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TITLE: Ecosystem restructuring along the Great Barrier Reef following mass coral bleaching

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ABSTRACT:

Global warming is markedly changing diverse coral reef ecosystems through an increasing frequency and magnitude of mass bleaching events1?3. How local impacts scale up across affected regions depends on numerous factors, including patchiness in coral mortality, metabolic effects of extreme temperatures on populations of reef-dwelling species4 and interactions between taxa. Here we use data from before and after the 2016 mass bleaching event to evaluate ecological changes in corals, algae, fishes and mobile invertebrates at 186 sites along the full latitudinal span of the Great Barrier Reef and western Coral Sea. One year after the bleaching event, reductions in live coral cover of up to 51% were observed on surveyed reefs that experienced extreme temperatures; however, regional patterns of coral mortality were patchy. Consistent declines in coral-feeding fishes were evident at the most heavily affected reefs, whereas few other short-term responses of reef fishes and invertebrates could be attributed directly to changes in coral cover. Nevertheless, substantial region-wide ecological changes occurred that were mostly independent of coral loss, and instead appeared to be linked directly to sea temperatures. Community-wide trophic restructuring was evident, with weakening of strong pre-existing latitudinal gradients in the diversity of fishes, invertebrates and their functional groups. In particular, fishes that scrape algae from reef surfaces, which are considered to be important for recovery after bleaching2, declined on northern reefs, whereas other herbivorous groups increased on southern reefs. The full impact of the 2016 bleaching event may not be realized until dead corals erode during the next decade5,6. However, our short-term observations suggest that the recovery processes, and the ultimate scale of impact, are affected by functional changes in communities, which in turn depend on the thermal affinities of local reef-associated fauna. Such changes will vary geographically, and may be particularly acute at locations where many fishes and invertebrates are close to their thermal distribution limits7. Fish and invertebrate communities transformed across the span of the Great Barrier Reef following the 2016 bleaching event due to a decline in coral-feeding fishes resulting from coral loss, and because of different regional responses of key trophic groups to the direct effect of temperature.

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