

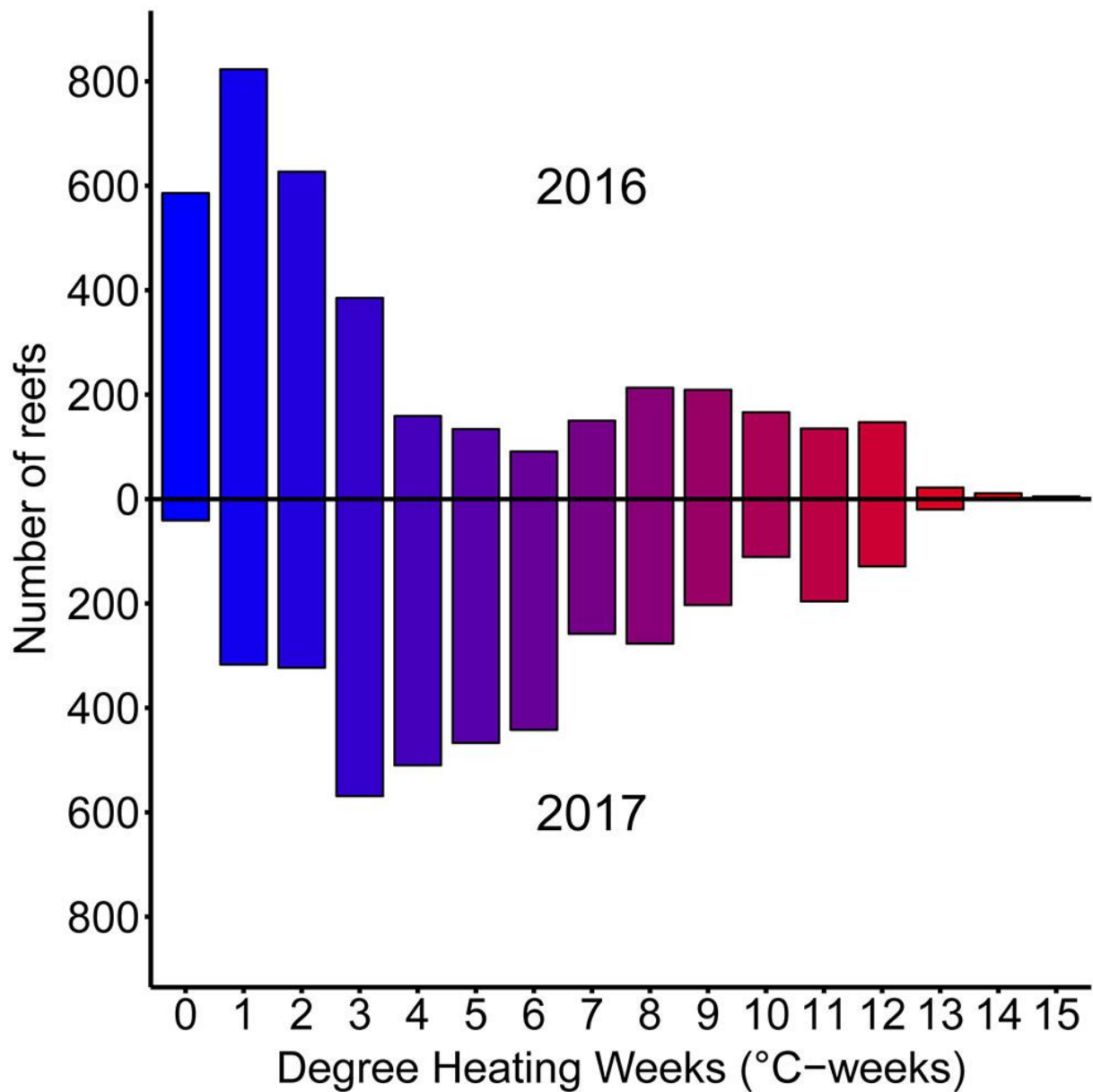
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Ecological memory modifies the cumulative impact of recurrent climate extremes

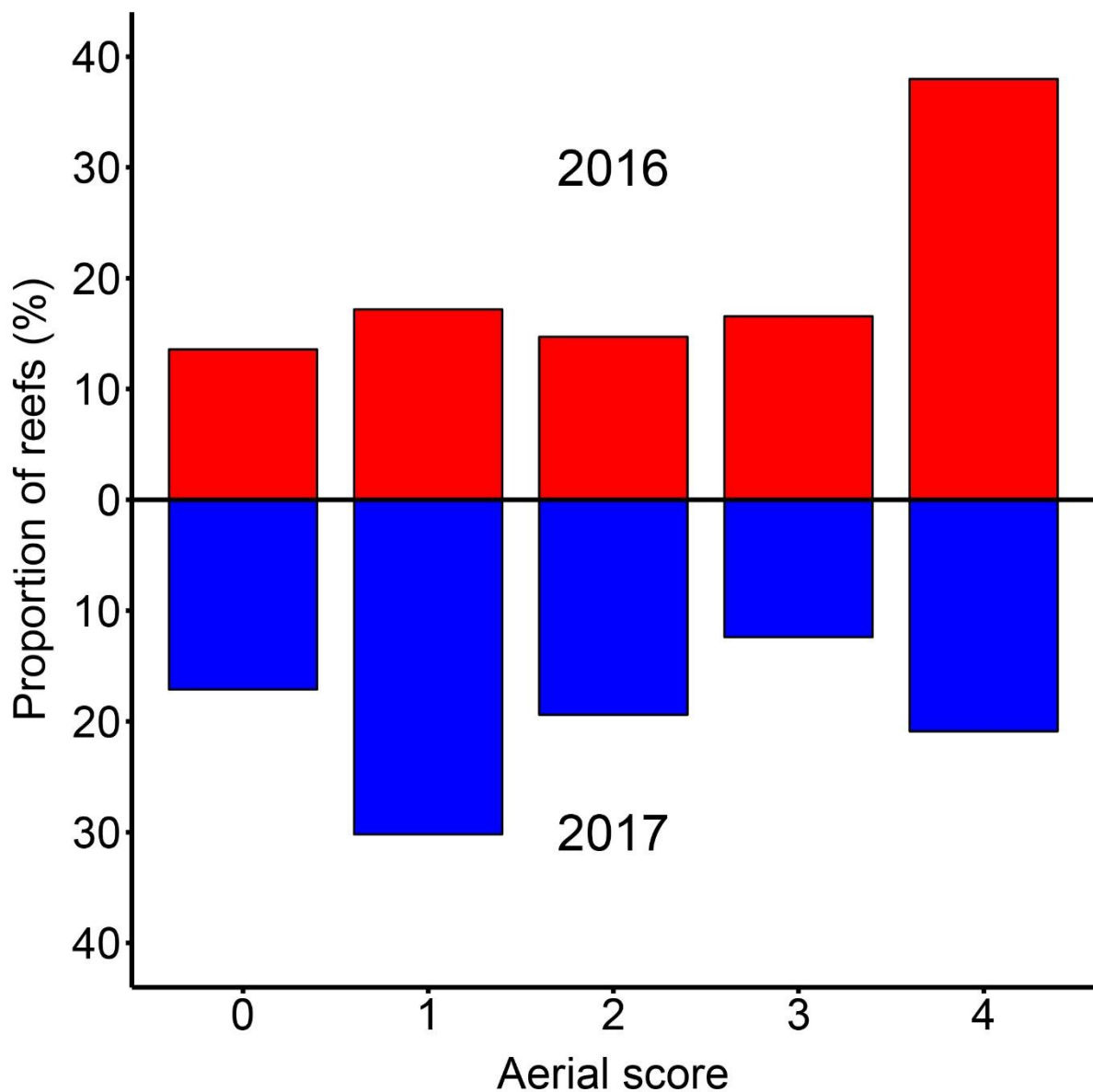
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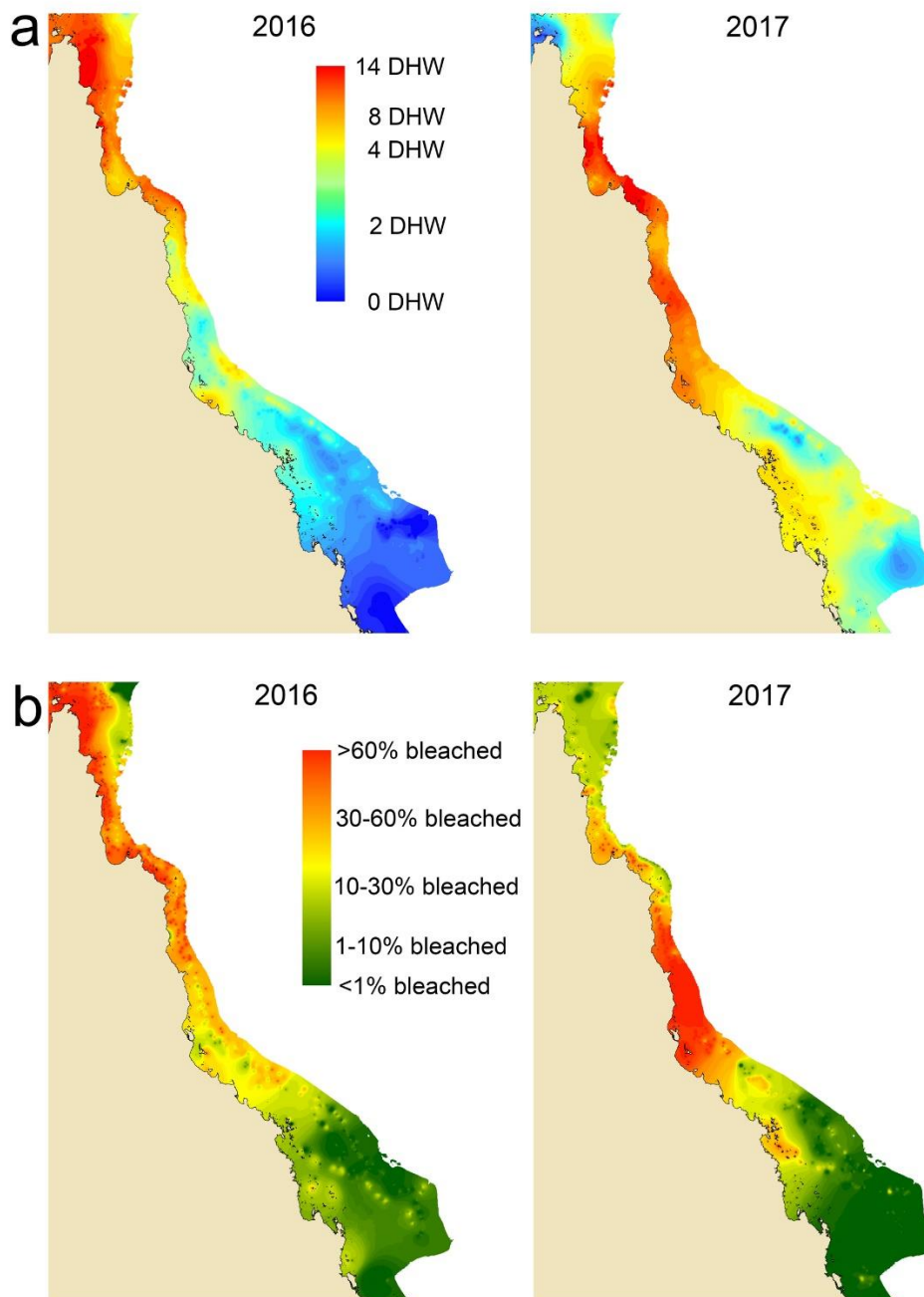
Supplementary Materials



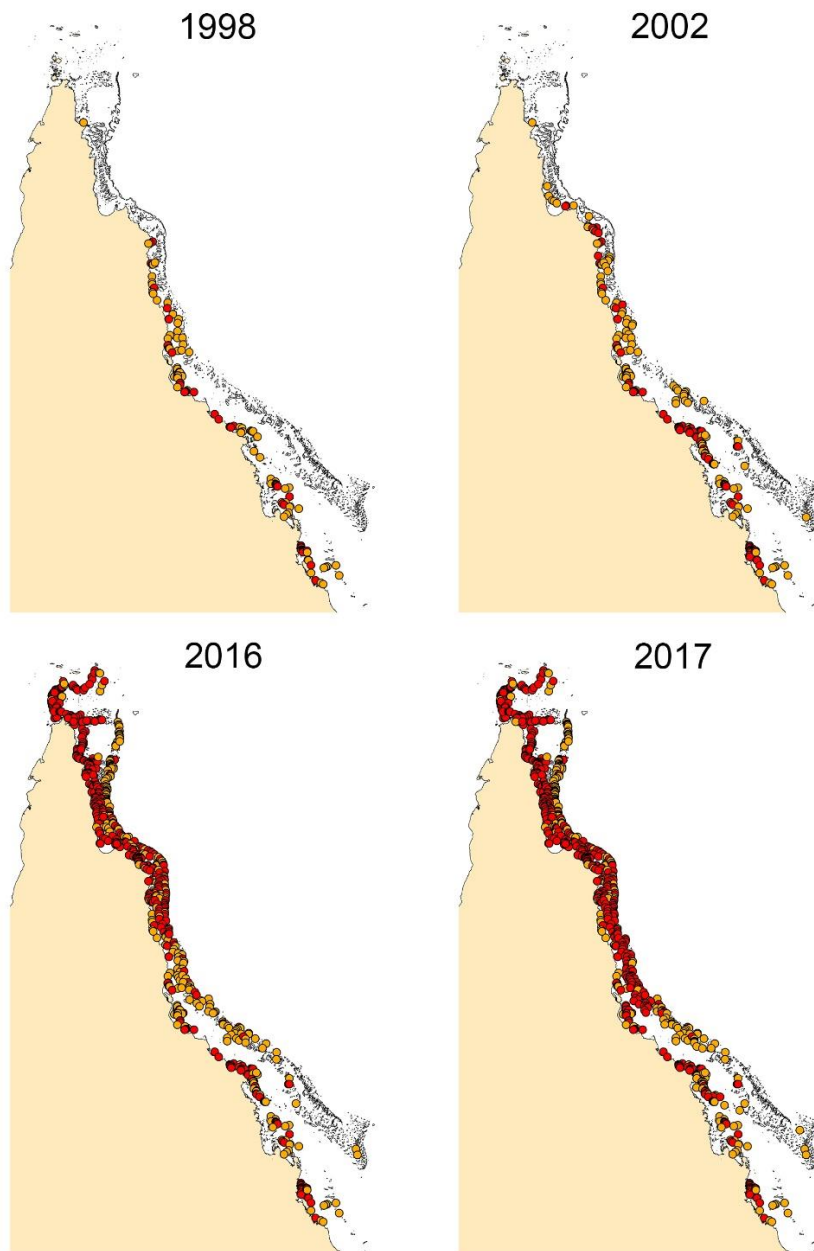
Supplementary Fig. 1. Heat exposure on the Great Barrier Reef during two consecutive marine heatwaves. Bars indicate the frequency distribution of accumulated heat exposure (Degree Heating Weeks, DHW, °C-weeks) on 3864 individual reefs, (top) in 2016 and (bottom) in 2017. See Supplementary Fig. 3a for a map of the spatial pattern of heat exposure in each year.



Supplementary Fig. 2. Aerial bleaching scores of individual reefs on the Great Barrier Reef during two consecutive marine heatwaves. Bars indicate the frequency distribution of scores, (top) in 2016 ($n = 1,135$) and (bottom) in 2017 ($n = 742$). The scores throughout the Great Barrier Reef are mapped in Supplementary Fig. 3b.



Supplementary Fig. 3. Spatial patterns in heat exposure and recurrent coral bleaching along the Great Barrier Reef. **a.** Heat exposure along the Great Barrier Reef in 2016 and 2017, measured from satellites as Degree Heating Weeks (DHW, °C-weeks). Figure 1a maps the difference in these DHW exposures between the two years. **b.** The geographic footprint of recurrent coral bleaching in 2016 and again in 2017, measured by aerial assessments of individual reefs.



Supplementary Fig. 4. Cumulative bleaching on the Great Barrier Reef. Each dot represents the most severe bleaching score recorded from 1998-2017 on individual reefs following each of four major beaching events, in 1998, 2002, 2016 and 2017. Successive maps includes earlier bleaching records to illustrate the expanding cumulative footprint through time. Red (>60% of colonies bleached); Orange (30-60%). For clarity, lower bleaching scores are omitted.

Movie S1. Video footage from helicopter over Beesley Island Reef (143.21°E, 12.25°S) during aerial surveys of mass coral bleaching in March 2016. Credit: James Kerry

Movie S2. Underwater video footage of widespread coral mortality at Zenith Reef (143.61°E, 12.77°S) during coral surveys in November 2016. Credit: Gergely Torda