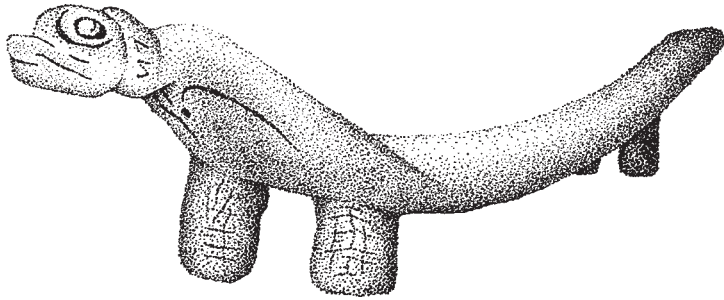


West Indian Iguana Specialist Group



Newsletter

IUCN - The World Conservation Union
Species Survival Commission

Volume 3, Number 2, Fall 2000

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News & Comments

In Caribbean, Endangered Iguanas Get Their Day

NY TIMES Science Section – October 10, 2000

By Mark Derr

While hunting hogs deep in the rugged Hellshire Hills of Jamaica one day in June 1990, Edwin Duffus rescued a large lizard from his dogs and carried it four hours by foot and bicycle to his home and ultimately to Kingston's Hope Zoo. There, Dr. Peter Vogel, a herpetologist at the University of the West Indies, and Rhema Kerr, a zoo curator, identified the lizard as a Jamaican iguana, believed extinct for nearly 50 years.

The rediscovery inspired an intensive effort to save both the Jamaican iguana and the dry tropical forest of the Hellshire Hills that is its last redoubt. After several exhaustive surveys, Dr. Vogel has estimated the iguana population at fewer than 100.

"The Hellshire Hills has the most significant natural dry forest left in the Caribbean," Dr. Vogel said. "Preserving it is key to the Jamaican iguana's survival and to maintaining the area's biodiversity."

The Jamaican iguana's return from oblivion also focused international attention on the plight of all West Indian iguanas, said Dr. Allison C. Alberts, head of ecology at the San Diego Zoo. In 1997, the World Conservation Union declared these iguanas of the Caribbean islands "the most endangered lizards in the world" and organized a group of scientists devoted to their preservation. Dr. Alberts is co-chairman of that group and the editor of a report issued by the World Conservation Union in August that summarizes what is known about the genetics, evolution and ecology of West Indian iguanas, the threats to their survival and programs to preserve them. The two most imperiled, she said, are the Anegada iguana, found only on the island for which it is named in the British Virgin Islands, and the Jamaican iguana. The Anegada iguana was once common on Puerto Rico and throughout the Virgin Islands.

Genetic analyses to be published in The Journal of Molecular Phylogenetics and Evolution show that the Anegada iguana is the oldest member of the genus *Cyclura*, dating back 15 million to 35 million years. The research was conducted by Catherine Malone, a doctoral candidate in



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genetics at Texas A&M University. As the Caribbean archipelago took its present shape, wind and ocean currents occasionally carried iguanas to more western islands, where, isolated, they evolved into 8 species and 16 subspecies. Every major island has its own species of *Cyclura iguana*, and Hispaniola has two. (Two species of iguana found on islands of the Lesser Antilles are from a different genus.) Next to the Anegada iguana, Ms. Malone found the Jamaican iguana to be the most genetically distinctive and biologically important species of the group. But inbreeding necessitated by its small numbers has forced the Jamaican iguana into a genetic bottleneck, making it susceptible to dangerous mutations, parasites and disease.

Before European colonization, West Indian iguanas were the largest terrestrial herbivores on their islands, where they dwelled in dry forests and thorny scrub. The lizards can live 40 years, and some, like the Jamaican and Cuban iguanas, can reach five feet in length and weigh around 17 pounds. The iguanas played an important role in island ecology, Dr. Alberts said. According to her recent research, seeds passing

through the iguanas' digestive tracts and then dispersed germinate faster and grow better than others. The iguanas' only natural predators were raptors and snakes. They also served as an important food for the Indians, and are still eaten on some islands. But Europeans and their animals have greatly altered the ecology of the Caribbean archipelago. Goats strip bare the vegetation on which iguanas feed; pigs and cattle disturb nests; cats, rats and Indian mongooses feast on hatchlings and eggs; and dogs kill mature animals.

More recently, resorts and housing developments on some Caribbean islands have reduced iguana habitats to almost nothing and forced scientists to move animals to safe havens on small, unpopulated islands. But sometimes there is little to eat and no place for an iguana to hide.

"There has been an 80 percent decline in the population of the Anegada iguana since the 1960's, due mostly to feral cats," Dr. Alberts said. In 1997, with fewer than 200 Anegada iguanas thought to exist and none reaching maturity, biologists began collecting hatchlings and raising them in a special site for release

Imperiled West Indian Iguanas

A number of factors, like residential development and the importation of predators, have contributed to the decline of West Indian Iguanas, many of which are either endangered or critically endangered. Below, those listed as critically endangered by the World Conservation Union.

Species	Estimated Population
White Cay Iguana	150-200
San Salvador Iguana	150-200
Bartsch's Iguana	200-300
Turks and Caicos Iguana	30,000
Anegada Iguana	200
Grand Cayman Iguana	100-175
Little Cayman Iguana	1,000
Jamaican Iguana	100
Ricord's Iguana	2,000-4,000

Photographs by Bruno Dittmar (White Cay), Glenn P. Gerber (San Salvador, Bartsch's, Turks and Caicos, Anegada, Grand Cayman, Little Cayman, Jamaican), Bill Christie (Ricord's)

Source: The World Conservation Union, Richard Hudson, Fort Worth Zoo

New Publication

Alberts, A.C. (ed). 2000. West Indian Iguanas: Status Survey and Conservation Action Plan. IUCN - the World Conservation Union. Gland, Switzerland.

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when they are too large for cats to attack. But the key to their preservation, experts agree, is removal of the feral cats.

The situation in Jamaica is more complex, Dr. Vogel said. Once so abundant in southeastern Jamaica that the coastal area around Kingston was named the Liguanea Plain, the native word for the lizards, the iguana population crashed after the human population doubled in the second half of the 19th century and the Indian mongoose was introduced in 1872. Imported to kill nocturnal rats devastating sugar cane fields, the mongooses feasted instead on bird, snake and reptile eggs and hatchlings. In developed areas, cats and dogs contributed to the slaughter. By the end of the 1940's, the Jamaican iguana was generally considered extinct.

The conservation effort begun in Jamaica in 1990 has concentrated on protecting the last two nesting sites in the south-central Hellshire Hills and collecting half the hatchlings and raising them at the Hope Zoo, which now holds 100 juveniles. After three to four years, when they are too large to be mongoose prey, some of these iguanas are released. Others are kept as a genetic reservoir.

Since 1996, biologists have released 26 iguanas, each equipped with a miniature radio transmitter for monitoring their movements. For the first several years, the abrasive limestone of the Hellshire Hills quickly destroyed the special vests holding those transmitters. So last year, after being approached by researchers, the Nike company provided vests custom-made of abrasive-resistant fabric, said Richard Hudson, a conservation biologist for the Fort Worth Zoo, who works extensively in the Caribbean. All the released

iguanas have survived, leading Mr. Hudson and other biologists to conclude that the lizards are "hard-wired" for life in the wild. Last year, Dr. Vogel said, a released female nested for the first time. But a captive breeding program under way at the Hope Zoo and six American zoos has failed to produce any offspring, for still unknown reasons.

Since 1997, field workers have trapped and killed mongooses in iguana territory. They also try to persuade dog owners usually pig hunters and people who gather hardwood for charcoal to keep their pets out of the area. But, Dr. Vogel cautioned, each year the charcoal makers push deeper into the Hellshire Hills in search of mature trees, driving the pig hunters before them. Without greater protection, he fears that dogs and people may overrun the iguanas' range.

Last fall, the government of Jamaica established the Portland Bight Protected Area, including the Hellshire Hills, but the preserve is not yet being managed and there are plans to build roads and houses and to mine limestone in the forest's interior, Dr. Vogel said. Until those plans are dropped, conservationists fear for the iguana and a number of other species that live only in the Hellshire Hills.

While recognizing that the Jamaican iguana and several of its cousins still teeter on the brink of extinction, biologists seeking to rescue the endangered animals remain optimistic that they will succeed, in large part because of increasing public awareness in the Caribbean and abroad. Mr. Hudson said flatly that none of the West Indian iguanas were going extinct.



AZA Conservation Endowment Fund Award ✨

In October, the American Zoo and Aquarium Association's Conservation Endowment Fund awarded a \$24,990 grant in support of critical conservation activities for the Jamaican and Anegada iguana programs. The grant, "Restoration of Two Critically Endangered West Indian Iguanas through Headstarting and Release," runs through December, 2001. Both species have undergone precipitous declines over the last century, and wild populations are currently estimated at no more than 100 to 200 individuals. For both species, the primary threat to survival of the remaining population is predation by introduced mammals. The rearing of juveniles in a protected environment until they reach a larger, less vulnerable body size has the potential to directly address the problem of reduced juvenile recruitment in each of these populations. The AZA grant will provide critically needed support for in-country headstarting efforts in Jamaica and the British Virgin Islands, including expansion of ongoing captive programs and long-term field monitoring of repatriated iguanas following release. In addition, we will continue to conduct survey work on wild populations of both species and to train local staff in iguana husbandry, restoration, and monitoring techniques.

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Legal News September 8, 2000 ✨ The following press release comes from Peter Murtha, United States Attorney, U.S. Department of Justice, Southern District of Florida

Guy A. Lewis, United States Attorney for the Southern District of Florida, Lois J. Schiffer, Assistant Attorney General for the Environment and Natural Resources Division of the U.S. Department of Justice, Jorge Picon, Resident Agent in Charge for the U.S. Fish & Wildlife Service in Miami and Frank Figueroa, Special Agent in Charge of the United States Customs Service in Miami, announced that Phillip David Langston, 48, of Naples, Florida was sentenced today for his role in a conspiracy to violate U.S. and international wildlife protection laws and U.S. Customs laws. Langston had previously pled guilty on an indictment handed-up by a grand jury in Miami on December 21, 1999 charging him with trafficking during the period of November 1994 through July, 1995, in reptile species that originated in Haiti and the Peruvian Amazon and that are protected under an international treaty known as "CITES," the Convention on International Trade in Endangered Species of Fauna and Flora, which is implemented in the United States through the Endangered Species Act. United States District Court Judge Norman C. Roettger sentenced Langston to 15 months in jail and a period of two years supervised release thereafter.

In entering his plea of guilty, Langston admitted to conspiring to smuggle and selling a large variety of reptile species protected under CITES and/or foreign law in the Southern District of Florida, including caiman lizards, dwarf caimans, frog-headed turtles,

The 2000 IUCN Redlist is now available at <http://www.redlist.org>

The Redlist is also available on CD-ROM. Because annual updates are planned, there will no longer be a printed version. This new version integrates plants and animals and consists of:

1. 1996 IUCN Red List of Threatened Animals
2. 1997 IUCN Red List of Threatened Plants
3. Oldfield's 1998 World List of Threatened Trees
4. Data from Bird Life International's "Threatened Birds"
5. New assessments, revisions and corrections from the SSC Specialist Groups for 1999 and 2000

Documentation for all species is included but varies depending on the species. Documentation exists for 20% of mammals, 84% of birds, 4% of reptiles, 15% of amphibians, 1% of fish (mainly the sharks and rays), 2% of invertebrates (mainly molluscs), and 91% of plants. Redlist coding links to the Endangerment Criteria. The database will eventually be transferred to the SSC website at <http://www.iucn.org/themes/ssc/siteindx.htm>

Gibba turtles, green anacondas, Haitian boas, Haitian dwarf boas, Haitian vine boas, mata mata turtles, red-tailed boas, rhinoceros iguanas, twistneck turtles, white-lipped mud turtles and yellow-footed tortoises. Langston specifically acknowledged selling approximately 60 rhinoceros iguanas, native to Haiti (as well as the Dominican Republic), which is a species currently threatened with extinction, and listed on Appendix I of CITES, the highest level of protection available under the treaty. Many of the other species he trafficked in, including the anacondas, boas, caiman lizards, dwarf caimans and yellow-footed tortoises are protected under Appendix II of CITES out of concern that unless trade in this species is strictly regulated they too could come under threat of extinction. The government established that the retail market value of the reptiles listed in the conspiracy charge of the indictment was at least \$120,000.

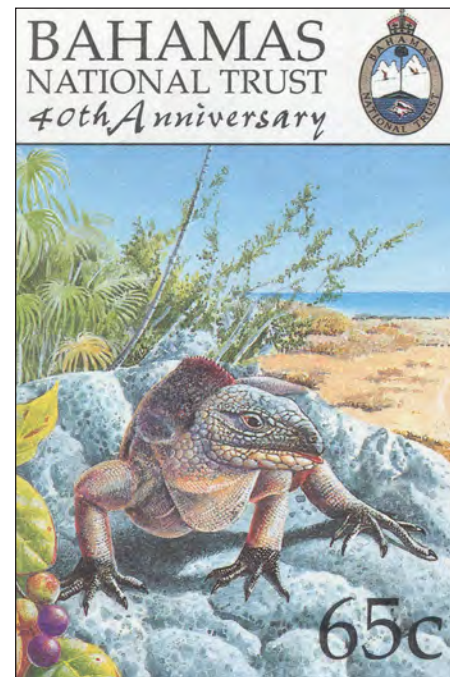
Langston also admitted to the Court that as part of his scheme to smuggle reptiles into the United States he established a “breeding farm” in Peru for the purpose of making it appear that wild-caught Amazon specimens (protected under U.S. law and Peruvian law) were instead captive-bred.

Under the terms of his plea Langston, was required to surrender his U.S. Fish and Wildlife import-export license. In addition to the license itself, Langston also surrendered to the U.S. Fish and Wildlife Service five Cuban rock iguanas, *Cyclura nubila nubila*, a CITES Appendix I species, which were transported in violation of the laws of Puerto Rico.

The prosecution of Langston is one of a series of related reptile smuggling prosecutions jointly pursued by the United States Attorney’s Office, the Department of Justice’s Wildlife and Marine Resources Section and the U.S. Fish and Wildlife Service stemming from the government’s execution of a search warrant of Strictly Reptiles, Inc. in February 1997. Strictly Reptiles, considered at the time to be the largest importer of reptiles in the United States, and its president, Michael Van Nostrand were convicted in Miami of felony wildlife trafficking charges with Strictly Reptiles losing its USFWS import-export license for five years and Van Nostrand being incarcerated for 10 months and jointly paying a total of \$250,000 in fines and restitution. Stemming directly from the Strictly Reptiles prosecution, eight other individuals representing four distinct reptile smuggling rings were convicted of felonies, and six were sentenced

to jail, with sentences ranging up to 24 months. These reptile traffickers were responsible for smuggling some of the rarest reptiles on earth, all protected under CITES Appendix I, including the Anegeda (British Virgin Islands) Rock Iguana and White’s Cay Rock Iguana, both with populations numbering in the hundreds, as well as the Argentine boa and the Black caiman.

Mr. Lewis commended the work of Special Agents Chip Bepler of the United States Fish and Wildlife Service and George White of the U.S. Customs Service for their work on the case. The United States was represented in this matter by Thomas Watts-FitzGerald, Chief of the Environmental Crimes Section at the U.S. Attorney’s Office and Peter J. Murtha, Senior Trial Attorney, United States Department of Justice, Wildlife & Marine Resources Section.



During 1999 the Bahamas Post Office issued four sets of postage stamps in celebration of the Bahamas National Trust’s Fortieth Anniversary. The set issued on 30 November 1999 included a 65 cent stamp illustrating the Rock Iguana species *Cyclura cyclura cyclura*.

Jamaican Iguana Program Receives International Conservation Award ✨ The American Zoo and Aquarium Association (AZA) recently awarded the International Conservation Award for the “Jamaican Iguana Conservation & Recovery Program” to twelve zoos who have participated cooperatively in this project. Officials of the Fort Worth Zoo, Zoological Society of San Diego, Indianapolis Zoo, Audubon Institute, Sedgwick County Zoo, Tulsa Zoo, Toledo Zoo, Central Florida Zoo, Columbus Zoo, Woodland Park Zoo, Gladys Porter Zoo and the Milwaukee County Zoo accepted the award at AZA’s 76th Annual Conference.

For nearly 50 years, the Jamaican iguana was believed extinct. In 1990, a relic population was discovered and is now considered by some to be “the world’s most endangered lizard species.” Since its rediscovery, the twelve zoos (coordinated by Rick Hudson, conservation biologist at the Fort Worth Zoo, Fort Worth, Texas) have spearheaded Jamaican iguana conservation efforts by producing logistical, technical, and financial support for the program.

The conservation and recovery program is multi-faceted and includes a nest site protection and active predator control program, the development of captive breeding populations in both the U.S. and Jamaica, a headstart program at the Hope Zoo in Jamaica, and a full-scale reintroduction program. To date, 26 headstarted iguanas have been successfully reintroduced into their native habitat. In just ten short years, the Jamaican iguana has gone from rediscovery to reintroduction, and over \$100,000 has been dedicated by AZA zoos to support recovery efforts. Today, the project is widely recognized as one of AZA’s premiere conservation success stories. In addition, the Jamaican iguana conservation and recovery program illustrates the significant impact of zoo-based partnerships in the recovery of endangered species.

The International Conservation Award is presented each year by the American Zoo and Aquarium Association for recognition of outstanding dedication to international conservation issues and development of natural resources.

The American Zoo and Aquarium Association was founded in 1924 and currently represents 185 accredited zoos and aquariums in North America. AZA’s mission is to support membership excellence in conservation, education, science, and recreation.

Present Investigations on the Cuban Iguana ✨ The Cuban iguana is one of the more abundant species of the genus *Cyclura* in the Antilles. Over the last few years in Cuba, several investigations on this reptile have been developed, including studies of juveniles in captivity and monitoring of their populations, and ecological studies for sustainable management. This last aspect is the one that our group from the Faculty of Biology at the University of Havana is addressing, in cooperation with the National Company for the Protection of the Flora and the Fauna (Ministry of Agriculture) and the Agency of Medio Ambiente (Ministry of Science, Technology and Medio Ambiente). We are testing two hypotheses with observations in the field.

1. The populations of iguana on the cays comprise a metapopulation, with subpopulations that act as sources and drains.

Prediction: The populations on cays that work as drains have a low rate of reproduction and a high frequency of hatchling and subadult immigration from the population sources.

2. The natural limiting factor is the availability of nest building sites and refuges, and is of key importance in determining the populations of adult iguanas.

Prediction: An increase in artificial refuges can increase the density of hatchling and subadult animals.

The predictions of both hypotheses are under study at the present time. Our work group aspires to disseminate our results widely and hopes that they can be applied to the management of other species of *Cyclura* in danger of extinction.



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Grand Cayman iguana (*Cyclura nubila lewisi*)

During the last decade, the Grand Cayman blue iguana (*Cyclura nubila lewisi*) has been a primary target species in the conservation programs of the National Trust for the Cayman Islands (NTCI), American Zoo and Aquarium Association (AZA) Lizard Advisory Group (via the Rock Iguana Species Survival Plan), and IUCN West Indian Iguana Specialist Group. With a wild population of less than 175 individuals (Burton 2000), captive populations were established by NTCI and AZA, which currently manages 67 individuals (NTCI: 22.14; AZA: 19.12).

The conservation strategy for *lewisi* applied scientific methodologies for assessment and long term management. Genetic evaluation of the U.S. and NTCI populations was conducted during the mid 1990s by Scott Davis at Texas A & M University. The findings revealed that all U.S. *lewisi* were descendents of one fecund pair residing at Life Fellowship Bird Sanctuary, Seffner, Florida. Although this analysis signaled the suspension of the AZA propagation program, it also provided the data to genetically manage both captive groups as a single entity to maximize genetic and reproductive potential (Hudson 2000). During this time the AZA regional studbook for West Indian rock iguanas (Christie 1995) was also published which presented both genetic and demographic data.

Following over four years of institutional planning and negotiations with regulatory authorities, an exchange of 6 *lewisi* between NTCI and AZA was accomplished in October 1999. Two animals (San Antonio, Studbook #690; Shedd Aquarium #421) were delivered to NTCI to add the U.S. gene pool to that population. Returning to the U.S. were four male *lewisi* distributed to Central Florida Zoological Park (CFPZ; #728), Indianapolis Zoo (INDY; #333, #782), and John G. Shedd Aquarium (JGSA; #605). During 2000, pairings incorporating the exchanged bloodlines were conducted at all four facilities with the following results:

NTCI: Female #421 (hatched 1990) was paired with #604 (hatched 1993) from mid April

through the first three weeks of May. Copulation was not observed, but there were no problems with sustained aggression. No eggs were laid. Male #690 (hatched 1994) was paired with female #729 (hatched 1994). There were no problems noted with aggression, copulation was not observed, and no eggs were laid. Both #421 and #690 were slow to become accustomed to large adults in neighboring cages in the Grand Cayman facility, and were still behaving nervously. The 2001 strategy will involve changing mates if these pairings continue to be sexually inactive by the second week of May.

CFZP: Male #728 (hatched 1994) was paired with female #429 (hatched 1990) in March 2000. Both animals were of similar size (1.75/1.6kg). Repeated female aggression directed towards the male resulted in separation of the pair for the season. Strategy for the 2001 breeding season includes promoting a weight gain for the male, and initiating an earlier introduction during January.



Male *Cyclura nubila lewisi*. Photo by Glenn Gerber

INDY: Male #333 (hatched 1985) was paired with female #422 (hatched 1990). Interactions resulted in a leg injury to the female that was surgically pinned. Upon re-introduction, copulation was observed but eggs were not subsequently produced. "Male" #782 was not paired with any other animals, yet laid a clutch of eggs which were recovered in her enclosure during August 2000. Fertility of the clutch was undetermined due to egg dessication and degradation. Strategy for the 2001 breeding season will be to continue with the reproductive management of #333 paired with #422, and implement forthcoming recommendations for pairing the newly identified female #782 (Gayle Weber, pers. comm.).

JGSA: Male #605 (hatched 1993) was paired with two females (#535, hatched 1992 and #691, hatched 1994) in January 2000. Separating and re-introducing individuals was needed to manage problems with aggression. The male was observed copulating with both females and both females subsequently laid infertile clutches. Strategy for the 2001 season will be to focus efforts on management of gravid females, nest site design, egg recovery, and artificial incubation (Allen Feldman, pers. comm.).

These results typify the challenges with long-lived, highly social/hierarchical iguanids that exhibit individual preferences and aversions to conspecifics. Individual animal recommendations for pairings are based on reaching the genetic goals for long term management of the population, and success is not achieved as easily as it appears on a computer screen. However the infusion of new genetic diversity from un-represented founder strains to the U.S. captive *lewisi* population now means that ex-situ *lewisi* breeding in the U.S. has the potential to contribute much more significantly to the conservation of this taxon.

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Andros iguana (*Cyclura cyclura cyclura*), Allen's Cay iguana (*C. c. inornata*), and Exuma Island iguana (*C. c. figginsi*)

The Shedd Aquarium had a very successful 2000 field season studying rock iguanas (*Cyclura cyclura cyclura*, *C. cyclura inornata*, and *C. cyclura figginsi*) on Andros and in the Exumas. The research was conducted in May with assistance from members of the general public and college students from the Chicago area aboard our research vessel R/V *Coral Reef II*. The research on Andros was conducted in Middle and South Bights, while in the Exumas we worked on Alligator, Bitter Guana, and Gaulin Cays.

Our Andros surveys over the past two years indicate that small populations of iguanas are present on numerous cays in Middle and South Bights. The Middle Bight populations appear small and the iguanas are extremely wary. Through conversations with the locals, we learned that people come down from North Andros to hunt the iguanas in Middle Bight

using dogs. The boat traffic in Middle Bight was much more noticeable than in South Bight and it appears that if any population gets large enough to be noticed, hunting eventually reduces it. Resident crab hunters and sponge collectors will also take iguanas if the opportunity presents itself. We worked in Middle Bight for over two days and observed 14 iguanas but captured none.

We proceeded south and worked the Lisbon Creek/South Bight areas. The iguanas were still sparse but not as wary as the northern populations. Our capture success was approximately 66% for all iguanas that were seen. We captured 22 iguanas from five locations.


While docked at Lisbon Creek, we met Mike and Petagay Hartman, who are constructing an eco-lodge on South Andros called Taimo. They are extremely conservation oriented and emphasize educating the local people about conservation related issues. They offered their lodge as a place to stay and I look forward to working with them in the future. We captured the largest iguana (8.3 kg) and a large female on their property. They are conscientious of the animals and want to prevent any adverse effects of tourism on the animals.

Overall, the range for the iguanas appears widespread but hunting pressure needs to be curtailed, especially in Middle Bight. Cursory interviews indicate that the iguanas are not hunted in the South Bight with as much zeal as in the north. Education programs and the presence of a full time warden in the area may help increase individual numbers and expand the ranges of existing populations.

Our work in the Exumas also went well. We noticed more signs of iguanas on Bitter Guana's north beach than during all of my previous trips to the cay. The warning sign that we erected on the beach in November 1998 was still standing and in good condition. The sand was washed away from the base of the sign at the middle

beach, so we moved it further up the beach and reburied it in the limestone storm berm. We erected an additional sign on Gaulin Cay because the old signs placed by Peggy Hall (former warden of the Exuma Cays Land and Sea Park) were broken and in need of repair. The "no dog" sign that we erected in November 1998 was still present and in good condition.

We are beginning to compile recapture data and estimate growth rates. High-density populations have a conspicuous lower growth rate than low-density populations. Hopefully these data can be compared and used to augment John Iverson's long-term *C. c. inornata* data. I continue to get a low number of captures from Alligator Cay, which is inhabited by the translocated *C. c. inornata* population. Catherine Malone (Texas A & M University) and I are preparing a manuscript on the paternity analysis that was conducted in 1999. I will begin my doctoral work on Andros in May 2001 and will continue working in the Exumas throughout 2001.

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Male *Cyclura cychlura cychlura*. Photo by Chuck Knapp

Jamaican iguana (*Cyclura collei*)

The Jamaican iguana recovery program has remained a high priority for the West Indian Iguana Specialist Group (WIISG) since its inception in 1997. For the fifth time over the past four years, small groups of headstarted Jamaican iguanas, *Cyclura collei*, have been released into their native habitat in the Hellshire Hills. As part of a strategy designed to restore the depleted wild population of iguanas, an ongoing series of experimental releases are underway in an effort to determine not only if iguanas reared in captivity since hatching can survive in the wild, but moreover whether they can integrate into the natural breeding population. Since 1996, 26 young iguanas, hatched in the wild from 1991 to 1993 and then raised at the Hope Zoo in Kingston, have been released, all equipped with radiotransmitters for monitoring. These releases have been cooperative endeavors between the University of West Indies (UWI), the Hope Zoo, the Natural Resources Conservation Authority (NRCA) and the Fort Worth Zoo. Funding from a core group of U.S. zoos has supported these releases, including substantial grants from the American Zoo and Aquarium Association (AZA) and the Zoological Society of San Diego. The WIISG continues to provide logistical support to both the Hope Zoo headstarting effort and the field research program.

The Jamaican iguana was rediscovered in 1990 after being considered extinct for nearly half a century.



Female *Cyclura collei* in Hellshire Hills, Jamaica. Photo by Glenn Gerber

A remnant population was found clinging to existence in the rugged and remote limestone forests of the Hellshire Hills along Jamaica's southeastern coast. Two active nest sites were also discovered and, given adequate protection, now provide a yearly source of hatchlings for headstart. This population exists today in a roughly 100 km² ecosystem which is being degraded and compressed as a result of charcoal burning. This factor, coupled with high juvenile mortality due to mongoose and cat predation, have brought the Jamaican iguana perilously close to the brink of extinction. Today, this species is considered to be one of the most critically endangered reptiles in the world. However, recent events provide cause for optimism.

In April 1999 the Hellshire Hills, along with a significant portion of southeastern coastal Jamaica known as the Portland Bight (which includes the Goat Islands, Portland Ridge, Braziletto Mountains, and encompasses all marine areas out to the 200 meter depth contour) have now received official protection under a management agreement with a local NGO, the Caribbean Coastal Area Management (CCAM) Foundation. The Portland Bight Protected Area has a total area of 724 mi² (1876 km²) making it Jamaica's largest protected area so far. With the Hellshire Hills having finally been granted protection, attention can now be directed to Great Goat Island, part of the iguana's former range. Under CCAM's management plan, the Goat Islands are slated for tourism, including a field station with boats. The plan also includes restoring the iguana population to the island and the time appears

right to begin developing plans to establish this as an iguana sanctuary.

The year 1999 also brought remarkable nesting results. At least 16 females nested this year and 104 hatchlings are known to have emerged, both record numbers since the project began in 1991. All but six of these were tagged and released to the wild. Efforts next year will be aimed at determining if any of the headstarted female iguanas are contributing to the breeding population. For the first time in the field project's nine-year history, several juvenile (1-2 year old) iguanas were captured, suggesting that young iguanas are benefiting from the predator removal


program undertaken by UWI staff to systematically trap mongoose, cats and rats from the core iguana areas.


The iguana release program has not been without its problems over the years, primarily related to radiotransmitter loss. A vest-type attachment was found to be optimal for securing transmitters, but finding a material that would withstand the rugged Hellshire Hills environment presented a major challenge. One of the predominant features of this ecosystem is the sharp limestone karst that forms crevices and retreats favored by iguanas. Generally, the vests would break down over several months and the transmitters would be shed, thus precluding the accumulation of any long-term monitoring data. The most that could be concluded was that the iguanas survived the short term following release, utilized the habitat in terms of locating food and refugia, and appeared to acclimate well. Due to its durability, Cordura-A was considered the best material for these vests, however it is not form-fitting and must be secured with elastic straps.

A breakthrough occurred in 1999 when a designer with the Nike Corporation learned of this dilemma and offered to help. Damon Clegg of Nike's All Conditions Gear Footwear Design Department began fabricating vests with a stretch Cordura-A material that was both rugged and form-fitting. Equipped with what we believe will be the prototype iguana vest (bearing the Nike trademark swoosh), six iguanas were released in November 1999 and are being successfully tracked. The current field team of Dr. Byron Wilson, predator control specialist, and student Delano Lewis, both affiliates of Dr. Peter Vogel of the Life Sciences Department of UWI, are monitoring the iguanas daily and making visual sightings at least weekly. Especially encouraging are the recapture data that are beginning to accumulate. Interestingly, iguanas from previous year's releases are beginning to turn up in mongoose traps. In their daily rounds checking trap lines, the field crew has recorded 20 iguana captures (about ten individuals including several headstarts) in live traps, providing for the first time much needed long-term survival data. With help from Nike, the team hopes to gather more specific information on dispersal and habitat utilization.

For their role in the project Nike has received a considerable amount of positive press and public relations value. The story was carried by the Associated

Press (AP) wire and featured in several major newspapers. Sports Illustrated magazine and National Public Radio (NPR) also covered Nike's involvement. The goal of the WIISG is to expand Nike's role in future release projects, not only in Jamaica but in Grand Cayman and the British Virgin Islands. Ultimately, we hope that Nike will become an official corporate sponsor for the WIISG and continue to work with the group as we strive to advance the developing science of reintroduction technology. The Nike Corporation has already proved to be a caring and reliable partner, not only designing and manufacturing iguana wear, but also replacing vests and reimbursing the iguana project for a shipment lost in a custom's warehouse fire in Jamaica. With Nike's continued support, we look forward to seeing more "fashion -savvy" iguanas bearing the trademark Nike swoosh in the coming years.

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Lesser Antilles *Iguana delicatissima* and *Iguana iguana*

Iguana delicatissima in Martinique

In April, 2000, on Ilet Chancel, in Martinique, we artificially increased the size of an *Iguana delicatissima* nesting site in a similar manner to Breuil (2000). This nest area is situated in an old charcoal kiln immediately behind a mangrove stand where iguanas live. In July, there were two nests patches, one with about ten nests the other with 15 nests. These patches were separated by approximately four meters of soil not used by laying iguanas because of stones, roots, and pieces of bricks that prevent females from digging. Our goal was to create a new laying surface between the two patches.

During this work, I found four old nests with egg shells on the edge of one patch. The first had 17 egg shells among which there were six dead babies, the second had 11 egg shells with one dead baby, and the third had nine and the fourth seven empty shells with no evidence of mortality. As we were at least two months before the laying season, we also cleared the

two existing nest sites which are commonly over dug by females (pers. obs. 1997, 1999, 2000), resulting in dozens of eggs lost. After two days, we had sifted and cleared the soil to about 40 cm deep over a 12m² surface.

This nesting area is surrounded by trees and partially shaded. The temperature of the nests early in the morning in July-August is around 28°C, rising to 34-36°C during the warmest part of the day. To prevent flooding of the nest area, we prepared the surface on a slight incline. This appears to be an important characteristic of all *I. delicatissima* nests in the French West Indies except in some sites in Petite Terre. Because this site receives a significant number of tourists (more than 10,000 a year) seeking to see a lime kiln, the ruins of an old brick factory, and the iguana, we fenced the area (about 100m²) with 40m of green wire netting to prevent tourists from trampling the nests but allows passage for iguanas. One of our most important problems is the high number of crabs. In July we counted 100 crabs at the site and 130 additional crabs in a 2m band outside the fence. It is impossible to prevent crabs from entering and eating the eggs, so we remove as many crabs as possible.

In July and August, we saw with Georges Tayalay, the first results of this work. The first females utilized the original nest sites, but later arriving individuals nested in the restored area between the two patches. Compared with preceding years, there was less egg loss overall at the site. In October, we will be able to determine whether hatching success was similarly enhanced.

In summer 2000, we found a 1997 tagged female that had grown from 87cm to 92cm (25.5 to 28cm SVL) in three years. Another 1997 tagged female in the mangroves near the lime kiln was found in July 2000 about 1.8km from its initial capture site. This individual had grown more slowly, from 98cm to 100.5cm (30 to 31cm SVL).

Morphological data collected to date show that the iguanas on this island are very small compared with others in the French West Indies. On Ilet Chancel, the males do not exceed 300mm SVL (1067mm TL) and 1900g (n = 20) and the females 305mm SVL (1030mm TL) and 1300g when gravid (n = 46). In Saint-Barthélemy, the longest male was 385mm SVL (1360 TL) and 2700g (n = 5) and the largest gravid female was 385mm SVL (1230mm TL) and 3050g (n

= 20). On Petite Terre, the longest male was 390mm SVL (1210mm TL) and 2450g (n = 17) and the longest female 335mm SVL (1150mm TL) and 1950g (n = 35). On Basse-Terre the largest male was 410mm SVL (1415mm TL) and 3400g (n = 10) and the largest female was 400mm SVL (1300mm TL) and 2700g when gravid (n = 15).

Our conservation work is founded by the Direction Régionale de l'Environnement de la Martinique (DIREN) with European funds and technical assistance provided from the Office National des Eaux et Forêts (ONF). I would like to acknowledge Mr. Millo and Mr. Gourbeyre (DIREN), and Mr. Leroy, Mr. Wentz, Mr. Robin, Mr. Tanasi, and all the workers of ONF for their interest in this project.

Iguana delicatissima in Saint-Barthélemy

In April 2000, I visited Fourchue (a small island north of Saint-Barthélemy) with botanists Dr. Anne Breuil and Dr. Claude Sastre, and Patrick Blanpain and Franciane Gréaux of the Saint-Barthélemy marine reserve. This island was reported to have more than 40 *I. delicatissima* in the 1960s (Lazell 1973). Goats were introduced there, resulting in total destruction of the vegetation and subsequent erosion. There are less than twenty trees (*Cordia*, *Capparis*) and the only other remaining vegetation is spiny plants including *Opuntia* sp. and *Caesalpinia bonduc*. In August, we found two nesting holes. The holes were only about 20cm deep and the hardness of the soil and the presence of large stones appeared to pose obstacles for digging. The only other evidence of iguana we found was a single scat sample.

In August, 2000, I visited the small island Petite Islette just west of Fourchue with Jean-Claude Plassais (Yuana Hotel) and Patrick Blanpain, where we found a lone female *I. delicatissima*. Previous to my visit, Patrick Blanpain had seen an iguana on Ilet au Vent, east of Fourchue. When we landed there together, we saw only a few scat samples. Apparently, there are some *I. delicatissima* (probably less than ten adults) which still survive on these islands. They are probably able to swim the 20m which separate Fourchue from the two islets.

In August, we also visited Frégate, which in the 1960s was also by *I. delicatissima* (Lazell 1973). The vegetation on this island has been destroyed by feral goats which have now been removed, except for an old

male. Since the removal of the goats, the *Tabebuia* trees are in good condition and regeneration is in progress. Hopefully this island will be suitable for a reintroduction program with *I. delicatissima* from Saint-Barthélemy (current population 300-500) in future years.

With the help of Mr. and Mrs. Plassais (Yuana Hotel) and Dr. Anne Breuil, I caught, measured, and tagged 25 *I. delicatissima*. The females ranged from 300 to 385mm SVL and 1400 to 3050g when gravid (n = 20). The males ranged from 330 to 385mm SVL and 1800 to 2700g (n = 5). We saw only two sub-adults, and caught a single juvenile male (195mm SVL, TL 790mm, and 430g). The lack of subadults may be due to the 1999 hurricanes, which were responsible for the death of nearly all one and two year age classes. Those surviving the storm, are still likely to die of starvation or be killed by dogs and cars while foraging long distance for rare food sources. Such climatic events are very important with respect to population turnover and reproductive success.



Hybridization in the Guadeloupean Archipelago

I first proposed the existence of competition between the two *Iguana* species when I observed in 1992 that the island of Terre-de-Bas des Saintes was mainly populated by *Iguana iguana*, whereas Lazell (1973) found only *I. delicatissima* there in the 1960s. Moreover, *I. iguana* was very hard to find on that island, as in the Chameau on Terre-de-Haut, where Lazell saw only *I. delicatissima*. Contrary to Lazell (1973), I proposed that these two species are able to occupy the same habitats with no significant ecological separation between them. In les Saintes, *I. iguana* have clearly invaded areas previously occupied by *I. delicatissima*. Moreover, some the *I. delicatissima* of Terre-de-Bas present an enlarged subtympenic plate which had been considered a diagnostic character between the two *Iguana* species (Lazell 1973). Based on this, I proposed a scenario of hybridization with ecological competition,

leading to the elimination of *I. delicatissima*. Because *I. iguana* lays between two to three times more eggs than *I. delicatissima*, this process is rapid. With genetic and morphological data, Day and Thorpe (1996) confirmed the hybridization hypothesis using animals from Basse-Terre and les Saintes. Day et al. (2000) report that hybridization was likely already in progress in the 1960s.

Since then I have found new hybridization zones in the Guadeloupean Archipelago on Grande-Terre and Basse-Terre where the two species occur together. This summer, I studied the mixed population on Grande-Terre, first discovered last year (Breuil 2000). This group lives in a small mangrove patch, where there are at least one pure pair of *I. delicatissima*, one female *I. iguana*, three hybrid adults, and some hatchlings of undetermined species identity.

In all known hybridization zones, the morphology of the hybrids is extremely variable, although this diversity falls into two main groups: the *iguana*-hybrid phenotype and the *delicatissima*-hybrid phenotype, each resembling one parental form more than the other. In the *delicatissima*-hybrid phenotype, nearly all the diagnostic characters are as in *I. delicatissima*, but one or two are typical of *I. iguana*. For example, these animals may exhibit a number of gular spikes, rounded lateral head scales, no conical scales on the nape, a



A hybrid adult male from Basse-Terre, iguana-hybrid phenotype, displaying the absence of subtympenic plate and the orange coloration.

plain tail, but possess an enlarged subtympnic plate (photo 1).

In the *iguana*-hybrid phenotype, nearly all the diagnostic characters are as in *I. iguana*, but one or two are typical of *delicatissima*. For example, a hybrid male from Ravine du Carber (Basse-Terre) is nearly orange-brown with no enlarged subtympnic plate, but possesses a row of nearly flat isodiametric scales, a low number of gular spikes (sometimes fused) localized in the upper part of the dewlap, and a tail with shaded transverse bands (photo 2).

All the iguanas depicted here were always found in places where the two species live together, sometimes in the same stand of trees or even on the same tree. According to our observations and those of others, in Basse-Terre and les Saintes, *I. iguana* has a short laying period, from the end of April to the end of May, and the eggs hatch approximately three months later. I have no data on the laying period of *I.*

delicatissima on Basse-Terre, but according to Du Tertre (1667), *I. delicatissima* descends from the mountains during May to lay 13 to 25 eggs in sand on the seashore. In Petite Terre, Martinique, and Saint-Bartélemy, *I. delicatissima* lays from June to August. In Dominica, gravid females are found from February to July (Day et al. 2000). Given the overlap in their reproductive seasons, these species could successfully interbreed.

Although data are not yet available, it is possible that hybrids are fertile or partially fertile, and able to backcross with either species, giving birth to the *iguana*-hybrid phenotype or the *delicatissima*-hybrid phenotype, or interbreed themselves. Another possibility is that the *delicatissima*-hybrid phenotype is the result of a mating between an *I. iguana* male and an *I. delicatissima* female or vice versa.

The hybridization problem is a very serious issue with respect to conservation. In 1998, Réserve Naturelle des Îles de la Petite Terre was created on my request to protect *I. delicatissima* (Breuil 1999). Here, as in la Désirade, there are no *I. iguana*. Unfortunately, a poster made by the local association for vertebrate protection (AEVA) to inform people of the threats to *I. delicatissima*, and to promote the natural reserve, does not discuss the problem of competition and hybridization. The translocation of iguanas by local people is a very common practice in the French



Photo 1. Left: A hybrid subadult from Basse-Terre possess characters typical of *I. delicatissima*, but the tail is banded, the dorsal coloration is green and lightly banded, and the number of gular spikes eight, all close to *I. iguana*. Right: A hybrid adult male from Terre-de-Bas des Saintes, *delicatissima*-hybrid phenotype, note the enlarged subtympnic plate.



Photo 2. A hybrid adult male from Basse-Terre, iguana-hybrid phenotype, displaying the absence of subtympenic plate and the orange coloration (same individual as on pg. 13).

West Indies. Translocation of *I. iguana* by humans from les Saintes to the south of Basse-Terre and then to other places, as in Grande-Terre, is responsible for the loss of *I. delicatissima* to hybridization. In Martinique, an *I. iguana* caught by the police was planned to be introduced into the *I. delicatissima* population of Ilet Chancel by a man who loves iguanas and wanted to provide the animal with a home. Because local administrations were aware of the competition and hybridization risks, the animal was not released.

We have plans to breed both species under controlled conditions in Guadeloupe to study mating structure and reproduction.

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A gravid hybrid female from Grande-Terre, iguana-hybrid phenotype, is beige, 148cm long, with eight gular spikes in the upper part of the dewlap and no subtympenic plate, but a series of three scales of 17, 15 and 14mm height and 18, 12, and 12mm width respectively, and a tail with shaded transverse bands.

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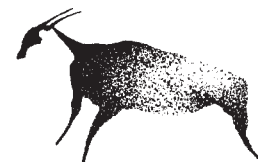
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