Linking climate variability and sardinella population in northwest Africa from a novel end-to-end modelling approach

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Small pelagic fish dominate the biomass of marine species in Eastern Boundary Upwelling Systems (EBUS), where they support a large part of the world's fisheries and represent a key intermediate link between plankton and top predators. In the Canary Upwelling System, these species account for nearly 70% of the total landings by weight of northwest African countries, with round sardinella (*Sardinella aurita*) standing out as the most abundant species in the southern flank of the system and a key resource for local economies and food security. However, the available observations across the region limits our understanding of how environmental variability affects its abundance and distribution, a constraint that is particularly problematic in the context of rapidly evolving fisheries and the uncertain impacts of climate change. In this work, a novel end-to-end ("climate-to-fish") modelling framework with an explicit representation of round sardinella dynamics is developed, building on earlier modelling efforts by Sánchez-Garrido et al. (2019, 2020) for anchovy and sardine in the same region. Our end-to-end approach, forced with oceanic and atmospheric reanalyses to generate a 50-year long (1959–2008) simulation, couples a regional ocean circulation model (ROMS), a lower-trophic ecosystem module (NEMURO), and an individual-based model representing all life stages of round sardinella. Our results allow us to propose consistent mechanisms by which large-scale climate modes such as ENSO impact the spatio-temporal dynamics of sardinella in the target region.