



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

4 November 2018

Arrive at Dallas/Fort Worth International Airport (DFW) or Dallas Love Field (DAL), Texas. Check-in at the Courtyard by Marriott, Fort Worth University Drive, 3150 Riverfront Drive, Fort Worth, Texas 76107.

6 – 9:00 pm Ice Breaker at The Woodshed, located across the street from the hotel

5 November 2018

- 9:00 am Welcome and self-introductions**
ISG Co-Chairs: Chuck Knapp and Stesha Pasachnik
- 9:20 am Welcoming Address**
Mike Fouraker, Director Fort Worth Zoo
- 9:30 am Life History Attributes of Fijian Crested Iguanas and their Food Tree Species in a Fijian Dry Forest**
Harlow, Peter*, Pita Biciloa, Eroni Matatia, Joshua Hatton, and Jennifer Taylor
- 9:50 am A Work in Progress: Restoring the Habitat of the Malolo Levu Island Crested Iguanas**
Rasalato, Sialis*, Steve Anstey, Marika Tuiwawa, Alivereti Naikatini, Robert Fisher, Kim Lovich, Adam Clause, Isaac Rounds, and Jone Niukula
- 10:10 am Review of Accomplishments on the Biogeography and Conservation of Pacific Iguanas (*Brachylophus* sp.)**
Fisher, Robert*, Jone Niukula, Kim Lovich, Nunia Thomas, Peter Harlow, and Sia Rasalato
- 10:40 am BREAK**

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

Figuerola, Cielo, Robert J. Mayer, Iván Llerandi, Darién López, and José L. Herrera
Introduced by Stesha Pasachnik, on Cielo's behalf

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

McKinney, Mallory*, Mark Welch, Tandora Grant, and Fred Burton

6 November 2018

- 9:00 am** **Daily agenda review, meeting logistics update**
Chuck Knapp and Stesha Pasachnik
- 9:10 am** **Phylogenomics of West Indian Rock Iguanas (*Cyclura*)**
Reynolds, R. Graham*, Aryeh Miller, Brian Drawert, Stesha Pasachnik, Charles Knapp, and John Iverson
- 9:30 am** **Genetic Investigations into the Role of Female Choice and Promiscuity in Inbreeding Avoidance in *Cyclura nubila caymanensis*, a Historically Small and Isolated Taxon**
Moss, Jeanette, Glenn Gerber, Aumbriel Schwirian, Anna Jackson, and Mark Welch*
- 9:50 am** **Update on the Repatriated and Translocated Subpopulation of *Cyclura rileyi cristata* in the Exumas, The Bahamas**
Buckner, Sandra D., Jill M. Jollay*, John B. Iverson, Susannah S. French, Shannan S. Yates, Erin Lewis, and Spencer B. Hudson
- 10:10 am** **2018 Update for the Anegada Iguana, *Cyclura pinguis*, Conservation Program**
Bradley, Kelly*
- 10:30 am** **BREAK**
- 10:50 am** **A New Era for the Jamaican Rock Iguana, *Cyclura collei*: Program Improvements for a Brighter Future**
Pasachnik, Stesha*, David Reid, Milton Rieback, and Tandora Grant
- 11:10 am** **Jamaican Iguana (*Cyclura collei*) Health Assessment Update on Headstarted Iguanas at the Hope Zoo**
Rainwater, Kimberly*, Stesha Pasachnik, Tandora Grant, and Milton Rieback
- 11:30 am** **Impacts of Site and Diet on the Gut Microbiotic Community of Bahamian Rock Iguanas, *Cyclura cyclura inornata* and *Cyclura cyclura figginsi***
Webb, Alison*, Karen Kapheim, Charles Knapp, John Iverson, Dale DeNardo, and Susannah French

- 11:50 am **Comparison of Fresh and Frozen Fecal Samples in Two Transport Media for the Detection of Enteric Bacteria in Rock Iguanas (*Cyclura* spp.)**
Rainwater, Kimberly*
- 12:10 pm **Semen Collection, Characterization, and Short-term Extensions in Grand Cayman Rock Iguana Hybrids (*Cyclura lewisi* x *nubila*) and Rhinoceros Rock Iguana (*Cyclura cornuta*)**
Perry, Sean M.*, Taesoon Park, and Mark A. Mitchell
- 12:30 pm **LUNCH**
- 1:30 pm **Long-term Monitoring Program of Lesser Antillean Iguana (*Iguana delicatissima*) Populations in French West Indies**
Angin, Baptiste* and Chloé Warret Rodrigues
- 1:50 pm **Riding out the Storm: the Challenges faced by *I. delicatissima* in a Post-Hurricane Dominica**
Brisbane, Jeanelle*, Thijs van den Burg, and Charles Knapp
- 2:20 pm **Taxonomic Assessment of *Iguana iguana* and Potential Threats of Intraspecific Hybridization in Native Island Populations**
van den Burg, Thijs*, Brian Bock, Wilfredo Falcón, and Catherine Malone
- Conservation Genetics of *Iguana***
Malone, Catherine* and Thijs van den Burg
- 2:50 pm **Support from the Local Community for Long-term Conservation of an Island Endemic and Control of an Invasive Iguana in Little Cayman**
Laaser, Tanja*, Jen Moss, Jane Haakonsson, Ed Houlcroft, Mark Welch, and Glenn Gerber
- 3:10 pm **BREAK**
- 3:25 pm **The Rise of Invasive Reptile Species**
Joseph Wasilewski
- 3:45 pm **Invasive Species Discussion**
- 4:00 pm **ISG History in Pictures**
Rick Hudson and Allison Alberts
- 4:10 pm **Auction and Drinks**
Joe Wasilewski, *emcee*

7 November 2018

- 9:00 am** **Daily agenda review, meeting logistics update**
Chuck Knapp and Stesha Pasachnik
- 9:10 am** **Code of Conduct**
Chuck Knapp, Stesha Pasachnik, Tandora Grant, ALL
- 9:30 am** **Mohamed bin Zayed Species Conservation Fund Opportunities**
Allison Alberts
- 9:50 am** **Reptile Smugglers, Update**
Tandora Grant
- 10:00 am** **Hurricane Response Plan and Climate Change**
Chuck Knapp
- 10:20 am** **Action Plans**
Chuck Knapp
- 10:40 am** **Florida IguanaFest Update**
Ty Park
- 10:50 pm** **Opportunities in Jamaica**
Stesha Pasachnik
- 10:55 am** **Travel Awardees Update**
Stesha Pasachnik
- 11:00 am** **ITWG Update, Species Status Review and Priority Actions, and Genetics Working Group Update**
John Iverson, Tandora Grant, and Catherine Malone
- 11:40 am** **Next meeting Location**
Stesha Pasachnik, Chuck Knapp, Tandora Grant, ALL
- 11:50 am** **Additional Discussion Items**
ALL
- 12:00 pm** ***LUNCH***
- 1:30 pm** **Red List Working Groups**

Tandora will remain in the meeting room to work with individuals on RL assessments

1:30 pm **Behind the scenes tours** of 1) MOLA (Museum of Living Art: reptile house) and
2) *Cyclura* Greenhouse and Texas Native Reptile Center (TNRC)

***Check your meeting badge for your group assignment; you must tour with your designated group.
Each tour is approximately 45 minutes.***

Group A:

1:30pm – MOLA TOUR: Meet inside *MOLA* near the King Cobra exhibit

3:00pm – IGUANA TOUR: Meet in front of *Blue Bonnet Café* (Texas Wild)

Group B:

1:30pm – IGUANA TOUR: Meet in front of *Blue Bonnet Café* (Texas Wild)

3:00pm – MOLA TOUR: Meet inside *MOLA* near the King Cobra exhibit

Feel free to wander around the zoo on your own, keeping in mind the zoo closes at 4 pm

5:30 – 8:30 pm **Closing Dinner** at Joe T. Garcia's (Depart by bus from Marriott Hotel)

*Feel free to stay in the Stockyards area and enjoy the attractions,
taking a taxi back on your own*

8 November 2018

8:00 am – 3:00 pm **Field trip** to the Dallas World Aquarium, including tour and lunch



**IUCN SSC Iguana Specialist Group Annual Meeting
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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

Angin, Baptiste*¹ and Warret Rodrigues, Chloé²

¹Ardops Environnement, Les Abymes, Guadeloupe, French West Indies); ²University of Manitoba, Winnipeg, Canada

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*

Fort Worth Zoo, Fort Worth, Texas, USA

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

Brisbane, Jeanelle*¹, Thijs van den Burg², and Chuck Knapp³

¹WildDominique, Roseau, Dominica; ²Univeristy of Amsterdam, Amsterdam, The Netherlands;

³Shedd Aquarium, Chicago, Illinois, USA

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

Buckner, Sandra D.¹, Jill M. Jollay*², John B. Iverson³, Susannah S. French⁴, Shannan S. Yates⁵, Erin Lewis⁴, and Spencer B. Hudson⁴

¹Nassau, The Bahamas; ²Tucson, Arizona, USA; ³Earlham College, Richmond, Indiana, USA; ⁴Utah State University, Logan, Utah, USA; ⁵Bahamas National Trust, Nassau, The Bahamas

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

Colosimo, Giuliano*¹, Lorena Canuti², Antonella Canini², Glenn Gerber¹, and Gabriele Gentile²

¹San Diego Zoo Institute for Conservation Research, Escondido, California, USA; ²Department of Biology, University of Rome Tor Vergata, Rome, Italy

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.)

Fisher, Robert*¹, Jone Niukula², Kim Lovich³, Nunia Thomas⁴, Peter Harlow⁵, and Sia Rasalato⁶

¹U.S. Geological Survey, San Diego, California, USA; ²National Trust of Fiji Islands, Suva, Fiji; ³San Diego Zoo Global, San Diego, California, USA; ⁴NatureFiji-MareqetiViti, Suva, Fiji; ⁵Taronga Conservation Society Australia, Sydney, Australia; ⁶Ahura Resorts, Suva, Fiji

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

Harlow, Peter*¹, Pita Biciloa², Eroni Matatia², Joshua Hatton¹, and Jennifer Taylor³

¹Taronga Conservation Society Australia, Sydney, Australia; ²National Trust for Fiji Islands, Suva, Fiji; ³Australian Catholic University, Sydney, Australia

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

Laaser, Tanja*¹, Jen Moss², Jane Haakonsson¹, Ed Houlcroft³, Mark Welch², and Glenn Gerber⁵

¹Cayman Islands Department of Environment, Grand Cayman, Cayman Islands; ²Mississippi State University, Mississippi State, Mississippi, USA; ³Green Iguana B'Gonna, National Trust of the Cayman Islands, Little Cayman District; ⁵San Diego Zoo Institute for Conservation Research, Escondido, California, USA

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

Maryon, Daisy F.*^{1,3}, David C. Lee¹, Stesha A. Pasachnik², and Tom Brown³

¹University of South Wales, Pontypridd, UK; ²Fort Worth Zoo, Fort Worth, Texas, USA; ³Kanahau Útila Research and Conservation Facility, Útila, Honduras

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

Moss, Jeanette¹, Glenn Gerber², Aumbriel Schwirian¹, Anna Jackson¹, and Mark Welch*¹

¹Dept of Biological Sciences, Mississippi State University, Mississippi State, Mississippi, USA; ²San Diego Zoo Institute for Conservation Research, Escondido, California, USA

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

Muggen-van Uden, Yoni*¹, Catherine Malone², and Tandora Grant³

¹Dutch Iguana Foundation, The Netherlands; ²Utah Valley University, Orem, Utah, USA; ³San Diego Zoo Institute for Conservation Research, San Diego, California, USA

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*

Nash, Ann-Elizabeth* and Stephen Mackessy

University of Northern Colorado, Greeley, Colorado, USA

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

Pasachnik, Stesha*¹, David Reid², Milton Rieback³, and Tandora Grant⁴

¹Fort Worth Zoo, Fort Worth, Texas, USA; ²National Environmental Planning Agency, Kingston, Jamaica; ³Hope Zoo, Kingston, Jamaica; ⁴San Diego Zoo Institute for Conservation Research, San Diego, California, USA

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*)

Perry, Sean M.*¹, Taesoon Park², and Mark A. Mitchell¹

¹Louisiana State University, Department of Veterinary Clinical Sciences, School of Veterinary Medicine, Baton Rouge, Louisiana, USA; ²Ty's Lizards, Punta Gorda, Florida, USA

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*

Fort Worth Zoo, Fort Worth, Texas, USA

Enteric bacterial growth in paired fecal samples from eleven 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 eleven 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 1mL 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 1mL aliquots of a

liquid 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 approximately 2 weeks, 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

Rainwater, Kimberly*¹, Stesha Pasachnik¹, Tandora Grant², and Milton Rieback³

¹Fort Worth Zoo, Fort Worth, Texas, USA; ²San Diego Zoo Institute for Conservation Research, San Diego, California, USA; ³Hope Zoo, Kingston, Jamaica

Health assessments have been conducted on Jamaican iguanas (*Cyclura collei*) for over two decades. 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 >900g, which were candidates for release. Blood testing included complete blood counts (indirect determination using the unopette method), chemistry panels, protein electrophoresis, and in 2018 only vitamin D, trace minerals, and blood gas analysis (EPOC analyzer). Similar results were seen for most analytes tested in both years except on EPH in which alpha 1 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 and also transported back to the US for quantitative parasite examination and enteric culture. Oxyurids and *Nyctotherus* were the predominant organisms. Capillaridae ova were seen in one iguana in 2018. In 2017, a 7 year-old female was diagnosed with a urinary bladder calculus, which was removed surgically. The female was re-examined in 2018 and no calculus recurrence was detected. Mites were found on 26/190 (13.7%) iguanas examined in 2018 and were identified as *Hirstiella* sp. In the future, information from health assessment may be used to determine the best indicator(s) of health in this species. Fostering collaborating with partners in Jamaica will enable more frequent evaluations, improved ability to manage health in the head-start population, and hopefully the ability to release more iguanas each year.

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

Rasalato, Sialisi*¹, Steve Anstey¹, Marika Tuiwawa², Alivereti Naikatini², Robert Fisher³, Kim Lovich⁴, Adam Clause⁵, Isaac Rounds⁶, and Jone Niukula⁷

¹Ahura Resorts, Malolo, Nadi, Fiji; ²University of the South Pacific, Laucala, Suva, Fiji; ³U.S Geological Survey, San Diego, California, USA; ⁴San Diego Zoo Global, San Diego, California, USA; ⁵University of Georgia, Athens, Georgia, USA; ⁶Conservation International, Suva, Fiji; ⁷National Trust of Fiji, Suva, Fiji

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*)

Reynolds, R. Graham*¹, Aryeh Miller¹, Brian Drawert¹, Stesha Pasachnik², Charles Knapp³, and John Iverson⁴

¹University of North Carolina Asheville, Asheville, North Carolina, USA; ²Fort Worth Zoo, Texas, USA; ³John G. Shedd Aquarium, Chicago, Illinois, USA; ⁴Earlham College, Richmond, Indiana, USA

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

van den Burg, Thijs*¹, Brian Bock², Wilfredo Falcón³, and Catherine Malone⁴

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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

Wasilewski, Joseph* and Nick Wasilewski

Natural Selections of South Florida, Inc., Princeton, Florida, USA

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 meriana*, 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

Welt, Rachel

American Museum of Natural History, New York City, New York, USA

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.

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

MINUTES

Special thanks to note takers: Wilfredo Falcón, Mallory McKinney, and Rachel Welt, and editors: Wilfredo Falcón and Tandora Grant

Note: Presenters are denoted by an asterisk (), questions are indicated by a “Q”, and answers are indicated by an “A” (given by the presenter, unless otherwise stated).*

Day 2: 5 November 2018

9:00 AM **Welcome and self-introductions** — (Chuck Knapp, Stesha Pasachnik)

9:20 AM **Welcome address** — (Mike Fouraker)

Life History Attributes of Fijian Crested Iguanas and their Food Tree Species in a Fijian Dry Forest (Harlow, Peter*, Pita Biciloa, Eroni Matatia, Joshua Hatton, and Jennifer Taylor)

- **Q (A-E Nash):** Are they eating dry leaf material? **A:** No, only live plants, based on fecal samples; they prefer fresh fruit, and young leaves. No dead leaves.
- **Q (John Iverson):** What were the cyclone’s effects on nesting site? **A:** It nests in the coldest spots of the island, with full shade; contrary to other iguanas. So probably low effect on the nesting sites from these cyclones.
- **Q (Karin Nelson):** Are invasive species present? **A:** There are no cats, no mongoose, nor boas; the harrier is the only predator. Goats were removed about 20 years ago.
- **Q (Bruce Weissgold):** Is there poaching for pet trade? **A:** Yes, 19 iguanas were taken in 2016 from this island.
- **Q (Bonnie Raphael):** How many were marked and recaptured? **A:** About 700 iguanas.

A Work in Progress: Restoring the Habitat of the Malolo Levu Island Crested Iguanas (Rasalato, Sialisi*, Steve Anstey, Marika Tuiwawa, Alivereti Naikatini, Robert Fisher, Kim Lovich, Adam Clause, Isaac Rounds, and Jone Niukula)

- **Q (Joe Burgess):** Where you able to continue checking for iguanas on other parts of the island? **A:** Yes, 2 months ago we were able to identify 5 iguanas at another site.
- **Q (Bonnie Raphael):** How many people visit the resort every year? **A:** Approximately 10,000 between the two resorts.
- **Q (Chuck Knapp):** Do you educate the guests? **A:** We give talks to the guests three times a week.

Review of Accomplishments on the Biogeography and Conservation of Pacific Iguanas (*Brachylophus sp.*) (Fisher, Robert*, Jone Niukula, Kim Lovich, Nunia Thomas, Peter Harlow, and Sia Rasalato)

- **Q (John Iverson):** How many species have you found? **A:** Four are named so far; there are probably 10–12 species in total.

Project Updates from Útila Concerning Critically Endangered Útila Spiny-tailed Iguana (Maryon, Daisy F.*, David C. Lee, Stesha A. Pasachnik, and Tom Brown)

- **Q (Graham Reynolds):** Is *Ctenosaura similis* only close to town? **A:** Yes, they are restricted to anthropogenic areas.
- **Q (Joe Burgess):** What is the frequency of hybridization? **A:** That is currently being studied in the lab.
- **Q (John Iverson):** Are you studying juvenile growth rates? **A:** No, not as this time, we have no juvenile recaptures to do that.

Personality, Behavioral Syndromes, and Social Networks in the Spiny-tailed Iguana, *Ctenosaura similis* (Nash, Ann-Elizabeth* and Stephen Mackessy)

- **Q (Joe Burgess):** What happened to the five females? **A:** They got stuck in the rainwater drainage system and died.
- **Q (Chuck Knapp):** Have you looked at ectoparasites? **A:** We have not studied ectoparasites yet.
- **Q (Joey Brown):** How do you attach the tags? **A:** Tags are attached with super glue, which works better with male than on females.
- **Q (Karin Nelson):** Are aggressive males more successful? **A:** Males have got to be a certain size. But after they reach a certain size, there doesn't seem to be a preference from females.
- **Q (John Iverson):** Have you studied the importance of fitness in this system? **A:** No, that work is awaiting funding to be performed.

Effective Reproductive Isolation Mechanisms (RIMs) between *Conolophus marthae* and *C. subcristatus*: the Possible Role of Chemical Signaling for Species Recognition (Colosimo, Giuliano*, Lorena Canuti, Antonella Canini, Glenn Gerber, and Gabriele Gentile)

- **Q (Chuck Knapp):** Did you study population from the other islands? **A:** We are not looking at populations from other islands, though we are studying the compounds from another population on the same island now.
- **Q (Allison Alberts):** Are there dietary differences between the species? **A:** Not sure about that now, Gabrielle has those data.

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

- **Q (Chuck Knapp):** What is going to be the name of the new genus? **A:** Not sure.
- **Q (Bruce Weissgold):** Have you considering auctioning naming rights for conservation dollars? **A:** No plans yet.

- **Q (Rick Hudson):** What is habitat like? **A:** Limestone in that area, mountain ranges, some parts are sandy. The quality appears to be ok.
- **Q: (John Bendon):** How old are these iguanas? **A:** They rafted over 65 million years ago.

Stories, SciComm Potential, and Conservation Research (Hedrick, David*)

- **Q (Robert Fisher):** What is Atlas Obscura? **A:** It is an online magazine.
- **Q (Elaine Powers):** Have you explored Pinterest? **A:** Not yet.
- **Comment (Rick Hudson):** Please encourage everyone to join this Field Communications Facebook page (non-public) to get information to us.
- **Q (?):** Have you noticed any difference on engagement between sharing photos vs. videos? **A:** Videos need to be short and high quality.
- **Comment (Joey Brown):** NatGeo has funding for digital media coverage of conservation research.
- **Comment (Ann Nash):** Twitter is a valuable platform to share your research and grow interest.

Collecting Educational and Outreach Material (Muggen-van Uden, Yoni*, Catherine Malone, and Tandora Grant)

- **Comment (Tandora):** This is a work in progress, hoping that we will one day also have a photo gallery online, but we need to figure out how to display some of this stuff on the website.

Education and Outreach Discussion (Elaine Powers*, Yoni Muggen-van Uden, ALL)

- **Q (John Bendon):** Do you take live iguanas to do outreach? **A:** Yes, I take iguanas to schools and nursing homes for outreach.
- **Comment (Chuck Knapp):** My kids love the poaching Andros iguanas book. We should all consider these resources for identifying differences between native and invasive iguanas.
- **Comment (Elaine):** I can make resources (books, activity books, etc.) specific to your needs.
- **Comment (Tanja Laaser):** Your books are very important to us, we keep them in the rooms for guests.
- **Q (A-E Nash):** Do we have real geographic markers for the iguanas? **A:** Books are meant to be used for specific locations and we can make new ones for locations if needed.
- **Q (Joey Brown):** Have you done calendars? They have been popular. **A:** Not yet, but we can.
- **Q (Karin Nelson):** I talk about iguanas in college classes I teach. How do I get my interested college students involved in iguana work? **A (Chuck Knapp):** There are a few Internship opportunities are posted on ISG website. **A (Daisy Maryon):** I have a lot of volunteer opportunities.
- **Comment (Robert Fisher):** We could do an *iNaturalist* group for iguanas (citizen scientists).

CITES Permit (Tandora Grant*, Chuck Knapp, Stesha Pasachnik, and Mark Welch)

- **Comment (Mark Welch):** Import/export sample numbers have been increased. Additions to permits can take 3–4 months. Mark can help people fill out import permits if needed. The Miami port can be problematic (avoid if possible). When you return with samples, please send Mark copies of import/export permits that have been stamped (cleared) for the permit's annual report and resubmission. You can also set up an appointment with specific FWS people at port of entry.
- **Comment (Chuck Knapp):** Last few years at Miami have been fine. This is a group permit and if someone doesn't follow rules in place we could lose the permit. Next permit has to go through a 90-day public comment period and we should get it in by the end of this month.
- **Comment (Bruce Weissgold):** Get in touch with the port of entry several weeks before clearing samples to prepare them to expect you.
- **Comment (John Iverson):** Precision of names/addresses is essential for permits
- **Q (Bonnie Raphael):** Are permit sample numbers specific to blood? **A (Chuck Knapp):** Yes, there are different limits for carcasses, toe clips, and blood. You need to write a justification for new tissue types you want to bring in and we can amend the permit.

Day 3: 6 November 2018

Daily Agenda Review and Meeting Logistics Update (Chuck Knapp, Stesha Pasachnik)

Phylogenomics of West Indian Iguanas (*Cyclura*) (Reynolds, R. Graham*, Aryeh Miller, Brian Drawert, Stesha Pasachnik, Charles Knapp, and John Iverson)

- **Q (Robert Fisher):** How does the historical biogeography of *Cyclura* compare to boas? **A:** Boas are much older (20–24 Ma) and experienced ecological speciation, but the colonization patterns are similar.
- **Q (Rachel Welt):** How did you date your phylogeny? **A:** Using fossils further away in Iguania; molecular rates as calibrations lead to variable results.
- **Q (Bonnie Raphael):** Which species are maintained with this work? **A:** This work presents species hypotheses, but *Cyclura cyclura cyclura*, *C. lewisi*, and *C. nubila* could be valid. You would need to define species concept before moving forward. *C. rileyi* are all very closely related; any species delimitation would be based on geography not genetics.
- **Q (Robert Fisher):** Can you incorporate ancient DNA samples with these marker types? **A:** Yes, that is the plan moving forward.
- **Q (Bruce Weissgold):** How has people moving iguanas between islands impacted this? **A:** That may explain *C. rileyi* being genetically conserved across large distances.
- **Comment (Mark Welch):** Phylogenetically informative loci methods may not be the most useful due to effect of hybridizations. You can look at linkage disequilibrium, and species tree vs. gene trees to tease these issues apart.
GR: Further work will look at other methods to explore this issue.

Genetic Investigations into the Role of Female Choice and Promiscuity in Inbreeding Avoidance in *Cyclura nubila caymanensis*, a Historically Small and Isolated Taxon (Moss, Jeanette, Glenn Gerber, Aumbriel Schwirian, Anna Jackson, and Mark Welch*)

- **Q (Robert Fisher):** How should we be managing captive populations given these inbreeding and reproductive findings? **A:** Comparative analysis of all headstart programs across different groups should be conducted to see what is working and what's not.
- **Comment (Tandora Grant):** Jen's paper is published and available in the ISG library.

Update on the Repatriated and Translocated Subpopulation of *Cyclura rileyi cristata* in the Exumas, The Bahamas (Buckner, Sandra D., Jill M. Jollay*, John B. Iverson, Susannah S. French, Shannan S. Yates, Erin Lewis, and Spencer B. Hudson)

- **Q (A-E Nash):** Are you seeing any aggression between males? **A:** No, there's enough space and resources on the Cay.
- **Q (A-E Nash):** Could they be more aggressive during breeding season? **A:** Possibly, we haven't observed that
- **Comment (John Iverson):** Elsewhere, an introduced raccoon was known to have wiped out females guarding nests, leading to the sex bias.
- **Comment (Jill Jollay):** We plan to further check on the population with a grant from the government; pit tagging is important.
- **Q (Yoni van Uden):** Do you know why they died upon return to The Bahamas? **A:** No
- **Q (Tanja Laaser):** Did you take genetic samples of offspring? **A:** Yes.
- **Q (Bruce Weissgold):** Do you know if local Bahamians helped to smuggle these individuals out? **A:** The girls that were caught with these animals are Romanian, but were probably assisted by Germans or Swiss; there is some evidence suggesting that other groups also removed animals (overturned rocks and disturbed nests were seen in 2005).
- **Q (Karin Nelson):** Are there any plans to add more females to the population? **A:** We may do this, but it is hard to find the females to reintroduce.
- **Comment (Bruce Weissgold):** Poachers have been targeting females also.
- **Q (Robert Fisher):** Do they have temperature-biased sex? **A (John Iverson):** No.

2018 Update for the Anegada Iguana, *Cyclura pinguis*, Conservation Program (Bradley, Kelly*)

- **Q (Allison Alberts):** Is there any evidence that the hurricane impacted the cat population? **A:** No, but there may have been an impact on cows.
- **Q (Yoni van Uden):** Can you share any materials with the database? **A:** Mostly games that we have available for outreach, but game rules can be shared.
- **Q (Stesha Pesachnik):** Can you also share the hurricane manual and kits? **A:** Yes, I'd like to work with the group for use in other areas.

A New Era for the Jamaican Rock Iguana, *Cyclura collei*: Program Improvements for a Brighter Future (Pasachnik, Stesha*, David Reid, Milton Rieback, and Tandora Grant)

- **Q (Chuck Knapp):** Do you have information on gut content of invasive species? **A:** We have done some work, and plan to do more (mongoose digest their food very quickly so it's not very informative).
- **Q (Robert Fisher):** Do you know the survivorship of headstarted animals? **A:** We know we had a dog incursion that took out some individuals, but we don't have full data details yet.

Jamaican Iguana (*Cyclura collei*) Health Assessment Update on Headstarted Iguanas at the Hope Zoo (Rainwater, Kimberly*, Stesha Pasachnik, Tandora Grant, and Milton Rieback)

- **Q (Bonnie Raphael):** Can you talk about the high lactate levels? **A:** It is pretty high, and higher than what you see in mammals. This means more anaerobic metabolism. Increase handling time causes this too, but the high average is due to outlier samples.
- **Q (Mallory McKinney):** We also see spinal deformities in blue iguanas, is there any genetic component? **A (Tandora Grant):** Very little pedigree information is available for this program.
- **Q (Sean Perry):** Do you see any morphological changes in white blood cells? **A:** Nothing significant in number, just a few had changes.
- **Q (Mark Welch):** Are you collecting the parasites that you find, and is anything common across the genus? I'm interested in comparative phylogenetic studies across the parasites for the animals. **A:** We're sending fecal samples for analyses in the US; it would be good to start collecting ectoparasites.
- **Q (Chuck Knapp):** What's the reasoning for euthanizing deformed animals? I've seen successful breeding in animals with similar deformities. **A (Tandora Grant/KR):** This individual had other issues too, leading to the decision to euthanize. It had been set to euthanize for a while and we hadn't got around to it yet. At the end of its life, it was being massaged to defecate.
- **Q (John Iverson):** Have other people found animals with deformed tails in the wild? **A (Tanja Laaser):** Nothing major like this deformity. **A (Peter Harlow):** Congenital deformities can be due to high incubation temperatures. **A (Susannah French):** Deformities can also be experimentally induced with corticosterone. **A (KR):** Or may be due to other nutritional issues.

Impacts of Site and Diet on the Gut Microbiotic Community of Bahamian Rock Iguanas, *Cyclura cychlura inornata* and *Cyclura cychlura figginsi* (Webb, Alison*, Karen Kapheim, Charles Knapp, John Iverson, Dale DeNardo, and Susannah French)

- **Q (Robert Fisher):** We've collected microbiome samples in ethanol, but were told that some bacteria use that as media? So we switched, but you've used ethanol? **A (Suzanna French):** We're testing this in the lab. **A:** Lots of things can affect quality of samples so you just do the best you can.

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

- **Q (Robert Fisher):** Did you do multiple replicates? Are fecal samples frozen at just -20°C or -80°C? *Salmonella* could be just a sampling artifact from collecting the scat. **A:** We just froze samples at -20°C for two weeks with one replicate.

Semen Collection, Characterization, and Short-term Extensions in Grand Cayman Rock Iguana Hybrids (*Cyclura lewisi x nubila*) and Rhinoceros Rock Iguana (*Cyclura cornuta*) (Perry, Sean M.*, Taesoon Park, and Mark A. Mitchell)

- **Comment (Rick Hudson):** Thanks for wearing a tie! You are the first person to wear a tie at an ISG Meeting.
- **Q (Ty Park):** Tell us more about the vibrational techniques? **A:** We tried vibrators, but they didn't work, though they are much easier to carry around than the electroejaculator, so we're working on it.

Long-term Monitoring Program of Lesser Antillean Iguana (*Iguana delicatissima*) Populations in French West Indies (Angin, Baptiste* and Chloé Warret Rodrigues)

- **Q (Tandora Grant):** Any plans for eradicating green iguanas? **A:** Yes, there are people that are qualified to discern the two iguanas.
- **Q (Joe Burgess):** How often do you do surveys for green iguanas on the nearby smaller islands? **A:** We don't, but there are observations ongoing at the bay and coastline.
- **Q (Thijs van den Burg):** Are tourist companies involved and helping out with Petite? **A:** Yes, they know that, financially, it is in their best interest to keep the green iguanas from spreading.

Riding out the Storm: the Challenges faced by *I. delicatissima* in a Post-Hurricane Dominica (Brisbane, Jeanelle*, Thijs van den Burg, and Charles Knapp)

- **Q (Robert Fisher):** Are you collecting genetic material from any dead iguanas with striped tails? **A:** Yes, we have material but they haven't been exported yet.
- **Q (Wilfredo Falcón):** Was the roadkill fresh enough to get tissue samples? **A:** Yes.
- **Q (Tanja Laaser):** Do you think you still have a risk of *Iguana iguana* coming in? **A:** I wish I had authority to do something about that. Some containers are still coming in from other islands. In terms of biosecurity, conditions are still bad. Cuban tree frogs have been seen coming in.
- **Q (Mark Welch):** Coastal areas are gone in some places; how many coastal nesting sites have a shot at being preserved? **A:** We only found *Iguana iguana* in core areas so far, so there are areas where populations are large and they should be safe from them.
- **Q (Bruce Weissgold):** Are red-eared sliders established in Dominica? **A:** We have had a pet shop from which people would have released pets, but Forestry removed as many as possible and they seem to be gone.

- **Q (Chuck Knapp):** What are you going to be doing in the next year about this issue? **A:** Thijs will help with iguana training, then we'll have a local trainee to deal with it, and focus on outreach and raising public awareness. We will also look at *I. delicatissima* nesting sites post hurricane to compare to Chuck's pre-hurricane data.

Taxonomic Assessment of *Iguana iguana* and Potential Threats of Intraspecific Hybridization in Native Island Populations (van den Burg, Thijs*, Brian Bock, Wilfredo Falcón, and Catherine Malone)

- **Q (Mark Welch):** Is there about as much variation in the haplotype network for *Iguana iguana* as across all of *Cyclura*? How many endangered species would that make? **A:** Yes; no comment.
- **Q (Robert Fisher):** Will the Curaçao species need a new name? Body size differences are pretty dramatic. Should focus on naming the new species over formally delimiting them in case there are pressing risks. **A:** Yes.
- **Q (Bruce Weissgold):** Do any of the islands import Green Iguanas for the pet trade? **A:** Yes, but they know about the pets and they seems secure.
- **Q (Robert Fisher):** Are there invasive boas in Curaçao? **A:** No, there are invasive boas in Aruba, but they have not gotten to Bonaire or Curaçao yet.

Conservation Genetics of Iguana (Malone, Catherine and Thijs van den Burg*)

- No questions.

Support from the Local Community for Long-term Conservation of an Island Endemic and Control of an Invasive Iguana in Little Cayman (Laaser, Tanja*, Jen Moss, Jane Haakonsson, Ed Houlcroft, Mark Welch, and Glenn Gerber)

- **Q (Tandora Grant):** It seems like you got more this year than last year; is that because of more time of better techniques? **A:** Yes, more people and time but it could be because the population is increasing but we don't know.
- **Q (John Iverson):** Have you had a female *C. caymanensis* move from one nesting area to another? **A:** Haven't had time to look at the data, but Jen Moss might know more.
- **Q (Robert Fisher):** What does SIRI stand for? **A:** Sister Island Rock Iguana
- **Q (Bruce Weissgold):** is it possible to get a pellet gun or rifle? **A:** All things with projectiles are illegal.
- **Comment (Sofie O'Hehir):** This is completely controlled by the police – it's a long process to try to get a permit.

The Rise of Invasive Reptile Species (Joseph Wasilewski*)

- **Q (A-E Nash):** You removed 10,000 Tegu? **A:** Yes, black and white tegus from Argentina.
- **Comment (Robert Fisher):** USGS picture paper just came out.
- **Q (Bruce Weissgold):** Years ago, a dealer left the US, and inspectors checked and found all his animals loose in his yard. **A:** Red headed agamids have been found and we know which house they came from.

- **Q (Karin Nelson):** Is dry ice an option for taking out animals? **A (Bonnie Raphael):** Anything that depends on inhalation takes a long time, but if you can freeze it very fast that's the same as blunt force head trauma.
- **Comment (JW):** Is there a more humane way to euthanize?
- Baptiste Angin: How is the population on Cat Cay? **A:** No larger green iguanas can be found now.
- **Q (Chuck Knapp):** Can your program be a source for a student? **A:** Yes.
- **Comment (Bruce Weissgold):** The US Fish and Wildlife Service can be petitioned to list Greens and others as invasive species.
- **Comment (John Bendon):** We have a colony of wallabies in England.
- **Q (A-E Nash):** How big is Cat Cay? Can you clear the island completely? **A:** No there are palm trees on the islands, it's impossible to remove them. We have knocked them out with drones but you need to use the expensive ones.
- **Q (A-E Nash):** What percentage (how close) are you getting to to manage them? **A:** Were getting close to that number.
- **Q (Chuck Knapp):** What can we do to help this process along [deal with invasive species]? **A (Sophie O'Hehir):** In Grand Cayman, 1.6 million [Green Iguanas] is the upper limit of the survey from this year. Last week we started another massive cull. Outsourcing and having many people involved. In one week, they got 62,000 iguanas. Need to incentivize with money. We are paying \$5 per iguana.
- **Q (Bruce Weissgold):** How do they catch them? **A (Sophie O'Hehir):** Some people have air rifle licenses, but a variety of other methods are used. There have been a variety of issues with people so they need to keep restrictions in place.
- **Comment (Peter Harlow):** They [Green Iguanas] were identified in Fiji in 2005, and the estimate for the costs of eradication went from \$75,000 to \$30,000,000 in eight years. The UN has offered help, but they still haven't started.
- **Comment (Robert Fisher):** That money is through the global environmental fund (GEF).
- **Q (Chuck Knapp):** Can we provide training to in-country partners so they can follow this same path?
- **Q (Kim Lovich):** Is anyone in our group on the Invasive Species Specialist Group? There's a lot of money at governmental level, it's a matter of accessing it.
- **Comment (Robert):** Europe has EU life funding for management and control for any countries that may be included there, or are part of the commonwealth.

Day 4: 7 November 2018

Daily Agenda Review and Meeting Logistics Update (Chuck Knapp, Stesha Pasachnik)

Code of Conduct (Chuck Knapp, Stesha Pasachnik, Tandora Grant, ALL)

A code of conduct was developed and available on our website (About tab).

- No questions.

Mohamed bin Zayed Species Conservation Fund Opportunities (Allison Alberts)

Summary — Allison Alberts serves in The Mohamed bin Zayed Species Conservation Fund Advisory Board as the herpetology expert, and discussed the funding opportunities for conservation work on iguanas. After her presentation there was a group discussion.

Minutes are censored, please contact Tandora Grant for notes.

- More information available at: <https://www.speciesconservation.org>

Reptile Smugglers, Update (Tandora Grant)

Summary — Tandora Grant presented information about reptile smugglers in order to raise awareness of this problem within ISG members. After her presentation there was a group discussion.

Minutes are censored, please contact Tandora Grant for notes.

Hurricane Response Plan and Climate Change (Chuck Knapp)

Summary — Chuck Knapp presented information/led the discussion about the hurricane response plans and climate change. The main points discussed include:

- The International Iguana Foundation has emergency funds available.
- Hurricane kit and protocols made for the Anegada Iguana will be made available by Kelly Bradley.
- Janelle Brisbane suggested having hurricane response teams in each of the Caribbean islands to coordinate and assist one another (e.g., mutual assistance between nearby islands).
- After a group discussion, it was suggested to have a point-of-contact in each place. Stesha Pasachnik and Chuck Knapp will coordinate through the ISG Listserve.
- Robert Fisher raised the point of the need for developing/strengthening protocols for biosecurity and early monitoring and detection of non-native species that could pose a threat to native iguana populations.

Action Plans (Chuck Knapp)

Summary — Chuck Knapp presented information about the status of the work on action plans. The main points discussed include:

- Format has been streamlined so that it is easier to implement the action plans.

- The ISG will revisit the Action Plan for the West Indian Iguanas to include all species.
- People interested in contributing to the action plans should contact Chuck, Tandora, or Stesha for coordination.

Florida IguanaFest Update (Ty Park)

Summary — Ty Park presented information about his background working with iguanas, how he got into iguana conservation, and the origins of the IguanaFest. The main points discussed include:

- ~\$64,000 available to fund research and conservation work on iguanas (\$10k left over from last year + \$54k from this year).
- Funding proposals have no specific format; there is a board in place to evaluate proposals.

Opportunities in Jamaica (Stesha Pasachnik)

Summary — Stesha Pasachnik presented information about research and conservation work in Jamaica. The main points include:

- Possibility for vet/zoo personnel exchange
- Jamaican Iguana & invasive species radio-tracking work coming up in 2019. Stesha is looking for potential MSc. students for this work (applications due on 1 December 2018).
- Public Service Video that was made in collaboration with JET entitled “Save the Jamaica Iguana” was presented. Accessible here: https://www.youtube.com/watch?v=TGJb1J_Avtc

Travel Awardees Update (Stesha Pasachnik)

Stesha congratulated all ISG Travel Award recipients, and thanked the generous donations of those that gave extra funds with their meeting registrations. Awardees this year were: Baptiste Angin, Jeanelle Brisbane, Wilfredo Falcón, Daisy Maryon, Mallory McKinney, Yoni Muggen-van Uden, Thijs van den Burg, Alison Webb, and Rachel Welt. Jeanette Moss was also offered an award but was unable to attend the meeting.

ITWG Update, Species Status Review, and Priority Actions (John Iverson, Tandora Grant)

- No questions.

Next Meeting Location (Stesha Pasachnik, Chuck Knapp, Tandora Grant, ALL)

Summary — Main points of the discussion include:

- Next meeting (2019) will possibly be held in Guatemala, hosted by Daniel Ariano. ISG Steering Committee is working with collaborators there to confirm/finalize the details.
- Baptiste Angin mentioned that the French West Indies can possibly host the 2020 meeting, in conjunction with a recovery planning meeting.
- Giuliano Colosimo offered Rome as a backup plan for 2019. Wilfredo Falcón mentioned Puerto Rico as a backup plan to host the meeting in 2019 and/or

the possibility to host the meeting in 2021 (with the help of Miguel [Toño] García).

Red List Working Groups (Tandora Grant, All participants)

Summary — T. Grant presented the species whose information needs to be worked on, either updated or created new. Several ISG members offered to help, and a list was compiled by Chuck Knapp.