

Supplemental material

Table S1. List and/or description of the benthic groups recorded in Islas Marietas National Park. Only the scleractinian corals included at species level.

Benthic group	Organisms or species per group recorded in Islas Marietas National Park
Scleractinian corals	<i>Porites panamensis</i> Verrill, 1866 <i>Pocillopora damicornis</i> (Linnaeus, 1758) <i>Pocillopora verrucosa</i> (Ellis & Solander, 1786) <i>Pocillopora capitata</i> Verrill, 1864 <i>Pocillopora meandrina</i> Dana, 1846 <i>Pocillopora grandis</i> Dana, 1846 <i>Pavona gigantea</i> (Verrill, 1869) <i>Pavona clavus</i> (Dana, 1846) <i>Psammocora stellata</i> (Verrill, 1866)
Octocoral	Subclass Octocorallia. Include gorgonians and soft corals.
Hydrocorals	Class Hydrozoa. Also known as false hard corals.
Sponges	Phylum Porifera.
Algal turf (Turf)	Multi-species assemblage of small filamentous algae
Articulated calcareous algae (ACA)	Order Corallinales. Characterized by calcareous segments alternated with non-calcareous sections, and therefore are flexible
Crustose calcareous algae	Order Corallinales. Characterized as crust-like layers adhered to the substrata, resulting in an encrusting growth
Macroalgae	Phyla Chlorophyta. Halimeda J.V. Lamorous, 1812 Phyla Rhodophyta

Table S2. PERMANOVA's pairwise comparisons of benthic composition and benthic coverage. Codes: t= t-test, P = P-value. P-values in bold indicate statistical differences ($P \leq 0.05$).

	Isla Larga		Isla Redonda	
	t	P	t	P
2012 <i>vs.</i> 2013	1.2008	0.2162	2.582	0.0002
2013 <i>vs.</i> 2014	1.2520	0.1943	1.693	0.0202
2014 <i>vs.</i> 2015	0.3944	0.8859	1.3301	0.1567
2015 <i>vs.</i> 2016	1.7208	0.0374	0.88498	0.5169
2016 <i>vs.</i> 2017	2.5551	0.0003	1.2294	0.2122
2017 <i>vs.</i> 2018	2.8041	0.0004	1.5708	0.0567
2018 <i>vs.</i> 2019	1.1018	0.3116	1.5261	0.0831
2019 <i>vs.</i> 2020	1.3420	0.1574	1.1817	0.2558
2020 <i>vs.</i> 2021	1.1160	0.2919	1.1308	0.2829
2012 <i>vs.</i> 2021	4.6680	0.0001	3.7116	0.0001
Isla Larga <i>vs.</i> Isla Redonda				
2012	5.0609	0.0001		
2013	4.8856	0.0001		
2014	2.8884	0.0003		
2015	2.618	0.0013		
2016	2.9951	0.0001		
2017	3.6326	0.0001		
2018	3.0613	0.0003		
2019	2.7776	0.0004		
2020	2.9212	0.0004		
2021	2.8465	0.0005		

Table S3. Spatio-temporal SIMPER results of the significant factors in the pairwise comparisons for benthic composition and coverage. Codes: Average Cov. = average coverage, contribution = Contrib%, cumulative contribution = Cum.%.

	Average Cov.	Average Cov.	Contrib%	Cum.%
2012				
Average dissimilarity = 11.11	IL	IR		
Macroalgae	2.80	0.05	39.08	39.08
Coral	18.12	8.85	15.91	54.99
CCA	5.88	11.95	14.2	69.19
2013				
Average dissimilarity = 11.61	IL	IR		
Macroalgae	3.13	0.03	43.37	43.37
Coral	21.82	8.55	21.69	65.07
2014				
Average dissimilarity = 14.31	IL	IR		
ACA	0.00	1.97	45.42	45.42
Coral	18.78	7.43	16.52	61.93
Macroalgae	1.04	0.14	15.12	77.05
2015				
Average dissimilarity = 9.29	IL	IR		
ACA	0.13	0.00	36.2	36.2
Coral	18.67	6.74	28.3	64.5
Macroalgae	1.47	0.31	21.62	86.12
2016				
Average dissimilarity = 9.62	IL	IR		
Coral	17.82	5.67	31.79	31.79
Macroalgae	1.82	0.38	23.25	55.04
ACA	0.02	0.00	22.33	77.37
2017				
Average dissimilarity = 10.64	IL	IR		
Coral	21.78	7.10	27	27
ACA	0.00	0.03	21.86	48.86
Turf	26.50	15.42	14.7	63.56
CCA	8.11	3.96	14.17	77.73
2018				
Average dissimilarity = 7.47	IL	IR		
Coral	25.87	9.61	35.68	35.68
CCA	3.99	7.49	17.35	53.03
Octocoral	0.14	0.39	12.93	65.96

2019**Average dissimilarity = 10.53**

	IL	IR		
ACA	0.08	0.00	27.53	27.53
Coral	28.49	10.51	26.13	53.66
Macroalgae	1.62	0.32	19.39	73.04

2020**Average dissimilarity = 7.69**

	IL	IR		
Coral	31.47	11.57	40.39	40.39
Macroalgae	0.50	0.16	16.4	56.79
Octocoral	0.09	0.30	14.95	71.74

2021**Average dissimilarity = 7.01**

	IL	IR		
Coral	34.26	13.98	41.28	41.28
Hydrocoral	0.17	0.67	22.21	63.48
ACC	4.78	7.01	12.65	76.13

Table S4. Spatio-temporal SIMPER results of the significant factors in the pairwise test for composition and benthic coverage. Codes: Average

Cov. = average coverage, contribution = Contrib%, cumulative contribution = Cum.%.

	Average Cov.	Average Cov.	Contrib%	Cum.%		Average Cov.	Average Cov.	Contrib%	Cum.%
<u>Isla Larga</u>					<u>Isla Redonda</u>				
Average dissimilarity = 6.33	2015	2016			Average dissimilarity = 5.99	2012	2013		
Hydrocorals	0.74	0.22	20.77	20.77	Sponges	1.90	0.33	38.99	38.99
ACA	0.13	0.02	20.6	41.37	Turf	27.00	15.52	27.54	66.53
Turf	11.17	16.24	15.49	56.86					
Sponges	0.52	0.23	13.39	70.25	Average dissimilarity = 10.18	2013	2014		
					ACA	0.00	1.97	64.67	64.67
Average dissimilarity = 7.66	2016	2017			Macroalgae	0.03	0.14	10.33	75
CCA	2.33	8.11	32.45	32.45					
ACA	0.02	0.00	25.79	58.25	Average dissimilarity = 9.33	2012	2021		
Turf	16.24	26.50	18.76	77.00	Sponges	1.90	0.20	30.38	30.38
					Turf	27.00	15.64	17.49	47.87
Average dissimilarity = 10.43	2017	2018			CCA	11.95	7.01	13.95	61.81
ACA	0.00	0.24	35.85	35.85	Hydrocorals	1.58	0.67	13	74.82
Macroalgae	2.36	0.46	21.19	57.04					
CCA	8.11	3.99	13.95	70.99					
Average dissimilarity = 10.89	2012	2021							
Macroalgae	2.80	0.14	34.65	34.65					
Coral	18.12	34.26	18.07	52.71					
Sponges	1.10	0.27	15.36	68.08					

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Table S5. Pairwise comparisons of the benthic groups' structural metrics. Codes: BGR = benthic group richness, H'_{BG} = Shannon entropy, D_{BG} = Simpson dominance, J'_{BG} = Pielou evenness, t = Student's t-test, P = P-value. P-values in bold indicate statistical differences ($P \leq 0.05$), ¹ = permutational ANCOVA, ² = permutational ANOVA.

	BGR^1		H'_{BG}^1		D_{BG}^1		J'_{BG}^2	
	t	P	t	P	t	P	t	P
2012 <i>vs.</i> 2013	0.3147	0.7536	1.1367	0.259	1.3989	0.1629	0.8192	0.4183
2013 <i>vs.</i> 2014	1.7523	0.0823	0.2451	0.8126	0.1164	0.9037	1.1869	0.242
2014 <i>vs.</i> 2015	0.9564	0.3352	0.1996	0.8433	0.48774	0.6233	0.6098	0.5426
2015 <i>vs.</i> 2016	2.4676	0.0146	4.1365	0.0001	3.1547	0.0022	2.9507	0.0041
2016 <i>vs.</i> 2017	0.0745	0.9413	3.6974	0.0003	3.5193	0.0011	4.0874	0.0001
2017 <i>vs.</i> 2018	2.1111	0.0352	1.003	0.3224	0.88705	0.3768	2.3028	0.0223
2018 <i>vs.</i> 2019	1.0265	0.297	0.7878	0.434	0.52331	0.598	1.5134	0.1294
2019 <i>vs.</i> 2020	0.8388	0.4031	3.1907	0.0015	2.5744	0.0149	2.382	0.0168
2020 <i>vs.</i> 2021	0.3777	0.6995	1.5162	0.1377	0.96808	0.3349	0.7706	0.4299
2012 <i>vs.</i> 2021	2.8992	0.0055	1.9145	0.0617	0.2631	0.7963	0.1184	0.9041

Table S6. Permutational ANCOVA's Pairwise comparisons of FRic_{BG}. Codes: t = t-test, P = P-value. P-values in bold indicate statistical differences ($P \leq 0.05$).

Groups	Fric _{BG} ¹			
	Isla Larga		Isla Redonda	
	t	P	t	P
2012 <i>vs.</i> 2013	0.3611	0.7201	1.406	0.1785
2013 <i>vs.</i> 2014	1.5849	0.1237	0.37511	0.7353
2014 <i>vs.</i> 2015	0.2613	0.7931	0.84776	0.4188
2015 <i>vs.</i> 2016	1.1601	0.2476	0.66966	0.5098
2016 <i>vs.</i> 2017	1.8259	0.0734	0.80927	0.4324
2017 <i>vs.</i> 2018	3.4428	0.0013	0.93073	0.3587
2018 <i>vs.</i> 2019	0.7162	0.4650	0.71177	0.4739
2019 <i>vs.</i> 2020	0.1343	0.8942	0.39102	0.7083
2020 <i>vs.</i> 2021	0.3840	0.6996	0.23469	0.8113
2012 <i>vs.</i> 2021	0.1362	0.8927	3.8395	0.0003
Isla Larga <i>vs.</i> Isla Redonda				
Years	t	P		
2012	1.1187	0.2816		
2013	1.3581	0.1798		
2014	9.05E-02	0.9278		
2015	0.59623	0.5575		
2016	1.0412	0.2974		
2017	1.0656	0.2862		
2018	2.6715	0.0093		
2019	1.7705	0.0811		
2020	1.9427	0.0602		
2021	2.5299	0.0154		

Table S7. Permutational ANOVA's pairwise comparisons of FDiv_{BC}. Codes: t = t-test, P = P-value, ¹ = P-values in bold indicate statistical differences ($P \leq 0.05$).

Groups	FDiv ²	
	t	P
2012 <i>vs.</i> 2013	2.2630	0.0228
2013 <i>vs.</i> 2014	1.3124	0.192
2014 <i>vs.</i> 2015	1.6995	0.0949
2015 <i>vs.</i> 2016	1.7256	0.0902
2016 <i>vs.</i> 2017	2.9010	0.0038
2017 <i>vs.</i> 2018	2.3371	0.0217
2018 <i>vs.</i> 2019	1.8567	0.0601
2019 <i>vs.</i> 2020	1.5871	0.1138
2020 <i>vs.</i> 2021	1.4257	0.1595
2012 <i>vs.</i> 2021	2.2944	0.0233