



**2017 IUCN SSC Iguana Specialist Group Annual Meeting
Meliá Hotel
Varadero Peninsula, Matanzas Province, Cuba**

22 October 2017

Arrive at José Martí International Airport (HAV), Havana. Transfer to **Roc Presidente Hotel** with Kronos

23 October 2017

- 7 – 8:00 am** Breakfast at **Roc Presidente Hotel**
- 9:00 am** **Depart Optional City Tour.** 4-hour walking tour of the historic colonial center, handicraft shopping, visit La Bodeguita del Media, and stop at El Capitolito.
- Lunch on your own**
- 3:00 pm** **Bus departure for Meliá Hotel, Varadero.** All-inclusive hotel meeting venue.
- 7:30 – 8:30 pm** **Ice Breaker,** Meeting Salon

24 October 2017

- 9:00 am** **Welcome and self-introductions**
ISG Co-Chairs: Chuck Knapp and Stesha Pasachnik
- 9:30 am** **Welcoming Address, information about surrounding area**
Garcia Martinez, Oscar Luis – Delegado del Ministerio de Ciencia Matanzas
- 9:40 am** **Reptiles of Cuba**
Díaz Beltrán, Luis
- 10:00 am** **Introduced Amphibians and Reptiles in the Cuban Archipelago: An Update**
Alonso Bosch, Roberto*, Rafael Borroto-Paez, Tomás M. Rodríguez-Cabrera, and L. Yusnaviel García Padrón
- 10:25 am** **Algunas Características de los Sitios de Nidificación de la Iguana Cubana en el Parque Nacional Caguanes, Sancti Spíritus, Cuba**
Falcón, Armando*, Elier Sánchez, Norgis V. Hernández, and Alfredo Z. Domínguez
- 10:50 am** **BREAK**



- 11:10 am** **Desarrollo Turístico en la Cayería Noreste de Villa Clara, Impactos Sobre las Poblaciones de Iguana. Algunas Experiencias en el Manejo de Especies Exóticas que las Afectan**
Arias Barreto, Angel*
- 11:35 am** **The Effects of Tourism and Food Provisioning on the Physiology of Exuma Rock Iguanas (*Cyclura cyclura*) in The Bahamas**
Webb, Alison*, Charles R. Knapp, John B. Iverson, Dale DeNardo, and Susannah French
- 12:00 pm** **A Tale of Two Iguanas: Physiological Responses to Tourism Vary Between Two Species of Iguanas**
French, Susannah S*, Alison Webb, John B. Iverson, Dale DeNardo, and Charles R. Knapp
- 12:25 pm** **Iguaninae Genetics Update, dealing with large amounts of data and a new genus**
Malone, Catherine*
- 1:00 pm** **LUNCH**
- 2:00 pm** **The Genetic Structure of *Cyclura cyclura*, their Parasites, and Pathogens All Suggest the Presence of Distinct Independently Evolving Groups of Populations**
Colosimo, Giuliano, Anna C. Jackson, Amanda Benton, Charles R. Knapp, John B. Iverson, and Mark E. Welch*
- 2:25 pm** **Population Densities, Distribution, and Nesting of *Cyclura* in Cabritos Island and the Invasion Story of Green Iguana (*Iguana iguana*) in Hispaniola**
Carreras-De León, Rosanna*, Liz A. Paulino, C. Esquea, Ernst Rupp, and Yolanda León
- 2:50 pm** **Habitat Use and Life History of the Sister Islands Rock Iguana (*Cyclura nubila caymanensis*) on Little Cayman**
Moss, Jeanette*, Glenn Gerber, and Mark Welch
- 3:15 pm** **BREAK**
- 3:35 pm** **Long-distance Dispersal Explains the Biogeographic Origin of Madagascar's Endemic Iguanas (Opluridae)**
Welt, Rachel*
- 4:00 pm** **Observations from the Field and Conservation Approaches of a Critically Endangered Island Endemic, Utila Spiny-tailed Iguana *Ctenosaura bakeri***
Maryon, Daisy F.*, David C. Lee, Stesha A. Pasachnik, Emma Higgins, and Tom Brown
- 4:25 pm** **The Dutch Iguana Foundation – What We Do**
Muggen-van Uden, Yoni*



- 4:50 pm** **Steering Committee Succession and New Members**
Chuck Knapp, Stesha Pasachnik, Tandora Grant
- 5:00 pm** **Steering Committee Meeting (closed)**
Closed: Alberts, Gerber, Grant, Iverson, Knapp, Malone, Pasachnik, new members

25 October 2017

- 9:00 am** **Daily agenda review, meeting logistics update**
Chuck Knapp, Stesha Pasachnik
- 9:10 am** **Disease Events and Management Actions in and around the Blue Iguana Breeding Facility on Grand Cayman**
Haakonsson, Jane Ebert*, Ioana Simona Popescu, James G. Fox, Zeli Shen, Paul P. Calle, Ken Conley, and Tracie Seimon
- 9:35 am** **The Present and the Future: Little Cayman's Fight Against the Invasive Green Iguana (*Iguana iguana*) Continues**
Houlcroft, Ed*, and Mike Vallee*
- 10:00 am** **Region-wide Decline of *Iguana delicatissima* and the Need for Immediate Conservation Action**
van den Burg, Thijs*, Charles Knapp, and Michel Breuil
- 10:25 am** ***BREAK***
- 10:45 am** **Marine Iguanas of the Galápagos – A Social Aspect**
Bendon, John*
- 11:10 am** **Conservation of a Worldwide Flagship Species: Development and Use of Miniaturized Technology and Infrastructure to Track the Critically Endangered Pink Iguana from Galápagos**
Colosimo, Giuliano*, Pierpaolo Loreti, Massimiliano De Luca, Lorenzo Bracciale, Glenn Gerber, and Gabriele Gentile
- 11:35 am** **Phylogeography, Phylogeny, and Systematics of *Hepatozoon* from Galápagos Land Iguanas (*Conolophus* spp.)**
Fulvo, Arianna, Marilyn Cruz, Leandro Patino, Saverio Vicario, Jorge E. Carrión, Virna Cedeño, Andrew Cunningham, Simon Goodman, and Gabriele Gentile*



- 12:05 pm** **Conservation of the Critically Endangered Monuriki Island Crested iguana (*Brachylophus cf. vitiensis*) Through a Captive Breeding Headstart Program in Fiji**
Brown, Joseph*, Kim Lovich, Ramesh Chand, Jone Niukula, Joelle Vadada, Sia Rosalto, Stesha Pasachnik, Baravi Thaman, Peter Harlow, Carlton Rochester, Stacie Hathaway, and Robert Fisher
- 12:35 pm** **LUNCH**
- 2:00 pm** **ISG Year in Review, Red List Update, New Membership Term 2017–2020, IUCN Portal, CITES Permit**
Tandora Grant, Chuck Knapp, Stesha Pasachnik
- 2:30 pm** **Poster Session with Presenter Introductions (In alphabetical order by last name)**
- Population Genetics of Motagua Spiny-tailed Iguana *Ctenosaura palearis* in the Dry Forest of Motagua Valley, Guatemala**
Castañón, Edwin, Guido Rossi*, Kervin Cardona, Miguel Morales, Daniel Ariano, and Gilberto Salazar
- Restoring Nesting Sites for the Mona Island Iguana through the Removal of the Invasive Australian Pine**
Figuerola, Cielo, Robert J. Mayer, Iván Llerandi, Idelfonso Ruiz, and José L. Herrera
- Community Based Recovery of the Monuriki Island Crested Iguana (*Brachylophus cf. vitiensis*) in Fiji**
Fisher, Robert, Peter Harlow, Ramesh Chand, Jone Niukula, Baravi Thaman, Elenoa Seniloli, Joeli Vadada, Sia Rasalato, Steve Cranwell, Tui Yanuya, Stesha Pasachnik, Kim Lovich, Nunia Thomas-Moko, and Joey Brown*
- Application of Drones for Radio Tracking Sister Islands Rock Iguanas (*Cyclura nubila caymanensis*)**
Hui, Nathan, Glenn Gerber*, Jeanette Moss, Ryan Kastner, and Curt Schurgers
- Community outreach for long-term conservation of the endangered Motagua Spiny-tailed Iguana *Ctenosaura palearis***
Gil-Escobedo, Johana, Gilberto Salazar, Daniel Ariano-Sánchez, Erik López and Guido Rossi*
- Investigating Intra-Island Translocation as a Conservation Strategy for the Turks and Caicos Iguana: The Impact of Homing and Stress**
Wagener, Tarren*, and Glenn Gerber



3:30 pm thru PM **Working Session for Red List Assessors and Invasive Iguana Statement Update:**
Red Listers: *Tandora Grant, Chuck Knapp, Stesha Pasachnik, Rosanna Carreras, Glenn Gerber, Catherine Malone, Thijs van den Burg, Gabriele Gentile, Giuliano Colosimo, John Iverson, Sandy Buckner*
Invasive Iguana Statement Update: *Joe Wasilewski (coordinator)*

26 October 2017

9:00 am **Daily agenda review, meeting logistics update**
Chuck Knapp, Stesha Pasachnik

9:10 am **Tribute to George B. Rabb**
Sandra Buckner

9:35 am **AZA SAFE Program, Recovery Plans and Improvements**
Chuck Knapp

10:15 am **How to Address Hunting with a Lack of Governmental Support**
Daisy Maryon

10:55 am ***BREAK***

11:20 am **Illegal Trade and Online Data Putting Species at Risk**
Gabriele Gentile, Yoni van Uden

12:05 pm **Hurricane Impacts and Responses**
John Iverson, Sandra Buckner, Tarren Wagener

12:40 pm **Biosecurity at Ports (Invasives and Natives)**
Jill Jollay, Thijs van den Burg

1:00 pm ***LUNCH***

2:00 pm **Use of Drone Technology**
Kyle Miller, Glenn Gerber, Stesha Pasachnik, Jen Moss

2:10 pm **Strengthening Engagement with Local Educational Programs**
Tom Wiewandt

2:20 pm **IguanaFest Update**
Stesha Pasachnik



- 2:35 pm** **Opportunities in Jamaica**
Stesha Pasachnik
- 2:40 pm** **Travel Awardees Update**
Stesha Pasachnik
- 2:45 pm** **Next Meeting Location**
Stesha Pasachnik, Chuck Knapp, Tandora Grant, All
- 3:00 pm** **Working Session for Red List Assessors and Invasive Iguana Statement Update:**
Red Listers: *Tandora Grant, Chuck Knapp, Stesha Pasachnik, Rosanna Carreras, Glenn Gerber, Catherine Malone, Thijs van den Burg, Gabriele Gentile, Giuliano Colosimo, John Iverson, Sandy Buckner*
- 4:30 pm** **Optional field trip:** Visit archaeological sites at the Ambrosio and Musulmanes Caves within the Reserva Ecologica Varahicaco.

27 October 2017

- 9:00 am** **Departure.** Optional visit to Zapata National Park, including lunch at Caleta Buena and beach time. Then return to Roc Presidente Hotel, Havana.



IUCN SSC Iguana Specialist Group Annual Meeting
Meliá Hotel, Varadero, Cuba
23–27 October 2017

ORAL PRESENTATION ABSTRACTS

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

Introduced Amphibians and Reptiles in the Cuban Archipelago: An Update

Alonso Bosch, Roberto*¹, Rafael Borroto-Paez², Tomás M. Rodríguez-Cabrera², and L. Yusnaviel García Padrón³

¹Museo de Historia Natural “Felipe Poey”, Facultad de Biología, Universidad de La Habana, La Habana, Cuba; ²Sociedad Cubana de Zoología, La Habana, Cuba; ³Museo de Historia Natural “Tranquilino Sandalio de Noda”, Pinar del Río, Cuba

The number of introductions and resulting established populations of amphibians and reptiles in Caribbean islands is alarming. Through an extensive review of bibliographical information on Cuban herpetofauna, we present a comprehensive inventory of introduced amphibians and reptiles in the Cuban archipelago. We classify species as Invasive, Established Non-invasive, Not Established, and Transported. We document the arrival of 26 species (five amphibians and 21 reptiles) in more than 35 different introduction events. Of the 26 species, we identify 11 species (42.3%) (one amphibian and 10 reptiles) as established, with nine of them being invasive. We present the introduced range of each species in the Cuban archipelago and document historical records, the population sources, dispersal pathways, introduction events, current status of distribution, and impacts. Additionally, during the last two years we have collected and identified another two potential invasive species (one amphibian and one reptile) in agricultural and urban environments from western Cuba. We compare the situation of introduced herpetofauna in Cuba with that in other Caribbean islands. The paper contributes a systematic review as well as new knowledge for national and international agencies and databases. This information is critical for use in conservation, management, eradication, and to avoid potential introductions.

Resumen: El número de poblaciones de anfibios y reptiles introducidas y establecidas en las islas del Caribe es alarmante. A través de revisión exhaustiva de información bibliográfica en la herpetofauna Cubana, nosotros presentamos un amplio intervalo de anfibios y reptiles introducidos en el archipiélago Cubano. Nosotros clasificamos las especies como invasivas, establecidas no invasivas, no establecidas y transportadas. Documentamos la llegada de 26 especies, cinco anfibios y 21 reptiles, en más de 35 eventos de introducción diferentes. De 26 especies, identificamos 11 especies (42.3%), un anfibio y 10 reptiles, como establecidas, siendo nueve de estas invasivas. Presentamos el rango introducido para cada especie en el archipiélago cubano y documentamos

datos históricos, fuentes de población, vías de dispersión, eventos de introducción, estado actual de la distribución e impactos. Adicionalmente, durante los últimos dos años, hemos colectado e identificado otras dos potenciales especies invasivas (un anfibio y un reptil) en ambientes agrícolas y urbanos en el occidente de Cuba. Comparamos la situación de la herpetofauna introducida en Cuba con otra isla caribeña. El artículo contribuye a la revisión sistemática como bien conocemos, para agencias nacionales e internacionales, y bases de datos. Esta información es crítica para su uso en conservación, erradicación y evitar potenciales introducciones.

Desarrollo Turístico en la Cayería Noreste de Villa Clara, Impactos Sobre las Poblaciones de Iguana. Algunas Experiencias en el Manejo de Especies Exóticas que las Afectan

Arias Barreto, Angel*

Centro de Servicios Ambientales, CITMA, Cuba

Cayería Noreste de Villa Clara, includes the cay Santa María, Ensenachos, Español de Adentro and Las Brujas. All of these cays have been affected by human activities since mid-1990s. On the other hand, these cays have been recognized by many authors as a place of significant importance for conservation as they have important faunistic value, particularly the reptiles due to marked local endemism. In the mid-1990s, iguanas were very abundant in a lot places in these cays. However, the habitat destruction, fragmentation, and the introduction of exotic species such as dogs and cats, has made their population very depleted today. To address this, actions have been taken by the Department of Environmental Protection, in conjunction with the hotel operators and the Ministry of Public Health, for the eradication of these introduced species. Although it is far from achieving the expected results, there are examples such as the hotel on Cayo Ensenachos where they have managed to eradicate dogs and control cats. This has led to a recovery of species in this hotel area and its surroundings. However, workers and tourists are still not aware of the importance of eradicating cats and dogs from the Cayería, which presents a great ethical dilemma since workers and tourists feel more empathetic to the introduced species than with native fauna.

Resumen: La Cayería Noreste de Villa Clara, comprende los cayos Santa María, Ensenachos, Español de Adentro y Las Brujas. Todos estos cayos, se han visto afectados por la actividad antrópica desde mediados de los 90. Por otra parte, dichos cayos han sido reconocidos por varios autores como lugar de gran importancia para la conservación, pues estos cuentan con importantes valores faunísticos, destacando los reptiles por su marcado endemismo local. Las iguanas, a mediados de los 90, eran muy abundantes en varios de estos cayos. Sin embargo, la destrucción de hábitat, la fragmentación y la introducción de especies exóticas, como el perro y el gato, hacen que hoy sus poblaciones estén muy diezmadas. En este sentido, se han comenzado a realizar acciones por parte del departamento de protección al medio, en conjunto con el operador de los hoteles y el ministerio de salud pública, para la erradicación de estas especies introducidas. Si bien se está muy lejos de alcanzar los resultados esperados, existen experiencias como las del hotel de Cayo Ensenachos, donde se ha logrado erradicar los perros y controlar los gatos. Lo anterior, ha traído como consecuencia una recuperación de las especies en áreas del hotel y sus alrededores. Sin embargo, todavía no se comprende por parte de trabajadores y turistas la importancia de erradicar gatos y perros de la cayería, presentándose un gran dilema ético, pues tanto trabajadores como visitantes se sienten más identificados con las especies introducidas que con la fauna autóctona.

Marine Iguanas of the Galápagos – A Social Aspect

Bendon, John*

Independent, UK

Marine Iguanas, (*Amblyrhynchus cristatus*), populate most of the islands of the Galápagos. Not all coastal areas have the same habitat. Some areas are rock and sand only, while others have plentiful vegetation as well. The study area concerned here has rocky shores, and a few yards inland there are lush carpets of *sessuvium*, trees, and shrubs. I observed the social interactions of the iguanas armed with a camera and a notebook, in Santa Cruz and for three days on Floreana, for six weeks over a two-year period and spending a total of ten weeks on the islands. The study area on Floreana is by the main docking area, where there is little vegetation and mostly lava rock. Quite a colony lives there and were only observed during the middle of the day.

I will present how the iguanas behave during the day out on the rocky shores and how they structure their groups, both on the shore and the places they sleep amongst the vegetation. This main study area is a portion of the Academy Bay shore, in Puerto Ayora, Santa Cruz. Three areas are used: the loading dock by the entrance to the research station, a small area between the station and the sea, on and around a boat ramp, and a stretch of shore about 500 meters east which is about one-kilometer-long and which I have named Darwin Beach. It consists of several small bays, with colonies of iguanas in each.

In the technical drawings presented, I have tried to show the similarities and differences between four subspecies from Floreana and Española, Santa Cruz, San Cristobal, and Albemarle (Isabela). From viewing the drawings without reference to DNA studies, the species are all difficult to distinguish from one another. This was the objective of this research, in addition to behavioral study. The drawings are done in pigment ink on cartridge paper and colored with 'Caran d'Ache' colored pencils. The poster presentation, in conjunction with the oral presentation, shows all the iguana's heads drawn for comparison.

Resumen: La Iguana Marina (*Amblyrhynchus cristatus*), se encuentra principalmente en las islas Galápagos. No todas las áreas costeras tienen el mismo hábitat. Algunas áreas son solo rocas y arena, mientras que otras tienen vegetación abundante. El área de estudio tiene costas rocosas, y pocos metros tierra adentro, hay exuberantes alfombras de *Sesuvium*, árboles y arbustos. Observé las interacciones sociales de las iguanas en Santa Cruz y durante tres días en Floreana, armado con una cámara y un cuaderno, durante seis semanas en un periodo de dos años, pasando un total de diez semanas en la isla. El área de estudio en Floreana es por el muelle principal, donde hay poca vegetación y sobre todo roca con lava. Una colonia vive allí, y solo se observó durante la mitad del día.

Voy a demostrar en la presentación como las iguanas se comportan durante el día en las costas rocosas, y como se estructuran en grupos, tanto allí como los lugares donde duermen entre la vegetación. Esta área de estudio principal es una porción de la costa de Academy Bay, Puerto Ayora, y Santa Cruz. Tres áreas son usadas: el muelle de carga por la entrada a la estación de investigación, una pequeña zona entre la estación y el mar; y en y alrededor de una rampa de barco y un tramo de costa tal vez 500 nuestros al este, que es de aproximadamente un kilómetro de largo, he llamado Darwin Beach. Consta de varias pequeñas bahías, con colonias de iguanas cada una.

En los dibujos técnicos presentados, he tratado de mostrar las similitudes y diferencias entre cuatro subespecies de Floreana, Española, Santa Cruz, San Cristobal y Albemarle (Isabela). Al ver los dibujos sin referencia a los estudios de ADN, las especies son difíciles de distinguir entre sí. Este fue el objetivo de esta investigación, además del estudio de comportamiento. Los dibujos se hacen en tinta de pigmento sobre papel de cartucho y coloreado con lápices de colores 'Caran d'Ache'. La presentación de póster, junto con la presentación oral, muestran todos los dibujos realizados para su comparación.

Conservation of the Critically Endangered Monuriki Island Crested iguana (*Brachylophus cf. vitiensis*) Through a Captive Breeding Headstart Program in Fiji

Brown, Joseph*¹, Kim Lovich², Ramesh Chand³, Jone Niukula⁴, Joelle Vadada⁴, Sia Rosalto⁵, Stesha Pasachnik⁶, Baravi Thaman⁴, Peter Harlow⁷, Carlton Rochester⁸, Stacie Hathaway⁸, and Robert Fisher⁸

¹University of Oklahoma, Norman, Oklahoma, USA; ²San Diego Zoo Global, San Diego, California, USA; ³Kula Wild Adventure Park, Sigatoka, Fiji; ⁴The National Trust of Fiji, Suva, Fiji; ⁵Ahura Resorts, Nadi, Fiji; ⁶Fort Worth Zoo, Fort Worth, Texas, USA; ⁷Taronga Zoo, Mosman, NSW, Australia; ⁸U.S. Geological Survey, San Diego, California, USA

The Critically Endangered Fijian Crested Iguana (*Brachylophus cf. vitiensis*) population of Monuriki Island has been declining for the last few decades. In 2010, a Memorandum of Understanding authorized the eradication of introduced rats and goats on Monuriki, and allowed for 21 wild iguanas to be captured for a captive breeding headstart program. In 2015, 32 captive-bred (CB) iguanas were implanted with PIT tags and reintroduced on Monuriki. In 2017, 16 of the original wild founders and 32 CB offspring were also PIT-tagged and released on Monuriki. For this five-month study, we monitored iguana survivorship, acclimation, and habitat use. We used radio telemetry to track ten wild founders from the headstart program and ten CB offspring. Thirteen wild iguanas were also captured and fitted with transmitters for behavioral comparisons between CB and wild individuals; the first-ever opportunity to track wild *Brachylophus*. Preliminary analyses show no significant differences in habitat preference among the three study groups. We also conducted routine night surveys examining long-term assessment of the headstart program and recovery of the wild population post-invasive eradication. New wild iguanas were PIT-tagged while location and habitat information was recorded. We identified 39 new wild iguanas and six CB iguanas from the introduction in 2015. All six 2015 CB iguanas exhibited habitat and perch preferences similar to their wild counterparts; one of these was a CB female that was repeatedly paired with a wild male. These findings are good indications of a successful headstart program by showing survivorship and acclimation of CB iguanas into the wild. Furthermore, due to a higher number of wild iguanas found post-invasive eradication, our results suggest recovery is slowly underway. However, with so few individuals remaining in the wild, continued monitoring is critical for assessing management success and ensuring the recovery of this species on the brink of extinction.

Resumen: La población de iguana con cresta fijiana (*Brachylophus cf. vitiensis*) En Peligro Crítico de extinción de la Isla Monuriki ha estado disminuyendo durante las últimas décadas. En 2010, un

Memorandum de Entendimiento autorizó la erradicación de ratas y cabras introducidas en Monuriki, y permitió la captura de 21 iguanas silvestres para el inicio del programa de crianza en cautiverio. En 2015, 32 iguanas criadas en cautiverio (CB) fueron implantadas con etiquetas PIT y reintroducidas Moniriki. En 2017, 16 de las fundadoras silvestres originales y 32 descendientes de CB fueron también etiquetadas con PIT y liberadas en Monuriki. Durante cinco meses de estudio, nosotros monitorizamos la sobrevivencia de la iguana, climatización y uso de hábitat. Nosotros usamos radio telemetría para rastrear las diez iguanas fundadoras iniciadoras del programa y diez descendientes CB. Trece iguanas silvestres fueron capturadas y equipadas con transmisores para comparaciones conductuales entre CB e individuos silvestres; la primera oportunidad para rastrear *Brachylophus* salvajes. Análisis preliminares muestran que no hay diferencia significativa en la preferencia de hábitat entre los tres grupos de estudio. También llevamos a cabo encuestas nocturnas de rutina para examinar la evaluación a largo plazo del programa de cría en cautiverio y la recuperación de la población silvestre después de la erradicación invasiva. Las nuevas iguanas silvestres fueron etiquetadas con microchips mientras la localización y la información de hábitat fueron registradas. Identificamos 39 nuevas iguanas silvestres y seis iguanas CB provenientes de la introducción de 2015. Las seis iguanas CB de 2015 exhibieron preferencias de hábitat y percha similares a sus contrapartes silvestres; una de ellas era una hembra CB que se emparejaba repetidamente con un macho silvestre. Estos descubrimientos son buenos indicadores de un programa de liberación exitosa debido a mostrar sobrevivencia y climatización de iguanas CB en estado silvestre. Además, debido a un mayor número de iguanas salvajes encontradas después de la erradicación masiva, nuestros resultados sugieren que la recuperación está en marcha lentamente. Sin embargo, con tan pocas personas en campo, la supervisión continua es crítica para evaluar el éxito de la gestión y asegurar la recuperación de esta especie al borde de la extinción.

Population Densities, Distribution, and Nesting of *Cyclura* in Cabritos Island and the Invasion Story of Green Iguana (*Iguana iguana*) in Hispaniola

Carreras-De León, Rosanna*^{1,2}, L.A. Paulino¹, C. Esquea², E. Rupp², and Y. León^{1,2}

¹Instituto Tecnológico de Santo Domingo, Santo Domingo, República Dominicana; ²Grupo Jaragua, Santo Domingo, República Dominicana

Cyclura ricordii and *Cyclura cornuta* are endemic to Hispaniola Island. Ricord's Iguana survives in only four natural populations in the southwest and *Cornuta* has a wider distribution in the island, however both are listed as Critically Endangered and Vulnerable by the IUCN Red List of Threatened Species, respectively. Additional threats are represented in all habitats by introduced mammals, agricultural pressure, and hunting. Both species inhabit Cabritos Island, located within Enriquillo Lake 40 meters below sea level, and is a key habitat for their conservation. The island went through a species eradication program recently, where all introduced mammals were removed. Population density estimates for over 60 transects were collected during non-reproductive season in 2010, and during Ricord's hatching and *Cornuta's* nesting season in 2015, to evaluate the population numbers on the island. Densities were estimated by the presence of active dens and iguana sightings through this study. The population size for *Cyclura* was 2,448 individuals using the sighting data. Also, a species and age class habitat partition was suggested with the plotted distribution. The use of dens to estimate population sizes has to be used with caution. We observed an overabundance of active dens in comparison to the number of iguanas,

suggesting that iguanas might use multiple dens in their different life stages and that the season surveyed greatly impacted the density estimates. Nesting surveys were completed in 2015, during Ricord's hatching and *Cornuta's* nesting. Nests for both species clustered in the NW side of the island, where the highest densities of iguanas are present. Green Iguanas were introduced in Hispaniola over 30 years ago. They are considered invasive and their importation and commerce have been prohibited by the Ministry of Environment since 2010. Two main dispersion spots have been detected – one located in Baní and the other north of Santo Domingo.

Resumen: *Cyclura ricordii* y *Cyclura cornuta* son endémicas de la Isla Española. La iguana de Ricord sobrevive en solo cuatro poblaciones naturales en el suroeste y la iguana rinoceronte tiene la más amplia distribución en la Isla, sin embargo, ambas están listadas como En Peligro Crítico y Vulnerable en la Lista Roja de UICN de Especies Amenazadas respectivamente. Adicionalmente, las amenazas están presentes en todos los hábitats por mamíferos introducidos, presión agrícola y caza. Ambas especies no habitan la Isla Cabritos, localizada dentro del Lago Enriquillo a 40 metros bajo el nivel del mar, hábitat clave para su conservación. La Isla pasó recientemente por un programa de erradicación de especies, donde todos los mamíferos introducidos fueron removidos. Estimaciones de densidad poblacional para más de 60 transectos fueron realizadas, para la temporada no reproductiva de 2010 y durante la temporada de eclosión de iguana de Ricord y de anidación de iguana rinoceronte en 2015 con el fin de evaluar el número de la población en la isla. Las densidades fueron estimadas mediante la presencia de madrigueras activas, y avistamientos de iguanas durante el estudio. El tamaño de población para *Cyclura* fue 2,448 individuos usando la información de avistamiento. También, se sugirió una distribución de hábitat de la especie y clase de edad. El uso de madrigueras para estimar el tamaño de la población tiene que ser usado con precaución. Se observó una sobreabundancia de madrigueras activas en comparación con el número de iguanas, lo que sugiere que las iguanas pueden utilizar múltiples madrigueras en sus diferentes etapas de vida y que la temporada de análisis impactó mucho en las estimaciones de densidad. El análisis de anidación se completó en 2015 durante la eclosión de iguanas de Ricord y la anidación de iguana rinoceronte. Los nidos de ambas especies están agrupados en el lado noroeste de la isla, donde se encuentran las densidades más altas de iguana. Las iguanas verdes fueron introducidas en Española hace más de 30 años. Son consideradas invasivas y su importación y comercialización ha sido prohibida por el Ministerio de Ambiente desde 2010. Dos puntos de dispersión han sido detectados, uno localizado en Baní y otro en el Norte de Santo Domingo.

Conservation of a Worldwide Flagship Species: Development and Use of Miniaturized Technology and Infrastructure to Track the Critically Endangered Pink Iguana from Galápagos

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Conolophus marthae, the Galápagos Pink Land Iguana (or simply Pink Iguana), is listed as Critically Endangered by the IUCN Red List of Threatened Species. Pink Iguanas are threatened by small population size (the most recent estimates are in the low hundreds), limited distribution (the species is uniquely found on Volcán Wolf on Isabella Island), and the presence of invasive mammals (feral cats in particular). Information regarding the general ecology of Pink Iguanas is scant, and is being accumulated only in recent years. For example, despite knowing the species is syntopic with another species of land iguana (*C. subcristatus*), little is known about how the two species partition habitat usage and resources, or whether they have an overlapping mating season. This lack of information is largely due to the difficult logistics working in the environment where the species are found. Thus, establishing effective conservation strategies for Pink Iguanas becomes difficult. This project aims to establish a long-term population study of Pink Iguanas on Volcán Wolf. Four objectives are prioritized, each of which is instrumental for conservation of the Pink Iguanas: 1) definition of a species distribution range; 2) characterization of reproductive strategies and identification of nesting sites; 3) elaboration of a habitat suitability model; and 4) monitoring of feral cats and other mammal populations on the site. To accomplish these objectives, the University of Tor Vergata, in collaboration with the Galápagos National Park Directorate (GNPD) and San Diego Zoo Global, will implement a specifically designed GPS and data networking infrastructure that will allow the long-term monitoring of the Pink Iguana population on Volcán Wolf from a remote location. Here we present some of the features of this new GPS system that should be installed on at least 15 males and 15 females of each iguana species on Volcán Wolf at the beginning of 2018.

Resumen: *Conolophus marthae*, la Iguana Rosada de Galápagos (o simplemente Iguanas Rosadas), aparecen en la Lista Roja de UICN de Especies Amenazadas como En Peligro Crítico. Las Iguanas Rosadas están amenazadas debido a que es una población pequeña (los estimados más recientes se aproximan a los cientos), con distribución limitada (la especie se encuentra únicamente en el Volcán Wolf, en la Isla de Isabela, dentro del archipiélago de Galápagos) y con invasión de mamíferos (en particular gatos). La información de la ecología general de las Iguanas Rosadas es escasa y solo de años recientes. Por ejemplo, a pesar de que la especie es conocida por ser simpátrica con otra especie de iguana (*C. subcristatus*) se conoce poco de como ambas especies comparten su hábitat y recursos, o si tienen épocas de apareamiento al mismo tiempo. La falta de información se debe en gran medida a que la logística en el ambiente donde viven es difícil. Establecer estrategias de conservación efectivas para las Iguanas Rosadas, por lo tanto, también es complicado. Este proyecto pretende establecer un estudio poblacional a largo plazo de las Iguanas Rosadas en el Volcán Wolf. Cuatro objetivos son prioritarios, cada uno siendo un instrumento para la conservación de las Iguanas Rosadas: 1) definir el rango de distribución de la especie; 2) caracterizar las estrategias de reproducción e identificar sitios de anidamiento; 3) elaborar un modelo hábitat adecuado; y 4) monitorear a los gatos y otras poblaciones de mamíferos en el sitio. Para poder cumplir con estos objetivos la Universidad de Tor Vergata, en colaboración con la Dirección del Parque Nacional de Galápagos (GNPD, por sus siglas en inglés) y el Zoológico Internacional de San Diego, implementarán una infraestructura de GPS y una red de datos diseñada específicamente para permitir el monitoreo a largo plazo de las Iguanas Rosadas. El sistema será instalado en al menos 15 machos y 15 hembras de cada ejemplar de iguana en el Volcán Wolf, a inicios del 2018.

Algunas Características de los Sitios de Nidificación de la Iguana Cubana en el Parque Nacional Caguanes, Sancti Spíritus, Cuba

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The main nesting sites of the Cuban Iguana, *Cyclura nubila nubila*, are identified in the Cayos de Piedra sub-archipelago within the Caguanes National Park, located on the central north coast of the island of Cuba, which constitutes a core area of the Buenavista Biosphere Reserve. The most extensive cays have more nests: Cayo Lucas, Cayo Salinas, and Cayo Fabrica. The nesting sites are found in two types of substrates: 1) on small beaches with an accumulation of sand mainly of organic origin formed by shells of marine mollusks (pelecipods and gastropods) from the marine prairies of the Bay of Buenavista; and 2) in terrigenous substrates in areas exposed to northeastern winds without vegetation and in limestone cave hollows filled with red rendzina. We will discuss the extent of some nesting sites, the number of nests or refuges, the types of vegetation, and the size and number of eggs. Two species of natural predators of the iguana hatchlings are identified in the area.

Resumen: Se identifican los principales sitios de nidificación de la Iguana Cubana, *Cyclura nubila nubila*, en el subarchipiélago Cayos de Piedra dentro del Parque Nacional Caguanes, ubicado en la costa norte central de la isla de Cuba, que constituye una zona núcleo de la Reserva de Biosfera Buenavista. Los cayos más extensos poseen mayor cantidad de nidos: Cayo Lucas, Cayo Salinas y Cayo Fábrica. Los sitios de nidificación se encuentran en dos tipos de sustratos: 1) en pequeñas playas con acumulación de arena de origen fundamentalmente orgánico formadas por conchas de moluscos marinos (pelecípodos y gasterópodos) procedentes de las praderas marinas de la Bahía de Buenavista; y 2) en sustratos terrígenos en zonas expuestas a los vientos del nordeste sin vegetación y en las oquedades de la roca caliza rellenas de rendzina roja. Se comenta sobre la extensión de algunos sitios de nidificación, la cantidad de nidos o refugios, el tipo de vegetación el tamaño y número de huevos. Se identificaron dos especies de depredadores naturales de los neonatos en el área.

A Tale of Two Iguanas: Physiological Responses to Tourism Vary Between Two Species of Iguanas

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Human population growth and development has left few natural populations untouched, and so a considerable amount of research has been conducted on high-impact disturbances such as urban development. However, much less is known about the effects of less obtrusive activities such as ecotourism. Past research has documented behavioral and hormonal changes to ecotourism. However, these studies rarely provide direct health and survival consequences, or examine

impacts over a gradient of disturbances. We performed studies on two different species of iguana (*Amblyrhynchus cristatus*, *Cyclura cyclura inornata*, and *Cyclura cyclura figginsi*) exposed to varying degrees of ecotourism to test the impact of tourism-related disturbance on the physiology of these species. Some physiological responses were comparable between Marine and Rock Iguanas, including oxidative stress and baseline glucocorticoid levels. However, other physiological metrics such as reproductive output and immunity varied considerably between species. Regardless of species and physiological response, we found that the degree of tourism significantly impacted iguana physiology. These contrasting responses between the species are likely due to the differential impacts of ecotourism (i.e., observation versus supplemental feeding), and differences in the natural history and ecology of the species.

Resumen: El crecimiento poblacional en los humanos y el desarrollo ha dejado pocas poblaciones naturales sin impacto. Esto ha llevado a mucha investigación en el impacto de perturbaciones como el desarrollo urbano. Sin embargo, se sabe mucho menos de los efectos de actividades de menor impacto como el ecoturismo. Estudios pasados han documentado cambios actitudinales y hormonales debidos al ecoturismo, o han examinado el impacto de perturbaciones progresivas. Nosotros realizamos estudios en tres diferentes especies de iguana (*Amblyrhynchus cristatus*, *Cyclura cyclura inornata*, y *Cyclura cyclura figginsi*) expuestas a diferentes niveles de ecoturismo para evaluar el impacto de perturbaciones fisiológicas relacionadas con él. Algunas respuestas fueron comparables entre iguanas marinas y de roca, incluyendo estrés oxidativo y niveles glucocórticos. No obstante, otras métricas fisiológicas como tasa de reproducción e inmunidad variaron considerablemente entre especies. Sin importar la especie o la respuesta fisiológica, encontramos que el nivel de turismo impacta significativamente sobre la fisiología de la iguana. Estas respuestas diferentes entre las especies probablemente se deben a los diferentes impactos de ecoturismo (i.e., observación versus alimentación suplementaria), y diferencias en la historia natural y ecología de las especies.

Phylogeography, Phylogeny, and Systematics of *Hepatozoon* from Galápagos Land Iguanas (*Conolophus* spp.)

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Hepatozoon sensu lato is a hemoparasite that includes hundreds of species. Identification is primarily based on morphological criteria, which may lead to underestimation of taxonomic diversity (Telford 1984; Harris et al. 2001). We used sequence data from part of the 18S ribosomal DNA gene to investigate the genetic differentiation, phylogeography, and phylogeny of *Hepatozoon* infecting land iguanas from the Galápagos Islands (*Conolophus* spp.). Our results indicate that the pattern of genetic variation across islands may be consistent with allele surfing from eastern islands (geologically older) to western (younger) islands, and a peak of population

expansion might have occurred during the Last Glacial Maximum (about 20 Kya). Genetic diversity positively correlates with prevalence and density of ticks (*Amblyomma*), which can act as a reservoir for *Hepatozoon* from Galápagos iguanas. Our data demonstrate that *Hepatozoon* from Galápagos are not monophyletic, and at least four separate colonization events occurred, of which, only one shows a clear direct origin from continental South America. In two of four events (the older ones), a radiation throughout the archipelago occurred after colonization. The third colonization seems to be limited to the western islands Fernandina and Isabela. Although a few haplotypes have also been found in the blood of *Amblyrhynchus* (the Galápagos Marine Iguana) and *Chelonoidis* (the Galápagos Giant Tortoise) in parallel studies of hemoparasites of Galápagos reptiles (Bataille 2012; Patino 2017), most haplotypes seem exclusive to land iguanas and none has been found outside of Galápagos. Similar evidence of specificity was provided by Patino (2017) who found two haplotypes exclusive to giant tortoises. Based on intra- and inter-specific genetic divergence data, more than one species of *Hepatozoon* sensu lato exist in Galápagos iguanas. In the light of a newly proposed classification of hemogregarine (Karadjian et al. 2015), none of the hemogregarine found in Galápagos reptiles thus far should remain within the genus *Hepatozoon*.

Resumen: *Hepatozoon* sensu lato es un hemoparásito que incluye cientos de especies. La identificación está basada primariamente en criterios morfológicos, que pueden llevar a una subestimación de la diversidad taxonómica (Telford 1984; Harris et al. 2001). Nosotros usamos datos de secuenciación de parte del gen 18S ribosomal para investigar la diferenciación genética, filogeografía, y filogenia del *Hepatozoon* que infecta iguanas de tierra de las Islas de Galápagos (*Conolophus* spp.). Nuestros resultados indican que la variación en el patrón genético entre las islas puede ser consistente con un alelo proveniente de islas orientales, más antiguas geológicamente, hasta islas occidentales, más jóvenes geológicamente. Un pico en la expansión de la población podría haber ocurrido en la última glaciación (más o menos 20 Kya). La diversidad genética se correlaciona positivamente con la prevalencia de densidades de pulgas (*Amblyomma*), que pueden actuar como un reservorio del *Hepatozoon* de las iguanas de Galápagos. Nuestros datos demuestran que el *Hepatozoon* de Galápagos no es monofilético, y al menos cuatro colonizaciones han ocurrido, de las cuales solo una muestra un origen directo de Suramérica continental. La tercera colonización parece haber sido limitada a las islas orientales Fernandina e Isabela. A pesar de que pocos haplotipos se han encontrado también en la sangre de *Amblyrhynchus* (la Iguana Marina de Galápagos) y *Chelonoidis* (Tortugas Gigantes de Galápagos) en estudios paralelos de hemoparásitos de reptiles de Galápagos (Bataille 2012; Patino 2017), la mayoría de haplotipos parecen ser exclusivos a las iguanas de tierra y ninguna se ha encontrado en Galápagos. Evidencia similar de especificidad fue proveída por Patino (2017) que encontró dos haplotipos exclusivos a tortugas gigantes. Basado en especificidad intra- e inter-específica de divergencia genética, más de una especie de *Hepatozoon* sensu lato existe en iguanas de Galápagos. En la luz de una propuesta nueva de clasificación para hemogregarianos (Karadjian et al. 2015), ninguno de los hemogregarianos encontrados en reptiles de Galápagos deberían permanecer en el género *Hepatozoon*.

Disease Events and Management Actions in and around the Blue Iguana Breeding Facility on Grand Cayman

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The Blue Iguana (*Cyclura lewisi*) was brought back from the brink of extinction through intensive captive breeding and through the protection of areas. While the species has been successfully reintroduced and has been down-listed from Critically Endangered to Endangered, the road to recovery is far from over. Amongst the main threats are development, dog attacks, hybridization, and disease events. On 5 May 2015, Blue Iguana Recovery Programme (BIRP) staff found a wild Blue Iguana displaying signs of lethargy within the Queen Elizabeth II Botanic Park (QEIBP). This animal had spiral bacteria evident on blood smear and died. Another wild Blue, whose territory overlapped with the first, was found by BIRP staff on 11 May with similar symptoms. He also had spiral bacteria evident on blood smear, but made a full recovery following immediate veterinary treatment. Subsequently another ten animals, both from the wild and captive populations at the QEIBP were found either clinically ill or dead over the next two years. Sick animals were treated immediately and out of 12 confirmed cases, five survived and made full recoveries. Necropsy examinations indicated systemic infection, but necropsy lesions were not specific. A novel *Helicobacter* species was identified by PCR in blood smears and necropsy tissues. Investigation of fecal samples from healthy live unaffected Blue Iguanas revealed a second different *Helicobacter* organism that did not appear pathogenic for Blue Iguanas. The novel pathogenic *Helicobacter* species is now suspected to be the cause of the deaths in and around the breeding facility. Management actions taken in light of these events include veterinary research, strict quarantine protocols prior to release, biosecurity measures, and continued monitoring of wild and captive populations. Very little is still known about the pathogenic *Helicobacter* bacteria, including its transfer, potential reservoirs, and other host species.

Resumen: La Iguana Azul (*Cyclura lewisi*) fue traída de vuelta del borde de la extinción a través de intensiva crianza en cautiverio y a través de áreas protegidas. Si bien la especie ha sido exitosamente reintroducida y se ha rebajado de Peligro Crítico a En Peligro, el camino hacia la recuperación está lejos de haber terminado. Entre las principales amenazas están el desarrollo urbano, ataques de perros, hibridación, y enfermedades. El 5 de mayo 2015, el equipo del Programa para Recuperación de la Iguana Azul (BIRP) encontró una Iguana Azul silvestre exhibiendo signos de letargo en el Parque Botánico Reina Elizabeth II (QEIBP). Este animal tenía espiroquetas evidentes en frotis de sangre y murió. Otra Iguana Azul silvestre; cuyo territorio traslapaba con la primera, fue encontrada el 11 de mayo por el equipo de BIRP con síntomas similares. También presentaba espiroquetas evidentes en frotis de sangre, pero logró una completa recuperación seguida de tratamiento veterinario inmediato. Subsecuentemente, otros diez animales, tanto de poblaciones silvestres como en cautiverio del QEIBP se encontraron clínicamente enfermos o muertos durante los siguientes dos años. Animales enfermos fueron tratados inmediatamente y de los 12 casos confirmados, cinco sobrevivieron y lograron una recuperación completa. Exámenes de necropsia indicaron una infección sistémica, pero lesiones

de necropsia no fueron específicas. Una nueva especie de *Helicobacter* sp. fue identificada por PCR en frotis de sangre y necropsia de tejidos. Investigación de muestras fecales de Iguanas Azules saludables reveló un segundo organismo de *Helicobacter* sp. que no parecía patogénico para Iguanas Azules. Las nuevas especies patogénicas de *Helicobacter* sp. ahora se sospechan son las causantes de muertes en y alrededor de las instalaciones de crianza. Acciones de manejo tomadas en luz de estos eventos incluyen investigación veterinaria, estrictos protocolos de cuarentena previo a la liberación, medidas de bioseguridad y monitoreo continuo de poblaciones silvestres y en cautiverio. Aún se sabe muy poco acerca de bacterias patogénicas de *Helicobacter* sp., incluyendo su transferencia, potenciales reservorios u otras especies hospederas.

The Present and the Future: Little Cayman's Fight Against the Invasive Green Iguana (*Iguana iguana*) Continues

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Green Iguanas (*Iguana iguana*) were first recorded on Little Cayman in 2007. Since then, the response to sightings was handled by volunteer Mike Vallee, later joined by Ed Houlcroft in 2012. They formalized their response to create Green Iguana B'Gonna (GIBG), through the National Trust for the Cayman Islands, Little Cayman District. The pressures of Green Iguanas on Little Cayman continue to increase. Throughout the first decade of the invasion, most Green Iguanas sighted on Little Cayman were captured, and were limited to a controllable level. Green Iguanas primarily arrive on the supply barge from Grand Cayman. As the population of Green Iguanas there increases at a rapid rate, the risk of them making the journey to Little Cayman increases. Neighboring Little Cayman five miles to the east is Cayman Brac, with a larger population of Green Iguanas than its neighbor, and it poses another threat to Little Cayman due to its proximity and supply barge movements. 2017 has brought the discovery of three more Green Iguana/Rock Iguana (*Cyclura nubila caymanensis*) hybrids, a greater proportion of Green Iguanas seen but not caught, and the second-ever recorded clutch of Green Iguana neonates on Little Cayman. GIBG is a volunteer project and therefore resource-limited. Efforts from the GIBG team include the use of experimental tactics, immediate response to sightings, and raising public awareness. Biosecurity measures are essential in stopping the flow of Green Iguanas to the island, however these actions are beyond the remit of the GIBG team. The Department of Environment of the Cayman Islands (DoE) has made a significant move by appointing an intern for November/December 2017 to make the first assessment of the logistics needed to secure the Little Cayman dock area. With all these efforts is eradication possible, or are Green Iguanas here to stay on Little Cayman?

Resumen: Iguanas Verdes (*Iguana iguana*) fueron reportadas por primera vez en Pequeña Caimán en 2007. Desde entonces, la respuesta a avistamientos fue manejada por el voluntario Mike Vallee, quien luego fue acompañado por Ed Houlcroft en 2012. Ambos formalizaron su respuesta para crear Green Iguana B'Gonna (GIBG), a través del fideicomiso Nacional del Distrito de Pequeña Caimán. La presión de Iguanas Verdes sobre Pequeña Caimán continúa incrementando. A lo largo de la primera década de la invasión, la mayoría de Iguanas Verdes vistas en Pequeña Caimán fueron capturadas y limitadas a un nivel controlable. Iguanas Verdes llegan principalmente en barcas de suministro desde Gran Caimán. Dado que la población de Iguanas Verdes aumenta a

un ritmo acelerado, el riesgo de que logren viajar a Pequeña Caimán aumenta. Aledaña a Pequeña Caimán 5 millas al este se encuentra Caimán Brac, con una población mayor de Iguanas Verdes que su vecina lo cual plantea otra amenaza hacia Pequeña Caimán debido a su proximidad y al movimiento de barcas de suministro. 2017 ha traído el descubrimiento de tres iguanas híbridas de Verdes/Iguanas de Roca (*Cyclura nubila caymanensis*), una proporción mayor de Iguanas Verdes vistas pero no capturadas y el segundo grupo reportado de Iguanas Verdes neonatas en Pequeña Caimán. GIBG es un proyecto de voluntariado y por lo tanto limitado de recursos. Esfuerzos del equipo de GIBG incluyen el uso de tácticas experimentales, respuesta inmediata a avistamientos y aumentar la conciencia pública. Medidas de bioseguridad son esenciales para detener el flujo de Iguanas Verdes a la isla, sin embargo, estas acciones están fuera del ámbito del equipo de GIBG. El Departamento de Ambiente de las Isla Caimán (DoE) ha hecho un esfuerzo importante al nombrar un funcionario en noviembre/diciembre 2017 para realizar la primera evaluación de la logística necesaria para asegurar la zona de muelle de Pequeña Caimán. Con todos estos esfuerzos, ¿es posible la erradicación o acaso las iguanas verdes llegaron para quedarse en Pequeña Caimán?

Observations from the Field and Conservation Approaches of a Critically Endangered Island Endemic, Utila Spiny-tailed Iguana *Ctenosaura bakeri*

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Ctenosaura bakeri is a Critically Endangered Iguana endemic to the small Honduran island of Útila. Útila is the smallest of the three Bay Islands in Honduras at 41km². As a mangrove specialist, *Ctenosaura bakeri* likely only inhabits less than 25% of the island and is threatened by habitat loss and fragmentation, hunting of adults and eggs, invasive species, and predation. Mangroves are particularly under threat for development on the Bay Islands. We have gained satellite images to determine the current distribution of mangrove across the island of Útila and how that critical iguana habitat has declined over the last few years. Currently the population size is unknown but could be fewer than 5,000 mature individuals. This project was started in January 2016 and is continuing into 2017 and beyond. While previous survey efforts focused on the eastern side of the island, with the 2017 protocol we choose to explore the central and western side of the island to gather a robust estimate of population size. Transects were set out across the island and we also utilized camera traps to monitor less accessible areas for nesting and behavioral data. We are collecting genetic material to look at the current rate of hybridization with *Ctenosaura similis*, which could possibly become a bigger threat with the increasing habitat destruction and with overlap areas becoming larger.

Surveying the entire island gives a clear idea of which areas are a priority for protecting and managing. Using this habitat information along with body condition, home range studies, and genetic work we increase our knowledge on which areas are key to this iguana's survival. The entire island is currently under private ownership (with the exception of Turtle Harbour Wildlife Refuge). With this new information, we hope to provide data to lobby for a new or expanded protected area on Útila.

Resumen: *Ctenosaura bakeri* es una iguana En Peligro Crítico de extinción endémica de la pequeña isla Hondureña de Útila. Útila es la más pequeña de tres islas de bahía en Honduras con 41km². Como especialista de manglares, *Ctenosaura bakeri* probablemente habita en menos del 25% de la isla y se encuentra amenazada por pérdida y fragmentación de hábitat, cacería de adultos y huevos, especies invasoras, y depredación. Los manglares se encuentran particularmente amenazados por el desarrollo humano en las islas de bahía. Hemos conseguido imágenes satelitales para determinar la actual distribución de manglares a lo largo de la isla de Útila y qué tanto de este hábitat crítico para iguana ha disminuido en los últimos años. Actualmente el tamaño de la población es desconocido, pero puede ser de menos de 5,000 individuos maduros. Este proyecto se inició en enero 2016 y continua en 2017 y más allá. Mientras que esfuerzos de sondeo previos se enfocaron en el lado Este de la isla, con el protocolo 2017 decidimos explorar las zonas centrales y Oeste de la isla para generar un estimado poblacional robusto. Se trazaron transectos a lo largo de la isla y también se utilizaron trampas cámara para monitorear áreas menos evaluables en información de anidamiento y comportamiento. Estamos colectando material genético para determinar el ritmo de hibridización actual con *Ctenosaura similis*, el cual podría volverse una amenaza más grande con la creciente destrucción de hábitat y con las áreas de traslape aumentando su tamaño.

Muestreando la isla para definir áreas prioritarias para protección y manejo, usando esta información de hábitat junto con condición corporal, estudios de ámbito de hogar y análisis genéticos, incrementamos nuestro conocimiento sobre cuáles áreas son clave para la supervivencia de la iguana. La isla entera está actualmente bajo posesión privada (a excepción del Refugio de Vida Silvestre Turtle Harbour). Con esta nueva información esperamos proveer de información para presionar por la creación de una nueva área protegida o la expansión de la ya existente, en Útila.

Habitat Use and Life History of the Sister Islands Rock Iguana (*Cyclura nubila caymanensis*) on Little Cayman

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The Sister Islands Rock Iguana, or SIRI, is a Critically Endangered subspecies of *Cyclura nubila* endemic to Little Cayman and Cayman Brac. This taxon exhibits a complex life history and many aspects of its behavioral ecology, in particular those affecting the juvenile stages of development, are poorly understood. Three consecutive years of capture-mark-release-recapture (CMRR) surveys on Little Cayman have revealed patterns of habitat use and dispersal associated with critical life history stages, including female nesting and neonate dispersal stages. Together with our recapture data, radio-tracking results demonstrate that dispersal patterns vary markedly between age classes, and that this may play some role in structuring the population. For example, hatchlings exhibit particularly long distance dispersal tendencies compared with adults and sub-adults in the population, and gravid females may undertake exceptionally long migrations during the summer months to nest at communal sites along the coast. Indeed, population genetic

patterns among communal nesting sites and adult home territories are consistent with high admixture and do not support natal philopatry. Meanwhile, recapture rates among territory-holding males in the population suggest saturation with relatively high turnover. Territory turnover could promote maintenance of population genetic diversity, as pedigree reconstructions indicate home territory overlap with nesting females frequently determines male reproductive success. Provided high recruitment levels are maintained, SIRI can be expected to fully utilize available habitat on Little Cayman. Because return rates among annually nesting females are consistent with site fidelity, the protection of high quality communal nesting sites and source habitats is advised to promote continued recruitment.

Resumen: La Iguana Roca de las Islas Hermanas, o SIRI, es una subespecie de *Cyclura nubila* En Peligro Crítico de extinción endémica a Pequeña Caimán y Caimán Brac. Este taxón presenta una compleja historia de vida y muchos aspectos de su ecología conductual, en particular aquellos que afectan las etapas juveniles de desarrollo, son poco comprendidas. Tres años consecutivos de sondeo mediante Captura-Marcaje-Liberación-Recaptura (CMRR) en Pequeña Caimán han revelado patrones de uso de hábitat y dispersión asociados con etapas de ciclo de vida críticas, incluyendo etapas de anidamiento en hembras y dispersión de neonatos. Junto con nuestra recaptura de información, resultados de rastreo por radio demostraron que los patrones de dispersión varían marcadamente entre clases de edad, y que esto puede jugar algún rol en su estructura poblacional. Por ejemplo, los neonatos presentan distancias particularmente largas en tendencias de dispersión comparados con adultos y subadultos en la población, y las hembras preñadas pueden emprender migraciones excepcionalmente largas durante meses de verano para anidar en sitios comunales a lo largo de la costa. En efecto, patrones genéticos poblacionales entre sitios comunales de anidación y territorios hogar de adultos son consistentes con alta mezcla y no apoyan la filopatría natal. Mientras tanto, tasas de recaptura entre territorios con machos en la población sugieren saturación con relativamente alto intercambio. El intercambio de territorio puede promover el mantenimiento de la diversidad genética poblacional, dado que reconstrucciones de pedigree indican traslape territorial con hembras anidando frecuentemente lo que determina el éxito reproductivo de los machos. Siempre que se mantengan altos niveles de reclutamiento, se puede esperar que SIRI utilice completamente el hábitat disponible en Pequeña Caimán. Dado que la razón de retorno entre hembras de anidación anual es consistente con fidelidad del sitio, la protección de sitios comunales de anidamiento de alta calidad y hábitats fuente se recomienda para promover el reclutamiento continuo.

The Dutch Iguana Foundation – What We Do

Muggen-van Uden, Yoni*

Dutch Iguana Foundation, the Netherlands

The Dutch Iguana Foundation is a small volunteer-based organization. Our foundation includes all iguana species and some other herbivorous lizards such as Monkey-tailed Lizards (*Corucia zebrata*) and Sleepy Lizards (*Tiliqua rugosa*). Our main goals are: 1) collecting data of iguanas; 2) spreading data about iguanas; 3) bringing iguana enthusiasts together; and 4) organizing and supporting conservation actions.

We stand for responsible ownership. Through education, we aim to promote the well-being of animals held in captivity. Online, we maintain a website with general information about iguanas, and also husbandry guidelines for several other species. It also contains a small medical library and a nutrition chart. Although our message board isn't being used as much as it did in the past, it contains a lot of information and personal experience accounts. Our Facebook page is used to connect with a wider public. Offline we have our own magazine, the Iguana Varia. In this magazine, we publish a variety of items, from enclosure building projects to conservation projects. Our contributors can send in their own reports.

We are also present at several reptile fairs with a booth. This is mainly to inform people about how to care for their iguanas, maintaining contacts, but also to sell some items such as books and our own leaf-eater pelleted feed.

To sustain our foundation, we rely on a small contributor base. With this money, we can maintain our website and magazine. The income from the fairs, combined with additional fees and gifts, and the remaining funds of our contributors, are used for conservation efforts. These aren't very large numbers, but are used for great projects.

Resumen: La Fundación Holandesa de la Iguana es una organización pequeña basada en el trabajo voluntario. Nuestra fundación incluye a todas las especies de iguana y algunas lagartijas herbívoras como la lagartija cola de mono (*Corucia zebrata*) y las lagartijas somnolientas (*Tiliqua rugosa*). Nuestros objetivos principales son coleccionar datos de las iguanas, distribuirlos, conectar investigadores de las iguanas, y organizar y apoyar programas de conservación.

Defendemos la propiedad responsable. Buscamos promover el bienestar de los animales cautivos por medio de la enseñanza. Mantenemos un sitio web con información general de las iguanas, también guías de manejo para varias especies. También contiene una pequeña biblioteca médica, e información nutricional. Aunque nuestro tablero de mensajes no se esté utilizando tan frecuentemente como en el pasado, contiene una gran cantidad de información y experiencias. Nuestra página de Facebook se utiliza para conectarnos con un público más amplio. Fuera de línea, tenemos nuestra propia revista, la Iguana Varia. En ésta, se publica una variedad de artículos, desde proyectos de construcciones de recintos hasta proyectos de conservación. Nuestros contribuyentes pueden enviar sus propios reportes.

También nos encontramos en varias ferias de reptiles con un puesto. Esto es principalmente para informar a la gente acerca del mantenimiento de las iguanas, contactos, y venta de artículos como libros y concentrados.

Para costear nuestra fundación, dependemos de pequeños contribuyentes. Con este dinero, podemos mantener nuestra fundación y revista. Los ingresos de las ferias, junto con las donaciones de nuestros contribuidores son utilizadas para esfuerzos de conservación. Esto no es mucho, pero es utilizado para excelentes proyectos.

Region-wide Decline of *Iguana delicatissima* and the Need for Immediate Conservation Action

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The Lesser Antillean Iguana (*Iguana delicatissima*) is a regional endemic of the Lesser Antilles and is threatened by habitat loss, vehicle collisions, invasive species, and hybridization with invasive Green Iguanas (*Iguana iguana*). Given the increasing persistence of these threats, its conservation status was elevated in 2010 from Vulnerable to Endangered under the IUCN Red List of Threatened Species guidelines. However, despite the elevated status and initiatives to protect the species, populations remain highly threatened and continue to decrease primarily due to the continuing spread of *I. iguana*. Here, we outline the current status for all populations with an emphasis on recent Green Iguana colonization and subsequent hybridization events, which underscore the need for immediate conservation action. Confirmed hybridization events in 2016 on St. Eustatius reaffirm that unauthorized colonization events of Green Iguanas continue. A 1995 natural over-water dispersal event of Green Iguanas to Anguilla has now resulted in a wide-spread Green Iguana population, and occurrence of hybridization in all but 19 remaining *I. delicatissima* individuals indicate the speed of the hybridization wave. Lesser Antillean Iguanas continue to decline in the French West Indies, but recent discoveries of Green Iguanas on La Ramiers and La Désirade are extremely concerning and illustrate that current biosecurity protocols are insufficient to stop the spread of Green Iguanas across the region. Currently, only seven islands where *I. delicatissima* occurs remain free of Green Iguanas, but only Dominica is larger than 2km². Without immediate and robust intervention to stop the spread of Green Iguanas and to implement mitigation initiatives, the Lesser Antillean Iguana is in danger of extinction throughout most of its range. As outlined in the IUCN Lesser Antillean Conservation Action Plan, we suggest increased efforts to fund and implement a comprehensive conservation awareness program at local and regional levels, and procedures to increase biosecurity and removal of non-native Green Iguanas.

Resumen: La Iguana del Caribe (*Iguana delicatissima*) es una variante regional de las Pequeñas Antillas, y está amenazada por pérdida de hábitat, colisiones vehiculares, especies invasivas, e hibridación con Iguanas Verdes (*Iguana iguana*) invasivas. Debido al incremento en la persistencia de estas amenazas, su estatus de conservación pasó a ser Amenazada en 2010, según los criterios de la UICN. Sin embargo, a pesar del estatus de amenaza elevado y las iniciativas para proteger la especie, las poblaciones se encuentran altamente amenazadas y continúan decreciendo debido principalmente a la propagación de *I. iguana*. En este estudio, se presenta el estado actual de todas las poblaciones, con un énfasis en la colonización reciente de la Iguana Verde y eventos de hibridación consecuentes, los cuales resaltan la necesidad de proyectos de conservación inmediatos. Los eventos de hibridación en 2016 en San Eustaquio, confirman que la colonización por parte de las Iguanas Verdes en Anguila provocó una población extendida de la Iguana Verde y casos de hibridación en todas excepto 19 *I. delicatissima*, indicando la rapidez de esta onda de hibridación. La Iguana del Caribe continúa disminuyendo en las Antillas Francesas, pero descubrimientos recientes de la Iguana Verde en La Ramier y La Desirade son extremadamente importantes e ilustran que los protocolos actuales de bioseguridad no son suficientes para evitar la propagación de la Iguana Verde en la región. Actualmente, solo siete islas donde se encuentra *I.*

delicatissima se mantienen libres de Iguanas Verdes, pero solo Dominica posee un área mayor a 2km². Sin intervención inmediata para detener la propagación de la Iguana Verde y para implementar medidas de mitigación, la Iguana del Caribe se encuentra en peligro de extinción en la mayoría de su distribución. Como se resalta en el Plan de Acción de Conservación de la Iguana del Caribe de la UICN, se sugiere aumentar los esfuerzos para realizar e implementar programas de concientización comprensible a niveles locales y regionales, además de procedimientos que incrementen la bioseguridad y la remoción de las Iguanas Verdes no nativas.

The Effects of Tourism and Food Provisioning on the Physiology of Exuma Rock Iguanas (*Cyclura cyclura*) in The Bahamas

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Tourism in The Bahamas has led to near daily interactions with humans and provisioning of atypical food items for some populations of *Cyclura* iguanas. Long-term studies of these populations have found them to exhibit unnaturally high densities on feeding beaches, higher endoparasitic infections, altered dietary nutrition, and to have decreased survival probability compared to populations not being visited by tourist groups. In this study, we expand on previous work to assess the impacts of dietary changes and anthropogenic activity on the physiology of iguana populations experiencing different degrees of tourism activity. We sampled both male and female iguanas in post-breeding condition from six sites. The sites were categorized as experiencing high, moderate, or low tourist activity based on the number of tourists which visit each site. Iguanas from high tourism populations have increased triglycerides and glucose, elevated activation of the immune system, increased reactive oxygen metabolites, and decreased circulating corticosterone compared to populations experiencing low or moderate tourism and food supplementation. Tourism in the Caribbean is likely to continue and understanding physiological mechanisms mediating survival could allow us to better influence conservation policy and understand the changes driven by anthropogenic forces.

Resumen: El turismo en Las Bahamas ha llevado a interacciones casi diarias con humanos y al suministro de alimentos atípicos para algunas de las poblaciones de *Cyclura*. Estudios a largo plazo de estas poblaciones han encontrado que estas exhiben una densidad poblacional inusual en playas donde son alimentadas, tienen una mayor tasa de infecciones por endoparásitos, un balance nutricional alterado, y una menor probabilidad de supervivencia comparada con poblaciones sin propósitos turísticos. En este estudio, nos expandimos de trabajos previos para evaluar los impactos de los cambios en la dieta y la actividad antropogénica en la fisiología en poblaciones de iguana con diferentes grados de actividad turística. Las muestras fueron tomadas de iguanas de ambos sexos después de su época reproductiva, en seis sitios diferentes. Los sitios de muestreo fueron categorizados con una alta, moderada o baja actividad turística en base al número de visitantes que tuvo cada sitio. Las iguanas de poblaciones con alta actividad turística presentaron niveles altos de triglicéridos y glucosa, una activación elevada del sistema inmune,

altos niveles de metabolitos reactivos de oxígeno, y bajos niveles de corticosterona en sangre comparado a las poblaciones con baja o moderada actividad turística y suministro de comida. El turismo en el Caribe probablemente continuará y el comprender los mecanismos fisiológicos necesarios para la supervivencia puede permitir tener una mayor influencia en políticas de conservación y entender los cambios provocados por actividades humanas.

The Genetic Structure of *Cyclura cyclura*, their Parasites, and Pathogens All Suggest the Presence of Distinct Independently Evolving Groups of Populations

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Three subspecies of *Cyclura cyclura*, the Northern Bahamian Rock Iguana, are recognized. *Cyclura c. cyclura* is distributed across the fragmented landmasses of Andros Island. The central and southern islands of the Exumas are home to *C. c. figginsii*, and natural populations of *C. c. inornata* are only known from the Allen Cays in the northern Exumas. The intraspecific taxonomy of *C. cyclura* is based on key morphological characters in addition to geography. However, previous molecular work by Malone and others based on mtDNA sequence data revealed that these recognized subspecies are not reciprocally monophyletic. We have again considered the population genetic structure of this species using nuclear microsatellites, and mtDNA. Analysis of nuclear microsatellite variation, while completely consistent with prior work, suggest that there is a genetic discontinuity among populations classified as *C. c. figginsii*. Curiously, this discontinuity correlates with the presence of distinct mtDNA haplotypes. These findings suggest that *C. c. figginsii* is polyphyletic, and that four distinct evolutionarily significant units (ESUs) within *C. cyclura* are reciprocally monophyletic with regard to mtDNA haplotypes. Further, the presence or absence of distinct species of ticks (*Amblyomma* spp.) reinforces this inference. *Cyclura c. inornata* lacks ticks while *C. c. cyclura* and *C. c. figginsii* in the central Exumas are parasitized by *A. albopictum*. *Cyclura c. figginsii* in the southern Exumas are the only populations parasitized by *A. torrei*. Further, mtDNA sequence variation among ticks indicates evolutionary divergence between *A. albopictum* on *C. c. cyclura* versus those collected from *C. c. figginsii*. Finally, two distinct strains of *Rickettsia* sp., a potential etiological agent, were also identified, one strain was restricted to the tick species *A. albopictum* collected from *C. c. cyclura* on Andros Island while the second was only found in the *A. torrei* ticks collected from *C. c. figginsii* from the southern Exumas. The concordance between the presence and absence of parasites and etiological agents with neutral genetic divergence among iguana populations suggests the potential for adaptive divergence, bolstering support for the presence of four distinct ESUs.

Resumen: Tres subespecies de *Cyclura cyclura*, la Iguana de Roca del Norte de Las Bahamas, son conocidas. *Cyclura c. cyclura* está distribuida entre las áreas fragmentadas de la Isla Andros. Las islas al centro y sur de las Exumas son el hogar de *C. c. figginsii*, y poblaciones naturales de *C. c. inornata* son conocidas solamente de los Cayos Allen en las Exumas del norte. La taxonomía

intraespecífica de *C. cyclura* está basada en caracteres morfológicos clave además de la geografía. Sin embargo, estudios moleculares previos realizados por Malone y otros basados en información de la secuencia de mtDNA reveló que estas subespecies reconocidas no son recíprocamente monofiléticas. Hemos analizado nuevamente la estructura genética poblacional de estas especies usando microsatélites nucleares y mtDNA. Se realizó Análisis de la variación en microsatélites nucleares, el cual consistió completamente en trabajos previos, encontrándose que existe una discontinuidad genética entre las poblaciones clasificadas como *C. c. figginsi*. Curiosamente, la discontinuidad está correlacionada a la presencia de distintos haplotipos de mtDNA. Estos hallazgos sugieren que *C. c. figginsi* es polifilética, y que cuatro diferentes unidades de significancia evolutiva (ESU) dentro de *C. cyclura* son recíprocamente monofiléticas en base a los distintos haplotipos del mtDNA. Además, la presencia o ausencia de distintas especies de garrapatas (*Amblyomma* spp.) refuerzan esta hipótesis. *Cyclura c. inornata* carece de garrapatas, mientras que *C. c. cyclura* y *C. c. figginsi* en las Exumas centrales son parasitadas por *A. albopictum*. *Cyclura c. figginsi* en las Exumas del sur son la única población parasitada por *A. torrei*. Además, variaciones en la secuencia de mtDNA entre garrapatas indica una divergencia evolutiva entre los individuos recolectados de *A. albopictum* en *C. c. cyclura* contra los recolectados de *C. c. figginsi*. Finalmente, dos distintas líneas de *Rickettsia* sp., un agente etiológico potencial, fueron también identificadas, una línea se encontraba restringida a la especie de garrapata, *A. albopictum*, recolectada de *C. c. cyclura* en la Isla Andros, mientras que la segunda solamente fue encontrada en garrapatas de la especie *A. torrei* recolectadas de *C. c. figginsi* de las Exumas del sur. La concordancia entre la presencia y ausencia de parásitos y agentes etiológicos con la diversidad genética neutral entre las poblaciones de iguana sugiere el potencial para una divergencia adaptativa, aumentando el soporte para la presencia de cuatro diferentes ESUs.

Long-distance Dispersal Explains the Biogeographic Origin of Madagascar's Endemic Iguanas (Opluridae)

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Opluridae are a family within Iguanidae (sensu lato), endemic to Madagascar and Grande Comoro. The presence of iguanas on Madagascar has long been a biogeographic mystery, as extant members of Iguanidae (s. l.) are primarily distributed through the New World and the fossil record has yet to provide evidence of their historical distribution in neighboring Africa. Previous studies have found support for each of three origin hypotheses (Gondwanan vicariance (175–120 mya), land bridge dispersal from South America through Antarctica (114–80 mya), and long-distance overwater dispersal (<80 mya)) when using various genetic markers to estimate familial relationships and timing of divergence. To resolve these conflicting findings, I have used sub-genomic-level sequencing combined with fossil information, and have applied multiple analytical methods to confirm that the South American family of Leiosauridae is Opluridae's closest extant relative, and to estimate the timing of their divergence. This work consistently finds support for a Paleocene dispersal event of the most recent common ancestor of Opluridae and Leiosauridae from the New World to Madagascar. Opluridae have spent approximately 60 million years in isolation of their Pleurodont relatives, and represent a unique lineage within the iguana

superfamily. Further research into this group will use genomic, morphological, and ecological data to delimit species and understand how these iguanas interact with Madagascar's environment. Together, this information will be used to update the conservation assessments of species in this family, and highlight areas in Madagascar that are required for the persistence of these distinct lineages.

Resumen: La familia Opluridae se encuentra dentro del grupo Iguanidae (sensu lato), esta es endémica a Madagascar y a Grande Comoro. La presencia de iguanas en Madagascar ha sido un misterio biogeográfico desde hace bastante tiempo, debido a que los miembros de Iguanidae (s.l.) son encontrados principalmente en el nuevo mundo, y el registro fósil aún no tiene evidencia de su distribución histórica en el África cercana. Estudios previos han descubierto evidencia que apoya cada una de las tres hipótesis (Vicarianza Gondwaniana (175–120 *10⁶ años), dispersión de Sudamérica por la Antártida por una conexión entre continentes (114–90 *10⁶ años), y dispersión a larga distancia sobre el océano (<80 *10⁶ años)) utilizando varios marcadores genéticos para estimar las relaciones filogenéticas y el tiempo de divergencia. Para resolver este conflicto, se utilizó una secuenciación a nivel subgenómico, combinado con información fósil, y la aplicación de múltiples métodos analíticos para confirmar que la familia Leisauridae en Sudamérica es el pariente más cercano a la familia Opluridae, estimando también el tiempo de divergencia. Se descubrió evidencia de un evento de dispersión en el Paleoceno del ancestro común más reciente entre Opluridae y Leisauridae del nuevo mundo a Madagascar. Opluridae ha pasado aproximadamente 60 millones de años aislada de sus parientes pleurodontes, y representa un linaje único dentro de la superfamilia de las iguanas. Investigaciones futuras de este grupo utilizarán información genómica, morfológica, y ecológica para delimitar las especies y entender cómo estas iguanas interactúan con el ambiente de Madagascar. Esta información se usará también para actualizar las evaluaciones de conservación para las especies de esta familia, y resaltar las áreas en Madagascar que son necesarias para la supervivencia de estos distintos linajes.

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

Population Genetics of Motagua Spiny-tailed Iguana *Ctenosaura palearis* in the Dry Forest of Motagua Valley, Guatemala

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The Motagua Spiny-tailed Iguana (*Ctenosaura palearis*) is endemic to Guatemala, is listed as Endangered by the IUCN Red List of Threatened Species, and is protected under CITES Appendix II. This iguana is restricted to the last remnants of seasonally dry tropical forest in the Motagua Valley in eastern Guatemala. The main threats for Motagua Spiny-tailed Iguanas is over-harvesting by local villagers for bushmeat, along with habitat loss. The main objective of this study was to determine a haplotype network for the species and the identification of possible evolutionary significant units in *C. palearis* populations throughout the valley. A total of 45 individuals were sampled from six distinct locations through all of the Motagua Valley. We amplified two mitochondrial genes, using primers we designed: NADH dehydrogenase subunit 4 (ND4) and lactate dehydrogenase subunit 1 (Ladh1). With the obtained haplotype networks, we concluded that for the *Nadh4* gene there are four different ESUs, with five well-marked haplotypes according to geographical locations and are the product of biogeographical barriers. Based on the analysis of molecular variance of the *Nadh4* gene, there is a defined genetic structure for *C. palearis* populations in the dry forest of the Motagua Valley ($\Phi_{ST} = 0.1858$, $p = 0.048$), with an 18.59% interpopulation variation in the species. Taking into account the number of haplotypes present per locality and in the ESUs found, the populations of most genetic importance for the conservation of *C. palearis* are Usumatlán, Cabañas, and Gualán.

Resumen: La Iguana de Cola Espinosa del Motagua (*Ctenosaura palearis*) es endémica de Guatemala y se encuentra en la Lista Roja de UICN de Especies Amenazadas como En Peligro y es protegida bajo el Apéndice II de CITES. Esta iguana está restringida a los últimos remanentes de bosque tropical estacionalmente seco en el Valle del Motagua al este de Guatemala. La principal amenaza para las Iguanas de Cola Espinosa del Motagua es la sobreexplotación de los pobladores locales por su cacería para carne, junto con la pérdida de hábitat. El objetivo principal del estudio fue determinar la red de haplotipos para la especie y la identificación de posibles Unidades de Significancia Evolutiva (ESU) en poblaciones de *C. palearis* a través del valle. Se tomaron muestras de un total de 45 individuos de seis localidades diferentes en todo el Valle del Motagua. Amplificamos dos genes mitocondriales: NADH deshidrogenasa subunidad 4 (*Nadh4*) y lactato deshidrogenasa subunidad 1 (*Ladh1*) y los cebadores utilizados fueron diseñados por nosotros. Con las redes de haplotipos obtenidas se llegó a la conclusión de que para el gen *Nadh4* existen cuatro ESU diferentes, con cinco haplotipos bien marcados según localidades geográficas y producto de barreras biogeográficas. Basado en el análisis de varianza molecular del gen *Nadh4*, existe una estructura genética definida para las poblaciones de *C. palearis* en el bosque seco del Valle del Motagua ($\Phi_{ST}= 0.1858$, $p=0.048$), encontrándose un 18.59% de variación

interpoblacional en la especie. Tomando en cuenta la cantidad de haplotipos presentes por localidad y en las ESU encontradas, las poblaciones de mayor importancia genética para la conservación de *C. palearis* son Usumatlán, Cabañas y Gualán.

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

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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 especially 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 by removing 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. Here, we present the proposed methodology to develop this initiative and results after the first pine removal efforts. With the help of volunteers, we cut trees using chainsaws, raked all pine needle debris from plots, and placed camera traps. Some of our preliminary results include restoring six areas which provide close to 1.08 km² of new nesting habitat for iguanas. In addition to this, several nests and attempts have been observed in these new sites that now offer optimal conditions for nesting. 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. The successful completion of these efforts will enable the development of management strategies to ensure that the unique ecological and historical values of Mona Island will remain part of the Caribbean's natural heritage.

Resumen: La Isla Mona es una de las más grandes islas inhabitadas de la región del Caribe. La isla mantiene un ecosistema bosque sub-tropical seco, uno de los ecosistemas más amenazados del mundo, con 80% de la fauna endémica y múltiples especies en peligro, como la Iguana de la Isla de Mona (*Cyclura stejnegeri*). Sin embargo, la integridad biológica de la Isla Mona es amenazada por una especie de planta invasiva que fue históricamente introducidas en la isla: el Pino Australiano (*Casuarina equisetifolia*). El impacto de esta planta invasiva incluye: alteración de hábitat, pérdida de biodiversidad, erosión y especialmente, representa una amenaza para las especies en peligro de extinción como la Iguana de la Isla de Mona a través de la reducción de las áreas de anidación. Teniendo esto en cuenta, nuestro objetivo es restaurar las áreas de anidación de la Iguana de la Isla de Mona mediante la eliminación del Pino Australiano invasor, sus agujas y restos de pino. Ha

habido esfuerzos en el pasado para lograr esto, pero han resultado en fracaso por la combinación de una metodología ineficiente y falta de gestión. Aquí, presentamos la metodología propuesta para desarrollar esta iniciativa y resultados después de los primeros esfuerzos de eliminación de pinos. Con la ayuda de voluntarios, cortamos árboles con motosierras, arrastramos todos los restos de agujas de pino de las parcelas y colocamos trampas para cámaras. Algunos de nuestros resultados preliminares incluyen la restauración de seis áreas que proporcionan cerca de 1.08 km² de nuevo hábitat de anidación para iguanas. Además de esto, se han observado varios nidos e intentos en estos nuevos sitios que ahora ofrecen condiciones óptimas para anidar. El desarrollo de estrategias de manejo para controlar y eliminar estas especies invasoras de la Isla Mona permitiría la recuperación de la biodiversidad endémica y en peligro y la protección segura del hábitat del bosque seco. La finalización con éxito de estos esfuerzos permitirá el desarrollo de estrategias de gestión para garantizar que los valores ecológicos e históricos únicos de la Isla de Mona sigan siendo parte del patrimonio natural del Caribe.

Community Based Recovery of the Monuriki Island Crested Iguana (*Brachylophus vitiensis*) in Fiji

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The Fijian Crested Iguanas (*Brachylophus vitiensis*) are a Critically Endangered species restricted to a few small islands in the dry forest zone of Fiji. This dry forest habitat is also critically endangered and restricted to a few isolated patches on disparate islands. The population of iguanas on Monuriki Island (40.4 hectares) is the third largest population of the Crested Iguanas that remains. Since its first documentation in the early 1980s it has been a well-known location that local resorts have harvested iguanas from for display. In the late 1990s, the first efforts to conserve and restore this island were discussed, but it took until the development of the Crested Iguana Recovery Plan in 2008 that conservation was implemented. Since 2008, goats and rats have been removed from the island, and ten pairs of iguanas were brought into captivity in Fiji for captive breeding. In 2015, the first 32 captive-bred iguanas were released back on the island. Twenty-six of these were radiotracked for the short-term to determine their fate, and 18 were found after 56 days indicating excellent short term survival. In February of 2016, Tropical Cyclone Winston passed through Fiji with a peak intensity of ten minute sustained winds of 230 km/hr and removed most or all of the canopy leaves from trees on Monuriki Island. In 2017, 16 of the original founders and another 32 captive produced offspring were reintroduced onto Monuriki, ending the successful captive breeding program. This could be accomplished in part due to also the tremendous recovery of the remaining iguanas on the island — apparently due to reduced hatchling predation from the rats and the excellent habitat recovery post-goat removal. Overall, this set of eradications has proven highly successful for the recovery of the iguanas, wedge-tailed shearwaters, and several other bird species.

Resumen: La Iguana con cresta de Fiji (*Brachylophus vitiensis*) es una especie En Peligro Crítico de extinción, restringida a unas pequeñas islas en el bosque seco de Fiji. El bosque seco es un hábitat también críticamente en peligro de extinción y restringido a unos parches aislados en islas dispares. La población de iguanas en la Isla Monuriki (40.4 hectáreas) es la tercera población más larga de las Iguanas con cresta que quedan. Desde su primera documentación a principios de la década de 1980, ha sido un lugar bien conocido que los centros turísticos locales han cosechado iguanas para su exhibición. A finales de la década de 1990, el primer esfuerzo para conservar y restaurar esta isla fue discutido, pero hasta el desarrollo de Plan de Recuperación de la Iguana de Cresta en 2008, fue implementado. Desde 2008, las cabras y ratas han sido removidos de la isla, y diez pares de las iguanas fueron llevados a Fiji para su cría en cautiverio. En 2015, las primeras 32 iguanas nacidas en cautiverio fueron liberadas en la isla. Veintiséis de estas fueron seguidas con radiotelemetría por corto plazo para determinar su refugio, y 18 fueron encontradas después de 56 días indicando excelente sobrevivencia a corto plazo. En febrero de 2016, el Ciclón tropical Winston pasó en Fiji con intensidad máxima de vientos sostenidos de diez minutos de 230 km/h, y eliminó la mayor parte o la totalidad de las hojas del dosel de los árboles de la isla de Monuriki. En 2017, 16 de los fundadores originales y los otros 32 descendientes producidos en cautiverio fueron reintroducidos en Monuriki, poniendo fin al exitoso programa de cría en cautiverio. Este programa podría terminarse, en parte, a la gran recuperación de las iguanas restantes en la isla, aparentemente debido a la reducción de las depredaciones de las crías por ratas y la excelente recuperación del hábitat después de la remoción de las cabras. En general, este conjunto de erradicaciones ha demostrado ser muy exitoso para la recuperación de las iguanas, pardelas de cola de cuña y varia otras especies de aves.

Application of Drones for Radio Tracking Sister Islands Rock Iguanas (*Cyclura nubila caymanensis*)

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Many iguana species live in areas with dense vegetation or terrain that is difficult to access. Such obstacles present difficulties when conducting radio telemetry studies, as access to tagged individuals can be severely limited. Most existing methods of radio telemetry tracking, which include radio direction-finding and triangulation, are therefore expensive in terms of man-power and effort, and can result in localizations with high probability of error. Over the past couple of years, we have developed a proof-of-concept drone that is capable of locating tagged individuals with greater precision than triangulation and less effort than radio direction-finding. With this technology, the team studying *Cyclura nubila caymanensis* tracked up to 24 iguanas dispersing from various nesting sites in a single day with an average error of less than 20 m. This technology tracked iguanas in a variety of difficult habitats including dense mangrove, tropical dry forest, and bushland vegetation. Existing tracking techniques would have taken more time and effort to achieve similar precision. In addition to providing faster tracking capabilities for single individuals, the drone is capable of simultaneously locating multiple individuals. We have been able to

demonstrate simultaneous localization of as many as ten unique transmitters. Adopting this technology and continuing development of such capabilities could enable order-of-magnitude increases in scientific data returned from radio telemetry studies.

Resumen: Muchas especies de iguana viven en áreas con vegetación densa, o difíciles de acceder. Estos obstáculos presentan dificultades al momento de realizar estudios con radio-telemetría, debido a que el acceso a los individuos marcados es bastante limitado. Muchos métodos de radio-telemetría incluyen triangulación por radio, por lo que son costosos en términos de esfuerzo y recursos humanos, y pueden resultar en localizaciones erróneas. Durante los últimos años, se desarrolló un dron capaz de localizar individuos marcados con mayor precisión que la triangulación y menos costosa que la misma. Con esta tecnología, el equipo estudió hasta 24 iguanas (*Cyclura nubila cayamanensis*) dispersas en varios sitios de anidamiento en un solo día, con errores menores a 20 m. Esta tecnología rastreó iguanas en distintos hábitats complicados, incluyendo manglares densos, bosques secos tropicales, y vegetaciones de arbustos. Las técnicas existentes podrían haber tomado más tiempo y esfuerzo para lograr una precisión similar. El dron es capaz de localizar a varios individuos, además de proveer rastreos más rápidos a los solitarios. Se logró la localización simultánea de hasta diez transmisores individuales. Con esta tecnología y continuando el desarrollo de tales capacidades, se podría mejorar en órdenes de magnitud los datos recuperados de estudios con radio-telemetría.

Community outreach for long-term conservation of the endangered Motagua Spiny-tailed Iguana *Ctenosaura palearis*

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Ctenosaura palearis is an endangered endemic iguana from the dry forests of Guatemala that has a conservation program within the Motagua Valley, led by the NGO Zootropic and Heloderma Natural Reserve (HNR), along with academic support from Universidad del Valle de Guatemala. This project has had the support of IIF since 2015 for the implementation of strategic objectives established by the National Conservation Strategy for the species. Because of the great success we had in 2016 with the school educational program component of the project, we had many requests from principals of other schools of towns near HNR and within *C. palearis* distribution area. We were able to consider these for inclusion in the education program in 2017. This year we visited the elementary schools in four small rural villages: San Luis, Quebrada Honda, Las Anonas, and El Tambor, which made a total of around 300 children and teachers exposed to the program. These communities are an average of 20 km (13 miles) away from HNR. This community outreach and education program also included a drawing contest and iguana conservation awareness t-shirts for students and teachers. Each school was visited monthly (from February to October) to present talks about the natural history, ecology, conservation, and the role of *C. palearis* on human well-being. HNR is now considered an education, research, and conservation center of *C. palearis* for local communities, so we implemented an activity monitoring iguanas with camera traps that have their home ranges within HNR. Those videos are used in the educational

talks and increases the bond between communities and the iguana. Also, one of the two trails within HNR had been named the “iguana trail”, with interpretive signs focused on in situ interpretation of the habitat, ecology, behavior, and environmental services provided by *C. palearis* in the valley.

Resumen: *Ctenosaura palearis* es una iguana endémica en peligro de extinción del bosque seco de Guatemala que tiene programas de conservación dentro del Valle del Motagua dirigido por la ONG Zootropic y la Reserva Natural del Heloderma (HNR), junto con apoyo académico de la Universidad del Valle de Guatemala. Este proyecto tuvo apoyo de IIF desde 2015 en la implementación de líneas estratégicas establecidas en la Estrategia Nacional de Conservación para la especie. Debido al gran éxito que tuvimos con nuestro programa de educación en las escuelas en 2016, recibimos muchas solicitudes de los directores de otras escuelas de pueblos cercanos a HNR y dentro del área de distribución de *C. palearis* para considerarlas como parte del programa educativo 2017. Este año visitamos las escuelas primarias de cuatro pequeños pueblos rurales: San Luis, Quebrada Honda, Las Anonas y El Tambor, que hicieron un total de alrededor de 300 niños y maestros. Estas comunidades están en promedio a 20km de distancia de HNR. Este programa comunitario de extensión y educación también incluyó un curso de dibujo y entrega de playeras sobre la conservación de la iguana para estudiantes y maestros. Cada escuela fue visitada mensualmente (de Febrero a Octubre) para dar charlas estructuradas sobre historia natural, ecología, conservación y el rol del humano en el bienestar de *C. palearis*. HNR es considerada ahora un centro de educación, investigación y conservación de *C. palearis* para comunidades locales, por lo que implementamos un programa de monitoreo de las iguanas que tienen su ámbito de hogar dentro de HNR con cámaras trampa. Esos videos se utilizan en las charlas educativas que aumentan el vínculo entre las comunidades y la iguana. Además, uno de los dos senderos dentro de HNR ha sido llamado “sendero de la iguana” con signos interpretativos enfocados en la interpretación in situ del hábitat, ecología, comportamiento y servicio ambiental provisto por *C. palearis* en el valle.

Investigating Intra-Island Translocation as a Conservation Strategy for the Turks and Caicos Iguana: The Impact of Homing and Stress

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The Turks and Caicos Iguana, *Cyclura carinata*, is Critically Endangered due to introduced mammals and habitat alteration. Inter-island translocations are a key conservation strategy, however suitable islands for translocation are scarce. This study, on Big Ambergris Cay, Turks and Caicos Islands, documented post intra-island translocation stress and homing by gender (male vs. female), age (adult vs. juvenile), and season translocated (wet vs. dry) for 96 iguanas over four, six-week study periods. Subject movements were radio-tracked and at each capture event (initial capture, capture for translocation, and post translocation), both baseline (under 3 min) and restraint-stress (30 min) blood samples were analyzed for corticosterone concentration by radioimmunoassay. Animals demonstrated the ability to mount stress responses throughout the study period, however, results indicate that there was a significant effect of translocation on

baseline and capture-stress-induced corticosterone concentrations. Baseline corticosterone concentrations increased over time and remained elevated, but did not reach initial restraint-stress concentrations. Across all ages, genders, and seasons, subjects traveled further during the translocation period than the baseline period and adults moved more total distance than juveniles. Among subjects that did not successfully home after translocation, adults traveled significantly further towards their original capture site than juveniles. There were effects of season on movement patterns during the baseline period only. Adults of both genders attempted to home, successfully homed, and did so in both the wet and dry seasons. No juveniles homed. Adult males homed faster than females, and the ability to home did significantly impact corticosterone concentrations. The results of this study provide a systematic test of the effects of homing and post-translocation stress and can be utilized to develop translocation methods that promote iguana-friendly development throughout the Caribbean.

Resumen: La Iguana de Turcas y Caicos, *Cyclura carinata*, es una especie En Peligro Crítico de extinción debido a la introducción de mamíferos al hábitat y la alteración del mismo. Una estrategia clave de conservación es la translocación entre las islas; sin embargo, existen pocas islas que permiten este método. Este estudio se enfocó en el estrés producido por la translocación entre las islas de Big Ambergris, Turcas y Caicos; realizando comparaciones por género (macho vs hembra), edad (adulto vs juvenil), y la temporada de translocación (húmeda vs seca) en 96 iguanas durante períodos de cuatro a seis semanas. Se rastreó a los sujetos de estudio por radio-telemetría, se analizó la concentración de corticosterona en la sangre, inicial (antes de 3 min) y en estrés moderado (30 min), por medio de un radioinmunoensayo para cada captura (inicial, para translocación, y post translocación). Los animales mostraron la habilidad de montar una respuesta de estrés durante el período de estudio; sin embargo, los resultados indican que hubo una diferencia significativa en las concentraciones de corticosterona iniciales y las inducidas por la captura. Las concentraciones de corticosterona aumentaron conforme pasaba el tiempo y se mantenían elevadas, pero no llegaban a las concentraciones de estrés moderado. En ambas edades, géneros, y temporadas; los sujetos se trasladaban más durante el período de translocación que durante el período base, y los adultos viajaban mayores distancias que los juveniles. La temporada solamente afectó los patrones de movimiento durante el período base. Los adultos de ambos géneros intentaban regresar a su hábitat en ambas temporadas; por el contrario, los juveniles no. Los adultos machos regresaban más rápido que las hembras, y la habilidad de regresar afectó directamente las concentraciones de corticosterona. Este estudio provee una prueba sistemática para probar los efectos de regreso al hábitat y estrés post translocación, y puede ser utilizado para desarrollar métodos de translocación amigables a la iguana en todo el Caribe.

2017 IUCN SSC Iguana Specialist Group Annual Meeting
Meliá Hotel
Varadero Peninsula, Matanzas Province, Cuba

MINUTES

*Special thanks to note takers: Joey Brown, Daisy Maryon, Jen Moss, and Thijs van den Burg;
Bonnie Raphael, Tandora Grant (editors)*

Day 1: 24 October 2017

9:00 am Welcome and self-introductions — (Chuck Knapp and Stesha Pasachnik)

9:30 am Welcoming Address, information about surrounding area — (Oscar Luis Garcia Martinez)

1. Reptiles of Cuba (Luis Díaz Beltrán*)

- **Question:** When will the book be available? **Answer:** In a couple of years.
- **Question:** Why not publish it sooner? **Answer:** We want to publish all the information at once to prevent confusion in the future and to incorporate the current ongoing research when it is finalized. We want to also include new genetic data and provide information on conservation.

2. Introduced Amphibians and Reptiles in the Cuban Archipelago: An Update (Roberto Alonso Bosch*, Rafael Borroto-Paez, Tomás M. Rodríguez-Cabrera, and L. Yusnaviel García Padrón)

- **Question:** How big is the pet trade in Cuba? **Answer:** The pet trade market is still small, although people take animals to other countries.
- **Question:** How many resources do you have or use to assess introductions of non-native animals? **Answer:** Authorities are stopping some species at ports; those are the most important places to prevent introduction. It is easier to find invasive amphibians in the field since these vocalize.
- **Question:** Pet collectors released species abroad when they get described, is that happening? **Answer:** That could be a problem in gardens.
- **Question:** Food production species, are those still used as a food source? **Answer:** The American Bullfrog is less eaten now. Other invasives might affect the introduced Bullfrog populations.

3. Algunas Características de los Sitios de Nidificación de la Iguana Cubana en el Parque Nacional Caganues, Sancti Spíritus, Cuba (Armando Falcón*, Elier Sánchez, Norgis V. Hernández, and Alfredo Z. Domínguez)

- **Question:** Are iguanas found over the entire cay? **Answer:** Occasionally they can be found in the mangroves, but mainly on rocky places. All cays are inhabited by people. Four days after hurricane Irma iguanas were found to be in good shape.
- **Question:** Are there any cats on the cays? **Answer:** No cats; only native species occur on the cays.

- **Question:** The nests look very shallow, what is the impact of sea level rise? **Answer:** The islands are not very high, the layer of sand is about one foot. Perhaps it would be helpful to bring substrate onto the cays, because nests can become useless due to loss of substrate.
- **Question:** Are they not filling the nests after egg laying? **Answer:** They only cover the area where the eggs are, not the opening.

4. Desarrollo Turístico en la Cayería Noreste de Villa Clara, Impactos Sobre las Poblaciones de Iguana. Algunas Experiencias en el Manejo de Especies Exóticas que las Afectan (Angel Arias Barreto*)

- **Question:** Did fishermen bring the dogs? **Answer:** Yes, they probably did.
- **Question:** Do the workers leave the cays or stay there? **Answer:** There are about 4,000 people that live and work there — working for 21 days and then off for 7 days. People that just work in the hotels don't sleep there.
- **Question:** Feral dogs on Galápagos don't eat the iguanas but do bite them, causing infections. How is that here? **Answer:** Some iguanas are only bitten; sometimes only the remains are found. In areas with a lot of dogs and few iguanas, the iguanas are quite big and dogs are small. No evidence of interaction between them has been observed so far.
- **Question:** Are the dogs fed and where do they come from? **Answer:** Yes, they are of good health, associated with workers, and probably came with them onto the island. The first introductions of cats and dogs date back from 7 years ago.

5. The Effects of Tourism and Food Provisioning on the Physiology of Exuma Rock Iguanas (*Cyclura cyclura*) in The Bahamas (Alison Webb*, Charles R. Knapp, John B. Iverson, Dale DeNardo, and Susannah French)

- **Question:** There is an identical case in Cuba; is there a control on the type of food that tourists give to the iguanas? **Answer:** The food has varied a lot, currently it is encouraged to only feed them grapes.
- **Question:** Is there an influence on survival? **Answer:** Male survival has dropped because they are disappearing since people are moving them. Tour operators might be relocating large male animals to other islands.
- **Question:** How many animals were in each group? What is the time period of the study, and were there repeat sampling of the same individuals? **Answer:** Some are repeated measures, some are not. Sampling was in May, June, and September in 2016 during one year for this study. Sample size was between 150–200 animals.
- **Question:** Was the range for body size surprising? **Answer:** Not really, it allowed us to determine that this was not affected by this study's grouping method.
- **Question:** What is the diet response? **Answer:** We would need to perform a longer study to determine that.
- **Question:** Were there differences between clutch size, and/or quality of eggs between groups? **Answer:** In the high tourism group, animals reach maturity sooner, egg size is similar, body size is similar, and reproduction frequency increases.

6. A Tale of Two Iguanas: Physiological Responses to Tourism Vary Between Two Species of Iguanas (Susannah S. French*, Alison Webb, John B. Iverson, Dale DeNardo, and Charles R. Knapp)

- **Question:** Following up on where the sites were, what males were you studying? **Answer:** Yes, we only studied territorial males. We used several clades of 2 different islands. El Nino didn't allow use of data from a third island.

7. Iguaninae Genetics Group Update, Dealing with Large Amounts of Data and a New Genus (Catherine Malone*)

- **Question:** What are subspecies? **Answer:** Lot of difference in opinions. Subspecies: units of designation, important for conservation value.
- **Question:** How to integrate different fields of biological data? **Answer:** Programs can do this for you nowadays. Some data is specific to each study and researchers for that study. Morphological data can show differentiation, but could be different from the genetic evidence. Another opinion: if adaptive genes show different clades, then describe new species.

8. The Genetic Structure of *Cyclura cyclura*, their Parasites, and Pathogens All Suggest the Presence of Distinct Independently Evolving Groups of Populations (Giuliano Colosimo, Anna C. Jackson, Amanda Benton, Charles R. Knapp, John B. Iverson, and Mark E. Welch*)

- **Question:** Did you look at which species of Rickettsia? Was Rickettsia in the blood? **Answer:** Yes, but there was no direct Blast hit. We didn't find it in the blood, but that doesn't mean it isn't there, it might be temporally unfindable.
- **Question:** Phylogenetic context of ticks, where is the most closely related species? **Answer:** Tick taxonomy is based on morphology, it's not a phylogeny and there isn't much genetic data on it, and could be from a different genus.

9. Population Densities, Distribution, and Nesting of *Cyclura* in Cabritos Island and the Invasion Story of Green Iguana (*Iguana iguana*) in Hispaniola (Rosanna Carreras-De León*, Liz A. Paulino, C. Esquea, Ernst Rupp, and Yolanda León)

- **Question:** What is the status of the removal on the island? **Answer:** It will probably be officially declared free of invasives soon.
- **Question:** Why are people breeding iguanas? **Answer:** Tourists might like to see iguanas. Some locals want to breed them for conservation, but don't have the necessarily knowledge. The purpose of most of the iguanarios is unknown.
- **Question:** Are there efforts or plans for managing the Green Iguanas island-wide? **Answer:** No, but the ministries are trying to control it. But there are already quite some active populations.

10. Habitat Use and Life History of the Sister Islands Rock Iguana (*Cyclura nubila caymanensis*) on Little Cayman (Jeanette Moss*, Glenn Gerber, and Mark Welch)

- **Question:** How did you affix the transmitters on the hatchlings? What about the snake population? **Answer:** Hatchlings get tags on the base of the tail. They are captured inside aluminum inclusion fences at the same time. One male and female per clutch got transmitters. And they were all released the next morning after application of the tags. There are a lot of

snakes around the nesting sites during hatchling season, such as the Cayman racer. Every year predation by snake is observed.

- **Question:** Is there predation by ants? **Answer:** One hatchling with the longest migration distance was found under rocks, dead and consumed by ants. Might have gotten stuck and was eaten.
- **Question:** Is there evidence of females skipping years of reproduction? What is their maximum longevity? **Answer:** Based on data from 2007-2011, the max longevity data would put animals just under 10 years. But that isn't necessarily the max, and Jenn expects it to be higher. More data is needed to look at whether they skip reproduction in some years, targeted sampling might have missed that.

11. Long-distance Dispersal Explains the Biogeographic Origin of Madagascar's Endemic Iguanas (Opluridae) (Rachel Welt*)

- **Question:** 1) Are you going to use morphological characteristics to get more detail in your phylogenetic tree? 2) Did climatic stability have an influence on the divergence within Oplurus? **Answer 1:** Not a lot, I'm now mainly focusing on ecological adaptation. **Answer 2:** Yes, this type of habitat will probably have been around for a long time and allowed fine scale differences, probably creating these different species and high potential for cryptic species.
- **Question:** Do you have an example of how the dispersal to Madagascar happened? **Answer:** That is something I will do here after and look at ocean currents for example. Another option could be that Africa was used as a stepping stone, but probably a less likely option.
- **Question:** Are these species in the pet trade and what is the impact of that trade? **Answer:** I don't think it is a major concern, at least for now. They are in the pet trade, but presence doesn't seem high currently.

12. Observations from the Field and Conservation Approaches of a Critically Endangered Island Endemic, Útila Spiny-tailed Iguana *Ctenosaura bakeri* (Daisy F. Maryon*, David C. Lee, Stesha A. Pasachnik, Emma Higgins, and Tom Brown)

- **Question:** How did you set up the camera traps? **Answer:** They were set on motion sensitivity.
- **Question:** Can you purchase land for conservation purposes? **Answer:** All land is privately owned on Útila, meaning there is a potential to buy land through real estate agencies. Potential interesting areas for conservation efforts are very expensive. Currently, I'm trying to identify area that is good for these efforts and is available for a normal price.

13. The Dutch Iguana Foundation – What We Do (Yoni Muggen-van Uden*)

- **Question:** How do you get your artwork? **Answer:** We do our own artwork.
- **Question:** Is there a big market for illegal pet trade of *Cyclura* in The Netherlands? **Answer:** No, not really, the number of people having *Cyclura* is probably less than 20.

Day 2: 25 October 2017

9:00 am Daily agenda review, meeting logistics update — (Chuck Knapp, Stesha Pasachnik)

14. Disease Events and Management Actions in and around the Blue Iguana Breeding Facility on Grand Cayman (Jane Ebert Haakonsson*, Ioana Simona Popescu, James G. Fox, Zeli Shen, Paul P. Calle, Ken Conley, and Tracie Seimon)

- **Question:** Are you sure its *Helicobacter* causing sepsis, or is it just opportunistic, or something else? **Answer:** Not sure.
- **Question:** Has sepsis been seen in anoles or other species? **Answer:** No, it hasn't been seen in any other species.
- **Question:** What samples did they find *Helicobacter* on/in? **Answer:** Feces.
- **Question:** Is it clear that its *Helicobacter* and where did it come from? **Answer:** Don't know where the disease came from, looking into other areas where seen.
- **Question:** Do Green Iguanas have anything to do with the introduction of *Helicobacter* disease? **Answer:** Not sure, maybe, still trying to find this out.
- **Question:** Is disease completely gone? **Answer:** We think so. There was one suspicious death this year, that sample is still under analysis. I don't think it was from *Helicobacter* disease.

15. The Present and the Future: Little Cayman's Fight Against the Invasive Green Iguana (*Iguana iguana*) Continues (Ed Houlcroft* and Mike Vallee*)

- **Question:** What do you do with captured Green Iguanas? **Answer:** Majority are small and are just euthanized.
- **Question:** What are the sizes? **Answer:** Majority are hatchlings, about 35. Bigger ones are correlated to shipping. Rarely find adults. Only one female was captured with eggs.
- **Question:** Can you talk about the hybrids? **Answer:** Two hybrids were caught. We believe from the first group. Six hybrids total have been found over the years.
- **Question:** The video we saw of Green Iguanas at shipping containers, what island was that? Do you have camera traps? **Answer:** At shipping port at Cayman Brac. We are working on getting camera traps for Little Cayman.
- **Question:** Is there a better way to police shipping containers? **Answer:** We're trying, working with multiple groups to get on-board for better biosecurity.
- **Question:** Are the hybrids fertile? **Answer:** Not sure yet, still too young. There are 1 male and 2 females (from little Cayman). Hopefully in another year or so. The 3 hybrids captured on Little Cayman were sent to Grand Cayman.
- **Question:** Why is the density greatest on edges of the island? What is the interior habitat? **Answer:** They are concentrated around population and construction. More sightings around edges because it is more populated. Interior of island is uninhabited and rough terrain. Interior habitat is flooded bush, difficult footing, rocky, and not often visited by people. Difficult for surveys.
- **Comment:** This island is quite different than many other islands in the Caribbean. It has very difficult and sharp rocky terrain.

16. Region-wide Decline of *Iguana delicatissima* and the Need for Immediate Conservation Action

(Thijs van den Burg*, Charles Knapp, and Michel Breuil)

- **Question:** How big a problem is the bacterial infection? A big problem? **Answer:** Three iguanas were sampled, so we are not sure how bad or how widespread.
- **Question:** In Dominica, do they produce their own agricultural products? **Answer:** The island imports a lot, but also exports a lot of bananas and fruit.

17. Marine Iguanas of the Galápagos – A Social Aspect (John Bendon*)

No questions

18. Conservation of a Worldwide Flagship Species: Development and Use of Miniaturized Technology and Infrastructure to Track the Critically Endangered Pink Iguana from Galápagos (Giuliano Colosimo*, Pierpaolo Loreti, Massimiliano De Luca, Lorenzo Bracciale, Glenn Gerber, and Gabriele Gentile)

- **Question:** Have you done any fecal analyses? **Answer:** Yes, we collected lots in 2010, but haven't fully analyzed the samples yet. Have discovered dietary preferences from different plant matter in feces. Examined seeds in feces to determine which fruits. Need to examine plant matter in feces through DNA studies.
- **Question:** Are there any hatchlings seen? **Answer:** No, there has been only one sighting of a juvenile in 2010. No idea of recruitment occurring.
- **Question:** What's the GTS resolution? **Answer:** 1 meter, fairly high resolution.
- **Question:** Where is data sent from the transmitter? **Answer:** Data is sent to an antennae, then sent to a satellite.
- **Question:** Any evidence of hybrids between Pink and Yellow iguanas? **Answer:** There is no evidence of hybrids.
- **Question:** Is there danger of the antennae blowing over? **Answer:** Yes, but it will be placed very carefully and is structurally strong. We'll need helicopters to bring in the antennas.
- **Question:** Is this a more advanced encounter system? What if 2 iguanas walk near antennae at same time? **Answer:** I guess in a way it is, animals exchange info between each other and either animal can pass that info onto the antenna. No need for human interaction. Multiple devices can share data with an antenna. The transmitter has a large memory with 1 GB of data capacity.
- **Question:** What is rate of frequency of losing a transmitter? **Answer:** We Iguana-tested an epoxied transmitter in Italy that stayed on for 1 year. Seems very stable. Haven't tested them in the Galápagos yet.
- **Question:** How much do transmitters cost? How much is the antenna? **Answer:** Still working with the company to produce them at cost for us, for the certain amount of transmitters needed. They are about 350 Euros to produce but that's not including labor, so possibly up to \$700–800 Euros with labor. The antenna cost \$3,000 Euros each.
- **Question:** How much sun exposure do antennas need? How long does the charge last? **Answer:** Solar panels could recharge a device in 10 minutes while in Rome. Probably can do it faster in the Galápagos. Each charge lasts 2 days.
- **Question:** Can you use them at night? **Answer:** Yes, the device can hold a charge.
- **Question:** How close do iguanas need to be for data to be transferred? **Answer:** In our tests in Rome, they need to be within at least 2 km, probably need to be closer in the Galápagos.

- **Question:** Have you used camera traps to look for predators? **Answer:** No, it is difficult to use them because then people have to monitor them. The location is difficult to access by personnel and it is a national park, so all researchers must be escorted by a ranger. But, we would like to use them in near future.

19. Phylogeography, Phylogeny, and Systematics of *Hepatozoon* from Galápagos Land Iguanas (*Conolophus* spp.) (Arianna Fulvo, Marilyn Cruz, Leandro Patino, Saverio Vicario, Jorge E. Carrión, Virna Cedeño, Andrew Cunningham, Simon Goodman, and Gabriele Gentile*)

- **Question:** Can we use these approaches to look at more recent introductions in the Galápagos? **Answer:** Yes, but not sure about how transmission took place.
- **Question:** Is anyone sampling the Lava Lizards? **Answer:** Not now, but planning to in the future.

20. Conservation of the Critically Endangered Monuriki Island Crested Iguana (*Brachylophus cf. vitiensis*) through a Captive Breeding Headstart Program in Fiji (Joseph Brown*, Kim Lovich, Ramesh Chand, Jone Niukula, Joelle Vadada, Sia Rosalto, Stesha Pasachnik, Baravi Thaman, Peter Harlow, Carlton Rochester, Stacie Hathaway, and Robert Fisher)

- **Question:** Is there sexual dimorphism in terms of stripes on the body? **Answer:** No, both males and females can exhibit various patterns and stripes. Only sexual dimorphism is in the shape of the head, but very minor. Males have a blockier head.
- **Question:** Do they nest in trees? **Answer:** No, they nest in the ground. Probably every two years with 4–6 eggs per clutch. Some work was done by Adam Clause checking for nesting in tree ferns up in canopies, but not sure the results.
- **Question:** Are there new dietary species being found? **Answer:** Yes, but hard to say 100% which species without fecal analysis. We are confident in knowing they are feeding on Marasa trees, Kau Loa trees, Beach Hibiscus (already known), Passion Fruit Vine and Wild Cucumber Vine. Found 13 species used for perching, but hard to say how many for diet.

21. ISG Year in Review, Red List Update, New Membership Term 2017–2020, IUCN Portal, CITES Permit (Tandora Grant, Chuck Knapp, and Stesha Pasachnik)

Reminder to the group that starting with this term it is now required by IUCN to update your membership details via the IUCN Union Portal. This change is also in alignment with the new EU regulations on data privacy.

We now have all (13) historical action/recovery plans in the main IUCN Library which gives us more exposure than just being on our ISG website alone. All have ISBN numbers assigned. Hopefully the 2016 Fiji action plan will be among this list soon.

Volume 16 of the ISG newsletter will be out soon, and includes 7 IIF grant reports. We also have a new listserve address as our former host moderator (Emilia Martins) moved to a new institution. We are now hosted on Google Groups, which means you can view all previous posts and threads on the website as well as in your email inbox. You can post to the group by emailing: IUCN-ISG@googlegroups.com

In 2017, our website had ~7,000 users, mostly visitors doing “organic searches”. Beyond the home page, the most visited pages are Species, then Next Meeting and Volunteer Opportunities. Reminder this is a plea for people to create Species Profiles (we only have 2 so far) and to keep fresh content on the News page (which was the second most popular page the previous year).

The Virtual Library has nearly doubled from last year, up to ~2,300 citations, and are continually expanding. Meeting presentations and many website articles were added as well as historical publications for *Sauromalus*, *Dipsosaurus*, and *Iguana*. The Library has ~900 visitors; Google Analytics shows where visitors are located. Last year I had reported that I thought it was odd that Russian was the 2nd most popular language among our viewers. This year we have high viewership from the UK, South Korea, Saudi Arabia, and Germany. In April of this year, I found out why Russian viewership was so high, because all 3 of our websites were hacked and being used to send loads of email spam about men's "physical health issues". Our sites were extremely slow in between page loads for a few months until the frequency increased to the point it crashed our host's server. The hackers probably entered our platform through the Contact Us page, which had not been secure. It took a big effort to remove the malicious code and restore functionality.

A plea was again made to complete all our Red List assessments in the next year. If we don't complete them the Snake and Lizard RL Authority based in Washington, D.C. will complete them for us. These assessments are very brief and nowhere near as valuable a resource as the ones we have completed. We are the experts, it is our duty. A refresher on use of the Criteria followed.

- **Question:** What is the definition that the Red List uses for population size? **Answer:** The number of mature individuals is the number we use to evaluate a population. Allows us to be consistent across all taxa. Not effective population size, or inclusive of juvenile stages.
- Stesha reminded the group about the political aspect of updating Red List assessments. We're a scientific community, and we need to be honest and give completely accurate assessments, regardless if that changes/improves a species status. If evidence shows a species is improving and actually moving from Critically Endangered to Endangered, we need to present that information. And celebrate our successes! No excuses about not completing Red List assessments!

Day 3: 26 October 2017

9:00 am Daily agenda review, meeting logistics update (Chuck Knapp, Stesha Pasachnik)

9:10 am Tribute to George B. Rabb (Sandra Buckner)

22. Discussion: AZA SAFE Program, Recovery Plans, and Improvements (Chuck Knapp, All)

Discussion led by Chuck about the AZA SAFE Program to introduce it to the group:

The Association of Zoos and Aquariums (AZA) has launched a program called Saving Animals From Extinction (SAFE). The program focuses the collective efforts within zoos and aquariums and leverages their massive audiences to help save species. The program is meant to increase direct conservation spending and build capacity among AZA to conduct field research. There are SAFE species (e.g., cheetah) and SAFE taxon groups (e.g., sharks, sea turtles). The ISG discussed the potential of including West Indian Iguanas as a SAFE taxon group. Some benefits include possible increased funding from other AZA members, direct access to a restricted funding source, and elevated exposure for conserving iguanas. The challenges include added bureaucracy, diluted effort, and potential confusion on leadership. The group thought it best to wait and see if the Lizard Taxon Advisory Group of the AZA decides to take action.

Mostly the AZA is comprised of US institutions and a few international members. Do we want iguanas to be a SAFE species (West Indies, or all taxa?). We need to update the Action Plan, as part of this or before? We have a template from the 2000 publication.

John Iverson: Is there any reason why we should not do this? Answer: There may be more bureaucracy and more time needed for the Action Plan, but it could be done by cutting and pasting.

Allison Alberts: Would it be driven by *Cyclura*? Tandora Grant: There are several zoo members with *Cyclura* in their zoo who would be happy to join SAFE probably and also participate by going to the field. We also need to maneuver animals collectively for long-term future so that we don't need to bring in animals from the field.

Yoni van Uden: Does it include European zoos? Tandora Grant: Europe has their own AZA-like association but they do participate in some of our programs. They will be part of the Species Survival Plan for Jamaican Iguanas soon.

Chuck Knapp: The WI Iguana Action Plan has been cited a lot, it can be used as a resource to promote iguanas as a group, one that needs to be conserved.

Stesha Pasachnik: The Plan needs to be updated if we want to include species other than *Cyclura*, such as Fijians and Ctenosaurs, etc.

Sandra Buckner: It could be done in volumes. Is there an association involving EU zoos? Chuck: Yes, WAZA (World Association of Zoos and Aquariums) and EAZA (European Association of Zoos and Aquaria).

Tandora: SAFE might be an opportunity for the smaller species and smaller zoos to participate in an action plan and recovery plan, like *Ctenosaura*. Chuck: Also, an opportunity to reach out to the people working on these species that are not part of this group.

Catherine Malone: Can it be a one–two page per species layout with objectives? Chuck: They are an average of two pages.

Tom Wiewandt: I want to volunteer to be the photo editor. Tandora: Yes, we have a lot of good photos available now.

Kyle Miller: Would it be possible to focus the SAFE program on *Cyclura* then expand later on? Chuck: Personally yes, that's how I see it too, but having the action plan for all iguanas is important.

Chuck: Should we move this idea forward? Update the West Indian Iguana Action Plan for 2020 to start?

Sandy: We have a good template to work from for guidelines to see what points we need to address.

Chuck: We can use the Red List assessments at least for the natural history side. Who's interested in helping? I will volunteer also.

Joey Brown: We could pair-up experienced ISG members with less experienced members to help with the action plans.

Chuck: Good idea.

Stesha: What about helping with Fiji?

Joey: Yes, I'd volunteer to help, *Brachylophus* would be very important to include.

Karin Nelson: Don't forget about Galápagos iguanas, it becomes a stronger document with more species included. We don't want to go backwards to just a West Indian iguana group.

Gabriele Gentile: We are considering preparing action plan for Pink Iguanas, not sure if they would apply for the SAFE program, but no species would be able to go to a zoo. Tandora: That's not at all a requirement.

Catherine: To keep it manageable still, instead of limiting it to just iguanas in the West Indies, what about focusing on the ones that are already in zoos, then doesn't just have it to be *Cyclura*?

Tandora: Do you know if SAFE species have to be associated with an SSP? Chuck: No, I don't think so, sharks are an example. Allison: I don't think it has to have an SSP, but it's useful. Tandora: SSPs require long-term breeding plans in zoos. Chuck: Black-tip Sharks and one other species have SSPs, but the shark SAFE covers all other species.

Gabrielle: Could be a good idea. Maybe have *Cyclura* as the umbrella species, and then have iguanas as a whole in the program. Is that possible? Chuck: We'll reach out to AZA and clarify. We need to update the action plan, start with those on the Red List and then expand. Jeff Lemm: We also have the updated sections in the *Cyclura* book.

Stesha: We should assign point persons for each genus. Chuck: For the 2020 action plan publication, maybe we want an overall editor too. Tandora: I'll certainly volunteer as coordinator/copy editor.

23. Discussion: How to Address Hunting with a Lack of Governmental Support (Daisy Maryon, All)

Daisy led the discussion on this topic with a review of the program in Útila.

The Útila Spiny-tailed Iguana is threatened with extinction by hunting; the species is protected by Honduran law which bans hunting. This law carries a prison sentence and fine, however, it is not enforced at all and no person has ever been prosecuted. How do we combat hunting when there is a lack of governmental support? How do we get the local community to stop them from hunting?

Joey: Your outreach is awesome work! Do you have captive animals to show in the schools? Daisy: Yes; the Iguana Station on island breeds *bakeri*. But, they don't wish to work with us, so we would need to get a new permit to take animals to schools.

Joey: Is the breeding for private holding, or do they release them? Daisy: They release them but they don't know the success rate.

Chuck: Are people seeing hunting on iguanas? Thijs van den Burg: Yes.

Question: Do people do sports in Útila? Daisy: Yes, there is a soccer team and we can suggest using the *Ctenosaura* as their symbol.

Gabriele: How about starting an "iguana adoption" program so that kids get attached. Ed Houlcroft: We did that in Grand Cayman and it worked well until most got run over by cars; people were donating from the U.S.

Daisy: It is difficult to get this concept in to their roots, it is easier to get the children involved and interested, rather than trying to eradicate something that was in their tradition. Gabriele: Well-educated adults would not commit further than a certain point. Ed: Get the message spread by people in their own community through the generations, start with teaching those kids the importance and putting pressure on the parents to a degree. Question: Do we have enough time to go through the generations, especially in a small place like Útila?

Bonnie Raphael: Also, we should stop the “super predators” (individual hunters) and raise awareness.

Stesha: There is a big influx of people from the mainland. In Roátan the same thing happens. In Honduras you should get 18 years of prison for killing iguanas according to the law, but is anybody enforcing it?

Tom: In 1975 in Dominican Republic, the first iguana survey was done and the younger people seemed to be less interested in iguanas than the adults. There was a master hunter named Turco, who was best at catching them. He knew there were 2 species, and a good deal about their behavior. He was supplying Chinese restaurants with the iguanas he was catching. His nephew is now one of the key people in the conservation of these species. Daisy: Iguana is a common food source in Honduras and there is a lot of people coming from the mainland, a constant influx, so it’s difficult to spread the message across.

Rosanna Carreras De León: Are you doing field trips with the kids? Daisy: Yes, I would like to do more.

Joey: Is there lack of police? Why no enforcement? Daisy: If the police catch up with iguana hunters they’ll just eat them themselves.

Chuck: The problem is finding the long-term solution. Is this a problem in Cuba? How do you address it?

Rosanna: We have an example with hawksbill turtle shell souvenirs; the only thing that stopped it from continuing was a huge fine from the government that stopped it within a year. Roberto: Law enforcement is not working. There should be incentive programs to provide alternative food sources or sources of income so that people don’t need to go hunting.

Yoni: Did you try to get people to understand that eating gravid females will eventually drive them to extinction? Daisy: They still do it; Utilian hunters blame Hondurans and vice versa.

Bonnie: A top Mexican model made an awareness advertisement about not eating turtle eggs, perhaps you could find a similar idea. Daisy: I thought about spreading the rumor that iguanas make guys impotent. Comment: The idea of the rumor is good because it should work immediately. But, you might need to request and obtain the support of the local government and authorities. Daisy: They don’t really have much power and find it difficult to enforce the law. The protected area has one full-time staff member (for example, in Cusuco national park Honduras). They likely won’t provide funds for enforcement, education, and everything. Chuck: In The Bahamas everybody knows each other so they don’t want to make arrests or prosecute.

Amnerys González Rossell (translation through Roberto): Amnerys was in Honduras recently, invited by the government, to discuss the protection of species in protected areas. In Honduras there are good examples of conservation for sea turtles. This is a good opportunity to make a connection and raise awareness.

Jeff: Do your iguanas have bead tags? That can be a way of adopting them giving the kids the same color items. Daisy: I had thought about that, particularly for girls.

24. Discussion: Illegal Trade and Online Data — Putting Species at Risk (Gabriele Gentile, Yoni van Uden, All)

Gabriele led the discussion by showing a Japanese zoo website featuring a pair of Pink Land Iguanas that seem to have been purchased by negotiation with the government of Uganda. The zoo claims to have done this for conservation purposes. Iguanas have never been legally exported from the Galápagos.

This discussion is censored from the minutes, contact Tandora Grant for notes on the discussion.

25. Discussion: Hurricane Impacts and Responses (John Iverson, Sandra Buckner, Tarren Wagener, All)

Sandy led the discussion: Natural forces can move animals. Also, humans may not want animals on or around their properties. This is the case for Hurricane Joaquin in San Salvador in October 2015, which devastated the island. Low Cay/High Cay at the southern end contains iguanas. The island is very sparsely populated with people, mostly in the Northeast. The whole island is privately owned with land grants that go way back. Iguanas (*Cyclura rileyi rileyi*) used to be all over San Salvador, but now they are restricted. The area where they landed on San Salvador after the hurricane only has a couple of houses, in great habitat, but it is going to be developed over the years. We don't know where to move the iguanas to because all land is privately owned. People who live in houses are winter residents that leave in summer.

Catherine: Are the home owners in San Salvador aware of iguanas? Sandy: At this point we have not yet been able to establish owner's names, but it could be done. Immediately after the hurricane, there was a big flurry of communication and then nothing. Information that the iguanas had made it to the mainland was readily available, but their effect on winter residents was not known until later. Iguanas are threatened on the mainland.

John: Two points: 1) How do we respond to emergency situations? Do we want to have a response team? 2) We need to publish documented, quantifiable cases. We don't have any to cite even though we report that hurricanes are a threat to iguanas (e.g., in Red List assessments).

Chuck: Documentation is important. Documentation of communal nest site destruction on Dominica was impactful.

Tarren: Fort Worth Zoo is very involved with iguanas and hurricanes. Our human collaborators have faced disastrous situations. Having preparations ahead of time would have been incredibly valuable. Kelly Bradley has amazing contacts in Anegada and was able to reach people in that National Parks Trust for a statement soon after the events. But we needed to have preparations ahead of time for human impacts. And we need to be able to support people with equipment/supplies to get to the animals. As a community we can identify resources that different partners have locally. We now have plans for preparation ahead of time to help our iguana/human partners. There was a disaster plan in place before, but it needed to be revised after Irma because it was not extensive enough.

Jill Jollay: Should there be a response team within the group, or within the community? A lot of time we can't get in to the region so we need to have a group that trains people. It would be good if someone onsite has a Garmin device to maintain contact at the very least. We need a contingency plan for contingencies.

Catherine: Can Tarren share their checklist of items in the "emergency kit"? We can build on it. Communication is key. Facebook is where most information was shared. Establish a network and make sure there are ways to communicate.

Chuck: It would be good to have both a group response and an in-country response. Trying to keep up preparedness in-country for rare events is not realistic over the long-term. Thijs: Having a local team is key. Having a team outside the area doesn't make sense because no one can get in, for most cases. Comment: This should probably be evaluated on a case by case basis, since islands are all different. Group response team does not have to mean actually going to the place, but making sure that supplies are available, and contact is made.

Armando Falcón: Related the experience in one of the national parks in Cuba. September 9, Irma impacted the whole bank as a category 5 storm. This level storm had never happened before in this area, which are very special keys geologically and are protected. They were able to visit and assess the cays 4 days after the hurricane. He is in charge of the iguana program within the park so he was very worried. They found iguanas thermoregulating as always. The area has a low, shallow bay and there are lots of refuges in cavities of rocks. This time the effect of the storm was okay, but thinking as a system, the other cays are very low, with lots of mangroves, and are very vulnerable. It is difficult to assess some regions immediately after the fact in many places. We are talking about an 800 km area; there is a need to evaluate damage locally.

Rosanna: Tropical storms affect nesting, if they are shallow nests. Babies drown if they are hatching when a storm rolls through. Stesha: Nests are normally very deep and babies take a while to get out. The timing this year was unfortunate.

Roberto: In the aftermath of Hurricane Maria on Dominica, it was thanks to good communication between Cuba and Dominica that there was immediate active transport of supplies. But movement of goods may have facilitated movement of animals as well. Is it possible to follow up with small team of assessors? They are not in a good position to care about iguanas right now. There needs to be an outside task force to do this.

26. Discussion: Biosecurity at Ports — Invasives and Natives (Jill Jollay, Thijs van den Burg, All)

We're getting all our goods through ports and ports are not secure. How do we establish regulations? Who is responsible? Governmental agencies? Port owners? Shipping companies? Containers are being packed separately.

Jane: A Sister Islands Rock Iguana planning meeting happened recently and biosecurity was a major topic. Conclusion: it is a national problem and needs to be addressed jointly with multiple government agencies and port authority involved. Where is enforcement? There is talk of gassing shipping containers for agricultural pests (by the Dept. of Agriculture) and controlling invasives (by the Dept. of Environment). It is a very complicated issue.

Thijs: The problem is region-wide. Is knowledge of the biosecurity issue widely available? Comment: A framework should be established region-wide, with knowledgeable NGOs leading to make sure individual countries are informed.

Ed: Whoever is in charge needs to have authority to go in and make things happen. A lot of organizations won't appreciate outsiders telling them what to do, but could have consultants in each country.

Mike Vallee: A lot of issues have been identified. The Caymans have the knowledge, it is a domestic issue, but identifying the problem is as far as we have gotten. Many other countries have not gotten this far. Awareness throughout the Caribbean should be the number one step for this group.

Chuck: Awareness is already a step in a lot of our action plans. We have talked about having a regional workshop for invasives. We need representatives in-country to keep up awareness.

Jane: A regulatory aspect remains the most important missing thing. We have been holding community meetings at ports in Cayman Brac, but awareness is not enough. There seems to be a complete lack of urgency. Superiors need to take responsibility and enforce. Ministries must incorporate this as an important national policy. Having the ISG put pressure on this issue is needed.

Question: Is there anything in our Invasive Iguana Position Statement that addresses biosecurity already? Should we make a separate statement? Ed: We could start with receptive countries, and definitely have a separate statement. Gabriele: We need to keep pushing to establish authorities, to regulate and enforce.

Thijs and Glenn will work together to draft a statement on biosecurity.

27. Discussion: Use of Drone Technology (Kyle Miller, Glenn Gerber, Stesha Pasachnik, Jen Moss, All)

Kyle led the discussion: Kyle had a big brainstorming session with Kashmir Robotics, based out of Washington, D.C. They are mostly focused on artificial intelligence and UAVs (unmanned aerial vehicles). They are interested in collaborating on a Cuban Crocodile project. Can develop algorithms for tracking individual animal species (such as the crocs); everything is customizable to specific research goals. Kyle's team was interested in distribution and mapping habitat. Has great implications for iguanas as well. The company puts you through a 3–5 day workshop to teach you how to use the drones and understand the algorithms. Processing data is in real time, so highly efficient. Cost can be kept down to ~\$3,000 per unit. They are also working on a drone system to track sea turtle tracks on beaches, and turtles in the water. All that has been done so far for the croc project is the brainstorming session.

28. Discussion: Strengthening Engagement with Local Educational Programs (Tom Wiewandt)

Tom related an event in South Texas where the Valley Land Fund got prize money from corporations for a photo competition. Money was split between landowners and photographers. This got landowners interested in the natural environment, flora, and animals. Every year this competition gets bigger. This event has good engagement of locals and could be a good model for iguana conservation too.

For those creating educational materials: suggest we break away from the habit of putting a lot of text with visuals. Let the images carry the message.

Comment: Another example was Kabaka Pyramid's reggae song mentioning iguanas and Goat Island (Jamaica). Engagement must come from within, not from outside.

Yoni: I will volunteer to help curate our education and outreach efforts to compile a repository and get it on our website. Something that has been in discussion to do for a long time.

29. IguanaFest Update (Stesha Pasachnik)

Ty Park hosted an IguanaFest at his facility in Florida this year. It was modeled off of CrocFest, which has raised \$300,000 so far. Average raised is \$25,000 a year and held twice a year.

About 400 people showed up for the Fest. Jill, Daisy, Stesha, Joe Wasilewski, and the Green Iguana B'Gonna team were all there. It was very successful and raised over \$61,000. Ty paid for most of the event details.

The IRCF, Green Iguana B'Gonna, Andros Conservancy and Trust, the IIF, and projects run by Chris Pellecchia, Stesha Pasachnik, and Daisy Maryon all received funds. Gladys Porter Zoo managed the funds (also coordinators for CrocFest) and a small committee including Bob Kraus, Jill Jollay, and Ty Park determined award recipients.

Solicitation for proposals was not completely clear. A lot of information went out via Facebook. Might need to improve upon this in the future. Based on this initial success, IguanaFest will turn into an annual event.

An auction would also be really successful in this group. If we have a meeting in the U.S., such as Fort Worth, should we organize an auction?

30. Opportunities in Jamaica (Stesha Pasachnik)

There are new opportunities for people/institutions to become involved in the headstarting program at the Hope Zoo in Kingston. With the new curator on board, they would like to encourage a keeper exchange for their staff to learn husbandry techniques at locations in the U.S. or elsewhere, perhaps other field programs also. Local veterinarians are also not very comfortable working with exotics, and those that are do not have much time for the iguana program. A vet exchange or training program might be needed.

There are six older adult iguanas that are currently being held at zoo. DNA analysis showed their genes are not unique, but rare in the existing wild population. We would like to release them and do radio-tracking, for their safety and awareness of where/when the females lay to target them for headstarting. We would need a student or volunteer to do this radio-tracking work. A stipend is negotiable.

Jane: Is there a response team to address the invasive Green Iguana issue in Jamaica? Answer: Not yet, meetings only.

31. Travel Awardees Update (Stesha Pasachnik)

In addition to the money that we get from the IIF general fund, several members donated extra amounts this year during the meeting registration process. These contributions are very much appreciated and always welcome!

Six travel grants were awarded this year, but Edwin Castañón was unfortunately not able to attend. We welcome awardees Joseph Brown, Daisy Maryon, Jeanette Moss, Guido Rossi, and Thijs van den Burg.

32. Next Meeting Location (Stesha Pasachnik, Chuck Knapp, Tandora Grant, All)

Our current model is that we try to alternate years between hosting expensive location meetings cheaper ones. Sometimes a location is expensive to fly to, but inexpensive once there.

We have three options under consideration for 2018:

- 1) Fort Worth Zoo, Texas — a very cheap and easy option, with easy access for flights.
- 2) Dominican Republic — currently has a lot going on with the 3 species of iguanas. Rosanna is there right now which would make logistics easier, and the eradication project on Isla Cabritos with Island Conservation is relevant. The invasive Common Green Iguana situation is pretty bad and needs to be addressed. We would probably not stay at a coastal resort. The city and airport (Santo Domingo) is 4–6 hours from any iguana locations, so a meeting site in a smaller town would be better.
- 3) French West Indies: Guadeloupe or Martinique — There is a serious need to address the threat from Common Green Iguanas and the conservation of *Iguana delicatissima*. It would be very timely for working on conservation issues in the region. Cons: it is expensive and difficult to get to; however, one of the bigger islands would not be as bad. St. Eustatius would be very relevant area for a workshop, however logistically it would be challenging. The regional stakeholders (and hotels) may not be ready to host a meeting so soon after the hurricanes.