Repeat bleaching drives coral physiotypes by environmental legacies and cellular memory

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Supplemental Tables and Figures

Supplementary Table 1. Statistical analysis of environmental history and bleaching event effects on Symbiodiniaceae endosymbionts and *Montipora capitata* physiology.

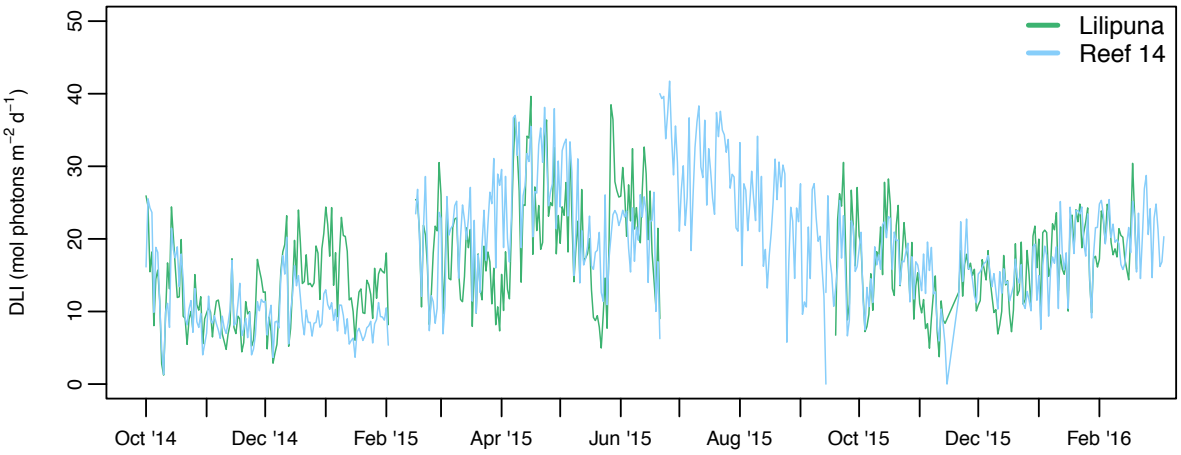
Dependent variable	*Effect*	*SS*	*df*	*F*	*P*
symbionts cm^{-2}	Period	1.108×10^{13}	3	9.470	**<0.001**
	Site	3.068×10^{10}	1	0.079	0.797
	Symbiont	5.640×10^{13}	1	144.647	**<0.001**
	Period × Site	4.604×10^{12}	3	3.936	**0.009**
	Period × Symbiont	3.461×10^{12}	3	2.959	**0.033**
	Site × Symbiont	8.347×10^{11}	1	2.141	0.144
	Period × Site × Symbiont	4.342×10^{12}	3	3.712	**0.012**
	Residual	1.174×10^{14}	301		
chlorophyll *a* cm^{-2}	Period	85.343	3	11.986	**<0.001**
	Site	23.851	1	10.049	**0.002**
	Symbiont	3.414	1	1.438	0.231
	Period × Site	7.037	3	0.988	0.399
	Period × Symbiont	66.062	3	9.378	**<0.001**
	Site × Symbiont	0.069	1	0.029	0.865
	Period × Site × Symbiont	12.746	3	1.790	0.149
	Residual	714.410	301		
chlorophyll *a* $cell^{-1}$	Period	19.268	3	6.870	**<0.001**
	Site	5.957	1	6.382	**0.012**
	Symbiont	181.229	1	193.843	**<0.001**
	Period × Site	4.064	3	1.449	0.229
	Period × Symbiont	14.105	3	5.029	**0.002**
	Site × Symbiont	3.234	1	3.459	0.064
	Period × Site × Symbiont	6.149	3	2.192	0.089
	Residual	278.608	298		
protein cm^{-2}	Period	0.058	3	0.722	0.540
	Site	0.053	1	1.980	0.160
	Symbiont	0.126	1	4.706	**0.031**
	Period × Site	0.412	3	5.135	**0.002**
	Period × Symbiont	0.035	3	0.440	0.725
	Site × Symbiont	0.011	1	0.394	0.530
	Period × Site × Symbiont	0.048	3	0.596	0.618
	Residual	8.020	300		
total biomass cm^{-2}	Period	7.363	3	78.602	**<0.001**
	Site	0.603	1	19.312	**<0.001**
	Symbiont	0.355	1	11.359	**<0.001**
	Period × Site	1.213	3	12.954	**<0.001**
	Period × Symbiont	0.346	3	3.696	**0.012**
	Site × Symbiont	0.085	1	2.738	0.099
	Period × Site × Symbiont	0.065	3	0.698	0.554
	Residual	9.398	301		

Period = Four events (first bleaching [October 2014], first recovery [February 2015], second bleaching [October 2015], second recovery [February 2016]); *Site* = two reef locations (Lilipuna and Reef 14); *Symbiont* = symbiont community dominated by *Cladocopium* spp. or *Durusdinium* spp. symbionts (C- or D-dominated). *SS* = sum of squares and *df* = degrees of freedom.

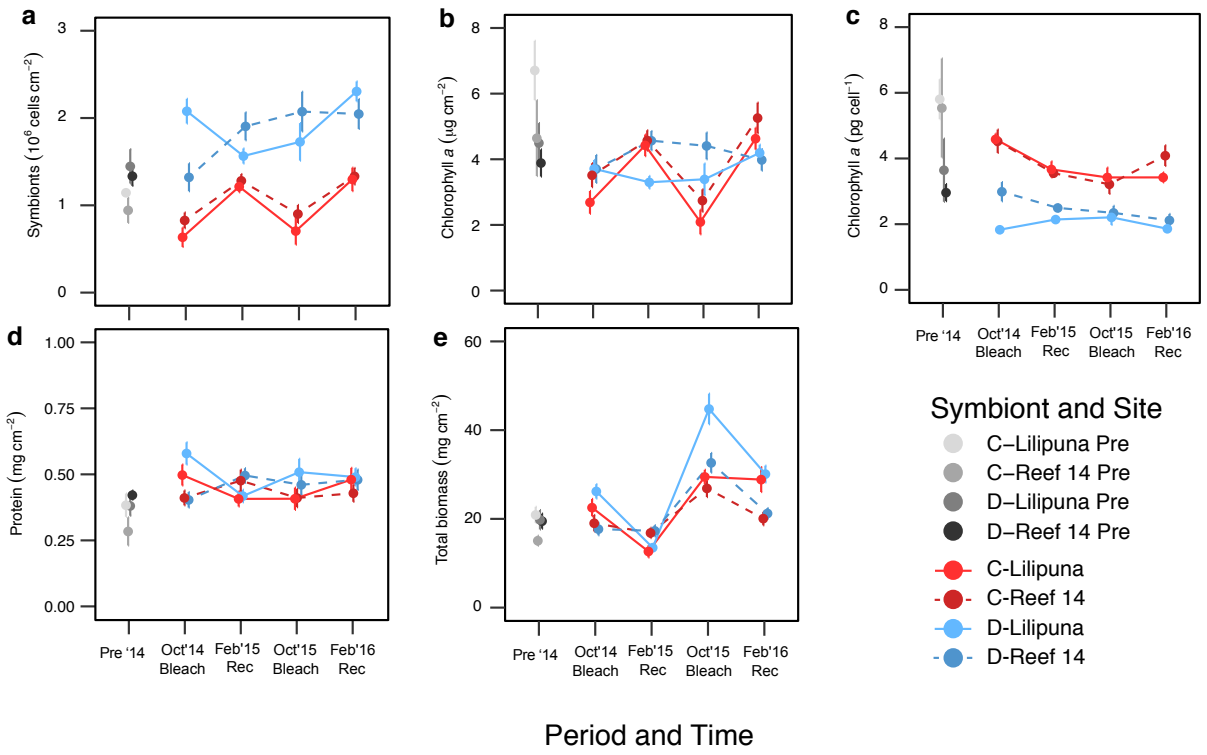
Supplementary Table 2. Statistical analysis of environmental history and bleaching event effects on antioxidant enzymes and immune activity of *Montipora capitata.*

Dependent variable	*Effect*	*SS*	*df*	*F*	*P*
Catalase (CAT)	Period	3048.497	3	117.049	**<0.001**
	Site	185.209	1	21.334	**<0.001**
	Symbiont	80.983	1	9.328	**0.002**
	Period x Site	228.314	3	8.766	**<0.001**
	Period x Symbiont	57.881	3	2.222	0.086
	Site x Symbiont	1.590	1	0.183	0.669
	Period x Site x Symbiont	22.454	3	0.862	0.461
	Residual	2526.337	291		
Peroxidase (POX)	Period	1.657	3	16.504	**<0.001**
	Site	0.121	1	3.619	0.058
	Symbiont	0.001	1	0.042	0.838
	Period x Site	0.089	3	0.884	0.450
	Period x Symbiont	0.363	3	3.612	**0.014**
	Site x Symbiont	0.018	1	0.547	0.460
	Period x Site x Symbiont	0.014	3	0.138	0.937
	Residual	9.502	284		
Superoxide dismutase (SOD)	Period	1.349×10^{10}	3	83.207	**<0.001**
	Site	2.631×10^{8}	1	4.867	**0.028**
	Symbiont	8.110×10^{7}	1	1.500	0.222
	Period x Site	9.381×10^{7}	3	0.578	0.630
	Period x Symbiont	2.319×10^{8}	3	1.430	0.234
	Site x Symbiont	3.041×10^{7}	1	0.378	0.539
	Period x Site x Symbiont	1.021×10^{8}	3	0.630	0.596
	Residual	1.616×10^{10}	299		
Prophenoloxidase (PPO)	Period	8.112	3	207.503	**<0.001**
	Site	0.055	1	4.227	**0.041**
	Symbiont	0.054	1	4.135	**0.043**
	Period x Site	0.002	3	0.051	0.985
	Period x Symbiont	0.020	3	0.510	0.676
	Site x Symbiont	0.069×10^{-3}	1	0.005	0.942
	Period x Site x Symbiont	0.001	3	0.031	0.993
	Residual	3.857	296		
Melanin (MEL)	Period	1.713	3	1133.636	**<0.001**
	Site	0.001	1	1.112	0.292
	Symbiont	0.013×10^{-5}	1	0.000	0.987
	Period x Site	0.016	3	10.241	**<0.001**
	Period x Symbiont	0.002	3	1.276	0.283
	Site x Symbiont	9.972×10^{-5}	1	0.198	0.657
	Period x Site x Symbiont	0.257×10^{-3}	3	0.170	0.917
	Residual	0.150	297		

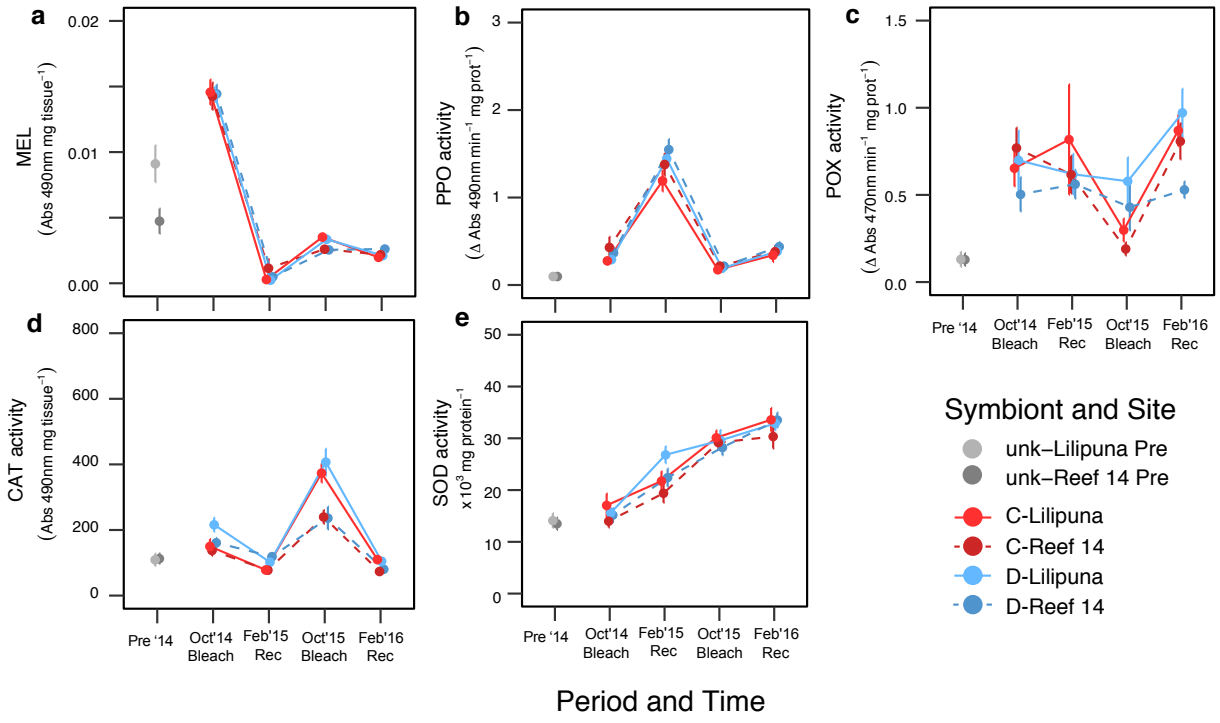
Period = Four events (first bleaching [October 2014], first recovery [February 2015], second bleaching [October 2015], second recovery [February 2016]); *Site* = two reef locations (Lilipuna and Reef 14); *Symbiont* = symbiont community dominated by *Cladocopium* spp. or *Durusdinium* spp. symbionts (C- or D-dominated). *SS* = sum of squares and *df* = degrees of freedom



Supplementary Figure 1. Light availability at two reefs in Kāneʻohe Bay during repeated bleaching and recovery periods. Photosynthetically active irradiance integrated over a 24 h day and expressed as the daily light integral (DLI) from October 2014 - March 2016. Gaps in data represent logger failure.



Supplementary Figure 2. Physiological metrics for *M. capitata* corals dominated dominated by *Cladocopium* sp. or *Durusdinium* sp. symbionts (C or D) from two reefs in Kāne'ohe Bay during repeated bleaching and recovery periods. Area-normalized **a**, symbiont cell densities and **b**, chlorophyll *a* concentrations **c**, chlorophyll *a* per symbiont cell **d**, area-normalized protein concentrations and **e**, total biomass represented as ash-free dry weight. Gray points (Pre) from Feb 2014 are from ambient laboratory conditions (Wall et al. 2018). Values are mean ± SE, n = 4 - 7 (Pre), 11 - 24 (other periods).



Supplementary Figure 3. Immunity metrics for *M. capitata* corals dominated dominated by *Cladocopium* sp. or *Durusdinium* sp. symbionts (C or D) from two reefs in Kāne'ohe Bay during repeated bleaching and recovery periods. a, Melanin (MEL) **b**, prophenoloxidase (PPO) **c**, peroxidase (POX) **d**, catalase (CAT) and **e**, superoxide dismutase (SOD). Gray points (*unk-Pre*) are from a field collection in Feb 2014 prior to bleaching but were without quantification of dominant symbiont community. Values are mean ± SE, n = 6 - 8 (unk-Pre), 11 - 28 (other periods).