proceedings

Abstract

Size-Based Indicators Reveal a Long-Term Decreasing Trend in an Estuarine Fish Assemblage and the Cumulative Impacts of Warming †

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Abstract

Introduction: Long-term ecological changes in estuarine communities are primarily driven by anthropogenic and environmental pressures. While abundance-based indicators are commonly used to assess these shifts, they often mask underlying ecological aspects related to age and/or size dynamics that may not necessarily be reflected in the abundance-based approach. Objective: This work tested a size-based indicator approach to examine the long-term changes in the size structure of the Mondego estuarine fish community (Portugal), using a 22-year dataset (2003 to 2025). Methodology: To capture the whole size structure, eight size-based indicators were applied, including mean length (MeanL), length at the 10th percentile (L10), median length (MedianL), length at the 90th percentile (L90), mean length of the 90th percentile (Lmax), size spectrum, the Large Fish index, and the Shannon index of length classes, at community and species levels and subsequently considered these in relation with with local and large-scale environmental factors. Results: Linear models identified a sharp, consistent decline in the overall size of the community, significantly correlated with the North Atlantic Oscillation index (NAO) and increasing estuarine water temperatures. A dynamic factor analysis (DFA) further identified one common trend across species for all indicators, corroborating the decrease in the overall size of the community while also acknowledging contrasting responses from different species, suggesting a heterogenous response across the fish community. Conclusions: These results highlight the importance of size-based indicators when assessing long-term ecological changes in marine ecosystems, allowing us to better understand how size structures shift, their relationship with a changing environment, and the long-term ecological outcomes in terms of community stability, resilience, recruitment, and ecosystem functioning.

Keywords: body-size; climate change; dynamic factor analysis; ecological shifts; time series

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