GUANA 2011

J. Lazell

The Conservation Agency

Exploration, Education, and Research

President
James D. Lazell, Ph.D.
401-423-2652

6 Swinburne Street
Conanicut Island
R.I. 02835 U.S.A.

12 May 2012

Annual Report
2011

Dr. Henry Jarecki
10 Timber Trail
Rye, NY 10580

Dear Henry:

Cover Story: A juvenile iguana in a tree. 2011 was the year of the iguana with 200 of our 400 bednights dedicated to iguana study. Start with K. Gebert.....p. 1

General Report and an abbreviated version, by J. Paré... p. 7

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A Bug Promise by T. Henry.....p. 41

A Colorful Finish: Birds by C. Boal.....p. 42

Back Cover: People like Iguanas!.....

Thanks and All the Best,
Skip
James Lazell

Juvenile Stout Iguanas (*Cyclura pinguis*) spend much of their time in trees. This individual (marked #12) was taking an afternoon nap in a White Cedar (*Tabebuia heterophylla*). It was not disturbed while this photograph was taken.

TRAVELOGUE

What Stout Iguanas (Don't) Do All Day

Katharina Gebert

Princeton High School, Princeton, New Jersey

Photographs by the author except where indicated.

While some 16-year-olds are busy debating the meaning of life or determining their purpose in the world, I spent a week doing field research in the British Virgin Islands (BVI). Guana Island, where the work was conducted, is a private island. It is home to at least 50 species of birds, five species of bats, more than 14 species of reptiles and amphibians, and hundreds of plant and insect species (Lazell, 2005). I have visited the island a few times in the past and had the chance to assist with a bird study last fall.

This past October, I designed and executed my own behavioral study on juvenile Stout Iguanas. *Cyclura pinguis*, commonly referred to as the Stout Iguana or Anegada Ground Iguana, is a critically endangered lizard that can be found only in the BVI. Eight individuals were moved to Guana Island in the 1980s in an effort to protect the species, whose one remaining population on Anegada was declining. I would be responsible for observing a critically endangered species, of which only a few hundred exist, but also be one of the lucky few to get the chance to study them. While writing up my project proposal, I grew more and more excited, dreaming up incredible scenarios of never-before-seen iguana interactions.

I set out to do a basic behavioral study on juveniles, as few had been done. I would be looking for time spent on the ground, time spent in trees, time spent sunning, what and when they were eating, and more. In my procedure, I assumed that once I arrived on the island, the iguanas would basically come flocking to my feet, begging me to study them. I had planned to radio-track five iguanas, hoping I would find three in one location and two in another. This way I would experience interactions between them, as well as see whether or not their behavior changed depending on the habitat in different locations. Unfortunately, finding five iguanas proved to be quite a challenge. They were present in abundance at the beginning of October, but by the time I arrived on Guana in late October, most of them had suddenly disappeared (perhaps because they knew a reckless adolescent was coming). However, two were found near the dining area and transmitters

Guana Island, home to all the juvenile *Cyclura pinguis* in this investigation.


GAD PERRY

The author using telemetry equipment to find one of the juvenile *Cyclura pinguis* in a Mango Tree (*Mangifera indica*) in the late afternoon.

were attached. Three more were found in the orchard, and so I had all five iguanas ready to go, thanks to the scientists already there. I now needed to learn how to use the equipment to track them, which proved to be another challenge. The receiver made beeping sounds I was supposed to interpret. Even during practice, while finding immobile transmitters, I picked up wrong signals, went in the opposite direction of the signal, or simply turned around in circles until I became dizzy. Nonetheless, by the end of the week, I had "mastered" the tracking equipment.

Being the unlucky teenager I am, a juvenile iguana died the first morning I was on the island. I followed a signal all the way to a pool behind one of the guesthouses. After looking around on the edge and in the surrounding bushes, I finally discovered the baby at the bottom of the pool. It had drowned. Although the death of the lizard had nothing to do with the study, I felt like a murderer. Not only that, but via Facebook — what else? — word got around my high school back home that I had chased a baby iguana into a pool and held it under water until it died. This was social suicide at its finest.

In the bio lab courses at my high school, the experiments are for the most part already set up, with clear instructions that, when carefully followed, earn an almost automatic A. On Guana, although I had to write the procedure myself, as long as I followed it exactly as written, I was *bound* to be successful, right? Boy, was I wrong! After the death of the iguana, I put my sadness and confusion aside, picked up the signal of my second iguana, and tracked it to a Spider Lily. I sat next to the Spider Lily, staring at it, for three hours. I recorded every rustle, movement, and bird overhead for three hours, then decided to recheck the signal and make sure it was still in the plant. Lo and behold, the signal was now coming from somewhere entirely different. I had sat staring at a plant, sweat pouring out of me, for *three hours*, and to no avail. I packed up my gear and followed the signal to the actual location of the iguana. When I spotted it sitting on a branch in a tree a ways off the path, my heart rejoiced. I had found my iguana, and it was alive! I then commenced my note-taking once again, writing down every movement, occurrence, sound, anything. By the end of the week I

Juvenile #19 basking in the afternoon sun.

Juvenile #12 doing "push-ups" around midday.

Juvenile #22 on the ground munching a vegetarian meal.

GAD PERRY

The author marking an iguana with Wite-out®.

discovered that juvenile Stout Iguanas do not do much. Even so, I kept myself busy writing down anything and everything that occurred.

The next day, we found a new iguana and attached a transmitter. All I could hope was that this juvenile survived, despite the cursed transmitter on its back. Further complications arose when one of the three iguanas from the orchard was released in the wrong location. This was the second detour from my thoroughly thought-out procedure. Why wasn't everything going as planned? I wanted an "A" on this lab! After trying and not succeeding in finding the misplaced iguana, I decided to make a little experiment out of the situation — I would see whether the iguana made it back to the orchard by the time I left. I figured, if nature was changing my experiment's course, so could I. I further amended my experiment, not only taking down behavioral observations but also taking a picture of the iguanas and of their surroundings every half hour. I would then determine the amount of sun exposure the iguanas had in their current location and the amount of sunlight available in their current environment.

I spent all of that second day watching the iguana near the dining area. I found it sitting in the exact location where I had left it the evening before. By the third day, I got into the rhythm of things — eating breakfast, sitting and watching iguanas for hours, eating lunch, sitting and watching iguanas for hours, eating dinner, checking location of iguanas, sleeping (with occasional nightmares of iguanas drowning). I had not expected this little excitement and movement to cause such exhaustion. That morning, I watched the iguana near the dining area until it began to rain and the lizard took cover. I headed to the orchard and, to my surprise, found one of the two lizards roaming around on the ground. Apparently, what I had laid out in my procedure was finally occurring. The iguana moved around on the ground almost all of that morning. While nibbling on some plants, it suddenly lurched toward me. A few seconds later, a snake (a Puerto Rican Racer, *Borikenophis portoricensis*) came out of a nearby bush, stopped, then continued on. My heart nearly jumped out of my chest, as I stood there with my baby at my feet. I began to imagine scenarios of the snake whipping its head around and attacking the juvenile. Part of me wanted to save the baby iguana if that were to happen, but another part of me shouted: "No! The baby must die because nature wills it!" Luckily I did not have to make that decision — the snake slithered off and never came back. I later found out that it was too small to have even considered eating the baby. When I came back in the afternoon, the juvenile was sitting in a tree. Patterns began to develop as I found that the juveniles usually roam, forage, and eat in the mornings, with activity peaking around 9 or 10 AM. They then retreat to higher, safer locations in the afternoon. More often than not, the location they were in around 3 PM was where I would find them the next morning.

The lizards often head-bobbed as soon as they became aware of my presence, as well as when other lizards were nearby. On the fourth day, both of the iguanas in the orchard were on the ground foraging. Although they were not close to one another, I stood between them hoping for some interaction. Naturally, nothing happened, but I still found them eating the same plants and climbing the same trees. In fact, when the iguanas were sitting in trees, they were always found in White Cedars (*Tabebuia heterophylla*). By the fifth day, one of the iguanas had shed its transmitter under a Mango Tree (*Mangifera indica*). I watched the one iguana left in the orchard for the rest of the morning, with foraging occurring around 10 AM, as every other morning. In the afternoon, I began to search for the mis-released iguana that belonged in the orchard. The signal was still coming from the general area of where it was released, although it had moved in the direction of the orchard. On the sixth day, I watched the lone orchard iguana yet again. After tracking the mis-released juvenile, I discovered it had made great headway in moving toward the orchard. It had moved 79 m closer after just a few days. It did the same again on the next day, moving another 71

Map of Guana Island showing movements of the iguana mistakenly released at a site other than where it was originally caught. "1" marks where the iguana was caught, and "2" where it was later released.

m toward the orchard. A few days after I left Guana, however, the iguana moved 54 m back toward the location where it had been released and away from where I first found it in the orchard.

On my last day on the island, I needed to catch all my iguanas and take the transmitters off. After an iguana was caught, I got a chance to hold it. As most transmitters had been put on before I got to the island, this was the first time I was able to hold one. My attachment to the little guys grew, as I finally got to experience what they felt like, see their faces up close, and marvel at the beauty of their coloration. Once the transmitter was removed, each iguana scampered off, and that was the last I saw of it.

When I got back home to freezing cold New Jersey, not only did I miss the warmth of Guana Island, but I also found myself longing to track the life of my newfound friends. I wanted to know what they were doing, where they were sleeping, whether they were still alive or not. I took stock of what I had learned. I found that juvenile *Cyclura pinguis* spend most of their time in trees. I observed them on the ground for an average of three hours a day, almost invariably in the morning, but found them in trees the rest of the time. Although I did not observe them for 24-hour periods, they apparently spend almost 90% of their time in trees. Not only do they spend a good amount of their day in trees, they were relatively high as well. On average, the iguanas were 5.5 m above the ground, although they occasionally were so high I was unable to see them at all. Being high in trees presumably offers juveniles added protection; they are well camouflaged in the foliage. Previous reports indicate that they are eaten by American Kestrels (*Falco sparvarius*) and snakes, both of which are common. Although I had hypothesized that the juveniles were actively seeking to maximize their sun exposure, I found that this was not necessarily the case. On average, 57 ± 24% of the iguana was exposed to sunlight, compared to 60 ± 17% of their environment. The difference between insolation at and away from iguana locations was not significant (Wilcoxon Signed Ranks Test; $Z = 0.87$, $P = 0.39$). Consequently, I concluded that the lizards do not appear to be choosing perches based on available sunlight. As the experimental group was relatively small (only 23 data pairs were tested) and the camera settings might have varied between photographs, these numbers should be considered preliminary data in need of further verification.

During my observations, lizards fed mainly on grasses and other vegetation on the ground, often small ground plants such as those in the genus *Ruellia*. Nonetheless, I occasionally spotted them eating leaves of trees in which they perched, and I cannot rule out the possibility that they feed on an occasional insect. I realized that other than eat and bask, the juveniles essentially did not do much. I also realized that these Stout Iguanas would not be critically endangered if everyone had the chance to follow them around for just a day. Their manners, their beauty, simply put, everything about them is fascinating. They need to be conserved for generations to come.

I also learned a lot about field research. Having done field research in the past, I am surprised time and time again by how much more I am able to learn doing hands-on work versus sitting in a classroom. Not only this, but I have finally learned how unpredictable working in nature is. Although high school experiments do serve an educational purpose, they dramatically misrepresent field research. The procedures provided in textbooks assist in organizing your thoughts, but such guidelines cannot anticipate every

KRISTA MOUGEY

The author holding one of the juvenile iguanas at the end of the project. Once the transmitter was removed, the iguana scampered off, and that was the last we saw of it.

Once Stout Iguanas are fully mature, their cuteness is replaced by a regal air.

eventuality. When Nature presents the unexpected, true researchers must quickly adapt to the situation for the good of the investigation. While the mis-releasing of one of the iguanas was an unforeseen accident, I ended up observing its attempt to return home, something nobody had previously reported.

Having to detour from my pre-determined procedures, although scary, emphasized the realization that nature is unpredictable. Although I am certainly no expert — yet, I was forced to practice making the necessary adjustments on several occasions during my week on Guana Island. I began to appreciate the times when my experiment did go as planned. I found indescribable joy in discovering my iguanas within a few minutes, rather than a few hours or not at all. Although the experiments in the high school lab will continue, I can now appreciate the amount of effort, energy, and reworking of procedures necessary for conducting most scientific investigations.

Finally, I learned a lot about myself (including that being tall is not necessarily an advantage when bushwhacking through dense vegetation). It was incredibly tedious to concentrate on one small, fluorescent green object for hours on end. In school, classes are only 50 minutes long, meaning I concentrate on a given topic for a maximum of 40 minutes (depending on the subject). These fairly stationary lizards taught me patience and extreme concentration. Not only that, but I am fairly certain my eyesight improved while on the island, seeing as I needed to strain my eyes more than I ever have before, trying to discover a green blob clutching a leafy, green tree. I am in awe of those who dedicate their life to this kind of work. However tedious the effort, the brief moments of movement provided me with a day's worth of excitement and gaiety. I grew attached to my juveniles, memorizing their transmitter numbers, and speaking of them as if they were my own. I had debated giving the iguanas names before beginning, to help me differentiate between them, but in retrospect I am glad I did not, otherwise the separation would have been unbearable.

Having this opportunity to work with critically endangered iguanas is one I will never forget. I cannot thank Dr. Henry and Gloria Jarecki enough for their interest in my project and for their vision to preserve the wildlife and natural beauty of this magical island. Guana would not be what it is today without their constant work and effort in caring for it. I also am deeply indebted to Drs. James "Skip" Lazell and Gad Perry for sharing their knowledge, being so generous with their time, showing infinite patience, providing constant encouragement, and a refreshing sense of humor — in short, being amazing mentors. I learned so much from them. My experience with telemetry equipment, discovery of iguanas, tagging of iguanas, and overall lack of insanity in the hours spent in the heat would be nothing without Krista Mougey. Special thanks to Renée Rondeau, whose unmatched plant knowledge proved to be indispensable when looking at multiple images of green, leafy specimens. I will be forever grateful for this opportunity that has further fueled my passion for biology, and I cannot wait until I get a chance to do field research again. Which is why I part with these words: "Beware iguanas. Katharina will be back."

Reference

Lazell, J. 2005. *Island: Fact and Theory in Nature.* California University Press, Berkeley.

WILDLIFE CONSERVATION SOCIETY

Trip Report:

Stout Iguanas in the British Virgin Island

Photos: © Joel Friesch

Highlights

- Translocation and creation of satellite populations of an endangered lizard
- Impact of island climate and geography on population demography
- Health parameters in critically-endangered lizards.

Biome

- Tropical
- Temp: 83° F

Key Species

- Stout, or Anegada Island, iguana
- Cyclura pinguis

Strategies

- Translocation, establishment of new satellite populations to guard against extinction.
- Health assessment of transloacated animals.

Key Conservation Issues

- Declining population of endangered species.
- Creation of a new population through translocation.
- Selection of a more favorable habitat for the species.

British Virgin Islands

Health Assessment of Translocated Endangered Stout Iguanas in the British Virgin Islands

The stout iguana (*Cyclura pinguis*), a critically-endangered lizard once found across the Greater Puerto Rico Bank, survived global extinction on the British Virgin Island (BVI) of Anegada in the Caribbean Sea, hence its other name: the Anegada iguana. Unlike other BVI islands of volcanic origin, Anegada is a flat, limestone and coral island located 20 miles north of the main archipelago. In situ conservation initiatives have been implemented, including a headstarting program, but the iguana population on Anagada is aging and still faces many serious challenges, such as introduced cats, dogs, and other predators, as well as ongoing competition with livestock for the already meager vegetation. In 1983, eight adult iguanas from Anegada were translocated to Guana, a privately-owned, mountainous, and mostly pristine tropical dry forest island with a few select, high-end tourist accommodations. Each year in October, Guana Island is closed to tourists for one month and made accessible to scientists.

On October 2nd 2011, WCS veterinarian Jean Paré and senior veterinary technician Karen Ingerman flew to the BVI to join a team of biologists and conservationists studying the Guana population of stout iguanas. In late September and in October, hatchling iguanas emerge from nests along the North Beach or White Bay Beach and disperse inland. For unknown reasons, they often immediately seek higher elevations, making their way up the hillsides. For the past several years hatchlings have been captured so that weights and morphometrics could be recorded and they could be equipped with a transponder, or microchip, for permanent identification. While hatchlings are often seen and rather easily captured, the same cannot be said of the much more secretive juveniles and subadults. Previously, there were very few juvenile and subadult sightings with some mystery surrounding their whereabouts. Adult stout iguanas are large, muscular, stocky, sharp-clawed, cryptic brown lizards with stunning turquoise over the rump and tail. When spotted, older lizards take full advantage of the dense, tangled vegetation and rocky, often steep terrain to quickly escape or disappear in a hole or other form of shelter.

This year, additional manpower was recruited so that in addition to hatchlings, special emphasis could be placed on the capture of older age groups. Two teams consisting of four to five field researchers allowed for increased sightings, and subsequently a coordinated effort to encircle spotted lizards and cut off their escape routes, maximizing chances of capture. In addition, the teams innovated by using strategically placed live-traps baited with juicy and colorful fruits which proved irresistible to several large lizards, many of whom would otherwise be impossible to capture.



(Photos: ©WCS/J. Paré

Blood analysis is a useful tool in assessing population health. The assistance of the WCS veterinary team allowed, for the first time on Guana, for blood to be collected from lizards. This provided a much-needed set of normal blood parameter value range for stout iguanas on Blood parameters from Guana iguanas could then be eventually compared to that of iguanas living on the harsher Anegada. For over a week, the WCS veterinary team collected and processed blood from an unprecedented 25 individual free-ranging stout iguanas spanning all age groups. Fecal samples were also collected from cooperating iguanas for later analysis. Ectoparasites found on several lizards were collected for later identification. Prior to release, each iguana was labeled with a large number using white-out or liquid paper. Several juveniles and adults were recaptures, as they had been micro-chipped as hatchlings in previous years. Therefore, a rough growth rate could be estimated which compared advantageously to the lizards on Anegada.

Iguanas on Guana appear to be thriving. This can only be good for the survival of the species. This ex-situ population may now exceed that of Anegada Island in number of individuals, a safety net, should the Anegada population suffer an unexpected or sudden decline. Guana Island iguanas have more recently been translocated to several other small BVI islands, and hopefully field work similar to that on Guana will determine if these introductions were as successful. The data contributed by WCS in this and other studies to come will assist in our current understanding of stout iguanas, as much remains to be learned about these beautiful lizards.

Vision

WCS's Global Health Program works to combat the wildlife health problems that complicate conservation efforts. Since its inception in 1989, the program has initiated dozens of wildlife health projects across the globe.

WCS Mission

The Wildlife Conservation Society saves wildlife and wild places worldwide. We do so through science, global conservation, education, and the management of the world's largest system of urban wildlife parks, led by the flagship Bronx Zoo. Together these activities change attitudes toward nature and help people imagine wildlife and humans living in harmony. WCS is committed to this mission because it is essential to the integrity of life on Earth.

For more information

Wildlife Conservation Society
Global Health Program
2300 Southern Boulevard
Bronx, NY 10460 USA

Year of the Lizard News

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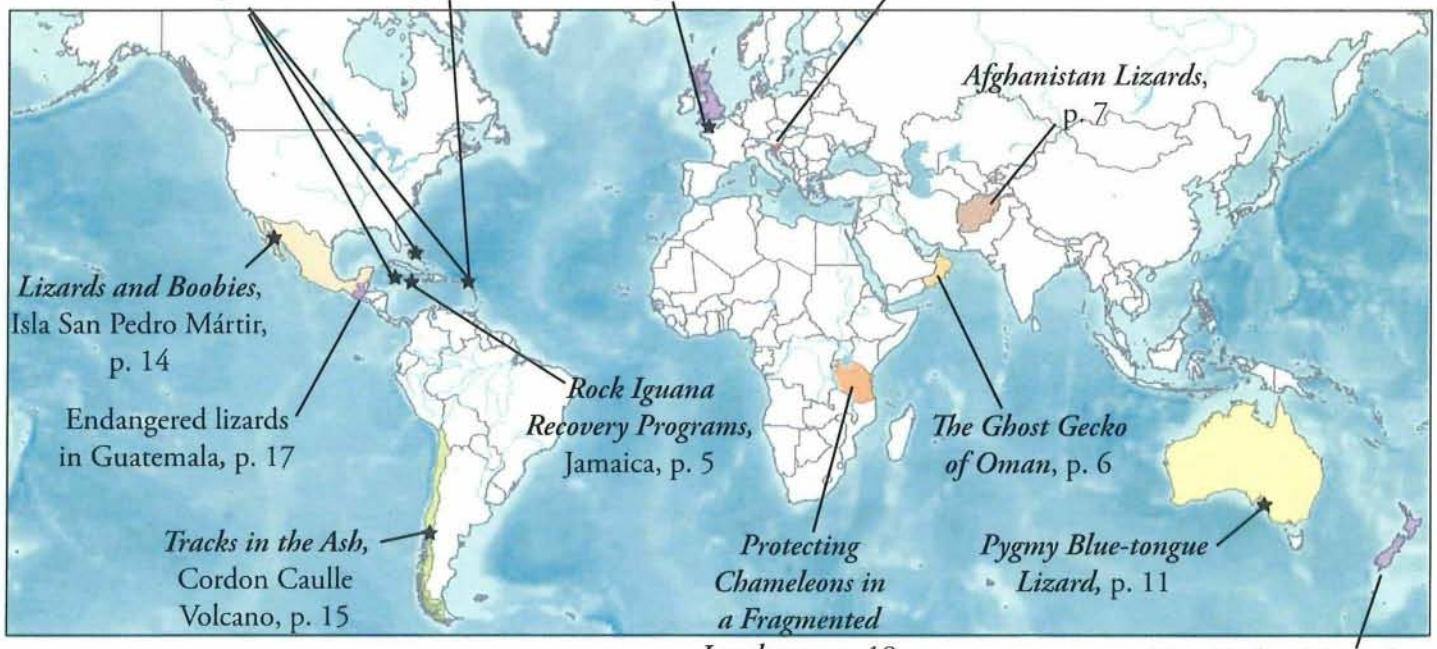
www.YearoftheLizard.org

Lizards Around the World



Inside:

Look for Issue No. 3 of Year of the Lizard News in May!

The genus Holbrookia belongs to the Phrynosomatidae, one of the Featured Families in this month's newsletter. Female Holbrookia maculata *(Common Lesser Earless Lizard) like this one photographed by Mike Hill become orange-striped when gravid, a feature that may warn off prowling males.*

"Precisely the least, the softest, lightest, a lizard's rustling, a breath, a flash, a moment - a little makes the way of the best happiness."
Friedrich Nietzsche (German classical scholar, philosopher and critic of culture, 1844-1900)

Health Assessment of Translocated Endangered Stout Iguanas in the British Virgin Islands

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This past October, WCS Associate Veterinarian Jean Paré and Senior Veterinary Technician Karen Ingerman flew to the BVI to join a team of biologists and conservationists studying the Guana population of Stout Iguanas. In late September through October, hatchling iguanas emerge from nests along the North Beach or White Bay Beach and disperse inland. For unknown reasons, they often immediately seek higher elevations, making their way up the hillsides. For the past several years hatchlings have been captured so that weights and morphometrics could be recorded, and equipped with a transponder or microchip for permanent identification. While hatchlings are often seen and rather easily captured, the same cannot be said of the much more secretive juveniles and subadults. Previously, there were very few juvenile and subadult sightings with some mystery surrounding their whereabouts. Adult Stout Iguanas are large, muscular, stocky, sharp-clawed, cryptic brown lizards with stunning turquoise over the rump and tail. Older, spotted lizards take full advantage of the dense, tangled vegetation and rocky, often steep terrain to quickly escape or disappear in a hole or other form of shelter.

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Measuring Stout Iguanas. Photo © Joel Freisch.

Estimation of population size of the Stout Iguana (*Cyclura pinguis*) on Guana Island, British Virgin Islands

Brent D. Bibles, Assistant Professor of Wildlife Ecology, Unity College, 90 Quaker Hill Road, Unity, Maine 04988. bbibles@unity.edu

INTRODUCTION

The stout iguana (*Cyclura pinguis*), is considered critically endangered by World Conservation Union (IUCN) Red List (Mitchell 1996). The population size of stout iguanas is effectively unknown, but estimates based on expert opinion are generally around 200 to 250 individuals (Perry et al. 2007). The Guana Island population of iguanas is believed to be the densest known population, with estimates of around 100 individuals based on expert opinion (Perry et al. 2007). Accurate estimation of iguana populations on Guana Island is problematic for several reasons. First, detectability of iguanas is limited both due to cryptic coloration and rough, densely vegetated terrain (Perry and Mitchell 2003). Second, iguanas commonly respond to capture and handling by retreating into burrows for extended periods (Perry and Mitchell 2003).

In October 2008, I undertook a pilot project to evaluate the potential of using occupancy modeling approaches (MacKenzie et al. 2006) to monitor iguana populations on Guana Island. Field work occurred from 18-30 October 2008, and involved visiting 20 plots across the island on five occasions and noting the presence or absence of iguanas. Two possible occupancy models were constructed and compared. The model which best fit the data was used to generate estimates of occupancy rate and detection probabilities. Occupancy modeling suggested that 55% of the island is occupied by adult iguanas, although precision was low (95% confidence interval = 15-89%). The low detectability of iguanas (0.18, 95% CI of 0.05-0.41) and clear heterogeneity in habitat suggests that occupancy modeling would involve substantially more intense effort to be useful for monitoring population trends of the iguanas.

Based on the results of the pilot work, I suggested a combination of occupancy modeling and mark-resight population estimators to evaluate population size on Guana Island. The following presents the results of work conducted in 2009 and 2011 implementing these approaches.

METHODS

In October 2009, a new random sample of 35 plots was established along the Guana Island trail system. Plots were 250 meter transects. Occupancy surveys were conducted from 18-28 October during both morning and afternoon surveys. Number of iguanas detected on the plot and distance from transect to iguana at detection was recorded. Site covariates were measured at 4 locations along the transect. Measured covariates included aspect, slope, canopy cover (%) and canopy height. Occupancy data were analyzed with Program PRESENCE using a model set of 10 models examining the influence of various combinations of site covariates on iguana occupancy (ψ) and time of survey (i.e., AM or PM) on iguana detectability (p). Sighting distance was analyzed with Program DISTANCE to determine an effective detection distance (e.g., transect strip width).

In October 2011, an intensive effort of trapping and marking adult iquanas was conducted on Guana Island. Capture effort occurred in the first two weeks of October. Capture effort was focused within the island "Core" which consists of the resort area, as well as the Flats and

surrounding forests. Iguanas were marked so that they could be individually identified at a distance. From 14-30 October, a series of resighting occasions was conducted. These data were analyzed using the immigration/emigration mixed logit-normal mark-resight estimator using Program MARK. Models evaluated the influence of daily variation in iguana detectability as well as individual heterogeneity in detectability. Models also incorporated a series of individual covariates (e.g., snout-vent length). Analysis was confined to adults.

RESULTS and DISCUSSION

The increase in number of occupancy plots from 20 to 35 improved the ability to estimate occupancy of Guana Island by Stout Iguanas. Forty-one adult iguanas were detected during surveys. The top model analyzed was $\psi_{(aspect)}p_{(AM/PM)}$. No model lacking consideration of the influence of aspect on occupancy or time of survey on detectability performed well (i.e., ΔAICc <3.0) strongly suggesting that these two variables need to be considered. The top model suggests that iguanas do not use, or minimally use, parts of the island with northeasterly aspects (0-120°). Occupancy rate of parts of the island with aspect from 120-360° was estimated at 36.83 with a 95% confidence interval on the estimate of 16-64%. The precision of this estimate is still too low for occupancy estimation alone to allow for monitoring iguana population trends. Not considering aspect, overall occupancy rate of the island was estimated at 26% (95% CI = 11.7-48.7%) Detectability of iguanas prior to noon was estimated at 18.7% (95%CI = 7.2-40.4%) while detectability of iguanas during afternoon surveys was 44.2% (95%CI = 19.7-72.0%). Effective detection distance of iguanas was best estimated using a uniform detection function with a cosine expansion. This model estimated an effective detection distance of 9 meters (95% CI = 7.5-10.9 m) suggesting that occupancy plots each consisted of 0.45 ha, with a total of 15.75 ha sampled.

Six mark-resight models were considered evaluating variation in detectability among surveys, effect of mass and snout-vent length on detectability, and individual heterogeneity. Detection probability clearly varied among surveys, and there is strong evidence of individual heterogeneity in resighting probability. Models failing to incorporate either time-variation or individual heterogeneity performed very poorly (ΔAICc>6.0). Although not selected as the top model, there is some evidence that iguana size, as measured by mass, influenced detectability. Based on the top model, population size of iguanas within the core area was estimated at 88 iguanas (95% CI = 77-104). Detection probability ranged from a low of around 7% to a high of 24% on October.

Extrapolation of mark-resight estimates to an island-wide estimate is contingent on estimation of the amount of iguana habitat on the island and the amount that is encompassed by the "Core" study area. Based on survey descriptions and location of iguana captures, a polygon representing the core area was created in ArcMap10. The core encompasses approximately 58.6 ha. Based on occupancy modeling, about 44 ha of the core is potentially occupied. The density of iguanas within the core is estimated at 1.98 adults/ha (95% CI = 1.74-2.35). Of the 309.7 ha on Guana Island, 207.6 ha (67%) have aspects that are other than 0-120 degrees., with an estimated 76.5 ha of the island occupied. Extrapolating the core area densities to this area results in an island-wide estimate of 152 adults (95% CI = 133-180). Although the distance analysis was not designed to produce a density estimate, based on the 2009 data an approximate island-wide coarse, and biased high, density of 2.6 iguanas/ha is estimated, resulting in a population estimate of 203 individuals. Because the distance-based estimate is known to be biased high, the population estimate of adult iguanas on Guana Island is believed to be in the range of 133-180.

CONCLUSION

Based on occupancy modeling and mark-resight analysis, the population of stout iguanas not including hatchlings, on Guana Island is around 152 individuals. This suggests an island-wide density of 0.5 adults/ha. From the modeling, as well as direct observation, it is clear that iguanas do not occupy a significant portion of the island, suggesting that the island presents a range of habitat quality for iguanas. Based on observations, iguanas are absent or infrequent from areas such as Longman's Point, the northwest side of the Pyramid, Grand Ghut and Palm Ghut. They do appear to occupy most of the Core area, possibly suggesting an association with human-influenced portions of the island. The apparent preference for areas not having a northeastern aspect may indicate the influence of prevailing winds on vegetation on the island, although it may be a sampling artifact resulting from an association with human-influence areas and the Core being largely on the leeward side of the island. Further work on iguana movements and habitat use would help clarify these questions.

Multiple methods suggest that detectability of adult iguanas is quite low. This is not unexpected due to their typical secretive behavior and the low sight distances on the island. Population estimates for this species need to incorporate this low detectability, as well as uthe uneven occupancy of the island. Mark-resight methods were successful in estimating population size of iguanas within the core area with a reasonable degree of precision. Continued effort to mark iguanas with permanent, individually-based marks would further improve these estimates, especially if surveys based on a robust-design framework were implemented. Based on the limited analysis of distance data, the use of distance sampling approaches to iguana population estimation may also be useful.

LITERATURE CITED

MacKenzie, D.I., J.D. Nichols, J.A. Royle, K.H. Pollock, L.L. Bailey, and J.E. Hines. 2006. Occupancy estimation and modeling: inferring patterns and dynamics of species occurrence. Academic Press, Burlington, MA.

Mitchell, N. 1996. *Cyclura pinguis*. In: IUCN. 2007. 2007 IUCN Red List of Threatened Species. www.iucnredlist.org. Accessed 3 January 2008.

Perry, G., and N. Mitchell. 2003. Guana and Necker Island population assessments 2002. Iguana 10(2):49.

Perry, G., J. Lazell, K. LeVering, and N. Mitchell. 2007. Body size and timing of reproduction in the highly endangered stout iguana, Cyclura pinguis, in the British Virgin Islands. Caribbean Journal of Science 43(1):155-159.

For illustrative purposes, I interpolated the conditional probabilities that sites were occupied given their detection histories in ArcMap 10 using a kernel-based interpolation. The results of this interpolation are displayed in Figure 1, with blue indicating areas with little indication of iguana use and red areas indicating areas of higher iguana use. Points on the figure indicate locations of the 35 occupancy plots.

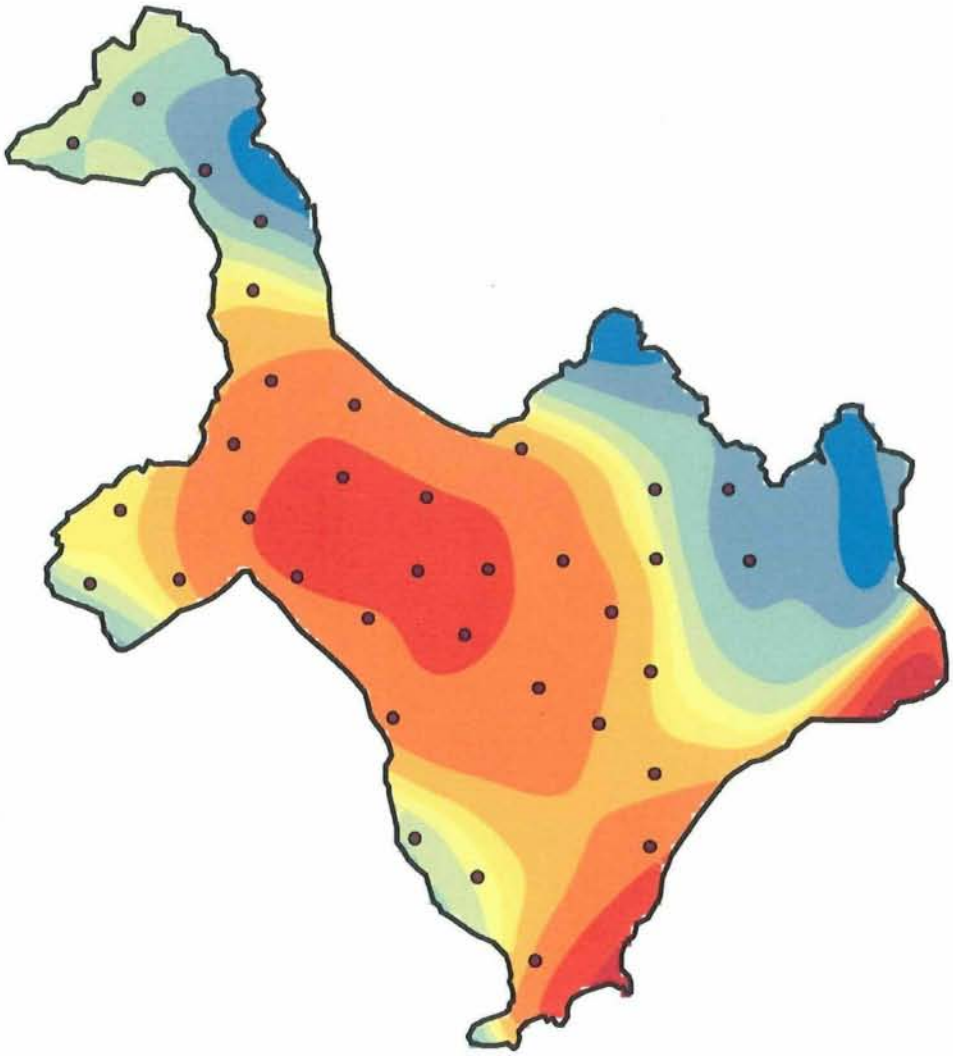
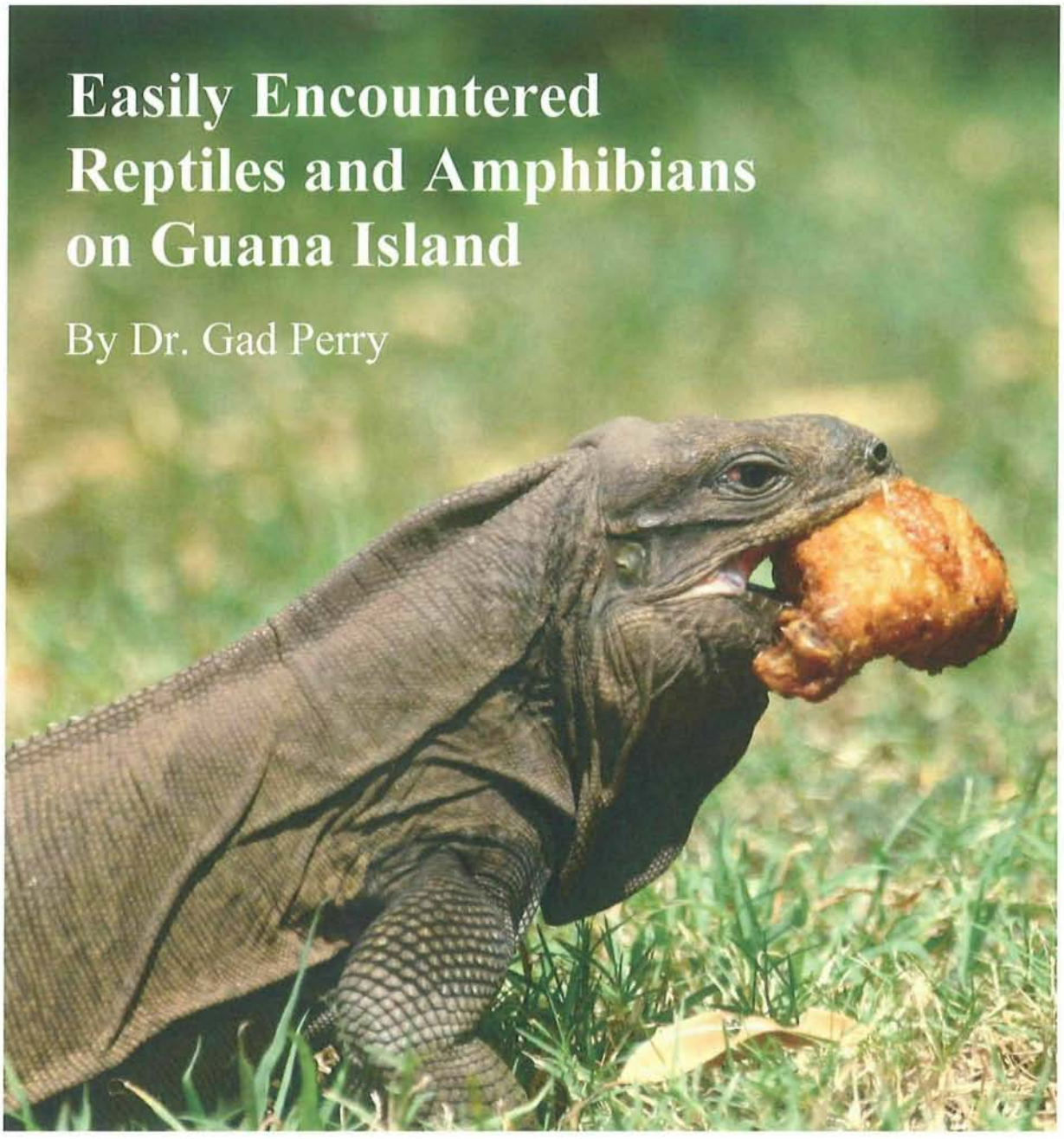


Figure 1. Kernel-based map of potential stout iguana use of Guana Island. Darker red colors indicate increasing conditional probability of use based on occupancy modeling. Occupancy plot centers are indicated by points.

A Special Publication by The Conservation Agency For Guana Island



Introduction

Guana Island is a special place. It is well protected from common problems such as habitat loss, and research into the biology has now been ongoing for three decades. We know more about the biology of Guana than of nearly any other place in the region, and the list of species found on the island is remarkably long.

Reptiles and amphibians are among the most apparent residents of Guana. This booklet is not intended to tell you everything about all of them. Instead, it offers a little bit about some of the most common. To learn more, read the natural history guide found in your room or the detailed book by Lazell that can be purchased at the boutique.

This guide was made possible by decades of research by dozens of dedicated colleagues. They contributed knowledge and pictures and will hopefully continue to do so for decades more. We are all grateful to the owners and staff of Guana Island, without whom that work would have been impossible.

Enjoy your visit to this remarkable place!

Frogs

Only one species of frog is naturally found on Guana, but it can be very common. On a rainy evening, the island rings with the whistling calls of the **Antillean Rain Frog**, locally known as "bo-peep". Despite the large voice, the frog itself is quite small – only about 3 cm (1 inch) in total length. Unlike most frogs, this species lays its eggs on land and small frogs emerge, completely skipping the tadpole stage. The frog feeds on insects and is also found on other islands.

Of particular concern is the **Cuban Treefrog**, a non-native species that has spread in the BVI. Much bigger, this voracious predator can eat native frogs, reptiles, and even small birds, but usually feeds on large insects. Its skin is slightly toxic, and it often breeds in cisterns containing drinking water. Much effort has been spent to keep them off Guana, because they are not a native species.

Left Photo: Male **Antillean Rain Frog** calling from a branch at night.

Right Photo: Searching for frogs in arriving ornamental plants.

Left Photo: **Cuban Treefrog** on a tree trunk (non-native species).

Turtles

Two species of sea turtle, the **Green Sea Turtle** and the **Hawksbill**, are often seen in the waters around Guana, most often near Monkey Point. Both sea turtles occasionally make land on Guana, seeking good places to lay their eggs in the sand. A third, the huge **Leatherback** (locally known as "trunk") can also be seen in BVI waters. Eating sea turtles has a long history in the islands. Although these species are endangered world-wide, the BVI populations appear to be increasing.

In recent arrivals on the island, several **Aldabra Tortoises** can now be seen in an enclosure near Jost house. These gentle giants are native to the Seychelles islands off the coast of Africa but are often mistaken for the more endangered tortoises of the Galapagos Islands. They are common in the pet trade but rarely do well in private homes because of their large size.

Above Photo: The **Red-legged Tortoise** was probably brought to the islands by humans and turtles such as this juvenile have not been seen on Guana in some years.

Above Photo: **Aldabra Tortoises** in their enclosure near Jost House.

Lizards: Anoles

The most commonly seen lizard on Guana Island is the **Crested Anole**, locally known as the "man lizard" because of the antics of the larger males. Females are much smaller and lack the "sails" that males have. This lizard is very common around the hotel and elsewhere. Males spend much of their time doing "push-up" displays and showing off their colorful dewlap – the skin flap underneath their throat. They primarily eat insects, often caught on the ground or close to it.

Two other species of anole are found on the island. One is the **Saddled Anole**, much smaller than the previous species and often found higher up on larger tree trunks. They too are easily seen around the hotel and have colorful dewlaps. When males fight, they stick out their orange tongues as part of an intimidation display. The final species is the **Grass Anole**, similar in size to the last animal, but very different in coloration and habits. Well-camouflaged, they are common but not often noticed.

Right Photo: Male **Crested Anole** surveys his domain from the top of an ancient cannon on White Bay.

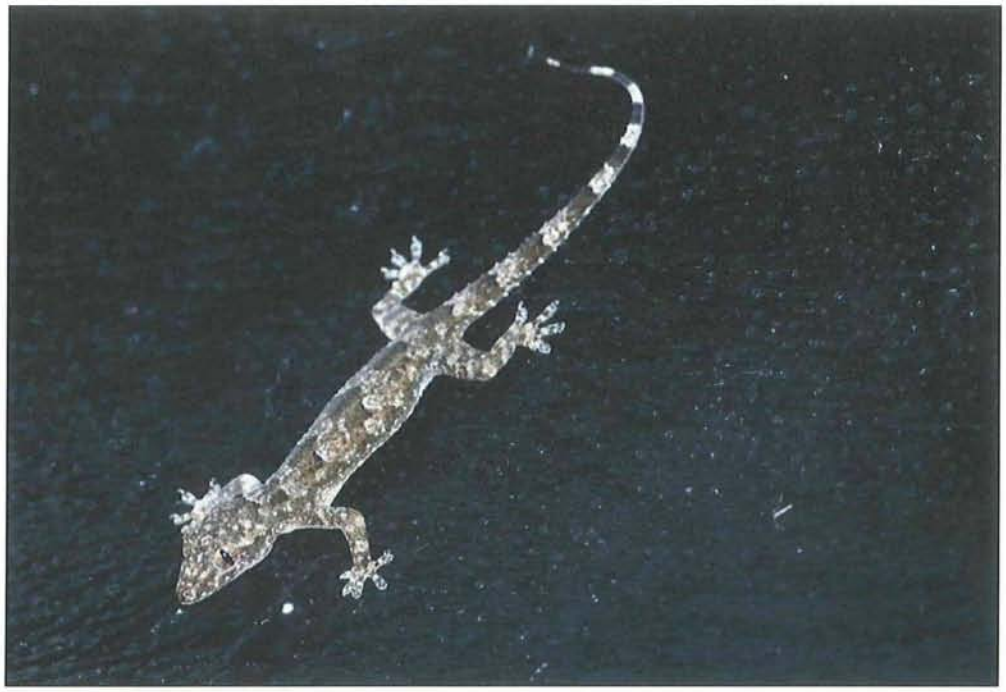
Above Photo: The **Saddled Anole** is small but feisty.

Above Photo: The **Grass Anole** is slender and typically found on narrow perches such as small bushes.

Lizards: Geckos

Most geckos are climbers that are active at night. That is the case with the **House Gecko**, a pale lizard that can be seen on buildings, often near lights. Insects are attracted to the illumination, and the geckos have learned to lay there in wait. Almost all geckos lay two eggs at a time, and the skin of these lizards is so translucent that you can see the eggs forming through the belly skin. The house gecko is locally known as the "wood slave," and some believe that if one jumps on a woman, she will immediately become pregnant.

The very small **Sphaero** is easily missed if you spend time only on the beach, but holds a world record: the Guana sphaero is the densest terrestrial vertebrate on the planet! The best time to see them active is during the day, and their stubby toes are not well-suited to climbing. They are most often seen in dense leaf litter in North Beach Woods or the orchard.



Above Photo: The **House Gecko** can be seen in the club at night. It is often lighter in color than shown here.

Above Photo: The **Minute Spahero** can be extremely abundant in leaf litter and occasionally comes into rooms.

Lizards: The Iguana

The biggest lizard on Guana, and the most endangered, is the **Stout Iguana**. A few decades ago the species was almost extinct. Only a few hundred animals remained on the island of Anegada (giving it its other common name). They were starving to death because the vegetation they feed on was being destroyed by feral goats, sheep, cows, and other farm animals. Baby iguanas were being eaten by roaming cats and dogs. Thankfully, the owners of Guana Island and Dr. James Lazell came to the rescue and arranged a deal: they brought flamingoes back to Anegada, where they had been killed off, and in return Guana received eight iguanas. The original eight have survived and bred and now we have several hundred iguanas on the island – probably more wild iguanas than anywhere else in the world!

We have been studying and marking the iguanas for decades now, watched their numbers increase and learned a lot about their lives. Some of them have names and come to be fed by the staff. Others are wary of people and stay away from visitors. They can live for decades and have been seen in nearly every part of the island.

Right Photo: An adult **Stout Iguana** standing on one if the trails.

Inset: Blue-white-yellow is the code for this animal.

Above Photo: Colored beads being attached to the back of the neck, where they can be used for long-term identification.

Below Photo: A juvenile **Stout Iguana**, marked as part of a study, sits atop a tree.

Other Lizards

Common in sunny spots, the **Ground Lizard** can grow to be an impressive animal. All the large, colorful individuals are males, and they can live to be five years or older. They feed on insects, spiders, and small lizards which they catch while actively searching, digging, and moving through the brush. Unlike the anoles, they almost never climb. Instead, they can often be seen emerging from or disappearing into holes in the ground.

About the same size as a large anole or small ground lizard, the **Slipperyback Skink** is highly secretive. It likes to live in rock piles and in large logs with openings into which it can duck to hide. It is not often active in the open, and many visitors never see one, despite several usually being found right around the club area.

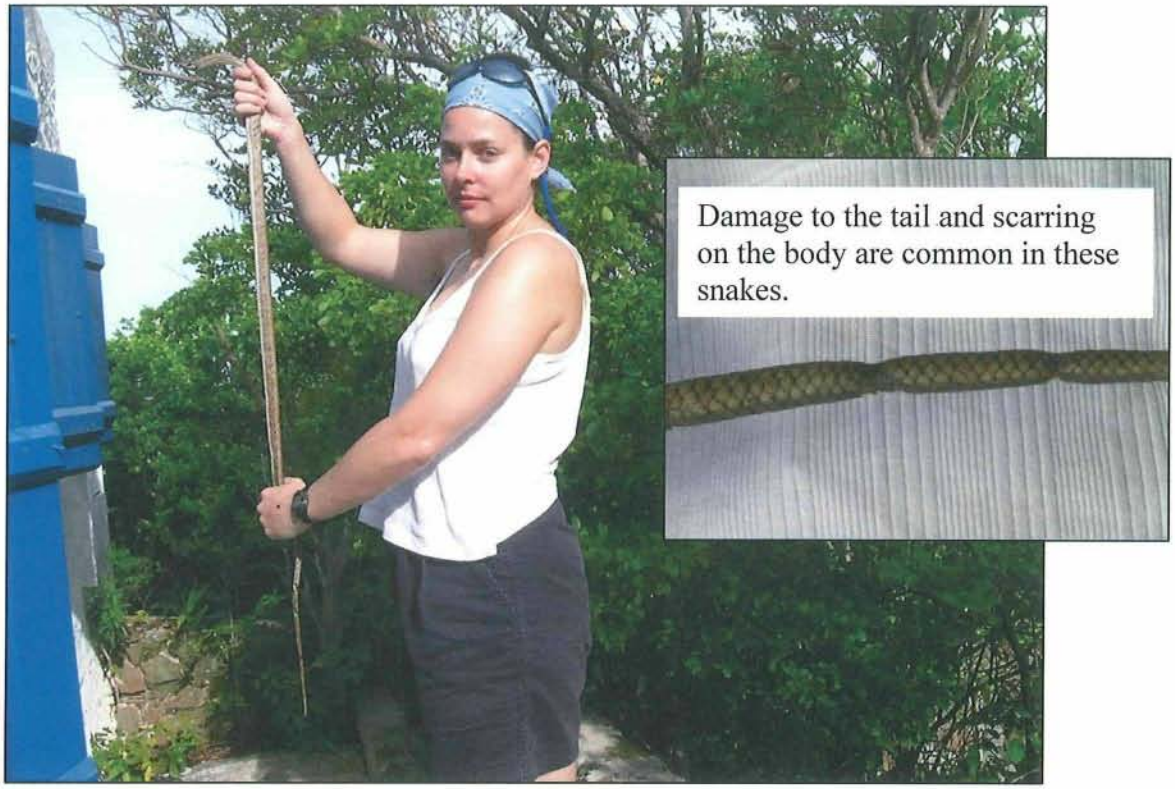
Above Photo: Two **Ground Lizards**, a male (left) and a female, sunning themselves at the hotel.

Above Photo: The **Slipperyback** is shiny and smooth.

Snakes

Only one snake, the harmless **Racer**, is common on Guana. Active during the day, this grey-brown animal can be seen anywhere on the island. Although mostly seen on the ground it can climb. Individuals usually stay in the same area for years at a time. The racer primarily feeds on lizards and is definitely not aggressive, although it will bite if captured. Females often have a yellowish throat, and both sexes can sometimes flatten their necks when alarmed to look a bit like a cobra. The tip of the tail is often missing in racers, perhaps because of predation by birds and crabs.

The **Boa** was reported from Guana Island once, many years ago. It has not been confirmed since, although tantalizing rumors surface every few years. The species is regularly seen on Tortola, where it can enter homes and is run over on the roads, but is highly protected in the US Virgin Islands where numbers are apparently lower. If you see this harmless snake, please take a picture and inform the office immediately!



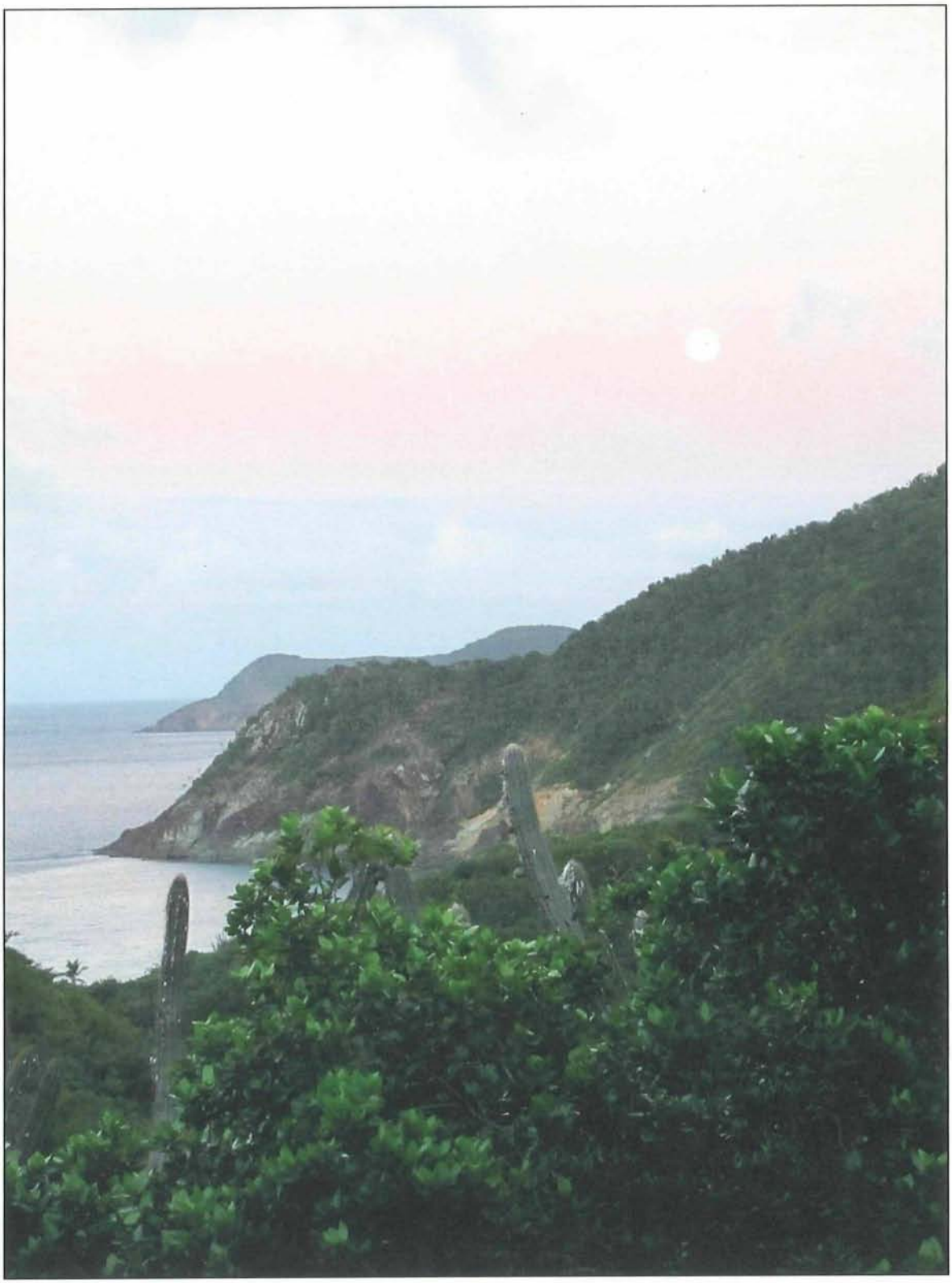
Above Photo: **Racers** this big are extremely rare.

Above Photo: The **Boa** has not been seen on Guana in many decades.

Photo Credits

Front cover: Ross Tsai
Rain frog: Bob Powell
Aldabra Tortoises: Krista Mougey
Spahero: Kristiina Ovaska
House Gecko: Bob Powell
Ground Lizard: Krista Mougey
Adult iguana: Mark Peyton
Juvenile iguana: Katrina Street
Beading an iguana (larger image): Joel Friesch
Boa: Brittany Barker

All others: Gad Perry



Habitat Use and Activity Influence Thermoregulation in a Tropical Lizard, *Ameiva exsul*

Matthew E. Gifford[1], Timothy A. Clay[2], and Robert Powell[3]

[1]Department of Biology, University of Arkansas at Little Rock, Little Rock, Arkansas 72204, USA
[2]Department of Applied Science, University of Arkansas at Little Rock, Little Rock, Arkansas 72204, USA
[3]Department of Biology, Avila University, Kansas City, Missouri 64145, USA

During October 2007–2011 on Guana Island in the British Virgin Islands, we examined the contributions of alterations in daily activity and behavioral selection of microhabitat to thermoregulation in a population of the lizard, *Ameiva exsul* (Teiidae), by combining data on lizard activity with data on the availability of sun-shade patches and operative temperatures (T_e). By comparing T_e distributions predicted by "no thermoregulation" and "only thermoregulation" hypotheses to those predicted by random use of thermal habitat, we assessed the relative contributions of microhabitat selection and daily activity to regulation of body temperature (T_b). Over the course of a day lizards maintained T_b very close to optimal temperature (T_{sel}) despite T_es that deviated substantially from T_{sel}. Data demonstrating a unimodal daily activity pattern reject the hypothesis of uniform activity throughout the day, nor was lizard activity positively correlated with the proportion of T_es within T_{sel} and negatively correlated with the absolute deviation of available T_e from T_{sel} (d_e) ("only thermoregulation"). Microsite use by *A. exsul* deviated significantly from predictions of "no thermoregulation" hypothesis, but our data could not reject predictions of the "only thermoregulation" hypothesis that lizards would use sun-shade patches relative to the proportion of microsites where T_e is within T_{sel}. Also, lizards appeared to actively select sunlit and partially shaded microsites at different times of day. Thus, despite thermal constraints imposed by the habitat, *A. exsul* maintained high and relatively constant T_bs throughout its daily activity period and thermoregulated effectively. This appears to be generally representative of West Indian species of *Ameiva*.

An adult male Puerto Rican Ground Lizard (*Ameiva exsul*) along the study transect on Guana Island. These lizards actively thermoregulate by selecting sunlit and partially shaded microsites at various times of day.

Figure 1. The distributions of available operative temperatures (T_e) and body temperatures (T_b) for a population of *Ameiva exsul* during October. The vertical black bar indicates the selected temperature range for this population (T_{sel}).

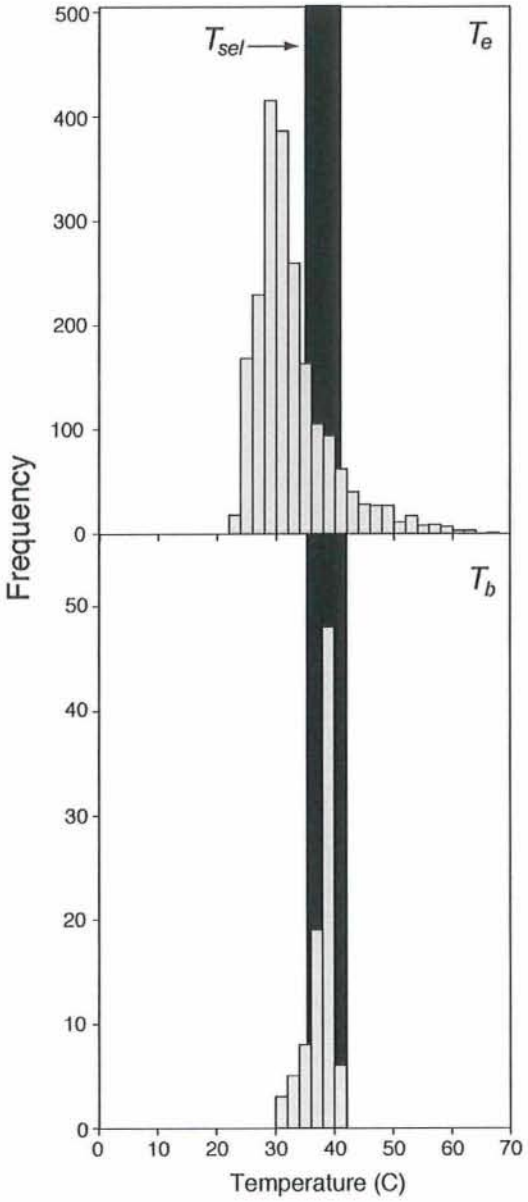


Figure 2. Hourly variation in body temperature of *Ameiva exsul* (T_b, solid squares and dashed lines) and habitat temperature for each available microsite (shade = diamonds, partial shade = solid squares with solid line, and sun = triangles). Data are represented as the mean ± 1 SE.

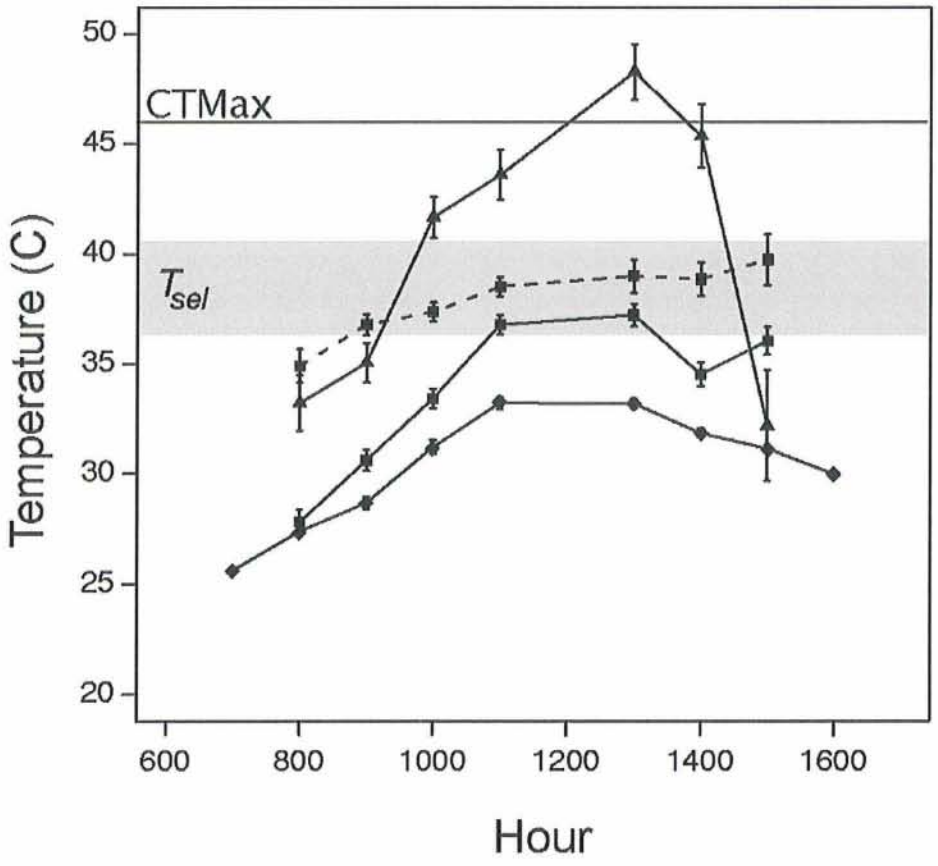


Figure 3. The number of lizards observed along the sampled transect during each hour of the day. The 1200 hour is left blank because of unequal sampling intensity over the course of this study.

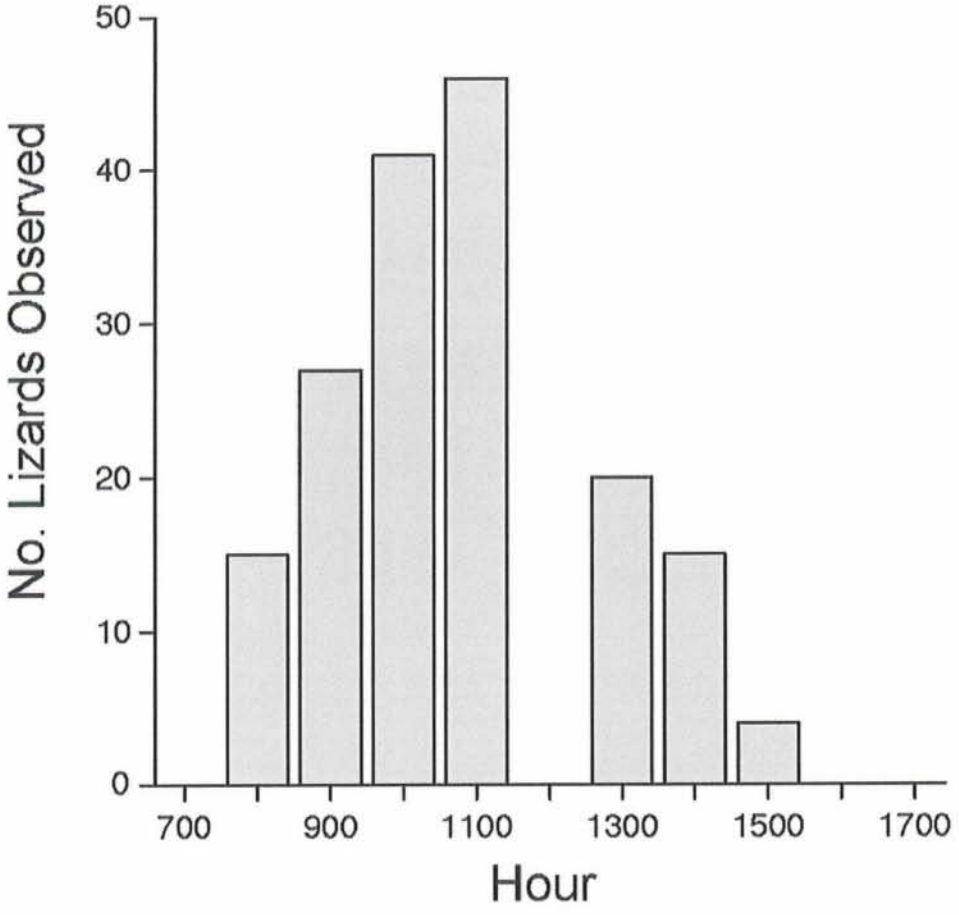
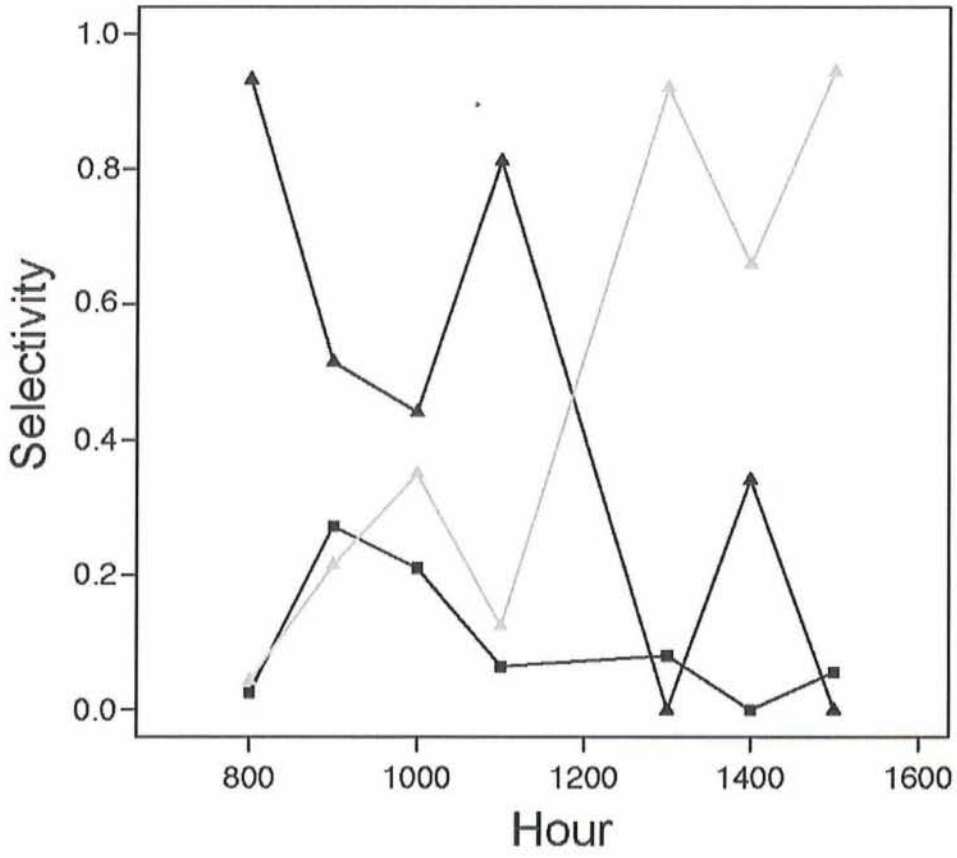


Figure 4. Microsite selection by *Ameiva exsul* estimated using Manly's α. Selectivity was calculated for each microsite type for each sampling period (shade = black squares, partial shade = gray triangles, sun = black triangles).



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skip lazell <wenhua3g

Guana entomology strategy

4 messages

Miller, Scott <MillerS@si.edu> Thu, Mar 1, 2012 at 11:12 PM
To: skip lazell <hq@theconservationagency.org>

For a variety of reasons, insect and spider sampling has been good over many years on Guana, resulting in many specimens in collections (which show up regularly in taxonomic revisions), but productivity of papers making significant contributions to the knowledge of Guana, or using Guana as the site for significant ecological or other work has been poor. I am sitting on significant yet to be published data, so I am part of the problem, but at least I've put out one fairly large paper focused on Guana, and six or more short ones. Lots of the entomologists who have gone to Guana have never published anything.

With this in mind, I do not think you need a "general entomologist" in the field, and you do not need more general sampling of insects. Instead, you need to think strategically about the investment of field time, and how to incentivize publications.

In terms of strategy, what do you want out of Guana insects and spiders? What are your "big questions" or even "little questions"? Choose the questions and seek out people who can fill the gaps, perhaps students who have to publish to launch their careers?

I would prioritize inventory and/or ecological studies on taxa or guilds that are significant to ecosystem process, such as ants, termites, pollinators (bees plus others), major herbivores (caterpillars), or insects that are food for vertebrates. Groups of medical/veterinary importance, disease vectors, and others are also interesting. Are there any insects that the BVI (or USVI) governments care about as pests or whatever?

Are there broader biogeographic questions that could be informed by arthropod studies on Guana? Many of these are probably laid out in your Guana book?

Then I would review the history of entomologists who have visited Guana. Are there any works in progress that could be finished? Published work that could be supplemented and taken to the next level? What would it take to motivate people to do this? Would small amounts of funding for technical support, illustrations, or page charges make a seminal difference? The single largest "missed opportunity" are the beetles – how can you motivate Mike and/or Barry to publish what they know? I know that Mike went through very severe health problems for multiple years, and is now

confined to a wheelchair, but I think he is working actively again.

Have you had contact with the Coddington spider student who is know at the University of Puerto Rico? Perhaps you could get him to finish the spiders?

Another possible approach for the historic people is to organize a group publication Guana entomology, and give people a year to compile the inventory documentation on their taxa. The peer pressure and the deadline might motivate some people to publish what they might never finish otherwise (might even work for me). The appendices in your Guana book worked this way, but that was awhile ago. Organize publication in some monographic serial that people respect, possibly Smithsonian Contributions to Zoology (which is back in business).

I would be happy to assist in the process of analysis, setting up a strategy, and then identifying people who might help (existing or new people). Perhaps we should discuss further by phone?

In my own case, Vitor and I have a manuscript almost ready for publication on the pyraloid moths. It just requires some polishing, and other more pressing things keep getting in the way, but I will get to it.

While I would in general prefer to finish working through the material I already have before taking on more material, it seems that I need fresh material to "DNA barcode" the Guana moths. We've tried a few of the Guana moths, but have failed to get good DNA; our last collections are a bit too old. But given the taxonomic work we have put into them, the Guana moths would form an excellent reference library for the Caribbean (e.g., Guana specimens would become the new standards for DNA identities of these species). So I'm thinking it might be worth a week of targeted collecting to get representatives of as many species as possible for DNA. So, for example, one "value added" product would be DNA barcodes for as many of the butterflies and large moths as we could acquire, building on the earlier inventory papers.

Scott

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skip lazell <wenhua3gs@gmail.com>

Annual Report

1 message

. Barry & Buena Valentine <bv@nwcs.com> Wed, May 9, 2012 at 5:53 PM
To: skip lazell <hq@theconservationagency.org>

Dear Skip,

Here is the very preliminary info on our Guana report. I am summarizing the entire collection.... which will take some time, but hopefully will provide diversity, distribution, and(when possible) identities. I am concentrating on the Guana fauna, and will include all other BVI records as currently known. At present, I am still going through alcoholic material, so there is a long way to go. More later.

Very best wishes to you both. Barry(&Buena)

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skip lazell <wenhua3gs@gmail.com>

Guana October

Henry, Thomas <Thomas.Henry@ars.usda.gov> Mon, Apr 23, 2012 at 4:30 PM
To: skip lazell <hq@theconservationagency.org>
Cc: Al Wheeler <awhlr@clemson.edu>

Dear Skip,

Thank you for the message and invitation to get back to Guana this year. Al and I definitely are interested and would like to reserve a seven-day period toward the end of October, if possible. If we could get into Barbatos Cabana where we have been the last two times, that would be great.

We have been holding off on our synopsis of the Guana Heteroptera until we could get one more collecting expedition in. Our plans are to provide a diagnosis of each family and the species found on Guana, along with a key to each to help identify them. Ideally, we also would like to include a color photograph of each species as well. We will try to have a draft of the paper by the time we get back to the island. Also, I have two other papers describing new taxa that are well along the might be completed by October. It always takes longer to finish some of these projects than originally anticipated.

Although your thoughts of canopy fogging the old forest have great merit, I don't think that would be the most productive way for us to collect—besides, we really haven't used that technique nor do we have the equipment. I think that light trapping in some of the more remote areas would be more productive. I am going to try to purchase two or three UV light traps (and several long extension cords) that we can set out each night and sort through as we have time. We could put one on the east end in the old-growth forest, one in the orchard, and maybe one up around the Garden of Eden. Wherever they go, we could need to have an electrical source. Rather than try to bring this equipment with us, can we have it shipped ahead to the Island before we get there? Let me know what you think would be the best strategy.

We look forward to seeing you, Wenhua, Berry, and the whole gang.

Best wishes,

Tom

Thomas J. Henry

Systematic Entomology Laboratory

ARS, USDA, MRC-168

ORNITHOLOGICAL MONITORING AND RESEARCH ON GUANA ISLAND, BRITISH VIRGIN ISLANDS

PROJECT REPORT 2011

Clint W. Boal, Ph.D.
USGS Texas Cooperative Fish and Wildlife Research Unit
Department of Natural Resources Management
Texas Tech University, Lubbock, TX 79409

18 April 2012

Bridled Quail-Dove (Watercolor)

ORNITHOLOGICAL RESEARCH AND MONITORING ON GUANA ISLAND, BRITISH VIRGIN ISLANDS: PROJECT REPORT 2012

Dr. Clint W. Boal, *USGS Texas Cooperative Fish and Wildlife Research Unit, Texas Tech University, Lubbock, TX 79409-2120*

INTRODUCTION

The Caribbean is an important region for neotropical migrant landbirds during their annual migration from North America to South America. While considerable research has been conducted on migrant ecology in the western Caribbean, comparatively little has been conducted in the Virgin Islands or east Caribbean (Wiley 2000). Thus, ornithological work on Guana Island makes substantive contributions toward a better understanding of the Virgin Islands as stop-over habitat for migrant birds (McNair et al. 2002, Boal et al. 2006, Boal and Estabrook 2007). Avian research on Guana Island is also important in adding to the understanding of the basic ecology and conservation needs of Caribbean birds (e.g., Chipley 1991, Boal et al. 2006, Boal 2008a,b, 2011).

Components of avian research on Guana Island are 1) mist-netting and banding neotropical songbirds that migrate through the Caribbean region during the autumn migration and 2) specific studies focusing on species resident to the island. Here I provide data and discussion of the results of the 2011 field season, a review of research productivity stemming from avian research on Guana Island, and plans for the 2012 Science Month.

RESULTS AND DISCUSSION

Mist-Netting and Migrant Ecology

Due to professional obligations requiring my participation in workshops elsewhere, the duration of my research period on Guana Island was shorter than usual during the 2011 Science Month. I operated the mist-netting array for a total of 308 net-hours from 13 to 22 October 2011. This was 45 hours less than the average 353 net-hours/year (Table 1). However, net captures and diversity of species captured were the lowest on record since I started in 2003 (Table 1). The only neotropical migrants captured were blackpoll warblers (n = 46) and yellow-billed cuckoos (n = 3), and these accounted for almost one third of all captures. Capture rates among resident birds were among the lowest recorded; only 27 new bananaquits were captured and banded, and only 11 physical recaptures were made. Similarly, I only recaptured 7 pearly-eyed thrashers. In general, bird activity among the resident species appeared to be substantively depressed compared to previous years. Capture rates were similarly low in 2009, but diversity of species captured was double that of 2011. There has been a general trend over the last three years of low capture rates and decreasing diversity, although we did have a high capture rate in 2010 due to substantial numbers of blackpoll warblers arriving on the island.

I am currently assessing annual species diversity and richness of neotropical migrant landbirds scaled to mist-netting efforts. I anticipate examining the data for correlations between species diversity and richness to weather patterns in the Caribbean and west Atlantic. This is, however, proving challenging as there is very little high quality weather data for the British Virgin Island. Most data have to be taken from the US Virgin Islands and assumed to be representative of the Virgin Islands as a whole.

Bananaquit Demography

Few bananaquits were captured and banded in 2011 compared to previous years. Additionally, reproduction appeared to be down; almost no young birds were observed during our activities and only 5 of 38 bananquits captured were young of the year birds. Since 1994, 886 bananaquits have

been banded on Guana Island. Since 2005, I have marked 258 bananaquits with unique color-band combinations. This has facilitated assessments of site-and pair-fidelity for the species. It has also assisted in estimates of survival. Normally, we calculate survival based on recaptures of individual birds banded in the previous years. With unique color-band combinations, we are also able to identify individuals that may not become trapped in our nets. This allows for more robust survival estimates.

With both physical recaptures and visual recaptures, I have an incredibly robust recapture data set with which I am modeling sex- and age-specific survival rates for the species. However, determining sex is not always possible. To alleviate this limitation, I and a colleague have developed a modeling approach in which sex can be estimated with high accuracy based on morphological measurements. I am currently going through my data set to assign sex to those individuals for which sex was unknown when captured. Once completed, and I include data I will collect in 2012, I will be able to look at survival over the 10 years in which I have been studying the species. I will also attempt to incorporate covariates of weather and climate factors to attempt to understand how global climate change may affect this species. If bananaquits are a suitable surrogate for other Caribbean birds, this may also allow broader predictions of the impact of climate change on Caribbean birds in general.

Bridled Quail Doves

Over the last 3 years I have specifically attempted to capture bridled quail doves. My goal is to study survival, pair fidelity, and location fidelity. I was able to captured 12 bridled quail doves in 2009, 3 in 2010, and 10 in 2011. These birds have been trapped primarily by slowly walking behind individuals to drive them into nets. All of these birds have been banded with unique combinations of color bands so that they are individually identifiable. I will be putting more effort into this study in future years. This will add considerably to the knowledge of this rare species (Boal 2011).

One particularly interesting item with the bridled quail doves is an apparent high rate of colobomas (see attached pictures). This is an abnormality of the iris, resulting in elongation of the pupil towards the front of the head. It results in a distinctive oblong rather than round pupil. The influence of this abnormality on vision, survival, or other aspects of life history remain unknown. This may be a phenomena associated with genetic isolation of the population on Guana Island. An elicitation of avian researchers working across in the Caribbean suggests that this phenomenon is not seen with any regularity elsewhere. However, few individuals have actually worked with bridled quail doves or observed them very closely. I will be monitoring birds captured in the future closely for this ailment to assess the proportion of the population on Guana that has it, and to assess the general extent of the erosion of the iris.

DISCUSSION

A common theme during the 2012 field season was low capture rates of all species in mist nets, and low responsiveness by cuckoos to playback surveys. In contrast, bridled quail doves were abundant, with at least 6 residing near the laundry facility and regularly foraging in the Garden of Eden area. Additionally, keeping with the recent trend, they were common near the workshop, the orchard area, Quail Dove ghut, and parts of Monkey Point trail. Oddly, they were not seen in the North Beach area this year. Another interesting aspect of 2011 was that numerous juvenile quail doves were observed and several captured. In contrast, almost no young bananaquits were seen and overall captures were low. I hope that the 10 year assessment including sex and age ratios and survival in context of climate patterns will allow insight as to the driving influences on bananaquit population trends.

PROJECT PRODUCTIVITY

Papers in Development

1. Timing and condition of blackpoll warblers arriving on Guana Island (to be completed following 2012 season).

2. Age and sex-specific survival of bananaquits (to be completed following 2012 season)
3. Autumn monitoring of resident avifauna on Guana Island, BVI (co-authored with Joseph Wunderle and Wayne Arendt) Submitted to Neotropica Ornitologia
4. Morphometric based sexual determination of bananaquits (co-authored with Brent Bibles) Submitted to Neotropica Ornitologia

Papers Published to Date

Boal, C. W. 2008a. Observations of an Antillean crested hummingbird (*Orthoryhncus cristatus*) attacking saddled anoles (*Anolis stratulus*). *Caribbean Journal of Ornithology* 21:48-49.

Boal, C. W. 2008b. Predation of a dwarf gecko (*Sphaerodactylus macrolepis*) by a bridled quail dove (*Geotrygon mystacea*). *Caribbean Journal of Ornithology* 21:50-51.

Boal, C.W. 2011. Bridled Quail-Dove (*Geotrygon mystacea*), Neotropical Birds Online (T. S. Schulenberg, Editor). Ithaca: Cornell Lab of Ornithology; retrieved from Neotropical Birds Online: http://neotropical.birds.cornell.edu/portal/species/overview?p_p_spp=177941

Boal, C. W., and T. S. Estabrook. 2007. Occurrence and condition of migrant Swainson's thrushes in the British Virgin Islands. *Wilson Journal of Ornithology* 119:716–720.

Boal, C. W., F. Sibley, T. S. Estabrook, and J. D. Lazell. 2006. Insular migrant species, longevity records, and new species records on Guana Island, British Virgin Islands. *Wilson Journal of Ornithology* 118:218–224.

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LITERATURE CITED

Boal, C.W. 2008. Observations of an Antillean crested hummingbird (*Orthorhyncus cristatus*) attacking saddled anoles (*Anolis stratulus*). *Journal of Caribbean Ornithology* 21:48–49.

Boal, C.W. 2008. Predation of a dwarf gecko (*Sphaerodactylus macrolepis*) by a bridled quail dove (*Geotrygon mystacea*). *Journal of Caribbean Ornithology* 21:50–51.

Boal, C. W. 2011. Bridled Quail-Dove (*Geotrygon mystacea*), Neotropical Birds Online (T. S. Schulenberg, Editor). Ithaca: Cornell Lab of Ornithology; retrieved from Neotropical Birds Online: http://neotropical.birds.cornell.edu/portal/species/overview?p_p_spp=177941

Boal, C. W., F. Sibley, T. S. Estabrook, and J. D. Lazell. 2006. Insular migrant species, longevity records, and new species records on Guana Island, British Virgin Islands. *Wilson Journal of Ornithology* 118:218–224.

Boal, C. W., and T. S. Estabrook. 2007. Occurrence and condition of migrant Swainson's thrushes in the British Virgin Islands. *Wilson Journal of Ornithology* 119: 716–720.

Chipley, R. M. 1991. Notes on the biology of the bridled quail-dove (*Geotrygon mystacea*). *Caribbean Journal of Science* 27:180–184.

McNair, D. B., F. Sibley, E. B. Massiah, and M. D. Frost. 2002. Ground-based nearctic–neotropic landbird migration during autumn in the eastern Caribbean. Pages 86–103 in Studies in Trinidad and Tobago Ornithology Honouring Richard ffrench (F. E. Hays and S. A. Temple, Eds.). Department of Life Sciences, University of West Indies, St. Augustine, Occasional Paper 11.

Wiley, J. W. 2000. A bibliography of ornithology in the West Indies. *Proceedings of the Western Foundation of Vertebrate Zoology* 7.

Table 1. Comparison of mist-netting effort and capture rates at the Guana Island field site, British Virgin Islands, 2003–2009. Captures listed include both new birds captured and recaptures of previously banded birds.

Year	Net hrs.	Total Birds Captured[1]	Birds /net hr.	Species Captured
2003	184	185	1.00	25
2004	218	168	0.80	20
2005	403	428	1.10	21
2006	400	284	0.71	24
2007	450	347	0.77	13
2008	460	271	0.59	20
2009	356	180	0.51	16
2010	405	374	0.92	9
2011	308	151	0.49	8

[1] Table does not include Bridled Quail Doves captured using nets specifically set for their capture.

Pictures from Guana Science Month 2011

Color-banded Bridled Quail Dove

Juvenile Bridled Quail Dove (note dark iris, brown plumage, indistinct white line below eye)

Adult Bridled Quail Dove (note elongated pupil)

Adult Bridled Quail Dove (note elongated pupil, apparent erosion of iris)