Chagos News

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Cover image: East Point Plantation Settlement UAV orthomosaic © Tim Wilkinson, Royal Botanic Gardens Kew

Editorial

Rachel McCaffery, CCT Chair

As a scuba diver with a deep love of the natural world, it was my honour to step into the role of Chair of the Chagos Conservation Trust earlier this year.

Learning about the environmental issues that impact the Chagos Archipelago and the challenges we face in regards to rectifying some of the damage that has been done is daunting.

But meeting and talking to so many people with the passion and drive to meet these challenges gives me optimism for the future.

As part of its mission to conserve the incredible flora and fauna of the Chagos Archipelago, CCT has a high-impact goal of eliminating invasive rats from the islands to support a functioning tropical ecosystem with healthy biodiversity that can help boost the coral reefs' resilience to climate change.

Earlier this year the board of trustees committed to funding a feasibility study that will determine the most efficient, costeffective and environmentally sound way to eradicate rats from the archipelago's outer islands; an essential first step in establishing a rat-free archipelago.

As Sarah Havery, RSPB and CCT trustee, explains on page 14 this is an ambitious goal but one that will have a significant positive effect on the archipelago.

In keeping with our focus on the terrestrial environment we were very happy to fund, through the John Topp Botanical Fund, the Royal Botanical Gardens, Kew's expedition to Diego Garcia last November.

The goal of the expedition, as the team explains on page 4, was to survey the vegetation and create a botanical collection of the island's flora as prior to this data was fairly limited.

We're proud that both of these projects help us achieve our aim to ensure that this valuable natural environment is conserved and, as always, we thank all of our supporters and partners for helping to make this happen.

Surveying the vegetation of Diego Garcia

Sara Bárrios & Tim Wilkinson, Science Department, Royal Botanic Gardens, Kew

In November 2018 Sara Bárrios and Tim Wilkinson, a botanist and a spatial scientist from the Science Department of the Royal Botanic Gardens, Kew headed to the island of Diego Garcia with the aim of surveying the vegetation and making botanical collections.

Once known for its coconut plantations, the vegetation of Diego Garcia is now a complex mix of abandoned plantation sites gone wild, and areas where native plant species dominate. Prior to this field trip only very limited plant survey data was available for Diego Garcia. Using a suite of different survey techniques, both traditional and modern, the team planned to survey the whole island and its various habitats.

Collection and survey work

The expedition began with a more traditional survey approach, where we divided the island into areas and defined survey lines

where vegetation was recorded every mile. Page 5 shows a map with the location for all observation points (186 in total) and botanical collections (34 in total) made during this trip.

These botanical data will be made available online via Kew's <u>UKOTs Online Herbarium</u>.

In addition to traditional recording of ground truth points with digital survey forms and 2D photos, we experimented capturing survey points with 360° photos.

Annotated habitat images were recorded using a Ricoh Theta V 360° camera, which are available to view <u>online</u>. We have found this imagery to be particularly useful for habitat classification.

The plant survey dataset collected will now be used to guide and validate the mapping of Diego Garcia's vegetation using very highresolution satellite images

We also travelled with a drone with the aim of



Tim Wilkinson preparing flight plans for the eBee Plus UAV (right) used to gather the aerial images © Sara Barrios, Royal Botanic Gardens Kew

and the court of the

performing flights to survey a representative area of the island vegetation.

In total six flights were flown covering a portion of the eastern limb of the atoll from the reserve entrance up to Horsburgh Point, and an area around the East Point plantation settlement.

A camera mounted on the drone recorded images at a resolution of 10cm per pixel and in total a distance of 105km was covered. For each flight the set of images have yielded high quality image maps, orthomosaics, and complimentary photogrammetrically derived digital surface models (DSMs).

The most significant problem we encountered was with finding appropriate take-off and landing sites as the high tides restricted the areas from which it was possible to launch and recover the drone, and hence the area of the reserve accessible for us to survey.

The orthomosaics and DSM's generated from drone imagery can provide a baseline map from which to measure change and have significant potential to map, quantify, and monitor plant species of interest, namely the coconut palm (*Cocos nucifera*) and ironwood (*Casurina equisetifola*), as well as locate bird roosts and record turtle tracks. To encourage recording of native and introduced species by Diego Garcia base personnel using the citizen science iNaturalist phone app, a <u>dedicated iNaturalist page</u> was set up and populated with some of our observations.

We also collected the first seeds from this overseas territory which have now been processed and accessioned at Kew's <u>Millennium Seed Bank</u> and several fungi which have likewise been incorporated in the <u>Fungarium</u> at Kew.

Main botanical findings

The native flora of the Chagos Archipelago, which includes Diego Garcia, is considered to comprise 41 species of flowering plants and four species of fern, plus a wide variety of mosses, liverworts, fungi and cyanobacteria.

No endemic species of plant have been identified yet, possibly due to the young age of this land mass. The flora is composed of pantropical widespread plant species which sustain all the other terrestrial island biodiversity.

On Diego Garcia, old plantation areas that are now abandoned show a very low diversity of plant species, forming what is known as



"coconut chaos". Natural light struggles to penetrate the ground and mosquitos and invasive rats are abundant.

In contrast, in areas where the native vegetation dominates the number of plant species is much higher, natural light is more abundant and native coconut crabs and seabirds thrive.

These areas, such as Barton Point-the most eastern point of the island, and small areas around Simpson Point on the western arm of the island, should be a priority for plant conservation on Diego Garcia.

Continuous monitoring of invasive species is heavily recommended, specifically the spreading of the following plant species: Tabebuia heterophylla. Bryophyllum pinnatum, Casuarina equisetifolia and Leucaena leucocephala.

Future work

In order to continue the work started during this expedition, future plant-driven expeditions should aim to complete ground 'truthing' of the outer islands of the Chagos Archipelago to validate the vegetation maps; map the full distribution of native and introduced plant species; develop a National Red List for

the native plant species of the archipelago, and establish a management strategy for introduced plant species.

Our work on the atoll will help to inform on the wider conservation management aims for the Chagos Archipelago, which look to foster the native vegetation to the benefit of the wider ecosystem.

Acknowledgements

We would like to thank the Chagos Conservation Trust (CCT) for the financial support for this trip and Helen Pitman, Director of Chagos Conservation Trust for facilitating and encouraging our funding application.

Our colleagues at Kew, Dr Colin Clubbe, Dr Martin Hamilton, Dr Justin Moat and Ms Jenny Williams for sharing their expertise and help in preparing the field trip logistics and data.

And finally, we would like to thank BIOTA's Chief Science Advisor and BIOT Environment Officer as well as the British Indian Ocean Territory Administration (BIOTA), for their encouragement of our plans and advocacy in our deploying the UAV to Diego Garcia and for help with permits and support with expedition logistics.



Tim Wilkinson, Royal Botanic Gardens Kew

News in brief



Island invasives

CCT's paper on the <u>Darwin Plus funded</u> <u>Ile Vache Marine pilot eradication</u> <u>project</u> has been published in the IUCN's proceedings of the international conference on island invasives 2017.

The paper, with lead author Dr. Grant Harper of Biodiversity Restoration Specialists, details the project that resulted in the first successful rat eradication in the Chagos Archipelago, representing a significant breakthrough for achieving a rat-free archipelago in the future.

The 2014 operation was successful on what are regarded as difficult islands for rat eradication, with their wet tropical climate and land crabs and coconut plantations to contend with. The outcome has engendered confidence to proceed with an eradication programme for the outer Chagos islands.

Read the article on P14 for CCT's next steps.



Seabirds of Danger Island

At the beginning of the year a team from ZSL's Institute of Zoology travelled to Danger Island to research its seabirds.

They deployed sets of tracking devices on 33 Red-footed Boobies and 15 Brown Boobies, enabling the researchers to track for the first time where the birds go when they leave the island.

During the expedition they also conducted a whole-island census of breeding seabirds. It is estimated that over 700 pairs of Red-footed Boobies are breeding on Danger Island, in addition to smaller populations of Brown Boobies and other seabird species.

Read the full blog here.

This important work is funded as part of the Bertarelli Programme in Marine Science.





Turtle Cove's turtles

Researcher Jeanne Mortimer continues her long-term study of juvenile sea turtles. Located at the extreme south end of the inner lagoon of Diego Garcia island, Turtle Cove provides a unique feeding habitat for these iconic reptiles.

The Critically Endangered hawksbill turtle is found here, along with small numbers of the Endangered green turtle.

These long-term studies have shown that individual turtles may reside at Turtle Cove for more than 20 years. During the expedition a previously tagged adult male hawksbill was captured who had originally been tagged in 1999.

Read the full blog here.

This important work is funded as part of the Bertarelli Programme in Marine Science.



The future for coral reefs

Coral reef experts from around the globe are calling for an urgent reevaluation of our climate goals in light of increasing evidence of the world's fragile coral reef ecosystems changing at an unprecedented rate.

In a <u>Functional Ecology</u> special feature some of the leading coral reef experts are asking questions about the priorities for reef conservation and reef ecology in the face of the changes that have been witnessed, which have far exceeded predictions.

Professor Nick Graham of Lancaster University said: "Coral reefs have been with us in some form since the dinosaurs and today they are at the frontline in terms of responses to climate change and a range of other human pressures...."

Read the full article here.



Rachel Jones, Zoological Society of London

The issue of plastic pollution is high on the list of environmental challenges we face today.

High-profile campaigns and shocking documentaries have shown how, in just a few decades since coming into common use, plastic has accumulated in huge quantities.

With less than 10% recycled to date and resisting degradation for decades, most of the billions of tonnes of plastic ever produced still exists somewhere in the world, much of it in the ocean.

A short walk along a beach in the Chagos Archipelago is all that is needed to see evidence of this problem piled up—and it's a disturbing sight.

These islands are some of the most remote in the Indian Ocean; the next nearest land mass is Addu atoll in the Maldives 500km away. However, if you look at the whole Indian Ocean basin you'll see a largely enclosed sea ringed by growing human populations along the coastlines from East Africa to South East Asia.

Ocean currents driven by monsoonal winds can bring floating debris from all over the Indian Ocean to the beaches of the archipelago—in oceanographic terms they are at the centre of a perfect storm of plastic.

Plastic debris collecting on beaches is particularly significant for sea turtles. The British Indian Ocean Territory Marine Protected Area has regionally significant populations of both green turtle (*Endangered*) and hawksbill turtle (*Critically Endangered*).

Long stretches of the island's beaches are studded with depressions called 'body pits' left by nesting females coming ashore to lay their eggs. However plastic waste in and on the sand can impede the females from excavating the deep holes they need to dig for their nests, sometimes causing them to give up.

While the eggs are developing in the nest, temperature plays a key role in determining the number of male and female hatchlings.

Too hot and the hatchlings can become overwhelmingly female, an increasingly common problem for turtles in today's warming world.

Microplastics in the sand column can conduct heat faster than the surrounding sand and may be changing the conditions in ways that skew hatchling sex ratios.

Beach plastic also accumulates in the body pit over the nest and when hatchlings emerge six weeks after the eggs were laid, they are immediately faced with a pile of waste between them and the sea.

Turtles may also ingest plastic when foraging and can even become entangled in plastic in the water. All of these things mean that for an aquatic, air-breathing animal dependent on clean beaches, plastics are a significant environmental hazard at several points in the sea turtle's life history. For all these reasons, better understanding how plastics affect the natural environment in the Chagos Archipelago is one of the key objectives of a new three-year project partnering the British Indian Ocean Territory administration with Swansea University and the Zoological Society of London, funded by the Darwin Plus fund from DEFRA.

The team will study the ways in which plastics interact with turtles and identify mitigations to minimise the negative impacts.

They will record and categorise the plastics washing up on beaches and recruit volunteer help to clear the beaches to coincide with the turtles' nesting seasons.

The final part of the puzzle is what to do with plastics that are collected when you are a long way away from the nearest recycling centre.

Over the course of the project the team will assess new technologies in the reuse and recycling of waste plastics, and look for ways to make them work in the challenging environment of the Chagos Archipelago.



BIOTA briefing

Celebrating World Oceans Day

The 8th of June marked World Oceans Day, an opportunity for people around the world to celebrate the oceans that connect us all.

Life on Diego Garcia is touched by the oceans every day, from the beautiful wildlife that has made BIOT its home, to the long white coral beaches that surround us.

World Oceans Day is also a day of action, a chance to defend our oceans from the human activities that threaten their health and well-being.

Coastal clean-up

Beach cleans are a regular and popular volunteering opportunity on Diego Garcia. Plastic and fishing waste arrives on the tide from across the Indian Ocean and washes up across BIOT.

The BIOT Administrator, Linsey Billing, and our two Environment Officers joined a group of volunteers from the Royal Navy and the US military to clean a stretch of beach near East Point Plantation.

They collected an impressive 40 bags of waste, showing not only their dedication to BIOT, but also the threat plastic poses to even the most remote areas of our planet.

Tackling the plastic problem

We look forward to welcoming the scientists from the Zoological Society of London who will be joining us to start a new plastics project, funded by the UK Government's Darwin Plus grant.

They will be look at the types of plastics on BIOT, its impact on our endangered turtle population, and possible technological solutions to recycle what has been collected.

New Environment Officer

The BIOT Administration would like to warmly welcome Nadine Atchison-Balmond who has joined as Environment Officer.

She will focus on terrestrial activities alongside Environment Officer Harri Morrall, who will focus on marine issues.



The British Indian Ocean Territory (BIOT) is one of 14 British Overseas Territories.

It is administered from London by the British Indian Ocean Territory Administration. https://biot.gov.io





Over the decade since the designation of the British Indian Ocean Territory's fully protected MPA, the Chagos Archipelago has seen two significant episodes of coral bleaching due to extreme sea temperatures, resulting in high levels of coral mortality and a reduction in the functionality of the reefs.

This is not unique; coral bleaching caused by global warming is damaging reefs worldwide. In the past, the archipelago's reefs have been able to recover because of their protected status and unpolluted waters.

But in recent years, as bleaching events have become more frequent, we need to do everything we can to help them recover.

The black rat (*Rattus rattus*) is one of the world's most damaging invasive species and was accidentally introduced to these islands in the 1700s. Rats decimate seabird populations by eating eggs and chicks.

It is now known that this in turn can affect the health of the surrounding reefs; scientists have recently discovered a link between healthy seabird populations on islands and key reef health metrics, such as herbivorous fish populations (Graham et al., 2018).

Where invasive rats are present, this natural link between islands and reefs is broken, causing degradation to coral reefs.

Rat-infested islands have significantly fewer seabirds, particularly ground nesting species, thus reducing the volume of bird droppings, which act as a natural fertiliser for corals and an important contributor to reef health and recovery. In addition, rats are significant predators of turtle eggs and hatchlings and therefore also impact Chagos Archipelago's iconic and globally threatened reptiles.

There is hope, however. Over the last 50 years conservationists in New Zealand and around the world have developed and honed

techniques to fully eradicate rodents from islands using both ground-based techniques and aerial operations with helicopters.

In total, over 332 successful rodent eradications have been successfully completed on islands globally (Howald et al., 2007). Aerial operations have enabled conservationists to scale up to the challenge, accounting for over 76% of the total invasive rodent-free area worldwide; with the largest successful rat eradication being on South Georgia, covering a total of 108,723 hectares.

Following eradication efforts, projects have seen the recovery of seabird populations as well as other biota including reptiles, plants and native mammals (Towns et al., 2006).

By eradicating rats, we can restore an entire ecosystem, allowing the natural plants and animals of the Chagos Archipelago to recover and once again flourish, in turn increasing the reefs' resilience to climate change.

CCT has set itself an ambitious and highimpact goal of eradicating invasive rats from all of the outer islands of the Chagos Archipelago. To do this, following international best practice procedures, CCT first aims to produce clear recommendations by early-2020 of the most appropriate and cost-effective method for achieving rat eradication.

Following effective planning and fundraising, CCT hopes to be in a position to be delivering the eradication by 2022/23.

By planning for a multi-island rat eradication programme, we will be aiming to provide 95% more invasive predator-free habitat for seabirds to repopulate which, in time, could result in a 250-fold increase in nutrient flow to the reefs.

Through this ambitious conservation action we hope to ensure the Chagos Archipelago is a functioning tropical ecosystem with healthy biodiversity and biomass levels, giving its reefs the best possible chance for recovery and building their resilience in the face of climate change.



The Chagos Archipelago is a rare haven of beautiful reefs, diverse wildlife and clean waters, located in the midst of the Indian Ocean. The Chagos Conservation Trust is the only UK charity dedicated to protecting it.

For more information please visit chagos-trust.org

If you would like to contribute to Chagos News please email chagosnews@chagos-trust.org

