

Marine heatwave causes unprecedented regional mass bleaching of thermally resistant corals in northwestern Australia

Morane Le Nohaïc¹, Claire L. Ross¹, Christopher E. Cornwall¹, Steeve Comeau¹, Ryan Lowe^{1,2}, Malcolm T. McCulloch^{1,2} and Verena Schoepf^{1,2,*}

1. ARC Centre of Excellence for Coral Reef Studies, UWA Oceans Institute and School of Earth Sciences, The University of Western Australia, Perth, WA, Australia

2. The Western Australian Marine Science Institution, Perth, WA, Australia

*Corresponding author. Email: verena.schoepf@uwa.edu.au

Supplementary Information

Supplementary Tables

Supplementary Table S1. Abundance of health categories for all hard coral genera at all sites (except Bremer Bay) at the first and second survey time point. Data represent the mean percentage ($\pm$ SE) of total live coral cover. Sample size is 4-6 transects. UB = unbleached, M = moderately bleached, S = severely bleached, D = dead (see Methods for details).

Site	Montgomery Reef	Cygnet Bay				Ningaloo Reef		Rottneest Island	
		Subtidal		Intertidal					
Survey time point	2	1	2	1	2	1	2	1	2
<i>Acropora</i> UB	5.9	87.2	2.8	65.6	9.8	18.4	29.5	40.9	31.8
	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$
	1.7	5.2	1.8	12.1	4.7	7.6	5.1	17.6	20.1
<i>Acropora</i> M	0.8	1.7	2.1	0.2	16.6	14.7			
	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$			
	0.3	1.5	1.0	0.2	3.4	7.9			
<i>Acropora</i> S	1.4		79.6	0.8	41.3	4.1			
	$\pm$		$\pm$	$\pm$	$\pm$	$\pm$			
	0.6		4.8	0.6	9.3	4.1			
<i>Acropora</i> D	5.5		14.9	4.1	11.0	23.7	66.6	0.04	
	$\pm$		$\pm$	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$	
	1.3		3.6	4.1	3.7	10.9	4.9	0.04	
									0.03
<i>Caulastrea</i> S									$\pm$
									0.03
<i>Caulastrea</i> D	0.1								
	$\pm$								
	0.1								
<i>Dipsastraea</i> UB	0.4	0.1	0.1	0.2	0.1	1.4			0.03
	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$			$\pm$
	0.1	0.05	0.04	0.1	0.1	1.4			0.03
<i>Dipsastraea</i> M	1.2	0.03	0.04			0.6			0.03
	$\pm$	$\pm$	$\pm$			$\pm$			$\pm$
	0.2	0.03	0.03			0.5			0.3
<i>Dipsastraea</i> S	1.4	0.05	0.5		0.1				
	$\pm$	$\pm$	$\pm$		$\pm$				
	0.2	0.05	0.3		0.1				

<i>Dipsastraea D</i>	0.3 ± 0.1		0.1 ± 0.1		0.3 ± 0.2		0.2 ± 0.1	
<i>Favites UB</i>	0.6 ± 0.4	0.1 ± 0.1	0.02 ± 0.02	0.4 ± 0.2		18.9 ± 11.5	0.2 ± 0.1	0.7 ± 0.4
<i>Favites M</i>	2.5 ± 1.0					0.7 ± 0.7	0.01 ± 0.01	0.04 ± 0.03
<i>Favites S</i>	3.5 ± 1.9	0.1 ± 0.1	1.0 ± 0.7	0.1 ± 0.05	0.1 ± 0.1			
<i>Favites D</i>			0.5 ± 0.4					0.2 ± 0.2
<i>Fungia UB</i>		0.1 ± 0.1	0.2 ± 0.2					
<i>Fungia S</i>	0.03 ± 0.03							
<i>Galaxea UB</i>	1.4 ± 0.5							
<i>Galaxea S</i>	7.2 ± 0.7				1.2 ± 1.2			
<i>Galaxea D</i>	2.1 ± 1.1				0.9 ± 0.9			
<i>Goniastrea S</i>	0.1 ± 0.1							
<i>Goniopora UB</i>	0.4 ± 0.4			0.6 ± 0.6				
<i>Goniopora M</i>	0.2 ± 0.2							
<i>Goniopora S</i>	0.3 ± 0.2		0.1 ± 0.1	4.9 ± 4.9	1.3 ± 1.2			
<i>Goniopora D</i>	0.4 ± 0.4		0.05 ± 0.05		1.7 ± 1.7			
<i>Herpolitha M</i>	0.2							

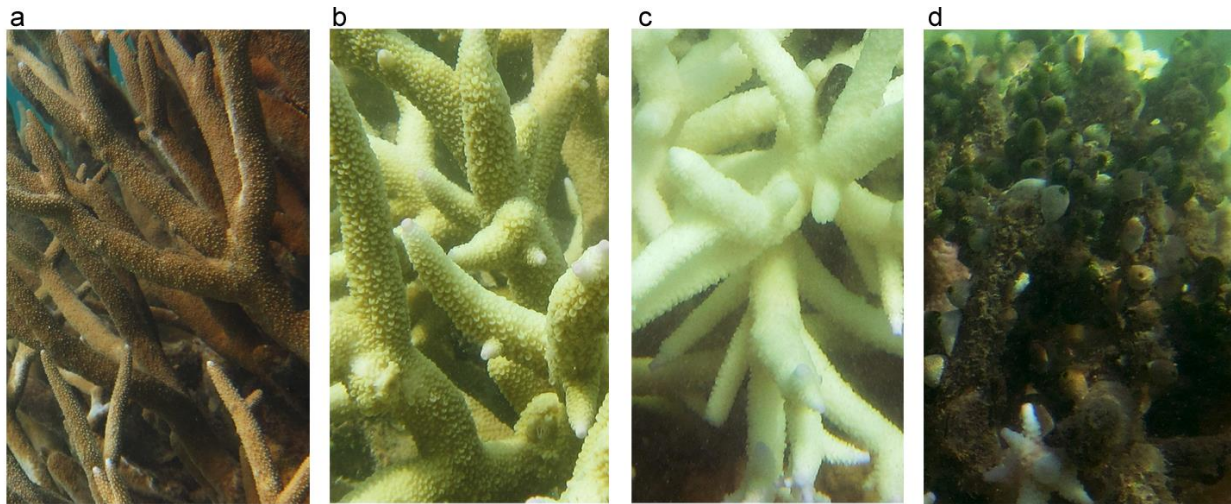
	± 0.2 0.03				
<i>Herpolitha S</i>	± 0.03				
<i>Lobophyllia UB</i>		0.05 ± 0.05	4.1 ± 3.8	1.1 ± 1.1	0.4 ± 0.4
<i>Lobophyllia M</i>	0.3 ± 0.3 1.3				
<i>Lobophyllia S</i>		0.3 ± 0.1		0.5 ± 0.5	
<i>Lobophyllia D</i>		0.02 ± 0.02		0.2 ± 0.2	
<i>Millepora UB</i>			1.1 ± 1.1		
<i>Montastrea UB</i>			0.4 ± 0.3		
<i>Montastrea M</i>	0.09 ± 0.06 0.3				
<i>Montastrea S</i>	± 0.03				
<i>Montipora UB</i>	9.4 ± 0.5 8.2	0.4 ± 0.3 0.1	2.1 ± 1.1		0.1 ± 0.1
<i>Montipora M</i>	± 2.5 10.8	± 0.1 0.5			
<i>Montipora S</i>	± 2.5 0.7	± 0.5 0.3			
<i>Montipora D</i>	± 0.7	± 0.3			
<i>Pavona UB</i>		0.04 ± 0.04	1.1 ± 0.7		

<i>Pavona</i> M				0.1 ± 0.1			
<i>Pavona</i> S			0.1 ± 0.04	0.3 ± 0.8	0.7 ± 0.6		
<i>Platygyra</i> UB		0.04 ± 0.03 0.05	0.05 ± 0.05 0.1	0.3 ± 0.2	3.6 ± 2.8	0.8 ± 0.8	7.7 ± 7.4
<i>Platygyra</i> M		3.7 ± 2.2 3.7	0.05 ± 0.05 0.03	0.1 ± 0.1			0.1 ± 0.1
<i>Platygyra</i> S		3.7 ± 1.9 0.3	0.03 ± 0.03	0.1 ± 0.1	0.5 ± 0.5 0.1		
<i>Platygyra</i> D		± 0.2			± 0.1		
<i>Pocillopora</i> UB		0.9 ± 0.7	0.03 ± 0.03				46.7 ± 15.8
<i>Pocillopora</i> M			0.1 ± 0.1	0.04 ± 0.04		3.7 ± 1.3	28.0 ± 14.3
<i>Pocillopora</i> S			0.7 ± 0.4				0.5 ± 0.4
<i>Pocillopora</i> D			0.2 ± 0.1			0.4 ± 0.2	0.7 ± 0.4
<i>Porites</i> UB		0.3 ± 0.3	0.8 ± 0.6	8.9 ± 3.6	2.6 ± 2.2	1.8 ± 0.8	0.1 ± 0.1
<i>Porites</i> M		0.3 ± 0.3	1.3 ± 1.2		2.0 ± 1.2	0.5 ± 0.5	
<i>Porites</i> S		1.0 ± 0.8	0.7 ± 0.2	0.3 ± 0.3	1.5 ± 0.6		
<i>Porites</i> D			0.2 ± 0.2		0.1 ± 0.1		
<i>Seriatopora</i> UB		0.6 ± 0.6	0.7 ± 0.4				

<i>Seriatopora</i> M		2.7						
		±						
		2.4						
<i>Seriatopora</i> S	1.3	0.02	0.4	0.3				
	±	±	±	±				
	0.6	0.02	0.2	0.3				
<i>Seriatopora</i> D	1.8		0.1					
	±		±					
	1.3		0.1					
<i>Stylophora</i> UB		0.05		0.8			0.1	
		±		±			±	
		0.05		0.8			0.1	
<i>Stylophora</i> S		0.5	1.0	0.2				
		±	±	±				
		0.4	0.8	0.2				
<i>Trachyphyllia</i> M				0.3				
				±				
				0.3				
<i>Trachyphyllia</i> S					0.1			
					±			
					0.1			
<i>Tubipora</i> UB	0.6							
	±							
	0.05							
<i>Turbinaria</i> UB	0.05	1.1	0.3	0.9	0.2	0.7		
	±	±	±	±	±	±		
	0.5	0.6	0.3	0.5	0.2	0.7		
<i>Turbinaria</i> M	0.1	0.1	1.5					
	±	±	±					
	0.1	0.1	1.5					
<i>Turbinaria</i> S	0.2		0.6					
	±		±					
	0.2		0.6					
<i>Turbinaria</i> D			0.3					
			±					
			0.3					
Unkown UB	4.9	3.6		1.9		5.3	1.1	0.3
	±	±		±		±	±	±
	2.0	2.8		0.9		3.3	0.7	0.3
Unknown M	0.8	0.2			0.6	5.0	0.2	
	±	±			±	±	±	
	0.2	0.2			0.5	4.6	0.1	
Unknown S	5.8			0.05	5.1			0.1
	±			±	±			±
	2.0			0.05	3.8			0.1

30	Unknown D	8.4	1.6
		$\pm$	$\pm$
		1.6	1.1

Supplementary Figures



Supplementary Figure S1. Photos of branching *Acropora* corals representing the four health categories: (a) UB = Unbleached, (b) M = Moderately bleached, (c) S = Severely bleached, and (d) D = Dead. Photos from M. Le Nohaïc and C. E. Cornwall.