

Supplementary tables for:

Moore *et al.*, 2021

Rapid multi-generational acclimation of coralline algal reproductive structures to ocean acidification

Table S1. Experimental tank carbonate chemistry calculated from pH and A_T measurements.

Standard error of pH measurements = 0.01 units. $n = 780$ per treatment. Mean measured day

time A_T ($n = 72$ – 85 per treatment, with s.e. in parentheses), and calculated mean ranges

between day and night dissolved inorganic carbon (DIC), pCO_2 , and calcite saturation states

of seawater (Ω_c), given salinity 36.2 and temperature 26.0 ° C. PC = present-day constant, PF

= present-day fluctuating, OC = ocean acidification constant, OF = ocean acidification

fluctuating.

Treatment	<u>Experimental Tank pH</u>				A_T ($\mu\text{mol kg}^{-1}$)	DIC ($\mu\text{mol kg}^{-1}$)	pCO_2 (μatm)	Ω_c
	Dusk	Day	Night	Mean				
PC	8.04	8.14	8.00	8.05	2347 (8)	1956– 2049	303– 415	5.03– 6.40
PF	7.98	8.23	7.65	7.96	2342 (7)	1889– 2214	230– 1130	2.61– 7.37
OA	7.71	7.85	7.65	7.73	2362 (4)	2145– 2242	691– 1140	2.63– 3.83
OAF	7.68	8.11	7.22	7.67	2362 (2)	1992– 2392	333– 3385	1.03– 6.13

Table S2. Sample size, mean conceptacle abundance and standard error for different generation and treatment combinations.

Generation	Treatment	N	Mean Conceptacle Abundance	SE
2	Present day	38	1.49835526	0.17597752
2	OA	51	0.59558824	0.08831741
3	Present day	31	1.50873656	0.09869015
3	OA	12	1.40451389	0.22312482
4	Present day	28	1.86979167	0.19160287
4	OA	20	1.84166667	0.20816002
5	Present day	28	2.16220238	0.13243243
5	OA	20	2.04375	0.16889884
6	Present day	28	3.08556548	0.19978131
6	OA	20	3.25208333	0.30523313

Table S3. Sample size, mean conceptacle abundance and standard error for conceptacle abundance measurements conducted during the reciprocal transplant experiment.

Transplant Treatment	Generation 2-6 Treatment	N	Mean Conceptacle Abundance	SE
Present day	Present day	13	3.19070513	0.3213564
Present day	OA	9	3.71527778	0.43049955
OA	Present day	15	3.05694444	0.26992726
OA	OA	11	4.03787879	0.28351457

Table S4. Sample size, mean conceptacle diameter and standard error for different generation and treatment combinations.

Generation	Mean	N	Mean Conceptacle Diameter	SE
2	Present day	35	88.6392772	3.70207203
2	OA	32	91.9677904	4.20586925
3	Present day	31	86.8638096	2.64971135
3	OA	12	89.907906	3.27158491
4	Present day	28	96.7404001	3.24375082
4	OA	20	92.7669657	3.59364374
5	Present day	28	88.9862808	1.65953181
5	OA	20	90.7503358	2.61476302
6	Present day	28	100.887692	3.03874489
6	OA	20	107.37352	2.69785351

Table S5. Sample size, mean conceptacle diameter and standard error for conceptacle size measurements conducted during the reciprocal transplant experiment.

Transplant Treatment	Generation 2-6 Treatment	N	Mean Conceptacle Diameter	SE
Present day	Present day	13	121.230251	3.4415678
Present day	OA	9	114.00721	3.07517175
OA	Present day	15	118.106698	3.20773451
OA	OA	11	120.478924	3.32495829

Table S6. Conceptacle Abundance analysis. Results of linear mixed effects model assessing the impact of “Generation”, “Mean Treatment pH”, “Site of Origin”, “pH Variability” and all possible interactions on conceptacle abundance. Residual degrees of Freedom = 247. Data met all assumptions of the model. Factors in bold indicate p values < 0.05.

Factor	Estimate	Std Error	F-Value	P-Value
Generation	0.13385	0.07234	206.882	<0.001
Mean Treatment pH	-0.95981	0.49574	8.241	0.00445
Site of Origin	-0.10116	0.44023	5.354	0.02150
pH Variability	-0.46719	0.53907	0.070	0.79100
Generation:Mean Treatment pH	0.17763	0.11069	8.204	0.00454
Generation:Site of Origin	0.02748	0.10270	0.313	0.57638
Mean Treatment pH:Site of Origin	-0.99815	0.90285	0.617	0.43286
Generation:pH Variability	0.10137	0.11815	8.248	0.00443
Mean Treatment pH:pH Variability	0.27134	0.76824	0.041	0.83875
Site of Origin:pH Variability	-0.27884	0.76052	2.387	0.12363
Generation:Mean Treatment pH:Site of Origin	0.15659	0.19124	0.023	0.88009
Generation:Mean Treatment pH:pH Variability	-0.02067	0.16805	0.053	0.81841
Generation:Site of Origin:pH Variability	0.01402	0.16692	0.773	0.38015
Mean Treatment pH:Site of Origin:pH Variability	0.88528	1.29144	0.465	0.49571
Generation:Mean Treatment pH:Site of Origin:pH Variability	-0.13831	0.27200	0.017	0.89733

Table S7. Conceptacle size analysis. Results of linear mixed effects model assessing the impact of “Generation”, “Mean Treatment pH”, “Site of Origin”, “pH Variability” and all possible interactions on the diameter of conceptacles. Residual degrees of Freedom = 227.

Data met all assumptions of the model. Factors in bold indicate p values < 0.05.

Factor	Estimate	Std Error	F-Value	P-Value
Generation	0.031711	0.018028	14.099	<0.001
Mean Treatment pH	-0.055174	0.103085	1.479	0.22526
Site of Origin	0.037250	0.102977	0.042	0.83804
pH Variability	0.089839	0.122117	2.748	0.09876
Generation: Mean Treatment pH	0.018756	0.025506	0.148	0.70053
Generation:Site of Origin	-0.008475	0.025734	0.847	0.35832
Mean Treatment pH:Site of Origin	0.396637	0.164305	2.790	0.09625
Generation:pH Variability	-0.003451	0.028755	0.321	0.57144
Mean Treatment pH:pH Variability	0.118693	0.167694	0.825	0.36467
Site of Origin:pH Variability	-0.064888	0.164707	3.134	0.07804
Generation: Mean Treatment pH:Site of Origin	-0.082831	0.040362	0.029	0.86528
Generation: Mean Treatment pH:pH Variability	-0.039740	0.040336	0.622	0.43118
Generation:Site of Origin:pH Variability	-0.000229	0.039427	4.875	0.02825
Mean Treatment pH:Site.of.origin:pH Variability	-0.673037	0.257308	0.001	0.97938
Generation: Mean Treatment pH:Site of Origin:pH Variability	0.165239	0.061032	7.909	0.00535

Table S8. Results of linear mixed effects model assessing the impact of “Growth”, “Generation”, “Mean Treatment pH” and all possible interactions on conceptacle abundance. Residual degrees of Freedom = 217. Data met all assumptions of the model. Factors in bold indicate p values < 0.05.

Factor	Estimate	Std Error	F-Value	P-Value
Growth	0.065357	0.026892	110.937	<0.001
Mean Treatment pH	-0.017052	0.523114	2.843	0.0932
Generation	0.321804	0.084885	122.551	<0.001
Growth: Mean Treatment pH	-0.008257	0.039377	0.006	0.9369
Growth:Generation	-0.005981	0.005733	1.958	0.1631
Mean Treatment pH:Generation	0.017716	0.115484	0.725	0.3955
Growth: Mean Treatment pH:Generation	0.001392	0.008465	0.380	0.5383

Table S9. Results of linear mixed effects model assessing the impact of “Conceptacle Abundance”, “Generation”, “Mean Treatment pH” and all possible interactions on the recruit area of the following generation of coralline algae. Residual degrees of Freedom = 217. Data met all assumptions of the model. Factors in bold indicate p values < 0.05.

Factor	Estimate	Std Error	F-Value	P-Value
Conceptacle Abundance	0.927544	0.232529	39.671	<0.001
Mean Treatment pH	-2.458781	1.157131	18.484	<0.001
Generation	0.008038	0.136606	7.610	0.0063
Conceptacle Abundance: Mean Treatment pH	0.433749	0.555358	2.024	0.1563
Conceptacle Abundance:Generation	-0.100434	0.051463	5.100	0.0249
Mean Treatment pH:Generation	0.352130	0.257901	3.452	0.0645
Conceptacle Abundance: Mean Treatment pH:Generation	-0.077190	0.104284	2.249	0.1351

Table S10. Conceptacle Abundance reciprocal transplant experiment analysis. Results of linear mixed effects model assessing the impact of “Transplant Mean pH”, “Generation 2-6 Mean pH”, “Site of Origin”, “pH Variability” and all possible interactions on conceptacle abundance. Residual degrees of Freedom = 18. Data met all assumptions of the model.

Factors in bold indicate p values < 0.05.

Factor	Estimate	Std Error	F-Value	P-Value
Transplant Mean pH	0.09445	0.16758	0.059	0.8104
Generation 2-6 Mean pH	0.38123	0.14367	7.797	0.0120
Site of Origin	0.25290	0.11864	0.008	0.9318
pH Variability	0.32498	0.18954	0.783	0.3878
Transplant Mean pH:Generation 2-6 Mean pH	-0.21760	0.15317	0.303	0.5887
Transplant Mean pH:Site of Origin	-0.14013	0.16326	3.090	0.0958
Generation 2-6 Mean pH:Site of Origin	-0.55930	0.21509	0.031	0.8632
Generation 2-6 Mean pH: pH Variability	-0.44257	0.17875	0.105	0.7496
Site of Origin: pH Variability	-0.62399	0.16196	0.139	0.7135
Transplant Mean pH:Generation 2-6 Mean pH:Site of Origin	0.48225	0.27275	0.130	0.7223
Transplant Mean pH:Generation 2-6 Mean pH:pH Variability	0.68215	0.23116	0.931	0.3474
Transplant Mean pH:Site of Origin:pH Variability	0.74786	0.22990	1.681	0.2112
Generation 2-6 Mean pH:Site of Origin:pH Variability	0.80362	0.27318	1.375	0.2563
Transplant Mean pH:Generation 2-6 Mean pH:Site of Origin:pH Variability	-0.75108	0.35726	0.849	0.3690

Table S11. Conceptacle size reciprocal transplant experiment analysis. Results of linear mixed effects model assessing the impact of “Transplant Mean pH”, “Generation 2-6 Mean pH”, “Site of Origin”, “pH Variability” and all possible interactions on conceptacle size.

Residual degrees of Freedom = 18. Data met all assumptions of the model. Factors in bold indicate p values < 0.05.

Factor	Estimate	Std Error	F-Value	P-Value
Transplant Mean pH	-0.088474	0.049259	0.106	0.74856
Generation 2-6 Mean pH	-0.026528	0.062698	0.597	0.44992
Site of Origin	0.036218	0.052150	8.498	0.00924
pH Variability	0.044380	0.057067	0.079	0.78160
Transplant Mean pH:Generation 2-6 Mean pH	0.143998	0.071752	0.922	0.34973
Transplant Mean pH:Site of Origin	0.141540	0.068988	3.443	0.07998
Generation 2-6 Mean pH:Site of Origin	-0.104638	0.078911	0.115	0.73835
Generation 2-6 Mean pH:pH Variability	-0.173172	0.083233	0.749	0.39830
Site of Origin:pH Variability	-0.072121	0.071892	0.014	0.90796
Transplant Mean:Generation 2-6 Mean pH:Site of Origin	-0.083066	0.107513	5.623	0.02909
Transplant Mean pH:Generation 2-6 Mean pH:pH Variability	0.053723	0.107221	0.010	0.92084
Transplant Mean pH:Site of Origin:pH Variability	-0.012885	0.097631	0.030	0.86422
Generation 2-6 Mean pH:Site of Origin:pH Variability	0.328233	0.112500	5.420	0.03177
Transplant Mean pH:Generation 2-6 Mean pH:Site of Origin:pH Variability	-0.126128	0.152100	0.455	0.50832