

Figure S1: Variation in seawater temperature within the mesocosm set-up throughout 3-month exposure of *Magallana gigas* exposed to two temperature levels: control (~16.5 °C); elevated (~20 °C).

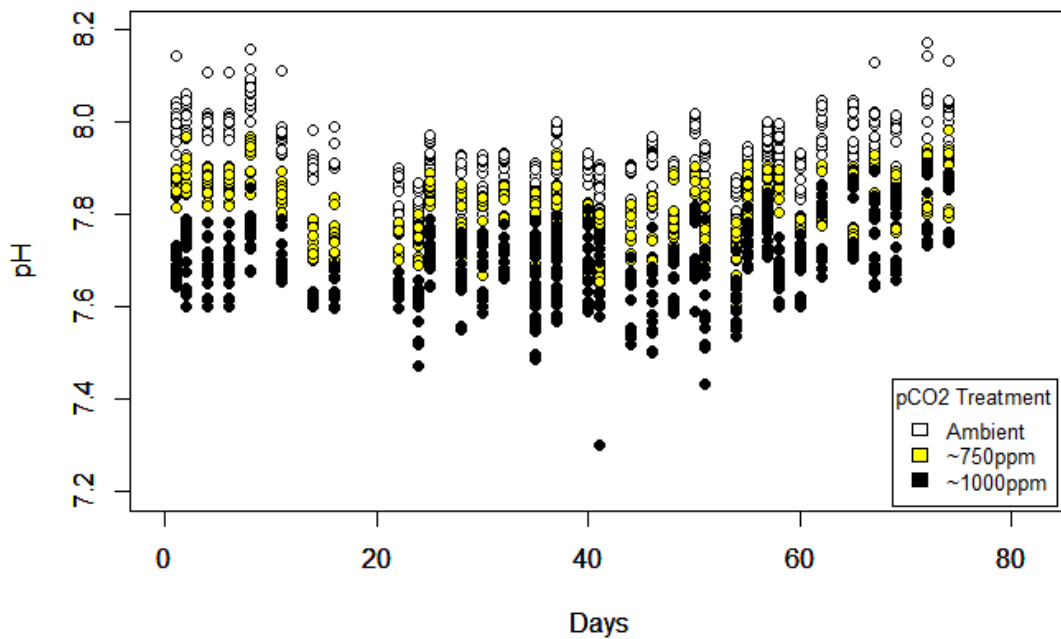


Figure S2: Variation in seawater pH within the mesocosm set-up throughout 3-month exposure of *Magallana gigas* to three atmospheric pCO₂ levels: Ambient (~400 ppm), ~750 ppm, ~1000 ppm.

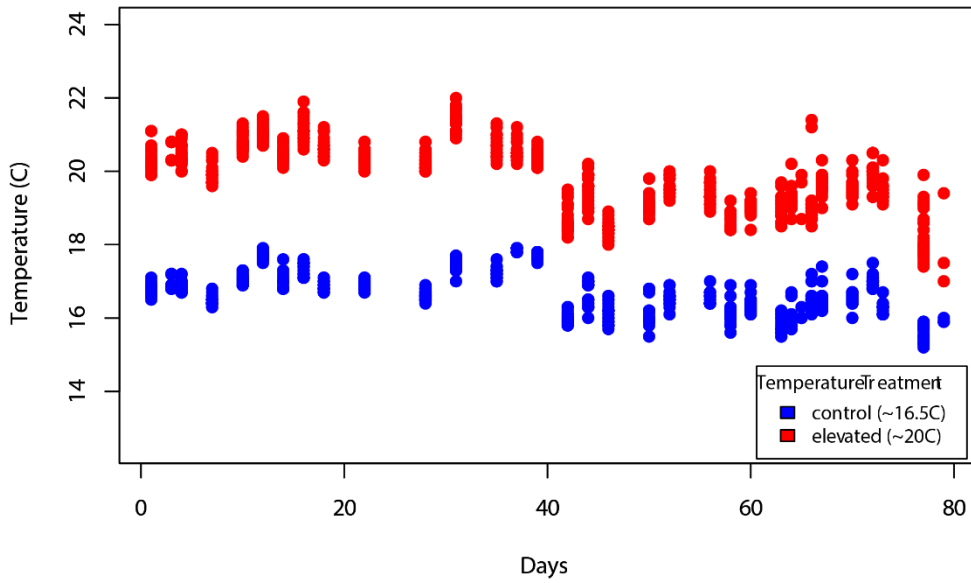


Figure S3: Variation in seawater temperature within the mesocosm set-up throughout 3-month exposure of *Ostrea edulis* exposed to two temperature levels: control (~16.5 °C); elevated (~20 °C).

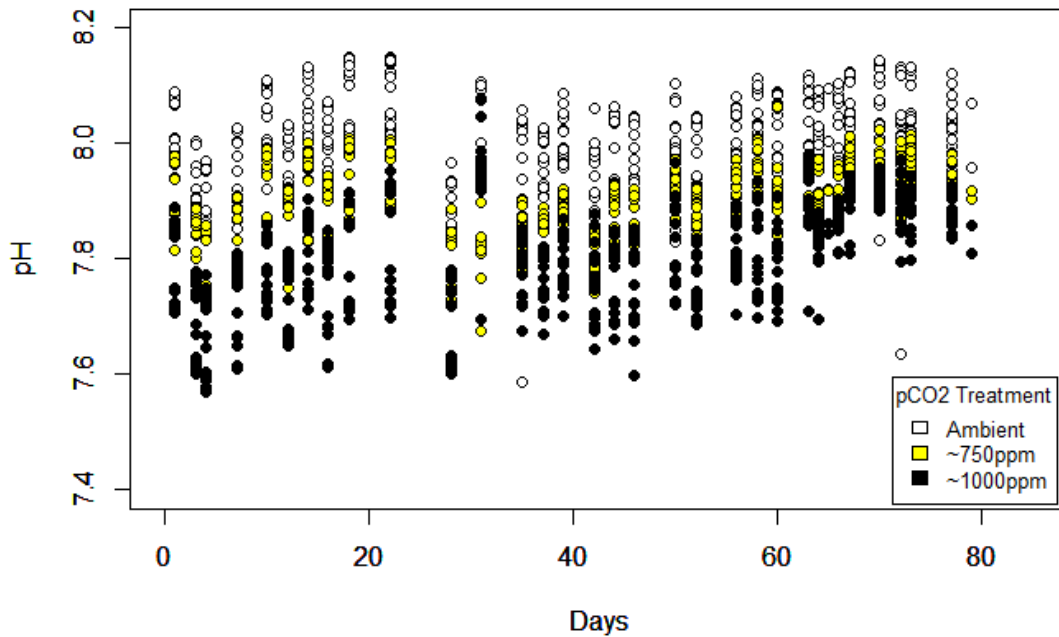


Figure S4: Variation in seawater pH within the mesocosm set-up throughout 3-month exposure of *Ostrea edulis* to three atmospheric $p\text{CO}_2$ levels: Ambient (~400 ppm), ~750 ppm, ~1000 ppm.

Table S1: Summary of ANCOVA results for the effects of $p\text{CO}_2$, Temperature, tissue dry weight (MeatDW), and their interactions on three traits related to the adductor muscle strength of *Magallana gigas* and *Ostrea edulis*. Df= degrees of freedom. SS= sum of squares. MS= mean squares. Bolded p -values denote significant effects at * ≤ 0.05 , ** ≤ 0.01 , *** ≤ 0.001 .

	<i>Magallana gigas</i>					<i>Ostrea edulis</i>					
	df	SS	MS	F	p	df	SS	MS	F	p	
<u>Initial resisting force</u>											
$p\text{CO}_2$	2	355	177.7	0.122	0.885	2	4951	2475.26	1.806	0.184	
Temperature	1	301	301	0.207	0.652	1	93	93.31	0.067	0.796	
MeatDW	1	832	832.3	0.573	0.455	1	7	7.2	0.005	0.943	
$p\text{CO}_2$:Temperature	2	4852	2425.9	1.670	0.205	2	4175	2097.69	1.523	0.236	
$p\text{CO}_2$:MeatDW	2	6729	3364.4	2.317	0.115	2	1521	760.25	0.555	0.581	
Temperature:MeatDW	1	2286	2285.6	1.574	0.219	1	1754	1754.21	1.280	0.268	
$p\text{CO}_2$:Temperature:MeatDW	2	872	435.9	0.300	0.743	2	136	67.83	0.050	0.952	
Residuals	31	45021	1452.3			27	37001	1370.41			
<u>Force necessary to open the valves</u>											
$p\text{CO}_2$	2	1334	667.02	2.432	0.104	2	628.9	314.46	0.573	0.571	
Temperature	1	459.9	459.87	1.677	0.205	1	195.9	195.93	0.357	0.555	
MeatDW	1	1340.6	1340.63	4.888	0.035	*	1	1444.2	1444.21	2.632	0.116
$p\text{CO}_2$:Temperature	2	493.4	246.71	0.900	0.417	2	785.4	392.72	0.716	0.498	
$p\text{CO}_2$:MeatDW	2	2977.9	1488.94	5.429	0.010	**	2	2708.6	1354.31	2.468	0.104
Temperature:MeatDW	1	476.7	476.7	1.738	0.197	1	19.9	19.9	0.036	0.850	
$p\text{CO}_2$:Temperature:MeatDW	2	8.1	4.05	0.015	0.985	2	2497.7	1248.84	2.276	0.122	
Residuals	31	8501.6	274.25			27	14815.7	548.73			

Force required to induce muscle tear

$p\text{CO}_2$	2	155.5	77.73	0.265	0.769		2	403.6	201.8	0.339	0.7160
Temperature	1	762	762.12	2.595	0.116		1	288.4	288.4	0.485	0.4938
MeatDW	1	17.7	17.61	0.060	0.808		1	7731.3	7731.1	13.004	0.002 **
$p\text{CO}_2$:Temperature	2	4764	2382	8.110	0.001	**	2	1256	628	1.056	0.366
$p\text{CO}_2$:MeatDW	2	508.3	254.15	0.865	0.430		2	209.5	104.7	0.176	0.840
Temperature:MeatDW	1	2940.3	2940.3	10.010	0.003	**	1	163.8	163.8	0.276	0.605
$p\text{CO}_2$:Temperature:MeatDW	2	257.1	128.56	0.438	0.649		2	3130.5	1565.2	2.633	0.095
Residuals	35	10280.4	293.72				21	12485.6	594.6		

Table S2: Summary of ANCOVA results for the effects of $p\text{CO}_2$, Temperature, shell dry weight (ShellDW), and their interactions on the shell strength of *Magallana gigas* and *Ostrea edulis*. Df = degrees of freedom. SS = sum of squares. MS = mean squares. Bolded p -values denote significant effects at * ≤ 0.05 , ** ≤ 0.01 , *** ≤ 0.001 .

	<i>Maallana gigas</i>					<i>Ostrea edulis</i>				
	df	SS	MS	F	p	df	SS	MS	F	p
Shell strength										
$p\text{CO}_2$	2	56087	28044	1.446	0.250	2	138167	69084	0.740	0.486
Temperature	1	331	331	0.017	0.900	1	480	480	0.005	0.943
ShellDW	1	166421	166421	8.578	0.006 **	1	1339909	1339909	14.361	<0.001 ***
$p\text{CO}_2$:Temperature	2	222324	111162	5.730	0.007 **	2	28371	14186	0.152	0.860
$p\text{CO}_2$:ShellDW	2	158710	79355	4.090	0.026 *	2	112678	56339	0.604	0.553
Temperature:ShellDW	1	414	414	0.021	0.885	1	46453	46453	0.498	0.486
$p\text{CO}_2$:Temperature:ShellDW	2	23800	11900	0.613	0.547	2	15719	7860	0.084	0.919
Residuals	34	659641	19401			29	2705686	93300		

Table S3: Summary of linear mixed-effect models results for the effects of $p\text{CO}_2$, Temperature, and their interaction on *Magallana gigas* and *Ostrea edulis* morphometrics (Condition Index (CI), muscle diameter and area, shell thickness), and of the linear mixed-effect models results for the effects of $p\text{CO}_2$, Temperature, Valve, and their interactions on their shell density. Df= degrees of freedom. SS= sum of squares. MS= mean squares. Bolded p -values denote significant effects at * ≤ 0.05 , ** ≤ 0.01 , *** ≤ 0.001 .

	<i>Magallana gigas</i>				<i>Ostrea edulis</i>			
	numDF	denDF	F	p	numDF	denDF	F	p
<u>Muscle diameter</u>								
(Intercept)	1	42	3589.987	<0.0001	1	36	2414.352	<0.0001
$p\text{CO}_2$	2	42	0.644	0.53	2	36	1.395	0.261
Temperature	1	42	0.004	0.947	1	36	0.121	0.73
$p\text{CO}_2$:Temperature	2	42	0.756	0.476	2	36	0.287	0.752
<u>Muscle area</u>								
(Intercept)	1	42	654.693	<0.0001	1	36	770.768	<0.0001
$p\text{CO}_2$	2	42	0.866	0.428	2	36	0.823	0.447
Temperature	1	42	0.232	0.632	1	36	0.511	0.479
$p\text{CO}_2$:Temperature	2	42	0.331	0.72	2	36	0.187	0.83
<u>CI</u>								
(Intercept)	1	42	1163.019	<0.0001	1	36	436.676	<0.0001
$p\text{CO}_2$	2	42	1.415	0.254	2	36	1.187	0.317
Temperature	1	42	0.703	0.406	1	36	0.427	0.518
$p\text{CO}_2$:Temperature	2	42	3.995	0.026 *	2	36	1.495	0.238
<u>Shell density</u>								
(Intercept)	1	43	7748.281	<0.0001	1	39	3387.904	<0.0001
$p\text{CO}_2$	2	41	0.089	0.915	2	39	1.618	0.211
Temperature	1	41	0.216	0.645	1	39	1.182	0.284

Valve	1	43	36.823	<0.0001	***	1	39	25.588	<0.0001	***
pCO ₂ :Temperature	2	41	0.225	0.8		2	39	1.465	0.244	
Temperature:Valve	1	43	2.536	0.504		1	39	0.077	0.782	
pCO ₂ :Valve	2	43	2.536	0.091		2	39	0.406	0.669	
pCO ₂ :Temperature:Valve	2	43	1.906	0.161		2	39	0.369	0.694	
<u>Shell thickness</u>										
(Intercept)	1	96	829.459	<0.0001		1	90	1726.127	<0.0001	
pCO ₂	2	42	0.122	0.886		2	39	0.168	0.846	
Temperature	1	42	0.719	0.401		1	39	3.359	0.075	
Temperature:pCO ₂	2	42	0.119	0.888		2	39	0.487	0.618	
