{rokbox title=|Exemplary red mullet left sagittae otolith :: Image: Authors| thumb=|images/stories/ieo/imagenespublicaciones/centro-oceanografico-baleares-ieo-csic-intra-stock-structure-kerametsidis-2026-thumb-et-al.jpeg|}images/stories/ieo/imagenespublicaciones/centro-oceanografico-baleares-ieo-csic-intra-stock-structure-kerametsidis-2026-et-al.jpeg{/rokbox}

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Abstract: Sustainable harvesting of marine resources relies on effective assessment and management plans, which in turn depend on accurately identifying stock structure. Interdisciplinary studies are increasingly recommended, with otolith chemistry and shape analyses among the most widely used tools for this purpose, providing complementary insights. In this study, we seek to shed light on the intra-stock structure of a metapopulation system of one of the Mediterranean key fishery resources, the red mullet (*Mullus barbatus*), by integrating otolith trace element analysis -specifically focusing on elements whose concentrations are directly influenced by ambient water chemistry- with wavelet-based contour analysis across three spatial scales. A high (>70%) classification success was achieved for specimens grouped following the spatial scale of the current assessment framework, and a moderate classification (up to 60%) was achieved when specimens were grouped following the more biologically realistic spatial ecoregions. Unsupervised classification based on trace elements revealed two distinct natal sources, while wavelet-based analysis identified seven morphotypes within the metapopulation system. Our findings are primarily explained by the high dispersal during early life stages, the overall spatial uniformity of environmentally influenced chemical markers, and the presence of distinct, environmental- and diet-driven spatial units. Our results align with the spatially complex structure of Mediterranean demersal stocks and emphasize the need for spatially explicit assessments and multi-marker approaches—combining tagging, simulations, and otolith data—to resolve fine-scale population structure and connectivity to inform on the complex population dynamics. The growing recognition of complex intra-stock structure worldwide makes our study of broad application for modern fisheries management.

Keywords:otoliths,trace element analysis,shape analysis,connectivity,stock structure.