Iguana Specialist Group
Newsletter

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IN THIS ISSUE

ISG Newsletter
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Editors:
Tandora Grant
Allison Alberts

News & Comments

International Iguana Foundation Formed ✵ A concept introduced at the Iguana Specialist Group's 2000 annual meeting in the Bahamas has now become a reality. The International Iguana Foundation (IIF) held its organizational meeting at the Fort Worth Zoo on 4 August 2001, and was officially incorporated as a Texas non-profit corporation on 29 August. The following individuals were present and represent the eight founding IIF Board of Directors and elected officers:

Allison Alberts, Zoological Society of San Diego, President
Karen Graham, Sedgwick County Zoo, Vice President
Anne Savage, Disney's Animal Kingdom, Secretary
John Binns, Cyclura.com, Treasurer
Debbie Olson, Indianapolis Zoo
Mike Fouraker, Fort Worth Zoo
Dan Maloney, Audubon Institute
Peter Tolson, Toledo Zoo

Five other founding organizations and individuals were not represented at the inaugural meeting but will hold Board positions:

John Behler, Wildlife Conservation Society/Bronx Zoo
Doug Warmolts, Columbus Zoo
Colette Adams, Gladys Porter Zoo
Carl Fuhri, Dragon's Glade
Stan Mays, Houston Zoo

The IIF will effectively replace the iguana conservation funds administered through the Fort Worth Zoo that have, over the years, helped operate the recovery programs in both Jamaica and Anegada. This Foundation will allow us to greatly expand our scope to include an array of other iguana projects that are also worthy of funding. Furthermore, it will provide a peer review process to objectively evaluate project proposals and funding requests. Foremost, it will place us in a position to generate additional funding and become financially secure. Previously it was nearly impossible to make any long-range plans (even a year in advance) because of the way

funds trickled in. Funds were spent as they came in and the decision as to what was funded usually rested with a few individuals. The IIF Board will establish a much tighter framework for the approval and administration of grants, and funding will be largely performance based.

With annual financial contributions from the core Board of Directors, the Foundation will be in a better position to plan and budget for the future. To date, over $42,000 in commitments from 13 organizations have been raised and this is expected to grow rapidly as new members come on board. Because an AZA Conservation Endowment Fund (CEF) grant is funding the 2001 field projects in Jamaica and Anegada, the IIF will have a solid base of funding available with which to begin its activity. Eight additional zoos (in Europe, Australia and North America) and corporations have also been identified who will be approached soon for funding and/or Board positions.

The bylaws of the new Foundation specifically outline the General and Specific Purposes of the IIF. It is generally understood and accepted that the IIF will take its funding priorities from those identified by the Iguana Specialist Group (ISG), essentially serving as the funding arm of the ISG, although the recovery efforts in Jamaica and Anegada will continue as priorities for funding for the immediate future. The mission of the IIF is to promote the conservation of all species of iguanas.

Rick Hudson, IIF Program Officer
Fort Worth Zoo
iguanhudso@aol.com

New Website Coming Soon John Binns of the Iguana Specialist Group has secured relevant domain names and is beginning the work of developing our new website. Some of the construction ideas include a secure members-only section, multiple language pages, an FTP directory for upload/download of files, and a POP server for email accounts. Bookmark for the future:

http://www.IUCN-ISG.org

Morris Animal Foundation Grant Awarded In July 2001, the Fort Worth Zoo received a $46,440 grant from the Morris Animal Foundation entitled 'Health Assessment of Free-Ranging and Headstarted West Indian Iguanas'. The proposal was a collaborative effort between five U.S. zoos involved with iguana conservation projects in the Caribbean. Principal investigators are Rick Hudson (Fort Worth Zoo) and Bonnie Raphael, DVM (Wildlife Conservation Society), and Co-investigators include Allison Alberts, PhD (San Diego Zoo), Jan Ramer, DVM (Indianapolis Zoo), Tim Reichard, DVM (Toledo Zoo) and Nancy Lung, VMD (Fort Worth Zoo). The grant provides critical funding to:

➢ establish baseline health parameters for five species of free-ranging iguanas.
➢ perform pre–release health screening on headstarted juvenile iguanas prior to release to the wild.
➢ provide training and technology transfer for local veterinarians and biologists to carry on this work in the future.

Establishing normal physiologic values for wild iguanas is necessary so that the corresponding values for headstarted/captive iguanas can be properly interpreted. This will help insure that only healthy iguanas are selected for release, and that exotic or novel pathogens are not inadvertently introduced to free-ranging populations. Iguana programs that will benefit from this research include those in Jamaica, Anegada BVI, Mona Island, Grand Cayman and the Dominican Republic (Ricord's iguana). For some programs, these activities are well underway in varying stages of advancement; for others such as Grand Cayman, this

grant will allow this important process to begin. A nutritional analysis component was included in this proposal, but was not funded. However the Morris Animal Foundation recognized the importance of understanding the nutritional requirements in the management of iguana recovery programs, and has requested that we submit a full proposal in the future.

Previously, much of this work was funded by the zoos sponsoring individual projects, or through small grants (Pittsburgh Zoo in 1999 for Anegada and Jamaica, Miami Metrozoo in 2000 for Jamaica). These activities are extremely expensive (travel, lab analysis costs) but are essential to maintain the standards set by the IUCN Position Statement on Translocation of Living Organisms. The ultimate goal of this project is to compile and publish a comparative physiologic database for use by future *Cyclura* researchers. To date such information has only been published for Cuban iguanas, *C. n. nubila*, by Allison Alberts and colleagues at the San Diego Zoo (Alberts, A.C., M.L. Oliva, M.B. Worley, S.R. Telford, Jr., P.J. Morris, and D.L. Janssen. 1998. The need for pre-release health screening in animal translocations: a case study of the Cuban iguana (*Cyclura nubila*). Animal Conservation 1:165-172.). This grant will be administered by the new International Iguana Foundation, and is scheduled to begin in October 2001.

Rick Hudson
Fort Worth Zoo
iguanhudso@aol.com

Errata ISG Newsletter 3(2), Fall 2000 contains an error in the photo captions of Michel Breuil's Taxon Report on *Iguana delicatissima* and *Iguana iguana*. The photo on page 13 should have the same caption as in photo two on page 15; they are both *iguana*-hybrid phenotype males. The caption on page 13 belongs with the photo on the lower right side of page 15. Corrected versions of the newsletter (either printed or in electronic pdf format) can be obtained by contacting tandora@sandiegozoo.org. The corrected version also now has color photographs throughout.

Recent Abstracts

The following two abstracts were provided by Amnerys González Rossell and Vicente Berovides Álvarez in Cuba. Complete papers can be obtained from tandora@sandiegozoo.org. Translated from Spanish by Jean-Pierre Montagne (San Diego Zoo).

Aspects of morphometrics, abundance and feeding of the Cuban iguana (*Cyclura nubila nubila*) in Canarreos Archipelago, Cuba. Amnerys González Rossell, María A. Castañeira Colomé (Centro Nacional de Áreas Protegidas, Agencia de Medio Ambiente), and Vicente Berovides Álvarez (Facultad de Biología, Universidad de la Habana).

In the present work general information is offered on some key biological aspects of the Cuban iguana (*Cyclura nubila nubila*) that can serve as a basis for its conservation. The study was carried out in Cayo del Rosario, Canarreos Archipelago, during October 1991, January, March, May, June, and October 1992. For morphometrics measurements and analysis of the stomach content, 39 individuals were sacrificed (17 males and 22 females). The abundance of iguanas, estimated from monthly transects (20 x 80 m) in 50 refuges, was moderate. Males presented an average snout-vent length of 37.7 cm and an average weight of 1723.3 g; the same averages for females were 31.3 cm and 1005.1 g respectively. Density fluctuated between 6.5 and 12.8 (iguanas / ha), with an average of 9.9 (DS = 9). 40% or more of the iguana refuges were in loose sandy soil, had vegetative cover, and were oriented to the northwest. The part of the plant preferred by the iguanas as food was the leaves (24% of cases) and *Erithalis fruticosa* and *Lantana involucrata* were the most represented species in the diet during the period of study in this locality.

Key words: morphometrics, abundance, diet (feeding), Cuban iguana

Intrapopulation variation of the abundance and the characteristics of the burrows of the Cuban iguana (*Cyclura nubila nubila*) in Cayo del Rosario, Canarreos Archipelago, Cuba. Amnerys González Rossell, María Antonia Castañeira Colomé (Centro Nacional de Áreas Protegidas, Agencia de Medio Ambiente), and Vicente Berovides Álvarez (Facultad de Biología, Universidad de La Habana).

This study quantifies the degree of spatial variation within a population of the Cuban iguana (*Cyclura nubila nubila*), which is constrained by burrow densities, dimensions, and associated microhabitat, in Cayo del Rosario, Canarreos Archipelago, southwest of Cuba. Within this cay, three zones of well-differentiated vegetation were delimited and iguana densities were estimated (individual/ha) during the years of 1991 – 1992. For the burrows, presence/absence of sandy ground, vegetative cover, orientation, occupation, width and height of the entrance, distance, and density were considered. The densities of iguanas did not vary significantly between months, but did vary between zones (zone I: 6.5 iguanas/ha; zone III: 15.2 iguanas/ha), as well as with burrow density, but this density did not totally coincide with that of iguanas. The zones showed marked differences (many of them statistically significant) in sandy ground, vegetative cover, occupation of burrows, and the diversity and distribution of vegetation. The results are discussed with relation to the management of the species.
Key words: Cuban iguana, intrapopulation variation, density.

The following four abstracts were presented at the Society for the Study of Amphibians and Reptiles annual meeting, La Paz, Mexico, June 2000.

Dispersal and survivorship of the hatchling rock iguanas (*Cyclura cornuta stejnegeri*). Nestor Perez, Universidad de Puerto Rico Departamento de Biología.

Cyclura cornuta stejnegeri is an endemic species from Mona Island (Puerto Rico) and it is listed as endangered by the IUCN. It has been reported that juvenile stages are absent in population censuses, presumably due to high mortality rates in those stages. The present study describes the dispersal process and mortality rates of hatchlings of *C.c. stejnegeri* during the first four months of life. During 1998's hatch, 36 hatchlings from ten nests were radio-marked and individuals were monitored using radiotelemetry. The dispersal distances ranged between 102 m and 5010 m. High dispersal distances may be enhancing genetic flow between different localities within the island. The survival rate was 0.13 and there is evidence suggesting that individuals were predated, probably by introduced feral cats. This result suggests that the rate of recruitment to adult stages might be critically low for this species. Using the results of this research, the Department of Natural Resources started in 1999 a management plan which consists on keeping hatchlings in captivity until they reach a minimal size that would allow them to avoid predation in the wild. The results of this work could be used for management of other species of the genus with similar demographic patterns.

Recovery of a locally depleted population of Cuban iguanas (*Cyclura nubila*) following habitat disturbance at the U.S. Naval Base, Guantanamo Bay, Cuba. T.D. Grant and A.C. Alberts, Center for Reproduction of Endangered Species – Zoological Society of San Diego.

In 1995, a large influx of Cuban and Haitian refugees to the U.S. Naval Base at Guantanamo Bay resulted in extensive clearing of natural habitat. Since 1997, we have been studying recovery of the local population of Cuban iguanas at the site, and how this correlates with revegetation of the area. By 1999, approximately 25 adult iguanas had recolonized the site. The relationship between mass and body length has remained comparable to that of undisturbed iguanas, and serum biochemistry studies indicated that the overall condition of iguanas at the site has improved. Although the biomass of plants at the site continues to grow, the rate of increase has slowed over time. Previous studies show that time to germination is shorter in seeds that have passed through the digestive tract of iguanas. We tested whether there is further enhancement of plant regeneration by collecting iguana scat samples at the site. Half of each sample was dissected and the seeds removed, while the remaining half was left intact. While neither the time to germination nor the number

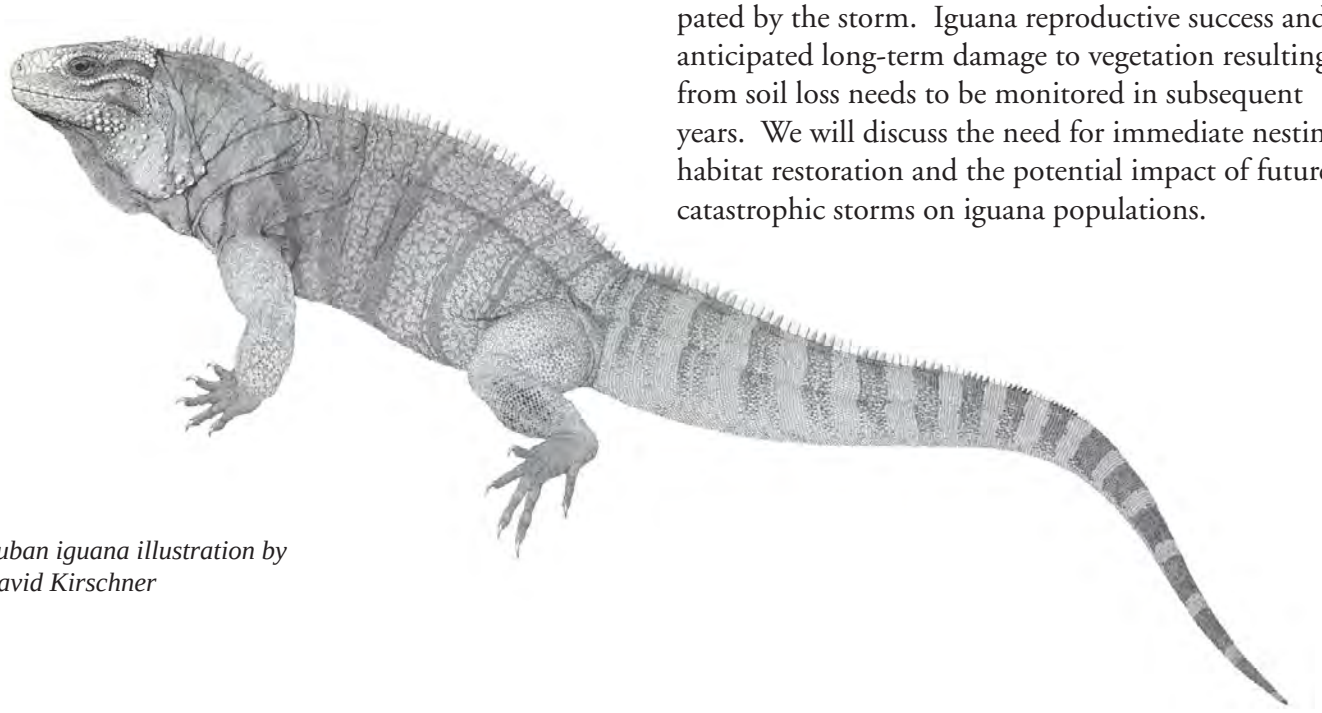
of seeds germinating differed, growth of seedlings produced from seeds left in iguanas scat was enhanced compared to seedlings originating from seeds dissected from iguana scat.

Reproductive ecology, spatial relationships, and diet of the endangered San Salvador island rock iguana *Cyclura rileyi rileyi*. S. Cyril, W.K. Hayes, and R.L. Carter, Department of Natural Sciences Loma Linda University.

Fewer than 700 *Cyclura rileyi rileyi* persist on seven tiny cays off San Salvador Island, Bahamas. We studied the Green Cay population during June and July 1999, where approximately one-third of the remaining iguanas dwell. Mating takes place from late-May to mid-June and egg-laying occurs throughout July. Females mature at approximately 20 cm SVL and 300 g. Clutch size (3-6 eggs; N=5) corresponds to SVL. A clutch of ten was found on Low Cay where adults are larger. Suitable nesting habitat (ca. 5% of Green Cay's 5.1 ha) is limited to scattered areas of sufficient sand/soil accumulation with minimal (<80%) vegetation cover. Egg chambers are 18-28 cm below the surface. Nest defense by females appears to vary with nesting density (mean = 1.7 nests/100 m +2; maximum = 7/100 m +2). Preliminary analyses suggest that males and females have similar home range sizes. These lizards consume a low diversity diet comprised of six of the ten plant species on Green Cay. *Borrichia*, *Rhachicallis* and *Opuntia* are browsed most. Recent shifts in areas of iguana use may reflect vegetation changes accompanying the decimation of *Opuntia* cacti by introduced *Cactoblastis* moths. These data will be useful in developing a management plan for population recovery.

The impact of hurricane Floyd on an endangered Bahamian rock iguana, *Cyclura rileyi rileyi*. R.L. Carter and W.K. Hayes, Department of Natural Sciences Loma Linda University.

Cyclura rileyi rileyi is endemic to San Salvador Island, Bahamas, where fewer than 700 remain on seven tiny cays just offshore or within the inland lake. Iguana numbers continue to decline as a consequence of feral rats, an introduced cactus-eating moth, and smuggling by humans. On 14 September, 1999, hurricane Floyd passed over San Salvador, lashing the island with 155 mph winds and a substantial storm surge. Population surveys one month later showed that adult iguanas were unaffected by the storm. However, the storm surge swept away most of the nesting habitat (loose sand and soil) from Green Cay, which supports approximately one-third of the remaining iguanas. Virtually all of the 1999 cohort of hatchlings was lost on Green Cay, where hatchlings were significantly under-represented in surveys (1%) compared to other cays (29-46%). Much of the vegetation (30-50%) was scoured from adjacent Gaulin Cay, which supported only a handful of iguanas that may have been extirpated by the storm. Iguana reproductive success and anticipated long-term damage to vegetation resulting from soil loss needs to be monitored in subsequent years. We will discuss the need for immediate nesting habitat restoration and the potential impact of future catastrophic storms on iguana populations.



Cuban iguana illustration by David Kirschner

Taxon Reports

Galápagos marine iguana (*Amblyrhynchus cristatus*)

During 2001, marine iguana research in the Galápagos islands focused on 1) continuation of long-term population monitoring on Santa Fe island (since 1981) and Genovesa island (since 1991), 2) evaluating effects of the January 2001 oilspill, 3) determining mechanisms of female mate choice, 4) evaluating the hormonal control of alternative male mating strategies and 5) analyzing the role of hindgut digestive microsymbionts.

Marked individuals on both islands were recaptured to calculate annual survival rates for these two island populations. These life table data suddenly gained additional importance when (2) the oil tanker Jessica ran ashore on San Cristobal island, only a few miles from our long-term study colony on Santa Fe island. Santa Fe shores were oil contaminated in the days after the spill, while Genovesa remained largely unaffected by the oil. Santa Fe iguanas were apparently physiologically stressed by yet unknown factors related to the oilspill, and we predicted low survival probabilities of oiled iguanas. To test this hypothesis, we will return to the islands in December 2001 and again recapture iguanas on both islands to calculate post-oiling survival rates (in collaboration with Michael Romero, Tufts University and Howard Snell, University of New Mexico). 3) As a basic research project, we are currently quantifying the energetic costs of mate choice in female marine iguanas using implanted heart rate body temperature recorders. These recorders are calibrated against metabolic rate and record energy expenditure for one year. Such data will also allow us to understand when iguanas forage, when they build up body reserves in order to produce eggs, and how seasonal their energy expenditure is. Subsequently, we can use these data to determine which periods throughout the year are most critical for the survival and health of marine iguanas. 4) Male marine iguanas show three alternative phenotypic mating tactics: sneaking, roaming around territories as satellite males, and being territorial. We are currently testing the prediction that such phenotypic tactics are flexible and can be transferred into each other via hormone secretions, in particular testosterone (in collaboration with Karin Nelson, UIUC). Such information could serve as an important basis for captive propagation efforts if this should ever become necessary. 5) Marine iguanas possess specialized hindgut microsymbionts/bacteria that allow them to digest algae. In collaboration with Rod Mackie (UIUC), we are trying to characterize these bacteria and determine what ecological role they play in the life of marine iguanas. We also aim to develop techniques of re-inoculating oiled marine iguanas with microsymbionts from unaffected conspecifics, as a potential tool for conservation managers.

In addition to projects on marine iguanas, we are conducting underwater weighing trials on green iguanas to develop a non-invasive way of determining body composition in wild reptiles/iguanids. Furthermore, we have started a set of experiments aimed at

Cruz Marquez, researcher from the Charles Darwin Research Station, takes a GPS coordinate of an oiled iguana in front of the stranded oil tanker "Jessica", on San Cristobal island, Galápagos, January 2001. Photo by Heidi Snell.

determining the bone growth pattern in green iguanas, as a surrogate species for marine iguanas (in collaboration with Tim Bromage, SUNY, NY). Bone growth information is important for wild marine iguanas as they can supposedly shrink and regrow bone during El Niño events, helping them to survive bad environmental conditions.

Another important aspect of iguana life history, the evolution of body size, is the aim of a common garden experiment involving green iguanas from the Republic of Panama and from the Caribbean island of Curaçao. We transported eggs from Curaçao to Panama and allowed the resulting hatchlings from Curaçao to grow up with hatchlings from Panama iguanas. Hatchlings were identical in size approximately three months after hatching, when Panama iguanas started to grow exponentially. At the same time, Curaçao hatchlings stopped growth for approximately six months, and only resumed growth when there would have been the rainy season in Curaçao (note that Curaçao hatchlings had been in Panama at that time for approximately eight months, and had never experienced Curaçao climatic conditions). This experiment currently continues and is conducted by Panamanian collaborators at the Smithsonian Tropical Research Institute.

Martin Wikelski
Princeton University
wikelski@princeton.edu
www.eeb.princeton.edu

Allen's Cay iguana (*Cyclura cychlura inornata*)

Former students Kirsten Hines and Jen Valiulis and I spent 15 June - 11 July 2001 camping on Leaf Cay in the Allen's Cays studying nesting behavior of the Allen's Cay rock iguana, *Cyclura cychlura inornata*. Although females had already begun digging nest burrows by the time of our arrival, the first actual nest was constructed on U Cay on 17 June and on Leaf Cay on 21 June. Nesting continued on U Cay until 6 July (mean date = 26 June), and on Leaf Cay until at least 10 July (mean date = 5 July). We excavated a total of 40 nests with known attending females. Nest burrows averaged 1.50 meters in total length from entrance to end of egg chamber and the depth to the bottom of egg chamber averaged 27.5 cm. Orientation of the initial opening of nest burrows was apparently random, and burrows were not associated with a particular vegetation type. Burrows did tend to be in open areas with considerable direct sun exposure to the site (mean percent canopy cover from a spherical densiometer placed on the ground directly above the egg clutch was 22.0%; range, 0 to 61.1%). Nest depth was inversely related to densiometer readings (i.e., canopy cover), suggesting that females may adjust burrow depth to achieve preferred temperatures therein (i.e., shadier sites require shallower nests). Females defended nests vigorously, chasing away all other iguanas (even large males) from an area of at least eight meters diameter around the nest. Nest defense continued until the time we left the islands (i.e., at least three weeks for some females), demonstrating that nest defense is very protracted. In addition, based on capture locations for nesting females captured in May 2001, many migrate considerable distances across the island to nest. We also recorded digital video of nest construction and defense, and plan to post excerpts of these on our web site in the future.

Nesting females ranged from 26.5 cm to 38.5 cm SVL (mean 32.5). Only three of 40 females were less than 29.0 cm SVL. The three youngest nesting females with good age-history records were estimated to be 13.8, 14.8 and 14.8 years posthatching. Additional growth analysis is underway, but our data suggest that sexual maturity in females is reached between 13 and 16 years. Clutch size averaged 4.8 eggs (range 2-9) and egg size averaged 67.1 mm in length x 34.4 mm width, and 48.5 g in mass (N = 184). Larger females laid bigger clutches of larger eggs in longer burrows and earlier in the season than smaller females. However, smaller females laid longer eggs than larger females (though the eggs were narrower and had less mass). Miniature temperature data loggers were placed among the eggs of eight nests to monitor incubation temperatures. We plan to return to the cays in October to check on egg survivorship in the marked nests.

We also continued our mark and recapture program on each island, capturing 169 iguanas on Leaf Cay, in addition to 279 others captured in May 2001. This total (448) suggests that the population on Leaf Cay must be near or slightly above 500 (excluding

young of the year), higher than our previous estimates. The difference is that we were able to sample the southern part of the island more extensively than during our previous visits. We also captured 26 more iguanas on U Cay (in addition to the 146 captured in May), and these numbers corroborate our earlier estimates of about 300 iguanas (excluding young of the year) on U Cay. We were also able to survey Allen's Cay more extensively during our field time, capturing six adult iguanas (four males, two females; in addition to one male in May) and observing five others. The population on Allen's Cay thus numbers at least 11 (distributed from the northern to southern ends of the island) and including at least a couple of juveniles, suggesting that some reproduction may be occurring. A few sinkholes have soil accumulations that may produce occasional successful incubation conditions. The most striking thing about these iguanas on this cay is their size. The males ranged from 56.5 to 62.0 cm SVL and females 51.0 to 53.0 cm SVL. These sizes exceed the maximums of their respective sexes on Leaf and U Cays by over 10 cm! The extraordinary growth seen on Allen's Cay may be a result of reduced competition there (because the population is so low), the presence of food plants not found on the other cays (e.g., morning glory) or the possible inclusion of Audubon's shearwaters (i.e., animal protein) in their diet.

Sandra Buckner (past President of the Bahamas National Trust), Kirsten Hines (Florida International University; Earlham College '97), and I spent 17-20 October 2001 in the Allen's Cays excavating 41 iguana nests on Leaf and U Cays that had been mapped in June and July 2001, as well as two others located during this trip by their hatchling emergence holes.

All hatchlings had left their nests by the time of this visit, and most emergence holes were old and collapsed by our visit. The last nests we located were deposited on 10 July, suggesting that natural incubation may typically be less than 98 days (10 July to 16 October). A mercury switch soldered to an event recorder and placed among the eggs of a nest laid on 19 June was not sufficiently jostled to record the hatching event; however, the invention still shows promise in that it clearly recorded our nest excavation activities. Although all hatchlings had left their nests, they were not in obvious abundance on the islands.

Digital temperature loggers that were placed in eight nests in June (though 3 failed), indicated that although incubation temperatures ranged from 25 to 34°C, average incubation temperatures in the five nests were between 31 and 32°C. We plan a much more thorough analysis of the temperature profiles in the near future to investigate the effects of shadiness, nest depth, and other factors.

As expected, individual nest survivorship was quite high, ranging from 0% to 100%, with an overall mean survivorship per nest for the 43 nests of 80.30% (84.39% for 31 nests on Leaf Cay, and 69.73% for 12 nests on U Cay). The difference in survivorship between Leaf and U Cays is not statistically different, and we have no hypothesis as to why they should be different. Of the 193 total eggs deposited in the 43 nests, 82.90% (160) hatched successfully (112 of 130 or 86.15% on Leaf Cay; and 48 of 63 or 76.19% on U Cay).

As far as we can determine, nest survivorship was not significantly related to nest date, female size or age, egg size, nest depth, nest burrow length, or nest shadiness. Mortality occurred during early development (apparently from desiccation; 11 of 193 eggs or 5.70%), during mid to late development (again apparently from desiccation; 6 of 193 eggs or 3.11%), at hatching (i.e., with full-term, fully pigmented embryos that apparently died as they hatched; 5 of 193 eggs or 2.59%), via insect predation at unknown developmental stages (4 of 193 eggs or 2.07%), or because eggs were completely removed from their nests (presumably by crabs; 7 of 193 eggs or 3.63%).

We plan to repeat this year's field work (full census in May, nesting study in June-July, and nest success follow-up in October); however, we also plan to focus next year on nest site fidelity and reproductive frequency (i.e., do all females reproduce every year).

We again thank Hugh and Sandra Buckner of Nassau, Nigel and Lara Bower of Powerboat Adventures of Nassau, and the Joseph Moore Museum of Earlham College for their continued support of this research.

John B. Iverson
Earlham College
johni@earlham.edu

Lesser Antilles *Iguana delicatissima* and *Iguana iguana*

Martinique

In summer 2001, with the help of Georges Tayalay and Michel Tanasi (Office National des Forêts), we captured 34 *Iguana delicatissima* on ilet Chancel. Among them, six were already tagged. One adult male (# 348) originally tagged by Mark Day in August 1993 as a subadult (SVL 230 mm, TL 840 mm) is now a beautiful male (SVL 315 mm, TL 1050 mm, W 1300 g). With respect to growth rate in this population, this iguana may be at least 11-12 years old, and thus may be among the oldest documented individuals in the population.

The improvements made to the breeding site in April 2000, appear to be successful. As in July 2000, females laid between the two small areas which were connected with sand (Breuil, 2000a). Moreover, at this site, late arriving females are no longer digging up previously laid eggs. During this study, we saw numerous newborn and very young iguanas about one month old at the end of July. These observations differ from the preceding year. Assuming a three month incubation period (Gibson, 2001), egg laying probably occurred between the end of March and the end of April. These observations suggest that the females can lay earlier in the year, perhaps because the nesting surface is soft and they do not have to wait for the rainy season, even during a very arid dry-season. As a conservation measure, increasing the surface of the nesting sites could be undertaken in other places where egg loss is a serious problem for population growth.

At another site (Breuil, 2000a) which has not been artificially modified, females dig at the limit of the plateau and the slope such that the laying surface is increasing. But the problem of overdigging nests remains. At this site, we noted the location of a female laying eggs. A few days later, we watched a second female dig in the same place, following the same route as the preceding one, and ten eggs were excavated.

Despite the very dry season this year, the *I. delicatissima* population of Chancel is healthy and we saw only one dead individual. This might be due to the fact that some trees (*Rhizophora mangle*, *Avicennia germinans*) and shrubs (*Capparis flexuosa*) on which iguanas feed keep their leaves all year round.

In Martinique, *Iguana iguana* was first introduced in Fort-de-France from les Saintes. From there, the species colonized other parts of the island. At the beginning of this year *I. iguana* were seen and photographed by nature wardens from Regional Natural Park in the vicinity of Diamant village (south Martinique). All these individuals have two spikes on their snout, typical of the phenotype *rhinolopha*. Since this phenotype occurs in Saint Lucia, it is possible that these iguanas originated from this island and not from Fort-de-France, where I have never seen this horned phenotype. I do not know how they might have arrived in Martinique: if they swam on their own, rafted, or landed with fishermen. Because they are a potential threat for *Iguana delicatissima*, wardens caught them and released them at Fort Saint-Louis. Fortunately, nearly every time an iguana is seen in a new place, authorities are informed, and the park wardens then educate villagers about the two iguana species and the problem of competition and hybridization. Moreover, a note is published in "France-Antilles", the local newspaper, which is read by most of the population.

Petite Terre (Guadeloupe)

Contrary to Chancel, the very arid dry-season in the Guadeloupean Archipelago had great impact on the *I.*

Dying Iguana delicatissima *on Petite Terre. Photo by Michel Breuil.*

Dead Iguana delicatissima *in a manchineel tree on Petite Terre. Photo by Michel Breuil.*

delicatissima population of Petite Terre. The first true rains arrived July 29, one week before I went to Petite Terre. Compared to 1993 and 1999 the situation was exceptional. In the bushy parts of the main island, hectares were without leaves and iguanas were very rare in known localities. For example, only two iguanas were seen alive in an area with a large mapou tree (*Pisonia fragans*), *Capparis flexuosa,* and some manchineel trees (*Hippomane mancinella*), where about 30 adults have usually been found. Also, in a manchineel wood of about one hectare that was regularly inhabited by more than twenty iguanas, 25 dead and zero living individuals were found. This mortality may be due to starvation and/or overheating since all the animals found dead were mummified. At the time of the visit, these trees had no leaves except some very small new growth formed after the first rains of the previous week. It could be too late for most of the iguanas, as the same rate of mortality was estimated in two other places.

In two and a half-hours, I counted 321 dead adult iguanas in all kinds of vegetation types. The mortality seemed to be higher in bushy areas than in wooded areas where big trees had some leaves with hollows where animals could hide. With these data, we estimate that around 2,500 adults died during this dry episode. This estimation does not include animals that could have died at the beginning of the drought and were eaten by hermit crabs and therefore impossible to find. It also does not estimate those expected to die because they are unable to walk and feed. Such animals were found hanging in the trees, barely alive. The adult loss may therefore be as high as 4,000. The mortality may have been higher for juvenile and subadult iguanas since they have a greater evaporative surface. The loss of so many adults, combined with weakened survivors that will perhaps be unable to lay a normal clutch, may have a great impact on effective population size.

Just after my visit to Petite Terre, I submitted a project report to the reserve managers quantifying the observed mortality with respect to age classes and vegetation type. Unfortunately, because of unsolved issues between local administrations, no collecting permits were given, even to the wardens, to gather the dead individuals for a scientific study. This is unfortunate because within two months most of the iguana carcasses will probably be eaten by hermit crabs.

Grande-Terre (Guadeloupe)

I. iguana is now present everywhere on the South Coast of Grande-Terre, from Pointe-à-Pitre to Saint-François and Pointe des Chateaux. At the beginning of the nineties, *I. iguana* was known in some of these places but seemed not to extend east of Saint-Anne. The progression of this invasive species in Guadeloupe is very fast. The concern is that green iguanas will arrive in la Désirade and Petite Terre. This is a very problematic situation because *I. iguana* is fully protected in Guadeloupe because it was previously thought to be indigenous. All the data from French chroniclers in the seventeenth to nineteenth centuries show that iguanas present during this period were actually *I. delicatissima.*

Female Iguana iguana *x* Iguana delicatissima *hybrid on Grande-Terre. Photo by Michel Breuil.*

I also visited the hybrid population of Saint-François (Breuil, 2000b). After extensive searching I found seven iguanas. Two were old, one of which was a tagged female, named Claudia, seen last year and discussed in a previous newsletter (Breuil, 2000b). Unfortunately it was impossible to catch her, though we could see she had lost half of her tail and it had regrown. Three were very shy subadults and impossible to see distinctly. Fortunately, two huge individuals not seen the previous years, were observed and photographed. One was a female with nearly the same phenotype as Claudia, and the other a male with an orange-red phenotype and a forked tail. This male has a nearly isodiametric and rounded row of labial scales and 8-9 gular spikes. These three hybrids have banded tails like the *I. iguana* phenotype, but the coloration, gular spikes, dewlap, and labial scales are as expected for a hybrid condition.

Saint-Barthélemy

I also visited Ilet Fourchue with Mowgli Scott of Saint-Barthélemy Natural Reserve. We found two *I. delicatissima*; one in a hole and one in a tree. The 20 or so remaining leafy trees are perhaps adequate to feed a small population. This year's dry season also appears to be responsible for the death of at least 20 goats, but more than a dozen still survive. Goats are responsible for the destruction of the vegetation at this site and thus of the drop in the iguana population. Since 2000, we have found *I. delicatissima* on Fourchue, Petite Islette and Ilet au Vent. This confirms that a small (ten?) population remains on these clumped islands. We do not know if these are old individuals which remain from the time when the vegetation was ungrazed, or if they are their offspring. Another possibility is that these iguanas came directly from Saint-Barthélemy. This hypothesis is based on the fact that a marine current flows from Saint-Barthélemy to the north and overturned boats in the Baie of Saint-Jean drift towards Fourchue (Mowgly Scott, pers. comm. August 2001).

Thanks to the hospitality of Mr. and Mrs. Plassais, I was able to catch 12 *I. delicatissima,* among which were six animals from the 24 tagged last year. Here also, the dry year has caused mortality that is difficult to estimate. Comparison of the data between the two years shows that growth rates are very low, about 1-1.5 centimeter in total length for adult individuals with SVL's between 94-129 cm. Weight changes varied across individuals. For example, a large male lost 300 g (2700 g to 2400 g) and a 2500 g female that had not laid eggs had increased by 200 g to 2700 g. These figures show that growth is very slow after adulthood.

References

Breuil, M. 2000a. Taxon Reports: Lesser Antilles *Iguana delicatissima* and *Iguana iguana*, *Iguana delicatissima* in Martinique and in Saint-Barthélemy. West Indian Iguana Specialist Group Newsletter. 3(2):11-13.

Breuil, M. 2000b. Taxon Reports: Lesser Antilles *Iguana delicatissima* and *Iguana iguana*, *Hybridization in the Guadeloupean Archipelago*. *West Indian Iguana Specialist Group Newsletter*. 3(2):13-15.

Gibson, R. 2001. Taxon Reports: Lesser Antilles iguana (*Iguana delicatissima*). Dustbins, D3, diet, and determination : how to make baby delicatissima. *Iguana specialist Group Newsletter*. 4(1):6-7.

Michel Breuil
Paris Museum of Natural History
mabreuil@club-internet.fr

Male Iguana iguana *x* Iguana delicatissima *hybrid on Grande-Terre. Photo by Michel Breuil.*

Anegada iguana (*Cyclura pinguis*)

Headstarting Facility Upgrade Project

This project was initiated as a result of a visit to the Anegada headstarting facility during the July 2001 recovery planning workshop on Tortola hosted by the British Virgin Islands National Parks Trust (BVINPT) for the critically endangered Anegada iguana. Despite the fact that the facility was in need of some repairs and the husbandry protocols required updating, the 52 captive juveniles were found healthy, although undersized in all age groups.

Of immediate concern was the need to improve the captive diet (nutritional balance/hydration content/quantity/frequency), and to address the tunnels and burrows honeycombed throughout the floors collapsing when stepped on, undersized hide-tubes, unstable stacked rocks, absence of visual isolation barriers and plants, and limited horizontal basking locations and temperature gradients. Secondary concerns of equal importance were husbandry issues, limited work hours to meet the demands of the facility, communications, medical procedures, manpower backup, and planned facility expansion to meet the goals of the five year recovery plan.

Lee Vanterpol (BVINPT), left, and Alberto Alvarez (DNER) discuss the newly improved headstart cage dynamics. Photo by John Binns.

With the headstarting facility already at capacity, placement of the expected collection of October hatchlings was a serious concern. Without adequate housing to allow collection of the hatchlings, these juveniles would have virtually no chance of survival in light of the sizeable feral cat population on Anegada. Given that remaining numbers of *C. pinguis* in the wild are estimated to be between 165 and 200 and that the identified nests were expected to yield between 40 and 60 hatchlings, the potential loss would be significant.

To address this urgent need, I assembled a team of individuals to address the condition in an accelerated timeframe. Funding came from John and Sandy Binns (Cyclura.com) with a donation of about $8,000; Dr. Juliann Sweet at $3,500; Joel Friesch at $1,500, all members of the team. To complete requirements of expertise, Miguel Garcia made available Alberto Alvarez (DNER) whose extensive work with the Mona Island Headstarting Facility made the team complete. Allison Alberts (San Diego Zoo - CRES), Rick Hudson (Fort Worth Zoo), and Glenn Gerber (San Diego Zoo - CRES) provided guidance, information, assistance, and ISG approval.

Upon receipt of the proposal, BVINPT approved the project. In addition, BVINPT offered a supply of lumber, cement, large construction tools, two laborers and full access to BVINPT personnel. Most importantly, BVINPT offered the encouragement and refocusing to escalate recovery plans for the Anegada iguana. This was expressed by Joseph Smith Abbott, Director of BVINPT, Deputy Director Esther Georges, and Project Manager Raymond Walker, who reviewed the progress of the project on one occasion, and reiterated recovery goals in a subsequent meeting on the last day of our visit.

The Upgrade Project team headed toward Anegada from different parts of the world on August 25, 2001. With all hands assembled, including Raymond Walker, Rondel Smith (BVINPT), and Lee Vanterpol (BVINPT), work commenced immediately.

The team, as planned, broke into two groups each with a list of objectives. Juliann Sweet and Sandy Binns were responsible for husbandry training (procedure / protocol), diet, and health. While John Binns, Alberto Alvarez, and Joel Friesch focused on construction of cage sub-division to increase housing area, burrow boxes to facilitate burrowing after removal of riddled floor substrate, vegetable boxes, cage habitat environment, and repair of facility wire-screening. Raymond, Rondel and Lee shared tasks between each group throughout the project.

Anegada Iguana headstart facility, British Virgin Islands. Photo by John Binns.

Despite some material shortages resolved by Randell and Linda Thielman of Neptune's Treasure guesthouse and their donation of an outside shower-stall, which was quickly converted into a hospital cage, all objectives of the project were completed on September 3, 2001. These accomplishments included:

1. Restructuring of the diet program to facilitate improved growth rates.
2. Incorporating water sources within the cage enclosures.
3. Broad spectrum of husbandry training of BVINPT personnel.
4. Sub-division of cages to double capacity of the facilities to 104 animals (short-term).
5. Construction of three vegetable boxes totaling 7.3 x 1.2 meters for fresh greens supply, with a water system.
6. Addition of one new cage to provide animal isolation or hospital utility.
7. Complete revamp of cage habitats, large hide-tubes, plants, branches, and floor-tubes.
8. Repair to existing facility.
9. Planting of food plants, cacti for fruit, trees including watering system, and landscaping.

During our visit the team traveled around Anegada, and we discovered a new land clearing for homesteading in the protected RAMSAR area directly across from a known *C. pinguis* nesting area. The clearing was slightly less than a hectare in size. Future research discovered that it had not been checked or cleared of *C. pinguis* also known to be in that area. The land was first cleared by burning, then leveled flat, leaving only a few larger trees. This discovery was reported to BVINPT for appropriate action.

The four members of the team also spent a day searching the Eastern End for any signs of *C. pinguis*, starting from Loblolly down to about 2,000 meters shy of Pelican Point. Our search extended up to 500 meters inland. Although we covered a substantial amount of ground, no tail drags or other signs of iguanas were found. Evidence of heavy concentrations of feral cattle and the presence of goats increased as we moved eastward. In areas similar to known iguana habitats, cattle tracks completely dominated much of the ground. We also suspect that cattle and goats may be drawn to this end of the island for food given the higher concentrations of vegetation.

Although the Upgrade Project was a success in terms of immediate improvements to the facility and its management, visiting Anegada painfully instills the slight margin the remaining *C. pinguis* hang on by each day. The continual destruction and devastation of habitat caused by feral cattle and goat, cat predation, and human encroachment into iguana nesting areas increase the daily likelihood of extinction. It is vitally important to keep the recovery of the *C. pinguis* in the forefront of our activities.

John Binns
Cyclura.com
jbinns@cyclura.com

July 2001 Recovery Plan Workshop

A Species Recovery Plan workshop for the Anegada iguana, *Cyclura pinguis*, was conducted in the British Virgin Islands (BVI) from 4 – 6 July 2001. A collaborative effort between the BVI National Parks Trust, the Iguana Specialist Group (ISG), and Fauna & Flora International (FFI), the workshop was funded largely by a grant from the Darwin Initiative for the Survival of Species. The workshop was organized and facilitated by ISG member Mark Day of FFI. Participants included Esther Georges, Raymond Walker, Nancy Woodfield, Rondel Smith and Clinton Vanterpol (BVI National Parks Trust), Miguel Garcia (Puerto Rico DNR and ISG), Glenn Gerber (San Diego Zoo CRES and ISG), John Binns (Cyclura.com and ISG), and Rick Hudson (Fort Worth Zoo and ISG).

The Anegada iguana is ranked as Critically Endangered by the IUCN Red List and the wild population has suffered a steady decline over the past 40 years primarily due to introduced exotic predators (cats), competition and habitat degradation from feral grazing animals (goats, cattle, donkeys) and loss of habitat from development. Field research since 1998 has focused on distribution and census of the wild population primarily in the Bones Bight/Windlass Bight area, habitat assessment, identification of threats, and location of nests. Current conservation measures involve the collection of hatchlings (most of which are lost to cats shortly following emergence) for headstarting and eventual repatriation.

This workshop began with a day trip to Anegada to meet with local residents and to gauge their impressions of the iguana and the conservation issues surrounding it. Though the meeting was sparsely attended by locals, some of their comments were particularly illuminating in terms of understanding their perceptions of the iguana situation within the context of historical events. The group returned to Tortola later that afternoon and concluded the first day by conducting a Threat Analysis for the Anegada iguana. Threats were prioritized and grouped into six broad categories including those related to (1) introduced species, (2) development, (3) awareness, (4) extreme weather, (5) impacts to existing project and (6) external factors. For each category, the specific threats were identified and a set of mitigation measures was recommended.

Juvenile Cyclura pinguis*, beaded for distant identification at the Anegada headstarting facility. Photo by John Binns.*

July 5 – 6 were spent designing the Recovery Plan. The process began with an overall project goal that was then broken down into specific objectives, followed by performance criteria, and concluding with specific action steps. The primary goal of this Recovery Plan is to remove the need for active conservation management of the Anegada iguana. This will entail the following broad objectives:

➢ To improve status of the Anegada iguana from 'Critically Endangered' to 'Endangered' by 2005.
➢ To increase the capacity and effectiveness of the head start facility to generate iguanas for release.
➢ To generate sufficient resources to implement the management plan.
➢ To review and implement the disaster preparedness plan for the head start facility annually.
➢ To increase awareness of the iguana conservation project.

➢ To establish and actively manage at least one protected area for the iguanas.
➢ To mitigate the effects of development in key iguana habitats.
➢ To review and strengthen existing legislation and strengthen enforcement in relation to iguanas.
➢ To reduce the impact of feral mammals on the iguana population.

A wide range of specific performance criteria by which these objectives can be achieved was written, and individual action steps designated. The action steps provide the real substance of the Recovery Plan as they indicate who will do what and when. This Plan is still preliminary, and a final version has not been completed or approved by the BVI National Parks Trust. If implemented properly and in a timely manner, this Plan will bring about the recovery of the Anegada iguana. However, aggressive action on many of these fronts is urgently needed as the situation with the wild population on Anegada appears to be much worse that previously thought and continues to deteriorate. While the headstarting facilities are a positive step, this program is merely an interim emergency measure until the 'real' conservation issues (predators, livestock, habitat loss) can be addressed.

Rick Hudson
Fort Worth Zoo
iguanhudso@aol.com

Recent Literature

Berovides, V. 2001. Usos potenciales de la iguana cubana (*Cyclura nubila nubila*). Revista Biología 15(1):3-8.

González, A.V., V. Berovides, and M.A. Castañeira. 2001. Aspectos de morfometría, abundancia, y alimentación de la iguana cubana (*Cyclura nubila nubila*) en el Archipiélago de los Canarreos, Cuba. Revista Biología 15(2):98-104.

Knapp, C.R. 2000. Home range and intraspecific interactions of a translocated iguana population (*Cyclura cychlura inornata* Barbour and Noble). Caribbean J. Sci. 36(3-4):250-257.

Malone, C.L., T. Wheeler, J.F. Taylor and S.K. Davis. 2000. Phylogeography of the Caribbean rock iguana (*Cyclura*): implications for conservation and insights on the biogeographic history of the West Indies. Mol. Phylog. Evol. 17(2):269-279.

Powell, R. 2000. Horned iguanas of the Caribbean. Rept. Amphib. Hobbyist 5(12):30-37.

Romero, L.M., and M. Wikelski. 2001. Corticosterone levels predict survival rates in Galápagos marine iguanas. Proc. Natl. Acad. Sci. 98:7366-7370.

Wikelski, M., C. Carbone, P.A. Bednekoff, C. Choudhury, and S. Tebbich. 2001. Female choice in marine iguana leks: a wider selection of males obtained at a cost. Ethology 107:623-638.

Wikelski, M., L.M. Romero, and H.L. Snell. 2001. Marine iguanas oiled in Galápagos. Science 292, 437-438.

Wilson, B.S. and P. Vogel. 2000. A survey of the herpetofauna of the Hellshire Hills, Jamaica, including the rediscovery of the blue-tailed Galliwasp (*Celestus duquesneyi* Grant). Caribbean J. Sci. 36(3-4):244-249.

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ISG Contact Information

Jose Ottenwalder, Co-Chair
UNDP-GEF Biodiversity Project,
Dominican Republic
Email: biodiversidad1@codetel.net.do

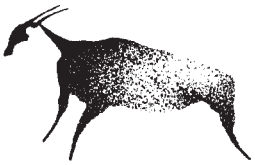
Richard Hudson, Deputy Chair
Fort Worth Zoo
Email: iguanhudso@aol.com

Allison Alberts, Co-Chair
Zoological Society of San Diego
Email: aalberts@sandiegozoo.org

Miguel Garcia, Deputy Chair
Department of Natural and Environmental
Resources, Puerto Rico
Email: miguelag@umich.edu

http://www.scz.org/iguana

IUCN
The World Conservation Union



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Tandora Grant
San Diego Zoo - CRES
PO BOX 120551
San Diego CA 92112