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An adult Fijian Banded Iguana (*Brachylophus fasciatus*) (stories on pp. 103 and 108). Photograph by Thomas Wiewandt.

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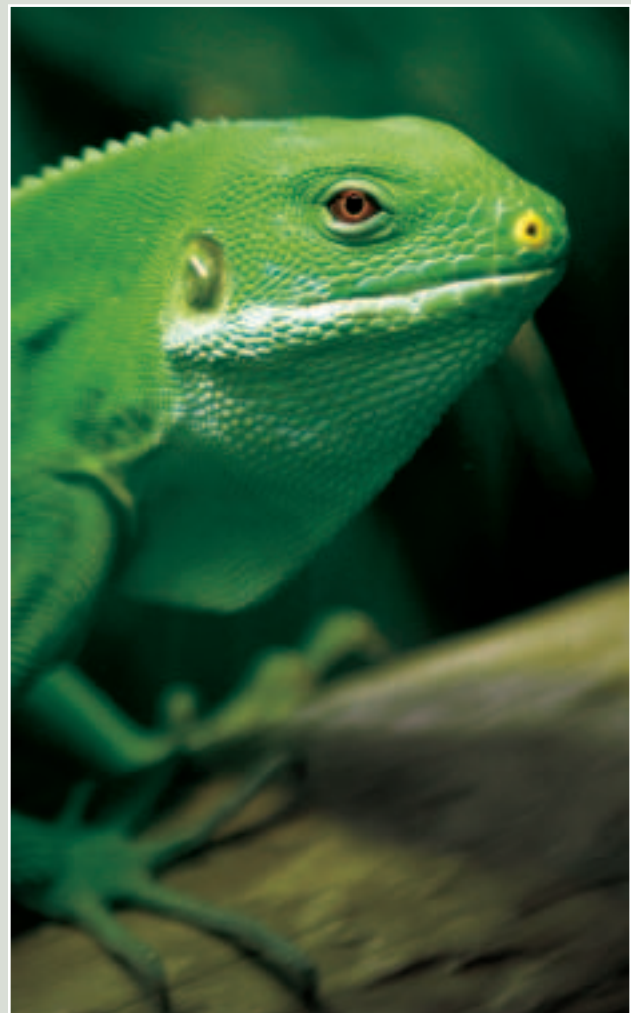
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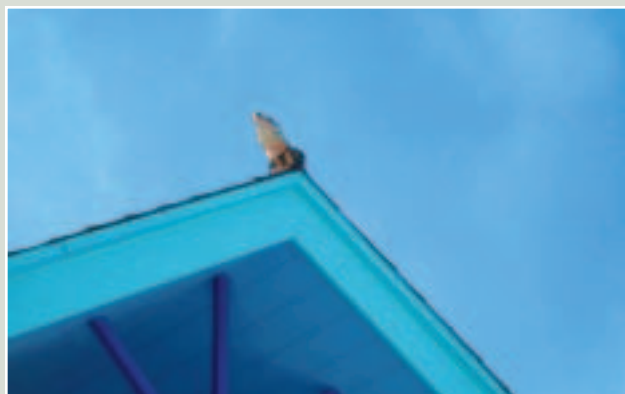
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Iguana management and husbandry. See article on page 129.



Fijian Banded Iguana (*Brachylopus fasciatus*). See



Monitors, Green Iguanas, and Spiny-tailed Iguanas, such as *Ctenosaura similis* (above), have taken up residence in Florida. See articles on pages 111 and



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# Searching for Banded Iguanas in the Lau Islands, Eastern Fiji

Peter Harlow  
Taronga Zoo, Sydney

**A**lthough the Banded Iguana (*Brachylophus fasciatus*) is the most familiar of the two species of *Brachylophus* found in the South Pacific, its status in the wild is virtually unknown. Based on published and verbal distribution records, the species is known to occur on 34 islands in Fiji. In addition, it is found on four islands in Tonga and an introduced population is established on Efate Island in Vanuatu. Currently, this iguana is the only *Brachylophus* species kept in zoos outside of Australia and Fiji.

Banded Iguanas are still regularly reported from many islands within Fiji, even inhabited islands where cats are common and forest remnants are few. Popular wisdom has always declared that Banded Iguanas are easiest to find on the large and heavily forested islands of Kadavu and Ovalau. However, after many weeks spent on these two islands over many years, I have yet to find a wild Banded Iguana on either. They are certainly there; a boy with a pet Banded Iguana can be found in many villages. Fijians still occasionally find them on forest paths, when they are clearing bush for new gardens, or when high up in an Ivi or Bau tree picking ripe, edible fruit.

In November 2000, a Portuguese bat biologist on sabbatical in Fiji, Jorge Palmeirim, contacted me to say that he had seen three Banded Iguanas in just a few hours while searching for bat caves on a tiny limestone island in eastern Fiji. Jorge had visited over 20 islands while working in Fiji, and these were the only Banded Iguanas he had seen. I was immediately excited by the possibility of an island where Banded Iguanas are common, and, as I had worked with Jorge surveying for Crested Iguanas in the Yasawa Islands earlier that year, I knew his information was accurate. Many Fijians and expatriates who have never seen an iguana often refer to the common arboreal green skink, *Emoia concolour*, as an “iguana.”

In September 2002, National Trust Crested Iguana Sanctuary ranger, Pita Biciloa, and I flew to the large inhabited island of Lakeba, 300 km east



A male Banded Iguana from the island of Ovalau.

of Fiji's capital, Suva. Jorge had seen the iguanas on one of the two Aiwa islands; these are small, uninhabited islands (total size 121 ha) separated by 50 m of deep water, that lie about 12 km southeast of Lakeba. Like most islands in Fiji, they are owned by a traditional Fijian clan (Mataqali), and any request to visit must first be approved by the local regional governmental administrator, and then permission obtained from the head of the Mataqali.

From Lakeba, the Aiwa islands are only a short trip by outboard motor boat. We landed first on the tiny beach at Aiwa Levu, the island where Jorge had seen the Banded Iguanas. We spent only two hours there, while we waited for midtide, so we could land on the adjacent, beachless island of Aiwa Lailai. Our local Fijian guide, Cakacaka, assured us that Aiwa Lailai had even more Banded Iguanas than Aiwa Levu, so we had decided to base our three-day survey there.

A walk around the rocky limestone island revealed some scattered and dried iguana egg shells and many distinctive iguana scats. I soon spotted a female Banded Iguana in a low and bushy Cevua Tree (*Vavaea amicorum*) over-

hanging a cliff of razor sharp limestone blades, with crashing waves below. Cevua leaves are a favorite food for Crested Iguanas, so it seemed a likely place to find a Banded Iguana. The boatman soon returned from his reconnaissance of Aiwa Lailai and was shouting at us to hurry to the boat. As we waded out to the waiting boat, he assured us that the tides, wave conditions, and currents were now suitable for us to attempt a landing on Aiwa Lailai. If we did not land within half an hour, we would miss our chance and would have to try again tomorrow.

At the landing site a few meters from the shore of Aiwa Lailai, we all jumped overboard on the orders of our boatman. Two of us held the bucking and tossing boat in chest deep, choppy water, while the other two quickly carried our gear ashore and tossed it on top of the undercut, two- to three-meter high limestone cliff that encircles the island. This included a large plastic barrel of fresh water, as both Aiwa Islands lack fresh surface water. As the last bag of camping gear was removed, the boatman jumped back in, started the motor and disappeared towards the fringing reef.



A gravid female Banded Iguana from the large inhabited island of Kadavu, where occasional sightings still occur.



The limestone island of Aiwa Levu, seen from the neighboring island of Aiwa Lailai.

He promised to return in three days — if the ocean was calm. If not, he smiled as he left, we could survive by eating the plentiful vokai (iguanas) and goats.

Pita and I undoubtedly looked puzzled, standing in waist-deep water under the two-meter high, undercut cliff of razor sharp limestone that confronted us. The thought of having to climb over the limestone blades that encircle the entire island was worrying. However, Cakacaka walked to a nearby cut in the cliff, reached high, and pulled down a sturdy tree trunk with convenient foot holds cut into it. It was kept there for just this purpose. Happily, we clambered up this three-meter “ladder” and began the task of carrying our supplies to a flat area at the top of the island, where we set up camp.

Both Aiwa Islands have been heavily grazed by goats for three or four decades and, although the tall forest appeared mature and diverse, the forest floor was completely open, with only an occasional sign of undergrowth or forest regeneration. Besides the goats, we noticed no other signs of human interference; no indications of forest fires, and certainly no cats or introduced rats (although the Pacific Rat, *Rattus exulans*, is present). This is an island of birds. Hours of searching that first day

revealed five species of pigeons and fruit-doves, including the rare (and tame) West Polynesian Ground Dove (*Gallicolumba stairi*), Pacific Harriers, and Barn Owls, plus over a dozen other bird species and just two Banded Iguanas.

Our night surveys, however, revealed a different story. In the beam of our powerful spotlights the bright yellow-green belly color of Banded Iguanas causes the sleeping lizards to stand out from the dark background vegetation. In the first few minutes of surveying that night, we spotted over a dozen Banded Iguanas; some as high as 18 m in the forest canopy. In three nights on Aiwa Lailai, we counted over 200 Banded Iguanas along our 2 km of transect lines. A wonderful result for the first systematic survey ever.

Although not as abundant as Crested Iguanas are in optimal forest habitat on the Crested Iguana Sanctuary island of Yadua Taba, Aiwa Lailai appears to support a very healthy population of Banded Iguanas. If Aiwa Levu has a similar number of Banded Iguanas per hectare (which seems possible, due to the similarity in vegetation and goat grazing pressure), then these two small islands may have a total population of 6000–8000 iguanas. Small, remote and virtually inaccessible islands are abundant around Fiji. Their remoteness



Our local guide, Cakacaka, on Aiwa Lailai with a female Banded Iguana easily captured with the aid of a very long stick.

may be their greatest asset, and hopefully will continue to keep feral animals, invasive plants, and destructive agricultural practices away.

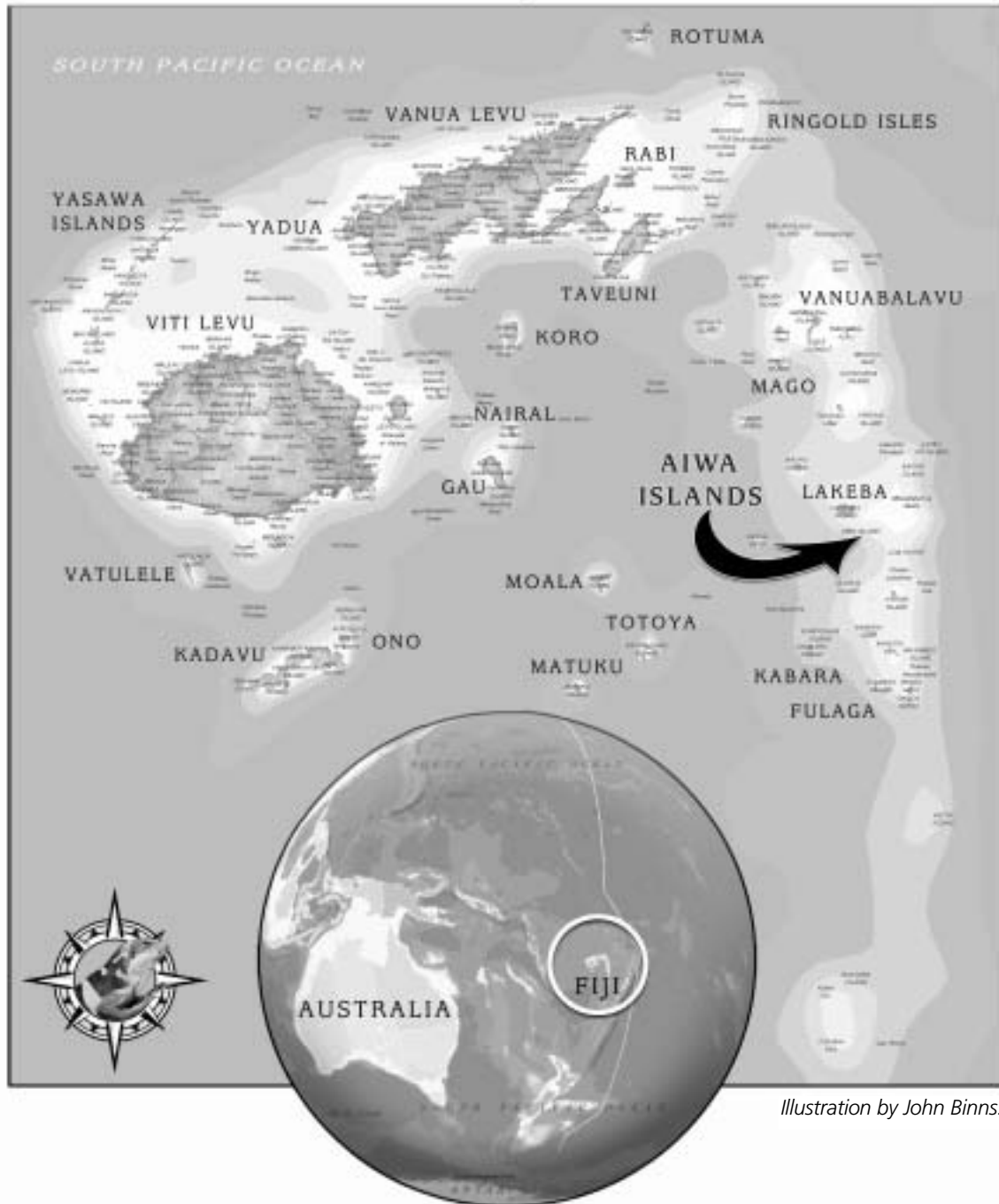
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The author with a pair of Banded Iguanas captured during night transects on Aiwa Lailai.

# FIJI



*Illustration by John Binns.*

# The History of Banded Iguanas in United States Collections

John Kinkaid

Animal Care Manager/Herpetology, Zoological Society of San Diego  
(all photographs are by the author except where noted)

**T**he Banded Iguana, *Brachylophus fasciatus*, was described to science in 1800, but has been in collections of United States zoos for only the past four decades. One of the most geographically isolated of all iguana species, *B. fasciatus* occurs naturally on the Fijian Island group and has been introduced into Vanuatu and Tonga. These animals are difficult to find in the wild, and little had been written about them, other than where they were alleged to be and some very basic natural history, until late in the 20th century. Early captives did not fare well and no captive reproduction took place until the mid-1970s.

Because they are beautiful and geographically unique, Banded Iguanas are highly desirable dis-

play animals. The National Zoo in Washington, D.C., and zoos in Jacksonville, Sacramento, Knoxville, Dallas, and San Diego have displayed this species since the early 1970s. Importations were rare, although the species was not listed as endangered by the USFWS or CITES until 1980 and 1981, respectively. Although some good behavioral and basic husbandry information had been obtained, longevity was relatively short and reproduction unheard of — until the Knoxville Zoo produced hatchlings in 1977. Fijian Iguanas, especially neonates, seem to require a great deal of ultraviolet (UV) light exposure, more than most other iguanid species. Modern artificial lighting systems and UV-transmitting plastics undoubtedly have facilitated the husbandry of this species.



An adult male Banded Iguana (*Brachylophus fasciatus*) at the San Diego Zoo.





The 1965 ceremony during which His Royal Highness, Prince Tupouto' a-Tungi of Tonga (right), presented the first Banded Iguanas to the San Diego Zoo. Howard Chernoff, a member of the Zoo's Board of Trustees (left), was instrumental in the acquisition of these animals. Photograph courtesy of the San Diego Zoo.



A hatchling male Banded Iguana at the San Diego Zoo.

The San Diego Zoo's long history of working with the species began in 1965, when a member of the Zoo's Board of Trustees, Howard Chernoff, was planning a trip to American Samoa. He asked the Curator of Herpetology, Charles Shaw, if any reptiles from the area were of interest. Mr. Shaw replied that it was too bad that Mr. Chernoff was not going anywhere near Fiji or Tonga, as it would be nice to get iguanas from there. Mr. Chernoff

coincidentally met His Royal Highness, Prince Tupouto' a-Tungi of Tonga, at a business meeting in Samoa. The Prince was pleased to donate six iguanas to the Zoo. These arrived with great ceremony, as they were among the first (or the very first) Banded Iguanas in the country. Five more animals were acquired from importers in 1975–1976, and the Zoo's first hatchlings arrived on 5 November 1981. Eager to start a viable long-



An adult female Banded Iguana on reserve at the San Diego Zoo.

term breeding program for this species, the Zoo needed additional founders. The Orchid Island Cultural Centre in Suva, Fiji, and the Fijian Government generously approved our plan and donated two pairs of iguanas in 1987 and an additional three pairs in 1989. No other iguanas have been imported into the United States since those animals arrived.

With the additional founders, more experience, and better knowledge of how to manage *Brachylophus*, the U.S. population continues to double every decade. Almost eighty animals are now in U.S. institutions. Over 130 hatchlings have been produced at the San Diego Zoo, which is now into its fourth captive generation. An AZA studbook and Population Management Plan are maintained at San Diego. These exist to assist in recommending movements, pairings, and breedings now and in the future. Several other U.S. zoos have also bred Banded Iguanas, and this success provides a hopeful future for these beautiful lizards.

However, needs remain. First, we will contact the Fijian government in an effort to implement population surveys, habitat analyses, predator control programs, and perhaps even reintroduction into suitable areas within the historical range of the species. Similar programs are already in place for the more critically endangered Crested Iguana, *Brachylophus vitiensis*. Also, because the U.S. population of Banded Iguanas was established with only twelve founders, a desperate need exists for additional animals in order to maintain genetic diversity. Consequently, future importations are recommended. Finally, I would love to apply

everything we've learned about Banded Iguanas to a breeding program for Crested Iguanas, possibly working in conjunction with existing programs in Fiji and Australia.



Reserve housing cages for Banded Iguanas at the San Diego Zoo.



Banded Iguana at The Toledo Zoo. Photograph by Stephanie Beiser.

# Introduced Iguanas in Southern Florida: A History of More Than 35 Years

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All photographs are by the senior author except where noted.

**R**esearchers have been aware of the presence of non-native reptiles and amphibians in Florida for more than 140 years. Cope (1863) reported the small, terrestrial Greenhouse Frog, *Eleutherodactylus planirostris* (Cope), from southern Florida, and the report of *Anolis sagrei* followed about 25 years later (Garman 1887). Since then, numerous papers have detailed the introduced herpetofauna of southern Florida (e.g., Carr 1940, Duellman and

Schwartz 1958, King and Krakauer 1966, Wilson and Porras 1983, Butterfield et al. 1997), and more than 40 non-native species are presently reported. These reptiles and amphibians were initially introduced and their populations are supplemented via various routes. Some of these exotics may find their way into the suitable climate of southern Florida as stowaways in shipments of ornamental plants and other commerce, but many recent introductions can be attributed to individ-



Adult female *Ctenosaura similis* on Key Biscayne using an old park bench as a basking site. Photograph by Joe Burgess.



Three species of iguanas have become established in southern Florida: *Ctenosaura pectinata*, from near Old Cutler Road (top), southeastern Miami-Dade County, and adult male *Ctenosaura similis* (middle), and *Iguana iguana* from Key Biscayne (bottom).

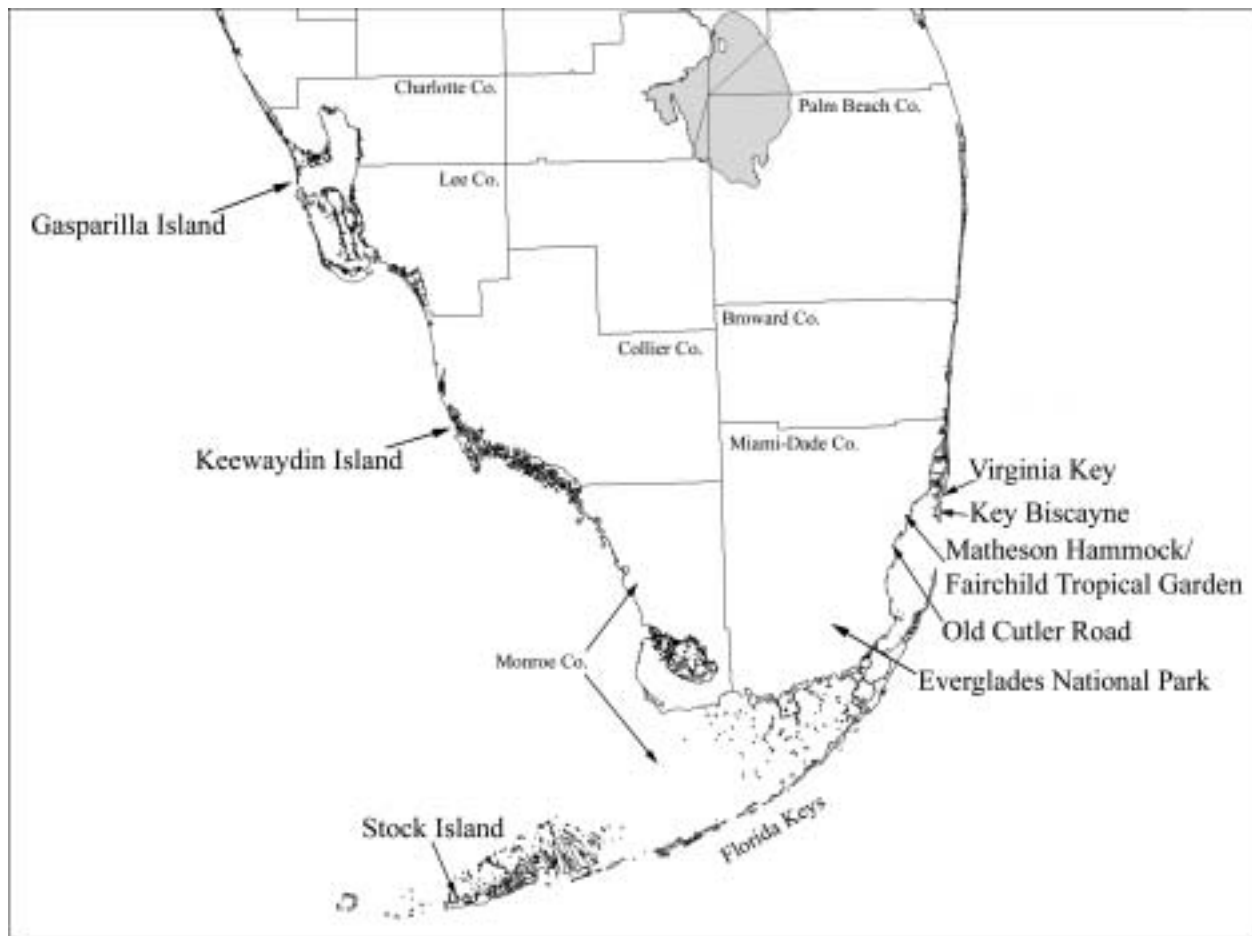
uals being intentionally released by or escaping from reptile dealers or pet owners. As the trade in reptiles and amphibians has increased, so has the number of exotic species that have become established. Some of the more notable, and noticeable, of these species are three large lizards in the family Iguanidae (*sensu* Frost et al. 2001): the Mexican Spiny-tailed Iguana, *Ctenosaura pectinata* (Wiegmann), the Black Spiny-tailed Iguana, *C. similis* (Gray), and the Green or Common Iguana, *Iguana iguana* (Linnaeus).

Lizards in the genus *Ctenosaura* are commonly referred to as Spiny-tailed Iguanas or Ctenosaurs. They are large iguanids that typically have tails ringed with rows of enlarged, spiny scales. Presently, 17 species are recognized. Ctenosaurs are found in southern Baja California, its offshore islands, and on mainland Central America from adjacent parts of Mexico to Panama (Köhler 2002; see also *IGUANA* 10(2):56–57 and 10(3):79–81). Two of these species, *C. pectinata* and *C. similis*, are known to be established in southern Florida.

*Ctenosaura pectinata* is native to the Pacific versant of southern Mexico. This species was first reported in Florida by Eggert (1978), who described digging up eggs and observing adults near Old Cutler Road in southeastern Miami-Dade County. However, Eggert (1978) erroneously identified this population as *C. similis*, which was later corrected by Wilson and Porras (1983). This case of mistaken identity was the first in a series of misidentifications involving introduced Ctenosaurs in Florida, as *C. pectinata* was subsequently reported from Key Biscayne (Butterfield et al. 1997), Gasparilla Island (Bartlett and Bartlett 1999, McKercher 2001, McCoid 2002), and from "... the streets and trees of metropolitan Miami" (Bartlett and Bartlett 1999).

After examining all Florida specimens of *Ctenosaura* in systematic collections and collecting specimens from all known localities in southern Florida, Townsend et al. (2003) concluded that most populations (including those known from Key Biscayne and Gasparilla Island) are *C. similis*, and the only extant population of *C. pectinata* occurs near the original Old Cutler Road site. We visited the Old Cutler Road site at least six times from 2002–2003 and observed two adult males, six adult females, and one subadult of unknown sex living on and adjacent to a single private property east of Old Cutler Road between SW 168<sup>th</sup> and SW 184<sup>th</sup> streets. No other *C. pectinata* was seen, and local residents with whom we talked were unfamiliar with the lizards and unaware of their presence. However, one resident of the Florida Keys related that she had observed Ctenosaurs crossing Old Cutler Road while driving through the area in 2002 and 2003 (H. Kavney, pers. comm.).

*Ctenosaura similis* is native to Central America, and is found from the Isthmus of Tehuantepec to northeastern Nicaragua and west-



Map of South Florida showing localities mentioned in the article.

ern Panama on the respective Atlantic and Pacific versants. The extent to which *C. similis* has become established in southern Florida is only now becoming clear. One of the earliest known populations of *C. similis* in Florida occurs on Key Biscayne. That population probably has persisted there since at least 1979, when the Crandon Park Zoo was closed and most of the exhibit animals were relocated to the Miami Metrozoo (Townsend et al. 2003). Since its introduction on Key Biscayne, *C. similis* has become well-established in Crandon Park and is being found in increasing numbers in Bill Baggs Cape Florida State Park at the southern end of Key Biscayne (E. Donlan and E. Golden, pers. comm.). This species also was introduced on Gasparilla Island, Charlotte and Lee counties, on Florida's southwestern Gulf Coast during the late 1970s or early 1980s, when an island resident released as few as three individuals brought back from Mexico (Krysko et al. 2003). *Ctenosaura similis* now

occurs on Gasparilla Island in large numbers and has expanded its range onto the adjacent mainland and onto Cayo Costa, a small island south of Gasparilla Island. Large populations also occur on Keewaydin and Little Marco islands and within the boundaries of the Rookery Bay Estuarine Research Reserve, Collier County. The latter population was established in 1995, when a Keewaydin resident intentionally (and illegally) released 5–30 *C. similis* on his property (Krysko et al. 2003). The deliberate introduction of non-native reptiles is illegal according to Florida Statute 372.265, which specifically prohibits the release of exotic wildlife without a permit from the Florida Fish and Wildlife Conservation Commission.

Confusion regarding the identities of southern Florida's Ctenosaurs may be attributed partially to a general similarity in the appearance of the two species. As adults, both *C. pectinata* and *C. similis* are large, dark-colored terrestrial lizards that may

Adult female (right) and an adult male and female (below) *Ctenosaura pectinata* near Old Cutler Road, southeastern Miami-Dade County.



(below) Adult male *Ctenosaura similis*, Key Biscayne.



appear striped or banded. Juveniles of both species are green at the time of hatching, gradually taking on the brown or black adult coloration as they mature. However, these two species may be distinguished easily by using a few morphological characters that were defined by Köhler and Streit (1996) and later applied by Townsend et al. (2003) to Florida Ctenosaurs. Adult *C. similis* usually have a gray or tan ground color with 4–12 well-defined dark dorsal bands that extend nearly to the ventral scales. Male *C. similis* also may take on an orange color around the head and throat during the breeding season. In contrast, mature *C. pectinata* have a black to brown ground color marked with irregular whitish blotches, with additional white coloration usually apparent in the area of the neck and throat. These white markings may give *C. pectinata* a partially banded appearance. Both *C. similis* and *C. pectinata* have tails that are ringed with rows of enlarged spiny scales, or whorls, that are separated by smaller smooth scales, or intercalaries — but differ in the number of intercalaries that separate the whorls. This is most apparent near the base of the tail. *Ctenosaura sim-*

*ilis* has whorls separated by two rows of intercalaries and *C. pectinata* has whorls separated by three rows of intercalaries. Florida *C. similis* also tend to have very few (usually zero) small dorsal scales between the posterior end of the dorsal crest and the anterior end of the caudal crest, whereas Florida *C. pectinata* usually has 7 or 8 (range 0–20) dorsal scales between crests (Townsend et al. 2003).

Currently, *C. pectinata* appears to be restricted to a single small area around Old Cutler Road, and occurs in low numbers there despite having been introduced at least 25 years ago. Expansion of this population may have been limited by natural and man-made geographic barriers, including a canal to the north, construction in the early 1980s of a large corporate headquarters to the south,

Biscayne Bay to the east, and Old Cutler Road to the west. A large area directly to the south of the current population was developed since the time it was reported by Wilson and Porras (1983), a process which may have reduced the numbers of *C. pectinata* to the low numbers seen today. In contrast, *C. similis* has been an exceedingly successful invader, becoming well-established and expanding its range in a number of Florida localities. Site fidelity associated with *Ctenosaura* utilization of holes or other refugia may slow the process of range expansion beyond the original site of introduction. Nonetheless, neither species of

*Ctenosaura* has been nearly as successful as an invader as their familiar relative, the Green or Common Iguana (*Iguana iguana*).

*Iguana iguana* is one of the most popular reptiles in the pet trade, with over 1.14 million imported into the United States in 1995 alone, and represents about 45% of all reptilian imports (Hoover 1998). *Iguana iguana* has a wide native range and is found at low elevations on the mainland from Sinaloa, Mexico south to Ecuador on the Pacific versant and Veracruz, Mexico to southern Brazil on the Atlantic versant, as well as on some Central and South American coastal islands



Adult male *Iguana iguana*, Key Biscayne.



Juvenile *Ctenosaura similis*, Key Biscayne.



Three Green Iguanas (*Iguana iguana*) sit at canal's edge, Key Biscayne.

An obviously gravid female *Iguana iguana* pauses while excavating her nest at Key Biscayne. Photographs by Esther M. Langan.



and adults are strictly herbivorous. In Florida, iguanas eat a wide variety of both exotic ornamentals and native plants (see *IGUANA*

10(3):94–95). *Iguana iguana* on Key Biscayne nests in sandy areas, often with multiple females utilizing a

and throughout the Lesser Antilles. In the United States, *I. iguana* has been introduced in southern Florida and Hawaii (McKeown 1996). *Iguana iguana* was first reported in southern Florida by King and Krakauer (1966), who indicated that iguanas could be found on Key Biscayne, Hialeah, Coral Gables, and near the Miami International Airport. *Iguana iguana* has since become established at least as far north as Palm Beach County on the Atlantic Coast and Lee County on the Gulf Coast (Bartlett 1980, Bartlett and Bartlett 1999, Townsend et al. 2002, Krysko et al. in press), and as far south as Stock Island in the Florida Keys, Monroe County. In all likelihood, this species is much more abundant in southern Florida than previously reported in the literature. The largest populations of *I. iguana* probably occur in eastern Miami-Dade County on Key Biscayne, in Fairchild Tropical Garden, and Matheson Hammock Park, but these lizards are now found at localities throughout the county and have been sighted numerous times in Everglades National Park (Meshaka et al. 2000).

In Florida, *I. iguana* usually is found near water, often in trees or on embankments bordering canals and lakes, or even basking on lawns or pavement in urban and suburban areas. Juveniles

and adults are strictly herbivorous. In Florida, iguanas eat a wide variety of both exotic ornamentals and native plants (see *IGUANA* 10(3):94–95). *Iguana iguana* on Key Biscayne nests in sandy areas, often with multiple females utilizing a single small area. Most hatchlings appear during July and August. Relatively few predators of juveniles occur in the urban and suburban areas of southern Florida, a factor that may lead to rapid growth in any introduced *I. iguana* population that contains multiple reproducing females. Lack of predators and abundance of food are some of the primary explanations for the very high population densities of *I. iguana* found in southern Florida.

Bill Baggs Cape Florida State Park (CFSP) occupies 174 ha at the southern end of Key Biscayne, almost all of it consisting of coastal strand habitat dominated by Saw Palmetto (*Serenoa repens*) or coastal hammock dominated by Buttonwood (*Conocarpus erectus*) and Sea Grape (*Coccoloba uvifera*). In 2003 alone, CFSP staff removed over 500 Green Iguanas (E. Donlan, pers. comm.). However, thousands of iguanas live on Key Biscayne outside of CFSP, and, when an *I. iguana* is removed from the grounds of CFSP, other iguanas from outside the park simply move in and take up available space. Low winter temperatures appear to be a major factor limiting the northern expansion of *I. iguana* in Florida; however, a freeze in Miami-Dade County during the winter of 2002–2003 did little more than tem-





A Buttonwood Tree (*Cornocarpus erectus*) provides food and a place to bask for this Green Iguana (*Iguana iguana*) on Watson Island in Miami. Photograph by Joe Wasilewski.

A Green Iguana (*Iguana iguana*) makes itself at home on a Coconut Palm (*Cocos nucifera*) in downtown Miami. Photograph by Joe Wasilewski.



porarily reduce numbers (see *IGUANA* 10(3):98). Interestingly, many *I. iguana* have learned to seek shelter in burrows or under buildings, and we have observed *I. iguana* taking refuge under water, exposing only their snouts for breathing, to escape extremely cold temperatures.

Another large iguanid, the Hispaniolan Rhinoceros Iguana or *Cyclura cornuta* (Bonnaterre), was reported in very small numbers in the vicinity of the Miami Seaquarium on Virginia Key and also possibly on Key Biscayne (King and Krakauer 1966). A few individuals of this species escaped from an exhibit at the Seaquarium and are purported to have reproduced in small numbers (Bartlett and Bartlett 1995). However, we have not observed this species in the wild, and no specimens from Florida are known to have been deposited in any systematic collections.

With the ranges and population sizes of *Ctenosaura similis* and *Iguana iguana* continuing to grow and the population of *C. pectinata* persisting for over 25 years, these species obviously have become a permanent part of the dynamic herpetofauna of southern Florida. These three lizard species are only a few of the growing number of introduced reptiles and amphibians that call southern Florida home. This number seems to be increasing as quickly as researchers are able to investigate each new report of a possible introduced species. Without importers and pet owners showing greater responsibility and stricter enforce-

ment of Florida state laws regarding the release of exotic animals, what remains of the native herpetofauna in southern Florida stands a good chance of being displaced by exotic species in the near future.

### Acknowledgements

We thank Kevin Kirwin and Ernest Link of Crandon Park; Elizabeth Golden and Ellen Donlan of Bill Baggs Cape Florida State Park; Reggie Norman, Ken Alvarez, Chris Angel, and Patty Middleton of Gasparilla Island State Park; and Steve Bertone of Rookery Bay Estuarine Research Reserve for facilitating field work at their respective parks and for providing much useful information. Helen Kavney provided additional information.



A Green Iguana (*Iguana iguana*) shares the shoreline with White Ibises (*Eudocimus albus*) in a Miami park. Photograph by Joe Burgess.

Green Iguanas, such as this juvenile, are a common sight in and around the Colobus Monkey exhibit at the Miami Zoo. Photograph by Carole Saucier.

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## SPECIES PROFILE: Nile Monitors (*Varanus niloticus*) in Florida

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Varanidae is a monotypic family of about 50 species of Old-World lizards containing only the genus *Varanus*. These generally large, intelligent, carnivorous lizards occur in Africa, Australia, and Southeast Asia in habitats ranging from deserts and savannahs to tropical rainforests and mangroves. At least one large species has gained a foothold in the Western Hemisphere and may represent a considerable threat to native wildlife populations.

The Nile monitor, *Varanus niloticus*, ranges naturally throughout central and southern Africa. Two subspecies, the Common (*V. n. niloticus*) and Ornate (*V. n. ornata*) Nile Monitor were once recognized, but full species status was recently awarded them both. The former has a blue tongue and 6–9 gold dorsal bands and the latter has a pinkish tongue and 3–5 dorsal bands. The oft-used vernacular name “Money Monitor” refers to its coin-sized, gold dorsal spots. Reaching a maximum total length of over two meters (usually about 1.5 m) and a maximum weight of over 10 kg (usually 5–8 kg), this is one of

the largest lizard species on Earth. They often live to be 10 or more years old, but reach sexual maturity in under three years, and larger, older females may lay 60–80 eggs in a clutch. In Kenya, they reach densities of 40–60 lizards/km<sup>2</sup>. As a result of their large size, high reproductive rates, and abundance, this species is heavily exploited for meat and leather, and is considered valuable in its native lands — but this species is particularly unwelcome outside its native range.

At least 13 years ago, this species became established in Cape Coral, a sprawling coastal residential area near Ft. Myers in southwestern Florida. In the 1950s, the wetlands of this region were ‘reclaimed’ for development by using the spoils dug from an over 400-mile-long network of deep canals. Additional aquatic and wetland habitats were created in the areas’ numerous golf courses. Moreover, Cape Coral is fringed by extensive mangroves and remote barrier islands. These freshwater canals, lakes, and wetlands, combined with a low density of homes and remote coastal mangroves, provide ideal conditions for the establishment and spread of this species. The origin of the introduced lizards remains unknown, but the extent of the problem became apparent in 2000 due to the efforts of Kraig Hankins (City of Cape Coral), Kenneth Krysko (University of Florida), and Kevin Enge (Florida Fish and Wildlife Conservation Commission). This species currently occupies over 50 km<sup>2</sup> of residential areas, canal banks, and surrounding pine flatwoods, mangroves,



This 5-foot, 15-pound Nile Monitor was captured at a residence in Cape Coral.



The remote pine flatwoods of the Charlotte Harbor Buffer Preserve provide valuable habitat for native species, but also may be a corridor for expansion of Nile Monitors.



Nile Monitors construct burrows in the banks of over 400 miles of canals in Cape Coral.

barrier islands, and other natural habitats in and around Cape Coral.

The impact of this species on native wildlife is largely anecdotal at this time, but in southwestern Cape Coral, pets have been disappearing, feral cats are relatively rare, and residents tell tales of monitors eating rabbits in their yards and goldfish in their ponds. In their native range, Nile Monitors are generalist carnivores that will take snails, spiders, crustaceans, insects, fish, amphibians, reptiles, birds, bird eggs, and mammals. Their diet changes with age from crabs and other invertebrates to vertebrates and carrion. They can dig their own burrows, but prefer to sequester an existing burrow after making a meal of the resident. These intelligent, stealthy predators are at home above and below ground, in water, and in trees. The potential for impact on native species is not yet known, but a few legally protected taxa may be particularly vulnerable.

Cape Coral has a notoriously large population of Burrowing Owls, a small species of terrestrial owl that digs burrows in open habitats and canal banks. The eggs and hatchlings of the Gopher Tortoise, another burrowing species, may be vulnerable to adult monitors. Nile Monitors compete with and consume Dwarf Crocodiles in their native haunts, suggesting that American Alligators could be at risk. Nile Monitors also harbor introduced parasites that could be transmitted to other vertebrates and even humans.

In July 2003, I initiated a research program at the University of Tampa with funding from the Charlotte Harbor National Estuary Program and the National Fish and Wildlife Foundation. With the help of local residents, lizards are being located, trapped, and ethically euthanized to obtain information about their current geographic distribution, density, natural history, reproductive cycle, diet, and impact on native



Nile Monitors patrol regular pathways and excavate burrows along artificial canal banks in Cape Coral, but also cross the canals and enter the surrounding natural mangrove habitats in the Charlotte Harbor Buffer Preserve.

species — and to assess the potential for range expansion and the possibility of eradicating this species from the area. Total eradication may prove unfeasible, but the knowledge gained will assist in managing populations of this and other introduced carnivorous lizards in Florida and elsewhere.



The author with the first Nile Monitor to trapped in his attempt to eradicate the species from Cape Coral.

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All photographs by the author.

# The Iguana Rescue Dilemma

AJ Gutman

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*All photographs by Carole Saucier except where indicated.*

**A**ccording to the Humane Society of the United States (2001), more than 3.9 million households in the U.S. keep one or more reptiles or amphibians as pets. Approximately 18% of these are Green Iguanas (720,000). Data collected between 1989 and 1997 indicate that an average of 381,000 Green Iguanas are imported each year, 566,000 in 1997 alone. Based solely on anecdotal evidence, many rescuers have long believed that as many as 90% of pet Green Iguanas die within a year. If more than half of the total pet iguana population is replaced each year, this tragic assumption is probably well-grounded in truth.

Properly tended, a Green Iguana can live for 20–30 years, but, undoubtedly, few reach such a

venerable age. Again, based on anecdotal evidence, I believe that only a tiny fraction of those Green Iguanas that manage to survive their first year in captivity actually live out their potential life spans in the hands of a single caretaker. What becomes of the rest of them? On a bad day, when I am inundated with phone calls and e-mail messages, I feel as if every last one of those survivors comes past my door.

## Why do people give up iguanas?

Aside from the “my iguana has gotten too big” and the “I can’t provide my iguana with enough attention,” calls, most of the other inquiries I receive asking for help with Green Iguana rescues begin with, “I have an awkward



Bronte (formerly Emily) has been at the Iguana Sanctuary for the last five of his approximately 16 years.

and very unusual situation ...” While the situation may indeed be awkward for the person on the other end of the line, after many years of rescuing all manner of reptiles, the stories are all too predictable for me. In fact, if you list the principal characters involved, I can generally fill in the scenario with great accuracy.

*We’re getting divorced and we need a home for the iguana.*

*I’m newly married and my spouse feels we need — (and the classic variation) I’ve been married for a year and my spouse feels we need ...*

*My son/daughter is leaving for college and we need ...*

*I’m moving and my new landlord insists that we find ...*

Those that are my least favorites require immediate attention:

*My tenant just moved out and left behind his iguana.*

*There’s an animal in the plum tree in my front yard. Can you come and get it?*

Occasionally, I encounter a novel variation (I’ve just been evicted, my spouse has been incarcerated, I found this on the railroad tracks), but, ultimately, everyone wants help and they want it immediately. If I can’t take their animal right away, the iguana is likely to be released. A fortunate few are brought to me by Animal Control.

### Boy or a Girl?

“The iguana is in good health — but I don’t know if it’s a boy or a girl.” Not surprisingly, those who cannot tell the difference between a male and



“It’s in pretty good shape.” Mina was actually all right — for an abandoned, stunted animal with only one dorsal spine that hadn’t rotted off, four digits that hadn’t been amputated by persistent constriction bands, an oozing infection in her upper chest and dewlap, and a couple of vertebral fractures.

a female iguana lack the wherewithal to judge the animal’s state of health. No, a hot rock and bowl of lettuce don’t cut it. Anyone with a truly healthy iguana knows that proper iguana nutrition is a four-letter word: W-O-R-K. Proper care requires a complex orchestration of planning, shopping, and preparation — and there aren’t any shortcuts.

Most of the iguanas that come to me (including those in “good health”) are in fact quite ill. I see all degrees of stunting, emaciation, deformity, and disease, most of them resulting from improper lighting or nutrition and the attendant stress. Those that are unadoptable and stay with me permanently are generally the most physically handicapped and ill-tempered, the “FLKs” and the “grumps.” “FLK” or “Funny-Looking-Kid” is a technical term that my husband learned in medical school to denote individuals with genetic aberrations leading to physical abnormalities. I also apply it to my animals with nutrition-related and congenital deformities.



Tatiana is the quintessential “Funny-Looking Kid.” Abandoned at a pet shop, she was purchased by another rescuer and eventually brought to me for further rehabilitation. Despite all the twists in her back and tail, she has no problem walking or climbing.



Odessa fits the profile of the large, aggressive female. Kept with other iguanas that match her in size, she has adapted well socially. Odessa was left behind when her owners moved out of their apartment; she was mistaken as a male by several other rescuers before she came to the Sanctuary.

The “grumps” are another fairly uniform group — they tend to be larger, older females that are a bit snappish and just won’t tolerate handling. These animals often are returned to me after an initial placement because they have been aggressive toward another iguana or people find themselves unable to relate to such an animal. From experience, I know that these “girls” will acclimate with time, but it’s a process that requires patience — sometimes years rather than months, and few people have the stamina to outlast their grumpiness.

### The aggressive male iguana

Any reasonable program of behavior modification should begin with an assessment of how the world must appear from the subject’s perspective. My work rehabilitating iguanas began with this principle and the assumption that the problems of every aggressive iguana could be addressed.

I have been privileged to gain a wealth of insight into iguana behavior from animals with which I have worked over the years, but none challenged my initial beliefs until I met Kurosawa. Kurosawa was a 13-year-old male that had been raised by an adoring and attentive owner. He had been neutered at the age of seven when he began to be quite aggressive, and this seemed to calm him for a time. But, after he left 42 stitches in his owner’s arm, she was considerably relieved that I was willing to take on her beloved “bad boy.” Large but comparatively thin upon arrival, Kurosawa immediately challenged one of my other



Kurosawa during a visit from his previous owner, he had plumped up but had not yet become unmanageably aggressive. *Photograph by Ron Miyashiro.*

male Green Iguanas, lost the scrap and then settled in peacefully and began to eat — and eat and eat. Several months and several pounds later, Kurosawa was no longer peaceful. He was terrorizing every other iguana that crossed his path. Then he started to challenge me. Initially, his challenges were merely aggressive posturing and gaping, but this quickly progressed to a stage in which he began leaping across the room to try and attack me. My great experiment had failed and, in consultation with Kurosawa’s previous owner, we decided that the only reasonable choice was euthanasia. In retrospect, I am tempted to believe that he had simply been biding his time until he had become big enough to once again assert himself.

**“My iguana needs a better home than I can provide.”**

What are the options for placement? Very few. Zoos, nature centers, and animal welfare groups (HSUS, SPCA) constantly receive calls regarding unwanted pet iguanas, and they inevitably refer these callers to me or others among a handful of

individuals willing to deal with reptiles. All of us tend to be constantly overwhelmed and underfunded. Quite simply, no formal organization in this country is willing and able to cope with the ever-increasing number of unwanted pet reptiles.

**“I’m going on vacation to Puerto Rico; couldn’t I just release my iguana there?” No!!!**

Over the years, hundreds, likely thousands, of Green Iguanas have been released into the wild in the state of Florida and, in most instances, they are considered pests. An article in the Miami Herald once addressed the feral iguana problem in Florida, and my telephone number was listed as a contact for the International Iguana Society. Although I live in Connecticut, I was deluged with calls from irate Miami residents demanding that I come immediately to fetch Green Iguanas from their ornamental shrubbery (see also the article on p. 111).

Green Iguanas are not native to Florida and, in places like the Keys, they compete directly with native animals for a limited supply of vegetation. In the Lesser Antilles, Green Iguanas not only out-reproduce, but are known to have hybridized with native *Iguana delicatissima*. Puerto Rico is a different case still; native *Cyclura pinguis* was extirpated from the island long ago, and an introduced Green Iguana population has become firmly established. Could a captive-raised Green Iguana sur-

vive in the wild? Yes, obviously better than we might have imagined. Nevertheless, the argument remains that captive-held animals are likely to have an intestinal flora, other bacteria, and external or internal parasites that do not occur in the wild — and which may adversely affect wild populations of native animals with which they come into contact.

**A frightening alternative**

For a brief time, I was almost able to delude myself that the iguana rescue traffic was slowing a little. An occasional caller who, when told that I was unable to take an iguana immediately, would ask me if had heard anything about a place that I’ll call the “Alternative Reptile Institution” (ARI), which would supposedly accept any healthy, unwanted reptile for a fee. I really hadn’t heard anything at all about the ARI, until another rescuer asked me for assistance with an extensive rescue effort.

I discovered that this was where the remainder of the rescue traffic from my area had been diverted. Countless Green Iguanas had been taken in by the ARI. Some of the healthy ones were immediately resold, but countless others had died. Those that I was able to rescue had been housed together in a fairly large enclosure heated with a single inaccessible bulb, no functional ultraviolet light, dirty water, and no food. The largest iguana was perched in the only available basking spot and

would not allow any of the others to approach the food on those rare occasions when any was available. All of the animals were emaciated, dehydrated, covered with mites, and in various states of further disrepair. Some had open wounds and broken bones from recent injuries, others had burns and secondary infections.

Among the animals I was able to rescue from the ARI was a small Rhinoceros Iguana that had been there for about a year. She had been housed



This rescued Green Iguana had extensive burns across her pelvis and rear limbs. She was able to heal once her mite infestation had been cleared.





This animal had a broken rear limb with an open wound, likely caused by a bite from a cagemate. In the absence of any medical treatment, the wound developed a huge abscess.

with two large males and another small female of her species. I was immediately drawn to her because she came over to the glass and looked me straight in the eye — a prototypical FLK. She had a spinal scoliosis that left her looking like a reptilian version of a water buffalo. Her emaciated pelvis was jutting out prominently and, even through the glass, I could see the top off her head crawling with red mites. She also had the most awkward method of locomotion, with her legs sprawling uncontrollably in every direction. I was later informed that this type of movement is called “hypertonus,” and is comparable to the human condition called cerebral palsy.

The Rhino enclosure was large and had clearly been quite impressive when new, but it had not been maintained. The pool was empty and the substrate filthy. The temperature gradient was appropriate and even a bit of UV light intruded — but not in a location accessible to the animals. A

platter of dandelions, which a volunteer had just picked outside, was available, but the two small females were consistently kept from feeding by the two larger males.

I was permitted to take both females. The crooked one (Dolly) was considered too unattractive for display, while the other (Loretta) bore clear signs of a developing infection. Both animals, at eight years of age, were barely half the size of the six-year old Rhino female that has been with me since she was a hatchling. Dolly, who had apparently been left at the ARI only a year earlier, blossomed quickly once she had her own exclusive basking spot and a “bottomless” bowl of nutritious food. Although her movements remain awkward, she is able to climb “handicap ramps” and has been accepted by my other Rhinos.

Loretta’s recovery proved to be much more challenging. Blistering that had been present on her legs and trunk when I took her had erupted



Despite a crooked spine and extremely awkward locomotion, Dolly has been well-received by the other members of the Rhino "family."

into extensive lesions, which took a very long time to heal and left extensive scarring. Her growth and socialization have been much slower, but I suspect she also will integrate comfortably into the Rhino "family" in time.

### The dilemma

So what's the dilemma? I truly love the work that I do and I find it enormously fulfilling, but it's also exhausting and unceasing. I've finally dragged myself through the endless process of becoming a not-for-profit organization and have been offered web space by a number of people. Yet, my greatest fear in creating a greater visibility for reptile rescue is that I will be completely inundated with even more unwanted animals without being able to obtain any help or funding.

In September, I was invited to attend an exposition for various animal rescue groups. I was eager to see how people working with other types of animals functioned. Unfortunately, I was obliged to back out of the engagement at the last minute when I discovered that I was required to pay a fee for a table as well as provide volunteers to assist in setting up. A fee? Most people giving up iguanas have little interest in providing for their care. Those who adopt animals will sometimes make a donation, but just as often need their resources to purchase equipment and food for their new charges. Volunteers? The occasional person has threatened to volunteer, but a closer look at the work reveals its generally unglamorous nature and

I've never had anyone show up and actually do any work. I thought it absurd to be asked to pay for the privilege of facing my usual dilemma.

So, how can the problem of unwanted Green Iguanas be properly addressed? Do we really need to ban the sale of these animals in pet shops? Require licensing? Ban ownership? Or perhaps insist that publicly supported animal welfare organizations take on the problem? Among the HSUS's stated charter purposes is to "protect all living things, especially animals." I was appalled to read their extensive documentation on the reptile pet trade and related "humane concerns," knowing that so little is being done by that organization. Even less impressive is the total lack of interest from a very large portion of the reptile pet industry, which directly benefits from the sale of these animals.

### A glimmer of light

Another recent rescue involved two Green Iguanas abandoned on the doorstep of a cat shelter. The stunted and battered little animals were in no way unusual, but the response of the shelter manager was encouraging. She knew that she lacked the knowledge to care for the iguanas, yet she recognized that they deserved her attention, and she undertook the process of tracking down someone who did. Between the time that she called me in the morning and when we met at a parking lot that same afternoon, she had clearly done some research. As I was transferring the animals from her car to mine, she was answering questions for a curious passerby: "No, they don't make good pets. They'll burn themselves on a hot rock and they need a wide variety of vegetables and fruits."

I don't know what the long-term solution will be — but I invest a considerable portion of the time and effort left after taking care of animals to promote education on proper iguana husbandry. And at least some of the most critical information seems to be filtering through.

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## *If Iguanas Could Speak*

*Andy Gogakis  
Athens, Greece*

I saw, in web unbroken,  
Its history outwrought  
Not as the loud had spoken,  
But as the mute had thought.

—Thomas Hardy

Someone once asked me why iguanas are mute. I skipped the whole vocal cords thing and gave him what I thought was a most appropriate answer. "Iguanas," I said, "are mute because, if God had given them a voice, we wouldn't be able to hear ourselves think for their screaming and crying..."

I was born and raised in Athens, Greece and my parents were considerate enough to introduce me to the wonders of animal life from an early age. Growing up in an environment filled with cats, dogs,

reptiles, and birds, I learned how to love life itself. In fact, I am quite certain that I learned how to love humans from my interactions with animals.

When I was 15, one of my Red-eared Sliders (*Trachemys scripta*) broke the right side of her shell in a fall from her terrarium. I was devastated. I took her to my dog vet, who apparently had no idea about reptiles and couldn't do a single thing to help her. I began searching for a reptile vet in Greece — but couldn't find one. After a rigorous search, I came to a sad discovery. I was completely alone. Not a single Greek veterinarian worked on reptiles! The pet shops, although full of reptiles, didn't know the first thing about herp care. The picture wasn't right — but I wasn't going give up on my turtle. I began purchasing foreign literature on pond turtles in order to



Andy Gogakis with his pet iguana, Eric. Photograph by Lucas Liaskos.

cure mine myself. That's when it hit me. Everything I had been doing in regard to turtle husbandry was utterly wrong.

Nobody in Greece was interested in reptiles. When confronted with the question: "What am I to do with my sick pet?" everyone, including many vets and my parents, responded: "Let it die and buy a new one; it's not like you are dealing with a dog." For crying out loud! We are talking about a living, breathing entity here. Come on, show some compassion here, people. I was confronted by the same response from everyone I talked to about the Blue Iguana extinction issue. Phrases like "Who

cares?" or mere grins were enough to make any considerate person angry. Suffice it to say, I cured the poor creature myself. Ten years after her accident she is doing well, although her shell never recovered completely (turtles have a very slow healing rate).

More serious problems arise when it comes to iguanas. Greece has to be the only country in the world that treats lizards as pests and not pets. Until 2000, very few people owned iguanas — but featuring one in a television series changed the whole picture. The owner of the iguana was portrayed as a weirdo, a societal outcast, a freak with strange hair color, who, to be honest, was quite funny. And, suddenly, that was it. Every kid in Greece wanted an iguana. Since the TV-series iguana ate only lettuce and spiders and lived in a 20-gallon tank, it was apparently easy to keep one. The fact that iguanas are very cheap in Greece has only encouraged people to acquire one. As a result, according to one of the largest pet shops in Athens, iguana sales have risen 500% in the past few years. On the opposite side of that coin, however, the mortality rate of these creatures is well over 95% — testament to throw-away attitudes toward reptiles and the lack of accurate information regarding proper husbandry.



*Photograph by Andy Gogakis.*

When I was confronted with my iguana's health problems, I quickly reached my wits' end. The only source of help was the Internet. I even sent e-mails to the Greek Veterinary Committee asking for assistance in finding a vet who would work on reptiles. The response was that no Greek vets had any interest in reptiles and that reptiles weren't even considered in university training programs. I also did some legal research and found out that animal care legislation in Greece covers only cats and dogs.

I finally decided to strike out on my own. After two years of hard work, intensive research, and many sleepless nights, I managed to cure my pet iguana, Eric, who suffered from mites, skin and spike problems, dehydration, advanced tail rot, and feeding problems. He had carried these problems with him since the day I saved him from a terrible pet shop, where he had shared a five-gallon tank with another iguana. Today he lives in a very large enclosure that resembles a tropical forest.

I am not one to tell you that all people are inconsiderate and cruel. I believe that proper educational efforts regarding reptilian pets will eventually incur dramatic improvements. In the interim, I just hope that the iguanas in Greece remain mute...

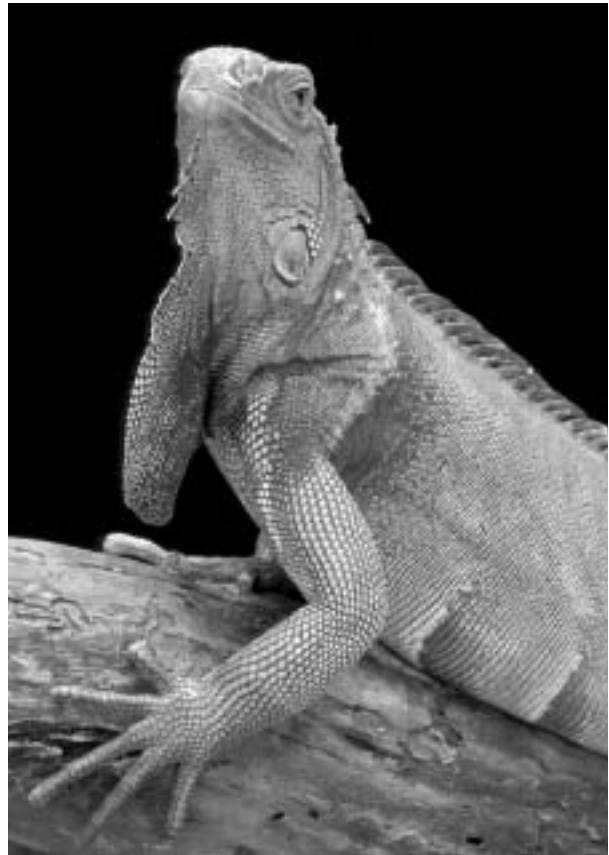
## HUSBANDRY

## Green Iguana Management and Husbandry<sup>1</sup>

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**G**reen Iguanas (*Iguana iguana*) are inappropriate pets. Like monkeys, raccoons, and skunks, they are cute and tractable as juveniles but become difficult to manage as they grow. Most captives suffer one of two fates. Either their needs are poorly met and they die at a young age, or they grow into large, active, aggressive adults for which few keepers can provide. Reptile adoption and rescue agencies are overwhelmed with unwanted iguanas. Successful iguana owners, those experienced in iguana care and behavior, are among the first to suggest that this species is a poor choice for all but the most dedicated keepers.

In choosing a pet, people select reptiles in general, or iguanas specifically, for a variety of reasons. A small group of keepers has a strong, sincere interest in herpetology and iguanas in particular. These people make the best keepers, and are always reading, researching, and trying to improve their knowledge and level of care. A bigger group of keepers uses the reptile to satisfy the basic human need to be unique and stand out: "Look at me, I have a weird pet." Many exotic pets are chosen for this reason, and these owners often take shortcuts in providing care because the animal itself is not as important as having it. Still others choose a reptile because they are non-allergenic, low-maintenance pets that can be left unattended for days at a time, and convenience outweighs dedication. The final group of keepers incorporates the impulse buyers who see an interesting, inexpensive lizard in the pet store and buy it with little regard for its captive requirements. These people



A healthy female Green Iguana (*Iguana iguana*).  
Photograph by Tom Wiewandt.

succumb to what Dr. Doug Mader calls the iguana's high "cool" factor.

Whatever the reason a reptile is chosen as a pet, iguanas are one of the more popular reptiles because they are inexpensive and readily available. Moreover, they are vegetarian and, in this age of animal rights, many owners prefer not to deal with insect or rodent prey. The down side, of course, is that vegetarian diets are much more difficult to balance than are insectivorous or carnivorous diets.

Like Pot-bellied Pigs, hedgehogs, and imported adult Ball Pythons before them, the Green Iguana fad is on the down slope of its bell-shaped curve of popularity when compared to the 1990s. The word

<sup>1</sup> This feature was adapted from an article of the same title presented as part of the Bayer Exotics Symposium in 2002 (*Suppl. Compend. Contin. Educ. Pract. Vet.* 24:13-22). Portions of that and this manuscript are based on Barten, S.L. In Press. Biology: Lizards. In: D.R. Mader (ed.), *Reptile Medicine and Surgery*. 2nd ed. W.B. Saunders, Inc., Philadelphia, Pennsylvania. Used with permission of the Bayer Corporation and Bayer AG Leverkusen.

is seemingly getting around that these are difficult captives. Nevertheless, a core of dedicated keepers will always be seeking veterinary advice.

One of the biggest problems of keeping iguanas — or any reptile — in captivity is that no standard of care has been established for them. Indeed, any internet search using the key words “iguanas, pets, and husbandry” (or “care in captivity”) will turn up an astonishing number of personal web pages for individual pet iguanas which are laden with advice, often conflicting, on captive care. Recommendations for captive care are almost universally based on anecdotal or personal experience with a few specimens rather than scientific research. Instead, captive care should be based on the biology and natural history of iguanas in the wild. The more their conditions mirror what they evolved to utilize in nature, the healthier captive iguanas will be.

### Natural History

Few reptiles have been studied as extensively as have Green Iguanas. This very brief summary of their biology is an overview meant to illustrate applications to captive management. Green Iguanas inhabit the New World tropics and subtropics from northern Mexico to Paraguay and southeastern Brazil, along with many Caribbean islands. Iguanas are diurnal and arboreal, preferring tree tops along rivers, lakes, and mangrove swamps. Trees provide an abundance of sun and shade for thermoregulation and basking, as well as food and sleeping perches. Iguanas sporadically descend to move to other trees, avoid threats or nest. An iguana may stay in one tree for anywhere from one day to several weeks. Iguanas also utilize more open, arid habitats if sufficient food resources are available.

The home range of a reptile is that area utilized for acquiring or accessing necessary resources such as food, shelter, basking sites, escape routes, mates, and nesting sites. Home ranges are not defended against conspecifics and ranges of individuals typically overlap. Territory is that subportion of the home range that is defended from conspecifics or other species, usually because it contains a critical resource. For iguanas living in trees, food is abundant and the main defensible resource is reproductive females. The measurement of home ranges for arboreal species is difficult because it is three-dimensional and contains gaps of unusable areas. Nevertheless, one study

reported mean home ranges for iguanas observed at least three times over a minimum of two months. Large males occupied 800 m<sup>2</sup>, medium and small males covered 2,200 m<sup>2</sup>, and females ranged over 2,450 m<sup>2</sup>. Another study showed mean daily movement totals of 111 m for male and 135 m for female iguanas. Flight distances of iguanas in trees (the distance at which the approach of a threat caused the lizard to flee) was 50–60 m after basking and 90 m before basking.

Iguanas are one of few totally herbivorous lizards. They are joined by many of the other New World Iguaninae, the spiny-tailed agamid *Uromastix* spp., Sailfin Dragons (*Hydrosaurus* spp.), Fiji Island Iguanas (*Brachylophus* spp.), and the Solomon Island Skink (*Corucia zebrata*). Suggestions that iguanas undergo an ontogenetic shift from insectivory to herbivory are based on observations of captives and anecdotal field observations and are incorrect. Iguanas spend 90–96% of their time resting and only 1% eating. Daily forage times last only 20–30 min. Iguanas



Tropical rain forest in Costa Rica. Green Iguanas were abundant and dozens and dozens of adult lizards were seen.



Iguanas are arboreal and prefer trees along rivers, lakes and mangrove swamps (A). This river was in Costa Rica. The speck on the branch of this tree is a large Green Iguana (B). Basking high in the top of a tree is typical iguana behavior, and serves as proof that most captive iguanas are kept in inadequately small cages.

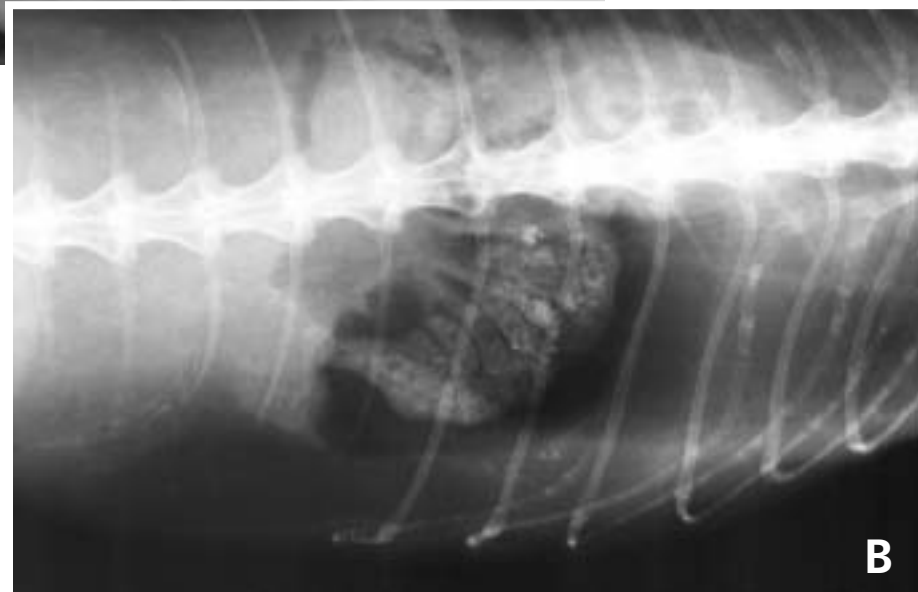


generally eat the leaves of trees and vines. Analysis of stomach contents from 31 iguanas in Panama revealed only plant material comprising 26 plant species. Twenty-four stomachs contained only leaves, four contained leaves and flowers, two only fruit, and one only flowers. Iguana teeth work like pinkish shears and cut out sections of leaves, but iguanas do not masticate before swallowing. All herbivorous lizards have an enlarged colon divided into compartments by circular and semilunar valves composed of infolded mucous membrane, submucosa, and the internal muscularis externa. The number of valves varies by species and Green Iguanas usually have 6 (5–7, but only four in populations from the northern Lesser Antilles). Their function may be to slow gastrointestinal transit time, increase surface area, or provide habitat for commensal microbe and

nematode populations. Wild herbivorous lizards typically have huge oxyurid (intestinal roundworms) burdens of up to 15,000 worms per lizard. These are not found in other lizard species. The nematodes may serve to mechanically mix and break down plant material, produce useable cellulase, vitamins and fatty acids, or promote healthy populations of fermentative microbes in the colon. Nevertheless, dewormed lizards had efficient digestion, so nematodes, although common, may be relatively unimportant. Thirty to 40% of nutritional energy derives from microbial fermentation in the hindgut. This process requires high temperatures and slow passage times, averaging 6.9 days in wild iguanas in Venezuela. Wild neonate iguanas inoculate themselves with fermentative bacteria by ingesting the feces of adult iguanas after hatching.



Adaptations for herbivory in Green Iguanas. (A) Iguanas have homodont (all the same shape), pleurodont (frequently shed and replaced) teeth designed for cutting large pieces of leaves, which are then swallowed relatively whole with little chewing. The points of the teeth interdigitate to cut leaves like pinking shears. (B) Dorsoventral radiograph of an iguana. The colon is silhouetted by air density in the lung. The semilunar valves that divide the colon into compartments, which are typical of herbivorous lizards, are outlined and made visible by ingesta.



Thermal ecology of reptiles is complex. The term “Preferred Optimum Temperature Zone” is common in the veterinary literature, but thermoregulation in ectotherms involves much more than that. The “Preferred Temperature” is the temperature selected by lizards in a thermal gradient when not distracted by other influences, like shelter. The “Mean Activity Temperature” is the mean temperature of all active lizards. The “Activity Temperature Range” is the range in which activity occurs. The “Voluntary Minimum and Maximum” are the lowest and highest temperatures tolerated in laboratory conditions, and these define the endpoints of the Activity Temperature Range. The “Critical Thermal Minimum and Maximum” are the extreme temperatures that result in immobility and death.

Voluntary minimum, maximum, and mean temperatures for Iguanidae were reported as 18.0°, 46.4°, and 36.7° C (64.4°, 115.5°, and 98° F), respectively. Circadian temperature fluctuations (low at night and high during the day) within the activity temperature range are very important, and lizards kept at uniform temperatures 24 hours a day fail to thrive.

Iguanas appear to have high requirements for ultraviolet light for vitamin D and calcium metabolism, although specific wavelengths, intensities, and photoperiods have not been quantified. Nonbreeding iguanas in Venezuela basked for approximately 4 h in the morning and another 2–3 h in the afternoon. Basking provides for thermoregulatory as well as ultraviolet needs.



Iguanas communicate primarily through visual signals. Dominant males exhibit physical characteristics that emphasize their size, such as large heads, opercular scales, crests, spines, and dewlaps, and sometimes orange skin coloration. Likewise, head bobs, pushups, throat expansions, and dewlap erection are used to convey threat. Threats may escalate to lunging, biting, and tail slapping, although, in the wild, displaying males tend to be well spaced so that displays outnumber actual fights. Chemical and tactile signals are less important; however, femoral pores are well developed in males and produce secretions that provide both chemical and visual cues. The femoral pore secretions of Desert Iguanas (*Dipsosaurus dorsalis*) reflect UV light in wavelengths that are visible to the lizards but not to humans.

Breeding is seasonal and associated with the dry season. Males display on perches and defend territories from November through January, becoming very aggressive toward intruding males. This corresponds to a seasonal testicular recrudescence, during which the testicles undergo marked enlarge-

ment and testosterone production peaks. Breeding behavior is characterized by dominant male hierarchies utilizing small mating territories, intense competition between males, and female mate selection determined by male fitness. Females nest 3–7 weeks after breeding, produce clutches ranging from 14–76 eggs (average 35–43), and eggs hatch after 10–14 weeks of incubation at 28–32° C. Iguanas often nest communally due to limited numbers of available sites, excavating nest sites at the bottom of burrows 1–2 m long and 0.25–0.5 m deep. Females guard nests from other females.

Nonbreeding iguanas are more tolerant of the presence of other iguanas and do not defend territories. Low-intensity antagonistic interactions occurred when two iguanas passed on a branch but ceased after they separated. Nonbreeding females occupy prime basking and sleeping perches and chase away new females.

### Husbandry

The conditions iguanas require and utilize in the wild obviously cannot be provided in captivity.



A very large, male, sedated Green Iguana. Size and dominance are communicated through visual cues. Note the large head, large opercular scale on the jowl, large dewlap, and tall dorsal spines. This iguana was caught as a feral animal in Florida, where it was thriving outdoors. The right front foot and forearm are swollen as a result of a bite wound from another iguana. Several iguanas including territorial males were housed together due to lack of space at an animal dealer's facilities.

No iguana husbandry can be described as “proper,” and captive conditions always have room for improvement. Captive iguanas tolerate less than ideal conditions, nevertheless keepers must be aware of iguana natural history and make every effort to provide for their needs. These needs include large, three-dimensional home ranges, focal heat sources approaching 36.7° C (98° F), strong UV sources, a balanced vegetarian diet, and avoidance of the various levels of aggressive and antagonistic behavior between individuals. Every captive iguana is under some degree of chronic stress just from being in captivity. Conditions that are well-tolerated by one lizard may cause serious problems in another, and keepers must be flexible in their techniques according to their results. Captive management should be investigated and improved for any iguana presented to a veterinarian for any reason, without exception.

Iguana husbandry has been the subject of innumerable books and magazine articles. To cover the topic in depth here would be to reinvent the wheel, and such a complex subject cannot be discussed in detail in this limited space. Veterinarians and owners alike should be thoroughly familiar with one or more of the three best books on iguana husbandry: Kaplan's *Iguanas for Dummies*, Hatfield's *Green Iguana: The Ultimate Owner's Manual*, and Rosenthal's *The Iguana: An Owner's Guide to a Happy Healthy Pet*. Melissa Kaplan is considered a leading authority on captive iguana management and, in addition to her excellent book, she maintains the Melissa Kaplan's Herp Care Collection web site at [www.anapsid.org](http://www.anapsid.org). This is one of the finest web sites on herp care because it is comprehensive, current, accurate, well-referenced, and frequently updated.

Two main schools dominate captive reptile husbandry. Traditionally, bare cages with newspaper substrate and a single branch and water bowl were recommended and popular. Ease of maintenance was achieved at the cost of stimulation and enrichment for the iguana. Lately, complex, naturalistic vivaria have become fashionable. Such cages are aesthetically pleasing, but also labor-intensive to maintain, and few but the most dedicated and experienced hobbyists do an adequate job of sustaining hygiene in complex cages. If a keeper cannot properly maintain a complex vivarium, then a simpler setup would be a better choice. Likewise, ingestion of substrate is common when gravel or bark is used, especially if the diet is unbalanced or

inadequate in amount. In spite of the potential problems, cages should be enriched to reduce stress and allow normal behaviors among inhabitants.

**Caging.**—Iguanas are arboreal lizards that require huge cages to accommodate their active behavior, and most keepers provide cages that are too small. One expert recommends a cage length equal 1.5–2 times the total length of the lizard housed within, and a cage width at least half that distance. Another expert suggests even more space, 0.4 m<sup>3</sup> cage space per 0.1 m total length for arboreal lizards. These are suggestions only and come nowhere near providing the space that wild iguanas utilize, with home ranges measuring over 2,000 m<sup>2</sup> (a square measuring 146 ft per side) and daily movements exceeding 100 m (328 ft). With that in mind, iguanas should be provided the biggest possible cages with the goal for adult lizards of at least 10 x 3 by 6 ft high, although a room-sized enclosure would be better. Anything smaller would be the equivalent of a human living in a telephone booth: possible, but hardly humane. Aquaria sold for juvenile iguanas will be outgrown in a few months, and the need for custom cages should be anticipated from the beginning. Outdoor aviary-style cages with shelters from the sun and inclement weather are strongly recommended in warm climates or during the summer months.

Cage sides should be smooth to prevent rostral abrasions. Metal screening should be used with caution, since it doesn't retain heat and can result in foot and rostral trauma. Plastic mesh, polyethylene hardware cloth, and plastic-coated wire mesh are less abrasive. Cages made of wood must be sealed with polyurethane, marine epoxy paint, or a similar waterproofing agent, and joints should be caulked to allow cleaning and disinfection. Ventilation is crucial, as ample air exchange is necessary to prevent the harmful buildup of bacteria and fungi.

Lizards allowed to roam free in the house may suffer suboptimal temperatures from the lack of a heat source or exposure to cold outside walls and windows or drafty floors. Trauma is common in free-roaming iguanas that may be trampled, closed in doors, fall from high shelves or curtains, or be attacked by dogs and cats. Uncaged iguanas commonly escape.

Arboreal species require vertical space and climbing branches. Dry climbing branches approximately the same diameter as the lizard's body



A Bahamian Ground Iguana (*Cyclura cyclura figginisi*) in a huge outdoor enclosure. Although not a Green Iguana, the principles are the same. About one eighth of the cage is visible here. It is located under a tree, providing both sun and shade. Note the ramp behind the lizard which leads to a heated enclosure to provide shelter on cool nights. Note, too, that the concrete walls are buried in the ground to prevent the lizards from burrowing underneath them. Photograph by Juliann Sweet.

should be placed diagonally in the cage and anchored to prevent toppling. Live, non-toxic plants that lack spines and slippery surfaces and are big enough to bear the weight of the lizard are recommended. *Dracaena* and *Ficus* trees with trunks as thick as the lizard's body work well for iguanas. These act as cage furniture, add humidity, shelter, and visual enhancement. They should be potted to facilitate cleaning. Silk plants may be coated with toxic, water-soluble stiffeners and should not be used.

**Substrate.**—Substrate can be flat newspaper, indoor/outdoor carpet, orchid or so-called “reptile” bark chips, alfalfa pellets, cyprus mulch, or commercial animal bedding made from recycled paper or wood pulp. Newspaper is inexpensive, clean, and easy to use, but not aesthetically pleasing. Carpet is labor-intensive, requiring washing. Alfalfa pellets are digestible if ingested and look nice, but are dusty and foul smelling when they get wet. Orchid or “reptile” bark products made from fir may be used, but never redwood or cedar. If bark chips are excessively dusty, they should be rinsed and dried before use. Coarse-grade bark can irritate the feet of lizards that dig repeatedly and fine-grade bark can cause fatal gastrointestinal impaction if swallowed. With the current popularity of naturalistic vivaria, many keepers feel the advantages of bark outweigh these risks. A shallow feeding dish can be used to minimize the risk of accidental substrate ingestion, but the bark should be removed if a keeper sees the lizard eat some or

finds it in droppings. Recycled paper animal bedding currently is a popular substrate to use because it is more absorbent and less dusty than alfalfa pellets; it can be changed less frequently and it is more or less digestible if swallowed.

Cedar shavings contain aromatic resins that may be toxic to reptiles. Other substrates to avoid include gravel, sand, crushed corn cob, clay kitty litter, and miscellaneous wood shavings.

**Thermoregulation.**—Reptiles are ectothermic and require supplemental heat in captivity. Temperatures within the Activity Temperature Range are necessary to optimize metabolic processes including digestion, growth, healing, reproduction, and immune system function. The Mean Activity Temperature ( $T_b$ , body temperature) for Iguanidae is reportedly 36.7° C (98° F); consequently, a focal hot spot reaching this level must be provided. Iguanas also are heliothermic (gain heat by basking) and not thigmothermic (gain heat by conduction from lying on warm rocks), thus overhead heat sources are preferred to substrate heaters. So-called hot rocks are commonly sold by pet stores for use with pet reptiles, but are inappropriate for this species. Substrate heaters under the tank may be used to provide background heat in cold climates, but not primary basking heat.

Reptiles in the wild control their core body temperature to within a few degrees of their mean activity temperature by thermoregulation — they move all or parts of their bodies into or out of

direct sunlight. Keepers should create a thermally complex environment for captive reptiles to allow them to adjust their body temperature behaviorally as they would in the wild. A thermal gradient on both a horizontal and vertical axis is ideal. This can be achieved by providing a focal hot spot on one side of the cage, covering less than 25% of the cage, using overhead lamps with reflectors, infrared ceramic heating elements, or radiant heat panels. These must be secured to prevent them from being tipped over or burning the lizard. Heat sources should be attached to thermostats to prevent accidental overheating, and a number of commercial models are available specifically for use with captive reptile enclosures. Fire safety precautions and smoke alarms should be used. However, maintaining the entire cage at a uniform temperature would be unnatural. Diurnal temperature fluctuations between day and night occur in the wild, so heat lamps should not be left on 24 h/day. Daily fluctuations in temperature seem to be important for lizards. Nighttime temperatures can approach the voluntary minimum temperature for iguanas (18.0°C, 64.4°F), but should not reach it to avoid stress and immunosuppression. Nighttime lows around 22°C (72°F) are well-tolerated as long as adequate daytime highs are provided.

The temperatures at both the hottest and coldest parts of the enclosure must be measured daily. Digital thermometer-hygrometers are useful. Likewise, infrared thermometers that instantly measure the surface temperature of objects from a distance are highly recommended. Both are available from electronics stores and reptile supply dealers. Adhesive aquarium thermometers stuck to the side of the cage are not recommended, because the temperature of the basking site where the reptile rests should be measured rather than the temperature on the side of the cage.

**Osmoregulation.**—Tap water usually is adequate, but bottled water might be used where the tap water quality is in question. Aging the water or dechlorination is not necessary. *Pseudomonas* spp. bacteria grow rapidly in water bowls, so bowls should be changed and disinfected or washed in hot soapy water every day.

Humidity is an important but often overlooked factor. In general, iguanas require more humidity than is typically present in our homes. From a practical standpoint, maintaining humidity levels of 50% is almost impossible, and such levels

result in blooms of mildew. Good ventilation is essential to prevent the rapid growth of bacteria and mold in the cage when humidity is added. Humidity may be increased by using water bowls with large surface areas to increase evaporation, frequent spraying of the cage, or the use of humidifiers. Different humidifier models produce hot or cold mist. The former must be kept far enough from the lizard to prevent burns. Machines kept within the enclosure must be secured to prevent iguanas from tipping them over.

**Ultraviolet Requirements.**—Ultraviolet wavelengths (UV) are important for vitamin D synthesis and calcium metabolism in diurnal lizards that do not eat vertebrate prey. UV-A (nearwave, 320–400 nm) produces beneficial behavioral and psychologic effects, but does not activate vitamin D precursors in the skin. UV-B (middlewave, 290–320 nm) is necessary for vitamin D activation. Reptiles benefit from *both* UV-A and UV-B light. Nevertheless, scientific studies into the specific requirement for UV light in captive lizards are lacking, and specific requirements for UV wavelength, intensity, and length of exposure are largely unknown. Iguanas are known to bask for many hours every day in the potent tropical sun, receiving levels of UV radiation that are difficult to duplicate in captivity.

The sun is a more effective UV source than any bulb, but certain precautions must be taken before exposing captive lizards to direct sunlight. First, window glass filters out UV rays, thus sunlight through a window is of no benefit. A reptile in a glass cage should never be placed in direct sunlight or overheating and death may occur. Reptiles should be in a screen or mesh cage to allow sunlight to enter but, at the same time, prevent the escape of the lizard. Part of this enclosure must be shaded with an overhang or plants to allow the animal to get out of the sun. Iguanas basking in the sun should be kept in an enclosure and not handheld, even with a leash, because direct sunlight can result in temporary changes in personality, and normally tame lizards can become agitated and very aggressive. These changes reverse readily when the lizard is brought back inside. Lizards basking in sunlight should be monitored to prevent overheating, exposure to predators, or theft, or any other problem that might arise. Basking outside should not be allowed if the ambient temperature is excessively high. Even 15–30 min of direct sunlight a week can be quite beneficial.

A number of artificial UV-B light sources for reptiles are commercially available. Obviously a bulb producing 5.0% of its emitted light as UV-B is more efficient than one producing 2.0% UV-B. Moreover, a 48-inch tube produces more light than an 18-inch tube, and two tubes produce twice as much light as a single tube. Traditionally, fluorescent tubes have been considered better UV-B sources than incandescent bulbs, but new products are available that claim to provide UV-B and heat in a single incandescent bulb. New UV light sources are becoming available on a regular basis, and each should be evaluated based on the wavelengths of UV produced.

Caution should be taken to avoid human exposure or eye contact with the UV rays, as these have been associated with skin cancer and cataract formation. Artificial UV light sources should mimic natural photoperiods and be turned off at night.

Artificial light sources cannot replace natural sunlight, and those reptiles with access to the sun in outdoor enclosures, even on a screen porch or patio, invariably have better growth, health, behavior, reproduction, and longevity than those kept indoors.

**Visual Security.**—Visual security is beneficial, especially for nervous specimens. A shelter or retreat should be provided for all cage inhabitants. Hiding places can be made from a cardboard box, terra cotta pottery, plastic flower pots, cardboard tubes, sheets of cork bark, or driftwood. Arboreal iguanas

also should be provided with real or artificial plants in which to hide. Some iguanas eat poorly and become stressed if they lack visual security.

**Disinfection.**—Cages and food and water bowls must be cleaned frequently. Three-percent sodium hypochlorite solution is an effective and economical disinfectant. The cage and its furniture must be rinsed thoroughly before returning a lizard to the cage. Keepers must wash their hands thoroughly after cleaning each cage and not transfer water bowls, uneaten food, or climbing branches between cages without disinfecting them first.

**Quarantine.**—Reptiles new to a collection must be kept in a separate area from the main collection for a minimum of 3 months. New arrivals should have physical examinations, body weights recorded, fecal examinations, parasite treatment, and be monitored for appetite, normal behavior, and symptoms of illness. At the very least, the owner should inspect new arrivals. The main collection should be fed and cleaned first and the quarantined animals second, with no transfer of animals, cages, food and water bowls, uneaten food items, or cage furniture between the two. Keepers must wash their hands and consider clothing changes after working with either collection to prevent the inadvertent transfer of pathogens. Ideally, different keepers would care for the two collections. The farther apart the two collections are physically, the less likely an epizootic will occur. No transfer of air should occur between the two



Two Rhinoceros Iguanas (*Cyclura cornuta*) in a large outdoor enclosure. The lizard on the right is threatening the other one with vigorous head bobs. Note the erect posture and orientation directly towards the other lizard. The other iguana soon submitted by retreating to the far corner of the cage.

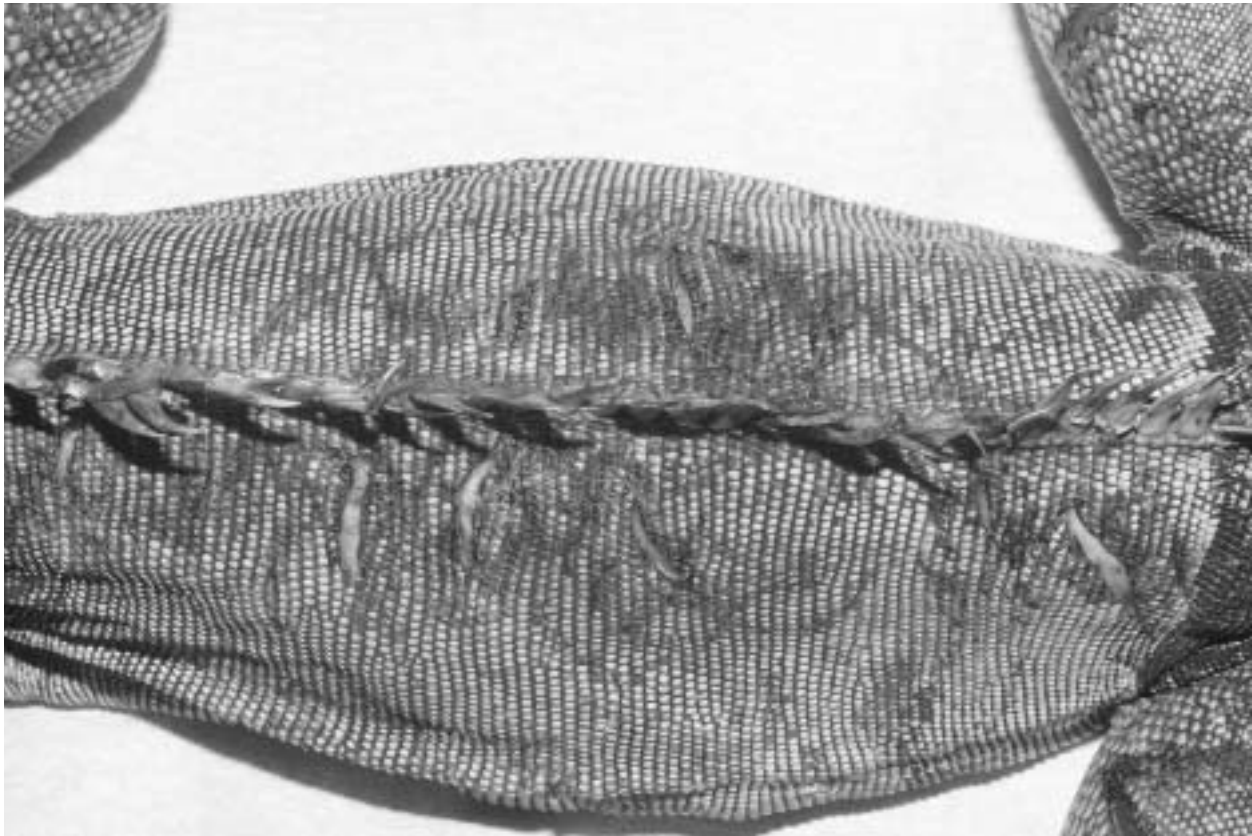
groups. When multiple animals are being quarantined, they should enter and leave the quarantine area as a group.

**Communal Housing and Handling.**—Pet stores often display iguanas for sale in crowded community tanks, suggesting that these are social animals. In the wild they may form loose aggregations if food is abundant, but they also have the opportunity to run away if they are being stressed or threatened by other iguanas. Lizards locked in a cage or room cannot run away. Male lizards are more territorial than females, and react more violently to other males than to females. Hormone fluctuations, and thus territoriality, are seasonal and are manifested most acutely during the breeding season. Iguanas gain little benefit from being housed together, but cannot stress or injure each other if housed separately.

When two or more lizards are kept together, the more aggressive individual may physically attack the subordinate one, sometimes inflicting

serious wounds. More often it dominates in more subtle ways by keeping the subordinate lizard away from food and heat sources. This allows the dominant one to digest its food more efficiently, grow faster, and have a more effective immune system than the subordinate lizard. The subordinate in a pair invariably suffers chronic stress, and thus fails to thrive. Symptoms include slow growth, emaciation, poor muscle tone, poor color, lethargy, and susceptibility to infections and parasites. The solution is to separate the lizards. Reflective surfaces and mirrors should be avoided, as lizards, especially males, will attack their own reflection. Keepers might occasionally observe two lizards in a cage to lie in the same spot and overinterpret that they have a relationship. However, stress may still be present.

Two or more iguanas may be kept together only if certain requirements are met. First, the enclosure must be large enough, with 1.5–2 times the recommended area for the biggest iguana pro-



Multiple bite wounds on the back of a subordinate male iguana, which also suffered a fractured ulna as the result of an additional bite. Seventy-eight stitches were needed to close the wounds. The owner had purchased two iguanas thinking they were social and in need of companionship. As the lizards grew, they both turned out to be males and began to fight. The owner tried to separate them by confining them in separate (and inadequate) 55-gallon aquaria in the same room. He came home one day to find the larger male had broken out of his cage and into the cage of the smaller lizard, pinning him down and chewing on him until the owner separated them.

vided for each iguana in the cage. Second, separate feeding, basking, and hiding areas must be provided for each iguana. Spatial complexity, so the iguanas can stay out of sight of each other behind logs, driftwood, and plants, is crucial. Third, keepers must be observant of the iguanas' behavior. A cage may appear suitable by the book, yet the individual iguanas may require more space or additional shelters or basking sites. Different iguanas have different personalities and requirements. Finally, the keeper must be aware that two iguanas simply may be incompatible. Just because they are the same species does not mean that they will get along. Females may dominate males, and smaller lizards may dominate larger ones, so the largest male is not always at the top of the social hierarchy. Lizards that are initially compatible may begin to fight months or years later. Keepers getting more than one iguana should be prepared to provide separate enclosures if the lizards become incompatible. Separate enclosures are not always enough, and often cages must be kept in separate rooms.

**Food and Feeding.**—Wild Green Iguanas are specialized folivores, eating primarily leaves from trees. Captive iguanas are exposed to, and accept, a number of food items they would never see in the wild. The owner must patiently work with his or her pet iguana and train it to eat a balanced diet. The lizard should never be allowed to choose what it eats, as taste and palatability do not necessarily equate to nutritional value.

Suboptimal temperatures and other husbandry conditions prevent adequate food intake and digestion. Under poor captive conditions the best diet in the world will be inadequate.

No captive iguana diet can be accurately described as "proper." The exact nutritional requirements for Green Iguanas have never been scientifically determined, and precise nutritional requirements for this species are not known. Wild iguanas eat leaves from trees that are not available in captivity. We can approximate a nutritious diet, but most formulations are based on anecdote, experience, and speculation rather than scientific feeding trials.

In captivity, herbivorous lizard diets should be based on a variety of chopped, dark green, leafy vegetables. Greens that contain oxalates, like spinach, or goitrogens, like kale, should be used sparingly. Fruit should be minimized, not because it is toxic but because it dilutes the beneficial nutrients of the other ingredients. In one study, adding

one cup of strawberries to one cup of romaine reduced the protein and calcium concentrations by two-thirds compared to romaine alone. A recommended diet including ingredients, amounts, schedules, and vitamin and mineral supplementation is described in the accompanying Table.

All plant material must be washed, chopped (a food processor is recommended), and thoroughly mixed. This will ensure a balanced diet in that all food items will be eaten, rather than just the favorites or the most tasty items. Prepare enough for 4–7 days, store it in the refrigerator between feedings, and serve it at room temperature or slightly warmer. Offer food after the iguana has had several hours to bask under its heat source in the morning, leave it in all day and remove uneaten food in the evening.

Grains such as bread, crackers, pasta, and seeds are recommended in some iguana diet recipes. This food group is low in the nutrients that iguanas need, especially fiber, protein, and calcium. Grains should be limited to occasional treats if used at all.

Traditionally, animal protein sources have been recommended. However, these lizards are vegetarians from birth, even though they might occasionally accept unnatural foods (e.g., crickets or even mice) in captivity. Although animal protein sources often are recommended for iguanas, their necessity has not been scientifically documented. Any protein supplements should be plant-based.

Commercial iguana diets are available, but vary in quality and palatability. The advantage of these products is that they are easier to use than preparing a balanced salad several times a week. The disadvantage is that, in spite of claims that the commercial diets are complete and balanced, they may not be. Commercial diets that have high levels of animal protein, fat, corn, soy, wheat, grains, goitrogenic vegetables, fruits, or flowers should be avoided. The main ingredient, which is always mentioned first on the ingredient list, should be alfalfa. Nutrient levels on a dry matter (DM) basis should include plant-based protein > 20%, fiber > 15%, and calcium 1.4%. Pelleted or powdered diets contain only 10% water compared to 85–90% in salads. Consequently, these diets must be moistened with water prior to feeding. Frozen diets can be deficient in thiamine. Commercial iguana diets may have a role in iguana nutrition but should be limited to less than half of the total diet until more is known.

## ***Recommended Diet for Captive Green Iguanas***

### **Hatchlings (to 14" in length)**

- Feed twice a day or provide continuous availability
- Plant matter finely chopped or shredded
- 1 small pinch of vitamin/mineral supplements per feeding. Give vitamins 4–5 days a week and calcium 7 days a week.

### **Juveniles (to 2.5 years of age or to 3 ft in length)**

- Feed once a day
- Plant matter fine to medium chopped or shredded
- 1 small pinch of vitamin/mineral supplements per feeding. Give vitamins 4–5 days a week and calcium 7 days a week.

### **Adults (over 2.5 years of age or over 3 ft in length)**

- Feed daily or every other day (an iguana cannot be overfed when using the high fiber, vegetarian diet recommended here)
- Plant matter coarsely chopped
- One full pinch of vitamin/mineral supplements per 2 lbs of body weight. Give vitamins 2–3 times per week and calcium 4–5 times per week (unless gravid or sick, then 5–6 times a week).

### **Ingredients**

1. Calcium-rich leafy greens, 40–45% of the diet or more with three or more items per feeding: turnip greens, mustard greens, collards, pesticide-free dandelion greens and flowers, clover, escarole, carrot tops, parsley, nasturtium leaves and flowers, and hibiscus leaves and flowers. Also offer endive, romaine, mint, and cilantro.

Spinach, chard and beet greens have high levels of oxalates which can tie up calcium, and kale, bok choy, and broccoli leaves have high levels of goitrogens. Both groups can be used, but in moderation.

Iceberg, Boston, butter, and head lettuces have little nutritional value compared to dark leafy greens. Romaine is intermediate in value, and should be used only in combination with the dark leafy green mentioned above.

2. Other vegetables, 40–45% of the diet with a variety weekly: raw green beans, snow and snap peas, squash, sweet potato, okra, bell pepper, mushrooms, and yams. Thawed, frozen mixed

vegetables can be used occasionally. Grated carrot should be used only occasionally, as it also contains high levels of oxalates. Vegetables with lower nutritional values include cucumbers, tomatoes, onions, olives, zucchini, and radishes.

3. Alfalfa is a good source of fiber and protein. Alfalfa is available as minibales or pellets for small mammals from pet and feed stores. Read pellet ingredient labels to make sure alfalfa is the first ingredient listed. Do not use mixes that contain seeds and other ingredients. Alfalfa also is available as powder, tablets, or capsules from health food stores. Pellets and powder should be softened by soaking them in water prior to feeding. Be sure to use mature leaves and stems rather than sprouts. If an iguana refuses to eat alfalfa as offered, powder or crushed tablets can be added at low levels to the salad, gradually increasing the amount over several weeks.
4. Fruits should be used only as occasional treats or supplements. Fruits are low in most nutrients including protein and calcium, and have high levels of phosphorus. Fruits dilute the good nutrients found in leafy greens and vegetables. The following may be offered: figs, papaya, melon, apple, peaches, plums, strawberries, banana (with skin), grapes, and kiwi.
5. Vitamin and mineral supplementation is advised. Vitamin and mineral deficiencies are common in iguanas. However, calcium and fat-soluble vitamins (A, D, E, and K) can be oversupplemented as well as undersupplemented. To avoid oversupplementation, natural sources from a varied diet are the best choice, with moderate vitamin/mineral use to balance the diet. To date, no documented studies address specific requirements for any lizard species.

Many commercial supplements are available for reptiles, but none of these products is required to prove potency or safety. Products vary widely in levels of ingredients. Look for a ratio of roughly 100 parts Vitamin A to 10 parts Vitamin D3 to 1 part Vitamin E. Human products with Vitamin D3 (rather than D2) may also be used. For minerals, use powdered calcium carbonate (cuttlebone shavings is one source) or calcium gluconate.

Vitamin powder on top of the salad may make it unpalatable. The powder should be mixed in thoroughly. If you can see the powder, you probably used too much.





An emaciated Green Iguana acquired by the Mid-Michigan Reptile Rescue. Photograph by Stephanie Beiser.

Green Iguanas, especially hatchlings, in retail outlets are often anorexic, underweight, and weak. They may weigh less than 10 g and have a sunken abdomen and a bony pelvic girdle. These lizards should be force-fed an appropriate vegetarian diet such as a commercial tube feed mixture for rabbits or a gruel of rabbit pellets, as opposed to a liquid diet for carnivorous dogs and cats, at 1–3% of their body weight every two days. At the same time, the juvenile lizards should be offered a finely chopped diet, as described in the accompanying Table, until they are eating on their own.

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A healthy Exuma Islands Iguana (*Cyclura cyclura figginsi*) enjoys a properly prepared meal. Photograph by Juliann Sweet.

## PROFILE

## Allison Alberts: A Consummate Conservationist

Tandora Grant

Center for Reproduction of Endangered Species, Zoological Society of San Diego



As for so many of us with an interest in iguanas, an early educational experience sparked Allison Alberts to pursue a career in science. She grew up in the San Francisco Bay Area of northern California, an urban center in close proximity to some of the most diverse and beautiful landscapes in the United States. When she entered the University of California–Berkeley, she was undecided in her studies, exploring both English and science. Not until she enrolled in a two-semester course entitled Natural History of the Vertebrates, which included once-a-week field trips, did her enthusiasm for a career in science solidify. After graduating with high honors in biology, she moved to the University of California–San Diego to begin a post-doctoral program. After her first year, she enrolled in the Tropical Ecology course with the Organization for Tropical Studies in Costa Rica. This was the first time Allison had traveled to the tropics and the experience was very influential in developing her career interests. Allison’s original thesis topic had been chemical communication strategies among Neotropical bats. However, after a few years (and some crazy adventures in Mexico), she realized that bat research in the tropics was logistically nightmarish and far too costly for a graduate student. She switched her thesis to chemical communication in Desert Iguanas (*Dipsosaurus dorsalis*), a project that could be accomplished in the deserts just east and north of San Diego. In many ways, Allison is thankful that she switched her thesis in mid-stride, as she has indeed fallen in love with lizard ecology!

As a post-doctoral fellow, Allison expanded upon her graduate work by examining communication in a species closely related to *Dipsosaurus*, but which experienced radically different habitat parameters. Wanting to return to the tropics, she began studying Green Iguana (*Iguana iguana*) chemical communication. This research was conducted partly in the field at Dagmar Werner’s



Allison and Cuban Iguana, “Sunny,” at the San Diego Zoo.

iguana ranch in Costa Rica, partly in the laboratory at Texas A&M University in College Station, and culminated at the Zoological Society of San Diego’s Center for Reproduction of Endangered Species. At CRES, Allison was exposed to a broader scope of research that included conservation as well as academic goals. After becoming an associate scientist at the San Diego Zoo, she began studying the ecology and reproductive biology of a relatively stable population of Cuban Iguanas (*Cyclura nubila nubila*) at the U.S. Naval Station at Guantanamo Bay, Cuba. As a group, the Caribbean iguanas are the most endangered lizards



Young iguana conservationists in training: Allison's children Jonathan (age 4) and Connor (age 6). Allison was instrumental in erecting these iguana-warning signs at the U.S. Naval Station at Guantanamo Bay, Cuba.

on earth, primarily due to habitat alteration and predation by introduced domestic and feral mammals. Many populations consist solely of adult iguanas with virtually no juvenile recruitment. A large and pioneering part of the Cuban Iguana research, supported by the National Science Foundation, included testing the viability of head-starting as a conservation strategy for depleted populations of large lizards. To quickly rebuild such a population, determining if hatchling iguanas could be raised in captivity until they obtain a size less vulnerable to predators and successfully persist in the wild was essential.

In 1991, the Jamaican Iguana (*Cyclura colleyi*) was rediscovered in a remnant patch of forest near Kingston. A year later, the Conservation Breeding Specialist Group hosted a Conservation Assessment and Management Plan workshop for iguanids and varanids, which was soon followed by a Population Habitat Viability Assessment workshop for the Jamaican Iguana. As a participant in these two workshops, Allison met many key people concerned with the conservation of Caribbean iguanas. Among these new colleagues was Rick Hudson of the Fort Worth Zoo in Texas, with whom she began incubating the idea of forming a specialist group for Caribbean iguanas. Together they organized the first informal meeting in Miami in 1996, which was attended by 25 people

from six countries.

Official sanction from IUCN (The World Conservation Union) in 1997 formally established the West Indian Iguana Specialist Group. Since that first meeting, the group has met every year to discuss on-going research, develop recovery strategies, and strengthen collaborations. The partnerships formed have been instrumental in the remarkable population recovery milestones for Caribbean Rock Iguanas seen in the last decade. Headstarting is now being success-



Allison with Iguana Specialist Group members, Rick Hudson, Fort Worth Zoo, and Miguel García, Puerto Rico Department of Natural Resources, leads the 2002 Iguana Specialist Group meeting in the Dominican Republic.



Allison Alberts and Glenn Gerber release Turks and Caicos Iguanas (*Cyclura carinata carinata*) on Bay Cay as part of a long-term restoration program for the species.



Allison and iguana friends (*Cyclura cyclura inornata*) on the Allen Cays, Bahamas.

fully applied to wild populations in Jamaica, Grand Cayman (*Cyclura lewisi*), Mona Island (*Cyclura cornuta stejnegeri*), and Anegada (*Cyclura pinguis*). Dr. Alberts' team has also been investigating how quickly iguana populations can recover after severe habitat disturbance in Cuba and using translocation to restore iguana populations to formerly inhabited cays in the Turks and Caicos Islands.

These days Allison spends less time in the field than in the past. As Head of the Applied Conservation Division at the San Diego Zoo, she oversees a staff of seventeen, with projects that focus on the reintroduction of ecologically important species, sustainable use of natural resources, and Southern California species and habitat conservation. Conservation of iguanas remains a principal focus for her and many of the division's staff members, but the group also is actively involved in reintroduction programs for the California Condor, San Clemente Island Loggerhead Shrike, and Giant Chacoan Peccaries in Paraguay. Additionally, because conservation nearly always requires modifications of human behavior, the division's projects in Madagascar and Mexico work with indigenous communities to develop butterfly-based programs that provide significant income, while at the same time promoting habitat preservation

and restoration. Finally, because San Diego is located in one of the world's biodiversity hotspots, the division's research continues to support conservation of Southern California ecosystems, through a seed banking effort and ongoing studies of local birds, mammals, reptiles, and their habitats. Summaries of some of these projects can be viewed on the San Diego Zoo's website ([http://www.sandiegozoo.org/conservation/field\\_projects\\_list.html](http://www.sandiegozoo.org/conservation/field_projects_list.html)).

Allison is the author of over forty journal articles, two books, ten book chapters, and scores of technical reports and popular articles. She has served on numerous editorial review boards and is a key contributor to several professional societies. Today, the West Indian Iguana Specialist Group has expanded its mandate to become a global Iguana Specialist Group that includes members concerned with all iguanids. Allison has been elected Co-Chair since the group's inception, which attests to her skills in diplomacy and communication, and to her science-based approach to conservation. Outside of work, Allison enjoys spending time with her husband Mike and two sons, Connor and Jonathan, as well as swimming, softball, reading, hiking, gardening, and travel. She is distinguished among scientists by her strong conservation ethic and compassion for the animals she studies.

## HISTORICAL PERSPECTIVES

# Iguanas of the Galápagos Islands<sup>1</sup>

Franz Werner,

with extensive quotations from Charles Darwin

**T**he Galápagos Islands are a world unto themselves. The majority of the plants and animals there are found nowhere else. Among the animals, the reptiles play a very important role, ecologically replacing the mammals that are absent from the islands, especially the herbivores. Only a few species are native, but each is (or was only a few decades ago) exceedingly abundant. Of particular interest are the iguanian squamates and, of those, two exceptionally unusual species stand out. These are easily distin-

guished from related iguanas by examining their dentition, the shape and scalation of their heads, the strength of the head skeleton, and the lack of a dewlap. Both species agree in general body form and they also demonstrate some behavioral similarities; neither of the two is particularly mobile and both are vegetarian, although they consume very different plants. In fact, one lives on land and the other is completely dependent upon water. Unique among squamates, the latter, which can accurately be called a marine animal, feeds exclusively on aquatic plants.

The Sea-lizard, as we are wont to call it, *Amblyrhynchus cristatus* Bell [translator's note: Thomas Bell was an Englishman who named many amphibians and reptiles in the 19<sup>th</sup> century], is the only representative of its genus. It is a very large iguana. Of the total length of 135 cm, 80 cm is tail. Weight can reach 12 kg. The short, broad head slopes steeply to each side, tapers toward the front, and the profile arches rapidly and sharply

from the forehead to the blunt snout. To best characterize the beast, I have taken the following information from Steindachner [Franz Steindachner was an Austrian ichthyologist and herpetologist associated with the Vienna Museum of Natural History from 1860 until his death in 1919], who wrote a treatise on the squamates of the Galápagos Islands [published in 1876]: The entire top of the head is covered in mosaic fashion by

<sup>1</sup> Excerpted and translated from Franz Werner (1913). Die Lurche und Kriechtiere von Alfred Brehm. Zweiter Band: Kriechtiere (Schuppenkriechtiere), pp. 86–92 + table "Lizards V," no. 3. In O. z. Strassen (ed.), *Brehms Tierleben. Allgemeine Kunde des Tierreichs*. 4th ed. Bibliographisches Institut, Leipzig and Wien. Translated by R. Powell. Quotes from Darwin were not translated from Werner's text, but instead were taken directly from C. Darwin (1845). *The Voyage of the Beagle*. 2nd ed.). Some excerpts omitted by Werner are included here.



Sea-lizard, *Amblyrhynchus cristatus* Bell. 1/6 natural size.



Granular-head, *Conolophus subcristatus* Gray. 1/5 natural size.

many quadrangular (usually) or six-sided scales of varying sizes; the largest are conical or even pointed and lie primarily toward the front of the head, whereas the smallest form the supraocular shields. The lateral but relatively highly situated, egg-shaped nares are angled from low in front to high in back, and are surrounded by an elevated leathery rim, which in turn is surrounded by small scales. Nine to ten five-sided plates form the upper lip and 12–13 four-sided plates make up the lower lip. An arc-like band of keeled scales extends from the region under the eye to the temple, whereas the underside of the head is covered by small rounded scales. The egg-shaped tympanum is embedded in a raised border of tubercular scales. The skin of the throat and neck is more or less loosely attached and forms a distinct gular fold. The body is generally robust, and the dorsal crest is continuous from the neck to the tip of the tail, although indentations mark the transitions from neck to body and body to tail. The scales of the body are distinguished by size and location. Dorsal scales are all keeled, lateral scales are tuberculate, whereas the ventral scales are completely smooth. The long tail has a thick base but becomes distinctly compressed laterally toward the tip, in essence forming a paddle or fin. The tail is covered with keeled scales, like those on the back, arranged in distinct rings. The limbs are short and stocky. The third and fourth toes are of equal length and

are longer than the others. All are connected by a small web and equipped with powerful, sharp, and slightly arched claws. The thick tongue is as wide as the mouth. The long, large teeth are serrated and attached to the outer fold of the deeply grooved jaws. Each upper jaw bears 22–25 teeth, each lower jaw 20–24, of which 6–8 are similar to the lateral teeth and are on the intermaxilla. The small and not particularly numerous teeth on the

pterygoid and sphenoid are easily displaced.

Color and pattern vary by age. Young Sea-lizards have numerous light gray flecks on both sides of the head, the chin, and on the sides of the body. These may reduce the black ground color to net-like reticulum. On the back, alternating dirty gray and black bands of flecks produce a more or less regular pattern of crossbands. The upper and lateral sides of the limbs are either punctuated with small gray flecks or larger gray spots. The chin is a dark dirty gray, the throat is black, and the belly a dirty yellow-brown. The digits, the axilla and groin, and the distal half of the tail are black. The dorsal crest is variably yellow or gray with black bands. Occasional individuals are entirely black.

Sea-lizards are phenomenally abundant on the Galápagos Islands. Darwin found them on all of the islands he visited; Steindachner found them on Albemarle, Charles, James, and Jervis islands, with those on the latter in particularly large numbers and including some individuals of imposing size; W.E. Cookson [an English explorer] also found them on Abingdon Island. Corresponding to their habits, these lizards restrict themselves to the rocky shorelines and, according to Darwin's observations, are not to be found more than 10 paces from the water's edge.

Darwin noted: "They are occasionally seen some hundred yards from the shore, swimming about; and Captain Collnet, in his Voyage, says,

‘They go to sea in herds a-fishing, and sun themselves on the rocks; and may be called alligators in miniature.’ It must not, however, be supposed that they live on fish. When in the water this lizard swims with perfect ease and quickness, by a serpentine movement of its body and flattened tail — the legs being motionless and closely collapsed on its sides. A seaman on board sank one, with a heavy weight attached to it, thinking thus to kill it directly; but when, an hour afterwards, he drew up the line, it was quite active. Their limbs and strong claws are admirably adapted for crawling over the rugged and fissured masses of lava, which everywhere form the coast. In such situations, a group of six or seven of these hideous reptiles may oftentimes be seen on the black rocks, a few feet above the surf, basking in the sun with outstretched legs.

“I opened the stomachs of several, and found them largely distended with minced sea-weed (*Ulæ*), which grows in thin foliaceous expansions of a bright green or a dull red colour. I do not recollect having observed this sea-weed in any quantity on the tidal rocks; and I have reason to believe it grows at the bottom of the sea, at some little distance from the coast. If such be the case, the object of these animals occasionally going out to sea is explained. The stomach contained nothing but the sea-weed. Mr. Bynoe, however, found a piece of a crab in one; but this might have got in accidentally, in the same manner as I have seen a caterpillar, in the midst of some lichen, in the paunch of a tortoise. The intestines were large, as in other herbivorous animals. The nature of this lizard’s food, as well as the structure of its tail and feet, and the fact of its having been seen voluntarily swimming out to sea, absolutely prove its aquatic habits; yet there is in this respect one strange anomaly, namely, that when frightened it will not enter the water. Hence

it is easy to drive these lizards down to any little point overhanging the sea, where they will sooner allow a person to catch hold of their tails than jump in the water. They do not seem to have any notion of biting; but when much frightened they squirt a drop of fluid from each nostril. I threw one several times as far as I could, into a deep pool left by the retiring tide; but it invariably returned in a direct line to the spot where I stood. It swam near the bottom, with a very graceful and rapid movement, and occasionally aided itself over the uneven ground with its feet. As soon as it arrived near the edge, but still being under water, it tried to conceal itself in the tufts of sea-weed, or it entered some crevice. As soon as it thought the danger was past, it crawled out on the dry rocks, and shuffled away as quickly as it could. I several times caught this same lizard, by driving it down to a point, and though possessed of such perfect powers of diving and swimming, nothing would induce it to enter the water; and as often as I threw it in, it returned in the manner above described. Perhaps this singular piece of apparent stupidity may be accounted for by the circumstance, that this reptile has no enemy whatsoever on shore, whereas at sea it must often fall prey to the numerous sharks. Hence, probably, urged by a fixed and hereditary instinct that the shore is its place of safety, whatever the emergency may be, it there takes refuge.” Darwin was unable to address reproduction in these animals.

Steindachner visited the Galápagos Islands in 1872 and, like Dampier and Darwin before him, saw thousands of Sea-lizards. “When my fellow traveler, Pitkins, saw a large number of these hideous animals, he ran into the midst of the densely packed mass. When I visited the same site shortly thereafter and again after about an hour, it was completely void of lizards. They had all fled

into the sea and probably had sought out another, more distant refuge. My experience, also on James and Jervis islands, indicated that the sea-lizards, although sluggish and awkward in their movements and easily captured without resistance, do these days seek the sea to escape



Granular-head, *Conolophus subcristatus* Gray. 1/8 natural size. Photograph by W.P. Dando, F.Z.S. — London.

potential threats when they notice enemies in the vicinity — instead of, as earlier, returning stubbornly to the same site on shore. On calm days, one frequently encounters these lizards long distances from shore swimming and diving with ease and surprising speed. Their movements in water resemble those of a snake. Only the head is emergent while swimming, and the limbs are adpressed. On Jervis Island, I found them only in the immediate vicinity of the sea, usually in herd-like masses of 100–150 packed into small spaces on the rough and rugged lava. On James Island, I encountered only a few individuals considerably above the shore along the edges of small, overgrown cavities in the rocks that might serve as nesting sites. The stomach and intestine, as Darwin already mentioned, are without exception stuffed with foliaceous green or dull-red algae.”

The second lizard of the Galápagos Islands, which we will call the Granular-head, differs distinctly from the Sea-lizard in overall stature and in the absence of pterygoid teeth in adults. Overall, these are even more plump and ponderous. Restricted to dry land, they lack webbing between the short toes that terminate the stout limbs. The tail also is shorter and only slightly compressed, oval in cross-section and almost without a crest. In contrast, the neck is considerably longer and bears longitudinal folds of skin on its underside. The head also is more elongate, consequently less distinctly arched in profile and sloping less steeply to the sides. For all of these reasons, Steindachner agreed with those researchers who considered the Granular-head, *Conolophus subcristatus* Gray [John Edward Gray was a 19th century English naturalist and is widely regarded as the founder of the herpetological collections at the British Museum], to be a representative of a unique genus (*Conolophus* Fitz. [“Fitz. refers to Leopold Fitzinger, a prolific Austrian zoologist who wrote *Neue Classification der Reptilien* in 1826 and *Systema Reptilium* in 1843]).

In terms of color, the Granular-head differs considerably from the Sea-lizard. The head is a more or less lively yellow, the back near the crest is brick- or rust-red, and, in rare cases, the body sports faint, alternating yellowish and reddish-brown crossbands. Down the sides, the reddish-brown color gives way to a dirty, dark brown. Here and there, one may notice dots or small black flecks with indistinct edges. The belly is dark yellow with a tinge of reddish-brown. The upper and outer surfaces of the forelimbs are reddish, the hindlimbs are brownish yellow, but the claws and toes are black. These lizards reach a length of 107 cm, of which 54 cm is tail.

Darwin observed Granular-heads in the central islands of the Galápagos Archipelago, Albemarle, James, Barrington, and Indefatigable, where they occupy both the higher, moister areas

## THE GALÁPAGOS ISLANDS



Illustration by John Binns.



and the lower, infertile regions, where they actually are more common. Darwin noted: "I cannot give a more forcible proof of their numbers, than by stating that when we were left at James Island, we could not for some time find a spot free from their burrows on which to pitch our single tent. Like their brothers the sea-kind, they are ugly animals, of a yellowish orange beneath, and of a brownish red colour above: from their low facial angle they have a singularly stupid appearance. They are, perhaps, of a rather less size than the marine species; but several of them weighed between ten and fifteen pounds. In their movements they are lazy and half torpid. When not frightened, they slowly crawl along with their tails and bellies dragging on the ground. They often stop, and doze for a minute or two, with closed eyes and hind legs spread out on the parched soil.

They inhabit burrows, which they sometimes make between fragments of lava, but more generally on level patches of the soft sandstone-like tuff. The holes do not appear to be very deep, and they enter the ground at a small angle; so that when walking over these lizard-warrens, the soil is constantly giving way, much to the annoyance of the tired walker. This animal, when making its burrow, works alternately the opposite sides of its body. One front leg for a short time scratches up the soil, and throws it towards the hind foot, which is well placed so as to heave it beyond the mouth of the hole. That side of the body being tired, the other takes up the task, and so on alternately. I watched one for a long time, till half its body was buried; I then walked up and pulled it by the tail; at this it was greatly astonished, and soon shuffled up to see what was the matter; and then stared me in the face, as much as to say, 'What made you pull my tail?'

"They feed by day, and do not wander far from their burrows; if frightened, they rush to them with a most awkward gait. Except when running down hill, they cannot move very fast, apparently from the lateral position of their legs. They are not at all timorous: when attentively watching any one, they curl their tails, and, raising themselves on their front legs, nod their heads vertically, with a quick movement, and try to look very fierce: but in reality they are not at all so; if one just stamps on the ground, down go their tails, and off they shuffle as quickly as they can. I have frequently observed small fly-eating lizards, when watching anything, nod their heads in precisely the

same manner; but I do not at all know for what purpose. If this *Amblyrhynchus* [in Darwin's day, both Galápagos iguanas were placed in the genus *Amblyrhynchus*] is held and plagued with a stick, it will bite it very severely; but I caught many by the tail, and they never tried to bite me. If two are placed on the ground and held together, they will fight, and bite each other till blood is drawn.

"The individuals, and they are the greater number, which inhabit the lower country, can scarcely taste a drop of water throughout the year; but they consume much of the succulent cactus, the branches of which are occasionally broken off by the wind. I several times threw a piece to two or three of them when together; and it was amusing enough to see them trying to seize and carry it away in their mouths, like so many hungry dogs with a bone. They eat very deliberately, but do not chew their food. The little birds are aware how harmless these creatures are: I have seen one of the thick-billed finches picking at one end of a piece of cactus (which is much relished by all the animals of the lower region), whilst a lizard was eating at the other end; and afterwards the little bird with the utmost indifference hopped on the back of the reptile.

I opened the stomach of several, and found them full of vegetable fibres and leaves of different trees, especially of an acacia. In the upper region they live chiefly on the acid and astringent berries of the guayavita, under which trees I have seen these lizards and huge tortoises feeding together. To obtain the acacia-leaves they crawl up the low stunted trees; and it is not uncommon to see a pair quietly browsing, whilst seated on a branch several feet above the ground. These lizards, when cooked, yield a white meat, which is liked by those whose stomachs soar above all prejudices. Humboldt [Alexander von Humboldt, a famous German naturalist whose explorations of South America thrilled Europe and inspired Darwin] has remarked that in intertropical South America, all lizards which inhabit dry regions are esteemed delicacies for the table. The inhabitants state that those which inhabit the upper damp parts drink water, but that the others do not, like the tortoises, travel up for it from the lower sterile country. At the time of our visit, the females had within their bodies numerous large, elongated eggs, which they lay in their burrows: the inhabitants seek them for food."

# BIOGRAPHICAL SKETCH:

## *Franz Werner (1867–1939)*

Franz Werner was born and raised in Vienna. At the age of six, his father presented him with a little glass terrarium in which a Green Treefrog (*Hyla arborea*) was supposed to forecast the weather by selecting perches on a miniature step ladder provided for that purpose. A common European Sand Lizard (*Lacerta agilis*) soon joined the treefrog — and a lifelong interest in herpetology was established.

Werner studied zoology at the University of Vienna, receiving his doctorate in 1890. He studied briefly in Leipzig before moving back to Vienna in 1895 to accept an appointment at the Imperial Zoological Institute at the university. He rose to full professor in 1919, retired in 1933, and died in 1939.

Despite an inability to work with the herpetological collection at the Naturhistorisches Museum in Vienna, due to the personal animosity of the director, Franz Steindachner, who may have perceived Werner as a competitor, Werner used material from other European



Franz Werner at Djebel Zalagh, near Fes, Morocco in 1928 (photograph courtesy of Kraig Adler).

museums and those in his personal collection to publish over 550 titles, most in herpetology. He described 24 genera and over 400 species and subspecies of amphibians and reptiles. Although he occasionally erred in describing as new well-known species based on specimens with poor or erroneous locality data, most of his work was quite competent.

Werner's major works included faunal surveys of Austria-Hungary (1897), the Bismarck Archipelago east of New Guinea (1900), and Greece (1938). Taxonomic monographs included one on chameleons (1902), a three-part series on colubrid snakes (1923, 1924, 1929), several issues in *Das Tierreich* series, and the two herpetological volumes in the fourth edition of Alfred Brehm's "Tierleben" series (1912–1913), from which the current and recent excerpts were taken. He also wrote the section on amphibians for the *Handbuch der Zoologie* (1930) and, with Rodolpho Kraus, the standard work on venoms and venomous snakes (1931).

Unlike many scientists, Werner was not averse to popular or semi-popular writing. His efforts along those lines, particularly a little volume entitled "Amphibien und Reptilien" (1910), did much to develop an interest in herpetology among German-speaking people, to encourage amateurs, and to stimulate and inspire young zoologists.

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Franz Werner with a *Boa constrictor* (photograph courtesy of Kraig Adler).

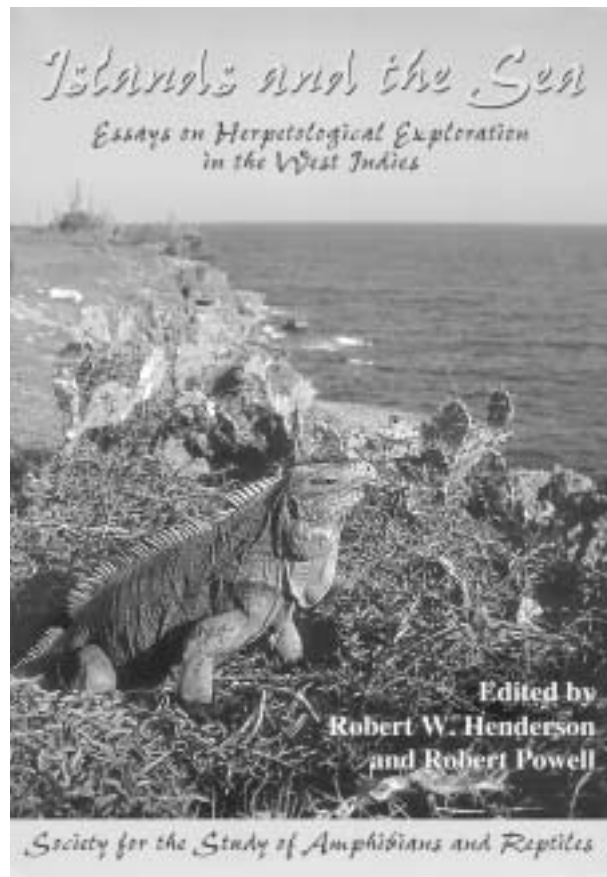
## BOOK REVIEW

*Islands and the Sea: Essays on Herpetological Exploration in the West Indies.* Robert W. Henderson and Robert Powell (editors). 2003. Society for the Study of Amphibians and Reptiles (SSAR), Ithaca, New York. 312 p., 316 photographs, 14 maps, indices. Clothbound, \$48. Available from: Breck Bartholomew, SSAR Publications Secretary, P.O. Box 58517, Salt Lake City, Utah 84158-0517 (ssar@herplit.com).

I will admit to having a few regrets in my career, and certainly my decision to decline Bob Powell's invitation to contribute an essay to this volume ranks among the highest. For anyone who has dedicated part of their career to working in the Caribbean, for those with a strong interest in the natural history and biogeography of islands, or if you simply enjoy stories of herpetological exploration and discovery, this is must-read material.

The book is well organized, 300 pages divided into six sections corresponding to the major island groups in the Caribbean: the Greater Antilles (Cuba, Jamaica, Hispaniola, and Puerto Rico), the Bahamas, and the Lesser Antilles. Regrettably, some islands received short coverage, with only one essay on Puerto Rico and none on the Turks & Caicos. Powell and Henderson's introduction and historical perspectives set the tone for the book and provide the reader with a scholarly overview of many of the early herpetologists and remarkable personalities that did much of the pioneering exploration in the West Indies.

Herpetological research in the West Indies is an intriguing pursuit for many reasons, the first and foremost being a remarkable degree of diversity. Recognized as one of the world's biodiversity hotspots, this is particularly evident with herps. An archipelago containing several hundred islands, ranging from huge landmasses to minute specs of land, the Caribbean is a living laboratory of evolution and speciation. Boasting over 600 species of reptiles and amphibians and a remarkably high rate of endemism, the Caribbean ranks second only to Mesoamerica in terms of reptilian diversity (438 species) and has the highest rate of endemism (84%) of any region in the world. Amphibians, though not as diverse, have a comparable rate of



endemism (86%). These impressive figures, combined with elevated numbers for vascular plants and birds, provide ample incentive for urgent conservation measures in these delicate ecosystems — but much of the Caribbean is under intense pressure and, sadly, many of us now devote considerable time and energy trying to save the last vestiges of species ravaged by the effects of man. I often wonder, and I know my colleagues share this sentiment, what it would have been like to set foot on these islands 100–200 years ago when they were still largely pristine.

The essays in this volume cover a broad expanse of time, dating from the 1950s to the present. Those early stories of herpetological fieldwork and discovery (Stan Rand and Sixto Incháustegui in the Dominican Republic, Skip Lazell in the Lesser Antilles, Meg Stewart in Jamaica, and Orlando Garrido in Cuba) take us back to a simpler time when collecting was less complicated (except for travel) and the habitats less damaged. The essays on Cuba, to me, are particularly compelling because they offer vignettes into a world that, due to narrow-minded political agen-

Ed. note: This review by Rick Hudson will also appear in the Bulletin of the Chicago Herpetological Society.

## BOOK REVIEW

das, few of us have the opportunity to experience. Perhaps the best read in this series is Alberto Estrada's vivid description of collecting herps while on an expedition to find a remnant population of Ivory-billed Woodpeckers. This story is both poignant and haunting in that we are able to glimpse, through a narrow window in time, the last sightings of a species before it slipped quietly into extinction.

The genus *Anolis* has undergone a remarkable degree of speciation in the Caribbean, where it reaches its apex of diversity, providing ample opportunities for fieldwork and research. Nowhere is this more evident than Richard Glor's "Rediscovering the Diversity of Dominican Anoles." Written in a fast-paced narrative, this lively essay recounts the ambitious attempt by him and his colleagues to collect all 40 species of Dominican anoles, a determined mission that literally comes down to the last species on the last day of their trip. An engaging story, this is about as exciting as herpetological reading can get.

Of course, no coverage of the Caribbean herpetofauna would be complete without featuring the prehistoric-looking Rock Iguanas of the genus *Cyclura* for which the islands are so well known. Undoubtedly the most conspicuous element of the region's reptilian fauna (evidenced by the photograph gracing the dusk jacket), these charismatic lizards have become flagship species for conservation in the West Indies. This book includes chapters describing Cuban Iguanas at Guantanamo Bay (Allison Alberts), Andros Iguanas (Chuck Knapp) and Allen's Cay Iguanas (Jen Valiulis et al.) in the Bahamas, Jamaican Iguanas in the Hellshire Hills (Byron Wilson), and Rhinoceros and Ricord's iguanas on Isla Cabritos, Dominican Republic (Sixto Incháustegui). Of particular interest in Sixto's chapter is a rare photo of Michael Carey, a well-known and near legendary (in that he seemed to vanish, dropping out of sight in the 1980s) *Cyclura* biologist, who published some seminal works on the genus through the Florida State Museum. For those of us obsessed with Rock Iguanas in the late 1970s and 80s, his was some of the most treasured reading material available.

*Iguana delicatissima* is discussed several times in the Lesser Antillean section, nowhere more vividly than in Michel Brueil's account, "In the Footsteps of French Naturalists." He examines the

processes (man-made, most harmful and negative, as well as natural) dating back to European colonization that have accounted for some of the perplexing distribution patterns seen in the French West Indies, including that of the genus *Iguana*. His story provides compelling evidence of just how rapidly species' distributions can change over a relatively short period of time, events which should cause us great concern given how this process has been accelerated today. This essay also provides cause for optimism in that it demonstrates the resiliency of many island populations (in this case a population of *I. delicatissima* reduced by half — from an estimated 10,000 to 5,000 — by a severe drought) and their ability to persist and rebound from horrendous natural disasters. This chapter also reinforces the reality that the primary threat to biodiversity in the region is introduced exotics.

My complaints on this book are few and only one merits mention. Photo credits are conspicuously absent from most of the book. They are provided inconsistently, some chapters have them but most do not. Maybe this is just a quirk of mine, but I like to know who shot the images. As it turns out, uncredited photos are by the authors of the respective essays, but nowhere is this explained. I found very few grammatical errors, and the editing appears to be thorough, the exceptions being a disparity in the number of Cuban anoles (59 by Garrido's count; "about 50" according to George Gorman) and a statement in Hinrich Kaiser's essay that *Eleutherodactylus amplinympha* is Dominica's only endemic vertebrate (it is the island's only endemic frog).

All in all, this is a thoroughly enjoyable read and I highly recommend it. If you are already passionate about Caribbean herpetology and working in the islands, this is required reading. If you have not experienced the sheer joy and exhilaration of exploring some of these remarkable destinations, this book should provide the spark that initiates your conversion. The allure of these islands is powerful, and once experienced, hard to shake off. But then who would want to?

Rick Hudson  
Co-chair, IUCN Iguana Specialist Group  
Program Officer, International Iguana Foundation  
Conservation Biologist, Fort Worth Zoo

## IGUANA NEWSBRIEFS

### New *Cyclura* Residence at the Bristol Zoo

Although Green Iguanas remain popular pets, interest in iguanas in England is minimal, and opportunities to see them are virtually non-existent. The genus *Cyclura* is represented solely by *Cyclura cornuta*, the Hispaniolan Rhinoceros Iguana, and British zoo policy permits concentration on only that species. Rhinoceros Iguanas represent what the British refer to as “large iguanas.” The Royal Zoological Society in London and Chester Zoo (North of England Zoological Society) both have colonies of “Rhinos,” as does the Bristol Zoo in the southwest of England.

The Bristol Zoological Gardens were founded in 1835 by a group of local citizens and opened to the public in 1836. It is the fifth oldest zoo in the world and the oldest not in a capital city. Over 200 shareholders contributed the capital that enabled the land purchase and zoo construction. Some of the descendants of the original shareholders remain connected with the zoo, but their only benefit is free admission. Buildings are scattered across pleasant gardens, a lake enhances the landscape, and winding pathways connect one animal area to another. Principal attractions include okapis, gorillas, tapirs, seals, penguins, and flamingos.

Tim Skelton, Head of Amphibians and Reptiles, spent five years at the Edinburgh Zoo and has been at Bristol for the same length of time. As recently as 2001, two large *Cyclura* were housed in a large room and two smaller individuals were held in a separate, smaller cage. The larger animals were suffering from skin problems, likely due to insufficient access to direct sunlight and an inappropriate substrate.

The pair of large Rhinoceros Iguanas both hatched in February 1980, the female at the Taronga Zoo in Sydney, Australia, and the male in the Dominican Republic (later sent to Taronga). Both were received from Taronga in November 1986. The female has laid eggs, most recently three years ago; all were infertile. The sub-adults are both four-year old males that were hatched at the Prague Zoo. Efforts to house all four together were not successful, as the older pair would not tolerate the younger individuals.



Adult male *Cyclura cornuta* in the new indoor pen. Photograph by John Bendon.



The entire outdoor enclosure; the large male *Cyclura cornuta* and an Aldabra Tortoise are visible. Photograph by John Bendon.

A plan to build new outdoor and indoor enclosures for the large iguanas and three Aldabra Tortoises (*Dipsosaurus dorsalis* = *Geochelone gigantea*) is now complete. The new house is approximately 30 m<sup>2</sup> in size and is landscaped with tropical plants. It is thermostatically heated and has a cool fan for hotter days. Windows are automatically controlled and the pool has a waterfall. Water is kept at 25°C. The outdoor enclosure is roughly 130 m<sup>2</sup>. Both adult iguanas and the giant tor-

toises have access to this area through wide “hospital” flaps of thick, transparent plastic; these keep the heat in when the animals come and go. The cost of this elaborate project was in excess of £50,000 (\$82,000), a magnificent sum of money to spend on iguanas and tortoises, but the result is a fine new exhibit that greatly enhances the visibility of both species.

The keepers have indicated that the iguanas’ skin problems are rapidly disappearing, and that outdoor access

## IGUANA NEWSBRIEFS

has led to dramatic behavioral changes — both animals are considerably more active and alert, and their appetite has increased sharply. Hopefully, access to direct sunlight will also trigger successful breeding behavior.

John S. Bendon

### Kansas City Herpetological Society Supports Jamaican Iguana Conservation

Shortly after the rediscovery of the Jamaican Iguana (*Cyclura collei*) in 1991, the Kansas City Herpetological Society (KCHS) donated funds to the Hope Zoo to facilitate the creation of a captive breeding program for this critically endangered species. This year, the KCHS donated \$1500 in continued support of this species and this important project. The KCHS would like to encourage other regional societies to get involved with important long-term conservation projects and continue to support them over time.



David Nieves, KCHS

### Anegada Iguana Releases

On 5–12 October 2003, 24 Stout Iguanas (*Cyclura pinguis*) headstarted at the Anegada Headstart Facility, British Virgin Islands, were released into two very distinct habitat types. The first cohort of 12 (6.6) was released into dense forest over a reef limestone substrate on Middle Cay. The area supports a population of iguanas, including many large adults. The second group of 12 was released in the Bones Bight area near the Faulkner House, a well-known landmark on Anegada. This area supports a fairly robust (by Anegada standards) population of iguanas with numerous burrows and nests. These releases and subsequent monitoring are being funded by the International Iguana Foundation (IIF).

Principals involved with the releases were Rick Hudson (Fort Worth Zoo), Kelly Bradley (Dallas Zoo), who, with Glenn Gerber (San Diego Zoo CRES), is responsible for monitoring the iguanas post-release, Lee Pagni, an Education Specialist hired by the San Diego Zoo to canvas local opinions and



An adult *Cyclura collei* in the breeding facility at Hope Zoo in Jamaica. Successful breeding remains a challenge, but the proposed upgrade to these enclosures holds promise for the future. *Photograph by John Binns.*

develop a proactive Education plan, Jeff Lemm (San Diego Zoo CRES), and Joe Wasilewski (International Iguana Society), who filmed the event.

A veterinary team from the Fort Worth Zoo had previously implanted transmitters in the abdominal cavities of the 24 iguanas. The releases went well and seeing some local residents assist with the releases was gratifying. The National Parks Trust staff was there with the local media. Coverage in the local

newspapers was good, and international coverage included CNN News Online.

Bradley and Lemm remained on-site for several days after the releases and they reported visual sightings of the iguanas every other day. The iguanas appear to be settling in and not moving far (except for two). Rondell Smith (Trust employee) will track the animals weekly while Bradley is off-island.

This event was significant in that the headstart program has now come



Post-release *Cyclura pinguis* surveying his surroundings from a dead Loblolly Tree on Middle Cay. *Photograph by Rick Hudson.*

## IGUANA NEWSBRIEFS



Jeff Lemm and Kelly Bradley are shown tracking newly released *Cyclura pinguis* from the back of a truck for elevation in the Bones Bight area. Photograph by Rick Hudson.

full circle: one of the three iguanas initially placed in the headstart facility by Hudson and Lemm in 1997 was one of the first animals released. The plan is to establish a regular cycle in which iguanas are released each year to accommodate the new hatchlings collected in October. This year just over 20 hatchlings from marked nests were placed in the facility.

The headstart facility is in excellent condition. The iguanas appear robust, healthy, and well-fed. The gardens are well-kept, with lots of iguana food being grown by the primary caretaker, Lee Vanterpool, who also collects native iguana food plants to supplement their diet.

**Rick Hudson, Co-chair**  
Iguana Specialist Group

### The IIS in Seattle

Joe Wasilewski, Joe Burgess, and John Binns represented the IIS this fall at the Pacific Science Center in Seattle for the Northwest Herpetological Society's "Reptiles Around the World." The two-day educational event was attended by reptile enthusiasts, beginners, and the curious. The IIS contingent promoted iguana conservation and responsible pet ownership. Izzy, John's large Cuban Iguana (*Cyclura*



The IIS table at the Pacific Science Center.



The IIS contingent in Seattle: Izzy, John Binns, Joe Wasilewski, and Joe Burgess (left to right).

*nubila*), became the star of the event, drawing admirers to learn more about this spectacular animal. Joe W. conducted several reptile shows for museum guests and demonstrated how a cute little iguana or snake can grow to be a powerful animal that can rapidly outgrow its home. He also discussed what types of reptiles would or wouldn't make good pets and graphically described the consequences of an impulse buy.

### Mexican Iguana Group is Online

Information about the activities of the Subcomité Técnico Consultivo para la Conservación, Manejo y Aprovechamiento Sustentable de las Iguanas in México (Advisory Technical Subcommittee for the Conservation, Management, and Utilization of Iguanas in Mexico) is available on the Subcommittee's new webpage (<http://www.subcomitedeiguanas.org/>).

**Victor Hugo Reynoso**  
Departamento de Zoología  
Instituto de Biología, UNAM  
México, D.F.

## IGUANA NEWSBRIEFS



Quincy is one of a record 84 Blue Iguanas hatched this year at the captive breeding facility on Grand Cayman. *Photograph by Fred Burton.*

### First Blue Iguana Sponsored in 2003

The John Gray Recyclers, a high school club on Grand Cayman Island, became the first sponsor of a Blue Iguana (*Cyclura lewisi*) hatched this year. The club, which promotes recycling, raised over US \$900 to name and sponsor "Quincy" for a year. The name comes from "quincentennial," acknowledging the 500th anniversary of the "discovery" of the Cayman Islands, which is being celebrated in 2003.

Quincy, who will keep the name permanently, is a very special little iguana; he was born with an incomplete forelimb on one side. The money raised will help support Quincy and his siblings as part of the Blue Iguana Recovery Program and help ensure the survival of the most endangered reptilian species on earth. For more information on the sponsorship program, see [www.blueiguana.ky](http://www.blueiguana.ky).

### The IIS and Iguana Education

IIS members John and Sandy Binns visited the Boys & Girls Club of the Peninsula in East Palo Alto, California and shared the iguana experience with over 140 children ranging in age from 6–14 years. Topics included a general overview of reptiles, daily struggles specific lizards face both in the wild and captivity, human perceptions, and conservation efforts in the past, present, and future. The children were excited and full of questions, as many of them had never seen or even heard of these animals. Each child had the opportunity for an up-close encounter with several different species including Green, Cuban, and Rhino iguanas, Spiny-tailed Dwarf Monitor, Uromastyx, Chuckwalla, and Blue-tongued Skink.

Sandy Binns



The Boys & Girls Club of East Palo Alto, California were delighted by a visit from John Binns (front row, holding an iguana) and Sandy Binns (front row, right).





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## Editors' Remarks

Conservation of iguanas and their habitats is the principal component of the IIS Statement of Purpose (printed in full just below this note). That also has been a recurring theme in every issue of the *Iguana Times* and will continue to be the predominant message in *IGUANA*. However, conservation is not merely something about which to write and read. Conservation requires action in the form of education, financial support, and sometimes even getting one's hands dirty. The IIS is actively engaged in all of those endeavors. In the past few months, representatives of the Society have carried an educational message from coast to coast: from Jacksonville, Florida to Seattle, Washington and East Palo Alto, California (see Newsbriefs in this and the previous issue of *IGUANA*). The Society has provided financial assistance to aid in developing a captive breeding program for Jamaican Iguanas at the Hope Zoo in Kingston (see Newsbriefs). We are monitoring and working closely with conservation agencies and organizations concerned with iguanas. Most recently, IIS representatives participated in the IUCN/SSC Iguana Specialist Group (ISG) meeting in the Turks and Caicos Islands, which included a Conservation & Management workshop for *Cyclura carinata* (a full report will be featured in the March issue of *IGUANA*). And IIS members prove again and again that they're willing to dirty their hands for worthy causes; see, for example, the Newsbriefs and the Letter from the President. Although every individual involved pays his or her own way or is supported by their home institution, the IIS message they spread is possible only through the support of the Society's members. Even if you have never stood in front of an audience and talked about iguanas, written a check to support an iguana conservation program, or traveled to the tropics to study or monitor a population of iguanas, you are a vital link in these efforts.

*Bob Powell, AJ Gutman, and John Binns*

### Statement of Purpose

The International Iguana Society, Inc. is a not-for-profit corporation dedicated to preserving the biological diversity of iguanas. We believe that the best way to protect iguanas and other native plants and animals is to preserve natural habitats and to encourage development of sustainable economies compatible with the maintenance of biodiversity. To this end, we will: (1) engage in active conservation, initiating, assisting, and funding conservation efforts in cooperation with U.S. and international governmental and private agencies; (2) promote educational efforts related to the preservation of biodiversity; (3) build connections between individuals and the academic, zoo, and conservation communities, providing conduits for education and for involving the general public in efforts to preserve endangered species; and (4) encourage the dissemination and exchange of information on the ecology, population biology, behavior, captive husbandry, taxonomy, and evolution of iguanas.

### Membership Information

*Iguana*, the Journal of The International Iguana Society, is distributed quarterly to members and member organizations. Annual dues:

<b>Individual U.S. and Canadian Membership</b> .....	\$25.00
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Additional copies are available at a cost of \$6.00 including postage.

**JOIN ON-LINE AT: [www.IguanaSociety.org](http://www.IguanaSociety.org)**

**Membership questions?** Call AJ at 860-236-8203, or write to: The International Iguana Society, Inc., 133 Steele Road, West Hartford, CT 06119

### Solicitations

Members of the I.I.S. are encouraged to contribute articles, letters to the Editor, news items, and announcements for publication in *IGUANA*. General articles can deal with any aspect of iguana biology, including conservation, behavior, ecology, physiology, systematics, or husbandry. Submission of photographs to accompany articles is encouraged.

Manuscripts may be submitted via e-mail (send to [ctenosaura@cyclura.com](mailto:ctenosaura@cyclura.com)). For any contribution, please include your name, address, phone number, and e-mail address. Authors of one page or more of print are entitled to five copies of the issue in which their article appears.

### Advertising Policy of IGUANA

We advertise only non-living products (except feeder insects). All products have been examined and been found to be high quality and fairly priced. Contact Sandy Binns, Advertising Director, at [sandy@cyclura.com](mailto:sandy@cyclura.com) or 3010 Magnum Drive, San Jose, CA 95135.

## LETTER FROM THE PRESIDENT

I've had the pleasure of some enriching moments during my 25-year career in wildlife conservation, working with a variety of reptiles, as well as Bald Eagles (*Haliaeetus leucocephalus*) and Ospreys (*Pandion haliaetus*). Over the years, I have captured, marked, and released well over three thousand American Crocodiles (*Crocodylus acutus*). Being able to release these endangered animals is extremely fulfilling, despite knowing that only 5–10% of them will survive the first year. Of the crocodiles that do survive, some will undoubtedly expand their range and, in some cases, encroach on populated areas. The available natural habitat of the crocodile is shrinking daily. Future interactions between humans and crocodiles are inevitable and educating people before such interactions take place is crucial.

Many of the same factors that cause eagles and ospreys and crocodiles to be endangered affect the various species of *Cyclura* throughout their respective ranges. In February 2001, I traveled to Jamaica with Rick Hudson of the Fort Worth Zoo to assist in the release of 13 Jamaican Iguanas (*Cyclura collei*). We accompanied Byron Wilson into the Hellshire Hills, the remaining natural range of the species. This particular event brought the number of head-started and released animals to 39. While the news may be encouraging for the Jamaican Iguana, the obstacles they face have not really changed: shrinking habitat, feral predators, and limited resources. Much work is still necessary to assist the iguanas and increase their population in the Hellshire Hills.

That story, however, brings me to another “happy ending” — the historic release of 24 head-started Stout Iguanas (*Cyclura pinguis*). In October 2003, I accompanied Rick Hudson, Jeff Lemm of the San Diego Zoo, and Kelly Bradley of the Dallas Zoo to the island of Anegada in the British Virgin Islands. The 24 oldest iguanas from the head-start program were selected, health screened, processed, and readied for release. Even with 24 new adult and sub-adult iguanas in the population, the threats, like those in Jamaica, remain the same. This time, however, the people of Anegada are making plans to eliminate the feral cat problem, and actually want to focus on preserving some of the core habitat. Time will tell if these measures will bring about positive results.

The emotions that come into play while releasing endangered animals are difficult to describe. I try to include people from all walks of life to assist in the releases and share in the experience. You actually have a sense of giving back and getting closer to nature. In

some small way, you are helping to preserve a species for posterity. For just a few moments, you watch in amazement and forget all the obstacles these animals will face. The iguanas don't just bolt away; they walk a bit, taste the ground, look up at you, maybe give a head bob or two. They seem at home and take their time walking away.

Even though we are now returning some of these animals to the wild, our work is not finished — instead, it has only just begun. All of the threats that brought these species to their current states still exist, and conservation organizations around the world must work together to preserve these animals for future generations.



Joe Wasilewski, IIS President, participating in the release on Middle Cay. Photograph by Rick Hudson.

The International Iguana Society is working with many organizations to make this a better world. If you know people who should join the society and help in this worthwhile endeavor, sign them up!!!

Joe Wasilewski

A feral Green Iguana (*Iguana iguana*) in Florida (story on p. 111). Photograph by Joe Wasilewski.



An advertisement for Monster Diets. The word "MONSTER" is written in large, bold, red letters. Below it, the word "DIETS" is written in smaller, red letters. Several small images of reptiles and insects are scattered around the text: a turtle, a lizard, a frog, a dragon, and a cricket. Below the text, there are seven cans of Monster Diets, each with a different color and design. The cans are labeled: "The Reptile MONSTER DIET", "The Lizard MONSTER DIET", "The Snake MONSTER DIET", "Aquatic Turtle MONSTER DIET", "Resealed Dragon MONSTER DIET", "Resealed Dragon MONSTER DIET", and "The Cricket MONSTER DIET". At the bottom, the website address "www.MONSTERDIETS.com" is written in red.

# WEST INDIAN IGUANAS

CYCLURA

NAVASSA ISLAND IGUANA  
CYCLURA ONCHORSE

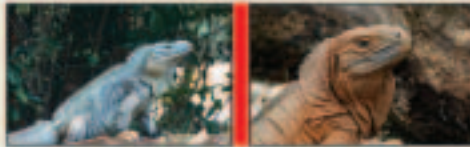
IN THE WILD 0



EXTINCT

GRAND CAYMAN BLUE IGUANA  
CYCLURA LEWISI

IN THE WILD 30



JAMAICAN IGUANA  
CYCLURA COLLEY

IN THE WILD 150

WHITE CAY IGUANA  
CYCLURA RILEYI CRISPATI

IN THE WILD 200



STOUT IGUANA  
CYCLURA PINOLESI

IN THE WILD 400

SAN SALVADOR IGUANA  
CYCLURA RILEYI RILEYI

IN THE WILD 500



BARTSCH'S IGUANA  
CYCLURA CARINATA BARTSCH

IN THE WILD 1000

ALLEN'S CAY IGUANA  
CYCLURA CYCLURA NORONATA

IN THE WILD 1000



RICORD'S IGUANA  
CYCLURA RICORDI

IN THE WILD 1300

EXUMA ISLANDS IGUANA  
CYCLURA CYCLURA FIGGINSI

IN THE WILD 1500



SISTER ISLES ROCK IGUANA  
CYCLURA ALBIDA CAYMANENSIS

IN THE WILD 1500

MONA ISLAND IGUANA  
CYCLURA CORNUTA STEINIGERII

IN THE WILD 1500



ANDROS ISLAND IGUANA  
CYCLURA CYCLURA CYCLURA

IN THE WILD 3500

ACKLINS IGUANA  
CYCLURA RILEYI AUCHALSI

IN THE WILD 13K



RHINOCEROS IGUANA  
CYCLURA CORNUTA CORNUTA

IN THE WILD 17K

CUBAN IGUANA  
CYCLURA ALBIDA ALBIDA

IN THE WILD 40K



TURKS & CAICOS IGUANA  
CYCLURA CARINATA CARINATA

IN THE WILD 50K

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