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TITLE: Pelagic bioregionalisation using open-access data for better planning of marine protected area networks

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ABSTRACT:

Systematic conservation planning (SCP) to design marine protected areas (MPAs) has traditionally focused on species distributions or benthic habitat features that drive the determination of conservation priorities. Pelagic ecosystem protection is usually incidental because these ecosystems are often data-poor and are difficult to visualize in a planning context. Pelagic ecosystems, however, face increasing and cumulative impacts from threats such as overfishing and climate change, and a precautionary approach is required to protect both known and unknown biodiversity patterns and ecosystem processes. Data-driven pelagic habitat classifications are important when planning for habitat protection in the absence of sufficient in-situ data. In this study, we describe a method for creating a bioregional map of the upper-mixed layer of South Africa's pelagic realm. We selected relevant variables and parameters that best reflect key ecosystem properties at broad, meso, and local scales. We conducted a hierarchical cluster analysis using open-access sea surface temperature (SST), chlorophyll-a (chl-a), net primary productivity (NPP), mean sea level anomalies (MSLA), and seabed slope and depth data. The resulting map delineates three bioregions subdivided into seven biozones and sixteen pelagic habitats within South Africa's continental Exclusive Economic Zone (EEZ). This habitat map was incorporated into SCP of a proposed expanded MPA network that includes offshore protected areas and meets National objectives. The proposed network will increase protection of the pelagic realm (>30 m depth) of the EEZ from 0.002% to 6.0%. We contend that bioregional analyses based on publicly available remote-sensing data are useful for identification of offshore habitats, especially when robust biological data are unavailable, as a framework for ecosystem reporting, and for inclusion in a systematic design for a representative offshore MPA network. Further research should focus on modelling and mapping the permanence of pelagic habitats and different spatio-temporal scales of variability, validating habitat boundaries with biological data, and understanding the threats and efficacy of achieving pelagic protection through management mechanisms like MPAs.

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