

a biannual English-language publication for members of the international network of Friends of Galapagos organizations



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This Nazca Booby was photographed standing in front of a natural blowhole that shoots seawater up to 100 feet high. As the early morning sunshine caught the spray, a spectacular rainbow formed momentarily. The sky behind was dark with rain clouds brought by the earlier-thanusual hot season.

The Nazca Booby is one of the three members of the gannet-like Sulidae family living in Galapagos. They nest on the ground, laying one or two eggs depending on the season and conditions. Dependent on marine species for food, their population varies enormously with climatic fluctuations and events such as the El Niño phenomenon forecast for 2009–2010 that may drastically cut their numbers.

Nazca Booby (Sula granti) at Punta Suárez, Española Island, Galapagos. Photo: © Jonathan R. Green (www.jonathangreenimages.com)



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### **GLOBAL THERMOMETER President's Report** Fall 2009

Tn September 2009, world leaders gathered at a United Nations summit on climate change in New York, working towards an agreement on policy changes within their countries that would alleviate rising world temperatures and address the devastating effect on the natural world.

First articulated in the 1992 Earth Summit in Rio de Janeiro, and later emphasized through the Kyoto Protocol five years later, the frank acknowledgement that the world's climate is changing is generally accepted. The evidence is inescapable. Global temperatures have risen, vast expanses of Arctic ice have melted, and sea-levels are rising. But by no means are the origins of climate change, nor the steps to ameliorate current and likely future effects, universally accepted among parties.

The Galapagos Islands are uniquely located to confirm and address the issues of climate change. Situated on the equator, this extraordinary marine system features a dynamic mix of tropical and Antarctic currents and rich areas of upwelling. Consequently, this system, largely protected by the designation of 131,000 square kilometers as a marine reserve, contains an enormous range of biological communities, featuring such diverse organisms as penguins, fur seals, tropical corals, and large schools of hammerhead sharks.

Sea mounts, recently the subject of study by the Charles Darwin Foundation, form a network of small



islands of rich biodiversity on the ocean floor which are only now beginning to be understood. El Niño and La Niña events are regularly measured in Galapagos waters, and some have characterized Galapagos as the "thermometer" of the Eastern Pacific.

The coastal areas of the Galapagos National Park (GNP), home to marine iguanas, sea lions, flightless cormorants, gulls, and boobies, are at risk. In this issue of Galapagos News, threats to Galapagos flora and fauna are described in detail. Dr. Stuart Banks of the Charles Darwin Research Station (CDRS) describes the fragile hold that Galapagos penguins and flightless cormorants have in Galapagos. In addition to the risk of disease and predation, these species will be first to struggle as climate change increases the frequency and intensity of El Niño events that disrupt their nesting and feeding behaviors. Cold water fauna such as macro algae, corals, and invertebrates are under increased scrutiny by scientists who fear that both rising water temperatures and intensive local fisheries will have fatal consequences.

The issue of climate change in Galapagos is real and unrelenting. Working with scientists and conservation managers throughout the world, the CDRS and GNP are focusing on protecting the most vulnerable species and are taking these lessons to the larger public. We are grateful to our membership and our network of scientists who are bringing international focus and attention to these fragile and irreplaceable systems.

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President Galapagos Conservancy



# Naval Attack



Patricio Goyes Arroyo is director of Ecuador's Instituto Oceanográfico de la Armada (INOCAR), the Oceanographic Institute of the Ecuadorian Navy.

This autumn, a 70-meter-long, bright red vessel will leave **L** Guayaquil on the Ecuadorian coast and set sail for Galapagos. It is a journey the Orion, the research vessel of Ecuador's Instituto Oceanográfico de la Armada (INOCAR), has been making every year for more than a quarter of a century.

One of INOCAR's missions is to provide permanent monitoring of the oceanic and atmospheric conditions of



The BAE Orion with its state-of-the-art technology for exploration, exploitation, and conservation of marine resources in the waters around Ecuador. © INOCAR.

Ecuadorian waters. A coastal network of weather stations and tide gauges (including a weather station in San Cristóbal and a tide gauge off Baltra) transmits a continual stream of data via satellite to the INOCAR headquarters in Guayaquil in almost real time. INOCAR's research vessel Orion also carries out frequent oceanographic cruises, mostly though by no means exclusively, in Ecuador's national waters. The Orion has been to the Antarctic on three occasions, in 1988, 1990 and 1998, and since it was built in 1981, has performed more than 100 scientific cruises, travelling hundreds of thousands of miles. These expeditions are highly multidisciplinary, involving dozens of researchers working on different projects in different Ecuadorian institutions. They are also international, involving collaboration with organizations outside Ecuador, such as the US National Oceanic and Atmospheric Administration.

(continued on page 8)



**PROVIDED BY THE CHARLES DARWIN FOUNDATION &** THE GALAPAGOS NATIONAL PARK SERVICE

### **Golden Celebrations**

The Charles Darwin Foundation (CDF) celebrated its 50th anniversary in July with an International Science Symposium in Puerto Avora. The focus of the symposium—combining research in both natural and social sciences-will lead to important changes in the way CDF operates, according to an official statement issued by the Foundation. Moving forward, CDF will promote "a holistic treatment of the particular needs of this Natural World Heritage site."

This broadening of CDF's research to include the human face of Galapagos has been ongoing for several years, but there was repeated emphasis on the importance of this approach throughout the meeting. Robert Constanza, an ecological economist and the kevnote speaker at the symposium summed things up. "Achieving interaction between the social and natural sciences is fundamental in Galapagos," he said. Provided that all stakeholders are able to agree on a shared vision of their future, Constanza was optimistic that Galapagos could become a sustainable society. "You might think this is not possible because of tourism pressure on Galapagos, but it is." The global financial crisis presents an opportunity, he said. "This crisis lets us rethink the whole economic model."

There were more than 100 experts from many different fields and from all over the world at the five-day symposium. CDF's executive director Dr. J. Gabriel Lopez echoed Constanza's address, stressing the importance of improving integration of the social and biophysical sciences and learning from the applied scientific work being done elsewhere in the world. CDF's president Peter



Dr. J. Gabriel Lopez at the CDF's July symposium. ©CDF

Kramer described the event as one of the most valuable he has been a part of in over 40 years of working with the Foundation. The Galapagos National Park (GNP) is also 50 years old, and has held several events to celebrate its many achievements since Galapagos became Écuador's first protected area in July 1959.

### **Mosquito Threat**

A systematic search of aircraft landing on Baltra has helped reveal the extent of insect introductions to the Archipelago. There were 74 live insects in the holds of 93 aircraft touching down on Baltra, report researchers in Proceedings of the Royal Society of London. Six of these were Culex quinquefasciatus mosquitoes, known vectors of West Nile Virus and avian malaria. An accompanying genetic analysis reveals that these stowaways can integrate into the population that has, in recent years, become established in the Islands. "That we haven't already seen serious disease impacts in Galapagos is probably just a matter of luck," said Simon Goodman, a biologist at the University of Leeds in the UK. In another article, published in Proceedings of the National Academy of Sciences, Goodman and a different team of researchers revealed that the black salt marsh mosquito (Aedes taeniorhynchus) may have been a resident of Galapagos for some 200,000 years. This has given it plenty of time to adapt to a diet of predominantly reptilian blood, raising concern that it could act as a vector of disease should new pathogens reach the Islands. "It is absolutely vital that...control measures are maintained and carried out rigorously, otherwise the consequences could be very serious indeed," said Goodman.

### Satellite System Nabs Fishermen

GNP has recently installed a Satellite Monitoring System to track tourism and fishing activities within the Galapagos Marine Reserve. Within weeks, the new set-up had drawn attention to the Tatiana II, an artisanal fishing boat that had repeatedly entered and left the reserve over a three-day period. A detailed inspection of the vessel subsequently revealed it had been involved in illegal shark fishing. The satellite system, put in place with support from WildAid and Conservation International, will allow GNP to monitor the activity of all vessels greater than 20 tons registered in Ecuador – including fishing

boats, tankers, and cargo ships – that are within a 60 mile radius of the Islands. Plans are afoot to widen the monitoring to include smaller boats.



Shark caught aboard Tatiana II. © GNP

### **Galapagos Remains on Endangered List**

Thirteen natural World Heritage Sites, including Galapagos, will stay on the World Heritage "in danger" list, according to the International Union for the Conservation of Nature (IUCN). "The decision to retain Galapagos on the World Heritage List shows the clear commitment of the government of Ecuador to continue with its conservation efforts and to work together with the international community to maintain the outstanding universal value of this unique place on Earth," says Pedro Rosabal of IUCN's Protected Areas Program.

### In the Pink

The enigmatic pink iguana on Isabela's Wolf volcano could be more abundant than researchers had guessed. An expedition to the volcano in May found 101 individuals with almost equal numbers of males and females. "This gives us time to complete the genetic analyses of the blood samples and evaluate other data to determine if any management measures are necessary for its conservation," says Washington Tapia of the GNP. The extraordinary rosada variety came to the world's attention last year, when researchers described its unique genetic makeup. It has now been formally recognized as a new species Conolophus marthae.

### **Royalty Visits Galapagos**

His Royal Highness Charles, Prince of Wales, visited Galapagos in March, pledging his support for CDF's efforts to encourage sustainable development of the Islands. During the British prince's tour of the Charles Darwin Research Station, Rodolfo Rendón, CDF Executive Council member and ex-Minister of the Environment of Ecuador, suggested that "Galapagos is the optimal place to test the implementation of a truly sustainable model for the world. If we can achieve it here, we can do so in any other part of the planet." Then, following his re-election in April with more than 50% of the popular vote, Ecuador's president Rafael Correa took his family on vacation

to Galapagos, taking the opportunity to acknowledge the fruitful partnership between CDF and GNP and emphasizing his government's commitment to the conservation and sustainability of the Archipelago.



Prince Charles, Camilla, Duchess of Cornwall, and CDF's Executive Director Lopez © CDF

### **Baltra Island Joins GNP**

A large chunk of Baltra Island – the gateway to Galapagos for many tourists - is now officially part of the Galapagos National Park, according to an Executive Decree passed in June. GNP is now responsible for managing almost 75% of the island, with the remainder split between the Ecuadorian Armed Forces and the Office of Civil Aviation.

### **Tree Finch Uplisted**

The medium tree finch (Camarhynchus pauper), found only in the highlands of Floreana, is now "critically endangered" according to recent updates to the IUCN's Red List of endangered species. The main threat to this species is thought to be the introduced parasitic fly Philornis downsi, which can destroy entire broods of chicks.

### Hope Again for George?

There are fresh hopes that Lonesome George, the last remaining Pinta tortoise, may still become a father. One of the females (from Wolf volcano on Isabela) that has shared his enclosure at the Charles Darwin Research Station for almost 20 years laid a clutch of five eggs in July. These are being artificially incubated and, if fertile, are expected to hatch out in November. Last year, both females laid clutches for the first time since they have been housed with George, although none of the eggs hatched.

### **70 Visitor Sites Monitored**

The Galapagos National Park Service has initiated monitoring of 70 terrestrial visitor sites in the islands. The monitoring process collects biophysical, social, and management data, which can help to detect changes in the visitor sites and tourism activities. All of the information collected is analyzed in order to determine whether or not conditions are acceptable and to determine what management actions, if any, are necessary.



### GALAPAGOS: PRESERVING DARWIN'S LEGACY

by Tui De Roy, Christopher Helm Publishers Ltd ISBN: 9781408108666

Tui De Roy's latest book is a stunning achievement. In Galapagos: Preserving Darwin's Legacy, the self-taught naturalist who grew up in Galapagos has assembled more than thirty enthralling personal reflections from RESERVING DARWIN'S LEGACY Galapagos experts – past and present – to capture the beauty and significance of these Islands like never before. It is chock-full of fascinating and original content, with highly readable essays on every imaginable aspect of Galapagos life – from lichens to molluscs to the recently discovered pink iguanas to all the usual Galapagos suspects – with 600 of De Roy's breathtaking photographs acting as the perfect gel to bind them together. It is a surprising experience to find non-fiction tingling one's spine. This is the perfect Christmas gift for the Galapagos devotee.

### GALAPAGOS: BOTH SIDES OF THE COIN

by Pete Oxford and Graham Watkins Imagine Publishing, Inc. ISBN: 9780982293935

contents of each issue.



(Reviewed by Henry Nicholls)

This is a unique and important book in the growing world of Galapagos literature. The subtitle will enthrall aficionados of Herman Melville's Moby Dick. There are literal, figurative and metaphorical uses of the word "coin" in the subtitle, a reflection of the many complexities of the modern day Galapagos Archipelago. What this

book does better than any other, to my knowledge, is in the section that invites the reader to invert the book and read from the "back" to see the other side of the coin. Here, former director of the Charles Darwin Foundation Watkins and photographer Oxford pull no punches on the modern reality of Galapagos, including over-fishing, prostitution, tourism, and resource extraction, as well as conservation efforts. It is a powerful reminder of the fact, frequently ignored by natural history programs, that approximately 30,000 residents live permanently in the Islands in four towns.

(Reviewed by Matthew J. James, Sonoma State University)

### **Back Issues of Galapagos Research are now** available for purchase for \$5 each in the Galapagos Gift Shop at www.galapagos.org

**Galapagos Research** is the Charles Darwin Foundation's printed scientific journal compiled of articles written by scientists who have conducted research in all areas of science in Galapagos over the last half century. To date, 67 issues have been printed, beginning with the first in 1963. We apologize that not all issues are available, and some issues that are available are bound copies of the original issues. Due to

the large number of issues, we are unable to give specific information on the





## **Feeling the Heat**

Author Stuart Banks is the Coordinator of Marine Ecosystem Monitoring and Investigation at the **Charles** Darwin **Foundation** 

Galapagos Penguins at sunset. © GC Member Jack Baldelli

Each year from November to March

The Galapagos marine environment **I** is one of the most dynamic in the world and is expected to become more so in the face of global climate change. Here is an overview of some of the species and aspects of Galapagos life that are especially sensitive to rapid fluctuations in the Archipelago's environment.

### **Galapagos Penguins**

No penguin in the world is found as far north as the charismatic Galapagos penguin (Spheniscus mendiculus). Normally sustained by the rising currents that bring rich food to the west of the Archipelago, Galapagos penguins and flightless cormorants suffered heavy mortalities during the strong El Niño events of 1982-83 and 1997-98. Today, with an increased risk of disease, invasive predation by cats upon nests, and becoming entangled in netting of baitfish for local fisheries, these species are at particular risk of becoming extinct. Scientists predict that climate change will increase the strength and duration of El Niño events, which will have an immediate impact on these sensitive, coldwater-adapted species. Charles Darwin Foundation (CDF) scientists working with the Galapagos National Park (GNP) and visiting groups continue a long-term monitoring program, studying pathology of blood parasites linked to avian malaria and investigating possible adaptation measures such as artificial nesting caves and adjustments to the coastal protected areas covering their home ranges.

### **Green Sea Turtle**

The green sea turtle (*Chelonia mydas*) has made Galapagos its principal nesting ground in the Eastern Tropical Pacific.

thousands of turtles forage across the productive coastal zones and seamounts in the reserve, and females pull themselves up the sandy beaches at night to lay eggs. However, beaches will warm in the future and sea-level changes could shift nesting beach habitat. Since the gender of hatchlings is determined by the temperature of the sand in the nest, there may be a change in the sex ratio, with an abundance of females and fewer males. This could reduce genetic diversity of the population and cause changes in migration behavior. Ongoing work with marine reptiles should clarify these long-term impacts of climate change. The creation of shaded zones along nesting beaches, conservation of mangrove areas and increasing protection from egg poaching and coastal development could all help reduce the impact of human-induced climate change on this species.



### Fisheries

In spite of repeated recommendations for quotas and closures, sea cucumber and lobster fisheries off Galapagos have been overexploited for the last 30 years. Given that the most productive coastal fisheries are located in the cold-water habitats that are particularly sensitive to climate change, fishing will be adversely affected. CDF scientists are exploring several options, including establishing sustainable

fisheries in the open water, encouraging hand lining for large pelagic fish such as wahoo, and carrying out tagging studies to examine the site fidelity of keystone predator species like hammerhead and Galapagos sharks. At the same time, we are using mathematical models to work out the best way to restore natural stocks of sea cucumber, lobster, and species taken in near-shore fin-fish fisheries. These steps are important, not just for the future livelihoods of artisanal fishers, but also to encourage a shift back to a natural, healthier ecosystem in which currently overfished reef-fish predators can regulate overgrazing, thereby aiding natural recovery after climatic disturbances.

### **Cold-Water Oases**

Without a doubt the most productive environments in the Archipelago are associated with the nutrient-rich water that rises around Fernandina and western Isabela. Like a hose spraying against a wall, the submarine Cromwell current collides from the west with the Galapagos platform, deflecting cold water up into the shallows where it generates astounding blooms of phytoplankton. These sustain a rich and cold-water-adapted marine fauna with high levels of endemism and generate an environment suitable for productive macro-algae beds, rare pockets of threatened solitary corals, and macroinvertebrates along the coastal fringe. Not surprisingly, these regions are also focal points for intensive local fisheries. We are using ecological monitoring data to model these complex interactions, which is crucial if we are to protect the vulnerable populations and marine communities in this region from the consequences of climate change.

### **Marine Aliens**

As climate shifts, new species and pathogens are likely to reach Galapagos and out-compete stressed native and endemic species. Although the marine realm is in a continual state of flux, new transoceanic pathways have opened in the last 40 years that greatly facilitate the transport of non-native species, developments that are unprecedented in the ecological history of the Islands. As the tourism industry expands at an alarming 14% per year, other marine organisms will reach the Islands on the hulls and anchors of the increasing number of regional and



Maren Vitousek is an ecologist and evolutionary biologist at the University of Colorado, Boulder. She has been studying the marine iguanas of Galapagos since 2002.

The dead iguana lay in the hot, black **L** sand about fifty meters from the ocean. It was a large male and appeared to have died fairly recently. After a brief look I continued walking along the shoreline, but managed only a few steps before coming across another. A few meters further along lay another, and another.

This was my fourth season studying Galapagos marine iguanas on the island of Santa Fe, one of the long-term study sites established by researchers Andrew Laurie and Fritz and Krisztina Trillmich in the 1980s. Dr. Laurie had set out to study the basic reproductive biology of this unusual species, but early in his research career the enormously strong 1982-83 El Niño hit, causing the deaths of many marine iguanas. Instead, his research proved to be a fascinating account of the struggle for survival. Inspired by this research, I was in Galapagos to investigate the effect of these climate cycles on reproductive behavior. Still, I was completely unprepared for the sight of so many of these amazing animals lying dead on the shore.

By most standards the El Niño that I witnessed in 2006 was fairly minor. Strong El Niño events, like those of 1982-83 and 1997-98, can kill up to 90% of marine iguanas on some islands. With death rates this high, there is a very real risk that an increase in the frequency or magnitude of these events could result in the extinction of marine iguanas on some islands.

Although all marine iguanas are members of the same species, animals from different islands vary widely in their size, color and behavior, and recent research shows that these island populations are genetically distinct. The disappearance of any of these unique groups would represent a major loss of biodiversity in Galapagos.



Marine iguanas are so sensitive to El Niño events because of the way they feed. Intrigued by their talent for swimming, Charles Darwin dissected a few animals and found their stomachs "largely distended with minced seaweed ... I do not recollect having observed this seaweed in any quantity on the tidal rocks," he wrote in his Journal of Researches. "I have reason to believe it grows at the bottom of the sea." Darwin correctly concluded that it's this "seaweed" (technically, algae) that lures these cold-blooded creatures into the sea. This algal diversity on which the iguanas depend is sustained by the cold, nutrient-rich upwelling that normally characterizes the marine environment in Galapagos. But during El Niño events, the upwelling moves away and the surface temperature of the sea rises dramatically



Jim Adelman of Princeton University prepares to measure the length of a marine iguana. © Nathan Gregory

# Shrinking Iguanas

throughout the Archipelago. The red and brown algae consumed by marine iguanas are not able to survive these changes, and the intertidal zone instead becomes colonized by tough brown algae of a different species. Starving iguanas fill their hungry stomachs with this new algal form, but in a cruel twist of fate they are unable to digest it.

The largest iguanas die first. Their higher energetic demands mean they have to go foraging more frequently, but once the algae disappear they can no longer find enough food to survive. Some iguanas show the astonishing ability to shrink in length by as much as 20% during food shortages. Animals that shrink, by absorbing bone mass, have a significant survival advantage over those that do not; however, if the edible algae fail to return, even the smaller animals begin to die. Interestingly, despite the high death rates overall, some iguanas are able to survive extensive periods with little or no food. Researchers Martin Wikelski and Michael Romero are currently trying to find out why some iguanas live while others succumb during these famines.

Fortunately, extremely strong El Niño events are rare, though weaker El Niños can still have a significant impact on Galapagos marine iguanas. Many individuals forego reproduction in the year following an El Niño. In normal years females are extraordinarily picky, mating with only the largest and most active males. The strength of these preferences determines what characteristics get passed down to the next generation. My research has shown that during even weak El Niños, females are less choosy about their partners. If El Niños do increase in strength or frequency, this is likely to cause

## Galapagos Islander

### SOLANDA REA is...

the meteorologist at the Charles Darwin Research Station in Puerto Ayora, Santa Cruz.

### Where were you born?

Guayaquil. I moved to Galapagos

when I got married. I remember the date I arrived – June 25, 1983. It was an El Niño year, Puerto Ayora was flooded, and the main street was damaged. There were few cars then and no buses, and we had to get a truck to take us to our house. It still took hours. Our plane had landed at midday but we were not home until 7 pm. The next problem was food. In those days there were few places to eat; we looked for somewhere but in the end we ate a can of tuna and cookies from a cupboard in the house. After this, things got better!

### What was Galapagos like 25 years ago?

My husband already worked at the Charles Darwin Research Station (CDRS) in herpetology. After being on the Islands for 15 days I got my first job at CDRS, working with the iguanas. It was so peaceful and relaxing here after the noise and pollution of Guayaquil. There were no paved roads when I came. You walked on earth and lava. There were some street lights but they went out at 11 pm and you had to use a flashlight. There was no main road to the highlands. Most people walked, some had bicycles, and a few had motorcycles. A driver from CDRS would pick up people and bring them to work.

### How did you get water and food?

In the early days we collected rainwater in tanks on the roofs. You could also collect it from Las Grietas, stunning water-filled crevices not far from Puerto Ayora. You had to boil it to drink it. Later, the municipal council introduced a pumping system, and you could get water for only one hour a day. Now it's three hours a day. When I came to Santa Cruz, there was very little agriculture on the island, so almost everything had to come from outside the islands.

### What does your job involve?

I now work in meteorology, taking readings and gathering information about the climate. It is very important to collect this information, as it has an impact on all the wildlife. I come to the station at around 7:30 am and spend most of my time collecting meteorological measurements, entering them into the database, and helping run the CDRS shop. I love my work; CDRS has been like a second home to me.

### How does the future of Galapagos look to you?

I am very concerned about the expanding population. There are so many outsiders coming here, the population is young and they are having large families. It's just not sustainable on a small island. In addition, there are too few opportunities for young people. My daughter is training to be a guide, and I hope she will be able to get work here in the future. My son studies gastronomy. He hopes to work in tourism. All institutions in Galapagos need to give young people from the Islands a chance. In the future I would like to see the major institutions managed by people from Galapagos. I have spent most of my adult life here in Galapagos, only leaving for three years when my husband's work took us to Costa Rica. It was beautiful there but we all missed Galapagos.

### *Continued from Page 3, Naval Attack*

The importance of Galapagos, both to Ecuador and to the international community, warrants a dedicated annual expedition to the Archipelago. This has given us a rare and valuable longterm set of data on the productivity of Galapagos waters, the strength and direction of currents from the surface down to a depth of 350 meters, surface and subsurface water temperature, salinity, nutrient content, acidity, and other key oceanographic and atmospheric measures. This year, INOCAR installed state-ofthe art multibeam echo sounders on the Orion. This new equipment, which will be tested in Galapagos waters in September, will allow us to map the ocean floor around the Islands in unprecedented detail.

In October, INOCAR will begin construction of a small laboratory in Puerto Avora to carry out oceanographic measurements and water-quality monitoring of the main visited bays. Later this year or early next year, construction will also start on the Centro de Investigaciones Marítimas de Galapagos (CIMAG) on San Cristóbal, a research center that will give INOCAR a permanent presence in the Islands. This will allow us greater opportunity to collaborate on projects with the Galapagos National Park, Charles Darwin Foundation, and other partners around the world.

INOCAR is currently involved in many projects that should help in the conservation of Galapagos' unique marine environment. We are studying changes in the acidity of seawater and the bleaching effect this can have on coral reefs. Based on the recommendations of organizations like the Intergovernmental Oceanographic Commission (IOC), the Permanent Commission for the South Pacific (CPPS) and others, we have started new projects investigating carbon dioxide, algal blooms and fertilization of the oceans. We are also defining a draft of the Oceanographic and Coastal Research Program of Ecuador and the Galapagos, which is due to be discussed at a forthcoming workshop.

In years to come, global climate change is expected to bring about several significant changes to Galapagos. It is likely to exacerbate the impact of *(continued on page 9)* 

### *Continued from Page 6, Feeling the Heat*

transoceanic vessels. There are several notable potential threats, including the North Pacific sea star (*Asterias amurensis*, below) and a barnacle (*Chthamalus proteus*). Their successful establishment elsewhere has resulted in complete restructuring of marine communities, requiring millions of dollars for their removal. A proactive, preventative approach is imperative in Galapagos and CDF will conduct diver surveys of hull epifauna and epiflora and of



bra and of marine species associated with local Galapagos and Guayaquil ports. This will allow us to assess the risk associated with particular

### Continued from Page 7, Shrinking Iguanas

a change in the body size of iguanas in future generations. Incredibly, the marine iguanas at our study sites today are, on average, around half the size they were a decade ago. This striking trend, too large to be explained by individual shrinkage alone, may result from higher death rates in larger animals during El Niño events, as well as the weakening of female preferences for large mates.

Long-term research projects like this one initiated more than two decades ago provide vital clues about the impact of El

### Continued from Page 8, Naval Attack

El Niño and La Niña events, alter rain patterns, affect coastlines through erosion or accretion, increase salinity, elevate sea level, cause ocean acidification, and possibly influence the pattern of currents. All these changes will have serious effects on the biodiversity of these unique islands. We hope that our investment now will pay off in the future as we attempt to minimize the impact of this damage.

A submarine view into the Galapagos Marine Reserve © Vanessa Green



itineraries, develop methods to control such invasive species, and communicate the problem to schoolchildren, shipping operators, and authorities.

### Corals

With global warming, the ocean is becoming more acidic. This makes it likely that entire groups of coral will become extinct over the next 50–100 years, an extremely alarming prognosis given the rich marine communities they support. The case for protecting Galapagos corals is particularly strong. In spite of severe bleaching of corals in recent years, there are still fragmented coral reefs in the Archipelago, notably off the northerly islands of Wolf and Darwin, suggesting that Galapagos corals may be better able to adapt to climate change than corals elsewhere. Working with international coral and taxonomic experts, CDF scientists recently produced an extensive

overview of the condition of those last reef communities. While we are developing links with paleoclimatologists in the hope that past climate change can inform the future, we are also improving our understanding of coral health and disease,

working out the best way to assist the recovery of bleached reefs, and studying the impact that shark removal, dive tourism, anchor damage, and pollution have on coral communities.



An invasive North Pacific sea star (left) and a seahorse (above) that depends on coral. © www.jonathangreenimages.com

Niño on these vulnerable populations. Our research shows that although marine iguanas appear to be quite sensitive to changes in climate, they have also developed a surprising variety of unique adaptations to increase their survival. The evolving response of marine iguanas to these temporary climate shifts also enables us to begin to predict how longer-term changes in climate will affect this unique and fascinating species.



A marine iguana searches for a meal. © www.jonathangreenimages.com



## MEMBERS' CORNER



## \$110,000 RAISED for **PINTA ISLAND RESTORATION**

It is with great pleasure that we announce that Galapagos Conservancy has raised **nearly \$110,000** in response to a challenge grant campaign launched earlier this year to support the Pinta Island Restoration Project.

Thanks to GC's loyal members, 852 generous Friends of Galapagos accepted the challenge and donated \$57,539 in funding for the Pinta Project—exceeding the original challenge amount of \$50,000. As promised, the Panaphil Foundation reciprocated with a matching gift of \$50,000, for a grand total of \$107,539!

### **UPDATE ON PROJECT PINTA:**

The release of Española tortoises on Pinta was delayed due to the exciting discovery of hybrid tortoises with Pinta genes on Wolf Volcano on northern Isabela. In December 2008, Galapagos National Park personnel and a group of scientists, primarily from Yale University, conducted a massive tortoise survey and collection of blood samples on Wolf Volcano. We are now working directly with the Yale group to ensure a rapid analysis of the more than 1,600 samples collected. The results of this work will help to determine the next steps toward the restoration of a reproductive population of giant tortoises on Pinta.

While these analyses are being carried out, we still need to get tortoises onto Pinta so they can play their critical role in restoring balance to the island's ecosystem. Galapagos Conservancy's science advisor, Dr. Linda Cayot, is working directly with the Galapagos National Park to ensure that this occurs within a year. Following the establishment of the Galapagos National Park and the Charles Darwin Foundation in 1959, several giant tortoises that had been maintained by private parties were returned to the Tortoise Center on Santa Cruz. In the early years, these tortoises were held together and allowed to reproduce, potentially creating hybrid tortoises with ancestry from more than a single island. This practice was discontinued in 1976. Given that hybrid animals cannot be returned to the wild, these animals would have to be maintained in captivity for 150 to 200 years. An alternative is to sterilize the tortoises and release them on Pinta. This allows the tortoises to live in the wild, reduces costs of maintaining them in captivity for more than a century, and provides a catalyst for the restoration of Pinta.

In November, Dr. Cayot and three veterinarians with expertise in reptiles will travel to Galapagos to complete the sterilization of approximately 40 adult tortoises. The tortoises will continue to be housed at the tortoise center for a few months — both to ensure that they have completely recovered from the surgery and to wait until the most appropriate time for their release on Pinta. With the onset of rains, sometime in early 2010, the Galapagos National Park Service will complete the release of the sterilized tortoises on Pinta.

Prior to their release, scientists from the CDRS, the State University of New York – Syracuse, and Dr. Cayot will determine the best satellite tracking system for the tortoises to ensure effective monitoring once they are released on Pinta. During the first few months of 2010, Pinta should once again have tortoises roaming its slopes.

### **Spotlight Donor** Leslie Lenny of Arlington, ÝA

documentary about the terrible impact of feral goats and pigs on Galapagos habitats. It made me so angry that man

had allowed this destruction to occur and it appeared nothing could be done to stop it.

Peter, my late husband, and I had long talked about traveling to the islands, but as his heal<u>th began to</u> fail it became clear we would not make this trip together. In 2005, about two years after his passing, I finally made it to the islands, and Galapagos didn't disappoint.

I remember one magical moment, sitting in the panga off the coast of Floreana as our guide described the various conservation projects underway in the islands. The sky was an incredible blue, there were penguins about, and the mountains seemed to explode from the ocean. I had finally made it to that place that had moved me so 10 years earlier on TV!

While visiting the Charles Darwin Research Station's book store, I picked up a beautiful book. You can imagine my surprise when I flipped to a list of Friends of Galapagos Organizations on the last page and learned that Galapagos Conservancy's office was located across the street from my dentist in Virginia!

Back at home, I met with Galapagos Conservancy staff and was impressed by the practical, hands-on projects they sought to support. I was asked to help pay for fuel and salaries of pilots and hunters for the final phase of the Project Isabela Island restoration program, and I gladly signed on.

I had the opportunity to make a return trip to Galapagos in 2007. While hiking on Floreana, I saw something move in the distance. My guide (pictured above) confirmed that it was one of the few remaining feral goats on the island, and went on to tell the other passengers about the tremendous success of Project Isabela, which had been extended to other islands. I was very pleased to know that I had played a part in such an important project.

Following her 2005 trip, Leslie Lenny made a generous 10-year pledge to support Galapagos conservation and joined the GC Legacy Society by designating GC as a beneficiary in her will. She volunteers in our offices from time to time, and is a passionate ambassador for Galapagos conservation.



### **GC Donors Supported the Following Galapagos National Park Projects** in 2009

Marine Reserve Management: Repairs to the Tiburon Martillo, the Park's interdiction boat used to protect the Bolívar Canal (between Fernandina and Isabela islands), and to the freezer system at the Collection Center used by fishermen on Santa Cruz to market their product.

Short-term Specialists: Support for consultants in areas such as communications, marine resources management, participatory management, environmental law, and monitoring of terrestrial areas.

Environmental Education: Workshops to strengthen environmental education programs in local schools, involvement of teacher and students in maintenance of park areas, such as the trail to Tortuga Bay, and promotion of the "Scout Ranger Program" designed to involve youths in community and environmental programs.

**Travel for Training and Institutional Partnerships:** 

Support to enable Park officials to attend an international workshop in Poland, where they signed a cooperative agreement with the University of Warsaw and gave a speech on Biodiversity and Climate Change, and to Yellowstone National Park, to exchange experiences with Park managers in the US regarding protected areas.

# **Friends of Galapagos Organizations**

Fifty years after its founding, the Charles Darwin Foundation (CDF) remains the leader in Galapagos conservation research and its application. In its jubilee year, CDF has integrated research, community outreach, and its role as a policy adviser into three signature initiatives, each examining a different facet of how people and nature can live together in a sustainable way.

Project Floreana, the first holistic project for the restoration of an inhabited island in Galapagos, is underway with support from Friends of Galapagos Organizations (FOGOs) around the world. Thanks to the generosity of several donors, the UK's Galapagos Conservation Trust (GCT) has already committed more than £135,000 (\$215,000) towards this project. Friends of Galapagos New Zealand, FOGO Netherlands and the Japanese Association for Galapagos are also making significant contributions. The rich human history of this island from the 1800s has included pirates, fortune hunters, farmers, convicts, and, since the 1920s, a small permanent population. Over time, the human presence has resulted in the extinction of plants and animals unique to Floreana and the loss of habitat for many more. Project Floreana links ecosystem restoration with the lives and aspirations of local



### **GALAPAGOS ANIMAL ADOPTIONS** Now Available at www.galapagos.org

Galapagos Conservancy now offers two symbolic animal adoptions—Giant Tortoises and Marine Iguanas. All adoption packages come with a species fact sheet, framed animal photo, and a personalized adoption certificate with the name of the recipient and a unique animal name. Adoption benefits increase with the value of your donation.

Your generous adoption gift will support marine and terrestrial conservation programs in the islands.





**GOING GREEN:** Help GC help the environment by requesting to receive this newsletter by email instead of by mail. It's simple: email member@galapagos. org. Put "Going Green" in the subject line, and include your full name and address in the body

residents. By involving the community in the efforts to rebuild the native habitat, help restore populations of rare birds and animals and manage invasive species, the local inhabitants' livelihoods are integrated with conservation action, creating a long term model for sustainability.

Galapagos Conservancy will also fund Project Floreana, but has extended its support to the two other flagship initiatives for this anniversary year and beyond. "Galapagos Climate Change" is an integrated effort that aims to predict the impacts of climate change on the people, plants, and animals of Galapagos. "Human Impacts in Galapagos" will measure how human activities affect the Galapagos land and ocean ecosystems.

Finally, the Swiss Freunde der Galapagos Inseln is celebrating its 15th anniversary this year. Since 1994, when an enthusiastic group of Galapagos lovers came together to found the association, it has grown slowly but steadily. Today, with more than 1500 members and 200 donors, the Swiss FOGO continues to support the work of CDF and the Galapagos National Park in conserving the unique biodiversity of these enchanted Islands.

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### 2010 Galapagos Calendars



### (11 x 17 in. when open, \$13)

Featuring 47 breathtaking photos that will delight any Galapagos enthusiast.

On sale now at www.galapagos.org

## Galapagos Conservancy 2010 Photo Contest

### Congratulations to Sue Cullumber of

**Chandler, AZ** for her #1 winning photo of Two Giant Tortoises in the 2010 Galapagos Conservancy Calendar Photo Contest. Her photo graces the cover of the 2010 Galapagos Calendar, as well as the month of December. Twelve other winners' photos mark each of the months and back cover while showcasing Galapagos' amazing biodiversity and rich landscapes.

Visit **www.galapagos.org** and click on the **GALLERY menu item** to view this year's winning photos under "Calendar Winners."

If you're eager to submit your photos for the 2011 Galapagos Calendar Photo Contest, we are now accepting submissions. Please be sure to visit www.galapagos.org to read submission guidelines and rules.

Deadline for submissions is: July 15, 2011







Photos by GC Members (from top): Sue Cullumber, Andy Teucher, and Srdjan Mitrovic

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