GALAPAGOS NEWS

Fall – Winter 2017

WHALE TAGGING

Shark Monitoring

The Real Cost of Plastics

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A Good Year for Penguins
Education for Sustainability
Floreana Tortoises

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GALAPAGOS CONSERVANCY

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Johannah Barry aboard a panga in the Galapagos Marine Reserve during a recent Board of Directors trip. © Richard Knab

FROM THE

PRESIDENT

Johannah Barry

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Cover Image
GC-funded scientist, Alex Hearn, approaches a whale shark in the Galapagos Marine Reserve. © Jonathan Green

The Galapagos Marine Reserve, over forty-four thousand square miles of protected waters, forms one of the most extraordinary marine sanctuaries in the world. With over 20% of its marine species endemic to the Galapagos Islands, and its waters providing safe haven for pelagic species traveling through the Tropical Pacific Ocean, we are privileged to see warm water corals next to cold-water loving penguins. Fur seals and sea lions share their habitats with boobies, flamingos, sharks, and whales. This unusual gathering of marine flora and fauna is made possible by the confluence of cold water currents coming up from Antarctica and warm water currents coming down from the north which creates an unrivaled, spectacular ecosystem enjoyed by visitors and residents alike.

In this issue of *Galapagos News*, readers will enjoy the exciting discoveries coming out of the whale and shark-tagging work done by an international consortium of academic institutions working in collaboration with the Galapagos National Park. Unraveling the mysteries of whale shark reproduction will provide some additional insights into the habits of this remarkable creature who (occasionally) calls Galapagos home. Hector Guzman's gripping description of his work with shark tagging reveals the importance of this research in protecting these migrating giants from accidental collision with freighters and other cargo boats in the open ocean. We are so grateful to all the institutions cited in these pages for their tireless work on behalf of these charismatic species.

Galapagos News also brings us updates on our Giant Tortoise Restoration work as well as our continuing success with the educational community in Galapagos in teacher and mentor training. Both of these multi-institutional programs continue to benefit from the unstinting support of our donors and we are grateful that they see the value in these long-term investments in the islands and their residents.

For our enthusiastic photographers, and we know that your numbers are legion, please consider joining expert wildlife photographers Suzi Eszterhas and Tui de Roy on a special photographers tour of the Islands in 2019. Details can be found on page 18.

We are so honored to announce the extraordinary opportunity offered by one of our long-time Galapagos friends who has put forward a $1 Million Matching Fund Challenge to our members in 2017. Each gift will effectively be doubled, providing GC with the resources we need to move all of our collaborative work within these pages forward.

As the year draws to a close, it is my pleasure once again to thank all of our readers and supporters for their generous and thoughtful support.

GALAPAGOS CONSERVANCY
Saving one of the world's great treasures

GALAPAGOS CONSERVANCY
11150 Fairfax Blvd., Fairfax, VA 22030 USA
Tel: 703.383.0077 Fax: 703.383.1177
member@galapagos.org www.galapagos.org

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Details and donation form at right.

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Galapagos Guardian Society members give recurring monthly contributions that are charged automatically to a credit card. These members help us reduce our fundraising costs because we do not send them annual membership renewal notices for the duration of their support. This is an easy and secure way to provide GC with ongoing funds that we can use to address the most critical conservation challenges in Galapagos.

To join, please see the mail-in form to the right or join online at **www.galapagos.org/monthly** or call **703-383-0077**.

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A great friend and long-time supporter of Galapagos Conservancy has generously offered to match every gift we receive from committed members like you by December 31, 2017 — up to $1 MILLION! That means your year-end contribution to Galapagos Conservancy today will be matched dollar-for-dollar.*

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*All gifts will be matched through 12/31/17, or until the $1,000,000 cap is met. Gifts received after the cap is reached will not be matched, but will support Galapagos Conservancy's vital work in the Galapagos Islands.

(B17KMATCH)

GALAPAGOS NEWS

PREGNANT WHALE SHARKS

© Alex Hearn

Galapagos conservationists have become the first team to carry out ultrasound scans on whale sharks in the wild. The findings could help solve one of the enduring mysteries of whale shark biology: where the females give birth.

Since 2011, the Galapagos Whale Shark Project (GWSP) has been working to improve the scientific understanding of whale sharks in the Archipelago and the measures needed to protect them within the wider Eastern Tropical Pacific region. The population visiting the Islands and congregating around Darwin and Wolf Islands in the north of the Galapagos Marine Reserve seems to be unique in that the majority of individuals appear to be pregnant females. Up until now, however, this has been impossible to prove.

In July, GWSP researchers — in partnership with the Galapagos Conservation Trust, the Galapagos National Park, the University of San Francisco de Quito (USFQ), Massey University and Okinawa Churashima Foundation — revealed that they had succeeded in capturing ultrasound images from three female sharks and blood samples from both a male and a female.

"Almost nothing is known about the reproductive ecology of whale sharks. No pupping grounds have ever been identified, and the only pregnant female ever to have been analyzed, found in Asia, carried more than 300 pups, all at different stages of development," says Alex Hearn, a marine biologist at the USFQ and one of the leaders of the GWSP. "For years, we have suspected that the females in Galapagos are pregnant, and that they may give birth over an extended period of time and spatial area, out in the ocean. However, as yet, all this has been speculation. At last, with the successful testing of ultrasound scans and blood extraction in the wild, we have the tools to really examine this idea."

If the females prove to be pregnant, this research, combined with ongoing tracking of their migration routes, could have huge implications for the future management of these endangered creatures, which are hunted globally for their meat and fins and listed as endangered on the IUCN's Red List of Threatened Species.

TORTOISES SPREAD INVASIVE SEEDS

By 2070, the area of suitable habitat for the alien species guava, *Psidium guajava*, on Santa Cruz will have moved down the gradient by nearly 1500m, advancing at a rate of almost 30m per year, researchers predict. Giant tortoises — well known for dispersing seeds owing to their long digestion time and with wide-ranging movements — could facilitate this spread, report Diego Ellis-Soto and colleagues in the journal *PLoS ONE*.

At present, many invasive plants are confined to the highlands and, though tortoises transport their seeds to the lowlands, the dry conditions have prevented germination. With climate change and increased moisture, however, this could change with guava (and possibly other alien species) invading the lowlands and threatening many of the arid-adapted species that live there.

© Sergio Garcia

ILLEGAL SHARK FISHING

In August, Ecuadorian authorities detained crew from a Chinese fishing boat which was suspected to have been illegally fishing in the Galapagos Marine Reserve. The boat was found to be carrying 300 tons of fish, 6,000 of which were sharks, including the endangered scalloped hammerhead and silky sharks. Twenty crew members were taken into custody and sentenced to 1–4 years in jail and fined $5.9 million. According to the GNPD, an investigation is underway to determine where the sharks were caught and where they were being taken. Walter Bustos, Director of the GNPD, reported that the boat was the largest vessel captured inside the Marine Reserve. Another large seizure took place in 2015 when Ecuadorian police seized 200,000 shark fins destined for Asia — where they are considered a delicacy.

FLOREANA TORTOISE TO BE RESURRECTED

The Galapagos National Park Directorate (GNPD) in collaboration with Galapagos Conservancy (GC), as part of the Giant Tortoise Restoration Initiative (GTRI), has initiated a breeding program to bring back the extinct Floreana tortoise (*Chelonoidis niger*, recently called *C. elephantopus*). This program is based on a decade of exploration and genetic analysis of saddleback tortoises found on Wolf Volcano, the northernmost volcano of Isabela Island.

During a 2015 expedition, 32 tortoises were transported from Wolf Volcano to the Tortoise Center on Santa Cruz Island; of these, 19 were found to have Floreana ancestry. A group of researchers led by investigators from Yale University reported these results in the journal *Scientific Reports – Nature* on September 13, 2017.

"This is one of the most exciting advances of the Giant Tortoise Restoration Initiative. To restore, even partially, the extinct Floreana tortoise population was unthinkable only a few years ago. And now we will live to see it happen," commented Dr. Linda Cayot, Science Advisor for Galapagos Conservancy and coordinator of the GTRI. Based on preliminary results provided by Yale University researchers to the GTRI, four breeding groups of tortoises, each with three females and two males, were established in March 2017. In approximately five years, offspring from these breeding groups will begin to be released on Floreana Island.

A tortoise in the new Floreana breeding program. © Wacho Tapia/GTRI

The restoration of a tortoise population on Floreana Island with high genetic similarity to the island's original tortoise is part of a larger island restoration program, which includes the elimination of introduced species such as rodents, and the return of other species, such as snakes and mockingbirds, that disappeared from the island.

6,000 illegally caught sharks © GNPD

ELECTION RESULTS

Lenin Moreno has succeeded Rafael Correa as president of Ecuador, after winning the elections by a narrow margin in April this year. Like Correa, Moreno is a member of the left-wing democratic socialist party Alianza PAIS. In June, Moreno appointed the former Minister of the Environment Lorena Tapia as the new governor of Galapagos, suggesting the new administration intends to keep the conservation of Galapagos at the center of its environmental policy.

SUNFISH MOVEMENTS

It's only recently that marine biologists confirmed the existence of the southern ocean sunfish, *Mola ramsayi,* in Galapagos. Now, researchers have published the first data on the behavior and movements of this enigmatic species in these waters. Since the late 1990s, there have been repeated sightings at what appears to be a cleaning station (where the sunfish come to have their parasites removed by other fish) off the northwest tip of Isabela. Tracking of an individual with satellite tags reveals that it travelled almost 3,000km to the northwest of Galapagos over the course of about 50 days, occasionally diving to depths of more than 1,000m. Ultrasound tags on this and other individuals indicate that the sunfish keep returning to the cleaning station, the researchers report in the *Journal of Marine Biology*. Last year, researchers succeeded in fitting several more individuals with tracking devices, which will help give further insight into the behavioral ecology of *M. ramsayi*. (See *Galapagos News*, Spring/Summer 2017).

© Alex Hearn

EXPEDITION BALLENA

by **Jen Jones**, *Galapagos Conservation Trust in the UK*

"Ballena, Ballena, BALLENA!" The speedboat swerves suddenly, almost throwing equipment and people (myself included) overboard.

After three long days of searching, we have finally spotted a whale a few miles off the south coast of Floreana. The chase is on to become the first team to tag a whale in the Galapagos Marine Reserve.

As is always the case in Galapagos, we had witnessed some incredible spectacles already. Scanning the horizon from the top deck of the fishing boat that we were calling home for the week-long expedition, we had seen a raft of around 100 waved albatross on the water, floating their way towards Española and the breeding season. On another occasion, large pods of playful bottlenose dolphins surfed in our wake. We were frequently entertained by rays doing elaborate acrobatic flips out of the water. However, now it was down to the business of trying to tag a whale.

"There!" The magnificent animal surfaces again and lets out a huge whoosh as it exhales. The slow, deep grey ridge of its back creates an arc over the top of the waves, eventually revealing its dorsal fin before disappearing back into the blue. What kind of whale is it? With so fleeting a glimpse, it's not possible to be sure, but we have photos which will allow us to make an identification. The team is buzzing with anticipation.

The speedboat swerves again to get within tagging distance. All of us are scouring the water for the next breach of the leviathan that, due to its immensity and swimming strength, might reappear at any moment in any location. In spite of being thrown unforgivingly around the speedboat, Julio Vizuete, a skilled pilot, is in control of a drone that is looking down on us from above, helping us to see the bigger picture. Hector Guzman, a whale researcher based at the Smithsonian Tropical Research Institute in Panama (see pg. 8), has tagged almost 100 humpback whales and knows better than anyone on board what the whale beneath us is likely to do next. Alex Hearn, a marine biologist at the Universidad San Francisco de Quito on mainland Ecuador and co-leader of the Galapagos Whale Shark Project, is an expert spotter and has a wealth of experience in marine surveying techniques (see pg. 7).

We see three more whales that evening with multiple sightings of each, but do not succeed in tagging any of them. They turned out to be fin whales and are most likely feeding in the productive waters in the south of the Galapagos Marine Reserve during a migration, though nobody knows precisely where they have come from or where they are heading.

This trip has been organized by MigraMar (migramar.org), a network of scientists studying the migrations of marine megafauna in the Eastern Tropical Pacific, including whales, sharks, and manta rays. As migratory species cannot be confined to protected areas in one country's jurisdiction such as in the Galapagos Marine Reserve, effective management is only possible if we have a better understanding of their movements. In practice, this means learning from individual animals, tracking them with technology like GPS loggers and acoustic tags to reveal the most important migratory

pathways. It is only with this evidence that we can argue the case for new protective corridors.

The perseverance of the team pays off. The following day, we are able to tag a whale in the Galapagos Marine Reserve for the first time. It turns out to be a pygmy blue whale, a sub-species of the famous ocean giant, the blue whale, but growing up to 24m in length the pygmy blue is hardly small. As she was tagged just off Floreana, an island famous for being home to Eloise Wagner de Bosquet, a self-styled "Baroness" in the 1930s (star of the film *The Galapagos Affair*), the team named the whale the "Blue Baroness." The plan is to return to the field in 2018, aiming to tag more whales to follow their journeys as we piece together their stories and work to protect them into the future. ■

JUVENILE SHARK **MONITORING PROJECT**

by Dr. Alex Hearn

Elsewhere in the Galapagos Marine Reserve, the Galapagos National Park and the Universidad San Francisco de Quito (USFQ) are using drones to map several sites around the island of San Cristóbal that appear to be important nursery grounds for blacktip sharks. With the help of aerial footage, we hope to determine if these nurseries persist from year to year and whether they increase the prospects of growth and survival for the sharks.

The Juvenile Shark Monitoring Project also provides a fantastic opportunity to involve students in some of the fieldwork and analysis. This year, we were proud to watch USFQ student Yasuni Chiriboga explain the importance of nursery grounds to presenter and Galapagos Conservation Trust ambassador Liz Bonnin in the recent BBC series, *Galapagos*. For her undergraduate research thesis, Yasuni has been surveying four potential nursery areas over two seasons, using an array of underwater receivers and electronic tags to track the movements of several blacktips in order to compare the relative importance of these sites.

For other shark species, the lives of juveniles are an even greater mystery. In the case of the endangered scalloped hammerheads that aggregate around Darwin and Wolf Islands, for instance, only a handful of juveniles have ever been observed, leading our research team to develop the regional MigraMar network (migramar.org) with the aim of establishing migratory routes between Galapagos and some of the other oceanic islands and known nursery grounds along the coastal lagoons of central America.

This year we had a major breakthrough, identifying a lagoon on the northern coast of San Cristóbal where we can consistently catch small numbers of young hammerheads, measuring only around 50cm long. In June, we were able to attach a small electronic tag to one of these sharks and track its movements for several hours. This proof-of-concept will allow us to develop a full research proposal aimed at determining the movement patterns and health of these (very cute) little sharks and how best to protect them during this vulnerable stage in their lives. ■

SCIENTIST SPOTLIGHT

Dr. Alex Hearn is Professor and Researcher at the Universidad San Francisco de Quito's School of Biology and Environmental Science. His relationship with Galapagos began in 2002 when he led fisheries research efforts, and was involved in the participatory management system of the Galapagos Marine Reserve. In 2006, Alex led the creation of the Shark Research Program in the Galapagos Marine Reserve and the development of MigraMar, a regional network of collaborating researchers focused on movement patterns and the importance of oceanic islands to populations of threatened hammerhead, silky, tiger and whale sharks, among others. Alex's main research interest is the connectivity of migratory sharks in the Eastern Tropical Pacific. In 2016 and 2017, he worked with Galapagos Conservancy to develop *Shark Count: Galapagos* — a citizen science app for smartphones and tablets that enables dive guides and tourists to help monitor populations of sharks and other marine species at key dive sites in the Galapagos Islands.

Top: Tagging a juvenile hammerhead shark for the first time to determine the movement patterns of these vulnerable animals.

Bottom: A juvenile blacktip shark is released back into the ocean after being measured for research. Both photos © Alex Hearn

Humpback Whale in Galapagos © JoAnne Rosen

HOW (AND WHY) TO TAG A WHALE

by **Hector Guzman**, *Smithsonian Tropical Research Institute in Panama*

Tagging a whale is not easy, but it's incredibly important if we are to reduce some of the many threats posed to these incredible creatures.

Every year, humpback whales migrate from the north and southern hemispheres to overwinter off the west coast of Central America, particularly near Panama and Costa Rica. However these waters are also among the busiest shipping lanes in the world, with routes that are travelled several thousand times a year by some of the largest cargo vessels and tankers in existence. The chances of a collision — usually fatal to the whale — are likely to be high.

Several years ago, we began to tag humpback whales wintering in the Gulf of Panama to get a more precise idea of the threat posed by cargo vessels to these animals. In order to deploy a satellite transmitter safely, we need to get within 5m of the animal, ideally even closer. We attach the transmitters in a thick layer of blubber a short distance below the dorsal fin to minimize potential injury to the animals. These devices only stay on the animal for a short period, likely a few months.

We now have data from almost 100 individuals tagged from Mexico to Chile, including Costa Rica, Panama, and Ecuador, and have been able to overlay and model their movements with the tracks of shipping vessels to see how often they coincide. The results are alarming, with individual whales typically coming within 200m of a ship at least once and sometimes many times every day in the case of vessels entering the Gulf of Panama. One whale we tracked experienced 45 of these close encounters in just four days.

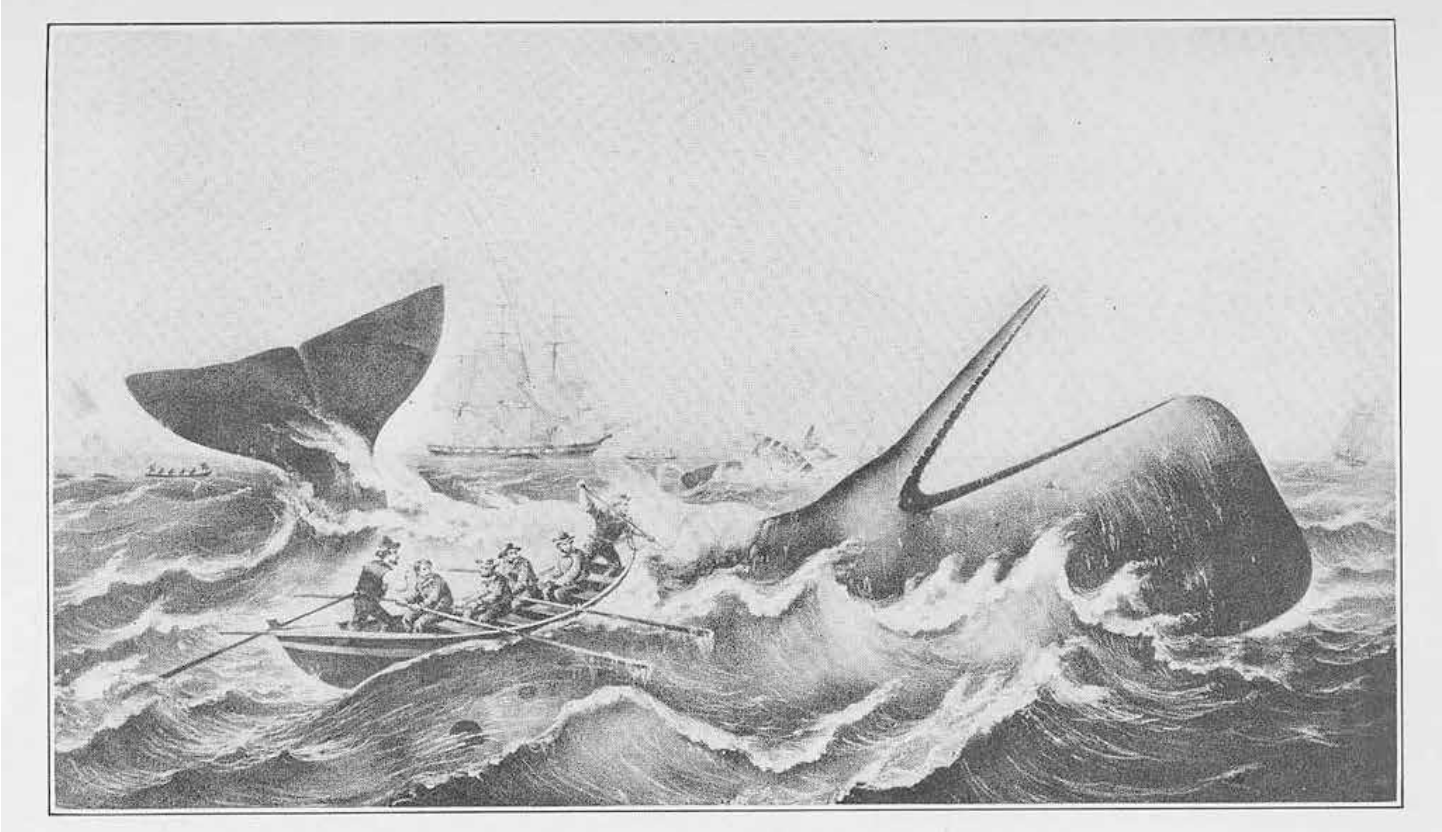
These and other findings are invaluable, both to us and, we hope, to the whales themselves. As a result, the International Marine Organization (IMO) has introduced changes to the way ships are routed that we estimate could reduce the frequency of collisions by 90%. In addition, Panama implemented a seasonal reduction in speed to 10 knots for all vessels passing through the danger zones at the peak of the breeding season.

The ideal scenario is to continue using the existing database to design and implement similar measures in Ecuador and Peru. In Galapagos, the risk of collision with vessels has also been reduced since the IMO adopted an outer ring around the Marine Reserve. Nevertheless, it is still important that we start tracking whales and find out about their movements and connectivity with other overwintering and feeding areas. It is only by doing so that we will have the scientific evidence on which to base policy changes that can lead to real protection for these enigmatic creatures. ■

SPERM WHALES OFF GALAPAGOS

The presence of sperm whales off Galapagos was first brought to wide attention by Captain James Colnett of the British Navy who visited the Islands in 1793. He was followed by fleets of American and European whalers, who killed sperm whales off Galapagos through much of the 19th century. The whaling industry hardly touched the Galapagos sperm whales during the 20th century, although during the height of modern whaling between the 1950s and 1970s, sperm whaling was intense and unsustainable off Chile and Peru, within the range of the Galapagos specimens.

by **Hal Whitehead**



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I first started studying sperm whales off the Galapagos Islands in 1985, only a few years after the end of Peruvian whaling. We went to Galapagos looking for somewhere with sperm whales and calm weather where we could study their behavior. It worked well, and, for a while, we returned every two years, learning a lot about this species. The animals spent most of their time foraging, looking for squid in deep waters to the west and north of the Islands. However sperm whales, especially female sperm whales, are intensely social so they also made time for interacting with each other, and this became a major focus of our study. Intriguingly, we found that the sperm whales off Galapagos could be divided into two distinct cultural clans, which differed in many aspects of their behavior and never associated with each other.

In the 1990s, sperm whales suddenly became harder to find in Galapagos and by the end of the decade there were some males but hardly any females. We, and others, found that several of the animals seen in Galapagos in the 1980s resurfaced off continental America, from Northern Chile to Mexico, but we can only speculate why they moved. Sightings of this species remained scarce in Galapagos throughout the 2000s, but in recent years they have been on the increase.

In 2013 and 2014, we returned to Galapagos to find that the sperm whales were indeed back, but things had changed. They were occupying waters to the south of the Archipelago rather than to the north and west, and all the animals appeared to be different from those we'd seen in the 1980s and 1990s. Even more startling, we found that while there were still two clans, they were ones we had previously observed elsewhere in the Pacific. Again, we can only speculate as to why; these are most intriguing creatures!

THE REAL COST OF PLA

by **Britta Denise Hardesty**, *Global Plastics Pollution Expert*

The first time I became aware of the impact of plastics on seabirds was when I visited Midway Atoll in the north Pacific in the 1990s.

I walked on supposedly pristine shores, much like Galapagos. However, I have photos of dead albatross from Midway with a tremendous amount of plastic — and many of those plastic pieces were readily identifiable. There were cigarette lighters, plastic lids to bottles, an entire toothbrush and lots of other items that certainly didn't belong in the diet of a beautiful seabird with a wingspan of two meters or more.

The Galapagos, or waved, albatross feeds quite similarly to those on Midway and also traverses the world's oceans during its annual migration. I also first visited the Galapagos Islands in the 1990s and was struck by how beautiful and clean the beaches were. I snorkelled with penguins, watched from underwater as boobies dived nearby looking for their meals, and swam with sea lions as they frolicked and came up to inspect me. However my recent visit in 2016 found me swimming in azure blue waters with bright red floating plastic lids, soft film-like plastics (such as are eaten preferentially by sea turtles), and reflecting on how much our oceans have changed in so short a time.

For the last decade, my research has focused on plastics — large and small, often referred to as macro (larger than 5mm) and microplastics (smaller than 5mm). Larger pieces of plastic can be eaten by bigger birds but also break down, through exposure to ultraviolet light and abrasion on the shoreline, into ever-smaller bits that can be consumed by ever-smaller and hence more numerous species.

Seabirds are called sentinels of ocean health or 'indicator species.' This means we look to these magnificent birds — whether frigatebirds that are called the 'pirates of the sea' because they steal fish from other birds, Galapagos penguins who fly underwater, red-footed and blue-footed boobies with their brilliantly colored feet — to tell us about the health of our marine systems. If these species are eating plastics, given how far away from land they feed, this tells us our human debris or litter is extracting too high a cost on the planet.

Seabirds and other marine mammals are innocent consumers. They don't set out to eat a plastic dinner, but instead mistake plastic for their normal prey items. We want to find out how much plastic Galapagos seabirds are eating, and to ask what the impact of this 'plastic diet' might be having on these species. We do this by taking a swab from the preening gland of a bird. You've probably watched birds in your garden 'preen' or rub their bill along their feathers. When they do this, they are waterproofing their feathers with oil from this gland (located just above the tail). With special equipment, we can see if the preen gland oil contains chemical components used in plastic manufacturing. By understanding what species are eating plastic (and perhaps how much plastic is in their diet) we can learn a bit more about which ocean basins and which species are most impacted by our trash.

We sampled six species of seabird last year, and another few species this year. We're asking questions about which species are ingesting more or less plastic, how do those birds feed, and do we think they're picking up plastic in proportion to what is in their environment, or are they seeking it out? One research team recently showed that plastic smells good to seabirds (many of them search for food based on smell or olfaction). If a plastic meal smells like squid, for example, birds that love squid are more likely to eat plastic than species that hunt for food by sight.

© Bill Gozansky

STICS

In addition, birds that feed on the ocean's surface are more likely to eat floating plastic by mistake.

Plastic production is growing exponentially. We have made as much plastic in the last ten years as was made from the time plastics came into use in the 1950s until that point. If current trends continue, it's been estimated that by 2050 some 99% of seabirds will have ingested plastic. Is this the world in which we want to live?

As consumers, we can make choices that make a difference; from everyday simple acts like bringing our own bags and refusing plastic bags, to buying products from companies whose sustainability practices we support, to bringing our own coffee cup and not taking single-use plastic items. We can refuse to buy toothpaste that has plastic in it and facial scrubs that use plastic microbeads to wash our face. Solutions are plentiful and consumers have the power to demand what they want from the manufacturers. ■

© Nina Sletmo

> "Approximately eight million metric tons of plastic waste enter the sea each year."

Left: A double-sided poster funded by Galapagos Conservation Trust, hung up in shops on San Cristóbal Island. It translates as '*going back for a plastic-free ocean*.'

THE PLASTIC-FREE OCEAN

A touring puppet show delivers the message about reducing plastic use.

by **Ashleigh Klingman,** *Fulbright Scholar and Education for Sustainability Expert*

The high-school students look dumbfounded. They are reviewing the list of Galapagos marine animals affected by plastics through ingestion or entanglement. *"You mean the same tragedy affecting marine birds worldwide could also be happening to the waved albatross and other species in Galapagos?!"*

Unfortunately, yes. The plastic plague has spread across all the oceans of the planet, even reaching Antarctica. Approximately eight million metric tons of plastic waste enter the sea each year, and unless there are improvements to the way we manage waste, the quantity of plastics currently in the oceans is projected to more than double by 2025, just eight years from now. At this rate and with continuing overfishing, it's been estimated that the mass of plastic in the ocean will outweigh that of fish by 2050. Microplastics are being passed up the food chain, accumulating from one species to the next and eventually ending up in humans.

In spite of its splendid isolation, the plastic problem is very much evident in Galapagos. In 2015, for instance, the Galapagos Governing Council interviewed shopkeepers across the four inhabited islands and estimated that more than eight million shopping bags and one million Styrofoam containers are used in Galapagos every year. This is clearly affecting local species. We have witnessed sea lions playing with plastic bags and researchers have dissected many dead animals, including albatross, and green and hawksbill turtles, to find plastic objects in their gizzards. Scientists at the Galapagos Science Center and the Galapagos National Park have evidence that plastic debris has a negative impact on at least 18 species in the Galapagos Marine Reserve.

For Galapagos residents and visitors, these statistics are shocking. However there are things that can be done. The Galapagos Governing Council followed up on its findings by imposing an Archipelago-wide ban on the use of plastic bags, a policy that has been relatively successful on the most populated island of Santa Cruz. Since 2009, each of the four main islands has also had a system in place for the separation and treatment of waste. However the sheer volume of plastic that enters the waste system calls for a still deeper cultural change.

The Grupo Eco Cultural Organizado (GECO) Association project "Going back for a plastic-free ocean" seeks to cement new habits through a grassroots, youth-led artistic campaign. By empowering local children and young adults as agents of change to spread the word to their peers and families, we have expanded our team from three to 20 and the extent of our outreach by an order of magnitude. We are now working to reduce plastic use in high-school cafeterias, carrying out neighborhood visits, promoting reusable bags in shops and hotels and designing new public garbage cans. We have created a touring puppet show, which has delivered the message about plastics to more than 500 local residents. We run regular artistic workshops and have arranged two community trash clean-ups, working with visiting groups from Denmark and the US to stop more than 1,500 pieces of trash from entering the Galapagos Marine Reserve. By December 2017, we hope to have halved the plastic bag use of at least 1,000 participants and reduced the amount of litter on the streets, in public parks, and on beaches by 25%.

While bigger non-profit groups might push for mass media campaigns, we at GECO understand the importance of a different approach for a mundane issue that most people dismiss as unimportant or unchangeable. Only through targeted discussion and encouraging people to think differently will we motivate personal change that collectively translates to systemic change. Our oceans are dying. We have to take action to decrease the direct harm to the Galapagos Marine Reserve and inspire similar action in the bigger polluters like China, the United States, Brazil and others. We can all do more to go back to a plastic-free ocean. ■

© Woods Hole Oceanographic Institution/Charles Darwin Foundation.

Deep Rover 2 on the peak of a seamount at 80m below the surface.

THE ISLANDS DARWIN NEVER SAW

by **Patricia Marti Puig,** *Senior Marine Scientist at the Charles Darwin Foundation*

Everything is dark, deep, and cold in the Galapagos that Charles Darwin never saw. The submersible *Deep Rover* 2 descends to the Galapagos platform, far below the surface of the ocean.

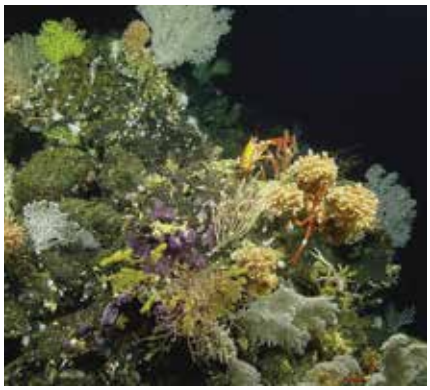
From the vantage point of the spherical cockpit, the sandy sea floor looks deserted and it feels like we could be in a spacecraft exploring an empty planet light years away from Earth. Then, the submersible's beams pick up some movement, a catshark, and suddenly, looming out of the void, there is a mountain of color: corals, sponges, crabs, lobsters, sea cucumbers and much, much more — a mosaic of life forms eking out an existence in the twilight zone, an otherworldly ecosystem that few humans have ever set eyes on.

This is a seamount, an underwater island formed by volcanic activity that rises from the seafloor but never breaches the surface. It is estimated that there could be nearly 100,000 seamounts dotted around the world's oceans, ranging in height from 100m hills to Everest-like mountains of 10km. These structures can be incredibly productive, hotspots of biodiversity that attract marine invertebrates, fish, and top predators. With their promise of new and intriguing species and prospects for fishing, mining, and tourism, these underwater islands attract humans, too.

Given the remote location of the Galapagos Archipelago and the protection offered by the Galapagos Marine Reserve (GMR), the 350 or so seamounts on the Galapagos platform are thought to be well preserved relative to those elsewhere in the world, which are threatened by trawling, oil and gas exploration, deep-sea mining, and climate change. Yet as growth continues in Galapagos, with the population and visitor numbers continuing to rise, so the pressures on the GMR and its seamounts are likely to increase. In 2015, the Charles Darwin Foundation (CDF) and Galapagos National Park (GNP) launched the Seamounts Research Project in collaboration with several international institutions to produce the first ever comprehensive description of these mysterious ecosystems of the deep.

So far, the project has resulted in four expeditions, using several research vessels and working with different partners, including the Ocean Exploration Trust, National Geographic, and the Woods Hole Oceanographic Institute. We have used multi-beam sonar to map the contours of 70 seamounts in exacting detail at depths of between 200m and 3,400m. We have deployed submersibles and remotely operated underwater vehicles to record more than 100 hours of video footage and capture photographs from more than 25 of these seamounts. We are characterizing the invertebrate communities and fish of these deep-sea ecosystems for the very first time. We are assessing the socioeconomic value of seamounts and have an outreach campaign to communicate our findings to the local community.

In collaboration with international taxonomists, CDF researchers are currently identifying almost 500 specimens collected from the deep, well over half of which have never been seen in the Galapagos Islands before and many of which might turn out to be entirely new species, previously unknown to science. From these initial findings, it is clear that we have only scratched the surface of this enigmatic and beautiful underwater world within the GMR, but it is information that is crucial for establishing a reference point that we can use in the future. These and other data will inform the GNP in its management of these unique communities, helping to preserve them and the benefits they bring to the local population for future generations. ■



© Ocean Exploration Trust/CDF

The invertebrate fauna found at 450m is an exquisite assembly of form and color.

From the GC BLOG

Philornis downsi *flies in the CDRS lab © Julio Rodriguez*

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

Returning to Santa Fe Island: New Experiences and Expectations

posted July 12, 2017

"But what most caught our attention was that in the two years since the first tortoise release, we have not found a single dead tortoise. To date, the survival rate appears to be close to or actually 100% — in comparison to long-term studies on Española Island where repatriate survival is just over 50%. Of course this survival rate will probably change as the years go by."

Author: **Washington Tapia** is Galapagos Conservancy's Director of the Giant Tortoise Restoration Initiative. He is a Galapagos native and reptile expert with decades of experience, including 15 years spent working for the Galapagos National Park Directorate.

A tortoise showing off his satellite tracking devices on Santa Fe © GTRI

A Meeting of the Minds at the Latin American Herpetology Congress

posted August 14, 2017

"In late July, I traveled to Quito, Ecuador, for the 11th Latin American Congress of Herpetology. I wouldn't normally travel such a long distance for a conference, but the invitation to participate in a half-day symposium organized by Galapagos Conservancy's Giant Tortoise Restoration Initiative (GTRI) team was too good to pass up. Many of us who conduct research on giant tortoises are spread around the world, and this was a great chance to get caught up on each other's work and make plans for the future."

Author: **Elizabeth Hunter** is currently a postdoctoral researcher at the University of Nevada, Reno. She has been working on Galapagos giant tortoises since 2010, when she completed her MS with GC's Adjunct Scientist and tortoise expert, Dr. James Gibbs, on the return of tortoises to Pinta Island.

Rearing an Invasive Fly in Galapagos: A Critical Step in its Control

posted August 18, 2017

"I arrived in the Galapagos Islands in the middle of 2013 after completing my undergraduate classes at the Central University of Ecuador. This was a new area of research for me; on the mainland I had studied ticks and mosquitos. My job was to help figure out how to raise the flies in captivity in the absence of its bird hosts — not an easy task and, to our knowledge, one that had never been achieved for flies that are parasites of birds. However, this study was very necessary. Researchers investigating methods to control Philornis downsi *could only access flies during the bird breeding season (January to May), thus losing out on valuable research time — seven months every year!"*

Author: **Paola Lahuatte** is an Ecuadorian junior researcher and the coordinator of the *Philornis* lab at the Charles Darwin Research Station in Galapagos. Galapagos Conservancy has been supporting the Charles Darwin Foundation's Landbird-*Philornis* project since 2013.

La Cumbre Volcano on Fernandina Island erupted on September 4, 2017. © GNPD

From the GC BLOG

Return to Española Island 2017

posted August 22, 2017

"Our field visit to Española Island in late June 2017 marked our fifth and final annual visit to track three important GC-supported projects related to restoring the island: tortoise effects on vegetation, response of nesting waved albatross to clearing of woody plants, and trends in the cactus population.

*As we backpacked up the rocky trail to our camp in the interior of the island, located underneath a massive "caco" tree (*Erythrina velutina*) — the only one we know for sure to exist on the entire island — we were struck by the hyper-abundance of Darwin's finches. Huge numbers exploded from the brush where they were well-hidden from owls. As many as 50 finches could be seen at a time festooning nearby shrubs. This has been a wet year and plant growth was profuse, as were caterpillars, nectar, pollen, and soft seeds — all good finch food. But "crunch time" will soon come — in a few months the plants will die back and there will be little to eat. Many of these finches will expire in the dry season. Some will survive to reproduce — evolution in action."*

Author: **Dr. James Gibbs** is Professor of Vertebrate Conservation Biology and Associate Chair of the Department of Environmental and Forest Biology at the State University of New York (SUNY-ESF). He has partnered with Galapagos Conservancy for many years in efforts to restore giant tortoise populations in Galapagos through the Giant Tortoise Restoration Initiative.

Rangers set up camp on Española Island. The highlands where the tortoises live are shown in the background. © James Gibbs

Eruption on Fernandina: A fleeting performance, but a recurring geological process

posted September 12, 2017

"Midday on September 4, thanks to social networks, I learned that La Cumbre volcano on Fernandina Island was erupting. The initial images captured and shared by naturalist guides who were near the island showed pyroclastic flows — currents of hot gas and ash — on the south side of the volcano. This continued into the night of September 5.

The Galapagos National Park Directorate (GNPD) invited me to participate as a member of a small technical team of three people in an overflight on September 7, to evaluate the eruption. We took off from Baltra airport at 10:30 AM in the GNPD's small seaplane."

Author: **Washington Tapia** is Galapagos Conservancy's Director of the Giant Tortoise Restoration Initiative. He is a Galapagos native and reptile expert with decades of experience, including 15 years spent working for the Galapagos National Park Directorate.

Combating Invasive Species: Protecting Galapagos Wildlife and Ecosystems

posted September 22, 2017

"I first arrived in Galapagos in 1996 as a tourist. I'd been working in agricultural research for 8 years before studying biology, so I was intrigued to learn about agricultural challenges around the world. With this in mind, I headed up the trail to Media Luna on the island of Santa Cruz, where the only person I met along the way was a farmer. Despite my limited Spanish, we managed to have a decent conversation. I learned that invasive species, particularly common guava and quinine, were rampant on his farm, making it difficult to produce agricultural crops and costing a lot of money to control."

Author: **Heinke Jaeger** is a Restoration Ecologist at the Charles Darwin Research Station where she focuses on investigating terrestrial plant and animal species in Galapagos.

A Good Year for PENGUINS

A skinny penguin (left) from February 2016 and a plump one (right) from February 2017. A penguin incubates two eggs in a constructed nest in July 2017. © Dee Boersma and team

Our research team from the University of Washington visited Galapagos in July 2017 to study the rare and endangered Galapagos penguin. On each of our twice-yearly trips, we check Galapagos penguin nests for signs of breeding and determine the body condition of adult and juvenile penguins. In 2010, the project built 120 artificial penguin nests by stacking plate lava or digging small lava tunnels out of scoria lava. Our goal is to provide breeding opportunities for penguins. Because their ability to breed is linked to the unpredictable availability of food, we want to make sure that, when breeding conditions are good and food is abundant, all the penguins have a high-quality nest site to keep their eggs safe and cool.

The nutrient-rich Cromwell Current that flows eastward into Galapagos heavily influences food availability for the Galapagos penguin. During El Niño events, this current slows and the flow of nutrients to the islands is disrupted. The 2015-2016 El Niño was not as devastating for the Galapagos penguins as the El Niños of 1972-73, 1982-83 or 1997-98, but we found no penguins breeding. In 2016, we counted more than 300 penguins and only one was a juvenile. The adults were skinny and coated with green algae, a sign that they had been spending lots of time in the water looking for food and little time out of the water drying their feathers.

Happily for the penguins, a La Niña followed El Niño in 2016-2017, and brought cool, nutrient-rich water into the western archipelago, supplying the seabirds of Galapagos with lots of fish to eat. During our visit in February 2017, juvenile penguins, blue-footed boobies, and pelicans were common.

In early July 2017, we set off aboard Godfrey's ship, *RATTY,* for Bartolomé, Isabela, and Fernandina Islands to see what the penguins were up to. We hoped to see more juveniles, a good indication of successful breeding over the last six months. We were eager to see if the penguins were nesting and if they were using our constructed nest sites. Life in Galapagos is dynamic, and we never know what we will find.

We found a penguin breeding bonanza! Similar to our trip in February, about 45% of the penguins we saw in July were juveniles, indicating successful breeding in the previous months. The penguins were in good body condition; they were plump and many looked as though they were ready to breed or molt. We also found 11 active nests (two constructed and nine natural). In these nests, we found penguins in many stages of breeding — courting adults, clean and white newly laid eggs, older and dirtier eggs just about to hatch, eggs that were hatching as we checked the nest, young chicks peeping for food, and big chicks left home alone. All the active nests were in Elizabeth Bay, Isabela.

The breeding we saw in July was promising, but the number of penguins is likely half of what is was before the 1972-73 and 1982-83 El Niños. Nevertheless, the recent breeding bonanza provided a much-needed boost to the population. With another La Niña predicted this autumn, we hope the breeding will continue into 2018. With support from Galapagos Conservancy, we will return to the islands next February to check nests and share our findings with locals, tourists, and our supporters. ■

SCIENTIST SPOTLIGHT

The Galapagos penguin research team has traveled to penguin breeding areas twice a year since 2010 to check constructed nests and study the penguins.

Dee Boersma is a professor at the University of Washington, Seattle, where she holds the Wadsworth Endowed Chair in Conservation Science and directs the Center for Ecosystem Sentinels. She has studied Galapagos penguins since she began her dissertation research on Fernandina Island in Galapagos in 1970. **Caroline Cappello** is a PhD student at the University of Washington studying the ecology and conservation of Galapagos and Magellanic penguins. She began her work with Galapagos penguins in 2015. **Godfrey Merlen** is a conservationist, natural historian, boat captain, and Director of Sea Shepherd's Galapagos office. He has lived in Galapagos since the 1960s and received the Disney Conservation Hero Award in 2015 for his conservation work in the Islands.

This project is a collaboration between Galapagos Conservancy and the Galapagos National Park Directorate.

Teachers Are Fired Up & READY TO GO

At 7:45 am on June 5, nearly 200 Galapagos teachers and school directors entered the campus of the Tomás de Berlanga School on Santa Cruz Island, notebooks in hand and ready to go to work. Meanwhile, another 125 equally-determined educators gathered at the Colegio Nacional Galapagos in Puerto Ayora and at the Escuela Alejandro Alvear on San Cristóbal Island.

The occasion was the 4th biannual Teacher Institute of the **Education for Sustainability in Galapagos Program (ESG)**, which is implemented jointly by Galapagos Conservancy, Fundación Scalesia, and Ecuador's Ministry of Education. Launched in April 2016, the program provides more than150 hours of professional development every year to the 325 Pre-K through 12th grade teachers from the 21 schools in Galapagos. Training focuses on helping teachers to learn proven educational strategies and to teach their subjects within the context of real-life local and global sustainability issues.

According to Richard Knab, GC's Director of Strategic Programs, "During the Institutes, every math, science, literacy, social studies, and English language teacher in Galapagos, and every school director, participates in 50 hours of intensive training, offered simultaneously on Santa Cruz and San Cristóbal. Teachers take this training very seriously and their enthusiasm is infectious. What makes the program special, however, is what takes place between these events."

Immediately following each Institute, and throughout the year, "instructional coaches" work with teachers in their classrooms. As the job title would suggest, coaches are educators trained to observe teachers and to guide their professional growth. A coaching session begins with a meeting between coach and teacher to discuss a lesson to be delivered, and the coach then observes the teacher delivering that lesson. The classroom observation is followed by a meeting during which the coach helps the teacher to reflect on their practice.

Teachers practice a hands-on rocket-launching science activity during the recent Teacher Institute in Galapagos. © Brian Goodman Photography

The coaching session closes with agreement between coach and teacher on an individualized professional development plan. Coaches sometimes offer demonstration classes or co-teach a lesson, depending on the needs of each teacher.

In addition to the Institutes and coaching sessions, teachers also participate in regular Learning Circles where they meet with teachers of similar grades and subjects, several times a month, to exchange experiences and to address shared needs.

During year three, the program will continue to offer Institutes, coaching and learning circles, and will begin to train a corps of 30–40 local instructional coaches. Also, specialized training will be offered to school directors to provide them with the tools needed to lead and support education improvements within their schools. ■

To learn more about the ESG Program, contact Richard Knab at rknab@galapagos.org

EDUCATOR SPOTLIGHT

Diego Roman, an architect of the ESG program and leader of the science team, is a native of Quito. Diego studied agronomy in Honduras and volunteered at the Charles Darwin Research Station, prior to earning his Masters in Education from the University of Wisconsin-Whitewater and his PhD in Educational Linguistics from Stanford University. He is currently on the faculty of the Simmons School of Education and Human Development at Southern Methodist University in Dallas, Texas.

"For me, it is personally and professionally rewarding to form a part of a world-class education program in my country and in such a special place as Galapagos. We are forming amazing relationships with teachers and school directors and we are all — teachers, directors and trainers — learning from one another. Together, we are building local capacity that will make sure that high-quality, sustainability-focused teacher professional development is available well beyond the five years of the ESG Program."

GALAPAGOS CONSERVANCY

Saving one of the world's great treasures

GALAPAGOS UPDATES

GALAPAGOS CONSERVANCY 2017 PHOTO COMPETITION

THANK YOU to all of our photo competition entrants! The GC team had a difficult task choosing the winners from ***more than 1,500 photos.*** Here is a sampling of some of the best.

Giant Tortoise by Linda Klipp of Key West, FL. **Kicker Rock** by Ron Modra of Fort Lauderdale, FL. **Land Iguana** by Lisa Sandow Lyons of Leonia, NJ. **Sea Lions** by Suzi Wattendorf of Tallahassee, FL. **Puffer Fish** by Ariane Gagnan-Francoeur of La Salle, QC, Canada. **Yellow Warbler** by Erik de Rijk of Aalsmeer, Netherlands.

ULTIMATE GALAPAGOS PHOTO TOUR

AUGUST 16 – 31, 2019

© George Defenbaugh

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

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

GALAPAGOS GIFTS

www.galapagos.org/shop/

Animal Adoptions, Gift Memberships, Books, Posters, Calendars, Puzzles, Ornaments, Glassware, Apparel, and more . . .

Gift Memberships and Honor & Remembrance Gifts

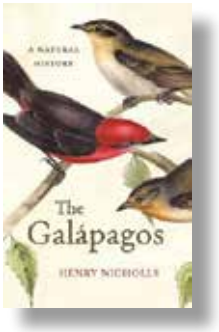
Honor your loved ones by supporting the important conservation efforts in Galapagos! Gift levels start at $25. Recipients will receive a beautiful card informing them of your gift, which you can personalize with a special message.

Symbolic Animal Adoption Kits

Ranging from $30 up to $150, we offer symbolic adoptions for tortoises, blue-footed boobies, sea lions, and marine iguanas. A great gift for a budding conservationist!

Books

Ranging from $15 up to $50, we offer a limited selection of Galapagos books for all ages, while supplies last.



2018 Galapagos Calendars, $15

Featuring stunning photos from the winners of our 2017 photo competition.

Support Galapagos Conservancy.

When you shop at **smile.amazon.com**, Amazon donates.

Go to smile.amazon.com

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Kids Care About Galapagos!

These creative kids are doing their part to help protect the animals of Galapagos.

Grayson Rigby has written ***Expedition to the Galapagos Islands***, a non-fiction children's picture book that takes you on an 8-year-old's adventure aboard the *National Geographic Endeavour* to the enchanting Galapagos. Grayson was inspired by the incredible animals and wrote daily about his observations and personal experiences in his journal. Included are face-to-face animal encounters written from a child's perspective, as well as beautiful full-color photographs and illustrations of the islands' animals in their natural environment. **Grayson is generously donating proceeds from the sale of his book to Galapagos Conservancy — you can order it on Amazon.com for $15.95.**

Will and Matty Gladstone continue to amaze Galapagos Conservancy staff with their dedication to selling blue socks to raise money to help the blue-footed booby. To date, they have raised more than $20,000 for scientists to study the threats and trends of the blue-footed booby population in Galapagos. **See the sidebar at left for ordering information.**

Stocking stuffers for Galapagos lovers!

To place an order, visit: bluefeetfoundation.com

Socks come in adult and kid sizes and are $12.50/pair.

Proceeds support Galapagos Conservancy.

GALAPAGOS
CONSERVANCY
11150 Fairfax Boulevard, Suite 408
Fairfax, VA 22030 USA

Congratulations, Bert Sirkin!
Our first place winner, hailing from West Hartford, Connecticut, won for this shot of Golden Rays in the Galapagos Marine Reserve near a dock in Puerto Ayora, Santa Cruz. His photo, chosen from more than 1,500 photos, is on the cover of our 2018 calendar.

2018 calendars can be ordered online at:
www.galapagos.org/shop/