

Chagos News

*The Periodical Newsletter of the
Chagos Conservation Trust*

No.33

January 2009

EDITORIAL

As one of the fortunate group to have visited Chagos, not only once but three times on research expeditions, I am delighted to have the opportunity to take on the editorship of *Chagos News*.

Those expeditions were the three largest ones, 1978, 1996 and 2006. In 1978 I worked on the Chagos molluscs and corals and on the last two I worked on the corals of these magnificent reefs and, in 2006, also on the seawater chemistry.

There is disastrous news about coral reefs from all over the world, with the effects of a triple whammy of warming seawater and ocean acidification as result of climate change combining with other more direct anthropogenic impacts such as pollution and over exploitation of marine resources. Chagos is a 'last stand' for the Indian Ocean, with its reefs and corals having a better chance of survival than any others in the Ocean because of the lack of anthropogenic impacts. This makes it even more important to preserve these islands; not just for some idealistic belief but as a necessary reservoir of resources for the peoples of the Indian Ocean rim.

Because of this important role for Chagos, it is essential to continue to monitor and research the Chagos environment. Some of the articles here are results of recent research which has been done there.

Ornithologist and 2006 expedition member Dr Andy McGowan, discusses the key importance of the Chagos islands as habitats for seabirds.

Prof Charles Sheppard presents the first of an occasional series which reviews and explains the science resulting from Chagos research expeditions. Results and papers continue to be produced for many years after the data have been collected on an expedition.

Nigel Wenban Smith has written an account of discoveries in Chagos other than those of the biological kind. His account of the archaeology of the islands gives a fascinating perspective of visits to Chagos from much longer ago than previously appreciated.

In July this year, five CCT members attended the European Union and its Overseas Entities conference on Strategies to Counter Climate Change and Biodiversity Loss. MEP Struan Stevenson, who also attended, writes a report on the conference.

I hope to continue to present some of the large store of information about what is possibly the most pristine marine habitat in the world, and possibly also to rekindle some memories for those who have visited these islands.

Anne Sheppard

News Clips

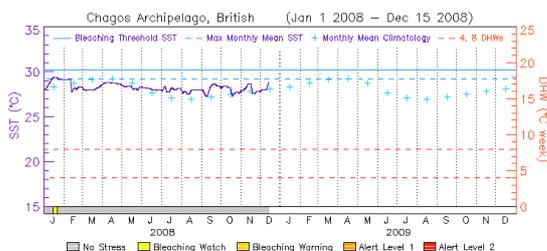
New Scientist Article

Research involving Chagos in the context of the western Indian Ocean was mentioned in the September issue of *New Scientist*, in relation to the paper by Nick Graham. The article can be seen at <http://environment.newscientist.com/article/dn14599-notake-zones-offer-no-boost-for-bleached-reefs-.html>

NOAA Coral Reef Watch

Charles Sheppard arranged with the U.S. National Oceanographic and Atmospheric Administration (NOAA) for Chagos to be added as a sea temperature hotspot monitoring site on their Coral Reef Watch site. The latest sea surface temperatures (SSTs) for Chagos can be seen at http://coralreefwatch.noaa.gov/satellite/current/experimental_products.html

The high resolution data is produced with a graphical output as seen below.



House of Lords Decision

On Wednesday 22nd October the House of Lords judgement on the Chagossian appeal to return to Chagos was published. The full report can be seen at <http://www.publications.parliament.uk/pa/d200708/ldjudgmt/jd081022/banc-1.htm>

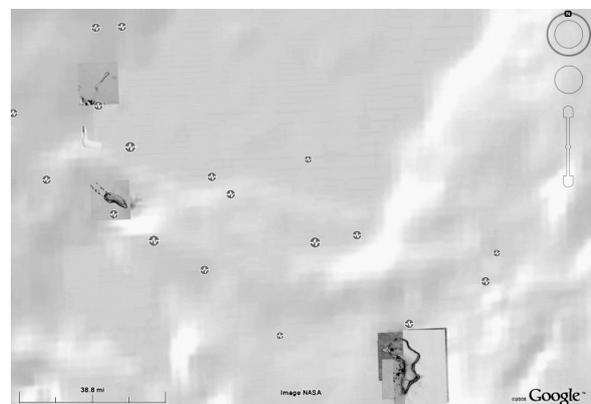
Google Earth

Many members may already be aware of, and use, *Google Earth*, the free to download satellite Earth imaging software. It is available from <http://earth.google.com> along with a comprehensive tutorial on how to use the software.

Some areas on the satellite images are high resolution and some are quite low. Their development is an ongoing process with more high resolution areas becoming available all the time.

A session exploring Chagos on Google Earth is the next best thing to being there! The archipelago is well covered by high resolution images. Diego Garcia, Egmont, Eagle and Sea Cow (mistakenly labelled Three Brothers), the eastern half of Salomon Atoll and all except the north east quadrant of Peros Banhos are now covered in high resolution. Danger Is and Nelsons Is are in low resolution but at the moment the Three Brothers and most of the submerged banks are not shown at all.

There are many layers which can be added over the top of the basic satellite view. The earthquake layer for instance shows just how many earthquakes have been recorded around Chagos, particularly around the southern half of the archipelago. The figure shows those of magnitude 4-7. If you zoom in even further, weaker quakes are revealed.

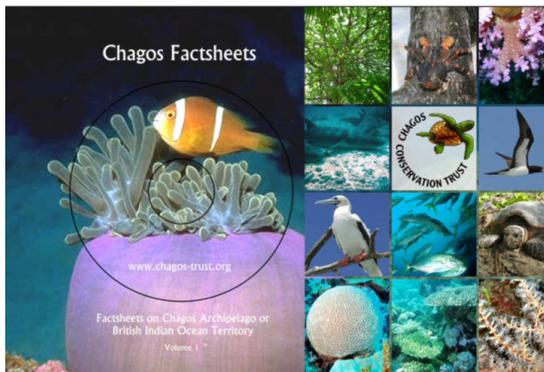


Factsheets

CCT are producing a series of A4 factsheets covering a range of subjects from science to history, technology and environment of Chagos. Some examples of these are available on the CCT website and it is anticipated that the full set becoming available on a member's page. We hope to print one on the back of each issue of *Chagos News*; the Coconut Palm by Chris Hillman is the first to be illustrated.

Factsheet CD

The factsheets mentioned above are also being produced on a mini CD on a postcard. These will be on sale, through the website and in Diego Garcia, at a cost of £5/\$7.50 to members and £6.50/\$10 to non-members, including postage.



A sample of the CD contents can be viewed at <http://chagosfacts.bio.warwick.ac.uk>

Chagos Brochure

A proposal for Chagos to become recognised as the globally significant Chagos Archipelago Reserve Area has been published in a full colour 26 page brochure with a grant from the Pew Foundation.

This, along with a supporting scientific document, will be distributed to individuals who may be able to influence and support

the proposal to obtain even greater protection of Chagos than now exists.



A significant feature of the proposals is for Chagos to have a large marine reserve area and no-take zone. There will be more news about this in the near future.

Forthcoming Chagos Lectures

February

3rd - Charles Sheppard - Royal Geographic Society: Chagos - Jewel in the Indian Ocean. 7pm. Members only, but 20 prearranged guests allowed, so contact charles.sheppard@warwick.ac.uk if you would like to attend.

<http://www.rgs.org/WhatsOn/City+Series.htm>

March

27th - John Topp - South London Botanical Institute: The Chagos Archipelago. 7.30pm.

<http://www.slbi.org.uk/programme.htm>

30th-31st - Charles Sheppard - British Ecological Society: Manchester Metropolitan University.

<http://www.besteg.org/events.html>

April

14th - Charles Sheppard - Zoological Society London: Scientific Meeting - The climate change threat to corals 6 pm. <http://www.zsl.org/zsl-london-zoo/whats-on/scientific-meeting-climate-change-corals,305,EV.html>

Science resulting from Chagos research expeditions

Prof Charles Sheppard

1. Coral cores, isotopes, rainfall and a sea temperature of 28.5 °C.

During the research expedition of 1996, two German geochemists took cores of some of the largest corals they could find (Figure 1). The drills were powered by compressed air supplied by a compressor in an inflatable boat. Cores over 2 metres long were extracted, then the holes were plugged to prevent erosion of the colony.

Corals grow in layers or bands, laying down skeleton of different density, one light density layer followed by one high density layer per year, not unlike tree rings except that the rings are made from limestone. A year's pair of rings is about 1-2 cm thick. A pair of bands 100 down from the top, therefore, was deposited 100 years previously. The different elements and isotopes in each layer reflect what was in the sea and atmosphere that same year. From the isotope and trace elements in that layer, geochemists can now measure the temperature, salinity (or conversely the rainfall) that occurred at that time, as well as many other ocean chemistry factors such as the amount of upwelling, with great accuracy.

The longer the core, the longer the time series that can be obtained. Records for the past several centuries are possible, which can be used to determine natural variability in the selected climatic factor, long before climate change effects began to be important. Furthermore, computerized drilling of the cores can extract sections that resolve not only annual average information, but seasonal changes within a year too.

Chagos coral cores have yielded (so far) bimonthly data back to 1876.



Figure 1. Prof Tony Eisenhauer and Dr Georg Heiss were geochemists who visited in 1996, here taking a core in Peros Banhos atoll. Above sits Dr Alasdair Jolliffe tending the increasingly dodgy air compressor.

One example of the use of the cores is analysis of the ratio of the two oxygen isotopes ^{18}O and ^{16}O , abbreviated to $\delta^{18}\text{O}$, which occurs in each band of the coral skeleton. This ratio varies according to both sea surface temperature and the isotopic composition of the seawater. The latter in turn is affected by local rainfall and salinity, partly because the lighter isotope ^{16}O evaporates from the sea proportionately more than does the heavier isotope over the whole ocean, and so rainfall is enriched in the lighter isotope. Thus, in evaporative areas the seawater (and hence the oxygen taken up into the corals' limestone) will have more ^{18}O , but where there is more rain it will have a greater proportion of the lighter ^{16}O . In rain itself, the heavier isotope tends to precipitate first, so the end result is complex. The temperature influence on the ratio of the oxygen isotopes in the coral skeleton is known from laboratory experiments. As an example of the magnitude of this effect, a cooling of 1°C leads to a change in the

ratio of the two isotopes of 0.22%, which may not appear much, but is sufficient for modern instrumentation to measure accurately. This ratio is affected by both temperature and rainfall in complex ways, so another ratio that is used is that of strontium (Sr) with calcium (Ca). Some Sr is taken up by corals 'mistakenly' instead of Ca, dependent upon temperature, and the Sr/Ca ratio very closely matches the water temperature in which the coral lived¹. The match between the element ratios and temperature is remarkably close. Furthermore, use of both methods in parallel yields more information than use of each alone.

The $\delta^{18}\text{O}$ from cores in Peros Banhos precisely record the depletion in ^{18}O during the NE monsoons when it rains a lot and so: "...coral $\delta^{18}\text{O}$ at this site can be used as a proxy of the temporal variability of precipitation patterns associated with the Inter Tropical Convergence Zone"², the ITCZ being a major climatic driver in this ocean. The ratio records rainfall variations on interannual to interdecadal time-scales, which is valuable for determining natural ranges, understanding patterns and in predicting future changes in the ocean as a whole.

Understanding the relationship between sea temperature and rainfall is one of the difficult problems in climate modelling. One of the Peros Banhos cores that extends from 1950 to its collection in early 1996 was examined for its Sr and Ca ratio³, which was compared with measured sea surface temperature and with its $\delta^{18}\text{O}$. It was found that the ratio documents a warming of 0.3 °C from 1950-1995, and that during the 1970s temperatures reached a critical threshold of 28.5 °C, above which small temperature differences are known to have a significant effect on atmospheric convection, with corresponding substantial changes in rainfall³. By comparing the Sr/Ca ratios with both the oxygen isotope ratios in Chagos coral cores and with available instrument temperatures, it was also found that

greater fluctuations in rainfall occurred after the 1970s when sea surface temperatures passed 28.5 °C.

Taking this on further, the isotope ratios were used to examine whether El Niño can be picked up in Chagos⁴. It can, using $\delta^{18}\text{O}$, but only after the mid 1970s when temperatures exceed 28.5 °C. El Niño related temperatures affect several oceanographic features of the Indian Ocean as well as the Pacific, causing fluctuations in rainfall, and hence changes in the isotopic ratios, which are recorded in the corals. These results show great potential for resolving the teleconnections and interactions between the monsoon cycle in the Indian Ocean and the Pacific's El Niño.

Using a 120 year core, the $\delta^{18}\text{O}$ record was also used to track the viability of the Inter Tropical Convergence Zone⁵. Up to the 1970s, there was an alternation of wet and dry spells lasting 15-20 years, but after that time the variability became annual, with a strong coupling to the Pacific El Niño. This supported evidence that there has in the last 20 years been a major change in the coupled Niño-monsoon system.

The precision of the techniques is matched by the complexity of the statistical procedures used to arrive at the answers. The work takes time too, from the coring in 1996 and the 'early' dating work of coral reefs⁶, to the present. The value of these studies though, is greatly magnified by examining not only Chagos in isolation but also coral cores taken from several other sites too, creating the understanding which can lead to better prediction of forecasts of various climatic patterns in the future as the oceans continue to warm.

I am very grateful to Dr Miriam Pfeiffer for checking that I have made sense rather than nonsense in my précis of what is extremely complex and detailed work (note that she is an author of almost all the papers cited below, amongst others).

1. Pfeiffer M, Dullo W-C, Zinke J, Garbe-Schonberg D. 2008. Three monthly coral Sr/Ca records from the Chagos archipelago covering the period of 1950-1995 AD: reproducibility and implications for quantitative reconstructions of sea temperature variations. *International Journal of Earth Science*, In Press.
2. Zinke J, Pfeiffer M, Timm O, Dullo W.-C. Davies GR 2005. Atmosphere–ocean dynamics in the Western Indian Ocean recorded in corals. *Philosophical Transactions of Royal Society A*. 363:121–142
3. Pfeiffer M, Timm O, Dullo W-C, Garbe-Schönberg D. 2006. Paired coral Sr/Ca and $\delta^{18}O$ records from the Chagos 2 Archipelago: Late twentieth century warming affects rainfall variability in the tropical Indian Ocean. *Geology* 34: 1069–1072.
4. Timm O, Pfeiffer M, Dullo WC. 2005. Nonstationary ENSO-precipitation teleconnection over the equatorial Indian Ocean documented in a coral from the Chagos Archipelago *Geophysical Research Letters*, vol 32: L2701 doi:10.1029/2004GL021738
5. Pfeiffer M, Dullo W-C, Eisenhauer A. 2004. Variability of the Intertropical Convergence Zone recorded in coral isotopic records from the central Indian Ocean (Chagos Archipelago). *Quaternary Research* 61:245-255.
- 6 Eisenhauer, A., Heiss, G.A., Sheppard, C.R.C., Dullo, W-C. 1999. Reef and island formation and late Holocene sea-level changes in the Chagos islands. In: Sheppard, C.R.C. and Seaward, M.R.D. (eds.). *Ecology of the Chagos Archipelago*. Occasional Publications of the Linnean Society of London. Vol 2. pp 21-34.

The European Union and its Overseas Entities: Strategies to counter Climate Change and Biodiversity Loss

Struan Stevenson, MEP

As a key event under the auspices of the French presidency of the EU and with the support of the International Union for Conservation of Nature (IUCN), the conference brought together more than 600 delegates from the 7 outermost regions and the 20 overseas territories and countries of the European Union

These 27 entities form a unique network distributed across all of the world's oceans. Regional ministers, consul generals, island governors and mayors, rubbed shoulders for 5 days with environmentalists, scientists and NGOs. There was a general recognition that these remote communities are on the front line when it comes to climate change. They will be the first to be hit. Their isolated geographical position makes them vulnerable to rising sea

levels and crumbling coastlines. Extreme weather conditions such as hurricanes, cyclones, droughts and floods are likely to multiply and aggravate their fragile environment. Their very existence, based on agriculture, fisheries and tourism is under imminent threat.



Struan Stevenson told the conference about the failings of the EU common fisheries policy and advocated a sensible alternative.

Photo: IUCN/Wiebke Herding

I had been invited by the French Government and IUCN in recognition of my role as President of the Sustainable Development Intergroup of MEPs in the European Parliament. This intergroup, with more than 100 participating Euro MPs, is at the forefront of the debate on climate change and biodiversity.

Shortly I found myself attending a session on the impacts of climate change on marine ecosystems. Scientific experts explained how even slight increases in sea temperature can cause fish to spawn and start migration patterns at the wrong times, leading to massive impacts on the ecosystem. We were told that because of global warming, many species in the world's oceans are now at their thermal limits and that ecosystem responses to such changes are not linear, especially in the warmer waters of the tropics. There are no gradual warning signs. No amber lights! Things can go from normal to

'dead' virtually overnight! Corals are damaged irreparably by rising temperatures and where corals are allowed to die and crumble the natural defences are swept away and increased coastal erosion results.



CCT executive committee member Professor Charles Sheppard, one of the scientists referred to by Struan Stevenson, gave one of the keynote speeches at the Reunion conference
Photo: IUCN/Wiebke Herding

Another scientist explained how basic chemistry demonstrates that if you add CO₂ to water you form an acid and the high amounts of CO₂ now in our oceans is gradually turning them into a chemical soup. This in turn kills off corals and wrecks fragile ecosystems. The doomsday clock is ticking towards midnight and our window of opportunity to take decisive action is fast disappearing. But still we dicker and dither. While we argue about costly new technologies to capture and store carbon in depleted undersea oil and gas wells, we crazily destroy vast swathes of global rainforest every year, cutting down and burning nature's own carbon capture and storage system. 21.5% of all CO₂ emissions annually come directly from deforestation. The only greater culprit as far as CO₂ is concerned is power plants at 26.6% annual emissions. (By contrast, all international transport by sea and air, only accounts for 2.4% of annual emissions, for those who question the value of

holding such a conference in the Indian Ocean!)

These were the issues under discussion in Reunion and it was reassuring to note that an official from the UK Government's Department for the Environment, Food and Rural Affairs (DEFRA) was present and indeed played a leading role in correlating the activities of the various working groups to produce a cohesive declaration of objectives by the end of the conference. But where were the UK government ministers? We have a minister responsible for Overseas Territories in the Foreign Office - Meg Munn MP. We have a minister responsible for biodiversity and climate change in the Environment Department – Joan Ruddock MP. But where were they?

More than half of the EU's outermost regions and overseas territories and countries are British...fourteen of the twenty seven, including places like the British Virgin Islands, Bermuda, Montserrat, Pitcairn Islands, Saint Helena, Ascension Island, South Georgia, the Falklands and the Turks and Caicos Islands. For the first time ever, all of them had high level representatives attending this unique conference, pooling their collective experience and wisdom. It is scandalous that the UK was not represented at ministerial level. It demonstrated a lack of interest by the government in the whole climate change debate. Indeed, as the only national British politician present, I had to make formal presentations to the conference on three separate occasions during my 70 hour sojourn in Reunion.

I explained to the conference how the EU is taking the climate change debate very seriously indeed. For example, we know how much the outermost regions rely on fisheries for their economic wellbeing and for food security. But we also know that unsustainable exploitation of fish stocks is causing a severe threat. That is why we have

introduced tough new controls to counter illegal, unreported and unregulated (IUU) fishing and we are phasing-in a ban on discards. It is also why we are placing renewed emphasis on aquaculture as a way of meeting demand for good, healthy fish protein.

But I also illustrated how sometimes our Brussels-based policies can go badly wrong. I cited the example of the Azores, where their 200 mile economic exclusion zone (EEZ) provided protection to a wealth of species fished in a wholly sustainable way by generations of Azorean fishermen. But then along came the Common Fisheries Policy and the EU Treaty obligation that requires EU waters to be openly accessible to all EU fishing fleets. In due course the Azorean EEZ was broken open and massive Spanish trawlers quickly hoovered up more fish in days than the local Portuguese fishermen had caught in decades. Stocks are now dangerously depleted and yet instead of recognising this catastrophic mistake and restoring the EEZ to its former glory, there are growing demands for the remaining exclusion zone to be dismantled, so that high-tech trawlers can fish right up to the shoreline of the Azores. In desperation the Azoreans are now considering designating a vast area surrounding their archipelago as a Marine Protected Area, within which carefully limited fishing zones will be authorised.

By the end of the week the key declaration from the conference proposed that the EU should set up a programme of action aimed at biodiversity conservation. There was also a call for greater cooperation involving the outermost regions and overseas territories in EU-wide research programmes and the launching of an initiative to fight invasive alien species which have wreaked havoc with indigenous flora and fauna. There was a plea for governments, big business and industry and NGOs to work together in partnership to find solutions.

The locally elected Regional Council President told us that it was fortunate his island had only been inhabited by man for little more than 360 years. During that time, he said, 22 species of birds, three species of reptile and three species of bat had been trapped and hunted to extinction. If man had been here even longer, he mused, the rich biodiversity of Reunion Island would have been totally destroyed. It was a salutary lesson. It brought home to me with a jolt how even a lush, tropical paradise like Ile de La Réunion, part of our global heritage, can be ruined through mankind's greed and stupidity.

Struan Stevenson is a Conservative Euro MP representing Scotland. He is Vice-President of the ruling EPP-ED Group in the European Parliament and President of the Sustainable Development Intergroup.



British and British Overseas Territories delegates at the European Union conference, Reunion, July 2008. The CCT delegates were Anne Sheppard, Charles Sheppard, Richard Martin, Ted Morris and Pete Raines.

Internationally Important Bird Areas for seabirds in the Chagos Archipelago

Dr Andy McGowan, University of Exeter

The tropical seabird populations of the world have been doing particularly badly in recent times. In the Indian Ocean, seabirds are subject to numerous threats, and populations are thought to be at a fraction of their historical levels. There are already 10 Important Bird Areas (IBAs) designated within the Chagos Archipelago, all based on the seabird congregations, demonstrating the important contribution that Chagos has to the region. As part of the Chagos Research Expedition in 2006 we carried out a rapid assessment of the seabird breeding populations of the Chagos Archipelago, effectively repeating the work of Peter Symens who conducted the first surveys in 1996. We surveyed 26 islands covering the four main island groups of the archipelago and recorded a total of 17 species of breeding seabirds. Since the last survey in 1996, nine species showed reductions in the number of breeding pairs, with brown noddy, *Anous stolidus* and lesser noddy, *A. tenuirostris* showing very large reductions of c. 22,000 and c. 27,000 pairs respectively. The remaining 8 species all showed increases with both great and lesser frigatebird and red-footed and brown booby doing particularly well.

From our surveys, we have found that Chagos is important for sooty tern, red-footed booby and Audubon's shearwater, from a global perspective as well as black-naped tern, lesser noddy and brown noddy in a regional (Indian Ocean) regional context. We have also proposed the islands of Petite Coquillage and Grande Coquillage for IBA status based on the large sooty tern breeding colonies that we discovered.

At first glance it is quite worrying to see such large declines in the two noddy

species but overall there are no clear patterns and it is difficult to interpret data of this type because we have two independent studies conducted 10 years apart. It is prudent to interpret observed changes as indicators of possible trends because the breeding cycle of all the seabirds in this study is likely to be a contributing factor as tropical and subtropical species tend to breed whenever conditions are favourable and not necessarily on a strictly annual cycle. Although both surveys occurred during February and March they may have taken place at different stages of the breeding cycle for some species. Without detailed knowledge of the breeding cycle of the seabirds in Chagos it is virtually impossible to draw any firm conclusions.



A sleeping red-footed booby in Chagos.
Photo: A McGowan

Given the important regional and global status of breeding seabirds in Chagos and the potentially worrying declines of some species, it would appear that further action is warranted. The lack of concerted ongoing monitoring outside of Diego Garcia is a cause for concern and we have strongly recommended implementation of an annual monitoring scheme, particularly on those islands hosting seabird colonies with IBA status, for this important aspect of the UK's biodiversity to be conserved effectively.

McGowan, A., Broderick, A.C. & Godley, B.J. 2008 Seabird populations of the Chagos Archipelago, Indian Ocean: an evaluation of IBA sites. *Oryx* 42:424-429

Archaeology in the Chagos

Nigel Wenban Smith

The history of human involvement with the Chagos islands is relatively short, with less than 300 years of habitation; even that is poorly documented, but what happened before the 18th century is scarcely known at all, other than through records of passing or visiting ships. And yet there may have been landings or even temporary settlements by Asian or Arab sailors prior to European discovery of the islands early in the 16th century. Clues to such events may be found in yet-to-be-discovered maps or writings of Arab or Chinese voyagers, or in artefacts found through archaeological searches. Finds of this sort could provide insights into the local history or, as easily, elucidate developments unrelated to the Chagos, such as changes in trade routes or internationally traded goods. For example, in 1997 a Malaysian fisherman found in his nets a large blue and white jar encrusted in coral, which he sold. The buyer searched for six years before finding the site of a Chinese cargo ship, wrecked in about 1620, with 800 undamaged pieces from an original cargo of 37,000 items of Ming porcelain. It is safe to say that no archaeological investigation of the Chagos took place during the plantation period, unless the digging up of the Poulailier de l'Anglais Mort on Diego Garcia in 1945 can be regarded as such. That was an attempt to establish whether this interestingly named and reputedly also haunted site concealed treasure or merely the bones of a deceased seaman¹. The discovery of a rusty iron cross, subsequently discarded into a dustbin in Hexham, suggests the latter. Yet the truth will never be known, for the site in question now lies deep beneath the concrete of the island's main runway. Nor has there been any organised archaeological examination of any part of the Archipelago since 1945.

While it seems at first sight unlikely that, with so small a land area and so little

external evidence of human activity, anything substantial will turn up predating the 16th century, there is enough to suggest that more may have been going on since that time than is commonly supposed. For example, wrecks are a common source of historical information in oceanic areas and the Chagos certainly had its fair share of such disasters. When Lieutenant Blair produced the first detailed chart of Diego Garcia in 1786, he marked its North East and South West coasts as having "many wrecks".

The best-known of the early Chagos wrecks, however, is that of the Portuguese merchant ship *Conceicao*, which supposedly went aground in Peros Banhos on 21 August 1555², but which seems more likely to have met her end elsewhere. Could an ancient anchor, embedded in the reef adjoining Nelson Island and spotted by a diver, belong to that vessel? Evidence of another wreck was found on Egmont Island in 2006, when the crew of the patrol vessel *Pacific Marlin* chanced upon a deposit of broken porcelain and collected a number of samples. These remain in the possession of their finder. A small number of fragments were left in a plastic bag aboard the vessel (see illustration) and handed to a member of



a visiting expedition. These have since been examined by the British Museum's experts and identified as Ming trade ware of the late 16th or very early 17th century. I myself know of 17 wrecks which have occurred in Chagos waters.

A favourite speculation is that the Chagos may have been used by one or other of the many pirate bands that operated in the western Indian Ocean. Sadly for romantics, there has been as yet no clear evidence to support the notion, though one of the sailors involved in the British attempt to settle Diego

Garcia in 1786 had been there before, aboard the *Concord*, a ship captured by a French privateer. However, when *Peak of Limuria* reported the story of the Poulailleur de l'Anglais Mort, Paul Caboche (one of CCT's honorary life members) was prompted to look again for the first time at two corroded coins he had picked up at East Point in 1941. Once he had cleaned them, he took rubbings, from which the numismatic specialists at the British Museum have been able to identify both as one-fifth ecu silver coins, minted at Poitiers in 1727. These were not small change, having had a purchasing power of nearly £30 at today's values. Were they part of a more substantial hoard? Only a search with appropriate instruments can tell.



Other items found by chance have been assembled in the island's small museum, but no catalogue of its contents is currently available.

These few examples suggest that there is more to be learned about the early history of the Chagos and that archaeology can play an important part in this process. Of course, claims to spend money for such purposes need to be assessed in relation to other demands on resources. Earlier this year, however, permission was sought to include the Chagos islands in

the ambit of a major research project being undertaken under the auspices of the Australian National University, as part of its long-term programme known as 'The Indo-Pacific Colonisation Project'. This imaginative and holistic project will enable the Chagos Archipelago's distant past to be set in the context of ancient patterns of migration and maritime navigation, as well as allowing terrestrial examination of some of its least-visited islets. At the time of going to press, there is optimism that this project will be allowed to proceed; what is more, its funding is already assured.

It is not altogether clear how historical study may fit into the framework of governance for the BIOT. Even for the CCT, this area of concern comes, naturally, second to natural conservation. However, the existence of BIOT legislation enabling Britrep, as Coroner, to hold inquests on treasure trove³ suggests the acceptance of some degree of official interest and responsibility. So does the ordinance⁴ regarding abandoned property, including wreckage, which allows Britrep to take such objects into public possession. It is to be hoped that, as and when physical indications of the earliest history of the Archipelago are discovered, arrangements for their conservation will be put in place, with opportunities given for expert examination.



1 *Peak of Limuria* (p70), 2004 Chagos Conservation Trust

2 See *Chagos News*, No. 29 (Jan 2007)

3 Coroner's Ordinance, 1985

4 Abandoned and Lost Property Ordinance, 2005

Objectives for scientific work in Chagos

Charles Sheppard¹, Nick Graham², Al Harris¹, Chris Hillman, Geoff Hilton³, Rachel Jones⁴, Andrew Price¹, Sam Purkis⁵, Pete Raines⁶, Bernhard Riegl⁵, Anne Sheppard¹, Mark Spalding⁷, Jerker Tamelander⁸, John Topp⁹, John Turner¹⁰.

1 Warwick University UK, 2 James Cook University Australia, 3 RSPB UK, 4 Zoological Society London, UK, 5 National Coral Reef Institute USA, 6 Coral Cay Conservation UK, 7 The Nature Conservancy, 8 IUCN, 9 Chagos Conservation Trust, 10 Bangor University UK

The Chagos archipelago is widely known to be an exceptional system of coral reefs and islets. The Pew Foundation's Ocean Legacy Program has identified it as one of six globally most important marine wilderness areas. In a time of cataclysmic decline in coral reefs world-wide, with firm predictions of worse to come, it provides a rare example of a reference area for coral reef ecology and climate change related research.

Because the ability of tropical marine environments to support the millions of people that depend on them is being threatened, and indeed has already failed in many places, there is a need for research into ways of understanding and then minimizing threats to reefs. Sites such as Chagos are extremely valuable in this regard.

The Chagos Conservation Management Plan was accepted by the BIOT Government in 2003. Parts of it have been implemented, based on previous research. Each element proposed below supports the objective of permitting continued and future adaptive management of the archipelago, and of maintaining and enhancing its worldwide value.

Three broad categories of research work have been undertaken in Chagos which should be developed along the lines below. They overlap.

Group A is basic monitoring necessary to maintain adequate environmental management of the archipelago, which is an obligation of the BIOT Government.

Group B relates to global issues. It is one of very few global locations where climate change effects are not complicated by direct forms of pollution and coastal development. Its geographical location also means it fills a gap in global programmes, or appears to be a crucial stepping stone in oceanic species distributions.

Group C covers work which should be done if the already recognized high ecological value of Chagos is to be restored and improved.

Costs: Some items are inexpensive, others costly. Cost to BIOT is generally no more than granting permission to visit and permission to use the BIOT Patrol Vessel or others offered by foundations in the manner done before. Funding would be as for all research, via applications to suitable bodies for post field work laboratory costs and staff time. Funds for several of the following are held already by potential visiting scientists.

The following, then, is a summary list. Each and all can be amplified, and would need to be as and when they can be taken forward. This list is the basis of a full scientific plan for Chagos.



Removal of invasive rats from infested islands is a priority restoration project. Photo: Chris Patrick

Group A research – Monitoring of reef and island condition

1. Repeated measurements of coral cover, community structure and juvenile recruitment to estimate extent and timing of recovery from previous climate change impacts.
2. Repeated measurements of reef fish status, abundance measurements of key groups and estimates of fish biomass, as indicators of responses to climate change and as a reference point for global comparisons.
3. Improve existing estimates of extent and damage from poaching, especially of shark, grouper and sea cucumbers.
4. Substantially upgrade monitoring of the internationally important seabird populations and their responses to environmental change and fluctuations.
5. Continued monitoring for marine diseases and species introductions, and consider preventative and remedial measures.
6. Micro-atoll measurements for data on past, present and future sea levels.
7. Base-line measurements of coastlines and linked measures of erosion.
8. Establish an ocean water alkalinity data series to measure acidification.
9. Improve understanding and modelling of reef and lagoon currents and circulations, to identify locations most at risk from shoreline alteration and erosion.
10. Continuation of temperature measurements at depth intervals.
11. Preliminary plankton studies of key groups which underpin much of this marine system.

Group B research – Global environmental research needs

12. Geochemistry cores of reef and corals to develop historical temperature records over the past 3-4 centuries, for referencing future changes.
13. Geochemistry cores for linkage and calibration of global climate oscillations.
14. Measurements of atmospheric gases for calibration of geochemistry cores, and to fill the gap in global coverage that exists in the Indian Ocean.

15. Continued genetic analyses to establish the biological 'connectedness' of Chagos with the rest of the ocean, and to understand its role as stepping stone and as a source of biological replenishment for depleted, inhabited areas.

16. Tagging studies to investigate key migratory fish species movements.

17. Biodiversity inventories to feed into international databases.



Scientist at work on 2006 expedition. Photo: C Sheppard (This picture was used in an article on Chagos in the August 2008 edition of BBC Wildlife magazine)

Group C research – Restoration of ecosystems and management improvements

18. Conduct island vegetation mapping, soil structure and stability assessments.
19. Rat eradication on Eagle Island (and subsequently other infested islands).
20. Chicken eradication on Nelsons Island, Eagle Island and the Three Brothers.
21. Vegetation restoration of Nelsons Island, Three Brothers and Eagle Island in conjunction with rat eradication.
22. Development-reestablishment of hardwood tree nursery on Diego Garcia for offsetting arrangements on Diego Garcia and to supply seedlings for other islands.
23. Investigation of turtle management (hatchery) with a view to accelerating their recovery from the past depredations.
24. Removal of flotsam where it is impeding turtle nesting success.

25. Building on GIS completed in 2007, complete archipelago-wide mapping of shallow-water habitats using satellite imagery; identification and mapping of highly vulnerable areas such as spawning sites, nursery areas and breeding grounds; areas of high erosion and likely inundation.

26. Exploration of unexamined areas such as the submerged banks and atolls, which are likely to influence archipelago resilience.

27. Linkage of the GIS to an image database.

28. Strategic environmental impact assessment to determine potential impacts and their consequences from a broad range of natural and anthropogenic factors.

29. Meta-analyses of research data and publications, to further define the global and regional (Indian Ocean) conservation value of the archipelago, including as a biodiversity refuge for reseeded degraded reef areas and as a natural heritage area.

30. Supply advice to BIOT for reducing poaching and fishing in the archipelago, in particular of top predators (sharks), iconic species (turtles) and lagoonal sand cleaners (sea cucumbers)

31. Adaptively refine Marine Protected Area boundaries and the management plan based on all of above.

This programme is comprehensive. It would maximise the unique opportunity which Chagos provides for scientific research, to permit its effective management and to benefit other reef areas which need intervention or management. Many of the elements are likely to greatly reduce future costs of environmental management.



Photo: Anne Sheppard

Membership News

2008 AGM

This year's AGM was held at the Royal Over-Seas Club on 18 November with more than 40 attending, including Chagossian guests. The Chairman's report was distributed to members (and is on the CCT website). He highlighted the constructive relationship with the Pew Trust and the creation of the Chagos Environment Network; this was promoting common proposals for the long term protection of the Chagos Archipelago. The formal business was then quickly concluded; a report has been sent to members.

There followed an inspiring presentation: Dr John Turner showed the wonderful natural biodiversity our Trust aims to conserve, including flamboyant coral, the huge variety of fish and other marine wonders, birds of many sorts and the variety of plants, all on beautiful islands in a clear sea that forms the Chagos archipelago.

Prof Charles Sheppard then brought us back to reality by showing damage already done, but then moving on to show how preservation is well within our grasp using good old fashioned hard scientific work combined with many new and exciting scientific methods.

Thereafter the Commissioner BIOT (and Foreign and Commonwealth Office Director, Overseas Territories) Colin Roberts, gave an encouraging address outlining the challenges the government faces and welcoming the support of CCT, the Chagos Environment Network and his Conservation Consultant and any other scientific support, in order to map a way forward for conserving the striking biodiversity of the BIOT environment.

The Commissioner drew attention to the need to raise public awareness of the environmental importance of the area

and welcomed particularly the production of the new brochure about the Chagos ecology and its conservation.



BIOT Commissioner Colin Roberts addressed CCT members at the 2008 AGM in London

During questions, when asked about the lack of “joined-up government” to protect the environment of the Overseas Territories, and BIOT in particular, the Commissioner agreed that it should be ‘ten times’ better.

Those present then continued valuable discussion over a glass of wine and other refreshments.

Anyone wanting a copy of the minutes of the meeting or any other information please contact the Secretary at secretary@chagos-trust.org

Chagos News is a private newsletter produced by the Chagos Conservation Trust; Registered Charity Number 1031561. The views expressed are those of individual contributors and are not necessarily those of the Charity or the Editor. All rights reserved. Permission to reproduce any part of Chagos News must be sought from the Editor at chagosnews@chagos-trust.org

CCT Committee

Following nominations, and there being sufficient places not to require a vote, the 16 Executive Committee members are -

William Marsden - Chairman
Richard Martin - Treasurer
Simon Hughes - Secretary
Michelle Taylor - Membership Secretary
Charles Sheppard John Topp
Chris Davies Geoff Hilton
Rachel Jones David MacLennan
Paul Pearce-Kelly Sam Purkis
Pete Raines Anne Sheppard
Mark Spalding John Turner

New Website Design

Members who have logged on to the CCT website www.chagos-trust.org will have noticed the exciting new design. There are a lot more pictures and information and more will be added over the coming months.

We are very interested in your feedback and there are email links on the website through which you can contact the chairman, secretary, treasurer, membership, webmaster, Chagos News and information.

If you have a relevant website and would like to link your website to the CCT website, please contact the webmaster. Links like these help increase the search engine optimisation and help make the website more prominent.

Chagos News

We are always pleased to receive submissions for *Chagos News* from members. Articles for consideration should be submitted to chagosnews@chagos-trust.org



The Coconut Palm – *Cocos nucifera*

Apart from the traveller's initial impression in the developed areas of Diego Garcia, the coconut palm dominates all the islands which have been inhabited. The islands, first viewed from the sea, present an even skyline of waving coconut fronds and an abrupt vertical transition from sea surface to palm top. Landing on the islands, you walk from the beach through a narrow band of *Scaevola* or *Argusia* (*Tournefortia*) scrub and under the cool but chaotic coconut canopy. High above, the stellate leaf rosette fans stand out against the sky, held by ruler-straight trunks with no branching. The ground beneath is littered with a deep mulch of palm material, overlain by more recently fallen giant fronds, old trunks, flower stalks, and an ankle-twisting layer of fallen coconuts with almost no other plant cover.

We do not know if man was instrumental in first bringing coconuts to these and other oceanic islands, or whether fertile nuts were carried there by sea currents. What is known is that after about 1800 many islands were drastically cleared of all native vegetation to be replaced by orderly rows of coconut palms, grown for their oil. It is these plantations that, since settlement came to an end between 35 and 70 years ago, have now run rampant with a tangled ground layer of shed detritus, a dense growth of competing juvenile trees, and a soaring canopy of older trunks. Few other plant species can compete in the shade beneath and against all the palm detritus at ground level. New palms generate wherever space presents itself along the beach or from a fallen elderly palm torn down by the winds.

Such dense mono-specific vegetation benefits few other species. Noddies and Fairy Terns will nest on the fronds, black rats (another human introduction) abound, boring their way into the heavy nuts amazingly rapidly, and the giant Coconut Crabs lumber below and up the trunks, tearing nuts apart with their powerful claws.

Clearly, in order to encourage the growth of the original indigenous vegetation with its giant long-lived trees and open clearings suitable for important bird nesting, the problem of dominance by the tree-weed coconut palm will need to be addressed.

The **Chagos Conservation Trust** is a charity (Registered in the UK No. 1031561), whose aims are to promote conservation, scientific and historical research, and to advance education concerning the archipelago. The Trust is a non political association.

If you would like more information on the publications or membership, please contact the Secretary

simonhughes@hughes-mccormack.co.uk

or visit www.chagos-trust.org