonderful hanging valley with the last outpost dâk bungalow snuggled in the center, surrounded by a host of tall spired silver firs and deodars. Spring was at its height, and the open spaces were almost paved with a mass of white strawberry blossoms, with roses and pink-flowered raspberries



BOMBARDED BY HAIL
Flying squirrels killed in the storm.

in the underbrush. In the dense shade of the deodars were lilies-of-the-valley and great banks of maiden's hair fern. Birds were courting or building, or, as in the case of an impeyan pheasant which I had discovered, were already sitting on eggs.

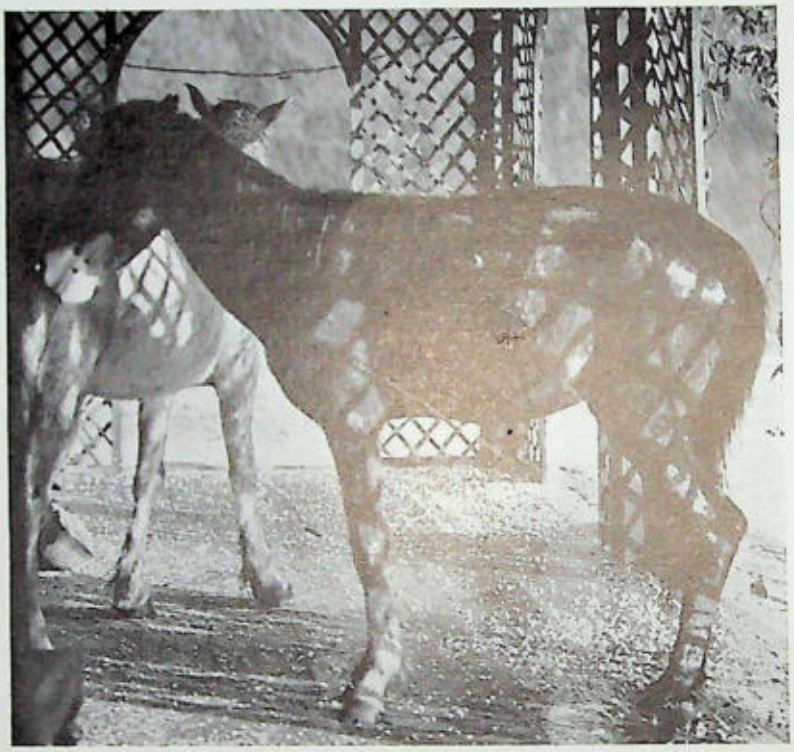
One day I surprised a troop of great grey langur monkeys in the act of robbing this nest, which fortunately I had already photographed. As I came along the slope, the marauders swung past me, old and young hurling themselves recklessly from spire to spire. Tree after tree shook and bent as in a terrific gale of wind; small dry branches crashed and splintered; cones, needles and twigs rained to the ground as the troop rushed by. The uproar which these banderlog creates has usually but little effect upon the lesser creatures of the forest. They well know the danger as well as the limitations of the four-handed folk.

But when this troop passed, quiet did not settle down. There was no wind, no movement of the needles. Even the ferns hung motionless. But there was a sinister undercurrent more potent than noise of elements. Something was about to happen, and not concerning any one animal, or in any one glade. The birds were restless and their notes were those of anxiety. Pheasants called in a way which they should not have done except in early morning; small creatures rustled here and there among the leaves. I picked up my gun and walked toward camp.

I crossed two bridges. Still no wind, but a sound of restless life everywhere, a tense uneasiness. And then came the climax, swiftly, mercilessly. From the Tibetan snow-peaks in the distance billowed a breath of cold air—icy, unfriendly—and a dark cloud swept across the sun. The mist grew thicker and closed down. The birds and forest creatures became silent as death, and for as long as two minutes the silence was oppressive. Then in the distance, dimly through the fog, the trees bent and straightened, the mist yellowed and a drop of



A SECURE RETREAT
Nest of a Babbler protected from the storm.



VERANDA OF A DÂK BUNGALOW
Horses seeking shelter from the hail.

rain fell. Finally came a sound as strange as any in the world, the noise of ice falling on flowers and leaves, a mitrailleuse volley of hail such as only the great Himalayas know.

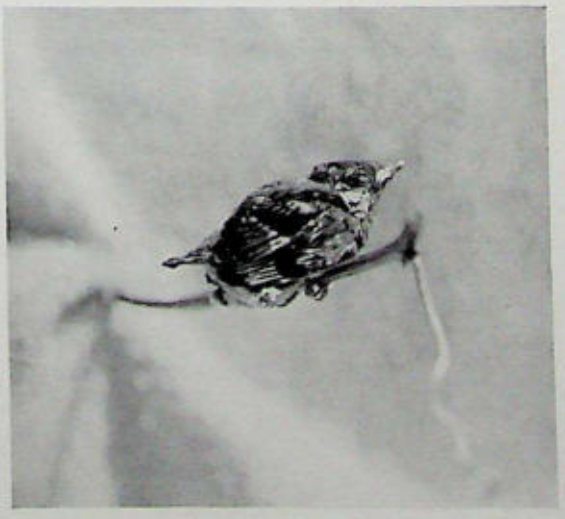
Lashed by the ice, our horses whinnied with pain and fright, and although wild mountain ponies, crowded close to us beneath the shelter of the dâk. They pushed in out of the downpour, and while they had been exposed only to the first, rather light, fall, yet their coats were covered with welts as if from blows of finely divided thongs of a whip.

After fifteen minutes of hail such as we are familiar with in the States, the stones grew larger and the downpour more furious, until the crash of falling ice dominated all other sounds. The floor of the valley became white and the hail-stones — now much larger than marbles — bounced and leaped high after their impact with the ground. I took several photographs which showed this, together with the flattening of the vegetation.

Leaves and whole fans of spruce needles were torn away and covered the bruised blossoms of the forest slopes. The air was a screen of straight lines, breaking near the ground into a maze of dancing, splintering crystal balls.

Before the bombardment ended I put out my hand, with the result that one stone struck my thumb and lamed it for three days. Without warning, the sun came out and made of the storm a translucent tapestry, through which the broken foliage was dimly visible. It was so wonderful, so unlike anything I had ever seen, that I forgot momentarily the terrible damage—the shredded foliage, the host of stricken nestlings and creatures which had not found a safe retreat. When the last missile had fallen I wondered whether the most hardy tenant of the forest had survived. And nature in mockery of my ignorance, having ceased her cruel torrent, sent out the frailest of frail butterflies, flickering its copper wings before me in the sun.

I found others which had not been so fortunate, and in one spot, beneath a thin-leaved bush were thirty-eight good-sized butterflies, with wings only slightly torn, but all killed and partly buried beneath a mass of jellied hail-stones. About fifty percent of the nests which I had under observation were destroyed, but some were preserved by overhanging banks. This was the



YOUNG TITMOUSE
Sole survivor of the brood killed by the hail.

case with a very beautiful babbler's nest, which with its three eggs was quite unharmed, sheltered in a niche, in the side of a steep grassy bank.

Not far away, behind a bit of loosened deodar bark, was a most delicate nest of a rufus-capped titmouse, with three dead and one unharmed young bird. Two big hail-stones had crashed down, one being wedged a few inches above the nest, while the other had fallen with full force into the mass of moss and pheasant feathers, and then slipped over the edge. The forlorn youngster, balancing himself on a bit of stick, looked as if life held out no hope of any kind, but at the chirp of his parents, he opened his eyes, and when I left him he had his mouth wide agape, begging as only infant birds can.

I found traces of many other tragedies, one of the most unexpected being the bodies of two giant flying squirrels. These splendid rodents, which weigh as much as five pounds and are sometimes over three feet in length, are not uncommonly seen in the dusk of evening, volplaning from trunk to trunk in these mighty evergreen forests. These had apparently been sleeping in a half hollowed out space behind some bark which had been torn away, and the ice had stunned and killed them before they could escape. Lizards were flattened on rocks and logs, and the total destruction of animal life must have been very great. Certainly no creature of small size had any chance if exposed to the full fury of the ice. A chicken in an open crate was so injured that we had to kill it.

Taken altogether, this Kashmir storm was the most severe one I have ever witnessed, and my servants would have had a bad time of it if they had not been able to reinforce the sloping walls of their tent and so keep under cover. As it was, great rents were torn in the canvas and the men were pretty badly frightened by the time it was all over.

The more immediate interest of this marvellously beautiful part of the world, and the significance of the danger to wild life from a storm such as that which I have attempted to describe, is enhanced for us by the fact that the in the Zoological Park there have been exhibited forty-nine species of living wild birds which inhabit these western Himalayas—Garhwal and Kashmir. These birds are as follows:

Himalaya Snow Partridge—*Tetraogallus himalayensis* Gray.
Chukar Partridge—*Caccabis chukar* Gray.
Bonham Rock Partridge—*Ammoperdix bonhami* (Fraser).
Gray Francolin—*Francolinus pondicerianus* (Gmel.).
Indian Hill Partridge—*Arboricola torqueola* (Val.).
Impeyan Pheasant—*Lophophorus impeyanus* Lath.
White-crested Pheasant—*Gennaeus albicristatus* (Vig.).
Cheer Pheasant—*Catreus wallichi* (Hard.).
Snow Pigeon—*Columba leuconota* Vig.
Blue Hill Pigeon—*Columba rupestris* Bonap.
Eastern Stock Dove—*Columba eversmanni* Bonap.
Indian Turtle Dove—*Turtur ferrago* (Evers.).
Spotted Turtle Dove—*Spilopelia suratensis* (Gmel.).
Hooded Vulture—*Vultur monachus* (Linn.).
European Goshawk—*Astur palumbarius palumbarius* (Linn.).
Lammergeyer—*Gypaetus barbatus* (Linn.).
Golden Eagle—*Aquila chrysaetos* (Linn.).
Imperial Eagle—*Aquila heliaca* Savign.
Booted Eagle—*Eutolmaetus pennatus* (Gmel.).
Indian Crested Eagle—*Spizaetus nipalensis* (Hodgs.).
White-tailed Eagle—*Haliaetus albicilla* (Linn.).
Peregrine Falcon—*Rhynchodon peregrinis peregrinus* (Tunst.).
Great Himalayan Barbet—*Megalaema marshallorum* Swin.
Blue-cheeked Barbet—*Cyanops asiatica* (Lath.).
Northern Golden-backed Woodpecker—*Brachypternus aurantius* (Linn.).
Streaked Jay-thrust—*Trochalopterum lineatum* (Vig.).
Slaty-headed Scimitar Babbler—*Pomatorhinus schisticeps* Hodgs.
White-headed Jay-thrush—*Garrulax leucolophus* Hard.
White-throated Jay-thrush—*Garrulax albigularis* (Gould).
Striated Jay-thrush—*Grammatopelia striata* (Vig.).
Red-billed Wren-babbler—*Stachyridopsis pyrrhops* (Blyth).
Himalayan Whistling Thrush—*Myiophoneus temminckii* Vig.
Black-capped Sibia—*Lioptila capistrata* (Vig.)
Gray-winged Blackbird—*Merula boulboul* (Lath.).
Small-billed Mountain Thrush—*Oreocichla dauma* (Lath.).
White-capped Redstart—*Chaimarrornis leucocephala* Vig.
Green-backed Titmouse—*Parus monticola* Vig.
Large Pied Wagtail—*Motacilla maderaspatensis* Gmel.
Himalayan Goldfinch—*Carduelis caniceps caniceps* Vig.
Himalayan Siskin—*Hypacanthis spinoides* (Vig.).
Eastern Linnet—*Acanthis cannabina fringillirostris* (Bonap. & Schleg.).
Eastern Meadow Bunting—*Emberiza cia stracheyi* Moore.
Indian Golden Oriole—*Oriolus kundoo* Sykes.
Red-billed Blue Magpie—*Urocissa occipitalis* (Cab.).
Wandering Tree Magpie—*Dendrocitta rufa* (Scop.).
Himalayan Jay—*Garrulus bispecularis* Vig.
Lanceolated Jay—*Laletes lanceolatus* (Vig.).
Chough—*Graculus graculus* (Linn.).
Alpine Chough—*Pyrrhocorax alpinus* Vieill.

BIRD LIFE OF A BIG CITY

Wild Birds of the New York Zoological Park and Immediate Vicinity

By Lee S. Crandall

CITY dwellers frequently are heard to bemoan the scarcity of birds in the vicinity of their homes. It is true that in the more densely populated districts, bird life is represented chiefly by house sparrows and starlings. But even in New York, as one approaches the suburbs, birds increase in variety and numbers. Central Park, most urban of sanctuaries, is famous for the unusual birds which find haven there, particularly during migrations.

The Zoological Park, surrounded on three sides by crowded apartment houses, retains much of its pristine wildness and provides excellent sport for those who hunt with the field-glass. The appended list names 158 species of wild birds that have been identified within our limits, or very close at hand. A number of others doubtless are occasional visitors and may at any time be added, but only those actually observed have been included.

Successful study of birds in the field depends greatly on the season. Many birds which do not nest in the Park pass through in spring and autumn, going to or from their breeding grounds. May is the harvest month of the bird student. The spring migration then is at its height and as the birds are in full song and color, they are more readily detected and identified.

After the vernal host has pushed northward, those species which elect to remain with us seek nesting sites. During the process of building, the characteristic songs often indicate the homes of each pair. But after the eggs have been laid and when the young have hatched, the parents become more secretive and their presence may be unknown to all but the most keen-eyed observer.

The return southward after the nesting season has ended is a more straggling affair, and endures from mid-August until November. The males of many species then have lost their nuptial plumage and their songs. Many young birds, generally in the dull coats of youth, are added to the throng. The autumn migration has nothing of the care-free casualness of the spring journey. In October, one comes on a flock of warblers, that in spring might well rival the butterflies in brilliancy of color and grace of movement. Now, in their sombre plumage, they are not easily detected, and only their flitting forms and sibilant call-notes betray their presence. They move rapidly from tree to tree, searching for insects as they go, with a grim haste that is in sharp contrast to their easy-going ways in the pleasant days of spring.

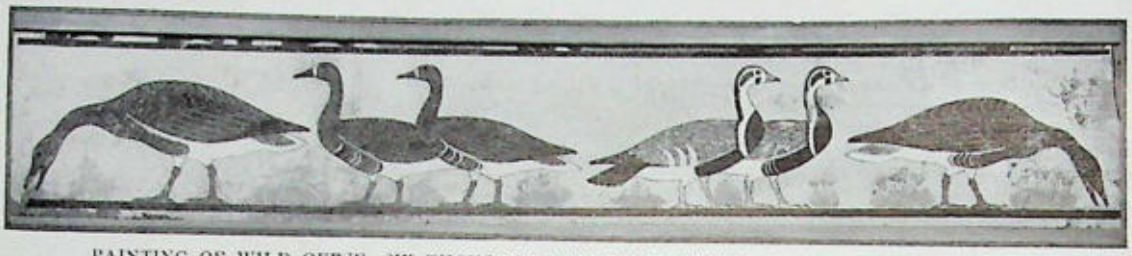
After the last of these travellers has passed southward on its romantic quest, we find the shrubbery and stubble repopulated by flocks of quietly-colored birds, even less obtrusive than those they have supplanted. These are the hardy winter residents, which have come from their northern homes to pass the winter in a climate only slightly less rigorous. It is they that visit our feeding stations, depending on our bounty to eke out the supply of weed seeds and dormant insect life. Thus there is no season when birds are entirely absent, and the persevering observer can always find some reward for his efforts.

In the Zoological Park, we have a still further supply of wild life. This consists of a number of kinds of birds which although not normally included in our fauna, we have successfully colonized at liberty. These are the mallard, black and wood duck, black-crowned night heron, Barbary turtle dove and mourning dove. Occasionally, one is treated to the sight of a pair of Canada geese, honking as they pass overhead in superb flight. All of these species are now well established and have become permanent additions to our bird life.

Wild Birds of the New York Zoological Park and Immediate Vicinity.

Pied-billed Grebe (occasional transient visitor).
Herring Gull (winter resident).
Mallard Duck (permanent resident; breeds).
Black Duck (permanent resident; may breed).
Baldpate (occasional transient visitor).
Green-winged Teal (occasional transient visitor).
Blue-winged Teal (occasional transient visitor).
Shoveller (occasional transient visitor).
Pintail (occasional transient visitor).
Wood Duck (permanent resident; breeds).
American Bittern (transient visitor).
Great Blue Heron (rare transient visitor).
American Egret (rare transient visitor; one record).
Green Heron (summer resident; breeds).
Black-crowned Night Heron (permanent resident; breeds).
Virginia Rail (transient visitor).
Sora Rail (transient visitor).
American Coot (transient visitor).
American Woodcock (transient visitor).
Least Sandpiper (transient visitor).
Semipalmated Sandpiper (transient visitor).
Greater Yellow-legs (transient visitor).
Yellow-legs (transient visitor).
Solitary Sandpiper (transient visitor).
Spotted Sandpiper (summer resident; breeds).
Killdeer (transient visitor).
Bobwhite (permanent resident; breeds).
Ring-neck Pheasant (permanent resident; breeds).
Mourning Dove (permanent resident; breeds).
Turkey Vulture (occasional summer visitor).
Marsh Hawk (summer resident; may breed).
Cooper Hawk (summer resident; may breed).

Sharp-shinned Hawk (summer resident; may breed).
American Goshawk (occasional winter visitor).
Red-tailed Hawk (occasional transient visitor).
Red-shouldered Hawk (occasional transient visitor).
Broad-winged Hawk (occasional transient visitor).
Bald Eagle (rare transient visitor; one record).
American Sparrow Hawk (permanent resident; breeds).
Long-eared Owl (occasional winter visitor).
Short-eared Owl (occasional winter visitor).
Barred Owl (winter visitor).
Saw-whet Owl (winter visitor).
Screech Owl (permanent resident; breeds).
Yellow-billed Cuckoo (summer resident; breeds).
Black-billed Cuckoo (transient visitor).
Belted Kingfisher (summer resident; breeds).
Hairy Woodpecker (occasional winter visitor).
Downy Woodpecker (permanent resident; may breed).
Yellow-bellied Sapsucker (transient visitor).
Red-headed Woodpecker (rare transient visitor).
Northern Flicker (summer resident; breeds).
Nighthawk (summer resident; may breed).
Chimney Swift (summer resident; breeds).
Ruby-throated Hummingbird (summer resident; breeds).
Kingbird (summer resident; breeds).
Crested Flycatcher (summer resident; breeds).
Phoebe (summer resident; breeds).
Olive-sided Flycatcher (transient visitor).
Wood Pewee (summer resident; breeds).
Yellow-bellied Flycatcher (transient visitor).
Least Flycatcher (summer resident; breeds).
Horned Lark (rare winter visitor).
Prairie Horned Lark (rare winter visitor).
Blue Jay (permanent resident; breeds).
American Crow (permanent resident; breeds).
Fish Crow (permanent resident; breeds).
Starling (permanent resident; breeds).
Bobolink (transient visitor).
Cowbird (summer resident; breeds).
Red-winged Blackbird (transient visitor; breeds nearby).
Meadowlark (transient visitor).
Orchard Oriole (transient visitor).
Baltimore Oriole (summer resident; breeds).
Purple Grackle (summer resident; breeds).
Bronze Grackle (transient visitor).
Evening Grosbeak (rare winter visitor; two records).
House or English Sparrow (permanent resident; breeds).
Purple Finch (transient visitor).
Redpoll (transient visitor and occasional winter resident).
American Goldfinch (permanent resident; breeds).
Pine Siskin (transient visitor and occasional winter resident).
Snow Bunting (rare winter visitor).
Vesper Sparrow (transient visitor).
Savannah Sparrow (transient visitor).
White-crowned Sparrow (occasional transient visitor).
White-throated Sparrow (winter resident).
Tree Sparrow (winter resident).
Chipping Sparrow (permanent resident; breeds).
Field Sparrow (summer resident; breeds).
Slate-colored Junco (winter resident).
Song Sparrow (permanent resident; breeds).
Swamp Sparrow (summer resident; breeds).
Fox Sparrow (transient visitor).
Rose-breasted Grosbeak (summer resident; breeds).
Towhee (summer resident, occasional in winter; breeds).
Indigo Bunting (summer resident; breeds).
Scarlet Tanager (summer resident; breeds).
Barn Swallow (summer resident; breeds).
Tree Swallow (transient visitor).
Cliff Swallow (transient visitor).
Cedar Waxwing (transient visitor).
Northern Shrike (occasional winter visitor).
Migrant Shrike (occasional transient visitor).
Red-eyed Vireo (summer resident; breeds).
Warbling Vireo (summer resident; breeds).
Yellow-throated Vireo (summer resident; breeds).
Blue-headed Vireo (transient visitor).
White-eyed Vireo (summer resident; breeds).
Black-and-white Warbler (summer resident; breeds).
Worm-eating Warbler (transient visitor).
Blue-winged Warbler (summer resident; breeds).
Golden-winged Warbler (transient visitor).
Lawrence Warbler (rare summer resident; one breeding record).
Nashville Warbler (transient visitor).
Tennessee Warbler (transient visitor).
Northern Parula Warbler (transient visitor).
Yellow Warbler (summer resident; breeds).
Black-throated Blue Warbler (transient visitor).
Myrtle Warbler (transient visitor; occasional winter resident).
Magnolia Warbler (transient visitor).
Chestnut-sided Warbler (transient visitor).
Bay-breasted Warbler (transient visitor).
Black-poll Warbler (transient visitor).
Blackburnian Warbler (transient visitor).
Black-throated Green Warbler (transient visitor).
Pine Warbler (transient visitor).
Yellow Palm Warbler (transient visitor).
Oven-bird (summer resident; breeds).
Water-thrush (transient visitor).
Louisiana Water-thrush (uncommon, transient visitor).
Connecticut Warbler (transient visitor).
Mourning Warbler (transient visitor).
Northern-breasted Chat (summer resident; breeds).
Hooded Warbler (transient visitor).
Wilson Warbler (transient visitor).
Canadian Warbler (transient visitor).
American Redstart (summer resident; breeds).
American Pipit (transient visitor).
Mockingbird (occasional visitor).
Catbird (summer resident; breeds).
Brown Thrasher (summer resident; breeds).
Carolina Wren (occasional transient visitor).
House Wren (summer resident; breeds).
Winter Wren (transient visitor).
Brown Creeper (winter resident).
White-breasted Nuthatch (permanent resident; may breed).
Red-breasted Nuthatch (occasional winter visitor).
Chickadee (transient visitor and occasional winter resident).
Golden-crowned Kinglet (transient visitor and occasional winter resident).
Ruby-crowned Kinglet (transient visitor).
Wood Thrush (summer resident; breeds).
Wilson Thrush (summer resident; breeds).
Gray-cheeked Thrush (transient visitor).
Bicknell Thrush (transient visitor).
Olive-backed Thrush (transient visitor).
Hermit Thrush (transient visitor).
American Robin (summer resident; occasional winter resident; breeds).
Bluebird (summer resident; breeds).



PAINTING OF WILD GEESE, SIX THOUSAND YEARS OLD—FRIEZE FROM AN EGYPTIAN TOMB

THE EVOLUTION AND DESTRUCTION OF LIFE

By William Beebe
Curator of Birds

I. Future Evolution

ABOUT six thousand three hundred and seventeen years ago a very excellent bird artist painted the above frieze of wild geese upon a tomb in Egypt. There are three species, and with such care were the birds delineated that every marking is distinct today, and we realize that the geese which are now spending the winter on the Nile are the selfsame species as those which were trapped by the Egyptians of the earliest dynasties. To us this period seems long; but let us multiply it a score of times, back to the life-time of the birds whose fossil bones we now find in caves, and we realize that even one hundred thousand years ago, many birds differed little or not at all from their living descendants of today.

Farther back than this we need not go, although even eight or nine millions of years will but take us to bird-like creatures which were volplaning through the air on feathers as perfect as any we know. The main thought is that all the emphasis of evolution of the animal world is necessarily laid on past time. Upheavals and cataclysms there have been; whole faunas wiped out by ice, by volcanic fire, perhaps by parasites. But always there was a new starting point; a continent from which the barren places could be repopulated. Always there was final cessation of the devastation; ultimate freedom for healthful competition; room for new races to be run.

The present, philosophically speaking, has no meaning for us. It is better to consider it as a temporal vanishing point, an impalpable eddy in the stream of life, itself composed of the inwhirling current of the future, passing out unceasingly into the slack water of past time.

In the distant past, then, all the organic evolution of which we are cognizant has taken place. The more immediate past—the historical—is barren. The present is so fleeting we can ignore it. The future is hopeless. Man has come and man has conquered, and already we see foreshadowed the beginning of the end in the hemming in of wild life in preserves, and in the ceaseless legal warfare over the actual existence of many wild creatures.

Until two scant centuries ago the scattering of red men over North America could hardly have interfered with any mutation or other variational change of the fauna. Today, only a fraction of the wild life survives, with absolutely no chance ever again to give rise to any new types, unless in forms like the house sparrow, degenerately parasitic on civilization. Throughout the Far East the Mongolian hordes are already brimming over, settling on neighboring lands and islands, and clearing off the jungle. The wild life of whole districts is being wiped out that we may have tires for our automobiles. Our head-lines flare when one of our own kind is run down in the crowded streets of our cities; no one gives a thought to the small folk of the jungle whose whole race has been blotted out by the inception of these resilient rubber rims of juggernaut.

The historian finds the future of absorbing interest; the morrow holding inexplicable surprises. In the evolution of the Mexican people, *mañana* may yield a renaissance or a cataclysm. But in spite of all the wonderful adaptations of the classic Mexican axolotl—that versatile salamander christened by the Aztecs—its race is run. It can live the life of a fish, swimming and breathing with gills; or it can become a land creature with ambulatory limbs and lungs, and produce its offspring under either condition. But its only concern at present is with life itself. Its hope now is not for progress, but for a few more years of mere existence.

We cannot consider our domestic animals. We may breed cows which will produce astounding quantities of milk; hens may lay two eggs a day; unheard-of monstrosities in the way of fancy pigeons may come into existence. But

this is not evolution. These are merely unstable toys of man; living but artificial; parasitic puppets which have no existence apart from yard or cote. Even the semi-feral rat who gnaws his way into our cold storage warehouse and there in course of time grows a longer coat of fur, can hope for nothing. In a hundred generations his brood would perhaps begin life less naked than today. But in five generations the cold-storage warehouse will have become so important a feature in the hoarding of food for hungry masses of humanity that it will be rendered rat-proof. Even a long-haired race of rats is a futile hope!

The only reason why the splendid wild creatures of the earth have held their own as well as they have, is because man in his travels has hitherto been confined to practically two planes of space. We see what incomparable success has been given to the world of insects and of birds by flight. Rising physically, the one above their worm-like ancestors, the other soaring over their reptilian forebears, without strength or weapons they have outstripped all other creatures and today divide the earth with mankind; at once his best friends and his most dangerous enemies. Our imagination readily pictures the future when the very few years have passed which separate us from complete success in this aerial field (today our very language is still of the earth, earthy!) Then, the most isolated of nesting haunts and the uttermost routes of migration will be bared to the commoner—the aerial pot-hunter. The farthest recesses of New Guinea mountains and of Brazilian jungle will be tragically accessible to man. And with the entering of mankind into the third plane of space, earth will wholly cease from her age-old, epoch-slow unrolling of the glories and mysteries of terrestrial organic evolution.

Earth will cease, I said,—I should have said dry land, for just beyond low tidal mark, nature will still defy mankind. And in these icy, silent, lightless ocean depths, life will still be undisturbed. Thousands of air-ships will come slowly sinking through the blue water overhead, but only to form a resting place, for a brief season, for barnacles and worms; then to dissolve to ooze.

This is a brief of the more distant future. For the present we should redouble our efforts to preserve at least the nobler animals and birds for a few generations.

II. Destruction

A period of seventeen months spent in Asia and the East Indies studying the life-histories of wild pheasants, left me with a decidedly pessimistic outlook as regards even the more immediate future of these splendid birds. I realized that even if I repeated the trip at once there were some which I should not be able to see again. The agencies working against the various pheasants were multiple and cumulative, and all had to do, directly or indirectly, with the changes wrought by the invading Caucasian, or at least the influence of his habits, weapons and diet.

In India and Burma, where for untold generations the law of the ancient religions has been kind to the life of wild creatures, there is, in the more out of the way places, a slackening of this gentle religious feeling. With the increase of sportsmen, and the disregard of Sahibs in general for the wild creatures, there has been diffused a conscious, or unconscious laxity, hardly noticeable to the casual onlooker, but discernable when away from the more densely populated centers. In some isolated districts this takes the form of wholesale trapping, the indirectness of this mode of taking life serving to gloss over the ultimate result. Thus also do the fishermen of some of the southern coasts keep faith with themselves and their belief. They cast their nets and enmesh whole schools of fish, but then hasten with them to the beach, and gently and considerately lay their catch upon soft grass and moss. Later, when the fishermen return, they express a naïve surprise to find that the fish have expired, when of course they are available for food with not the slightest infringement of the law. If this disregard for tradition should ever become more widespread it would work havoc with the trusting peafowl and junglefowl which scream and crow near the villages, and the kaleege which fatten on the crops of rice and barley.

In the Malay States and elsewhere another factor becomes apparent. One may ride for mile after mile and, instead of primeval jungle, see nothing but hundreds of thousands of spindling rubber trees, sprouting from raw, fresh earth with no hint of the marvelous fauna and flora, the orchids, the birds, the four-footed creatures of the deep jungle, which peopled this land shortly before. This is as it should be; man is stronger and is inheriting the earth, but it is sad to see the age-old course of things so suddenly, so blatantly interrupted. The call of the fireback and the wonderful cry of the argus never resound among these saplings, planted with mathematical accuracy and cherished with the care which a lucrative future demands.

Wherever the Englishman holds sway, there the pheasant gets fair play and a chance for the

life of the species. But the plumage hunter runs riot in Nepal and Yunnan. I have seen valley after valley despoiled of their one or two pairs of magnificent resident tragopans; and only to beguile the days of a lowly Nepalese shepherd, without caste, but with all the time in the world to make snares. In Burma the terrestrial birds and animals of a valley are sometimes completely wiped out by a half-mile bamboo fence, punctuated every few yards with dead-falls.

Even in China, where for unnumbered years the pheasants have taken their moderate toll of rice and repaid with the compound interest of an insect diet the rest of the year,—even there changes are at hand. With the more or less successful adoption of foreign hats and garments, seems to have occurred a yearning of the inner man for change, from rice and fish to pheasant flesh. And in many parts of the Celestial Republic the birds are paying heavy toll to this demand. Not only this, but tens of thousands of pheasants were being sent up and down the rivers to huge cold storage warehouses, to be frozen and sent to European restaurants.

A new, wholly unexpected change has now come to pass, and the terrible history being made in Europe will mean a new, however brief, lease of life to the creatures of the Eastern jungles. The capital necessary for many of the rubber plantations will not be available. The demand for this product and for the luxury of frozen pheasants will lessen. The milliner will be unable to sell his ill-gotten wares, and the pressure of caucasian commercial influence will lighten everywhere. Hundreds of intended clearings will be abandoned, projected buildings will be deserted and the voice of the wild pheasant — the firebacks, the monal, the koklass, the argus, the golden and the silver, will, for a time, increase in volume throughout the jungles of the Far East. It may, however, be the last pause in the slow, certain kismet which can only result finally in the complete extinction in the wild state of these splendid but intolerant birds.

ITEMS OF INTEREST

Zoological Park

By Raymond L. Ditmars

The Beaver Colony.—The most definite change of habits from the cold seasons to the warm ones, may now be noted among our beavers. Last fall these intelligent and industrious animals collected a large amount of food-wood and built what appeared like an elaborate levee, extending about twenty feet from their mound-like home. They were constantly diving and lacing the long branches under water in constructing this levee of brush, and it was evident that their intention was to prepare a supply of bark for winter food that could be reached beneath the ice.

During the mid-winter months they made under-water trips to the larder, and as the ice melted during March, the brush structure was rapidly consumed. The food levee has now disappeared, and the beavers are at work reconstructing their house for warm weather. The interior living room has been enlarged by the removal of the many pieces of food-wood and these have been taken downstream to the dam.

Work on the dam now is an all-day task, as the house interior is made larger. As the beavers' inflexible rule is that the entrance must be kept submerged and hidden, it necessitates elevating and broadening the dam to raise the water level of the spring-fed lake in which the house is situated. The best time to see the beavers at work on the dam is about four o'clock in the afternoon.

A Test in Acclimatization.—Our exhibit of coypu rats is a good example of the possibilities of acclimatization. These large, aquatic rodents inhabit Central America and represent typical animals of the tropics. They are hardy as captives, and we determined to experiment with them under outdoor conditions during the winter. They were provided with a cement shelter house with a wooden floor and a vestibule, or similar device, to exclude the wind. These animals were abroad during the coldest days of the winter. The keepers kept the ice broken in one corner of their inclosure and the writer several times watched them diving through the small opening and remaining under the ice several minutes. Emerging from this chilling bath they would roam over the ice and nibble at the branches of willow and birch in as complacent a fashion as during warm weather. They were abroad as usual during the severe cold periods, when the temperature registered from two to six degrees below zero.

Exhilarating Spring.—There is a joyous exodus of the tropical hoofed animals from their stalls to the yards with the beginning of the warm weather. After about five months confinement in the stalls, the removal of the storm doors, and the first sight of green foliage outside brings much capering and rushing about the yards. It is difficult, in fact, to induce the animals to return to the building at the close of the afternoon.

A Timid Giraffe.—Despite the rejoicing of the other animals in the Antelope House and the Small-Deer House, the giraffe continues—after two years of eccentric behavior—to accept the invitation of sunshine and fresh air with great reserve. During the first year that this animal was on exhibition, he persistently refused to leave his stall, although he would gaze wistfully through the door in a fashion that made him appear a spectacular picture in a huge frame. It was necessary to break him to halter last summer and forcefully lead him into the yard. Once outside, he was quite contented. The trouble appeared to exist in the doorway, although this was of ample height and width and the runway had been given a very gradual slope by filling and banking with cement. During the first ten days of the present spring that the stall door has been open, he has gone out in the yard but three times. This is disappointing, as we thought the long winter would eliminate that lurking suspicion of the dangers that might be encountered in passing the door.

The Capering Lamb.—It is particularly interesting just now to spend some little time watching the infant aoudad on Mountain Sheep Hill. There are four of these lively babies—the twins in the extreme southerly corral, and youngsters that appeared within the same week in the adjoining yard. The aoudad is a wild sheep of the Barbary States and inhabits semi-desert mountains of steep slopes and huge rocks. They are extremely agile in climbing and the parents induce the lambs to begin mountaineering when the latter are but a few days old. The lambs are plucky and ambitious. The mother leads them over the rocks in a fashion that brings slips and falls, but the nimble little animals persistently keep at it. Their antics are so interesting and amusing that crowds of visitors often collect in front of the corrals.

Park Liberty Loan.—The Zoological Park employees have gone "over the top" with a subscription of $8,000 to the Third Liberty Loan, as compared with $7,000 for the First Loan and $4,250 for the Second Loan. This makes a total subscription of $19,250 from our men for the three loans.

The Park appears to be a favorite visiting place for our soldiers and sailors and on crowded Sundays there is a decided martial aspect. Platoons of sailors carrying their rifles, have visited the Park; going through the buildings in squads. Among our visitors are British and Canadian soldiers, men in blue from France, and recently the Anzacs have visited the Park. These Australian and New Zealand soldiers have been interested particularly in our large exhibits of mammals, birds and reptiles from their home country.

War-Time Plantings.—With the beginning of the planting season and the continued need of thorough and systematic food conservation, the farming work of the past year has been extended and elaborated, and is now in full swing. The areas under cultivation include the entire Elk Range, a large portion of the Wild Horse Paddocks, the Play Ground and extended portions of the Nursery. At this early part of the season, the hoofed animals already are receiving cuttings of rye that was sewn last fall.

Our New Chimpanzee.—We have purchased an exceptionally large and fine female chimpanzee. This ape weighs 138 pounds, and is unusually interesting in having been educated to perform various amusing tricks. She dines at a table, and is particularly adept in handling dining utensils. The most startling part of her exhibition is the smoking of a cigarette—and a particularly mild brand (cubeb) is kept on hand for her morning and afternoon exhibitions. Our collection of great apes was never more interesting. It now comprises four chimpanzees, two orang-utans and a white-handed gibbon.

Park Guards.—The military company of the Zoological Park, which is a part of the New York Police Reserves, 53d Precinct, continues its drills and remains at a high state of efficiency in readiness for emergencies. The Police Reserve of New York City has just been reorganized along more disciplinary lines by Special Deputy Commissioner Rodman Wanamaker, and but recently the captains were called to Police Headquarters for examination as to military and administrative fitness. The Zoological Park Company within two weeks' time has appeared in exhibition drills at the 13th Regiment Armory, Brooklyn, and the 22d Regiment Armory, Manhattan. Five regiments were assembled on each occasion and the men were reviewed by the Mayor, Police Commissioners and other noted guests. The company also marched in the Liberty Loan parades and a position has been assigned in the Police Parade. Under the new order of units of the Police Reserve, the Park company is now designated as Company H., Battalion D., Seventh Regiment.

The Gentle Wolf.—One of our timber wolves is rearing a lively family of five puppies. The young wolves are as playful and friendly as dogs, and their very proud mother permits them to be petted.



Photograph by Herbert Lang

TYPICAL HABITAT OF THE OKAPI

Its favorite haunts are the higher, more open forests, where the big trees reach an average height of one hundred and fifty feet, and not the swampy, impenetrable stretches that are traversed as a rule only on well beaten tracks.

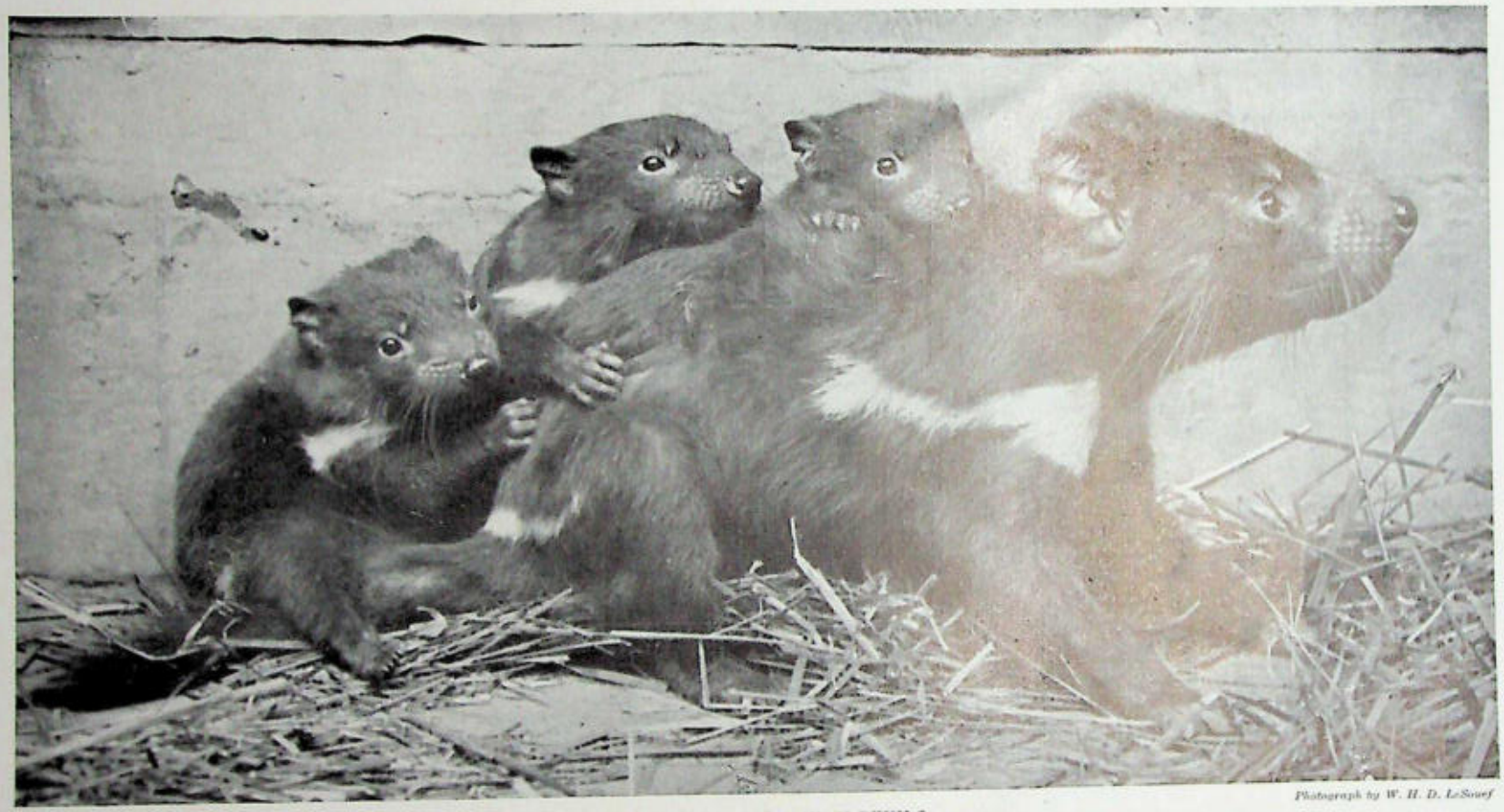
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Photograph by W. H. D. LeSouef

A FAMILY OF TASMANIAN DEVILS

Apparently this rather forbidding animal has received its name partly from its color, and partly from its savage temper and strength of jaw. It breeds in captivity and frequently is seen in collections of living animals.

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WILD LIFE PRESERVATION AND EXTINCTION IN AUSTRALIA

By W. H. D. LE SOUEF,
Director, Zoological Gardens, Melbourne.
Author "The Mammals of Australia," "Wild Life of Australia," etc.

AUSTRALIA is a large country, approximately 2,000 miles square, and is very sparsely populated, therefore although good laws exist for the protection of native game, it is very difficult to see that they are enforced in the thinly populated districts. For example, Queensland has an area of 670,000 square miles, but its population is only about 190,000 whites, and approximately 9,000 aborigines. New South Wales is better, having an area of 309,460 square miles and a population of 1,847,214. Victoria has an area of only 87,884 square miles, but has a population of 1,397,977, so is considerably more dense than the other States. South Australia consists of 380,070 square miles and has 433,616 people, but Western Australia has the large area of 975,920 square miles and a population of only 308,806.

The Northern Territory also is a large district, consisting of 523,620 square miles, and inhabited by only 4,767 people, excluding natives. The island of Tasmania has 26,215 square miles, with a population of 199,925.

In glancing over these figures one can easily realize the difficulty in fully enforcing game laws. The only way that native animals surely can be preserved for those that come after us is to form reserves in various types of country. This is being done in many of the States, but only to a limited degree at present, because the subject is a difficult one. Introduced foxes and domestic cats that have gone wild, to say nothing of rabbits, cannot well be kept out of these reserves. The foxes and cats prey on the protected game, and the rabbits destroy the native grass and shrubs that it is sought to preserve. Of course, these animals are not all over Australia yet, but they certainly will be in course of time, despite fences, and we cannot possibly estimate the havoc they will play with the ground game and waterfowl. It is quite possible that some species will become extinct before we realize it.

Then again, parts of Australia are subject to severe droughts, and thousands of small animals, as well as birds and kangaroos, perish. And emus cannot migrate as they used to do, on account of fences and settlements. The sheep and cattle help to denude the country and drain the waterholes. Therefore, in some districts where certain forms of life formerly were in evidence, none are seen now. Take as an example, about fifty miles inland from Rockhampton in Queensland. There the beautiful parrakeet, (*Psephotus pulcherrimus*) was fairly plentiful, but since the drought in 1896 not a bird has been seen in the whole district. The pig-footed bandicoot was comparatively common in the southern districts of Australia, but now one is rarely, if ever, found.

Gilbert's rat-kangaroo, (*Potorous gilberti*), of South West Australia, apparently is extinct. The so-called native cat, (*Dasyurus*) was exceedingly plentiful in Victoria, but now they are just as scarce as they once were plentiful. It is difficult to say why these various animals have almost disappeared. Of course the settlements and what they bring with them might account for a good deal, but certainly not for all. We really know little as to the unaccountable disappearance of small mammals in districts

where they were numerous, and when we wake up to the fact they have gone, it is usually too late to take measures of protection. Probably the same thing occurs in America and elsewhere.

The introduction of foxes into Australia by private persons is bound to cause the destruction, and possibly, extinction, of certain ground game. Inasmuch as much of the country has been cleared of scrub, the game does not have the same cover that it had formerly. The animals that live in burrows probably will hold their own longer than those that make their nests on the surface. Tasmania, being of comparatively small area, is sure to lose the marsupial wolf or thylacine before long, as the dense brush is cleared and the country becomes more thickly settled. Even now it is scarce, and the settlers snare and destroy it whenever they get the opportunity. The Government has lately established a large reserve for it near Hobart.

In Queensland there are ninety-two Honorary Rangers, and that State is trying to protect its animal life, but having so much sparsely populated country it is difficult. In the near future, they probably will convert more crown land into reserves. So far only four have been made for animals and fifty-two for birds. It is now under consideration to take up the subject of the exportation of the skins of Australian native wild animals, and to place this important matter on a proper basis. It probably will be under the control of the Commonwealth Government, and further efforts will then be made to preserve our fast disappearing fauna. In every country there are what are popularly called "game hogs," heedless men as well as thoughtless boys, who seek to destroy the fauna of the country for their own individual benefit, and with no thought for posterity, or whether they are exterminating the fauna or not. Simply for what they call "sport," they carelessly destroy all they can, making little use of what they do kill. Persons of this class always are with us, more or less.



A. D. Hardy, Comp.

AUSTRALIA: GREAT BRITAIN'S SOUTHEASTERN EMPIRE

The development of Australia outruns the imagination. How many Americans know that a great transcontinental railway now links Brisbane, Sydney and Victoria with far-distant Perth and Western Australia? Notwithstanding her tremendous outpouring of men, munitions, ships and money for the war, Australia is vigorously maintaining her chain of zoological gardens, and a remarkable series of sanctuaries for the preservation of wild life.



Photograph by W. H. D. LeSouef

A TYPICAL FOREST IN THE PROVINCE OF VICTORIA, AUSTRALIA

This home of the beautiful Tree Fern is also the favorite haunt of the now rare Lyre Bird, the Black-Tailed Wallaby, Yellow-Breasted and Rose-Breasted Robins, Giant Kingfisher and Giant Earthworm. "Fern gullies always are delightful places to visit on a hot day."

DIRECTOR LE SOUEF AND THE AUSTRALIAN FAUNA.

In length and breadth of departure from the recognized standards of mammalian anatomy and physiology, the mammals of Australia are, per capita, the most odd and remarkable of any continental group. With the exception of the dingo, a few rodents and bats, all those species that do not lay eggs are marsupials, and carry in the abdominal pouch the astoundingly minute newly-born young until it grows to a size fit to take a small place in the outer world. A newly-born kangaroo cannot possibly be appreciated by a stranger until it is seen.

The Australian marsupials display a remarkable line of radiating development that is quite inexplicable to zoologists. This relates to the production of forms within an order, that strikingly parallel in external appearance the characteristic forms of members of various orders of mammals. It would appear as if the scheme of evolution among the Australasian marsupials tended to produce an aggregation of pouched mammals that in form and habits would cover the strange absence of other orders. The Tasmanian "wolf" may be cited as an example and the ant-eating echidna, with its porcupine-like quills, as another. There are carnivorous, fox-like phalangers, marsupial "mice," the wombat—in form and habits like a gigantic woodchuck, and the flying phalanger, which latter animal is precisely like a flying squirrel in form and actions. Yet more remarkable is a marsupial mole.

The New York Zoological Park always has been rather strong in Australian mammals. They are so universally interesting as to be irresistible. Our Australian collection is now very rich. As a contribution to public interest in these strange creatures from the continent wherein Nature has done everything differently, the distinguished Director of the Melbourne Zoological Gardens has been prevailed upon to write a series of short popular

sketches of the Australian species now or recently exhibited here, and illustrate many of them with photographs taken by him in Australia.

Mr. Le Soeuf is a man of charming personality and successful habit. He visited and lectured in America about eight years ago, and thereby greatly strengthened the bonds of interest between the zoologists of his country and ours. He is the author of books on the wild life of Australia that are at once deeply interesting and thoroughly reliable. The titles of those best known are "Wild Life in Australia" (London, 1907), and "The Animals of Australia," by A. H. S. Lucas and W. H. Dudley Le Souef (London, 1909).

This collection of sketches will be followed by another in the issue of the BULLETIN *for September, which will illustrate the most interesting kangaroos, phalangers, marsupial mice and others.—W. T. H.*

AUSTRALIA'S MOST REMARKABLE MAMMALS

BASED ON THE COLLECTIONS OF THE NEW YORK ZOOLOGICAL PARK

By W. H. D. LE SOUEF

Director Zoological Gardens, Melbourne

Author of "The Mammals of Australia," "Wild Life of Australia," etc.

THE ECHIDNA

OF these most interesting animals, the Echidnas, or as they usually are called in Australia, Porcupine Anteater, there are three species, namely, that found in New Guinea, (*Echidna lawesii*), about fourteen inches in length, which has short spines; the Brown Echidna, (*E. setosa*) from Tasmania, with long hair almost concealing the spines, and the Australian form, (*E. aculeata*) which is slightly larger than the New Guinea species, being about seventeen inches long and without as much hair as the Tasmanian species.

These animals live entirely on the ground and their food consists of small insects, and, especially termites and ants, which they easily can obtain by digging with their powerful claws into the ants' nests or termites' mounds. The tongue, which is covered with sticky saliva, is then protruded, and when covered with ants is drawn back into the mouth. In captivity they are fed on finely chopped raw meat, eggs and milk. They have no true teeth, but have small spines at the back of the tongue. The tail is rudimentary and the feet short and strong. When in danger, the animal rolls itself up something like a hedgehog. The sharp spines not only are presented to its enemy, but also are stuck into the ground, making it harder to lift up.

The only way it can be carried conveniently is by grasping it by its hind feet, so that its head hangs down. It can dig in any hard soil by the aid of the spines as well as by the strong claws, and it is remarkable how quickly it seems to sink into the ground. It also can hold so tightly to the soil that it is only with difficulty that it can be raised, even by the aid of a spade or strong stick. It also is very difficult to dislodge from the corner of a room, and can climb over almost any wire fence and also out of any ordinary box at the corners, and unless the lid is very firmly nailed on, will push it off, and get through a very small aperture. The strength of the animal is astonishing, and even if tightly fastened by a cord around one of its hind legs, is almost certain to get it off.

These animals generally hibernate during the winter; usually under the surface of the ground, and frequently by a rock or rising ground. It is at this time that the egg is laid and the young hatched. The shell of the egg is soft and not calcified, and measures about half an inch. The mother by rolling herself up helps to protect the young which are in her pouch, and as the female has no nipples the young one when hatched has to lick the milk from the folds in the pouch. The young Echidna leaves the pouch just as the spines begin to appear, and when it is a little over three inches long. The pouch then gradually disappears until the next breeding season. Like the kangaroo, it is very rarely that two young are born. These animals are more or less nocturnal, as are nearly all the Australian animals.

THE PLATYPUS

The Duck-Billed Platypus, (*Ornithorhynchus anatinus*) is of great interest. It is found in the rivers of Tasmania and eastern Australia, except the extreme north. Like the echidna, it belongs to the egg-laying *Order Monotremata*,



Photograph by E. R. Sanborn

ECHIDNA

but passes its time in water and not on land, except when coiled up in its burrow with its tail tucked underneath, which usually is most of the day. It seeks its food generally in the evening or sometimes during the day in some very sheltered spot, feeding on earthworms, shell-fish, crustaceans and water insects, generally; a certain amount of which it can store in its cheek pouches.

Although the young have rudimentary teeth, they have none when they reach an adult stage; horny plates developing in the place of them, which enables the animals to masticate their food, which they usually do when lying on the surface of the water. The fur, which looks very much like that of a seal when the longer hairs are removed, is of two kinds; the longer being shiny and crisp and the under fur soft and short. The bill is soft and leathery, but shrinks considerably when dry, as in museum specimens. The under parts are lighter in color, usually greyish white. The tail is broad and flat and of a dark color above. The under part is usually devoid of hair, especially in the older animals. Their eyes are very small, but as their bill is usually sensitive, they generally can find their insect prey by the sense of touch.

Being unable to raise the body high from the ground like ordinary animals they can only shuffle along in an awkward manner. It is a burrowing animal and makes a long, upward tunnel in the river banks, sometimes thirty feet in length, usually starting at the roots of a tree that grows to the water, with the entrance generally under the surface of the water. At the end is a small chamber lined with leaves and grass, generally not so far from the surface of the ground, so that the natives frequently can tell where the nest is by striking the surface of the ground above and listening for the echo. When swimming the claws and web are stretched out to their full extent, but on land the extended web is always doubled up underneath; the end of the claws then coming in contact with the ground.

In nearly all specimens in museums, the web is expanded beyond the claws, although the animal is represented as being on the ground. But that is incorrect.

These animals are very timid, and though they possess no external ears, they are very quick at hearing, and any suspicious sound



Photograph by E. R. Sanborn

UNDER SURFACE OF THE ECHIDNA



Photograph by W. H. D. LeSouef

THE PLATYPUS, OR DUCK-BILL

We regret to say that owing to the food habits of this most remarkable animal, it is never seen alive outside of Australia. There is little ground to hope that a living Platypus can be brought to New York and shown in captivity.

makes them dive out of sight. The male measures about eighteen inches, tail six inches. The spur on its heel is larger than that on the female. The latter animal is about fourteen inches in length.

The most astounding feature of this animal is the fact that it reproduces by laying eggs, and hatching them. The shell of the egg is of a tough, leathery texture, and from two to four eggs are laid at a time. As the mother has no pouch, she practically makes one by rolling herself up in her nesting chamber. She has no nipples, but the mammery glands which are in two groups, are underlying the skin on the underside, and the milk is pressed out by a contraction of the muscles and the young takes its food by applying its flat face and tongue to the lacteal surface.

TASMANIAN WOLF

The Marsupial Wolf, (*Thylacinus cynocephalus*). These rare animals probably will become extinct before very long, as the settlers are prejudiced against them on account of their destruction of sheep and other stock. The dark marks across the back as so very striking and distinctive that the animal is usually called locally the Tasmanian Tiger. They utter a peculiar coughing bark, rapidly repeated and something like that of the kangaroo. They have a fair-sized pouch which opens backwards and usually bear from one to two young at a time.

These animals resemble in form some of the short-legged wolves, but have short, close hair. During the day they generally sleep in hollow logs, holes, under rocks, etc., and hunt their prey in the evening and at night. They are not very fleet of foot but have a keen scent and usually spring on their prey, which consists, besides the stock of settlers, of wallabies, rat-kangaroos and other ground game. They swim well and readily cross rivers in pursuit of their prey, one having been recently observed swimming a river after a wallaby; quickly overtaking it. They are now found only in Tasmania, but their bones have been found in Australia. Why they disappeared from the mainland, it is difficult to say.

TASMANIAN DEVIL

The Tasmanian Devil, (*Sarcophilus ursinus*) is strictly terrestrial and is now found only in Tasmania, although formerly it was plentiful in the southern districts of Victoria, judging by the remains found. But that animal was apparently extinct before the arrival of Europeans. It is a strong but sluggish beast, it has powerful canine teeth, and is a match for any ordinary dog. It is carnivorous and can bite se-



Photograph by E. R. Sanborn

FLYING PHALANGER

verely, while the molar teeth enable it to crush bones with ease.

As the Tasmanian Devil is comparatively slow of movement, it usually catches its prey by a sudden spring, which it then eats greedily, bones and all. It utters a disagreeable kind of snort. It has three to four young, which when too large to remain in their mother's pouch generally cling to her back. It lies up in hollow logs or burrows during the day, coming out at night to catch its prey. It is destructive to poultry and lambs, consequently has few friends and is being killed out of all settled districts. Its color is jet black with a white horse-shoe mark on the chest, but it often has patches of white on other parts of the body. So far I have not seen an albino specimen such as one finds among the kangaroos, wallabies, etc.

THE KOALA

The Koala or Native Bear as it is always called, of which there is but one species, (*Phascolarctus cinereus*) is found in all the eastern districts of Australia. It is strictly arboreal, living in the eucalyptus trees, and sitting during the day in a coiled-up position in a fork, where it is more secure. On account of this habit it is therefore easily shot, or killed by the heavy bush-fires. Like phalangers, the young cling to the back of the parent when they become too large for the pouch. The querulous, high-pitched note of the little ones is exactly like the crying of a child, but the old animals utter a prolonged, deep base note. This animal is grey with white feet, and has thick, woolly fur. It does not possess a tail.

[The food habits of the Koala are a misfortune to the zoological gardens of the world. This animal is so very difficult to keep alive in captivity that it rarely is seen in captivity outside of Australia. We know of only one that reached America alive, for which a price of $900 was asked, but not given by us. Three specimens which collectors attempted to bring to us died at sea.—W. T. H.]

An interesting little animal, *Tarsipes rostratus*, that is not often seen in captivity is found in Western Australia. It is only thirty-one inches in length, and its tail three and one-half inches. The color is grey, striped dorsally with dark brown. Its principal food is insects, but it also sucks honey from flowers.

PHALANGERS OR AUSTRALIAN OPOSSUMS

The Australian Phalangers, locally mis-called opossums, are not carnivorous like the American opossum, but feed entirely on vegetation; eucalyptus leaves forming the principal part. They live entirely in trees, and are nocturnal in their habits, sleeping during the day in some hollow or in their domed nest. They once existed in very large numbers, despite having formed the principal article of food of the aborigines, in days gone by, but as their fur is of value for rugs they have been shot and trapped unmercifully and practically cleared out of many districts; over a million skins sometimes being exported annually from Australia. Foxes are now taking their toll of them in southeast Australia; catching them as they pass on the ground from one tree to another. They climb the trees by jumping quickly upwards with all feet at once; the sharp claws being extended to their fullest extent, and thus securing a firm hold in the bark. They choose the upper side of a tree should it be reclining in any way, and a defined track will be made on the bark of one that is much used, which serves to guide the na-



Photograph by E. R. Sanborn

TASMANIAN WOLF



Photograph by W. H. D. LeSouef

THE KOALA IN ITS TREE-TOP HAUNT

tives in finding the hollow in which the opossums are coiled up asleep. They usually are caught by placing a long, thick branch or stick against the tree, and the animal will always ascend by this in preference to going up the straight trunk. In descending the branch, the animal advances head first, thrusts its head through a wire noose that has been placed on the stick, and thereby meets its fate. Many are shot; a moonlight night being chosen for the purpose, as the animals then can be distinguished against the face of the moon. The skins from the animals that have been shot are not as valuable as those that have been snared.

The smaller race of phalangers, called the Ring-Tailed, (*Pseudochirus*) are found in Tasmania, Australia and New Guinea. They also construct bulky, domed nests of sticks and leaves near the top of some thickly growing shrub, on which their tracks are not easily seen. They have from two to three young at a birth which, on leaving their mother's pouch, hang to her back for some weeks, by clinging with their claws to her fur, and are carried about until they are able to look after themselves. As their tail is prehensile and frequently used for clinging, the underpart of the end of it is rough and bare. Sometimes when shot and badly wounded they will hang on by their tails before life leaves them, and remain in that position after death for a considerable time; frequently a day. The end of the tail is usually white. In the Herbert River district in Queensland, a small lemur-like variety, (*P. lemuroides*) is found. The soft, woolly brownish-grey fur is darker on the shoulders and lighter on the hips, and the head is brown and the tail black It measures fifteen inches and tail twelve inches.

Australia possesses other forms of Flying Phalangers that are popularly called Flying Squirrels. When the Phalangers stretch the feet well out, the loose skin that acts as a parachute holds the air sufficiently to allow the animal to glide from the higher branches of one tree to the lower trunk of another; the long, furry tail acting as a rudder. As they alight, a quick upper movement is made, the sharp claws enabling them to hold on to the bark, when they quickly can ascend the tree again and repeat



Photograph by W. H. D. LeSouef

KOALA, OR NATIVE BEAR



Photograph by E. R. Sanborn

RABBIT-EARED BANDICOOT

the performance. All the species have beautiful long, soft fur.

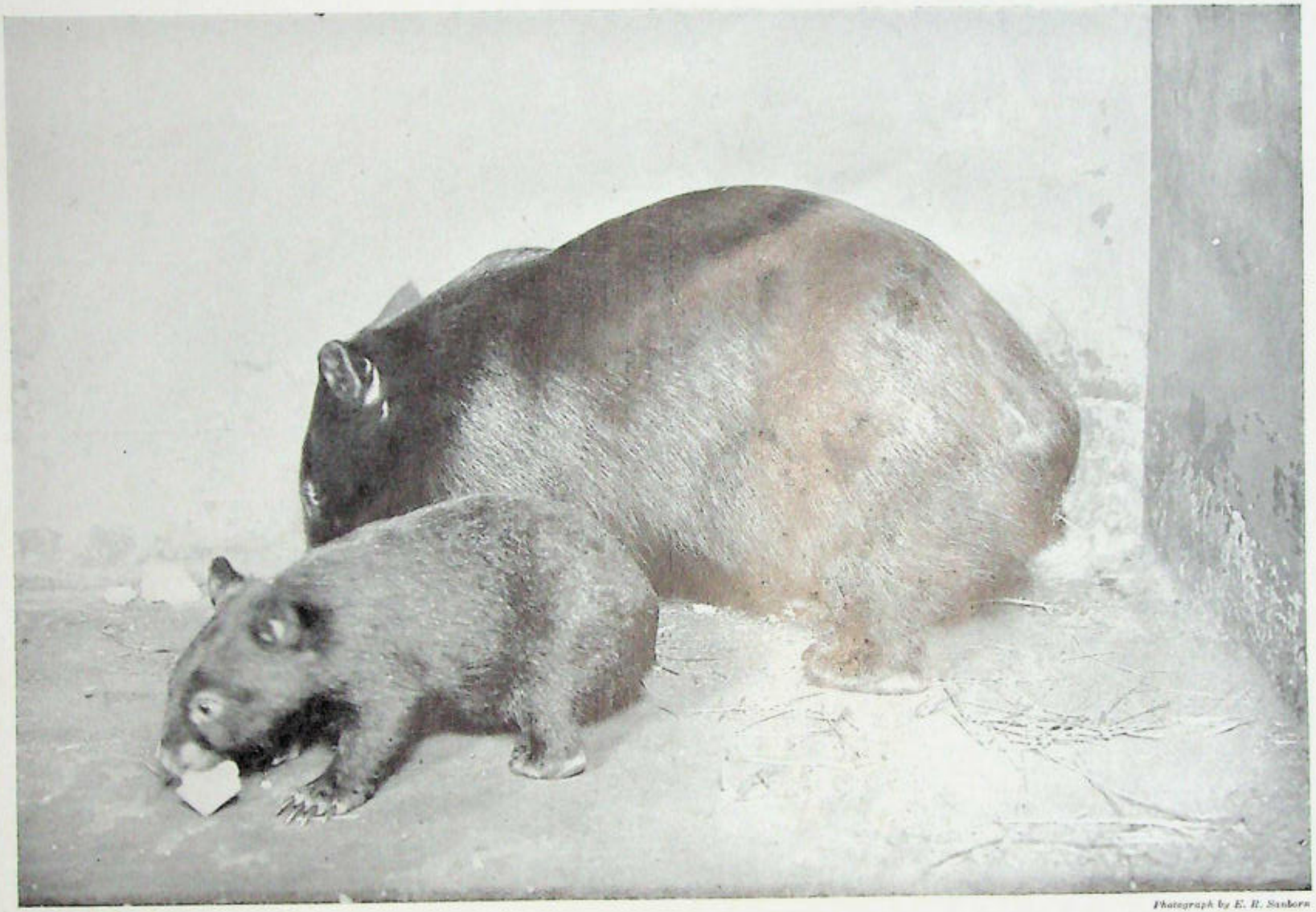
The Pigmy Flying Phalanger, (*Acrobates pygmaeus*), well distributed over the eastern parts of Australia, is a delicate looking little creature, three inches long and with a tail three and one-half inches. The soft, silky fur is greyish-brown, the under-surface is white and the edge of the parachute is tipped with the same color. They usually have four young. On the timbered ranges of the coastal districts of Victoria and New South Wales, a large form of flying phalanger is found, called the Yellow-Bellied, (*Petaurus australis*). Their color is greyish-brown, but varies in shade. The claws are strong and much curved, to enable them to get a good hold of the tree trunk when alighting, the body length of the species measures eleven and one-half inches and the very long and bushy tail is sixteen and one-half inches. The Squirrel Flying Phalanger, (*P. sciureus*), a much smaller form, measuring only ten inches and tail ten and one-half inches, is light grey with a dark line on the crown. They are easily tamed and make interesting pets. They are found in eastern Australia.

A small, mouse-like animal, the Dormouse-Phalanger, (*Domica*) is closely allied to the flying phalangers, but has no flying-membrane. Two forms are found in Tasmania. One, *D. lepida*, measuring only three inches with a tail of the same length, is a graceful little animal, light fawn in color with fine, soft fur like all the others, numerous long whiskers and large ears. The other form, *D. nana*, fawn in color, but with the legs usually grey, also found in Victoria and New South Wales, is slightly larger, measuring four inches and its tail slightly longer. They have four young at a time. These little animals often have fatty accumulations on the body. The Long-Tailed, (*D. caudata*), which is the larger of the genus, comes from northwest New Guinea. It measures four inches in length, tail five and three-quarter inches and the general color is rufous, with two dark lines on each side of the face.

The smallest form, the Lesser, (*D. concinna*), found in South and West Australia, measures only three and one-half inches, and the tail slightly longer. Their color is fawn, and the underparts white. These little animals live well in captivity. Another genus, *Gymnobelideus leadbeateeri*, has been described from the mountainous districts of Southeast Australia (Gippsland), and is very rarely found. It is five and three-quarter inches long, tail a little longer, and the color of the body is grey with a dark line on the top of its head.

THE BANDICOOTS

The Rabbit Bandicoot, (*Peragale lagotis*), from Southwest Australia, is about the size of a



Photograph by E. R. Sanborn

WOMBAT AND YOUNG

The young specimen was born in the New York Zoological Park. It now weighs about 70 pounds, and is so docile that a child may fondle it.

rabbit. The fawn-grey fur is long and silky, head and ears are long, an indistinct dark line runs vertically from the back on the sides of the rump, the underparts are white and the tail towards the end is also white and crested. Bandicoots are destroyed chiefly by dogs and cats, and were far more plentiful in the days gone by than they now are. They are nocturnal, resting during the day in burrows and feeding at night upon insects, grubs, earthworms, fungus and roots. They are marsupial and the pouch opens backwards. Their general color is olive-grey, with bars across the lower part of the back. The smaller Bandicoots belong to another species, namely *Perameles*. The Short-Nosed (*P. obesula*) is the most widely distributed, being found all over Southern Australia and Tasmania. It is fourteen inches long and the short, coarse fur is grizzled-yellow and black, the underparts are white and the ears short and broad. They are usually found in swampy localities where the vegetation is very dense.

THE WOMBATS

Wombats, (*Phascolomys*) are still fairly plentiful in southeastern Australia and Tasmania. They dig deep burrows and are safe there from foxes and dogs, as they are quite able to defend themselves. Their length averages about forty-four inches. They prefer scrubby, mountainous country and their food is entirely vegetable. They are nocturnal, resting during the day in their burrows. They have no tail.

The common variety, (*P. mitchelli*) is found in Victoria and New South Wales. They vary in color from dark yellowish-grey to black. The Tasmanian, (*P. tasmaniensis*) is smaller and usually of a dark greyish-brown color, and the Flinders Island form, (*P. ursinus*), the form originally, but incorrectly described as from Tasmania, is yet smaller, being thirty-six inches in length. The Hairy-Nosed (*P. latifrons*), grey in color with the end of its muzzle white, is found only in South Australia. They are not as uniformly colored as the other varieties. These animals are very strong and burrow with great rapidity with their powerful claws; a habit that makes them very troublesome to settlers, as they dig under and damage wire-netting fencing. In walking, they shuffle along in a clumsy manner. They live well in captivity, but are very susceptible to skin disorders.

SPOTTED DASYURE

The Spotted Dasyure, or, as it is popularly called in Australia, the Native Cat, used formerly to exist in thousands in South Australia, but from some unknown cause these pretty little animals have now disappeared from many districts. There are three varieties, namely, The North Australian, (*Dasyurus hallucatus*), which is small, only measuring eleven inches and its tail eight inches; the Black-Tailed, (*D. geoffroyi*) from all Australia except the extreme north and the coastal districts of the southeast, and the Common (*D. viverrinus*) from eastern New South Wales, Victoria, South Australia and Tasmania.

These animals are marsupial, having about six young ones at birth. They are usually of a reddish-grey color, but also often black and are well marked with white spots, but not on the tail, which is usually white at the tip. They measure about seventeen inches and the tail ten inches. A larger variety, the Spotted-Tail, (*D. maculatus*) found from eastern Queensland to Tasmania, is more than twice the size of the other species. These animals can climb well, although they are mostly terrestrial, taking refuge during the day in hollow logs and among rocks, etc. If several are kept in the same compartment in captivity, they are liable to turn cannibals; the stronger eating the weaker. They are carnivorous, taking birds and their eggs, mice, rats, bandicoots, and other game, and are very destructive to poultry. Consequently, they are not spared by the settlers. They are plentiful in Tasmania; more so than on the mainland.

MARSUPIAL MICE

A form of Pouched Mouse with habits the same as the others, is the genus *Phascogale*. Their pouch is hardly visible. They bear from six to ten young ones at birth, and live principally in holes in trees, lining their nests with grass and leaves. Nine species have been described, namely: the Crest-Tailed, (*P. cristicardata*), which measures about five and one-half inches with a tail three and one-half inches, much thicker at the base, is found in central and southern Australia. *P. macdonnellensis* from central Australia has an abnormally thickened tail at the base. The Lesser Brush-Tailed Pouch Mouse, (*P. calura*), also found in southern and central Australia, is five inches long and has a tail six inches. *P. penicillata* or Greater Brush-Tailed Mouse is ten inches long and tail nine inches, is the largest of this genus.

They are found all over Australia except at the extreme north, and live almost entirely in trees, making their nests in the hollows of the branches. They have thick tails and the end is covered with long, black hair, forming a brush.

There is a very small variety named *P. minutissima*, found in southern Queensland and New



Photograph by E. R. Sanborn

FAT-TAILED OPOSSUM MOUSE

South Wales, that is only three inches long. The Yellow-Footed, (*P. flavipes*) with yellow legs and feet, as its name indicates, ranges from eastern Australia to New Guinea. In Tasmania and the adjacent islands, a small variety is found, (*P. minima*), or Little Pouched Mouse, with a body length of five inches, and tail three and one-half inches, and in Queensland a still smaller form is *P. minutissima* or Pigmy Pouched Mouse, only three inches long and tail two and one-half inches. Tasmania and southern Victoria has still another variety, *P. swainsoni*, which has long, soft fur. In West Australia is found the Freckled, (*P. apicalis*), which is freckled, reddish-grey above. Australia is well off for Marsupial Mice, and other varieties certainly will be found, as these little animals are easily overlooked. Insects form a large part of their food.

Still other Pouched Mice, (*Sminthopis*) are slender and active little animals, from three to four inches long, with large ears and a well-developed pouch in which they carry the three to four young they have at birth. They are terrestrial, insectivorous and do not often burrow. Their grey fur is soft and fine. Six species have been described, *S. larapinta*, from Central Australia, near the Finke River, and the Fat-Tailed, (*S. crassicaudata*), which is found all over Australia except the north.

Both of these little animals have the basal portion of their tail much thickened. The Common, (*S. murina*) is found over the southern and central portions of the continent. *S. psammophila* lives near Lake Amadeus in Central Australia among the sand hills covered with tussocks of porcupine grass. The White-Footed, (*S. leucopus*) extends over eastern Australia from Cape York to Tasmania and is plentiful in certain localities. *S. virginae* is known only in eastern Queensland. It is five inches long.

A MARSUPIAL ANT-EATER

An interesting animal found in southwestern and southern Australia, of which but one species is known, is the Marsupial Anteater, (*Myrmecobius fasciatus*). It frequents both the ground and hollows in the trees and its food consists of insects, generally. The fur is short and strong, of a general rufous color which darkens to black toward the tail, with prominent bands of white. It therefore is distinguished readily. The underparts are light yellowish. The females have no pouch, the young adhering to the nipples. It leaps along the ground like a squirrel, with the tail slightly raised. They make charming pets and never attempt to bite. It measures ten inches long and its bushy tail seven inches.

THE MARSUPIAL MOLE

Australia possesses a marsupial Mole, (*Notoryctes typhlops*) found in central and western Australia, but, naturally, it never is seen in captivity. It is about six inches long, with a curious ringed tail about an inch in length, and much thickened at the base. The nose has a hard shield. The fur is soft with an iridescent effect, and varies in color from a yellowish tint to chestnut-brown. They have two young at a birth, live underground entirely, are without eyes and subsist on insect food.

ZOOLOGICAL SOCIETY BULLETIN

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ELWIN R. SANBORN,
Editor and Official Photographer

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THE EMBARGO ON WILD ANIMAL IMPORTS

The New York Zoological Society now is feeling acutely the pressure of conditions that hourly remind us of the universal expression of all France, "C'est la guerre!" (It is the war). We have endured with resignation the loss of our young men, the increased cost of food and materials, and the scarcity of steel. We bowed to the inevitable stoppage of the inflow of wild animals from Africa and Asia, and by way of consolation helped ourselves bountifully to mammals and birds from Australasia.

Practically nothing is coming to us across the Atlantic. Very little has been coming from South America, but to us that little meant much. South America is not a continent teeming with important wild life. There is too much jungle around each bird and mammal. Even in the best of times the receipts from South America are small, and few in a hill; but we always were, and are, thankful according to the length of the list.

Now, alas! a new blow has fallen, like the final straw to which the camel's back succumbed.

On May 20 we applied to the War Trade Board for permission to import from British Guiana 2 small capybaras, 6 agoutis, 3 monkeys, 1 porcupine, 1 young jaguar, 5 macaws, 1 curassow and 1 scarlet ibis.

The request was promptly denied, on the ground that cargo space on ships could not be spared for wild animals "not for breeding purposes." We wrote again, asking for a hearing, and at the same time stating our reasons against being put out of business. We went so far, in our effort to ameliorate war imposts, as to set forth the activities of the Zoological Society and Park in promoting the war.

Our case was presented to the Bureau of Imports of the War Trade Board, by the Director of the Bureau of Imports, and on June 20 we had the misfortune to receive the following blow:

June 17, 1918.

W. T. Hornaday, Esq.,
New York Zoological Park,
185th Street & Southern Boulevard,
New York City.

Dear Sir:

Careful consideration has been given to all the points so forcefully presented in your letters of May 20, May 27 and June 5 in the hope that we might find a way whereby the Bureau of Imports could make an exception to its import restrictions and grant you a license to import the wild animals and birds you desire from British Guiana for exhibition purposes.

It is a matter of keen regret to me personally and, I believe, to the War Trade Board as a whole, that its previous refusal must stand. You may be sure that this decision has not been reached without the most thoughtful and thorough examination of every phase of the matter.

There is no question that the purpose of this importation is highly important. But importance is a relative term, and in a world crisis such as this things ordinarily important become minor. There is room only for the essentials. The reason is that with shipping space and tonnage so precious as they are today, every square inch and every pound must be conserved for the importation of essentials to the military requirements and to the physical well-being of the civil population. Everything else must wait until these have been taken care of.

It is unfortunate that a valuable collection such as yours cannot be added to as it deserves. It is to be hoped that you can maintain it at something like its present degree of completeness until the return of better conditions makes it possible for you to develop it as you desire. You doubtless recall that in 1870 the French were obliged to eat the animals in their zoo. While this is not urged as parallel to the present conditions in any way, it may suggest to you the kind of sacrifices which war makes necessary.

We appreciate all that you have told of the splendid work done by your organization in the various movements that have had for their object the winning of the war. We regret that it is necessary to require of you an additional service of sacrifice and self-denial.

Since it is necessary—and we assure you that otherwise it would not be asked—we trust that you will bear as patiently and cheerfully as you may the hardship of this import restriction until such time as it becomes possible to remove it.

Yours very truly,

FRED B. PETERSON,
Director, Bureau of Imports.

This reminds us of old Shylock's last shot at Judge Portia: "You take my LIFE when you do take the means whereby I live."

Ever since the British government stopped all importations of wild birds into England because birds consumed seeds and other foods, we

have believed that there is such a thing as taking even a war too seriously, and carrying the rigors of war to unnecessary extremes. However, the continent of North America still is open to us, and if we must hereafter be deprived of all other faunas, we can and will specialize on home-grown species.—W. T. H.

GOLD MEDAL AWARDED FOR TREATY ON BIRDS

By the Associated Press

London, May 2.—The gold medal of the Royal Society for the Protection of Birds has been conferred on Dr. William T. Hornaday of New York and Dr. Charles Gordon Hewitt of Ottawa, in recognition of their successful efforts in furthering the treaty between Canada and the United States for the protection of migratory birds.

W. H. Buckler, special attache to the American embassy who received the medal on behalf of Dr. Hornaday, said:

"This war, which has shown us the value of aviation, has taught us also as never before, the vital importance in relation to food supply, of that most experienced of all aviators, the bird. Certain worms and grubs are the submarines of the countryside, while the bird is the airship patrol which detects and destroys these enemies. Birds are a precious international asset. The organized effort for their protection has been one of the chief public services which Dr. Hornaday has been performing for the past twenty years."

TROUBLES OF THE BERLIN ZOO

Failure of Food Substitutes

The quarterly report of the Berlin Zoological Society shows that the wild animals there have not been able to digest the food substitutes provided by German science. The mortality has been heavy,—the giraffes, the mandrill, the chimpanzees are among the more valuable animals which have died this winter,—while the general health of the surviving animals is not good. The society expresses some doubt as to the exact cause of death of the chimpanzee. It is admitted that the dates and bananas and other tropical fruits being unprocurable, the apes were fed on a kind of biscuit made of musty flour; but it is said they may have pined away with grief at the loss of their keeper, who was called up for the army.

The carnivores managed to get on fairly well on scraps from the slaughterhouses, but the animals requiring grain and seeds have not thrived on the wild roots given them as substitutes.

—*Hamlyn's Menagerie Magazine, London.*

FINAL RATIFICATION BY CONGRESS OF THE MIGRATORY BIRD TREATY

Once more the bird lovers of America owe Congress a vote of thanks for its absolutely unbroken record in the protection of birds. The bill to provide for carrying into effect the terms of the already complete treaty with Canada for the protection of all migratory birds passed the House on June 6, by a vote of 246 to 48. A prolonged fight over the bill was precipitated by an attempt to pump oxygen into the corpse of the old state-rights fetich, which died and was decently buried about fifty years ago.

There was no amendment to the bill save one proposed by the Committee in charge. In this the Senate concurred, and the completed bill was finally laid before the President, and promptly signed by him. While the act carries no appropriation for enforcement, the Agricultural bill contains an item of $50,000, which was expressly inserted to provide funds until special and larger appropriations begin. The situation calls for at least $200,000 per year.

This extremely gratifying action renders the triumph of the international bird treaty complete, and disposes forever of all questions of the constitutional right of the federal government to take an active interest in protecting the birds of the nation from unjustifiable slaughter. At last the humiliating spectacle of game-hogs flouting the United States government on account of the weakness of a federal bird law has ended.

Viewed as a whole, this treaty, fully protecting 1,022 species of North American birds from the Mexican boundary to the North Pole, is the greatest item of bird protective legislation ever enacted in any country.

The Canadian half of the treaty, and its corresponding enabling act, have been for several months in active operation.

WAR ON PARK VANDALS

The army of park vandals is to be given a hot reception by Mayor Hylan, Police Commissioner Enright and the City Magistrates. The campaign opened on May 28, by the promulgation of this beautiful document, which covers all the parks of Greater New York:

ORDER BY THE MAYOR

All persons are forbidden, under penalty of the law, to throw newspapers, bottles, lunch waste or refuse of any kind in the Public Parks, or to mutilate or destroy branches, trees or other park property.

This law will be vigorously enforced by the Park and Police authorities.

JOHN F. HYLAN,
Mayor.

Speaking for the Zoological Park only, it gives us great pleasure to report that on June 18 Commissioner Enright directed that for the more thorough protection of that Park, Inspector Collins and Police Captain John Ievers were empowered to make a permanent detail, for the summer season, of two policemen in plain clothes to suppress vandalism and other forms of disorder. This measure will completely thwart the sometimes-shrewd disorderly persons who watch for the disappearance of the uniformed policeman in order to transgress the rules of decency and good order. From this time henceforth the rubbish-throwers and newspaper-fliers never can tell which is the plain citizen who will hale them to court. The only safe course is to be a good citizen, and be decent.

The action of the Police Commissioner will be in the Zoological Park a measure of economy in man power, and it also will result in a cleaner park. We hope that this plan will be extended to all city parks; for abuses elsewhere are quite as serious as they have been here.

There is strong ground for the belief that the City Magistrates will continue to support vigorously the efforts of the police and park departments to curb vandalism, and establish the reputation of New York *as a city of clean parks!*—W. T. H.

THE VISIONARY "PHEASANT FARMS" OF CHINA

DURING the past year, several efforts have been made by the commercial agents of firms in China engaged in the exportation of pheasant skins to convince the United States Treasury Department that golden and silver pheasants are bred and reared in confinement, in China, in great numbers. If that claim can be established by satisfactory evidence, then the United States will permit the importation of pheasant skins for millinery purposes. If it cannot be proven, the plumage is permanently barred.

The good faith of the American firms proposing to import pheasant skins on the strength of affidavits and assurances from China is not questioned. The representations from China have been regarded with grave suspicion. Having been called upon for opinions and advice, the New York Zoological Society began a search for testimony.

Mr. William Beebe, Curator of Birds at the Zoological Park, and who recently traveled in China in quest of pheasants of all available species, reported having seen no pheasant farms, nor having heard of any, nor of having seen any pheasants in captivity in China.

Mr. Roy Andrews, who late in 1917 returned from extensive zoological travels in Yun-nan, China, declares that he saw no pheasant "farms" in southern China, heard of none, and in all his travels saw only two captive birds. Like Mr. Beebe, he believes that no pheasant farms exist in China.

Finally, a letter was addressed by Dr. W. T. Hornaday to the French Consul at Mongtseu; and this elicited the attached reply. It quite effectually disposes of the visionary "pheasant farms" of China, producing annually from 10,000 to 20,000 silver and golden skins for commercial purposes. It is hoped that with this direct eye-witness testimony no one ever again will seek to import pheasant skins from China into America under claims of domestication as the source of the product.

The Zoological Soicety has in its possession a brief emanating from a firm in Canton which, beside the following letter, may fairly be regarded as a curiosity:

[Translation]

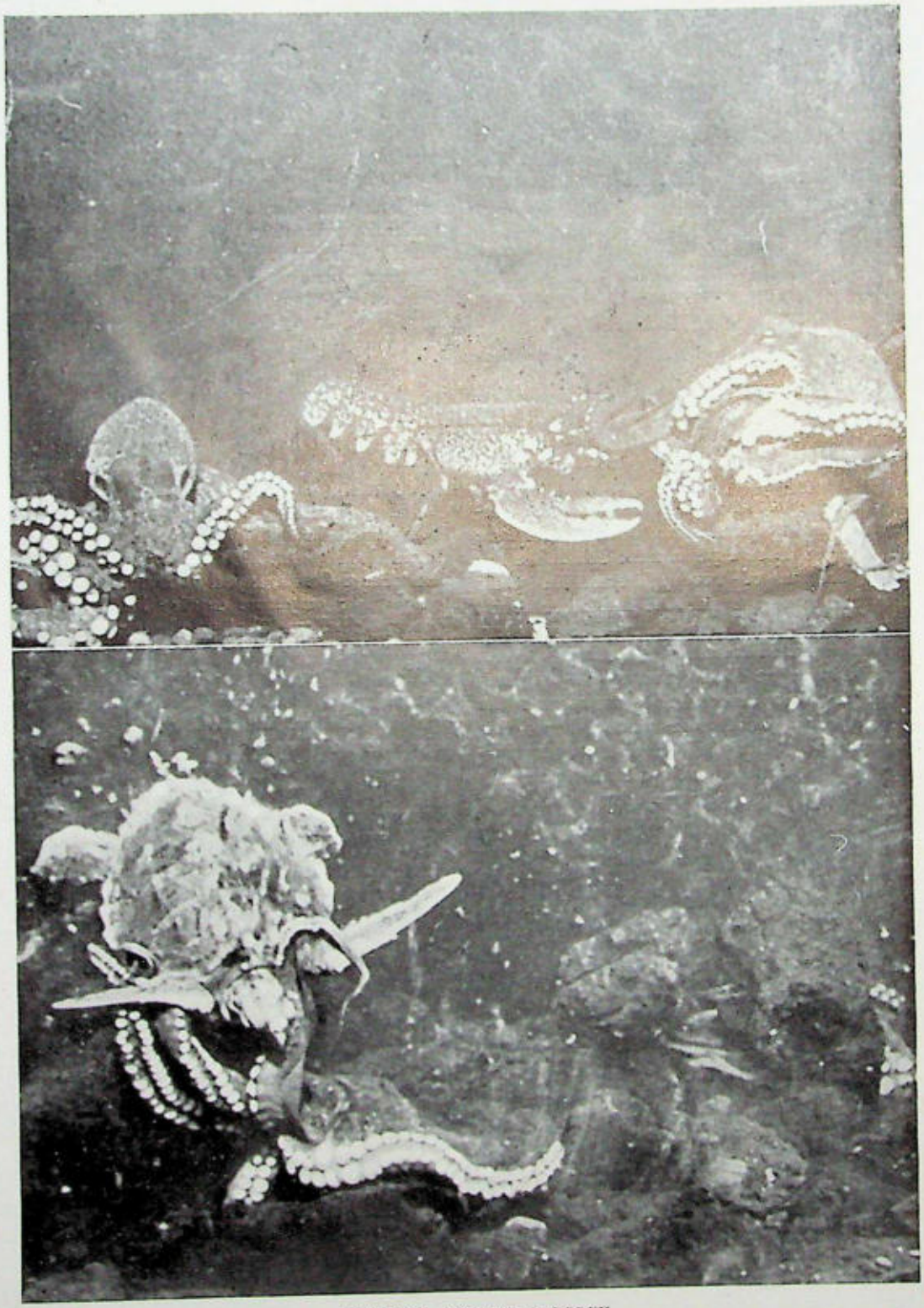
CONSULAT DE FRANCE
A
MONGTSEU
No. 207

République Française,
Mongtseu, April 6, 1918.

Mr. W. T. Hornaday,
Director of the New York Zoological Society,
185th Street & Southern Boulevard,
New York.

Dear Sir:

I received yesterday your note of February 16, telling me that you are a friend of my cousin, Du-Pont, and asking me for some information regarding the breeding of gold and silver pheasants in this country.



THE DEVIL FISH AND ITS PREY

Eight sinuous arms, studded with powerful suction discs, enable the Devil-Fish to overpower its prey and employ its strong beak. These scenes of marine life were filmed at the Naples Aquarium. The series of motion pictures, representing years of patient work, have been arranged and are being presented to the American public by Mr. Raymond L. Ditmars.



STRANGE CREATURES OF THE SEA

Mr. Ditmars had these enlargements reproduced from motion picture film prepared at the Naples Aquarium. The upper figure shows the Argonaut, an ally of the Devil-Fish, which floats the seas in its papery shell. Under the surface it moves by pumping water through a tube seen at the top of the illustration. The lower scene shows the Anemone—animate sea-flowers—which live in a limy tube and throw out their petal-like tentacles in search of floating particles of food.

I have never seen any farms for the breeding of pheasants in this province, and I never have heard it said by anyone that they exist.

Not having been in Yunnan for nine years, I have consulted some of the oldest residents, among others Father Maire, Catholic missionary, who has been in this province more than thirty years, and has resided and traveled in numerous regions of Yunnan. He also has not seen any farms where the breeding of pheasants is carried on, and never has heard establishments of this kind spoken of.

Dr. Legendre, a French traveler, whose name you perhaps know, was at Mongtseu at the time of the receipt of your letter. He has many times traveled through Yunnan and Seutchoan and has gone as far as the borders of Thibet. I showed him your letter and he gave me the same answer as Father Maire.

I have often seen in the markets live pheasants (silver or golden, and argus pheasants), but these birds always had been taken with a trap or a net. They were very savage and sought to escape from the bamboo baskets in which they were confined. These birds have never been domesticated, for it is very difficult to keep them in a coop. One would lose the half of them. Even the golden pheasants refuse to eat; grow thin and die.

Perhaps that which has given rise to the fable of "pheasant farms" is the habit of two tribes, Lolos Sa-Gni and Ahi, which inhabit the mountain in the region of Lounan (above Mile, east of Yunnan), who keep some male pheasants which they utilize as decoys. They remove some feathers from these pheasants, try to tame them, and in the spring they carry them into the fields to attract the hen pheasants. In this region, Father Maire tells me, the peasants cultivate maize and buckwheat, and the pheasants are very numerous.

A pheasant which has been used as a decoy may, if it is tamed, be sold for six silver taëls (about 13 Mexican piastres). Then the price of a pheasant for the table is, in Mongtseu, from 30 to 40 piastres. In the mountain the prices are less high. I have bought at Mongtseu a pair of beautiful living argus pheasants for 80 piastres. (All the prices given herein are in Mexican piastres.)

The exportation of these birds alive, and of their skins, is strictly prohibited, both in China as well as in Indo-China. It requires a special authorization to export any pairs of live pheasants. Their skins are confiscated. In Indo-China even the peddling of silver and argus pheasants is forbidden, except for propagation.

The French and Chinese authorities have acted very wisely in forbidding trade in the skins of pheasants, for the sale of them has encouraged the natives to slaughter great quantities, and they would rapidly have annihilated these magnificent species of birds. This exportation was carried on chiefly by the people of Canton. I know that the Chinese Custom House officer seized, about three years ago, a case containing several thousand skins dispatched to a merchant in Canton.

Evidently, if the domestication and breeding of pheasants had been an accomplished fact, the French and Chinese would not have prohibited the exportation of these birds, or their skins.

I am at your disposal for any further information that you may wish to demand of me, and I am happy to have been able to be of service to you.

Accept, Sir, the assurance of my best sentiments.

L. FLAYELLE.

P. S.—I have just had the explanation of the origin of this story. Mr. Anderson, American Consul-General at Hongkong, some two years ago, on the strength of incorrect information, pointed out in one of his reports the existence of "pheasant farms" in Yunnan.

A JUNGLE INCUBATOR

By LEE S. CRANDALL

AMONG the rhododendrons near the Jungle Walk in the Zoological Park, there is a heap of leaves and forest debris. It appears commonplace and uninteresting, but its origin and purpose are not those of the conventional rubbish pile.

The fauna of Australia contains many curious forms. Its marsupial mammals, paralleling in a marvelous way numerous groups of more highly organized creatures, are well represented in the collections of the Zoological Society. Its birds, while less generally remarkable, still include many species of unusual habits. Two groups in particular, one containing the emus and cassowaries, the other the megapodes or mound builders, have developed aberrant methods of reproduction. The emu family, with its prettily striped babies, motherly father and advanced mother, are well known to our visitors. But now we shall make the acquaintance of an ultra-modern bird, whose habits might inspire the imaginative humorist. Here the tendency to slough off maternal duties has reached its logical end, for nobody cares for the babies at all!

The Encyclopedia Brittanica says that artificial incubation has been known to the Egyptians and Chinese from "time immemorial." That honored phrase is not chronologically exact, but whatever the period may be, it is fairly safe to say that incubators were in use before the days of Confucius, and without the guiding intellect of man. In the untravelled bush of Australia, birds were making use of the principle on which the modern 10,000-egg machine is founded.

The brush turkey, the most familiar bird of the megapode group, nests from September to January, a period that, in the Antipodes, corresponds to our spring and summer. But this nest building consists of no conventional weaving and binding. The brush turkey's skill lies rather in its feet than in its beak, and it is well equipped for the work to be done. So generous is its endowment, in fact, that the length of its toes, coupled with the bare and highly colored head and neck, led to its early description as a vulture, although it is really a member of the family of fowls. But these feet were fashioned



Photograph by E. R. Sanborn

MOUND OF A BRUSH TURKEY IN THE ZOOLOGICAL PARK

This mound composed of soil, leaves and twigs. It measures about twelve feet in diameter and three in height.

for a softer purpose than holding prey in process of rending.

Turning his back to the chosen spot, the brush turkey begins to scratch. And then it is obvious that this is indeed his forte. Huge footfulls of leaves and twigs from the jungle floor fly toward the common center as though borne on the wings of an infant whirlwind. Material frequently is brought from considerable distances and often the ground for many feet about is scraped quite clean. Small streams are no obstacle, for the brush turkey dredges as well as he gleans.

In an incredibly short time, a heap of very respectable proportions has been formed, perhaps as high as six feet and ten or twelve in diameter. The core is composed of humus and leaves in an advanced stage of decomposition. The outer layer of coarser material forms a protective jacket for what is destined to become the incubation chamber. After the mound has stood for a period sufficient to insure the beginning of fermentation, the cover is scraped away and a hole is dug in the center of the central mass. Here the female deposits her egg, point down, and the mound is again closed. It is commonly stated that the work of building the mound and preparing it for the reception of the eggs is performed by the male alone. Further observations seem necessary to confirm this belief.

A period of several days appears to intervene between the laying of each egg and its successor, so that a mound operating at full capacity contains eggs in all stages of incubation. Each pile is usually the property of a single pair of birds, but huge structures, measuring many feet in diameter, have been found. These large affairs are said to be used in common by several pairs of brush turkeys—somewhat after the fashion of the municipal plants which we are sometimes told will be the final outcome of modern human tendencies!

While the mound contains eggs, it is watched over with great solicitude by the parents, which are quick to repair any damage. The heat generated by the decaying vegetation gives the interior of the mound a temperature of about 95° Fahrenheit. From 100° to 103° are required for the incubation of the eggs of the common fowl, but less heat seems to be needed for those of the brush turkey. After a period of six weeks, the first chick emerges. Buried beneath a heap of sodden rubbish, his case seems hopeless. But youthful as he is, the spirit of the upward trend has marked him for its own. From his parents he has inherited sturdy feet and the will to use them. He promptly scratches his way to the surface and begins to preen his feathers in the pleasant sunshine. For feathers he has, and wings as well.

Disdainful of parental discipline, as might be expected, he scuttles off into the underbrush, to search for the insects which will form his first meal. But the parents are not offended, for to them he is a perfect stranger. When night approaches, this infant prodigy flies with his precocious wings to a convenient perch, and spends the night in happy indifference to his lonely state.

And now what shall we say of our own "upward trends" and "advanced movements?" For this dingy bird of Australia has developed the problem of parental duties to a state which even our ultra-thinkers have hardly dared approach.

In the summer of 1917, two brush turkeys arrived at the Zoological Park. In the belief that they were a pair, the birds were placed in a large run at the Ostrich House. It soon became apparent, however, that both were males. It is not the nature of the brush turkey that two males should occupy the same enclosure, however large. This point was brought so strongly to the attention of the weaker bird that it took leave, climbing the eight-foot fence and launching itself in lop-sided flight from the topmost strand. A thorough search failed to reveal its whereabouts and we had given up hope of finding it, when a strange accumulation of leaves and sticks was reported near the Jungle Walk. Investigation showed the ground nearby to have been cleaned in a workmanlike manner. Mystified at first, and suspecting an over-industrious child, we found that our lost brush turkey was obeying the commands of instinct. He must build a mound, although its purpose could not be fulfilled.

After a winter passed in the Pheasant Aviary the bird was liberated this spring and promptly returned to his haunts in the Beaver Valley.

ITEMS OF INTEREST

By Raymond L. Ditmars

Our Tame Wombat.—One of the most interesting animals in the Park occupies an unpretentious cage in the Small-Mammal House, and many visitors examine it without realizing its unique character. It is a full grown wombat, from Australia, a remarkable pouched animal, or marsupial, that attains a weight of about seventy pounds and in appearance is a nondescript. In form it suggests both an overgrown bear cub and a gigantic woodchuck. Our specimen is unique in the history of captive wombats. It was born in the Park, and is so tame that it follows Keeper Lansberg like a dog. This an-

imal is so absolutely docile that a child can fondle it, although its aspect is not reassuring. The wombat possesses great strength, and sharp claws for digging. It constructs burrows, even in stubborn and rocky ground, and leads much the same life, on a magnified scale, as our common ground "hog."

Animal Weather Prophets.—Our prairie dogs appear to be quite reliable forecasters of the weather, and this has been particularly noted the past spring, when there were numerous, heavy rains. On a number of occasions the larger members of the colony were observed to be loosening the earth around their mounds with their forefeet, then shovelling the soil upward with the hind feet. Other members worked within the burrow throwing out earth to aid in the building process. When the borders of a crater had been considerably raised the animals went to work tamping down the earth with their heads. This is an amusing process. They look like miniature goats, pounding the ground with the tops of their heads. These operations invariably took place before a rain, and the object was the construction of a circular dyke to prevent water running down the burrow.

Tame Swallows.—Several swallows have built their nests in the elks' shelter shed, and have become remarkably tame. They fly between and over the members of the herd when the deer are in their shed, and pay no attention to the keeper as he cleans the enclosure. In their constant trips for aerial insect food, they pass so close to the keeper's face that he frequently feels the displaced air from their wings. Their nests are built of mud and plastered against the wall. Several of them are so accessible that one may stand and look into them. This procedure does not greatly disturb the swallows, which for a moment circle away, but immediately return as if nothing unusual had happened.

A Strange Rat-Trap.—We have found it necessary to watch for the appearance of rats in the prairie dog enclosure. Owing to the construction of the fence, with its internal overhang, this circular enclosure forms a gigantic rat-trap. The prowling rodents are enticed by the food within, and after climbing the fence from the outside, find it impossible to return. We recently noted a large rat killing a young prairie dog, and at once several rat-traps were set. A full dozen of the marauders were captured during the night.

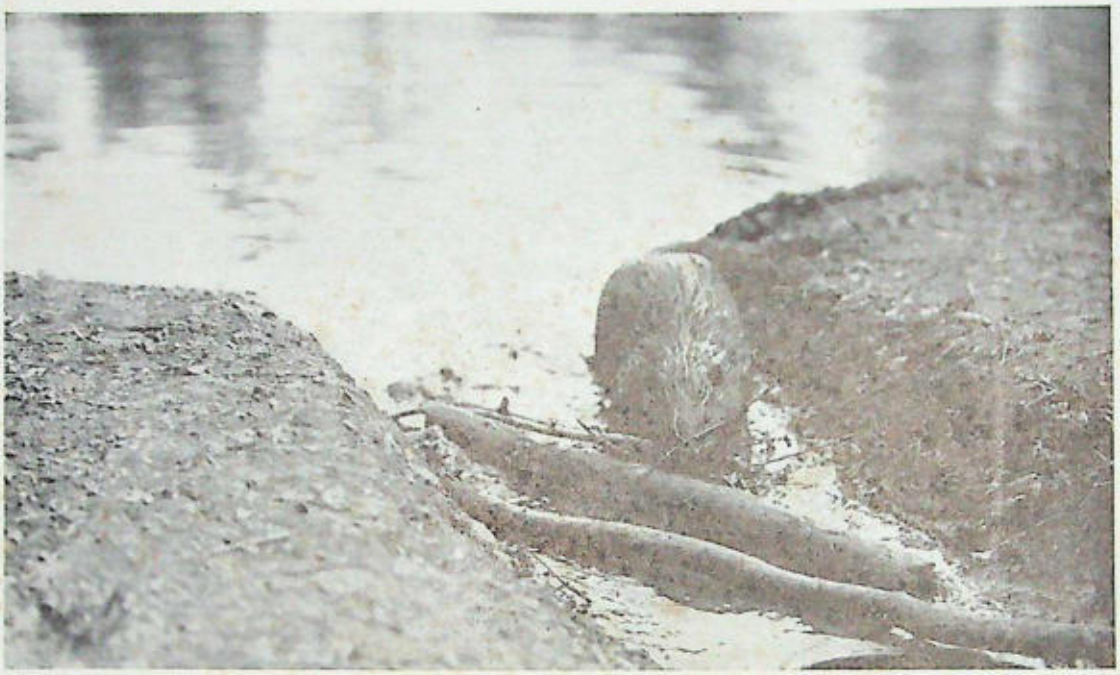
A Duel in the Bear Dens.—For the first time in several years we had the misfortune to be compelled to witness a fight to the death in one of the larger bear dens. The combat involved a small female Yezo bear, from Japan, and a large hybrid Sloth-Russian bear, born in the Park. The latter animal was the aggressor, and the attack was made without the slightest premonitory symptom of hostility. Bears often act that way.

Everything possible was done by our force of keepers to separate the combatants, but to no avail. The infuriated hybrid bear seemed to be unaware of the energetic use of clubs, bars, streams of water and ammonia fumes. The struggle lasted many minutes, and at its end the Yezo bear was killed and dragged into a sleeping den. The hybrid became so savage and aggressive that for an entire day the keepers were unable to enter the den. Rather than risk another tragedy, the murderous animal was mercifully destroyed.

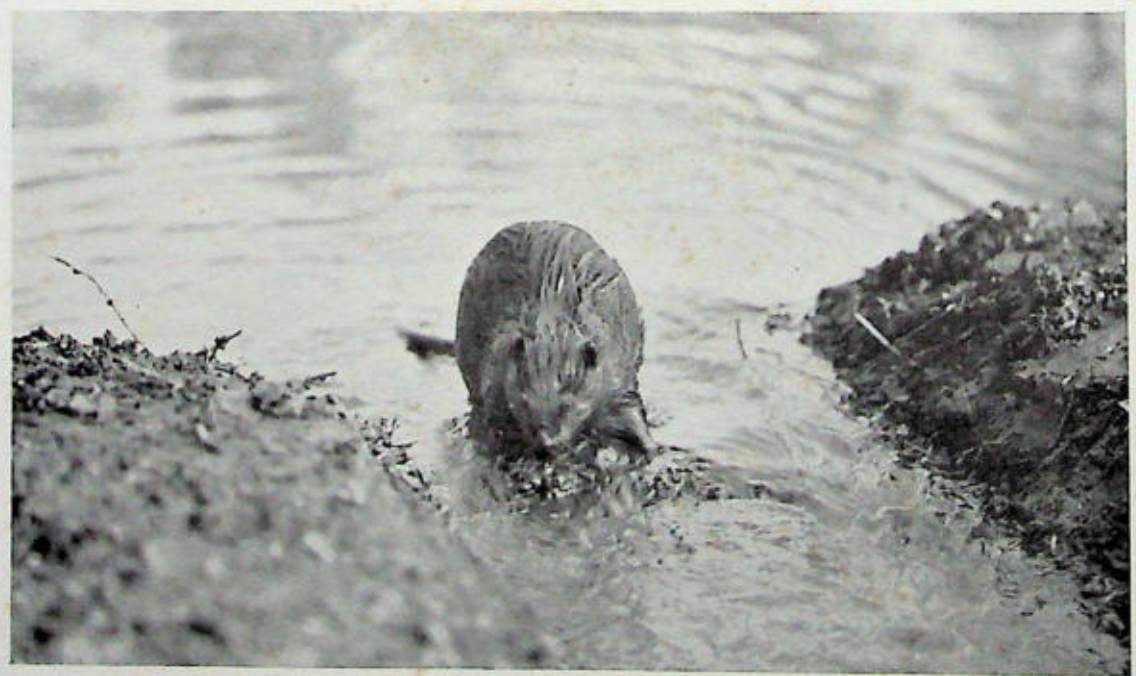
Battling Under Water.—A few days after the combat at the bear dens, there was a tragedy at the Sea-Lion Pool. A recently arrived sea-lion had at first been very friendly with the two others which had amicably occupied the pool. Trouble developed without warning, and the most of the fighting took place under water. Our second best specimen was killed by a savage bite through the head. This was our first fatal case of fighting between sea-lions.

Strange Antics of a Monkey.—There is a large rhesus monkey in the Park that seems to entertain strange hallucinations. Whether or not this animal is actually insane is a problem. From a position of rest he will suddenly glare ahead, then make a frantic reach for an imaginary something that seems to be passing near. The motion appears like an effort to grasp a passing fly. At times the endeavor is with both hands, as if the object were large and formidable. Often he will spring several feet in the effort. These antics take place only if the keeper is near, and sometimes considerable energy is consumed. The animal is in splendid physical condition.

Giant Otters.—For the past six months the Zoological Society has been in long-distance possession of three giant otters, in the hinterland of French Guiana,—bought and paid for, but undelivered because of a lack of ships to bring them. "It is the war!" We never yet have exhibited that remarkable species, and it is rather galling to *at last* be so near to de-facto possession, and yet so far. Apparently those giants are destined to live and die in their own country.



REPAIRING THE BEAVER DAM
Placing sticks on the dam.



Photographs by E. R. Sashorn.

FILLING THE CREVICES WITH MUD

The very heavy rains of early June were disastrous to the work of our beaver colony. The pond became so filled that it overflowed a portion of the dam, and in the process a section of the beavers' work was carried away. This happened in the morning, and by noon there was much excitement among the members of the colony.

There was frequent diving for water-soaked sticks, and when materials had been located, the repairs were started with a rush. Each of the industrious animals made dozens of trips to the dam, carrying sticks—often twice as long as themselves, then covering these with mud and wet leaves. At one time five beavers were counted working together in placing peeled branches, and packing the crevices with mud.

The result of these activities was a much longer and higher dam than has previously been built by our beaver colony. It should be understood that the beaver's idea in building a dam and making a pond is to keep the entrance of its mound-like home submerged and hidden, and also to provide water in which to dive and escape from its enemies on shore.

ZOOLOGICAL SOCIETY BULLETIN

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A HOMING PIGEON OF THE SOCIETY'S FLOCK

The true racer is always keen and alert, like the thoroughbred it is. This bird has flown 500 miles, and represents the best strains in existence.

ZOOLOGICAL SOCIETY BULLETIN

Published by the New York Zoological Society

VOL. XXI SEPTEMBER, 1918 NUMBER 5

THE DOVE OF WAR

By LEE S. CRANDALL

AT a time when every force for good is rallying to the cause of freedom and justice, we may look for strange things. Men whose interests have centered in business and sports, women whose thoughts have seldom wandered from home and shopping, have risen to undreamed-of heights of sacrifice and devotion. That the dove, the popular symbol of peace itself, should assume the guise of a messenger of Mars, is perhaps the most astounding of all.

As a matter of fact, pigeons and doves are far from being confirmed pacifists. Tradition and the proverb maker have conspired to give them a reputation which mere earthly creatures find difficulty in maintaining. Five minutes spent before an aviary containing doves of assorted species, or in a loft of domestic pigeons, may well result in a lifetime of wondering why the idealized bird which represents this group was chosen as the emblem of peace. The idea has been a great help to cartoonists, but the dove has been placed in a false position. It is true that it has no teeth, claws or wing-spurs, with which to fight, but otherwise it does the best it can. The beak and the wings are the doves' only offensive weapons; but woe betide the columbine trespasser on nesting sites, or the misguided squablet that strays from its parental box.

And so it happens that our great war has given a sturdy race of birds a rare opportunity to show its spirit. News reports teem with the praises of the stout-hearted little bird which already has won itself undying glory on the battlefields of France. What greater praise could be given the erstwhile dove of peace than its new and well-won title of "war pigeon"?

The pigeon is not entirely new to war. There are hazy references to its use as a messenger by the ancient Egyptians and Persians, when its owners were engaged in warlike as well as peaceful pursuits. The cultivation of the homing instinct, from the time of the Romans down to the present day, is a matter of history. For centuries the development of this faculty was confined to Eastern peoples, and it was not until a considerably later, though indefinite, period that the birds were brought to Western Europe. They then became popular, and were widely kept, particularly in Holland, Belgium and England, where they developed various breeds. Pigeon racing finally became a national sport in Belgium, and we are indebted to that country for the production of the modern homing pigeon.

The blood of the ancient strain gradually became mixed with that of others, so that the direct line of lineage has been lost. Early in the 18th century we find the Belgians in possession of a short-beaked, frill-breasted pigeon, known as the Smerle. This bird probably represents the original Eastern homer with an infusion of the blood of a round-headed African breed, possessed of great intelligence and powers of flight, which was known as the Owl. The Smerle was a fairly efficient flier, and traces of its characters are still to be seen in modern birds.

The English, in the meantime, had produced from their importations various closely related breeds used for homing purposes, chiefly the Dragoon, Horseman and a cross-breed known as the Skinnum. These were large and powerful birds, heavily wattled about the eyes and beak. Some of these birds, probably Dragoons, found their way to Belgium, where they were

promptly crossed with the native Smerle. The Cumulet, a white-plumaged bird of tumbler derivation, but noted for high-flying, was also introduced.

From this seeming chaos, after many vicissitudes, the racing Homer, unequalled in speed, endurance and intelligence, finally was evolved. These three characters have remained the great objectives of the breeder, and color, markings and other points commonly sought among domestic pigeons have been ignored. Many derivatives, bred for exhibition points only, have risen to popularity, but the racer, not always uniform in type and color, though never failing in courage and love of home, still remains the pigeon of pigeons.

Having proved its value as a flier in Belgium, the newly evolved breed was quickly imported into England, and later was brought to America. The sport of pigeon racing soon became popularized, and its devotees now number thousands. In America hundreds of races are flown yearly, under the auspices of local clubs and the larger national organizations with which they are affiliated. With the over-running of Belgium by the German hordes of pickers and stealers, the great majority of the famous studs of racing pigeons were seized and sent to Germany. However, the blood of these great strains is widely spread and strongly cherished in England and in America, so that they will not become lost to civilization.

Through a confusion of names, which has become widespread, the homing pigeon is almost invariably referred to in news reports as the "carrier." He is a carrier so far as service performed is concerned but, unfortunately, that name was long ago preempted by an entirely different bird, closely related to the Dragoon and Horseman, and known as the English Carrier. This pigeon, while perhaps originally used for flying, now is useless for that purpose and is kept for exhibitoin only. It is a large bird, with extremely long neck and legs, and carries a huge mass of flesh about the eyes and on the beak. This misuse of names has caused much of the credit due the true homer to be given a pigeon which would not home from a distance of a mile.

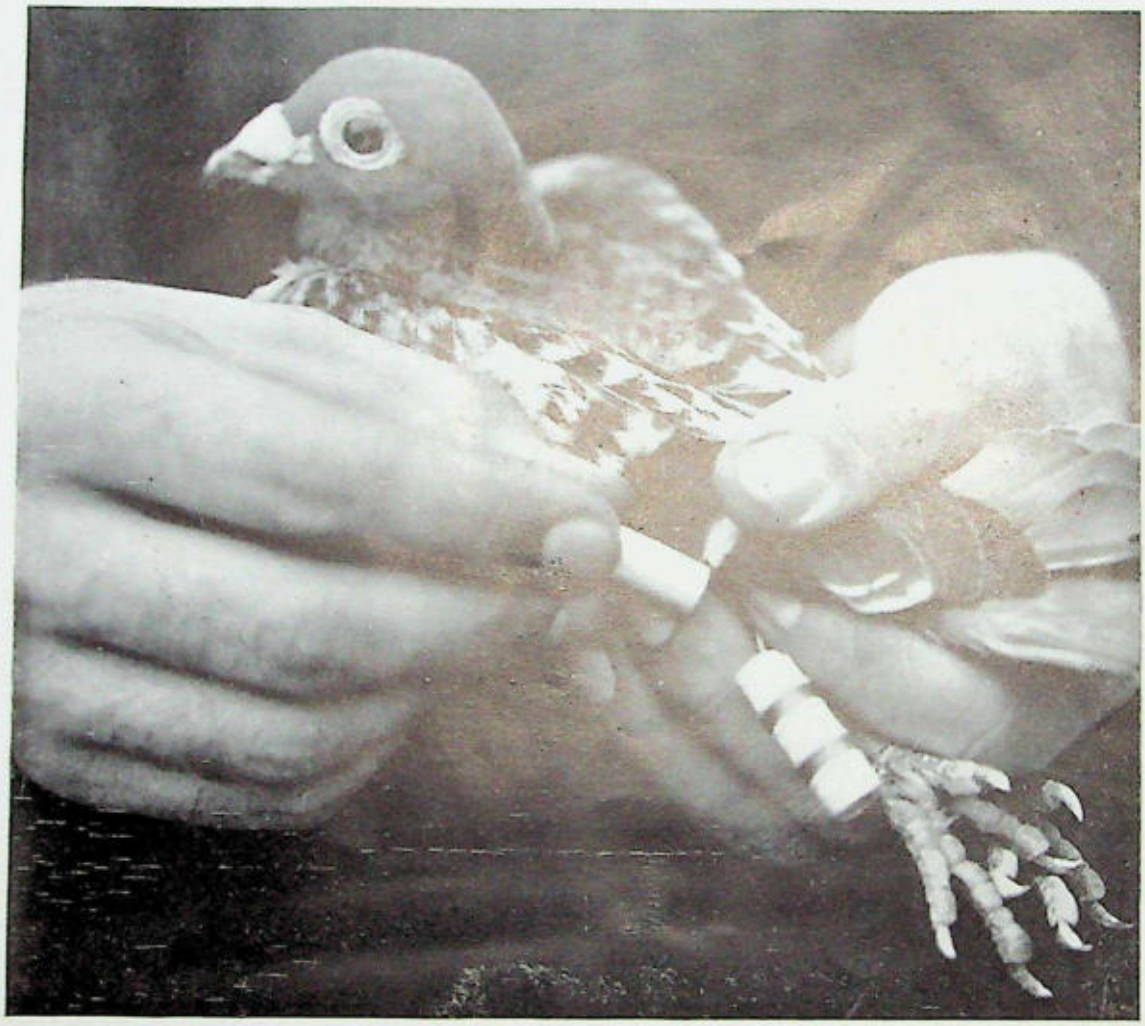
Many misunderstandings have arisen as to the homing abilities of the war pigeon. Many persons appear to believe that it is merely necessary to whisper a few directions in the bird's ear, toss it into the air and watch it strike out for the destination indicated. Other fancies, still wider of the truth, are numerous. There is nothing supernatural about the homer. It simply has a strongly developed love of home, a wonderful sense of direction and the strength and courage to return to its loft when released at a distance.

Sense of direction is strongly developed in most birds. We have only to consider the marvellous migration flights of many species to realize that this is true. In domestic pigeons this sense, doubtless native to the wild Rock Dove from which they are descended, has degenerated through countless generations of life in captivity. Only in the homer has it been retained and magnified by long continued breeding and selection for this point alone.

Many theories have been advanced to account for the ability of the homer to find its way. Some explain that the bird is gifted with remarkable vision and is able to distinguish the immediate surroundings of its home from great distances. Others hint vaguely of electrical currents and subtle influences of the air. But the most reasonable explanation is the operation of the mysterious sense direction, common to all birds, developed and strengthened by the intensive training to which the young homer is subjected.

As soon as the young bird leaves the nest, it is placed in a position from which it can view the surroundings of the loft without having its full liberty. Pigeons of this age, getting their freedom without this gradual introduction, will often burst into flight and never return. After the young bird has become accustomed to the out-of-doors, it is allowed to walk out. Under favorable conditions, it quickly becomes settled, but the slightest fright at this stage may cause it to dash off in a state of excitement. When the baby fat begins to be replaced by the firm muscles of adolescence, the bird will begin to take daily flights, often of long duration, in company with its fellows. It thus becomes familiar with the country for several miles about.

Now serious training is begun. A particular direction is selected, usually chosen with regard to prevailing winds and other conditions, and the birds are worked toward that point of the compass by a series of tosses at gradually increasing distances. The first flight usually is half a mile, the second a mile, and so on until ten have been accomplished. The steps are then lengthened so that after the fifty-mile mark has been passed, jumps of from fifteen to twenty miles are made. When one hundred



HOW THE WAR PIGEON CARRIES MESSAGES
The aluminum capsule is of the type used in active service, and was secured through the courtesy of the Signal Corps, Eastern Department, U. S. A.

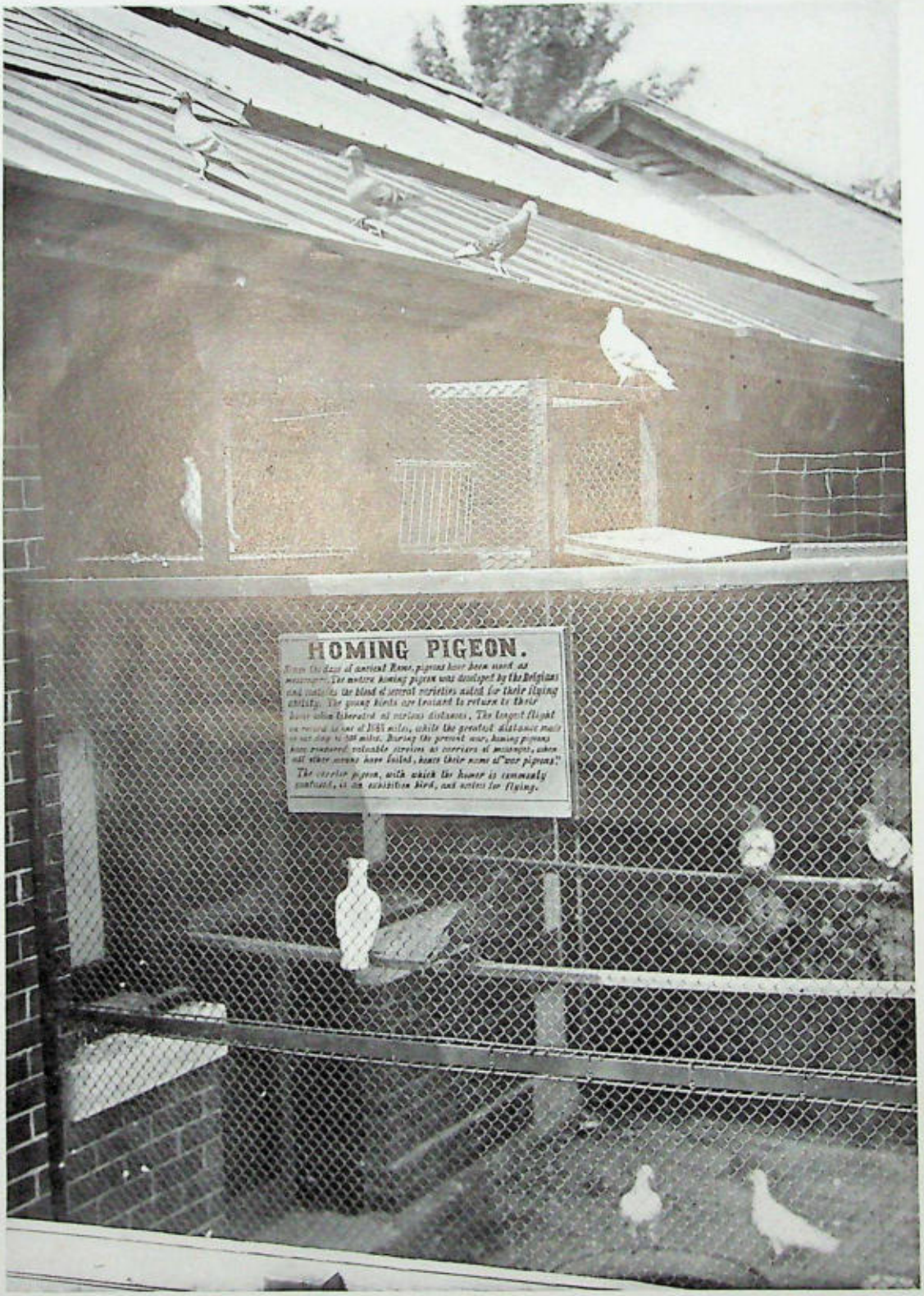
miles have been flown, the birds are sent to 150, 200, 300 and 400 without intermediate stations.

Four hundred miles is the greatest distance birds of the year usually are asked to accomplish, but exceptional youngsters occasionally have done 600. Five hundred miles is the most popular long distance race for old birds, but contests up to 1,000 miles are flown yearly. Eight hundred miles were accomplished in one day by a famous bird, but distances over 500 miles usually require more than a single day.

The speed at which homing pigeons fly is one of the first questions that comes to the mind of the inquiring layman. This varies greatly with the distance, the shorter distances naturally being flown in much faster time. Flights of 100 miles, with a favoring wind, often are made at the rate of a mile a minute, or even better. Recent tests under the supervision of the Signal Corps showed that field messages sent by means of homing pigeons were delivered in much shorter time than by automobile or motorcycle.

The longest official distance flown by a homing pigeon was a flight from Denver, Colorado, to Springfield, Mass., 1,689 miles. A little more than twenty-three days were required for this feat, the bird flying only by day, gleaning its food from fields and poultry yards as it came.

The fastest time for 1,000 miles is one day and eleven hours, a truly remarkable performance. This bird, rejoicing in the name of "Bullet," still lives in Fort Wayne, Indiana. It



WAR PIGEONS AT HOME IN THE ZOOLOGICAL PARK

Love of home is the strongest characteristic of the homing pigeon, and everything has been done to add to the contentment of our birds. The bars in the entrance at the top swing inward, so that the pigeons can enter the loft, but cannot leave again.

is a satisfaction to know that both these world's champions were produced in America, giving assurance that the heritage of the now scattered lofts of Belgium has not been neglected in this country. Grandchildren of both these famous birds are included in the flock recently installed in the New York Zoological Park. Others of almost equally illustrious descent complete the new exhibit, which is proving of great interest to our visitors.

Automatic selection, operating through the medium of severe trials of flight, will leave us only the best individuals at the beginning of the next breeding season, when the product of our loft will be placed at the disposal of the Government. Especial thanks are due to Mr. F. C. Schmidt, secretary of the United Homing Pigeon Concourse, of Greater New York, for much valuable advice in our newest undertaking.

Particular interest in the Pigeon Section of the Signal Corps will be taken by members of the Zoological Society when it is known that two keepers of the Department of Birds, Louis Wahl and William Smead, recently have joined its ranks. Corporal T. Donald Carter, until recently one of our keepers of birds, is now in France in the same branch of the service.

AUSTRALIA'S MOST REMARKABLE MAMMALS

Based on the Collections of the New York Zoological Park.

PART II.

By W. H. D. Le Souef,

Director of the Zoological Gardens, Melbourne.

Author of "The Mammals of Australia," "Wild Life of Australia," etc.

THE KANGAROOS

ALL kangaroos have more or less the same habits and are usually found in small companies in country where they are not disturbed. They are protected for the whole year in Victoria and soon increase if undisturbed. Partial protection is given them in New South Wales, but not in Queensland, except in certain districts. The number of skins annually sent to other countries from Australia, especially from Queensland, runs into many thousands. Of this number, the United States receives a large share; sometimes over 80,000 in one year.

Many men make their living entirely by shooting kangaroos with a rifle; one man I know having shot over 400 last year (1917). This means that in the course of comparatively a few years, these interesting animals will become very scarce, as the skins of all species, including wallaby, are used for leather. The introduction of the fox into Australia will not help matters as they are sure to kill some of the young ones. These animals fortunately live and breed freely in confinement, having one young one at birth, although twins have been known to occur occasionally.

They are hunted on horseback with the aid of a large dog of the grey-hound type, known as a kangaroo dog, and if the country should be sufficiently open, they usually are caught and killed. When hard pressed, they often will take refuge in a river or in swamps where they stand waist deep in the water awaiting their enemies. Should a dog swim out to them, they will hold it under water with their fore arms and eventually drown the venturesome animal. When attacked on land, the old males that are not as speedy as the females, often stand with their back to a tree ready to fight with the dogs; and they are usually quite a match for any single dog. Young kangaroos are often caught and reared by hand, when their mother has been shot or otherwise killed. Their backs are easily damaged if roughly handled. When leaning forward to feed on short grass, they often rest on the upper part of their paws, as well as on the under part in the ordinary way. When in this position, the young that may be in the pouch, and old enough, can nibble on the grass at the same time.

Kangaroos are diligently sought for their skins, and although they are well protected in Victoria, and to a certain extent in other parts of Australia, their numbers are diminishing. A small, slender species, Parry's Kangaroo, (*M. parryii*) is found in the hilly coastal districts of Queensland and northern parts of New South Wales. The short, soft and light bluish-grey fur marked with a white line on each side of its face as well as on the neck, and long, thin tail, have suggested its local names the Pretty-Face or Whip-Tail Kangaroo. It usually frequents scrubby country and often may be seen



BLACK SWAMP-WALLABY
Young kangaroos seek refuge in the mother's pouch until one-third grown. This young specimen was fully weaned, but rushed for the mother upon the slightest disturbance.

in the Darling Downs district from railway carriages when one is travelling from Brisbane to Sidney, or vice-versa. It is three feet in height and its tail is two and one-half feet in length. The Red Kangaroo, (*Macropus rufus*) is probably the largest of the kangaroos. The short, woolly fur is red in color in the male and bluish grey in the female. When standing upright, practically on its hind toes, and resting the weight of its body on the end portion of the tail, it measures about six and one-half feet; otherwise four to five and a half feet.

Old males get very pugnacious and frequently fight one another. They do so by scratching, if possible, with their fore paws, and also by leaning back and resting the weight of their body on the extreme end of their tail, only about six inches, and striking forward with the hind feet. The claws are sharp and although they do not often do much damage to each other, they can easily rip up an unwary dog should one tackle them. These animals live on the plain country of New South Wales and southern Queensland, generally remaining during the heat of the day under the shade of the trees that fringe the plains. They can easily travel at the rate of twenty miles an hour when pursued, and exceed that speed when pressed. They cover about twelve feet at a jump and can clear a fence eight to ten feet high. Occasionally they are pursued on the plains with motor cars, although I hardly think that is a fair way to get them, as they have no chance, unless they get into a belt of timbered or rough country. However, the sport is not destined to be very popular as motoring over the plains at over twenty miles an hour is usually a very bumpy experience. A female kangaroo when hard pressed in flight if she should be carrying a heavy young one, or joey in her pouch, will take the young one out and conceal it under a bush, coming back when all danger is over, should she have a chance.

The only safe way to hold a kangaroo is by the tail, and it takes a strong man to hold one. The young are born in the ordinary way, but in a very immature state. They are about an inch long, the fore feet are twice the size of the hind feet and the tail very small. It is placed on



BENNETT'S TREE KANGAROO

The tail is not prehensile, but is used in balancing. The forefeet are adept in grasping. These animals sometimes leap to the ground from a height of fifty feet.



GIANT RED KANGAROO

Largest known species among the kangaroos. A standing specimen measures six and a half feet high. The tail is used as a prop as well as a balancing member in leaping.

the nipple in the marsupium by the mother and the pressure of the milk forms a small bulb at the end of the nipple at the back of the mouth. This swelling being larger than the entrance to the mouth of the young one, holds it on. If the young kangaroo is pulled off at an early stage it cannot be replaced.

The Grey Kangaroo, (*Macropus giganteus*) is found across the entire southern part of Australia as well as in Tasmania. The species from that island (*M. fuliginosus*) is now very scarce. It has long, dark fur and the under parts are white. The female is much lighter in color than the male. Those on the western side of the mainland usually are darker, but generally melanism is more pronounced among the animals in the western portion of Australia than in the eastern. These animals are only a little inferior in size to the red kangaroo, and the fur is longer and coarser. The males are a dark grey and the females and young much lighter. They are found in open forest country and frequently are called locally the Forester Kangaroo. The variety from Tasmania and Kangaroo Island (*M. fuliginosus*) is now very scarce. It has long, dark fur, the under parts being white. The female is paler than the male.

The Wallaroo or Euro Kangaroo, (*M. robustus*), has long and coarse fur; the color of the male being dark reddish-grey and that of the females more bluish-grey. Farther north in Queensland, the color is often dark greyish-brown in the males. The exact tint varies considerably. This variety is found in the central districts of Australia, as well as towards the coast. They live only on the rocky ranges and are thickset and strong and adepts at bounding over the often rough country where they are found, and where fequently it is difficult for a dog to follow them.

Several sub-species of this animal, (*M. woodwardi*) from northwest Australia, have been described. The color of the short close hair of the male is bright red and that of the female fawn. The head and body measures four feet and the tail three feet. The fur of *M. alligatoris* from north Australia is also short and the color more or less rufous, with the neck, arms and foreback, fawn. Another sub-species from southwestern Australia, *M. cervinus,* is lighter in color, and lastly *M. isabellinus* from Barrow Island off West Australia, has a dark rufous back with the front of the neck white. In the southern districts of Australia, in the drier and frequently sandy country where the mallee eucalyptus grows, is found a darker and more slender variety of kangaroo, the Black-Faced (*M. melanops*). However, as this country is being cleared rapidly for wheat-growing, this animal will become scarce, as it is destroyed by the farmers.

The Antilopine Kangaroo, (*M. antilopinus*) is found in the Coburg Peninsula in north Australia, and very little is known of this animal. It is of a heavy build with short fur, rufous in color with underparts white. The female is smaller and of a fawn color. The head and body are four and one-half feet and the tail two feet long.



CAPTIVE TREE KANGAROOS
In the Zoological Gardens at Melbourne, Australia.

The Tree Wallaby

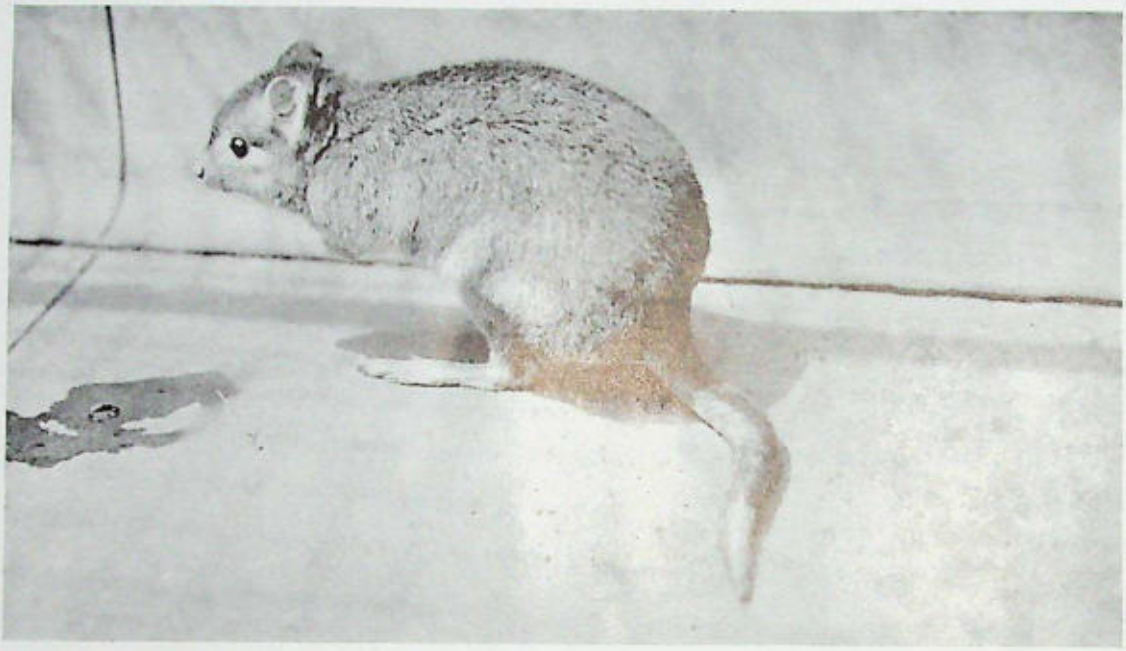
These interesting animals are found in the mountain ranges near the coast of northern Queensland as well as in New Guinea. Two varieties inhabit Australia, namely Lumholt's, (*Dendrolagus lumholtzi*) and Bennett's, (*D. bennettianus*). The former which has long yellowish-brown fur with a black chin and white chest is found in the more southern districts near Cardwell, and the latter which has long dark brown fur, further north near Cooktown. Like most of the other grazing Australian animals, they rest during the day and feed chiefly at night. They live almost exclusively in trees or on tops of granite boulders that are covered with vegetation. I once saw one of these animals that I disturbed when in the latter situation, jump to a rock below, a distance of about forty-five feet. It is wonderful the way they are able to jump from bough to bough and rarely make any miscalculation. Their long tail is not prehensile and is used for balancing only, and the soles of their hind feet are serrated and that prevents them from slipping.

The natives obtain them by going to the upper portions of the scrub-covered ranges in the early morning with their dogs, and the latter are frequently able to pick up the scent of a kangaroo that has gone from one tree to another or to track it to the tree in which it is feeding. Some of the natives then climb any tree in proximity to one that shelters the wallaby, to prevent it escaping into it, while another of their number climbs the tree that harbors the animal, and either catches it by the tail or forces it to jump to the ground in its endeavors to escape. The other natives with the dogs are there on the lookout for it and generally secure it.

The tree wallabies frequently get from one bough to another by going along towards the end of a branch, and clinging to it with their fore paws. As it bends they are enabled to get a foothold on one at a lower level. They can also jump a considerable distance from one bough to another. As a rule, when they are on the ground they lean well forward and keep their tail clear of the soil. In ascending a tree they do so by clinging with their fore paws round a creeper and moving both hind feet up at the same time; and they go up very quickly. They cannot ascend an ordinary trunk of a tree, but, as the forests in the districts where they are found abound with creepers, practically



BENNETT'S TREE KANGAROO
They both climb and nimbly jump from branch to branch.



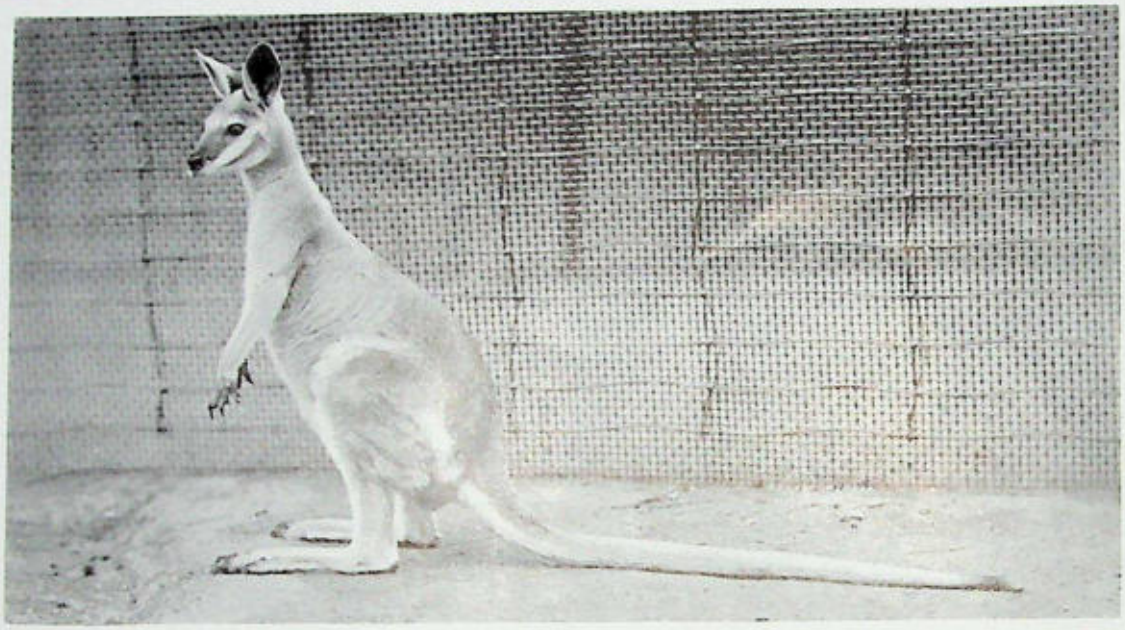
RAT KANGAROO
The tail is prehensile and is employed in seizing and carrying grasses with which the animal makes its nest.

every tree having one or more, they have no difficulty in climbing. They also can climb an ordinary two or three-inch rope with ease, or even a gas or water pipe; their serrated pads enabling them to get a secure hold. Should one escape on board a vessel, it quickly climbs the ropes and easily gets to the mast-head. These animals in their native state are more or less infected with two or three kinds of parasites and often have sore places caused by them. As their food consists of leaves and various shrubs, they live well in captivity.

Wallabies

There is little difference between kangaroos and wallabies. The members of the genus *Macropus* whose head and body are over four feet in length are called kangaroos, and those three feet and under, usually wallabies. One of the largest of the latter is the Black-Tailed, (*Macropus ualabatus*) measuring just under three feet and the tail two feet. This animal which is of rather a heavy build, and not nearly so active as many of the smaller kinds, is always founds in scrubby country. Its color is very dark brown or reddish-grey and light rufous underneath. They formerly existed in countless numbers in the densely timbered portions of the coastal districts of New South Wales and Victoria, and hundreds of thousands of their skins have been exported. But trappers and settlements have so reduced their numbers that they are now protected in Victoria. During the day they usually remain well hidden, coming out in the evening to feed. A very closely allied variety, (*M. apicalis*) is found in the same class of country in the coastal districts of Queensland. It has shorter fur and the rufous color is more intense. Probably the largest of these animals is the Red-Necked Wallaby. It is of more slender build than the preceding species, is greyish-fawn in color, with a reddish neck and rump, and measures three and one-half feet and its tail two and one-half feet. It is found in the eastern parts of Australia from southern Queensland to Victoria where it usually inhabits the open forest country.

The Tasmania form of this wallaby, (*M. bennettii*) has thicker and longer fur and is slightly darker in shade. Its neck and rump are dull brown instead of red. It also is found in southern Victoria and on the islands in Bass Strait. Formerly it was very plentiful, especially in the Islands, but now the hunters with their dogs have completely exterminated them also, except in Tasmania, where they still hold their own in the rough parts. In captivity they easily become tame and do not knock themselves about in the way other species often do. In Victoria and south Australia, Grey's Wallaby,



PARRY'S KANGAROO
Distinct facial markings render this species quite recognizable.

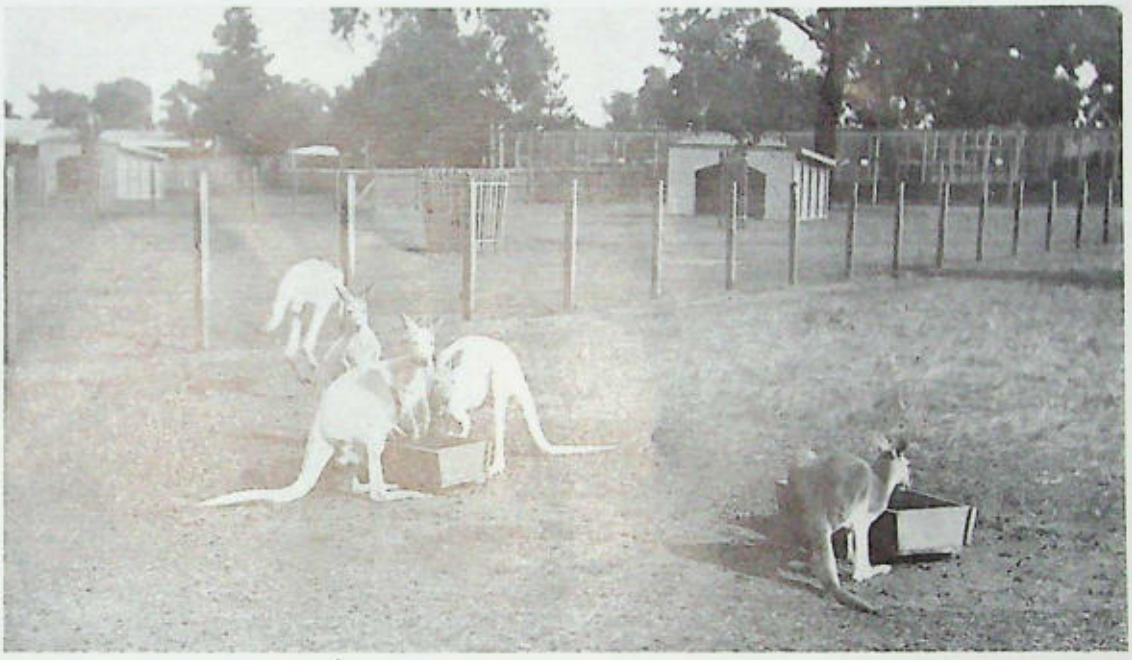
(*M. greyi*) is found. It is a slender animal and can travel very fast. The color is greyish-fawn with a rufous tinge on the neck. It measures about two and one-half feet in length and its tail slightly under. Another fine wallaby, the Black Striped, (*M. dorsalis*) is found in the inland districts of New South Wales and southern Queensland. The general color is grey with a reddish tinge on the forequarters, and it is readily distinguished by a narrow black line down the center of its back. It measures slightly over two and one-half feet and its tail two feet.

The Black Gloved Wallaby, (*M. irma*) from southwestern Australia is a well-marked animal, with soft fur of a bluish-grey above, white below the chin, cheek stripes also of the same color, and another white stripe on the neck, edged with darker color. They measure about three feet and tail two and one-half feet, thrive well in captivity and make very docile pets. The Agile Wallaby, (*M. agilis*) is a heavier animal with short, coarse dark sandy-colored fur, very short ears and a long tail that easily distinguishes it. The habitat of this species is southeast New Guinea, as well as in the northeastern portion of Australia. The Cape York Wallaby, (*M. coxeni*), another species from northeast Australia, is also a dark sandy color, darker on the back with white underparts and a white hip-stripe. These animals are small, being only twenty-eight inches long and their tail fourteen inches.

The Rufous-Bellied Wallaby, (*M. billardieri*) used to be exceedingly numerous in Victoria and especially on the islands in Bass Straits, as well as in Tasmania, but those on the islands have been nearly cleared out. The hunters with packs of kangaroo dogs, used to burn the thick patches of scrub in which they knew the wallabies had taken refuge during the day and their dogs caught the unfortunate animals as they ran out. Their habitat is in the dense scrub and although their runs are very numerous in such places, they are fairly safe under ordinary circumstances. Many hundreds of thousands of their skins have been exported. These animals are of stout build, have thick, soft fur of a dark greyish-brown color, face and head olive-grey and no face markings. The body measures twenty-seven inches and the tail which is very short, only fourteen inches.

The Short-Tailed Wallaby, (*M. brachyurus*) from western Australia is the smallest of the wallabies. Its body measures twenty-three inches and its tail ten inches. Its fur is long and coarse and is a uniform greyish-brown. The ears are small and rounded. Its habits are identical with those of the rufous-bellied wallaby.

The Rock Wallabies (*Petrogale*), are found all over Australia, but not in Tasmania. As their name implies they live only in rough, rocky



ALBINO RED KANGAROOS
In the Melbourne Zoological Gardens.

country, whereas the members of the family *Macropus* are usually found in the more level districts. The Rock Wallabies lean well forward, using their long, bushy tails only for balancing and not as a third support, as do the Macropus family, especially for the larger forms. The underside of the toes are covered thickly with small tubercles that prevent the animals from slipping on the rocks, especially when they are wet. They usually take refuge during the day in caves or under rocks, coming out to feed in the evening and at night. The wonderful way that they can bound freely and without hesitation from rock to rock, sometimes onto excrescences that can hardly be seen, is extraordinary. A dog naturally and fortunately has little chance of catching them. In the many runs among the rocks that have been used by countless numbers of these animals for many years past, the rocks are perfectly polished and shiny. No ordinary fence will stop this active animal, and, should they escape from captivity they seem to enjoy hopping about the roofs of buildings, apparently quite at home and where they cannot well be followed.

The Brush-Tailed Wallaby (*P. pencillata*) found in the Eastern coastal districts of Australia, is a thick set animal with long, coarse brown fur, a light cheek-stripe and short ears. It measures thirty inches long and the tail, usually tipped with yellow, is twenty-four inches.

There are three wallabies belonging to the genus *Onychogale* (Nail-Tailed). They are well marked animals having fairly long tails, crested at the ends and provided with spurs. These are the only marsupials that have such an excrescence. Among mammals, the lion is the only one that has a similar spur. The Nail-Tailed Wallaby, (*O. unguifera*) from northwest and north-central Australia is a slender and graceful fawn-colored animal, with a darker medium band, and white hip-stripes and under parts. The body measures twenty-six and the tail twenty-eight inches. The tail is long and white on the upper side with a few, faint brown rings showing towards the end, which is black. The spur is flattened laterally and hidden in the long hairs.

Rat Kangaroos

We now come to the Rat-Kangaroos, or as they are called in Australia, Kangaroo Rats. They formerly were exceedingly plentiful, but dogs and foxes have taken a heavy toll of them and in the settled districts they have almost disappeared. They are about eighteen inches in length with a tail fourteen inches, and of a sandy-grey color. They usually sleep coiled up in their nests during the day, coming out to feed in the evening and at night. The largest of



SHORT-TAILED WALLABY
With these smaller species the tail is of little use as a prop.

them, readily distinguished by its reddish-grey color, the Rufous (*Aepyplymnus rufescens*) is found only in New South Wales, and is twenty-one inches long with a tail fifteen inches. It has an indistinct stripe in front of the hips.

There is another family of these active little animals namely the Bettongs, (*Bettongia*), characterized by the fact that they are the only ground animals having prehensile tails, which they use for carrying bundles of grass for the construction of their nests. A hollow is first scraped out in the ground and in it a dome-shaped nest of grass is built; the top being about level with the surface of the ground. The animal upon entering the nest draws a bunch of grass after him, and closes the entrance so perfectly that the nest cannot be detected, easily. A fox or dog, however, can readily detect the presence of the owner; if he happens to be at home. If he should be, there is little hope, for the intruder simply pounces down on the nest and usually secures the owner. The varieties of these animals are closely allied externally and are difficult to identify without knowing the locality from which they came. The Tasmanian variety, (*B. cuniculus*) is slightly the largest and has white feet instead of brownish, as in the others. The underparts are white and, generally, there is a white tip on its tail. The New South Wales variety, (*B. gaimardi*) has hair of a more woolly texture than the others and white hind paws; also a few white hairs at the tip of the tail. The Brush-Tailed Rat-Kangaroo, (*B. penicillata*) is found all over southern and central Australia and has a body length of fourteen inches. The tail which is twelve inches long has a black crest along the upper surface of the lower portion, but not white hairs at the tip. The phinarium is bare of fur as in the other species. This is the variety that is usually seen in captivity.

Educated Chimpanzees.—Our keepers at the Primates' House are giving daily exhibitions in which the chimpanzees and orang-utans prominently figure. These exhibitions take place in the large outside cage at the north end of the building, and illustrate the adaptability of the anthropoid apes in learning to do many things that require a high degree of intelligence. The animals take their meals from tables, ride bicycles and go through other interesting manoeuvres.

Growth of the Warthog.—Our single specimen of the African wart-hog has developed into a most spectacular animal. Although his tusks have developed into very long and formidable weapons, he remains fairly tame, and his keepers freely enter his enclosure. On approach, this animal inspires respect and caution, as he has an alarming habit of gnashing his tusks. In retreat, however, the wart-hog provokes a smile, caused by his insignificant tail. It appears that nature has been singularly stingy in providing him with means of fighting flies, and while his tail is a very busy appendage, it looks like the remnant of an animated shoe-string.



HOME OF THE TREE KANGAROO



MALE OF THE SWAMP-WALLABY

The dexterous manipulation of the forefeet is clearly shown.

ZOOLOGICAL SOCIETY BULLETIN

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Elwin R. Sanborn,
Editor and Official Photographer

Vol. XXI, No. 5 SEPTEMBER, 1918

THE JOHN J. PAUL GIFT OF BOOKS

In the first instance, every great zoological library is founded upon a certain number of the great illustrated folios of birds and mammals, such as the average young zoologist ardently longs for but rarely achieves until their usefulness—to him—has passed.

For ten long years, dating back to the opening of the Administration Building at the Zoological Park, we have longed for the sumptuous works of Gould and Audubon and Elliot, without having achieved a single folio volume. The Society had so many other lines of endeavor that the Library simply had to wait.

Now, at last, our library's Good Genius has appeared. His name is John Jay Paul, and his habitat is Watertown, Florida. We have a suspicion that he is interested in the lumber industry; but in any event the printed catalogue of his library is sufficient to excite envy in the breast of every book-worm.

Mr. Paul observed the yawning chasms in our half-fledged library, and then his gifts began to come in, in a stream that seemed to be intended to make up in one grand coup the deficits of twenty years. Beginning with Cuvier's "Animal Kingdom," in sixteen volumes, and Gray's "Illustrations of Indian Zoology," the scene shifted to Richardson's "Fauna Boreali Americana," the various exploring expeditions of the western hemisphere, and ran the gamut of the best zoological treatises of America, India, Africa and the Far East. There came also a fine series of books of zoological travels.

All these, however, represented merely a foretaste of the splendid folios that followed. To show a sample of each of the latter on Members Day required a series of tables twenty feet long. The truly great folio works, representing thousands of dollars in value, were the following:

Audubon & Bachman's "Quadrupeds of North America," 3 vols. and text.

Cuvier & Saint Hilaire's "Natural History of Mammals." 4 vols.

Gould's "Partridges of America."

Grau's "Illustrations of Indian Zoology." 2 vols.

Elliot's "Monograph of the Birds of Paradise."

Elliot's "Monograph of the Ant Thrushes."

Elliot's "Monograph of the Hornsbills."

Elliot's "Birds of North America." 2 vols.

Taken altogether, Mr. Paul's gift of books forms a noteworthy collection, and goes far toward taking out of the mouth the bad taste of ten lean years.

BEQUEST OF COL. OLIVER H. PAYNE

Through a bequest contained in the will of Col. Payne, for many years a member of the Board of Managers of the Society, our library has fallen heir to a fine copy of Audubon's "Birds of North America," in three double elephant folio volumes, and also a copy of Audubon and Bachman's "Quadrupeds of North America," in three volumes of the same size.

REMARKABLE ABNORMAL GROWTH OF ELEPHANT TUSKS

A letter recently received from Mr. A. G. R. Theobald, State Shikari of Mysore, transmits a photograph of a dead elephant in a bamboo jungle, bearing remarkable abnormal tusks. Mr. Theobald's description of this strange case follows:

"Last year my son shot three rogue elephants which were proscribed by the Government, as they had become vicious mankillers, and terrorized the Forest Department Staff and the surrounding jungle tribes. One of these elephants had a very unique pair of tusks. Instead of growing in the usual manner, they grew out almost at right angles to the head, like the upper tusks of a wild boar, and making a sharp curve formed a full semicircle. The tip of one had penetrated over six inches into the head just behind the eye, leaving an open, festering wound. The animal was in an emaciated condition, and must have suffered excruciating pain from the wound, which was probably the cause of it becoming so vicious. I am enclosing a photograph of the elephant, showing the curious formation of the tusks."



INDIAN ELEPHANT WITH SIDE-GROWING TUSKS
Shot by Charles Theobald, Mysore, S. India.

ITEMS OF INTEREST

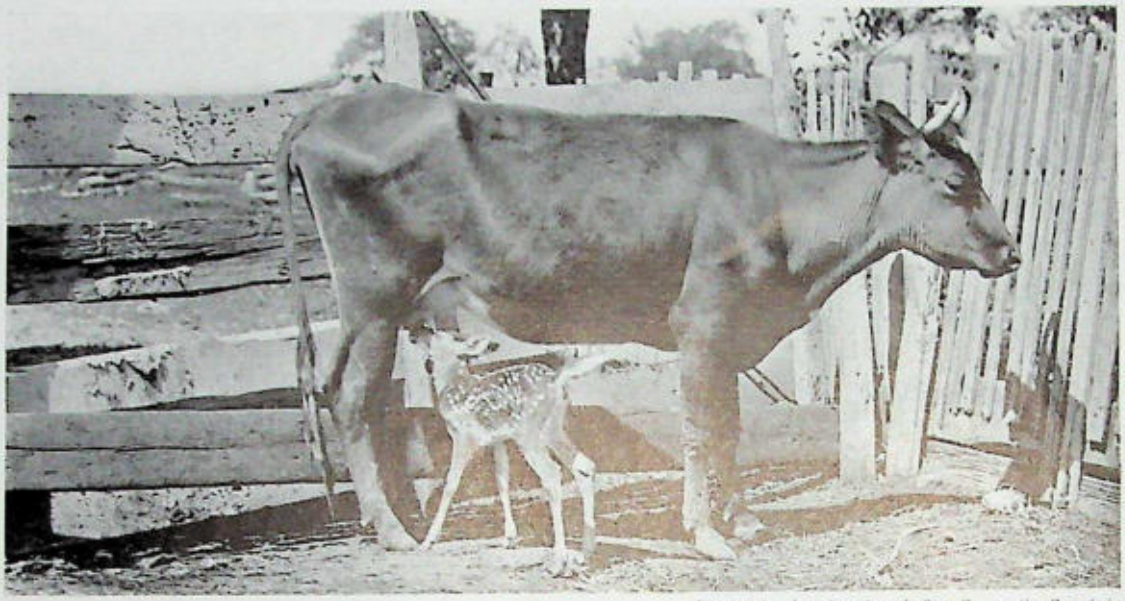
By Raymond L. Ditmars.

Improved Small-Mammal Cages.—A complete outfit of new cages has been built in the Small Mammal House by our own construction force, and this building, with its varied and elaborate collections, is now in much better shape than when it was quite new. These latest specimens of cage work quite successfully solve the old problem of lighting, drainage and sanitary floors, for the housing and display of the smaller mammals. The disagreeable odors usually existing in such buildings have been almost eliminated, and the air purified by electrical machines producing a flow of ozone. While a large series of small-mammals is difficult to maintain at a high standard, even in normal times, the present market conditions render purchases extra difficult.

The good condition of the collections in this building speak well for sanitary conditions and for the efficiency of the keepers in charge.

A Rare Arrival.—In these days of animal embargos, we were particularly fortunate in obtaining a specimen of the echidna, of Australia. There are two families of mammals, whose members lay eggs, and from these their young are hatched as are those of birds. They form the lowest order of mammals, and appear to form a sort of connecting link between the mammals and birds. The Australian echidna is an odd, flat-bodied animal, covered with heavy quills. When alarmed it rolls into a bristling ball. Its snout is much like the beak of a merganser duck, and it is provided with an enormously elongated tongue, which is used in catching ants.

A "Horned" Rattlesnake.—We have recently received another decorated rattlesnake, which is the result of rather clever surgical work by Indians. This specimen arrived from Brownsville, Texas, as the gift of W. A. Snake King, who makes a specialty of collecting and selling rattlesnakes, and who at times has hundreds of these reptiles in corrals on his ranch. Certain



Photograph and specimen from the State Conservation Commission

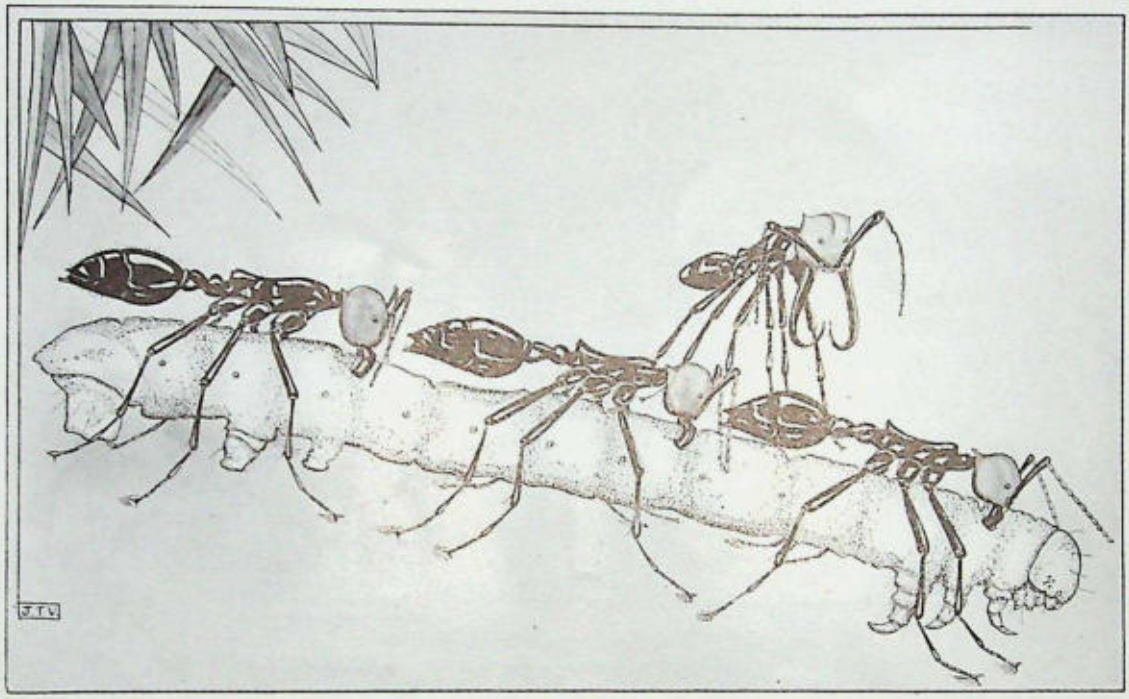
THE GOOD STEP-MOTHER

How an "up-state" White-Tailed Deer fawn was saved for the Zoological Park. The kind-hearted farmer is, unfortunately, invisible.

Indians enjoy the diversion of taking a large rattlesnake and grafting a rooster's spur upon the top of its head. The surgical operation is so cleverly performed, and the healing so perfect, that the decorative appendage appears to have grown there. One of these "unicorn" specimens lived for many months in the Reptile House. Of late, the Indians have elaborated the operation and decorate rattlesnakes with two horns. It is a specimen of this type that has been received at the Park, and it attracts much interest. It was sold to the highest bidder in Brownsville, the purchase price being donated to the local Red Cross unit, and Mr. Snake King kindly procured the sending of the reptile to us.

Savage Hybrid Bears.—Our bears are peaceful and hardy animals and the years pass without combats or sickness in our large collection. The keepers enter the dens each morning and after driving the big carnivores to the top of the rocky ledge, proceed to wash the den floors. Accidents to the keepers have been rare, and the few instances that have occurred could have been avoided. Recently we were startled to hear a great commotion at the Bear Dens and discovered two of these animals in furious combat. The participants were a female Yezo bear from Japan, and a hybrid Russian-Sloth bear born in the Park two years ago. The latter animal was the aggressor. Keeper Romanoff entered the den and with a stout club endeavored to separate the combatants. So infuriated was the hybrid bear, that the blows from the club, blinding streams of water, ammonia fumes and eventually the use of heavy iron bars wielded by several keepers, were utterly futile in making an impression. The Yezo bear was killed and finally dragged into one of the sleeping dens. The hybrid bear continued savage for several days and developed such a threatening attitude towards the keeper that it was decided to mercifully execute him. We have noted in other instances that hybrid bears usually develop a bad temper within their second or third year.

Insect Songsters.—Late afternoon ushers in the katy-did chorus in the Reptile House. To some of our visitors who have never examined these tree-top songsters, or noted how they "sing," the effect is quite startling. A descriptive label explains that the loud call is produced by rubbing together the stridulating organs, which in plain English are the brittle portions of the wings. We hear frequent exclamations of astonishment about the volume of sound produced by these insects. The collection of katy-dids resulted from the arduous work of Keeper Palmer while on a vacation trip. The insects were hunted at night, and stalked by their calls. It was necessary to climb into trees after them, and locate each specimen by means of a flash-lamp.



INSECT TYRANTS

By William Beebe

Illustrations by John Tee Van

I STOOD on the brim of a pit dug in an ancient sand dune in the heart of the Guiana wilderness. A horde of those Huns of the jungle, army ants, had made their drive directly across the glade, and scores of fleeing insects and other creatures had fallen headlong into this deep pit. From my man's height it was a dreadful encounter, but crowding near the edge it became even more terrible; and when I flattened myself on the sand and began to distinguish individuals, and perceive details from an ant's point of view, I realized the full horror and irresistibility of an assault by these ants.

I perceived a large toad squatted on a small shelf of sand in the pit, close to the edge of a crowded column of ants. He was a rough old chap, covered with warts and corrugations, and pigmented in dark grey, with mottlings of chocolate and dull red and occasional glints of gold. He was crouched flat, with all his fingers and toes tucked in beneath him. His head was drawn in, his eyes closed, and all his exposed surface was sticky with his acid perspiration—the sweat of fear. He knew his danger—of that there was no doubt—and he was apparently aware of the fact that he could not escape. Resignedly he had settled on the very line of traffic of the deadly foe, after intrenching himself and summoning to his aid all the defenses with which nature had endowed him.

And he was winning out! He was the first vertebrate I have ever known to withstand the army ants. For a few minutes he would be ignored and his sides would vibrate as he breathed with feverish rapidity. Then two or three ants would run toward him, play upon him with their antennae, and examine him suspiciously. During this time he was immovable. Even when a soldier sank his mandibles deep into the roughened skin and wrenched viciously, the toad never moved. He might have been a parti-colored pebble embedded in its matrix of sand. Once when three bit him simultaneously, he winced, and the whitish, acrid juice oozed from his pores. Usually the ants were content with merely examining him. I left him when I saw that he was in no immediate danger.

For the dozens of grasshoppers, crickets, roaches, beetles, spiders, ants, and harvest men, there was no escape. One daddy-long-legs did a pitiful dance of death. Supported on his eight

long legs, he stood high out of reach of his assailants. He was balanced so exactly that the instant a feeling antenna touched a leg, he would lift it out of reach. Even when two or three were simultaneously threatened, he raised them, and at one time he stood perfectly balanced on four legs, the other four waving in mid air. But his *kismet* came with a concerted rush of half a dozen ants, which overbore him, and in a fraction of time his body, with two long legs trailing behind, was straddled by a small worker and borne rapidly away.

I now flattened myself on an antless area at the edge of the pit and studied the field of battle. In another half-hour the massacre was almost over. Five double, or often quadruple, columns were formed up the sandy cliffs, and the terrific labor of carrying out the dead victims began. The pit was five feet deep, with perfectly straight sides, which at the rim had been gutted by the rain, so that they actually overhung. Yet the ants which had half climbed, half tumbled their way to the bottom in the wake of their victims, now settled themselves to solving the problem of surmounting these cliffs of loose, crumbling grains, dragging loads which, in most cases, were much heavier than themselves. Imagine a gang of men set to carrying bundles of one to two hundred pounds up perpendicular cliffs twelve hundred feet in height, and the task of the army ants is made more vivid. So swiftly did they work and so constantly shift their formations and methods of meeting and surmounting difficulties, that I felt as I used to feel when looking at a three-ring circus. I could perceive and record only a small part of the ingenious devices and the mutual assistance and sharing of the complicated conditions which arose at every step.

When two traffic columns reached the summit, three others were forging rapidly ahead. All used a similar method of advance. A group of mixed castes led the way, acting as scouts, sappers and miners. They searched out every slope, every helpful step or shelf of sand. They took advantage of every hurdle of white grass-roots as a welcome grip with which to bind the shifting sand-grains. Now and then they had to cross a bare, barren slope with no natural advantages. Behind them pressed a motley throng, some still obsessed with the sapper instinct, widening the trail, tumbling down loose, dangerous grains. Some bore the first fruits of victory, small ants and roaches which had been the first to succumb. These were carried by one, or at most by two ants, usually with the prey held in the jaws close beneath the body, the legs or hinderpart trailing behind. In this straddling fashion the burden was borne rapidly along, an opposite method from the overhead waving banners of the leaf-cutters.

With these came a crowd of workers, both white and black-headed, and soldiers, all empty-jawed, active, but taking no part in the actual preparation of the trail. This second cohort or brigade had, it seemed to me, the most remarkable functions of any of the ants which I saw during my whole period of observation. They were the living implements of trail making, and their ultimate functions and distribution were so astounding, so correlated, so synchronized with the activities of all the others that it was difficult not to postulate an all-pervading intelligence, to think of these hundreds and thousands of organisms as other than corpuscles in a dynamic stream of life controlled by some single, outside mind.

Here, then, were scores of ants scrambling up the steep uneven sides, over ground which they had never explored, with unknown obstacles confronting them at every step. To the eye they were ants of assorted sizes, but as they advanced, numbers fell out here and there and remained behind. This mob consisted of potential corduroy, rope-bridges, props, handrails, lattices, screens, fillers, stiles, ladders and other unnamable adjuncts to the successful scaling of these apparently impregnable cliffs. If a stratum of hard sand appeared, on which no impression could be made, a line of ants strung themselves out, each elaborately fixing himself fast by means of jaws and feet. From that moment his feverish activity left him; he became a fixture, a single unit of a swaying bridge over a chasm; a beam, an inorganic plank, over which his fellows tramped by hundreds, some empty, some heavily laden. If a sudden ascent had to be made, one ant joined himself to others to form a hanging ladder, up which the columns climbed, partly braced against the sandy wall.

At uncertain, unguarded turns a huge soldier would take up his station, with as many functions and duties as a member of the Broadway traffic squad. Stray, wandering ants would be set right by a single twiddle of antennae; an over-burdened brother would be given a helping jaw and assisted for some distance to the end of his beat. I was especially interested in seeing, again and again, this willingness to help bear the burdens. It showed the remains of an instinct, inhibited by over-development, by ul-

tra-specialization of fighting paraphernalia, still active when opportunity gave it play. At the first hint, by sound or smell, of danger, the big soldier whirled outward and, rearing high on his legs, brandished his mighty blades in mid-air. Here was an ideal pacifist, who could turn his sword into a ploughshare at will, and yet keep the former unsheathed for instant use.

When I watched more closely, I detected more delicate gradations of mutual aid. At the same level in two columns of ascent, the same stratum of hard sand was encountered. To one column the sand presented a rough surface which gave a good foothold. Here the single line of ants which was ranged along the lower edge of the trail, in lieu of hand-rail, all faced downward, so that the ants passing above them walked partly on the abdomens and partly on the hind-legs of their fellows. In the second column, the surface of the sand was smooth, and here the burdened ants found great difficulty in obtaining a foothold. In this instance the supporting gang of ants faced upward, keeping their place solely by their six, sturdy legs. This left head and jaws free, and in almost every case they helped the passage of the booty by a system of passing from jaw to jaw, like a line of people handing buckets at a fire. The rightful carriers gave up their load temporarily and devoted their attention to their own precarious footing.

I learned as much from the failures of this particular formation as from its successes. Once a great segment of wood-roach was too much for the gallant line clinging to the sides of the pit, and the whole load broke loose and rolled to the bottom. Of the hand-rail squad only two ants remained. Yet in four minutes another line was formed of fresh ants—ants who had never been to the spot before—and again traffic was uninterrupted. I saw one ant deliberately drop his burden, letting it bounce and roll far down to the bottom of the pit, and instantly take his place in the line of living guard-rails. The former constituents of the line had clung to the roach segment through all its wild descent, and until it came to rest at the bottom. Without a moment's pause they all attacked it as if they thought it had come to life, then seized it and began tugging it upward. In a fraction of time, without signal or suggestion or order, the handrails had become porters. The huge piece of provender had rolled close to an ascending column on the opposite side of the pit, and up this new trail the bearers started, pulling and pushing in unison, as if they had been droghers and nothing else throughout the whole of their ant-existence.

One climax of mutual assistance occurred near the rim of the pit on a level with my eyes, where one column passed over a surface which had been undermined by heavy rain, and which actually overhung. I watched the overcoming of this obstacle. All the ants which attempted to make their way up at this point lost their footing and rolled headlong to the bottom. By superformicine exertions a single small worker at last won a path to the rim at the top. Around the edge of the pit innumerable ants were constantly running, trying, on their part, to find a way down. The single ant communicated at once with all which came past, and without hesitation a mass of the insects formed at this spot and began to work downward. This could be done only by clinging one to the other; but more and more clambered down this living ladder, until it swayed three inches in length, far out over the vastness of the pit. I had never lost sight of the small worker, who had turned on his tracks and was now near the bottom of the ladder, reaching wildly out for some support—ant, grass or sand. I was astonished to see that, as the length and consequent weight of the dangling chain increased, the base support was correspondingly strengthened. Ant after ant settled itself firmly on the sand at the top, until a mat of insects had been formed, spread out like animate guy ropes.

At last the ultimate ant in the rope touched the upraised jaws of a soldier far below. The contact acted like an electric shock. The farthest ant in the guy-rope gang quivered with emotion, a crowd of ants climbed down and another up, and bits of insect and spider prey began to appear from the depths of the pit, over the living carpet suspended from the brim. For an inch the droghers climbed over the bodies braced against the cliff. Then, where the surface became smooth, the dangling chain came into use. Before the rim of the pit was reached, the chain had become a veritable hollow tube of ants, all with heads inward, and through this organic shaft passed the host from the ascending column. But it was far more than any mechanically built tube. When an extra large piece of loot came up, the tube voluntarily enlarged, the swelling passing along until the booty and its bearers emerged at the top.

Within five minutes after this last column was completed, there passed over it, out of the pit, a daddy-long-legs with legs trailing, perhaps the same one which I had seen in the

tragic little dance of death. There followed two silvery-gray ants, a wood-roach in two installments, part of a small frog, three roaches and two beetles. These latter gave a great deal of trouble and tumbled down the cliff again and again.

When the tropical night began to close down, the last of the columns were making their way out, systematically from the bottom up, each ant following in turn. The moment the last bit of prey passed up the column, by some wonderfully delicate and subtle sense, every ant knew of it, and the corduroy rose, the hand-rails unjointed themselves, the ropes unspliced, the embankments dislodged of their own volition, and stepping-stones took to themselves legs. After hours of total inactivity, these sentient paraphernalia of the *via formica* became, once more, beings surcharged with ceaseless movement, alert and ready to become a useful cog in the next movement of this myriad-minded machine. I jumped down into the pit. The great gold-spotted toad stretched and scratched himself, looked at me and trembled his throat. I was not an army ant.

I looked out and saw the last of the mighty army disappearing into the undergrowth. I listened and heard no chirp of cricket, no voice of any insect in the glade. Silence brooded, significant of wholesale death. Only at my feet two ants still moved, a small worker and a great white-headed soldier. Both had been badly disabled in the struggles in the pit, and now vainly sought to surmount even the first step of the lofty cliff. They had been ruthlessly deserted. The rearing of new hosts was too easy a matter for nature to have evolved anything like stretchers or a Red Cross service among these social beings. The impotence of these two, struggling in the dusk, only emphasized the terrible vitality of their distant fellows. As the last twilight of day dimmed, I saw the twain still bravely striving, and now the toad was watching them intently.

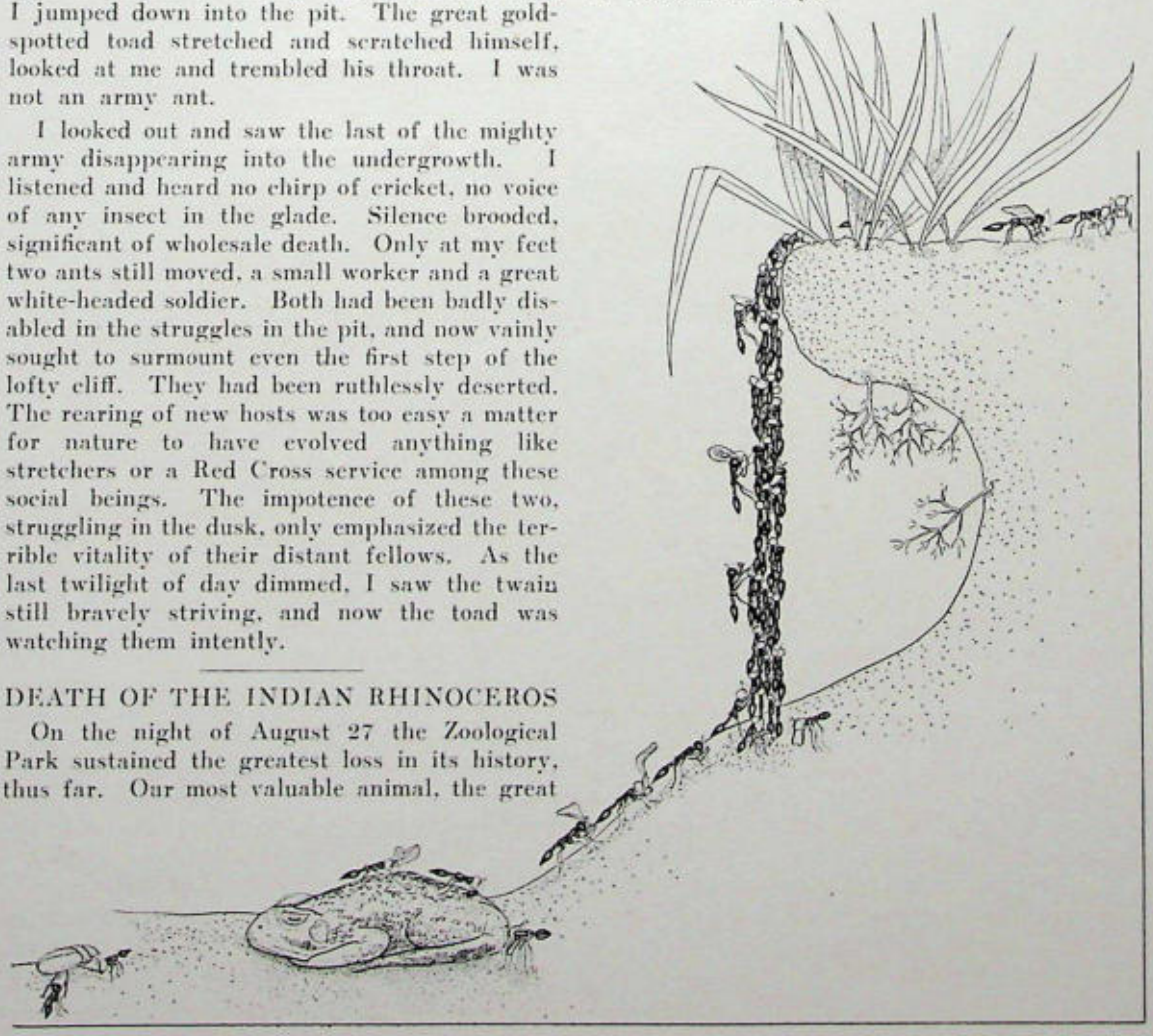
DEATH OF THE INDIAN RHINOCEROS

On the night of August 27 the Zoological Park sustained the greatest loss in its history, thus far. Our most valuable animal, the great Indian rhinoceros, Mogul, was found dead in his corral, quite without any visible illness, and practically without a struggle. On the previous day he had missed but one meal.

The autopsy that was made by Dr. D. J. Mangan disclosed the fact that the death of Mogul was due directly to carditis, to which other heart troubles contributed.

Mogul was a full-grown male specimen of *Rhinoceros unicornis*, and one of the only three specimens of that species known in captivity. He was caught in Kashmir in 1906, and, having reached the Zoological Park in 1907, he had been on exhibition here for eleven years. His weight was 2,620 pounds. When only one year of age his cost to us was $6,000, and ever since he attained full maturity he has been valued by the Zoological Society at $25,000.

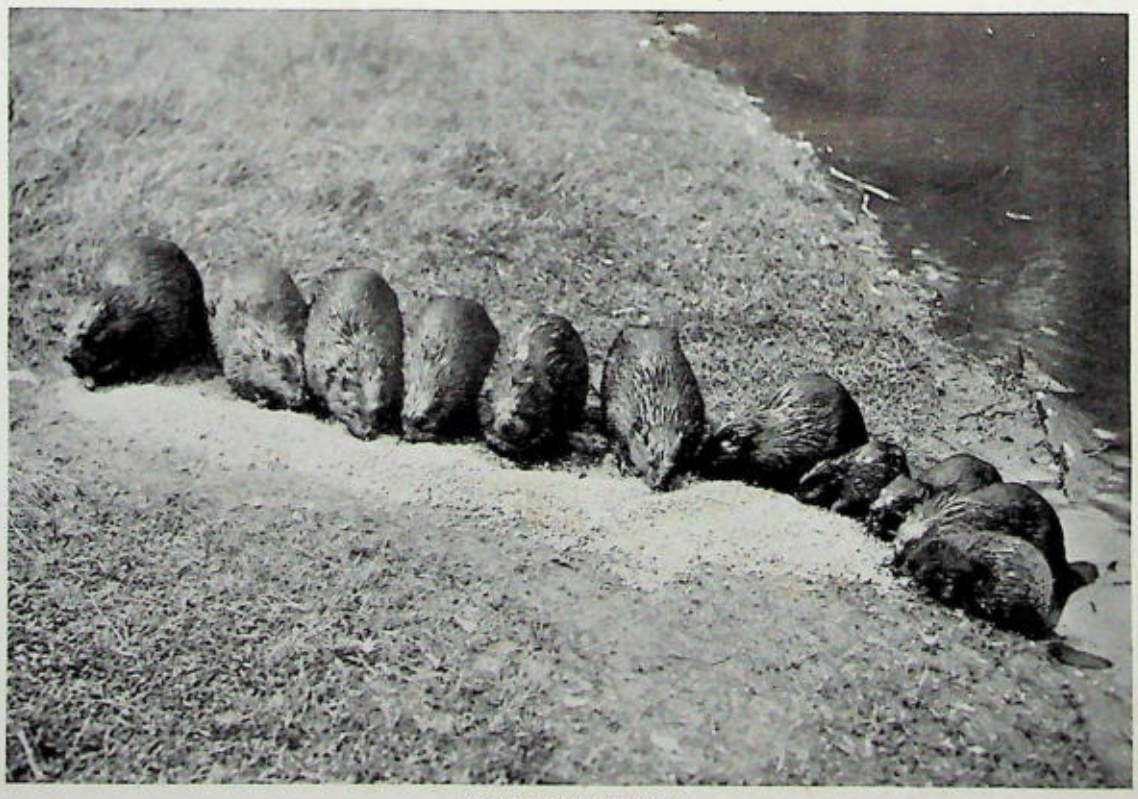
Both the skin and complete skeleton of Mogul have been presented to the American Museum of Natural History.





THE PARK'S BIG BEAVER COLONY

The society now possesses the most satisfactory colony of beavers that ever has inhabited our Beaver Pond. There are twelve specimens, representing three generations. Their constant engineering work in the repair of their home and construction of their dam is a source of great interest to visitors, chiefly because it is performed in the daytime, in full view. A pair of swans live amicably with the colony.



DINNER FOR ELEVEN

The beavers are feeding upon cracked corn. They also eat much bark from browse that is daily provided.

ZOOLOGICAL SOCIETY BULLETIN

AQUARIUM NUMBER

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E. R. Sanborn, Photo

GREEN MORAY (*LYCODONTIS FUNEBRIS*)
New York Aquarium.

ZOOLOGICAL SOCIETY BULLETIN

Published by the New York Zoological Society

VOL. XXI NOVEMBER, 1918 NUMBER 6

THE GREAT OCEAN SUNFISH

(*Mola Mola*)

By C. H. TOWNSEND

THE Aquarium had the unique privilege of exhibiting a live ocean sunfish for a short time on the third of June. Our hope of making this wonderful guest a permanent member of the Aquarium family faded quickly, and on the following day the Museum of Natural History had profited by our loss.

The specimen, a small one of its kind, weighed 165 pounds. Its length, from its short snout to the posterior edge of its remarkably short tail, was nearly four feet, but this measurement gives little idea of its size.

It was caught on June 2 by two fishermen in a motor boat, at the mussel beds about a mile off Manhattan Beach, Coney Island, where the water is seventeen feet deep. The fishermen were using clam bait on sea bass hooks, and the fish was hooked at the bottom. It took nearly half an hour to bring the heavy fish to the surface, when it was tied to the motor boat, towed into Sheepshead Bay and made fast to a wharf.

The Aquarium collector arrived promptly, spent several hours in a vain search for a well-smack to transport it, and as a final resort telephoned to the Aquarium for a tank and motor truck. The long haul from Sheepshead Bay to the Battery proved fatal, and for the hundredth time the Aquarium records the loss of a large and remarkable marine animal for sheer lack of a suitable collecting boat.

It is not often that an ocean sunfish small enough for exhibition in a public aquarium becomes available, as it is one of the largest of fishes. A specimen eight feet long, taken off Redondo Beach, California, in June, 1893, weighed 1,800 pounds. The skin was mounted by Mr. T. Shooter of Los Angeles, and it is said that the body of the fish was cut up and weighed in sections.

Dr. B. W. Evermann examined and described a nine-foot sunfish brought into San Francisco in May, 1915, which he believed to weigh not more than 1,800 pounds.

The American Museum of Natural History has a mounted specimen, ten feet long, which must have been much heavier than either of those just mentioned. It was taken off Long Beach, California, in May, 1911.

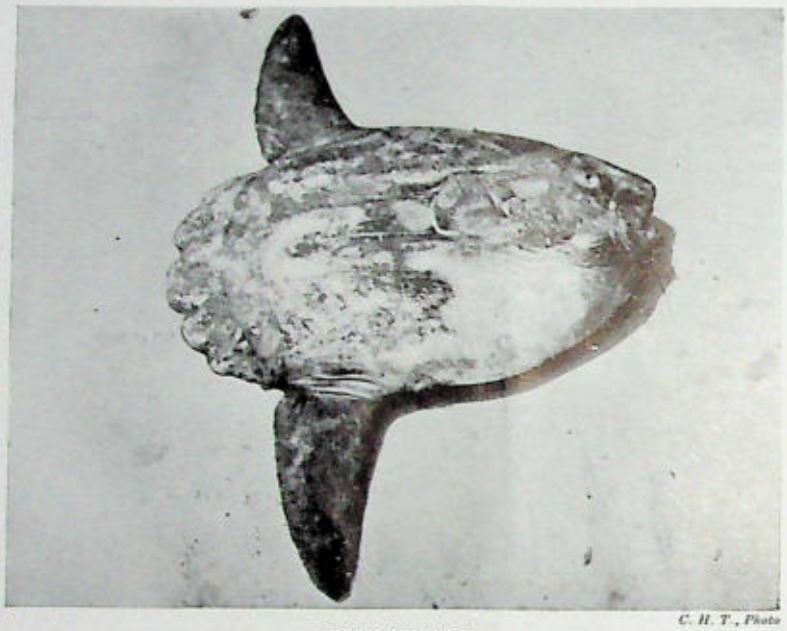
There is a popular magazine reocrd of an ocean sunfish killed in Australian waters which was said to have been ten feet in length and fourteen feet in vertical measurement.

All of these were taken in Pacific waters. The largest specimen recorded for the Atlantic was eight feet long. It was taken off Cape Lookout, North Carolina, in May, 1904.

The measurements of the Aquarium specimen were as follows: Length, three feet eleven inches; vertical measurement, five feet two inches; dorsal and anal, each one foot, seventeen inches in length by nine inches in width; height of tail, twenty-two inches; length of tail at center, six inches; pectoral, six inches long by six inches wide; diameter of eye, two inches.

The photographs at hand appear to show that in the larger specimens of ocean sunfish the dorsal and anal fins are relatively shorter and broader than in fishes of smaller size, indicating changes in proportions after the animal reaches maturity.

The ocean sunfish inhabits the warmer parts of the Atlantic and Pacific, and in summer wanders north as far as Massachusetts and



C. H. T., Photo

OCEAN SUNFISH

Captured off Long Island, N. Y., June 1918, by Messrs. Ehrlein and Wagner. Length 4 feet, weight 165 pounds. Brought alive to the New York Aquarium.

California. It occurs off the New Jersey and Long Island shores every summer, and specimens, usually too large to be handled, are reported yearly to the Aquarium by fishermen.

The name sunfish is derived from the habit the fish has of basking at the surface in calm weather, with the high dorsal fin projecting above water. The scientific name *Mola* is Latin for mill-stone, referring to the circular outline of the body. It is also called head-fish. It is a sluggish creature, quite indifferent to the presence of man. Fishermen without any means of capturing or killing it, often prod the big fish with their oars without greatly disturbing its composure.

I once saw a large specimen basking near the U. S. Steamship *Albatross*, while that vessel was engaged in making a deep sea sounding off the west coast of Mexico. We were not disposed at that time to undertake the task of getting it on board. The fish paid no attention to the vessel nor the pistol shots fired at its projecting fin by foolish marksmen.

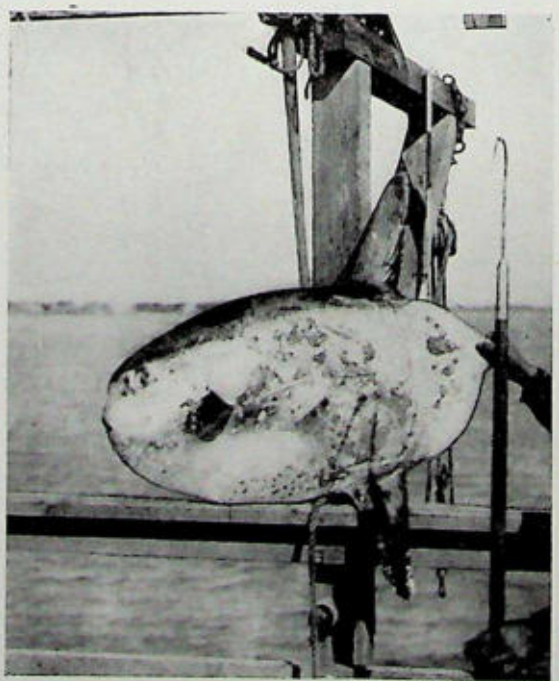
One of the accompanying photographs shows a specimen captured southeast of Long Island by Mr. George McKesson Brown, of New York, who informed me he had no means of bringing it alive to the Aquarium.

The ocean sunfish has a rough, shark-like skin, rather silvery in coloration. The pectoral fins are small and rounded, and the small gill opening is fitted with a valve. It lacks ventral fins. The vertical dorsal and anal fins are conspicuously long and heavy, but appear to have rather limited freedom of movement.

The tail of this fish is its most remarkable external feature. It is very short and thick and projects but little behind the large vertical fins, forming a heavy rudder, hinged to the "sawed-off" body by a soft and flexible base. The tail, with its few but heavy and thick rays, extends nearly to the height of the body. Technically the fish has no tail, the long dorsal and anal fins being actually united behind the body.

The rather small mouth contains a parrot-like beak, the teeth in both jaws being solidly fused together.

Of the food habits of the ocean sunfish not much is known. Our specimen, a male, when dissected at the Museum, had little in its stomach but two or three handfuls of green seaweed (*Ulva*). The beak is well adapted for crushing



Photographed by George Pollock

OCEAN SUNFISH (*MOLA MOLA*), PALM BEACH, FLORIDA

such small mollusks and crustaceans as inhabit the surface of the sea. It is known to feed to some extent on jelly fishes, while eels in the larval stage have been found in its stomach. The stomach of our specimen had no longitudinal folds, to indicate bulky foods causing distension.

Little has been ascertained regarding its breeding habits. The young are quite unlike the adult in appearance and were formerly known under other names. Some of the stages of growth are shown in accompanying photographs. The early larval stage is still unknown. The eggs have been reported as minute.

Statements regarding its edible qualities are at variance, some pronouncing the flesh palatable, while others declare it worthless. The Aquarium specimen, like most of the ocean sunfishes described, was covered with conspicuous round and flattened fleshy parasites about the size of a silver quarter (*Tristomum molae*) and a few crustacean parasites (*Cecrops latrielli*).



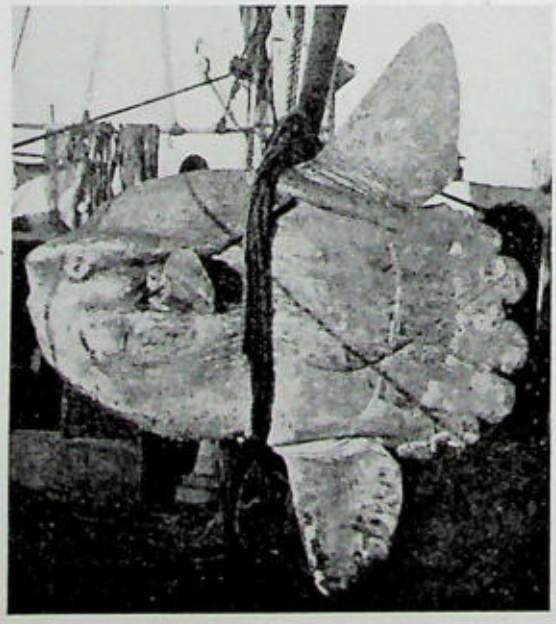
C. H. T., Photo

OCEAN SUNFISH

Length 7 feet 6 inches. Weight, estimated, 1000 pounds. Captured by Mr. Ambrose Monell, Jr., off Palm Beach, Florida, 1916.

In some of the published accounts of the fish it is said to be phosphorescent at times.

The ocean sunfish is apparently lacking in powers of defense. Its mouth is small and its skin is not sufficiently thick and hard to protect it from the attacks of sharks. Specimens lacerated by sharks have often been found. Its speed cannot be sufficient to enable it to elude an active enemy such as the killer whale or the shark. How such a conspicuous and defenseless creature drifts about the wide oceans year after year, attaining great size and weight, remains an unanswered question.



OCEAN SUNFISH

Captured by the Norwegian Fisheries Steamer, *Michael Sars*, north of the Azores. Length 6 feet.

SEA LIONS AND THE FISHERY INDUSTRIES*

By C. H. Townsend.

An important report on The Sea Lion Question in British Columbia has recently been made by a commission appointed by the Biological Board of Canada. The commission was charged with an inquiry respecting the effect of the bounty offered by the Dominion Government, with a view to reducing the numbers of sea lions in British Columbia, where there are important salmon-canning and other fishery industries.

*An article on the subject was published in The Bulletin for November, 1915.



OCEAN SUNFISH
Captured off Redondo Beach, Cal., 1893. Weight 1800 pounds.

The bounty was offered at the instigation of fishermen, market men and cannery men, on the claim that sea lions were enormously destructive to food fishes.

The work of the commission, or certain members of it, extended over several seasons. It included not merely inquiries relative to the bounty, but investigations covering the breeding places, numbers, food habits and utility of sea lions, together with hearings of complaints based upon their alleged destructiveness.

The commission, headed by Dr. Charles F. Newcombe of Victoria, performed its arduous field work with faithfulness. Notwithstanding the enormous local importance of the industries inimical to the existence of herds of sea lions, the conclusions and recommendations of the report are free from considerations of expediency.

The report covers the years 1915-16 and is an important contribution to the ever-recurring subject of seals and sea lions in their relation to the commercial fisheries.

These carnivorous animals abound along the coasts of many countries and have always been condemned by those who live by exploiting the fisheries. It is a remarkable fact that their food habits under natural conditions have not yet been studied to the extent necessary to the determination of their economic status. It is not many years since a vigorous attack against sea lions was made by fishing interests on the Pacific Coast of the United States. Many of them were killed before the extensive slaughter proposed by fishermen was checked. The rather limited investigations which were made at the time by federal agents served to show that most of the charges made by fishermen could not be proved. But we are not yet in possession of such facts regarding the food habits of the sea lion, as have been brought out in the case of the fur seal, which has been studied intensively. Until this has been done, the sea lion question cannot be determined on a basis of fact.

The inquiries made in British Columbia have thrown light on the subject, but what constitutes the *principal* food of the sea lion remains to be discovered. What the animal may eat when it wanders into the vicinity of extensive fishing operations, or what damage to fishing apparatus might be attributed to it, cannot safely be made the excuse for wholesale extermination.

It has been definitely ascertained that the principal food of the fur seal is *not fish*. The same may be true with regard to the sea lion, but it will be more difficult to determine. The stomachs of large numbers of fur seals killed in the open ocean while feeding, were examined on the decks of sealing vessels and the results were conclusive. In the case of sea lions, examinations have been made of animals shot at their breeding places, where advanced digestion left few traces of food.

From the reports at hand from British Columbia, it appears that the bounty of $2 was paid on 4,074 sea lions. It is stated that not more than 50 per cent. of those killed could be secured, and "at a conservative estimate there must have been 8,000 killed," while the numbers killed elsewhere "would add materially to this number." The number of sea lions in that region was estimated in 1913 by Dr. Newcombe, Chairman of the Commission, at 11,000. In the report for 1916, it is stated, "while in round numbers 10,000 fairly well represents those seen on the rocks at the rookeries, there is a large number besides these, possibly even as great a number or greater, scattered over a wide area along the whole coast." The estimate of 10,000 does not include the 8,000 believed to have been killed previously.

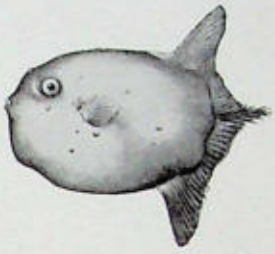
The commission reports that there was little evidence of serious damage in 1916. "The sea lion is undoubtedly to blame for some torn nets and mutilated fish, but that he alone is to blame is open to question. Nets are commonly torn at other fish centers where the men scarcely know what a sea lion looks like. Valuable observations were made on the stomach contents of sea lions killed. Since it has been shown that fish not used for food as well as squid and devil fish are eaten, he cannot at all times be the epicure that some people would have us believe. Although he requires animal food, it is probable that he will take any kind available in quantity to satisfy his hunger. It is even possible that in helping to keep down other injurious species he does more good than harm to the fishing industry, provided he can be kept away from the nets or other fishing gear. If the disappearance of the dogfish is in any sense due to the presence of the sea lion, the sooner the matter is investigated the better. No other species is so much a pest as dogfish."



Very early larval stage.



Early larval stage.



Advanced larval stage.

OCEAN SUNFISH (*MOLA MOLA*)

In connection with the question as to the amount of food required by an adult sea lion, it might be well to mention that a California sea lion fourteen years old, which has lived in the New York Aquarium for eleven years and which weighed in 1917, 610 pounds, eats about sixteen pounds of fish a day. It would eat more, but this amount has been found sufficient to keep it in good condition. An eight-foot porpoise in captivity requires much heavier feeding.



OCEAN SUNFISH (*MOLA*)
Captured by E. Ehrlein and C. Wagner off Long Island, N. Y., 1918.

Careful consideration is given to the commercial uses to which sea lion carcasses might be put. The weight of a twelve-foot sea lion was ascertained to be 2240 pounds. The skin and fat are of recognized value, and the meat might also be made use of. There would certainly be fewer objections to the killing of sea lions if the carcasses were utilized. "It will be seen that in paying a bounty of $2 for each muzzle of a slain sea lion, and disregarding the hide and carcass, there is lost an opportunity to encourage the prevention of fishing depredations and at the same time, by means of a business organization centered in the government officials, make the sea lion, through its hide and carcass, pay the bounty and more."

Here we seem to be arriving at a possible solution of the problem. If the latent resources in the herds of sea lions which appear to some undetermined extent to be injurious to the salmon fishery, can be developed, the whole situation will change rapidly. When the sea lion itself becomes the basis of a fishery, in which the leather, oil and guano trades are interested, its conservation will be considered for commercial reasons. At present seal oil and leather are derived chiefly from the hair seals of the North Atlantic region. The sea lion of the North Pacific is available for legitimate exploitation.

"While the commissioners recommend that sea lions should be driven away or greatly reduced in numbers where it is evident that they are doing appreciable damage, they are not satisfied that there is any necessity for decreasing the numbers at other rookeries, except after some organized plan by which the pups could be free from injury, as in the case mentioned off the Oregon coast, in order that the industrial value of the sea-lions should be conserved, and more particularly in view of the possible friendly offices of the sea-lion that suggest further inquiry. Even in the case where it is considered necessary to diminish the number of sea-lions materially, the monetary value of the hide and



Photo, U. S. S. Albatross, Bering Island, 1892

FRAME OF "BIDARRAH", READY FOR ITS COVERING OF SEA LION SKINS

This type of native boat is used as a lighter at the Pribilof and Commander Islands for loading and unloading ships.

carcass should be taken into consideration in any plan adopted."

Commercial fishermen in general have not distinguished themselves for broadmindedness. A fight to save the pelican has just been won in the legislature of Florida, fishermen having introduced bills to permit the killing of pelicans, gulls and other birds which they describe as "terrifically destructive to food fishes." A bill introduced in the New Jersey legislature to permit the killing of gulls was barely defeated.

The conservator of wild life has little chance to sit with folded hands. The tendency to destroy wild creatures not immediately serviceable to man always exists.

We know little of the food habits of sea lions and less of salmon after they enter the sea. Perhaps the salmon has an enemy in some form of marine life which is held in check by the sea lion. Such relationships are well known to science. The Pacific salmon and sea lions have dwelt closely together for ages, and were once infinitely more numerous, and it might not be well to divorce them.

If by some magic the sea lions could be wiped out of existence, the commercial fish catchers would doubtless be reckless enough to do it. They would be incapable of appreciating injuries that might result from disturbance of Nature's balance. Naturalists are broader minded.

The investigations made in British Columbia show that the killing of sea lions prior to 1916 on the rookeries adjacent to the Rivers Inlet region, served to keep them away that year. The manager of the canneries located there admitted that it was not necessary to kill sea lions, but that it would suffice merely to drive them away from that neighborhood. The commission very properly declines to favor any plan looking toward extermination, it having been shown that sea lions can be frightened away from localities where they do some damage. This they suggest could best be accomplished through the Federal Department of Fisheries, and add that "Indiscriminate and promiscuous killing should not be tolerated."

The species under consideration is Steller's sea lion (*Eumetopias stelleri*), which is found from California to Bering Sea and the Asiatic Coast. It is the largest of all sea lions. The writer killed a specimen on the Alaska Peninsula nearly thirteen feet in length.

It probably attains a weight of more than 1400 pounds. Although as yet of little commercial interest, it has always been of great importance to the Aleutian Islanders, who make use of its skin, oil and flesh. The huge skin is the covering of their boats, the intestines split and sewed together are made into excellent rainproof garments, while the stomach is used for the storage of oil. On the Pribilof and the Commander Islands the supply of sea lions is carefully conserved, their skins being used in the construction of the great lighters or "bidarrahs" used in the loading and unloading of ships. A photograph of this efficient native craft is presented in this BULLETIN.

We cannot believe that the civilized world, having hitherto made little use of this large and abundant animal, can afford to destroy it for comparatively trivial reasons. While its numbers run into thousands, the figures count for little when compared with the millions that would have to be used in numbering the salmon.

The world is now, as never before, considering its supplies of food and oil and leather. The sea lion constitutes one of the resources of the sea. It must not be destroyed because its presence irritates salmon fishermen. Although formerly more numerous than at present, it produced no known effect on the stupendous runs of salmon that crowded the Pacific salmon rivers before wholesale and often unregulated commercial fishing decimated them.

AIR-BLADDER TROUBLE IN CAPTIVE FISHES.

By L. L. Mowbray.

AMONG the larger marine tropical fishes, especially the groupers, kept in the Aquarium, there are sometimes troubles arising from the nature of the foods supplied. These fishes in their native waters feed to a considerable extent on large crustaceans which are unobtainable as fish food for northern aquariums. The lack of these bulky foods apparently affects the operation of the air bladder.

I have taken a large spiny lobster from the stomach of a black grouper (*Mycteroperca bonaci*), that had been swallowed within four hours after the lobster had been placed in the fish trap. The stomach of the fish was so packed that the outline of the lobster showed plainly. The action of the gastric juices had been so rapid that the lobster, when cut out, looked as if it had been boiled, and its hard shell was so softened that the finger could be pushed through it with ease.

A captive fish suffering from lack of bulky crustacean food to keep the stomach well stretched and use up the gastric juices, spends much time swimming with its head out of water. Occasionally it will dart downward, but soon returns to the surface as if seeking air. The trouble is evidently caused by contraction of the walls of the stomach when hard food is lacking, which in turn contracts the gullet. This has the effect of closing the air duct opening from the air bladder. The air duct in such a case may long have been inactive as a result of the fish having been kept at an even depth, the tanks being only four feet deep. Under natural conditions these fishes range from shallow water down to considerable depths, while in captivity the action of the air bladder is restricted.

The fish gradually acquires much buoyancy when living in shallow water and the tendency to remain at the surface becomes greater. The trouble is usually overcome by puncturing the enlarged swim bladder, but this would not be necessary if it could have been supplied with more of its natural food. The puncture is made by piercing the left wall of the body behind the pectoral fin, a distance two-thirds of its length. The operation is performed with a grooved needle. By piercing at this point the pectoral girdle is cleared, and the smaller lobe of the liver being on the left side, its puncturing is avoided. The air escapes as the needle is withdrawn, the little flap of skin cut by the grooved instrument falls back into place, the fish is relieved, and the wound soon heals.

This operation may again become necessary unless the fish is supplied with the hard and bulky food it requires.

AQUARIST AND AQUARIAN

By Ida M. Mellen.

WHAT is the correct title for a person who understands the management of aquaria? For some years this has been a vexed question. *Aquarian, Aquarium-keeper, Aquarist,* and other names have been given. A similar difficulty accompanied the selection of a word to describe a receptacle or building containing live aquatic plants and animals, *aquavivarium* and other names having been used before *aquarium* was finally settled upon.

The euphonius and unique name of "Aquarial Garden" was bestowed upon an aquarium opened in Boston in 1860. Professor E. S. Morse, President of the Boston Society of Natural History, thinks it may have been suggested by Agassiz, who was greatly interested in the institution. The *Leisure Hour* of 1864 states that Agassiz "may frequently be seen walking towards the Boston Aquarial Gardens." As the histories and guide-books of Boston covering that period, tell very little about the opening of the Aquarial Garden, it is interesting to learn from Professor Morse that the exhibition consisted of "individual aquaria round the hall, and in the centre a huge tank in which seals, a shark and other animals were displayed. Afterwards a group of Africans, Zulus, Hottentots and other negroes danced and sang on the stage."

Such awkward words as *aquavivarium* and *aquarium-keeper* are not likely to become popular. A book in our Aquarium library, published sixty years ago in London, is entitled *The Aquarian Naturalist.* This is typically English. From old American dictionaries we learn that Aquarians were members of an heretical Christian sect that flourished about the middle of the 18th century and were so called because they used only water at the Lord's Supper. Murray's *English Dictionary,* at present the standard dictionary in England, gives this definition and also defines *Aquarian* as "One who keeps an aquarium." It also states that the word has been used, though rarely, as an adjective, an article in the *Intellectual Observer* for 1865 being entitled "Aquarian Principles."

The word *Aquarist* was adopted some years ago by the New York Aquarium. In perfectly correct form, probably, it should be *Aquariist;* but the contraction is preferable. The publishers of the *Century Encyclopedia,* conferring with the officers of the Aquarium on the subject

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Elwin R. Sanborn,
Editor and Official Photographer

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several years ago, stated that in view of our adoption of the word, its usage would be regarded as established, and they purposed inserting it in the next issue of their encyclopedia. This has not yet been printed.

Mr. W. A. Poyser, editor of *Aquatic Life*, revived the word *Aquarian* in 1916 and has since used it in his magazine, though he also uses *Aquarist*.

Mr. Poyser advised the writer last summer that he had received intelligence of the formation of an astrological society in Boston for the purpose of studying mental, moral and physical effects of planets on human beings. As the world was passing through the portion of the universe dominated by the sign Aquarius, the society was named *The Boston Aquarian Society*, its members being known as Aquarians. Mr. Poyser's informant expressed a humorous fear lest a confusion of the titles *Aquarian* and *Aquarist* lead to the latter being accused of star-gazing. But however that might be, aquarium lovers may take assurance from the moral in the old story about the little boy who, being a star-gazer, finally fell into a pond while looking skyward—which only shows that he was obliged to direct his attention to aquatic life sooner or later.

It is true that the word *Aquarian* has proved most versatile, having found a place successively in the realms of religion, pisciculture and astrology; but *Aquarist*, being capable of but a single construction, seems to hold the advantage.

NEED OF A COLLECTING BOAT FOR THE AQUARIUM.

The recent loss of a fine specimen of the ocean sunfish which might today have been on exhibition alive in New York, brings up again the question of a boat for the Aquarium.

Boat and pound-net fishermen along the adjacent coast frequently telephone the Aquarium when unusual marine animals are taken. These the Aquarium cannot often secure for mere lack of suitable transportation facilities.

There is no reason why a small-sized ocean sunfish could not be kept at the Aquarium. During the summer months the Gulf Stream drifts interesting creatures northward, which enter our bays and are frequently captured, but which cannot be transported in ordinary shipping tanks. All aquariums must do their own collecting, as the animal dealer keeps no aquatic animals but seals and alligators.

Fishes and most other marine animals must be transported in their natural element, and there is no device so well suited to this purpose as the ordinary fishing sloop or power boat provided with a water compartment. In the common type of "well-smack," as it is called, there is a water compartment built in the middle of the craft, to which sea water has access through small holes in the hull. It is, of course, entirely water-tight in its relation to other parts of the boat. The well-smack is an old type of fishing boat and has been used in many countries for carrying fishes to market alive. It was in extensive use along the New England coast before the practice of carrying ice became general. There are many still in use, even in the neighborhood of New York. All lobstermen continue to use them.

In tropical regions, as in Florida, Bermuda, and the West Indies, the day's catch is brought to market alive in well-smacks, usually of small size. In fact, the first tropical fishes exhibited alive in New York were brought in a large well-smack from Bermuda by the late William E. Damon. They were exhibited at Barnum's Museum, then located at Broadway and Ann Street.

With a well-smack of suitable size, the Aquarium could lay the whole coast, from Massachusetts to South Carolina, under tribute for specimens in the summer season.

The New York Aquarium has never been able to keep the perpetually interesting octopus, for the reason that it does not survive transportation in tanks, although specimens have been shipped yearly from southern points. It is no uncommon thing for Bermuda fishermen to keep octopi alive in the wells of their smacks for weeks together. The octopus lives long in captivity and is nearly always to be seen in the tanks of Bermuda, Naples, and other aquariums, to which it can be transported without injury. It is common at Charleston, from which point its transportation to New York in a well-smack would be entirely practicable.

At present the New York Aquarium can exhibit nothing except what will stand the rather rough treatment involved in the use of shipping tanks. Our list of interesting marine forms which cannot be handled by this method is a large one.

By the use of a well-smack the expense of collecting and the loss of specimens in transit could be greatly reduced.

The people of New York have missed seeing many wonderful marine creatures because the Aquarium has never been able to add a boat with a large water compartment to its collecting equipment.

Who wants to buy the Aquarium a well-smack?

THE MIGRATIONS OF FISH

By Ida M. Mellen

Alexander Meek, in his book on *The Migrations of Fish* (1916), records various interesting phenomena, special and general, illustrative of the habits and activities of fishes.

He shows that many fishes, like many birds, migrate with the seasons; and, like birds that fly with or against the wind, fishes swim with or against the current.

That currents are an incentive to a change of habitat is evidenced by the fact that ocean fishes are much more prone to migrations than fresh-water species.

Some of the principal ocean currents have special designations, as the Mediterranean, the Canary, the Japanese, the Northern Icelandic, and the Counter Equatorial current, also the Gulf Stream; besides which there are numerous superficial, circulatory, and bottom currents, unnamed. Some of the arctic currents are green, and some, issuing from the tropics, are dark blue.

Mr. Meek gives a chart of the oceanic currents of the world, which presents as bewildering a maze as one could well imagine. It is as though the seas were designed from the famous old puzzle, Pigs in the Clover; and after seeing it, we wonder, not that salt water fishes journey hundreds of miles, but that they are ever found twice in the same locality. We are not surprised that the sheepshead, whose one-time steady presence around Long Island gave Sheepshead Bay its name, is no longer commonly found in these waters, but farther south; that the basking shark, formerly a regular migrant to the North Sea, now limits its hunting grounds to the Irish and Norwegian coasts; or that the mackerel is reported to be quitting this side of the Atlantic for the other.

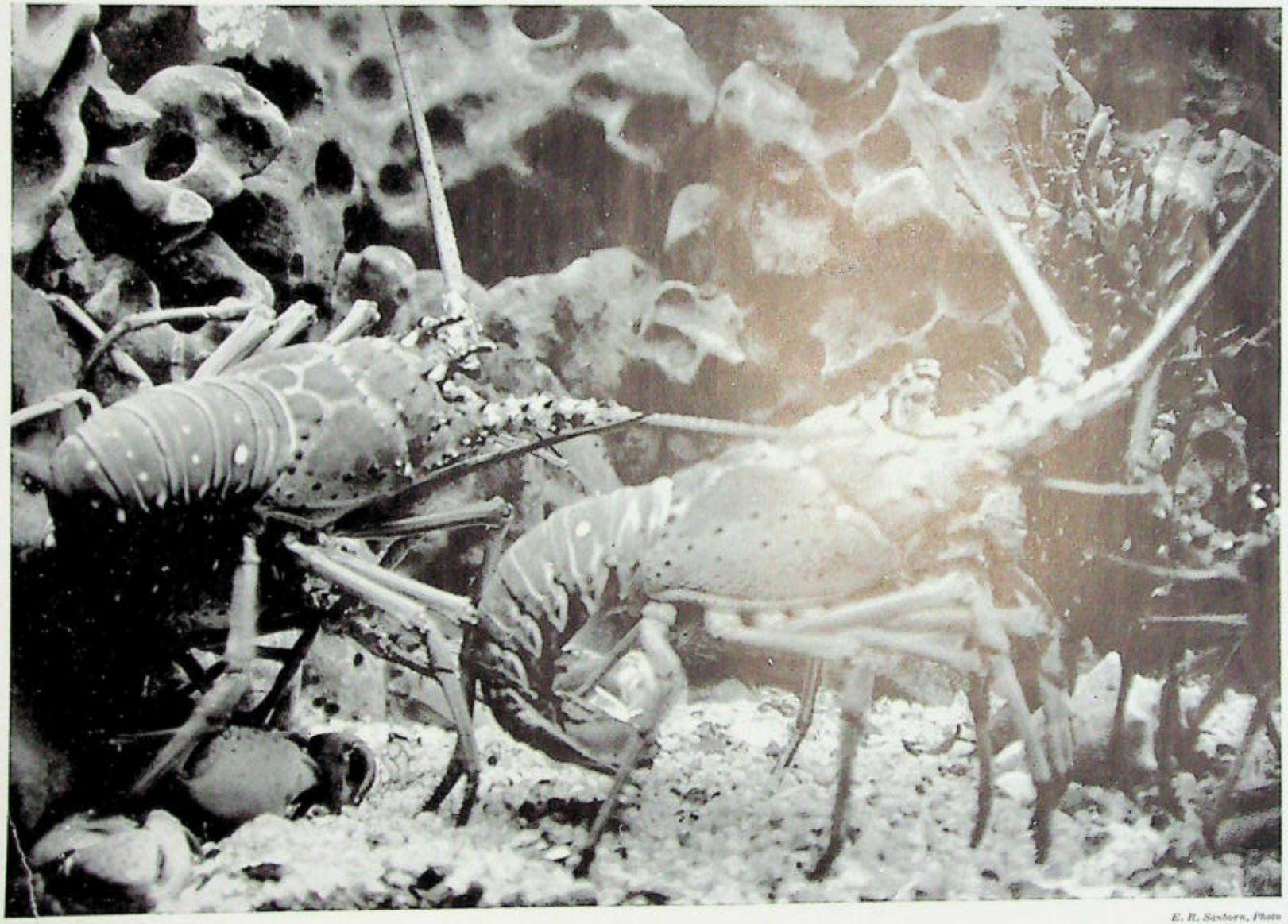
Salt water buoys up an egg that would sink in fresh water, and multitudes of the eggs and larvae of ocean fishes float upon or immediately beneath the surface of the sea, carried along by currents for days, weeks, or months, in passive migration. Great quantities of the fry of a single species may settle together on the bottom of a region remote from the ground on which they were spawned; or the fry of several species may become mixed together.

The migrations of fishes are not, however, due essentially to currents, but to several other causes.

Migration may be actuated by the food supply. Both young and old fishes are subject to periodic migration. The young are also affected by seasons, and enter upon so-called seasonal migrations, while the older fishes engage in yearly spawning migrations under the impulse of sexual maturity, which occurs when they are three or more years old. The migratory instinct is so powerful in the mature fishes that considerable loss of life ensues among some species during these "annual pulsations" from the sheer exhaustion of travel. They generally have regular spawning grounds. The salmon, marine lampreys, and most of the herrings and shads enter the rivers to spawn; while the eel journeys from fresh water to the ocean. Some species migrate from the shore to mid-ocean, some rise from the depths to spawn at the surface. They are all nocturnal in habit. The deep-sea species, during migration, move upward by night, feeding and traveling, and downward by day, to rest. Dogfishes migrate in large companies into shallow water for the summer, and deep water for the winter. Herring also migrate in enormous shoals, and one writer estimates that if a herring be allowed for every cubic foot, and a shoal 18 feet deep is limited to one square mile (many are of vastly larger dimensions), it would contain 500,000,000 fish. "The herring," he says, "would literally choke the sea if not largely destroyed by other fish as well as by birds."

Some of the lung fishes of Africa hibernate in mud in the winter, and this is looked upon as a substitute for migration. It appears that the majority of fishes are great travelers.

Attendance.—The number of visitors at the Aquarium to date has fallen off somewhat as compared with the same period of 1917. The million mark was passed in September.



E. R. Sanborn, Photo

SPINY LOBSTER (*PANULIRUS ARGUS*)
New York Aquarium.

ON SPIDER WEBS AND SPIDER WEB FISH NETS

By E. W. Gudger,
Professor of Biology, State Normal College, Greensboro, N. C.

IN the Bulletin for March, 1918, I published a short article on the spider-web fish-net, giving all the accounts then at hand of this interesting fishing apparatus. Since that time, however, some additional data have come to hand and it seems desirable to put these on record, and all the more so because many people have thought the first article a "fish story" and not worthy of credence. The data now to be presented will amply confirm the accounts previously given.

The account in question had its origin in a communication from the distinguished Russian traveller, Miklucho-Maclay, to the German explorer, Kubary, and by him passed on to Louis Becke, the Australian South Sea trader and writer of charming books on South Sea Life and customs. In addition to a search made for me at the time of the writing of the first article through the available publications of Miklucho-Maclay, I have myself made during the past summer a careful search through his bibliography for all titles bearing on New Guinea. The New Guinea papers were all gone through one by one and page by page, but nowhere was there found any account of the spider-web fish-net story as related by Kubary. The record, if any was made, seems to have been lost.

As opportunity has offered during the past six months, notes have been made of unusually strong spider-webs. And interesting in themselves as well as furnishing corroboratory evidence, some paragraphs may well be devoted to such accounts.

As early as 1725, Sir Hans Sloane in his book on Jamaica wrote of a large wood spider which made nets "so strong as to give a man inveigled in them trouble for sometime" and he quotes Jan de Laet that at Cumana there were spiders' webs so strong that considerable force was needed to break them. Laet wrote somewhere in the sixteen hundreds, but I have not been able to verify the citation, nor one from Oveido to the same effect for the West Indies.

Later on, (1745), Wm. Smith records the fact that on St. Kitts, Leeward Islands, certain huge spiders make such large webs reaching from bush to bush that they are troublesome to pedestrians. He quote Woodes Rogers that at St. Vincent's, Cape Verde Islands, there are found spiders' webs of even stronger texture than those found at St. Kitts. This statement of Rogers' I have not had opportunity to verify by reference to his book.

Jacobs (1844) says of certain large spiders in Mauritius that: "Their webs, nearly as large and strong as small fishing nets, and suspended in the open spaces between the underwood, frequently and seriously retarded our progress."

Of the neighboring island of Madagascar (loq. cit.) quotes from Purchas Peter Williamson Flores and one Keeling, that there are spiders therein which make exceedingly strong webs.

Darwin in his celebrated "Voyage of the Beagle" (1860) notes that at Rio de Janeiro the paths in the forest were "barricaded" with the strong yellow webs of an *Epeira*.

Moseley (1892), writing of the large and strong spiders' webs previously referred to as being found on the Cape Verde Islands, says:

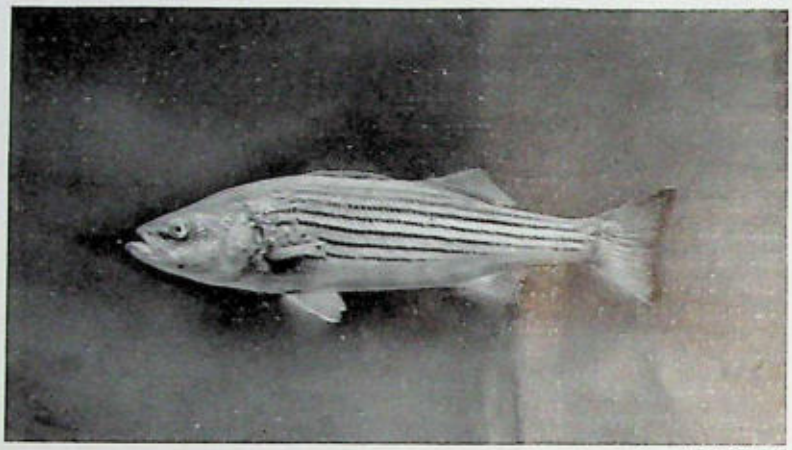
"A large and handsome yellow spider makes large webs of yellow silk everywhere among the bushes. The silk is remarkably strong, and the supporting threads of the web often bend the tips of the tamarisk twigs, to which they are fastened, right down. Either the spider drags on the thread and bends the twig, or the twig becomes bent in growing, after being made fast to."

Turning now to New Guinea, we find D'Albertis in his book on that great island, saying (Vol. II, p. 15), that near the mouth of the river Fly, "A large kind of spider abounds to an extraordinary extent. This insect constructs a web from one branch to another at the height of a man from the ground, by which it causes the greatest inconvenience to those who walk in the island."

In the not far-distant Celebes, Hickson speaks of huge, coarse webs made by large and brilliant colored spiders. While in the nearby Solomon Islands, Woodford (1890) writes of large spider-webs woven across the paths which were so strong that catching him across the face they offered considerable resistance.

Slightly outside the line of this search, but still worthy of quotation, is Douglas Rannie, who, on p. 94 of his "My Adventures Among South Sea Savages," London, 1912, speaks of seeing at Toman Island a bag made of spider's web used by its native owner to carry a small bamboo box. Similarly somewhat foreign to this article but still of very great interest is the following quotation from A. S.. Meek's "A Naturalist in Cannibal Land," London, 1913. On p. 123 he writes:

"My natural history notes on this district (inland New Guinea, near the head of the Aroa



E. R. S., Photo

STRIPED BASS (*ROCCUS LINEATUS*)

River, 1903), begin with a note on the very curious Saturnid moth found there, high on the hills, which spins its web on communal lines. A number join together to make a huge web which is sometimes two feet and more across. The natives use the web (which somewhat resembles cloth) as a head-dress to keep out the rain. It is perfectly water-tight."

The reader has probably before getting thus far asked himself if large insects may not be caught in these great strong nets, as flies are caught in our country in the weaker webs of our smaller spiders, and in answer to this query the following accounts are given:

Thomas Belt in his "Naturalist in Nicaragua" (London, 1874,) writes (p. 108), that: "Here a large spider had built strong yellow silken webs, joined one to another, so as to make a complete curtain of web, in which were entangled many large butterflies, generally forest species, caught when flying across the clearing."

So also D'Albertis (1881, Vol. I, p. 385), speaks of a large spider which had made a net under one of his boxes and in it had taken prisoner a butterfly at least ten times its own size.

However, the natives of New Guinea are not content to let the butterflies catch themselves in the spider webs, but actually make nets for the purpose of catching them. Witness Meek (1913, pp. 140-141):

"They capture specimens (of a large hairy butterfly living in the mountains), too, with nets most ingeniously made of spiders' webs. The manner of making these nets was this: With a very fine forked stick the native would make something like the framework of a tennis racquet. This he would run again and again through and through the strong web spun by the big yellow spider common to the bush there. Having thus got some web across the net, I have sometimes seen the natives get a big fat spider onto the frame, then shake him off. As he tried to climb up they would keep twisting the frame and shaking it slightly to prevent him ever reaching it. Thus the spider was made to spin fresh strands for the net."

It should be noted here that these butterflies are so large that the alternative method of taking them is by shooting them with a bow and arrow. They were as large as fair-sized hedge-row birds. From this we can reckon the strength of the net.

The possibility of birds being caught in such large and strong spider-webs has also probably occurred to the reader, and hence the following accounts will be of interest.

For our first reference to this we must go back to Sloane (1725) who says of spiders' webs in Jamaica that they are made of silken threads so strong that they "will stop not only small birds, but even wild pigeons." While for earlier authorities than himself he quotes Jan de Laet, Peter Martyr, and one "Smith of Bermudas" that spiders' webs are known in the West Indies to catch birds as big as blackbirds.

Mosely (1892) records the following interesting occurrence:

"At Little Ke Island (South of the west end of New Guinea) von Willemoes Suhm actually found a strong and healthy glossy starling caught fast in a yellow spider's web, and he took the bird out alive and brought it on board the ship to be preserved."

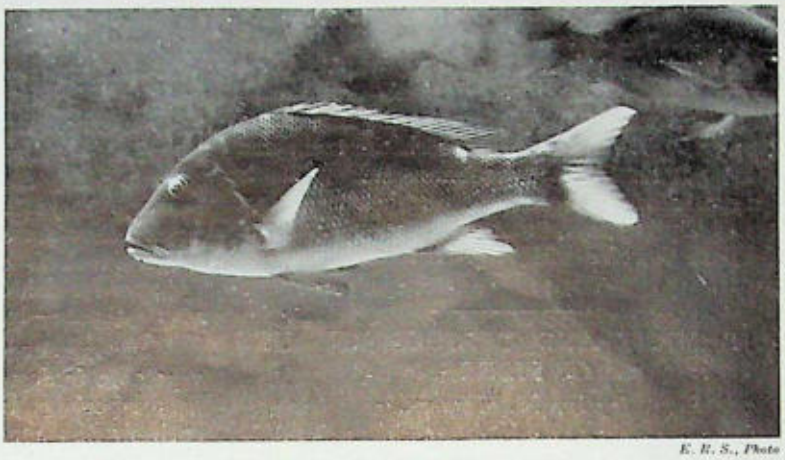
Meek (1913) says that such nets are used for catching butterflies, as his description quoted above shows, and possibly also for catching small birds.

We now come to the use of spiders' webs for fish nets, and in addition to the data given in the former paper, the following brief accounts are set forth.

Hardy and Elkington in their fascinating book "In the Savage South Seas," London, 1907, describe in detail many interesting methods of fishing, but, in describing the various kinds of nets used, merely note of ours, "Some are even made of a tough spider's web." From this mere

statement it is certain that they never saw this net, for had they done so a figure and description would have surely been given.

Van der Sande (1907) states that a spider-web fish-net (such as described by Pratt — (see my paper in the BULLETIN for March, 1918) is not known in that part of Dutch New Guinea explored by him. Likewise Meek (1913) does not think it is so used, and characterizes Pratt's account as a fairy story, though he agrees that such nets "were (used) for prawns or very small fish." He bases his negative conclusions on the fact that a native left such a net made for taking butterflies outside in the rain over night, and when morning came all the stickiness was gone, and gone consequently was its usefulness for butterfly catching since the threads were glazed all over. However, there is no reason to judge from this that it could not be used to catch fish, and in fact he says that it is so used for taking small fish.



E. R. S., Photo

MUTTON FISH (*LUTIANUS ANALIS*)

The next references, however, are absolutely positive and corroborating as they do Pratt's account (1906), leave no doubt that such a net is actually used by the natives of New Guinea. It should be stated furthermore that the author to be quoted seems to have had no knowledge of Pratt's book.

Mr. Robert W. Williamson spent some months in the Mafulu district of New Guinea inland from Yule Island and Redscar Bay—these two being the basal corners of a triangle of which Mafulu was the apex. Returning to England he wrote two books, from which the following extract is taken.

In both his books Williamson, after describing a dip net of hand-woven mesh, goes on to say, using the same words:

"The other form (of dip net) is also found on a looped cane; but the loop in this case is larger and more oval in shape, and the netting is made of the web of a large spider. To make it they take the already looped cane to where there are a number of such webs, and twist the looped end round and round among the webs, until there is stretched across the loop a double or treble or quadruple layer of web, which, though flat when made, is elastic, and when used becomes under pressure more or less bag-shaped."

Before leaving this interesting subject there may be given a use of the spider's web which is intermediate between that described above and that which will be described in full in another and later paper. The account referred to of this use is found in H. B. Guppy's book "The Solomon Islands and Their Natives," London, 1887. On page 158 he writes:

"The following ingenious snare was employed on one occasion by my natives in Treasury (Island), when I was anxious to obtain for Dr. Gunther some small fish that frequented one of the streams on the north side of the island. I was very desirous to have some of these fish, and my natives were equally anxious to display their ingenuity in catching them. They first bent a pliant switch into an oval hoop, about a foot in length, over which they spread a covering of stout spider-web which was found in the wood hard by. Having placed this hoop on the surface of the water, buoying it upon two light sticks, they shook over it a portion of a nest of ants, which formed a large kind of tumor on the trunk of a neighboring tree, thus covering the web with a number of struggling young insects. This snare was then allowed to float down the stream, when the little fish, which were between two and three inches long, commenced jumping up at the white bodies of the ants from underneath the hoop, apparently not seeing the intervening web on which they lay, as it appeared nearly transparent in the water. In a short time one of the small fish succeeded in getting its snout and gills entangled in the web, when a native at once waded in, and placing his hand under the entangled fish, secured the prize. With two of these web-hoops we caught nine or ten of these little fish in a quarter of an hour."

Another use of spider web is that of a lure for fishing with a rod or by trolling with a hand line, a pole, or a kite. The lure is in the form of a miniature tennis racquet with the threads strung or wound over it, or in the form of a loop or mass of cobweb in which the teeth and snout of the fish become entangled. This is especially used in connection with kite-fishing, but as Kipling says, "that is another story," and the data therefor will be given later in another paper.

THE MANY AND CURIOUS ENEMIES OF FISHES.

By Ida M. Mellen.

IT is a singular fact—and singular in spite of our knowledge that life everywhere preys upon life—that nearly all of the great divisions of the animal kingdom contain species that are enemies of fishes. Two-thirds of the living world, one might say, is inimical in one way or another to fish life.

Like most other animals, they have microscopic enemies and parasites of various sorts, both plant and animal.

Among the vertebrates, beginning with the fishes themselves, whose almost universal cannibalism perhaps entitles them to be regarded as their own worst enemies, the majority of animals have a taste for fish. Salamanders and other amphibians, crocodiles, alligators and other reptiles, many birds that live exclusively on fish; and, among the mammals, the seals and porpoises, most, if not all, of the cat family, and the human species, are prominent in their appetite for the finny tribe.

After this brief enumeration of the general enemies of fishes, we should perhaps experience no surprise on learning of certain curious and special ones; yet the subject is one that does elicit our interested surprise.

That a large fish will almost invariably eat a smaller one is a familiar enough fact; that eels have a special taste for trout is not startling; but what shall we say to the discovery that one species of fish will hunt another species in schools; that dogfishes in overpowering numbers will surround a school of mackerel, hedging them in on all sides and from beneath, effectually preventing their escape, and hacking and devouring them piecemeal?

We have heard of Bostonians who pronounced themselves dear lovers of beans, and it may not be amiss in this sense to say that bullfrogs and fishes are dear lovers, one of the other. A bullfrog loves a small fish—for breakfast—and a big fish loves a bullfrog. The same state of keen mutual interest exists between crayfishes and fishes.

Water snakes have often been seen issuing from ponds with a horn-pout, carp or perch in their mouths. One close observer estimated that a medium-sized snake would devour forty young carp in a day and concluded that water snakes consume more fishes than fish-eating birds, though they are outdone in fresh waters by the mink, which is accredited with possessing an appetite for fish quickly running—from the human estimate—into a hundred dollars' worth.

Musk rats, once believed to be almost strictly vegetable feeders, are now known to prey upon fish, especially carp and trout. Some turtles, such as the musk, snapping, Blanding's and others, also catch fish.

Shrew mice are great enemies of young fishes, eating even the eggs, and specimens have been caught with ten young trout in their stomachs.

The otter is a huntsman rather unfair in his extravagant habit of consuming only a small portion of each fish he captures and then hunting another. The wild cat and raccoon, as well as the weasel and skunk, go a-fishing, and ducks and geese, world over, prey upon fish. The crow is said to be a skillful fisher.

The beautiful kingfisher, with which man bitterly contests the privilege to fish (though doubtless the kingfisher's claims should be preferred upon rights of priority), is said to swallow a dozen fingerling fishes a day. The rule against wantonly killing birds "Because nobody has a right to take the life of any animal except for food or self-protection," appears to have been sadly broken by that German who, in fourteen years, killed seven hundred kingfishers, purely in a spirit of competition.

On this subject the State Zoologist of Pennsylvania in 1896 pointedly remarked that the number of fish taken every year by lawless persons in defiance of the statutes of his state, was a hundred times over more than the number captured by the fish-eating birds and mammals combined. And he named over twenty-five species of birds and several mammals whose prey is largely or wholly fish. What a lessened chance of sustenance the birds and mammals must have when man fishes with legal license!

The jealousy of the German who killed the kingfishers was quite outdone in British Columbia during the summer of 1917 if reports are true. It is said that two hundred hair seals basking in the sun at the mouth of the Fraser River were destroyed with dynamite for the sole reason that the seals happen to enjoy a certain fish that the human palate also craves.

Numerous species of crustaceans are inimical to fishes, and at one time it was reported that the minute fresh-water shrimp, collected in such quantities by man to feed his aquarium fishes with, would actually fasten in numbers upon very young trout and eat them alive; surely, if true, a case of unconscious retribution.



E. R. S., Photo

SANDFISH (*MALACANTHUS PLUMIERI*)

The waters of lakes, ponds and brooks are populous with beetles, bugs, mites, and the larvae of insects born in the water and later developing wings—particularly beetle and dragon-fly larvae—that prey upon young fishes. Many aquatic bugs are armed with sharp and serviceable sabres which they use to spear fishes several times their own size; the beetles have powerful jaws, and seven or eight in unison will attack and devour a live fish; and the dragon-fly larva is a formidable enemy, with its long, arm-like "mask" bearing on the end a pair of miniature ice tongs, that can be darted out suddenly to seize an unsuspecting passerby in the shape of fish, tadpole, or brother dragon-fly.

It has been estimated that a dragon-fly larva will make away with several hundred little fishes in a day, though several dozen is probably nearer the mark. In a test of the capacity of the water tiger (the larva of the predaceous diving beetle) in which tadpoles were used, the present writer found that the creature would devour thirty-nine tadpoles in a twenty-four-hour day; and young fishes would, no doubt, in a state of nature, fall prey similarly. The appetite of the dragon-fly is much the same.

A most curious and interesting case of the destruction of very young fishes by mosquitoes was reported some years ago by a gentleman who said that as he was sitting in the shade of some willows overhanging a mountain creek in Colorado, the morning sun fell upon the almost transparent bodies of some young trout—babies still bearing a portion of the yolk sac. They came to the surface every few minutes, and over them circled a swarm of mosquitoes. When a little head reared itself level with the water, a mosquito would light upon and instantly transfix it by inserting its bill into the brain and sucking out the life juices, whereuopn the dead trout would turn over on its back and float down the stream. This massacre of the innocents he witnessed for half an hour, during which twenty victims were counted.

A large black spider was once observed in New Jersey catching a fish, which it bit, gripped, and dragged out on land.

Some mollusks are said to eat the spawn of fishes, and fresh-water mussels, as is well known, are parasitic on the fins and gills of fishes in the early stages of their growth.

In a test once made of the survival of the fittest, between beetles, bugs, fishes and other pond inhabitants, a salamander was seen devouring little fishes at the rate of forty an hour.

Some species of fish appear to have more enemies than others. The salmon has numerous foes besides man,—brown bears, seals and wolves, eagles, gulls, terns and mergansers all finding it palatable, besides which trout and sculpins prey extensively upon the eggs and young.

Sharks rank second only to man as destroyers of cod.

Jelly-fish capture fishes of various sizes by stinging them with poison nettles, and a species of colorless fresh-water hydra paralyzes infant fishes in the same way, making many a meal off them.

Among the foes of little fishes, carnivorous plants have not escaped suspicion, though their enmity is believed to be neither persistent nor formidable in a state of nature. Darwin described plants that, by means of highly specialized leaves secreting gastric juices, capture and consume small insects—insectivorous plants—and he described the manner in which the bladderwort, *Utricularia vulgaris*, imprisons and

destroys small crustaceans, worms, and microscopic animals. Since his time it has been observed that this bladderwort, when confined in an aquarium with the newly-hatched young of perch, roach, carp, or small aquarium fishes, will trap them and therefore become, upon occasion, a piscivorous plant. Minute objects are enabled to enter the bladders of the plant, but not to leave them. After a few hours or days the victims suffocate or starve, and the products of decay are absorbed into the cells of the bladders and thence into the tissues of the plant itself.

Fishes have ever been prolific animals; were, indeed, one of the common symbols of fecundity in the ancient worship of Nature. The group, therefore, despite its multitudinous enemies, has continued throughout the centuries to hold a prominent place in the world of life; and for all we can tell may be existing and reproducing its kind many ages after even its most cunning enemy, man, shall have become extinct.

WAR WORK AT THE AQUARIUM.

By C. H. Townsend.

Navy Recruiting Station.—At the invitation of the Director, the Navy Department opened a recruiting station at the Aquarium in April. This station proved to be well located, as the Navy yeoman in charge often had as many as 125 applicants a week. Preliminary examinations as to age, eyesight, hearing, etc., were made at the Aquarium, where such as were clearly unfit could be rejected. Those passed by the officer in charge were sent elsewhere for medical examination.

The Aquarium had its customary 5,000 visitors a day during the spring and summer, but the conspicuous Navy signs at the entrance probably caught the eye of many a stroller in Battery Park and conveyed the idea of enlistment.

Lantern Slides for Army Camps.—At the request of the Young Men's Christian Association, the Aquarium prepared sets of colored lantern slides for use in Army camps. These were illustrative of the forms of aquatic life exhibited at the Aquarium and were accompanied by written lectures, making the pictures available in the hands of any Y. M. C. A. camp worker, where an illustrated lecture was desirable.

The Aquarium at the Food Show.—At the request of the U. S. Bureau of Fisheries, the Aquarium contributed several tanks of living fishes in connection with the Government exhibit at the Food Show held in the Grand Central Palace in June. The tanks were installed and the water connections made by employees of the Aquarium, who also cared for the exhibit. The fishes were mostly those edible but less popular species, that the Bureau is now exploiting as food fishes that should be utilized to a greater extent, such as bowfin, burbot, yellow perch and carp.

The bowfin and burbot, both of which are abundant in the Great Lakes, were formerly but little used, but are now being shipped east in considerable quantities. The consumption of carp, abundant in all our waters, is greatly on the increase.

The Bureau distributed circulars relative to fishes but little utilized, setting forth the best methods of capture, preserving, shipping and cooking.

The Commissioner writes that the living fishes "proved a most attractive feature and added immeasurably to the success of the fisheries exhibit."

Testing of Life Preservers.—A committee, of which the Director of the Aquarium is a member, has, during a period extending over several months, tested life preservers of the various patterns used on shipboard.

It will be remembered that the first vessel reaching the scene of the *Titanic* disaster found but one body afloat, while a few days later, bodies with life preservers properly attached, reappeared at the surface.

The committee undertook the examination of life preservers under such conditions as would thoroughly test their buoyancy and balance. The tests were made at night in the tanks of pure sea water at the Aquarium, after the building had been closed to visitors. The flotation of each pattern was first observed while being used by a fully dressed man of average size. Sufficient weight was then attached to its lower edges to sink it to a water line previously marked when it was in actual use. It was then left afloat for twenty-four hours or longer. Steamship men and naval officers were present. The work will be continued as other forms of life preservers are secured. The tests have been reported upon so far only to the proper department at Washington—and the committee has no report to be made public.

Fourth Liberty Loan.—As the Bulletin goes to press, the Aquarium Station of the Fourth Liberty Loan is in active operation. A naval band is playing in the building. Two men arrayed in the full-length life-saving suit of the type used for wounded men on homeward-bound transport ships, are giving public demonstrations of its effectiveness in the large central

pool. The big sea lion which has lived eleven years in the building is dodging about keeping out of their way. And the sale of Bonds is in progress.

ITEMS OF INTEREST.

By C. H. Townsend.

The American Fisheries Society.—The American Fisheries Society, which held its forty-eighth annual meeting in New York this year, was given a reception at the Aquarium on the evening of September tenth. About 125 persons were present and the entertainment took the form of a smoker, with motion pictures and refreshments. The motion picture films were supplied by the U. S. Bureau of Fisheries and by Prizma, Inc., of New York. The Prizma films were natural color pictures of unusually fine quality. All were illustrative of the fishery industries and fish culture.

During the week the meetings of the Society at the Waldorf-Astoria were well attended. Much time was given to discussion of the subject of water pollution by manufacturing wastes and the sewage of towns. The pollution of our streams and lakes is on the increase and now constitutes the greatest danger to our fishery resources.

A Photograph of the Sandfish.—Mr. Sanborn has succeeded, after several futile attempts, in making an admirable photograph of the coy and elusive sandfish (*Malacanthus plumieri*), which has been living in the Aquarium for more than a year. It is the habit of this fish to make tunnel-shaped lairs in the eel grass in which it hides. In order to provide a hiding place which would still permit of its being observed, a piece of tile piping was placed in its tank, but the mere setting up of the camera sent it under cover and a satisfactory photograph has not been made until recently.

This is a common food fish in Florida, Bermuda and the West Indies, reaching a length of three feet and a weight of twelve pounds. What little is known of its habits was published in the Bulletin for March, 1915.

Fish Trophies for the Aquarium.—The Racquet and Tennis Club has presented to the Aquarium several large mounted game fishes killed at various times by members of the Club. The largest is a 500-pound tuna from Nova Scotia, taken by Mr. Robert W. Chanler. Another tuna weighing 152 pounds was taken by Mr. M. G. Foster. There are two tarpons, one weighing 186 pounds, killed by Mr. H. M. Inman, and a smaller one by Mr. S. L. Husted, Jr. There is an 8-foot sail-fish, taken by Mr. W. S. Brown, and a California yellow-tail, sent without date. All of these fishes were taken with rod and reel.

The Zoological Society hereby extends to The Racquet and Tennis Club its grateful thanks for this gift to the Aquarium.

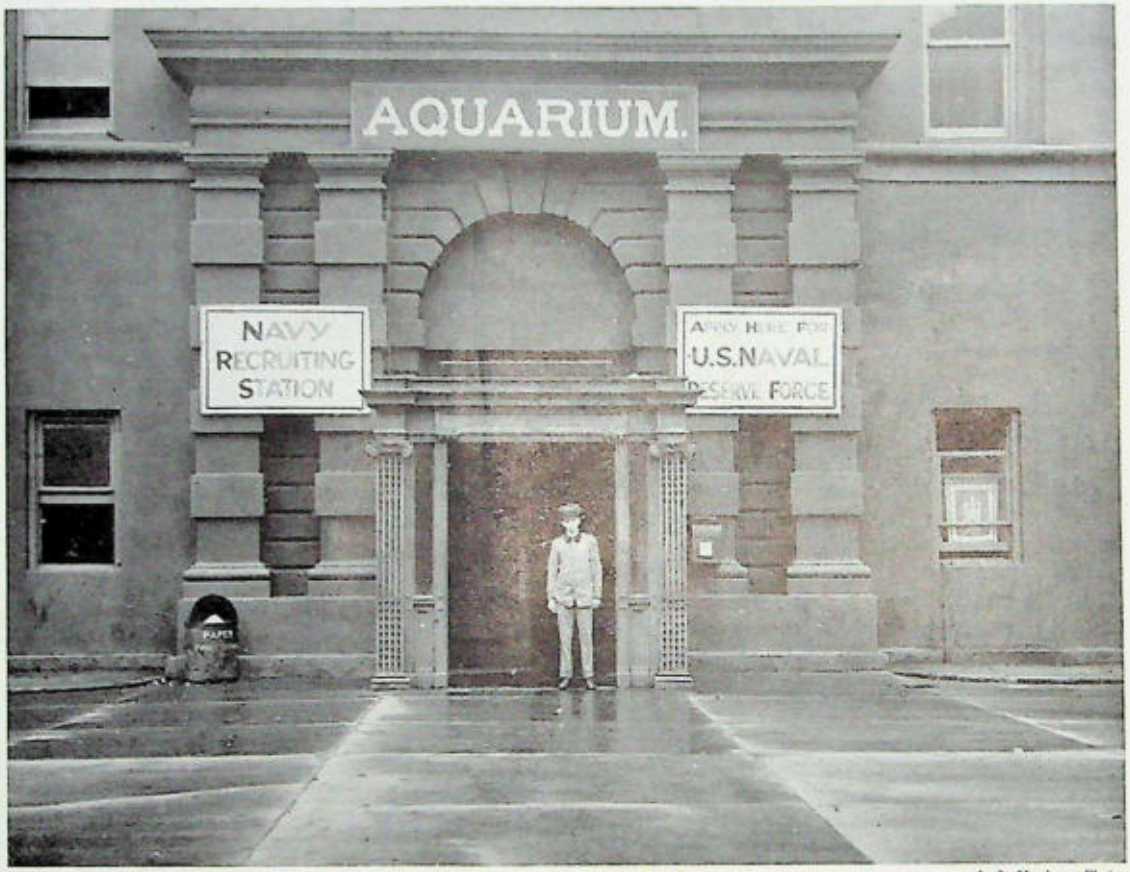
Fur Seal Herd in 1918.—The Bureau of Fisheries at Washington has announced the result of the census of the Alaska fur seal herd for the season of 1918. The total number of seals of all ages is given as 496,600. The census is of date of August 10, the close of the breeding season. The figures given do not include the 33,881 surplus male seals taken during the season, which would bring the total size of the herd in the summer of 1918 to 530,481, an increase of 67,107 seals since the census of 1917.

Ocean sealing, which involved the killing of many more females than males, and which had been going on for many years, was discontinued by international agreement in 1911. At that time the herd had become reduced to 123,600 seals. At present there are more than five times that number. Since the cessation of ocean sealing there have been no losses of breeding females, with the accompanying losses of nursing young. Whatever sealing may be done on the Pribilof Islands from year to year, will be limited to the surplus males of this highly polygamous species, with no injury to the breeding stock. We may confidentially expect a progressive increase in this immensely valuable herd as time passes.

Reception to the Zoological Society.—The annual reception to members of the Zoological Society at the Aquarium on May 6 was attended by over three hundred persons. The building was specially illuminated and was decorated with plants. Music and refreshments were furnished. A shipment of tropical fishes, received a few days earlier, added many interesting exhibits.

A High Tide.—The highest tide in the basement fireroom of the Aquarium which has yet been recorded, occurred on April 11, when the water rose thirty-six inches above the floor, or within two inches of the furnace grate bars. After many years of protest, the work of the Aquarium is still being done under the old handicap. The sea has always flooded the fireroom monthly during the new-moon tides.

Collecting Specimens.—The work of collecting fishes and other marine exhibits for the Aquarium has gradually become more difficult owing to war conditions. Shipments by sea have become more expensive, shipments by rail are hampered by railway restrictions, and the movements of small boats about the lower bay are



L. L. Mowbray, Photo

THE ENTRANCE, NEW YORK AQUARIUM, 1918

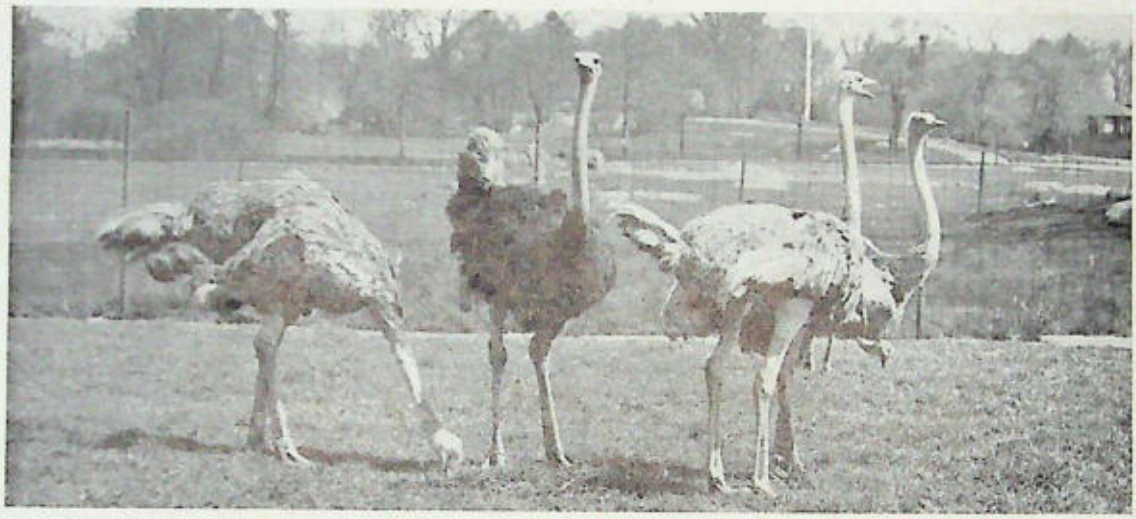
limited. As all aquariums must procure their own exhibits, from natural sources of supply, the indications are that the collections of the New York Aquarium will not be quite up to the standard until after the war.

Lecture on Fish Culture.—The Director of the Aquarium gave an illustrated lecture on the subject of Fish Culture for Farms, at Columbia University, on February 15. This was one of the winter series of lectures under the auspices of the University Department of Agriculture.

Whale Meat.—New York has not yet received a very large share of the whale meat that is now being made available. While Pacific Coast cities have been using it for months, shipments to eastern cities have been rather limited. Boston has had a few carloads. It was recently quoted in the New York wholesale market reports at seventeen to eighteen cents a pound, and was for sale at a dozen or more retail stands. It appears that the supply was largely taken by the uptown district. Canneries have already been established on the Pacific, and limited quantities of the canned article have been available for some time.

Whale meat is palatable and nutritious, and there is little evidence of prejudice against it. It is no doubt destined to come into general use. Whales are enormously large animals, and the vast quantities of whale meat hitherto wasted or converted into fertilizer, will hereafter be put to better use. A report has just been received from British Columbia that the season's whale catch for that region is the largest since 1911, amounting to about 1,000 whales.

Food Fishes at Trenton Fair.—At the request of the New Jersey Fish and Game Commission, the Aquarium lent several shipping tanks of food fishes for exhibition at the State Fair at Trenton, September 3—October 4. Shipment was made at the expense of the Commission. Most of the fishes sent were returned, together with many others collected for the occasion. A similar arrangement was effected last year which proved equally advantageous to the State Commission and the Aquarium.



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Photograph by Elwin R. Sanborn

OSTRICHES FROM THE BLOOMSBURG OSTRICH FARM

Quoting Mr. Crandall "the birds are of unusual size and quality"

ZOOLOGICAL SOCIETY BULLETIN

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A CORNER IN OSTRICHES

By LEE S. CRANDALL,
Curator of Birds.

SUPPOSE that you were an inhabitant of a small town in the coal fields of northern Pennsylvania, and that you had worked hard and long to save a little money, but found that wealth and ease were still far off. If, with these facts firmly established, you were given an opportunity to become a stock-holder in an enterprise of the bonanza order, which could not fail to bring large returns and presently make you very rich, would you invest? Unless you were vastly different from the other citizens of Bloomsburg, you would. You, with several hundreds of your friends and neighbors, would have bought largely of the securities of the African Ostrich Farm and Feather Company, capital stock $1,000,000. In common with your fellow investors, you would still be wondering whether perverse fortune, lax business methods or pure chicanery had deprived you of the handsome income which should have been forthcoming.

About ten years ago there arrived in Bloomsburg a tall and dignified gentleman possessed of compelling magnetism, a voice of velvet, and an idea. This idea was much too good to keep, and soon it was disclosed that the particular location and climate of Bloomsburg were eminently suited to the production of young ostriches, and of ostrich plumes of the finest quality. It appeared, quite reasonably, that ostriches, on being exposed to the arctic temperatures which are the salient features of the winters of that locality, would promptly give forth feathers of unusual size and quality, as nature's shield against the elements. If nature grows her best fur in the far north, why should not the same laws operate on ostrich plumage? Also, as fully explained in the carefully worded and well printed prospectus which presently appeared, these feathers would be double the number produced by the coddled birds of softer climes!

Plainly enough, the ordinary product of California, Arizona and even South Africa, could not compete in the open market with the superplumes that could be grown in sub-arctic Bloomsburg.

Bloomsburg was proud of the fact that, of all the towns of the coal belt, it alone had been chosen for this honor. It never had thought that the severe cold which it had endured and the heavy snows through which it had plodded for many winters, could hold such golden possibilities. It saw itself the seat of a great, new industry, envied of its sister towns, and the Mecca of the feather buyers of the world.

Thus it was that when the formation of a company to exploit the great idea was suggested, there was no lack of investors. The enterprise was duly launched, and stock to the value of $350,000 was eagerly purchased by the privileged inhabitants of town and countryside.

Espey, a hamlet about two miles distant from Bloomsburg, was selected as the ideal site. Here, two rich and fertile farms, of respectively nineteen and forty-six acres, were secured. These farms, bordering on the Susquehanna, and including level pastures and rolling hills, were the finest in the vicinity, lending themselves well to the skill of the photographer. For this was no mean undertaking and as such, must have wide publicity. And what better vehicle could be conceived than well reproduced pictures of blooming fields and gentle slopes, made to give forth a product the like of which had not been seen before?

But mere fields and meadows were not all: for presently there appeared a fine array of elaborate stables and runways, soon to be occupied by great birds whose yield of plumes would reduce all rivals to a state of wondering shame. The larger of the old farm houses was remodeled and furnished with wide verandas, whose striped awnings invited the warm and awe-struck visitor. Well equipped incubator and brooder houses, and display rooms for the finished plumes, soon were added. An office building on the main street of Bloomsburg was acquired for handling the voluminous correspondence and increasing business of the new concern.

All was now ready, and only the birds themselves were lacking. In order that the finest stock might be secured as a foundation, it was necessary to make a trip to Africa where, the stockholders were solemnly assured, the choicest birds of the wild flocks would be run down and captured by subtle devices known only to the promoter of the plan. Still ornamenting a wall of the erstwhile ostrich farm-house is an enlarged photograph, showing the gentleman mounted on a dromedary, well armed with a long rifle of Arab design, alertly guarding three naked and grinning negroes, who firmly hold an anaemic and resigned cock ostrich of diminutive size, all striking exhibits of the dangers of the expedition.

On July 16, 1910, the ostrich caravan finally reached Bloomsburg. When word came that the long-awaited birds were actually about to arrive, the town restrained itself with difficulty. Data as to the exact number of ostriches are not now available, but the large and heavy crates were so numerous as to tax severely the trucking possibilities of the town. Ancient vehicles of strange design, decrepit farm wagons, rusted and warped from long disuse, loudly protesting at every revolution of twisted wheels, were drawn up at the station platform in proud array. When finally the precious loads were all in place, the procession started on its way to the Ostrich Farm. Such a sight never before had been seen in Bloomsburg, and it was missed by few. Schools were closed for the day and business, aside from that of ostrich farming, was at a standstill.

In spite of many difficulties, the ostriches finally reached their destination, and were installed in their respective pens. Bloomsburg and its jealous neighbors feasted their eyes for many days, at twenty-five cents per person. The Ostrich Farm as a local attraction was a decided success. Somewhat to the disappointment of the stockholders, however, it was explained that the first crop of plumes could not be harvested at once, because the birds must have time to recuperate from their trying journey, and begin to feel the benefits of the bracing cold which was to stimulate them to unheard of feats of feather growth. This slight check to enthusiasm was more than outweighed by the information that these ostriches were positively the last that could be exported from Africa, since the various governments, realizing too late the great potential wealth which was slipping through their fingers, had sternly forbidden that any more such birds be allowed to leave. Backed by this dictum, and firmly believing that all ostriches on farms in other parts of America were inbred, degenerate and incapable of producing plumes superior to those of a turkey gobbler, Bloomsburg was content to let nature take its course.

To while away the interval between the arrival of the birds and the harvesting of the plume crops, diversions in the form of fancy stock breeding were conceived. Herds of Guernsey cattle and blooded sheep were installed in capacious barns and while Bloomsburg was satisfied that its income from the ostriches alone would be sufficiently bountiful, it felt that if the increase of the herds could be disposed of at the rate at which the original purchases were made, these side lines might not be without advantage.

Time passed, and strangely enough the plumes still were in the making. Happily, it was now found that there were large deposits of lime stone on the property, and a prompt prospectus quoted an imported expert in such matters, who explained that the stone was real, and that it could be made to produce a profit of fifty cents per load, delivered. It is probable that this announcement was calmly received by the knowing, since many other farms in the vicinity were equally endowed, the lure of the suppositious fifty cents not being a sufficient inducement to those inclined to develop quarries.

Next in order, the surprising discovery was made that the bed of the Susquehanna, where it passed the property of the Ostrich Farm, was covered with great quantities of free coal, which could be dredged out at small cost.

The particular flaw in the latter plan does not develop, but the fact remains that for two years the Ostrich Farm dragged along, paying no dividends. Doubting stockholders were appeased for a time by the sub-developments, and finally by the increase in paper value of the

stock issued. But human hopes cannot be continued indefinitely without some concrete support, and finally the uneasy stockholders demanded an account. It then developed that the affairs of the Ostrich Farm were in a precarious state, and a receiver was promptly appointed.



AN OSTRICH FOR AMERICA
Bringing in an undersized male captive

Just what brought about this unfortunate condition is still a mystery. It is possible that the great drop in the value of ostrich plumes contributed to the calamity. Apparently, no plumes whatever were plucked from the birds on the farm, although many were brought from other sources and offered for sale there. The friends of the promoter argued that he was a well-meaning though visionary person, brought to misfortune by injudicious divergings from the original purpose of the enterprise. Others, not so charitably disposed, hinted darkly at less innocent causes. This faction, having considerable strength, even went so far as to hail the fallen leader before a court of justice, but there found that the careful wording of prospectuses and other documents afforded no hold whatever for the hands of the law.

Bloomsburg, now fully awake to the bursting of its ostrich bubble, relapsed into indifference. As in all such lamentable affairs, many persons lost their entire savings, but such calamities are common enough in the history of investment. A receivers' sale was held, and there three or four of the heaviest stockholders banded together to retrieve, if possible, a portion of their losses. One of their number, appointed as spokesman, bought the farm, expecting to be reimbursed by his fellows.



IN THE INTERIOR OF AFRICA
The start for the Pennsylvania Ostrich Farm



THE PENNSYLVANIA OSTRICH FARM
The arrival of the caravan of ostriches

Unfortunately for him, this backing was not forthcoming, and he found himself saddled with the farm and a considerable number of white-elephant birds on his hands. Handicapped by lack of knowledge and by insufficient funds, he was unable to meet his constantly accumulating obligations, and a second sale was shortly held, this time by the sheriff. But the intrepid former owner, mortgaging some property held by his family, again bought the farm, for a considerably smaller sum than before.

The Ostrich Farm was then partly righted and attempted to continue on its way. But various obstacles arose. Finally, the owner announced his inability longer to provide food for the few remaining birds, and consigned them to the mercy of the local agent of the Society for the Prevention of Cruelty to Animals.

The agent, although finding himself burdened with unexpected duty, rose to the situation and forthwith provided food; but calls of distress were sent to various potential sources of relief, among them the Zoological Park.

We were told that if we would take them away, we could have the birds at our own price. At that time we had a good collection of ostriches, and did not really need more, but finally we made an offer of a nominal sum for six of the birds. A prompt acceptance of our terms specified only one condition,—that we should remove them at once. Now fairly embarked in the enterprise, we could not turn back, and the writer was appointed envoy extraordinary to the Bloomsburg Ostrich Farm.

No time was lost in getting to Bloomsburg; and once there, the farm was soon under inspection. It was found to be in possession of one South African cock ostrich and five North African hens, all, it must be said, being birds of unusual size and quality. It is a fact of history that the fine jet-black cock bird acquired by us once changed hands, with his mate, at the astonishing price of $1,400! Beside the six good birds there were certain under-sized or otherwise undesirable specimens. The latter, on being rejected for shipment to New York, were promptly disposed of to the various hostelries of Bloomsburg, between whom great rivalry arose as to who should serve the first ostrich dinner!

After a day occupied in building and assembling suitable crates, we were ready to commence the operation of packing. Strangely enough, Bloomsburg seemed far less interested in the departure of the ostriches than it had been in their arrival. No crowds of willing helpers appeared to assist in crating the birds, and there was a striking lack of vans. Instead,



WINTER AT THE OSTRICH FARM
The ostriches revelling in the snow in Zero weather

a small boy of fourteen and a kind-hearted and plucky farmer, were the only assistants available.

Strong and vigorous ostriches, accustomed to liberty in large enclosures and for several years free from all restraint, are not easily induced to enter crates two feet by five. Especially is this true when the usual plucking pens and other devices are wanting. It was a case of rough and tumble, in which we were not always victorious. Clothes, shoes and especially hats, suffered severe casualties, to say nothing of barked shins and elbows. At length the dauntless and indestructible six were safely boxed, and dissuaded from leaping over the sides of their crates by the simple expedient of a cover of thin cloth, which prevented them from looking out.

Six trips with a single sturdy farm wagon replaced the cavalcade of a previous year, and at length the crates were safely landed at the station at Espey. Here they were received by the lonely agent, but with the crushing statement that while he would gladly make out papers and receive any moneys due, he could not be expected to place the birds upon the train. It thus became necessary to impress the services of passing farm laborers, who willingly and kindly lent their strong muscles to the last rites. With this efficient help, the birds were quickly lifted into the express car that finally drew up at the little platform.

The following day, six fine ostriches were delivered at the Zoological Park, none the worse for their journey. Quartered in the large runs at the Yak House, they make a striking display. There they are happy and contented, and while their daily rations are assured, the investing public of Bloomsburg is still wondering.

THE COLOGNE ZOOLOGICAL GARDENS AFTER THE ARMISTICE.

By Lieutenant Delacour.

From Avicultural Magazine, (London)

MY duties with the British Army having summoned me into the part of Germany occupied by the Allies, I was able to visit the Cologne Zoological Gardens on December 23rd last.

Having many a time heard during the course of the war that the starving Germans had been compelled to sacrifice their animals, I supposed that I should see only empty cages. What was my astonishment to still find there a very fine series of animals, and a collection, all things



ALASKAN BROWN BEAR, KOBUK

This fine animal was captured when a cub, in 1907 on the Kobuk River, Alaska, about 300 miles northeast of Nome, and only 300 miles from the Arctic Ocean. It is of unusual interest because it extends the range of the Brown Bear group to that far-north razion.

considered, better, indeed, than that in Paris or even London!

On entering one finds on the right some pheasant aviaries which only contain common species —golden, silver, sacred, Reynaud's—and some pigeons; then come, in the enclosures, fallow deer, hog deer, sika, and red deer. One of the yards bears this label:

HELDERHIRSCH.
geb. 23—5—16,
St. Gobain (Aisne).

A stag taken in France during the war!

In the series of cages one finds many wolves, foxes, and other indigenous and exotic carnivora. The bears are very numerous—at least a dozen brown bears, as many white ones, and several other species.

The Bird House is very well appointed: one finds cages all around. The centre is occupied by aquaria and vivaria. The collection of parrakeets there is remarkable. Almost all the species of macaw and cockatoo are represented —amongst others, Lear's macaw and the gang-gang cockatoo (*C. galeatus*), and a fine pair of *Polythorynchus stellatus*. The Amazons, *Pionus*, etc., are well represented (*A. diadamata, bodini, P. menstruus*, etc.). There are but few parrots, but there is a good pair of *Cyanolyseus patagonicus* and a charming *Brontogenys pyrrhopterus*. Further on I note a little heron with a most curious, enormous beak (*Cancbroma cochlearia*); a *Dacelo gigantea*, a toco toucan, several hornbills, a Nicobar pigeon, a giant whydah, Chinese blue magpies, and a number of small and medium-sized birds. Further on I observe a couple of *Goura coronata* and a couple of the rare Sclater's goura pigeon, and some white sacred ibises.

In the centre of the house one sees a *Python molurus* and a reticulated python, a certain number of crocodiles, alligators, and caimans; lizards, tortoises, bullfrogs; butterflies and other insects. In the aquaria one finds various chancitos, some hemi-chromids, etc., and young sturgeons.

On the sheets of water the web-footed birds are not very numerous, but belong to a variety of species. One finds snow geese, Ross's blue, Canada, and Magellanic geese, etc., and *Anseranus melanoleuca*, Bahama ducks, whistling and Chilian ducks, etc. There were at least fifty rosy flamingoes, and three red flamingoes from Mexico which appeared to have been newly imported.

The collection of Raptores is very fine; almost all the larger species figure in it—eagles, vultures, condors, ospreys. I call attention to a harpy eagle, a Bengal vulture, and a king vulture. There were also a certain number of nocturnal birds.

The big birds are a rhea, two emus, a Bennett cassowary, a Westermann cassowary, European, Numidian, white-necked and blue-crowned cranes; and finally, a couple of the rare monk crane.

I note also two fine American bison in the midst of a series of buffaloes, yaks, llamas, and camels. There remain, amongst the great Carnivora, three lions, three tigers, two jaguars, two leopards, a puma, and a black panther. The Monkey House is well enough filled, without containing anything of particular interest. Some lemurs, skunks, raccoons, otters, and other small mammals occupy numerous cages, both in and out of doors. Finally, the Zoo of Cologne still possesses some big animals—a young giraffe, a hippopotamus, an Asiatic elephant, an Indian tapir, and a grand two-horned rhinoceros. In the same apartment one finds zebras, some antelopes, and a gnu (*Catablepas gorgon*).

Let me add that all the animals are in excellent condition, and appear very well fed. The establishment is well managed. To sum up, the Zoological Garden of Cologne has scarcely suffered at all from the war, and it is likely that it is the same with other German Gardens.

It is not without bitterness that I have compared it with the mournful ruins, the heaps of rubbish, the smashed trees, the twisted ironwork and broken glass which represent today my poor garden at Villers-Bretonneux, which was still flourishing less than a year ago. I conclude that our public and private collections which have been destroyed by the Germans ought to be reconstructed at their expense.

BOLSHEVIKS DESTROY A GREAT GAME PRESERVE.

IN Russia, private game preserves have been exceedingly few, and far between. One of the finest, and the most celebrated, was that of Count Potocki, at Pilawin in southeastern Russia, made famous by the visits and writings of the English naturalist, Richard Lydekker, and Walter Winans. The former wrote a book descriptive of the sanctuary and his visit.

A letter written in Paris on March 17 by Mr. Pierre Amédee-Pichot, a prominent member of the French National Society of Acclima-

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Elwin R. Sanborn,
Editor and Official Photographer

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tation, contains a brief account of the total destruction of Count Potocki's estate and game sanctuary. It says in part:

"Hundreds of deer, wapiti, European bison and animals of all sorts were kept there, in 7,000 acres of enclosed forest, which was part of a great tract of 30,000 acres. The place was invaded by 2,000 Bolshevik Red Guards, who shot every animal, and left their corpses to rot on the ground. The palace, its furniture and collections were destroyed, and the servants and keepers of the game were not only murdered, but *tortured to death,* with indescribable ferocity.

"This will certainly spread and come to us if our governments continue to close their eyes to the anarchistic propaganda which is raging more than ever."

* * * * *

Not only servants and game-keepers, but even the wild animals all are wantonly murdered by the Bolsheviki. W. T. H.

BIRDS ON BATTLEFIELDS OF EUROPE.

Unaffected By Strange Sounds—Fearless Under Fire.

By G. Inness Hartley,
Captain, 302nd Ammunition Train, A. E. F.

The conflict of last summer and fall afforded small opportunity for observation other than that necessary to carry on the work of fighting. Much of the night was spent on the road. The day was passed in thick woods or deep ravines to escape observation from enemy planes. Consequently bats and owls of France are more familiar to me than the birds of the day. Nevertheless it was necessary at times to scout out the way by daylight so that the going for convoys of ammunition would be easier at night, and I was able to catch glimpses, here and there, of what was going on among the birds and animals of the battle zone.

Three weeks of sun, rain and shells had fallen on the Vesle Valley before it became true conquered territory. Fismes and Bazoches had ceased to exist as towns. The forests on the south were masses of fallen timber; on the north the hills were gouged and torn by our artillery fire, and the valley was a flooded morass of swamp, shell holes, reeds and machine-gun nests. Hundreds of dead lay blackening in the grass where they had fallen. The hills were dotted for two miles back with the remains of horses that had drawn ammunition or rations within the danger zone. The taint of battle in the air was quite evident.

In the tropics a dead animal attracts visitors almost immediately—beetles, flies, vultures and opossums. They act as nature's sanitary train and carry out their labors with speed and finesse. Nor is the Temperate region wanting in its battalions. The sun was hot on the Vesle and things did collect. There were the world-over swarms of flies—blue bottle, the common house variety, and a large brown species. Rats took the place of opossums. They were plentiful in the open fields as well as in the ruins. Daylight held no terrors for them.

Crows were numerous. They hunted singly or feasted in great flocks. There were big ones and little ones. The larger birds were more exclusive and seldom traveled in groups of more than six, while the others often changed a field from green or brown to black. All rested at night in the broken trees that crowned the hills. The first streak of dawn was the signal for a babel of hoarse caws, and, as the gray of morning became fixed, they flew croaking to their early meal.

Soon after sunrise swallows appeared as tiny specks in the sky, or glided low to the ground. No swifts were present. Finches lived in the bushes and fields. They quickly became so accustomed to the explosions, which to them probably were sharp bursts of thunder, that their flight to the next field to escape the dust and fragments was scarcely hurried. Gas drove them only temporarily from their posts in the edges, though it sometimes searched out victims, as demonstrated by the discovery of two dead yellow finches in a gas-browned alfalfa patch.

One day the enemy conceived the idea of shelling the wood that was our temporary camp. Fortunately his calculation of angles was not what it should have been, and every

twenty seconds, his "messengers of hate" destroyed some sod in the little clearing a hundred yards to the east. The noise and flinging of stones lasted about twenty minutes. At the first burst, which was a loud one, dozens of finches hastily betook themselves to the shelter of our trees and remained there. A few crows flapped over the hill. But an hour after the firing ceased they were all back again, the finches hidden in the bushes and tall grass where they inquisitively inspected the new craters; the crows busied on their horses once more.

Small chestnut-red squirrels scampered among the trees and splintered stumps. There was no other place to go. Rabbits remained in their beds regardless of the repeated jars to the earth. Gas in the bottom-lands must have caused havoc among them, but of this there was no evidence. They were present on the hills during the battle. Partridges were not so valiant. They ran in coveys from the noise and were seen only in the back areas.

One evening, just before sun-down, three herons flew over the trees and soared low toward the marsh of the valley. They seemed about to alight for they circled several times above a certain newly formed lake, but something suspicious about the place made them hesitate. Then a large two hundred and ten shell—locally named a "rolling kitchen"—clattered by and buried itself in the pond. It gave forth a dull hollow sound for it struck deep, and black smoke mixed with mud and a shower of rain filled the neighborhood. There was a squawk, and three frightened herons, much to the enjoyment of my orderly who rode behind me, rose high in the air. With outstretched necks and frantically beating wings they sought less cyclonic regions.

Hawks were plentiful, though not so common as I found later in the Argonne Forest. The large broad-winged varieties could be seen each day wheeling high above the trees, while the smaller falcons from time to time hovered barely fifty feet from the ground. They seemed to have a special enmity toward the larger species and boldly attacked them whenever seen. One even charged up to meet an approaching aeroplane, but the rattle of the engine, the size of the machine or its obvious indifference to attack caused the falcon to change its mind before it had gone far, so it turned to seek a more timid foe.

Anti-aircraft guns disturbed the higher flying buzzards, and usually when the little white and grey puffs appeared they foregathered to areas not quite so jarring. They returned, however, when the firing was over, attracted, no doubt, by the aeroplanes that still hovered about.

We arrived in the Argonne Forest in the latter part of September. Back of the lines, which had been quiet for two years, the forest life, so far as it had to do with birds, was normal. Migration had commenced and the woods were full of feathered creatures I had never seen before. Between the trenches, in No-Man's-Land, finches were common, for the entire area, except small exciting sections where No-Man's-Land consisted only of a great coil of wire between the opposing trenches, was grown over with weeds and low bushes. Here old nests were later found built on the barbed wire. Wrens made their homes in nooks of the trenches. Magpies dotted the grassy bottom-lands and flew to the dead poles that four years before had been trees. Crows were scarce, for the pickings were poor, and did not appear in numbers until a few days after the attack commenced.

The famous barrage that opened the battle lasted for many hours. Tens of thousands of shells were fired. One battery of four guns alone fired thirty-two hundred rounds and there were hundreds of guns in action. The noise and concussion was terrific. And yet, a few days later, when I was more at leisure to examine the battered areas, the birds were still there in their accustomed haunts, or what was left of them. Several wrens had quarters in the same old trench as I, and the terrible blast of a six-inch rifle—G.P.F.—perched a few yards above us affected them less than it did me. They only cocked their tails at the report and looked wise.

The second great attack which took us to Sedan and the Meuse, began on November first. We covered territory so rapidly that beyond a heavy blasting of roads and machine gun nests little damage was done to the country. The fields were unmarred, and deer and wild pigs that had escaped the eye of the prowling Hun remained undisturbed in the forests, which were full of migrating birds. The sounds of the passing conflict left the birds unterrified, for, to them, perhaps, it was but an autumnal storm.

A camp was sure to attract hundreds of larks, starlings and English sparrows to feed on the scraps and grain thrown out. One night the enemy bombed a large field in which rested hundreds of weary men and horses. At dusk the spaces around the wagons and near the picket lines were covered with larks and spar-

rows. Not content with one call, Jerry repeated his visit several times and on each occasion dropped his "eggs." More than a hundred bombs fell, but in the morning the birds were still there. The concussions were so great that fifty yards away a man could scarce stand against them, and they fell close. Yet daylight found starling and sparrow squabbling as heartily and undisturbed as if they were in the streets of New York City.

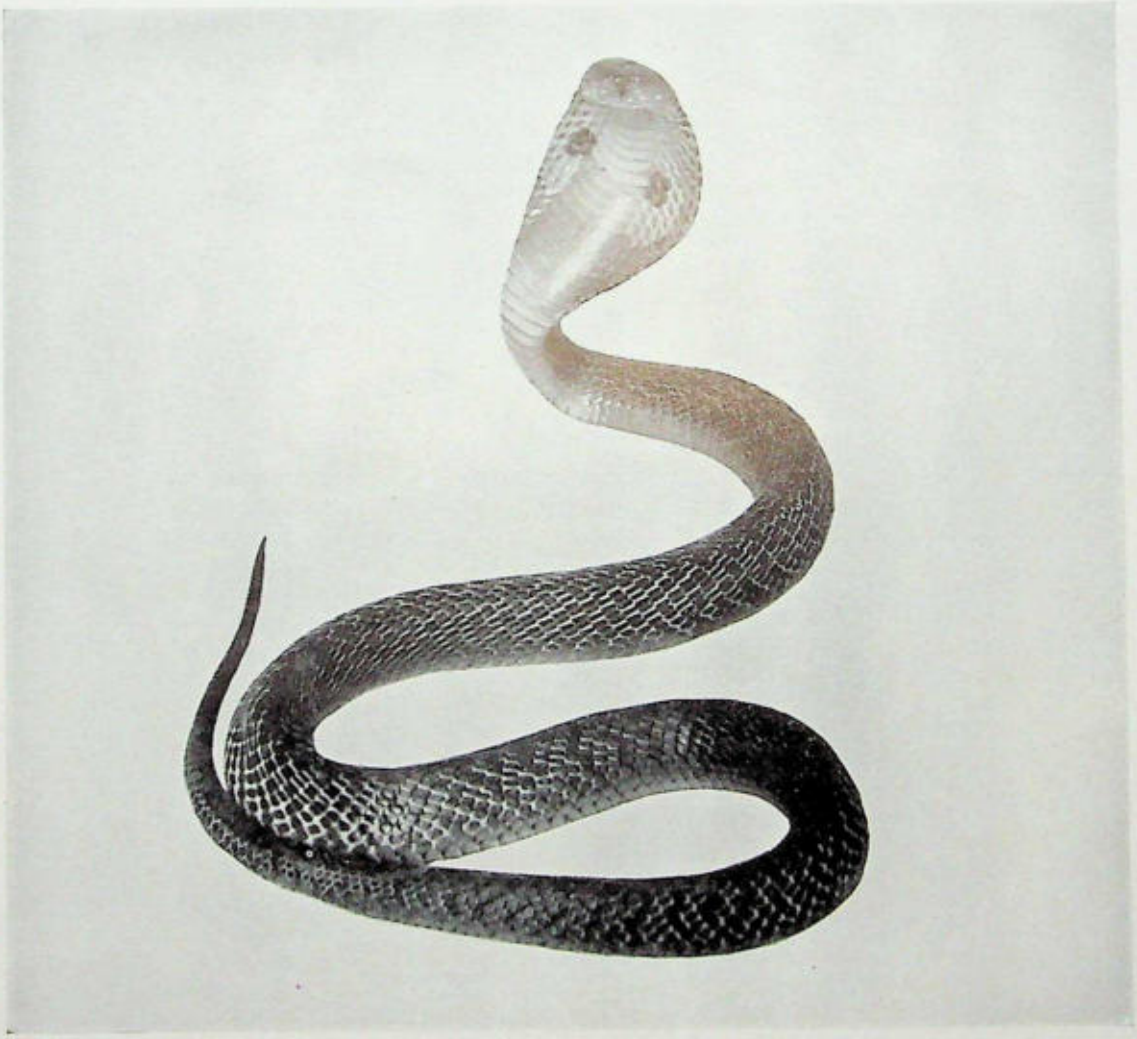


Photo. by Elwin R. Sanborn

INDIAN CORBA

Two cobras have been on exhibition in the Reptile House for more than twelve years.

OUR OLDEST SPECIMENS

Some of the Aged Members That Still Are Living in the Park.

By Raymond L. Ditmars,
Curator of Reptiles.

THE Park's veteran mammals are an elk and two bears that have been on exhibition since the formal opening to the public on November 8, 1899. The former is the sole survivor of a herd presented to the New York Zoological Society on October 11, 1899. This animal was about three years old upon arrival at the Park, and thus records the ripe old age of twenty-two years for the American wapiti. One of the bears arrived as a tiny

cub, born early in the year 1899. It was presented to the Park on October 13, 1899, by Messrs. W. W. and J. Barron Niles. This animal is a very good representative of the Alaskan brown bears and weighs about seven hundred pounds. The other bear arrived a day later—October 14. It is a grizzly bear from Colorado, born early in 1899 and is the gift of The Engineers' Club, of New York City, through Mr. Arthur C. Humbert.

There is but a single specimen in the Reptile House that has survived since the Park's opening day. This is an American alligator presented to the writer by Mr. Charles R. Knight in the summer of 1894. When the Reptile House was opened this specimen was less than two feet long. It is now eight feet long, and weighs about one hundred and seventy-five pounds.

No specimen of the bird collection has survived the Park's opening day, although there is a Griffon vulture living in the collection that has been on exhibition nearly seventeen years, and several of our pelicans have been with us for a period slightly over sixteen years.

Veteran members of the mammal collection have been on exhibition for the following periods: Alaskan brown bear, "Admiral," seventeen years; Russian brown bear, seventeen years; red deer, one specimen eighteen years, two specimens, sixteen years; Indian sambar deer, fifteen years; Florida deer, fifteen years; Addax antelope, fifteen years; white-tailed gnu, fifteen years; alpaca, fifteen years; Indian antelope, fourteen years; mouflon, fourteen years; American bison (born here), fourteen years; Malayan sambar deer, fourteen years; Himalayan tahr, thirteen years; Mongolian wild horse, thirteen years; alpaca, thirteen years; Eld's deer, thirteen years.

A considerable number of animals now on exhibition have lived in the Park for twelve years.

Veterans of the Reptile House that have arrived since the opening of the Park are about equally divided among the various orders. We have specimens of the giant Galapagos tortoise that have been on exhibition twelve years. Our big python has been on exhibition ten years, and the Indian cobras the same length of time. An alligator that was hatched in the Reptile House on October 20, 1900, and then weighed one and three-eighth ounces, and was eight inches long, is now eight feet three inches long and weighs slightly over two hundred pounds.

The biographies of some of our veteran specimens form valuable records. A very complete card catalogue is steadily kept up to date in the Department of Mammals. Many of the cards are closely written with notes relating to observations of increase of weight, change of color, habits and phases of illness. Collectively, these cards would furnish the material for an interesting memoir on the development and longevity of mammals. As an example it may be noted that the card relating to the Alaskan brown bear on exhibition since the Park opened, shows the following:

"This bear was born in February, 1899. When nine months old, it weighed ninety pounds and was very different in coloration from an adult of the species. It was of the same dark hue as a grizzly cub and from this color gradually changed to a distinct tan. This color then slowly darkened until at three years of age this bear ceased to grow (at about seven hundred pounds weight), and exhibited the dark brown pelage characteristic of the Alaskan bears."

There are about a dozen spectacular veterans in the bear collection that arrived here as playful cubs and have attained huge proportions. One of these is Ivan, our largest Alaskan brown bear, which now weighs approximately eleven hundred pounds and standing upon his hind feet can reach upward to a height of over nine feet. He is probably the largest captive bear anywhere on exhibition and his prime condition and happy demeanor would indicate that he will survive many years. The writer also well remembers the arrival of our Syrian bear, also in flourishing condition at this date. She came into the Park on a crowded Sunday afternoon, whining hungrily from the depths of a fragile box which was ordinarily used in shipping a few dozen oranges. As the fluffy little creature was nervous at a touch of one's hand, we carried her crouching within a derby hat to the Bear Dens, and then found she was so small she could crawl beneath the bottom panel of the iron work—through a space provided for the feeding of the bears. This opening was covered with a wooden strip and the tiny creature soon outgrew the possibility of squeezing through the aperture. This bear arrived in May of 1901.

Our oldest deer—a female elk or American wapiti, shows an interesting record. During the nineteen years this animal has been on exhibition in the Park, she has reared seventeen young. She has, in fact, given birth to a perfect fawn every year since her arrival, with the exception of the year she arrived and the year 1913, when she suffered from acute rheumatism.

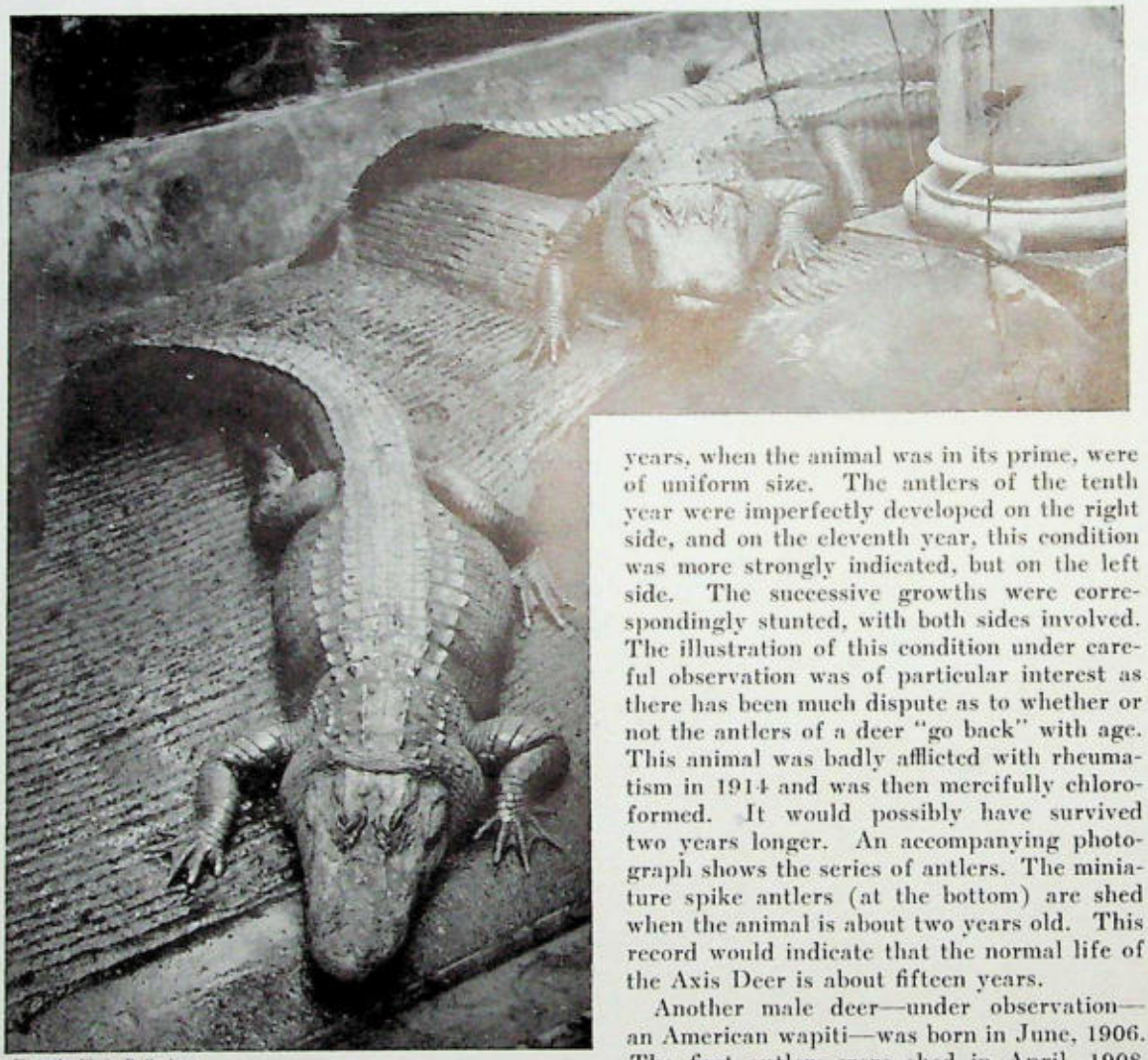


Photo. by Elwin R. Sanborn

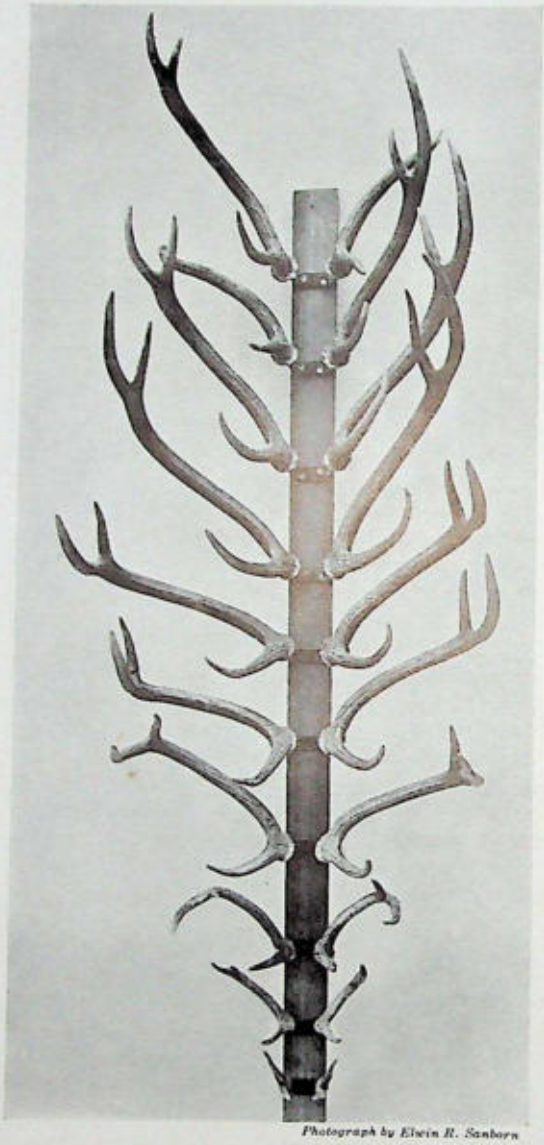
VETERAN PARK ALLIGATORS
The 'gators enjoy basking in the warm light of the afternoon sun as it filters through the skylights above

Among the records of our deer we can cite the history of an axis deer, which was born in the Park and apparently passed through the normal duration of life for this medium-sized, tropical species. This deer inhabits India and is characteristic in being vividly marked with white spots. Our herd has always flourished and bred well. The filed record-card of the male deer in question shows this animal to have been born on April 15, 1901. We saved the complete series of its shed antlers, until its death, on October 6, 1914. Each pair of antlers markedly increased in size up to the seventh year, although between the age of three and four years the animal was mature for breeding. The antlers of the seventh, eighth and ninth years, when the animal was in its prime, were of uniform size. The antlers of the tenth year were imperfectly developed on the right side, and on the eleventh year, this condition was more strongly indicated, but on the left side. The successive growths were correspondingly stunted, with both sides involved. The illustration of this condition under careful observation was of particular interest as there has been much dispute as to whether or not the antlers of a deer "go back" with age. This animal was badly afflicted with rheumatism in 1914 and was then mercifully chloroformed. It would possibly have survived two years longer. An accompanying photograph shows the series of antlers. The miniature spike antlers (at the bottom) are shed when the animal is about two years old. This record would indicate that the normal life of the Axis Deer is about fifteen years.

Another male deer—under observation—an American wapiti—was born in June, 1906. The first antlers were shed in April, 1908. There was a steady increase in size of each new pair of antlers up to 1912, when the only increase was a slight thickening toward the base until 1916, when the successive growth of antlers continued of uniform size to date. The pair of antlers shed this spring, on April 3, weigh seventeen and a quarter pounds.

A male Florida deer, (*Odocoilus virginianus osceola*), was born in the Park sixteen years ago and shows no indications of "dropping back" at this date.

A particularly interesting series of observations were made and noted in relation to our largest specimen of the Galapagos tortoise, now on exhibition twelve years. There has been a common allegation that the species of giant tortoises from the Gallapagos and Aldabra Islands live to a great age—supposedly three to



Photograph by Elwin R. Sanborn

ANTLERS OF THE AXIS DEER

A series of antlers shed by an Axis deer born in the Park. The stages of development progress from the bottom to the top

four hundred years. Also that their rate of growth is exceedingly slow. It has even been alleged that these tortoises require a period of fifty years to attain full size. The growth of our veteran specimen does not indicate a growth such as this. It arrived during October, 1904, and then weighed one hundred and forty pounds. Ten years later it had increased to a weight of two hundred and ninety-five pounds and two years later had increased an additional twenty pounds.

The twelve years' history of our big Malayan python shows interesting items relating to feeding and shedding of the skin, but no apparent increase in length. This snake was twenty feet long upon the time of arrival and the species attains maturity when twenty to twenty-five feet in length. The normal duration of life of a serpent of this size is unknown, but a specimen quite similar in its early history to ours, lived for thirty years in the Zoological Gardens at London. Its death was caused by a type of disease that would not occur in natural environment. When hungry, our big python feeds at intervals of two weeks, but its feeding periods are irregular. It may feed in this way for three or four months, then persistently fast for an equal, or longer period. At one time it stubbornly refused food for twenty-two months, yet during this lengthy time showed but slight indications of emaciation. There are fairly regular indications of fasting each year, these periods probably relating to seasonal times when food is difficult to obtain in a native condition.

Our observations on the duration of life of the smaller serpents are illustrated by the following: Two Indian cobras have been on exhibition for twelve years' time. They were mature when received and show no lack of activity or vigor at the present time. A specimen of the common striped or garter snake was under the writer's observation for eleven years and a Florida rattlesnake for thirteen years. The latter was killed by an injury, and judging from its growth of rattles—four to the year—as compared with the rattles of captured specimens, would have normally lived many years longer.

The Park's vetertan alligator has actually been under observation for a period of twenty-eight years. This specimen was received from Florida by Mr. Charles R. Knight, in 1891. It was then about sixteen inches long. Three years later Mr. Knight sent it to the writer, who kept it in his labarotory in a small tank. The conditions were not suitable for its development, and though it fed well, for a period of five years it did not seem to increase in size as much as one inch. It was sixteen inches long when placed in the Reptile House in 1899.

For about a year it showed no increase in size, despite its favorable quarters,—a large tank of tepid water. At the expiration of its first year in the Park it was attacked by a young crocodile and badly lacerated. Its abdomen was torn open nearly the entire length, through which aperture the intestine protruded. Another big tear on the side exposed the heart and lungs. As this specimen had been in the



Photograph by Elwin R. Sanborn

ALASKAN BROWN BEAR, BELLA
This bear even to this day is very active and vigorous.
Gift of William White Niles and J. Baron Niles.

writer's possession for so long a time he endeavored, with but little hope of success, to save its life. The intestines were carefully replaced, and the abdominal laceration sewed up. When the tear on the side had been similarly treated, the creature was placed in a shallow tank of tepid water from which it could not escape. The treatment was as nearly antiseptic as conditions would permit.

The lacerations rapidly healed, with attendant vigorous sloughing. Within ten days the reptile was feeding in normal fashion. More remarkable than the reptile's reconstructive energy in healing its great wounds, was the effect upon its subsequent development. At once it began to grow and at this date it is about eight feet long and weighs approximately one hundred and seventy-five pounds.

Another of our veteran alligators was hatched from an egg in the Reptile House in October, 1900. At time of hatching its weight was slightly under two ounces and its length was eight inches. At nineteen years of age this specimen is between seven and eight feet long and weighs slightly more than one hundred and fifty pounds. It will probably add but little to this length and weight. Many alligators never attain a length of much over seven or eight feet. These are stunted individuals that have had the misfortune to take up their abode in localities wherein food had become scarce, or presented little variety. Sometimes we find localities where there exist whole colonies made up of stunted members. It is possible to retard the growth of captive specimens by feeding them raw beef only, or a diet composed entirely of small fish, and excluding whole, warm-blooded prey, with its attendant bone nourishment. If the process is continued for several years' time with a specimen about half grown, and then a miscellaneous and wholesome diet is substituted, the reptile will grow but little afterward and perhaps not at all, although it may become sexually mature and vigorous, and breed regularly.

Captive reptiles seldom or never attain the full size of wild specimens owing to a lazy disposition that comes from food which requires no stalking and a lack of the tonic effect of unadulterated sunshine and air.

ITEMS OF INTEREST.

By Raymond L. Ditmars,
Curator of Reptiles.

Our Friendly Peafowl.—Our flock of peacocks has become particularly friendly this year. They have selected the vicinity of the Reptile House as their rendezvous and become familiar to the extent of even entering the building and roosting on the guard rails. Their first appearance in the building came about through an open window. Recently the writer observed three pea-hens stalk through the front door as it was pushed back by a visitor. The near location of the alligator tank and the decided interest of the big crocodilians during such visits prompts the keepers in immediately ushering fowls outside, but it is a common occurrence to see them back again in a few minutes' time. A very spectacular albino peacock spreads its tail and struts in the tortoise yards every fine morning. A fine Indian peacock, of normal coloration, demands attention from an adjoining yard. These showy birds appear to consider the smooth, sanded yards of the tortoises as ideal arenas for the display of their gorgeous plumages.

War Pigeons.—Seven homing pigeons, all of which saw service with the American Army in the trenches of France, have been deposited in the Zoological Park by the Chief Signal Officer, Department of the East. Two of the birds were severely wounded while carrying messages, which they succeeded in delivering, and several others have received special citations. They will be exhibited at the southern end of the Pheasants' Aviary.

Wild Babies.—Though the season is very early, the Park already contains a number of very interesting baby animals. Crowds of visitors are daily entertained by the antics of three infant bears, which are well worth coming a long way to see. These youngsters are of one litter and are hybrids. The mother is a Russian brown bear and the father—in an adjoining den—came from Asia Minor and is known as the hairy-eared bear. There is a playful litter of timber wolf puppies on exhibition and on the Asiatic Deer Hill are fawns of the Eld's deer, barasingha deer, Malay sambar deer and vividly spotted axis deer. An eland was born early in April; also four aoudad in the Mountain Sheep collection. On the walk between the subway gate and the Antelope House may be seen a particularly impressive family—an adult emu and five brightly-striped young. The point of particular interest about these birds is the fact that the parent, so busily caring for the young, is the father, whose duty it also is to hatch the eggs.

Fickle Spring.—After an exceptionally mild winter, with only one severe "cold wave," there were very apparent indications of spring by the middle of March, when the buds were opening and the grass becoming very green. The croaking of wood frogs and the whistle of "spring peepers" in the marshes, were heard quite early in March. Various species of birds also arrived earlier than usual. There was one set-back in the shape of a snowstorm assuming blizzard proportions and arriving on March 28. The total precipitation was three inches, but a wind of ninety miles an hour produced drifts from three to four feet high. The temperature dropped to twenty degrees and remained low for several days. Early leaves were much affected and were drooping and withered, but a subsequent growth has now eliminated all signs of damage. With the exception of this storm, the total snowfall for the entire winter was slightly over *one inch* and the lowest temperature recorded at the Park was seven degrees above zero for a single evening.

Influenza in the Park.—The world-wide epidemic of influenza and bronchial diseases has affected a number of our animals. Every member of the series of chimpanzees and orang-utans has been seriously sick with bronchial troubles and one of the largest specimens died of pneumonia. The commoner symptoms were fever and severe coughing and the treatment was to isolate the animal, place it in a canvas-covered cage and impregnate the air with the fumes of a vapor lamp containing carbolized oil of eucalyptus. This was followed by cough syrup and finally the administration of systematic doses of cod-liver oil emulsion. A considerable number of the smaller animals were lost through similar troubles and the following report from Dr. G. A. MacCallum, who has made a number of our post mortems at the College of Physicians and Surgeons, is of much interest: "Your snakes and lizards, as well as some of the birds, have been dying of pneumonia or influenza, but probably the result of both. Nearly all the reptiles I have lately examined have had decided pneumonia. I have access to the opinions of some

good pathologists, who agree that this is the condition."

Jumbo's Rival.—The majestic height of the African elephant Kartoum points to the probability of this animal becoming a rival of the once famous Jumbo. Kartoum is already over nine feet in height and is rapidly growing. Jumbo was between ten and eleven feet high and the largest elephant ever exhibited in the United States. It should be remembered that Kartoum is of the same species and type as Jumbo, and while not many years ago he was so small that a child could climb upon his back, he is already rated as one of the most spectacular elephants in the United States.

Odd Associations.—In a large collection of animals there are always demonstrations of strange friendships, but occasionally we note most incongruous acquaintances. The writer has seen a peacock vainly strutting and spreading its tail among a number of large and much surprised tortoises. He has also observed a large and exceptionally savage baboon tenderly adopt a frightened little monkey which had escaped from its cage and darted through the bars of the baboon's cage into what we for the moment considered certain destruction. The most remarkable case of animal association we have ever witnessed in the Park was portrayed during a cold spell the present spring. The writer was passing the installation where the camels, llamas and alpacas are quartered. The black alpaca was taking a sun bath, close to the barn wall and reclining in the familiar position of these animals, with limbs bent beneath the body, while its luxuriant coat fell like a heavy mat over its back. The writer thought that he detected a rat peering from beneath the alpaca's heavy pelage and to make sure as to whether such familiarity were possible, extended his hand to the alpaca as offering some food. The animal arose and a rat was seen to dart from beneath it, scurrrying under the barn, but the most surprising thing happened immediately after. The alpaca advanced a few steps, then stopped and deliberately shook its heavy coat like a dog coming out of water. It repeated the process with more vigor and three large rats that had been clinging beneath the heavy pelage, apparently on its back, tumbled to the pavement and scurried for cover as they discovered the human intruder. The alpaca then sauntered to the fence.

Primate Aberration.—There is a puzzling specimen in the Primate House, the mental condition of which has been a problem to us for several years. This is a fine adult example of the rhesus monkey, from India, that is normal in every way aside from the eccentric antics it performs when the keeper passes its cage. If one of the keepers passes within the railing, this animal gazes intently at some imaginary object within a yard or so of its face, then makes a quick grasp—only to have its hand close upon nothing. The chase immediately becomes more exciting. Both hands make a grasp for the invisible object and there is a furious chase about the cage. The entire performance reminds one of a pursuit of a will-of-the-wisp and is really uncanny. After the keeper has passed, the animal assumes its former nonchalant demeanor.

"What's in a Name."—Some of our youthful visitors have made the remark that we have inappropriately titled our specimen of spotted hyena, which the label also describes as the laughing hyena. This specimen occupies a commodious cage in the Lion House and sometimes gives voice to its characteristic call which terminates like a diabolical laugh. More frequently, however, the hyena makes faces at visitors, in an effort to be friendly. Its lips are stretched very wide, disclosing the teeth in a spectacular smile and the children insist that our label should refer to the smiling hyena and add that they have patiently waited, but have been unsuccessful in observing a reason for the wording of our label.

Dietetical Elegancies.—A most unhappy fate befell a young llama which came into the port of New York on the U. S. S. Munaires. The animal was won at a ball game in Buenos Ayres by the United States sailors, who brought him north with the intention of presenting the animal to the Park. Not realizing the innate voracity of a llama, the men failed to bring enough hay to last the animal throughout the long trip north—particularly when they generously permitted the llama to wander into the hay compartment at will and eat all he wished at each visit. The hay gave out when the ship was crossing the Equator, but the llama solved the difficulty by discovering several brooms and eating the last wisp of straw away from the handles. In a desperate spirit the men collected all the brooms on board and fed them to the llama. When the brooms were gone the animal became demonstrative, but refused every substitute until dried prunes were offered him. On this diet he arrived in New York in active condition, but a sudden cold spell brought him bronchial troubles and the mascot died of pneu-

monia. Incidentally, the U. S. Bureau of Animal Industry at Washington would not permit it to be landed in the United States.

BIRD SURGERY ON A WAXWING.

By Ernest F. Keller.

ONE Sunday morning in the early fall of 1917, an automobile stopped at my garden gate and a small boy alighted, carefully carrying a paste-board box covered with mosquito netting.

The tall man that followed the boy through the gate, I recognized as Mr. Frye, of Ridgewood, N. J., a brother member of the garden club. Master Frye being introduced, told me that he had a little bird in the box which he had rescued from a cat an hour before, and as his father had told him how I cared for the birds, he thought I might be able to do something for his feathered charge.

The bird was a full grown cedar waxwing. His right wing hung down limp, apparently broken, but a careful examination showed that only the flesh was badly lacerated, and that the bones were intact. The bird seemed to realize his helpless condition and exhibited not the slightest fear. I offered him some raspberries, which he devoured while perching on my young friend's finger.

After promising Master Frye that I would do all in my power to make the little bird well, he departed with his father, and I commenced working over my patient. I carefully washed the wounded wing with lysol solution and after drying it with cotton, dusted it over with aristol. After the wound was dressed, I had my son hold the bird while I carefully placed the wing in its natural position, and wound lantern slide binding-tape around the bird, covering the entire wing, but leaving the lacerated tissues exposed. After the gummed tape had dried, the injured wing was immovably secured. I placed the bird in a large box covered with wire netting provided with a small branch, on which he promptly perched and proceeded to preen his feathers. This looked promising. The bird showed interest in life. The only treatment I gave him from now on was an occasional dusting of the wound with aristol.

On a diet of elderberries and meal worms my patient seemed to lose no weight. I am sure that his appetite was fine, and we were now so thoroughly acquainted that he promptly answered me with a very low melodious call, and seemed much pleased when he hopped on my finger to be taken out for an airing. Strange to say he never made a single attempt at flying. After ten days the healing process had so favorably progressed, that I considered it safe to remove the tape.



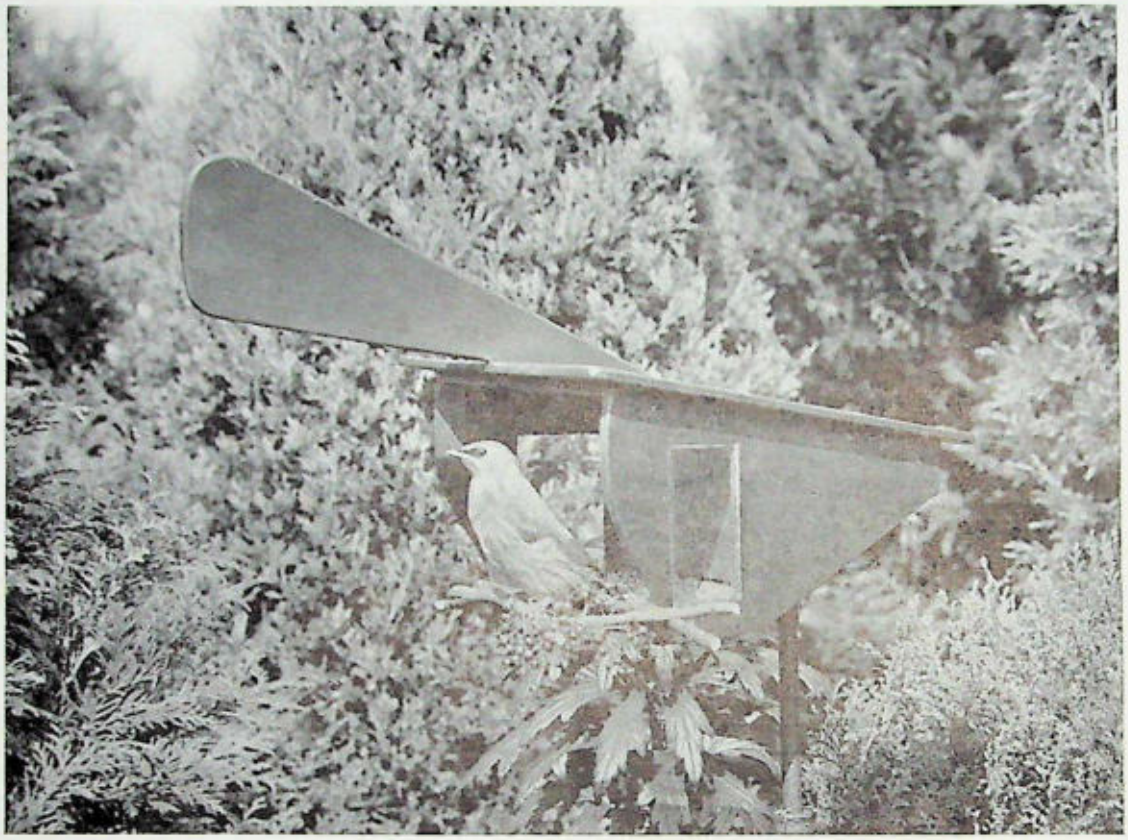
A YOUNG WILD BIRD SAMARITAN
Master Frye with a Cedar Waxwing that he rescued from a cat. Photograph by Mr. Keller.

I prepared a warm bath in a suitable dish and submerged my patient up to his neck for about ten minutes. I could now remove the thoroughly softened tape without trouble, and after rinsing the bird in several changes of clean, warm water to remove all traces of gum, I carefully wiped my protege with cotton and set him on the branch of a cedar tree in front of the porch.

The last treatment was apparently the least appreciated. My patient became so resentful that he even tried to bite me, and he certainly looked as if something awful had happened to him.

On examining the bird I found to my satisfaction that the wound had healed perfectly; the injured wing drooping a little.

After sitting in the sunshine for about an hour, the bird began to clean and arrange his plumage. He worked particularly on the wing that had been bandaged and to my astonishment he finally flew from the cedar tree to the top of a shrub near the fence, a distance of about thirty feet, without an effort. From now on I left my patient unrestricted. Of course I furnished him meals, but he had to find his own lodging.



THE CEDAR WAXWING RESTORED TO HEALTH

The bird is perched on one of the many bird food stations placed in Mr. Keller's garden. Photograph by Mr. Keller.

Within a few days the bird was at home in the garden, flying all over the place, but choosing a haunt among the evergreens, as a favored spot.

At roosting time I would go out and call, which he promptly answered, until I had located him. If he roosted too low, or too near the outer edge of the tree, I would guide him to a higher and safer spot, and he always followed my suggestions and stayed where I put him.

Bunches of elderberries suspended from the perches of the food houses were readily located and the bird would fly to the food stations whenever he got hungry, and to this very day I find small elder bushes growing all over my garden that were propagated from the berries that the waxwing dropped.

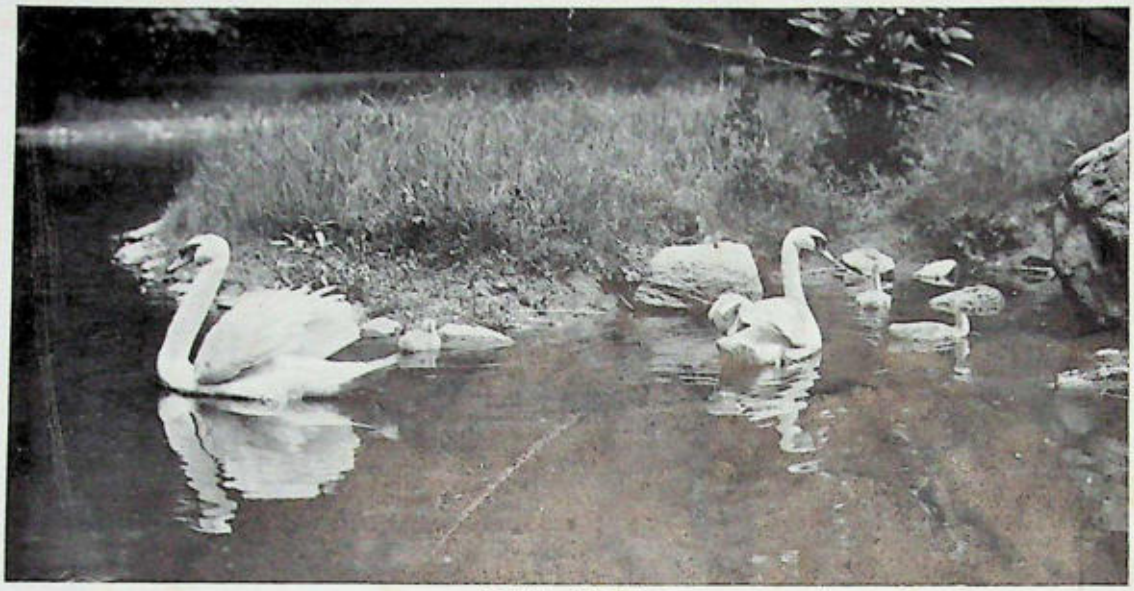
Three weeks had gone by and still the bird remained with us. He would come to me when I called him and take a meal worm from my hand without fear. Not even Teddy, our Airedale, seemed to disturb him in the least. He had absolute confidence.

By this time I considered the bird as a fixture of the garden, and I even went so far as to make preparations for the winter by gathering and drying elderberries, but I lost my little boarder in a natural but most pleasant way.

One afternoon while working in the garden, I heard a number of cedar birds call, which my little protege answered, and in a few moments a flock of about fifteen birds alighted in the evergreens. I hurried over and arrived just in time to see my bird join the others, and departed with the flock without saying adieu or au revoir. He had answered the "call of the wild."

I had telephoned that very afternoon to Mr. Frye, inviting him and his tender-hearted little son to call and see how splendidly the bird had recovered.

When Master Frye arrived about an hour later and I told him about the bird's departure, he looked somewhat disappointed, but turning to me he thanked me and with a smile of satisfaction said, "I am glad he got well."



MUTE SWANS

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A THRIVING FAMILY OF MUTE SWANS

For several years these beautiful birds have graced our lakes and ponds, bringing each season to the collections their broods of cygnets. The parent birds are exceedingly courageous and never hesitate for an instant to protect their young.—Photograph by Elwin R. Sanborn

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AN OKAPI REARED IN CAPTIVITY

A BELGIAN WOMAN FIRST TO ACHIEVE SUCCESS

By HERBERT LANG, F.Z.S.,
Asst. Curator, Department Mammalogy, American Museum Natural History.

IN a letter from Faradje (Uele, Belgian Congo) dated April 2, 1919, one of the most obliging Belgian friends of the Congo Expedition of The American Museum of Natural History, the Hon. Charles Smets, communicates some interesting notes on the rare okapi. The readers of the BULLETIN, who perhaps remember the article on the okapi in last year's May number, may welcome additional information on the subject.

The members of the Congo Expedition always shared Dr. Hornaday's belief in the possibility of rearing a young okapi in captivity, provided there was a sufficient supply of milk during the early period and we have already described how through the lack of milk we lost the young okapi captured alive in the heart of Africa for the New York Zoological Park. We are therefore delighted to hear that what to many seemed impossible has now been successfully accomplished.

Judge Smets was greatly surprised recently to see a nearly full-grown female okapi, which to all appearances had made its home in the Post at Buta, in the Uele. Inquiry revealed that it had been caught when young by the natives and reared on the bottle by Mrs. Landeghem, the District Commissioner's courageous and resourceful wife. Through her devotion and patience the animal grew up astonishingly well and tame. Think of an okapi considered by all the shyest of forest animals, walking freely and fearlessly about the Post, where hundreds of natives come and go. This okapi even gathered much of its own food. It loved to browse upon the bushes of exotic rose mallows (*Hibiscus*) and especially on croton (*Phyllaurea*), planted all over the Post for decorative purposes, the latter on account of the variegated glossy leaves. Sweet potato leaves, thrown into the stable where the okapi spent the night, also seem to have been partly responsible for its healthy growth. Strange though this disclosure may seem, it is very encouraging with regard to the possibility of keeping okapis alive in captivity, and at the same time verifies our field observations, upon which we based the statement that Okapis feed on many kinds of bushes and are by no means restricted to one species of plant, on the occurrence of which some naturalists have tried to explain the okapi's limited range.

Judge Smets made another curious observation. As in the giraffe, the okapi's prehensile tongue is the means by which the leaves are grasped and introduced into the mouth without aid from the lips, which are closely attached to the skull, although heavy and readily movable in the giraffe and camel. But this tongue performs even more remarkable feats. Occasionally the flexible, muscular tip is called upon to reach far backwards to relieve the eyes of the annoyance of flies and to remove impurities lodged therein.

Mrs. Landeghem deserves the hearty congratulations of all naturalists for so successful an enterprise, she being the first to rear an okapi for though several were previously captured, they have all perished. During a time when her country was passing through so many trials she endeavored to add a new jewel to the Belgian Zoological Garden in Antwerp, which will now be the first to have the honor of exhibiting a live okapi. Mr. Lebrun, an official of the



AN ADULT FEMALE OKAPI

The proportions of this rare animal are well shown in this fine picture of a specimen taken by the American Museum Expedition.
Photograph by Herbert Lang



BLEATING FOR HIS MOTHER

A young okapi that was destined for the Zoological Park. He was captured at Niapu, Belgian Congo, in 1914, by the American Museum Expedition. Photograph by Herbert Lang

Belgian Government, and himself a lover of animals and an excellent naturalist, will take the okapi to Belgium. No one is better fitted for the task and there is excellent reason to believe that his efforts will be crowned with success. Let us hope that this record will introduce a new era, affording an excellent opportunity for the closer study of many of the rare Congo mammals which have never before been exhibited alive in any zoological garden.

THE FRIGATE-BIRD POST OF THE PACIFIC.

By E. Hopkinson, M.B., D.S.O.
From Avicultural Magazine.

IN a note to a paper by Bowdler Sharpe on a few birds from the Ellice Islands ["Proceedings of the Zoological Society," 1878, p. 274], the Rev. S. J. Whitmee, a missionary in the Pacific, writes on one of the very last birds one would expect to hear of in captivity as follows:

> "The *frigate-bird* . . . . is domesticated by the natives (of the Ellice Islands), and when I was there in 1870 I saw scores of them about the villages sitting on long perches erected for them near the beach. The natives procure the young birds and tie them by the leg and feed them till they are tame. Afterwards they let them loose and they go out to sea together to get their food and return to their perches in the villages at intervals."

Some little time back, before I had come across the above, I had heard a slightly different version of the same from a friend of mine, much of whose life had been passed in the Solomons, Gilberts, and other little-known Pacific Islands. In many places he had often seen captive frigate-birds, but in one particularly isolated island or group the natives had got as far as using these birds as postmen! These islanders were dependent for the little outside trade

they had on very occasional (sometimes at intervals of two or three years) arrivals of trading schooners. These never made the islands under ordinary circumstances, as they were so remote from the usual routes and also so poorly furnished with the usual matters of trade, but would no doubt do so "if sufficient inducement offered," as the steamer announcements put it. One of the places which the traders regularly visited happened to include a nesting site of the frigate-birds. It was by means of this that our islanders (I believe they were part of the Ellice group, but am not sure) communicated with the outside world. Just before the nesting-season they caught a certain number of birds to whose legs they tied bladders; after which they let them go. The bladders contained pieces of stone, stick, shell, etc., which constituted the message. This always referred to the amount of "trade" (copra, pearl-shell, or whatever it was) ready for removal. As far as my informant knew, no more personal news was sent, at any rate nothing written, for that was an art beyond them. In due course the birds repaired to their breeding-place. Here any would-be visitor caught any bladder-bearing bird he saw, and no doubt decided from the news thus brought whether it was worth his while making the journey to their place of origin. That it would be easy to catch the nesting-birds is obvious, but how the first captures were managed is by no means so clear. If they were caught just before the breeding season, they must then have been full-winged. This point never struck me till I read the missionary's note; his were caught young, and this may have been the case with the others also, but even so, where were they caught? It could not have been at the breeding-place, for then there would have been no need for the employment of the birds as messengers, for the message itself could have been left by the catchers, and had a more certain chance of meeting the eye of the proper recipient. The whole point of the need for the birds was the remoteness of the islanders in question and the single breeding-place which was used by every bird for hundreds of miles round.

THE TROPICAL RESEARCH STATION

By William Beebe.

THE Society's Tropical Research Station in British Guiana was established in 1916 at Kalacoon on the Mazaruni River. Late in 1917 the work was continued for a short time directly across the river within the park-like boundaries of the Penal Settlement. Early in April of the present year, it was shifted upriver, to the apex of the triangle at Kartabo where a permanent home has been found. The large bungalow which is being used as a laboratory was erected a number of years ago by an American mining company who ceased work after taking out $800,000 worth of nuggets and dust.

The Station is at the very point of juncture of the Mazaruni and Cuyuni Rivers (see map in Zoological Society's Bulletin, July, 1916, p. 1,370) and is of considerable historical interest. Over three hundred years ago, the Dutch settled here, built a little Stadt Haus and raised cassava. They brought bamboo seedlings from Java and planted them, and today there are more than a score of clumps of giant bamboos about the laboratory. Now, as then, the jungle comes up behind to the very edge of the clearing, and so abundant is the wild life that for three months none of us have been more than a mile away from the laboratory.

Within ten minutes walk are sandy and rocky beaches, mangroves, grassland, swamp and high jungle, each with a wealth of life peculiar to itself. The front gallery looks out upon a wide expanse of water—the junction of the two great rivers, one bringing gold-bearing sediment from Venezuela, the other with the flotsam of strange seeds from far distant Brazilian mountain streams. Sometimes terrific wind storms sweep down on us, bending the bamboos and blowing our macaw off his perch, followed by driving rain which floods our compound gutters, and cuts deep channels in sand and white clay banks. Half an hour later the water is like a silvered mirror, broken now and then by dolphins, or fresh-water flying fish, or great pacus and lucanannis, which come up, roll, and descend in the swirl of their own vortices.

A careful enumeration of the sounds alone which we hear from the laboratory during a period of twenty-four hours would indicate the diversity and abundance of animal life at Kartabo. The morning chorus begins at 5:30 sharp, with the loud cries of the kiskadee, and the songs of our nesting wrens, and works up to a climax with such varied noises as the roaring of the red howling monkeys, the yapping of

toucans and the squeaks of hummingbirds. Passing over scores of sounds, there come to mind at high noon the cries of caracara hawks, the splashing of great fish in the warm water, the high notes of white-fronted antbirds on the battle front of army ants, and the hammering of giant woodpeckers. Then toward late afternoon we hear the shrill cries of parrakeets swinging in compact flocks down to roost in our bamboos. With them come the soft night notes of great black caciques.

The 6 o'clock cicada, or "bee," as the natives call it, lifts his rasping wail almost on the hour, and ushers in the evening sounds. When the tinamous have closed their sweet, plaintive trills, the great tree-toads take up the harmony, and send reverberating, rumbling roars far across the water. Then come the night-hawks, the who-are-yous, the great tree-crickets and finally the poor-me-ones from the distant swamp.

There are only three of us in the Station at present, but we have much company. There are seven leaf-nosed bats which hang in a tight little bunch from the rafters, and hawk past our lamps, winnowing the air about our heads for the insects which come to the lights. Then there are tarantulas,—grey and brown,—which come out and catch big moths and beetles, and finally a multitude of geckos, which scurry across the walls and occasionally utter their quaint little shivering cry.

We had an automatic house-cleaning one day, more thorough than sand blast or vacuum cleaner, when the army ants invaded us and sent five columns into the house from different points, the end of each spreading out into a living network whose meshes closed upon every creature, spider, lizard, bat, moth, centipede or scorpion which fell within them. We ate a meal or two sitting on the table while the ants in legions ran about beneath. These soldier ants with their great curved scimitars of mandibles are a very good reason why one does not linger long in the vicinity of an attacking column of these insects.

Here at Kartabo we have begun that work of naturalists, which is endless. Though we spent our whole lives in this one spot, we could do no more than to outline the problems. Here we have begun a collection of mammals,—skins, skeletons, and whenever possible, living ones,—and within walking distance have already gathered over thirty species, ranging from a tiny mouse opossum to a full-grown jaguar which was secured only after it had killed many sheep and cows across the river.

Here we have chosen our various fields of work and endeavor to concentrate on them. But often it taxes all one's resolution to be dissecting a specimen, and looking up to see an Indian with some strange animal, or one of the servants with a new frog or a leaf butterfly, or caterpillar with unheard of markings, or an orchid which has suddenly come into bloom; or to listen to a strange new bird note ringing out from the jungle nearby,—and to disregard all these and keep on trying to get at the wherefore of the one thing in hand. Reading Herbert Spencer in a subway rush-hour car, or discussing an oriental theory of relaxation at a crowded afternoon tea, are quite comparable with the study of a single fact or factor at our jungle laboratory, except that in the first case, the disturbance is from unworthy distractions, in the latter from a multitude of equally alluring subjects.

THE TERMITES OF KARTABO.

By Alfred Emerson, Jr.,
Research Assistant, Tropical Research Station.

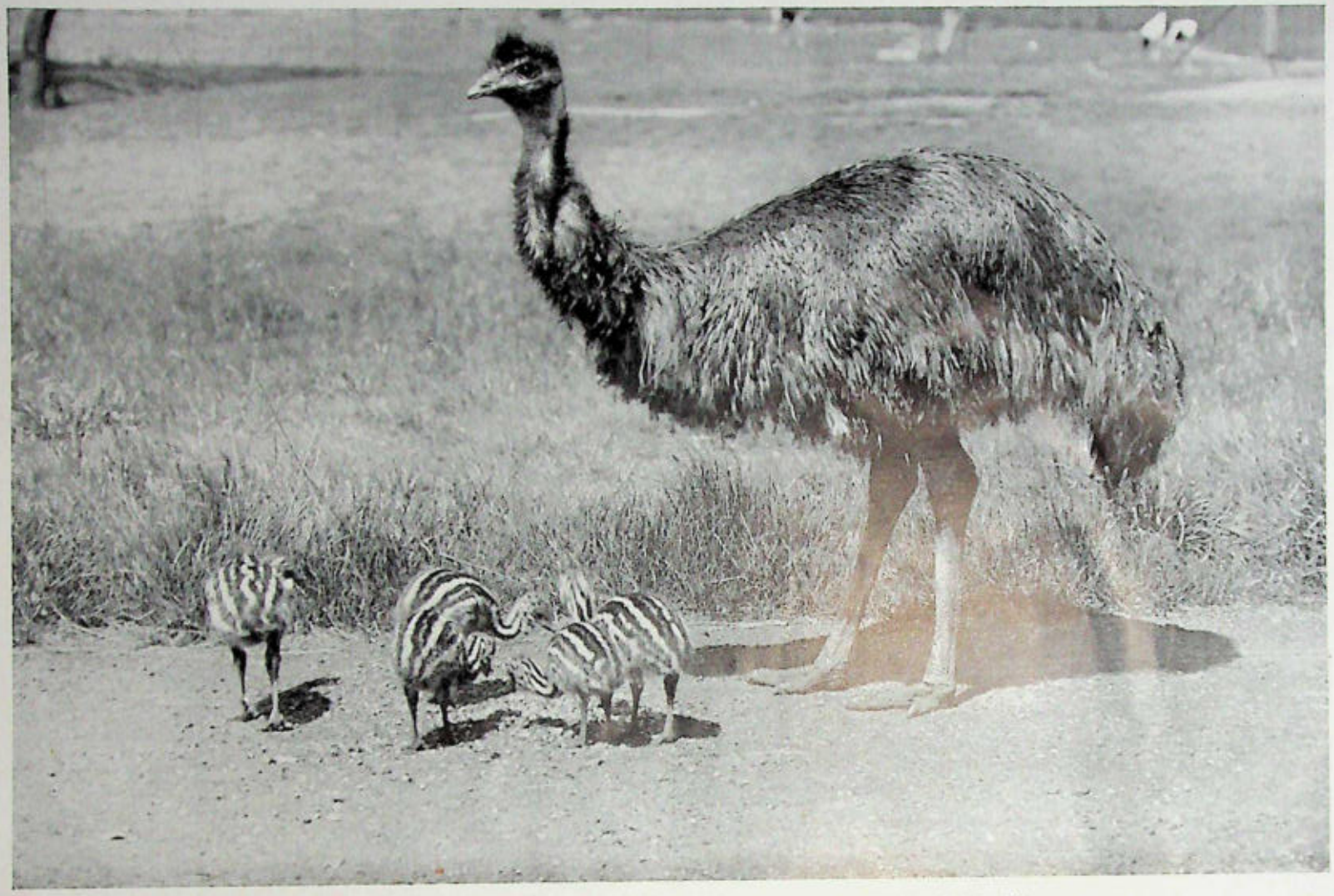
In the tropical jungle of Guiana every stump and every decaying log has one or more colonies of termites, and nearly every stick or fallen branch has been eaten by them until only a shell remains.

These interesting insects show a high specialization in social development, as high, probably, as the bees, wasps and true ants. However, because they exhibit many primitive characteristics of development and form, they are placed near the bottom of the classification of insects, while the other social insects are considered the highest.

They are undoubtedly a group which separated early from the rest of the insect world and the development through the ages has been along exceedingly interesting lines of specialization.

In addition to their great interest from an evolutionary standpoint, they are of high importance economically. Where they are abundant, they do immense damage to houses, books and timbers, often not suspected until the wood collapses or the books are taken from the shelves. The true home of termites is near the equator where the largest number of species are found. They gradually become less numerous as they approach the temperate regions, only a few species reaching as far north as Canada.

Kartabo, in the midst of the tropical jungle, offers an immense field for observation upon these interesting insects. In three months' time,



THE MALE PARENT BIRD AND BROOD OF YOUNG EMUS IN THE ZOOLOGICAL PARK

Our emus are persistent and prolific breeders, and each succeeding season witnesses the expansion of our flock of these interesting birds. They are most satisfactory specimens to rear. The last brood numbers five, all perfect and growing rapidly. Photograph by Elwin R. Sanborn

forty-five species have been found within a mile of the station. In one ten-foot square of average jungle taken haphazardly I have found fifteen colonies of three different species, and in a similar square nearby I have found four different species in five colonies. The presence of these termites would have been unnoticed by the casual observer, no nest being visible.

There are, however, large conspicuous nests upon the sides of trees, often far up among the branches. Large covered passageways lead from the nest to the ground and to the dead branches in the trees. Some of these nests are of considerable size, reaching a height of five feet, with a diameter of three or four feet. These large nests contain from two hundred thousand to five hundred thousand individuals, all of which are nymphs or sterile workers and soldiers, with the exception of one king and one queen which reproduce for the entire colony. A queen which was procured from one of these large nests was about an inch in length with a greatly enlarged abdomen. I kept her eighteen hours, during which time she laid two thousand, nine hundred and thirty-eight eggs. This makes an average of two and three-fourths a minute or about four thousand a day.

Queens over two inches in length have been procured near the station. The royal couple occupied a large cell near the center of the nest. From this cell passageways extended in all directions through which the workers pass as they carry eggs to adjoining cells. In contrast to the thick-walled interior of the nest, the outside is of a flimsy construction with a shell-like covering. The nest was defended by a large number of soldiers with a long pointed conical projection on each of their heads. They eject a strong smelling sticky fluid from these projections. These soldiers lack conspicuous mandibles, but soldiers of other species possess large mandibles of a great variety of form. These exhibit remarkable adaptations. Several species have asymmetrical mandibles which they snap as we snap our fingers. These are not used for biting, but are adapted for snapping, the soldier being able to jump four or five inches by this action. The typical soldier, however, uses its mandibles for biting, some of them being able to draw blood. A few species lack soldiers altogether while others lack the caste of workers.

Termites are used as food by a large number of jungle animals. A small anteater, brought in by our Indian hunter, had eaten one hundred and fifty thousand termites of two species, and lizards, frogs, spiders, ants, wasps, fish, and birds have been observed to feed on both the winged forms during the swarming flight and upon the wingless soldiers, workers and nymphs.

The nests are used for cover and protection by a host of animals. We found one nest with six large lizard eggs in the center almost ready to hatch. Many insects use the nest for shelter, but most interesting of all, are the true guests which live with the termites, feeding upon waste matter, dead termites, and even preying upon the live ones. Several orders of insects are represented as guests, the most common of which are beetles. Some of these insects mimic the termites in a remarkable manner.

Practically nothing, as yet, is known concerning the life histories and associations of these tropical species and many of them are undoubtedly wholly new to science.

MAJOR W. REID BLAIR, D. V. S.

By W. T. Hornaday.

THE most important contribution of the Zoological Park to the war was Major W. R. Blair, D.V.S.

Immediately following America's declaration of a state of war with Germany the greatly valued and highly esteemed veterinary surgeon of the Zoological Park at once offered his services to the War Department. In view of the great number of horses certain to be required by our army in France, and the high cost of placing them there, their conservation became a matter of prime importance. It was said that the average life of a horse in the French army, in the real zone of war, was about five days!

Dr. Blair's extensive experience in the treatment of animal wounds and diseases constituted an asset of pronounced value, and it was a pleasure to observe that this fact commanded immediate recognition and respect.

The following record of Dr. Blair's enlistment and services in the army is copied from the *Journal of the American Veterinary Medical Association* for July, 1919:

"Major Blair was commissioned in the Veterinary Corps on November 28, 1917, ordered to temporary duty in the Surgeon General's Office on December 19, 1917, and on December 22, 1917, was ordered to Camp Lee, Va., for the

ZOOLOGICAL SOCIETY BULLETIN

Departments:

Mammals
W. T. Hornaday.

Aquarium
C. H. Townsend.

Birds
William Beebe.
Lee S. Crandall.

Reptiles
Raymond L. Ditmars.

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Elwin R. Sanborn,
Editor and Official Photographer

Vol. XXII, No. 4. JULY, 1919

purpose of organizing advanced Veterinary Hospital No. 5 for duty overseas. This hospital was composed of 311 enlisted men and seven officers.

"After a period of training at Camp Lee and Camp Hill, Major Blair and his organization sailed from Newport News on May 9, 1918, landing at St. Nazaire, France, the latter part of May, 1918. Immediately after landing, his hospital was assigned to duty at Auxiliary Remount Depot No. 1, Base Section No. 1, at St. Nazaire. Finding no adequate facilities here for quarantine and hospital treatment of the large number of animals suffering from strangles, influenza, pneumonia, etc., a series of barracks occupied by French Colonial Troops were obtained from the French authorities, and after these were vacated the barracks were converted into a model hospital. This hospital was located about three-quarters of a mile from the Remount Station, so that all contagious or infectious diseases were removed from the Remount Depot. After the hospital had been in operation two months, it was visited and inspected by the Commander-in-Chief of the A.E.F., with a number of his staff. The arrangement of the hospital and the work of the organization were highly commended by General Pershing.

"On August 1, 1918, Major Blair with his organization was ordered to the Headquarters of the 3rd Army Corps, with station at Mezy-on-the-Marne, for the purpose of assisting in the evacuation of animals during operations in that vicinity.

"On August 22, Major Blair with Hospital No. 5 was ordered to the Headquarters of the 4th Army Corps located at Toul. Here, he was assigned as Corps Veterinarian of the 4th Army Corps, and the command of Veterinary Hospital No. 5 taken by Major Nelson.

"In his capacity as Corps Veterinarian, Major Blair organized the veterinary service preparatory to the 4th Corps' participation in the St. Mihiel drive during September 12th to 14th. The veterinary service of the evacuation of animals during this drive received the commendation of the Corps Commander, General Dickman.

"On Major Blair's recommendation, a number of concrete dipping vats for the prevention and treatment of mange were established throughout divisional areas so that animals could be treated without evacuating them to the hospitals in the rear. This method of treatment was highly successful and met with the hearty approval of the organization commanders who were universally opposed to the complete evacuation on account of no replacements being available during this period.

"After the Armistice, Major Blair accompanied the Headquarters of the 4th Army Corps when it became a part of the Army of Occupation in Germany, finally locating at Cochem, Germany, where he remained until relieved by Major English and ordered to the United States. Major Blair reached the United States May 22 on the S. S. "Imperator." Upon his arrival in the United States, he was ordered to the office of the Surgeon-General for report and was discharged May 31, 1919.

"Major Blair expressed himself as having enjoyed the Army and as having received the very best kind of co-operation during his service in the A. E. F. Having commanded both veterinary hospitals and the veterinary services of Corps Troops, it enabled him to gain a very wide and valuable experience, and his views on reorganization and the needs of a properly-organized veterinary service have been greatly appreciated."

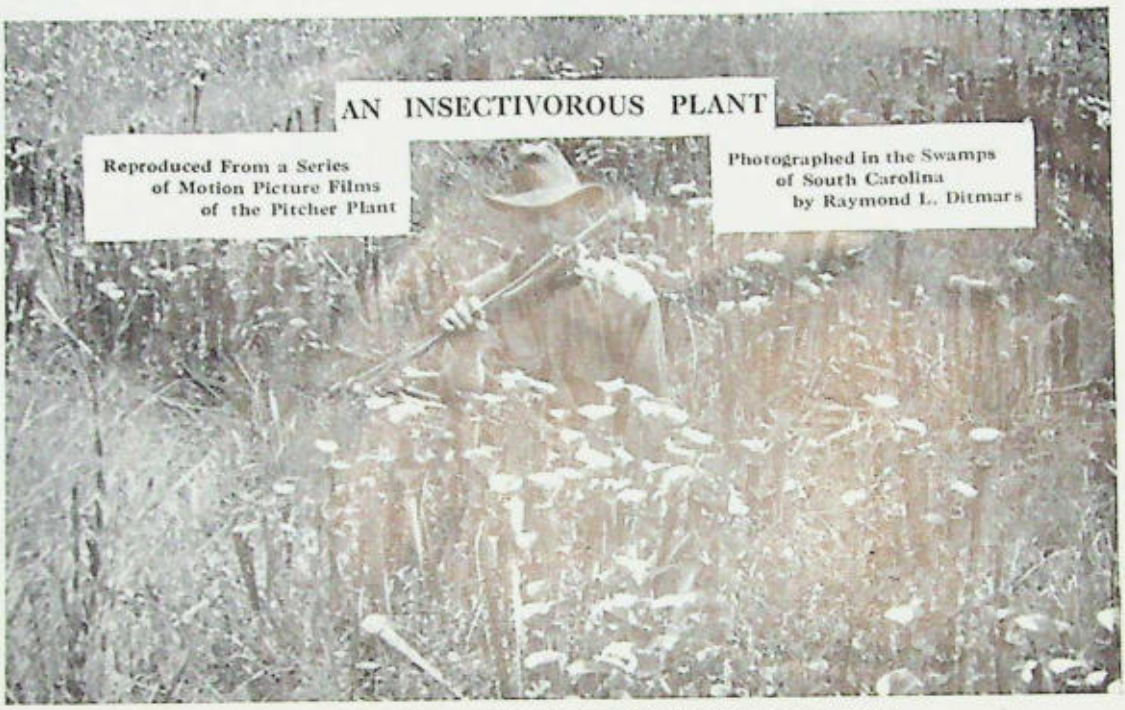
Major Wm. Reid Blair, V.C., was honorably discharged from the Veterinary Corps, May 31, 1919.

Immediately upon being mustered out of the army, Major Blair resumed his position and his duties at the Zoological Park, where officers, men and animals welcomed him with open arms.



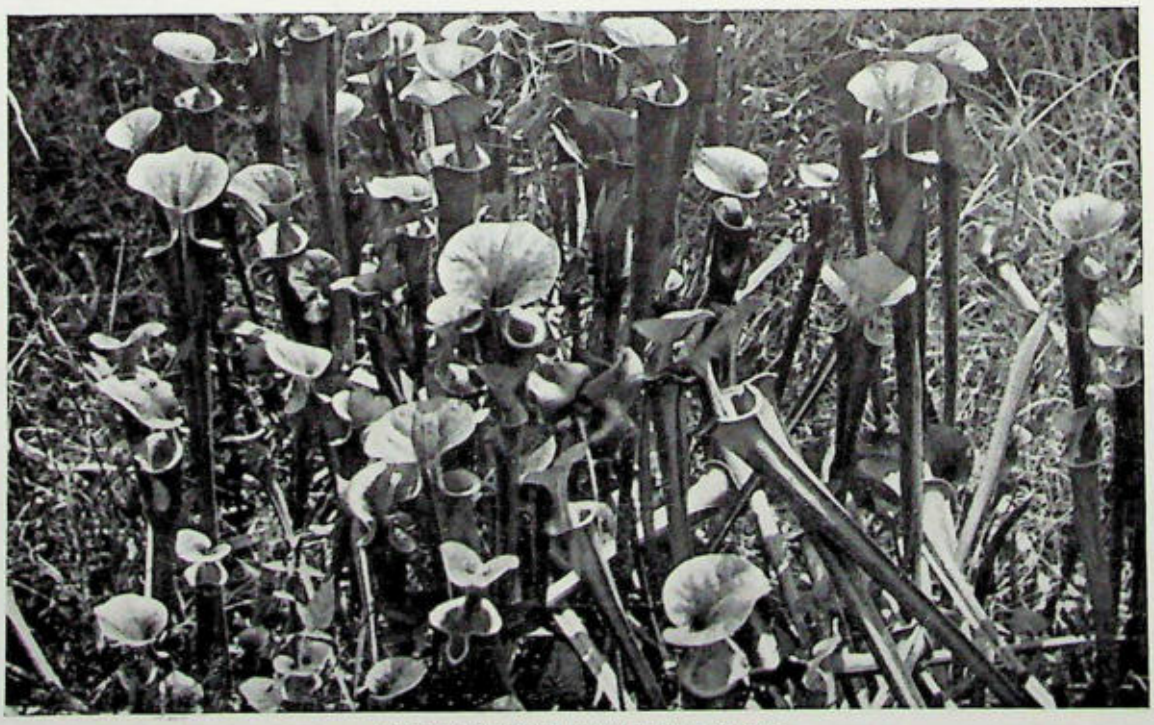
MAJOR W. REID BLAIR, D. V. S.

Late of the Headquarters Staff, Fourth Army Corps, American Expeditionary Force. Toul, St. Mihiel, Cochem-on-the-Rhine
Photograph by Elwin R. Sanborn



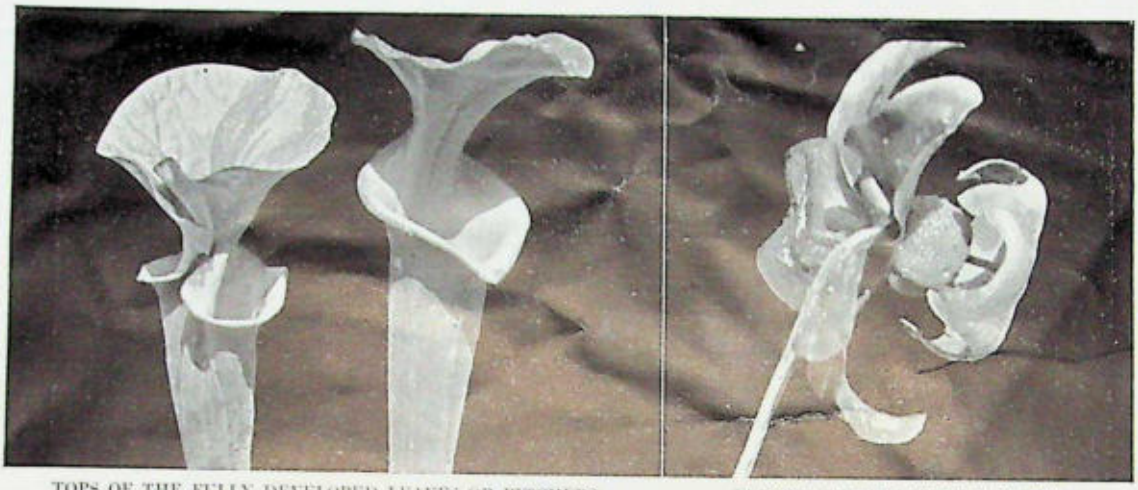
A TYPICAL PATCH OF SOUTHERN PITCHER PLANTS *SARRAVENIA*

In Jasper County, South Carolina, they grow in grassy "prairies," in sandy soil infiltrated with the moisture of nearby swamps and water-holes. Various types of pitcher plants, of widely different and unrelated groups, are found in many parts of the world, but mostly in the tropics



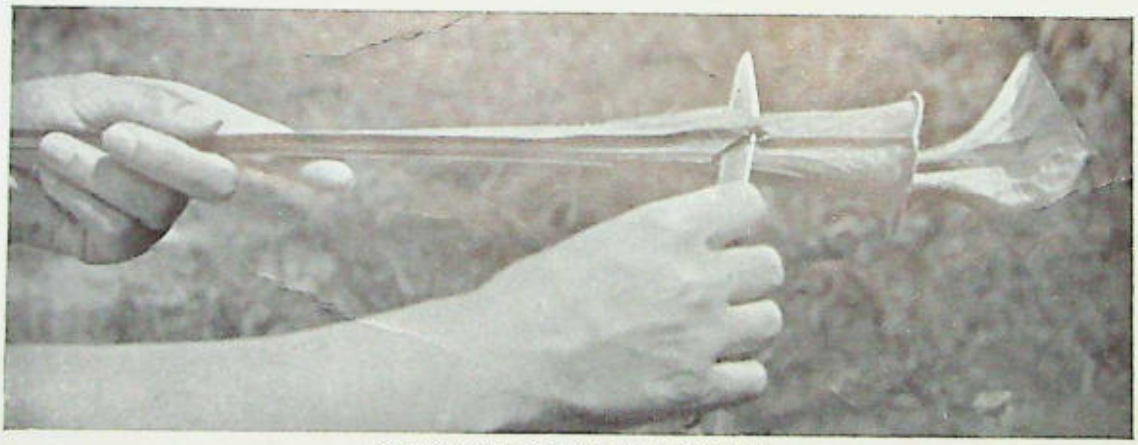
A MORE INTIMATE VIEW OF THE PLANTS

Upon approaching the patch—which is a brilliant, yellowish-green color and very distinct in hue from the surrounding grass—an odor, sweet, distinctly displeasing, and difficult to describe, is immediately discernible



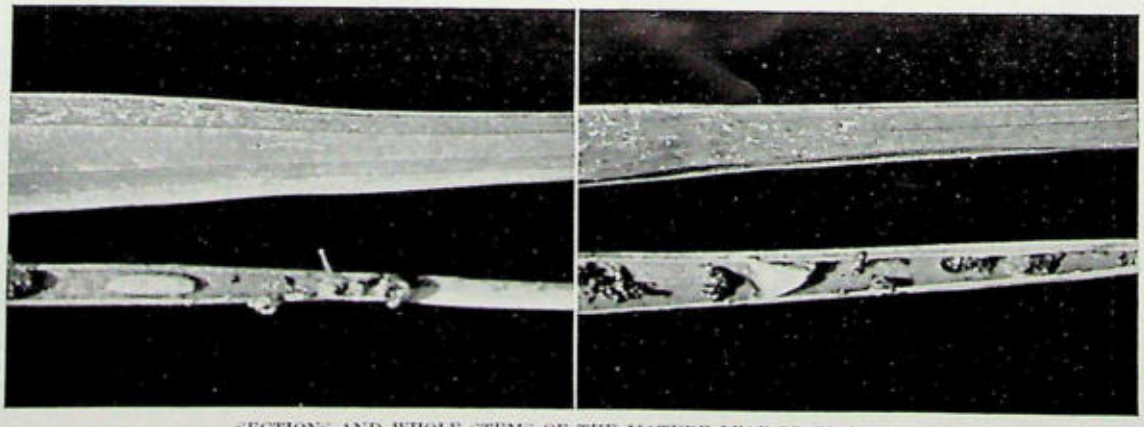
TOPS OF THE FULLY DEVELOPED LEAVES OR PITCHERS. FLOWER OF THE PITCHER PLANT

(Left) They are more like slender vases and the latter effect would be particularly strong were it not for the flaring top. The object of this flare is problematical, but possibly it prevents the pitcher from filling too high during heavy rains. The bottom of the vase always contains several inches of sweet-smelling water, and a mass of the drowned bodies of various insects, that the plant appears to assimilate. Within the vase are down-pointing hairs to prevent the escape of venturesome prey—largely thirsty ants.
(Right) The flower is remarkable in having an arrangement of petals like an umbrella, the object being to protect the pollen from being washed away in heavy rains



SECTIONING THE STEMS OF A PITCHER

The observer divided many of the hollow leaves in this manner to note the variety of captured insect life



SECTIONS AND WHOLE STEMS OF THE MATURE LEAF OR PITCHER

(Right) The section shows the various types of insects that have been lured within and drowned. There are disintegrating masses of ants, a moth may be seen at the middle of the aggregation, and immediately above it is a small species of native bee.
(Left) The most interesting observation was the discovery, in about every third stem, of an insect immune to the conditions within the fateful pitcher, and sufficiently aquatic to freely enter the water. This is a large and active white maggot; apparently the larva of a large fly. It is carnivorous, and shares with the plant the booty of its insect prey



A GOOD MOTHER IN THE TRUE SENSE OF THE WORD

Another Grant Zebra was added to our collections on the morning of May 29, 1919, and its picture is shown herewith. It is a very vigorous little animal as this picture mutely testifies, for the photograph was made but a very short time after its natal hour.—Photograph by Elwin R. Sanborn

HOW BIRDS OF PARADISE ARE CAUGHT.

By An Old Australian Bird-Lover.
From Avicultural Magazine.

RECENTLY, Mr. J. E. Ward arrived from New Guinea with a large and varied collection of this wonderful country's birds, each of them a treasure in itself. To see them makes one long to have them all in one's aviaries. There were not only a large number of birds of paradise, such as the great, the king, the six-wired, the magnificent, the superb, and the long-tailed but also six specimens of the "blue bird" species (*Paradisornis rudolphi*)—the largest number ever brought alive out of New Guinea by any collector. There were also beautiful parrots of all colors, pigmy parrakeets in blue, yellow, black, and white; different species of rails (some looking like sparrows on stilts); gorgeously colored fruit-eating and some seed-eating pigeons not much bigger than starlings. Further, some lovely wrens and other soft-billed birds, New Guinea finches of the nun type, and a new species of chestnut finch. The golden-crested bower birds were worth special mention, and the gems of the collection were the long-tailed kingfishers and wonderfully-colored pittas. Of minor importance, though attractive enough, were the red-eyed glossy starlings, quails, and minahs, and various others I cannot just now remember. Besides birds, Mr. Ward brought a new species of wallaby and a collection of reptiles, which, by their wonderfully vivid colors aroused the admiration of even those who are less friendly inclined towards snakes and lizards. I asked Mr. Ward to tell me how he procures his birds, and he was good enough to do so and give me permission to relate some of his observations and experiences in the "Avic. Mag." This is what he told me:

"Port Moresby is generally the place where the outfit for an expedition into the interior of New Guinea is procured. A collector's license has to be obtained, as well as a special license for the taking of birds of paradise, dead or alive. The fees for both are about £25, and the number of birds of paradise permitted to be taken are stated on the license. As one cannot leave British New Guinea except *via* Port Moresby the conditions of the permit are strictly enforced, and an official counts the birds before they are allowed to leave the country. Around Port Moresby, in fact within days of it, nothing of value in birds could be caught. The collecting grounds as far away, along the Agabung River, the Fly—or St. Joseph's—River, which are reached *via* Yule Island. As one travels inland there are localities met with, as in Australia, devoid of natives and birds, simply because there is nothing to eat for either—it is desolation. To cross these districts with a transport of birds, the food for which has to be gathered on the way, is a very trying matter.

"The king bird of paradise and the great bird of paradise are the first to be met within the sultry river flats, and to obtain them is comparatively easy. Mr. Ward says the catching of the great bird of paradise is quite a religious ceremony with the natives, and although he tried hard during his several visits to be allowed to be present he never succeeded in seeing one caught. The men whose job it is to catch them must not eat meat for days prior, besides conforming to minor regulations. After having absented themselves from the village the women will carry their food (taro and bananas), leaving it on the track unseen by the men. The birds are caught in their dancing-tree with snares, the most favorable method being a double slipknot placed around a limb of the branch of the tree in such a way that when the bird gets his foot into the noose the cord tightens on to it, and releasing itself from the branch, leaves the bird dangling. Another way is to spread a fine meshed net a little below the dancing birds, which, when frightened, will fly downward towards the under scrub and thus become entangled in the net. The six-wired also dances, and like the magnificent, performs on a ledge on the ground. The long-tailed bird of paradise dances on vines which spread from tree to tree, using them in the same way as children would a swing. The natives, knowing the birds' dancing-vine, build a little hut or shelter close by, and when the bird dances and is unconscious of its surroundings they grab it by the tail, the feathers of which are so tightly wedged into the body that they withstand the struggles which follow."

Mr. Ward got his blue birds of paradise 6,000 feet high in very hostile country, and says the natives there are the most superstitious he ever met with in New Guinea. Whilst he was able to make himself understood amongst the tribes lower down in the Motu language, a sort of Esperanto in New Guinea, he found here the greatest difficulties, and even his interpreter left much to be desired. To make the natives understand the kind of bird he wanted he drew and painted the blue bird, noting the exclamations of the natives when they saw it. In this wise he learned the native name for it, being manika. He stayed in this village for several weeks, but neither presents of tobacco, knives, tomahawks,



OUR INTERESTING FAMILY OF BACTRIAN CAMELS

During the campaign of the British forces in the Holy Land, in the late conflict, thousands of Egyptian camels were used as pack animals. An acquaintance in the Royal Engineers writes, "At no time did I ever see a native camel driver sit at a meal *before* he first had given both food and water to his charges." The animals received the most solicitous care

Photograph by Elwin R. Sanborn

nor the much-valued of all, "salt," could induce the natives to catch the much longed-for blue bird for him. Eventually, he decided to make use of their superstition, and coiling a large snake around his neck, walked through the village. He tells me that the effect of this trick upon the natives was most comical. The street emptied itself as if by magic, no native being visible. He then instructed his interpreter to tell them that the snake was his brother, and that he had decided to depart but leave his brother behind, and as he had many cousins he would call them all, and the village would be alive with them because his brother was very angry that they had taken his presents and not caught him any blue birds! He evidently succeeded beyond expectations for a day or two after the first pair of blue birds arrived, being followed within a few days by another *eleven!* Unfortunately, the natives are very cruel in carrying the birds they bring in, tying them tightly by the thick part of the leg to poles with head downward; when resting they are just pitched anywhere, so that a number are half or quite dead on arrival. Mr. Ward considers that the blue birds are not at all rare, but being a kind of sacred bird it is hard to induce the natives to catch them. Other birds, especially those of bright plumage, the feathers of which they use themselves in their dancing costumes, they will readily bring in in any number. In this altitude Mr. Ward also obtained his superbs and long-tails without trouble. As far as he could observe, the king bird is the only one which does not dance or perform in some way. Parrots and pigeons are very plentiful, and form the main item on the menu. The natives catch them with snares and bring as many as required for small remuneration.

One of the most interesting birds is the golden-crested bower bird, which is taken in the net. The bower of this bird by description must be most remarkable. A straight little sapling perhaps two feet high is selected, and in some way the bird kills it and strips it of its leaves. Then he will plant in a circle around this little flagpole, in the shape of a little mound, moss, which in this ever moist and steamy atmosphere grows very quickly. He will then place a dead stick from the outer rim of the mound against the upright, and build a network of little sticks up the upright and the lean-to stick, leaving an opening on the mossy mound through which he plays.

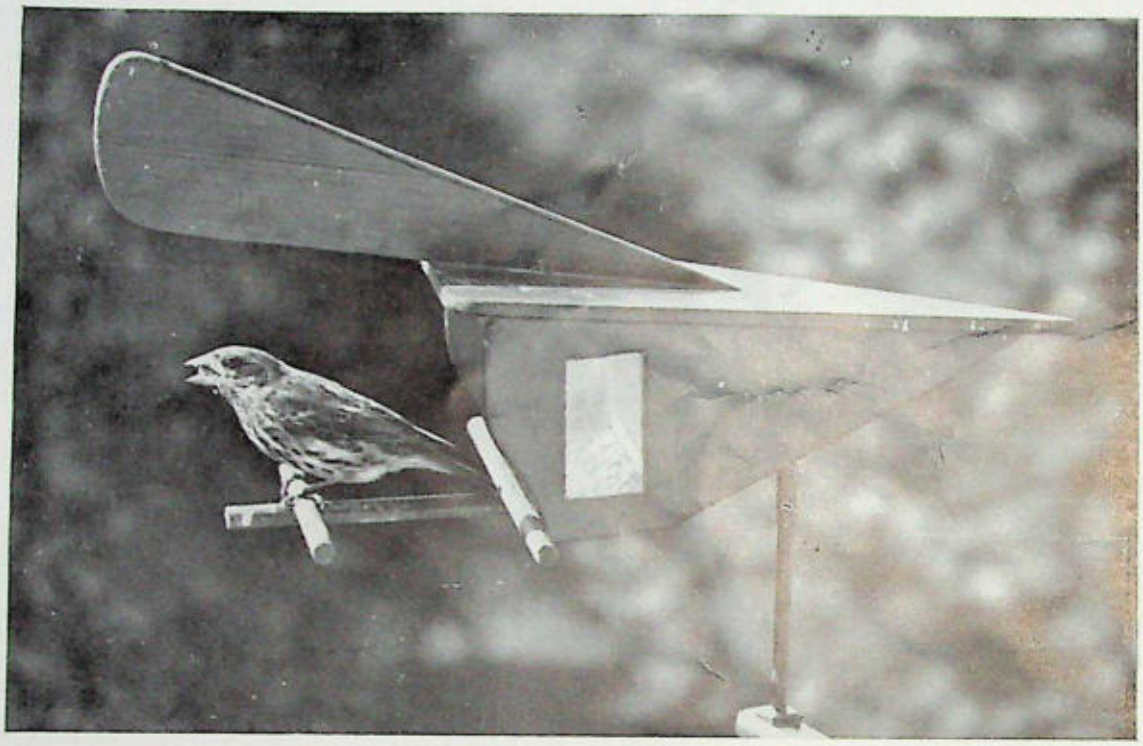
One of the most common birds of New Guinea is a gorgeously plumed, long-tailed kingfisher. Little boys catch them any time they want to, taking the half-curled bark of a banana tree, and fastening a grasshopper into the centre. Two or three inches each side of it they fix a snare with the noose upright inside the bark. Having located the bird, they put their trap on the ground close by, and clapping their hands so as to attract the attention of the bird, they walk backward away. The bird invariably swoops down in a half-circle, and if he is not caught on his way to the grasshopper, he generally finds himself in the noose getting away from it. To catch these birds, which get their food on the wing, is one thing; to keep them is another. Mr. Ward, after losing scores of them for want of live food, conceived the idea of bleaching the flesh of pigeons—the only meat available—and getting the natives to hunt up some white grubs, such as are found in decayed wood. He commenced by tying small pieces of this bleached meat on to the white grubs. Each day the grub became smaller, the piece of meat bigger; eventually there was only the still-moving head and the meat attached. In the end even the head went, and Mr. Ward was repaid for his infinite trouble and perseverance by bringing a number of these lovely birds, living on meat, to Sydney—probably the first seen alive out of New Guinea.

Altogether, the food question for birds during transport must have been very trying; in many districts Mr. Ward could only get green bananas, and the artificial food brought along would go sour an hour after opening the air-tight tins. Also the trouble he had with his carriers, especially in hostile country, needs remembering, and would dishearten anyone less enthusiastic or energetic. On account of their quarrelsomeness, many of his birds had to be transported in separate cages; others would fight through the bars of their cages and destroy or maim each other, and as the native track through this endless jungle is but the width of a man, the cages would bump against any obstacle—little would it trouble the natives if these valuable birds suffered or not. From a height of 6,000 feet up mountains and down paths almost perpendicular, over ridges sharp as razors with a consignment of rare and valuable birds, eventually landing them in wonderful condition—one might say almost ready for showing—is an achievement of which anyone might be proud. It is only the few of us—like the writer of this article—who have traversed an inhospitable country similar to New Guinea, suffering the terrors of the tropical jungles, and that scourge of all tropical countries—malaria—who realize



CHILIAN SEA EAGLE

The collections of the Park have been enriched by the gift of a pair of sea eagles. The birds originally were presented to the crew of the U. S. S. Tacoma by friends in Montevideo, Uruguay, and in turn they were given to the Park. Those birds are valued both for their rarity in collections and because of their exceeding docility. Both submit to handling, even by strangers. The dignity and graceful carriage of the male bird are very well portrayed in this picture
Photograph by Elwin R. Sanford



A PURPLE FINCH AT A KELLER FOOD-STATION

Here is a bird food-station that is both pleasing to the eye and useful as well. A combination of the hopper principle and the weather vane, it holds a generous supply of seeds that constantly runs down the slide to the food shelf; and the fin on the top of the station heads the submarine like prow right up into the wind's eye. On each side, two tiny glass-covered ports admit the light to the food-shelf, which, thanks to the ingenuity of the designer, is always dry and sheltered. The birds soon learn to patronize these graceful little stations, clinging to the outer perch, while in the humming wind the food-vane tosses around like a tiny ship and thrusts its nose into the teeth of the storm. Securely sheltered, the little waifs eat their fill of seeds and then give way to others.
Photograph by E. F. Keller

what it means to collect live birds in the virgin forests. Sick or well, the birds have to be fed and watered, yet how many of us—the lucky possessors of tropical bird treasures—realize what hardship and bodily misery it may have cost the collector to obtain the specimens we now admire in our aviaries?

THE MURDER OF THE BIRDS.

Last of the Sea-Eagles of the Shetlands.

A BRIEF obituary notice appears in the current number of "Bird Notes and News" of the last of the white-tailed or sea-eagles of the Shetlands. This is also believed to be the last of the British race of these noble birds and has only survived to the present day through the protection afforded by the Watchers of the Royal Society for the Protection of Birds (23 Queen Anne's-gate, S. W.). She had outlived her mate for eight years and grown quite white; but for several years after the disappearance of the male bird—probably shot in some unprotected area—she haunted the old nest and watched and waited.

The Society unfortunately was too late to preserve the British ernes, and man's hand had been too long against them. Down to 1836 it was the custom of the "Commissioners of Supply," in an outburst of economic zeal not unparalleled in later days, to give 3s. 6d. for every eagle killed. The collector did his best to help in the destruction, one writer, who visited Shetland in 1837, mentioning that he obtained eight specimens. Since then the resident birds and also wandering individuals have been eagerly shot "for preservation," with the result that the British erne has now to be added to the list of exterminated birds lost forever to this country's fauna.—*London Observer*, April, '19.



ALONE IN THE WORLD
"I want my mother"



HAS AN IDEA
"I'll find her somehow"



FINDS A BROTHER
"I feel a bit cheerful"



FINDS ANOTHER BROTHER
"I believe I could lick something"



THE FAMILY UNITED
"These peanuts are pretty good. The world isn't such a bad place after all"
Photographs by Elwin R. Sanborn

Special Redwoods Number

SAVING THE REDWOODS

An Account of the Movement During 1919 to Preserve the Redwoods of California

By MADISON GRANT

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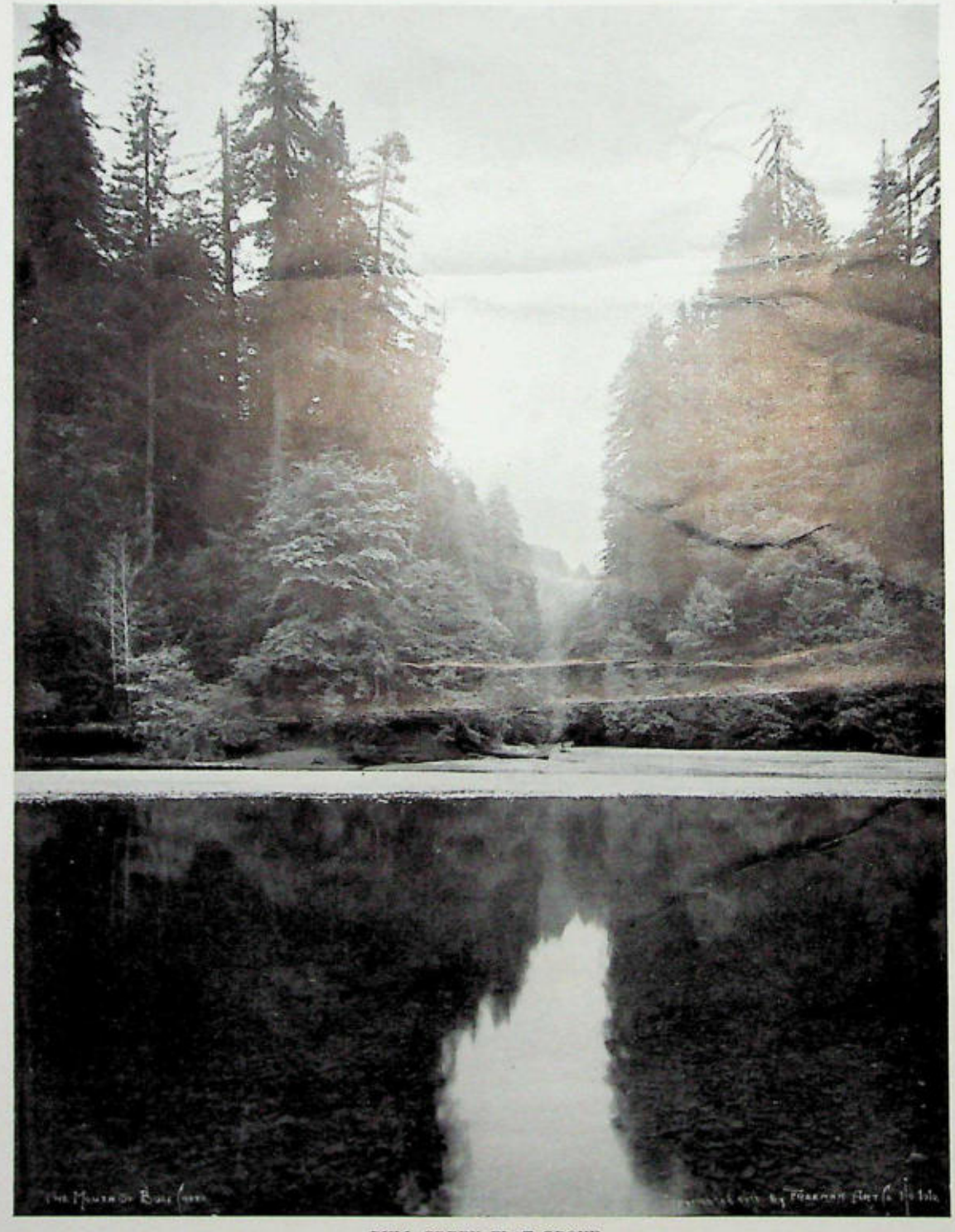
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BULL CREEK FLAT GROVE

Looking west across the South Fork of the Eel River and up Bull Creek, August 1917
Humboldt County, California. (See Page 112)

ZOOLOGICAL SOCIETY BULLETIN

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SAVING THE REDWOODS

By MADISON GRANT

AN ACCOUNT OF THE MOVEMENT DURING 1919 TO PRESERVE THE REDWOODS OF CALIFORNIA

WHILE the cause of conservation of game and forest in the United States has advanced with a rapidity and with a degree of public support that could not have been anticipated by the early conservationists, nevertheless it has been too slow to keep pace with the forces of destruction. Members of the Zoological Society know only too well that the ever-increasing stringency of game protective measures has failed to save many species of our wild life outside of national parks and other sanctuaries, and that in them alone the game will find its final refuge.

The forests are now threatened with annihilation. It is officially stated that *at the present rate* of destruction the *old stand* of forests in the United States will all be cut over within the next sixty years. It will not last sixty years because the new and efficient methods of logging by machinery now generally introduced are not only more rapid, but make a clean sweep of every standing stick, while the old method left behind many of the smaller trees as well as a few giants which were defective and not worth cutting.

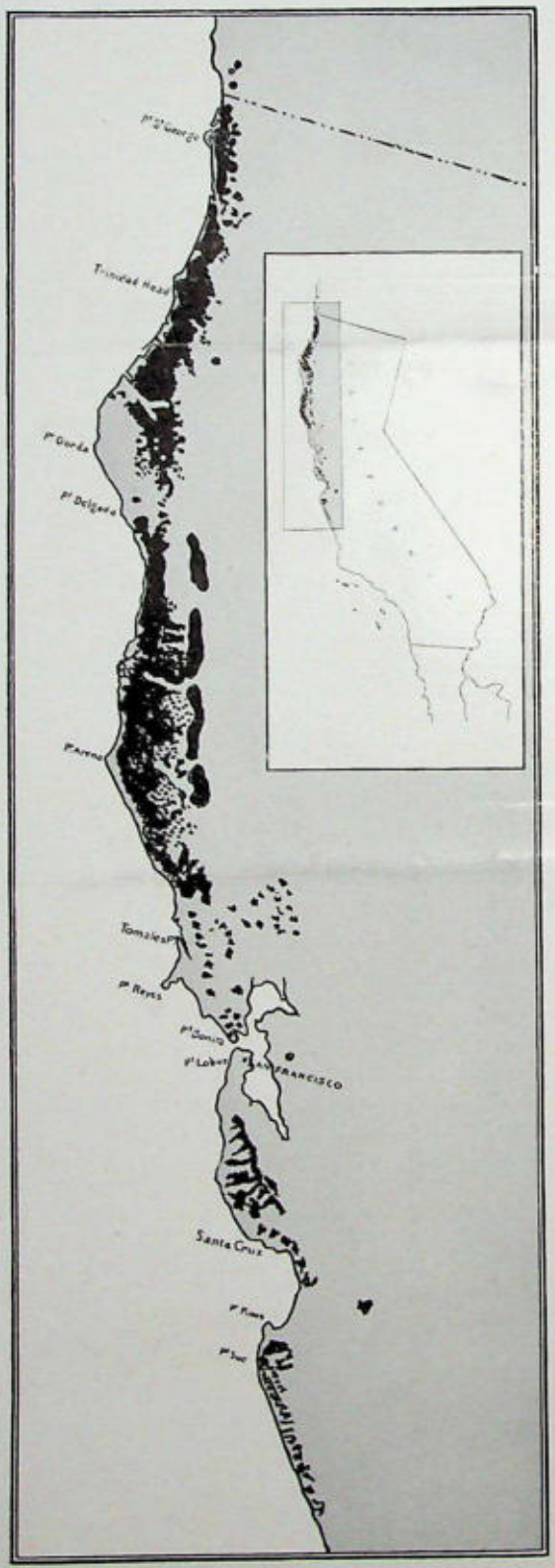
The most serious threat of devastation,—certainly the most dramatic,—is the impending destruction of the giant Redwoods of the California coast, and the following pages are devoted to a description of the efforts being made to save them.

History of the Sequoia.

The genus *Sequoia*, to which the two surviving species of the great trees of California belong, is a member of the *Taxodiaceae* and stands widely separated from other living trees. This genus together with closely related groups once spread over the entire northern hemisphere, and fossil remains of Sequoia and kindred genera have been found in Europe, Spitzbergen, Siberia, Alaska, Canada and Greenland. Changes in climate and other causes have led to their gradual extinction until the sole survivors of the genus are confined to California, one to high altitudes in the Sierra Mountains, and the other to the western slope of the Coast Range. Fossil leaves and cones of genera closely related to Sequoia occur in the rocks of the Jurassic and of the Trias, and the members of the genus *Sequoia* were common and characteristic trees in California throughout the Cretaceous.

To give some idea of what this bald statement means, these trees, virtually in their present form, flourished in California before the mammals developed from their humble, insectivorous ancestors of the Mesozoic and while the dinosaurs were the most advanced form of land animals. The mountains upon which these trees now stand contain fossil records of early Sequoia-like trees, proving that this group abounded before the rocks that constitute the present Sierras and Coast Ranges were laid down in the shallow seas, to be upheaved later and eroded into their present shapes. In the *base* of Mt. Shasta and under its lava flows, the ancient rocks are marked with imprints of their leaves and cones. Such antiquity is to be measured not by hundreds or thousands, but by millions of years.

While the duration of the family, of the genus, and even the existing species, or species so closely allied as to be almost indistinguishable, extends through such an immense portion of the earth's history, the life of the living trees is correspondingly great.



Map showing the original distribution of the Coast Redwoods, Sequoia sempervirens. (See Page 94)

The Sequoia is not only the oldest living thing on earth, but it is the tallest tree on earth, and we have no reason, so far as our paleo-botanical studies have gone, to believe that there ever existed on earth either individual trees or forests that surpassed in size, in girth, in height or in grandeur, the Sequoias of California. And these are the trees that modern commercialism is cutting for grape stakes, for railroad ties and for shingles.

The Big Tree of the Sierras.

While the purpose of this article is to deal with the Redwoods of the coast rather than the Big Trees of the Sierras, both of the genus *Sequoia*, a description of the Redwood should be preceded by a few words on the Big Tree. The Big Trees, *Sequoia gigantea*, are very different from the Redwoods and are found on the western slope of the Sierra Nevadas in California, at an altitude of from five to eight thousand feet above the sea, with a north and south range of about 250 miles. They do not constitute a solid stand, but occur in more or less isolated groves, and mixed in with them are other huge trees, chiefly white fir, incense cedar, sugar and yellow pine.

These groves are stated generally to be about thirty-two in number and are much scattered and isolated in the northern part of their range, while in the south they are larger and closer together. This distribution shows that the Big Tree is on the decline, the various groves having long since lost touch with each other, while in the north the reproduction is very poor. They all grow in spots sheltered by surrounding forests and the slopes of the Sierras are more or less windless, but unless artificially protected in national parks they would soon be destroyed for their valuable lumber.

They have suffered throughout the ages from ground fires. Their enormously thick bark, which is from one-half to two feet through, is a great protection, and the tree lives on, although its heart has been burned out, so long as this bark and its underlying cambium layer can reach the earth. If protected by human care the Big Tree has remarkable recuperative power, and many of the trees in the Giant Forest show an accelerated growth owing to their immunity from fire even for a few decades.

These trees are from five to twenty-five feet in diameter at shoulder height above the ground, and in the Giant Forest alone there are said to be 5,000 trees of over ten feet in diameter.

The height varies from 150 to much over 225 feet, and as they are without taproots they stand absolutely straight, often without branches from the ground to a height of 175 feet.

The crown usually is dead; not blasted by lightning, as has been often stated, but because ancient fires have eaten in at the base so that the flow of sap to the extreme crown has been checked. When connection with the ground and the life-giving water supply has been strongly re-established, growth takes place from the topmost uninjured branches, and forms a new but false crown. It is estimated that if these trees had escaped upsetting by the wind and had been allowed to grow entirely free from fire throughout their age long existence and had carried their proportionate growth (calculated from the tapering of the trunk) to their uttermost limits, these giants would be 600 feet high.

This is mere speculation, as is the theoretical age of some of the more ancient trees. The known age of trees which have been cut is from 1,100 to 3,250 years, but there is little doubt that this long period is much exceeded in such cases as the General Sherman tree or the Grizzly Giant. The life of these monsters can be computed only by comparison with the measured trunks of lumbered trees the actual age of which has been ascertained from the rings of growth. There is always a factor of uncertainty in the size of trees depending on their rate of growth and supply of water. In exposed positions with poor water and soil, development may be greatly retarded and a tree may be very ancient although relatively small in size. On the other hand, a favorable location, such as a pocket in the rock or access to underlying water, might greatly accelerate the growth of a tree within the same grove.

Some close observers claim that the size of the annual ring increases with the dryness and not with the moistness of the season. They argue that there is little or no rainfall in the Sierras during the summer and the ground water comes from melted snow, that growth takes place during the months when the ground is free from snow, and that a wet season means a heavy snowfall which lies around the trees late in the spring and gathers again early in the autumn, thus shortening the number of weeks available for increase of bulk.

If this theory be correct, then the series of gradually thickening rings, culminating and then thinning out again, which is characteristic



The California State Highway in 1917—before cutting



PANORAMIC VIEW OF THE CALI-
Along the South Fork of the Eel River, Humboldt

of nearly all the Big Trees that have been studied, would record *dry seasons* and *not* those of abundant moisture. This theory flatly contradicts the evidence recently deduced from a study of the growth rings of these trees with reference to oscillations of climate throughout the Northern Hemisphere.

Redwoods of the Coast.

The Redwood of the coast, *Sequoia sempervirens*—the immortal Sequoia—well deserves its name. Far from being a battered remnant like its cousin of the Sierras, whose shattered ranks remind one of ponderous Roman ruins, the Redwood is a beautiful, cheerful and very brave tree. Burned and hacked and butchered, it sprouts up again with a vitality truly amazing. It is this marvellous capacity for new growth from trunk or from root saplings, which is perhaps the most interesting character of the Redwood in contrast with the Big Tree, which has no such means of regeneration and must depend on its cones for reproduction.

All the Redwood forests have been more or less injured by fire, often deliberately started by the lumbermen to clear away the slash, and it is a wonderful sight to see a charred trunk throw out a spray of new growth twenty or thirty feet above the ground, or a new tree standing on top of an ancient bole and sending its roots like tentacles down into the ground around the mother stump. Other trees stand athwart the fallen bodies of their parents and continually



A REDWOOD FOREST
Before Cutting



FORNIA STATE HIGHWAY IN 1919
County, before lumbering operations were started



A REDWOOD FOREST
After Cutting

readjust their root system to the decaying trunk beneath it.

The vitality of the second growth throws up a circular ring of new and beautiful Redwoods around the parent stump, and these little trees come up again and again if cut. If, however, they are burned several times in succession, this capacity of shoot reproduction appears to be lost and there are cases, notably about fifteen miles north of Arcata, in Humboldt County, where the highway passes through three or four miles of very large and thickly set burned stumps that show little or no signs of reforestation, proving that there are conditions where human greed and human carelessness make it impossible for even the Redwood to survive.

The age of the Redwood is about half that of the Sierra Big Tree, and the life of a mature Redwood runs from 500 to 1,300 years, in many cases probably rather more.

The diameter of the larger Redwoods is sixteen feet and over, and the height runs from 100 to 340 feet. Thus, while the diameter is less, the height is far greater than its cousin, the Big Tree, with the result and effect of a graceful beauty rather than vast solidity. It is probable that trees will be found which will exceed this maximum altitude, and it is quite possible that an ultimate height of 350 feet may be recorded. One would anticipate the discovery of this *tallest tree on earth* either in Bull Creek Flat or along Redwood Creek.



LUMBERING OPERATION NEARLY COMPLETED

McKee mill on the Highway, South Fork of the Eel River, Humboldt County, 1919. (See Page 107)

Photograph by Freeman Art Co., Eureka, California

Of course, in discussing the present Redwoods, one must always bear in mind that many of the finest groves have fallen to the axe, judging from the silent records of gigantic stumps along the Eel River, especially at Sonoma Flat, only recently destroyed, to say nothing of forests to the north long since cut away. It is probable that the existing groves, with few exceptions such as Bull Creek Flat, do not represent the finest groves of Redwoods of fifty years ago. How needless all this sacrifice of Humboldt Redwoods has been may be measured by the fact that few if any of the lumber companies have proven profitable investments, if their failure to pay dividends is a test of their commercial success.

On rare occasions, notably where a strong wind follows long rainy seasons, Redwoods when exposed on high ridges may be blown down, but there are no such windfalls as are found in the forests of Canada. The danger of wind overthrowing Redwoods, even when in a thin strip along a road, is very slight if there is reasonable protection from the contour of the ground.

The original range of the Redwoods extended from Monterey north along the California coast to a point a few miles over the Oregon line, embracing an area with a length of about 450 miles and a width not exceeding forty miles. The narrowness of this range seems to be determined by the fog which sweeps in from the Pacific, and the writer has seen the edge of the fog-bank clinging closely to the inland limit of the Redwood belt. The natives, with the usual human capacity for error, state that the Redwoods attract fog, but of course it is the moisture of the fog deposited on the tops of the Redwoods that determines their inland distribution. These forests are sometimes so wet that the dripping from the high crowns is like a thin rain, and at Redwood Creek during the past summer it was hard to tell whether it was raining or not, so saturated with moisture were the foliage and the trunks, when the fog darkened the forest.

In the southern and larger half of its range, the Redwood is somewhat broken up in more or less isolated groves, and the axe of the lumberman has now separated these groves still more widely. In the north there is an almost continuous series of solid stands of Redwoods, constituting the most magnificent forests in the world, not even excepting the great Douglas firs and pines that adjoin them in Oregon.

The Redwoods in the south seem to show a marked variation from those of the north, being generally redder in color, and their growth in rings or circles is much more frequent than in the groves of Humboldt and Del Norte Counties. A further study will probably bring out other characteristic differences.

South of San Francisco the Redwoods are now chiefly found in the Big Basin, which has been wisely made into a state park, and in the famous Santa Cruz grove. Intermediate spots along the Coast Range, notably at La Honda, are interesting chiefly as showing the pathetic solicitude with which the owners of surviving trees care for the battered remnants amid the charred stumps of former giants. Here at least the owners have learned that the value of a living tree at a public resort or along a highway far exceeds the value of its lumber. All these southern groves are mere reminders of the forests that are gone, but the surviving trees will be carefully protected.

North of San Francisco, the Muir Woods on the slopes of Mount Tamalpais are easily accessible and show something of the forest grandeur formerly found in the region of the Golden Gate. The preservation of this grove is entirely due to the wise munificence of Mr. William Kent, who presented it to the nation, and put into practical form that devotion to California about which so many of its sons talk eloquently and do so little to perpetuate.

To the north, Sonoma County has purchased for public use the Armstrong Grove, and Mendocino County probably will be impelled to buy the Montgomery Grove. These last trees are situated near the highway to the north of Ukiah, and will be the first grove visited by the northbound tourist. If they are purchased by the town or county, Ukiah will become the entrance to the Redwood Park series, and like Merced at the entrance to the Yosemite Valley will derive a great revenue from motor tourists.

After leaving Mendocino County one enters the great groves of Humboldt and Del Norte Counties. Here are solid stands of Redwoods and their subtle charm is so uniform that the observer finds it difficult to distinguish between one grove and the next.

Four great forests stand out prominently: They are the groves along the south fork of the Eel River and the west bank of the main Eel, culminating in the Bull Creek Flat and the Dyerville Flat; the immense Redwood Creek grove; the Klamath River groves, and the Smith River groves in Del Norte County. Each has its peculiar beauty and it is difficult to choose among them, but it is the trees of Humboldt which at the present moment are most in peril.

See pages 111, 113, 114, 115.

Destruction

The groves along the south fork of the Eel River are traversed by the state highway now



IN THE DEPTHS OF THE REDWOODS IN 1919.
On the edge of a grape-stake cutting along the Highway in South Fork basin (See Page 99)
Photograph by the Freeman Art Co., Eureka, California

in the process of construction. The route of this highway made the timber accessible and the immediate result was the establishment of small lumber camps that are destroying the trees along its edge. Not only are the trees along the road cut down, but the highway itself in many cases has been injured. It is hard to find more disastrous bungling even in road construction.

One logging company, having thoroughly devastated large areas of its home state in the east, has recently purchased great tracts of Redwoods. These have been farmed out in small plots of forty acres each to various individuals, who purchased on what was virtually a stumpage basis, and the cutting was in full swing in July 1919. The writer drove through these same groves two years ago, in August 1917, and the change was sickening. This example of human greed and waste can scarcely be described. The pictures on pages 101-102, 104-105 tell the story better than words.

These great trees with their hundreds of feet of clear timber have among other valuable qualities the unfortunate characteristic of easy cleavage or splitting, and so they are doomed to the ignoble fate of being riven for railroad ties, for shakes or shingles, and perhaps worst of all, for grape stakes. Let no one, whether opposed to Prohibition or not, waste sympathy on the California wine-growers, whose sad lot it was last year the fashion to deplore. Grapes in California command today two or three times the price they ever brought before, and the development of the vineyards is the most immediate and threatening danger to the Redwoods of California. These superb trees are sacrificed to supply the stakes to carry vines, because of the practically indestructible character of their wood, which will stand in the ground almost indefinitely without rotting.

Survey of the Redwoods in 1919

On August 7, 1919, Stephen Tyng Mather, Director of National Parks, and the writer left San Francisco to study the available Redwood stands with reference to the selection of a site for a National Redwood Park, and to observe at first hand the actual destruction in progress.

The first night brought the party to Willits, beyond Ukiah in Mendocino County. Up to this point there were few or no Redwoods except the Montgomery grove, which lies to the west of the highway. From Willits the highway is under construction, and the Redwoods begin to appear along the roadside in small and scattered groups about fifty miles to the north, and while they are insignificant in comparison with the great Humboldt groves, nevertheless these trees are highly important in connection with the highway and should be preserved.

The highway itself has not been built with an intelligent regard for the preservation of natural features, and the usual wasteful and destructive methods common to road contractors are everywhere followed.

In the construction of motor roads here and elsewhere in California, and for that matter in Oregon and Washington, the commissions in charge should employ a landscape engineer; that is, an engineer with some elemental sympathy with nature should supervise the work. The contractors should not be allowed to leave a wide area of devastation adjoining the roadway. Unnecessary vandalism, such as wrapping wire cables around the bases of the trees to support derricks, should be stopped; but, no doubt, all this will come after the trees and the scenery have been largely destroyed.

As to the trees along the highway in Mendocino County, the possibility of their protection depends entirely upon the action of the Highway Commission in securing a right of way which should not be less than an average width of 300 yards.

The Redwoods grove at Hicks Camp is the first important camping site to be passed, and about twelve miles south of Garberville is the Sterns Camp grove, which is about ten acres in extent with a width of about 300 yards, and is a fine stand on a level flat. At this point it becomes evident that any park in connection with the highway must take in the entire erosion valley of the south fork of the Eel from crest to crest. The skyline with its superb trees is nearly as important as the flat bottom and much more important than the intermediate area. The river valley is narrow, in fact, little more than a wide gorge, with a level bottom, and the timber on the slopes has less commercial value than that upon the flat. If the timber along the highway is to be preserved, a relatively small amount of additional cost would save the entire valley. While it may not be necessary to go far beyond the crest, nevertheless as the trees are exposed a substantial amount of timber behind probably will have to be taken to protect them.

There is a fine grove at Red Mountain, and a little beyond the first cutting appears.

At a point six miles south of Garberville the first very large stand occurs. Here we were shocked to learn that the California Highway Commission not only had failed to acquire a



CUTTING AND BURNING REDWOODS IN 1919

Mill of Percy Brown on the Stafford Tract on the main Eel River above the Highway Bridge, Humboldt County
Photograph by the Freeman Art Co., Eureka, California



TYPICAL LUMBER MILL

On the State Highway, South Fork of Eel River, Humboldt County. Photograph by Chas. P. Punchard August 1919. (See Page 107)



GRAPE STAKE CUTTING

On the South Fork of Eel River, Humboldt County. Photograph by Chas. P. Punchard August 1919. (See Page 107)



LUMBERING ALONG THE HIGHWAY IN 1919

On South Fork of Eel River. Note the mammoth Redwood stump on left and piled grape stakes on right. (See Page 107)

Photograph by the Freeman Art Co., Eureka, California

sufficient right of way to protect the timber along the route, but actually had contracted with the owners of the land for the removal of the timber. In other words, the Commission bought a hundred foot strip with the understanding that the owners should cut off the only thing of value, namely, the timber. This incredible folly can only be explained by the widespread belief that a strip of timber along the road will blow down unless covered and protected by the forest behind.

The writer does not intend to enter into a discussion of this question, but it seems to be universally believed in the Redwood country that trees blow down if the adjoining forest is cut off. There is but the slightest basis for this tradition. Trees on ridges which have been exposed by cutting, or an isolated strip of trees standing *across the line* of prevailing winds, may in exceptional cases be blown down, because the Redwoods, like the other great trees of California and Oregon, are without taproots. The writer (who has been through the Redwood belt twice from end to end and has visited practically every grove of importance) never has seen a single instance where trees have been blown down en masse, and he has seen again and again isolated trees and groups of trees in most exposed positions, that have stood for years in defiance of wind and storm. This is particularly significant as many of these trees were imperfect or burned at the core and consequently had but insufficient support.

This myth of trees being blown down has been exploded again and again, but in order to kill definitely this old woman's tale it must be made the subject of an authoritative report by the Bureau of Forestry. The superstition stands precisely in the same class of evidence as does the silly story universally believed by trappers that the porcupine shoots its quills. It is strange that the one place where misinformation about zoology and the habits of animals flourishes most is among backwoodsmen and even guides, just as ignorance of the true principles of heredity is so widespread among the breeders of horses and dogs. In the same way, men in the lumber country are surprised when a skeptic from the outside world ventures to question the sacrosanct doctrine that, if cutting in a forest is once started, all the trees must be lumbered or they will be blown over by the wind. Possibly this belief has been encouraged by the wiser lumbermen for ulterior purposes.

The mere fact that there is little or no evidence of trees blowing over even though in the most exposed positions, and the further fact that numberless trees, isolated or in groups, which have been deprived of all their supporting trees, stand for years without falling, are of little weight against this venerable superstition.

This yarn is encountered throughout the north, perhaps with rather more justification, among the yellow pine forests, but even there the writer has failed to find any evidence for it, although he does not pretend to have covered the ground as in the case of the Redwoods. Among the Redwoods one of the most noticeable features is the absence of fallen trees, such as cover the ground everywhere in Canada and the northern greenwood forests.

Another superstition of the same character is, that Redwood trees and timber are not injured by burning over because of the fact that these trees, like nearly all other very large trees of California, are resistant to fire by reason of their thick bark, and that many of them show scars of ancient conflagrations, even in the damp forests of the north. The result is that there has been a great deal of deliberate burning of brush, both preceding and following lumbering operations. In the ordinary lumbering operations the trees are felled and the masses of fallen material—brush, shattered branches and sometimes trunks—are then burned. This is said to be necessary in order to saw up the giant trunks, several reasons being given, chiefly the difficulty of lumbering among masses of fallen débris. The statement is also made that the workmen object to the alleged danger of cutting unless the rubbish has been burned.

However that may be, the burning results in very substantial destruction of good timber, estimated in some cases as high as thirty per cent. This proportion was said to be established by an experiment made many years ago by the A. B. Hammond Lumber Company, which has been unusually intelligent in the utilization of its holdings. A comparison was made between two tracts of equal area, one burned over in the usual wasteful manner and the other logged without burning, and the result showed that the burning destroyed about thirty per cent. of the timber. Whether or not there is any economy in the method of lumbering with assistance of fire, the public has a right to put a stop to this destruction of good timber because the time is coming when wood will be as valuable in California as it now is in Europe. What action would the state take, and rightly take, if the hotels in New York threw away one-third of the food which was purchased to supply their guests on the theory that it was their prop-



PILES OF GRAPE STAKES
Along the Highway, South Fork of Eel River, Humboldt County, in 1919.
Photograph by the Freeman Art Co., Eureka, California



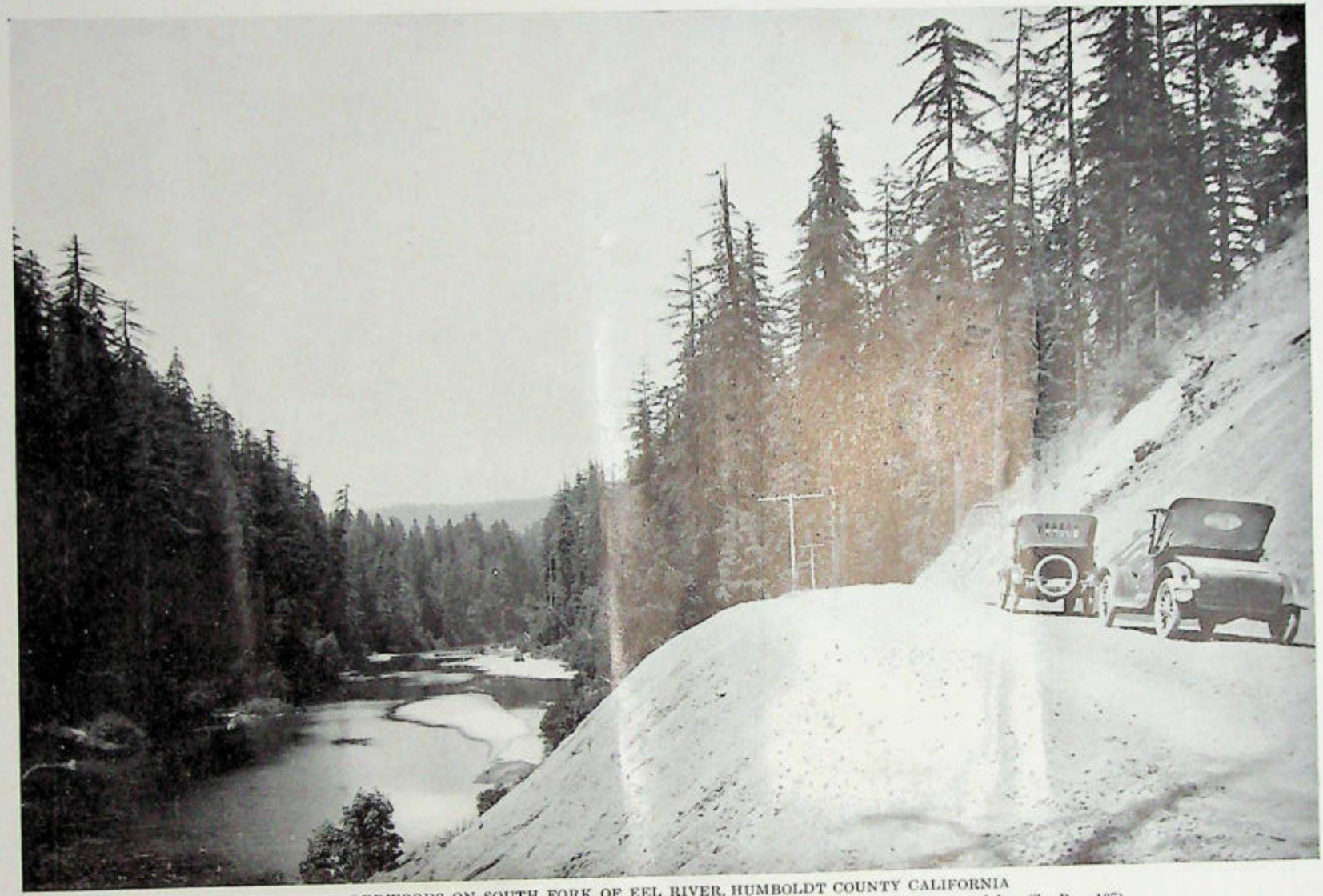
SPLITTING THE REDWOODS

Along the Highway, South Fork of Eel River, Humboldt County. Photograph by Chas. P. Punchard August 1919. (See Page 107)



LUMBERING ALONG THE STATE HIGHWAY

South Fork of Eel River, Humboldt County. Photograph by Chas. P. Punchard August 1919. (See Page 107)



REDWOODS ON SOUTH FORK OF EEL RIVER, HUMBOLDT COUNTY CALIFORNIA
Looking south and up South Fork of Eel River with Bull Creek Flat Grove on right and Dyerville Flat Grove on left. (See Page 107)
Photograph by the Freeman Art Co., Eureka, California

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ELWIN R. SANBORN,
Editor and Official Photographer

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erty? Surely this is one of the most glaring examples of the necessity of the state interfering with the management of private property to prevent its wasteful exploitation. Countless tons of slabs and lumber also are burned to get them "out of the way." Are there no by-products from lumber such as there are in the refining of petroleum or in the conversion of hogs into bacon?

In Garberville, we were received by a group of citizens headed by Judge F. A. Cutler and A. E. Connick, who showed our party over the road as far as Eureka, and pointed out the lumbering operations in full progress along the road, examples of which are shown in the accompanying illustrations on page 105.

The railroad ties were purchased under the authority of the United States Railroad Administration, but in justice to the officials it may be said that they did not realize the vast injury to the state highways when they authorized the use of Redwood timber for ties. The Railroad Administration, through its chief, Mr. R. G. Sproul, and Mr. H. W. Ellicott, Purchasing Agent of the Northwestern Railroad, immediately stopped the buying of ties from areas which would come within the proposed reservation, as soon as the matter was officially brought to their attention by the writer, and they expressed their entire sympathy with the plans for the preservation of these trees.

The cutting has been done in almost every case along the east bank of the south fork of the Eel River and on the very edge of the highway, and while the devastation is appalling, nevertheless the damage if arrested at the present time can ultimately be minimized.

Some distance below Garberville, the highway leaves the river and does not reenter the Redwoods until just above Phillipsville, where there is a fine stand of Redwoods on the left bank. At Phillipsville itself there are five acres of very fine trees on both sides of the road, and again at Fish Creek there is a four-acre tract of Redwoods which has not yet been injured by cutting.

Below Miranda, on Logan's Flat, there is a fine stand on both sides of the road some four or five hundred acres in extent. This is offered for sale, but as yet there has been no cutting.

The first cutting below Garberville appears at Elk Creek, where a few trees have been cut for grape stakes, and more cutting appears a little below. Further down the river there is another stand of about 200 acres of bottom land, with more or less cutting. Further down again on the left bank is a very fine, thick stand of Redwoods, 700 acres in extent. This tract is not in immediate danger because it belongs to the A. B. Hammond Lumber Co., which is not cutting in this section. These trees undoubtedly should be included in any park along the highway. Below this point and near the river and highway, cutting is actively going on and there is serious danger of the entire destruction of the flat.

Near here and on the right side of the highway a stand of timber belongs to the University of Minnesota. It is reasonable to assume that a university—an educational institution—may be interested in the permanent preservation of these trees.

Below this again there are some small mills. Most of the cutting here has been finished, and while the destruction has been very serious further work has been suspended. See page 96.

Further down the river at Pepper Wood the forest has been greatly exposed by cutting, showing again that trees will stand along these river flats even though left entirely without shelter.

In connection with the theory that exposed trees blow down, it should be stated that the Northwestern Pacific Railroad owns a few Redwoods on its right of way between the tracks and the main Eel River, and that some of these trees, being absolutely isolated and in a very exposed position, have been overthrown by the wind.

After these scenes of devastation and threats of worse, we turned into Bull Creek Flat, perhaps the finest forest in the world. Bull Creek flows into the left side of the south fork of the Eel River just above Dyerville, where the south fork joins the main Eel. It is a magnificent stand of trees, some 10,000 acres in extent. See pages 90 and 106.



REDWOODS GROVE, DYERVILLE FLAT, HUMBOLDT COUNTY, CALIFORNIA, IN 1919

Entrance to the proposed Redwoods Park. Used as a camping ground. Now being cut by the Pacific Lumber Company. (See Page 109)

Photograph by the Freeman Art Co., Eureka, California

The total area which must be taken for the Highway Park, from the upper reaches of the South Fork down to the mouth of Bull Creek, contains about 10,000 acres in addition to the Bull Creek grove.

Bull Creek Flat belongs to the Pacific Lumber Company, except two sections in the upper part, which are the property of the Metropolitan Lumber Company. The officials of both these companies expressed their sympathy with the park project so far as it relates to Bull Creek Flat. This tract is said to contain one enormous tree, possibly the largest Redwood and the tallest tree in the world.

Immediately opposite the mouth of Bull Creek is Dyerville Flat, a triangular area between the two forks of the Eel River. At this point is located South Fork railway station, and it will be the natural entrance to the Park. The trees have been cleared away around the station to the extent of 150 or 200 yards and the Pacific Lumber Company has just begun lumbering at this point, in September 1919. If this cutting is continued it will greatly injure the approach to the proposed park. The reason given for commencing lumbering operations here is the shortage of man power, making it desirable to log on a flat and in the immediate vicinity of the railroad in order to keep the mills supplied. This cutting is the one great danger to the proposed park and is a most serious situation as yet unprovided for. See page 108.

Below the junction of the South Fork, the timber on the right bank of the main Eel River has been entirely destroyed and the landscape presents a scene comparable only to the devastated regions of France. Few Redwoods are left, but a magnificent example has been provided to show how the whole country will appear when lumbering operations are extended to the west bank. Reforestation is very slight and many places show no signs of regeneration. The stumps have been charred and burned, and the land lies worthless.

This cut over area on the right bank would be a suitable site for reforestation experiments under the present California Forestry Board. The land could be acquired, and reforested at nominal cost. It is only a question of time when the state, for its own protection, will be forced to undertake this work.

The fundamental tragedy of the whole Redwood situation lies in the fact that these great trees are nearly all in the hands of private owners who cannot reasonably be expected to sacrifice their holdings for public benefit. The state and nation, however foolish they may have been in giving away these lands, must now buy back at least a large portion of them.

On the east bank of the Eel River for many miles below the Forks there are very few Redwoods in sight of the river except at Fortuna, where 2,300 acres of fine Redwoods have been preserved temporarily and are known as the Carson Woods. This grove is a mile or so east of the highway and should be preserved as a local park.

Along the lower stretches of the Eel River below Scotia, the Pacific Lumber Company is said to have checked reforestation by cutting during successive years the sprouting saplings which bravely tried to lift their heads around the old stumps. This was done under the impression that the land could be made available for pasturage. It has proved a failure and the only result has been to destroy in many places the chance of reforestation.

Below the forks on the left bank there is a magnificent stand of trees extending from the water's edge to the crest of the main slope, nearly all of which belongs to the Pacific Lumber Company. This area is some 20,000 acres in extent and the highway runs through it. It should be preserved, although the cost would be great, because of the size of the tract and the fine quality and thickness of the timber. Below this forest, the land on both sides of the river has been almost entirely destroyed, so far as timber is concerned.

At Eureka there was great interest shown on the occasion of our visit. The citizens were organizing actively to put a stop to the destruction of the Redwoods along the highway. Public meetings were held, which developed later into affirmative action to be described later. This enthusiasm was due in great degree to the recent visit of Secretary of Agriculture Houston and Col. Graves, Chief of the United States Bureau of Forestry, who had aroused the people of Humboldt County to the importance of protective measures.

Along the coast from Eureka north about twenty miles, there is little or nothing but cleared country, and beyond Arcata the road runs between some three or four miles of charred stumps which show no signs of reforestation. This condition appears to be entirely due to repeated fires.

At Orick, on the Big Lagoon, we passed the lower end of the Redwood Creek grove, one of the very best stands of Redwood in Humboldt County, approximately 50,000 acres in extent; the lower part largely owned by the A. B. Hammond Lumber Company and the upper part by

the Sage Lumber Company. This stand of Redwoods is largely mixed with spruce and the ground is carpeted with ferns in great abundance and variety.

One of the most conspicuous features of these Redwood forests, especially in Del Norte County and the northern portions of Humboldt, is the profusion of ferns. It is said that some thirty species of ferns are found in these woods.

This Redwood Creek stand is as yet untouched and should be carefully considered for a national park, because the timber being inaccessible can be acquired at a relatively small cost.

The most important groves north of this section are on the Klamath River and also on the Smith River in Del Norte County, known as Mills Creek grove. There are several other groves in this region and the Redwood stand throughout Del Norte County is exceptionally fine. The trees, perhaps, are less healthy but they are larger, more weird and grotesque in their contours, and while less valuable for timber, are even better adapted for preservation in a park. As Del Norte County is somewhat remote it may be immune for a short time from serious inroads by the axe, and there is no doubt that the Smith River Redwoods should be acquired ultimately for a national park.

On our return from the north the writer was called upon, as one of the representatives of the Redwoods League, to return to Eureka and take part in the park movement which had made great progress since our first visit. The citizens of Eureka had brought together at a public meeting all the small holders who were actually operating along the highway. As a result of this remarkable public demonstration, the lumbermen agreed for the sum of $60,000 to suspend cutting and to give two-year options on their property at reasonable figures. Thirty thousand dollars of the money needed were donated by Stephen T. Mather and by William Kent, both Vice-Presidents of the Redwoods League. The remaining $30,000 were supplied from the county funds of Humboldt County. These options were purchased upon the understanding that they would be exercised when due and the lands paid for by special county bond issues. The state of California is expected to furnish a general bond issue for the purchase of the remaining timber lands on the south fork of the Eel, together with the Bull Creek and Dyerville Flats, containing in all some 20,000 or 25,000 acres.

The great stand of Redwoods on the left bank of the main Eel River below the forks was left out of consideration temporarily because of the large sum involved in its purchase, but if the preservation of the South Fork is once secured public interest will inevitably demand the extension of the Park to include these trees. It is perfectly obvious from the aroused public sentiment in Humboldt County and elsewhere in California that the time is at hand when lumber companies will not be allowed to destroy such superb groves for a net return often absurdly small.

The protection of these Redwoods must be secured by Humboldt County and by the State of California, but the Federal Government also must do its share by establishing a large National Redwoods Park. To obtain Congressional action is a matter of many months, but a resolution has been offered in Congress by Representative Lea, calling for an investigation of the whole Redwoods problem with a view to the establishment of such a park. Heretofore national parks have been carved out of the public domain and it will be a new departure for Congress to buy private lands for public use on any such scale as will be necessary here.

The Redwoods League looks confidently to private holders of timber to donate either groves of Redwoods which are within the proposed park area (and several such donations have already been offered), but it also expects to receive gifts of Redwoods which can be exchanged for land within the park area. There are many patriotic Californians who will be only too glad to donate funds for the preservation of the Redwoods when they realize that there is an organization ready to accept, administer these groves and turn them over to the State or Nation when the proper time arrives.

The inhabitants of Del Norte and Humboldt Counties have scarcely awakened to the possibilities of fabulous wealth in their Redwoods as an attraction for visitors. The annual value of the tourist crop to southern California is said to be about $80,000,000, although natural curiosities other than the climate sometimes have to be manufactured. As an amusing example of the business acumen of southern California, one may mention Ramona's "place of marriage" and her "grave," at San Diego, to both of which the tourist is religiously conducted and gravely assured that, if Ramona ever had lived other than in the brain of a sentimental novelist, she would have been married and buried at these mythical shrines.

When Humboldt and Del Norte Counties awaken to a full realization of the revolution effected by automobiles, which will flood the country with tourists as soon as the highways



KLAMATH RIVER REDWOODS

The tree on left is eighteen feet in diameter. Courtesy of Charles Willis Ward

(See Page 97)

are completed, they will find that a Redwood grove, such as Bull Creek Flat, is an attraction that is worth to the county many times the full net value of the timber contained in it. When the last Redwoods are destroyed, towns like Eureka and railroads like the Northwestern Pacific Railway will be without resources, and will die away like many another predecessor in the United States and Canada.

All these are purely commercial considerations. It is scarcely necessary to dwell on the crime involved in the destruction of the oldest and tallest trees on earth. The cutting of a Sequoia for grape stakes or railroad ties (and an eighteen-foot tree was cut this summer for that purpose along the new state highway) is like breaking up one's grandfather's clock for kindling to save the trouble of splitting logs at the woodpile, or lighting one's pipe with a Greek manuscript to save the trouble of reaching for the matches.

After the fall of the Roman Empire the priceless works of classic art were "needed" for lime, and statues by Phidias and Praxiteles were slacked down for this purpose, but the men who did it are today rightly dubbed "vandals and barbarians." What then will the next generation call us if we continue to destroy these priceless trees because lumber is "needed" for grape stakes and railroad ties?

It will cost money to preserve the Redwoods, —many millions; but California has no choice. Either the amount needed to save the groves must be supplied today, or else a far greater sum will be required ten years hence to purchase a butchered and isolated tenth part of the forests. Those are the only alternatives. If the groves are bought in their present condition and at relatively small cost, it will be a great innovation because heretofore Americans have followed the wasteful policy of recklessly exploiting wild life, forests and streams, and then as soon as the destruction is complete, the policy is changed, game is reintroduced and attempts are made to reforest the mountains at vast cost. But Redwoods never can be replaced.

In the negotiations for the purchase of timber lands, the officers of the Redwoods League found sympathetic and cordial support for the park among the lumbermen. They know the value of the timber only too well. The timber is their property, and their business is to cut and to realize on it. It is not fair for a community to ask them to hold this timber, to pay taxes on it and then to sacrifice their financial interests for the public welfare. It is the duty of the county, the state and the nation to purchase their holdings at the proper value. The question involved is not local, it is a state, a national, in fact an international concern, as the benefit derived from the preservation of the Redwoods will be for the people of the nation and the world at large. There is no reason why the lumbermen should abandon their interests without adequate remuneration, although in many cases individuals and companies will donate a certain portion of their timber, or sell at low figures. If the state had been sufficiently intelligent, before building the highways which made the timber accessible, to have approached the lumbermen properly and to have made it a condition precedent that a strip of timber on either side of the road should be donated, no doubt in many cases the lumbermen would have found it greatly to their interest to accept the proposal. The fact that this was not done was the fault of the state, its highway commission and its legislature, and not the fault of the lumbermen.

Experience has shown that the only effective, persistent and intelligent conservators of wild game have been sportsmen who have evolved from game killers into game protectors, and personally the writer believes that the lumber owners themselves, who are among the finest men on the coast, will be found to be most generous and helpful in any scheme looking to the preservation of the timber. The writer says this not out of any desire to placate the lumbermen, but from a genuine belief, based on the character of the men he has interviewed, that this will prove to be the case.

A distinction must be made between the owners who are doing the lumbering themselves, and absentee owners who have no interest in the country, no knowledge of the trees, and who are operating through local agents. These agents have no choice except to obey orders, and the absentee landlords have no interest in the country except to extract an income, and they care not a rap what happens to the land after it has been devastated and plundered.

The Redwoods League

Such were the conditions when the "Save the Redwoods League" was formally organized in San Francisco in July 1919. This League had its origin in a trip made in 1917 by the writer in company with Prof. Henry Fairfield Osborn and Dr. John C. Merriam through the groves of Mendocino, Humboldt and Del Norte Counties. The grandeurs of the Bull Creek Flat Grove and its threatened destruction weighed so heavily upon the members of this party that a letter was addressed to Governor Stephens of



REDWOODS ON KLAMATH RIVER

One of the features of these Redwood forests is the growth of ferns. Courtesy of Charles Willis Ward

(See Page 97)



KLAMATH RIVER REDWOODS

Courtesy of Charles Willis Ward, Esq.

(See Page 97)



CAMPING SITES

Among the Klamath River Redwoods. Courtesy of Charles Willis Ward

(See Page 97)

California, who was about to visit the Redwoods in Humboldt County, asking him to take steps to preserve this stand of giant trees. See page 90.

During 1918 the writer again went to California and endeavored to interest the California Highway Commission in securing a strip of timber along the new highways, but owing to the war and other causes no substantial progress was made until the winter of 1918-19, when Dr. Merriam and the writer finally succeeded in enlisting the support of a group of patriotic Californians in the proposed League, which was then organized as follows:

President
FRANKLIN K. LANE
Secretary and Treasurer
ROBERT G. SPROUL
Executive Committee
JOHN C. MERRIAM, Chairman

Madison Grant	Henry S. Graves
William E. Colby	Stephen Tyng Mather
George M. Cornwall	Ralph P. Merritt
Wigginton E. Creed	Charles F. Stern
William H. Crocker	Walter Mulford
William Kent	Benjamin Ide Wheeler
Henry Fairfield Osborn	Ray Lyman Wilbur
Frank S. Daggett	Charles B. Wing
Joseph D. Grant	Wilbur L. Jepson

This League is at present under the active direction of Dr. John C. Merriam, of the University of California, Berkeley, California, and to him all applications for membership should be addressed.

Subscriptions also of any amount are greatly needed.

The purposes of the League are as follows:

(1) To purchase Redwood groves by private subscriptions and by county bond issues.

(2) To secure a state bond issue to buy the finest Redwood groves along state highways.

(3) To establish through Federal aid a National Redwoods Park.

(4) To obtain through state and county aid the protection of timber along the scenic highways now in course of construction throughout California.

(5) To encourage the state to purchase cut-over Redwood areas for reforestation by natural means, or by replanting where repeated fires have made sprout reproduction impossible.

Committees have been formed to study the subjects of Redwood distribution, variation and the most efficient commercial use of Redwood products, in the belief that nearly all the purposes for which this lumber is now used can be adequately served by second growth trees.

A committee of ladies has been formed and the assistance of automobile and other associations and clubs in California has been enlisted.

The salvation of these great trees probably will depend on two factors just entering into active political life,—one the automobilists and the other the women voters. The California Redwoods League is primarily indebted to two men, Stephen Tyng Mather and William Kent, for the funds to start work. These gentlemen guaranteed $10,000 and thus made possible the preliminary organization and later made other subscriptions as described above.

Conditions in Oregon and Washington

After leaving California Mr. Mather and the writer traversed the entire breadth of central Oregon and Washington, motoring up the east side of the Cascades, down the Columbia highway to Portland, and up the Cowlitz Valley to Mount Ranier in Washington, thence southward through the Willamette Valley in Oregon, over to Klamath Falls and then south through the Pitt River Cañon back to San Francisco, a total of about 2,200 miles.

Preliminary steps were taken for the organization of leagues in Portland and in Seattle, under the direction of the ablest men on the coast. The objects in view were to preserve the timber along the main roads and along the shores of lakes and rivers, and to protect by the establishment of state parks the high peaks and crests of the Cascade Mountains. Both Oregon and Washington are constructing a system of great highways without adequate protection to the scenic features along the route.

Among other purposes in view are the extension of Crater Lake National Park to include the Diamond Lake region, so that the finest game district in Oregon can be protected as a game sanctuary. Crooked River Cañon also is under consideration as a national monument or state park.

Burney Falls in California should be preserved as a state park, but this is a matter outside of the scope of the Redwoods League and must be handled by the state. The sale of the wonderful beach road south of Monterey, known as the Seventeen Mile Drive, and the threatened destruction of its extraordinary cypress forests, unique in the whole world, for a real estate development scheme is another state matter which must demand attention.

The most immediate need in Oregon and Washington is for highway commissions of greater vision than those that are now constructing roads in accordance with obsolete methods. The state highway leading from Tacoma to Mount Ranier recently ran through the welcome shade of giant pines and firs, but



STATE HIGHWAY THROUGH THE REDWOODS. HUMBOLDT COUNTY, CALIFORNIA, IN 1917

Photograph by the Freeman Art Co., Eureka, California

the Washington Highway Commission cut a swath 300 feet wide and then burned the timber against the adjacent forests instead of in the middle of the strip. The result is that one drives for miles through a blasted desert of burned and twisted stumps of what was once a magnificent forest, while the trees on either side have been needlessly scorched and charred with fire, and are frequently girdled by the steel ropes used by the contractors as supports for derricks. All this is recommended [illegible]. The only defense that the writer heard was that the inhabitants of the state had not yet awakened to a realization of the value of trees and that road builders have "always cut a wide strip for a road so that the sun could dry the mud." The fact that modern roads are concrete and do not need drying has not yet come to their attention. The old-fashioned method of burning underbrush to "improve the forests," an inheritance from Indian days and locally known at "Piute forestry," is still in the ascendant.

The great fight, however, of both the Oregon and the Washington Leagues will be to induce the state not to build highways through timbered tracts *unless a strip of timber on either side is first secured as part of the right of way.* Such an arrangement nearly always can be made with the owners of the timber if the reservation of a strip of trees is made a condition precedent to the construction of the road. A notable example is the new highway now under construction from Ashland to Klamath Falls, Oregon, through some thirty miles of sugar and yellow pine and Douglas fir. If the trees are preserved, this will be one of the most beautiful roads in the world; if they are cut, the road will pass through a desert.

On the whole, the results of the summer's work,—the complete organization of the League in California, and the start made in Oregon and Washington,—have undoubtedly inaugurated a movement which will have far-reaching effects. The energy of the earnest and able men now in charge of the California League, and the tremendous popular support behind it, probably will solve the problem of the Redwoods of Humboldt County. The forests of the north may have to await action by the federal government; but if the trees along the south fork of the Eel are saved, public sentiment will be overwhelmingly in favor of their preservation.

The task of the Leagues in Oregon and Washington will be harder. The population is less dense and has far less respect for trees. The magnificent Columbia highway, which is proving to be a profitable investment for Portland, may serve as an example, but even there the promoters failed to secure the land along the right of way and will have to pay out large sums to secure the continuance not only of the forests but of the water supply of the falls along the route. The borders of the highway with its trees could have been secured at the start with but small expenditure. When lumbering operations have completed the destruction of the timber on the mountains above the highway, and Multnomah Falls shall have dwindled away, Oregon probably will awaken to the necessity of preserving such scenic features as then remain intact.

In Washington, the contrast between the cool and wooded road within Mount Ranier National Park, which has been built without injury to the trees, and the devastated horror which the State Highway Commission has constructed outside of the Park boundaries, inevitably will strengthen the hands of the Washington League and perhaps enable it to save the trees along the highway between Tacoma and Seattle, where beautiful forests at the side of the road are now sacrificed for fire wood.

As this goes to press, the welcome news comes from Bend, Oregon, that the Shevlin-Hixon Lumber Company is considering the creation of a memorial to the late Thomas Shevlin by the dedication of the timber in Tumalo Cañon and perhaps along the highway to the purpose.

With the co-operation of Col. Graves and the Bureau of Forestry, other stretches of timber along new roads may thereafter be set aside systematically so that the Forest Reserves as well as the National Parks can be utilized by the public as driveways and camp sites. The increase of motor traffic especially along the proposed system of highways to connect the important national parks in the far west will make these proposals widely popular.

Throughout the Pacific states there are everywhere evidence of the old competition between the growing enlightenment of the people and the forces of destruction. Old frontier conditions have passed—waste of natural resources, scenic or otherwise, sooner or later will be checked and a proper appreciation of the value of an undefiled nature will succeed—but the problem of today is to save for coming generations some substantial portion of our national endowment.

The author desires to make special acknowledgment to Mr. Chas. Punchard, the talented landscape architect of the National Park Service, who accompanied Mr. Mather and himself, for many of the photographs used in this paper.

New York Zoological Society

THE NEW YORK ZOOLOGICAL SOCIETY is a private scientific association [illegible] contract with the City of New York, is vested with the sole control and ma[illegible] the New York Zoological Park, and of the New York Aquarium.

The Society is national in scope and appeals to all Americans wh[illegible] the preservation of our heritage of wild life. The forces at wor[illegible] animals and birds are multiplying rapidly, and the Society b[illegible] necessary to preserve and protect the remnants.

To those who are interested in the study and [illegible] in North America, the Society offers an ec[illegible] devoted to that end. The work contemp[illegible]

1. *Endowment Fund.*—The increase of the present Endowment Fund is the most imperative need. Without a substantial addition, either by donations or bequests, the Society will not be on a satisfactory financial basis, and its work will continue to be hampered for lack of funds. The present Fund is less than $375,000.

2. *Zoological Park.*—Development of the Zoological Park, 264 acres in extent, and the care and increase of its collection of over 4,000 animals.

3. *Aquarium Development.*—Development and administration of the New York Aquarium, and the extension of its marine exhibits of nearly 6,000 specimens.

4. *Aquarium Improvements.*—The alteration of the present Aquarium Building so as to remove the boilers that are daily flooded at high tide, to a site outside the present building. The space then could be devoted to additional exhibits. [illegible] eral more rooms are needed, also, by th[illegible] trative force, and for research wo[illegible] with the scientific utili[illegible] of gross material that is a[illegible] would cost upward [illegible]

5. *Pension Fund.*—The enlargement of the Permanent Pension Fund for employees. The Society's contribution to the present fund is $8,000, of which $4,335 is derived from a fund of $100,000 provided through the generosity of the late Andrew Carnegie. An additional $150,000 is required to provide adequate relief for widows, the permanence of the present pension plan and to relieve the Society of its annual contribution of $3,665.

6. *Tropical Station.*—Maintenance of the Tropical Zoological Station in South America for study and research work in tropical life, the publication of the scientific results obtained, and as a source of supply for the Park and Aquarium collections.

7. *Publication.*—Scientific studies on the care of wild animals and fishes in captivity. This work should be accomplished in 1920.

8. Publication in *Zoologica* of a series of scientific articles of great value on living animals, and in *Zoopathologica* of medical and pathological material on the diseases of wild animals.

9. *Pathology and Anatomy.*—Research and investigation in pathology and anatomy through the Prosector's department.

10. *Photographs.*—Publication in permanent form of photographs taken at the Park of great value to science.

11. *Wild Life Paintings.*—Completion of the gallery of oil paintings to include all American species of large mammals and of such other mammals and birds as are threatened with extermination. These pictures are of great artistic merit and are prepared from accurate studies gathered in the habitat of each animal. Nineteen pictures already have been completed and hung in the Administration Building.

12. *Heads and Horns Museum.*—The erection and equipment of a museum on Baird Court to contain the National Collection of Heads and Horns. This Museum will be open to the public, and will contain the present collection of 870 specimens, which is already of unique value, as many of the species represented are verging on extinction. Under existing conditions abroad, the Society will have the opportunity of securing many record specimens at low prices. The fund has been partly subscribed, but more will be needed to increase the variety and number of the collection.

[illegible]*ological Library.*—Establishment of a zoo-[illegible]ibrary, greatly needed for research work [illegible]t is the intention of the Society [illegible] library at the Zoological Park [illegible]e available, that relates to the [illegible]-wide conservation movement. The [illegible]n this subject is widely scattered, [illegible] best of it should be gathered and made available for those engaged in preserving our heritage of wild life and forests. Adequate funds have not been available for the library, and scientific work, even for the identification of specimens, has suffered accordingly.

14. *Game Protection.*—Establishment of Game Sanctuaries in the National Forest Reserves. This is the most practical plan for permanently protecting American wild life. The success of the Yellowstone National Park as a game sanctuary has been abundantly demonstrated.

15. *Game Protection.*—Maintenance of existing game laws, and the extension of laws prohibiting the sale of game, spring shooting, use of automatic guns, and in the promotion of closed seasons for species threatened with extinction. Appeals for financial help for these causes are constantly received from all over the United States and Canada.

16. *Stream Protection.*—Many of the finest American rivers and streams have been polluted by dye waste, chemicals from pulp mills, sawdust, sewage from towns and villages, and other defiling and poisonous materials. The result has been the destruction of many valuable and interesting fishes, notably salmon and shad, and the transformation of beautiful woodland streams into a menace to public health and a blot on the landscape. The Society intends to attempt to abate these evil conditions and prevent their extension, as soon as funds are available.

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AQUARIUM NUMBER

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COVER DESIGN FOR THE NEW AQUARIUM GUIDE BOOK

This drawing was made by Mr. H. Murayama from twelve photographs of living sea horses in the New York Aquarium. They are shown among the eel-grass in which they are often found

ZOOLOGICAL SOCIETY BULLETIN

Published by the New York Zoological Society

VOL. XXII NOVEMBER, 1919 No. 6

MAKING USE OF THE SHARK

By C. H. TOWNSEND

THE shark has at last found a champion. The tanner informs us that the shark is a most useful fish and is rapidly increasing in value to man. The tanner himself did not know this until recently, but the Ocean Leather Company of New York is now passing five hundred shark skins into its tannery every day and its president says every large tanned shark skin is worth about thirty dollars. We have seen the tannery, the shark skins, the piles of tanned shark leather, and are informed that the leather trade is buying the product for the making of shoes, traveling bags, pocket books, furniture coverings and other purposes.

The tannery, which is devoted exclusively to the manufacture of leather from the skins of sharks and other marine forms, is supplied from four shark fishing stations, with a total catch of over five hundred sharks a day. The supply of sharks at the stations already established is plentiful and there are no signs of diminution. On the contrary, the past year's work indicates that the increase of the catch is only a matter of additional stations and nets. Where the sharks all come from, the fishing gangs don't know, but the nets are full of them every morning.

Additional land has been secured for the enlargement of the tannery with the view to increasing its capacity to two thousand sharks a day.

Many of the sharks being taken at the stations in Florida and North Carolina are of large size, six of those captured exceeding twenty-eight feet in length. The skin of a very large shark yields more leather than that of an ox, and the leather is available for similar uses.

Should the shark catchers get an occasional basking shark, or a whale-shark like the forty-footer pictured in the BULLETIN for November 1913, they would have a hide equal in square feet to those of several oxen.

The leather now being derived from the sea is therefore an important contribution to the supply derived from land animals, and promises to be still greater. We must now learn to regard the rapacious shark as a valuable resource, capable of great commercial exploitation.

The extensive utilization of the shark has another bearing quite aside from the value of the products derived from it. The shark is carnivorous and is enormously destructive to food fishes. With world-wide shark fisheries in operation, there should follow an increasing relief from the damage sharks do to the fishing industries. The extent of their ravages is scarcely imagined by those not directly acquainted with them. In some parts of the world they destroy more fishes than are caught for food, while the destruction of nets and other fishing gear is enormous.

Along our North Atlantic coast sharks find their way into the large pound nets every summer, devouring quantities of fishes and often liberating the entire catch by tearing holes in the nets.

The fishermen have their revenge and also some compensation, for the sharks now captured in New York and New Jersey pound nets are sent to the New York market.

Shark leather is available for many uses, according to species and size. The skins of all sharks are thick and strong. When tanned they are pliable like other leathers. The skins of young sharks make very soft and handsome leather. The leather is finished in varying



A BOAT LOAD OF SHARKS
Taking sharks from the nets, Sanibel Island, Florida



THE CATCH LANDED
Sharks for leather, oil, etc. Sanibel Island, Florida

Courtesy of the Ocean Leather Co.

shades of black and brown, some of it smooth and polished and some showing shrunken grain.

Shark leather resists dampness and makes excellent shoes. While its preparation costs about the same as that of other leathers, it is sold at a lower price, one dollar a square foot, as the supply of skins can be had for the cost of catching. Like Pat's pig, the shark raises himself.

The skins of sharks have often been tested by tanners, but having a hard shagreen surface which was difficult to remove, their utilization did not get far beyond the experimental stage. By a recently discovered process, the hard shagreen is now removed without difficulty. The horny matter of which it is composed is completely dissolved chemically in an hour or two, leaving the surface as smooth as that of other skins.



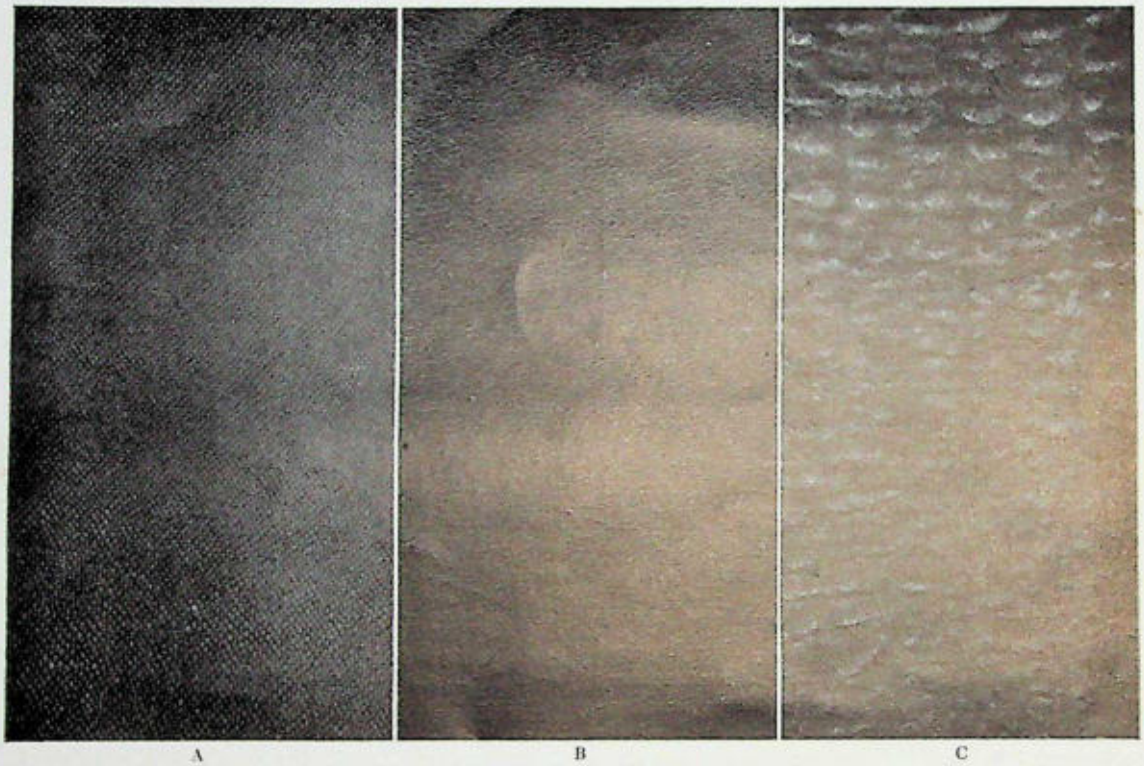
LEATHER FROM SANDBAR SHARK
(Shrunken grain)
Courtesy Ocean Leather Co.

The nets used in the new shark fishery are gill-nets, made especially strong for the purpose. They are from six hundred to eight hundred feet in length, with meshes measuring from eight to fourteen inches, according to the sizes of the sharks to be captured. They are set in the open sea not far from shore, and also in the deep channels of estuaries. Pound nets are also used for taking sharks in Florida waters. It is stated that one of the gill-nets captured two thousand sharks within ten days.

More than a dozen different kinds of sharks appear in the catch and all kinds and sizes are available for leather.

The shark fishing stations now in operation have been equipped for converting the carcases into oil and fertilizer. Shark liver oil is worth about a dollar a gallon unrefined.

We have not as yet made much use of the shark for food, but the food of the shark, like that of other fishes, is fish, and in countries where it is used as food it is known to be palatable and wholesome. A paper read by Mr. Allen Rogers before the American Chemical Society in September 1919 deals with the use of shark meat as a food product and shows that it would be possible



A B C

SAMPLES OF LEATHER MADE FROM SHARK SKINS

Showing plain and shrunken grain leathers
Courtesy Ocean Leather Co

to secure approximately 200,000 pounds of this material daily, or 75,000,000 pounds annually:

"Assuming that the market price could be set at ten cents it shows that at the present time we are wasting a food product with a value of $7,300,000. The edible portion of the shark consists of about fifty per cent. of the weight of the body and resembles in its texture and flavor either the halibut or sword fish. In some markets this product is now being sold under the name of deep sea sword fish and a certain species of shark known as dog fish is being canned and labelled grey fish. Cooking experiments have shown the food to be very palatable and nourishing."*

There was a time when our now valuable sturgeon was regarded as utterly worthless and was thrown on the beaches of the Great Lakes simply to get its troublesome bulk out of the nets. The shark has enjoyed immunity long enough and must be put to use.

We know that in the Carolines and other Equatorial atolls of the Pacific, shark catching means money making. Sharks visit these islands at times in great schools and the natives sell their dried fins by the boat load to trading vessels, for use in China as food.

A score of canoes fishing together will sometimes take a shark too big to be handled. In this case he is turned loose with a large wooden float, to tire himself until he becomes manageable.

Sharks are more abundant among the Pacific islands and in Australian waters than elsewhere and there is little doubt that the time is approaching when they will be utilized for many purposes.

* Science, Oct. 31, 1919.

THE AQUARIUM.

Serene the silver fishes glide,
Stern-lipped, and pale, and wonder-eyed;
As through the aged depths of ocean,
They glide with wan and wavy motion.
They have no pathway where they go,
They flow like water to and fro.
They watch with never winking eyes,
They watch with staring, cold surprise,
The level people in the air,
The people peering, peering there,
Who wander also to and fro,
And know not why or where they go,
Yet have a wonder in their eyes,
Sometimes a pale and cold surprise.

—EASTMAN.



1—PUFFER FISH
Fish distended with water



2—BUR-FISH
Chilomycterus spinosus

PUFFER-FISHES AND SOME INTERESTING USES OF THEIR SKINS

By E. W. Gudger
American Museum of Natural History

THE puffers are fishes inhabiting tropical and warm temperate seas, and sometimes drifting beyond these limits in warm currents. The Gulf Stream, for instance, carries them as far north as Woods Hole, Massachusetts, while along the North Carolina coast they are very abundant; the writer not infrequently taking a dozen at one haul of the seine in the harbor of Beaufort.

The puffers are short-bodied fishes devoid of scales, or rather having these transformed into spines strong or weak, and are especially notable for having the skin over the belly loose and very distensible. The fish by inflating the abdomen with air or water may more than double its volume, and become a veritable balloon; whence the names puffer, globe-fish, balloon-fish. When thus inflated the fish becomes more or less globular in shape with the fins and tail forming mere protrusions. If filled with air, the fishes float at the surface belly up like so many small balloons, for poor swimmers at the best, they are now entirely at the mercy of the wind and tide, having practically no power of locomotion whatever. I have taken scores, almost hundred of puffers at Beaufort in the seine, and in the great majority of cases they came ashore more or less inflated. If filled with air the fisher boys are sometimes cruel enough to jump on them to hear them explode.

The puffers may readily be caused to inflate their abdomens by fear, by driving them against some obstacle like the net, and especially by scratching them on the belly. I have often taken advantage of this latter characteristic to cause them to swell up, in order to display them to visitors in the aquarium of the United States Bureau of Fisheries laboratory at Beaufort, North Carolina. The air or water is taken into the stomach or into a sac lying in the body cavity external to the stomach, the opening into this being in the throat. This opening has a valve-like structure which readily admits air or water but refuses exit unless at the will of the fish. Air or water is swallowed in a gulping fashion, the abdomen becoming more and more tense like a football bladder attached to a pump or being blown up by a strong-lunged boy. When the water is allowed to escape it comes in intermittent spurts at first, later in a stream, and finally declines to a mere trickle.

In this connection reference may be made to an interesting modification of this habit in the common swell-toad of our southern coast, *Chilomycterus spinosus*. Dr. Townsend,[1] Director of the New York Aquarium, has noted that this fish in the exhibition tanks there, will sometimes come to the surface and sticking out its mouth will squirt a small stream of water into the air. This habit, however, was noted for *Diodon* by Arthur Adams so long ago as 1848.[2]

The trick of inflation is a great means of protection to the puffers. An enemy fish would certainly be greatly astonished and even disconcerted to have a puffer in a few moments swell up to twice its size. Moreover, the rotund shape of the distended fish is a protection

[1] Townsend, C. H. Water-throwing Habit of Fishes in the New York Aquarium., Bull. N. Y. Zool. Soc., April, 1909, p. 488.

[2] Adams, Arthur. Notes on the Natural History of the Islands [of the East Indies] in Sir Edward Belcher, Narrative of the Voyage of H. M. S. Samarang in the years, 1843-46, Employed in Surveying the Islands of the Eastern Archipelago. Vol. II, 1848.

against its enemies, since only a fish of extraordinary gape can take one in whole; the ordinary fish in biting at a puffer merely pushes it away or causes it to roll over. Further these fishes, especially the ones called porcupine-fishes, are covered with spines, *Diodon hystrix*, with its long, slender, needle-pointed spines, being the best example. If the puffers with few and weak spines are well protected by their ability to inflate themselves how much more are those like *Diodon*, which when inflated are covered hedgehog-like with an almost impenetrable forest of fine pointed spines.



3—BUR-FISH
Lateral view of fig. 2 fully distended

Some of the puffers grow to be three feet long, but these are the giants of the tribe. The largest ever seen by the writer was about two feet long, and the smallest about the size of a forty-four-caliber bullet, or the size of the end of one's little finger. This was a little *Chilomycterus antillarum*, as its name indicates, a straggler from the far south, taken by the writer in a tide-pool, on a sandbar in the mouth of Beaufort Harbor. It was an interesting little fish, and, as it was kept in an aquarium for some time, it became a pet. It fed greedily on bits of oyster and I used, when it was trying to swallow a fragment of oyster, to take it in my hand and tickle it on the belly whereupon it would partly inflate its abdomen. Then when freed in the aquarium it would set its tiny fins and sculling with its diminutive tail would make its way to the bottom. However, its small specific gravity would not let it remain there, and like a true balloon it would come to the surface only to begin the struggle again, and this would continue until the oyster was swallowed so that the air could be discharged.

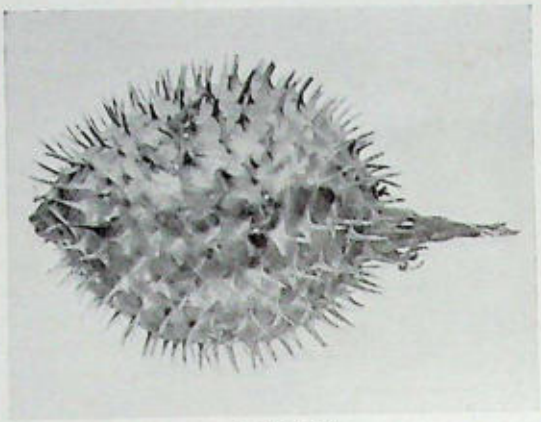


4—DRIED BUR-FISH
Photographed from above by the author

The puffers belong to that suborder of fishes known as Gymnodontes, naked-toothed fishes, so called because the lips are drawn away from the teeth which in turn are solidly fused into beak-like masses. The puffers considered in this paper belong to two of the four families which comprise the *Gymnodontes*. The first family is that of the puffers proper, the Tetraodontidæ, so called because each beak is divided by a suture in the median line into two halves, making four parts to the jaws; *tetra*, four; *dens*, tooth: four-toothed. These fish have an inflatable sac lying outside the peritoneum with an opening in the esophagus. The other family is that of the porcupine or globe-fishes, the Diodontidæ, which have no suture or fissure, and hence are Diodontids (*di*, two; *dens*, tooth) two toothed. These inflate the abdomen by taking air or water into the stomach, its exit being controlled by sphincter muscles in the gullet.

The common puffer, swell-fish, or swell-toad of our Atlantic Coast is the Tetraodont *Spheroides maculatus* whose name describes its appearance quite accurately. It is taken so frequently in the seine at Beaufort that it is not even regarded as a curiosity. Figure one is a side view of this fish showing how it distends itself with water.

Another Tetraodont puffer found on the North Carolina coast, is the so-called rabbit-fish, *Lagocephalus laevigatus*. While not common at Beaufort, the fish is occasionally taken in haul-seines, and in the course of ten summers' work at the Bureau of Fisheries laboratory there the writer has seen some half dozen specimens. The fish justifies its name—*laevigatus*, smoothed; *Lagocephalus*, hare-head—inasmuch as the head and mouth somewhat resemble those of a rabbit, and



5—GLOBE-FISH
Lateral view. Photographed by the author

the skin is smooth and entirely devoid of prickles.

The porcupine-fishes and the bur-fishes belong to the second family referred to above, the Diodontidæ, and are fishes having all the tooth structures in each jaw confluent into a turtle-like beak. In addition to their peculiar tooth structures these fish have the scales converted into spines or prickles. Two genera of this family are found on our Atlantic coast, *Diodon* and *Chilomycterus*, and both are reported from Beaufort, the former from one specimen only and the latter from hundreds.

Chilomycterus spinosus, the spiny toad-fish, is the most common puffer on the North Carolina coast. Caught by dozens in the seine, our aquarium in the Beaufort laboratory was rarely without one or more specimens. However, it was necessary to watch it in one of the large tanks in the New York Aquarium to see a feat next in interest to its habit of inflation. Here one day Dr. Townsend pointed out its habit of getting in the current of the incoming jet of water and turning somersaults. Figure two shows the specimen *au naturel* while figure three is from a photograph of an inflated specimen.

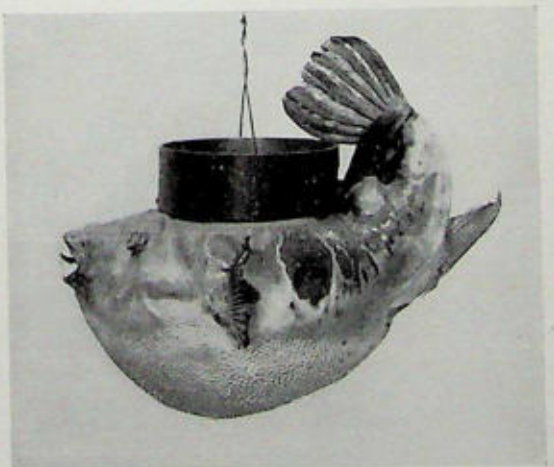
Both these figures [3] are from photographs of a living fish, while figure four is a dorsal view of a dried specimen in the author's possession. The spines on this puffer, as all the figures show, are short and blunt and not very offensive.

The most interesting of all the puffer-fishes is the porcupine or globe fish, *Diodon hystrix* (*hystrix*, the porcupine or hedgehog). This fish is a tropical form, common to all the warm oceans of the world, but on our coast is not normally found north of Florida. As a straggler the Gulf Stream sometimes carries it as far north as Woods Hole, Massachusetts. At Beaufort but one specimen has ever been taken, and that curiously enough was a young specimen only two and five-tenths inches long. The fish is not uncommon in southern Florida, and in the curio shops at Key West there may be seen elegant specimens of the fully distended dried fish, some fifteen inches in length. During several summers spent at the Tortugas laboratory of the Carnegie Institution of Washington, I was constantly on the lookout for the porcupine-fish, but vainly so. However, Prof. W. H. Longley one day had the good fortune to see two fine specimens drift by the eastern dock, but tantalizingly just out of reach of his longest dip net. They were fully inflated and were rapidly carried out to sea by the tidal current setting in that direction. As all the boats were on the other side of the island, half a mile away, pursuit was out of the question. Figure five is a lateral view of a dried specimen in full inflation.[4] This figure shows well the justification of the names, porcupine-fish and globe-fish.

These fish, when put alive into preserving fluids like formalin or alcohol, will sometimes die inflated, and may then be dried. I have found it better to dilate the stomach or extra-peritoneal sac with strong formalin pumped in with a syringe, and then to hang the fish up until it is both dry and cured. Such fish are quite translucent and Dr. Townsend has in the New York Aquarium such a fish, an Hawaiian

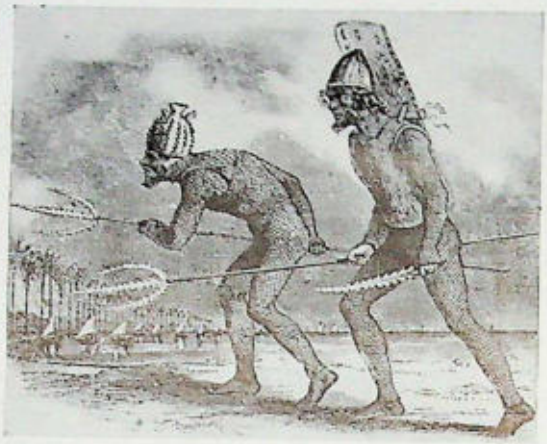
3 These photographs were made in the Fisheries Laboratory at Beaufort by a professional photographer whose name cannot be recalled.

4 This dried specimen was very kindly loaned me for photographic purposes by Mr. E. E. Hanner of Greensboro, N. C.



6—A DRIED PUFFER LANTERN
From the New York Aquarium

species, converted into a lantern, the fish being hung up with a candle or small electric light suspended inside. The subjoined figure (6) is made from a photograph of this puffer-fish lantern and is taken from Dr. Townsend's article on "The Puffer, Its Defense by Inflation," published in the BULLETIN of the New York Zoological Society for March, 1916, page 1331.



7—A DIODON SKIN HELMET
Drummond Islander (Kingsmills). After Wilkes

In this article Dr. Townsend further says:

"It is a common practice with the Japanese to make lanterns of inflated and dried puffers by cutting out the back as shown in the accompanying photograph of a puffer 'lantern' in the New York Aquarium. A candle suspended by a wire serves as a light which shows as brightly through the stretched skin of the fish as through a piece of oiled paper." The puffer from which this lantern is made is eighteen inches long. In the course of a fairly extensive examination of books of travel in the South Seas, a number of instances of a still more remarkable use of the skin of the porcupine fish *Diodon* has come to hand. If this fish makes use of its spine-covered skin for its own protection, why should not man likewise and for the same reason use it? And so the ingenious natives of these interesting regions have done. Commander Charles Wilkes, in Vol. V of his Narrative of the United States Exploring Expedition during the years 1838-1842 published in 1845, has on page forty-eight a figure of a Drummond Islander wearing a *helmet* made of the dried skin of a porcupine fish, *Diodon*. There is, however, no reference to it in the text. The figure is reproduced herein as figure seven. Wilkes also gives a separate drawing of the helmet.



8—A TARI TARI ISLANDER, GILBERT GROUP
Wearing a Diodon skin helmet. After Mayor

A few years later (1847), however, we come across a very definite statement in John Coulter's Adventures on the West Coast of South America and . . . . Including a Narrative of Incidents at the Kingsmill Islands, etc. In Vol. I, page 191, he describes the Drummond Islanders (in the Kingsmills) accoutered for war, the head being "surmounted by an extraordinary looking apology for a helmet, in a conical shape and made of dried fishes' skin, with two or three feathers of various colours stuck in the top for a plume." In the next few pages he twice refers again to this "fish-skin cap."

Likewise George French Angas, in his book Polynesia (London, 1866), says of the Kingsmill warriors that: "On the head is worn a cap formed of the skin of the porcupine fish, bristling with sharp spines."

The next account chanced upon is from the pen of William Wyatt Gill, a missionary in the South Seas whose powers of observation were keen and highly developed as the wealth of natural history notes in his books shows. On page 108 of his Jottings from the Pacific (New York, 1885), he writes that "The Islanders came to see the white strangers and to dispose of helmets of porcupine fish [skin]."

(Continued on page 132)

ZOOLOGICAL SOCIETY BULLETIN

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Elwin R. Sanborn, *Editor*

Vol. XXII, No. 6. November 1919

AN OUTSIDE PUMPING PLANT FOR THE AQUARIUM

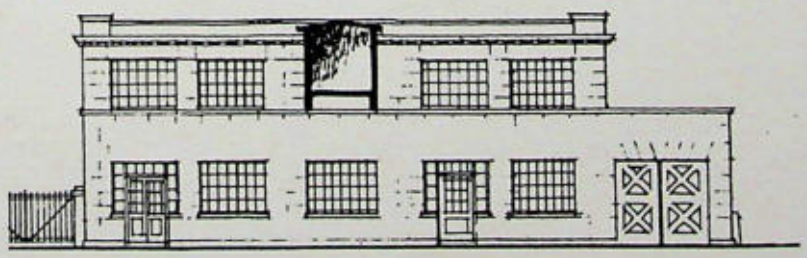
The capacity of the Aquarium building for the display of aquatic collections is by no means fully developed.

The double series of ninety-four tanks encircling the greater part of the interior, is broken on the south side by a section more than fifty-six feet long, devoted entirely to machinery. This is equal to one-fifth of the great circle occupied by exhibition tanks. It is a walled-up section, cutting off light and air, both on main floor and balcony, from a building already too dark and poorly ventilated for the comfort of the public; and it occupies the only space that logically can be used for enlarging the exhibits of the Aquarium. The only expansion of the collections that has hitherto been possible has been secured by enlarging certain tanks on the ground floor, and this work has about reached its limits.

The chief argument in favor of a new position for the pumping and heating plant lies in the defects inherent in its present position. The furnace room is subject to flooding during monthly high tides, and the coal space is limited in capacity and difficult of access, making the expense of operation greater than is necessary. Moreover it is unsanitary and uncomfortable for the men who work there.

It has been suggested that space be made for the mechanical equipment of the Aquarium by excavations below the main floor, but engineers do not advise this for several reasons, chiefly cost and the difficulty of exculding sea water.

The simplest and cheapest solution of the matter unquestionably lies in the removal of all machinery to an outside building. It is proposed that it be built on stone piers erected on the rocky reef just behind the Aquarium, its front resting on the edge of the sea wall. The building as planned would be no higher than the outer wall of the Aquarium, and would be practically out of sight of Battery Park except from the sea wall promenade. A sketch of an inexpensive building that would serve the purpose is presented herewith. C. H. T.



Sketch of low structure proposed for the pumping plant of the Aquarium.

THE AQUARIUM BOAT

Owing to labor troubles, the collecting boat which has been under construction for several months has not yet been launched. It now seems probable that the Aquarium will derive little or no benefit from the use of the boat during the present season. Although work on the hull has been finished, there is considerable work to be done on cabin, engine room and rigging.

This craft has attracted much attention from local fishermen as a boat for transporting fishes alive. She is strongly built, has a large well, cabin space for four men, and good engine and sail power.

The delay in construction has been a great disappointment as the Aquarium is in need of collections from local waters, which are now difficult to secure by the ordinary methods.

The usual autumn shipment of tropical fishes had to be omitted owing to the general wreckage of fishing craft in Florida by the recent destructive storm.

Our efforts to hire small boats so far have been unavailing, and with a shortage in the force it may be necessary to omit the collecting work usually done in the fall as a safeguard against the long winter season when no collecting can be done.

Unfortunately exhibits of public aquariums cannot be purchased, each institution being necessarily its own purveyor. C. H. T.

BOOKS USEFUL TO AQUARISTS

A Partial List

Compiled *by* IDA M. MELLEN

OLDER WORKS

(Most of these are now out of print and can be procured only from the dealer in second-hand books.)

THE SEA-SIDE AND AQUARIUM, by John Harper. Edinburgh, 1849. Small plants and animals common on both sides of the Atlantic. Illustrations.

THE AQUARIUM: An unveiling of the Wonders of the Deep Sea, by Philip Henry Gosse, A. L. S. Van Voorst, London, 1854. Colored plates. This book is devoted to the common invertebrates. Useful at the seashore.

OCEAN AND RIVER GARDENS: The History of the Marine and Fresh-Water Aquaria, with the Best Methods for their Establishment and Preservation, by H. Noel Humphreys. Sampson Low, Son & Co., London, 1857. Colored plates. Describes invertebrates and fishes, sea-weeds, etc.

POPULAR HISTORY OF THE AQUARIUM of Marine and Fresh-Water Animals and Plants, by G. B. Sowerby, F. L. S. Reeve, London, 1857. Devoted principally to marine invertebrates. Describes the water-spider, a common pet in European home aquaria. Colored plates.

THE AQUARIAN NATURALIST: A Manual for the Sea-Side, by Thos. Rymer Jones, F. R. S. With a chapter on aquaria. Van Voorst, London, 1858. Colored plates. Devoted almost entirely to small marine invertebrates.

THE FAMILY AQUARIUM, by Henry D. Butler. Dick & Fitzgerald, New York, 1858. Fresh and salt water plants and animals. Illustrations.

THE FRESH AND SALT WATER AQUARIUM. With colored plates. By Rev. J. G. Wood, M.A., F.L.S. Routledge & Sons, London, 1868. Invertebrates and fishes.

RECENT WORKS

THE AMATEUR AQUARIST: How to Equip and Maintain a Self-sustaining aquarium. Illustrated. By Mark Samuel. Baker & Taylor Co., New York, 1894. Fresh-water plants, paradise fish, sticklebacks and goldfish, frogs, newts and snails.

OCEAN WONDERS: A Companion for the Seaside. With a chapter on marine and fresh-water aquaria. Illustrated. By William E. Damon. Appleton's, New York, 1896. Devoted principally to invertebrates, with chapters on fishes, seals, fresh-water plants and animals, etc.

LIFE IN PONDS AND STREAMS, by W. Furneaux, F. R. G. S. Longmans, Green & Co., New York, 1896. Colored plates and a chapter on aquaria. Devoted principally to invertebrates.

THE AQUARIUM: Its Inhabitants, Structure and Management by J. E. Taylor, Ph.D., New Edition. Grant, Edinburgh, 1901. Plants, fishes and other animals, for both fresh and salt water aquaria. Illustrated.

THE HOME AQUARIUM AND HOW TO CARE FOR IT: A Guide to its Fishes, other Animals, and Plants, with many Illustrations, by Eugene Smith. Duttons, New York, 1902. Plants, fishes and invertebrates for the fresh-water aquarium.

THE GOLDFISH AND ITS SYSTEMATIC CULTURE: A Through Guide for Goldfish Keeping and Goldfish Breeding in the House and Out-of-Doors. The Construction and Care of the Parlor Aquarium and Ponds for Breeding. Illustrated. By Hugo Mulertt, New York, 1902.

THE BOOK OF AQUARIA: Being a Practical Guide to the Construction, Arrangement and Management of Fresh-Water and Marine Aquaria. Illustrated. By Rev. Gregory C. Bateman, A.K.C., and Reginald A. R. Bennett, M.A. Part I., Fresh-Water Aquaria. Part II, Marine Aquaria. Scribners, New York, 1902. A comprehensive work.

THE SEA SHORE, by W. S. Furneaux. Longmans, Green & Co., 1903. Has a chapter on the marine aquarium. Describes plants and small animals. Profusely illustrated, with a few colored plates.

GOLDFISH BREEDS AND OTHER AQUARIUM FISHES: Their Care and Propagation, by Herman T. Wolf. Innes & Sons, Philadelphia, Pa., 1908. Goldfishes and other small fishes, their diseases and enemies. Fresh-water plants and molluscs. Terraria. Illustrated.

THE FRESH-WATER AQUARIUM AND ITS INHABITANTS: A Guide for the Amateur Aquarist. By Otto Eggelling and Frederick Ehrenberg. Henry Holt & Co., New York, 1908. Plants, fishes, reptiles, amphibians, invertebrates, fish maladies, etc. Illustrated.

JAPANESE GOLDFISH: Their Varieties and Cultivation. A Practical Guide to the Japanese Methods of Goldfish Culture, for Amateurs and Professionals. Colored plates. By Hugh M. Smith. W. F. Roberts Co., Washington, D. C., 1909.

THE CARE OF HOME AQUARIA, by R. C. Osburn, Ph.D. New York Zoological Society, 1914. Both fresh and salt water. Illustrated. For sale at the Aquarium, 55c. postpaid.

GOLDFISH VARIETIES AND TROPICAL AQUARIUM FISHES, by William T. Innes. Innes & Sons, Philadelphia, Pa., 1917. Includes pond plants, insect enemies of fishes, aquarium appliances. Profusely illustrated.

PERIODICALS

AQUATIC LIFE. J. E. Bausman, Publisher. 542 E. Girard Ave., Philadelphia, Pa., $1.25 a year.

TERRARIA

THE VIVARIUM: Being a Practical Guide to the Construction, Arrangement and Management of Vivaria.—Containing full Information as to all Reptiles suitable as Pets, how and where to obtain them, and how to keep them in Health. By Rev. Gregory C. Bateman, A.K.C. Gill, London, 1897. Describes reptiles and amphibians, plants for aquaria and terraria, fern-cases, etc. Illustrated.



9—MARSHALL ISLAND NATIVE
Wearing a Diodon skin helmet. After Alexander



10—GILBERT ISLAND WARRIOR
Wearing a Diodon skin helmet. After Hartzer

Chronologically we next come in 1890 to James Edge-Partington and Charles Heape who published at Manchester, England, in two volumes their very interesting Album of the Weapons, Tools, Ornaments, and Articles of Dress of the Natives of the Pacific Islands. In Vol. II, page 170, is a figure of a native of the Kingsmill Group wearing a cap of fish skin. There is no descriptive text and as the figure is not very distinct, it will not be reproduced here.

Our next authority is James M. Alexander, whose book The Islands of the Pacific was published in 1895. To face page 222 is a plate, the lower half of which, shows a Micronesian wearing a dried *Diodon* helmet. Comparison with Wilkes's figure shows that Alexander has copied it without giving any credit whatever. To face page 230 is another plate the lower half of which is labelled "Marshall Island Warrior." This man also wears a *Diodon* helmet. This figure is given as number nine of the present paper.

Our next reference is to a book[5] by Fernand Hartzer, a Catholic missionary in the South Seas. Under date of 1900, he writes that the Gilbert Islanders, go into battle variously armed while "A casque, fashioned out of the dried skin of a large fish with strong spiny scales, surmounts the head as a helmet." On this same page is a pen and ink sketch showing this helmet and to face page 248 is a photograph of a native in full armor. This latter figure is reproduced herein as figure ten.

Few men of the present day have a wider or more accurate acquaintance with the South Seas and with the customs of the people living therein than Dr. Alfred G. Mayor. In an article, Men of the Mid-Pacific, in the Scientific Monthly for January 1916, Dr. Mayor has an illustration showing a warrior of Tari Tari Island, Gilbert Islands, armed with weapons beset on the edges with sharks' teeth, and having on his head a helmet of dried *Diodon* skin. Through Dr. Mayor's kindness, this illustration is reproduced as figure eight.

Study of the localities noted above shows that the use of dried Diodon skins for helmets is con-

5 Hartzer, Fernand. Les Iles Blanches (Archipels Gilbert et Ellice) das Mers du Sud. Paris, 1900.

fined to the inhabitants of the Kingsmill, Gilbert and Marshall groups; in short to that part of Oceanica known as Micronesia, the region of "little lands," as these islands have been named. The reason for this must be an ethnological one, and in that science the explanation must be found.

SAND BARS AND FLATS AT LOW TIDE

By W. I. DeNyse

For the lover of nature, a trip out on the sand bars and flats at low tide in midsummer when they are teeming with life, means many agreeable surprises. He need provide himself only with a dip net and a pair of rubber boots, thoroughly to enjoy the great variety of marine animals asleep or apparently so, and the small, natural aquariums existing in the tidal pools. Walking on the eel grass left flattened by the ebb tide, one discovers here and there a mysterious mound, which on being uncovered, turns out to be a blue crab, its claws held close to the body in a resting position while it dozes in its snug retreat. Instantly on being disturbed, it is wide awake and ready for fight, rising on its legs and snapping the large claws together threateningly. As soon as the intruder disappears, it settles again under the sand, to await the incoming tide. Another mound, disrupted, may prove to be the retreat of a horseshoe crab, largest of American crabs, which, like its neighbor, awaits the incoming tide. Depressions here and there in the grass, containing a few inches of water, harbor very young flounders, pigmy sculpins, toadfish, pipefish, eels and minnows, less patient for the approach of the waves that will carry them to a larger swimming ground.

Approaching the high and dry sand bar, one observes numerous miniature fountains playing into the air from the syphons of clams—hard-shelled, soft-shelled, and razor. Some of the little streams play upward for several feet and seem to multiply as the tide begins to rise.

Perhaps the most attractive of Nature's seaside exhibits are the beautiful aquariums in the tidal pools, perfectly equipped with rich green *Ulva*, deep red *Soleria chordalis*, crimson *Grinella* and other handsome sea plants. Small hermit crabs and the young of the horseshoe, blue, spider, green and lady crabs, scamper over the bottom, minnows are spawning, and here and there a winkle or conch spins out its button-shaped egg-strings and a whelk forms its collar-shaped mound in which to deposit its eggs.

One may be lucky enough to catch a pair of sea horses in the love season, the male changing its colors from brown to near snow-white to attract its mate. A pipefish may be detected stealing eggs from the swimmerets of a defenseless shrimp, while under a bit of *Ulva* a blue crab casts its shell for a bright new one, growing a bit larger during the process. It is fearful of enemies while the new shell is soft, and dares not venture abroad for a day or so, till the shell hardens sufficiently to protect it.

Everywhere the flats and sand bars are literally alive with mud snails, some partly buried and others moving slowly over the bottom in search of food, and performing their valuable services as scavengers of the beaches.

PREHENSILE-TAILED PIPEFISHES

By Ida M. Mellen

IT is the custom in this part of the world to refer to the sea horse as the only fish possessing a prehensile tail. The discovery of a paragraph in Wallace's Natural Selection, relative to pipefishes with prehensile tails, seemed therefore quite worthy of investigation, although it is not clear whether he refers to British or Australian species. Directly after a paragraph on Australian sea horses, he says:

"There are now in the aquarium of the Zoological Society some slender green pipefishes which fasten themselves to any object at the bottom by their prehensile tails, and float about with the current, looking exactly like some cylindrical algae."

Pipefishes and sea horses have been grouped by most ichthyologists under the family Syngnathidae, but at the Aquarium we have found the classification of Theodore Gill far more convenient: sea horses—Hippocampidae, pipefishes—Syngnathidae.

It seemed certain to us and to American and British authorities to whom we referred the matter, that Wallace had made an error of observation. Everywhere we met with the assurance that "sea horses are the only Syngnathidae with a prehensile tail."

Pursuing Wallace's prehensile-tailed green pipefish through the literature on pipefishes, we discovered several suspiciously similar observa-



SNAKE PIPEFISH WITH CURLED TAIL
From Couch's History of the Fishes of the British Islands

tions, almost invariably accompanied, however, by the statement that pipefishes do not have prehensile tails.

Francis Day, in The Fishes of Great Britain and Ireland, states that the tails of pipefishes are not prehensile, yet he quotes Couch as saying that the ocean pipefish (*Nerophis aequoreus*), also called snake pipefish, shorter pipefish and painted sea adder, sometimes rise to the surface in the summer months and bask in the sun, retaining their position "by clasping with their tail cords, buoys of crab-pots, seaweeds, sticks or floating substances." He quotes Ogilby, who recorded the capture of pipefishes of this species at Portrush, where they were taken in open network lobster pots, to which they "were invariably found clinging with the ends of their tails curled once or twice round the network." He also quotes Andrews, who says that these pipefishes, when the sea is calm, "may be seen side by side, clinging with their tails to the tufts of *Zostera marina*" (sea grass). In this position the male is better able to place the eggs in his brood pouch.

The breeding habits of pipefishes are somewhat similar to those of sea horses, the male of most species carrying the eggs; but in some of the pipefishes the egg pouch is a mere groove, formed of cutaneous folds situated on the tail, instead of being a stout sac at the base of the abdomen, as in the sea horse. In these cutaneous folds of the male snake pipefish, the skin is raised like a minute cup around each of the eggs, thus holding them firmly in place, and it is said they are very difficult to dislodge.



BERMUDA PIPEFISH
From Barbour's Notes on Bermudian Fishes

Jonathan Couch, in a History of the Fishes of the British Islands, figures a snake pipefish (*Syngnathus ophidion*) with a curled tail, and says it has a "slender and prehensile tail" with which it lays hold of loose and floating objects.

Colors of pipefishes vary—yellow, brown, red, black and green predominating, with mixtures of these colors, and some are capable of a change of color to match their environment. They are preyed upon by large fishes, the pollack being a particularly insatiable enemy, and protective form and color are consequently of great benefit in preserving the species.

Finally to settle the question of prehensility in pipefishes' tails, we corresponded with some Australian authorities. Through the courtesy of Mr. R. Etheridge, Director of the Australian Museum at Sydney (to whom our inquiry on the subject, in which we quoted Wallace, was forwarded by Prof. Sir Baldwin Spencer, director of the National Museum at Melbourne), we are in receipt of a photograph taken by Mr. A. R. McCulloch, zoologist, of the Australian Museum, the leading authority on Australian fishes. This picture, here reproduced, shows some common Australian pipefishes (*Stigmatopora argus*) clinging to their favorite sea grass (*Zostera*).

The close study of the picture that is required to determine which of the slender bodies represents a pipefish and which a blade of sea grass, gives one a fuller understanding of the protection this little fish finds in its curious resemblance, both in form and color, to the green sea growth that it inhabits. Mr. Etheridge, moreover, imparts the following interesting information:



AUSTRALIAN PIPEFISHES

Thirteen pipefishes (Stigmatopora argus) may be seen clinging to the green seaweed which they resemble
Photograph by A. R. McCulloch*

"A common species in S. E. Australia, *Stigmatopora argus*, has just the habits you describe. This is very plentiful in the *Zostera* weed on sandy flats in Port Jackson, and when swaying in the current with narrow leaves, can scarcely be detected; its tail is prehensile as described. The attached print represents this species among the *Zostera* leaves."

Later we discovered in Dr. Thomas Barbour's Notes on Bermudian Fishes, a picture of a new species of pipefish, *Stiphostoma dendriticum*, taken from a single specimen captured off Ireland Island, Bermudas, in 1904. The curled tail suggested the possibility of prehensility and we therefore wrote Dr. Barbour on the subject. He says "There is no question as to its having a prehensile tail." Although Dr. Barbour originally classified the fish as *Siphostoma*, he thinks now that it may properly be said to belong to a new genus of pipefishes.

There is no longer any doubt that the sea horse is not entitled to the distinction of being called the only fish with a prehensile tail, since several kinds of pipefishes, in different parts of the world, are similarly endowed.

*Mr. McCulloch is the foremost authority on fishes of Australia.

THE MIAMI AQUARIUM

By C. H. Townsend

A NEW public aquarium is now under construction at Miami, Florida, and Mr. L. L. Mowbray of the staff of the New York Aquarium has been called to take charge of it. The location is on Miami Beach, about a mile from the city, across Biscayne Bay. The building will be 220 feet in length by seventy in width and will contain fifty large exhibition tanks. There will be three large outdoor pools for sea turtles, manatees and other forms too large for indoor tanks.

This aquarium will be devoted to marine collections only, and will have a reservoir holding 75,000 gallons of sea water. It is being erected by the Miami Aquarium Association. The management informs us that space will be provided for a marine laboratory with about ten tables available for biological students and investigators.

The plans for the Miami Aquarium, like those prepared for the aquariums at Detroit and Boston, were brought to the New York Aquarium for further study and suggestions. During the past two years many of the glass-fronted exhibition tanks in the New York Aquarium have been vastly improved by being enlarged to three or four times their original size. More than half of the tanks of the Miami Aquarium will have a depth backward from the glass fronts of eight feet, a decided improvement over those built in the Detroit and Boston aquariums.

Although the city of Miami is not large, the situation of the Aquarium on Biscayne Bay gives promise of admirable exhibits of marine life, secured in great abundance and variety from local waters. Much of the expense of aquarium operation can be avoided in a latitude where the water requires no heating in winter, and where the exhibits can be had without expensive transportation for long distances.

Mr. Mowbray, who has left to take up his new work at Miami, has been connected with the New York Aquarium since 1914. He is well equipped for the task, having previously had charge of the aquariums at Bermuda and Boston. Mr. Conway, now in charge of the Detroit Aquarium, was formerly attached to the staff of the New York Aquarium. Inquiries have been received from San Francisco relative to a former member of our staff who may be wanted for the aquarium soon to be constructed under the management of the California Academy of Sciences.

While we cannot but regret the loss of competent men, there is some gratification in the

fact that they are considered experts and secure responsible positions with other aquariums.

A reconciling thought in connection with the loss of one of our men to the Miami institution is the promise of coöperation in the procuring of tropical collections for the New York Aquarium.

THE GIANT CRAYFISH

The Fresh-Water Lobster of Tasmania

By C. H. Townsend

THE fresh-water crayfish or lobster (*Astacopsis franklinii*), inhabiting the streams of northern Tasmania, is the largest of all crayfishes, reaching a length of nearly two feet and a weight of eight or nine pounds. It inhabits small streams rather than rivers and is even found in brooks that one could leap across. Geoffrey Smith in The Naturalist in Tasmania says he obtained large specimens in a small rivulet. "It seemed extraordinary to fish these huge monsters out of little pools in which one would expect to find nothing larger than a minnow."

This crayfish is excellent for food, being of finer quality than the marine crayfish (*Panulirus*) of Australian seas, but is little used as few people are acquainted with it other than bushmen and prospectors. It is taken in lobster pots baited with raw meat. The claws of large specimens are formidable weapons about the size of a man's hand.

An allied species (*A. serratus*) found in southern Australia and nearly as large, is sold in the markets of Melbourne and Sydney as Murray River lobster.

As several species of trouts from Europe and North America have been successfully acclimatized in Tasmania, Australia and New Zealand, it may be that the antipodes can contribute something of value to the fresh waters of our own latitude. Northern Tasmania, in about forty-one degrees south, occupies a position comparable in latitude with our northern states, and the climatic conditions are not greatly different.

These large crayfishes might be carried across the tropics with no more difficulty than attends the transportation of trout and salmon. Crayfishes stand transportation well. The Aquarium has living specimens of Columbia River crayfishes which were sent by mail from San Francisco to New York, with no more moisture than that retained in several wrappings of damp paper and moss. The package was just one week in transit.



THE GIANT CRAYFISH OR FRESH-WATER LOBSTER OF TASMANIA

A Crayfish of the British Isles shown at the left

Perhaps the Bureau of Fisheries can arrange with the fishery authorities of Tasmania for a supply of fresh-water lobsters for acclimatization in the north?

KING ALBERT VISITS THE AQUARIUM

THE King of the Belgians, accompanied by the Crown Prince and several Belgian and City officials, appeared unannounced at the Aquarium on October 4. Fortunately the arrival of the party at the door was noticed in time for suitable greetings

The King apparently loses little time while sight seeing, leading the way at his own pace and taking in the situation visually, rather than by lingering with a party that might detain him. It did not take us three minutes to discover that sight *seeing* on his own account was his idea and others might do the following.

This does not mean that the King was not interested during the half hour he remained at the Aquarium. He halted at the large plaster model of the proposed new Aquarium and re-

marked on its great size, as well as on the size of the burly 200-pound Florida groupers in the adjoining floor pool. He asked few questions, however, until he reached the pool containing some huge sea turtles, where he showed a very active interest, making inquiry as to where they came from, whether they inhabited the Atlantic Ocean and whether they ever came ashore. He expressed surpise at the great size of an 800-pound sea turtle and discussed the subject with the Beligian Ambassador. We got the impression that he had never seen and perhaps never even heard of sea turtles before.

With a view to escaping from a large crowd that was gathering, the Director led the way into the service gallery for a view behind the scenes. A tankful of hungry green parrot fishes came to the surface as they often do for the man who feeds them, and began squirting little jets of water from their mouths three or four inches into the air. His Majesty exclaimed, "They are spitting water!" This is just what they were doing. He called the attention of a Belgian officer to this to him totally unexpected performance, and was disposed to linger to see what might happen next.

Viewing the occupants of the tanks from the rear where they receive direct light from overhead, displays their colors to better advantage than when viewed horizontally through the glass fronts. The King found much to interest him. It is said that children and pets seldom behave well before company; but our living things responded satisfactorily. A dip net full of puffers was lifted from a tank to show how these fishes inflate themselves when taken from the water. Most of the specimens began sucking in air at once and were soon as round and tightly inflated as little balloons. Our distinguished visitor found this performance worth seeing and was correct in his surmise that "it must be for defense." All puffers do not swell up promptly, some lie gasping and limp until taken in the hand and encouraged by a little tickling. The King succeeded in making one of the laggards inflate, and commented on its being "rigid" when it had pumped itself into as tight a globe as air could make it.

We were interested in the King's height. He seemed to tower nearly a head above the other men of his party and must stand about six feet, four inches. He had not much to say to those speaking English, conversing more freely with the French-speaking members of the party.

The King and the Crown Prince expressed their pleasure at having seen the Aquarium and departed after cordial handshakings.

C. H. T.

THE GROWTH-RATE OF PACIFIC CORAL REEFS

By Alfred Goldsborough Mayor

Carnegie Institution, Washington, D. C.

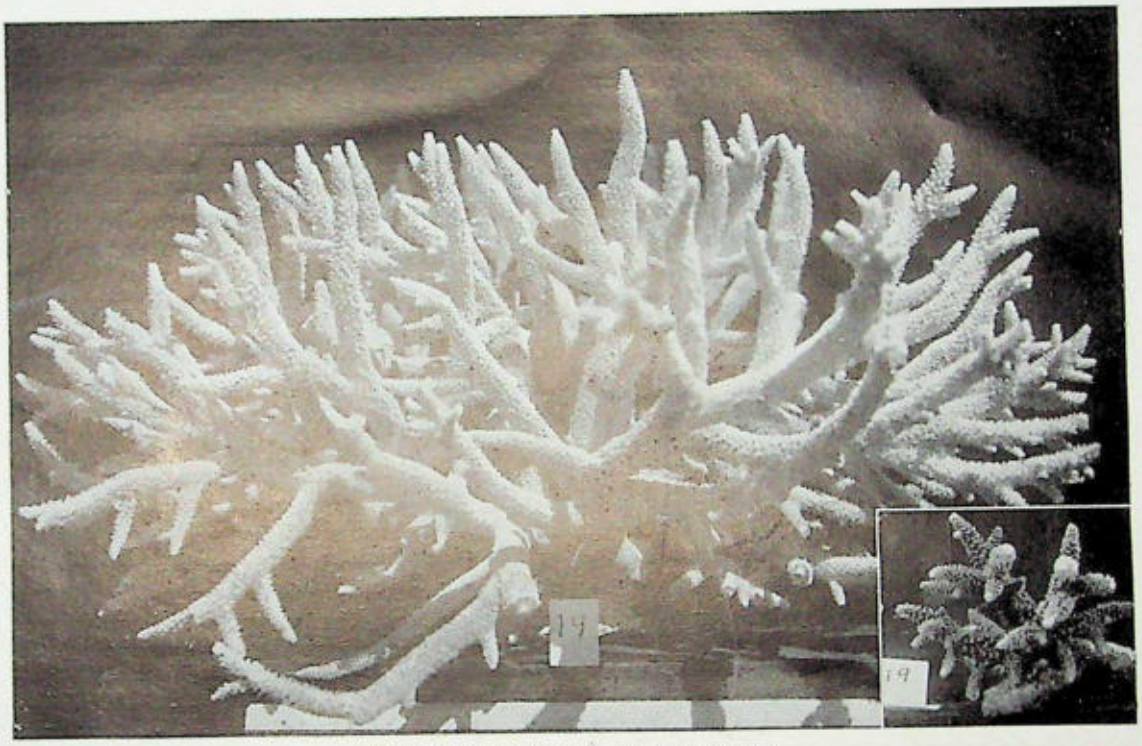
THE growth rate of Atlantic corals is well known through the extensive studies of T. Wayland Vaughan at Tortugas, Florida, and at Andros Island, Bahamas, but observations by various students upon the corals of the Pacific were incomplete and gave so high a growth rate that it seemed worth while to go to Samoa to study the subject.

As a result we find that the Pacific corals actually do grow at about twice the rate of corresponding genera in the Atlantic. The reason may be that animals so lowly organized as corals grow at a rate somewhat proportional to their food supply.

Corals feed exclusively on small marine animals, most of which they capture by means of the stinging thread-cells of the tentacles which encircle the mouths of the coral polyps. Now in the Atlantic the corals grow on the seaward edges of great shallow flats the water above which is so heavily charged with minute particles of precipitated chalk that the floating animals are largely killed; and so the corals are well fed only when the tide comes in from the deep water beyond the flats. In the Pacific on the other hand the corals are usually close to, or surrounded by, deep water and there is very little precipitated carbonate of lime to kill the floating creatures upon which they feed.

The large massive heads called *Porites* which are so dangerous to ships grow upward at an average rate of an inch a year in the Pacific, and charts might well state this fact, for such heads are common on the bottoms of many reef entrances.

The beautifully branched forms called *Acropora* grow even faster and their branches make an average increase in length of four inches each year. The illustration shows one of these forms called *Acropora pharaonis*. The small photo-



GROWTH-RATE OF ACROPORA PHARAONIS

The small picture on the right shows this coral as it was on April 10, 1917 and the large picture represents it on the same scale on July 11, 1918

graph on the right represents this coral as it was in April 1917 and the larger picture shows it on the same scale as it was in July 1918. It increased from two to seventy ounces in weight, and developed more than 250 new branches, increasing in dimensions from 3.3 x 2.3 x 2.6 inches to 16.5 x 15.2 x 9 inches high.

On an average about five and one-quarter ounces of limestone appear to be added each year to each square foot of the upper surface of the reef flats of Pago Pago Harbor, Samoa, due to the growth of corals, and this would give an average upward growth of 0.35 inches per annum over the entire area of the upper surface of the reef-flats.

Now we have bored through the reef flat in Pago Pago Harbor, Samoa, near its seaward edge and find that 121 feet of coral reef overlies the volcanic rock. A submerged platform from about one to three miles wide and about 100 to 240 feet deep extends all around the Island of Tutuila, and the modern coral reefs are growing outward from the shores upon this platform, and are now about 120 feet thick on their seaward faces.

We see then that if the reefs grow upward at the rate of 0.35 of an inch a year, a reef 121 feet thick would be formed in 4120 years. It is interesting to note that Professor G. Stanley Gardiner calculated that in Fiji the corals might grow so as to produce a reef seventeen feet thick in 1000 years, and we see that at this rate a reef 121 feet thick might be made in 7120 years. In a later publication, however, in his Fauna and Geography of the Maldives, Professor Gardiner expresses the opinion that a reef might be built up to sea level from a depth of 150 feet in 1000 years. Now, while these various calculations are not very accordant they all agree in ascribing a rapid growth rate to reefs and force us to conclude that the reefs which now surround the islands of the tropical world might easily have grown up since the glacial period.

My own calculation is doubtless based upon too slow a growth-rate, for corals are more densely clustered, and are less disturbed below the level of wave action, than over shallow reef flats where they are dashed by the heavy surges. We must also bear in mind that holothurians, boring plants, sponges, mollusks, worms and many other animals are constantly destroying the corals, while currents carry away small loose particles, although these degrading influences are more or less offset by the growth of

stony seaweeds, corallines, and bryozoa over the reefs.

We have not yet been able to evaluate the effects of all of these agencies but even so it seems quite certain that the reefs around Tutuila are, geologically speaking, structures of the present day.

In other words we conclude that these reefs have grown outward from the shore over an old submerged platform which was cut down to the then sea level in a past age, perhaps in the glacial epoch when the ice was heaped up in a vast sheet over the northern regions of America, and the surface of the tropical oceans may have thus been lowered about 120 feet, as is maintained by Professor Reginald A. Daly.

ITEMS OF INTEREST

THE BLUE LOBSTER.—The blue lobster, though rare, is not distinct in species from the common green lobster.

Almost by accident we learned at the Aquarium that the blue lobster may be born green, like the common lobster, and later change to blue.

It is said that any lobster, exposed long enough to bright light, will turn temporarily a brilliant blue. In referring to blue lobsters we mean only those which are naturally blue. Most of these have been taken from the depths of ocean, and the Aquarium exhibited one giant indigo blue lobster from deep waters which was described in the November 1917 BULLETIN.

A small, common green lobster, that had molted once under observation in our laboratory, was transferred to an exhibition tank, and a few months later molted and came out blue. It never had been subjected to bright light. The animal was returned to an observation tank and within a year cast its first dark blue shell, twelve inches long, for another blue one, the heavy claws being a beautiful sky-blue, the body darker and mottled along the sides with cream. It seems certain now that this lobster is "true blue" and unlikely to molt back into its original green.

From Herrick's studies of the lobster, we judge by the size of our specimen that it must have molted, since birth, twenty-five or twenty-six times before turning blue, and that its age was then six or seven years.

If this lobster, which has already lived longer than any blue lobster ever kept captive, attains its full growth at the Aquarium, it will be the first blue lobster ever reared in captivity.

Among crustaceans, lobsters are notable for longevity, and Herrick estimates that giant specimens weighing twenty-five or thirty-five pounds, have weathered the storms of life for possibly fifty years or more.

I. M. M.

THE DOGGER-BOAT.—The Aquarium, it is hoped, will soon be in possession of its new well-boat, the completion of which has been greatly delayed by labor troubles.

Well-boats are not modern inventions, though the name is comparatively recent, superseding "dogger-boat," from the middle Dutch "dogger-boot."

It seems quite certain that the Dutch had well-boats as early as the 17th century and perhaps considerably earlier, for English dictionaries printed in the beginning of the 18th century mention the dogger or dogger-boat, so called from the Dutch "dogger-boot"—a vessel with a well in the center for bringing fish alive to shore; also dogger-fish—fish brought alive to shore in such vessels; and dogger-men—fishermen and sailors employed on doggers.

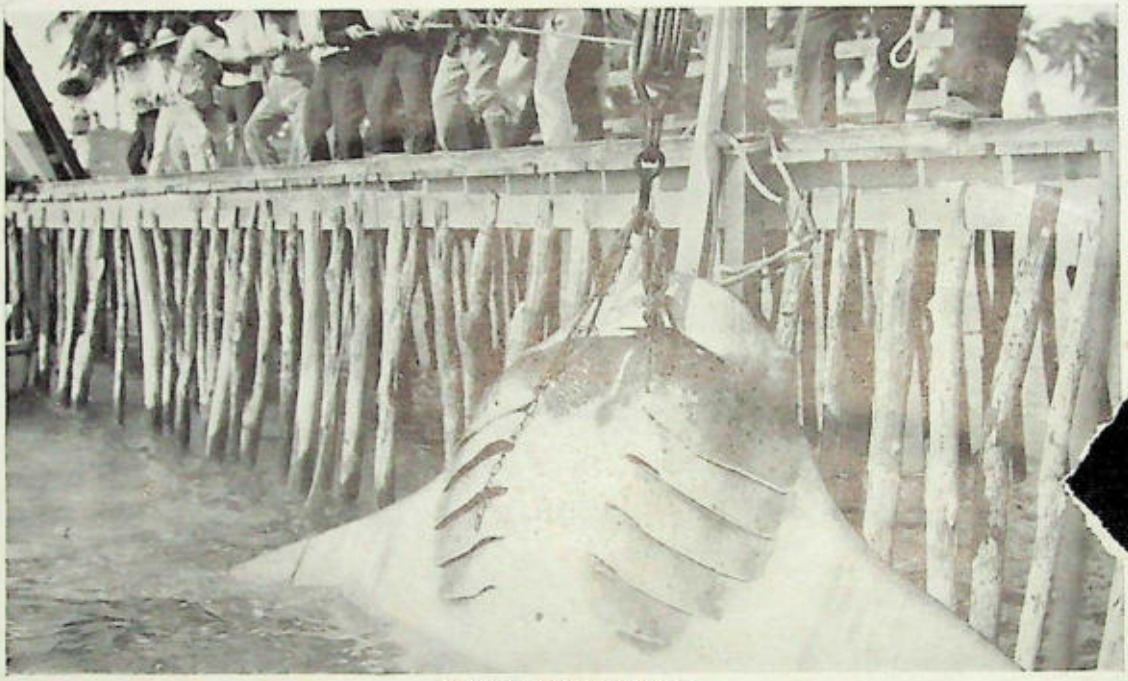
The origin of the word is not altogether clear, the earliest dictionary that mentions its derivation stating that it is from dog, a sea term. This is interesting, and not improbable, since the Dutch word for dog is dogge; but later dictionaries differ on this point. One printed in the 18th century says it is from Dogger Bank, where dogger-boats are principally used, two 19th century authorities state that dogger is Dutch for cod, and a third that it is Dutch for trawling vessel.

We know that cod and herring were much sought for upon a certain shoal in the North Sea, and might reasonably infer that if dogger is Dutch for cod, this shoal came to be called Dogger Bank because of the cod that were there; that the boats with live wells used by the Dutch for capturing cod off the Dogger Bank, came thus to be called dogger-boats; and that eventually any sandbank was called a dogger-bank, any fisherman a dogger-man, and any fish taken alive to shore in a well-boat, dogger-fish.

English-Dutch dictionaries, however, do not give dogger as the Dutch for cod, though they indicate that a "dogger-boot" is synonymous with a "heringsboot."

In any event, if the Dutch dogger-fish are exclusively cod and herring, the Aquarium dogger-fish will have a much wider range; for it is expected that a great variety of species will come to New York in our "dogger-boot."

I. M. M.



DEVIL-FISH OR GIANT RAY
From a copyrighted photograph made by John O. LaGorce

HERRINGS AND POTATOES.—A barrel of potatoes, or a barrel of herrings, is not, even in these hard times, an object of surpassing general interest. Yet we recall the story in our school readers, of Louis XVI proudly wearing in his buttonhole a blossom from one of the first potato plants raised in France.

No monument was erected to the discover of the potato, which is believed to have originated in Peru, but a statue was erected to the memory of the man who discovered the art of curing and barreling herrings in 1416.

He was a plain fisherman of Dutch Flanders, William Beuckels (or Boekel) by name, and at least one monarch—Charles V—paid homage to his ingenuity by visiting his tomb, though probably neither king nor fisherman foresaw the universal importance of Beuckels' discovery, the thousands of firms and the hundreds of thousands of men that would one day be engaged upon both sides of the Atlantic, in curing and barreling herrings. *I. M. M.*

NOTE.—Most authorities credit the Dutchman with this discovery, though there is one statement extant that the curing of herrings with salt was discovered by Peter Chivalier, a Yarmouth merchant, prior to the year 1155.

A GIANT DEVIL-FISH.—The Manta or devil-fish (*Manta birostris*) is one of the largest of fishes, and the accompanying photograph represents what appears to be the largest specimen actually measured. Its capture is described by Mr. J. O. LaGorce, from whom the photograph was received, in a recent number of the National Geographic Magazine.

This big fish, which was killed off Bimini Island, Bahamas, after towing a heavy launch for nearly five hours, measured twenty-two feet across the pectoral fins and seventeen feet from head to tip of tail.

The Manta is an inhabitant of tropical seas and many have been killed in Florida waters. Large specimens have been killed in the Caribbean Sea and in the Gulf of California.

We have seen large Mantas in some of the atoll lagoons of the Low Archipelago, in the Pacific, but none approaching in size the specimen shown in this picture. Its skin has been preserved by a Florida fishing club.

C. H. T.

The San Francisco Aquarium.—We are informed that the California Academy of Sciences has received the fund bequeathed by the late Mr. Steinhart of San Francisco for the building of an Aquarium in Golden Gate Park. The architect and engineer selected by the Academy will vsit the New York Aquarium at an early date, for the purpose of studying various features of aquarium equipment.