

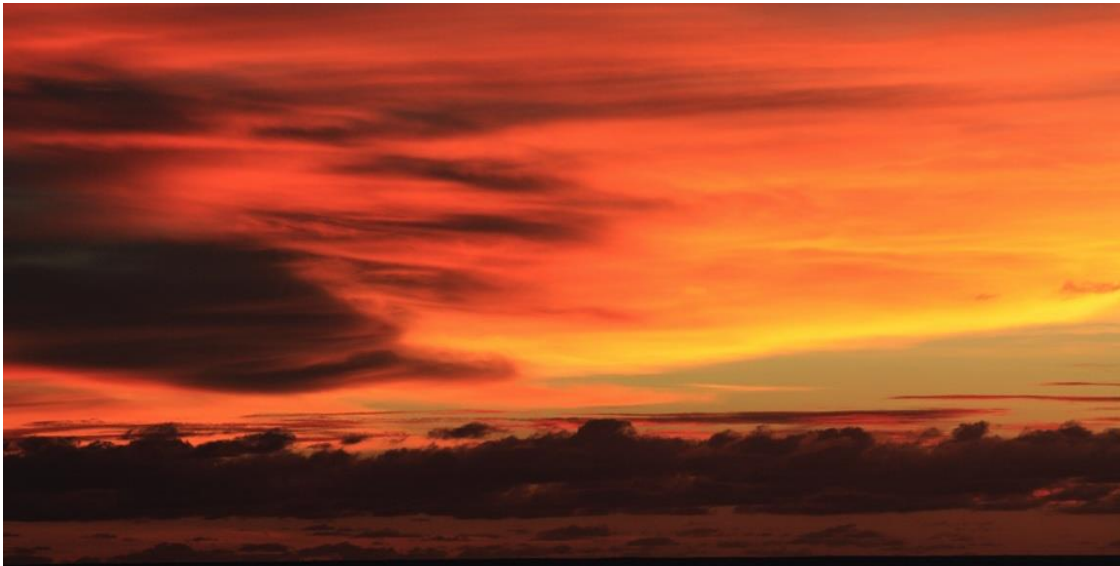
BIOT Animal Tracking & Monitoring Receiver Retrieval Expedition

Final Report, April/May 2017

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Executive Summary

The British Indian Ocean Territory (BIOT) is among the largest no-take contiguous marine protected areas in the world. The ecosystems of BIOT are notable for being among the healthiest in the world, which provide a unique opportunity to examine the impacts of climate and humans on marine resiliency. The Bertarelli Programme for Marine Science (BPMS) was created to conduct scientific monitoring of marine ecosystem and population health and collect biological data from the region to foster informed management. To achieve these goals, researchers from Stanford University, the University of Western Australia and the Zoological Society of London have been using electronic tag technologies to study mobile predators and the habitats they use. In March and April 2016, in order to expand the array coverage we deployed 16 acoustic release (AR) receivers on deep seamounts and canyons which until recently were inaccessible without such remote technologies as they lie outside safe diver-retrievable depths. The battery life of the receivers requires that they be retrieved within 14 months of deployment to ensure sufficient battery life to activate the release mechanism. In April/May 2017, scientists from Stanford University and the Zoological Society of London joined with the crew of the BPV Grampian Frontier to retrieve these acoustic units and the critical data they hold. Over a 5-day expedition, our team successfully combined retrieval and fisheries enforcement operations, making full use of the versatility of the new patrol vessel and her daughter crafts. We recovered 12 of 16 AR receivers and serviced 2 VR4 Global units in addition to patrolling nearly 500 miles of the reserve and building relations with the new crew. The four remaining receivers were either unable to release or unresponsive. The units retrieved contained over 500,000 detections, underscoring the importance of the acoustic network to highlight the connectivity and role of seamounts throughout BIOT.

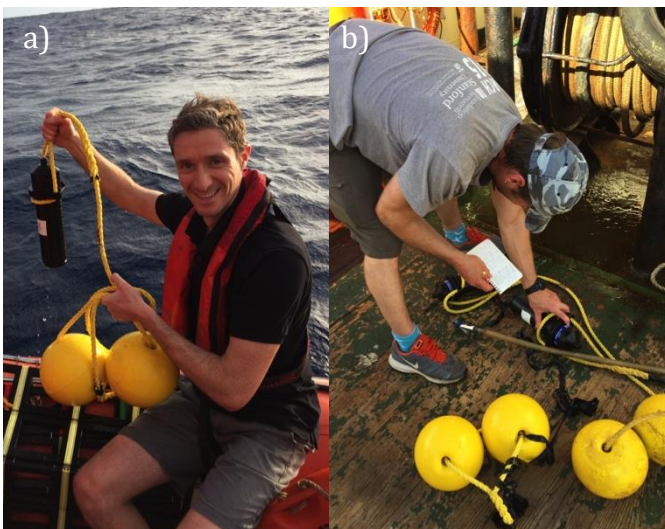


Figure 1. a) Dr Jacoby retrieves the first Acoustic Release receiver at Sandes Seamount. This unit was retrieved from 550m. b) Dr Chapple catalogues receivers retrieved after nearly 13 months at 600m.

Introduction

The British Indian Ocean Territory (BIOT) is among the world's largest marine protected areas and effective long-term biodiversity and fisheries management strategies are only possible with extensive knowledge of how and when species utilize this region. The Bertarelli Programme for Marine Science (BPMS) has supported efforts to assess how elasmobranchs and teleost fishes utilize this area and how isolated island and atoll ecosystems are connected by large fish movement patterns. To achieve these goals, researchers from Stanford University, the University of Western Australia and the

Zoological Society of London (ZSL) have used electronic tag technology to study the residency, habitat use and connectivity of fish, sharks and mantas, within and around BIOT. This research is vital for understanding the importance of the archipelago as a refuge for pelagic fish and elasmobranchs, and the more residential reef associated animals, in addition to assessing the efficacy of the reserve as a whole for protecting these species. Telemetry data obtained from long-term acoustically tagged animals can be used to estimate home range and habitat use of the focal species. Such geospatial data is vital for understanding habitat use, identifying aggregation hot spots and estimating predator density throughout BIOT.

To support these goals, the BPMS team undertook two research expeditions in March and April of 2016 aboard the M/Y VAVA II. During these expeditions the scientific team expanded the current acoustic monitoring array to include deep-water seamounts and canyons, deploying receivers outfitted with an acoustic release (AR) mechanism and tagging 137 animals, with acoustic tags. These areas were chosen as they were thought to be hotspots for marine animal activity, but their extreme depths previously prevented deployment of diver-serviced receivers.



Figure 2. Crew from the BPV Grampian Frontier (background) assist in retrieving an Acoustic Release unit at Schwartz Seamount

Though these AR units can remain in the water for up to 14 months, they must be retrieved before their battery lifespan expires. Therefore, to retrieve these units scientists from Stanford University and ZSL joined a fisheries patrol with the BIOT Patrol Vessel Grampian Frontier (BPV). Together the team was tasked with retrieving the 16 AR acoustic receivers, while actively patrolling for illegal activities within BIOT.

Results & Discussion

The BPV and BPMS team left Diego Garcia on April 27th. Over the next six days we patrolled over 500 miles throughout BIOT. We successfully retrieved 11 of the 16 receivers and gathered detection data from a 12th. Three receivers were either unresponsive or had shifted from the deployment location due to strong currents or tides. The final receiver was responsive, but unknown circumstances prevented its release. Along with the 12 receivers, we retrieved an Acoustic Doppler Current Profiler from Manta Alley in Egmont channel and serviced the two remaining VR4 Globals.

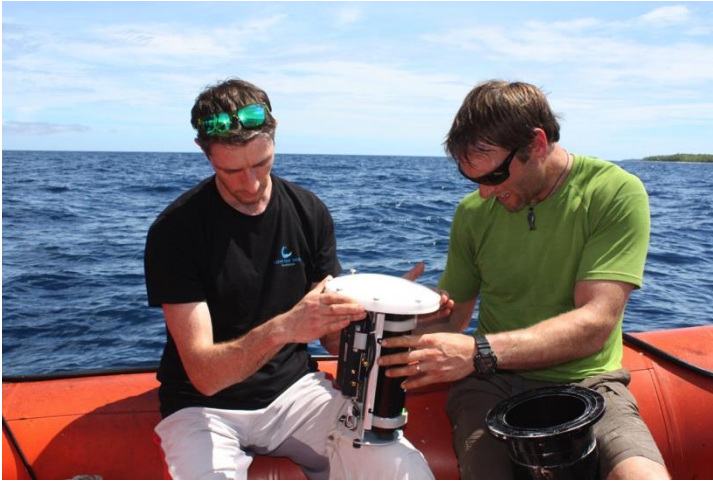


Figure 3. Drs Jacoby and Chapple service a VR4 Global unit near YeYe Island on a support vessel from the BPV Grampian Frontier.

The 12 receivers provided an unprecedented wealth of data and insight into the connectivity of the archipelago (Fig. 4). These data contribute to a long-term data set from BMR that is unparalleled in its size and geographic coverage and that continues to grow by the day. Receivers at Sandes and Schwarts Seamounts (n=4) collected 433,456 detections from 159 unique individuals. Receivers around Egmont (n=2) recorded 92,632 detections from 54 different animals. Speakers Bank (n=3), the

northern-most extent of the array, recorded 279 detections from 3 individuals. Interestingly, the receivers at Pitt Bank (n=3) had no detections on them, indicating there is little connectivity between nearby seamounts and the Bank. These acoustic data will greatly increase our understanding of connectivity throughout the nearby and far extents of the archipelago.

We also serviced the batteries of the VR4 Global near YeYe Island in Peros Banhos and inside the lagoon at Egmont. These units are now powered to remain in place until April 2018. The Acoustic Doppler Current Profiler, retrieved from Manta Alley at Egmont has stored information about the current profiles of this newly discovered manta highway and will provide vital environmental data for assessing why this area is so important for this species. Data from this unit will be downloaded and analyzed upon return to the lab at Stanford University.

Lastly, an important component of this expedition was to meet the new crew and the Fisheries Enforcement Officer Dave Hughes, whom several members of the BPMS will be working with closely over the coming years. Drs Jacoby and Chapple provided a series of presentations to the crew of the BPV summarising the tagging and monitoring efforts and the goals of the BPMS team. During the seven days aboard the BPV, a number of useful discussions were had regarding the past and present enforcement strategies and also FAD monitoring which will be of particular relevance to the programme as we move forward with proposals 1 and 3. Furthermore, the crew of the BPV are now familiar with our programme and goals so we can further build the collaborative potential for future joint expeditions into BIOT.

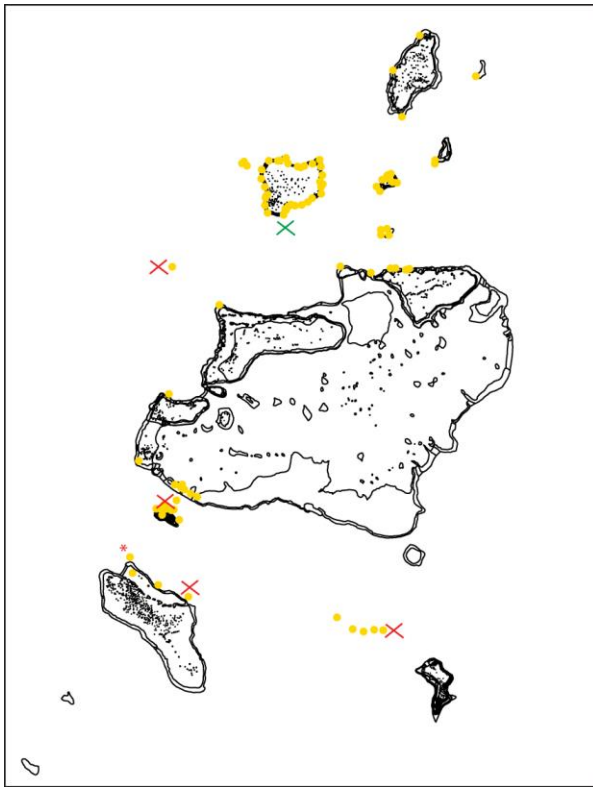


Figure 4. Acoustic monitoring devices deployed around the BMR. Crosses show the acoustic release (AR – Red, VR4 Global – Green) receivers that we were unable to retrieve. Asterisk shows the receiver at Pitt Bank where we were able to determine remotely that the receiver contained no detections.



Figure 5. Drs Chapple and Jacoby put on an evening of talks for the different shifts of the BIOT Patrol Vessel informing the crew of the aims, objectives and recent findings from the BPMS.

Acknowledgements

This fieldwork was funded by the Bertarelli Programme for Marine Science and would not have been possible without the hard work of a number of people. We would like to thank the BIOT Administration for approving the expedition and Helen Stevens and Gracie Dumlao for continued logistical and movement support. We also thank the Master and crew of the BPV Grampian Frontier for all their support, technical assistance and interest during our time aboard, in addition to Dave Hughes (SFPO) for the interesting discussions and assistance in understanding the role and strategy for enforcement of the BMR.

Table 1. Timeline, work plan and locations visited during the scientific research trip aboard the BPV Grampian Frontier Apr – May 2017.

DATE	LOCATION	ACTIVITY
04/27/17	Diego Garcia	AMC Flight from Bahrain
04/28/17	Steaming west: Sandes Seamount (4 AR retrieved, 1 unable to release)	Board the BPV (DG), safety briefing, deployment of small craft to find and retrieve deepwater receivers using the surface modem and acoustic release mechanism.
04/29/17	Egmont Islands, Pitt Bank (5 AR and VR4 Global retrieved, 1 unable to release, 2 no communication)	Arrive in channel between Egmont and Pitt, TKC heads north to Egmont in the Daughter Craft to service the VR4 Global unit and switch batteries, DMPJ boards the Fast Response Craft to retrieve deep receivers on Pitt Bank.
04/30/17	Steaming north: West Grand Chagos Bank, Peros Banhos (1 VR4 Global retrieved and serviced, 1 AR no communication)	Fisheries patrol, battery change at northern Peros Banhos and search for seamount AR west of GCB. Yacht sightings and permit checking in southern PB.
05/01/17	Speakers Bank (3 AR retrieved)	Fisheries patrol, AR retrieval.
05/02/17	Nelsons Island	Assisted SFPO with camp and turtle nest monitoring of north shore of Nelsons Island before continuing east out into deep water to continue patrol activities.
05/03/17	Diego Garcia	Overnight steam back to DG, AMC flight back to Bahrain

Table 2. Status of deployments and retrievals of Acoustic Release receivers and servicing of VR4 Globals

WPT	LAT	LONG	DEPTH_M	Deployed	Date recovered
AR01	-5° 40.449	71° 22.359	300+	4/7/16	No Communication
EG08	-6° 38.072	71° 20.411	66	4/11/16	4/29/17
EG09	-6° 37.07	71° 23.40	286	4/11/16	4/29/17
EG10	-6° 34.109	71° 24.796	75	4/11/16	No Communication
PITT01	-6° 50.826	71° 12.117	20	4/10/16	No Communication
PITT02	-6° 57.572	71° 18.956	69	4/10/16	4/29/17
PITT03	-6° 54.698	71° 12.741	79	4/10/16	4/29/17
PITT04	-7° 00.429	71° 26.280	31	4/10/16	Unable to release
SB02/AR02	-4° 52.800	72° 15.880	52	4/7/16	5/1/17
SB03/AR05	-4° 54.260	72° 35.970	140	4/7/16	5/1/17
SB04/AR06	-4° 44.390	72° 22.380	39.3	4/7/16	5/1/17
SS01	-7° 05.429	72° 02.311	1124	4/12/16	Unable to release
SS02	-7° 08.294	72° 06.115	621	4/12/16	4/28/17
SS03	-7° 08.876	72° 08.756	248	4/12/16	4/28/17
SS04	-7° 08.444	72° 11.313	350	4/12/16	4/28/17
SS05	-7° 08.542	72° 13.516	370	4/12/16	4/28/17
EG4G01	-6° 39.460	71° 22.144	20	4/11/16	4/29/17
PB4G01	-5° 15.491	71° 56.385	19.6	4/6/16	4/30/17