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TITLE: Evaluating the ecological status of cold-water coral habitats using non-invasive methods: An example from Cassidaigne canyon, northwestern Mediterranean Sea

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ABSTRACT:

Cold-water coral ecosystems have been identified as vulnerable, but quantitative data on their conservation status is very limited. The Marine Strategy Framework Directive (MSFD) is the tool implemented by the European Union?s Integrated Maritime Policy to achieve Good Environmental Status (GES) of marine waters by 2020. In this context, the aim of this study was to evaluate the Ecological Status of benthic habitats in Cassidaigne canyon, focusing in particular on cold-water coral habitats dominated by Madrepora oculata. Data were collected during the Videocor1 cruise (2017). Videos and photos collected during eight dives of the H-ROV Ariane were used to reconstruct, in 3-dimensions, the areas where cnidarians have settled in the canyon. A total of 33 3D models were built, which allowed measuring the spatial and vertical distribution, surface, density and size structure of cnidarian populations at four different sites. When 3D reconstructions were not possible, GIS tools were used. The seven cnidarian species considered were the scleractinian M. oculata; three antipatharians: Leiopathes glaberrima, Antipathella subpinnata, Antipathes dichotoma; and three aclyonaceans: the precious red coral Corallium rubrum and the gorgonians Callogorgia verticllata and Viminella flagellum. Using photogrammetry, we were able to reveal the size structure of the dense population of M. oculata in the canyon, as well as to obtain knowledge on a complex site (Cassis-200) composed of 15 knolls, and to quantify the surface occupied by M. oculata at a separate site (Cassis-500) influenced by industrial discharges. At the southern flank of the canyon we found a highly diverse site (SW Flank) dominated by antipatharians and gorgonians composing large forests, and finally a reservoir of M. oculata was identified under overhangs at a site called the Wall. The diversity of accompanying species is also reported and marine litter quantified. Images collected before 2017 were compared to the 3D models to precisely locate them on the sites, and assess temporal changes in M. oculata colony sizes at Cassis-200 site. We also report on the ground-truthing of predicted habitat maps produced previously, and confirm their good representation of the distribution of cold-water coral habitats. Finally, we quantified the criteria defined by the MSFD, aimed at evaluating the GES of benthic habitats for M. oculata ecosystems, at the scale of the Cassidaigne canyon. Measurements showed that the extent of loss of the observed M. oculata habitat reached 56% according to the MFSD definition.

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