**Repeat bleaching drives coral physiotypes by environmental legacies and cellular memory**

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**Supplemental Tables and Figures**

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| **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* |
| symbiontscm-2 | Period | 1.108 × 1013 | | 3 | | 9.470 | | **<0.001** | |
|  | Site | 3.068 × 1010 | | 1 | | 0.079 | | 0.797 | |
|  | Symbiont | 5.640 × 1013 | | 1 | | 144.647 | | **<0.001** | |
|  | Period × Site | 4.604 × 1012 | | 3 | | 3.936 | | **0.009** | |
|  | Period × Symbiont | 3.461 × 1012 | | 3 | | 2.959 | | **0.033** | |
|  | Site × Symbiont | 8.347 × 1011 | | 1 | | 2.141 | | 0.144 | |
|  | Period × Site × Symbiont | 4.342 × 1012 | | 3 | | 3.712 | | **0.012** | |
|  | Residual | 1.174 × 1014 | | 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. | | | | | | | | | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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 | Period | 3048.497 | | 3 | | 117.049 | | **<0.001** | |
| (CAT) | 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 | Period | 1.657 | | 3 | | 16.504 | | **<0.001** | |
| (POX) | 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 | Period | 1.349 × 1010 | | 3 | | 83.207 | | **<0.001** | |
| (SOD) | Site | 2.631 × 108 | | 1 | | 4.867 | | **0.028** | |
|  | Symbiont | 8.110 × 107 | | 1 | | 1.500 | | 0.222 | |
|  | Period x Site | 9.381 × 107 | | 3 | | 0.578 | | 0.630 | |
|  | Period x Symbiont | 2.319 × 108 | | 3 | | 1.430 | | 0.234 | |
|  | Site x Symbiont | 3.041 × 107 | | 1 | | 0.378 | | 0.539 | |
|  | Period x Site x Symbiont | 1.021 × 108 | | 3 | | 0.630 | | 0.596 | |
|  | Residual | 1.616 × 1010 | | 299 | |  | |  | |
|  |  |  | |  | |  | |  | |
| Prophenoloxidase | Period | 8.112 | | 3 | | 207.503 | | **<0.001** | |
| (PPO) | 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 | Period | 1.713 | | 3 | | 1133.636 | | **<0.001** | |
| (MEL) | 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 | | | | | | | | | |

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**Supplementary Figure 1. Light availability at two reefs in Kāne‘ohe 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.

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**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)](https://paperpile.com/c/Afh7Wf/HP0F). Values are mean ± SE, *n* = 4 - 7 (Pre), 11 - 24 (other periods).

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**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).