

G U A N A
I S L A N D



A N A T U R A L H I S T O R Y G U I D E



Ticia Giovannone

Princeton Caterpillar



Jan Soderquist

Crested Anole

GUANA ISLAND

A Natural History Guide

by

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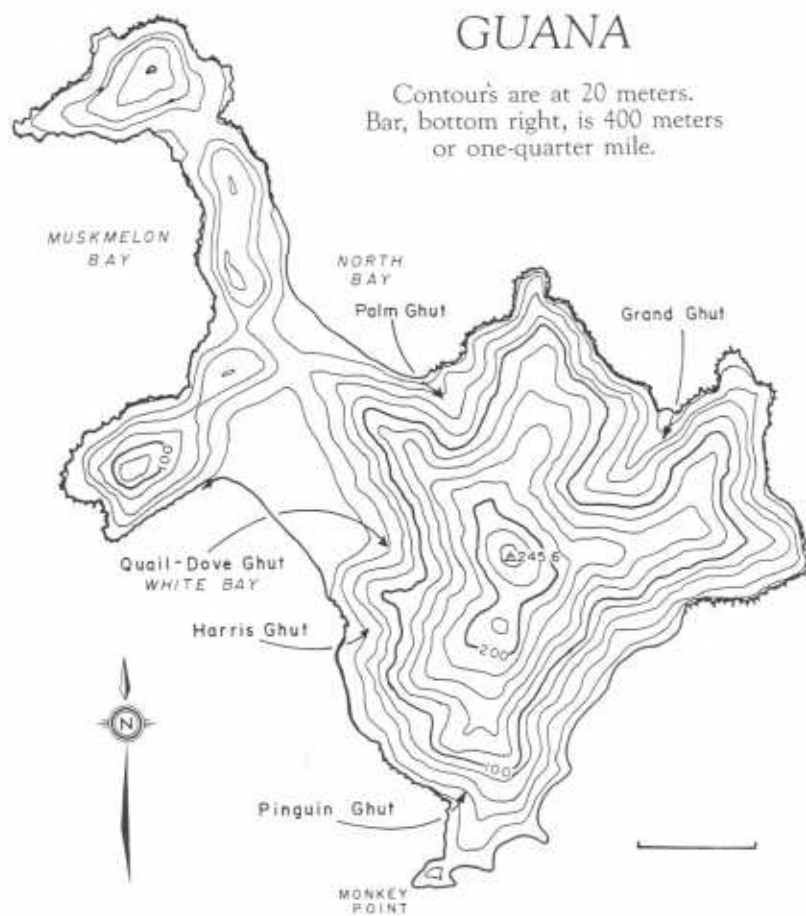
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Front cover: Caribbean flamingos by Ralph Rusher
Back cover: Brown pelicans and brown booby
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GUANA

Contours are at 20 meters.
Bar, bottom right, is 400 meters
or one-quarter mile.



A Natural History Guide

Guana Island is a wildlife sanctuary. Although only about 340 hectares (850 acres) and about 246 meters high (806 feet), Guana has the richest fauna known for an island of its size anywhere in the West Indies — and probably in the world. There are at least 50 species of birds which may be regularly seen, and more than twice that number possible. There are at least 14 species of reptiles and amphibians — none dangerous! There are four species of native mammals — all bats — and several more introduced (cats, European rats, sheep, and burros). The plants and insects number in the hundreds of species. Close inshore, more than 125 species of fishes may be observed.

This brief guide is an introduction to the natural wonders of Guana Island and intended to be used as a supplement to other guides. Some fine guides are:

- Bond, James. 1985. *Birds of the West Indies*. Collins, London: 256 pp.
- MacLean, William P. 1982. *Reptiles and Amphibians of the Virgin Islands*. MacMillan, London: vii + 54 pp.
- Raffaele, Herbert. 1983. *A Guide to the Birds of Puerto Rico and the Virgin Islands*. Fondo Educativo Interamericano, San Juan: 255 pp.
- Riley, Norman. 1975. *A Field Guide to the Butterflies of the West Indies*. Collins, London: 224 pp.
- Stokes, Joseph, and Charlotte Stokes. 1980. *Collins Handguide to the Coral Reef Fishes of the Caribbean*. Collins, London: 160 pp.

FLAMINGO

In the last century, when the great explorer-naturalist Robert H. Schomburgk reported to the Royal Geological Society in London on his Antillean investigations, thousands of pairs of Caribbean or **roseate flamingos** (*Phoenicopterus ruber*) nested in the British Virgin Islands. The birds were very popular as food because the young — called *pulli* (singular, pullus) — could be readily rounded up and herded. Each year, the crop of youngsters was herded — first through the towns of each island supporting a nesting colony — and then on to ships and small boats for transport to other islands where they were sold. Populations dwindled rapidly and even in Schomburgk's day the survivors were only on remote islands like Anegada, with low human populations and difficult of access.

A few nesters persisted until after World War II, but then the widespread use of firearms by indiscriminate "sport" shooters extirpated the remainder. Until 1986 our most spectacular native bird species could be seen only as occasional stragglers from the Bahamas and Hispaniola. The native flamingo is a threatened species, listed in the IUCN Red Book (International Union for the Conservation of Nature) and banned from international trade. Because of this, local tourist attractions in the Virgin Islands have often imported African flamingos — not at all the same as the native.

In 1983 The Conservation Agency began efforts to re-establish the native flamingo to its rightful place in the fauna of the British Virgin Islands. The undertaking was legally complex, difficult, and very expensive. The Guana Island Wildlife Sanctuary was the only appropriate place to begin, as it afforded protection and support. The flamingos you see here today are the real thing, natives whose ancestors came from the nearby southern Bahamas. They were reared initially on Bermuda and came to us through the great efforts and generosity of the Bermuda Aquarium and Zoo.

SHOREBIRDS, WADERS, AND DUCKS

While ogling our flamingos, take time to notice the other rich bird-life of the Salt Pond. Here are elegant **black-necked stilts** which nest from January through July. They are tall and thin, black and white, with long blood-red (when breeding) to pink legs. They are very territorial and defensive and will actually attack if you get too close to their nests (which are in grass on the ground). We are proud of our excellent breeding population of Bahama ducks or **Antillean pintails** (*Anas bahamensis*). They are beautifully patterned in black and white, with white cheeks, brown backs, and long tails. Most nest from January to March. The thick-billed or **Wilson's plover**, *Charadrius wilsonia*, was named for the father of American ornithology, Alexander Wilson (1766-1813). They are plump, brown-backed shorebirds with a black neck band. We usually have several nesting pairs each year in the spring.

The **little blue heron** frequents the salt pond. It is slaty-blue or purplish with a maroon-tinted neck. Also watch for the smaller **"green" heron**. It is striped and our subspecies is largely brown with orange legs. The handsome **yellow-crowned night heron** also stalks the pond edge as well as the Island's coast. It is grey and white with a black face, white cheeks, and a white plumed crown (yellow-tinged when the bird is in breeding plumage).

Cattle egrets, whose ancestors spread from Africa virtually all over the world in the last few centuries, frequent the grassy flat. They are white with buffy plumes. **Great blue** and **great white herons** occasionally visit Guana.

Along the rocky coast watch for **oystercatchers**. Superficially, these look like a stocky version of the stilt: black and white with red legs. Their massive, chisel-like, red and black bills identify them. **Turnstones**, the sprightly harlequins of the plover family, **spotted sandpipers**, who teeter and bob, and many other species come to Guana in their migratory seasons.

SEABIRDS

Twenty-two species of seabirds inhabit the Caribbean. In a recent exhaustive summary, Halewyn and Norton (1984, ICBP Technical Publication 2: 169-222) concluded that 11 of these were in need of major conservation attention. Threats to them come from eggging (the practice of collecting eggs for human consumption), shooting, development on small cays where they nest, depletion of fish fry stocks from reef death caused by siltation (caused in turn by poor land management and erosion), and the use of insecticides.

On Guana four of those eleven are common. Two nest in large numbers.

The most immediately obvious is the large **brown pelican**. Victim of all the malpractices noted above, the brown pelican plummeted from extreme abundance throughout the warm parts of North America and the Caribbean to near extinction by 1960. We have a fine breeding colony, the first in the BVI located since the great decline, and the largest. Brown pelicans plunge headfirst into the water, scoop up a gallon or so in their grand pouches, and sit on the surface draining. Often the common **laughing gull** will come along at this time and perch on the pelican's head or back. The gull hopes to get the very small fry drained away with the water from the pelican's pouch before the pelican swallows the larger fishes.

The **brown booby** — not an endangered species — is very common on Guana, nesting by the hundreds on the north face of Long Man's Point. It too dives for fishes, but lacks a large pouch. Adults have snow-white bellies that look turquoise as the birds fly over the blue water and white sand bottom on White Bay. Look for the **masked booby**; it is white with black wingtips, trailing wing edges,

and tail feathers. Still regular at Guana, this is the rarest and most endangered of Caribbean boobies. We have no proof of nesting.

Another endangered species very common in the skies over Guana is the **magnificent frigatebird**. Adult males of these long-winged, scissor-tailed oceanic birds are all black (with a scarlet pouch visible when courting). Females wear a white vest, and immatures have white heads and bellies. The only known breeding colony in the BVI is at Great Tobago, east of Jost Van Dyke.

Tropicbirds are the oceanic birds of paradise. They are elegant, largely white, streamer-tailed relatives of the frigatebirds. Two species occur: the yellow-billed or white-tailed is fairly common, but the larger red-billed (also with a white tail) is rare and endangered. The BVI are a last stronghold for the red-billed. A few pairs of tropicbirds nest on the cliffs at the north end of Guana.

Our other rare and endangered species is the **roseate tern**. These are silver-grey above, white below, black capped, and have long swallowtails. In the breeding season, April and May, several hundred nest along the south coast of Guana on Bigelow Bay and nearby beaches. It is important to avoid disturbing these birds at that time. Often dozens can be seen resting on Monkey Point as one comes to and from the Island. In breeding plumage the breast is tinged with rose.

PIGEONS AND DOVES

Oceanic islands are usually rich in these birds, the columbiforms. Guana has four species — one, the **bridled quail dove**, is our pride and joy. Our quail dove is a plump ground waddler, reluctant to fly and often quite curious. Its behavior made it easy prey to everything from feral cats to boys with slingshots. With a gun, one could extirpate whole populations. By the mid-1950's the bridled quail dove, ranging from Puerto Rico through the northern Lesser Antilles, was on the verge of extinction.

They are making a come-back, and Guana is their prime habitat. They are somber brown with russet in the wings, bright iridescent necks, pink bills and feet, and orange eyes. They wear a bold, white, bridle mark across the face. Do not confuse them with the large, slate-colored, **red-necked pigeon** so common in our big trees.

We also have lots of cooing **Zenaida doves**, quite like American mourning doves but with blunt tails, and tiny **ground doves**: brown and little bigger than a sparrow.

RAPTORS

Of resident birds of prey, we have but three. Beautiful little **kestrels**, or "sparrow hawks," are true falcons. They feed mostly on insects such as roaches, and are common. Females have rusty backs and wings, but males have blue-grey wings contrasting with their reddish backs.

A high, shrill note from the sky often heralds the **red-tailed hawk**, a buteo. It is a superb ratter and a most welcome resident. We usually have at least one nesting pair.

Our most wonderful raptor is a small owl. One of the rarest and least known birds in the world, **Newton's barefoot screech owl** has been believed extinct. We rarely see one, but we annually collect their pellets for diet analysis from our small Guana Island caves. They eat mostly insects, but also lizards, bats, and small birds. This owl makes a wavering call, almost a trill, quite like a North American screech owl. Rarely one will come and sit on a house roof. If you are good at imitating screech owls, or have a recording, you could join the ranks of fewer than a dozen observers to have seen this bird live. Its closest relative in the bird books is the Puerto Rican screech owl.

HOUSE AND GARDEN BIRDS

If you just relax on the veranda at Guana you will see a lot of birds. Gawky, belligerent **pearly-eyed thrashers** will attack your breakfast (often walking in the butter). Brilliant yellow-breasted **bananaquits** love fruit — and fruity, tropical drinks. Tiny **crested hummingbirds** and much larger **green throated caribs** zoom from hibiscus to tabebuia to frangipani blossoms. The sparrow-like **black-faced grassquit** likes floors and chair rungs. Two **flycatchers**, the big, bold grey and the small, drab *elaenia* work the trees and make themselves useful consuming flying insects.

And, watch for rarities. The Antillean **mango hummingbird**, long thought gone from the Virgin Islands, has been seen right by Dominica House on Guana. It is stocky with a long, strong, curved bill. The male is nearly black and hard to tell from a carib, but the female is like no other area hummer: brown with white outer tail tips. During the winter months dozens of American migrants — wood warblers, vireos, and the like — may be seen on Guana. We need good lists with accurate dates, times, and places.

LIZARDS

Lizards abound on Guana; all are harmless and beneficial. The most obvious lizards are the anoles, members of the genus *Anolis* in the iguana family. They are small insectivores. The most conspicuous is the **crested anole**. It likes to perch on rocks, tree trunks and bushes from knee- to eye-level. Patterned in shades of brown, the males sport grand throat fans with red borders and green centers. They display their fans in courtship or combat rituals. They have large crests on their tails. The females look quite different: little brown lizards with a bold, light stripe down the *middle* of the back.

The **saddled anole** is also very common. It is smaller and mossy grey or greenish with small, sooty saddle markings across the back. Males and females look alike except that males have a very large orange throat fan with a rich yellow border.

Our scarcest anole is the slender, long-tailed, **grass anole**. It sports a bold yellow stripe along each side from chest to abdomen. The sexes look quite similar, but males have a huge crimson throat fan with white scales scattered over it, giving it bold spots. Grass anoles live low in the ground vegetation, as their name implies.

Big **ground lizards** called ameivas scoot and zoom in seeming terror at human approach. They have two narrow light stripes, one on each side of the back. The very rare **slipperyback**, or, more properly, Sloane's skink, is a metallic bronze or coppery lizard with *three* short light stripes on the neck. Guana is one of its last sanctuaries in the world and it is of considerable scientific interest. It has the most mammal-like reproductive system of any known reptile. It produces tiny ova, like a mammal, which grow not from yolk, but from a placental attachment to the mother, into very large, well-developed, live-borne babies.

In Guana's woods you may notice tiny brown lizards scurrying in the leaf litter. These are **sphere-toed geckos**. They live lives rather like North American woodland salamanders. Their close relative is the house gecko. He appears on walls and ceilings at night and loves to catch insects around the lights. Local opinion is that the mere touch of a **house gecko**, called "wood slave," causes pregnancy, but I have handled hundreds and that never happened to me.

And, of course, there is the great '**guana**, a truly huge and remarkable lizard. Our species, *Iguana pinguis*, formerly was widespread through the Virgin Islands to and including Puerto Rico. Iguanas were reported surviving on Guana as late as 1930, but since then — until 1984 — they survived only on Anegada. Then we brought them back.

Our 'guanas are not to be confused with the common *Iguana iguana*, a species found from the USVI through the Lesser Antilles, all over tropical South and Central America, north to Mexico, and in virtually every zoo and pet shop. The 'guana of Guana is far more massive, attaining more than six feet in total length (more than half tail), and weights of over 70 lbs. Timid and shy, largely herbivorous, these are beneficent monsters more interesting, rarer, and much less well studied than their relatives people travel all the way to the Galapagos to see.

TURTLES

Guana Island provides nesting habitat for **sea turtles**, especially the green and hawksbill. We have few records of nesting because few people walk the beaches — especially White Bay — at night. Crawls, the tracks turtles leave behind, are regularly reported in the spring. We need people to look for and observe sea turtles. All our species are endangered. You just might find a nesting leatherback — largest living reptile, weighing up to a ton. They do nest on Tortola.

The turtle you are most likely to see, however, is the **red-legged tortoise**. The term tortoise is nothing more than an alternate word for turtle, although we usually think of tortoises — like the red-legged — as dry land animals. ("Tortoise shell," however, comes from a sea turtle, the hawksbill.) Red-legged tortoises were formerly abundant throughout the Lesser Antilles and Virgin Islands. Fossil giant relatives occurred east and west, on Sombrero and Mona.

These tortoises are very good eating and have been consumed on most of the islands where they previously occurred. They are omnivores but eat mostly grass, leaves, and fruits. The males, especially, are very colorful, unlike their Galapagos relatives. They do not get nearly so large, but a big one will have a straight-line shell measurement of 18 inches and weigh 50 lbs.

SNAKES

Our snakes on Guana Island are all basically harmless and beneficial. If grabbed, most will bite, and a big one can draw a bit of blood. They are difficult to grab, however, because they are very wary, shy, and much more afraid of you than you are of them. There are four species, but three are very rare or inconspicuous. The only snake commonly seen has no very good common name, being simply called "snake" throughout the area where it occurs, from Anegada to Tortola. It was first described from Anegada, and is sometimes called "Anegada ground snake." It is fast, like our American racers. It gets to be about three feet long and feeds on rats, mice, and lizards.

There is a much smaller, very closely related species which looks just like a baby of the common snake. Even experts have trouble telling them apart. A tiny, nearly blind burrowing species may be found under rocks or logs, or in termite nests. (The big globular masses often up in trees are termite nests.)

Grant's boa, a tiny species attaining no more than three feet, was originally known only from Guana Island and Tortola. It has since been found on St. Thomas, but it is one of the world's rarest snakes. It spends its life hidden in rocks or logs and is very hard to find.

FROGS

Only one species of frog, the Antillean **piping frog**, is known from Guana, but others are suspected. Piping frogs, genus *Eleutherodactylus*, occur all over the West Indies. Most, like ours, lay their eggs in foam nests in damp places on land and have no tadpole stage. Ours lives in the woods, grows to about two inches head-body length, and calls — a piping whistle — during very heavy rains.

Anyone willing to go out at night in the rain and catch frogs might find something quite new and wonderful.

BATS

We have no vampires and there has never been rabies recorded in any of our species. Our most common bat is the little **mastiff**

bat. It has a wing-spread of about eight inches, a face like a mastiff dog, and eats thousands of insects — especially gnats — each night.

Another common species is the Antillean **fruit bat**. It has a wing-spread up to 18 inches, a big nose leaf, and no tail. Similar in size, but with a tiny nose leaf, is the rare **cave bat**, an omnivore. The cave bat is interesting because it is one of the few animals on Earth with bicuspid canines. Both of these species roost in the bat cave on the west face of Guana peak.

Our largest species is the **fishing bat**. It has a wingspread of more than two feet. Several may be seen over White Bay or the Salt Pond, usually late at night. They scoop fish from the water with their hind legs, and also eat insects.

INSECTS

There are at least 10 million species of insects in the world, making them more diverse than all other groups of animals or plants. Fewer than two million have been even described and named scientifically, and we have life history and ecological data for only a handful (usually those that bite us or eat our crops). There are at least 4,000 species of insects in the BVI, but there is no list or reference manual. Many had never been collected here previous to the beginnings of our efforts in the early 1980's.

For example, there were only about 20 species of moths of the family Tineidae recorded in the scientific literature from the Greater Puerto Rican region. Only five were known from the BVI. Their tiny caterpillars are scavengers. Our studies have turned up over 30 species in the BVI, many previously unknown to science.

In addition to discovering new species, we have found many "lost" species. Some of the first New World species named by scientists came from the Virgin Islands. Those descriptions, published some 200 years ago, are inadequate by modern standards. The specimens upon which they were based have often been lost or damaged. We have been able to secure fresh, high-quality specimens and begin reanalysis of the historic records and redescription of the species.

On Guana we have found so far at least 300 species of moths (about 200 with names), and 22 butterflies (all named). There are about a dozen species of dragonflies. Worldwide, by far the most numerous of insects are beetles. My favorite comment on this vast group came from Dr. J.B.S. Haldane, the great British biologist and pioneer geneticist. He was asked by a group of distinguished theologians just what he could determine about The Creator from study of His Creation. He thought a moment, then said: "An inordinate fondness for beetles."

Still Guana has only about 200 beetle species. This may be because most beetles are short-distance flyers and thus may not be good island colonizers. Obvious exceptions are our handsome tiger beetles one may see on the hot, open sand of the upper beach. These agile, fast, strong flyers are hard to catch.

Although a few insects are irritating to us, most of our species fill vital roles in nature. They are basal elements in food chains because of their abundance. They are the principal plant pollinators. Insects such as termites are indispensable for converting plant material into the nutrients required by all life on Earth.

Guana termites have been the subject of especially intensive studies. We have only nine proven species, but that is remarkable. Guana has a more varied termite fauna than has been found on nearby islands thus far, and is unusually rich in species for an island of its size.

Three types of termites are found on Guana: **nasutes**, the most specialized ones with glue-squirting soldiers; dry-wood termites, living in sound wood, usually dead and sometimes in buildings; and subterranean termites, pest species that enter structural timbers from the soil and cause much damage.

Termites play an important role in communities as recycling agents, breaking down the tough cell walls in wood or other plant material and returning the contained nutrients to soil to be utilized by other plants. This recycling activity is now recognized as essential to the survival of forest, desert, and grassland plant communities in warm areas.

Termites contain bacteria that fix nitrogen — an ability rare in the world. You are familiar with the nitrogen-fixing abilities of the bacteria inhabiting root nodules of legumes; these are important, as the only other sources for usable nitrogen are lightning and manures or commercial fertilizers. The bacteria in the termites provide nitrogen they use for growth; any excess is excreted in the manure and used in nest construction. These nests, broken into small pieces, are used as fertilizer in some areas. Trees in tropical rain forests develop roots from even high branches, penetrating the termite nests. This relationship deserves further study.

Termites have complex societies — but individual termite behavior is much more rigid than mammalian behavior. The colony as a unit, however, has great flexibility, and has been compared to an organism in its ability to meet changes and environmental challenges. Termites provide many questions of interest, as well as useful products and essential activities permitting survival of plants in the communities of which they are a part. Most species of termites are beneficial, but those that live in buildings cause a large amount of damage. Non-pest species live in dead wood, or forest litter, leaves or humus, eating the material in which they live.

If you are fortunate enough to be here during the time some species of termites have their dispersal flights, you will be able to see some of the courtship behavior: after a short flight, the termites lose their wings, and males begin to follow females closely. The pair will seek a place to hide and begin a new colony.

Nesting termites are fascinating in their own right. There will be many small, dark, very fast individuals with nozzle shaped heads,

the **nasute** soldiers. You will probably detect a turpentine-like odor when you disturb the nest, and may even get brown stains on your hands. This material is a chemically unique glue that the soldiers squirt out of their heads when disturbed. It can stop an attacking ant in its tracks, gumming up antennae and legs. The soldiers are blind; we are not sure how they manage to aim so well, but we suspect they react to air currents. Anyhow, these "Bazooka-headed" termites can defend the nest against ant attack until the damage is repaired. Workers, the fat, dark brown individuals that make up the majority of the colony population, hurry to mend breaks in the nest or in the dark covered trails leading from the nest to the ground.

A striking feature one can observe here is a large brown nest on trees, built by termites. This nest is composed of chewed wood fragments and secretions from the termites, a material called **carton**. If mosquitoes were a problem, they could be repelled easily, pleasantly, and safely by simply taking a chunk of this nest, knocking all the termites out, then lighting it as one would burn incense. The fragrant smoke is a potent, non-toxic mosquito repellent!

For most of the foregoing material, I am indebted to Dr. Margaret Collins (Smithsonian), Dr. Scott Miller (Bishop Museum, Honolulu), and Dr. Vitor Becker (Department of Agriculture, Brasil). These three renowned entomologists have pioneered our efforts on Guana. I have lifted material verbatim from some of their reports and letters, with permission.

OTHER CREATURES

This has been a quick sketch and hundreds of species have been left out. For example, Guana has a peculiar, foxy-faced, nearly blind, burrowing reptile with no legs — but related to lizards. It has no common name (and is genuinely rare), but its scientific name is *Amphisbaena*. It belongs to a species found only in the Virgin Islands.

There are lots of big ground spiders, popularly called tarantulas, but they live underground, and only come up to their entrances at night, and never seem to bite anyone. There are two species of small scorpions. Both pack a snappy sting — no worse than a honey bee. You have to hunt for scorpions as a rule, usually under rocks in the woods. There are huge millipedes — shiny and near black — which like to live in the trees. They are harmless but exude a foul-smelling, dark-staining liquid if handled.

Princeton worms — really caterpillars — defoliate the frangipani trees in a perfectly natural cycle. They are velvety black with yellow rings and orange heads. They get to be about six inches long and metamorphose into lovely paisley moths, *Pseudosphinx tetrio*. They are harmless at all sizes.

The worst problems come from wasps called "Jack Spaniards." They are small and yellow-banded. They make little nests under leaves or overhangs — often right in trails. One sting is no big problem,

unless you are allergic, but people may hit a nest inadvertently and so get stung several times. Watch where you walk!

There are many species of **land crabs**. People are astounded by the abundance of **soldier crabs**, which live in snail shells (usually topshells) in places like the North Bay woods. **Ghost crabs** scuttle over the beaches, and will boldly steal objects like sunglasses from unwary baskers. Calico **rock crabs**, *Grapsus*, live on the rocky shores, and huge, very delicious *Cardisoma* crabs make the large burrows on the flat — especially along the road to the dock.

TREES

There are several dozen tree species on Guana. I list here the ones most often asked about.

Tabebuia. — Tall, slender, often multi-trunked trees with pale lavender-blue to pink-tinged flowers — favorites of hummingbirds. These trees are common around the buildings and down on the flat.

Frangipani. — These are primitive-looking small trees with dichotomous branching. The leaves — if not eaten off by Princeton worms — are large and have prominent, parallel veins at right-angles to the midrib. The flowers of the wild-type are white. There are two native species: the common form, with several good-sized specimens right by Dominica House, and the slender leaved: little more than a bush and most frequent in rough, rocky, open areas and cliffs.

Royal poinciana. — This member of the pea family produces large, showy, red and yellow flowers. It is also called "flamboyant" and "flame-of-the-forest." It has compound leaves that look feathery. It is a native of Madagascar, now introduced all over the tropical world.

Gumbo-limbo. — These red trees have thin, papery bark that is forever peeling, so they are often called "tourist trees." They produce a thick gum with a pungent odor which earns them another common name: "turpentine tree." They attain large size. Classic specimens may be seen at the old sugar works ruin between North Bay and the Salt Pond.

Pisonia. — The trunks and roots look like accidentally poured concrete: grey and lumpy. Also called "blolly" or "loblolly," these trees attain very large size — to over three feet in diameter. They are very common and big ones can be seen on the flat and throughout the woods.

Tamarind. — These pea-family trees attain huge size. They provided deep shade in agricultural areas, as well as an edible pod, so they were frequently allowed to live when other trees were felled and land cleared. The leaves are compound and feathery; the bark is dark brown and very rough. The bark tends to flake and fall off in slabs. Big tamarinds are usually hollow and often contain wild bee hives. The pods contain a tart, sticky matrix in which the seeds develop. This material makes excellent jams and jellies. There are big tamarinds by the garden and in the bottom of Quail Dove Ghut.

Seagrape. — This member of the buckwheat family is often little more than a bush, but giants grow on Guana. The leaves are large, thick and stiff — nearly round in outline. The fruits grow in grape-like hanging clusters and are a favorite food of iguanas and tortoises. Seagrapes grow along all the beaches and in big clumps on the flat.

GEOLOGY

The Puerto Rico Bank includes all islands from Puerto Rico itself to Anegada, northeasternmost of the Virgin Islands. Only St. Croix and its small satellite cays are not part of this geological unit. During glacial maxima ("ice ages"), the entire Puerto Rico Bank is dry land; the British Virgin Islands are hills or ranges on a broad plateau; the climate is generally much stormier because tropic heat and ice caps are in close juxtaposition and great weather fronts are generated.

During interglacials, such as the one we presently live in, sea level rises a hundred meters or more and the Puerto Rico Bank becomes an archipelago. During the Sangamon Interglacial, about 100 thousand years ago, sea level was about 20 meters or 70 feet above its present level. At that time limestone formed from algae and corals that capped over many shallow water features. Today some of these stick out above water and are the limestone islands of Anegada (BVI) and Lovango, Grass, and Thatch (USVI). There are smaller interglacial limestone deposits on most other Virgin Islands too, including Guana.

Most of the Virgin Islands and the entire foundations of the Puerto Rico Bank are of ancient volcanic origin, rocks called **igneous extrusives**. Guana is typical, mostly made of **andesite** and **tuffs**. Andesite is hardened lava and tuffs are made of ash. Hot, eruptive ash consolidates to make welded tuff. Chunks of rock, usually andesite, may be included in the tuff. If so, the result is aglomeratic tuff; it looks like sedimentary conglomerate but the included rock fragments are jagged, not rounded.

Tuffs are highly pervious to water and can erode out to form shallow shelter caves, like those visible on the pyramid, around the Guana Head, and our bat caves.

The igneous rocks of Guana and other Virgin Islands date from the Cretaceous, at the end of the Age of Reptiles, about 70 million years ago. Direct evidences of their volcanic origin, such as craters or calderas, have long been obliterated by erosion. Our islands are much older than the Lesser Antilles, where active vulcanism can be seen today (Guadeloupe, Dominica, Martinique, etc.)

How the Greater Puerto Rico Bank originated is the subject of impassioned debate. In the early 1900's geologists and biologists envisioned great mountain ranges extending across the Caribbean Sea. They thought the present islands were fragments of these continuous land areas called "land bridges." That view was wholly discredited by a new wave of geologists and biologists who combined evidence

to "prove" the islands (or at least the banks — islands at glacial maxima) had independent origins and never had land connections to each other or the continents. Recent enthusiasm for plate tectonics and continental drift has produced a coterie of geologists and biologists who believe the islands are fragments of other lands — most from Central America, but perhaps some from Africa or a hypothetical Atlantis — that have drifted to their present positions. I have dubbed this the "land barge" theory. Biological evidence for it is the exact same stuff proffered by the land bridge school. Thus the land barge theory has a decided quaintness not often associated with intellectual revolutions.

None of the life forms known from Guana, or the other Virgins and Puerto Rico, are especially old in geological history. People often ask if our great 'guanas are direct descendants of the dinosaurs of the Cretaceous, alive when the land formed. Sadly or remarkably, the answer is no. All our reptiles are rather modern, up-to-date sorts. Turtles do indeed go back as a group to the Age of Reptiles, but our species — land and sea — are advanced, highly derived forms.

Humans first came up into the Antilles from South America something like three to five thousand years ago. They ate up a lot of the larger kinds of animals we know now only from subfossil bones associated with aboriginal trash heaps called **middens**. There were large, flightless birds, several giant tortoises, and huge rodents. One, a porcupine-sized rodent, persisted in the mountain forests of Puerto Rico until European settlement. It may have occurred in the Virgin Islands too. There were once parrots and sea cows, or manatees, in the Virgins. These cling to survival, rare and endangered, in Puerto Rico. Our great 'guana formerly occurred in the USVI and Puerto Rico, where its bones are found today. It clings to survival here.

Perhaps the saddest case is that of the little monk seals called "sea wolves" — **lobos marinos** — by the Spanish and "sea dogs" by the British. We know them now only from their bones and the names they inspired for small islets — the Dogs and Seal Dogs — where they were abundant when Columbus and Drake passed this way. The last one was killed in 1954.

The relative richness of our fauna results in large part from the geological history of the Puerto Rico Bank, alternating vast continuity (glacial maxima) with fragmentation to many islands (interglacials). Successful species may spread over the entire Bank at low water. Then, a few tens of thousands of years later, high water isolates them from their relatives and they begin independent evolution, leading to new species. This pattern has been repeated at least four times in the last million years, and uncounted times before that. Thus these islands provide a theatre of dynamic evolution where speciation processes can be documented and studied to advantage. Human activities have disrupted evolutionary patterns in most lowland areas, at least, but Guana remains to a large degree an example of how things were before we came.

HIKES

Apart from negotiating the Guanaberry Trail to the beach, or Crab Cove Trail for snorkelling, there are a number of hikes one can take on Guana Island. Three which provide the best opportunities for observing birds and wildlife and unusual plants are here described in some detail.

North Bay. — Begin on the lawn beside the cannon outside Dominica House, overlooking the Salt Pond. Go left along the grassy trail with a hairpin switchback. Watch for grass anoles and slipperybacks (Sloane's skinks), two of our rarer lizards, both regularly seen here. This trail brings you to the driveway just above the pipe grid.

As you cross the pipe grid you leave a sheep enclosure. Notice the difference in ground vegetation on either side of the grid and adjacent fence line. At the next switchback, on the paved driveway, go straight ahead into the woods. This trail leads straight on to the junction of the North Bay road and the Grenada House driveway.

Go nearly straight ahead, passing Grenada House driveway to your left and the road to the sugar works ruin on your right. You go over a low col, or saddle, and down a rocky road into the woods. Listen for the plaintive *weeep, weeep* calls of **ani** birds. These graceless, floppy relatives of cuckoos are all black and have large, parrot-like bills.

On the North Bay flat bear right along the overgrown, shady road. Stop a moment to listen. You will hear an almost continuous rustling (at least at a reasonably early hour of the morning). Pick a nearby rustler and look closely: The noise is made by foraging soldier crabs, hauling their massive shells (which they acquired from snails in the sea). Soldier crabs are less active at midday and afternoon. They climb both trees and mountains — the latter to more than two thousand feet. They will return to the sea to lay their eggs.

Look in the trees — and occasionally on the ground — for huge, nearly spherical structures that look like they are made of honey-combed masonite. These are the homes of the nasutes — "nose termites."

As you walk along in the North Bay woods, look closely at the leaf litter in front of your feet. You should soon see a tiny sphere-toed gecko scurrying. A big adult is about two inches, total length. These little lizards consume vast quantities of ants and other insects. They like to lay their eggs in nasute galleries, but do not seem to eat the termites.

Soon you will come into low scrub and open sand areas. In the heat of the day some of our largest ground lizards — ameivas — are active here. A very big, old one loses its rusty back color and prominent dorsolateral stripes and looks cloudy blue-grey.

Veer left through low seagrasses, past the lonely coconut palm, onto the beach. Remember this coconut: it will help you find your

way back! North Bay beach is windward and high energy. You will notice striking differences from White Bay, the better swimming beach. Turn right and walk down the beach. Looking up to the jungle-covered slope on your right, you can see sabal palms. These are very rare in the Virgin Islands and we have some of the few native specimens. The great leaves have leaflets that radiate from the base at first, then, at the midline, branch off a single vein. Thus the sabal has a leaf type intermediate between the broom palm (coming up soon) and the coconut palm. Broom palms have *radiate* leaves, coconuts have *pinnate* — feather-like — leaves.

In the low woods at this southern end of the North Bay flat the tree trunks are decorated by brilliant lichens: mossy green, chartreuse, yellow, orange, and even blood red.

Farther along the beach you will come to an area of beach rock. This concrete-like, sedimentary material forms very rapidly from a mixture of calcium, fine sand, and algal glue. It came as a great surprise to archeologists when they found European artifacts — forks and knives — solidly imbedded in West Indian beach rock a few decades ago.

Scramble over the rock head at the foot of the beach. This is an excellent place to see calico rock crabs, *Grapsus*. As they grow, they shed their old shells. These turn brilliant orange in the sun and are often easy to spot on the rocks. The living animal is more olive drab.

Proceed along the cobble beach to the bottom of the ravine called Palm Ghut. You can go through the seagrapes into this Ghut and climb up into the forest over beautiful rock formations. At an elevation of about 20 meters (70 feet) above sea level, you will enter the palm zone. Here the understory of the forest is dominated by little broom palms, *Coccothrinax*. This is another unusual species, now rare except on Guana. It gets its name from the use of its radiate leaves to make brooms.

If you examine the palm fronds closely you may find Guana palm snails. These little tree snails get about one half inch in diameter and are patterned with lines of terra cotta and beige. This species was first described in the nineteenth century on the basis of specimens received at the British Museum, but no one knew where they had come from! We rediscovered them on Guana Island in 1982.

Now you can decide to either retrace your steps, down the Ghut, and back along the beach, or go for the summit. If you elect the latter, do not change your mind halfway. The Ghut becomes broad and branched higher up, and finding your way back down to the original entrance (exit) can be difficult. In the woods you will not be able to readily discern directions.

However, up — always, undeviatingly up — is safe. Sooner or later you will break out to the peak

Guana Peak. — The easiest way to reach the peak of the Island is the Ridge Trail. Proceed as towards North Bay until you reach the

junction at the Grenada House driveway. Pass it, as before, to your left, and walk to the crest of the col on the road which descends to the North Bay flat before you, and to the sugar works ruin behind. Look to your right for the rough trail going right along the ridge line through the woods. It is marked by cutlass chops and white paint blazes. The trick with this trail is just to keep to it, right along the ridge.

Along the way are rock outcrops affording lovely views to windward and leeward, over the flats. These are excellent vantages from which to see red-tailed hawks, frigatebirds, and tropicbirds.

Right around the summit, in shady woods just off the trail, are interesting plants which grow in this moist zone. These include long-petalled spider orchids and *pepromia* growing on rock ledges and faces, and sword ferns growing up from between the boulders. The view from the top is worth the trip. Be sure to log your passage on the rolls in the jar beside the old radio tower ruin. Notice the mam-mee apple tree, *Clusia*, with large, thick, pear-shaped leaves. It is scarce.

Now you can either retrace your steps back down the ridge, or make an adventurous choice. (For those who climbed the Palm Ghut both alternatives are new ground).

You may elect to return by way of Quail Dove Ghut, second largest ravine or valley on the Island. To do this, work your way south from the main peak into the col, or saddle, between it and the secondary high point of the Island. In this col search for a circular depression flanked by flat rocks. We have no idea who built this or why, but it is an excellent land mark. Having found it, you want to turn right-angle right, which is just north of due west, and go down the ravine. This is the best area on the Island to observe the bridled quail dove, and many other bird species too.

As one gets towards the bottom of the Ghut, a good trail emerges along the left-hand side. Watch out for hanging hives of Jack Spaniards — small wasps. At the bottom of the Ghut is a very large, table-like rock under an ancient tamarind tree. To the left of this, look for a gourd tree, or calabash. It produces volley-ball-sized fruit whose shells were used for bowls and water vessels in the past.

The deep ditch just beyond the calabash tree was made to trap runoff water from the Ghut and get it into the ground water system of the flat. Pass this ditch to your right and follow the trail out onto White Bay flat.

Monkey Point. — For the hardy and adventurous, this is a great hike. It is best to pack a lunch — and plenty of water — and go to the beach on the south side of Monkey Point by boat.

After enjoying the beach (and lightening your pack), start to walk back. It is not easy.

First you must scramble over the ridge into the Penguin Ghut — next valley northwest — or negotiate the cliffed coast proceeding north from the beach. (The beach goes right across Monkey Point

from southeast to northwest.) Along the northwest facing down-slope of this basin-like valley you enter the land of the penguins. Not at all Antarctic birds, these attractive but thorny plants, *Bromelia pinguin*, are native relatives of the pineapple. The tree-dwelling bromeliads seen all over Guana are more distant relatives, too.

Follow the Ghut, or ravine channel, up out of this little valley, curving to your left: northwest. On the shoulder of the hill are the ruins of the old Lake House, residence of the Lake family, Quakers who settled Guana Island in the early eighteenth century. Notice the beds of aloe — revered for its medicinal properties and always an indicator of old homesites.

Try to contour the Island from here: travel around the hillside, staying at the same elevation. With luck, you will come into the col between Harris Ghut and Guail Dove Ghut. This is an area of deep, shady woods, but old stone walls attest previous land-clearing and civilization — some 250 years ago.

From this col you may either go north, into Quail Dove Ghut and so out to White Bay flat, or southwest down Harris Ghut, and travel back along the beach. You will want a frosty drink at the beach bar on your way home.

REEFS

Guana has three very distinct reef areas, at least one perfect for any level of snorkelling or scuba experience.

White Bay. — Here are a set of parallel patch reefs in shallow water, roughly at right angles to the beach. Surge channels separate these small reefs, but White Bay is leeward, so there are no strong waves or currents. This area is ideal for the fish-watcher and snorkeller, or the beginning diver. Get an overview from Dominica House so you know the lay of the reefs.

Swim along the side of a patch reef in the channel. This is a perfect place to see about 100 tropical reef fishes, waving gorgonians called "fan corals," and the various species of hard corals. The large silver fishes one encounters here are usually tarpon and quite harmless. There are barracudas and small sharks, from time to time, but none have ever bothered anyone here. Barracudas are attracted to shiny objects such as rings and metal bracelets.

Great green morays sometimes lurk under the dock, or in holes in the reef. These, too, are harmless unless provoked. Do not grab or prod one: they can bite.

Often great schools of fry come into the Bay, forming what look like curtains of millions of little fish glinting in the sun. These attract dozens of seabirds, hunting from the air, and bigger predatory fishes, hunting from below.

Muskmelon Bay. — This is a deep bay with spectacular reefs at 60 to 80 feet. It is a wonderful area for the experienced diver.

Crab Cove makes a fine introduction to Muskmelon Bay for the

snorkeller or beginning diver. A sandy bottom extends out from Muskmelon Beach, clearly visible from atop Camanoe House, out into the deeper reef. Large, oceanic fishes like tuna and king mackerel may be seen here. The experienced diver will want to arrange a trip here by boat.

North Bay. — This windward, rough water bay is very different from the others. Definitely the place for experienced divers, North Bay has excellent deep reefs and wrecks. It can be best approached only by boat, so special arrangements must be made for this adventure.

Ongoing research in marine biology, ornithology, mammalogy, herpetology, entomology, archeology, and botany focuses on Guana Island and is directed by The Conservation Agency. It involves scientists and students from the British Virgin Islands, the College of the Virgin Islands (USVI), Harvard University, Yale University, the University of Massachusetts, The Nature Conservancy, the Smithsonian Institution, the California Academy of Sciences, the Bishop Museum of Hawaii, and the Guangdong Institute of the Chinese Academy of Sciences (Academia Sinica) — to cite a partial list. We have just begun and there is much to learn. Interested persons may contact us for additional information.

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Iguana pinguis

