Table S1: ANOVA and Kruskal Wallis test results.

(A) Exp. 1: One-way ANOVAs for extracellular acid-base and ion status of large mussels (factor: seawater pCO_2, $pCO_{2\ sw}$). Significant post-hoc tests ($p<0.05$, Tukey HSD) indicated in the manuscript figures and tables. Six seawater pCO_2 levels (39 to 405 Pa / 385 to 4000 µatm), N = 12 replicates for 39 to 142 Pa, N = 6 replicates for 405 Pa. (B) Exp. 2: Two-way ANOVAs for shell and somatic growth (factors: seawater pCO_2 and initial size). Significant post-hoc tests ($p<0.05$, Tukey HSD) are indicated in the text. Three seawater pCO_2 levels (39, 142 and 405 Pa / 385, 1400 and 4000 µatm) and two size classes (small, medium), N = 4 replicate aquaria for each treatment. (C) Exp. 2: One-way ANOVAs for shell microstructure (SEM) analysis of medium sized mussels (factor: seawater pCO_2, $pCO_{2\ sw}$). Significant post-hoc tests ($p<0.05$, Tukey HSD) indicated in the text. Three seawater pCO_2 levels (39, 142, 405 Pa), N = 5 replicate mussels analyzed. (D) Exp. 2: Kruskal-Wallis test results for comparison of shell dissolution area at the umbo and shell dissolution severity at the umbo vs. pCO_2 (39, 142, 405 Pa), N = 20 replicate medium sized mussels analyzed. Significant Dunn's multiple comparison tests are shown in Fig. 6.

A) Extracellular acid-base and ion status (Exp. 1)

	Factor	F	p
Extracellular pH	$pCO_{2\ sw}$	$F_{(5,56)}=172494$	**<0.001**
Extracellular $[HCO_3^-]$	$pCO_{2\ sw}$	$F_{(5,54)}=1.8$	>0.12
Extracellular $[CO_3^{2-}]$	$pCO_{2\ sw}$	$F_{(5,53)}=4.4$	**<0.003**
Extracellular pCO_2	$pCO_{2\ sw}$	$F_{(5,54)}=16.7$	**<0.001**
Extracellular $[K^+]$	$pCO_{2\ sw}$	$F_{(5,55)}=1.7$	>0.15
Extracellular $[Na^+]$	$pCO_{2\ sw}$	$F_{(5,56)}=5.0$	**<0.001**
Extracellular $[Ca^{2+}]$	$pCO_{2\ sw}$	$F_{(5,56)}=2.3$	>0.05
Extracellular $[Mg^{2+}]$	$pCO_{2\ sw}$	$F_{(5,56)}=2.0$	>0.09

B) Shell and somatic growth (Exp. 2)

a) shell length growth vs. seawater pCO_2 (pCO_2 sw) and initial size (size)

	SS	d.f.	MS	F	p
Intercept	6436.4	1	6436.3	7864.5	<0.001
size	636.5	1	636.5	777.8	**<0.001**
pCO_2 sw	16.6	2	8.3	10.1	**<0.002**
size * pCO_2 sw	0.5	2	0.3	0.3	>0.71
Error	14.7	18	0.8		

b) dry mass growth vs. seawater pCO_2 (pCO_2 sw) and initial size (size)

	SS	d.f.	MS	F	p
Intercept	7465.7	1	7465.7	8174.2	<0.001
size	3838.2	1	3838.2	4202.5	**<0.001**
pCO_2 sw	63.2	2	31.6	34.6	>0.05
size * pCO_2 sw	32.7	2	16.3	17.9	>0.19
Error	164.4	18	9.1		

c) shell mass growth vs. seawater pCO_2 (pCO_2 sw) and initial size (size)

	SS	d.f.	MS	F	p
Intercept	323798.4	1	323798.4	1996.6	<0.001
size	160413.0	1	160413	989.2	**<0.001**
pCO_2 sw	5566.3	2	2783.1	17.2	**<0.001**
size * pCO_2 sw	1930.4	2	965.2	6.0	**<0.02**
Error	2919.1	18	162.2		

C) Shell microstructure (SEM) analysis (Exp. 2)

	Factor	F	p
Initial shell length	pCO_2 sw	$F_{(2,12)}$=2.9	>0.09
Final shell length	pCO_2 sw	$F_{(2,12)}$=0.1	>0.93
95% shell length: calcite thickness	pCO_2 sw	$F_{(2,12)}$=0.85	>0.44
75% shell length: calcite thickness	pCO_2 sw	$F_{(2,12)}$=1.45	>0.27
75% shell length: aragonite thickness	pCO_2 sw	$F_{(2,12)}$=0.35	>0.70
75% shell length: number of aragonite layers	pCO_2 sw	$F_{(2,12)}$=0.1	>0.91
75% shell length: thickness of aragonite layers	pCO_2 sw	$F_{(2,12)}$=56.8	**<0.02**

D) Shell dissolution analysis (Exp. 2)

a) dissolution area at umbo vs. pCO_2

group	N mussels	Sum of ranks	Mean of ranks
39 Pa	20	35.5	1.8
142 Pa	20	64.6	3.2
405 Pa	20	83.0	4.2
Kruskal-Wallis Statistic = 19.49, **p<0.001**			

b) dissolution index at umbo vs. pCO_2

group	N mussels	Sum of ranks	Mean of ranks
39 Pa	20	36.7	1.8
142 Pa	20	56.9	2.8
405 Pa	20	89.5	4.5
Kruskal-Wallis Statistic = 25.41, **p<0.001**			