

# Galápagos Marine Iguanas: A Living Heritage

By Karl H. Switak

*“...this lizard is extremely common on all the islands throughout the Archipelago. It is a hideous-looking creature, of a dirty black colour, stupid and sluggish in its movements. I have seen a large one which weighed 20 pounds.”*

—Darwin 1839

However, Darwin wasn't the only observer who used the term “hideous” when describing the marine iguana. Beebe (1924) quotes Captain Porter as follows: “... to our great surprise and no little alarm, on entering the bushes [we] found myriads of iguanas, of an enormous size and the most hideous appearance imaginable.” Obviously satisfied with his inapt description, Porter goes on with “...we soon, however, discovered them to be the most timid of animals, and in a few moments

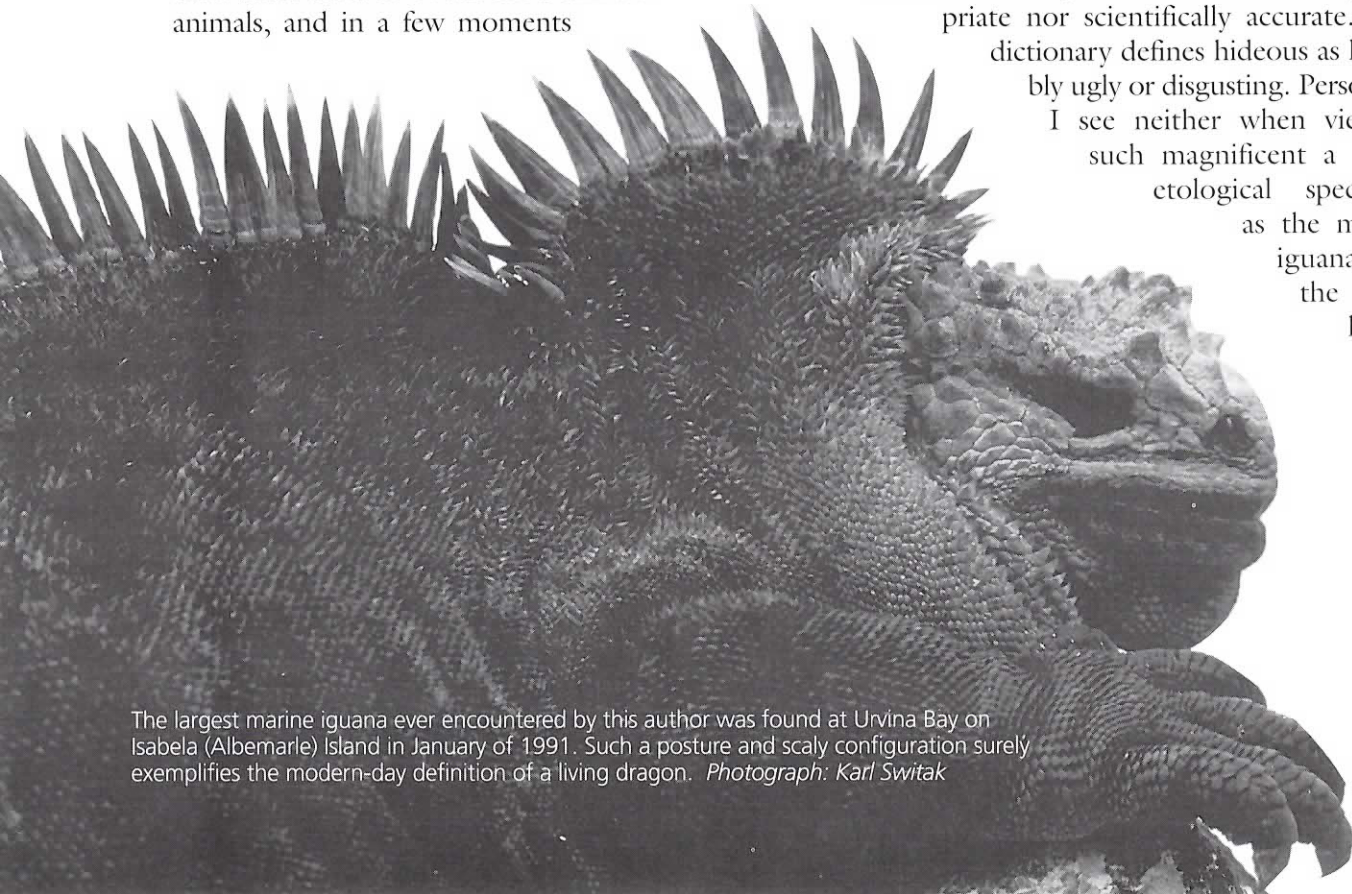
knocked down (killed!) hundreds of them with our clubs, some of which we brought on board and found them to be excellent eating, and many preferred them greatly to the turtle.” In this case Porter referred to Albemarle (Isabela) Island.

I certainly agree with Charles Darwin and others that this lizard species is extremely common on the Galápagos Islands. As a matter of fact, it is the most prolific reptile found there. But calling it a

“hideous-looking creature” is neither appropriate nor scientifically accurate. The dictionary defines hideous as horribly ugly or disgusting. Personally

I see neither when viewing such magnificent a herpetological specimen

as the marine iguana. On the other hand,



The largest marine iguana ever encountered by this author was found at Urvína Bay on Isabela (Albemarle) Island in January of 1991. Such a posture and scaly configuration surely exemplifies the modern-day definition of a living dragon. Photograph: Karl Switak



A colony of marine iguanas thermoregulating on the shores of Academy Bay, Santa Cruz (Indefatigable) Island. The plant is *Sesuvium*. Photograph: Karl Switak

I suppose, beauty (or the lack thereof) reflects in the eyes of the beholder.

Thirteen years have passed since my first visit to the Galápagos Archipelago. Since then I've undertaken three additional safaris, and plan on even more in the near future, but that first excursion back in August of 1986 must go down in history as one of my very best. During said maiden voyage our group sighted a number of marine iguanas on Isla Isabela that can only be described as "being of royal stature and of monstrous proportions."

My primary purpose for visiting the Galápagos has always been to study and photograph the reptile community, which numbers in the tens of thousands within the confines of this insular paradise. To this end I was never disappointed and Darwin (1839) put it sublimely when he wrote as follows: "[we] will now turn to the order of reptiles, which forms, perhaps, the most striking feature in the zoology of these islands. The species are not common, but the number of individuals of each kind, is extraordinarily great."

The geographical range for the marine iguana, *Amblyrhynchus cristatus*, encompasses all of the coastal areas of all the islands in the archipelago, which includes islets and sea rocks. It is endemic to the Galápagos and found nowhere else on Earth. On some islands this monotypic genus is represented by thousands, on others by but a handful, and on a few it is extinct—or nearly so. Bowman (1960) reported no marine iguanas being sighted in the vicinity of Black Beach on Floreana Island and neither did the California Academy of Sciences expedition in 1905-06. However, our group did find this species on Black Beach, Floreana Island, during January of 1991. Due to the jagged and unforgiving coastline that embraces many of the islands in the archipelago, obtaining a correct number of these lizards borders on the impossible. It has been estimated by some that as many as 200,000 marine iguanas may live on the various islands, and in really favorable years this maximum could even be closer to the 300,000 mark!

To exemplify the marine iguana populations that flourish in most regions of the archipelago, a

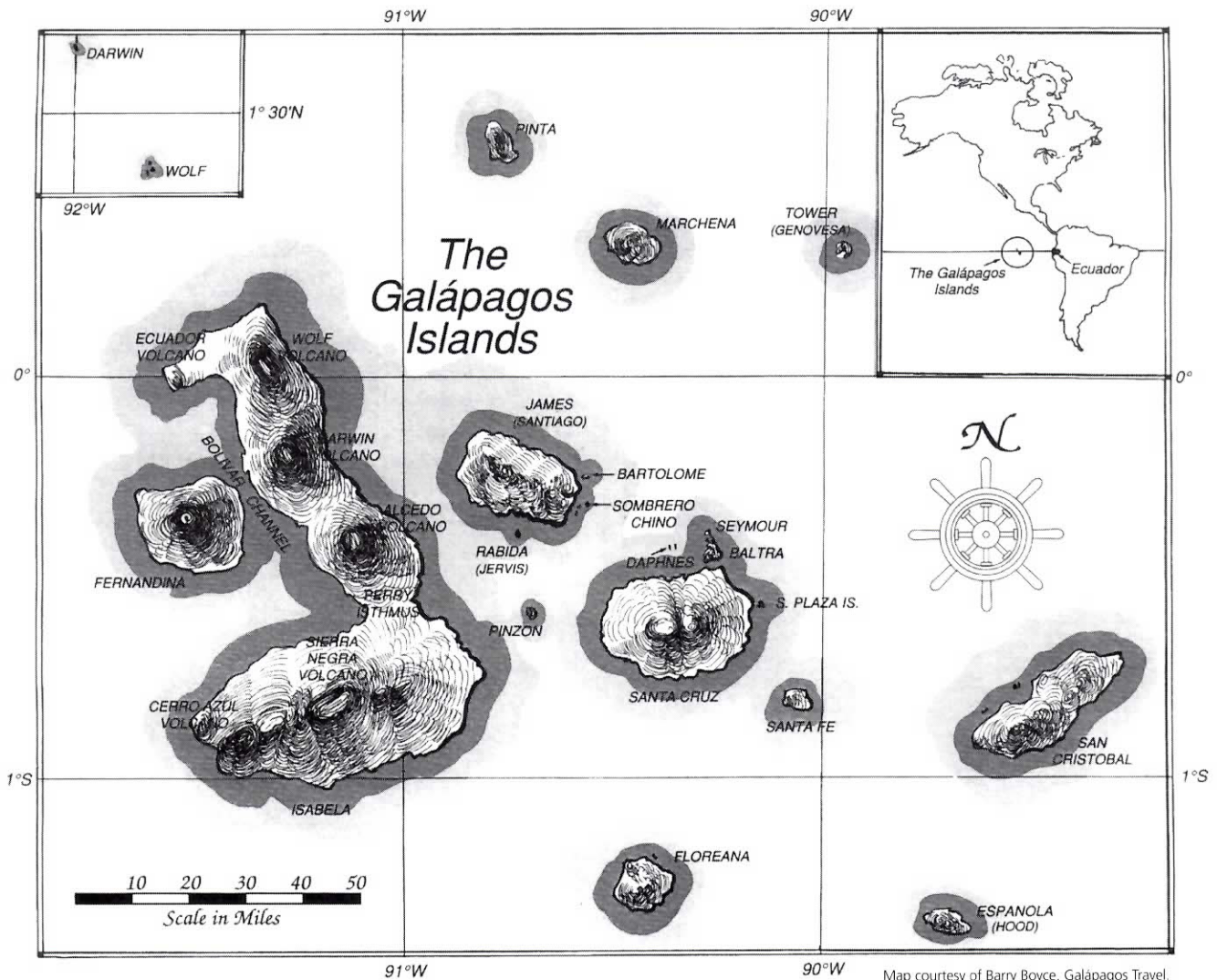
few noteworthy comments from previous authors are of great importance:

Carpenter (1966) writes that perhaps the most concentrated biomass of these lizards exists at Punta Espinosa, Fernandina Island. On a single rocky projection, measuring a mere 6m by 18m, the following density estimates were made. January 25, 1964 = 350 lizards, January 26 = 300 lizards, and January 27 = 500 lizards. A census taken of the entire point on January 27 yielded a total number of 1,885 lizards.

Nagy & Shoemaker (1984) estimated the number of marine iguanas at Punta Espinosa, Fernandina Island, to be about 2,000 strong and “that such a concentration would consume some 28 tons of fresh algae each year.”

Jackson (1993) writes that perhaps 3,000 marine iguanas may occur on a single kilometer of coastline.

Marine iguanas are large, robust lizards, with a long, vertically compressed tail, a somewhat chunky head, and extremely powerful claws. The average length ranges between 0.91 m to 1.2 m, although larger specimens have been recorded. Slevin (1935) mentions males reaching a length of 1.5 m and a weight of 20–22 pounds. During my first visit to the Galápagos in August of 1986, our expedition found several colonies of *Amblyrhynchus* at Punta Albemarle, Isabela Island, that were all of enormous size (especially the males). But the very largest specimen I ever ran across came from the western side of Isla Isabela at Urvina Bay, found in January of 1991. This individual (a male) and several like him definitely fit the description of a living dragon. Not actually being able to touch the lizards (this pertains to the entire endemic fauna) we could only estimate their



Map courtesy of Barry Boyce, Galápagos Travel.

(Below) Adult female marine iguana from Academy Bay, Santa Cruz (Indefatigable) Island. These reptiles are brilliantly adapted to life on the shoreline, as exemplified by huge claws that serve as anchors among the jagged lava rocks. *Photograph: Karl Switak*



individual lengths. This, we agreed, was better than 1.5 meters from the tip of the nose to the very end of an enormous tail.

As many as seven varieties (sub-species) of marine iguanas are recognized by some authorities. The largest originate from the western islands of Isabela and Fernandina, and the smallest, *Amblyrhynchus cristatus nannus*, is endemic to the northern island of Genovesa.

As the name implies, marine iguanas are lizards that often frequent the rather tepid ocean waters that surround all of the islands in the archipelago.



(Above) Before entering the water to feed, marine iguanas usually spend a considerable length of time thermoregulating on top of lava rocks, demonstrated by this male individual at Academy Bay. *Photograph: Karl Switak*

But they only enter the water to feed or perhaps to cool off when the equatorial sun turns those black lava rocks on which they live into a hellish confinement. They are excellent swimmers and often seen in coastal surf where even the best of human swimmers would be demolished against such jagged and dangerous an environment.

To obtain speed while diving below the surface of the water in search of algae, this reptile propels itself forward by pressing all four appendages against its body. It then uses the vertically compressed tail as both a rudder and forward propeller and undulates through its aquatic abode with the greatest of ease. This motion might well be described as a sinuous action of body and tail. They have been known to dive to an incredible depth in excess of 21 meters. Huge hooked claws and powerful, very muscular legs, serve as an anchor among those ever present lava rocks while the lizard forages well below the surface of the water.

Beebe (1924) did not believe this species to dive for food and writes as follows: "I never saw the iguana dive for food, and indeed there would seem no need for it, for at ordinary times an abundance of the weed was always exposed. As this growth thrives only where there was active surf, so the feeding reptiles were often completely covered, three or four feet deep, by an incoming wave.



Marine iguanas often congregate by the "hundreds." This colony was photographed at the Fur Seal Grotto on Santiago (James) Island in August of 1986. Photograph: Karl Switak

Never did I see one dislodged, and from my experience of trying to drag them out of crevices, I count any such danger as negligible."

The estimated length of time that a marine iguana can stay submerged varies considerably. Hobson (1965) reports of a specimen staying submerged for over 30 minutes. Darwin (1839) reports of a seaman aboard the *Beagle* who attached a heavy weight to a marine iguana, "...thinking thus to kill it directly; but when an hour afterwards he drew up the line, the lizard was quite active."

Although considered a herbivore and feeding primarily on several species of algae, *Amblyrhynchus* has been known to accept food items other than algae. Carpenter (1966) mentions a specimen from Hood Island (Española) that had fragments of small crabs in its stomach, and another had shrimp remains. On Punta Espinosa, Fernandina Island, Carpenter also observed a marine iguana eating the dried fecal remains of its own species.

Perhaps the most noteworthy records (up to this point in time) on the non-algae feeding habits of marine iguanas, are those from Karl Angermeyer who at that time resided at Academy

Bay, Santa Cruz Island. Karl's house was built on a lava ledge very near the water's edge, where these lizards wandered back and forth over his porch and even into his living room. Karl stated that he often was able to call the iguanas to the porch to be fed and they never showed any fear of his large dog. Karl made quite a ritual out of feeding these supposedly "herbivorous" reptiles.

He placed a dish, containing pieces of raw goat meat, on the porch. First only one iguana approached. It was then followed by as many as five or six. Each one snatched up a piece of that raw goat meat and gulped it down quickly. Karl further stated that they would also eat oatmeal and other foods, and he had seen them feeding on cockroaches in his living room. Karl also has a photo where he is feeding a marine iguana by hand in the presence of his large dog.

Marine algae are definitely the mainstay in the diet of *Amblyrhynchus*. In this respect the lizard may even show a preference for specific types of algae, as stomach contents have indicated. At least ten genera of algae have been recorded from stomach remains.



At James Bay on Santiago (James) Island numerous marine iguanas use self-dug burrows below a sandstone ridge for night-time retreats. These individuals made an appearance prior to 0745. Photograph: Karl Switak

Marine iguanas are excellent swimmers, but before entering the often tepid waters that surround the islands (on the equator!), they first enjoy a thorough basking on the black lava rocks to elevate their body temperature. Galápagos waters are fed, in part, by the Humboldt (Peru) Current and sea temperatures range from approximately  $16^{\circ}\text{C}$  to  $28^{\circ}\text{C}$ , depending on seasonal weather activity. Cloacal temperatures taken of 129 *Amblyrhynchus* at Academy Bay on Santa Cruz Island (Carpenter 1966) ranged from  $28.2^{\circ}\text{C}$  to  $40^{\circ}\text{C}$ . It appears that the optimum body temperature is approximately  $34^{\circ}\text{C}$ . Such a high body temperature is undoubtedly required when the lizard dives into the cold water where it often remains submerged for up to 20 minutes in search of food. It is then that this species truly demonstrates its “cold-blooded” existence. Immediately leaving the turbulent water they once again assume that spread-out position atop those hot lava rocks and in no time at all regain optimum bodily function. But life isn’t always that simple for the otherwise placid marine iguana. Sea lions have been observed to pull these lizards back into the surf, apparently for amusement only, just as the reptiles reach the safety of shore.

The start of the breeding season varies considerably from island to island, but usually commences in January and lasts into March. Prior to this period male marine iguanas are quite docile and blend perfectly into the masses of this reptilian presence on the Galápagos. However, when duty calls, and the instinct to mate erases all previous commitments, these otherwise tranquil males take on an altogether different attitude. They become edgy, and antagonistic, quickly reacting to an intruding male by not only threatening to fight, but by actually butting their heads together and often biting viciously.

Adult marine iguanas practice a “harem syndrome” when it comes to reproduction. Some males swim, or even crawl, for long distances along the coast, or even venture to other islands, in order to establish territories that include a number of females. Harem groupings were noted at Punta Espinosa, Fernandina Island, by several researchers, one of whom I must now quote: “[a] curious promiscuous polygamy evidently prevails among them (marine iguanas), the group of females forming a harem for the old males.” I have observed this grouping of a single male with

(Right) While swimming, the movement of a marine iguana might best be described as "a sinuous action of body and tail." They are excellent swimmers and capable of diving to great depths.  
*Photograph: Karl Switak*



Marine iguana tracks on La Loberia Beach, Wreck Bay, San Cristóbal (Chatham) Island, clearly demonstrate how far these lizards venture from the ocean's shore. *Photograph: Karl Switak*

numerous females during the mating season at Academy Bay on Santa Cruz Island in January of 1991. After the mating season concludes, everything returns to a colonial, peaceful coexistence.

Actual courtship is simple and straightforward. First the larger and more robust male seizes the smaller female by the scruff of her neck. He then presses his body against hers and at the same time uses one of his front legs to hold her down. Now

he tactfully twists his tail under hers, after which intromission takes place.

Nesting activity usually commences after territorial tendencies have all but subsided, and after those combative males have once again grouped into massive aggregations. Females may start digging several nest sites before deciding on just the right spot. Once completed, the female positions herself in the burrow so that her head points outward, after which the actual egg laying commences. Only one to four leathery white eggs are deposited once a year. Incubation period lasts from three to four months, being regulated by the ambient temperature that surrounds the eggs.

Even though the female lays very few eggs, they are quite large in comparison. A total of 38 eggs collected at Punta Espinosa, Fernandina Island, measured between 7.8 cm and 10 cm in length.

No parental care exists. Therefore, predation on hatchling and very young marine iguanas is extensive. Many fall prey to gulls, herons, hawks, snakes, and feral pests such as dogs and cats.

Adverse weather conditions, such as the "El Niño" phenomenon, have a direct impact on the number of marine iguanas and other animal species that inhabit the archipelago.

Late in 1982 and well into 1983 a most dramatic El Niño wrought havoc with the islands. Ocean water temperatures rose considerably (up to 31°C) killing off algae that these lizards feed on. In turn, thousands died of starvation.

According to Dr. Cayot (pers. comm.) approximately 70% of all *Amblyrhynchus* died during

(Right) Prime habitat for *Amblyrhynchus* at Sullivan Bay, Santiago (James) Island. Photograph: Karl Switak



Adult male marine iguana from Academy Bay, Santa Cruz (Indefatigable) Island. Note powerful front legs and extremely long claws. Photograph: Karl Switak

the reign of this powerful El Niño. On the western islands of Isabela and Fernandina, flight-less cormorants were observed actually using the dead bodies of marine iguanas for nesting material. Boobies and other sea birds virtually disappeared and the fur seals on Fernandina took a real beating. However, strictly land dwelling animals (tortoises, land iguanas, etc.) fared much better. The extensive

amounts of rain associated with El Niño cause vegetation to grow rapidly and naturally provide many a fresh water pool. From December 1982 to July 1983, the Charles Darwin Research Station on Santa Cruz Island received 3,224 mm of rain. Compare this to the mean annual rainfall of a mere 200 mm for the years 1965 to 1970 (Harris 1974).

Fortunately, El Niño comes and goes, and in no time at all the plant and animal populations return to normal. By mid 1986, less than four years after one of the most dramatic El Niños on record, Dr. Cayot (pers. comm.) estimated that the marine iguana colonies in the archipelago had returned to numbers between 200,000 and 300,000 strong. Such an explosive breeding potential, following extremely adverse weather conditions plus a 70% decline in numbers, must indeed be solidified as a most remarkable recovery.

### Evolution in Progress?

During the last few years, starting as early as 1993, a number of people have observed a most noteworthy occurrence in the feeding habits of marine iguanas living on the small island of Seymour (also North Seymour). I was fortunate to witness this extraordinary phenomenon personally in April of 1995, and again in March of 1997.

Historically, marine iguanas have always fed in and under the water, or from algae-covered rocks next to the ocean's shore (tidal region). Algae, consisting of numerous species, have been the lizard's major food intake—until now!

On Seymour Island, which lies just to the north of the much larger Santa Cruz Island, these lizards are now feeding **on dry land** some 75-100 meters away from the ocean. The plant they are freely ingesting is a succulent-type known as *Batis maritima* of the family *Batidaceae*. Thus far only marine iguanas living on Seymour have been observed feeding on this plant species, although it is found on other Galápagos Islands such as Baltra, Bartolomé, Isabela, San Cristóbal, Santiago, Santa Cruz, and Floreana.



The specific region on Seymour Island where these marine iguanas are feeding on *Batis* is often bone dry, but may also be flooded by rainwater from torrential downpours. There exists the possibility that during a violent storm, and consequent high seas, some salt water may enter this region. However, there is no direct seepage from the ocean and any water, fresh, salt, or a mixture of both, soon dries out under the powerful equatorial sun. Marine iguanas have been observed to feed here both during **completely dry periods** and when rainwater was present. Additionally, mating activity plus digging burrows for egg deposition has been recorded for this locale.

It was my dear friend, Dr. Fred Caporaso of Chapman University in Southern California, who first mentioned this feeding phenomenon to me back in April of 1993 when he visited Seymour Island with a group of students. At that time the entire region was flooded with rainwater. In April of 1995 Fred and I both observed quite a few *Amblyrhynchus* feeding on *Batis* (region almost completely dry), and again in March of 1997

when only a shallow puddle of water was evident. The number of marine iguanas feeding on *Batis* in 1997 was much greater than in 1995. Some of the lizards were eating the plant that was partially in the water (non-salt), but most were “vigorously grazing” on completely dry land. Not just the occasional mouthful, but serious feeding!

Because *Batis maritima*, like marine iguanas, is found on many of the Galápagos Islands, it can be assumed that the lizards may very well be feeding on this plant elsewhere. But to this date no such activity has been officially reported except from Seymour Island.

However, in March of 1997, I observed another case of unusual feeding behavior for *Amblyrhynchus cristatus*, this time on the large island of Santa Cruz. The specific locale was Academy Bay near the Hotel Galápagos. A group of marine iguanas, sunning themselves in a massive growth of the plant *Sesuvium* attracted my attention. Upon closer examination I found one of the adults (a female) with a small piece of this “non-marine” plant sticking out of its mouth. Other individuals



In August of 1986 our expedition found a sizeable colony of large marine iguanas (mostly males) at Punta Albemarle, Isabela (Albemarle) Island. Note the adult lava lizard just below the iguana. Lava lizards (and finches) often pick off the flies that land on the iguanas' bodies. Photograph: Karl Switak



Marine iguanas are not common on Black Beach, Floreana (Charles) Island, but our group did locate a few individuals in January of 1991. Pictured here is a large male.

Photograph: Karl Switak

showed greenish coloration on both upper and lower jaws, suggesting that the entire group had feasted on this plant species. *Sesuvium*, like *Batis*, is found on many of the Galápagos Islands. I have to assume that marine iguanas from this locale on Santa Cruz Island may on occasion feed directly—on dry land and away from the ocean—on yet another “non-marine” plant species.

Are we in fact witnessing an evolutionary process that could in time find most all of the marine iguanas feeding on land far away from the ocean’s shore? It is well documented that during an El Niño year (or years) thousands of marine iguanas perish due to starvation. The marine algae they feed on do not thrive in warmer waters. By switching to a plant, or plants, that in fact flourish during a warm and wet El Niño season, the lizards would be assured of a constant food supply. After all, it was here in the Galápagos Archipelago that the theory of evolution was spawned, and I am certain that if Charles Darwin were still alive today he would love to see his hypothesis in working order.

This is only a preliminary report, one that needs many years of research before a viable explanation or scientific reason can be ascertained. I for one will surely travel to the Galápagos Islands again and again, with the specific goal in mind of keeping a close eye on those “land-loving” marine iguanas on Seymour Island and Academy Bay.



(Editor’s note: At least three species of Bahamian iguana are also consumers of *Sesuvium*.)

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## Recent Update (August 1999)

It has come to my attention (pers. comm., Dr. Fred Caporaso) that the latest El Niño of 1998-1999 had, in part, a devastating effect on certain (if not all) marine iguana colonies. Recent observations indicate that all of the marine iguanas on Seymour Island have died. This of course includes the colony that freely ingested the plant *Batis maritima*. In addition, the plant itself has disappeared from the region in question on Seymour Island. Furthermore, and this needs additional verification and research, it has been suggested that during a severe El Niño season marine iguanas actually reduce in body size. Such a phenomenon would require further research.

How long will it take for a viable marine iguana colony to re-establish itself on Seymour Island? If so, will the plant *Batis* also re-appear and will the “new” iguanas use it for food? Some very good questions, but without immediate answers. However, it does mean additional journeys to this island paradise in the not too distant future.

Now follows a real test for evolution.