Ecosystem-based spatial prioritization for marine conservation in Sardinia

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In response to the EU Biodiversity Strategy for 2030 mandate to protect 30% of European marine waters, this study proposes a multi-disciplinary methodological framework for identifying conservation priorities within the territorial waters of Sardinia (central-western Mediterranean). The research adopts a socio-ecological lens integrated into the Maritime Spatial Planning (MSP) process to support a shared and more resilient management of marine space.

The spatial prioritization process based on ecological criteria was focused on the habitat suitability of *Posidonia oceanica* meadows (Habitat 1120) and reefs (Habitat 1170). A core component of the analysis was the evaluation of ecological connectivity by identifying potential corridors between existing Marine Protected Areas and Natura 2000 sites.

To balance conservation with human presence, the framework incorporated socio-economic dimensions through Cumulative Effects Assessment (CEA) and Maritime Use Conflict (MUC) Tools4MSP models. These tools evaluated the pressure of anthropogenic activities on sensitive habitats and mapped spatial overlaps between maritime sectors and conservation objectives.

This framework was further refined through participatory mapping, which integrated spatial data derived from stakeholder engagement into the modeling pipeline, ensuring that social perceptions and traditional knowledge were embedded into the spatial analysis.

The final spatial prioritization was executed using the R package *prioritizr* to generate optimized conservation scenarios. This systematic approach allowed for the identification of areas that maximize conservation priorities while minimizing potential conflicts with anthropogenic activities.

The results provide a transparent, science-based framework for expanding the regional network of Sardinian protected areas. By combining habitat suitability modeling, connectivity analysis, conflict assessment, and stakeholder engagement, this study demonstrates a scalable technical workflow for achieving 30% marine protection targets through an Ecosystem-Based approach.