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TITLE: The influence of different deep-sea coral habitats on sediment macrofaunal community structure and function

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ABSTRACT:

Deep-sea corals can create a highly complex, three-dimensional structure that facilitates sediment accumulation and influences adjacent sediment environments through altered hydrodynamic regimes. Infaunal communities adjacent to different coral types, including reef-building scleractinian corals and individual colonies of octocorals, are known to exhibit higher macrofaunal densities and distinct community structure when compared to non-coral soft-sediment communities. However, the coral types have different morphologies, which may modify the adjacent sediment communities in discrete ways. Here we address: (1) how infaunal communities and their associated sediment geochemistry compare among deep-sea coral types (Lophelia pertusa, Madrepora oculata, and octocorals) and (2) do infaunal communities adjacent to coral habitats exhibit typical regional and depth-related patterns observed in the Gulf of Mexico (GOM). Sediment push cores were collected to assess diversity, composition, numerical abundance, and functional traits of macrofauna (>300 µm) across 450 kilometers in the GOM at depths ranging from 263-1,095 m. Macrofaunal density was highest in L. pertusa habitats, but similar between M. oculata and octocorals habitats. Density overall exhibited a unimodal relationship with depth, with maximum densities between 600 and 800 m. Diversity and evenness were highest in octocoral habitats; however, there was no relationship between diversity and depth. Infaunal assemblages and functional traits differed among coral habitats, with L. pertusa habitats the most distinct from both M. oculata and octocorals. These patterns could relate to differences in sediment geochemistry as L. pertusa habitats contained high organic carbon content but low proportions of mud compared to both M. oculata and octocoral habitats. Distance-based linear modeling revealed depth, mud content, and organic carbon as the primary factors in driving coral infaunal community structure, while geographic location (longitude) was the primary factor in functional trait composition, highlighting both the location and ecological differences of L. pertusa habitats from other coral habitats. Enhanced habitat structural complexity associated with L. pertusa and differences in localized hydrodynamic flow may contribute to the dissimilarities in the communities found among the coral types. Our results suggest a decoupling for infaunal coral communities from the typical depth-related density and diversity patterns present throughout soft-sediment habitats in the GOM, highlighting the importance of deep-sea corals in structuring unique communities in the nearby benthos.

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