

THE FATE OF WILDLIFE IN THE GALAPAGOS ISLANDS

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On the 15th of September, 1835, a young naturalist landed on Chatham, the most easterly island of the Galapagos archipelago : he was none other than Charles Darwin, and it was there he first came into contact with the facts over which he pondered during the immortal voyage of the *Beagle* and which his genius translated into theories on evolution.

What, in fact, are these rather mysterious islands, whose size is so out of proportion to their scientific interest ? They lie on the Equator, 600 miles out in the Pacific, far away from the coast of the Republic of Ecuador to whom they belong. There are about 15 large islands and numerous smaller ones, some of them only rocks, but the total land surface is not more than 2,900 square miles. Some islands are mountainous with summits rising to over 5,000 ft.

The archipelago is purely volcanic in origin ; the rocks of which it is made are just plain lava of various ages, except for some minor deposits of lime dating from the Pliocene or Pleistocene, a consequence of bascule movements caused by volcanic action. The islands represent the peaks of a cluster of submarine volcanoes risen from the bottom of the ocean after many eruptions. Geographers numbered more than 2,000 craters over the whole archipelago. Some of them are still active, though the last important eruption goes back to 1825, when the Narborough volcano resumed activity. An eruption with lava flow was recorded in 1957 on the south coast of Albemarle.

These volcanic islands are completely oceanic in their origin and were never connected to the American mainland during any period of their history. This important fact determined the number and varieties of plants and animals which reached them.

The remote position of the Galapagos, far out at sea and away from any main sea route, explains why their discovery was relatively recent. They were, however, visited several times by the Indians in pre-Columbian times. Reliable Spanish chronicles from the early years of colonization tell of an expedition organized by the Inca chief Tupac Yupanqui who sailed out into the Pacific during the years 1485-1488 and discovered " mountains of fire with strange beasts ". In 1953 the Norwegian

Archaeological Expedition led by Thor Heyerdahl discovered more than 2,000 remains of pottery belonging to several cultures well known along the Ecuadorian and Peruvian coasts.

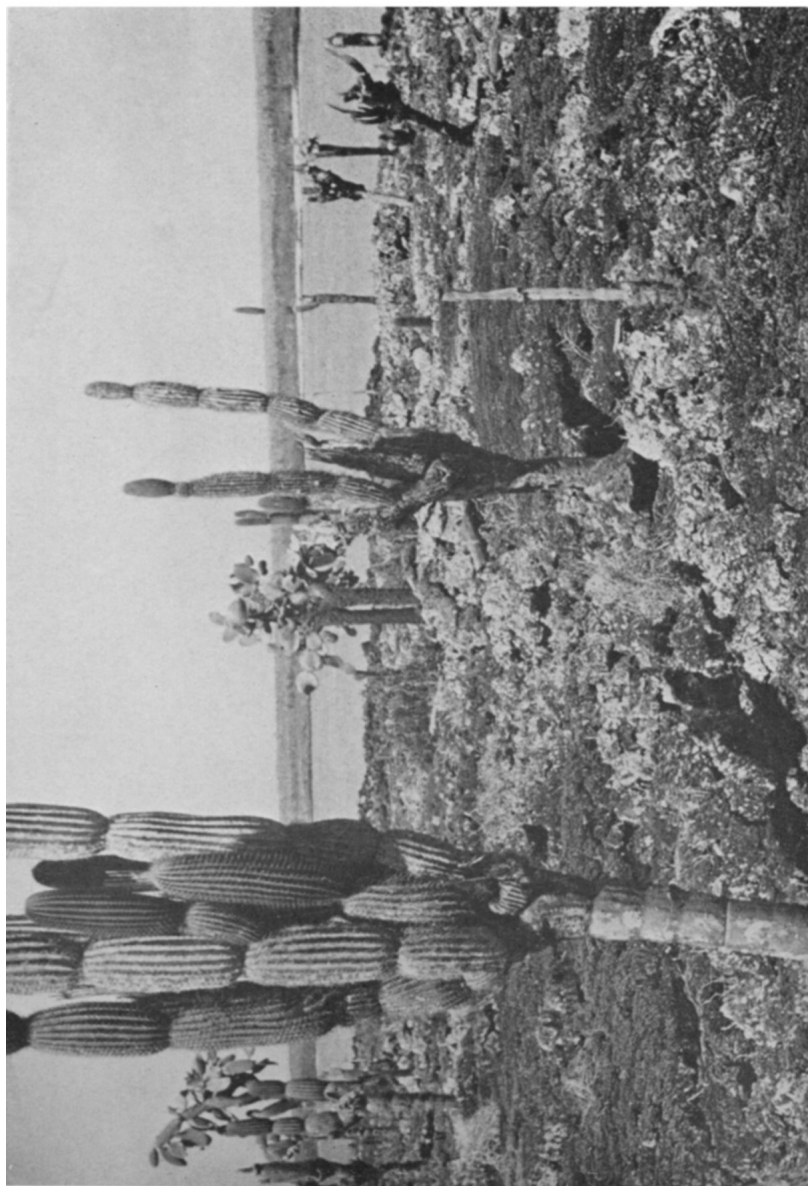
Tomas de Berleaga, Bishop of Panama, must be given credit for the "official" discovery of the Galapagos; sent to Peru by the King of Spain, he drifted westwards on the currents during prolonged calms and in March, 1535, landed finally on an island which we may suppose to be Charles. In his report he gives a good description of the islands and their fauna, and he says that the barren coasts looked "as though God had caused it to rain stones".

Most of the land of the Galapagos is indeed desert. The cold Humboldt or Peruvian current, coming from the Antarctic seas, and sweeping up the coasts of Chile and Peru, changes its direction at the latitude of Ecuador and then flows in a westerly direction. It brings cold waters around the archipelago and causes a very dry climate—like that along the Peruvian coast. Except during a short and irregular rainy season, from January to March, it never rains on the islands; the water shortage, and the almost complete lack of springs or wells oblige the inhabitants to collect rain water and to store it in tanks for use the whole year round.

The lack of rainfall determines the botanical landscape of the Galapagos Islands. The lowlands and a large part of the mountains are either barren or covered by thorn scrub and cacti. Some of the commonest *Cereus* and *Opuntia* grow very high, up to 30 ft, giving a very peculiar aspect to the lava plains, which Darwin described as the "cultivated parts of Hell".

Nevertheless the highest zones of some of the islands, especially the slopes facing the moist south-easterly trade winds, receive more rain and are enveloped for long periods of the year in cloud and fog. These meteorological circumstances produce abundant vegetation. In some places true rain forest occurs: the trees are some 60 ft. high, especially the *Scalesia*, an endemic arborescent genus of the Compositae family, and are covered with ferns, orchids, bromeliaceae, mosses and lichens, with a dense undergrowth. This curious biotope, so different from those encountered on the coastal plains, is replaced on the windy tops of the mountains by grassy moorland.

In spite of its dreary aspect the Galapagos archipelago is one of the high spots of science, above all for the study of evolution. These islands are, as Howell, a botanist who studied their plant life, said, "Evolution's workshop and showcase". No wonder Darwin was strongly impressed when he landed on the archipelago. Two years after his visit, he wrote: "In July (1837) I



SOUTH COAST OF INDEFATIGABLE, TORTUGA BAY, NEAR ACADEMY BAY.



MARINE IGUANA, INDEFATIGABLE.

opened my first notebook on *Transmutation of Species*. Had been greatly struck from about the previous March by the character of South American fossils and species on Galapagos archipelago. These facts origin (especially latter) of all my views ”.

During their history the Galapagos Islands served as a refuge for several archaic types of animals, and especially for reptiles. Since they have never been connected to any continental land mass, their fauna, remotely of American origin, presumably came from over the sea by swimming or by using huge rafts—like those still carried by large tropical streams and ocean currents—the crossing being easier then than it is now. (Tentatively we may admit, as suggested by K. W. Vinton, that a land bridge was elevated during Miocene times over the Pacific ocean and came from Central America towards the old Galapagos land mass.) For these reasons the islands’ fauna is specifically very poor. There are no amphibians and also no mammals except a bat, two pinnipeds and a rodent, and consequently no predator or competitor for cold blooded vertebrates. Up to now the Galapagos Islands have lived in the reptile age and the visitor as he comes ashore, feels carried back to the Jurassic period. Large colonies of Marine Iguanas (*Amblyrhynchus cristatus*), some 5 ft. long, are assembled on the lava boulders sunning themselves and waiting for low tide so that they may graze the marine green algae, their only food. Inland, the Land Iguana (*Conolophus subcristatus*) settles in large areas, feeding on cactus pads and thorny twigs. But the really spectacular animals are the giant tortoises, reaching a length of 5 ft. and sometimes more, divided into some 15 more or less differentiated species all belonging to the genus *Testudo*. These tortoises are so peculiar to this archipelago—the only other giant tortoises still in existence are found in the Seychelles—that they gave their name to the islands. Galapagos is the Spanish word for tortoises.

But the archipelago has also been a centre of differentiation, in complete isolation from all that happened in the rest of the world, and with a high proportion of endemic species. As the number of ancestral phylums was very small, the mechanism of evolution became visible. This is especially true of the Darwin’s Finches or Geospizidae, a group of 14 species of Passerines related to the finches, which constitute the major part of the terrestrial birds in the Galapagos Islands. As David Lack and several other authors have shown, these finches have differentiated in such a way as to fill a great variety of ecological niches

in the rest of the world, filled by birds belonging to widely separated groups. This adaptive radiation explains how seed-eaters, like the ancestral stock and the most primitive species still existing (especially some Ground-finches) have given rise to frugivorous species, like the Tree-finches (*Camarhynchus*), or to seed-eaters with a huge, thick, almost parrot-like bill; one of them (*Certhidea olivacea*) even became an insect eater, exactly like a warbler in its external appearance and behaviour.

But evolution is still in progress under our eyes in the Galapagos Islands, especially in ecological adaptations. This is true of sea animals, and above all of sea birds. As we have already seen, the cold waters of the Humboldt current caused a very peculiar oceanographic situation and between the various islands of the archipelago cold and warm waters mingle in very complicated ways. Due to these physical conditions, the plankton is very abundant in the surrounding seas and oceanographers describe the waves "black with animals" breaking against the rocks of the coast. This abundance of food attracted many fishes, whales, pinnipeds (sea lions and fur seals) and above all, sea birds. Among them rank purely tropical species, like frigate birds, tropic-birds and several boobies. But there are also birds of antarctic origin, and above all a penguin (*Spheniscus mendiculus*), the only one among all Sphenisciformes to live on the Equator. This flightless bird probably came north by following the coasts of South America where related species still live in Chile and Peru. Its occurrence on the Galapagos Islands is a real paradox which can only find an explanation in the oceanographic conditions.

We must emphasize the fact that even among sea birds, the proportion of endemic forms is very high. There are very peculiar gulls, like the Fork-tailed Gull (*Creagrus furcatus*) and the Sooty Gull (*Larus fuliginosus*), whose slate grey plumage tones exactly with the dark lava blocks on which it rests. Most interesting of all is the Flightless Cormorant (*Nannopterum harrisi*), whose wings are so reduced that it cannot fly. We can guess that this regressive evolution is correlative with the absence of any indigenous predator in the Galapagos Islands. This bird is one of the most exciting curiosities of the archipelago.

The Galapagos Islands still constitute a living laboratory of evolution. Their unique fauna—and flora—which have already inspired so many valuable theories, have much more to tell the observer. But most of the animals are seriously threatened with extermination and some of them are even on the verge of

complete extinction. When Tomas de Berleuga landed on the islands, they were in a virgin state and constituted a world in themselves. Since those days man has occasioned heavy damage of all kinds ; he alone is responsible for the dreadful events which have occurred. During the 17th century the islands became a den of buccaneers, corsairs and pirates, most of them British or Spanish. During the next century came the tortoise hunters, seeking the giant tortoises which supply an oil renowned for its taste. The slaughter of these reptiles, an easy prey, was organized on an industrial scale. After the tortoise had been killed, the shell was opened and the body was put into heaters to extract the oil—one to three gallons per head. Even now the visitor may come across skeletons of unfortunate tortoises killed by oil makers. Townsend, who made an estimate of the number of tortoises killed by hunters during the last century, as reported in the log-books of whaling vessels, believes that from 1811 to 1844, the crews of 105 ships sent to the Galapagos Islands killed more than 15,000 tortoises. This was only a small fraction of the whole, for during this period the United States sent more than 700 ships and other nations did the same. According to the same author, not less than 100,000 tortoises were killed by American oil hunters after 1830, and G. Bauer thinks that since the discovery of the islands, no less than 10 million tortoises were killed for their oil. This figure seems incredible, but probably it is not far from the truth.

During the last century, man settled the archipelago ; but in those days, the colonists were often convicts, or mutinous regiments sent to the islands to be reformed in communities organized and ruled in philanthropic ways. Of course, conditions have now completely changed and the Galapagos Islands are settled by an honest, hard-working population of Ecuadorian or even European origin. Unfortunately many of them are not well acquainted with the principles of nature conservation. In spite of the excellent legislation adopted by the Ecuadorian government—a new law reinforcing the former laws was passed in 1959—destruction of habitats and illegal killing of tortoises and other native animals still continue in many places throughout the archipelago.

To the direct impact of man, we must add the effects of domestic animals introduced during the last century, now feral almost everywhere. Goats are the worst of all, but there are also cattle, pigs, cats, dogs, mice and rats. All compete for food and some are predators. Their presence is a threat to the reptiles, especially the tortoises, for goats eat their food while dogs and

pigs prey on their eggs and young. Some authors doubt whether from the time that the egg is laid until the tortoise is a foot long more than one in 10,000 escape. Then comes man's turn.

In several islands, such as Barrington and Charles, tortoises are already extinct, and their populations are alarmingly low in most of the others. Iguanas suffered greatly, mainly the Land Iguana. Many birds are threatened in several ways, and we must fear that the Penguin and the Flightless Cormorant are on the verge of extinction. Unless a survey proves their existence in some other part of the archipelago, we must realize that their populations concentrate on the shores of the Bolivar Channel, between Narborough and Albemarle, which is, as Banning said twenty-five years ago, "the scene of a dramatic struggle against encroaching civilization". Robert I. Bowman and I. Eibl-Eibesfeldt who visited the archipelago in 1957, recorded that the total tortoise population did not exceed a few dozens of each species.

The Government of Ecuador has already taken measures to protect this unique fauna. But their excellent laws were never applied as severely as they should have been. To help conservation, UNESCO and the International Union for the Conservation of Nature have sent several missions in recent years to survey the fauna and to propose suitable measures for the preservation of this natural inheritance. Their efforts were strongly supported by zoologists all over the world; the XV Congress of Zoology, held in London in 1958, passed a resolution and welcomed "the project initiated by the International Union for the Conservation of Nature and Natural Resources for establishing on the Islands an International Biological Station for research, associated with the name of Darwin, and for assisting the Authorities of Ecuador in the task of Conservation".

All this led to the creation of the Charles Darwin Foundation for the Galapagos Islands, established in 1959 in Brussels. This international organization, presided over by Professeur V. Van Straelen, is governed by an executive board on which all the countries interested have representatives. Owing to the great help of UNESCO it was possible in 1960 to send a Swiss biologist, Mr. Raymond Lévêque, to form a station in the Galapagos. After many administrative and financial difficulties, the project is now under way with funds raised in the United States and in various European countries; we have good hopes of setting up the first field laboratory in 1961 and to provide all the necessary equipment for research including a boat for transport and oceanographic work.

The programme of research includes many subjects in the field of evolution ; but many other biological subjects can be studied on the Galapagos Islands, especially in the field of ecology and behaviour of reptiles and birds. Other disciplines will not be forgotten, for these islands provide unique facilities for oceanographers, seismologists, pedologists and meteorologists.

The existence of a station run by the Galapagos Foundation should also help conservation in the Galapagos. Biologists working on the spot will be able to advise the Ecuadorian government on measures which must be taken to bring reality to the existing laws. They will also provide opportunities to interest the settlers in our efforts and to educate them in conservation. The primary objective of the International Foundation is to preserve the Galapagos habitats and the indigenous fauna.

REFERENCES

- HEYERDAHL, Th., 1955. Preliminary Report on the Discoveries of Archæology in the Galapagos Islands. *Anais XXXI Congr. Intern. Americanistas*. (See also HEYERDAHL and SKJOLSVOLD, 1956, *American Antiquity*, Vol. 22, No. 2, pt. 3.)
- BERLENGA, T. de. Carta al Emperador Carlos V, dando cuenta del descubrimiento de las Islas. *Col. Documentos Inéditos de Indias*. T. 41, pp. 538-544, Madrid, 1883.
- HOWELL, J. T., 1941. The Templeton Crocker Expedition of the California Academy of Sciences, 1932, No. 40. The genus *Scalesia*. *Proc. Calif. Acad. Sci.* (4), 22, pp. 221-271.
- DARWIN, Ch. Quoted in : Charles Darwin's Diary of the Voyage of H.M.S. *Beagle*. Cambridge University Press, 1933; p. 438 (46).
- VINTON, K. W., 1951. Origin of Life on the Galapagos Islands. *Amer. J. Sci.*, 249, pp. 356-376.
- TOWNSEND, C. H., 1925. The Galapagos tortoises in their relation to the whaling industry. A study of old logbooks. *Zoologica*, 4, pp. 55-135.
- BAUER, G., 1889. The gigantic Land Tortoises of the Galapagos Islands. *Amer. Nat.*, 23, pp. 1039-1057.
- BANNING, G. H., 1933. Hancock Expedition of 1933 to the Galapagos Islands ; general report. *Bull. Zool. Soc. San Diego*, No. 10, pp. 1-30.