

Jamaican Iguana Recovery Group

Annual Report (November 2012 – October 2013)

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Caribbean Wildlife Alliance
C-CAM
Fort Worth Zoo
Dutch Iguana Foundation
Hope Zoo
International Iguana Foundation
IUCN-ISG
Jamaica Environment Trust
Milwaukee County Zoo
MTIASIC/NEPA
National Zoo (Wash. D.C.)
San Diego Zoo
UDC
UWI, Mona
Zoo Miami**

Acknowledgements

Special thanks to Dawn Fleuchaus, Mark Gold, Tandora Grant, Evert Henningheim, Leon Samson, Dennis Smith, Kimberly Stephenson, Rick van Veen, and Kenroy Williams for assistance with the work that went into this report. Any errors or opinions in this document are strictly mine.

Preamble

This document represents the standard, annual report on activities by the JIRG, and covers the same time period (Nov. to Oct.) as previous reports. However, this current 2012-2013 report also includes summary information dating back to 2010, which was the start of the MTIASIC project. That project ended in September 2013, and a specific deliverable was a project ending report; hence the inclusion of three-year summary discussions of primary activities and results. This report also includes relevant activities for the year ending months of November and December, 2013. Finally, because NEPA has assumed the responsibility of managing the field project (from 1 January 2014), this report will

highlight activities that are recommended for continuation; hence, these recommendations can serve as a blue print for continuing the successes outlined below.

Executive Summary

Following another successful campaign during the 2011-2012 period, the JIRG once again recorded a record year for recovering the Critically Endangered Jamaican iguana during the 2012-2013 period. Most notably, we recorded another record year for females nesting at the primary communal nesting sites -- 53! This represents a 6-fold increase over the original (core) nesting population documented in 1991, and constitutes the only measure of abundance that can be compared to the early years of the conservation effort. This dramatic recovery is presumably attributable to two primary interventions aimed at **MITIGATING THE THREAT OF INVASIVE ALIEN SPECIES (IAS)**: (1) continuous IAS predator control in the core iguana conservation zone, and (2) the release of captive-reared, 'head-started' iguanas.

The project's primary field intervention is the continuous operation of an invasive predator trapping grid in the core iguana conservation zone. This mongoose-focused effort was expanded to include a new 'Western Loop' (completed in December 2012), including the addition of over 100 new mongoose/cat traps provided by the MTIASIC project. A new 'Eastern Loop' trail has been completed, and traps are currently (December 2013) being deployed to this new segment of the trapping system. Deployment of the remaining traps and activation of this new component is projected to occur in January-February 2014.

When both new segments are operational it will provide a ~3-fold increase in the area receiving protection from IAS predators such as the mongoose, including communal 'rock hole' nesting areas that had previously been subject to heavy (100% documented) nest predation by mongooses.

During November 2012 to October 2013 trapping efforts resulted in the removal of 156 mongooses, 23 pigs, 17 cats, two dogs, and various other IAS (e.g., *Rattus*, *Bufo marinus*). Notably, a total of 383 iguana captures were also recorded – including 100 captures in the nesting month of June. And while many of these represented repeated captures of single individuals, or captures of recently released headstarters, these data are encouraging, and will ultimately be very useful in estimating the size of the wild population.

2013 was also a banner year for repatriation efforts, as a record 52 headstarters were released back into Hellshire in April. Those releases brought the project total to 226 headstarters repatriated back into Hellshire.

Given the record number of iguanas (53) depositing eggs at the core, monitored nesting areas, it is perhaps unsurprising that the project also documented a

record hatch and harvesting year – 320 hatchlings collected and processed, 42 of which were taken to the Hope Zoo for headstarting, with the remaining 278 being released at their respective hatching sites following field processing.

Other notable achievements for the period include the completion of a 17th consecutive year of a pitfall trapping experiment aimed at assessing the impact of mongoose control, and the continuation of related conservation projects in the Hellshire Hills (e.g., forest ecology, crocodile ecology and management). Finally, a new collaboration with the Botanical Research Institute of Texas resulted in four botanical surveys (2012-2013) that significantly enlarged the species list for the Hellshire Hills, and further underscores the importance of the Hellshire Hills as a repository of global diversity.

Unfortunately, the primary threats to the iguana's persistence appear to be more ominous than ever. First, charcoal burning continues to proceed every day in Hellshire, and in 2013 incontrovertible (photographic) evidence of charcoal burning within 1 mile of the known communal nests was obtained; this, after a NEPA/UDC/Forestry Dept. flyover and assessment incorrectly reported that charcoal burning was not an issue in the core iguana area. Make no mistake, charcoal burning remains ... a burning issue that remains unaddressed by the relevant authorities.

Second, a government plan to essentially sell the Goat Islands and adjacent areas of the Portland Bight Protected Area to a Chinese investor threatens the future of not just the iguana, but the entire Goat Islands-Cabarita Swamp-Hellshire Hills ecosystem – arguably the most spectacular coastal marine and dry forest complex remaining in the insular Caribbean. It was against this unfortunate backdrop that the annual IUCN Iguana Specialist Group meeting was held in November, in Kingston. So, rather than a celebration of a globally recognized conservation success story, the meeting was a rather depressing affair held under a gloom of uncertainty.

Specific Objectives

1. *Continuous IAS predator removal trapping programme in Hellshire Hills.*

Activities undertaken: The current grid (loop trail) of ~180 live box traps were operated every day between 1 November 2012 and 31 October 2013, with traps being checked and re-baited every 1-3 days. These traps form the core of our control efforts, as they focus on mongooses in the primary iguana nesting area.

Results: A total of 156 mongooses and 17 cats were trapped and removed from the core iguana area. Because of previous experimental confirmation that iguana nests and hatchling iguanas show enhanced survival as a result of predator control, this activity remains the most important *in situ* intervention.

In addition to the mongooses and cats, trapping efforts also resulted in the removal of 23 pigs and two dogs.

Future: This intervention is critical to the recovery effort.

2. *Expansion of existing trapping grid by addition of 200 new mongoose/cat traps and deployment of 12 dog/pig traps in core iguana area.*

Activities undertaken: Additional traps were procured (through the MTIASIC project) and transported to interior Hellshire. As with the previous acquisition of traps, these new traps (200) were transported by hand from Manatee Bay up to the iguana area for deployment on the new trap loop expansion (see below). Because we were unable to obtain JDF helicopter assistance to transport traps to central Hellshire, we were unable to deploy the 12 large dog/pig traps, which are currently stored at the Port Royal Marine Laboratory. The mongoose/cat traps of course, were small enough to permit hand carrying the several kms into the study area.

The 'New Western' trapping loop has been operational for a year, and the 'New Eastern' loop is slated for activation in early 2014. The 'Western Loop' was opened in December 2012, using a large number of traps, some of which were subsequently deactivated and carried to the 'New Eastern Loop'. Between the New Western Loop and the original, central loop, ~ 180 traps have been operational on a daily basis. The 'Eastern' access/trap loop trail has now been completed, and the field team is in the process of shuttling traps to their deployment locations. This new trapping (eastern) loop meanders up and along the main high point and ridge in central Hellshire, and the field team is to be commended on what amounts to a construction marvel of sorts. That the completion of this loop took as long as it did is readily understandable when one actually walks the loop: it is a fine trail indeed, traversing some very rugged terrain, and will make this important expansion of the trapping programme a reality.

Future: As per #1, above, this intervention is critical to recovering the iguana population. Field crew should be directed to spend the necessary time based at the field station, to provide the time to complete this project.

3. *Collect DNA samples for determining genetic structure and variability of the iguana population.*

Activities undertaken: DNA (blood) samples were collected from over 300 wild iguanas (mostly hatchlings) between November 2012 and October 2013. These samples are being stored at the Herpetology lab at the Department of

Life Sciences, UWI, awaiting shipment (courier) to take them to the U.S. and ultimately to the laboratory of Dr. Mark Welch in Mississippi – ideally coinciding with the annual health screening and headstart-release effort, generally around March or April.

Dr. Welch and his postgraduate student, Armed Rasberry, have been conducting the laboratory analyses and have made excellent progress. Both Dr. Welch and Mr. Rasberry delivered talks at the recent IUCN ISG meeting and iguana workshop held in Kingston, in November 2013.

Results: Although the population experienced a major genetic bottleneck subsequent to the initiation of the recovery programme in 1991, it now appears that the rate of inbreeding, which is an unavoidable consequence of small population size, is decreasing. Because the rate of inbreeding is inversely proportional to the genetically effective population size (N_E), the recent successes in increasing the size of the breeding population appear to have mitigated the potential influence of inbreeding depression. This seems likely because approximately 95% of the genetic variation observed in the population upon its rediscovery is present among hatchlings that have been sampled in recent years.

Laboratory analyses and the completion of Mr. Rasberry's thesis are eagerly awaited, and will contribute greatly to future efforts aimed at managing the Jamaican iguana population – both *in situ* and *ex situ*.

Future: Genetic management of the population is essential, especially for selection of potential founders for new populations (e.g., Goat Islands). DNA samples should be obtained whenever possible.

4. *Locate new iguana nesting sites and, if possible, collect new genetic material to invigorate the existing captive population.*

Activities undertaken: No new nesting areas were discovered, but several known nesting sites outside of the core nesting area were monitored with camera traps (N=11 units in total), and results were similar to previous years: mongoose predation (see discussion below).

Results: Amazing images have verified both the long-assumed carnage attributable to mongoose predation, and the importance of maintaining and expanding an IAS trap-removal programme. Specifically, camera trap monitoring indicates that nest loss attributable to the mongoose can reach 100% in areas with no predator control. These observations also underscore the importance of a rapid initiation of the Goat Islands rehabilitation and iguana re-introduction project.

Future: This activity should be continued if possible. (NB: camera trap units will be in used through 2014 as part of R. van Veen’s UWI thesis research)

5. Daily monitoring of known iguana nesting areas to assess nesting composition and nest position.

Activities undertaken: Primary nesting areas were observed daily from hides constructed adjacent to the monitored, communal nesting areas, and identities of nesting females and deposited nests were recorded. Like 2012, 2013 was an early nesting season, and intensive monitoring of nesting areas began in early-mid May.

Results: 2013 was another record year, with 53 female iguanas depositing clutches in the monitored communal nesting areas (= UNS, LNS and secondary LNS; see Figure 1). Given that only eight or nine females nested in 1991, the first year of nest site monitoring, our 2013 results indicate that the remnant breeding population has increased 6-fold in the past 20 years – presumably due to intensive recovery efforts. Also noteworthy is the observation that more than half of this breeding population consists of repatriated, headstarted individuals – clearly demonstrating the efficacy of this technique for mitigating the impact of IAS predators.

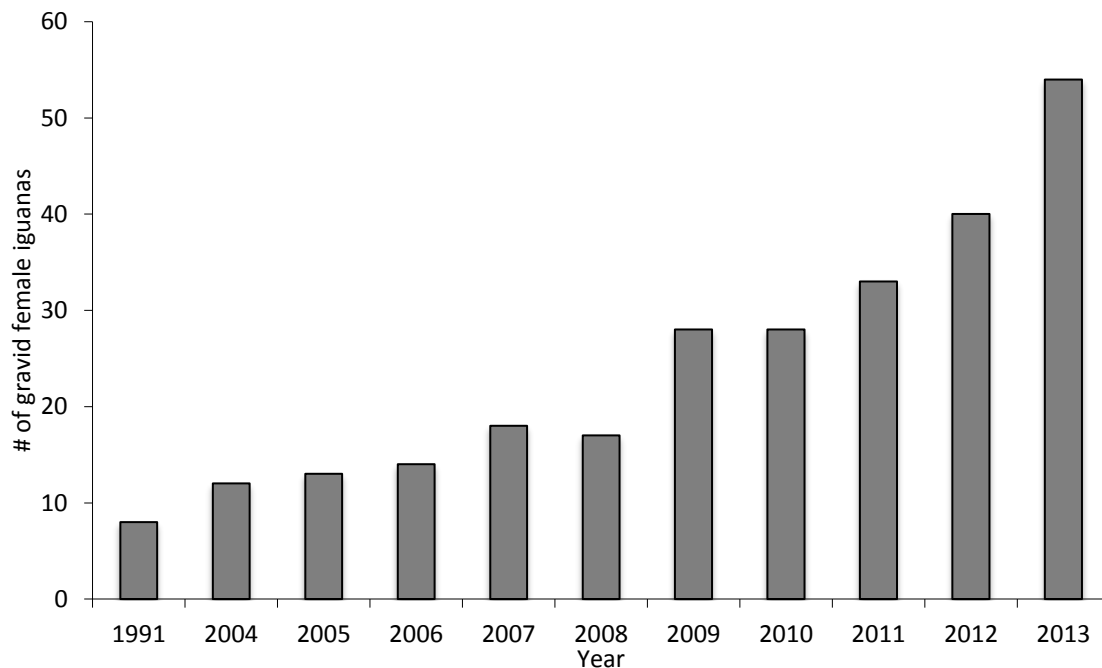


Figure 1. Number of gravid females recorded as nesting in the monitored, communal nesting areas.

Also noteworthy was the use (2 successful nests in 2013) of the artificial nesting area that was completed in 2012. It will be interesting to follow the future success of this intervention, but evidence to date, together with the longer-term success of the 'accidental' artificial nesting area at South Camp, suggest that the construction of additional nesting areas in predator-controlled zones would enhance both nesting and nesting success.

Future: This activity could be very beneficial to the future recovery effort; additional artificial nesting areas should be constructed in core, predator-controlled area.

6. *Erect nesting site enclosures to protect and collect hatchling iguanas.*

Activities undertaken: Nest site surrounds were erected around the three monitored communal nesting areas early in 2013 – beginning in the 2nd week of August – in anticipation of an exceptionally early hatching season.

Results: Representative hatchlings from multiple nests were sampled; given the large number of successful clutches, it was not possible to determine the number of successful clutches, but a conservative estimate, based on the number of hatchlings enumerated (plus estimated contributions from a few clutches known to have hatched outside of, or escaped from the surrounds), would be over 40 – a rate of hatching success comparable to previous estimates (roughly >80%).

Future: This activity is critical to the recovery effort, and constitutes the main index for assessing trends in iguana population size.

7. *Daily monitoring of nesting areas, processing of hatchlings; transfer of N=40 hatchlings to the Hope Zoo headstart facility.*

Activities undertaken: Nest site enclosures were checked a minimum of 2-3 times daily throughout the hatching season (mid August up to mid September, and ~every 1-3 days until the end of September). All hatchlings found within enclosures were collected and processed (weighed, measured, PIT tagged, blood sampled).

Results: A total of 320 hatchlings were collected and processed. 42 hatchlings were transported to the Hope Zoo for headstarting; the remaining 278 individuals were released at their site of capture.

Future: This activity is critical to the recovery effort and to the maintenance of the headstart programme.

8. Continuation of annual pitfall trap surveys to index abundance of terrestrial vertebrates and large arthropods in core iguana area – serves as both a long-term monitoring exercise and a field experiment testing the efficacy of predator control as a conservation tactic.

Activities undertaken: All 64 assessment traps were opened on 8 February 2013 and checked daily until being closed on 16 March 2013. As per the previous 16 years, traps were again opened on 27 March and checked daily until being closed for the season on 8 April. Thus, we completed a 17th consecutive year of this novel experiment.

Results: On capture, targeted species (e.g., most ground lizards) were measured (SVL), weighed, assigned a unique toe-clip combination, and released. Other reptiles and arthropods were enumerated and released. In addition to targeted native species, we also recorded the presence of IAS, especially cane toads, rats, and mice. These data will be used to assess changes in the populations of these non-native species, particularly in relation to on-going predator control activities. In all, several thousand records were generated and have now been entered into the master EXCEL file. Analyses of these data are underway, in conjunction with the Climate Change Group (Physics Department, UWI), and will provide novel information on potential changes in faunal abundance in light of the impacts of Global Climate Change.

Postgraduate student Ms. Kimberley Stephenson has been conducting these analyses, and she was successful with her PhD up-grade in early 2013. This research project aims to map and project the climate of Hellshire, and to develop a model to project future abundance of arthropods and lizards, based on the current influence of rainfall, temperature and relative humidity. Preliminary findings show strong influences of seasonal rainfall and temperature on abundance, particularly the affect of the late rainy season. Findings also indicate that predictive equations can be constructed using climate variables and interspecies relationships for even a small population, and can explain most of the variance in population size. The ultimate goal of the project is to identify the vulnerability of the study site to the affects of the shifting climate of the island and, by extension, to consider future conservation needs.

Future: This effort represents the longest running terrestrial fauna monitoring programme on the island. Given the specter of Global Climate Change, it is recommended that this activity be continued as a tool for detecting long-term trends in biodiversity. And while not essential to the recovery of the iguana, this activity requires field workers to patrol northern portions of the iguana area; hence, it benefits the iguana project indirectly by increasing observer presence.

9. *Continue baseline, pre-eradication surveys of the Goat Islands, including the establishment of vegetation plots to monitor post-eradication responses.*

Activities undertaken: No field activities were undertaken on this objective, with the exception of botanical surveys conducted by colleagues from the Botanical Research Institute of Texas.

Results: Because the Goat Islands project never received the requisite government approval, it never got off the ground, and ultimately, the MTIASIC project took the decision to cancel the planned Goat Island eradication and iguana re-introduction activities that it was to have supported. Given the importance of this objective to the long-term survival of the iguana, and given its stated priority in NEPA's National Strategy and Action Plan on Biodiversity for Jamaica, failure to realize the initiation of this project was a major disappointment to the JIRG and to international collaborators and funding partners.

Future: Recommend that NEPA act on their National Strategy and Action Plan on Biodiversity for Jamaica...and initiate this long overdue project.

10. *Repatriation of headstarted iguanas back into the Hellshire Hills.*

Activities undertaken: The annual iguana health screening and 'headstarter' repatriation exercise was conducted in April 2013, and was spearheaded by Tandora Grant, the IUCN -- Iguana Specialist Group's Program Coordinator and Red List Authority. With excellent veterinary support provided by Dr. Carlos Sanchez (Fort Worth Zoo), and with support from vet tech Sherri Hughes (National Zoo, Washington D.C. [Smithsonian]) and Evert Henningheim (Dutch Iguana Foundation), the team worked with Hope Zoo staff to health screen a total of 243 iguanas housed at the facility.

Results: Ultimately, 52 headstarters were selected for repatriation, and all were returned to their birth place in the central Hellshire Hills. The historic release of the 2013 cohort (N=52) brought to 226, the number of headstarted iguanas that have been repatriated back into Hellshire.

Future: This activity is critical to recovering the Hellshire iguana population; releases should also begin on the Goat Islands, after appropriate IAS eradications.

11. *Continue monitoring (1-3 times per week) ~3 km of coastline fringing the iguana conservation zone.*

Activities undertaken: All five (5) sea turtle index beaches were surveyed a minimum of once per week during the November 2012 to October 2013 period.

Results: Although sea turtle activity was meager, and most nests continue to be depredated by IAS, this exercise remains one of the more important activities necessary to ensure the success of the overall iguana recovery project. Beginning in 2004, these regular patrols of the iguana forest's southern boundary have amounted to providing the ranger patrols that are otherwise absent from this 'protected' area. Indeed, even more frequent (than weekly) patrols should be a critical management activity conducted by the relevant management authority, once such an entity is identified.

Future: Although not directly required for continuing the iguana recovery, this activity represents the only early warning system for incursions into the iguana forest from the coast. Given that such incursions occur periodically, these patrols represent a critical means of detecting and reporting infractions. Ideally, this activity would be expanded to several days per week.

12. *Continue Hellshire forest structure and regeneration project.*

Activities undertaken: Postgraduate student Adit Sharma successfully up-graded to a PhD in 2013, and has now completed data collection for his thesis, except for one component. Mr. Sharma will use an IRGA (infrared gas analyzer) to assess seedling ecophysiology and separate species into functional types. This effort is part of an analysis of change over time, in the prevalence of different functional types, in response to deforestation and/or climate change.

Results: Currently under analysis.

Future: Critical research nearly completed; follow-up research (e.g., on long-term trends) desirable, but not essential to recovery efforts directed at the iguana.

13. *Continue up-grading remote field station in Hellshire.*

Activities undertaken: Basic maintenance and a few minor up-grade efforts were completed during the period.

Results: Aside from basic maintenance, including the harvesting and storage of rain water, the only notable improvement was the rat-proofing the main food storage area.

Future: A critical component of the recovery effort is simply providing a presence in the forest; in all likelihood the core iguana area would have been burned down by now, were it not for the near constant presence of the iguana team in the area. Maintaining a comfortable, livable camp is a requirement for extended living in the forest. This objective should not be trivialized; rather, an emphasis should be placed on camp maintenance, and on encouraging workers to remain in the forest as much as possible.

15. *Continue surveys aimed at delimiting the iguana's distribution within Hellshire, and generating the first-ever quantitative estimate of population size based on mark-recapture data.*

Activities undertaken: Iguana team members were in the field in Hellshire during most days and every week of the 12-month period. Particularly during the nesting season assessments, efforts were made to trap iguanas (in addition to the live predator traps in continuous operation). Toward that end, 2013 saw a record number of captures in a single month, with 100 iguana captures recorded for the month of June.

Results: In all, 383 iguana captures were recorded during the period – an average of an iguana a day, and a new record. These records will be added to the long-term data set, and their analysis to generate a quantitative estimate of population size will constitute a chapter in the thesis of Rick van Veen, the completion of which is anticipated in 2014.

Future: This activity is critical to long-term monitoring of the iguana population.

16. *Deploy camera traps to gather information on species abundance, distribution patterns, and behavior.*

Activities undertaken: Reconyx Hyperfire camera traps (up to 23 simultaneously), were deployed throughout the iguana conservation zone during the period. Aside from traps stationed at nesting areas during the nesting season, the primary objective was to continue gathering image data to index the abundance of both native species and IAS in relation to our predator control efforts. Our pitfall trapping experiment was designed to index the relative abundance of small terrestrial species; use of camera traps is allowing us to index the relative abundance of larger species, particularly the endemic iguana and hutia, as well as various IAS predators (mongoose, cat, dog, pig). Of course, this effort also assists in delineating the distribution of the iguana population, and provides supplementary information for demographic analysis.

Results: In all, literally thousands of faunal images have been obtained, and the analysis is tedious, and on-going. Preliminary results however, have been

obvious, and astounding. Most importantly, and as expected, camera trap data will confirm the experimental reduction in mongoose density due to trapping and removal, and have already highlighted the exceedingly high rates of nest loss due to mongooses in areas not protected by removal trapping.

In addition to the demographic and distribution data obtained for the iguana, camera traps have also captured phenomenal images of iguana behavior (including mating), temporal data (i.e., activity times) and other natural history information for various species (such as the little known Jamaican hutia), and other incidents of management importance (e.g., a cat eating a Blue-tailed Galliwasp; mongoose raiding iguana nest in the dark of early morning).

Future: Although not critical to the iguana recovery effort, monitoring long-term trends in faunal abundance and assessing long-term impacts of predator control are worthy research goals, and would benefit from the continuation of camera trapping.

2010-2013: Three years of recovery activity

As mentioned in the Preamble, an explicit obligation and objective of this report is to summarize work completed during the MTIASIC project, which supported JIRG activities for the period June 2010 – September 2013. Of course, project work and significant developments have occurred since the cessation of MTIASIC funding, and for completeness, this 2010-2013 summary will include the period October-December 2013. In addition to summarizing results for the most critical project objectives, this section will also provide a discussion of current conservation challenges.

Primary Objectives

1) ***Mitigating the impact of IAS predators on the remnant Jamaican iguana population I: predator control.***

A major objective of the MTIASIC project was to maintain and expand the predator (IAS) trapping programme to provide enhanced protection to threatened endemic species such as the iguana. At the time of this writing (January 2014), the planned expansion is nearly complete. The effort, which entailed cutting walk-able trails enclosing (on the east and west) the core iguana area, was a massive undertaking by the field crew. All recently obtained mongoose/cat traps (from the MTIASIC project) have now been hand carried into the core area, and the last ~100 traps are now being positioned along the recently completed 'Eastern Loop'. The 'Western Loop' has been operational since December 2012.

2) ***Mitigating the impact of IAS predators on the remnant Jamaican iguana population II: headstart-release.***

At a workshop to revise the Species Recovery Plan (SRP) for the Jamaican iguana (Kingston, 2006) it was agreed upon to expand the headstart programme

by doubling the number of hatchlings harvested annually (from 20 to 40), and ultimately, double the number of headstarters repatriated into Hellshire on an annual basis. So beginning in 2007, the field team has collected 40-40+ hatchlings for the Hope Zoo headstart programme, and 2013's record release of 52 iguanas is proof of the improved efficacy of this expanded programme.

3) ***Protect and monitor primary communal nesting sites.***

This effort, integral to #2, above, results in two outcomes: First, intensive IAS trapping and human presence provide significant protection to these critically important nesting areas. Second, our most valuable index of iguana abundance is the number of females using these same monitored nesting areas; this, because these two sites were subjected to detailed investigation in 1991, and provide our only 'window' into the iguana population at the time of its re-discovery. Hence, our index of success, and proxy for overall iguana abundance, is the number of females depositing nests at the same sites monitored by Vogel et al. in 1991 (published in 1994; Carib. J. Sci.).

Vogel et al. (1994) confirmed that 6 females laid eggs in 1991, and several other gravid females (up to 3) were observed in the area but not documented as laying eggs at the monitored nests. Based on this index of abundance, the core nesting population has increased 6-fold since 1991, and has nearly doubled since 2010, the beginning of the MTIASIC project.

The number of hatchlings harvested is dependent on several factors, including the number of nests deposited, average clutch size, hatching success, and of course, harvesting success. Nevertheless, with the exception of years during which harvesting efficiency was compromised by tropical storms or bad luck, the number of hatchlings enumerated has steadily increased in concert with the increasing number of females depositing nests. For example, in 2010 a total of 216 hatchlings were collected and processed; in 2013 that number had increased to 320 – a 50% increase!

Conservation challenges

Woodley (1971) long ago articulated the major conservation challenges facing the iguana: IAS predators, charcoal burning, and the specter of large scale development projects. As detailed above, the biological interventions aimed at mitigating the impact of IAS predators have been demonstrably effective, with the core breeding population increasing by a factor of six (6) since conservation activities were initiated in 1991.

Unfortunately, essentially nothing has been done to ameliorate or eliminate the potentially catastrophic threats posed by charcoal burning and large scale development projects.

Charcoal burning

2010-2013 was another horrible time to be a tree in the Hellshire Hills Forest Reserve. Although charcoal burning and illegal tree cutting for other purposes (e.g., fence posts, fish pot sticks) have progressed unchecked for decades, two recent episodes stand out as noteworthy. First, in 2011, a chain saw was heard from the field station 'South Camp' -- for the first time since the station's establishment in 1997. This served as a sobering reminder that the destruction of the remaining primary forest is progressing steadily, and will eventually reach the most sensitive iguana areas. To be sure, much of what was formerly considered the 'core iguana zone' has now been degraded by charcoal burning.

In response to our reports of chain saw activity, the agency with responsibility, NEPA, suggested that the problem was due to the JIRG's use of the sea/coast to access the iguana area from the south, and suggested that the iguana team (including postgrad students) re-involve charcoal burners (operating to the north) in the project, as was done in the early days of the project. Given that this assessment and recommendation came from the enforcement branch of the agency, it was disappointing on two fronts. First, it has been obvious for a long time that the original use of charcoal burners was perhaps necessary, initially at least, but ultimately led to damage to the forest. It didn't work. Indeed, those 'iguana workers' contributed to significant habitat damage in the core area as a direct result of their involvement in the iguana project. Second, the enforcement of the Wild Life Protection and Forestry Acts should not be the responsibility of UWI researchers; rather, it should be the responsibility of the relevant agency (or agencies). So the suggestion that UWI workers and students perform a security and enforcement task came as disappointing commentary, because it suggests that the authorities currently have no capacity or willingness to manage the area.

2013 brought yet another charcoal crisis to light. After much pressure to 'do something' about the charcoal burning issue, NEPA organized a helicopter and ground survey effort involving the UDC and Forestry Department. The results were presented at a NEPA brief in June, and the conclusions were that: (1) there was no problem with charcoal burning in the core iguana area, and (2) much of the forest, especially to the north of the iguana zone, appeared to be healthy, recovering secondary forest.

Because both of those conclusions were erroneous, the JIRG, in collaboration with the Jamaica Environment Trust (JET) organized an independent helicopter survey and obtained high quality (professional) images of active charcoal burning within one aerial mile of the monitored, communal nesting areas of the iguana. Again rather than address what has been an obvious problem for decades, and a major threat to the iguana's persistence, the relevant agency appears to be in denial. Indeed, subsequent discussions, for example during the November IUCN-ISG meeting, confirm that no agency is willing to take responsibility for

enforcing tree cutting laws in Hellshire, and as a result, the area will continue to be cut down and burned...every day of the year.

Large scale development projects

The 'big news' of 2013 of course, was the announcement in August that the Government of Jamaica was in discussions with Chinese investors, and was giving serious consideration to the investor's plans to construct a trans-shipment port on the Goat Islands. The plan has been shrouded in much secrecy, but if true, and if it were to come to fruition, it would eliminate the iguana's best hope for survival (i.e., an IAS-free Goat Islands reserve), and almost certainly lead to the destruction of the adjacent Hellshire Hills dry forest ecosystem – home to the iguana's only remaining wild population.

This 'development', and the potential for the complete devastation of the Goat Islands-Cabarita Swamp-Hellshire Hills ecosystem, is fast becoming the biggest environmental battle the island has ever seen. And so it should be. Aside from knowingly driving a species to almost certain extinction, the destruction of the Goat Islands and associated portions of the Portland Bight Protected Area could fatally undermine the country's protected areas system, result in a major loss of international funding for environmental projects, and perhaps cripple the tourism industry. In short, destroying the island's largest and arguably most important protected area won't improve the island's image as 'the land of wood and water'. In terms of potential species extinctions and other losses (e.g., ecosystem services such as fish nurseries), the Goat Islands trans-shipment port idea is about the most environmentally damaging and unsustainable proposal tabled in recent times, perhaps the most damaging ever.

Other Project Accomplishments (2010-2013)

Publications related to iguana project or general IAS issues

Books

Hailey, A., B. S. Wilson, and J.A. Horrocks (eds.). 2011. Conservation of Caribbean Island Herpetofaunas. Volume 1: Conservation Biology and the Wider Caribbean. Brill, Leiden. 224 pp.

Hailey, A., B. S. Wilson, and J.A. Horrocks (eds.). 2011. Conservation of Caribbean Island Herpetofaunas. Volume 2: Regional Accounts of the West Indies. Brill, Leiden. 440 pp.

Chapters in Books

Wilson, B.S. 2011. Conservation of Jamaican amphibians and reptiles. Pages 273-310 *in* A. Hailey, B. S. Wilson, and J. A. Horrocks (eds.), Conservation of Caribbean Island Herpetofaunas. Volume 2: Regional Accounts of the West Indies. Brill, Leiden.

Wilson, B. S., J. A. Horrocks, and A. Hailey. 2011. Introduction: Conservation of insular herpetofaunas in the West Indies. Pages 3-17 *in* A. Hailey, B. S. Wilson,

and J. A. Horrocks (eds.), Conservation of Caribbean island herpetofaunas: conservation biology and the Wider Caribbean. Brill, Leiden. (reprinted from Applied Herpetology 3:181-195).

Refereed Journal Articles

- Parham, J.F., T. J. Papenfuss, P. P. van Dijk, B. S. Wilson, C. Marte, L. R. Schettino, and W. B. Simison. 2013. Genetic introgression and hybridization in Antillean freshwater turtles (*Trachemys*) revealed by coalescent analyses of mitochondrial and cloned nuclear markers. *Molecular Phylogenetics and Evolution* 67:176-187.
- Bohm, M., et al. 2013. The conservation status of the World's reptiles. *Biological Conservation* 157:372-385.
- Wilson, B., T. Edwards, and R. Powell. 2012. Pages 126-128 in: Island lists of West Indian amphibians and reptiles (R. Powell and R. W. Henderson, Eds.). *Bulletin of the Florida Museum of Natural History* 51(2):85-166.
- Holmes, I., K. McLaren, and B. Wilson. 2012. Surveys for frog diversity and *Batrachochytrium dendrobatidis* in Jamaica. *Herpetological Review* 43:278-282.
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- Lewis, D.S., van Veen, R., and B.S. Wilson. 2010. Conservation implications of small Indian mongoose (*Herpestes auropunctatus*) predation in a hotspot within a hotspot: the Hellshire Hills, Jamaica. *Biological Invasions* 13:25-33.

Abstracts

- Johnson, J. N., B. Wilson, and R. Robinson. 2012. Surveillance of the parasitic fauna of the cane toad, *Bufo marinus* (Anura: Bufonidae), in Mona, St. Andrew, Jamaica. Proceedings of the Ninth Conference: Faculty of Pure and Applied Sciences, University of the West Indies, Mona, April 13-15.
- Welch, M.E., A. Rasberry, T. Grant, R. van Veen, O. Robinson, D. Fleuchaus, and B. Wilson. 2012. POSTER. Assessing the Genetic Impact of Headstarting and Potential for Mitigation in the Jamaican Iguana, *Cyclura collei*. 7th World Congress of Herpetology. August 8-14, Vancouver, British Columbia, Canada.
- Welch, M.E., A. Rasberry, T. Grant, R. van Veen, and B. Wilson. 2011 Assessing the Genetic Impact of Headstarting on Jamaican Iguanas (*Cyclura collei*) in the Hellshire Hills. 14th Annual IUCN SSC Iguana Specialist Group Meeting. November 13-17, Antigua, Guatemala.

Non-refereed research based/scholarly publications

- Grant, T., Pagni, L. and Wilson, B. (eds.). 2013. Jamaican Iguana: Species Recovery Plan, 2006—2013. IUCN SSC Iguana Specialist Group, Gland, Switzerland.
- Grant, T. D., Gibson, R. & Wilson, B. S. 2010. *Cyclura collei*. In: IUCN 2010. IUCN Red List of Threatened Species. Version 2010.4. <www.iucnredlist.org>. Downloaded on 27 October 2010.

Honours/awards

- 2013** Jamaica Environmental Action Award (Wildlife Conservation category); awarded by the Jamaica Environment Trust (JET) to the Jamaican Iguana Recovery Group.
- 2012** The Principal's Research Day Award for the "Best Researcher," Faculty of Pure and Applied Sciences, UWI, Mona, Research Day 2012 (shared with M. Taylor)
- 2012** The Principal's Research Day Award for the "Best Publication," Faculty of Pure and Applied Sciences, UWI, Mona, Research Day 2012 (Dr. McLaren's excellent paper on the antiquity of the Hellshire forest).
- 2011** Jamaica Environmental Action Award (Wildlife Conservation category); awarded by the Jamaica Environment Trust (JET) to the Jamaican Iguana Recovery Group.

Special Presentations and Invited Lectures

- 2012** Invited lecture (and Co-Chair of panel) for SALISES 50/50 conference at the Pegasus, Kingston. See appendix XX for media coverage.
- 2012** Invited lecture on threatened Jamaican species for an "Afternoon with a Scientist" programme at the Institute of Jamaica (four primary schools in attendance)
- 2012** Invited lecture on threatened Jamaican species to the St. Andrew High School for Girls Environmental Club annual induction ceremony
- 2011** 7th Annual EFJ Public Lecture. On the brink of extinction: saving Jamaica's vanishing species. The Pegasus, Kingston.

Other Oral Presentations

- 2013** Taxon report for Jamaican Iguana, at the annual meeting of the IUCN Iguana Specialist Group, in Kingston, Jamaica.
- 2013** Symposium presentation at workshop Co-hosted by UWI, Hope Zoo, IUCN-ISG, and NEPA, Kingston. Talk on the future of the Jamaican iguana and the Hellshire Hills.
- 2012** Taxon report for Jamaican Iguana, at the annual meeting of the IUCN Iguana Specialist Group, in Huatulco, Mexico.
- 2011** Taxon report for Jamaican Iguana, at the annual meeting of the IUCN Iguana Specialist Group, in Antigua, Guatemala.
- 2010** Taxon report for Jamaican Iguana, at the annual meeting of the IUCN Iguana Specialist Group, in Cuba.

Media Interviews and presentations related to pilot iguana project or IAS/biodiversity issues (B. Wilson)

- 2013** Love 101 radio interview about Jamaican iguana
- 2013** Live interview on CVM TV Live at 7 (via skype – on the Goat Islands)

- 2013** RJR radio interview about Goat Islands issue
- 2013** Love 101 radio interview about the Goat Islands issue
- 2013** Hot 2012 FM radio interview about the Goat Islands issue
- 2013** Radio interview for RJR, on issue of charcoal burning
- 2012** Radio interview on iguanas, for 'The Current', a CBC (Canada) radio programme
- 2012** Letter to the editor of the OBSERVER on funding teak farms
- 2011** Love 101 radio interview about biodiversity issues
- 2011** Live studio interview for TVJ's "Smile Jamaica" programme
- 2011** Radio interview with RJR regarding threatened species
- 2011** Live studio interview about biodiversity, for CVM TV evening show
- 2011** Radio interview regarding EFJ annual lecture/biodiversity issues

Workshops

- 2013** Hosted, as Head of the JIRG and UWI representative, the annual IUCN-Iguana Specialist Group meeting, in Kingston (November 14-15, at the Hotel Four Seasons)
- 2013** Co-hosted (with Hope Zoo, NEPA, and IUCN-ISG) 2-day symposium/workshop focused on the Jamaican iguana and its remaining habitat (November 12-13, at the Hope Zoo; see **Appendix A** for abbreviated list of presentations)

Grants and Funding Awards

- 2013** Disney Worldwide Conservation Fund (\$25,000U.S.); submitted through IIF): conservation of the Jamaican iguana (on-going).
- 2012** Disney Worldwide Conservation Fund (\$25,000U.S.); submitted through IIF): Conservation of the Jamaican Iguana.
- 2012** Mohamed bin Zayed Species Conservation Fund (\$10,000U.S.; Co-PI with PI M. Welsh): Conservation genetics of three *Cyclura* species (on-going).
- 2011** Disney Worldwide Conservation Fund (\$25,000U.S.; submitted through IFF): Conservation of the Jamaican Iguana.
- 2011** Mohamed bin Zayed Conservation Fund (\$3,000U.S.; Co-PI with I. Holmes): Conservation of Jamaican amphibians and ecology of the invasive chytrid fungus.
- 2011** MiamiMetro Zoo (\$5000U.S.; Co-PI with I. Holmes): Conservation of Jamaican amphibians – invasive chytrid fungus surveys.
- 2011** Fresno Chaffe Zoo Conservation Fund (\$1213U.S.; Co-PI with PI T. Grant): Genetic analysis of the Jamaican iguana (on-going).
- 2010** MacArthur Foundation (\$340,000U.S; Co-PI, with PI. K. McLaren): Conservation of the Cockpit Country and Black River Lower Morass (on-going).
- 2010** Anonymous Foundation (\$45,000U.S.; through the International Iguana Foundation (IIF), with Co-PI R. Hudson): Conservation of the Jamaican Iguana (on-going).
- 2010** Fort Worth Zoo (\$2500U.S.; Co-PI with I. Holmes): Conservation of Jamaican amphibians and ecology of the invasive chytrid fungus.
- 2010** Mohamed bin Zayed Conservation Fund (\$25,000U.S.; submitted through IIF): Conservation of the Jamaican Iguana and Hellshire Hills.
- 2010** Mohamed bin Zayed Species Conservation Fund (\$4,981U.S.; Co-PI with PI M. Welsh): Conservation genetics of the Jamaican iguana (on-going).

2010 Beneficia Foundation (\$10,000U.S.; Co-PI with R. Hudson): Conservation of the Jamaican Iguana – for use on Goat Islands rehabilitation and iguana re-introduction project.

Appendix A

Conservation of the Jamaican iguana and its remaining natural habitat

Workshop hosted by the University of the West Indies, Mona, the Hope Zoo, and NEPA

In collaboration with the IUCN-Iguana Specialist Group

12-13 November 2013, Hope Zoological Gardens

Abbreviated Schedule for Day One (12 November): Jamaican iguana/Hellshire Hills Symposium (to be published as a special volume of *Caribbean Naturalist*)

- 0925 Introduction of Plenary Speaker – Stesha Pasachnik
- 0930 Plenary Talk – Blair Hedges
- 1015 Thanks to Blair – Stesha Pasachnik

- 1020 Coffee Break

- 1040 History of Jamaican iguana recovery effort – Rick Hudson
- 1110 History, value, and future of Hellshire -- Byron Wilson
- 1130 Geology and geomorphology of Hellshire Hills – Simon Mitchell and David Miller
- 1150 Cultural history of Hellshire -- Andrew Pearson
- 1210 Botanical inventory of Hellshire Hills -- Amanda Neil
- 1230 Forest ecology and impacts of charcoal burning -- Kurt McLaren
- 1250 Climate change impacts on the Hellshire fauna -- Kimberly Stephenson

- 1310 Lunch

- 1415 Introduction to afternoon session – Chuck Knapp
- 1420 Overview of captive population and headstarting programme -- Tandora Grant
- 1440 Ecology and status of the Jamaican iguana in the wild -- Rick van Veen
- 1500 *C. collei* management: genetic issues (Mark Welch)
- 1515 Closing comments and introduction to Hope Zoo tour – Orlando Robinson
- 1530 Tour of Hope Zoo, refreshments