

Habitat stability modulates temporal β -diversity patterns of seagrass-associated fauna across biogeographical scales

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Abstract

Aim Identifying drivers that shape biodiversity across biogeographical regions is important to predict ecosystem responses to environmental changes. While beta diversity has been widely used to describe biodiversity patterns across space, the dynamic assembly of species over time has been comparatively overlooked. Insights from terrestrial and marine studies on temporal beta diversity has mostly considered environmental drivers, while the role of biotic mechanisms has been largely ignored. Here, we investigated patterns of temporal variation in beta diversity of seagrass-associated animals (amphipods, as model organisms). **Location** We conducted a study in three biogeographical regions across a temperate to subtropical latitudinal gradient (approximately 2,000 km, 13° of latitude). In each region, we randomly selected three *C. nodosa* meadows, totalling nine meadows sampled seasonally (i.e., four times per year) from 2016 to 2018. **Methods** We partitioned temporal beta diversity into its turnover (i.e. species replacement) and nestedness (i.e. differences in species composition caused by species losses) components and addressed the relative influence of both temporal variation in habitat structure (i.e., biotic driver) and environmental conditions on such patterns. **Results** Our study revealed high temporal beta diversity of amphipod assemblages across the three biogeographical regions, denoting significant fluctuations in species composition over time. We identified species turnover as the primary driver of temporal beta diversity, strongly linked to temporal variability in local habitat structure rather than regional climatic drivers. Subtropical Atlantic meadows with high structural stability over time exhibited the largest turnover rates compared with temperate Mediterranean meadows, under lower structural stability, where nestedness was a more relevant component of temporal beta diversity. **Main conclusions** Our results highlight the crucial role of habitat stability in modulating temporal beta diversity patterns on animals associated with seagrasses, stressing its importance for developing management and restoration actions in the context of diversity loss and fragmentation of ecosystems.

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