Ichthyoplankton assemblages and dispersal pathways in the South-Central Tyrrhenian Sea.

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Abstract

This thesis investigates ichthyoplankton communities in the South-Central Tyrrhenian Sea, with a focus on two submarine canyons: Dohrn, in the Gulf on Naples and Cuma in the Gulf of Gaeta, and the coastal LTER-MC station in the Gulf of Naples. By integrating ecological, molecular, and modelling approaches, it assesses spatial and temporal differences in larval assemblages between canyon and coastal sites. These patterns were examined in relation to physical variables such as temperature, salinity, chlorophyll and dissolved oxygen.

Taxonomic identification of fish larvae, often constrained by the absence of diagnostic morphological traits and convergent morphologies, was enhanced through DNA barcoding of the COI gene. This approach confirmed preliminary morphological assignments, resolved ambiguous specimens and improved overall taxonomic resolution, highlighting the potential underestimation of species richness using traditional methods.

Larval dispersal dynamics were examined using Lagrangian Particle Tracking simulations combined with connectivity analyses. The simulations revealed seasonal variability in dispersal patterns, with the two gulfs exchanging roles as sources and sinks across seasons.

Seasonal and spatial patterns in ichthyoplankton assemblages were strongly influenced by both hydrographic conditions and canyon morphology. In summer, Gobiidae dominated the canyon assemblages, while European anchovy (*Engraulis encrasicolus*) was the most abundant pelagic species. Autumn assemblages were characterized by high abundances of Myctophidae, Clupeidae (*Sardina pilchardus*), and Mugilidae, reflecting a mix of mesopelagic and neritic taxa. Winter larval assemblages, under vertically homogeneous conditions, were dominated by *Sardina pilchardus* eggs and balanced larval communities, whereas spring showed variable contributions from mesopelagic taxa such as *Cyclothone braueri*. Interannual variability further modulated these patterns, with shifts in the relative abundance of dominant taxa corresponding to changes in stratification, temperature, and sampling timing.

By combining ecological, molecular, and modelling approaches, this study provides an integrated perspective on larval diversity, dispersal, and connectivity. This work addresses a knowledge gap in ichthyoplankton ecology of the South-Central Tyrrhenian Sea, a region where larval dynamics remain largely unexplored. The findings also hold societal relevance, as understanding patterns of larval dispersal and connectivity is fundamental for the conservation and sustainable management of fisheries in one of the most heavily exploited areas of the Mediterranean.