

1 Table S1. Water chemistry parameters for three CO₂ levels used in 28-day
 2 experiment on summer flounder. Parameter values (mean ± SD) are based on
 3 observations (above separator) or derived calculations (below). Water
 4 temperature and salinity during experiment were 19.6 (± 0.74) °C and 20.9 (±
 5 0.44) PSU, respectively. Abbreviations: Dissolved inorganic carbon (DIC),
 6 partial pressure of carbon dioxide (pCO₂), bicarbonate (HCO₃⁻), carbonate
 7 (CO₃²⁻), alkalinity (ALK), aragonite saturation state (Ω aragonite), calcite
 8 saturation state (Ω calcite).

Parameter (units)	Low	Intermediate	High
pH	7.81 ± 0.02	7.47 ± 0.10	7.06 ± 0.07
DIC (μmol kg ⁻¹)	2036 ± 21	2124 ± 48	2189 ± 70
pCO ₂ (μATM)	775 ± 42	1808 ± 362	4714 ± 557
HCO ₃ ⁻ (μmol kg ⁻¹)	1930 ± 20.5	2023 ± 45	2012 ± 74
CO ₃ ²⁻ (μmol kg ⁻¹)	79 ± 4	39 ± 10	15 ± 3
ALK (μEq kg ⁻¹)	2116 ± 21	2114 ± 44	2048 ± 79
Ω aragonite	1.28 ± 0.07	0.63 ± 0.16	0.24 ± 0.04
Ω calcite	2.07 ± 0.11	1.02 ± 0.26	0.39 ± 0.07

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1 Table S2. Mean (\pm SE) for survival and morphological measurements of summer flounder larvae by age (days from hatching) when
 2 exposed to three levels of CO₂. Principal components (PC) analysis performed on morphological measurements for all individuals in each
 3 separate age sample. Also given are the percentages of total variance in morphological measurements accounted for by significant
 4 principal component (one each PC for 0 and 14-dph larvae; two for 28-dph larvae), and the contribution (loadings) to the PC of each
 5 individual morphological variable. Morphological measurements are shown in Figure 1. Abbreviations: Survival (S), yolk length (YL),
 6 yolk depth (YD), oil globule diameter (OGD), pre-caudal body length (BL), standard (or notochord) length (SL), total length (TL), body
 7 depth at vent including finfold (FDV), muscle mass depth at vent (MDV), mandible length (ML), flexion length (FL), flexion angle (FA).
 8 Statistics based on means of experimental replicate means (N = 3 per CO₂ level). Blank entries denote variables unavailable for that age
 9 of larvae.

Age (d)	CO ₂ level ¹	S ²	YL (mm)	YD (mm)	OGD (mm)	BL (mm)	SL (mm)	TL (mm)	FDV (mm)	MDV (mm)	ML (mm)	FL (mm)	FA (deg)	PC (%)
0	Low	0.56 (0.134)	1.00 (0.015)	0.44 (0.031)	0.21 (0.004)	1.47 (0.017)	3.00 (0.046)	3.11 (0.049)	0.61 (0.026)	0.18 (0.004)				
	Intermediate	0.29 (0.105)	0.75 (0.086)	0.31 (0.087)	0.20 (0.006)	1.53 (0.029)	3.31 (0.178)	3.44 (0.193)	0.71 (0.096)	0.20 (0.010)				
	High	0.11 (0.055)	0.68 (0.110)	0.30 (0.091)	0.20 (0.012)	1.50 (0.062)	3.31 (0.139)	3.45 (0.153)	0.72 (0.043)	0.20 (0.006)				
	PC1 loading		-0.77	-0.88	-0.72	0.65	0.96	0.97	0.84	0.79				68.8
14	Low					2.30 (0.017)	5.25 (0.055)	5.49 (0.056)	1.43 (0.006)	0.39 (0.006)	0.55 (0.009)			
	Intermediate					2.33 (0.028)	5.49 (0.071)	5.76 (0.072)	1.50 (0.028)	0.42 (0.016)	0.58 (0.007)			
	High					2.36 (0.044)	5.63 (0.116)	5.89 (0.114)	1.55 (0.060)	0.43 (0.024)	0.57 (0.014)			
	PC1 loading					0.91	0.97	0.98	0.95	0.94	0.79			85.4
28	Low	0.78 (0.049)				3.24 (0.162)	7.38 (0.248)	8.00 (0.398)	2.57 (0.177)	1.29 (0.106)	0.78 (0.039)	6.79 (0.333)	20.7 (2.93)	
	Intermediate	0.71 (0.036)				3.86 (0.340)	8.71 (0.692)	9.59 (0.865)	3.03 (0.321)	1.40 (0.153)	1.00 (0.095)	7.70 (0.514)	23.9 (3.45)	
	High	0.78 (0.067)				3.36 (0.084)	7.48 (0.096)	8.39 (0.206)	2.62 (0.118)	1.32 (0.071)	0.86 (0.028)	7.01 (0.057)	29.2 (4.58)	
	PC1 loading					0.99	0.93	0.99	0.95	0.75	0.96	0.98	0.11	77.5
	PC2 loading					0.07	0.33	0.07	-0.18	-0.52	0.05	0.18	-0.95	16.9

¹ CO₂ levels, uatm (pH): low: 775 (7.8); intermediate: 1808 (7.5); high: 4714 (7.1)

² Age-0-dph survival is the proportion surviving the embryonic period (fertilization to hatching); Age-28-dph survival is the proportion surviving to Day 28 discounting those sampled during larval period.

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1 Table S3. Mean (\pm SE) cranial-facial (C-F) measurements (mm) of summer
 2 flounder larvae by age (days from hatching) when exposed to three levels
 3 during CO₂ experiment. Principal components (PC) analysis performed on
 4 the entire set of C-F measurements of all individuals for all age samples.
 5 Also given are the percentages of total variance in C-F measurements
 6 accounted for by significant principal component (one PC for these data),
 7 and the contribution (loadings) to the PC of each individual C-F variable to
 8 the PC. Morphological measurements defined in Methods. Abbreviations:
 9 Total length (TL), mandible length (ML), lower jaw length (LJ), upper jaw
 10 length (UJ), snout length (SL). Statistics based on means of experimental
 11 replicate means (N = 3 per treatment except where noted).

Age (d)	CO ₂ level ¹	TL	ML	LJ	UJ	SN	PC %
7	Low	3.67 (0.062)	0.30 (0.009)	0.40 (0.006)	0.07 (0.004)	0.43 (0.015)	
	Intermediate	3.49 (0.061)	0.30 (0.005)	0.42 (0.006)	0.09 (0.009)	0.42 (0.014)	
	High	3.66 (0.053)	0.28 (0.028)	0.42 (0.071)	0.10 (0.018)	0.44 (0.011)	
14	Low	4.53 (0.128)	0.35 (0.007)	0.56 (0.017)	0.14 (0.016)	0.52 (0.014)	
	Intermediate	4.60 (0.115)	0.38 (0.003)	0.58 (0.016)	0.15 (0.006)	0.52 (0.003)	
	High	4.75 (0.093)	0.38 (0.008)	0.64 (0.027)	0.18 (0.015)	0.52 (0.010)	
21	Low	5.28 (0.227)	0.45 (0.022)	0.70 (0.036)	0.26 (0.033)	0.61 (0.031)	
	Intermediate	5.23 (0.194)	0.42 (0.024)	0.72 (0.035)	0.24 (0.019)	0.60 (0.025)	
	High	5.14 (0.183)	0.43 (0.008)	0.70 (0.024)	0.25 (0.019)	0.56 (0.015)	
28	Low ¹	7.34 (0.192)	0.61 (0.029)	1.07 (0.037)	0.43 (0.015)	0.92 (0.045)	
	Intermediate	6.92 (0.319)	0.56 (0.064)	0.92 (0.105)	0.36 (0.039)	0.83 (0.090)	
	High	7.24 (0.172)	0.60 (0.022)	0.97 (0.030)	0.38 (0.011)	0.91 (0.027)	
	PC loading	0.97	0.96	0.97	0.97	0.98	93.7

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¹ CO₂ levels, uatm (pH): low: 775 (7.8); intermediate: 1,808 (7.5); high: 4,714 (7.1)

² N = 2 replicates.