Chagos Scientific Research Expedition to Northern Atolls
Outline

21st February – 12th March 2013

PRIFYSGOL BANGOR UNIVERSITY

ZSL LIVING CONSERVATION

THE UNIVERSITY OF WARWICK

DARWIN INITIATIVE

Overview

Between 21th February – 12th March 2013 a scientific research expedition will take place in the Chagos Archipelago (British Indian Ocean Territory). Most of the cash funding comes via DEFRA's Darwin Initiative, but the expedition is supported and facilitated also by the BIOT Administration and numerous other institutions including Chagos Conservation Trust and institutions of all participants. Fourteen scientists and supporting team members will participate. Our research plans prioritise the continuation of long-term monitoring programmes for the large BIOT marine reserve, and continue to establish the best and most resource-efficient methods to monitor and manage the area. The work includes both shallow reef and island work and is designed to assist BIOT in understanding and managing the world's largest fully no-take MPA, maintaining this extraordinarily rich area of marine and terrestrial biodiversity.

Research Objectives

These are in no particular order. The programme as a whole will follow previous planning patterns in terms of a general anti-clockwise rotation around the atolls, with access determined sometimes by weather conditions, slippage in programmes (or the reverse), and taking opportunities when something unexpected occurs (e.g. investigation of the unexpected outbreak of the coral predator 'Crown-of-Thorns' off Eagle Island in 2012). We have always previously succeeded in achieving most goals and more, thanks also to the enthusiastic support from the Officers and Crew of the *Pacific Marlin*.

1. **Long-term monitoring of reef condition in the Indian Ocean (Charles Sheppard, John Turner, Anne Sheppard, Ronan Roche, Morgan Pratchett)**

There are two long-term reef monitoring programmes that involve measurement of reef changes over time. One has involved coral cover measurements since 1978, including coral recovery assessments following the climate change driven mortality of 15 years ago. The value of this routine, ongoing project has been to show that coral recovery patterns in Chagos are unmatched by most other places in the world, and that the value of this area is extremely important in the context of the ocean. Furthermore few places have coral cover data over such a long period and over such a significant time for coral reefs, which is scientifically of considerable importance.

We will conduct repeat measurements at the same locations across Chagos to contribute to the longest time series of reef condition data in the Indian Ocean – this being valuable because a 'trajectory' yields far more information than does a one-off set of measurements. Archival video will be recorded at permanent monitoring sites for future comparison, and for comparison with video records first made 7 years ago, at a time when the reefs were just beginning to recover from major bleaching events.

Now that recovery is complete - following the 1998 bleaching event, but perhaps only until another warming episode – we will expand monitoring to measure juvenile coral recruitment, which is the basis of the next generation of reef and island building corals.

In addition, growth and growth rates of selected and dominant forms of corals will be measured. This is an indication of coral 'health' in broadest terms, and good growth (which is apparent though unquantified) underpins the growth of reefs and islands as a whole.

2. **Technology development for monitoring fish and shark assemblages across the Chagos shelf (Gary Fletcher)**

Deployment of video systems during both pelagic and coastal expeditions in Chagos during 2012 in order to study the fish and shark assemblages of the coral reefs yielded extremely positive results. However, these deployments were limited only to 2-3 hours and as such only provided a snapshot of the species and associated habitats of interest. As such, solutions to allow longer term-monitoring will be developed as part of the present expeditions. This will improve the techniques, and the efficiency of their data collection, that are presently being utilised and also allow satellite up-link of these units to allow real-time analysis of data. Once these sentient units are complete, it will offer a low-cost monitoring system that, when deployed as a network, will greatly expand the area that can be observed.

While the primary focus for these units is the monitoring of large, especially pelagic fish, which have previously remained a significant gap in our understanding of the BIOT region, they can easily be deployed to monitor shallower ecosystems.

3. Coral reef biodiversity (Catherine Head, Morgan Pratchett, Michelle Gaither, Daniel Wagner)

Our understanding of biodiversity of smaller species groups is extremely poor in comparison with that of some groups such as reef-forming corals, fish and some bottom-dwelling invertebrate mega-fauna, despite making up the largest component of coral reef diversity. This project develops the work which was started in 2012 and focuses on assessment of the diversity of select groups of reef crypto-fauna and examines the relationship between these and reef-forming corals, fish and conspicuous mega-fauna on the relatively pristine reefs. To assess the number of small bottom-dwelling invertebrate species and their abundance at sites within the Chagos Archipelago dead coral heads and coral rubble will be collected on exposed and sheltered sides of the reef slope. Samples will be analysed using a combination of morphological and molecular methods, including novel DNA barcoding methods. These will be compared with the diversity of corals, fish and conspicuous megafauna, established using conventional survey methods.

The broader scope of this project involves biodiversity assessments over varying scales of human impacted reefs at locations across the Indian and Pacific Ocean enabling a trans Indian–Pacific Ocean biodiversity and connectivity comparison to be made with the Chagos Archipelago.

In addition, standard blocks of settlement plates will be deployed for collection a year later, to help understand new recruitment of biota to the reefs.

4. Long-term monitoring of bird populations (Pete Carr, Yannick Mandarin)

We will continue the long-term monitoring and research of the important breeding seabird colonies on the ten designated and two proposed Important Bird Areas (IBAs). The focus of the monitoring and research is to unravel the breeding phenology of the seabirds of BIOT in order to determine whether the present specific island designation for IBAs (as opposed to island clusters) is the best long-term conservation management strategy for breeding seabirds in BIOT (collaborative project with RSPB), and, what triggers breeding of seabirds in BIOT?

5. Monitoring physical parameters on Chagos reefs (Charles Sheppard, Anne Sheppard)

We will continue the collection and replacement of currently deployed temperature loggers which have recorded a set of two-hourly sea temperature measurements taken at many depths and locations, some since early 2006. Analysis of these data is helping to determine what physical factors assist in maintaining the good condition of Chagos reefs.

6. Video transects of reefs (John Turner, Ronan Roche)

Many sites have been used for recording for many years. Several were filmed along transect lines in 2006. These form permanent records for later lines of work. These transects will be recorded again.

7. **Structural complexity of coral reef communities (John Turner and Ronan Roche)**

Recovered reefs have increased in their structural complexity, and this will be measured by assessing rugosity (the roughness)of the coral canopy, and identifying the types of coral that most contribute to creating that structure at habitat scale.

8. **Filming of BIOT marine reserve (Jon Schleyer)**

High definition video will be taken of the underwater, terrestrial and aerial wildlife and environment of the BIOT marine reserve, as well as the scientific efforts and research being undertaken by the expedition. The focus will be on natural history, to document for future use and reference, and for outreach as decided by the BIOT Government.

9. **Sample collection (Anne Sheppard)**

Important, value-for-money aspects of previous expeditions have been collection of material for other research programmes in other parts of the world, including for laboratories and collaborating scientists in UK, USA, Germany and Taiwan. This will be continued.

10. **Sea cucumber recovery (Anne Sheppard)**

Heavy poaching in earlier years greatly reduced the population of these animals, one of whose functions on the reef is essentially to clean sand. In 2012 signs were evident of recovery with large numbers of juveniles spotted on a couple of locations. These will be measured systematically this time in order to determine the rate and extent of recovery of this key group of organisms.

11. **Reef fish connectivity work (Michelle Gaither)**

The position of the Chagos Archipelago in the geographic centre of the Indian Ocean indicates that its reefs may act as a stepping stone between the habitat-rich regions to the east and west: a role that would have important biodiversity consequences throughout the region. New collections during the proposed expedition, coupled with the samples previously collected from elsewhere in the Indian Ocean, can shed light on the level and direction of migration within the region and allow us to address several questions of evolutionary and conservation importance, including 1) Is there cryptic diversity in the Chagos archipelago? 2) How important is Chagos as a stepping stone between the western and eastern Indian Ocean? 3) Are populations of reef fish in the BIOT more affliated with locations to the west, as suspected from oceanographic current patterns, or to the north, as predicted from geographic proximity? This work began in 2009, will continue in 2013 and subsequently.

Participants

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Principal grant holder of Darwin Award.
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BIOT Commissioner's environment Advisor and Expedition Leader.
Dr Jon Bailey, Expedition doctor, medical logistics.
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