

## Severe tissue damage in Atlantic cod larvae under increasing ocean acidification

### Supplementary material

Supplementary Table 1: Effect size statistics using the natural logarithm of the response ratio (LnRR) of dry weight (DW) and relative protein and lipid contents for two treatment levels (medium and high) vs. the control. Given are the mean, the variance (v) and the 95% confidence interval (CI). Significant results are in bold.

LnRR	DW			% Protein/ DW			% Lipids/ DW		
	32 dph	39 dph	46 dph	32 dph	39 dph	46 dph	32 dph	39 dph	46 dph
<b>control vs medium</b>									
Mean =	0.215	-0.052	0.011	0.090	<b>0.186</b>	0.021	0.388	0.132	0.011
v =	0.047	0.034	0.026	0.014	<b>0.004</b>	0.004	0.101	0.007	
95% CI =	0.425	0.362	0.313	0.235	<b>0.120</b>	0.120	0.623	0.163	
<b>control vs high</b>									
Mean =	<b>0.462</b>	<b>0.195</b>	0.082	0.041	0.015	0.034	<b>0.717</b>	0.036	<b>0.140</b>
v =	<b>0.033</b>	<b>0.003</b>	0.027	0.012	0.003	0.006	<b>0.060</b>	0.010	<b>0.004</b>
95% CI =	<b>0.355</b>	<b>0.112</b>	0.324	0.218	0.115	0.154	<b>0.482</b>	0.195	<b>0.124</b>

Supplementary Table 2: Comparison of distribution (Kolmogorov-Smirnov test statistic D), median (Wilcoxon signed ranked statistic W), mean (students t-test statistic t) and variance (F-test statistic) between treatments for different tissues and the summed damage of the tissues from larvae at 32 dph. Significant results are in bold.

32 dph		distribution		median		mean			variance		
		D	p	W	p	t	p	df	F	p	df
<b>Control to Medium</b>	Eye	0.50	<b>0.005</b>	433.5	<b>0.000</b>	4.03	<b>0.000</b>	37.60	2.79	<b>0.017</b>	23.00
	Liver	0.26	0.467	150.0	<b>0.039</b>	-2.38	<b>0.026</b>	23.52	0.19	<b>0.000</b>	18.00
	Pancreas	0.39	0.116	107.0	<b>0.004</b>	2.88	<b>0.010</b>	18.00	0.17	<b>0.000</b>	15.00
	Kidney	0.27	0.576	110.0	0.128	-1.58	0.125	30.78	1.06	0.927	14.00
	Gut	0.28	0.372	156.5	0.072	-1.86	0.070	38.25	0.97	0.927	18.00
	Bacteria	0.13	0.990	273.0	0.069	-1.81	0.083	23.00	0.00	<b>0.000</b>	23.00
	Sum Damage	0.27	0.313	302.5	0.860	0.02	0.986	38.05	0.39	<b>0.024</b>	23.00
<b>Medium to High</b>	Eye	0.71	<b>0.001</b>	250.5	<b>0.000</b>	-3.60	<b>0.004</b>	12.14	0.10	<b>0.000</b>	11.00
	Liver	0.19	0.947	93.5	0.387	-0.81	0.428	23.18	0.96	0.907	11.00
	Pancreas	0.29	0.644	55.5	0.078	1.87	0.087	11.81	0.13	<b>0.001</b>	10.00
	Kidney	0.43	0.140	40.0	<b>0.001</b>	-3.94	<b>0.001</b>	18.30	0.23	<b>0.009</b>	13.00
	Gut	0.37	0.205	84.0	0.006	-3.30	<b>0.003</b>	28.22	3.68	0.017	14.00
	Bacteria	0.25	0.586	144.0	0.070	-1.75	0.093	24.07	0.46	0.088	15.00
	Sum Damage	0.52	<b>0.011</b>	74.5	<b>0.001</b>	3.11	<b>0.005</b>	26.10	0.57	0.218	15.00
<b>Control to High</b>	Eye	0.21	0.878	192.0	0.070	-0.18	0.095	14.24	0.29	<b>0.011</b>	11.00
	Liver	0.45	0.083	66.0	<b>0.004</b>	-0.29	<b>0.013</b>	13.10	0.18	<b>0.001</b>	11.00
	Pancreas	0.68	<b>0.002</b>	37.5	<b>0.000</b>	-2.85	<b>0.017</b>	10.23	0.02	<b>0.000</b>	10.00
	Kidney	0.60	<b>0.005</b>	32.0	<b>0.000</b>	-4.91	<b>0.000</b>	17.39	0.24	<b>0.005</b>	13.00
	Gut	0.65	<b>0.001</b>	56.0	<b>0.000</b>	-5.92	<b>0.000</b>	34.87	3.56	0.018	14.00
	Bacteria	0.38	0.123	130.0	<b>0.001</b>	-3.00	<b>0.009</b>	15.00	0.00	<b>0.000</b>	15.00
	Sum Damage	0.62	<b>0.001</b>	347.5	<b>0.000</b>	-3.41	<b>0.003</b>	19.18	0.22	<b>0.001</b>	15.00

Supplementary Table 3: Comparison of distribution, median, mean and variance between treatments for different tissues and the summed damage of the tissues from larvae at 46 dph. Significant results are in bold. ° denotes no difference.

46 dph		distribution		median		mean			variance		
		D	p	W	p	t	p	df	F	p	df
<b>Control to Medium</b>	Eye	0.08	1	256.0	0.432	-0.84	0.404	38	0.81	0.591	19
	Liver	0.18	0.901	197.5	0.342	-1.27	0.216	22	0.31	<b>0.008</b>	16
	Pancreas	0.05	1	326.5	0.420	-0.78	0.440	35	0.40	<b>0.022</b>	22
	Kidney	0.00	1	°	°	°	°	°	°	°	°
	Gut	0.00	1	299.0	°	°	°	°	°	°	°
	Bacteria	0.00	1	°	°	°	°	°	°	°	°
	Sum Damage	0.25	0.512	305.5	0.261	0.80	0.433	23	0.20	<b>0.000</b>	18
<b>Medium to High</b>	Eye	0.20	0.897	160.0	0.451	0.31	0.763	21	0.45	0.115	13
	Liver	0.22	0.759	226.0	0.139	1.29	0.206	29	1.71	0.249	21
	Pancreas	0.09	1	187.5	0.263	1.45	0.162	22	inf	<b>0.000</b>	14
	Kidney	0.00	1	°	°	°	°	°	°	°	°
	Gut	0.63	1	172.5	0.252	1.00	0.333	15	0.00	0.000	15
	Bacteria	0.00	1	°	°	°	°	°	°	°	°
	Sum Damage	0.24	0.592	259.0	0.449	0.94	0.353	41	1.51	0.373	18
<b>Control to High</b>	Eye	0.12	0.999	212.5	0.793	-0.22	0.826	18	0.37	<b>0.025</b>	13
	Liver	0.12	0.993	326.5	0.406	0.20	0.839	37	0.53	0.128	21
	Pancreas	0.03	1	232.5	0.509	1.00	0.326	29	inf	<b>0.000</b>	14
	Kidney	0.00	1	°	°	°	°	°	°	°	°
	Gut	0.63	1	195.0	0.220	1.00	0.333	15	0.00	0.000	15
	Bacteria	0.00	1	°	°	°	°	°	°	°	°
	Sum Damage	0.46	<b>0.009</b>	426.0	0.048	1.94	0.063	28	7.44	<b>0.000</b>	26

Supplementary Table 4: Summary of carbon system parameters (mean with standard deviation):  $A_T$ , total alkalinity,  $C_T$ , total dissolved inorganic carbon,  $pCO_2$ , partial pressure of  $CO_2$ ,  $pH_T$  (total scale) at a salinity of 33.3.

Treatment	$C_T$ ( $\mu\text{mol kg}^{-1}$ SW)	$A_T$ ( $\mu\text{mol kg}^{-1}$ SW)	$pCO_2$ ( $\mu\text{atm}$ )	$pH_T$
<b>Control</b>	2106.5 $\pm$ 35.2	2282.3 $\pm$ 34.0	367 $\pm$ 73.7	8.08 $\pm$ 0.08
<b>Medium</b>	2330.6 $\pm$ 53.8	2287.5 $\pm$ 36.1	1881.7 $\pm$ 693.3	7.45 $\pm$ 0.15
<b>High</b>	2471.8 $\pm$ 48.2	2290.7 $\pm$ 30.5	4257.4 $\pm$ 865.0	7.08 $\pm$ 0.09