



Fish β -diversity to assess the ecological effectiveness of MPA zoning: implications for conservation planning to achieve biodiversity targets

Quattrocchi Federico^{1-3*}, Cattano Carlo²⁻³, Turco Gabriele¹⁻³, Bressan Giulia¹⁻³, Spatafora Davide²⁻³, Mininni Claudia²⁻³, Leone Agostino¹⁻³, Calò Antonio¹⁻³, Chemello Renato¹⁻³, Milazzo Marco¹⁻³

*lead presenter: Federico.quattrocchi@unipa.it

1 Department of Earth and Marine Science (DiSTeM), University of Palermo, Palermo, Italy

2 Stazione Zoologica Anton Dohrn, sede Sicilia, Palermo, Italy

3 National Biodiversity Future Centre (NBFC), Palermo, Italy

The Global Biodiversity Framework calls for the protection of at least 30% of land and sea by 2030, and the EU Biodiversity Strategy adds that 10% of this area should be strictly protected, raising questions about how strict protection can be effectively achieved and implemented in practice. Italian national Marine Protected Areas (nMPAs) include zones with different protection levels, from fully protected no-take zones (NTZs; A and Bs) to partially protected zones (PPZs; B and C) where some human activities are allowed, but those more impacting habitats and species (e.g., trawling, mining, etc.). Here, we present a preliminary analysis aimed to assess the ecological effectiveness of seven nMPAs around Sicily by comparing fish communities in NTZs, PPZs and several unprotected areas. In summer 2024, we deployed standard Baited Remote Underwater Video systems at 25-75m depth to estimate fish species richness and abundance across protection levels and MPAs, and measured abundance based β -diversity (BD) as an indicator of variation of fish assemblages, partitioned in species replacement (turnover of individuals among species across sites) and changes in overall abundance (gradient or nestedness). Although BD increases with decreasing levels of protection, the contribution of the components driving this metric is not consistent across protection levels. In PPZs and unprotected areas, differences among fish assemblages were linked to species replacement, suggesting a key role of human disturbance in these zones. By contrast, in NTZs this relationship was much weaker and a clear size effect was evident, with NTZs larger than ~80ha (3 out of 7 MPAs) increasing the differentiation among fish assemblages. Expanding NTZs to this threshold would increase the ecological effectiveness of these nMPAs. These results provide useful guidance for nMPA zoning effects or spatial conservation planning and suggest that NTZs' size should be considered when defining areas that can contribute to biodiversity targets.