

Interactive climate change and runoff effects alter O₂ fluxes and bacterial community composition of coastal biofilms from the Great Barrier Reef

Verena Witt^{1,2,*}, Christian Wild², Sven Uthicke¹

¹Australian Institute of Marine Science (AIMS), PMB 3, Townsville MC, Queensland 4810, Australia

²Coral Reef Ecology (CORE), Leibniz Center for Tropical Marine Ecology (ZMT), Fahrenheitstr. 6, 28359 Bremen, Germany

*Email: verena.witt@zmt-bremen.de

Aquatic Microbial Ecology 66: 117–131 (2012)

Supplement. Tables S1 to S3 summarize the 24 h net O₂ production ($\mu\text{mol O}_2 \text{ cm}^{-2} \text{ biofilm area d}^{-1}$), production/respiration (P/R) ratios, total organic carbon, total organic nitrogen, and T-RFs with clone and accession number detected for biofilms from different temperatures, nitrate concentrations and light availabilities. The light conditions used included high light of $200 \mu\text{mol photons m}^{-2} \text{ s}^{-1}$ and low light of $40 \mu\text{mol photons m}^{-2} \text{ s}^{-1}$. The filled boxes in Table S3 represent the presence of a T-RF in at least 1 of the 3 replicates per treatment. Table S4 shows the results of analysis of variance (ANOVA) of linear regression analyses of net O₂ production vs. chl *a*, TOC and TON contents.

Table S1. 24 h net O₂ production ($\mu\text{mol O}_2 \text{ cm}^{-2} \text{ biofilm area d}^{-1}$) and production/respiration (P/R) ratios of biofilms from different temperatures, nitrate concentrations and light availabilities. High light: 200 $\mu\text{mol photons m}^{-2} \text{ s}^{-1}$; low light: 40 $\mu\text{mol photons m}^{-2} \text{ s}^{-1}$. Mean (standard deviation)

Temperature ($^{\circ}\text{C}$)		26			29			31		
Nitrate concentration (μM)		0.5	1.0	1.4	0.5	1.0	1.4	0.5	1.0	1.4
24 h net O ₂ production	High light	12.75 (3.03)	21.68 (3.31)	15.49 (1.06)	11.41 (2.24)	15.20 (5.58)	14.35 (2.47)	9.37 (1.45)	9.65 (4.80)	6.78 (1.14)
	Low light	6.70 (0.57)	10.05 (4.42)	7.93 (0.25)	9.64 (1.39)	9.41 (2.68)	8.20 (4.37)	5.13 (3.64)	5.13 (3.64)	4.33 (1.26)
P/R ratio	High light	6.33 (2.07)	6.82 (0.86)	3.85 (0.94)	7.19 (1.48)	6.46 (2.45)	7.08 (1.43)	5.96 (1.79)	4.41 (0.91)	3.33 (0.91)
	Low light	6.27 (0.67)	8.33 (0.99)	8.05 (1.37)	9.25 (1.40)	3.52 (1.37)	6.97 (2.91)	5.75 (0.51)	5.92 (1.42)	3.31 (1.50)

Table S2. Total organic carbon and total organic nitrogen for biofilms from different temperatures, nitrate concentrations and light availabilities. High light: 200 $\mu\text{mol photons m}^{-2} \text{ s}^{-1}$; low light: 40 $\mu\text{mol photons m}^{-2} \text{ s}^{-1}$. Mean (standard deviation)

Light	Temperature ($^{\circ}\text{C}$)	Nitrate concentration (μM)	Total organic carbon ($\text{mg}^{-1} \text{ cm}^{-2}$)	Total organic nitrogen ($\text{mg}^{-1} \text{ cm}^{-2}$)
<i>High light</i>	26	0.5	0.94 (0.14)	0.18 (0.02)
	26	1	0.95 (0.49)	0.19 (0.09)
	26	1.4	0.82 (0.54)	0.15 (0.07)
	29	0.5	0.60 (0.30)	0.11 (0.04)
	29	1	0.66 (0.12)	0.14 (0.04)
	29	1.4	0.96 (0.29)	0.16 (0.04)
	31	0.5	0.27 (0.12)	0.07 (0.04)
	31	1	0.52 (0.15)	0.14 (0.03)
	31	1.4	0.58 (0.12)	0.13 (0.05)
<i>Low light</i>	26	0.5	0.33 (0.04)	0.08 (0.02)
	26	1	0.31 (0.12)	0.07 (0.03)
	26	1.4	0.19 (0.04)	0.05 (0.02)
	29	0.5	0.21 (0.03)	0.05 (0.02)
	29	1	0.31 (0.07)	0.09 (0.04)
	29	1.4	0.13 (0.10)	0.03 (0.02)
	31	0.5	0.14 (0.00)	0.02 (0.00)
	31	1	0.10 (0.06)	0.02 (0.01)
	31	1.4	0.10 (0.01)	0.02 (0.00)

Table S3. T-RFs with clone and accession number detected from biofilms from different temperature, nitrate and light treatments. High light: 200 $\mu\text{mol photons m}^{-2} \text{s}^{-1}$; low light: 40 $\mu\text{mol photons m}^{-2} \text{s}^{-1}$. Filled boxes represent the presence of a T-RF in at least 1 of the 3 replicates per treatment

T-RF size (bp)	Clone and GenBank accession no.	Light	Temperature ($^{\circ}\text{C}$)								
			Nitrate concentration (μM)								
			26			29			31		
			0.5	1	1.4	0.5	1	1.4	0.5	1	1.4
55	<i>Flavobacteriaceae</i> (HQ601837)	High			■				■	■	■
		Low							■	■	■
56	<i>Flavobacteriaceae</i> (JF261845)	High	■	■	■	■	■	■	■	■	■
		Low	■	■	■	■	■	■	■	■	■
58	<i>Flexibacter</i> (HQ601790)	High	■			■			■		
		Low	■	■	■	■			■	■	
88	<i>Rhizobiales</i> (JF261891)	High		■		■	■	■	■	■	■
		Low							■		■
90	<i>Alphaproteobacteria</i> (HQ601722)	High								■	■
		Low	■	■							■
91	<i>Alcanivorax</i> (HQ601742)	High	■	■	■	■				■	■
		Low		■	■		■	■		■	■
94	<i>Rhodobacteraceae</i> (JF261820)	High	■		■	■			■	■	
		Low	■								
95	<i>Oceanospirillum</i> (JF261814)	High	■	■	■	■	■	■	■	■	■
		Low	■	■	■	■	■	■	■	■	■
106	<i>Flexibacter</i> (JF261796)	High	■						■		
		Low	■	■							
107	<i>Pelagiobacter</i> (JF261854/ HQ601633)	High			■	■					
		Low	■		■	■			■		■
113	<i>Erythrobacter</i> (JF261950)	High				■			■		■
		Low			■	■			■		■
116	<i>Hyphomonas</i> (JF261762)	High			■						
		Low		■	■				■		■
125	S-oxidising symbiont (JF261830)	High	■			■			■	■	
		Low	■	■		■	■	■	■	■	■
126	<i>Desulfuromonas</i> (JF261784)	High			■				■		
		Low		■	■		■	■	■		■
127	<i>Nannocystaceae</i> (HQ601730)	High									
		Low		■		■	■				
168	<i>Flavobacteriaceae</i> (HQ601823)	High									
		Low	■	■					■	■	■
400	<i>Ruegeria</i> (JF261782)	High	■		■	■			■	■	
		Low	■	■	■	■			■	■	
401	<i>Roseobacter</i> (JF261798)	High	■	■	■	■	■	■	■	■	■
		Low	■	■	■	■	■	■	■	■	■
404	<i>Pseudoruegeria</i> (JF261709)	High	■		■	■	■	■	■	■	
		Low	■	■	■	■	■	■	■	■	■
416	Unidentified	High									
		Low						■	■		■
451	<i>Gammaproteobacteria</i> (JF261871)	High									
		Low		■					■	■	■
453	<i>Gammaproteobacteria</i> (JF261872)	High									
		Low	■	■	■				■	■	■
456	<i>Synechococcus</i> (JF261753/HQ601728)	High			■						
		Low				■			■		
457	<i>Cyanobacteria</i> (JF261915)	High	■	■	■	■	■	■	■		
		Low	■	■	■	■	■	■	■	■	■
459	Diatom plastid <i>Phaeodactylum</i> (JF261837)	High	■		■						
		Low	■	■		■	■	■	■	■	■
461	Diatom plastid <i>Haslea</i>	High	■	■	■	■	■	■	■	■	■

	(JF261789)	Low	■	■	■	■		■	■	■	■
462	Unidentified	High	■	■	■			■	■		■
		Low						■	■		■
469	<i>Vibrionaceae</i>	High									
	(JF261867)	Low	■	■	■				■	■	■
471	<i>Vibrio</i>	High									
	(HQ601620)	Low	■						■	■	
472	<i>Polyangium</i>	High									
	(HQ601725)	Low							■		■
485	Unidentified	High									
		Low	■							■	
510	<i>Olleya</i>	High	■								
	(HQ601810)	Low							■		■
512	<i>Flavobacteriaceae</i>	High	■		■						
	(JF261929)	Low									
581	Diatom plastid	High									
	(JF261919)	Low	■						■		■
583	Diatom plastid	High									
	(JF261935)	Low	■							■	
585	Diatom plastid	High	■			■		■			
	(JF261881)	Low		■	■	■	■	■			■

Table S4. Linear regression analyses on 24 h net O₂ production vs. chlorophyll *a* (chl *a*), total organic carbon (TOC) and total nitrogen (TN). *p < 0.05

Measurement	Independent variable	Standardized coefficient	R ²	F-ratio	p
24 h net O ₂ production	Chl <i>a</i>	0.42	0.25	16.9	0.0001*
	TOC	0.37	0.39	33.77	<0.0001*
	TN	0.39	0.35	28.11	<0.0001*