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TITLE: Large?scale bleaching of corals on the Great Barrier Reef

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ABSTRACT:

Abstract In 2015?2016, record temperatures triggered a pan?tropical episode of coral bleaching. In the southern hemisphere summer of March?April 2016, we used aerial surveys to measure the level of bleaching on 1,156 individual reefs throughout the 2,300 km length of the Great Barrier Reef, the world's largest coral reef system. The accuracy of the aerial scores was ground?truthed with detailed underwater surveys of bleaching at 260 sites (104 reefs), allowing us to compare aerial and underwater bleaching data with satellite?derived temperatures and with associated model predictions of bleaching. The severity of bleaching on individual reefs in 2016 was tightly correlated with the level of local heat exposure: the southernmost region of the Great Barrier Reef escaped with only minor bleaching because summer temperatures there were close to average. Gradients in nutrients and turbidity from inshore to offshore across the Great Barrier Reef had minimal effect on the severity of bleaching. Similarly, bleaching was equally severe on reefs that are open or closed to fishing, once the level of satellite?derived heat exposure was accounted for. The level of post?bleaching mortality, measured underwater after 7?8 months, was tightly correlated with the aerial scores measured at the peak of bleaching. Similarly, reefs with a high aerial bleaching score also experienced major shifts in species composition due to extensive mortality of heat?sensitive species. Reefs with low bleaching scores did not change in composition, and some showed minor increases in coral cover. Two earlier mass bleaching events occurred on the Great Barrier Reef in 1998 and 2002, that were less severe than 2016. In 2016, <9% of scored reefs had no bleaching, compared to 42% in 2002 and 44% in 1998. Conversely, the proportion of reefs that were severely bleached (>60% of corals affected) was four times higher in 2016. The geographic footprint of each of the three events is distinctive, and matches satellite?derived sea surface temperature patterns. Our aerial surveys indicate that past exposure to bleaching in 1998 and 2002 did not lessen the severity of bleaching in 2016. This data set of aerial bleaching scores provides a historical baseline for comparison with future bleaching events. No copyright restrictions apply to the use of this data set other than citing this publication.

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