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IGUANA

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Andros Island Rock Iguana (*Cyclura cychlura cychlura*) (see article on p. 8). *Photograph by Charles R. Knapp.*

The Sweetwater Preserve in the Tucson Mountain foothills supports a healthy population of Mule Deer (*Odocoileus hemionus*). Thanks to the deer, Mountain Lions still visit the area. This photograph graced the cover of the *Sweetwater Preserve and the Sonoran Desert Conservation Plan* (see article on p. 14). *Photograph by Thomas Wiewandt.*

Adult female Andros Island Rock Iguana (*Cyclura cychlura cychlura*) on a termite nest in which she laid her eggs (see article on p. 8). *Photograph by Charles R. Knapp.*

Tuatara (*Sphenodon punctatus*) are restricted to a few small islands off New Zealand. Experience a visit to Stephens Island (see travelogue on p. 38). *Photograph by John Binns.*

Savanna Racers (*Chironius carinatus*) are quick, aggressive snakes (see article on p. 23). *Photograph by César Luis Barrio Amorós.*

Adult *Corallus caninus* from 101 km S Santarem, Pará, Brazil (see article on p. 2). *Photograph by Laurie J. Vitt.*

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Corallus caninus from Rio Formoso, Rondônia, Brazil. *Photograph by Laurie J. Vitt.*

The Emerald Puzzle: Geographic Variation in *Corallus caninus*

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Abstract.—The Emerald Treeboa *(Corallus caninus*) is one of the most famous and easily recognized snakes in the world. Despite this and its aesthetic appeal as an exhibit animal, surprisingly little is known about its biology. It has a wide geographic distribution in South America (the Guiana Shield and Amazonia), but is common nowhere. Emeralds are nocturnal and occur in mature rainforest where they prey on lizards, marsupials, and rodents. *Corallus caninus* has had a remarkably stable taxonomic history since being described nearly 250 years ago, but ongoing examination of geographic variation in morphological characters and analysis of DNA sequences strongly indicates that more than one species may be masquerading under the *C. caninus* umbrella.

Key Words: Treeboas, *Corallus caninus*, South America, Amazonia, Guiana Shield

The Emerald Treeboa (*Corallus caninus*) is one of the species most readily recognized by snake enthusiasts worldwide, yet we know remarkably little about its natural history. It has an extensive distribution on the Neotropical mainland that encompasses most of the Guianas, a large portion of Venezuela, Amazonian Colombia, Ecuador, and Perú, northern Bolivia, and much of the Brazilian Amazon at elevations from sea level to about 1000 m. In addition, valid records of *Corallus caninus* exist for the departments of Antioquia and Córdoba in northwestern Colombia. Although largely arboreal, the Emerald Treeboa does occasionally descend to the ground. Like other members of the genus, it is nocturnal. Its diet is comprised mostly of rodents (e.g., Rice Rats, *Oecomys* sp.), but it also includes opossums and lizards. Despite many references to a diet of birds in the popular and technical literature, stomach content analysis has failed to support this notion. Observations in the field strongly suggest that *C. caninus* is an ambush predator that may perch close to ground level with its head angled downward to await a passing rodent. Next to nothing is known regarding population biology. A population density estimate of one treeboa per 2.7 km^2 (= 0.004/hectare) came from Departamento San Martín, Perú, but the investigator was dubious about the reliability of that figure. In contrast, I have calculated densities in excess of 50 *Corallus grenadensis* per hectare at one site on Grenada. However, most *C. grenadensis* in a local population prey on ubiquitous and phenomenally abundant *Anolis* lizards, whereas *C. caninus* prey almost exclusively on small mammals that occur at much lower densities.

Emeralds may reach a total length in excess of 2.0 m, with those from the Guiana Shield attaining larger size than those from Amazonia. The head of *Corallus caninus*, attached to a relatively slender neck, looks menacing, due, in part, to the heat-sensitive labial pits. In addition, these snakes are armed with long teeth on the anterior portions of the maxillae and mandibles. These meat hook-like teeth prevent prey from accidentally falling irrecoverably to the ground below.

Emerald Treeboas are called "emerald" because of the exquisite green ground coloration on the dorsum. Coupled with the striking white markings typically occurring along the dorsal midline and in the form of the ventrolateral blotches found in some populations, their aesthetic appeal as exhibit animals in zoos and for herpetoculturists is easy to understand. Some of the latter are sufficiently enamored to specialize only in this species. Occasionally snakes from the Guiana Shield lack the typical middorsal white markings, yet are still eye-catching because of the vivid shades of green that may occur on a single individual. Still other individuals are heavily pigmented with black on the dorsum. Newborn treeboas are usually brick-red dorsally, and

Map illustrating the approximate range of the Emerald Treeboa (*Corallus caninus*).

Print of *Corallus caninus* capturing a domestic chicken (from an unknown source). Currently, we have no evidence of emeralds preying on birds (domestic or otherwise) by day or night.

the ontogenetic change to adult coloration is, I believe, part of the attraction of this species.

Taxonomic History

Corallus caninus has maintained a rather remarkable taxonomic stability since described by Linnaeus nearly 250 years ago. Although other "emerald" species were subsequently described (e.g., *Boa aurantiaca* Laurenti 1768, *Chrysensis batesii* Gray 1860), all were eventually relegated to the synonymy of *Corallus caninus*. One hundred and forty-five years have passed since Gray described *Chrysensis batesii* based on a juvenile specimen collected by pioneer Amazon naturalist, Henry Walter Bates, in the "Upper Amazon." Boulenger placed it into the synonymy of *Corallus caninus* in 1893. Since then, surprisingly little attention has been paid to the biological relationships of *C. caninus*, despite its enigmatic juvenile coloration, its eye-catching adult coloration, and its popularity in zoos and among herpetoculturists.

Aside from a long-standing interest in *Corallus* biology, I was intrigued by the apparent lack of interest in and information about such a "famous" snake. I knew it was highly coveted by herpetoculturists, and that some pattern morphs commanded prices in the thousands of dollars. I also was aware that the species is exported in substantial numbers for the pet trade (e.g., during 1990–1996, 6830 *C. caninus* were exported from Guyana and Suriname) and may be vulnerable to local extirpations. Most boas are listed as CITES Appendix II (i.e., species which may be threatened with extinction or which may be affected by international trade; those not listed as Appendix II are Appendix I), and that includes Emerald Treeboas. Although

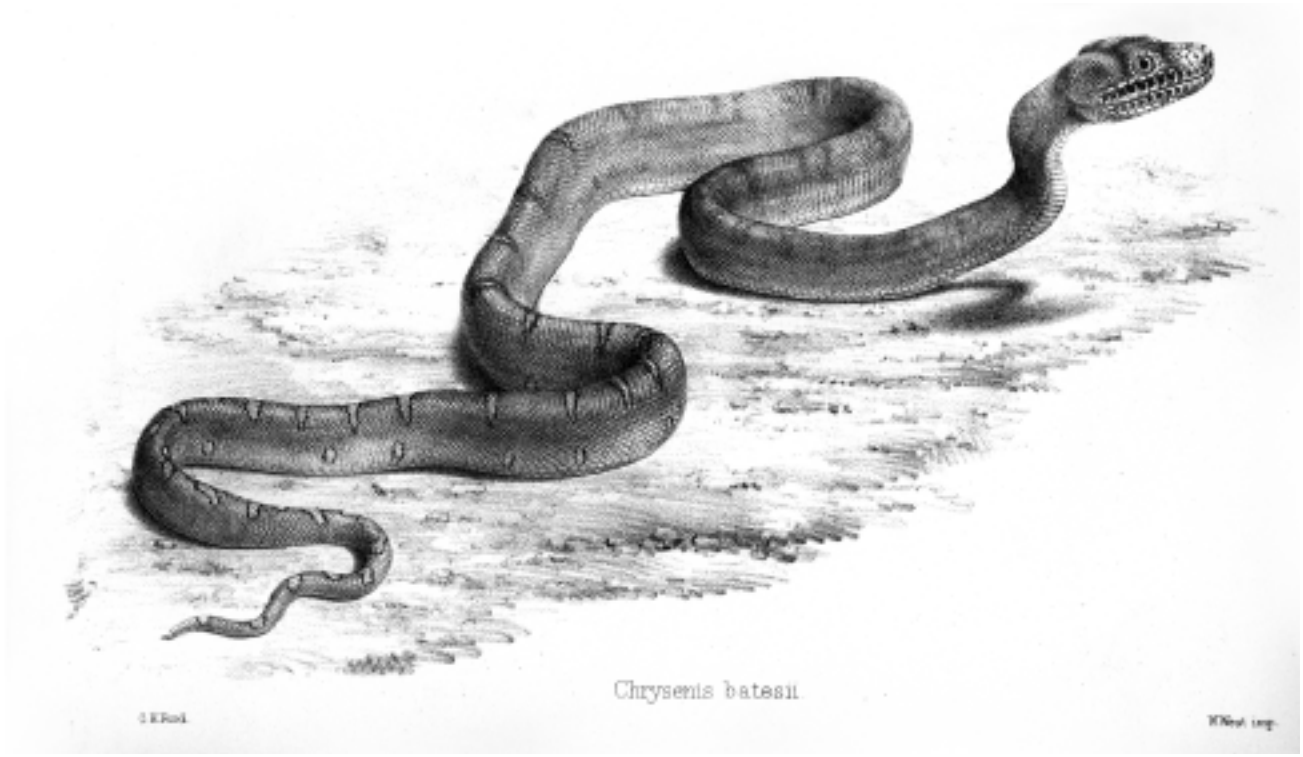
the species occurs over a wide geographic area, it is nowhere common, and occurs mostly in primary rainforest, which is disappearing at alarming rates.

I began borrowing preserved specimens of Emerald Treeboas about 15 years ago. Geographic variation was apparent, and I published some of my data over a decade ago. Subsequently, however, articles by herpetoculturists who specialized in breeding *C. caninus* caught my attention when they referred to "northern" or "shield" emeralds and "basin" emeralds. Although I had already observed and described some of the same geographic variation, I felt the species warranted more intensive scrutiny. I began anew my examination of preserved specimens of *Corallus caninus*, but only about 75 with reliable locality data were held in U.S. collections. Some countries within the range of *C. caninus* either were not represented by any specimens (e.g., French Guiana) in U.S. collections, or were poorly represented (e.g., Venezuela; one specimen). Also, treeboas from Brazil were, again, poorly represented in U.S. collections, and about 60% of the species' range falls in that country. I contacted collection curators in Brazil, Colombia, and Venezuela (Museo de Historia Natural La Salle), and also France (for French Guiana material), the Netherlands (for Suriname specimens), and Germany. Not surprisingly, more specimens were in Brazilian collections than elsewhere, and I received enthusiastic assistance from the Instituto Butantan, Museo de Zoologia at the Universidade de São Paulo, and the Museo Paraense Emílio Goeldi in Belém. Not all of the Brazilian specimens I wished to examine were available for loan, so I solicited the collaboration of Marinus Hoogmoed. A Dutch herpetologist, Dr. Hoogmoed has been studying South American frogs and reptiles for many years, and he now lives in Brazil. I was pleased when he agreed to collaborate and examine the many specimens housed at the Museo Paraense Emílio Goeldi.

Pieces of the Puzzle

After examining several dozen treeboas from across the wide range of the species, I clearly recognized that snakes from the Guiana Shield (the area north of the Rio Amazonas and east of the Rio Negro, *fide* Hoogmoed 1979) were distinct from those elsewhere in the range. Most obvious was the virtual lack of lateral blotches (mean of 1.5 ± 0.52 in 32 snakes), a low number of scales across the top of the muzzle (mean = 3.4 ± 0.24), and pale tissue (usually) in the mental groove. That was the easy part. South and west of the Guiana Shield, variation was more like a jigsaw puzzle.

To date, I have had the opportunity to examine about 125 *Corallus caninus* with accompanying locality data. Most snakes from eastern Brazil south of the Amazon (states of Pará and Maranhão) have conspicuous lateral blotches (mean of 16.4 ± 1.46), a white middorsal stripe connecting the bases of the white triangle-like markings that lie along the dorsum, more scales across the top of the muzzle (mean of 6.7 ± 0.34 in 16 snakes), and black interstitial tissue in the mental groove. In the state of Rondônia in western Brazil and in western Mato Grosso state, lateral blotches are absent or greatly reduced in number (mean of 5.8 ± 2.3 in 9 snakes), the middorsal stripe is absent, the number of scales across the top of the muzzle is reduced (mean of 4.9 ± 0.45), and the tissue in the mental groove is variable (white, gray, or black). In Amazonas state north of the Amazon and west of the Rio Negro (i.e., west of the Guiana Shield), the number of scales across the dorsal surface of the muzzle increases, lateral blotches are present, and the interstitial tissue



Engraving of Gray's *Chrysensis batesii* from the "Upper Amazon," based on a juvenile *C. caninus* (from the *Proceedings of the Zoological Society, London* 28:132–133).

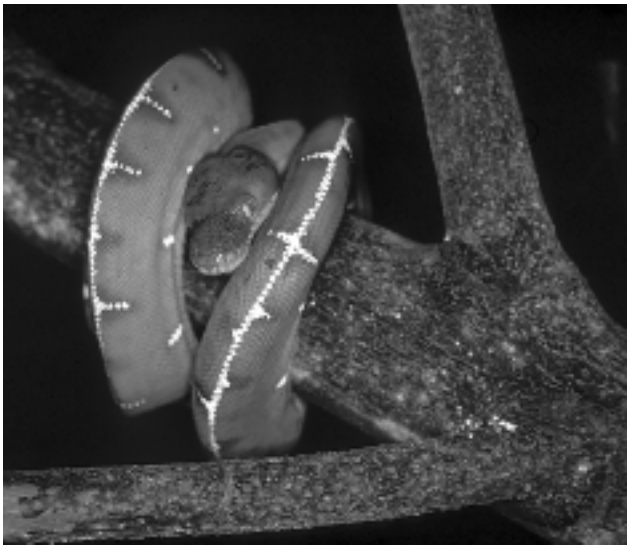
A young Emerald Treeboa from kilometer 88 on the road between El Dorado and Santa Elena de Uairen, Bolivar, Venezuela. Note the absence of a middorsal stripe and lateral blotches. *Photograph by César Barrio, courtesy of Serpentario Los Llanos.*

Adult *Corallus caninus* from the vicinity of Ariquemes, Rondônia, Brazil, illustrating the absence of a middorsal stripe and lateral blotches. *Photograph by W. Carl Taylor.*

of the mental groove is black in adults (like dorsal ground color, this tissue undergoes an ontogenetic shift from yellowish to black). Surprisingly, I have no records from central Brazil (south of the Rio Amazonas) in the state of Amazonas.

Moving west into Ecuador, Perú (where the species occurs to 1000 m above sea level), and Bolivia, lateral blotches are a constant (although shapes are variable) and are more numerous than elsewhere across the range (mean of 23.4 ± 1.1 in 36 snakes). Likewise, the dorsal triangles are more numerous (mean

A juvenile *Corallus caninus* (SMF 80017) collected at ca. 1000 m above sea level at Pozuzo, Depto. Pasco, Perú. This is probably at or close to the upper altitudinal extreme for the species. *Photograph by Edgar Lehr.*



Emerald Treeboa from Santa Cecilia, Sucumbios, Ecuador, illustrating the middorsal stripe and lateral blotches common in *C. caninus* from some areas of Amazonia. *Photograph by William E. Duellman.*

of 32.8 ± 1.04 versus 25.9 elsewhere). A middorsal stripe may or may not be present. *Corallus caninus* from Ecuador and Perú also exhibit more scales across the muzzle than elsewhere (mean of 8.1 in 36 snakes).

Legitimate records of Emerald Treeboas at what appear to be localities isolated from the rest of the range occur north of the Colombian cordilleras Occidental and Central. Through the kind cooperation of Olga Castaño (Instituto de Ciencias Naturales, Universidad Nacional de Colombia) and Juan Manuel Daza-R. (Instituto de Biologia, Universidad de Antioquia), I have seen photographs and received scale and pattern data regarding these snakes. They lack middorsal stripes, but have lateral blotches typical of snakes from the upper Amazon. Likewise, the number of scales across the muzzle falls into the range for Colombian emeralds collected east of the Andes.

Assembling the Puzzle

Considering the breadth of the range of *Corallus caninus*, that the species displays geographic variation is not surprising. DNA

A road-killed *Corallus caninus* from Tierra Alta, Depto. Córdoba, Colombia (ICN 8398). *Photograph by Mikael Lundberg.*

sequences from critical areas across the range of *C. caninus* parallel the morphological data so far collected, and more than one species appears to be masquerading under the taxonomic umbrella of *C. caninus*. Many hypotheses (e.g., refugia, riverine barrier, marine incursion) have been addressed in order to explain speciation in Amazonia, and various authorities have noted that any Amazonian speciation model will be complex and, to some extent, species-specific. Collecting pieces of the "emerald puzzle" and their assembly is ongoing, with the analysis of morphological data hopefully providing additional insights into geographic variation and possible taxonomic partitioning of *C. caninus*.

Acknowledgements

I am grateful to Laurie Vitt for providing photographs of Emerald Treeboas and for sharing his observations from the field and lab. Juan Manuel Daza-R. called my attention to the Colombian record from Antioquia. Bill Lamar provided much useful information and offered photographs for my use. Nicolas Vidal was a pleasure to work with on the DNA material. Additional photos were provided by César Barrio, William Duellman, Edgar Lehr, Mikael Lundberg, Marcio Martins, and Carl Taylor. Rose Henderson scanned images from old sources, and Robert Powell provided the map. Joseph Polanco and Tony Nicoli shared information based on their experiences breeding emeralds in captivity. I especially thank the personnel from many institutions in several countries who have, so far, loaned specimens for my examination.

An Emerald Treeboa from Triunfo, slopes of Santa Rosa Tepui, Serrania del Supamo (100 km SSE of El Manteco), Estado Bolivar, Venezuela clearly showing the heat-sensitive labial pits that help give these snakes a menacing appearance. *Photograph by César Barrio.*

References

Boulenger, G. A. 1893. *Catalogue of Snakes in the British Museum (Natural History). Vol.1., Containing the Familes Typhlopidae, Glauconiidae, Boidae, Ilysiidae, Uropeltidae, Xenopeltidae, and Colubridae aglyphae, Part.* Trustees of the British Museum, London.

Bush, M. B. 1994. Amazonian speciation: A necessarily complex model. *Journal of Biogeog*raphy 21:5–17.

Chiras, S. 1998. Identification and husbandry of Amazon Basin Emerald Tree Boas (*Corallus caninus*). *Reptiles* 69(3):48–67 + 70–75.

Cracraft, J. and R. O. Prum. 1988. Patterns and process of diversification: Speciation and historical congruence in some Neotropical birds. *Evolution* 42:603–620.

Emmons, L. H. 1984. Geographic variation in densities and diversities of non-flying mammals in Amazonia. *Biotropica* 16:210–222.

Gray, J. E. 1860. Description of a new genus of Boidae discovered by Mr. Bates on the Upper Amazon. *Proceedings of the Zoological Society, London* 28:132–133.

Henderson, R. W. 1993. On the diets of some arboreal boids. *Herpetological Natural History* 1(1):91–96.

Henderson, R. W. 1993b. *Corallus caninus. Catalogue of American Amphibians and Reptiles* (574):1–3.

Henderson, R. W. 2002. *Neotropical Treeboas: Natural History of the* Corallus hortulanus *Complex.* Krieger Publishing Co., Malabar, Florida.

Hoogmoed, M. S. 1979. The herpetofauna of the Guianan region, pp. 241–279. In: W. E. Duellman (ed.), *The South American Herpetofauna: Its Origin, Evolution, and Dispersal.* University of Kansas Museum of Natural History Monograph (7), Lawrence, Kansas.

Kivit, R. and S. Wiseman. 2000. *The Green Tree Python & Emerald Tree Boa: Their Captive Husbandry and Reproduction.* Kirschner & Seufer Verlag, Keltern-Weiler, Germany.

Laurenti, J. N. 1768. *Specimen Medicum, Exhibens Synopsin Reptilium Emendatum cum Experimentis circa Venena et Antidota Reptilium Austriacorum, quod Authoritate et Consensu.* J. Thomæ Trattnern, Viennae.

Lehr, E. 2001. New records for amphibians and reptiles from departamentos Pasco and Ucayali, Peru. *Herpetological Rev*iew 32:130–132.

Martins, M. and M. E. Oliveira. 1998. Natural history of snakes in forests of the Manaus Region, Central Amazonia, Brazil. *Herpetological Natural History* 6:78–150.

Renjifo, J. M. and M. Lundberg. 1999. *Anfibios y Reptiles de Urrá.* Skanska, Sweden.

Schulte, R. 1988. Observaciones sobre la boa verde, *Corallus caninus*, en el Departamento San Martín-Perú. *Boletim de Lima* 55:21–26.

Vidal, N., R. W. Henderson, A.-S.Delmas, and S. B. Hedges. Submitted. Phylogeny of the Emerald Treeboa (*Corallus caninus*).

A female Andros Iguana protecting the termite mound where she just deposited her eggs. Females may protect the mound for up to 10 weeks and can be extremely aggressive towards other females and even humans.

Working to Save the Andros Iguana

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Photographs by the author unless otherwise indicated.

The Bahamian Andros Iguana (*Cyclura cychlura cychlura*) is the largest native terrestrial vertebrate, and the only iguana (of three species, seven subspecies) in the Bahamas that is not confined presently to small cays. Until recently, it was among the least-studied of the Bahamian species of iguanas and virtually no natural history data were available. In addition, scientists had no indication how many iguanas roamed Andros, and were forced to make arbitrary estimates of between 2500 and 5000 individuals for the International Union for the Conservation of Nature (IUCN) West Indian Iguana Action Plan (Buckner and Blair 2000). Prior to 1999, the only information scientists could garner was that the Andros Iguana faced particularly severe anthropogenic pressures relative to other island-dwelling iguanas in the archipelago. These include habitat loss, illegal hunting, predation by feral animals (e.g., cats, dogs, and hogs), and impact from historic large-scale logging practices for Caribbean Pine (*Pinus caribaea* var. *bahamensis*), which destroyed large tracts of iguana habitat in the 1960s and 70s. Recent anecdotal accounts from the island presented grim scenarios featuring iguanas either already in cooking pots or in cages stoically awaiting that fate. Some individuals were even discovered in a hunting camp with their arms and legs tied behind their backs and their mouths sewn shut.

Andros Island is actually a composite of three main islands and dozens of associated cays. *Graphic by John Binns.*

Little regard was given to the Andros Iguana by international conservation organizations, mainly because reliable natural history and population-trend data were sorely lacking and no scientist was doing the work. The late Walter Auffenberg initiated preliminary field expeditions in the early 1970s, but the surveys were short-lived and generated only cursory observations. The lack of more recent work was not unwarranted. Andros is the fifth largest island (~ 165 km long by 65 km wide) in the West Indies, travel is expensive, and logistics are a nightmare.

Andros actually is a composite of three main inhabited islands (North Andros, Mangrove Cay, and South Andros) and dozens of associated uninhabited cays, separated by saline tidal channels called bights. Much of the low-relief island (~ 90% < 6 m above mean sea level) is punctuated with small cavities and large blue holes. From east to west, a coastal ridge (to 30 m elevation) gives way to a flat and pine-forested interior. Approximately halfway across the island, forest grades into extensive mangroves as the water table reaches the surface, and then is reduced to extensive mud flats.

Except for North Andros, no roads slice beyond the eastern edge of the island making the interior accessible only by shallow-draft boats and hours of trudging through mangrove and poison wood-tangled bush. The labyrinth of waterways crosshatching the island and the quirky tides make reliable navigation difficult. Also, in the 1980s, Andros was a haven for drug-running bandits and interior passage was unsafe.

These logistical hardships for humans actually benefit the iguanas inhabiting the interior of the South Andros area. Access into the interior on North Andros is facilitated by a series of hard-packed logging roads — relics from past timber exploitation. These roads allow hunters and their dogs to gain access to the interior of the island, where few iguanas remain. In contrast, the South Andros area is characterized by large and small isolated cays accessible only by boat. These isolated havens are free from large feral mammals and are not visited as frequently as areas to the north. The waters are teaming with bonefish, eagle rays, sea turtles, and dolphin. On calm, windless days, surface waters settle and return to the clouds a reflection that is so breathtaking, it gives the illusion of flying through the air instead of planing on crystal-clear water. The isolation is raw and real, making it more unsettling when evidence of humans and their illegal activities are uncovered.

In the late 1990s, while the dismal anecdotal iguana accounts were emerging from Andros, I was trying to develop a

field project for my doctoral degree at the University of Florida. The Andros Iguana population apparently was in decline, and I felt that I could make a difference by studying the animal to facilitate initiation of a science-based management plan for the species. However, I did not intend to study only the iguana, make recommendations, and leave the island with a doctorate in tow. I wanted to help with on-the-ground conservation by working with local people, regional organizations, and the national government. If nothing else, I wanted the Andros Iguana to have an advocate for its preservation.

Before I could even initiate fieldwork, I had to uncover iguana populations dense enough for meaningful study. The problem is that finding an iguana on Andros is akin to searching for a needle in a haystack. Hundreds of kilometers of island interior had to be searched. Where to begin? Fortunately, I have been leading "citizen-scientist" research expeditions to the Bahamas since 1995 aboard the John G. Shedd Aquarium's research vessel, R/V *Coral Reef* II. In 1999, we made the decision to cruise the waters of Andros in search of iguanas. We have returned to the island each year (see *Iguana Times* 1(2):17–18, 1(3):4–7, 8(1):7–15, 8(4):8–10, 8(4):12–16) and the field participation from public assistants has been vital in making long-term ecological studies of the iguana a reality (see Knapp 2004). In fact, we return in May 2005 to continue the work, which includes the seventh year of a mark and recapture study, and the investigation of the enigmatic nesting behavior of the Andros Iguana. The Andros Iguana is the only iguana in the world documented to deposit its eggs in termite mounds. Witnessing a female iguana aggressively guarding a nesting mound is still among my favorite sights.

Ray Dean from South Andros island assisting with radio-tracking on Linder Cay, Andros Island in 2002. Ray had a knack for finding lost transmitters during the first unsuccessful season of radio-tracking.

An adult male Andros Iguana moves through the extensive mangrove system. Note the radio transmitter sutured to the dorsal/pelvic crest. This animal was tracked for a total of four months in 2003.

Whereas the ecological studies have been successful and have yielded information that will be used in establishing a management plan (see Knapp and Owens 2004 and other articles in press and in preparation), the opportunity to work with the local people on Andros has been most memorable. For the past few years, I have been trying to raise awareness of iguanas among local settlements by taking advantage of frequent opportunities to get to know people and talk with them about their native iguana.

Sometimes, serendipitous events help spread the word about iguana conservation. In late October 2002, during my water "commute" to one of my study sites, I noticed two men walking the shore of a distant, small cay. It seemed odd to me that two people would be so far from civilization with no apparent boat in sight. I cut a wake in the smooth surface water and veered toward the men to check and make sure that they were OK. I was astonished to discover that they had been stranded for two days because they had run out of fuel. They shared two sandals between them and had to resort to a makeshift second sandal fabricated from snorkel fins. They were without food or water and were attempting to walk and swim across cays and waterways to reach safety. The thought of the men walking through the bush on the jagged limestone with little protection, and their inevitable battle with mosquitoes during the crepuscular hours made me shudder. I took the appreciative men back to their settlement and, from that day forward, I was known as the "iguana man who saved Larry and Luther."

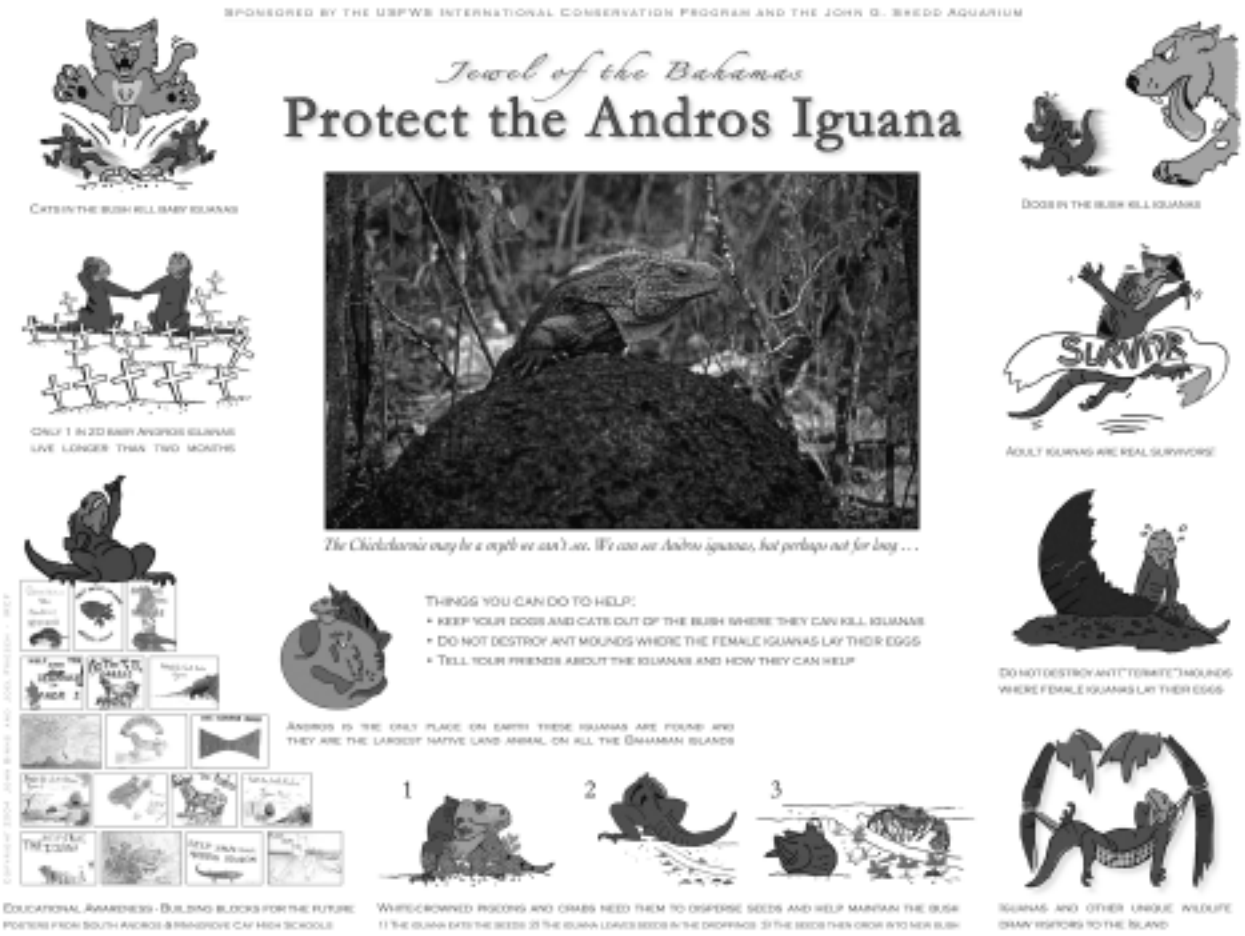
As fate would have it, a week later, I was slated to leave the island with Joe Wasilewski, who had come to visit for a few days

to help with the research. We decided to leave one day early because Hurricane Michelle was churning up the Caribbean and heading for Andros. As rain fell and the sky darkened, we waited anxiously in the one-room airport on Mangrove Cay, hopeful that our plane would come to deliver us to safety. Instead, we were flooded with forbidding radio reports about how the hurricane was to make a direct hit on Mangrove Cay. We will never forget the radio announcer exclaiming, "the nation prays for Andros!" No planes came and the nervous crowd retreated to the safety of shelters. Joe and I were stranded for hours, still hoping

Andros Iguana skull found in May 2004 at a known hunting camp on the West side of Andros. According to anecdotal accounts, 40 iguanas were captured for food in just one illegal hunting expedition. We found many bones at the site and it was littered with shed iguana skin. Typically, iguanas are brought back to the settlements alive and sold.

Local Andros boys, Ricardo, Ray, and Bradley assisting the author in the field.

The author with participants from the 2003 Shedd Aquarium iguana research expedition to Andros. *Photograph by John Bendon.*



Protect the Andros Iguana poster designed by John Binns and Joel Friesch. The poster is currently in schools and government buildings throughout Andros. A few even hang in local bars, since some of the most productive iguana-related conversations take place in those types of establishments.

that a plane would come and carry us away. However, we would face the impact of the hurricane while in a concrete hotel, and then be left stranded on Mangrove Cay for an additional two days. Thankfully, damage was not as bad as expected and no one was hurt, so Joe and I made the best of the situation by talking about iguanas with anyone who would listen. To this day, people still remember both of us and the reasons we study iguanas, because of that unexpected meteorological episode.

Reaching out to children and trying to establish a conservation ethic has been one of my major goals. I frequently bring high school students into the field with me to help with research. Most of these students have not been off their individual subislands and none have ventured into the watery interior of Andros. That pleasure is reserved for bonefish guides and fishermen. I instruct the students on how to capture and handle iguanas. Some even get to try their luck at radio-tracking. Another world opens up for them and the smiles on their faces speak volumes.

In order to reach more students and make a larger conservation impression, I have been bringing iguanas to the local high schools and giving presentations. The presentations are fun and the animated crowds always buzz with excitement when I pull out a 4-kg iguana from its bag. My first school appearance stressed the importance of these presentations. First, I asked how many students had ever seen an iguana. Approximately half the group raised their hands. I then asked how many had ever eaten an iguana and, again, approximately half raised their hands. Following my presentations, I often would hear from parents that students were talking about iguanas while at home.

The initial presentations provided the opportunity to develop a drawing contest for the students to further raise their awareness of iguanas. Students were given the opportunity to draw a mural with a "Protect the Andros Iguana" theme. All contestants were given an Andros Iguana t-shirt and winners received monetary prizes. Our initial thought was to use the winning entries as background for a poster that was in development with the help of John Binns and Joel Friesch of the International Reptile Conservation Foundation. Instead, we incorporated all the entries into the poster and it made a great impact. Last September, I returned to the schools to award the prizes and donate the posters. The teachers were all thankful that we were bringing something back to the community and the students enjoyed seeing their artwork on a poster that will be displayed in all government buildings and schools (as well as most

The poster contest winners from Mangrove Cay High School with their poster.

Students interacting with the author and an Andros Iguana at the Mangrove Cay High School. *Photograph by Audrey Owens.*

bars) on the island. One teacher even thanked us because our contest proved to students that good things can happen when they are presented with an opportunity, and then meet that opportunity with hard work.

As expected during this project, I have learned a substantial amount about the natural history of the Andros Iguana. Unexpected, however, was my conclusion that I should not be the spokesperson for the Andros Iguana. Instead, the local community must take stewardship and assume the role of actively protecting their iguanas. Only in this manner will the long-term survival of this impressive lizard be realized. I am much encouraged by the many dedicated people who I have met and who are willing to help take on this responsibility.

Acknowledgements

The Andros Iguana would still be an enigma if not for the gracious assistance of many organizations and individuals. The John G. Shedd Aquarium has been the largest benefactor of Andros Iguana research and their support is greatly appreciated. Recent financial assistance for educational materials was made possible through a grant from the U.S. Fish and Wildlife Service International Conservation Fund. Among many contributions, Tiamo Resorts of South Andros has provided crucial logistical support and contributed monetary prizes for the poster contest. Invaluable members of the research team include John Bendon, who designed t-shirts and maps, Audrey Owens, and Sandra Buckner. Lou Roth, John Rothchild, and Charles Julian of the Shedd Aquarium's research vessel have been assisting beyond the call of duty for years. In addition, the volunteers participating in the John G. Shedd Aquarium research expeditions are responsible for allowing us to repeatedly visit the island aboard the research vessel. Thanks also to John Binns and Joel Friesch of the IRCF for producing an incredible and invaluable conservation poster for the Andros Iguana.

References

Buckner, S. and D. Blair. 2000. Species account: *Cyclura cychlura cychlura*, pp. 31–32. In: A. Alberts (ed.), *West Indian Iguanas: Status Survey and Conservation Action Plan*. IUCN — The World Conservation Union, Gland, Switzerland.

Knapp, C.R. 2003. You study iguanas in the Bahamas? pp. 23–28. In: R.W. Henderson and R. Powell (eds.), *Islands and the Sea: Essays on Herpetological Exploration in the West Indies*. Society for the Study of Amphibians and Reptiles Contributions to Herpetology, volume 20. Ithaca, New York..

Knapp, C.R. and A.K. Owens. 2004. Diurnal refugia and novel ecological attributes of the Bahamian Boa, *Epicrates striatus fowleri* (Boidae). *Caribbean Journal of Science* 40:265–270.

Knapp, C.R. and A.K. Owens. In Press. Home range and habitat associations of a Bahamian Iguana: Implications for conservation. *Animal Conservation.*

Knapp, C.R. and A.K. Owens. In Press. An effective new radio transmitter attachment technique for lizards. *Herpetological Review.*

Research Opportunity

Join me from 6–15 May 2005 during the next, and possibly last, Shedd Aquarium iguana research expedition to Andros Island. This truly is a trip of a lifetime because we take you to areas that no one else has the opportunity to explore. We will be capturing iguanas for study and we also will witness the incredible behavior of the only iguana in the world that deposits its eggs in termite mounds. Only a handful of people have ever seen this event, so bring your camera and plenty of film (or memory card space)! Besides working in the field, you also will have opportunities to snorkel and swim, visit with local people, and travel to cays never before explored. If time allows, we will go fishing along the barrier reef and visit Bimini Island.

The price is $1895, which includes accommodations, meals from breakfast on day 2 through lunch on day 10, transportation during the expedition, and departure taxes. Airfare to and from Miami, alcoholic beverages, and dinner on day 1 are not included. If interested, please contact Michelle Jost at *mjost@sheddaquarium.org* or (312) 692–3191 for more information. Also feel free to contact me at *cknapp@ufl.edu* with specific questions concerning the fieldwork.

GILA MONSTER (*Heloderma suspectum*).—This non-aggressive resident of the Sweetwater area is our largest, most fabled, and only venomous lizard in the United States. Few people have had the good fortune to see one in the wild. These secretive reptiles have large home ranges that span a mile or more and are readily displaced by urban sprawl. They occasionally turn up in swimming pools.

The Sweetwater Strategy: Saving Habitat at the Grassroots Level

Thomas Wiewandt

Wild Horizons, Tucson, Arizona

Photographs by the author except where indicated.

Saving crucial habitat is by far the most effective means of conserving wildlife. Traditionally, conservationists have abdicated this responsibility to institutions, public or private — but sometimes individuals have to take the initiative into their own hands. Following is a step-by-step guide based on the successful establishment of the Sweetwater Reserve near Tucson, Arizona.

Step 1: Recognize the Opportunity — and Act!
Identifying a parcel of land of ecological importance is critical. Even experienced biologists, trained to recognize biological values that might be missed by the amateur, cannot do it alone. Ecologists may know to consider parcel size, its ecological diversity, and its connections with other protected natural areas. These are crucial attributes. Land lacking even one of these elements probably doesn't warrant protection. Opposition to the proposal will quickly recognize and exploit such inherent weaknesses. However, biological significance isn't enough. An area's

OUR GOAL:

Acquisition of Sweetwater Preserve by a public agency for conservation and open space purposes to help achieve the goals of the Sonoran Desert Conservation Plan.

SWEETWATER PRESERVE.—This view is to the northeast toward Tucson, as seen from the western end of the Sweetwater property. Tucson and the Santa Catalina Mountains appear on the distant horizon. Saguaro-studded hills in the foreground block views of homes along Camino del Cerro.

recreational potential and aesthetic appeal must be taken into account. Selling the idea of a sanctuary that would be "off-limits" to people is much more difficult than promoting one with some carefully managed recreational potential and visual appeal. To effectively integrate such varied concerns, a team that includes nature lovers such as birders, hikers, campers, artists, and ordinary citizens is necessary.

Once an area has been identified, act quickly! Determine who owns the land and investigate its potential for acquisition. Trying to stop a project after the property has been sold to a developer almost invariably proves futile.

Step 2: Organize

Like-minded citizens should meet to discuss the proposal and develop an action plan. An effective group should include scientists and the nature lovers to which we alluded above, but a consortium that effectively solicits support from individuals with a wide variety of skills will have a much higher probability of success. Involvement of persons such as attorneys, writers, photographers, real estate agents, graphic designers/publishers, and community members skilled in public speaking and political activism will dramatically enhance the likelihood of success.

Part of any effective action plan is the recruitment of an appropriate broker to negotiate the acquisition. Ideally, this would be a widely recognized and reputable conservation organization such as The Nature Conservancy, an Open Land Trust, the Trust for Public Lands (TPL), or comparable regional and

Sweetwater Preserve: Key Points

Size and Diversity
Proximity to Other Conservation Areas
Watershed and Riparian Habitat
Vertebrate Species of Concern
Cultural and Historic Resources
Viewsheds
Trails

FISHHOOK BARREL CACTUS (*Ferocactus wislizeni*).—Succulent surprises abound within the Sweetwater Preserve. Dense stands of young Saguaros (*Carnegiea gigantea*) and ancient barrel cacti of enormous proportion populate the land. Flowers of the barrel cacti open in July and August during the summer rainy season, providing nectar and pollen for native bees. In autumn, Mule Deer (*Odocoileus hemionus*), Antelope Ground Squirrels (*Ammospermophilus* sp.), and Curved-billed Thrashers (*Toxostoma curviostre*) are among the animals that feast on the lemon-yellow fruit.

Sweetwater Timeline

June 2000	Tucson Mountains Committee (TMC) prepares report identifying Sweetwater as the largest remaining tract of undeveloped land in the eastern Tucson Mountains
March 2001	Community members meet with county supervisor and are directed to prepare a detailed report and to talk with the Trust for Public Land (TPL) to solicit their support in acquiring the property
July 2001	TPL meets with county supervisors, the county administrator, and the Tucson Mountains Association (TMA) and agrees to assist the county and community in efforts to secure Sweetwater
September 2001	TMA Sweetwater Preserve Committee completes report and presents it to county supervisors, the National Park Service, and the Arizona congressional delegation
October 2001	Began ongoing process of soliciting endorsements from diverse community, environmental, and governmental organizations; in all, 52 endorsements were secured, including: National Park Service, Arizona Sonoran Desert Museum, Coalition for Sonoran Desert Protection, Pima Trails Association, Southern Arizona Hiking Club, Neighborhood Coalition of Greater Tucson, Tucson Pima County Historical Commission, Sierra Club, Tucson Mountain Riders, Arizona Daily Star
November 2001	TPL begins negotiations with the landowners to secure an option for the potential acquisition of Sweetwater
August 2002	TPL completes negotiation of terms of option contract; TMA raises > $30,000 for option payment contribution
November 2002	TPL and the landowners sign the option contract for the 620-acre Sweetwater parcel with the understanding that a bond election is planned for May 2003; property owners begin survey of property to plan development in the event the bond does not pass
December 2002	Supervisors delay bond vote until November 2003
July 2003	Supervisors delay bond vote until May 2004
December 2003	TPL/landowner option agreement expires; TPL negotiates a contract extension through mid-June 2004, requiring additional option payment and firm TPL purchase commitment by February 2004; additional 80 acres added to the project after consultation with county and community/environmental groups
February 2004	Purchase agreement completed; Pima County Board of Supervisors approve purchase of Sweetwater (with contingencies) by a 5–0 vote
May 2004	"Open Space" bond passes with Sweetwater as the first property listed; final appraisal provided by TPL to county for review and approval
October 2004	Sweetwater Nature Preserve becomes a Pima County Park

even international entities. In some cases, this organization eventually would become the owner/steward of the property; in others, they would act as an intermediary between the land owner(s) and the recipient organization, e.g., a city or county government. Representation by such an institution lends credibility to the effort. Not only does it remove the possibility of criticism that those involved seek to benefit personally in any way, but such entities do not become engaged in proposals that lack substance, and their participation provides a means of soliciting financial support via deductible contributions.

In the Sweetwater effort, the neighborhood group worked with the Tucson Mountains Association and TPL. TPL entered a prolonged and difficult three-year negotiation with the owners on behalf of Pima County, Arizona, and eventually purchased the land for the county government, a loan to be repaid with funds raised through a local bond election.

DESERT SPADEFOOT TOAD (*Scaphiopus couchii*).—Awakened by vibrations from pounding raindrops during violent summer storms, spadefoot toads emerge to breed in temporary puddles in arroyos. Life in the water — from egg to tadpole to toadlet — can be completed in less than two weeks. By eating only one big meal of termites, adults can outwait fickle rains and make it through another year of sleep underground.

Step 3: Prepare a Report

A visually and intellectually enticing document is essential for moving the project forward — and the difficulty of doing this effectively should not be underestimated. Experience and expertise are critical. Seek outside help if the assembled team doesn't already include such persons. A poorly written and poorly executed report will waste everyone's time and will almost inevitably doom the project to failure.

BUYING TIME

Arizona Daily Star, 22 October 2002

Despite the pace of development on the West Side over the last 20 years, large portions of the desert landscape remain relatively undeveloped. One of the more pristine areas is a 615-acre tract in the foothills of the Tucson Mountains near the western extremity of Sweetwater Road. It's a remarkably scenic and peaceful slice of the Sonoran Desert, but in the absence of county action, it may one day be turned into another resort.

The land is now owned by Sweetwater Properties, Inc., a company partly controlled by local investors who evidently are willing to sell if the price is right. The Tucson Mountains Association wants to see the land turned into a nature preserve that would be open to the public for hiking, horseback riding and bicycling. A deal is in the works, but its success depends partly on public donations and partly on county action.

The owners of the tract say they'll take the land off the market for a year if somebody comes up with the $40,000 property tax payment due on November 15.

The Tucson Mountains Association has raised approximately $18,000 and the Trust for Public Lands, a national conservation organization, has agreed to put up $20,000. This is a cause worth supporting. It potentially will have long-range benefits for the entire community, both in terms of outdoor recreation opportunities and the preservation of plants and animals native to the Sonoran Desert.

Success or failure hinges to a large extent on whether the Pima County Board of Supervisors votes to include the Sweetwater property in a bond election that will be held next year. The board's vote is expected early next month. A spokesman for the Tucson Mountains Association says it will not cash any of the donations it has received until it knows for certain that the property will be included in the bond election that will be held next May.

The land in question is a stone's throw from the eastern boundary of Saguaro National Park. The University of Arizona's entomological research station is about a quarter mile to the south. The county's extraordinary Tucson Mountain Park is also nearby. This is an area that is populated but not densely developed. It should be kept that way.

The proposed Sweetwater Preserve is a rare opportunity for the community. The property would make an excellent regional park that could be managed to protect wildlife corridors and the rare vegetation native to the Sonoran Desert.

At present, the fate of this project is precarious. The land has not yet been appraised and no one knows beyond a doubt what its market value is. The owners — so far the names of those involved in Sweetwater Properties Inc. have not been disclosed — are willing to delay any sale if somebody else pays the property taxes until the matter is settled. For the public, this remains a risky investment but one with potentially great rewards.

The document should be concise, yet filled with compelling facts and a sense of urgency. This will require the engagement of specialists to make surveys and assessments to broaden the appeal of the project and strengthen its case. If possible, include critical habitat for rare or endangered species, but keep the focus broad. The Endangered Species Act offers tremendous legal clout, but emphasizing the integrity of the whole endeavor will help build wider community support for a conservation project and alleviate possible fear of excessive governmental interference on the part of those who own property adjacent to the focal parcel.

Prepare the report so that it is easy to digest. Assume that important decision-makers, whose support (or lack of opposition) is crucial, won't take the time to study in detail every document that comes their way. Use engaging photographs with descriptive captions, an "Executive Summary," and sidebars or pullouts to emphasize key points. Ask yourself, "Would someone completely unfamiliar with this project come away with a full grasp of its significance by just reading the Executive Summary, the photo captions, and the highlighted bits of text?" If the answer is "yes," the report will most likely serve its purpose.

Have the document professionally designed and printed. Local designers and printers who identify with your cause will often do the job at cost or even offer their services for free. In the Sweetwater project, the designer discounted her services; and one printer handled the color pages while another did the black-and-white printing, collating, and binding — all at their cost. A supporter paid for the design and printing services, channeled through a non-profit organization (TPL) to make this a tax-deductible contribution.

Step 4: Form Alliances

With a convincing report in hand, circulate copies to important individuals and community organizations for support. Seek written endorsements from a broad base, including such groups as neighborhood associations, newspapers, women's organizations, experts on natural resources, hiking clubs, and conservation societies. The more, the better — keeping in mind that support from persons and groups with disparate agendas will strengthen dramatically the appeal of the proposal to decision-makers. Add such letters of support to the document.

continued on p. 22

Dense stands of the saguaro cactus populate Sweetwater Preserve, and young plants are numerous…. During the early summer dry season, when food and water are often critically scarce, the saguaro provides the desert's only source of moist fruit; and the multitude of animals that feed on it are as diverse as wasps, bats, javelinas, and woodpeckers.

Reptiles of the Tucson Mountains[2]

LIZARDS: Western Banded Gecko (*Coleonyx variegatus*), Mediterranean Gecko (*Hemidactylus turcicus*)*, Desert Iguana (*Dipsosaurus dorsalis*), Spiny-tailed Iguana (*Ctenosaura hemilopha*)*, Lesser Earless Lizard (*Holbrookia maculata*), Greater Earless Lizard (*Cophosaurus texanus*), Common Collared Lizard (*Crotaphytus collaris*), Long-nosed Leopard Lizard (*Gambelia wislizenii*), Desert Spiny Lizard (*Sceloporus magister*), Clark's Spiny Lizard (*Sceloporus clarkii*), Side-blotched Lizard (*Uta stansburiana*), Tree Lizard (*Urosaurus ornatus*), Regal Horned Lizard (*Phrynosoma solare*), Giant Spotted Whiptail (*Cnemidophorus burti stictogrammus*)**, Sonoran Spotted Whiptail (*Cnemidophorus sonorae*)**, Western Whiptail (*Cnemidophorus tigris*)**, Gila Monster (*Heloderma suspectum*).

SNAKES: Western Blind Snake (*Leptotyphlops humilis*), Spotted Leaf-nosed Snake (*Phyllorhynchus decurtatus*)***, Saddled Leaf-nosed Snake (*Phyllorhynchus browni*)***, Coachwhip (*Masticophis flagellum*), Sonoran Whipsnake (*Masticophis bilineatus*), Western Patch-nosed Snake (*Salvadora hexalepis*), Glossy Snake (*Arizona elegans*), Gopher Snake (*Pituophis melanoleucus*), Common Kingsnake (*Lampropeltis getula*), Long-nosed Snake (*Rhinocheilus lecontei*), Black-necked Garter Snake (*Thamnophis cyrtopsis*), Banded Sand Snake (*Chilomeniscus cinctus*)****, Southwestern Black-headed Snake (*Tantilla hobartsmithi*), Lyre Snake (*Trimorphodon biscutatus*), Night Snake (*Hypsiglena torquata*), Western Coral Snake (*Micruroides euryxanthus*), Western Diamondback Rattlesnake (*Crotalus atrox*), Sidewinder (*Crotalus cerastes*), Black-tailed Rattlesnake (*Crotalus molossus*), Tiger Rattlesnake (*Crotalus tigris*), Mojave Rattlesnake (*Crotalus scutulatus*).

TURTLE: Desert Tortoise (*Gopherus agassizii*).

* introduced

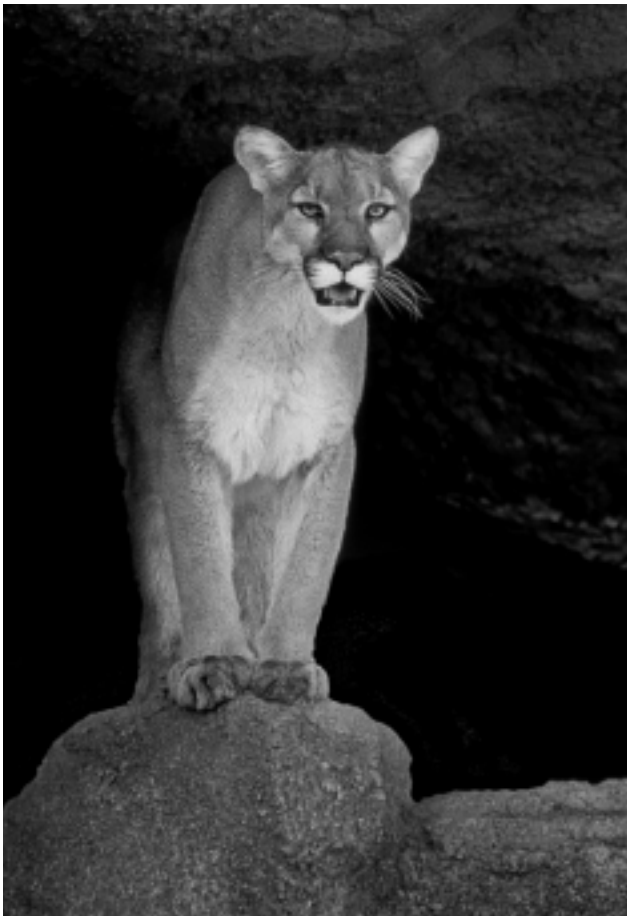
** North American lizards formerly assigned to *Cnemidophorus* are now placed in the genus *Aspidoscelis*

*** confirmation is needed nearer the mountains

**** Sand Snakes are now placed in the species *Chilomeniscus stramineus* (see *Iguana* 11(1), p. 7).

[1] This and all other boxed items were excerpted from the Sweetwater Preserve and Sonoran Desert Conservation Plan, prepared by the Tucson Mountains Association Sweetwater Preserve Committee, September 2001.

[2] Compiled by Cecil Schwalbe and Taylor Edwards. Note that not all species listed are found within the Sweetwater Preserve.



MOUNTAIN LION (*Puma concolor*).—Many of us who live in Tucson dream of the day when we can capture an image like this one in the wild. Symbol of the Arizona-Sonoran Desert Museum and photographed there, this magnificent cat still roams our desert mountain ranges. In recent years, Mountain Lions have been observed on several occasions in the Sweetwater area.

TIGER RATTLESNAKE (*Crotalus tigris*).—This attractive reptile lives only in the desert mountains of southern Arizona and northern México. Thirty years ago, this species was relatively common in Tucson Mountain Park near Gates Pass; today it is rare there. It is unprotected, prized by snake collectors, and, like many desert reptiles, suffers heavy mortality on paved roads. Paved roads trap heat, so heat-seeking pedestrians — reptiles and amphibians — often linger on these warm surfaces. Tiger Rattlesnakes still are seen regularly in the Sweetwater Preserve area.

SWEETWATER PURCHASE IS NEARING REALITY

Tony Davis (Arizona Daily Star, 16 June 2004)

The 700-acre Sweetwater Preserve in the Tucson Mountains is now on the verge of public ownership, after the Board of Supervisors took a crucial step Tuesday toward buying it.

The board approved the sale of $11.7 million in bonds to cover Sweetwater's purchase. The vote came more than three years after neighbors of the parcel near Tortolita Road south of Camino de Oeste launched a campaign to save it. The sale, part of a larger sale of $65 million in county bonds, gave the Trust for Public Land the assurance it needs to buy Sweetwater from its private owners, County Administrator Chuck Huckelberry said.

The county will in turn buy the land from the trust.

By the end of June, the county will buy the Sweetwater preserve area, lying in the shadow of Saguaro National Park West and Tucson Mountain Park. This will be the first major purchase with the county's new, $174 million open-space bonds voters approved in May.

On Tuesday, the private, nonprofit trust sent a title company the money for the land. Formal closing will occur in a week, said Michael Patrick, the trust's Sweetwater project manager.

The parcel's size, its classically Sonoran mix of saguaro, ocotillo, prickly pear, creosote, palo verde and the scenic mountain views it affords have long made it a priority for its neighbors and many other Tucson environmentalist to buy.

In February, supervisors unanimously agreed to its purchase if three other conditions were met: voter approval of the open-space bonds, county approval of a property appraisal and a recommendation for the purchase by the Conservation Acquisition Commission.

But partly because of the parcel's high cost and because the board approved it before the open-space bond vote in May, the purchase has had critics.

Last week, five acquisition commission members abstained on the recommendation. Three members supported it. But nobody spoke against the Sweetwater purchase Tuesday.

Debbie Hecht, co-chairwoman of the Sweetwater Nature Preserve Committee, told the board that Tucson Mountain residents had put in countless volunteer hours and raised tens of thousands of dollars to help keep an option alive to buy the property.

XERORIPARIAN HABITAT AND THE 700-ACRE SWEETWATER PRESERVE.—Habitats with intermittent water supplies are vital to the welfare of more than toads, they help sustain most wildlife in the Tucson Mountains. Besides providing opportunities to drink, desert streambeds offer food and shelter that is unavailable or less desirable elsewhere. For many large mammals, arroyos serve as roadways, making travel across desert terrain quick and easy. Four major washes on Sweetwater Preserve have been identified by Pima County as important Xeroriparian "A" habitat; i.e., that of greatest value to wildlife. Sweetwater Drive and adjacent areas with low-density private dwellings is on the left, two major tributaries of Sweetwater Wash join as they intersect with Blue Bonnet Road in the lower left, and hiking/equestrian trails can be seen to the north (right) of these important natural watercourses. *Photograph taken from an ultralight aircraft by Adriel Heisey.*

SWEETWATER NATURE PRESERVE BECOMES A PIMA COUNTY PARK

Celebration planned for October 17, 2004 at the Tortolita (north) side of the property
www.TucsonMountainsAssoc.org

The County's Open Space Bond was approved in a landslide victory on May 18, 2004, with the voters of Pima County approving $174 million to acquire lands for protecting biologically important habitat, providing additional open space for the community and preventing urban encroachment of Davis-Monthan Air Force Base.

Pima County announced on June 11, 2004 that it completed the purchase of the Sweetwater Preserve, 695-acres of important biological habitat and open space land in the Tucson Mountains, with assistance from the Trust for Public Land. The property will be set aside for permanent use as a recreational and natural resource area and as an addition to the County's Tucson Mountain Park. This acquisition is the first land protected using funds from the County's open space bond funds.

TMA expressed their gratitude to Supervisor Richard Elias, Supervisor Sharon Bronson, Pima County Administrator Chuck Huckelberry, Congressman Raul Grijalva and Michael Patrick from the Trust for Public Land, who have supported this effort for the past four years. "Saving Sweetwater required a tremendous commitment in grassroots volunteer efforts from the people of the Tucson Mountains, including a major effort to get out the vote in support of the May open space bond measure. The best is yet to come as our children and grandchildren enjoy this pristine land for years to come. We look forward to working with Pima County Parks and Natural Resource staff in the park planning process for Sweetwater," said Debbie Hecht, who along with Paula Chronister co-chaired the Sweetwater Nature Preserve Committee.

The Sweetwater Preserve Committee wrote the Sweetwater Report starting the process in June 2000. TMA was advised during meetings with Supervisor Raul Grijalva (who was District 5 Supervisor at the time) and Chuck Huckelberry, Pima County Administrator to ask for help from the Trust for Public Lands. TMA raised over $30,000, which was used as part of the money to secure the option on the property. TMA volunteers worked many hours with the Friends of the Sonoran Desert to pass the 2004 Open Space Bond.

Sweetwater Preserve is the largest remaining undeveloped property in the eastern portion of the Tucson Mountains, located south of Camino del Cerro, north of Sweetwater and west of Camino de Oeste, just three miles outside of Tucson's city limits. In addition to providing for outstanding recreational uses by County residents, the property provides habitat for a number of vanishing species, for example the cactus ferruginous pygmy owl, desert tortoise, gila monster, lesser long nosed bat, grey fox, tiger rattle snakes and mountain lions. It also contains many thousands of young and mature saguaro cacti. Because of the diverse geology of the Tucson Mountains and uneven distribution of plants and vegetative communities in this area, the Sweetwater Preserve will provide additional protection for the estimated 30% of the botanical diversity in the Tucson Mountains that falls outside the boundaries of the Saguaro National Park West.

The preserved area contains Sweetwater Wash, a major watershed for the Tucson Mountains and a major wildlife connector between the National Park and the Santa Cruz River. Acquisition of the property has received endorsements from over fifty organizations, including National Park Service, U.S. Fish and Wildlife Service, the Arizona Sonoran Desert Museum, Tucson Audubon Society, the Coalition for the Sonoran Desert Protection, Arizona Open Land Institute, The Nature Conservancy, Southern Arizona Hiking Association, Pima Trails and the Sonoran Institute, among others.

Today, the Gila monster is celebrated for what he is: a unique, native Southwesterner whose infrequent appearances bestow a special blessing on the land and brighten any day afield. The animal's venomous nature is considered fascinating rather than sinister, and his bizarre reputation is regarded more as charming regional folklore than the product of Gothic nightmares. As one of the most brilliantly colored, yet least seen and understood inhabitants of the Sonoran Desert, the lizard has come to symbolize the desert's beauty and mystery. Let us hope the Gila monster will remain a source of such inspiration and be with us always.

— from Brown & Carmony, 1991
Gila Monster: Facts and Folklore of America's Aztec Lizard

DESERT TORTOISE (*Gopherus agassizii*).—This charismatic reptile is especially vulnerable to habitat disturbance, illegal collecting, and disease. Alien grasses that take root and spread from roadsides and housing developments foster desert fires. Fires injure and kill tortoises and degrade their habitat. Because females mature slowly and produce few young, the loss of just one animal per year can be catastrophic to a declining population. In Arizona, killing or collecting Desert Tortoises is illegal, but they are not federally protected at this time. Adults and juveniles are regularly seen within the Sweetwater Preserve.

ing team members experienced in political activism who have already established contacts). Many such meetings are required to keep the project in constant view (politicians, especially, often have short attention spans). Be certain that all public hearings are well attended by knowledgeable and well-spoken persons who support the project. Detractors must be out-voiced, and the best way of achieving this is to present overwhelming quantities of supportive evidence, which almost always wins over even the most loudly voiced opinions.

Step 5: Persevere

Challenging those who would rather see wildlife habitat turned into a resort or a housing project is never easy. Don't assume victory until the papers are signed. The hurdles are numerous and will sometimes seem insurmountable. However, with a well-designed and effectively implemented strategy and perseverance, grassroots conservation projects can succeed.

The Tucson Mountains support a surprising botanical richness.... No other desert range of similar size has such a large flora. One reason for the great richness is its topographical diversity ranging from the Santa Cruz River through valley floors and bajadas, rocky slopes, deep canyons, and a summit that is just above the desert in relict oak-grassland vegetation. The equal summer and winter rainy seasons contribute further to the number of plants; numerous species respond mainly to one or the other season. Lastly, because of its position on the wet eastern edge of the Sonoran Desert there are numerous elements coming in from the grasslands to the east.

— Mark Dimmitt

Chironius Attack!

César Luis Barrio Amorós

Fundación AndígenA, Apdo. Postal 210, Mérida 5101-A, Estado Mérida, Venezuela (cesarlba@yahoo.com)

Venomous snakes can be lethal. Unfortunately, many of us forget that even some non-venomous snakes usually considered to be harmless can, in fact, be very dangerous. Accidents with large boas and anacondas (especially the latter) can be nasty and potentially life threatening. One of my jobs has been to catch anacondas and show them to tourists. Over time, one gets to know (or believes that one knows) these animals, and one develops tricks to avoid bites. Sadly, in certain situations, even with a lot of care, accidents can happen. When they do, one does not quickly forget an anaconda bite. These massive animals live in water, and their mouths and saliva are full of bacteria. Even a relatively inoffensive bite from a baby anaconda can quickly become infected and produce a lot of pain, and the bite of an adult is another matter entirely!

Another snake that can be really aggressive and potentially dangerous is the Common Savanna Racer, *Chironius carinatus*. These snakes usually are encountered crossing roads, along paths, on beaches, or along rivers in bushes. I've been bitten by more than just a few. Bites are very bloody, but usually no deeper than a cat scratch. On those (unfortunately frequent) occasions when I have been bitten while capturing one of these aggressive snakes, I take advantage of the opportunity to show people that they are non-venomous and pose little danger — until now…

The author with the *Chironius carinatus* that attacked his face. *Photograph courtesy of Arassari Trek/Fundación AndígenA.*

I have had two previous encounters with *Chironius* attacking my face, in the rainforests of the Guiana Shield. On the first occasion, I was handling a *Chironius fuscus* in front of a group of gold miners, with the intent of showing them that it was "harmless." I let go of its neck for only a second and it immediately attacked my nose. At the time, I thought it was funny, but some of the garimpeiros almost died of heart attacks! The second time, I had seen a large, red *C. scurrulus* crossing a forest path. I ran and caught it by the tail — and the next view I had was the open mouth approaching my face at an amazing speed. I immediately released the snake and luckily avoided a bite.

Neither of those episodes was anything like my most recent encounter with a *Chironius* in Los Llanos. Rather than providing an amusing tale, that experience was quite serious. I had seen the tail of a big *C. carinatus* disappearing into a pile of dead logs along the bank of the Apure River. I grabbed the tail and was showing the snake to a group of tourists before securing its neck — big mistake! I never would have imagined that its tail was strong enough to support its entire body, nor that an apparently panicked snake could effectively identify a particular target. I had considered the two previous attacks to my face as coincidental, mainly because bites resulting from handling these snakes at serpentariums were directed at my hands and arms, but I now realize that was due to the fact that only a small portion of the total length of those animals was free.

I now believe that *Chironius* attacks the face strategically. With at least 1.40 m of the animal's total 1.60 m free, it had the potential to reach my face — and it did! It twice attacked the same eye, and after that my side and my arm, all in the few seconds before I finally secured its neck. Of course, I closed my eye, and that saved my sight. Even so, the bite was frighteningly effective. If *Chironius* had longer teeth, such as those of an anaconda or a treeboa, they would have easily penetrated the eyelid and severely damaged my eye. I was extremely fortunate not to lose the eye, and I can only hope that I will be far more cautious the next time I handle a monster *Chironius*!

All Savanna Racers, like this Venezuelan *Chironius carinatus*, are quick, aggressive snakes that bite readily when handled. *Photograph by the author.*

IUCN-SSC Iguana Specialist Group Meeting

15 November 2004

The IUCN-SSC Iguana Specialist Group met in Suva, Fiji in November 2004, with the development of a Conservation and Management Plan for the Fijian Crested (*Brachylophus vitiensis*) and Banded (*B. fasciatus*) iguanas as a major goal. Peter Harlow, Taronga Zoo (Australia) was responsible for planning and organizing the meeting.
Following are selected reports from that meeting, some of which have been updated by authors since they were originally submitted to the ISG.

SESSION 1: TAXON UPDATES

2004 Research Update for *Cyclura cychlura cychlura* and *C. c. figginsi*

Andros Iguana (*Cyclura cychlura cychlura*).—Research in 2004 focused on adult reproductive ecology and hatchling survivorship, dispersal, and habitat preference. Every one to three days, we were able to monitor nests in termite mounds that were known from previous years to observe nesting behavior, verify ovipositioning dates, and document nest-site fidelity. We are confident that nesting did not occur before the May investigation since the monitored termite mounds were not yet in use or defended by females. The first nest of the season was discovered on 8 May. We know of one nesting event after our 13 June departure date. Nesting females ranged from 31–46.5 cm SVL (mean = 38.6 cm). A total of 22 nests were excavated, with clutch sizes ranging from 5–18 (mean = 10.1). Of these nests, six females nested in 2003; one of these nested in a different mound after the attendant termite colony from 2003 died. Another female, after partially destroying her 2003 mound while test digging in 2004, oviposited her clutch in sand. We also uncovered an additional clutch oviposited in sand from the same study area. Egg predation by crabs (*Cardisoma guanhumi*) was confirmed from three nests and suspected in four additional nests. The entire clutch was lost in each of these instances.

Andros Iguana (*Cyclura cychlura cychlura*). *Photograph by Charles R. Knapp.*

Hatchlings ranged from 8.1–10.6 cm SVL (mean = 9.6 cm) and 31–55 g BM (mean = 42.4 g). Thirty-six hatchlings had radio transmitters affixed and were tracked for 18–28 days. Twenty-one of these hatchlings were confirmed to have been eaten by snakes (*Alsophis vudii* and *Epicrates striatus*), one was suspected to have been taken by a bird, another by a fish, and six were unknown, with stationary underground transmitter signals. A single-day overwater dispersal distance of 2.3 km was recorded for one hatchling. Of the eight hatchlings alive at the end of the study, six were observable in mangrove habitat > 50% of the time.

We heard anecdotal accounts of people selling up to 40 iguanas in April 2004 from a hunting camp on the west side of the island. We also were told of a different group of people selling 10 iguanas from the same camp at the end of 2003. We investigated the camp in May and discovered increased signs of activity from our previous 2000–2003 visits. Usually, iguanas are taken back to settlements to be sold alive, but we found evidence that iguanas were killed at the camp. The ground was literally covered with shed iguana skin, and we found bones from a minimum of three iguanas. We returned to the same camp in August and noticed that it had been used again after our May visit. Although people use the camp as a base for multiple purposes such as crabbing, sponging, fishing, and collecting wood, iguanas are always taken when the opportunity allows. Therefore, the increased activity at the camp concerns us because

it represents more iguanas being taken from the wild. Although other transitory camps are used, this camp is a permanent fixture on the west side of Andros, and we recommend that it be dismantled and the perpetrators warned that illegal activity will not be tolerated.

We were able to visit South Andros and Mangrove Cay High Schools in September and present iguana education posters that incorporated artwork from the students. We were well received, as were the posters, and additional presentations will be made on North Andros in 2005.

Pasture Cay, Exumas.—We were able to visit Pasture Cay for only one day in May to study the translocated population of *Cyclura cychlura figginsi*. Of the 16 original founders (11 males, 5 females), we captured seven males and three females. Two additional animals were seen but eluded capture. Since the 2002 translocation, two male iguanas are confirmed dead (2003), and two were not seen or captured in 2004. We are concerned for the largest remaining males on the island. When translocated in 2002, the two males captured this past May weighed > 7 kg. In May 2004, the males had lost 2.9 and 3.4 kg of their initial BM and did not appear healthy. We heard from multiple sources at the Exuma Cays Land and Sea Park (ECLSP) that the winter was unusually cold. John Iverson described the same conditions and reported finding an unusually high number (27) of iguana carcasses. We also found the first iguana carcass from the translocated iguana colony from Alligator Cay in the ECLSP.

The remaining iguanas gained up to 1.15 kg in mass from 2002 and appeared healthy and active. At least 20 burrows were observed in the sand surrounding the island. A minimum of three second-year hatchlings and two first-year hatchlings were detected on the island. We captured one second-year iguana with a BM of 118 g and SVL of 13.7 cm. Rats were again trapped from the island, confirming their presence.

Lee Stocking Island.—Sandra Buckner and Chuck Knapp visited Lee Stocking Island to perform a habitat suitability analysis for a potential iguana (*C. c. figginsi*) translocation. The details of the study are outlined in a report drafted by both SB and CK. That habitat is suitable for iguanas and we support a translocation based on our recommendations outlined in the report.

Charles R. Knapp
John G. Shedd Aquarium and University of Florida
Audrey Owens
University of Georgia
Coleman Sheehy, III
University of Florida

Anegada Iguana (*Cyclura pinguis*): 2004 Update

Anegada Iguana (*Cyclura pinguis*) marked before release. *Photograph by Rick Hudson.*

For the third year, the Anegada Iguana project received funding from the IIF to support fieldwork related to the head-start-and-release program. Additional funding for the project came from the Morris Animal Foundation to support health screening of headstarted animals, and the IUCN/SSC Sir Peter Scott Fund through the ISG for fieldwork, educational initiatives, and publication of a Species Recovery Plan resulting from a workshop held in Miami in April 2004 (see *ISG Newsletter* 7(1)).

The first release of headstarted Anegada Iguanas took place in October 2003, with the release of 24 animals ranging from 4–6 years of age and weighing 750–2050 g. These animals have been tracked every month or two since their release, and 20 of the animals (83%), including the five smallest animals released, survived their first year in the wild (see *ISG Newsletter* 7(1) for further details). In October 2004, a second group of 24 headstarted animals were returned to the wild using an identical release strategy to that employed in 2003 — except that the minimum size of released animals was reduced from 750 g to 550 g in an effort to determine the minimum size of iguanas able to coexist with feral cats. As in 2003, 12 iguanas (6.6) with surgically implanted radiotransmitters were released at each of two study sites located in the core iguana area: Windlass Bight (coastal sandy scrub) and Middle Cay (interior limestone woodland). To date, one animal released at Middle Cay has died (only the transmitter was recovered). The other 23 animals released this October are doing well and have established home areas within 400 m of their respective release sites. At two months post-release, animals have increased in mass by 5–260g.

In July, a single nest was located in the Windlass Bight area and fenced off. Unfortunately, only two hatchlings were recovered from the nest in October, as only three of the eight eggs laid resulted in emerging juveniles and one of these escaped. However, five additional hatchlings were captured from various locations in October. All seven animals were transferred to the headstart facility managed by the BVI National Parks Trust.

We are grateful to Rick Hudson, Sandy Hurlbut, AJ Marlar, Nina Palmer, and Bonnie Raphael for health screening and surgical implantation of transmitters. For assistance in the field, we thank Carol Andersen, Cynthia Bennett, Kim Harding, Elyse Kitterman, Kerri Mitchell, Lee Pagni, and Joe Wasilewski.

Glenn Gerber
Zoological Society of San Diego
Kelly Bradley
Dallas Zoo

Booby Cay Report, *Cyclura carinata bartschi*

A trip to Mayaguana and Booby Cay, Bahamas, was undertaken in October 2004 in order to assess the islands post-hurricanes Francis and Jeanne. Sustained winds of 140 mph were reported and parts of the islands had been inundated by storm surges. Damage was minimal, as it seems that the people are well prepared for hurricanes. A small percentage of vegetation (miscellaneous trees and shrubs) was destroyed. Iguanas were abundant as on previous trips and, during the course of one day, 65 animals of all size classes were observed, including juveniles. Three beaded animals were seen. The chronic goat problem remains, with goat tracks covering the entire Cay.

Booby Cay Iguana (*Cyclura carinata bartschi*). *Photograph by Joe Wasilewski.*

Major development is planned for Mayaguana. A new airport terminal is near completion. Approximately 2500 second homes are planned along with a hotel/resort with up to 3500 rooms. Presently, the entire population of Mayaguana is no more than 400 people. The plans seem ambitious, but Mayaguana is the last frontier in the Bahamas. The airport expansion already exists, with the terminal far exceeding present needs. If development proceeds as planned, visits to Booby Cay will likely increase in frequency as will the likelihood of disturbance to the iguanas directly or through the introduction of feral predators.

Future Goals include: (1) Analysis of blood samples, (2) Continuation of transect surveys, (3) Further meetings with Bahamian officials to address the goat problem, and (4) Discussion and feasibility assessment of gaining National Park status.

Joe Wasilewski, Steve Conners, and John Bendon

Cuban Iguana (*Cyclura nubila nubila*) Update

The Population and Habitat Viability Assessment (PHVA) meeting for the Cuban Iguana was held at the Havana Zoo, Cuba, on 20–23 January 2003. Thirty participants representing 14 institutions formulated a plan for conserving the Cuban Iguana. Cuban Iguanas do not represent a direct threat or any health, hygienic, or epidemiological problems for humans. They are very important for biological, scientific, and cultural reasons. Their conservation requirements coincide with the protection of other animal and plant populations, especially in dry coastal forests. Conservation of a healthy coastal ecosystem, its biological diversity, and its natural beauty has great importance, not just ecologically and culturally, but also economically. The Cuban Iguana is an ideal flagship species (as the object of admiration, respect, rightful patriotism, and human care) for conservation measures.

Pepino is the most important founding male Cuban Iguana (*Cyclura nubila nubila*) in the program at the Prague Zoo. *Photograph courtesy of the Prague Zoo.*

During a postconference stay in 2003, I visited some important localities on the Cuban mainland, from the Guanahacabibes in the west to the Sierra Maestra in the east. The present state of Cuban Iguanas provides some hope for the animal's survival — assuming that its range will remain protected against ruthless exploitation and that people provide the species with needed protection and support.

PHVA results showed the necessity for additional research. I have taken responsibility for helping to fulfill some research tasks, and have submitted a proposal for an international project to implement a phylogeographic analysis of wild populations on Cuba and its satellite islands, an assessment of intrapopulational genetic variation in the largest wild populations, an assignment of animals in the principal captive lineages to their geographic origin, an evaluation of genetic variation and conservation value of current breeding stocks, a determination of the principal behaviors (social structure and activity patterns), growth rates, reproductive effort, and other life history traits in captive populations, and relationships between these traits and responsible variables (origin, inbreeding, mother's condition, feeding strategy, etc.). The realization of the project on an international level depends on finding a way to export samples for genetic analyses from Cuba. However, in 2004, a similar national project was initiated at Charles University in Prague, Czech Republic, using specimens held in European herpetological collections. At present, samples are being collected and initial results and first publications should appear during 2005–2007.

According to the decision of the Amphibian and Reptile Taxon Advisory Group of the European Association of Zoos and Aquaria, the European captive population should be intensively managed as an EEP (European Breeding Program), which I will coordinate.

Ivan Rehak
Prague Zoo

Ricord's Iguana (*Cyclura ricordii*): Species Recovery Plan Update

To develop a regional conservation strategy for the critically endangered Ricord's Iguana, a five-year (2002–2007) Species Recovery Plan was drafted under the auspices of the ISG in November 2002, and a local Ricord's Iguana Recovery Group (RIRG) was formed and assigned the task of implementing the plan. The overall goal was to prioritize the conservation actions necessary to ensure the long-term survival of Ricord's Iguana throughout its natural range. In response to one of the objectives in the 2002 SRP, a meeting was organized to revisit the SRP and to adjust priorities and recommendations based on this new information. Hosted by ZooDom, a group composed of local RIRG and ISG members met on 27–28 July 2004 to conduct a second workshop to review progress and update the SRP. Prior to this meeting, some participants were hosted by Grupo Jaragua, with which they traveled to the Barahona Peninsula, visiting a newly identified "hotspot" for *C. ricordii* near Pedernales. The discovery of this robust population has important implications for the conservation of this endangered iguana, and was a decisive influence on the direction of the revised SRP. Future work in this region will focus on two main components: capacity building and field research. Plans to cultivate support among the local community (by creating economic opportunities) coupled with a public awareness campaign are taking shape, and preliminary efforts are already underway by Grupo Jaragua to protect this area under the local municipality. A small grant from Riverbanks Zoo Conservation Fund to investigate the socioeconomic impact of Ricord's Iguana conservation in this area was awarded to Grupo Jaragua and Indianapolis Zoo in early 2004. Field research will be directed at gaining a clearer understanding of the biology of *C. ricordii* (nesting ecology, feeding and habitat requirements, threats) in order to better design an effective conservation strategy. The other priority region for habitat surveys is the south shore of Lago Enriquillo, where a population of Ricord's Iguana is suspected to exist, but has yet to be confirmed. The population on Isla Cabritos continues to be an important study population, and Indianapolis Zoo and ZooDom will continue the transect and habitat work they started there in 2003. Baseline biomedical work on all three populations, including genetics, is also recommended. Field studies should include investigating the relationship with the sympatric *C. cornuta*.

The Education objective, including curriculum development and local capacity building initiatives in the Pedernales region, is moving ahead, thanks to two grants totaling $34,000 from the U.S. Fish & Wildlife Service and AZA's Conservation Endowment Fund to the Indianapolis Zoo. Both Grupo Jaragua and ZooDom will be involved with implementing this objective, which strives to create awareness and encourage participation and support among the local community for protecting the newly identified "Pedernales hotspot for *C. ricordii*."

The Captive Management objective recommends new directions for the ZooDom program. For *C. ricordii*, the emphasis will shift to applied research to better define the factors necessary for successful breeding and management. Incorporation of new bloodlines from the wild should be undertaken periodically using only hatchling or juvenile specimens. It was recommended that the Rhinoceros Iguana breeding and release program should be scaled back and phased out.

Finally, a strategy for approaching external funding sources over the next two years was developed. This includes the International Iguana Foundation, U.S. Fish & Wildlife Service, Indianapolis Zoo, AZA Conservation Endowment Fund, and Disney's Wildlife Conservation Fund.

Many thanks to Alfonso Ferreira and ZooDom for hosting the meeting this summer, and to Sixto Incháustegui and Grupo Jaragua for their remarkable hospitality during the pre-meeting field trip to Pedernales.

Jan Ramer
Indianapolis Zoo
Rick Hudson
Fort Worth Zoo

Status of the Blue Iguana (*Cyclura lewisi*) Recovery Program

In 2004, all but one of 84 viable eggs hatched successfully, despite complications imposed by Hurricane Ivan in September. During July and August, "Team Blue," assembled by the IRCF and comprised of 13 volunteers from the U.S., U.K., and Cayman Islands, including representatives from the Indianapolis, Tulsa, Knoxville, and Phoenix zoos, built 102 juvenile and 30 hatchling cages. Subsequently, Fred Burton and local

Ricord's Iguana (*Cyclura ricordii*). *Photograph bby Kacie Ehrenberger.*

Grand Cayman Blue Iguana (*Cyclura lewisi*). *Photograph by John Binns.*

volunteers constructed 25 iguana retreats used to encourage the fidelity of released iguanas to specific release site locations in the Salina Reserve, where a second reintroduced population is being established now that the QE II Botanic Park is nearing carrying capacity. To date, 13 females have been released and appear to be doing well. The release effort will continue into January.

Dorothea Schwab of Wild Wings Vision continued filming for the Blue Iguana DVD, "Too Blue to Lose." Film of Hurricane Ivan's aftermath and effects on iguana habitat will be edited into the original storyboard. One version of the film aired on the VOX (documentary) channel in Germany on 27 November 2004 and reached an audience of 1.1 million. A more expanded version will be sold internationally along with an English-language version (funded by Deutsche Offshore – Cayman Ltd.); both are expected to be available in fall 2005. Proceeds from the sale of the DVD will go to the Blue Iguana Recovery Program.

Immediately after Hurricane Ivan passed, Fred Burton, Matt Goetz (Durrell Wildlife Conservation Trust), and Nick Lewis (private sector), made multiple attempts to reach the Botanic Park, but the south road was too heavily damaged and debris-strewn to allow passage. Eventually, emergency services bulldozed through the debris and allowed the team to make their way close enough to hike into the park. Miraculously, although heavily flooded, the facility was intact and all of the iguanas had survived and appeared healthy. Subsequently, cages have been re-outfitted with retreats, rocks, palm leaves, and branches. Also, construction of six subadult cages to make smaller cages available for hatchlings and new cement pens was completed.

Although the overall progress made in 2004 was promising and difficulties associated with the hurricane may actually provide some opportunities for improving facilities and building support, concerns remain. The greatest of these is in finding or generating the funds to pay warden and keeper wages, because, without them, management of a facility with 200+ captive animals will be impossible.

John Binns
International Reptile Conservation Fund
Fred Burton
National Trust for the Cayman Islands

Jamaican Iguana (*Cyclura collei*) Recovery Project, 2004 Update

Predator Control.—John Kunna and Rick Van Veen completed the eighth year of pitfall trapping, monitoring the effect of 'mongoose-trapped' and 'non-trapped' areas on population structure and abundance of ground lizards and other animals within the Jamaican Iguana's known distribution range. Exotic mammal trapping (see Table 1) continued through the year (Jan–Dec) along with an increased effort toward controlling feral cats, dogs, and pigs in the iguana nesting areas. Preparations are also underway to produce locally made mammal traps for the expansion of the current trap grid.

Predator/Pest	Number Extinguished
Mongooses	61
Cats	7
Rats	46
Goats	3
Dogs	3
Pigs	25

Table 1. Body Count (Feb–Oct 2004)

Reproduction and a New Population.—Thirteen females were observed nesting at the two known communal nesting sites; however, only seven clutches hatched, producing 64 hatchlings, all of which were PIT-tagged, weighed, and measured. Nineteen of the 64 were radio-tracked, 19 went to the Hope Zoo to join the headstart program, and the rest were released. An additional 13 were found to have hatched at a new nesting site, and two other potential nesting sites were also found. A new population was confirmed in the Wreck Bay area, along with anecdotal evidence of a further communal nesting area. Four hatchling Jamaican Iguanas also were produced in captivity at the Hope Zoo from a small colony of young adults.

Management Issues.—Dr. Byron Wilson now heads the field project and has continued to expand project interest with regular student field trips and collaboration with other researchers (i.e., feral pig and mongoose parasitologists). Management of the Portland Bight Protected Area (PBPA) has now been resolved, with the National Environment Agency (NEPA) delegating the management authority of the Hellshire Hills and Goat Islands to the Urban Development Corporation (UDC). Preliminary discussions with UDC regarding collaboration, conservation, and preservation of the PBPA appear very positive.

Radio-tracking Hatchling Iguanas.—Nineteen iguana hatchlings were radio-tracked between 2 September and 2 November. At this point, six remained alive, the fate of three is unknown, and the remaining ten radios were retrieved without the animals, suggesting that they are likely to have been victims of exotic predators. On three occasions, mongooses were observed actively searching retreat sites that were in use by hatchling iguanas. We finished with dispersal data for 15 animals and home range data for 11 animals. A dietary list of 25 plant species was compiled,

Jamaican Iguana (*Cyclura collei*). *Photograph by John Binns.*

and, of these, 3–4 species of vines appeared to be most important. Retreat-site fidelity was strong, and retreat-site selection appeared distinctly uniform; hatchlings preferred half-fallen dead hollow trees, 6–15 cm in diameter, with a northwesterly aspect. No doubt these are the same resources sought by illegal forest users (charcoal burners).

Rick Van Veen and Byron Wilson
University of the West Indies

Turks and Caicos Iguana (*Cyclura carinata carinata*): Research Update

In addition to ongoing support from the San Diego Zoo, grants for the Turks and Caicos Iguana project were received through the IIF from the Disney Wildlife Conservation Fund and the Steve and Carol Weinberg Foundation. Disney funds are being used to support fieldwork, educational initiatives, and completion, publication, and implementation of the Turks and Caicos Iguana Conservation and Management Plan (CAMP) drafted at the 2003 ISG meeting in Providenciales. Lorna Slade, a UK conservationist residing in the TCI, has been contracted to finish the CAMP document and begin implementation. The plan is nearly complete now and scheduled for publication in early 2005. Lorna recently implemented a small-scale trapping program for feral cats on Little Water Cay with assistance from the Turks and Caicos SPCA and the TC National Trust, and a $2000 contribution from a local developer (Johnston's). In partnership with the NGO Island Conservation, additional funds are being sought to implement an island-wide cat eradication program to safeguard this important population.

Funds received from the Weinberg Foundation are being used to complete nutritional analyses of food plants, dietary analyses of scats, and construction of a detailed habitat GIS for each of the six islands that constitute the translocation program (source islands: Big Ambergris Cay and Little Water cays; reintroduction islands: French, Bay, Middle, and Six Hills cays). Each of the translocation and source cays were visited in May to collect data for ongoing studies of survival, growth, reproduction, habitat use, nutrition, and diet. In addition, vegetation surveys were conducted on each cay to quantify the abundance and distribution of plant species and aid the construction of a habitat GIS. In June and August, a nesting study was undertaken on Little Water Cay to quantify reproductive parameters. Twenty nests were monitored during the study, but fieldwork was terminated before all the nests hatched due to Hurricane Frances. Joe Burgess, Todd and Kym Campbell, Mike Fouraker, Rick Hudson, Sue Keall, Andy Keech, Jeff Lemm, Karen Lisi, Bryan Manco, Greg McMillan, JP Montagne, Ernst Rupp, Catherine and Dan Stephen, Tarren Wagener, and George Waters provided valuable field assistance in 2004.

In spite of the above advances, a significant setback for TCI iguana conservation occurred this year with the announcement of a proposed large-scale development for the Bay Islands National Park. The park, which will be declassified if the development plan is approved, includes two islands with iguanas:

Turks and Caicos Iguana (*Cyclura carinata carinata*). *Photograph by John Binns.*

Major Hill Cay and East Bay Cay. The latter cay supports between 5,000 and 10,000 iguanas, the largest extant population outside of the Ambergris Cays (the largest of which is presently under development). Worse still, the development plan calls for a causeway connecting the cays to North Caicos, providing easy access for cats and dogs and virtually ensuring the extirpation of iguanas. Our strong opposition to this development has been voiced.

Glenn Gerber and Allison Alberts
Zoological Society of San Diego

St. Lucia Iguana (*Iguana iguana*) Update

Because the Saint Lucian Green Iguana is very difficult to locate throughout its range, population censusing efforts have been concentrated at the two known nesting beaches, Louvet Beach and Grand Anse Beach. From late February through mid-May, nesting indices were recorded in order to generate a nesting population index for future monitoring efforts. Five active nests were excavated with a maximum of 21 eggs (range 17–21). This substantiates the use of hatchling-emergence surges (mean 19.5) to estimate nesting female population size. Three females radio-tagged at Louvet Beach in March were followed back to their home ranges (1.61 km, 1.57 km, and 80

St. Lucia Iguana (*Iguana iguana*). *Photograph by Matthew Morton.*

m). A female radio-tagged in September 2003 migrated >2 km to Louvet Beach in May.

Hatchlings were counted at each beach from mid-May through mid-August (est. 1300 at Louvet Beach, est. 140 at Grand Anse). Gender, body measurements, physical appearance, and emergence time were recorded for each hatchling. Forty-seven hatchlings were subjected to racing and climbing trials to test the effects of two transmitter sizes (0.62 g and 1.2 g) on performance. Slight increase in mean race time correlated with increased transmitter size, although test differences were not statistically significant. Two transmitter sizes were used to radio-track 19 hatchling iguanas at Grand Anse and Louvet. One male and two females carrying small transmitters traveled over 1 km. Of these, one female traveled 1.56 km, crossed a ridgeline, and settled near an adjacent beach. In contrast, a male with a large transmitter traveled 400 m to a good food source. Ten animals slipped their transmitters during the study. Three of the recovered transmitters showed slight damage that could indicate predation. Two recovered transmitters were glued dorsolaterally to new hatchlings, a method that we recommend for future studies.

Karen S. Graham
Sedgwick County Zoo
Matthew Morton
Durrell Wildlife Conservation Trust

Distribution, Natural Reserves, and Conservation of Mexican Ctenosaurs

The protection of Spiny-tailed Iguanas (genus *Ctenosaura*) is an ongoing issue in Mexican conservation programs and politics, since several species are subject to ongoing threat from native rural communities. This project attempts to evaluate which portions of the ranges of Spiny-tailed Iguanas warrant protection as nature reserves.

Percentages of total distribution areas contained within reserves were estimated by modeling potential distribution areas using GARP analysis (Genetic Algorithm of Rule Set Prediction) for six Mexican species of *Ctenosaura: C. acanthura, C. hemilopha, C. clarki, C. macrolopha, C. pectinata,* and *C. similis*. Models were constructed using georeferenced locality data from museum collections and literature. Overprediction in GARP models was eliminated based on the presence of known collecting sites within recognized natural regions or subregions. To estimate the percentage of area for each species included within the reserves, we calculated the number of pixels predicted by 10 GARP models (where the presence of the species is most probable) in the total distribution areas of each species, and the pixels occupied by the species within the natural reserves. The percentage of pixels in the whole distribution areas included within reserves is considered an estimate of how much of the species' range is well-protected in the long term.

Results show that all species in the study are scarcely protected, since only 10.0% or less of their total ranges are included within reserves. *Ctenosaura similis* is the best-protected species, with 10.0% of its Mexican distribution in natural reserves

Black Iguana (*Ctenosaura similis*). *Photograph by John Binns.*

(information excludes distribution data in Central America). Only 2–4% of the ranges of *C. hemilopha, C. acanthura, C. macrolopha,* and *C. pectinata* are in natural reserves. The worst case is *C. clarki*, which currently receives no long-term protection as no portion of its range is within natural reserves. This species is listed as "threatened" by the Mexican Red List (NOM-ECOL-059-2001) and is endemic to the Balsas Depression. The lack of natural reserves within this area will affect not only *C. clarki*, but other endemic reptiles sharing that area. Humans throughout México commonly consume all large species of *Ctenosaura*. This poses a threat to all wild populations near human settlements. Protecting only 3.5% (average) of the iguanas' ranges would not be enough to preserve the necessary genetic diversity, and governmental conservation programs should focus on the creation of natural reserves and sustainable exploitation programs, rather than criminalizing the traditional use of Spiny-tailed Iguanas.

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SESSION 2: GENERAL REPORTS

Cyclura Studbook

The *Cyclura* studbook contains a record of all animals that have lived in US zoos and some non-zoo facilities. The current living population is (M.F.Unk):

Cyclura cornuta cornuta: 27.23.21 (71) in 20 zoos
Cyclura cychlura figginsi: 1.5 (6) at the Los Angeles Zoo
Cyclura nubila nubila: 7.7 (14) in 4 institutions
Cyclura nubila caymanensis: 1.0 at the Atlanta Zoo
Cyclura ricordii: 1.3.14 (18) at ZooDom (Dominican Republic)
Cyclura pinguis: 9.9 (18) at the San Diego and Miami Metro Zoos. The US population consists of 1.2 founders and 2.1 potential founders. Approximately 56 animals live in the

headstart facility on Anegada. Twenty-four were released in October 2003 and 24 were released in Fall 2004.

Cyclura collei: 8.11 (19) in 6 institutions. Approximately 32.25.61 (118) are living at the Hope Zoo in Kingston, including 24 hatchlings from 2003 and 19 from 2004. Six deaths were attributable to the recent hurricane, but an additional four were captive-hatched in the headstart facility.

Cyclura lewisi: 12.9 (21) in 9 U.S. institutions, 19.19.37 (75) at the Grand Cayman breeding facility prior to the 2004 hatching season. The U.S. population is currently represented by six founders and an importation of 5.5 animals scheduled for January 2005 will add an additional six founders. The Grand Cayman facility has 7.5 founders and 3.1.1 potential founders. Headstarting of juveniles from nests in the QEII Botanic Park continues with 52 collected in 2003 and 25 raised in 2002, which are scheduled to be released in December 2004.

Tandora Grant
San Diego Zoo, CRES

ISG Veterinary Advisor Update

A grant from the Morris Animal Foundation (MAF) provided three years of funding for the purpose of: establishing baseline health profiles of free-ranging iguanas, performing and establishing protocols for health screening of head-started iguanas, and providing training to local veterinarians. The grant covered five species of iguanas (*Cyclura lewisi*, *C. collei*, *C. c. stejnegeri*, *C. ricordii*, and *C. pinguis*) and involved veterinarians and veterinary technicians from the Wildlife Conservation Society, Indianapolis Zoo, Toledo Zoo, and Fort Worth Zoo.

Initially the health assessments consisted of: physical exam; blood sampling and analysis, including white blood cell count, packed cell volume, total solids, chemistries, minerals, and vitamin D; and fecal examination via direct and floatation methods for parasites and bacterial culture.

Samples obtained from free-ranging animals were more limited than originally anticipated. A total of four *C. lewisi*, 10 *C. pinguis*, 19 *C. collei*, 20 *C. c. stejnegeri*, and 23 *C. ricordii* samples were collected and analyzed. Samples collected from captive animals included 62 pre-release and 30 captive non-release *C. lewisi*, 49 pre-release and 25 captive non-release *C. pinguis*, 80 total captive *C. collei*, and 25 total captive *C. c. stejnegeri*.

In February 2004, Drs. Reichard, Ramer, Marlar, Lung, and Raphael met to compare data from all groups. Some of the conclusions regarding the health status of head-started animals are: (1) Rates of endoparasitism are low; the longer *C. lewisi* are held in captivity on dirt substrate, the more likely they are to have endoparasites; (2) Rates of *Salmonella* sp. in captive animals are low; and (3) No infectious diseases were identified in the animals sampled.

Health screening of headstarted animals needs to be done close to the time of release of those animals. Based on the findings of screens that have already been conducted, the health screening process of individual headstarted animals can be streamlined. A new protocol has been developed to reduce the number of laboratory tests needed and to perform all relevant tests for individuals on-site within days of release. The pre-release health screening protocol for headstarted animals is: (1) Perform a physical exam including weighing; (2) Collect whole, heparinized blood and perform a white blood cell count using the Natt and Herricks method and determine packed cell volume and total solids; and (3) Collect feces and perform a direct microscopic exam.

In order to monitor the collective health of captive animals, full work-ups need to be performed on 10% of the captive animals in the facility every year. Some of these can include pre-release animals. The testing includes white blood cell counts (Natt and Herricks), total solids, packed cell volume, direct and floatation fecal exam, fecal/cloacal culture, mineral and chemistry panels, and vitamin D determination.

In addition to the routine health screening, in 2003 and 2004, transmitters were surgically implanted intracoelomically in a total of 48 headstarted *C. pinguis*. Animals were released 10–14 days after the surgeries. Survival of the 2003 cohort at one year is 84% and 100% for the 2004 group at 60 days.

In addition to the testing done using MAF funds, two other species were sampled this year. WCS veterinarian Stephanie James performed health assessments on free-ranging wild Allens Cays Iguanas (*C. cychlura inornata*) during John Iverson's field season and Nancy Lung, veterinarian at the Fort Worth Zoo, did the same on free-ranging wild *Cyclura rileyi*. Funding was provided by WCS and the Smithsonian, respectively. This was significant in that health assessments have now been performed on all nine species of *Cyclura*. Final results and comparisons among species are pending.

A medical records survey was conducted via email request. Twenty-eight North American institutions responded, sending medical records encompassing 100 years, 380 medical records, 978 individual entries, and 110 necropsies. Six species of *Cyclura* were represented. Of the 114 occurrences of parasites, oxyurids and entamoeba were reported most frequently. Other parasites included external mites, strongyloides, trematodes, cestodes, mesocestoides, trichuris, physeloptera, coccidea, flagellates, balantidium, nycthotheris, and one possible cryptosporidea. Trauma (lacerations, fractures, lameness) accounted for 118 entries, and seven accounts of thermal burns and nine accounts of hypothermia were submitted. Infections (abscesses, pneumonia, and others) were recorded 89 times, including renal failure in 34 accounts, and 50 reproductive events (gravid, oophoritis, salpingitis, egg yolk peritonitis, and egg binding). Calcium/phosphorus/vitamin-D related problems (metabolic bone disease, tetany, and hypocalcaemia) were reported 32 times, anorexia and lethargy in 22 accounts, one report of bladder stones, and ten accounts of intestinal obstruction/obstipation/sand impactions. No attempts were made to apply statistics to the results.

Bonnie Raphael
Wildlife Conservation Society

SESSION 3: WORKING SESSIONS

Alliance for Zero Extinction (AZE)

The Alliance for Zero Extinction is an initiative led by a group of biodiversity conservation organizations to identify and protect the last remaining habitats for the world's most endangered species. The Alliance aims to stem species extinctions, beginning with terrestrial vertebrates whose populations and distributions are best known, and including other species as soon as sufficient information becomes available to assess their threat level. By starting with the species that are most endangered, the Alliance aims to create a front line of defense against extinction that will hold until broader scale conservation efforts can restore sufficient habitat to enable populations to rebound. The AZE mission is to pinpoint and conserve epicenters of imminent extinctions.

To be listed, an AZE site must meet three criteria: (1) *Endangerment.*—An AZE site must contain at least one Endangered (EN) or Critically Endangered (CR) species, as listed by the IUCN-World Conservation Union. (2) *Irreplaceability.*—An AZE site should only be designated if it is the sole area where an EN or CR species occurs, or contains the overwhelmingly significant known resident population of the EN or CR species, or contains the overwhelmingly significant known population for one life history segment (e.g., breeding or wintering) of the EN or CR species. (3) *Discreteness.*—The area must have a definable boundary within which the character of habitats, biological communities, and/or management issues have more in common with each other than they do with those in adjacent areas.

Both the ISG and IIF have signed an MOU with AZE and agreed to participate. It is in our best interest to have key iguana locales listed as AZE sites because those species then become eligible for funding through Conservation International's (CI) Critically Endangered Neotropical Species Fund. Already, and without the benefit of ISG/IIF input, the Jamaican Iguana program received funding from CI because the Hellshire Hills ecosystem is listed in the AZE database map. The group discussed other potential candidates for AZE listing, including the Grand Cayman Blue Iguana, Utila Iguana, and the Fijian Crested Iguana. The ISG will provide additional recommendations as the intricacies of the criteria for listing become better understood.

Iguana-friendly Development Guidelines

Ideas were discussed for drafting iguana-friendly guidelines for island countries pursuing land development. This initiative was formulated at the TCI Iguana CAMP. Topics and criteria for each are: (1) *Flora.*—Natural areas should be incorporated into development; inclusion of iguana food plants; no invasive plants used for landscaping; minimal use of exotics. (2) *Exotic Animals.*—Containment of pets, leashed dogs and no cats (guidelines tailored to a resort versus private homes); spay and neutering required; permanent identification and registration required; no pets during construction phase; no livestock or domestic fowl. (3) *Design.*—Minimal footprint; build into existing landscape; speed control, road signage, golf carts where practical (no ORVs); include footpaths and/or boardwalks to contain foot traffic; protection of nest sites and access to nest sites; work through homeowners associations where applicable. (4) *Conservation and Science.*—Interpretive materials, educational signage, brochures, opportunities to donate to conservation efforts; no feeding of iguanas, emphasize the danger to iguanas and people; provide training for staff members of resorts (include etiquette for visitors); establish conservation and impact fee (from mitigation funds?) and hold funds in bond in event that feral mammals invade and require eradication; allow (fund?) assessment by iguana biologist before construction; allow (fund?) ongoing biological monitoring during and after construction; enforcement of legislation with penalties for harassment or removal.

A Task Force consisting of ISG members Lee Pagni, Glenn Gerber, and Steve Conners was formed to expand these guidelines and screen existing guidelines for sea turtles for additional ideas.

Iguana Specialist Group and Fiji National Trust Co-Sponsor Conservation and Management Plan Workshop for Fijian Iguanas

On 10–11 November 2004, the IUCN-SSC Iguana Specialist Group and the Fiji National Trust co-sponsored a Conservation and Management Plan workshop for Fiji's native Crested (*Brachylophus vitiensis*) and Banded iguanas (*B. fasciatus*). The workshop was held on the Laucala campus of the University of the South Pacific, and was attended by 50 participants from both within and outside Fiji. The purpose of the workshop was to develop a comprehensive strategy to guide conservation of Fiji's native iguanas by identifying and prioritizing the actions needed to ensure their future survival. For Crested Iguanas, a series of key objectives was identified, including prioritization of islands most suitable for long-term survival, implementation of a comprehensive management plan for the Yadua Taba Crested Iguana Sanctuary, recommendations for field research on iguanas and their habitats, development of captive breeding and reintroduction strategies, and establishment of education, awareness, and ecotourism programs. For Banded Iguanas, about which much less is currently known, a research agenda was developed that focuses on collection of baseline data, genetic studies, and education needs. Results of the workshop will be published early next year.

Following the workshop, participants had the opportunity to visit a traditional Fijian village on Yadua Island, home to the custodians of the Crested Iguana sanctuary on nearby Yadua Taba. Following a traditional *sevusevu* ceremony, permission to visit the sanctuary was given, and participants had the rare treat of viewing an extraordinarily dense population of Crested

Fijian Crested Iguana (*Brachylophus vitiensis*). *Photograph by Joe Wasilewski.*

Iguanas in the wild. After returning to the main island of Viti Levu, the annual Iguana Specialist Group meeting was held in Suva on November 15. The meeting centered on planning discussions for a number of key taxa, as well as special sessions on public relations and the media, iguana friendly development guidelines, and funding priorities for 2005.

Fiji National Participants: Bill Aalbersberg (Institute of Applied Sciences, USP); Pita Biciloa (Yadua Taba Senior Ranger, National Trust of Fiji Islands); Ramesh Chand (Kula Eco Park, Korotogo); Indra Devi (National Trust of Fiji Islands); Elizabeth Erasito (National Trust of Fiji Islands); Linda Farley (Wildlife Conservation Society, South Pacific); Philip Felsted (Kula Eco Park, Korotogo); Gunnar Keppel (Department of Biology, USP); Craig Morley (Department of Biology, USP); Clare Morrison (Department of Biology, USP); Alifereti Naikatini (South Pacific Regional Herbarium, USP); Jone Niukula (National Trust of Fiji Islands); Rob Perry Jones (CITES, WWF Fiji); Luke Qiritabu (Department of Environment, Fiji); Avisaki Ravuvu (National Trust of Fiji Islands); Sereima Savu (National Trust of Fiji Islands); Manasa Sovaki (Department of Environment, Fiji); Apisai Tinakoro (National Trust of Fiji Islands); Marika Tuiwawa (South Pacific Regional Herbarium, USP); Teri Tuxson (Mamanuca Environment Society); Di Walker (Mamanuca Environment Society); Dick Watling (Consultant Biologist, Fiji); Praveen Wignarajah (Greenforce and National Trust of Fiji Islands).

International Participants: Allison Alberts (San Diego Zoo, USA); Joe Burgess (International Iguana Society, USA); Steve Conners (Miami Metro Zoo, USA); Robert Fisher (U.S. Geological Survey, San Diego, USA); Glenn Gerber (San Diego Zoo, USA); Karen Graham (Sedgwick County Zoo, Wichita, USA); Tandora Grant (San Diego Zoo, USA); Peter Harlow (Taronga Zoo, Australia); Stacie Hathaway (U.S. Geological Survey, San Diego, USA); Sara Hicks (Taronga Zoo, Australia); Rick Hudson (Forth Worth Zoo, USA); Scott Keogh (Australian National University, Australia); John Kinkaid (San Diego Zoo, USA); Wendy Kinsella (Taronga Zoo, Australia); Charles Knapp (Shedd Aquarium and University of Florida, USA); John Kunna (Jamaican Iguana Recovery Project, Jamaica); Jeff Lemm (San Diego Zoo, USA); Bonnie Raphael (Wildlife Conservation Society, New York, USA); Ivan Rehak (Prague Zoo, Czech Republic); Victor Reynoso (Instituto de Biologia, Ciudad Universitaria Mexico, Mexico); Jennifer Taylor (NSW National Parks and Wildlife Service, Australia); Rick Van Veen (Jamaican Iguana Recovery Project, Jamaica); Joe Wasilewski (International Iguana Society, USA).

Crested Iguana (*Brachylophus vitiensis*) on the beach at Yadua Tada, the Crested Iguana Sanctuary, in the Fijian Islands. *Photograph by Allison Alberts.*

PROFILE

Rick Hudson: A Hero for Iguana Conservation

Allison Alberts

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

Rick was born in Roanoke, Virginia, in 1954, and grew up nearby in the small town of Stuart in the heart of the Blue Ridge Mountains. From the very beginning, he was adamant that he would be a zoo man. His earliest childhood memory was standing in front of the hippo exhibit at the National Zoo in Washington, D.C. when he was four and getting stung by a bee. Always a catalyst for action, twelve-year old Rick opened his very own backyard "Woodland Zoo," featuring local lizards, frogs, turtles, salamanders, and other assorted creatures. The operation attained local fame in his native Patrick County, even leading to a feature article in the local newspaper in 1966. The article quoted Rick as saying that, when he grew up, he aspired to "become a naturalist and work in a real zoo" — and that's exactly what he did. Showing an uncanny aptitude for creative fundraising that I'm fairly certain will last a lifetime, Rick once admitted to me that he supported his mini zoo by charging a quarter to curious kids wanting to watch the rabbits … well, you get the idea.

Rick and his "mini-zoo" in 1965. *Photograph by R.D. Hudson.*

After graduating from the University of Richmond with a degree in Biology, Rick's dream of a zoo career was realized in 1980, when he joined the professional staff of the Fort Worth Zoo. There he served as Assistant Curator of Reptiles for 20 years, building a model program that was to become widely admired throughout the international zoo community. Rick's tenure in the herpetological department was guided by an enduring philosophy that recognized the need to link captive populations to their wild counterparts in order to achieve the greatest conservation impact. As a result, the remarkable collection at Fort Worth was integrally tied to field conservation programs around the world, including chameleons on Mt. Kenya, geckos, boas, and chelonians in Madagascar, arboreal alligator lizards (genus *Abronia*) in southern México, and Komodo Dragons in Indonesia. Nowhere, however, was this philosophy more effectively put into action than in the islands of the Caribbean.

Rick first visited this unique and beautiful region in 1977 with a trip to Jamaica. It was no less than love at first sight. Since then, his appreciation and affection for these islands, their natural communities, their unique cultures (did I mention cuisine?), and most of all their majestic iguanas, has only grown. He has had the good fortune to work with Rock Iguanas (genus *Cyclura*) not only in Jamaica, but also in the Cayman Islands, the British Virgin Islands, Cuba, the Dominican Republic, Puerto Rico, the Turks and Caicos Islands, and the Bahamas. By Rick's account, the DR is his all-time favorite because of the rich cultural experience and warmth of the people.

Initially, Rick's contributions were realized through his capacity as Chair of the American Zoo and Aquarium Association's Lizard Advisory Group from 1991–2003, and as Coordinator of the Rock Iguana Species Survival Program from 1996 to the present. In these roles, he has served as a tireless organizer, involving over 25 U.S. zoos in such varied activities as education, field research, captive propagation and reintroduction, technology transfer, and genetic and nutritional research, not to mention generating over $400,000 to support iguana conservation. That so many zoos have become committed at such a remarkable level attests to Rick's innate ability to bring people of diverse backgrounds together and inspire them to achieve a shared vision.

I first met Rick in 1992 at an IUCN Conservation Breeding Specialist Group (CBSG) workshop in Vancouver. The

Rick was completely "disarmed" by this young Javan Gibbon at the Taman Safari Wildlife Park in Bogor, Indonesia (taken while on his honeymoon in 1994). *Photograph by Lis Hudson.*

goal of the workshop, led by the late Ulysses S. Seal, then head of CBSG and one of Rick's most influential mentors, was to develop a Conservation Assessment and Management Plan for iguanid and varanid lizards. Although I had previously conducted ecological research on Desert and Green iguanas, I was a novice to lizard conservation and relatively new to the people and issues involved. Rick welcomed me warmly and assured me that I had a contribution to make. So began a friendship that would steer my life in a new direction. Over the next two days, we tried in vain to fill in Excel® spreadsheets with data about species distributions, population trends, and threats to survival. We were finally forced to admit how woefully little information was available for so many species, especially iguanas. A need to organize researchers and managers to gather the expertise needed to help guide and prioritize conservation efforts was clearly evident — and Rick had the skills and drive to do it.

The next two years were pivotal for Rick. He cites two inspirational experiences that served to define his future career path. Sitting in a headstart facility at the Hope Zoo, surrounded by young Jamaican Iguanas (*Cyclura collei*), watching their interactions, and then later that summer at Guantanamo Bay, Cuba, observing a dense congregation of habituated Cuban Iguanas (*C. nubila*), something clicked, and the connection was so visceral that he remembers thinking, "You know, this is worth dedicating your life to. This is where I need to be."

Rick assisting with health screening of a Grand Cayman Blue Iguana in November 2001. *Photograph by John Binns.*

A logical place to start was the Jamaican Iguana, a species thought to be extinct until the remarkable rediscovery in 1990 of a tiny remnant population clinging to existence in the rugged Hellshire Hills outside Kingston. Again working with Ulie and CBSG, Rick and Peter Vogel of the University of the West Indies organized a Population and Habitat Viability Analysis workshop for the species, then considered to be the most endangered lizard in the world. Although a solid plan was developed and key research needs identified, perhaps the most significant outcome occurred the day after the workshop officially concluded, when the participants stayed on to informally share information on a variety of Rock Iguanas and to brainstorm how we might work together in a more coordinated fashion to help ensure their future survival. It was here that the idea of forming an IUCN Iguana Specialist Group was born, with the consensus that our initial focus would be on the critically endangered iguanas of the West Indies.

To gain official sanction for the group from the somewhat resistant IUCN Species Survival Commission, Rick enlisted the help of Commission Steering Committee members Ulie Seal, George Rabb (Chicago Zoological Society), and Russ Mittermeier (Conservation International) in lobbying for approval. Rick's tenacity finally paid off three years later, when George announced to the assembled iguana enthusiasts at the American Society of Ichthyologists and Herpetologists (ASIH)/Herpetologists' League (HL) meeting in Seattle that the West Indian Iguana Specialist Group had become a reality. In 2000, the group expanded its mandate to become a global Iguana Specialist Group, which I have had the pleasure to co-chair, most recently with Rick. He has been instrumental in developing a new Species Recovery Planning process that is changing the way we approach iguana conservation by fully engaging local partners and thereby ensuring a lasting impact. If I bring a scientific, analytical perspective to the Iguana Specialist Group, then Rick surely represents its heart and soul. He is a joy to work with, always upbeat and eager to take on even the most

Rick releasing a headstarted Jamaican Iguana in the Hellshire Hills in 1998. *Photographer unknown.*

complex problems and situations. His commitment never wanes, and it is clear from watching him that his work on behalf of iguanas is truly a labor of love.

In 2000, the Fort Worth Zoo wisely realized that the cause of conservation would be better served by allowing Rick to devote his energy and talents full-time to this endeavor. He became their Conservation Biologist, able to devote 100% of his time to endangered species recovery programs. This was also the year that things came full circle for Rick, when a group of twelve zoos, led by Fort Worth, shared the AZA International Conservation Award for their collaborative efforts to help save the Jamaican Iguana. Rick will proudly tell you that recognition of the Jamaican Iguana Conservation and Recovery Program as one of the world's great conservation success stories was a highlight of his professional career — but, if you catch him in a more personal frame of mind, he might also share with you a defining experience he had when participating in a release of headstarted iguanas deep in Jamaica's Hellshire Hills. As he was watching a repatriated iguana slowly move away from the release site, the animal looked back, directly into Rick's eyes, and he felt a connection so profound that he was moved to tears. That was a moment that embodied everything Rick has worked so hard to achieve, and a memory that will remain with him all his life.

Never satisfied with the status quo, Rick's most recent contribution has been to act as the impetus for the formation of the

Rick digging in Jamaica's Hellshire Hills to install a data logger in an iguana nest. *Photograph by Glenn Gerber.*

International Iguana Foundation. The mission of the non-profit foundation, which Rick serves as Program Officer, is to support conservation, awareness, and scientific programs that enhance the survival of wild iguanas and their habitats. The foundation, which has raised over $236,000 to date in direct support for iguana conservation activities, works hand-in-hand with the Iguana Specialist Group to develop and administer programs, as well as determine funding priorities.

In looking back over his years of contributions to iguana conservation, Rick had this to say: "The successful iguana reintroduction programs that we've launched in Jamaica, Grand Cayman, and Anegada prove that captive-reared or headstarted iguanas are good candidates for such recovery strategies. They appear to be hard-wired, and rapidly adapt to wild conditions. We are seeing good survival rates, and released iguanas are now integrating with wild populations and reproducing naturally. Programs such as these once received harsh criticism from some in the academic community, but I take great pride in proving the critics wrong. Reintroduction technology is such a wide-open field and there are so many possibilities, we are just starting to write the book. I'm just happy to be involved with it at such an intimate level. When I consider my primary influences and my most productive collaborations in iguana conservation, three people come to mind: Allison of course, who has been with me from day one, and has always shared my 'let's get it done' attitude. With her, I am confident that anything is possible. For strategic thinking and planning, especially fund-raising, my Director, Mike Fouraker, has been instrumental. Plus he recognized my abilities and gave me the time and support to use them. And, most recently, John Binns; his tireless work ethic and perfectionist attitude is contagious, just being involved with him drives you to give it your best. I know as long as John is around that I will never be able to sit back and rest on my laurels."

Amazingly, Rick still finds time to make major contributions to herpetological conservation efforts beyond iguanas. In 2001, he co-founded the IUCN Turtle Survival Alliance (TSA), a non-profit organization with the goal of developing and maintaining a global network of living tortoises and freshwater turtles that maximizes future options for the recovery of wild populations. The TSA is particularly committed to helping alleviate the Asian turtle crisis, brought on by the enormous and unsustainable harvest of turtles throughout Southeast Asia for the

Rick overlooking the western ponds complex on Anegada, taking a break after a long day of fieldwork. *Photograph by Jeff Lemm.*

Chinese food market. To date, over 4,727 turtles belonging to 38 species have been rescued by the alliance and placed in managed captive programs worldwide. Under Rick's guidance the TSA has emerged as a widely recognized force for turtle conservation, expanding their global network to support range country programs in India, Malaysia, Vietnam, and Myanmar. Rick shares that he is "particularly passionate about insuring TSA's success, because we are proving the naysayers wrong. Most doubted that such a diverse coalition of partner organizations and individuals could unite for a common cause — saving turtles. But then I've made a career out of proving the critics wrong and I've never minded sticking my neck out for a good cause. But more importantly, I know this is a battle we can win." In addition, Rick serves as an active member of the IUCN Conservation Breeding, Crocodile, Reintroduction, and Madagascar Reptile and Amphibian Specialist Groups. He has traveled widely to destinations that include two "tours of duty" in Madagascar (that he still considers the trips of a lifetime), Africa, Costa Rica, Guatemala, México, Malaysia, India, and Indonesia, where his up-close and personal experiences with Komodo Dragons while on honeymoon absolutely fulfilled a lifetime dream.

Rick has never been one to shy away from controversial issues or seemingly lost causes. In fact, he has made a living by tackling tough issues and successfully rallying others to do the same. He entices all the stakeholders to the table, and has a rare gift for keeping them there in the pursuit of mutual solutions to challenging conservation problems. His dedication and passion continue to enable him to recruit new partners to the cause of iguana conservation and motivate them to make a difference. Rick will tell you that he lives by a simple creed: Every species has a right to survive, and humankind does not have the right to cause the extinction of another species. As long as Rick has anything to say about it, iguanas are in good hands indeed.

If you would like to help, please visit the websites of the International Iguana Foundation (www.iguanafoundation.org) and the Turtle Survival Alliance (www.turtlesurvival.org).

Rick during his first trip to Madagascar in 1991, shown here at the Amphijora Field Station, site of the breeding program for the endangered Angulated Tortoise, *Geochelone yniphora. Photograph by John Behler.*

TRAVELOGUE

Stephens Island: Land of "Lizards"

Jennifer Germano

Zoology Department, University of Otago, Dunedin, New Zealand

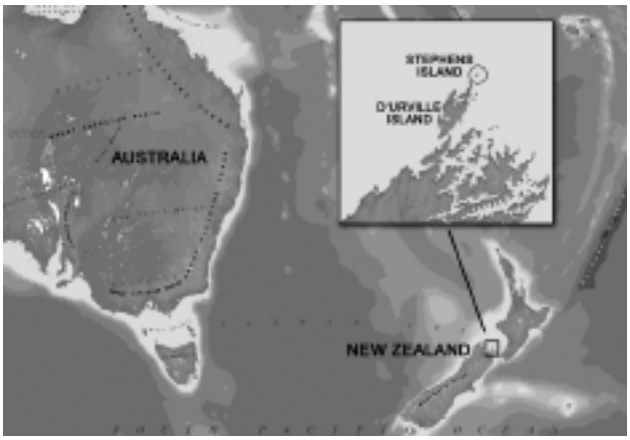
I took one big leap and let out a sigh of relief when my feet hit solid ground. I dropped my bag and turned around to help unload supplies as they were tossed off the boat that had just brought us from the little village of French Pass, New Zealand. Stephens Island lacks a proper wharf, just a bit of rock that sticks out into the ocean, so landings can be quite a challenge when the sea is rough. From our landing site, we carried our gear up a narrow track and put it in a trailer that would be winched up the hill. All of the gear would be placed in the rat-free room until we could check it for rodents trying to hitch a ride to this predator-free island. Not counting marine life, the only native mammals found in New Zealand are two species of bats, but numerous other mammalian species that have been introduced either purposefully or inadvertently have wrought havoc on this island nation's wildlife. For many endemic species, predator-free islands such as Stephens are one of the last safe refuges.

Every ecosystem seems to have its own battle with invasive species. In the States, Honeysuckle, Kudzu, Zebra Mussels, and pretty much everything in south Florida has taken advantage of hospitable conditions and the absence of predators and competitors, but nowhere are ecosystems more vulnerable to the effects of invasives than on islands. Perhaps that is why the fauna of island nations such as New Zealand have been so devastated by the introduction of nonnative species.

Because Stephens is a scientific reserve administered by the New Zealand Department of Conservation (DoC), access is restricted to researchers and DoC personnel in order to protect the island's unique wildlife. After a hike up the steep hill to the hut, we certainly got the impression that the conservation measures were working. With every few steps, we noticed a rustle in the grass or a glimpse of a tail just as it was disappearing. The place can almost be considered a temperate version of the Galápagos, with Fairy Prions (*Pachyptila turtur*) instead of Boobies and Tuataras (*Sphenodon punctatus*) instead of Marine Iguanas. Wildlife is everywhere, and much of it is endemic to New Zealand. Sea Lions rule the beaches and sea birds such as "titi" (Sooty Shearwaters, *Puffinus griseus*) and Fairy Prions fly in from the ocean at night. Three kinds of "weta" (giant nocturnal cricket-like insects in the family Stenopelmatidae) inhabit the forest and little Blue Penguins (*Eudyptula minor*) hop up the hill every evening after they return from the sea. The summit of the island holds a rock bank that is home to Hamilton's Frog (*Leiopelma hamiltoni)*, perhaps one of the most endangered frogs in the world. Despite all of these marvelous creatures, however, Stephens Island is truly an island of reptiles. With four species of skinks, three types of geckos, and the largest colony of Tuataras in the world, the entire island seems to be ruled by "lizards."

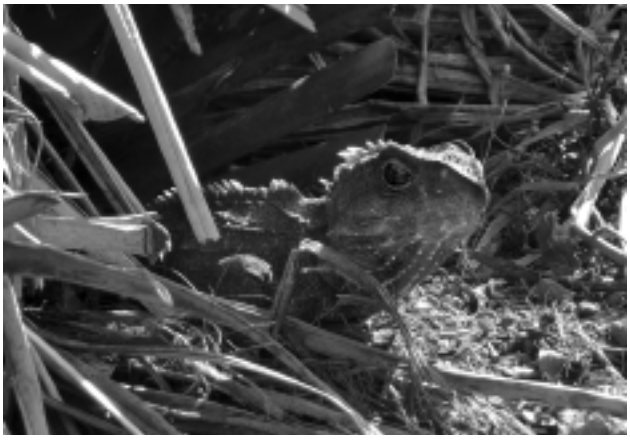
Stephens Island has no shortage of researchers. I was there for a week to help one of them, Jo Hoare, set up a radio-tracking project to study the behavior of Marlborough Green Geckos (*Naultinus manukanus*). As I walked up the steep trail that zigzagged its way up the hill, Jo pointed out a few of the island's landmarks — the trail that led down to Queen's Beach, the winch house which was spewing smoke as the ancient piece of machinery groaned and pulled our gear up the slope, the old sheep-shearing barn converted into a lab known as the Palace. All the while, though, I was staring at the ground, trying to catch a glimpse of what was rustling in the clumps of tussock along the path. We stopped for a moment to catch our breath (nothing on Stephens is flat and the trails are often narrow and

Stephens Island from the air. *Photograph by Jo Hoare.*



Location of Stephens Island, New Zealand. *Graphic by John Binns.*

Fairy Prions (*Pachyptila turtur*) are one of many species of sea birds found on Stephens Island. They often nest in burrows not far from the Tuataras that have been known to eat their chicks. *Photograph by Jo Hoare.*



A Tuatara (*Sphenodon punctatus*) outside its burrow. Although primarily active at night, Tuataras occasionally may be seen during the day. Unlike most of the lizards that they superficially resemble, they tolerate very cool temperatures. *Photograph by the author.*

A Common Skink (*Oligosoma nigriplantare*) pauses before escaping into the grass. *Photograph by Jo Hoare.*

A "weta," this giant cricket-like creature is one of New Zealand's largest insects. *Photograph by Phil Bishop.*

filled with holes from the Tuatara and Fairy Prion burrows) and Jo motioned for me to go ahead. That was when I spotted my first Tuatara, sitting in the middle of the path with its crest proudly erected. It stared at me for a moment and only when I approached very closely did it scuttle into the safety of the grass. Amazed, I walked on and smiled as I saw another Tuatara basking only a few meters farther along the track. With up to 2,000 Tuataras (or "tuts" as they're commonly called) per hectare, Stephens Island is truly a herpetologist's paradise.

Due to its split from Gondwanaland some 80 million years ago and the fact that humans arrived only during the last 1,000 years, no mammalian predators are present, and New Zealand consequently has one of the most unique herpetofaunas in the world. A number of New Zealand's species have been called "living fossils," species that have changed little from their extraordinarily ancient origins. These include the Tuatara and all four of the native leiopelmatid frogs, the most endangered of which lives on Stephens Island. In addition to these ancient species, the lizards have their own unique adaptations, including a number of skinks and geckos that are livebearers.

Within an hour after disembarking from the boat, I was climbing trees with a radio receiver in hand trying to find the first of Jo's telemetered geckos. Marlborough Green Geckos have reached such a level of camouflage that they are almost undetectable on the leaves of the native bushes. Their color, in addition to the fact that they move very little — and very slowly when they do creep from leaf to leaf, makes them perfectly adapted to a world in which the main threat comes from avian predators. Jo, a Ph.D. student at Victoria University, is studying these geckos in the presence and absence of introduced predators to see if the threat of mammals such as stoats, ferrets, and rats has affected their basking behavior. After locating the first gecko basking happily on top of a tree, we decided that the transmitter attachment wasn't having any ill effects on the gecko's movements. This meant that Jo could proceed with her project and we set off to catch four more geckos. This was easier said than done, as it took nearly an hour with five people searching to locate the next two geckos that would be tracked for the study.

We attached transmitters to the geckos using a sort of backpack made of colored gauze and bandage tape with the transmitter's antennae trailing along the back and tail of the lizard. We released the lizards where they were caught and monitored their movements among the trees every hour for the next week.

The fact that these geckos move very little, if at all, made our job a bit easier, and gave me plenty of time for spotting skinks and Tuataras along the trails.

Most of my days on Stephens consisted of tracking Green Geckos, which went fairly smoothly until we decided to attempt tracking one of the nocturnal Common Geckos *(Hoplodactylus maculatus)*. While the Green Geckos spend most of their time on leaves and tree branches, making them perfect candidates for the use of external transmitters, the Common Geckos tend to wedge themselves under rocks, in crevices, or between boards — and this one was no exception to the rule. A day after releasing him, he ended up with nearly fifty other geckos in between the boards that held up the roof of the old woodshed behind the former lighthouse keeper's home. Staring into the eyes of a dozen geckos peering at you from under the sheetmetal roof made it rather clear that observing only one gecko was going to be quite difficult. It also meant that the possibility of the transmitter getting jammed or coming off was anything but remote. Jo ended up abandoning this portion of her project after I left, focusing solely on Green Geckos.

Each night, as we were finishing dinner in the old lighthouse keeper's home that now serves as a field base for researchers, scientists studying the nocturnal critters of the island donned their headlamps and headed out into the dark. Feeling fairly awake, I decided to join some of them and set off to the island's highest point to help with the Hamilton's Frog census. As I mentioned earlier, Hamilton's Frog is New Zealand's most endangered frog, with only 200–300 individuals occupying a 600-square meter rock pile on Stephens. The trail to the top of the island is narrow and winding and bordered on either side by

A young Marlborough Green Gecko (*Naultinus manukanus*) basking on a leaf. *Photograph by the author.*

An adult Marlborough Green Gecko (*Naultinus manukanus*) with a radio-transmitter backpack. *Photograph by the author.*

A Tuatara (*Sphenodon punctatus*) perched above the trail at night. *Photograph by Jo Hoare.*

A nocturnal Common Gecko (*Hoplodactylus maculatus*) searches for prey in the dark. *Photograph by the author.*

A Hamilton's Frog (*Leiopelma hamiltoni*) emerging from the rock piles at night. *Photograph by the author.*

trees and bushes and the occasional stinging nettle. Unfortunately for me, it had started raining during dinner — great for frogs, not so good for dirt tracks. Halfway up the steep hill, with the Fairy Prions attracted by our headlamps and flying into our heads, I managed to slip and fall into a patch of nettles. Now, this stuff is unlike anything I've ever encountered in the States. No itchy red rash like Poison Ivy, no visible thorns or prickles to remove — but the minute you touch it, you know. My whole hand swelled up and I felt a burning sensation run through my fingers. The good thing about working with biologists is that they have a pretty good understanding of their environment, and within a few minutes someone had found a local plant, whose leaves we crushed and rubbed all over my hand to numb the pain. It wasn't entirely adequate and the strange tingling feeling in my hand persisted for nearly a week, but it was bearable.

After the nettle incident, I managed to make it up to the frog bank. A series of boardwalks have been constructed to criss-cross the giant rock pile where the frogs live, allowing researchers to monitor the population without the danger of squashing frogs. In addition, a giant fence has been constructed around the rock pile to keep the Tuataras out. Crazy to think, but this is one of the few places where one rare species must be protected from being eaten by another. We did find one young tut that had managed to sneak in among the rocks, no doubt a bit fuller from a feast of frogs. He was caught and placed in a bag so he could be relocated outside the frog bank.

We moved slowly along the boardwalks, crawling on our hands and knees trying to catch a glimpse of the frogs. Unlike most frogs, the native species of New Zealand don't call. One of the most primitive frogs in the world, they lack eardrums and can't hear. Researchers believe that they communicate more like salamanders than other anurans, using some form of chemical communication to differentiate between kin and non-kin, male and female, and the size of other individuals. In addition, these evolutionarily peculiar frogs breed without water and, although it has yet to be confirmed in the wild, males in captivity tend to the young by guarding the eggs and later carrying the little froglets on their backs. We managed to catch nearly a dozen of these frogs, all of which were put into plastic containers until they could be weighed, measured, and photographed before being released at the original site of capture.

The lighthouse on Stephens Island guides boats through the Cook Strait. Mount Taranaki on the North Island is visible in the background. *Photograph by Phil Bishop.*

After a long night of frogging, we made the hike back down the hill to the hut. The fog had rolled in from the sea, but you could still see swarms of seabirds flying through the headlamps' glare. They were so close that you could smell them and feel their wings beat as they flew past. Others made it a bit closer than that and occasionally you would look up just in time to see a Fairy Prion fly right into your face before crashing onto the ground, where it would wobble around, searching for its burrow.

After a few nights of frogging and one full night of sleep (although sleep is hard to come by in a hut that is constantly being bombarded by seabirds…… earplugs would be highly recommended to any future travelers to Stephens), I decided that the time had come for a night out with the Tuatara team. Led by Nicola Nelson of Victoria University in Wellington, the tut team spends months every year monitoring the breeding population of Tuataras on Stephens Island. Armed with PIT-tags, flashlights, and some pretty heavy-duty Pesola scales (although you must remember that this is coming from someone who

A Tuatara (*Sphenodon punctatus*) in front of Stinging Nettle (also known as "ongaonga" in New Zealand). *Photograph by Jo Hoare.*

works with skinks and frogs that you can easily hold in one hand), we split into groups and moved into the fields that were until recently grazed by sheep. DoC removed all of the remaining sheep from the island within the last year, although the female Tuataras seemed to prefer the unnatural short grassy fields to the forests. Despite this, they still tend to move out from the bush each night to dig their nests in the dirt of the old paddocks.

Surprisingly, Tuataras aren't that hard to catch. Just like a snake, you grab them right behind the head in hopes that they won't turn around and bite you with their three rows of teeth

The author successful in her search for nesting Tuataras (*Sphenodon punctatus*). *Photographer unknown.*

A Tuatara (*Sphenodon punctatus*) making a meal of a "weta." *Photograph by Phil Bishop.*

(one on the lower jaw and two on the top, a feature that distinguishes Tuataras from iguanas and other lizards). Once you have them in hand, they generally remain calm and tolerate being weighed and tagged without too much of a fuss. We spent the rest of the night walking transects through the fields and catching any females we encountered. Nests were marked with a bit of flagging tape and the females were checked for PIT-tags to see if they had been marked during a previous nesting year.

To observe these amazing creatures in their natural habitat was truly an opportunity of a lifetime. The tuts are the only living members of the Order Sphenodontia and, although they were once found throughout New Zealand, today they are limited to a handful of offshore islands. Unfortunately, perhaps because their eggs are laid in burrows on the ground, the mainland populations of these animals disappeared after the introduction of predators such as rats. Unlike lizards, Tuataras don't have visible ear openings and the young tuts have a "third eye" to collect extra UV-rays during the first few months of their lives. In addition, male Tuataras lack a penis, mating by passing sperm directly from cloaca to cloaca.

Tuts remain active through most of the night, preparing their nests, mating, and feeding on wetas and the unsuspecting chicks of seabirds that dig their burrows nearby. It takes nearly the whole night to finish the transects before heading back to the hut. Only a few hours of sleep for me and then I'm up early to pack my things. A helicopter brings supplies to the island once a week during the research season, and this is to be my ride back to the mainland. Unfortunately, due to the unpredictable New Zealand weather and a bit of persistent fog, three attempts were necessary before the helicopter made it to the island.

We lifted off from the grassy lawn next to the lighthouse and moved out over the ocean. I watched as Stephens Island disappeared in the fog behind me. A week is not enough time to spend in such an amazing place. Few people ever get a chance to see some of the exceptional creatures that live on the offshore islands of New Zealand. With visitors restricted to researchers and DoC staff, fewer still have the opportunity to visit Stephens. However, perhaps because of those restrictions, life goes on for the reptiles of Stephens Island — and I'll certainly never forget my little glimpse into their world.

HISTORICAL PERSECTIVES

Protective Devices of Snakes: Rattlesnakes[1]

Thomas Barbour

The rattle of the rattlesnake (all members of the genera *Crotalus*, with small scales on the head, and *Sistrurus*, with large plates on the head, are called rattlesnakes) is more or less familiar to every one. Those who have not seen or heard it have surely heard about it. It seems at first thought to be one of the most difficult of developments to understand and explain. However, when we consider the habit, which a vast number of different species of snakes have, of vibrating the tip of the tail when they are excited, together with the fact that the outer horny layer of the skin is shed at frequent intervals, it is not difficult to look back over what have very probably been the steps which led to the formation of the rattle. Many species of snakes, such, for instance, as the bushmaster and the copperhead, have a large horny spine at the end of the tail. It is only necessary to suppose that some ancestor of the rattlesnake in the distant past had such a spine, which perhaps swelled into a knob possessing a slight constriction about its circumference. Now, since the outer covering of this terminal scale, whatever its form, is shed just as are the coverings of all other scales, the constriction allowed the shed layer to be left hanging as a dry shell upon the new layer which pushed it off. This is indicated on the diagram (Fig. 38). The result is a string of shed castings of the terminal spinal button, forming in the aggregate the rattle (Fig. 39). Whenever this is agitated, it makes the familiar half metallic, half insect-like sound.

Thus, in a few words, a long and slow process may be recapitulated, but why, indeed, has the rattle been produced, or why do snakes vibrate their tails when they are frightened or disturbed? We know from experience that species living among dry leaves make a considerable noise in this way, but the rattlesnake, living in the open grassy plains, would not do so. Surely, the rattle is not needed to warn away the snake's prey. No such altruism need be considered. The rattler lies in wait, striking the rabbit or bird upon which it feeds, then withdraws without rattling, to wait for the prey to die. At first sight, man seems to be the snake's only enemy, but the rattler is, of course, far older than man on this continent. What native animal, then, had the rattlesnake to fear on a wholesale scale, which coincided in its distribution with the area where these snakes may conceivably have been evolved? Ancestors of the wide-ranging bison fulfill these conditions, and we know that there were earlier bisons, for their fossil remains have been found. They were probably widespread also, for the remains occur in Michigan, Kentucky, and many other States. The hoofs of these ponderous animals, traveling over the plains, must have been distinctly dangerous to snakes living in the open, while the snake's bite would be distinctly unpleasant to the bison, although death would probably have rarely ensued. The bison would gladly keep out of the snake's way if warned, and this warning the rattle gave.

A Neotropical Rattlesnake (*Crotalus durissus*) from Querétaro, México in defensive posture. *Photograph by Louis Porras.*

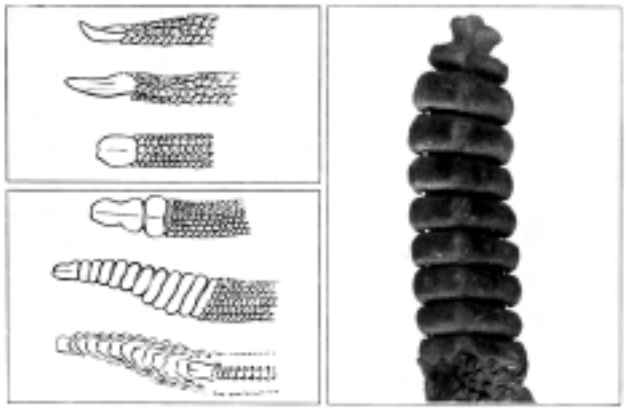


fig. 38. TIPS OF THE TAILS OF SNAKES
Upper two, non-rattling vipers; lower four showing rattle during growth, lowest in cross section.
fig. 39. THE RATTLE OF THE RATTLESNAKE IN LIFE

It has been suggested that the rattle served some purpose for signaling between the snakes, perhaps a mating call or an assembly call for group hibernation. This is not a fact. In the first place, abundant opportunity for observation has never shown it to serve such a function; and, again, recent experiments have shown that the rattlesnake's hearing is confined to a range of sounds of wave length far different from that of the rattle. Thus the snake is deaf to the noise of its rattle.

[1] Excerpted from Barbour, T. 1926. *Reptiles and Amphibians. Their Habits and Adaptations.* Houghton Mifflin Company, Boston and New York.

A New Rock Iguana from Porto Rico[1]

Thomas Barbour

In 1917 Dr. G. M. Allen and Lieut. James Lee Peters visited Porto Rico in the interest of the Museum of Comparative Zoölogy. They explored with great success a large cave near Ciales and found in the floor, under an opening in the high domed roof, a considerable number of both mammal and reptile bones.

The latter have recently been sorted out and substantiate the statement which I made some time ago (Proc. Biol. Soc. Wash., 30, 1917, p. 98) when I said that I believed Dr. Allen had found jaws of *Cyclura*. In 1918 Miller (Proc. U.S. Nat. Mus., 54, 1918, p. 509, pl. 81) named *Cyclura mattea*[2] from shell heaps in St. Thomas, — a species which proves to be very closely related indeed to the form which I am about to name. It is perhaps not remarkable that the Rock Iguana evidently became extinct in Porto Rico at an early time. It was probably exterminated by the considerable population of Porto Rican Indians before the Conquest, because no tradition of its existence seems to remain amongst either living inhabitants or in the literature. The description of this species likewise fills the last considerable gap in the known distribution of the genus and confirms the surmise ventured by Mr. Noble and myself that Rock Iguanas had formerly been much more widely distributed than their present dispersal would indicate. The limits of the range of the genus coincided exactly with those of the Greater Antillean subregion, including the Bahaman province and thus the distribution of the genus becomes at once more suggestive as it becomes more completely definable.

This form may be known as **Cyclura portoricensis**, sp. nov.

Type, M.C.Z. No. 12,460, from the floor of the cave near Ciales, Porto Rico, collected by Allen and Peters in February, 1917; being the extremities of a left humerus.

Paratypes: A femur; tibia; two ulnae; a sacral and several dorsal vertebrae; several incomplete mandibles; as well as a number of other bones less perfect.

The extremities of a fully adult humerus are chosen for the type for comparison with the type of Miller's *C. mattea*, also a left humerus. The two species are evidently very closely related, more so with each other than with other neighboring species of *Cyclura*, viz., *pinguis* of Anegada or *stejnegeri* and *cornuta*. The species differs from *mattea* in being even larger and more massive. (Cf. Miller, l. c., pl. 81, fig. 4 and 5.) The bones figured herewith are life size as are those figured by Miller. The greatest diameter of the expanded proximal extremity of the type humerus (fig. G) is 35 mm. In an adult Cuban Rock Iguana (*C. macleayi*[3]) about three feet long (M.C.Z. 6915 Santiago de Cuba; Col. Wirt Robinson, coll.) the same dimension is 19 mm.

U.S.N.M. 59,359, humerus, paratype of *C. mattea*, is before me and in this example the distal expansion is 30 mm. and the proximal extremity though broken appears to be correspondingly smaller and less massive. The bicipital depression or radial fossa in *mattea* is very conspicuously deeper and more extensive than in *portoricensis*; in this respect the latter is even more like *stejnegeri* or *cornuta* than is *mattea*. This is what one would expect from its geographic station.

Portoricensis was so far as known the largest member of the entire genus.

I wish to thank Dr. Stejneger and Mr. Miller for permission to compare the paratype of *mattea* with the material in hand.

There is no reason to believe that man has played any part in the dispersal of *Cyclura*, as has beyond doubt been the case with the spreading of *Iguana* through the Antilles. The distribution of *Iguana* is absolutely haphazard, while that of *Cyclura*, as now definable, is typical of those forms which spread by non-fortuitous or natural means. *Cyclura* undoubtedly occurred in comparatively recent times on every suitable island which has remained of the once more extensive Greater Antillean land. It is improbable that this list of species with their habitats could be the result of chance dispersal when it is considered that not one *Cylura* is found elsewhere

C. macleayi Gray, Cuba and surrounding Cayos.
C. caymanensis Barbour and Noble, Cayman Islands.
C. baeolopha Cope[4], Andros Isl., Bahamas.
C. inornata Barbour and Noble[5], Exuma Keys, Bahamas (extinct?).
C. rileyi Stejneger, Watlings Isl., Bahamas.
C. nuchalis Barbour & Noble[6], Fortune Isl., Bahamas (extinct?).
C. carinata Harlan, Turks and Caicos Isls., Bahamas.
C. collei Gray, Jamaica and surrounding cays (extinct?).
C. cornuta (Bonnaterre), Haiti and neighboring islets.
C. nigerrima Cope[7], Navassa Isl. (extinct?).
C. stejnegeri Barbour & Noble, Mona Isl.
C. portoricensis Barbour, Porto Rico (extinct).
C. mattea Miller, St. Thomas (extinct).
C. pinguis Barbour, Anegada (extinct?).

The existing place names and early literature and tradition prove that *Cyclura* was previously found upon many other Bahaman Islands where it has completely disappeared.

EXPLANATION OF THE PLATE.
A. Ventral view of left femur.
B. Ventral view of left tibia.
C. Dorsolateral view of left ulna.
D. Dorsolateral view of right ulna.
E. Posterior view of first sacral vertebra.
F. Dorsal view of distal extremity of left humerus.
G. Dorsal view of proximal extremity of left humerus.

[1] From the *Proceedings of the Biological Society of Washington* 32:145–148 (1919).

[2] Both *Cyclura mattea* and *C. portoricensis* are now considered synonyms of *C. pinguis*.

[3] Now considered a synonym of *C. nubila*.

[4] Now considered a synonym of *Cyclura cychlura cychlura*.

[5] Currently considered a subspecies of *Cyclura cychlura*.

[6] Currently considered a subspecies of *Cyclura rileyi*.

[7] Now considered a synonym of *Cyclura onchiopsis*.

Collecting Herpetological Specimens in Haiti[1]

Thomas Barbour

I landed one morning from the *Utowana*[2] on the Island of Saona, off the coast of Haiti.[3] It is a rather flat, uninteresting little island and I was not prepared for what I found. I knew that there was a high degree of endemicity on all these islands around the Haitian coast. I knew, also, that Saona had never been visited by anyone in search of reptiles, so I walked around the confines of a small open garden patch, knowing that this was the sort of terrain where one might expect to find Ameiva lizards. Lizards of this genus have a way of splitting up, so novelties may be expected.

I hunted a long time before I heard a noise in the dead leaves. Ameiva lizards are anteaters and scratch with their paws among the leaves, throwing them about in their search for the insects which may be below them. I approached the sound as stealthily as possible and could scarcely believe my eyes when I saw a perfectly typical Ameiva, and by the same token one utterly unlike any which I had ever seen. I have collected countless numbers of lizards of this genus. I shot this lizard on April 8, 1934. It was lilac gray on the back, washed with fawn colour on the head and turning to pale blue on the tail. A black band, beginning with the eyes, ran along the side of the body and the tail, which was azure blue beneath, while the undersurfaces of the body were glaucous blue, suffused anteriorly with cream colour. The sides of the head were buff yellow. All in all, it was one of the most beautiful and strikingly coloured reptiles which I have ever seen.

I sent the specimens to Miss Cochran of the National Museum in Washington, who was writing a herpetology of the Island of Hispaniola,[4] although I fairly itched to describe it myself. I realized it was new the second I saw it, as I have said before, and I asked her if she would name it for my wife. She not only named this species *Ameiva rosamondae*,[5] but without my knowing it she named the Ameiva from La Gonave Island for me.

The Haitian peasants are so poor that they will struggle hard to catch lizards, snakes, frogs, and toads — which they do not really like to do — if they can sell them for five cents each, and I mean five cents of a Haitian gourde, which is only worth fifteen cents to start with. We often had as many as a hundred people collecting for us. In this way, on the islands that were populated of course, it was possible to secure in a few days as much material as a single person could have gotten during a long stay, so that while we stopped at innumerable different localities during these voyages on the *Utowana* and never had very much time at one place, all around Haiti and in the Bahamas we got big collections. You can do this in Jamaica, but not in Cuba.

We stopped on one occasion at Isle Tortue. I went ashore in the morning and passed word around that we would be back in the latter part of the afternoon prepared to purchase what might be forthcoming, explaining what we wanted. I had a sack of Haitian five-cent pieces on board the yacht. We found that we got much better results from our collectors if we ourselves did not stay where they could watch us. It was so much more fun to stand and stare at strangers than it was to do anything else that the temptation was quite overwhelming. But if we went ashore in the morning and spread the news of what we were prepared to do, then disappeared on board and hauled up the gangway, by the middle of the afternoon we could go ashore and be overwhelmed by a rabble of men and women, boys and girls, with snakes and lizards dangling at the ends of dozens of little lassoes which they fashioned cunningly from shredded palm leaves.

On one occasion a poor old man came up to us with a gourd full of fat white grubs. These he had dug out of a rotten palm trunk. I recognized them at once as the larvae of a big weevil which lives in decayed palm wood. Of course he brought them feeling sure we would buy so succulent a dainty, for the Haitians are extremely fond of these grubs fried. Rosamond was utterly disgusted by their very appearance and I was not allowed to take them on board and eat them, which I should have greatly enjoyed doing. I have no right to complain, however, for the family did not relish the intimacy with a wide variety of reptiles which they patiently endured.

Ameiva taeniura is widely distributed across the relatively mesic lowlands of Hispaniola. The population on Isla Saona (*A. t. rosamondae*) was named for Thomas Barbour's wife by Doris Cochran of the National Museum. *Photograph by Father Alejandro J. Sánchez Muñoz.*

[1] Excerpted from Barbour, T. 1950. *Naturalist at Large.* Robert Hale Limited, London.

[2] A 210-foot yacht owned by Allison Armour, on which Barbour toured the West Indies and adjacent areas of the American mainland in 1929, 1931, 1933, and 1934. See also the excerpt from Barbour's *Allison Armour and the Utowana*, which follows this account.

[3] Actually part of the Dominican Republic; the island, Hispaniola, was often referred to as "Haiti" at that time.

[4] Cochran, D. 1941. The Herpetology of Hispaniola. *Bulletin of the U.S. National Museum* (177):1–398.

[5] Now considered a subspecies of *Ameiva taeniura.*

Allison Armour and the Utowana[1]

Thomas Barbour

Visits to Saba, St. Kitts, Nevis, Antigua, Guadeloupe, Marie Galante, Dominica, St. Lucia, Barbados, St. Vincent, Cariacou, Grenada, Tabago [*sic*], Trinidad, followed, then La Guaira and Puerto Cabello in Venezuela, Curacao, Santa Marta, and Cartegena [*sic*] in Colombia, Colon in the Canal Zone, Port Limon in Costa Rica, Tela, Honduras, and Cienfuegos, Cuba, where we fetched up on the 15th of April. The collections from the West Indies in the Museum of Comparative Zoology are extraordinarily rich and varied, so that in many localities there was nothing especially for me to do but to see the sights. This always gave me the greatest possible enjoyment. Next to vigorous collecting in a new locality, nothing is so interesting to the naturalist as the opportunity to see those places from which he has studied material gathered by other collectors. That was the case with all these islands in the Lesser Antilles, which I myself had never visited before.

From Beata Island,[2] however, we had no material whatsoever in the Agassiz Museum so that everything which we got there was new to us, and we made a fine haul, too, all pure gold. This is one of those islands where one of those great and strange looking rhinoceros iguanas[3] once abounded. The big, bulky lizards crept about the high limestone hills not far inland from the beach. Harmless and inoffensive nevertheless they look like fearsome dinosaurs on a miniature scale. Each about three feet long and weighing perhaps fifteen or more pounds they walk slowly about browsing on buds and leaves and before scuttling away with surprising alacrity when they are approached, they first stare at the intruder and bob their heads up and down in a singularly truculent way. This might be a bit disconcerting to one unfamiliar with the ways of lizards in general and iguanas in particular. We preserved several. I am glad we did, for observations made during this visit, and subsequent ones as well, forced the conclusion that they belong to a doomed race.[4] No young individuals were to be found and tracks in the sand showed that feral cats, escaped from the abandoned camps of fishermen, who go to Beata to dry fish or catch turtles, were responsible. I may add that the fishing off the west coast of the island near our anchorage was splendid.

[1] Excerpted from Barbour, T. 1945. *Allison Armour and the Utowana.* Priv. Published, Cambridge, Massachusetts.

[2] Off the southern tip of the Barahona Peninsula of Hispaniola.

[3] *Cyclura cornuta.*

[4] The population on Beata is extant and doing well, despite Barbour's pessimistic assessment.

Barbour's conclusion that the Rhinoceros Iguana population on Isla Beata was a "doomed race" was premature. *Photograph by John Binns.*

BIOGRAPHICAL SKETCH

Thomas Barbour (1884–1946)[1]

Thomas Barbour was born to a wealthy family on Martha's Vineyard, Massachusetts in 1884. Much of his inheritance was applied to his chosen life's work, which, after a winter in Florida and the Bahamas recuperating from typhoid fever, focused largely on reptiles, the tropics, and island faunas.

Growing up in New York, he built a collection of preserved reptiles, largely composed of specimens saved for him by the zoo. The donation of this collection was his entrée to the Museum of Comparative Zoology when he entered Harvard College as a student. Barbour graduated in 1906, continued for graduate study (A.M. 1908, Ph.D. 1911), and, while still a graduate student, took over responsibility for the museum's collection of amphibians and reptiles in 1910.

After completion of his doctorate, Barbour became Associate Curator of Reptiles and Amphibians. Until the early 1920s, when he gave up curatorial responsibilities, he tripled the number of species. Much of the growth is attributed to his own collecting throughout the world, but much was the result of an aggressive exchange program with other institutions and purchases out of his own pocket.

In 1923, Barbour became the executive officer charged with the development of Barro Colorado Island, formerly a forested hill that became an island when Gatun Lake was formed during construction of the Panama Canal. Barbour recognized the site's potential for research, personally bought out the banana growers, hired the first superintendent, and supervised the construction of the first building on the site, which now serves as the Smithsonian Tropical Research Institute. Barbour continued as executive director until 1945.

Thomas Barbour (*photograph courtesy of Kraig Adler*).

Barbour also developed the domestic production of snake antivenin. In 1926, he, Raymond Ditmars (see the biographical sketch in *Iguana* 10(3):92), and other North Americans, advised by Afrânio do Amaral, founded the Antivenin Institute of America. The organization, which included a venom-collecting serpentarium in Honduras and an antivenin-producing laboratory in Pennsylvania, also published a journal (*Bulletin of the Antivenin Institute of America*) from 1927–1932, which Barbour funded and co-edited. He also supported the journal of the American Society of Ichthyologists and Herpetologists (*Copeia*) by covering its operating deficits for many years.

In 1927, Barbour became Director of the Museum of Comparative Zoology and continued in that position for the rest of his life. He liberally supported museum projects and never drew a salary. Several noted herpetologists (e.g., Archie Carr, Emmett Dunn, and G. Kingsley Noble) began their careers under his guidance and benefited from his support.

Despite his influence on American herpetology, his own research was rather diffuse and sometimes superficial (see also Henderson and Powell. 2005. Thomas Barbour and the Utowana expeditions (1929–1934) in the West Indies. *Bonner Zoologische Beiträge* 52:297–309). His first two monographs (1912 and 1914) covered the amphibians and reptiles of the East and West Indies, respectively. The largest fraction of his more than 200 subsequent herpetological titles also addressed the West Indian herpetofaunas, continuing a tradition of Harvard herpetologists that began with Samuel Garman in the late 19th Century and continues to this day.

Major herpetological works included five editions of checklists of North American amphibians and reptiles (1917–1943, with Leonhard Stejneger), "Herpetology of Cuba" (1919, with Charles Ramsden), "*Sphaerodactylus*" (1921), "Antillean Terrapins" (1940, with Archie Carr), and a semi-popular book entitled *Reptiles and Amphibians and Their Adaptations* (1929, revised in 1943).

Despite his formal training, many accomplishments, and numerous honors, Barbour was in many ways more of a wealthy amateur than serious professional. In *Naturalist at Large* (1943), one of four autobiographical books completed shortly before his death in 1946, he provided a glimpse into his complex life (p. 45).

[1] **Source:** Adler, K. 1989. Herpetologists of the past, pp. 5–141. In K. Adler (ed.), *Contributions to the History of Herpetology*. Society for the Study of Amphibians and Reptiles, Contributions to Herpetology, Number 5. Ithaca, New York.

COMMENTARY

Comments from an Old Naturalist About Exotic Species and a New Herpetocultural Ethic

Ray Ashton

The Gopher Tortoise Conservation Initiative
Newberry, Florida

The natural world in Florida, as in much of the rest of the world, is changing so rapidly that it is virtually beyond comprehension. From a biological perspective, we often do not know how to respond. Should we be alarmed and take immediate action? I think we should definitely be alarmed; and, in some instances, appropriate action can mitigate much of the damage resulting from the changes. However, in other instances, we have little choice but to remain passive observers of the most intensive period of change in the Earth's biological history.

I choose not to dwell on the obvious changes like habitat loss due to development, changes in the environment due to pollution, global warming, and simply because humans have long since crossed the dangerous threshold of exceeding the world's carrying capacity for their own species. However, I will comment on other circumstances in the role of an "old dinosaur naturalist" (a title applied by younger colleagues to non-specialist biologists who began watching nature, catching critters, and learning about natural processes as children). First, I am shocked at the large number of herpetologists who seek to curtail the rights of "new herpers" to keep and enjoy reptiles and amphibians in their homes. Combine this with the loss of habitat and changes that are causing substantive declines in the numbers of our native reptiles and amphibians, and we will soon have a society that is completely indifferent to these animals. The Discovery Channel and all of the "TV cowboy herpers" who are providing less-than-factual information to our kids will do little to encourage current youngsters to become passionate or even vaguely concerned about conservation. We have already lost the political momentum for wildlife conservation throughout the world. What will the situation be like in 20 years without the stimulation of having a live herp from which to learn?

The new generation of herpers is estimated to number in the millions. When I was a kid, probably no more than 50 kids and young adults in the whole of the state of Ohio were interested in herps. We formed a society so that we could talk and learn from each other. Few books and no Conant Field Guides were available in those days. In stark contrast, millions of people care about herps today, but their interest seems very different than ours. We wanted to learn about the animals in the wild — but we also were excited about keeping them in captivity. This desire led to efforts to breed them and develop good husbandry, something the current generation takes for granted.

Advances in the captive breeding of some reptilian species have resulted in easy access to a wide variety of herps. The current popularity of herpetoculture is very similar to the tropical fish craze some thirty years ago. One unfortunate result of this is that people with pet herps (just like people with dogs and cats) get tired of them or cannot keep them and find out they cannot sell them or even give them away. This situation has contributed dramatically to one of the big changes in our environment today — the presence of invasive exotics.

The list of exotic animals and plants that can be found in this country is quite extensive. Incidentally, many of the exotics that have wrought havoc with the natural environment (and continue to do so) were brought into the United States by various federal and state agencies. Non-native plants and insects are causing serious damage to native wildlife and habitats. Southerners will readily tell you about the devastation caused by Fire Ants (*Solenopsis* spp.) and Kudzu (*Pueraria montana* var. *lobata*).

Now that we have millions of people with pet herps, the release of herps has become an issue, especially in Florida. We now have what I call "shake and bake ecology." One can find more than 40 exotic herps in Florida (see Mashaka et al. 2004. *The Exotic Amphibians and Reptiles of Florida*, Krieger Publishing Company, Malabar, FL). Without a doubt, some of these animals are exerting a profound impact on native herps. A single adult Cuban Tree Frog (*Osteopilus septentrionalis*) can eliminate all the native frogs around a house in one summer. Other species may fit niches that are not filled and will have no immediate impact on the environment, yet we cannot predict the full consequences of such introductions.

One interesting twist to exotic releases is that no one has complained about the Whooping Crane (*Grus americana*), an exotic recently released in Florida by federal and state game agencies. No evidence exists that this species has been a resident of this state in either recent or prehistoric times. Apparently these now resident birds (worth hundreds of thousands of dollars in tourist revenues) prefer to eat many more snakes and frogs than they do in their native habitat. One crane can find and eat an amazing number of snakes. What impact will this have on Indigo Snake (*Drymarchon corais*) populations? I suggest that some of our agencies need to practice what they preach.

Opinions expressed are those of the author and may or may not reflect those of the IRCF.

Recently, two lizard controversies have reared their heads in Florida: the Nile Monitor (*Varanus niloticus*, see *Iguana* 10(4):119–120) population in and around Cape Coral and the Spiny-tailed Iguanas (*Ctenosaura similis*, see *Iguana* 10(4):111–118) on Gasparilla Island (see "Newsbriefs" in this, p. 58, and recent issues). In the former instance, local citizens have lodged complaints (probably initiated by one or two folks and then snowballing). Many are deeply concerned that these predators will impact listed species like the Florida Burrowing Owl (*Athene cunicularia floridana*) and nesting sea turtles. Dog and cat lovers, who illegally let their wildlife-devastating animals run loose, are worried that their predatory pets will, in turn, become prey for introduced exotics. This may be the case, and we should be alarmed — and we should study the situation to determine what really is happening. Of course, what stimulated this article is that residents of Gasparilla Island have fussed about ctenosaurs coming into their yards and destroying their (mostly exotic) vegetation. Naturally, when a biologist suggested that we shoot them, the resultant outcry of disgust obscured the reality that few alternatives exist to this direct method of "getting rid of the problem." Trapping lizards, darting lizards, or any other method of taking the lizards is less efficient and certainly more stressful for the animals. The fact is that a lot of ctenosaurs live there — and a considerable effort and a great deal of money will need to be expended to get rid of them. The same is true for the monitors on Cape Coral. These are species that have established a strong foothold in their new environment. Unlike many of the geckos that were largely restricted to specific buildings near the Miami airport, the monitors and Spiny-tailed Iguanas, along with Green Iguanas, will likely be part of the Florida landscape as long as one remains.

When exotic plants like Brazilian Coffee (*Coffea arabica*) or animals such as the iguanas achieve huge population sizes, the cost in money and time essentially makes them impossible to eradicate. Some control may be possible, but eradication is unlikely. In my opinion, I think we have little choice but to live with the situation.

However, the introduction of exotic amphibians and reptiles is not a good idea and the new generations of herpetologists and herpetoculturists should develop a new conservation ethic if they wish to retain their right to keep animals in captivity. We used to tell the herpers of my day that they should take only the specimens that served a specific purpose. Today, we need to establish some new rules, which should include:

1. Before buying any pet, learn about it! Do not count on the pet store staff to know more than you do. BUY AND READ A BOOK about the animal. Learn about the species' natural history, not just how to keep it in captivity. For example, do you know that some tortoises eat more than 400 species of plants? Much of this type of natural history information is not listed in care manuals, but it may well be the key to successfully keeping and breeding some reptiles.
2. Acquire your pet from a reputable source. Do not become part of the problem by encouraging the collection of rare species from ever-declining habitats. In almost every instance, no justification exists for buying anything but captive-bred animals (one exception might be to catch your own exotic species — folks on Gasparilla, for example, would appreciate your efforts).

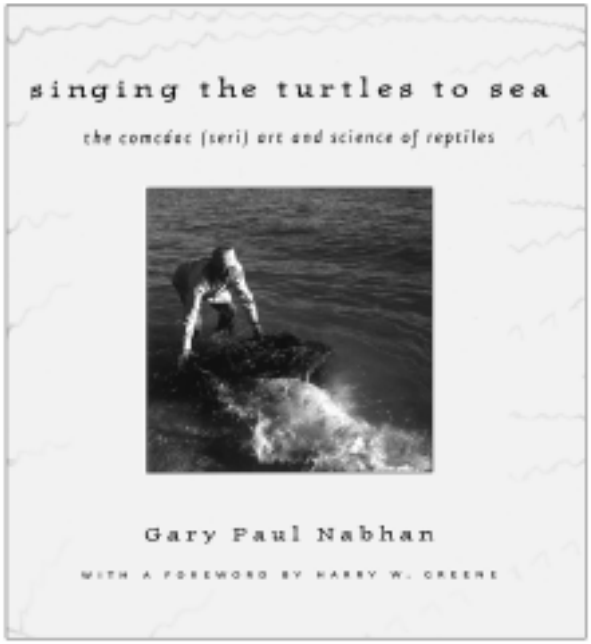
Spiny-tailed Iguanas (*Ctenosaura similis*) are firmly entrenched on Gasparilla Island, where residents might be well advised to learn to live with them. *Photograph by John Binns.*

3. Make sure that your caging is appropriate for the type of animal you plan to keep — and that it is escape proof! If real (or artificial sunlight) is required, don't settle for less, or you've likely doomed your pet to a nasty death.
4. Ascertain your pet's nutritional requirements and make sure you can devote the time and money necessary for purchasing and preparing the right food on an appropriate schedule.
5. Many keepers are avid about breeding their pets. Social needs are enormously variable from species to species, but most amphibians and reptiles are not social and do not need companions. In many instances, adding an additional animal to a confined space may create stress that can lead to immunocompromise and disease. An iguana has a home range in the wild that can cover several acres of land. How big is the cage you can provide?
6. Have an escape strategy for when you want to get rid of your pet (or its offspring). Perhaps the pet store or animal dealer from which you obtained it will permit you to return it, or you might be able to take it to an animal rehabber who may have better contacts. If all else fails, take it to a veterinarian or animal shelter to be euthanatized. Sound awful? Well, think about what may happen to the animal before you hand over the money for it. DO NOT LET THE ANIMAL GO, even if it is a species that is found locally. If you have exotic and native herps, be sure to keep them in separate cages (or, better yet, separate rooms). The release of pets may result in the transfer of deadly pathogens to populations of native species. Such a situation can be far more dangerous to wildlife than the animals competing with or preying on each other.
7. Avoid confrontations with neighbors. Be respectful of their concerns and fears. Educate them, but don't try to force them to accept your exotic pet. If you want to take your pet outside, do it in a private place. One incident is all that's needed to set non-herpers on the warpath. That, in turn, will inevitably lead to knee-jerk responses from local politicians. Ultimately, it all boils down to common sense.

BOOK REVIEW

The Art and Science of Reptiles

Nabhan, G.P. 2003. *Singing the Turtles to Sea: The Comcáac (Seri) Art and Science of Reptiles.* University of California Press, Berkeley. xviii + 318 pp. Hardcover. $34.95.



Gary Nabhan, professor and director of the Center for Sustainable Environments at Northern Arizona University, collaborated closely with Seri Tribal Governors and the Traditional Council of Elders on this ethnoherpetological treatise. If ethnoherpetology sounds stodgy and suitable only for graybeards of academia, think again. Nabhan is an award-winning nature writer who brings both the Seri and the myriad reptiles with which they interact to life. Also, as Harry Greene notes in his foreword, lessons abound for all of us interested in conservation: "Why do reptiles, elsewhere so often reviled rather than protected, play such a central and positive role in the lives of the Seri? Can local communities sustainably harvest globally endangered organisms in a framework that encompasses both conservation and traditional beliefs? And more broadly, what can indigenous peoples teach us about managing and appreciating our surroundings? How can we as outsiders, onlookers, or even participant-observers in the life of a particular place steer between two incomplete and misleading visions: that native peoples always live in harmony with nature, and that exclusive reliance on Western science will save us from the ever more devastating impact of humans on Earth?"

Nabhan makes the case early on in his introduction that "indigenous communities' traditional ecological knowledge is a curious mix of scientific insight and artistic expression." He also suggests that this traditional knowledge "has the capacity to enrich our own views of the natural world and, accordingly, to encourage us to better protect natural diversity," but goes on to warn that, "If however, this 'folk knowledge' is categorically dismissed as unscientific and ultimately replaced by Western scientific knowledge alone, we stand to lose something of import," not just by diminishing the local culture, but possibly losing knowledge that could "help protect, restore, and recover threatened reptiles."

Following a key to the pronunciation of words in the Cmique Iitom language of the Comcáac[1], the foreword by Harry Greene, and his introduction, Nabhan organized this volume in two parts: eight chapters that collectively provide a narrative account of traditional ecological knowledge that uses the Seri people's voices to raises issues and offer general answers and a second part, consisting of a single "chapter" that provides "in essence a status report on what is known of the herpetofauna of the Comcáac homelands from both indigenous and Western scientific perspectives." Following part 2 is an appendix listing specimens of reptiles from the Sonoran Coast of the Sea of Cortés and nearby islands, an extensive literature cited (testament that, despite the volume's narrative format in part 1, this is, in fact, a rigorous study), and an index that is both complete and utilitarian.

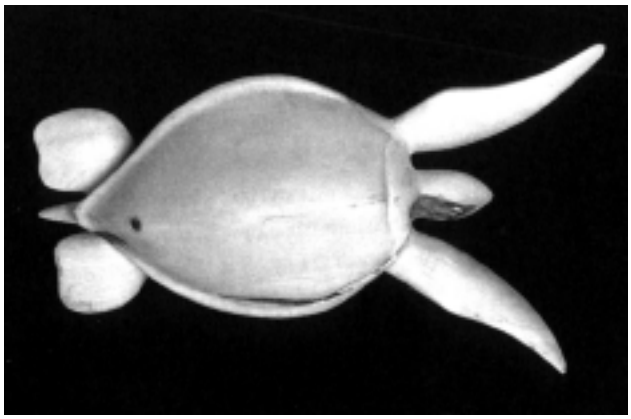
Typographical errors are very few and both editorial and production standards are high. On a minor note, I did not like the use of different fonts to distinguish stories from analysis or (instead of italics) to emphasize certain terms. I found that affectation distracting, although I thoroughly, like most readers, I suspect, enjoyed the stories, which brought a vibrancy to the narrative that might otherwise have drifted, at least occasionally, into the drier prose of traditional academia. I particularly liked those anecdotes that addressed cultural conflicts, many of which mirror those I've experienced myself in other places. More importantly, as a biologist, but not an ethnobiologist, I very much appreciated the excerpts from the notes and literature of the latter discipline that were used to highlight specific points and introduce individual chapters. They lent insights into perspectives of both the Comcáac and ethnobiologists that I, to my detriment, would otherwise have missed.

The color plates (25 plates on 16 pages) and the black and white figures are of consistently high quality, especially considering that many are historical and would normally reveal the ravages of age. However, I wanted desperately to see more images — especially of the phenomenally realistic portrayals of many reptiles by Seri artisans. I also believe that the book would have benefited greatly from portraits of the animals themselves (only a few species are illustrated), as many readers will not be famil-

[1] Nabhan uses "Comcáac" to refer collectively to the people and their culture and "Seri" to refer to activities peculiar to one or a few individuals within the community, as well as to products advertised to the outside world as "Seri Indian."

iar with the many peculiar forms native to the region. The latter concern could be addressed by keeping close at hand a copy of Lee Grismer's excellent *Amphibians and Reptiles of Baja California, Including Its Pacific Islands and the Islands in the Sea of Cortés* (2002. University of California Press, Berkeley — both it and the volume at hand are parts of the University of California Press's series on "organisms and environment," which also includes *Lizards: Windows to the Evolution of Diversity* by Eric Pianka and Laurie Vitt, 2003; reviewed in *IGUANA* 11:183–184). Although Grismer's volume does not address specifically the Sonoran fauna, it does portray and discuss the many endemics of the islands in the Sea of Cortés, plus many of the Sonoran species have close counterparts on the Baja California Peninsula.

A Sidewinder (*Crotalus cerastes*) carved out of ironwood by José Luis Blanco. *Photograph by Helga Teiwes* (from Nabhan 2003).



A Green Sea Turtle (*Chelonia mydas*) carved from Elephant Tree wood by Armando Torres. *Photograph by Helga Teiwes* (from Nabhan 2003).

To best illustrate the colorful range of cultural perspectives regarding Comcáac responses to reptiles — which include the naturalistic, aesthetic, mythic, and utilitarian — I have chosen to excerpt quotations (some rather extensive) from each chapter, mostly from the stories, which, as I mentioned previously, lend so much life to the narrative. Better than any summary I could provide, the use of the author's words dramatizes both the scope of this volume and much of its appeal.

Chapter 1: Islands of Uniqueness. Endangered Cultural Knowledge of Endemic Creatures. "It dawned on me that we were participating in a sacrament, one that has been performed ever since the Comcáac first became seafaring people. By blessing this yound woman's rite of passage with the meat and blood of *moosni cooyam* [Green Sea Turtle], they were linking her life to the very creature that swims through their culture's stories, songs, dreams, and diet.

"I felt honored and humbled to be part of the communion. But as I looked up again into the face of the sea turtle shining in the firelight, another wave of emotion washed over me. Because I once shared quarters with a marine biologist who worked tirelessly to protect the nesting beaches of sea turtles, I had for twenty years boycotted any restaurants that featured sea turtle meat, eggs, or soup.

"Caught up in the moment, perhaps flattered by the invitation to share sea turtle with Seri friends, had I suffered some ethical lapse, somehow forgetting that sea turtles are endangered? Or had I not let my ethics slip, but instead accepted a tenuous balance between how I express my concern for an endangered people and how I express my concern for an endangered animal?"

Chapter 2: Mapping the Comcáac Sense of Place. Seri Homelands and Reptilian Habitats. "I remembered what Amalia Astorga said to me when she learned a month ago that I would be going to the island she called Coftécöl, 'Giant Chuckwalla': 'Don't go out there unless you are with someone who knows the song to placate Coimaj Caacoj. He's the giant serpent who lives underwater between Islas Tiburón and San Esteban. By writhing along on the ocean bottom there, he churns up the water between the two islands much of the time. If you try to cross his place between the islands without paying him respect, he'll smash your boat to bits.…'

"Alfredo was in his late fifties and had harvested fish and turtles from the waters between the islands for decades. He had always maneuvered these waters in boats equipped with less than optimal equipment — old engines, cracked or bent props, leaking hulls. And yet, by following the routes he had been taught and remembering certain sacred petitions, he had been spared the difficulties to which other, more reckless, *pangueros* had succumbed."

Chapter 3: The Shape of Reptilian Worlds. Island Biogeography and the Herpetofauna of the Sea of Cortés Region. "I quietly crawled toward the resting chuckwalla, then advanced upslope from it,

Sauromalus varius is found on islas San Esteban and Roca Lobos and may have hybridized with *S. ater* and/or *S. hispidus* on Isla Acatraz. This is the focal species at the Captive Breeding Exhibit at Punta Chueca. *Photograph by Brad Hollingsworth.*

where I carefully began removing cobbles on either side of the ledge it was hidden under. As I dislodged one cobble, the partially exposed chuckwalla stirred, revelaing another, smaller, chuck tucked in safely behind it.

"After taking a deep, quiet breath, I made my move. My right hand clasped the bigger chuckwalla, a male, just in front of his back legs. He tried to dig further in under the ledge, but I lifted his lumpy black-and-buff body up into the air before he could lodge himself deeper into the crevice. He flailed his chubby legs for a moment, but then, as I stroked his underbelly, he grew calm and tame.

"He was the size of a Sunday newspaper rolled up and thrown onto your porch. That made him far larger than any I had seen on the mainland, and he had many more black blotches than those I recalled from my earlier trip to Isla San Esteban with two Seri men from Punta Chueca. I remembered how Alfredo López had held one of the Piebald Chuckwallas there, looking at its buttonlike femoral pores on the back legs, which he likened to poker chips.

"'Yes, this one is a male,' he said, laughing and pointing to the swollen hormone-charged pores lining the crease of its back leg. 'He's muy macho; see his winnings?' He told a story about chuckwallas being good gamblers and winning their femoral-pore 'poker chips' from other inhabitants of San Esteban.

"I held my own chuckwalla up in the dusky light and saw that five or six large pores were oozing goo out along the ridges of each back leg. This confirmed that the chuck was indeed a male, but I was not sure what species he was. He looked as though he had gathered traits from several different species, like the melting-pot descendants of immigrants who had passed through Ellis Island off New York. [See also Hollingsworth. 2004. *IGUANA* 11:78–85].

"Whatever his species, this giant was *my* 'winnings' for the night. Catching him was no big deal, but spending time in the hunt had helped me better understand a creature whose history is intimately linked to that of the Comcáac. I sensed that the Comcáac had created a distinctive 'breed' of chuckwallas, just as much as the Navajo had shaped their own breed of Churro sheep, and Australian aborigines had shaped the course of dingo evolution.

"My friends hollered for me to get back to the boat, and I placed the chuckwalla on a flat rock still warm from the day, released it, and watched as it lumbered off into the darkness. Once I and my party headed home, vacating the island, the chuckwalla once again became the largest flightless land animal on Isla Alcatraz, the 1,800-gram king of the mountain."

"To say that there are Seri individuals intimately familiar with the locations of reptile nest sites is to understate the matter. Between 1978 and 1982 biologists S. Reyes-Osorio and R. B. Bury conducted Desert Tortoise surveys of Isla Tiburón, working together with Seri field assistants, and in so doing they claimed to have recorded one of the highest densities of Desert Tortoises ever found. One of their Seri fieldhands, Alfonso Méndez, later told me that he worked as their "finder" of Desert Tortoise congregating places. He recalled finding several hibernating groups — one numbering no less than seventy-five individuals holed up in a single cave — that the biologists told him were much larger than any they had ever found on their own.

Whether this Seri hunter simply had a knack for tracking down hibernating colonies, or whether he had a good recall of places where other Seri had formerly found them, I do not know. However, in spring 2001, Méndez joined me and my students on Isla Tiburón and relocated several tortoise caves he had seen previously. Historically, both Comcáac women and men would seek out these *iime* shelters with the aid of dogs, which could smell the hibernating Desert Tortoises long before humans could see them. (The exact location of some *iime* for chuckwallas, tortoises, and rattlesnakes could also be deduced by tracing the tracks and tail draggings left on sand- or silt-covered beaches back into the rocks where these animals were sequestered.) Since any given area has only a few suitable shelters, these *iime* were likely used by generations of tortoises over many centuries. The Comcáac community has consequently kept in its collective memory a living record of where particularly large congregations of Desert Tortoises can be encountered during extended periods of cold or drought."

"… herpetologist Lee Grismer has concluded that the presence of spiny-tailed iguana populations on Islas San Esteban and Cholludo 'is probably the result of aboriginal introduction by Seri Indians who once inhabited the island. The coastal distribution of *C*[*tenosaura*]. *hemilopha* on mainland Sonora only extends as far north as near Guaymas, approximately 115 km south of the nearest coastal mainland locality opposite Isla San Esteban.'

This distributional anomaly is matched by an ecological anomaly: San Esteban is the only island out of more than one hundred in the Sea of Cortés where both spiny-tailed iguanas and gigantic chuckwallas occur together. Contrary to predictions from ecological niche theory, they successfully coexist there, foraging for largely the same plants in the very same habitat, at the same time of day, over the same season." (See also Grismer. 2002. *IGUANA* 9:3–8).

"Preliminary results illustrate the obvious: (1) children more easily catch lizards than adults do; and (2) contemporary Comcáac villages serve as artificial oases for some native species, but they repel others. Despite the fact that villages offer permanent sources of water, structural heterogeneity for roosts, and plenty of artificial crevices for nesting or escape, they also pose significant threats to reptilian well-being: fast cars, carnivorous pets, parasites, and microbes. Only Western Whiptails and Side-blotched Lizards seem to thrive in the presence of such perils, while Tree Lizards, banded geckos, and Zebra-tailed Lizards find these new habitats to be both a blessing and a curse. The risks of Comcáac villages today are vastly different from those of the historic encampments, where a small number of families stayed for only a few weeks and so had a relatively short-term impact on lizards' and snakes' habitat."

Chapter 4: Naming the Menagerie. How to Sort One Snake from Another. "During a time when the Comcáac knew just one kind of chuckwalla within their prehistoric territory, it was apparently called simply *coof*, polysemous with a verb, 'to hiss' or 'to blow air.' Later, when they encountered a second kind of chuckwalla on Isla San Lorenzo or Ángel de la Guarda, they called this large, dark-colored species *coof coopol*, or 'chuckwalla blackish.'

However, when they came upon another kind of reptile in the mountains that reminded them of chuckwallas, they fashioned a name for it using a modifier in front of the generic term for chuckwalla: *hast coof*, for instance, a name that means something like 'chuckwalla-like mountain dweller' and is now used for collared lizards."

Chapter 5: Reptiles as Resources, Curses, and Cures. How the Comcáac Recognize Beauty, Utility, and Danger. "While the mere sight of certain animals would terrify my own aunts or my O'odham neighbors, the same sickening feeling came to my Comcáac friends not with rattlesnakes but with geckos. Not with seasnakes but with night lizards. Not with coralsnakes but with Desert Iguanas. And not with Gila Monsters but with collared lizards.

"To the Comcáac, it does not matter that the former creatures deliver toxic bites while the latter are known to be nonvenomous. Their fear of particular reptiles is rooted in the notion that considerable psychosomatic harm can come to anyone who does not behave appropriately around geckoes, night lizards, Desert Iguanas, collared lizards, and even their usually benign friends horned lizards, Desert Tortoises, and Leatherback Turtles.

The Desert Tortoise (*Gopherus agassizii*) features prominently in Seri traditions. *Photograph by Thomas Wiewandt.*

"Danger, like beauty and utility, is in the eye of the beholder."

"It is remarkable how many men, women, and children in the Comcáac community handle venomous and nonvenomous snakes, dead or alive, without the flinching of their non-Seri neighbors. They have often had to evict rattlesnakes from their camps or kill them with stones or sticks or process the skins, meat, oil, and bones for practical uses. … Children grow up among elders who carry, skin, butcher, and roast or boil snakes, iguanas, and turtles without blinking an eye, and boys acquire these skills themselves at an early age. They learn stories and songs about serpents, some of them mythical giants who live high in the mountains or deep within the ocean. They see rattlesnake designs elaborated in basketry and carvings, and women wearing rings made from Gila Monster and Western Coralsnake skins. Clearly, one cannot consider the Comcáac as ophidiophobic, or snake-aversive, as many of the other cultures surrounding them."

"The capture or use of Desert Iguanas is simply not an option for the Comcáac. In general, it appears that some of the taboos associated with Desert Iguanas, Regal Horned Lizards, Leatherback Turtles, and Desert Tortoises are associated with ancient stories referring to the time when animals could understand Cmique Iitom and could themselves speak and argue. Seri individuals who fail to heed the message of these stories put themselves at risk, becoming susceptible to illness or even death. …, Seri who break a taboo and realize it often experience great anxiety and psychosomatic trauma that can be relieved only through a shamanistic purification ritual that restores healthy relationships with particular animals."

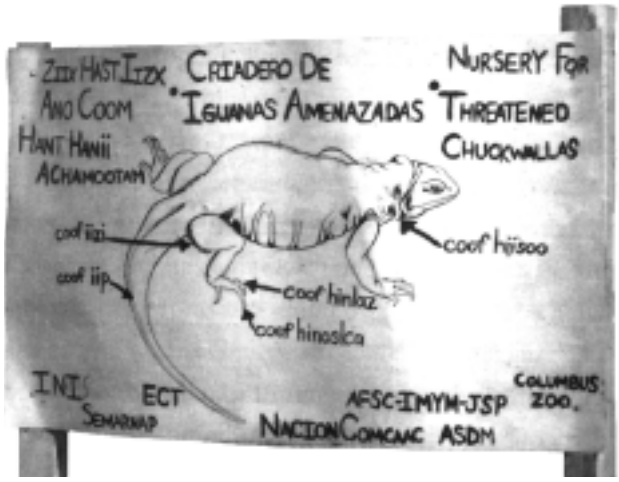
Chapter 6: What Eats from the Turtle's Shell, What the Turtle Eats. Comcáac Perceptions of Local Ecological Interactions. "…, *hamísj catójoj*, the name for what English speakers know as the Brown Vinesnake (*Oxybelis aeneus*), refers to this snake's mimicry of the stems of Ashy Limberbush (*Jatropha cinerea*), on which it hides. This name makes perfect sense (and is therefore quite memorable) in a hyperarid land where few true vines even grow."

"Some ecological processes may simply be more fascinating to the human mind than others, regardless of their practical value. I have been struck at the number of times a Seri ecotourist guide and foreign naturalists have stood together watching ecological interactions in utter delight: those between whipsnake and rattler, horned lizard and ant, or tortoise and cactus. Academic scientists may ask different questions and answer them using different tools than do local naturalists, but the same sense of biophilia holds when they witness a female sea turtle lumber onto a beach to lay her eggs or a spiny-tailed iguana climb high into the arms of a Cardón cactus."

Chapter 7: The Comcáac as Conservationists. Practicing What They Preach, and Benefiting from Alliances. Responding to a proposal by "several agencies in the federal and state governments … jointly proposing that the Comcáac community assume complete management authority over the natural resources of the islands" (Islas Tiburón and San Esteban), "Tribal Governor Pedro Romero took over the microphone. He reminded the entire congregation that his people had been the legitimate managers and stewards of the two islands all along. In an eloquent philosophical tone, he posed a series of rhetorical questions to the audience: Why, he asked, were there so many animals still on these two islands that scientists could not find anywhere else? Perhaps because the Comcáac did not deplete their populations as some of their neighbors had done elsewhere. Why were animals like the Desert Tortoise more abundant in Comcáac territory than nearly anwhere else scientists had studied them? Perhaps because Comcáac spiritual traditions taught respect for these animals, and so they had reasons to refrain from hunting tortoises at certain times, or under certain conditions. Why should the Comcáac be the managers of this land and not the state or the federal government? Perhaps because the Comcáac had detailed local knowledge of the resources unique to the area, and had shared this knowledge down through the generations over centuries. Their ancestors had lived and died there. For that reason alone, it would be hard for them to ever let this land be destroyed or developed."

Chapter 8: The Historic Decline and Recent Revival of Traditional Ecological Knowledge. "During the fall of 2000, a traditional school was inaugurated in Punta Chueca by elder Antonio Robles as one more means of providing young Seri individuals with training in the native flora and fauna and their curative powers. The opening of the school was celebrated with a feast of traditional foods, including fish, reptile meat, prickly pear, mesquite, and agave.

"Perhaps the children attending this school will be more prone to heed the words of their former tribal governor, Pedro Romero, when he said that 'Islas Tiburón and San Esteban and the midriff of the Sea of Cortés have great economic and cultural significance for us, the Comcáac. It is from here that our people obtained an important part of our nutritional and spiritual sustenance, and received the strength to survive times of great social or natural adversity."



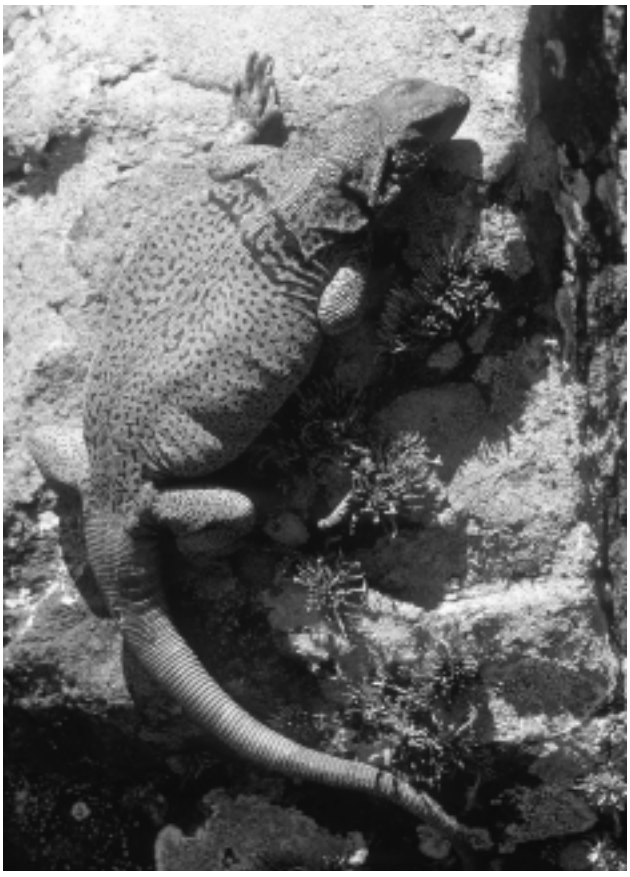
Sign at the Chuckwalla (*Sauromalus varius*) Captive Breeding Exhibit at Punta Chueca. *Photograph by Karen Krebbs* (from Nabhan 2003).

Part 2, Chapter 9: Accounts of Reptiles Known by the Comcáac. "Part 2 (chapter 9) is perhaps a more 'standard' ethnobiolgoical monograph in that it offers a species-by-species account of the herpetofauna of the central Sonoran coast and its adjacent islands." I use two entries in their entirety as examples to illustrate the combination of traditional and practical Seri lore with "Western" science. Cited references are listed at the end of this review.

Sauromalus hispidus, *S. obesus* (*S. ater*[2]), *S. varius*, and hybrids
English common names: Spiny (Black) Chuckwalla, Northern Chuckwalla, and Piebald (Isla San Esteban) Chuckwalla, respectively
Spanish name: *iguana*
Comcáac names: *coof coopol*, *ziix hast iizx ano coom*, and *coof*, respectively

Coof is related to the verb *coof*, meaning "to hiss, snort, or puff" like a chuckwalla. *Ziix hast iizx ano coom* loosely means "living thing that wedges itself into a rock crevice." Becky Moser informs me that *iizx* is from the verb *cazx*, "to tear or to split," which describes the sound heard when one tries to remove an inflated chuckwalla from its crevice. These three chuckwallas are distinguished from one another by color and size, with the *coof coopol* of Islas San Lorenzo, Ángel de la Guarda, and nearby islets being the darkest and least blotchy in coloration. The shrubs, caves, and crevices that these species frequent are well known to contemporary Comcáac hunters, who formerly scared the animals out of hiding by whirring wandlike branches of *Asclepias* milkweeds overhead to make a windlike noise (Felger and Moser 1985). The bloated animals were also deflated with pointed sticks and removed by hand. Although the San Esteban people had few land animals available as food, it is said that they did not particularly like the taste of chuckwallas so did not overexploit them (Bowen 2000). In one cave near the mouth of Arroyo Limantur, says Ernesto Molina, during the winter they stacked themselves atop one another clear to the ceiling, in a behavior which he called *ano yasnan*, "blanketing" or "stacking"; here they would have been particularly vulnerable to overharvesting.

Tom Bowen and the Mosers have recorded an oral history which suggests supernatural punishment for those who senselessly kill or drown chuckwallas. As Bowen (2000) puts it, "*Hast Cmique* said it is wrong to kill animals without reason…. A person who mistreats a chuckwalla by throwing it into the sea will



Sauromalus ater is the species found on the mainland surrounding the Gulf of California. *Photograph by Brad Hollingsworth.*

[2] Actually, the proper scientific name is *Sauromalus ater*; see Hollingsworth (2004. *IGUANA* 11:78–85) and the transcript of the ICZN Opinion 2072 (case 3143), *IGUANA* 11:86.

be punished when he is at sea, perhaps by being subjected to strong winds."

The chuckwallas themselves are known to relish ironwood leaves and cholla cactus flower buds. A song composed by Jesús Félix tells of a chuckwalla waiting for the sun to break through the fog before it goes to eat its favorite things. When José Juan Moreno went foraging with me on Isla San Esteban, he found a female chuckwalla on a ridge covered by cacti and agaves, and caught it with little trouble. At first I throught her snout had blood on it from biting José Juan's finger, but he laughed and said that her reddish mouth was from subsisting on *Pitahaya agria*, "sour cactus fruit" (*Stenocereus gummosus*), over the previous weeks. Moreno disabled his catch by twisting her legs, and kept the animal alive until he was back home in Punta Chueca. He savored the meat, including the fat-laden tail, the next morning.

Zooarcheologist Richard White (pers. comm.) informs me that the Comcáac have occasionally brought island chuckwallas to the mainland for release. Only recently have they formally initiated translocation for the purpose of wildlife conservation. Several Comcáac reported to me that their ancestors released chuckwallas from San Esteban onto Tiburón and Punto Sargento, and I was able to confirm the latter. In September 1998, the Comcáac community in Punta Chueca launched a chuckwalla captive breeding program with one male and three females from Isla San Esteban. By September 1999, the weakest female had died, but three other males had been recruited from the island. The Seri then discussed plans to shift the sex ratio of the group and expand their foraging area and native plant diet. The project, which they named *Ziix Hast Iizx Ano Coom Hant An Ihacámot*, meaning "Chuckwalla Nursery Grounds Refuge," remains successful as of the date of this publication.

Chilomeniscus stramineus may be banded or uniformly colored and common names reflect that difference, although both pattern phases represent the same species. *Photograph by Robert Powell.*

Chilomeniscus stramineus (*C. cinctus*[3])
English common name: Bandless Sandsnake
Spanish names: *culebra de los médanos, coralillo falso*
Comcáac name: *hapéquet camízj*

Hapéquet camízj means something akin to "causing a pregnant woman to have a well-formed child." The bandless morph of this sand-loving snake is treated with great affection by the Comcáac. They know that it burrows effortlessly through sand, and if they encounter one while digging, they will hold it in their hands and stroke it, then release it. It will not bite them; for their part, the Comcáac felt that they must protect this friendly snake from predatory coralsnakes and uncaring humans.

To ensure that a baby will be born with lovely skin, this snake is captured and passed across the belly or the small of the back of the expectant mother. This ritual, performed less and less frequently, is also intended to give pregnant women hopeful feelings and help them give birth to good-looking children.

Did I enjoy this book? Immensely. Why? I'm less sure. Part of its allure may have been pleasant memories of fieldtrips to the region around the Sea of Cortés and part of it may be a general fascination with desert landscapes and their reptilian faunas, but I think most of my favorable response can be attributed to a combination of an appreciation for new insights into favorite topics and getting caught up in the author's enthusiasm for his subject. Because I believe strongly in a conservation ethic, I also benefited from a better understanding of relationships between aboriginal peoples and the nature on which they depend.

Will other readers be equally enthralled? Maybe. Despite a broad interest in etymology and the generally utilitarian key to pronunciation of words in Cmique Iitom, I often became frustrated with my inability to translate the strangely spelled words into anything pronounceable. Others may find this even more daunting. Also, without a familiarity with the animals of the region prior to reading the book, many of the references and insights make sense only in retrospect. Although this is a common trait in academic monographs, casual readers should be fully aware that this is inevitable — or make sure to have the aforementioned copy of Grismer's guide to the Baja California herpetofauna readily at hand. If, however, one can cope with those two issues, the author's ability as a science writer as well as a scientist will inevitably make reading this volume eminently enjoyable. Nabhan's prose is down-to-earth and resorts to discipline-specific jargon much less frequently than almost any book that is comparably authoritative. He has invested much of his life in getting to know the human subjects of this narrative, and his obvious like of them, as well as of the animals who share the limelight, carries over to the printed page. His formal training as an ethnobotanist lends insights that introduce new dimensions for consideration by those of us whose expertise and interests have largely been limited to animals. Ultimately, however, what makes this book a winner is its unique ability to provide perspectives on animals in which we share an interest and which we could otherwise acquire only by spending years in the Comcáac territories.

References

Bowen, T. 2000. *Unknown Island: Seri Indians, Europeans, and San Esteban Island.* University of New Mexico Press, Albuquerque.

Felger, R.S. and M.B. Moser. 1985. *People of the Desert and Sea: Ethnobotany of the Seri Indians.* University of Arizona Press, Tucson.

[3] The name *Chilomeniscus cinctus* is no longer considered valid; see Powell (2004. *IGUANA* 11:7) and references cited therein.

CONSERVATION RESEARCH REPORTS

Snapping Turtle Conservation

On the assumption that drivers were harvesting Common Snapping Turtles (*Chelydra serpentina*) crossing the roads, almost invariably females searching for nesting sites, TUCKER AND LAMER (2004. *Turtle and Tortoise Newsletter* (8):10–11) examined sex ratios of turtles collected in three bodies of water in rural Illinois, two near a heavily traveled road and one on a National Wildlife Refuge, isolated from heavy vehicular traffic. Preliminary results indicated that the sex ratios in populations near the road where turtles are easily removed were heavily male-biased, whereas that of the population not subject to adventitious collecting was essentially 1:1. Also, sex ratios of Red-eared Sliders (*Trachemys scripta*), which presumably are not subject to collection for the cooking pot, were approximately 1:1 in all three lakes. The potential impact on the effective breeding size of the affected populations is severe. The authors recommended that the harvest of Common Snapping Turtles during the nesting season (May and June in Illinois) be prohibited and that similar surveys be conducted in other parts of the species' range to determine the range of this problem.

Reptiles are particularly vulnerable to road mortality due to thermoregulatory needs that favor the use of heat-retaining paved roads as heating surfaces, relatively slow locomotion, and migratory patterns exhibited by some species. This Prairie Kingsnake (*Lampropeltis calligaster*) was killed in Christian County, Missouri. *Photograph by Brian S. Edmond.*

Road Mortality in European Vipers

In a study of road mortality of Lataste's Viper (*Vipera latastei*) and Iberian Adder (*V. seoanei*) in a Portuguese national park, BRITO AND ÁLVARES (2004. *Amphibia-Reptilia* 25:459–465) reviewed a problem that affects many animals and proposed some ameliorating actions. They noted that road construction and accompanying vehicular traffic not only kill animals, but also change behavior, fragment habitats, create barriers, introduce pollutants, enhance the spread of exotic species, and increase human activity in fragile landscapes. Affecting animals ranging from invertebrates to large mammals and aquatic, terrestrial, and aerial species, road mortality modifies the demography and population structure of species and affects the recovery of endangered species or contributes to the endangerment of others. Local management strategies that could reduce the intensity of road mortality, at least in national parks or similar areas, include: (1) educational programs aimed primarily at children (see, however, the summary of Gomez et al. 2004 on this page), (2) active removal of live animals from the roads, (3) studies identifying the areas where mortality is highest and erection of warning signs, barriers to block animals from entering those sections of road, and under-road passages to allow safe transit.

Snapping Turtles are usually aquatic, rarely venturing out of the water. However, during the nesting season, females often range widely in search of suitable nesting sites. This adult female had recently emerged from a small lake when photographed. *Photograph by Robert Powell.*

Classroom Snake Talks and Attitudes toward Conservation

In a Canadian study, GOMEZ ET AL. (2004. *Herpetological Review* 35:338–341) tested the assumption that class-

room "snake talks" (interpretive programs) effectively alter grade-2 children's attitudes toward snakes and conservation. Results of the carefully designed study, implemented with full cooperation of the local public schools, showed that a "surprisingly high positive mean-attitude score" immediately and shortly after the presentations had returned to much lower pre-program levels within a week, and remained there until the end of the study two months later. The only exception to this general trend was an improved perception about touching snakes. "Although this positive attitude change did not influence the students' overall attitudes towards snakes, it still may have helped shape their 'mental picture' of them." The authors suggested that interpretive programs should not be discontinued and that periodic revisiting of the topic might improve results, but that caution should prevail until additional, possibly longer-term studies address unanswered questions regarding the effectiveness of snake talks.

Attitude assessment instrument used to quantify children's reactions.

Endangered St. Croix Ground Lizards on Green Cay

The St. Croix Ground Lizard (*Ameiva polops*) was listed as endangered by the U.S. Fish & Wildlife Service in 1977, and the population on Green Cay had not been surveyed since the mid-1990s. **McNair and Lombard** (2004. *Caribbean Journal of Science* 40: 353–361) conducted surveys and conservatively estimated the population at 183 lizards, which suggested a decline in the long-term population size. The presence of lizards was positively associated with greater numbers of shrubs. Ground Lizards were more abundant than expected in forested areas in the southern half of the cay, but less numerous than anticipated on beaches. The authors recommended additional population surveys using a variety of methods to monitor the population and assess ongoing effects of hurricanes. (Note that a PDF file of the entire article is available at www.caribjsci.org).

Ameiva polops from Green Cay. *Photograph by Amy Mackay.* (Ms. Mackay is a Ph.D. candidate at the Maryland Cooperative Fish and Wildlife Research Unit, University of Maryland Eastern Shore, and her dissertation deals with the Green Cay population of *A. polops*).

TSD in River Terrapins

A long-standing conservation program in Malaysia for the critically endangered River Terrapin (*Batagur baska*) may be hampered by the fact that clutches of headstarted animals raised from artificially incubated eggs and later released to the wild may be all male or all female. **Heng** (2005. *Turtle Survival Alliance Communiqué* 2(1):1–2) described studies by Dr. Gerald Kuchling, University of Western Australia, who used non-lethal endoscopy to examine animals from three headstart facilities on opposite coasts of Malaysia. He concluded that animals from eggs incubated indoors in styrofoam boxes tended to be all male, whereas those produced by outdoor in-ground incubation were sometimes all female and sometimes a combination of both sexes, possibly reflecting the ambient temperatures in different years. Incubation trials are being conducted to further investigate temperature-dependent sex determination (TSD) in this species.

Critically endangered River Terrapin (*Batagur baska*). *Photograph by Chris Tabaka, DVM.*

IGUANA NEWSBRIEFS

Getting Rid of the Gasparilla Island Ctenosaurs: The Lizards Don't Want to Leave

A news item in the Boca Beacon, the Boca Grande (Gasparilla Island) weekly newspaper, reported that reptile rescuers Jamie and Mark Mitchell of Pinellas County came to the island with about a dozen volunteers in an attempt to round up as many of the introduced Spiny-tailed Iguanas (*Ctenosaura similis*) as they could capture on 17–18 December and attempt to domesticate them. The Mitchell's claimed to have screened 300 individuals who had applied to adopt the captured animals and had a further 2,000 adoption applications. On both days of the roundup, conditions were partly cloudy and daytime highs were around 70 °F. According to Sarah Watkins, Director of the Gasparilla Island Conservation and Improvement Association, with whom the rescuers had coordinated their efforts, the actual number of animals caught was "around six."

As well-intentioned as I'm sure the Mitchell's were, a brief study of some ctenosaur natural history might have served to increase their chances of capturing animals. These ctenosaurs are wily ground-dwellers. On Gasparilla, they have adapted to hiding (sometimes in Gopher Tortoise burrows) on days when temperatures are suboptimal. Each individual, regardless of age or gender, will usually occupy a clearly defined territory capable of providing adequate food resources, basking spots, lookout spots, and a snug retreat into which it can quickly escape at the first sign of danger. In short, these animals are not easy to catch even for professionals, much less a random collection of volunteers.

A second, equally relevant issue is the proposed plan to "domesticate" the animals once they were captured. In my experience with the captive care of six (of 17) different ctenosaur species, I would say that *Ctenosaura similis* is among the more difficult species to maintain. Some ctenosaurs, notably *C. acanthura* and *C. pectinata*, are social and well-adapted to living in groups. *Ctenosaura similis* is not the least bit social and individuals must

Ctenosaurs such as those established on Boca Grande (Gasparilla Island) are quite elusive. *Photograph by John Binns.*

be housed separately. These animals also are easily extremely wary and, if unable to retreat into a secure spot, they can become very aggressive, even to the point of being self-destructive. In essence, they make poor captives.

A number of years ago, I adopted six Gasparilla ctenosaurs trapped by a local rescuer. Even the very youngest of these animals, little more than a hatchling, had enormous difficulty adapting to captivity and I have had a 50% mortality rate.

Perhaps, as Ray Ashton (Commentary, p. 48) has suggested, this is one instance when we simply cannot correct the human folly that created the situation, and the best response is to stand back to observe and learn while nature takes her course.

— AJ Gutman

An Endoscope and Iguana Burrows

The International Reptile Conservation Foundation (IRCF) donated an endoscope with the intention that it be used to probe iguana burrows during surveys in the Dominican Republic (see IGUANA 11(1):8–14). Ernst Rupp, Grupo Jaragua, reports that they started out by introducing the endoscope directly into burrows. Unfortunately, the tip of the endoscope gets clogged with dirt and dust and visibility is quickly reduced to zero. Maneuvering the cable in the fairly wide burrows also was difficult. In an effort to avoid those problems, they have experimented with inserting the endoscope into various flexible plastic hoses and tubes that can be maneuvered by pulling on one of two strings that are attached to the distal end. Flexible tubes seem to work best and they feel that they are making some progress.

They have experienced some success inserting the endoscope into the burrows of juvenile iguanas. Grupo Jaragua recently acquired a digital camera that can be attached to an adapter purchased for the endoscope, so they hope to be able to generate photographs in the near future.

Unfortunately, the 3-meter cable of the endoscope is not long enough to reach the end of the burrows of adult iguanas, which may be as long as 5 m. Larger endoscopes are too expensive at the moment and an additional problem would arise in regard to the light source (weight, batteries, power). In the interim, they will continue to work on improving their methods.

An endoscope of the type used to explore iguana burrows in the Dominican Republic (note, however, that the scope used in the field has a much longer optical cable than illustrated here).

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Publisher's Remarks

The International Reptile Conservation Foundation (IRCF) would like to welcome members of the now dissolved International Iguana Society. The IRCF will continue to publish the journal, IGUANA, and expand on the original mission of the IIS by striving to preserve reptiles and their habitats through the support of conservation efforts, educational programs, and scientific research that promote the welfare of natural ecosystems.

The IRCF provides support to conservation and research programs throughout the world, and promotes conservation awareness in schools, at special events and conventions, on television, and through its public website, Cyclura.com. Among others, the IRCF has assisted the Blue Iguana Recovery Program, Conservation Project Utila Iguana, Turtle Survival Alliance, Chinese Alligator Fund, International Conservation Fund for the Fijian Crested Iguana, and Anegada Iguana recovery efforts.

As a member of the IRCF, you will continue to receive our quarterly journal, IGUANA. While continuing to focus on iguanas, content of the journal will reflect the broader mandate of the IRCF as described by the addition of Conservation, Natural History, and the Husbandry of Reptiles below the title. As in previous issues, IGUANA will continue to provide regular feature articles, species profiles, husbandry, profiles of prominent herpetologists and conservationists, historical perspectives, book reviews, and newsbriefs. Beginning with this issue, we also will include travelogues that feature herpetologically interesting places throughout the world, commentaries on topics important to conservation, summaries of current reptile conservation efforts, and a "Focus on Conservation" that will highlight a specific conservation effort worthy of your support.

Membership dues for IGUANA will remain $25 per year for our domestic and Canadian members, while the price for international members will be raised to $50 to cover the expense of mailing the journal overseas. Both domestic and international members will have the option of receiving a digital version of the journal in Abode PDF format for $25. The latter can be downloaded on demand, and notification of each new issue will be sent to digital subscribers via email. The Adobe PDF is optimized for web publishing and does not provide the quality and resolution of the archival printed version, especially noticeable in photographs and complex graphics.

We at the IRCF look forward to your continuing support. Please don't hesitate to contact us if you have any questions.

— John Binns, President, IRCF

Erratum: On p. 214 of the December 2004 issue of *IGUANA*, the photograph labeled "*Cyclura cychlura figginsi*" actually portrays a concentration of Allen Cays Iguanas (*C. c. inornata*) on Leaf Cay.

Statement of Purpose

The International Reptile Conservation Foundation works to conserve reptiles and the natural habitats and ecosystems that support them.

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FOCUS ON CONSERVATION

Grand Cayman Blue Iguana (*Cyclura lewisi*)

Blue Iguana Recovery Program

GRAND CAYMAN, CAYMAN ISLANDS

Conservation action for the Grand Cayman Blue Iguana began in 1990 and accelerated in late 2001, after the Cayman Islands hosted a meeting of the World Conservation Union's Iguana Specialist Group. At that landmark meeting, the world's top experts on iguana conservation worked with local scientists and managers to conceive an action plan to save the Blue Iguana. Shortly thereafter, news came in from field surveys that wild Blue Iguanas were truly on the verge of functional extinction, and the Blue Iguana Recovery Program was founded in its present form.

The original program began with captive breeding, combined with long-term field studies of the remnant wild Blue Iguana population. This yielded essential scientific data to guide early conservation planning. By 1994, enough information was on hand to enable the Cayman Islands National Trust's small team to test a key strategy: release of captive-bred subadults back to the wild. Captive breeding success led to stepwise expansion of the captive facilities, which were relocated in 1995 to the QE II Botanic Park, and by 2004 reached the capacity to rear and release up to 100 subadult Blue Iguanas annually.

Captive-bred Blue Iguanas released into the QE II Botanic Park were breeding in the wild by 2000: but, as this restored population gradually expanded, the original wild population was in catastrophic decline, falling to between 10 and 25 individuals by 2002. Today, the Park is near its limit, with about 30 free-ranging Blue Iguanas, and a second restored population has recently been founded in the National Trust's Salina Reserve. The Program owes much of its current success to expanding volunteerism and financial support from many sectors. Both are as critical now as they have ever been, now that the work moves toward large-scale population restoration, giving the Grand Cayman Blue Iguana a future once more.

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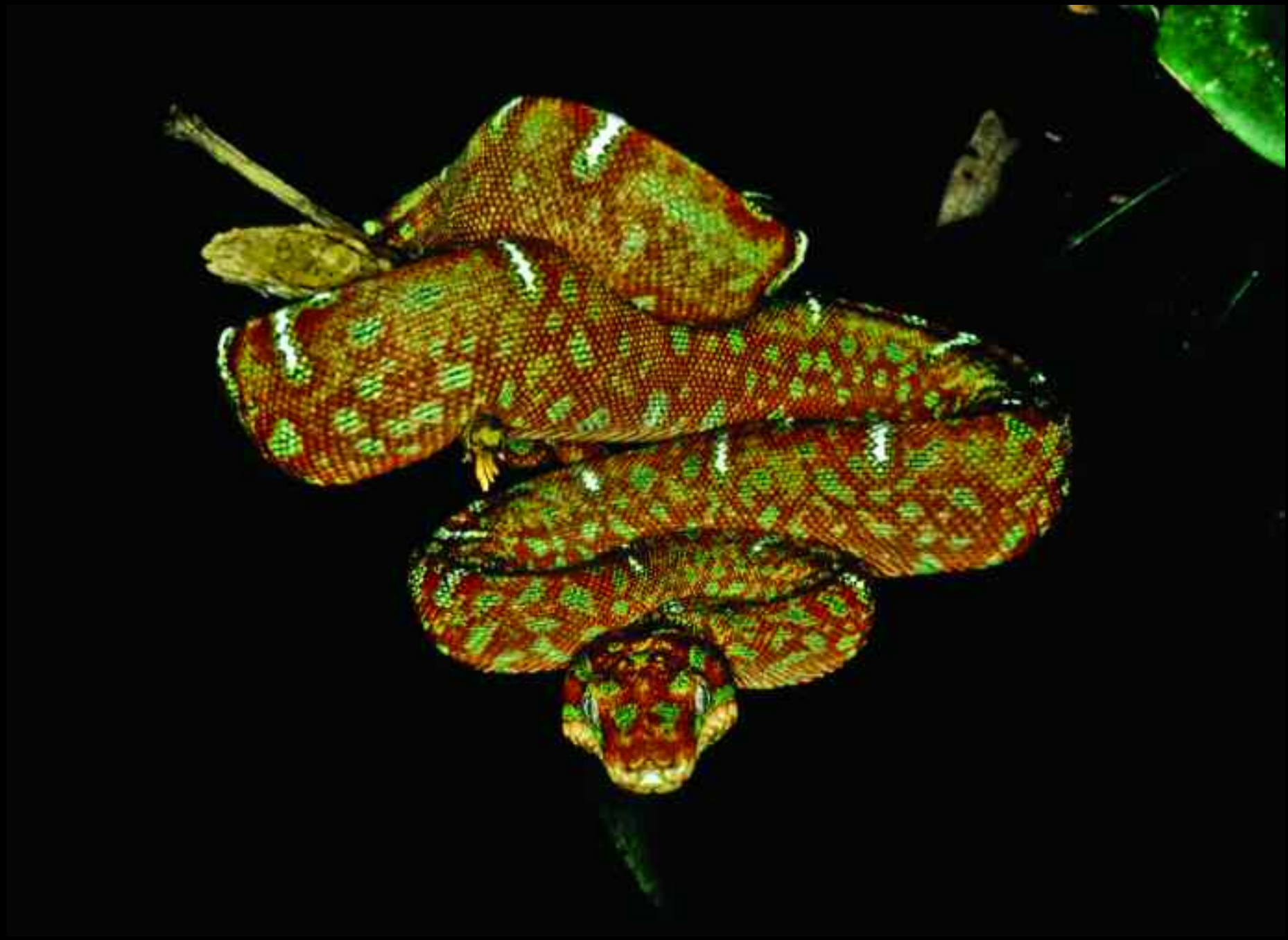
Gila Monsters (*Heloderma suspectum*) are rare residents of the Sweetwater Preserve (see article on p. 14). *Photograph by Thomas Wiewandt.*



Juvenile *Corallus caninus* from 101 km S Santarem, Pará, Brazil (see article on p. 2). *Photograph by Laurie J. Vitt.*