



Surviving the Galapagos: A Letter from the Field

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I am back again in the Galapagos Islands on a two-month trek following in Darwin's footsteps, as well as documenting ecological changes that have occurred in these islands over the last half century, based on evidence from old photographs. People often go to the Galapagos these days looking for a wonderful vacation spot. Aboard their sleek tour vessels with delicious meals, fine wines, and attentive service, such visitors have little idea what a harsh environment they are visiting during their twice-a-day walks on carefully manicured trails.

In addition to my scientific inquiries, I collect stories about people who have disappeared in these islands. These stories include ones about tourists who have wandered off trails and got lost, and even some locals who, despite their superior knowledge of the geography, have suffered the same fate and died of dehydration. One visitor, trained in survival tactics, lasted eleven days and was miraculously found alive. Every morning he sucked moisture off plant leaves, left by occasional nightly fog, or *garúa*. Finally, he lay down to die, but he was found by a search team before he succumbed. A twenty-three-year-old Israeli commando, Guy Nahmoni, was less fortunate and died in the Tortoise Reserve on Santa Cruz Island in 1991. He is thought to have survived for fifteen days, which is the time it took him to walk about

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eleven kilometres, the distance from the Tortoise Reserve to the coast. Two and one-half months of searching by a group of more than fifty people failed to turn up Nahmoni's body, which was accidentally discovered by fishermen shortly after the formal search had ended. Philippe Degel, head of the search team, told me that the vegetation and terrain are so difficult in this part of Santa Cruz Island (dubbed "Hell's Kitchen" by the locals), that searchers themselves sometimes get lost, requiring secondary searches to locate these missing rescuers.

A local legend refers to such cases as "the curse of the tortoise." The tortoise lives for upwards of 180 years. For this reason, it is said, the tortoise can see into the hearts of visitors and know their intentions. If people come to the Galapagos in peace, they escape the curse of the tortoise, but if they come to plunder its environment, the curse sometimes strikes them. Darwin was lucky. He repeatedly dined on tortoise meat but somehow eluded the curse of the tortoise and was able to return to England and write his masterwork, *On the Origin of Species by Means of Natural Selection* (1859).

Tortoises are rather clumsy creatures, and perhaps for this reason their curse sometimes misses the mark and strikes down innocent victims. I have had a few close calls with the curse myself; just to be on the safe side, I try to be especially nice to tortoises and other local creatures. So far I have escaped with only extreme dehydration, heat stroke, and a few other unpleasant experiences. However, when one goes into the field, as Charles Darwin did during a five-week period in 1835, the Galapa-

gos becomes a place to survive rather than just to visit. What follows is an account of my experiences, and those of my fellow expedition members, as we explored the remarkable island group that inspired Darwin's conversion to the theory of evolution.

Inspections and Quarantines

This was my eighth expedition to the Galapagos Islands since 1968, and I have visited twelve of the sixteen main islands (and each of the four islands where Darwin landed). Field trips require careful planning, including consideration of the terrain, an examination of satellite photographs, the best maps, and an accurate estimation of how far one can travel before water finally runs out. When necessary, I stash water along the coast so that we only have to carry twelve litres (weighing twelve kilograms) at any one time. Along with other equipment, this brings the weight of our packs to about thirty-two kilograms. Transporting more weight than that is nearly impossible, so field trips up and down volcanoes are generally limited to three days, unless one hires porters or unless the National Park Service happens to have a highlands *caseta* (a shelter built for conservation purposes), as is the case on Santiago. At such *casetas* one can obtain rainwater that is collected on the roof and stored in tanks.

Some food items have to be ordered in advance from Guayaquil (in the field, we dine mostly on tinned tuna, sardines, and smoked oysters, together with chocolate bars, dried fruit, and nuts). Water (four litres a day, per person) is obtained from the

Charles Darwin Research Station and is transported to campsites in twenty-litre *chimbuzos*. Before we set out to another island, all our personal belongings and equipment are carefully inspected by the staff of the Darwin Station and sprayed with insecticide, and then they undergo a twenty-four-hour quarantine to prevent the accidental transport of insects or seeds to our final destination. Food and water are also kept in a locked storehouse prior to field trips. The process of assembling food and water and the meticulous inspection of camping gear for seeds and insects take up most of a day before each field trip. In the field, if we visit more than one island, we conduct additional inspections for seeds and insects, which can easily become hidden in camping gear and accidentally transported to another island.

Fernandina Field Trip: The Perils of Lava

Our first field trip was a thirteen-day affair, undertaken just two days after our arrival in the Galapagos. This excursion began with a four-day climb of Fernandina (fifteen hundred metres), one of the most active volcanoes in the world. Fernandina is not a forgiving island. The ascent to the summit is enough to practically kill, or at least incapacitate, anyone who is not in good physical shape and also properly acclimatized. Going up, it was almost all bare lava—with a few scattered plants here and there, dead grasses, and small ferns clinging to life in crevices where they happened to be shielded from the equatorial sun. This island is a particularly bleak place, and life here barely seems to win out

over the lethal effects of the relentless sun shining down on a volcanic landscape that has no water, except what arrives from occasional rains that quickly dissipate into the scattered vents, crevices, and lava rubble.

As our expedition ascended Fernandina from Cape Douglas, on the northwest corner of the island, we walked for two hours over a difficult field of *a'a* lava and then up occasional flows of easier *pahoehoe* lava. (*A'a* lava consists of jumbled blocks, often having razor-sharp edges. *Pahoehoe* is smoother and sometimes forms beautifully rippled sheets. These two geological terms have been adopted from the Hawaiian language, in which they mean “stony” and “ropy,” respectively.) As we climbed, the footing was difficult, and the heat was extreme in spite of the cloud cover. I continuously sweated through all of my clothes: shirt, pants, and socks—from head to toe, everything was soaked with perspiration. I had to wring out, repeatedly, a towel that I wore around my neck to remove the sweat from my face and neck.

At the top of the volcano I was anxious to photograph the interior of the caldera in order to document any changes since I visited this crater in 1970. The huge lake that had been at the bottom in 1970 had disappeared in the late 1980s, but it was now back again. Over the next two days, I was able to obtain comparative images of the effects of multiple volcanic eruptions since 1970. Curiously, although the interior of the caldera had been remodelled by these eruptions since my last visit, the shape of the lake was still more or less the same. Right away, however, I noticed that a

prominent cone, which was once an island within the lake, had completely disappeared. Rock slides within the crater were a frequent source of noise, day and night, as the unstable caldera walls tumbled to the lake about 425 metres below. Given the steep walls, getting to the bottom of the caldera seemed almost suicidal, but some people have managed to do it.

The rim of the caldera is home to many golden-coloured land iguanas (*Conolophus subcristatus*). These creatures, about a metre in length when they are mature, are endemic to the Galapagos. Their closest relative, from which they split apart some fifteen to twenty million years ago, is another remarkable Galapagos iguana, *Amblyrhynchus cristatus*, which is the world's only ocean-going lizard. On the top of Fernandina we found land iguana burrows everywhere, just as Charles Darwin described on Santiago before the iguanas there went extinct owing to the introduction of black rats, pigs, and dogs. As I was walking around the crater rim, I fell through several iguana burrows, which are often difficult to detect. Fortunately, no one was home.

In pursuit of landscape photographs for my ecology project, I bushwhacked about a quarter of the way around the caldera rim through thick vegetation. Lacking a machete, I did not succeed in reaching the spot to the northwest where I had ascended in 1970. It was just too far to go in one day through this kind of tangled vegetation. As it was, I bushwhacked for eight hours straight with Miguel Sangroquiza, an Ecuadorean student who accompanied our group, and Miguel and I were completely exhausted when we returned to our camp.

On the crater rim, the endemic hawk (*Buteo galapagoensis*) was everywhere. These hawks occasionally pose for pictures on the edge of the caldera. At night, we saw a couple of barn owls (*Tyto alba punctatissima*—an endemic Galapagos subspecies). Also at night, Miguel conducted research on the two endemic species of bats, using specialized equipment to detect their echolocations as they circled overhead looking for insects.

After successfully summiting Fernandina, two of my companions had to return to the United States owing to medical problems. Dan Bennett, a hardy Explorer's Club member who has been to the North Pole and many other exotic places, had trouble with one of his knees on the rough lava. Another expedition member, Josef Vascovitz, fell on the lava near the shore during our descent on the fourth day. When one of our field assistants came across him, covered in blood from multiple cuts to his face, hands, and legs, this stalwart Ecuadorean—used to all sorts of difficulties—had to turn his face away. I was reminded of a tourist who, many years ago, tried to climb this volcano alone. His compass exploded and the rubber on his shoes melted from the intense heat. Barely alive and suffering third-degree burns from the sun, this fellow was miraculously located halfway up the volcano by rescuers.

So far, my Galapagos expeditions in the last four years have had an attrition rate of about 30 per cent, with five people having to return for medical reasons (one of them requiring hospitalization), and two more quitting in the middle of their trip. I guess I would not make a good travel agent, unless

it was for a club of masochists. However, the survivors of such expeditions get to see the Galapagos that tourists never see, but that Darwin himself fully experienced as a result of his own inland treks during his five-week stay in 1835.

Santiago Field Trip: In Darwin's Footsteps

I went on, after Fernandina, to the highlands of Santiago (nine hundred metres), spending a week there accompanied by one of my Spanish-speaking field assistants, Riquelme Cueva. Darwin camped on this island for nine days in 1835, his longest stay on any of the islands. Based on his description of where he went, my own route to the summit retraced his footsteps very closely. Darwin's reports about the vegetation near the summit indicate that considerable destruction has gone on since his visit, mostly owing to feral goats, but also including damage by feral donkeys, pigs, dogs, and rats.

It was a challenge speaking only Spanish with my assistant for seven days. I have never formally studied this language, but I have managed to pick it up in rudimentary form on various Galapagos expeditions over the years. I have no difficulty saying what I want to say, but I generally understand less than half of what Riquelme says back to me. Much of our conversation was about trails: "A very hidden trail," Riquelme would say, or "This trail is much better than the last," "There is no trail here at all," "We are going to have to use the machete to get up this hill," and "The vegetation here is just impossible; we must cut a new trail somewhere else." It took us two hours to

cut one trail going just a half of a kilometre. When climbing up a steep hill through dense vegetation, especially when wielding a machete, one sweats volumes.

After we reached the summit, we were enveloped by *garúa*. We could not see more than twenty metres in front of us and hence could not locate any landmarks. As a result, we completely lost the trail, got ourselves into some impenetrable vegetation in the rain, and were going to be stuck there—forever, it seemed—in the thick, intertwined growth. We decided to return to a waypoint on my GPS device, fortunately left over from a previous expedition. There, under our feet in the dense fog, we found the faintest impressions of the trail to the *caseta*, about five kilometres away. Without that one waypoint we would have been camped for the night and much of the next day, caught in an infuriating tangle of thorny plants and soaked to the bone from the drizzle and rain, and not knowing where we were in relation to the barely perceptible trail we could not find.

On Santiago I continued documenting ecological changes in the landscape from the many large-format (six-by-seven-centimetre) photographs that I had taken during my three-month expedition in 1970. These comparisons show the devastation caused by goats, which have now been almost eliminated on this island through a hunting program. (Last year, sharpshooters in helicopters killed about sixty thousand goats.) We did see three live goats during our one-week trek, and the National Park is now monitoring the few remaining animals with radio transmitters fixed to "Judas goats."

In 1970 I had climbed to the summit of this island with Leonardo Apolo, caretaker of the equipment at an abandoned salt mine visited by Darwin 135 years earlier. Apolo and I had had no maps, and Apolo lacked hiking equipment, so we'd fashioned a primitive backpack for him using an old burlap bag. For the next three days the straps of this crude backpack had cut into Apolo's shoulders, although he barely complained. At that time, not much had been known about the highlands of this island. So we'd blindly climbed straight up the north side, nearly nine hundred metres, going over every hill and cutting our way through dense vegetation with a machete. Today all the National Park trails on this island wisely go around these hills, so Riquelme and I had to cut our way back to the same remote hilltops that Apolo and I had bull-headedly scaled in 1970.

The good news was that because Apolo and I (and almost everybody else at the time) had known

so little about the geography of Santiago, causing us to scale the hills that we could have circumvented with better information, I had taken my large-format pictures of the Central region in the highlands from nearly ideal spots above the plain. After two previous and unsuccessful attempts to again reach these hilltops overlooking Central, in 2002 and 2004, I wasn't too sure I would actually be able to find the right locations, given the dense vegetation. But with the help of my machete-wielding assistant, I was finally able to reach the rocky ledge, 150 metres above Central, where I had taken my 1970 photographs. To my surprise, I was able to identify individual rocks visible in my old photographs. From this elevated location, the resulting photographic comparisons are dramatic. The new series of images shows clearly the disappearance of hundreds of trees in the valley below, as a result of depredation by goats. I also found where photographer Tui de Roy had taken ten images, from the



late 1970s and early 1980s, and I was later able to procure almost two dozen comparative images from these and other locations.

During this latest field trip, I fell seriously only once. With a thirty-kilogram backpack on one's shoulders, tripping and falling on the uneven lava terrain is always a dreaded possibility. As I was coming down to James Bay from the summit of Santiago after four days in the highlands, I stumbled at the very top of a six-kilometre lava flow that runs all the way to the coast (and which Darwin had crossed in 1835). As I reached down to break my fall, a thorn from an *Opuntia* cactus—the size of a horse needle—went almost completely through the palm of my right hand. Amazingly, a day later the puncture wound hardly hurt at all, even though the palm of my hand was noticeably swollen.

Rábida and Pinzón Field Trips: Cat's Claw and Fire Ants

After my trip to Santiago, I made a five-day trip to Rábida and Pinzón, two small islands between Santa Cruz and Santiago. I visited these two islands with Jill Key, a staff member of the Charles Darwin Research Station who studies rats, mice, and bats, and who coordinates programs about invasive species. On Rábida, Jill and I found virtually all the sites of my 1970 photographs. In two instances, we were able to identify the exact same palo santo trees (*Bursera graveolens*) that are visible in my earlier images. These trees have hardly grown at all, sending out just a few new shoots in thirty-five years. In the lowlands these plants exist with prac-

tically no leaves. After it rains in the period from January to May, they do form leaves, followed by flowering and the formation of seeds. But some years are dry, and there does not seem to be much overall growth after occasional reproduction is achieved. I also found a place where two *Opuntia* cacti, about one metre high in 1970, were still growing. They are now about double that height, with several new branches. Considering that these cacti can reach a height of nine metres, this is pretty slow growth in three decades.

On Pinzón we found many old tortoises (*Geochelone elephantopus ephippium*). Most of the major islands in the Galapagos group, as well as the five principal volcanoes of Isabela, have their own distinct tortoise subspecies. The ones on Pinzón are a saddleback form, common to the lower and drier islands. The raised form of the carapace, above the neck, helps these tortoises reach upwards for cactus pads hanging down from the giant *Opuntias*, which have evolved into trees in the Galapagos to escape being consumed by the tortoises who derive food and moisture from them. On elevated islands that have a highlands, where the clouds gather and provide rainfall that supports a lush vegetation, the tortoises are dome-shaped, giving them more protection from predators such as hawks, owls, and rats.

The tortoises on Pinzón stopped reproducing in the 1890s, after introduced rats began devouring all the young. Rats bite off the forelimbs, hind limbs, and eventually the head. In 1970 we did not see a single tortoise there that was fewer than seventy years old. At the Darwin Station, staff

members have successfully reared baby tortoises of this subspecies and have reintroduced many hundreds since the late 1960s. On our latest trip, Jill and I encountered a few of these smaller, reintroduced tortoises.

In trying to find the places where I had taken my 1970 photographs on Pinzón, Jill and I had to bushwhack for six hours through cat's claw (*Zanthoxylum fagara*). Once this plant catches anywhere on your body, it entangles itself in your skin and tears at it. Very nasty stuff. Then there were the *Acacia* thorns, which actually managed to enter our feet through the thick rubber soles of our boots. Compared with these troublesome plants, *Scutia* thorns, about five centimetres long—but less dangerous because they are not curved—were not so bad; but the overall tangle of thorny vegetation was sometimes pretty horrible.

After finding my 1970 photographic locations, we took another three hours to bushwhack back to our campsite. We decided to do so via the north crater, the floor of which looked pretty bare from a distance. When we got there we encountered a lot more vegetation than we had anticipated, slowing us down and, yet again, scratching us all over. From the floor of the north crater, our route back to camp involved a 150-metre climb up an *a'a* lava cliff, with boulders almost the size of cars. I fell twice as I tried to negotiate this cliff but was not seriously hurt.

Back at our campsite, we found that a tortoise had eaten a hole in my tent. My tent is green, and the thought evidently materialized in the tortoise's brain, very slowly but deliberately, "GREEN... THING... EAT... IT." Using their long necks,

some tortoises had also got into food that we thought was quite secure, since we had placed it on a high rock. The hungry tortoises had consumed a whole bag of granola. I later learned from Cruz Marquez (senior herpetologist at the Darwin Station) that National Park wardens built the *caseta* in the highlands on Santiago because of similar prob-



lems with persistent tortoises getting into people's tents and belongings. Tortoises treat almost everything as food. On Pinzón we found blue tape, used to mark the trails, in some of their scats.

Normally, tortoises are rather wary around humans and will, on being approached, retreat into their shells. They do this with a loud whooshing sound as they let out most of the air in their lungs and drop suddenly to the ground. I gave one very large tortoise a cactus pad, which he eagerly consumed. Several hours later, when I returned his way, this same tortoise appeared to remember me. He immediately came toward me, head and neck outstretched, apparently hoping for more. As I stooped to photograph him, getting down to his eye level, he practically ran over me. These tortoises lie underneath the giant *Opuntia* cacti all day, hiding from the equatorial sun and just waiting for cactus pads or fruits to drop—which happens every few days or weeks. So giving a tortoise a juicy cactus pad is like giving a child a giant bowl of ice cream.

San Cristóbal Field Trip: Beware of the Poison Apples

During this field trip to San Cristóbal we also went to another part of the island, not too far from the craterized district, in search of a rare form of *Lecocarpus*—a member of the daisy family—that only Darwin and one other collector (Alban Stewart in 1906) had ever found. Following a dry riverbed, described by Stewart, we discovered this plant almost exactly where Stewart said he had gone on

this part of the island, at a height of about 250 metres above Sappho Cove. The plant has heavily divided leaves like the forms of *Lecocarpus* on Española, and I was able to get the photograph I wanted of Alan Tye examining this rare plant in the field. A Danish botanist had previously claimed that Darwin must have been given his atypical specimen by someone on the *Beagle* who visited Española, forty-five kilometres to the southwest. But all of Darwin's plants, which I have personally examined at Cambridge University in England, are carefully and accurately labelled by island, so this botanist seems to have been mistaken. To many people's surprise, San Cristóbal turns out to have two distinct varieties or species of *Lecocarpus*.

The photograph I took of Alan Tye examining Darwin's lost *Lecocarpus* cost me dearly. During our eleven-hour trek on a very hot day, I developed heat stroke and repeatedly threw up. Then I ran out of water in spite of having brought two and a half litres, so throwing up just made my problems with dehydration even worse. I also managed to get manzanillo tree sap in my eyes as I was cutting a trail using a machete. The tortoises love the apples of these trees, but the apples are deadly poisonous to humans, as are the sap and pollen, which can cause temporary blindness. The alkaline sap got onto my wristband as I was cutting the overhead manzanillo branches, and when I wiped sweat from my brow, I transferred the sap into one of my eyes. As I tried to remove what I thought was a piece of debris from my right eye, rubbing it with my wristband, I spread the poison to my other eye. For the next six hours I was almost blinded by this poison. I

had to wear dark glasses just to be able to keep my eyes open a bit.

To get back to camp, I had to walk for five hours, over the dry riverbed of huge lava boulders that we had followed to this site, across occasional ravines, and through thick vegetation, while hardly being able to see. I could walk for about ten seconds, but after having my eyes open that long, it felt like sand had been thrown in them. So I had to stop and close my eyes tightly for five or six seconds, sometimes balancing gingerly on large boulders and along the edges of ravines. Oddly, the pain from closing my eyes was excruciating. But after my eyes had been tightly closed, the pain subsided, and I could then see again for another ten to fifteen seconds.

We all made it back to camp just as the sun was setting and the light rapidly failing. As soon as I returned, I drank some water and promptly vomited it all up. A swim finally brought my body temperature down, and I recovered within a few hours. The irritation to my eyes went away after two more hours, helped by antihistamine medication and a powerful narcotic painkiller—a supply of which I carry for just such field emergencies.

We collected land snails on San Cristóbal, accompanied by a local National Park warden, Jeffreys Málaga, and we found a number of live ones. Unfortunately, most of the snails that one finds here are empty shells. Perhaps eleven of the seventeen endemic species that were once present on this island have gone extinct, for unknown reasons—but probably connected with human habitation. During one hunt for land snails, Christine Parent,

a Simon Fraser University doctoral student, left her GPS at a lunch spot. Jeffreys volunteered to go back to retrieve it, a task that took him two hours. Meanwhile, Christine, her assistant Deborah, and I began to attract blackflies (*Simulium bipunctatum*), which were accidentally introduced to this island from the mainland around 1989 and have made a home for themselves in the highlands. Because we were hot and sweaty and not moving, we were repeatedly bitten by these nasty creatures. The flies feast on one's blood until they are bloated. I later counted more than 150 bites on my arms, legs, and neck. The only relief was to walk rapidly around in circles, an action that succeeded in leaving some of the flies behind, at least for a few minutes. These flies have become such a serious problem in the highlands on San Cristóbal that some farmers have abandoned their fields.

Santa Cruz Field Trips: Avian Casualties

Back on Santa Cruz Island, I engaged in a couple of shorter field trips, mainly to document ecological changes over the last thirty years. I also engaged in one somewhat oddball activity with my good friend, Juan Tapia, a local naturalist guide. One Sunday morning I hired a taxi, and Juan and I, with his partner, Astrid, and their one-year-old son, Konrad, set out on an unconventional tour of the island. As Darwin noted, birds are very tame in the Galapagos, having evolved without contact with humans. As a result, they are often run over by cars. Juvenile yellow warblers are particularly susceptible, and about five thousand are killed every year

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on the roads, despite signs warning drivers to slow down in certain *zonas de aves* where the birds are most at risk. Using a fish-eye lens that takes in a 180-degree view, I lay on my stomach about five centimetres from each dead bird we located, and photographed the carcass just as cars and trucks were rushing by in the other lane. My photographic yield for the day was a recently killed yellow warbler, with fresh blood on the feathers; a mockingbird; an ani (an introduced species that has become a pest); a Darwin's finch; and a beautiful barn owl, also recently killed so that not a feather appeared to be disturbed.

We then headed to the town garbage dump, a landfill area on the uninhabited northern side of the island. The trash there was being burned unattended, and flies were everywhere. Surrounded by smoke, I waded through endless broken bottles, smouldering cans, and burning trash to photograph the many brightly coloured plastic bags of garbage waiting their turn to catch fire. Somehow, I felt, this garbage dump epitomized so many of the serious ecological problems that are facing the Galapagos with its overly rapid growth in population. When I first visited Santa Cruz Island in 1968, there were

about fifteen hundred people living there. Now there are almost ten times that number, and considerably more than ten times the amount of garbage.

Despite my experiences in the Galapagos with dehydration, falls and puncture wounds, fire ants, shredded boots, semi-blindness from manzanillo sap, and bites by insidiously blood-sucking blackflies, I never seem to tire of what Darwin once called the land of "mystery of mysteries." It is a land of harsh realities—one that helped to shape, moreover, the stark view of nature that Darwin pioneered with his theory of evolution by natural selection. "It may be said that natural selection," Darwin wrote in the *Origin*, "is daily and



hourly scrutinising, throughout the world, every variation, even the slightest; rejecting that which is bad, preserving and adding up all that is good; silently and insensibly working, whenever and wherever opportunity offers. . . ." This is the uncompromising, Darwinian view of life that comes to mind each time I set foot in the Galapagos Islands.