



IUCN SSC Iguana Specialist Group Annual Meeting
Fort Worth Zoo, Texas, USA
4–8 November 2018

ORAL PRESENTATION ABSTRACTS

In alphabetical order by author's last name, presenter denoted by *

Long-term Monitoring Program of Lesser Antillean Iguana (*Iguana delicatissima*) Populations in French West Indies

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The Lesser Antillean Iguana (*Iguana delicatissima*) has been updated in the IUCN Red List as Critically Endangered in 2018. It only survives in a few islands in the Lesser Antilles. French West Indies islands are home to several populations of this species that are mainly threatened by competition and hybridization with the Common Green Iguana (*Iguana iguana*). Since 2012, we have implemented a yearly monitoring of three populations using Mark-Recapture method. During this period, we have tagged more than 1,000 iguanas in each population. We estimate yearly abundance for adult iguanas. These surveys also allowed us to evaluate the frequency and evolution of health problems, parasitism, and variations in length and mass in iguanas. We are currently using the data from our Mark-Recapture protocol in a study of the dynamics of those populations.

2018 Update for the Anegada Iguana, *Cyclura pinguis*, Conservation Program

Bradley, Kelly*

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The Anegada Iguana program is entering its 21st year, and is centered on headstarting iguanas to combat high juvenile mortality due to the presence of feral cats. Unfortunately, Hurricanes Irma and Maria devastated the entire British Virgin Islands (BVI) in September 2017. One year later the territory is still facing serious challenges as it works to recover pre-storm conditions. The Fort Worth Zoo is working with our in-country partners the National Parks Trust of the Virgin Islands to improve conditions created by the 2017 hurricane season and creating an effective disaster preparedness system. Bradley continues to supply ongoing support of the headstart program through nest surveys, hatchling collection, and release of iguanas back to the wild to ensure the

program does not lose its pre-storm momentum. Though ongoing research projects were severely interrupted, Bradley continues the long term monitoring program (camera trapping and retreat surveys) and to collaborate with the Royal Botanical Gardens, KEW to investigate iguana/flora interactions on Anegada. This presentation will highlight these activities and present the results of the sixth annual Anegada Iguana Fest.

Riding out the Storm: the Challenges Faced by *I. delicatissima* in a Post-Hurricane Dominica

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Iguana delicatissima (Lesser Antillean Iguana) is a regional endemic known to exist historically between Anguilla and Martinique. Anthropogenic threats and region-wide displacement caused by hybridization and out-competition with *Iguana iguana* (Common Green Iguana) have caused an extensive decline in this species' range to <20% of its historic area. This rapid, continuing decline led to the recent change in the species' status on the IUCN Red List to Critically Endangered (June 2018). Prior to 2018, Dominica was considered the last stronghold as the only island >2 km² with a large *I. delicatissima* population free from *I. iguana*. However, this species' safety net was severely impacted in September 2017 by the eye of the category 5 Hurricane Maria. This hurricane caused wide-spread habitat loss, food shortage, direct deaths, and an increase in poaching by locals and foreign aid workers (Forestry, Wildlife, and Parks Division, personal comm.) coupled with the ongoing road mortalities during nesting and hatchling season. It was feared that the dramatic increase in relief boats and containers from surrounding islands would allow for *Iguana iguana* to invade Dominica's shores. In April 2018, this was confirmed by the first wild sighting of a gravid female *I. iguana*, then in June by a male juvenile *I. iguana* both possessing hybrid characteristics, and again in August by another juvenile *I. iguana*. Each invasive iguana was found near ports of entry, with the gravid female located 1.3 km from the largest *I. delicatissima* communal nesting site on Dominica. A rapid outreach program was established to alert locals of the differences between the two iguana species and the dire conservation consequences Dominica's native iguanas would face if the threats were not addressed. Local conservation groups await funding to assess current iguana populations and habitat integrity post-hurricane. These efforts will help refine the current IUCN Conservation Action Plan for *I. delicatissima*.

Update on the Repatriated and Translocated Subpopulation of *Cyclura rileyi cristata* in the Exumas, The Bahamas

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Cyclura rileyi is one of three species of rock iguana endemic to the Bahamas archipelago. All species of *Cyclura* in The Bahamas are protected under the Wild Animals Protection Act 1968 and the Wildlife Conservation and Trade Act, 2004, and are listed on the IUCN Red List of Threatened Species

as Endangered or Critically Endangered and are CITES Appendix I. On 3 February 2014, 13 smuggled rock iguanas (*Cyclura rileyi cristata*) were discovered at London Heathrow Airport. Twelve of the rock iguanas were alive and one was dead. These 12 were repatriated on 9 July 2014. Three of the repatriated iguanas died within 24 hours of arrival back in The Bahamas. On 13 September 2014, the surviving iguanas were released into the wild on a selected cay within a National Park. On 26 March 2015, with the permission and support of the Bahamas Government (Bahamas Environment Science and Technology Commission) and the Bahamas National Trust, 27 *Cyclura rileyi cristata* were selected from a source cay and released on the cay with the repatriated iguanas.

The translocation brought the number of rock iguanas in that subpopulation to 36, only three of which were determined to be female. In July 2015, and March, June, and September 2016, monitoring teams found the iguanas to be growing in size and mass and they appeared healthy. The habitat was also monitored. The teams did not visit the Cay in 2017, but visited twice in 2018. Juvenile iguanas of two age groups were observed thus confirming reproduction was taking place. One juvenile was caught and processed. One of the recorded three females was caught and proved to be a male. Monitoring of this sub-population and the status of the cay will be on-going.

Effective Reproductive Isolation Mechanisms (RIMs) between *Conolophus marthae* and *C. subcristatus*: the Possible Role of Chemical Signaling for Species Recognition

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The only known population of *Conolophus marthae* and a population of *C. subcristatus* are syntopic in only one place in the Galápagos. It has been recently shown that no gene flow currently occurs between the two species and gene flow that might have occurred in the past did not impact on their genetic integrity. The above raises the issue of the existence of effective reproductive isolation mechanisms (RIMs) between *C. marthae* and *C. subcristatus*. A variety of organisms, including many reptiles, use chemical signaling for species recognition. In these species, chemical cues may be used to avoid interspecific matings, and studies have shown that chemical signals are important in preventing hybridization between congeneric species of snakes and other squamates. Femoral pore secretions have been indicated as important in chemical inter- and intraspecific communication in squamates. We hypothesized that differences in biochemical profiles should be expected between the two species if such secretions play a role as a RIM. To investigate this hypothesis, in June 2012 we collected femoral gland exudate from 146 adult individuals (74 *C. marthae* – 52 ♂ and 22 ♀, and 72 *C. subcristatus* – 40 ♂ and 32 ♀). Samples were processed using Gas Chromatography coupled with Mass Spectrometry (GC-MS). We identified a suite of over 100 different chemical compounds. Non Metric Multidimensional Scaling (nMDS) was used to graphically represent the level of similarity of sampled individuals based on their chemical profiles. Results from non-parametric statistical tests indicate that the separation between the two species is significant, suggesting that the chemical profile signatures of the two species may be involved in preventing hybridization between *C. marthae* and *C. subcristatus*. Further investigations are needed to uncover temporal patterns and variation of biochemical profiles.

Review of Accomplishments on the Biogeography and Conservation of Pacific Iguanas (*Brachylophus* sp.)

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Significant progress has been made on understanding the biology and conservation needs of the Pacific Iguanas (*Brachylophus* sp.) over the last few years. This includes the description of a fourth iguana species, restoration and recovery actions on several islands, and further discovery of new island populations. The genetic work to date indicates some complex evolutionary patterns and relict genetic diversity isolated in small populations. A series of conservation actions are outlined in the draft IUCN Recovery Plan for the genus, several of which are projected to be underway in 2019. This talk will review actions taken and those still needed to understand the biology and management options for conserving the species diversity within this highly iconic Fijian genus.

Life History Attributes of Fijian Crested Iguanas and their Food Tree Species in a Fijian Dry Forest

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The Fijian Crested Iguana (*Brachylophus vitiensis*) is a Critically Endangered species, and is common and secure on only one small (70 ha) island, the small (70 ha). We have been monitoring this arboreal species in a small, 50 m x 50 m forest quadrat (1/4 ha) using mark-recapture. Recently we captured 306 iguanas in this small forest quadrat, which suggests an abundance of around 1,200 per hectare, surely the densest population of any iguanid in the world? Fifty-three percent of those captured were recaptures from previous years, some from the first mark-recapture trip in 2005. The total population on the island is now estimated to be greater than 15,000, up from an estimated abundance of 6,000 in 1999, and continues to increase as the native forest matures and spreads into what was previously grassland. We have also monitored the growth, survival, and recruitment of all trees in this study area, 90% of which are important iguana food species. There was 9.3% recruitment and 7.4% mortality of forest trees in nine years from 2005 to 2014, with a disproportionate amount of the mortality (34%) being of one non-food species *Glochidon vitiensis*. Trunk diameter growth rate varied among species from 0.11 to 0.73 cm per year (mean = 0.16 cm per year). About 80% of the 634 trees in the area are two of the most-commonly eaten tree species, *Vavaea amicorum* and *Diospyros phlebodes*. In this immature forest, canopy height varied from 7 m to 12 m, but the largest tree was < 50 cm diameter. The majority of the favoured food trees were small at < 20 cm diameter, and the slowest growth rate was for the most abundant and important iguana food tree species, *Vavaea amicorum*.

Stories, SciComm Potential, and Conservation Research

Hedrick, David*

International Iguana Foundation

Most people in the developed world spend some portion of their daily life interacting with others and finding information in the digital realm. Generating content related to research and conservation for an audience is more important than ever. Increasingly, engaging directly with followers interactively about research is becoming part of the work itself. Telling stories and informing people are key components in the current era of science and communication.

Support from the Local Community for Long-term Conservation of an Island Endemic and Control of an Invasive Iguana in Little Cayman

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Human development can have profound negative impacts on vulnerable island ecosystems. Therefore, consistent monitoring is crucial to identify threats. *Cyclura* populations are mainly affected by habitat loss and the introduction of non-native species. The Sister Islands Rock Iguana (SIRI) (*Cyclura nubila caymanensis*) is endemic to two small, isolated islands: Little Cayman and Cayman Brac. This Critically Endangered species is threatened by limited availability of pristine nesting habitat, vehicular traffic, predation by feral mammals, and interactions with invasive Common Green Iguanas (*Iguana iguana*). It was in Little Cayman that cross-breeding between *Iguana iguana* and *Cyclura* was observed for the first time, revealing a much greater threat posed by Common Green Iguanas than previously expected.

To maintain long-term conservation efforts and continuous data collection, the Department of Environment (DoE) established an internship position based in Little Cayman. Responsibilities include monitoring and tagging rock iguanas, as well as conducting surveys during nesting and hatching seasons. Additionally, to control the Common Green Iguana population, barge inspections and night searches are regularly performed. Data collected on the native population in 2018 can be compared to data collected in previous years to infer population trends and further characterize SIRI life history. Nest counts at major survey sites have remained fairly consistent over the last four years. However, a declining trend continues to be observed at a main site on Little Cayman. Moreover, five Common Green Iguanas have been captured in 2018, including one adult female with 41 eggs and one individual discovered as stowaway on the barge from Grand Cayman.

The success of this work owes itself largely to the recruitment of volunteers, demonstrating how small-scale efforts can have large effects for conservation on a small island. Through community involvement, it was possible to increase appreciation for this unique species and thereby establish the foundation for sustainable conservation.

Project Updates from Útila Concerning Critically Endangered Útila Spiny-tailed Iguana

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Ctenosaura bakeri is a Critically Endangered iguana, endemic to the small Honduran island of Útila, part of the Bay Islands chain. As a mangrove specialist, *Ctenosaura bakeri* inhabits less than 10 km² of the 41 km² island and is threatened by habitat loss and fragmentation, hunting, hybridisation, plastic pollution, and predation from invasive species. This update will provide new information gained in 2018 to include new threats to the species, current outreach and education techniques and activities, including the creation of an environmental education internship and mobile iguana-themed recycling center.

Preliminary results from population analysis by distance sampling will give us a true idea of the population size of *C. bakeri*. From data collected in the last two years we estimate the best-case scenario to be less than 12,000 individuals, however with our 2018 data added we hope to reach a confident number in the next few months. This year, new threats are challenging the species with the discovery of an introduced and apparently established population of *Ctenosaura bakeri* to a small cay approximately 50 m from the island of Roatán (64 km east of Útila). As of yet the impact on the endemic Roatán Spiny-tailed Iguana are unknown, but hybridization could pose a prominent risk to the endangered population. Tissue samples of two individuals from the introduced population have been taken back to the University of South Wales to assess any potential hybrid status. Current DNA analysis of hybridization between *Ctenosaura bakeri* and *Ctenosaura similis* on Útila is being carried out at the University of South Wales. The first results will be available in the autumn of 2018 and will provide some answers to whether there is increased hybridization from what is previously recorded, and whether this occurs more frequently in habitat-altered areas which are occupied by both species.

Genetic Investigations into the Role of Female Choice and Promiscuity in Inbreeding Avoidance in *Cyclura nubila caymanensis*, a Historically Small and Isolated Taxon

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In natural populations susceptible to inbreeding depression, behaviors such as female promiscuity and disassortative mating may enhance the production of outbred progeny and help maintain genetic variation at the population-level. However, empirical tests of such hypotheses have largely focused on mating systems in which female choice is known to play a large role. In insular reptile populations, cryptic choice may be important for overcoming constraints on pre-copulatory choice and diversifying breeder representation. Behavioral studies of iguanids (Sauria: Iguanidae) provide mixed interpretations of the role of female choice in pre-copulatory courtship, and very little is known about the genetic outcomes of mating in wild populations. We carried out pedigree reconstructions of 50 clutches of Critically Endangered *Cyclura nubila caymanensis* to investigate the prevalence and efficacy of strategies theorized to optimize genetic compatibility among mate pairs.

We found that females mating disassortatively and multiply, but not with respect to male heterozygosity, tended to produce more heterozygous offspring on average. Pair relatedness also had a negative effect on hatching success, while additional sires positively influenced clutch size. Despite evidence for direct and indirect benefits, females did not mate with more outbred or genetically dissimilar males than expected by chance. Our data imply strong reproductive skew among males, with geographic proximity and body size largely predicting siring success. Multiple-paternity occurred in a minimum of 38% of clutches. Paradoxically, females were not more promiscuous when confronted with more males, as demonstrated at a site supporting high local densities. We deduce that small territories and access to plentiful food resources allows dominant males to be more successful at limiting females' access to additional mates. Our data imply that while female mating behaviors have the potential to confer adaptive benefits in this small population, the trajectory of mating system evolution may be largely constrained by sexual conflict.

Collecting Educational and Outreach Material

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To improve the exchange of existing educational, public awareness, and outreach material, we have decided to create a database. To do so, help is needed from other organizations and individuals to share their material. The database will include a diversity of formats and will be divided in searchable categories. The main purpose of this collection is to help out conservation programs, searching for ways to involve the community in order to benefit iguana conservation.

Personality, Behavioral Syndromes, and Social Networks in the Common Spiny-tailed Iguana, *Ctenosaura similis*

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Social structure complexities of reptile groups are poorly known, yet social cohorts may influence mate choice, foraging and nesting sites, predator avoidance, and disease transmission. To address this dearth of information, I examined the influence of personality, network position, and genetic relatedness on a group of free-ranging Common Spiny-tailed Iguanas (*Ctenosaura similis*). These social (but non-cooperative) animals form stable aggregations (>5 years) and shape complex relationships through repeated, non-random interactions. During four field seasons, ~28 lizards wore solar-powered physical proximity tags for six weeks, recording associations when lizards were ≤ 2 meters from each other. Observed networks were analyzed for individual characteristics and overall group measures. To evaluate personality and behavioral syndromes, lizards were assayed via flight initiation distance, arena tests, and observed agnostic encounters with conspecifics. There is strong support for personalities and a boldness/aggression behavioral syndrome in *C. similis*, stable across four seasons. Social network positions, however, fluctuate by season as animals assume different roles. Females associations with other females remain

constant during but differ between seasons, perhaps indicating less need to remain near a preferred mate. Social network analysis demonstrates high group density, yet animal disappearances across seasons were not rapidly filled, possibly weakening group predator avoidance, foraging information, and mate acquisition. This suggests targeted individual removal may deteriorate the social structure, and offers a way to control *C. similis* where it is an invasive species. This is the first large-scale study to look at personality and social network structure in an egg-laying, neotropical lizard. Species that exhibit facultative group formation offer important insights into conditions in which sociality emerges. As an IUCN Red List species of Least Concern, this proxy lizard may reveal social structure characteristics and complexities needed to support a self-perpetuating population of endangered iguanas.

A New Era for the Jamaican Rock Iguana, *Cyclura collei*: Program Improvements for a Brighter Future

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The endemic Jamaican Iguana (*Cyclura collei*) was considered extinct by the 1940s, due to habitat conversion and Invasive Alien Species (IAS). Its rediscovery in 1990 galvanized the zoo and conservation community to develop an extensive recovery effort. The first 20 years of work focused on building IAS control and iguana headstart programs, and nest site protection. These efforts were led by the University of the West Indies until 2013 when the Jamaican government's National Environmental Planning Agency (NEPA) took over the program. Since 2016, the Fort Worth Zoo and International Iguana Foundation have been working closely with NEPA and the Hope Zoo to improve the program and support a more sustainable and rapidly growing population. Previous to 2017, a maximum of 40 hatchlings were brought into the headstart program each year and the turnover rate averaged 5–8 years. In 2017, we built 30 new cages and brought in over 70 hatchlings. This year we are on track to house at least 100 hatchlings. We also revamped the captive diet and expect the turnover rate to be three years in the near future. Indeed, this year we will have a second release, totaling nearly 80 individuals for the year. In Hellshire we are conducting intensive radio tracking to better understand post-release behavior and design a plan for increasing the IAS control zone. To date the program only protects a small core area, IAS incursions are common, and natural recruitment is virtually zero. Advanced methods that incorporate a buffer zone with varied trap and bait types will ensure the level of protection needed for recruitment and population growth. Lastly, the Hellshire base camp space has been greatly improved, with nearly double the space and solar power, making it accessible for additional researchers in what is a vastly growing program.

Semen Collection, Characterization, and Short-term Extensions in Grand Cayman Rock Iguana Hybrids (*Cyclura lewisi x nubila*) and Rhinoceros Rock Iguana (*Cyclura cornuta*)

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Semen collection utilizing electroejaculation (EEJ) while anesthetized has been repeatedly performed successfully in Common Green Iguanas (*Iguana iguana*). The objective of this study was to electroejaculate Grand Cayman Rock Iguana hybrids (*Cyclura lewisi x nubila*) and Rhinoceros Rock Iguanas (*Cyclura cornuta*) to characterize their semen, evaluate short-term semen extension, estimate testicular volume utilizing ultrasonography, determine plasma testosterone concentrations, and provide an alternative anesthetic protocol for EEJ. Electroejaculation was performed on *Cyclura cornuta* and *Cyclura lewisi x nubila* at two different times. Initial collection attempts were successful in *Cyclura lewisi x nubila* (5/5 EEJ events) while unsuccessful in *Cyclura cornuta* (0/7 EEJ events). *Cyclura lewisi x nubila* (0/8 EEJ events) and *Cyclura cornuta* (0/3 EEJ events) were again electroejaculated, 51 days following initial attempts, which were unsuccessful. Following ejaculate collection and initial semen characterization, a prospective experimental study was performed evaluating two semen extenders, INRA 96, (IVM Technologies) and Test Yolk Buffer (Irvine Scientific) in *Cyclura lewisi x nubila* at refrigeration temperature (4° C) for 72 hours. Ultrasonographic testicular measurements were obtained prior to each electroejaculation event and testicular volumes were estimated. Additionally, blood samples were taken for plasma testosterone concentrations. Plasma testosterone concentrations were determined utilizing three different immunoassays to determine the agreement between methodologies. A new safe and effective anesthetic protocol for Iguanid EEJ included premedication of dexmedetomidine (45 mcg/kg, *Cyclura cornuta* and 40 mcg/kg, *Cyclura lewisi x nubila*) and midazolam at 1 mg/kg administered subcutaneous, followed by intravenous ketamine (2mg/kg, *Cyclura cornuta* and 1 mg/kg, *Cyclura lewisi x nubila*) 15 minutes following pre-medication. No apnea was observed in any animal. Semen collection can be successful in Grand Cayman Rock Iguana hybrids (*Cyclura lewisi x nubila*) although timing collection appears to determine collection success. Further work is needed to determine the best methods to estimate timed collection.

Comparison of Fresh and Frozen Fecal Samples in Two Transport Media for the Detection of Enteric Bacteria in Rock Iguanas (*Cyclura* spp.)

Rainwater, Kimberly*

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Enteric bacterial growth in paired fecal samples from 11 captive rock iguanas (four *Cyclura lewisi*, five *Cyclura pinguis*, and two *Cyclura collei*) were evaluated to determine effects of transport medium type and freezing on bacterial recovery. Fresh fecal samples were collected over a three-day period from the 11 iguanas. Four swabs (Copan Diagnostics Inc, Murrieta, CA 92562, USA) were inserted and rotated into each fresh fecal sample. Two swabs from each sample were placed in 1 mL aliquots of a liquid Cary-Blair (CB) transport medium (Protocol™ C&S Medium, Fisher Diagnostics, Middletown, VA 22645, USA) and two swabs were placed in 1 mL aliquots of a liquid

modified Amies (AM) transport medium (BD ESwab Transport System, Becton, Dickinson and Company, Sparks, MD 21152 USA). For each iguana, one CB and one AM aliquot were submitted for enteric culture. The second CB and AM aliquots were stored at -20° C for 14 days, then submitted for enteric culture. Eighteen bacterial isolates identified to either genus or species were detected in these fecal samples. Most notable was *Salmonella*, which was cultured from 6/11 (54.5%) iguanas in all four sample types (fresh and frozen CB media and fresh and frozen AM media). The five *Salmonella* serotypes detected were III 50:k:z, IV_45:g.z51:-, 4,5,12:l:-, III Rough O:k:z, III Rough O:k:-. *Escherichia coli* was found in more than half of the iguanas with prevalence of 9/11 (81.8%) in fresh AM, 8/11 (72.7%) in fresh CB, 6/11 (54.5%) in frozen AM, and 7/11 (63.6%) in frozen CB. Lower prevalence was found for other bacterial species with some variability between the two media and storage conditions. These results indicate that both media may have utility for performing enteric cultures in field, especially for detection of *Salmonella*, but recovery of certain bacterial species may be affected by sample freezing.

Jamaican Iguana (*Cyclura collei*) Health Assessment Update on Headstarted Iguanas at the Hope Zoo

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Annual health assessments have been conducted on Jamaican Iguanas (*Cyclura collei*) for over 20 years. Between 2017 and 2018, management changes were made to improve access to food and reduce competition, displacement, and aggression. In both 2017 and 2018, blood collection and evaluation was focused on iguanas >900 g, which were candidates for release. Complete blood counts (indirect determination using the unopette method) were performed on-site and in 2018, blood gas analysis (EPOC analyzer) was performed on a subset of iguanas. Additional testing was performed on subsets of plasma samples imported to the U.S. In 2017, chemistry panels and protein electrophoresis was performed. In 2018, chemistry panels, protein electrophoresis (EPH), vitamin D, and trace minerals were evaluated. Similar results were seen for most analytes tested in both years except on EPH in which alpha1 globulins were lower while alpha2 and gamma globulins were higher in 2018. On-site blood gas analysis provided additional information such as ionized calcium values. There was good agreement between sodium values on the EPOC analyzer (168 +/- 5.51mmol/L; mean +/- standard deviation) and the chemistry panels done at Idexx reference laboratory (168 +/- 6.52mmol/L). There was less agreement between potassium values (EPOC analyzer 3.15 +/- 1.13mmol/L; Idexx 2.82 +/-1.97mmol/L). Feces were evaluated for parasites on-site. Oxyurids and *Nyctotherus* were the predominant organisms detected. Capillaridae ova were seen in one iguana in 2018. A subset of fecal samples were transported back to the US for quantitative parasite examination and enteric culture. In 2017, a 7-year old female was diagnosed with a urinary bladder calculus. Coordination with a local veterinary clinic was arranged to enable cystotomy and calculus removal. The female was re-examined in 2018 and no calculus recurrence was detected. Mites were found on 25/190 (13.2%) iguanas examined in 2018 and were determined as *Hirstiella* sp.

A Work in Progress: Restoring the Habitat of Fijian Crested Iguanas

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Many have heard of the threats our tropical rainforest are under. However, very few have heard about dry forests, one of the most threatened tropical ecosystem on the planet. In Fiji, dry forests covers a small percentage of the country's forest. These forests are restricted to the leeward or rain shadow regions of the Fiji Islands, particularly the Mamanuca Group. Dry forests are essential habitat to the survival of the Fijian Crested Iguana. This type of forest historically covered the islands in the Mamanuca group. A case in point, on one island, only about 3% of dry forest is still intact which provides a very complexed habitat for Fijian Crested Iguanas. As part of the recovery actions for these Crested Iguanas, Ahura Resorts have implemented a dry forest restoration program that addresses an urgent conservation priority. Sheltered within Ahura leases, the resort have taken steps to speed the regrowth of the dry forest. Since 2014, the resort has maintained a nursery area with staff dedicated to its operation. The nursery currently supports live, potted stock of almost 22 native dry forest species. Most of these species are known to be preferred food plants for the Fijian Crested Iguana, which is a strict herbivore. The nursery also has two large raised beds for dry forest seed propagation. As of September 2018, the team at Ahura Resorts has planted over 5,000 tree species covering four hectares of land area. The dry forest nursery has also produced stock for tree planting initiatives to fight against desertification at two nearby landowning community villages.

Phylogenomics of West Indian Rock Iguanas (*Cyclura*)

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Cyclura is one of the most imperiled genera of squamate reptiles. An understanding of species diversity, evolutionary relationships, diversification, and historical biogeography are crucial for implementing sound long-term conservation strategies. Despite their significant conservation concern and limited taxonomic diversity (15 extant species and subspecies), the major molecular phylogenetic hypothesis for the group consists of a single 900 base pair (bp) region of the mitochondrial genome. An understanding of *Cyclura* evolution and diversification requires an updated phylogeny incorporating information from both the mitochondrial and nuclear genomes. Here we present the results of a phylogenomic analysis of all recognized *Cyclura* taxa. Using a baited sequence-capture approach followed by next-generation sequencing, we generated between 5×10^5 – 2.7×10^6 150 bp sequence reads per individual across both mitochondrial and

nuclear genomes. We sequenced multiple individuals per taxon, from which we extracted a series of sequence data matrices for phylogenomic analysis. We captured and aligned near-complete mitogenomes for all taxa and generated maximum likelihood and Bayesian phylogenetic trees using these data. We then performed a maximum likelihood phylogenetic analysis using a reduced nuclear loci dataset (1,872 loci and >687,000 bp), followed by calculating parsimony informative sites for each locus and extracting the 50 most-informative loci for further Bayesian species delimitation analyses. We present the results from the laboratory and bioinformatic pipelines, as well as the resulting phylogenomic reconstructions of the evolutionary relationships among extant *Cyclura*.

Taxonomic Assessment of *Iguana iguana* and Potential Threats of Intraspecific Hybridization in Native Island Populations

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Species with broad ranges might in fact hide cryptic diversity and their identification is especially important from a conservation point. Indeed, range-wide genetic analyses in *Iguana iguana* revealed one highly distinct island population: Curaçao. In fact, differentiation between Curaçao and the other three clades had higher distinctiveness than between some species within other Iguanidae genera. However, a sampling gap around the Curaçao population restricts our biogeographic understanding of this region, and any taxonomical or conservation implications. In addition to being genetically distinct, the population on Curaçao has a different natural history than in wet climate-occurring populations: highly seasonal growth pattern, shorter maximum SVL, lack of size dimorphism, and smaller clutch size with larger eggs and larger hatchlings. Although these data suggest cryptic diversity, no research or conservation effort is yet focused on Curaçao iguanas. Current lack of data from the Curaçao and surrounding populations prevents our ability to assess the taxonomic status of this population or region. Furthermore, there is anecdotal evidence that mainland individuals have become established on the island of Curaçao, threatening the genetic integrity of this native island population. We set out to fill these knowledge gaps by creating a distribution-wide morphologic dataset and collecting genetic samples from Curaçao and geographically close populations. From these data we will present preliminary results on: 1) the taxonomy of the *I. iguana* population on Curaçao; 2) our understanding of *I. iguana* biogeography; and 3) whether the genetic integrity of the Curaçao population is compromised and if non-native iguanas are present.

The Rapid Influx of Invasive Reptiles Throughout Florida, the Caribbean and The Bahamas

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In the state of Florida, U.S.A., 63 species of herpetofauna have been documented as breeding populations. Some, such as lizards of the genus *Hemidactylus* would have found a way to make a

home there through natural means, but a large number have found their way through introductions from unscrupulous animal dealers or unknowing pet owners. These invasive species in Florida are beginning to occur in The Bahamas. Common Green iguanas, *Iguana iguana*, are one of the largest problems to date. Populations have sprung up in Florida, from Palm Beach and Martin Counties, south to Key West. They are becoming more common on many Bahamian islands. Grand Cayman estimates their population of Common Green Iguanas at approximately 1.6 million. There are over one million Common Green Iguanas in Puerto Rico; pockets are turning up in several geographical areas of Jamaica.

The population of Burmese Pythons, *Python molurus*, in the Florida Everglades is well known. Boa Constrictors are becoming a common sight on the island of Aruba. In Florida, Tegu lizards, *Tupinambus merianae*, are being removed by the hundreds. Cat Cay, The Bahamas, is a privately-held island belonging to the Commonwealth of The Bahamas and managed by a U.S.-based company. The island is approximately 8 km south of Bimini, The Bahamas. Biologists have removed almost 15,000 Common Green Iguanas from the island. Common Green Iguanas have also been documented on Bimini, Grand Bahama, and Exuma and are being moved from island to island. Many projects are currently underway to remove these populations and are evolving constantly. To date, no introduced, invasive species of reptiles has been completely eradicated.

Impacts of Site and Diet on the Gut Microbiotic Community of Bahamian Rock Iguanas, *Cyclura cyclura inornata* and *Cyclura cyclura figginsi*

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The gut microbiome is composed of a diverse and prolific community of commensal bacteria which largely participate in keeping their host healthy by aiding in digestion, supplying vital nutrients, interacting with the immune system, and even altering host behavior. The composition of the gut microbiome is dynamic and capable of responding to changes in the environment, diet, and physiology of an individual. Here we investigate species differences and the impact of tourist feeding activities on the composition of the gut microbiome across season and populations. Fecal swabs and blood samples were collected from high, moderate, and low/no food supplemented populations of *Cyclura cyclura inornata* and *figginsi* in June 2016 and again in September 2016. Following DNA extraction, the V4 region of the 16s rRNA was amplified and libraries were sequenced using the Illumina MiSeq platform. Clear sub-species differences are observed in the gut microbiotic community composition while site differences exhibit more overlap. The potential evolutionary drivers, relationships with individual physiology, and the health implications of these relationships will be discussed.

Cryptic Speciation and Micro-endemism of Madagascar's Iguanas (Opluridae) Necessitate Conservation Reassessment

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Opluridae are a family of Iguanidae (sensu lato) endemic to the arid and semi-arid regions of Madagascar and Grande Comoro. The current taxonomy of this group recognizes eight species and two genera, and thus Opluridae are considered a relatively species-poor group by Madagascar's standards. However, genetic species delimitation analyses confirm that six of these eight species comprise species complexes, for which seven new species are awaiting description. Among these cryptic species, several appear to be micro-endemics with highly localized distributions, and the isolated population on Grande Comoro, which I find to merit species status, is currently classified as Critically Endangered. Additionally, an eighth previously unidentified taxon also represents a likely micro-endemic species and will be described through this work. Currently, the arid habitats to which oplurids are so well adapted are highly threatened, primarily due to conversion for agriculture. Therefore, it is important to rapidly assess the conservation status of these new species, especially those that appear to have restricted ranges, as they are particularly vulnerable to these habitat changes. Formal descriptions of all of these species are awaiting morphological data collection. Additional research into the mechanisms driving diversification in this group are underway and the results of such analyses may contribute useful information to species assessments and can be valuable in recommending areas for protection through these arid regions.

POSTER PRESENTATION ABSTRACTS
In alphabetical order by author's last name *

Initial Stages of Assessment — the Effects of the Invasive Common Green Iguana (*Iguana iguana*) on Puerto Rico's Agriculture

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Managing introduced invasive species relies on the assessment of scale and effect of the invasion. The Common Green Iguana (*Iguana iguana*) is a widespread invasive species that has caused concerns over its effects on native biodiversity as well as on anthropological communities. Although a concern, data on the Common Green Iguana's populations and their effects on natural or human-made environments is scarce. In this work, we propose an evaluation of the impact of the Common Green Iguana in Puerto Rico. We focus on the Common Green Iguana's effect on agricultural crops and the communities of people that surround them. Our goal is to assess the impact of the species by answering three major questions: 1) what are the effects of the Common Green Iguana on agriculture; 2) what strategies are farmers using to mitigate these effects; and 3) how effective are those management strategies? To answer these questions, we draw from tools in ecology and social science. We developed semi-structured interview questions that focused on the farmers' experience with the Common Green Iguana. With these questions we also sought to gain insight on management and asked farmers about the strategies they use to mitigate any issues. We've since learned that hunting is used as one of the methods to manage the reptile. We propose using visual encounter surveys before and after hunting events to monitor the effects of this practice through time. To date we have completed nine of our goal of 30 interview accounts. Moreover, we have identified a farm where hunting will occur and are working to begin monitoring efforts. In the future, we expect to understand what sectors of the agricultural community are most vulnerable to impact by the Common Green Iguana. In addition, we expect our data will be pivotal for the management of the invasive range.

Disentangling the Origin of Common Green Iguanas in the Virgin Islands

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Common Green Iguanas (*Iguana iguana*) have become invasive in many places around the world, and the pet trade and illegal imports have been proposed as the two main introduction pathways. Previous work showed that, consistent with historic trade data of Common Green Iguanas in the U.S. (where they imported thousands of pet iguanas from Colombia and El Salvador and re-

exported iguanas elsewhere), most individuals from introduced populations were associated to Central America/north-west of the Andes populations/clades. However, it also revealed that all individuals from St. Thomas in the U.S. Virgin Islands shared haplotypes found in iguanas native to two Caribbean Islands. This finding supported the notion that the presence of Common Green Iguanas in the Virgin Islands precedes the pet trade introductions (c.a. 1960s) and re-ignited the debate on whether they arrived by natural dispersal or Amerindian/colonial-human introductions. Caribbean haplotypes were also found on the islands of Vieques (PR) and St. Croix (USVI), where iguanas from Central and South America have been introduced recently. In this study, we aim to further assess the origin of Common Green Iguanas in the Virgin Islands, and the distribution and admixture level of the different haplotypes in the eastern Puerto Rican Bank (EPRB). We will do so by conducting more intensive sampling across the EPRB (focusing on the Virgin Islands) and performing phylogenetic analyses using nuclear (PAC, MLH3) and mitochondrial (ND4) sequences. In addition, we will perform genetic analyses on ectoparasitic mites found on Common Green Iguanas on the EPRB and from native Caribbean iguana populations as a proxy for iguana population divergence time, which we expect to allow us to better assess the dispersal and biogeographic history of shallow lineages within the Common Green Iguana. We recommend taking preventive measures to avoid introductions of exotic Common Green Iguanas to St. Thomas until more samples are collected and analysed.

Restoring Nesting Sites for the Mona Island Iguana through the Removal of the Invasive Australian Pine — Update

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Mona Island is one of the largest uninhabited islands in the Caribbean region. The island supports a sub-tropical dry forest ecosystem, one of the most threatened ecosystem types in the world, with 80% fauna endemism and multiple endangered species, like the Mona Island Iguana (*Cyclura stejnegeri*). However, the biological integrity of Mona Island is threatened by an invasive plant species that was historically introduced to the island: the Australian Pine (*Casuarina equisetifolia*). The impacts of this invasive species include: habitat alteration, biodiversity loss, erosion, and specially, it poses a threat to endangered species like the Mona Island Iguana through the reduction of nesting areas. Considering this, our objective is to restore nesting areas for the Mona Island Iguana through the removal of the invasive Australian Pine, its pine needles and debris. There have been efforts in the past to achieve this but resulted in failure due to a combination of inefficient methodology and lack of management. With the help of volunteers, we cut trees using chainsaws and raked all pine needle debris from plots to expose sandy substrate. After 18 days of fieldwork, we restored six areas which will now provide close to 1.08 km² of new nesting habitat for iguanas, cut 36 pine trees and removed over 500 pounds of pine needle debris. In addition to this, we documented 10 iguana nests with 120 hatchlings successfully emerged, presenting a hatching success of 92%. Developing management strategies to control and remove these invasive species from Mona Island would allow the recovery of endemic and endangered biodiversity and

secure protection for the dry-forest habitat on Mona Island. These management strategies will continue being implemented throughout 2019 as well as other similar efforts focused on other invasive species, such as feral cats and pigs.

Inbreeding Depression in the Endangered Grand Cayman Blue Iguana (*Cyclura lewisi*)

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The Grand Cayman Blue Iguana is a flagship species for conservation efforts in the Caribbean. As with most *Cyclura* species, they may be essential seed dispersers, and their loss could result in irrevocable change to their associated ecosystems. The population was reduced to less than 25 wild adults and 22 founder individuals in captivity, some of which have been bred since the early 1990s. After more than 20 years of conservation breeding and headstarting, over 1,000 animals have since been released into the wild. *Cyclura lewisi*, provides an opportunity to study the effects of genetic erosion resulting from population size reduction on the survivorship of captive bred animals after their reintroduction to a more natural habitat. Specifically, we should be able quantify the effects of inbreeding depression following this severe population bottleneck and subsequent population growth. We hypothesize that inbreeding depression limits the success of recruitment of captive bred juveniles into the reproductive population. Polymorphic microsatellites are used to determine individual heterozygosity across multiple loci. If our hypothesis holds, then individual heterozygosity should correlate with fitness. We used body condition index prior to release, as well as survival after release from captivity as fitness proxies. DNA has been extracted from 422 individuals with estimated birth years ranging from 1935 to 2015, providing an opportunity to study genetic diversity over time. Genetic data has been collected on 296 individuals at 21 loci with data on an additional 126 individuals and eight loci in progress.