

Table S1. Mean values (\pm s.d) for the physico-chemistry seawater parameters. Temperature, salinity and pH were measured daily and dissolved inorganic carbon (DIC) was measured monthly. The remaining parameters: carbon dioxide partial pressure ($p\text{CO}_2$); bicarbonate (HCO_3^-) and carbonate (CO_3^{2-}) ion concentration; and calcite (Ω_{cal}) and aragonite (Ω_{ara}) saturation state, were calculated retrospectively using the programme CO2SYS (Pierrot et al., 2006). Level of replication is provided in parentheses.

Seawater parameter	Experimental condition			Ocean warming and ocean acidification combined
	Control	Ocean warming	Ocean acidification	
Temperature (°C)	27.14 \pm 0.80 (921)	29.90 \pm 0.69 (667)	27.01 \pm 0.92 (606)	29.81 \pm 0.59 (640)
Salinity	34.50 \pm 0.94 (918)	34.64 \pm 0.86 (657)	34.83 \pm 1.14 (599)	34.62 \pm 0.97 (621)
pH (NBS scale)	8.01 \pm 0.14 (921)	8.01 \pm 0.16 (661)	7.59 \pm 0.13 (601)	7.61 \pm 0.16 (631)
DIC ($\mu\text{mol kg}^{-1}$)	3038.68 \pm 249.98 (56)	2908.11 \pm 377.93 (38)	3141.46 \pm 276.34 (38)	3085.47 \pm 251.57 (36)
$p\text{CO}_2$ (μatm)	673.55 \pm 307.78 (56)	728.98 \pm 246.15 (38)	1973.86 \pm 570.34 (38)	2172.05 \pm 536.66 (36)
[HCO_3^-] ($\mu\text{mol kg}^{-1}$)	2704.25 \pm 249.18 (56)	2598.32 \pm 341.89 (38)	2978.43 \pm 259.48 (38)	2916.93 \pm 234.67 (36)
[CO_3^{2-}] (mmol kg^{-1})	321.48 \pm 67.86 (56)	297.16 \pm 75.89 (38)	121.39 \pm 33.81 (38)	111.72 \pm 34.97 (36)
Ω_{cal}	7.73 \pm 1.63 (56)	7.14 \pm 1.83 (38)	2.91 \pm 0.81 (38)	2.68 \pm 0.83 (36)
Ω_{ara}	4.85 \pm 1.02 (56)	4.48 \pm 1.15 (38)	1.83 \pm 0.51 (38)	1.69 \pm 0.52 (36)

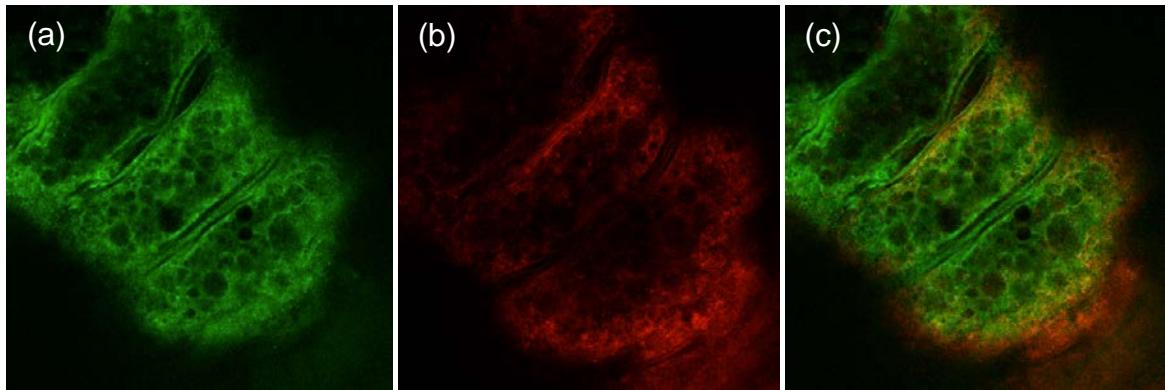


Fig. S1. Confocal image of reactive oxygen species production and mitochondrial density in chaetigers 4 and 5 of *Ophryotrocha labronica*. Each individual was incubated with (a) 400 nM of MitoTracker Green FM and (b) 5 μ M of CellROX Deep Red for 30 min (c) shows a composite image showing the co-localization between the two dyes. Fluorescence was captured at 488 and 640 ± 10 nm by a confocal laser-scanning microscope (LSM 700, Carl Zeiss, Oberkochen, Germany). All images were taken at $\times 20$ magnification.

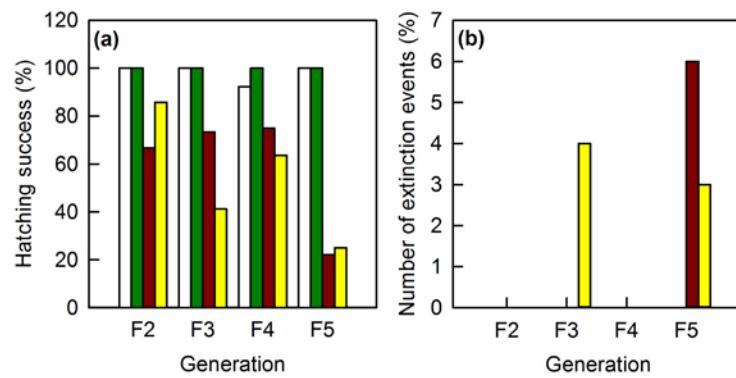


Fig. S2. Selection pressures imposed by multiple generations of exposure to ocean warming and acidification. Histograms show: (A) the percentage of successful hatching events and (B) the number of extinction events imposed by multiple generations of exposure to ocean warming (30 °C, pH 8; red) and ocean acidification (30 °C, pH 7.6; green) in isolation and in combination (30 °C, pH 7.6; yellow) relative to control individuals (white).

Table S2. Mean \pm s.d. life-history and physiological traits in *Ophryotrocha labronica* following multiple generations of exposure to ocean warming and acidification, in isolation and combination. Level of replication is given in parentheses.

Trait	Control (C)					Ocean warming (W)				Ocean acidification (A)					Ocean warming and acidification (WA)					
	F2	F3	F4	F5	F6	F2	F3	F4	F5	F6	F2	F3	F4	F5	F6	F2	F3	F4	F5	F6
Juvenile	1.56	1.62	1.46	1.55	1.58	1.50	1.73	1.60	1.61	1.72	1.49	1.33	1.44	1.60	1.55	1.52	1.61	1.68	1.85	1.71
developmental rate	1.22	0.09	0.21	0.16	0.16	0.21	0.16	0.14	0.14	0.17	0.098	0.20	0.17	0.10	0.16	0.11	0.11	0.14	0.11	0.11
(12)	(12)	(12)	(12)	(12)	(12)	(12)	(11)	(12)	(12)	(7)	(12)	(11)	(12)	(12)	(12)	(12)	(12)	(8)	(7)	(3)
Survival to sexual maturity	69.10	66.21	60.36	80.00	69.82	54.50	66.55	63.27	71.60	75.33	66.52	61.75	57.09	76.36	81.67	65.24	54.32	61.14	79.43	80.30
Average body size	13.03	13.44	12.93	11.69	15.00	18.74	18.00	18.59	13.37	4.27	14.67	17.97	13.33	20.21	10.85	12.58	17.55	21.67	17.50	8.45
(12)	(12)	(12)	(12)	(12)	(12)	(12)	(11)	(12)	(12)	(7)	(12)	(11)	(12)	(12)	(12)	(12)	(12)	(8)	(7)	(3)
Fecundity	18.31	17.64	18.82	18.41	18.11	18.76	18.98	18.78	17.63	17.42	17.917	18.17	18.47	18.40	17.52	17.93	18.32	19.07	17.61	17.78
ROS	0.63	0.88	0.99	0.90	1.00	1.40	1.00	1.83	1.29	3.98	1.03	0.93	1.43	1.09	0.94	1.11	1.49	1.27	1.46	2.41
(12)	(12)	(12)	(12)	(12)	(12)	(12)	(11)	(12)	(12)	(6)	(12)	(11)	(12)	(12)	(12)	(12)	(12)	(8)	(7)	(3)
CS activity	590.00	635.25	535.75	750.76	512.08	552.42	599.73	440.83	253.25	272.86	609.92	523.45	482.50	592.67	520.58	457.34	355.33	502.13	255.43	234.33
ETS activity	165.07	100.54	244.80	188.19	208.27	211.43	226.06	238.89	150.86	262.58	242.88	167.74	218.63	207.24	254.84	127.50	124.92	210.36	128.21	127.54
(12)	(12)	(11)	(12)	(12)	(12)	(12)	(11)	(12)	(12)	(7)	(12)	(11)	(12)	(12)	(12)	(12)	(12)	(8)	(7)	(3)
0.29	0.37	0.29	0.29	-	0.80	0.45	-	1.07	-	0.22	0.38	-	-	-	0.390	0.48	-	1.31	-	
0.16	0.15	-	0.20	-	0.85	0.48	-	0.60	-	0.12	0.33	-	-	-	0.19	0.44	-	0.27	-	
(9)	(9)	-	(6)	-	(10)	(7)	-	(6)	-	(8)	(10)	-	-	-	(10)	(10)	-	(2)	-	
0.023	0.02	0.02	0.02	0.02	0.04	0.02	0.02	0.02	0.03	0.032	0.02	0.02	0.02	0.02	0.04	0.01	0.02	-	0.04	
0.01	0.01	0.01	0.01	0.00	0.02	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	-	0.01	
(5)	(5)	(11)	(9)	(11)	(8)	(10)	(12)	(3)	(3)	(8)	(4)	(6)	(7)	(8)	(6)	(6)	(5)	(5)	(5)	
0.045	0.06	0.05	0.02	0.01	0.08	0.02	0.02	0.01	0.03	0.05	0.04	0.05	0.02	0.02	0.06	0.02	0.02	-	0.04	
0.01	0.02	0.02	0.00	0.01	0.02	0.01	0.00	0.00	0.01	0.02	0.01	0.02	0.00	0.01	0.01	0.00	0.00	-	0.01	
(5)	(5)	(7)	(9)	(11)	(8)	(11)	(12)	(3)	(4)	(8)	(4)	(8)	(7)	(9)	(6)	(6)	(5)	(5)	(5)	

Table S3. Mean \pm s.d. life-history and physiological traits in *Ophryotrocha labronica* in F5 following reciprocal transplantation of *Ophryotrocha labronica* from control to experimental conditions and vice-versa. Level of replication is given in parentheses.

Trait	Transplantation									
	C-C	C-W	W-C	W-W	C-A	A-C	A-A	C-WA	WA-C	WA-WA
Juvenile developmental rate	1.55 <i>0.16</i> (12)	1.72 <i>0.13</i> (12)	1.54 <i>0.14</i> (12)	1.61 <i>0.14</i> (12)	1.60 <i>0.11</i> (12)	1.64 <i>0.13</i> (11)	1.60 <i>0.10</i> (12)	1.67 <i>0.10</i> (12)	1.44 <i>0.04</i> (7)	1.85 <i>0.11</i> (7)
Survival to sexual maturity	80.00 <i>11.69</i> (12)	78.40 <i>14.19</i> (12)	68.00 <i>14.47</i> (12)	71.60 <i>13.37</i> (12)	80.00 <i>14.97</i> (12)	69.45 <i>17.18</i> (11)	76.36 <i>20.21</i> (12)	82.91 <i>14.28</i> (12)	78.86 <i>11.71</i> (7)	79.43 <i>17.50</i> (7)
Average reproductive body size	18.41 <i>0.90</i> (12)	18.20 <i>1.08</i> (12)	17.43 <i>2.37</i> (12)	17.63 <i>1.29</i> (12)	17.42 <i>1.07</i> (12)	18.47 <i>0.85</i> (11)	18.40 <i>1.09</i> (12)	17.79 <i>1.49</i> (12)	17.52 <i>1.33</i> (7)	17.61 <i>1.46</i> (7)
Fecundity	750.76 <i>188.19</i> (12)	526.47 <i>214.73</i> (12)	609.39 <i>288.31</i> (12)	253.25 <i>150.86</i> (12)	515.42 <i>250.73</i> (12)	707.27 <i>220.02</i> (11)	592.67 <i>207.24</i> (12)	532.58 <i>225.75</i> (12)	539.95 <i>272.94</i> (7)	255.43 <i>128.21</i> (7)
ROS	0.29 <i>0.20</i> (6)	0.72 <i>0.60</i> (8)	0.86 <i>0.41</i> (7)	1.07 <i>0.60</i> (6)	0.63 <i>0.59</i> (12)	0.73 <i>0.43</i> (10)	- -	0.55 <i>0.55</i> (10)	0.46 <i>0.46</i> (5)	0.27 <i>0.27</i> (2)
CS activity	0.02 <i>0.01</i> (9)	0.02 <i>0.00</i> (7)	0.02 <i>0.01</i> (7)	0.02 <i>0.00</i> (3)	0.02 <i>0.01</i> (11)	0.02 <i>0.01</i> (9)	0.02 <i>0.01</i> (7)	0.02 <i>0.00</i> (8)	0.02 <i>0.00</i> (7)	- -
ETS activity	0.02 <i>0.00</i> (9)	0.02 <i>0.00</i> (6)	0.02 <i>0.01</i> (7)	0.01 <i>0.00</i> (3)	0.02 <i>0.00</i> (10)	0.02 <i>0.00</i> (9)	0.02 <i>0.00</i> (7)	0.02 <i>0.01</i> (7)	0.02 <i>0.01</i> (7)	- -

Table S4. Mean \pm s.d. life-history and physiological traits in *Ophryotrocha labronica* in F6 following reciprocal transplantation of *Ophryotrocha labronica* from control to experimental conditions and vice-versa. Level of replication is given in parentheses.

Trait	Transplantation									
	C-C-C	C-W-W	W-C-C	W-W-W	C-A-A	A-C-C	A-A-A	C-WA-WA	WA-C-C	WA-WA-WA
Juvenile developmental rate	1.58	1.68	1.65	1.72	1.55	1.61	1.55	1.68	1.67	1.71
	0.16	0.11	0.14	0.17	0.10	0.12	0.16	0.08	0.12	0.11
	(12)	(12)	(12)	(7)	(12)	(12)	(12)	(12)	(6)	(3)
Survival to sexual maturity	69.82	75.56	73.63	75.33	68.00	78.00	81.67	69.45	75.63	80.30
	15.00	13.15	18.41	4.27	21.37	14.62	10.85	13.35	25.96	8.45
	(12)	(12)	(12)	(7)	(12)	(12)	(12)	(12)	(6)	(3)
Average reproductive body size	18.11	16.81	18.24	17.42	17.44	18.31	17.52	17.39	19.81	17.78
	1.00	2.95	2.56	3.98	0.94	0.92	0.94	1.52	1.17	2.41
	(12)	(12)	(12)	(6)	(12)	(12)	(12)	(12)	(6)	(3)
Fecundity	512.08	260.92	491.00	272.86	412.17	442.67	520.58	219.08	494.67	234.33
	208.27	217.36	382.13	262.58	190.67	154.90	254.84	113.34	107.02	127.54
	(12)	(12)	(12)	(7)	(12)	(12)	(12)	(12)	(6)	(3)
ROS	0.02	0.02	0.02	0.03	0.02	0.02	0.02	0.02	0.02	0.04
	0.00	0.00	0.01	0.01	0.00	0.01	0.01	0.01	0.00	0.01
	(11)	(4)	(11)	(3)	(7)	(10)	(8)	(5)	(4)	(5)
CS activity	0.01	0.01	0.02	0.03	0.02	0.02	0.02	0.02	0.03	0.04
	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	(11)	(4)	(11)	(4)	(7)	(7)	(9)	(3)	(4)	(5)