GALAPAGOS MATTERS

SPRING | SUMMER 2016

El Niño Impacts

Tortoises through time

Hammerhead Behaviour

Galapagos Conservation Trust

galapagosconservation.org.uk

GALAPAGOSMATTERS

CONTENTS

Cover
One of several marine iguanas (*Amblyrhynchus cristatus*) that live on the beach beneath the Charles Darwin Research Station in Puerto Ayora on Santa Cruz. "This group has no doubt witnessed many changes around town," says photographer Tui De Roy. © Tui De Roy.

CONTRIBUTORS

In the 1980s, **Linda Cayot** was one of the first people to study the behavioural ecology of giant tortoises. She went on to become herpetologist and then head of protection at the Charles Darwin Research Station. Since 2008, she has been science advisor for the Galapagos Conservancy.

Cyler Conrad is PhD student in anthropology at the University of New Mexico in Albuquerque. His research focuses on understanding human-environmental relationships in the past using animal bones from archaeological sites.

Washington Tapia Aguilera is the director of the Giant Tortoise Restoration Initiative at the Galapagos Conservancy. He is a biologist from Galapagos and in the past has served as both executive director and research director at the Galapagos National Park.

David Jacoby is a postdoctoral researcher at the Institute of Zoology in London. David's work uses animal tracking technology to inform the management and conservation of marine species. With a particular passion for shark behaviour, he conducts research in Japan, the Chagos Islands and the UK.

FROM THE
CHIEF EXECUTIVE

by **Sharon Johnson**

This is likely to be an uncertain year for Galapagos. The arrival of a strong El Niño to the Islands in late 2015 will have ongoing impacts over the next few years, with marine species in particular feeling the effects (**pp. 8-11**).

Over the past few months, there has been an increase in rainfall in the Islands, and we've already had reports of flooded tortoise nests. With many species threatened by this dramatic change in the environment, it is crucial that we put plans in place for species facing a real risk of extinction.

With this in mind, 2016 will be a forward-thinking year for GCT. As well as continuing to raise the much-needed awareness and support for our most urgent projects like the Mangrove Finch Project (**pp. 14-15**), we will be cementing our strong foundations in Galapagos by working with local organisations and scientists in the field. As the only organisation in the UK dedicated to conserving the Islands, we will continue to strengthen our work with the global network of Galapagos organisations as well as our partnerships in the UK. As the number of visitors to Galapagos continues to increase, in 2016 we will also have a particular focus on working more closely with the tourism industry.

Your generosity through our Galapagos Penguin Appeal was astounding. A massive thank you to everyone who donated. We raised over £45,000 which will enable us to continue to support the vital monitoring study of the penguins and cormorants in 2016 - essential for the protection of these species threatened by rapid changes to the environment (**p. 13**). I know you'll agree that with phenomena such as El Niño, we must work harder now than we ever have. We are continually looking to expand and develop our work to ensure that we have the greatest impact we can in the Islands. 2016 will see new seasons of fieldwork for projects on the Galapagos bullhead shark and the Galapagos racer (**pp. 14-15**). Sustainable living and education will also be at the forefront of our work, with further developments to our education programme Discovering Galapagos which will see the launch of a new evolution-focused module, Discovering Darwin (**p. 15**).

I am very much looking forward to building upon GCT's 20 years of success, but we will need your help more than ever to reach our goals, so we hope you'll take the opportunity to get involved wherever possible. A huge thank you for your ongoing support, and I hope you enjoy reading this latest instalment of *Galapagos Matters*.

Sharon Johnson
Chief Executive

Galapagos Conservation Trust

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WILD GALAPAGOS

Our 2015 Photography Competition winner, Luis Piovani, snapped this great image of a female small tree finch, *Camarhynchus parvulus*, during his trip to Galapagos in December 2014. Taken at Media Luna, Luis and his wife were walking to Cerro Crocker on Santa Cruz island, when they spotted this finch perching in the rain. The bird is resting on a hill raspberry, *Rubeus niveus*, one of the most widespread invasive plants on the Islands. The small tree finch uses its curved beak to pick up insects from the leaves and bark of trees, however during the dry season (June to December) fruits and seeds constitute a large part of its diet.

For details on this year's competition, see page 22.

GALAPAGOS NEWS

NEW TORTOISE

There is a new species of tortoise in Galapagos. In 2005, geneticists revealed that Santa Cruz appeared to be home to two distinct species of giant tortoise rather than one. After ten years of further investigation, researchers have now formalised this distinction.

Based on genetic evidence, it appears that tortoises reached Santa Cruz not once but twice. The first settlers probably floated over from San Cristobal or Espanola around 1.7 million years ago, resulting in the population at "La Reserva" on the south-western slopes of Santa Cruz. More than one million years later, it looks like there was another colonisation event, giving rise to the population at Cerro Fatal some 20 km to the east.

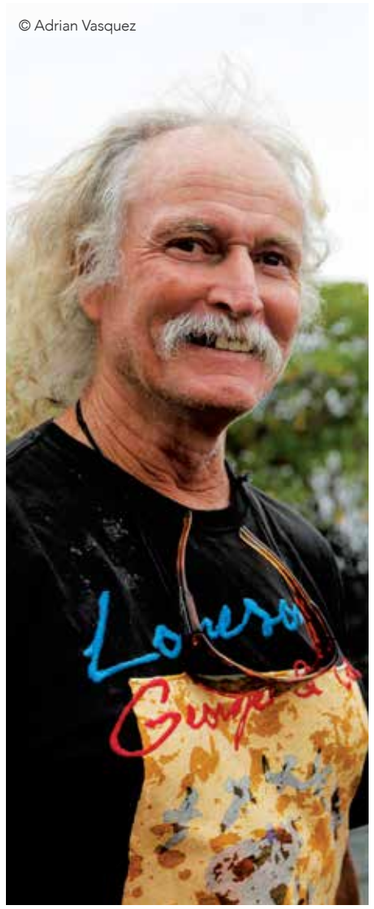
In spite of their proximity, there has been very little mixing between these tortoises. "They are as different from each other as any other tortoises in the Archipelago," says Adalgisa Caccone, a geneticist at Yale University and lead author of the study. The Reserva tortoises retain the original name given to the Santa Cruz tortoises, *Chelonoidis porteri*, whilst the Cerro Fatal population is now called *Chelonoidis donfaustoi*, a tribute to the work of Galapagos National Park ranger "Don Fausto" Llerana who retired in 2014 after 43 years of service.

In December, the Galapagos National Park carried out an ambitious expedition to Wolf Volcano on Isabela in an effort to locate tortoises with Floreana and Pinta ancestry. **Feature on page 18**.

Above: A tortoise from the Cerro Fatal population, with retired ranger Fausto Llerana. Galapagos National Park.

TOURISM INCREASE

The number of visitors to Galapagos continues to rise. In the first half of 2015, there were 113,613 visitors, an increase of roughly 5% on the same period in 2014, according to a report by the Galapagos National Park. More than half of these tourists chose to stay in one of the inhabited towns, an increase of 8% on the first six months of 2014.



© Adrian Vasquez

CONSERVATION HERO

Galapagos Conservation Trust ambassador Godfrey Merlen has been awarded the prestigious Conservation Hero Award by the Disney Conservation Fund. The accolade acknowledges Merlen's long and varied contribution to Galapagos over the last 45 years, including careful observations of natural history, preventing the spread of invasive species and battling against illegal fisheries. Over the last decade, Disney has honoured more than 100 conservation heroes from around the world. Merlen was one of 22 recipients in 2015.

© Kelvin Boot

RED-FOOTED RECOVERY

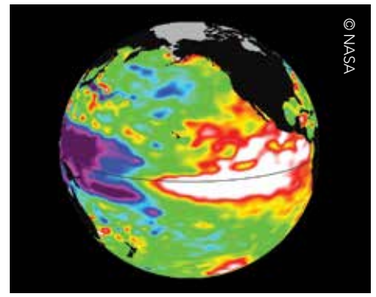
The colony of red-footed boobies (***Sula sula***) at Punta Pitt in the east of San Cristobal has shown a remarkable recovery. Almost 20 years ago, the El Niño event of 1997-98 brought the population down to just 45 adults. Since then, careful conservation efforts have seen a steady increase. In January, Galapagos National Park rangers counted 974 adult birds at this site. Elsewhere on San Cristobal, the Galapagos rock purslane (*Calandrinia galapagosa)* is also making a comeback, almost doubling in abundance since 2013.

EL NINO

In November 2015, the World Meteorological Organization confirmed that an El Niño event was underway, "one of the strongest ever measured". Galapagos has experienced more rainfall than normal, an intense spate in January causing localised flooding in the highlands of Santa Cruz. This affected several households and closed the road from Baltra to Puerto Ayora for a short period. As yet, however, the rainfall and ocean temperatures in Galapagos have not reached levels seen during the last major El Niño of 1997-98. **Feature on page 8**.

TRAFFICKER SENTENCED

A Mexican who attempted to smuggle 11 iguanas from Galapagos has been sentenced to two years in prison and a fine of $20,000. In September last year, Gustavo Eduardo Toledo Albarran was arrested in Puerto Ayora after he was found with nine marine iguanas (*Amblyrhynchus cristatus*) and two land iguanas (*Conolophus subcristatus*) in a backpack. These are both species endemic to Galapagos. He was sentenced in February under Article 247 of the Ecuadorian Criminal Code.



© NASA

TURTLE MONITORING

In January, the Galapagos National Park established camps at Las Bachas on Santa Cruz and Quinta Playa on Isabela, both important nesting sites for green turtles (*Chelonia mydas)*. By monitoring the number of females that come ashore, the nests and the hatchlings produced, the rangers will be able to assess the impact of El Niño and the presence of tourists on this species.

The tortoise floated, bounced against rocks, walked a bit, then floated again

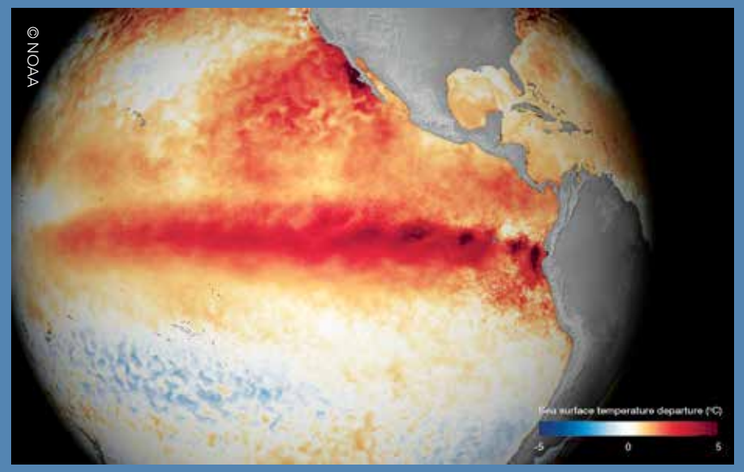
Linda Cayot

WHEN IT RAINS

With an El Niño underway, we look at the impact of this cyclical weather phenomenon on life and work in Galapagos.

El Niño is a big deal for most species in Galapagos. The trade winds, which normally blow across the Pacific from east to west, begin to weaken and the Humboldt Current that brings cold, nutrient-rich water from Antarctica to Galapagos slows. As the temperature and composition of waters around Galapagos changes, so too does the marine ecosystem, with knock-on consequences for any species further up the food chain. The increased temperatures can result in excessive rainfall and localized flooding. Under these conditions, the struggle for survival can become too great and many species suffer a precipitous decline, experiencing changes in population structure that last for years.

The suffering is not only felt by plants and animals, but also by humans. We asked several Galapagos residents and researchers to describe how they have been affected by El Niños past.



© NOAA

Above: The Galapagos Islands just off the west coast of South America receives the full brunt of El Niño

© Ole Hamann

It was the first and last time I took a swim in a quadrat

Ole Hamann

Ole Hamann, University of Copenhagen

It was the first and last time I took a swim in a quadrat. One of the ways botanists monitor plants is to peg out quadrats, patches of habitat that are visited repeatedly to see how the vegetation is changing. In 1983, soon after the El Niño rains had stopped, I travelled to Santa Fe only to find that one of my quadrats had become a lake. The corner poles were barely visible. All the plants were drowned. Without any data to collect, I took a dip.

Even large plants and trees can be seriously affected by extreme rainfall. After the 1982-83 El Niño, almost all the old *Scalesia* trees in the Santa Cruz highlands died. Seedlings did eventually emerge a couple of years later but they struggled to compete against invasive plants taking over. The *Opuntia* cacti too can become seriously waterlogged and collapse under their own weight. On Santa Fe, for instance, the number of big opuntias decreases dramatically after an El Niño event and the number of shrubs increases.

© Linda Cayot

Linda Cayot, Galapagos Conservancy

Late one afternoon, during the first months of the 1982-83 El Niño, I was completing a two-day watch of an adult male tortoise on Santa Cruz when he decided it was his time to migrate. Once the rains begin in earnest, the highlands are transformed. Rivers, sometimes 30 metres wide, rush through the forests. And there is mud. So much mud. The tortoises escape this by heading down to the lowlands en masse.

Rather than plodding down the muddy trail, this tortoise chose a more efficient route: a river. He floated, bounced against rocks, walked a bit, then floated again. I followed, crawling with the current. Bushes grabbed at my daypack, much as they did at the tortoise's carapace, giving me a new sense of empathy for my study species. El Niño and the resulting migration of tortoises had a huge impact on my work. After nearly two years collecting data in the highlands, I had to start over in the lowlands.

© Martin Wikelski

Martin Wikelski,
Max-Planck Institute for Ornithology

El Niño has always been a dramatic event for marine iguanas. In the early 1990s, I lived through an El Niño on Genovesa in the northeast of the Archipelago. The sea temperature, normally around 18°C, rose to over 30°C, killing off the red and green algae that are the iguanas' main source of food. Some 90% of the population perished and only the smallest animals survived.

Many of these small iguanas made it through a subsequent El Niño in 1997-98, but I got the impression they were getting even smaller. It sounded completely crazy and the intense heat and isolation of fieldwork can play tricks on your mind. But when I analysed the data, it became clear that a marine iguana's skeleton does indeed become shorter during an El Niño year, lengthening again afterwards. Each iguana will experience this phenomenon, over and over, throughout its lifetime. It sounded strange at the time but we now know that other animals, like fish, tortoises and even some mammals do the same thing. They shrink and regrow.

> A marine iguana's skeleton becomes shorter during an El Niño year, lengthening again afterwards
>
> Martin Wikelski

Carlos Valle,
Universidad San Francisco de Quito

El Niño is not a new phenomenon, so there have probably been very severe episodes in the past. But for the marine realm in Galapagos, the most dramatic event on record is indisputable. During the 1982-83 El Niño, the seabirds in Galapagos stopped breeding and abandoned their nests, eggs and chicks. Inshore feeders, like the blue-footed booby, wandered through the Archipelago in flocks of several hundred birds, while others left the Islands altogether in search of food.

At the time, I was working on Galapagos penguins and flightless cormorants around Fernandina and both these species suffered greatly, the penguin population declining by around 80% and the cormorants by some 50%. Once the El Niño had passed and the fish returned to the waters, the penguins and cormorants began to breed again. I'll never forget how the cormorants used the mummified remains of marine iguanas to line their nests.

© Joanne F. Avery

© Henry Nicholls

Kate Huyvaert, Colorado State University

We knew we were in trouble just looking at the clouds building over the ocean behind Punta Cevallos on Espanola. They were big and dark, heavy with rain and lightning, a portent of things to come. After the rains began in late October 1997, we spent our days measuring the effects of the El Niño event: we emptied the rain gauge countless times over six months, recording nearly a metre of rain; we tracked daily changes in the growth of the vines creeping through camp; we tallied the cans of tuna eaten; and we watched our hair grow in the heat and humidity.

We also tracked the effects this monster event had on the Nazca boobies that call Punta Cevallos home. The warmer sea surface temperatures characteristic of El Niño in the eastern tropical Pacific drive fish deeper into the ocean where they are difficult for seabirds to catch. On Espanola, nests became murky puddles where booby chicks shivered unattended. Our daily records included the numbers of nests lost because the chicks starved or the nest was washed away by the rain or the tide. At night, we swatted the mosquitoes that swarmed into our tents and outside the boobies did likewise, slap-slapping their feet on the rocks to unsettle the insects. That year, nearly all the Nazca nests that we were monitoring failed.

SAFEGUARDING THROUGH THE STORM

Whilst El Niño is a natural phenomenon with which Galapagos species have had to contend for thousands of years, there is concern that these events are becoming more frequent and more extreme, and could drive the extinction of particularly vulnerable species like the flightless cormorant and the marine iguana. Later this year we will be launching our Safeguarding Through The Storm Appeal to support urgent research and monitoring for these susceptible species. This work will not only improve our understanding of the impacts of El Niño, but also ensure that conservation action can be taken quickly and effectively. Help us kick-start the appeal by making a donation using the foldout form at the back of the magazine.

UK NEWS

CEO IN GALAPAGOS

In November 2015, our chief executive Sharon Johnson embarked on her first visit to Galapagos. In a whirlwind trip, with just nine days in the Islands, Sharon started out in Santa Cruz where she met up with our partners from the Charles Darwin Foundation, tracked tortoises with scientist Dr Steve Blake (something she had not done for 20 years since being on the Aldabra atoll), and met with teachers at the Tomas de Berlanga School. She then headed over to San Cristobal to meet up with the leaders of some of the projects GCT is currently supporting on the Islands. Sharon was also able to squeeze in a quick trip to Isabela for a day's rest and the chance to experience some of the island's wildlife, including snorkelling with Galapagos penguins.

© Adrian Vasquez

GCT TEAMS UP WITH SEA LIFE AQUARIUMS

Over the past few months, we have teamed up with SEA LIFE aquariums, taking part in day-long events at both London and Brighton aquariums. Working with SEA LIFE has provided us with a fantastic opportunity for outreach, and through this we've generated new contacts and reached new audiences. Raising awareness for conservation issues in Galapagos is hugely important to us, and we look forward to continuing to team up with other UK partners throughout 2016.

ROYAL COLLEGE OF NURSING ADOPTS TORTOISES

The Royal College of Nursing (RCN) has adopted 18 Galapagos giant tortoises to celebrate its centenary. Like the college, tortoises also live to be over 100 years old, and so are perfect for a centenary celebration. Adopting a tortoise for each of its offices around the UK, the RCN has plans to include new soft-toy mascots in many centenary-themed events and activities throughout the year.

If you, or your business, are interested in partnering with GCT, please contact our CEO, Sharon Johnson, by email **(sharon@gct.org)** or telephone **(020 7399 7440)**

ROGER PERRY

We are saddened to announce the recent death of Roger Perry, who passed away in January aged 82. Roger was the first director of the Charles Darwin Research Station (CDRS) from 1964-70, and the longest serving director of the CDRS to date. "The most urgent task in 1964 was to protect the surviving populations of giant tortoises," he wrote in *Galapagos Matters* in 2009 (then *Galapagos News*). "So far as we knew there were only the remnants of colonies on Santa Cruz and the northern volcanoes of Isabela. Other races, those of Pinzon and Espanola, were critically endangered. I proposed that we should begin a captive-breeding program. This was to become one of our most encouraging ventures." The Espanola population now stands at over 2,000 individuals, demonstrating the impact of Roger's contribution to the conservation of Galapagos giant tortoises.

GCT is honoured to be the recipient of a legacy in his name, which will be used to ensure his outstanding work in conservation continues well into the future.

© Sarah Janman

CONSERVATION CHAMPIONS

Year 3 and 4 children from Hawkinge Primary School in Kent fundraised throughout January to adopt three Galapagos giant tortoises and one Galapagos penguin. Our communications officer, Holly, visited the school to give a talk on their chosen species and to present the children with their certificates. Holly was very impressed with the understanding and enthusiasm the children showed; they had more questions than she had time to answer.

PENGUIN APPEAL

Thank you to everyone who has donated to our Galapagos Penguin Appeal. Your generous contributions have raised over £45,000 for penguin conservation through the Penguin & Cormorant Monitoring Study**,** ensuring we were able to support this vital work in 2015 and can continue to support the project throughout 2016.

The project has been running for five years now, and this year's monitoring work is more important than ever. A strong El Niño hit the Islands at the end of 2015, bringing with it warm waters. The changes in ocean temperature substantially reduce the food availability for both penguins and cormorants, which can have catastrophic knock-on effects, such as starvation and a decline in breeding rates.

This spring, the project team will make their first monitoring trip of the year, collecting crucial data on population demographics that will allow them to assess rates of mortality and reproduction. During these expeditions, each penguin is weighed and the researchers take feather samples to test for traces of toxic metals and blood samples to screen for infectious diseases like avian malaria. All this information gives an understanding of the overall health of the penguin population. The team will also record the presence of the introduced animals such as rats and cats, to assess the efficacy of existing management strategies for invasive species.

Further trips to the colonies will be made in July and September 2016 and will help to assess the true impact of the El Niño on the penguins. The long-term nature of the study is of great significance as it is the only way to gauge accurate population trends of both penguins and cormorants, information that will inform the Galapagos National Park's management of these unique species.

There is still time to give the penguins a helping hand this year. If you would like to make a donation to help species affected by El Niño, simply fill in the fold-out flap found at the back of the magazine, and post it back to us in the enclosed envelope. Alternatively, donations can be made by phone on 020 7399 7440, or online at **www.galapagosconservation.org.uk/donate.**

© Sam Rowley/CDF

THE DEEP

We would like to say a massive thank you to our partners at The Deep aquarium in Hull who have donated £14,000 towards the Penguin & Cormorant Monitoring Study for 2016. Their donation was raised through a penny collection fund at the aquarium, and will enable us to make huge progress with the project this year.

The Deep is an education and conservation charity, and home to over 3,500 fish, including green sawfish as well as a colony of gentoo penguins. To find out more, go to **www.thedeep.co.uk**

THE DEEP
For conservation, not profit.

GALAPAGOS PENGUIN ADOPTION

£30

Available to purchase online or via the foldout form at the back of the magazine

Help conserve one of Galapagos' most iconic species by adopting a Galapagos penguin. This limited-edition adoption pack includes a Galapagos penguin soft toy, a fact-filled file about this endangered penguin species and a personalised certificate. The recipient will also receive email updates every six months about the conservation work we are doing in Galapagos to protect these endangered birds.

PROJECT UPDATES

CITIZEN SCIENCE IN THE GALAPAGOS MARINE RESERVE


© GCT

2015 saw the launch of a new citizen science project supported by GCT: the Galapagos Bullhead Shark Project. Spanning three years, the project will uncover the mysteries of a shark that has been neglected by science since its discovery 175 years ago.

The Galapagos bullhead shark is small and inconspicuous, and despite being discovered in 1840, it has received no scientific attention since. With no information available on its distribution or population size, it is currently listed as Data Deficient on the IUCN Red List. Lack of species population data is highly problematic for conservation management. Without the knowledge of how many bullhead sharks there are and what habitats they require, scientists and marine reserve managers are unable to ensure that adequate protection is in place.

Led by Max Hirschfeld, researcher at the Galapagos Science Center on San Cristobal island and James Cook University in Australia, this project takes an innovative approach, combining research cruises, dive surveys and citizen science to answer the following key questions:

- How many bullhead sharks exist in the Galapagos Marine Reserve?
- Where are the sharks' breeding and feeding grounds?
- Is the Galapagos population genetically distinct from others on the South American coast?
- What are the current threats that these sharks are facing and how can we protect them?

By involving tourists and the local community in collecting data, this project is a great example of a holistic approach to conservation and is one that could be replicated with other scientific projects on the Islands.

The project is already well underway with the first research cruise taking place last October. The researchers found bullheads of different size and sex around the Archipelago, and the data are currently being analysed to look at patterns in the presence of the sharks and in environmental conditions such as ocean temperature.

Next, the team will set up a photo-identification website, which will allow anyone to submit their bullhead shark images, thus contributing data to the project. This will enable both locals and tourists to get involved with the research and engage in scientific discoveries.


© Nataly Guevara

GALAPAGOS SHARK DAY

At the end of November, the first Galapagos Shark Day was held in Puerto Baquerizo Moreno, San Cristobal to share the findings of the project with the community and raise awareness about shark conservation. Over 60 children and their families attended and joined in with a number of shark-themed games and activities. Some of the materials prepared will be featured on GCT's Discovering Galapagos website.


© Max Hirschfeld


© Michael Dvorak

MANGROVE FINCH PROJECT

The arrival of El Niño in Galapagos has resulted in a late breeding season for the mangrove finches. At the time of going to print, the Mangrove Finch Project team had yet to return from the field where they were collecting eggs from the two tiny patches of mangroves where this species is found (32 hectares in total). However, we have had word from the team that it looks like this will be a very productive year for the head-starting programme. Keep your eyes peeled for an email update with details on how many eggs have been collected, and the number of chicks that successfully fledge.

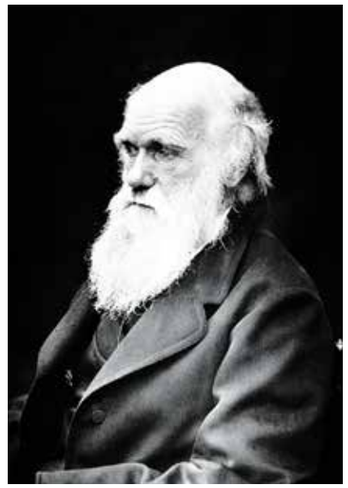
Thanks to GCT supporters, we are supporting the Mangrove Finch Project as the major funder for the second year running. The project team, led by Francesca Cunninghame of the Charles Darwin Foundation, comprises Galapagos National Park rangers, experts in endangered species recovery from the Durrell Wildlife Conservation Trust, captive-rearing specialists from San Diego Zoo Global and other international experts. In the first two years, the team succeeded in raising and releasing a total of 23 finches – a major boost to a population that was thought to be as low as 60 – 80 individuals before this project began.

In September, we supported a workshop in Galapagos to produce an updated five-year conservation action plan for this critically endangered species. Among the recommendations, it was suggested that the head-starting project should continue for another two years (i.e. the 2016 and 2017 seasons). The team hopes that in this time we will be able to find out if the first released fledglings have started to breed.

'Head-starting' is a technique in which mangrove finch eggs are collected from wild nests early in the breeding season. They are taken to a captive-rearing room at the Charles Darwin Research Station on Santa Cruz, where the chicks are reared under quarantine conditions. Once independent, they are taken back to Isabela and spend four to six weeks in pre-release aviaries within the mangrove forest where they are able to adapt to their natural surroundings before being released. The fledglings are then radio tracked for a further month to monitor their initial post release.

Acknowledgements:
The Mangrove Finch Project is a bi-institutional project carried out by the Charles Darwin Foundation and Galapagos National Park in collaboration with San Diego Zoo Global and Durrell Wildlife Conservation Trust. The project is supported by the Galapagos Conservation Trust, the Mohamed bin Zayed Species Conservation Fund, Durrell Wildlife Conservation Trust, the Leona M and Harry B Helmsley Charitable Trust, Swiss Friends of Galapagos, Galapagos Conservancy, and the British Embassy in Ecuador.

DISCOVERING GALAPAGOS IS EVOLVING!



GCT's education programme Discovering Galapagos is going from strength to strength. Since the launch of the two teaching resource websites in September 2014, we have had over 40,000 unique users visit the English and Spanish sites. About 200 lesson plans and associated activities are downloaded every month in the UK and the requests for school visits and Skype lessons are increasing every month. In Galapagos we are working with local partners to maximise the impact of conservation education in the Islands both through the formal school system and informal education offered by community groups and local organisations.

The most recent addition to the resources will be a dedicated Evolution module featuring materials on the life of Charles Darwin, the Voyage of the *Beagle* and the scientists at work today in Galapagos that were inspired by the great man himself. An understanding of evolution is crucial to understanding the natural world and underpins the connection between humankind and Planet Earth. Its principles are hugely relevant to many areas of science but also to sustainable development and sociology and we feel that this section will be a great asset to the existing resource of Discovering Galapagos.

From finding out where Darwin collected his samples in Galapagos to meeting the motley crew of HMS *Beagle*, be sure to visit the site to discover more (**discoveringgalapagos.org.uk**).

We would love to hear what you think. Please send us your comments and questions to **projects@gct.org**.

THE GOLD RUSH AND THE TORTOISE

Below: Archeologists busy excavating Thompson's Cove in 2011.

Far Right: Whalers collecting sea turtles in the early 1800s, just as Gold Rush entrepreneurs harvested giant tortoises from Galapagos en route to California.

Bottom Right: Gold diggers in the Sierra Nevada, the site that sparked the Gold Rush in 1848.

Right: The Galapagos tortoise humerus excavated from Thompson's Cove.

Below Right: An advert in the Daily *Alta California* from 11 March 1851 for Galapagos tortoises imported into San Francisco.

© Cyler Conrad


© National Library of Australia

by **Cyler Conrad**

Three metres beneath the streets of downtown San Francisco lie the remains of a small inlet called Thompson's Cove, a thriving trading port that had its heyday in the middle of the 19th century during the California Gold Rush (1848-1855).

In 2011, I worked on the archeological analysis of this site. It was one of the first well-controlled and properly dated investigations of life in the early days of San Francisco. We uncovered thousands of objects – ceramic and glass bottles, part of a ship's mast and anchor chain, bricks and much more – but one of the most puzzling items was the forelimb of a Galapagos giant tortoise.

This bone was found in a cluster with several others, but it was strikingly distinct. At first, I thought it had to be from a sea mammal, perhaps a harbour seal. It was only after talking to a colleague specialising in Galapagos tortoise anatomy that I came up with a match. I began to research how and why a giant tortoise could have ended up in a major city, thousands of miles from its native home, more than 150 years ago.

The answer, I believe, is gold. In 1848, the discovery of this precious metal at Sutter's Mill in the nearby Sierra Nevada marked the beginning of the California Gold Rush. The news spread quickly. Between 1848 and 1849 alone over 20,000 people from all around the world travelled to the region. But with the transcontinental railroad yet to be built, many of the gold-seekers came by sea. Thompson's Cove and neighbouring coastal settlements became flooded with prospectors, new arrivals spilling into the vibrant and turbulent streets of San Francisco, drinking, gambling, shooting and shouting. This was the American Wild West.

Ships reached San Francisco from all round the world. The most popular passage from the Atlantic was round the tip of South America. Just like the whalers in the first half of the 19th century, the travellers needed fresh food for their long maritime journeys and passed Galapagos on their voyage north. In the days before refrigeration, the hardy nature of a living Galapagos tortoise proved indispensable.


© Kale Bruner and Archeo-Tec

© California Digital Newspaper Collection


© Bancroft Library, University of California, Berkeley

It soon became common practice for these vessels to stop in Galapagos and collect tortoises, colloquially referred to as 'terrapin'. It is not known how many thousands of tortoises were transported to northern California to feed the burgeoning human population, but accounts of more than 500 animals in a single vessel indicate the extent of this activity. According to an eyewitness on board the *Canton*, which passed through Galapagos in 1849, if passengers and crew were unable to take tortoises near the shore they were prepared to venture far inland. The *Canton* left Galapagos with a total of 60 large reptiles, a mixture of tortoises and sea turtles.

Once in California, the prospectors were able to sell the live animals for enormous sums. One man by the name of Franklin Mead reached San Francisco in 1849 and quickly sold 17 Galapagos tortoises for a fortune, roughly $50,000 adjusting for inflation. Marine turtle racing became a popular pastime, with turtles being released from fenced enclosures behind restaurants onto the streets, providing the population with entertainment and followed by a hearty meal. The insatiable demand drew these reptiles into cities closer to the gold fields and, for a time, Galapagos tortoises could be seen grazing along the banks of the Sacramento River while they were slowly consumed in Sacramento's saloons.

It was not until the California Academy of Sciences expedition to Galapagos in 1905 that the world began to realize the substantial impact of human activity on all aspects of life in the Islands and especially on the tortoises. It is now clear that the argonauts exploited giant tortoises as much as, if not more, than the whalers had done before them. Whilst whalers collected tortoises solely for their own consumption, commerce took the Gold Rush exploitation to a new extreme. It is only with future research that we will begin to understand just how abundant and damaging this process was to Galapagos during the mid-to-late nineteenth century.

> Turtle racing became a popular pastime

> The long-term goal is to restore the ecological integrity of Floreana and Pinta

TORTOISE RESURRECTION

by **Washington Tapia**

The Lonesome George-like tortoise on the slopes of Wolf Volcano.

Top Right: The helicopter airlifts giant tortoises onto the waiting *Sierra Negra*.

Bottom Right: Tortoises arriving at the Fausto Llerena Tortoise Center on Santa Cruz.

I was ascending the craggy, rugged slopes of the volcano, alongside a canyon. In the distance, I could see the distinct shape of a tortoise neck at full stretch. It had to be a saddleback, but it was not just any saddleback. As I got closer, I realised I had come face to face with Lonesome George's twin. It was 24 November last year, my birthday. I could not have wished for a better present.

Several days earlier, the Galapagos National Park vessel, the *Sierra Negra*, had dropped anchor off the northeast coast of Isabela. We were there to search for giant tortoises on Wolf Volcano, the highest in Galapagos, its capricious topography made more unpredictable by several days of intense rain.

Thanks to genetic analyses carried out by researchers at Yale University over the last two decades, we knew that Wolf is home to many hybrid tortoises, some with genes of the long-lost tortoises of Floreana and others with genes of the Pinta lineage, a species that went extinct with the death of Lonesome George in 2012. These revelations gave us hope. The expedition's goal was to search for, locate and remove as many of these hybrid animals as possible, bringing them into captivity to participate in a carefully planned breeding programme.

The *Sierra Negra's* onboard helicopter began to transport expedition gear, food and water onto the volcano and small field teams of rangers and scientists set off on foot, each group heading for one of ten different sites covering a combined area of over 70 km². The next morning, at 5.30am, each team began its daily routine, crawling out of tents, preparing breakfast and then heading off in search of tortoises.

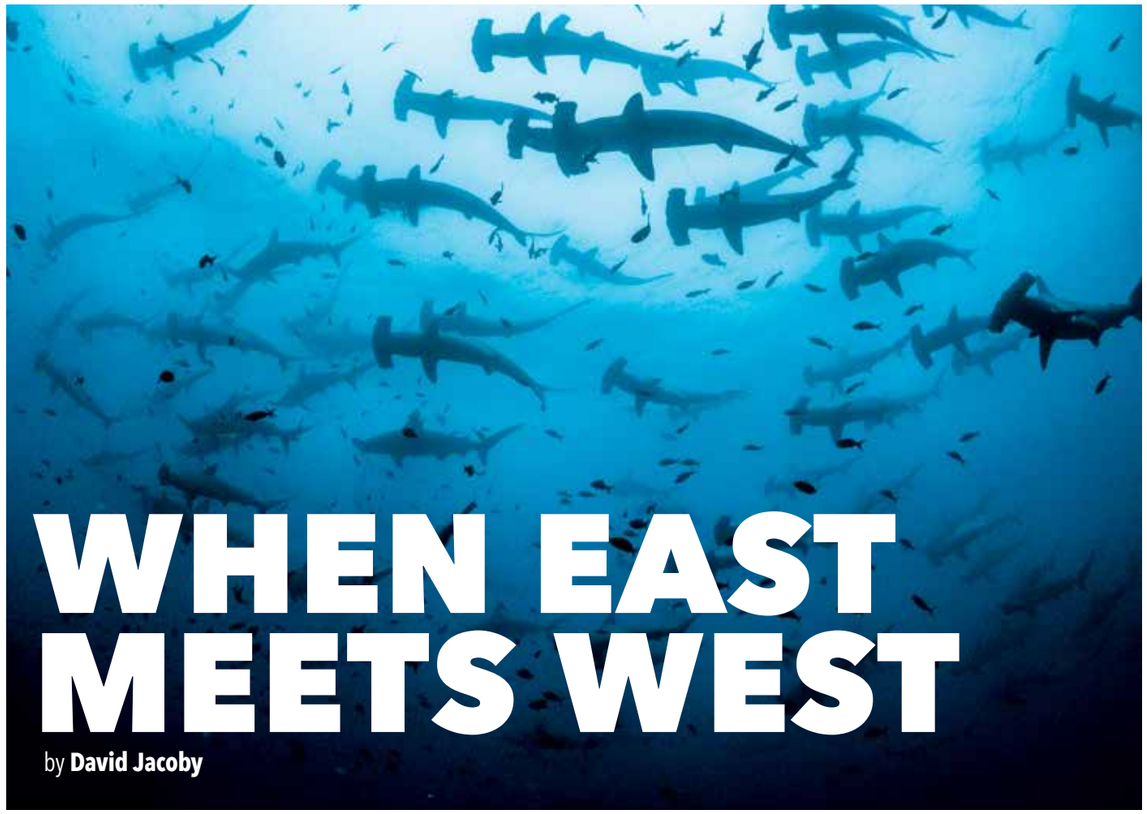
It was almost one week into the expedition that I came across the Lonesome George-like saddleback. As I took measurements from him, I became even more excited. His carapace was the same size as George's. It was a great moment that provided an injection of encouragement to push on and find still more hybrids.

At 3pm every day, each team would radio in to the *Sierra Negra* to report the GPS location

of any tortoises of interest. The helicopter would then travel back and forth, ferrying tortoises from the island to the vessel in a hanging net. By the end of the two week-long expedition, we had recovered 32 hybrid tortoises from Wolf, two with Pinta ancestry, five of Floreana descent and the rest with saddleback shells, a good indication that they may be animals of conservation value.

The *Sierra Negra* shipped all these tortoises to Santa Cruz, where they were airlifted into the Fausto Llerena Tortoise Center near the headquarters of the Galapagos National Park. The geneticists at Yale will run detailed genetic analyses of all these animals, information that will inform the captive breeding. The long-term goal is to restore the ecological integrity of Floreana and Pinta by repopulating these islands with tortoises that carry the same genes as their long-dead ancestors.

Each day, as I review these hybrids as part of the quarantine procedure, I take some moments to contemplate the male twin of Lonesome George. Watching him strengthens my conviction that we are on the right road to recover not only Lonesome George's lineage but the ecosystem of his native island.



© Simon Pierce

WHEN EAST MEETS WEST

by **David Jacoby**

Out of the murky water, the predators appear like a mirage, passing silently overhead, tantalisingly close. A few seconds later and they are gone.

Scalloped hammerhead sharks are an enigma. They are found in oceans all round the world, in the waters of an extraordinary 82 different countries. They are renowned for their large, polarized aggregations. Yet their cautious nature and propensity to frequent remote, offshore islands means that there are very few places where it's possible to observe them with any reliability.

One of these places is in the choppy waters around Mikomoto Island in Japan, which seems to attract large numbers of schooling hammerheads at certain times of year. Even here, however, it takes extraordinary measures to study their behaviour. Since hammerheads have low stress thresholds, catching individuals is out of the question. So we have enlisted the help of professional freediver Mark Healey to attach miniature acoustic transmitters and satellite tags to free-swimming sharks. This is no mean feat.

Researchers in Galapagos are only too familiar with such challenges. Pete Klimley (aka Dr Hammerhead) has been studying scalloped hammerhead sharks in both Galapagos and the Gulf of California since the 1970s. This has helped to reveal social strategies and periodic movements of this species at key locations in the Eastern Pacific Ocean and the vulnerability of aggregations around the Cocos and Galapagos Islands to overexploitation. In 2007, the scalloped hammerhead was classified as Endangered on the IUCN's Red List of Threatened Species and in 2014 it became the first shark to be protected under the US Endangered Species Act.

Some 13,500 km to the west of Galapagos, the hammerheads around Mikomoto Island are equally vulnerable, but there has – as yet – been very little research on them. Indeed, marine conservation is a relatively recent endeavour in Japan despite a strong cultural respect that the Japanese have for the creatures that live in their seas. I am part of a long-term programme to monitor hammerhead sharks in these waters. With the work in the Eastern Pacific acting as an inspiration, we are hoping to reveal the ecology of this species in the Western Pacific and, through an active outreach programme, strengthen the growing appreciation of marine conservation in Japan.

We have installed receivers on the sea floor around Mikomoto to listen for the acoustic pulses being transmitted from the tagged sharks. From these data, it will be possible to infer the temporal, spatial and environmental drivers of aggregation and test some of Klimley's theories developed in the Eastern Pacific some 30 years ago. We will also be able to assess at what times of day and which months these sharks are most vulnerable to overfishing, which will help inform conservation decisions in the region. If there is evidence to suggest Mikomoto is key to the ecology of this population, there would be grounds to propose the island as one of the first marine protected areas in Japanese waters. It is even possible that new insights from the scalloped hammerheads in the Western Pacific could, in turn, inform future research in Galapagos and elsewhere. Indeed, it is hoped that as the programme of research develops in Japan, there will be increasing scope to work collaboratively with researchers in Galapagos to compare the movement and behaviour of scalloped hammerheads at the two locations.

While we wait to retrieve our first year of acoustic data, however, the Japanese scalloped hammerheads remain as enigmatic as ever.

MEMBERSHIP

by **Leah Jones**

SURVEY RESULTS

Thank you to all our members who took part in our 2015 Membership Survey. The results prove what an interesting and diverse group of members we have! We have very much enjoyed reading all your comments, and below are some ways in which we are going to incorporate your feedback into our 2016 activity.

We wanted to know what makes you passionate about Galapagos, and results show that you have an eclectic range of interests, from cutting edge science, to marine conservation. However, the most popular subject by far was the protection of endangered species, so we will endeavour to increase coverage of the vital projects that you support, which are helping to save endangered wildlife.

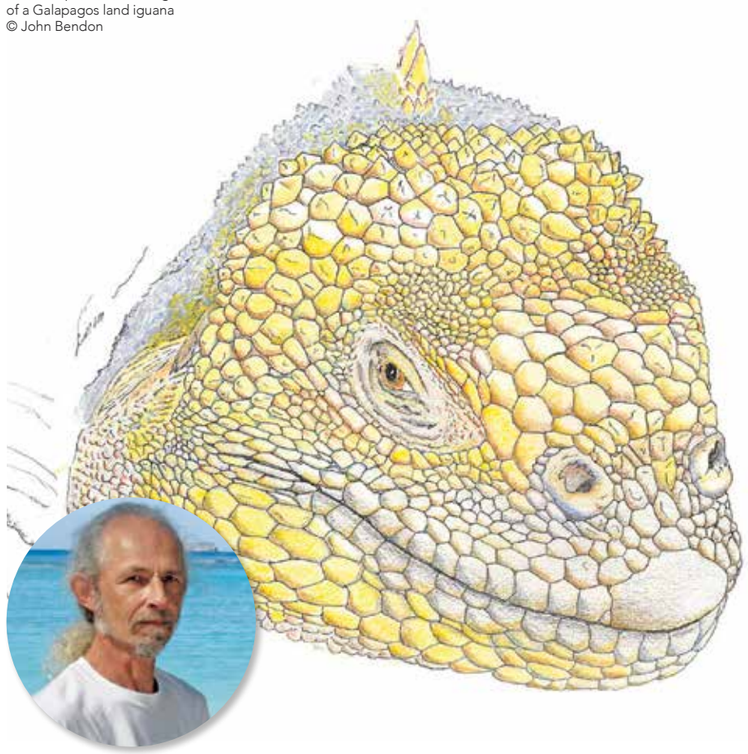
As a result of the survey, we have been examining the format and pricing of GCT supporter events, and we are excited about the upcoming 2016 events programme. We want to create as many opportunities as possible to bring you information about how your support is helping protect Galapagos. We are also keen to spread the message about conservation as widely as possible around the UK. If you or someone you know has a club or school that would like us to give a talk on any Galapagos-related topic, please get in touch. We can also provide images, information and PowerPoint presentations if you would like to give a talk of your own!

Finally, we asked you about a 'members only' section on our website. The majority of you told us that you do not use the internet enough to make use of this facility, but you would like to be able to renew your membership online. We are pleased to say that you can now do this at **www.galapagosconservation.org.uk/membership.**

Renewing via Direct Debit ensures even more of your subscription goes towards projects in the Islands, as it renews automatically on either an annual or monthly basis.

Although the survey is now complete, we would still be delighted to hear your opinions on all things Galapagos, so if you have any stories or questions, please do not hesitate to contact me at **leah@gct.org**.

Below: A previous drawing of a Galapagos land iguana © John Bendon



LEGACY LEAFLET

Thank you to everyone who helped us with the design of our new legacy leaflet. The most popular design was number 3, but we have tried to incorporate as many of your ideas and suggestions as possible.

MEMBER FOCUS

John Bendon is a GCT member from Bath, England. He is an illustrator/author/photographer who has worked with iguanas for over 35 years, on many iguana projects in various locations around the world, including Galapagos. He has been to most of the islands where iguanas are found, and photographed all the different species to make drawings which show the exact scale configuration of each species. In 2014 he decided to concentrate on the marine iguana, focusing on behaviour and morphology and is currently working on a set of drawings depicting each of the different island forms. You can read about more of John's work on the GCT blog **(www.galapagosconservation.org.uk/blog)**.

REVIEWS

LOST HERO

THE INVENTION OF NATURE:

The Adventures of Alexander von Humboldt, the Lost Hero of Science

by Andrea Wulf, John Murray, 2015, £25, ISBN 9781848548985

Reviewed by Phoebe Shaw Stewart

The life-bringing, oceanic current and the charismatic penguin are just two examples amongst a great number of species, geographical features and places named after Alexander von Humboldt. Considered a polymath, Humboldt approached science and exploration with seemingly endless enthusiasm. This book guides the reader through the development of Humboldt's life, from a young Prussian aristocrat brought up by a cold, uncaring mother, to one of the most famous men in Europe whose scientific travels influenced the likes of Simon Bolivar, Charles Darwin and William Wordsworth. *The Invention of Nature* helps to explain the origin of what is now considered obvious, and it is perhaps for this reason that Humboldt is not as famous as those he subsequently inspired. His ideas on nature as an interconnected, global phenomenon are now well accepted, but he was amongst the first to document his explorations in this way. This fantastically written book will engage and educate the reader in equal measures. Excitement and adventure are served up alongside history as Humboldt navigates the Napoleonic wars and the Spanish Royal Family in order to complete his explorations in South America. With later travels across Europe and Russia, this is the perfect inspiration for your next adventure.

DARWINIAN ADVENTURE

GALAPAGOS REGAINED

by James Morrow, St Martin's Press, 2015, £19.99, ISBN 9781250054012

Reviewed by Holly Forsyth

The heroine of this fictional tale is Chloe Bathurst, an unemployed Victorian actress who finds work on Charles Darwin's Down House estate just after his return from the *Beagle* voyage. There, she looks after some of the creatures that author James Morrow imagines he brought back from his trip. When Chloe gets wind of the Great God Contest, sponsored by the Percy Bysshe Shelley Society, she decides that Darwin's ideas on the origin of species might secure him the £10,000 prize money. Chloe begins a wild adventure, involving a voyage by brigantine to Brazil, a steamboat trip up the Amazon and a hot-air balloon flight across the Andes, but it is Galapagos that she is heading for, intent on collecting more live specimens through which she might demonstrate evolutionary theory to the contest judges.

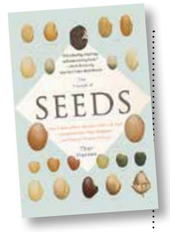
HEED THE SEED

THE TRIUMPH OF SEEDS:

How Grains, Nuts, Kernels, Pulses, & Pips Conquered the Plant Kingdom and Shaped Human History

by Thor Hanson, Basic Books, 2016, £10.99, ISBN 9780465097401

Reviewed by Henry Nicholls



Imbued with an open-eyed, childlike passion for his subject, conservation biologist Thor Hanson celebrates the triumph of seeds. These small, apparently inert objects are, in fact, forever active, containing a "fierce energy" that has had a profound impact on the evolution of other species and on human culture. Hanson is a genial and poetic guide, cleverly weaving together biology and culture into a charming and beautifully illustrated book. He makes several diverting visits to the "Raccoon Shack", a laboratory-cum-study at the end of his garden, germinating a series of avocado stones, dissecting grass seeds and attempting to unpick a cotton boll. Darwin's finches pop up, a radiation driven in large part by variation in the landscape of seeds. Hanson also appreciates the enormous significance that the collection of Galapagos plants had on Darwin's thinking about the distribution and evolution of species.

2016 GALAPAGOS PHOTOGRAPHY COMPETITION

DEADLINE FOR ENTRIES: 12 JUNE 2016

Our 2016 Galapagos photography competition is now open. We invite you to submit your best Galapagos shots into our annual competition to be in with the chance of winning two tickets to Galapagos Day 2016, a year's free membership to GCT and a copy of Henry Nicholls' book "The Galapagos: A Natural History". The winning image will also feature in our 2017 Galapagos calendar.

The five categories for entry are:
· Animal portrait
· Animal behaviour
· Landscape
· Botanical
· Man in the Archipelago

So if you think you have captured the delights of Galapagos in a unique way, then simply visit our website and upload your photographs to be in with a chance of winning.

© Ken Wild

Please note these books are not available to buy from the Galapagos Conservation Trust.

EVENTS

For more information about events and to book your tickets, simply visit galapagosconservation.org.uk/events or call us on 020 7399 7440

GARDEN PARTY

THURSDAY 30 JUNE 2016
14 CLEVELAND ROW, WESTMINSTER

Join us for a summer's evening in the garden of one of London's most stunning private residences, Bridgewater House. Over drinks and canapes you'll have the chance to catch up with old friends, whilst finding out the latest news from the conservation projects you are supporting in Galapagos. Tickets are priced at £30 each which includes drinks and canapés.

© Jennifer Bracegirdle

GALAPAGOS DAY

WEDNESDAY 22 SEPTEMBER 2016
REGENT'S UNIVERSITY

Save the date! This year Galapagos Day will be held at a new venue: Regent's University, in Regent's Park. We have taken on board the feedback you gave after Galapagos Day 2015, and we hope to make this year's event better than ever. Further details, including the announcement of guest speakers to follow soon.

© Bex Heaton

GALAPAGOS GIFTS

Purchasing one of our Galapagos gifts is a fantastic way to help support GCT. Not only do the profits go directly towards supporting conservation in the Islands, but you can also help share our important messages with friends and family worldwide.

Mary Ellen was trained and licensed as a naturalist guide by the Galapagos National Park and Charles Darwin Research Station from 1982-87.

In 2008, Mary Ellen returned to the Galapagos Islands to paint a commemorative series for Charles Darwin's 200th anniversary of habitat relating to the six most endangered birds in the Galapagos - a small step in giving something back to such a special place in her life.

Working closely with GCT, Mary Ellen raises awareness in the public eye for this critical situation and donates a percentage of her artwork and notelet sales to support Galapagos projects funded by GCT.

Mary Ellen Taylor
Contemporary Botanical & Nature Art

Galapagos Endangered Bird Notelets *Set of 6 cards and envelopes. £10 inc. P&P*

A beautiful set of cards featuring 6 of the most endangered Galapagos birds and their habitats. Cards measure 12x12cm.

Galapagos Wildlife Giclee Prints £79

These stunning prints feature Galapagos' most enigmatic species. Each print is mounted and cellophane wrapped, and measures 41 by 31cm. Choose from:

- Galapagos Giant Tortoise
- Floreana Mockingbird
- Galapagos Petrel
- Mangrove Finch
- Land Iguana
- Waved Albatross
- Flightless Cormorant
- Galapagos Penguin

If you are interested in purchasing a print, please contact the GCT office on **gct@gct.org** or via telephone on 020 7399 7440.

CONTACT DETAILS

Please fill in your details below:

Name: .....
Address: .....
.....
.....
Post code: .....
Telephone: .....
Email: .....

METHOD OF PAYMENT

Please tick one:

☐ Cheque (payable to Galapagos Conservation Trust)
☐ Credit card ☐ Debit card ☐ CAF voucher ☐ CAF card

NB: We do not accept American Express.

Name on card: .....
Card no: .....
Expiry date: .....
Issue no / Start date: .....
Security code: .....

giftaid it

☐ Yes! I am a tax payer. Please reclaim tax on all my donations and subscriptions made in the past four years and all future donations.

☐ No, I am not a taxpayer.

Date: .....

GCT ANNUAL RAFFLE

Win the trip of a lifetime for just £1.

Enter the annual GCT raffle and be in with a chance of winning a cabin for two on a five-day cruise of Galapagos and £1,000 each towards flights. The cruise will be hosted by Metropolitan Touring, in association with Mundy Adventures, on board the *Santa Cruz II* yacht. By entering, not only could you win a cruise, but you will also be helping to support vital conservation work in the Galapagos Islands.

Enter using the payment form overleaf. You can pay for tickets by cheque, credit/debit card or online at www.galapagosconservation.org.uk/raffle. Cheques should be payable to 'Galapagos Conservation Trust'. The winner will be notified by email or telephone, and announced at Galapagos Day on 22 September 2016.

The Galapagos Conservation Trust is registered with the Gambling Commission for Great Britain and encourages people to gamble responsibly. Licence No: 000-004768-N-316490-003. Registered Charity No: 1043470. Tickets are not to be sold to or by any person under the age of 16. Maximum 50 tickets per person. Promoter: Sharon Johnson, Charles Darwin Suite, 28 Portland Place, London, W1B 1LY. Tickets are non-refundable. Please gamble responsibly.

Closing date: 17 September 2016.

If you would like to sell raffle tickets for the GCT cruise within your local community or social groups, please get in touch on 020 7399 7440.

PAYMENT FORM

There are several easy ways to place an order or donate in support of our work.

1. Via our website **galapagosconservation.org.uk**
2. By telephone on **020 7399 7440**
3. By completing the details on this form and returning with your preferred payment method to:
   Galapagos Conservation Trust,
   Charles Darwin Suite,
   28 Portland Place, London, W1B 1LY

Safeguarding Through The Storm	Total Price £
Make a donation to our El Niño appeal	
I would like to give: £30 / £60 / £100 / £300 / Other (please circle) to help protect species threatened by El Niño.	

Raffle Tickets	Price £	Qty	Total
Maximum per person: 50 tickets	1		

Gifts	Price £	Qty	Total Price £
Galapagos Endangered Bird Notelets by Mary Ellen Taylor	10		
Limited Edition Galapagos Penguin Adoption	30		
Name and email address of adoption recipient:			
I enclose a donation*			
TOTAL			

Postage and packaging is included in the price. For delivery overseas, please contact the GCT office on 020 7399 7440, or order via our online shop.

*All donations will go towards supporting conservation in Galapagos.

DIVE CRUISE

28 August - 5 September 2016

© Jonathan Green

This summer you could be diving the Galapagos Islands with professional photographer and whale shark scientist Jonathan Green. Developed in partnership with Dive Worldwide, this unique cruise gives you the opportunity to visit one of foremost diving destinations in the world, and in peak whale shark season. For more information contact Dive Worldwide on 01962 302 087 or email **reservations@diveworldwide.com**