Supplementary Material – 4

The shade plot does not show a regional pattern in coral recruit species richness variability among regions, but show high variability among locations within each region in coral recruit species richness (Figure S1). Of all the locations, CDP off the eastern coast showed the highest richness (17 species), followed by BTA (15 species) and PME (14 species) in Culebra, and TPA in the western coast (12 species). No coral recruits were documented on the two hurricane-impacted shallow reefs at TAR and DAK in Culebra, which showed extensive framework pulverization, with unstable substrates that can freely move and overturn with wave action (Figure S1).

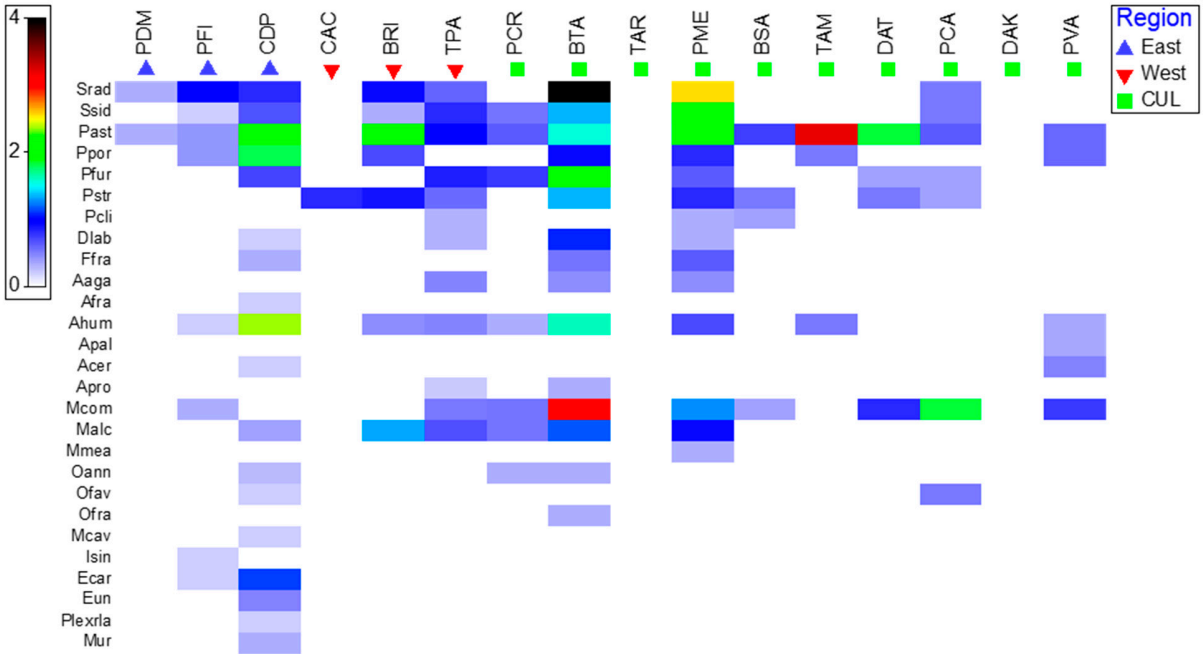

Figure S1. A) Shade plot based on the √-density (#/m²) of coral recruits by species x region x location; B) PCO analysis based on the √-density (#/m²) of coral recruits x region x location. This solution explains 61.7% of the observed spatial variation. Refer to the Methodology for the description of acronyms.

A bubble plot based on nMDS analysis produced four clusters that go from lowest to highest total coral recruit density (Figure S2). A first cluster was composed by DAK, TAR and PDM, with the first two locations being hurricane-impacted locations in Culebra Island, and PDM showing chronic water quality degradation in the eastern coast. This cluster showed the lowest coral recruit density. The second cluster consisted of locations with moderate to low recruit density at CAC, BSA, PFI, PVA and PCR, which represent a mixture of locations affected by hurricane impacts (PVA, PCR) in Culebra, and recurrent degraded water quality pulses (CAC, PFI, BSA). The third cluster was composed of locations with moderately high recruit density, including TAM, PCA, and DAT in Culebra, and BRI and TPA in the west coast. The fourth cluster consisted of BTA and PME in Culebra, and of CDP, off the eastern coast, and represent locations with the highest coral recruit densities. A total of 27 species of coral recruits were documented.

A bubble plot based on n-MDS analysis similarly showed four clustering patterns based on a gradient of species richness (Figure S3). The first cluster was composed of hurricane-impacted DAK and TAM in Culebra. The second cluster was composed of moderate to low species richness, and included CAC, PDM,

PFI, DAT, PCA, BSA, DAK, PCR, and PVA. The third cluster consisted of locations with moderate to high species richness and included BRI and TPA. Locations with the highest species richness dominated the final cluster, including PME, BTA, and CDP.

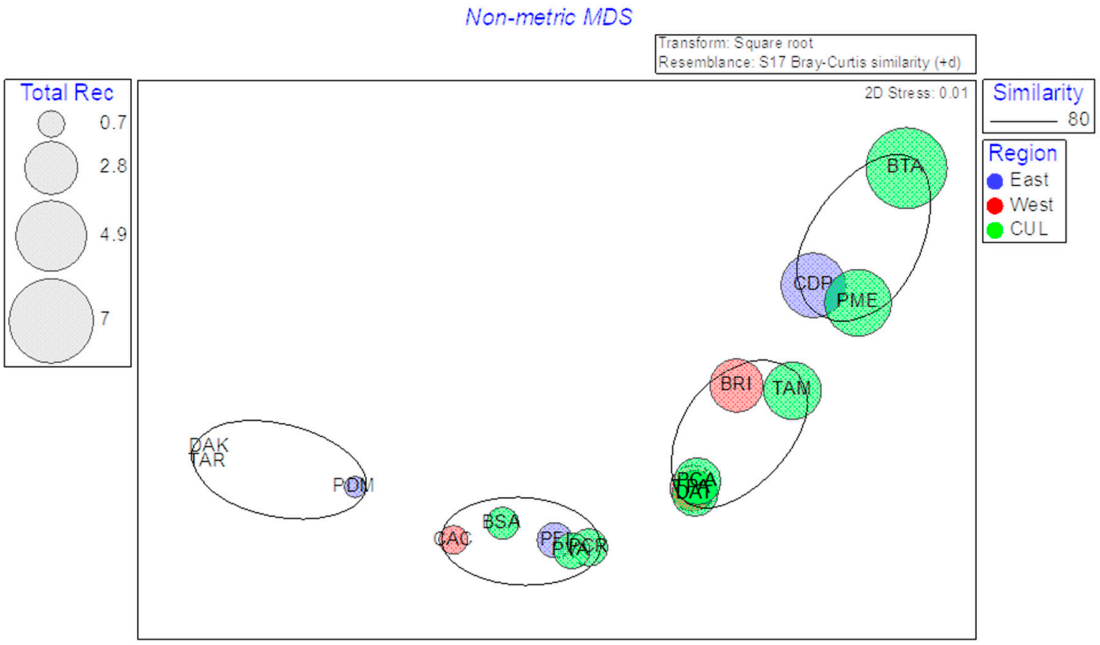

Figure S2. Bubble plot based on a non-metric multidimensional scaling analysis (nMDS) on the √-density (#/m²) of all coral recruits by region and by sampling location. Refer to the Methodology for the description of acronyms. Stress level= 0.01.

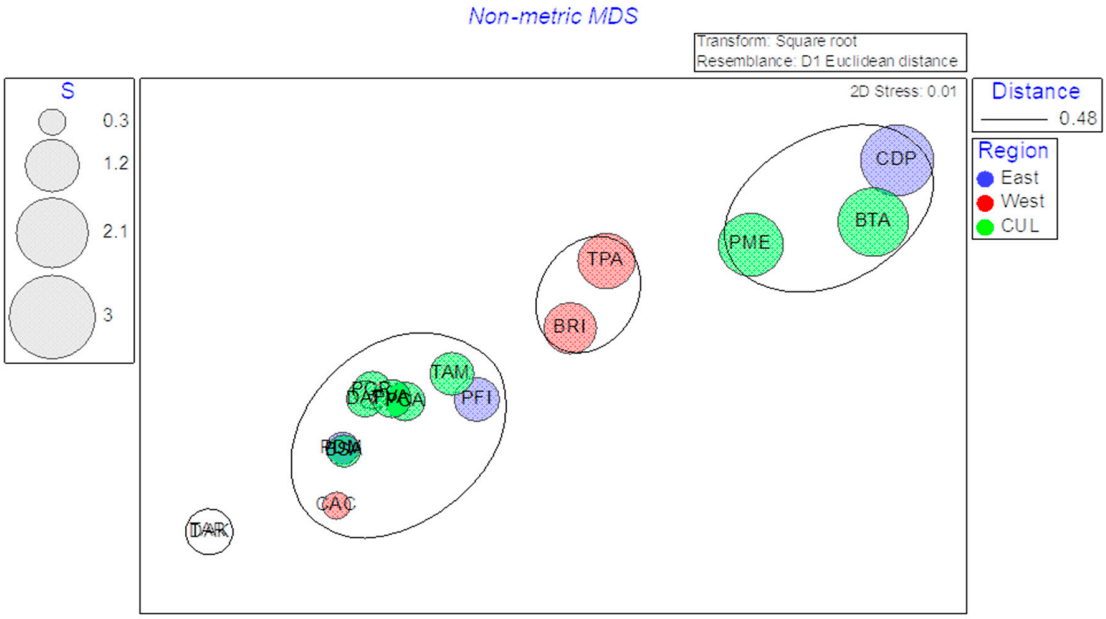

Figure S3. Bubble plot based on a non-metric multidimensional scale analysis (nMDS) on the species richness (S) of all recruits by region and by locality. Refer to the Methodology for the description of acronyms.

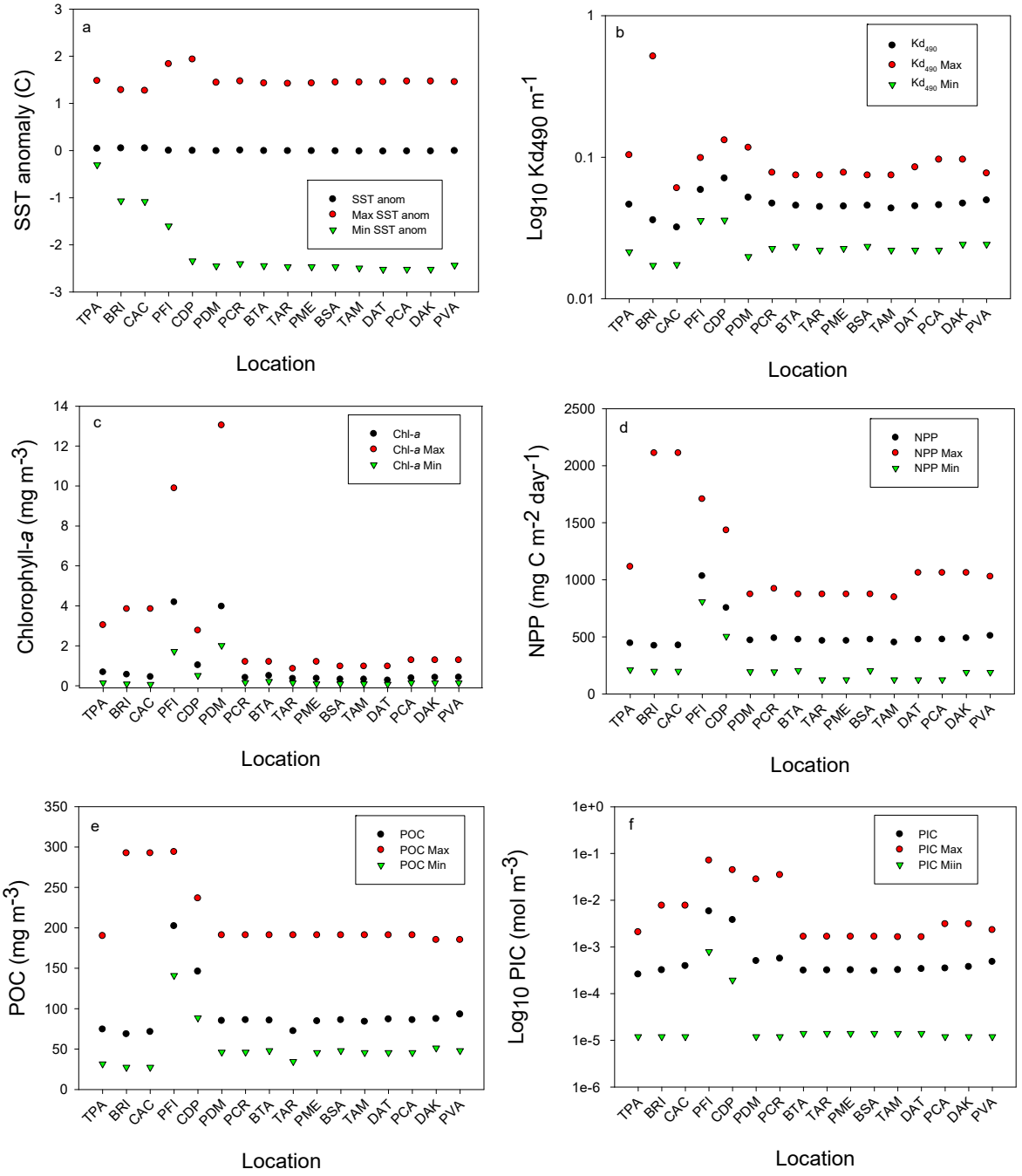

Figure S4. Running mean, maximum and minimum values of remotely sensed water quality parameters (2017-2020) across study locations: a) Sea surface temperature anomaly (°C); b) Light extinction coefficient Log_{10} Kd_{490} m^{-1}; c) Chlorophyll-*a* concentration (mg m^{-3}); d) Net primary productivity (mg C m^{-2} day^{-1}); e) Particulate organic carbon concentration (mg m^{-3}); and f) Particulate organic carbon concentration (Log_{10} mol m^{-3}).

Table S4. Annual values of remotely sensed water quality parameters (2017-2020) across study locations.

Parameter*	TPA	BRI	CAC	PFI	CDP	PDM	PCR	BTA	TAR	PME	BSA	TAM	DAT	PCA	DAK	PVA
SST Anom Ave	0.039	0.048	0.047	-0.003	-0.006	-0.012	0.001	-0.008	-0.012	-0.012	-0.013	-0.017	-0.019	-0.018	-0.017	-0.010
SST Anom Var	0.161	0.159	0.159	0.292	0.291	0.211	0.207	0.209	0.210	0.210	0.210	0.212	0.213	0.211	0.211	0.208
SST Anom Max	1.476	1.281	1.268	1.833	1.931	1.438	1.467	1.425	1.418	1.425	1.443	1.444	1.451	1.465	1.465	1.452
SST Anom Min	-0.305	-1.068	-1.084	-1.602	-2.342	-2.449	-2.4	-2.443	-2.464	-2.467	-2.464	-2.492	-2.521	-2.519	-2.519	-2.434
SST Anom Range	1.781	2.349	2.352	3.435	4.273	3.887	3.867	3.868	3.882	3.892	3.907	3.936	3.972	3.984	3.984	3.886
Kd_{490} Ave	0.0462	0.0358	0.0319	0.0587	0.0708	0.0518	0.0470	0.0454	0.0445	0.0449	0.0454	0.0434	0.0450	0.0458	0.0470	0.0495
Kd_{490} Var	0.0003	0.0008	0.0005	0.0001	0.0002	0.0003	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001
Kd_{490} Max	0.1034	0.5162	0.0604	0.0986	0.1318	0.1166	0.0776	0.0744	0.0744	0.0776	0.0744	0.0744	0.0848	0.096	0.096	0.0768
Kd_{490} Min	0.0214	0.0172	0.0174	0.0356	0.0358	0.0198	0.0226	0.0234	0.022	0.0226	0.0234	0.022	0.022	0.022	0.0242	0.0242
Kd_{490} Range	0.082	0.499	0.043	0.063	0.096	0.0968	0.055	0.051	0.0524	0.055	0.051	0.0524	0.0628	0.074	0.0718	0.0526
Chl Ave	0.6748	0.5562	0.4441	4.1858	1.0275	3.9669	0.4056	0.5033	0.3565	0.3607	0.3191	0.3204	0.2758	0.3840	0.4138	0.4178
Chl Var	0.3170	0.3968	0.2493	2.9895	0.1213	6.1893	0.0233	0.0260	0.0118	0.0213	0.0137	0.0126	0.0102	0.0188	0.0248	0.0253
Chl Max	3.0389	3.8454	3.8454	9.8863	2.7662	13.0370	1.2010	1.2010	0.8552	1.2010	0.9759	0.9758	0.9759	1.2787	1.2787	1.2787
Chl Min	0.1477	0.0918	0.0723	1.7210	0.5174	2.0199	0.1656	0.2147	0.1473	0.1044	0.1044	0.1044	0.0768	0.1473	0.1485	0.1485
Chl Range	2.8912	3.7536	3.7731	8.1653	2.2488	11.0171	1.0353	0.9863	0.7079	1.0966	0.8715	0.8715	0.8991	1.1314	1.1301	1.1301
NPP Ave	444.1	422.5	425.6	1033.2	754.4	470.4	488.7	476.9	465.0	465.5	477.1	450.9	477.0	477.4	488.3	509.2
NPP Var	33869	71145	72508	41059	20433	12444	13042	3174	14874	14927	13215	16543	16063	16115	16964	18213
NPP Max	1115	2111	2111	1707	1433	873	921	873	873	873	873	848	1062	1062	1062	1029
NPP Min	212	199	199	809	505	195	195	206	125	125	206	125	125	125	190	190
NPP Range	903	1912	1912	897	928	678	726	667	748	748	667	723	937	937	872	838
POC Ave	74.4	68.5	71.3	202.1	146.0	85.0	85.9	85.5	72.3	84.5	86.0	83.8	86.9	86.0	87.4	92.9
POC Var	1267	2150	2355	2481	980	563	547	616	466	566	655	553	552	532	499	527
POC Max	190	292	292	294	237	191	191	191	191	191	191	191	191	191	185	185
POC Min	32	27	27	141	89	46	46	48	35	46	48	46	46	46	51	48
POC Range	158	265	265	153	148	145	145	143	156	145	143	145	145	145	134	137
PIC Ave	0.0002	0.0003	0.0004	0.0058	0.0038	0.0005	0.0005	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0004	0.0005
PIC Var	1.29^{-7}	1.14^{-6}	1.51^{-6}	1.53^{-4}	4.46^{-5}	3.61^{-6}	5.51^{-6}	8.68^{-8}	7.44^{-8}	7.86^{-8}	8.53^{-8}	6.15^{-8}	6.48^{-8}	9.21^{-8}	1.07^{-7}	1.38^{-7}
PIC Max	0.0021	0.0077	0.0077	0.0706	0.0440	0.0279	0.0345	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016	0.0031	0.0031	0.0023
PIC Min	1.20^{-5}	1.20^{-5}	1.20^{-5}	7.92^{-4}	1.94^{-4}	1.20^{-5}	1.20^{-5}	1.40^{-5}	1.40^{-5}	1.40^{-5}	1.40^{-5}	1.40^{-5}	1.40^{-5}	1.20^{-5}	1.20^{-5}	1.20^{-5}
PIC Range	0.0021	0.0076	0.0076	0.0698	0.0438	0.0279	0.0345	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016	0.0031	0.0031	0.0023

* SST Anomaly= Sea surface temperature anomaly (°C); Kd_{490}= Light attenuation coefficient (Kd_{490}/m); Chl= Chlorophyll-*a* concentration (mg/m^3); NPP= Net primary productivity (mg C/m^2/d); POC= Particulate organic carbon concentration (mg/m^3); PIC= Particulate inorganic carbon concentration (mol/m^3). Ave= Average; Var= Variance; Max= Maximum; Min= Minimum

Table S5. Distance-based linear model analysis (DISTLM) of the impact of the normalized maximum annual values of remotely sensed water quality parameters (2017-2020) on coral recruit abundance.

Marginal tests	SS(trace)	Pseudo-F	*p*	Proportion
SST anomaly	216.9	0.22	0.8012	0.0178
Kd_{490}	447.1	0.46	0.6166	0.0366
Chl-*a*	3235.2	4.32	0.0359	0.2649
NPP	247.3	0.25	0.7872	0.0202
POC	237.2	0.24	0.8069	0.0194
PIC	572.3	0.59	0.5249	0.0469

[1] Residual df= 12.

Sequential tests	R^2	SS(trace)	Pseudo -F	*p*	Prop.	Cumul.	Res. df
+SST anomaly	0.01776	216.9	0.22	0.8031	0.0178	0.0178	12
+Kd_{490}	0.06716	603.5	0.58	0.5271	0.0494	0.0672	11
+Chl-*a*	0.44001	4554.2	6.66	0.0083	0.3729	0.4400	10
+NPP	0.48856	593.0	0.85	0.3829	0.0485	0.4886	9
+POC	0.51342	303.7	0.41	0.6367	0.0249	0.5134	8
+PIC	0.59525	999.5	1.42	0.2561	0.0818	0.5953	7

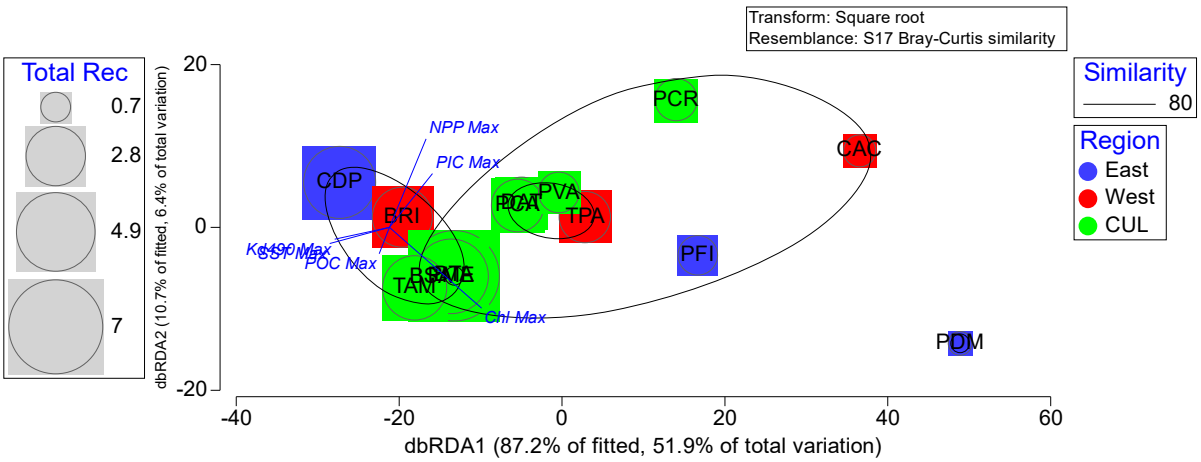

Figure S5. Distance-based redundant analysis (dbRDA) of the impact of the normalized maximum annual values of remotely sensed water quality parameters (2017-2020) on coral recruit abundance by region and location. This solution explains 97.96% of the observed fitted variation and 58.31% of the total variation. Refer to the Methodology for the description of acronyms.