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Heliana Teixeira,
University of Aveiro, Portugal

*CORRESPONDENCE
Katerina Vasileiadou
k.vasileiad@gmail.com

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Editorial: Marine biodiversity hotspots – challenges and resilience

Katerina Vasileiadou[1]*, Eva Chatzinikolaou[2], Stefania Klayn[3], Christina Pavloudi[4] and Sofia Reizopoulou[1]

[1]Institute of Oceanography (IO), Hellenic Centre for Marine Research (HCMR), Anavyssos, Greece, [2]Institute of Marine Biology, Biotechnology and Aquaculture (IMBBC), Hellenic Centre for Marine Research (HCMR), Heraklion, Greece, [3]Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, Sofia, Bulgaria, [4]European Marine Biological Resource Centre - European Research Infrastructure Consortium (EMBRC-ERIC), Paris, France

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Editorial on the Research Topic
Marine biodiversity hotspots – challenges and resilience

Biodiversity hotspot is a term coined by conservation specialists for areas characterised by high species richness or endemism or facing serious threats (Jefferson & Costello, 2020) that need to be prioritised for preservation. In the modern era,massive loss of biodiversity has been related to climate change and other human activities, and scientists urge for immediate action. Characterising areas as biodiversity hotspots marks them as conservation priorities, and forces management authorities to act. Marine hotspots started to be defined later than the terrestrial ones and currently, 43 such areas exist, ranging from tropical coral reefs to polar regions (Costello et al., 2022).

The papers of this Research Topic focus on the species richness of various habitats, ranging from artificial reefs to seagrass meadows, which face natural and anthropogenic threats, and whose protection is of major concern. The Topic aims to bring Marine Biodiversity Hotspots under the spotlight and contribute towards the conservation of these fragile systems.

The 6th IPCC report points out that marine hotspots are threatened by the direct and indirect effects of climate change (Costello et al., 2022); an impact of climate change is the geographical alteration of species distributional ranges. Monteiro et al. performed a fine-scale assessment of the distributional limits of 34 warm-water, cold-water and thermally neutral macroalgal species in the northwestern coast of Iberian Peninsula, which is considered a biodiversity hotspot area and has a strong latitudinal thermal gradient. Population and range shifts were identified using historical data and in comparison to non-indigenous macroalgal species distributions. Results indicated a potential homogenization of the macroalgal communities across north-western Iberia, proven by the observed decrease in the abundance of some cold-water species, and the concurrent increase in warm water species, while non-indigenous species are becoming dominant, favoured by the ocean warming conditions. Such alterations may indicate significant ecological disturbances likely to affect ecosystem functioning in the investigated areas.

Marine protected areas (MPAs) are a key tool for preserving biodiversity hotspots, and for maintaining ecosystem resilience and services in the face of multiple concurrently acting stressors (Leenhardt et al., 2015). It is important to effectively conserve marine habitats and their biodiversity, and ensure that MPAs do not just exist "on paper" (Rife et al., 2013); up-to-date information on benthic habitat distribution and community structure is a prerequisite for achieving this goal. In one of the most detailed benthic studies in Black Sea MPAs, Begun et al. assess the biodiversity and ecological state of benthic communities in two MPAs: Cape Tuzla and Mangalia Sulfur springs. Using benthic samples combined with remote sensing techniques, the authors map seven infra- and circalittoral habitats in the MPAs and describe the macrobenthic species richness and community structure. Most of the habitats are found to be resistant to human stressors, as they achieve Good Environmental Status; however, further research and management actions are needed to ensure their future resilience. The spatial analyses performed are particularly valuable for the development and implementation of ecosystem-based management and conservation measures, as well as spatial planning, to comply with EU directive requirements in the area.

Franzitta et al. focus on Sabellarid reefs, a biodiversity rich habitat protected under EU law. These formations are significant as feeding grounds and nurseries for many species, and are also valuable for water filtration; perhaps most importantly, they are also stabilising the sediment, thus preventing erosion. Sabellarid reefs face natural threats such as storms and hydrodynamics, as well as anthropogenic threats like bait fishing. The authors suggest methods for their restoration by fixating reef fragments into vases and translocating the fragments to new areas. The method proved promising, although further research is needed to expand the possibilities of its application.

Surugiu et al. focus on seagrass habitats that nearly disappeared from the Romanian Black Sea coast due to eutrophication and water quality deterioration (Surugiu, 2008). The seagrass bed in the study area is found to be a hotspot of macrobenthic biodiversity, with faunal richness and abundance significantly higher than that of the neighbouring bare sediments. This is remarkable considering its small size, recent re-establishment in the area, and its close location to sources of human disturbance. Seagrasses may also influence the local sedimentary habitats well beyond the meadows' edge, e.g., through export of production, and make a substantial contribution to local benthic diversity.

Apart from traditional conservation approaches, eDNA metabarcoding can also be applied to investigate biodiversity in hotspots and MPAs (e.g., Gold et al., 2021; Valdivia-Carrillo et al., 2021). Staehr et al. used eDNA metabarcoding on samples from nine marine boulder reefs across the North Sea to the Baltic Sea transition zone, and argued that it could differentiate the reef-associated communities, depending on their location. Moreover, eDNA metabarcoding results were similar to those observed by visual census methods; the main difference between the two approaches was that eDNA metabarcoding did not satisfactorily detect macroalgae which dominated the diver-based assessments. This could be attributed to the choice of marker genes and the lack of a plant specific gene (e.g., rbcL, tufa) (Bartolo et al., 2020). Despite this discrepancy, usage of eDNA metabarcoding is becoming an essential component of biodiversity monitoring programs since its benefits outweigh its shortcomings and it provides valuable cost-effective information (Ruppert et al., 2019).

Genetics as a tool for conservation were also used by Mugnai et al.; they suggested an integrative method for monitoring shifts in marine benthic communities of artificial substrates units (ASUs). ASUs host variable species, and monitoring their biodiversity is important also for the development of local economies. The method can be applied for monitoring marine systems under conservation; it is an integrative practice that combines taxonomic identification of benthic organisms with DNA metabarcoding of the COI gene. The approach was very effective in detecting both the spatial and the temporal fluctuations of the communities of ASUs, offering a powerful tool for conservation specialists.

Marine Biodiversity Hotspots are a relatively new, yet continuously growing field for Conservation Biology. Further research is needed to cover in depth the aspects of this topic. The present Topic endeavours to be a meaningful and fruitful contribution for the future studies, providing modern applications for conservation and management.

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KV: Writing – original draft, Writing – review & editing. EC: Writing – original draft, Writing – review & editing. SK: Writing – original draft, Writing – review & editing. CP: Writing – original draft, Writing – review & editing. SR: Writing – review & editing.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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