

ID: W2904923712

TITLE: Megafauna distribution along active submarine canyons of the central Mediterranean: Relationships with environmental variables

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ABSTRACT:

The tectonically-controlled margins off Southern Italy are carved by several shelf-indenting submarine canyons that are periodically flushed by sedimentary gravity flows. In this study, the distribution of benthic and demersal megafauna within the thalweg of some of these canyons (i.e. the Gioia-Petrace and Caulonia Marina canyons in the Tyrrhenian and the Ionian Calabrian margins, respectively, and the Sant'Agata, San Gregorio, Tremestieri and Messina canyons in the Messina Strait) was studied using Remotely Operated Vehicle video transects. The relationships between fauna distribution and environmental conditions (i.e. seafloor type, depth, slope, aspect and canyon system) extracted from video footage and bathymetric data were assessed to identify the main physical drivers influencing the megafaunal assemblages within active submarine canyons. These latter have their heads in shallow water, so representing highly dynamic environments affected by present-day sediment transport. Hierarchical Cluster Analysis allowed to distinguish seven different assemblages occurring in the study areas. PERMANOVA analysis showed significant differences among species groups associated to different seafloor types, depth ranges and canyon systems. Distance-based linear modeling (DistLM) identified the canyon system as the main factor explaining the variability of the megafaunal assemblages across the study areas. In the Gioia and Petrace canyons, both characterized by homogenous fine-grained sediment, the assemblages were mainly dominated by Polychaeta Sabellidae and Ceriantharia. The almost total absence of sessile fauna at the canyons' head was interpreted as an effect of a strong physical disturbance due to the impact of sedimentary flows. In the canyons of the Messina Strait, the presence of more varied seafloor encompassing fine and coarse sediment along with an higher spatial heterogeneity of physical disturbance, determined more diversified faunal assemblages, featuring species associated with hard and soft substrates. More in detail, in the Sant'Agata, San Gregorio and Messina canyons the colonization of cobbles and boulders by slow-growing species vulnerable to physical disturbance such as the gorgonians *Acanthogorgia hirsuta* and *Swiftia dubia* was recorded. For the Tremestieri canyons a stronger impact by sedimentary flows was reflected both by a very high abundance of land-based litter and the lowest values of species richness. Interactions between megafauna and marine litter, whose widespread occurrence was recorded on the floor of all these canyons, have been also presented and discussed. Although in several cases litter caused entanglement of benthic species, the anthropogenic debris was also used as growing substrate or shelter by some invertebrates and fishes, suggesting complex fauna-litter interactions that should be better explored. Overall, the large variability in morphology and seafloor characteristics across the studied canyons is reflected on the variability of megafauna assemblages, suggesting a strong influence of the physical conditions specific of each canyon in controlling fauna distribution.

SOURCE: Progress in oceanography/Progress in Oceanography

PDF URL: None

CITED BY COUNT: 25

PUBLICATION YEAR: 2019

TYPE: article

CONCEPTS: ['Megafauna', 'Submarine canyon', 'Oceanography', 'Canyon', 'Mediterranean sea', 'Submarine', 'Geology', 'Geography', 'Mediterranean climate', 'Environmental science', 'Continental shelf', 'Geomorphology', 'Paleontology', 'Archaeology', 'Pleistocene']