

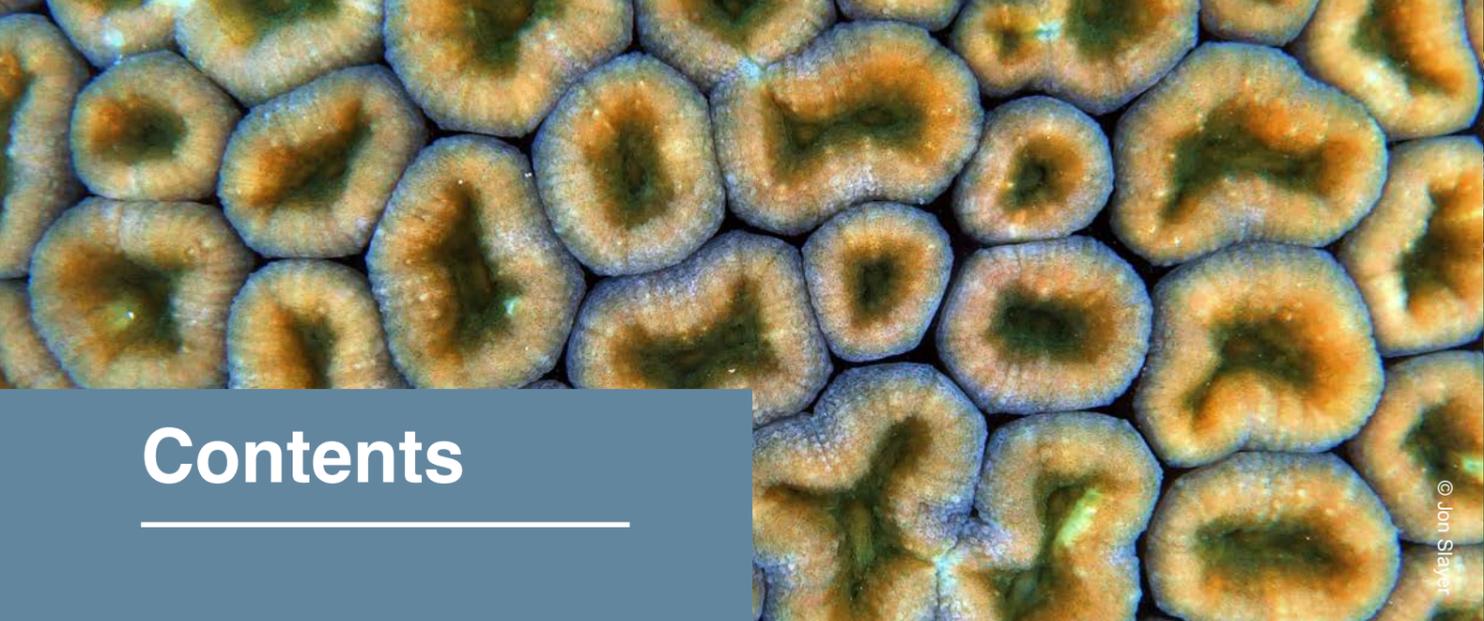
# Chagos News

The Periodical Newsletter of the  
Chagos Conservation Trust and  
Chagos Conservation Trust US

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Dr. Natasha Gibson

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**The events of the last few weeks have brought climate change back into focus, namely the unprecedented heat dome in the Pacific Northwest, and to a lesser extent, the controversy around UNESCO’s intention to put the Great Barrier Reef on a world heritage “in danger” list.**

The headline article in this edition of the Chagos News is timely as it is an eyewitness account of the bleaching that occurred in 2015 in the Chagos Archipelago because of global warming of the oceans.

This event was followed by another event in 2017, but also evidence the rat-free islands in the area were more resilient to bleaching. Studies established the link between seabird guano runoff and coral resilience, and to CCT’s development of the rewilding Healthy Islands, Healthy Reefs programme.

This programme is now ramping up with the successful application for funding from the Darwin Plus scheme. This is a UK government grants body that finances projects that protect the unique biodiversity and improve resilience to climate change within the UK Overseas Territories.

CCT can now embark on the second phase, Research and Development, and hire a Programme Manager, and Chagossian research assistant for the proposed 2022 field expedition.

The aim of this phase is to investigate proposed rewilding methodologies and investigate the current environments of the initial islands targeted for the rewilding phase.

This staffing also reflects CCT’s ongoing commitment to involving the Chagossian community here in the UK in conservation in the archipelago.

Our second article highlights a complementary study that suggests that habitat reconstruction is significantly improved when remnant agricultural plantations are removed.

In the Chagos Archipelago, these are the former coconut plantations that were established in the middle of the islands and now form a monoculture with limited biodiversity as seabirds prefer not to nest in these trees.

And our final article details the recent expedition by two PhD students from Imperial College to collect eDNA samples to investigate the zooplankton as well as shark species diversity on the archipelago’s coral reefs.

These researchers were also able to assist CCT by collecting a small set of similar samples to test whether terrestrial mammalian species could be detected from island water runoff in shallow reef environments.

If successful, this technique could be a valuable tool in monitoring biodiversity before, during, and after the rewilding plans of Healthy Islands, Healthy Reefs.

Thank you again for your continued interest and support, and all of us here at CCT continue to look forward to updating you on the progress of Healthy Islands, Healthy Reefs!

Cover image: The Golden Shadow in the Chagos Archipelago © Khaled bin Sultan Living Oceans Foundation/Sam Purkis

Copy editor: Rachel Mills <https://about.me/rachmillstravel>

# Last Stop on the Global Reef Expedition

Liz Thompson, Director of Communications, Khaled bin Sultan Living Oceans Foundation

**Scientists aboard the Global Reef Expedition – the largest systematic coral reef survey and mapping expedition in history – travelled to Chagos Archipelago to explore its remote coral reefs. What they found were reefs teeming with life, but also worrying signs of the unfolding coral reef crisis.**

The Khaled bin Sultan Living Oceans Foundation conducted a Global Reef Expedition to assess coral reef status and resiliency around the world.

The Expedition took 10 years and circumnavigated the globe, visiting more than 1,000 reefs in 15 countries in the Atlantic, Pacific and Indian Oceans and their associated seas.

The Global Reef Expedition surveyed coral and fish communities on some of the most remote coral reefs on Earth, and there is no

better place for this than the Indian Ocean's Chagos Archipelago.

In 2015, an international team of scientists arrived on the archipelago to carry out its final Global Reef Expedition research mission.

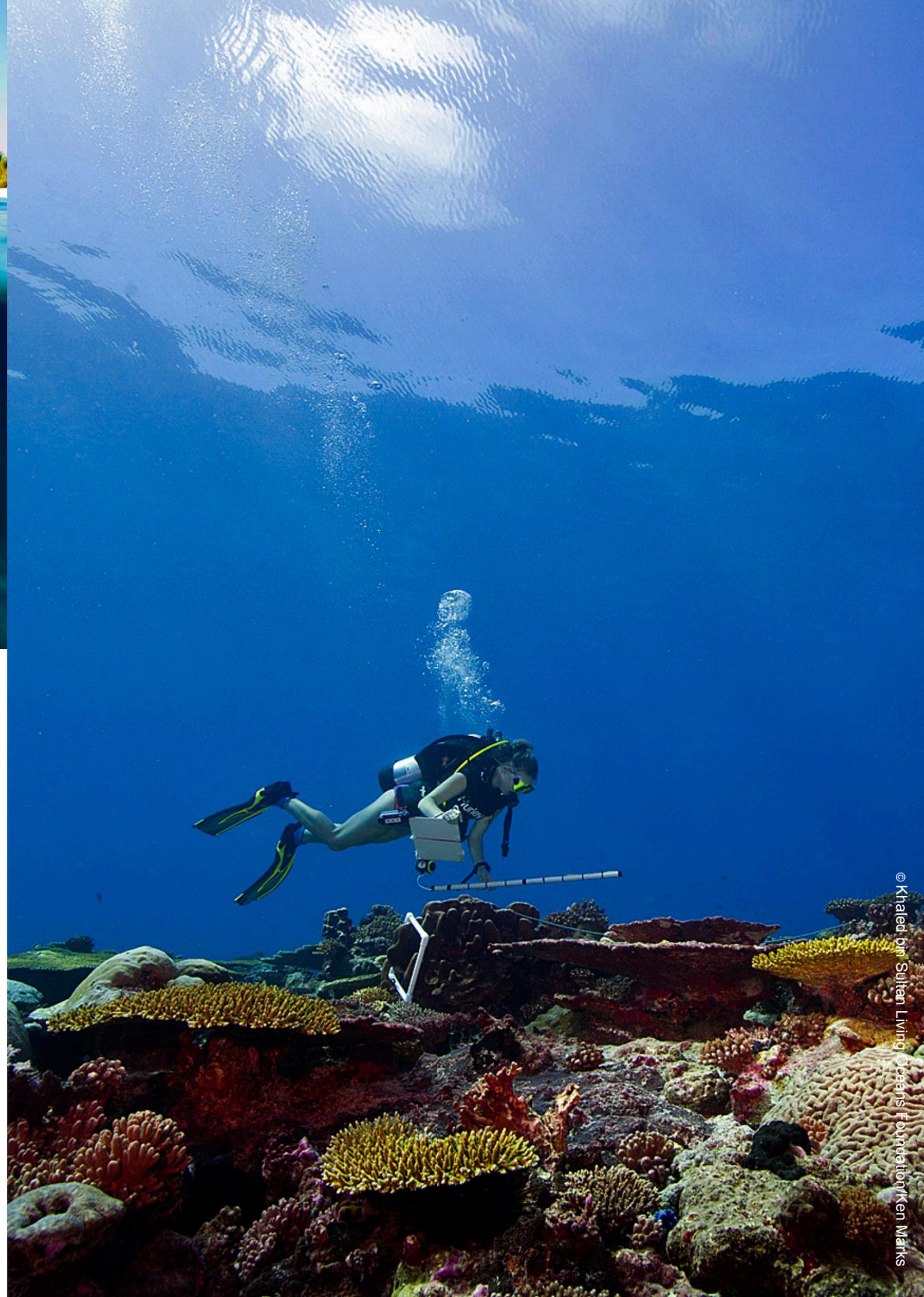
Over the course of two months at sea, the scientists conducted thousands of surveys of the benthic and reef fish communities at over 100 locations.

## The last great coral reef

Because of its remote location and protected status, Chagos Archipelago is the perfect place to study global issues such as climate change and overfishing that threaten the long-term survival of coral reefs.

Around the world, reefs are declining due to a variety of human impacts, including coastal development, fishing and pollution, but on the archipelago these local pressures are absent

© Khaled bin Sultan Living Oceans Foundation/Ken Marks



© Khaled bin Sultan Living Oceans Foundation/Ken Marks

since it is uninhabited, save for the military base on Diego Garcia. Prior to the expedition, estimates indicated the Chagos Archipelago could contain more than half of the healthy reefs remaining in the Indian Ocean.

What the Global Reef Expedition found was a stark reminder that the coral reef crisis is affecting reefs everywhere, even in the last great coral reef wilderness on Earth.

When the research mission in the Chagos Archipelago began, scientists found reefs that were truly exceptional; they had some of the highest density of coral and fish recorded on the entire Global Reef Expedition.

Reefs were teeming with schools of jacks and snappers, swarms of small fish clung to the reefs, and large fish such as groupers, sharks and rays were found throughout the area.

The archipelago had a diverse assemblage of corals and an astounding abundance and diversity of life in the water and on the seafloor.

However, towards the end of the research mission, the scientists witnessed the beginning of what would become a catastrophic and global coral bleaching event.

### A global coral bleaching event

In the clear and unusually calm waters of the Indian Ocean, scientists watched as a warming ocean bleached reefs before their eyes.

During the first signs of bleaching, corals turned vibrant, almost neon-coloured shades of pink, blue and yellow before turning white, as the corals tried to protect themselves from the sun's harmful rays after losing their symbiotic algae.

As the warm waters persisted, the extent of the bleaching was readily apparent and impacted the vast majority of the shallow-water corals.

There was hope that corals of Chagos Archipelago would bounce back to health

relatively quickly. But a study after the bleaching event found live coral fell dramatically from the relatively healthy 31–52% observed on the Global Reef Expedition, to only 5–15% shortly after.

Since then, there have been promising signs the reefs are recovering, but it is unlikely that the reefs will regain their high coral cover for at least a decade.

Because the Global Reef Expedition was the last research mission to survey the reefs prior to the bleaching, the Living Ocean Foundation's findings will be extremely useful to marine managers as they assess the impact of the bleaching event and monitor how the reefs are recovering over time.

The scientific findings from the research mission were recently published in *The Global Reef Expedition: Chagos Archipelago Final Report*.

This report contains detailed information on the diversity and abundance of corals and reef fish species, along with valuable baseline data on the state of the reefs at a point in time.

This report can help government agencies, conservation organizations and scientists manage and conserve reefs in the archipelago.

### Will the archipelago's reefs survive?

The world has lost 50% of its coral reefs in the past 30 years. The rest could be gone by the end of the century if nothing is done to save them.

With the increased frequency of coral bleaching due to a changing climate, combined with growing human impact including overfishing and pollution, coral reefs face an uphill battle to survive.

However, the reefs of the Chagos Archipelago face some of the best odds of survival, despite this recent bleaching event. They are protected, relatively free from human influence and they still contain large and healthy fish populations and a stunning diversity of life.

This diversity may be helping the reefs recover from bleaching and may also be one of the key factors that could help these reefs survive well into the future.

The Global Reef Expedition mission to the Chagos Archipelago gave scientists the chance to study pristine coral reefs.

Their findings illustrate what remarkable places coral reefs can be when given the opportunity to thrive, but they also highlight the perils all reefs face in a changing world.



© Khaled bin Sultan Living Oceans Foundation/Phil Renaud

### The Khaled bin Sultan Living Oceans Foundation

The Khaled bin Sultan Living Oceans Foundation is a nonprofit environmental organisation that works to protect and restore the world's oceans through scientific research, outreach and education.

As part of its commitment to *Science Without Borders*®, the Living Oceans Foundation provides information to governments, scientists and local communities so that they can use the latest science to work towards sustainable ocean protection.

[www.livingoceansfoundation.org](http://www.livingoceansfoundation.org)

# News in Brief



## Milestone for CCT

CCT has hit an important milestone in its Healthy Islands, Healthy Reefs programme.

The BIOT Administration has approved the feasibility study, which included an environmental impact assessment, commissioned by CCT in 2020.

These important documents, peer-reviewed by Island Conservation and the Island Eradication Advisory Group, determine the most efficient and cost-effective method for eradicating invasive rats from the Chagos Archipelago.

CCT would like to thank the BIOT Administration for its continued support of this important programme of work and Grant Harper, Pete Carr and Sarah Havery for their expertise.



## Filling knowledge gaps

CCT has been awarded a Darwin Plus grant as part of the Healthy Islands, Healthy Reefs Research and Development project.

The project will include an expedition to the archipelago in 2022 where experts will acquire increased knowledge and data about the presence or absence of introduced predators on the remaining unconfirmed islands.

It will determine the optimum bait application rates by considering bait off-take by rats and crabs and develop the specialised requirements for baiting mangroves.

It is vital to acquire this information to maximise the probability of successfully eradicating rats, an essential step to rewilding the archipelago.



## Impact of heatwaves on turtles

Researchers have found that the impacts of devastating marine heatwaves extend to terrestrial systems and cause high sea turtle nest temperatures with the lowest hatchling survival rates in 70 years.

They recorded anomalously warm conditions on both coral reefs and sandy beaches in 2016, which caused major coral bleaching and likely had consequences for sea turtle hatchling survival and sex ratios. Modelled hatchling success dropped from >85% to <70% during the heatwave.

As marine heatwaves increase in frequency and intensity, sea turtle nesting beaches and other terrestrial coastal environments will be impacted negatively.

[Read the full paper here.](#)



## Chagossian Voices conference

Chagossian Voices held a virtual conference on Saturday 3rd July, where they outlined their views, concerns, needs, demands and personal histories in an interactive conference format.

The conference was for all those who represent Chagossians, speak for and about Chagossians, who have and have had influence over their lives, who believe in justice and representation and all who want to learn and understand more about what Chagossians actually think, feel and need.

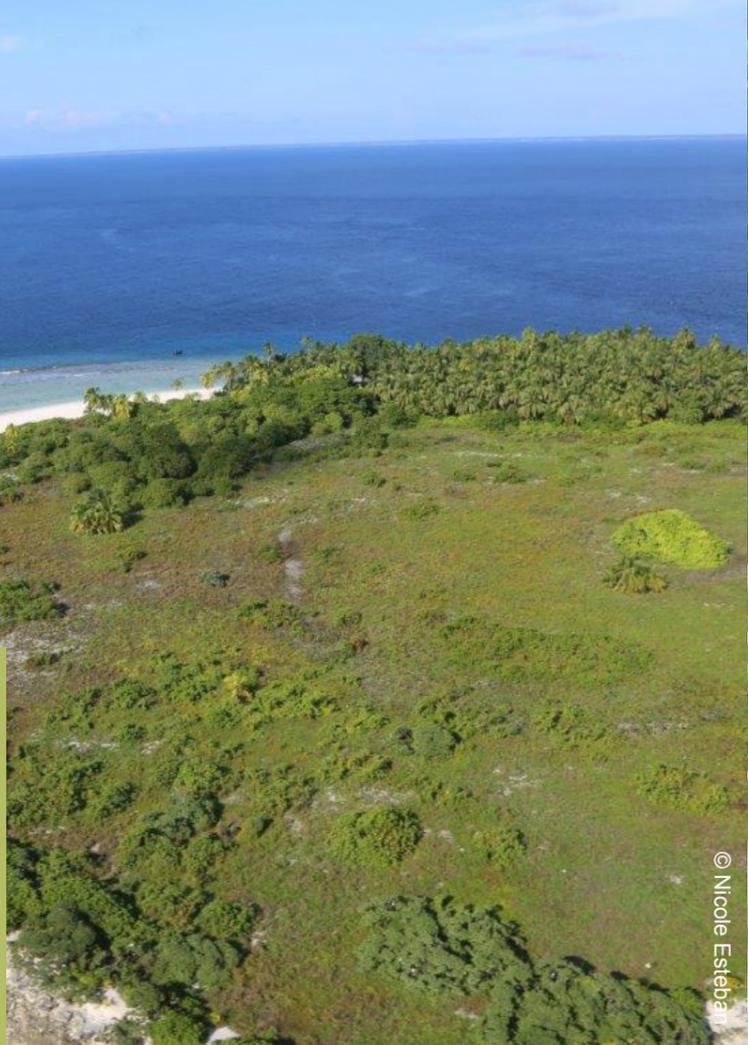
It had videos from government and charitable organisations who have influence over the lives of the Chagossian people as well as from members of other community groups who they have been working with, interspersed with music and live sessions.

[The conference can be viewed on their Facebook page here.](#)



# Rats, Coconuts and Seabird Islands

Peter Carr, Institute of Zoology, Zoological Society of London



© Nicole Esteban

**Extensive research has been carried out into whether breeding seabirds will benefit from the conversion of abandoned coconut plantations to native habitats, after the islands' predators have been eradicated.**

On many Pacific and Indian Ocean islands, colonisation by humans brought invasive species, native vegetation destruction and development of coconut plantations, leading to the decimation of seabird populations. The coconut industry on oceanic islands has since crashed, leaving the legacy of abandoned coconut plantations that by themselves, are species poor biomes.

When an island's flora is dominated by abandoned coconut plantations and it has invasive rats, it becomes an avian desert.

A team from the Institute of Zoology, Zoological Society of London along with colleagues from the Royal Botanic Gardens,

Kew and Exeter and Heriot-Watt Universities have been researching the possible outcomes for breeding seabirds of eradicating rats from oceanic islands, with and without conversion of the associated abandoned coconut plantations.

Working for over a decade collecting data in the Chagos Archipelago, we have counted every breeding seabird on all 55 islands of the archipelago and mapped and recorded the habitat they were breeding in.

By comparing the number of seabirds breeding in a specific habitat on rat-free islands, we were able to predict the number of seabirds that could potentially colonise an island if invasive rats were eradicated and abandoned coconut plantations were converted to native habitats.

This is especially relevant in the Chagos Archipelago as some 94% of the terrestrial landmass is rat-infested and the vegetation



© John Cubbe

on these rat-infested islands is dominated by abandoned plantations.

We hypothetically ecologically restored Ile du Coin in Peros Banhos atoll, a rat-infested island where 92% of its vegetation is former coconut plantation. It is the fourth largest island (1.26 sq km) in the archipelago and is representative of all rat-infested islands in the archipelago larger than 50 hectares.

At present there are 51 pairs of breeding seabirds made up of three generalist species, brown noddy (*Anous stolidus*), lesser noddy (*Anous tenuirostris*) and common white tern (*Gygis alba*).

We predict that following rat eradication, without any habitat management, the number of breeding pairs could rise to 4,306 of 14 species. If though, 1 sq km of abandoned plantation was converted to equal measures of native savannah and forest, the number of breeding species could potentially increase to 319,762 of 16 species – more than the entire archipelago at present.

This research has practical applications not just in the tropical Indian Ocean, but throughout the tropics. We have shown that to restore tropical oceanic seabird islands that have been ecologically degraded due to introduced mammalian predators and native habitat destruction, eradicating the predator

as a single intervention is unlikely to result in fully functional seabird-driven ecosystems.

On degraded islands where invasive rats and abandoned coconut plantations exist together, to restore seabird-driven ecosystems, rats must be eradicated, and the abandoned plantations converted to native habitat.

In the Chagos Archipelago, as elsewhere in the Indian Ocean, restoring seabird islands is no longer a 'green dream', it is a matter of funding and political goodwill.

Our research shows the requirement for an ecosystem-wide approach and demonstrates the potential gains to the family of birds that are suffering the greatest decline in number – seabirds.

This research was published as:

Peter Carr, Alice Trevail, Sara Bárrios, Colin Clubbe, Robin Freeman, Heather J. Koldewey, Stephen C. Votier, Tim Wilkinson & Malcolm A.C. Nicoll. (2021). *Potential benefits to breeding seabirds of converting abandoned coconut plantations to native habitats after invasive predator eradication*. Restoration Ecology DOI: 10.1111/rec.13386

This research was conducted as part of the Bertarelli Programme of Marine Science.

This article has previously been published in the Indian Ocean Seabird Group newsletter 8.



## Chagossian Voices: Stronger Together

Helen Pitman, Chagos Conservation Trust

### Chagossian Voices is a community platform for the Chagossian global diaspora.

Made up of members of the community from Crawley, Manchester and Derby in the UK and working alongside groups in Mauritius and the Seychelles, they provide communication between Chagossians, and present Chagossian priorities to the wider world, particularly to those with the power and influence to improve their lives.

Since they launched in October 2020, Chagossian Voices has organised a major international conference (December 2020), organised several meetings with the FCDO and the Home Office, liaised and partnered with established Chagossian community groups and presented Chagossian priorities to the UK parliament's Chagos APPG.

In addition, they organised a submission to the consultation for the UK government's New Plan for Immigration alongside a petition from the community with 500 signatures.

They continue to lobby many organisations, including the UN, in order to ensure that Chagossian voices are heard, and they aim for co-operation between Chagossian groups and community leaders, whilst providing the Chagossian community with accurate and up-to-date information.

CCT is very proud to be partnering with this dynamic group to develop a community website that will be a great resource for the community and for people wanting to learn more about the community and the Chagos Archipelago.

We hope this will be a long-term relationship that can ensure all our work has community input and we're starting by recruiting a community member to join the 2022 expedition as a research assistant.

Over 40 community members completed the Connect Chagos programme that ran until 2015 and we're hoping some people would like to get involved again.



© Pete Carr



© Jon Slaver

# BIOTA Briefing

**In June, on Diego Garcia, Holly Stokes (Swansea University) and Milly Fellows (BIOT Environment Officer) hosted an exciting event on World Sea Turtle Day, to celebrate the 20<sup>th</sup> anniversary of the Indian Ocean and South East Asia (IOSEA) Marine Turtle Memorandum of Understanding (MOU).**

The event was well attended with a record-breaking number of volunteers collecting data from 19 hawksbill turtles (*Eretmochelys imbricata*) and one immature green turtle (*Chelonia mydas*).

The event was a huge success. Over five hours, the team captured, measured and weighed, tagged and took skin biopsies (for DNA analysis) from all turtles. Additionally, they were able to retrieve three satellite tags attached to turtles in 2018 and two depth loggers attached in Feb 2021.

The event was filmed by a media team (American Forces Network) and is now being aired on the island and contributed to a documentary by the IOSEA about ongoing turtle research (view on YouTube).

The event was particularly enjoyable as Turtle Cove is usually off bounds for swimming to

protect this important foraging habitat for turtles, sharks and rays. It also gives the volunteers hands on opportunities to work with sea turtles.

Diego Garcia is an important place for two species of sea turtle, hawksbill and green. The variety of habitats that the island provides include open nesting habitat for green turtles that nest all year round, with a peak from June to September.

Hawksbills also nest here with a peak from November to February. Immature hawksbills can be found in relatively high numbers at Turtle Cove, as it provides an area of shelter and food.

Flipper tagging research indicates that some turtles have been resident in Turtle Cove for over 20 years.

As well as giving presentations to the contractors and military personnel about turtle ecology, recent findings and ways to reduce single-use plastic on the island, the turtle team carry out ongoing research including looking at environmental conditions such as vegetation type and sand temperature data to see how this affects reproductive success of nesting turtles.

New methodologies to estimate nesting turtle populations are carried out by deploying camera traps on Diego Garcia as well as some of the outer islands.

The team are recording tracks and false crawls to determine the success of nesting and nest excavations to understand the success of hatchling emergence; these surveys are also well attended by volunteers.

Beach cleans are a popular volunteer activity on the island, even being carried out by visiting ships. This helps to clear important nesting areas from debris that has washed up and often gathers at the vegetation line.

Made up of mostly plastic, rubbish on the nesting beaches can complicate nesting and obstruct hatchlings reaching the ocean.

2021 was another hugely successful turtle expedition. It began in February 2021 (Holly stayed on for additional time) and created a strong volunteer base and interest, as well as a positive rapport with contractors and military personnel.

It is the volunteers that make our work possible and the turtle team would like to extend a huge thank you to everyone for their ongoing support!



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.

## Obituary - Bruce Dinwiddy

We are sad to inform our readers of the death of one of our members, Bruce Dinwiddy, CMG, on 1 April 2021.

He was a loyal supporter of CCT for many years, a good friend and an extremely pleasant character who will be greatly missed by those longer-standing readers who were fortunate enough to know him.

Bruce was a diplomat who joined the FCO in 1973 and held a wide range of foreign postings before being appointed Head of the Africa Department (Southern) and Commissioner of the British Indian Ocean Territory from 1995 to 1998.

He was High Commissioner to Tanzania from 1998 to 2001 before being appointed Governor of the Cayman Islands from 2002 to 2005.

He had a real interest in, and worked hard to support, environmental and conservation issues in the Chagos Archipelago and West Indies, and served on the Council of the UK Overseas Territories Conservation Forum (UKOTCF) from 2006.

He attended many CCT receptions and events and was one of the CCT team who attended the IUCN International Conference on Climate Change and Biodiversity Loss in La Réunion in July 2008.

Bruce lived in London with his wife Emma, and leaves a son and a daughter.



# Exploring the Invisible Diversity of Reefs

Rosie Dowell, PhD student, Imperial College London



**You may have noticed the term ‘environmental DNA’ or ‘eDNA’ cropping up more and more in articles about conservation, including recent mentions in this newsletter.**

A relatively new monitoring technique, eDNA uses genetic material left behind by organisms in the environment to investigate the presence of a single species or describe whole communities.

When targeting large vertebrates, the main source of this DNA is sloughed skin cells, faeces, gametes and mucus. This becomes a less clear cut when we target smaller organisms, such as plankton, where the genetic material picked up is likely to be a mix of those above and whole organisms captured in the sample.

Environmental samples, such as sediment and water, can be collected, preserved and processed in the lab to provide biodiversity data, without the taxonomy specialists and

large amounts of time or equipment required in traditional field techniques.

As part of the Bertarelli Programme in Marine Sciences (BPMS) investigation into the conservation value of coral reef biodiversity, we are hoping to utilise this method to better describe and understand zooplankton communities in the archipelago.

Coral reefs are considered among the most diverse ecosystems on Earth, but because the majority of research is focussed on coral and fish communities, little is known about the diversity of plankton.

Reef-associated zooplankton play a crucial role in coral and fish communities, providing a major food source and linking primary producers and higher trophic levels. Zooplankton can be hugely diverse and is made up of two important groups: Holoplankton, organisms whose entire life cycle is planktonic, and the meroplanktonic larvae of benthic invertebrates.

This planktonic life stage facilitates the dispersal and recruitment of many reef organisms and ultimately connects coral reefs together on small and large scales. This is crucial in maintaining their genetic diversity and resilience in the face of anthropogenic threats.

## **Chagos Archipelago reef expedition**

In April and May of this year, thanks to a lot of hard work from everyone on the BPMS team, we were able to safely undertake the annual reef expedition to the Chagos Archipelago.

After two weeks of quarantine aboard the BIOT patrol vessel, the *Grampian Frontier*, and a quick pit stop in Diego Garcia to pick up dive tanks and our science equipment, we were off.

We were graced with beautiful weather for (almost) the whole trip and a fantastic team of scientists and boat crew who worked night and day to meet everyone’s goals.

We used two main methods to collect water for eDNA analysis. The first involved SCUBA diving from one of the smaller boats and filling sample bottles with water from just above the benthos.

The second requires a specialised sampling bottle called a niskin, which is lowered to the required depth and “fired” by sending a weight down the line. Both methods were used to collect six litres of seawater from all of our sample sites.

Once onboard, our water samples were filtered and frozen as quickly as possible to prevent any further degradation of the eDNA.

## **What we do with eDNA**

Back in the UK, the eDNA is extracted and amplified, before finally being sequenced. To look at zooplankton communities, we use two universal arrays that each target a different part of the genome to investigate the diversity of organisms living in the water column.

Once we have this data, we hope to team up with researchers from Stanford University,

who have a multitude of sensors deployed to measure environmental conditions (temperature, dissolved oxygen, salinity and currents) on the reefs, to identify important environmental drivers of the zooplankton communities.

On this most recent trip, eDNA samples were collected to look at more than just zooplankton. PhD student at Imperial College London and Zoological Society London, Nick Dunn, is using eDNA to detect the presence and distribution of grey reef and silvertip reef sharks.

He collected water from sites where acoustic receivers were deployed and will compare his eDNA results to shark tagging data to validate shark hotspots. Together with Nick, we also collected eDNA samples at four time points throughout the day, over the seven days we were anchored in Peros Banhos.

This mini-experiment will hopefully help guide future sampling by exploring the impact of the time of sampling, as little is known about how quickly eDNA signals can change over a small period of time.

Chagos Conservation Trust have also teamed up with NatureMetrics, a company leading the development of DNA-based biodiversity monitoring, to test if eDNA can be used to monitor planned rat eradications as part of the Healthy Islands, Healthy Reefs rewilding programme.

Water samples were taken from shallow reefs surrounding nine islands in the archipelago and will be used to see if rat presence can be determined with this new technology. The data may also be used to monitor marine biodiversity around these islands as this pest species is removed and, hopefully, seabirds return!

Overall, during our 26 days on the *Grampian Frontier* we took over 400 water samples from the Chagos Archipelago. Now the lab work begins, but we look forward to bringing you the results from this new and exciting method.

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](http://chagos-trust.org)

If you would like to contribute to Chagos News please email [chagosnews@chagos-trust.org](mailto:chagosnews@chagos-trust.org)

