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IGUANA

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ROBERT POWELL

This juvenile Lesser Antillean Iguana (*Iguana delicatissima*) is feasting on leaves of a Noni Tree (*Morinda citrifolia*) in Dominica. See article on p. 222.



The Amethystine or Scrub Python (*Morelia kinghorni*) is the largest snake and arguably the largest terrestrial carnivore in Australia (see article on p. 213).



The Lesser Antillean Iguana (*Iguana delicatissima*) survives on fewer than ten main islands in the northern Lesser Antilles (see article on p. 222).



One session of the 2006 IUCN Iguana Specialist Group meeting was devoted to Ctenosaurs, such as critically endangered *Ctenosaura melanosterna* (see ISG Reports on p. 228).



The Puerto Rican Ground Lizard (*Ameiva exsul*) actively roots in leaf litter and soil while searching for prey (see article on p. 226).



Efforts to conserve the Grand Cayman Blue Iguana (*Cyclura lewisi*) involve releases of captive-bred and reared individuals (see ISG Reports on p. 228).



TABLE OF CONTENTS

FEATURE ARTICLES

Giants in the Rainforest: A Radiotelemetry Study of the Amethystine Python in North Queensland, Australia	Alastair Freeman and Amanda Freeman	214
Ecology and Conservation of the Lesser Antillean Iguana (<i>Iguana delicatissima</i>)	Charles Knapp	222
Predation on a Tarantula (<i>Cyrtopholis bartholomaei</i>) by a Puerto Rican Ground Lizard (<i>Ameiva exsul</i>)	Luis O. Nieves	226

MEETING REPORT

2006 Meeting of the Iguana Specialist Group (ISG)		228
Blue Iguana Recovery Program Update	Fred Burton	
Notes on the Distribution of <i>Cyclura ricardii</i> and Problems Facing the Species	Ernst Rupp, Sixto Incháustegui, and Yvonne Arias	
Turks and Caicos Iguana, 2006 Update	Glenn Gerber, Lee Pagni, and Allison Alberts	
Jamaican Iguana Recovery Project	Byron Wilson and Rick Van Veen	
Anegada Iguana 2006 Conservation and Research Update	Glenn Gerber, Lee Pagni, and Kelly Bradley	
Mona Island Iguana: Reports on Ecology, Conservation, and Blindness	Néstor Pérez-Buitrago, Keysa Rosas, Stephan Funk, Miguel García, Alberto Álvarez, and Owen McMillan	
Problem Assessment and Control of the Introduced Cuban Iguana (<i>Cyclura nubila nubila</i>) on Isla Magueyes	Alberto Álvarez, Néstor Pérez-Buitrago, Maria Andrade-Núñez, and Miguel García-Bermúdez	
2006 Research Update for Allen Cays Iguanas	John Iverson	
Preliminary Diet Analyses for <i>Cyclura cyclura inornata</i> and <i>Cyclura cyclura figginsi</i> : Assessing Potential Impacts of Tourist Feeding	Kirsten Hines	
Taxon Reports for <i>Cyclura cyclura</i> and Future Research Plans for <i>Iguana iguana</i>	Charles Knapp	
The Conservation of <i>Iguana delicatissima</i> in Martinique and a Future Action Plan for the French West Indies	Jean-Francois Maillard and Michel Breuil	
St. Lucia Iguana 2006 Project Update	Matthew Morton	
Fijian Crested Iguana Update	Peter Harlow	
Evolution of Spiny-tailed Iguanas (Genus <i>Ctenosaura</i>): How Identification of Species Groups and their Relationships Can Help with Conservation Priorities	Larry Buckley, Katelyn Pagel, and Oscar Flores Villela	
Molecular Analysis of the <i>Ctenosaura melanosterna</i> Clade: Insights into Phylogeography, Speciation, and Conservation ...	Stesha Pasachnick	
Black Iguana Project 2006 Update: Genetics, Demography, and Feeding	Victor Reynoso, Eugenia Zarza-Franco, Wendoli Medina Mantecón, and Pilar Rueda Zozaya	
Report on <i>Ctenosaura palearis</i> in Guatemala	John Binns	
Update on Iguaninae Phylogeography and Phylogenetics	Catherine Stephen	
Using Coalescent-Based Analyses of Multilocus Microsatellite Data to Estimate the Past and Recent Population Histories of Three Species of Caribbean Rock Iguanas	William Modi, Glenn Gerber, Charles Knapp, Jennie Lau, Maggie Reinbold, Leona Chemnick, Oliver Ryder, Peter Andolfatto, and Catherine Stephen	
A Model for Protecting Island Ecosystems Using Integrated Regional Conservation Programs	Brad Keitt	
Does Education Really Help Conservation? Lessons from Two <i>Cyclura</i> Conservation Programs	Lee Pagni	
Indianapolis Zoo Reports First Jamaican Iguana Breeding in the United States	Richard Reams and Jan Ramer	

HISTORICAL PERSPECTIVES

Two Early Reports of Intentionally Released Reptiles		254
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COMMENTARIES

Six Wonders are Enough	Leonard Krishtalka	256
The Ongoing Privatization of Public Universities	Gad Perry, Steve Mackessy, Jack Sites, and Neil Ford	257

BOOK REVIEWS

<i>Herpetological History of the Zoo and Aquarium World</i> by James B. Murphy	Joseph R. Mendelson III	259
<i>Hispaniola: A Photographic Journey through Island Biodiversity</i> by Eladio Fernández	Robert Powell	260

CONSERVATION RESEARCH REPORTS: Summaries of Published Conservation Research Reports		261
NATURAL HISTORY RESEARCH REPORTS: Summaries of Published Reports on Reptilian Natural History		260
NEWSBRIEFS		263
OBITUARY: Peter Vogel		271
IRCF on the Move		272
EDITORIAL INFORMATION		275
FOCUS ON CONSERVATION: A Project You Can Support		276



The Atherton Tablelands is a 700–900-m high plateau in North Queensland, Australia. Prior to European settlement, the region was covered largely by upland rainforest interspersed with areas of more open sclerophyll forest. Large-scale clearing for agriculture began in the early part of the 20th century and continued for a number of decades. Logging was in decline by the time most of the remaining rainforest was incorporated into the Wet Tropics World Heritage Area in the late 1980s.

Giants in the Rainforest: A Radiotelemetry Study of the Amethystine Python in North Queensland, Australia

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Photographs by the senior author except where indicated.

Chasing Big Snakes

The ping from the receiver indicated the Amethystine Python (*Morelia kinghorni*) was very close; judging by the volume it was less than two meters in front of me. Once again, I am amazed at how these large snakes manage to “melt” into the forest floor. After some frustration and muttered curses, like a switch coming on in my head, I see him. Stretched out in the

leaf litter is the large muscular predator right where I had been looking for the last minute or so. At 3.5 m, this male is larger than average, which is slightly less than 3 m in length (A.B. Freeman, unpubl. data; Fearn et al. 2005). We have been following him for over two years now and he has become like an old friend. He watches me cautiously as I quietly withdraw a short distance to start data collection. Five minutes later, he decides



Amethystine Pythons (*Morelia kinghorni*), such as this large male, appear to “melt” into the forest floor.



ELLEN REID

Catching a large python is often a collaborative effort. Here the authors chase a telemetered snake.

that I am no threat and turns to continue on his way. After two and a half years and many hours spent studying these magnificent animals in the wild, the sight of this large reptile moving over the forest floor still gives me a buzz of excitement.

We started the radiotracking project in April 2004. For the preceding two years, we had been collecting roadkill data and incidental records for this species on the Atherton Tablelands in North Queensland. We came to the conclusion early that radiotracking individuals would be necessary to really understand more about the ecology of this species in the wild. In particular, we had become interested in how this large predator uses a land-

scape that is highly modified by land clearance and agricultural development.

Where and How Do You Study Big Snakes?

The Atherton Tablelands is a mid-elevation plateau (700–900 m), situated southwest of the city of Cairns in North Queensland, Australia. Prior to European settlement, the region was covered largely by upland rainforest interspersed with areas of more open sclerophyll forest (Winter et al. 1987). Large-scale clearing for agriculture began in the early part of the 20th century and continued for a number of decades (Winter et al. 1987). Logging was in decline by the time most of the remaining rainforest was incorporated into the Wet Tropics World Heritage Area in the late 1980s. Today, the area is a mosaic of pasture, crops, and small towns. Interspersed among these are rainforest fragments ranging in size from a few trees to 600 ha, many dissected by major and minor roads. Small areas of secondary growth are common, particularly along riparian corridors. Large areas of continuous forest are confined to the slopes of hills that surround the Tablelands. Our study area is situated on the eastern edge of the Tablelands, centered on the School for Field Studies Centre for Rainforest Studies. In the immediate vicinity are all of the main habitat types known to occur in the Atherton Tablelands, everything from cattle pastures to World Heritage rainforests that have never been cleared.

The Amethystine or Scrub Python is the largest snake in Australia. It is also arguably the largest terrestrial carnivore in Australia. Surprisingly, very little is known about its ecology in the wild. Most accounts of this species have been observations of specific events (Fearn and Sambono 2000; Turner 2001;



The Amethystine or Scrub Python (*Morelia kinghorni*) is the largest snake and arguably the largest terrestrial carnivore in Australia. Surprisingly, very little is known about its ecology in the wild.

Fearn 2002), valuable in themselves but far from the detail needed to get a complete picture of this species' ecology. Scientific studies have been few and far between (Martin 1995; Fearn et al. 2005).

The radio transmitters are surgically inserted into the body cavity of the snake near the vent. Because of the body shape of snakes, this is the only practical way one can "attach" a transmitter to them. After about 9–11 months, pythons are recaptured and the transmitter is removed or replaced before the batteries expire. Over a period of 27 months, we have radiotracked six individual pythons for varying lengths of time. The snakes are located on average twice a week. When located, detailed notes are made of the habitat in which they were found, their exact locality is recorded using a handheld GPS, and air and ground temperatures and a range of behavioral variables are recorded. If at all possible, we try to visually locate the snakes, but many times, particularly when they are in the canopy and emergent layers of the forest, they are impossible to see.



Map of the Atherton Tablelands in North Queensland, Australia.



Today, the Atherton Tablelands of North Queensland, Australia is a mosaic of pasture, crops, and small towns. Interspersed among these are rain-forest fragments ranging in size from a few trees to 600 ha, many dissected by major and minor roads. Small areas of secondary growth are common, particularly along riparian corridors. Large areas of continuous forest are confined to the slopes of hills that surround the Tablelands.

Some Preliminary Results

The tracking so far indicates that Amethystine Pythons on the Atherton Tablelands are strongly but not exclusively forest dwellers. The majority of sightings of radiotracked snakes (around 75%) have been in forest habitats, either rainforest or rainforest regrowth, with around 20% of sightings of animals in clearings or along the forest edge. The remaining sightings are in sclerophyll forest. One of the most interesting findings to emerge from the study is knowledge of the snakes' behavior during the cool misty winters of the Tablelands. Radiotracking has shown that during the coldest part of the year, Amethystine Pythons spend most of their time in large epiphytic basket ferns (*Drynaria* sp.) in the canopy and emergent layers of the forest. Similar behavior was documented on the Atherton Tablelands in the late 19th century by the explorer Carl Lumholtz, who described how in winter his Aboriginal guides would climb high into ferns to catch pythons for food. Although he referred to those snakes as *Morelia variegata* (Lumholtz 1889), judging by their size, they could only be Amethystine Pythons. Studies in Neotropical rainforests have shown that temperatures are significantly higher in the canopy and above it than below it (Madigosky 2004). These very large epiphytes (most are larger than 1 m in width) in the canopy and in emergent trees therefore serve as ideal basking platforms.

Far from being a big, slow sluggard of a snake, the Amethystine Python can move far and relatively quickly when

necessary. In many ways, these pythons, with their gracile bodies, long tails, and slender necks, are built more like an arboreal colubrid or treeboa than a large python.

One of the males has a home range of over 200 ha, whereas another male moved over 800 m in a 24-hr period. They seem to apply both "sit-and-wait" and "active-foraging" strategies for prey capture. During the warmer months, we have come across



Although most frequently encountered lying motionless on the forest floor or in the canopy, one male Amethystine Python (*Morelia kinghorni*) had a home range of over 200 ha, and another male moved over 800 m in a 24-hr period.



Radiotracked snakes were located on average twice a week. Detailed notes document the habitat in which they were found. Here the senior author is radiotracking the snake visible on the ground.



Rainforest canopy from below. During the coldest part of the year, Amethystine Pythons (*Morelia kinghorni*) spend most of their time in large epiphytic basket ferns (*Drynaria* sp.) in the canopy and emergent layers of the forest.

individual snakes displaying what can only be called active “exploratory” behavior in the middle of the day. In one case, a large male was observed moving systematically over the forest floor, his tongue constantly flicking, pushing his head into holes and then withdrawing it. Active foraging by Amethystine Pythons, while seldom observed, is fairly well known because of the number of pythons that are trapped in chicken coops after eating their fill and then being unable to squeeze back out through the wire mesh. More commonly, these pythons have been found in a sit-and-wait foraging stance, often next to obvious mammalian trails through dense grass or undergrowth.

While we have never observed an animal “in the act” of swallowing prey, we have obtained some information on diet in the study area from droppings, regurgitated samples, and the contents of one dissected stomach. So far, the Amethystine Pythons have shown a preference for Bandicoots (*Isodon macrourus* and *Parameles nasuta*) and Red-legged Pademelons (*Thylogale stigmatica*). The former are small marsupial omnivores similar in appearance to a large rat; the latter is a medium-sized forest macropod. Other food items that we have recorded from pythons in the study area and elsewhere include Spectacled Flying Foxes (*Pteropus conspicillatus*), rats (*Rattus* sp.), cats (*Felis catus*), and birds. The most unusual item we have found is reptilian eggs that were in the droppings of one of the radiotracked females. How



BRUCE TONKIN

Amethystine Pythons (*Morelia kinghorni*), such as this female, can move far and relatively quickly when necessary. In many ways, these pythons, with their gracile bodies, long tails, and slender necks, are built more like an arboreal colubrid or treeboa than a large python.

these came to be in the snake we have no idea, and we have yet to identify the species to which the eggs belong.

Sadly, we have collected almost no data on reproductive behavior. No observations have been made of fighting behavior in males or of mating, and none of the three tracked females has attempted to brood a clutch.



AMANDA FREEMAN

Amethystine Pythons (*Morelia kinghorni*), such as this female, use both “sit-and-wait” (seen here) and “active-foraging” strategies for prey capture.



AMANDA FREEMAN

Bandicoots, small marsupial omnivores similar in appearance to a large rat, are favored prey for Amethystine Pythons (*Morelia kinghorni*).

Other Reptiles in the Study Area

In addition to the Amethystine Python, another boid present in the area is the smaller and more common Carpet Python (*M. spilota*). Two subspecies of this species are thought to occur on the Atherton Tablelands: the specialist rainforest-inhabiting “Jungle Carpet” and the more widespread “Coastal Carpet” (Barker and Barker 1994). However, from roadkill and incidental data that we have collected, no consistent pattern of habitat use differentiates the two supposed subspecies (Freeman and Bruce 2007). Consequently, we believe that the presence of two subspecies on the Atherton Tablelands is unlikely.

Other snakes that have been observed in the study area include Brown Treesnakes (*Boiga irregularis*), Common Treesnakes (*Dendrolaphis calligaster*), Yellow-faced Whipsnakes (*Demansia psammophis*), Small-eyed Snakes (*Cryptophis nigrescens*), Eastern Brown Snakes (*Pseudonaja textilis*), and the impressive Red-bellied Black Snake (*Pseudechis porphyriacus*). However, perhaps the most spectacular and unlikely sighting in the area was of a Coastal Taipan (*Oxyuranus scutellatus*). This species is generally thought to be a snake of dry open areas. One of us (ABF) came across a 1.8-m animal on an old logging track in thick rainforest. This highly venomous species tends to have a bad reputation among the general public, but, in this case, the snake sat quietly for 30 seconds or so while it was photographed before moving off into the forest.

Lizards in the study area include a number of Wet Tropics endemics. The Chameleon Gecko (*Carphodactylus laevis*) and spectacular Northern Leaf-tailed Gecko (*Salturus cornatus*) are regularly observed at night during the warmer months, while the more secretive Boyd’s Forest Dragon (*Hypsilurus boydi*) is less frequently seen. The skink fauna numbers eight species, ranging from the diminutive *Saproscincus tetradactylus* with a SVL of 33 mm to the impressive Pink-tongued Lizard (*Cyclodomorphus gerrardii*) with head-body lengths to 200 mm.

Other more widely distributed species that occur in the area include Eastern Water Dragons (*Physignathus lesueurii lesueurii*) and the imposing Lace Monitor (*Varanus varius*). This large varanid can reach lengths of 2 m elsewhere in Australia, and we have observed individuals over 1.5 m in our study area.

Where to from Here?

The radiotracking is about to finish, the last two snakes will be caught soon and their transmitters removed before they are released back into the wild. While the radiotracking will finish, we will continue to collect feeding observations for this species. Also, some circumstantial evidence suggests that Amethystine Pythons may suppress the densities of browsing folivores such as opossums and tree kangaroos in some rainforest fragments. Perhaps that will be our next research project.



Coastal Taipans (*Oxyuranus scutellatus*) are generally thought to be snakes of dry open areas. This highly venomous species tends to have a bad reputation among the general public, but, in this case, the snake sat quietly for 30 seconds or so while it was photographed before moving off into the forest.



Adult Lace Monitors (*Varanus varius*) are seen regularly in the study area. These large varanids can reach lengths of 2 m.

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A number of people have assisted with this project. Rick Shine, Sydney University, and Andrew Krockenberger, James Cook University, provided radiotransmitters. Wendy Bergan and Carol Esson provided veterinary assistance with insertion and removal of transmitters. Radiotracking equipment was made available by the Queensland Parks and Wildlife Service Threatened Species Group. Logistical support was provided by the School for Field Studies Centre for Rainforest Studies. Financial assistance was provided by Australian Geographic. A special thanks goes to all the students and staff at the School for Field Studies Centre for

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Wet Tropics endemic Northern Leaf-tailed Geckos (*Salturus cornatus*) are regularly observed at night during the warmer months.



ROBERT POWELL

The Commonwealth of Dominica is believed to support the largest single population of Lesser Antillean Iguanas (*Iguana delicatissima*), largely because of its expansive, undisturbed coastal habitats.

Ecology and Conservation of the Lesser Antillean Iguana (*Iguana delicatissima*)

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The Lesser Antillean Iguana (*Iguana delicatissima*) survives on fewer than 10 main islands in the northern Lesser Antilles. Historically, these iguanas probably were common on every island from Anguilla in the north to Martinique in the south. The contemporary range reductions are associated with European colonization. Hunting and introduction of exotic predators and competitors threaten Lesser Antillean Iguanas with extinction across their range. The genetic integrity of the species also is in jeopardy on some islands because of hybridization with the introduced Green Iguana (*I. iguana*). Finally, in

tropical island systems such as those in the Caribbean, road construction and subsequent development occurs primarily along coastal areas to accommodate the tourism industry. As coastal roads and development projects expand, *I. delicatissima* becomes increasingly susceptible to road mortality during terrestrial movements. Often such terrestrial movements are to historic coastal nesting habitats, many of which have been severely degraded or completely destroyed. Decades of neglect and lack of appropriate conservation efforts have placed the Lesser Antillean Iguana in jeopardy of extinction. In fact, populations



ROBERT POWELL

Many extant populations of Lesser Antillean Iguanas have been reduced to extremely low numbers and restricted to remaining “natural” areas, causing concern about the long-term viability of the entire species.



CHARLES KNAPP

Lesser Antillean Iguanas (*Iguana delicatissima*) are susceptible to road mortality during terrestrial movements, which may be associated with historic coastal nesting habitats.

have already been extirpated from several islands (Barbuda, St. Christopher, Nevis, Antigua, Les Îles des Saintes, Marie-Galante, and St. Martin/St. Maarten. Moreover, many extant populations have been reduced to extremely low numbers and restricted to remaining “natural” areas, causing concern about the long-term viability of the entire species. Lesser Antillean Iguanas are listed as “vulnerable” to extinction by the IUCN (Hilton-Taylor, 2000). However, individual populations on several islands are critically endangered and only one population (Petite Terre) is considered stable (Powell, 2004).

Conservation and Research for Endangered Species (CRES) at the Zoological Society of San Diego has initiated a multiyear study of *I. delicatissima* in order to acquire ecological information that can be used to make informed conservation management decisions throughout the species’ range. Our aim also is to raise community awareness about the plight of the iguana, because the long-term survival of the species will require local stewardship and pride. Our focal study population is on the island of Dominica. The Commonwealth of Dominica is believed to support the largest single population of *I. delicatissima*, largely because of its expansive, undisturbed coastal habitats (Day et al., 2000). This population provides an opportunity to study the species under natural conditions prior to catastrophic declines and the subsequent cascading demographic perturbations that are occurring elsewhere in the Lesser Antilles.

This study focuses initially on investigating coastal populations of *I. delicatissima*. Specifically, we are investigating life-history variation between disturbed and undisturbed iguana populations. Study variables include clutch size, age to reproduction, nest-site selection, hatching rate, juvenile and adult survival, and diet. Because coastal features on many Lesser Antillean islands are similar, data from “control” undisturbed and disturbed sites can be used to predict the fate of populations on Dominica and other islands where coastal development is increasing — primarily to address the demands of tourism, which has become the economic mainstay of many regional island nations. Road surveys will be conducted to quantify current levels of road-kill



ROBERT POWELL

The population of Lesser Antillean Iguanas on Dominica provides an opportunity to study the species under natural conditions prior to catastrophic declines and the subsequent cascading demographic perturbations that are occurring elsewhere in the Lesser Antilles.



ROBERT POWELL

Life-history data about Lesser Antillean Iguanas are limited.



ROBERT POWELL

Hatchlings were abundant in June.

mortality and identify its impact on population sustainability and demography. In addition to investigating life histories, we are radio-tracking adults to acquire movement data, which will help evaluate the impact of migrations to coastal nesting areas and possibly mitigate concomitant road mortality. Surveys also will be used to identify and qualify attributes of important crossing points characterized by high-frequency mortality events. Lastly, we will be radio tracking hatchlings from nests to record dispersal and survival, and document significant natural and invasive predators.

Working with coastal *I. delicatissima* populations on Dominica provides a means to close the gap in connecting different landscapes using charismatic species as conservation flagships. Currently on Dominica, parrots are seen as flagships for inland mesic forests, whereas sea turtles represent beach habitat. However, the coastal scrub areas lack such a focal species, and *I. delicatissima* has charisma and conservation appeal. Additionally, Dominica is one of the last strongholds for *I. delicatissima* and the methodologies used and results garnered during this study could be used as a model for other Lesser Antillean islands. Furthermore, we hope to establish a conservation footprint to spin off and replicate on other islands, using our results as leverage elsewhere.

Finally, iguanas are charismatic conservation ambassadors and we expect to work with local educators to develop programs focusing on iguanas and their importance to the island. Educational opportunities will include the provision of hands-on field-research experiences with students and teachers. With permission and assistance from the Division of Forestry, we will engage students in the classroom with educational lectures involving study animals.

Presently, life-history information about the Lesser Antillean Iguana is limited. This project offers an excellent opportunity to study the iguana comprehensively in its one remaining stronghold, use the data to educate Dominicans about its importance, and devise conservation and management strategies for iguana habitat throughout the region.

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ROBERT POWELL

Although largely arboreal, Lesser Antillean Iguanas readily forage and bask on the ground.



MICHAEL A. POWELL

The Puerto Rican Ground Lizard (*Ameiva exsul*) is most frequently observed in relatively open areas actively rooting in leaf litter and soil.

Predation on a Tarantula (*Cyrtopholis bartholomaei*) by a Puerto Rican Ground Lizard (*Ameiva exsul*)

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Photographs by the author except where noted.

The Puerto Rican Ground Lizard, *Ameiva exsul* (Teiidae) is the most widely distributed ground lizard on the Puerto Rican Bank, which includes Puerto Rico, many satellite islands, and the Virgin Islands (but excluding Saint Croix, Desecheo, and islas Mona and Monito, which are on their own island banks). Although mainly coastal in their distribution, these lizards can be found at elevations >360 m above sea level in Puerto Rico and have been observed at ~525 m on Sage Mountain, Tortola, British Virgin Islands.

Male Puerto Rican Ground Lizards can exceed 20 cm in snout-vent length; females are smaller. These lizards are strictly diurnal and are most frequently observed in relatively open areas actively rooting in leaf litter and soil, using their tongues to probe for food. Puerto Rican Ground Lizards have a rather catholic diet, and are known to eat many arthropods, snails, frogs, other lizards and lizard eggs, as well as fungi, fruits, and even carrion.

The largest and most visible of the Virgin Island tarantulas is the Ground Tarantula (*Cyrtopholis bartholomaei*). These spiders build their nests in dry soil. With legs spread, they can span 10–13 cm.

Predation by a Puerto Rican Ground Lizard on a Ground Tarantula occurred at exactly 1029 h on 14 October 2007 in leaf litter associated with a rocky area along the road to the pier at White Bay on Guana Island, British Virgin Islands. An adult *Ameiva exsul* (SVL ~11 cm) was observed tongue-flicking what



A Puerto Rican Ground Lizard (*Ameiva exsul*) devours a Ground Tarantula (*Cyrtopholis bartholomei*).

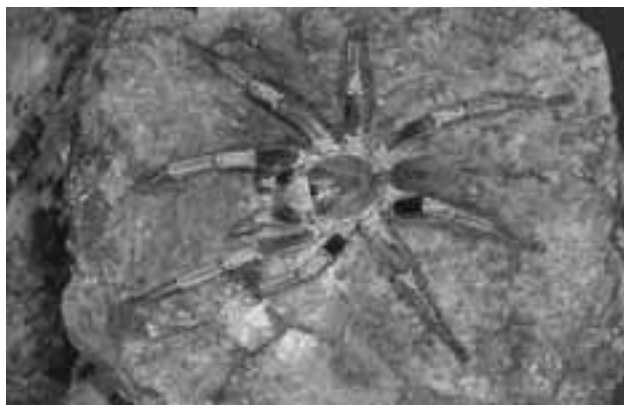
I later identified as a tarantula burrow. Initially, the lizard jumped back from the burrow, but it quickly reentered and emerged with the tarantula grasped by its abdomen. The lizard then proceeded to dismember and eat the spider. The entire episode lasted about two minutes. Subsequently, the *Ameiva* recommenced foraging.

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The Ground Tarantula (*Cyrtopholis bartholomei*) can grow quite large, spanning as much as 10–13 cm.



The Mona Iguana (*Cyclura cornuta stejnegeri*) is characterized by low density compared to *C. c. cornuta* on Hispaniola and other species of *Cyclura*, and by an age pyramid strongly biased toward large individuals, which indicates low levels of juvenile recruitment into the breeding population.



Iguana Specialist Group Meeting

10–12 November 2006

Lajas, Puerto Rico



TOMAS WALLER

Participants in the 2006 ISG Meeting (left to right, standing): Hugh and Sandra Buckner, Ivan and Katarina Rehak, Tarren Wagener, Samantha Addinall, Allison Alberts, Fred Burton, Lee Pagni, Rex McAliley, Karen Graham, Jan Ramer, Stephan Funk, John Kunna, Larry Buckley, Stesha Pasachnik, Bill Modi, Rick Hudson, John Kinkaid, Victor Reynoso, Ernst Rupp, (sitting): Alberto Puente, Georgina Kenyon, John Bendon, Alberto Álvarez, Chuck Knapp, Candee Ellsworth, Tandora Grant, Catherine Stephen, Byron Wilson, Joe Burgess, Miguel García, Bonnie Raphael, Gustavo Olivieri, John Iverson, Kirsten Hines, and Glenn Gerber. Not pictured: Néstor Pérez and Peter Tolson.



JOHN BINNS

This large male Grand Cayman Blue Iguana (*Cyclura lewisi*) in the QEII Botanic Park is testament to the progress achieved by the Blue Iguana Recovery Program (BIRP).



JOHN BINNS

This Grand Cayman Blue Iguana (*Cyclura lewisi*) bears beads that permit individual identification after release in the Salina.

Blue Iguana Recovery Program Update

Fred Burton

National Trust for the Cayman Islands

Salina Reserve Releases.—Shortly after last year's ISG meeting, the Blue Iguana Recovery Program (BIRP) geared up to release 68 two-year-old Blues (*Cyclura lewisi*) into the Salina Reserve, adding to the 25 that were released in late 2004. This involved manufacturing 68 release retreats, which were built locally by the Rotary Club of Grand Cayman Central. Bolstered by local volunteers, the BIRP then had them airlifted by helicopter into two central points in the north and central release zones. Craig Pelke (Milwaukee County Zoo) then joined the team to distribute the retreats to their final locations, which required an extension of the existing trail system. The 68 two-year-old iguanas designated for release were health screened by Dr. Paul Calle and Kate McKlave (WCS, Bronx). Jessica Hite (University of Tennessee) assisted with the release, and continued to accurately map the locations of all the release retreats by averaging multiple GPS readings. All 68 iguanas were free in the Salina Reserve by the end of December 2005, along with four more that were released to the QEII Botanic Park.

The following May through July, we recaptured as many of the 2004 and 2005 releases as possible to assess their growth. We recaptured or at least observed 84% of the 2004 release, and 50% of the 2005 release. This should not be regarded as evidence of lower survival rate for the second group, but rather that the population is now so large that we should not expect to see and catch them all in the time frame of our summer field season. Also, the younger animals were more cryptic in the presence of older individuals. We are moving past the point where total population censuses are realistic, and we will need to shift to sampling techniques for ongoing population monitoring. In 2006, we observed three of the 2004-release females nesting, and at least one had hatchlings emerge successfully. This is the first documented breeding in the Salina Reserve since the restoration began.

So far, we've seen little evidence of rats in the Salina, but fresh cat scat was found at one location and one feral cat was trapped. To date, we have never seen dogs in the release zone, and we probably won't, as long as the trail access is not improved too much. Chuck Knapp and Jeff Lemm (San Diego Zoo) created a trail to the southernmost soil zone in the Salina Reserve, expanding the area available for future releases.

Immediately following the 2006 ISG meeting, Team Blue 2006 volunteers will be arriving and gearing up to release 114 more Blues to the Salina. This time, we plan to release some yearlings as well as two-year olds, with the aim of comparing survival rates by analyzing recapture or census data over a number of years.

Genetically speaking, we won't want to release anything like this number in coming years — the focus now needs to switch to breeding under-represented genetic lines and making sure we have at least 20 different founders well represented in the released population. We still haven't completed data entry and analysis of the summer tracking data. This, and perhaps one more summer's work, should be enough to allow us to quantify the carrying capacity of the Salina Reserve for Blue Iguanas with a reasonable degree of confidence.

QEII Botanic Park Hatchlings.—The population release in the QEII BP has been on a much smaller scale than the popula-

tion restoration in the Salina, but it has been the engine for headstarting large numbers of hatchlings for release. Since enough genetic representation from the QEII BP is present in the Salina Reserve now, eggs were left in the ground to hatch naturally this year.

Seven nests were corralled in September and two hatched by early November. Those hatchlings were PIT- and bead-tagged along with a number of others from uncorralled nests that were found running around in the Park. Over the following weeks, we caught and scanned 29 *Alsophis cantherigerus* snakes, but didn't pick up any hatchling PIT-tag signals. We managed to monitor several hatchlings for fairly long periods without using radio-transmitters. They all spent most of the time high in trees, and showed no interest in the hatchling retreats we so carefully prepared for them.

Dog Predation.—At the height of the nesting season, two wild dogs (abandoned after the hurricane?), entered the Park and killed adult free-roaming Blue Iguanas known as "Slugger" and "Sapphire," and also maimed the nesting female "Yellow Blue." This is a harsh reminder that we still haven't solved the problems that led to the decline of this species in the first place.

Captive Facility.—Last year, Mike Fouraker and colleagues from the Fort Worth Zoo built a storage and food preparation shed, battling extraordinarily wet and windy weather to meet an improbable deadline. With funding from the Dart Foundation, we have subdivided the original large WWF pen into four, effectively gaining three new pens. We still need to build more, as our young potential founders mature and grow, and the emphasis switches from needing juvenile cages to large pens for space-hungry adults. We've secured the captive facility with a fence, both for security and to control tours for income. We are also starting conceptual plans for a visitor center and research center at the facility.

As a result of this December's release, the stock of captives will drop considerably, and we are not recruiting nearly as many hatchlings to the captive facility since we need to focus now on different genetic lines. We hope to focus more resources on quality of care, since the Program will not be quite so overwhelmed with quantity.

Resources.—Major donor channels were the International Reptile Conservation Foundation (27%), Durrell Wildlife Conservation Trust (24%), and local corporate sponsors (18%). The National Trust for the Cayman Islands (BIRP's parent organization) assisted with warden salaries for several months. Sales and general donations comprised 12% of the budget, and a small grant from the International Iguana Foundation contributed a further 6%.

Matching that, we have been making very heavy use of local and international volunteers. The local press has been giving us extensive coverage, IRCF is keeping the news current on our web site, and internationally we've broken into some big name publications: New Scientist, BBC Wildlife, and the BBC News website. On Christmas Day, the Travel Channel will air a story on our Blue Iguana Safari tour.

IRCF continues to help us with merchandise. Bobbleheads were this year's hot item. Also, we are very close now to being able to offer Blue Iguana sponsorships online. Tours are beginning to generate a little income, with potential to make a lot



JOHN BINNS

Grand Cayman Blue Iguana bobbleheads supplied by the IRCF were this year's hot merchandizing item supporting the Blue Iguana Recovery Program.

more. The FCCA conference in Grand Cayman gave us an opportunity to bid for business with all the major cruise operators, and we already have seasonally good business from several hotels.

Protected Areas.—The BIRP, the National Trust for the Cayman Islands, and the Cayman Islands Department of Environment are still working on the key issue of securing more protected land. We are currently investigating two parcels, both of which include some areas of Crown land. Pending a key meeting with government ministers, which we are trying to schedule, we may be launching a major local and international bid for land purchase funds over the next two years.

Iguana iguana on Grand Cayman.—*Iguana iguana* continues to spread as an invasive species on Grand Cayman, where it is developing a reputation as a pest. Thankfully, it has not yet reached the Sister Isles. Local government is paralyzed in any kind of response, because local legislation is out-of-date and fails to distinguish between species of iguanas. Pending passage of a draft National Conservation Law, Green Iguanas and Blue Iguanas have the same legal status.

***Cyclura nubila caymanensis*.**—On the Sister Isles (Cayman Brac and Little Cayman), many years have now passed since Glenn Gerber completed a year-long study. That work remains unpublished, and we are long overdue for an updated population and status assessment. Durrell Wildlife is considering funding for Matt Goetz to survey the region in 2007 or 2008.

Notes on the Distribution of *Cyclura ricordii* and Problems Facing the Species

Ernst Rupp, Sixto Incháustegui, and Yvonne Arias

Grupo Jaragua

Ricord's Iguana (*Cyclura ricordii*) is endemic to Hispaniola. Its population is divided into two isolated ranges in the southwestern Dominican Republic. On the Barahona Peninsula, the species

has been dislodged from its historic natural habitat, which consists of flat alluvial plains around the town of Pedernales. It survives in the surrounding marine terraces, where it depends on depressions filled with soil ("fondos") for reproduction. Four fondos have been monitored over the last three years for nesting results. A Municipal Protected Area has been created to protect the remnant habitat occupied by the species.

In the Neyba Valley, the species is still found in its historically known range, which consists of Isla Cabritos and the southern shore of Lago Enriquillo. While Isla Cabritos is within the Enriquillo National Park, the southern shore of the lake does not have any legal protection. Habitat alteration by charcoal production and hunting are threatening the species in this area. In spite of these problems, evidence exists of ongoing recruitment of hatchlings into the extant population, and reproduction does not seem to be limited by ground conditions. High concentra-



JAN RANIER

Only a portion of the range of critically endangered Ricord's Iguanas (*Cyclura ricordii*) is protected.



JOHN BINNS

Feral mammal assessments of Little Water, Water, and Pine cays were conducted in order to investigate the feasibility of eradicating cats and rats from these interconnected islands in efforts to conserve the Turks and Caicos Iguana (*Cyclura carinata carinata*).

tions of Ricord's Iguana dens can be found in dry creek beds. The rare natural occurrence of flooding may represent a real threat to the animals living in these creeks.

A small population of *C. ricordii* has been spotted in a marine terrace near the town of Anse-a-Pitres, Haiti. This is the first report of the species in this country. The population is threatened by extreme habitat alteration due to charcoal production as well as hunting. Despite intensive searching during the nesting season, no nests were found and recruitment may be a severe problem for the species in this area.

Turks and Caicos Iguana, 2006 Update

Glenn Gerber, Lee Pagni, and Allison Alberts
Zoological Society of San Diego

In March 2006, a team from Island Conservation (IC) and CRES (San Diego Zoo's Conservation and Research for Endangered Species) visited the Turks and Caicos Islands (TCI) to conduct a feral mammal assessment of Little Water, Water, and Pine cays, and investigate the feasibility of eradicating cats and rats from these interconnected islands. In addition to field-work, meetings were held with stakeholders for these cays, including the Turks and Caicos National Trust (TCNT), the Department of Environment and Coastal Resources (DECR), the Pine Cay Home Owners Association (HOA), and a representative for the Water Cay development. IC made a second trip to the TCI in April 2006 to make a presentation to the Pine Cay HOA at their annual meeting. The Pine Cay HOA has committed \$50,000 toward the eradication of cats, which is estimated

to cost \$155,000. IC also wrote a proposal for submission by the TCNT and DECR to the Turks and Caicos Conservation Fund for an additional \$50,000 for this project, and negotiations are underway with the Water Cay developers to provide the final \$50,000 needed. Feral cat eradication is expected to commence in July 2007. Eradication of rats will be much more expensive and is not currently anticipated.

A collaborative genetic study examining the subspecific status of the Booby Cay population of *Cyclura carinata* in the Bahamas was completed and submitted for publication. Five mtDNA haplotypes at the ND4 locus were identified for populations within the TCI, and the Booby Cay population was found to be fixed for the most common of these haplotypes. Based on this finding, and the lack of significant morphological variation between Booby Cay and TCI populations, we propose sinking the subspecies *C. carinata bartschi*.

Several educational projects were completed in 2006, including the production of six traveling conservation awareness kits for TCI primary schools, and a set of three graphic panels for the new TCI National Environmental Center that describe the iguana conservation and research program. In addition, we wrote our third popular article on iguana conservation and research for the popular in-flight magazine, *Discover Turks and Caicos*. Two used 190-horsepower diesel engines were purchased for the TCI-based research vessel, *Cyclura*, and installation of these engines, as well as other needed upgrades and repairs, will be completed in early 2007. A research trip is planned for March/April 2007 to monitor iguana populations translocated



Based on a genetic study and the lack of morphological variation between Booby Cay and Turks and Caicos Islands populations, the Booby Cay Iguana (*Cyclura carinata bartschi*) is no longer recognized as a distinct subspecies.

in 2002/2003, and to conduct surveys of iguana populations on Little Water, Water, and Pine cays to provide baseline data prior to cat eradication. To safeguard the existing iguana populations on Little Water, Water, and Pine cays during the cat eradication process, an ISG representative will be on site when the project commences to verify that iguanas are not being harmed and to help modify methods if needed. Establishment of the non-profit Caribbean Wildlife Foundation (CWF) in the TCI is underway, awaiting completion of articles of incorporation and bylaws.

This will be followed by transfer of ownership for the *Cyclura*, its tender, and associated research equipment to the CWF from the Zoological Society of San Diego. The CWF will be run by a three-member board (initially) and its mission will be the preservation of biodiversity in the wider Caribbean region.

Jamaican Iguana Recovery Project

Byron Wilson and Rick Van Veen

University of the West Indies

2006 was a very productive year for the project, but also one that presented some serious challenges to our capacity and resolve. In particular, illegal tree cutters encroached into the “core” iguana (*Cyclura collei*) area and brought habitat destruction and security issues to the forefront of our concerns. Field assistance was provided by Dawn Fleuchaus, Leon Samson, Brian and Stephanie Wicker, Rhonda Pike, Tom Biltoft, and University of the West Indies students. Mark Gold, our superlative boatman and field companion, continued to provide safe and reliable transport, as well as help with land-based aspects of the field effort. Funding was provided by grants from Conservation International, the Disney Wildlife Conservation Trust, the International Iguana Foundation, the International Reptile Conservation Foundation, and by a New Initiative grant from the University of the West Indies, Mona.

New Iguana Conservationist.—A most exciting development for the project has been the addition of a talented and highly reliable field worker in the form of Leon Samson. With



After post-Hurricane Ivan reconstruction of “South Camp,” the field station that serves as the base for studies of the Jamaican Iguana (*Cyclura collei*), additional improvements have increased capacity and improved livability.

close ties to the Port Royal Marine Laboratory (the UWI Life Sciences facility that provides boat transport for the project), Leon joined the recovery effort in January 2006. With funding from UWI New Initiative and Conservation International grants to Byron Wilson, Leon has been making a significant contribution to our efforts. Training of Leon to assume additional field duties is ongoing. This training, together with his high level of enthusiasm, should produce a long-term project member who will ultimately take over the reins of field coordinator from Rick van Veen.

South Camp Renovations.—Having completed a major post-Hurricane Ivan reconstruction of our field station, further improvements to “South Camp” have been ongoing. In 2006, the team constructed two large wooden platforms to serve as bases for tents, which increases the field worker capacity. Other improvements included the acquisition of four deep-cycle batteries, additional electrical components, and the subsequent establishment of a functioning wind generator for supplying power to camp. A two-burner gas stove was obtained for a dramatically remodeled kitchen and additional cement work was also completed.

Habitat Protection Advocacy and Support.—One positive development is that management capacity for the Hellshire Hills may finally become a reality. The National Environment and Planning Agency (NEPA) has apparently delegated management authority to the Urban Development Corporation (UDC). Encouragingly, the first ever “no tree cutting” signs were posted along the periphery of Hellshire in the vicinity of Hillrun and

Coquar Bay. Significantly, the UDC has hired a new Environmentalist and a new Environmental Officer, whose work will focus on implementing the UDC’s Hellshire Environmental Management Plan (HEMP).

2006 Nesting Season.—The two main nesting areas in central Hellshire (“Upper Nesting Site” [UNS] and “Lower Nesting Site” [LNS]) were monitored from newly constructed observation hides during the month of June. In total, 13 females were confirmed as having deposited nests in these two areas. These communal nesting areas were surrounded with metal flashing prior to the hatching season in September enabling the collection and enumeration of over 100 hatchlings. Several other successful nests also were discovered during the hatching season. Fourteen hatchlings emerged from a secondary nest near the LNS, and a minimum of six hatchlings (1 + 5) emerged from two small “rock-hole” nests. Another rock-hole nest southwest of the main nesting areas was also discovered, but this nest was flooded by heavy rains, as it had been in 2005. One other potential rock-hole nest was noted but was not accessible and therefore could not be examined to determine whether it had produced hatchlings. Finally, “Stumpy,” a head-start release from 2001, deposited eggs in the camp vegetable garden; these eggs did not hatch. Overall, a minimum of 21 potentially successful nests and 23 nesting attempts were recorded. In total, we documented the successful production of 125 hatchlings. 85 were PIT-tagged and released, 20 were taken to the Hope Zoo for head starting, while the remainder were enumerated based on the discovery of hatched eggs.



BYRON WILSON

Jamaican Iguana (*Cyclura collei*) communal nesting areas were surrounded with metal flashing prior to the hatching season in September enabling the collection and enumeration of over 100 hatchlings.

Radiotelemetry.—Starting from the nesting season, Rick van Veen began attaching small (BP-2) radio transmitters to postpartum female iguanas and other adult or subadult animals. The main objectives of the exercise were to determine the distances females were traveling to access the two known communal nesting areas, to map their non-nesting season home ranges, and to gather additional information on habitat-use patterns. In total, 15 females and 11 males were radiotagged. Several of the transmitters failed almost immediately or became detached from the lizards. In all, reliable data were obtained for 20 animals. As expected, females have smaller home ranges than males, but somewhat surprisingly, these females apparently live quite close to the nesting areas. We had expected that, given the paucity of suitable nesting sites (i.e., dirt areas), some of them would have traveled considerable distances.

This study revealed some interesting aspects of iguana behavior and habitat use that may have important conservation implications. For example, well-worn iguana trails (“pads”) leading to and from particular fruiting trees were noted during radiotelemetry efforts. These pads appear to have been used by iguanas for decades (or longer), and point to the critical importance of these resources. This, of course, underscores the imperative of curtailing tree cutting in the Hellshire Hills.

Population Inferences.—During the course of live-trapping iguanas to obtain subjects for the telemetry study, a total of 34 adult or subadult animals were captured. Of those, nine were previously PIT-tagged wild adults, four were “new” wild subadults or young adults, and 21 were headstarters. Hence, 62% of the trapped sample were headstarters, further suggest-

ing the importance of headstarting/augmentation to the remnant population residing in the very central part of the iguana area.

Pitfall Trapping Experiment.—This field experiment, examining the impact of mongoose control on the terrestrial herpetofauna of the Hellshire Hills, proceeded into its tenth year. Although we have not seen the increase in ground-reptile abundance that was anticipated, this long-term trapping exercise represents a novel monitoring program for a Caribbean dry forest, and certainly represents the most useful gauge of biotic patterns within the Hellshire Hills.

Predator Control.—We continued to operate and expand our predator trapping program in 2006. Trapping capacity was enhanced by the addition of 30 new mongoose/cat traps and 120 new snares obtained through a grant to the pig project being conducted by Professor R. Robinson and the iguana team. Numbers of invasive predators caught and removed were similar to previous years: around 100 mongooses, half a dozen cats, and over 30 pigs. Also removed were substantial numbers of rats and Cane Toads (*Bufo marinus*). No dogs were trapped during 2006, although they were an occasional presence in the forest.

Goat Islands Restoration.—As always, interest in a rehabilitation program for the Goat Islands has been high, but awaits higher-level management activity before it can become a reality. At present, the UDC is working on the development of an MOU with the Durrell Wildlife Conservation Trust, which is a necessary prerequisite for DWCT to embark on a fundraising campaign to fund the restoration effort. In addition to continuing interest from the IUCN-ISG and the IIF, Island



Of Jamaican Iguanas (*Cyclura collei*) trapped for a telemetry study, 62% were headstarters, reinforcing the importance of headstarting and augmentation to the remnant population residing in the very central part of the iguana area.



Interest in a rehabilitation program for the Goat Islands is high, but higher-level management activity is necessary before it can become a reality.

Conservation has also expressed an interest in participating in the eradications of invasive species on the Goat Islands.

Tree Cutting Crisis.—In November 2005, we discovered cut *Lignum vitae* trees well within the “core” iguana conservation zone. Occasional incursions continued until October 2006, during which *Lignum* were cut within 150 m of the Lower Nest Site. Ground reconnaissance revealed that the incursions were emanating from a trail ~100 m west of our historical trail. Large commercial charcoal operations were also noted within the iguana area and a subsequent Jamaica Defense Force helicopter trip confirmed both the extent of charcoal operations in central Hellshire and their proximity to our research and conservation activities.

Police operations also resulted in the confiscation of charcoal, both in the vicinity of Hillrun and along the coast. One arrest was apparently made at a charcoal-burning site east of Manatee Bay. What level of legal action was taken against coal burners along the northern edge of Hellshire is unclear. Unfortunately, the public education program to be launched by the UDC lagged behind police activities, and rumors of coal-burner anger directed at iguana researchers have emerged. Armed police escorts have been used in special cases, but having iguana workers accompanied by the police during every activity is not practical. Accordingly, we are now continuing activities as before, albeit with a heightened sense of unease. Should these security problems remain unaddressed or worsen, the viability of the iguana recovery effort must certainly be viewed as tenuous.

Residential and Tourism Development.—The UDC has revised the original plans for residential expansion in the Hellshire area. Old plans for a large development in the central

Hellshire area have apparently been shelved; at present, ongoing and future development will be limited to the eastern portion of the peninsula, adjacent to existing development in the vicinity of the Hellshire Beach community. These new plans provide for the protection of most of the remaining Hellshire forest, including what we consider to be the core iguana area in central Hellshire. However, a densely populated community located deeper in Hellshire, with an increase in human and other species incursions (especially dogs and cats), is of concern.

A more insidious threat is the potential for tourism interests to overwhelm conservation concerns and result in the construction of large hotels along Hellshire’s remaining white sand beaches. Local and foreign development interests have turned their eyes on every undeveloped beach remaining on the island. The combination of government ineptitude, personal greed, and the temptation of foreign investment have already proven disastrous in Jamaica. The general pattern is as follows: a foreign entity pledges support, political will overrides the country’s environmental legislation, the project starts without a proper EIA, ground is broken and suddenly hundreds of new workers are employed. Because taking jobs away from desperately poor people is something that “can’t be done,” the project then attains a momentum that is impossible to halt. Therefore, ensuring that these projects never get off the ground is imperative.

Anegada Iguana 2006 Conservation and Research Update

Glenn Gerber,¹ Lee Pagni,¹ and Kelly Bradley²

¹Zoological Society of San Diego ²Dallas Zoo

Headstarted Iguana Releases.—Twenty-four headstarted Anegada Iguanas (*Cyclura pinguis*) fitted with radiotransmitters were released in October 2005. As with previous releases in October 2003 and 2004, 12 animals, six males and six females, comprising similar size ranges, were released at each of two sites: Middle Cay, with rocky woodland habitat, and Windlass Bight, with sandy scrub habitat. In 2005, we continued the trend of releasing slightly smaller animals than the year before, in an attempt to determine the minimum size at which iguanas can survive with cats. The smallest iguanas released in 2005 were 450 g, as opposed to 600 g in 2004, and 750 g in 2003. Unlike previous



Twenty-four headstarted Anegada Iguanas (*Cyclura pinguis*) fitted with radiotransmitters were released in October 2005.

releases, when all 24 animals were fitted with internal transmitters, only the eight smallest animals released in 2005 (those between 450 and 600 g) received internal transmitters. The largest 16 iguanas were fitted with external transmitters attached to the nuchal crest.

Iguanas released in 2005 were tracked for a total of 15 weeks, over a one-year period (October–October), to monitor survival, growth, habitat use, behavior, and home range. In addition, iguanas released in 2004 and 2003 continued to be monitored whenever possible. Despite releasing a range of differently sized animals each year, decreasing the minimum size of released animals, and releasing animals in two very different habitat types, we have observed no differences in survival between years or study sites one year after release (overall mean = 86% survival), and no associations between animal size and survival.

In October 2006, the fourth annual release of iguanas took place. All animals in the headstart facility that weighed 450 g or more (29 individuals) were released, bringing the total count for animals released since 2003 to 101. 2006 was the first year animals were released without radiotransmitters. Based on previous work, we feel confident these animals will experience survival rates similar to prior release groups. Of the 29 iguanas released, 15 were released at Windlass Bight and 14 at Middle Cay. Sex ratios and size ranges of released animals were balanced between the two sites, as with earlier releases.

Health Screening.—In October 2006, a veterinary team from the Wildlife Conservation Society (Robert Moore and Kate McClave) performed prerelease health screens on iguanas at the headstart facility. All of the animals slated for release were found to be in good physical condition with acceptable blood chemistry and hematology profiles.

Feral Mammals.—In March 2006, a team from Island Conservation (Brad Keitt and Bill Wood) and CRES visited the British Virgin Islands (BVI) to conduct a feral mammal assessment of Anegada and investigate the feasibility and cost of eradicating cats, livestock, and rats from the island. In addition to fieldwork, meetings were held with local stakeholders, including representatives from the BVI National Parks Trust (NPT), the Conservation and Fisheries Department, and the Agriculture Department. Island Conservation's recommendation is to first

eradicate feral cats and livestock. Eradication of rats will be much more expensive and is not currently a priority.

Nests and Hatchlings.—During the first half of July 2006, a team of five volunteers (Joe Burgess, George Waters, Tina Bouse, and Todd and Kym Campbell) traveled to Anegada to help with the annual nest search and other fieldwork. Four nests were located: one at Cooper Rock on the northeastern shore, and three at Windlass Bight along the north-central coast in the core iguana area. As in years past, temperature data-loggers were placed in each nest, and a fence of metal flashing was erected around each nest site to contain the hatchlings upon emergence and to exclude feral mammals.

In October, hatchlings emerged and were collected from each of the four nests found in July. The number of hatchlings emerging from individual nests was 14 for the Cooper Rock nest, and nine, nine, and six for the Windlass Bight nests. Despite attempts to excavate all nest sites after emergence, only the egg chamber for the Cooper Rock nest could be located. It contained 14 empty eggshells (100% hatching rate). In addition to recovering 37 of the 38 hatchlings known to have emerged from our four marked nests, an additional five hatchlings were captured during the course of other fieldwork, and one hatchling was captured in the Settlement, bringing the number of hatchlings placed in the headstart facility to 43 this year.

Headstart Facility.—The Anegada headstart facility, maintained and operated by the BVINPT, presently consists of 12 large cages with 66 iguanas (41 hatchlings collected in October, and 25 older juveniles weighing < 450 g) housed in groups of similarly sized individuals. In addition, 29 animals weighing greater than 450 g were released in October, as described above. Four deaths have been documented at the facility in the past year. However, two of these were animals with extenuating conditions: one animal from the 2005 hatch with severe spinal deformities and a 2006 hatchling from the Settlement that sustained a substantial injury to its tympanum before being brought to the facility. Growth of animals in the facility, including the 29 iguanas released in October, was generally good and showed considerable improvement in the last six months. This is attributed to improved care by facility staff (Alex Varlack, Michael Young, and Rondel Smith) and the addition of Samantha Addinall, with prior experience at



KELLY BRADLEY

In October, Anegada Iguana hatchlings (*Cyclura pinguis*) emerged from each of the four nests discovered during fieldwork in July.



RICK HUDSON

The Anegada headstart facility presently consists of twelve large cages that contain a total of 66 iguanas.

the iguana facility on Grand Cayman, to oversee operations on Anegada for the BVINPT. In the coming year, the BVINPT hopes to improve the headstart facility by adding 56 smaller cages (to begin housing animals individually) and constructing a building with facilities for food preparation, equipment storage, and office space.

Genetics.—In 2006, in addition to the routine collection of blood samples from all new captures on Anegada ($n = 47$), blood sampling materials and protocols were shared with researchers on Guana Island. As a result, 29 samples from the translocated population on Guana (founded by eight adults from Anegada between 1984 and 1986) and five samples from the translocated population on Necker (founded by four offspring from Guana in 1995) were added to our sample collection for the species.

Vitamin D Study.—In an effort to fill gaps of our knowledge of baseline physiological values, we initiated a new blood chemistry study this year. We collected blood samples to measure serum 25-hydroxy-vitamin D3 (25-OH-D3), calcium, and parathyroid hormone (PTH) concentrations in wild, released, and captive iguanas throughout the year. We collected 20 samples each month for May, July, and October. By taking serial samples, we hope to demonstrate seasonal changes in these variables over time. Bill Gehrman and Gary Ferguson, from Texas Christian University, and Michael Holick, from Boston University of Medicine, are participating in this study.

Education.—Thanks in part to the IRCE, several educational projects were completed in 2006, including the production of laminated headstart facility guides, and 500 posters and 1000 brochures promoting Anegada, its native wildlife, and the iguana conservation and research program. In addition, with partners at the BVI National Parks Trust, a hands-on educational program for the public was held in conjunction with the release of headstarted iguanas in October. Participants included Anegada school children and their teachers, ecology students and instructors from Stout Community College on Tortola, and adult residents of Anegada.

New Field Initiatives.—In July, with the help of our volunteer field team, we began a new initiative to put permanent ID markers at all known retreat sites, and collect spatial and ecological data for these sites using a data-logging differential GPS. This work was continued in October, and we presently have over 100 retreats mapped and marked in the core iguana area. We will continue this work in 2007, and anticipate mapping and marking at least another 50 retreats. We also are beginning a trapping program to capture, measure, and mark as many wild iguanas on Anegada as possible, in an effort to better estimate population size and other demographic parameters. We experienced good success using live-traps to recapture released headstarted iguanas during the past year and also trapped a handful of wild adults in the process. We now have 14 live-traps on Anegada and, in 2007, will begin a concentrated trapping effort focused on the wild population, by systematically trapping animals associated with marked retreats.

In May 2007, we plan to begin attaching two-year external radiotransmitters to adult male and female iguanas at our Windlass Bight and Middle Cay study sites, to determine home range and movement patterns of resident adults in these areas and for comparison to our radiotelemetric studies of released head-

started iguanas at these sites. In addition, as opportunities arise, we hope to use radiotelemetry to track: (1) females leaving coastal nesting sites and returning to their territories; (2) juveniles dispersing from Windberg Cay, a small islet in Red Pond that appears to serve as a natural headstart facility; and (3) the movements and survival of hatchlings following emergence from nests.

Funding.—In July 2006, CRES received a two-year grant of 70,000 Euros from the Nando Peretti Foundation for the Anegada project. Funds will be used for the new field initiatives outlined above, continuation of fieldwork associated with the headstart and release program, educational needs, and the construction of additional cages at the headstart facility. In addition, \$3,000 from Henry Jarecki (the owner of Guana Island) and \$1,000 from Gad Perry (Texas Tech University) have been pledged to CRES for the analysis of DNA samples from the Guana and Necker iguana populations.

Anegada SRP.—The Anegada Species Recovery Plan, originally drafted in 2004, has been finalized and submitted for layout and publication. Copies should be available in early 2007.

Mona Island Iguana

Reports on Ecology, Conservation, and Blindness

Néstor Pérez-Buitrago, Keysa Rosas, Stephan Funk, Miguel García, Alberto Álvarez, and Owen McMillan

University of Puerto Rico and Puerto Rico Department of Natural and Environmental Resources

The Rhinoceros Iguana, *Cyclura cornuta cornuta*, is widely distributed throughout Hispaniola (Haiti and Dominican Republic), whereas the Mona Iguana, *C. c. stejnegeri*, is endemic to the remote island of Mona (Puerto Rico). Mona is located in a deep-sea channel between Hispaniola and Puerto Rico and no evidence is indicative of a historic connection between Mona and either Puerto Rico or Hispaniola. The Mona Iguana is characterized by low density compared to *C. c. cornuta* and other species of *Cyclura*, and by an age pyramid strongly biased toward large individuals, which indicates low levels of juvenile recruitment into the breeding population. These two traits have led to the conclusion that the Mona population “is abnormally small.” In order to investigate the factors determining the demography of Mona Iguanas and to strategically plan conservation management, the Center of Applied Tropical Ecology (CREST-CATEC) at the University of Puerto Rico and the Natural Resources Department (DRNA-PR) started an intensive research program in 2003. Research focuses on three study sites representing three environments (vegetation structure and composition) and different levels of human disturbance (from none to high disturbance). To date, we have captured, measured, sampled, and marked 235 iguanas in the three study areas. Captured animals continue to demonstrate “vision problems.” Nine of 28 animals captured in 1998–99 appeared to be blind, lending credence to earlier anecdotal reports of “vision problems” (Tim Reichard, Toledo Zoo). However, the causes for the condition remain unknown, in particular whether it is based on environmental/climatic factors, nutrition and condition of iguanas, or genetic predisposition.

A total of 42 iguanas were marked with radiotransmitters and radiotracked during the reproductive and non-reproductive seasons. Iguanas occupy home ranges with little to no overlap



Mona Island Iguanas (*Cyclura cornuta stejnegeri*) occupy home ranges with little to no overlap among animals of the same sex, indicating sex-specific territoriality. This gravid female is radio-collared to track movements.

among animals of the same sex, indicating sex-specific territoriality. During the mating period, some females “visit” neighboring males, with which they do not interact during the non-reproductive season. During the nesting period, females seek a place for nesting and either go directly to a specific nesting location or visit many potential nesting areas. Females appear to exhibit strong competition for nesting sites in communal nesting areas that are already in use by other females. The maximum distance traveled was by a young female that visited many nesting areas before reaching the final spot after moving 12.8 km. Hatching success varied from 55–89% during the study period.

In 2003 and 2004, we captured hatchlings either for marking with PIT-tags ($n = 163$) and immediate release or for the headstarting program. So far, only one PIT-tagged hatchling was recaptured between 2005 and 2006. The headstarting program was launched in 1999 and employs the DRNA-PR captive facilities on Mona Island. Hatchlings collected in 1999 and 2000 were released in 2002 and 2003. Hatchlings collected in 2003 and 2004 are awaiting release. In 2003, we implemented an intensive mark-recapture program in order to estimate population density and to quantify survival and growth rates of wild and headstarted iguanas.

We are utilizing molecular genetic tools in order to quantify reproductive success of males and to assess multiple paternity. After testing 20 microsatellite primers developed for Cuban Iguanas, *C. nubila*, failed to produce interpretable results, we developed a microsatellite library for the Mona Iguana. From 29 primer pairs for Mona Iguana-specific microsatellite loci, we

have optimized 19 primer pairs resulting in scorable genotypes. Ten loci exhibit three or more alleles (range 3–16, mean = 5.0) in a subset of 55 adults. The marker set has low probability of identity and high exclusion power even for highly related individuals, thus the marker set is highly suitable for studies of paternity, social organization, and relatedness. Initial parentage analyses for three nests of one female suggest both single and multiple paternity within clutches of different years, different males between years, and sharing of the same nest site by two or more females. Currently, we are confirming and extending these preliminary results by further genotyping.

The Mona Island population is ideal for assessing the economic costs, reliability, and precision of different methodologies for the estimation of population size because iguanas have been easily observed during the intensive monitoring of the three study areas over the last years. Direct observations, mark-recapture, and radiotracking suggest that all resident animals have been individually marked. Using information obtained between 2003 and 2005 (mark-recapture and home range sizes) as baseline data, we currently are comparing costs (time, manpower, and resources) and density estimates of mark-recapture, distance sampling, non-invasive genetic tagging using fecal samples. In addition, we monitor communal nesting areas during the short hatching season (only three weeks in October) in order to investigate whether the method allows the estimation of population trends. In 2006, we counted 680 hatchling emergence holes in the coastal nesting areas, which comprise ~74% of the suitable areas available for iguana nesting on Mona Island.

Problem Assessment and Control of the Introduced Cuban Iguana (*Cyclura nubila nubila*) on Isla Magueyes

Alberto Álvarez, Néstor Pérez-Buitrago, María Andrade-Núñez, and Miguel García-Bermúdez

University of Puerto Rico and Puerto Rico Department of Natural and Environmental Resources

The exotic Cuban Iguana (*Cyclura nubila nubila*) was introduced in the mid-1960s to Isla Magueyes (southwest of Puerto Rico) as part of an erstwhile zoo exhibition (Rivero 1978). The island (7.2 ha) harbors the facilities of the Department of Marine Sciences—University of Puerto Rico (DMS-UPR), Mayagüez campus. Anecdotal information suggests that the actual Cuban Iguana population in Magueyes comes from one founding pair. In 1986, an estimate of population size was 167 individuals (23.2 iguanas/ha). Since then, the population has showed a noticeable increase in density (55–70 iguanas/ha), an effect attributed to a cat and rat-removal program implemented in the mid-1990s. The most recent census in November 2005 estimated the population at 422 individuals. This abnormal iguana abundance has become a nuisance for some members of the university community in Magueyes, who claim that they are frequently harassed and occasionally bitten by iguanas, creating an unsuitable environment and posing potential legal implications for DMS. In contrast, other people view the presence of this iguana as having a cultural and sentimental value for Magueyes. This situation motivated the administration of DMS

to request DNER action to manage/control or eradicate this population. Several options have been under scrutiny since this request: extirpation (donations to zoos, NGOs, and/or private entities), translocation to other known populations of this species, and eradication as a last resource. *In-situ* activities were also considered such as the destruction of nest areas after oviposition.

To address this issue, DNER's Division of Wildlife personnel, along with students from UPR Department of Biology (Rio Piedras campus), started a mark-recapture program in June 2006 as an initial effort to expand our knowledge of this population relevant to making appropriate management decisions; an initiative endorsed by the Iguana Specialist Group (IUCN-ISG). This information would be critical from the perspective of ongoing ecological/genetic processes that this unplanned introduced population is having and how they have changed compared to "normal" *Cyclura* populations. In addition, this group offers a unique opportunity to develop research into processes that, although documented for populations of *Cyclura*, are difficult to quantify, such as frequency of cannibalism and the effect of exotic predators on the population and demography of the species on the island. Finally, a major priority of this research is to establish the genetic identity of the population, since its origin is uncertain.

An agreement between DNER and DMS granted a 1.5-year period (ending December 2007) to conduct research on the population before decisions concerning its management are executed. By November 2006, we have collected tissue samples, gathered morphometric data on 135 individuals, plus collected some demographic information. Our plan is focused on two major aspects: (1) ecological research, which includes demography, nesting ecology, and diet; and (2) genetic research aimed at establishing the genetic identity of the species and the level of inbreeding in the population. We also intend to develop an experimental design to quantify the impact of cats on a high-density iguana population.

2006 Research Update for Allen Cays Iguanas

John Iverson

Earlham College

Fieldwork in March (one week) and July (one week) focused on surveys of islands in the vicinity of the two natural populations of Allen Cays Iguanas (*Cyclura cyclura inornata*) on Leaf Cay and U Cay in the Allen Cays (Exumas, Bahamas). We surveyed eight of these cays, and found iguanas on six of them (0.25–14 ha); however, reproduction is occurring on only one of those islands. The latter cay had no iguanas present in 1996, but now has a population of over 100 individuals. In July, we confirmed that at least eight females had nested on the cay. Some individuals on at least three of the cays were originally marked on Leaf or U Cay, and subsequently translocated to those cays by humans. We believe that tour boat operators may be relocating aggressive iguanas from the Leaf and U Cay beaches, where people are allowed to feed the iguanas. Blood samples were drawn from animals from all islands for a study of the origin of the introductions. Additional survey work is planned for 2007, as well as additional study of the nesting ecology of the iguanas on the two cays with introductions. Allen Cays Iguanas now occur



NESTOR PÉREZ

The exotic Cuban Iguana (*Cyclura nubila nubila*) was introduced in the mid-1960s to Isla Magueyes (southwest of Puerto Rico) as part of an erstwhile zoo exhibition. This individual was the first female captured and marked. At present, morphometric data have been collected for over 180 iguanas.



LYNNE PETER

Of eight cays surveyed in the Allen Cays (Exumas, Bahamas), Allen Cays Iguanas (*Cyclura cyclura inornata*) were found on six, but reproduction is occurring on only one.



JOHN BINNS



KIRSTEN HINES



KIRSTEN HINES



KIRSTEN HINES

Leaf Cay (Allen Cays, Exumas, Bahamas), home to the largest population of the endangered Allen Cays Iguana (*Cyclura cyclura inornata*), is the most popular iguana feeding location, receiving an ever-growing number of tourists, easily exceeding 100 visitors on an average day.

on at least nine separate islands, although only four of these have substantial, reproducing populations. The total world population has increased from about 150 in 1970 to perhaps 1300 today.

**Preliminary Diet Analyses for *Cyclura cyblura inornata*
and *Cyclura cyblura figginsii***

Assessing Potential Impacts of Tourist Feeding

Kirsten Hines

The Institute for Regional Conservation

Tourism is a staple of the Bahamian economy and over half the workforce is employed in tourism-related industries. In an attempt to compete in this market, tour operators have turned to eco-tourism. Airline magazines now tantalize visitors with flashy ads that promise remote beaches in the Exumas and a chance to feed sharks, stingrays, and iguanas. Leaf Cay (Allen Cays), home to the largest population of the endangered Allen Cays Iguana (*Cyclura cyblura inornata*) and the most popular iguana feeding location, receives an ever-growing number of tourists, easily exceeding 100 visitors on an average day. The industry has been so successful that the concept has spread to the southern Exumas, affecting populations of endangered Exuma Island Iguanas (*Cyclura cyblura figginsii*). In order to assess potential impacts of tourist grape offerings on iguana diet, 92 *C. c. inornata* fecal samples were collected from seven cays in the northern Exumas and 131 *C. c. figginsii* fecal samples were collected from six cays in the southern and central Exumas over the past year. While samples at most locations consisted of native vegetation, preliminary analyses indicate a dietary shift on Leaf Cay (Allen Cays), primarily at the tourist-feeding beach. About 30% of fecal samples from this beach contained high concentrations of grapes and sand (compared to < 10% for other areas on Leaf Cay and 0% on other cays), and one sample contained only grapes and sand. This beach also was the only area with a high incidence of diarrhea that dried to a cement-like tube instead of the natural cigar-style wrap of leaves. Initial observations suggest that minimal or infrequent food supplementation may not affect iguana diet, but prolonged periods of regular feeding appear to alter diet composition. This dietary shift may be limited to individuals that frequent feeding beaches, but as eco-tourism expands globally, more individuals of these species and others may be affected. Prohibiting the expansion of this industry seems unrealistic and maybe even unnecessary, but we must understand its impact to minimize potential damage. Future research will focus on quantifying differences among scat samples; establishing a pre-tourist expansion baseline by analyzing samples collected across the Exumas by John Iverson in the 1980s, examining the health impacts of a dietary shift, and recording behavioral differences between areas with tourist feeding and those with none.

**Taxon Reports for *Cyclura cyblura* and
Future Research Plans for *Iguana iguana***

Charles Knapp

Zoological Society of San Diego

Andros Iguana (*Cyclura cyblura cyblura*).—Some aspects of the Conservation and Management Plan for the Andros Iguana that



JOE BURGESS

In June 2006, the Nature Conservancy organized a rapid ecological assessment of the marine and terrestrial ecosystems on the western side of Andros Island. This assessment was conducted, in part, to fill information gaps on the distribution of high-profile endangered species such as flamingos, sea turtles, and Andros Iguanas (*Cyclura cyblura cyblura*).

were identified as priority projects in November 2005 have been initiated or completed. Lee Pagni, Deirdre Ballou, and I (San Diego Zoo) received a \$10,000 USFWS Wildlife Without Borders grant for conservation education initiatives for Andros Island that focus on raising awareness of the iguana. The grant includes provisions for teacher workshops, mobile outreach education kits, and funding for Ricardo Johnson's soccer club.

In June 2006, the Nature Conservancy organized a rapid ecological assessment of the marine and terrestrial ecosystems on the western side of Andros Island. This assessment was conducted, in part, to fill information gaps on the distribution of high-profile endangered species such as flamingos, sea turtles, and iguanas. Objectives for the iguana rapid assessment were to: (1) locate areas of relatively high iguana density; (2) survey within the existing Central Andros National Park boundary on North Andros; and (3) conduct general herpetofaunal surveys to produce species distribution lists. In general, few, if any iguanas inhabit the western side of North Andros Island. Additionally, the existing National Park on North Andros Island is not adequate to ensure the long-term survival of the Andros Iguana.

Exuma Islands Iguana (*Cyclura cyclura figginsii*).—Surveys in the Exuma Island chain were conducted in April 2006. Objectives for 2006 were to: (1) survey iguana populations in the south-central Exuma chain; (2) translocate iguanas from Leaf Cay (northeast of Normans Pond) to Pasture Cay in the Exuma Cays Land and Sea Park to augment the initial colony that was translocated in 2002; and (3) collect preliminary dietary and body-condition data for comparative studies of iguana populations inhabiting Exuma cays visited by tourists versus unvisited cays. In addition to the April surveys, Gaulin, Bitter Guana, and Pasture cays were visited 26 May–4 June 2006. During the April surveys, we captured and processed a total of 123 iguanas from five cays. During the May/June surveys, we captured an additional two founder iguanas from Pasture Cay, one iguana from Bitter Guana, and 51 iguanas from Gaulin Cay. Of the 51 Gaulin captures, 27 were recaptures dating back as far as 1998. On 10 April, we set Sherman live rat traps on White Bay ($n = 28$ traps) and Leaf Cays ($n = 30$ traps). We trapped six rats from White Bay and none from Leaf Cay. To date, rats have been confirmed from White Bay, Gaulin, Bitter Guana, and Pasture cays. North Adderly, Noddy, and Guana cays still need to be surveyed for rats. The translocated seven (5.2) founder iguanas recaptured on Pasture Cay all appeared healthy and had gained body mass since last capture. Two founder iguanas (1.1) were observed but not captured. Three subadults that were hatched on the island were either captured or observed. Evidence of exploratory dig-

ging activity was observed on the northern beach and two iguanas appeared to have nested.

Green Iguana (*Iguana iguana*).—A 2007 study will be conducted to test the locomotor effects of transmitter burdening on hatchling Green Iguanas (*Iguana iguana*) in the laboratory and then correlate performance with survival of hatchlings in the field. Specific objectives will include: (1) measuring maximal sprint speed of *I. iguana* hatchlings affixed with radio transmitters that equal 2.5, 5.0, and 7.5% of body mass; (2) measuring jump speed of hatchlings affixed with radiotransmitters varying in the same ratios; and (3) releasing and radiotracking a subset of 30–40 hatchlings in the Gandoca-Manzanillo Wildlife Refuge on the Caribbean coast of Costa Rica to test for survival differences between the three different treatment groups.

Specific conservation goals for this study include quantifying the effects (if any) of transmitter burdening on lizards. Because radiotransmitter studies will be required to answer conservation-oriented questions on multiple lizard taxa (including the genus *Cyclura*), having information pertaining to the effects of transmitter burdening is imperative in order to establish quantitative guidelines and recommendations for future ecological studies. In addition, Green Iguana populations are becoming threatened in parts of the species' range, therefore, survival and dispersal data stemming from this work will be used to guide future management strategies for the species.



CHARLES R. KNAPP

Exuma Islands Iguanas (*Cyclura cyclura figginsii*) translocated from Leaf Cay to Pasture Cay in the Exuma Cays Land and Sea Park in 2002 appeared healthy and had gained body mass since the previous survey.

The Conservation of *Iguana delicatissima* in Martinique and a Future Action Plan for the French West Indies

Jean-Francois Maillard¹ and Michel Breuil²

¹Agency of Hunting and Wildlife, Martinique

²Natural History Museum, Paris

Iguana delicatissima has been protected in the French West Indian islands of Martinique and Guadeloupe since 1989. The French Ministry of Ecology and Sustainable Development, with the Strategy for Biodiversity, is responsible for preserving the endemic fauna and flora of the French tropical areas. Since early 2006 on Martinique, a new project has been undertaken to conserve and enhance populations of *I. delicatissima*. The French Agency of Hunting and Wildlife (Office National de la Chasse et de la Faune Sauvage, ONCFS) is collaborating with Dr. Michel Breuil from the French Natural History Museum of Paris (Musée National d'Histoire Naturelle, MNHN) to facilitate this two-year scientific and technical project, which is financially supported by the European Union, the French Ministry of Ecology, and the ONCFS.

In Martinique, populations of iguanas are scarce. At least two populations are known to inhabit the northern portion of the island, but demographic data are sparse because the mountainous areas are difficult to access. A second population inhabits Islet Chancel, a 70-ha island in the bay of Robert on the Atlantic Coast. The objectives of the ONCFS project are to assess the demography of *I. delicatissima* on Islet Chancel, to augment the iguana population by introducing iguanas to Islet Ramier in the bay of Fort de France, and to remove individuals of *I. iguana*, which were released from a zoo and are rapidly reproducing.

From April–July, 168 adult iguanas have been captured, measured, PIT-tagged, and released on Islet Chancel. Using capture/recapture methods, we estimate the population size at 600 individuals with a sex ratio of 1:1.3. We are waiting to publish our results because we need to complete our database and want to compare spatial distribution of the two sexes between the breeding and non-breeding seasons. Additionally, M. Breuil has captured and marked adult iguanas since 1993, and we will be analyzing individual growth rates.



OFFICE NATIONAL DE LA CHASSE ET DE LA FAUNE SAUVAGE (ONCFS)

Male Lesser Antillean Iguana (*Iguana delicatissima*) on Islet Chancel (top), an adult female captured for radiotagging (lower left), and a female on islet Chancel fitted with a radiotransmitter for tracking movements (lower right).

On Chancel, the physical parameter limiting the growth of the population appears to be poor conditions for nest-burrow excavation. This limiting abiotic condition was first recognized in 1994 by the French Forestry Agency (ONF). In 2006, we improved the nesting area on top of the islet by removing rocks, which were impeding burrow construction. The results were immediately evident, as many females came to the site and burrow excavation was observed. Other nest sites will be improved by the end of the year.

With the help of the French Navy and with permission of the owner of Islet Ramier (2 ha), a new population of *I. delicatissima* was introduced on the islet in July 2006. Nine adults from Islet Chancel were PIT-tagged and affixed with radiotransmitters. After four months, the iguanas appear to have established normal home ranges and movement patterns.

The Green Iguana (*I. iguana*) population has been growing at an alarming rate on Martinique, and the objective of the Ministry of Ecology in Martinique is to reduce and eliminate this species to avoid contact between the two species of iguanas. Negative effects of these contacts have been well documented in Guadeloupe. A new law on Martinique now allows *I. iguana* to be killed by the French Agency of Hunting and Wildlife police.

St. Lucia Iguana 2006 Project Update

Matthew Morton

Durrell Wildlife Conservation Trust

As in previous years, work on St. Lucia Iguanas (*Iguana iguana*) was a collaboration between the Durrell Wildlife Conservation

Trust and the St. Lucia Ministry of Agriculture's Forestry Department, with assistance from volunteer overseas biologists.

Iguana Nesting.—Nests were monitored for 44 days at Louvet (36 days between 1 February–30 April) and 38 days at Grand Anse (34 days between 1 February–30 April). As in 2004 and 2005, nesting activity was greater at Louvet than at Grand Anse. The mean tail-drag count for both beaches was lower in 2006 than in either 2004 or 2005. We cannot infer any population trends from just three years of data. This index, as planned, will have to be measured over a number of years; however, evidence is suggestive of a decline. These data have yet to be analyzed (using Generalized Linear Modeling as in 2005), but linear regression indicates no significant trend to date.

Average clutch size was 23 eggs/female (14–28, SD \pm 4.4, n = 14), including an additional five clutches from 2004. All eight nests opened in 2006 were reopened post-hatching, and an average of 63% of eggs were confirmed hatched: 15% seemed infertile (no skeletal remains in egg), 7% fertile but unhatched (skeletal remains), and 15% were missing when nests were reopened.

Increasing Tourism Pressure.—In early 2006, Louvet Estate was sold to FM Properties. At initial meetings with the new owners, they made clear their intentions for development, projected to include a hotel, golf course, and condominiums. We were able to present the new owners with preliminary suggestions for zoning the site to take wildlife sensitivities into account. These areas are primarily littoral vegetation behind the beach, in which iguanas use sandy patches to nest, and 'ravine' areas



Studies of St. Lucia Iguanas (*Iguana iguana*) are collaborations between the Durrell Wildlife Conservation Trust and the St. Lucia Ministry of Agriculture's Forestry Department, with assistance from volunteers. The individual illustrated was captured shortly after this photograph was taken and barbecued by local residents.



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St. Lucia Iguana (*Iguana iguana*) nest monitoring provided evidence suggestive of a decline in activity. These hatchlings were photographed in 2005.

(buffers around stream courses), which appear to have higher densities of iguanas (and other species of interest such as the White-breasted Thrasher, *Ramphocinclus brachyurus*), and hopefully can be used by iguanas as migration corridors onto and away from the nesting area. Management of additional areas (such as the open beach at night during turtle nesting) would also be needed.

FM properties seemed responsive to these suggestions and showed us a conceptual plan that avoided development in the sensitive zones (including relocating the hotel behind the beach, with footpaths for tourists through the littoral vegetation belt maintained as a nature reserve). However, to the best of our knowledge, no planning application has been submitted. The Forestry Department is expected to be consulted on Terms of Reference for any Environmental Impact Assessment, and Durrell will be able to contribute to these Terms of Reference and, as with the Praslin Bay development, review the EIA with other referral agencies.

Non-native Predators.—Kills of adult iguanas by dogs increased at Louvet this year, with six nesting females (of which we are aware) killed, most if not all over a period of two to three days. No evidence of cats was found at or near the nesting sites this year, although one was caught about a kilometer from the beach and euthanized. Our main effort at invasive predator control this year targeted the introduced small Indian Mongoose (*Herpestes javanicus*). Mongoose control research comprised the bulk of fieldwork in 2006, using a 72-ha trapping grid of 90 live traps at Louvet. We attempted to test the hypothesis that a small effort in mongoose control could keep an area at a reduced population of mongooses for an extended period. Unfortunately, this test of mongoose response to an area cleared of mongooses was compromised by much-lower-than-predicted captures in the culling grid (10 individuals compared with >80 in 2005, albeit the latter over a slightly larger trapping area). This is positive insofar as it suggests that mongoose culling has an even longer-lasting effect than we had anticipated.

The large data set from this work has yet to be analyzed, but we believe that we will have a robust population density esti-

mate. A preliminary estimate of pre-culling captures estimated the population at 69 mongooses (54–124 mongooses, 95% confidence limits; Huggins closed captures model, implemented in program MARK), or a density of roughly 0.6 mongooses/ha. For the culling traps only the estimate was 21 mongooses (19–34, 95% CL) or 0.5/ha, compared with the 2005 estimate of mongoose density on the culling grid of 0.8/ha. Relatively low-level culling apparently has an ongoing effect (reduction in mongoose activity) even a year later (i.e., from 2005–2006), which bodes well for iguana nest protection.

Trapping data also provide an indication of average inter-trap movement distances and some data on mongoose habitat preferences (e.g., more captures closer to rivers). Preliminary compositional analysis using fixes and home ranges indicate significant non-random habitat use by mongooses with habitats ranked (from most to least preferred) as: riverine > forest > scrub > grazed > sand. These findings will help to guide optimal trap placement in future years.

Capacity Building.—To maximize the chances of successfully detecting population trends in the St. Lucia Iguana, the Forestry Department needs to be able to monitor both Grand Anse and Louvet beaches for 30 days from 1 February–30 April, with a minimum of two monitoring days per beach per week during this period. We designated 120 people-days (equivalent to two people per beach over 30 days) for iguana monitoring to assess the Forestry Department's capacity to conduct such a monitoring program. We used three measures of success in achieving this objective: (1) attendance showed a marked improvement compared with attendance in 2005, although it still fell short of our objective; (2) time-keeping was less successful, particularly at the Louvet site, and needs to be addressed as this will compromise future chances of the monitoring program's success; and (3) count performance was to a high, consistent standard. This capacity now clearly exists within the Forestry Department. A number of recommendations were made, although impending development at Louvet (see above) might require monitoring protocols to be reassessed. Durrell has developed a proposal to pilot an alternative baseline (using occupancy probability) in 2007 to address this contingency.

Awareness Raising.—Community and one-on-one meetings, television broadcasts, including “jingles” in advertising slots, and a documentary produced by the Ministry of Agriculture on wildlife conservation, which was presented from Louvet and Grand Anse by contestants in the Miss Earth beauty pageant, were all used to raise awareness of iguana conservation issues, in particular the threat from uncontrolled dogs at nesting sites.

Fijian Crested Iguana Update

Peter Harlow

Taronga Zoo

Research continues on the Fijian Crested Iguana Sanctuary Island of Yadua Taba. Suzie Morrison has just completed her first year's research on Yadua Taba where she captured and PIT tagged 270 resident iguanas (*Brachylophus vitiensis*) in a 0.25-ha dry forest quadrant containing 591 trees. This forest site will be the basis for her long-term mark-recapture project to collect data on growth rates, movement, reproduction, survivorship, diet,

and social structure. This year Suzie recorded the first-ever data on the nesting habits of this species in the field. Several other projects are running simultaneously, including work on the phenology of important food tree species and the effect of the introduced exotic 'crazy ant' and Pacific Rats (*Rattus exulans*) on iguana nest and hatchling survivorship.

Clare Morrison (University of the South Pacific) and her team of post-graduate biology students and Fiji National Trust staff recently completed the last of four field trips to investigate seasonal changes in Crested Iguana diet on Yadua Tabu. Iguana tree-use data from six permanent 250-m transects, as well as analyses of fecal material have given a good indication of diet. Tree-use data were collected on 1,425 iguana sightings, and 26 plant species were identified in the scats of 233 iguanas. The invasive plant and weed management plan for Yadua Tabu continues to be carried out by the Iguana Sanctuary ranger Pita Biciloa (National Trust for Fiji Islands) and men from the nearby village on Yadua Island.

On the 40-ha island of Macuata, where Crested Iguanas were rediscovered in 2004, Craig Morley (University of the South Pacific) and students, with local assistance, recently completed the last rapid iguana survey. Over 40 Crested Iguanas have been PIT-tagged and both *Rattus exulans* and *R. rattus* have been identified, making this the first Crested Iguana population known to co-exist with *R. rattus*.

Ctenosaura Session

Evolution of Spiny-tailed Iguanas (Genus *Ctenosaura*): How Identification of Species Groups and their Relationships Can Help with Conservation Priorities

Larry Buckley,¹ Katelyn Pagel,¹ and Oscar Flores Villela²

¹Rochester Institute of Technology

²Instituto de Biología, UNAM, México

The most diverse group of iguanas (15/37 species) is the Spiny-tailed Iguanas, genus *Ctenosaura*, with 15 currently recognized and at least two unrecognized species. Members of the genus inhabit primarily lowland (< 1200 m elevation) tropical dry and arid forests on both coasts of Mexico and Central America. All species fall within one of seven strongly supported clades (species groups). Clade distributions show a strong geographic component and are associated with well-established biogeographic areas. Closely related species (within species groups) are characterized by allopatry, whereas sympatry is common among species from divergent clades. The relationships among these clades have been the focus of a study using morphological characters and multiple genetic loci (one mtDNA and two nucDNA) in order to establish the branching topology of their evolution in the region. These results contrast significantly with current morphological interpretations, and point to several instances of convergence in morphological characters commonly used in systematic studies of the genus *Ctenosaura*.



Researchers studying the Fijian Crested Iguana (*Brachylophus vitiensis*) on the Sanctuary Island of Yadua Tabu recorded the first-ever data on the nesting habits of this species in the field.

**Molecular Analysis of the
Ctenosaura melanosterna Clade:
Insights into Phylogeography,
Speciation, and Conservation**

Stesha Pasachnik

University of Tennessee

The genus *Ctenosaura*, overlapping in range with the Mesoamerican hotspot, exemplifies the “hotspots” reasoning, brought forth by Myers et al. in 2000, in that it is diverse, is threatened with extinction, and lacks sufficient means of protection. Four of the five critically endangered species of *Ctenosaura* make up the *C. melanosterna* clade, which occurs in Honduras and Guatemala. Due to the current status of these species, an immediate evaluation of this clade is imperative in order to facilitate critical management decision-making and direct future research. Preliminary molecular analysis has been performed on species in the *C. melanosterna* clade and the wide-ranging congener, *C. similis*. The results from two mitochondrial markers and three nuclear markers suggest that this clade has gone through rapid speciation resulting in four narrow-range endemics that occur in both insular and continental habitats. Evidence of hybridization between the island endemic, *C. bakeri*, and *C. similis* on Utila has been documented using a single nuclear marker. Additional analysis is needed in order to evaluate the status of each species, date the colonization events associated with these species, and define the degree and direction of introgression that is occurring between *C. bakeri* and *C. similis* on Utila.

**Black Iguana Project 2006 Update:
Genetics, Demography, and Feeding**

Victor Reynoso, Eugenia Zarza-Franco, Wendoli Medina
Mantecón, and Pilar Rueda Zozaya

Instituto de Biología, UNAM, México

Recent research (since 1998) on Black Iguanas (*Ctenosaura pectinata*) at the Instituto de Biología (UNAM, México) has been coordinated by Dr. Víctor Hugo Reynoso and has addressed: (1) phylogeography and population genetics, (2) demography, and (3) the effect of food, temperature, and sex on growth and digestion efficiency. Genetics and phylogeography of the Black Iguana are part of Eugenia Zarza-Franco's Ph.D. project in the Laboratory of Molecular Ecology in the Centre for Ecology, Evolution, and Conservation at the University of East Anglia, UK, with Dr. Brent Emerson. This project intends to evaluate genetic differentiation among populations of *C. pectinata* to establish the geographic history using mitochondrial and nuclear DNA. Dr. Emerson also aims to understand the species limits, history, structure, and genetic variation to promote countrywide conservation strategies. Until now, *C. pectinata* has been considered a single species with a broad distribution; however, data suggest that the species actually consists of several well-differentiated genetic clades. Because of the existence of different human cultures throughout the distribution of the Black Iguana, each clade is subject to different human impacts and needs a specific conservation effort. For example, northern clades are less threatened than southern clades, since Black Iguanas are not eaten in the north as they are in the south. However, hatchlings in south-



JOHN BURNS

Four of the five critically endangered species of *Ctenosaura* make up the *C. melanosterna* clade, which occurs in Honduras and Guatemala. This is *C. melanosterna*.



JOHN BINNS

Black Iguanas (*Ctenosaura pectinata*) have been the subject of considerable research at the Instituto de Biología (UNAM, México).

ern clades have better survival conditions compared to the more extreme conditions in which northern clades live. The study involves a very detailed sampling of several individual Black Iguanas distributed among more than 50 sites. ND4, Cyt-B, Alpha enolase, and OD DNA sequences will be compared, as will external morphology.

Simultaneously, Eugenia Zarza-Franco is analyzing the genetic structure of *C. pectinata* and *C. macrolopha* in the contact zone where hybrids have been found. Projects still in progress concern the phylogeography and identity of clades in the *C. hemilopha-macrolopha* complex and the phylogeography of *C. acanthura* and *C. oaxacana*.

The project "Demography of the Black Iguana" is conducted in the Instituto de Biología, UNAM, as a Bachelor and Master's thesis by Wendoli Medina-Mantecón under direction of Víctor Reynoso and associated with Ernesto Vega of the Instituto Nacional de Ecología, SEMARNAT, México. This project aims to solve the over-exploitation problem of the Black Iguana as a food source and establish local management programs based on new demographic models such as Sensibility and Elasticity analyses. The species is listed in the Mexican Red List NOM-059-2001 as Threatened, and hunting is currently illegal. However, our results suggest that, if iguana populations are exploited carefully in accordance with certain very well-established rules, natural populations can be hunted without decreasing population size. New precise models testing several management strategies are being developed, and future work will model possible scenarios to promote the best hunting strategy to achieve iguana sustainability.

As an alternative to hunting, the Mexican wildlife agency SEMARNAT is promoting intensive farm production as the best strategy to maintain Black Iguanas as a traditional food supply. The project, entitled "Growth Plus Digestion Efficiency of

Ctenosaura pectinata: Effect of Food, Temperature, and Sex," is being developed by Pilar Rueda-Zozaya under the direction of Víctor Hugo Reynoso in association with Germán Mendoza of the Universidad Autónoma Metropolitana, Xochimilco, México. This study seeks to estimate the effect of commercial food, incubation temperature, and sex in the growth and digestion efficiency of the Black Iguana by evaluating chicken and rabbit pellets as a low-cost captive food option. Food consumption and digestion variables such as dry matter intake, digestible dry matter intake, neutral detergent fiber intake, digestible neutral detergent fiber intake, dry matter digestibility, neutral detergent fiber digestibility, weight gain, food conversion, and food intake as a percentage of animal mass were estimated. This research has suggested that pellet food can be used successfully in iguana farms.

Report on *Ctenosaura palearis* in Guatemala

John Binns

IRCF

Ctenosaura palearis, variously known as the Guatemalan Black Iguana or Paleate Spiny-tailed Iguana, is the only member of the *C. melanosterna* clade with a distribution outside Honduras. Found exclusively in the semi-arid Motagua Valley of Guatemala, the species is listed as Critically Endangered on the IUCN Red List based on the limited size of its range. Recent investigations reveal that, while *C. palearis* was intensively hunted as a protein source in the past in preference to the sympatric *C. similis*, the species is now extremely rare in some areas.

The International Reptile Conservation Foundation (IRCF), in partnership with Zootropic and Zoo Atlanta, has initiated Project *Palearis* in order to develop and execute a recovery action plan for *C. palearis*. This project will be able to leverage many of the components of Project *Heloderma*, designed to preserve the sympatric Guatemalan Beaded Lizard (*Heloderma horridum charles-*



DANIEL ARIANO

Critically Endangered Guatemalan Black Iguanas (*Ctenosaura palearis*) are the only members of the *C. melanosterna* clade with a distribution outside Honduras. This species is found exclusively in the semi-arid Motagua Valley of Guatemala.

bogerti). Specifically, *C. palearis* will be included in Zootropic's educational program for *Heloderma*, and will be able to utilize the facility proposed for breeding *H. h. charlesbogerti*.

The IRCF has provided a vehicle and seed money for research investigating the distribution, ecology, and conservation status of *C. palearis* beginning in May 2007. Zootropic's Daniel Ariano, and University of Guatemala undergraduate student, Paola Coti, will be bead-tagging and releasing all animals located. Five males and two females are already under observation at the research site in the Motagua Valley. Thanks to the efforts of Zootropic, *C. palearis* has been granted protection under Guatemalan law and animals may no longer be exported from the country.

Genetics Session

Update on Iguaninae Phylogeography and Phylogenetics

Catherine Stephen

Utah Valley State College

Iguana Phylogeography.—*Iguana* consists of two species, *I. iguana* and *I. delicatissima*. Whereas *I. delicatissima* historically has a very limited range restricted to the Lesser Antilles, *I. iguana* is found throughout the Neotropics and the Lesser Antilles. That *I. iguana* constitutes a single interbreeding population is highly unlikely, given the enormous physical distances and barriers to gene flow. We are using nuclear and mitochondrial DNA sequence data to explore the phylogeographic history of this species. Samples included in the preliminary analysis have been collected from 17 countries. Results from both data sets show a congruent, deep lineage divergence between the Central American populations and the South American plus Lesser

Antillean populations of Green Iguana. The topology of the phylogeny indicates that *I. iguana* arose on the South American continent.

Iguaninae Subfamily Phylogenetics.—Iguaninae is an ancient group with eight modern genera distributed throughout the Western Hemisphere and in the Fijian Archipelago. Previous morphological and molecular studies of iguanine relationships have relied on incomplete sample sets that yield conflicting topologies. The subfamily collectively spans thousands of miles across multiple geographical boundaries, and exhibits a high degree of regional and island endemism. Because of its age and distribution, the group is uniquely suited to test biogeographic hypotheses, such as suggested occurrences of past refugia or relictual fragments, as well as allowing empirical evaluation of molecular clock models. In order to generate a robust phylogeny, we have collected DNA sequence data at four loci (two nuclear and two mitochondrial) for all eight genera, including 28 of the iguanine species. Phylogenies generated from maximum likelihood analysis of separate data sets result in congruent phylogenies with varying levels of resolution. Preliminary analysis strongly supports *Dipsosaurus* as the most basal lineage in the subfamily followed by an early dispersal of *Brachylophus* to the Fijian Archipelago and a subsequent divergence of the *Cyclura* lineage. A sister relationship between *Sauromalus* and *Iguana* is supported by the combined analysis, and this clade is sister group to the rest of the subfamily (*Ctenosaura*, *Amblyrhynchus*, and *Conolophus*). Interestingly, *Ctenosaura defensor* falls outside the *Ctenosaura* clade in the three data sets in which it is included.



JOHN BIRNS

Results of genetic studies of Green Iguanas (*Iguana iguana*) show a congruent, deep lineage divergence between Central American populations and those from South America plus the Lesser Antilles. Efforts to conserve these unique genetic lineages are complicated by the wide and indiscriminate introduction of iguanas outside their natural ranges. This individual was photographed on Grand Cayman, where the species does not occur naturally and the origin of the population is unknown.

Using Coalescent-Based Analyses of Multilocus Microsatellite Data to Estimate the Past and Recent Population Histories of Three Species of Caribbean Rock Iguanas

William Modi,¹ Glenn Gerber,¹ Charles Knapp,¹ Jennie Lau,¹ Maggie Reinbold,¹ Leona Chemnick,¹ Oliver Ryder,¹ Peter Andolfatto,² and Catherine Stephen³

¹*Zoological Society of San Diego*

²*University of California, San Diego*

³*Utah Valley State College*

Although the significance of recent anthropogenic activity on the census sizes of insular populations is relatively easy to determine, the concomitant impact on genetic diversity is less obvious. Assessing genetic diversity is important for predicting the future fitness and long-term survival of endangered species. The genetic architecture of most species has been molded by population contraction and/or expansion following historical climatic changes, and this tends to obscure the effects of more recent, human-mediated activity. However, the development of Bayesian computational methods allows for sophisticated statistical modeling of population histories. Specifically, coalescent simulations can calculate the likelihood of observed data under the stationary distribution of a specific demographic model. If the influence of recent anthropogenic events has been significant enough, it can be teased apart from earlier paleoclimatic effects. Four events have potentially influenced iguana populations: last glacial maximum (15,000 years ago), first humans (4,000 years), arrival of Europeans (500 years), modern society and domestic animals (50 years). Microsatellite data for *Cyclura pinguis* (133 individuals, 23 loci) are currently being analyzed. Additionally, 600 DNA samples are available each for *C. cyclura* and *C. carinata* from over 50 islands, and will be genotyped in the near future.

General Reports

A Model for Protecting Island Ecosystems Using Integrated Regional Conservation Programs

Brad Keitt

Island Conservation

Introduced mammals are one of the greatest threats to island ecosystems. This is because most island ecosystems historically lacked mammalian predators and herbivores and therefore many islands' flora and fauna lack defenses necessary to compete against these invasions. Removing introduced mammals from islands can protect island ecosystems, and we believe this can be done effectively by regional island conservation organizations that integrate: (1) applied research and priority setting; (2) public education and policy work; (3) capacity building; (4) conservation action; and (5) monitoring and evaluation.

In northwestern Mexico, we developed such an organization to protect the region's 230+ islands. These islands have 26 species of breeding seabirds and over 210 species and subspecies of endemic vertebrates. Non-native mammals have been introduced to at least 44 islands and are responsible for the probable extinction of 21 endemic vertebrate species and subspecies. Island Conservation, the Universidad Nacional Autónoma de México, Centro de Investigaciones Biológicas del Noroeste, and the Mexican National Protected Areas Department collaborated with local people and NGO's to remove one or more introduced mammals from 25 islands. This integrated model for the conservation of island species is exportable to other parts of the world. Given that *Cyclura* iguanas are especially susceptible to introduced mammals, the development of a program to remove introduced mammals from *Cyclura* range islands in the Caribbean is an important part of their conservation.



ISABELA PROJECT (GALAPAGOS NATIONAL PARK SERVICE/CHARLES DARWIN FOUNDATION)

Introduced mammals are one of the greatest threats to island ecosystems because most island ecosystems historically lacked mammalian predators and herbivores and therefore many islands' flora and fauna lack defenses necessary to compete against these invaders. Illustrated is the Isabela Project (Galapagos National Park Service/Charles Darwin Foundation). Habitat recovery on Santiago Island, Galapagos: Before goat and pig eradication, fenced area is goat and pig free (left), after goat and pig eradication (right). Galapagos Land Iguanas (*Conolophus subcristatus*) were extirpated by introduced mammals after Darwin's voyage. Iguana reintroduction is now an option given the removal of these threats.

Does Education Really Help Conservation? Lessons from Two *Cyclura* Conservation Programs

Lee Pagni

Zoological Society of San Diego

The question of whether education should play a role in conservation seems rhetorical. In general, conservationists feel that education is a key component of conservation activities. This is fortunate, because obtaining evidence that education programs directly result in conservation action is difficult, time-consuming, and filled with uncertainties. This is not to say that evaluation of programs is unwarranted. In fact, only through evaluation of education programs can we hope to improve their effectiveness.

Since 2000, the Zoological Society of San Diego (ZSSD) has supported outreach activities related to the conservation of and research on the Turks and Caicos Iguana (*Cyclura carinata*). These activities have taken many forms in order to reach numerous members of several audience categories. In descending order of priority, these audience categories are: locals (adults and children), visitors to the Turks and Caicos Islands (TCI), and other adults and children, including conservation colleagues and ZSSD members and visitors. Outreach activities have included writing articles for local and in-flight magazines, developing education kits for local 5–8 grade students, posting project information on ZSSD and other websites, holding capacity building workshops for TCI colleagues, giving presentations to local and international colleagues, creating a series of posters regarding the project, and producing informational signs to be posted on offshore islands.

Several types of evaluational tools have been used to help design and measure the effectiveness of these programs. One tool, a simple matrix, allows us to see which audiences we are reaching with which messages using which media. Other evaluation tools have included needs assessments, pre/post testing to measure changes in knowledge and attitude from programs, and formative evaluations to help improve materials such as the education kits. Although no overall program evaluation has been conducted, anecdotal evidence has elucidated a couple important points: (1) Education programs take time to become effective. We began to notice a greater awareness of our conservation, research, and outreach efforts after two to three years. (2) Utilizing a variety of media helps reach more audience members. This is not a unique finding. However, this confirms the importance of promoting a consistent message across various media to reach the most people.

Significant outreach programs for the Anegada Iguana (*Cyclura pinguis*) restoration program began in 2003, concurrent with the first releases of headstarted iguanas. Since then, the number of people who know about and are interested in the program has increased each year. A highly successful example of the outreach program is the local involvement in the annual release of headstarted iguanas. In 2003, approximately four people from the BVI were involved in the releases. In 2006, this number grew to over 40 individuals. Although the releases are an obvious opportunity for holding a public event, the interest in participation indicates that creating public events around conservation activities can help increase awareness and support among the local community.

Because of the small size of the local population (estimated between 100–200 people), outreach activities have been less

intense on Anegada than those in the Turks and Caicos Islands. Instead, activities have focused on collaborating with local partners at the BVI National Parks Trust to involve the next generation of Anegadians (students) and keeping community members informed of research activities and conservation goals. The next stage of outreach activities will attempt to raise countrywide awareness of the iguanas' conservation status and situation.

As with the TCI project, no over-arching evaluation of the outcomes of our education evidence has been conducted. Anecdotal evidence suggests a greater awareness of the intricacies of the restoration project and support for conservation and research activities.

I thank all my collaborators at the following institutions whose efforts continue to improve our outreach activities for the Anegada Iguana: BVI National Parks Trust, Dallas Zoo, Fort Worth Zoo, International Reptile Conservation Foundation, International Iguana Foundation, Virgin Island Network of Environmental Educators (VINE), and the Zoological Society of San Diego's Conservation and Research for Endangered Species (CRES) and Education Department.

Indianapolis Zoo Reports First Jamaican Iguana Breeding in the United States

Richard Reams and Jan Ramer

Indianapolis Zoological Society

The Indianapolis Zoo is pleased to report the hatching of several Jamaican Iguanas (*Cyclura collei*) in late August and early September 2006. Two separate females produced 35 eggs, of which 22 hatched. The eggs hatched after approximately 80 days and were incubated at 86–88 °F. The 22 neonates are currently doing great and are growing fast. Starting at just 22 g, many now weigh over 200 g.

Prior to this successful reproduction, only 18 animals were in North American zoos. This breeding more than doubles the North American population to 40 iguanas. Most of these genetically valuable animals will be sent to other North American zoos in the near future. This breeding represents the first captive breeding of *C. collei* outside Jamaica.



RICHARD REAMS

Twenty-two neonate Jamaican Iguanas (*Cyclura collei*) hatched at the Indianapolis Zoo in late August and early September 2006, more than doubling the North American population to 40 iguanas.

HISTORICAL PERSPECTIVE

Two Early Reports of Intentionally Released Reptiles

Notes on *Heloderma suspectum* and *Iguana tuberculata*¹

Pennoyer F. English

On April 2, 1923, the writer received a poisonous lizard, *Heloderma suspectum*, from Wheelock, Robertson County, Texas. This village lies in the southeast part of the county on no highway and about twelve miles from the nearest railroad. This animal had been killed by a farmhand as it was crawling about on his land, and was brought by a student to the department of biology of the Agricultural and Mechanical College of Texas. The finding of this reptile in Robertson County so far from its native home is indeed interesting. Ditmars ["Reptiles of the World," 1922], Gadow ["Amphibia and Reptilia," Cambridge Natural History, Volume 8], Hegner ["College Zoology," revised edition, 1926], Hornaday ["The American Natural History," 1904] and Pratt ["Manual of the Vertebrates of the United States," 1923], limit the distribution of these animals to Arizona, New Mexico and northern Mexico. Only one other occurrence of the Gila Monster in Texas is recorded in the literature available to the writer. Cope ["The Crocodilians, Lizards and Snakes of North America," Report U.S. National Museum, 1898] lists a specimen taken at Fort McDowell, Texas. This single find was referred to by Strecker ["Reptiles and Amphibians of Texas," 1915] who comments somewhat skeptically on the report and states that he made careful search in favorable localities for these reptiles, but failed to find them in Texas. Any attempt to explain

how this lizard found its way to Wheelock, some four or five hundred miles from its native haunts, would be mere guesswork.

The writer has lately received from Mr. L. T. Hunter, county agent, Childress County, Texas, another most interesting find — the common Iguana, *Iguana tuberculata*. This reptile was killed on a roadside near Childress and was sent to the Agricultural and Mechanical College of Texas on December 20, 1926. Childress County lies close to the eastern border of the Panhandle of Texas, touching the southwest corner of Oklahoma. This find is even more remarkable than the former, since the iguana was much farther from its native home — tropical America. The specimen measures three feet, nine and one half inches in length and apparently is only partly grown. Gadow states that *Iguana tuberculata* attains a length of five or six feet. Ditmars, Gadow, Hegner and Hornaday give the distribution as Central and South America and the West Indies, where it lives in trees. How such a reptile could find its way from its tropical and arboreal habitat in the jungles to the almost treeless plains of Childress, Texas, is an interesting speculation.

Heloderma Suspectum, Automobile Tourists and Animal Distribution²

Charles T. Vorhies

In a note in SCIENCE, Mr. P. F. English ["Notes on *Heloderma suspectum* and *Iguana tuberculata*," SCIENCE, Vol. LXVI, No. 1697, p. 37] records two instances of the finding of large lizards at considerable distances from their known native habitats. One of these occurrences is that of *Heloderma suspectum*, the Gila monster, concerning which the author remarks that "any attempt to explain how this lizard found its way to Wheelock [Texas], some four or five hundred miles from its native haunts, would be mere guesswork." Concerning the other, an *Iguana tuberculata* from Central America taken in Texas, admittedly a still more difficult occurrence to explain, he says, "How such a reptile could find its way from its tropical and arboreal habitat in the jungles to the almost treeless plains of Childress, Texas, is an interesting speculation."

The present writer heartily agrees to the interesting character of the speculation induced, but believes that an explanation for the first, if not the second instance, may be offered which will be much better than "mere guesswork." Incidentally a new, or if not new, little considered, factor in animal distribution may be given point.



RUSTY DOBSON

Gila Monsters (*Heloderma suspectum*) showing up far from their original range in the 1920s was attributed to intentional transport and release by humans.

¹ Originally published in *Science*, New Series, Vol. 66, No. 1697, 8 July 1927, p. 37.

² Originally published in *Science*, New Series, Vol. 68, No. 1756, 24 August 1928, pp. 182–183.



JAMES HODGINS

Although Green Iguanas (*Iguana iguana*) have been widely introduced in recent years, their appearance in Texas in the 1920s was difficult to explain.

During the course of a dozen years in my present location I have received from interested and curious persons many specimens of the peculiar or unique animals of the southwest; and there have passed through my hands, mainly from these sources, probably nearly one hundred Gila monsters. During that period of time, though my work has taken me afield frequently, I have in person come across barely a half dozen of these conspicuous and not very swift lizards. This indicates, first, the extent to which people gather up specimens of animal life that excite their curiosity, and transport them in a spirit of helpfulness, curiosity or cupidity. (I have been asked to pay ten dollars for a very ordinary Gila monster, and been solemnly assured that they were worth one hundred dollars.) Secondly, the modern auto tourist is likely to tire of and release his "specimen" unless he can dispose of it to advantage. I have been the recipient of two *Helodermas*, each of which had been carried for some time by auto touring parties, and for distances of not less than two hundred miles. Further, such a specimen is frequently carried tethered somewhere on the outside of the car by an insecure noose about its neck or leg. Tourists in this region often express a desire to take a "Gila" "back home," anywhere from five hundred to fifteen hundred miles from here — and no doubt many of them attempt to do so. A certain dealer in live animals sells surprising numbers of them for this very purpose.

The finding of the specimen in Texas is no surprise to me. It seems much more certain than "guess work" to assume that such an animal, or any interesting animal of readily transportable size, found even hundreds of miles from its native home, has been carried most of the distance by rail or auto, especially the latter. The *Heloderma* mentioned might easily have wandered from the nearest main highway, even though the distance be considerable, for this lizard is tenacious of life, and that locality would not, I believe, be a particularly unfavorable environment for it.

The principles involved in the foregoing statements have many and various illustrations, as every inspector at a horticultural inspection station on a main auto highway in the southwest can testify. The auto tourist carries everything interesting from where he finds it to some other place; anything from a "horned toad" to an entire cotton plant, leaves, bolls, boll wee-

vils and all. The *Iguana tuberculata* record is, to be sure, somewhat less likely to be the result of transfer by auto, but not unlikely to have come up by train. I have now a live *Iguana* sp. which recently arrived in Tucson in a bunch of bananas by rail from the west coast of Mexico. A few years ago I was the recipient of a live five and one-half foot *Boa imperator*, picked up by an autoist just beyond the border town of Nogales, Sonora. This, I should judge, came up from Central America nearly to the United States by train, thence it certainly came another seventy miles by auto. Mr. Roy McCain, of Tucson, relates that, while hunting a few miles northwest of Pantana, a station about thirty miles east of Tucson, in the foothills of the Rincon Mountains, he met a large lizard which he killed with a stick. This measured three feet in length and must have been an *Iguana* sp., though unfortunately it was not saved. This was in October, 1927.

I have now alive in my laboratory an opossum, carried into this new (and probably unfavorable) environment from Arkansas. Its captor chanced to tire of it just at this point, but might equally well have elected to turn it loose in some favorable looking spot in the state — or in California. It is known that opossums have previously been released in this region. Arizona (likewise California) has a cordon of horticultural inspectors stationed at strategic points for intercepting and inspecting autos coming into the state. The findings of these inspectors, plus the other instances cited, have served to emphasize for us here the possibilities of auto traffic as a factor in animal distribution in a manner which, perhaps, has not come forcibly to the attention of biologists in many other states. The cotton plant incident is a fact from the experiences of the inspectors.

Editor's Remarks

Invasive species are a major problem that conservation biologists face on a regular basis. In recent years, we have been seeing more and more reports of reptiles and amphibians appearing far from their natural ranges. Traditionally, introduced species were thought to arrive in "foreign" destinations mostly by accident. A recent note (2006. *Iguana* 13:272–277) described an attempt to prevent such arrivals on Guana Island in the British Virgin Islands. Recent research, however, has shown that a large number of these invasives are intentionally released by pet owners and others. The two brief reports that follow clearly show that this is not a new phenomenon: Some eighty years ago, large lizards and snakes were being noted hundreds of miles from their native ranges. P.F. English found this confusing, but C.T. Vorhies identified people as the primary vector long before others became aware of the issue. These fascinating early notes are a strong reminder to never release a captive animal — we now understand the potentially disastrous consequences of such irresponsible behavior.

Gad Perry
Texas Tech University

C O M M E N T A R I E S

Six Wonders are Enough¹

Leonard Krishtalka

Biodiversity Institute at Kansas University, Lawrence, Kansas

One hundred million votes transmitted over cell phones and the Internet have chosen seven new wonders of the world. Like the seven old wonders, they honor ancient architectures, each magnificent in its art: The Great Wall of China; Petra, the pink ruins of a Jordanian city; Mexico's Chichen Itza, the ruins of a Mayan city; Peru's Machu Picchu, the remains of an Incan city; Rome's Colosseum; India's Taj Mahal; and the statue of Christ blessing Rio de Janeiro.

But is the measure of a world wonder more than ancient bricks and mortar? In the end, built things are ephemeral. They demand a pilgrimage to a place. Perhaps more wondrous is the pilgrimage to an idea, one that endures, sustains, and is embodied in our sense of place.

First, for me, among world wonders is the biosphere, the Earth as a breathing, pulsing planet. It alone in our solar system has a wealth of plants, animals, and microbes, some 15 million species, that provide our food, fuel, fiber, and pharmaceuticals; that clean our air, water, and soil; that buffer against drought and floods; that make the planet blue, looking down from space or up from Earth. The life of the planet is priceless and irreplaceable.

Second is our place in the universe. The discoveries of Galileo, Copernicus, Darwin, and Einstein freed humans from being at the center of all things. Indeed, there is no center of all things. The Earth is not at the center of the solar system. It is in a



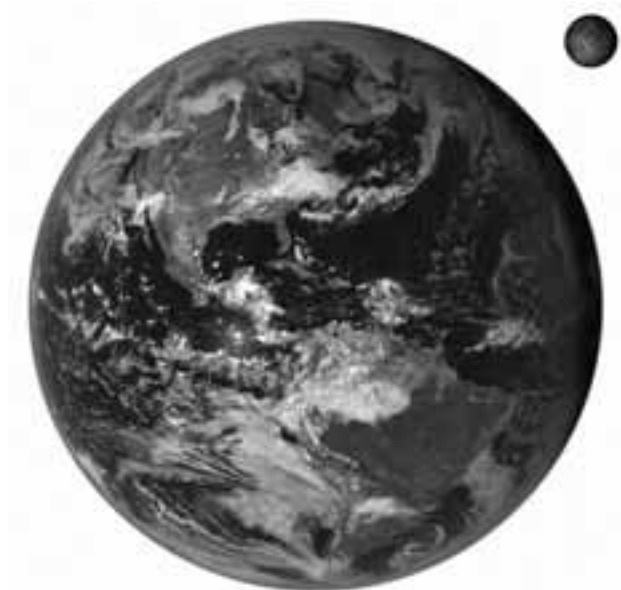
Rome's Colosseum was chosen as one of the seven new wonders of the world.

galaxy that is hurtling away from all other galaxies. Humans are not the center of creation. Our biological origins, more than 3 billion years in the making, are shared genetically and geologically with all of life on Earth. Relativity theory tells us that gravity defines the shape of space and time. Without Earth's mass, which induces gravity, space and time have no meaning. This sounds like magic and, in a way, it is. If humans are special, it is because we can discover this magic about the universe and our place in it.

Third is freedom of expression. In architecture, art, prose, poetry, song, symphony, dance, science, and speech, lives the freedom of the mind to think and create across the human registers. From Monet's "Water Lilies" to Serrano's "Piss Christ," from Beethoven's Fifth to gangsta rap, from Machu Picchu to Rio's shanty town, human expression is free to be structured or unstructured, to engender beauty or revulsion, inquiry or apathy.

Fourth is freedom of communication. What made humans human is our ability to gather information, manage it, store it, make it into knowledge, and tell it to everyone else. The information age did not begin in the 1990s. It began four million years ago, ever since we sensed our environments, natural and cultural, and passed on what we learned through stories, rock carvings, print, and now the Internet. The Web is today's ultimate democratization of knowledge, communicating what we think and what we think we know.

Fifth is freedom of equality under the law. Neither nature nor nurture can take credit for "all men are created equal," but the law can. In fact, nature guarantees an inequality of genes among individual humans — it's why six billion people on Earth are each different from one another.



Unlike structures of bricks and mortar, the biosphere alone in our solar system has a wealth of plants, animals, and microbes, some 15 million species, that provide our food, fuel, fiber, and pharmaceuticals; that clean our air, water and soil; that buffer against drought and floods; that make the planet blue, looking down from space or up from Earth. The life of the planet is priceless and irreplaceable.

¹ Originally published in the Lawrence (Kansas) *Journal-World & News* on 19 July 2007.

Nurture guarantees an inequality of “memes,” the cultural and social attributes people learn from other people, beginning with their parents. The law, imperfect as it might be in practice, levels nature and nurture for rich or poor, tall or short, white or black or any color, educated or not.

Sixth is the Mayan calendar. A year should be elegant. But with 365 days, 5 hours, 48 minutes, 46 seconds, it's mathematically deranged. Same for months. Some have 30 days, some 31, and one has 28 when it doesn't have 29. A 7-day week isn't celestially special either. It makes for 52.1428 weeks in a solar year and 50.571 weeks in a lunar year. Lunacy. Our calendar is out of kilter because the earth's orbit of the sun (a year), the moon's orbit of Earth (a month), and the earth's rotation (a day) are badly out of sync.

The solution is an ancient wonder of the world, the Mayan calendar. It has 60 six-day weeks for an even 360 days in the year. That leaves an untidy 5 days and change in the solar year after Week 60, which, if I were in charge, would be the only period allowed for electioneering.

There is no seventh wonder. Frankly, we need to be freed from the number seven. Seven has become the cardinal sum of our species, the most resonant number on Earth. It is consecrated biblically: seven days of creation, seven years of plenty, seven lean years, seven deadly sins, seven sacraments. Geography wanders the seven seas and the seven hills of Rome.

History recounts the Seven Years War, the Seven-Day war, and the “Seven Against Thebes.” And the media gives us “Seven Samurai,” “The Magnificent Seven,” and “The Seven Year Itch.” Even the human head rests atop seven neck vertebrae. Six wonders of the world are enough.



The discoveries of Galileo (pictured), Copernicus, Darwin, and Einstein freed humans from being at the center of all things.

The Ongoing Privatization of Public Universities

Gad Perry, Texas Tech University

Steve Mackessy, University of Northern Colorado

Jack Sites, Brigham Young University

Neil Ford, University of Texas at Tyler

We have recently returned from a herpetological society meeting in St Louis. This is an annual event that we highly recommend to anyone who has not experienced it yet. For a week or so, hundreds of herpetologists from around the world meet, talk, eat, and party. For a week, one is surrounded by enthusiastic people who share a similar passion and can tell tales of places you haven't been and species you have not seen. Three such major events will be held in the Americas in 2008: the Latin American herpetological congress will be held in Cuba, the North American joint meetings will be in Montreal, and the World Congress of Herpetology will meet in Manaus, Brazil.

One of the often-discussed issues was the status of higher education. Many of the attendees are students or faculty at public universities, and this is an issue about which they care deeply. A common complaint in recent years has been the ongoing privatization of American public education. According to Florida International University, per-student funding was 16% lower in 2003 than it was four years earlier. The percent of total public university revenues provided by state governments, according to the National Center for Education Statistics, declined from over 45% in 1980–81 to about 36% in 2000–01. In 2003, an alarmed *Wall Street Journal* reported that state aid accounted for



about a quarter of the budget at the University of Wisconsin, 22% at the University of Texas at Austin, 13% at the University of Virginia, and a mere 10% at the University of Michigan, all of them supposedly public institutions. In Colorado, per-capita funding for higher education consistently ranks 49th out of the fifty states. In 2007, state support provided less than 10% of the total for the University of Colorado budget. Paradoxically, Colorado also has one of the highest percentages of citizens with higher degrees in the nation.

With demand for admission increasing and state support declining, public universities find themselves in a bind. How can they continue providing a first-rate education? — apparently by becoming more like for-profit institutions. At the University of Colorado, privatization is receiving serious consideration. Some argue that this is a good thing, and that the free market ensures the best all-around outcome in most situations. We believe that public education is not one of them.

The most obvious change that the public has seen in academia has been a steep increase in tuition, which has risen more rapidly than inflation for some years. This has alarmed many, who are concerned that students from lower-income families are being denied access. In fact, according to a *New York Times* report from September 2007, university fees have gone up even faster, at an annual rate of 8–11%. In a world where education is a key to higher paying jobs, this means talented people are unable to get the education they need to produce the personal and societal benefits of which they are capable. Modest increases in financial aid opportunities have helped defray the cost for some, but not all. Many of our undergraduates choose to work many hours per week to make up the financial shortfall, resulting in less effective learning and a longer path to graduation.

Increased tuition and time-to-graduate is only the most obvious outcome of decreasing public support of higher education. Another is a reduction in the quality of education that is provided. Field- and laboratory-intensive classes, such as herpetology, are expensive. They require vehicles, specimens, chemicals, and considerable organization. As a result of cost cutting, fewer of them are being offered, and those that are often reduce the number of labs and field trips. Limited funds available are often shifted to fund perceived “high-yield” courses in more

“modern” disciplines, such as molecular biology. And, as education becomes a service industry, geared toward producing a product, the emphasis shifts from product quality — skills and knowledge gained, social benefit produced — to customer satisfaction — an easy A and having fun.

Faced with growing numbers of students and unwilling to invest in additional infrastructure and human capital, legislatures are pressuring universities to reduce the number of hours required to graduate or to use funds “more efficiently.” This means cramming more students into each classroom. Large classes are indeed cheaper on a per-person basis, but they do not allow much one-on-one interaction with the instructor, nor is in-class discussion of the kind required for teaching students to think critically — arguably the most important skill college can teach — promoted. A reduction in the number of credit hours does get a diploma-carrying person onto the streets more rapidly, but that diploma is devalued. In many cases, a Master’s degree is now needed to qualify for positions that not long ago may have been available with a Bachelor’s.

The effects do not end there. Public universities have traditionally considered basic research to be part of their mandate. That is becoming more and more difficult, however, as funds dry up. Projects that once would have been supported by internal funds now have to find another source, or — more frequently — not occur. This is changing the nature of research. This shift from basic and long-term to applied and short-term research may yield immediate financial benefits, but technological advances ultimately falter. What is even worse is that the fruits of research, rather than being freely made available to the public that paid for them, are increasingly being patented, either directly by universities or by for-profit collaborating entities. The universities help make up the financial shortfall, but the public ends up paying much more for a product they have already paid to develop.

Other undesirable outcomes reflect the current trend, but we believe that the shortsightedness of the current policy is already clear. Short-term savings are resulting in the de-facto privatization of public universities. The long-term benefits that society accrues by having unbiased research in the public domain and access to affordable education are being replaced by corporate greed and short-term profit margins. Some lawmakers have held hearings about the problem of rising tuition, hypocritically pretending that this is not a direct outcome of the lowered funding levels for which they have repeatedly voted. But it is *our* collective fault, not just theirs. We need to be more vocal in our demonstration of the overwhelming need to have an educated public, capable of making critical evaluations and difficult decisions. We are the voters who choose the politicians (from both parties) who make these decisions, and we applaud when they tell us how “efficiently” they are spending our hard-earned money. We also are the only option for derailing this dangerous trend. If the United States is to remain competitive in the global arena, let alone be a leader, then public higher education, particularly in the sciences, must regain the respected status it received in generations past.

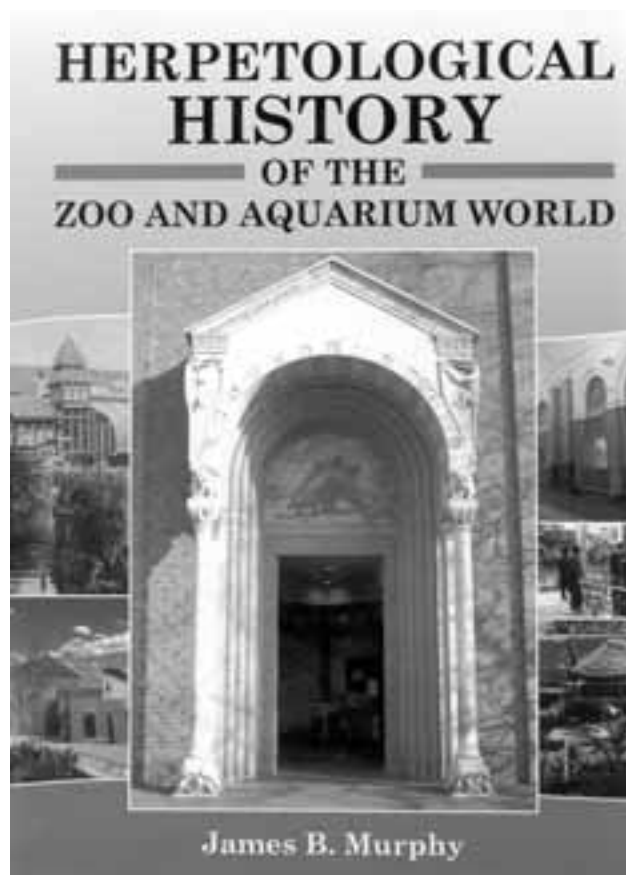
BOOK REVIEWS

Herpetology in the Zoo and Aquarium World

Herpetological History of the Zoo and Aquarium World. 2007. By James B. Murphy. Krieger Publishing Company. xv + 327 p. ISBN 1-57524-285-0. \$79.50 (hardcover).

This is a remarkable volume of work that is as notable for its depth and thoroughness as for its warm celebration of a history of institutions and individuals that could only be told by Jim Murphy. Murphy's time in the Special Collections Library at the Smithsonian's Natural History Museum is evident. The book is loaded with wonderfully incisive and ironic quotes from obscure sources and images from throughout the history of the profession. In separate sections, Murphy recounts the stories and traditions of the discipline from the various perspectives that define zoo and aquarium herpetology — taxa, individuals, programs, and institutions. This approach leads to some redundancy, but, somewhat ironically, is simultaneously efficient and highly readable. The approach is appropriate, for example, because one cannot truly understand the inestimable impact of Roger Conant solely from the perspectives of the Toledo or Philadelphia zoos. Likewise, the remarkable contributions of those institutions cannot be appreciated only through their associations with Dr. Conant. Similarly, describing the historical importance of crocodilians in the bestiary—menagerie—modern zoo transition would be impossible by simply listing which institutions had published the most papers or successfully bred which species. This neat multifaceted approach is broadened by the inclusion of a unique chapter entitled "Historical Vignettes" that highlights programs, twist-of-fate stories, or simple but important ideas. Here, Murphy's story-telling style works well in relating a series of compelling tales that expand the confines of biographical or institutional sketches. These are labeled with interest-catching titles, such as "Why Galápagos Land Iguanas From Baltra Island Are Not Extinct."

The chapter entitled "Evolution of a Discipline" is built around a taxonomic framework that highlights major advances in the field in terms of, for example, simply getting snakes to eat in captivity or the remarkable insights into snake behavior that could only have been gathered from healthy, captive individuals. What really struck me in this review was the lack of effort on the part of zoo herpetologists in the realms of taxonomy and morphology. This is a shame, given the access to countless specimens and variants that typifies the discipline. In this vein, I believe I may have detected the only oversight in this otherwise terrific book, as I found no references to the seminal papers on reptilian morphology and evolution by George Rabb (Brookfield Zoo) and his colleague Hymen Marx (Field Museum of Natural History). This chapter, as important as it is, is a bit difficult to read, as Murphy was forced to include as many references to published works as possible (one of his stated metrics of a zoo's historical impact) and, given the uneven spread



of such papers taxonomically and topically, the chapter varies greatly in its depth of coverage. While perhaps a clumsy read, I shudder at the thought of having to organize and write such a review.

The chapter "Pioneers in Zoo Herpetology" and the closing chapters highlighting significant institutions from throughout the world are the heart and soul of the book. These could have been dull accounts of persons, places, dates, and discipline-firsts, except that Murphy personalizes each topic with his own experiences and perceptions. For an author to inject so much of himself into a work like this is always a bit risky. If poorly done, it reeks of arrogance. However, with his usual story-telling eloquence and his famously self-effacing personality, Murphy succeeds. Few curators or keepers in the field today have heard of the inimitable Joe Laszlo of the San Antonio Zoo, but thanks to Murphy his legend lives.

The chapter "Evolution of an Idea" was my favorite. Murphy takes the reader on a historical (and highly personal) journey through the remarkable transition through which zoo herpetology passed in a time span shorter than a single career. Murphy helps us realize that zoo-based conservation programs

were in place for mammals and birds while herp departments remained unable to determine the gender of their charges and had standing orders with people who poached rattlesnake dens! However, Murphy repeatedly makes the point that the transition is still far from complete — especially in the case of amphibians, which remain an afterthought in all but a very few programs. Nevertheless, the current respectable state of zoo herpetology is attributable to individuals like Roger Conant, James Oliver, and, of course, James B. Murphy. Murphy reminds us of times when representatives of zoos were not really welcome at scientific conferences, when research papers by zoo personnel or those based on work at zoos were not considered worthy of publication, and when the animals themselves were not considered worthy of conservation. With such a dramatic conceptual turn in their histories, zoos are fortunate that Murphy places this

remarkable transition in an appropriate perspective. A nice touch also is that this transition figures heavily in the Foreword by the late Roger Conant. How appropriate that this book provides us with one more bit of wisdom from the undisputed “godfather” of zoo herpetology.

Murphy relates, with great pride, the progress zoo herpetology programs have made, mainly by emphasizing their very real contributions, including their leading role in the development of important conservation programs such as the Declining Amphibian Population Task Force. Reading this book made me proud of our profession — and that’s a nice feeling. Thanks, Jim!

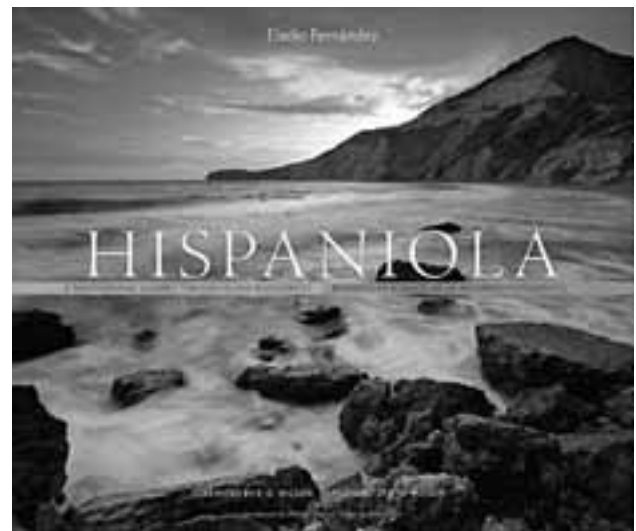
Joseph R. Mendelson III
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Island Paradise

Hispaniola. A Photographic Journey through Island Biodiversity. Biodiversidad a Través de un Recorrido Fotográfico. 2007. By Eladio Fernández. The Belknap Press of Harvard University Press, Cambridge, Massachusetts. xx + 374 pp. Hardcover — ISBN-10: 0-674-02628-4 — \$ 60.

My first trip to the West Indies was to the Dominican Republic. I’ve since spent considerable time on other islands, but when I’m asked which is my favorite, I always come back to Hispaniola. Rather than attempt to explain (usually in vain) why the island is so enticing, I now can direct anyone to Eladio Fernández’s profusely illustrated book that so eloquently defines the island’s natural beauty through the discerning eyes of a knowledgeable naturalist and gifted photographer. A total of 375 color photographs, many of them covering two facing pages in this coffee-table volume, show flowers, landscapes, insects, birds, and, of particular interest, amphibians and reptiles. Better yet, in many instances, the reader is not just greeted with portraits, but is immersed into natural habitats as pollinators visit flowers, predators consume prey, and anoles fan their dewlaps intent on attracting a mate or dissuading a rival. Even the vistas emanate life in a way seldom experienced through photographs.

This is a volume of images, some subtle, many powerful, all beautiful. The text is almost an afterthought, yet no less valuable — once one finds the strength to turn away from the photographs. All text is bilingual (English and Spanish), from the title to the acknowledgments. The foreword by noted naturalist Edward O. Wilson deftly provides the context that makes the volume so appealing — that the beauty portrayed is ephemeral, all the more so for lack of a human commitment to treasure and preserve it. Philippe Bayard, of the Société Audubon Haïti, states explicitly how effectively art can promote conservation. The photographer’s note by Fernández includes a somewhat wistful wish that this book may “raise awareness and spark an interest in preserving [his] island’s natural heritage.” Additional “essays” by a virtual who’s who of Neotropical biologists address the diversity of Hispaniola’s birds (Steven C. Latta and Christopher C. Rimmer), mammals (Charles A. Woods and José A. Ottenwalder), amphib-



ians and reptiles (S. Blair Hedges), insects (Brian Ferrell), vegetation (Milciades Mejía and Ricardo García), and fungi (Timothy J. Baroni and Sharon A. Cantrell). All are eloquent, concise, and consistent in acknowledging both the unique nature and perverse fragility of the island’s habitats and their denizens.

The book effectively surprises, entertains, and pleases on each subsequent page. Only the all-too consistently dark images (undoubtedly attributable to cost-cutting decisions on the part of the publisher, otherwise not known to pinch pennies) detract — but fortunately not to the point where the grandeur of the subject or the gift of the artist are compromised. I only wish I could have avoided this one criticism of what is otherwise one of the best packages under one cover to come along in many, many years. Anyone who has experienced the islands or who wishes to do so some day should buy a copy, curl up in a warm chair on a cold night, and dream of paradise — before it’s too late.

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CONSERVATION RESEARCH REPORTS

Traditional Maori Knowledge of Tuatara

Traditional ecological knowledge can be highly informative and integrated with complementary scientific knowledge to improve species management. This is especially true for abundant species with which indigenous peoples have frequent interactions (e.g., through harvest), but has been studied less frequently in isolated or declining species. RAMSTAD ET AL. (2007. *Conservation Biology* 21: 455–464) examined Maori traditional ecological knowledge of Tuatara (*Sphenodon* spp., reptiles that resemble lizards, but are the last living representatives of the order Sphenodontia) through semi-directed interviews of elders of Te Atiawa, Ngati Koata, and Ngati Wai Iwi (similar to tribes), the guardians of several islands currently inhabited by Tuatara. Maori are indigenous to New Zealand, having settled 800–1,000 years ago. Tuatara are endemic to New Zealand, have declined in numbers since human settlement, and are now restricted to 37 offshore islands. The detail and volume of Tuatara traditional ecological knowledge were less than that recorded in studies of more abundant or accessible species. In addition, traditional knowledge of the cultural significance of Tuatara was more common and detailed among the elders than traditional knowledge of Tuatara biology or ecology. The traditional knowledge collected, however, provided the first evidence of seven former sites of Tuatara occupation, suggested five additional sites Tuatara may currently occupy, contained novel hypotheses for scientific testing, and



JENNIFER M. GERMANO

Although traditional Maori ecological knowledge of Tuatara (*Sphenodon* spp.) was less than that recorded in studies of more abundant or accessible species with which the Maori were more familiar, interviews with elders revealed new information about areas formerly inhabited by Tuataras and cultural roles not previously reported.

described Tuatara cultural roles that have not been reported previously. The authors concluded that, in at least some cases, traditional ecological knowledge may persist as species decline and may serve as a valuable source of ecological information for conservation.

Changes in Tropical Forests Affect the Herpetofauna

Plantation forests and second-growth forests are becoming dominant components of many tropical forest landscapes, but little information is available concerning the consequences of different forestry options for biodiversity conservation in the tropics. GARDNER ET AL. (2007. *Conservation Biology* 21: 775–787) sampled the leaf-litter herpetofauna of primary, secondary, and *Eucalyptus* plantation forests in the Jari River area of northeastern Brazilian Amazonia. They used four complementary sampling techniques, combined samples from two consecutive years, and collected 1,739 leaf-litter amphibians (23 species) and 1,937 lizards (30 species). They analyzed the data for differences among forest types regarding patterns of alpha and beta diversity, species-abundance distributions, and community structure. Primary rainforest harbored significantly more species, but supported a similar abundance of amphibians and lizards compared to adjacent areas of second-growth forest or plantations. Plantation forests were dominated by wide-ranging habitat generalists. Secondary forest faunas contained a number of species characteristic of primary forest habitat. Amphibian communities in secondary forests and *Eucalyptus* plantations formed a nested subset of primary forest species, whereas the species composition of the lizard community in plantations was distinct, and was dominated by open-area species. Although plantation forests are relatively impoverished, naturally regenerating forests can help mitigate some negative effects of deforestation for at least some herpetofaunal species. Nevertheless, secondary forest does not provide a substitute for primary forest. In the absence of further evidence from older successional stands, we caution against the optimistic



RAY ROYER

claim that natural forest regeneration in abandoned lands will provide refuges for the many species that are currently threatened by deforestation.

claim that natural forest regeneration in abandoned lands will provide refuges for the many species that are currently threatened by deforestation.

Invasive Green Iguana Roadkills

SMITH ET AL. (2007. *Journal of Kansas Herpetology* 22: 14–16) examined 11 years of reptilian roadkill data from Cape Florida State Park (CFSP), a vegetatively restored, urban state park in southern Florida that was largely destroyed by Hurricane Andrew in 1992. The survey recorded 135 individuals of eight reptilian species, of which three were exotics. Native Southern Black Racers (*Coluber*



GARY BUSCH

Invasive Green Iguanas (*Iguana iguana*) often cross roads and even pause to bask on them, and consequently comprised 30.4% of the total number of roadkills in Cape Florida State Park.

constrictor priapus) and invasive Green Iguanas (*Iguana iguana*) each comprised 30.4% (N = 41) of the total number of roadkills. The other exotics were Giant Ameivas (*Ameiva ameiva*; N = 7) and a Red-eared Slider (*Trachemys scripta elegans*). The three exotic species collectively accounted for 36.3% of records. Roadkilled iguanas were first recorded in 2001 and peaked in frequency in 2003 (N = 13) and 2004 (N = 12), which coincided with periods of greatest density recorded at CFSP. Results underscore the threat of exotic species faced by protected areas and the need for data necessary for making sound management decisions.

Unintended Consequences: Raccoon Removal Helps Invasive Green Iguanas

MESHAKA ET AL. (2007). *Herpetological Conservation and Biology* 2: 149–156) examined the demographic responses of Green Iguanas (*Iguana iguana*) to the removal of Raccoons in an urban maritime state park in southern Florida. The rapid growth of iguanas to sexual maturity in an underexploited, if not vacant, niche contributed to rapid recruitment during the 4.5 years since removal of the limiting predator. The authors propose that at sites where Green Iguanas and high-density Raccoons are syntopic, Raccoon removal programs should be concurrent with equally concerted efforts to remove Green Iguanas. By replacing one limiting predator with another, a population explosion can be prevented.



An adult male Green Iguana (*Iguana iguana*) fends off a Raccoon (*Procyon lotor*) attack at Hugh Taylor Birch State Park in southern Florida.

American Crocodile (*Crocodylus acutus*) in Florida

When the American Crocodile (*Crocodylus acutus*) was classified as endangered in 1975, few data were avail-



Despite greater numbers of American Crocodiles (*Crocodylus acutus*) in Florida and a broader range in which reproduction is occurring, crocodiles are still threatened by land and water use modifications to adjacent habitat.

able upon which to base informed management decisions. Monitoring programs focusing on nesting ecology, growth, and survival show that crocodiles have responded positively to protection. The U.S. Fish and Wildlife Service is now considering downgrading the species from endangered to threatened.

Despite the progress, crocodiles are facing new problems, such as the continuing degradation of ecosystems in Florida and Biscayne bays. MAZZOTTI ET AL. (2007). *Journal of Herpetology* 41:122–132) reviewed results of research and monitoring programs that have been used as a basis for reclassifying *C. acutus*. They found that, despite greater numbers of crocodiles and a broader range in which reproduction is occurring, crocodiles are still threatened by land and water use modifications to adjacent habitat. To enhance habitat conditions and prey production and availability for crocodiles, freshwater flows to estuaries need to be restored to a natural pattern. A final concern is that, as crocodiles continue to recover and expand their habitat in coastal areas, interactions with humans will increase in frequency, posing additional challenges to the recovering population.

Investigating Natural Population Dynamics of New Zealand's Cryptic Diurnal Geckos

Habitat losses resulting from human settlement and introduction of mammalian predators have had a significant impact on New Zealand's threatened diurnal geckos. Approximately one-third of New Zealand's reptiles are restricted to mammal-free offshore islands, three species of lizards are extinct, and many others have dramatically reduced ranges. Clearly, New

Zealand's terrestrial vertebrates are in need of effective conservation management.

The endemic Marlborough Green Gecko (*Naultinus manukanus*) is confined to the Marlborough Sounds region of New Zealand. *Naultinus manukanus* is arboreal and diurnal. Potential threats include habitat fragmentation, loss of successional shrubland habitat, and competition with introduced species for habitat and food. Unfortunately, the behavior of these diurnal geckos makes conservation of this species a challenge. Few studies have been conducted on their reproductive biology, ecology, and behavior, because they are cryptic and difficult to detect. Accurate biological information about this species is vital for proper conservation management.

HARE ET AL. (2007). *Journal of Herpetology* 41:81–93) analyzed the population dynamics of *N. manukanus* as a model for understanding the ecology of other threatened diurnal geckos of New Zealand and to generate data necessary for the conservation of these species. Studies spanned 25 years, providing essential information about natural population dynamics, habitat use, and daily movement patterns. By analyzing sex ratios and reproductive rates, the authors found that the low reproductive output of *N. manukanus* renders them vulnerable to predation by invasive mammals. Although long-term prospects for *N. manukanus* appear good on Stephens Island, populations on the mainland are at high risk of declines because of habitat destruction, predation, and competition with exotic species. The K-selected life-history strategies of these unusual geckos require intensive management of competitors and predators to allow population trajectories on the mainland to become more stable.



Mainland populations of the New Zealand endemic Marlborough Green Gecko (*Naultinus manukanus*) are at high risk of population declines because of habitat destruction, predation, and competition with exotic species.

Frog-Human Interactions

From human popular culture to drug development and biological research, frogs have been model organisms to which most people readily relate. TYLER ET AL. (2007. *Applied Herpetology* 4:1–18) explored interactions between frogs and humans. They focused on the major declines in frog populations and the increasing evidence for the role of humans in habitat destruction and introductions of invasive species. Human uses of anurans are discussed, including the wide range of chemical compounds found in anuran skin, some of which have led to the development of drugs for human and veterinary use. Cultural uses of anurans (e.g., food and entertainment) also are described.

Some human modifications to environments, such as run-off aggravated by development, may provide breeding sites for certain species and could be seen as a benefit. Overall, however, the effects are negative. Although human use for scientific purposes may have had some negative impact on anurans, these are scant in comparison to numbers lost from habitat destruction and large-scale environmental degradation. Better enforcement of regulations in the food and pet trade could improve the status and chances of long-term survival of frog populations.



Frog-human interactions are almost inevitably detrimental to frog populations. Better enforcement of regulations in the food (this is a frog/fish market in Myanmar) and pet trade could improve the chances of long-term survival of frog populations.

Introduced Boa Constrictors Threaten the Native Biota of Cozumel Island

Invasive species can upset the delicate balance in island ecosystems. Understanding the biological effects of exotics on a native biota is important. In 1971, Boa Constrictors (*Boa constrictor*)



The Spotted Turtle (*Clemmys guttata*), a species of special concern in Pennsylvania, was among 15 herpetofaunal species observed at a National Superfund Site in Erie County.

were introduced to Cozumel Island, México, and they have negatively affected native (some endemic) prey species. In order to develop strategies to reduce boa pressure on the native biota, ROMERO ET AL. (2007. *Biodiversity Conservation* 16:1183–1195) studied changes in boa abundance over time. In addition, they used nocturnal road transect sampling and data from boa encounters during fieldwork to estimate distribution, abundance, and habitat use.



Boa Constrictors (*Boa constrictor*) introduced to Cozumel Island, México, have negatively affected native (some endemic) prey species.

The study found that boas are widely distributed across Cozumel and occupy all vegetation types. However, snakes were most abundant in areas uninhabited by humans, and boa mortality was relatively common in human-inhabited areas. Boas are habitat generalists, and control or eradication will pose challenges. Public education on the control of boas and the negative effects on native species is very important for a well-planned management program on Cozumel. Prevention of similar introductions elsewhere is also imperative.

Herpetofauna of a National Superfund Site

GRAY (2007. *Bulletin of the Maryland Herpetological Society* 43: 129–133) surveyed the herpetofauna of the Harper Drive Hazardous Waste Area, a National Superfund Site in Erie County, Pennsylvania, between 1995–1999. He observed two salamander, six frog and toad, three turtle, and four snake species, including the Spotted Turtle (*Clemmys guttata*), a species of special concern in Pennsylvania. The base-line data presented in this report, along with any future surveys at the site, may be useful in evaluating the effects of remedial action on the area herpetofauna.

Roads Threaten Galápagos Lava Lizards

Galápagos Lava Lizards (*Microlophus albemarlensis*) are heavily impacted by roads. TANNER ET AL. (2007. *Bulletin of the Chicago Herpetological Society* 42:125–132) measured mortality on Santa Cruz Island and found that fatalities averaged 0.4 mature males and 1.8 juveniles per km/day. Lizard population models that considered but were not limited to impact from roads suggested that the lizard population is on the path to local extirpation.



Galápagos Lava Lizards (*Microlophus albemarlensis*) are heavily impacted by roads.

NATURAL HISTORY RESEARCH REPORTS

Escape Behavior in Cuban Curly-tailed Lizards

Several aspects of escape behavior are predictable by escape theory based on expected costs due to predation risk and escaping. Although the function of pursuit-deterrent signaling is to dissuade predators from attack, relatively little is known about relationships between specific components of escape and the signaling behavior. COOPER (2007. *Herpetologica* 63: 144–150) studied effects of the risk factor distance from refuge on flight initiation distance, distance fled, probability of entering refuge, and the distance between predator (an approaching human) and prey when pursuit-deterrent display begins (display distance) in the Cuban Curly-tailed Lizard (*Leiocephalus carinatus*). The author also investigated whether starting distance (distance between predator and prey when approach begins) affects escape behaviors. As predicted by escape theory, flight initiation distance and distance fled were greater and refuge entry was less probable at greater distance from refuge, indicating that qualitative predictions of escape theory apply to pursuit-deterrent signalers. Starting distance did not affect escape behaviors, presumably because it did not affect perceived risk, but might do so at a faster approach speed. Display distance and flight initiation distance were identical in the data set analyzed, but individuals sometimes perform tail displays prior to fleeing.



JOHN BINNS

Tail-curling may serve as a pursuit-deterrent signal in Cuban Curly-tailed Lizards (*Leiocephalus carinatus*).

Native Predators May Limit Iguanas in Florida

Known predators of Green Iguanas (*Iguana iguana*) in Florida include Raccoons (*Procyon lotor*), domestic dogs (*Canis familiaris*), Yellow-crowned Night Herons (*Nyctanassa violacea*), Florida Burrowing Owls (*Athene cunicularia floridana*), and a hawk (*Buteo* sp.). Smith et al. (2007. *Journal of Kansas Herpetology* 23: 7–8) report nest predation and attempted adult predation on Green Iguanas by a Gray Fox (*Urocyon cinereoargenteus*) and suggest that avian and mammalian predators may potentially function as limiting factors on colonization patterns of exotic iguanas in Florida.



GARY H. BUSCH

A Gray Fox (*Urocyon cinereoargenteus*) excavating a Green Iguana (*Iguana iguana*) nest and eating the eggs at Hugh Taylor Birch State Park in Broward County, Florida.

Survival of Timber Rattlesnakes (*Crotalus horridus*)

Juvenile survival is one of the least known elements of the life history of many species, in particular snakes. BROWN ET AL. (2007. *Copeia* 2007: 656–671) conducted a mark-recapture study of Timber Rattlesnakes (*Crotalus horridus*) from 1978–2002 in northeastern New York near the northern limits of the species' range. They marked 588 neonates and estimated annual age-, sex-, and morph-specific recapture and survival rates. Wild-caught neonates (field-born, $n = 407$) and neonates produced by captive-held gravid females (lab-born, $n = 181$) allowed comparison of the birthplace, or lab treatment effect, in estimated survival. Recapture rates declined from about 10–20% over time while increasing from young to older age classes. Estimated survival rates ($S \pm 1$ SE) in the first year were significantly higher among field-born (black morph: $S = 0.773 \pm 0.203$; yellow morph: $S = 0.531 \pm 0.104$) than among lab-born snakes (black morph: $S = 0.411 \pm 0.131$; yellow morph: $S = 0.301 \pm 0.081$). Lower birth weights combined with a lack of field exposure until release apparently contributed to the lower survival rate of lab-born snakes. Subsequent sur-



SUZANNE L. COLLINS, ONAH

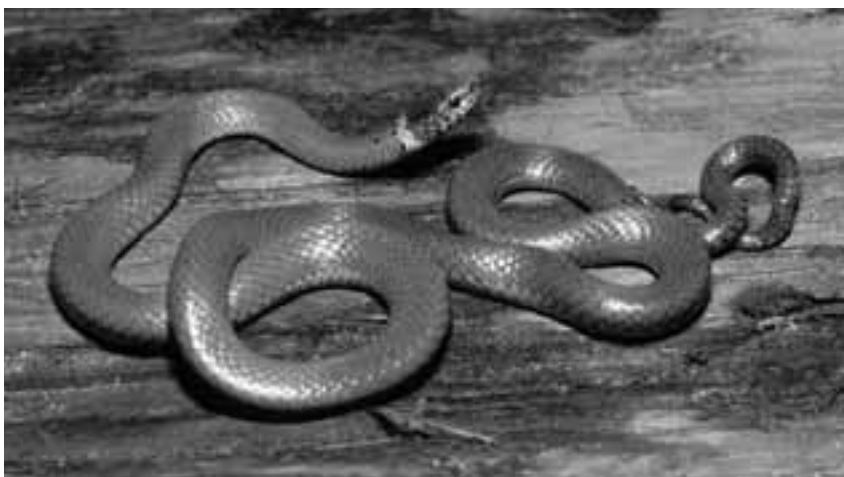
For young Timber Rattlesnakes (*Crotalus horridus*) (ages 1 yr and 2–4 yr), survival tended to decline over the years for both “yellow” and “black” morphs, whereas for adult snakes (> 5 yr), survival was constant or even increased slightly.

vival estimates for 2–4-yr-old snakes were $S = 0.845 \pm 0.084$ for the black morph and $S = 0.999$ (SE not available) for the yellow morph, and for > 5 -yr-old snakes $S = 0.958 \pm 0.039$ (black morph) and $S = 0.822 \pm 0.034$ (yellow morph). The most parsimonious model overall

contained an independent time trend for survival of each age, morph, and lab-treatment group. For snakes of the first two age groups (ages 1 yr and 2–4 yr), survival tended to decline over the years for both morphs, whereas for adult snakes (> 5 yr), survival was constant or even increased slightly. These data on survival and recapture are among the first rigorous estimates of these parameters in a rattlesnake and among the few available for any viperid snake. These data are useful for analyses of the life-history strategy, population dynamics, and conservation of this long-lived snake.

Ringneck Snakes are Toxic to Prey

Ringneck Snakes (*Diadophis punctatus*) are suspected of being venomous because their Duvernoy's gland secretions have high levels of phospholipase activity, which is characteristic of many viperid and elapid venoms, and because anecdotal reports of feeding behavior are consistent with the use of a venom. O'Donnell et al. (2007. *Toxicon* 50: 810–815) tested the toxicity of



SUZANNE L. COLLINS, CNRH

Northwestern Ringneck Snake (*Diadophis punctatus occidentalis*) oral secretions are toxic to a natural prey species, Northwestern Garter Snakes (*Thamnophis ordinoides*).

Northwestern Ringneck Snake (*D. p. occidentalis*) oral secretions to a natural prey species, Northwestern Garter Snakes (*Thamnophis ordinoides*), by injecting 2–35 μ l of oral secretions intraperitoneally. All doses were 100% lethal within 180 min. The dose significantly affected the time to loss of a right-

ing response. Neither injection of saline nor denatured oral secretions resulted in loss of a righting response or any visible detrimental effects. The authors suggested that Northwestern Ringneck Snakes may have evolved venom to subdue larger prey items than the snake would otherwise be capable of taking.

NEWS BRIEFS

Virginia Herpetological Society Publications On-line

The Virginia Herpetological Society has digitized all of its publications from 1958 to 2005, providing easy access to almost 50 years worth of field notes, articles, and the history of the society. Interested herpetologists are encouraged to access this resource at fwie.fw.vt.edu/VHS/ (or publications specifically at fwie.fw.vt.edu/VHS/vhs_history.htm).

Fourth Annual Sonoran Desert Herpetological Symposium

The Tucson Herpetological Society and its cosponsors are pleased to announce the fourth symposium on "Current Research on Herpetofauna of the Sonoran Desert" from 11–13 April 2008. The goals of this meeting are: (1) Presenting research on the herpetofauna of the Sonoran Desert (in the states of Arizona, Sonora, and on the Baja California Peninsula and gulf islands),

and (2) Bringing the interested community together to get better acquainted. Invited speakers are Harry Greene, Ed Moll, and Cecil Schwalbe.

The first three Sonoran Desert

Herpetofaunal symposia were an epiphany for many. These symposia revealed the wide variety of research being conducted in the area. For more information, see: <http://tucsonherpsociety.org/>.



THOMAS WIEVANDT, WILD HORIZONS

The Tucson Herpetological Society and cosponsors announce the fourth symposium on "Current Research on Herpetofauna of the Sonoran Desert."

Officials Warn 'Beware the Snakes'

Three experts and an eye witness launched kayaks into the Hanalei River on Kaua'i to try to track down a snake spotted on 25 June — the fourth reported sighting there since March.

"A snake flew out of the tree and splashed into the water," said 16-year-old Paulina Michel, of Princeville. "Then we started paddling really hard to get away." Demonstrating with her hands outstretched about 3-feet apart, 8-year-old Pearl Cuevas described her version of what she saw. "It was about this big," she gestured.

Although Hawaiian officials scour aircraft for the invasive species and take other, serious precautions to keep the state snake-free, the threat of the existence of the Brown Tree Snake (*Boiga irregularis*) on Kaua'i is a real one. The Brown Tree Snake is a nocturnal and arboreal snake that, after World War II, was introduced to Guam, probably via military cargo returning from use in the war in New Guinea. The species' rapid spread throughout the island resulted in the extinction of nine of the island's 12 forest birds and half of its lizards. With that in mind, Department of Agriculture officials are taking action to prevent what could be a drastic change to the fragile balance of Kaua'i's ecosystem.

Michel and Cuevas said they were about a mile from Hanalei Bay on their return to the Kayak Kaua'i port when they saw the snakelike creature slither away under the water. The pair — along with Michel's 8-year-old sister Jolene, who was trailing in a kayak with her father — reported the sighting to authorities immediately upon their return. State officials from the Hawai'i Department of Land and Natural Resources and Agriculture, Ed Pickop and Al Silva, with Invasive Species Committee member

Eric Twedt, arrived later at the Kayak Kaua'i office. They brought with them a "snake sighting interview kit." The experts asked the witnesses questions using different sizes of polyvinyl chloride pipe, rope, and pictures in an attempt to identify the snake.

Rain hampered efforts to kayak to the spot where the girls saw the snake, but Paulina said she was eventually able to show the experts the approximate location. "They got out and looked for tracks but didn't find anything," she said. The officials plan to return soon to further investigate. "We're not messing around. We take this very seriously," Pickop said.

After an alleged snake was spotted two weeks previously, DLNR officials posted signs on the Kayak Kaua'i office in Hanalei asking all sightings be reported. "It was a very interesting, action-packed day," Paulina said. "Beware the snakes."

In an ongoing effort to keep the snakes from hitchhiking to Hawai'i in military planes, ships, and cargo, Sen. Daniel Inouye has been working to include a Guam-based snake inspection process in the annual defense spending bill.

Nathan Eagle
The Garden Island
26 June 2007

A Major Victory for Gopher Tortoises

INCIDENTAL TAKE IS ALL BUT HISTORY! Thousands of citizens have been emailing, writing, attending meetings, and demonstrating a wish to conserve Gopher Tortoises (*Gopherus polyphemus*) and all the species that live with them. Private landowners, developers, and others are working together to take the next important step, namely to make sure that the Florida Wildlife Commission (FWC) Gopher Tortoise Management Plan is based on the management and monitoring practices that insure sustaining the species and its habitats in perpetuity.

Danger signs are rising all over the place that indicate that what is now a good foundation may not meet the criteria that will insure tortoise conservation for generations to come. More than twenty years ago, FWC staff assured those of us with concerns about the



JOE BURGESS

Private landowners, developers, and others are working to insure that the Florida Wildlife Commission Gopher Tortoise Management Plan is based on management and monitoring practices that sustain the species and its habitats in perpetuity.

details of how relocation and incidental take were going to be handled that those details would be changed. More than 10 years later, FWC responded to the science that expressed concern about upper respiratory tract disease (URTD) and proposed requirements that some kind of testing for URTD be incorporated in relocation efforts, but then did not respond to new information acquired during those 10 years that showed URTD was not the problem originally believed. Had, however, the original URTD concerns been correct, far more tortoises would have died than ever were taken by incidental take due to the 10-year response time.

The Gopher Tortoise Council (GTC) is preparing a review of the plan. One important issue still being ignored is the "Single-Family-Home" or "Five-Tortoises-or-Fewer" permits. A University of Florida study recently indicated that 187,000 single-family homes were built in 2006 alone. Plots ranged from less than one to several hundred acres in size. Meanwhile, in the history of the current permitting system, around 7,000 permits have been issued for this category. If only one tortoise per unit (not acre) is affected, the number far exceeds the losses reported by FWC.

Without the general public's concern and constant reminders to the FWC and County Commissions around the state, this and other key issues will be overlooked or ignored in the final plan. Establishing an economically sustainable program that will support relocation monitoring and management can be done in such a way that developers, agricultural interests, and large landowners will support the effort.



GAD PERRY

An introduction of Brown Tree Snakes (*Boiga irregularis*) on Kaua'i is a real threat.

GTC appreciates the work done by the FWC, hoping that it inaugurates a new era in which the staff uses science and public interest to develop real workable policies — but a few more months are necessary in order to get it done right. After twenty years of waiting, these changes will seal the fate of this keystone species, and if it takes another ten or twenty years to correct mistakes, no tortoises or commensals may be left to save.

The Gopher Tortoise Council

Litigation Looms

On 30 August 2007, The Center for Biological Diversity, headquartered in Tucson, Arizona, filed a formal notice of intent to sue the Department of the Interior for political interference with 55 endangered species recommendations in 28 states. The notice initiates the largest substantive legal action in the 34-year history of the Endangered Species Act. The full list of species is available at www.biologicaldiversity.org/swcbd/press/interference-08-28-2007.html.



GARY NAFIS

The Alameda Striped Racer (*Masticophis lateralis euryxanthus*) is one of two reptiles included in the list of species for which the Department of the Interior is accused of exerting political interference with endangered species recommendations. The Mexican Garter Snake (*Thamnophis eques megalops*) is the other.

North American Reptiles Faring Better Than Expected

A newly completed assessment of the conservation status of North American reptiles (Class Reptilia) shows that most of the group is faring better than expected, with relatively few species at severe risk of extinction. The comprehensive international assessment was carried out by zoologists from NatureServe, working in partnership with reptile experts from universities, the World Conservation Union (IUCN), and

Conservation International. The study covered 721 species of lizards and snakes found in Mexico, the United States, and Canada. About one in eight lizards and snakes (84 species) was found to be "Threatened" with extinction, with another 23 species labeled "Near Threatened." For 121 lizards and snakes, the data are insufficient to allow a confident estimate of their extinction risk, while 493 species (about two-thirds of the total) are at present relatively secure.

When viewed in comparison with the perils facing other animals, this is reasonably good news for North America's squamate reptiles. A comparable recent global assessment of amphibians, for example, found nearly one-third of the planet's amphibians to be at risk of extinction.

The results of the two-year assessment were announced today as a key component of the 2007 IUCN Red List of Threatened Species. Widely recognized as the most definitive tally of the planet's threatened wildlife, the Red List is a joint effort led by IUCN and its Species Survival Commission, working with official Red List partners BirdLife International, Conservation International, NatureServe, and the Zoological Society of London. Publication of the conservation status assessments for North American reptiles is



THOMAS MEYLANDT, WILD HORIZONS

The Two-legged Worm Lizard (*Bipes biporus*) of Baja California is listed as "Least Concern" on the IUCN Red List in view of its wide distribution, tolerance of a degree of habitat modification, presumed large population, and because it is unlikely to be declining fast enough to qualify for listing in a more threatened category.

a major step toward completion of the first-ever Global Reptile Assessment, an ongoing effort by the Red List Consortium to assess the status of all reptiles worldwide. The North American effort was funded primarily by the Regina Bauer Frankenberg Foundation for Animal Welfare, a New York-based foundation dedicated to the care and conservation of the world's animals.

Grand Cayman Blue Iguanas Hatch at the San Diego Zoo

The San Diego Zoo's Conservation and Research for Endangered Species (CRES) is pleased to announce the hatching of three Grand Cayman Blue Iguanas (*Cyclura lewisi*). The hatchlings emerged from their eggs over a three-day period from 17–19 September 2007. The mother, who weighed only 550 g, nested four eggs in the soil of a potted *Hibiscus* plant at CRES. The nesting and hatching dates are similar to those for iguanas in Grand Cayman. Average weight and size of the eggs was 56.5 g and 66 x 45 mm. The eggs were placed on a mixture of vermiculite and water at a ratio of 1:1 by weight, and incubated at a temperature of 30 °C. The first animal pipped after 83 days of incubation. Average weight and snout-vent length of the hatchlings was 44.2 g and 97 mm.

The Grand Cayman Blue Iguana is considered by many to be the most endangered lizard in the world. Threats include severe habitat loss and fragmentation, road traffic, and intense predation from non-native feral and domesticated animals. The Blue Iguana Recovery Program was developed with several international collaborators to reverse the iguana's path to extinction by headstarting, breeding, and releasing iguanas within protected reserves on Grand Cayman. To date, over 250 iguanas have been released and the prospect for species survival is slowly improving. One of the many program goals is to develop a self-sustaining *ex-situ* captive population that mirrors the genetic diversity of the remaining wild population and provides a hedge against catastrophic loss in Grand Cayman.

The dam hatched in 2001 at the headstart and breeding facility in Grand Cayman. She and the sire (hatched 2002) were brought to CRES in 2005



JEFFREY M. LEMM



Hatchling Grand Cayman Blue Iguanas (*Cyclura lewisi*) at the Center for the Reproduction of Endangered Species (CRES) at the San Diego Zoo.

with eight other juveniles representing five founder pedigrees new to the United States captive population. This is the first breeding of this species at San Diego; only two other zoos (Gladys Porter and Indianapolis) have bred Blue Iguanas in the United States in the last decade. CRES has been an integral part of the AZA's *Cyclura* SSP since its inception, and is a collaborator in the Blue Iguana Recovery Program.

Jeff Lemm

Research Animal Coordinator
Applied Animal Ecology Division
CRES, Zoological Society of San Diego

Bootmaker for World Leaders Arrested

A bootmaker to world leaders, including President Bush and Vicente Fox, is in a Colorado jail, charged with money laundering and conspiring to illegally smuggle the skins of protected animals into the United States to provide exotic footwear for high-end clients.

The arrest of Martin Villegas — and Mexico's raid of a warehouse filled with hundreds of cowboy boots and belts made from endangered species — has raised questions about how much Fox knew of the scheme and whether the former Mexican president purchased illegal boots himself. Before Fox left office in December, Villegas created a special

brand of cowboy boot named after him, which was manufactured in Mexico's shoemaking capital, Leon, in Fox's home state of Guanajuato. The Mexican bootmaker also produced footwear for Fox's bodyguards, Cabinet members, relatives and friends — including Bush, a fellow lover of ranchwear, who accepted a pair of ostrich-skin cowboy boots as a gift during a visit to Fox's ranch in 2001.

Villegas was arrested 6 September along with two other Mexican nationals and two U.S. residents following a three-year undercover operation by U.S. Fish and Wildlife Service agents. The five allegedly made 25 illegal shipments of banned skins into the U.S. since 2005, the department said. Days later, Mexican federal agents raided the Canada Grande factory and warehouse in Leon, which is owned by one of the other Mexican suspects, Esteban Lopez Estrada. They found about 400 pairs of cowboy boots and 150 belts made of the skins of endangered sea turtles, as well as products made illegally from the hides of crocodiles, lizards, and cobras.

The seized boots, belts, shoes, and skins are being stored in an environmental protection agency office in Guanajuato, where a chain-link cage is filled with more than 200 cardboard boxes with drawings of ostriches and serpents. "Exotic Boots ... export quality," is written in red lettering on the boxes. A pair of turtle-skin cowboy boots sells on the black market in Mexico for about \$70. Across the border, they can fetch as much as \$500. Turtle skins, which sell for about \$9 in Mexico, go for about \$80 in the U.S. Any commercial trade in sea turtles is prohibited under the Convention of International Trade in Endangered Species of Wild Fauna and Flora.



A prominent bootmaker is in a Colorado jail, charged with money laundering and conspiring to illegally smuggle the skins of protected animals into the United States to provide exotic footwear for high-end clients.

Smuggling Endangered Iguanas in a Prosthetic Leg

A California resident was indicted on federal smuggling charges for bringing into the United States several extremely rare iguanas after stealing them from a nature preserve in the Republic of the Fiji Islands and concealing them in his prosthetic leg. The smuggling charge, which carries a penalty of up to five years in federal prison, alleges that Jerome James stole three hatchling Fiji Island Banded Iguanas (*Brachylophus fasciatus*) and brought them to the United States in violation of federal and international law.



JOHN BINNS

A California resident was indicted on federal smuggling charges for bringing into the United States several extremely rare Fiji Island Banded Iguanas (*Brachylophus fasciatus*) after stealing them from a nature preserve and concealing them in his prosthetic leg.

The Fiji Island Banded Iguana is threatened with extinction and is protected under an international treaty known as the Convention on International Trade in Endangered Species of Wild Fauna and Flora. While on a trip to Fiji in September 2002, James apparently abducted three young iguanas from an ecological preserve. He then allegedly brought them into the United States by concealing them in a special compartment he had constructed in a prosthetic leg that he uses.

After receiving a tip that James possessed several specimens of the endan-

gered species, the United States Fish & Wildlife Service opened an undercover investigation. During the investigation, James told an undercover operative that he sold a trio of Fiji Island Banded Iguanas four years ago for \$32,000. After a series of meetings with the defendant, Fish & Wildlife Service agents executed a search warrant at James's house in July and recovered four of the endangered iguanas.

Andros Iguana Outreach

In October, an outreach project utilizing workshops and outreach materials was initiated on Andros Island, Bahamas. The objective of this project is to advance efforts to protect the endangered Andros Iguana (*Cyclura cythlura cythlura*). The San Diego Zoo's Education Department and Conservation and Research for Endangered Species (CRES) collaborated with the Bahamas Ministry of Education and the Bahamas National Trust (BNT) to hold two two-day workshops for Andros Island educators. Thirty-four educators (teachers, administrators, and resource specialists) representing all 19 public schools on Andros participated in the events. The workshops were supported by a United States Fish and Wildlife Service "Wildlife Without Borders" grant.

The workshops were designed to improve the educators' understanding of Andros Iguanas, their habitat, and their conservation. Participants gained valu-

able knowledge and experience through a variety of activities, discussions, and a fieldtrip. The groups received training on the use of a portable education kit with three complementary lessons and associated materials. Two of these kits will travel throughout the Andros school system during the year. Educators also received resource materials including an iguana conservation poster, wildlife identification posters, and a pine forest resource book produced by the BNT. Participants also received custom t-shirts to help promote pride in Andros Iguanas and their conservation.

The project also supports diffusion of iguana related information through youth sports and civic clubs. A series of trading cards was created as a fun way to inform youths and their families about Andros Iguana natural history, threats, and conservation. The Central Andros Iguanas Football Club, the Governor General Youth Awards Program, and the Bahamas National Trust will distribute the cards as prizes to members and participants in community events. The 70-member football club also received sports backpacks and water bottles printed with the club's logo and a conservation message.

The success of the workshops has already led to plans for further collaboration and activities. A subsequent evaluation of the effects of the activities and materials will help improve future conservation outreach activities on Andros and other islands.



BILL TOONE

Thirty-four educators representing all 19 public schools on Andros Island (Bahamas) participated in a two-day workshop using materials that focused on Andros Iguanas (*Cyclura cythlura cythlura*).

Start Them Young

The countdown to choosing the nation's top young scientist began several months ago by Discovery Communications and one of the 40 finalists is herpetologist-in-training, Rick Schaeffer, a junior chelonian scientist with a science fair project on the Asian Giant Tortoise, *Manouria emys*.

Over 7,000 students won a nomination at their local, regional, or state science fairs, of which approximately 2,000 were considered for the award and 400 were chosen as semifinalists. In spring 2007, while an 8th-grade student in Jacksonville, Florida, Rick Schaeffer placed first in zoology at the Florida State Science Fair, receiving the Discovery Channel Young Scientist Award at both the regional and state competitions.



Rick Schaeffer presenting his award-winning talk: "A Comparison of the Activity Levels of Different Age Cohorts of the Asian Giant Tortoise, *Manouria emys*, by Photoperiod."

Rick presented his findings from a previous Science Fair project at the University of Florida Herpetology Conference in spring 2006. This summer, he presented his first place award-winning current project at the 2007 Annual Symposium on the Biology and Conservation of Tortoises and Fresh Water Turtles in Atlanta, Georgia. He has also presented his research at the Gopher Tortoise Council Annual Meeting. He was the youngest speaker ever at both the University of Florida Herpetology Conference and the Annual Symposium on the Biology and Conservation of Tortoises and Fresh Water Turtles.

Protection a Shell Can't Provide

Their short tails beat back and forth faster as their noses concentrated on a pile of rotting wood, wet leaves, and

thorny brush in the dense Montgomery County forest. "Look, look," said John Rucker, a turtle activist from Tennessee, pointing at his three Boykin spaniels. "Think they found one." Sure enough, Sparky brought his snout out of the brush with a yellow-spotted Eastern Box Turtle (*Terrapene carolina carolina*) carefully clutched in his teeth.

The half-dozen turtle hunters were combing the woods yesterday along the planned route for Maryland's intercounty connector, which could replace the turtle-friendly habitat with a six-lane toll highway. The aim is to catalogue and fit the turtles with transmitters so they can be rounded up and evacuated from the area when, or if, construction begins.

State Highway Administration officials are heeding the advice of their Box Turtle advisory committee with an "environmental stewardship" campaign to save the turtles from being crushed under bulldozers or trapped under the asphalt, said Robert Shreeve, the connector's environmental manager. The campaign, which began about a month ago, is estimated to cost up to \$20,000. Unlike deer, birds, and other woodland and wetland creatures in the area, turtles "are slow-moving and have a very difficult time getting out of the way," Shreeve said during a news conference in the woods yesterday morning.

Major construction on the long-delayed highway was set to begin October 16th but has been put on hold as a federal judge considers two lawsuits alleging that Maryland officials did not properly evaluate the highway's environmental impact. The 18-mile highway would run north of the Capital Beltway connecting Interstate 270 in Gaithersburg and Interstate 95 in Laurel. U.S. District Judge Alexander Williams, Jr. began hearing arguments Monday and is expected to rule this month. While the lawsuits are pending, highway officials and activists are continuing with turtle relocation plans. They have found 90 turtles and hope to bring that number to 150. Some of the creatures were tagged with donated transmitters and released in the spots where they were found, but most are being held in a pen until the transmitters the highway administration ordered arrive.

If the judge rules in the state's favor and major construction begins, officials



Maryland State Highway Administration officials are heeding the advice of their Box Turtle advisory committee with an "environmental stewardship" campaign to save Eastern Box Turtles (*Terrapene carolina carolina*) from being killed during construction of a six-lane toll highway.

will locate the turtles, which will probably be hibernating under four to six inches of dirt and leaves. The best way to move "pretty much comatose" turtles is to work on a cold day and keep the turtles at a constant low temperature, said Christopher W. Swarth, a committee member and director of Jug Bay Wetlands Sanctuary in Anne Arundel County.

They will then place the turtles in a new hibernation hole on the other side of the highway construction fence, which will be reinforced with thin mesh so the turtles can't crawl back. Shreeve said construction workers also will be trained on what to do if they spot a turtle: Pick it up and alert the environmentalists. The activists involved said none of them has ever moved this many turtles before — and they aren't sure whether it will work. "Just because we'll pick up buckets of turtles doesn't mean they'll still be around in a few years," Swarth said.

Eastern Box Turtles can be found in many spots in the region, the activists said, but their population is slowly dwindling for a number of reasons: low egg counts, collisions with fast-moving cars, dwindling habitats, pesticides and, yes, children with sticks. Moving a whole population of turtles, even a few miles, could be enough for that species to disappear from the area.

Turtles hardly ever venture more than a few miles from their home, said Susan Hagood of the Humane Society of the United States. Turtles that are trans-

planted usually don't settle down, she said, and instead keep wandering in search of home. Plus, the little guys might not be happy being pulled out of hibernation. "We're trying something that history has said doesn't work," she said. "But with a declining species, we can't do nothing."

Although the activists said they were glad the highway administration has publicly supported saving the turtles, they worry that the support came too late. Committee member Sandy Barnett, a longtime herpetologist, said that the panel formed nearly a year ago and that highway officials should have started the process in June so they could mark the turtles before they started their fall hibernation routine. She is also upset that the transmitters have not arrived and will be too large for some of the baby turtles. "It's a \$2.4 billion [highway] project," she said. "They have all of these funds to allocate, and they can't take care of these turtles?"

Jenna Johnson
Washington Post

Biodiversity: Exotic Pet Collectors Drive Extinction

In an ironic twist, officially listing a species as endangered drives up its value to collectors and consumers, putting it on an even faster track to extinction, researchers in Paris reported Tuesday. A perverse human penchant for possessing the last remaining member of a species increases its value so that collectors will spend thousands of dollars and go to any length, legal or illegal, to obtain them. This triggers a positive feedback loop between exploitation and rarity that drives a species into an extinction vortex, Franck Courchamp and colleagues write in the scientific journal *PloS Biology*.

"It can be dangerous for a species to announce that it has become rare if it cannot be protected from exploitation," Courchamp said. "Even inconspicuous species can suddenly become valuable just because they are rare." Hobby collectors, the exotic pet trade, trophy hunters, traditional medicine, and luxury goods made from rare species are among the forces pushing rare species into extinction — and the scientific literature is often used to identify the next hot

species. Immediately after an article recognized the small Indonesian turtle (*Chelodina mccordi*) and Chinese gecko (*Goniurosaurus luii*) as rarities, their prices soared on the exotic pet market. The turtle is now nearly extinct and the gecko can no longer be found.

Exotic pet traders covet a wide range of creatures, including orangutans, monkeys, reptiles, birds, and wild cats, as well as arachnids, insects, and fish. The Internet is a major factor in driving species into extinction faster than ever, says Ernie Cooper, director of wildlife trade at the World Wildlife Fund-Canada. "The Internet makes it very easy for sellers to connect with buyers," Cooper said. A seller can easily and quickly sell 200 exotic salamanders on the net, which would have been very difficult to do a decade ago. "It's just scary how fast a species can be depleted," Cooper noted.

Two years ago, he found out that 50 Kaiser's Spotted Newts (*Neurergus kaiseri*), a threatened species endemic to Iran, were for sale in Canada. He traced the Canadian dealer to a Ukrainian dealer who was offering up to 200 Kaiser's Spotted Newts for sale. "There are less than 1,000 Kaisers left in only a few small streams in Iran," Cooper said. Although protected in Iran and collected illegally, it is not illegal to sell the Kaisers on the many amphibian collector websites. "If I hadn't stumbled on to the trade in Kaisers, it would have gone extinct before anyone knew."

The IUCN World Conservation Union's "red list" of threatened species now considers Kaisers to be a "critically endangered" species — just one of nearly 16,000 plants and animals known to face a high risk of extinction. Not surprisingly, the collector's price for Kaisers has jumped from \$200 to \$400 dollars, and some are still for sale today.

The pre-eminent scientific authority on species at risk, the IUCN red list offers no legal protection for species, says Peter Galvin of the Centre for Biological Diversity, an environmental group in California. Instead, each country should establish laws to protect species and to list a species under the Convention on International Trade in Endangered Species (CITES) to make it illegal to trade endangered species. "If there are no legal protections, then it might be a good



L. LEE GRIMMER

Immediately after the Chinese Leopard Gecko (*Goniurosaurus luii*) was formally described as "rare," its prices on the exotic pet market soared. The gecko can no longer be found in its natural habitat.

idea to keep secret the fact that a species has become rare," he said.

However, in many cases a widely publicized announcement that a species is threatened with extinction is the only way to motivate governments to pass laws and take other measures to protect them. China adopted stringent measures to protect the Giant Panda only after worldwide public outcry following published scientific reports showing that the species was in trouble. "Most countries are embarrassed to let one of their species go extinct," Galvin pointed out.

In the United States, species have only been protected after lawsuits forced the government to put them on the U.S.

Endangered

Species List — or

at least that is the

way it has been

under the George

W. Bush adminis-

tration, he says.

"No species has

been put on the

list without a

court order,"

Galvin said. That

process can take

years, leaving a

species known to

be rare without

any legal protec-

tion — but keep-

ing quiet doesn't

work either, since

species are going

extinct at record

rates. "Publicly

listing a species as

threatened cuts

both ways,"

Cooper agreed.

However, he

believes there are cases when it would be better to keep a species' status secret.

It is probably already too late for the Kaisers. Even if Iran wanted to make it illegal to trade the newts internationally, the CITES process can take two or more years — and the looming extinction of Kaisers is not a top priority for Iran, Cooper said.

Educating collectors on the consequences of their hobby — driving species into extinction — doesn't work for some because they tend to be obsessive personalities. "They are often experts who know a species has been collected into extinction but they must have it in their collection," he explained. Courchamp has conducted experiments on this human compulsion for rarity. "People are always interested in the rare," he said. "Even if two objects are identical, if you tell them one is rare, that one becomes their focus. It is a very strong tendency."

Stephen Leahy

IPS-Inter Press Service

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O B I T U A R Y

In Memoriam:
Peter Vogel¹

Herpetologist Peter Vogel, a leading advocate for preserving Jamaica's wildlife, was found dead in his home on 19 July 2007. Police are investigating his death as a homicide. To date, the crime remains unsolved.

Dr. Vogel, who was Swiss born, was the 2006 recipient of the Gleaner Honour Award for Science and Technology. A major area of his work revolved around the discovery of the Jamaican Iguana (*Cyclura collei*) in the Hellshire Hills of St. Catherine. He also was a recipient of the Institute of Jamaica's special Silver Award for science in 2001. Vogel initially arrived in Jamaica in 1979, spending a year at the University of the West Indies collecting data on anoline lizards for the University of Bochum, Germany. He subsequently completed his Ph.D. in animal behavior and ecology from the University of Basel in Switzerland. When he returned to Jamaica in 1985 to conduct a two-year research project on anoline lizards, he was hired as a lecturer in the Department of Life Sciences at a time when the country had been without a locally based herpetologist for several decades. This became especially critical in 1990, when the Jamaican Iguana was rediscovered in the remote Hellshire Hills. Peter was the obvious person to become chairman of the rapidly formed Jamaican Iguana Research and Conservation Group (JIRCG), and his speedy response to an emergency conservation issue probably served to avert the otherwise likely extinction of the island's largest land animal. In addition to implementing critical conservation activities, Peter kept the JIRCG going for many years, making it possible for other iguana conservationists to continue the effort.

Vogel's research interests focused on the ecology and conservation of land vertebrates and their habitats. He was involved in various biodiversity projects, including studies of communities of amphibians, reptiles, and birds in the Cockpit Country, the Blue and John Crow Mountains, and the dry forests of the southern coast. An important element of these projects was to assess threat factors, and to identify and implement conservation measures. Dr. Vogel also served extensively on boards of environmental NGOs. He was an executive member of BirdLife

Jamaica, the Jamaican Iguana Research and Conservation Group, and the Game Bird Research Committee. Peter's quiet resolve and understanding of the conservation climate in Jamaica inspired a generation of local conservationists, and the success of those efforts will ultimately be a fitting tribute to his love and concern for Jamaica's endemic reptiles.

He is remembered by his widow, Parlan, and three children. May he rest in peace.



JOHN BIRNIS

Peter Vogel at the Main Camp in the rugged Hellshire Hills of Jamaica in June 2002.

¹ Adapted from a news release and an obituary by Byron Wilson, current JIRCG Director, that appeared in *Reptiles* magazine.



BYRON WILSON

The survival of the Jamaican Iguana (*Cyclura collei*) and the Jamaican Iguana Research and Conservation Group are two of Peter Vogel's ongoing legacies.

IRCF ON THE MOVE



JOHN BINNS

"Slim," one of the IRCF's awareness ambassadors, was recently filmed and photographed at Tippet Studio in Berkeley, California, as a reference model for "Chico," a computer-generated iguana character in Disney's new movie "South of the Border," which is scheduled for the second half of 2008.



IMAGE COURTESY OF ZOOMED

"Baby," another IRCF awareness ambassador, now appears on the label of Zoomed's recently released Adult Iguana Food product.

IRCF participation in Reptile Shows and Conservation events brings its message of conservation directly to reptile enthusiasts. "These events are great because we are able to meet people who share a common interest with the IRCF — a love for Reptiles," says John Binns, Founder and CEO of the IRCF. "This is also a great place to find new members who are willing to join the fight to help save endangered reptiles."

Unfortunately, due to logistical constraints, the IRCF has been able to attend events only on the West Coast. If you are interested in helping represent the IRCF at a show close to your home, please contact Sandy at sb@ircf.org.

7–9 September, NARBC, Anaheim, California

The IRCF expresses its gratitude to Bob Ashley and Brian Potter, NARBC pro-

motors, who provided the exhibit space. The IRCF also is grateful to IRCF member Nigel Marvin, who donated the proceeds from his autographing session to our conservation efforts. This is the first show at which the IRCF employed wireless technology for membership signup and payment processing. Manning the

booth were Sandy Binns, Desiree Wong, Michael Kern, Joel Friesch, John Binns, and Izzy (Cuban Rock Iguana).

Also, NARBC-sponsored auctions in Anaheim, California, Chicago, Illinois, and Chantilly, Virginia donated a portion of the proceeds to the IRCF. Thank you Bob Ashley and Brian Potter for your generosity and assistance in helping our conservation efforts.



JOHN BINNS

Avery Friesch (Joel's daughter) demonstrates her skill at riding IRCF's Blue Dragon. Fifteen Blue Dragon sculptures are distributed across Grand Cayman, making up the Blue Dragon Trail. This is the only Blue Dragon in the United States.



JOHN BINNS

IRCF-branded stress figures (compliments of Desiree) were offered with a small donation.



JOHN BINNS

Desiree Wong speaks with a young attendee about the importance of protecting species in the wild.



JOHN BINNS

Booth at the NARBC.

28–30 Septembe, Upscale Reptiles, Sacramento, California



From the left, Michael Kern, Desiree Wong, Sandy and John Binns, and Izzy in the fore-front.



MICHAEL KERN

From left to right: IRCF member Stephanie Marshall, Sue Solomon, IRCF member and longtime supporter, John Binns, and Desiree Wong. The IRCF thanks Sue Solomon for her very generous donation.



DESIREE WONG

Basketball Star Mikki Morore and John Binns discuss conservation issues while being videotaped for later airing at various basketball games.



DESIREE WONG

IRCF Ambassador Izzy, a Cuban Rock Iguana, is kept warm prior to the opening of the show.



DESIREE WONG

As with every show, Izzy is the star attraction.

6 October, WCN San Francisco, California

The IRCF participated in the 6th Annual Wildlife Conservation (WCN) Expo, which brought together over 600 guests and 48 wildlife conservation organizations. The Keynote speaker this year was Dr. Jane Goodall, DBE. This event is a unique opportunity for the public to learn about conservation projects from around the globe, meet world-class conservationists in person, and learn about their work, their challenges, and hopes for the future.

The IRCF expresses its gratitude to the Wildlife Conservation Network for the space and electricity they provided.



JOHN BINNS

Central area of the WCN show.

2–4 November, Upscale Reptiles San Jose, California

This year's San Jose show drew a moderate but consistent flow of attendees to our exhibit. The show broke our old record for signing new members and renewals. Manning the IRCF booth were Sandy Binns, Desiree Wong, Michael Kern, and Joel Friesch.



DESIREE WONG

The large IRCF exhibit just prior to the show's opening.

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Editors' Remarks

Readers will notice that many of the pages in this issue are devoted to reports from the 2006 IUCN/SSC Iguana Specialist Group (ISG) meeting. We've done this in the past (and hope to continue doing so in the future). Our intent is two-fold: (1) Iguana conservation reflects the heritage of *IGUANA*. As many long-time readers will remember, the journal began as the *Iguana Times* (*Journal of the International Iguana Society*), focusing entirely on conservation and natural history of iguanas. Although we expanded the scope of the journal to all reptiles with volume 12 in 2005 (shortly after the International Reptile Conservation Foundation became the publisher of *IGUANA*), the plight of iguanas continues to serve as a model for the conservation of reptiles and their habitats throughout the world. (2) The ISG remains a phenomenally active agency for promoting iguana conservation, and the meetings of that organization effectively chronicle ongoing efforts at habitat preservation, captive breeding and reintroduction and relocation to historically occupied sites, and educational efforts to promote conservation at the grass roots level. By reprinting the meeting reports, we seek to more widely disseminate this valuable information.



Mona Island Iguana (*Cyclura stejnegeri*)

JOE BURGES

The Editors of *IGUANA*

Statement of Purpose

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

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

Membership Information

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

*The Adobe PDF is optimized for web publishing and does not provide the quality and resolution of the archival printed version, especially noticeable in photographs and complex graphics.

www.IRCF.org

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Membership Questions?

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

Solicitations

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

Donations

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

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

FOCUS ON CONSERVATION

The Mountain Lizard of the Turimiquire Massif: Natural History and Conservation of Croizat's Skinks¹



GILSON RIVAS (MABUYA CROIZATI PROJECT, PROVITA, CARACAS)

Croizat's Skink (*Mabuya croizati*) is endemic to the Turimiquire Massif, an isolated mountain in north-eastern Venezuela. These lizards are restricted to elevations above 2,000 m. This species recently was listed as vulnerable in the Red List of Venezuelan fauna. Aspects of its population status and ecology remain enigmatic, mainly because few specimens have been collected since its initial discovery in the 1930s (although the species was not formally described until 1973).

The known geographic distribution of *Mabuya croizati* consists of only three localities, all of which have elevations above 2,000 m and comprise a total area of 8,000 ha. However, the species has been extirpated in two of these locations (including the type locality). On the other hand, at least 35 areas above 2,000 m on the Massif have yet to be surveyed for the presence of this species, but, in the last six years, only a single population was found in the "Cerro El Guamal." This locality consists of approximately 17 km² and has undergone substantial human-mediated changes, associated primarily with deforestation and the installation of radio and telecommunication antennas and their maintenance. Deforestation and agricultural activities affect 60–70% of the Turimiquire Massif.

Since 2005, Venezuelan researchers (Gilson Rivas, Tito Barros, and César Molina), Walter Schargel (University of Texas at Arlington), and Aurelien Miralles (Paris Museum) have been working intensively to discover new populations. Their investigations include multidisciplinary evaluations of ecology, natural history, and evolutionary history. Preliminary molecular analyses are intriguing and suggest that the Turimiquire Massif was previously connected with the lowlands of the Guiana Shield.

Investigators are continuing their research on the population at Guamal, with the intent of proposing to environmental officials in Venezuela that the Guamal area be set aside as a natural reserve and that radio-telecommunications activities be relocated. If you are interested in supporting this project, contact the International Reptile Conservation Foundation (IRCF).

¹ Text reviewed by Carl J. Franklin



ROBERT POWELL

Heat-loving Dominican Ground Lizards (*Ameiva fuscata*) are often abundant in forested areas. This adult male takes advantage of a patch of sun to bask.



The Andros Island Iguana (*Cyclura cyclura cyclura*) has been the focus of conservation and educational efforts. See ISG Reports on p. 228.