

VOLUME 15, NUMBER 1

MARCH 2008

IGUANA

CONSERVATION, NATURAL HISTORY, AND HUSBANDRY OF REPTILES

International Reptile Conservation Foundation

www.IRCF.org



JOHN BINNS

Although the subspecies is listed as Critically Endangered on the IUCN Red List, very little is known about the Sister Isles Iguana (*Cyclura nubila caymanensis*) on Little Cayman or Cayman Brac. See article on p. 12.



MICHAEL D. KERN

The labyrinthine corridors of Guatemalan markets provide a wealth of cultural artifacts, including textiles, clothes, and statues, along with fruits, vegetables, meat, fish, shoes, and wedding dresses (see Travelogue on p. 42).



JOHN BINNS

The Cayman Sister Isles Iguana Project seeks to establish baseline data on the status of *Cyclura nubila caymanensis*, which is endemic to Little Cayman Island and Cayman Brac, and about which very little is known (see article on p. 12).



PHILIP FRANK

Strikingly colored hatchling Ashy Geckos (*Sphaerodactylus elegans elegans*) provide ample rewards to keepers of these tiny, but hardy little lizards (see article on p. 36).



MICHAEL D. KERN

The IRCF is actively engaged in facilitating the conservation of Guatemalan Beaded Lizards (*Heloderma suspectum charlesbogerti*) (see articles on p. 20, 36, and 61).



MICHAEL J. MOREL

American Kestrels (*Falco sparverius*) are diligent hunters of West Indian reptiles, this individual has captured a Puerto Rican Ground Lizard (*Ameiva exsul*) (see article on p. 8).



JOHN BINNS

Ricord's Iguanas (*Cyclura ricordii*) occur only in the most xeric Hispaniolan habitats, where their existence is threatened by human activities (see article on p. 2).



TABLE OF CONTENTS

FEATURE ARTICLES

Conserving <i>Cyclura ricordii</i> 2007	<i>Ernst Rupp, Sixto J. Incháustegui, and Yvonne Arias</i>	2
Avian Predators of West Indian Reptiles	<i>Robert Powell and Robert W. Henderson</i>	8
The Cayman Sister Isles Iguana Project: Identifying the Conservation Needs of <i>Cyclura nubila caymanensis</i> ...	<i>Matthias Goetz</i>	12
The Guatemalan Beaded Lizard Breeding Program at Zoo Atlanta	<i>Brad Lock</i>	20
Ticks (<i>Amblyomma</i> spp.) on Black Iguanas (<i>Ctenosaura similis</i>) in Costa Rica	<i>Jesus A. Rivas</i>	24
Iguanas: Early European Impressions and Illustrations	<i>Chuck Schaffer and Rick Schaffer</i>	28

HUSBANDRY

The Reef Geckos of Florida	<i>Tom Heagy and Phillip Frank</i>	36
----------------------------------	------------------------------------	----

TRAVELOGUE

Surprising Guatemala: A Journey with a Cause	<i>Michael D. Kern</i>	42
--	------------------------	----

HISTORICAL PERSPECTIVES

The Fighting Behaviour of Marine Iguanas	<i>I. Eibl-Eibesfeldt</i>	49
The Booming Lizard of Australia	<i>Walter H. Bone</i>	50

COMMENTARY

Anaconda Conservation: A Reply to Rivas	<i>Tomás Waller and Patricio Alejandro Micucci</i>	51
---	--	----

BOOK REVIEWS

<i>Snakes of the Southeast</i> by Whit Gibbons and Mike Dorcas	<i>Robert W. Henderson</i>	54
<i>Lizard Love</i> by Wendy Townsend	<i>AJ Gutman</i>	55

CONSERVATION RESEARCH REPORTS: Summaries of Published Conservation Research Reports	56
NATURAL HISTORY RESEARCH REPORTS: Summaries of Published Reports on Reptilian Natural History	58
NEWSBRIEFS	59
IRCF on the Move	61
EDITORIAL INFORMATION	63
FOCUS ON CONSERVATION: A Project You Can Support	64



BILL ZIEGLER

Conservationists believe only about 1,500 Gharials (*Gavialis gangeticus*) are left in the wild, many of them in a sanctuary based along the Chambal River, where conservationists and scientists are scrambling to determine what killed at least 50 of the critically endangered reptiles in recent months. Suspected causes include an unknown parasite found in the dead Gharials' livers and kidneys and the possibility that they may have died after eating contaminated fish from the polluted Yamuna River, a tributary of the Chambal.



JAN PANER

The critically endangered Ricord's Iguana (*Cyclura ricordii*) has a very limited geographic distribution in the southwestern Dominican Republic and an adjacent area in Haiti.

Conserving *Cyclura ricordii* 2007

Ernst Rupp, Sixto J. Incháustegui, and Yvonne Arias

Grupo Jaragua Inc.
El Vergel # 33
Santo Domingo
Dominican Republic
(jaragua@tricom.net)

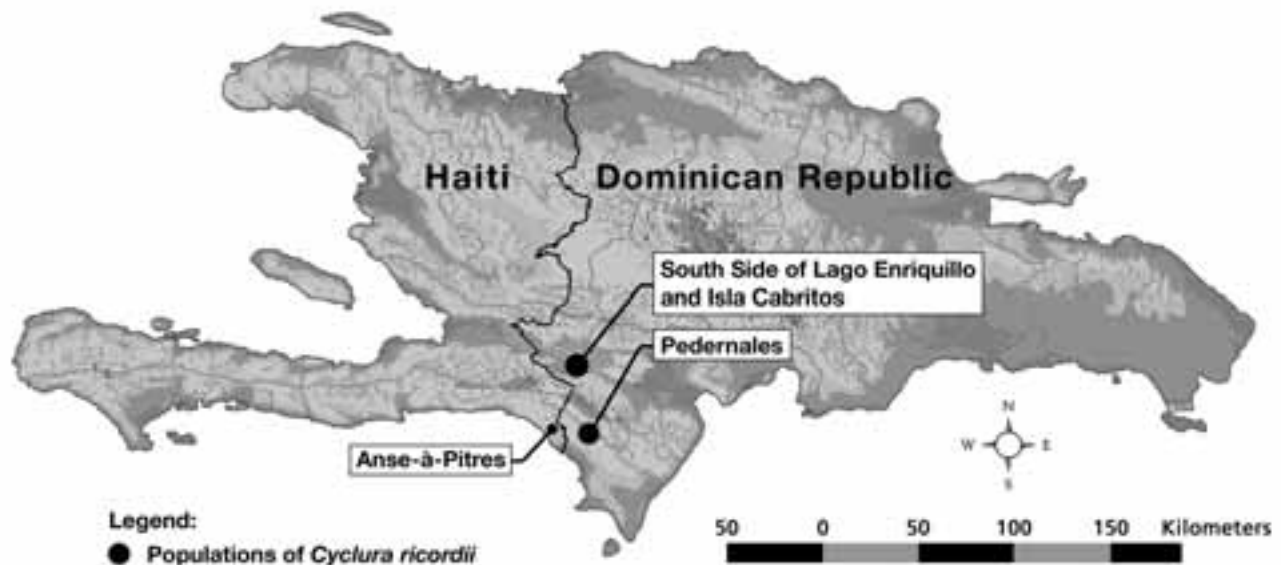
Photographs by Ernst Rupp except when otherwise indicated.

Ricord's Iguana (*Cyclura ricordii*) is one of the most specialized iguanas of the endemic Caribbean genus *Cyclura*. The species, which is sympatric with the Rhinoceros Iguana (*Cyclura cornuta*), has a very limited geographic distribution in the southwestern Dominican Republic. Three known subpopulations are within the Dominican Jaragua–Bahoruco–Enriquillo Biosphere Reserve. A fourth population has been discovered recently in Anse-à-Pitres, Haiti. The species is included as Critically Endangered in the IUCN Red List, and is the subject of a recovery plan produced by the IUCN Iguana Specialist Group (ISG) in 2003 and reviewed in 2004.

Grupo Jaragua, a Dominican not-for-profit conservation organization, has been working for biodiversity conservation in the area for the last 15 years. It is a member of a consortium of national and international organizations that has been working for the recovery of the species under the leadership of the International Iguana Foundation and the Iguana Specialist Group.



Ricord's Iguanas (*Cyclura ricordii*) survive today only in the most xeric Hispaniolan habitats.



The known distribution of Ricord's Iguana (*Cyclura ricordii*) on Hispaniola.

The recovery of *C. ricordii* is part of Grupo Jaragua's program to conserve biodiversity in the biosphere reserve in the southwestern part of the Dominican Republic, thought to be one of the most diverse sites in the insular Caribbean. Work is conducted in close coordination with the Dominican Government, integrating community-based local municipalities, national, and international organizations.

During 2007, Grupo Jaragua continued to survey nesting activities of *Cyclura ricordii*. A land tenure study in the Pedernales region was undertaken, and we began the investigation of population densities. We are presently working on the translation of the iguana teaching manual from Spanish into French for Haitian schools.

Nesting

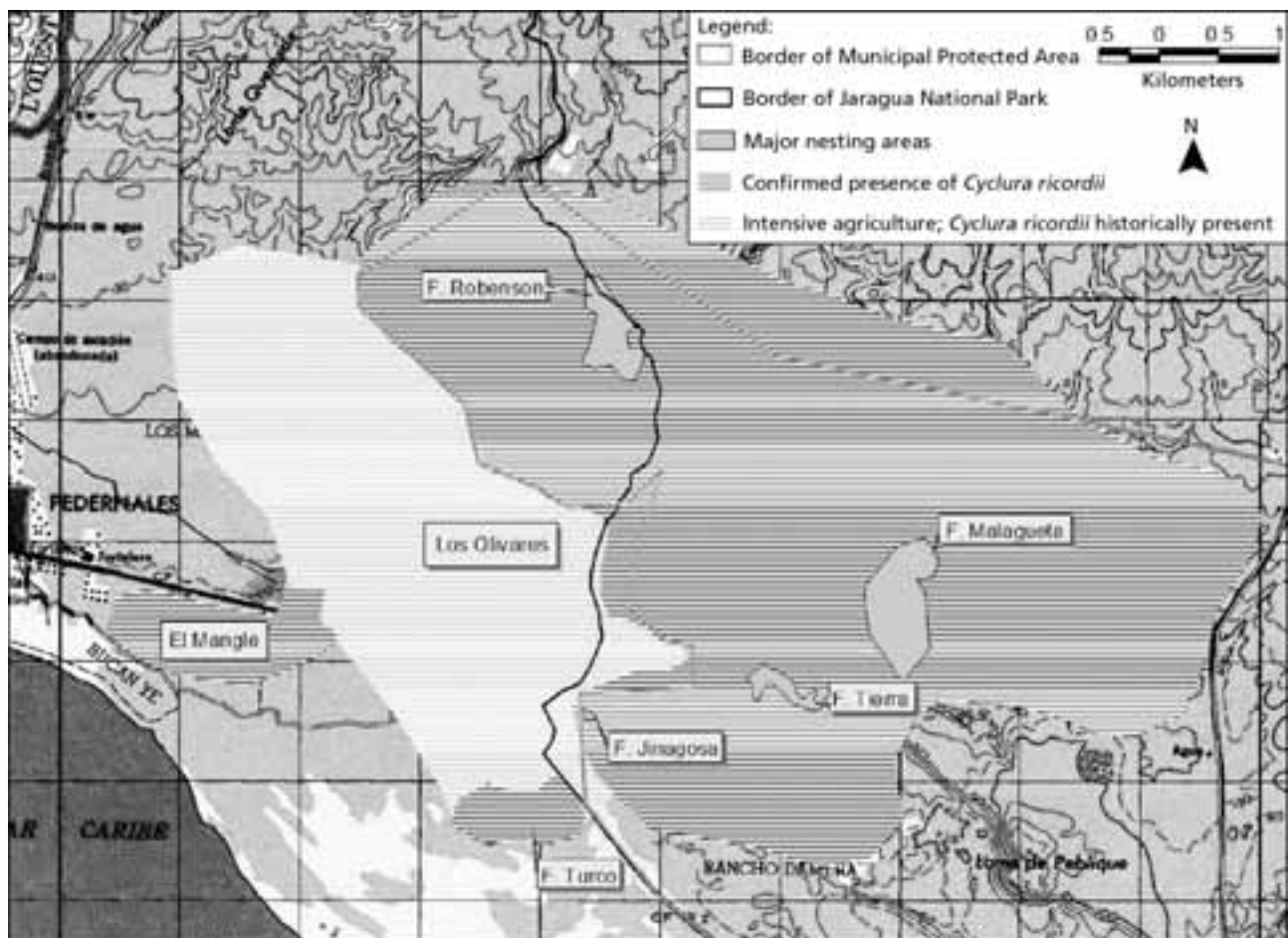
After the 2007 season, we now have four years of data on the nesting of *C. ricordii* and *C. cornuta* in the Pedernales area. The study includes the four major nesting zones of *C. ricordii*, which are Fondo de la Tierra, Fondo de la Malagueta, Fondo de Robenson, and Fondo de la Jinagosa. Two nesting sites where only *C. cornuta* is present (Puente arriba and Puente abajo) also are included in the study.

Nests were marked with flags and their coordinates taken with GPS. Hatched nests are easily identified by the escape holes hatchlings excavate when digging their way out of the nests.

The nesting season for *C. ricordii* starts in early to mid-March and extends for roughly three months until early to mid-June. Hatching occurs from the second half of June to the later half of September. The nesting season for *C. cornuta* starts in mid-June and ends in mid-July. Hatchlings appear from mid-September to mid-October. The nesting season for *C. ricordii* spans three months, but that for *C. cornuta* lasts barely a month. The nesting seasons of the two species do not overlap. The main nesting efforts of Ricord's Iguana are in April and May, which usually coincides with the spring rainy season, and hatching occurs during the drier part of the year. For *C. cornuta*, the situation is reversed. Nesting occurs during the dry parts of June and July, and hatching coincides with the heavy autumn rainy season. Hatchling *C. ricordii* may have a harder time finding sufficient food resources when hatching during a period with little fresh vegetation, whereas hatchling *C. cornuta* usually are able to feast on lush new growth.

A total of 194 nests were found and marked during the 2007 nesting season. Hatching success for marked nests in all study areas combined was 92.4%. Adding non-marked hatched nests found during hatching season, a total of 219 hatched nests were encountered.

When examining the nesting results for the last four years, the number of "total nests hatched" fluctuates around 200 nests per year. Nesting success has been relatively constant.



Localities in the Pedernales region where the presence of *Cyclura ricordii* has been confirmed.

Table 1. Nesting and hatching seasons of Rock Iguanas in the southwestern Dominican Republic.

Year	Species							
	<i>Cyclura ricordii</i>				<i>Cyclura cornuta</i>			
	Nesting		Hatching		Nesting		Hatching	
2003	APR/MAY		JUL/AUG		—		—	
2004	19 MAR	2 JUN	29 JUN	12 SEP	16 JUN	16 JUL	02 SEP*	20 OCT
2005	08 MAR†	16 JUN	10 JUN	19 SEP	22 JUN	17 JUL	14 SEP	17 OCT
2006	15 MAR	09 JUN	11 JUL	19 SEP	15 JUN	17 JUL	10 OCT	15 OCT
2007	12 MAR	08 JUN	—	19 SEP	13 JUN	10 JUL	14 SEP	19 OCT

* Hatchlings dug out of nest

† First nest outside study area on 28 FEB

Table 2. Nesting records for *Cyclura ricordii* in 2007. 1 = Fondo de la Tierra; 2 = Fondo de la Malagueta; 3 = Fondo de Robenson; 4 = Fondo de la Jinagosa.

Site	Size (ha)	Transect Area (ha)	Nests Marked	Nests not Found	Escape Hole not Found	Marked and Hatched	Percent Nests Hatched	Non-marked Hatched	Total Nests Hatched	Nests Hatched per ha
1	10.3	—	89	2	8	79	88.8	24	103	10.0
2	47.1	4.2	83	1	5	77	92.8	10	87	20.7
3	25.1	4.3	15	—	—	15	100.0	4	19	4.4
4	0.6	—	7	—	—	7	100.0	3	10	16.7
Total	—	—	194	3	13	178	92.4	41	219	11.3

Table 3. Total *Cyclura ricordii* nests hatched in the four major study areas (see text).

Year	Nests Marked	Nests not Found	Escape Hole not Found	Marked and Hatched	Percent Nests Hatched	Non-marked Hatched	Total Nests Hatched	Nests Hatched per ha
2004	208	5	20	183	88.0	15	198	10.2
2005	166	1	14	151	91.0	27	178	9.2
2006*	214	5	23	186	86.9	51	227	11.7
2007	194	3	13	178	92.4	41	219	11.3

* vegetation was destroyed in Fondo de la Tierra before nesting season

Multiplying 200 nests by the average of 12.5 eggs per nest provides an estimate of ~2,500 hatchlings/year for all study areas combined.

A new record was set for the number of eggs in a single nest. One nest in the Fondo de la Tierra contained 20 hatched eggs. The old record was 19 eggs.

The fondos, with their deep, well-drained soils, seem to provide the perfect nesting medium for *C. ricordii*. *Cyclura cornuta* also uses these fondos for reproduction, but seems to confine nesting activities to the fringes of the fondos close to the surrounding rocky areas. The fondos with *C. ricordii* nests support a low number of *C. cornuta* nests. In contrast, the two small fondos of Puente Arriba and Puente Abajo, where Ricord's Iguanas are not known to nest, show a high concentration of *C. cornuta* nests.

The number of hatched *C. cornuta* nests dropped sharply from 101 in 2006 to 38 in 2007. We attribute this reduction to



Nest with a new record of 20 hatched eggs in the Fondo de la Tierra excavated by students Gerson Feliz and José Luis.

Table 4. *Cyclura cornuta* nests hatched where *C. ricordii* is present (four major study areas combined).

Year	Nests Marked	Nests not Found	Escape Hole not Found	Marked and Hatched	Percent Nests Hatched	Non-marked Hatched	Total Nests Hatched	Nests Hatched per ha
2004	23	0	0	23	100.0	5	28	1.4
2005	25	0	3	22	87.0	2	24	1.2
2006*	17	0	2	15	88.2	3	18	0.9
2007	32	0	3	29	90.6	3	32	1.6

* vegetation was destroyed in Fondo de la Tierra before nesting season

Table 5. *Cyclura cornuta* nests hatched where *C. ricordii* is not present (Puente Arriba and Puente Abajo combined).

Year	Nests Marked	Nests not Found	Escape Hole not Found	Marked and Hatched	Percent Nests Hatched	Non-marked Hatched	Total Nests Hatched	Nests Hatched per ha
2004	—	—	—	—	—	124	124	1,851
2005	—	—	—	—	—	101	101	1,507
2006*	—	—	—	—	—	101	101	1,507
2007	—	—	—	—	—	38	38	567

the presence of a band of feral dogs that rampaged through the nesting grounds at Puente Arriba and Puente Abajo. Fourteen mutilated *C. cornuta* carcasses were found in those areas. During the *C. ricordii* nesting season, we also found three mutilated Ricord's Iguana females in the Fondo de la Malagueta. The estimated number of dogs ranges between 5 and 15 according to different witnesses. These animals are extremely shy and seem to have a very large activity range. We are trying to capture them in order to avoid further disasters.

We have surveyed the area around Anse-à-Pitres in Haiti now for the second year without finding any nests.

Land Tenure

In the Pedernales region, *Cyclura ricordii* is found mainly in an area of limestone terraces northeast of "Los Olivares," a flat plain of roughly 12 km² characterized by well-drained, deep soil of reddish color. It is currently subject to intensive agricultural use, which includes an elaborate irrigation system. Residents mention that Los Olivares had a dense population of *C. ricordii* before being converted into agricultural land.



Carcass of gravid female Ricord's Iguana killed by feral dogs.

The rocky outcrops of the limestone terraces where Ricord's Iguanas still exist do not offer the same soil conditions as those found in Los Olivares. Soil occurs only in depressions within the rocks, which are called "fondos." These are the sites where females nest. The fondos constitute less than 5% of the area where the species is still extant. They thus represent a limited resource, in sharp contrast to former times when the flat plain of Los Olivares provided many suitable nesting sites.

In order to provide Ricord's Iguanas a future, special attention must be given to the protection of the fondos, especially the larger ones like Fondo de la Malagueta, Fondo de Robinson, Fondo de la Tierra, and Fondo de la Jinagosa. The creation of the Municipal Protected Area by the Municipality of Pedernales in 2004, which covers most Ricord's Iguana living space and includes all four of the major fondos, was a huge step in providing legal protection for the species. Part of the area also is within the limits of Jaragua National Park.

In February 2006, a powerful land baron claimed to have bought the Fondo de la Tierra and started to remove the vegetation with bulldozers with blatant disregard for its legal protected status. Alerted by our field assistant Salvador, Grupo Jaragua, in cooperation with the Municipality of Pedernales, was able to intervene and the destruction was stopped. However, considerable damage had already been done. About 40 active Ricord's Iguana retreats had been destroyed. Although nesting activities later in the same year were not affected, we decided to fence the entrance to the fondo to prevent further unwanted access. Unfortunately, the danger of intrusion remains. The Fondo de la Tierra and other minor nesting areas are bordered closely by agricultural land. Without a buffer, the desire of farmers to extend their property into iguana territory is an ever-present threat.

In the southwest of the country, government-owned land traditionally has been regarded as no man's land that could be



Field assistants Pirín and Salvador at the entrance of the Municipal Protected Area.

claimed and possessed by simply putting it to agricultural use or fencing it. Although the legal picture regarding ownership has changed in recent years, some people cling to this practice. Especially during periods prior to elections — and 2008 will see another presidential election — when vigilance is less effective, this practice takes its toll, even in protected areas. The Ricord's Iguana areas are not immune.

Aware of this imminent danger, Grupo Jaragua proceeded with a study to determine land tenure in and around the critical habitats. The study itself is somewhat tricky as hardly any



Surveyor Tédus Pérez and student José Luis mapping fenced areas within Ricord's Iguana habitat.

ownership is actually recorded with a land title in the official government registry. So, we had to go to the field to survey the area plot by plot to determine the actual owners. Fieldwork has been completed and a final report, with legal conclusions, will be available by the end of the year.

The idea of the exercise is to pinpoint critical areas where a clash between agricultural use and conservation could potentially occur. Viable solutions for these areas must be resolved. Means of defusing smoldering conflicts should probably include some combination of the following strategies: (1) The purchase of land for a buffer zone around sensitive areas, especially the nesting areas (in contrast to the lack of respect for government-owned land, private ownership is generally acknowledged in the community). (2) The promotion of land use with minimal impact on the iguanas (bee keeping, agroforestry systems with native species). (3) Vigilance in close coordination with the applicable government agencies to prevent further fencing of critical iguana habitat.

Population Studies

Ongoing fieldwork is providing preliminary results for the Pedernales region, and we will address the southern shore of Lago Enriquillo during the next few months. Ideally, we will combine forces with the crew from the Indianapolis Zoo in April. They are planning to do population studies on Isla Cabritos, which will facilitate a coordination of methods and an exchange of information.

Translation of Iguana Manual

The Spanish version of the iguana manual has been translated into French and is being proofread in Canada. We are looking forward to cooperating with the IRCF on the layout for the manual. John Binns of the IRCF has designed t-shirts promoting Ricord's Iguana conservation and is polishing our reports for publication. The manual is of great importance in a country where printed material is scarce. It will be used by schoolteachers as a teaching aid.

Acknowledgements

We thank the IIF for financial support, and also express our gratitude to the Ministry of Environment and Natural Resources and the Municipalities of Pedernales and Duvergé for collaboration in the project.

References

- Arias, Y., S.J. Incháustegui, and E. Rupp. 2004. *Cyclura ricordii* on the Barahona Peninsula: A Preliminary Report. *Iguana* 11:9–14
- Ottenwalder, Jose. 1999. Ricord's Iguana, *Cyclura ricordi*, pp. 51–55. In: A. Alberts (comp. & ed), *West Indian Iguanas: Status Survey and Conservation Action Plan*. IUCN/SSC West Indian Iguana Specialist Group. IUCN, Gland, Switzerland and Cambridge, UK.
- Ramer, J. 2004. A Survey of Ricord's Iguanas (*Cyclura ricordii*) and Rhinoceros Iguanas (*Cyclura cornuta*) in Isla Cabritos National Park, Dominican Republic 2003: A Preliminary Report. *Iguana* 11:89–95.





ELADIO FERNANDEZ

Many West Indian birds not normally associated with predation on vertebrates will eat lizards when the opportunity for a high-energy meal presents itself. This Hispaniolan Trogon (*Priotelus roseigaster*) has captured a Hispaniolan Twig Anole (*Anolis singularis*).

Avian Predators of West Indian Reptiles

Robert Powell¹ and Robert W. Henderson²

¹Avila University, Kansas City, Missouri

²Milwaukee Public Museum, Milwaukee, Wisconsin

On continents, birds that regularly prey on vertebrates are usually raptors (birds of prey) that exploit abundant and prolific rodent populations. Although other mammals, birds, reptiles, amphibians, and even fish are taken, they rarely comprise the focus of a predator's attention, and are instead taken opportunistically or when seasonally abundant, such as during migration periods. On tropical islands, however, reptiles — especially lizards — often are the most abundant and visible vertebrates, and constitute the principal quarry of raptors and many other birds not usually associated with hunting vertebrates.

In our forthcoming compilation of data pertaining to the natural history of West Indian amphibians and reptiles, we cited 36 references that recorded avian predation on reptiles. These constitute 37 species of birds and 58 species of reptilian prey. In addition, many published accounts speak of avian predation affecting population sizes of lizards, especially on very small islands with minimal cover, or of birds taking anoles (*Anolis* spp.), for example, but without identifying the species of lizard. Others note that a number of large, insectivorous birds were observed eating anoles, but do not identify the predators. Those accounts

are not included in the totals above or in the accompanying table, which lists only records of known predators and prey. Particularly in light of the reality that recorded observations are mostly anecdotal (except for a few studies of raptor diets that are included), those listed must reflect but a small percentage of actual predation events. Nevertheless, the number of such records testifies eloquently to both the ability of predatory birds (obligate or facultative) to exploit an abundant and prolific resource and the ability of their prey to maintain population numbers in the face of substantial but obviously sustainable losses.

Acknowledgments

We thank Michael J. Morel (whose photographs also grace the inside front and back covers of this issue), Eladio Fernández, and Brenda S. and R. Duncan Kirby for the use of photographs. That by Eladio Fernández previously appeared in *Hispaniola. A Photographic Journey through Island Biodiversity. Biodiversidad a Través de un Recorrido Fotográfico* (2007; reviewed in *Iguana* 14(4): 260), and those by Brenda S. and R. Duncan Kirby in *The Reptiles and Amphibians of the Dutch Caribbean: St. Eustatius, Saba, and St. Maarten* (2005; reviewed in *Iguana* 12(4): 273–274).



BRENDA S. AND R. DUNCAN KIRBY






American Kestrels (*Falco sparverius*) are small raptors that frequently take insects, especially when abundant and concentrated, as well as small vertebrates. They have been documented as predators of 12 different species of West Indian lizards (ten of them species of anoles). The Puerto Rican Kestrel illustrated on the inside front and back covers is eating a Puerto Rican Ameiva (*Ameiva exsul*). These birds are eating a Statia Bank Tree Anole (*Anolis bimaculatus*; left) and a Statia Bank Bush Anole (*A. schwartzii*; right).

Table. Avian predators on West Indian reptiles. Predators are listed alphabetically by scientific name in four categories: (1) Raptors (birds of prey that regularly or exclusively take vertebrate prey); (2) Seabirds (primarily marine birds that feed mostly on fish, but may opportunistically take terrestrial vertebrates); (3) Egrets and herons (wading birds that regularly take aquatic and terrestrial vertebrates); and (4) Birds not usually considered to be predators on vertebrates, although several species in this list are known to forage opportunistically for lizards and small snakes, and reptiles may constitute a major component of their diets.

Avian Predator

Prey

Raptors

<p>Red-tailed Hawk (<i>Buteo jamaicensis</i>)</p>  <p style="font-size: small; transform: rotate(-90deg); position: absolute; left: -40px; top: 50px;">DANIEL CARDIFF</p> <p>Red-tailed Hawks are large raptors capable of taking lizards as large as iguanas.</p>	<p>Lesser Antillean Iguana (<i>Iguana delicatissima</i>) Common Iguana (<i>Iguana iguana</i>) Puerto Rican Crested Anole (<i>Anolis cristatellus</i>) Puerto Rican Giant Anole (<i>Anolis cuvieri</i>) Puerto Rican Emerald Anole (<i>Anolis evermanni</i>) Yellow-chinned Anole (<i>Anolis gundlachi</i>) Puerto Rican Spotted Anole (<i>Anolis stratulus</i>) Puerto Rican Racer (<i>Alsophis portoricensis</i>)</p>
<p>Broad-winged Hawk (<i>Buteo platypterus</i>)</p>	<p>Lesser Antillean Iguana (<i>Iguana delicatissima</i>) Puerto Rican Giant Anole (<i>Anolis cuvieri</i>) Grenada Tree Anole (<i>Anolis richardii</i>) Leeward Groundsnake (<i>Liophis juliae</i>)</p>
<p>Ridgway's Hawk (<i>Buteo ridgwayi</i>)</p>	<p>Dominican Giant Anole (<i>Anolis baleatus</i>) Northern Green Anole (<i>Anolis chlorocyanus</i>) W-headed Racer (<i>Laltris dorsalis</i>) Hispaniolan Lesser Racer (<i>Antillophis parvifrons</i>) Sharp-nosed Treesnake (<i>Uromacer oxyrhynchus</i>) Hispaniolan Trope (<i>Tropidophis haitianus</i>)</p>
<p>American Kestrel (<i>Falco sparverius</i>)</p>  <p style="font-size: small; transform: rotate(-90deg); position: absolute; left: -40px; top: 50px;">LUIS O. NIEVES</p> <p>American Kestrel with a Crested Anole (<i>Anolis cristatellus</i>) on Puerto Rico.</p>	<p>Stout Iguana (<i>Cyclura pinguis</i>) juveniles Lesser Antillean Iguana (<i>Iguana delicatissima</i>) juveniles Common Iguana (<i>Iguana iguana</i>) juveniles Statia Bank Tree Anole (<i>Anolis bimaculatus</i>) Cuban Giant Anole (<i>Anolis equestris</i>) Anguilla Bank Tree Anole (<i>Anolis gingivinus</i>) Anguilla Bank Bush Anole (<i>Anolis pogus</i>) Cuban Green Anole (<i>Anolis porcatius</i>) Saba Anole (<i>Anolis sabanus</i>) Cuban Brown Anole (<i>Anolis sagrei</i>) Statia Bank Bush Anole (<i>Anolis schwartzi</i>) Les Saintes Anole (<i>Anolis terraaltae</i>) Cuban Ameiva (<i>Ameiva auberi</i>) Hispaniolan Giant Ameiva (<i>Ameiva chrysoleama</i>) Puerto Rican Giant Ameiva (<i>Ameiva exsul</i>) Dominica Ameiva (<i>Ameiva fuscata</i>) Anguilla Bank Ameiva (<i>Ameiva plei</i>)</p>
<p>Cuban Pygmy Owl (<i>Glaucidium siju vittatum</i>)</p>	<p>Cuban Ameiva (<i>Ameiva auberi</i>)</p>
<p>Puerto Rican Screech Owl (<i>Otus nudipes</i>)</p>	<p>Puerto Rican Gracile Boa (<i>Epicrates monensis</i>)</p>
<p>Osprey (<i>Pandion haliaetus</i>)</p>	<p>Central Bahamas Rock Iguana (<i>Cyclura rileyi</i>)</p>
<p>Barn Owl (<i>Tyto alba</i>)</p>  <p style="font-size: small; transform: rotate(-90deg); position: absolute; left: -40px; top: 50px;">GRABME PURDY</p> <p>Although primarily nocturnal, Barn Owls occasionally take diurnally active lizards.</p>	<p>Jamaican Giant Anole (<i>Anolis garmani</i>) Slender Cliff Anole (<i>Anolis lucius</i>) Haitian Giant Anole (<i>Anolis ricordi</i>) Jamaican Croaking Gecko (<i>Aristelliger praesignis</i>) Hispaniolan Giant Ameiva (<i>Ameiva chrysoleama</i>)</p>

Seabirds

<p>Magnificent Frigatebird (<i>Fregata magnificens</i>)</p>	<p>Anguilla Black Ameiva (<i>Ameiva corax</i>)</p>
<p>Laughing Gull (<i>Larus atricilla</i>)</p>	<p>Cuban Iguana (<i>Cyclura nubila</i>) eggs and hatchlings Anguilla Black Ameiva (<i>Ameiva corax</i>)</p>
<p>Royal Tern (<i>Sterna maxima</i>)</p>	<p>Cuban Iguana (<i>Cyclura nubila</i>) eggs and hatchlings</p>
<p>Brown Booby (<i>Sula leucogaster</i>)</p>	<p>Anguilla Black Ameiva (<i>Ameiva corax</i>)</p>

Egrets and Herons

<p>Cattle Egrets (<i>Bubulcus ibis</i>)</p>	<p>St. Croix Anole (<i>Anolis acutus</i>) Grenada Bush Anole (<i>Anolis aeneus</i>) Puerto Rican Eyespot Sphaero (<i>Sphaerodactylus macrolepis</i>)</p>
<p>Snowy Egret (<i>Egretta thula</i>)</p>	<p>Mona Blindsnake (<i>Typhlops monensis</i>)</p>
<p>Yellow-crowned Night Heron (<i>Nyctanassa violacea</i>)</p>	<p>Anguilla Bank Ameiva (<i>Ameiva plei</i>) Puerto Rican Gracile Boa (<i>Epicrates monensis</i>) American Crocodile (<i>Crocodylus acutus</i>) hatchlings</p>

Birds not usually considered predators of vertebrates

Puerto Rican Parrot (<i>Amazona vittata</i>)	.....	Puerto Rican Giant Anole (<i>Anolis cuvieri</i>)
West Indian Woodpecker (<i>Centurus superciliosus</i>)	.....	Cayman Islands Sphaero (<i>Sphaerodactylus argivus</i>)
Brown Trembler (<i>Cinlocerthia ruficauda</i>)	.....	Dominica Anole (<i>Anolis oculatus</i>)
Mangrove Cuckoo (<i>Coccyzus minor</i>)	.....	Dominica Anole (<i>Anolis oculatus</i>)
Bananaquit (<i>Coereba flaveola</i>)	.....	Caymans Blue-fanned Anole (<i>Anolis conspersus</i>)
Smooth-billed Ani (<i>Crotophaga ani</i>)	.....	Caymans Blue-fanned Anole (<i>Anolis conspersus</i>)
		Jamaican Giant Anole (<i>Anolis garmani</i>)
		Les Saintes Anole (<i>Anolis terraektae</i>)
Cuban Blackbird (<i>Dives atrovirens</i>)	.....	Cuban Brown Anole (<i>Anolis sagrei</i>)
Zapata Wren (<i>Ferminia cerverei</i>)	.....	Cuban Brown Anole (<i>Anolis sagrei</i>)
Domestic Chicken (<i>Gallus gallus</i>)	.....	Smooth-scaled Worm Lizard (<i>Gymnophthalmus underwoodi</i>)
		Southern Green Anole (<i>Anolis coelestinus</i>)
		Hispaniolan Stout Anole (<i>Anolis cybotes</i>)
		Jamaican Gray Anole (<i>Anolis lineatopus</i>)
Pearly-eyed Thrasher (<i>Margarops fuscatus</i>)	.....	Common House Gecko (<i>Hemidactylus mabouia</i>)
		Statia Bank Tree Anole (<i>Anolis bimaculatus</i>)
		Puerto Rican Giant Anole (<i>Anolis cuvieri</i>)
		Puerto Rican Emerald Anole (<i>Anolis evermanni</i>)
		Anguilla Bank Tree Anole (<i>Anolis gingivinus</i>)
		Yellow-chinned Anole (<i>Anolis gundlachi</i>)
		Dominica Anole (<i>Anolis oculatus</i>)
		Anguilla Bank Bush Anole (<i>Anolis pogus</i>)
		Saba Anole (<i>Anolis sabanus</i>)
		Statia Bank Bush Anole (<i>Anolis schwartzii</i>)
		Puerto Rican Spotted Anole (<i>Anolis stratulus</i>)
		Anguilla Bank Ameiva (<i>Ameiva plei</i>)
		Guadeloupe Anole (<i>Anolis marmoratus</i>)
Guadeloupe Woodpecker (<i>Melanerpes herminieri</i>)	.....	Caymans Blue-fanned Anole (<i>Anolis conspersus</i>)
La Sagra's Flycatcher (<i>Myiarchus sagrae</i>)	.....	Cuban Green Anole (<i>Anolis porcatus</i>)
House Sparrow (<i>Passer domesticus</i>)	.....	Neotropical Clawed Gecko (<i>Gonatodes albogularis</i>)
		Hispaniolan Twig Anole (<i>Anolis singularis</i>)
Hispaniolan Trogon (<i>Priotelus roseigaster</i>)	.....	Grenada Bush Anole (<i>Anolis aeneus</i>)
Carib Grackle (<i>Quiscalus lugubris</i>)	.....	Cuban Iguana (<i>Cyclura nubila</i>) eggs and hatchlings
Greater Antillean Grackle (<i>Quiscalus niger</i>)	.....	Caymans Blue-fanned Anole (<i>Anolis conspersus</i>)
		Cuban Brown Anole (<i>Anolis sagrei</i>)
		Puerto Rican Giant Anole (<i>Anolis cuvieri</i>)
		Puerto Rican Emerald Anole (<i>Anolis evermanni</i>)
		Yellow-chinned Anole (<i>Anolis gundlachi</i>)
		Puerto Rican Spotted Anole (<i>Anolis stratulus</i>)
		Cuban Giant Anole (<i>Anolis equestris</i>)
		Cuban White-fanned Anole (<i>Anolis homolechis</i>)
		Western Giant Anole (<i>Anolis luteogularis</i>)
		Spotted Brown Trope (<i>Tropidophis pardalis</i>)
		Jamaican Giant Anole (<i>Anolis garmani</i>)
Jamaican Lizard Cuckoo (<i>Saurothera vetula</i>)	.....	Cuban Giant Anole (<i>Anolis equestris</i>)
Red-legged Thrush (<i>Turdus plumbeus</i>)	.....	Caymans Blue-fanned Anole (<i>Anolis conspersus</i>)
Loggerhead Kingbird (<i>Tyrannus caudifasciatus</i>)	.....	Jamaican Giant Anole (<i>Anolis garmani</i>)
		Dominica Anole (<i>Anolis oculatus</i>)
Gray Kingbird (<i>Tyrannus dominicensis</i>)	.....



ROBERT POWELL

Pearly-eyed Thrashers are effective, albeit opportunistic predators of small vertebrates.



ROBERT POWELL

Cuckoos are opportunists, feeding on a variety of arthropods, some surprisingly small for such relatively large birds. They often concentrate on seasonally abundant prey, such as caterpillars, for which they frequently function as biological controls. On West Indian islands, however, many cuckoos selectively forage for small reptiles, especially anoles, and may run along the ground “chasing” lizards as well as picking them off arboreal perches. Although species such as this Yellow-billed Cuckoo (*Coccyzus americanus*) may occasionally take small reptiles, a focus on reptilian prey has led to many island forms with the common name of “Lizard Cuckoo.”



Adult Sister Isles Rock Iguana (*Cyclura nubila caymanensis*) in the interior shrubland of Little Cayman.

The Cayman Sister Isles Iguana Project: Identifying the Conservation Needs of *Cyclura nubila caymanensis*

Matthias Goetz

Herpetology Department, Durrell Wildlife Conservation Trust

Photographs by the author except where noted.



Among the world's most endangered reptiles, West Indian rock iguanas of the genus *Cyclura* have attracted considerable attention from the conservation community. Monitoring, captive-breeding and reintroduction efforts, or translocation projects have been initiated for many species. The numbers of Cuban Rock Iguanas (*C. nubila nubila*) are relatively large (Perera 2000), but monitoring the status and assessing numbers of the subspecies, *C. n. caymanensis*, endemic to the islands of Little Cayman and Cayman Brac, has been neglected. Whereas the subspecies is listed as Critically Endangered on the IUCN Red List (Gerber, 1996) due to the small area of occupancy and the fact that only about 40 animals are believed to survive on Cayman Brac (Burton, pers. comm.), surveys never have been conducted on Little Cayman. Little Cayman is a small island



Adult male *Cyclura nubila caymanensis* at the west end of Little Cayman (top), and an adult female (bottom).



MICHAEL VALLEE

The author and volunteer Adam Mitchell taking blood samples for genetic analysis from a juvenile iguana.

(28 km²) inhabited by fewer than 200 residents. Most of the land is in private ownership, and the rate of development increasing steadily.

In the mid-1990s, about 1,500–2,000 iguanas were thought to live on the island, although declines were projected (Gerber 1996). What little knowledge we have concerning the population since then, its status and current threats, is the result of irregular trips by Fred Burton, head of the Blue Iguana Recovery Program on Grand Cayman, over the past decade and unpublished research conducted by Glenn Gerber in 1993. A population update, status assessment, and determination of the long-term conservation needs of *C. n. caymanensis* are long overdue.

Aims

In 2007, in close collaboration with the Cayman Islands Government Department of Environment and the National Trust for the Cayman Islands, the Durrell Wildlife Conservation Trust initiated the multiyear Cayman Sister Isles Iguana Project. The overall goal is to provide the Caymanian Government and Little Cayman and Cayman Brac residents with the knowledge and tools to preserve this subspecies in the long-term.

Without any reliable and current figures on the overall population size and its status, the first task for field researchers was to try to determine the existing population size, distribution, and

genetic heterozygosity. Future research will investigate aspects of nesting ecology applicable to conservation, and identify the factors limiting distribution and density with a view towards their amelioration.



TYNE LACOMBE

The author measuring and flagging a sample quadrat in the shrubland of Little Cayman.

Fieldwork 2007

From the beginning of October until the end of November 2007, an estimate of the current population size was made by plot sampling using randomly allocated 20 x 40 m quadrats, as other methods (e.g., distance sampling) are unsuitable for *Cyclura* spp. in the types of habitat present in the Cayman Islands (Burton, pers. comm.). Each quadrat was visited on three consecutive days to allow occupancy modeling of rock holes (i.e., occupied retreats were counted rather than visible iguanas). The third visit to each quadrat included a four-hour observation period beginning at sunrise and conducted by three people and additionally using five IRCF ID cameras (see *IGUANA* 14(3): 208–209).

Using this method, we visited 22 quadrats, but surprisingly could detect only a single occupied retreat. With this very small sample size, our population estimate is a total of 1,800 individuals on Little Cayman; however, this is only reliable to an order of magnitude.

The problem is that the method was designed for randomly or evenly distributed populations or population patches, but, in suitable natural habitats on the island (i.e., dry scrubland and less dense forest — we did not include the abundant mangroves and wetlands, as iguanas are not present in these habitats), a disturbingly low number of iguanas were encountered. In fact, hiking through the bush almost daily for two months to reach the sample quadrats, we encountered or heard only another five individuals. The statement that iguanas reach their maximum densities in the interior shrubland (“bushland” — Brunt 1994, in Gerber 2000) therefore cannot be confirmed.

The situation was very different along roads or in otherwise disturbed areas, mostly around areas of human habitation. Adult iguanas were encountered frequently along roadsides in the south and east, and around houses in the west, giving residents and tourists the impression of a fairly healthy population. Disturbingly, younger age classes were very rarely seen.

This clustering of adult iguanas in disturbed areas and its potential effects on the population, whether detrimental or beneficial, will be addressed further in future field trips. Similarly,



“Disturbed” habitat is not necessarily inhabited by people. A landfill near the site of the attempted but until now abandoned new airport. One adult pair and three hatchling iguanas have been observed at this locality.



Typical shrubland habitat in the interior of the island. Whether iguanas reach their maximum populations densities in such habitat cannot be confirmed at this time.



ADAM MITCHELL

Volunteer Michael Vallee and the author taking measurements.

with appropriate survey methodologies, we will be able to obtain more accurate data on the population sizes in clustered areas, as well as a better understanding of the apparently very low density in undisturbed habitats.

In addition to the population study, we opportunistically recorded GIS positions of all 90 iguanas we encountered. We were able to catch 52 of these, which we marked with PIT-tags and color-coded bead tags on their dorsal crests. Morphometric

data also were taken from all captured individuals and blood samples were collected from 48 for genetic analysis, the results of which are pending.

Glenn Gerber marked approximately 200 iguanas in his 1993 study (Gerber, pers. comm., Gerber 2000) but, as PIT tags were not widely available at the time, no reliable long-term tag data were available for reference purposes.

Threats

The most imminent threats to *C. n. caymanensis* on Little Cayman seem to be feral cats and road mortality. During our stay in October and November, we found three freshly killed adult iguanas on the road, but residents advised us that many more road deaths occur during the breeding season. This is to be expected, as males roam more widely in search of mating partners around May, and gravid females migrate to nesting sites on the beaches beginning in June. Taking this into account, as well as the fact that not all road deaths will be detected or reported, we are estimating that the population might lose 40–50 breeding adults per year as a consequence of road mortality. To establish more accurate numbers and involve the entire community, we initiated a collaborative plan with the Department of Environment to record road deaths while also providing public education and opportunities for public involvement.

As on many other islands, feral cats present a huge danger to hatchling iguanas and small juveniles. This now has been recognized by the Cayman Islands Government, and we were involved in an initial cat eradication program run by the Department of Environment, the results of which are pending. Encouragingly, a public education campaign indicated that residents are aware of threats to “their” iguanas and enthusiastic about protecting them from decline or extinction.



Freshly road-killed adult female *Cyclura nubila caymanensis*.



ADAM MITCHELL

The author with a recently run-over and partially paralyzed adult female on the North road.

Development presents a threat that often is less immediately noticeable but potentially very significant. As one of the least developed Caribbean islands, Little Cayman is about to lose its unique natural character as more and more of the beachside lots are offered for sale. Numerous additional retirement homes and resorts already are in the planning stages. A harbinger of the pressure by investors is the new road crossing the island from south to north in an area not associated with any immediate benefit to the existing human population.

The relatively higher density of *C. n. caymanensis* around houses and resorts might indicate at first glance that the species could cope well with development and could survive on an intensively developed Little Cayman. Maybe the iguanas are indeed attracted out of their natural habitats toward human settlement, possibly because of better and more abundant retreat and basking sites, or perhaps because of additional food resources provided by residents. However, cats and dogs, whether feral or not, and road mortality are likely to act as negative forces in those population clusters. Also, as beach lots are



A typical sight along the coastal roads, where most land is advertised for sale.



The newly constructed third road dissecting Little Cayman is clear evidence of the continuing development.

developed, the continuous disturbance and sealing of the ground there will prevent sufficient recruitment as nesting locations vanish and hatchlings are killed by pets.

The difficulties inherent in assessing recruitment (i.e., reliably detecting hatchlings and juveniles) present a major problem. Until this can be overcome, a seemingly healthy co-existence of (adult) iguanas in and around human settlements needs to be viewed with great caution.

Cayman Brac

The population of *C. n. caymanensis* on the slightly larger island of Cayman Brac (38 km²), which is 7.5 km from Little Cayman and, with approximately 1,000 residents, much more densely populated, is estimated at no more than 40 iguanas (Burton, pers. comm.). Again, accurate data are missing and no thorough study has been undertaken. Development on “The Brac” is much more advanced than on Little Cayman, and feral cats and dogs are abundant (Burton, pers. comm., Cottam, pers. comm.), so that extirpation of the iguana population there seems to be only a matter of time.

We will visit Cayman Brac during the next field seasons to collect genetic material for comparison. If funding can be generated, a status assessment will be conducted, but without the local commitment to tackle introduced predators, conservation resources may preferentially be focused on Little Cayman.

The Future

In 2008, fieldwork is planned for the nesting season to allow identification of coastal nesting areas and possible female migra-

tion routes to those areas. The focus will be on locating possible communal nesting sites, which would then be a priority for protection. Little is known about the location of available nesting sites in the interior of Little Cayman or where the females nesting on the beaches have their territories. Therefore, identifying migration routes would not only be of conservation concern, but following females back to their original territories after nesting could show us where to look for populated natural habitat in the island's interior. To facilitate this, we will fit as many as 30 female *C. n. caymanensis* caught on the beach after nesting with radio transmitters, and then locate them several times a day until they have been stationary for a number of days. Funding provided, in 2009 we will continue with more radio-tracking during the mating season, when following roaming males could lead us to other iguanas, allowing a more accurate estimation of overall population size.

Another focus from 2009 onward will be determining population sizes in the more densely populated areas, as well as research into habitat parameters and what might attract iguanas from natural habitats into disturbed areas (if this proves to be the case). The results may well indicate whether this situation could be halted or even reversed to attract a viable population into protected areas, enhancing chances for the long-term survival of this subspecies on Little Cayman despite increasing development.

Acknowledgements

Thanks are due to Adam Mitchell, Michael Vallee, and Jude Bryja for their invaluable help in the field, and Fred Burton for



Adult *Cyclura nubila caymanensis* in the interior shrubland of Little Cayman.



his immense support and continued collaboration. The Cayman Islands Government's Department of Environment provided the necessary permits and provided considerable support, as did the National Trust for the Cayman Islands and its members on Little Cayman. Durrell Wildlife Conservation Trust provided in-kind support through professional time, and the Balcombe Trust generously provided all financial support. The International Reptile Conservation Foundation facilitated the recruitment of volunteers. The manuscript was greatly improved by comments from Kay Bradfield.

References

- Gerber, G. 1996. *Cyclura nubila* ssp. *caymanensis*. In: IUCN 2008. *2008 IUCN Red List of Threatened Species*. www.iucnredlist.org.
- Gerber, G. 2000. Lesser Caymans Iguana, *Cyclura nubila caymanensis*. In: A. Alberts (ed.), *West Indian Iguanas: Status Survey and Conservation Action Plan*. IUCN/SSC West Indian Iguana Specialist Group, IUCN, Gland, Switzerland and Cambridge, UK.
- Perera, A. 2000. Cuban Iguana, *Cyclura nubila nubila*. In: A. Alberts (ed.), *West Indian Iguanas: Status Survey and Conservation Action Plan*. IUCN/SSC West Indian Iguana Specialist Group, IUCN, Gland, Switzerland and Cambridge, UK.



Other endemic species will benefit by sharing habitat conserved for iguanas. Two examples are this juvenile Little Cayman Trope (*Tropidophis parkeri*; top) and this Cayman Galliwasp (*Celestus maculatus*; bottom).

Ecology and Conservation of Grassland Vertebrates

The Sutton Avian Research Center, a unit of the Oklahoma Biological Survey and the Oklahoma Chapter of the Nature Conservancy are hosting a conference titled "Ecology and Conservation of Grassland Vertebrates." The conference will be held at the University of Oklahoma in Norman on 15–19 April 2008. For more information, please see <www.suttoncenter.org/ecgv.html>.

Brenda D. Smith-Patten
Sam Noble Oklahoma Museum of Natural History



SUZANNE L. COLLINS, ONAH

The Slender Glass Lizard (*Ophisaurus attenuatus*) is a limbless denizen of the Midwestern grasslands.



Detail of the external appearance of one hide area constructed for Guatemalan Beaded Lizards (*Heloderma horridum charlesbogerti*) at Zoo Atlanta. The plastic tube connects to the deep shelter surrounded by flat stones.

The Guatemalan Beaded Lizard Breeding Program at Zoo Atlanta

Brad Lock

Zoo Atlanta

Photographs by Jason Brock, Zoo Atlanta



In the ongoing effort to reproduce potential founder animals at Zoo Atlanta, we have recently modified an outdoor enclosure to hold our Guatemalan Beaded Lizards (*Heloderma horridum charlesbogerti*). The captive reproduction of these specimens is an important part of the overall “Project Heloderma” program for Zoo Atlanta and its partners, the International Reptile Conservation Foundation and Zootropic. Our lone female and our three males were wild-caught adults when brought into captivity and are of unknown ages. Thus, with every year that goes by, they get that much closer to being non-

reproductive. In addition, the female has had two surgeries to remove cystic (fluid filled, non-viable) follicles from her ovaries. The good news is that prior to the surgeries that removed the diseased follicles she had not produced any eggs — but has since ovulated successfully. In 2005, she produced six yellow, non-calcified, and non-viable eggs, and, in 2006, she produced four similar eggs.

To no one’s surprise, when the lizards were placed outside in the sun, their behavior changed to more closely reflect that of their wild counterparts. With that information, all five animals



Outdoor habitat for Guatemalan Beaded Lizards (*Heloderma horridum charlesbogerti*) at Zoo Atlanta.



The outdoor Guatemalan Beaded Lizard enclosure showing the hide areas and logs used for climbing.



Male Guatemalan Beaded Lizard taking advantage of a sunny patch for basking on a cool morning.



were placed outside this past June. The enclosure and the hide areas were designed to “resemble” some of the structures we had seen in their native habitat in Guatemala. The hide areas were

dug into the ground so that a cool, dark, humid environment was created. Logs and grasses were placed in the enclosure for security and to provide climbing structures. After a very short



Detail of the hide area. They are dug into the ground to provide a cool, humid, and dark shelter.

(2–3 day) exploration period, during which the lizards were constantly on the move, tongue-flicking every inch of the enclosure and the structures within it, they settled into a routine. This routine, however, was much different than the behaviors observed in their indoor enclosures. Inside, lizards moved very infrequently and were very docile in interactions with the staff. Outside, they would lie at the entrances to their hide areas until the sun struck the enclosure, and then they would bask for a few hours, especially on cool mornings. If a person entered the enclosure when a lizard was out exploring, that animal would “run” very quickly to a shelter and “dive in.” In addition, if the entrance to a hide was blocked, the animal would rear up and give an open-mouthed hiss.

All of these new behaviors were great! In September the males began to fight, and were observed copulating with the female. Soon, she was evidently gravid and ultrasound revealed large follicles, but without the extra fluid usually seen in her coelomic cavity. In the previous two years, when she had large follicles or eggs present, she retained a large amount of fluid along with them. This time, however, she did not. An ultrasound a few weeks later revealed six shelled eggs. Over a four-week period in late September and November, she laid six eggs, and four appeared viable. Those four were very white in color and had nicely calcified shells. Unfortunately, none of the eggs had the blood spot that is present within a day or two and sig-



Guatemalan Beaded Lizards have relatively small eggs. This is an egg from 2007 that is the normal white color with a nicely calcified shell.

nifies viability. Over the next three to four weeks, no development was observed and the eggs contracted.

During the upcoming breeding season, we will place all of the animals in outdoor enclosures in the early spring and leave them there until fall. We are very excited that this year will be the year during which the first fertile eggs are produced in captivity. Stay tuned.

I.H.S.
International Herpetological Symposium
Celebrating our 32nd year!

All serious herpers,
**PROFESSIONAL
& AMATEUR,
WELCOME!**

2008 GUEST SPEAKERS
Rom Whitaker - India
Wade C. Sherbrooke - U.S.A.
David A. Warrell - England

Nashville, Tennessee
June 18 - 21, 2008
Sponsored by T-Rex

www.kingsnake.com/ihs
or CALL Ken Foose at (702) 631-7387



Black Iguanas (*Ctenosaura similis*) are among the most visible of Costa Rican reptiles, occurring in various habitats throughout the country.

Ticks (*Amblyomma* spp.) on Black Iguanas (*Ctenosaura similis*) in Costa Rica

Jesus A. Rivas

Department of Mathematics and Natural Sciences, Somerset Community College, Somerset, Kentucky

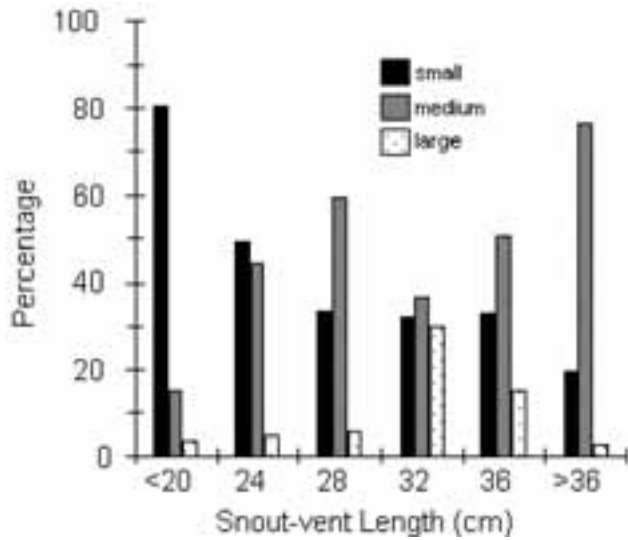
Reptiles can be exposed to various ectoparasites, some of which carry diseases or otherwise negatively affect their populations (Hanley and Stamps 2002, Wikelski 1999). Conventional wisdom suggests that animals with high parasite loads must be in worse physical condition than animals with lower infestations, but this assumption has not been documented in many reptiles. In the United States, a number of exotic ectoparasites have been introduced with their reptilian hosts (Burrige and Simmons 2003). Predicting the fates of these reptile-associated introductions is difficult without greater knowledge of the parasite-host systems. Data presented here on tick infestations of free-ranging Black Iguanas (*Ctenosaura similis*) from Palo Verde National Park, Costa Rica will add to the general body of knowledge for these kinds of systems.

In July 1996, I caught 20 *C. similis* (mean = 873 g, 240–2,080 g) near the Organization of Tropical Studies (OTS) Palo Verde Biological Field Station (10°21'N, 85°21'W; elevation ~10 m) by noosing them on branches or capturing them by hand in holes. Each animal was measured (SVL, to nearest cm), weighed (to nearest g), and the ticks on each were counted and classified visually into three size classes: small (< 2 mm), medium (2–4 mm), and large (> 4 mm). I also classified the shedding status of the iguana as recently shed, old shed, or shedding, depending on whether they had bright new skin without remnants of an old shed, some remnants of shed at the joints, or widespread larger patches of shedding epidermis, respectively. I used a non-parametric Kruskal-Wallis test to compare the effects of the shedding status on the number of ticks. The Fulton

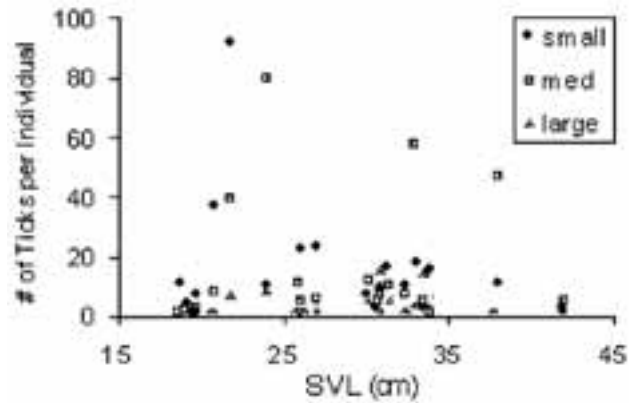


ROBERT POWELL

Even heavy tick infestations on free-ranging Black Iguanas (*Ctenosaura similis*) in Costa Rica seem to have little effect on the lizards' body conditions.



Percentage of each tick size class found on the different sizes of *Ctenosaura similis* in Palo Verde National Park, Costa Rica.



Number of ticks in each size class found on the different sizes of *Ctenosaura similis* in Palo Verde National Park, Costa Rica.



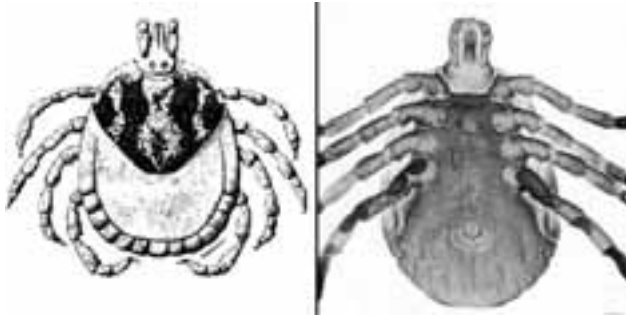
Index (Bolger and Connolly 1989) is a condition index that is calculated by dividing the mass of an individual by the cubic power of its length. I used Spearman correlation tests to assess the effects of tick infestations on the condition of the ctenosaurs and the effects of body size on the number of ticks present per individual.

I recorded two tick species on *C. similis*: *Amblyomma scutatum* and *A. dissimile*. *Amblyomma scutatum* was more abundant than *A. dissimile*. The mean number of ticks per animal was 56 (0–217). Only one animal did not carry ticks. I found no significant relationship between the total number of ticks



J. MAURICIO GARCÍA-C.

Ticks (*Amblyomma scutatum*, top; *A. dissimile*, bottom) embedded in the skin of Black Iguanas.



Ticks frequently found on Black Iguanas (*Ctenosaura similis*) in Costa Rica: *Amblyomma scutatatum* (left) and *A. dissimile* (right).



J. MAURICIO GARCÍA-C.

Unlike ctenosaurs in Palo Verde National Park, those in the dry forest in Puntarenas often are free of parasites. This individual had sought shelter in the hollow core of a fallen tree.

and the size of individual ctenosaurs ($r = 0.18$, $P = 0.46$; $N = 20$), but smaller *C. similis* seemed to have more small ticks, and medium-sized ticks seemed to be more abundant on larger ctenosaurs. Large ticks occurred in relatively low numbers across all sizes of ctenosaurs. Four animals had shed recently, seven were in the process of shedding, and eight had old skins. I found no significant differences in the number of ticks among the three shedding categories (Kruskal-Wallis test; $\chi^2 = 0.69$, $P = 0.71$).

Most of the study animals had a heavy tick load, but heavily infested animals did not appear to be in poorer physical condition. No correlation existed between the number of ticks and the condition of the animal as estimated with Fulton's Index ($r = -0.38$, $P = 0.10$; $N = 20$), suggesting that ticks may not be a burden to healthy ctenosaurs. Both this lack of relationship and the lack of relationship between shedding status and the number of ticks were unexpected. Both findings could be explained by a fast turnover of ticks on individual ctenosaurs, where each tick may spend but a short time on a given animal before attaching itself to another animal that has just shed. In view of the large number of exotic animals moving across national boundaries due to the pet trade, we must consider the potential effect of seemingly healthy animals introducing their parasites as well.

Acknowledgments

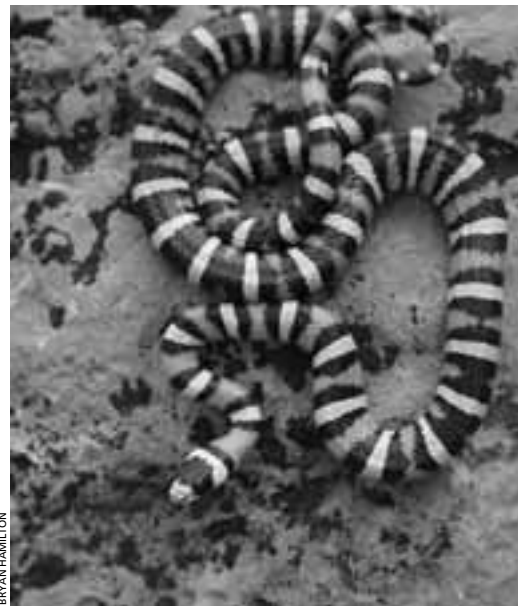
Data were collected during the OTS Course 96-3. James Keirans identified the tick, Eric Olson and members of the OTS course helped in the field, and Sarah Corey provided helpful editorial comments.

References

- Bolger, T. and P.L. Connolly. 1989. The selection of suitable indices for measurement and analysis of condition. *Journal of Fish Biology* 34: 171–182.
- Burridge, M.J. and L.A. Simmons. 2003. Exotic ticks introduced into the United States on imported reptiles from 1962 to 2001 and their potential roles in international dissemination of diseases. *Veterinary Parasitology* 113: 289–320.
- Hanley, K.A. and J.A. Stamps. 2002. Does corticosterone mediate bidirectional interactions between social behaviour and blood parasites in juvenile Black Iguanas, *Ctenosaura similis*? *Animal Behaviour* 63: 311–322.
- Wikelski, M. 1999. Influences of parasites and thermoregulation on grouping tendencies in Marine Iguanas. *Behavioral Ecology* 10: 22–29.

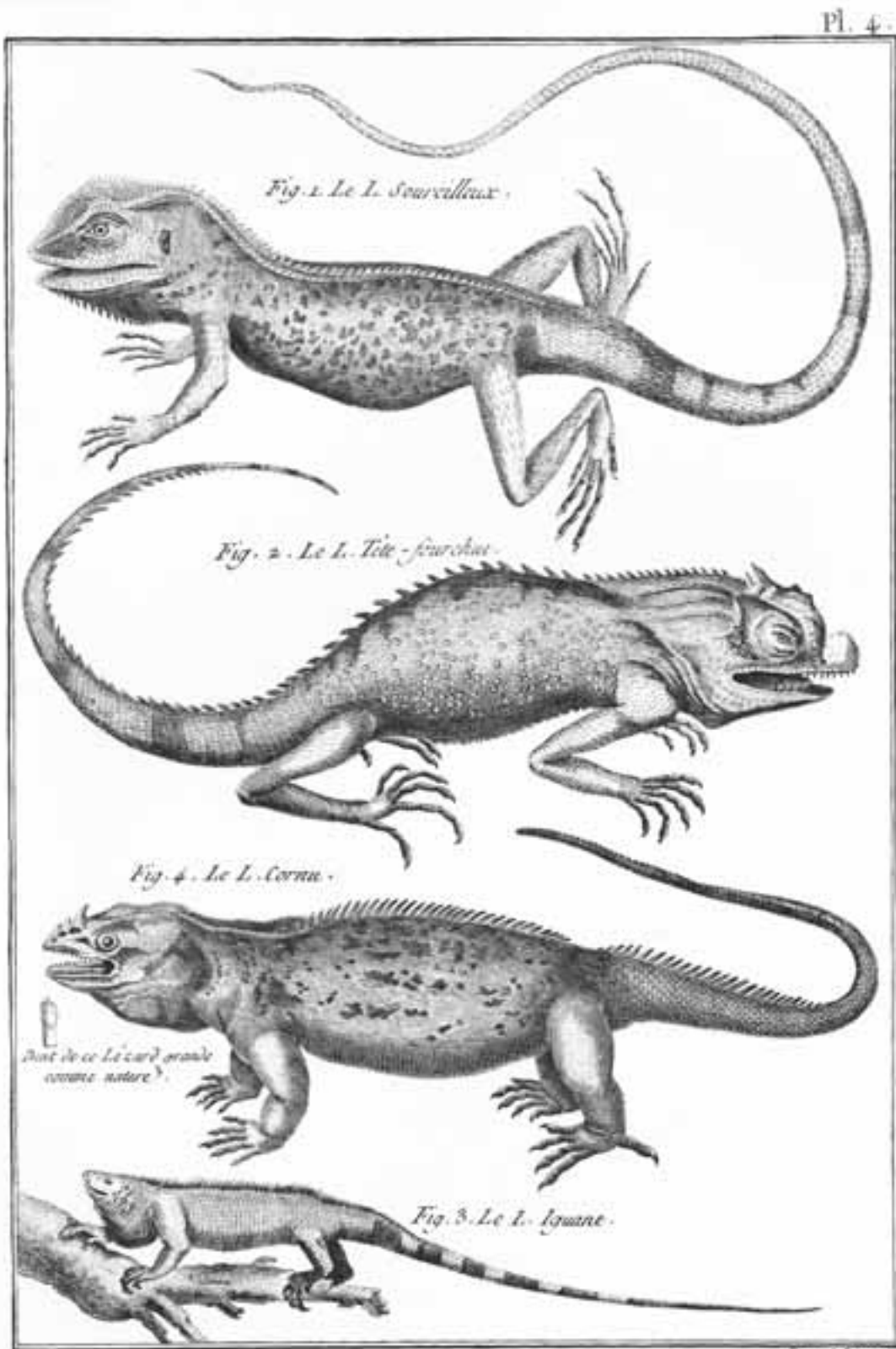
Sonoran Mountain Kingsnake Survey

The Nevada Department of Wildlife and Great Basin National Park are pleased to announce the 3rd Annual Great Basin Sonoran Mountain Kingsnake Survey on 12–16 May 2008. For more information contact: Bryan Hamilton (bryan_hamilton@nps.gov).



BRYAN HAMILTON

The Sonoran Mountain Kingsnake (*Lampropeltis pyromelana*) inhabits rocky mountain habitats from 850–2,800 m in the western United States and adjacent regions in Mexico.



HISTOIRE NATURELLE.

Many early illustrations of exotic species were presented in anthologies of the natural world, often figured and described by Europeans who never saw the animals in life. This page, with the iguana at the bottom, is from L'Abbé Bonaterre's 1789 "encyclopedia of nature."

Iguanas: Early European Impressions and Illustrations

Chuck Schaffer¹ and Rick Schaffer²

¹Turtle and Tortoise Newsletter, Jacksonville, Florida

²Stanton College Preparatory School, Jacksonville, Florida

Although Europeans were certainly not the first people to find (and consume) iguanas, they were the first to commit images to paper. Several depictions appeared in the 16th century, and the number grew over time. However, iguanas were celebrated in clay, island names, and dinner far earlier than that. The name given to the island of St. Lucia by the Kalinago, the last group of indigenous native people before European arrival, was “where the iguana is found.” The Kalinago name *loüanálao* is derived from the Arawak for iguana (*yuwána*) as recorded by Père Raymond Breton, a Dominican missionary, who composed a dictionary of the Amerindian languages in the 1660s. Iguana also is thought to stem from the Taino word “higuana.” Part of the word itself may be significant, as the Taino words for gold, parrots, fire, and many of their chiefs contain “gua.”

Utilization of iguanas as food has been documented from as early as 2,700 BP in the Caribbean, but earlier records probably will be found. Archaeologists have excavated iguana and marine turtle bones in middens from throughout the Caribbean and Central America. Images of the marine turtle, another common dietary item, have been immortalized in pottery, along with those of iguanas, as seen below in the three Tolita-Tumaco culture (2,600 and 1,600 BP) pottery effigies from southwestern coastal Colombia and northwestern coastal Ecuador. This culture is well known for its figurines made from light gray clay. Many of these effigy heads are fragments of earthenware. In Tolita culture, the iguana symbolizes the male reproductive

organ and the spikes of its tail are associated with communication and positive interaction. Other New World traditions correlate the iguana with water and rain.

In his popular pieces, journal articles, and Earthwatch Expedition Reports from Grand Turk, Dr. William Keegan of the Florida Museum of Natural History reported a number of faunal finds, many of them of iguana material. The Coralie site on Grand Turk is the oldest archaeological site in the Bahamian Archipelago, with artifacts dated from 1,330–1,100 BP. It is also the only site from this period excavated outside of Puerto Rico. The site is archaeologically significant, as its occupation occurred during a period when sea level was lower and the climate extremely arid. Both of these factors contributed to better faunal preservation. Additionally, the remains are virtually unique when compared to other sites that show significant disturbance. This site was pristine. From the excavations to date, Dr. Keegan has concluded that this site must have been an early colony. The faunal assemblage included sea turtles, iguanas, fishes (many of them very large), and birds. Analyses of these bones suggest that iguanas were once up to a meter or more larger than extant forms. One hearth contained an entire sea turtle carapace together with large fish and iguana bones. Other food items apparently were cooked in the turtle shell along with the turtle itself.

An Italian navigator also wrote of Iguanas. Although the exact site is debated, many authorities believe that, on 12 October 1492, the Lucayo were the first Native Americans to

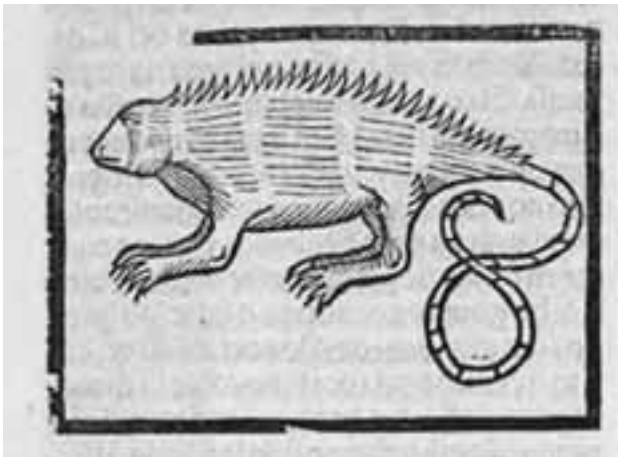


Tolita-Tumaco culture (2,600 and 1,600 BP) pottery effigies from southwestern coastal Colombia and northwestern coastal Ecuador (illustrations after Brezzi).

come in contact with Cristoforo Colombo. Most history books state that the meeting occurred on the island of Guanahani (meaning iguana in their language), which he renamed San Salvador. Columbus wrote of iguanas in his *Journal of the First Voyage of Colon*. Presumably on Watling's Island, he noted, "[t]here are no indigenous quadrupeds larger than a rat, and few reptiles, the largest being the iguana," which he mentioned later. "The sailors killed an iguana here, which they called a serpent ... at a spot now called Frenchman's Wells."

Between 1492 and 1535, the first natural history of the New World was written and subsequently published in Seville by Gonzalo Fernandez de Oviedo y Valdez. Titled *Historia General y Natural de las Indias Occidentales*, it sought to compile both the social and natural history of the "Indies," as the New World was then known. In this work, the iguana was first described and illustrated by Europeans. Oviedo noted that the indigenous people ate iguanas, keeping them in the villages for extended periods without food or water until they were eaten. Some Spaniards enjoyed eating iguana, but they found its appearance repugnant.

Peter Martyr D'Anghera, a contemporary of Oviedo, recorded the Taino cooking method: stewed and served with pepper! "Thirty-two caciques were assembled in the house of



Illustrations of iguanas from Oviedo (1535; top) and Ramusio (1550; bottom).

Anacauchoa, where they had brought their tribute. In addition to what had been agreed upon, they sought to win favour by adding numerous presents, which consisted of two kinds of bread, roots, grains, utias, that is to say, rabbits, which are numerous in the island, fish, which they had preserved by cooking them, and those same serpents, resembling crocodiles, which they esteem a most delicate food. We have described them above, and the natives call them iguanas. They are special to Hispaniola. Up to that time none of the Spaniards had ventured to eat them because of their odour, which was not only repugnant but nauseating, but the Adelantado, won by the amiability of the cacique's sister, consented to taste a morsel of iguana; and hardly had his palate savoured this succulent flesh than he began to eat it by the mouthful. Henceforth the Spaniards were no longer satisfied to barely taste it, but became epicures in regard to it, and talked of nothing else than the exquisite flavour of these serpents, which they found to be superior to that of peacocks, pheasants, or partridges. If, however, they are cooked as we do peacocks and pheasants, which are first larded and then roasted, the serpent's flesh loses its good flavour. First they gut them, then wash and clean them with care, and roll them into a circle, so that they look like the coils of a sleeping snake; after which they put them in a pot, just large enough to hold them, pouring over them a little water flavoured with the pepper found in the island. The pot is covered and a fire of odorous wood which gives very little light is kindled underneath it. A juice as delicious as nectar runs drop by drop from the insides. It is reported that there are few dishes more appetising than iguana eggs cooked over a slow fire. When they are fresh and served hot they are delicious, but if they are preserved for a few days they still further improve. But this is enough about cooking recipes. Let us pass on to other subjects. ... They are not neglectful, however, of hunting, they have, as we have already said, utias, which resemble small rabbits, and iguana serpents, which I described in my First Decade. These latter resemble crocodiles and are eight feet long, living on land and having a good flavour."

The next time that images of an iguana would appear was not until the 1580s, when watercolors were painted by John White. Another image of a "hiogan" (iguana) appeared about 1590 in an anonymous manuscript now known as *Histoire Naturelle Des Indes: Countenant Les Arbres, Plantes, Fruits, Animaux, Coquillages, Reptiles, Insectes, Oyseaux, &c. qui se trouvent dans les Indes...* or the *Drake Manuscript*. The original is housed in the Pierpont Morgan Library, although it has been reproduced in book form in two printings.

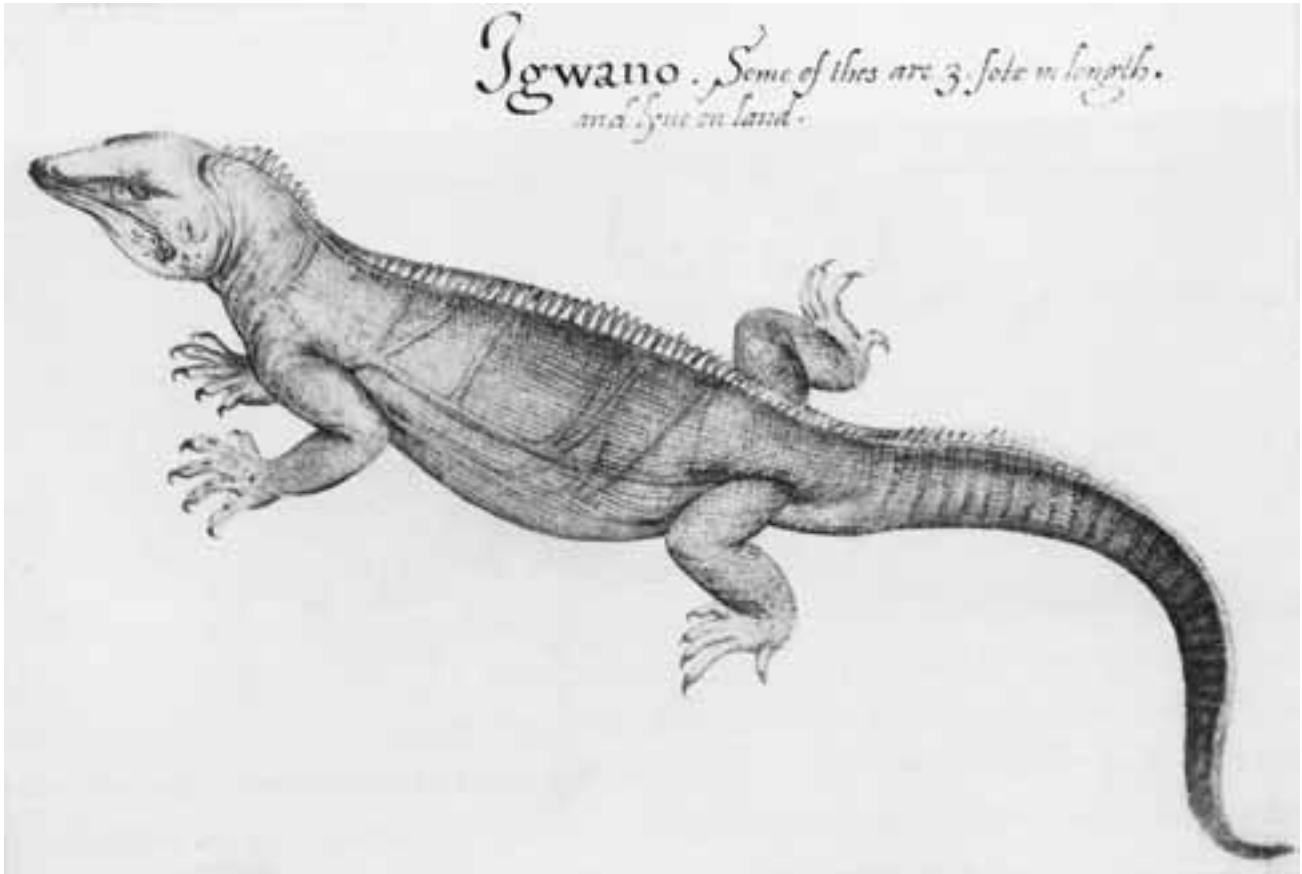
White's original watercolors have been reproduced by the British Museum. They are significant, as numerous early sources based their illustrations on them. These included Harriot, de Bry, Bigges & Croftes, and Catesby. The Boazio plates, which are included in Bigges and Croftes in two sizes in the two editions, made one later contemporary appearance, in de Bry's *Grands Voyages*, Part VIII. (1618, 1619). Those engravings are derived from the smaller engravings (keyed in numerals rather than letters). The figures of the iguana are after drawings by John White, and are in fact the first publication of any of White's illustrations. John White's drawing is likely the first English illustration of the iguana. An early Elizabethan description stated that they are

“caught by the Indian people who sell them to the Spaniards. They are a sad dull green colour, their body of the bigness of a cony (rabbit) in fact bigger. They are eaten by the Indians and Spaniards and so likewise by us for a very delicate meat. In the breeding time the female is full of eggs in great number, and they of all the rest are esteemed the most delicate.”

When Alonso de Ojeda and his crew reached Columbian shores, the Indians fled. The Spanish followed them inland and came upon an Indian settlement where strange animals were being prepared for a feast. Among the items on the menu were

“horrible snakes with feet and wings” (iguanas). This image appeared in de Bry’s *Grand Voyages*, Part X (1618 in German and 1619 in Latin).

The fanciful tales of Philoponus (1627) contained a liberal mix of history and fantasy and told the tale of the Benedictine missionaries who accompanied Columbus on his second voyage to Hispaniola in 1493, and also included descriptions and depictions of iguanas. Quaint copperplate engravings in the style of de Bry (whom the author despised) depicted a variety of scenes ranging from attacks on the Spanish crew by cannibals to



The “Igwano” of White executed in the 1580s (Lorant 1946) and the “Hiogane” (Anonymous 1590).

instances of indigenous hospitality, such as feasts depicting local fruit and an iguana served on European silver.

For nine months in 1725, Mark Catesby visited the Bahama Islands during which time he was the guest of Governor George Phenney and stayed at the Government House. While there, he visited the islands of Eleuthera, Abaco, and Andros. In *The Natural History of Carolina, Florida and the Bahama Islands*, he detailed the harsh lifestyle of the early settlers, barely surviving through the collection of ambergris, subsistence farming, fishing, turtling, and hunting birds and iguanas. His text provided most of what we know regarding life at that time, and included descriptions of the iguana and also the crocodiles that once lived in the Bahamas. A number of his illustrations, such as the iguana, are obvious plagiarisms of White.

However, the earliest iguana illustration found to date was produced by Gonzalo Fernandez de Oviedo y Valdes in *Historia General y Natural de las Indias. Islas y tierra firme del mar Océano*. He wrote of the iguana: “This is a serpent or dragon, or such terrestrial animal (or aquatic), that for those who do not know it, is of ugly and frightful view, strange lizard, big, with four feet; furthermore it is larger than the lizards of Spain, because the head is bigger than the fist or closed hand of a man, the neck is short, the body longer than two hand spans, and other two in circumference, and the tail of three and four hand spans long. These measurements are for the larger animals; many of them have shorter tails, I do not know if it is due to cut tails from bites

among each other, or if they shed it. (...) they have on the dorsal midline a line of spines that by itself appears fierce. It has sharp teeth and a dewlap that is long and wide that goes from the chin to the chest, like the ox. And so it is such a quiet animal, that neither shouts, nor moans, nor makes any sounds, and it stays anywhere that they put him, without causing damage nor making any noise, ten or twenty days and more, without eating and drinking any thing, even if you offer it, also it eats a little bread or grass or similar thing, according to what some say. But I have had some of these animals tied in my house some times, and I never saw them eat, and I have watched. And in short, I have not known nor been able to understand what they ate while in my house, and everything that was offered was left whole. In the field I do not know what they eat. The arms, feet, hands, and the nails, all these are like of lizard, and the long nails, but skinny and not of grasping. It is in as much way of terrible appearance, that no man would venture to wait for this animal, if he were not of great spirit, and to eat of it none, unless he was of bad sense or beastly (I say not knowing its being, tameness, and good taste)” (translation courtesy of Dr. Sam Rivera).

Another aspect of Oviedo’s work was the extremely ambitious task of assigning names to the American flora and fauna found in Spanish territories. This was by no means a smooth process, and during the course of this endeavor, he came into conflict with Spanish scientists and administrators. Oviedo attempted to develop a local, rather than imperial approach, undertaking it in the manner of Pliny by telling it as the narrative of a traveling naturalist, often mixing fact with fiction, science with myth. “Escribió Plinio treinta e siete libros en su Natural Historia, e yo en aquesta mi obra e primera parte della, veinte, en los cuales, como he dicho, en todo quanto le pudiere imitar, entiendo hacerlo” (Pliny wrote thirty-seven books in his Natural History, and I in my work ... will attempt to imitate him).

Oviedo the man was more straightforward. He was a Spanish historian, who was born in Madrid in 1478 and died in Valladolid in 1557. He was familiar with the explorations, had met Columbus, his sons, and some of the third voyage’s crew, but did not actually reach the Caribbean until 1513, after which he made a number of journeys. He was appointed governor of La Antigua in 1526 and commander of the castle of Santo Domingo in 1535, remaining in that position until 1545. At that time, he returned to Spain with the appointment of “Historian of the Spanish Indies.” He continued the history that he had begun in 1515, of which a summary had appeared under the title of “La Historia de las cosas sucedidas en mi tiempo en America” (1526). The first substantial portion appeared as *Historia General y Natural de las Indias Occidentales* (1535), and the revision of the entire work was finished in 1548. Its publication, begun in Valladolid in 1550, was interrupted by the author’s death, and the first complete edition was printed by order of the Royal Historical Academy in Madrid in 1851.

This work has been judged harshly due to a number of inaccuracies in the historical portion, and a strong underlying prejudice against Columbus. However, that it is one of the most profound and significant early accounts has become evident, and it certainly qualifies as the first work on the natural history of



Plate 4 from de Bry (1618 & 1619) and Philoponus (1627).

America. In that respect, the author was eminently qualified. During his journeys in the New World, Oviedo compiled detailed descriptions and illustrations, many of which might

serve as examples to modern naturalists, of products and goods. He introduced Europe to America's natural history, and was the first European to describe iguanas, manatees, and pineapples. He



Oviedo's text page with plate (Fernández de Oviedo Gonzalo, *Historia General y Natural de las Indias*, Selección, Ed. Bruño, 1991, Libro XII, Capitulo VII. P. 122).

also presented an enormous variety of previously unheard of “exotica,” including canoes, smoking tobacco, tamales, and hammocks. Along with Pedro Mártir de Anglería and Bartolomé de Las Casas, Oviedo was one of the first European “chroniclers of the Indies,” having written two comprehensive works on America, including the rare *Historia*.

Partial translations of Oviedo’s work appeared in Italian by Giovanni Battista Ramusio (1550) and in English by Richard Eden (1577). Two works, also translated by Ramusio without giving the author’s name, “Tratado del palo Guayacan y del palo Santo como antidoto contra la sífilis” and “Navegación del rio Marañon,” also are attributed to Oviedo. Ramusio, who was born on 20 July 1485 in Treviso, Republic of Venice (Italy) and died on 10 July 1557 in Padua, was an Italian geographer who compiled an important collection of writings on various travels

in his *Delle Navigazioni et Viaggi (Some Voyages and Travels, 1550–1559)*. The book contained works by over fifty other authors. Ramusio was assisted by the artist Gastaldi in the monumental task of engraving the maps that illustrated the accounts.

Oviedo’s work is quite rare and no recent auction records have been found for the original editions. Later versions (1851–1855) command prices in the range of \$5,000. The work also was reprinted in 1959, 1978, 1986, 1989, 1992, and 2002. Even these editions sell for as much as \$250.

References

- Alexander, M. (ed). 1976. *Discovering the New World*. Harper and Row, New York.
 Anon. ~1590. *Histoire Naturelle Des Indes: Countenant Les Arbres, Plantes, Fruits, Animaux, Coquillages, Reptiles, Insectes, Oyseaux, &c. qui se trouvent dans les Indes...* (Ms. Pierpont Morgan Library).



Page 64 & facing plate. “Lacertus Indicus, Senembi & Iguana dictus: The Guana” and “Anona maxima, foliis latis fructu maximo luteo conoide, cortice glabro” (pp. 64–T 64, from Catesby 1754). This illustration is considered by most authorities to be taken from White. The associated text was on a separate page in English and French (not shown).

- Anon. 1996. *Histoire Naturelle des Indes*. Norton, New York.
- Anon. 1996. *The Drake Manuscript*. Andre Deutsch, London.
- Bigges, W. d. 1586. *A Summarie and True Discourse of Sir Frances Drakes West Indian Voyage. Wherein Were Taken, the Townes of Saint Iago, Sancto Domingo, Cartegena & Saint Augustine*. London.
- Bigges, W. and M. Croftes. 1588. *Expeditio Francisci Drake Equitis Angli in Indias Occidentales*. Fr. Raphelengius, Leyden.
- Bonaterre, L.A. 1789. *Tableau Encyclopédique et Méthodique des trios Règnes de la Nature*. Chez Panckouche, Paris.
- Brezzi, A. 2007. Tulato: Window to the prehistory of America. (www.villegaseditores.com/loslibros/9588160359/catalogo.php).
- Breton, R. 1665. *La Dictionnaire Caraïbe-Française*. Gilles Bouquet, Auxerre, France.
- Castillo, J.C. 2003. Naming Difference: The Politics of Naming in Fernandez de Oviedo's *Historia General y Natural de las Indias*. *Science in Context* 16:489–504.
- Catesby, M. 1754. *The Natural History of Carolina, Florida and the Bahama Islands: Containing the Figures of Birds, Beasts, Fishes, Serpents, Insects and Plants*. Vol II. C. Marsh, London.
- Dalby, A. 2001. Christopher Columbus, Gonzalo Pizarro, and the Search for Cinnamon. *Gastronomica* 1(2):40–49.
- De Bry, T. 1599. *AMERICÆ PARS VIII. Continens PRIMO, DESCRPTIONEM (Grands Voyages, Part VIII, Latin version)*. De Bry, Frankfurt.
- Du Tertre, J.-B. 1667. *Histoire Generales des Antilles Habitees par les Francais*. T. Jolly, Paris.
- Eden, R. 1577. *The History of Travayle in the West and East Indies*. Richard Jugge, London.
- Hulme P. and N. Whitehead. 1992. *Wild Majesty: Encounters with the Caribs from Columbus to the Present Day*. Oxford University Press, Oxford.
- Honychurch, L. 1997. Crossroads in the Caribbean: A site for encounter and exchange on Dominica. *World Archaeology* 28(3):291–304.
- Honychurch, L. 2004. Pitons, Soufrières and Three-Pointer Zemis: The mythic geography of Caribbean volcanoes and indigenous cultures. Paper delivered at the 50th Anniversary Conference of the St. Lucia Archaeological and Historical Society, Castries.
- Honychurch, L. 2005. Iōtānalao People and the First Resistance: Peace and War among the Kalinago of St Lucia. (cavehill.uwi.edu/bncde/stlucia/conference/papers/honychurch.html).
- Hulton, P and D.B. Quinn. 1964. The American drawings of John White, 1577–1590. In: D.B. Quinn (ed.), *The Roanoke Voyages*. Vol. I, pp. 243–313. The Hakluyt Society, London
- Jesse, Rev. C. 1963. The Spanish Cedula of December 23, 1511 on the subject of the Caribs. *Caribbean Quarterly* 9(3). Mona, Jamaica.
- Keegan, W.F. 1995. History begins on Grand Turk. *Times of the Islands: The International Magazine of the Turks and Caicos*. Summer 1995. (www.flmnh.ufl.edu/caribarch/TClarchaeology.htm).
- Keegan, W.F. 1996. Grand Turk. Earthwatch Expedition Report. February 1996. (www.flmnh.ufl.edu/caribarch/grandturk.htm November 2007).
- Keegan, W.F. 1997. Grand Turk. Earthwatch Expedition Report. March 1997. (www.flmnh.ufl.edu/caribarch/grandturk97.htm November 2007).
- Keegan, W.F. and B. Carlson. 1997. The Coralie Site, Grand Turk. *Times of the Islands: The International Magazine of the Turks and Caicos*. Summer 1997. (<http://www.flmnh.ufl.edu/caribarch/coralie.htm>).
- Keegan, W.F. and B. Carlson. 2007. Talking Taino: Lizards and snakes. *Times of the Islands: The International Magazine of the Turks and Caicos*. (www.timespub.tc/index.php?id=356).
- Kraus, H.P. 2005. Sir Francis Drake: A Pictorial Biography by Hans P. Kraus. (www.loc.gov/tr/rarebook/catalog/drake/drake-catalogue.html November 2007).
- Lorant, S. 1946. *The New World: The First Pictures of America*. Duell, Sloan, & Pearce, New York.
- Martyr, P. 1533. *De Rebus Oceanicis & Orbe Novo Decades Tres*. Joannes Bebelius, Basel.
- Milton, G. 2000. *Big Chief Elizabeth, How England's Adventurers Gambled and Won the New World*. Sceptre/Hodder and Stoughton, London.
- Oviedo y Valdez, G.F. de. 1526. *La Historia de las Cosas Sucidadas en mi Tiempo en America*. Toledo.
- Oviedo y Valdez, G.F. de. 1535. *Historia General y Natural de las Indias Occidentales*. Seville.
- Oviedo y Valdez, G.F. de. 1547, 1557. *Historia General y Natural de las Indias. Islas y Tierra Firme del Mar Océano*. Seville.
- Oviedo y Valdez, G.F. de. 1851. *Historia General y Natural de las Indias. Islas y Tierra Firme del Mar Océano*. Imprenta de la Real Academia, Madrid.
- Oviedo y Valdez, G.F. de. 1978. *Historia General y Natural de las Indias. Islas y Tierra Firme del Mar Océano*. Espasa-Calpe, Madrid.
- Oviedo y Valdez, G.F. de. 1986. *Historia General y Natural De Las Indias: La Provincia de Venezuela*. Fundacion de Promoción Cultural de Venezuela, Caracas.
- Oviedo y Valdez, G.F. de. 1992. *Historia General y Natural de las Indias. Islas y Tierra Firme del Mar Océano*. Biblioteca de Autores Españoles, Madrid.
- Philoponus, Honorius (pseudonym of Caspar Plautius, O.S.B.). 1627. *Nova Typis Transacta Navigatio. Novi Orbis Indiae Occidentalis*. Linz.
- Ramusio, G.B. 1606–1613. *Delle Navigazioni et Viaggi ...* Giunti, Florence.
- Porter, C.M. 1992. The Scientific Cosmos of Columbus: An Overview. *Proteus* 9(1):1–10.
- Smith, H. 1990. John White and the earliest (1585–1587) illustrations of North American reptiles. *Brimleyana* 16(1):119–131.





Ashy Geckos (*Sphaerodactylus elegans elegans*), native to Cuba and Hispaniola, have been introduced in the Florida Keys.

H U S B A N D R Y

The Reef Geckos of Florida

Tom Heagy¹ and Phillip Frank²¹Apple Valley, Minnesota²Field Associate, California Academy of Sciences, San Francisco

Photographs by Phillip Frank except where indicated.

Formerly considered a subfamily, Sphaerodactylinae, of the cosmopolitan lizard family Gekkonidae, these small and unique geckos, confined to the Western Hemisphere, have recently been elevated to familial level as the Sphaerodactylidae, a clade distinct from all other geckos. In addition to *Sphaerodactylus*, other genera in the family include *Aristelliger*, *Coleodactylus*, *Gonatodes*, *Lepidoblepharis*, and *Pseudogonatodes*.

Four species have been recorded as part of the fauna of the United States. However, three and possibly all four of these are thought to have been introduced. Little is known of the status of one species, the Yellow-headed Gecko (*Gonatodes albogularis*),



Ashy Geckos prefer moist areas, and can be found in leaf litter and other detritus, wood and rock piles, and under bark.



Reef Geckos (*Sphaerodactylus notatus notatus*) range from extreme southwestern mainland Florida, through the Florida Keys, the Dry Tortugas, Cuba, and the Bahamas. They may be the only geckos native to the United States.

beyond the fact that populations were in apparent decline. Further consideration of this possibly extirpated species is beyond the scope of this paper.

The remaining three species are known collectively as “Reef Geckos,” and all are in the genus *Sphaerodactylus*, the Ashy Reef Gecko (*S. elegans*), the Ocellated Reef Gecko (*S. argus argus*), and the Florida Reef Gecko (*S. notatus notatus*), which is considered by some to be the only gecko native to Florida.

The beautiful coloration of the Reef Geckos is often cryptic and their behavior is both bizarre and fascinating. Based on observations in the field, supplemented with information on captive maintenance gleaned from our own experience, we describe the husbandry of the three species known to occur in the Florida Keys.

When compared with most lizards, those in the genus *Sphaerodactylus* are true dwarves. The world’s smallest known land vertebrate is *S. ariasae*, found on Beata Island off the coast of Hispaniola. Adults of this species average only 16 mm in snout-vent length (SVL). However, the majority of species are larger, with the “giant” of the genus, *S. torrei* from Cuba and the Bahamas, reaching a SVL of 39 mm. However, their diminutive size should not discourage husbandry of these hardy and engaging geckos. They are easy to accommodate and are surprisingly robust. Also, unlike many other geckos, many sphaerodactyls are



Sphaerodactylus ariasae, from Beata Island off the southern tip of Hispaniola, is the world’s smallest amniote (which includes reptiles, birds, and mammals, vertebrates with embryos surrounded by fluid-filled membranes). Adults of this species average only 16 mm in snout-vent length.

active during the day. One major concern in keeping these species in captivity is aggressive behavior among individuals of the same sex. For the potential *Sphaerodactylus* owner, we suggest that only groups of two should be kept together, as even females can become overtly aggressive toward each other, often resulting in the death of the subordinate animal.

In their native habitats, sphaerodactyls are secretive. They typically are found in leaf litter, under old boards and trash piles, inside walls, and under rocks and logs, in fact, anywhere offering suitable cover, food, and security from predators. They can occur communally in high population densities, and communal egg laying has been observed. On some of the Florida Keys, all three species occur in sympatry.

Ashy Geckos

(*Sphaerodactylus elegans elegans*)

The Ashy Reef Gecko was introduced into Florida. The species is native to Cuba and Hispaniola, with the nominate subspecies (that in Florida) endemic to Cuba. This is the largest of the three species, with a maximum SVL to 39 mm. Ground color varies from golden tan to dark rusty brown in adults. The entire dorsum is covered by tiny whitish-cream to yellow spots, conjoin-



Sphaerodactyls are secretive. They typically are found in leaf litter, under old boards and trash piles, inside walls, and under rocks and logs, in fact, anywhere offering suitable cover, food, and security from predators. In the Florida Keys, they often are associated with humans and their debris.



ing on the head and tail to form a worm-like pattern. Males and females both exhibit similar patterns, but sexing can be accomplished by visual inspection of adults. Males generally have well-developed preanal pores and hemipenial bulges. Also, as with most sphaerodactyls, males exhibit a shiny, reflective patch of scales (“escutcheon patch”) just anterior to the vent where the two rows of preanal pores meet. By holding an animal in a clear glass container and examining the ventral area, individuals can be sexed without being harmed (or the eyes of the keeper being unduly strained).

Hatchlings and juveniles are strikingly colored. Interspersed black and yellowish-tan bands on a purplish-gray head and a green body with a crimson tail and red legs make them one of the most beautiful geckos. As they grow, the colors diminish, with the banding fading into the adult pattern in just a few short months.

These shy animals often are found near human habitation. They are diurnal and crepuscular. They prefer moist areas, and can be found in leaf litter and other detritus, wood and rock piles, and under bark. Although predominately terrestrial, they are the most arboreal of the group and can be observed in search of food on fences, and high in trees under bark or on walls near lights at night.

This is a hardy and adaptable species. A standard 2.5-gallon aquarium is suitable for a pair of these animals. Keeping this species in larger groups is not recommended. The cage should be furnished with a 2-inch substrate composed of equal parts topsoil and sand. Cover in the form of overturned plant crocks, bark, and rocks should be provided. Loose, dry leaves offer additional security. Live plants are useful for cover and to help maintain proper humidity levels. Branches for climbing may be beneficial, and, if the back wall of the terrarium is covered with pieces of bark or similar material, this will increase the surface area of the terrarium and provide additional hiding places by more accurately simulating natural habitat.

A water dish will rarely be used. The animals get plenty of water from daily sprayings of half of the terrarium, which should keep half of the terrarium substrate moist — but not wet. Temperatures in the terrarium should range from 24–30 °C



These shy animals (*Sphaerodactylus elegans*) often are found near or on human habitation.



Female Ashy Geckos usually deposit eggs in a concealed area directly on the substrate, in crevices, or under other objects.

(75–85 °F). A small, slightly warmer area should be provided to allow for proper thermoregulation, which helps encourage reproduction. Lighting for the enclosure is not necessary; enough indirect light to allow the animals to differentiate the photoperiod is sufficient. If lighting is desirable, fluorescents and low-wattage spots should be considered. Be careful to avoid overheating a small enclosure.

As insectivores, geckos are best fed appropriately sized prey items such as small crickets, roaches, wax worms, fruit flies, isopods, house flies, and field sweepings. Prey items should be dusted with calcium and/or vitamin supplements at every feeding. Feed every other day, although breeding and gravid females may require daily feedings to maintain proper body weight.

Breeding this species is not problematic. Instead of spraying once a day, regularly spray twice a day for a period of up to several weeks to ensure that at least half of the substrate stays moist. This is an important factor in initiating breeding activity. Raising the average temperature in the terrarium also may help, as this further increases the lizards' activity levels.

After fertilization, a female will lay within 18–30 days. She can produce a single hard-shelled oblong egg every two weeks for over two months after the initial pairing. Gravid females carry one very large egg easily seen through the ventral skin. Eggs are usually deposited in a concealed area directly on the sub-

strate, in crevices, or under other objects. They frequently deposit their eggs in the transition zone between the wet and dry areas in the terrarium. *In situ* incubation is possible, and young can be reared with the parents until sexual maturity. At that time the males will begin engaging in aggressive behavior toward one another. We prefer to remove the eggs for incubation on a dry substrate in a bottle cap or similar container placed in a cup filled with saturated perlite or vermiculite. The ambient humidity will provide all the moisture the eggs require, but direct contact with moisture can be fatal to the embryo. Fruit-fly mesh lids are applied to prevent the tiny hatchlings from escaping while allowing proper ventilation. Suitable temperatures for incubation are in the 25–30 °C (78–85 °F) range. The brightly colored young hatch in 50–85 days.

Young can be reared in jars, small terraria, or our preferred method, in 32-ounce deli cups outfitted with a fruit fly mesh lid. An inch or so of soil is placed in the bottom of the cup, with egg cartons torn and crumpled and set into stacks inside the cup to provide cover and access to both moist and dry areas. Provide similar care as for the adults; however, young animals should be fed every day, with supplements used at every feeding. By 5–8 months of age, the young have lost their striking juvenile colors, and the males are now sexually identifiable. We suggest holding animals back from breeding until at least one year of age.



At 5–8 months of age, young Ashy Geckos lose their striking juvenile colors (left), but bands may remain apparent for a little longer.

Ocellated Geckos

(*Sphaerodactylus argus argus*)

This species has been introduced into the Florida Keys and is native to Cuba and Jamaica. Ocellated Geckos are a rare find in the Florida Keys, found only on two islands and just recently rediscovered after a 26-year hiatus between sightings! These diminutive geckos have a SVL to 33 mm. Ground color ranges from all shades of brown to olive, and, as the name suggests, tiny white ocelli occur above the shoulders and nape and on the head, collectively forming four broken stripes that start at the nose and fade about mid-body. The body has many single-scaled white spots. Juveniles have a pattern similar to that of adults, but with an orange wash, which may persist into adulthood, predominately on the tail. Adult patterning appears at about four months of age. Mature males exhibit clearly defined preanal pores and hemipenial bulges.

This is easily the most cryptic of our resident sphaerodactyls. These geckos are found in leaf litter and debris around buildings. They are more moisture-dependant than the other Florida Reef Geckos, and prefer habitat with ready access to freshwater, such as gardens and mulched areas near buildings.

A terrarium designed for these animals should incorporate all of the aspects listed for *S. elegans elegans*, but particular attention to adequate cover must be addressed. A thick substrate consisting of a 50–70% sand and black topsoil mixture is a preferred choice. Leaf litter cover is a must. Use dry, sanitized maple or oak leaves, and cover a majority of the cage floor, piling the leaves against the cage walls and objects to increase the number of hiding places. Provision of a background of rock when dealing with these species seems beneficial, although they are primarily terrestrial. A structural focal point, such as a cork flat or overturned plant crock, is a necessity as well. The terrarium should be sprayed daily, enough to keep half of the floor substrate moist — but not wet. Suitable temperature values are 27–30 °C (80–85 °F), with a small “hot spot” for thermoregulation. A temperature drop at night can be tolerated if it is less than 6 °C (-10 °F).

These insectivorous lizards should be fed appropriately sized crickets, roaches, isopods, fire brats, wax worms, and fruit flies every other day. Breeding or laying females should be offered food daily, as should hatchlings. Dust prey items at every feeding with vitamin and/or mineral supplement.

Slightly raising ambient temperatures and increasing sprayings to twice a day is the tried-and-true method for inducing breeding. Be careful not to over-saturate the terrarium substrate. The second spraying of the day is needed only to spike the relative humidity.

Eggs are incubated at temperatures of 25–30 °C (78–85 °F), with humidity levels of 60–90% appearing adequate. Young will hatch in 40–70 days and thrive under similar conditions as the parents. House them in small terraria, jars, or large deli cups. Feed daily with supplement-dusted prey items.

Reef Geckos

(*Sphaerodactylus notatus notatus*)

Reef Geckos range from extreme southwestern mainland Florida, through the Florida Keys, north along the southeastern Florida coast to Fort Lauderdale, and across the Dry Tortugas, Cuba, and the Bahamas. These small geckos attain a maximum SVL of 34

mm. Their most striking feature is the strongly keeled, overlapping scales, which are reminiscent of fish scales. The colors are deep earth tones, with the ground color generally a rich shade of brown. Body and tail are covered in dark spots. This species exhibits sexual dimorphism, with females having three broad



Upward-directed eyes, clearly evident in this Ocellated Gecko (*Sphaerodactylus argus argus*), facilitate detection of predators from within leaf litter. Ocellated Geckos are native to Cuba and Jamaica but have become established in the Florida Keys.



Leaf-litter cover is a must for housing sphaerodactyls such as this Ocellated Gecko. Use dry, sanitized maple or oak leaves to cover a majority of the cage floor.



Like most sphaerodactyls, Ocellated Geckos produce a single oblong egg.

stripes on the head and a pair of white “eye” spots on the shoulders. Males are essentially spotted all over, including the head. They possess hemipenial bulges and preanal pores.

Reef Geckos are leaf-litter dwellers by preference, but also can be found in rock piles and under debris around human habitation. For captive maintenance, a 2.5-gallon terrarium is adequate for a pair of this species. A thick substrate should consist of black topsoil and sand in a 1:1 ratio. The terrarium should be planted with live plants, such as Pothos, Philodendron, or any other good ground cover. An overturned, broken crock or piece of cork bark should be provided for cover. Scatter dried, sanitized maple or oak leaves over a majority of the terrarium floor. Indirect lighting is sufficient, if proper temperatures can be maintained. The gradient inside the terrarium should be 24–30 °C (75–85 °F) during the day, with a drop of 2–3 °C (-5–6 °F) at night. Animals should be misted at least once a day, with more than 50% of the terrarium floor kept moist — but not wet. A water dish is unnecessary as sphaerodactyls are strictly droplet drinkers, although it might serve to maintain proper humidity.

Reef Geckos are insectivorous. Feed appropriately sized fruit flies, crickets, roaches, wax worms, fire brats, and isopods every other day. Breeding or laying females and hatchlings should be offered food daily. Dust with a vitamin and/or mineral supplement at every feeding.

As with the other sphaerodactyls, reproduction can be initiated with a slight temperature increase and by increasing the number of sprayings per day. Be careful not to soak the substrate too much; if moisture levels are adequate, spray only enough to raise the relative humidity.

A female will produce a single oblong egg about 14–21 days after impregnation, and will continue to produce 2–4 more every 14–28 days. Eggs are generally laid directly on the surface, in a crack or fissure, or in curled leaves. Be extremely careful when searching for them. Eggs can be incubated *in situ*, but we recommend removal for incubation. Incubation is the same as for *S. elegans*, except the young hatch in 45–60 days.

Newly hatched *S. notatus* are extremely large, often 25 mm in total length. House them separately in deli cups or small ter-



Reef Geckos (*Sphaerodactylus notatus notatus*) exhibit sexual dimorphism, with females (right) having three broad stripes on the head and a pair of white “eye” spots on the shoulders. Males (left) are essentially spotted all over, including the head.



Reef Geckos are leaf-litter dwellers by preference, and dried, sanitized maple or oak leaves should cover the majority of the terrarium floor.

rarria under conditions like those of the adults. They begin to lose juvenile coloration at 3–4 months of age, with males beginning to develop noticeable preanal pores and hemipenial bulges at 5 months. They are sexually mature by 8–10 months under captive conditions, but we suggest holding animals back until 12 months of age for breeding purposes.

Summary

The small size and undemanding nature of these animals, coupled with an inherent hardiness, wide array of behaviors, and attractive appearance make them worthy of attention. Whether you're a serious herpetoculturist or an inexperienced hobbyist, they are well suited for those with limited time and space availability, and are very economical as well. They require very little lighting or heating. The only regular investment for keeping these animals healthy is a reliable supply of small insects. Additionally, they are prolific under captive conditions, making them a fun and educational terrarium subject.

Furthermore, the frustration of acquiring these animals is coming to an end. Groups of dedicated hobbyists and researchers are working to ensure a solid understanding of husbandry needs and an ability to provide a captive-bred supply of these animals. As more hobbyists learn about their husbandry and ease of care, Reef Geckos will soon become commonly available species.

Acknowledgments

Special thanks to Yuri Huta and Jay Sommers for breeding information and photographs.

References

- Henkel, F.W. and W. Schmidt. 1995. *Geckoes: Biology, Husbandry, and Reproduction*. Krieger Publishing Co., Malabar, Florida.
- Henkel, F.W. and W. Schmidt. 2003. *Professional Breeders Series: Geckos – All Species In One Book*. Edition Chimaira, Frankfurt am Main, Germany.
- Krysko, K.L. and K.J. Daniels. 2005. A key to the geckos (Sauria: Gekkonidae) of Florida. *Caribbean Journal of Science* 41:28–36.
- Meshaka, W.E., Jr., B.P. Butterfield, and J.B. Hauge. 2004. *Exotic Amphibians and Reptiles of Florida*. Krieger Publishing Co., Malabar, Florida.
- Schwartz, A. and R.W. Henderson. 1991. *Amphibians and Reptiles of the West Indies: Descriptions, Distributions, and Natural History*. University of Florida Press, Gainesville.



Shopping in Guatemala is a treat, with shops loaded with handcrafted cultural artifacts.

TRAVELOGUE

Surprising Guatemala: A Journey with a Cause

Michael D. Kern

Palo Alto, California

Photographs by the author except where noted.

This past December, I had the opportunity to travel to Guatemala with members of the Project Heloderma team that included Brad Lock of Zoo Atlanta and John Binns and Desire Wong from the International Reptile Conservation Foundation. The purpose of the trip was simple, team up with our partner Zootropic and consummate a land deal in the Motagua Valley. This land would be used to establish a reserve, breeding facility, and research and education center to help protect the Guatemalan Beaded Lizard (*Heloderma horridum charlesbogerti*), the Guatemalan Black Iguana (*Ctenosaura palearis*), and the unique ecosystem in which they live.

The trip was short, lasting only one week. The primary focus was the land transaction, but we also visited a few of the many Guatemalan tourist sites. Specifically, we flew into Guatemala City and toured for a day. In the evening, we visited our host, Zootropic's headquarter building, and conducted the land transfer ceremony. The next day, we headed into the Motagua Valley, where we visited the land just purchased and got a first-hand look at the rare ecosystem that supports these amazing creatures. We also reviewed the development plans for establishing the breeding, research, and education complex to be established on the property. After that trip, we wound down by



The Guatemalan Black Iguana (*Ctenosaura palearis*) also occurs in and around the Motagua Valley. Both the Beaded Lizard and the Black Iguana will benefit from the newly established reserve.



The Guatemalan Beaded Lizard (*Heloderma horridum charlesbogerti*) makes its home on the steep mountainsides bordering the Motagua Valley.



JOHN BENNS

Aerial view of Guatemala City.

spending a few days in Antigua Guatemala, the country's ancient capital city. Finally, we traveled back to Guatemala City to catch our flights home.

Although this was my first trip to Central America, I have traveled and worked in over 30 countries around the world and pretty much thought I knew what to expect from a developing country, namely, amazing natural beauty under siege from bustling cities living on a decaying infrastructure. So, I set my expectations accordingly.... Boy, was I ever wrong.

First of all, unlike journeying to many expedition destinations, traveling to Guatemala from the United States is quite easy. Instead of having to travel through the International Date Line on a journey of consecutive daylong plane flights, this was a mere five-hour flight from Los Angeles, resulting in a rather pleasant overnight journey. We left LA in the evening and arrived at dawn the following day in Guatemala City. For Brad Lock, the trip was even easier, a three-hour flight within the same time zone. Although we battled long lines at the airport, once inside the plane, all was good — and the flight was short, sweet, and uneventful.

We arrived in Guatemala City and were greeted at the newly renovated airport by members of the Zootropic team who would serve as our hosts during this visit. We checked into the charming Hotel Otelito, which was once a private mansion. It's modern, open, and intimate design could easily have been featured in the pages of *Architectural Digest*. We freshened up and started our tour. In the old town center, we visited one of the largest markets I have seen. During all of my travels, I have

learned that the best place to determine how culturally different you are from the country you are visiting is in the markets and the churches. I already had been pleasantly surprised by the easy



One of the many exotic vendor stands in the central market in Guatemala City.



The Palm Pit Viper (*Bothriechis aurifer*) is an attractive but venomous pitviper found in Guatemala and Mexico.

trip and the quality of our hotel, but this market made me drool at what I saw. The colors — no, I should say THE COLORS were out of this world. The labyrinthine corridors of this indoor/outdoor market presented us with a wealth of cultural artifacts including textiles, clothes, and statues along with fruits,

vegetables, meat, fish, shoes, and wedding dresses. The people, a mix of Indian and European descent, were happy, warm, and responded to our amazement with laughter — without a doubt a unique and unforgettable sensory experience.

Next, we visited the Zootropic facility where many of the indigenous reptiles used to support the research and educational programs are kept. This was like a private tour through an amazing zoo. A diversity of indigenous snakes, lizards, and arachnids was on display. We were able to take pictures of some of the most beautiful vipers in the world, including *Bothriechis aurifer*, *B. bicolor*, and *B. schlegeli* — and, of course, several of the few captive Guatemalan Beaded Lizards in the world were there too. These rare animals are slated to become genetic founders at the proposed breeding facility. During our visit, we learned from the Zootropic field personnel about the different species and their native habitats.

That evening, we walked the few blocks from our hotel to the Zootropic office. The meeting between the Paiz family who sold the land, Zootropic, Zoo Atlanta, and IRCF personnel was quite interesting. Mr. Paiz talked about the history of the land and the hopes of his family to establish a foothold for conservation in this unique area. We learned how, over time, the area had changed and about the current challenges facing the people and animals that live there. Clearly, life in this region is out-of-balance, with humans rapidly converting all available area into farmland. The meeting was rather emotional, mainly because everyone felt strongly that this transaction was the first major salvo in the battle to protect this critically endangered area and its native species. Everyone shared perspectives over a few glasses of Guatemala's famous Ron Botran, which happens to be produced by the family of Zootropic's president, Rodrigo Botran. After the meeting, we returned to our hotel exhausted, content,



Project Heloderma Team Members from Zootropic, Zoo Atlanta, and the IRCF presenting a check for the land. From left: Daniel Ariano, Zootropic, Brad Lock, Zoo Atlanta, Mr. Paiz, previous landowner, John Binns, IRCF, and Rodrigo Botran, Zootropic.



The Motagua Valley is rapidly being converted into farmland, which reduces the native habitat needed for the survival of many critically endangered indigenous species.

and anxiously awaiting tomorrow's journey into the Motagua Valley, the remarkable area we had been working to protect for the past two years.

The trip from Guatemala City to the Motagua Valley in the department (state) of Zacapa took a few hours by car, and then another hour or so before we reached the property itself. By this time, we were off the paved roads and traveling by car "upstream" in a dry riverbed. You can read all you want about why this area is unique, but being there helped me understand its singular place in our world. Where to begin? First of all, the Motagua Valley is located at the foot of the Sierra de las Minas, which rise to 3,000 m above sea level. These mountains create a natural barrier to the moisture that originates over the Atlantic, resulting in the uniquely xeric region.

The area also is interesting from a geological perspective, since the Motagua Valley sits over the junction of the Caribbean and North American plates, an area rich in earthquakes and volcanoes attributable to the intense geological pressure caused by the two plates grinding against one another. The region also produces

some of the best translucent blue jade in the world, which was mined by Mayans at the peak of their reign over Middle America.

The Motagua Valley contains two unique habitat zones, a subtropical thornscrub and a subtropical dry forest. The dry forests are of the greatest interest to Project Heloderma, because that's where the Guatemalan Beaded Lizard resides at elevations of 300–800 m. Not so coincidentally, this is exactly the terrain and elevation where the purchased property lies. To find the site, Zootropic had conducted a number of studies to determine the land best suited for this purpose using a method called "Multi-Criteria Evaluation." Simply stated, this process examines the intersection of appropriate vegetation, temperature, slope, and elevations within a region to determine the potential distribution of a given species. The data for this study are generated by the conditions at sites where animals were actually sighted. The team is excited about this property specifically because it is in the center of the largest contiguous geographic area that matches the unique requirements of the Beaded Lizard. This means that the reserve potentially can expand. Already, discussions are



The Motagua River cuts through the Motagua Valley, providing a rare source of moisture.



The Guatemalan Beaded Lizard (*Heloderma horridum charlesbogerti*) is amazingly agile and can easily climb trees in search of food or safety.



The thornscrub terrain of the Motagua Valley.

underway with neighboring landowners who are considering that sale of adjacent lands to Project Heloderma.

For me, the most unique aspect of the land is the admixture of thornscrub and dry forest in a single area. I was used to seeing areas of thornscrub and I was used to seeing dry forests, but never in the same place. The difference is subtle but noticeable. I mean, how often can you find cactus in the middle of a forest?

When we finally arrived at the property, we were greeted by members of the Zootropic field team, who happened to have



John Binns and Desiree Wong survey the newly acquired land in the Motagua Valley.



Removing the mystery and fear surrounding the Beaded Lizard and educating local villagers on the value of conservation of endangered species is a critical component of Project Heloderma.

with them a recently captured juvenile *Ctenosaura palearis* that they were measuring. We also brought with us one of Zootropic's breeding Beaded Lizards, so we could take photographs of the rare species in its natural habitat. After a few hours of hiking and photography, we returned to the property gate to talk about the future plans for the site.

We then headed into El Arenal, one of the major villages in the area. Here we met with Gilberto Salazar, who is Zootropic Biologist Daniel Ariano's field assistant and the village liaison to Project Heloderma. While in the village, we talked to many local



Antigua is considered to be one of the best-preserved colonial cities in Spanish America. UNESCO has declared it a World Heritage Site.



The beautiful Spanish colonial city of Antigua is surrounded by three active volcanoes.

people about why we were there, and, since we had a Beaded Lizard with us, conducted some impromptu educational sessions with both the young and old, helping them understand the value and unique qualities of the creature and the land surrounding them. Through these educational sessions, the project seeks to dispel old fears and habits that more often than not, resulted in the killing of any lizard found by residents. Especially by working with the children, the project hopes to create a more conservation-friendly generation. These ongoing educational efforts appear to be working. Recently, a villager happened to catch a Beaded Lizard and was offered a large amount of money to sell it into the illegal exotic pet trade, but he instead offered the animal to Zootropic to help establish the necessary stock required for the breeding facility being constructed on the recently purchased land.

With the business of the trip complete and less than two days before we returned stateside, we headed to Antigua Guatemala (i.e., “Old Guatemala,” often just called Antigua), the country’s erstwhile colonial capitol. Considered by many to be the best-preserved colonial city in Spanish America, it is a well-kept secret in the international tourist world. Simply put, Antigua is beautiful, and the Spanish influence can be seen everywhere. At an elevation of 1,500 m, it lies in the shadow of three majestic and active volcanoes that provide a unique and

unmistakable landscape. Antigua also is a cultural shopper’s Mecca well known for its crafts. Store after store present wares ranging from silver and jade jewelry, wooden sculptures, traditional costumes, textiles, and weavings to crafts made from terracotta, ceramics, and/or wrought iron. If you’re not interested in shopping, simply stroll down the cobblestone streets and among the pastel buildings. Visit one of the many churches or sit in the town square and watch the people go about their daily routines. A number of great restaurants grace the town, and the hotels fit right into the architectural/historical landscape. A visitor really feels like he’s in an old Spanish colony.

Antigua was the last of many pleasant surprises on this trip. After two days of enjoying the slow pace of colonial Guatemala, we returned to Guatemala City and caught our flights home. What a magical week it had been. After all, this was supposed to be a working trip and we were going to a developing country that was bursting at its seams. I couldn’t have been more wrong — and the most amazing thing? We hadn’t even visited many of the most famous tourist sites that the country has to offer, notably the Mayan ruins at Tikal or Quetzaltenango, beautiful Lake Atitlán, or the tropical rainforests in the northern lowlands. Certainly, I will return to Guatemala to see how the reserve matures and the breeding programs develop, but also to renew friendships made and to see the many wonders of this beautiful country.

HISTORICAL PERSPECTIVES

The Fighting Behaviour of Marine Iguanas¹

I. Eibl-Eibesfeldt

Max-Planck-Institut, Seewiesen

The Marine Iguana (*Amblyrhynchus cristatus*) is a species endemic to the Galapagos Islands. It lives in large aggregations along the rocky shorelines throughout the archipelago. It is the only iguanid specialized for feeding on marine algae, which they crop at low tide from the exposed rocks or even by diving down to the bottom of the sea.

The animals are extremely gregarious and sometimes hundreds of iguanas bask on the lava rocks in bodily contact with each other. Besides this mutual attraction, however, no specific forms of social interaction like grooming, mutual feeding rituals, etc. are to be observed. This is in striking contrast to the social behaviour of birds and mammals that use such patterns for bond formation. These bond-forming behaviour patterns are mainly derivatives of maternal behaviour, which seem to be preadapted for this purpose. Reptiles lack maternal behaviour and this may in part explain their inability to form a closer bond between adults.

During the breeding season the male Marine Iguanas become territorial. They defend a small area of lava rock against other males, whilst females are allowed to stay. If a male rival approaches the territory, its owner displays. He opens his mouth, nods with the head, and walks stiff-leggedly up and down in front of the rival, showing his lateral aspect. The dorsal crest is erected and the gular regions extended. If the rival answers by the same display, fighting is initiated. The opponents rush at each other. However, in spite of the biting intentions shown during the display, they never bite each other, but instead lower their head and butt. The hornlike scales on the roof of the head interlock and the animals try to push the other away. This can con-

¹ Adapted from the original publication in the *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences*, Vol. 251, No. 772, A Discussion on Ritualization of Behaviour in Animals and Man (29 December 1966), pp. 475–476.



MAXIM FOMETUN

The threat display of a Marine Iguana (*Amblyrhynchus cristatus*).

tinue for a while, with pauses in between, during which the opponents display frontally. The struggle ends when one of the rivals is pushed from the rock or when he gives up by assuming a submissive posture (lying flat on his belly). The winner then stops fighting and waits in threat display for the rival to leave. The fight is a highly ritualized tournament in the course of which the stronger wins, without hurting the loser.

Only if one introduces a male artificially into the territory of another male, can damaging fights be observed. Then the territory owner rushes at the introduced individual, which does not show the introductory ceremonies that normally release ritualized fighting. The introduced individual is bitten as a consequence.

Females fight in some places of the archipelago for the rare egg-laying sites. In contrast to the males, their fighting is far less ritualized. It begins with threat display and head-pushing, but soon they bite and shake each other viciously. They have less developed hornlike scales than the males.

Ritualized fighting is fairly widespread in animals that are capable of inflicting serious damage to conspecifics. Poisonous snakes never bite each other, but the rivals wrestle according to the fixed rules. Cichlid fishes have developed various forms of mouthfighting, and thus avoid mutual damage. In a number of

species (e.g., in wolves), fighting starts as a damaging fight, but ends by a submissive posture of the loser, which inhibits further aggression (Lorenz 1963). The existence of ritualized combats shows clearly that the killing of a conspecific is generally avoided in vertebrates. Only animals without weapons or animals that can easily retreat after the exchange of bites have no such social inhibitions. This is, for example, true for the hamster (*Cricetus cricetus*), where the loser has no difficulty in running away. The winner never follows far. In captivity, species of this type often kill each other. From the fact that ritualized fighting occurs, we can learn furthermore that strong selection favors aggression. Otherwise aggression would have been counterselected in species that can do damage to conspecifics. However, they developed the most complicated fighting techniques instead, in order to permit fighting, as a mechanism for spacing-out (Eibl-Eibesfeldt 1951, 1961).

References

- Eibl-Eibesfeldt, I. 1955. Der Kommentkampf der Meerechse (*Amblyrhynchus cristatus*). *Zeitschrift der Tierpsychologie* 12: 49–62.
- Eibl-Eibesfeldt, I. 1961. The fighting behavior of animals. *Scientific American* 205(6): 112–122.
- Lorenz, K. 1963. *Das sogenannte Böse, zur Naturgeschichte der Aggression*. Borotha-Schoeler Verlag, Wien.

The Booming Lizard of Australia¹

Walter H. Bone

Linnzan Society of New South Wales, Sydney

In July, 1913, I was hunting in the Cove's River Ranges with two companions—Andrew and John Duncan, of Megalong. We found a black-and-yellow banded monitor lizard about five feet long concealed in a crevice on the face of a wall. We had no intention of injuring him, but out of mischief Andrew Duncan suggested that we should make him yell. I was sceptical, but both men assured me that the lizard could, and would yell under persuasion. On condition that there should be no cruelty, I consented to a demonstration. They laughed at the idea of cruelty. Andrew picked up a stick and began poking the reptile in the ribs and tickling him under the arm. It stood it for a while, merely squirming closer down in the crevice, then, having had enough of it, blew himself out and emitted a most comically doleful bellow that could be heard several hundred yards away. This he did repeatedly until we had laughed ourselves tired. It was funny, on looking back after we had gone fifty yards, to see the lizard stick his head around the corner to make sure that we had really departed.

I have had for the last four years at my hunting-box on the Naltai River, a tame monitor whom I have called "Joseph" on account of his coat of many colors, and who is the interesting

companion of my solitude and incidentally keeps the snakes away. With the above in my mind, I experimented on him. I found him camped under the bench beneath the window, and irritated him with the end of a stick. He did as the other had done — filled himself with wind and then emitted it in a prolonged bellowing groan. By the way, our "bookbook owl" does much the same thing. He fills himself nearly to bursting in a succession of gasps, and then says "Hoo-hoo-hoo" till he has no more breath, then fills up again.



"Black-and-yellow banded monitors" (= Lace Monitors, *Varanus varius*) can be loudly vocal when disturbed.

¹ Originally published in *Science* 52: 273 (1920).

COMMENTARY

Anaconda Conservation: A Reply to Rivas

Tomás Waller and Patricio Alejandro Micucci

Fundación Biodiversidad, San Martín 945 piso 3 #23, Buenos Aires, Argentina C1003AAS

Since 2002, Fundación Biodiversidad (FB) has conducted a management program for Yellow Anacondas (*Eunectes notaeus*) in Formosa Province, Argentina. The main objective of the program has been to establish a sustainable-use model that ensures equity among users while promoting research and conservation of the resource. Recently, Rivas (2007, *Iguana* 14(2): 74–85) criticized the program in the context of his opinions regarding the impact of global economic development on the conservation of Green Anacondas (*Eunectes murinus*). Although we provided a detailed review of the Argentine program (Micucci and Waller, 2007, *Iguana* 14(3): 160–171), we believe a more specific response to his comments is appropriate and necessary.

Rivas's views are based almost entirely on a brief visit he made during September 2002 to Formosa, at the end of the first experimental hunting season. He was seeking images of Yellow Anacondas for a National Geographic Channel (NGC) documentary. Two years later, FB was invited to review the "Objective Anaconda" script with a commitment of "... not putting on-air the documentary until all comments were taken into consideration" (V. Linares, in litt., NGC — Research, Standards, & Practices, 30 March 2004). Since the most questionable opinions were made by Rivas on-the-air, this apparent compromise was not adequately addressed, and the final product was, at least, controversial. In reviewing his recent article in *Iguana*, we quickly came to the conclusion that, in these subsequent years, he has chosen not to inform himself properly regarding the basics of the program, which would have allowed him to support his position with facts instead of errors and misconceptions.

Specifically, Rivas stated that the Argentine program promotes the hunting of specimens larger than 2.3 meters, not specifying if this size relates to skin size, snout-vent length (SVL), or total length. He also mentioned that hunting takes place "... at the beginning of the warm season..." when, in fact, the Program allows local people to harvest snakes above 2 m SVL during the local winter (June–August). Additionally, Rivas stated that the skin minimum size limit established (2 m SVL = 2.3 m skin length) responds to a commercial requirement for large skins. On the contrary, the current skin size limit was established as a control variable (Micucci et al. 2006). Historically, specimens over 1.3 m SVL were hunted with no additional considerations, affecting all size classes in the population; the 2-m limit reduced by half the snakes vulnerable to hunters. Logically, the international markets prefer large hides (this is true of all reptilian species in the skin trade); the coincidence between market preferences and program requirements is circumstantial but advantageous because it warrants economic sustainability.

Further, Rivas provided a simplistic analysis of the program's economics by referring to what he called "the lion's share" of the income going to the private sector. However, on the 'cost' side of his analysis, he only took into consideration the price of the skins paid to hunters (in 2002), but forgot to mention the other costs that are paid by the private sector (e.g., program research and running expenses, logistics, freight, state and national taxes). Rivas's logic falls apart if we apply the same criteria to other examples, such as comparing the price of a valued fish on a fancy restaurant menu to the cost of that fish paid at



TOMÁS WALLER

Yellow Anacondas (*Eunectes notaeus*) harvested as part of the Yellow Anaconda Management Program (YAMP) in Formosa Province, Argentina. Snakes are held alive for biological studies before being killed and skinned.

acquisition from the fisherman. Rivas implied that the program failed to ensure resource (land and snakes) protection without providing any evidence — and based only on a weekend-trip during the first year of the program! He ignored the realities that the La Estrella marsh is an area protected by law since 2005 and that the anaconda harvest program is the only operation permitted in that wetland. Another misconception occurred when he proposed that “... the program was less of an effort to manage anacondas than an economic enterprise using anacondas as a capital commodity...” We see no contradiction in managing anaconda populations for selling skins to benefit local people and committed investors, similar, for example, to programs that ranch and harvest alligators in the United States, crocodiles in Cuba, or caimans in Venezuela.

This author also stated that the program resulted solely from a proposal by the private sector in Formosa in response to the 2002 breakdown suffered by Argentina. This is, to say the least, false and absurd. FB conceived and proposed the Yellow Anaconda program as an alternative to the historical misuse of this living resource that had been exploited without restrictions for more than 60 years! Rivas chose to ignore decades of tradition of Argentina as a wildlife exporter (e.g., up to 1 million Tegulizard hides/year and 300,000 fox hides/year) and demonstrated considerable naivety by suggesting that the impact of the harvest of 5,000 Yellow Anacondas per year would modify the course of the nation’s or even the province’s, economy! In addition, his interpretations of national or provincial competence at managing natural resources are simplistic. Since the Yellow Anaconda



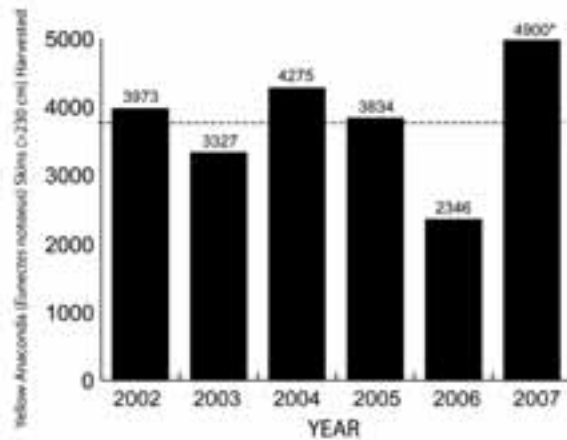
EMILIO WHITE

Emergent logs and logs covered by climbing plants, locally known as “champas,” are preferred basking sites of *Eunectes notaeus* in La Estrella marshes in northeastern Argentina. Snakes seek these microhabitats during the winter, when water temperatures drop to 15 °C or lower. Both males and females need warmer temperatures to complete gonadal cycles before the onset of the mating season in spring.



EMILIO WHITE

Yellow Anacondas (*Eunectes notaeus*) are most vulnerable to collection during the winter when they are cold and leave the water to bask.



Yellow Anaconda (*Eunectes notaeus*) skins (>230 cm) harvested between 2002 and 2007. Average: 3,800 (dotted line). *Definitive value pending.

is a CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) Appendix-II species, the government's only responsibility is to assure compliance with Article IV (non-detriment finding) of the Convention.

Rivas affirmed that the program harvests mainly female snakes. Although 75% of the animals harvested are females, the rationale for this practice does not correspond to his unsophisticated deductions. Instead, this proportion results from the interplay of a minimum size limit, the species' natural size distribution, and a pronounced female-biased sexual size dimorphism (Micucci and Waller 2007). If the minimum size were reduced in an effort to reduce the *proportion* of females versus males taken (presumably because more males would be hunted), the actual result would be an increase in the *absolute* numbers of females harvested, since allowing smaller animals to be taken would inevitably entail the sacrifice of young and small adults of both sexes that currently are protected by the program. Ultimately, what matters is the actual proportion of females taken from the population, which we estimate to be less than 5%. Rivas also erroneously stated that *pregnant* females are differentially affected by the harvest, on the assumption that gravid females are most visible when basking. However, at our latitude the harvest occurs during the cool winter months, exactly when the species is not reproducing, a fact that he as an anaconda specialist should not ignore. At the end of his article, he affirmed that local hunters "... anticipated a sharp decline in anacondas..." This comment, aside from a lack of scientific rigor, is far from reality, since, five years after his visit, the 2007 harvest season generated record results — without significant changes in skin size or sex structure of the population.

We consider that Rivas' article was fostered by an exaggerated concern for anacondas. According to CITES statistics, current volume in trade is null or negligible compared to historical records and aquatic habitat destruction has been slight on a global scale, especially when compared to the fate of terrestrial ecosystems. Consequently, we believe that Rivas exploited these "TV-fashionable" animals in order to express his personal views on the world economy and his prejudices against wildlife-utilization policies that he rejects for subjective reasons. For example, his statements that management under sustained yield models

(i.e., Yellow Anacondas in Argentina, most fisheries) demands a previous assessment of a species' population size and intrinsic rate of increase and that obtaining basic biological data is a prerequisite for management are both readily disputable. Sustained-yield models were devised to manage non-easily assessable populations (like most fisheries) and, due to the feedback that management provides, estimates of basic demographic parameters like abundance and rates of increase are then possible (Caughley and Sinclair 1994). In fact, management decisions rarely result from pure research (Webb 2002), and the "adaptive management" concept (Hollings 1978) evolved to overcome the usual insurmountable difficulties that represent acquisition of basic demographic parameters as a prerequisite for wildlife management.

Rivas opined that some practical conservation initiatives are *laudable*, but that conservationists would be more *effective* in achieving conservation goals by subscribing to anti-globalization movements is non-realistic. Predicting the outcome of changing economic policies that are not expected to be realized for 25–50 years is impossible (Wallerstein 1999). Moreover, opposition to economic changes does not provide solutions for wildlife conservation, as the main concerns of such movements are socio-economic in nature, and have little to do with human population growth and its effects on wildlife and habitats. Although we totally agree that the world's emphasis on development at all costs fails to address many crucial issues, we are simultaneously convinced that practitioners of conservation should address actual problems with available tools and technologies in order to be effective. Boycotting current conservation strategies in favor of ideological utopias is both ineffective and discouraging. If I suffer from a smoking-related illness, even though I believe it would be laudable for my physician to support anti-tobacco movements, I still need his medical expertise right now in order to preserve my life. In conclusion, we emphasize that "care must be taken to assure that subjective criteria about *what the natural world should look like* are not confused with objective management goals" (Sinclair 1997).

References

- Caughley, G. and A.R.E. Sinclair. 1994. *Wildlife Ecology and Management*. Blackwell Scientific Publications, Boston, Massachusetts.
- Holling, C.S. 1978. *Adaptive Environmental Assessment and Management*. J. Wiley, London.
- Micucci, P.A. and T. Waller. 2007. The management of Yellow Anacondas (*Eunectes notaeus*) in Argentina: From historical misuse to resource appreciation. *Iguana* 14: 160–171.
- Micucci, P.A., T. Waller, and E. Alvarenga. 2006. Programa Curiyú. Para la conservación y aprovechamiento sustentable de la boa curiyú (*Eunectes notaeus*) en la Argentina. Etapa experimental piloto 2002–2004, Formosa, pp. 77–92. In: M.L. Bolkovic and D. Ramadori (eds.), *Manejo de Fauna Silvestre en la Argentina. Programas de Uso Sustentable*. Dirección de Fauna Silvestre, Secretaría de Ambiente y Desarrollo Sustentable, Buenos Aires.
- Rivas, J.A. 2007. Conservation of Green Anacondas: How Tylenol conservation and macroeconomics threaten the survival of the world's largest snake. *Iguana* 14: 74–85.
- Sinclair, A.R.E. 1997. Carrying capacity and the overabundance of deer, pp. 380–394. In: W.J. McShea, H.B. Underwood, and J.H. Rappole (eds.), *The Science of Overabundance — Deer Ecology and Population Management*. Smithsonian Institution Press, Washington, DC.
- Wallerstein, I. 1999. *The End of the World As We Know It: Social Science for the Twenty-first Century*. University of Minnesota Press, Minneapolis.
- Webb G. 2002. Conservation and sustainable use of wildlife: An evolving concept. *Pacific Conservation and Biology* 8: 12–26.

BOOK REVIEWS

Enamored with Snakes

Snakes of the Southeast. 2005. By Whit Gibbons and Mike Dorcas. The University of Georgia Press, Athens. 253 pp., 300+ color illustrations. Softcover — ISBN 0-8203-2652-6 — \$22.95.

Having grown up about a 2.5-hour car ride from the “frozen tundra” of storied Lambeau Field in Green Bay, Wisconsin, my boyhood daydreams focused on snake hunting in much warmer places. I was especially taken with the American tropics, and devoured books by Bates, Wallace, Barbour, Ditmars, and Carr — but I was also fascinated with the southeastern United States and, compared to southeastern Wisconsin, its diverse and exciting snake fauna: Indigos, Yellow and Red rat snakes, Scarlet Snakes, Water Moccasins, and Eastern Diamondbacks. Kauffeld’s *Snakes and Snake Hunting* became an instant favorite, especially the chapter entitled “Okeechobee.” When my parents agreed to allow me to keep snakes in my bedroom, I chose species that were native to Florida, including an Eastern Diamondback, a Red Rat Snake, and my favorite, a Yellow Rat Snake. So, it was with much anticipation that I read *Snakes of the Southeast*.

The stated goal of the book is “to teach people about snakes and to foster appreciation of them as valuable components of our natural heritage.” This book easily accomplishes the first goal; only time will tell if the authors were successful with the second. Neither Gibbons nor Dorcas are “armchair” herpetologists; rather, both have devoted their careers to studying snakes in the habitats where they live. This, alone, makes their book desirable, as it is based on firsthand experience with snakes in nature, and not on information gleaned only from secondary sources or from captive animals. Geographic coverage of the book includes Virginia, Tennessee, the Carolinas, Louisiana, Mississippi, Alabama, Georgia, and Florida.

The book begins with a heavily illustrated, clearly presented 24-page primer of snake biology divided into various topics (e.g., Diversity, Food and Feeding, Locomotion, Predators, Temperature Biology). A five-page section on identifying the snake species of the Southeast includes traditional morphological characters (scale type, body shape), but also geographic location, habitat, and when the snake is active. The heart of the book, however, is the 182-page section devoted to the species accounts. This section is divided into smaller sections dealing with “small terrestrial snakes” (13 species; e.g., *Virginia*, *Storeria*, *Tantilla*), “mid-sized terrestrial snakes” (10 species; e.g., *Ophedryx*, *Thamnophis*, *Heterodon*), large terrestrial snakes (8 species; e.g., *Pituophis*, *Elaphe*, *Drymarchon*), “watersnakes” (15 species; e.g., *Regina*, *Nerodia*, *Farancia*), “venomous snakes” (6 species; e.g., *Agkistrodon*, *Crotalus*, *Micrurus*), and “introduced species” (2 species; *Python*, *Rhamphotyphlops*). The last sections of the book include one on “People and Snakes,” a table for determining what species occur in which states, a map illustrating the distribution and diversity of venomous snakes in the Southeast and another for all snake species in the area, a useful

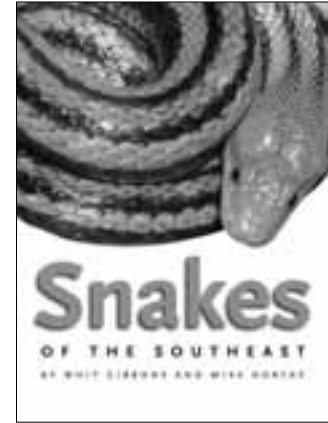
glossary, a short list of “further reading,” and an index to common names.

Each species account includes a brief description of the adult, a description of babies of that species, other common names, distribution and habitat, behavior and activity, food and feeding, reproduction, predators and defense, and conservation. Each account has a kind of sidebar that provides a thumbnail key for identifying that species (e.g., scales keeled or smooth, anal plate single or divided, body shape, body pattern and color, distinctive characters, and size). Also included is a map delineating the species’ distribution in the Southeast and throughout the US. If multiple subspecies occur in the area (e.g., *Elaphe obsoleta*, *Lampropeltis getula*), photographs of the subspecies are color-coded with the distribution map. Multiple color photographs accompany each account, and these range in quality from adequate to excellent.

I have a strong feeling that a great deal of thought went into the content and design of this book. It is extremely user-friendly. The writing is clear and concise, the species accounts provide useful and interesting information, maps are clear and attractive, and virtually every page includes at least one color photograph of a snake (usually in a natural setting). One of my favorite features, however, is the “Did you know?” spots (described as providing “interesting or anomalous facts”).

The 15 pages addressing people and snakes are as important as anything in the book. They provide information to a young person who may be interested in a career in herpetology, including the importance of following state and federal laws, snakes that might be encountered in one’s backyard or other places in close proximity to human activity, as well as what one can do to encourage snakes to take up residence in their yards. This section goes on to provide the pros and cons of keeping snakes as pets, but stresses the importance of choosing a captive-bred snake as opposed to one from the wild. A section on conservation discusses the roles of snakes in nature, their importance as bioindicators or biomonitors of environmental integrity, and threats to snakes (with habitat destruction being the primary conservation concern). The authors feel that public education is the best hope for protecting snake habitats and preventing malicious killing.

I really can’t recommend this book strongly enough. Nothing in it will be particularly eye-opening to professional herpetologists, except, perhaps, the enlightened design and layout. The photographs, of course, will be enjoyed by everyone, although the only possible shortcoming of the book is the absence of photographs depicting different habitats. However,



as the authors' introductory remarks state, the book is aimed more at young people and adults who may not yet appreciate snakes and their place in nature. This book makes a valiant and, I hope, successful effort to "develop an acceptance of — better yet, an admiration for — snakes that equals that expressed for many other wild creatures."

I still think of the Southeast as a herpetological paradise, but friends who grew up in Florida suggest that it ain't what it used

to be. Nevertheless, at least from a distance, it seems very exotic, and, despite having cumulatively spent years in the Neotropics studying many wonderful snakes, the snake fauna of the southeastern United States still has a romantic quality — and I'd still like to have another Yellow Rat Snake for a pet someday.

Robert W. Henderson
Milwaukee Public Museum

Reptile-Assisted Coming of Age

Lizard Love. 2008. By Wendy Townsend. Front Street, Boyds Mill Press, Honesdale, Pennsylvania. 196 pp. Hardcover — ISBN-10: 1932425349 — \$ 17.95.

Wendy Townsend is a newly minted graduate of the Vermont College MFA Program in Writing for Children and Young Adults, but she has been writing all her adult life and has long been a personal hero of mine. Fifteen years ago, when I was struggling to understand Green Iguanas well enough to rehabilitate seriously damaged individuals, Wendy's writing (much of which appeared in early issues of the *IGUANA TIMES*) was an inspiration — not only could she write a clear and concise technical description of iguana husbandry, she also spoke eloquently of her detailed behavioral observations, delineating complex group dynamics, as well as the personality differences and moods of the various individuals in her charge. With Dr. Frederic Frye, Wendy co-authored the pioneering *Iguanas: A Guide to their Biology and Captive Care* in 1993. In that same year, she, sadly, predicted that ill treatment at the hands of the pet trade would lead Green Iguanas down the same path as "dime-store turtles and county fair anoles, doled out as token prizes, like [so many other] valueless objects."

Wendy brings all her love of nature, her sympathetic touch with language, and her observational skills to bear in her delightful debut novel for young adults. The book's protagonist, a young mammalian female named Grace, appears in the prologue as a six-year old at her grandparent's country home. Her best friends are the local birds and insects and the denizens of the garden and the local pond, which include the beloved bullfrog that she blissfully hugs to the party dress she has worn to her aunt's wedding.

We next encounter Grace as an adolescent living with her mother far from her childhood Eden in the gray concrete metropolis of New York, replete with dim winter light, constant mechanical chatter, and oppressive odors. Grace finds her haven at a local pet shop, "Fang and Claw," where she meets an amphibian surrogate in the form of Walter. "He was chubby, with soft-looking skin almost as white as the T-shirt he wore. Across the front it said Bronx Zoo Reptile House. His shaggy hair was a pale color. He made me think of the tree frog who blends in with silvery lichen on tree trunks." She also meets Spot, a wonderful creature with a "great spiky crest and a black banded tail," his head covered with colorful jewel-like scales. Grace learns about reptiles while helping the gentle Walter rehabilitate damaged animals. Just as Walter pro-

vides a hide box in order to help a frightened monitor adapt to her surroundings, Spot the iguana helps Grace adapt to the unfamiliar environment of the city, her love for her pet bolstering her self-esteem as she crawls through the school year.

Back at her grandparent's house with Spot for the summer, Grace finds that even Eden is not eternal. Grandpa has given up gardening to avoid spending so much time in the sun, and all of the habitat provided by the unruly blackberry brambles has been uprooted by "helpful" neighbors from the newly built houses along the now much busier roadway. Nevertheless, Spot enjoys his time in the summer sun, gradually becoming more and more orange even as Grace succumbs to the physiological changes inherent with the onset of adolescence. By the time she's due to head back to the city, Grace finds herself so much altered that she desperately wishes she were more reptilian and less pronouncedly mammalian.

Teased mercilessly at school and even subject to a "love bite" from Spot, Grace struggles to come to grips with her changed physical self. Experiencing the sexual maturity of the iguanas, snakes, and monitors in her world, Grace finally has some measure of success at adapting with the help of her animal and human friends, especially the kind and "naturally" wise Walter.

Townsend makes excellent use of her natural history knowledge to elaborate, yet not overwhelm this charming coming-of-age tale. Many of her animal characters are taken from real life. Spot the iguana, for instance, lived a remarkable 24 years, and, having been privileged to tour "backstage" at the Bronx Zoo Reptile House, I suspect that much of the detail from that part of the story is also very real. Young readers, especially animal lovers, will empathize with the embattled Grace and her coping mechanisms. Older readers/animal lovers (who enjoy young adult fiction as I do) are liable to see their youthful selves reflected.

AJ Gutman
IRCF

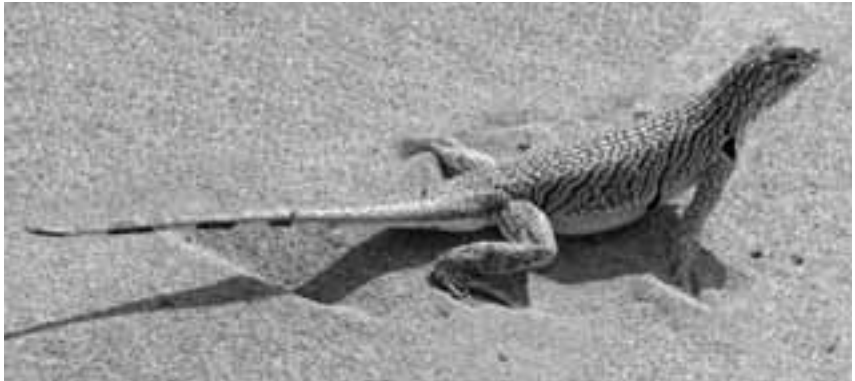


CONSERVATION RESEARCH REPORTS

Prescribed Fire and the Herpetofauna of Mississippi Pine Savanna

Few of us have not encountered Smokey the Bear and his anti-fire message over the years. Research over the last few decades, however, consistently shows that fire is important to many ecosystems, and that preventing it leads to both ecological consequences and more severe fires. Because of the historical importance of fire in some ecosystems, prescribed burning has become a common and important tool for ecosystem management. The southeastern United States is one of the most fire-dependent ecosystems. However, past research has typically focused on plants, mammals, and birds. Research in historic pine savanna communities led to the conclusion that frequent fire is necessary to prevent hardwood encroachment and remove understory vegetation associated with anthropogenic fire exclusion. Little information exists on the effects of prescribed burning on amphibians and reptiles.

LANGFORD ET AL. (2007. *Herpetological Conservation and Biology* 2: 135–143) examined the effects of a restoration burn on an amphibian and reptile community within a wet pine savanna in Grand Bay National Estuarine Research Reserve and surrounding U.S. Fish and Wildlife Service's Grand Bay National Wildlife Refuge. Prescribed fire was predicted to have a positive effect on



HECTOR GARDEN ESPARZA

Anthropogenic habitat transformations and climate change could result in a 40% reduction of the range of *Uma exsul* by 2020.

the herpetofaunal community. To test this hypothesis, the authors recorded abundance, species diversity, evenness, and species richness of amphibians and reptiles. They found 429 individuals and 29 species during the study period. Although species diversity was equal between burned and unburned treatments, the authors found greater numbers in burned than in unburned areas.

Climate Change and Lizards in the Genus *Uma*

Global climate change is likely to affect diverse aspects of our lives over the next century or more. Concerns are growing about its biological impacts on other species as well, including reptiles. According to the Intergovernmental Panel

on Climate Change, the warming trend is expected to continue at even higher rates during the 21st century, and is likely to affect species with higher environmental specialization and more restricted distributional ranges. To address this, BALLESTEROS-BARRERA ET AL. (2007. *Journal of Herpetology* 41: 733–740) studied two species of Fringe-Toed Lizards, *Uma exsul* and *Uma paraphygas*, in Coahuila, Mexico. Habitat conversion by humans has had an impact on both species, resulting in a reduction of population sizes and leading to a high degree of inbreeding. Both species exhibit low genetic variation, reduced vagility, and low effective population sizes.

Strong climatic changes are projected to occur in the central Chihuahuan Desert, particularly in the period 2020–2050. The combination of anthropogenic habitat transformation and climate change is expected to be severe for both species. One model predicts a 40% reduction in the range of *U. exsul* and 60% in that of *U. paraphygas* by 2020. By 2050, the ranges of both species are expected to be completely eliminated. Both species may be extinct in our lifetimes.

Fungal and Viral Pathogens in Costa Rican Amphibians

Amphibians are declining globally at rates far above historical levels, leading to major concerns about both the taxonomic group and what its ongoing disappearance may presage for other taxa. Two hypotheses for enigmatic declines in Neotropical



SUZANNE L. COLLINS, CMNH

The Rough Green Snake (*Ophedrys aestivus*) was one species found only in Mississippi savanna habitats that had been subjected to prescribed burns.



DEVON EDMONDS

The Golden Palm Treefrog (*Hyla ebreccata*, recently reassigned to the genus *Dendropsophus*) was one of five of 16 sampled species that tested positive for the Chytrid Fungus (*Batrachochytrium dendrobatidis*) in Costa Rica.

amphibians include disease and climate change. One amphibian pathogen, *Batrachochytrium dendrobatidis* (often abbreviated Bd), has been detected at many sites of declines, and is implicated as the main cause of enigmatic Central American amphibian declines. PICCO AND COLLINS (2007. *Journal of Herpetology* 41: 746–749) examined amphibian declines attributable to Bd, as well as another implicated pathogen called “ranavirus,” which has also been suspected to cause amphibian population declines.

Bd was detected in amphibian populations at two Costa Rican study sites with histories of amphibian declines. Of the 16 species tested in this study, five (*Hyla ebraccata*, *Centrolenella prosoblepon*, *Hyla pseudopuma*, *Eleutherodactylus underwoodi*, and *Duellmanohyla rufioculus*) were positive for Bd infection. Ranaviruses were not detected at either study site.

Amphibians and Reptiles in Madagascar

Madagascar is a center of herpetological diversity, but little research has been conducted in the Montagne des Français. D’CRUSE ET AL. (2007. *Herpetological Conservation and Biology* 2: 87–99) surveyed the amphibians and reptiles of the area in order to document the geographical, ecological, and seasonal distribution of the species found within the massif, highlight the herpetological importance of this area and reinforce the need for its



MICHAEL D. KERN

The Panther Chameleon (*Furcifer pardalis*) is one of only 16 (of 52) species recorded from both relatively undisturbed forests and anthropogenically disturbed habitats in northern Madagascar.

protection, and create an effective management plan. Research conducted over one year consisted of four sampling periods (two wet and two dry seasons).

Of the 61 species found, 37 (61%) occurred only in relatively undisturbed forest. Human-dominated landscapes contained only five species. Because most of the species appear to be dependent on undisturbed forest habitat, conservation of this area is crucial.

Post-Nesting Migrations of Leatherback Turtles

The Leatherback Turtle (*Dermochelys coriacea*) has the largest geographic range of any living marine reptile. Protecting these turtles requires a better understanding of their movement patterns. BENSON ET AL. (2007. *Chelonian Conservation and Biology* 6: 150–154) tracked nine Leatherback Turtles from one of the largest remaining western Pacific Leatherback nesting beaches in Jamursba-Medi, Papua, Indonesia. Satellite-linked transmitters were attached to nesting females to track distances traveled over 111–695 days. Turtles moved into tropical waters of the Philippines and Malaysia, into the Sea of Japan, and across the equatorial Pacific to temperate waters off North America, providing the first record of a trans-Pacific migration by a Leatherback. The longest distance traveled by a single turtle was 12,744 miles. The track between New Guinea and shelf waters off Oregon (USA) may represent the longest known migration between breeding and foraging areas of any marine vertebrate.



DOUG FERRINE, SEAPICS.COM

Leatherback Turtles (*Dermochelys coriacea*) may complete extensive migrations in both the Atlantic and Pacific oceans.

NATURAL HISTORY RESEARCH REPORTS

Trophic Ecology of a Spiny-Tailed Iguana

Animals respond to changes in food quality, resource availability, and patterns of food dispersion by modifying foraging behaviors. In species such as the Cape Spiny-tailed Iguana (*Ctenosaura hemilopha*), predation pressure also may affect escape behavior, habitat use, and foraging behavior. BLÁZQUEZ ET AL. (2007. *Biotropica* 39: 496–501) studied the diet of adult spiny-tailed iguanas in the desert of southern Baja California. Their goals were to determine if spiny-tailed iguanas behave as food generalists or specialists, to evaluate the role of iguanas in seed dispersion, and to evaluate whether iguanas modify their diets as a function of predation risk.



WILLIAM KATZ

Although Cape Spiny-tailed Iguanas (*Ctenosaura hemilopha*) can move around to feed, they rarely do.

Iguanas consumed mostly plants, consuming at least 22 of the 83 species occurring in the study area. The mainstay of their year-round diet consists of the leaves of three legumes, as well as flowers and fruit when available. Spiny-tailed Iguanas use leafy trees, such as *P. articulata* and *L. candida*, and the selection of those trees as habitat allows them to access food and refuges at the same location, reducing predation risk. Although iguanas could move around to feed, they rarely did. Intense predation by raptors and mammals may be the strongest factor influencing iguana foraging behavior.

Genetic Variation in Introduced *Anolis* Lizard Populations

Invasive species usually are established with a small number of founders, and therefore are expected to have relatively low genetic diversity. Even when numbers increase, reduced within-population genetic variation is expected when compared to the native range. The increased relatedness among individuals can cause inbreeding depression, limiting population growth and increasing the probability of extinction of a population. In contrast, some recent studies have shown that invasive populations can have higher genetic variation than native populations and experience rapid evolution because they are formed by multiple introductions from different portions of the species' native range.

Recently, KOLBE ET AL. (2007. *Conservation Biology* 21: 1612–1625) used mitochondrial DNA sequence data to examine the molecular genetics of ten introduced populations belonging to eight species of *Anolis* lizards. Evidence indicates that 80% of *Anolis* lizard introductions originated from multiple source populations. Seven of eight introduced species of *Anolis* in Florida were derived from multiple native-range sources, and one of two introductions to the Dominican Republic had multiple sources. The results suggest that multiple introductions from several sources, followed by admixture, is the norm rather than the exception in this genus.



KEVIN ENGEL

Seven of eight introduced species of *Anolis* in Florida, including *A. distichus* (illustrated here), were derived from multiple native-range sources.

Gila Monsters in California

The Gila Monster (*Heloderma suspectum*), widely distributed in parts of the Mojave, Sonoran, and Chihuahuan deserts of the southwestern United States and northwestern Mexico, is rare in California. Habitat in which the species has been observed in California is characterized by rocky, deeply incised



MARK SEWARD

Most Gila Monster (*Heloderma suspectum*) habitat in California is protected or relatively free from human disturbance.

topography, in most cases associated with large and relatively high mountain ranges. Most localities are in riparian areas (including the lower Colorado River) and range from near sea level to over 1,200 m. All records except one (Mojave River) occur east of about 116° longitude. The distribution of the species in California suggests an invasion into the high mountain ranges of the northeastern Mojave during the last interglacial via the Colorado River corridor. LOVICH AND BEAMAN (2007. *Bulletin of the Southern California Academy of Sciences* 106: 39–58) explored the hypothesis that climate patterns shaped the current distribution of the Gila Monster in California. Warm season precipitation data from recording stations closest to Gila Monster localities are almost identical for those in western Arizona, where the species is more common. Summer precipitation may be important in the foraging ecology of the species. Gila Monsters were probably already rare in California long before the arrival of Europeans due to changes in climate and landforms that delimited the marginal location of California in the range of this species. Fortunately, most of the habitat for this species in California is protected or relatively free from human disturbance.

NEWSBRIEFS

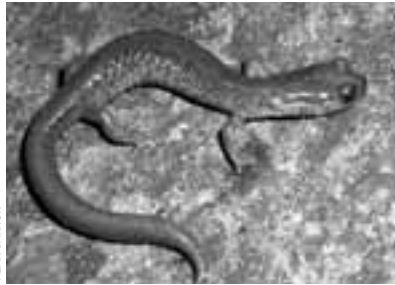
Pseudoscience Used to Deny Protection for Salamanders

The U.S. Fish and Wildlife Service determined that Siskiyou Mountains (*Plethodon stormi*) and Scott Bar (*P. asupak*) salamanders do not warrant protection under the Endangered Species Act. The finding relies heavily on studies conducted by Timber Products Company, a major regional landowner who stands to profit from a lack of habitat-based logging restrictions, to argue that the salamanders do not need old-growth forests to survive.

“The decision to deny the Siskiyou Mountains and Scott Bar salamanders protection flies in the face of sound science,” stated Noah Greenwald, conservation biologist with the Center for Biological Diversity. “The Bush administration has become infamous for suppressing science to support resource extraction and this decision is no exception.”

The finding admits that the only peer-reviewed science on the habitat requirements of the salamanders found that they were closely associated with old-growth forests. Indeed, the study conducted by Forest Service researchers concluded: “... mature to late-seral-forest attributes provide optimal habitat for the Siskiyou Mountains Salamander” and “... stands of mature and older forests evenly distributed and interconnected across the geographical range of this species would likely best insure its long-term viability.” Yet in their finding, Fish and Wildlife repeatedly discounted these conclusions by relying on unpublished timber industry studies to conclude that the salamanders “persist in a wide variety of habitat conditions.” They rely on these studies despite acknowledging that they were not based on systematic unbiased sampling, were never peer-reviewed, and were conducted by the timber industry. This kind of selective reliance on science has become all too characteristic of the agency under the Bush administration.

“The Bush administration has slammed the door on protection of endangered species,” said Joseph Vaile, Campaign Director for Klamath-Siskiyou Wildlands Center. “The Siskiyou Mountains and Scott Bar sala-



The U.S. Fish and Wildlife Service determined that the Scott Bar Salamander (*P. asupak*) does not warrant protection under the Endangered Species Act.

manders need the safety net of the Endangered Species Act to survive.”

To date, the Bush Administration has protected just 58 species, which is the fewest number in the history of the Endangered Species Act, and hardly compares to the 522 species protected under the Clinton Administration or 231 protected under Bush Sr.’s Administration. The administration has not listed a single species for 625 days — by far the longest drought in the history of the Act — and has denied or delayed protection for literally hundreds of

imperiled species, including these two salamanders.

Denial of protection for these rare salamanders comes at a time when federal land managers and the state of California are weakening protections. The Forest Service has eliminated the Survey and Manage Program, which required surveys and protection for the salamanders, the Bureau of Land Management is in the process of revising their land management plans for western Oregon to eliminate reserves created by the Northwest Forest Plan, and the California Fish and Wildlife Commission is considering removing protection for the salamanders, which are currently listed as threatened species under the California Endangered Species Act.

“We’re just beginning to understand these unique salamanders that breathe through their skin and primarily live under the cover of old-growth forests,” stated Scott Greacen, Public Lands Coordinator for the Environmental Protection Information Center. “Yet, despite the fact that protections for the salamanders are highly uncertain, Fish and Wildlife has refused to even conduct a status review to determine if federal protection is necessary.”

Additional Background Information

The Endangered Species Act is one of America’s most important environmental laws, providing a safety net for wildlife, fish, and plants that are on the brink of extinction. The law requires the U.S. Fish and Wildlife Service to protect the places these species call home, and to use the most rigorous science available when making management decisions. The Endangered Species Act has prevented the extinction of the American Bald Eagle, Coho Salmon, the Gray Wolf, and hundreds of other animals and plants.

Endangered Species Act protections for the salamanders are necessary, in part, because the Administration has eliminated other environmental safeguards. The salamanders were formerly protected under a provision of the Northwest Forest Plan called the “Survey and Manage” Program, which required the Forest Service and BLM to conduct surveys for the salamander and protect its habitat. The Bush Administration eliminated the Survey and Manage Program on 23 March 2004 to expedite logging of old-growth forest. Hundreds of northwestern wildlife species are threatened by the Administration’s jettisoning of Survey and Manage protections (see www.endangerearth.org/library/nwfp-saving-the-pieces.pdf). The Survey and Manage Program has been reinstated by court order, but the Bush Administration is in the process of conducting the necessary environmental review to again eliminate the important protections provided by the Program.

St. Catherine's Island Sea Turtle Program

The St. Catherine's Island Sea Turtle Program (SCISTP) is dedicated to the study of the interactions of coastal geology, biology, and human development on the nesting ecology of Loggerhead Sea Turtles (*Caretta caretta*). The website (created in 1995, revised in 2007) presents an overview of marine turtle nesting habitat and ecology, classification, and reading of Georgia Loggerhead nests, morphology of sea turtle nests deposited in Georgia, protocols used in nest conservation by the SCISTP, a summary of traces and trace fossils left by nesting Loggerhead Sea Turtles, including a description of the World's only described fossilized sea turtle nest from the Cretaceous of Colorado, and models, activities, and downloadable products for science education based on sea turtle conservation. Created in 1990, the program contributes to better understanding and management of Loggerhead Sea Turtle nests in Georgia through "Conservation, Research, and Education." For more information, visit the web site at www.scistp.org.



SCISTP

The St. Catherine's Island Sea Turtle Program (SCISTP) is dedicated to the study of the interactions of coastal geology, biology, and human development on the nesting ecology of Loggerhead Sea Turtles (*Caretta caretta*).

Natural Areas Protected in the British Virgin Islands

The System Plan for the BVI has passed Cabinet review and will be approved at the next convenient sitting of the House of Assembly. A formal announcement will be made by the government in the near future. The document provides the context and sets aside a number of natural areas for protection throughout the BVI. All areas as proposed in the document (marine and terrestrial) were approved. Its ultimate passage in the House of Assembly will allow for the expansion of the network of protected areas for the natural and economic benefit of Virgin Islanders.

The National Trust congratulates and expresses a heartfelt thanks to all

who in some way aided in assessing areas and subsequently mapping them, collaborating in various meetings with government and the public, who drafted or revised the multiple versions of the document, who lobbied for its passage and met with various officials, and who provided support for the 27 years it took to pass the system plan. This is a major achievement of which we should be proud and which we should celebrate.

Rare Victory for Madagascar Tortoises

The Ploughshare Tortoise (*Geochelone yniphora*) is the rarest tortoise in the world. Conservationists are celebrating a double victory over tortoise smugglers in Madagascar. Earlier this month, a Nigerian man was arrested with 300 tortoises and another 20 have been returned to their habitat after being seized on a neighboring island. But campaigners' relief might not last long. The live animal trade, particularly in reptiles, is big business.

The island's unique wildlife also attracts financial interest. The haul of 300 seized from a house after a tip-off may be the largest in the world, conservationists say. Collectors could have netted as much as \$200,000 (£100,000) for them in exotic pet markets.

Eight of the tortoises saved were of the rarest species in the world. Conservationists believe that only about 1,000 Ploughshare Tortoises (*Geochelone yniphora*) remain. They live in a small area of northwestern Madagascar, and the loss of even a small number would be devastating. According to the Durrell Wildlife Conservation Trust, the Ploughshare will

be extinct within 10 years if they continue to disappear at the current rate.

It is a global trade. The Nigerian man, who faces up to 10 years if convicted, was found with three passports with three different names from three different countries. The reptiles could have been bound for rare animal markets in Bangkok, Thailand. Although tortoises are protected, some species are still eaten in parts of the country, but the real risk is from international collectors. To buy a tortoise to eat might cost \$10 (£5). To buy one as a pet might cost you \$10,000 (£5,000). "Why do people do it? If you're talking about Malagasy people, they are poor, so they can easily be attracted by big bucks from the smugglers," says Hasina Randriamanampisoa of the Durrell Wildlife Trust. "As far as foreigners are concerned, well I can imagine, some people are so rich they just want something rare in their possession."

Felicitee Rejo Fienena, who works for the government in southern Madagascar, wants more to be done to protect wildlife. "If buyers continue to exist on the international market, then collectors will continue to exist in Madagascar," she says.

The game of cat-and-mouse between collectors and the authorities continues. People trying to protect the tortoises here are wary of advertising the sheer value of the trade for fear of attracting even more fortune hunters to the island. On the other hand, if they do not draw attention to the threat, the desirability of certain species may lead to their extinction.

Jonny Hogg

BBC News, Antananarivo



MICHAEL OGLE

Ploughshare Tortoises (*Geochelone yniphora*) are among the rarest tortoises in the world, with an estimated 1,000 remaining.

IRCF ON THE MOVE

Exo Terra Supports the Protection of Threatened Reptiles and Their Habitats by Becoming a General Sponsor of the International Reptile Conservation Foundation

Exo Terra, a global market leader in terrarium products, has become a strategic sponsor of the International Reptile Conservation Foundation (IRCF). "Exo Terra is committed to conservation and, after a long search, we felt that the IRCF was by far the conservation organization most closely aligned with our goals," says Emmanuel Van Heygen, lead product developer of Exo Terra. "Our products tend toward more realistic and naturalistic terrarium designs, but nothing can replace the amazing beauty of the natural world. We all need to do our part to help preserve it." "Exo Terra's investment in the IRCF will help the IRCF by reaching out to a larger community of supporters and in turn expanding our ability to help species and habitats in need," says Michael Kern, IRCF Chief Operating Officer. "Corporate investment is a strategic component of how the IRCF operates, and we are happy to see Exo Terra join us in our cause."

As a General Sponsor, Exo Terra will make a cash donation to the IRCF that will be used to enhance *Iguana*, the quarterly journal distributed to all IRCF members. Specifically, the journal will incorporate a four-page color spread sponsored by Exo Terra. "The more color in the journal, the larger the audience we can reach. Since most of our money is raised through memberships, the more members we can attract, the more money we can raise, the more ecosystems we can help protect," says Sandy Binns, IRCF Chief Financial Officer.

Additionally, Exo Terra and its parent company, Hagen Inc., will look for opportunities to use its market-leading presence in the reptile and pet communities to increase awareness of the IRCF and the conservation needs of reptiles and amphibians around the world. Says Rolf Hagen, President and CEO of Rolf C. Hagen, Inc.: "We believe we can help the IRCF get its conservation message out to a broader audience. Whether through web-site linkage, trade show presence, or strategic product labeling, we believe this relationship creates great opportunities for Exo Terra and the IRCF, and, most importantly, supports the fragile reptile-rich ecosystems of the world."

"We are happy to have Exo Terra as a sponsoring partner of the IRCF," says John Binns, IRCF founder and CEO. "Exo Terra is truly an innovative company with market-leading products and a unique philosophy of aligning its market activities to the natural world."

The June 2008 issue of *Iguana* will be the first to incorporate the Exo Terra-sponsored color enhancements.

About the IRCF

The principal aim of the IRCF is to support conservation and research programs that contribute to the survival of threatened reptiles and their habitats. IRCF support may include fundraising, land acquisition, logistical support, communications and promotion of species awareness, publications, and volunteer coordination. Programs supported to date include Project Heloderma (Guatemala), Blue Iguana Recovery Program (Grand Cayman), Project Palearis (Guatemala), Gharial Multi Task Force (India), Argentine Sand Dune Lizard, Fijian Crested Iguana, Chinese Alligator Fund, Jamaican Iguana Recovery, an IIF-supported program, Anegada Iguana Recovery Program (British Virgin Islands), Ricord's Iguana (Dominican Republic), Conservation Project Utila Iguana (Honduras), Turtle Survival Alliance, Rhinoceros Iguana (Dominican Republic), and the Turks and Caicos Iguana Relocation Program. The IRCF is a 501 (c)(3) not-for-profit organization.

About Exo Terra

Exo Terra, a global leader in terrarium products, is a brand division of Rolf C. Hagen Inc. Exo Terra's product line caters to almost any species of reptile or amphibian from almost any specialized habitat. Thanks to Exo Terra's natural approach, the terrarium hobby has evolved tremendously over the past few years. All Exo Terra products and components have been designed to work together, helping hobbyists create and establish a harmonized natural-looking microhabitat.

About Rolf C. Hagen Inc.

Rolf C. Hagen Inc. has its international headquarters in Montreal, Quebec, Canada and has wholly owned subsidiaries in the United States, England, France, Germany, and Malaysia. The company has joint ventures in Spain, Japan, Korea, Thailand, and South Africa, and additional long-standing partnership agreements in Mexico, Italy, Australia, Russia, Poland, Czech Republic, Portugal, and New Zealand. Rolf C. Hagen Inc.'s distribution capacity spans the globe to provide the very best in pet supplies.



Critical Conservation Foothold Established in Guatemala's Motagua Valley

Surrounded by the Sierra de las Minas, Guatemala's Motagua Valley receives the least rainfall in all of Central America. The lack of moisture is responsible for one of the world's unique ecosystems. With its distinctive thornscrub and semi-arid forest zones, this area is home to many indigenous plants and animals. Unfortunately, it is also under intense pressure from human development, and has been identified as critically endangered by the World Wildlife Federation. Until now, the region has had no conservation protection and much of the area has already been converted into farm- or ranchland. In December 2007, a consortium of Zootropic, Zoo Atlanta, and the International Reptile Conservation Foundation (IRCF) purchased a tract of land known to be the home of two of the most critically endangered endemic reptilian species: the Guatemalan Beaded Lizard (*Heloderma horridum charlesbogerti*) and the Guatemalan Black



Iguana (*Ctenosaura palearis*). This land deal is intended to provide a strategic foothold for the protection of this unique region's flora and fauna.

Leading to this point and working under the moniker of "Project Heloderma," the three partners, Zootropic, Zoo Atlanta, and the IRCF initially focused their conservation efforts on the Guatemalan Beaded Lizard. Conservation synergies were soon identified with the Guatemalan Black Iguana. The combined emphasis continues today through the efforts to conserve both species and the habitat in which they live.

Initial conservation activities were directed toward the education of the local population, who had regarded the lizards as either dangerous, a food source, or an opportunity to engage in illegal trade in exotic animals. Concurrently, fundraising efforts were initiated, and the species studied in order to establish an effective conservation and educational program. Early in 2007, the project team identified a critical piece of property. The owner, sympathetic to the conservation cause and Project Heloderma, came to terms and a land deal for 139 acres was consummated in December of that year.

Although considerable work has already been invested, the land purchase isn't an end in itself. For Project Heloderma, it is simply the end of the beginning — for now, real conservation work can begin: the establishment of protected areas for the animals, building of a breeding facility to help reestablish the diminished populations of these species, and an education/research center to facilitate both ongoing research into the species and the education of the local human population regarding the benefits and importance of these creatures and the



MICHAEL KEHN

In December 2007, Project Heloderma acquired critical habitat for the conservation of the Guatemalan Beaded Lizard (*Heloderma horridum charlesbogerti*) and the Guatemalan Black Iguana (*Ctenosaura palearis*). From left: Daniel Ariano, Zootropic, Luis Alvarado, Zootropic, Brad Lock, Zoo Atlanta, Mr. Paiz, previous landowner, Rodrigo Botran, Zootropic, and John Binns, IRCF.

land in which they live. Ideally, protection of these species will require more land, so fundraising and the search for additional strategic parcels continues.

In time, Project Heloderma believes that the Motagua Valley can become an important eco-destination, one that serves to build additional support for the species and provide economic benefits to the region, together encouraging a path of conservation instead of exploitation. Set against the diverse color, customs, and culture of the region, this ideal is clearly attainable.



MICHAEL KEHN



MICHAEL KEHN

The subtropical dry forests of the Motagua Valley provide habitat for critically endangered Guatemalan Beaded Lizards (*Heloderma horridum charlesbogerti*; right) and Guatemalan Black Iguanas (*Ctenosaura palearis*; not illustrated).

Editors

Robert Powell

Executive Editor

Avila University, Kansas City, MO

AJ Gutman

Editor

West Hartford, CT

Gad Perry

Associate Editor

Texas Tech University, Lubbock, TX

Kaela E. Champlin

Assistant Editor

Texas Tech University, Lubbock, TX

Michael Ripca

Art Director

Atco, NJ

John Binns

Graphics/Photography

International Reptile Conservation
Foundation, San Jose, CA

Sandy Binns

Services Coordinator

International Reptile Conservation
Foundation, San Jose, CA

Editorial Board

Allison C. Alberts

Zoological Society of San Diego

Frederic J. Burton

Blue Iguana Recovery Program

Arthur C. Echternacht

University of Tennessee

L. Lee Grismer

La Sierra University

Robert W. Henderson

Milwaukee Public Museum

John B. Iverson

Earlham College

Charles R. Knapp

Zoological Society of San Diego

Gunther Köhler

Senckenberg Museum

Kenneth L. Krysko

Florida State Museum of
Natural History

Jan Ramer

Indianapolis Zoo

Thomas Wiewandt

Wild Horizons

Editors' Remarks

If you have read "IRCF on the Move" (p. 61), you know that **Exo Terra** has become a general sponsor of the IRCF. You also know that the first concrete expression of that sponsorship will be a full-color "centerfold" in *Iguana* beginning with the June issue (we used a centerfold once previously, in *Iguana* 14(1) to highlight the conservation of Gharials). We hope that this new feature will be but a first step toward the use of more color in future issues. We believe color is important, not for its own sake (although we enjoy pretty pictures as much as the next person), but because we hope that it will serve to attract more readers, which in turn will provide more funds for conservation. Again, if you haven't already, look at "IRCF on the Move" for mention of the many conservation efforts currently supported by the IRCF.

The Editors of *Iguana*

ERRATUM: Some of the photographs used in Ali Reza (Travelogue: Destination Bangladesh: From the Himalayas to the Bay of Bengal. *Iguana* 14(2): 106–114) should have been attributed to Stephen Mahoney rather than the author. The following images were not credited properly: Tokay Gecko (p. 108), Sal Forest and Reeve's Ground Skink (p. 109), Sticky Frog (top), Asian ranid and Berdmore's Narrow-mouthed Frog (p. 110), Bowring's Supple Skink and Spotted Litter Skink (p. 111), and Tawney Cat Snake and Bronze Grass Skink (p. 112).

Statement of Purpose

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

The International Reptile Conservation Foundation, Inc. is a non-profit 501 c(3) California corporation.

Membership Information

IGUANA, the Journal of The International Reptile Conservation Foundation, is distributed quarterly.

Annual Rates:

Individual U.S. Membership	\$25.00
Individual Membership, Digital (Adobe PDF)*	\$25.00
Institutional U.S. Subscription	\$30.00
International Membership (including Canada)	\$55.00
International Institutional Subscription	\$60.00

Additional copies are available upon request at \$6.00 each plus postage.

*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.

www.IRCF.org

Join Online at: www.IRCF.org

Membership Questions?

Email: info@IRCF.org, or contact AJ at 860-236-8203, or write to: IRCF, 3010 Magnum Drive, San Jose, CA 95135

Solicitations

The IRCF encourages contribution of articles, letters to the Editor, news items, and announcements for publication in *IGUANA*. General articles can deal with any aspect of reptilian biology, including conservation, behavior, ecology, physiology, systematics, or husbandry. Submission of photographs to accompany articles is encouraged. Manuscripts may be submitted via e-mail (send to AJ@IRCF.org). Authors of one page or more of print will receive a free copy of the journal in which their contribution appears, and will receive a PDF file of their article for distribution.

Donations

For any donations, please include your name, address, phone number, and e-mail address.

Advertising Policy

We advertise only non-living products (except feeder insects). For advertising rates and options contact Sandy Binns, Advertising Director, at SB@IRCF.org or 3010 Magnum Drive, San Jose, CA 95135.

FOCUS ON CONSERVATION

Lesser Antillean Iguanas on St. Eustatius



ALL PHOTOGRAPHS BY ROBERT JAN VAN OOSTEN



YOUR NAME HERE

PLEASE SUPPORT THIS CAMPAIGN

Lesser Antillean Iguanas (*Iguana delicatissima*) are endemic to the Lesser Antilles. Extant populations occur on only a few islands, and few of these populations are thriving. Most are affected by habitat loss and, to a lesser extent, exploitation (mostly for food). Hybridization with introduced Green Iguanas (*Iguana iguana*) is threatening the integrity of the gene pool on some islands.

In 2004, the population on St. Eustatius (= Statia) was estimated at **425 individuals**. However, St. Eustatius National Parks protect substantial tracts of suitable habitat and many landowners with adjacent properties maintain gardens that are extensively exploited by iguanas. Prospects for conserving a viable and stable population are quite good. However, roadkills occur and, although Stadians rarely kill and eat iguanas, guest workers often fail to distinguish Lesser Antillean Iguanas from the Green Iguanas routinely consumed on their home islands. Consequently, ongoing educational efforts are necessary, if only to reinforce the pride Stadians should take in their endemic population.

In 2004, the International Iguana Society donated signs that were placed in prominent locations throughout the island. Unfortunately, they have not held up well to the tropical sun. The IRCF is spearheading an effort to replace them with new color signs that carry a 20-year guarantee. If you are interested in making a donation to support that effort or want more detailed information, please visit:



www.IRCF.org/eustatius (or accessible from the IRCF home page)

Donors who contribute \$50 will have their names listed on the signs and those who donate \$100 or more also will receive a special T-shirt featuring the artwork of Joel Friesch.

There is a restriction on characters due to space limitations. See website.

GET THE T-SHIRT!



Beautiful color artwork of *Iguana delicatissima* by Joel Friesch



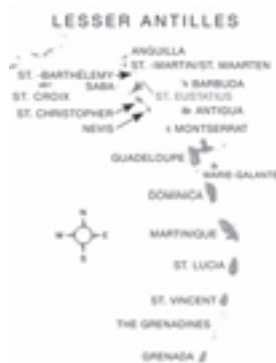
Color IRCF logo labeled CONTRIBUTOR St. Eustatius, Lesser Antilles



www.STATIAPARK.ORG



www.IRCF.ORG



CORPORATE SPONSORS. Corporate logo added below the bottom of the back artwork & name added to the sign: \$1,000. Contact the IRCF for more information.



MICHAEL J. MOREL

American Kestrels (*Falco sparverius*) have been documented as predators of 12 different species of West Indian lizards. This Kestrel has captured a Puerto Rican Ameiva (*Ameiva exsul*). See article on p. 8.



MICHAEL D. KERN

Guatemalan Beaded Lizards (*Heloderma horridum charlesbogerti*) are found only in the Motagua Valley of Guatemala. See article on p. 20, travelogue on p. 42, and "IRCF on the Move" on p. 61.