Supplemental Information

Table S1. ANCOVA results comparing the effect of seawater pCO2 and the length of exposure to treatment conditions (days) on the proportion of mussels (M. trossulus) that produced mineralized repaired shell (reached S3 or S4) over 10-weeks.

Source	df	SS	F-value	P-value
Time	6	340.07	48.01	<0.001
pCO_2	6	6.11	0.86	0.53
Residuals	36	42.5		

Table S2. ANOVA results comparing the effect of seawater pCO2 and mussel condition (condition index, CI) on the inorganic content (%) and force required to dislodge repaired shell material (N) within the endpoint population (10-weeks).

Variable	Source	df	SS	F-value	P-value
Inorganic Content	pCO_2	1	1410	7.211	0.013*
	CI	1	10	0.050	0.825
	Residuals	25	4888		
Force	pCO_2	1	25.5	1.313	0.263
	CI	1	5.7	0.291	0.594
	Residuals	25	485.5		

Table S3. ANCOVA results comparing the effect of seawater pCO_2 and the length of exposure (days) to treatment conditions on the force required to dislodge repaired shell (N), the inorganic content of repaired shell (%), the condition index (CI), and gonad index (GI) of mussels over course of 10-weeks within seven OA treatments.

Variable	Source	df	SS	F-value	P-value
Force	Time	6	25.6	5.28	<0.001*
	pCO2	6	12.4	2.57	0.021*
	Time x pCO_2	36	45.7	1.60	0.029*
	Residuals	195	158		
Inorganic content	Time	6	20.8	4.59	<0.001*
	pCO2	6	17.5	3.85	0.001*
	Time x pCO_2	36	53.3	1.96	0.002*
	Residuals	195	147.3		
Repair area	Time	6	0.70	0.72	0.638
	pCO2	6	0.78	0.80	0.573
	Residuals	36	37.7		
CI	Time	6	3.66×10^{-5}	7.55	<0.001*
	pCO2	6	1.28×10^{-5}	2.65	0.017*
	Time x pCO_2	36	2.60×10^{-5}	0.89	0.645
	Residuals	194	1.57×10^{-4}		
GI	Time	6	8.94×10^{-2}	2.98	0.008*
	pCO2	6	1.47×10^{-2}	0.49	0.814
	Time x pCO_2	36	0.047	0.98	0.512
	Residuals	194	0.971		

Table S4. ANCOVA results comparing the effect of seawater pCO_2 on the mean and max grayscale value from µCT scans of endpoint samples (see Figure 6B).

Variable	Source	df	SS	F-value	P-value
Mean grayscale value	pCO_2	6	2.77	0.43	0.85
	Residuals	23	24.5		
Max grayscale value	pCO_2	6	2.77	2.98	0.56
	Residuals	23	2.96×10^2		

Table S5. The results of two-way ANOVA and Tukey HSD comparisons of initial and final (after 10 weeks) condition (condition index, CI) and gonad indices (GI) comparing mussels in OA and field treatments.

	Source	df	SS	F-value	P-value
CI	Treatment	7	26.63	3.72	0.001*
	Time	1	41.53	40.60	<0.001*
	Treatment × Time	7	16.7	2.33	0.030*
	Residuals	110	112.52		
GI	Treatment	7	0.121	2.73	0.012*
	Time	1	0.006	0.95	0.331
	Treatment × Time	7	0.083	1.88	0.080
	Residuals	107	0.674		

	Variable	group		Variable	group
CI	field.initial	a	CI	1600.initial	abc
	field.final	abc		1600.final	abc
	400.initial	abc		1900.initial	a
	400.final	bc		1900.final	bc
	700.initial	ab		2200.initial	ab
	700.final	bc		2200.final	c
	1000.initial	abc		2500.initial	abc
	1000.final	bc		2500.final	abc

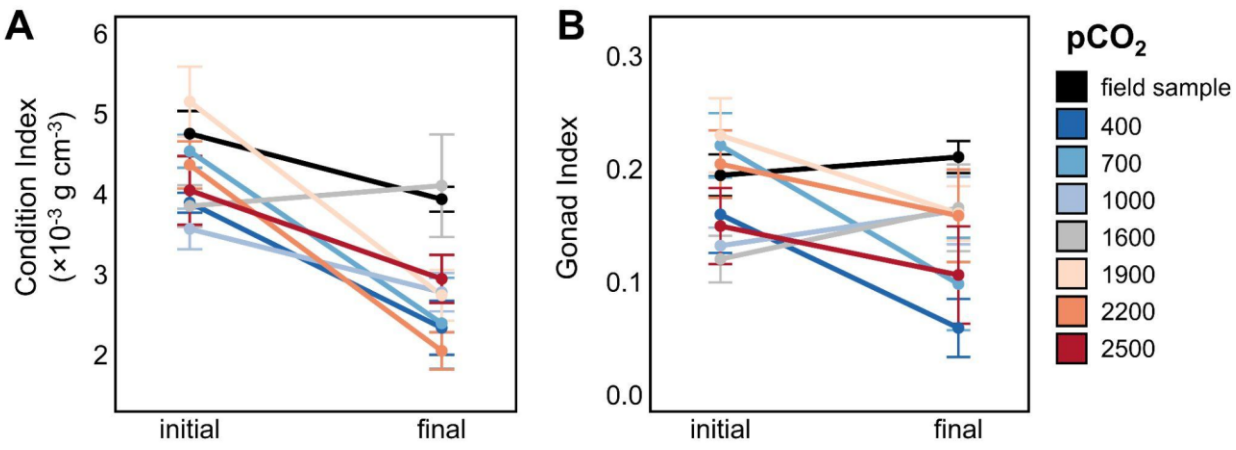

Figure S1. Comparison of the initial and final (after 10 weeks) condition (A) and gonad (B) indices across OA treatments and field samples.

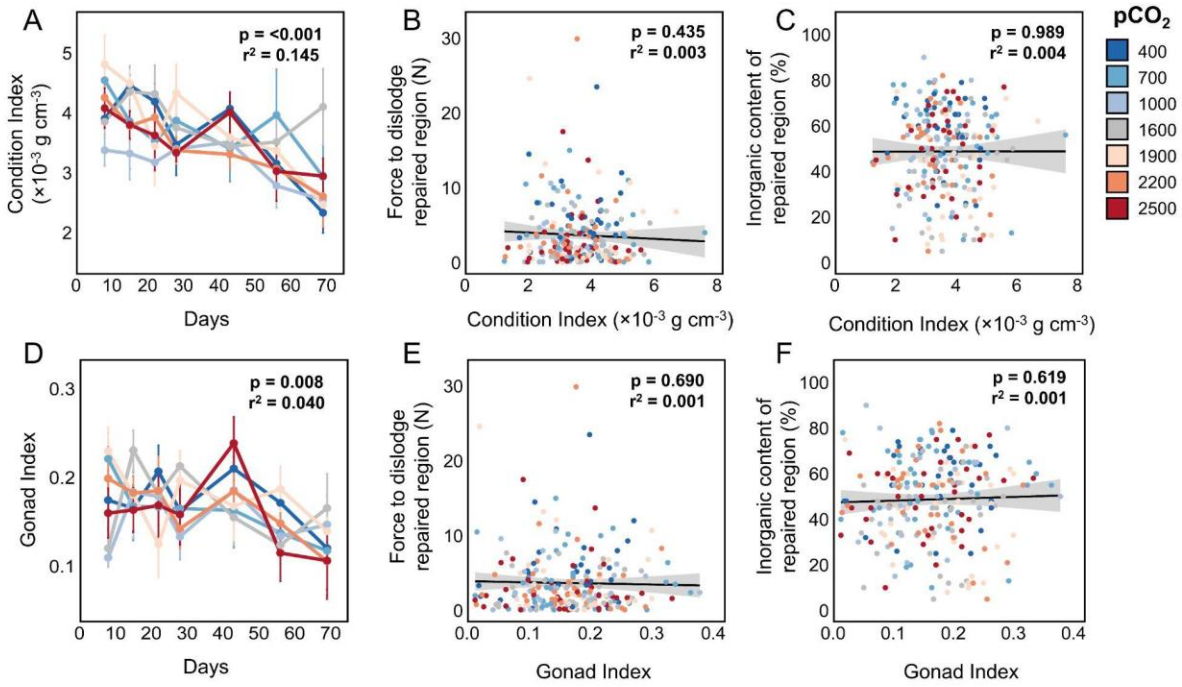

Figure S2. Effect of condition index (CI) and gonad index (CI) on shell repair during OA laboratory experiments. The CI of mussels universally declined under laboratory conditions regardless of OA treatment (A), with no observed effect of CI on the force required to dislodge repaired regions (B) or their inorganic content (C). Similarly, the GI of mussels also declined while housed in the laboratory (D) but did not significantly affect the force to dislodge (E) or inorganic content (F) or repaired shell region.