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# THE SCIENCE OF Saving Species

SAN DIEGO ZOO GLOBAL®

INSTITUTE FOR CONSERVATION RESEARCH



## Island Iguanas: Saving the World's Rarest Lizards

Still dedicated to protecting island species after 25 years, San Diego Zoo Global and its partners share a long-term commitment that continues well into the future.





*Our hope is that iguanas, with their wide distribution in the tropics and subtropics, will continue to serve as flagship species for the conservation of threatened island*

*systems.* —Glenn Gerber, Ph.D.

- 520 reptile species on Caribbean islands
- 95% are found nowhere else
- 80% of extinctions since 1500 have been island species
- 40% of threatened animal species live on islands



# PROTECTING PARADISE

## Why Islands and Island Species Matter in the Fight to End Extinction

By Glenn Gerber, Ph.D.,  
Scientist, Population Sustainability  
and Caribbean Program Head

*Photo courtesy of Charles Knapp, Ph.D.*

### Rescuing Flagship Species

When Institute scientists mention the Caribbean islands where they work with endangered rock iguanas, they describe dry tropical scrub forests, cacti, jagged limestone cliffs, steep terrain, hurricanes, diseases like zika and dengue fever, extreme and steamy temperatures—and those large lizards that have razor-sharp toenails. Yet all these challenges haven't discouraged San Diego Zoo Global's research team, still together after 25 years and more determined than ever to save rock iguanas from extinction. As one of our scientists said, "These incredible animals deserve our protection, because without them the islands will be diminished in so many ways." They have definitely become flagship species for their Caribbean habitat.

### How You Can Help

San Diego Zoo Global research teams all over the world rely on the generosity of donors like you to help achieve our vision to lead the fight against extinction. To learn ways you can help, please call Maggie Aleksic at 760-747-8702, option 2, ext. 5762, or email [maleksic@sandiegozoo.org](mailto:maleksic@sandiegozoo.org).

**CONSIDER THIS STUNNING STATISTIC: ISLANDS REPRESENT LESS THAN 5 PERCENT OF THE EARTH'S LAND BUT ARE HOME TO MORE THAN 40 PERCENT OF THREATENED ANIMAL SPECIES. FURTHER, APPROXIMATELY 80 PERCENT OF EXTINCTIONS THAT OCCURRED OVER THE PAST 500 YEARS HAVE BEEN ISLAND SPECIES. WHY? BECAUSE ISLANDS, DUE TO THEIR ISOLATION, HARBOR MANY UNIQUE SPECIES THAT ARE EXTREMELY VULNERABLE TO HUMAN IMPACTS. OF THE WORLD'S 35 BIODIVERSITY HOTSPOTS—EARTH'S MOST BIOLOGICALLY RICH YET THREATENED AREAS—NEARLY ONE-THIRD ARE OCEANIC ISLAND GROUPS. SAFEGUARDING RARE ISLAND SPECIES AND THEIR THREATENED HABITATS HAS BEEN A MAJOR FOCUS AT THE INSTITUTE FOR CONSERVATION RESEARCH OVER THE PAST 25 YEARS.**

For life to take hold on a newly formed oceanic island, such as an emerging volcano, species must colonize from elsewhere. Wildlife that colonize these islands early in their history encounter harsh conditions but are rewarded with little competition or predation from other species, leading to great ecological opportunity. Successful colonizers often evolve into groups of new species adapted to exploit unique environments—but

not all species are good island colonizers. For example, animals that fly or swim are more likely to colonize islands than those that do not. Among terrestrial vertebrates, reptiles are better island colonizers than mammals because of their lower metabolic requirements and the ability to go without food or fresh water for long periods, increasing their chances of surviving an unintentional ocean crossing. As a result, island ecosystems typically





# ISLAND IGUANAS



Dr. Gabriele Gentile

Continued from page 2

contain few mammals, other than bats, and are often dominated by reptiles and birds. Caribbean islands, for example, are home to 69 native mammal species (mostly bats) versus 520 native reptile species. Of the reptiles, 95 percent are found nowhere else.

Without large mammalian predators or competitors, reptiles on oceanic islands may evolve into giants, such as Aldabra tortoises and Komodo dragons, and often lack a natural fear of humans and other mammalian predators. Iguanas

of the Caribbean, Galápagos, and Fiji islands are other examples. Some species can reach 5 feet in length and 30 pounds, like Cuban iguanas. In addition to being among the largest native animals on the islands they inhabit, iguana species are dominant herbivores and seed dispersers, reaching extraordinary densities in undisturbed island habitats.

Unfortunately, iguanas are also exceptionally vulnerable to introduced mammalian predators and competitors, such as mongooses, cats, dogs, rats,

and livestock. These mammals, along with habitat degradation and destruction, have accompanied human colonization of islands for hundreds of years. Consequently, iguana species native to oceanic islands are now among the most threatened reptiles in the world.

All this reinforces our combined efforts to save them. As spectacular, high-profile natives of the tropics and subtropics, iguanas have become flagship species for the survival of threatened island ecosystems.



## WHERE PINK IGUANAS ROAM

At the highest peak on the biggest island in the Galápagos, 200 elusive pink iguanas make their last stand. Living on the edge of an active volcano, they exist nowhere else in the world. But perhaps most shockingly, we only learned about them recently—and then the race to save them swiftly began.

First described to science in 2009, pink iguanas, *Conolophus marthae*, are listed as critically endangered on the IUCN Red List. In addition to living in an extremely small, high-risk area on Isla Isabela, no juveniles of the species have been observed, which strongly suggests the population is decreasing.

San Diego Zoo Global is joining the fight to save the pink iguana from extinction. In collaboration with our partners at the University of Rome Tor Vergata, we have a plan to save this critically endangered species, but we need your help: stay tuned!





BACK IN 1992, NO ONE COULD PREDICT THAT A PROJECT WITH CUBAN IGUANAS AT GUANTANAMO BAY WOULD LEAD TO AN EXTENSIVE RESEARCH PROGRAM IN THE CARIBBEAN TO RESCUE CRITICALLY ENDANGERED ROCK IGUANAS FROM EXTINCTION. IT ALL BEGAN WHEN ALLISON ALBERTS, THEN A YOUNG POSTDOCTORAL FELLOW WITH SAN DIEGO ZOO GLOBAL, JOINED FELLOW RESEARCHERS TANDORA GRANT AND JEFF LEMM IN CUBA. NEXT, THEY WENT TO JAMAICA FOR A FEW DAYS TO PARTICIPATE IN A RECOVERY PLANNING PROGRAM THAT EVENTUALLY LED TO THE FORMATION OF THE IUCN IGUANA SPECIALIST GROUP.

# ROCK IGUANA DIARIES

## 25 Years and Counting

By Mary Sekulovich, Senior Editor,  
Development Department

These were exciting years for conservation researchers because Jamaican iguanas were rediscovered in 1990—after being declared extinct in the mid-1940s—when a tiny population of fewer than 50 was found in the Hellshire Hills near Kingston. Soon after, rock iguana conservation programs were launched, with the Association of Zoos and Aquariums recommending assurance populations of endangered iguanas in zoos, to protect against catastrophic loss in the wild. In 2000, Glenn Gerber joined the team as a postdoctoral fellow, setting up projects in several countries and eventually overseeing the Caribbean field program that included successive postdoctoral fellows Charles Knapp, Stesha Pasachnik, and Giuliano Colosimo. In addition to Cuba and Jamaica, our teams have worked in The Bahamas, Turks and Caicos, Puerto Rico, Dominican Republic, Cayman Islands, Dominica, and the British Virgin Islands.

Working with the least endangered rock iguanas in Cuba, the team was soon posing conservation questions and refining techniques like egg collection and incubation. They also pioneered a new technique in the region for rock iguanas called headstarting: hatchlings would be raised in protected care for several years until they weighed more and had a better chance of evading predators, such as mongooses and cats, when released. Tandora says that “iguanas are resilient—they adapt well to reintroduction programs—and know immediately where to find food, dig nests, find mates. You don’t need to prepare them for release like birds and mammals.”

The first step is to find wild nests and wait for hatchlings to emerge, then add transponder chips so they can be tracked throughout their life, including annual health checks—and iguanas can live as long as 60 years. The goal is to raise them at island facilities and release headstarted youngsters. For example, Jamaican iguanas need to weigh at least 2 pounds before release, which could take 3 to 7 years.

We look for relatedness among founders living in zoos and in island facilities as well as any changes in genetic diversity from the original groups after years of headstarting and translocations to new islands. Knowing how these iguanas are related determines breeding pairs and release strategies, which are maintained in a studbook format for each species. Tandora manages the pedigree analysis for Jamaican and Grand Cayman blue iguanas—both species are considered among the rarest lizards in the world. At the Griffin Reptile Conservation Center, Jeff Lemm oversees our breeding program for Jamaican, Grand Cayman, and Aneгада iguanas.

In the Turks and Caicos, which has over 200 islands, Glenn Gerber works with the smallest rock iguana species and oversees reintroductions and long-term population studies. Volunteers are essential for helping with this fieldwork that includes navigating between islands on our dedicated research vessel: some on his team have made 25 trips with Glenn so far. He has also worked extensively on Little Cayman and on Aneгада, where he and Jeff Lemm began headstarting youngsters in 1997.

After working together for 25 years, the team is optimistic about the future for iguanas. As island nations take on responsibilities for restoring habitat and predator control, and technologies and education improve, iguanas have become flagship species for conservation in the region. For the team, this is their life’s work. Along with dedicated partners and buy-in from islanders and their governments, saving an endangered species will always depend on those who share a long-term vision.



*Remember that iguanas are the largest land animal on most islands and are critically important seed dispersers, keeping their ecosystem healthy. And the sheer beauty of pink, green, and blue iguanas cannot be ignored!*

—Allison Alberts, Ph.D.,  
Chief Conservation and  
Research Officer,  
San Diego Zoo Global



Grand Cayman  
blue iguana

*Translocated iguanas are released from tubes on the beach in the Turks and Caicos Islands.*



Jeff Lemm

Turks and  
Caicos iguana



Glenn Gerber, Ph.D.



John Birns/International Reptile Conservation Foundation

## The Art of Saving Species

There is an art to contributing to sustainable wildlife management in a country other than your own. There are no shortcuts: understanding the local culture is key to having a long-term impact, and it is as important as understanding the biology of a species. Our teams welcome the opportunity to work with partner organizations as well as local communities in creating conservation solutions for endangered species.

### SAN DIEGO ZOO GLOBAL ISLAND IGUANA CONSERVATION PARTNERS

Blue Iguana Recovery Program  
British Virgin Islands National Parks Trust  
Cayman Islands Department of Environment  
Department of Environment and Coastal Resources, Turks and Caicos Islands  
Fort Worth Zoo  
Galápagos National Park

Hope Zoo, Kingston, Jamaica  
International Iguana Foundation  
Island Conservation  
Mississippi State University  
National Environment and Planning Agency of Jamaica  
National Trust for the Cayman Islands

Puerto Rico Department of Environment and Natural Resources  
Royal Society for the Protection of Birds  
Turks and Caicos National Trust  
University of Rome Tor Vergata  
University of the West Indies  
Wildlife Conservation Society





“Every effort we make now is dedicated to keeping Fijian iguanas from becoming extinct in the wild.”  
—Kim Lovich

# FIJIAN IGUANA CONSERVATION:

## A Race Against Time

Fanfare greeted the first six Fijian banded iguanas that arrived at the San Diego Zoo in 1965: they were a gift from His Royal Highness Tupouto’ a-Tungi, the prince and ruler of Tonga. While in the U.S. on business a few months later, the prince visited the San Diego Zoo and had a reunion with Zoo trustee Howard Chernoff, who visited Tonga in December 1964 and requested the rare lizards for a breeding program. More than five decades later, the Zoo still breeds this endangered iguana species, under authority of the Fijian government, and

maintains the largest colony of banded iguanas in the world. What has changed significantly since 1965 is how we manage breeding programs for these endangered species and help protect wild populations. While our Institute scientists and their partners conduct field surveys and genetics studies to understand Fijian iguana populations and their relatedness, in my role as Species Survival Program (SSP) coordinator, I assist with banded iguana husbandry at the Zoo and maintain the North

By Kim Lovich, Curator of Herpetology & Ichthyology, San Diego Zoo Global

American studbook. With our partners, we work together to create a holistic approach to Fijian iguana conservation and recovery. Overall, we hope to expand the connections between our animal husbandry expertise, conservation science, and external partnerships to help strengthen and support local Fijian conservation efforts.

Breeding recommendations are made based on best-available genetics information that supports long-term sustainability of a population. Our Conservation Genetics team

tested blood and skin samples from iguanas living on 35 of Fiji’s islands—and for 27 of those we were the first to sequence them. There were some surprises: we found at least one new species that needs to be described. Once we understand the genetics and biology of these lizards, then the IUCN Iguana Specialist Group can develop a conservation reintroduction strategy for them, depending on the species and where they roam.

Even more surprising, the first Fijian iguana known to science was the Lau banded iguana,

*Brachylophus fasciatus*: it was first described by science in 1800 and was believed to be the only Fijian iguana species for almost 200 years. Then in 1979, the Fijian crested iguana (pictured), *B. vitiensis*, was discovered on a volcanic island, which was set aside as a sanctuary where the species could thrive. In 2006, a third species was identified, the Fijian banded iguana, *B. bulabula*, which is our SSP focus at the Zoo, where we have an extremely successful breeding program: 172 have hatched there since 1981.

While habitat loss and predation continue on many Fijian islands, threatening iguana populations just as they do in the Caribbean, we believe we can reverse the decline of these critically endangered species. Our team is optimistic that when several factors come together—such as raising public awareness about the plight of Fijian iguanas and understanding the genetics and biology of these reptiles—we can prevent the extinction of these beautiful lizards. Optimism is a byword in conservation science: we never give up when fighting against extinction.

## Building Partnerships



The SSP supports conservation efforts to protect and reintroduce rare Fijian iguanas by building partnerships with other organizations, including the U.S. Geological Survey, Taronga Zoo, Los Angeles Zoo, National Trust of Fiji, NatureFiji–MareqetiViti, Kula Eco Park, Mamanuca Environmental Society, Ahura Resorts, BirdLife International, and traditional landowners. With funding from the International Iguana Foundation and others, the SSP also develops ways to support education outreach within Fiji, iguana ranger training, habitat restoration support, and husbandry guidance for iguana assurance colonies.

Kim traveled to Fiji in November 2016 to help release juvenile iguanas raised in protective care under a headstarting program.

1965: Six Fijian iguanas arrive at the Zoo

172 total hatches at the Zoo

2006: 3rd species is identified, *B. bulabula*





## HONORS AND AWARDS

**Symon Masiaine**, Chief Research Officer, Kenya Giraffe Conservation Program, was awarded a prestigious MasterCard Foundation full scholarship to complete his master's degree at Michigan State University.

**Dr. Candace Williams**, Reproductive Sciences, published a paper on dietary shifts in giant pandas that was awarded the top prize for microbiome papers in 2016 by *Microbiome Digest*.

**Dr. Megan Owen**, Recovery Ecology, and **Asako Navarro**, Conservation Genetics, were invited to participate as panelists at the Salk Institute for Biological Sciences' "Women in Biotech" event as part of the STEAM (Science, Technology, Engineering, Arts, and Math) Leadership Series.

**Dr. Barbara Durrant**, Reproductive Sciences, was invited to be the keynote speaker at the Southwest Embryology Summit in Phoenix, Arizona.

## PUBLICATION HIGHLIGHTS

Our San Diego Zoo Global conservationists, scientists, and researchers are constantly working to help us lead the fight against extinction. From studying how environments and social factors impact decisions animals make, to disease issues facing reintroduced species and efforts to save palm habitats, there is much work to be done.

## Here's what we've published lately:

Drs. Megan Owen and Ron Swaisgood used an integrative approach to study the ways that environmental and social context may influence how animals make decisions. The results are a variety of ideas with important implications for behavior-based conservation biology.<sup>2</sup>

A recent paper from Dr. Bruce Rideout represents the first proposed set of guidelines for ranking the potential impact of parasites on reintroduction programs, based on principles of disease ecology. A critical recom-

mendation is the need to prevent introduction of alien parasites into free-ranging populations.<sup>3</sup>

Christa Horn worked with colleagues to review the current literature available on *Mauritia flexuosa* and identified research needed to address conservation issues facing this palm and its habitats. The review focused on literature related to palm ecology, human livelihoods, habitat management, and the relationships between them.<sup>4</sup>

### Citations:

<sup>1</sup> Crudge, B., D. O'Connor, M. Hunt, E. O. Davis, and C. Browne-Nunez. 2016. Groundwork for effective conservation education: an example of *in situ* and *ex situ* collaboration in South East Asia. *International Zoo Yearbook* 50: 34-48.

<sup>2</sup> Owen, M. A., R. R. Swaisgood, and D. T. Blumstein. 2017. Contextual influences on animal decision-making: Significance for behavior-based wildlife conservation and management. *Integrative Zoology* 12: 32-48.

<sup>3</sup> Rideout, B. A., A. W. Sainsbury, P. J. Hudson. 2016. Which parasites should we be most concerned about in wildlife translocations? *Ecohealth* 14 (Suppl 1): 42.

<sup>4</sup> Virapongse, Arika, B. A. Endress, M. P. Gilmore, C. Horn, and C. Romulo. 2017. Ecology, livelihoods, and management of the *Mauritia flexuosa* palm in South America. *Global Ecology and Conservation* 10: 70-92.



*This is the most advanced rock iguana breeding facility in the world. Here we can mirror the iguanas' natural habitat and raise the young to reinforce our work in the field—and it's up to us to give the iguanas the correct conditions to make them successful.*

—Jeff Lemm

2008  
Griffin Center  
opened

20 iguanas  
currently in  
residence

2008  
First Grand  
Cayman  
blue iguana  
hatched

2013  
First Jamaican  
iguana  
hatched

## Gifts & Grants

### The Griffin Reptile Conservation Center

*By Jeff Lemm, Conservation Program Specialist, Population Sustainability*

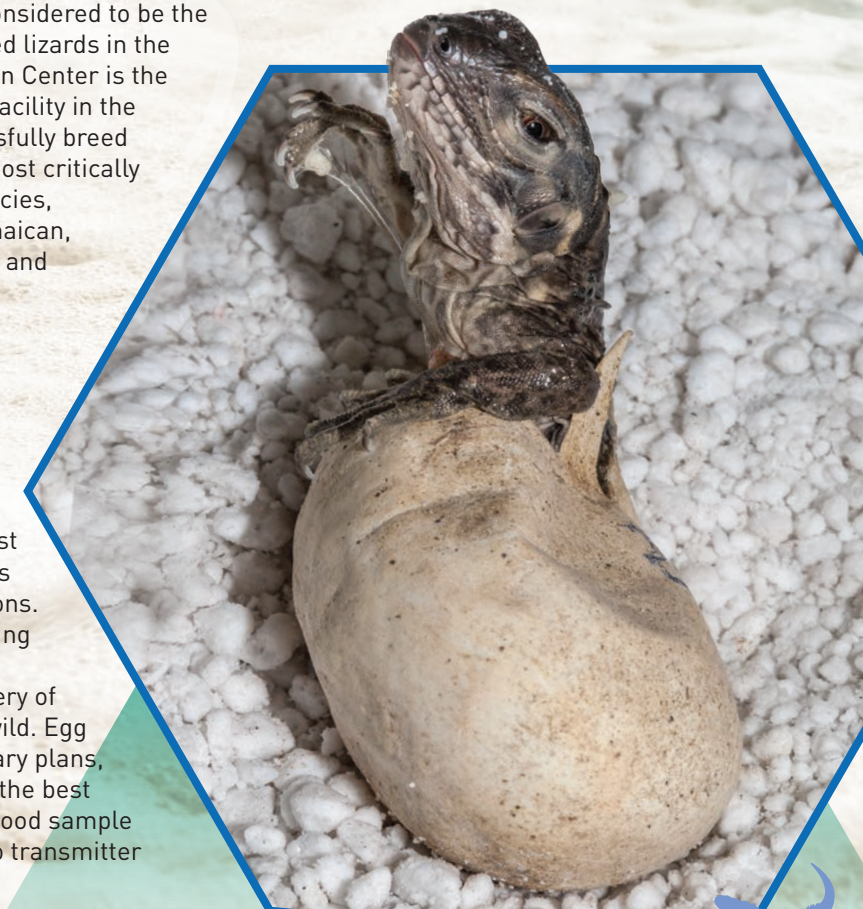
It takes a rare person to appreciate not-so-cuddly animals. Fortunately, our iguanas have a big fan and generous supporter in Kenneth Griffin. Several years ago, he visited the Komodo Islands and saw one of the Komodo dragons with a radio collar, which was part of our team's research project. Ken also noticed a sign that said San Diego Zoo Global was studying the giant lizards. It caught his interest and inspired his first gift to us for this remarkable program.

In 2008, our breeding iguanas moved from the San Diego Zoo to the newly constructed Griffin Reptile Conservation Center, an off-display breeding facility at the San Diego Zoo Safari Park. The 2,500-square-foot sanctuary was built specifically to accommodate the husbandry and breeding of Caribbean rock iguanas, considered to be the most endangered lizards in the world. The Griffin Center is the only zoological facility in the world to successfully breed and hatch the most critically endangered species, the "Big 3": Jamaican, Anegada Island, and Grand Cayman blue iguanas.

The focus at the Griffin Center is to create an assurance population as a safety net against catastrophic loss of wild populations. It is also a working research facility that helps recovery of iguanas in the wild. Egg incubation, dietary plans, and fine-tuning the best way to draw a blood sample or attach a radio transmitter

have all been studied here. Our newly installed camera system even allows us to observe secretive behaviors we would not normally be able to document, such as nesting.

The Griffin Center has made it possible for us to study and reproduce some of the most endangered vertebrates on the planet. The generosity of Kenneth Griffin has enabled the researchers and the iguanas here to be successful, creating a safer future for some of the world's rarest reptiles. In addition to funding this groundbreaking facility, Kenneth Griffin has also sponsored research to help Galápagos pink iguanas and Komodo dragons, which sparked his interest years ago. Thank you, Ken, for recognizing the plight of these often-overlooked animals and for your extraordinary generosity!



August 2013: First Jamaican iguana hatched at the Griffin Center.



### RECOVERY ECOLOGY

Our team placed GPS satellite transmitters on 10 burrowing owls to improve post-relocation settlement and survival.

### PLANT CONSERVATION

Center for Plant Conservation network gardens across the continental U.S. and Hawaii made 37 seed collections of 30 globally rare species growing on federal lands, like *Monardella viminea*.

### POPULATION SUSTAINABILITY

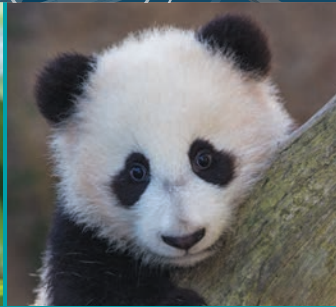
We hosted researchers from San Diego State University who are sampling rattlesnake venom in the Safari Park Biodiversity Reserve to study venom resistance in small mammals.

### GLOBAL PARTNERSHIPS

We signed an agreement to develop new technologies to understand and protect Grevy's zebras in Kenya, including new methods to identify individuals and assess population genetics.



# WHAT'S NEW



### CONSERVATION GENETICS

We hosted a Frozen Zoo<sup>®</sup> cell culture workshop to share our experience and knowledge with international scientists, so they can return home with the tools and skills to establish their own conservation biobanks.

### REPRODUCTIVE SCIENCES

We successfully collected ovarian tissue from a Guam kingfisher, a species that is now extinct in the wild, safely cryopreserving it in the Frozen Zoo<sup>®</sup>.

### DISEASE INVESTIGATIONS

Our researchers met with collaborators in Dujiangyan, China, to develop research projects that focus on giant panda disease surveillance.

### COMMUNITY ENGAGEMENT

We conducted interviews and workshops in San Felipe, Mexico, in order to explore sustainable livelihoods that protect Gulf biodiversity, including the critically endangered vaquita porpoise.

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