Supplement 2 – Abundance-based multivariate analysis

To illustrate the insensitivity of the temporal patterns in community change that were observed in the Southern California Bight to different analytical approaches, we replicated all of the multivariate analyses using taxon abundance data instead of taxon presence/absence data.

Changes in benthic faunal community composition were characterized using non-metric Multidimensional Scaling (nMDS) ordination. Bray-Curtis dissimilarity values were calculated based on taxa abundance (zeros included) through time at each sample site. Dissimilarity values were ordinated 2-d nMDS across a minimum of 250 iterations. A 1-way Permutational Multivariate Analysis of Variance (PERMANOVA) was then used to quantify the influence of time on community structure from each sampling site. PERMANOVAs were conducted (10,000 permutations) on Bray-Curtis dissimilarities as the response variable and year of collection as the predictor variable. The correlation between year of collection and the pattern in 2-d ordinations was also calculated across 1,000 permutations. All similarity calculations, ordinations, PERMANOVAs, and correlations were conducted in the vegan package (v2.6-2) (Oksanen et al 2022) in R (v3.6.1) using the metaMDS, adonis2, and envfit functions.

Though there are slight differences in the ordination plots between Figure S1 and Figure 2 in the main body of the text, the pattern of change is still clearly apparent. There is a gradual, unidirectional change in the composition of the communities at all for sites and across all three depth zones. These visual patterns are similarly echoed by the results of the multivariate correlations of the ordinations with year of collection (Table S3) and PERMANOVAS of community composition predicted by year (Table S4).

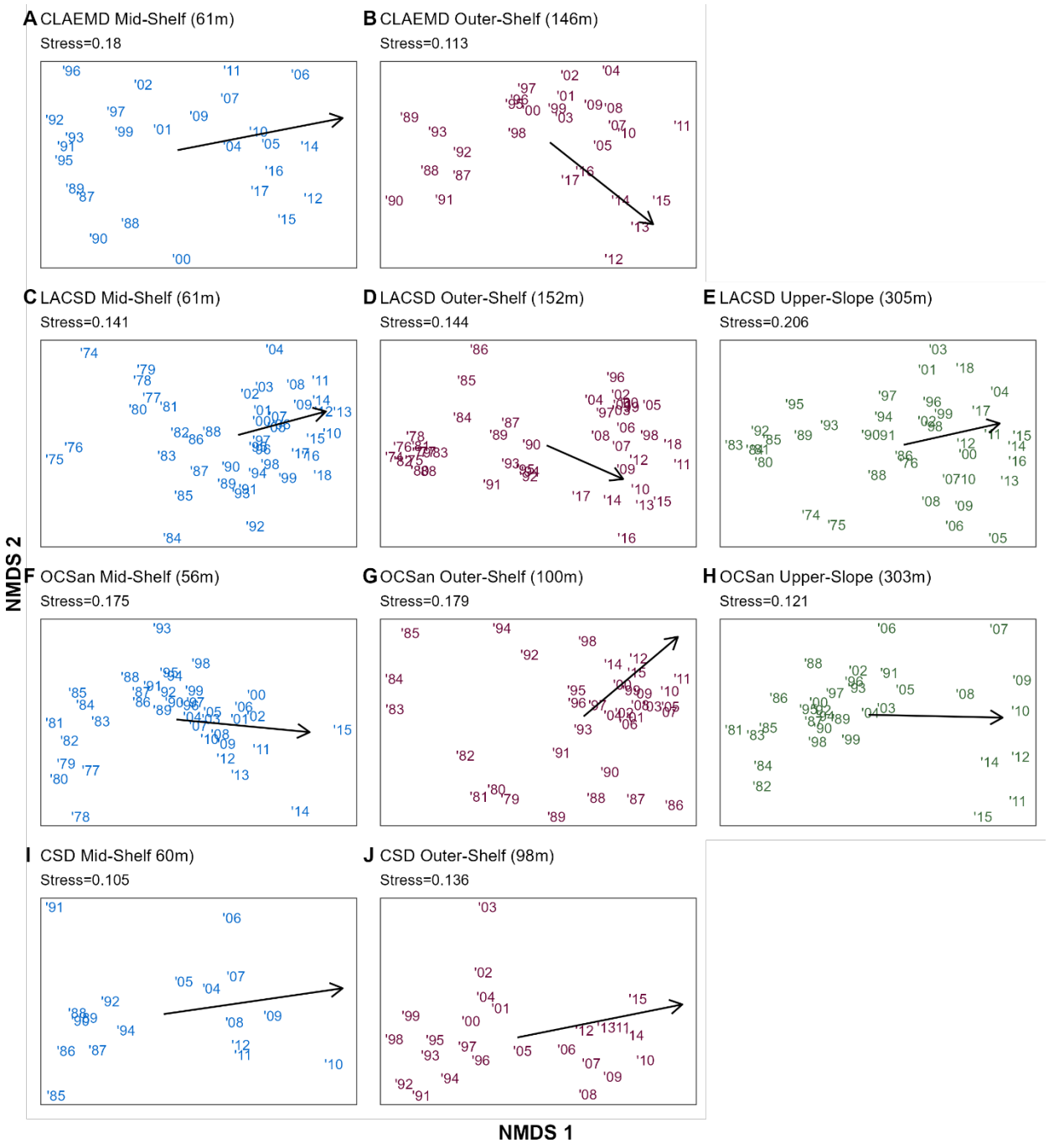

Figure S1 A 2-D nMDS ordination plots of Bray-Curtis dissimilarity values of benthic infauna communities at each of the sampling sites from each year across the breadth of the data set. The two-digit numbers represent the year of collection (i.e., 1998=98, 2001=01). The black arrows indicate the trend of time across the different ordinations based upon the multivariate correlations (Table S3). Ordinations based upon dissimilarities of taxa abundance data with a minimum of 250 iterations.

Table S3 Multivariate correlation of year of sampling with the nMDS ordinations presented in Figure S1. Correlations were calculated across 1,000 permutations.

Depth Zone	Sample Location	r	p-value
Mid-Shelf	CLAEMD	0.92	0.002
	LACSD	0.95	0.002
	OCSan	0.93	0.002
	CSD	0.96	0.002
Outer-Shelf	CLAEMD	0.91	0.002
	LACSD	0.95	0.002
	OCSan	0.91	0.002
	CSD	0.95	0.002
Upper-Slope	LACSD	0.84	0.002
	OCSan	0.91	0.002

Table S4 Outputs of 1-way PERMANOVAs testing the differences in macrobenthic community structure through time at the different depth zones of each of the four sampling locations based upon Bray-Curtis dissimilarities of taxon abundance over 10,000 permutations.

Depth Zone	Sample Location	Term	Df	SS	Pseudo r^2	F	p-value
Mid-Shelf	CLAEMD	Year	1	1.494	0.30	11.48	<0.001
		Residual	27	3.515	0.70		
	LACSD	Year	1	2.488	0.23	13.07	<0.001
		Residual	43	8.189	0.77		
	OCSan	Year	1	1.352	0.15	6.64	<0.001
		Residual	37	7.537	0.85		
	CSD	Year	1	0.792	0.29	6.38	<0.001
		Residual	16	1.986	0.71		
Outer-Shelf	CLAEMD	Year	1	1.133	0.19	5.52	<0.001
		Residual	24	4.928	0.81		
	LACSD	Year	1	3.551	0.26	14.86	<0.001
		Residual	43	10.274	0.74		
	OCSan	Year	1	1.437	0.18	7.55	<0.001
		Residual	34	6.469	0.82		
	CSD	Year	1	1.002	0.21	6.15	<0.001
		Residual	23	3.749	0.79		
Upper-Slope	LACSD	Year	1	1.675	0.13	5.56	<0.001
		Residual	38	11.457	0.87		
	OCSan	Year	1	1.685	0.26	10.83	<0.001
		Residual	31	4.826	0.74		