

Chagos News

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Editorial

Alistair Gammell, CCT acting chair



As a direct and indirect consequence of the discovery of the Chagos Archipelago by European sailors, and of its subsequent settlement and exploitation over the past 250 years, all of the 55 islands of the archipelago have been affected by invasive alien species, with rats being the greatest problem on over 50% of the islands.

The original settlers felled the native forests on many islands and replaced them with coconut plantations. The coconut plantations shaded out any regrowth of native vegetation and provided an unwelcoming environment for nesting seabirds and other wildlife, but they did at least provide a basic economy for the inhabitants.

As copra and other coconut products became uneconomic, many of these plantations were neglected or abandoned and of course since the islands were depopulated in the 1960s, all fell into disuse.

Though abandoned, coconuts have retained their dominance shading out all other vegetation, meaning native forest and its associated biodiversity can never return.

The result has been a marked difference in biodiversity between islands with rats and unmanaged plantations and those that remained less impacted by man, therefore still having native forest and no rats.

The restoration of these damaged islands through the felling of the coconuts and removal of coconut seedlings, and their replacement by planting native forest trees, and by the eradication of the rats, is perfectly feasible and the payback for nature is massive and swift.

From our successful pilot project on Ile Vache Marine where rats have been eradicated for the first time we have seen seabirds recolonise the islands almost immediately.

On rat free islands marine turtles have greater breeding success as likewise their eggs and young don't face rat predation, and as native plants begin to thrive, the insects and other wildlife which relies on them begins to flourish.

To build on the success of Ile Vache Marine, we need skilled and dedicated people, a hired boat to deliver supplies and equipment – food, tents, rat poison, chainsaws and everything else needed to keep hard working and dedicated teams safe and able to do the job - and that means money.

Restoration is not cheap, but it is both very effective and once done, lasts forever without further costs.

Restoring those degraded Chagos islands to their natural state and allowing them to live again is a priority for the Chagos Conservation Trust in 2018.



Coconut crabs: from behaviour to conservation

Dr. Mark E. Laidre, Dartmouth College

During the Voyage of the Beagle, Charles Darwin passed through the Indian Ocean. Not far from the Chagos Archipelago Darwin made his first encounter with the coconut crab (*Birgus latro*) and he noted in astonishment how this species “grows to a monstrous size” (Darwin, 1845).

Indeed, the coconut crab is the world’s largest terrestrial invertebrate (Figure 1), reaching over 1 metre in leg span and weighing up to 4 kilograms. Perhaps due to the remote locations that coconut crabs inhabit, on isolated coral atolls and tropical islands throughout the Indo-Pacific, this species has received scant scientific study since Darwin’s pioneering observations.

From January to March 2016 I undertook an expedition to study coconut crabs on the archipelago.

People are sometimes surprised to learn that, evolutionarily speaking, coconut crabs are hermit crabs—small crustaceans well known for inhabiting empty snail shells. Specifically, coconut crabs belong to the

infraorder Anomura (Crustacea: *Decapoda*) and their closest evolutionary relatives are terrestrial hermit crabs (*Coenobita* spp.). During their life, coconut crabs transition from being microscopic larvae in the ocean to shell-wearing juveniles on land to, eventually, massive shell-less adults.

This species thus spans the marine and terrestrial environment, sometimes even climbing high into the trees (Figure 2).

As larvae, coconut crabs disperse through the ocean planktonically. After approximately a month at sea, they then transition to a fully terrestrial existence and thereafter are unable to breathe underwater. On land, their juvenile stage is spent occupying empty snail shells for protection, like the terrestrial hermit crabs from which they evolved.

Yet unlike terrestrial hermit crabs, coconut crabs re-calcify their otherwise soft abdomens as they grow and eventually cease using externally-derived shells—for none would be large enough to accommodate the extreme size which they ultimately reach in adulthood.

Interestingly, measurements of molting and growth across coconut crabs' lives have led to conservative estimates of their longevity, which indicate that individuals do not reach full adult size for at least several decades, and that especially large individuals may be well over 100 years old.

For the better part of a decade I had been completely engrossed intellectually with studying terrestrial hermit crabs (e.g., Laidre 2010, 2014). It is no exaggeration to say though that during this time I had always dreamed of extending my studies to include coconut crabs.

I was, however, quite picky about where to initiate a study of coconut crabs, for one of my central interests in wishing to study coconut crabs was to understand their natural behavior. And sadly, coconut crabs have been negatively impacted by humans in many locations throughout their once vast range within the Indo-Pacific.

Indeed, hunting and habitat destruction by humans have dramatically reduced their numbers in places where they were formerly abundant; and even in locations where coconut crabs persist to the present, their natural behaviour has often been severely altered by humans. Where then to launch a study of coconut crabs?

The answer to this question came when I was contacted by the BBC Natural History Unit in January 2015. They asked me to be their scientific consultant and help them acquire video footage of the natural behavior of coconut crabs. Their proposed location: the Chagos Archipelago.

This opportunity had me leaping out of my proverbial shell, since it is arguably one of the most pristine locations on the planet to study coconut crabs. I therefore immediately said yes to the BBC, our agreement being that I would help them get their footage for a couple of weeks and thereafter spend a much longer period collecting systematic scientific data for my own project on coconut crab behavior.

Alas, after submitting our permits both to video and study on the archipelago, and after waiting over a year since the BBC had initially contacted me, a BBC producer casually phoned me to say they were dropping out: the wait for permit approval was proving to be too long for them.

I remained patient though, given my interest in studying in this unique environment. And as luck would have it, just a month after the BBC dropped out, my own scientific permits were approved!

Thankfully, National Geographic also offered me a scientific grant to fund my expedition. So with both approval and funding in hand, nothing but scientific fieldwork lay ahead, which I eagerly dove into for two wonderful months of near non-stop data collection, natural history observations and experiments.

Now, nearly two years after this successful scientific expedition, I am still writing up the many results of these sundry studies of coconut crabs. Remarkably, at the time of my expedition, no published scientific paper even existed on how coconut crabs open coconuts, despite this being the very origin of their name (clearly there were many low-hanging scientific fruits!).

My multi-faceted investigation of coconut crabs thus included detailed studies of everything ranging from coconut opening to: population abundance and genetic diversity; measurements of underground lairs and burrow architecture; transects of activity levels during day and night; experimental tests of social behavior; fine-grained quantification of biomechanical claw strength; analyses of fighting behavior and competitive interactions between invasive rats and coconut crabs; and systematic observations of foraging ecology and predatory behavior (for published studies, see: Laidre 2017, 2018a, b).

Of course, much still remains to be learned about these fascinating animals, including the vital role that coconut crabs may play in shaping communities of surrounding species and maybe even whole island ecosystems.

Also, while coconut crabs were once classified as 'vulnerable' on the IUCN red list in 1981, no systematic surveys have since been undertaken, so presently the species is classified as 'data deficient'—a situation that needs remedying. The data analysis and reports from my first expedition have kept me busy (as Darwin's Beagle Voyage did for him); but I am now planning future expeditions to the Archipelago, as well as to other sites.

Only through careful continued research on coconut crabs, from larval through adult life stages, and only with much deeper knowledge of coconut crabs' fundamental



Coconut crab (*Birgus latro*) climbing a coconut tree © Mark Laidre

behavior, ecology, and evolution, will humanity ever have the necessary knowledge to conserve this unique species.

As a Dartmouth professor in the early stages of building a lab full of eager and curious postdocs and PhD students, one of my chief objectives is to continue a long-term field research program on coconut crabs. My goal is to foster further scientific discoveries, which can help inform coconut crab conservation efforts, both in the Chagos Archipelago and throughout the Indo-Pacific.

Critically, a solid funding base over the next decade will be essential to this enterprise. Thus, while I hope the BBC may consider joining my team on future scientific expeditions to the archipelago, I am now most eager to intersect with organizations such as CCT and the Bertarelli Foundation, since these have the alluring potential to fund our future long-term research on coconut crabs.

Darwin, I suspect, would smile upon these aspirations. For as we build on his pioneering observations and continue to learn more about coconut crabs, we can ultimately provide a foundation for conserving this unique species, thereby ensuring it exists for many future generations to appreciate and learn from.

Acknowledgements:

My study was facilitated by many kind and helpful people, whom I thank and remain deeply grateful to. I am grateful to the BBC Natural History Unit for tipping me off about the Chagos Archipelago as a study site.

I thank Jon Slayer for facilitating many logistics and also for providing helpful field assistance during the beginning phase of my expedition. I am especially grateful to Edward Lees (the British Representative and Commander of the Royal Navy) for approving all my observations and experiments and for allowing a longer-than-usual study period, which enabled me to collect detailed behavioural data.

I also am grateful to Helen Stevens (the Environment Officer), Nestor Guzman, and Mahan Luchmun, all of whom provided helpful information and even occasionally lent a hand during my fieldwork. Pete Carr, who I fortuitously overlapped with during the initial portion of my expedition, passed on much useful information and he has been a valuable colleague ever since.

Finally, I thank the Committee for Research and Exploration of the National Geographic Society for funding my expedition.

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- Dartmouth News article (on coconut crab art-science exhibit):
<https://news.dartmouth.edu/news/2017/01/worlds-largest-land-crab-fierce-and-under-threat>

News in brief



Chagos corals feature on limited-edition stamps

In September the British Indian Ocean Territory Administration released a souvenir sheet of six stamps and a first day cover featuring coral species found in the Chagos Archipelago.

Using photos from CCT's Chagos Information Portal, kindly donated by Anne Sheppard, the stamps aim to showcase the coral diversity found in the archipelago, but also highlight threats such as climate change.

Even in the archipelago where human impacts are limited, localised coral bleaching events have occurred. This year it was affected by the third global bleaching event in two decades, causing mass coral mortality.

Visit [here](#) for information on how to purchase the stamps.



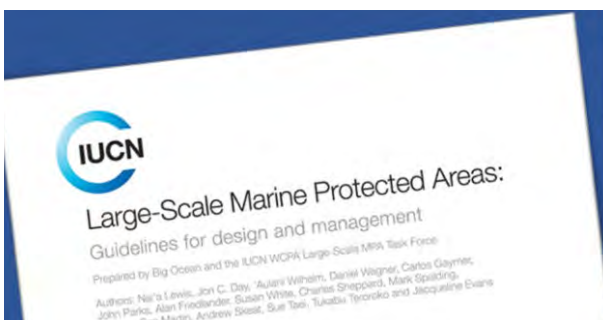
Britain leads the way in ocean conservation

A new commitment outlining Great Britain's global leadership in ocean conservation, and ambitions for the future, was launched by former Fisheries Minister Rt Hon. Richard Benyon MP, in partnership with the [Great British Oceans](#) coalition in October.

[Blue Belt 2.0](#) details the progress made since the government created the Chagos Marine Reserve in 2010, which includes funding to designate, implement and manage other marine protected areas within UK Overseas Territories.

Extending the UK's network of marine reserves will make a significant contribution towards the UK's commitment to the [UN Convention on Biological Diversity](#) to protect 10% of the world's coastal and marine areas by 2020.

Existing funding of £4.8 million per year will be extended to 2022 to mirror the new end of parliament. Read the full article [here](#).



CCT contributes to new guidelines on large-scale marine protected areas

CCT has joint-authored new guidelines which provide [practical guidance on managing large-scale marine reserves](#) and outline the known benefits and challenges of dealing with protected areas of this size.

Released in September, they were written mainly for marine managers and their teams, but are also relevant for elected officials, government decision-makers and indigenous peoples and local communities contemplating “going big” with their marine protection efforts.

The guidelines provide the most significant lessons learned from the management of established large-scale marine reserves.

They are also intended to help existing reserves, such as the Chagos Marine Reserve, improve their management as they grow and mature.



Chagos corals destroyed by climate change

Climate change is responsible for destroying about 90% of coral found on the shallow reefs of the Chagos Archipelago.

The findings from research conducted on coral bleaching and mortality after two consecutive years of extreme sea temperatures are reported in a new paper published by the [Smithsonian Institution](#).

Water temperatures across the archipelago have risen between one third of a degree and over one half of a degree over the last two years, causing the recent severe mortality.

CCT trustee Professor John Turner said: “Warming conditions in recent years have been exceptional; we have never experienced consecutive events like these before. Therefore we do not know how the reefs will respond in future years and further warming events may severely hamper reef recovery.”

Full story [here](#).



Sea turtle conservation research on Diego Garcia

Nicole Esteban, Swansea University
Graeme Hays, Deakin University

Green turtle © RD and BS Kirby

This autumn Dr Nicole Esteban and Professor Graeme Hays visited Diego Garcia as part of ongoing conservation research on the ecology of hawksbill and green turtles in the Chagos Archipelago.

The objectives of the three-week expedition were to increase understanding of sea turtle movements within and outside of the Chagos Archipelago, to assess the population size of nesting turtles, and to monitor nesting incubation conditions in different areas of the island.

To better understand turtle movement around the archipelago, a 4 kilometre stretch of beach in south-west Diego Garcia was patrolled between sunset and sunrise to locate and fit nesting turtles with satellite tags.

More than 80 volunteers from the island community assisted with the night-time patrols. A method for attaching the satellite tags that had already been successfully tested in Diego Garcia (Figure 1) was used, as well as the same brand of tag.

After release of the turtles, GPS location data are relayed via Argos polar-orbiting satellites. Data can be transmitted for up to 2 years, although more typically transmissions cease after 9-12 months as the turtles' shells grow and cause the tags to fall off.

Building on previous work on Diego Garcia (Figure 2, upper panel), 23 nesting green turtles have now been fitted with satellite tags.

By the end of the expedition, initial satellite tracking locations showed that three of the turtles were migrating on a south-westerly trajectory towards Madagascar (Figure 2, lower panel). Two of the turtles remained just offshore of the nesting beach.

Assessing the temperature of turtle nests in the archipelago is an ongoing project following the publication of initial findings in 2016 (*Esteban et al. 2016*).

Sea turtles exhibit temperature-dependent sex determination, so continued measurements of sand temperature will allow informed predictions of the hatchling sex



Figure 1. A green turtle being equipped with a satellite tag on Diego Garcia. Top panel: painting the epoxy with black antifouling paint. Bottom panel: a turtle returns to the sea after the attachment is complete and can then be tracked for up to 2 years.

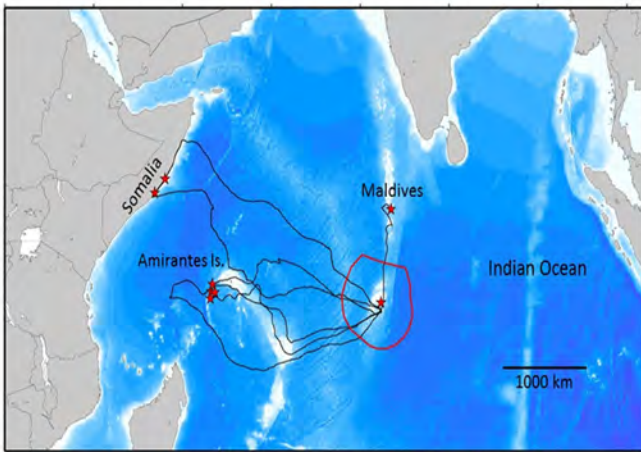


Figure 2.

Upper panel: migration of eight green turtles after nesting on Diego Garcia, 2012 (from Hays et al. 2014).

Lower panel: current work builds on these tracking data. Initial green turtle migration tracks for individuals equipped in 2017 while nesting on Diego Garcia. Monitoring the movements of the equipped turtles continues as they move to their foraging sites. Tracking data will be supplied for up to 2-years. Taken together these results indicate a very broad range of destinations for the turtle migrations.

There is a need to track more individuals so the full extent of space use across the Indian Ocean can be gauged and hence the appropriate conservation measures instigated across this ocean basin.

The aim is to build to a database of >30 tracked adult green turtles. In total there are currently 23 adult green turtles equipped.

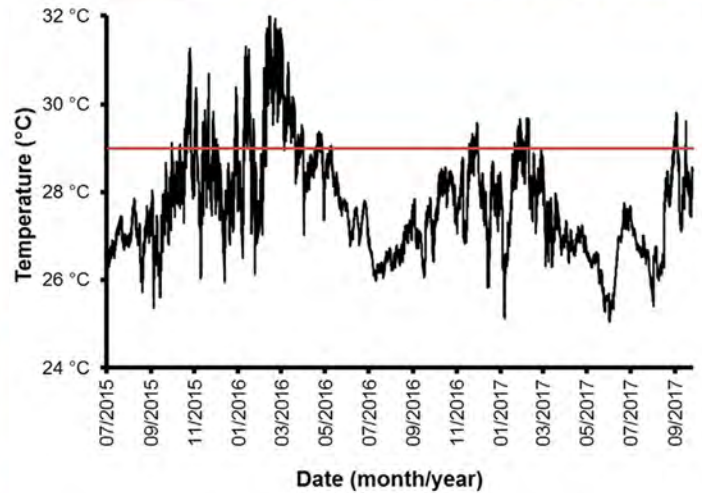


Figure 3.

Left panel: excavation of temperature loggers from partially shaded zone on the nesting beach.

Right panel: A 2-year record of sand temperature at nests depths on Diego Garcia.

The red horizontal line at 29°C is the incubation temperature at which equal numbers of male and female hatchlings are produced.

In contrast to many nesting beaches around the world, these relatively cool incubation temperatures at Diego Garcia will ensure both high survival of eggs during incubation as well as the production of both male and female hatchlings.

ratio and guide conservation activities for the long-term protection of turtles around the archipelago.

On the recent expedition, temperature loggers deployed in 2015 were recovered. The loggers are fully waterproof and store temperature data for up to 2 years.

Six loggers were excavated from a range of turtle nesting depths in two areas (shaded and unshaded) close to the beach entrance on the south-west of Diego Garcia, with the Royal Marines providing invaluable assistance with locating and excavating loggers (Figure 3).

The recovered loggers are providing a wealth of information on sand temperature (Figure 3). Initial analysis shows relatively cool incubation temperatures that straddled the thermal range where both male and female hatchlings are produced. Incubation temperatures in this range are also likely to maximise hatchling survival in nests (*Hays et al. 2017*).

These conditions spell good news for sea turtles in terms of successful production of high numbers of male and female hatchlings, and indicate the important role the archipelago could play in the future of these species.

Acknowledgements:

We would like to thank Ernesto and Kirsty Bertarelli, and the Bertarelli Foundation, for supporting this research. We acknowledge and thank the British Indian Ocean Territory (BIOT) Administration for assistance and permission to carry out this expedition in Diego Garcia.

We are grateful for the thorough logistical assistance provided by the Headquarters British Forces, BIOT and BIOT Administration in London.

We also thank the British Representative, Commander Karen Cahill, Executive Officer, Major Marty Adams, Logistics Officer, Lieutenant Ben Samuel and Environmental Officer, Harri Morrall, for their excellent support in our scientific activities.

Thanks to Nestor Guzman, Natural and Cultural Resources Program Manager, NAVFACFE PWD Environmental.

Finally, we wish to express our gratitude to the 81 volunteers from British Forces, US Navy, US Air Force and US and Philippine Contractors who assisted us during night patrols on the beach.

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BIOTA briefing



New faces

The British Indian Ocean Territory Administration (BIOTA) has welcomed three new members of staff over the past few months.

Dr Bryony Mathew has been appointed as Deputy Commissioner. She will support the Commissioner, Ben Merrick, in his role as Head of the Administration.

Linsey Billing took on the role of Administrator and Director of Fisheries in July this year. Linsey is responsible for the day-to-day running of BIOT, and is supported by a Deputy and Assistant Administrator.

Finally, BIOTA has a new Environmental Officer, Harri Morrall. Harri divides her time between BIOT and the UK. Her focus is on environmental monitoring, conservation management and supporting increased scientific interest in the Territory.

The year ahead

One of BIOTA's main priorities over the next year will be to continue and expand its work on conservation and sustainable environmental management.

Look out for more details coming soon.

Showcasing BIOT's wildlife

BIOTA recently completed a number of environmental information projects with funding from the EU BEST initiative aimed at raising awareness of protecting species and habitats in BIOT.

These projects included information boards, located at key sites on Diego Garcia, as well as environmental brochures and an educational film.

All of the resources can be viewed [here](#).

And finally...

A coconut crab in the territory made the headlines when it was filmed eating a red footed booby, a seabird found in the territory.

Take a look at this extraordinary behaviour filmed by Dr Mark Laidre on the [New Scientist news feed!](#)



The British Indian Ocean Territory is one of 14 British Overseas Territories that is administered from London by the British Indian Ocean Territory Administration.



Butterfly on Scaevola on Ile Bois Mang © Jon Slayer



Claudia diving on a Chagos Archipelago reef

My cultural and environmental history

Claudia Naranja, CCT trustee

Over the last few months I have made it a personal mission to understand the history of the Chagos Archipelago and the Chagossians, and our culture and traditions.

My grandparents passed their knowledge onto me and the importance of knowing where we came from. I now hope to pass this onto my own children so that it is never forgotten, and so that the Chagos Archipelago is never forgotten.

After their expulsion in the 1960s, the Chagossians were sent to different countries. They were forced to live in exile with no place to call home and with only hope in their hearts that one day they might return.

We unfortunately cannot erase the past, and blaming others and ourselves will never give us peace. Instead we can learn from it, and try to understand it, so that we can move on and look ahead to the future.

I am a second-generation Chagossian born in Mauritius. I had the chance to grow up

in not only a beautiful country, but also a multicultural one. I learnt to live with different races, how to cook different culinary dishes and how to speak different languages - but despite all of this it was not home.

Every day we were reminded of where we came from, despite trying very hard to integrate. We chose to share our love, knowledge, culture and tradition with others to help us feel like we belonged.

At a very young age I was taught the history of Mauritius, of how it all started and where we all came from; except this wasn't the history of the Chagos Archipelago as we were the "Ilois" meaning islanders, or should I say the "outsiders".

It has taken people a long time to understand our frustration of being called the "Ilois". Weren't we all islanders with a similar past? A lot of islands around the world have been explored and conquered, so what made us so different from each other?

My education about our history continues

from the UK where I graduated from the Connect Chagos programme (read Claudia's [blog](#) about her time with Connect Chagos and her [mission](#) to Hawaii).

With thanks to a lot of people, both the older and younger generations of Chagossians, I have been able to reconnect with our cultural and natural heritage.

We have said our goodbyes to a lot of our native born Chagossians who unfortunately were not able to say goodbye to their homeland.

The community hope that the remaining natives will continue to have the opportunity to say hello again - or goodbye - to this beautiful place called the Chagos Archipelago, so that they can die with peace in their hearts.

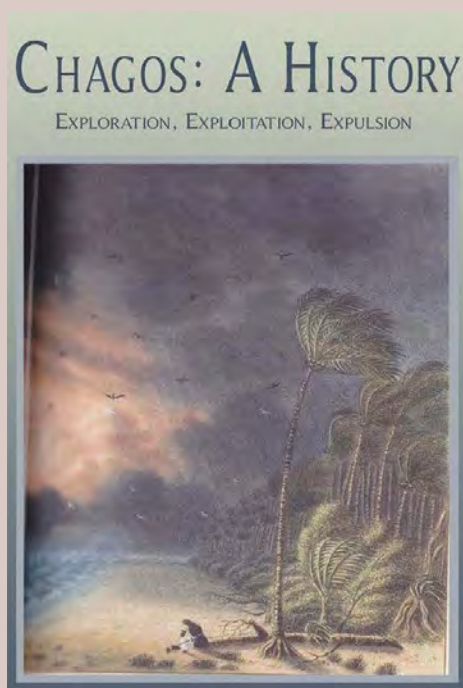
The last book I read about the archipelago was by Nigel Wenban-Smith and Marina Carter, Chagos: A History, which I enjoyed reading. It talks about the exploration of the archipelago and the exploitation and expulsion of the Chagossians.

I hope other people, not only Chagossians, will enjoy reading it too, find the answers that they have been seeking, and that they no longer see us as being the "Ilois".

Chagossians from all over the world, wherever you are, you will never be forgotten.

*We are the people
Of the islands
Of the sea and salt
Of the wind and reef
Of the freedom
Five generations
Not forgotten
In every song that has been
written
In every sega that has been
sung
In every note given
The voice of the drum
Listen, to the call of the island
home
Listen, to the voice of the
drum...*

Chagossian poem taken from a book called Chagos Songs, hearts in exile by Valerie Van Halten.



Chagos: A History: Exploration, Exploitation, Expulsion by Nigel Wenban Smith and Marina Carter is in hard back, fully illustrated in colour and, over 500 pages, and will cost £40.00, plus postage and packing.

This is a scholarly, comprehensively researched account of the Chagos Archipelago up to the final closure of the coconut plantations in 1973. Long forgotten archives from around the world were combed for accounts from, for example, visiting magistrates. It contains, in short, the accurate story of this archipelago.

Available from [York Publishing Services](#).

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 the editor at chagosnews@chagos-trust.org

