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### **Synchronous effects of climate variability on fish larvae and juveniles in an estuarine nursery**

Filipe Martinho, Miguel Pardal, Ana Lgia Primo

University of Coimbra, Portugal

#### **Abstract**

Marine ecosystems are being drastically affected by climate change and its pervasive effects on marine organisms. Indeed, species vulnerability to climate change depends mostly on their most sensitive stages to climate-induced bottlenecks, which for marine fishes also includes larval and juvenile stages.

In this study, we used 13 years (2003-2015) of continuous monthly sampling in the Mondego estuary (Portugal) to better understand the effects of climate variability on larval and juvenile fish assemblages. In total, we identified 31 larval and 47 juvenile species, and grouped both life stages into ecological, feeding mode and vertical distribution guilds to account for the long-term effects on ecosystem functioning. Then, mean annual abundances were related with dominant local- and large-scale climate drivers.

We observed a synchronous effect of environmental variability in both larvae and juveniles. The ecological groups most associated with the estuarine upper reaches (freshwater, catadromous and residents) were positively correlated with precipitation and river runoff, and negatively relate with salinity, highlighting the key role of local hydrology in structuring fish larval and juvenile assemblages. A similar response was observed for the more generalist feeders (invertebrate and omnivorous). In contrast, marine species were positively influenced by salinity, pointing to the effects of "estuarine marination" as a consequence of reduced river runoff imposed by droughts. Conversely, the NAO was negatively correlated only with marine larvae and juveniles, highlighting the control exerted at wider scales in the marine environment, particularly on the species with complex life cycles that display ontogenic habitat changes between coastal and estuarine habitats.

Our study suggests how multiple factors interactively shape estuarine larval and juvenile fish communities at temperate latitudes, and that these ecosystems are particularly sensitive to hydroclimatic variability linked to global climate. This has clear implications for ecosystem and fisheries management, as many species here included are commercially exploited.

**Keywords**

Estuaries, Climate Change, Fish, Hydrology