

## Inhibited growth in a photosymbiont-bearing foraminifer *Marginopora vertebralis* from the nearshore Great Barrier Reef, Australia

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**Supplement 1.** Here we provide a compilation of the water quality data known for the Whitsunday region and the inshore Great Barrier Reef, with additional statistical notes from the Kruskal-Wallis test and laboratory design for this study

Table S1. Water quality parameters known for the Proserpine and O'Connell rivers, Great Barrier Reef, Australia

Site	Flow conditions	n	Total suspended solids (mg l <sup>-1</sup> )	Total nitrogen (µg N l <sup>-1</sup> )	Particulate nitrogen (µg N l <sup>-1</sup> )	Total filterable nitrogen (µg N l <sup>-1</sup> )	Filterable organic nitrogen (µg N l <sup>-1</sup> )	Ammonia (µg N l <sup>-1</sup> )	Nitrate + nitrite (µg N l <sup>-1</sup> )	Total phosphorus (µg P l <sup>-1</sup> )	Particulate phosphorus (µg P l <sup>-1</sup> )	Total filterable phosphorus (µg P l <sup>-1</sup> )	Filterable organic phosphorus (µg P l <sup>-1</sup> )	Filterable reactive phosphorus (µg P l <sup>-1</sup> )
Proserpine <sup>a</sup>	Event	5	4–160	60–150						50–271				
Proserpine <sup>b</sup>	Wet season Max	18		1060				85	38	220				807
Proserpine <sup>b</sup>	Wet season Median	18		940				41	20	180				183
Proserpine <sup>a</sup>	Median	1	28	744	138	606	582	8	16	130	50	80	15	65
Proserpine <sup>a</sup>	Ambient	1	5.6	4520	300	4220	2	3670	548	1570	180	1390	1261	129
O'Connell <sup>b</sup>	Wet season Max	8		450				56	56	90				31
O'Connell <sup>b</sup>	Wet season Median	8		420				33	12	60				14
O'Connell <sup>c</sup>	Max	11	478	1270	600	949	694	47	538	211	155	77	27	50
O'Connell <sup>c</sup>	Median	11	104	1020	241	668	393	9	310	139	71	52	9	41
O'Connell <sup>c</sup>	Ambient	1	1.6	201	81	120	113	2	5	22	9	13	11	2

<sup>a</sup>Faithful (2003); <sup>b</sup>Mitchell et al. (1991); <sup>c</sup>Rohde et al. (2006)

Table S2. Mean chlorophyll *a*, dissolved inorganic phosphate and dissolved inorganic nitrate values from inshore reefs in the Whitsunday Islands, the whole Great Barrier Reef (GBR) and flood plume values for the central GBR. Means are presented  $\pm$ SE

Location	Distance from river (km)	Chl <i>a</i> ( $\mu\text{g l}^{-1}$ )	PO <sub>4</sub> ( $\mu\text{g l}^{-1}$ )	NO <sub>3</sub> ( $\mu\text{g l}^{-1}$ )
North Repulse Island <sup>a</sup>	17.6	0.88 $\pm$ 0.18	0.20 $\pm$ 0.02	0.21 $\pm$ 0.07
Calf Island <sup>a</sup>	42.6	0.86 $\pm$ 0.16	0.20 $\pm$ 0.02	0.19 $\pm$ 0.04
Pine Island <sup>a</sup>	45.4	0.83 $\pm$ 0.13	0.19 $\pm$ 0.02	0.19 $\pm$ 0.04
Long Island <sup>a</sup>	50.9	1.07 $\pm$ 0.22	0.19 $\pm$ 0.01	0.18 $\pm$ 0.03
North Molle Island <sup>a</sup>	63.0	1.21 $\pm$ 0.25	0.20 $\pm$ 0.03	0.26 $\pm$ 0.06
Armit Island <sup>a</sup>	86.2	0.40 $\pm$ 0.05	0.19 $\pm$ 0.02	0.15 $\pm$ 0.02
Double Cone Island <sup>a</sup>	80.6	0.31 $\pm$ 0.03	0.17 $\pm$ 0.01	0.19 $\pm$ 0.02
Flood plume average for GBR <sup>b</sup>		4.6		14.3
Ambient (non-flood) average for GBR <sup>c</sup>		0.4		0.02
Central GBR <sup>c</sup>	Inshore	0.4	3	0.3
Central GBR <sup>c</sup>	Mid shelf	0.3	3	0.4
Central GBR <sup>c</sup>	Outer shelf	0.3	3	0.6

<sup>a</sup>van Woesik et al. (1999); <sup>b</sup>Devlin et al. (2001); <sup>c</sup>Furnas (2003)

Table S3. Summary of water quality variables measured in the water column at the 5 field experiment sites in the Whitsunday Islands during the dry winter and wet summer. Chl *a*: chlorophyll *a*; DIN: dissolved inorganic nitrogen; DIP: dissolved inorganic phosphorus; PN: particulate nitrogen; POC: particulate organic carbon; PP: particulate phosphorus; TDN: total dissolved nitrogen; TDP: total dissolved phosphorus; TSS: total suspended solids. Values are means  $\pm$  SE

	Deloraine	Edward	Double Cone	Daydream	Pine
2008 dry winter					
DIP ( $\mu\text{mol l}^{-1}$ )	0.16 $\pm$ 0.01	0.13 $\pm$ 0.01	0.16 $\pm$ 0.02	0.17 $\pm$ 0.02	0.16 $\pm$ 0.04
DIN ( $\mu\text{mol l}^{-1}$ )	0.16	0.11	0.13 $\pm$ 0.03	0.22 $\pm$ 0.01	0.18 $\pm$ 0.04
PP ( $\mu\text{mol l}^{-1}$ )	0.06 $\pm$ 0.00	0.05 $\pm$ 0.00	0.07 $\pm$ 0.00	0.10 $\pm$ 0.00	0.10 $\pm$ 0.00
PN ( $\mu\text{mol l}^{-1}$ )	0.84 $\pm$ 0.02	1.00 $\pm$ 0.11	1.17 $\pm$ 0.04	1.07 $\pm$ 0.15	1.28 $\pm$ 0.04
TDP ( $\mu\text{mol l}^{-1}$ )	0.18 $\pm$ 0.002	0.18 $\pm$ 0.015	0.39 $\pm$ 0.022	0.22 $\pm$ 0.026	0.17 $\pm$ 0.028
TDN ( $\mu\text{mol l}^{-1}$ )	4.21 $\pm$ 0.29	5.00 $\pm$ 1.10	4.87 $\pm$ 0.01	4.92 $\pm$ 0.32	5.11 $\pm$ 0.32
POC ( $\mu\text{mol l}^{-1}$ )	10.10 $\pm$ 1.35	14.31 $\pm$ 0.68	10.47 $\pm$ 0.99	13.91 $\pm$ 1.40	16.51 $\pm$ 2.82
TSS ( $\text{mg l}^{-1}$ )	1.84 $\pm$ 0.02	1.84 $\pm$ 0.08	2.65 $\pm$ 0.09	1.76 $\pm$ 0.15	3.71 $\pm$ 0.75
Chl <i>a</i> ( $\mu\text{g l}^{-1}$ )	0.34 $\pm$ 0.03	0.34 $\pm$ 0.01	0.35 $\pm$ 0.01	0.48 $\pm$ 0.01	0.46 $\pm$ 0.05
2009 wet summer					
DIP ( $\mu\text{mol l}^{-1}$ )	0.10 $\pm$ 0.01	0.12 $\pm$ 0.01	0.11 $\pm$ 0.00	0.14 $\pm$ 0.02	0.17 $\pm$ 0.03
DIN ( $\mu\text{mol l}^{-1}$ )	0.24	0.31 $\pm$ 0.12	0.39 $\pm$ 0.12	0.88	0.92
PP ( $\mu\text{mol l}^{-1}$ )	0.07 $\pm$ 0.00	0.09 $\pm$ 0.01	0.13 $\pm$ 0.00	0.17 $\pm$ 0.00	0.33 $\pm$ 0.00
PN ( $\mu\text{mol l}^{-1}$ )	1.22 $\pm$ 0.16	1.98 $\pm$ 0.98	1.46 $\pm$ 0.06	1.26 $\pm$ 0.05	2.02 $\pm$ 0.20
TDP ( $\mu\text{mol l}^{-1}$ )	0.18 $\pm$ 0.00	0.18 $\pm$ 0.01	0.39 $\pm$ 0.02	0.22 $\pm$ 0.03	0.17 $\pm$ 0.03
TDN ( $\mu\text{mol l}^{-1}$ )	9.82 $\pm$ 0.59	10.11 $\pm$ 2.83	6.81 $\pm$ 1.04	10.47 $\pm$ 0.00	10.04 $\pm$ 0.38
POC ( $\mu\text{mol l}^{-1}$ )	13.70 $\pm$ 1.98	7.82 $\pm$ 0.29	17.63 $\pm$ 0.15	14.22 $\pm$ 0.14	23.59 $\pm$ 0.15
TSS ( $\text{mg l}^{-1}$ )	0.78 $\pm$ 0.04	1.95 $\pm$ 0.01	3.14 $\pm$ 0.015	6.8	17.5 $\pm$ 0.08
Chl <i>a</i> ( $\mu\text{g l}^{-1}$ )	0.73 $\pm$ 0.02	0.56 $\pm$ 0.04	1.29 $\pm$ 0.04	0.63 $\pm$ 0.04	0.72 $\pm$ 0.01

Table S4. Results (p-values) of Tukey's HSD post hoc pairwise comparisons following a Kruskal-Wallis non-parametric test ( $H_{15} = 186.4881$ ,  $p < 0.001$ ,  $n = 309$ ). Pairwise comparisons are based on ranking the 1-way ANOVA. DW: dry winter; WS: wet summer; DIN: dissolved inorganic nitrogen; DIP: dissolved inorganic phosphate; Ambient: ambient nutrient concentrations. Bold numbers indicate significant pairwise comparisons ( $p < 0.05$ )

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
(1) Deloraine DW															
(2) Edward DW	1.000														
(3) Daydream DW	0.502	0.485													
(4) Double Cone DW	<b>&lt;0.001</b>	<b>&lt;0.001</b>	0.091												
(5) Pine DW	<b>0.002</b>	<b>0.002</b>	1.000	1.000											
(6) Deloraine WS	1.000	1.000	1.000	<b>&lt;0.001</b>	<b>0.020</b>										
(7) Edward WS	1.000	1.000	1.000	<b>0.008</b>	1.000	1.000									
(8) Daydream WS	<b>0.032</b>	<b>0.034</b>	1.000	0.892	1.000	0.234	1.000								
(9) Double Cone WS	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>0.030</b>	1.000	1.000	<b>&lt;0.001</b>	<b>0.002</b>	0.361							
(10) Pine WS	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>0.020</b>	1.000	1.000	<b>&lt;0.001</b>	<b>0.001</b>	0.254	1.000						
(11) Ambient 22°C	1.000	1.000	1.000	<b>0.001</b>	<b>&lt;0.001</b>	1.000	1.000	1.000	<b>&lt;0.001</b>	<b>&lt;0.001</b>					
(12) DIP 22°C	<b>&lt;0.001</b>	<b>&lt;0.001</b>	0.805	1.000	1.000	<b>&lt;0.001</b>	<b>0.007</b>	0.805	1.000	1.000	<b>0.001</b>				
(13) DIN 22°C	<b>0.001</b>	<b>0.001</b>	1.000	1.000	1.000	<b>0.011</b>	1.000	1.000	1.000	1.000	1.000	1.000			
(14) Ambient 28°C	1.000	1.000	1.000	<b>0.036</b>	1.000	1.000	1.000	1.000	<b>0.012</b>	<b>0.008</b>	1.000	<b>0.031</b>	1.000		
(15) DIP 28°C	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>0.028</b>	1.000	0.299	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>0.028</b>	1.000	1.000	0.001	1.000	0.473	<b>0.001</b>	
(16) DIN 28°C	<b>&lt;0.001</b>	<b>&lt;0.001</b>	1.000	1.000	1.000	<b>&lt;0.001</b>	<b>0.034</b>	1.000	1.000	1.000	<b>0.005</b>	1.000	1.000	0.115	1.000

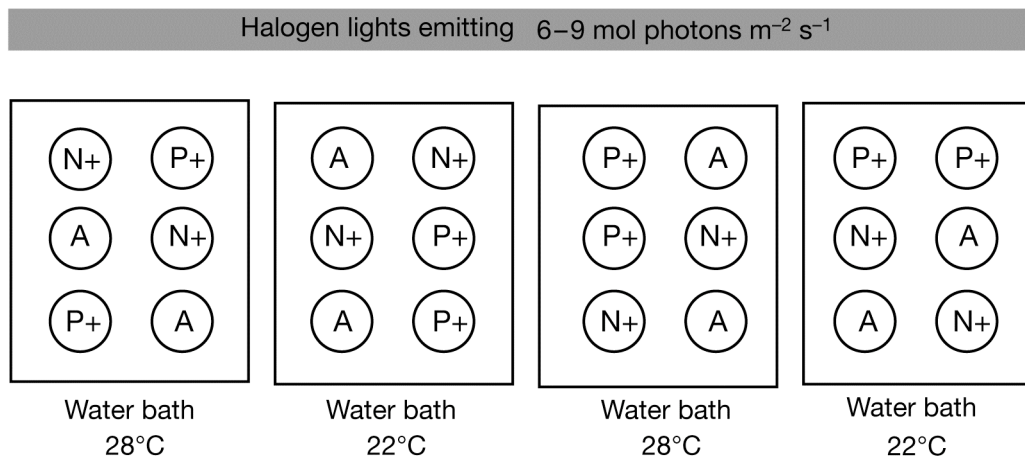


Fig. S1. Experimental setup of the laboratory trial testing the effects of temperature and nutrient concentration in the water on foraminiferal growth. A: Ambient seawater; N+: 2 μM addition of potassium nitrate (KNO<sub>3</sub>); P+: 0.2 μM potassium dihydrogen phosphate (KH<sub>2</sub>PO<sub>4</sub>). Circles represent 500 ml cylinders containing 5 *Marginopora vertebralis* each

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