

LIZARDS LOST IN TIME: GALAPAGOS LAND IGUANAS

LESTER E. HARRIS, JR.
DEPARTMENT OF BIOLOGY
LA SIERRA UNIVERSITY
RIVERSIDE, CA 92515 USA

At the edge of an inland patch of thornbrush (*Lycium minimum*), on the great volcanic island of Fernandina, Galapagos, a large Galapagos land iguana stood tall in the direct rays of the afternoon sun. His body turned broadside to me to demonstrate his intimidating size. He puffed up his body to become even larger. A comb of stout, round, horny spines stood out on the nape of his neck. The spines became laterally flat as they continued along his back, topping a lateral fold of fatty flesh. His throat puffed out. His dewlap turned pink. His beautiful reddish coat faded into sulphur yellow on the lower body.

All this flashed before me in seconds. I was entering his territory. He did not like it. What I did not know was why he was so feisty toward me. His mate was motionless behind him, invisible in the thornbush. He appeared to be protecting her. His orange-red unblinking eyes, surrounded by heavy lids, stared at me. I approached to within a few meters of the big lizard. Slowly lifting his head until his nose pointed to the sky, he raised up as high as possible. Then he nodded up and down with a rapid jerking motion. His dewlap flapped from side to side. He hissed long and vigorously. His tail snapped sideways in my direction as if to say, "Come no closer."

The lighting on this magnificent reptile was perfect. I had to get a slide-filling closeup. I got down on my hands and knees and crept forward closer and closer. The big iguana had enough. He suddenly charged straight at me with blood red mouth wide open. I snapped the shutter an instant before he hit the lens, nose first, driving the camera back into my face. He did no great harm beyond giving me a good scare. I retreated, properly intimidated, leaving him in charge of his domain.

Size

The Galapagos land iguana, *Conolophus subcristatus*, is an endemic lizard frequently more than a meter in length. It has a fat belly that always looks full in spite of its living in arid regions of sparse vegetation. Males average 8 kg in weight; females average 3.5 kg.

Charles Darwin's description of the land iguana is not too flattering. "Like their brothers the sea kind [marine iguanas], they are ugly animals, of a yellow-orange beneath, and of a brownish red colour above: from their low facial angle they have a singularly stupid appearance."



Galapagos land iguana, *Conolophus subcristatus*.

Distribution

Two species were recognized by Van Denburgh in his 1913 revision of the genus. *Conolophus subcristatus* occupies the central group of islands, Fernandina, Isabela, Santiago, North Seymour, Plazas, and Santa Cruz. *Conolophus pallidus* is restricted to Santa Fe island. This distinction remains to this day.



Galapagos land iguana, *Conolophus pallidus*. Of the two species recognized, this one is confined to Santa Fe Island. Photograph: Lester E. Harris, Jr.

The land iguanas of two islands are now extinct. Iguanas from Baltra were introduced into North Seymour in 1932 and 1934. During the early 1940s, American soldiers were based on Baltra. It is commonly believed that they were responsible for exterminating the iguana population there. Recently (April 1992) some of the North Seymour iguanas were repatriated back to Baltra. The Santiago island iguanas were abundant at the time of Darwin's visit there in 1839. He spoke of iguana holes being so numerous that they could not find an area large enough to put up their tent. By 1905, members of the California Academy of Sciences Expedition could find only bones on the island. A huge population of feral goats on Santiago probably caused the land iguana's extinction.

Ecotourist Attractions

Land iguanas are gentle creatures. Though wary, they are unafraid of man. The coming of many thousands of tourists since 1970 has made the land iguana more wary and shy. Only the Fernandina population is relatively undisturbed by man. In the early seventies, before the National Park Service was able to monitor the South Plaza

population, the land iguanas there climbed all over tourists for tidbits of sandwiches or other food. They became dependent on tourists for food and ignored their natural foods, which on Plaza are mostly the pads and fruits of the *Opuntia* (prickly-pear) cactus. Snell (1984) says that as the goats eat off the vegetation the soil becomes drier and drier. There is not enough moisture left in the soil for normal development of the iguana egg embryos,

which dehydrate and die. In 1971, after goats were eradicated from Santa Fe, the land iguana population immediately increased in numbers to the healthy level we find today.

National Park law now forbids feeding the land iguanas. As a result, the iguanas have reverted back to their natural ecology. Oblivious to the snap-shooting tourists around them, they go about the business of living their lives. Thornton, in Darwin's Islands (1971), refers to an interesting feeding behavior of the land iguana. He says, "Pinchot (1931) seems to be the only person to have seen a land iguana 'preparing' a fallen cactus apple for eating by brushing off the spines with its front feet." Throughout a Galapagos field trip in 1972, I watched land iguanas from one island to the next hoping to see this odd behavior. Then on South Plazas island I saw and photographed a land igua-

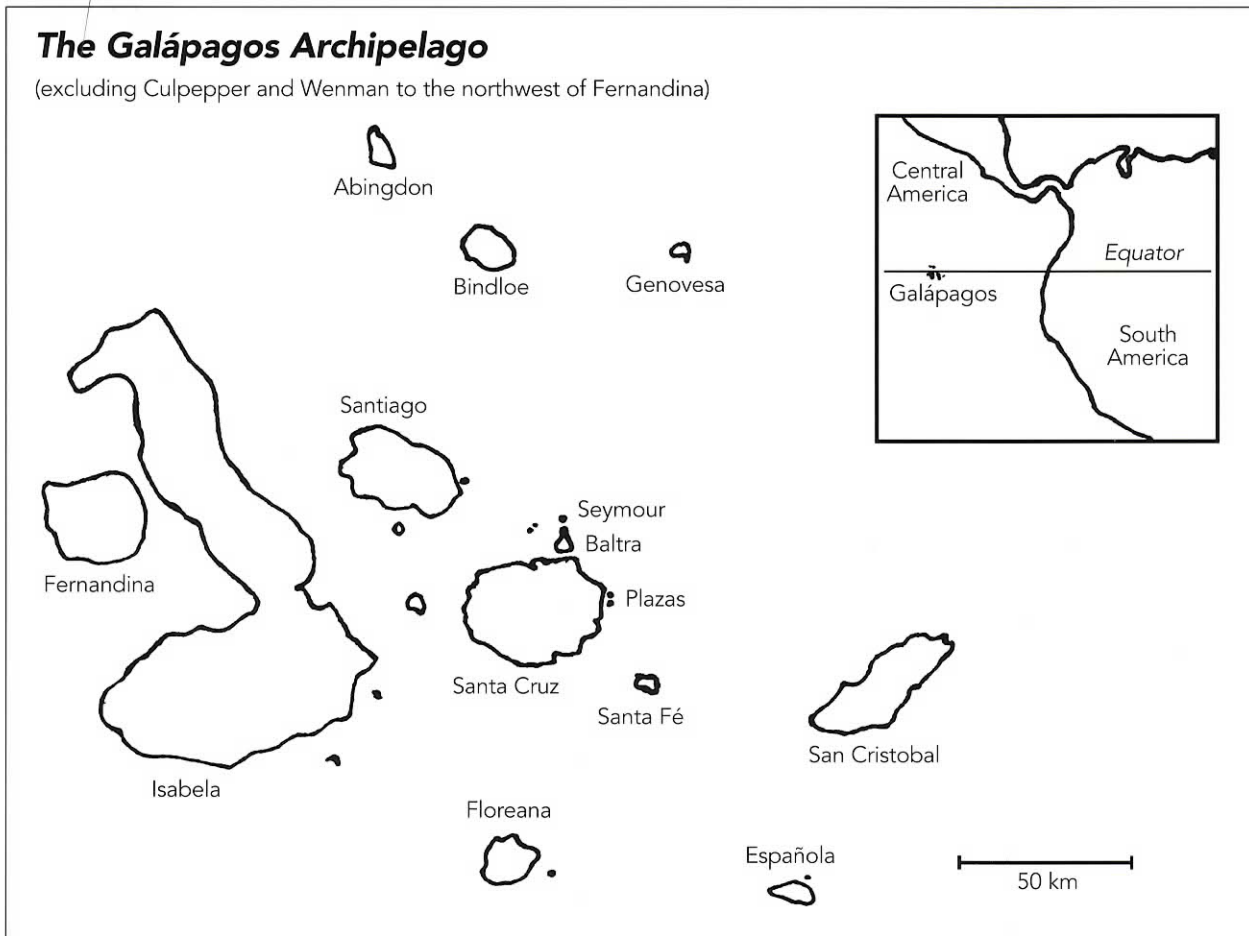
na that picked up a cactus fruit in its mouth and carried it to the surface of a flat, embedded rock. The lizard carefully placed the fruit on the rock, then rolled it back and forth with its outstretched front leg until all of the spines were broken off; then it ate the fruit. Over the next eleven years I visited this and other land iguana populations without ever seeing this behavior repeated. Then, in 1983, upon returning to South Plazas island, I discovered that virtually the entire population of land iguanas were despinning their cactus fruits before swallowing by rolling them on the rocks.

Social Behavior

Galapagos land iguanas have formed a complex social structure in their colonies. Dagmar Werner (1983), observing the entire yearly cycle, studied several populations on Fernandina from 1976 through 1979. Three sites, often many miles

apart, are occupied by the lizards through the year. The first site is “home base;” here, the males and females establish territories. Usually this is an area in which holes are easily dug and there is a food source nearby. This is the first part of the reproductive phase. The second part of the reproductive phase occurs at the nesting site and involves the females almost entirely. Both of these phases occur during the warm part of the year. The nonreproductive females are dispersed over a large habitat area wherever their food plants are available. Close proximity of lizards is avoided. In fact, individuals chase each other away. Here the only limiting factor to area occupied is food availability.

When food is sparse over a sizeable home base region, this area becomes the lizard’s home range. Burrows are dug, maintained, and defended the year round. Males defend a small area





Galapagos land iguana, *Conolophus subcristatus*, charging the author on Fernandina Island. Photo taken just before the lizard crashed into the camera. Photograph: Lester E. Harris, Jr.

around their burrows. Females defend only their burrow. In home base areas where food is more abundant there may be sixteen to twenty-one individual territories. These territories average 625 square meters in size—the smallest territory 250 square meters and the largest territory 1600 square meters. Throughout the breeding season, territories are dynamic areas subject to constant change in borders as aggression of neighboring males waxes and wanes. An ideal territory is one in which the soil is soft for burrow construction, the territory is dotted with shrubs for shade, and there is an abundance of nearby food. The more ideal the territory area the higher mating success will be. The central part of any one male's territory is the place where he digs and maintains from one to eight burrows. The more active a male is the more burrows he digs.

The male Galapagos land iguana society is divided into two basic types during the breeding season. There are the territorial males (Werner calls these T-males) who establish, defend, mate with females, and rarely leave their territories, and the non-territorial males (Werner calls these N-males) who concentrate on the periphery of the T-male's territory and try to rape his females

when he is not looking. N-males may be old males no longer capable of holding a territory for themselves, or young males not yet bold or strong enough to hold their own territory. Perhaps they simply do not choose to establish a territory.

An N-male may run into a T-male's territory, grab a female by the neck and run out of the territory with her, whereupon he rapes her. After mating, she runs back into her territory. T-males may do the same thing to a

neighbor's female. Males generally go back to the same territory each year. A male may have as many as seven females in his harem, but, Werner reports, he will not mate with more than four in any one season.

Territorial defense by males starts three months before actual mating begins. Males dig new burrows, clean out old burrows, and patrol the central area of their territories unless challenged by an adjacent T-male or an N-male getting too close to the owner's area. Males will perform aggressive displays toward one another by inflating their bodies, standing up tall, and sidling toward each other. Displays may turn into fights, which last only a few minutes to several hours with little damage to either combatant. Occasionally a fight may end in serious injury to the loser. Werner observed one combative pair who fought up to eight hours a day during a two month period.

Courtship and Mating

As males fuss around their burrows and construct new ones, females inspect the burrows. Males and females retire into the burrows at night. As they emerge in the morning, they hang around

the burrow entrance for a time. Once a female has chosen a specific burrow, the male approaches her and performs the "shudder bob" which is common among many iguanid lizards. He pauses in his advance toward the female and rapidly vibrates his head up and down. The female assents to his demonstration and mating takes place. Males mate no more than twice a day with each of the females in his harem. Usually a female will mate with no more than two males in a season. After mating the female hangs around her chosen burrow. Then various females leave the mating area to go to the nesting grounds. Courtship behavior of the male ceases. During courtship females regularly eat while the males eat nothing. Now the males begin to forage for food.

In the population Werner studied in detail, the females ascended to the summit of Fernandina volcano, taking from three to ten days to travel over six kilometers distance to a height of one hundred meters above the mating grounds. Some females travelled from as far as fifteen kilometers away and climbed to a height of 1400 meters from their mating grounds. Werner observed several thousand females circling the rim while hunting for a way down the vertical walls of the 900 meter deep caldera. Some females laid their eggs in crevices in the crater wall, some nested on a shelf inside the crater, but most headed for an area where fumarole activity from a crevice several meters long heated the surrounding earth. Nest temperatures here measured 32-35°C, while nest temperatures away from the fumarole measured from 26-30°C. The land iguanas are definitely taking advantage of the volcanic heat for incubating their eggs.

Egg Laying, Hatching and Longevity

On Fernandina, the egg laying peak is in the first two weeks of July. Nest sites are guarded by the females for a short time after laying. Nests are one to two meters apart over the nesting area. A clutch will contain from eight to twenty-two eggs. With such large clutches it is no wonder that it takes a female up to three hours to fill in the burrow after she lays the eggs. Her energy expenditure from mating to egg deposition has been

enormous. She has been drawing on body fat deposits for sustenance.

Hatching in Fernandina occurs in October about three and one-half months after laying. The times of egg laying and egg hatching vary greatly from population to population throughout the Galapagos islands. Incubation time is relatively constant. The young hatchlings are easy prey for the Galapagos hawk and the Galapagos snake, but at maturity the iguanas are too large and tough for these predators to bother them. Juvenile mortality is very high. Sexual maturity is reached in seven to ten years for females and eleven to sixteen years for males. The land iguana life span is judged to be about twenty to forty years.

Diet

Like all large iguanas, the land iguana's diet is primarily vegetable matter. More than fifty different plants are found in this iguana's diet. Favorite food items vary with the available vegetation from island to island. Among the plants eaten are *Opuntia cactus*, *Scalesia* (the tree sunflower), *Ipomea* (the morning glory), *Sonchus* (the sow thistle), and various sedges and grasses. Land iguanas have also been seen in trees eating




Galapagos land iguana rolling a cactus fruit on a flat rock to remove the spines. Photograph: Lester E. Harris, Jr.



Galapagos land iguana eating cactus fruit after removal of spines. Photograph: Lester E. Harris, Jr.

the berries of the palo santo, bursera, and the muyuyu, cordia. If animal matter is easily available, the land iguana will eat it. Caterpillars and grasshoppers are commonly eaten. Young land iguanas will jump into the air to catch grasshoppers on the wing. Females have been reported eating dry fecal matter which suggests the recycling of incompletely digested material. Ingested along with green vegetation is a sizable amount of dirt, presumably a source of minerals and a supply of cellulose digesting enzymes for the lizards.

Conclusion

The Galapagos land iguana in its native habitat is like a small dinosaur—a creature lost in time but still with us. 

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