Revised Supplemental Material

Regional Similarity and Consistent Patterns of Local Variation in Beach Sand Bacterial Communities throughout the Northern Hemisphere

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Running title: Characterization of bacteria in beach sands

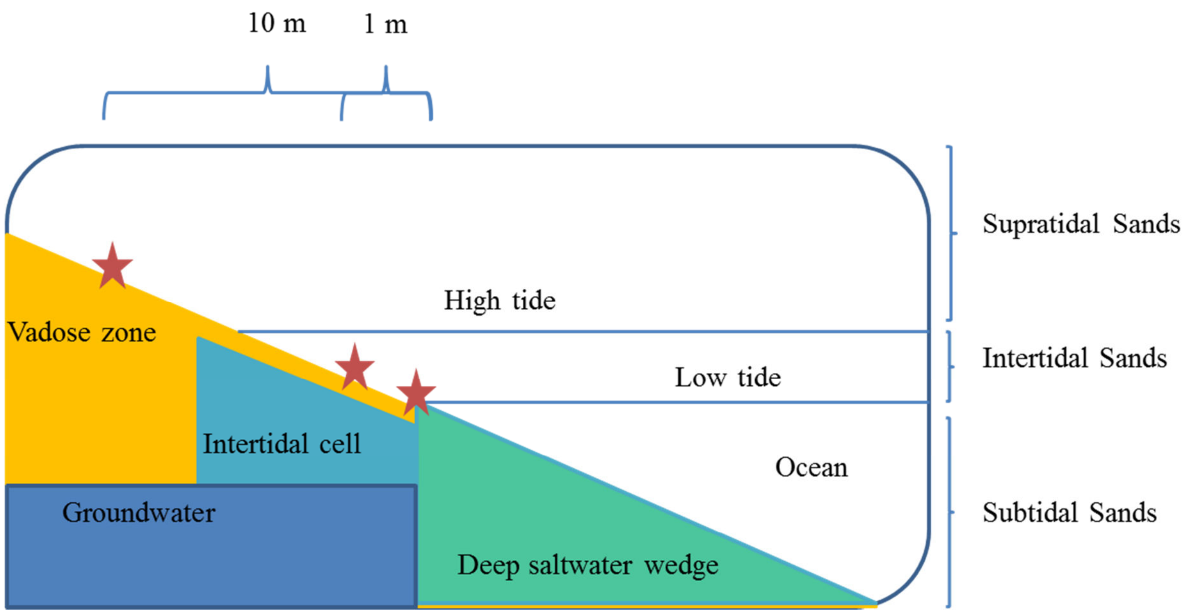


Figure S1. Diagram of beach features and sampling locations (stars).

A

B

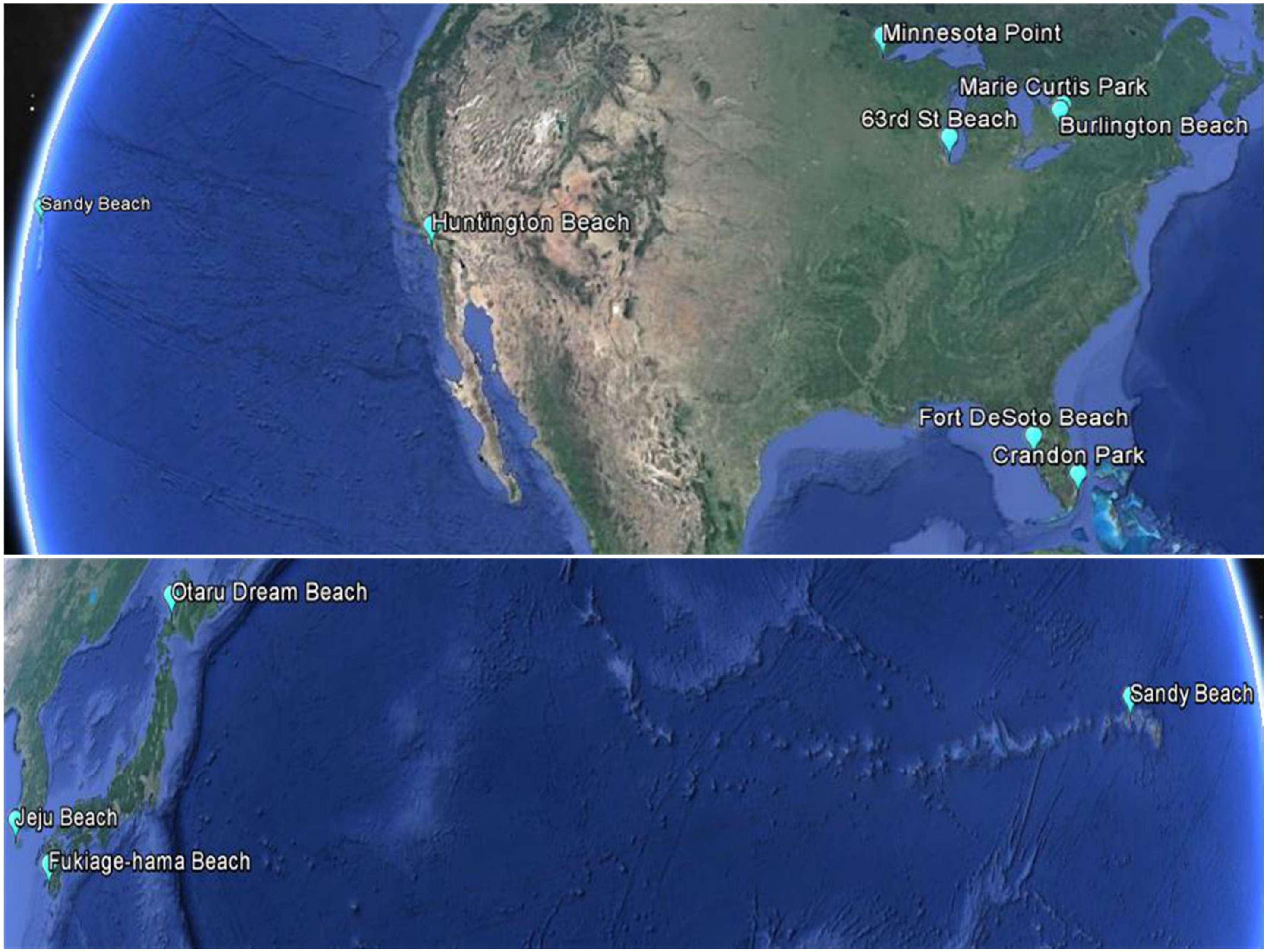


Figure S2 – Locations of beaches sampled (A) in the United States and (B) in the Pacific Ocean. This map was generated using Google Earth.

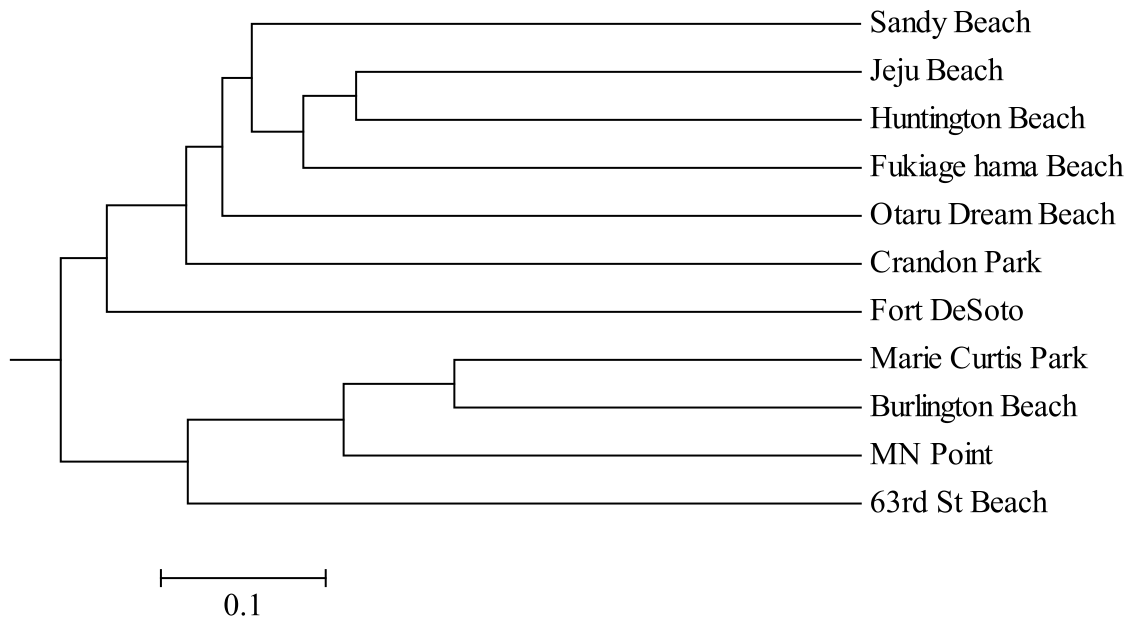


Figure S3. Phylogenetic tree of Bray-Curtis dissimilarities among sampling sites constructed using the unweighted pair group method with arithmetic mean.

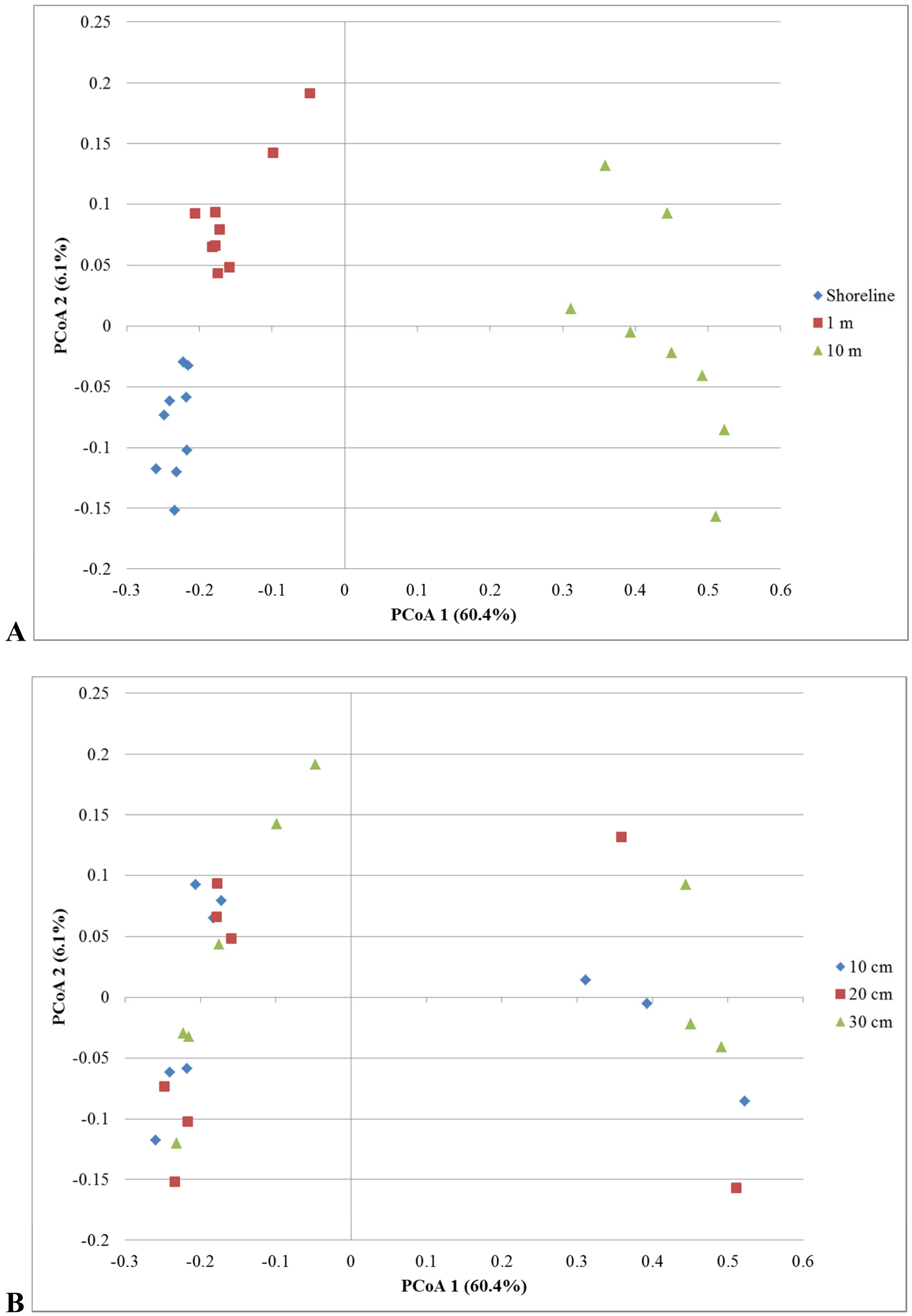
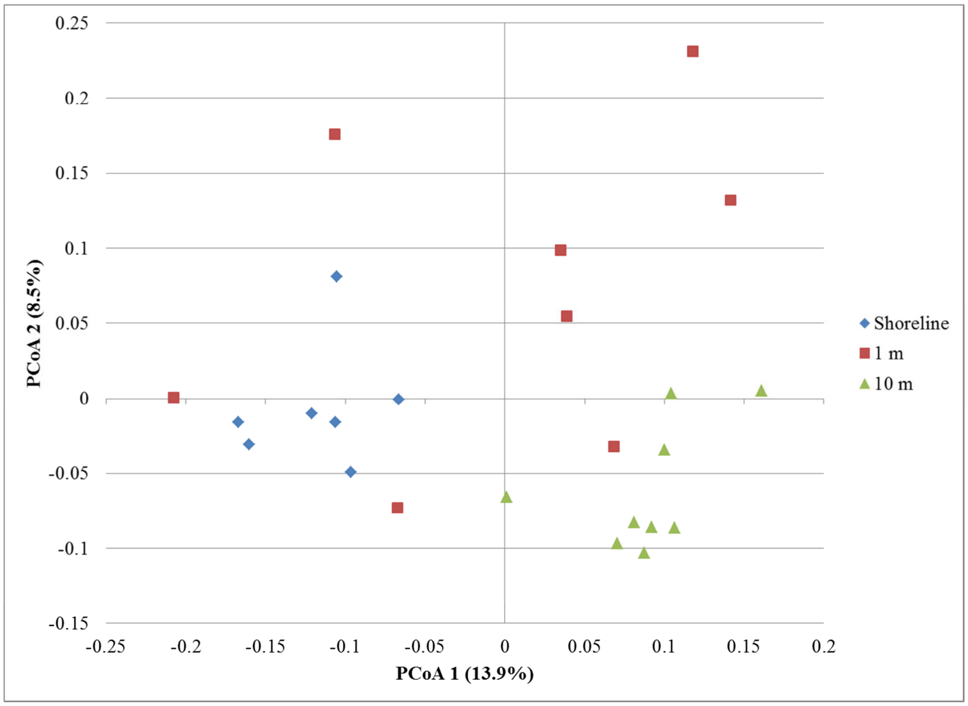
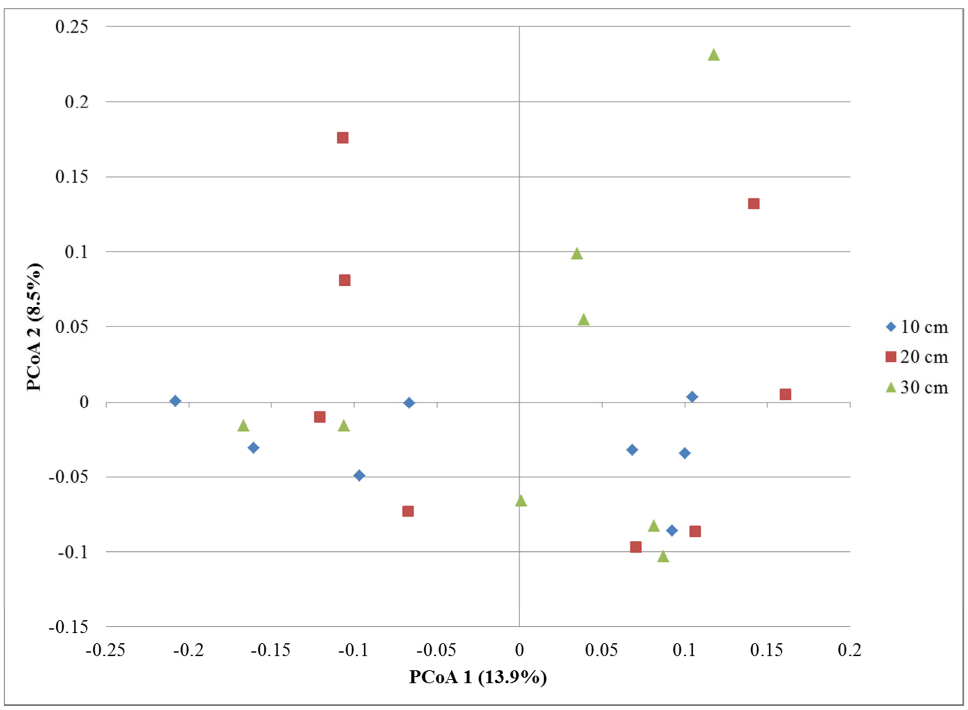


Figure S4 - Principal coordinate analysis of samples collected from MN Point by distance (A) and depth (B). The relationship between the ordination plot and distance matrix: $r^2 = 0.96$.

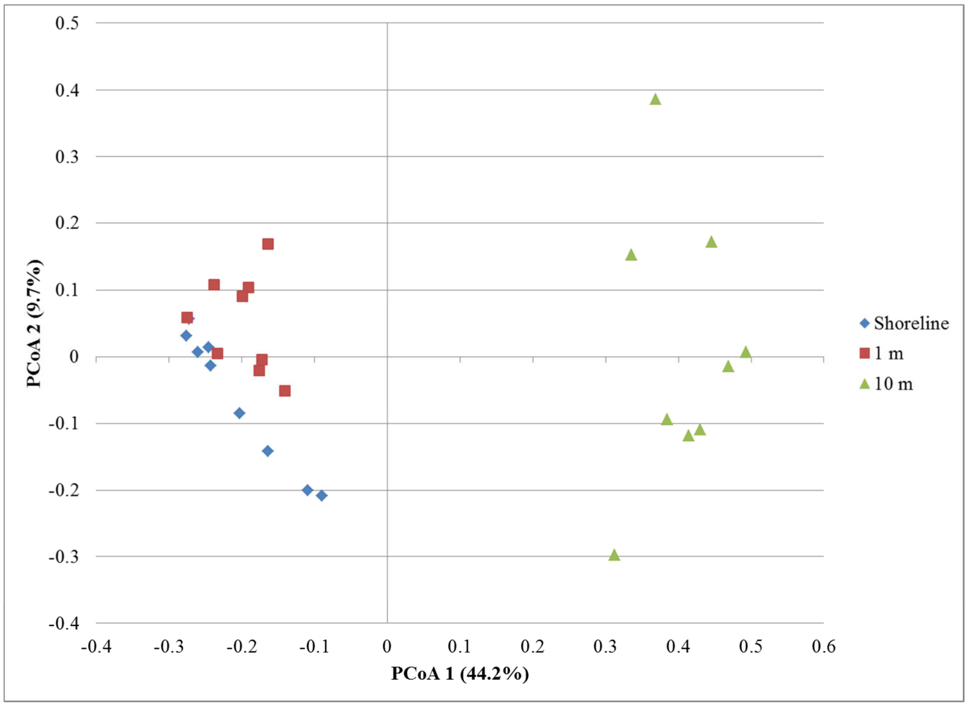


A

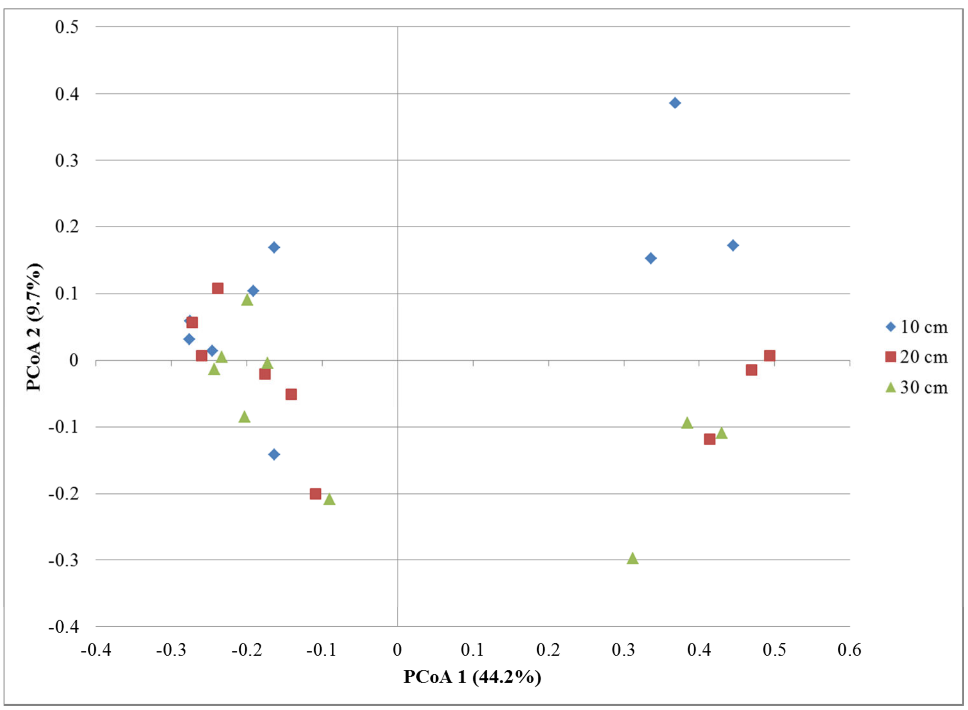


B

Figure S5 - Principal coordinate analysis of samples collected from Burlington Beach by distance (A) and depth (B). The relationship between the ordination plot and distance matrix: $r^2 = 0.49$.

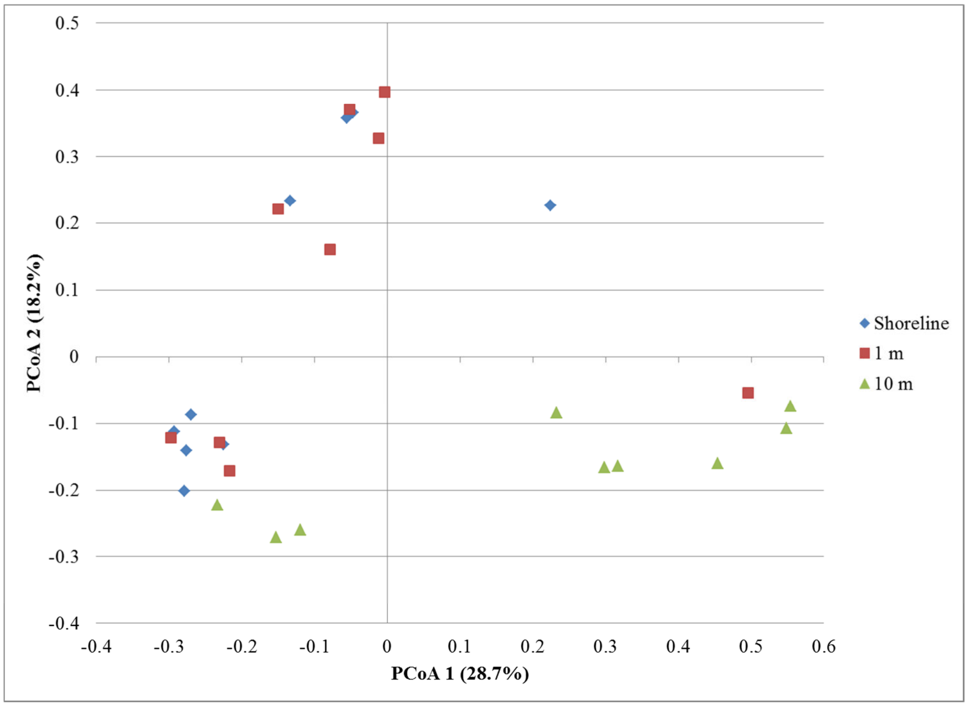


A

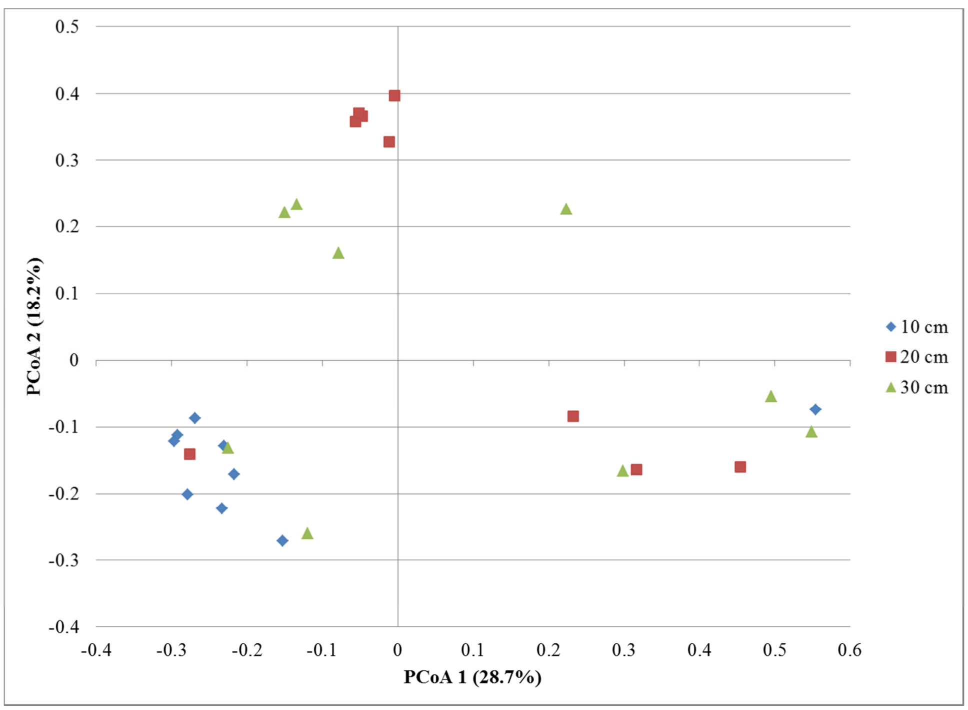


B

Figure S6 - Principal coordinate analysis of samples collected from Marie Curtis Park by distance (A) and depth (B). The relationship between the ordination plot and distance matrix: r^2 = 0.92.

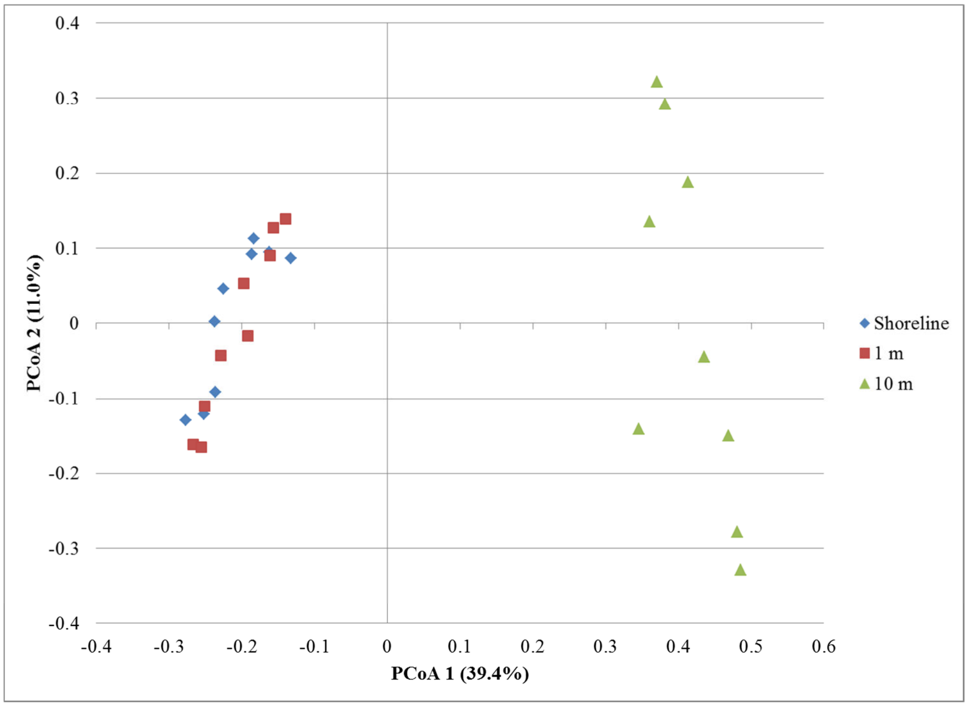


A

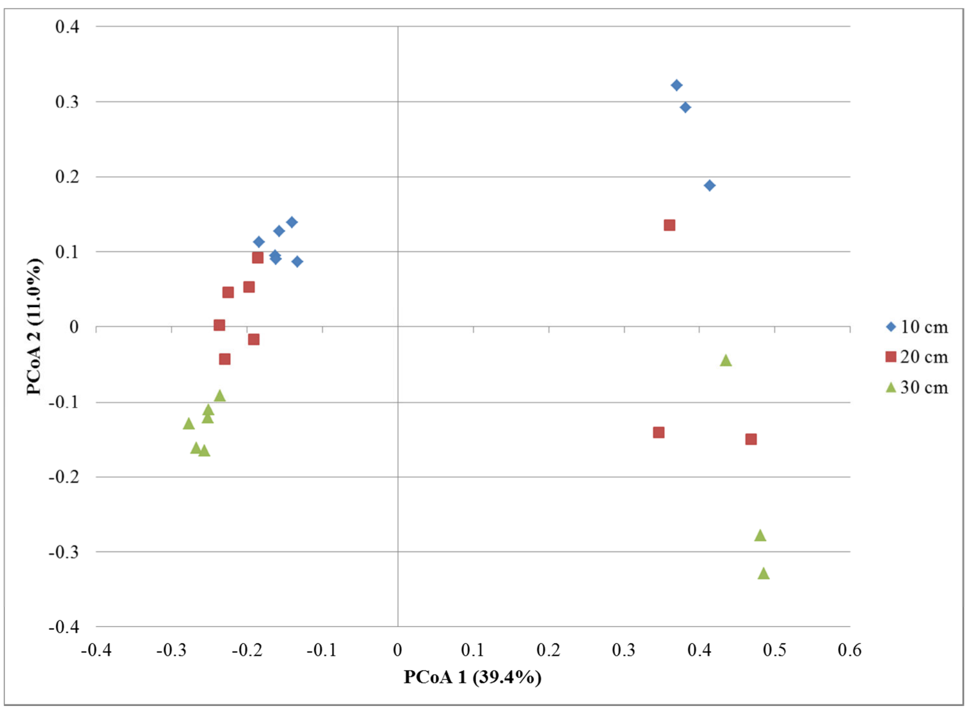


B

Figure S7 - Principal coordinate analysis of samples collected from Fort DeSoto by distance (A) and depth (B). The relationship between the ordination plot and distance matrix: $r^2 = 0.78$.

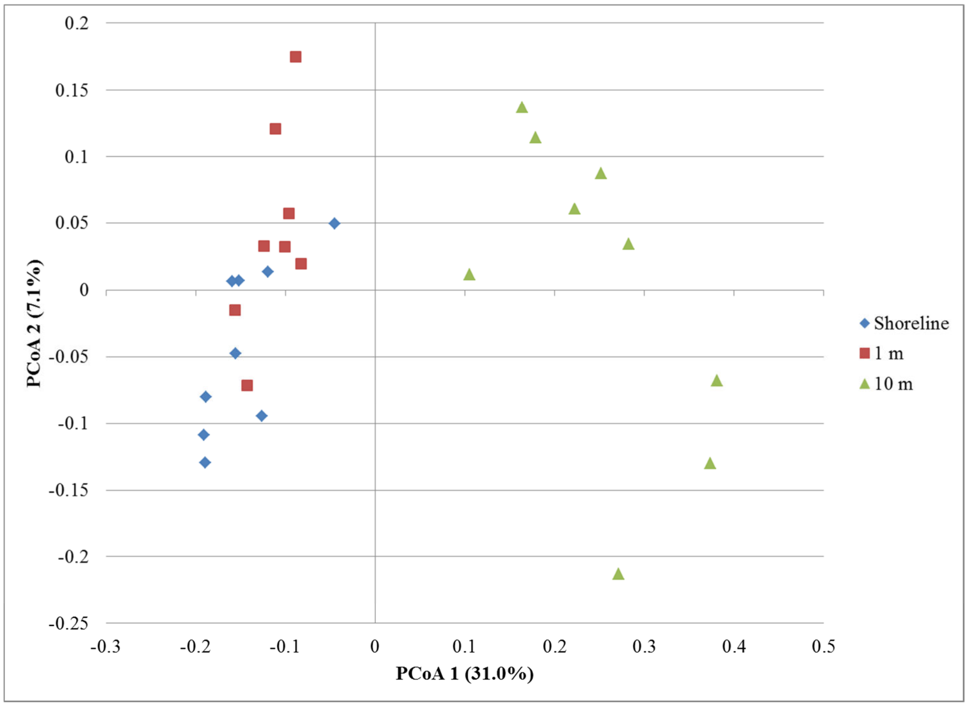


A

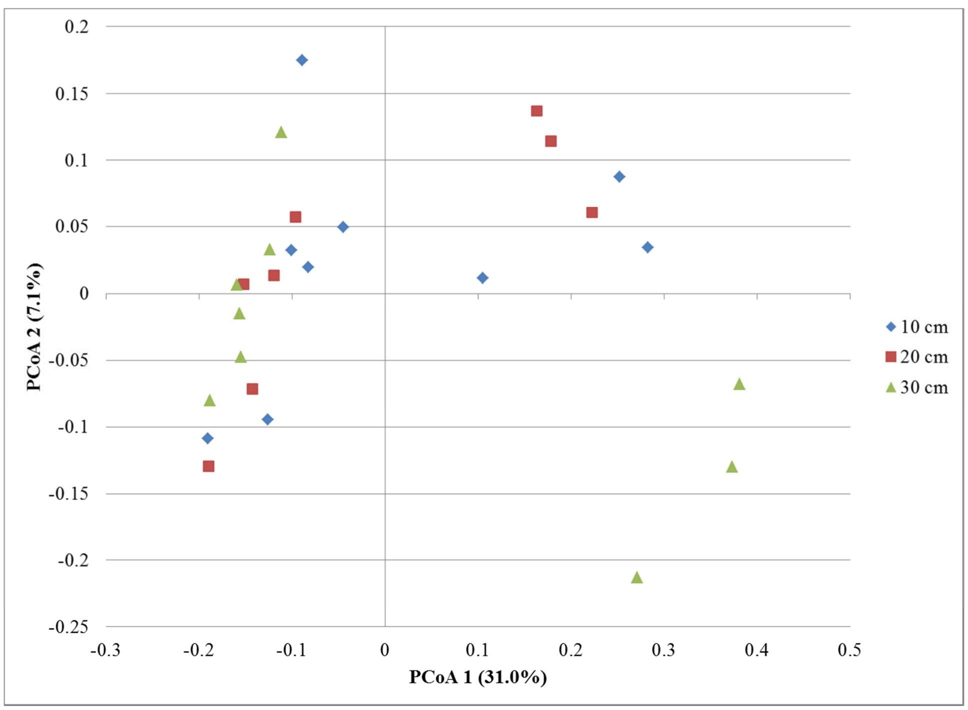


B

Figure S8 - Principal coordinate analysis of samples collected from Crandon Park by distance (A) and depth (B). The relationship between the ordination plot and distance matrix: $r^2 = 0.93$.

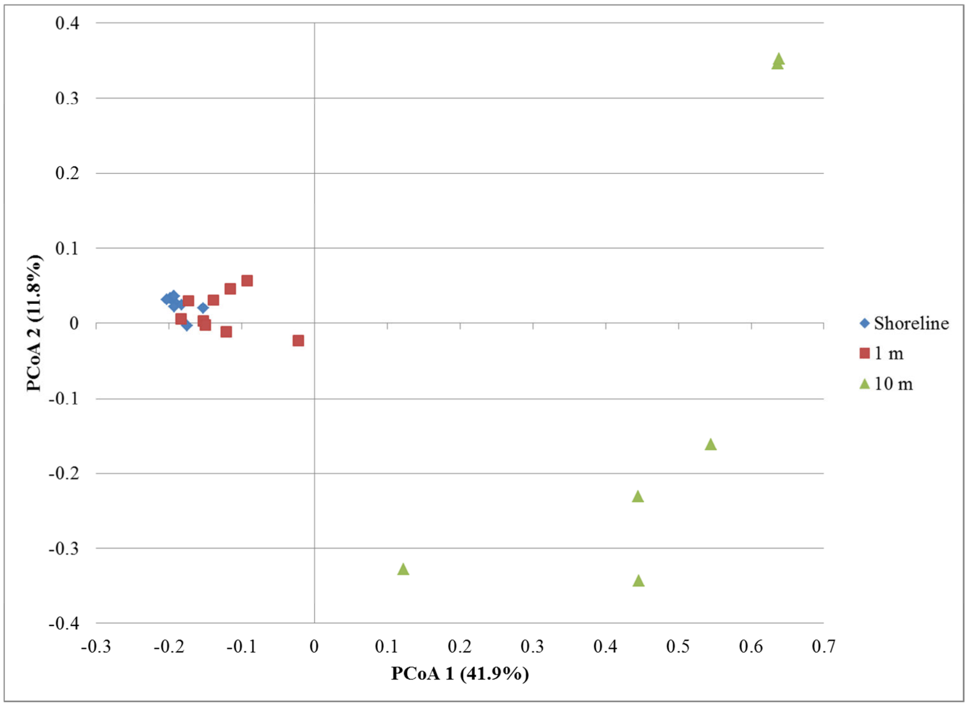


A

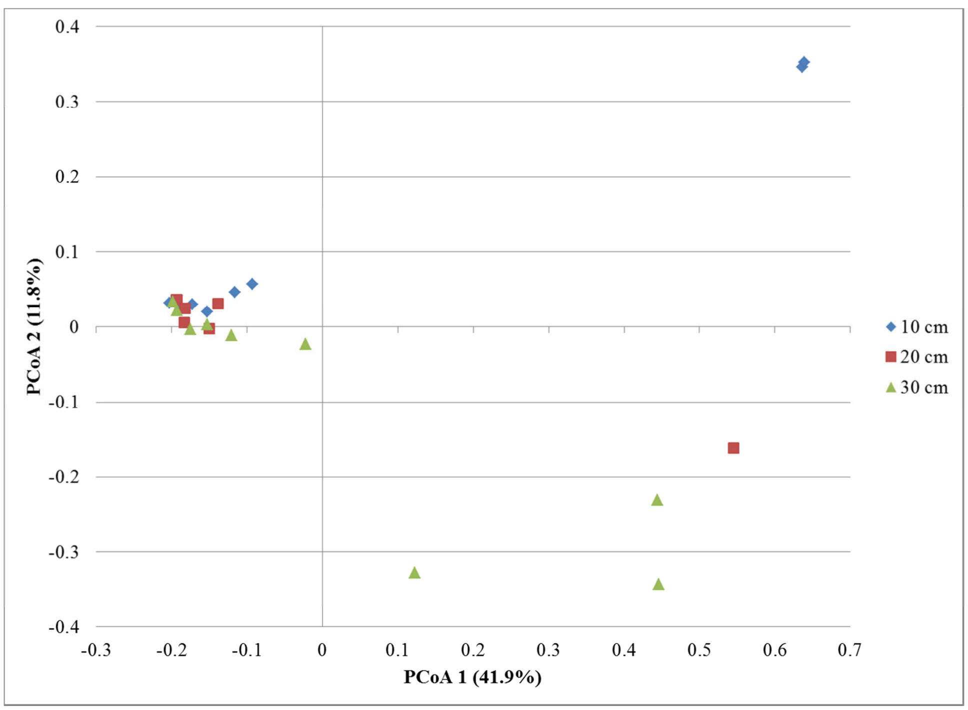


B

Figure S9 - Principal coordinate analysis of samples collected from Huntington Beach by distance (A) and depth (B). The relationship between the ordination plot and distance matrix: r^2 = 0.89.

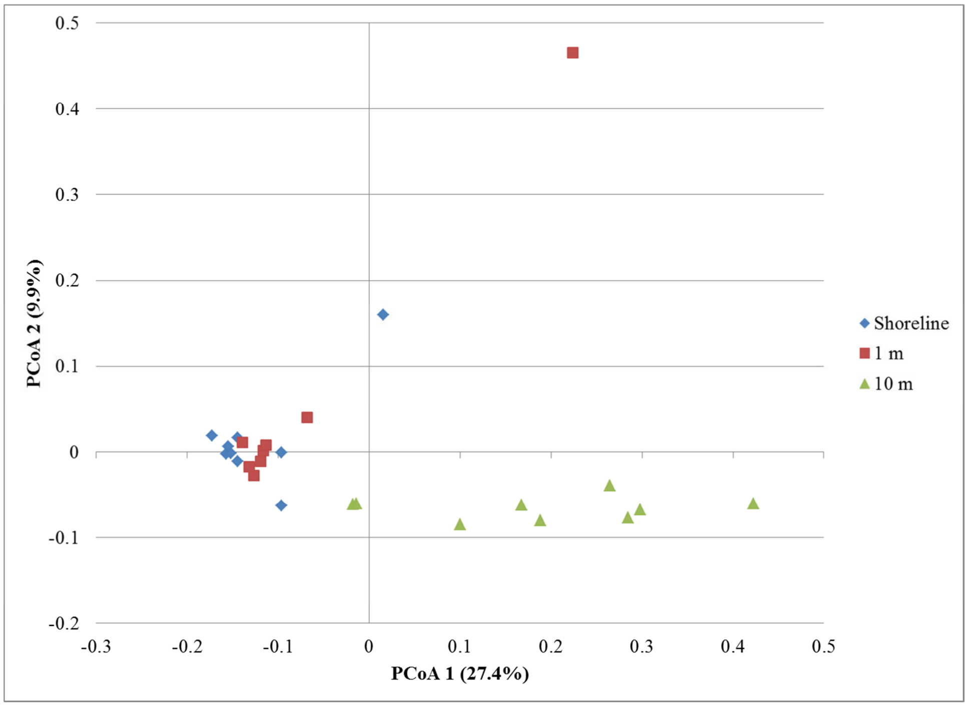


A

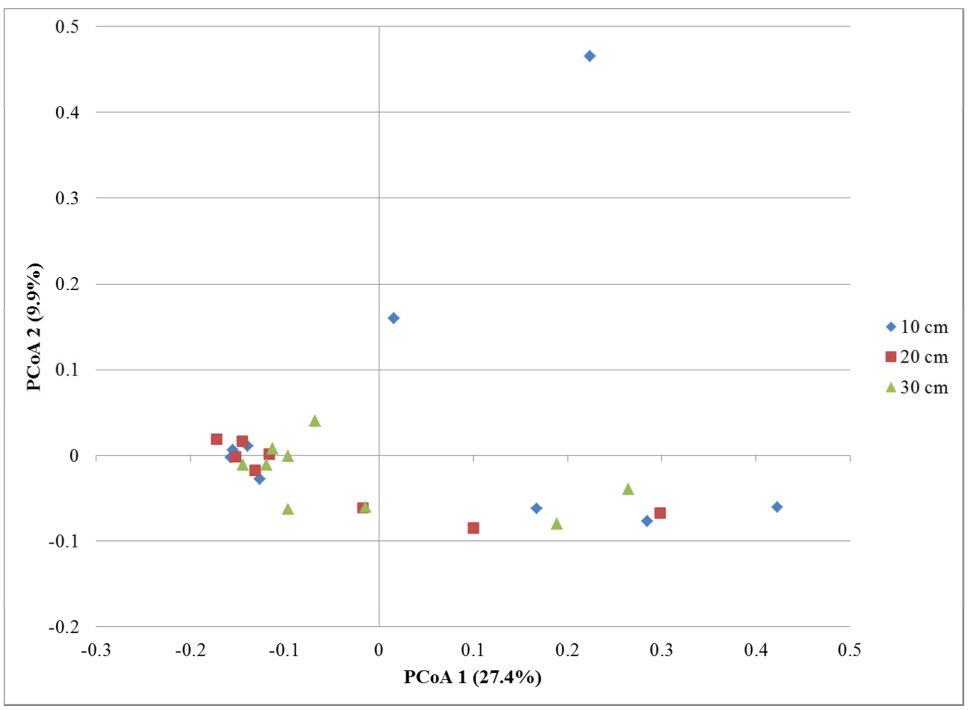


B

Figure S10 - Principal coordinate analysis of samples collected from Sandy Beach by distance (A) and depth (B). The relationship between the ordination plot and distance matrix: $r^2 = 0.96$.



A



B

Figure S11 - Principal coordinate analysis of samples collected from Otaru Dream Beach by distance (A) and depth (B). The relationship between the ordination plot and distance matrix: $r^2 = 0.89$.

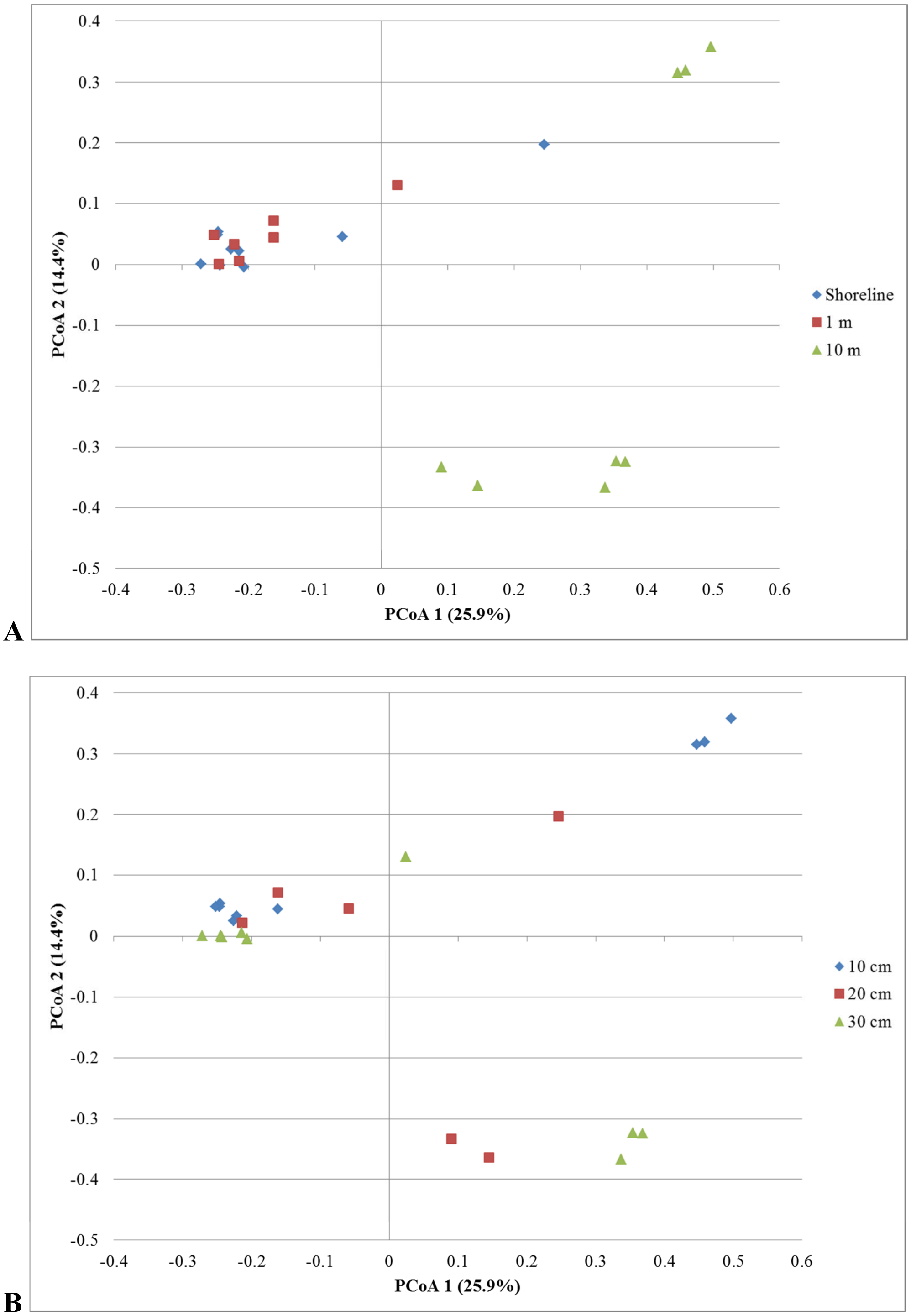


Figure S12 - Principal coordinate analysis of samples collected from Fukiage-hama Beach by distance (A) and depth (B). The relationship between the ordination plot and distance matrix: r^2 = 0.85.

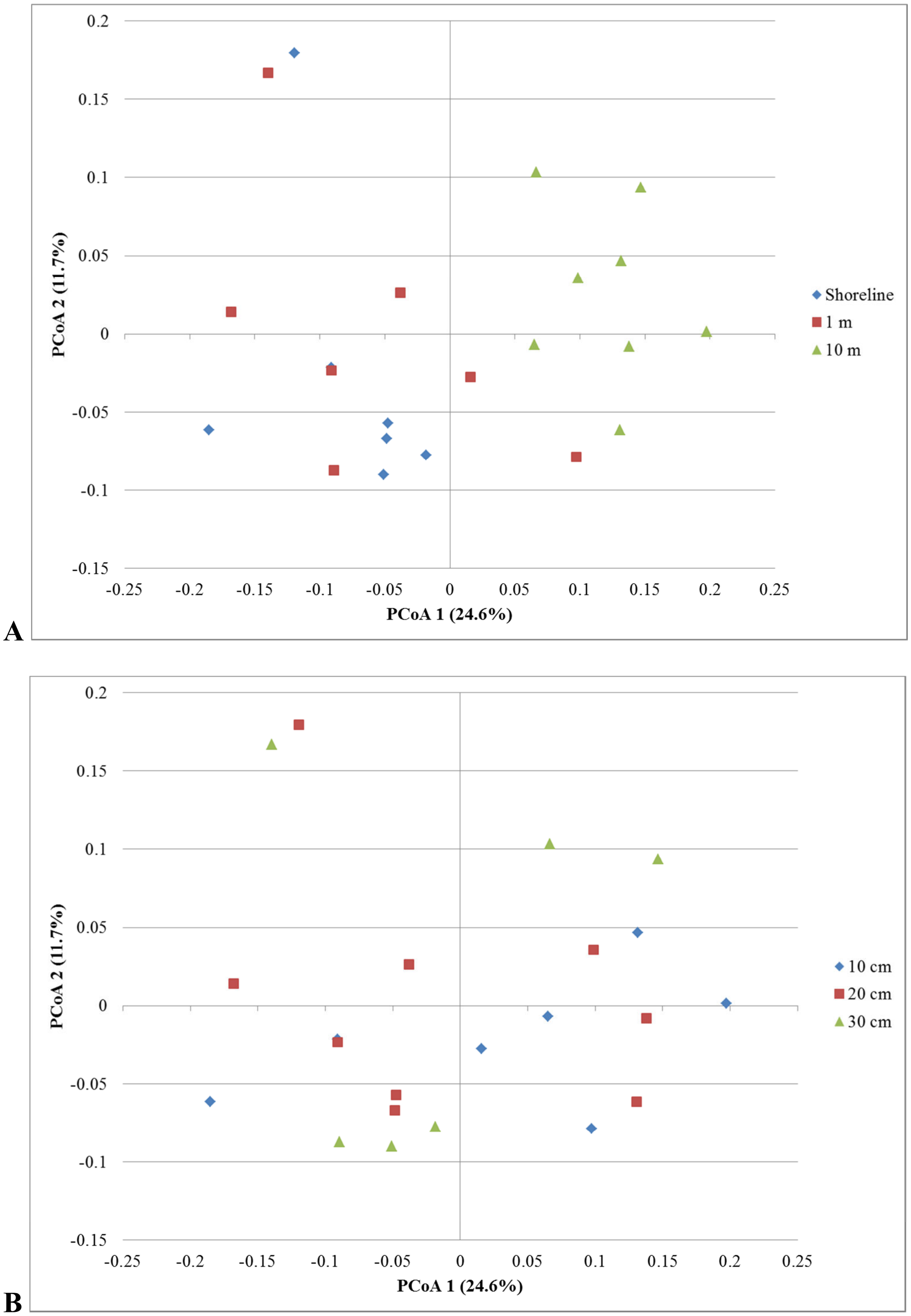


Figure S13 - Principal coordinate analysis of samples collected from Jeju Beach by distance (A) and depth (B). The relationship between the ordination plot and distance matrix: $r^2 = 0.90$.

Table S1 – Shannon (A) and ACE (B) indices (mean ± standard deviation) for Great Lakes beaches by transect, distance from shoreline, and depth.

A	Distance	Depth	Transect A	Transect B	Transect C
		10cm	5.76 ± 0.09	5.73 ± 0.07	5.89 ± 0.21
	Shoreline[a]	20cm	5.74 ± 0.16	5.76 ± 0.20	5.92 ± 0.37
		30cm	5.87 ± 0.16	5.81 ± 0.26	5.97 ± 0.39
		10cm	5.48 ± 0.31	5.57 ± 0.32	5.66 ± 0.13
	1m[a,b]	20cm	5.68 ± 0.10	5.83 ± 0.30	5.87 ± 0.24
		30cm	5.89 ± 0.19	5.75 ± 0.33	5.63 ± 0.17
		10cm	5.68 ± 0.40	5.62 ± 0.36	5.30 ± 0.75
	10m[b]	20cm	5.57 ± 0.72	6.06 ± 0.31	5.49 ± 0.70
		30cm	5.54 ± 0.85	5.55 ± 0.76	5.33 ± 0.57

[a,b]Differences in diversity were significant due to distance (P = 0.031) and superscripts indicate *post-hoc* significance. Differences due to depth were not significant (P = 0.497).

B	Distance	Depth	Transect A	Transect B	Transect C
		10cm	2132 ± 430	2013 ± 343	2497 ± 698
	Shoreline	20cm	2152 ± 858	2498 ± 1540	2401 ± 1149
		30cm	2577 ± 607	2141 ± 549	2488 ± 913
		10cm	1505 ± 675	1713 ± 762	2364 ± 202
	1m	20cm	2326 ± 1253	2168 ± 649	2520 ± 659
		30cm	2329 ± 450	2162 ± 658	1769 ± 189
		10cm	1929 ± 495	2258 ± 1014	2166 ± 1403
	10m	20cm	1946 ± 1011	2660 ± 910	2123 ± 907
		30cm	1873 ± 1125	1848 ± 764	2424 ± 1470

Differences in diversity were not significant due to distance (P = 0.436) or depth (P = 0.472).

Table S2 – Shannon (A) and ACE (B) indices (mean ± standard deviation) for Pacific Ocean beaches by transect, distance from shoreline, and depth.

A	Distance	Depth	Transect A	Transect B	Transect C
		10cm	6.05 ± 0.28	5.89 ± 0.33	6.14 ± 0.20
	Shoreline[a]	20cm	6.03 ± 0.39	5.94 ± 0.42	5.67 ± 0.99
		30cm	6.11 ± 0.35	6.01 ± 0.32	6.11 ± 0.28
		10cm	6.15 ± 0.18	6.08 ± 0.10	5.58 ± 0.56
	1m[a]	20cm	6.16 ± 0.20	6.06 ± 0.23	6.35 ± 0.19
		30cm	5.96 ± 0.47	6.13 ± 0.19	6.05 ± 0.21
		10cm	5.17 ± 1.25	5.36 ± 1.26	5.07 ± 1.32
	10m[b]	20cm	5.92 ± 0.30	5.98 ± 0.19	6.05 ± 0.12
		30cm	6.04 ± 0.13	5.94 ± 0.35	5.80 ± 0.50

[a,b]Differences in diversity were significant due to distance ($P = 0.010$) and superscripts indicate *post-hoc* significance. Differences due to depth were also significant ($P = 0.042$), but *post-hoc* differences were not significant ($P \geq 0.057$).

B	Distance	Depth	Transect A	Transect B	Transect C
		10cm	3817 ± 2076	3530 ± 2376	4660 ± 2868
	Shoreline	20cm	3601 ± 1587	3868 ± 3353	3748 ± 2366
		30cm	3564 ± 2011	3812 ± 2636	3366 ± 1721
		10cm	4030 ± 1839	3481 ± 1517	1982 ± 791
	1m	20cm	4161 ± 2021	3677 ± 1617	5139 ± 1055
		30cm	3718 ± 2237	2876 ± 714	3031 ± 1681
		10cm	2417 ± 1933	2887 ± 1750	2667 ± 2252
	10m	20cm	3482 ± 2598	3230 ± 2216	4822 ± 2846
		30cm	3017 ± 1649	3176 ± 1970	2262 ± 1087

Differences in diversity were not significant due to distance ($P = 0.218$) or depth ($P = 0.305$).

Table S2 – Shannon (A) and ACE (B) indices (mean ± standard deviation) for Florida beaches by transect, distance from shoreline, and depth.

A	Distance	Depth	Transect A	Transect B	Transect C
		10cm	6.23 ± 0.18	6.40 ± 0.21	6.37 ± 0.33
	Shoreline	20cm	6.55 ± 0.03	6.51 ± 0.02	6.34 ± 0.18
		30cm	6.33 ± 0.37	6.49 ± 0.22	6.35 ± 0.34
		10cm	6.35 ± 0.14	6.62 ± 0.08	6.53 ± 0.04
	1m	20cm	6.52 ± 0.33	6.47 ± 0.13	6.53 ± 0.02
		30cm	6.31 ± 0.06	6.34 ± 0.36	6.44 ± 0.55
		10cm	6.17 ± 0.21	6.17 ± 0.05	6.27 ± 0.04
	10m	20cm	6.72 ± 0.12	6.50 ± 0.26	6.54 ± 0.28
		30cm	6.70 ± 0.08	6.41 ± 0.38	6.44 ± 0.44

Differences in diversity were not significant due to distance (P = 0.730) or depth (P = 0.064).

B	Distance	Depth	Transect A	Transect B	Transect C
		10cm	5458 ± 1235	5647 ± 1349	6249 ± 1981
	Shoreline[a,b]	20cm	7191 ± 2809	5864 ± 93	7656 ± 1959
		30cm	5375 ± 637	7006 ± 3248	6163 ± 3676
		10cm	4543 ± 1632	7015 ± 1134	5787 ± 3727
	1m[a]	20cm	5418 ± 3506	7356 ± 1694	7562 ± 1803
		30cm	5664 ± 1903	7116 ± 4124	8707 ± 5743
		10cm	5727 ± 4056	3131 ± 1328	5583 ± 358
	10m[b]	20cm	4458 ± 559	4573 ± 2067	3913 ± 382
		30cm	6511 ± 4163	4813 ± 1513	4962 ± 772

[a,b]Differences in diversity were significant due to distance (P = 0.041) and superscripts indicate *post-hoc* significance. Differences due to depth were not significant (P = 0.555).