

Table S1. Mean carbonate chemistry conditions in minicosms

Tank	$f\text{CO}_2$ (μatm)	pH_T	DIC ($\mu\text{mol kg}^{-1}$)	PA ($\mu\text{mol kg}^{-1}$)
1	343 \pm 30	8.10 \pm 0.04	2188 \pm 6	2324 \pm 11
2	506 \pm 43	7.94 \pm 0.03	2243 \pm 8	2325 \pm 10
3	634 \pm 63	7.85 \pm 0.04	2270 \pm 5	2325 \pm 12
4	953 \pm 148	7.69 \pm 0.07	2314 \pm 11	2321 \pm 11
5	1140 \pm 112	7.61 \pm 0.04	2337 \pm 5	2320 \pm 10
6	1641 \pm 140	7.45 \pm 0.04	2377 \pm 8	2312 \pm 10

Data are mean \pm standard deviation of triplicate pseudoreplicate measurements

Table S2. Initial conditions of seawater sampled from Prydz Bay, Antarctica

Condition	Value
$f\text{CO}_2$, μatm	356 \pm 6
pH_T	8.08 \pm 0
DIC, $\mu\text{mol kg}^{-1}$	2187 \pm 6
PA, $\mu\text{mol kg}^{-1}$	2317 \pm 6
Temperature, $^\circ\text{C}$	-1.03 \pm 0.17
NOx, μM	26.19 \pm 0.74
SRP, μM	1.74 \pm 0.02
Silicate, μM	60.75 \pm 0.91

Data are mean \pm standard deviation of all six minicosm measurements

Table S3. Average light irradiance ($\mu\text{mol photons m}^{-2} \text{s}^{-1}$) in minicosms

Tank	$f\text{CO}_2$ (μatm)	Low light	Medium light	High light
1	343	0.94	22.02	97.41
2	506	0.60	15.95	59.68
3	634	1.04	26.41	103.24
4	953	1.19	22.53	118.33
5	1140	0.71	21.44	71.51
6	1641	0.90	22.02	92.95

Low light: quarter CT blue filter, two 90% ND filters, light-scattering filter
 Medium light: quarter CT blue filter, one 60% ND filter, light-scattering filter
 High light: one quarter CT blue filter, light-scattering filter

Table S4. ANOVA table for Chl *a* statistics

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Day	1	12304.2	12304.2	1802.5	< 0.001
I(Day ²)	1	2214.5	2214.5	324.4	< 0.001
$f\text{CO}_2$	5	267.0	53.4	7.8	< 0.001
Day: $f\text{CO}_2$	5	186.0	37.2	5.5	0.002
Residuals	23	157.0	6.8		

Table S5. ANOVA table for GPP_{14C} statistics

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Day	1	6405.2	6405.2	1271.6	< 0.001
I(Day ²)	1	1056.1	1056.1	209.7	< 0.001
<i>f</i> CO ₂	5	211.9	42.4	8.4	< 0.001
Day: <i>f</i> CO ₂	5	124.6	24.9	4.9	0.003
Residuals	23	115.9	5.0		

Table S6. ANOVA table for bacterial abundance statistics

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Day	1	2.1 x10 ¹⁸	2.1 x10 ¹⁸	1470.6	< 0.001
I(Day ²)	1	4.3 x10 ¹⁶	4.3 x10 ¹⁶	30.1	< 0.001
<i>f</i> CO ₂	5	2.0 x10 ¹⁷	4.1 x10 ¹⁶	28.1	< 0.001
Day: <i>f</i> CO ₂	5	7.1 x10 ¹⁶	1.4 x10 ¹⁶	9.8	< 0.001
Residuals	185	2.7 x10 ¹⁷	1.5 x10 ¹⁵		

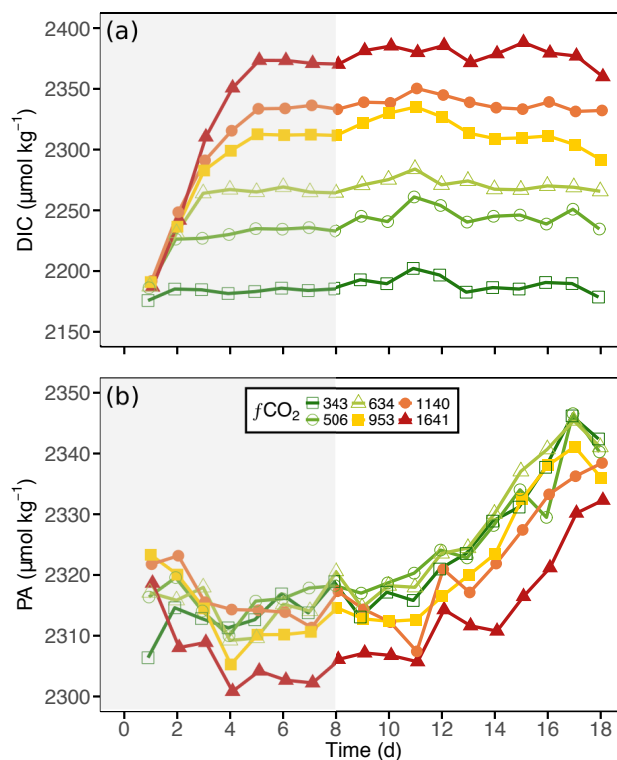


Figure S1. (a) Dissolved inorganic carbon (DIC) and practical alkalinity (PA) conditions within each of the minicosm treatments throughout the experimental period. Grey shading indicates CO₂ and light acclimation period.

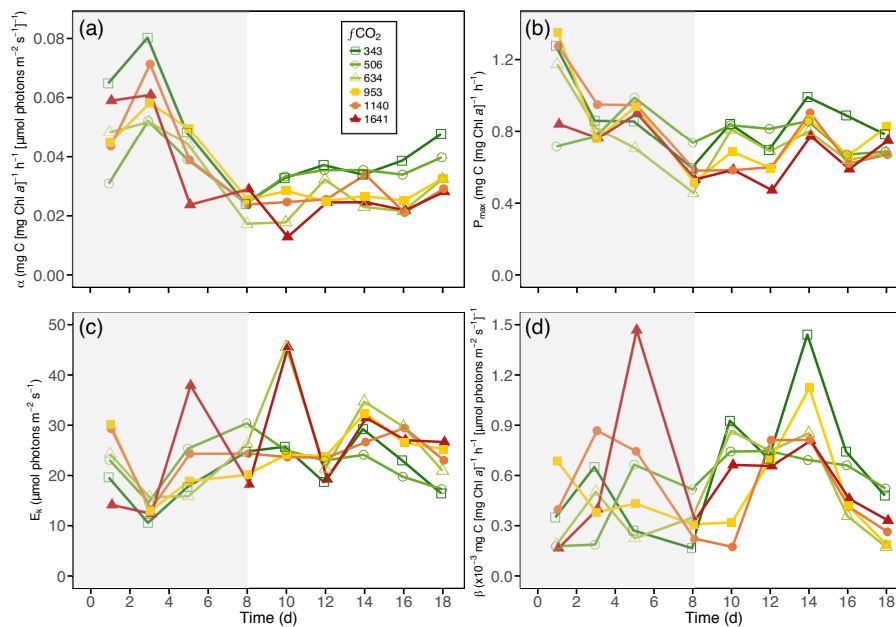


Figure S2. Photosynthetic parameters from ¹⁴C-derived photosynthesis versus irradiance (PE) curves from each of the minicosm treatments over time. (a) Maximum photosynthetic efficiency (α), (b) maximum photosynthetic rate (P_{max}), (c) saturating irradiance (E_k) and (d) photoinhibition rate (β). Grey shading indicates CO₂ and light acclimation period.

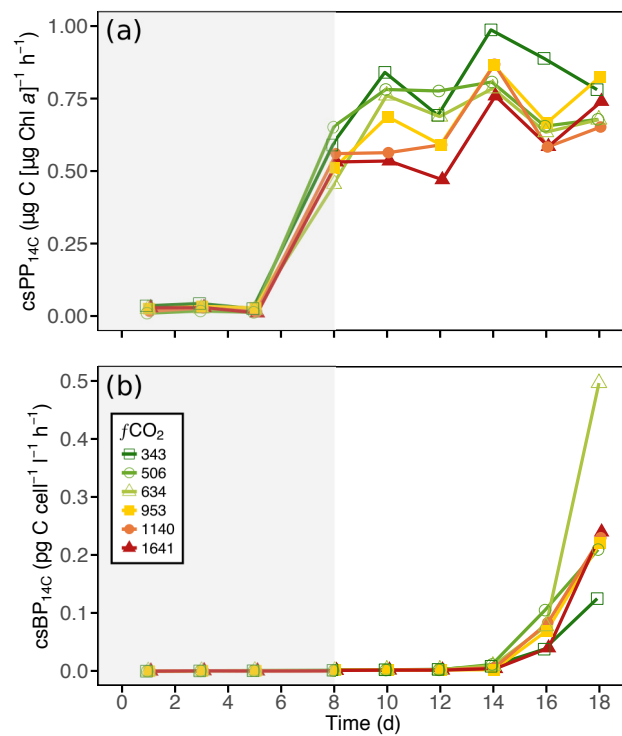


Figure S3. ¹⁴C-derived primary productivity within each of the minicosm treatments over time. (a) Chl *a*-specific primary productivity (csPP_{14C}) and (b) cell-specific bacterial productivity (csBP_{14C}). Grey shading indicates CO₂ and light acclimation period.

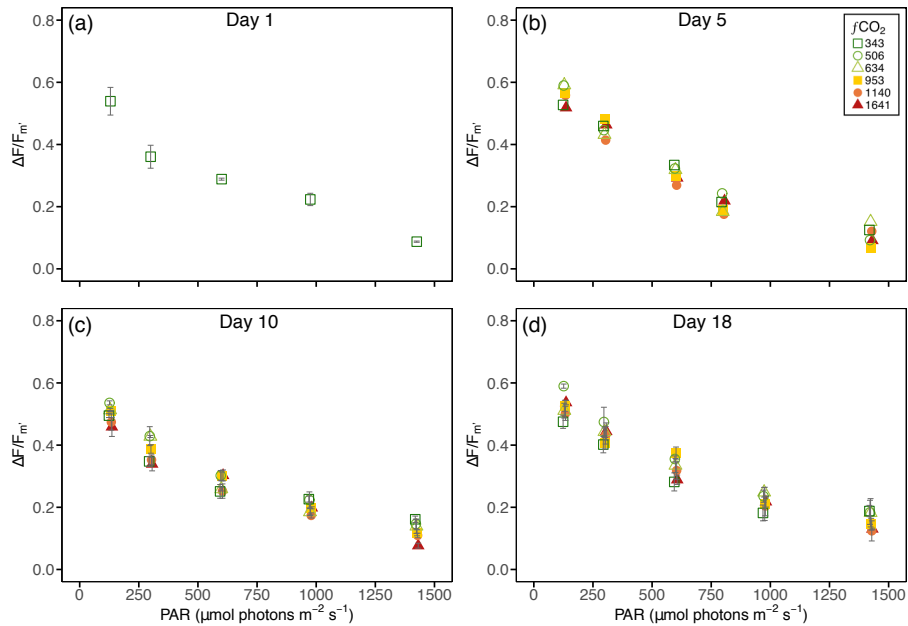


Figure S4. Effective quantum yield ($\Delta F_v/F_m$) within minicosm treatments on days 1, 5, 10, and 18. Error bars display one standard deviation of pseudoreplicate samples.

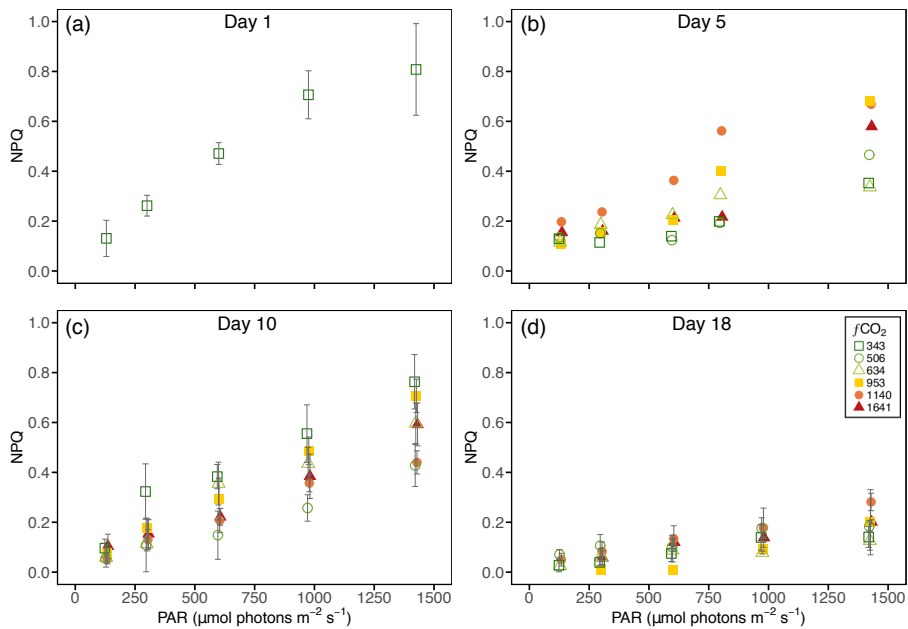


Figure S5. Non-photochemical quenching (NPQ) within minicosm treatments on days 1, 5, 10, and 18. Error bars display one standard deviation of pseudoreplicate samples.

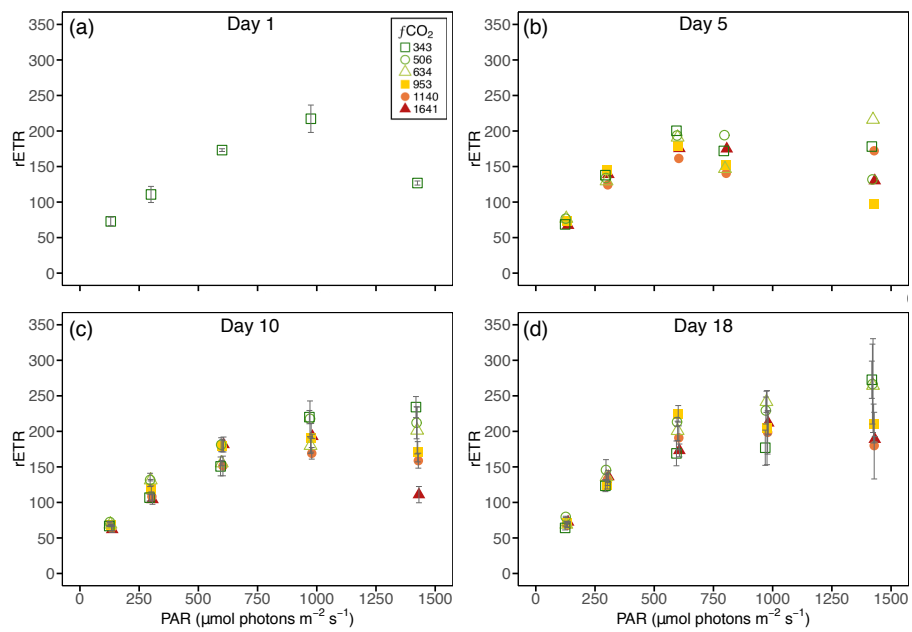


Figure S6. Relative electron transport rate (rETR) within minicosm treatments on days 1, 5, 10, and 18. Error bars display one standard deviation of pseudoreplicate samples.