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IGUANA

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International Reptile Conservation Foundation www.IRCF.org

Ricord's Iguana (*Cyclura ricordii*) (see article on p. 222). Photograph by John Binns.

Special Emphasis: Conservation in the Dominican Republic

THOMAS WIEWANDT

Ricord's Iguanas (*Cyclura ricordii*) are the focus of an extensive conservation and educational effort in the southwestern Dominican Republic (see article on p. 222).

ROBERT POWELL

Leiocephalus personatus is one of several lineages of terrestrial Hispaniolan lizards with ranges that terminate at a sharp ecotone near the city of Baní in the Dominican Republic (see article on p. 234).

GUNTHER KOHLER

The Utila Anole (*Norops* [*Anolis*] *utilensis*) occurs only in a few mangrove forests on the Honduran Bay Island of Utila. It may be the world's most endangered anole (see article on p. 240).

JOHN BINNS

Many Monitor Lizards (*Varanus* spp.) become large, are fierce, and require substantial space and care; they are definitely not appropriate for beginning hobbyists; this is a Red Dwarf Monitor (*V. acanthurus brachyurus*) (see article on p. 246).

JOHN BINNS

Rhinoceros Iguanas (*Cyclura cornuta*) remain locally abundant in a few locations in the Dominican Republic, but many populations appear to be declining (see related article on p. 222, travelogue on p. 256, historical perspective on p. 263, and inside the back cover).

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International Reptile Conservation Foundation

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Although once widely distributed on Hispaniola, the only remaining large population of American Crocodiles (*Crocodylus acutus*) in the Dominican Republic is in Lago Enriquillo (see travelogue, p. 256).

THOMAS WIEWANDT

Ricord's Iguana (*Cyclura ricordii*) on Isla Cabritos.

Conservation of *Cyclura ricordii* in the Southwestern Dominican Republic and a Brief History of the Grupo Jaragua

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Grupo Jaragua Inc.
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Photographs by Ernst Rupp unless otherwise indicated.

After the IUCN SSC Iguana Specialist Group drafted a species recovery plan for Ricord's Iguana (*Cyclura ricordii*) during a workshop in Santo Domingo on 17–18 November 2002, Grupo Jaragua (GJ) began systematically searching for populations on the Barahona Peninsula. Work was initiated in December 2002 by looking for informants who would share their knowledge of the species. Subsequently, GJ scheduled field trips to verify the information.

On 8 April 2003, we found the first signs of a Ricord's Iguana. They consisted of a head, a stomach, and the intestines of a freshly killed animal. The body was gone. Somebody had taken it, possibly with the intention of preparing a meal. Since then we have been able to find more animals, live ones, their dens and nests. Major help in making these discoveries accrued from the integration of a young man from Pedernales into our research team. His name is Miguel Mella Pérez. Salvador (the Savior), as he is commonly known, never had a formal education. He spent most of his youth hunting and trapping iguanas with his uncle "Turco," who was a folkloric figure who made a living catching and selling iguanas. Turco was killed in a gun-

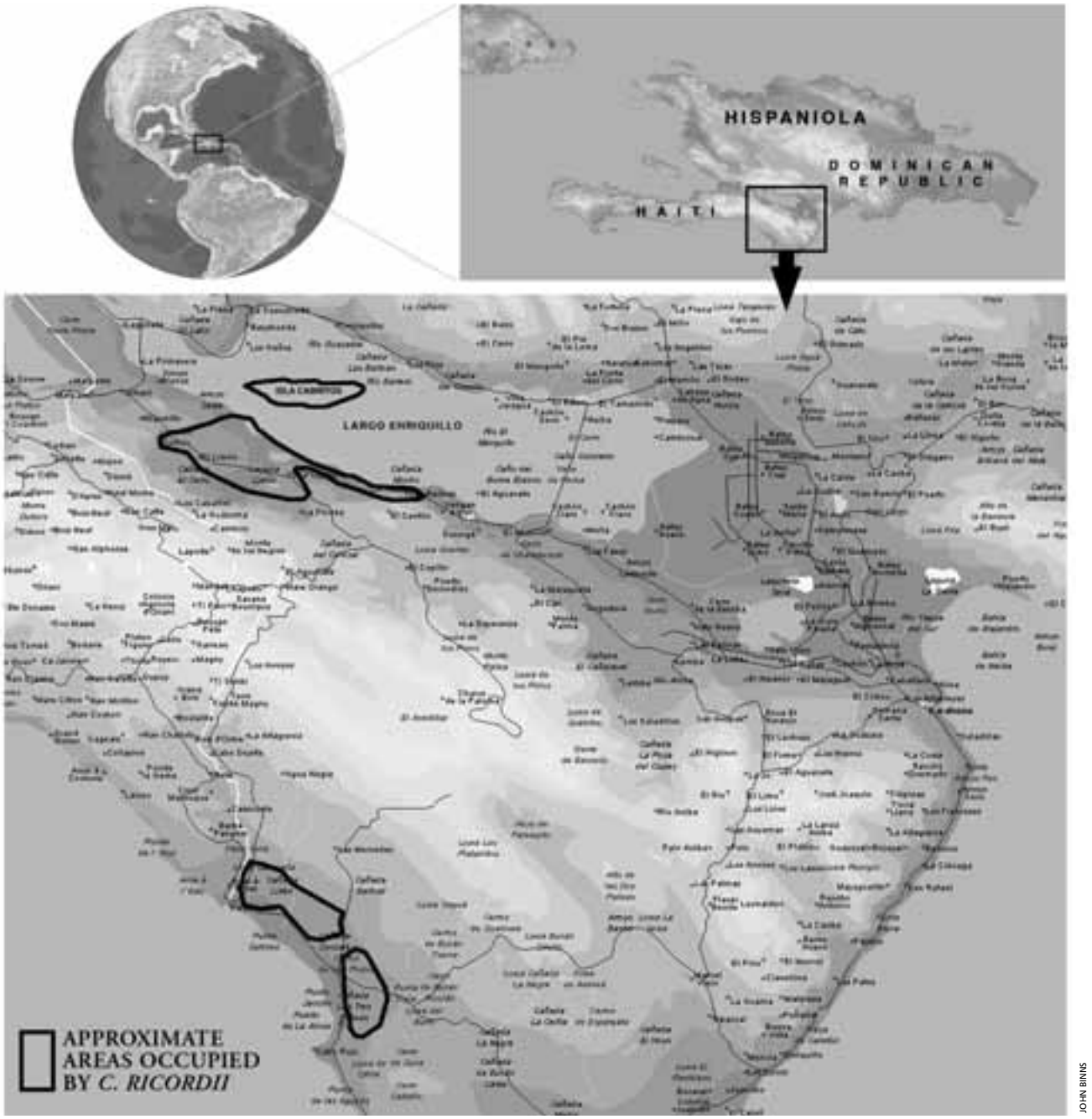
Young Ricord's Iguanas (*Cyclura ricordii*) are testament to successful recruitment into extant populations.

Salvador (Miguel Mella Pérez) with a Rhinoceros Iguana (*Cyclura cornuta*).

Pirín (Jairo Isaa Matos Arache) measuring the depth of a *Cyclura ricordii* nest.

fight 17 years ago when he tried to recover some of his stolen goats. Salvador is still pursuing iguanas, but now for the good of the species. With his gift of patient observation, he has acquired an immense knowledge about iguanas that has helped us to compile valuable data needed for the conservation of the species. Also strengthening our research efforts was the involvement of Jairo Isaa Matos Arache. Pirín, as we call him, made it to 3rd grade. He spent many years trying to make ends meet by burning and selling charcoal. Now he is dedicated to conservation work. He is an excellent field assistant with a natural curiosity. He has been crucial in developing the simple methods that we use in our research on nesting ecology.

On the Barahona Peninsula, *C. ricordii* can be found in an area of about 32 km^2 just to the east of the town of Pedernales. The area surrounds a low alluvial plain called "Los Olivares," which consists of fertile reddish soils. During the past 30 years, Los Olivares (8 km^2) has been successively cleared to make way for agricultural production under irrigation. Unfortunately, this area also has been the major living and nesting grounds of *C. ricordii*. According to Salvador and other local residents, the species maintained high population densities in Los Olivares before clearing began. The species is now confined to the periphery of Los Olivares, an area that consists of a mosaic of smaller depressions filled with reddish soils (fondos), marine terraces of limestone rock, and intervening areas covered by gravel and boulders. Although of less value for agriculture, this periphery is conducive to the production of free-ranging cattle. The land in the area is owned by the state. In 2003, it had no legal protec-



Map of the southwestern Dominican Republic showing the areas where Ricord's Iguanas (*Cyclura ricordii*) are known to occur.

tive status, and persons with the necessary financial means often enclose state land with fences before clearing it and then declaring it to be their own property.

Pedernales is a small border town with a population of about 12,000. The jobless rate is above 50%. The proximity to impoverished Haiti aggravates the economic situation. Many Haitian citizens are illegally crossing the border trying to earn a meager living by clearing land to produce short-term crops or burn charcoal.

Limestone mining and the production of cement in the Cabo Rojo area have generated some income during the past two years. Bauxite mines in the lower regions of the nearby Sierra de Bahoruco also have been reopened. These activities, though economically beneficial to a small percentage of Pedernales residents, have had a high environmental cost in the form of dust pollution and destruction of iguana (*C. cornuta*) habitat.

Being aware of the imminent danger of more destruction of remnant *C. ricordii* habitat, GJ decided to initiate conservation measures based on a bottom-up approach. The basic principles of this approach are: (1) Integration, participation, and empowerment of the main stakeholders in the local community in the conservation process. (2) An effective educational program to inform and convince the local community of the importance and value of endangered species. (3) Conservation activities that generate economic benefits for the community.

Hatchling *Cyclura ricordii* in the Fondo de la Malagueta, about 5 km northeast of Pedernales.

A local support group has been formed. Members of this group are young women and men from Pedernales, whose love for nature has committed them to conservation. GJ has provided logistical support and training as nature guides. The principal person responsible for this process is Laura Perdomo. Laura never seems to get tired and never stops smiling. She studied veterinary medicine at the Universidad Nacional Pedro Henriquez Ureña, Santo Domingo, and holds a Master's degree in Management and Conservation of Wildlife from the Universidad Nacional de Heredia, Costa Rica.

The local support group has formed its own association of nature guides (AGUINAPE). Apart from showing visitors the wonderful and unique natural attractions around Pedernales, they also are involved in environmental education in local schools and run a radio program to inform the general public of environmental issues. AGUINAPE plays an important role in the strategy of promoting ecotourism in the southwestern region of the country, which has been declared a Biosphere Reserve by UNESCO. Strong pressure exists from influential political groups to bring mass tourism to the region and turn the last pristine beaches into high-capacity resorts. GJ has been spearheading a resistance movement to counteract those plans and to develop alternative tourist concepts that keep intact the natural resources of the region. In May of this year, the members of the town council of Pedernales voted in favor of a resolution that declares their hometown a "Town of Sustainable Tourism." This resolution was the result of a process involving intense discussions by local stakeholders, including small business entrepreneurs, to decide their own future. They decided in favor of sustainable tourism.

The town council passed another resolution in September. This establishes two "Espacios Municipales Protegidos" (Municipal Protected Areas). One involves wetlands close to Cabo Rojo that serve as an important bird sanctuary. The other, with an area of 85 km^2, covers most of the presently known *C. ricordii* range north and east of Los Olivares as well as a fairly extensive buffer zone. A nature path is being built to allow visi-

Hatchling *Cyclura ricordii* in the Fondo de la Malagueta, about 5 km northeast of Pedernales. The nest was excavated between 19 May and 1 June 2004. Emergence of the hatchling occurred on 2 September. How long the hatchling spent in the nest after hatching is unknown.

tors to actually watch Ricord's and Rhinoceros iguanas in the adjacent marine terrace. Members of AGUINAPE will guide tourists on the path, and Salvador is providing the necessary training to find and correctly identify animals at a distance.

Two other local groups have access to the protected areas. One is the "Asociación de Bosque Seco" (Dry Forest Association), which extracts dead wood from the northern part of the protected area, where vegetation is denser. This association had been active in the zone long before the protected area was declared. To stop their activities would have created a social conflict that may have put in jeopardy the success of the resolution. The other group consists of beekeepers who are allowed to place hives in

Laura Perdomo (center) on an excursion with nature guides from Oviedo.

Members of AGUINAPE during their general assembly meeting. Esteban Garrido is on the left, second row.

Alcibiades Ledesma and Ernst Rupp discussed the resolution of protected areas with the mayor and members of the town council of Pedernales well into the night.

designated spots. Fences are presently built in strategic areas to prevent entry into the area by free-ranging cattle.

The man responsible for the lobbying that was necessary to convince the mayor and members of the city council of the importance of establishing a protected area for Ricord's Iguanas is Alcibíades Ledesma. He was born in Pedernales and is an agricultural engineer by profession. He is the director of the "Unidad de Gestión Ambiental Municipal" (Municipal Environmental Unit) and is responsible for the improvement of environmental conditions in and around Pedernales. His love for and dedication to the local flora and fauna make him a valuable ally. Another important ally has been the Vice-secretary of Protected Areas and Biodiversity of the Ministry of Environment and Natural Resources, Angel Daneris Santana, who has cleared the legal pathways in order to establish the local municipal protected areas.

ANDREAS SCHUBERT

Sixto Incháustegui with Gloria Santana and other colleagues during field work at Enriquillo Lake.

While Ricord's Iguanas may have gained some time and space to breathe more freely on the Barahona Peninsula, the situation for the population along the southern shore of Lago Enriquillo is still uncertain. In May 2005, GJ began focusing considerable attention on that area. We have found juveniles and adults, but the actual distribution of the species in that region has not yet been studied.

The future of the species may be bleak for those iguanas. The area has no legal protected status. The vegetation where Ricord's Iguanas are found is impoverished. Intensive charcoal burning in the past seems to have taken a heavy toll on the original flora. Today, vegetation is dominated by only a few species (*Prosopis juliflora*, *Cylindropuntia caribaea*, *Opuntia moniliformis*, and *Cephalocereus polygonus*).

Trapping of iguanas and excavation of their dens also appears to be a major problem. Signs of these activities can be seen everywhere. The problem is aggravated by the fact that people in the area believe that iguanas are a deadly threat to young goats. According to well-circulated stories that have never been substantiated, iguanas crawl under the bellies of young goats, rip the bellies open with their sharp crests, and supposedly eat the goats. Overcoming such notoriety is difficult, and goat owners are not very happy to find iguanas in close vicinity to their animals.

In addition to all the problems already listed, habitat destruction is rampant. Just recently, the senator of the province ran a bulldozer through the area and opened up a 4 km-long

"Pet" *Cyclura ricordii* in the town of Baitoa on the southern shore of Lago Enriquillo.

strip with the intention of clearing the land for agriculture. This illegal action within a RAMSAR Site has been denounced by the Ministry of Environment and Natural Resources, which has taken legal action against the senator. The case was highlighted by the press and constituted one of the biggest recent environmental scandals in the country. Nevertheless, the damage has already been done.

In a situation where the majority of the people are without a stable income, clearing land for agricultural production is often popular and is perceived as an appropriate measure for improving the local economy. Sustainable alternatives are not considered.

With traditional beliefs that justify persecution of iguanas and a senator, who is a popular political figure, destroying iguana habitat to increase agricultural production, the task of securing a future for *C. ricordii* on the southern shore of Lago Enriquillo does not appear very promising — but this task is a challenge which has to be met.

Excavated *Cyclura ricordii* den on the southern shore of Lago Enriquillo. Note also the new den of a smaller animal in front of the dog.

Gravid female *Cyclura ricordii* in search of a nesting site near Pedernales.

The challenge of conserving Ricord's Iguanas, Rhinoceros Iguanas, and other endangered species and habitats is complex and inevitably of long duration. We cannot save the iguanas by focusing solely on them as individual species. The southwestern Dominican Republic is one of the most important biodiversity sites not only of Hispaniola, but also of the entire insular Caribbean. For this reason, the first biosphere reserve of Hispaniola was established there. Jaragua Bahoruco Enriquillo Biosphere Reserve extends from Beata and Alto Velo Islands across the flat limestone plateau of the Barahona Peninsula, over the Sierra de Bahoruco, and into the lowlands of the Neyba Valley, the location of Lago Enriquillo.

Having a biosphere reserve established in the region has been the result of hard work by many individuals over the past 25 years. Many Dominicans and foreigners have contributed to the knowledge of the region's biodiversity. Many species new to science have been discovered, and more new species continue to appear. One of the most important, primarily for the resultant international attention garnered, was the discovery of the Jaragua Dwarf Gecko (*Sphaerodactylus ariasae*), the smallest known tetrapod in the world. This diminutive lizard was discovered in Jaragua National Park and named after Yvonne Arias, in recognition of her work for biodiversity and conservation.

The National Parks Department was legally created in 1974 (now included, since 2000, in the Ministry of Environment and Natural Resources). In 1983, the protected areas system was expanded beyond the five parks included in 1974 (one of which was Jaragua National Park). A management

S. BLAIR HEDGES

The Jaragua Dwarf Gecko (*Sphaerodactylus ariasae*) is the smallest known tetrapod in the world.

IGUANAS AND EDUCATION

John Foster

Indianapolis Zoo

Ricord's Iguanas (*Cyclura ricordii*) are mysterious creatures found only in the Dominican Republic. The majority of Dominicans who have an awareness or understanding of the creature are park rangers and those individuals who hunt iguanas for food. An additional handful of Dominicans are working to expand our understanding of these creatures, both in terms of field conservation and captive husbandry. Although the body of knowledge regarding Ricord's Iguanas continues to expand, most Dominican citizens are unaware of the species' existence — and this has the potential to be problematic. Gaining support to protect habitat for an endangered species that no one has ever heard of and certainly not seen is, at best, very difficult.

To begin to address the unknown lizard phenomenon, a partnership has been established between Grupo Jaragua, a major NGO conservation group in the Dominican Republic, ZooDom, the National Zoological Park, and the Indianapolis Zoo. This partnership was formed in order to develop curricular materials and a resource kit that could be used by elementary school teachers in the Dominican Republic. The partners met in 2004 in order to establish goals for the curricula and identify educators' needs.

U.S. Fish and Wildlife and AZA Conservation Endowment Fund grants funded the development of curricular materials. These grants not only helped underwrite curricular development and teacher resource kits but expenses associated with implementing teachers workshops. The curricula will allow teachers to take their students on an exploration of Ricord's Iguana natural history and conservation threats through games, simulations, and other activities while simultaneously strengthening math and language arts skills.

Teacher training workshops will be held in two geographic regions. ZooDom staff will lead workshops for teachers in and around Santo Domingo. Grupo Jaragua staff will conduct similar activities for teachers whose students live "sympatrically" with Ricord's Iguanas in the southwestern Dominican Republic. When all the workshops are conducted, 400 teachers will have been trained to use the materials. The partners hope that as we expand our knowledge and ability to conserve Ricord's Iguanas, we will have helped build a community that values these animals and supports activities to conserve them.

Two-year-old *Cyclura ricordii* in the Fondo de la Malagueta, about 5 km northeast of Pedernales.

plan was published in 1986. Immediately thereafter, a group of concerned citizens, mostly biologists, working in different governmental agencies and universities, explored options for providing permanent support of Jaragua and other parks and biodiversity in general. After a year of discussions and reflections, the Grupo Jaragua, a Dominican Biodiversity Conservation NGO, was established. GJ is now one of the leading organizations to have contributed significantly to the preservation of the nation's natural resources.

Sixto J. Incháustegui served as its first president. Sixto is a Dominican biologist, who was committed to conservation even before he started college. He had the opportunity, for instance, to participate in the release of Green Turtle hatchlings sent to the Dominican Republic Marine Biology Institute from Dr. Archie Carr's program in 1968. The same year, he made his first trip to the southwest, where he visited Isla Cabritos in Lago Enriquillo with Michael Carey. That visit was coordinated by Albert Schwartz, arguably the "dean" of West Indian herpetology, and recounted by Sixto in a recently published essay (see references).

KIRSTEN ALLEN

Sixto Incháustegui during a visit to a Cape Town, South Africa biodiversity hotspot during the Fifth IUCN World Parks Congress in 2003.

Yvonne Arias is another founding member of the organization who has been actively working in biodiversity research, conservation, and education since the 1970s. She succeeded Sixto as president of GJ. She feels as comfortable discussing biodiversity problems with the president of the country, ministers, congressmen, and mayors of local governments as with fishermen, farmers, and the women and children of local communities. She has created the very popular Jaragua Environmental Educational Summer Camps for children from local communities in the region. The eighth camp took place this past summer.

In 2001, Ernst Rupp joined GJ. Ernst is a strange mixture, as are many who are devoted to conservation. After years of being in business administration, he studied agrobiology in his native Germany. After visiting the Dominican Republic for the first time in 1984, he has served in various positions, all directly related to local development and conservation, throughout the country for 13 years.

Seventeen years of hard struggle have passed since Grupo Jaragua was established. Gaining the confidence of local citizens has been one of the most important issues, showing them that we are not interested in their lands for short-term personal gain, but are instead interested in understanding and learning from one another, developing programs together for sustainable livelihoods, including those initiatives directly related to iguana conservation.

GJ is presently developing an agroforestry program that has integrated local people from the beginning. It is intended to promote the use of local plant species with economic value. The region, in most cases, is extremely dry with little soil and almost no freshwater. Developing such a program is a real challenge. If successful, it will provide sustainable livelihoods for local people,

protect local plant species, and offer habitats for iguanas, birds, and other endangered and endemic plants and animals.

We have learned much through the many programs and projects that we have undertaken over the years, but if we had to highlight one of the most important factors involved in our success, unquestionably it would be local support. Almost from the beginning, GJ has received strong local support. Pericles Mercedes, a well-known primary school director from Oviedo, offered key support. Olga Vidal and Esteban Garrido, residents of Oviedo, are members of the GJ board of directors. Esteban, in fact, has become one of the best field ornithologists in the country. After several years of work in the southwest, something happened that was quite unexpected to most of us. Youngsters decided to form a volunteer conservation group, Voluntarios Comunitarios de Jaragua, to support GJ's work. This was, indeed, powerful and welcome feedback to our work.

A few years later, another even more relevant event is happening. From those local community children and youngsters

Iguana Breeding Program at ZooDom

Jan Ramer

Indianapolis Zoo

Parque Zoológico Nacional (ZooDom) is the national zoo of the Dominican Republic. Situated near downtown Santo Domingo, the zoo occupies over 250 acres of wooded hills. ZooDom opened in 1975, and has large, wonderful, naturalistic habitats for the many species that live there. They have had very successful breeding programs with a number of species, including both Rhinoceros Iguanas (*Cyclura cornuta*) and Ricord's Iguanas (*C. ricordii*). In the late 1990s, a new Ricord's Iguana exhibit was completed and filled with native plants collected from Isla Cabritos. Under the watchful eyes of General Curator Angelica Espinal, a pair was placed in the exhibit, and as fortune would have it, the first hatchlings emerged during the 2002 ISG meeting in the Dominican Republic. Needless to say, we were all very excited to see these beautiful, critically endangered lizards. Those four babies (three males and one female) are thriving today as juveniles. Since then, the pair produced ten more babies in 2004, all of which were examined and had PIT-tags placed last spring — and all appeared to be healthy and strong.

One of the objectives of the revised Ricord's Iguana SRP is for ZooDom to maintain this breeding pair, learning as much as we can about breeding behavior, incubation, hatchling development, and any other relevant subject. Another enclosure with a second pair for increased genetic diversity is on the horizon. Congratulations to ZooDom on their successful breeding program.

EMILY HANSEN

ZooDom General Curator Angelica Espinal (standing), Head Keeper "Nacho" Nacisso, and the author conducting a physical examination of Ricord's Iguana hatchlings at ZooDom.

EMILY HANSEN

Each hatchling Ricord's Iguana was carefully examined, weighed, and measured.

EMILY HANSEN

A PIT-tag, donated by the Indianapolis Zoo, was inserted in each hatchling.

Yvonne Arias and Hector Andujar during the last summer camp.

Pirín (Jairo Isaa Matos Arache) working in the nursery for native and endemic plants.

who had been participating in summer camps, volunteer work, and nature guide courses during recent years, some decided to go to college and study biology. Hector Andujar is leading the group. Young, strong, and committed, he is a native of Los Tres Charcos, a community of about 100 houses within the Biosphere Reserve. He currently is in his third year of college. Pablo Feliz, native of El Cajuil, a community of nearly 125 houses near the Laguna de Oviedo, is the son of an entrepreneurial local woman, Chucha, the only fisherwoman in town. Pablo is very different in personality than Hector. He is quiet and relaxed, but equally committed. He is now in his second college year. The list could go on. At present, six young people native to local villages are studying or about to start school in Santo Domingo.

These events have exceeded all of our expectations. I doubt that any of us, although we love our careers in field biology and conservation, ever told any of these young people to become biologists. However, today, they represent the long-term sustainability of GJ as an organization. They represent the sustainability of iguana conservation and the sustainability of Jaragua Bahoruco Enriquillo Biosphere Reserve. They are the new generation of Dominican conservationists. If Ricord's Iguana conservation faces hard times, the unexpected and spontaneous recruitment of young local people into biology and conservation offers the needed means and hope for supporting current and future conservation efforts in the southwestern Dominican Republic.

Acknowledgments

We thank IIF, AECI/Araucaria/ONAPLAN, and Ford Motor Foundation for their financial support. We also express special gratitude to the Ministry of Environment and Natural Resources, the Municipality of Pedernales, and the community for their collaboration in the project.

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ROBERT POWELL

An adult male *Leiocephalus personatus* from near Juanillo, La Altagracia Province. This wide-ranging species reaches the westernmost extent of its range along the southern coast in association with a sharp ecotone near Baní.

Ecotones and Hybrid Zones: Implications for Conservation Illustrated by Ground-dwelling Lizards from Hispaniola

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Photographs by the author except where indicated.

Hybrid zones have been of great interest to evolutionary biologists for quite some time. However, only in the last few decades have they received much attention. This change follows a paradigm shift from viewing hybrid zones as rare occurrences in the general distribution of "pure" forms to their potential importance as regulators and creators of biodiversity (Harrison 1993). The resultant research effort has created a realization that the analysis of hybrid zones can provide information with far-reaching implications for speciation, adaptation, and even conservation (Arnold 1997, Harrison 1993). With this in mind, the following article discusses hybrid zones in the context of their consequences for speciation and conservation, focusing on an area identified as a zone of secondary contact between two lineages of the lizard *Ameiva chrysolaema* in the Dominican Republic.

Hybrid zones can be defined as regions (either narrow or broad) of genetic or anatomical changes that separate otherwise continuous and homogeneous "taxa." "Taxa" is placed in quotes here to represent not only recognized species but also divergent

Ameiva chrysolaema from 5 km west of Duvergé, Independencia Province. Two distinct lineages of this species meet at the ecotone near Baní.

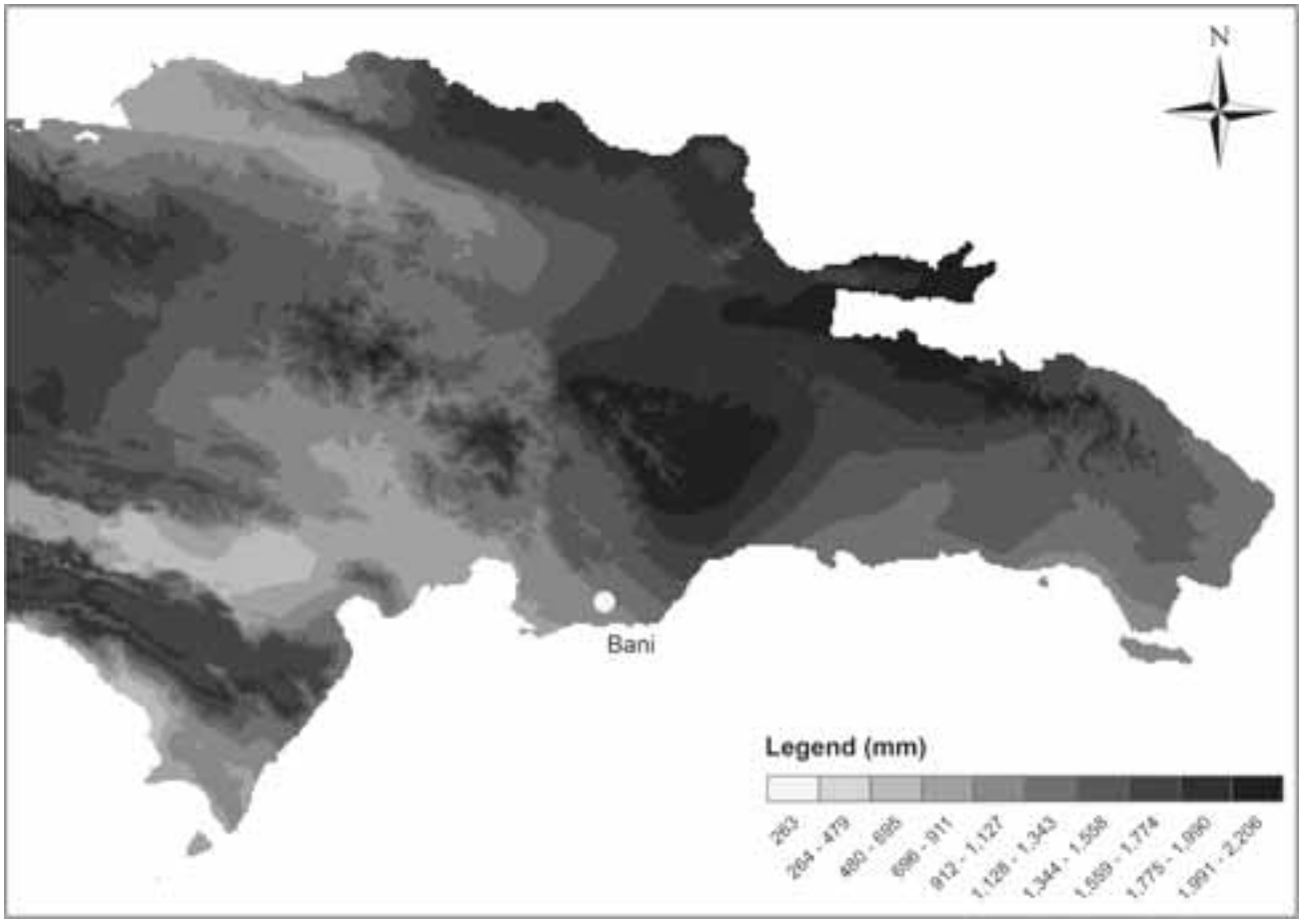
lineages that may or may not be formally recognized. The advent of new methodologies and availability of increasingly detailed genetic data has revealed that previously unknown lineages are common and characterize most widely distributed groups of organisms. Areas of contact between lineages many times result in interbreeding among members of these lineages. Such zones provide unique opportunities to study the process of speciation and adaptation. Combined analyses of different types of characters (genetic and anatomical) provide information on the processes that maintain hybrid zones or contribute to their collapse (Barton and Hewitt 1985). Hybrid zones can form in areas of continuous habitat or at habitat transitions (i.e., ecotones). The hybrid zone discussed herein is associated with a prominent ecotone in the south-central Dominican Republic near the city of Baní.

The island of Hispaniola has had a dynamic geological history highlighted by periodic inundation of the Cul de Sac-Neiba Valley in the central portion of the island. These inundations separated Hispaniola into two paleoislands at various times during the Miocene to Pleistocene epochs (~15–1 million years ago [mya]; Mann et al. 1999, McLaughlin et al. 1991, Taylor et al. 1985). After recession of seawater, habitable land likely became emergent during the late Pleistocene and Holocene. Genetic data suggest that these seawater inundations fragmented populations of *Ameiva chrysolaema*, forming eastern and western lineages along the southern coast of the island (Gifford et al. 2004). This study also identified a restricted area (in the vicinity of Baní) where these two lineages have come into secondary contact.

The diverse topography of the island contributes to a vast array of environmental conditions and creates near Baní a sharp environmental shift from relatively moist conditions in the east to extremely dry conditions in the west. Character shifts in *A. chrysolaema* associated with this ecotone include body size (SVL), dorsal scale size, and both nuclear and mitochondrial genetic characters (unpubl. data). In the following section, I consider what these character shifts imply about the nature of the hybrid zone and discuss the implications of these shifts for speciation, adaptation, and conservation in the group. Please note that this discussion is based on preliminary data and is used only to illustrate a thesis. Additional data collected during future field seasons will be necessary to further characterize this hybrid zone and test the hypotheses discussed here.

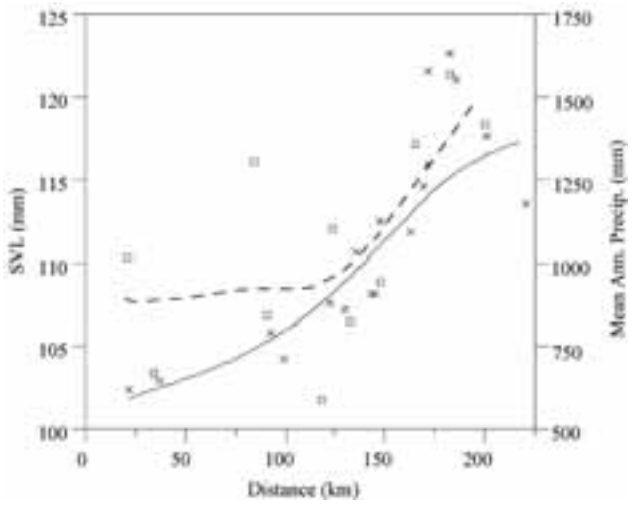
Patterns of character variation across the zone

Mitochondrial genetic characters show a sharp change in frequency from those characterizing the western lineage being found in essentially all individuals in those populations west of the ecotone, to being absent from populations on the east side of the ecotone. However, two populations within the ecotone contain characters of both lineages (Gifford et al. 2004). Preliminary data from studies of nuclear genetic material show a similar pattern, but the area over which the change occurs



Map of mean annual precipitation (mm) for the Dominican Republic. The ecotone discussed in the text refers to the area in the vicinity of Baní.

appears to be wider. Anatomical characters also seem to exhibit comparable relationships across the contact zone. In the case of body size, populations in dry habitats to the west tend to contain smaller individuals than populations in the moister eastern environments. This is illustrated clearly by a positive correlation between precipitation and SVL across the contact zone.



Morphological (dashed line) and environmental (solid line) clines for populations of *Ameiva chrysolaema* sampled across the ecotone. Boxes represent mean SVL (mm) for each sampled population along the transect. Crosses represent mean annual precipitation (mm) for each sampling point along the transect. The x-axis represents distance (in km) from an arbitrary locality on the western side of the ecotone.

Implications of contact zones for speciation and adaptation

The coincidence of contact zones (i.e., the occurrence of zones corresponding to several characters in similar geographic locales) and the concordance of changes (i.e., similar rates of change over the contact zones for different characters) have been used as evidence that natural selection can maintain a hybrid zone (Endler 1977, Barton and Hewitt 1985). However, two types of selection could be responsible and are indistinguishable from one another. Selection may work against individual hybrids, which would suffer a decrease in fitness relative to "pure" forms. Alternately, selection may favor local adaptation to different selective pressures on either side of the zone. One may be able to distinguish between these types of selection by using additional data. For example, the first hypothesis may be supported if populations in the hybrid zone are found in a population density trough (i.e., have decreased population densities), which is a testable prediction. That hypothesis would be further strengthened if reciprocal transplant experiments indicated a decreased fitness of hybrids in all transplanted habitats. Although testing these predictions takes considerable time and effort, the important point here is that natural selection is important in structuring the hybrid zone.

Variation among transition zones for anatomical characters could arise in several ways. Some characters may be under selection while others are effectively neutral. That could lead to transition zones for neutral characters governed most strongly by totally random factors (as opposed to selection). Variation among transition zones for genetic characters might be gener-

Leiocephalus semilineatus from 5 km west of Duvergé, Independencia Province. This very drought-tolerant species is largely confined to the very dry Cul de Sac-Neiba Valley and reaches the easternmost extent of its range at the ecotone near Baní.

ated by the different properties of mitochondrial versus nuclear genes. The latter generally evolve more rapidly, so differences might be coupled with the age of the hybrid zone. If genetic variation is minimal and anatomical variation pronounced, natural selection on anatomical features may be very strong. Different patterns may suggest that the lineages are diverging while others might indicate that they are merging in a fashion that could result eventually in a single genetic lineage.

Implications of hybrid zone studies for conservation

At first glance, the presence of a hybrid zone may cause problems for conservationists. These problems likely stem from the lack of consensus about the appropriate methods by which we should identify species. By viewing speciation as an extended process and species as elements of populations-level lineages (*sensu* de Queiroz 1998), some of these problems may be

Leiocephalus schreibersii from 5 km west of Duvergé, Independencia Province. This species is largely associated with very dry habitats; like *L. semilineatus*, it reaches the easternmost extent of its range at the ecotone near Baní.

Leiocephalus lunatus from Catuano, Isla Saona, La Altagracia Province, Dominican Republic. Although this individual is not from the main island of Hispaniola, the species is fairly uniform in pattern across its range. This species has a largely coastal distribution that reaches its westernmost extent at the ecotone near Baní.

ROBERT POWELL

Ameiva lineolata from Isla Catalina, La Romana Province. Although most populations of this drought-tolerant species are found in the very dry Cul de Sac-Neiba Valley west of the ecotone near Baní, some apparently relict isolates are found far to the east.

addressed more effectively. The goal of conservation is to preserve biodiversity. Biodiversity can be defined as the natural diversity of independently evolving lineages (as opposed to formally recognized species or even higher taxa; see, for example, Powell 2004 and references therein). Consequently, we must understand the evolutionary consequences of lineage contact and the processes acting to either maintain lineage differences or facilitate lineage merger. Ecotonal contact zones mark the confluence of different environmental conditions that may also represent the limits of other species adapted to the alternative environments. As such, these ecotones represent areas of high faunal turnover and, hence, high diversity. By conserving these areas, we may preserve the selective pressures (environmental heterogeneity) that have shaped the current distribution of taxa and the processes that maintain and structure biodiversity. Other ground-dwelling lizards whose distributional limits are located at this particular ecotone include *Leiocephalus semilineatus*, *L. schreibersii*, and *Ameiva lineolata* on the dry western side and *L. personatus* and *L. lunatus* on the moister eastern side.

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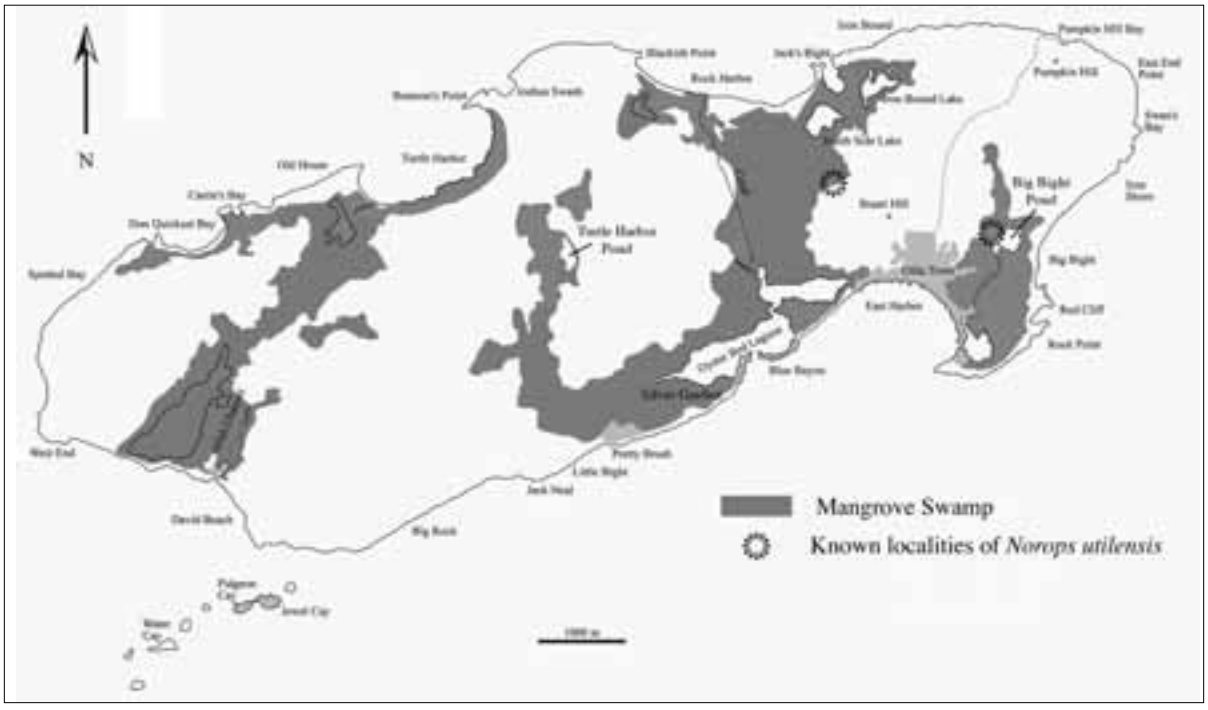
ROBERT POWELL



The World's Most Endangered Anole?

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Photographs by the author unless otherwise indicated.

Norops utilensis[1] is endemic to the Isla de Utila (Islas de la Bahia, Honduras). Discovered in 1995, it is a poorly known member of the *N. pentaprion*-group. In contrast to the other members of the group, all of which live in broadleaf tropical rain forests, *N. utilensis* dwells exclusively in a highly spe-

Because suitable nesting holes are a limited resource in the mangrove forests, Utila Anoles may lay their eggs communally. The two shells in this nest hole in a hollow Red Mangrove root are remains of eggs that were undoubtedly laid by two different females.

[1] In 1987, Craig Guyer and Jay Savage (*Systematic Zoology* 35: 509–531) proposed a classification of anoles that included formal recognition of several distinct genera within the group. One of these genera was *Norops*, to which the Utila Anole has been assigned. Although recognition of those genera has been strongly advocated by some authorities, others, who would refer to the Utila Anole as *Anolis utiliensis*, prefer a more conservative approach until a number of concerns regarding generic relationships among anoles have been addressed. Those concerns were best summarized by Ernest Williams in 1989 (In: C.A. Woods (ed.), *Biogeography of the West Indies: Past, Present, and Future*. Sandhill Crane Press, Gainesville, Florida).

An adult female Utila Anole (*Norops utilensis*).

cialized habitat – the salty mangrove swamps of Isla Utila (see *Iguana* 12:142 for detailed descriptions of the habitat).

Norops utilensis is a medium-sized anole, reaching about 150 mm in total length, most of it tail (maximum known snout-vent length = 59 mm). They are well-camouflaged due to a lichenose gray-brown dorsal pattern, which makes them difficult to detect as they adhere closely to the surface of mangrove trunks and branches. A red dewlap is present in both

Natural habitat of *Norops utilensis* at the type locality: A mixture of Black (*Avicennia germinans*) and Red Mangroves (*Rhizophora mangle*).

ROBERT POWELL

A Common Black Hawk (*Buteogallus anthracinus*) in the Big Bight, one of the areas where *Norops utilensis* is known to occur. Although these hawks typically prefer larger prey (including iguanas), they might occasionally take an anole. Predation pressure from visual predators may contribute to the cryptic coloration and shy behavior of Utila Anoles.

One-day-old hatchling Utila Anole at the egg-laying site (tree hole in a *Rhizophora mangle* root).

JOE BURGESS

Utila Anoles are associated strictly with mangrove stands near the Big Bight.

Utila Anoles rely heavily on crypsis to avoid predators and rarely extend their dewlaps (see also inside front cover).

males and females, but is much larger in males and forms a bright shining signal flag when they respond to intruders or advertise their presence to females. Utila anoles are entirely arboreal and live and behave in a gecko-like fashion, pressing their bodies tightly against the substrate as they cling closely to the surface of mangrove trunks and twigs at heights ranging from 1–7 m above the waterlogged ground.

Like most anoles, females lay a single egg at a time, using suitable, detritus-filled tree holes. These tree holes are a limited resource within the mangroves; consequently, communal nesting appears to be common. Although the local climate is strictly seasonal (with distinct wet and dry seasons), *N. utilensis* reproduces throughout the year. Most reproductive activity occurs during the rainy season (when food is presumably most plentiful), but individuals quickly become reproductively active during periods in the dry season when favorable conditions exist.

Norops utilensis is not common in the mangrove swamps. Since its discovery, only 13 specimens have been detected at two localities. Due to the specialized and severely limited habitat, apparently low population sizes, and ongoing human threats to the habitat (e.g., deforestation and use of the mangrove swamps for solid waste disposal), *N. utilensis* meets all of the IUCN Red List criteria (http://www.redlist.org/info/categories_criteria.html) to qualify for critically endangered status. As for so many other threatened insular endemics, the best chances for long-term survival lie in controlling the size of the human population, education, and preservation of critical habitats (see *Iguana* 10:28–37 and *Iguana* 11:206–211 for additional pertinent information).

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Laws Governing the Importation and Exportation of Reptiles

Compiled by the Editorial Board[1]

If you are involved in reptile research and need to import or export specimens, tissue, blood, or DNA samples or, if you are importing or exporting live reptiles, you may need to apply for a CITES and/or ESA permit. You probably have heard of the U.S. Endangered Species Act (ESA), but you may not have heard of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Although some overlap exists between the two, they are, in fact, distinctly different entities. In addition, the Lacey Act may apply. Under its provisions, it is unlawful to import, export, sell, acquire, or purchase fish, wildlife, or plants taken, possessed, transported, or sold: (1) In violation of U.S. or Indian law, or (2) In interstate or foreign commerce involving any fish, wildlife, or plants taken, possessed, or sold in violation of state or foreign law. The law covers all fish and wildlife and their parts or products, plus plants protected by CITES or state laws.

JOHN BINNS

Part of the Species Recovery Plan for the Jamaican Iguana (*Cyclura collei*) involves captive-breeding programs in U.S. zoos. Repatriated individuals born in the United States would require CITES permits to enter Jamaica.

ROBERT POWELL

The Red-bellied Racer (*Alsophis rufiventris*) of St. Eustatius and Saba in the Netherlands Antilles has been extirpated on Nevis and St. Kitts. Although "red-listed" by IUCN, the species is not listed in CITES.

ESA was enacted in 1973 and CITES in 1975. CITES remains the only global treaty that ensures that international wildlife trade is based on sustainable use and management of wild and captive populations. It provides a framework for cooperation and collaboration among nations to prevent further decline in wild populations of animals and plants. CITES establishes a system of import/export regulations to prevent the overexploitation of plants and animals listed in three appendices to the Convention. Today, 168 countries, including the United States, implement CITES, with additional countries joining each year. Different levels of trade regulations are set depending on the status (i.e., Appendix) of the listed species and the impact any trade has on the decline of the species. For example, if a species is listed in Appendix I of CITES (such as West Indian Rock Iguanas, *Cyclura* spp.), it may not be traded for primarily commercial purposes, whereas an Appendix II-listed species such as the Common or Green Iguana (*Iguana iguana*) may be traded commercially. Based on the level of protection under CITES, different criteria are evaluated, so an application for an Appendix II-listed species would likely be processed more quickly than one for an Appendix I-listed species. Depending on the status of the species in the wild, the level of protection may change over time. For example, the Spider Tortoise (*Pyxis arachnoides*) was uplisted (afforded more protection) from Appendix II to Appendix I of CITES in January 2005. The American Crocodile (*Crocodylus acutus*), on the other hand, was downlisted from Appendix I to Appendix II due to an evaluation of new data. Every two–three years, CITES signatories meet to discuss wildlife trade, review species, and make revisions as needed.

[1] In consultation with Amy Brisendine, U.S. Fish and Wildlife Service.

JO HOARE

Tuataras (*Sphenodon punctatus*) are restricted to a few small, very strictly protected islands off New Zealand (see *Iguana* 12:38–42). Permission to import into the United States any animals or parts would require CITES permits from both New Zealand and the U.S.

AMY MACKAY

Because the St. Croix Ground Lizard (*Ameiva polyps*) is found only within a U.S. Commonwealth, the Endangered Species Act would apply to any efforts to study the species.

Over the last few decades, CITES has helped ensure global conservation of species. Some of the recent cases in which these laws have halted illegal wildlife trade include: in 2005, a man in New York was sentenced to six months in jail for smuggling wildlife parts; ten individuals in New Mexico were indicted for illegal hunting and killing of wildlife on a National preserve; and a man in Indiana was required to pay more than $450,000 for several violations of wildlife laws (for copies of the news releases, visit news.fws.gov). As advancing technology makes it possible to ship wildlife anywhere in the world and as issues of wildlife use grow ever more complex, CITES provides tools to effectively conserve the world's diverse natural resources.

In sharp contrast, the ESA is strictly a U.S. law and is not enforced in other countries; that is, it may only be enforced within the jurisdiction of the United States. It prohibits unauthorized taking, possession, sale, and transport (import and/or export) of endangered species such as the Jamaican Iguana (*Cyclura collei*). Examples of permits issued for ESA-listed species include reasons such as *bona fide* scientific research or enhancement of the survival of the species in the wild. The Service frequently receives applications from zoos and research institutions such as universities or non-profit foundations to conduct these types of activities.

Below are some frequently asked questions and answers that may help you in determining if you need permits to conduct your activities:

THOMAS WIEWANDT

Not only is the Star Tortoise (*Geochelone elegans*) listed in CITES Appendix II, so are all species of *Geochelone*. This often is necessary to prevent confusion between similar taxa within a genus, all of which are in need of protection.

Q. Is a particular species CITES-listed?
A. You can check to see if and how a species is listed by visiting www.cites.org. If it is listed by CITES, submit form 3-200-29, which is available from www.fws.gov/permits. If you need additional information, look at the "How to Apply" section for detailed information on application procedures.

Q. Is a particular species listed by the ESA?
A. Visit www.fws.gov/permits and click on "species lists" to check if a species is listed. If it is listed by ESA, you may use form 3-200-37. The U.S. Fish and Wildlife Service (FWS) will generally combine CITES and ESA permits into a single permit.

Q. What can I do to make the process go smoothly?
A. Plan at least six months in advance and submit your application at least five months in advance of your trip in order to have permits ready in time. CITES export permits are typically valid for six months; CITES import permits for one year.

Q. Once my permit is received, what do I do?
A. Instructions will be enclosed with the permit. You will have to clear the wildlife samples through FWS at the port of export or import. If you need additional information, please visit www.le.fws.gov.

Q. Where can I research these wildlife laws?
A. The CITES website is www.cites.org and the website for the U.S. CITES Management Authority is www.fws.gov/permits.

If you have additional questions about importing or exporting wildlife samples, you may contact the U.S. Fish and Wildlife Service, International Affairs / Division of Management Authority, 4401 N. Fairfax Drive, Room 700, Arlington, VA 22203 or (800/703) 358–2104 or send an email to managementauthority@fws.gov.

HUSBANDRY

Captive Care of Monitors Part II: Diet and Reproduction[1]

Bernd Eidenmüller

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Photographs by author.

In the previous issue of IGUANA, we presented Captive Care of Monitors, Part I: Introduction and Housing. Part II follows.

Diet

Almost all monitors are carnivorous, that is, they are exclusive meat eaters. Two notable exceptions are *Varanus olivaceus* and the newly described *V. mabitang*, both of which live in the Philippines and prefer to eat fruit and leaves (Auffenberg 1988, Gaulke and Curio 2001). Insects, spiders, crayfish, fish, amphibians, reptiles, eggs, birds, and mammals make up the bulk of the diet of most monitors. Prey size and type generally depends on the size of the monitor. In the wild, monitors, particularly *V. niloticus*, *V. gouldii*, and *V. panoptes*, are known to find clutches of eggs of other monitors or crocodiles (Bayless 1992, Lenz 1995). In general, monitors do not appear to be particularly selective regarding food. Occasionally, they are even cannibalistic. *Varanus komodoensis*, from Komodo Island, not only feeds on pigs, which occur on this island, but also takes Red Deer and other feral animals. Humans also have fallen prey to the Komodo Monitor.

Because size varies considerably between species, the food spectrum is also highly variable. In the wild, members of the smaller species feed mainly on insects and smaller reptiles, which they can overpower. The examination of stomach contents from wild monitors has revealed the preferred food items of some species (James et al. 1992, Losos and Greene 1988, Pianka 1968, 1969a, b, 1970a, b, c, 1982, Shine 1986, Sprackland 1993, Ziegler and Böhme 1996, Gaulke and Curio 2001).

Grasshoppers make an appropriately sized meal for the Pilbara Monitor (*Varanus pilbarensis*).

A Dwarf Monitor (*Varanus storri*) at mealtime.

The variety of food available to captive monitors is much more limited. Common food items suitable for smaller species include crickets, grasshoppers, locusts, cockroaches, and larvae of the giant mealworm. Newborn mice (thawed or recently euthanized) are occasionally offered to expand the menu. Any captive diet lacks the balanced mixture of vitamins, minerals, and fiber available in the wild, thus supplementation is necessary to provide these nutrients. All insect prey should be dusted with a vitamin and mineral mixture such as Nekton MSA® or Miner-all®. Do not offer too much food, especially crickets and cockroaches, as they tend to hide within the furnishings of the cage, where the monitors cannot reach them. Unconsumed nocturnal insects also may represent a physical risk to the sleeping monitor. To date, no reports have documented crickets attacking healthy monitors, but evidence suggests that crickets in a cage have consumed dead monitors. The risk of injury, especially for young offspring, should not be overlooked.

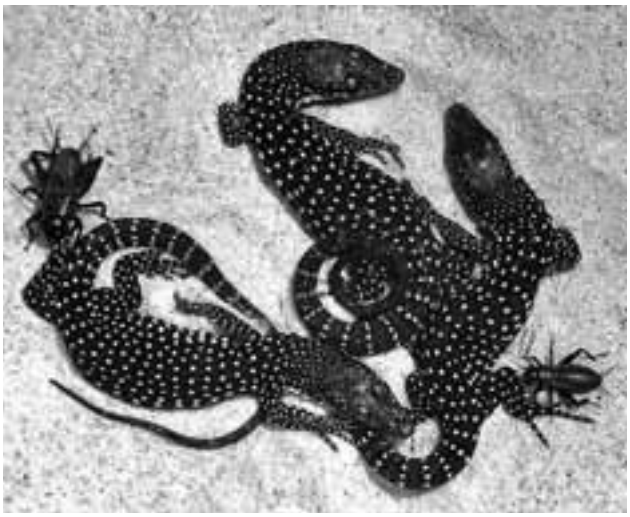
Larger monitors require larger food items. Feeding a lizard the size of a *V. mertensi* on crickets and locusts is prohibitively

[1] Adapted by AJ Gutman from B. Eidenmuller, *Monitors: Natural History — Captive Care — Breeding*. Herpeton Verlag, Offenbach, Germany.

expensive. Mice, and occasionally rats and chicks, are much more appropriate food items. The unit price is low and the protein more concentrated so less total food volume is required. Feeding chicks has at least one drawback for the keeper; it tends to result in monitor excrement that is very runny and smells unpleasant. If you feed monitors on chicken, the enclosure should be cleaned immediately for hygienic reasons. Canned dog or cat food should not be fed to captive monitors as these products contain too much protein and are very low in minerals and fiber. ZuPreem (Premium Nutrition Products, Inc.) produces a canned monitor and tegu diet that provides the proper balance of nutrition.

Conditioning for Breeding

All monitors live a solitary existence in the wild and, in captivity, should be maintained singly or at most as pairs. In order to synchronize pairs of animals sexually, I recommend an occasional period of separation. Separations lasting between four weeks and three months can be carried out several times during the year. Similarly, a brumation period lasting between one and three months, with an ambient temperature of approximately 15 °C is appropriate for animals from colder areas (e.g., for monitors from the southern parts of Australia or South Africa). A period of quiescence also will simulate a summer aestivation for animals from a tropical climate (e.g., *V. mertensi* or *V. acanthurus*), thereby promoting synchronization of the sexes and post-hibernation breeding. Another possibility is the introduction of a rainy season that simulates the conditions required by animals from the equatorial rain forests (e.g., *V. prasinus*). A hibernation or aestivation period is comparatively simple to adopt in captivity by continuously reducing both the photoperiod and the amount of time that heat is supplied to the lizards over a winter rest period. In the middle of winter, the animal does not require significant heat and illumination within its enclosure. Therefore, a spotlight that is switched on for short periods of time for the animal to bask is sufficient. Throughout this period of relative dormancy, animals should always have a bowl of fresh drinking water available in the enclosure, so that



Large food insects can pose a hazard to hatchlings such as these Timor Monitors (*Varanus timorensis*).

This Mangrove Monitor (*Varanus indicus*) has just eaten a mouse.

when they wake up, they are able to drink. A real hibernation, in which animals are maintained without light and heat over long periods of time, is neither required nor recommended for any monitor species. When an animal enters this period of dormancy during the colder months, little other care is required until it emerges with the onset of warmer months. Most animals will survive this period in their hiding places and remain inactive. Animals should not be reactivated too quickly when the weather warms. They will note the change in climatic conditions and gradually over a period of days and in some cases weeks, reappear to seek a basking site and food. After they have recommenced basking over a few days, food can be offered.

Monitors from a tropical rainforest environment (e.g., members of the *V. prasinus* complex and *V. scalaris* from Cape York Peninsula) do not require the above-mentioned hibernation period. A rainy period can trigger mating behavior. The entire enclosure can be moistened two or three times a day with water from a spray bottle to simulate a rainy season. This will raise the humidity, as will a water basin placed in the enclosure on top of an under-tank heating mat. Ultrasound humidifiers can increase humidity during the day by repeatedly switching on and off. These are very effective, but generally expensive.

Bird nest boxes have proven to be acceptable egg-laying sites for tree dwellers such as *Varanus prasinus*.

Emerald Tree Monitors (*Varanus prasinus*) mating on the back wall of their terrarium.

Reproduction and Egg Husbandry

If pairs of monitors have been maintained together for some time and they appear compatible, these animals may be successfully bred to produce clutches of eggs and healthy offspring. The time between the last observed mating and egg-laying in most monitors is between four and eight weeks. An exception seems to be *V. mertensi*. In this species, the time appears to be three weeks between mating and egg-laying. After mating activity has ceased, the female should be allowed to bask and obtain food as needed; therefore, after mating behavior has stopped, the male should be removed from the enclosure. This is particularly important for *V. prasinus*, because these animals are very stress-sensitive, even outside of the mating season. The high stress induced by contact with conspecifics is an indication that members of this species are generally found as solitary individuals.

Prior to egg-laying, females show an increase in body size, becoming more rotund. At this stage, a suitable egg-laying box should be offered. The size of the egg-laying box should be suited to the size of the animal (e.g., a box 40 x 25 x 20 cm, LWH is sufficient for *V. acanthurus*). For larger species, the egg-laying box should be proportionally larger. Bird nesting boxes have been used successfully for *V. prasinus*; these can be natural hollow logs with a cap on each end and a hole part way down for entry (Eidenmüller 1996, Eidenmüller and Wicker 1992) or made of plywood (Dedlmar 1994). These nests are filled with lightly moistened bark mulch or vermiculite. Irrespective of whether the box is made of wood or plastic, the animal must be able to gain access to it from above. The box must be light impermeable, show a thermal gradient ranging from about 30 °C at the top to about 25 °C at the bottom, and the substratum must contain sufficient moisture to prevent desiccation of the eggs before they can be removed and incubated elsewhere. In some cases, the placement of a piece of cork bark on the substratum in the box may be helpful. This serves two purposes, first, it will allow little light into the burrowing material (bark mulch, sand, or vermiculite), and second, the digging animal gains a sense of security that the walls of her nest burrow will not collapse.

An appropriate nest box for a small ground-dwelling monitor.

Many monitors cease feeding prior to egg-laying. While food denial is not a sure sign of forthcoming egg-laying, it is nevertheless a good indicator that a lizard is gravid. If an animal does cease to feed, access to the egg-laying chamber is imperative. A substantial amount of energy is used during reproduction, and food must be available to the exhausted animal after oviposition. The tail base and thigh musculature have generally collapsed. Egg-laying is a stressful time and can be accompanied by problems.

In general, stress is the single greatest factor that can lead to difficulties in husbandry during reproduction. For example, animals that have not laid in the prescribed time are likely stressed by some unseen and intangible factor that can be very difficult to ascertain. Possible conditions that can result in an animal failing to lay eggs include the nest box not being in place or in an inappropriate position, a male still present in the cage, insufficient nest humidity, or that the keeper had spent too long viewing the animal. Stress factors must be teased out by a process of elimination.

Most monitors undertake test-diggings for suitable egg chambers some days before actually being ready to deposit eggs. As soon as they stop test-digging and refuse food, egg-laying is nigh. Similarly, the collapse of the tail base and thighs may indicate imminent ovipositioning. If the monitor has been digging test holes for some time and then ceases all activity at a time when you are confident she should be laying but has not yet done so, medical help should be consulted. This is the single largest indicator that something has gone wrong. Often a qualified veterinarian can induce egg-laying using the hormone oxytocin. If, however, egg-laying is long overdue, a Caesarean section may be needed. Examples of a prolonged egg-laying period include clutches of both *V. acanthurus* and *V. scalaris* that were only partially laid, with the remaining eggs becoming bound to the oviduct. Surgery was required to save the female and ensure her reproductive health for subsequent years. This is only one of many situations that can arise when egg-laying in a monitor is overdue. If egg deposition is weeks overdue, I can only suggest that the animal be placed in the care of a reliable reptile veterinarian.

Incubation

As soon as the eggs have been laid, they must be removed from the enclosure or the egg-laying box. Eggs are part of the diet of most monitors and they will be consumed quite readily by adults or destroyed during digging activities. In reptile eggs, the embryo attaches to a disk at the top of the egg and adheres via a membrane to maintain its position within the egg. In bird eggs, however, the embryo is held in position via a sinew, which allows the egg to be rotated during incubation. Monitor eggs must be kept oriented along a single plane and not rotated. Eggs can be marked on the upper (dorsal) surface with a graphite pencil to show the plane of orientation. A pen should not be used to mark eggs, as some types of ink contain toxic substances that can be fatal to the embryo. When marked, the eggs can be placed into a prepared box that is used for incubation. This box should contain either vermiculite or perlite mixed with an equivalent weight of water. *Varanus mertensi* eggs can tolerate a huge range in humidity or water potential, and this ranges from a 2:1 to a 5:1 ratio of water to substrate (Eidenmüller and Wicker 1998). The particle size of either substrate is not significant. During incubation, the temperature should be between 26.5 °C and 29.5 °C, with humidity between 80% and 90%. If the water uptake of an egg is too high, the embryo inside can

Freckled Monitor (*Varanus tristis orientalis*) hatching.

Gould's Monitor (*Varanus gouldii flavirufus*) hatching in a perlite incubation medium.

Mertens's Water Monitor (*Varanus mertensi*) hatching.

become stressed by the water pressure and die. A small indentation of the egg is not a concern, provided that the eggshell is white. If more water is added to the substrate, this will be absorbed by the egg and plump up any indentations, especially if this occurs early in the incubation process. Be careful not to drop water onto the surface of the egg, as this may harm the development of the embryo. Generally, the incubation period correlates with the adult size of each species, but it may also depend on the temperature and humidity during incubation. Incubation is a process that requires a great deal of patience, because the incubation periods in the literature can be different than the incubation period that you experience, even for the same species. If hatchlings are overdue and the eggs still appear viable, do not open the egg. In most cases, the egg will be opened too early and reveal a premature hatchling, which is unlikely to survive.

If the humidity in the egg-incubation box is high it sometimes becomes apparent that eggs have swollen and in some cases there is water exuded from the egg. This is called "sweating." If one or more eggs start to sweat during incubation, carefully slit the egg on the upper side. This slit in the egg decreases the pressure on the embryo and may enhance its chances of survival.

Rearing Hatchlings

After hatching, each individual should be measured and weighed carefully. These data may be of interest to other breeders. Special care should be taken to avoid injuring the young animals, especially when trying to weigh and measure them. They likely will be intent on escape and even seemingly innocuous movements in the hand can damage a young varanid. After measuring the hatchlings, they should be placed in a cage where they can be reared. The size of the enclosure should be sufficient for the animals to move about their new quarters with ease. The cage should not, however, be so large that you do not have sufficient control over the food items being presented to the new arrivals. This will prevent insects that escape the hatchlings from becoming hidden in some recess of the cage, reappearing at night when the hatchling is asleep, and presenting a physical risk to its survival. The furnishings within a hatchling enclosure should be much the same as those of the adults, although they may be somewhat smaller. Care must be taken to ensure that cork bark and stones are securely positioned so that they cannot fall and crush the hatchlings. A small bowl of fresh water should always be available.

Hatchlings of most monitor species can be kept together in small groups. Exceptions to this are *V. storri* (Eidenmüller and Horn 1985) and *V. prasinus*, which should always be raised separately. Young *V. storri* have fatally injured each other through constant biting, and the only way to avoid this is by keeping them separately. Other species also may exhibit aggression toward one another, so I suggest keeping a close eye on all groups of hatchlings until a determination that they are compatible is justified. The problem of stress can be quite pronounced in *V. p. beccarii*; hatchlings in some instances have been known to refuse food and die within hours (Eidenmüller

Hatchling Emerald Tree Monitors (*Varanus prasinus*) must be raised individually.

Hatchling Pilbara Monitor (*Varanus pilbarensis*) in the terrarium.

1996, Eidenmüller and Wicker 1991). Most other monitor species are not problematic in this respect. When rearing a group of hatchlings, close attention should be paid to the feeding behavior of all individuals to ensure that they are all obtaining sufficient food. As they grow, some animals will become dominant and exclude others from the food. These animals should be removed.

During the first two to ten days, the small monitors still live on yolk, which is the last thing to be incorporated into the body cavity before hatching. This food source for a newly hatched varanid can last between hours and days depending on the health of the female, size of yolk in the egg, and metabolic rate of the hatchling. Hatchlings should be offered food items that are small enough for them to overpower, such as small crickets or cockroaches. Food animals should always be treated with a vitamin and mineral powder. Freshly caught grasshoppers are an excellent addition to the diet of a captive monitor as they contain more vitamins and fiber than cultivated insects. Be certain to avoid catching insects from agricultural land, beside freeways, or in some gardens, where they are likely to have been subjected to pesticide and herbicide applications. Many of these applications may be harmful to your hatchling. Cultivated crickets and locusts are fed a biased diet that may not have all the necessary vitamin and mineral components to ensure the long-term health of your monitors. Several manufacturers sell gut-loading cricket diets that considerably improve the nutritional value of food insects.

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MISSION STATEMENT

Grupo Jaragua is a non-govermental, non-profit organization founded in 1987. Its mission is to achieve the effective management of the Dominican Republic's Biodiversity Resources through research and implementation of specific projects to solve local conservation problems. Grupo Jaragua places special emphasis on regional development of Protected Areas through participatory processes at the community level, in particular in Jaragua National Park and its surrounding communities. To achieve its mission, Grupo Jaragua works in collaboration with government and non-government institutions, as well as grass-roots organizations.

PHILOSOPHY AND VALUES

We believe that it is possible to achieve at the same time the conservation and the sustainable use of biological diversity. We also believe that human wellbeing and development are basic rights that guide all our actions. Respect for human plurality is our highest priority; we try to conduct our work in harmony, acknowledging and respecting differences in views, while at the same time highlighting our common goals and the way forward towards conservation and sustainable development. We place high value in altruism, professional and human ethics, and we respect cultural differences. We strive to find consensual solutions, respect cultural differences, and encourage the widest participation of all stakeholders.

PROFILE

The Faces of Grupo Jaragua

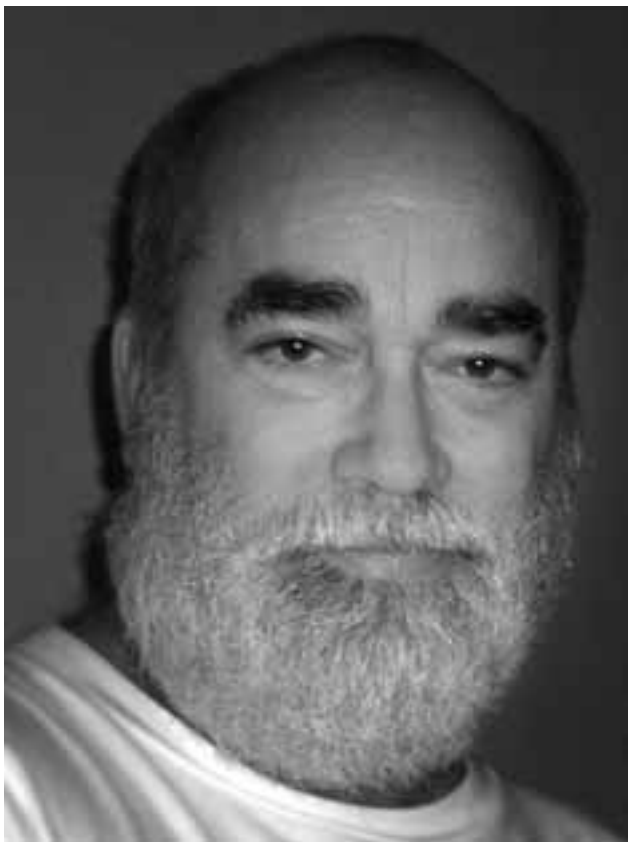
Jan Ramer

Indianapolis Zoo

Conservation is hard work. It requires patience, perseverance, teamwork, compassion, and respect, not to mention the ability to accomplish big things on a shoestring budget.

Grupo Jaragua is a non-governmental organization (NGO) in the Dominican Republic that exemplifies a conservation group that works well — sometimes under extraordinarily difficult circumstances. With a staff of only 13 dedicated people and a network of collaborators, Grupo Jaragua has worked tirelessly for the past 15 years to achieve their mission, which is the "effective management of natural resources through research and implementation of specific projects to solve local conservation problems." They work primarily in the southwest of the country in and around Jaragua National Park, and their list of accomplishments and honors is long and varied (visit their website www.grupojaragua.org.do for a complete list). They have partnered with organizations like The Nature Conservancy, World Wildlife Fund, The Ocean Conservancy, BirdLife International, Center for International Migration and Development, Conservation International, and the MacArthur Foundation. Projects include a national campaign in bird conservation, marine conservation and research including the development of a Hawksbill Sea Turtle Education Campaign, developing a freshwater fish inventory, and implementation of a sustainable use program in the area around Jaragua National Park. That latter includes job creation, capacity building, and public use of natural resources.

Yvonne Arias is the current president of the Grupo Jaragua.



Sixto Incháustegui was instrumental in founding both the National Museum of Natural History and the Grupo Jaragua.

Grupo Jaragua has recently received a grant from the MacArthur Foundation for a three-year project to complete a conservation plan that will help link protected areas in the southwestern Dominican Republic through the development of biological corridors, building scientific understanding of the island's ecological communities, and enhancing local livelihoods and environmental stewardship through eco-tourism and improved agro-forestry practices. They worked with the Dominican government to establish under UNESCO the first Dominican Biosphere Reserve — Jaragua-Bahoruco-Enriquillo Biosphere Reserve. And this is just a short list!

I've had the privilege of working with three key Grupo Jaragua members on Ricord's Iguana conservation for the past five years. Together, they are the public face of the organization.

Yvonne Arias earned her master's degree in ecology and environmental conservation in 1992, and has over 20 years of experience in herpetology and ecology. Yvonne has been with Grupo Jaragua since its inception and is currently its president. She is involved with all aspects of the organization, from developing curriculum and training students in environmental conservation, to meeting with lawmakers when critical habitat is in political jeopardy. She serves on several national committees and projects involving environmental education, environmental protection, and research, and has over 30 publications on these subjects. In addition to the work she does in the Dominican Republic, she has consulted on projects in Guatemala, Honduras, and Costa Rica.

Dr. Sixto Incháustegui has been working in the field of herpetology and environmental conservation for over 30 years, but his love affair with reptiles started at a very early age. He tells a story about his father bringing back four baby turtles from a trip to the United States when Sixto was eight years old. He enjoyed them so much that he saved all his money and ordered 10 more the next time his father returned to the States. He set up a breeding colony, which did very well, and he still has some of those turtles to this day! In one way or another, Sixto has been studying reptiles ever since. In college, he initiated an exchange of letters with Dr. Albert Schwartz, who encouraged him to host Michael Carey, one of Dr. Schwartz's students working with *Cyclura*. After that first field trip, which was his "official" introduction to the study of *Cyclura*, he was hooked. Over the years, he and Yvonne have worked with José Ottenwalder to pioneer the study of *C. ricordii* and *C. cornuta* in and around Lago Enriquillo. Sixto is a pioneer in several ways, being the first Dominican herpetologist, the first Dominican biologist who became director of the School of Biology, one of the founders of both the National Museum of Natural History in Santo Domingo and the first Dominican NGO working for environmental conservation (Grupo Jaragua). He is currently professor of biology at the Universidad Autónoma de Santo Domingo, professor and investigator at the Instituto Tecnológico de Santo Domingo (INTEC), an invited professor at the City College of New York, to name a few of the institutions to which he contributes. Sixto's publications are too numerous to mention, and his contributions to the field of conservation are so significant that the IV Congress on Caribbean Biodiversity in January 2002 was dedicated to him.

2004 meeting with educators; back row (from left): two educators, Elizabeth Skeet, two more educators, Dr. Alfonso Ferreira; front row (from left): Gloria Santana, Josepha Castro, Quentin Bloxam, the author, Angelica Espinal, John Foster, Sixto Incháustegui, Ernst Rupp, and Rick Hudson.

JOE EHRENBERGER

Informal 2003 meeting at the Hotel Hispaniola in Santo Domingo; (from left) the author, Sixto Incháustegui, Yvonne Arias, and Ernst Rupp.

Ernst Rupp was born in Germany, earned his Master's of Business Administration at the University of Iowa, worked for three years on assignment with the German Development Service (GDS) in Malaysia as an economic advisor to the Federal Agricultural Marketing Authority, then, in 1984, moved to the Dominican Republic on assignment with the GDS as an advisor to a farmer's cooperative. He has been working in the Dominican Republic ever since, with projects ranging from reforestation with native tree species, GDS advisor to the Dominican Wildlife Department coordinating a program to manage the buffer zone of the national park "Sierra de Neiba," with special emphasis on local participation, and investigating the distribution of bats in the Sierra de Neiba. He has been with Grupo Jaragua since 2001, promoting and coordinating the investigation of endangered species and of the threats to these species, collecting data on these species and human impact, integrating the data in a data bank, establishing the use of geographical information systems (GIS), and developing programs of conservation for these species while involving the local communities. Ernst has been concentrating his efforts on Ricord's Iguana conservation and research since 2002, and says about his work with iguanas, "Maybe I just was at the right place at the right time for once in my life."

These are three pretty amazing people. I remember being very nervous at my first meeting with Yvonne and Sixto — after all, she was the president of Grupo Jaragua and he was a living legend! I was a naïve veterinarian from Indiana who had only just started working with iguanas, had fallen in love with the Dominican Republic, and wanted to help with Ricord's Iguana conservation in any way that I could. I was prepared to be completely intimidated by these conservation icons; but, at that first meeting with Sixto, Yvonne, and Ernst, next to the pool at the Hispaniola Hotel, I met three genuine, dedicated, warm, and welcoming people, who immediately put me at ease.

Grupo Jaragua's work with iguanas could fill many pages, so I'll concentrate here on their work since the 2002 IUCN Iguana Specialist Group meeting, during which the Ricord's Iguana Species Recovery Plan (SRP) was developed. During that meeting, I enjoyed watching Yvonne, Sixto, and José Ottenwalder — the most respected environmental conservationists in the Dominican Republic — work so hard to develop an aggressive

but realistic plan to recover this critically endangered species. Since then, Grupo Jaragua has identified the two remaining populations of *C. ricordii* outside of Isla Cabritos — the Pedernales population and a population that lives along the southern shore of Lago Enriquillo. Ernst has been working hard with the Pedernales population and habitat, hiring Salvador (Miguel Mella Pérez), previously an iguana hunter, as his main guide. Needless to say, Salvador is very good. Ernst has conducted socioeconomic interviews in the area, funded in part by a grant from the Riverbanks Zoo, to determine the human impact on iguana populations. Through this ongoing work, we now know the actual status and distribution of *C. ricordii* in Pedernales Province, breeding information for both *C. ricordii* and *C. cornuta*, and the main threats to both species in this region. Ernst has worked hard to increase the local community's participation in iguana conservation, actively involving two local conservation groups: Asociacion de Guias de la Natraleza de Pedernales (AGUIPE) and Voluntarios Comunitarios de Oviedo. He is now turning his attention to the *C. ricordii* population on the southern shore of Lago Enriquillo, where he will use many of the same methods to determine status, distribution, and threats.

In July 2004, a second workshop was held to discuss progress on the 2002 SRP and to adjust goals as needed. Grupo Jaragua, ZooDom (the Dominican national zoo), and government officials met with Quentin Bloxham, Rick Hudson, and me to go over the 2002 SRP line by line, and, once again, Grupo Jaragua stepped up, volunteering to move many of the new action steps forward. During that meeting, Yvonne was very busy, spending long hours in fighting legislation that removed protected status from a beautiful stretch of sand beach in Jaragua National Park. Unfortunately, the bill passed while we were there — but, thanks to Yvonne, significant changes were made; as of today, construction on the resort has not yet begun, and the fight continues. While Yvonne was working on this bill, Sixto and Ernst took our small party to see the habitat in Pedernales. We got to meet Salvador, viewed many active *C. ricordii* nests, and saw several adult animals. During our visit to the area, the governor of the province signed into law the first municipally protected land in Pedernales, protecting critical *C. ricordii* habitats that are not included in the nationally protected areas system — another first for Grupo Jaragua! On our way back to Oviedo, Sixto took us briefly across the border into a Haitian town — his interests include all of Hispaniola. We saw no iguanas, but the cultural differences were interesting to see, and the rum was good…

As if fighting environmentally unsound laws, establishing protected areas, and participating in a Species Recovery Plan meeting were not enough, Yvonne and Sixto treated us to a wonderful Dominican lunch at their home in Oviedo. We ate delicious food prepared by Yvonne, under the shade of native trees purposely planted in their back yard, and watched the tanks of native fish that Sixto has been breeding over the years — all in all a very special afternoon!

The bottom line here is that Sixto, Yvonne, and Ernst, and all of the other members of Grupo Jaragua, are among the most dedicated environmental conservationists in the Caribbean and maybe even the entire world. Their stated values include altruism, professional and human ethics, and respect for cultural differences. They strive to find consensual solutions and encourage the widest participation of all stakeholders. They live these values. I have truly enjoyed working with these three individuals over the past five years, and I am honored to call them my friends.

This meeting was held on 26 August of this year in Fondo Paradí, a newly created ecotourism venue in Jaragua National Park that is devoted primarily to birdwatching. Present were rangers of the National Park, the administrator of the park, the mayor of Oviedo, commanders of the Armed Forces, Oviedo Police Department, and the marine base in Cabo Rojo, and representatives of Grupo Jaragua. Participants in the meeting discussed problems and possible solutions and pledged closer coordination between the various entities represented. The meeting was deemed an overwhelming success.

TRAVELOGUE

The Rock Iguanas of Parque Nacional Isla Cabritos[1]

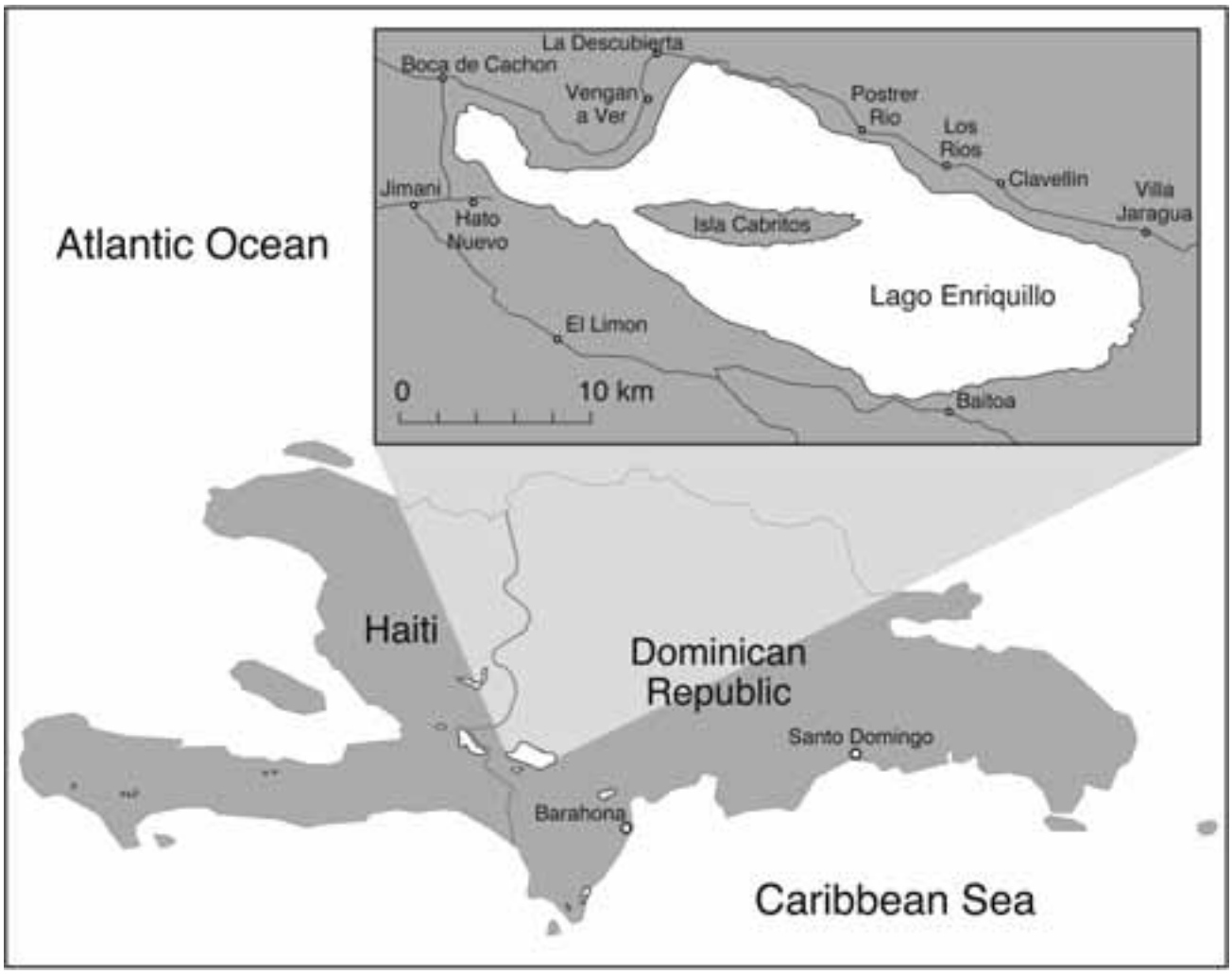
Barb L. Banbury[2] and Yanerys M. Ramos[3]

If you want to see two species of West Indian Rock Iguanas (*Cyclura* spp.) in natural habitat at the same time, your only choice of destinations is the Dominican Republic (DR). The DR shares the island of Hispaniola with the Republic of Haiti; however, the biogeographic boundaries of the island differ substantially from the current political configuration. Two major islands, referred to as the North and South paleoislands, were joined when the South Island "caught" the North Island after the latter collided with the Bahama Platform. This event probably occurred during the middle of the Tertiary Period. Reef limestones were deposited in the former marine channel that separated the two islands. This area is now a barren valley known as the Plaine de Cul-de-Sac in Haiti and the Valle de Neiba in the DR. Much of this valley lies below sea level in the rain-shadow of the Sierra de Neiba. Two of the four large lakes that

[1] Updated from an article first published in the *Iguana Times* 8(2):3–7 (summer 2000).

[2] Natural History Museum, University of Kansas, Lawrence, Kansas (current address: Department of Biological Sciences, University of Missouri-Rolla; Rolla, Missouri).

[3] Section of Neurobiology and Behavior, Cornell University, Ithaca, New York (current address: Venus Gardens, San Juan, Puerto Rico).



Parque Nacional Isla Cabritos lies in Lago Enriquillo, in the heart of the Valle de Neiba, Dominican Republic.

KIM SCHNEIDER

An adult male Ricord's Iguana (*Cyclura ricordii*) outside its burrow on Isla Cabritos. Notice the characteristic vegetation.

characterize this valley lack outlets to the sea and are saline. Powell et al. (1999) provided a summary of the geological history of Hispaniola, listing pertinent references and documenting the herpetofauna of biogeographic regions, including the Valle de Neiba.

Lago Enriquillo is a hypersaline lake situated 40 m below sea level. It is named after a native-American Taino chieftain who successfully resisted Spanish efforts to enslave the indigenous population during the early colonial period. Annual temperatures in the area average 28 °C (Hoppe 1989), although daily temperatures often exceed 40 °C during the summer months. Average annual rainfall is only 642 mm, most of which falls during two "rainy seasons," one in late spring and the other in late summer and early fall (the latter associated with the hurricane season).

A small island (12 x 2.0–2.5 km), Isla Cabritos, lies in Lago Enriquillo. It was incorporated into the Dominican system of national parks in 1974, and serves as a sanctuary for a flora and fauna that include a number of species endemic to Hispaniola. The plant community on the island is characterized as dry thorn forest — and just about every plant is equipped to stick, stab, or scratch the unwary hiker. Cacti, including the tree cactuses, Caguey (*Neoabottia paniculata*) and Alpargata (*Opuntia moniliformis*), Cholla (*Opuntia caribaea*), and a tall cactus locally known as Cayuco (*Cereus hexagonus*), fill gaps between scrubby trees. The most common trees are Mesquite (*Prosopis juliflora*), Ziziphus (*Ziziphus rignoni*), and Catalpa (*Catalpa longissima*) (Hoppe 1989).

Birds and reptiles are the most conspicuous components of the island fauna. Sixty-two species of birds have been recorded (Hoppe 1989). Hispaniola's largest flock of Greater Flamingos (*Phoenicopterus ruber*) feed on arthropods and mollusks, and Great Blue Herons (*Ardea herodias*) and Little Blue Herons (*Egretta caerulea*) fish the shallows. Glossy Ibis (*Plegadis falcinellus*) and Roseate Spoonbills (*Ajaia ajaja*) frequent the shores, and Hispaniolan Palm Crows (*Corvus palmarum*) call raucously while carefully surveying visiting humans in hopes of soliciting (or stealing) a handout. The most famous inhabitants of the island, however, are the large, endangered reptiles, American Crocodiles (*Crocodylus acutus*), Rhinoceros Iguanas (*Cyclura cornuta*), and Ricord's Iguanas (*Cyclura ricordii*).

In the summer of 1999, we were part of a National Science Foundation-funded undergraduate research program working in the Dominican Republic. In the course of our three-week-long studies of lizard communities, we made arrangements with the National Park Service (Dirección Nacional de Parques) to take a day off and visit Isla Cabritos to see crocodiles and iguanas in their natural habitat.

On 12 June 1999, we left our base in Barahona well before dawn in order to catch an early boat to the island. The boat drivers generally prefer to return by early afternoon before the offshore winds, funneled through the valley from the east, kick up high waves. The morning was cloudy and surprisingly cool, exceedingly pleasant for humans, but less than ideal if you are searching for basking reptiles. Nonetheless, we had high hopes for success — and were almost immediately rewarded. While we were still waiting on the dock as the drivers were preparing the boat for our trip, we saw a small crocodile swimming nearby. Although not visibly disturbed by our presence, it swam away slowly, submerged, and we didn't see it again.

After an uneventful crossing, we docked on the north side of Isla Cabritos and took a trail that led us to the park station. Cicadas and the ubiquitous crows serenaded us as we wound our way along the path through the prickly vegetation. The ground underfoot was sandy, but often gave way to large areas of darker consolidated rock. Upon close examination, we observed that both rock and sand were composed of coral and shell fragments, relics of the ancient sea life inhabiting the former marine channel. After a short stop at the park station, our driver, now in the role of guide, led us toward the south side of the island to a beach where crocodiles frequently bask.

Along the way, our guide took us on a short detour to look for iguanas. Almost instantly, we spotted a large male *Cyclura ricordii*. Although we had been alerted to watch for iguanas, we were unabashedly amazed by his size and demeanor. We took some pictures, but the ruckus raised by our excited group scared the iguana back into its burrow. A short walk later, we arrived at the beach. Cautioned to remain quiet, as the crocodiles are very sensitive to human disturbance, we approached from behind some vegetation along a shoreline dune. Unfortunately, no crocodiles were basking, but a large individual was swimming just off the beach. Although it continued to swim away, we got a good look through binoculars and snapped some pictures.

The range of the American Crocodile includes coastal regions of southeastern North America, Central America, northwestern South America, Cuba, Jamaica, and Hispaniola. The species was once very abundant in Hispaniola, but is now found only at Lago Enriquillo and in the nearby Haitian lake, Etang Saumatre. The depletion of populations has mainly been the result of habitat destruction, hunting, and nest poaching (Schubert and Santana 1996). At Lago Enriquillo, nesting sites are scattered along the main shoreline and along the shores of Isla Cabritos. After hatching, the baby crocodiles, which cannot tolerate the high salinity of the lake, must move from the nesting beaches to fresh water habitat. Crocodile mothers nesting on Isla Cabritos have to carry their babies from the nesting beaches to areas where freshwater springs, called borbollones, empty into the lake. We visited Isla Cabritos at the end of the nesting season and saw an empty nest, littered with egg fragments.

On the way back from the beach, we stopped again at the iguana burrow and found that the iguana had re-emerged and was sitting in a small patch of sunlight. This time we were quieter and everyone had a chance to take pictures and admire this beautiful animal for a few minutes.

Cyclura ricordii is endemic to Hispaniola, where it can be found in the Valle de Neiba and on the lower Península de Barahona, where apparently separate populations occur near Pedernales and along the southern shore of Lago Enriquillo. Although the species is common on Isla Cabritos, thanks to the legal protection provided by the island's status as a national park, other populations in Hispaniola are of uncertain size and may

BARB BANBURY

An adult male Ricord's Iguana (*Cyclura ricordii*) outside its burrow on Isla Cabritos.

JOHN BINNS

An adult American Crocodile (*Crocodylus acutus*) in Lago Enriquillo off the southern shore of Isla Cabritos.

be declining. The separate populations probably are genetically as well as geographically isolated from each other, rendering the threat of extirpation more serious, since unique gene pools could be lost forever. Because it is more of a habitat specialist than *C. cornuta*, *C. ricordii* is more susceptible to alterations in its habitat. Other threats include predation by and competition with exotic species, and hunting (J.A. Ottenwalder, pers. comm.). Captive breeding programs were established in the early 1990's at the Indianapolis Zoo and Parque Zoológico Nacional (ZooDom) in Santo Domingo (Christie 1996), but became inactive within a few years due to a lack of animals (W. Christie, pers. comm.). Since the level of success in these programs was low (J.A. Ottenwalder and W. Christie, unpubl. data), better captive husbandry techniques needed to be developed. In 1999, a successful breeding program was reestablished at ZooDom to help ensure a future for this species.[4] Major threats to *C. ricordii* on Isla Cabritos are nest predation by feral cats, and competition for forage with mammalian herbivores that cross the land bridge connecting the island to the shore during dry periods.

In the meantime, the weather had cleared and the day was heating up, so we went looking for *C. cornuta*. Our guide led us to a regularly visited burrow. Almost immediately, we saw a female, but she quickly retreated. This burrow was situated under a limestone ledge, like most of the others we were to see. Ledges or the root systems of trees or bushes provide necessary support for large burrows in sandy soil, which would collapse if not reinforced. While continuing our search, one member of the group spotted a big male. Unlike the other individuals we had seen previously, he was not at all shy. Instead, he walked directly toward us before apparently losing interest and wandering away. The guide told us that this male, named "Pancho" by the guides, and a few other individuals had grown accustomed to human visitors and their handouts. This might not have been the most natural behavior, but it was an excellent opportunity to get a close look. On the way back to the dock, we saw several more

[4] See article on p. 222.

ROBERT POWELL

An adult male Rhinoceros Iguana (*Cyclura cornuta*) named "Pancho" by local guides.

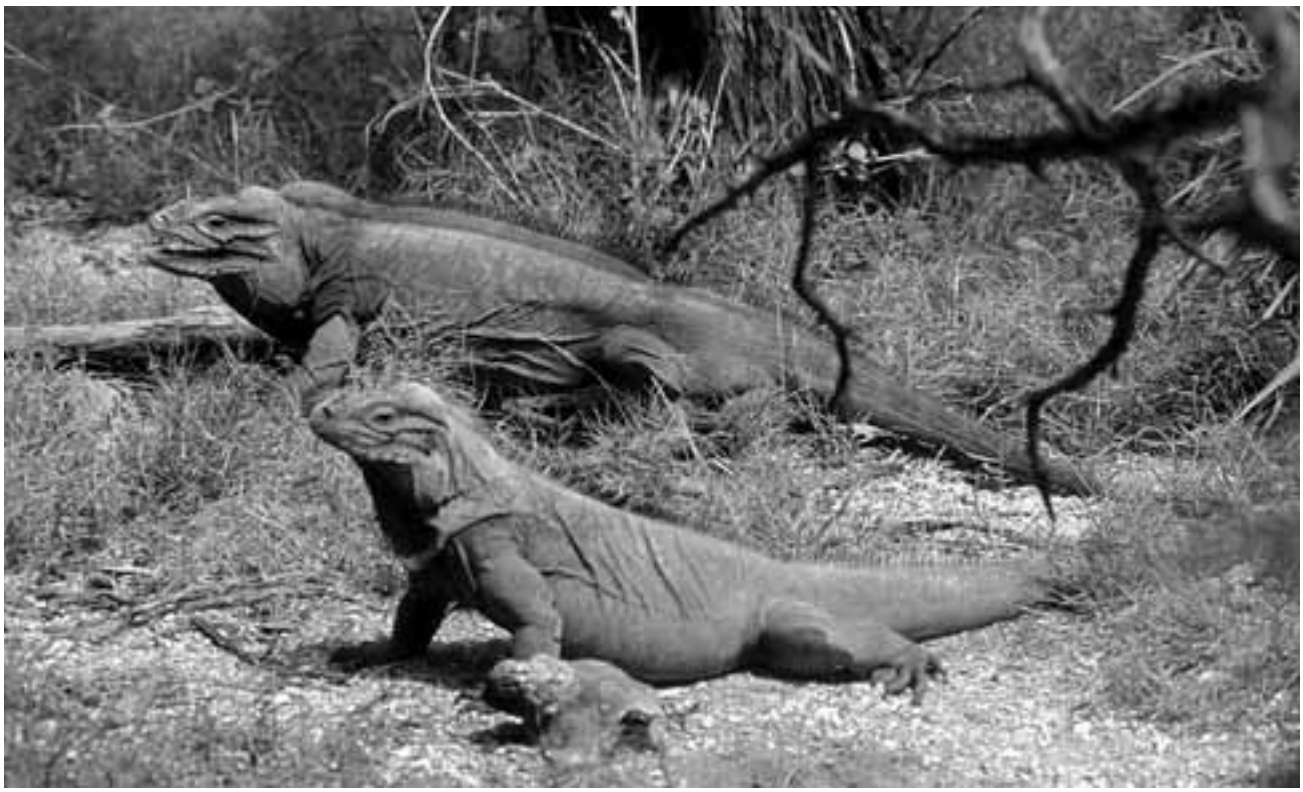
Rhinoceros Iguanas and a female *C. ricordii*, most basking just outside their burrows. As they were less accustomed to visitors than Pancho, we were careful to maintain our distance.

Prior to the early 1950s, *C. cornuta* was very common in the arid areas of Hispaniola, but populations have declined substantially (Ottenwalder and Powell 2002). Even though the preferred habitat of *C. cornuta* is not favorable to human settlements, the introduction of exotic animals has increased the competition with and predation on the iguanas. They have also been illegally hunted for food and the pet trade. Because Isla Cabritos is protected, it is one of the few areas where population densities appear to be near what are assumed to be pre-Columbian numbers.

On the boat ride back to the mainland, we stopped by the borbollones to look for more crocodiles. Instead, we got a close look at flamingoes. One of them took off and flew over our

JOHN BINNS

Birds are conspicuous residents of Lago Enriquillo. Most birds in this view are either Great (*Ardea alba*) or Snowy Egrets (*Egretta thula*). A few Greater Flamingos (*Phoenicopterus ruber*) and Black-necked Stilts (*Himantopus mexicanus*) are evident, and a single Little Blue Heron (*Egretta caerulea*) can be seen in flight (upper left). Notice also the American Crocodile (*Crocodylus acutus*) in the foreground.



ROBERT POWELL

Male Rhinoceros Iguana (*Cyclura cornuta*) courting a prospective mate.

JOHN BINNS

Adult female Ricord's Iguana (*Cyclura ricordii*) on Isla Cabritos.

JOHN BINNS

Female Rhinoceros Iguana (*Cyclura cornuta*) outside her burrow on Isla Cabritos.

heads (Fig. 10). When we returned to the mainland, several people were waiting to visit the island. Most were Dominicans, testament to the growing awareness of the unique ecological value of the Lago Enriquillo area. Educational programs presented locally through slide shows and nationally on television illustrate natural communities and feature endangered species. Posters and brochures about the lake and its species are to be distributed throughout the country (Schubert and Santana 1996). This heightened awareness among Dominicans is critical to the success of any conservation efforts.

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Getting to Lago Enriquillo from Santo Domingo requires a 2½–3 hour drive, taking the road toward Barahona, turning right on the road to Neiba and continuing to La Azufrada. At La Azufrada, you can hire for a modest fee one of the commercial boats or one of the Parques boats to take you to the island. Inexpensive park permits can be acquired at the main office of Dirección Nacional de Parques in Santo Domingo or at La Azufrada. The closest tourist accommodations are about one hour away in the town of Barahona. However, pensions and a few very modest hotels can be found in the nearby town of La Descubierta, along with some small restaurants, the best of which is at the "Hotel Iguana," where the more intrepid traveler may want to stay.

JAN RAMER

Although not normally considered to be human commensals, some Dwarf Geckos, such as this *Sphaerodactylus altavelensis enriquilloensis*, seem to seek out human companionship. This photograph was taken at the Hotel Iguana in La Descubierta, near Lago Enriquillo.

SPECIES PROFILE

Hispaniolan Vinesnakes

Robert Powell[1] and Robert W. Henderson[2]

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[2]Section of Vertebrate Zoology, Milwaukee Public Museum, Milwaukee, Wisconsin

The term "vinesnake" applies to several genera of long, slender, usually arboreal snakes and is descriptive rather than taxonomic (i.e., vinesnakes look alike but are not necessarily related). On Hispaniola, one endemic genus (*Uromacer*) includes three species that share the structural characteristics of all vinesnakes, are mostly arboreal (even sleeping coiled on the ends of branches), and are egg-laying opisthoglyphs (rear-fanged).

Uromacer catesbyi reaches a maximum snout-vent length (SVL) of about 0.8 m. Adults are bright green, with or without light lateral lines; hatchlings have green heads but gray to tan bodies. Although elongate, these snakes are much less slender than their congeners. A wider head and a stouter body facilitate capture and consumption of relatively large prey, including many treefrogs. Other prey items are invariably lizards, usually anoles. These snakes spend most of their time in trees, but may engage in extensive forays on the ground. Individuals employ both sit-and-wait (for anoles) and active (for treefrogs) foraging strategies. This species is found islandwide on Hispaniola.

Uromacer oxyrhynchus reaches a maximum SVL of about 1.5 m. Most adults are green above and tan below, but some individuals are entirely green and a very few entirely tan. All possess white lateral lines that extend almost the entire length of the body. These snakes feed exclusively on lizards, mostly anoles, but also on ground-dwelling *Leiocephalus* and *Ameiva*. The species is widely distributed across the North Paleoisland (north of the Cul-de-Sac Plaine/Valle de Neiba), although it has successfully invaded the South Island.

Uromacer frenatus reaches a maximum SVL of a little less than 1 m. Heads are usually green, but body color may vary from green to gray to tan or brown. If lateral lines are present, they fade before reaching midbody. These exceedingly elongate snakes feed exclusively on lizards, especially anoles, but also substantial numbers of terrestrial *Leiocephalus* and *Ameiva*. Although largely arboreal, individuals may assume a sit-and-wait posture near the ground, waiting for ground-dwelling lizards. These snakes are widely distributed across the South Paleoisland and Île-de-la-Gonâve.

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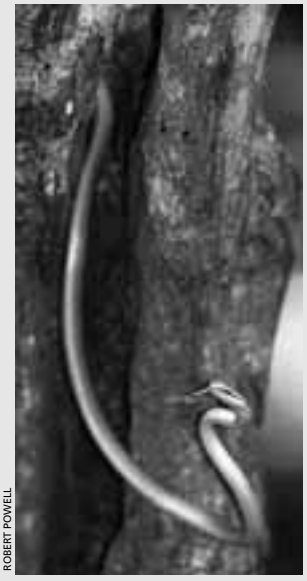
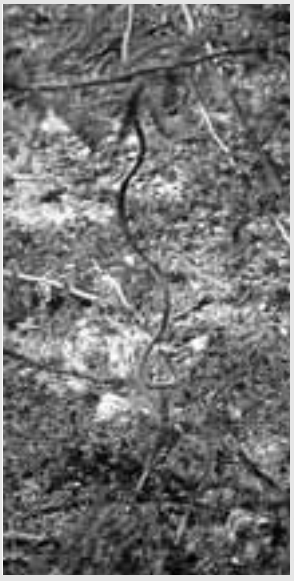

ROBERT POWELL


ROBERT POWELL


SUZANNE L. COLLINS, CNAH


ROBERT POWELL

A relatively blunt head and stout body allow *Uromacer catesbyi* (left) to consume large prey. The long snout, green color, and a longitudinal light line to disrupt the snake's shape allow *U. oxyrhynchus* (center) to blend effectively into its surroundings. Very slender *U. frenatus* (right) adopts a sit-and-wait foraging pose near the ground in order to prey on terrestrial lizards.

HISTORICAL PERSPECTIVE

The Herpetology of Hispaniola[1]

Doris M. Cochran

INTRODUCTION

This study of the herpetology of Hispaniola has been undertaken for the purpose of advancing the survey of the amphibian and reptile fauna of the Greater Antilles. Of these islands Hispaniola has remained the least known faunistically until the past two decades, during which time thorough collecting in certain regions has multiplied the number of species known to science. Although undoubtedly a great many more species, and perhaps even some genera, remain to be discovered in areas in which little collecting has so far been done,[2] it is hoped that the following keys, descriptions, and figures of the species already known from Hispaniola may prove to be a stimulus to further discoveries.

Hispaniola, with the adjoining islets, now divided between the Republic of Haiti and the Dominican Republic, has been referred to by earlier writers as San Domingo, St. Dominique, Santo Domingo, Hayti, and Haiti. When such names are used without any specific river or town or other geographic feature that might serve to locate them definitely, it is often impossible to say whether it was the intention of the author to refer to the entire island or to either one of its political subdivisions, properly spoken of as the Republic of Haiti and the Dominican Republic. The old name of Hispaniola is now taken to refer to the island as a whole and the adjoining islets Gonave, Tortue, Sept Frères, Saona, Alta Vela, Beata, Île à Vache, and the Cayemites. In the locality lists the abbreviation "D. R." refers to the Dominican Republic, and "Haiti" to the Republic of Haiti alone. Equivocal records are given in quotation marks. While the island of Navassa[3] is not included in this survey, figures of the types of the two Navassan reptiles, *Typhlops sulcatus* and *Celestus badius*, will be found in the discussion of their apparent allies in Hispaniola.

For the loan of specimens my thanks are due to Dr. Thomas Barbour[4], of the Museum of Comparative Zoology; to Mrs. Helen T. Gaige, of the Museum of Zoology at Ann Arbor; and to K. P. Schmidt, of the Field Museum. I am indebted to Dr. G. K. Noble, of the American Museum of Natural History, for the loan of several paratypes, and to Dr. E. R. Dunn for specimens in the Academy of Natural Sciences of Philadelphia. I have borrowed some Leiocephali from the British Museum, which Boulenger had listed, and H. W. Parker kindly furnished me with lists of other specimens in that museum, while I was later allowed to examine these specimens and those in several other European collections during a visit in 1938. My sincere thanks are due to Dr. Leonhard Stejneger, of the United States National Museum, whose unfailing interest, encouragement, and assistance in the many problems involved have made the completion of the work possible.

Most of the figures for this Herpetology of Hispaniola were made by me from photographs. In a few instances, where the specimens were mutilated or otherwise unsuited to photography, the drawings are freehand. When figures have been copied from earlier publications, credit is given in the legends.

PHYSIOGRAPHY

An excellent summary of the geographical features of Hispaniola appeared in "The Birds of Haiti and the Dominican Republic," by Dr. Alexander Wetmore and Bradshaw H. Swales [U. S. Natl. Mus. Bull. 155, pp. 2–7, 1931]. There is little to add to their discussion, except to remark that the extremely rugged character of the island's surface has proved to be a very effective means of isolation to certain genera of amphibians and reptiles, so that a truly astonishing number of entirely localized forms is often found within a relatively restricted area.

The Massif de la Selle Mountains, whose tops were islands when the Cul-de-Sac Plain was below sea level, supplies a good example of this condition, for within the past few years two new genera of lizards and a new genus of snakes have been found on Peak La Selle.

Another interesting evidence of specialization carried out to subspecies is found in the genus *Leiocephalus*. No less than 11 distinct subspecies of the *personatus* group are now known from Hispaniola as a whole — seven from the mainland and one each from four of the adjoining islets.

The snakes of the genus *Leimadophis* [= *Antillophis*] have the tendency to local specialization to nearly the same degree, as

[1] Excerpted from the *United States National Museum Bulletin* (177): vii + 398 pp. (1941). This long out-of-print book will soon be available as The Center for North American Herpetology Facsimile Reprint Series, Number 1 (check www.cnah.org for availability).

[2] For a more recent list of Hispaniolan species of amphibians and reptiles, see: Powell et al. 1999. The Hispaniolan herpetofauna: Diversity, endemism, and historical perspectives, with comments on Navassa Island, pp. 93–168. In: B.I. Crother (ed.), *Caribbean Amphibians and Reptiles*. Academic Press, San Diego, California.

[3] For more information about Navassan reptiles, see: Powell. 1999. Herpetology of Navassa Island, West Indies. *Caribbean Journal of Science* 35: 1–13 (www.caribjsci.org) or www.avila.edu/biology/Bobweb/6pownav.htm.

[4] See *Iguana* 12:43–47.

seven subspecies of the *parvifrons* stock can be recognized, three rather poorly separated forms from the present main body of the island and four rather distinct forms from outlying islets. An example of the effect of the removal of a natural barrier is evident here. Almost within the memory of the oldest inhabitant, Samaná Peninsula was an island separated from the main body of Hispaniola by a rapidly filling strait, in which pirate vessels were said to have lain in wait for richly laden merchantmen sailing for Europe. On this island a black form of *Leimadophis* developed. The melanistic color is found in a good many of the *protenus* specimens from the northeastern part of the Dominican Republic, and, as a matter of fact, it is at present very difficult to find a satisfactory basis for the separation of *niger* and *protenus* as subspecies, since so many intergrading specimens now exist in the lowlands lying between the areas once separated by stretches of sea.

DISTRIBUTION OF GREATER ANTILLEAN GENERA

In table 1 are listed the genera occurring on the neighboring islands of the Greater Antilles. Hispaniola has 19 genera in common with Cuba. Cuba has 10 genera that Hispaniola lacks, but, on the other hand, Hispaniola has 13 genera not found in Cuba.

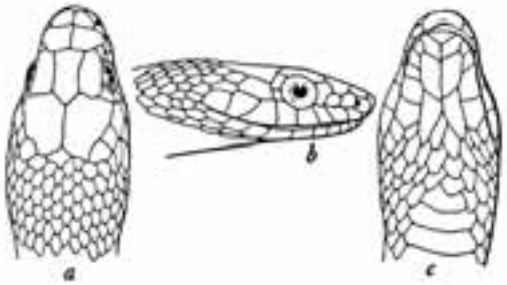
Hispaniola and Jamaica have 19 genera in common. Jamaica has no genus that is not also found in Hispaniola, while Hispaniola has 13 that do not occur in Jamaica — a condition perhaps to be expected as Hispaniola is so much the larger of the two islands.

The tiny isolated rock called Navassa supports 10 genera, all of which are represented in Hispaniola, including the highly specialized iguanid genus *Chamaelinorops* [now included in *Anolis*, and no longer believed to occur on Navassa], which is not known from any other localities except Navassa and western Haiti.

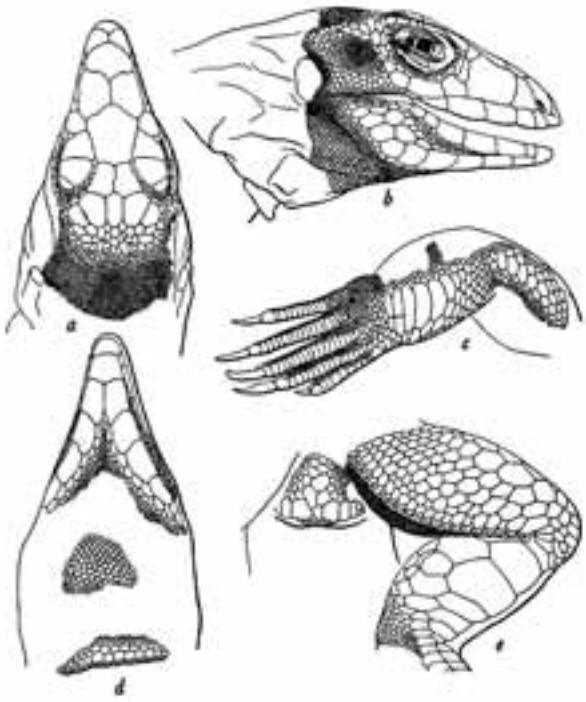
Surveying the islands east of Hispaniola, we find that Puerto Rico has only one (nonendemic!) genus — *Phyllodactylus* — which is not represented on Hispaniola [*Phyllodactylus* is now known to occur on Hispaniola], while Mona does not have a single genus peculiar to itself. Puerto Rico lacks 15 of the genera that characterize Hispaniola, while the two islands have 16 genera in common.

DISTRIBUTION OF HISPANIOLAN SPECIES

Table 2 lists the species found in Hispaniola and indicates their distribution among the various regions.



Leimadophis [= *Antillophis*] *parvifrons parvifrons* (USNM No. 60607, from Moline, Haiti).



Ameiva chrysolaema chrysolaema (USNM No. 66730, from Tubano, Azua Province, Dominican Republic). See also article on p. 234.

THE NONINDIGENOUS SPECIES

Out of 128 species and subspecies now known to inhabit Hispaniola, only 6 or 7 are not indigenous. Of the 32 known genera, 7 are found nowhere else.

Among the nonendemic forms now recorded from Hispaniola, *Bufo marinus*, which was very recently introduced, seems to be gaining a real foothold in Monte Cristi. *Hemidactylus brookii*, originally introduced from Africa with the traffic in slaves[5], has now become established in tropical America.

The same is true of *Hemidactylus mabouia*. Another gecko, *Sphaerodactylus cinereus*, is one of the commonest species in Cuba, whence it was probably transported to southern Florida, Navassa, and Haiti[6]. The slipperyback, *Mabuya mabouia sloanii*, represented very rarely in Hispaniola, is considered by Dr. Dunn (1936, p. 546) to be the same as the form occurring in the southern Bahamas, Jamaica, the Virgin Islands, Mona, and Puerto Rico[7]. *Typhlops lumbricalis* is a species of which more Hispaniolan material is needed before an ultimate decision as to

[5] See discussions in: Powell and Maxey. 1990. *Hemidactylus brookii. Catalogue of American Amphibians and Reptiles* (493):1–3, and Powell, R., R.I. Crombie, and H.E.A. Boos. 1998. *Hemidactylus mabouia. Catalogue of American Amphibians and Reptiles* (674): 1–11.

[6] Cuban and Navassan populations once considered to be *Sphaerodactylus cinereus* are no longer considered to be conspecific with the Haitian populations.

[7] The status of West Indian populations of *Mabuya* is poorly understood and in much need of work by researchers using genetic data. Currently, as many as four species are thought to occur in the region, but at least two of these may represent species complexes of uncertain complexity.

Table 1.—Distribution of Greater Antillean genera of amphibians and reptiles[1].

Genus	Cuba	Jamaica	Navassa	Hispaniola	Mona	Puerto Rico
Bufo	X	(X)	—	X	—	X
Hyla	X	X	—	X	—	
Eleutherodactylus	X	X	—	X	—	X
Leptodactylus	—	—	—	X	—	X
Sminthillus	X	—	—	—	—	—
Gonatodes	X	—	—	X	—	—
Phyllodactylus	—	—	—	—	—	(X)
Hemidactylus	(X)	(X)	—	(X)	—	(X)
Aristelliger	—	X	X	X	—	—
Tarentola	X	—	—	—	—	—
Sphaerodactylus	X	X	X	X	X	X
Chamaeleolis	X	—	—	—	—	—
Xiphocercus	—	X	—	X	—	—
Chamaelinorops	—	—	X	X	—	—
Audantia	—	—	—	[X]	—	—
Deiroptyx	X	—	—	—	—	—
Anolis	X	X	X	X	X	X
Norops	[X]	—	—	—	—	—
Cyclura	X	X	X	X	X	X
Leiocephalus	X	—	X	X	—	—
Hispaniolus	—	—	—	[X]	—	—
Celestus	X	X	X	X	—	X
Sauresia	—	—	—	[X]	—	—
Wetmorena	—	—	—	[X]	—	—
Cricosaura	[X]	—	—	—	—	—
Ameiva	X	X	X	X	X	X
Cadea	[X]	—	—	—	—	—
Amphisbaena	X	—	—	X	—	X
Mabuya	—	X	—	X	X	X
Typhlops	X	X	X	X	X	X
Epicrates	X	X	—	X	X	X
Tropidophis	X	X	X	X	—	—
Natrix	X	—	—	—	—	—
Tretanorhinus	X	—	—	—	—	—
Uromacer	—	—	—	[X]	—	—
Alsophis	X	X	—	X	X	X
Leimadophis	X	X	—	X	—	X
Hypsirhynchus	—	—	—	[X]	—	—
Arrhyton	[X]	—	—	—	—	—
Darlingtonia	—	—	—	[X]	—	—
Ialtris	—	—	—	[X]	—	—
Pseudemys	X	X	—	X	—	X
Crocodylus	X	X	—	X	—	—
Total	29	19	10	32	8	17

[1] (X) Introduced; [X] endemic.

Table 2.—Distribution of Hispaniolan species of amphibians and reptiles[1] [for a current list of the island's species, see: http://evo.bio.psu.edu/caribherp/lists/HSP-LIST.HTM].

Genus	Haiti, mainland	Sept Frères	Tortue	Gonave	Petite Gonave	Grande Cayemite	Petite Cayemite	Île à Vache	Beata	Alta Vela	Dominican Republic	Saona
Bufo güntheri	X	—	—	—	—	—	—	—	—	—	X	—
marinus	—	—	—	—	—	—	—	—	—	—	X	—
Hyla dominicensis	X	—	—	—	—	—	—	—	X	—	X	—
pulchrilineata	X	—	—	—	—	—	—	—	—	—	X	—
vasta	X	—	—	—	—	—	—	—	—	—	X	—
heilprini	—	—	—	—	—	—	—	—	—	—	X	—
Eleutherodactylus inoptatus	X	—	—	—	—	—	—	—	—	—	X	—
ruthae	—	—	—	—	—	—	—	—	—	—	X	—
jugans	X†	—	—	—	—	—	—	—	—	—	—	—
ventrilineatus	X†	—	—	—	—	—	—	—	—	—	—	—
flavescens	X	—	—	—	—	—	—	—	—	—	X	—
poolei	X	—	—	—	—	—	—	—	—	—	—	—
glandulifer	X†	—	—	—	—	—	—	—	—	—	—	—
darlingtoni	X†	—	—	—	—	—	—	—	—	—	—	—
glanduliferoides	X†	—	—	—	—	—	—	—	—	—	—	—
minutus	—	—	—	—	—	—	—	—	—	—	X	—
weinlandi	X	—	—	—	—	—	—	—	—	—	X	—
rufifemoralis	—	—	—	—	—	—	—	—	—	—	X	—
schmidti schmidti	—	—	—	—	—	—	—	—	—	—	X	—
schmidti rucillensis	—	—	—	—	—	—	—	—	—	—	X	—
abbotti	X	—	—	—	—	—	—	—	—	—	X	—
femur-levis	X†	—	—	—	—	—	—	—	—	—	—	—
pictissimus	X†	—	—	—	—	—	—	—	—	—	—	—
brevirostris	X†	—	—	—	—	—	—	—	—	—	—	—
audanti	X†	—	—	—	—	—	—	—	—	—	—	—
intermedius	—	—	—	—	—	—	—	—	—	—	X	—
semipalmatus	X†	—	—	—	—	—	—	—	—	—	—	—
montanus	—	—	—	—	—	—	—	—	—	—	X	—
bakeri	X†	—	—	—	—	—	—	—	—	—	—	—
auriculatus auriculatoides	X	—	—	—	—	—	—	—	—	—	X	—
auriculatus wetmorei	X†	—	—	—	—	—	—	—	—	—	—	—
armstrongi	—	—	—	—	—	—	—	—	—	—	X	—
Leptodactylus dominicensis	—	—	—	—	—	—	—	—	—	—	X	—
Gonatodes notatus	X	—	—	X	—	—	—	—	—	—	—	—
Hemidactylus brookii	X	—	—	—	—	—	—	—	—	—	X	—
mabouia	X	—	—	—	—	—	—	—	—	—	—	—
Aristelliger expectatus	X	—	—	X	—	—	—	—	—	X?	—	—
lar	X	—	—	X	—	—	—	—	—	—	X	—
Sphaerodactylus cinereus	X	—	—	—	—	—	—	—	—	—	—	—
copei	X	—	—	—	—	X	—	—	—	—	—	—
stejnegeri	X	—	—	—	—	—	—	—	—	—	—	—
samanensis	—	—	—	—	—	—	—	—	—	—	X	—
difficilis	X	X	—	—	—	—	—	—	—	—	X	—
armstrongi	—	—	—	—	—	—	—	—	—	—	X	—
altavelensis	—	—	—	—	—	—	—	—	—	X	—	—
Xiphocercus darlingtoni	X†	—	—	—	—	—	—	—	—	—	—	—
Chamaelinorops wetmorei	X†	—	—	—	—	—	—	—	—	—	—	—
Anolis ricordii	X	—	—	—	—	—	—	—	—	—	X	—
semilineatus	X	—	—	—	—	—	—	—	—	—	X	—
olssoni	X	—	—	X	—	—	—	—	—	—	X	—
bahorucoensis	—	—	—	—	—	—	—	—	—	—	X	—
distichus dominicensis	X	—	X	—	—	X	X	—	—	—	X	—
distichus juliae	—	—	—	—	—	—	—	X	—	—	—	—
distichus altavelensis	—	—	—	—	—	—	—	—	—	X	—	—
distichus wetmorei	—	—	—	—	—	—	—	—	X	—	—	—
distichus caudalis	X	—	—	X	X	—	—	—	—	—	—	—
cybotes cybotes	X	—	X	—	—	X	—	X	—	—	X	X
cybotes longitibialis	—	—	—	—	—	—	—	—	X	—	—	—
cybotes doris	—	—	—	X	X	—	—	—	—	—	—	—
monticola	X†	—	—	—	—	—	—	—	—	—	—	—
darlingtoni	—	—	—	—	—	—	—	—	—	—	X	—
chloro-cyanus	X	—	X	X	—	—	—	—	—	—	—	X
coelestinus	X	—	—	X	—	X	—	X	—	—	—	—
hendersoni	X	—	—	—	—	—	—	—	—	—	—	—

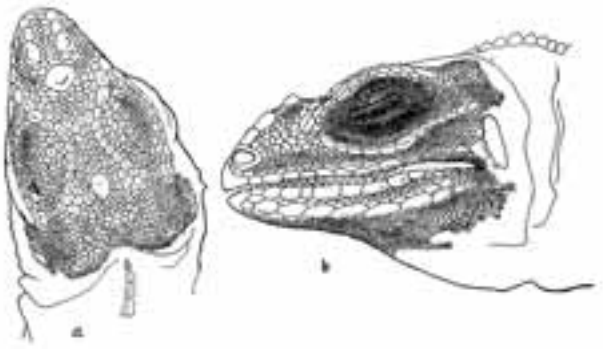
[1] A dagger (†) indicates species peculiar to the southwestern mountains of Haiti.

Table 2.—continued

Genus	Haiti, mainland	Sept Frères	Tortue	Gonave	Petite Gonave	Grande Cayemite	Petite Cayemite	Île à Vache	Beata	Alta Vela	Dominican Republic	Saona
Audantia armouri	X†	—	—	—	—	—	—	—	—	—	—	—
shrevei	—	—	—	—	—	—	—	—	—	—	X	—
Cyclura cornuta cornuta	X	—	X	X	X	X	—	—	—	—	X	—
ricordii	—	—	—	—	—	—	—	—	—	—	X	—
Leiocephalus schreibersii	X	X	X	—	—	—	—	—	—	—	X	—
melanochlorus	X	—	—	—	—	—	—	X	—	—	X	—
personatus personatus	X	—	—	—	—	—	—	—	—	—	—	—
personatus semilineatus	X	—	—	—	—	—	—	—	—	—	—	—
personatus barahonensis	—	—	—	—	—	—	—	—	—	—	X	—
personatus altavelensis	—	—	—	—	—	—	—	—	—	X	—	—
personatus aureus	X	—	—	—	—	—	—	—	—	—	—	—
personatus scalaris	X	—	—	—	—	—	—	—	—	—	X	—
personatus mentalis	—	—	—	—	—	—	—	—	—	—	X	—
personatus lunatus	—	—	—	—	—	—	—	—	—	—	X	—
personatus beatanus	—	—	—	—	—	—	—	—	X	—	—	—
personatus vinculum	—	—	—	X	—	—	—	—	—	—	—	—
personatus louisae	—	—	—	—	—	—	—	—	—	—	—	X
Hispaniolus pratensis	X	—	—	X	—	—	—	—	—	—	—	—
Celestus costatus	X	—	—	—	—	—	—	—	—	—	X	—
darlingtoni	—	—	—	—	—	—	—	—	—	—	X	—
Sauresia sepsoides	X	—	—	X	—	—	—	—	—	—	X	—
Wetmorena haetiana	X†	—	—	—	—	—	—	—	—	—	—	—
Ameiva lineolata lineolata	X	—	—	—	—	—	—	—	—	—	X	—
lineolata beatensis	—	—	—	—	—	—	—	—	X	—	—	—
taeniura	X	—	—	—	—	X	X	X	—	—	X	—
chrysolaema chrysolaema	X	X	X	X	—	—	—	X	—	—	X	—
chrysolaema woodi	—	—	X	—	—	—	—	—	—	—	—	—
chrysolaema abbotti	X	—	—	—	—	—	—	—	X	—	—	—
chrysolaema affinis	X	—	—	—	—	—	—	—	—	—	—	—
barbouri	—	—	—	X	—	—	—	—	—	—	—	—
rosamondae	—	—	—	—	—	—	—	—	—	—	—	X
Amphisbaena manni	X	—	—	—	—	—	—	—	—	—	X	—
innocens	X	—	—	X	X	—	—	—	—	—	—	—
caudalis	—	—	—	—	—	X	—	—	—	—	—	—
Mabuya lineolata	—	—	—	—	—	—	—	—	—	—	X	—
mabouya sloanii	—	—	—	—	—	—	—	—	—	—	X	—
Typhlops lumbricalis	X	—	—	—	—	X	—	—	—	X	X	—
pusillus	X	—	—	—	—	—	—	—	—	—	X	—
Epicrates striatus striatus	X	—	X	—	—	—	—	X	—	—	X	—
inornatus fordii	X	—	—	X	—	—	—	—	—	—	X?	—
gracilis gracilis	X	—	—	—	—	—	—	—	—	—	X	—
Tropidophis maculatus haitianus	X	—	X	X	—	—	—	—	—	—	X	—
Uromacer catesbyi	X	—	X	X	—	—	X	X	—	—	X	—
scandax	—	—	X	—	—	—	—	—	—	—	—	—
frenatus	X	—	—	—	—	—	X	X	—	—	X?	—
wetmorei	—	—	—	—	—	—	—	—	X	—	—	—
dorsalis	—	—	—	X	—	—	—	—	—	—	—	—
oxyrhynchus	X	—	X	X	—	—	—	—	—	—	X	—
Hypsirhynchus ferox	X	—	—	—	—	—	—	—	—	—	X	—
Alsophis anomalus	X	—	X	—	X	—	—	—	—	—	X	—
melanichnus	X	—	—	—	—	—	—	—	—	—	X	—
Leimadophis parvifrons parvifrons	X	—	—	—	—	—	—	—	—	—	—	—
parvifrons lincolni	—	—	—	—	—	—	—	—	X	—	—	—
parvifrons niger	X	—	—	—	—	—	—	—	—	—	X	—
parvifrons protenus	X	—	—	—	—	—	—	—	—	—	X	—
parvifrons alleni	—	—	—	X	—	—	—	—	—	—	—	—
parvifrons tortuganus	—	—	X	—	—	—	—	—	—	—	—	—
parvifrons rosamondae	—	—	—	—	—	—	—	X	—	—	—	—
Darlingtonia haetiana	X†	—	—	—	—	—	—	—	—	—	—	—
Ialtris dorsalis	X	—	—	—	—	—	—	X	—	—	X	—
parishi	X	—	—	—	—	—	—	—	—	—	—	—
Pseudemys stejnegeri vicina	X	—	—	—	—	—	—	—	—	—	X	—
decorata	X	—	—	—	—	—	—	—	—	—	—	—
Crocodylus acutus	X	—	—	—	—	—	—	X	—	—	X	—

[1] A dagger (†) indicates species peculiar to the southwestern mountains of Haiti.

its status can be made. *Crocodylus acutus* is found in Cuba, Hispaniola, Jamaica, Florida, and Central America.



Cyclura cornuta (USNM No. 82107, from Petite Gonave Island, Haiti). See also article on p. 222.

SPECIES ERRONEOUSLY RECORDED FROM HISPANIOLA

The type of *Spelerpes infuscatus* Peters, now in the Berlin Museum (No. 6556), supposedly from "Hayti," has been positively identified by Dr. E. R. Dunn as *Oedipus lineolus* Cope and hence must have come from Mexico (Dunn, 1926). The intensive collecting done during the past few years leaves little expectation of finding any endemic tailed amphibians in the West Indies.

Hispaniolan records of *Eleutherodactylus auriculatus* Cope are undoubtedly based on misidentifications of the several small frogs that bear quite a close resemblance to the rather variable true *auriculatus* of Cuba.

Boulenger's record of a *Dendrobates trivittatus* (1882, p. 145) from "S. Domingo" is probably based on an incorrect locality record, as no true *Dendrobates* is to be expected so far out of its range.

BIOGRAPHICAL SKETCH

Doris M. Cochran (1898–1968)[1]

Doris Mable Cochran was a specialist in Neotropical herpetology and was for many years the custodian of the American national collection at the Smithsonian Institution in Washington, D.C. Her interest in natural history began as a child growing up in a small town near the shores of Lake Erie and, while still an undergraduate at George Washington University (A.B. 1920, M.S. 1921), she became Aide in the Division of Herpetology at the United States National Museum. Although formally under the curatorship of Leonhard Stejneger, Cochran was responsible for the day-to-day administration of the herpetological collections. In 1927, she became Assistant Curator and, in 1942, Associate Curator, before formally taking charge of the collections after Stejneger's death in 1943. In the interim, she earned a Ph.D. at the University of Maryland (1933) with a thesis on crab myology. Eventually promoted to Curator in 1956, she retired in 1968, and died less than a month later.

Cochran's research emphasized the herpetofaunas of southeastern Asia, the West Indies, and South America, particularly those of Brazil and Colombia. She published nearly 90 titles from 1922–1970, most of them short taxonomic papers describing new genera (8) and species and subspecies (125). Her interest in the West Indies spanned a 20-year period and culminated in *The Herpetology of Hispaniola* (1941). Subsequently, she focused most of her attention on South American frogs, about which she published many papers and two books, *Frogs of Southeastern Brazil* (1954) and *Frogs of Colombia* (1970), the latter published posthumously with her longtime collaborator, Coleman J. Goin. She also wrote numerous semi-popuular articles and some wartime booklets for use by the military. Her most widely known book was the profusely illustrated *Living Amphibians of the World* (1961), which was translated into at least ten languages. *The New Field Book of Reptiles and Amphibians* (1970), coauthored with Goin, was not successful and never competed seriously with existing North American field guides by Roger Conant and Robert C. Stebbins.

Doris M. Cochran (photograph courtesy of Kraig Adler).

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

COMMENTARY

The Case Against Captive Reptiles and Amphibians

Ann-Elizabeth (Ae) Nash, Director

Colorado Reptile Humane Society (CoRHS)
(www.corhs.org)

Photographs by the author.

Keeping animals as pets is an accepted facet of American society. Domestic cats hold the number one spot followed by dogs, rodents and rabbits, birds, and finally, reptiles. Approximately 10% of the US population keeps reptiles and amphibians as pets: 3 million 'herps' are in private ownership. What is the state of affairs for captive reptiles and amphibians? How are reptiles and amphibians like other pet animals and how are they different? Are necessary resources available? These include veterinary attention, knowledgeable husbandry practitioners, nutritious foods, and useful supplies for owners to care for their pets properly. Simply stated, can we do a good job for a captive herp? If not, why? What are the consequences of our failures?

Ray Ashton's "Commentary from an Old Naturalist About Exotic Species and a New Herpetocultural Ethic," (*Iguana* 12(1), March 2005) inspired me to think anew about reptile- and amphibian-related animal welfare and conservation issues. While we warrant a new ethic toward this group of animals, my conclusions start and end at a very different spot: I am a "new herper" who hopes to end the practice of keeping reptiles and amphibians in captivity.

Pablo is a recent arrival at Colorado Reptile Humane Society (CoRHS). Even among the few Green Iguanas that survive captivity, few live out their entire natural lifespan of 20–30 years in the care of a single owner.

Ashton referred to himself as an 'old naturalist' interested in reptiles and amphibians since childhood, and one of a small minority whose curiosity had been piqued by these animals. Conversely, 'new herpers' may come later to such interests and are more easily able to join study societies, interest groups, and have other resources available that simply didn't exist a generation ago.

In his commentary, Ashton ostensibly offers seven useful and logical steps toward responsible reptile and amphibian ownership. These ideas are often repeated in hobby journals, internet groups, and countless herpetological societies. Using the Green Iguana (*Iguana iguana*), a very common and most neglected, discarded, unwanted, and abused reptilian pet for the basis of my discussion, we can see that Ashton's set of rules is difficult to follow or achieve.

1. **Learn about your pet.** Purchasing and reading a book about the common Green Iguana won't necessarily provide an owner with correct, up-to-date husbandry information. Some publishers are unscrupulous about their editions, updating a photo here and there so a new copyright date hides gross inaccuracies. New books can also be poorly written and edited, directing a motivated owner toward a potentially fatal husbandry mistake. Few single sources provide all the knowledge we need about any one species.
2. **Only purchase captive bred animals.** Discussions regarding Captive Bred (CB) versus Wild Caught (WC) are largely rhetorical. Removing wild animals for introduction into the pet trade will negatively effect a wild population. Yet, we rarely consider the fate of CB reptiles and amphibians. Questions remain — how well can we care for a CB reptile or amphibian? Is our care humane? Potential suffering of a CB animal must be considered of equal importance to that of a wild-caught animal.
3. **Provide secure caging and lighting.** We can build escape-proof cages and provide UVB lighting — but we do not yet

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

know how much UVB lighting is enough or too much. Many other habitat elements also need consideration: climate, seasonal weather, visual breaks, height versus area, etc.

4. **Provide appropriate food.** Nutritional research focused on longevity versus breeding is scarce, as are commercially available diets based on such research. Most owners cannot offer natural foods for *I. iguana* in captivity. It is time-consuming and tiresome to prepare fresh foods daily.
5. **Consider habitat size.** What percentage reduction in space is tolerable when housing a lizard that typically roams an acre of area in its natural habitat? If we house a single adult *I. iguana* in a bedroom (10 x12' = 120 sq. ft.), we've removed more than 99.7% of its normal home range. Is this acceptable? Even a 2000 sq. ft. house represents only 5% of a normal habitat.
6. **When you need to 'get rid of' your pet.** No animal should be sent to an uncertain fate, released in a park, a stream, from a moving car, or any other cruel method that causes unnecessary stress, injury, or death. Animal welfare thinking encourages pet ownership *for the life of the pet*, not the fluctuating interest of the owner. Is a profit-motivated pet store a good avenue for an unwanted animal? Shelters and rescuers are unable to re-home all Green Iguanas that come through their doors. No one wants another iguana. Euthanasia is often the outcome when an owner "exit strategy" is implemented.
7. **Avoid confrontations with non-herpers.** Respecting your neighbors always makes sense when you house any animal. No one likes a barking dog, bird killing 'barn cat,' or other at-large pet. Fear of snakes is especially deeply felt, regardless of legitimate danger. However, negative reactions from individuals or politicians should not be seen as unthinking. Many concerns about keeping wild animals as pets are reasonable.

Reptiles and amphibians are readily available for sale or trade from outlets that include retail stores, internet sellers, and breeder's shows. In my home state of Colorado and other states in the US, certain species may be legally taken from their wild habitats and held in captivity. The average owner follows few of the points outlined in Mr. Ashton's list, purchasing whichever reptile or amphibian they desire with little or any research regarding care, longevity, and nutrition. However, even the most dedicated and educated owners, supporting the pet trade through the purchase of a CB reptile or amphibian, subject a wild animal to a life of imprisonment and often a reduced life span, even in the absence of predators. Why is this acceptable?

We have not truly domesticated any reptile or amphibian; I will therefore conclude that CB animals are as wild as their WC counterparts. CB reptiles and amphibians may be more or less acclimated to life near or with humans; they may or may not display aggressive behaviors to territorial intruders or other encounters and experiences. They may or may not make 'good' wild animals since, as often as not, breeders keep alive every hatchling regardless of fitness. To declare an animal unable to withstand the pressure of a life in its wild habitat does not make it any less wild. The individual animal would have simply met demise early in its natural life.

A malformed Three-toed Box Turtle (*Terrapene carolina triunguis*) suffered from an insufficient diet and a lack of ultraviolet light.

Moving from the difficulties of caring for reptiles and amphibians in captivity, a far more important question needs addressing: On what grounds do we humans have the right to impose captive conditions on wild animals? Combined with the problems of invasive exotic species, Mr. Ashton should not be surprised that some 'new herpers' wish to curtail reptile and amphibian ownership for both the wild animals themselves and for good stewardship of native populations. While we may possess a legal right to keep reptiles and amphibians in captivity, I suggest that we lack the moral right to keep a wild animal captive for our own personal benefit or other financial or emotional needs, whether it is captive bred or wild caught.

Much of my ethos regarding reptiles and amphibians stems from experiences as the founder and director of a small humane society in Colorado that is dedicated to this group of animals. Through my work, I have personally appreciated many reptiles and amphibians. From this familiarity has grown a profound sadness for these wild animals that are captive solely as a consequence of human folly.

The new generation of reptile and amphibian owners does not share any values beyond possession — any more than Ford automobile owners or ice cream purchasers constitute a distinct socio-economic, other demographic, or moral class. Old herpers, Mr. Ashton declares, were interested in learning about wild animals — "but were also excited about keeping them in captivity." I have no doubt that this is true. Keeping and breeding reptiles and amphibians generated great enthusiasm among pet owners — but at what cost to the animals? I am confident that a thorough investigation will clearly answer Mr. Ashton's shock toward those of us who would see the end of the worldwide trade in reptilian and amphibian pets:

- When the best and most resourceful owners cannot provide even a small percentage of the real estate a wild animal has in its natural habitat, we have failed that animal.
- When nutrition research focused on longevity (not breeding) is scarce, when the foremost veterinary medical text is a mere 512 pages for all species of reptiles and amphibians,

when we have no antibiotics or other drugs designed for even a single species, we have failed.

- When reptile and amphibian owners cause immense suffering and death to at least 500,000 Green Iguanas each year in the US alone — and who knows the numbers for other species — we have failed.
- When we refuse to recognize that most captive-breeding programs bring into existence wild animals doomed to a life in captivity, we have failed.

After seven years of sheltering and euthanizing unwanted reptiles and amphibians, I would suggest that the average individual with a typical amount of space, time, and funds is simply not equal to the responsibilities of owning a pet reptile or amphibian — even if it began as an appropriate endeavor. In fact, most reptile and amphibian owners surrendering their animals to the Colorado Reptile Humane Society can probably tell you more about the attributes of their cell phone and calling plan contract than the live animal of which they now wish to rid themselves. Like all bell curves, a few humans do a great job for their pets, a few would meet a legal definition as perpetrators of cruelty, and the great majority provide mediocre care. Mediocre care to millions of reptiles and amphibians seems to me something old naturalists and new herpers ought to oppose collectively. Does the fact that an amphibian or reptile was captive-bred really matter?

Can we learn from our myriad failures and experiences? Some will answer that better research will yield the knowledge we presently lack, that educated owners will improve husbandry issues, and that we can protect our native ecosystems from invasive species. My experiences tell me otherwise. On a typical afternoon at the Colorado Reptile Humane Society's shelter, one owner who 'got rid of' his Bearded Dragon (*Pogona vitticeps*) because she was 'too boring' was already planning the purchase of a chameleon. Another owner brought forth an iguana with an advanced type of metabolic bone disease, misdiagnosed by a veterinarian. The owner had provided UVB lighting, but it was too far away from the lizard to be useful. Red-eared Sliders (*Trachemys scripta*) are dumped by the dozens after outgrowing aquaria that were never large enough. Who is going to house an unwanted (and unsocialized) 4.5' Black-throated Monitor (*Varanus albigularis* spp.)? He was surrendered because his fecal material "smelled bad." Owners do not often advance their own education beyond "Cool — a reptile!" These animals forfeit their natural lives on human whim.

A realistic accounting of how captive reptiles and amphibians endure our lack of largesse would convince most individuals that we only rarely meet the lowest bar of care standards — and that wild animals should remain wild animals. I often counsel would-be adopters of North American box turtles (*Terrapene* spp.) that these turtles roam about two football fields worth of habitat. Subjecting box turtles to life in a 55-gallon aquarium is equivalent to a human living out the rest of her life in a small bathroom — and without internet, cell phone, or other stimuli. As North American box turtles experience a near 70% predation rate on relocation, they cannot be released. However, for permanent captives, we can raise the standards we allow to pass for captive husbandry.

Let me propose a less than radical notion toward reptiles and amphibians: Acknowledge them as the wild animals they are and operate as their conservation advocates and wardens, keeping them and their needed ecosystems protected in our world — and out of all living rooms. Reptiles and amphibians are not appropriate personal pets, any more than we would reasonably consider mountain lions, hippos, or ostriches. If they were larger, vocal, and able to harm us more easily and more often, I suspect they would no longer be such a popular part of

Rosie, a Green Iguana (*Iguana iguana*), now a permanent resident of the Butterfly Pavilion (www.butterflies.org), is seen here atop her tree bower.

This Ornate Monitor (*Varanus ornatus*) is now deceased. An animal that can attain a length of two meters, has a naturally aggressive disposition, and requires a largely aquatic habitat is a questionable choice as a pet for most people.

the pet trade. We can shut down the introduction of new individuals and new species of reptile and amphibians into the pet trade — and greatly reduce suffering and death. These ideals should inform a true conservation ethic.

A conservation ethic might include captive breeding to increase the chances for a species' survival — but wild animals that exist only as captive specimens are already lost to our natural world. We assure a species' survival when we realize the animal can function as a wild animal only in its natural habitat. Captive breeding for release must already encompass habitat preservation and management — without which release is impossible.

We need a conservation-focused ethic — for the reptiles and amphibians we hope to protect and not for the reason of continued ownership of wild animals in our homes. Conservation needs to occur because, as Mark Beckoff observed, the human race has already won the race — and included in our winner's 'spoils' could be a greater future for reptiles and amphibians than captive animals suffering and dying for short-term enjoyment. As winners, we could instead be generous toward these often-misunderstood animals, protecting them in the wild, while reducing and eliminating their human-imposed captivity.

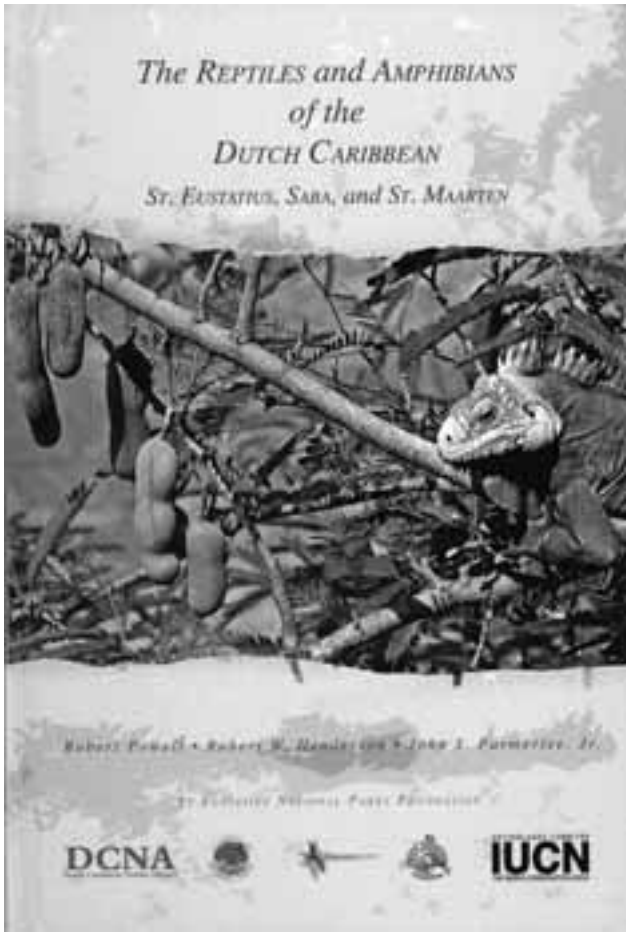
As a model for enjoying reptiles and amphibians in the wild, we could duplicate many of the elements of bird watchers. Life-long species lists (without taking herps from the wild!), reptile-watching trips, photography contests, and reptile conservation societies could greatly contribute to the protection of these wonderful species — all without subjecting them to captivity or an early demise. Instead, land could be protected for habitat, and participants could help collect useful data and assist researchers and conservationists.

The natural world is a wonderful place and to rediscover, as most of us do, that it contains reptiles and amphibians, should be exciting. I can conceive of no better gift than to leave wild animals wild, hippo and herp alike.

BOOK REVIEW

Dutch Windward Island Herpetofauna

Powell, R., R. W. Henderson, and J. S. Parmerlee, Jr. 2005. *The Reptiles and Amphibians of the Dutch Caribbean: St. Eustatius, Saba, and St. Maarten*. The St. Eustatius National Parks Foundation, Gallows Bay, St. Eustatius, Netherlands Antilles, 192 pp. Softcover. ISBN 978-09673958-8-3. $25.00 plus shipping. U.S. distributor: Bibliomania! (www.herplit.com).



These days, it's fairly easy to produce a field guide to the amphibians and reptiles of a relatively small geographic area. It isn't even necessary to know much about the natural lives of the animals. It's enough to have access to good photographs of each species, often taken under controlled conditions in artificial "habitat" sets, and an abbreviated discussion of the distribution and biology of the species. Knowledge of the latter can often be found in scientific and lay literature, including other field guides. Such guides may be useful in identifying the animal before you — but, unless your only goal is to add a species to your herpetological life list, they may leave you hungry for more. A really good field guide is worth its weight in gold, and distressingly few are available. You probably already know this. You may have several guides to the amphibians and reptiles of a particular area on your shelf, but only one is dog-eared from page turning and trips to the field. To my mind, the ideal field guide is portable (it is, after all, supposed to be a *field* guide), includes photographs that are useful not only for purposes of identification but illustrate some aspect of the ecology or behavior of the animals, and text that includes descriptions of the species, including developmental, sexual, and geographic variation, how to distinguish each species from similar species that occur in the region, and discussions of distribution, habitat, food habits, reproduction, behavior, and conservation status. A general discussion of the geography of the region covered by the guide and of the habitats that are found there should be included, as well as a glossary of terms used in the guide with which the reader may not be familiar and a bibliography or literature cited section to lead the interested reader to more detailed information. Powell, Henderson, and Parmerlee (hereafter, PHP) have produced a field guide to the amphibians and reptiles of the Dutch Antillean islands of St. Eustatius, Saba, and St. Maarten that meets my expectations.

Including introduced species, the herpetofauna of the Dutch Windward Islands (the Dutch Leewards are Aruba, Bonaire, and Curaçao, which are South American continental islands) consists of two species of amphibians, both frogs, 15 or 16 (depending on whether or not the Green Iguana of Saba is a species distinct from *Iguana iguana*) species of lizards, three of snakes, and two of turtles, plus three species of sea turtles known to nest in the islands and a fourth that is sometimes seen in the surrounding waters. This relatively small fauna has allowed PHP to produce a guide that is portable while including extensive accounts for each species. A similarly detailed guide for the herpetofauna of, for example, Cuba (which has at least 50 species of anoles alone) would take on the proportions of an unabridged dictionary.

Following the Introduction, the guide describes the natural features of each island. Included are topographic maps and aerial photographs and a discussion of the region's geological history. This is followed by a history of the human occupation of the islands; this section is enhanced by additional photographs of each island, including archival photographs that sometimes highlight the changes that have accompanied the human occupation and development of the region. Next comes a section on conservation that identifies parks and reserves, and emphasizes the local conservation organizations that are working to conserve the natural heritage of each island.

Next is an extensive section introducing amphibians and reptiles. It begins with definitions: What are amphibians and reptiles. The definitions go beyond external morphology to

include features associated with respiration, reproductive biology, and thermoregulation. There follows a short discussion of scientific names, their derivation, and why they occasionally change. Common names and why they can create difficulties are discussed next. A subsection on biogeographic relationships emphasizes human-mediated introductions in the Dutch Antilles and the biogeographic similarities and differences among the three islands. Disappointingly, a discussion of the biogeographic origins of the elements of the herpetofauna of these islands is lacking, although species accounts remedy this shortcoming to some degree. A general discussion of conservation status includes concise descriptions of the conservation threat categories employed by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and the Red List of the World Conservation Union (IUCN). The Dutch Antillean species listed by either organization are discussed, as are the negative effects of the introduction of mongoose on the herpetofauna of St. Maarten. This section concludes with "Stories about Reptiles," including a discussion of the medicinal use of reptiles, iguana meat as an aphrodisiac, and other myths. Here you can find two recipes for lizard soup, once thought to be a treatment for bronchitis and asthma.

The bulk of the book is devoted to individual species accounts. This section is a little anachronistic in not following the usual taxonomic organization of amphibians first, then turtles, then lizards, and then snakes. Instead, lizards appear first, then snakes, then turtles, with amphibians bringing up the rear. Even within the lizard accounts the order of presentation of the families is unusual. None of this, however, detracts from the quality of the individual family and species accounts.

Family and species accounts begin with the common English and scientific names, and the derivation (etymology) of the scientific name. The latter is an interesting feature omitted from most field guides. This is followed, for family accounts, by a statement of the geographic range and of any interesting taxonomic considerations. Species accounts include a description that will facilitate identification, as well as any changes in color or pattern that are associated with age or sex. The distribution among the three islands is stated and note is made of populations known to have been extirpated. In some accounts (e.g., *Iguana delicatissima*), the origin of the species is discussed. Habitat is described in some detail and additional subsections address food and predators. The discussion of reproduction may include, among other things, seasonality, mode of reproduction (e.g., eggs, live-bearing, parthenogenesis [= reproduction within all-female population]), and clutch size. Rare in a field guide, the discussion of behavior is usually fairly extensive. Each species account concludes with a discussion of conservation status including primary threats and, if known, recent population trajectories. The accounts are all copiously illustrated (the book contains over 300 color and eight black & white photographs). The photographs of amphibians and reptiles were taken, for the most part, in natural habitat and often highlight differences among similar species, document age and sex variation in color and pattern, or illustrate aspects of behavior.

Following the species accounts is a section entitled "Strays and a Vagrant." The strays are species that were introduced to areas where they do not naturally occur but failed to become established. Strays are known only on St. Maarten and include two species which occur naturally elsewhere in the Dutch Antilles (Green Tree Lizard, *Anolis bimaculatus*; Red-bellied Racer, *Alsophis rufiventris*) and five exotic snakes: Boa Constrictor (*Boa constrictor*), Rainbow Boa (*Epicrates cenchria*), Blood or Short-tailed Python (*Python curtus* group), Ball Python (*Python regius*), and Corn Snake (*Elaphe guttata*). The Loggerhead Sea Turtle (*Caretta caretta*) is listed as a vagrant. Not known to nest in the Dutch Antilles, Loggerheads are occasionally encountered at sea around the islands.

The book concludes with a Bibliography, a List of Taxonomic Authorities for each Dutch Antillean species (unique, so far as I know, for field guides), a Glossary, and an Index to Names of Reptiles and Amphibians. The Bibliography lists 164 citations, two-thirds of which date from 1990 or later. The glossary contains 112 entries.

My complaints about the book are minor. Each page is UV-coated, lending a glossy appearance that dramatically enhances the photographs and renders the book moisture and mildew resistant (not an unimportant consideration for a guide to the herpetofaunas of tropical islands), but the slick surfaces stick together, making it next to impossible to casually leaf through the book. The book, although ostensibly soft covered, is heavy and stiff. Whether the quality of the images and weather resistance justifies the unusual feel may well vary from reader to reader. Also, I think we needed to have only one photograph of a mongoose, and a few individuals are illustrated more than once (figures 177 and 251 of a Red-bellied Racer, *Alsophis rufiventris*, are an interesting example of photographic pseudoreplication).

The PHP guide ought to serve multiple audiences. For the amateur naturalist visiting the Dutch Antilles, it can serve as both an introduction to the islands and the herpetofauna, facilitating the location and identification of species. The book will serve the same purpose for the professional biologist new to the islands. In addition, it provides enough information on the biology of the amphibians and reptiles, and clues as to what is *not* known, that it will point the way for future research. With respect to all of these, the book ought to be widely read by anyone conducting research on the amphibians and/or reptiles of the Dutch Antilles and beyond. It should be particularly popular with graduate students contemplating work in the region.

PHP have conducted research on amphibians and reptiles throughout the West Indies for an aggregate of over 60 years and, together with a small army of students, they have worked extensively in the Dutch Antilles. Fifty of the citations in the PHP Bibliography are authored or co-authored by Powell, Henderson, or Parmerlee. Although new species may yet be discovered in these islands, and others will without doubt be introduced, this guide will be the gold standard for years to come. The World Wildlife Fund (Netherlands) and Prince Bernhard Nature Fund (Netherlands) are to be commended for funding its publication and allowing the proceeds from sales to go toward conservation efforts in the Dutch Antilles. However, as PHP was not produced by a major publisher, the number of copies printed may be relatively small. Get yours while you can!

Arthur C. Echternacht
University of Tennessee, Knoxville

CONSERVATION RESEARCH REPORTS

Conserving an Amazonian River Turtle Using a Community-based Sustainable Harvest of Eggs

The exploitation of South American river turtles as a food source has long been considered the main factor contributing to the decline of populations. Along a stretch of the Aguarico River (Ecuador), CAPUTO ET AL. (2005. *Biological Conservation* 126:84–92) investigated the spatial and temporal distribution of Terecay (*Podocnemis unifilis*) nests, factors affecting nest success, and the effect of offering a reward for each hatchling captured on the pattern of egg consumption by the local human community. Flooding appears to be particularly important in this Amazonian region, destroying 63.1% of all nests, which is in excess of the number of nests needed to satisfy the local community's consumption needs (28.2%). The proposed reward for each hatchling ensured the voluntary participation of the Cofan people in the Terecay conservation project, leading to: (i) nests being harvested only from sites where hatching possibilities were very low, (ii) efficient management and protection of nesting beaches with abolition of poaching of nests and adult females, and (iii) transplantation of nests from sites that would be flooded (and whose yield exceeds human consumption). Therefore, we argue that in this area of Aguarico River both biological and social conditions favor the establishment of a sustainable harvest of Terecay eggs.

SANDY BARNETT

Populations of Terecays (*Podocnemis unifilis*), a South American river turtle, may be able to sustain a controlled harvest of eggs in at least one part of the Aguarico River system.

Genetic Diversity of Amazonian Crocodilians

FARIAS ET AL. (2004. *Animal Conservation* 7:265–272) used the mitochondrial cytochrome *b* gene to study the population genetic structure of *Melanosuchus niger* (Brazil: Negro and Purus Rivers, Lake Janauacá; French Guiana: Kaw River swamps), and *Caiman crocodilus* (Brazil: Purus River, Lake Janauacá; French Guiana: Kaw River swamps). Analyses indicated that isolation-by-distance was an important population dynamic in *M. niger*, but were unable to differentiate between isolation-by-distance, historical fragmentation or range expansion in *C. crocodilus*. Hypotheses of demographic expansions were supported in one out of four and two out of three sampled localities of *M. niger* and *C. crocodilus*, respectively. Populations of *M. niger* in central Amazonia also appeared to show differentiation that was correlated with water type. These results are compatible with the life-style of these two crocodilians; *C. crocodilus* is a habitat generalist and appears to disperse rapidly to newly available habitats, whereas *M. niger* is a more sedentary habitat specialist. Both species appear to be recovering from unregulated over-harvesting; however, their responses are life-history- and, potentially, ecologically dependent.

JOHN THORBJARNARSON

Black Caimans (*Melanosuchus niger*) are relatively sedentary habitat specialists. Genetic studies indicated that more geographically distant populations and those associated with different water types are more genetically distinctive.

Home Range and Habitat Associations of a Bahamian Iguana: Implications for Conservation

The Andros Iguana (*Cyclura cychlura cychlura*) is an endangered lizard threatened by habitat loss, illegal hunting, impacts from historic large-scale logging practices, and predation by feral animals (e.g., cats, dogs, and hogs). Local and national conservation organizations are interested in demarcating protected areas for the iguana in the southern portion of its range. However, no life history information is available. In order to provide data that can be applied in a science-based management strategy for the Andros Iguana, KNAPP AND OWENS (2005. *Animal Conservation* 8:269–278) investigated seasonal variation in home-range size and habitat selection using

CHUCK KNAPP

Large home-range sizes and associations with open pine forest and shrublands must be considered when establishing protected areas for the Andros Iguana (*Cyclura cychlura cychlura*).

radio telemetry. Home ranges were the largest reported to date for free-ranging *Cyclura* (30.6 ha for males, 5.6 ha for females). Open pine was the only habitat type out of four where iguanas occurred more than expected by chance. However, the pair-wise comparisons of habitat types reveal that iguanas were found significantly closer to open pine and shrubland than to closed pine. Conservation implications of the dynamic seasonal home-range fluctuations and habitat usage are discussed and recommendations are offered for establishing protected areas.

Spatial Ecology of Endangered Grand Cayman Blue Iguanas

West Indian Rock Iguanas (*Cyclura* spp.) are among the most endangered lizards in the world and many populations will need to occupy human-modified habitats to escape extinction. Fewer than 25 Grand Cayman Blue Iguanas (*C. lewisi*) remain in the wild. GOODMAN ET AL. (2005. *Journal of Herpetology* 39:402–408) examined spatial ecology of released, captive-bred iguanas in a botanic park on Grand Cayman. Males used larger areas and moved greater distances than females in the summer but not in the fall and overall male home range sizes were greater than those of females. A few home range estimates were greater than any previously reported for *Cyclura*. Especially males during the breeding season used areas outside the park, where they are vulnerable to predation, vehicular death, and hunting by humans. Reserves for *C. lewisi* must be large and surrounded by buffer zones or fenced.

DESIREE WONG

Released, captive-bred male Grand Cayman Blue Iguanas (*Cyclura lewisi*) in a botanic park used larger areas and moved greater distances than females in the summer but not in the fall.

Displacement of Native Geckos by Introduced House Geckos

How introduced reptiles cause the loss of endemic reptiles is poorly understood. COLE ET AL. (2005. *Biological Conservation* 125:467–474) investigated the role of the introduced House Gecko (*Hemidactylus frenatus*) in causing a catastrophic decline and extinction of the endemic night gecko (*Nactus* spp.) populations in the Mascarene Islands. Competition for enemy-free space was tested in experimental enclosures and showed that *H. frenatus* displace endemic *Nactus coindemirensis* and *Nactus durrelli* from favored positions in and near refugia, thus increasing the risk of predation and exposure to stochastic events. The ability of *H. frenatus* to grip substrates with their pad-bearing toes was examined, and the data indicated that naturally occurring substrates with a greater amount of loose surface material of a higher particulate concentration and size excludes *H. frenatus*, but not *Nactus*. These findings support the hypothesis that *H. frenatus* led to the fragmentation and extinction of endemic *Nactus* populations and demonstrate that artificial refugia made of a crumbly substrate may be used to limit future disturbances by this gecko and others like it in the Mascarene Islands and elsewhere.

NIK COLE

Introduced House Geckos (*Hemidactylus frenatus*, top left) are displacing endemic Night Geckos (*Nactus coindemirensis*, top right, and *N. durrelli*, bottom) from favored positions in and near refugia in the Mascarene Islands.

NEWSBRIEFS

Flat-tailed Horned Lizard Gets Another Chance

A lizard known for its dinosaur-like features is back in line for endangered species protection, according to backers of the tiny, desert reptile. A federal judge in Arizona on 13 September ruled that the U.S. Fish and Wildlife Service erred when it dropped the Flat-tailed Horned Lizard (*Phrynosoma mcallii*) from consideration as a "threatened" species eligible for special legal protection. In a 15-page ruling, District Court Judge Neil Wake said the government "violated the Endangered Species Act" by failing to evaluate the impact of habitat loss on the species when it withdrew a proposal to list it as threatened.

WENDY HODGES

The ruling means that the Flat-tailed Horned Lizard will once again be considered for threatened species status. Environmentalists say that could help the reptiles recover from building and other pressures that have pushed it from developed areas like much of the Coachella Valley.

Federal wildlife officials say they don't yet know the ramifications of the decision. "Without a listing it really just gets lip service," said Daniel Patterson, desert ecologist for the Center for Biological Diversity, one of the environmental groups behind the legal challenge. "You can't just go out and plow lizard habitat into the ground," Patterson said.

However, if the lizard were to gain the special status, it could mean costly new building requirements in its habitat, including places like the Coachella Valley. Listing opponents say the lizard litigation battle is more about thwarting development than preserving reptiles. Earlier decisions by the Fish and Wildlife Service to withdraw threatened species consideration for the Flat-tailed Horned Lizard were based on sound science, said Ed Kibbey, spokesman for the desert chapter of the Building Industry Association.

If the lizard were to get added protection it could mean builders would have to compensate the government in exchange for disturbing lizard habitat, Kibbey said. That could mean anything from setting aside land on a project site to buying land for the lizard elsewhere, he said.

The Flat-tailed Horned Lizard has already been driven from much of its local habitat, said Allan Muth, director of the Palm Desert-based Boyd Deep Canyon Research Center, a University of California, Riverside desert wildlife research center. He said it once roamed around Snow Creek and other sandy areas, but is now limited to the Coachella Valley Preserve, a refuge in Thousand Palms. "They can't survive in developed areas," he said. "Too many kids, cats, dogs, traffic, all those things."

The lizard has been the subject of intense legal and bureaucratic battles dating back to 1982. In 1997, the U.S. Fish and Wildlife Service withdrew a proposal to list the Flat-tailed Horned Lizard. In 2001, a federal judge ordered the service to reconsider. The lizard was again proposed for listing, but in January wildlife officials withdrew it once more. "This species has been the subject of a fair amount of litigation over the years," said Jane Hendron, a spokeswoman for the Carlsbad office of the Fish and Wildlife Service.

A proposed local plan to balance economic growth with protecting the environment was designed to ensure the Flat-tailed Horned Lizard sufficient habitat to survive in the Coachella Valley, even without federal listing — but the Coachella Valley Multi-Species Plan is not yet in place, and some lizard supporters say the government's threatened species tag would give momentum to ongoing preservation efforts.

Wake's ruling Tuesday drew praise from the environmentalists, but it didn't outline what the government would need to do to comply. The judge scheduled a conference between the opposing groups.

Benjamin Spillman
The Desert Sun

ARIZONA-SONORA DESERT MUSEUM (TWO-COLUMN)

The protected status of Flat-tailed Horned Lizards (*Phrynosoma mcallii*) has been the subject of intense legal and bureaucratic battles dating back to 1982.

Proposed Regulations In PA: Bad News For Rattlesnake Roundups, Good News For Herps

No two states handle wildlife management the same way — especially reptiles and amphibians. Even after the Pennsylvania Fish and Boat Commission (PFBC) reluctantly took charge of these animals in 1980, the state's 76 reptilian and amphibian species and subspecies

remained an unwanted burden and were continually tossed back and forth between PFBC and the Pennsylvania Game Commission. Whereas most fish and wildlife create millions of dollars of state revenue through hunting and fishing licenses, reptiles and amphibians are not so lucrative. Neither agency has ever wanted to deal with them, so they have remained largely unregulated in Pennsylvania — until recently.

Pennsylvania is one of seven states where Rattlesnake Roundups are still legal (others are Texas, Oklahoma, New Mexico, Kansas, Alabama, and Georgia). Pennsylvania is home to no less than nine or ten roundups per year, despite the fact that the state's rattlesnakes are a candidate-threatened species (Timber Rattlesnake, *Crotalus horridus*) and an endangered species (Eastern Massassauga, *Sistrurus c. catenatus*).

Unlike the relatively resilient Western Diamondback collected for most Southwestern roundups, the candidate-threatened Timber Rattlesnake is quite vulnerable. Adults only reach sexual maturity after 8–10 years, and only reproduce once every 3–5 years. Research shows Timbers may abandon den sites that have been molested. Survival rates are well under 25% for snakes released outside of their small 1–2 mile home range. During roundups, dens are commonly disturbed or destroyed and snakes that aren't killed or kept often are released outside their home ranges. After decades of roundups, these actions have taken their toll. A several-year study by state biologists has shown 71% of Pennsylvania's South Mountain Timber Rattlesnake population has gone the way of the buffalo.

SUZANNE L. COLLINS, CNAH

New regulations in Pennsylvania will provide protection for Northern Copperheads (*Agkistrodon contortrix mokasen*, top) by requiring permits for their harvest, and for threatened Timber Rattlesnakes (*Crotalus horridus*, middle) and endangered Eastern Massassaugas (*Sistrurus catenatus catenatus*, bottom) by implementing restrictive rules on participants in the state's rattlesnake roundups.

Currently wildlife advocates are working on a long-term project to completely do away with roundups. In the meantime, the PFBC has come up with a short-term solution involving new roundup regulations. To roundup organizers, these new regulations are a major roadblock. To wildlife advocates, these changes are a big step in the right direction.

Under current regulations, a $5 permit allows roundup participants to take up to two Timber Rattlesnakes per year, regardless of sex or age. In fact, "heaviest rattlesnake" prizes are awarded at roundups, encouraging participants to seek out and capture gravid females from the wild. Under the proposed regulations, Timbers will receive much more protection. Hunt permits will cost $50 instead of five, and participants will be allowed only one snake instead of two. Females will be completely off-limits, and males must be a minimum of 42 in (average adult length of a male Timber is 41 in). Although roundups will still be legal, they will be far less harmful to rattlesnake populations.

Pennsylvania also leads the union with more roads per square mile than any other state. Consequently, the state's amphibians and reptiles have really felt the sting of fragmentation and habitat loss. Other changes proposed in the new regulations aim to sustain many other declining populations. Northern Copperheads (*Agkistrodon contortrix mokasen*) will be given a closed season and collection-permit for the first time. A new permit system for Snapping Turtles (*Chelydra serpentina*) will monitor their collection much more closely. Snapping Turtle changes came after a single Philadelphia meat vendor reportedly sold 12,000 pounds of Snapper meat per year. Additionally, every other species in the state is given extra protection with possession limits being dropped from two to one. Several species that have been negatively affected by collection from the wild (e.g., Eastern Box Turtle, *Terrapene carolina carolina*) will no longer be legal to collect at all.

SUZANNE L. COLLINS, CNAH

A new permit system in Pennsylvania will monitor the harvest of Common Snapping Turtles (*Chelydra serpentina*) much more closely than in the past.

Proposed regulations are being met with fierce opposition from Rattlesnake Roundup organizers, who make thousands of dollars from roundups. In order for the improved regulations to pass, wildlife advocates who support these changes must make their opinions known to PFBC. Proposed regulations are up for public comment from 15 October through 15 December. Comments concerning the proposed regulations can be e-mailed through PFBC's website (www.fish.state.pa.us). Copies of the new regulations are available at http://sites.state.pa.us/PA_Exec/Fish_Boat/rulemakings/175nprp.htm.

Jesse Rothacker
Forgotten Friend Reptile Sanctuary

Eastern Box Turtle Regional Conservation Workshop

28 September 2005
National Wildlife Center, Patuxent Research Center, Laurel, Maryland

This was the first ever workshop that concentrated on the Eastern Box Turtle (*Terrapene carolina carolina*). Its goal was not just to go over what we know, but what must be done. The issues and actions discussed do not just pertain to the Eastern Box Turtle but all North American box turtles.

SUZANNE L. COLLINS, CNAH

Eastern Box Turtles (*Terrapene carolina carolina*) were the focus of a conservation workshop in Maryland and will benefit from new no-harvest regulations in Pennsylvania.

Presentations were given by Dr. Kenneth Dodd, author of *North American Box Turtles: A Natural History*, on challenges to conserving box turtles in the 21st Century. Dr. Richard Seigel spoke about the importance of population demography. A rather frightening report documented the discovery of an iridovirus that has been discovered in wild populations of box turtles and which has caused massive die offs.

Breakout sessions produced lists of suggestions concerning further research needs, the state and federal roles, education, the problem of repatriations and rehabilitation of box turtles, development threats. and more.

Plans already are in the works for developing a special working group on box turtles that meets every two years. (tentatively in North Carolina in fall of 2006).

Allen Salzberg
HerpDigest

Illness Threatens Turtles in Puerto Rico

A population of endangered Green Sea Turtles (*Chelonia mydas*) is in danger of being wiped out on the Puerto Rican island of Culebra because of a tumor-causing illness, environmental officials said Thursday. Five of the tiny island's some 300 Green Sea Turtles have died from the tumors recently, and officials fear more could fall ill, said Carlos Diez, a biologist with Puerto Rico's Department of Natural Resources and Environment.

The tumors, believed to be caused by a form of the herpes virus, form internally and externally, obstructing the turtles' breathing, intestinal system, and vision, Diez said. "Eventually, (the virus) kills the animal, putting the species in danger," he told reporters. Diez said it was unclear how the turtles might have become infected with herpes, which is usually transmitted sexually among humans. Possible causes could be contamination in the ocean, changes in ocean water temperature, or problems with the turtles' immune systems. Authorities are conducting tests on the waters where the turtles live around Culebra, an island off eastern Puerto Rico, to check for contamination.

Besides Puerto Rico, Green Sea Turtles are found around the U.S. Virgin Islands, Florida, and throughout the North Pacific. The species received endangered status in 1978, although the current worldwide population size is not known. The biggest cause of the species' dwindling numbers is the commercial harvest of eggs for food, according to the U.S. National Marine Fisheries Service.

Associated Press
27 October 2005

PAUL HOETJES

Caribbean Green Sea Turtles (*Chelonia mydas*), such as this young adult, may be vulnerable to a tumor-causing virus.

Grand Cayman Blue Iguana Twins Hatch at Gladys Porter Zoo

On 22 August 2005, the Herpetarium crew at the Gladys Porter Zoo in Brownsville, Texas was elated to learn that the sole Grand Cayman Blue Iguana (*Cyclura lewisi*) egg that had been in their incubator for 76 days contained not one, but two, Grand Cayman Blue Iguanas. The twins were connected by the umbilical stalk, and both seemed quite vigorous. The stalk was tied off and the two lizards were separated and returned to the incubator.

After 15 days, one of the two began to eat and, by three weeks of age, both of them were eating well. They prefer various types of red flowers, including the pistils from Hibiscus flowers, which are cut into tiny bits with scissors.

Although the hatchlings weigh less than half the average for normal baby Blue Iguanas, based on data provided by Frederic J. Burton, Director of the Blue Iguana Recovery Program on Grand Cayman, their chances for survival are good.

The egg hatched from a clutch of eight laid on 7 June at the zoo. Three eggs appeared to be fertile at time of laying, but only one developed. Keepers noted that the egg did not retain the typical oval shape of a developing *Cyclura* egg. Midway through incubation, it was almost perfectly round.

This represents the first successful hatching of a Grand Cayman Blue Iguana at the Gladys Porter Zoo. The female that produced the offspring is of U.S. captive stock and, in previous years,

The West Indian Rock Iguanas of the genus *Cyclura* are, as a group, under severe threat throughout their range. As large island animals with no adaptations for dealing with mammalian predators and competitors, they are suffering catastrophic declines from dog, cat, and rat predation, hunting, habitat degradation by goats and cattle, and large-scale habitat loss to human activities. The Grand Cayman Blue Iguana is the most endangered in the group, with an estimated 10–25 individuals surviving in the wild.

GLADYS PORTER ZOO

Twin Grand Cayman Blue Iguanas (*Cyclura lewisi*) were hatched at the Gladys Porter Zoo in August 2005.

had been paired with Godzilla, the 60+ year-old Blue Iguana that passed away in May 2004 (see *Iguana* 11:168–171). Although copulation had been observed and the female has laid eggs nearly every year, none were fertile until she was allowed to breed with another male.

Dog Tracks Burmese Pythons in the Everglades

A detection dog is sniffing out an unusual problem — his specialty, Burmese Pythons (*Python molurus bivittatus*). Because so many non-native snakes have been released by pet owners in South Florida, the population of these snakes is growing, especially in the Everglades.

Now, a one-year-old beagle, nicknamed Python Pete, is hot on the trail of the snakes. Pete's owner and handler is wildlife technician Lori Oberhofer. She bought Pete from a Missouri breeder and had him shipped to Florida. "Beagles are used around the world," Oberhofer said. "They have a great sense of smell."

Oberhofer tests Pete's skills often by dragging snakes in a mesh bag through the grass, leaving a scent trail for Pete to track. "I don't want him to get there before me, so he is on a short leash. When he sees a python, I can see him and I can pull him back," Oberhofer said.

His twice-a-week training sessions should be finished by this winter, when it's expected that Python Pete will be ready to spring into action on a regular basis. Once he finds snakes in the Everglades, they will be removed. From the mid-1990s to 2003, more than 50 Burmese Pythons were caught in the park. But with the surge in the snake population, last year alone, 61 of the snakes were taken out of the park. The plan is to use Pete around park roads and trails where the snakes are most likely to run into people.

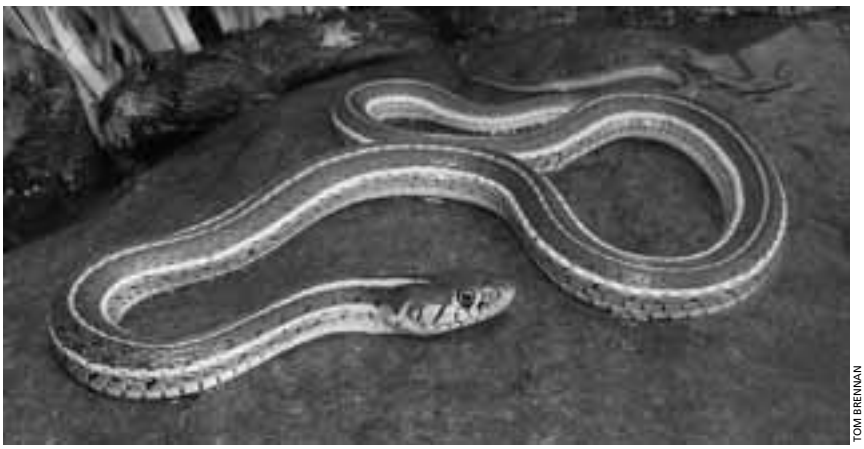
WPLG
Miami, Florida; 1 July 2005

LORI OBERHOFER (NATIONAL PARK SERVICE)

This one-year-old Burmese Python (*Python molurus bivittatus*) was caught as a hatchling in Everglades National Park and now serves as a training snake for Pete, the detector dog.

Environmentalists Sue USFWS over Mexican Garter Snake

The Center for Biological Diversity is accusing the U.S. Fish and Wildlife Service of failing to respond to a petition seeking the protection of the Mexican Garter Snake (*Thamnophis eques*) as an endangered species. The Tucson-based organization filed a lawsuit in an attempt to get the federal agency to act on the petition it filed more than a year ago. It says the Mexican Garter Snake has vanished from most of its native range across Arizona, southwestern New Mexico, and México, including the San Pedro, Gila, Colorado, and Santa Cruz rivers. The snake eats mostly native fish and frogs, but also may eat mice and lizards. Biologists say the snake's decline is tied to the disappearance of native fish and frogs and the declining quality of stream habitats.



TOM BRENNAN

Mexican Garter Snakes (*Thamnophis eques*) have disappeared from much of their native range and an environmental advocacy group has accused the U.S. Fish & Wildlife Service of failing to respond to a petition seeking protection for the species.

KVOA
Tucson, Arizona; 19 May 2005

IUCN IGUANA SPECIALIST GROUP MEETING

South Andros, The Bahamas

6–7 November 2005

The IUCN Iguana Specialist Group conducted their annual working meeting, 6–7 November 2005 in South Andros, Bahamas. Generously hosted and substantially underwritten by Mike and Petagay Hartley of Tiamo Resorts, ISG participants enjoyed what is aptly described as "barefoot sophistication" at the eco-friendly Tiamo Lodge. Planning and travel arrangements fell on the shoulders of Chuck Knapp, who did an admirable job of facilitating the arrival of so many people to this remote destination.

For 1½ days, the ISG heard various species update reports and then discussed a number of pressing issues relevant to the group's activities. One of the more productive discussions focused on drafting a prioritized list of ISG projects for 2006, an exercise that has implications for short-term funding opportunities. Finally, a Jamaican Iguana sub-group convened and began planning a Species Recovery Plan workshop, tentatively scheduled for July 2006. This will be the first time since the Jamaican Iguana PHVA workshop in 1993 that this conservation strategy has been officially revisited. This information will be detailed in the meeting minutes in the upcoming ISG newsletter.

The 2005 ISG meeting represented a significant milestone: It has now been ten years since this group began meeting together to discuss, plan, and strategize iguana conservation activities in the Caribbean region. Hosted by the Miami Metrozoo, we first met in 1996, although we were not formally recognized as an official Specialist Group — initially the West Indian Iguana Specialist Group — by the IUCN Species Survival Commission until the following year in Seattle. We will recognize our official 10-year anniversary next year and plans are already being discussed for a cumulative photo expose on the ISG's work.

Following the ISG meeting, a Species Recovery Plan (SRP) workshop for the Andros Iguana, *Cyclura c. cychlura*, was convened. An important component of all SRPs is having local participants that help draft and then endorse the final product. Thanks to support from the Shedd Aquarium in Chicago, key local players and stakeholders were involved in the production of this Plan. Four primary working groups split off to work on the following topics: Protected Areas, Education and Public Awareness, Fund-raising, and Research Priorities. These documents will be incorporated into an overall conservation strategy (SRP). One of the most exciting outcomes was the emergence of a bright, articulate, and highly motivated local high school teacher and coach, Ricardo Johnson, who plans to use the iguana as the mascot for the school's soccer team. Mascots are not commonly used in the Bahamas and we have high hopes that this

TOM WIEWANDT

The lodge at the eco-friendly Tiamo Resort in South Andros was the venue for a Species Recovery Plan workshop for the endangered Andros Iguana (*Cyclura cychlura cychlura*). This one-day meeting enjoyed strong participation by the local community, and separate working groups "broke out" to discuss education/local awareness, protected areas, research priorties, and fund-raising. This workshop represented a major first step toward producing a conservation strategy for the iguana, with the species emerging as a potential icon for biodiversity conservation on South Andros.

Participants in the IUCN ISG Meeting, South Andros, The Bahamas, 6–7 November 2005 (from left): Rick Hudson, Peter Tolson, Kristin Hines, Steve Conners, Tom Wiewandt, Stesha Pasachnik, Joe Burgess, Quentin Bloxam, Ricardo Johnson, Jeff Lemm, Byron Wilson, Karen Graham, John Iverson, Allison Alberts, Catherine Stephen, Miguel Garcia, Bruce Weissgold, Jan Ramer, Fred Burton, Tandora Grant, Samantha Addinall, Tarren Wagner, Joe Wasilewski, Sandra Buckner, and Chuck Knapp; not pictured, Janet Conners, who took the photograph.

JANET CONNORS

The IIF Board met in conjunction with the ISG in South Andros; front row (from left): Mike Hartman (Tiamo Resort Manager), Quentin Bloxam (Durrell Wildlife Conservation Trust), Mike Fouraker (Ft. Worth Zoo), Karen Graham (Sedwick County Zoo); middle: Rick Hudson (Ft. Worth Zoo); back row (from left): Allison Alberts (Zoological Society of San Diego), Jackie Ogden (Disney's Animal Kingdom), Colette Adams (Gladys Porter Zoo), Peter Tolson (Toledo Zoo), Jan Ramer (Indianapolis Zoo), and Chuck Knapp (Shedd Aquarium).

action will serve to elevate the iguana from relative obscurity to iconic status in the eyes of the local community. Popularizing the Andros Iguana and improving local awareness should have a positive impact on efforts to protect them and their habitat. South Andros is a large island, with vast expanses of undisturbed wilderness that support considerable biodiversity. With the potential to become a showcase for biodiversity preservation in the region, one of the goals of the workshop was to include an iguana management zone within a much broader protected area on South Andros. Hopes remain high that this will become a reality and that this workshop will serve to catalyze this much-needed action.

TOM WIEWANDT

Some of the participants took advantage of a break in the action to go snorkeling.

Following the ISG workshops, the Board of Directors of the International Iguana Foundation met on 9–10 November. This is the first time the two groups have met together, a trend that will likely continue. The primary order of business was reviewing 2005 funding proposals and awarding grants. The Board reviewed five proposals requesting a total of $53,473. Due to funding constraints, the Board was able to award $31,864 to the following five projects or programs: (1) *Restoration of a Second Subpopulation of Wild Grand Cayman Blue Iguanas, Phase 2*, $5,864. Fred Burton, Principal Investigator (PI); (2) *Jamaican Iguana Recovery Program*, $9,000. Byron Wilson, PI; (3) *Conservation of the Anegada Iguana: Public Education, Headstart Optimization, and Nest Protection*, $8,000. K. Bradley and G. Gerber, PIs; (4) *Conservation of the Critically Endangered Fijian Crested Iguana*, $3,000. J.S. Keogh, P. Harlow, and S. Morrison, PIs; and (5) *Development of a Cost-efficient and Effective Monitoring Program for the Mona Iguana Population*, $6,000. N. Perez-Buitrago, S.M. Funk, W.O. McMillan, and M. Garcia, PIs. Subsequent to the IIF Board meeting, a $3,000 emergency request was awarded to Ernst Rupp (Grupo Jaragua) for a Ricord's Iguana survey on the southern shore of Lago Enriquillo, Dominican Republic.

Rick Hudson
ISG Co-chair
IIF Executive Director

IRCF
International Reptile Conservation Foundation

Editor's Remarks

In this issue (p. 240), we feature the Utila Anole (*Norops* [*Anolis*] *utilensis*), which may be the world's most endangered anole — and a species about which we know very little. Unfortunately, many of the reptilian species that are threatened by human activity are similarly unknown and consequently receive little or no protection. A few years ago, an intense effort to assess the conservation status of amphibians worldwide resulted in many species that had previously received little or no attention afforded at least an acknowledgement of their precarious state through inclusion on the IUCN Red List. Although a comparable effort is being initiated for reptiles, an obvious inequity currently exists. For example, when considering amphibians and reptiles of the Dominican Republic, 32 of 37 native species of amphibians (86%) known to occur in the country are redlisted. In stark contrast, only 15 of 108 native reptilian species (14%) are included in the IUCN list (and four of the listed species are sea turtles that are endangered throughout the region and the world). Among species that are excluded is one snake that may already be extinct (*Alsophis melanichnus*) and several others that are known to be very rare (*A. anomalus* and two species in the genus *Ialtris*) — all are diurnally active and terrestrial. The principal threat is undoubtedly predation by introduced mongooses (*Herpestes javanicus*), also implicated in the extirpation of *A. antiguae* from Antigua proper and in the presumed extinction of *A. ater* from Jamaica. Although redlisting may come too late for some of these snakes, we hope that efforts to assess the conservation status of the world's reptiles succeeds in shedding light on the plight of species for which hope may still exist.

Robert Powell

Statement of Purpose

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

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FOCUS ON CONSERVATION

Hispaniolan Southern Slider / Hispaniolan Elegant Slider (*Trachemys decorata*)

Conservation of Hispaniolan Southern Slider in Jaragua-Bahoruco-Enriquillo Biosphere Reserve

The Antillean Terrapins comprise a group of at least four species of freshwater turtles with a discontinuous distribution in the Greater Antilles and the Bahamas. The Hispaniolan Southern Slider (*Trachemys decorata*) is endemic to the south paleoisland of Hispaniola (south of the Cul de Sac Plain – Neiba Valley). The Central Antillean Slider (*Trachemys stejnegeri*) occupies suitable habitat on the north paleoisland. As for other important endemic Antillean groups, such as Todies (small birds in the genus *Todus*) and Rock Iguanas (*Cyclura* spp.), Hispaniola is the only island with two different species in each of those genera.

The Hispaniolan Southern Slider is a moderately sized freshwater pond turtle. Males can reach 220 mm in carapace length, whereas larger females can reach 320 mm. The carapace is light brown and the plastron is yellow with scattered dark ocellated ovals. The skin is grayish brown with black-bordered yellow stripes, including the supratemporal stripe or "ears." This turtle inhabits brackish and freshwater lakes. Habitat destruction, pollution, and over-harvesting threaten the existence of this species, which is included as "vulnerable" on the IUCN Red List.

In the Dominican Republic, the Hispaniolan Southern Slider has a natural distribution that corresponds to a large degree with that of the critically endangered Ricord's Iguana (*Cyclura ricordii*), and the conservation of both species is intrinsically tied to the conservation of the Jaragua – Bahoruco – Enriquillo Biosphere Reserve. Grupo Jaragua works for the conservation of these turtles, their natural habitats, and associated biodiversity by implementing and supporting conservation efforts in the Biosphere Reserve.

www.GrupoJaragua.org.do

Rhinoceros Iguana (*Cyclura cornuta*): A Lithograph by Joseph Smit from Lydekker's *The Royal Natural History* (1893–1986). Richard Lydekker (England, 1849–1915) is not one of the great names in the history of zoogeographical inquiry, but he did explore the subject frequently, often as a function of his studies in vertebrate paleontology. As a young man, he joined the Geological Survey of India, and there he was able to carry out extensive investigations that prepared him for his later position with the British Museum of Natural History. On returning from India, he was charged by the Museum to prepare catalogues of their fossil vertebrate collections; this was accomplished in less than ten years. In his later years, Lydekker took an increasing interest in public venues, contributing to changes in exhibit design at the Museum and preparing many writings of a more popular orientation.

Joseph Smit (1836–1929) was a very skilled lithographer and excellent artist who illustrated numerous 19th Century natural history publications. A native of Holland, he moved to England in the 1860s, at first specializing in bird illustrations, but later painting mammals as well. By the end of the century, he was considered to be the best animal painter in the country.

JOE BURGESS

The Utila Anole (*Norops* [*Anolis*] *utilensis*) may be the world's most endangered anole (see article on p. 240).