Biol. Mar. Mediterr. (2018), 25 (1): 275-276

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MICROPLASTICS IN MARINE SEDIMENTS IN THE AREA OF PIANOSA ISLAND

MICROPLASTICHE NEI SEDIMENTI DELL'ISOLA DI PIANOSA

Abstract *- The occurrence of plastic contamination in sediments collected in the area of Pianosa Island was investigated in 2015 by collecting 20 sediment samples along a 25 km-long transect. All sediment samples contained plastics. In terms of numerical abundance, microplastics accounted for 64.4% of the total amount found. Six polymers types were recognized through FT-IR spectroscopy.*

Key-words: *microplastics, sediments, pollution, Adriatic Sea.*

Introduction - World production of plastics has strongly expanded, from 1.7 million tonnes in 1950 to 322 million tonnes in 2015. Discarded "end-of-life" plastic accumulates particularly in marine habitats (Avio *et al*., 2017). The Marine Strategy Framework Directive, MSFD (2008/56/EC) follows a holistic functional approach identifying a set of 11 Descriptors, which collectively represent the state and functioning of the whole system. Descriptor 10 (D10) is identified as "Properties and quantities of marine litter do not cause harm to the coastal and marine environment". Microplastics are considered specifically in descriptor 10 of the MSFD [10.1.3 "*Trends in the amount, distribution and, where possible, composition of micro-particles (in particular micro-plastics)*"]. According to the MSDF, microplastics should be categorized according to their physical characteristics including size and shape. It is also important to obtain information on polymer type. We investigated the occurrence and extent of plastic contamination in sediments collected in the Central Adriatic Sea, in the area of Pianosa Island, outside the boundaries of the MPA.

Materials and methods - In November 2015, 20 sediment samples (Van Veen grab, area 0.1 m^2) were taken along a 25 km-long transect, at depth varying between 119 and 142 m. At the laboratory, plastic debris in samples were removed under a dissection microscope, counted, weighted, measured and classified into three dimensional groups, and finally categorized according to shape. Fourier-transform infrared spectroscopy (FT-IR) analysis of plastic debris was carried out with a CARY 600 FT-IR (Agilent Technologies) instrument. Measurements were carried out in attenuated total reflectance (ATR) configuration, with a Pike Miracle diamond cell. Tests were carried out at 25 °C in dry air. Particles were identified by comparing FT-IR absorbance spectra of the microplastics to those in a polymer reference library.

Results - Seafloor was characterized by particles ranging from gravels (diameter between 4-2 mm) to clay (diameter <0.0039 mm), according to the Wentworth grain-size classification. The fraction of finer sediments (silt + clay) was always dominant.

All sediment samples contained plastics. In terms of numerical abundance, microplastics accounted for 64.4% of the total amount found, mesoplastics made up 33.1%, macroplastics accounted for 2.5%. Filaments (66.1%) were the most common shape category, followed by fragments and film (16.9% each). All plastics in our samples were secondary products derived from degradation and fragmentation of larger fragments, but it was not possible to attribute a specific source or a specific activity of origin if not for some fishing lines filaments. Identification through FT-IR spectroscopy evidenced the presence of 6 polymer types: polyethylene, polypropylene, nylon 6.6, linear low-density polyethylene-octene copolymer, ethylene vinyl alcohol copolymer, and thermoplastic polyurethane. Considering abundance, the majority of plastic debris were nylon (53.2%), followed by polyethylene (18%). By weight, polyethylene (61.4%) was the most represented polymer type, followed by polypropylene (19.6%). The latter plastics can be carried long distances because they are less dense than seawater.

Conclusions - This study gives a first insight into microplastic pollution on the seafloor in the Pianosa area. All plastics in our samples were secondary products derived from degradation and fragmentation of larger fragments, but it was rarely possible to attribute a specific source or a specific activity of origin if not for some fishing lines filaments. This part of the Adriatic Sea is a busy shipping route with thousands ships passing by per year. We hypothesize that plastics found at our sampling sites are originated from marine-based sources including fishing vessels, merchant vessels and recreational boats. Results from this study could be used as reference or baseline data to test the effectiveness of any reduction measures adopted to address the MSFD requirements.

References

AVIO C.G., GORBI S., REGOLI F. (2017) - Plastics and microplastics in the oceans: from emerging pollutants to emerged threat. *Mar. Environ. Res.*, **128**: 2-11.