GALAPAGOS MATTERS

AUTUMN | WINTER 2013

The importance of
mangroves

Marine invasive species

The whale shark enigma

Galapagos Conservation Trust

savegalapagos.org

GALAPAGOS MATTERS
CONTENTS

Cover Image
A scalloped hammerhead shark swims in open water around Darwin Island.

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Galapagos Conservation Trust

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FROM THE
CHIEF EXECUTIVE

by Ian Dunn

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WELCOME TO THE AUTUMN/WINTER EDITION OF GALAPAGOS MATTERS

Thank you for the overwhelmingly supportive comments made about the content and style of the new-look magazine, and for suggesting further improvements. We have tried to incorporate these where possible and trust you will also enjoy this edition with its marine focus.

Since the last issue, there has been a range of activities with regards to our work in Galapagos, possible due to your support. One of the most frequent comments made by those who travel to the Islands is that there is considerable scope for improvement in the visit to the tortoise-breeding centre and the Charles Darwin Research Station on Santa Cruz. There is real progress on both fronts. I was invited to participate in a highly professional workshop run by the Galapagos National Park on improvement of the visitor experience at these sites. The Ecuadorian government has now put up funds that should improve the tortoise-breeding facilities. With GCT funding and support, the redesign of the Research Station's visitor centre and shop is also under way. I am sure that those following in our footsteps will have a noticeably improved experience. Additionally since the last magazine and as a consequence of a successful songbirds appeal we have been able to supply funding for an on-going study into *Philornis downsi,* the botfly causing enormous damage to land-birds. We have also given support to a long-running programme to monitor the populations of penguins and cormorants which you can read about on **page 15**.

Although perhaps the most iconic memories of visitors are from experiences on land, the Galapagos Marine Reserve covers over 138,000 km^2, more than half the size of the United Kingdom. Without the strong, nutrient-rich currents, the attendant biodiversity and a coastline greater than that of mainland Ecuador, Galapagos would be a very different place indeed. Yet so little is known about so much of the marine reserve, not just the phytoplankton and microorganisms, but also some of the largest animals on the planet. The whale shark (*Rhincodon typus*), the focus of our summer appeal, **(page 11)** is a case in point. The largest of all fish on Earth, we risk endangering them before understanding little more than a fraction of their life story. Read our whale shark feature starting on **page 8** for more details. Our November Galapagos Marine Symposium will also be centred on the Marine Reserve and have talks by leading experts **(page 12)**.

In June we felt highly privileged to be joined by Sir David Attenborough in celebration of the Three Dimensions of Galapagos and I am sure those of you who were able to join us will hold fond memories for a long time to come. In August we ran a highly engaging event with the Zoological Society of London in support of the Galapagos Tortoise Movement Ecology Programme and on **pages 14-17** you can read more about this and the other projects supported by your funds.

Please do take time to look at our merchandise page **(page 23)** and particularly at our new-look calendar for 2014. Featuring stunning photography as well as information on our conservation priorities, this would be great as a gift or hung on any wall. Profit from our sales goes to support projects in any of the three fields of science, education and culture and remember you can make a donation at any time to further support our efforts. I would like to extend a warm welcome to Leah Meads who has joined as Membership Officer and Pete Haskell who has joined as Communications Officer. Do enjoy this edition and, as ever, please do feel free to provide feedback on this or any other aspect of our work. I really do appreciate all inputs.

Finally, you will find enclosed some raffle tickets with the superb first prize of a Galapagos cruise. Please endeavour to sell as many as possible on our behalf, either these paper tickets or online. It is a couple of years since we have held a raffle and I was initially reluctant to ask our members to support us in this task, but raffle income is critical to support the running costs of the Trust enabling more of our fundraising efforts to be focused on the conservation work we all aspire to. ■

WILD GALAPAGOS

Former executive director of the Charles Darwin Foundation Graham Watkins photographed this longnose hawkfish *Oxycirrhites typus* off Cousin's Island, a popular dive site just off the northeast coast of Santiago. From its hideout amongst the fronds of a colonial hydroid, this small but stunning fish keeps a watchful eye for small crustaceans on which to feed. Reprinted from Galapagos: **Both Sides of the Coin** (2009) by Pete Oxford and Graham Watkins, courtesy of Charlesbridge Publishing, Massachusetts.

GALAPAGOS NEWS

© FRANCESCA CUNNINGHAME, CDF

We owe much to our predecessors who had the foresight to preserve this unique species in captivity in anticipation of conservation tool innovations like these.

Bill Waldman | Island Conservation

TORTOISE RECOVERY

GIANT TORTOISES are reproducing on Pinzon for the first time in over a century, a direct consequence of a recent campaign to eradicate invasive black rats from the island.

It's likely that rats have been present on Pinzon since the 18th century. In 1965, when conservationists first took stock of the island's unique species of giant tortoise (*Chelonoidis ephippium*), they found a population of aging adults. With non-native rats feeding on eggs and hatchlings and no young tortoises surviving, conservationists came up with a temporary solution: they began removing eggs before the rats got to them, hatching the tortoises in captivity and – when old enough to withstand rats – returning them to Pinzon.

But following a bold restoration initiative last year, the Pinzon population might now be able to recover without further intervention. In December 2012, the Galapagos National Park (in collaboration with Island Conservation, the Charles Darwin Foundation and several other partners) distributed rodenticide on Pinzon and several smaller islands. The survival of tortoise hatchlings on Pinzon is a strong indication that this has been successful.

"This is a dream come true for conservationists around the world," said Bill Waldman, chief executive officer of Island Conservation, an international charity that specializes in the eradication of invasive species from islands. "We owe much to our predecessors who had the foresight to preserve this unique species in captivity in anticipation of conservation tool innovations like these."

Eradication of invasive rodents is now planned for the much larger island of Floreana in 2015. ■

LEGAL REFORM

Ecuador's National Assembly is currently debating a revision to the law that governs Galapagos that should see significant, constructive changes to the human face of the archipelago. The Special Law for the Galapagos, which came into force in 1998 was a landmark piece of legislation, an explicit acknowledgement that the special nature of Galapagos required a special rule of law. Yet a revision has been long overdue. Of the many proposed amendments, the most significant involve a new institutional framework for the province with more power to the governing council, tougher rules on migration and a new fee structure for entry to the Galapagos National Park. ■

SOLAR TAXI

An illegal fishing vessel impounded by the Galapagos National Park in 2011 has been transformed into the archipelago's first solar-powered taxi. There are over 20 water taxis that ferry tourists and residents to and from Puerto Ayora. The new taxi, refitted under the guidance of the World Wide Fund for Nature (WWF) in Galapagos, has been named Solaris after the 24-arm endemic marine sea star *Heliaster solaris*, which has not been seen in Galapagos for more than 30 years. "This venture can help pave the way for sustainable development of commercial activities whilst promoting ecotourism in Galapagos under a clear reduction of the fossil fuel footprint in the islands," says Veronica Toral Granda, programme officer for the WWF in Galapagos, which helped convert the fishing vessel. ■

NIGHT VISION

© MAX PLANCK INSTITUTE FOR ORNITHOLOGY

Swallow-tailed gulls hunt most often under a new moon, according to a new study. The researchers fitted gulls with data loggers and water sensors, enabling them to record when the birds were at sea. This revealed that gulls are influenced by the lunar cycle, concentrating their foraging efforts to coincide with the new moon when the abundance of prey species at the surface is at its greatest. "With a diving depth of no more than one metre, the prey is quickly beyond their reach on nights with a full moon," says Martin Wikelski of the Max Planck Institute for Ornithology in Germany. The swallow-tailed gull is noted for having particularly large eyes, an adaptation that helps it to detect its prey in low-light conditions. ■

LONESOME GEORGE STAMP

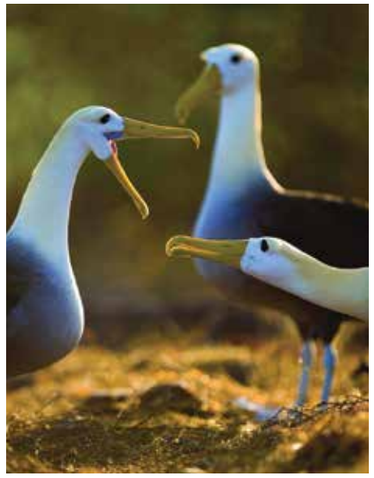
The Ecuadorian postal service has issued a Lonesome George stamp to mark the anniversary of the death of the famous Pinta tortoise on 24 June 2012. In March this year, the Galapagos National Park sent George's body to the American Museum of Natural History in New York, where expert taxidermists are preserving his body before returning it to Galapagos. ■

NEW DIRECTOR

Ecuador's Ministry of Environment has named Arturo Izurieta as the new director of the Galapagos National Park. He replaces the biologist Edwin Naula, who has been in office for the last three years. This will be Izurieta's second term in this post. He was director of the GNP between 1991 and 1995. ■

ALBATROSS COLONY

A new colony of waved albatross has been recorded in the centre of Espanola, according to the Galapagos National Park. The discovery was made during a routine survey of the island to monitor its recovery following the eradiation of goats some 40 years ago. Elsewhere, researchers have used the *Galapagos albatross* to test out a new tracking system that combines GPS and environmental data. "This is a powerful tool for understanding how weather and land forms affect migration patterns," says Roland Kays of North Carolina State University. This revealed that the waved albatross takes advantage of tailwinds by flying a clockwise journey from Galapagos to feeding grounds on the Peruvian coast and back again. ■



© MICHAEL LAMBIE

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SEA LION STRESS

The presence of humans in Galapagos may be placing a significant burden on sea lions, according to a new study. On San Cristobal, where there is a significant human population, the sea lions were thinner and had more active immune systems than on the uninhabited island of Santa Fe, report scientists from the Zoological Society of London. This may be because of infectious diseases introduced by household pets or through increased levels of sewage exposing sea lions to microorganisms. ■

© JONATHAN GREEN

SHARK LEGISLATION

The European Parliament has voted overwhelmingly in favour of an amendment to legislation regarding shark finning, closing a loophole some member states were exploiting to continue the practice. As of November last year, European fishermen must leave fins attached to all sharks brought to port. "The EU legislation is a major step in the right direction with regard to managing the take of sharks from the oceans," says Ian Dunn, chief executive of GCT. "It is, however, not yet enough and continued concerted action is required across the globe, including in key shark regions like Galapagos, to ensure we can assign shark finning to history," he says. ■

© JONATHAN R. GREEN

THE GREAT GALAPAGOS WHALE SHARK MYSTERY

by Jonathan R. Green

AN ENCOUNTER with a whale shark is something one never forgets. Even now, after more than two decades diving in Galapagos, every brush with a whale shark is an incomparable thrill. In fact, the more I have got to see of this species in Galapagos, the more captivated I have become.

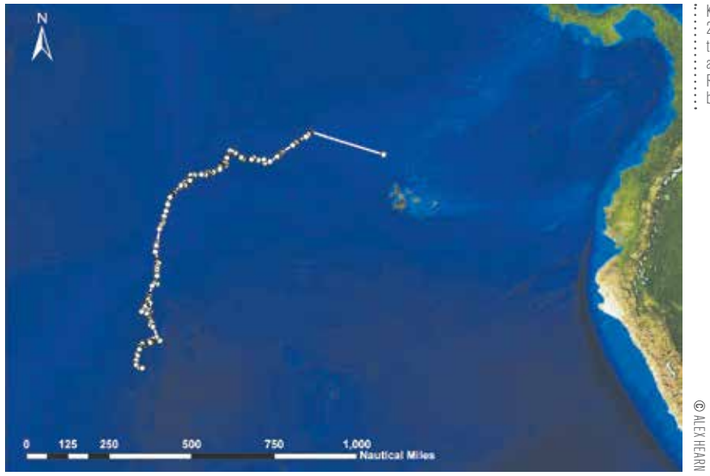
There are two observations that are particularly fascinating: almost all sightings are made in the far north of the archipelago, just off the tiny island of Darwin with its renowned dive site "The Arch"; and over 99% of all sharks that are spotted are adult females, a statistic that sets Galapagos apart from any of the other dozen-or-so whale shark aggregations around the world where sightings of males and juveniles are a common occurrence. What is going on?

The Galapagos Whale Shark Project, a collaboration involving scientists from the Galapagos National Park, the Charles Darwin Foundation and the University of California Davis, is beginning to find some answers. In 2011, with funding from the Rapier Family Foundation, we began one of the most ambitious tagging projects ever attempted for this species, obtaining unprecedented data on the sharks that visit The Arch during the cool season between May and December.

In our first year, we succeeded in tagging more than 20 animals, most of which were adult females in an advanced state of pregnancy. When they left the waters around Darwin, they travelled some 100 km north along a series of sea mounts and fissures until they reached the Galapagos Rift, the east-west cleft between the Cocos Plate to the north and the Nazca Plate to the south. At which point, the satellite signals showed that most of the whale sharks did something extraordinary. They turned west along the Rift and began to swim towards its junction with the East Pacific Rise. At this point, one of only two juveniles in the cohort – a young female we named Kymberly – turned due south and followed a sequence of fissures for over 2000 km before her tag became detached and we lost her signal. The tags deployed in our second year yielded similar results: when the sharks reached the Galapagos Rift, most of them made a sharp 90° turn, just as a motorist might at a T-junction.

These are still early days, but it's looking increasingly clear that whale sharks are navigating by way of features on the ocean floor, sensing the magnetic "signature" of fault lines, ocean trenches and seamounts that lie thousands of metres beneath them.

Such features cross the oceans, quite literally, and it is possible that whale sharks use them to travel vast distances. This is supported by the preliminary analysis of DNA carried out by geneticists at the University of Illinois in Chicago, which found no significant difference between the genetic architecture of the whale sharks we tagged in Galapagos and those elsewhere in the world. This strongly suggests that genetic material is flowing freely between oceans and that whale sharks must be globetrotters.

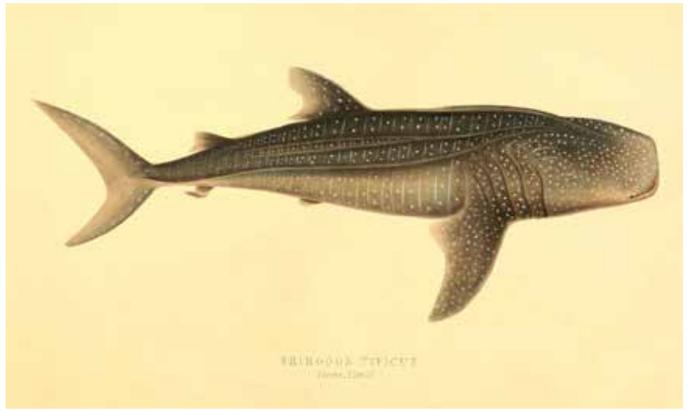


© ALEX HEARN

Kymberly, a whale shark tagged in 2011, travelled north from Darwin, turned west at the Galapagos Rift and then south at the East Pacific Rise. She swam a further 2000 km before she lost her tag.

Continued on page 10 ▶

SCIENTIFIC NAME:	*Rhincodon typus*
FIRST DESCRIBED:	By Scottish zoologist Andrew Smith in 1828
CLAIM TO FAME:	The world's largest fish
LENGTH:	Up to 18 metres
BODY MASS:	Can be over 30 tonnes.



Right: An early engraving of the whale shark that appeared in *Illustrations of the Zoology of South Africa* by Andrew Smith, the Scottish zoologist who first described the species from a specimen harpooned in Table Bay, South Africa in 1828.

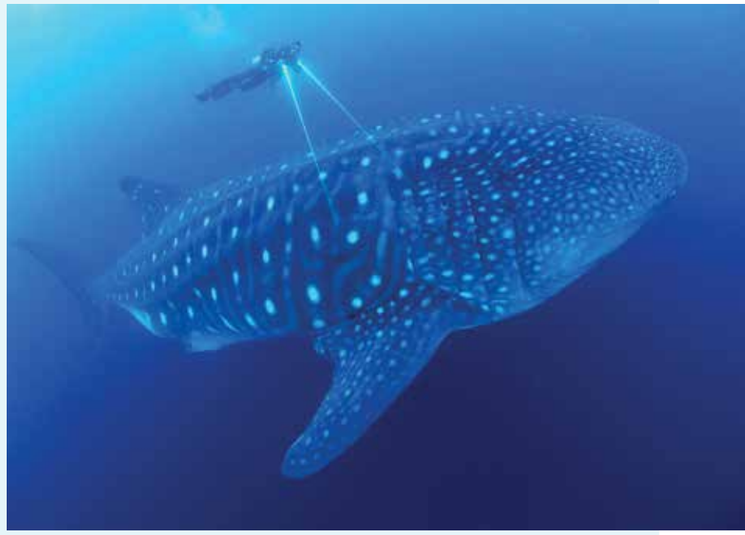
Below: Darwin's Arch in the northwest of the archipelago is the best place to go whale shark watching. © Tom Gruber.

In spite of these insights, we still do not know the reason why they appear to be so fond of The Arch. Our satellite tracking data provide conclusive evidence that sharks come to the area early in the season, travel away and then return later the same season. Could they be feeding? As the plankton in this area is relatively scarce and we almost always see sharks with their mouths clamped shut, this seems unlikely. How about mating? The apparent absence of adult males suggests not, unless they are hiding out of sight in deeper waters nearby. What about the possibility that the waters around The Arch act as the elusive birthing grounds of this species? This would certainly account for the abundance of pregnant females but it would not explain why there are so few juveniles.

It may be many months or, more likely, years until we have answers to these and other questions that have emerged from our work. Next year, we will dive again in an effort to fathom the mysteries that surround this fascinating, awe-inspiring species. Much remains to be done. In order to build up the bigger picture, we need to cast the net wider and tag the sharks that frequent the coastal areas off the Peru and Chile to find out where they go when they leave these waters. Even then, if we really want to understand the whale shark, perhaps the only option is to climb into a submersible, follow them as they dive and enter their world. ■

MULTIPLE METHODS

THE GALAPAGOS WHALE SHARK PROJECT is using several different approaches to collect data on individuals in the archipelago. In order to record movements, it is necessary to fix a tracking device to the shark. These can come in several different forms: one tag allows the shark to be tracked in real time (provided it is not too deep); another is designed to record variables like the depth and temperature of the water before detaching from the shark, floating to the surface and being recovered; a third tag – the gold standard – combines the properties of both these tags. We are also using a software programme, initially developed by NASA for the mapping of constellations, to discriminate between whale sharks based on unique differences in their characteristic white markings. An even more recent development is the use of lasers to estimate the length of a fish with unprecedented accuracy. Finally, we have been taking a small tissue sample for DNA analysis. This can give us an indication of how closely related individuals are, both within a population and between populations from different oceans, specifically to what degree are they meeting, mixing and mating. This, in turn, could indicate possible mating and birthing areas that may inform the conservation strategy for this species and the long-term planning of marine protected areas. ■



Above: A researcher projects lasers onto the body of a whale shark, a technique that allows accurate measurement of each individual. If the animal is recaptured, it is then possible to determine its rate of growth. © Jonathan R. Green.

THE GLOBAL STATUS OF WHALE SHARKS

by Dr Simon Pierce

WHALE SHARKS are a globally distributed species, ranging from Canada in the north to New Zealand in the south. Before 1986, only 320 sightings had been confirmed globally and while much has been learnt since then, many aspects of their biology and ecology remain a mystery.

In certain areas throughout the tropics and subtropics, aggregations of whale sharks are known to occur, coming together to feed on zooplankton or small fishes. Ongoing discovery of these feeding areas, along with the realisation that each individual shark can be photo-identified by their unique spot pattern, has given scientists an insight into their numbers and movement patterns for the first time (see **whaleshark.org**). But although there are over 4000 whale sharks on the global database, only a handful of individuals have been sighted in more than one country and their migration patterns are still largely unknown.

Certain characteristics, such as slow growth rate and late maturation age, make the whale shark particularly susceptible to overfishing and they are currently considered "Vulnerable" to extinction. With their population in decline, getting answers to some of the fundamental questions is essential if we are to conserve this species. ■

GALAPAGOS WHALE SHARK APPEAL 2013

GCT IS COMMITTED TO HELPING protect the whale shark, which is why we have dedicated our summer appeal to raising funds for the Galapagos Whale Shark Project. We need your help in supporting critical research on these threatened sharks in Galapagos. Every penny makes a difference, so if you haven't donated already and wish to be a part of the conservation action, please visit our appeal website: **whalesharkappeal.co.uk** or contact the GCT office on **020 7399 7440**. ■

Left: Beautiful but deadly. Since around 2000, the red lionfish's presence in the eastern Atlantic and Caribbean has been growing rapidly, with devastating consequences for native reef fish. © Abel Valdiva.

Middle: Underwater clipboards. The survey team gets to work recording species along a 50m transect on the ocean floor. © Ken Collins.

Right: An unwanted visitor. The seaweed *Caulerpa racemosa* is an aggressive, highly invasive species that threatens to smother seagrass meadows and out-compete native algae. © David Acuña.

HIDDEN INVADERS

by Inti Keith

3…2…1…Splash! I enter the crystal-clear water and descend past a school of yellow-tailed surgeonfish, a pair of king angelfish, a parrotfish. A juvenile sea turtle swims past. I can make out a couple of white-tip reef sharks resting on the bottom. It's 6am and time to work.

I began diving in the Galapagos Marine Reserve 11 years ago. I can still clearly remember my first encounter with a school of hammerheads, the first time a playful sea lion imitated my movements and my admiration of the colourful reef fish swimming amongst the rocks. It's experiences like these that underscore the special nature of the marine realm in Galapagos and the importance of an international, collaborative project to protect it from invasive species.

In 1997, the Charles Darwin Foundation (CDF) began extensive monitoring of the Galapagos Marine Reserve. Amongst much else, these surveys have revealed the presence of a number of marine invasive species, most likely introduced to the islands along with the increasing boat traffic between mainland Ecuador and the archipelago. Since April 2012, the UK government's Darwin Initiative has been funding a project (run jointly by CDF and the University of Southampton and in collaboration with several other Ecuadorian and international institutions) to improve the detection of invasive species in the marine reserve, characterise the impact they are having on the native ecology and suggest how best to manage them.

Off the island of Fernandina in the west of the archipelago, I am hit by a blast of chilled water. Even deep down, the cold current can throw you around like a beach ball. I begin to navigate a prescribed path along the ocean floor, joined by others on the diving team. At each monitoring site we lay out a 50m tape. One member of the team records the fish along this transect whilst others note larger species living on the seabed and use a quadrat at regular intervals to study the seabed community in detail. In particular, we are on the lookout for the seaweed *Caulerpa racemosa*, the red algae *Asparagopsis taxiformis* and the Christmas tree hydroid *Pennaria disticha*, three invasive species that have already been observed in Galapagos waters. Our concern is that these could grow rapidly and out-compete native species.

Others – like the red lionfish *Pterois volitans* – have yet to reach the islands. But this species, native to the Western Pacific and Indian Ocean, has spread owing to its popularity as an aquarium fish and its predatory appetite. In the Caribbean, for instance, non-native lionfish are thought to have contributed to an alarming loss of biodiversity in recent years. If they make it through the Panama Canal and reach Galapagos, the consequences could be devastating.

Prevention will always be far more effective than trying to control invasive species once they've become established. At present, supply ships from mainland Ecuador visit each of the four inhabited islands. A better system, which the Galapagos National Park and the Galapagos' new biosecurity agency is working towards, is for cargo ships to service a single dock, with local vessels subsequently distributing supplies throughout the archipelago. It will be more work, but if we are to prevent such species reaching Galapagos – transported either on hulls or in ballast water – this is the sort of vigilance that will be needed. ■

UK NEWS & EVENTS

SUCCESS IN THREE DIMENSIONS

© GCT

GCT is happy to announce that our Three Dimensions of Galapagos event at the end of June was a great success, welcoming nearly 200 guests to the home of BAFTA in the name of Galapagos conservation.

An impressive 3D viewing of the special edition Colossus Productions film was followed by an interesting and amusing Q&A session with Sir David Attenborough and Anthony Geffen, the series producer. Highlights included Sir David recounting his morning spent with Lonesome George just weeks before this famous tortoise died, and Anthony explaining how the team was forced to fix one of the 3D cameras with a hypodermic needle during filming in these remote islands.

After a wonderful dinner, the Honourable Simon Carr led a highly entertaining auction and Sir David pulled the lucky winner of the evening's raffle. A final thank you to everyone involved.

RETURN OF THE GCT RAFFLE

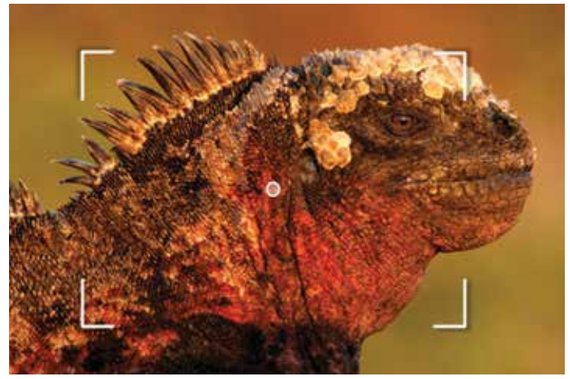
© majesticgalapagos.com

A couple of years have passed since we last held a raffle so we thought it was about time we gave our supporters another opportunity to win a Galapagos cruise for two. The prize for one lucky winner will be two spaces on the Majestic Motor Yacht for an 8-day cruise around Galapagos, hosted by the Galapagos Travel Centre. Cruise dates are flexible and can be negotiated with the travel company (**royalgalapagos.com**).

We have enclosed two books of raffle tickets for you to sell to friends and family (and of course you can enter yourselves too) and would be hugely grateful if you could help spread the Galapagos conservation word. Raffle tickets can also be purchased online via our website **savegalapagos.org**.

2013 PHOTOGRAPHY COMPETITION

We are pleased to announce that GCT's 2013 photography competition is now open for entrants. Jonathan and Angela Scott, Pete Oxford and Tui De Roy, four world-renowned wildlife photographers, will be judging this year's competition. If you have visited Galapagos and believe that you have a winning image we would love to see it. To see the categories for this year's competition, read the terms and conditions of entry, or to see winning images from previous years, please visit our website **savegalapagos.org**.



© KAREL DE PAUW

© DOLPHIN, WOLF ISLAND

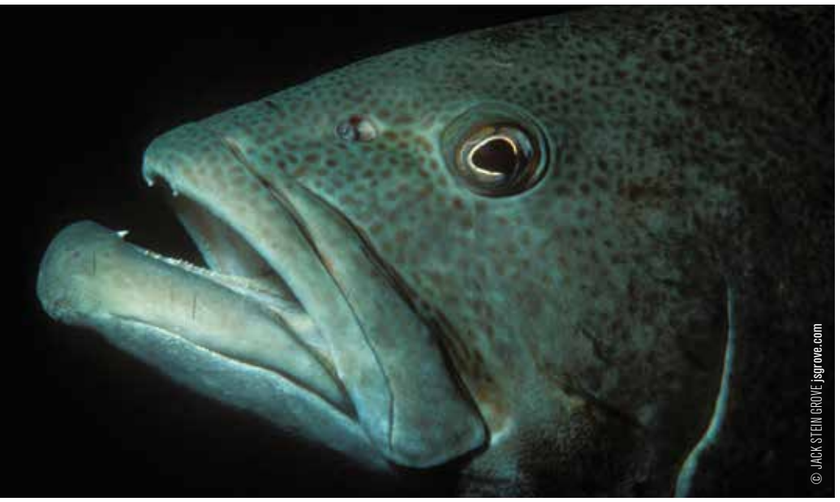
MARINE SYMPOSIUM
13 NOVEMBER 2013

Join GCT for the final event of 2013. To finish the year we will be hosting a Marine Symposium at our residence at 28 Portland Place on 13 November. The evening will consist of informative talks by guest speakers as well as giving our supporters an update on our current Whale Shark Appeal.

Refreshments will be provided and there will be the opportunity to talk to the speakers, GCT staff and other members at your leisure. The event will be free with a suggested donation of £10. Spaces will be limited, so book online now at **savegalapagos.org/events** or call the office on **020 7399 7440**.

PROJECT UPDATE

by Jen Jones


© JACK STEIN GROVE jsgrove.com

GALAPAGOS MARINE RESERVE: WHITEFISH MONITORING

IN ADDITION TO WORLD-CLASS SHARK RESEARCH, the Charles Darwin Foundation has also achieved significant success in working towards better management of the fisheries in the Galapagos Marine Reserve (GMR). During 2012, with support from the Waterloo Foundation, GCT was able to fund vital work to improve management strategies for sustainable fisheries both in Galapagos and as a model for other areas in the world.

The key goals of this ongoing project are to increase the understanding of the role of large predatory fish within the GMR and to improve knowledge about commercially exploited species. This information will be used to create management models that balance conservation recommendations with social and economic demands. Findings are then reported to the Galapagos National Park and the Participatory Management Board, an organisation that contains representatives from many stakeholder groups including the fishing community.

A range of techniques is used to assess the populations of key whitefish species including bacalao (*Mycteroperca olfax*) and wahoo (*Acanthocybium solandri*). These include stock assessment based on measurements of length and catch frequency, monitoring of by-catch in other fisheries, stomach-content analyses and acoustic tagging. This valuable information can be linked to environmental conditions to feed into predictor models to show the possible effects of climate change and strong El Nino events. Another important part of the project is community outreach to communicate the significance of sustainable management in an engaging way that builds resource stewardship.

Since the banning of industrial fishing in the GMR in 1998, populations of large pelagic fish and sharks are beginning to show signs of recovery, with the bacalao and wahoo showing a healthy status. This does not necessarily mean these species are off the hook. Severe reductions in the sea cucumber and spiny lobster fisheries due to intense overfishing is likely to increase the fishing pressure on pelagic species. As our understanding of many of the commercially important species remains poor, continued monitoring of the GMR is crucial.

TORTOISE CONSERVATION UPDATE

As you read in the last issue of *Galapagos Matters*, GCT is coordinating a programme that will unite the great work of the Galapagos Tortoise Movement Ecology Programme and the Zoological Society of London (ZSL). This is going from strength to strength thanks to further support from the Woodspring Trust. Those of you who were able to join us on 21 August heard Dr Stephen Blake talk about ongoing research into the ecology and conservation of giant tortoises in the field and ZSL's Iri Gill speak about the important role that captive breeding can play in the conservation effort. The Galapagos giant tortoises are fascinating species that play a very important symbolic role communicating wider environmental messages about the archipelago. In addition to the scientific benefits brought by this collaboration, we are developing a school outreach programme to supplement our **Discovering Galapagos** educational scheme. We look forward to updating you with progress on this project; check our website for updates at **savegalapagos.org**. If you know a school that might be interested in being involved with our outreach programme, please get in touch at **gct@gct.org**


© ALEX HEARN

PROTECTING PENGUINS AND CORMORANTS


© SABINE VAN DER MEULEN, PENGUINS

THIS YEAR MARKS THE LAST OF A THREE-YEAR STUDY by the Charles Darwin Foundation (CDF) on the two famous flightless bird species of the archipelago – the flightless cormorant (*Phalacrocorax harrisi*) and the Galapagos penguin (*Spheniscus mendiculus*).

The unforgiving phenomenon of El Nino brings warmer waters to Galapagos, with a loss of productivity that has an alarming impact on the fortunes of these two iconic species. In addition, they face increasing anthropogenic pressures, including habitat loss, overfishing and the predatory presence of invasive species like rats and cats. With forces like these pushing these popular species to the brink of extinction, it is crucial that we learn as much as we can about them in order to put successful conservation strategies in place. With population size closely linked to environmental conditions, both penguins and cormorants are powerful indicator species, a reliable measure of the health of the Galapagos Marine Reserve that can help inform management decisions.

This project has achieved some great insights so far and, by collaborating with researchers looking at disease dynamics (especially avian malaria) and manmade habitats for penguins, has the potential to achieve much more. With funds raised from our upcoming **Winter Penguin Appeal** we hope to maximise the impact of this study by extending the survey and ensuring that adequate conservation measures are taken to preserve the remaining populations of these endemic birds. We also hope to add more elements to the project such as the support of further Masters students, the production of a documentary to share with the community and the wider conservation world, and further outreach and educational activities in conjunction with our **Discovering Galapagos** programme.

For a full account of a recent field expedition by project leader Dr Gustavo Jiménez, see our blog **galapagosblog.org**. Also, keep an eye out for updates on our appeal and how you can help.

> The information that we collect will help us to address the huge objective of conserving these species for the long term.
>
> Dr Gustavo Jiménez | CDF

REMOTE CONTROL GALAPAGOS

by Jen Jones

JEN JONES IS GCT'S PROJECT MANAGER. Back in July, she travelled to Galapagos to conduct a site investigation and assessment for a ground-breaking project that promises to feed live images from remote locations in the archipelago to the visitor centre on Santa Cruz. . . *and beyond.*

Thick mist and near-constant drizzle. If you have ever visited the islands in July, you may not be surprised that these were the conditions I encountered on an early morning drive into the highlands of Santa Cruz. The influence of the cold Humboldt Current, which originates in Antarctica, is most prominent between July and September. The chilly mist, known as *garua*, lends an eerie atmosphere to areas of higher altitude on Santa Cruz, San Cristobal and southern Isabela. I was heading for Cerro Crocker, the highest point on Santa Cruz to complete the first stage of a site assessment for GCT's **Camera & Image Transmission Projec**t.

I set out from the vehicle to hike to the summit along with two rangers from the Galapagos National Park (GNP) and Peter Barlow of Outersight (a company specialising in wildlife observation systems). The route of the trail showed the fascinating zonation for which Santa Cruz is famous. From the transition zone (mostly used for agriculture), we passed through the humid zone (featuring *Scalesia* forest) and on to the *Miconia* zone (a shrub-like plant that is sustained by the *garua*). There was an undeniable beauty to this area although the obvious presence of mora (an invasive relative of a Himalayan raspberry) was a constant reminder of the severe conservation challenges that we face in Galapagos.

The reason for the hike was to check out the antennae, solar panels and other transmission equipment located at the highest point on Santa Cruz at an altitude of over 860 metres above sea level. On a clear day, the views from this spot are tremendous. But all I could see was a few metres ahead of me, the biting, salty mist shrouding everything, including the radio antennae. Up close, however, our inspection proved successful. We were able to determine that the potential camera sites we have identified would have a clear "line of sight" to the transmission equipment at the summit of Cerro Crocker that will carry the imagery further afield.

On the following day, it was time to visit potential camera locations. In stark contrast to the conditions we'd encountered in the highlands, we boarded the GNP boat in the bright sunshine at the port on Baltra. Our first destination was South Plaza, a tiny islet to the east of Santa Cruz with an area of only 0.13 km^2 and an altitude of just 23m. We assessed several potential locations for the cameras, considering the landscape, vegetation, wildlife and proximity to tourist trails. Most of the island is covered with a dense carpet of *Sesuvium*, an endemic perennial herb that changes colour from a rich green in the rainy season to a reddish purple in the dry season. There are prickly pear *Opuntia* cacti, which provide a food source for finches and the resident population of land iguanas whose burrows were plentiful in the areas of softer sediment. The sheer cliffs on the western side of the island host nesting swallow-tailed gulls and other seabirds like frigatebirds, blue-footed boobies, brown noddies and red-billed tropicbirds that spend their time foraging here. Lazy-looking Galapagos sea lions and several marine iguanas also inhabit this island, ticking all the boxes for a good remote camera site.

We then motored on to the larger island of North Seymour (with an area of 1.9 km^2) and its very different habitat. This island is home to breeding colonies of blue-footed boobies and magnificent frigatebirds. The contrast between the dry Palo Santo trees and the bright scarlet throat pouches of the frigtebirds, the unearthly blue of the boobies' feet and the golden yellow of the land iguanas also present here was truly a site to behold. We discussed the possibility of installing a 'nest cam' no larger than a lipstick in addition to a larger 360° remotely controlled camera. As well as a great addition to the visitor centre, the use of this technology could have high scientific value by providing an insight into the breeding and nesting behaviour of these threatened populations.

The value of wildlife remote viewing in delicate environments is undeniable: live-feed cameras have great potential to enhance the visitor experience and also to further science. This project is a first for Galapagos and it is hoped that this pilot will pave the way for similar programmes including the use of marine cameras, integrating citizen science participation and also for educational applications with local schools. With the variety of habitats that Galapagos has to offer, we now have a difficult decision to make about where the first camera goes. ■

LOOK OUT FOR FUTURE UPDATES from the **Camera & Image Transmission Project** on our website and blog: **savegalapagos.org**; **galapagosblog.org**.

WHAT MAKES THE BEST SITE FOR A REMOTE VIEWING SYSTEM?

- Plentiful wildlife (diversity and abundance is ideal)
- Year-round wildlife activity (seasonal changes are a bonus)
- Views of other islands and landmarks
- Protection against ocean spray and severe weathering
- An area away from visitor trails

Opposite above: The view from South Plaza.
Opposite below: A land iguana on North Seymour.
Above left: A hungry juvenile swallow-tailed gull.
Above middle: A Galapagos sea lion on South Plaza.
Above right: A misty hike up Cerro Crocker.
All images © GCT.

LIFE ON THE EDGE

by Pete Haskell

LIVING AN AMPHIBIOUS LIFE at the boundary between land and sea, mangrove forests provide a degree of stability in an otherwise harsh and changeable environment. Being partially submerged in salty seawater one hour and in baking hot equatorial sunshine the next, only the hardiest of species can survive in this tidal habitat, yet mangrove forests are among the most productive and complex ecosystems on Earth. They provide food for scavengers, nesting space for birds, hunting grounds for predators and nursery areas for fish.

Why then is this habitat so often overlooked and seldom visited by tourists? For some, it may be the pungent smell of decaying organic matter that puts them off, but the real reason probably lies in the dense, interlocking aerial roots that make mangroves so difficult to penetrate. It's these intertwined growths that enable the mangrove to cope with the challenges of an intertidal lifestyle: not only do they allow the plants to "breathe in" oxygen from the air to support respiration in the root system, they also provide a wide anchor for the mangroves to prevent them from being washed away by the relentless lapping of the waves.

That's not all. By forming a barrier between the sea and the land, the root system traps sediment that is washed off the land and slows its onward oceanic journey, a service that benefits coral reefs just off shore that are sensitive to sedimentation. For many animals, the roots also provide a refuge, impenetrable to larger predators. Fiddler crabs can be found scavenging on fallen leaves. Galapagos penguins, flightless cormorants, sea lions, sharks, golden cownose rays, turtles and a whole host of other species seek both prey and protection among the tangle of roots. Brown pelicans and great blue herons stalk fish in the shallows, while the branches above provide a nesting site for red-footed boobies and a home for the critically endangered mangrove finch, an endemic species with a population now estimated to be less than 100 individuals.

Despite their importance, mangroves face a variety of threats, including coastal development, pollution and climate change. "The main threat lies in populated areas and the destruction of mangroves for housing," says Leonardo Garcia, a technical director at the Galapagos National Park. Their importance cannot be overstated, he says. "Besides acting as natural barriers, mangroves play an important role in the dynamics of the Galapagos marine life. They are areas that supply organic matter to the sea, shelter for juveniles of many species and food for others. Inside the program of environmental education, the importance and protection of mangroves is one of the main topics." As the stress placed on forests through tourism, community expansion, land degradation and climate change increases, even tighter regulations may be necessary in the future to protect what pockets of this incredible habitat remain. ■

Above: Black Turtle Cove, Santa Cruz. © Hanna Tozer.

Opposite: Sea lion predating on a juvenile Galapagos shark. © Greg Cope.

Pete Haskell is a Marine Ecologist who works as the Communications Officer at the Galapagos Conservation Trust.

PLANKTON UNDER PRESSURE

by Professor Nicholas Owens

© SIR ALISTER FOUNDATION FOR OCEAN SCIENCE

"IF YOU CAN SEE IT IN THE SEA, IT IS NOT IMPORTANT". This was the take-home message of a lecture I used to give to the new intake of marine biology undergraduates at the University of Newcastle. Those students with visions of snorkelling over coral reefs or recording the songs of humpback whales were inevitably a little put out. But there was a very serious message to my lecture

I want to convey the importance of marine plankton, a catch-all term that includes animals (zooplankton), plants (phytoplankton), bacteria and viruses. The common feature of these organisms is that they drift at the mercy of oceanic currents (the Greek word "planktos" translates as "drifter"). Although some planktonic organisms are large, like jellyfish, the vast majority are invisible to the naked eye. But in spite of their small size most are highly complex and well adapted to their environment.

The statistics about plankton are amazing. If you weighed all living things on the planet, plankton would be responsible for more than half of it. One drop of seawater contains at least a billion viruses, tens of millions of bacteria and many tens of thousands of other animals and plants. Since plankton sits at the base of the food chain, every living thing in the ocean is – in some way – dependent upon it. Even land-dwelling creatures depend on it too: half of all the oxygen we breathe, for instance, has been produced by marine phytoplankton.

Yet the plankton is under pressure on several fronts. Climate change, for example, is having a profound effect on planktonic biodiversity. As the ice caps melt, so sub-Arctic species are beginning to struggle and sub-tropical and temperate species are moving steadily northwards. We are also observing dramatic changes in the timing of the key events in the life cycles of many plankton, with certain species appearing ever-earlier each spring most likely because the oceans are getting warmer. We cannot yet predict the consequences of such rapid changes and it is vital that we keep monitoring. But as no two organisms will respond to these pressures in the same way, it's almost inevitable that significant imbalances in the food chain, and hence biodiversity, will develop.

Plankton and the wider marine environment are also facing the spectre of ocean acidification, a little-known consequence of the production of carbon dioxide (CO_2) from the use of fossil fuels. It's estimated that around half of the CO_2 produced by human activity since the start of the industrial revolution has dissolved in the sea rather than accumulating in the atmosphere. As a consequence, the oceans have become, largely imperceptibly, more acidic. This is of concern for many marine organisms, notably those with shells or body parts made from calcium carbonate as is the case for many planktonic species.

> "One drop of seawater contains at least a billion viruses, tens of millions of bacteria and many tens of thousands of other animals and plants.
>
> Professor Nicholas Owens | SAFOS

What are the consequences for Galapagos? We can only speculate, much as we have to for any specific region. Although we do not have a long-term dataset on marine plankton in Galapagos, it's almost certain that the archipelago's suite of planktonic organisms has experienced the same pressures as other regions in recent decades. If anything, in fact, the relatively cold currents that feed Galapagos are likely to make marine organisms even more sensitive to changes in CO_2. It would be of great value to initiate an enduring plankton survey around the islands. Without third-party support the costs of such an initiative are prohibitive. If nothing else, however, we should acknowledge the importance of plankton. For without this hidden majority, none of the wonderful Galapagos 'megafauna' would exist. ■

MEMBERSHIP

by Victoria Creyton

© MADALINA BLANTON.

WE WOULD ONCE AGAIN LIKE TO THANK those members that have undertaken individual fundraising challenges on behalf of the Galapagos Conservation Trust. Chris Livemore from IBEX earth swam the channel with a relay team in September, and is due to take part in a 50km race and climb Mount Kilimanjaro. Part of the money he raises will go to the Trust. To find out more about the challenge or support Chris please visit: **mydonate.bt.com/fundraisers/off2france.**

We would like to send a very big thank you all the way to New York, to the now fourth grade class of Far Brook School. On hearing the sad news of Lonesome George, this talented group decided to hold a music and poetry recital in order to raise funds for conservation of giant tortoises in Galapagos. The performance was a great success and achievement, raising over $500, which was generously donated to the Trust. To thank the children personally and answer any questions they might have about our work, the GCT team took part in a Skype video call with the class, who had some very interesting questions relating to science, conservation and the possibility of bringing dodos back from extinction. Thank you again to all the pupils who took part.

At GCT we realise the importance of communicating conservation messages to the younger generation, and always enjoy being able to work with children and visit classrooms when possible. Consequently we will be involved with a fantastic new project initiated by digital communications company, Made by Many, and in collaboration with Fabien Cousteau's Mission 31 project. The initiative will see a month of marine-themed lessons going live globally and streaming directly into classrooms around the world. GCT will be directly involved in developing lessons for this resource, which will allow us to spread our conservation messages across the globe. For more information on this programme or GCT visiting classrooms please contact me: **victoria@gct.org.**

If you are interested in active fundraising for GCT why not join us on a trek along the Jurassic coast. GCT will be linking up with the world heritage site's experts for a three-day walk along the coastline, which will include fossil hunting, rock pooling and a talk from the site director. All funds raised from the challenge will go towards supporting island conservation. ■

UPGRADES

UPGRADING YOUR MEMBERSHIP fee could help us further support our **Whale Shark Appeal**. In 2010 GCT membership prices were increased to **£36** (Friend), **£48** (Joint Friend), and **£108** (Benefactor) per annum, this was to help cover running costs of the programme and support Galapagos conservation projects. We still have many supporters who are on the previous rates, especially those who pay their subscription via standing order. We estimate that if all our members on old rates were to upgrade to the current price brackets we would raise enough to tag a sample set of whale sharks on their migration from Galapagos to Peru, extending the vital research project even further and increasing the global significance of this important work.

EVENT REVIEWS

FOLLOWING ON FROM YOUR FEEDBACK IN 2012, we put together a busy and varied events programme. Due to success and demand we look to do the same in 2014 so get in touch if there is a specific Galapagos-related event you would like us to organise next year. See below for feedback on our 2013 events programme:

Cambridge University Botanic Garden

"I would like to thank GCT for a splendid evening at the Cambridge Botanic Garden. Professor Parker was a wonderfully engaging and informative speaker, the organisation and hospitality was excellent and even the Jade Vine was in flower. Please do it again sometime."

© GCT

Down House

"Since our visit to the Galapagos a couple of years ago we had been promising ourselves a visit to Down House. Had we attended a normal public entry day it would have been a good experience, but with the programme led by Randal Keynes (Darwin's great-great-grandson) our visit on Tuesday was really very special!"

Three Dimensions of Galapagos

"I was delighted to see how you encourage awareness in order to protect the islands and to promote promote its beauty."

ZSL

"It was a great evening – thank you. The talks were fascinating and enjoyable."

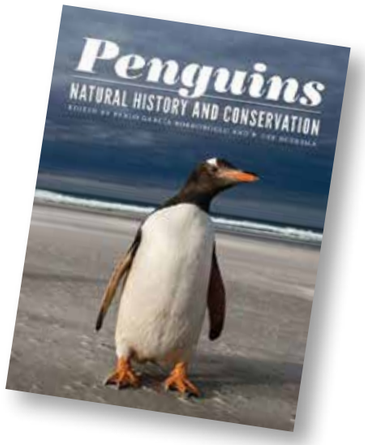
Marine Symposium

For details on our final event of the year, see page 13.

MARCH OF THE PENGUINS

PENGUINS: NATURAL HISTORY AND CONSERVATION

By Pablo Garcia Borboroglu and P. Dee Boersma (eds), University of Washington Press, 2013, £26.99, ISBN 9780295992846



This handsome volume with a plethora of lavish photographs has the appearance of a coffee-table book but offers much more. With each chapter focusing on a different penguin species, authored by one or more experts in their field, *Penguins* is an update of sorts of the penguin 'bible' compiled by Tony Williams almost 20 years ago (*The Penguins,* Oxford University Press). Its most valuable contribution is a series of sections detailing the threats, research priorities, current conservation efforts and suggestions for increasing population resilience of each species.

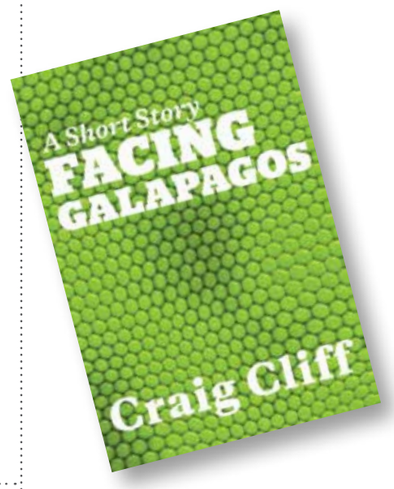
It does, however, lack the extensive introduction on the aspects of life history common to all penguins that Williams provides.

Reviewed by **Dr David Ainley**

ISLAND SHORT

FACING GALAPAGOS

By Craig Cliff, Random House New Zealand, 2013, Ebook, ISBN 9781869799496



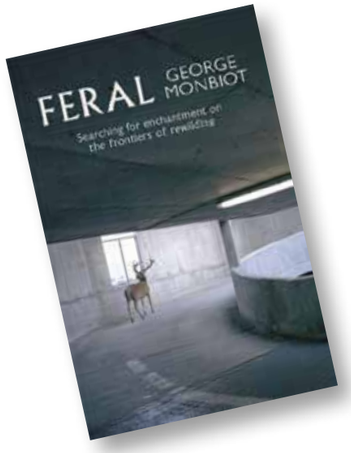
David Leon is holding down a mundane office job in New Zealand when he receives an email from Charles Darwin. He flips one back without thinking, and so begins an unlikely correspondence that gives Leon – who is facing some kind of existential crisis – itchy feet. When he works out that the mystery emails originate in Galapagos, he sets off to track down the imposter. Or is it Darwin himself? This clever, witty, award-winning short story from the 2011 Commonwealth Best First Book prize will leave you smiling for days.

Reviewed by **Henry Nicholls**

WILD AT HEART

FERAL: SEARCHING FOR ENCHANTMENT ON THE FRONTIERS OF REWILDING

By George Monbiot, Allen Lane, £20, May 2013, ISBN 9781846147487



George Monbiot's latest book combines new insights into the ecological damage already effected on the British Isles (and what we might be able to do about it – with some refreshing success stories) and the need for humans to reconnect with the natural world around us. Arguing for a process of 're-wilding', or allowing the natural world to find its own way to regeneration, you may not agree with all that Monbiot writes but it is a provoking read that will get you thinking differently about the countryside and waters of these islands with a new level of appreciation.

Reviewed by **Jen Jones**

ROCKY ROAD

ON THE ROCKS

By Bryan Nelson, Langford Press, £20, May 2013, ISBN 9781904078562

A combination of insight into the work of an expert field biologist, acute observation of the natural world and of people, and a travel log, this is an absolutely delightful book and well worth a read.

Islands, seabirds, the oceans and the spirit of adventure make for a heady mix. Working in Galapagos in the early 1960s with his wife June, Bryan Nelson experienced the islands with few creature comforts, little contact with the outside and a largely untouched environment. *On the Rocks*, as I'm sure the title is intended, captures the extraordinary changes that have occurred on islands like Galapagos in such a short timeframe.

Reviewed by **Ian Dunn**

GALAPAGOS GIFTS

2014 Galapagos Calendar

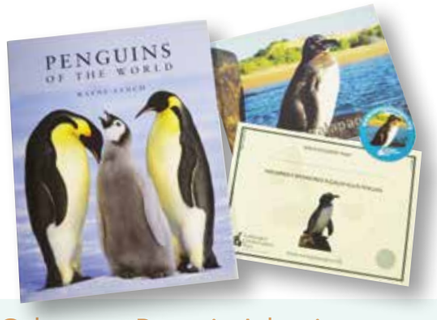
£10.00

Our 2014 calendar is now available to order, featuring a mix of incredible photographs of the iconic and unique wildlife of Galapagos. A special bulk discount is available for orders of ten or more calendars for a company or a group of friends and family. Email us at **gct@gct.org** or phone **020 7399 7440** to inquire about a discount. All proceeds help us to support conservation projects in Galapagos..

Hammerhead Shark Adoption

£40.00

Galapagos is one of the few remaining places where scalloped hammerhead sharks come together to school in their hundreds. Yet these highly evolved predators are particularly vulnerable to illegal fishing and are endangered globally. By adopting a hammerhead shark you will be helping us to support the research, monitoring and protection of this iconic species. Your adoption pack includes an official certificate and a cuddly hammerhead shark toy, perfect as a gift this Christmas.



Galapagos Penguin Adoption

£40.00

Galapagos Penguins are the only penguins found north of the equator and are unique to the Galapagos Islands but their population is declining due to a variety of threats. Will you help secure their future? By adopting a Galapagos penguin you will be directly helping towards our efforts to conserve this iconic species. Your certificated adoption pack will include an official certificate and a copy of the fantastic hardback book 'Penguins of the World' by Wayne Lynch.

Galapagos Cards *(pack of 10)*

£4.95

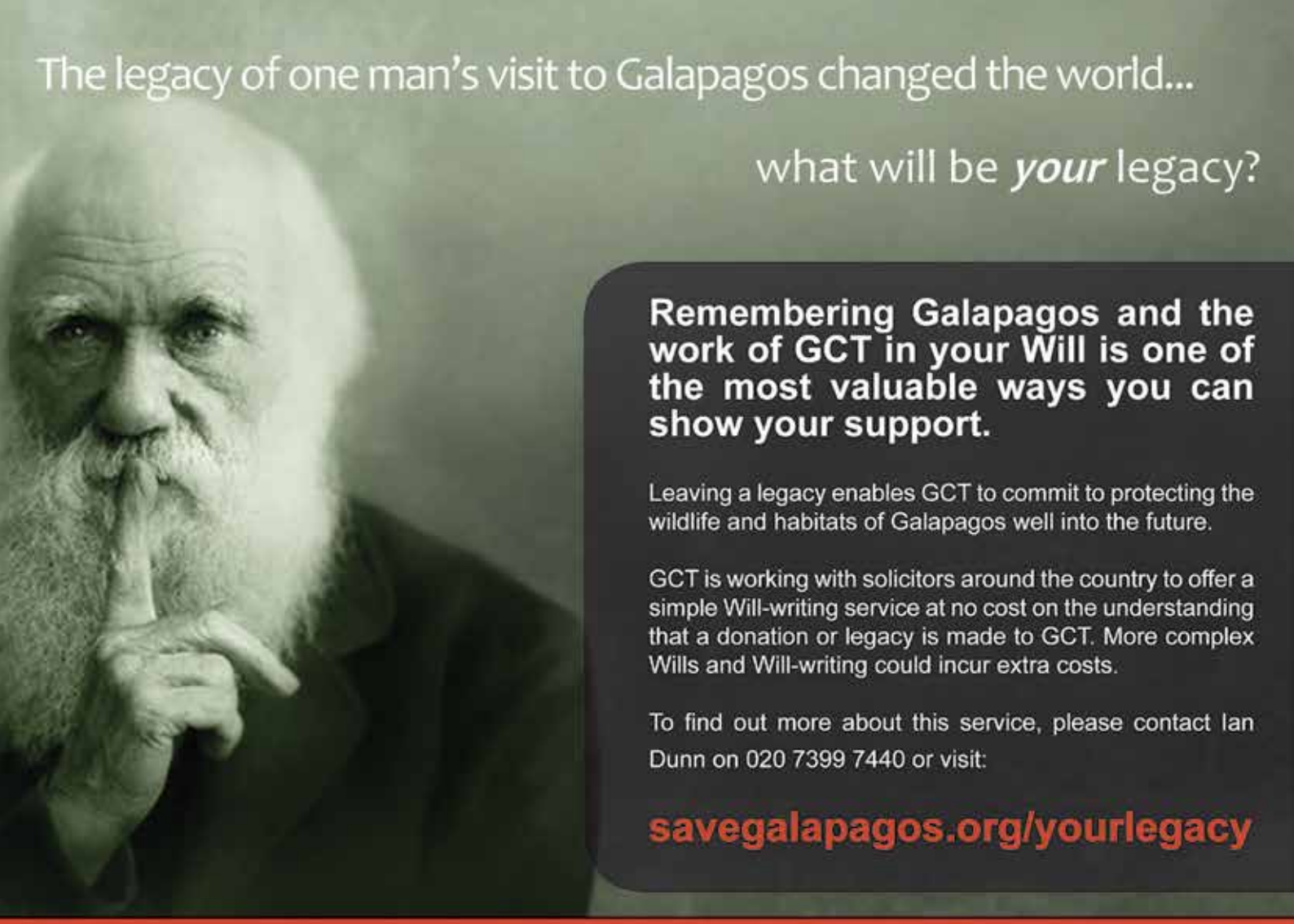
Our range of Galapagos cards features beautiful photographs of iconic wildlife. The cards are blank inside so perfect for sending to friends and family for any occasion throughout the year. Each pack of ten cards contains two of each of the five designs.

Galapagos Christmas Cards *(pack of 10)*

£4.95

Our newly designed Christmas card features this stunning illustration by children's author and artist Alexis Deacon. The card reads "Season's Greetings | Felices Fiestas" and comes in packs of ten. Long Christmas card list? Enjoy a special discount when you place a bulk order of five or more packs of cards. Email us at **gct@gct.org** or phone **020 7399 7440** to inquire about a discount.

Gift items that are not featured on this page are also available for order on the attached form and can be viewed and purchased through our website **savegalapagos.org**



Remembering Galapagos and the work of GCT in your Will is one of the most valuable ways you can show your support.

Leaving a legacy enables GCT to commit to protecting the wildlife and habitats of Galapagos well into the future.

GCT is working with solicitors around the country to offer a simple Will-writing service at no cost on the understanding that a donation or legacy is made to GCT. More complex Wills and Will-writing could incur extra costs.

To find out more about this service, please contact Ian Dunn on 020 7399 7440 or visit:

savegalapagos.org/yourlegacy

Enter the 2013 GCT Raffle for a chance to win two spaces on an 8-day cruise of Galapagos hosted by the Galapagos Travel Centre. More details inside...