DEEP-SEA BIOGEOGRAPHY: TESTING FOR LATITUDINAL, LONGITUDINAL, BATHYMETRIC AND ENERGETIC GRADIENTS DRIVING DEEP-SEA BIODIVERSITY

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The knowledge of the spatial distributions of species diversity both in marine and terrestrial ecosystems is one of the main goals of ecology and evolution. In particular, understanding how biodiversity varies at different spatial scales and the drivers of these patterns is a crucial issue in current research. This is particularly evident for the deep sea, the largest biome of the biosphere, where information on the spatial and temporal variability of biodiversity is almost completely lacking. Although the Mediterranean basin covers <1% of the world ocean surface, none the less it hosts more than 7.5% of the global biodiversity. The high biogeographic complexity and the presence of steep ecological gradients contribute in making the Mediterranean a region of very high diversity.

Here we report the results of a series of investigations on the patterns of deep-sea biodiversity in the Mediterranean Sea and other oceanic regions, in relation with bathymetric, latitudinal, longitudinal and energetic gradients. We report here the presence of a high biogeographic complexity in the deep benthic domain of the Mediterranean Sea. This was largely related to the variability of species richness and turnover (beta) biodiversity. Using, for the first time, a hierarchical sampling strategy from 10s of meters (small scale) to 100s of kilometers (macroscale, between basins) we found that the variability in faunal biodiversity was 2-3 times lower than the one observed for

abundance. Turnover diversity was highest at the macroscale, followed by variability at the mesoscale, which in turn were higher than those observed at the local scale. But turnover diversity was uncoupled with values of species richness. Functional diversity was largely associated to the change in the richness of deep-sea predators. We observed that the drivers of spatial variability of biodiversity were different at different spatial scales. Food quantity play a key role in controlling variability in biodiversity at the macroscale, while food quality and bioavailability play a key role in driving beta diversity at lower spatial scales.

We conclude that changes in food availability, expected also as a consequence of climate change, will have a significant impact in setting biogeographic constraints of deep-sea species.