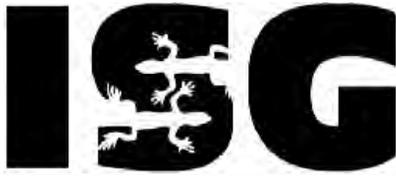


Iguana Specialist Group Newsletter

Volume 9 • Number 1 • Summer 2006



The Iguana Specialist Group prioritizes and facilitates conservation, science, and awareness programs that help ensure the survival of wild iguanas and their habitats.

News & Comments

Conservation Centers for Species Survival Formed ✨ *Cyclura* spp. were selected as a taxa of mutual concern under a new agreement between a select group of American zoos and the U.S. Fish and Wildlife Service. The zoos - under the banner of Conservation Centers for Species Survival (C2S2) - and USFWS have pledged to work cooperatively to advance conservation of the selected species by identifying specific research projects, actions, and opportunities that will significantly and clearly support conservation efforts. *Cyclura* are the only lizards selected under the joint program. The zoos participating in the program include the San Diego Wild Animal Park, Fossil Rim Wildlife Center, The Wilds, White Oak Conservation Center and the National Zoo's Conservation and Research Center. USFWS participation will be coordinated by Bruce Weissgold in the Division of Management Authority (bruce_weissgold@fws.gov).

IN THIS ISSUE

News & Comments	1
Iguanias in the News	3
Taxon Reports	7
<i>B. vitiensis</i>	7
<i>C. pinguis</i>	9
<i>C. cyclura inornata</i>	10
<i>C. cyclura figginsi</i>	12
Recent Literature	14
ISG contact information	14

ARCC Facility at Fort Worth ✨ The Fort Worth Zoo recently opened their Animal Outreach and Conservation Center (ARCC) in an off-exhibit area of the zoo. The \$1 million facility actually consists of three separate units. The primary facility houses the zoo's outreach collection, while a state-of-the-art reptile conservation greenhouse will highlight the zoo's work with endangered iguanas and chelonians. The greenhouse is a 20 x 45 foot facility utilizing UV transmitting acrylic roof panels. One side is devoted to rock iguanas and has ten indoor units and five adjacent outdoor units; the indoor units have removable panels such that they can be expanded or enlarged depending on need. Species targeted include Grand Cayman, Jamaican and Anegada Island iguanas. The ARCC opened with a pair of *Cyclura lewisi* recently received from St. Catherines Island. The zoo's resident pair of *C. collei* will move in after the 2006 breeding season and 2.2 *C. pinguis* are expected soon from the San Diego Zoo. The rock iguana program will help showcase the zoo's involvement with iguana conservation and the IIF and ISG. An iguana research unit is located





adjacent to the greenhouse and has ten indoor and ten outdoor units for rearing juvenile *Cyclura*. Nutritional studies and the effects of social groupings on growth are two of the anticipated research projects targeted for this area.

The other side of the greenhouse is designed for chelonians and will highlight the zoo's commitment to turtle conservation and the Turtle Survival Alliance. Three tortoise and six aquatic turtle species are targeted, including seven taxa listed on the "Top 25 World's Most Endangered Turtles" list. The tortoises have indoor pens with outdoor access. The aquatic turtles will share a 16 x 5 foot pool with a nesting beach, two types of water filtration, and a UV sterilizer.

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2006 Annual ISG Meeting

The annual Iguana Specialist Group meeting will be held 10-11 November in Puerto Rico, on the off-shore island of Magueyes, site of the abundant introduced *C. nubila nubila*. A field trip to Caja de Muertos island will follow on 12 November. The IIF Board of Directors meeting will begin November 13 in San Juan. Contact Miguel Garcia for more information.

New Shelter Constructed in Grand Cayman ✨
A construction team from the Fort Worth Zoo led by Zoo Director and IIF Board member Mike Fouraker recently returned from a trip to Grand Cayman during which they constructed a new building for the Blue Iguana Headstart Facility in the Queen Elizabeth II Botanic Park. Construction of the shelter took eight days, and the new building will be used for storage and diet preparation by facility staff and volunteers. The 16' x 16' building is divided into two separate areas. The front area is a 16' x 8' screened diet preparation area. The back area is fully enclosed and will be used as a secure storage area. The building has a pitched shingled roof and an attic storage area above the front screened area. Hurricane straps were installed throughout and the entire structure was bolted down to a cement foundation pad. Prior to construction, a 10' x 10' open-sided tent canopy was used for these purposes. The trip was funded by a grant from the Aquarium and Zoo Facilities Association's (AZFA) Clark Waldram Conservation Fund. The fund, named for an AZFA member and Kansas City Zoo employee who passed away in 2000, provides money to local and worldwide conservation programs specifically to help pay for construction projects. An additional donation from the International Iguana Foundation (IIF) helped to pay for the project.

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NEWS FLASH!!



Jamaican Iguanas Hatch at Indianapolis Zoo ✨ The first successful hatching of *Cyclura collei* in the U.S. occurred on 29 August 2006. Indianapolis is one of six zoos housing Jamaican iguanas since the 1990s. Captive reproduction has occurred only twice before at the Hope Zoo in Jamaica in 2001 and 2004 when hatchlings were discovered in a headstarting cage. Two more eggs from this female's clutch, as well as several eggs from the zoo's second female, are still incubating. Congratulations, Indy!



Photos by Richard Reams. For Press Release see: <http://www.indyzoo.com/pdf/JamaicanIguanasHatched.htm>

Iguanas in the News

Soccer Growing in Andros

The Nassau Guardian - March 23, 2006

By Renaldo Smith

NEW PROVIDENCE, BAHAMAS. In recent months, the sport of soccer has been making headlines as it continues to become increasingly popular here in New Providence.

Now thanks to Ricardo Johnson, Founder and Head Coach of the Central Andros Iguanas Football Club, the sport is growing on the island of Andros also. The club which started just six months ago in October of last year, is focused on both teaching the game of soccer and educating Bahamians on the value of the Iguana as an endangered species.

"Presently the club is open to all students between the ages of 5-10, but that is just a starting age group. By September we plan to branch out up to age 13, and within the next year be able to offer it to all youth," said Johnson. "The goal of the club is to teach

students to enjoy the game of soccer and marries the need of conservation of the iguana. We are concentrating our efforts on just one age group for now so that we can build a foundation. The club already has 40 members and the reputation of the club as a well structured organization is growing, so more and more persons are flocking to join the club," he added.

Johnson, who teaches Biology at the Central Andros High School, said he believes the club was a long time coming for the island, and it now provides the youth with a constructive extra curricular activity to participate in. Assisting him in the training of the youngsters is his wife Michele' Helene Johnson, and Assistant Coaches Shantol Coakley, and Darvin Brown. Johnson has always been involved in the sport of soccer and first dealt with youths as an assistant coach with the Dynamos Football Club under the watchful eye of Head Coach Carl Lynch.

Johnson and the Iguanas, will get their first real test when they travel here to New Providence to face the Dynamos from the 7-9 of April.

"I think that he is doing a fantastic job and I am just glad that myself and the other coaches had a chance to mentor him and help him out along the way. We continue to mentor him as far as putting him onto contacts locally or in the States and will continue to provide any assistance that we can," said Lynch. "We are always excited about teams coming here to play and with the kids in the off-season it would be good for them. The club will increase the awareness of the sport on the island and shine some positive light on the work that Johnson and his wife are doing. We are looking forward to them coming and right now my roster has about 130 kids so it should be exciting," he added.

Despite the fact that the club is the first ever of its kind on the island, Johnson says he has big plans for the near future.

"We hope to be able to diversify what is happening with soccer on the island. We want to encourage multiple teams in Andros that will play amongst them, and then we can eventually host invitationals here. It has just begun and the future looks promising for Andros and for the youth with some wholesome activity. High school students have bombarded me with requests to join the organization, so there is a strong interest from the older groups on the island," said Johnson.

Thus far, the Iguanas have received a great amount of support from international organizations such as the Chicago Shedd Aquarium, the Iguana Specialist Group, and the International Reptile Conservation Foundation. While the Andros Nature Conservancy, and the Bahamas National Trust has supported the up and coming club on the local scene.



Andros Iguanas team logo by Joel Friesch.

Blue Iguana Still Needs Man's Help

Caymanian Compass - October 4, 2005

By Cliodhna McGowan

GRAND CAYMAN. Despite all the wonderful work achieved by the Blue Iguana Recovery Programme over the past five years, the Cayman Blue Iguana is still the most endangered lizard on earth. Concerned scientists, conservationists, Blue Iguana experts and government representatives got together last week to put their heads together in order to figure out how to continue saving Cayman's own Blue Iguana from extinction.

And helping the team along the way was Grand Caymanian Managing Director Theresa Foster who provided free accommodation, meeting space, and refreshments for the forward thinking group.

"Theresa and the Grand Caymanian are hosting this to a ridiculous extent. We can't thank her enough," said Blue Iguana Recovery Programme Director Fred Burton.

The group consisted of: National Trust Chairperson Carla Reid; Blue Iguana Recovery Programme Director Fred Burton along with staff members Chris Carr and Samantha Addinall; Department of Environment Director Gina Ebanks-Petrie and DoE's Special Projects Officer Mat Cottam; representatives of Durrell Wildlife Conservation Trust, Wild Conservation Union Iguana Specialist Group, and International Reptile Conservation Foundation.

"These people are friends and allies that bring in resources to our programme," explained Mr. Burton.

The team spent Wednesday and Thursday putting their heads together to come up with a plan for conserving the iguanas over the coming years. A field trip was scheduled for the group on Friday. Back in 2001 the first strategic plan was written up to save the Blue Iguana. This plan has now been accomplished.

"Back then we didn't even know how many Blue Iguanas were left in the wild," commented Mr. Burton. However, a population survey soon disclosed that shockingly, there were only 10 to 25 left. The improved captive breeding facility at the Queen Elizabeth II Botanic Park has resulted in tremendous success in breeding and now over 80 iguanas a year are hatching. There are now 30 free-roaming Blue Iguanas in the Botanic Park and 23 have been released into the Salina Reserve.

But a fresh look needs to be taken at the where the programme, which is dependent on donations and charitable grants, is going. Local corporate support provides the biggest funding followed by that of inter-

national conservation groups including The Darwin Initiative. One thing the meetings have put in perspective is just how much work is still left to do, asserted Mr. Burton, who explained that the Cayman Blue Iguana is still the most endangered lizard on earth. One of the biggest challenges is getting enough protected habitat to allow the programme to restore a viable live population of Blue Iguanas into the wild.

“The Salina Reserve and the Botanic Park cannot support enough iguanas to have a viable live population so we’re looking at additional areas. This could mean finding a new area or the management of existing areas,” he said. Another element being looked at is funding. “We need more money now on a sustainable basis and we’re looking at grant funding opportunities and at how iguana-related tourism can make an income for us,” he said. Cruise passenger tours at the iguana facility at the Botanic Park started in May, but so far bookings have not been great. It is hoped that coming into high season these will improve.



Grand Caymanian Managing Director Theresa Foster, Blue Iguana Recovery Programme Director Fred Burton, and National Trust Chairperson Carla Reid.

Ms. Allison Alberts, of the Wild Conservation Union Iguana Specialist Group, who has supported the iguana programme in Cayman from the outset, pointed out that the same themes keep coming up. One of these is the need to educate people that this animal is found nowhere else on earth. Another is the fact that the population requires intensive management to keep it growing. The conservation biologist cites the Cayman Blue Iguana as her favourite species. “They are more complex and highly adapted to their environment than people give them credit for, They also contribute to a healthier forest environment, as important seed dispersers,” she said.

Mr. Quentin Bloxam of Durrell Wildlife Conservation Trust describes the Blue Iguana Recovery Programme as one of the best run and high quality conservation programmes. He pointed out that saving the species requires acquisition of a reasonable size habitat in the Eastern district. This would also help save the dry forest, which is the most endangered type of forest in the world. In this way, a biodiversity system would be saved. The issue of wild dogs and cats attacking iguanas also needs to be addressed, as does confusion between green iguanas and the rare Blue Iguana.

The Grand Caymanian’s Blue Iguana Grill supports the National Trust’s Blue Iguana Recovery Programme by giving information about this work to tourists and the placement of fund-raising boxes on the premises. The Kid’s Club at the resort also teaches children about this endangered species which is native to Cayman. Ms Theresa Foster commented, “Sponsoring the Blue Iguana Recovery Programme is important because they are an indigenous species so it is important to keep it an indigenous species and I don’t think the awareness on this is as big as for other local issues.”

Puerto Rico Prepares to Rid Airport Runways of Basking Iguanas

Associated Press - June 2, 2006

SAN JUAN, PUERTO RICO. Green iguanas basking on runways at Puerto Rico’s largest international airport have become such a hazard that this U.S. Caribbean territory plans to rid the area of the invasive reptile species, an official said Friday.

Javier Velez Arocho, secretary of the island’s Department of Natural and Environmental Resources, said he hopes that teams can begin killing or capturing the iguanas, which he described as “a plague,” in roughly two weeks at the Luis Muñoz Marin International Airport near the capital of San Juan.

An effort to capture the iguanas alive was under consideration, Velez said at a news conference. But authorities also were discussing other options: flooding burrows where the iguana’s lay their eggs or sending teams armed with .22-calibre rifles to shoot the adult reptiles, which can grow to be more than a metre long.

Flight landings and takeoffs have been delayed because of the reptiles, which are sold in Puerto Rico as exotic pets. The cold-blooded lizards also create

traffic hazards as they soak up the sun on roads near the airport.

Carla Capalli, of the Humane Society of Puerto Rico, said she recognized that the iguanas posed safety problems but questioned some of the methods Velez suggested to eradicate them.

"I understand that they have become a plague, a danger, and a threat and that they must be removed from the area, but . . . 22-calibre rifles are also a public security danger," Capalli said.



*ISG member Joe Wasilewski (left) was on-hand protecting iguana habitat during the filming of *The Pirates of the Caribbean*, starring Johnny Depp.*

Editorial: Environmental and Lizards 'Tales'

Jamaica Gleaner - May 7, 2006

by Orville W. Taylor

XAYMACA: "The land of wood and water," is what the Tainos used to call Jamaica. It took us more than 500 years before we realized that they were mistaken for Arawaks. It is taking an even longer time for us to understand that we are destroying our natural heritage and legacy. Be warned! By the time Edward Seaga's love child is able fully to appreciate his contribution to the preservation of Jamaican culture she may not know of the diversity of plants and animals that lived here.

Our national bird is the doctor bird or streamer-tailed hummingbird. How many of you have ever seen one? And for those who have, when last? What does a John Crow look like? And I don't mean your spouse. Have you ever seen the Indian Coney, a large rodent that looks like a guinea pig? Where did you last see a Jamaican snake outside of the zoo? Do you understand that crocodiles play an integral role in the environment? Do you realize that the encroachment on their habitats affects your supply of river fish and shrimp? Did you know that the Jamaican iguana was once believed to be

extinct and would have been so except for the vigilance and determination of the University of the West Indies (UWI) and Hope Zoo?

A Nasty Bite. I won't pretend that the shy iguana is harmless because, if harassed or held it can deliver a nasty bite. However, so will your parakeet, common fowl, puss, dog, hamster, and woman. Especially her. Nevertheless, I am quite aware that the average Jamaican is totally petrified of lizards, even those which cannot possibly hurt them.

A Surinamese friend, a little woman, barely taller than a 'condensed tin,' was amazed that her five foot eleven, slightly feminine female roommate was afraid of a tiny 'Polly lizard' that was smaller than her poorly-done acrylic nails. In a statement that left me completely flatfooted, she declared the obvious, while chasing away a 10-inch croaking lizard. "Lizard smaller than me!"

Yet, the phobia that the Amazonian Jamaican revealed is not unique. It pervades the ranks of badmen, police, macho males, and even pastors. Many a pastor has successfully chased out demons and rebuked evil doers but cowered in mortal terror as a defiant green lizard (the Jamaican anole,) did push-ups and 'long out his tongue'. Poor pastor truly understood that, as the Bible says, if one is speaking in tongues and no one is there to interpret, then he or she should keep silent. So right, because our lizards do not stick out their tongues. That brightly-coloured sac they display is called a dewlap and it serves to woo females and discourage other males.

Our fear of snakes is understandable because in Africa and India where most of us originate, there are cobras, vipers, and 20-odd foot long pythons capable of swallowing a man whole. An ability not limited to female snakes. Still, none of our Jamaican snakes are dangerous, including our nine-foot Jamaican boas. Neither are any of our lizards harmful. Yet, the inexplicable phobia is best expressed by my elderly neighbor: "All snakes and lizards are dangerous. Those who don't bite you will frighten you to death!"

It is perhaps this fear that has made the governmental agencies less than vigilant in the protection of reptilian habitats. There is a rumour that the only place where Jamaican iguanas are known to still breed outside of captivity is being viewed for sale and hotel development. The UWI scientists have worked assiduously to save this species and have received much

international recognition for the effort. It would be a damned shame if such a sell out were to take place. No responsible government should allow this to occur and no Opposition should let it go unnoticed. Let's hope that it is untrue.

Nonetheless, apart from the wanton treatment of our wildlife there is even less governmental scrutiny regarding plant life. The national fruit, the ackee, like most of us is a 'deportee' from Africa. It is the only national plant that is policed to any extent and that is because it is fraught with export challenges. More pathetic is the national flower, the indigenous *lignum vitae*, the 'wood of life.' Grown without any stimulants it is the hardest wood around. Yet, there are apparently no protective measures to prevent the 'rape' of this national treasure. Outside of protected forestry reserves, nothing prevents the wanton cutting down of these plants to make tourist trinkets and idiotic caricatures such as those which jut out into the road in Fern Gully. This national icon had been so decimated that poachers travel from as far as Trelawny to remove trees next to prime iguana nesting sites in Hellshire. Why can't we stick signs in the airports saying, 'don't buy *lignum vitae*!' Most of our children will never know what this plant is. Ironically, the plant is protected by international law but no local statute.

Endangered. Anyway, how many have ever seen the blue mahoe? Despite sounding like an African American pornographic star, it is the national tree. Like the *lignum vitae* it is also endangered and poorly monitored. Which laws restrict or outlaw the possession of the wood from these trees? We must hasten to the point of criminalizing the abuse of these plants because as my female environmentalist laments, "hard wood is hard to replace."

On a similar note, a non-native Asian restaurateur had illegal shellfish on his menu. What bothered me was not that being too expensive it was appropriately called 'robster.' Rather, he was selling it out of season.

Dr. Orville Taylor is senior lecturer in the Department of Sociology, Psychology and Social Work at the University of the West Indies, Mona.

Taxon Reports

Fijian crested iguana (*Brachylophus vitiensis*)

Two important research projects on iguanas continue on the Fijian Crested Iguana Sanctuary Island of Yadua Taba by unrelated researchers, both by the name of 'Morrison'!

Suzie Morrison, a Ph.D. student from the Australian National University (Canberra), has just completed her second season on Yadua Taba. Her first trip was during the idyllic sunny days of the dry season, whereas the February-May trip was during the very wet season. Clothes soaked in February never dried again, and eventually just rotted on her back! Her main study area is a quarter hectare dry forest quadrat containing 591 trees, where she has captured, measured and PIT tagged 270 of the arboreal crested iguanas, including 43 hatchlings. Her results suggest a much higher density of iguanas than the 200 per hectare previously estimated by transect surveys in this same forest. 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.



Suzie Morrison and Peter Harlow measure up with a Fijian crested iguana. Photo by Zachary Pierce.

The wet season is also the nesting season, when female iguanas lay three to five large eggs in burrows constructed on the forest floor. Suzie and her partner Zachary Pierce located many nesting females, and recorded the first data ever on the nesting habits of this species in their natural habitat. They will return in November to record the hatching of the monitored nests.

To identify seasonal variations in the diet of the herbivorous crested iguana between and within plant species, several hundred trees from the 15 species known to be eaten by iguanas (in addition to the trees in the mark-recapture plot) are being monitored across the island. Phenological information is recorded from each tree across all seasons to supply information on iguana habitat preferences and the relation these have to seasonal changes in food availability.

The only terrestrial mammal on Yadua Taba is the Pacific rat (*Rattus exulans*), a species which has had a great impact on reptile populations in New Zealand. Though arriving about 3000 years ago with Polynesian or Melanesian people, Pacific rats are often classed as an introduced species and their effect on Fijian ecosystems is unknown and surrounded by conjecture. Suzie has begun a mark-recapture study to determine the density of rats on the island, their population structure and how the population reacts to seasonal variations in food resources. For more information and continuing updates on Suzie's project visit the project website at: www.fijiancrestediguana.com

The second 'Morrison', Clare, from the University of the South Pacific, Suva, assisted by her team of post-graduate biology students and staff from the National Trust for Fiji Islands, recently completed the last of four field trips to investigate the seasonal changes in crested iguana diet on Yadua Taba. Iguana tree-use data from six permanent 250 metre transects, as well as analyses of fecal material will give a detailed picture of seasonal changes in diet. Tree-use data were collected on 1425 iguana sightings during these four survey trips, and a random subset of these iguanas were captured and bagged for 24 hours to obtain feces for diet analyses. Over all seasons and transects, this represents an average sighting of one crested iguana for every 4.2 meter of transect searched!

The invasive plant and weed management plan for Yadua Taba, being carried out by the Iguana Sanctuary ranger Pita Biciloa and men from the nearby village

on Yadua Island, continues. During February-March this year more large rain trees (*Samanea saman*) were poisoned, but unfortunately several of the *Wedelia trilobata* or 'trailing daisy' infestations which were removed by hand in November 2004 had re-grown. After initial removal these infestations require regular follow-up visits and further hand removal for at least a few years. Crested iguana research continues on the 40 hectare island of Macuata, which is one kilometer off the north coast of Viti Levu, Fiji's biggest island. Crested iguanas were re-discovered on this island in 2004, and it is now second in importance after Yadua Taba for the long-term conservation of this species.

In April 2006 Craig Morley and Phillip Trevnen (University of the South Pacific), with local assistance, completed the last of the rapid iguana surveys of Macuata. Over 40 crested iguanas were captured and PIT-tagged between September 2005 and April 2006. From these surveys, three areas of different habitat have been selected for permanent transects. Differences in iguana temperament have been observed between Macuata iguanas and those on Yadua Taba, however DNA analyses to show the relationship between these two populations are yet to be completed.

Rat surveys on Macuata Island confirmed the presence of both *Rattus exulans* and *R. rattus*, making this the first crested iguana population known to co-exist with *R. rattus*. An additional unconfirmed sighting of the larger Norway Rat (*R. norvegicus*) have still to be verified. This island is a possibility for a rat eradication program in the future (associated with a study on the vegetation), which will allow us to determine what effect the rats have on the iguana population and vegetation structure.



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Anegada Island iguana (*Cyclura pinguis*)

Genetic Analysis of Anegada Iguanas. In order to determine the genetic suitability of the San Diego Zoo's six adult (3.3) Anegada iguanas for a captive breeding program, relatedness within the captive population was examined by comparing their microsatellite variation to that observed for two groups of wild Anegada iguanas, one known to be closely related (clutchmates from marked nests) and one presumed to be randomly related (haphazardly captured adults and juveniles).

A *Cyclura pinguis* DNA microsatellite library was constructed using 23 of 48 candidate loci screened for polymorphism and found to be useful for analysis. DNA was extracted from a total of 178 Anegada iguanas: 12 captives at the San Diego Zoo (the six adult founders and their six offspring) and 166 wild individuals (68 haphazardly captured animals assumed to be randomly related, and 98 hatchlings from eight nests assumed to represent eight sibling groups). Genotypes were obtained for all individuals and the average number of alleles observed across the 23 loci in the captive and wild populations was 2.8 and 4.3 respectively, with observed heterozygosity determined to be 0.61 in the captive group and 0.53 in the wild population.

A maximum likelihood statistical approach, using the six captive founders and most of the wild individuals sampled, was used to infer relatedness among the captive adults. Results of this analysis suggest the six captive adults contain three related pairs (one pair of males, one pair of females, and one male and female pair) and that each related pair is unrelated to the other pairs. The statisti-

cal approach used requires more markers to estimate specific relationships, such as determining whether two iguanas are likely to be siblings, half-siblings, parent-offspring, etc. For this reason, we can only generally state whether each pair is likely to be related or not.

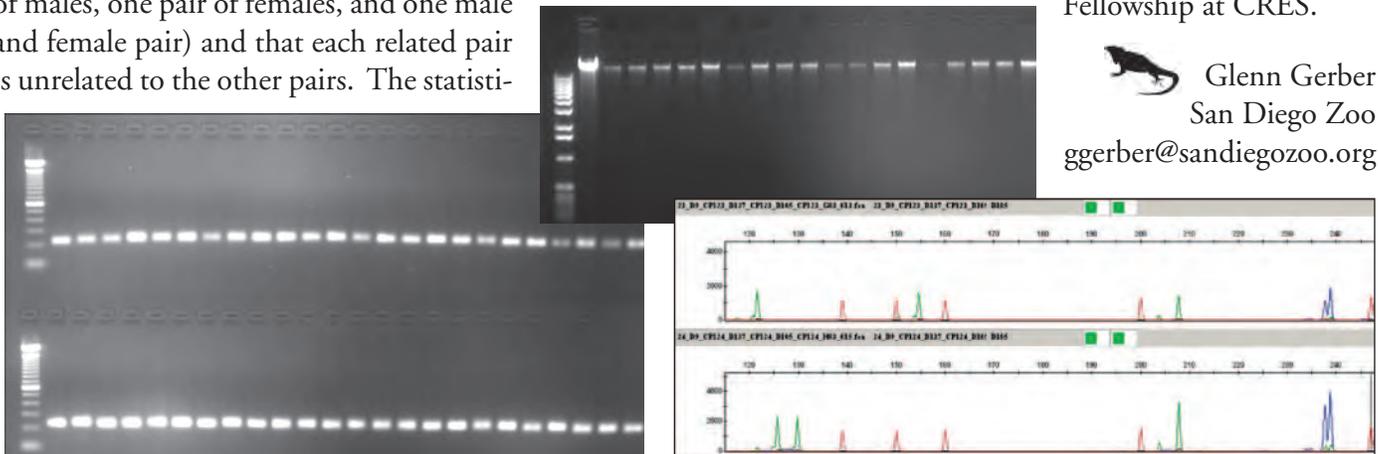
The molecular data compiled to infer relatedness of the six adult founders was also used to correctly assign parents to a captive offspring with a questionable pedigree. The adults that were believed to be the parents of the offspring were excluded at 7 out of 23 loci. Of the four other possible adult candidates, microsatellite allele data revealed that only one male and female qualified as parents of the offspring at all 23 loci.

The microsatellite data have also provided important information about the genetic diversity of the wild population on Anegada. Although population estimates suggest that the wild population contains less than 300 individuals, the microsatellite data suggest that the population is genetically healthy (observed heterozygosity is 0.53) and that subpopulations are not significantly subdivided (F_{ST} is 0.153).

The genetic data also supports the presence of partial sibling relationships across multiple field seasons for hatchlings captured on the tiny islet of Windberg Cay (0.26 ha) in Red Pond, suggesting that females return to this cay year after year to lay their eggs.

This work was jointly undertaken by the Genetics and Applied Conservation Divisions of CRES and was funded by a grant from the Institute for Museum and Library Services and with a Van Ness Research Fellowship at CRES.

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Upper right: Gel image of genomic DNAs extracted from Anegada iguanas. The multi-band lanes on the left are 1000 base pair ladders used for size comparison. Above left: Gel image of Anegada iguana PCR products. To the left are 100 base pair ladders. The four rows of single-band PCR products are roughly 250 base pairs in size, and were generated via amplification of genomic DNA using microsatellite primers and the polymerase chain reaction. The two rows of single bands show that the DNA is of good quality and high molecular weight. Lower right: Example of Anegada iguana microsatellite genotype data. The green and blue peaks represent alleles generated by a number of different microsatellite primer sets. An individual inherits two alleles at each locus, one from each parent. The two alleles can be the same size (homozygous individual), and only one major peak is displayed, or they can be two different sizes (heterozygous individual), in which case two peaks are produced. Images by Maggie Reinbold.

Allen Cays iguana (*Cyclura cyclura inornata*)

Allen Cays. Two separate research trips were made to the Allen Cays area in the northern Exumas, Bahamas – one from 18-26 March 2006 and one from 16-21 July 2006. The March trip consisted of an alumni team that surveyed cays in and around the Allens Harbour for potential migrant iguanas and for the collection of blood samples. This expedition replaced the normal May trip for current Earlham students that involves intensive mark-recapture work on Leaf and U Cays. The July trip focused on nesting activity on Flat Rock Reef Cay (FRRC) just northeast of Leaf Cay. We hoped to compare nesting parameters in this rapidly growing population with those observed in 2001 and 2002 on Leaf and U Cays where populations are presumed to be at or near carrying capacity.

March Survey Trip. As early as 1995, JBI (author) began hearing reports that iguanas were seen on islands around Leaf and U Cays where they had not been previously observed. By 2001, populations had been confirmed on Allen Cay and FRRC (ca. 1 km NE of Leaf Cay), both of which contained individuals previously marked on Leaf or U Cays. Our assumption was that people were relocating iguanas. In 2005, two iguanas and a carcass, none of which were marked, were discovered on a tiny islet just north of Leaf Cay that had yielded no sign of iguanas when surveyed in 2001. In order to better understand the issue, 13 Earlham alumni and associates spent six days in March 2006 in the Allen Cays area to survey islands and to collect blood samples for future DNA work.



John Iverson exhumes *Cyclura cyclura inornata* eggs.
Photo by Kirsten Hines.

A total of 12 cays were visited during this trip. U Cay and Leaf Cay were visited long enough to collect blood samples, but no other work was conducted there. Allen Cay and FRRC were extensively sampled and blood was collected at each location. Total population estimates for each now stand at 20 (total marked) and 100 (based on 38 captures this trip (including five recaptures) and a total of 45 marked for the island, respectively. To date, neither juveniles nor adequate nesting sites have been observed on Allen Cay.

FRRC, which had no evidence of iguanas in 1994, now has a thriving, growing population and the estimate of 100 iguanas includes a subjective count of 30 elusive juveniles. Eight other cays between the Allen Cays and Robert's Cay just south of Ship Channel Cay, most of which had never been surveyed before, were also visited during this trip. A total of seven iguanas was seen on three of these islands and a fourth island had iguana scat and tail drags. Of the observed iguanas, two were captured and blood was collected from each. One of these iguanas was unmarked and the other was a female originally from U Cay that had clearly been relocated there sometime after 2001 since it had been included in our nesting study on U Cay from that year.

July Nesting Study. JBI and KNH returned to FRRC for five days after the presumed nesting season (mid-June to mid-July on Leaf and U Cays). A total of ten potential nest sites were identified based on mound presence, soil and vegetation disturbance patterns, and female attendance. All ten sites were excavated and egg clutches were uncovered at seven of the sites. Unlike on Leaf and U Cays, female nest defense was minimal and it took some time to determine which nests had associated females. Nonetheless, seven nesting females were identified and six were matched with precise clutches. One female was associated with a potential nest site, but the eggs were never uncovered. There was also one nest where eggs were found, but no female was observed. Two of the identified sites yielded no eggs nor associated females, indicating that our initial nest identification may have been incorrect for those sites.

In addition to a lack of strong nest defense, it tentatively appears that the most important differences between the young population on FRRC and the older populations on Leaf and U cays are a higher clutch frequency (40-50% on FRRC; ~33% on Leaf and U

Cays) and more rapid growth rate (32cm SVL = 10 years on FRRC; 32cm SVL = 18-23 years on Leaf and U cays) on FRRC. The latter apparently results in female sexual maturity being attained in less than a decade on FRRC rather than the 12 or more years taken on the other cays. Other nesting parameters, including clutch size, egg size, and distance between closest nests, do not appear to differ significantly between FRRC and Leaf and U Cays.

As a follow-up to the March survey, JBI and KNH revisited one of the cays where four iguanas had been observed and the previously unmarked individual had been captured. We observed a total of five individuals and captured two. As with the March capture, these were unmarked, adult females. The captured females demonstrated site fidelity suggestive of nesting, and digging was observed, but there appeared to be too little soil for actual nest construction. No juveniles were observed, reinforcing the notion that these individuals may be unable to nest on this island.

Conclusions. Our research this year leads us to wonder whether this might be an optimal time for the Bahamas government to formally protect the Allen Cays iguana area. The discovery of a U Cay female as far away as Robert's Cay (6 km to the north) verifies that unauthorized persons are relocating iguanas from Leaf and U Cays. The presence of unmarked adult iguanas on at least two new cays also suggests a wider natural distribution than previously known. For example, at least three of the five iguanas on the newly surveyed cay appear to be long-term natural inhabitants. Aside from Leaf, U, and FRR Cays, however, the other cays appear to lack nesting habitat, potentially rendering the iguana populations there biologically dead.

Results of DNA analyses from collected blood and future survey work should help clarify relationships among these island-separated populations. In the meantime, preliminary nesting results from FRRC verify that populations can establish quickly given appropriate nesting habitat. In addition, the island with five iguanas offers a potential experimental site to study the demographic effects of adding nesting soils to an



Female Cyclura cychlura inornata. Photo by Kirsten Hines.

island. Launching an educational campaign that includes informational kiosks on Leaf and U Cays is essential to the long-term well-being of the Allen Cays iguana. Leaf Cay and its iguanas support a booming tourist industry, but the latter depends on a vulnerable species that is made even more so by increased human involvement. Well-meaning tourists may be creating some of these biologically dead populations. There are too many islands which may either support only single sex individuals, or may not have sufficient nesting soil. Furthermore, preliminary observations suggest that tourist feeding has dramatic impacts on a subset of the populations. We have yet to understand the implications this may have on the health of individuals and the population as a whole. Education, combined with a cooperative agreement among the owners of Leaf and U Cays and the Bahamas government, could go far in ensuring the long-term existence of the Allen Cays iguana, the indigenous endangered Audubon's shearwater, and other flora and fauna in that area of the Exumas.



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Exuma Island iguana (*Cyclura cychlura figginsi*)

Iguana (*Cyclura cychlura figginsi*) surveys in the Exuma Island chain were conducted from 6 to 11 April 2006. The surveys were part of the John G. Shedd Aquarium's citizen-scientist iguana research program and included the islands of Leaf [northeast of Normans Pond], White Bay, North Adderly, Noddy, and Pasture Cays. Objectives for 2006 were to 1) survey iguana populations in the south-central Exuma chain because they have not been visited since 1998, 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 diet and body condition data for comparative studies of iguana populations inhabiting Exuma cays visited by tourists versus un-visited cays.

In addition to the April surveys, Gaulin, Bitter Guana, and Pasture Cays were visited by CK (author) between 26 May and 4 June 2006. The surveys were part of a Bahamas Ecology course that included undergraduate students to help collect data from each cay (Gaulin - 27, 28 May and 4 June; Bitter Guana - 27 May; Pasture - 26 May and 2, 3 June). Research on Gaulin and Bitter Guana Cays is part of an annual monitoring project initiated in 1998. Approximately 2.5 days were spent on Gaulin Cay, one day on Pasture Cay, and three hours on Bitter Guana Cay.

General surveys and morphometrics. During the April surveys, we captured and processed a total of 123 iguanas from five cays (Leaf, $n = 19$; North Adderly, $n = 33$; Noddy, $n = 14$; White Bay, $n = 51$, Pasture, $n = 6$). This was the first year that iguanas were all marked with PIT tags on these cays (except Pasture Cay) for long-term identification. 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 to as far as 1998 (Table 1). There was no difference in body mass, snout-vent length, or ectoparasite load between the North Adderly, White Bay, and Gaulin Cay iguana populations (all $P > 0.05$). Leaf and Pasture Cays were excluded from statistical analyses because they represent translocated populations with low densities and thus exceptional large body sizes. Noddy and Bitter Guana Cays also were excluded from analyses because of small sample sizes. The southern end of Bitter Guana Cay was surveyed by CK and L. Roth on 27

May. Twelve iguanas representing multiple age classes were observed but only one large male was captured because of the extreme wariness of the iguanas and our short time on the island. Additionally, while at anchor on 26 May off of Bitter Guana Cay, four iguanas were observed foraging on the north beach. These observations represent an increase in recorded iguanas over the past nine years. Although speculative, annual increases in observations coincide with the informative/protective signs posted on the island in 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 Cay (not visited in 2006) still need to be surveyed for rats.

Translocation. The original translocation from Leaf Cay [northeast of Normans Pond] to Pasture Cay in the Exuma Cays Land and Sea Park was conducted as a necessity because of a land sale dispute that required the removal of as many lizards as possible in two days (see past IUCN newsletters for details). The translocated colony was heavily male-biased (11.5) resulting in an initial loss of large males. Since December 2002, three male iguana carcasses have been recovered while the fate of four (2.2) iguanas remains uncertain. One of the male carcasses was discovered in December 2002 washed up on Compass Cay located approximately five km south of Pasture Cay. Interestingly, two large iguanas have been spotted this year on the north beach of a private cay (Little Halls Pond) located 1.5 km north of Pasture Cay (Tom Barbernitz, personal communication). We were not granted permission to land on the island so we were unable to determine if those iguanas came from Pasture Cay. However, there are no iguana-inhabited islands in the area so if the iguanas did not originate from Pasture Cay, they were purposely put on the island from a distant iguana-inhabited cay.

Seven (5.2) of the founder iguanas remaining were recaptured on Pasture Cay and all appeared healthy and gained body mass since last capture. Two additional founder iguanas (1.1) were observed but not captured. One subadult that hatched on the island was recaptured and increased its body mass by 302g and SVL by 5.9cm (BM = 420g; SVL = 19.6cm) since it was last captured in 2004. Two other subadults were observed but not captured.

Evidence of exploratory dig activity was observed on the north beach and two iguanas appeared to have nested. One female was aggressive towards male and female conspecifics in her nesting area and chased iguanas away from the area if they approached too closely. A snake (*Alsophis vudii*) was captured on the island in April. High predation rates of iguana hatchlings by these snakes on Andros Island warrants future investigations concerning predation effects on Pasture Cay.

Diet comparisons. Visitor traffic in the Exuma Cays has been increasing significantly over the past decade. Many of these tourists land on cays inhabited by iguanas. For example, the Allens Cays in the northern Exumas experience up to 600 people each week from one-day Nassau excursions. The islands in the southern Exumas also receive high-impact visitors from Great Exuma aboard one-day excursion tourist trips. Previously undisturbed populations in the more remote central Exumas are also becoming frequent visitor destinations because of increased traffic from Staniel Cay Yacht Club. Consequently, there are few iguana populations remaining in the Exumas that are free from visitor impacts. Visitors purposely feed the iguanas, thus altering their natural behavior and potentially their health. In order to assess impacts of tourist feeding on populations of rock iguanas in the Exumas, general diet data were collected for comparative analyses between disturbed and undisturbed islands. We collected 131 scat samples from six cays in the central and southern Exumas (White Bay, North Adderly, Pasture, Noddy, Leaf [northeast of Normans Pond] and Guana). In March 2006, KH (with John Iverson) collected 84 scat samples of *C.c. inornata* from seven cays in northern Exumas (Leaf [east of Allens], Southwest Allens, Flat Rock Reef, Roberts, and three unnamed cays just north of Allens). Scat was collected in different habitats and areas including wooded interior, rocky areas, and beach habitat. Preliminary results indicate that prolonged, high rates of feeding do alter iguana diet. Of the islands sampled, Leaf Cay (Allens) has by far

the longest history and greatest rate of food provisioning by tourists. Scat samples from the main tourist beach on Leaf Cay contained high levels of ooid sand grains (six of 19 samples), remnants of grapes (seven of 19) and fresh samples with more of a loose/liquid consistency than fresh samples found on other parts of the island (sand in two of 17 samples; grapes in one of 17; no loose/liquid samples). To a much lesser extent, other sampled iguana populations experience food provisioning by tourists (e.g., White Bay Cay, Southwest Allens Cay) but there were no distinct differences between samples from these islands and samples from populations with minimal or no food provisioning by tourists. More data are needed to make meaningful conclusions but we now have a working hypothesis for future studies. Future work will also focus on blood chemistry and behavioral comparisons.

Further reinforcing the timeliness of this work, we documented an increase this year in tourists visiting Gaulin and Pasture Cays thereby stressing the need for signs advertising the protective status of the iguanas. Additionally, dialogue needs to be initiated to prohibit the feeding of iguanas on selected cays to prevent potential perturbations and/or preserve selected "natural" populations.

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Island	Area (ha)	N	BM (g)	SVL (cm)	Ticks
North Adderly	5.9	33	800 ± 290 [190-1480]	27.65 ± 3.98 [17.2-36.0]	5.81 ± 4.9 [0-21]
Noddy	5.9	14	620 ± 380 [220-1770]	25.04 ± 4.14 [18.5-35.9]	13.5 ± 13.5 [3-53]
White Bay	4.6	51	820 ± 300 [300-1600]	28.02 ± 3.93 [19.9-38.2]	5.63 ± 7.5 [0-49]
Leaf	12.4	19	1550 ± 700 [710-3320]	31.54 ± 4.78 [24.8-39.8]	9.9 ± 8.8 [2-31]
Gaulin	13.6	51	970 ± 520 [130-2550]	27.26 ± 5.81 [14.7-37.5]	8.37 ± 5.9 [0-26]
Pasture	4	8	3570 ± 1630 [420-4980]	40.94 ± 10.0 [19.6-48.1]	26.7 ± 18.4 [5-54]
Bitter Guana	~76	1	3810	45.9	11

Table 1. Island size, sample sizes, body mass (BM), snout-vent length (SVL), and tick load of iguanas captured during the 2006 iguana surveys in the Exumas, Bahamas. Island areas (except Bitter Guana) were calculated by walking island perimeters with a handheld, WAAS enabled, Garmin eTrex Legend® GPS unit with the capability to calculate area.

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