

**Disclaimer:** Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government

**Table S1:** Site locations and number of specimens sampled. The numbers in brackets indicate samples which were *Diadema antillarum* scutico-ciliatosis Philaster clade (DaScPc) 28S ribosomal RNA (rRNA) quantitative polymerase chain reaction (qPCR) positive. CA = Currently Affected at time of sampling, UA = unaffected at time of sampling, PA = previously affected, NR = not reef.

Jurisdiction		Site	Date Sampled	Site Status	Hexacoral	Hydrozoan Coral	Octocoral	Zoanthid	Other Cnidarian	Sponge	Plant	Echinoderm	Crustacean	Mollusk	Urochordate	Annelid		Surface	Plankton	
Aruba	Aruba	Tres Trapis N	20-Aug-22	CA	2	-	-	-	-	2	5	3	-	-	-	-		-	-	
		Tres Trapis S	20-Aug-22	CA	-	-	-	-	-	-	2 (1)	-	-	-	-	-		-	-	
		Mangel Halto	19-Aug-22	CA	5 (3)	6 (2)	2	1	-	-	3	-	-	-	-	-		5	-	
		Druif/Bushiri Hotel	20-Aug-22	CA	-	-	-	-	-	1	10	-	-	-	-	-		1	-	
Cayman Islands	Cayman Brac	Panama Can.	11-Oct-22	CA	8	2	-	-	-	-	-	-	-	-	-	2		2	-	
		Buccaneers	11-Oct-22	CA	6	6	4	-	-	-	-	-	-	-	-	2	-		-	-
		Preacher Bar.	12-Oct-22	CA	4	2	-	-	-	-	-	-	-	-	2	-	-		-	-
		Radar Reef	12-Oct-22	CA	6	2	-	-	-	-	-	-	-	-	-	-	-		-	-
		Lion's Club	12-Oct-22	CA	8	-	-	-	-	-	-	-	-	-	-	-	-		-	-
	Little Cayman	Cayman Is	20-Aug-22	UA	-	-	-	-	-	-	9	2	1	1	-	-		-	-	

Florida	Conch Reef	Conch Key	15-Aug-23	UA	5	-	3	-	-	2	6	-	-	2	-	-	-	-	
	Vaca Key	Sunset Bay Park	15-Aug-23	UA	41	-	-	-	-	9	5	-	-	-	-	-	-	-	
	Marathon	Bluegreen Harbor	15-Aug-23	NR	6	-	-	-	-	-	-	-	-	-	-	-	3	-	
Saba	Saba	Rocky Point	10-Oct-23	PA	9	1	2	-	-	2	1	-	-	-	-	-	10	-	
USVI	St John	Anna Point	25-Aug-22	PA	6	1	7	-	-	4	2 (1)	-	-	-	-	-	5	-	
		Booby Rock	24-Aug-22	PA	-	1	-	-	1	-	2	1	-	-	-	-	-	-	-
		Brown Bay	24-Aug-22	PA	6	2 (1)	6	-	-	9 (1)	5 (1)	2	-	-	-	-	-	-	-
		Cinnamon Key	22-Sep-22	PA	4	2	-	1	-	7 (1)	3 (1)	2	-	-	2	-	5 (1)	3 (1)	
		Haulover South	24-Aug-22	PA	3 (1)	-	-	-	-	6	2	1	-	-	-	-	-	-	
		Long Point	24-Aug-22	PA	-	2	2	-	-	1	2	2	-	-	-	-	-	-	
			26-Apr-22	CA	-	2 (1)	1	-	-	1	-	1	-	-	-	-	-	-	
		Pope Point	24-Aug-22	PA	3 (1)	-	1	-	-	2	10	1	-	-	-	-	-	-	
		Salt Pond	24-Aug-22	PA	2	-	2	-	-	-	1	3	-	-	-	-	-	-	

		Sugar Mill	24-Aug-22	PA	6 (2)	2	1	-	1	5	4 (1)	7	1	1	1	-	-	-
		Turner Point	24-Aug-22	PA	-	2	2	-	-	2	-	-	-	1	-	-	-	-
	St Thomas	Black Point	23-Sep-22	PA	19	4	-	2	-	2	2	-	-	-	-	-	-	-
		Brewers Bay	23-Sep-22	PA	8 (3)	-	1	-	-	1	-	3	-	-	-	-	13	-
		Compass Point Marina	23-Sep-22	NR	-	-	-	-	-	2	-	-	-	-	-	-	16	1
		Flat Cay	25-Aug-22	PA	15 (2)	3	3 (1)	-	-	14 (2)	3 (1)	8	-	1	-	-	3 (1)	3
		Hull Bay	23-Sep-22	PA	8	-	10	3	-	-	-	-	-	-	-	-	-	-
		Linbergh Bay	24-Sep-22	PA	8 (2)	2	-	-	-	11	6 (1)	4	-	-	-	-	-	-
		Magens Bay	23-Sep-22	NR	-	-	-	-	-	-	-	-	-	-	-	-	2 (2)	-
		Perseverance Bay	30-Apr-23	PA	9	-	1	-	-	3	1	4	-	-	-	-	2	3
		Peterborg	23-Sep-22	PA	-	-	-	-	-	-	-	-	-	-	-	-	20 (3)	-
		Range Cay	30-Apr-23	PA	3	-	-	-	-	1	-	3	10	-	1	1	2	2
		Red Point	30-Apr-23	PA	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Totals					152 (14)	32 (4)	45 (1)	7	2	57 (4)	59 (7)	47	12	8	6	3	59 (7)	11 (1)

**Table S2:** Coral specimens pre-dating the 2022 mass mortality event, tested for the detection of *Diadema antillarum* scuticociliatosis *Philaster* clade (DaScPc) through nested polymerase chain reaction (PCR). Tissue state = grossly normal or abnormal. SCTL D = Stony Coral Tissue Loss Disease; BBD = Black Band Disease. \* = specimen furnished by Amy Apprill (2024).

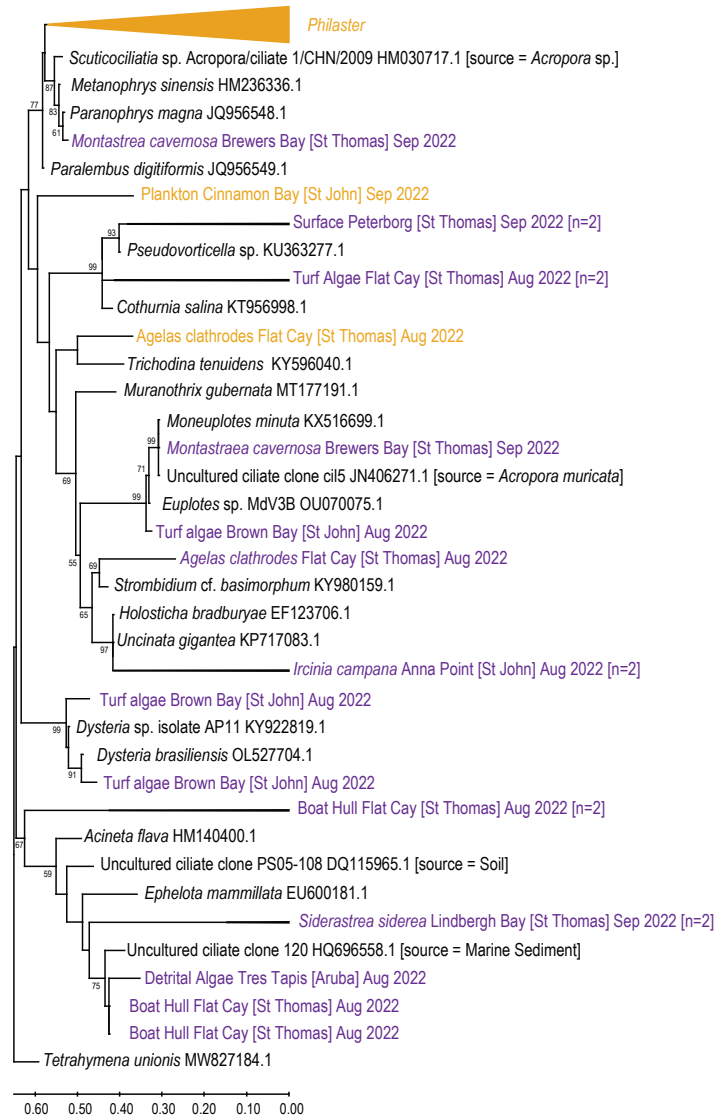
Location	Coral Species	Tissue State	Abnormal Condition	No. Specimens	Date	Reference
St Thomas, USVI	<i>Montastraea cavernosa</i>	Abnormal	SCTL D	6	Feb-19	Becker et al., 2022
St Thomas, USVI	<i>Montastraea cavernosa</i>	Normal		12	Feb-19	Becker et al., 2022
St Thomas, USVI	<i>Colpophyllia natans</i>	Abnormal	SCTL D	8	Feb-19	Becker et al., 2022
St Thomas, USVI	<i>Colpophyllia natans</i>	Normal		8	Feb-19	Becker et al., 2022
St Thomas, USVI	<i>Meandrina meandrites</i>	Abnormal	SCTL D	4	Feb-19	Becker et al., 2022
St Thomas, USVI	<i>Meandrina meandrites</i>	Normal		5	Feb-19	Becker et al., 2022
St Thomas, USVI	<i>Orbicella franksi</i>	Abnormal	SCTL D	3	Feb-19	Becker et al., 2022
St Thomas, USVI	<i>Orbicella franksi</i>	Normal		3	Feb-19	Becker et al., 2022
St Thomas, USVI	<i>Colpophyllia natans</i>	Abnormal	SCTL D	1	Sep-20	*
St Thomas, USVI	<i>Colpophyllia natans</i>	Abnormal	SCTL D	1	Dec-20	*
St Thomas, USVI	<i>Colpophyllia natans</i>	Abnormal	SCTL D	6	Jan-21	*
St Thomas, USVI	<i>Colpophyllia natans</i>	Abnormal	SCTL D	2	May-21	*
St Thomas, USVI	<i>Colpophyllia natans</i>	Normal		10	Jul-20	*
St Thomas, USVI	<i>Colpophyllia natans</i>	Normal		7	Sep-20	*
St Thomas, USVI	<i>Colpophyllia natans</i>	Normal		9	Dec-20	*
St Thomas, USVI	<i>Colpophyllia natans</i>	Normal		4	Jan-21	*
St Thomas, USVI	<i>Colpophyllia natans</i>	Normal		4	Apr-21	*
St Thomas, USVI	<i>Colpophyllia natans</i>	Normal		12	May-21	*
St Thomas, USVI	<i>Colpophyllia natans</i>	Normal		4	Sep-21	*
St Thomas, USVI	<i>Colpophyllia natans</i>	Normal		3	Dec-21	*
Carrie Bow Key, Belize	<i>Orbicella annularis</i>	Abnormal		4	Jul-13	Meyer et al., 2017
Carrie Bow Key, Belize	<i>Orbicella annularis</i>	Abnormal		3	Feb-13	Meyer et al., 2017
Carrie Bow Key, Belize	<i>Orbicella annularis</i>	Abnormal		6	Sep-15	Meyer et al., 2017
Carrie Bow Key, Belize	<i>Orbicella annularis</i>	Normal		3	Sep-15	Meyer et al., 2017
Carrie Bow Key, Belize	<i>Orbicella faveolata</i>	Abnormal		2	Sep-15	Meyer et al., 2017
Carrie Bow Key, Belize	<i>Orbicella faveolata</i>	Normal		1	Sep-15	Meyer et al., 2017
Carrie Bow Key, Belize	<i>Pseudodiploria strigosa</i>	Abnormal	BBD	1	Jul-13	Meyer et al., 2017
Carrie Bow Key, Belize	<i>Pseudodiploria strigosa</i>	Abnormal	BBD	2	Sep-15	Meyer et al., 2017
Carrie Bow Key, Belize	<i>Pseudodiploria strigosa</i>	Normal		1	Sep-15	Meyer et al., 2017
Fort Lauderdale, Florida	<i>Montastraea cavernosa</i>	Abnormal	SCTL D	4	Jul-17	Meyer et al., 2019
Fort Lauderdale, Florida	<i>Montastraea cavernosa</i>	Normal		12	Jul-17	Meyer et al., 2019
Looe Key, Florida	<i>Orbicella faveolata</i>	Abnormal	BBD	1	Jul-13	Meyer et al., 2017

**Table S3:** *Diadema antillarum* scuticociliatosis *Philaster* clade (DaScPc) matches to metagenomic and metatranscriptomic data at Joint Genome Institute Integrated Microbial Genomes-Microbiome Expert Review (IMG-MER) ( $E < 10^{-40}$ ) by BLASTn.

DaScPc Gene	IMG Taxon ID	Scaffold ID	Geographic Location	Coral Species	Scaffold Length
18S rRNA	3300010033	Ga0126339_10878606	Mexico, Puerto Morelos	<i>Orbicella sp.</i>	444
	3300008044	Ga0099804_1772785	Mexico, Puerto Morelos	<i>Orbicella sp.</i>	394
		Ga0099804_1007707	Mexico, Puerto Morelos	<i>Orbicella sp.</i>	533
	3300008043	Ga0099807_1484788	Mexico, Puerto Morelos	<i>Orbicella sp.</i>	271
		Ga0099807_1006446	Mexico, Puerto Morelos	<i>Orbicella sp.</i>	266
	3300008041	Ga0099806_1001225	Mexico, Puerto Morelos	<i>Orbicella sp.</i>	850
	3300008038	Ga0099805_1705591	Mexico, Puerto Morelos	<i>Orbicella sp.</i>	391
		Ga0099805_1035714	Mexico, Puerto Morelos	<i>Orbicella sp.</i>	580
	3300008035	Ga0099808_1661925	Mexico, Puerto Morelos	<i>Orbicella sp.</i>	239
	3300008033	Ga0099820_1601529	Mexico, Puerto Morelos	<i>Siderastrea sp.</i>	329
	3300008031	Ga0099817_1185384	Mexico, Puerto Morelos	<i>Siderastrea sp.</i>	261
		Ga0099817_1081769	Mexico, Puerto Morelos	<i>Siderastrea sp.</i>	525
	3300008029	Ga0099812_1326047	Mexico, Puerto Morelos	<i>Diploria sp.</i>	200
	3300008016	Ga0099818_1560243	Mexico, Puerto Morelos	<i>Siderastrea sp.</i>	264
	3300008015	Ga0099816_1021017	Mexico, Puerto Morelos	<i>Siderastrea sp.</i>	711
	3300008013	Ga0099809_11075876	Mexico, Puerto Morelos	<i>Orbicella sp.</i>	360
	3300003317	BLZ4_1440229	Belize, Carrie Bow Key	<i>Orbicella annularis</i>	309
		BLZ4_1440185	Belize, Carrie Bow Key	<i>Orbicella annularis</i>	309
		BLZ4_1394541	Belize, Carrie Bow Key	<i>Orbicella annularis</i>	332
		BLZ4_1233692	Belize, Carrie Bow Key	<i>Orbicella annularis</i>	425
3300003309	Guam_1142833	Guam	<i>Goniopora fructosa</i>	200	
	Guam_1142801	Guam	<i>Goniopora fructosa</i>	200	
	Guam_1141615	Guam	<i>Goniopora fructosa</i>	226	
	Guam_1134224	Guam	<i>Goniopora fructosa</i>	306	
	Guam_1127775	Guam	<i>Goniopora fructosa</i>	332	
	Guam_1038782	Guam	<i>Goniopora fructosa</i>	1239	
28S rRNA	3300003309	Guam_1036514	Guam	<i>Goniopora fructosa</i>	699
		Guam_1102423	Guam	<i>Goniopora fructosa</i>	401

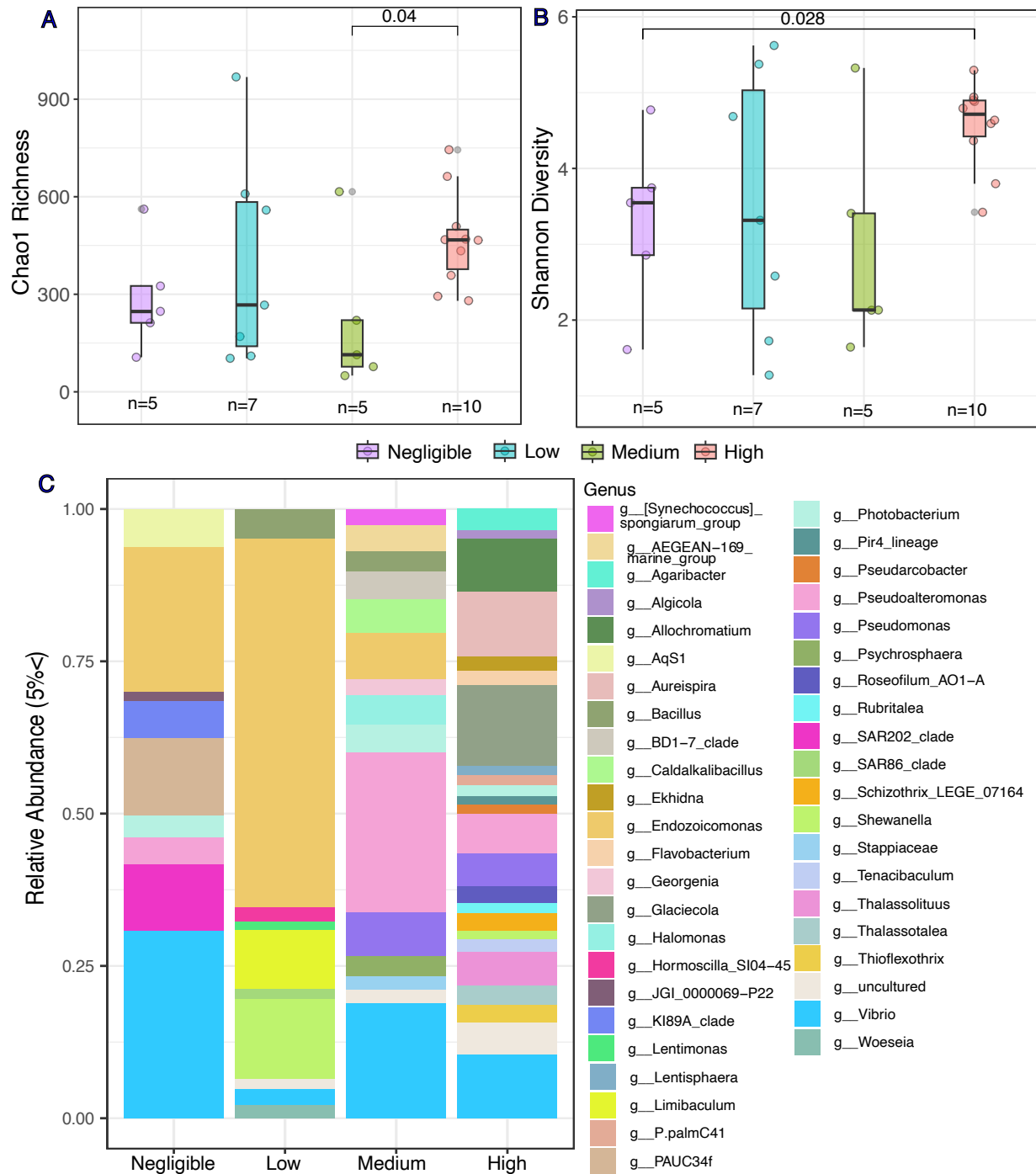
	Guam_1116315	Guam	<i>Goniopora fructosa</i>	365
	Guam_1126001	Guam	<i>Goniopora fructosa</i>	511
	Guam_1142481	Guam	<i>Goniopora fructosa</i>	207
	Guam_1144627	Guam	<i>Goniopora fructosa</i>	179
3300003317	BLZ4_1303250	Belize, Carrie Bow Key	<i>Orbicella annularis</i>	380
	BLZ4_1456533	Belize, Carrie Bow Key	<i>Orbicella annularis</i>	299
3300008006	Ga0099819_1062350	Mexico, Puerto Morelos	<i>Siderastrea sp.</i>	231
	Ga0099819_1070796	Mexico, Puerto Morelos	<i>Siderastrea sp.</i>	218
3300008013	Ga0099809_10016070	Mexico, Puerto Morelos	<i>Orbicella sp.</i>	1029
	Ga0099809_10986925	Mexico, Puerto Morelos	<i>Orbicella sp.</i>	836
3300008015	Ga0099816_1038086	Mexico, Puerto Morelos	<i>Siderastrea sp.</i>	604
	Ga0099816_1046493	Mexico, Puerto Morelos	<i>Siderastrea sp.</i>	1320
3300008016	Ga0099818_1025519	Mexico, Puerto Morelos	<i>Siderastrea sp.</i>	903
	Ga0099818_1449199	Mexico, Puerto Morelos	<i>Siderastrea sp.</i>	264
	Ga0099818_1487564	Mexico, Puerto Morelos	<i>Siderastrea sp.</i>	728
3300008031	Ga0099817_1104253	Mexico, Puerto Morelos	<i>Siderastrea sp.</i>	1021
	Ga0099817_1106876	Mexico, Puerto Morelos	<i>Siderastrea sp.</i>	487
	Ga0099817_1108707	Mexico, Puerto Morelos	<i>Siderastrea sp.</i>	1007
	Ga0099817_1180419	Mexico, Puerto Morelos	<i>Siderastrea sp.</i>	786
3300008033	Ga0099820_1493904	Mexico, Puerto Morelos	<i>Siderastrea sp.</i>	226
3300008034	Ga0099810_1457470	Mexico, Puerto Morelos	<i>Diploria sp.</i>	226
	Ga0099810_1470803	Mexico, Puerto Morelos	<i>Diploria sp.</i>	202
3300008035	Ga0099808_1008455	Mexico, Puerto Morelos	<i>Orbicella sp.</i>	519
	Ga0099808_1014128	Mexico, Puerto Morelos	<i>Orbicella sp.</i>	465
	Ga0099808_1689120	Mexico, Puerto Morelos	<i>Orbicella sp.</i>	1007
3300008038	Ga0099805_1680905	Mexico, Puerto Morelos	<i>Orbicella sp.</i>	304
	Ga0099805_1704235	Mexico, Puerto Morelos	<i>Orbicella sp.</i>	343
	Ga0099805_1716309	Mexico, Puerto Morelos	<i>Orbicella sp.</i>	929
3300008041	Ga0099806_1041521	Mexico, Puerto Morelos	<i>Orbicella sp.</i>	906
	Ga0099806_1062376	Mexico, Puerto Morelos	<i>Orbicella sp.</i>	1081

	3300008043	Ga0099807_1528117	Mexico, Puerto Morelos	<i>Orbicella sp.</i>	433
		Ga0099807_1529021	Mexico, Puerto Morelos	<i>Orbicella sp.</i>	903
		Ga0099807_1543185	Mexico, Puerto Morelos	<i>Orbicella sp.</i>	310
	3300008044	Ga0099804_1008824	Mexico, Puerto Morelos	<i>Orbicella sp.</i>	912
		Ga0099804_1740889	Mexico, Puerto Morelos	<i>Orbicella sp.</i>	452
		Ga0099804_1805375	Mexico, Puerto Morelos	<i>Orbicella sp.</i>	948
	3300010006	Ga0133898_103762	Belize, Carrie Bow Key	<i>Orbicella faveolata</i>	508
		Ga0133898_104980	Belize, Carrie Bow Key	<i>Orbicella faveolata</i>	429
		Ga0133898_108589	Belize, Carrie Bow Key	<i>Orbicella faveolata</i>	338
		Ga0133898_127891	Belize, Carrie Bow Key	<i>Orbicella faveolata</i>	213
		Ga0133898_132083	Belize, Carrie Bow Key	<i>Orbicella faveolata</i>	202
	3300010010	Ga0133901_103386	Belize, Carrie Bow Key	<i>Orbicella annularis</i>	1270
		Ga0133901_107148	Belize, Carrie Bow Key	<i>Orbicella annularis</i>	886
	3300010012	Ga0133895_1001256	Belize, Carrie Bow Key	<i>Pseudodiploria strigosa</i>	1944
	3300010013	Ga0133902_181266	Belize, Carrie Bow Key	<i>Orbicella annularis</i>	216
	3300010019	Ga0133897_1029701	Belize, Carrie Bow Key	<i>Pseudodiploria strigosa</i>	1026
		Ga0133897_1038580	Belize, Carrie Bow Key	<i>Pseudodiploria strigosa</i>	927
	3300010020	Ga0133900_1165202	Belize, Carrie Bow Key	<i>Orbicella faveolata</i>	466
	3300010021	Ga0133905_1000316	Belize, Carrie Bow Key	<i>Orbicella annularis</i>	2746
	3300013617	Ga0117785_106073	Australia, Great Barrier Reef	<i>Pocillopora damicornis</i>	539
	3300022595	Ga0215184_1159901	Panama, Bocas del Toro	<i>Orbicella faveolata</i>	392
	3300022597	Ga0215185_1068734	Panama, Bocas del Toro	<i>Orbicella faveolata</i>	390
	3300022598	Ga0215180_1052071	Panama, Bocas del Toro	<i>Orbicella faveolata</i>	396
3300022600	Ga0215182_1085299	Panama, Bocas del Toro	<i>Orbicella faveolata</i>	508	
3300028319	Ga0303716_1137115	USA, Florida	<i>Montastraea cavernosa</i>	208	
3300045489	Ga0495726_20620	USA, Florida	<i>Montastrea cavernosa</i>	1418	
ITS	3300008031	Ga0099817_1502510	Mexico, Puerto Morelos	<i>Siderastrea sp.</i>	231
	3300008038	Ga0099805_1620045	Mexico, Puerto Morelos	<i>Orbicella sp.</i>	261
	3300010019	Ga0133897_1346171	Belize, Carrie Bow Key	<i>Pseudodiploria strigosa</i>	280

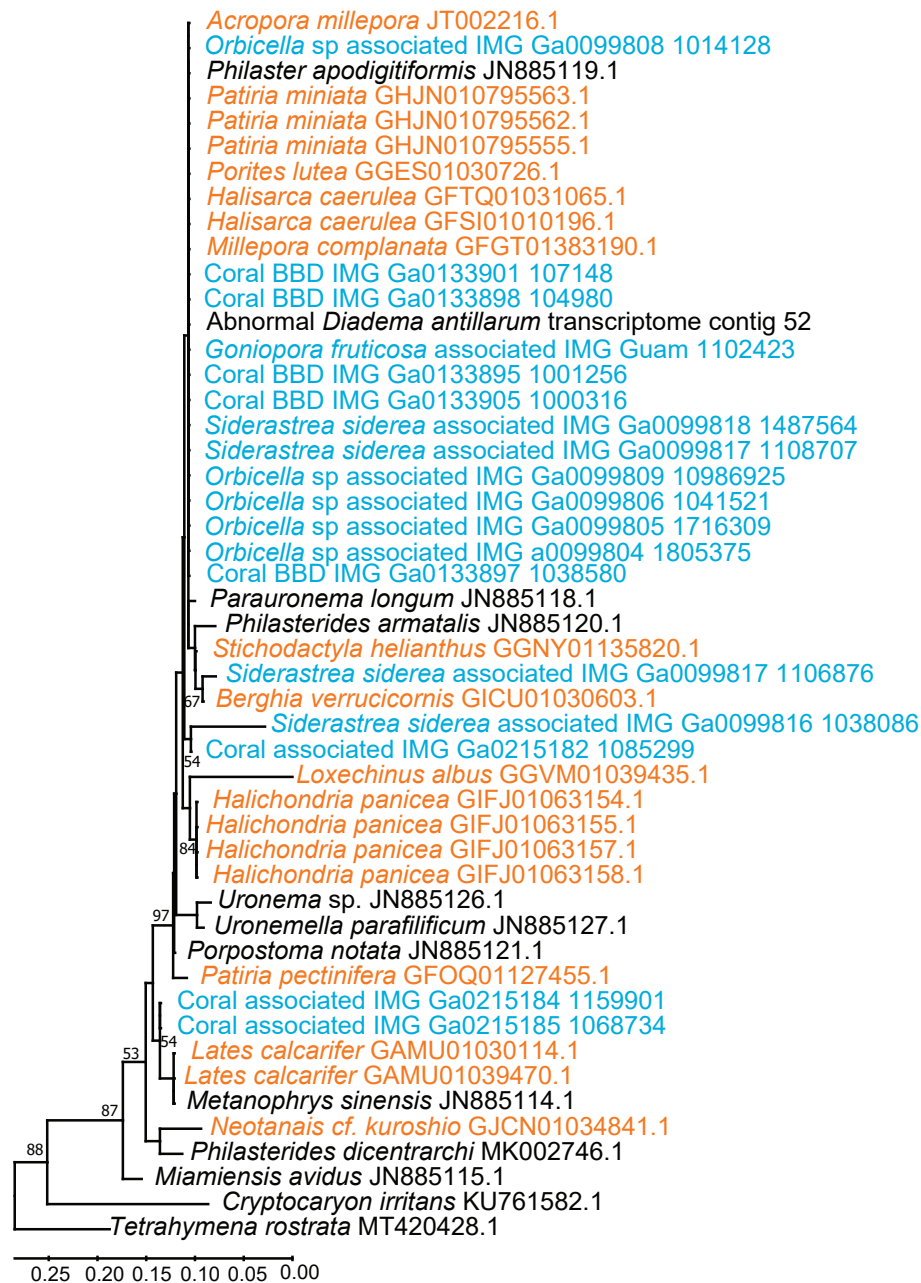


**Fig. S1:** Phylogenetic reconstruction of *Ciliophora* sequences recovered from the swab survey. Phylogenetic reconstructions were performed on a 281-313 bp portion of the 18S rRNA gene, including closest relatives in the nonredundant (nr) database at NCBI. The alignment was performed using MUSCLE (Edgar, 2004). The tree was created using MEGAX (Kumar et al., 2018) using Maximum Likelihood and the Kimura-2 parameter model with gamma distributed sites and the nearest-neighbor interchange heuristic model. Bootstrap values represent 1000 iterations. Sequences in purple are those primed with the Scutico-634F and 1187R primers, while those in yellow are with pan-*Ciliophora* 384F and 1187R. See Fig. 3 for expansion of *Philaster* spp.





**Fig. S2:** Microbial community assessment of *Diadema antillarum* scuticociliatosis *Philaster* clade (DaScPc) positive surface samples categorized by quantitative polymerase chain reaction (qPCR) determined DaScPc copies per ng extracted DNA [negligible (0 - 100), low (100 - 800), medium (800 - 5000) and high (>5000)]. Alpha diversity analysis showed significant differences, using Kruskal Wallis Test, on Chao1 microbial richness (A) between the negligible and medium range when compared to high range. Moreover, there was significant difference in Shannon diversity of microbial communities between negligible and high range (B). Taxonomic composition was analyzed to identify bacteria above 5% relative abundance on each sample (C) and grouped by range of DaScPc quantity  $\text{ng [DNA]}^{-1}$  to show differences in highly abundant taxa.



**Figure S3:** Phylogenetic reconstruction of scaffolds retrieved by BLASTn of the *Diadema antillarum* scuticociliatosis *Philaster* clade (DaScPc) 28S rRNA against publicly available datasets preceding the 2022 mass mortality event. Orange represents transcriptome sequence assembly and blue represents Joint Genome Institute Integrated Microbial Genomes-Microbiome Expert Review (IMG-MER) matches ( $E < 10^{-40}$ ) by BLASTn.

## References

- Becker CC, Weber L, Zgliczynski B, Sullivan C, Sandin S, Muller E, Clark AS, Kido Soule MC, Longnecker K, Kujawinski EB, Apprill A (2023). Microorganisms and dissolved metabolites distinguish Florida's Coral Reef habitats. *PNAS Nexus* 2: pgad287
- Meyer JL, Paul VJ, Raymundo LJ, Teplitski M (2017). Comparative Metagenomics of the Polymicrobial Black Band Disease of Corals. *Front Microbiol* 8: 618