



JOE BURGESS

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 QEIIIBP 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 QEIIIBP 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 fieldwork, 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



JOE WASILENSKI

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



JOHN BENNIS

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.

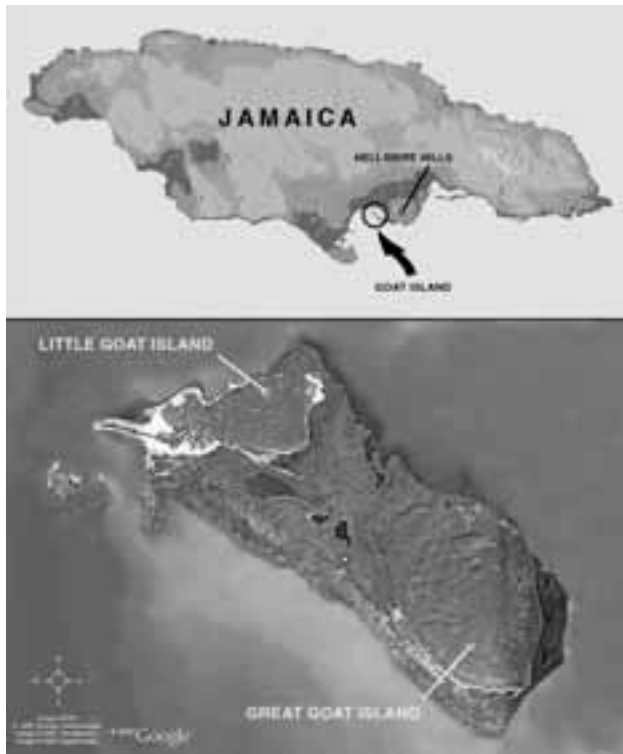
Predator Control.—We continued to operate and expand our predator trapping program in 2006. Trapping capacity was enhanced by the addition of 30 new mongoose/cat traps and 120 new snares obtained through a grant to the pig project being conducted by Professor R. Robinson and the iguana team. Numbers 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



BYRON WILSON

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



NESTOR PÉREZ

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. nubiola*, 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



NESTOR PEREZ

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.

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



LYNNE PFEFER

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 figginsi***

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 figginsi*). 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. figginsi* 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 Taba. 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 Taba 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 Villeda²

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*.



JOE BURGESS

Researchers studying the Fijian Crested Iguana (*Brachylophus vitiensis*) on the Sanctuary Island of Yadua Taba 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 BINNS

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 BINNS

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

¹Zoological Society of San Diego

²University of California, San Diego

³Utah 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.