
Notes on the Behavior and Ecology of the Galapagos Tortoise on Santa Cruz Island

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There are many species of animals whose existence today is precariously balanced between man's attempts to insure their survival and the peculiarities of his various cultures. One such form is the Galapagos tortoise (*Testudo elephantopus*), the endemic and variable giant of the Galapagos Islands (Archipelago de Colon), Ecuador.

Ecological and behavioral information on these tortoises is scant and scattered in scientific publications. Future investigators attempting to study these animals in their natural haunts will find it extremely difficult. These tortoises are now presumed to be extinct on all but three or four of the larger islands. On those islands where tortoises are present, their accessibility to field observation would be extremely difficult and time consuming because of their remoteness and also because of the very rugged lava terrain, often covered with inhospitable vegetation, which must be traveled to reach them.

The following information on the life history and behavior of the tortoise (*Testudo elephantopus porteri* Rothschild) found on Santa Cruz Island is reported here, and in "second hand" manner, because of the possibility that such information may not be obtainable in the future.

An inhabitant of the village of Academy Bay on the island of Santa Cruz, Señor Gilberto Moncayo, is the son of a "turtle hunter" of many years. Señor Moncayo has been hunting tortoises for the past 18 years (since the age of 10). At the time of my acquaintance with him, he was employed by the Charles Darwin Research Station near Academy Bay to carry on a tortoise marking program. Throughout my stay on the Galapagos, I became more and more convinced that this man did indeed have a truly exceptional acquaintance with the tortoises on Santa Cruz Island. The keenness and credibility of his observations (in light of known facts) tend to vouch for their value as a contribution to knowledge of this species.

This information was obtained by interrogation of Gilberto Moncayo through an interpreter, Mr. Raymond Leveque, then (February 1962) the director of the Charles Darwin Research Station. Mr. Leveque (Swiss) is a professional ornithologist and field zoologist. Questions presented to Señor Moncayo were worded, in so far as possible, to avoid prejudicing his answers. Some questions were worded so as to cross check previous answers. He was asked questions covering all phases of the life history of this animal.

Moncayo states there are possibly 3,000 tortoises now on Santa Cruz Island. From July 1960 until February 1962, 1,050 tortoises were paint marked (there is a possibility of some duplication if paint marks were lost). Many of the smaller tortoises are not seen, especially in the drier areas.

The majority of the tortoises measured 50 cm or less in height at this time. The smallest individual seen was estimated to be about 7 to 8 cm in length. The largest seen, as measured against a point on Moncayo's chest, measured approximately 138 cm in height.

Tortoises are generally, if and when, active from about 8:00 AM to 5:30 PM. They sleep below bushes, beside trees and below stones. They try to hide when sleeping at night. The head and legs are drawn in when sleeping. During and after rains they are very active, moving faster—"as if getting out of prison." They often appear to "sleep" in water holes with the head in the water or buried in the mud. Moncayo thinks they have very big lungs and stay under water very long periods of time without breathing. These tortoises can swim if in a water hole, but do not enter the ocean. If thrown overboard at sea, they do get to shore.

During the day they sleep on the pampas (grassy areas) with their heads and legs outstretched, staying in one position for 1-2 hours.

These tortoises often use the same trails, especially those leading to the beach or coastal areas. In the dry season, they move toward the coast. It is drier, but here they can obtain the cactus (*Opuntia*) ears that fall to the ground. They readily exhibit knowledge of these trails, for they return to the same places on the island, showing some homing ability. One tortoise was recorded as moving 15 kilometers in 8 days. Moncayo thinks they can easily move a kilometer or more per day, but they usually do not move in a straight line.

Though many of these tortoises do dwell alone, they often appear to be gregarious. In the Chata area of Santa Cruz, Moncayo states he has seen 280 tortoises in an area of 50 by 50 yards. There was standing water there. Many of the tortoises were beneath manzanita trees. They seemed to be looking for water (which is premium to them) and in some places tortoises were lying upon other tortoises. He states that this group had 20 individuals when first seen and within three weeks had increased to the 280. They all left this area when it became dry. During February 1962 he saw 28 tortoises in this same area.

Aggressive actions by the larger individuals are not uncommon. When small tortoises (60 cm) are placed before large individuals, the larger give chase, the small tortoise quickly fleeing to some hiding place. He has seen large males do most of the chasing, but does not know if the male is more aggressive than the female.

The small tortoises are found farther down the hill (near the coast) in the driest areas, perhaps because the larger individuals drive them there.

A fight was once observed between two males of equal size (36 inches high). The action started at about 9:15 AM and lasted for ten minutes. The location was near a water hole 2 ft in depth, but since it was raining, it was probable they were not competing for water. The two males approached each other head on, on fully extended legs, from two meters apart. They came together and bumped shells, the collision producing a loud noise ("like the sound of a hammer hitting against a wall"). Each pulled his head in just before they hit ("if heads were out, they would have killed themselves"). Immediately after the contact, both dropped down as they quickly drew in their legs. They then parted for 3 ft, each extended his head and neck fully and then started to wave his head and neck back and forth from side to side. This waving often resulted in the "banging" of the heads together. Eight times they parted for two yards followed by head-on charges leading to bumping of the shells. The carapace extends forward more on the larger males and may give them an advantage in such contacts. There was no vocalization during this fight.

Courtship and mating activity begin in February and continue through March. The place of courtship and mating appears to be "where they meet" (coincidental) in the Transition and *Scelsia* zones. They were never observed performing these actions in the arid coastal zone. Most mating takes place during the day, less at night and the latter only when courtship started in late afternoon.

A female may be eating when a male comes up beside her. The female extends her head and the male appears to smell her head. The female then turns about and the male smells her tail. The male then begins to mount the female, climbing high on her carapace. The head of the male is stretched completely out and is laid down almost at the side of the head of the female which is retracted as if retreating from the weight of the male on top. From this position, the male moves back and forth over the carapace of the female, moving forward, sliding back, his head keeping its position with respect to that of the female. During the courtship, the female tries to move her legs and in these attempts moves her shell up and down. As the female rises on all four legs, the male slides back and attempts to bring his tail next to hers. The male of the pair is usually so much larger than the female, that he holds her down, all four of his legs almost or sometimes resting on the ground. Moncayo thinks the movement of both male and female is necessary to effect intromission.

Each time the male slides back on the carapace of the female he groans or grunts. This sound produced by the male during courtship sounds like the "roar of a bull" and can often be heard up to 2,000 meters away. Moncayo once thought he heard a large animal coming, but it proved to be a courting tortoise.

Once the female is "hooked" (intromission effected) the female begins to turn around. Courtship may last for hours. Moncayo once watched a pair from 7:00 AM to 1:00 PM in these courtship actions, the male continually moving up and down on the female. At 1:00 PM the male put his tail down and it joined with the tail of the female in a twisting manner. The female then began turning around, and continued in a circling fashion, breaking sticks and fallen branches, etc., while turning. This action continued until 4:00 PM. They then separated and departed from each other.

The largest female he observed mating was about 30 inches high. The carapace of the female is much "rounder" than that of the "flatter" male, and the female may also differ from the male in color.

The nesting and egg-laying take place during April, the last eggs being laid in May. These nests are located in openings in the arid (*Opuntia cactus*) and transition zones, two to three kilometers from the sea. Nest sites are in the sun most of the day. Moncayo states that most nests are dug in the red soils.

In digging the nest, the female uses her front legs. She excavates a basin-shaped hole about six inches in diameter, up to a maximum depth of eight inches. After completing the hole, the female turns about and deposits five eggs in the hole. She then turns around, puts her head down and covers the eggs, using her head to push the dirt. The female turns again, makes a heap of earth, urinates on it, then with the front legs, pushes this dirt over the hole (this cover is called the crown). She then crawls over this and smooths the top of the nest out. In this way the eggs are covered by damp soil. The covered nest usually has only earth above it, though Moncayo states that sometimes a female pushes a stone over the nest. The female then leaves this nest.

Moncayo once followed a female for one-half day while she was nesting. After completing one nest with five eggs, she moved two hundred yards to a new location and dug another nest. She repeated this three more times, making five nests in all during this period. He dug up the first and fifth nests and found each to have five eggs. Moncayo thinks one female can easily lay 40 to 50 eggs in a day. He once dissected a female which contained "hundreds of eggs".

The eggs are white, spherical and about the size of a billiard ball. The shell is harder than that of a chicken egg. He says they can fall five feet and not break. A local "story" relates that these eggs have a leather lining inside from which the young tortoises get their shells.

Moncayo once built a corral around a nest in which he had watched the female lay her eggs. Seven months later they had not hatched. Thirteen months later the young started digging out. The nest soil at this time was dry. From this he deduces that the young are hatching when the females are again laying. He has examined other nests, not knowing when the eggs were laid, and found the young were not ready to hatch. Sometimes all five eggs in a nest hatch, sometimes none of them hatch. He has seen rotting eggs in a nest and one nest where all that was present in the eggs was yolk. Some hatch, but the young are not able to crawl out because the earth above them is like cement.

The hatchlings are very difficult to find. When newly hatched they are whitish (enamel white) and measure about three to three and one-half inches in length. They turn blackish very quickly.

The smallest female observed laying eggs was approximately 16 inches high, while some of the largest measured up to 30 inches high.

The wild pigs (introduced) find many of the fresh nests and also some of the older nests. Moncayo thinks that the pigs smell the eggs rather than the female's urine.

In the arid zone of Santa Cruz Island, the tortoises feed on the *Opuntia* cactus, grasses, the fruit of the manzanilla and the strong-smelling leaves of croton. They do not appear to eat the abundant salt bush (*Cryptocarpus*). In the wet zone, they feed on the leaves of *Scaevola* and chiuu, though they prefer the grasses in wetter areas, one of these being donkey grass. The hatchlings eat the fallen leaves of the cactus and dry grass. The cactus, eaten by all sizes, is devoured spines and all. Three times Moncayo has observed tortoises feeding on the dried skin of a goat. He states they will eat meat, if available, for he has seen them feeding on a rotting goat carcass. No food preference is indicated by tortoises of different sizes.

The feces are in the form of long oval pellets, the size depending on the size of the tortoise, with some measuring six inches in length. He has observed no coprophagy. There appears to be no special place for defecation.

These tortoises now have amoeba (local term for worms). These have appeared only in the last twelve years. These small parasites are seen in the tortoise gut by the thousands and all are white, thread or hair-like and measured about 1 cm in length. Moncayo says the tortoises do not have ticks because of their very tough leathery hide. He describes a parasite, also found on horses on the island, called the garpata, which infests the upper forelegs and neck of the tortoises. These garpato are about 0.5 cm in length and have five legs on each side. They have two little "teeth" in front and stick to the tortoise by their legs and pincher. Some are black and others yellow in color.

Most senses are poorly developed. Moncayo states their sight is only good for a few meters. He thinks that they are deaf or their hearing is very poor. The best developed sense is that of smell ("smell much better than they see"). If an animal is passing by, the tortoise raises his head and sniffs. He has painted the carapace of a tortoise from behind, during which the tortoise gave no sign of awareness, but continued to feed.

The enemies of the tortoise are many, but all have been introduced by men. The tortoise must compete for food and water with the pigs, goats, and cattle. He does not think the Galapagos Hawk preys on the tortoises. The pigs could probably be poisoned, but such a poison would probably kill the tortoises also. The Norway rats, feral dogs and cats may also kill some.

Other than the pigs, he feels their great enemy is the "Christian." Man has continually exploited them and to some extent still does. However, he says it is not worthwhile to kill tortoises today, for the islanders obtain enough oil from the frequent boats to the islands. Large tortoises contain gallons of fats and oil though (he states) the tortoises today do not have as much oil as they used to. The tortoise liver is excellent food.

The marking program for the tortoises on Santa Cruz Island is being continued, but these tortoises are now marked by shell notching techniques. Records are made of various measurements of the animals, their approximate location, and behavior. Over a number of years, it may be possible to learn more about growth, movement, etc. Such records will be kept by the Charles Darwin Research Station which employs Señor Moncayo.

A large enclosure, walled with lava boulders, has been constructed at the Darwin Research Station on Santa Cruz Island. A number of tortoises of various sizes have been introduced into this enclosure in the hope that behavioral and ecological observations of a significant nature can be obtained.

The survival of the Galapagos tortoises in their native habitats is doubtful, unless rigid conservation measures are maintained to stop poaching and eliminate or control predation and competition.