{rokbox title=|Map of the Western Mediterranean Sea quantifying the velocity of climate change :: Image: Authors| thumb=|images/stories/ieo/imagenespublicaciones/centro-oceanografico-baleares-ieo-csic-climate-velocity-drives-species-mediterranean-sanz-et-al-2024-thumb.jpg|}images/stories/ieo/imagenespublicaciones/centro-oceanografico-baleares-ieo-csic-climate-velocity-drives-species-mediterranean-sanz-et-al-2024.jpg{/rokbox}

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Climate velocity drives unexpected southward patterns of species shifts in the Western Mediterranean Sea

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Abstract: The Mediterranean Sea is one of the most vulnerable ecosystems in the world due to the variety and severity of cumulative impacts faced, including high climate risk. Species distributions are expected to track climate niches in response to warming, with meridionalization (i.e. northern spread of native warm-water species) as a common documented response. However, the Mediterranean environment is also highly heterogeneous and structured at regional scales, constraining generalized species responses. Based on long-term monitoring data of demersal communities in the Western Mediterranean (1994–2019), we calculated seven indicators characterizing the space–time patterns of multiple species distributions and their temporal rates of change. Simultaneously, we computed climate velocity based on the space–time variation of sea surface temperature. Subsequently, we modeled the space–time patterns of species distributions as response to climate velocity, taking into account the species' temperature and depth preferences. Contrary to the generalized northward expectation as a consequence of communities' meridionalization, a large number of species have shifted their distributions toward the south and southwest to higher and medium r climate velocity values and averaged warmer conditions. In general, cold-water species with an affinity for low and moderate mean temperature and wide and narrow temperature ranges were better at tracking climate velocity. Furthermore, species distributed over the continental shelf shifted towards shallower and inshore waters in response to high climate velocity, as opposed to shallower waters further away and contrary to a priori expectations of shifts towards deeper waters, following the bathymetric gradient. The ranges of dispersion and the spatial heterogeneity of

these species expanded, although not explicitly in response to climate velocity, suggesting additional synergistic drivers. Our results confirm the importance of climate velocity as a useful metric for predicting species responses at sub-regional levels and provide information on expected species responses at the scales required for embracing regional to local management measures.

Keywords: Climate velocity, Demersal species, Mediterranean Sea, Spatial indicators, Resilient responses, Sub-regional scale