

Canopy macroalgae influence understorey corallines' metabolic control of near-surface pH and oxygen concentration

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Table S1: Treatment sequences for each *Corallina* cobble replicate. For each replicate, vertical profiles of pH and O₂ concentration were made at the same location under three canopy treatments (*Carpophyllum*, mimic and *Corallina* only), at three flow speeds (2, 4, and 8 cm s⁻¹) and two irradiance treatments (L = 190 and D = 0 μmol photons m⁻² s⁻¹). For each replicate, the canopy treatment order and the subsequent flow treatments were randomised and irradiance levels alternated (see text for details). At the end of profiling and before changing canopy treatments flow velocity profiles were made at the same location as the pH and O₂ concentration profiles at the three flow speeds. After every second replicate, the array of cobbles in the flume was exchanged.

Array	Cobble Replicate	Treatment sequence
1	1	<i>Carpophyllum</i> [8L,2D,4L,4D,2L,8D], mimic [4L,8D,8L,2D,2L,4D], <i>Corallina</i> [2L,4D,4L,2D,8L,8D]
	2	<i>Carpophyllum</i> [2D,8L,8D,4L,2D,4L], <i>Corallina</i> [4D,4L, 8D,2L, 2D,8L], mimic [2L,8D,4L,2D,8L,4D]
2	3	mimic [2L,4D,4L,2D,8L,8D], <i>Carpophyllum</i> [8L,8D, 2L,4D, 4L,2D], <i>Corallina</i> [2L,2D,4L,8D,8L,4D]
	4	<i>Corallina</i> [8D,4L,4D,8L,2D,2L], <i>Carpophyllum</i> [8D,4L,4D,2L,2D,8L], mimic [2L,2D,8L,8D,4L,4D]
3	5	<i>Carpophyllum</i> [4L,4D,2L,8DL,8L,2D], mimic [2L,2D,8L,4D,4L,8D], <i>Corallina</i> [2D,8L, 4D,4L, 8D,2L]
	6	<i>Carpophyllum</i> [2L,4D,8L,2D,4L,8D], <i>Corallina</i> [8D,8L, 2D,4L, 4D,2L], mimic [4L,8D,8L,4D,2L,2D],
4	7	<i>Corallina</i> [4L,2D,2L,4D,8L,8D], mimic [4L,2D,8L,8D,2L,4D], <i>Carpophyllum</i> [8L,2D,2L,4D,4L,8D]
	8	Mimic [2D,8L,4D,4L,8D,2L], <i>Corallina</i> [4L,4D,8L,8D,2L,2D], <i>Carpophyllum</i> [4D,8L,8D,4L,2D,2L]

Table S2: Repeated measures ANOVA examining the effect of bulk seawater velocity, canopy treatment type (“Canopy”), and irradiance on the pH/ O₂ concentration near the surface of the CCA.

	Factor	Degrees of Freedom	<i>F</i> value	<i>p</i> value
pH [H ⁺]	Canopy	2	0.19	0.83
	Bulk velocity	2	1.78	0.32
	Irradiance	1	60.62	< 0.01
	Canopy × Bulk Velocity	4	0.57	0.68
	Canopy × Irradiance	2	2.18	0.12
	Bulk velocity × Irradiance	2	16.81	<0.01
	Canopy × Bulk Velocity × Irradiance	4	0.55	0.70
	Residuals	117		
[O ₂]	Canopy	2	4.42	0.01
	Bulk velocity	2	6.68	< 0.01
	Irradiance	1	50.57	< 0.01
	Canopy × Bulk Velocity	4	0.88	0.48
	Canopy × Irradiance	2	6.08	< 0.01
	Bulk velocity × Irradiance	2	11.44	< 0.01
	Canopy × Bulk Velocity × Irradiance	4	1.02	0.40
	Residuals	117		

Table S3: Repeated measures ANOVA examining the effect of bulk seawater velocity, canopy treatment type (“Canopy”), and irradiance on the pH/ O₂ concentration boundary layer thickness.

	Factor	Degrees of Freedom	<i>F</i> value	<i>p</i> value
pH [H ⁺]	Canopy	2	5.13	< 0.01
	Bulk velocity	2	18.14	< 0.01
	Irradiance	1	3.89	0.09
	Canopy × Bulk Velocity	4	3.65	< 0.01
	Canopy × Irradiance	2	0.29	0.74
	Bulk velocity × Irradiance	2	1.57	0.21
	Canopy × Bulk Velocity × Irradiance	4	0.46	0.77
	Residuals	117		
[O ₂]	Canopy	2	15.82	< 0.01
	Bulk velocity	2	27.36	< 0.01
	Irradiance	1	18.60	< 0.01
	Canopy × Bulk Velocity	4	6.27	< 0.01
	Canopy × Irradiance	2	2.62	0.08
	Bulk velocity × Irradiance	2	5.70	< 0.01
	Canopy × Bulk Velocity × Irradiance	4	0.46	0.76
	Residuals	117		