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Marine heatwaves threaten global biodiversity and the provision of ecosystem services

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Supplementary information

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This file includes:

Supplementary Figs. S1 to S5

Supplementary Tables S1

Fig. S1. The maximum spatial extents of the eight warming events included in the meta-analysis: Events associated with El Niños in (A) 1982/1983, (B) 1986/1987, (C) 1991/1992 and (D) 1997/1998, and (E) the 1999 Mediterranean MHW, (F) the 2003 Mediterranean MHW, (G) the 2006 Mediterranean MHW, and (H) the 2011 Ningaloo Niño MHW. Colours indicate the associated sea surface temperature anomalies (relative to baseline seasonal climatology, 1983-2012). Red contour indicates the largest contiguous area experiencing MHW conditions over the course of the MHW in the associated region (date and area [million km²] shown in panel title).

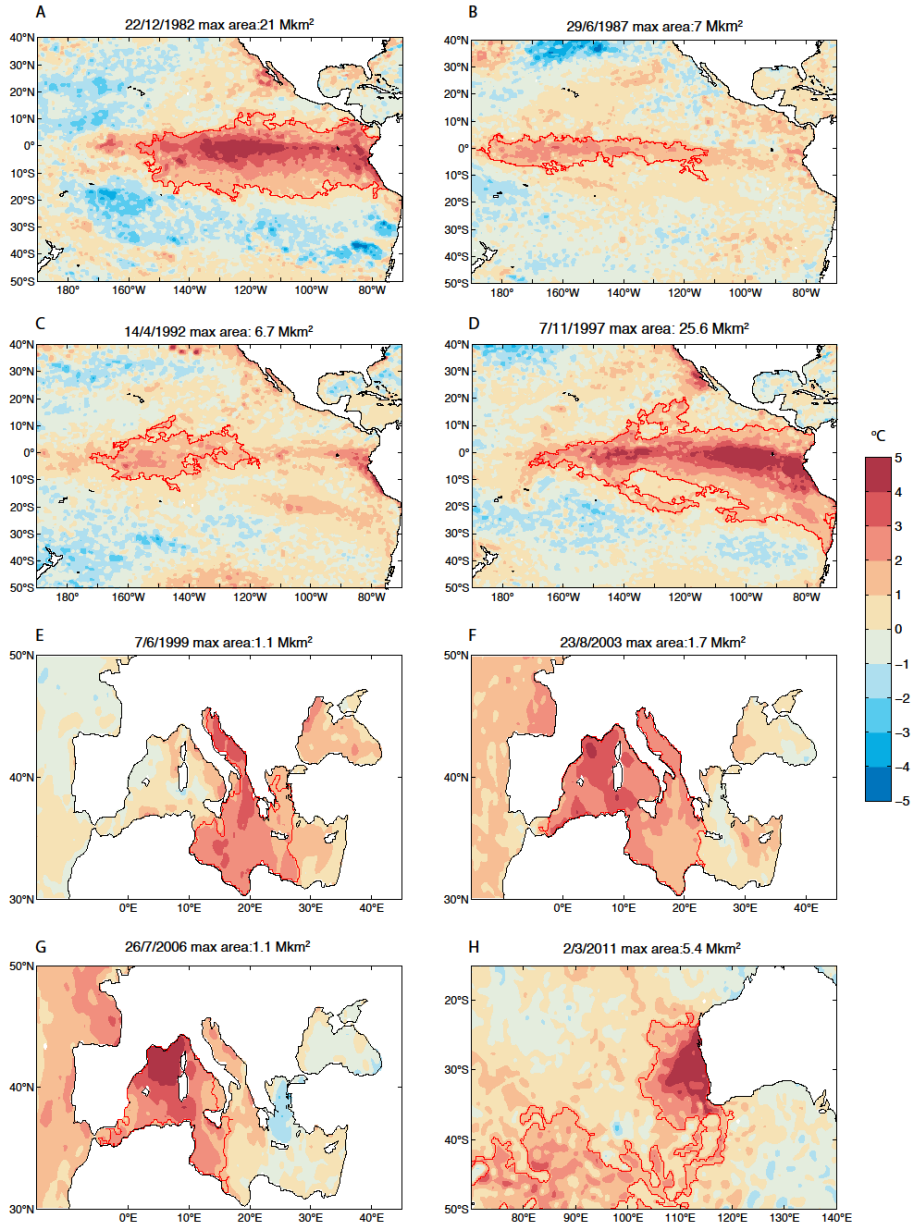


Fig. S2. PRISMA flow diagram relating to the meta-analysis of MHW impacts. PRISMA framework adopted from Moher et al. (2009) Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6: e1000097.

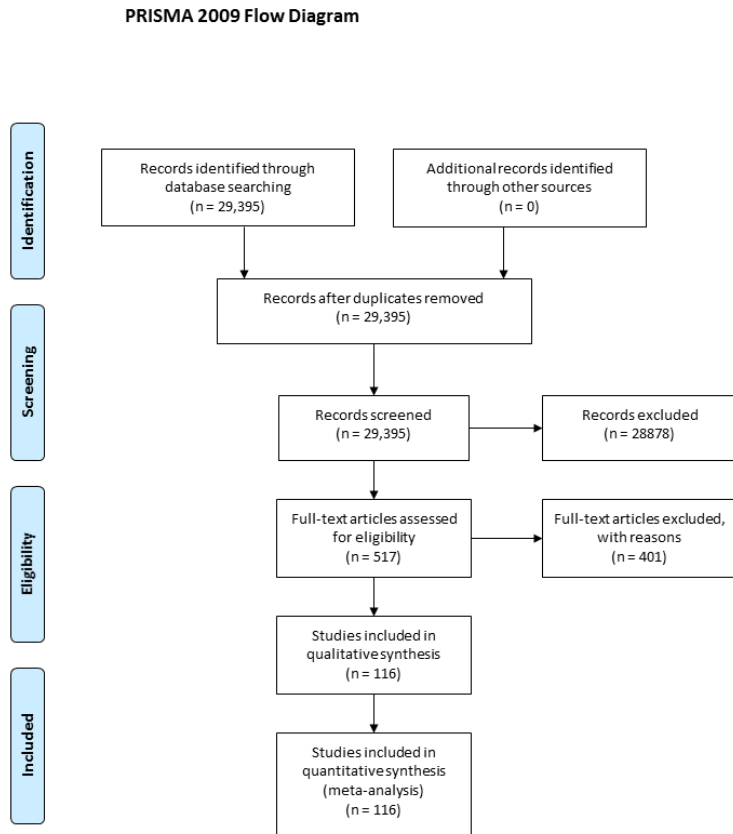


Fig. S3. Map indicating locations of observational studies included in the meta-analysis of ecological impacts of MHWs. Map generated using ArcGIS 10.4 software.

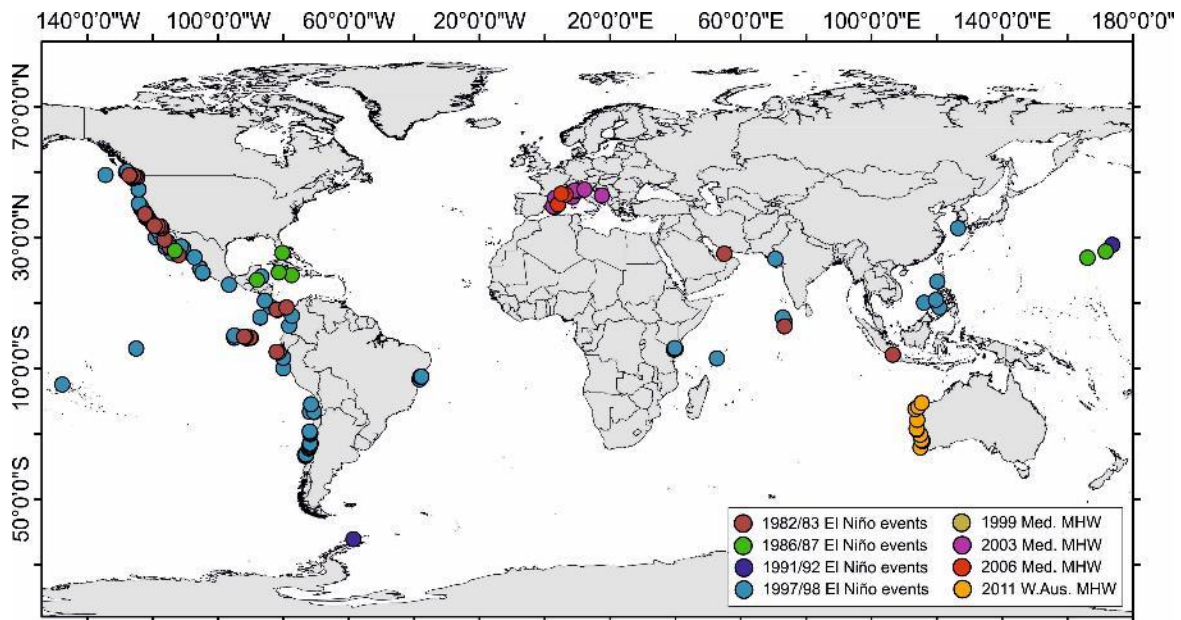


Fig. S4. Funnel plots of effect sizes extracted from the meta-analysis of MHW impacts. Filled circles are observed data ($n = 182$), while open circles are simulated data generated by the trimfill method to correct asymmetry of the funnel plot.

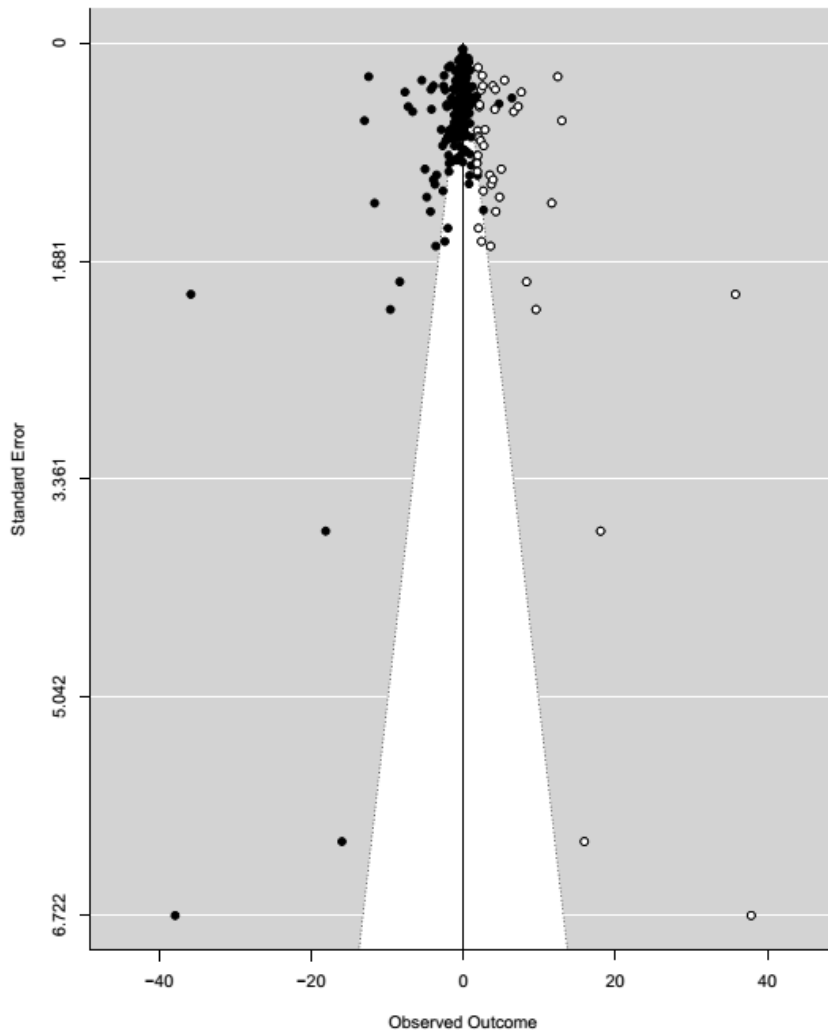


Fig. S5. Map indicating location and spatial extent of study regions used for the analysis of MHW impacts on habitat-forming species (see Fig. 3 main text). Map generated using ArcGIS 10.4 software.

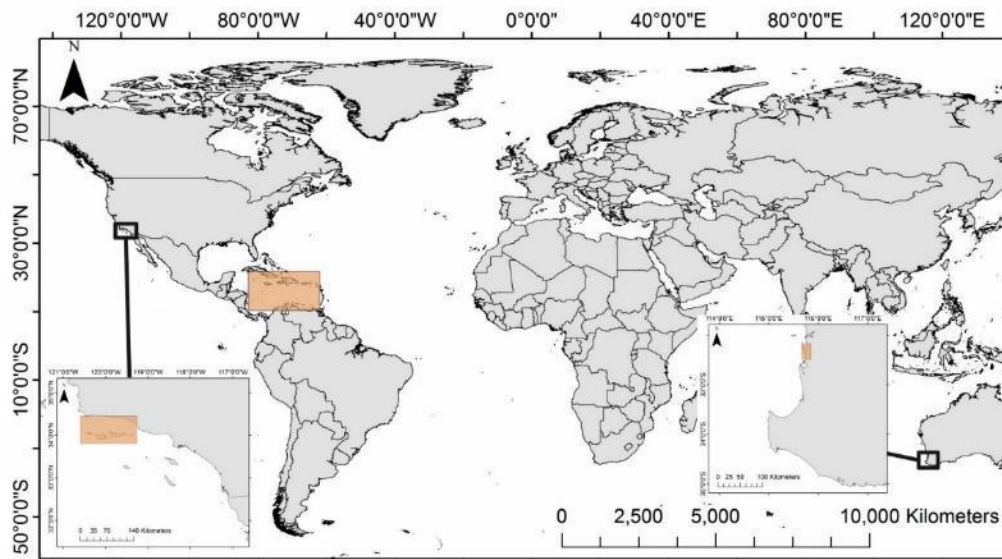


Table S1. Correlation coefficients (Pearson's r) between three metrics of ocean climate (annual number of MHW days, annual mean SST, annual maximum SST) and the health of coral, seagrass and kelp. Coral bleaching data were collated for the Caribbean Sea region, seagrass metrics were recorded in Western Australia and kelp biomass was quantified for the California/Baja California region (see Fig. 3 main text). NB for both seagrass density and kelp biomass, ocean climate variables from the previous year were correlated with ecological variables; kelp biomass was Ln transformed. Significant correlations are indicated as follows: * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$.

	Coral bleaching	Seagrass density	Kelp biomass
MHW days	0.71***	-0.62*	-0.58**
Mean SST	0.53**	-0.39	-0.49**
Max. SST	0.56**	0.09	-0.23