**Supplemental Material to**:

**Characterizing Community Structure of Benthic Infauna from the Continental Slope of the Southern California Bight**

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**Supplemental Material #1 Clustering of Reference Samples**

Figure S1-1 represents a cluster dendrogram of reference samples (Station-Year) from continental slope ecosystem of the Southern California Bight illustrating sample groups used to establish potential macrobenthic assemblages and habitats. Taxa were lumped to the genus level and only the 90% most frequently observed taxa (i.e., taxa observed in a sample) were used in the clustering. Samples were clustered using Bray-Curtis dissimilarities of untransformed abundances and a hierarchical sorting algorithm with unweighted pair groups. Colors correspond to clusters trimmed to produce the fewest number of single-sample clusters.

**Figure S1-1 – Genus-level dendrogram**

As noted in the main text, A picture containing compact disk, vector graphics

Description automatically generateddifferent degrees of taxonomic resolution – species (Figure S1-2), genus, or family (Figure S1-3) – were investigated to identify most useful taxonomic resolution to use in the clustering. The goal was to balance taxonomic precision with a manageable number of sample groups derived from the dendrograms. Using a similar trimming approach to the genus-level dendrogram, the species-level clustering yielded 9 distinct groups, while the family-level Chart

Description automatically generatedclustering yielded only 1 distinct group.

**Figure S1-2 – Species-level dendrogram**

**Supplemental Material #2 – Dominant Taxa in Each Habitat**

**Figure S1-3 – Family-level dendrogram**

**Table S2-1 Total, relative, and cumulative abundance, as well as frequency of occurrence (number of samples within that habitat in which the taxon was observed) of dominant benthic infauna (i.e., >1% of total abundance) in reference samples from each of the three habitats identified across the continental slope of the Southern California Bight. Superscript numbers indicate taxa unique to each habitat among the dominant taxa.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Upper Slope Habitat (Cluster 1) (123 Samples) | | | | |
|  | Taxon | Total Abundance | Relative Abundance (%) | Cumulative Abundance (%) | Frequency of Occurrence |
|  | *Maldane sarsi* | 555 | 4.7 | 4.7 | 74 |
|  | *Chloeia pinnata* | 373 | 3.2 | 7.9 | 41 |
|  | *Paraprionospio alata* | 373 | 3.2 | 11.1 | 86 |
| **1** | *Macoma carlottensis* | 370 | 3.2 | 14.3 | 53 |
| **1** | *Tellina carpenteri* | 329 | 2.8 | 17.1 | 41 |
| **1** | *Mediomastus* sp | 277 | 2.4 | 19.4 | 46 |
| **1** | *Spiophanes kimballi* | 270 | 2.3 | 21.7 | 37 |
| **1** | *Axinopsida serricata* | 241 | 2.1 | 23.8 | 33 |
|  | *Yoldiella nana* | 221 | 1.9 | 25.7 | 23 |
| **1** | *Phyllochaetopterus limicolus* | 200 | 1.7 | 27.4 | 20 |
|  | *Nuculana conceptionis* | 194 | 1.7 | 29.1 | 46 |
|  | *Amphiodia* sp | 193 | 1.6 | 30.7 | 20 |
| **1** | *Compressidens stearnsii* | 191 | 1.6 | 32.3 | 52 |
| **1** | *Melinna heterodonta* | 180 | 1.5 | 33.9 | 41 |
| **1** | *Pectinaria californiensis* | 162 | 1.4 | 35.3 | 47 |
|  | *Fauveliopsis glabra* | 161 | 1.4 | 36.6 | 24 |
|  | *Onuphis iridescens* | 151 | 1.3 | 37.9 | 72 |
| **1** | *Aphelochaeta monilaris* | 150 | 1.3 | 39.2 | 51 |
|  | *Eclysippe trilobata* | 143 | 1.2 | 40.4 | 25 |
|  | Amphiuridae | 128 | 1.1 | 41.5 | 41 |
| **1** | *Ampelisca unsocalae* | 126 | 1.1 | 42.6 | 41 |
| **1** | *Spiophanes berkeleyorum* | 122 | 1.0 | 43.6 | 22 |
|  | *Adontorhina cyclia* | 113 | 1.0 | 44.6 | 36 |
|  | Other Taxa combined | 6,488 | 55.4 | 100.0 |  |

Table 4 cont.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Northwest Slope Habitat (Cluster 2) (26 Samples) | | | | |
|  | Taxon | Abundance | Relative Abundance (%) | Cumulative Abundance (%) | Frequency of Occurrence |
|  | *Byblis barbarensis* | 181 | 16.6 | 16.6 | 2 |
| **2** | *Amphissa bicolor* | 81 | 7.4 | 24.0 | 6 |
| **2** | *Prionospio* (*Prionospio*) *ehlersi* | 67 | 6.1 | 30.2 | 16 |
| **2** | *Paraphoxus* sp 1 | 42 | 3.8 | 34.0 | 6 |
| **2** | *Cyclocardia gouldii* | 35 | 3.2 | 37.2 | 5 |
|  | *Onuphis iridescens* | 32 | 2.9 | 40.1 | 11 |
| **2** | *Astyris permodesta* | 31 | 2.8 | 43.0 | 2 |
|  | *Maldane sarsi* | 29 | 2.7 | 45.6 | 11 |
| **2** | *Bipalponephtys cornuta* | 28 | 2.6 | 48.2 | 11 |
|  | *Paraprionospio alata* | 28 | 2.6 | 50.8 | 11 |
| **2** | *Heteromastus filobranchus* | 26 | 2.4 | 53.2 | 11 |
| **2** | *Brisaster townsendi* | 25 | 2.3 | 55.5 | 8 |
| **2** | *Saxicavella pacifica* | 24 | 2.2 | 57.7 | 4 |
| **2** | *Amphissa undata* | 19 | 1.7 | 59.4 | 3 |
|  | *Chloeia pinnata* | 18 | 1.6 | 61.0 | 2 |
| **2** | *Brisaster latifrons* | 16 | 1.5 | 62.5 | 5 |
| **2** | *Limifossor fratula* | 14 | 1.3 | 63.8 | 10 |
| **2** | *Glycera nana* | 14 | 1.3 | 65.1 | 10 |
| **2** | *Calocarides quinqueseriatus* | 14 | 1.3 | 66.4 | 9 |
| **2** | *Chaetoderma nanulum* | 13 | 1.2 | 67.6 | 5 |
| **2** | *Lirobittium* sp | 13 | 1.2 | 68.7 | 1 |
| **2** | *Glycinde armigera* | 12 | 1.1 | 69.8 | 10 |
| **2** | *Cyclocardia* sp | 11 | 1.0 | 70.9 | 2 |
| **2** | *Myriochele olgae* | 11 | 1.0 | 71.9 | 1 |
|  | Other Taxa combined | 307 | 28.1 | 100.0 |  |

Table 4 cont.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Lower Slope Habitat (Clusters 3, 4, & 5) (59 Samples) | | | | |
|  | Taxon | Abundance | Relative Abundance (%) | Cumulative Abundance (%) | Frequency of Occurrence |
|  | *Byblis barbarensis* | 181 | 7.6 | 7.6 | 14 |
|  | Ophiuroidea | 83 | 3.5 | 11.1 | 25 |
| **3** | *Paralysippe annectens* | 72 | 3.0 | 14.1 | 11 |
| **3** | *Neilonella ritteri* | 70 | 2.9 | 17.1 | 12 |
|  | *Fauveliopsis glabra* | 62 | 2.6 | 19.7 | 12 |
|  | *Maldane sarsi* | 57 | 2.4 | 22.1 | 21 |
|  | *Eclysippe trilobata* | 55 | 2.3 | 24.4 | 22 |
|  | Amphiuridae | 46 | 1.9 | 26.4 | 7 |
| **3** | *Monticellina* sp | 42 | 1.8 | 28.1 | 15 |
| **3** | *Tritella tenuissima* | 39 | 1.6 | 29.8 | 19 |
| **3** | *Monticellina cryptica* | 36 | 1.5 | 31.3 | 17 |
| **3** | *Harpiniopsis epistomata* | 36 | 1.5 | 32.8 | 19 |
| **3** | *Leucon bishopi* | 33 | 1.4 | 34.2 | 12 |
| **3** | *Axinodon redondoensis* | 33 | 1.4 | 35.6 | 19 |
|  | Maldanidae | 33 | 1.4 | 37.0 | 18 |
|  | Lineidae | 32 | 1.3 | 38.3 | 24 |
| **3** | *Spiochaetopterus costarum* Cmplx | 32 | 1.3 | 39.7 | 5 |
| **3** | *Maldane californiensis* | 28 | 1.2 | 40.8 | 13 |
| **3** | *Falcidens hartmanae* | 28 | 1.2 | 42.0 | 15 |
| **3** | *Adontorhina cyclia* | 26 | 1.1 | 43.1 | 17 |
| **3** | *Sonatsa carinata* | 24 | 1.0 | 44.1 | 13 |
|  | *Yoldiella nana* | 23 | 1.0 | 45.1 | 12 |
| **3** | *Myriochele gracilis* | 23 | 1.0 | 46.1 | 11 |
|  | Other Taxa combined | 1,281 | 53.9 | 100.0 |  |

**Supplemental Material #3 – Reference/Non-Reference Temporal Ordination**

With benthic faunal data spanning multiple decades, there is the potential for changes in the taxa that make up the community due to variety of factors, including exposure to local stressors, changes in regional stressors, and natural community drift (Gillett et al. 2017; Hale et al. 2018). The magnitude and type (e.g., taxon replacements or increases in overall taxa richness) of change in community composition through time may influence the construction of an assessment tool and the use of reference community profiles. As such, we were interested in identifying the presence of and characterizing the nature of any temporal shifts across our multi-decade benthic infauna data set.

As noted in the main body of the manuscript, part of determining the potential impact of temporal changes in benthic community involved comparing community composition between reference and non-reference samples in each habitat through time. Change in community composition was evaluated using with a 2-way permANOVA and visually illustrated with a nMDS ordination of non-transformed abundance data (Bray-Curtis dissimilarities). Visual inspection of the nMDS ordinations of the reference and non-reference samples illustrates a clear temporal pattern among the Upper Slope samples, with older samples to the left and more recent samples on the right-side (Figure S3-1). However, there is a consistent gradation from non-reference to reference samples in ordination space within each decade. This pattern is clearest in the Upper Slope samples but is also apparent in the Lower slope samples. These patterns mirror the patterns in the temporally combined data seen in Figure 6 of the main body of the manuscript.

**A screenshot of a cell phone

Description automatically generatedFigure S3-1 nMDS ordination plots of reference (dots) and non-reference (triangles) benthic infauna samples (non-transformed abundance) within the Upper (A), Northwest (B), and Lower (C) continental slope habitats. The color of the points indicates the decade during which the samples were collected.**