

Global coral disease prevalence associated with sea temperature anomalies and local factors

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Supplement. Further analyses of disease prevalence

Overall mean disease prevalence and thermal anomaly indices

We regressed disease prevalence by region and year against the 6 thermal indices proposed in this work (see ‘Materials and methods’ section of main text for calculation details; Fig. S1). The patterns for sea surface temperature (SST) Indices 1 and 2 (frequency of warm and cold anomalies respectively) were not as statistically significant as those for SST Indices 5 and 6. However, by removing some outliers, all indices could show the same relationship as that reported in the main text.

Our data also show that thermal stress is significantly greater in the Caribbean than in the Pacific for SST4, (Wilcoxon Mann-Whitney test: $W = 40499$, $p = 0.00095$) and marginally significant for SST3.

Overall mean disease prevalence

Using the mean transect prevalence White Signs/Syndromes appears as the most prevalent disease, followed by non-thermal bleached spots and yellow signs (Fig. S2). White Signs/Syndromes (with higher prevalence values in acroporids and mussids), Yellow Band (faviids and acroporids), and Dark Spot (siderastreids) appeared as the most important diseases for the Caribbean basin (Table 3). For the Pacific, Skeleton Eroding Band (merulinids and pocilloporids), White Signs/Syndromes (fungiids, pectiniids and merulinids) and Brown Band Disease (acroporids) were the more prevalent diseases (Table 3).

Prevalence levels by region and year

We disaggregated unhealthy conditions, diseases and compromised health conditions prevalence by region and year. In contrast with the pattern reported in the main text, we observed that occasionally the mean unhealthy conditions prevalence in the Great Barrier Reef (GBR) is higher than that of several locations from the Caribbean; however this pattern seems to be generated mainly by the prevalence of compromised health conditions (Figs. S3 to S7).

Table S1. Local mean prevalence of all diseases in acroporids at each location in each year. Locations and years with disease prevalence levels over 25% in **bold**. Due to weather conditions, not all sites were sampled in all years. MPA: Marine Protected Area, na: not available

Site – Year	Prevalence (proportion)	
	Mean	SEM
Akumal - 2005	0.205449	0.060157
Akumal - 2006	0.201742	0.069845
Akumal - 2007	0.101345	0.037172
Andes Wall - 2006	0.000000	na
Andes Wall - 2007	0.500000	na
Apo Fished - 2006	0.240670	0.150006
Apo Fished - 2007	0.280871	0.108335
Apo MPA - 2006	0.010101	0.010101
Apo MPA - 2007	0.027778	0.027778
Balicasag Fished - 2006	0.005952	0.005952
Balicasag Fished - 2007	0.011494	0.011494
Balicasag MPA - 2006	0.000000	0.000000
Balicasag MPA - 2007	0.000000	0.000000
Basdiot Fished - 2006	0.080912	0.044590
Basdiot Fished - 2007	0.074725	0.038099
Basdiot MPA - 2006	0.013228	0.013228
Basdiot MPA - 2007	0.009763	0.005107
Boya – 2006	0.000000	na
CCS Bay - 2006	0.169421	0.057321
CCS Bay - 2007	0.465928	0.073684
Culebrita - 2005	0.333333	0.166667
Culebrita - 2006	0.250000	0.250000
Culebrita - 2007	0.333333	na
East site - 2006	0.066667	0.066667
East site - 2007	0.187500	0.187500
French Frigate - 2007	0.005529	0.004140

Gilutungan Fished - 2006	0.020833	0.020833
Gilutungan Fished - 2007	0.051587	0.026022
Gilutungan MPA - 2006	0.003876	0.003876
Gilutungan MPA - 2007	0.015528	0.010570
Guanica - 2005	0.172932	0.110732
Guanica - 2006	0.083333	0.083333
Guanica - 2007	0.333333	0.333333
Heron Island - 2005	0.104827	0.011804
Heron Island - 2006	0.217782	0.042871
Heron Island - 2007	0.093494	0.009507
Lizard Island - 2006	0.180435	0.030391
Lizard Island - 2007	0.246150	0.851025
Mahahual - 2005	0.062637	0.030241
Mahahual - 2006	0.016156	0.011553
Mahahual - 2007	0.117143	0.036389
One Tree Island - 2005	0.081137	0.014928
One Tree Island - 2006	0.135380	0.013371
One Tree Island - 2007	0.077486	0.010938
Pearl and Hermes - 2007	0.106473	0.069245
Puerto Morelos - 2005	0.250000	0.250000
Puerto Morelos - 2006	0.031746	0.031746
Puerto Morelos - 2007	0.102564	0.082803
Punta Allen - 2006	0.112143	0.043532
Punta Allen - 2007	0.039872	0.035148
Saavedra Fished - 2006	0.035088	0.035088
Saavedra Fished - 2007	0.030753	0.015452
Saavedra MPA - 2006	0.014925	0.014925
Saavedra MPA - 2007	0.000000	0.000000
SeaAquarium - 2005	0.344835	0.180077
SeaAquarium - 2006	0.158466	0.075804

Sea Aquarium - 2007	0.266463	0.083725
South Point - 2005	0.000000	0.000000
South Point - 2006	0.000000	na
South Point - 2007	0.000000	na
Uvero - 2005	0.041008	0.020722
Wistari Reef - 2005	0.116151	0.022455
Wistari Reef - 2006	0.093524	0.010425
Wistari Reef - 2007	0.075592	0.009834
Xcalak - 2005	0.033100	0.023156

Table S2. Local mean prevalence of all diseases for faviids at each location in each year. Locations and year with disease prevalence levels over 25% in **bold**. Due to weather conditions not all sites were sampled all years

	Prevalence (proportion)	
Site - Year	Mean	SEM
Akumal - 2005	0.074067	0.013321
Akumal - 2006	0.451479	0.041812
Akumal - 2007	0.453399	0.036123
Andes Wall - 2005	0.025971	0.063315
Andes Wall - 2006	0.030931	0.044081
Andes Wall - 2007	0.045428	0.021512
Apo Fished - 2006	0.000000	0.000000
Apo Fished - 2007	0.027972	0.014131
Apo MPA - 2006	0.041667	0.041667
Apo MPA - 2007	0.000000	0.000000
Balicasag Fished - 2006	0.025641	0.025641
Balicasag Fished - 2007	0.016138	0.009757
Balicasag MPA - 2006	0.000000	0.000000
Balicasag MPA - 2007	0.019765	0.011116
Basdiot Fished - 2006	0.007576	0.007576
Basdiot Fished - 2007	0.023496	0.015453

Basdiot MPA - 2006	0.024946	0.013658
Basdiot MPA - 2007	0.037037	0.037037
Boya – 2006	0.011647	0.014873
Cayo Roldan - 2005	0.000000	0.000000
Cayo Roldan - 2006	0.000000	0.000000
Cayo Roldan - 2007	0.000000	0.000000
CCS Bay - 2006	0.114560	0.015916
CCS Bay - 2007	0.112822	0.013420
Chub Cut - 2005	0.043836	0.012751
Chub Cut - 2006	0.022518	0.010701
Chub Cut - 2007	0.035861	0.008734
Culebrita - 2005	0.117747	0.113511
Culebrita - 2006	0.154743	0.086062
Culebrita - 2007	0.104383	0.052177
Dragon - 2006	0.024243	0.011130
Dragon - 2007	0.029891	0.010659
East site - 2006	0.040574	0.023853
East site - 2007	0.084447	0.021932
Flamingo Bay - 2005	0.016906	0.063424
Flamingo Bay - 2006	0.016864	0.006496
Flamingo Bay - 2007	0.030674	0.011800
French Frigate - 2007	0.000000	0.003831
Gilutungan Fished - 2006	0.007072	0.003961
Gilutungan Fished - 2007	0.031552	0.005083
Gilutungan MPA - 2006	0.011820	0.008179
Gilutungan MPA -2007	0.025251	0.007055
Guanica - 2005	0.047417	0.058848
Guanica - 2006	0.054326	0.025352
Guanica - 2007	0.015963	0.023894
Habitat Hotel - 2005	0.107466	0.016872
Habitat Hotel - 2006	0.171223	0.033623

Habitat Hotel - 2007	0.084321	0.015946
Heron Island - 2005	0.007826	0.011802
Heron Island - 2006	0.016599	0.026599
Heron Island - 2007	0.001176	0.003300
Isla Colon (STRI) - 2005	0.000000	0.085081
Isla Colon (STRI) - 2006	0.003636	0.010060
IslaColon (STRI) - 2007	0.000000	0.005714
Lizard Island - 2006	0.000000	0.004178
Lizard Island - 2007	0.000000	0.044262
Mahahual - 2005	0.050764	0.012271
Mahahual - 2006	0.388359	0.028473
Mahahual - 2007	0.315417	0.033289
One Tree Island - 2005	0.002381	0.003194
One Tree Island - 2006	0.008475	0.020869
One Tree Island - 2007	0.042617	0.020350
Pearl and Hermes - 2007	0.000000	0.011111
Puerto Morelos - 2005	0.070060	0.018861
Puerto Morelos - 2006	0.192384	0.026126
Puerto Morelos - 2007	0.181834	0.024552
Punta Allen - 2006	0.230884	0.017143
Punta Allen - 2007	0.230799	0.022704
Rita - 2005	0.013643	0.002715
Rita - 2006	0.002496	0.002125
Rita - 2007	0.010773	0.004951
Saavedra Fished - 2006	0.016965	0.008627
Saavedra Fished - 2007	0.022903	0.013123
Saavedra MPA - 2006	0.000000	0.000000
Saavedra MPA - 2007	0.000000	0.000000
SeaAquarium - 2005	0.049262	0.016822
SeaAquarium - 2006	0.080349	0.016973

SeaAquarium - 2007	0.071991	0.016704
Snake.Pit - 2006	0.005292	0.003270
Snake Pit - 2007	0.044133	0.011768
South Point - 2005	0.019031	0.044040
South Point - 2006	0.039878	0.019812
South Point - 2007	0.025624	0.006771
Uvero - 2005	0.015118	0.006309
Valleys - 2005	0.013941	0.058973
Valleys - 2006	0.186517	0.059886
Valleys - 2007	0.100493	0.023419
Wistari Reef - 2005	0.014394	0.048760
Wistari Reef - 2006	0.002488	0.016285
Wistari Reef - 2007	0.037213	0.019939
Xcalak - 2005	0.127153	0.032931

Table S3. Principal Component Analysis (PCA) results comparing 6 sea surface temperature (SST) indices. See ‘Materials and methods’ section for explanation of SST indices

	PC1	PC2	PC3	PC4	PC5	PC6
SST Index 1	-0.0027	0.0050	-0.0015	0.061	-0.48	0.87
SST Index 2	-0.0048	-0.0047	0.059	0.0093	-0.87	-0.49
SST Index 3	-0.63	0.78	0.012	0.041	0.0043	-0.0069
SST Index 4	0.78	0.63	-0.048	-0.0098	-0.008	-0.0051
SST Index 5	-0.03	0.028	0.070	-0.99	-0.034	0.050
SST Index 6	0.048	0.020	0.99	0.068	0.053	0.026

Table S4. Total number of colonies of each coral family sampled in this study and their proportion in each basin

Family	No. of colonies counted	Proportion of colonies	
		Caribbean	Pacific
Acroporidae	59294	0.0358	0.9642
Agariciidae	61373	0.9676	0.0324
Astroconiidae	13764	0.9991	0.0009
Caryophylliidae	101	0.0000	1.0000
Dendrophyllidae	176	0.1818	0.8182
Euphyllidae	327	0.0000	1.0000
Faviidae	71491	0.8703	0.1297
Fungiidae	1374	0.0000	1.0000
Meandrinidae	4907	1.0000	0.0000
Merulinidae	880	0.0000	1.0000
Mussidae	3711	0.4853	0.5147
Oculiniidae	348	0.0230	0.9770
Pectiniidae	382	0.0000	1.0000
Pocilloporidae	10387	0.0000	1.0000
Poritidae	62498	0.7855	0.2145
Rhizangiidae	35	1.0000	0.0000
Siderastreidae	28434	0.9794	0.0206

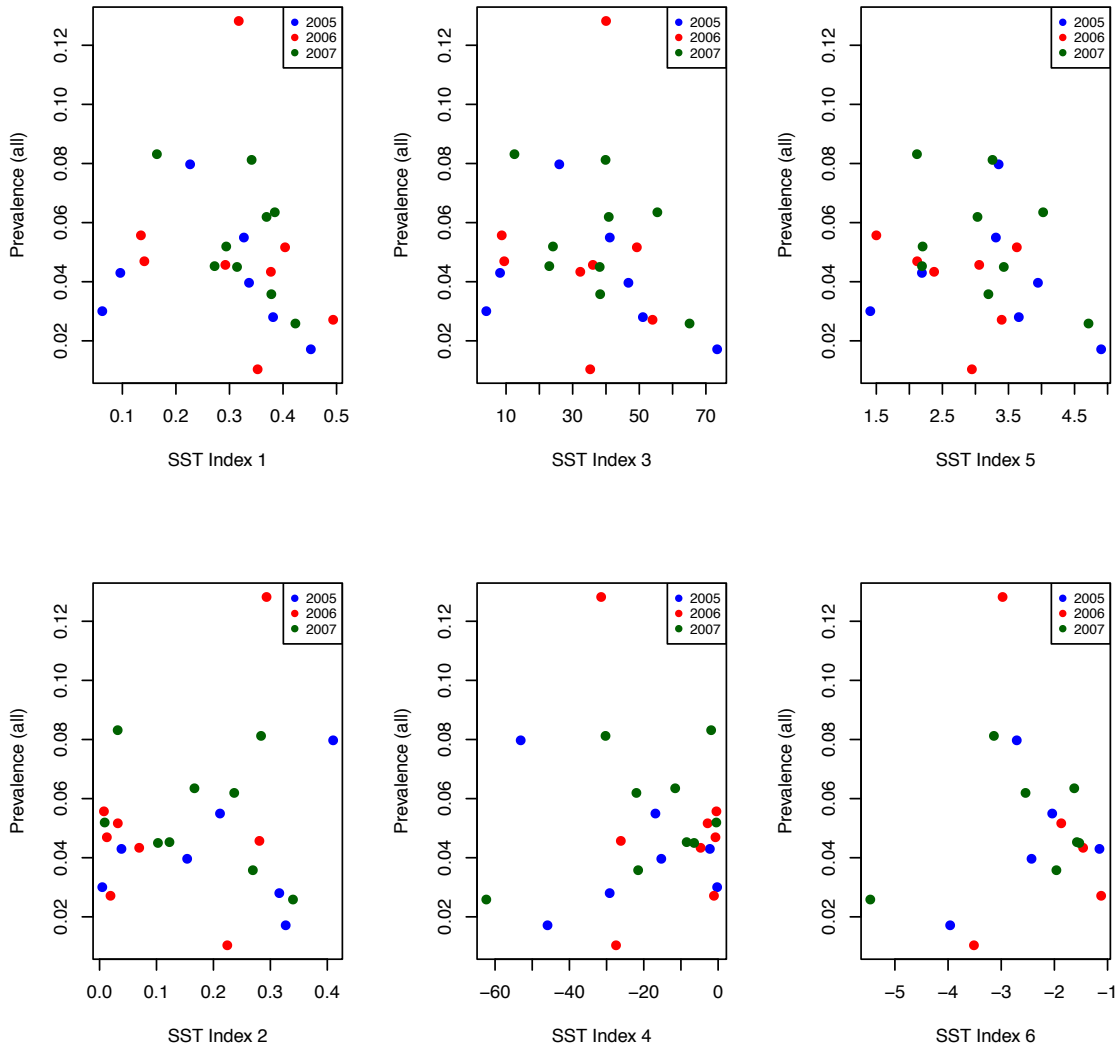


Fig. S1. Regional disease prevalence (proportion) and thermal anomalies indices

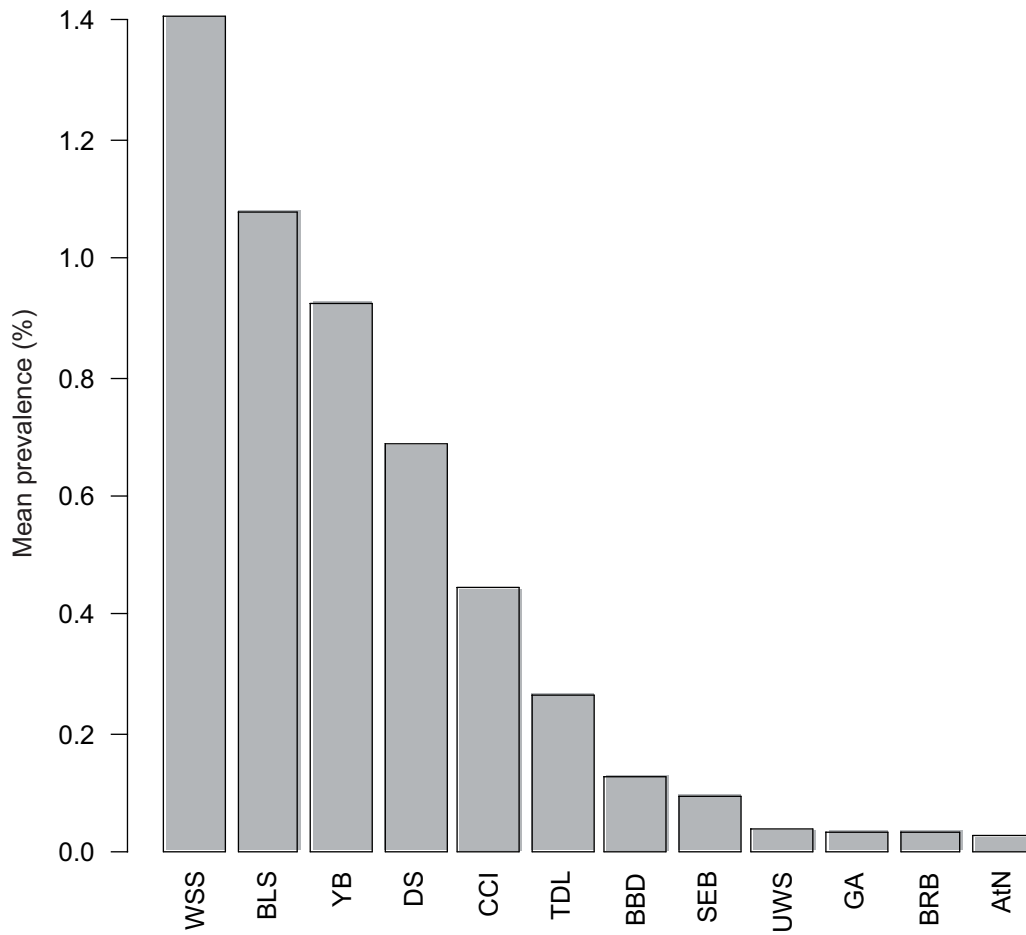


Fig. S2. Overall global mean disease prevalence by disease category. AtN: Atramentous Necrosis, BBD: Black band disease, BLS: Non-thermal bleached spots, BRB: Brown Band disease, CCI: Caribbean Ciliate Infections, DS: Dark Spots, GA: Growth Anomalies, SEB: Skeleton Eroding Band, TDL: Thin Dark Line, UWS: Ulcerative White Signs, WSS: White Signs and other White Syndromes, YB: Yellow Band

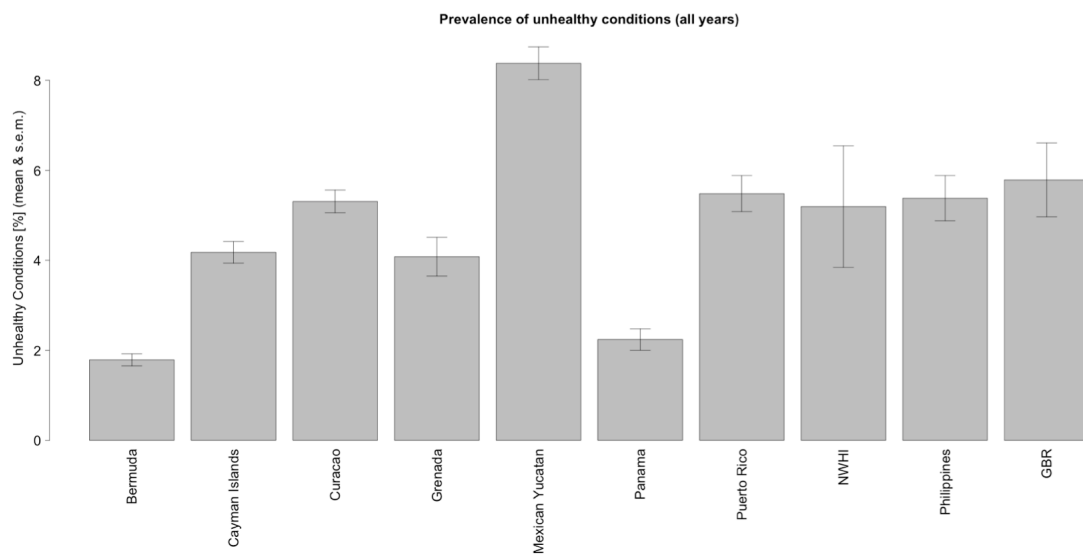


Fig. S3. Mean (\pm SE) prevalence of unhealthy conditions by region for all years. NWHI: Northwestern Hawaiian Islands, GBR: Great Barrier Reef

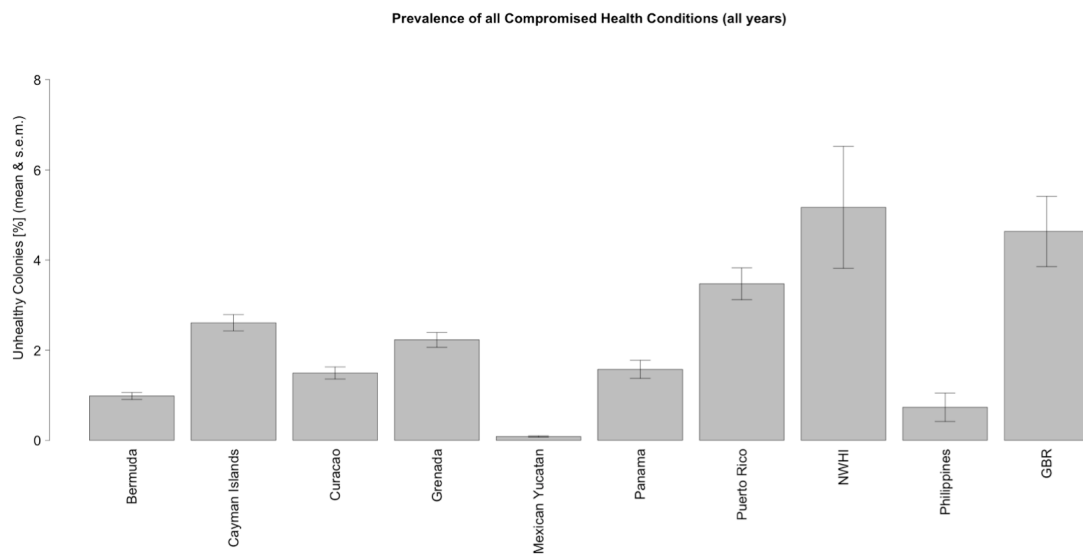


Fig. S4. Mean (\pm SE) prevalence for all compromised health conditions by region for all years. NWHI: Northwestern Hawaiian Islands, GBR: Great Barrier Reef

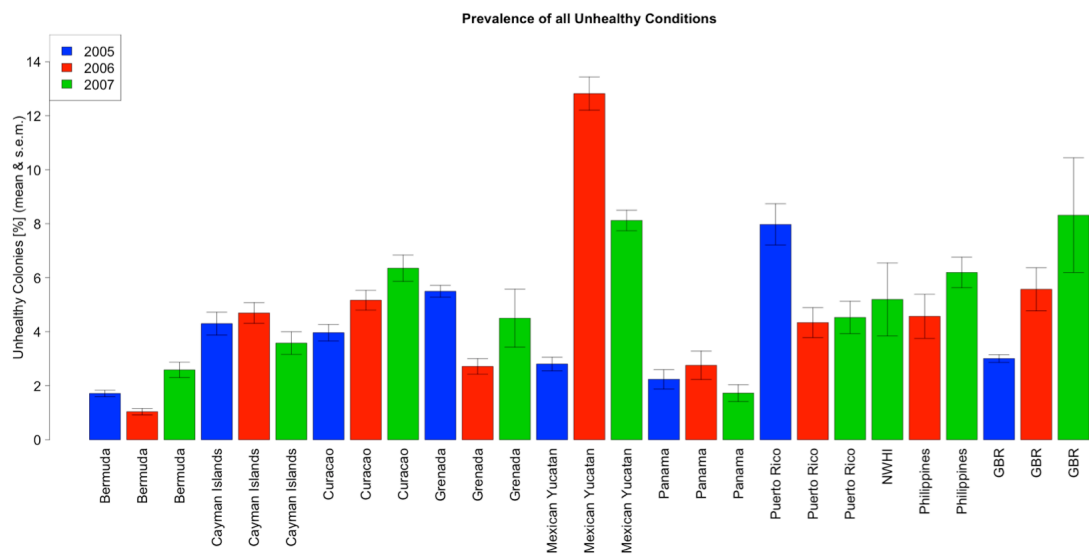


Fig. S5. Mean (\pm SE) prevalence for unhealthy conditions by region and sampling year. NWHI: Northwestern Hawaiian Islands, GBR: Great Barrier Reef

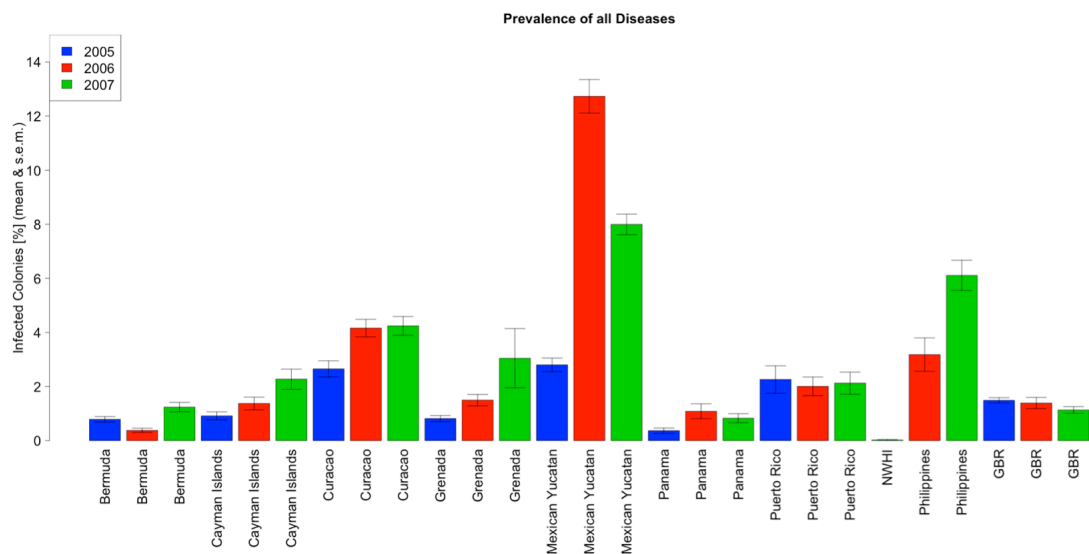


Fig. S6. Mean (\pm SE) prevalence for all diseases by region and sampling year. NWHI: Northwestern Hawaiian Islands, GBR: Great Barrier Reef

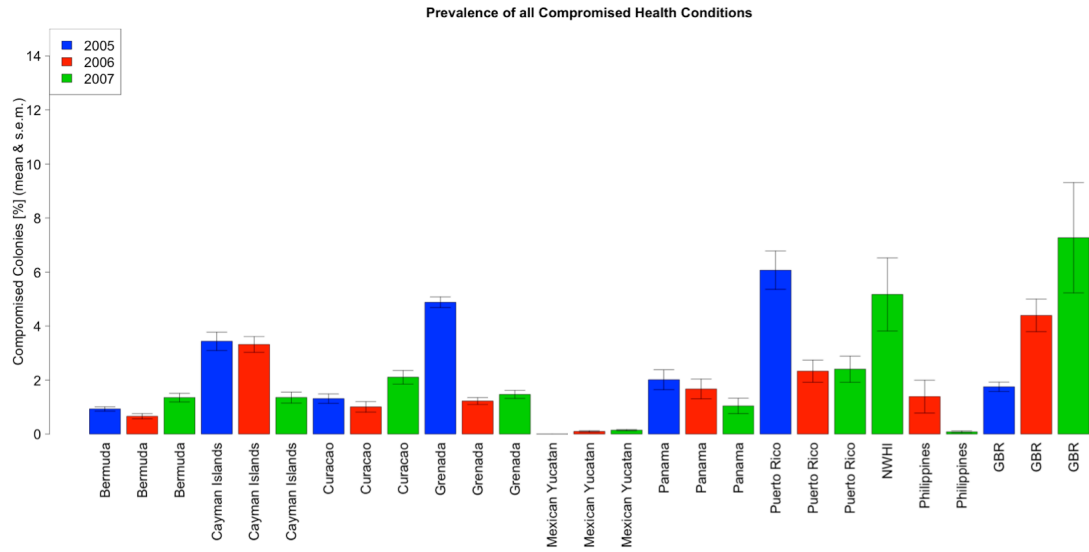


Fig. S7. Mean (\pm SE) prevalence for all compromised health conditions by region and sampling year. NWHI: Northwestern Hawaiian Islands, GBR: Great Barrier Reef