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PROCEEDING OF THE RUFFORD IN-COUNTRY CONFERENCE

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BLEACHING PATTERNS AND CAPACITY BUILDING FOR MALDIVES CONSERVATIONISTS DURING REEF CHECK EXPEDITIONS

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Introduction

One of the particularly concerning attributes of coral reefs is the potential for 'phase shifts' from coral to non-coral dominated assemblages (e.g. Jamaica 25 years ago) (Dudgeon *et al.*, 2010). The reefs of the Maldives were variously regarded as 'pristine' or a 'wonderland' by initial visitors with SCUBA such as Cousteau in the 1950s, but profound ecological change has occurred since then. The 2016 bleaching event in the Maldives was induced by water temperatures of 32 degrees Celsius for two weeks in early May.

The Maldives is a nation built on atoll coral formation. Geological records show a relative stability in the environmental conditions of global reefs of the world up until the last 50 years, since when there have been an increasing number of warming events (e.g. 1998, 2002, 2016 for the Maldives). The Maldives has developed since the 1970s from a country of little tourism with a developing export market for tuna, to a country where global markets for tuna, live reef fish (e.g. grouper), and mass-tourism are starting to affect many of the local reefs and resources. The global bleaching event of 1998 led to 80% bleaching and mortality (90%) of hard corals to water depths of over 30m (Edwards *et al.*, 2001). By 2005 many sites had recovered much of their hard coral (Morri *et al.*, 2015), with a mean percent cover from Biosphere Expeditions of 35% between 2005 and 2015 for central atoll reefs. But our expeditions have come across two some completely degraded reefs where *Discosoma* corallimorphs are almost completely dominant (Adhureys reef in southeast Rasdhoo atoll, Deh Giri in Northwest Male' atoll). There are concerns over the ability of the habitat to recover after bleaching (Schumacher *et al.*, 2005; Zahir, 2002), particularly where coral reefs may change state to reefs dominated by *Discosoma*. The main purpose of our expeditions is to assess recovery and coral health. Our expeditions have provided capacity building opportunities for local Maldivians including joint training and supporting the training of Maldivian survey dive teams.

Methodology

The method used by the Biosphere-Expeditions team is the internationally recognized method, Reef Check. Reef Check trains volunteers to record benthic lifeforms, recognize anthropogenic impacts, count invertebrates and fish populations (Hill and Wilkinson, 2004).

Sites were selected based on accessibility from Male' during a week-long liveaboard trip (Figure 1). They include sites in inner atoll locations (thillas) and outer reefs. Some of the thillas are house reefs that are adjacent to resorts, and some were selected to be further away from development – these can be smaller, submerged reefs such as giris. Many of the outer and channel reefs are both adjacent to deep water, in areas of greater wave action, and have increased currents. These were selected based on safety, practicality and in areas that are known dive sites for liveaboard operators with whom the dive survey team have collaborated.

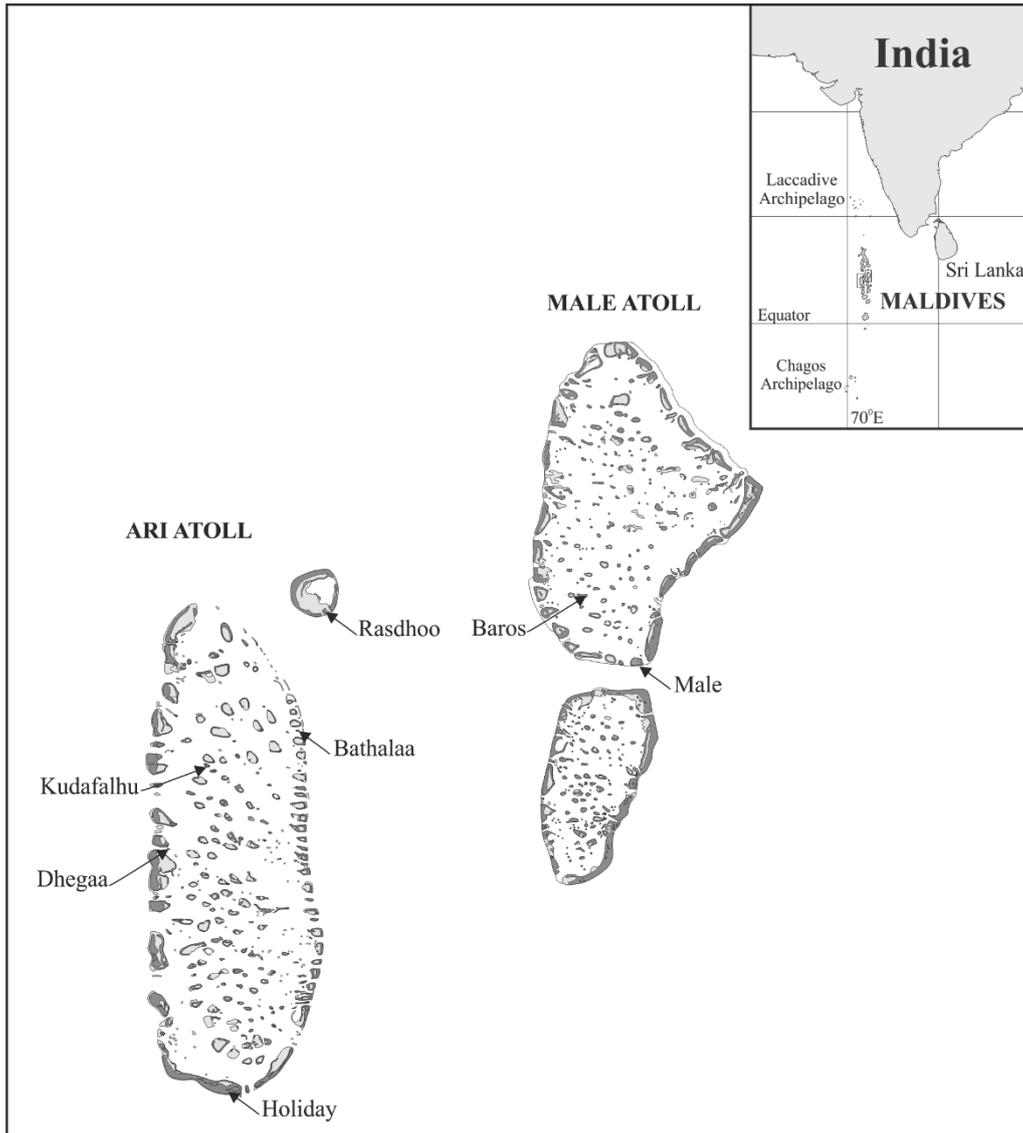


Figure 1. Location of 2016 surveys. Note the sheltered locations of the thilla sites – Baros, Kudhafalhu, Dega and Holiday. Rasdhoo is the most exposed, with Bathalaa slightly less exposed. A further site was surveyed on the outside of Dhigurah Island outside the large (Ari) atoll to the left.

Results and Discussion

Figure 2 shows that the coral cover of Rasdhoo and Bathalaa maagaa (both outer reefs, with Rasdhoo an almost vertical slope) show the highest cover of bleached hard coral, relative to inner atoll sites such as Dega, Holiday and Kudafalhu thillas. Baros data was recorded during the bleaching event in May 2016. This is why the ‘bleached coral cover’ is so high, and the ‘coral cover 2016’ is so low relative to other sites. For the sites recorded in July 2016, 2 months after the bleaching event, the most sheltered inner thilla sites such as kudhafalhu had already been infested with algae covering the dead and bleached coral. Also, this site had suffered from storm damage, as had some of the corals at Holiday thilla.

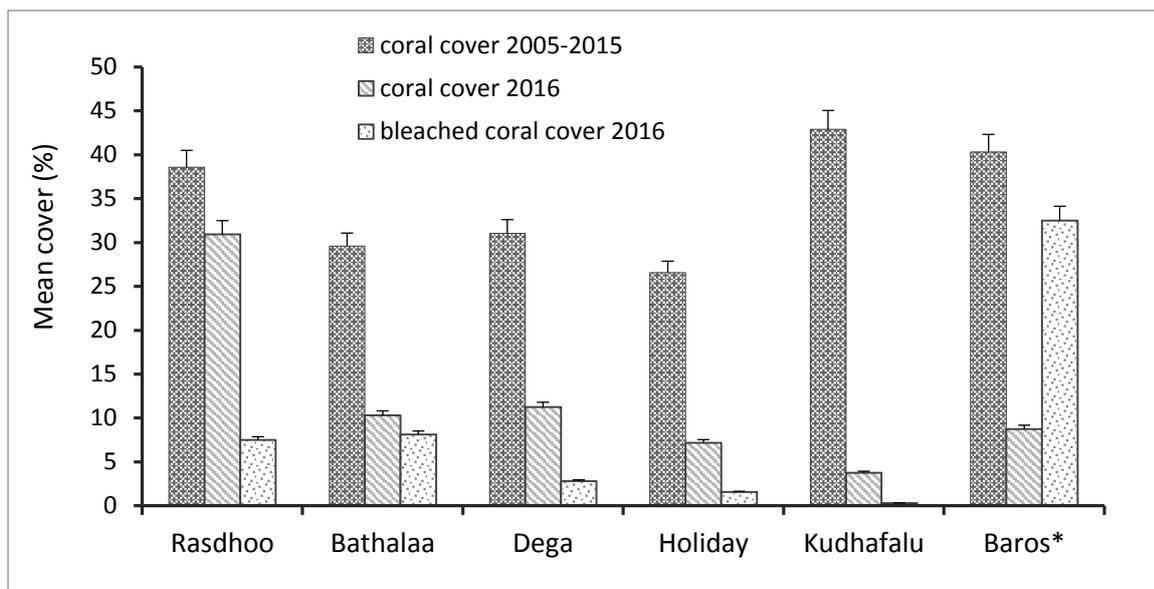


Figure 2. Mean live hard coral cover (\pm SE) before the bleaching event (data from all years pooled for each site) 2005-2015; live hard coral cover 2 months after the bleaching event, and the % bleached coral cover 2 months after the bleaching event. * Baros is exceptional in that the 2016 data was recorded during the bleaching event.

Some sites have shown extraordinary resilience to temperature-induced bleaching. Surveys in mid-July, 2 months after the bleaching event in May, showed corals in areas of deeper waters on the outside of atolls to be (a) either still bleached, some two months after the bleaching event, (b) recovered, or (c) not to have been bleached at all (e.g. Rasdhoo, Bathalaa). However, more sheltered reefs within the central lagoons showed mass colonisation by algal turfs, encroachment of vulnerable reefs by *Discosoma* corallimorphs, and Crown-of-Thorns invasions.

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