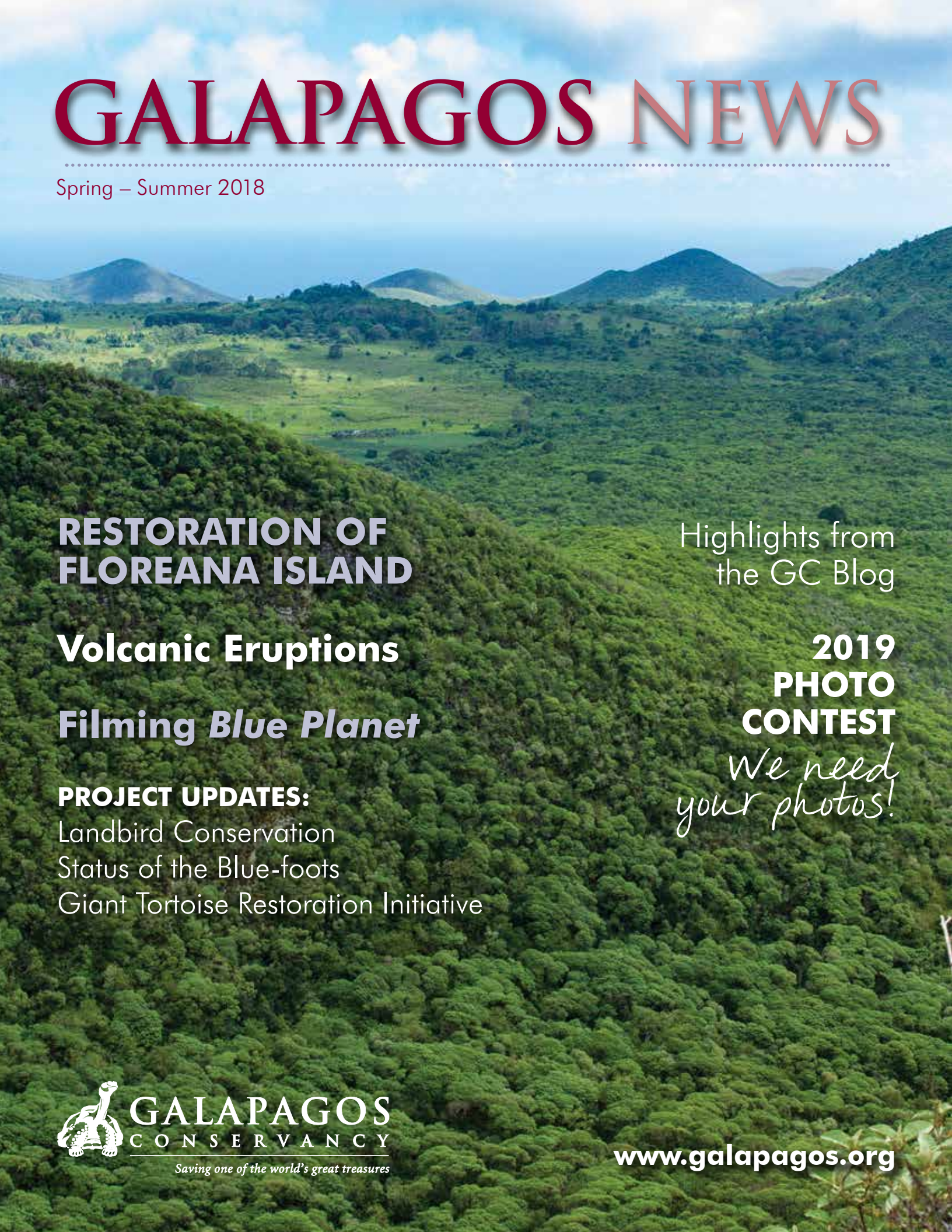
GALAPAGOS NEWS

Spring – Summer 2018



RESTORATION OF FLOREANA ISLAND

Volcanic Eruptions

Filming *Blue Planet*

PROJECT UPDATES:
Landbird Conservation
Status of the Blue-foots
Giant Tortoise Restoration Initiative

Highlights from the GC Blog

2019 PHOTO CONTEST
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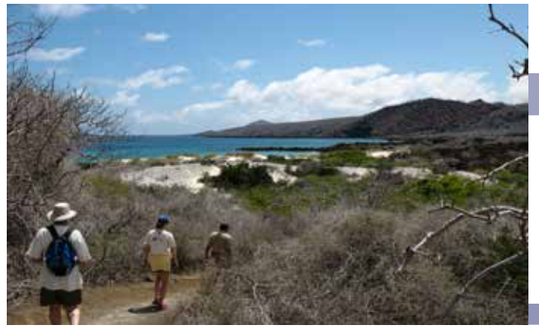

The view from the path that leads to beautiful Flour Beach, a popular visitor site and sea turtle nesting site, on Floreana Island's northern coast.
© Lori Ulrich

FROM THE

PRESIDENT

Johannah Barry

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Cover Image
The Floreana Island community is working with conservation organizations like Island Conservation and Galapagos Conservancy to restore the island and save its native species from extinction.
© Tommy Hall for Island Conservation

Over the decades, scientists and conservation managers in Galapagos have set many seemingly impossible goals. Starting in the mid-90s with Project Isabela, the Galapagos National Park and the Charles Darwin Foundation teamed together with conservation experts around the world to undertake the largest ecosystem restoration project ever attempted in a protected area. The project, completed in 2006, was an overwhelming success. And later, managing the first deliberate introduction of a non-native species, scientists in Galapagos imported the Australian ladybug to battle the introduced cottony cushion scale. Once again, the results were met with world-wide acclaim. Most recently, the Giant Tortoise Restoration Initiative (GTRI) has set as its overarching goal the restoration of tortoise populations to their historical distribution and numbers across Galapagos, including on islands where tortoises went extinct.

But perhaps the most ambitious goal to date is the restoration of Floreana Island. Of all the Galapagos Islands, Floreana is the one most altered by the presence of humans, their activities, and the invasive species they brought with them. Goats and other large mammal invasives were completely removed by the Galapagos National Park in 2007, but much of the damage had already been done — several key species native to Floreana were no longer present, including the Floreana mockingbird, the Floreana tortoise, and the native snake. Other species were *critically endangered* such as hawks, barn owls, and three species of finch.

The process has begun with groundbreaking work on mockingbird restoration which relies on the native bird populations still inhabiting two small islands off Floreana. And while giant tortoises went extinct on Floreana in the mid-1800s, the GTRI's search expeditions and captive breeding efforts have already begun to produce young tortoises with partial Floreana ancestry.

While one might not equate Galapagos conservation efforts with larger, continental ecosystem protection, it is not a mistake to call this process the "rewilding" of Floreana. Through an ambitious effort linking national institutions, non-government organizations, local governments, and residents, the goal is to protect and reintroduce key species that once were part of the island's unique ecosystem. The goal of rewilding is to create naturally-functioning ecosystems that include species once present but now gone. Restoring Floreana will be a significant test of how humans and wilderness can successfully co-exist in the Galapagos Islands. Over the next several years, as the various components of this work take effect, we will continue to support Project Floreana, knowing that your generosity and encouragement will be a large part of its success.

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Galapagos News is a twice-yearly publication that is produced for Galapagos Conservancy supporters and friends.
The information in this issue was obtained from various sources, all of which have extensive knowledge of Galapagos.
The opinions expressed are those of the authors, and not necessarily of Galapagos Conservancy.
Editors: Lori Ulrich, Henry Nichols Designer: Lori Ulrich

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(B18F)

GALAPAGOS NEWS

FIGHT AGAINST ILLEGAL FISHING

It is estimated that more than 73 million sharks are killed each year for the illegal shark fin trade worldwide. Sadly, the Galapagos Marine Reserve (GMR) is also under threat from illegal shark fishing.

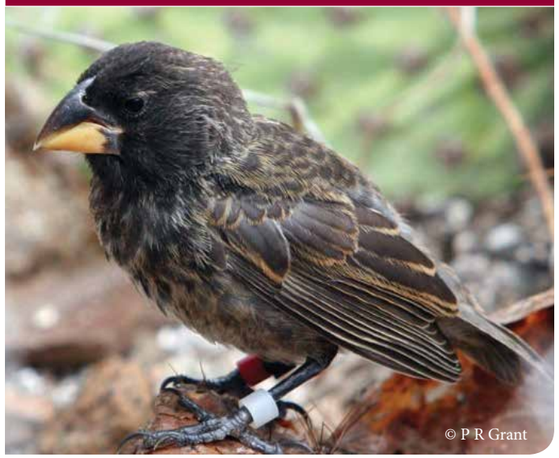
In December 2017, an Ecuadorian fishing vessel, *Don Gerald V,* was caught two miles inside the GMR with sharks and other protected species on board. The fishing vessel was detected by the Galapagos National Park Directorate (GNPD) control center and detained by park rangers and Ecuadorian Navy officials. On inspection of the cargo, they found a total of 156 individual sharks, including thresher, blue, and silky sharks. Silky sharks are listed as *vulnerable* on the IUCN Red List, and are one of the three most traded species in the global shark fin trade. Although only a small vessel, this incident demonstrates that Ecuador's sharks are facing threats from the domestic fishing industry. The helmsman of the fishing vessel has been sentenced to three years in prison and 16 crew members have received a sentence of 18 months.

As with the capture of a Chinese cargo vessel in August 2017 that held 6,000 individual sharks, including *endangered* scalloped hammerhead sharks, the responsiveness of the GNPD shows the preventative measures taken to stop illegal fishing within the GMR.

This is the second sentencing that has taken place for illegal shark fishing in the last six months. Walter Bustos, former Director of the GNPD stated, "This new arrest reflects the high level of preparation and professionalism that the park rangers have." According to the GNPD, 19 vessels have been captured within the GMR since 2009. Hopefully, this will serve as a strong deterrent, demonstrating the swift action taken to prevent domestic and foreign threats of illegal fishing activity within the GMR.


© GNPD

NEW FINCH SPECIES


© P R Grant

Researchers Peter and Rosemary Grant have observed the evolution of a new species of finch in just over two generations on the island of Daphne Major. The newly formed 'Big Bird' finch (as shown in the image), which now consists of about 30 individuals, is believed to derive from the arrival of a lone male cactus finch from the island of Española, mating with a resident female medium ground finch. Despite the previous assumption that two individual species were unable to interbreed, researchers now believe that such speciation events might have previously played a key role in the formation of modern-day finches throughout the Islands.

GALAPAGOS BATS

Very little is known about bats in Galapagos. A group of scientists, along with the rangers of the Galapagos National Park Directorate (GNPD), are researching and investigating the two species of bats found in the Archipelago to learn more about their distribution and ecology. After three weeks, the team only caught seven bats, but these will help scientists understand the mammals' biology, state of health, and whether or not the species are endemic to Galapagos. GNPD rangers will continue to monitor the bats and start to develop training for handling, measuring, and sampling methods.

GIANT TORTOISES ON IUCN RED LIST

The IUCN Red List of Threatened Species, founded in 1964, is the world's most comprehensive inventory of the global conservation status of biological species. As conditions change, the conservation status of species must be updated. Between 2016 – 2018, Galapagos Conservancy's Giant Tortoise Restoration Initiative team worked with the Turtle Taxonomy Working Group to update the status of Galapagos giant tortoise species. In the 1996 update, all Galapagos tortoises were considered subspecies of a single species. The recently updated Red List now lists 14 separate species, designating six Galapagos giant tortoise species as *Critically Endangered*, three as *Endangered*, three as *Vulnerable*, and two as *Extinct*. The Santa Fe tortoise, an undescribed species, is also extinct. These updates are a vital part of ensuring governmental and financial support for the long-term conservation of Galapagos tortoises.

MANAGING THE DOG & CAT POPULATIONS IN GALAPAGOS

Dogs and cats can wreak havoc on the biodiversity of island ecosystems — Galapagos is no exception. A partner of Galapagos Conservancy, Animal Balance (AnimalBalance.net) is a non-profit organization dedicated to creating community-based population management programs for dogs and cats while partnering with local institutions to get the job done. In May of 2018, a team from Animal Balance completed a two-week campaign on the Galapagos Islands of Isabela and San Cristóbal where they provided free sterilization for cats and dogs to the communities on those islands. They also provided support to their partner organization, the Biosecurity Agency of Galapagos (ABG), as they offered DHLPP vaccines to dogs in Galapagos for the first time ever. In all, 386 cats and dogs were sterilized and hundreds more were vaccinated during this campaign, continuing the mission to improve the lives of animals and providing humane pet population management solutions to the Galapagos Islands.


© Animal Balance

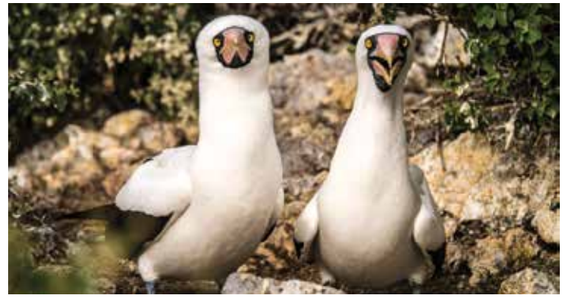
© Galapagos National Park

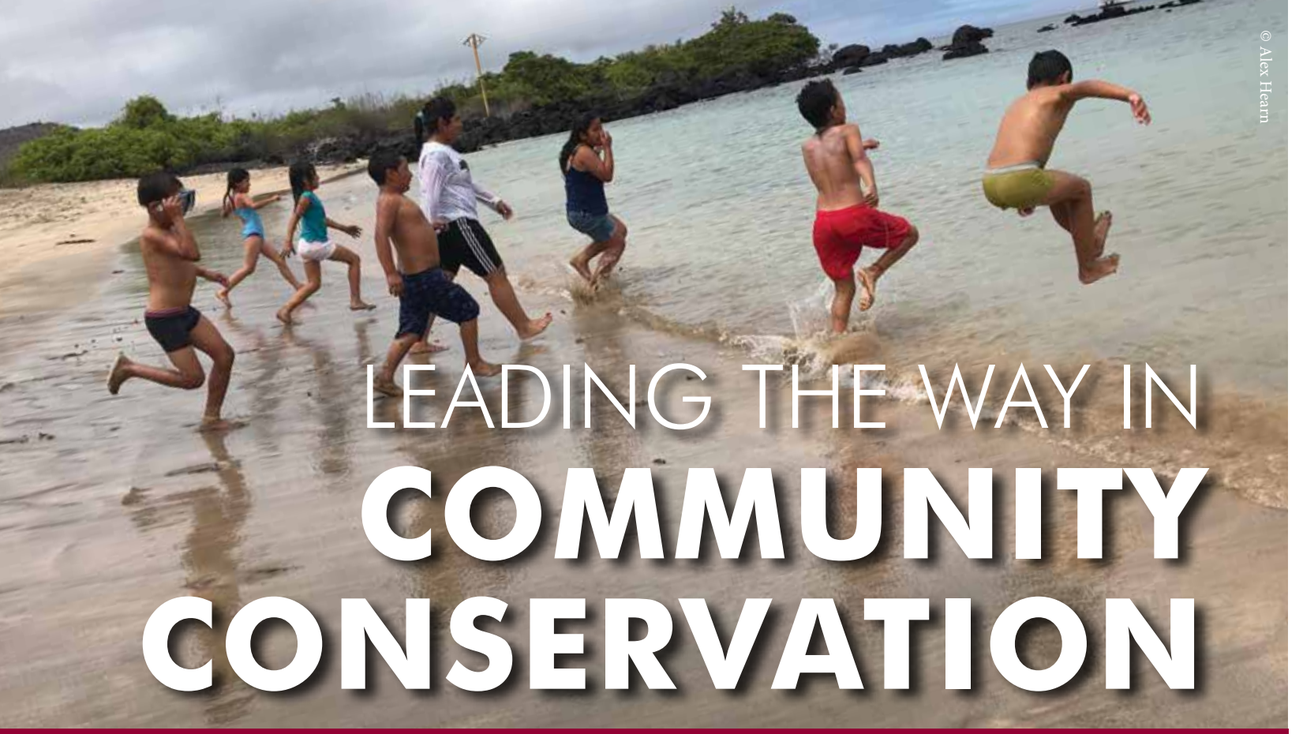
HAMMERHEAD SHARK NURSERY

The first scalloped hammerhead shark nursery area has been discovered in Galapagos, in mangroves along the coast of Santa Cruz. Galapagos is famous for its scalloped hammerheads, which are listed as *endangered* on the IUCN Red List. The Galapagos Marine Reserve has already been shown to be incredibly important for sharks, and this remarkable discovery, made by the Galapagos National Park, will help the authorities to develop further conservation strategies to protect this *endangered* species at a particularly vulnerable stage in its life.

NAZCA BOOBY RESEARCH

With rising ocean temperatures around Galapagos, the Nazca booby population is expected to shrink. Major shifts in the seabirds' diets have already occurred as the ocean has become too warm for key prey species such as sardines. Flying fish, which are less nutritious, have now become the main component of the birds' diet, affecting their overall reproduction rates. Avian species, including the Nazca booby, will be monitored to see how they adjust and adapt to climate change. This research was conducted by scientists from Wake Forest University.


Nazca Boobies © Simon Pierce



LEADING THE WAY IN COMMUNITY CONSERVATION

by **Gloria Salvador**, *Floreana Project Facilitator for Island Conservation*

Floreana was the first island of the Galapagos Archipelago to be colonized. Today it is home to a population of 140 people without whom the Floreana Restoration Project, and its aim to protect the unique biodiversity of the island, would not be possible.

Floreana residents have created a community that fosters a tranquil life away from the bustle you may find in big cities, or other inhabited islands in the Archipelago. This small community of people, who call themselves "Floreanenses," are proud to live on the island and share their daily lives as farmers, teachers, park guards, and so forth, with nature.

The island's biodiversity is astounding — many rare and beautiful species are present on Floreana. Many of the island's species, such as the *critically-endangered* medium tree finch, are found nowhere else on Earth. Others are found only in the Archipelago, such as the Galapagos petrel, of which the largest colony breeds on Floreana.

Over the years, the island has changed. Increased tourism, population growth, and developing industries challenge locals to find new and creative ways of living, while still upholding their traditional values. Floreana's residents actively participate in social and economic development, including creating their own community eco-tourism project which allows the benefits of tourism to be shared among the Floreana residents.

Aside from changes within the Floreana community, the island has also experienced ecological changes. Unfortunately, the people who have visited or lived in the Archipelago over the years, including pirates, whalers, political outcasts, and first settlers, have brought introduced species with them either accidentally or deliberately, presenting urgent conservation challenges to the residents of Floreana today.

The introduction of invasive species, such as house mice, black rats, feral cats, and the *Philornis* fly, has driven many native species to extinction or near-extinction. A total of 12 species have become locally extinct from the island. Currently 55 Floreana species are listed as *threatened*, with at least two of these species classified as *critically endangered*, meaning there is a high likelihood of their extinction within our lifetime.

Life on Floreana has changed dramatically since its first visitors set up camp, but the residents' commitment to maintaining the traditional community values and practices that were once acknowledged as the "Galapagos way of living" offers hope for a brighter future. Living inside a national park has created an environmental sensitivity for "Galapagueños." Working to protect local species and the environment has become a lifestyle here in Galapagos, and the Floreana community is at the helm of conservation efforts in the Archipelago. The people of the community work hard every day to protect native wildlife and ecological integrity, providing hope for Floreana's native species.

> "This small community is proud to live on their island and share their daily lives with nature."

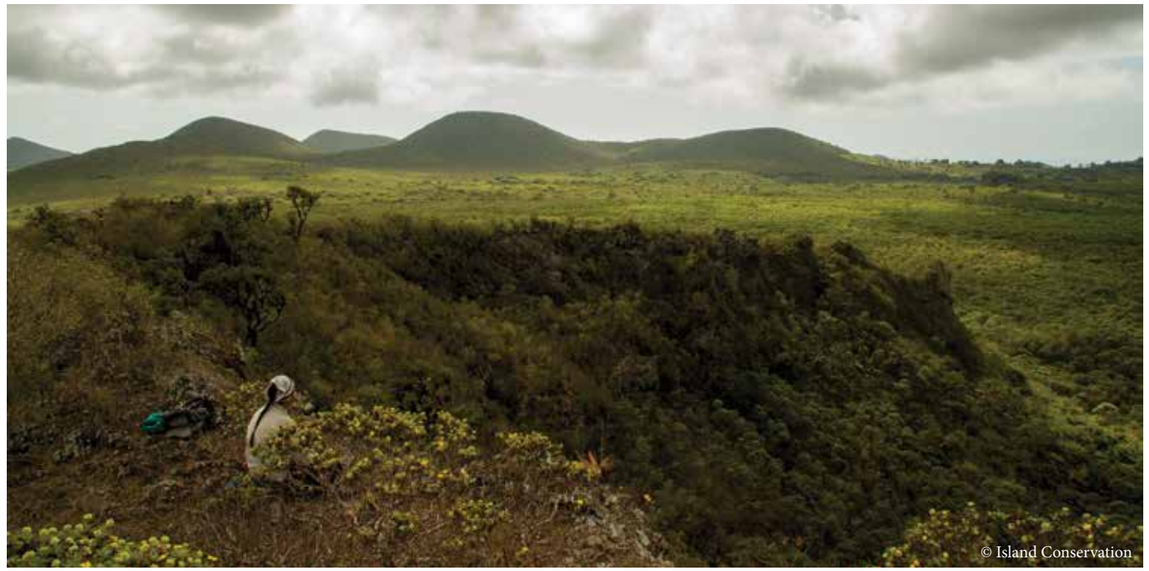
To prevent further loss of Floreana's species, local government, NGOs, community members, and scientists are working to restore the ecosystem and to return locally extinct species to their rightful home.

Island Conservation, Galapagos Conservancy, and local and international partners are working with the community through a variety of programs to achieve a restored and thriving Floreana Island. These programs include the sterilization of pets, educational campaigns, and outreach conducted by the Galapagos National Park Directorate, as well as support to change the livestock management on the island, with the purpose of helping the Ministry of Agriculture to restore Floreana Island.

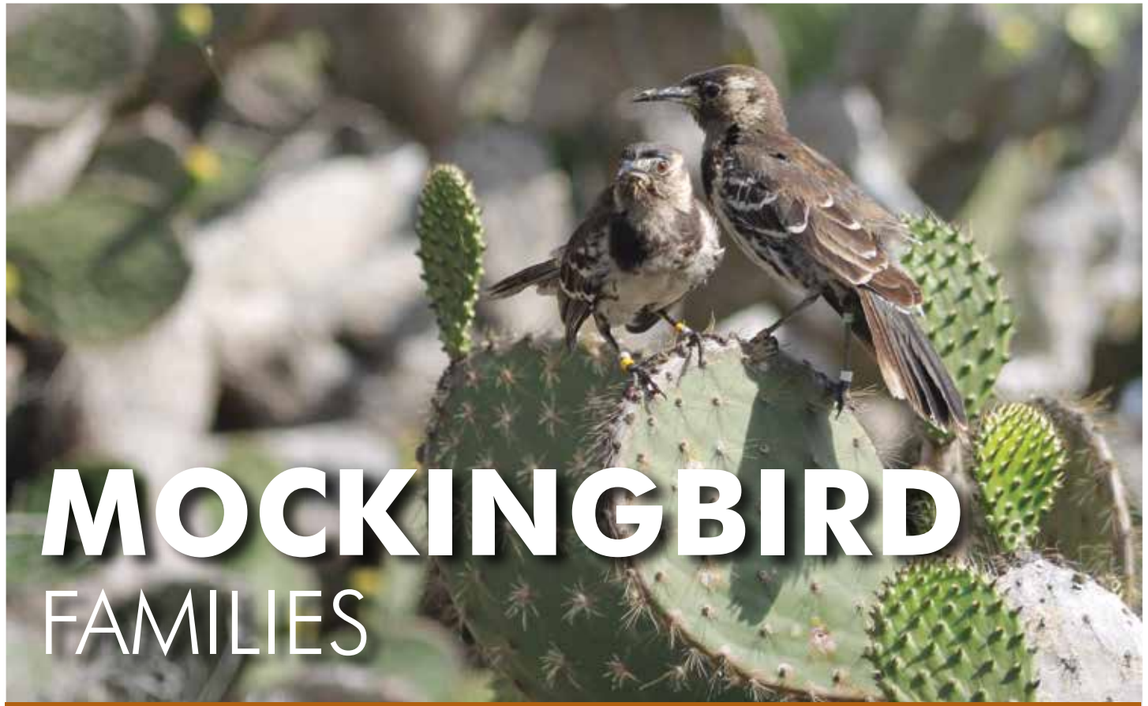
The Floreana Restoration Project's main goal is to restore the island by removing the primary threat — invasive species. Our hope is that in the near future, some, if not all of the locally extinct species, can return to Floreana.

Once invasive rodents and feral cats are removed, native species such as the Floreana mockingbird, Floreana giant tortoise, vermilion flycatcher, and others can be reintroduced, and species currently present, like the Galapagos petrel, will have the chance to thrive. This endeavor will give Floreana Island the opportunity to recover, which will benefit the vibrant Floreana community and the entire Galapagos Archipelago. ■

Left: Partners on Floreana, including Island Conservation, the Galapagos National Park Directorate, and community members, discuss the Floreana community tourism management plan.



Below: Despite looking relatively pristine, habitats in Floreana have undergone years of destruction due to introduced species such as rats and cattle.



© Luis Ortiz-Catedral

MOCKINGBIRD FAMILIES

by **Enzo Reyes**, *Ecuadorian biologist and PhD student at Massey University in Auckland, New Zealand*

I have a lifelong fascination with birds fueled, in part, by the nature documentaries I used to watch on TV. Due to this passion, I decided to go to the University of Guayaquil to start a project on the trophic ecology of dry forest owls as part of my Bachelor's degree. After completing my undergraduate studies, I became part of a long-term study on the ecology of seabirds in the Galapagos Islands. This experience helped me to develop valuable field skills for research in Galapagos.

In 2016, I approached Dr. Luis Ortiz-Catedral from the Institute of Natural and Mathematical Sciences at Massey University who, for some years, had been researching the *critically-endangered* Floreana mockingbird. I learned about his work through friends who have also been involved in his research program.

I saw my first Floreana mockingbird on Champion Islet in November 2016. It was a very special moment for me as they are locally extinct from their home island of Floreana, and only found on this and another small islet. From the first trip, Dr. Ortiz-Catedral and I developed some ideas on how to unravel the behavioral adaptations that enable these birds to carve out a living on extinct volcanoes in the middle of the ocean. These ideas are now part of my PhD research at Massey University under Dr. Ortiz-Catedral's supervision.

The main aim of my research project is to create the baseline for the reintroduction of the Floreana mockingbird to Floreana Island. My project focuses on three components: behavior, ecology, and conservation.

First, we are observing the social interactions between family groups to distinguish which birds are dominant or submissive, and deploy telemetry devices to determine the home range of each group. These behavioral experiments will also help us to decide which kind of bird, dominant or submissive, is the best candidate to consider for future reintroduction.

After that, I will characterize the vegetation in the birds' current home ranges, with the aim to search for similar habitats using satellite images of Floreana Island to establish where the mockingbirds can be reintroduced. We are also considering a variety of methods to avoid the negative effects from inbreeding on Champion islet. Hopefully, my research project will answer the questions that we need to make the reintroduction of the mockingbird to its original home on Floreana a reality. ■

Enzo, out in the field in Galapagos.

© Juan Carlos Garcia

With more commercial flights travelling to Galapagos, and a larger number of boats within the Islands, there are an increasing number of pathways for the introduction of alien species.

STOWAWAYS TO PARADISE

by **Veronica Toral-Granda**, *Former CDRS scientist and PhD student at Charles Darwin University in Australia*

In Galapagos, the human-mediated movement of goods and services is bringing introduced species to the Islands. Introduced species are one of the worst threats to islands and among the top problems for this Archipelago. These non-native species can cause environmental, economic, and health problems, and are often difficult to control and rather challenging to eradicate.

The Galapagos Islands were unknown to the world until 1535, when they were discovered by the Bishop of Panama, Tomas de Berlanga. Over the next few hundred years, pirates, buccaneers, and whalers exploited the Islands by collecting giant tortoises for meat on their long voyages. In 1833, the Islands became part of Ecuador and home to a permanent human settlement. Since the 'discovery' of the Archipelago, there has been approximately three newly introduced species per year.

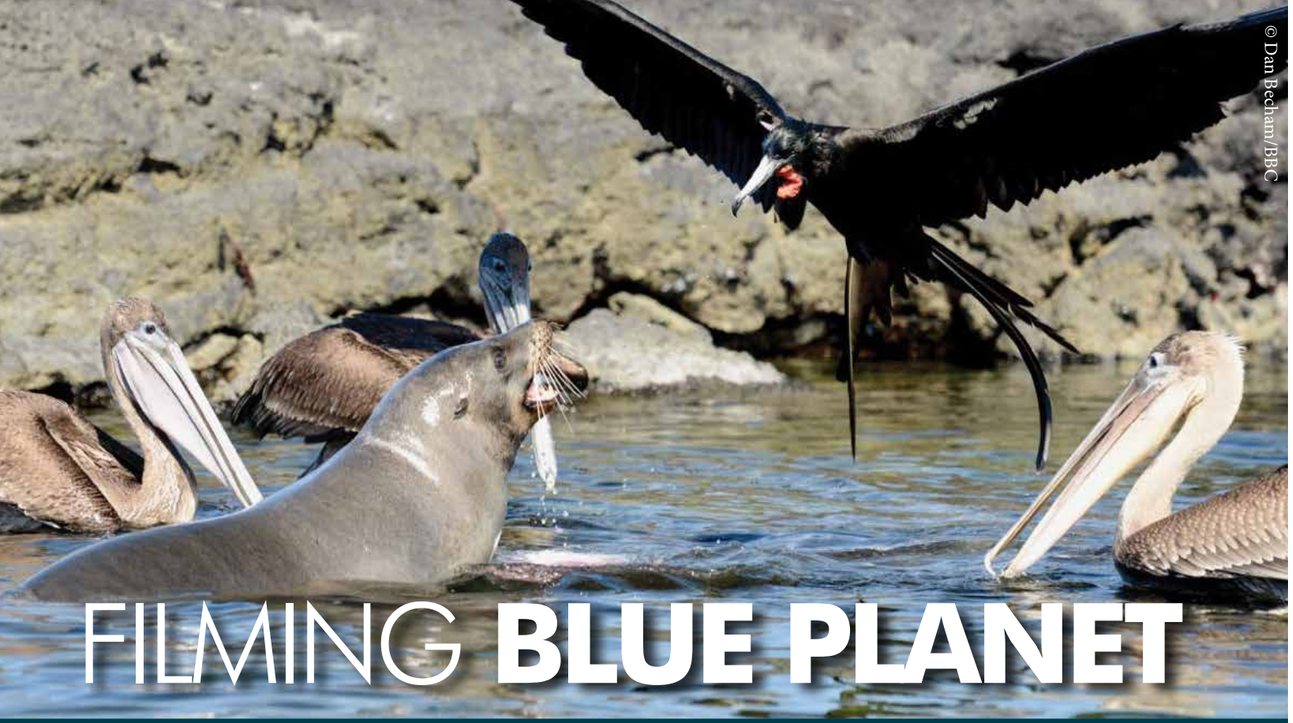
Our paper published in the *Public Library of Science* (*PLOS ONE*) showed that there are 1,476 introduced species established in Galapagos — that we know of. The majority are plants, followed by insects and invertebrates. In addition, a further 82 species were intercepted in biosecurity procedures and prevented from entering the Archipelago. There are 17 historical records of introduced species that are no longer found on the Islands, and four species have been eradicated. This brings the total to 1,576 introduced species that have been recorded in Galapagos. All but 30 species were introduced by humans, either intentionally or accidentally.

Today, Galapagos is a tourist destination renowned worldwide for its unique wildlife and landscapes. Organized tours started in the 1970s and, with them, an increase in the resident population to cater to the needs of, what has become, the most important economic activity in Galapagos. More settlers and tourists have created a need for increased goods and services, generally brought in by planes and boats.

The number of commercial flights has risen from around 3,800 in 2010 to more than 5,500 in 2015. Similarly, the number of tourist boats navigating in the Galapagos Marine Reserve has increased from 40 (with 597 berths) in 1981, to 74 (with 1,740 berths) in 2015. These pathways are forming invisible bridges connecting the Islands to the outside world.

The Galapagos Biosecurity Agency, in charge of biosecurity and quarantine for Galapagos, intercepted more than 14,000 products during routine inspections in 2015 and 2016, including those that were prohibited or did not meet specific requirements. Almost 70% arrived with tourists travelling to Galapagos.

Globally, trade and tourism are directly linked to the spread of introduced species. Galapagos seems to be no exception. The number of pathways for the introduction of alien species has increased over time, and will probably continue to do so in the future. If Galapagos is to be protected against new introduced species, investing in activities such as stringent biosecurity and quarantine measures, monitoring transport, and implementing education campaigns aimed at tourists and residents will play a role in conserving the health of the ecosystem and local livelihoods, ultimately preserving Galapagos as one of the most pristine archipelagos in the world. ■


© Dan Beecham/BBC

FILMING **BLUE PLANET**

by **Richard Wollocombe, Dan Beecham, and Jonathan Green**

The first episode of BBC *Blue Planet II*, which aired last year, was the most watched TV show in the UK in 2017, attracting more than 14 million viewers. Among other awe-inspiring moments, it highlighted a new behavior in Galapagos sea lions and showcased the hunt for the birthing ground of the whale sharks that pass by Darwin and Wolf islands. We asked cameramen Richard Wollocombe and Dan Beecham, and Galapagos Whale Shark Project founder Jonathan Green for their behind-the-scene insights.

THE CAMERAMAN: RICHARD WOLLOCOMBE

Galapagos sea lions recently featured in the coastal episode of the famous BBC *Blue Planet II* series. Our team was deeply privileged to film the sea lions collaboratively chasing yellowfin tuna from the open ocean into coastal bottlenecks off the coast of Isabela island, with the aim to trap these magnificent, fast-swimming predators for a viable meal. The filming of this discovery could not have been achieved without support from the Galapagos National Park.

The sea lions became the focus of global admiration, showing us their extraordinary prowess and intelligence as highly skillful and sophisticated hunters. It was a fitting tribute to them that so many people were able to experience how special and remarkable Galapagos sea lions are. The surprise, joy and wonder that the sea lions gave us all should be tempered, however, with the acknowledgement that they are thought to have declined 60-65% between 1978 to 2001 and are now considered an endangered species.

For such a large, dynamic, and conspicuous animal like a sea lion to have only recently revealed this remarkable behavior begs an interesting question. Have we not witnessed this behavior in the past because it is a relatively new behavior born out of the need to adapt to changing food sources brought on by climate change? That sea lions showed us that they are capable of such a high level of intelligence should perhaps give us hope that they can use their sophisticated brains to adapt to changing environmental circumstances. After all, survival is partly about being able to adapt to changing circumstances.

Whatever the case, this recently discovered behavior also drives the point home that Galapagos is still very much a wilderness that we are in the process of discovering, and we should do all we can to continue the support to preserve this priceless natural wonder of the world.

THE DRONE CAMERAMAN: DAN BEECHAM

I have to admit, when I first heard about the sea lions' behavior, I was highly skeptical about the chances of this phenomenon happening, let alone of being able to film it. It seemed fanciful to me at first — a fisherman's tale (literally, the series first learned about it from a local fisher). Of course sea lions are adept and highly-evolved hunters, but yellowfin tuna are fast — REALLY fast.

I'm glad to say that upon arriving in Galapagos I was soon proven wrong. The amazing hunting success rate for the sea lions comes down to a combination of their speed and agility, combined with cunning and strategy.

My role on the shoot was to document the spectacle from the air using drones. The hope was that an aerial perspective on the event would reveal a side to the behavior that was not possible to demonstrate shooting underwater or doing traditional long lens work.

Drones have revolutionized aerial filming in natural history documentaries. Being small, easy to transport, and relatively low cost, we were able to take a couple of drones with us and work effectively in an extremely remote location.

Our days on Isabela Island started early. We would set up at a high spot that gave us a good view of where the sea lions would likely be herding the tuna back into the bay. Then we would sit, and wait; we would stay for what, at times, seemed like endless hours. When someone spotted a sea lion finally porpoising into the bay (which we had learned meant they were chasing in tuna), everyone would spring into action. After many failed attempts, I managed to get into position quickly enough to film the sea lions corralling the tuna from the open ocean in towards the coast.

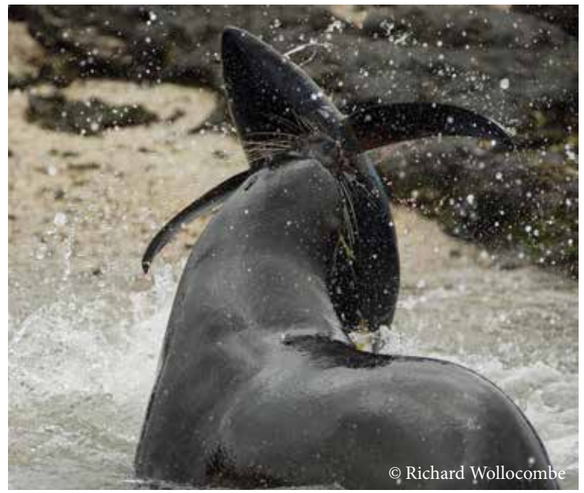
The drone helped to reveal that the sea lions acted more like a team than we originally anticipated. They appeared to have different roles, with some individuals herding the tuna into the bay, some being responsible for tiring and eventually catching the tuna, and some acting as 'blockers' cutting off any exits that a sneaky tuna might try and escape through. It was one of the most amazing behaviors I've seen in close to 20 years of diving and working around the ocean.

> "It was one of the most amazing behaviors I've seen in close to 20 years."

THE SCIENTIST: JONATHAN GREEN

Like so many, I grew up with the extraordinary work of the BBC Natural History Unit and was mesmerized by the first Blue Planet. I never in my wildest dreams thought I would get an opportunity to work with the team to help spotlight the plight of whale sharks and that of the oceans. So little is known about whale sharks that any efforts to protect them have to be at a global scale. Finding out key facts such as possible pupping or birthing areas would be a huge discovery.

Documentaries help create awareness and Blue Planet II will air to at least a billion people over the coming months. It was both exciting and inspiring to see the dedication of a relatively small group of people to produce a landmark documentary that will certainly sway the future of our oceans and our planet. To be a part of this, no matter how small a part, helped me realize that even as individuals we can all help make a difference. ■


© Richard Wollocombe

Richard Wollocombe (left) is an award-winning cameraman specializing in terrestrial and aquatic natural history filmmaking. He is a resident of Galapagos and has spend 25 years exploring the Islands. His work has taken him around the world but Galapagos remains his favorite place on Earth. **Dan Beecham** (middle) is a cameraman specializing in filming creatures great and small — in, on, and around the world's oceans. Dan spent two years working full time on the *Blue Planet II* series under the BBC, spending over 500 days in the field. **Jonathan R. Green** (right) began working in Galapagos in 1988 as a Dive Master and naturalist with the GNP. He established the Galapagos Whale Shark Project in 2005 to try to discover the importance of Galapagos to whale sharks and answer basic questions about their natural history.

AUTHOR SPOTLIGHT



VOLCANIC ERUPTIONS IN AN ISLAND PARADISE

Sierra Negra, on Isabela island, last erupted in 2005.

©Tui de Roy

by **Michael Stock,** *Volcanologist at the University of Cambridge*

The Galapagos Archipelago is one of the most volcanically active regions on Earth, with eruptions typically occurring every three to five years.

Each island in the Archipelago is entirely composed of one or more volcanoes, which sit on top of the Nazca tectonic plate. However, very little is known about the volcanoes, making it hard to predict when they might erupt.

Two of the most remarkable features of Galapagos — the biodiversity and intense volcanic activity — are intimately linked. Weathering of volcanic rocks give rise to fertile soils and the erosion of lava flows in Galapagos produces a nutrient-rich layer, which can support the dense and diverse vegetation and biodiversity.

Recent evidence has shown that the Archipelago contained many islands in the past, and land bridges may have existed between parts of the Archipelago that are now separated. This has led to new evolutionary theories on speciation and how the Islands' geology played a vital role in its ecological development.

Living in such a volcanically active region, however, is not all plain sailing. Many species endemic to Galapagos live within geographically-restricted areas and are at significant risk during eruptions. In 1998, Cerro Azul volcano, on Isabela island, erupted close to a giant tortoise breeding site. The Galapagos National Park was forced to evacuate individual tortoises, using a helicopter to carry them to safety in Puerto Villamil. The 2015 eruption of Wolf Volcano, also on Isabela, sparked fears for the safety of the *critically-endangered* pink iguanas, which live exclusively at the summit of the volcano. Recently (since mid-2017), numerous earthquakes have been detected on Isabela in the area surrounding Sierra Negra volcano. It is a stark reminder that volcanoes in the Archipelago are still active and pose an ongoing threat to the Islands' flora and fauna.

Charles Darwin famously undertook botanic and zoological studies which led to his ground-breaking contribution in evolutionary biology. However, history often forgets that he also produced a substantial amount of geological research. In fact, Darwin produced twice as many notes on geology compared to biology on the voyage of *HMS Beagle*. Nowhere was Darwin's geological intrigue more apparent than in the Galapagos Islands, where he eagerly anticipated studying the active volcanoes. In 1835, he wrote in a letter to W.D. Foxx, "I look forward to the Galapagos, with more interest than any other part of the voyage. They abound with active Volcanoes and I should hope contain Tertiary strata."

Apart from Darwin's early interest in the geology of Galapagos, very little is known about the processes that occur before eruptions take place in the Archipelago, particularly compared to regions with similar volcanic activity, such as Iceland and Hawaii. This makes it challenging for contemporary volcanologists to monitor volcanic activity and gather data that could reveal critical warning signs ahead of an eruption.

However, an exciting international research project, led by the University of Cambridge, is attempting to find solutions. Scientists are applying state-of-the-art techniques to analyze the chemistry of rocks expelled during past Galapagos eruptions. The results will shed light on the processes that occur within the magma systems beneath the volcanoes to reveal what triggers eruptions.

Despite the scientific challenges and physical demands of the project, scientists will gain a better understanding of Galapagos volcanoes. Better interpretation of monitoring data will improve our ability to protect Galapagos' unique ecosystem in the future. ■

A typical daily scene at the tortoise center on Isabela Island. These young tortoises are about 4 years old and have one year left before being released into the wild.

♦GC PROJECT UPDATE♦

Giant Tortoise Restoration Initiative

by **Linda Cayot,** *Galapagos Conservancy Science Advisor and Coordinator of the GTRI*

67 FLOREANA TORTOISE HATCHLINGS

The first nesting season of the four breeding groups of tortoises with partial ancestry from the extinct Floreana tortoise (*Chelonoidis niger*), established in March 2017, has ended. Of the 143 eggs laid, 67 (or 47%) hatched. Nesting conditions in the tortoise corrals have been improved to ensure an increase in future hatching percentages.

The 67 young tortoises are all doing well. Once they reach five or six years old, they will be released onto Floreana Island as part of a long-term program to repopulate the island with giant tortoises and restore the natural ecosystem. Blood samples for DNA analysis will be collected from all tortoises prior to their release into the wild.

NEW EGG INCUBATORS INSTALLED!

In 2018, the incubators used at the Tortoise Centers on Santa Cruz and Isabela Islands were modernized. The old system of heating the incubators with hair dryers (yes, you read that right!) controlled by thermostats was replaced with much-improved technology designed and donated by **Automated Control Logic (ACL)** of Thornwood, New York. The new incubator heat delivery system uses the latest Schneider Electric technology. To ensure sufficient capacity for the growing tortoise breeding program, four incubators were installed at each of the tortoise centers in Galapagos. Galapagos Conservancy and the Galapagos National Park Directorate thank the team at ACL for their important contribution to the conservation of Galapagos giant tortoises.

GTRI STAFF SPOTLIGHT

Galapagos Conservancy welcomes its newest Giant Tortoise Restoration Initiative (GTRI) staff member, **Jonathan Cueva.** Jonathan began work as GTRI technical assistant in April 2018. He will be assisting Wacho Tapia (GTRI Director) in all technical, scientific, and logistical aspects of the GTRI, with an emphasis on field trips and regular supervisory visits to the Galapagos National Park Directorate's tortoise centers.

Jonathan, a 25-year-old biologist from Loja in southern Ecuador, is no stranger to Galapagos. For two seasons, he participated as a field assistant in the Mangrove Finch Project on western Isabela Island. His field experience in continental Ecuador includes monitoring flagship species, including, among others, the spectacled bear (*Tremarctos ornatus*) and the culpeo or Andean fox (*Lycalopex culpaeus*).

Jonathan's participation will help the GTRI continue to expand its efforts to more of the tortoise populations as we work to restore all species and their islands.

©Kris Lo Presto

•GC PROJECT UPDATE•

STATUS of the BLUE-FOOTS

by **Dr. David Anderson,** *Galapagos Seabird Expert and Professor at Wake Forest University*

How long do you have to study a bird to achieve a basic understanding of its breeding biology? In the case of blue-footed boobies in Galapagos, more than 20 years. Since 1997, visitors and scientists in Galapagos have observed little evidence of a fundamental aspect of the blue foots' biology: reproduction. I began a long-term study of blue-footed booby breeding back in 1984. It went great until 1997, the year of a powerful El Niño warm-water event. Many seabirds struggle under El Niño conditions, so when the blue-footed boobies vanished from our study site on Española Island, I was not surprised.

Habituated for 13 years to this species' enthusiasm for making babies, I did, however, expect their return in 1998. But instead of adding their annual ~1,000 new "teenagers" to the Galapagos population, blue-footed boobies never returned in meaningful numbers. Had the blue-footed boobies stopped breeding on Española and relocated elsewhere in Galapagos? What could account for the birds not reproducing for so long — longer even than the lifespan of most adults?

In 2012 we aimed to find out. With financial support from Galapagos Conservancy, Swiss Friends of Galapagos, and the Galapagos Conservation Trust (UK), Ecuadorian graduate student David Anchundia spent 12 months making frequent visits to all known colonies, monitoring breeding, and examining diet samples from adults. Few adults attempted to breed, and even fewer succeeded. David saw almost no young.

And their diet…not good. Our data from Española during the boom years before 1997 showed that almost the entire blue-foot diet was oil-rich sardines taken from large schools. In 2012, a wide variety of species were represented, but few sardines. Breeding success of their close relatives, Nazca boobies, had dropped by 50% when sardines disappeared from the diet in…yes, 1997. Our take on this was that sardines are an exceptional food and good to specialize on if they are available, but blue-footed boobies had apparently specialized to the point of a fatal attraction. After 1997, when sardines apparently disappeared, blue-foots could live — but not live and breed — eating other food items.

What happens to the population of a species that, from 1997 until 2012, fails to replace older birds that die? It should become progressively smaller, and older. We used an estimate from the late 1960s of 20,000 adults as a benchmark for comparison. In 2012, we conducted a three-day comprehensive survey of the coastlines to count the birds. We found 6,400 adults — a dramatic decline, but expected for a population of 20,000 in 1997 (with typical annual adult mortality of 10%) that did not produce young for 15 years.

In 2017, Galapagos Conservancy funded another assessment thanks to donations from the **Blue Feet Foundation**. This coastline survey was run in the same way as in 2012. With sardines still absent from the diet of Nazca boobies, we expected to see a continued decline of the adult blue-foot population, and our preliminary analysis is consistent with this expectation.

But, contrary to the survey of 2012, we did see several hundred blue-foots in the juvenile plumage of one- and two-year-olds in 2017. In 2012 we saw only two, so possibly reproduction picked up in the previous year. New diet samples do not show higher sardine availability, but it's too early to say for sure. Still, we can speculate that the long nightmare of Galapagos blue-foots is ending. However, even if sardines come back and breeding improves, this population has a long way to go to recover its pre-1997 numbers, especially since most of the remaining adults likely have the breeding capacity that you would expect of the elderly.

And what happened to the sardines? We can't say with confidence, but we propose that the Galapagos schools rise and fall in association with sardines on the continental margin, on a scale of several decades. If that is correct, we would expect an upturn in sardine availability in the next 5-10 years, based on the up-down cycle in the 1900s. What a joy to see colonies full of yammering fluffy blue-foot nestlings again; I could re-start that project on Española Island! ■

© Sarak Knutie

•GC PROJECT UPDATE•

LANDBIRD CONSERVATION

by **Dr. Birgit Fessl,** *Coordinator of Galapagos Landbird Research for the Charles Darwin Foundation*

I first came to Galapagos in December 1995 to assist on the PhD project of Sabine Tebbich, who was studying tool use behavior of the woodpecker finch. I was doing a PhD myself at the time, but Galapagos was a dream destination for me and I gave this trip priority. I never imagined that more than 20 years later I would be leading research to conserve the landbirds of Galapagos!

During field trips to Galapagos with Sabine, two important things happened.

We discovered the parasitic fly *Philornis downsi* — by chance. This nasty fly was accidentally introduced to Galapagos in the 1960s and became established without anyone noticing, until we found its blood-sucking larvae in a woodpecker finch nest. As we investigated further, we found it in nests of other bird species. To date, it has been found in the nests of 18 native or endemic landbird species in Galapagos. One of the priorities of the Galapagos Landbird Conservation Program, a bi-institutional program of the Charles Darwin Foundation (CDF) and the Galapagos National Park Directorate (GNPD), is to find a method to protect birds from these deadly parasites.

Secondly, while collecting information on the density of woodpecker finches living in the different vegetation zones of Santa Cruz, we realized that surprisingly very little was known about how many birds are found on each island. Despite extensive studies on the breeding biology and evolution of Darwin's finches and other birds, no one had actually counted them!

Without knowing how many birds are out there, how could we know if population numbers were healthy or in need of some kind of conservation action? Establishing a baseline for bird densities on each island and setting up a long-term monitoring system was thus essential and a priority for the Landbird Conservation Program. Galapagos Conservancy and other partners also recognized this and provided much needed financial support, enabling us to make significant progress toward achieving our goal.

We use the point count method for estimating the density of birds. This involves recording all singing birds that you hear in a 5-minute interval and estimating their distance from the listener. This required everyone to learn the different song types and dialects of Galapagos landbirds. However, even after we learned them, identifications were often challenging — especially when birds were far away or when bird songs varied by island. To ensure correct identifications on each and every monitoring trip, our team of counters spends the first day or two of every trip together, to test our skills and make sure that our bird identifications coincide.

Now, for the first time, we have baseline data for all passerine species and most other landbirds from San Cristóbal, Floreana, Santa Cruz, the highlands of Santiago, and Sierra Negra Volcano on Isabela, as well as some of the smaller islands. We began our work on the human-inhabited islands, as that is where the most serious declines in population numbers are occurring. Our goal over the next few years is to carry out surveys in the remaining islands of the Archipelago.

The data collected in these surveys are already providing insights into the status of bird populations and what we need to do to protect them. For example, because of the data collections begun during Sabine's thesis, we have discovered that several small, insect-feeding bird populations have severely declined on Santa Cruz. The IUCN threat status of three of these species has been upgraded, and we are now working intensively with the GNPD to reverse these declines. ■

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Galapagos Conservancy has been supporting the Charles Darwin Foundation's Landbird project since 2013.

From the GC BLOG

Members of the Marine Invasives team collect data on the floor of the Galapagos Marine Reserve.
© Inti Keith

Dr. Luke Flory, Catherine Fahey, and Heinke Jäger investigating quinine in the field.
© Heinke Jäger

From the GC BLOG

The Galapagos Conservancy blog is full of engaging conservation stories from many contributors in and outside the Islands. Here, we share with you a few excerpts from recent posts. Full stories can be found online at **www.galapagos.org**

A Promising Year Ahead

posted January 3, 2018

"Galapagos Conservancy works with local partners, such as the Galapagos Biosecurity Agency, the Galapagos National Park Directorate, the Fundación Scalesia, and public school teachers and school directors in ways that help build stronger and more stable institutions. This approach continues to be important as Galapagos students become scientists, policy makers, and public leaders working to protect this extraordinary World Heritage Site. Collaborators from around the world bear witness to the fact that Galapagos holds a special place in our imaginations and is truly a world treasure."

Author: **Johannah Barry** is the President and Founder of Galapagos Conservancy.

Protecting the Giant Tortoises of Cerro El Fatal

posted January 29, 2018

"When I was 20, I became a park ranger for the Galapagos National Park. I was born and raised on Santa Cruz Island in the farming sector El Camote. Since I was very young, I have been familiar with the giant tortoises ... because they always came up to my farm. Whenever I went goat and pig hunting in the area known as Cerro El Fatal, I encountered them. The trails they opened made it easier for me to walk around looking for pigs ...

Since 2016, Galapagos has undergone a long period of drought with very low temperatures. This caused the 2017 tortoise nesting season to be delayed. In November, which usually marks the end of the nesting season, we found newly dug nests. That gave us the opportunity to find 60 hatchlings emerging from their nests."

Author: **Wilman Valle** has been a park ranger for the Galapagos National Park for 26 years. He has been collaborating with the Giant Tortoise Restoration Initiative in recent years, with his efforts to preserve and protect the tortoises of Santa Cruz Island – both the Eastern Santa Cruz Tortoise and the Western Santa Cruz Tortoise.

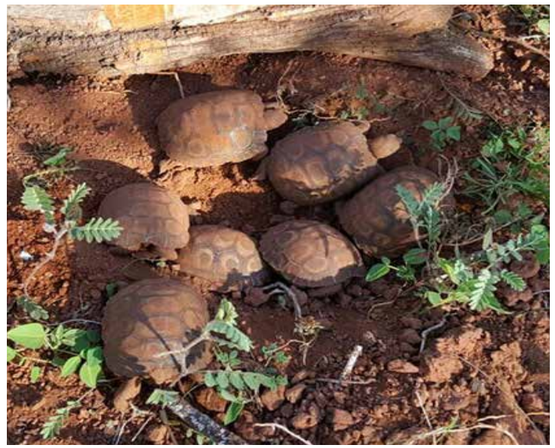
Studying Marine Invasive Species in the Galapagos

posted February 28, 2018

"Invasive species are an increasing problem in areas with growing populations and tourism, as well as throughout the Islands. In Galapagos, marine invasive species have increased with the increase in boat traffic, which is in response to more settlers on the islands and the increase of visitors. Who can blame anyone for wanting to come here? The magic of the Galapagos Islands lures people in; it is like Disney World for biologists, full of wonders and discoveries to be made. Having partially grown up in Galapagos due to my parents' work, I always considered the Islands to be extraordinary — and after my university studies, I couldn't think of a better place to work with my conservation biology degree in hand."

Author: **Sofía M. Green Iturralde** grew up alternating between life in the Galapagos and in mainland Ecuador. She is a graduate in Conservation Biology and Equine Sciences and is volunteering for a year in the Galapagos Islands before continuing postgraduate studies in Marine Biology. She is currently working with the Marine Invasive Species Team at the Charles Darwin Research Station.

Note: Sofia is also the daughter of Galapagos scientist, Jonathan Green. Read his article on page 11.



Hatchling tortoises from a natural nest in Cerro El Fatal.
© Wilman Valle

Protecting Galapagos from Invasive Ants: My Work with the Biosecurity Agency (ABG)

posted March 7, 2018

"While it is true that native ants play a very important role in ecosystem dynamics, introduced ants can cause great damage, especially to a unique environment such as the Galapagos. Damages in Galapagos include displacement of endemic and native ants, invasion of bird nests, symbiosis with crop pests, and general nuisance to farmers at harvest time. In 2017, ABG proposed a project on controlling and monitoring invasive ants to Galapagos Conservancy. Since the creation of ABG, GC has been a strategic partner, and in this case, provided the necessary funding."

Author: **Erika Guerrero** was born on Santa Cruz in 1993. Erika studied at the Miguel Ángel Cazares high school in Puerto Ayora and completed her university degree at the Central University campus in Galapagos. She identified the first fruit fly (*Bactrocera tau*) in the Baltra airport, which helped to impede its expansion and reproduction in the Islands.

A Galapagos racer slithers up a branch.
© Luis Ortiz-Catedral

The Rise and Fall of the Invasive Quinine Tree

posted April 25, 2018

"An invasive plant species introduced to Galapagos in the 1940s completely changed a highland ecosystem on Santa Cruz Island before experiencing a mysterious decline. We are trying to find out why ...

About 10 years ago, scientists, farmers and others began to notice that the quinine trees, both within the national park and in the agricultural zone, were losing their leaves and appeared much less vigorous than previously. We wanted to understand why. Perhaps whatever was causing the decline could be exploited as a natural biological control of quinine."

Author: **Heinke Jäger** has been working at the Charles Darwin Research Station (CDRS) since 1998 on several research projects involving introduced species, such as quinine and blackberry, and also on many rare and endangered plant species. She is now a Restoration Ecologist at CDRS; her research focuses on terrestrial plant and animal species in Galapagos, including distribution, impacts, and control of invasive species, as well as the restoration of invaded ecosystems.

Unravelling the Mystery of the Snakes of Galapagos

posted May 8, 2018

"Animal taxonomy is complicated. Snake taxonomy, very complicated. Galapagos terrestrial snake taxonomy, well… it may be in a class of its own.

In September 1835, Charles Darwin collected a small, light brownish-grey snake on Floreana Island. Twenty-five years later, that single specimen (housed at the Natural History Museum in London) was the basis for the description of a new species, now known as the Galapagos (Floreana) racer, Pseudalsophis biserialis. *Unfortunately, this species later disappeared from Floreana, although it can still be found on one of the satellite islands."*

Author: **Luis Ortiz-Catedral** is a Lecturer in Environmental Science and Ecology at Massey University in New Zealand. Since 2010 he has worked with the Galapagos National Park monitoring and researching threatened native species in Galapagos.

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GALAPAGOS NEWS & CONSERVANCY VIEWS

Educating for Sustainability

© Jonathan Drake, T2TI

From June 4-8, nearly 370 Galapagos educators participated in our 5th biannual Teacher Institute on Santa Cruz and San Cristóbal islands. Our work began in April 2016 by helping all K-12 teachers in Galapagos to develop proven teaching strategies that promote active learning and the development of higher-order thinking skills, and to begin to integrate local examples and sustainability issues as they teach core subjects. The program has provided more than150 hours of intensive, ongoing professional development each year.

During the next three years, we will continue to help teachers strengthen their classroom skills and content knowledge, but we will focus even greater attention on achieving more profound integration of local conservation and sustainability examples in day-to-day teaching and learning. We will also build a strong base of enlightened school directors and peer mentors that will be motivated and capable of perpetuating professional development well beyond the program's five-year timeline.

The Galapagos-based Fundación Scalesia and Ecuador's Ministry of Education continue to be key partners in this work, and the Ministry of Education is already replicating aspects of our program on the mainland.

GC would like to acknowledge the generous donors who have made our education work possible, especially the following:

Individuals: Kirke Lathrop, Judie Muggia, Ken and Diane Saladin, Gretchen Bauta, Gina Colasacco, Carol Piras, Kathleen Diamond, Sally Kleberg, Katie Burdick, Emily Shepherd, Janice Swab, Judy and Normand Smith, Edward and Judy Schwartz, Cleve and Rae Hickman, and Randall and Sally Knight.

Foundations: Tinker Foundation, The Bay and Paul Foundations, Lindblad Expeditions-National Geographic Fund, Galapagos Conservation Trust, Celebrity Xpedition Fund, the Philecology Foundation, Moritz Foundation, the Schaffner Family Foundation, Pistell Family Foundation, and the Gallagher Family Foundation.

MEMBER SPOTLIGHT

Don & Sandi McVay

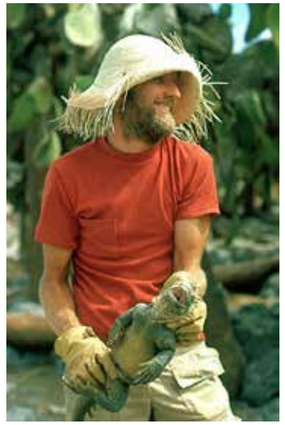
Galapagos Conservancy counts on the deep commitment of our supporters and friends, and that commitment is often born of a personal experience in the Islands. In recent email correspondence with GC President Johannah Barry, long-time donors **Don and Sandi McVay** casually mentioned their 1970s research project in Galapagos! Intrigued, Johannah asked the two for more information and below is their story:

"Our Galapagos research began when we attended an American Association for the Advancement of Science meeting in San Francisco in 1973 where the focus was Galapagos. At the time, we were both teaching biology — Don at a community college and Sandi in high school. We were intrigued about the possibility of contributing in some way, as both our Master's theses were in organismal biology (fish and amphibians). At the meeting we met Dagmar Werner, who was currently studying the Galapagos lava lizard, and we offered to volunteer (and pay all our expenses) to be involved with her research. She added us to her permit and assigned us to work on Española Island in autumn, as she was always teaching at that time and was interested in comparing her results with what we might find. We were both granted sabbaticals from our teaching assignments for September – December 1974.

Dagmar sent us some equipment and instructions, and we managed to procure other equipment at the Charles Darwin Research Station after we arrived. We spent from October 2 until November 17 on Española camping on the beach, and bringing all our food and water with us. After a week at the station to re-supply our food and water, we spent 11 days on South Plaza where we conducted our own project on juvenile Galapagos land iguanas, since they had rarely been seen on the island and not for several years. (We found some!) We also observed basic behavior and tagged a few adults. After a week at the station compiling our data, we departed for home on December 9th.

All told, it was a marvelous experience and life-changing in many ways. As we read about today's Galapagos, it is hard to believe how different it is now. In Puerto Ayora there was one dusty unpaved street, a few guest houses, and a general store where we were able to buy a few canned goods to take on each project."

We'd love to hear from our intrepid supporters and learn about your Galapagos adventures. Thank you, Don and Sandi, for more than thirty years of support and this delightful story. ■



(Left) Sandi poses at the McVays' camp on Española Island in 1974. (Above) Don investigates a land iguana on South Plaza.

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Symbolic Animal Adoption Kits

Ranging from $30 up to $100, we offer symbolic adoptions for tortoises, blue-footed boobies, sea lions, and marine iguanas. A great gift for a budding conservationist!

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Honor your loved ones by supporting the important conservation efforts in Galapagos! Gift levels start at $25. Recipients will receive a beautiful card informing them of your gift, which you can personalize with a special message.

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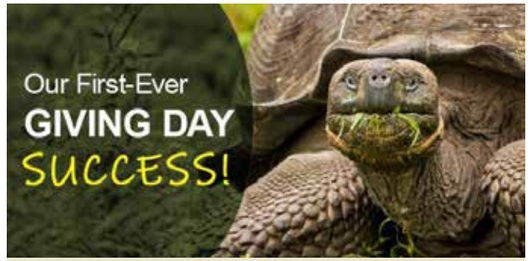

Thank You, DONORS!

RAISED MORE THAN $25,000 FOR WORLD TURTLE DAY in MAY

Wow...we're thrilled to report that our first-ever online Giving Day for World Turtle Day on May 23, 2018 was a major success! We raised more than $25,000, surpassing our goal by $10,000! These funds will go towards Galapagos Conservancy's collaborative Giant Tortoise Restoration Initiative with the Galapagos National Park, which aims to restore healthy tortoise populations across the Galapagos Islands. This critical conservation work wouldn't be possible without your support — a big THANK YOU to everyone who donated or helped spread the word through social media or on email!

ULTIMATE GALAPAGOS PHOTO TOUR

AUGUST 16 – 31, 2019

© Amy Doherty

Join famed professional wildlife photographers **Suzi Eszterhas and Tui De Roy** for a two-week photo tour of the Galapagos Islands on the luxurious *EVOLUTION*. They plan to share their expertise while photographing some of the Islands' most iconic wildlife, including waved albatross, Galapagos penguins, blue-footed boobies, frigatebirds, giant tortoises, and more — often at first light, before other tour groups have arrived.

Suzi has graciously offered to donate $500 per passenger to Galapagos Conservancy to help fund our conservation efforts when you mention GC upon booking. **THREE ROOMS LEFT** as of this printing. More information can be found on our website at: **www.galapagos.org/travel/**

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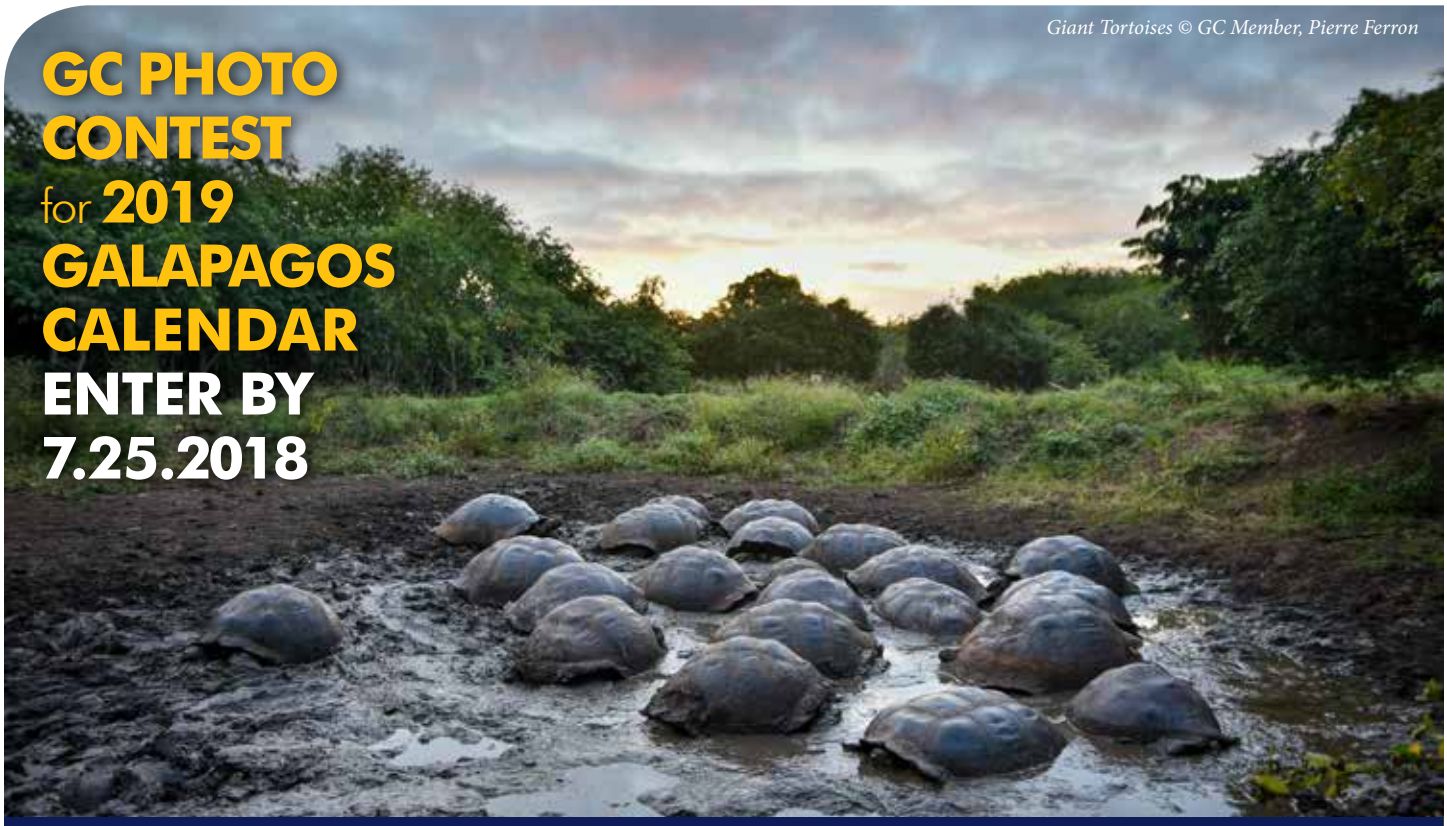

Giant Tortoises © GC Member, Pierre Ferron

GC PHOTO CONTEST for 2019 GALAPAGOS CALENDAR

ENTER BY 7.25.2018

Please email no more than 5 photos, one per email, to photo@galapagos.org. Include your name, subject of the photo, and location (if known) in the email subject line. Include your full contact information in the body of the email, with any other descriptive details about the photo. Visit **www.galapagos.org/travel/travel/photo-contest/** for rules, permissions, and to view last year's winners.