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Baseline

Submarine canyons along the upper Sardinian slope (Central Western Mediterranean) as repositories for derelict fishing gears

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ABSTRACT

By means of ROV surveys, we assessed the quantity, composition and bathymetric distribution of marine litter in 17 sites along the Sardinian continental margin (Central Western Mediterranean) at depths ranging from 100 to 480 m. None of the investigated sites was litter free, but the mean density of litter (0.0175 ± 0.0022 items m^{-2}) was lower than that reported from other Tyrrhenian regions. The difference in the total litter density among sites was negligible, but the density of derelict fishing gear (DFG) items (most of which ascribable to small scale fishery) in submarine canyons was higher in submarine canyons than in other habitats. Our result suggest that submarine canyons (known to be highly vulnerable ecosystems) act as major repositories of DFGs, and, therefore, we anticipate the need of specific measures aimed at minimizing the loss and abandonment of DFGs in submarine canyons.

With millions of tons of solid waste entering the marine environment every year, marine litter has become a fast-growing global concern, with alarming evidences coming from all oceanic regions (Jambeck et al., 2015). This global phenomenon has countless input sources and a variety of habitats being affected, with apparently no area of the ocean immune from this threat (Levin and Le Bris, 2015). The Mediterranean Sea, with an estimate of > 62 million macro-litter items currently floating on its surface, is one of the world marine regions most affected by marine litter (Suaria and Aliani, 2014).

While most of plastic marine litter floats on the sea surface, macro-litter items composed of heavy materials typically descent to the seabed, where, because of their inertia to decomposition, tend to accumulate even in the long term. Regardless of its nature and specific composition, benthic litter alters the receiving habitat in different ways: while at times providing new hard substrata for epibiosis (Melli et al., 2017), it causes physical damage to already settled organisms or even foster chemical contamination. Among benthic litter, a particularly relevant category includes derelict fishing gears (DFGs). DFGs tend to remain entangled on the rocks as well as on habitat structuring species (e.g., corals, sponges, bryozoans). Additionally to the mechanical damage to benthic fauna, DFGs still function for very long times and are able to catch and trap fish and other organisms, so that these abandoned gears cause the so-called ghost fishing (Fernandez-Arcaya et al., 2017). Moreover, since these DFGs are made of non-biodegradable

compounds, they also represent a persistent contamination source of the marine environment, especially of habitats below the photic zone.

The Marine Strategy Framework Directive (MSFD), developed by the European Commission (Directive 2008/56/EC) represents to date the most important coordinated framework to protect European seas by achieving a 'Good Environmental Status' (GES) by 2020. GES is evaluated through 11 descriptors, the 10th of which is marine litter: for this descriptor GES is achieved once "Properties and quantities of marine litter do not cause harm to the coastal and marine environment". For this reason, the number of monitoring activities and scientific investigations aimed at quantifying and qualifying marine litter in European Seas is continuously increasing. However, the data available on marine litter distribution in deep-sea benthic habitats are still scarce if compared with data from shallower areas (Suaria and Aliani, 2014). Most of the accumulated data on deep-sea litter has been obtained with invasive and semi-quantitative sampling gears (e.g. trawls, dredges; Galgani et al., 1996; Pasquini et al., 2016; Strafella et al., 2015), which, according to the "Guidance on monitoring of Marine Litter in European Seas" (GMML) are preferred for the study of incoherent bottoms (Galgani et al., 2013). More recently, the development and increasing utilization of Remotely Operated Vehicles (ROVs) has allowed to explore conservatively (i.e. limiting the damage to the benthos), also hard bottoms (Angiolillo et al., 2015; Bo et al., 2014; Cau et al., 2015; Melli et al., 2017).

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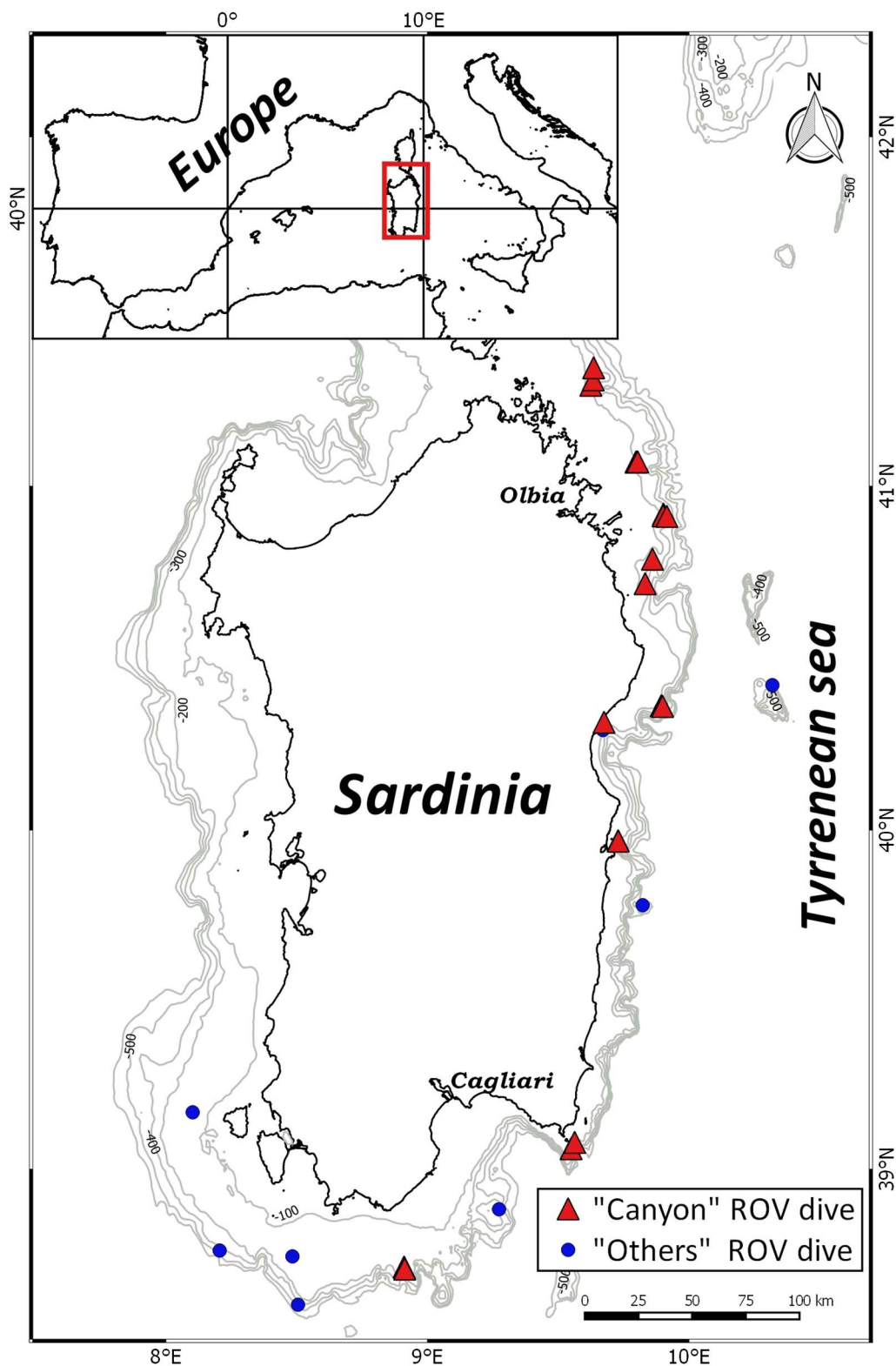


Fig. 1. Location of the sampling area and the ROV dives along the Sardinian upper slope.

We investigated the quantity, composition and bathymetric distribution of benthic marine litter in 17 sites located along the Sardinian continental margin (Central Western Mediterranean) at depths ranging from 100 to 460 m (Fig. 1). Investigated sites were a priori assigned to two categories of habitat: ‘canyons’ and ‘others’, according the output of MultiBeam Echo-Sounder (MBES; EM 2040 Kongsberg, 300 kHz

frequency) survey conducted prior to ROV dives and to three geographical categories: ‘north’, ‘east’ and ‘south’, according to their location (Fig. 1).

Data were acquired during a total of 29 ROV dives onboard the R/V “Astrea” in summer 2013, with 1–4 dives per site (Table 1). The software DVDVIDEOSOFT was used to extract high-resolution photo

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