SUPPLEMENTARY MATERIAL

Contents

Table S1. Coordinates for collection sites in Puerto Rico and Bonaire.

Collection Site	Island	Latitude	Longitude
Manchas Exteriores	Puerto Rico	18°14’32.58” N	67°12’41.52” W
Cayo Ron	Puerto Rico	18°05’14.40” N	67°17’10.44” W
Atravesado Reef	Puerto Rico	17°55’48.00” N	67°05’18.00” W
Enrique	Puerto Rico	17°57’15.36” N	67°02’37.86” W
Terremoto Reef	Puerto Rico	17°55’44.10” N	66°58’27.50” W
Media Luna	Puerto Rico	17°56’04.44” N	67°02’04.20” W
El Veril	Puerto Rico	17°53’18.12” N	66°59’53.16” W
Fallen Rock	Puerto Rico	17°53’55.32” N	66°56’37.32” W
Cayo Coral	Puerto Rico	17°56’18.78” N	66°53’36.66” W
Funchi’s Reef	Bonaire	12°06’04.74” N,	68°13’14.76” W
White Hole	Bonaire	12°05’38.88” N	68°13’52.08” W
Margate Bay	Bonaire	12°03’11.70” N	68°16’28.14” W
Andrea II	Bonaire	12°11’28.74” N	68°17’52.74” W
Cliff	Bonaire	12°10’23.76” N	68°17’22.50” W
Karpata	Bonaire	12°13’10.26” N	68°21’07.08" W
Keepsake	Bonaire	12°08’44.04” N	68°18’04.14” W

Table S2. Counts of corals (*Eunicea flexuosa* and *Gorgonia ventalina*), sediment and water samples collected at each site in Puerto Rico and Bonaire.

Puerto Rico Sites	*Eunicea flexuosa*	*Gorgonia ventalina*	Sediment	Water
Manchas Exteriores	12	12	3	3
Cayo Coral	12	12	3	3
Media Luna	12	12	3	3
Fallen Rock	11	12	3	3
Atravesado	12	12	3	3
Terremoto	12	12	3	3
Enrique	12	12	3	3
El Veril	12	12	3	3
Cayo Ron	12	11	3	3
Bonaire Sites				
Cliff	12	1	3	3
Andrea II	9	5	3	3
Karpata	11	10	3	3
Keepsake	10	12	3	3
Funchi’s Reef	12	11	3	3
White Hole	12	12	3	3
Margate Bay	12	11	3	3

Table S3. The sample type, environmental threshold, and source information for the tested water quality parameters. We assessed DIN, a summation of all nitrogen-related parameters, to aid in site type designations, so no environmental thresholds are given for nitrate, nitrate and ammonium.

Water Quality Parameter	Sample Type	Environmental Threshold	Threshold Source
Nitrite (NO_2^-)	0.22 µm Sterivex-filtered H_20	-----	-----
Nitrate (NO_3^-)	0.22 µm Sterivex-filtered H_20	-----	-----
Ammonium (NH_4^+)	0.22 µm Sterivex-filtered H_20	-----	-----
Phosphate (PO_3^{-4})	0.22 µm Sterivex-filtered H_20	0.1 µmol/l	Bell, 1992; Slijkerman et al., 2014
DIN ($NH_4^+ + NO_x$)	Calculated: $NH_4^+ + NO_x$	1 µmol/l	Bell 1992; Slijkerman et al. 2014
DIN: PO_3^{-4} Ratio	Calculated: DIN/PO_3^{-4}	Low < 2 Moderate= 2-4 High > 4	Based on range of ratios obtained in this study
Chlorophyll *a*	2µm glass microfiber pre-filter	0.2 µg/l	Bell et al., 2014

Table S4. Water quality values (± SE) averaged from three samples from each collection site.

	Nitrite (NO_2^-) µmol/l	**Nitrate (NO_3^-) µmol/l**	**Ammonium (NH_4^+) µmol/l**	**DIN ($NO_x + NH_4^+$) µmol/l**	**Phosphate (PO_3^{-4}) µmol/l**	**DIN: PO_3^{-4} ratio**	**Chlorophyll *a* µg/l**
Puerto Rico Sites							
Manchas Exteriores	0.075±0.015	0.174±0.072	0.553±0.143	0.803±0.167	0.187±0.030	4.514±1.033	0.219±0.006
Cayo Coral	0.076±0.020	0.184±0.079	0.795±0.263	1.055±0.202	0.164±0.032	6.564±1.170	0.159±0.028
Media Luna	0.072±0.011	0.452±0.065	0.151±0.062	0.675±0.088	0.177±0.011	3.870±0.664	0.293±0.021
Fallen Rock	0.144±0.001	0.426±0.048	0.051±0.023	0.621±0.045	0.314±0.015	1.977±0.054	0.122±0.005
Atravesado	0.037±0.024	0.940±0.357	0.284±0.169	1.260±0.476	0.210±0.026	6.488±2.968	0.058±0.004
Terremoto	0.037±0.026	0.195±0.102	0.339±0.150	0.571±0.121	0.131±0.020	4.773±1.637	0.203±0.044
Enrique	0.055±0.033	0.078±0.040	0.313±0.023	0.446±0.051	0.175±0.049	2.786±0.453	0.265±0.034
El Veril	0.053±0.009	0.458±0.041	0.170±0.170	0.681±0.204	0.146±0.016	4.961±1.886	0.101±0.013
Cayo Ron	0.056±0.033	0.189±0.095	0.114±0.104	0.360±0.020	0.156±0.043	2.593±0.567	0.184±0.093
Bonaire Sites							
Cliff	0.099±0.002	0.309±0.109	0.895±0.213	1.303±0.312	0.307±0.008	4.294±1.163	0.050±0.010
Andrea II	0.090±0.002	0.126±0.006	0.578±0.045	0.794±0.049	0.349±0.025	2.284±0.145	0.012±0.004
Karpata	0.075±0.003	0.284±0.065	0.590±0.163	0.949±0.171	0.385±0.020	2.499±0.506	0.056±0.013
Keepsake	0.106±0.005	0.056±0.020	0.869±0.196	1.031±0.197	0.319±0.023	3.346±0.793	0.046±0.011
Funchi's Reef	0.124±0.001	0.492±0.334	0.912±0.309	1.528±0.345	0.413±0.102	3.770±0.605	0.029±0.002
White Hole	0.111±0.014	0.149±0.051	0.286±0.173	0.545±0.172	0.339±0.033	1.674±0.640	0.039±0.013
Margate Bay	0.076±0.002	0.122±0.041	0.157±0.004	0.355±0.042	0.313±0.015	1.130±0.081	0.058±0.005

Table S5. The impact rating and evidence used to determine ratings for qualitative and/or untested (in this study) site quality parameters for sites from Bonaire and Puerto Rico. Impact ratings include: low impact, moderate impact, and high impact.

Site Quality Parameter	Low Impact	Moderate Impact	High Impact
% Coral Cover[1,2,3,4,5,6,7]	• >30% live coral cover • High coral density and diversity	• ~20-30% live coral cover • Evidence of increased macroalgal cover	• <10% live coral cover • Evidence of increased macroalgal cover
Fresh H_2O Proximity	• >4 km from freshwater outflow	• 2-4 km from freshwater outflow	• <2 km from freshwater outflow
City/ Resort Proximity	• >6 km from, or upcurrent of (even if proximity is closer than 6 km), a coastal city (any size) and/or sizable resort/hotel establishment • Low recreational diver activity	• <6 km from, or downcurrent of, a coastal city (pop. <20,000) and/or sizable resort/hotel establishment • Moderate recreational diver activity	• <6 km from, or downcurrent of, a coastal city (pop. >20,000) and/or sizable resort/hotel establishment • Heavy recreational diver activity
Industrial Activity	• >6 km from, or upcurrent of (even if proximity is closer than 6km), notable industrial activity including shipping, factories, sewage outflows, etc.	• <6 km from, or downcurrent of, notable industrial activity including shipping, factories, sewage outflows, etc.	• <6 km from, or downcurrent of, notable industrial activity including shipping, factories, sewage outflows, etc.
Nutrient/ Sediment Load[2,3,8]	• Visibility >50m (author observation) **AND** • No evidence of either sedimentation OR elevated water quality parameters ((e.g., P, NH4+, DIN, TN) in the literature	• Visibility <50m (author observation) **OR** • Evidence of either sedimentation or elevated water quality parameters ((e.g., P, NH4+, DIN, TN) in the literature	• Visibility <50m (author observation) **AND** • Evidence of sedimentation and/or elevated water quality parameters in the literature (e.g., P, NH4+, DIN, TN)

[1] Goenaga & Cintrón, 1979
[2] Morelock et al., 2001
[3] Larsen & Webb, 2009
[4] Stokes et al., 2010
[5] de Bakker et al., 2016
[6] Dutch Caribbean Nature Alliance, 2017
[7] Sommer et al. 2011
[8] Slijkerman et al., 2014

Table S6. Anthropogenic impact on each collection site. A combination of published data and location information (see Table S5) and water quality nutrient sampling (from this study = asterisks; see Table S4) was used to assess site quality and determine a designation of impact level. Shades show the level of impact each criterion has on each collection site (light gray = low impact, medium gray = moderate impact, dark gray = high impact. Each shade was assigned a point value then used to calculate a final quantitative measure of the anthropogenic impact; a lower total in the PTS column (≦6) indicates a less impacted site while a higher total (>6) indicates an impacted site.

	Stress or Degraded Reef Quality Indicators										
Puerto Rico Sites	**% Coral Cover**[9,10,11,12,13,14,15]	**Fresh H_2O Proximity**	**City/ Resort Proximity**	**Industrial Activity**[9,10,13]	**Nutrient /Sediment Load**[9,10,16]	***DIN**	***PO_4^{-3}**	***DIN/ PO_4^{-3} Ratio**	***Chloro-phyll *a***	**PTS**	**Final Site Type**
Manchas Exteriores										17	Impacted
Cayo Coral										17	Impacted
Media Luna										8	Impacted
Atravesado										8	Impacted
Fallen Rock										7	Impacted
Terremoto										6	Less Impacted
Enrique										6	Less Impacted

(Table S6 Continued on Pg. 7)

[9] Goenaga & Cintrón, 1979
[10] Morelock et al., 2001
[11] Larsen & Webb, 2009
[12] Stokes et al., 2010
[13] de Bakker et al., 2016
[14] Dutch Caribbean Nature Alliance, 2017
[15] Sommer et al. 2011
[16] Slijkerman et al., 2014

Puerto Rico Sites	% Coral Cover [17,18,19,20,21,22,23]	Fresh H_2O Proximity	City/ Resort Proximity	Industrial Activity [17,18,21]	Nutrient /Sediment Load [17,18,24]	*DIN	*PO_4^{-3}	*DIN/ PO_4^{-3} Ratio	*Chloro-phyll *a*	PTS	Final Site Type
Cayo Ron										6	Less Impacted
El Veril										5	Less impacted
Bonaire Sites											
Cliff										11	Impacted
Andrea II										9	Impacted
Karpata										7	Impacted
Keepsake										7	Impacted
Funchi's Reef					NA					6	Less Impacted
White Hole					NA					3	Less Impacted
Margate Bay										2	Less Impacted

= low impact (0 pts) **= moderate impact (1 pt)** **= high impact (2 pts)** *** =From this study**

[17] Goenaga & Cintrón, 1979
[18] Morelock et al., 2001
[19] Larsen & Webb, 2009
[20] Stokes et al., 2010
[21] de Bakker et al., 2016
[22] Dutch Caribbean Nature Alliance, 2017
[23] Sommer et al. 2011
[24] Slijkerman et al., 2014

Table S7. Sequencing information for *Eunicea flexuosa*, *Gorgonia ventalina*, sediment and water samples. Sequence data includes raw microbial read count, post quality control (QC) microbial read counts and microbial read counts following rarefaction analyses. Raw read and post- (QC) read counts are averaged across sample types.

		97% OTU Clustering		ASV Clustering	
Sample Type	**Raw Reads (±SD)**	**Post-QC Microbial Reads (±SD)**	**Number Samples Post-rarefaction (15,000 reads/sample)**	**Post-QC Microbial Reads (±SD)**	**Number Samples Post-rarefaction (15,000 reads/ sample)**
***Eunicea flexuosa* (n=184)**	213,562 ± 253,634	138,872 ± 213,935	156	116,654 ± 193,811	152
***Gorgonia ventalina* (n=168)**	346,472 ± 411,856	94,035 ± 186,710	123	70,954 ± 130,498	121
Sediment (n=48)	893,516 ± 288,931	844,317± 271,861	46	-----	-----
Water (n=48)	760,559 ± 207,537	718,071 ± 194,423	48	-----	-----

Table S8. Presence of the 10 most abundant ASVs with differential abundance between impacted and less impacted sites for *Gorgonia ventalina* in Bonaire and Puerto Rico and *Eunicea flexuosa* in Bonaire. No ASVs are shown for *E. flexuosa* in Puerto Rico because none were differentially abundant. Presence is displayed as a percentage of the total colonies sampled per site type on each island.

ASV	Impacted sites	Less impacted sites
Gorgonia ventalina – Bonaire		
Endozoicomonas-2	47.4%	93.1%
Gammaproteobacteria-1	0.0%	96.6%
Tychonema-1	15.8%	51.7%
Burkholderiaceae-1	73.7%	44.8%
Caedibacter-1	26.3%	62.1%
Oligoflexaceae-1	0.0%	24.1%
Gorgonia ventalina – Puerto Rico		
Endozoicomonas-2	95.3%	100.0%
Escherichia-Shigella-1	95.3%	96.7%
Tychonema-1	9.3%	30.0%
Eunicea flexuosa – Bonaire		
Endozoicomonas-3	69.4%	86.7%
Endozoicomonas-4	50.0%	6.7%
Mycoplasma-1	11.1%	46.7%
Mollicutes-1	44.4%	0.0%
Mycoplasma-2	0.0%	50.0%
Synechococcus CC9902-1	72.2%	46.7%
Endozoicomonas-8	0.0%	13.3%
Endozoicomonas-9	0.0%	13.3%

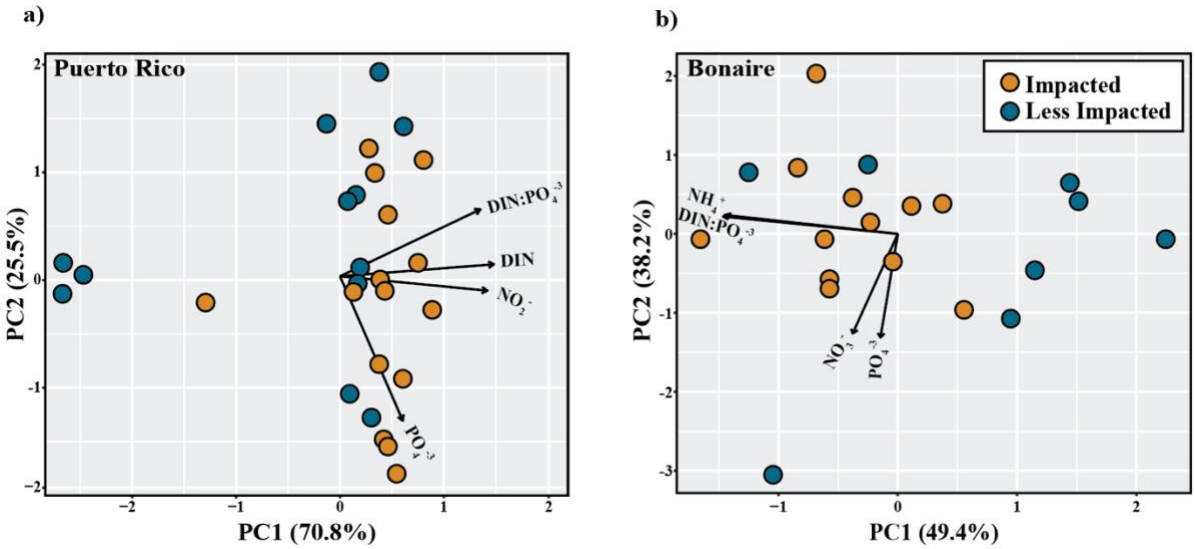

Figure S1. Principle components analysis (PCA) of the four water quality parameters that contributed the most to distinguishing impacted (orange) and less impacted (blue) sites in a) Puerto Rico, and b) Bonaire.

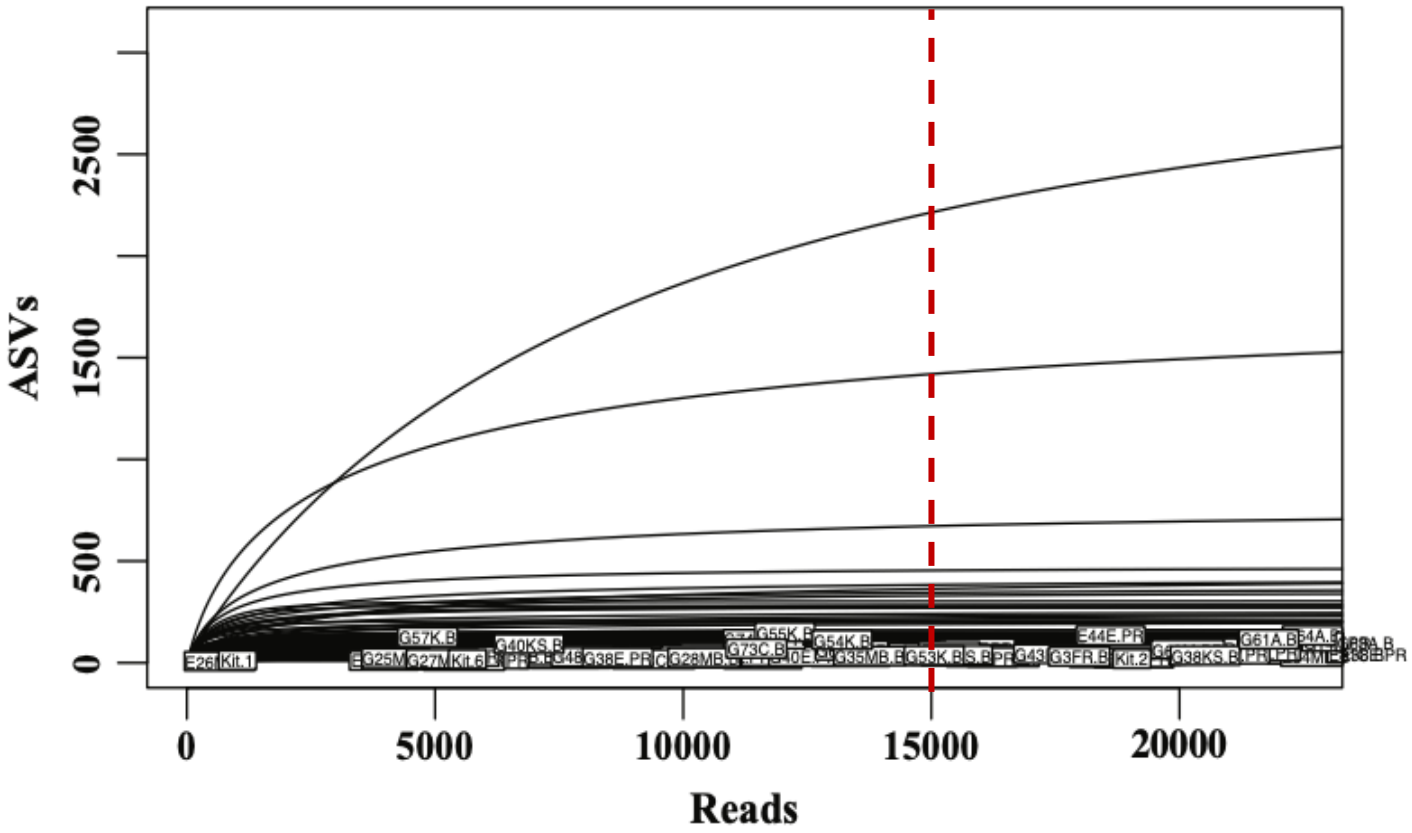

Figure S2. Rarefaction curve showing the number of ASVs associated with each coral sample as read count increases. Black lines are labeled with sample name and end at the maximum number of reads in each sample. The dashed red line indicates the read count chosen for rarefaction (15,000).

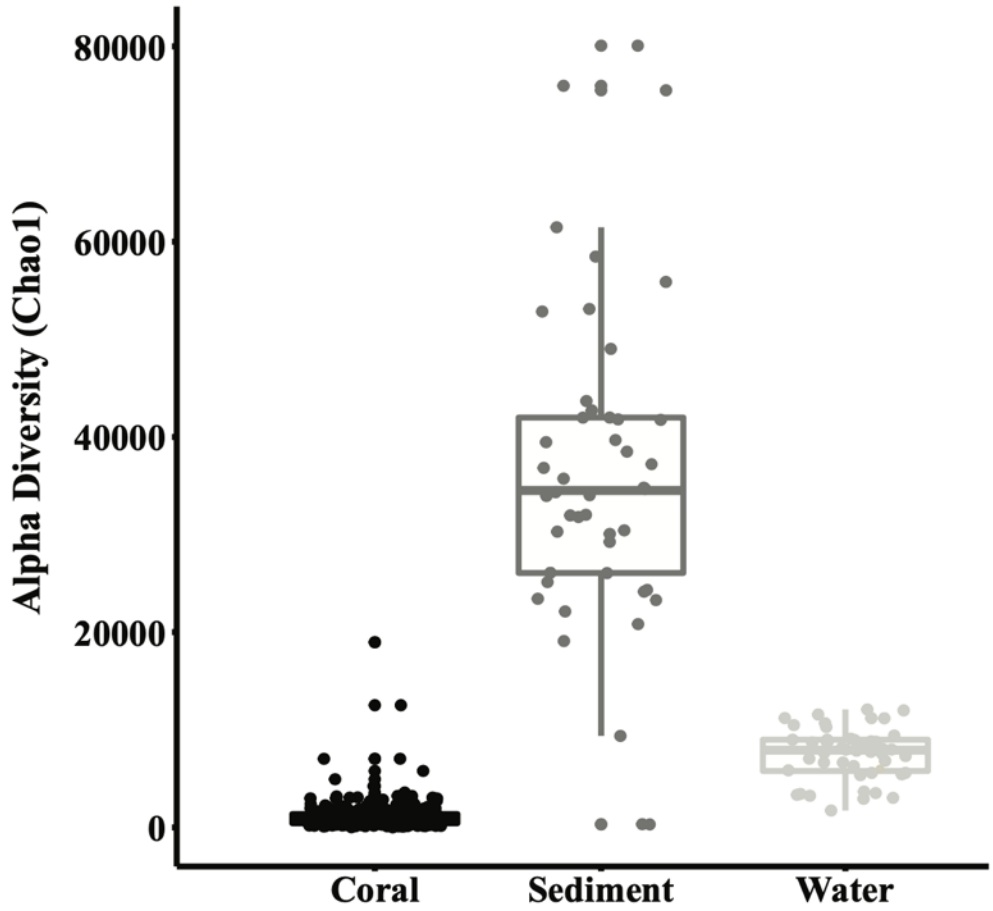

Figure S3. Alpha diversity (Chao1) box plot of 99% OTUs for coral (black), sediment (dark gray), and water (light gray). The lower and upper hinges represent the first and third quartiles. The lower and upper whiskers extend to either the largest or smallest value that is no more than 1.5* the interquartile range (i.e., distance between the first and their quartiles). Each sample is plotted as an individual point.

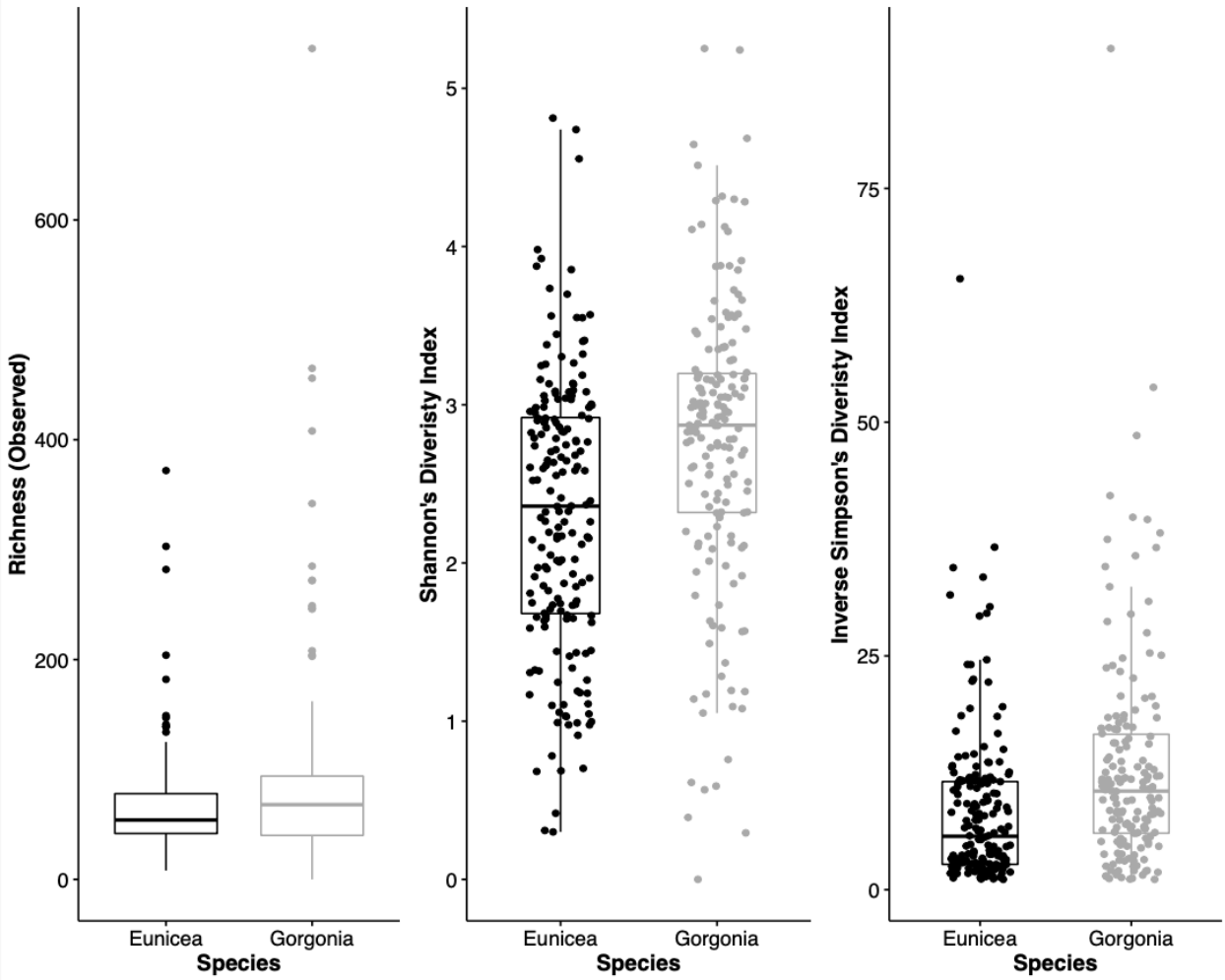

Figure S4. ASV alpha diversity (Richness, Shannon's Diversity and Inverse Simpson's Diversity) box plots for rarefied *Eunicea flexuosa* (black) and *Gorgonia ventalina* (gray) samples. The lower and upper hinges represent the first and third quartiles. The lower and upper whiskers extend to either the largest or smallest value that is no more than 1.5* the interquartile range (i.e., distance between the first and their quartiles). Outliers are plotted as individual points.

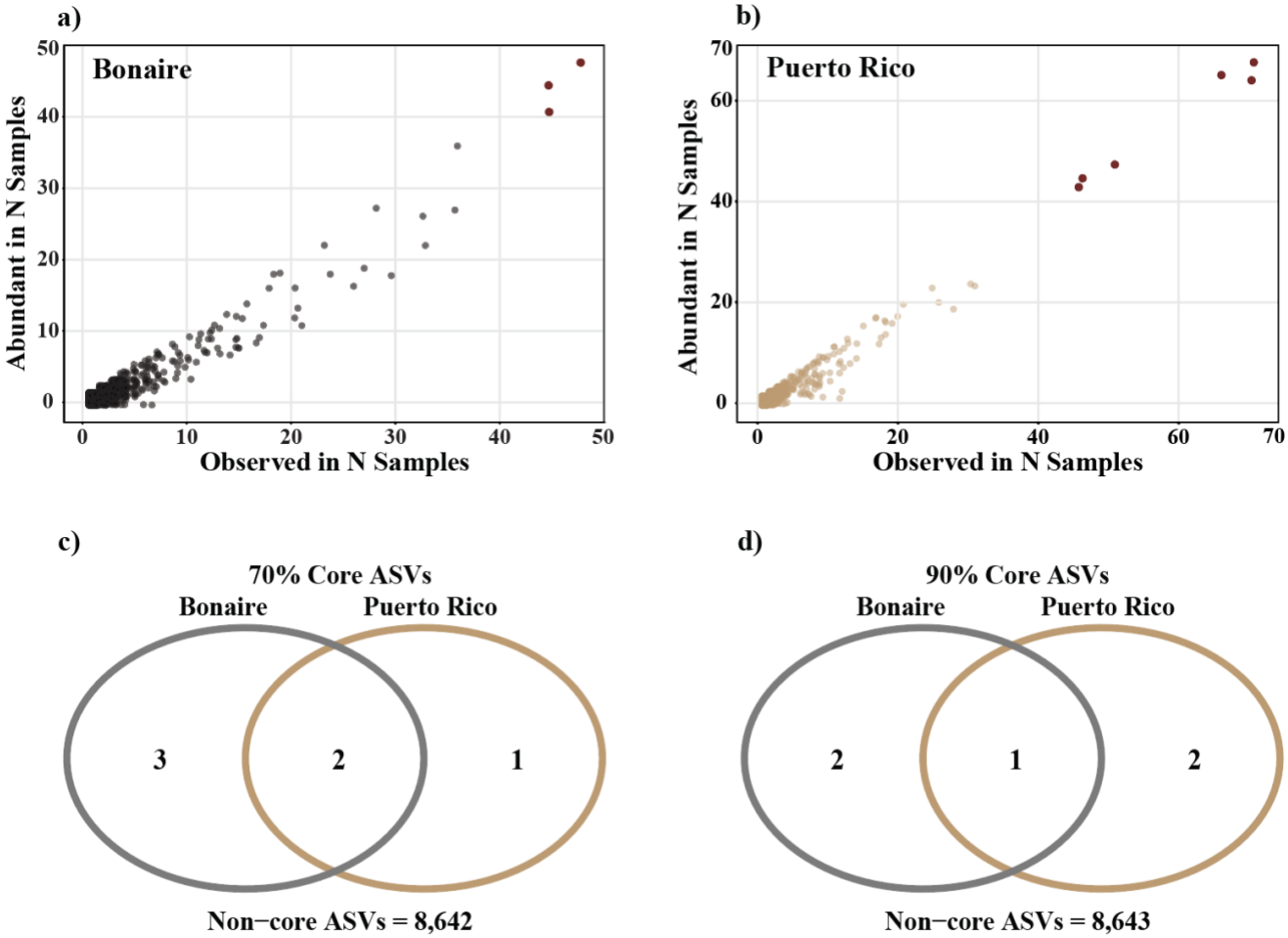

Figure S5. Geographic variation in the microbiome core for rarefied *Gorgonia ventalina* samples. Core scatterplots plot the number of samples from a particular group that each ASV (Bonaire ASVs = black; Puerto Rico ASVs = tan) is observed in against the number of samples it is abundant in (≥1% abundance threshold). Red dots indicate the ASVs that are abundant in more than 40 samples from a) Bonaire and b) Puerto Rico. Venn diagrams illustrating the number of ASVs belonging to the c) 70% core (i.e., present in at least 70% samples in the defined group), and d) 90% core (i.e., present in at least 90% samples in the defined group) for Bonaire, Puerto Rico and all *G. ventalina* samples.

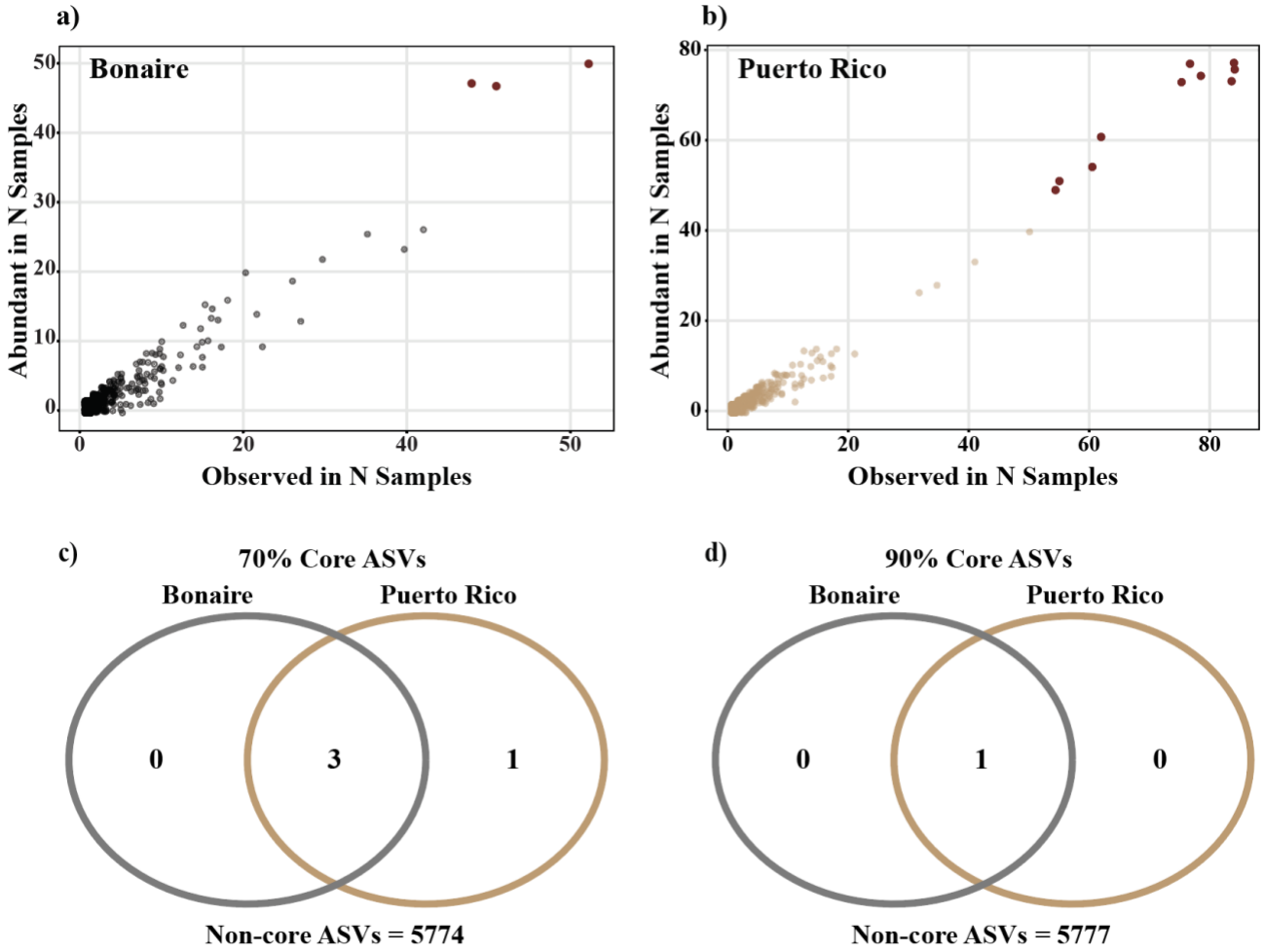

Figure S6. Geographic variation in the microbiome core for rarefied *Eunicea flexuosa* samples. Core scatterplots plot the number of samples from a particular group that each ASV (Bonaire ASVs = black; Puerto Rico ASVs = tan) is observed in against the number of samples it is abundant in (≥1% abundance threshold). Red dots indicate the ASVs that are abundant in more than 40 samples from a) Bonaire and b) Puerto Rico. Venn diagrams illustrating the number of ASVs belonging to the c) 70% core (i.e., present in at least 70% samples in the defined group), and d) 90% core (i.e., present in at least 90% samples in the defined group) for Bonaire, Puerto Rico and all *E. flexuosa* samples.

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