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Spatial distribution of life-history traits and their response to environmental gradients across multiple marine taxa

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Abstract. Trait-based approaches enable comparison of community composition across multiple organism groups. Yet, little is known about the degree to which empirical trait responses found for one taxonomic group can be generalized across organisms. In this study, we investigated the spatial variability of marine community-weighted mean traits and compared their environmental responses across multiple taxa and habitats, including pelagic zooplankton (copepods), demersal fish, and benthic infaunal invertebrates. We used extensive, spatially explicit datasets collected from scientific surveys in the North Sea and examined community composition of these groups using a trait-based approach. In order to cover the key biological characteristics of an organism, we considered three life-history traits (adult size, offspring size, and fecundity) and taxon-specific feeding traits. While many of the traits co-varied in space and notably demonstrated a south–north gradient, none of the traits showed a consistent spatial distribution across all groups. However, traits are often correlated as a result of trade-offs. When studying spatial patterns of multiple traits variability in fish and copepods, we showed a high spatial correlation. This also applied to a lesser extent to fish and benthic infauna, whereas no correlation was found between benthic infauna and copepods. The result suggested a decoupling in the community traits between strictly benthic and strictly pelagic species. The strongest drivers of spatial variability for many community traits are the gradients in temperature seasonality, primary productivity, fishing effort, and depth. Spatial variability in benthic traits also co-varied with descriptors of the seabed habitat. Overall, results showed that trait responses to environmental gradients cannot be generalized across organism groups, pointing toward potential complex responses of multi-taxa communities to environmental changes and highlighting the need for cross-habitat multi-trait analyses to foresee how environmental change will affect community structure and biodiversity at large.

Key words: community composition; copepod; environment; fish; habitat; infauna; multi-taxa; North Sea; trait.

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