

DEEP-SEA ECOSYSTEMS OF THE MEDITERRANEAN SEA:

ECOLOGICAL IMPORTANCE AND VULNERABILITY TO CLIMATE CHANGE AND BOTTOM FISHING

Executive Summary - April 2026

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Mediterranean deep-sea ecosystems, particularly those between 600 m and 1000 m depth, are among the region's most ecologically valuable yet vulnerable environments. They host a mosaic of habitats, including cold-water coral reefs, sponge grounds, sea pen fields, bamboo coral (*Isidella elongata*) facies, submarine canyons, seamounts, and extensive soft-sediment plains. These systems support high biodiversity, important commercial species, and increased climate resilience, as natural, long-term reservoirs where carbon is stored. They are also highly vulnerable and slow to recover from damage, because they comprise slow-growing, long-lived species, with limited resilience to disturbance.

Bottom-contact fishing remains the most pervasive pressure on these habitats. In particular, bottom trawling removes habitat-forming species, alters sediment structure, and disrupts key linkages between the seafloor and the water column, with long-lasting impacts on ecosystem functioning and carbon burial. Evidence from the Mediterranean



Sea shows that repeated bottom trawling leads to habitat degradation, reduced biomass of commercially important species, and loss of vulnerable marine ecosystems (VMEs). The Critically Endangered bamboo coral *Isidella elongata*, once widespread, now occurs only in scattered low-density populations due to trawling impacts.

Climate change is amplifying these pressures. Warming waters, deoxygenation, acidification, and reduced food supply are already affecting deep-sea species, with the Mediterranean warming faster than the global ocean. Habitat suitability models project significant declines in key VME taxa under high-emission scenarios, with suitable habitats shifting deeper and shrinking in several sub-regions. These trends threaten the long-term stability of deep-sea ecosystems and the fisheries they support.

Despite their vulnerability, deep-sea habitats may function as climate refugia, due to their relatively stable environmental conditions. However, this potential depends on maintaining ecological integrity. Degraded habitats lose structural complexity, functional redundancy, and carbon -storage capacity, reducing their ability to buffer climate impacts.

For the Mediterranean basin, strengthening deep-sea protection is both scientifically justified and strategically important. The region's deep-sea ecosystems underpin fisheries productivity, biodiversity conservation, and carbon-sequestration services. Expanding and reinforcing Fisheries Restricted Areas (FRAs), adopting depth-based closures, and implementing VME-specific protections would significantly reduce cumulative impacts and enhance ecosystem resilience. These actions would also support the Contracting Parties of the General Fisheries Commission for the Mediterranean (GFCM) in meeting international

commitments under the Convention on Biological Diversity (CBD), Food and Agriculture Organization (FAO) guidelines, and the GFCM 2030 Strategy for sustainable fisheries and aquaculture in the Mediterranean and the Black Sea.

International experience from Regional Fisheries Management Organizations (RFMOs), demonstrates that precautionary, broad-scale measures to limit bottom-trawling impacts on deep-sea ecosystems are effective and feasible. Depth-based closures (e.g. trawl bans below 600-800 m), permanent VME/Essential Fish Habitat (EFH) closures, and gear restrictions are widely adopted tools that reduce impacts in data-poor contexts. These measures are enforceable, compatible with existing monitoring systems (Vessel Monitoring System - VMS, Automatic Information System - AIS, Synthetic Aperture Radar - SAR), and aligned with United Nations General Assembly (UNGA) Resolutions and FAO VME guidelines.