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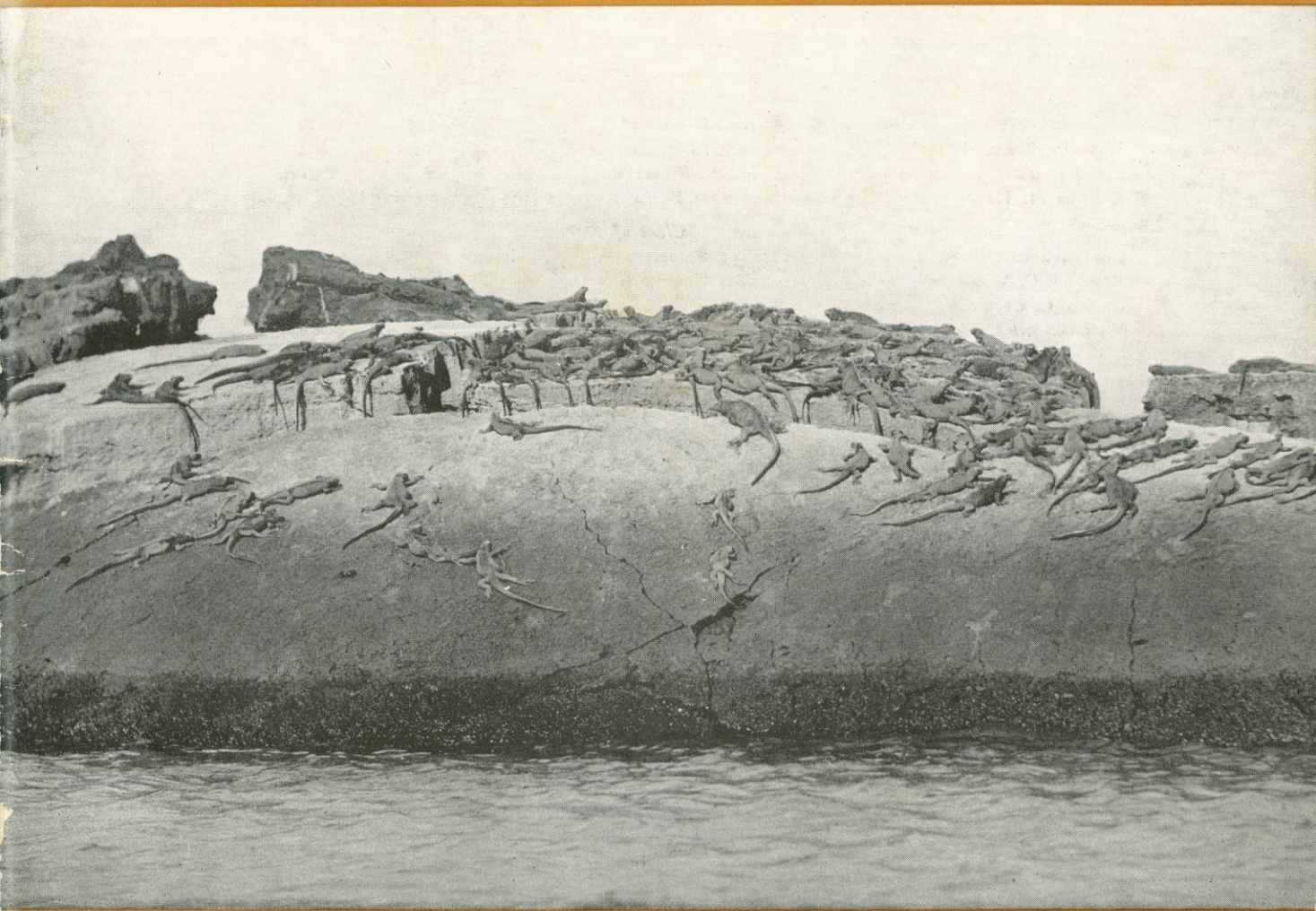
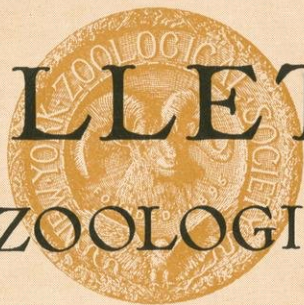
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BULLETIN

NEW YORK ZOOLOGICAL SOCIETY



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OVER since its founding in 1895 the New York Zoological Society has attracted the active interest of persons who believe, with the founding group, that instruction and entertainment and important scientific achievement can go hand in hand through the maintenance in New York City of well-balanced collections of mammals, reptiles, birds and fishes from all parts of the world.

In the Society's work of gathering, maintaining and exhibiting its collections, as well as its constant efforts in behalf of conservation of wild life everywhere, every Member shares, and through the privileges of Membership and the Society's publications is rendered an accounting of the work in which he participates.

The New York Zoological Society invites the Membership of all persons who wish to lend financial support to the purposes for which the Society was founded and to co-operate in a tangible way toward the future development of the Zoological Park and the Aquarium.

Annual Membership in the Society is \$10, renewable annually. Life Membership may be obtained for \$200. A contributor of \$1,000 becomes a Patron; \$2,500 an Associate Founder; \$5,000 a Founder; \$10,000 a Founder in Perpetuity, and \$25,000 a Benefactor.

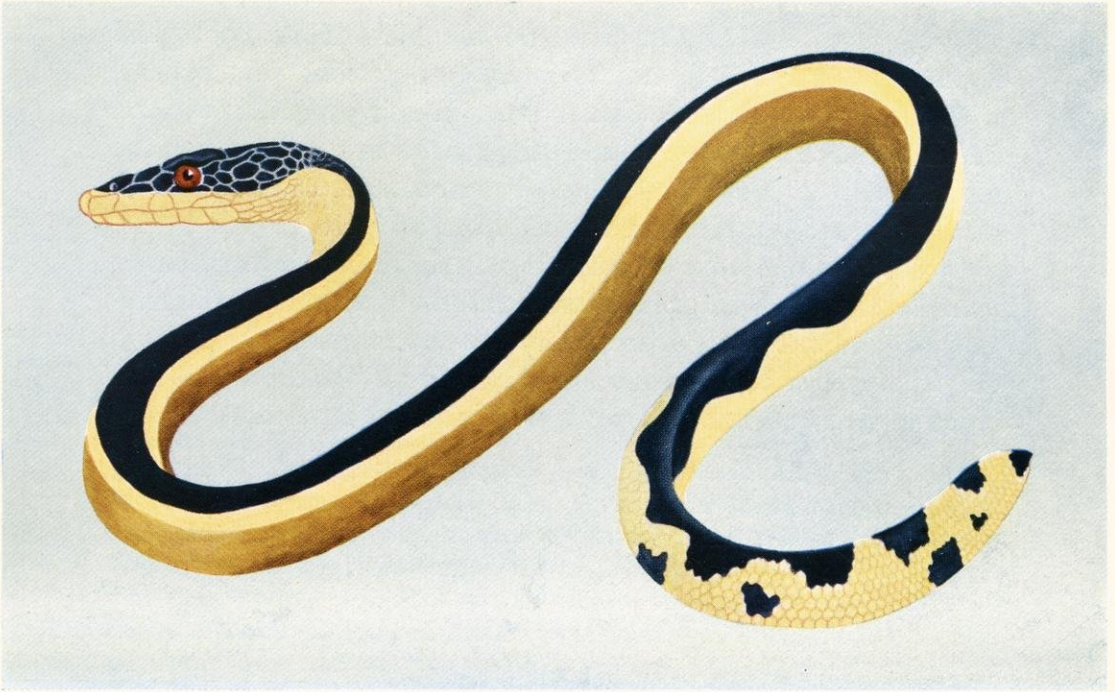
All classes of Members are entitled to receive every periodical publication, the privileges of the Administration Building with its lounges and reception rooms and gallery of paintings of animals, to attend lectures, open meetings and entertainments, and to be admitted free to the Zoological Park and the Aquarium every day in the year.

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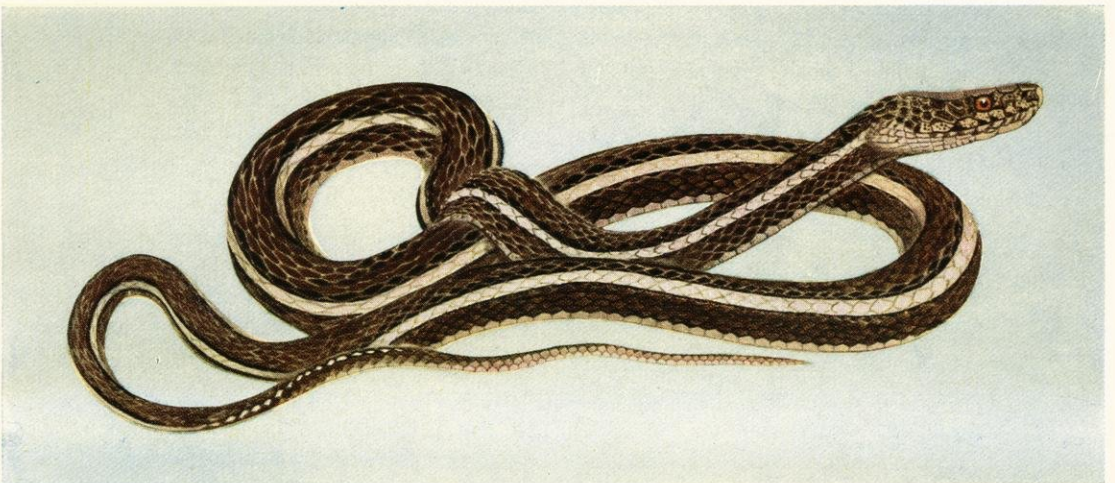
Zoological Park or the Director of the Aquarium, or may be mailed directly to the Secretary, 101 Park Avenue, New York City, for action by the Executive Committee.

The Zoological Park is open every day in the year from 10 o'clock in the morning to one-half hour before sunset. Admission is free every day except on Mondays and Thursdays when an admission fee of 25 cents is charged for adults and 15 cents for children between the ages of five and twelve. These days have been set aside primarily for the benefit of Members and their friends, who are admitted free on tickets issued with Membership, so that the collections may be seen to the best advantage. All holidays are free.

The Aquarium also is open every day in the year. From April 1 to September 30 its hours are 9 o'clock in the morning to 5 o'clock in the afternoon, and for the remainder of the year, from 9 o'clock in the morning to 4 o'clock in the afternoon. No admission is charged.



The Yellow-Bellied Sea Snake (*Pelamis platurus*) Found in Galápagos Waters Is the Most Widely Distributed Salt Water Snake and Has a Broad Range in Tropic Seas. Human Deaths from Its Bite Have Been Reported.



The Land Snake (*Dromicus hoodensis*) Is One of the Seven Species of Terrestrial Snakes Found Only on the Galápagos Islands, Although the Genus Flourishes on the South American Mainland. All Are Non-Venomous. (Both Watercolors by William B. Hayden)

BULLETIN

NEW YORK ZOOLOGICAL SOCIETY

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An Account of the Reptiles Inhabiting the Galápagos Islands

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DURING the past few years the Galápagos islands have become a point of particular interest to some of those who were fortunate enough to be able to visit them in private yachts or in other vessels chartered for the purpose. No doubt that most interesting and well illustrated volume entitled "Galápagos: World's End," by Dr. William Beebe, was the primary cause which started several visitors on cruises to the islands, although for a hundred years they had claimed the attention of some of the world's most famous naturalists.

The author is indebted to his friend, Captain G. Allan Hancock, for the privilege of making his second voyage to the Galápagos on board the steamship *Oaxaca* in 1927 and 1928. The first was made as a member of the expedition of the California Academy of Sciences in 1905 and 1906.

Situated on the Equator about 600 miles West of Ecuador, to which country it belongs, the Galápagos archipelago extends from Latitude $1^{\circ} 40'$ North to $1^{\circ} 30'$ South and from Longitude 89° West to 92° West. Of the six principal islands, Albemarle, the largest of the group, is about 75 miles long and about 45 miles wide at the widest part. Nine smaller islands and many islets, many of them mere rocks, make up the remainder of the archipelago. All of the islands are volcanic, the larger ones having mountain peaks from 1,000 to 4,000 feet high. Many of these peaks have

perfectly formed craters and that of Villamil mountain is about six miles in diameter.

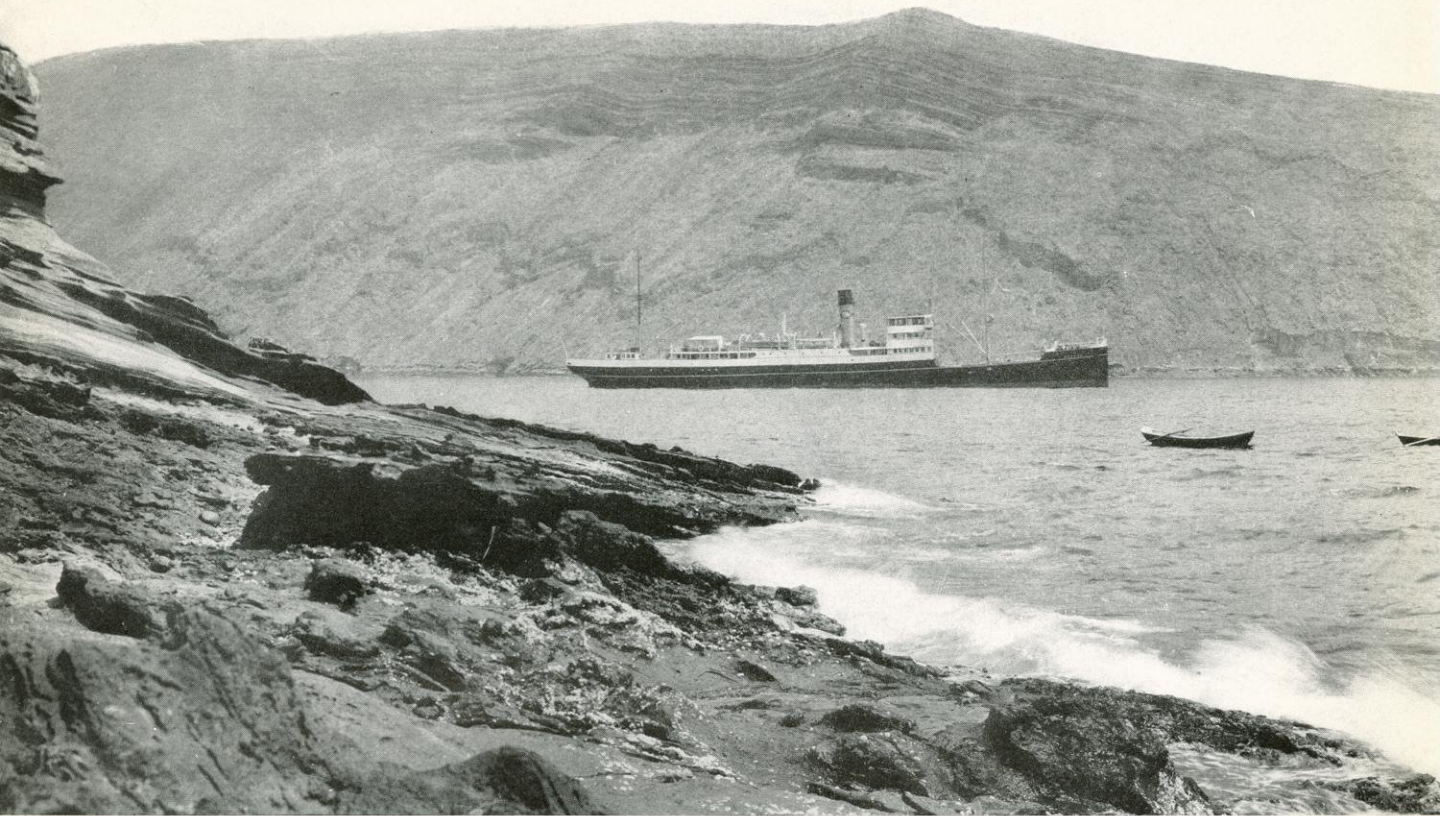
The Galápagos archipelago, although it does not support a reptile fauna as varied and abundant as many other parts of the globe, even the nearest point of the adjacent mainland, has a most interesting and unique one. The most striking reptiles are the Giant Land Tortoise, the first account of which we owe to Dampier in his "New Voyage Around the World," published in 1697, and the Marine Iguana, solely dependent on the ocean for its food and found nowhere else in the world. The Galápagos Land Iguana, still found on some of the islands, always attracts the attention of visitors and no doubt is next in point of interest. In order that future visitors, lacking the various and scattered works dealing with the herpetology of the archipelago, may enjoy the convenience of a general account, the present paper treats of the various species in turn, gives an idea of their distribution and habits, and discusses what has caused them to become rare on certain islands and extinct on others.

The writer expresses his thanks to Captain Hancock and to Mr. Templeton Crocker for the original photographs from which several of the illustrations have been made, and for permission to publish them. The colored frontispiece is from watercolor paintings by Mr. William B. Hayden.



Giant Land Tortoises probably made their appearance on the earth about the beginning of the Cenozoic period, the age of mammals, and reached their greatest stage of development in the Miocene. During the Miocene and Pliocene periods they were very widely distributed over the earth and were particularly abundant in

what is now North America, their fossil remains being found in great numbers in the Miocene deposits of our Midwestern States. There is no doubt that some of the extinct tortoises were very much larger than any living today. The plaster restoration made from the fossil bones of *Testudo atlas*, a tortoise found in the Lower Pliocene beds of the Siwalik hills in India, is in



Tagus Cove at Albemarle Island and the Oaxaca at Anchor. Sometime During the Formation of the Galápagos Archipelago, an Elevation of the Ocean Bottom Appears to Have Taken Place. Here at Tagus Cove, Characteristic Cavities Made by Sea Urchins Were Found Several Hundred Feet Above Sea Level. (Photo by George Stone)

the Government Museum at Melbourne, Australia, and measures eight feet in length. Although this may not be accurate, on account of the bones of several specimens being used, those from which it was made leave no doubt as to the immense size of some of these extinct tortoises.

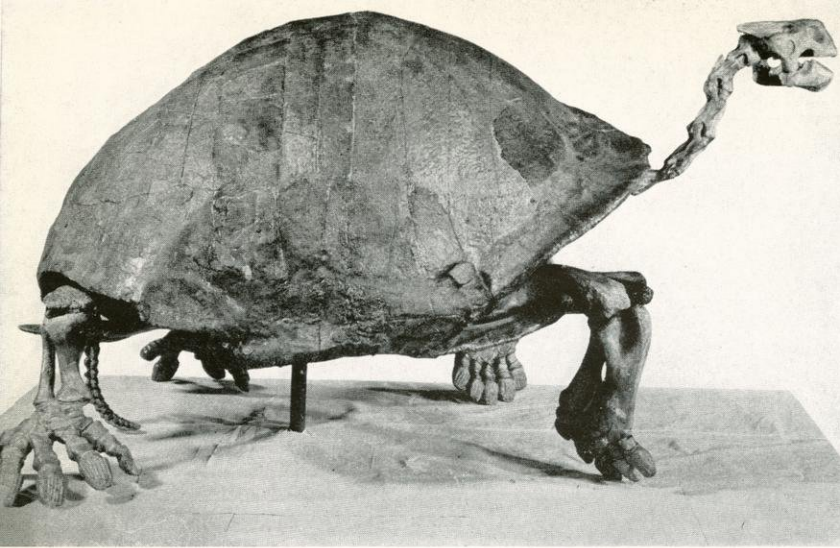
Besides the Galápagos archipelago, the only other places where Giant Land Tortoises have been found living are the islands off Southeast Africa, which include the Mascarene islands, the Aldabra-Madagascar group, and the Seychelles. All of these tortoises belong to the genus *Testudo*, the same as that which inhabits the Galápagos.

The tortoises of the African islands were practically exterminated some hundred years ago owing to the inroads made upon them by the early voyagers who, like those visiting the Galápagos, used them for food. In 1737 the supply of tortoises was becoming exhausted on the island of Mauritius. In 1761 they were being taken off of Rodriguez and by 1770 were

so thinned out that it became unprofitable to hunt them. With the exception of South Aldabra, which has very few tortoises left, the Galápagos islands now harbor the last members of the race in their natural or wild state.

What caused their near disappearance is not known but it may be that they were unable to adapt themselves to the changes taking place on the earth and, having small brain capacity, were ill-fitted to withstand the onslaught of the more active and intelligent mammals.

The Galápagos Tortoises—All the juvenile tortoises are similar in shape and it is not until mature individuals are placed side by side that the variations in the shape of the shell, which distinguish the several species, are noticeable. It was Captain David Porter of the U. S. Frigate *Essex* who first called attention to the fact that differences existed between the tortoises of the several islands. In his "Journal of a Cruise Made to the Pacific Ocean" (New York, 1822), Porter states: "Those of James



A Giant of Long Ago—A Fossil Land Tortoise (*Colossochelys atlas*) Found in the Pleistocene Beds of the Siwalik Hills of Northern India. Its Shell Is 7 Feet. 4 Inches Long Over the Curve. (Photo from the American Museum of Natural History)

island appear to be a species entirely distinct from those of Hood and Charles islands. The form of the shell of the latter is elongated, turning up forward in the manner of a Spanish saddle, of a brown color and of considerable thickness. They are very disagreeable to the sight, but far superior to those of James island in point of fatness, and their livers are considered the greatest delicacy. Those of James island are round, plump, and black as ebony, some of them handsome to the eye, but their liver is black, hard when cooked, and the flesh altogether not so highly esteemed as the others."

A study of the various species has resulted in their being divided into the following races:

THE SADDLE-BACKED RACES

ISLAND

<i>Testudo abingdoni</i>	Abingdon
<i>phantastica</i>	Narborough
<i>becki</i>	Albemarle (North)
<i>ephippium</i>	Duncan
<i>hoodensis</i>	Hood
<i>elephantopus</i>	Charles

On the Morning of December 27, 1927. While the Author Was Returning from the Galápagos Aboard the Oaxaca, a Landing Was Made on Malabelo Island—the First Landing, As Far As the Records Show, Since that of the Spanish Commodore Malaspina in 1789. (Photo by George Stone)



THE INTERMEDIATE RACES

<i>Testudo darwini</i>	James
<i>chathamensis</i>	Chatham
<i>microphyes</i>	Albemarle (Tagus Cove)
<i>güntheri</i>	Albemarle (Southeast)
<i>vicina</i>	Albemarle (South)
<i>wallacei</i>	Jervis

THE DOME-SHAPED RACES

<i>Testudo porteri</i>	Indefatigable
<i>vandenburghi</i>	Albemarle (Cowley Mountain)

The saddle-backed tortoises have longer necks and legs and the concave plastron of the males is much more pronounced than in the non-saddle-backed races. Another peculiarity of the saddle-backed races which is characteristic of only one other species of Galápagos tortoise, *Testudo güntheri*, one of the intermediate races from Southeast Albemarle, is that the adult males have the posterior extremity of the plastron terminating in thick, knob-like processes. In *Testudo güntheri* both the male and the female possess these processes. In all of the races the adult males can readily be distinguished from the females by the concavity of the posterior portion of the plastron and the greater length of the tail.

The general coloration of the shell and limbs of all of the Galápagos tortoises is black, the males of the saddle-backed races having the throat and lower jaw marked with yellow.

Large male tortoises have been known to weigh more than 500 pounds. Lord Rothschild records a male tortoise in his collection at Tring

as having weighed 593 pounds, but of course this is an exception. A Galápagos tortoise taken in June, 1899, and kept at Riverside, California, until April, 1914, when it died from exposure on wet ground, weighed 415 pounds at the time of its death. In seven years it increased in weight from 29 to 350 pounds. The weight of the average sized large male is probably about 300 pounds.

It is a well known fact that tortoises are long-lived animals, and if certain suppositions concerning what is known as Marion's tortoise are correct, there is evidence that a tortoise lived 152 years. Captain Parsfield Oliver, who made a study of the history of the Mascarene islands, believes that a tortoise which died on the island of Mauritius in 1918 was one of the original tortoises taken there in 1766 by the French explorer, Marion de Fresne. Lord Rothschild records an individual, whose history he has traced, as "an exceedingly old animal, at least 300 years."

*Habits of the Giant Land Tortoises—*On the islands such as Albemarle and Indefatigable, which have mountain peaks some 3,000 feet high, the land tortoise is found more abundantly at the higher elevations (about 2,500 feet), where the fog hangs over the green zone and ferns, trees, vines, and grass grow in abundance. Darwin in his "Journal of Researches" (New York, 1902) says: "Those which frequent the higher and damp regions eat the leaves of various trees, a kind of berry (called guayavita) which is acid and austere, and likewise a pale green filamentous lichen (*Usnera plicata*), that hangs in tresses from the boughs of the trees." Villamil mountain is typical tortoise country, where the open grass land has scattered patches of trees and bushes, with numerous puddles formed by the rains. In certain types of country, such as at Iguana Cove mountain, the vegetation extends to the water's edge and here tortoises may be found among the trees and heavy growth of cactus. By constant traveling up and down the mountain they have worn trails which are easily distinguishable even



And a Giant of These Days—A Galápagos Tortoise (*Testudo vicina*) from Albemarle Island. Thirty Years in the Zoological Park. It Is Probably the Largest in the United States. It Weighed 140 Pounds in 1904 and in Recent Years Has Not Added Much to Its Weight of 305 Pounds in 1929. The Shell Is 3 Feet, 10½ Inches Over the Curve.

by persons inexperienced in tortoise hunting.

The first sign to strike the eye of the hunter would probably be a tunnel through the underbrush. If the trail were old, or over ground without any partially buried lava boulders, the tunnel might be all that would betray the tortoise.

However, close observation generally can turn up fresh signs. Across or beside the tunnel, vines are likely to be stretched taut or snapped, leaves disturbed and turned to expose the undersurface, or marks of toenails scratched in the soft earth. A fresh cactus leaf partly eaten shows where the tortoise has been feeding, and a clearing of fresh earth close by the trail is a sign that it has been resting.

Some of the old trails that lead to waterholes have been used for so long that exposed lava



In Country of This Kind Around the Base of Iguana Cove Mountain on Albemarle Island, the Giant Land Tortoise May Be Found. Its Paths Through the Underbrush Are Full of Signs for the Tortoise Hunter. (Photo by R. H. Beck)

boulders have been worn smooth and almost polished by the dragging shells.

The land tortoise is fond of lying in pools of water, or in mudholes formed by the overflow of lagoons into the depressions back of the sand beaches. Here it may stay for hours at a time, or it may seek the shade of some protecting bush, dig out a slight hollow in the earth, and remain there during the heat of the day.

There seems to be no particular time in which tortoises travel about feeding, but on cool and cloudy days they are more active, especially after a rain. They are strictly vegetarian, the fresh leaves of the cacti being particularly ac-

ceptable. Besides the cacti, orchilla, a species of lichen, forms a major portion of their food, especially among the tortoises of Duncan island. The small apple-like fruit of the *Hippomene*, found commonly along the South Albemarle coast, is eaten by the tortoises in the vicinity of Cape Rose. Practically all species of grasses and vines found on the islands are readily eaten.

Although the land tortoise is fond of water and drinks great quantities when available, there are certain parts of the country where it is unable to get any for most of the year and it then must rely on the moisture from the leaves of the cacti and the dew on the orchilla and grass. It often happens during the rainy season that holes in the lava become filled with water and temporary lakes are formed where the water does not sink too rapidly into the porous soil, and it is then that the tortoise is able to drink its fill.

Again to quote Darwin, who has given the best account of the land tortoises ever written: "The tortoise is very fond of water, drinking large quantities and wallowing in the mud. The larger islands alone possess springs, and these are always situated toward the central parts, and at a considerable height. The tortoises, therefore, which frequent the lower districts, when thirsty, are obliged to travel from a long distance. Hence broad and well-beaten paths branch off in every direction from the wells down to the seacoast; and the Spaniards, by following them up, first discovered the watering-places. When I landed at Chatham island, I could not imagine what animal traveled so methodically along well-chosen tracks. Near the springs it was a curious spectacle to behold many of these huge creatures, one set eagerly traveling onward with outstretched necks, and another set returning after having drunk their fill. When the tortoise arrives at the spring, quite regardless of any spectator, he buries his head in the water above his eyes, and greedily swallows great mouthfuls, at the rate of about ten in a minute. The inhabi-



A Picture that Speaks for Itself and Tells Why the Giant Land Tortoise Has Become Extinct, or Almost Extinct, on Many Islands of the Galápagos. This Is an Abandoned Oil-Hunters' Camp on Albe-marle. Photographed by R. H. Beck on the Expedition of the California Academy of Sciences to the Galápagos in 1905-1906.

tants say each animal stays three or four days in the neighborhood of the water, and then returns to the lower country; but they differed respecting the frequency of these visits. The animal probably regulates them according to the nature of the food on which it has lived. It is, however, certain that tortoises can subsist even on those islands where there is no other water than what falls during a few rainy days in the year.

"The tortoises when purposely moving toward any point travel by night and day, and arrive at their journey's end much sooner than would be expected. The inhabitants, from observing marked individuals, consider that they travel a distance of about eight miles in two or three days. One large tortoise, which I watched, walked at the rate of sixty yards in ten minutes, that is 360 yards in an hour, or four miles a day, allowing a little time for it to eat on the road."

The breeding season is in March and April. The males become quite active at this time, and make a hoarse bellowing noise which can be heard for a distance of about 300 yards. Considerable time elapses after mating before the eggs are laid, some that we found in November

being perfectly fresh. The female digs a small hole in the soft earth, a little more than a foot in width, preferably along a cattle trail or at the edge of some opening where the sun will shine upon the spot for at least part of the day, and deposits her eggs in two or three tiers, each tier separated by a layer of earth an inch or two in thickness. The earth is left loose around the eggs, but when they are all covered the tortoise makes a hard crust, three or four inches deep, over the nest by turning about on the earth and packing it down by her own weight. The eggs are not all laid at once, but in two or three separate lots, judging from the varied development of eggs in females examined. Nests discovered and dug out contained from eight to seventeen. These are white, globular in shape, about the size of a billiard ball, and have a hard, porous shell.

In regard to the breeding habits of the tortoise, Darwin states: "During the breeding season, when the male and female are together, the male utters a hoarse roar or bellowing, which, it is said, can be heard at the distance of more than a hundred yards. The female never uses her voice, and the male only at these times; so



In Its Slow Way, the Giant Tortoise Travels Over Difficult Terrain. *Testudo ephippium* Günther Climbing a Lava Hill on Duncan Island. (Photo by John Tee-Van)

that when the people hear this noise they know that the two are together. They were at this time (October) laying their eggs. The female, where the soil is sandy, deposits them together, and covers them up with sand; but where the ground is rocky she drops them indiscriminately in any hole; Mr. Bynoe found seven placed in a fissure. The egg is white and spherical; one which I had measured was seven inches and three-eighths in circumference, and therefore larger than a hen's egg."

Causes which Led to the Extinction, or Near Extinction, of the Giant Land Tortoises—The Giant Land Tortoises, from which the archipelago gets its name, (*galápagos* being the Spanish for tortoise), are all but extinct on most of the islands on which they have been found, and are extinct on some.

Of the various causes which led to this situation, the two most notable are the inroads made upon them by the whale ships of the early days, and later the slaughter by oil hunters. The cap-

tains of the whalers cruising about the islands found in the tortoises an excellent supply of fresh meat for their crews. Being easily kept on board ship, as they require neither food nor water for long periods of time, they furnished a constant supply of fresh meat, no doubt helping in a great way to make the whaling industry possible when ships made cruises of two to three years' duration. Dr. C. H. Townsend in his paper, "The Galápagos Tortoises in Their Relation to the Whaling Industry," (*Zoologica*, New York Zoological Society, 1925), records more than 10,000 tortoises taken off the islands between 1831 and 1868. These figures are taken from the log-books of American whalers. When it is considered that the logs he examined represent only a part of the American whaling fleet and none of the British whalers, men-o'-war, or the buccaneers who frequented the

islands, it can readily be seen that the slaughter was appalling.

Lieutenant J. Shillibeer, R.M., attached to HMS *Briton*, (Sir Thomas Stains, Captain, R. N., Commanding), spent ten days in the Galápagos in 1813 and made the following entries in his journal concerning the tortoises of Charles, Chatham, and James islands: "Charles island, July 25, 1813. We found but few tortoises and no water.

"Chatham island, July 26, 1813. Here we were fortunate in our search for tortoises, and took more than a hundred, among them were several weighing upwards of 370 pounds. Amongst the grass on the isthmus, we took some land tortoises. One of these creatures greatly exceeded the others in size, and as the progress this species makes in growing is particularly slow, I am led to conclude it to have been of great age. From its having been taken at this island, the sailors whimsically bestowed on it the name of Lord Chatham. It soon lost its natural shyness, became much petted among the crew, and latterly, was in regular attendance in

the galley at the hour of meals, when it partook of the ship's allowance, and was fed by the men either out of their hands or some of their utensils, but notwithstanding, every care was taken, its life could not be preserved in the excessive cold, of a high southern latitude."

Of James island he said: "Land tortoises are found here in great abundance, whose meat being very fine, we found it a great relief from salt provisions."

In 1875 Commander Cookson of HMS *Peterel* reported that tortoises were extinct on Charles island, few survived on Chatham island, and that on Hood, James, and Indefatigable their numbers were so greatly reduced they were no longer hunted. He also reported them still abundant on the Southeast end of Albemarle and tolerably numerous at Tagus Cove, Albemarle island. According to the whalers' logbooks examined by Dr. Townsend, the last tortoises were taken off Charles island in 1837.

The oil hunters next claim attention and it is no doubt owing to them that the tortoises were

all but exterminated. In the year 1835 Captain Fitzroy, of HMS *Beagle*, found a party camped on James island killing tortoises for the oil. In 1902 Mr. R. H. Beck, leader of the Academy's expedition of 1905-1906, found the oil hunters at work on Villamil mountain, southern Albemarle, where they had already made such great inroads on the tortoises that the skeletons around the waterholes showed that the larger ones were doomed. When the writer visited this locality in 1905, very few large tortoises were to be found. The simple equipment of the oil hunter—a few sacks, casks, and a boiling pot—enabled him to move rapidly from place to place and the extermination of the tortoises in a particular locality was only a matter of days or weeks.

We now come to the worst of the natural enemies of the tortoises: wild dogs and rats. Unfortunately, the early voyagers introduced dogs and rats onto the islands, and these animals have so greatly increased in numbers that they now present a real danger to the tortoises, the rats eating the young, which have just hatched from



Galápagos Vegetation Was Made for Tortoises and Iguanas and Not for Humans. A Sample from the Neighborhood of Conway Bay, Indefatigable Island. (Photo by John Tee-Van)

the egg, and the dogs eating both these and fully grown individuals. The wild dogs have developed wonderfully strong jaws and, by catching hold of the edge of the shell, gradually bite off portions of the bone until the flesh is reached. Once an opening is made in the skin they literally eat the tortoise out of its shell. The chief sufferers from the dogs are the tortoises of Villamil mountain. It is encouraging, though, that when Dr. Townsend visited the Galápagos in 1928, on board the U. S. Fisheries Steamer *Albatross II*, about 180 small tortoises were taken off Villamil and from the immediate vicinity. These were brought to the United States, where they were distributed among various zoological gardens. A few were afterwards sent to Honolulu and to Sydney, Australia. The fact that on Villamil mountain there are many wild cattle, which are more easily killed than the tortoises, no doubt helps to protect the latter. It may be readily seen that between man and its natural enemies, the tortoise is hard pressed and its extinction sooner or later is inevitable.

Besides those killed for food, some were transplanted by the early navigators to other islands of the Pacific, where most of them perished. Amasa Delano, in 1818, carried 300 tortoises from James island to the island of Mas Afuera, where he landed half of them after having them sixty days aboard ship. Captain David Porter, of the *Essex*, carried a number to Rotumah island, where he distributed some among the chiefs and turned many others loose.

In the "Records of the Australian Museum" (Sydney, April 17, 1899), Mr. Edgar R. Waite gives a very interesting account of one of these tortoises. He says: "For particulars of the early history of this tortoise I am indebted to Miss Annie C. E. MacDonald. About the year 1866 it was given to her father, the late Alexander MacDonald, by King George of Tonga, and was what was called a chief's gift, that is, a gift supposed to pass between two great chiefs of equal standing. When taken to Tonga from Rotumah, the reptile caused a great sensation among the natives and was presented to Mr. MacDonald in recognition of his kindness to the King's son when in Sydney, both father and son having taken a violent fancy to the well-known trader.

"The tortoise was brought to Sydney in the schooner *Ida*, one of MacDonald's and Smith's whalers. Captain Howard, who was in command of the vessel, had known the tortoise for fifty years previously on the island of Rotumah, it having been landed there from the Galápagos islands by an American whaler¹ many years before. It was, within the memory of the inhabitants, always the same size.

"From 1866 to the end of 1896 the tortoise lived in Sydney, and at the latter date was removed to England, having been purchased, I understand, by Hon. Walter Rothschild for his menagerie at Tring."

According to the records of Lord Rothschild, this tortoise died in Regent's Park, London, in July, 1898.

Mr. Thomas G. Thrum, in the "Hawaiian Annual" for 1904, gives an account of two Giant Tortoises in Honolulu at that time, under the heading: "A Historic Tortoise or Land Turtle (*Testudo microphyes* Günther).

"There is cared for at Waikiki by an aged couple, retainers of the late Queen Dowager Kapiolani, a tortoise, or land turtle, of great age, of which the following brief history is gathered:

"The subject of this sketch was brought to these islands by Capt. John Meek from Kahiki, the natives say, on his arrival at these islands. This means from some unknown foreign land about the year 1812, but in actual fact it must have been a number of years later.

"Capt. Meek first touched at these islands as first officer of a vessel in the Northwest trade in 1880; then visited and sailed out of this port as master on trading voyages between Mexico and China from the year 1812, and became a resident of Honolulu in 1825.

"It is known that he brought a number of horses from the coast during these early voyages, and report says he brought cattle also, with many of these land turtles, which latter, very likely, were brought on one of his trips from Mexico. These were said to have been all kept on the Meek premises, on King Street, and attracted the attention of the Chiefs, foreigners, and common people. This fact would bring it to not earlier than 1825.

¹Evidently a mistake for the American frigate *Essex*.

"Upon their disposal, or distribution, this one was given by Captain Meek to King Kaukeouli, Kamehameha III. During the time the High Chief Paki was Chamberlain to the King, it was under his charge and cared for at his Aigupita premises, Ewa-wards of the new Young Hotel, on King Street.

"After the death of the King and of Paki, this tortoise became the property of B. Nama-kaeha, first husband of the late Kapiolani, and was taken to his premises at Kaalaa. At Nama-kaeha's death it was moved to Waikiki, where it has since been cared for by two old retainers from Paki's time. Upon the death of Kapiolani a few years ago, it naturally came into the possession of her new nephew, Prince David.

"There is another similar venerable-looking tortoise in Nuuanu Valley, owned by Mrs. M. E. Foster, which is said to have been brought here on a whaleship many years ago from the Gallipagos Islands, their natural habitat, but no further particulars can be gathered. These two are probably the only ones of their kind on the islands."

In May, 1915, Mr. Thomas Gerrard of London visited Honolulu and reported five tortoises living on the Hawaiian islands at that time. Two of these he secured for Lord Rothschild and shipped to England. The clerk of Public Parks at Honolulu reported that the last of the old tortoises in Kapiolani Park died in 1929, but was unable to give any information regarding the two remaining ones reported by Gerrard. I have been unable to find any trace of them through other sources, so it may be that they have since died.

Another Giant Tortoise was reported by Mr. Edward W. Gifford as living on the island of Tonga in 1921. His letter dated January 29, 1921, from Nukualofa gives the following information regarding it:

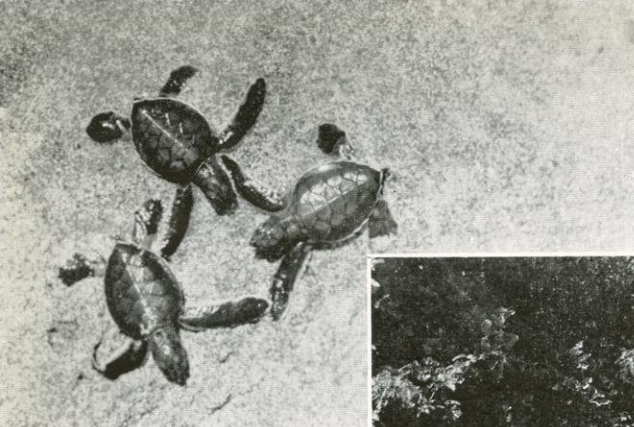
"There is a tortoise in Nukualofa known as Tui Malila (King of Malila). It is the property of the Queen. One story has it that Captain Cook presented it to the ruler of Tonga; another that King George I obtained it from a vessel which called in Haapai, probably in the first half of the last century. As Cook does not mention the presentation of a tortoise, I think the latter story is the more likely."

Concerning this tortoise, Sir Joseph Carruthers in his work on Captain Cook, (Captain James Cook, R.N.; 150 Years After. New York, 1930), says: "Although there is no mention of the matter in Cook's journals, there is, from Tongan sources, handed down from generation to generation, the tradition that Captain Cook left two tortoises at Haapai, one of the islands in the Tongan group, during one of his two visits there between 1774 and 1777. One of these still survives and is an honored guest in the grounds of the Royal Palace at Nukualofa, in the island of Tongatabu.

"There is no doubt about the tradition, which was committed to writing as soon as the natives were able to do so. I received a copy of this from the Rev. R. Page, chairman of the Tongan Wesleyan Mission, in 1927, when I first visited the Tongan islands. I then also met the Prince Consort, Tungi, the grandson of the Chief to whom Cook gave the two tortoises. At the royal palace Prince Tungi showed me the tortoise, now partially blind and considerably battered as the result of bush fires (in which it was three times caught) and of an injury from a heavy limb of a tree falling on it and partially crushing its shell. Otherwise the tortoise was doing as well as could be expected at his age, possibly 200 years and certainly more than 160 years."

Sir Joseph further states: "Two tortoises were brought, but one died. The other, Tu'i Malila, is still alive. The name originated from the residence of the Tu'itoga, the name of which is Malili; and the name, "King of Malila," was given to the tortoise, which had free run of the grounds. The tortoise was cared for by the people, just as if it were a chief, and it went where it pleased in Tonga."

At various times in past years expeditions have visited the Galápagos for the purpose of bringing back living tortoises for zoological gardens, notably those of New York and London. In 1897 the schooner *Lila and Mattie* arrived in San Francisco with live tortoises to be shipped to London, and in 1902 the schooner *Mary Sachs* arrived with a load for the same destination. Another schooner, the *W. S. Phelps*, Captain Richard Nye, arrived in 1902 with a cargo of 37 live tortoises. One of these is still



At Left—Young Green Turtles (*Chelonia agassizii*) on the Sand at Black Beach Road on Charles Island.

Below—A Green Turtle Nest Dug Out at Black Beach Road on May 15, 1932. Contained 92 Empty Egg Shells and Three Infertile Eggs. Tracks of Many Recently Hatched Turtles Were Found, Leading Toward the Water. (Photos by Toshio Asaeda)



living in the zoological garden at San Francisco.

Distribution and Present Status of the Galápagos Land Tortoises—Tortoises had been found on Abingdon, James, Duncan, Indefatigable, Chatham, Hood, Charles, and Albemarle islands previous to the Academy's expedition of 1905-1906. Narborough and Jervis islands were then added to the list. Old eggs were dug out of

the ground and tortoise remains were found on Barrington island, but there are no records of living tortoises ever having been taken there.

There are fifteen species credited to the archipelago. Albemarle has five, but each of the other tortoise islands has its own individual species. The status as given by Van Denburgh in 1914 is as follows:

NAME	ISLAND	PRESENT STATUS
1. <i>Testudo abingdoni</i>	Abingdon	Rare
2. <i>phantastica</i>	Narborough	Very rare
3. <i>becki</i>	Albemarle (North)	Fairly numerous
4. <i>ephippium</i>	Duncan	Fairly abundant
5. <i>hoodensis</i>	Hood	Very rare
6. <i>elephantopus</i>	Charles	Extinct
7. <i>darwinii</i>	James	Rare
8. <i>chathamensis</i>	Chatham	Nearly extinct
9. <i>microphyes</i>	Albemarle (Tagus Cove)	Fairly numerous
10. <i>güntheri</i>	Albemarle (Southeast)	Abundant
11. <i>vicina</i>	Albemarle (South)	Fairly numerous
12. <i>wallacei</i>	Jervis	Very rare
13. <i>porteri</i>	Indefatigable	Not rare
14. <i>species?</i> ¹	Albemarle (Cowley Mt.)	Rare
15. <i>species?</i>	Barrington	Extinct

¹ Now named *Testudo vandenburghi* for the late Dr. John Van Denburgh.

Of late years tortoises have been taken on Hood, Duncan, Indefatigable, and Albemarle islands. At the present time they are extremely rare on Hood, Abingdon, James, Jervis, Chatham, and Narborough islands, and they are cer-

tainly extinct on Charles and Barrington. On the Academy's expedition living tortoises were seen but not taken on Duncan, James, and Abingdon islands. The expedition of the *Albatross II* in 1928 showed them to be still abun-

dant on South Albemarle, and no doubt they are still common on Duncan island. Owing to the fact that Indefatigable island now has permanent inhabitants, the tortoises will probably be thinned out considerably. In all places except South Albemarle, Duncan, and possibly Indefatigable, it would take persistent hunting by a person familiar with their habits ever to find one.

The Sea Turtle

The common Green Turtle (*Chelonia agassizii*), ranging throughout the tropical waters of the Pacific and reaching as far North as Lower California, is the marine turtle found commonly in the waters of the Galápagos. Although they are particularly common in some of the large lagoons, such as those on the northern coast of Indefatigable, and wherever there are fine sand beaches, as at Gardner Bay Hood island, they may be found anywhere about the archipelago from Culpepper island on the North to Hood island on the South.

Habits—From the stomachs of the Green Turtles examined, it appears in its natural state to be principally a vegetarian although in captivity it readily eats fish and meat, and particularly is fond of the young shoots of the mangrove. For this reason it is usually common about the lagoons and coast line wherever the mangroves grow in abundance. It frequently hauls out on the sand beaches to dry off, and it is here the female comes ashore to deposit her eggs, the nesting season beginning about the month of May. The female hauls up just above the high tide line, where she digs a moderately large hole, two or three feet deep, and deposits from 100 to 200 eggs. These are white, about one inch in diameter, with a thin leathery shell. The turtle covers the eggs with sand, smoothing off the top of the nest to the beach level with her flippers, and leaves them to be hatched by the heat of

the sun. The period of incubation is from six to eight weeks, when the turtles, breaking their way through the egg shell, work their way to the surface and make directly for the water. The adult turtle has few if any enemies other than man. Probably a shark bites off a flipper now and then, but the greatest mortality takes place among the young which are devoured by the larger fish, and only a very small percentage of those which reach the water survive.

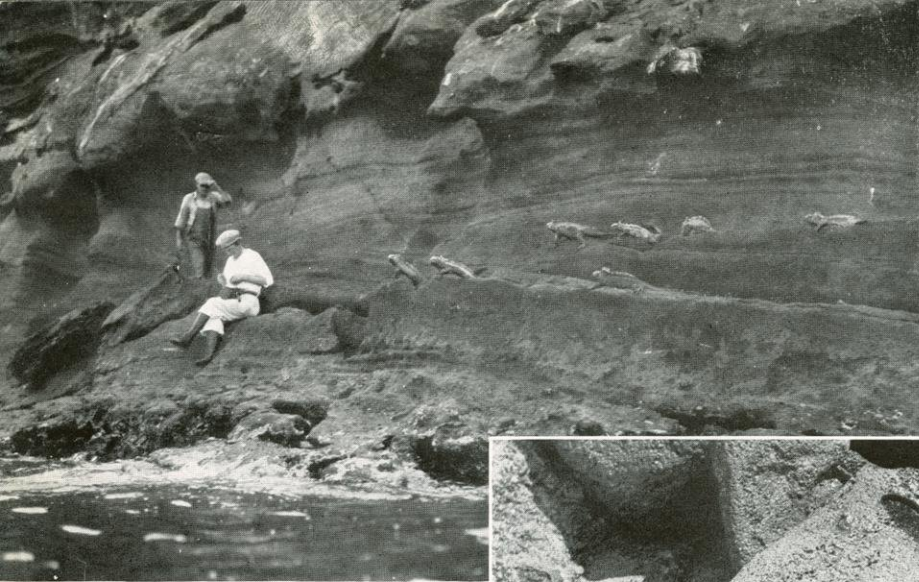
The Sea Iguana

Next in point of interest to the Giant Land Tortoise is the Sea Iguana (*Amblyrhynchus cristatus*), the only lizard in the world solely dependent on the ocean for its food, and confined strictly to the Galápagos archipelago. Some of the large males reach a length of five feet and exceed the Land Iguana in size. The largest individuals have been found at Iguana Cove, Albemarle, and off the South coast of Indefatigable to the westward of Academy Bay. In 1875 Commander Cookson of HMS *Peterel* reported that the rocks about Iguana Cove were thickly covered with Sea Iguanas and that they were more numerous than at any other place. They were found to weigh twenty to twenty-two pounds, against twelve to fourteen pounds from other localities.

Lieutenant Shillibeer reported Sea Iguanas common on Charles island under the date of July



While Swimming, the Sea Iguana Keeps Its Legs Close to the Body and Propels Itself by an Undulating Movement of the Body and Tail. (Photo by George Stone)



At Left—Sea Iguanas Inquisitively Watch the Preparations of the Cameraman. (Photo by George Stone)

Below—*Amblurhynchus cristatus* Enjoys Basking on the Lava Boulders at Conway Bay, Indefatigable Island. (Photo by John Tee-Van)



25, 1813. He says: "Guanas we found here in great abundance, and notwithstanding their disgusting appearance, they were eaten by many of the sailors, who esteemed them as most delicious food." A subsequent entry in his journal shows that he is referring to the Sea Iguana.

The Sea Iguana has a strongly compressed tail, flattened for swimming and large convex or conical shields on the top of the head. A dorsal crest of large, lanceolate spines extends from the back of the head almost to the tip of the tail. The claws are long and sharp, the digits compressed and united at the base with a rudimentary web. The eye is chestnut-brown, with a round, black pupil.

During the mating season the Sea Iguanas are brilliantly marked with large blotches of metallic green and red, but at other seasons of the year the coloring is quite somber with only traces of dull red and green on a ground color of black. The smaller iguanas are a uniform dull black.

Despite the fact that they are armed with sharp tricuspid teeth, they never offer to bite or even open their mouths when picked up by the tail.

Distribution—There is but one species of Sea Iguana and it has been found on nearly all of

the islands and islets of the archipelago. It is still common or abundant on all but Chatham and Charles. On account of the wild dogs it has become very rare on the former and probably extinct on the latter. However, it is common on Champion and Enderby, about a mile off Charles, where there are no dogs.

Habits—The Sea Iguana never wanders from the coast line but confines itself closely to the rocks along the water's edge or to the sand beaches. Its food consists solely of "sea lettuce," an alga which it gathers off the rocks at low tide. When not feeding, the Sea Iguana generally resorts to the lava boulders where it may be found singly or in pairs or in colonies basking in the sun. In places, the rocks are discolored over large areas from the droppings of generations of iguanas at some favorite spot. Some herds seen on Narborough island contained hundreds of individuals. When the tide

is low the Sea Iguana crawls over exposed flats or swims to the outlying rocks to feed. If it happens to be on a rock that is swept by the sea, it keeps a close watch on the approaching swells. As the incoming sea is about to break, the iguana crouches close, allowing the water to wash completely over it; the long, sharp claws enable it to cling so tightly that not even a

heavy swell will dislodge it.

Although the Sea Iguana is an excellent swimmer, unless making its way to some outlying rock for food it is loath to enter the water and if thrown in will make for the nearest point of land and climb to safety. This might be on account of the great number of sharks in the Galápagos waters, which seem to be its only enemy. It swims with its legs folded close to the body and propels itself by an undulating movement of the body and tail.

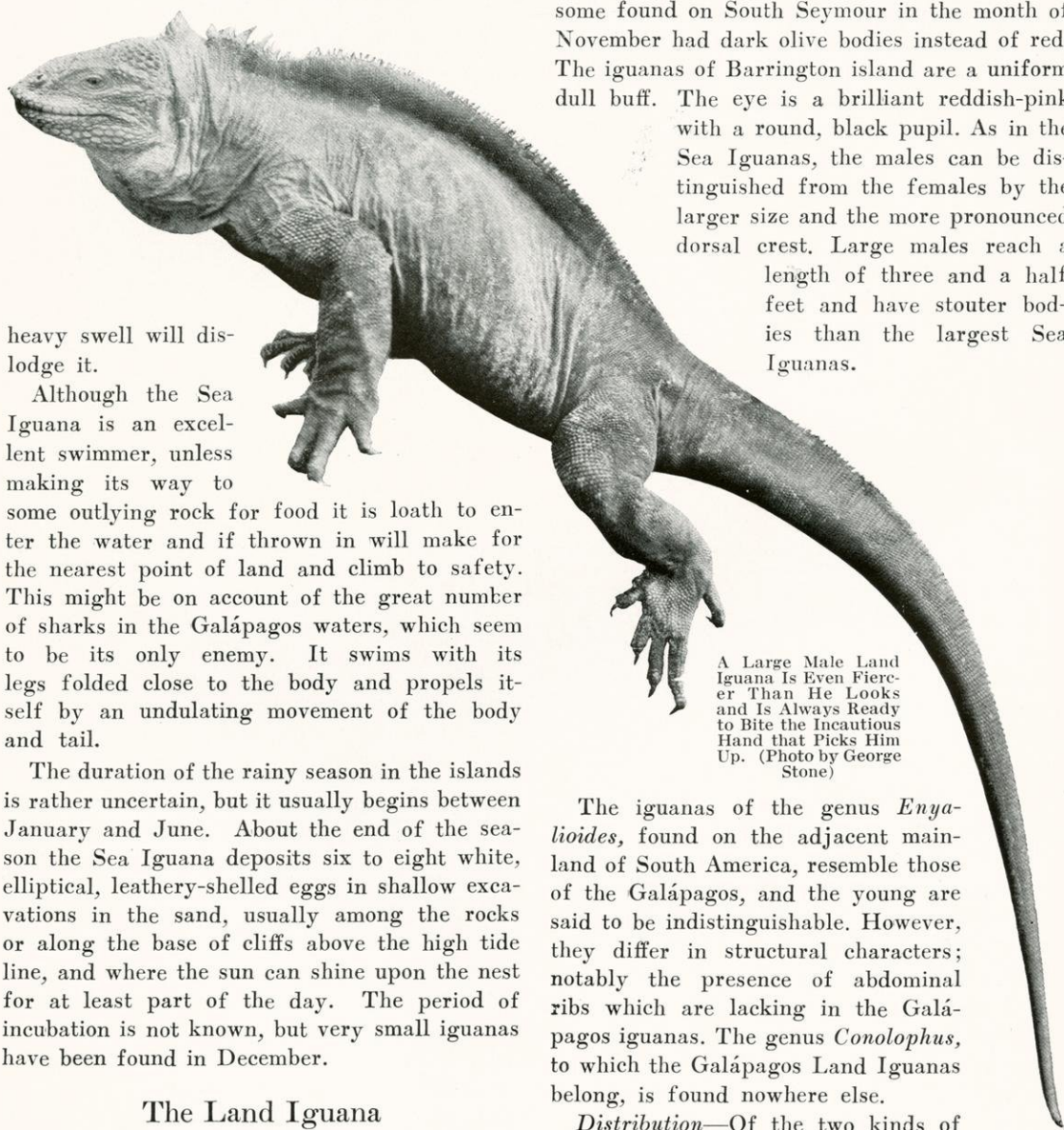
The duration of the rainy season in the islands is rather uncertain, but it usually begins between January and June. About the end of the season the Sea Iguana deposits six to eight white, elliptical, leathery-shelled eggs in shallow excavations in the sand, usually among the rocks or along the base of cliffs above the high tide line, and where the sun can shine upon the nest for at least part of the day. The period of incubation is not known, but very small iguanas have been found in December.

The Land Iguana

The Land Iguana differs from the Sea Iguana both in form and coloration. The tail is rounded instead of flattened and there is no

trace of a web at the base of the digits or toes. The head is considerably longer, the jaws more powerful, and the large conical head-plates characteristic of the Sea Iguana are lacking.

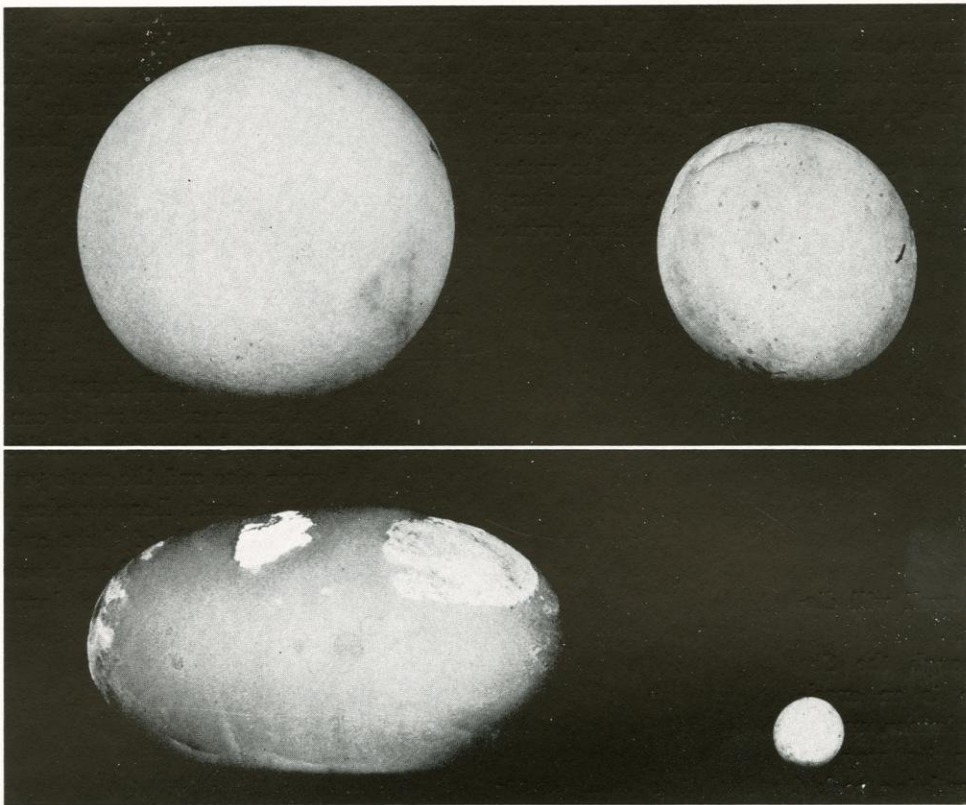
The general coloration of the Land Iguana inhabiting South Seymour, Narborough, Albemarle, and Indefatigable islands is reddish on the body with yellow head and feet, but some found on South Seymour in the month of November had dark olive bodies instead of red. The iguanas of Barrington island are a uniform dull buff. The eye is a brilliant reddish-pink with a round, black pupil. As in the Sea Iguanas, the males can be distinguished from the females by the larger size and the more pronounced dorsal crest. Large males reach a length of three and a half feet and have stouter bodies than the largest Sea Iguanas.



A Large Male Land Iguana Is Even Fiercer Than He Looks and Is Always Ready to Bite the Incautious Hand that Picks Him Up. (Photo by George Stone)

The iguanas of the genus *Enyalioides*, found on the adjacent mainland of South America, resemble those of the Galápagos, and the young are said to be indistinguishable. However, they differ in structural characters; notably the presence of abdominal ribs which are lacking in the Galápagos iguanas. The genus *Conolophus*, to which the Galápagos Land Iguanas belong, is found nowhere else.

Distribution—Of the two kinds of Land Iguanas found in the archipelago, one species (*Conolophus pallidus*) is confined to Barrington island and the other (*Conolophus sub-*



Above (Left)—The Hard-Shelled Egg of the Giant Land Tortoise (*Testudo g  ntheri*). (Right) The Thin, Leathery-Shelled Egg of the Green Turtle (*Chelonia agassizii*). Natural Size.

Below (Left)—The Leathery-Shelled Egg of a Gal  pagos Land Iguana (*Conolophus pallidus*) Compared with the Little, Hard-Shelled Egg of the Gecko (*Phyllodactylus tuberculatus*) at the Left. Natural Size. (Photos from California Academy of Sciences)

cristatus) has been taken on Narborough, South Seymour, Albemarle and Indefatigable islands. The latter species is still common on South Seymour and Narborough but very rare on Albemarle and Indefatigable. On Albemarle an occasional one may be met with around the base of Tagus Cove mountain, and on Indefatigable in the vicinity of Conway Bay. The Hassler expedition (1872) reported that Land Iguanas were common at Tagus Cove. On James island they are probably extinct. Some bones were found on the Academy's expedition of 1905-1906, but no signs of living iguanas or recent burrows were discovered. Captain Abel de Petit-Thouars, of the French Frigate *Venus*, reported them (1836) numerous on James island. The introduction of dogs was the primary cause of the decline in numbers, although natives who killed them for food are partly responsible.

Habits—On Barrington island the iguanas were found to be living in a colony on a plateau near the center of the island, the females inhabiting burrows in the loose soil and most of the males living in the rock piles encircling the plateau. The ground is composed of soft volcanic ash in which burrows can be dug with ease. These are about three feet in depth and dug obliquely into the earth. On South Seymour and Narborough the iguanas are found scattered promiscuously about the islands, and not in a colony such as was found on Barrington. South Seymour is a low, flat island and is not to be taken as representative of the elevation at which they may be found elsewhere. On Narborough which, according to the South America Pilot, is 3,720 feet high and according to the Hydrographic Office chart 4,320 feet, they range from sea level to the rim of the crater.

Great numbers of old burrows are still to be found on Albemarle and Indefatigable and judging from the extent of these extinct colonies their numbers must have run into the hundreds and possibly to a thousand or more. Darwin, in his "Journal of Researches" (*op. cit.*) says of the colonies on James island: "I cannot give a more forcible proof of their numbers than by stating that, when we were left at James island, we could not for some time find a spot free from their burrows on which to pitch our single tent."

Lieutenant Shillibeer remarked that, "The number of guanans we saw here, can alone be conceived; they had regular burrows, and were much more plentiful than I have ever seen rabbits in a preserve in this country. They are of a light red color, about two to three feet long, and when pursued, do not like those at Charles Island, take to the water."

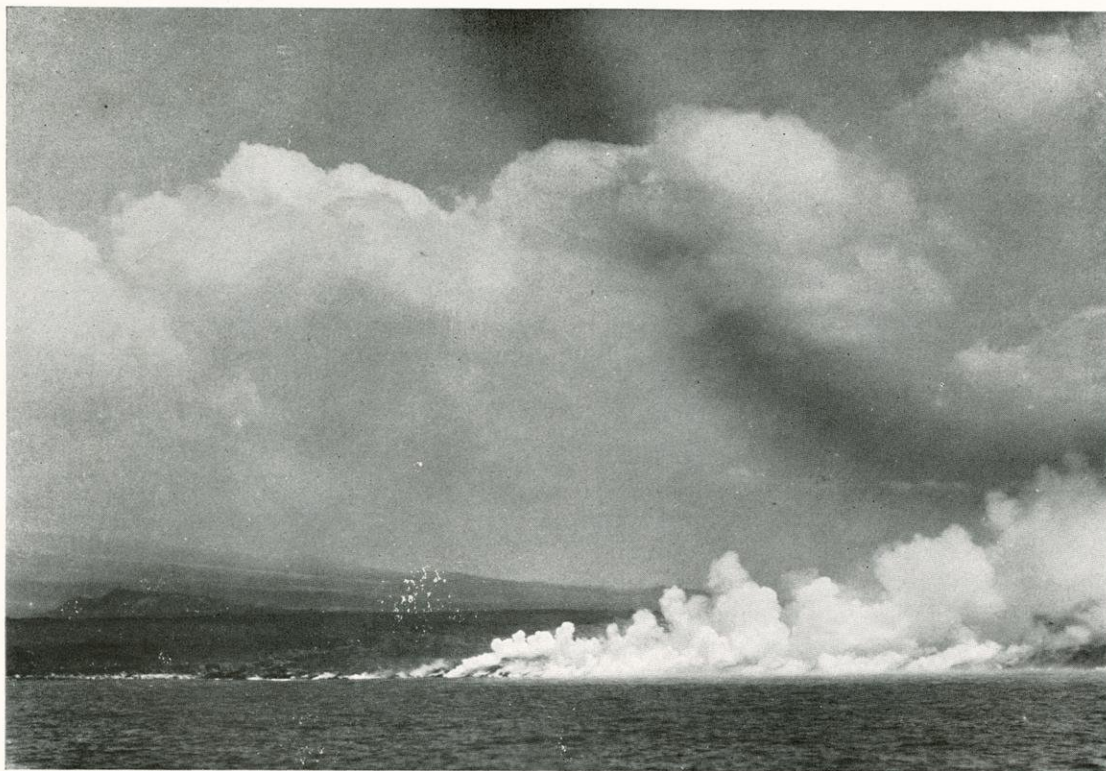
The Land Iguana feeds on almost any sort of vegetation and although mostly terrestrial is

occasionally found climbing up the low bushes or trees where it can reach the flowers or the fruit of the cactus.

Although awkward in their movements, they can cover the ground at a fair rate of speed for a short distance. When chased they usually make for a rock pile or their burrows, from which they can be pulled with ease by the tail.

The female deposits her eggs in the loose earth, allowing the heat of the sun to hatch them. The exact time they are deposited is not definitely known but females taken on Barrington island late in December had seven to ten white, elongate, leathery-shelled eggs ready for extrusion. These measured three inches in length and an inch and three-quarters in diameter. Strange to say, recently hatched young have never been found.

Unlike the Sea Iguana, which is very docile, the Land Iguana is extremely vicious. When held by the tail it will keep its mouth wide open



Passing Close to Mangrove Point on Narborough Island, the Captain G. Allan Hancock Expedition Found One of the Minor Craters in Eruption and the Molten Lava Pouring Into the Sea Through a Subterranean Tunnel. (Photo by George Stone)

ready to grab whatever comes within reach, and the sharp, tricuspid teeth and powerful jaws enable it to inflict a severe bite.

The Lava Lizards

Next to the iguanas, the moderate sized Lava Lizards attract the attention of the visitor. The genus *Tropidurus*, to which they belong, is not confined to the Galápagos but is found throughout a greater part of South America and a closely allied genus (*Liocephalus*) occurs in both South America and the West Indies. However, none of the species occurring on these islands is found elsewhere. The Lava Lizards of several of the islands may appear similar to the casual observer, but a more thorough examination of those from Abingdon, Duncan, Bindloe, and Chatham islands will at once show that they differ from each other and from those of the other islands of the archipelago, a fact which tends to show an early isolation of these particular islands. Those of Hood island have the largest males of any of the species, reaching a length of twelve or thirteen inches and differing greatly from the females in both size and coloration. The males have large crests, many irregular black spots on the back, with much red on the sides and belly, while the females are a dull uniform olive with brick-red heads and throats. The males of all of the species may be distinguished by the larger size and the more pronounced dorsal crest.

The principal enemy of the Lava Lizards is the Galápagos Hawk, while the snakes account for a few. On Charles island where cats have been introduced, this lizard has become almost extinct. Only occasionally is it met with on the lava beds at the North end of the island.

Distribution—Lava Lizards occur on almost every island and islet of the archipelago, the most notable exceptions being Culpepper, Wenman, and Tower islands. There are several of the islands each having its own peculiar species, but no island has more than one. The following list of species and of the islands on which they occur is made from a study of the material secured on the Academy's expedition of 1905-1906:

	ISLAND
<i>Tropidurus pacificus</i> ...	Abingdon
<i>duncanensis</i>	Duncan
<i>habelii</i>	Bindloe
<i>bivittatus</i>	Chatham
<i>delanonis</i>	Hood
	Gardner (near Hood)
<i>grayii</i>	Charles
	Gardner (near Charles)
	Champion
	Enderby
<i>albemarlensis</i>	Indefatigable
	South Seymour
	North Seymour
	Daphne
	James
	Jervis
	Cowley
	Brattle
	Albemarle
	Narborough
<i>albemarlensis</i>	
<i>barringtonensis</i> ..	Barrington

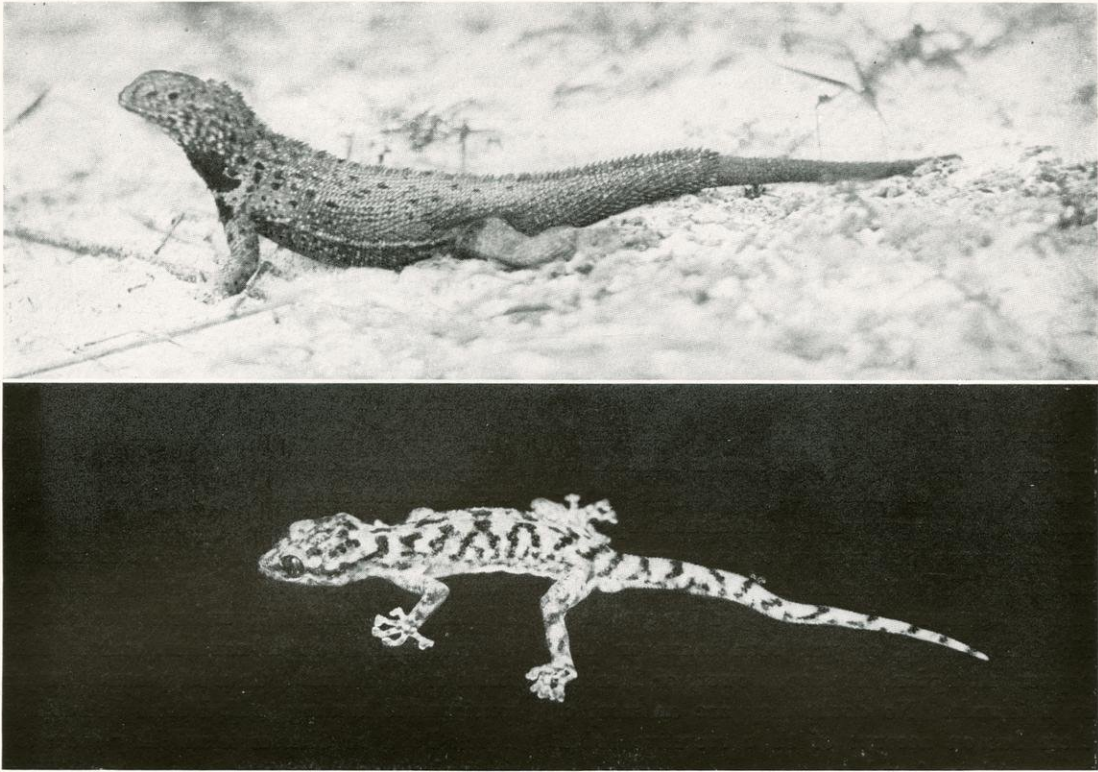
Habits—On the smaller islands these lizards range from the shore line to the summit, but on the larger ones they are found more commonly along the coast. They are never seen high up in the green zone of the mountains, as on Albemarle and Indefatigable, and are rarely seen above 800 or 900 feet.

In the months of May and June females were seen digging holes in the sand, no doubt for depositing their eggs, and during this time were found with three to six eggs about ready for extrusion. These were about an inch long and, like the eggs of the iguana, have a soft, leathery shell.

Although these lizards are mostly terrestrial they at times climb into the bushes and to the tops of the cactus leaves to get the fresh buds. While a large portion of their diet is composed of vegetable matter, they also feed on grasshoppers, flies, beetles, and other insects.

The Geckos

The remaining lizard of the archipelago is the Gecko, belonging to the widely distributed genus *Phyllodactylus*. Geckos of this genus are found in South America, Central America, South



Above—A Male Galápagos Lava Lizard (*Tropidurus delanonis*) on Hood Island. The Tail Has Been Broken Off and Has Regrown. (Photo by Toshio Asaeda)

Below—This Species of Gecko (*Phyllodactylus tuberculosus*) Was Found on Chatham Island. The Vertical Pupil of the Eye Can Easily Be Observed in the Living Specimen, and the Picture Shows the Peculiarly Shaped Toes. Natural Size. (Photo from California Academy of Sciences)

Africa, the Antilles, the United States, and Australia.¹

The Geckos of the Galápagos can readily be distinguished from the Lava Lizards by their small size (the largest are not more than four inches long), by the character of the skin, which is very delicate and soft and covered with minute tubercles, and by the peculiar construction of the feet. Close examination will show that each digit has many transverse lamellae or thin leaf-like processes. Pressing down the foot on any surface forces out the air and minute vacua are produced by a partial retraction, which allows the lamellae to resume their original position. It is thus that the Gecko is enabled to climb smooth and vertical surfaces

or to run along the ceilings. The pupil of the eye is vertical, instead of round as in the Lava Lizards, showing that it is nocturnal in its habits, and it has no movable lid. The ground color of the Gecko is a light gray, sometimes with dark or black reticulations. At night, when these little lizards are under a bright light, they appear to be almost transparent.

Although Geckos are perfectly harmless, it seems to be a popular belief throughout the world that they are extremely venomous and even deadly.

Distribution—The distribution of the Galápagos Gecko is as follows:

	ISLAND
<i>Phyllodactylus tuberculosus</i>	Chatham
<i>leei</i>	Chatham
<i>barringtonensis</i>	Barrington
<i>gilberti</i>	Wenman

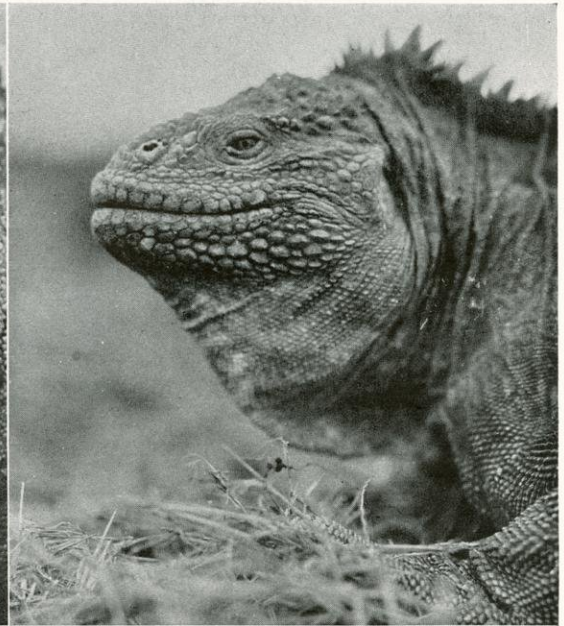
¹A second genus of Gecko (*Gonatodes*) has been reported as having been taken on Chatham island by Dr. George Baur, but as it has never been taken by any other collector, despite the fact that hundreds of Geckos have been collected on Chatham, other authors have suggested that it might have been at Guayaquil, where Dr. Baur also collected, and that there was a mistake in the labeling of the collections.

<i>bauri</i>	Charles
	Gardner (near Charles)
	Champion
	Enderby
	Hood
	Gardner (near Hood)
<i>galapagoensis</i>	Indefatigable
	James
	Cowley
	Brattle
	Albemarle
<i>galapagoensis</i>	
<i>daphnensis</i>	Daphne

As is seen in the foregoing list, Chatham is the only island having more than one species of Gecko. One of these (*Phyllodactylus tuberculatus*) is a very widely distributed species, and thus may be assumed to be a recent importation, all of the other species found in the Galápagos having been developed by evolution. No Geckos have, as yet, been taken on Culpepper, Abingdon, Bindloe, Tower, or Narborough islands. No doubt they are on most of them but on account of their secretive habits have not been found.

Habits—Geckos are really beneficial in tropical countries where they are found most commonly, as they frequently inhabit the houses, feeding on the numerous insects which help to make life unpleasant. In the daytime they secrete themselves back of pictures on the walls, in hollow bamboo rafters, and in the thatched roofs. As it turns dark they emerge from their hiding places and lie in wait around the lights for any insects which may come near. On sighting their prey, they scurry across the ceiling and grab their victims with such speed that the eye has difficulty in following.

Like the Lava Lizards, the Galápagos Geckos are confined more or less to the lower levels and are rare above 1,500 feet. Being so small and also nocturnal, a visitor to the islands would probably not meet the species unless he knew just where to look. Where there are no habitations, Geckos hide under stones, the bark of trees, in the dead branches, and in hollow stalks of dead brush. In most places it requires considerable hunting to find them but at Black Beach Road on Charles island they seem to be particularly abundant and easy to find. By



At Left—The Head of a Sea Iguana (*Amblyrhynchus cristatus*). Note the Conical Shields on the Top of the Head and the Short Mouth.

At Right—The Head of the Land Iguana (*Conolophus subcristatus*) Shows More Powerful Jaws, a Larger Mouth, and a Lack of the Conical Shields of the Sea Iguana. (Both Photos by George Stone)

turning over stones in the vicinity of the landing it would not be difficult to find numbers of them. Where there are good sand beaches they may be found at night just above the high tide line, running along the edge of the piles of debris washed up by the sea. Here they feed on various minute insects, ants, and flies, which form a considerable portion of their food.

The Gecko lays its eggs under stones or in the trunks of hollow trees sometimes ten or more feet above the ground. The eggs, sometimes three or four but mostly two in number, are globular or slightly oval in shape, about ten or eleven millimeters in length, with thin, white, hard shells. Broken shells are often found under stones and the bark of trees. Fresh eggs were taken in April.

The Snakes

Seven species of Land Snakes and one species of Sea Snake have been reported from the Galápagos. The Land Snakes belong to the genus *Dromicus*, also found on the adjacent mainland, and are distributed as follows:

	ISLAND
<i>Dromicus biserialis</i>	Charles
<i>hoodensis</i>	Hood
<i>slevini</i>	Gardner (near Hood) Duncan
<i>steindachneri</i>	Narborough Albemarle (Cowley Mountain)
<i>dorsalis</i>	Indefatigable South Seymour Jervis
<i>occidentalis</i>	James
<i>occidentalis helleri</i> .	Indefatigable South Seymour Barrington Narborough Brattle Albemarle (Cape Berkeley)

None of these species is found elsewhere than on the Galápagos. These snakes are non-venomous, rather slender in form, and reach a length of from three to four feet. To distinguish the various species requires a somewhat close study, but the casual observer will note

that there are two distinct types of coloration: striped and a spotted form. Both may belong to the same species and be found on the same island. Snakes are found most commonly on Hood and Indefatigable islands.

No snakes have been taken on Culpepper, Wenman, Abingdon, Bindloe, Tower, or Chatham islands.

Habits—Like the lizards, the Galápagos Land Snakes are generally found in the brushy areas of the lower levels. They are considerably more shy than the other reptiles and will not allow too close an approach. If frightened, they at once seek the cover of some sheltering crevice in the lava. Their food consists of lizards, both the Gecko and the Lava Lizard, grasshoppers, beetles, and various other insects. Nothing is known concerning the breeding habits of Galápagos Land Snakes.

A Yellow-bellied Sea Snake (*Pelamis platurus*) was recorded by the Academy's expedition of 1905-1906 between Chatham and Hood islands. This is the only other species of snake found in the archipelago and is the most widely distributed of any of the salt water snakes, being found from Indo-Australian waters as far North as southern Siberia, and South of Tasmania. It ranges in an easterly direction across the Pacific to the coast of Central America and is found abundantly in the Gulf of Panama.

This Sea Snake belongs to the *Proteroglypha*, a group of snakes which have the anterior maxillary teeth deeply grooved or folded, so as to appear hollow. Like all other sea snakes, it is venomous and human deaths from the bite have been reported.

This particular species is probably the most variable in coloration of any of the sea snakes. The most common coloration is a dull black with yellow and brown on the sides and belly, the two colors being well defined. However, some may be yellow on the sides and belly with a vertebral series of spots, and some entirely yellow. The tail is usually yellow with black or bluish bars. This extreme variation has led some students to believe that they were dealing with several distinct species, but it is now recognized that these differences are simply color variations of different individuals that are all of one kind.

In their natural habitat the sea snakes are graceful and rapid swimmers and are often seen coming to the surface to breathe, then diving down again with remarkable rapidity, the nostrils being fitted with an interior valve which may be opened during respiration and closed when diving. The flattened tail, specialized for life in the water, enables them to dive with swiftness and grace. Their food consists of small fish which are killed by the action of the venom before being swallowed.

At times *Pelamis platurus* may be seen in large numbers while basking upon the surface of the water along the Central American coast, or it may be seen at night under the anchor lights of vessels. Like all other sea snakes, it is viviparous. During the breeding season the female visits small rocky inlets or tide pools to give birth to the young. The adult reaches a length of about three feet. Raptorial fish and birds of prey seem to be the chief enemies.

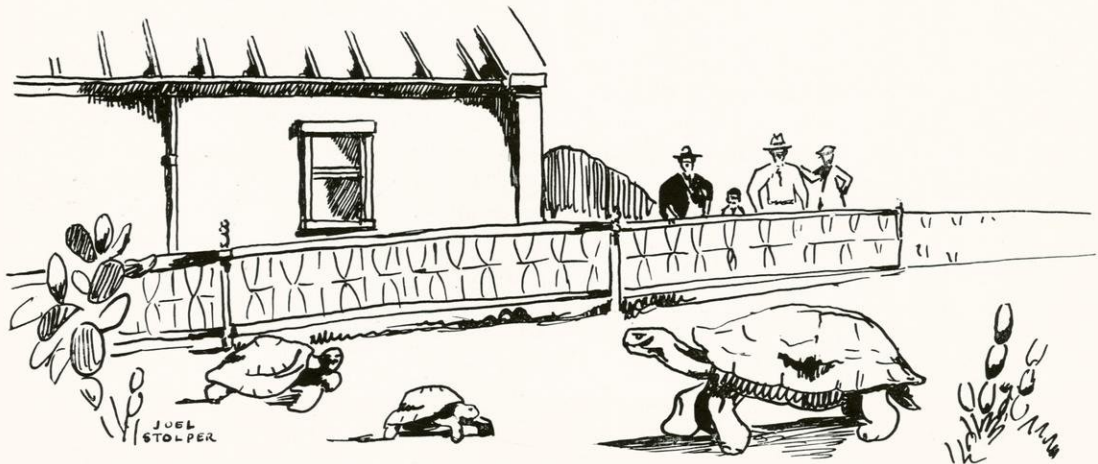
Summary

A study of the reptiles tends to show that at one time the Galápagos archipelago was a single land-mass, which at some remote geological period gradually broke up to form the present group of islands. As a gradual depression took place, the higher parts became isolated islands, and through a long period of time changes took place in the isolated colonies of reptiles, producing specific and subspecific differences. Each island has its own species of

Tropidurus, and each, with the exception of Albemarle, its own species of tortoise. Study of the tortoises of Albemarle island leads one to the conclusion that at one time its five mountain peaks were separate islands and remained so long enough to permit specific characters to develop; hence it has five species of tortoises. There is evidence that at some period during the formation of the archipelago, an elevation of the ocean bottom took place, joining the five peaks of Albemarle so as to form the present island. Terraces containing the characteristic cavities made by sea urchins were found several hundred feet above sea level, near Tagus Cove, and old sea cliffs situated inland from Iguana Cove give proof of a recent elevation having taken place.

In the formation of the present archipelago a study of the lizards of the genera *Tropidurus* and *Phyllodactylus* tends to show that the breaking up of the land-mass began at the northern part, and that Wenman, Abingdon, and Bindloe became separate islands to the northward. Changes then taking place in the southern portion, Hood and Chatham separated from the main island, leaving a large arm or bay extending northward and isolating Duncan island.

The remaining portion, no doubt, formed a single island for a long time after the separation of the northern and southern islands, but their history is much more difficult to trace, differentiation in the reptiles not having reached an advanced stage as yet.



Observations on the Seasonal Hair Moults in a New York State Weasel (*Mustela noveboracensis*)

CHARLES V. NOBACK

A NEW YORK STATE weasel (*Mustela noveboracensis*) which had been kept by Dr. W. J. Hamilton, Jr., of the Department of Zoology at Cornell University at Ithaca, New York, for more than two years, was sent to the New York Zoological Park and was received on June 29, 1933.

The slender, active, and nervous creature was about eight inches long, with keen, black, beady eyes and black-tipped tail. His white abdomen faintly tinged with yellow stood out in contrast to the brown summer body coat. On account of his highly sensitive nature, the weasel was kept in a secluded quiet place in order to avoid its being disturbed. Any undue noise caused it to become greatly excited and go into convulsions.

During the course of a few days the weasel, nicknamed "Herman the Ermine" by newspaper reporters, who watched his progress with interest, became very much at home when housed in a large, comfortable, half-inch wire mesh cage and fed on choice bits of fresh beef or mice, and supplied with a dish of clean and cool water. A wooden platform was provided at one end of the cage, where Herman would lie stretched out as he basked in the warm sunlight or romp about, according to his mood.

While the fact is known that weasels in northern latitudes may have a pure white winter pelage with a black-tipped tail and later during early spring acquire a coat of brown hair for the summer, relatively few records have been made as to when these changes in the hair coat take place and how long it takes before they are completed. In other words, what is the duration of the spring and fall moults?

It is naturally very difficult, if not impossible, to observe these lively creatures in their wild state in order to make accurate observations on their color changes. Consequently, observations as to when and how long it takes for these changes to occur can best be made by studies of captive specimens.

The literature on moulting in weasels has been carefully reviewed by Dr. Hamilton in his

work, "The Weasels of New York: Their Natural History and Economic Status," published in *The Midland Naturalist*, Volume XIV, July, 1933, No. 4.

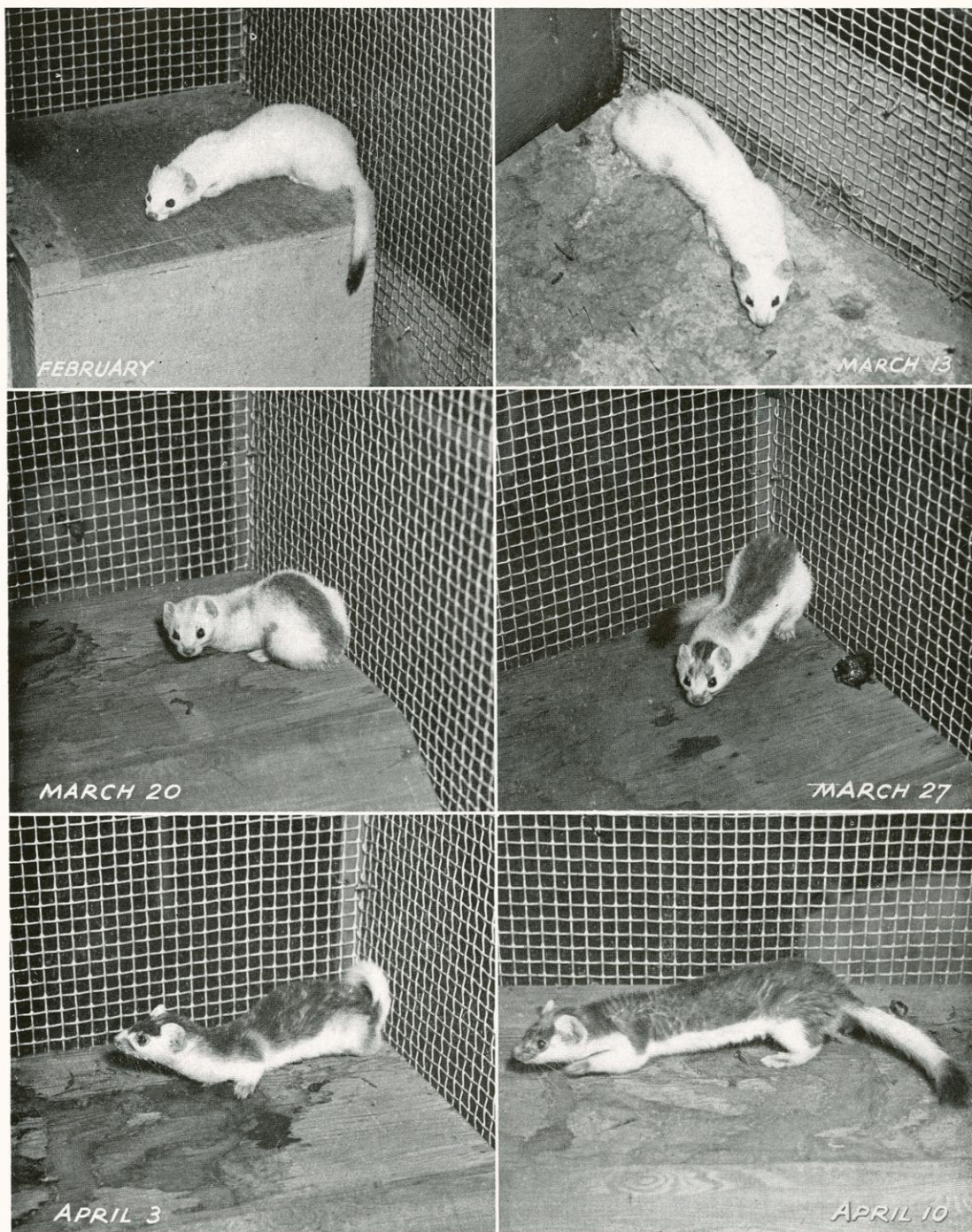
The purpose of this note is to record some observations made on the color changes in the hair coat of a captive New York State weasel.

During the summer and early fall of 1933 the weasel continued to remain brown except for the white abdomen and black-tipped tail. The first change in the color of the pelage or hair coat was noted on about October 15. At that time the first white hairs were seen around and between the eyes. During the following three weeks white hairs were observed cropping out along the sides of the face, on the shoulders, legs, and sides of the tail. The dorsal or upper part of the tail remained brown while the tip remained black.

On November 6 a considerable amount of white hair was seen to be present on the face, throat, ventral portions of the neck, part of the shoulders, forelimbs, abdomen, sides of the body (flanks), and tail, except its black tip. The dorsal portion of the tail was still mottled brown and white. The hair of the forehead, top of the head, the whole dorsal area of the body (back) from the nape to the tail was light brown with a sprinkling of white—pepper and salt. Fur trappers call this the "grayback" stage. They consider pelts of this kind valueless, since they are neither brown nor white. From the general appearance of the weasel at this date it seemed that the pelage would be pure white within about two more weeks.

The hair coat continued to change steadily from brown to white from November 6 to November 10.

The status of the color of the hair coat on November 11 was as follows: Small amounts of brown hair were present on the back of the head, neck, along the back, and upper flank. The brown hairs were being rapidly shed and replaced by white hairs. Some brown hairs were present on the sacral and gluteal regions, as



Herman the Ermine in His Great Transformation Scene—a Series of Photographs of a New York State Weasel (*Mustela noveboracensis*) Taken at Intervals of One Week as He Moulded from Winter to Summer Pelage. (Photos by Joseph Lyons, Staff Photographer of The New York Sun)

well as at the base of the tail. The tail hairs were all white, except for the black tip. The remainder of the body was white.

On November 16 the outer margins of the ears were hairless and were pigmented light brown to yellowish. Traces of brown hairs were visible along the posterior half of the back; the remainder of the body was white.

Except for traces of brown on the haunches, the weasel was pure white on November 18.

On November 20 only a few very faint traces of brown hairs were present in the region on the tail and on the rump.

On November 22 the weasel at last was snowy white, except for the characteristic black tip on its tail. In its coat of pure white it closely resembled the ermine, a species of pure white weasel found in the Arctic regions, whose fur is highly prized and is used for making capes for royal personages.

It took about 37 days for the change or moult from the brown summer pelage to the white winter pelage to take place in this weasel. A picture of the weasel in his snowy white coat of winter is shown in the accompanying photograph.

During the winter months, Herman remained white until about March 5, when two narrow brown pencil-like stripes were seen just over the eyebrows and a faint brownish stripe began to show itself along the spine. These were the first indications that the change from the white winter pelage to the brown of summer was taking place.

By March 7 a clearly defined band of brown became clearly visible along the back from the shoulder to the base of the tail. It could now be recognized that the brown hair of the newly forming summer pelage was replacing the white winter hair.

Two brown stripes over the eyes and two brown stripes alongside the nose, together with a relatively broad band of brown over the posterior half of the back, showed the marked changes in color over a period of eight days—from March 5 to March 13—as illustrated in the photograph made on March 13.

Definite and striking changes took place in the hair coat during the next week. The brown stripes over the eyes, alongside the nose, the

prominent brown patch on top of the head, and the clearly defined band of brown hair over the rump, stood out clearly in contrast to the white body, as can be seen in the photograph made on March 20.

From March 20 to March 27, the brown pelage was clearly apparent—solid brown from the face, over the top of the head, along the nape, over the back, along the sides, flanks, and part of the tail.

On April 7 the change had been practically completed and "Herman the Ermine" was clothed in his summer coat of brown. The spring change or moult lasted approximately 33 days.

The rhythm of color changes in the pelage of this weasel coincides with the seasons—white in winter and brown in summer. It is interesting to note that the specimen under observation had been kept indoors at a constant temperature of from 65° to 75° F. and had not been out of doors during the winter season. The color changes in this case coincided with the seasonal changes, as noted in some weasels under natural conditions.

The process of change appeared to manifest itself by a complete shedding of the brown, or colored hairs, for each morning clumps of brown hair were found on the floor of the cage.

There were no bare areas on the skin but instead new white hairs were present, indicating that perhaps new white hairs had grown out to replace the brown hairs and the latter were then shed. It seems that the old loose hairs caused a slight itching of the skin, because it was noticed that the weasel scratched himself and caused the old hair to fall out.



BULLETIN

NEW YORK ZOOLOGICAL SOCIETY

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 WILLIAM BRIDGES, *Editor and Curator, Publications*

NOTE: All pictures not otherwise credited are from the photographic collection of the Zoological Park.

The death of William White Niles, a member of the Board of Trustees of the New York Zoological Society, took place at his residence in this city on January 12, 1935.

The useful and earnest life of Mr. Niles was distinguished by his devotion to state and civic affairs and by his loyalty to the best interests of the Zoological Society for a period of forty years.

The following resolution expressing the sincere regret of the Executive Committee was duly adopted:

WHEREAS, William White Niles passed away on the twelfth day of January, 1935, and

WHEREAS, Mr. Niles was instrumental in amending and passing the Bill for the Charter and Incorporation of the New York Zoological Society while an Assemblyman at Albany, and

WHEREAS, Mr. Niles was closely identified with the organization and management of the Society and was the author of various amendments to the Charter, and

WHEREAS, he had served continuously on the Board of Trustees since 1898, and

WHEREAS, he had acted as the Executive Sec-

retary of the Society since 1926, now therefore be it

Resolved, that his death is an irreparable loss to the Society and its work at the Park and Aquarium, and be it further

Resolved, that the Trustees of the New York Zoological Society hereby place on record their sense of profound loss and desire to express to Mr. Niles' family their deepest sympathy, and be it further

Resolved, that a copy of this resolution be sent to the family of the late William White Niles.

Elwin R. Sanborn

Mr. Elwin R. Sanborn, Editor and Photographer, whose services to the Zoological Society have extended over a period of more than thirty-five years, retired on pension on December 31, 1934.

It is no exaggeration to say that the work of Mr. Sanborn in the field of wild animal photography is in a class by itself, and beyond compare. The splendid library of photographic negatives which the Zoological Society possesses is the finest in existence and reflects great credit upon Mr. Sanborn's skill and artistic ability.

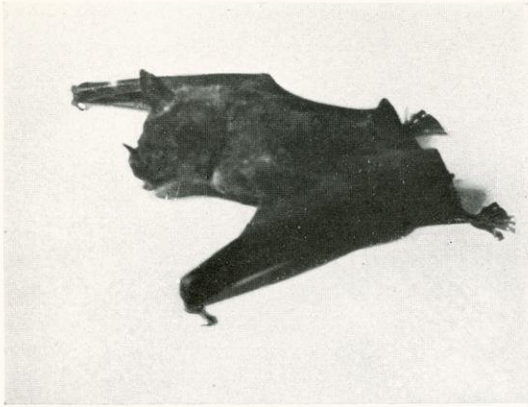
Mr. Sanborn retired with the good will and esteem of the officers of the Zoological Society as well as that of the officers and men of the Zoological Park, who wish him many years of enjoyment of the rest that he has so justly earned.

* * *

William Bridges

Mr. William Bridges, late of the New York Sun, has joined the staff of the Zoological Park as the Editor and Curator of Publications.

Mr. Bridges is a graduate of Franklin College, Franklin, Indiana, and since he has had extensive experiences as a writer and in the publishing field, the Zoological Society is fortunate in finding so able a man to undertake the important and constantly increasing duties connected with the publications of the Society.



This Grovelling, Spraddled Style of Walking Is Typical of the Large Spear-nosed Bat (*Phyllostomus hastatus panamensis* Allen). Its Progress on the Ground Is Awkward and Ungainly in the Extreme.

Vampire Research

Studies of the Vampire Bat are being continued by the Curator of Mammals and Reptiles. The results of investigations thus far have attracted quite broad attention, and were originally based upon a single Vampire Bat brought up from Panama.

As this was the first Vampire Bat ever exhibited in a zoological institution it aroused great interest and newspapers from coast to coast printed articles about it. Visitors at the Park were very keen about seeing it, and the specimen was placed on exhibition in one of the large, glass-paneled cages in the Reptile House, where it was nightly provided with a dish of defibrinated blood from one of the slaughter houses.

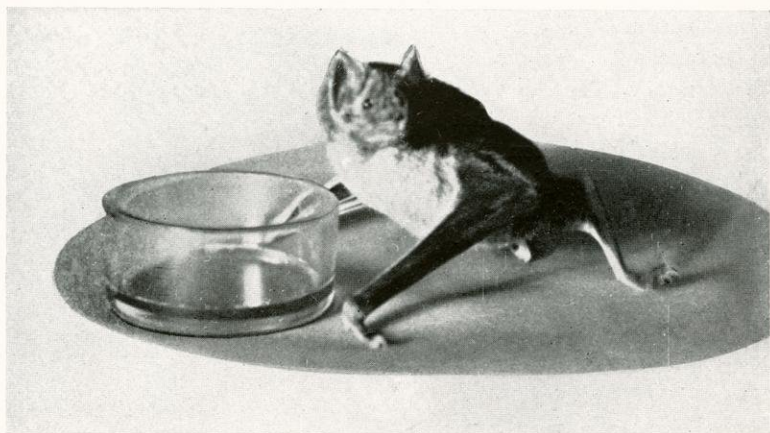
As all sorts of stories and allegations about the habits of the Vampire Bat have appeared in various publications—in fact dubious assertions may be found in some rather formal books relating to natural history—the Curator of Mammals was anxious to study the habits of the new specimen carefully. This was difficult because of the bat's aversion to light, but the evening illumination near the cage was increased week after week until at last, in a

light strong enough to note accurately what was happening, the bat would come down to the dish of defibrinated blood and consume her nightly meal. When this happened, surprising things were noted. The bat walked in slow and strange quadrupedal fashion. It also lapped its meal from the dish, with long, darting tongue.

Here was indication that the vampire was not a "blood-sucking" bat. If the action was persistent, there would be ample proof of this. Not only were the habits checked, night after night, but another steady increase of the light was made until it was possible to record all these formerly unknown habits on motion picture film.

With the film arranged as illustrative matter for a technical paper, this was presented before one of the scientific societies. There was the usual discussion and a final summary by the reader of the paper, to the effect that the habits observed quite changed the alleged history of the Vampire Bat and that the notes would soon be brought out in detail in a formal article to appear in *Zoologica*.

An unusual point of scientific ethics was brought up by one of the members of the society before which the pictures were shown. This was to the effect that a claim for the discovery of new habits, based upon a single specimen, were not satisfactorily convincing, even though the manifestations were constant in their repetition. The argument was based upon the possibility that the single specimen might be individually eccentric. This was a disturbing



On the Other Hand, the Vampire Bat (*Desmodus rotundus*) Is Remarkably Active on the Ground and Walks with a Free, Quadrupedal Motion. It Is Even Able to Hop.

note to the observer, who had worked through weeks of nightly vigils in checking the actions of an extremely difficult subject.

The argument brought about the decision, however, to obtain additional vampires, and in an area well separated from the country where the first bat had been captured.

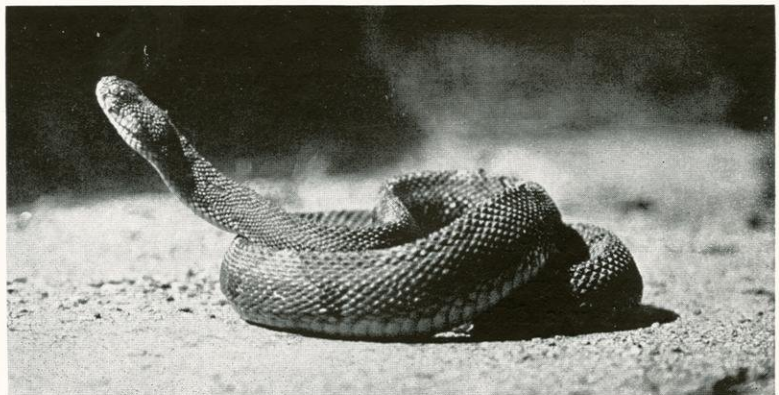
Consequently, during the past summer, the Curator of Mammals and Reptiles selected as an area of reconnoiter the island of Trinidad, which in its fauna is similar to the South American mainland in the latitude of Venezuela. There was delay in departure, and Arthur M. Greenhall, student at the University of Michigan, went on several weeks ahead. Before the Curator arrived in Trinidad, Greenhall had obtained and quartered in a screened house on the experimental grounds of the Imperial College of Tropical Agriculture, four specimens of Vampire Bats, which represented a different subspecies from the Panama form. When the Curator arrived, he spent a number of evenings watching these bats in the dim light of a lantern and he noted that all the actions of the first specimen were precisely duplicated.

The four vampires were successfully brought back to the Zoological Park and here a special cage, in which they might fly and otherwise exercise, was constructed. The cage is fronted with a long plate glass panel to provide facilities for the best possible photographic records.

In this cage the bats were gradually introduced to brighter light and finally it was possible to produce motion picture records of vampires captured about 700 miles from the source of the first one. These demonstrated in every way that the Curator's assertion that habits of the Vampire Bat, up to the time of observation of the Panama specimen, had been incorrectly or misleadingly described, and much that was new had been brought out. The motion picture records thus have been made very complete and stand as unique and of considerable value.

It is not only for the interest of exhibiting the Vampire Bat and recording its strange habits that this work has been done. The Curator is collaborating with two phases of investigation going on respectively at the Gorgas Memorial Laboratory at Panama under the direction of Dr. Herbert C. Clark and the work of a scientific commission with which Professor F. W. Urich is associated on the island of Trinidad. Both phases of research are of high importance as they relate to certain vampires carrying the organisms of disease. In Panama it has been carefully checked and conclusively proved that the vampire is a vector, or transmitting agent, of a trypanosome which lives in the blood of cattle, which are resistant to it, but when transferred to horses quickly produces a fatal result. Fortunately, this organism will not live in human blood. As vampires during their nightly flights may bite infected cattle on one occasion and on the next attack a horse, the spread of this tropical disease, called "murrina," is a serious problem. Through the study of the vampires at the Park it is hoped to determine their length of life, the amount of fluid nourishment they require, their periods of feeding, and other habits. These investigations are of benefit to Dr. Clark in expanding his work. They similarly help Professor Urich in Trinidad, where an even more serious problem is being worked out, relating to vampires as the agents in transmitting paralytic rabies, which, as so far demonstrated, is fatal to all types of victims that are bitten.

Another phase of investigation now under way



From This Coiled Position the Bushmaster (*Lachesis muta*) Can Throw His Head Forward in a Lightning Stroke Attack. The Picture Clearly Shows the Rough Texture of His Skin From Which He Gets His Native Name of "Mapipire z'Anana," the "Pineapple Snake."



During One of the Coldest of the January Cold Spells, a Shipment of a Dozen Gopher Snakes Arrived at the Park from Brownsville, Texas, and in the Brief Time it Required an Express Company to Transport Them from Lower Manhattan to the Bronx, All Twelve Were Frozen Stiff. Thawed Out in Front of a Radiator, Six Recovered and Showed No Ill Effects from the Accidental Refrigeration. This Picture Shows Two of the Snakes When They Arrived.

at the Park includes experiments to determine whether the Vampire Bat carries an anticoagulant in its saliva, which, carried to a wound by the lapping tongue, induces prolonged bleeding after a vampire bite. Certain it is that the wounds produced by these bats may bleed for a long time after the bat has gone. This is another matter to be solved in assisting in the work of the scientists in the tropics. Dr. Barry King, of Columbia University, is now engaged in this research.

R. L. D.

The Bushmaster

The Bushmaster, brought up from Trinidad the past summer, died about three months after arrival in the Park. This serpent gained considerable renown, as the species is elusive and difficult to capture. Only three other specimens have been exhibited during the thirty-five years since the opening of the Park, and there was a gap of nearly twenty years preceding last summer's arrival.

As an adult Bushmaster had never been known to take food in captivity—a circumstance that checked with other individuals and institutions that had attempted to handle them—it was decided to force-feed our specimen every week in an endeavor to keep it strong and get it accustomed to captive conditions.

Since the specimen was only six feet long and young, the process of pinning down its head, grasping it by the neck and forcing a freshly killed rat into its mouth was not difficult. Happily, the serpent took rather good-naturedly to the operation and immediately finished the process by swallowing the rat without further urging.

Soon after the snake arrived it was noticed that it was having difficulty with its old skin and cage temperature and moisture were carefully regulated to approximate tropical forest conditions. To our surprise and gratification, the snake shed its skin quite successfully and

emerged blooming and vivid in a pattern of pinkish brown with broad cross-bands of black.

Two months later, after a regular diet of forced rats and young rabbits, it apparently had improved in condition, and it shed its skin again.

We were thus rather shocked three months after the serpent's arrival to find it dead in its cage one morning. Headkeeper John Toomey announced the event with the same lack of emotion that greets all the discoveries he makes around the Reptile House—the birth of a baby Vampire Bat on one occasion, the death of a famous old alligator on another.

Dr. Noback performed an autopsy that disclosed that the snake was heavily infested with several kinds of parasites—so many and so well developed that he had obviously carried them with him when he was brought back from Trinidad. A more complete discussion of the parasites—with their interesting life cycle passed partly in the rats upon which the Bushmaster feeds—will be found in Dr. Noback's section of the Annual Report of the Society.

This Bushmaster aroused so much interest that various collectors in the tropics went in search of the species. Simultaneous efforts broke out in Panama, Colombia, Dutch Guiana, and Trinidad. In consequence, by late fall of the past year, three additional Bushmasters had been distributed respectively to the Reptile Houses at St. Louis, Philadelphia, and Washington. At this writing, all have died, without any inclination among any of them to take food voluntarily.

R. L. D.

No Beauty, But—

During the past five years, severe restrictions concerning the importation of parrots into the

United States have been enforced by the Federal health authorities. There may be some latitude where the bird is a pet and is accompanied by its owner, but dealers' shipments must spend two weeks in quarantine, under government supervision. During this period, there must be no deaths, or the consignment is not released.

Under this system, a few parrots of the more

common, teachable species are imported, usually in lots of 100. But for small shipments of the rarer kinds, the cost is prohibitive, so that practically none are brought in. The birds of the parrot group are noted for their hardiness and willingness to live when properly cared for. However, they are not immortal and the shortage is beginning to be felt by our own institution as well as by others of its kind. Consequently, we experience a feeling of jubilation when something out of the ordinary appears, even though it may once have been fairly common.



No Beauty—But Hard to Get. This Is the Lesser Vasa Parrot (*Coracopsis nigra*) Recently Added to the Park's Bird Collection.

The Lesser Vasa Parrot (*Coracopsis nigra*) never was a really common bird, but specimens were usually obtainable from time to time. It is, however, not noted for its talking ability and there seem to have been no importations since the quarantine restrictions went into effect. In fact, our last specimen was obtained in October, 1923. When this bird died, in 1929, there was good reason to suppose that it would soon be replaced, but the Federal regulations appeared to write *finis* to our expectations.

The unexpected is a potent factor where collections of living animals are concerned, and something of the sort occurred to relieve the Vasa Parrot situation. A bird lover, somewhere in the Middle West, decided that she could no longer keep the pet Vasa she had had for some years. She prevailed upon her local bird dealer

to take it in exchange and he, in turn, sent it to a New York dealer, on a similar basis. On its arrival here, we examined the bird, found it in excellent condition, and bought it for a moderate sum.

Wild caught Vasas are so very shy and timid that it is difficult to gain their confidence, but hand-reared ones are charmingly tame if sympathetically treated. Our bird belongs to the latter group and is delightfully quiet and steady.

There are five kinds of Vasa Parrots, two occurring in Madagascar and the others in the nearby Seychelles and Comoros. All are colored in a shade found in no other group of true parrots; a dull, brownish black. The Lesser Vasa is not a bird of beauty, nor is he a gifted linguist, but he makes up in rarity for what he lacks in other respects. L. S. C.

Animals on the Curriculum

During the past month the Department of Educational Activities, in co-operation with the American Institute, conducted a series of lecture-demonstrations at the Park.

Four Saturday mornings were given over to members of the Junior Science Clubs from various public schools, junior high schools and high schools of the city. Two different groups were represented, the boys and girls composing them being chosen by the Institute, and that organization sponsored the two courses and made all arrangements for attendance. Both courses proved to be very popular and, following a preliminary announcement, it was found necessary to limit the registration for each session to 30 pupils. The final attendance was exceptionally good and practically the full list of registrants showed up for the meetings, despite cold and rainy weather.

The first two sessions, for the Junior members, were offered as a course in the "Care of Wild Animals in Captivity." Under the guidance of the Curator, this group visited the Reptile House, Small Mammal House, the Chef's headquarters, and the Hospital. In each building the club members were brought in direct contact with some of our Park animals and observed food materials in preparation. At the same time they participated in an informal discussion and demonstration of the numerous re-

quirements for maintaining wild animals in a comfortable state of captivity.

On the following two Saturdays a Senior Science group attended the course entitled a "Study of Wild Animals." Although much of the work done during the previous two weeks was repeated for this course, special attention was paid to the characteristics of various animal groups, especially those involved in classification and in demonstrating relationships.

All the members of these courses enjoyed a more intimate contact with wild animals than they had ever experienced before. This was the direct inspiration for numerous interesting and intelligent questions concerning animal life, and many expressed their regret that the sessions could not be extended over a longer period.

Meetings such as these do a great deal toward creating a sympathetic interest in animal life. The Department offers a similar service to all school groups and a number of classes have already been scheduled for the coming year. C. W. L.

Newcomers in the Cages

Shipments of mammals during the fall and winter were, as usual, few. However, the arrival of two Spectacled Bears from South America is to be noted. These were cubs, now thriving and growing. The species is of particular interest as it is the only bear found anywhere in South America. When adult, it is similar to a medium-sized North American Black Bear and characterized by white "spectacle" markings around the eyes—whence its name. It occurs only in the mountains of Peru and Colombia. Another accession among the mammals is a fine young Bengal Tiger.

A number of reptiles have been received. Among these are specimens of the Giant Anolis or Cuban "chameleon," African Chameleons, Tegus from Demarara, South American "two-headed" lizards and the big yellow and black poisonous lizard from Mexico which is allied to the Gila Monster.

Among the snakes there has been a variety of small, brightly-colored species from the American tropics, including a dwarf and degenerate ally of the boas, which lives in ant hills. This curious creature is deceptive when one tries to

recognize its extremities at first glance. Its head and stubby tail are almost precisely matched in outline. Moreover, it usually glides with the head flat to the ground and the tail well reared. Its pattern is extremely handsome—ringed with coral-red and lustrous blue-black, symmetrically spaced. On the ground it looks more like a gaudy necklace than an actual reptile. R. L. D.

Guests of the Park

During the winter months, when wild bird visitors to the Zoological Park are less numerous than in summer, our attention is considerably occupied by ducks. Few people, aside from sportsmen and naturalists, realize that many thousands of wild fowl pass the cold weather within a few miles of New York. The shallow waters along the shores of Long Island and the numerous rivers flowing into the Sound make ideal feeding grounds for the hosts of ducks that frequent them.

During mild or even normal winters, there appears to be an abundance of food and the visiting flocks seem to thrive. But when there is excessive cold and heavy falls of snow are frequent, as during the winter of 1933-1934, the rivers are likely to freeze over and ice may form along the shores of brackish waters. Then the ducks are forced into deeper water to avoid being frozen in, and here they cannot reach the bottom for food. Last winter, the wild flocks suffered heavily and each of the many severe storms took its toll. Hundreds of dead birds were strewn upon the nearby beaches, to become the prey of swarming herring gulls. Rafts of starving ducks floated on the waters of the East River as far South as Clason Point, too far from shore to be enticed by proffered grain.

When too weakened by hunger to offer further resistance, many of the birds floated in and crept upon the ice along the shore. Most were too near death to survive for long, but a few were picked up by chance and brought to us. If there had not been too much delay, they usually fed at once, and many survived. These were mostly Greater Scaup but among them was a lovely male Canvasback, dug from a snowbank at Clason Point, where this species is rarely seen. A male Lesser Scaup was picked up in

Burnside Avenue, in the Bronx. This bird, no doubt, had fallen exhausted from a passing flock seeking more friendly waters.

Up to the middle of January, at least, the present winter was marked by the absence of severe storms and extreme cold, so that ducks, in general, should have had a fairly good time of it. Undoubtedly they did, for the most part, but a flock of Greater Scaup, wintering in the East River, did not fare so well. Early in January, two boys brought us a female, picked up on the Bronx shore near Old Ferry Point. She was very light, the feathers of her abdomen matted with oil. Her rescuers reported that there were "plenty more" and volunteered to bring us a male, which they did the same day. A few days later, a second male was retrieved by another party of explorers. All of these birds responded promptly to an abundance of food and the removal of the threat of pneumonia, which frequently results when the insulating property of feathers has been reduced by oil.

The problem of floating oil, as an agent of destruction of bird life, is world wide, of course, and has received much attention from conservationists and others. It appears, however, that this is just another source of pollution of the local waters of New York, and is not likely to be completely eradicated. If this is true, then the wintering of ducks in and near New York will soon be a thing of the past.

While the arrival of these stricken birds at the Zoological Park always occasions a wave of interest and solicitude, it is the hordes that come of their own volition that bring with them a real problem. There was a time when visiting water fowl were both scarce and welcome. As far back as 1900, seven Canada Geese were captured from a flock of nine that had been decoyed by the captive birds on Lake Agassiz. From that time on, a few ducks, mostly Blacks and Mallards, have dropped into our lakes during migrations. For many years, their numbers were hardly noticeable, but gradually the crowd has increased until, during the past four or five winters, as many as a thousand have added themselves to our own flocks. At first, they were likely to move on after sampling our grain; now they find it so entirely palatable that they spend the winter. The season of 1933-1934, per-



Friends of the Park Whose Visits Have Become a Habit—Part of the Flock of 600 to 700 Black Ducks, 200 Mallards, and a Scattered Few Green-winged Teal, Pin-tails and Bald-pates Who Are Spending the Winter on the Wildfowl Pond Where They Can Be Sure of Regular Meals at No Trouble to Themselves.

haps because of severe conditions, marked the high spot. This winter we seem to be entertaining from 600 to 700 Black Ducks, with perhaps 200 Mallards and a smattering of Green-winged Teal, Pintails, and Bald-pates.

The problem of food for these birds is no small matter. They require from 100 to 150 pounds daily—they like a little extra when the temperature is low! Our own ducks are fed largely on a grain mixture known as scratch food, and at first we simply increased the allowance when the visitors arrived. This soon proved too expensive, however, and now all have to be content with western corn, the cheapest suitable grain we have been able to find.

L. S. C.

Books of Interest

HALF MILE DOWN. By William Beebe, Director of the Department of Tropical Research of the New York Zoological Society. Published under the auspices of the Society. 344 pp., with 123 illustrations and 8 colored plates. Harcourt, Brace & Co., New York, 1934. \$5.

Dr. Beebe's deep sea exploration in the bathysphere built by Otis Barton in 1929 has been reported from time to time in the Bulletin, but it seems that despite all the technical and public interest in his adventure, not even the half has been told heretofore. Much that is new—impressions, observations, descriptions of the

technique of working in a bathysphere—remained to be developed more fully and attained expression in the present volume published under the auspices of the Zoological Society.

For that matter, it is not likely that the half can ever be told of such an experience as a descent more than half a mile into the cold, eternally black depths of the ocean. One can do it, and then talk about it and write about it indefinitely, and still the kernel of the experience is elusive. To depart only half a mile from other human beings, and yet to be where no others of your kind have ever been—alive—is one of those simple facts that hold infinite possibilities for the imagination.

Dr. Beebe makes the most of the imaginative possibilities of his adventure in "Half Mile Down," but he also has added, fragmentarily, it is true, to objective human knowledge of a world that heretofore seemed cut off by impassable barriers.

His researches into the history of diving lead him to the inference that as early as 4500 B.C. men must have been in possession of some means of working under water to procure mother-of-pearl. Thus there are more than 6,000 years of history behind the bathysphere, and many were the attacks made on the problem of descending into the depths and returning alive,

although few, it must be confessed, were undertaken for as disinterested a purpose as the observation and study of deep-sea life.

Alexander the Great is supposed to have descended in a glass cage, to look at fish, and was rewarded for his initiative by observing one that took three days to swim past. Dr. Beebe was not so fortunate; he did, indeed, observe some large, shadowy forms but they were too indistinct for any such account as Alexander presumably gave, and there were enough minute wonders clearly visible to satisfy him.

The bathysphere was put into operation in Bermuda waters in 1930 and a depth of 1,426 feet was reached—a depth that seemed sufficiently great in those early experimental days when the underwater observers realized that at a quarter of a mile, the pressure upon the bathysphere was more than six and a half million pounds.

The next year took them below 1,700 feet, the utmost limit of light from the surface, to 2,200 feet. The following year the same depth was attained, and it was on Dive Number 32, on August 15, 1934, that the ultimate depth of 3,028 feet was touched by Dr. Beebe and Mr. Barton.

Dr. Beebe's accumulated observations at varying depths have made some definite contributions to knowledge of the abundance and kind of life deep in the ocean, and have raised more problems that may never be solved until super-bathyspheres are built. He saw sea creatures that no other human being has ever seen, and he saw them distinctly enough to instruct artists in the preparation of drawings; some he even named, on the strength of his brief observation. Such a practice is, perhaps, not in accordance with the standard scientific method, but it is the pioneer's privilege, and after 6,000 years of diving, Dr. Beebe is still a pioneer.

CONFESSIONS OF A SCIENTIST. By Raymond L. Ditmars, Curator of Mammals and Reptiles at the New York Zoological Park. 241 pp., with 39 illustrations. The Macmillan Company, New York, 1934. \$3.50.

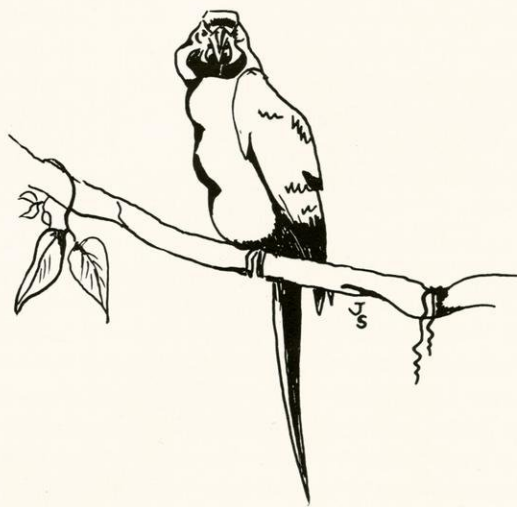
The Curator of Mammals and Reptiles of a populous institution such as the Zoological Park inevitably, in the normal course of his working day, leads a busy and sometimes adventurous

life. If he spends his vacations busily hunting more adventures, as Dr. Ditmars does, his year is likely to be very, very full.

Some of the things that have happened to him are recounted by Dr. Ditmars in "Confessions of a Scientist." His own interest obviously centers strongly around his research into the natural history of the Vampire Bat, the first specimen of which he brought back from Panama in the autumn of 1933, augmenting his research facilities with four specimens from Trinidad in the past summer.

He tells of snake hunting trips to the tropics and it must be counted as a confession that on one such expedition, to Panama, the only snake he saw during the whole journey was—aboard the boat when he sailed for home! Somehow a baby Boa Constrictor found its way into the cabin of the ship's doctor.

"Confessions of a Scientist" is a medley of observations and comments on experiments with animal photography, field work at home and abroad, the handling of animals and reptiles in the Zoological Park, the perennial interest that animals have for the newspaper-reading public, the part that some of Dr. Ditmars' charges—certain reptiles—have played in the treatment of cancer and hemorrhage. Many of the matters of which he treats have been mirrored in the day's news and "Confessions of a Scientist" is in the nature of the ever-interesting "inside story."



PUBLICATIONS

Free to Members:

Bulletin: The official publication of the New York Zoological Society reports bi-monthly on interesting phases of work at the Park and the Aquarium and contains articles on natural history in a sound yet popular form, with many illustrations. Thirty-seven volumes have been completed.

Zoologica: Scientific contributions of the New York Zoological Society. Volumes I-VI and Volume VIII are complete, and other volumes are in preparation. *Zoologica* is illustrated, and is published as material is presented. It is sent to Members on request.

Zoopathologica: Scientific contributions of the New York Zoological Society on the diseases of animals. Volume I is completed and Volume II is in preparation. It is illustrated, appears when material is available, and is sent to Members on request.

Annual Report: Documents, reports and pictures of the work of the various departments of the Park and the Aquarium. As a rule it contains articles of scientific value and considerable general interest.

Gallery of Wild Animal Paintings in the Zoological Park: A handsomely illustrated catalogue of the gallery in the Administration Building at the Park, which Members may receive on request.

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Aquarium Publications

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| <p>Official Guide to the Aquarium Collections (<i>Townsend</i>). Third edition. Profusely illustrated. 50c.</p> <p>Cultivation of Fishes (<i>Townsend</i>). 27 pp.; 17 illus. 35c.</p> <p>Porpoise in Captivity (<i>Townsend</i>). 11 pp.; 14 illus. 30c.</p> | <p>Postcards: General Exhibits. Set of 12, colored. 35c.</p> <p>Postcards: Tropical Fresh-water Fishes. Set of 12, colored. 35c.</p> <p>For all Aquarium publications or any work relating to aquatic life, address the New York Aquarium, Battery Park, New York City.</p> <p style="text-align: center;">(Postage Included in Price)</p> |
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A classified list of the publications of the Society, with subject headings of articles printed in the *Reports*, *Zoologica* and *Zoopathologica*, as well as reprints from them, will be furnished on request. Some of the publications have become exhausted and orders for any issues will be governed by this circumstance. Orders for any of the publications should be addressed to H. R. MITCHELL, *Manager, Zoological Park*, 185th street and Southern Boulevard, New York City.

No effort will be spared to ensure delivery of the regular publications to Members of the Society, but changes of address, forwarding points and non-delivery of mail should be reported promptly. Back numbers of *Bulletin* still in print will be supplied to Members and others at the rate of 30 cents each. Postage 3 cents extra.

Clark and Fritts, New York, Printers.

