A VISIT WITH IGUANAS OF THE GALAPAGOS ISLANDS

MARY LANG EDWARDS

Rough black bodies sprawled lazily across the basalt lava, absorbing warming rays from the equatorial sun. With arms and legs draped haphazardly across the backs of neighboring companions, there was hardly a vacant spot on the rocks for the lava lizards scurrying among their larger reptilian relatives. Dorsal crests marched characteristically from the head to the tail of the slumbering giants. Muscular arms and legs, bigger around than the oars of the dinghy I had just left behind, emerged from robust bodies with dagger-like claws curving from elongated toes. As I stood admiring for the first time the marine iguanas (*Amblyrhynchus cristatus*) of South Plaza island of the Galapagos, I recalled Charles Darwin's description of these improbable lizards 150 years ago: "It is a hideous-looking creature, of a dirty black color, stupid, and sluggish in its movements." In a strange twist of circumstances, I viewed the same creatures as marvelous animals, engineered in time by environmental forces which have modified their gene pool, a real testimony to the validity of Darwin's treatise on natural selection.

Now, as I approached a colony of iguanas, I learned that they would tolerate my presence to about a meter in distance; any closer and I was startled with a threatening blast of a "sneeze". Apparently, marine iguanas make use of the sneeze, a natural method for expelling excess salt from their nasal salt glands, to warn or intimidate a perceived threat. I learned during the next eight days of exploring the Galapagos Islands that marine iguanas, although appearing to be unaware of their surroundings as they bask, actually remain alert to the slightest movement. A number of times, I attempted to slowly sneak up to a "sleeping" iguana only to have it "sneeze" or edge away as I unobtrusively approached (I thought), even from the rear. Perhaps living in colonies provides added protection from predators; if the intended victim does not see an advancing threat, surely a neighbor lying at even a slightly different angle will.

Land iguanas (*Conolophus subcristatus*) were abundant on South Plaza, basking on lava rocks just behind sandy beaches and even peering out from crevices between rocks further inland. Sometimes surprisingly similar in appearance to marine iguanas, they can be distinguished by a more pointed snout (the face of the marine iguana is more rounded or blunt) and they usually have some yellow on the face or legs. Otherwise, both species are similar in size, with blotched skin hanging in folds and the tail as long as the body. Our guide, Dr. Ettienne de Backer, described three hybrids on South Plaza: two look like marine iguanas but act like land iguanas and one looks like a land iguana but swims and acts like a marine iguana. I do not know whether their hybrid state is speculation or documented. On several occasions I watched land iguanas bite off chunks of cactus without apparent concern for spines. Yellow flowers were often abundant on the various islands and prompted me to wonder whether these iguanas feast upon them.

Colorful, agile larva lizards (*Tropidurus albemarlensis*) scurried around and over marine iguanas as if they were as inanimate as the lava rocks on which they basked. Several times I observed lava lizards on the back or head of an iguana, feeding on insects. Various species live on the islands of the archipelago and differ in color and pattern. Adult females often have blotches of red on the face or neck. The variation from island to island demonstrates the uniqueness of each gene pool and studies show significant differences in the behavior of these lizards. I found these lizards to be as attractive and interesting as any lizards I have ever seen.

The following day, while motoring around the towering cliffs of Espanola Island in a rubber dinghy, we spotted a small dark lava heron perched inconspicuously in a cave-like depression in the rocks. Numerous swallow tail gulls and masked boobies circled overhead or clung to the edge of cliffs far above the surface of the water. Disembarking on the white sandy beach, we were greeted by the low guttoral grunts of sea lions encountered everywhere in the Galapagos. Nearby lay a mass of seven marine iguanas, their mouths drawn in the perpetual smile so characteristic of the species. The dull black color of the males was dramatically enlivened with deep red splotches that gave the appearance of severe sunburns to these lizards. Head bobbing, a characteristic threat display, was readily observed in the larger group of iguanas lying prostrate on the black lava rocks further down the beach. It soon became apparent that marine iguanas usually assume one of two positions. Lying flat on the substrate while basking allows iguanas to maximally absorb heat, and therefore, is most useful when the animals attempt to raise body temperature. The other position, elevated basking, consists of sitting up so that the head and chest do not touch the substrate, or readily absorb its heat. Perhaps this position allows the iguanas to maintain a steady body temperature, or even to cool off.

Moving inland, we found blue footed boobies engaged in their ritual dance: resplendent high-stepping blue feet, wings spread apart, ending with the traditional sky pointing. Male hisses were answered with resounding female honks. So many birds nested on the ground that my constant attention was required to avoid stepping on them. Further inland, we encountered an open expanse that served as an albatross courting ground. As the honking calls of the albatrosses reverberated over the island, I was mesmerized by the scene unfolding before me! Many albatross pairs stood facing each other, beaks clanging in mock sword fights, followed by sky pointing and a preening finale, only to be repeated over and over again.

Marine iguanas are found in large numbers on sandy beaches or lava rocks throughout the Galapagos Islands. When not lazily soaking up heat on land, they can be found in ocean water, heads bobbing in the swells or waves crashing against boulders edging the shoreline. In shallow water, iguanas often graze on green algae which seems so sparse that it is surprising that it meets their dietary needs. Brisk and agile swimmers in deep water, they suddenly appear from the depths below and swim back to land, crawling up steep faces of rocks before nudging their way into the usual mass of basking iguanas. On Santiago Island we were once fascinated by the playful antics of a young sea lion as it grabbed the tail of a marine iguana in its mouth, holding on tightly as the iguana struggled to get to shore. After towing the iguana around in a small lagoon, the sea lion finally released its increasingly frustrated "toy" who then made its way to land.

One of the most interesting observations of marine iguanas was made during our frequent snorkeling expeditions. Concealed from the observer on land are enormous boulders of pillow lava, spewed out from ancient volcanic eruptions and now lying on the ocean floor surrounding many of the islands. These boulders create unique habitats for many sea creatures and provide substrate for green algae. As I swam after leopard rays and green sea turtles or played with sea lions, I sometimes spotted marine iguanas heading out into the ocean to graze or returning to land from a recent meal of green algae. The lumbering iguana on land is transformed into a graceful and competent swimmer in water. At first from the water's surface, I watched them clinging to rocks under water at depths up to 5 or 6 meters as they grazed on the algae covered lava. But then curiosity compelled me to dive down for a closer look. Oblivious to my presence (no more "sneezes"), they continued to eat even when I approached to within a foot. Usually they remained under water for 10 or 15 minutes before surfacing and heading back to land.

The Galapagos Islands are protected by the Galapagos National Park Service (GNPS) which was founded by the Ecuadorean government in 1959. The Charles Darwin Foundation for the Galapagos Isles and the Charles Darwin Research Station located at Puerto Ayora, Academy Bay, Santa Cruz Island were created soon after. These organizations work together to ensure the conservation of the unique ecosystems of the islands and to promote scientific studies, most of which are directed toward conservation. One of the most challenging programs has been to eradicate introduced species which are destructive to native flora and fauna. Another project has been the reintroduction of native species to various islands. These on-going plans to return the islands to their natural state have led to breeding programs for Galapagos tortoises and some subspecies of iguanas at the research station, and to releasing young animals on their original islands. The GNPS provides a rigorous training program for the guides who must accompany all tourists. In addition to escorting tourists from island to island, guides are knowledgeable about island ecology, and oceanography, and are excellent instructors. They must ensure that the islands are protected, and they are trained to report back to the Research Station certain data they observe as they explore the islands. The successes in the conservation of the spectacular ecosystems of the Galapagos Islands is a tribute to the concerted and on-going efforts of these organizations.

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I.I.S. Bookstore

As a service to our membership, a limited number of publications will be distributed through the I.I.S. Bookstore. We believe this will become a valuable source of information. The following publications are now available:

No. 01 **The General Care and Maintenance of the Green Iguana**, by Philippe de Vosjoli. 1990. $4.40 (including postage); $5.50 (non-members).

No. 02 **Guide to the Identification of the Amphibians and Reptiles of the West Indies (Exclusive of Hispaniola)**, by Albert Schwartz and Robert Henderson. 1985. $19.00 (including postage); $27.00 (non-members).

Data from sea floor could resolve a long-standing controversy.

From Herald Wire Services

Scientists have discovered evidence that could resolve a long-simmering feud that has grown out of Charles Darwin's historic study of the evolution of species on the Galápagos Islands.

The islands are only about three million years old, and some biologists have argued that that is not enough time for the wide diversity of wildlife to have evolved there, as Darwin's work suggested.

But geologists aboard the Thomas Washington, a Scripps Institution of Oceanography research vessel, have found something that Darwin could not possibly have known: There were other, much older islands in the region that have long since slipped beneath the ocean, and some of the creatures on Galápagos that needed more time to evolve may have begun their ancestral journey on islands that are no longer there.

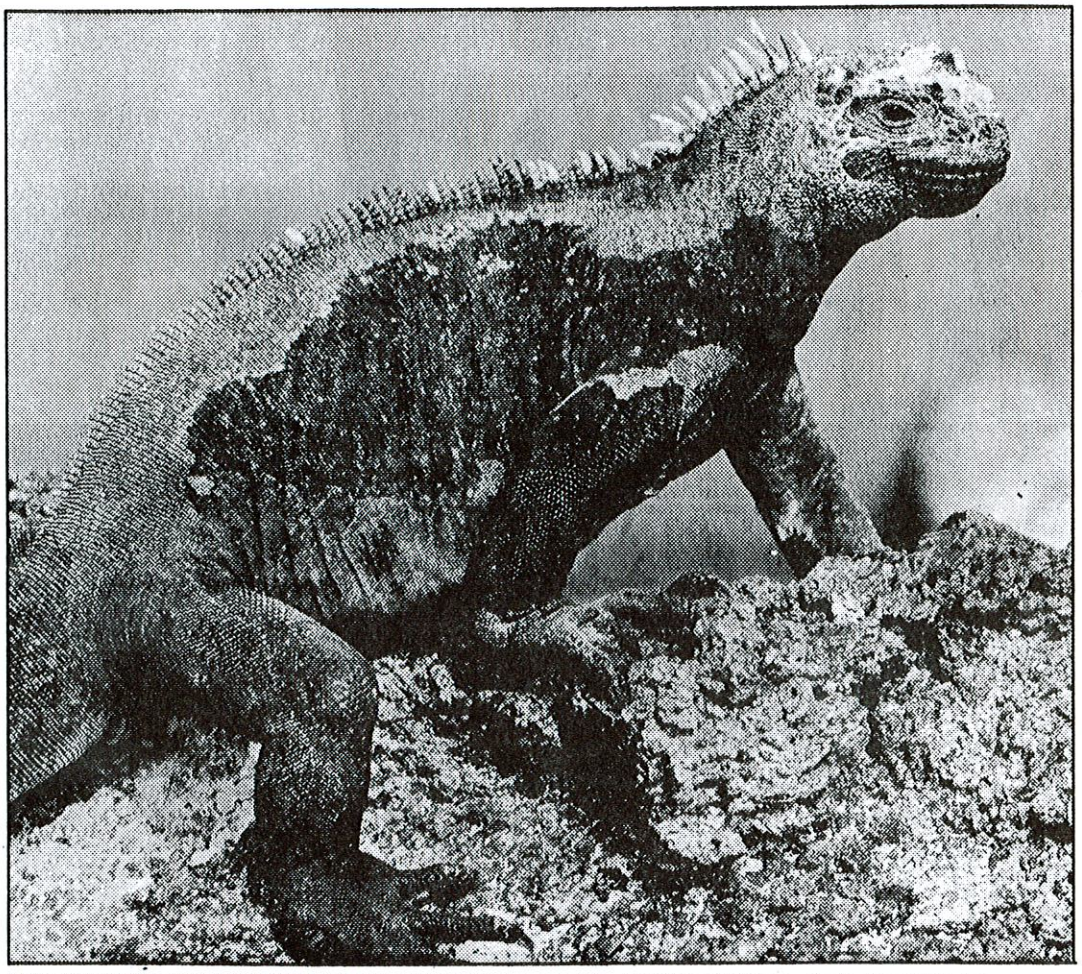
Some of the hidden islands are at least nine million years old. Some may be 90 million years old.

The finding does not prove Darwin's theory of evolution, but it does make the theory compatible with the current understanding of genetics and how long it would have taken for some species to diverge into separate groups.

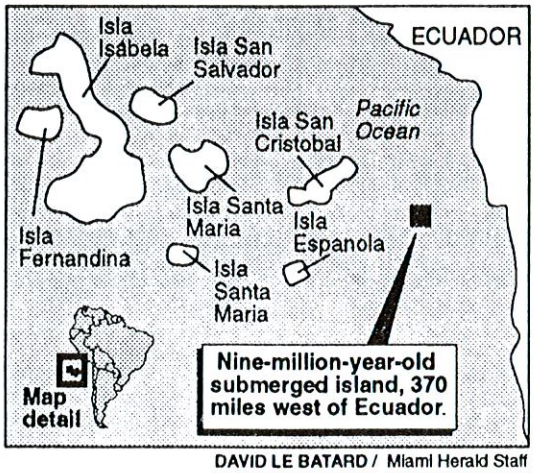
It also confirms a controversial hypothesis by two molecular biologists, Dr. Vincent M. Sarich and Dr. Jeffrey S. Wiles of the University of California at Berkeley. In 1983, they predicted that such "drowned" islands would be found. They reasoned that only the existence of long-vanished islands could account for the extensive evolutionary changes undergone by Galápagos species in the period since their ancestors arrived on the islands, which were originally lifeless.

"The controversy may disappear," Hampton L. Carson of the department of genetics and molecular biology at the University of Hawaii wrote in an analysis of the research, published recently in the journal Nature.

A PUZZLE SOLVED?



ON GALAPAGOS ISLANDS: The marine iguana, above, and land iguana are believed to be descended from a common ancestor many millions of years ago.



DAVID LE BATARD / Miami Herald Staff

The existence of an island chain at least 6 million years older than the present Galápagos Islands would account for the state of evolution of some animals — such as the marine iguana, above — seen on the islands today, biologists say.

Darwin's voyage

Darwin was only 22 when he began an expedition aboard the H.M.S. Beagle in 1831 that was to revolutionize human thinking. Biologists thought then that species either had continued unchanged since their creation, or acquired characteristics that could simply be inherited by their offspring. But the young naturalist found evidence to conclude that all plant and animal species change over time to meet

Galápagos animals may be older than their islands

environmental demands.

On the Galápagos Islands, Darwin studied birds that were distinct from those found on the mainland. Some were also different from others found on the 10 widely separated islands. Darwin concluded that the birds had evolved through natural selection, or "survival of the fittest," and the evidence from the islands formed a key part of his seminal research published a quarter of a century later.

As other experts studied the research many years later, they found no proof that the birds Darwin studied could not have evolved during the three million-year history of the present islands. But there were other creatures on the islands, including iguanas, whose "genetic time clocks" would have required much longer for them to evolve, Carson said.

When David M. Christie, a geologist at Oregon State University in Corvallis, and several colleagues returned to the Galápagos aboard the Scripps vessel in the summer of 1990, they found the evidence that could explain how the critters found time to evolve.

How islands were created

The Galápagos Islands were created in much the same way as the Hawaiian Islands. In both cases, a "hot spot" deep inside Earth sends plumes of hot mantle boiling toward the surface, where it burns through the crust and forms volcanoes. Each "hot spot" remains in a fixed position relative to Earth, but the huge tectonic plates that make up the crust are constantly moving.

As a result, the hot spot constantly produces new volcanoes as the crust passes over. The youngest volcanoes are directly over the hot spot, and older islands are left behind as the plate moves on.

Scientists have long understood that process, largely because of extensive research on the Hawaiian islands and a series of subsurface hills — called seamounts — that stretch northwestward across the Pacific. Similar evidence has been found near the Galápagos, but it was not clear whether the small seamounts found there had ever been tall enough to reach above the Pacific and become islands.

Christie said images created with sonar equipment aboard the Scripps vessel reveal that some of the old seamounts have terraces that look as though they were cut by waves, suggesting that the mounts once existed as islands. But that was not the most conclusive evidence. The vessel also has dredging equipment that allowed the scientists to retrieve rocks from the slopes of the seamounts.

"The real clincher is we found lots of beautiful rounded pebbles like you would find on an Oregon Beach," he said. "You can't make those in the deep ocean."

The submerged seamount of the Galápagos chain lying closest to the present-day coastline of South America is about 370 miles west of Ecuador, something less than half the distance from Ecuador to the existing islands. The age of this seamount, whose summit is now about 6,500 feet below the surface of the waves, is about nine million years, the scientists determined.

The existence of an island chain that old would be long enough to account for the state of evolution of the Galápagos animals seen today, biologists say.

Evolutionary clock ticks

Sarich and other molecular biologists have demonstrated a chemical basis for the ticking of an evolutionary clock at a more or less constant rate. Essentially, each tick occurs when one amino acid in the backbone chain of a particular protein molecule is switched for another. The protein Sarich uses for his clock is albumin, and he reckons that in a typical species, between 2.5 and 3 of these substitutions occur in the course of a million years.

Sarich also studied the protein chemistry of several Galápagos species, particularly that of the marine and land iguanas. These two species, Sarich said, clearly descended from a common ancestor, a sea-faring pioneer who floated from the South American coast aboard some kind of natural raft.

The marine and land iguanas of the Galápagos are more closely related to each other than either is to mainland relatives. However, Sarich said, they have evolved in very different ways. The units of difference in the amino acids of their respective albumins suggest that these two species must have diverged from their common ancestor many millions of years ago, and this finding led Sarich and a coauther to publish a paper in 1983 entitled "Are the Galápagos iguanas older than the Galápagos?"

"So you can see why," he said, "that we were pretty sure these sunken islands would eventually turn up. I'm not at all surprised by Dr. Christie's discovery."

IGUANA TIMES

Hatchling Cuban Rock Iguana, *Cyclura nubila*

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