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TITLE: Severe Continental-Scale Impacts of Climate Change Are Happening Now: Extreme Climate Events Impact Marine Habitat Forming Communities Along 45% of Australia's Coast

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ABSTRACT:

Recent increases in the frequency of Extreme Climate Events (ECEs) such as heatwaves and floods have been attributed to climate change, and could have pronounced ecosystem and evolutionary impacts because they provide little opportunity for organisms to acclimate or adapt. Here we synthesize information on a series of ECEs in Australia from 2011-2017 that led to well-documented, abrupt and extensive mortality of key marine habitat-forming organisms ? corals, kelps, seagrasses and mangroves ? along nearly more than 45% of the continental coastline of Australia. Coral bleaching occurred across much of northern Australia due to marine heatwaves affecting different regions in 2011, 2013, 2016 and 2017, while seagrass was impacted by anomalously high rainfall events in 2011 on both east and west tropical coasts. A marine heatwave off western Australia during the 2011 La Niña extended into temperate and subtropical regions, causing widespread mortality of kelp forests and seagrass communities at their northern distribution limits. Mangrove forests experienced high mortality during the 2016 El Niño across coastal areas of northern and north-western Australia due to severe water stress driven by drought and anomalously low mean sea levels. This series of ECEs reflects a variety of different events ? marine heatwaves, intense rainfall from tropical storms, and drought. Their repeated occurrence and wide extent are consistent with projections of increased frequency and intensity of ECEs, and have broad implications elsewhere because similar trends are predicted globally. The unprecedented and widespread nature of these ECE impacts has likely produced substantial ecosystem-wide repercussions. Predictions from ecosystem models suggest that the widespread mortality of habitat-forming taxa will have long-term and in some cases irreversible consequences, especially if they continue to become more frequent or severe. The abrupt ecological changes that are caused by ECEs could have greater long-term impacts than slower warming that leads to gradual reorganisation and possible evolution and adaptation. ECEs are an emerging threat to marine ecosystems, and will require better seasonal prediction and mitigation strategies.

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