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Note

Is the microplastic selective according to the habitat? Records in amphioxus sands, Mäerl bed habitats and *Cymodocea nodosa* habitats

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ABSTRACT

This study estimated for the first time the total loads of plastic litter (macro- meso- and micro-plastics) in sediments of different habitat types from the Northern Adriatic Sea. Samples were collected in March 2016. The sampling sites were settled in shoreline, on the *C. nodosa* bottoms, Amphioxus sands, and Mäerl bed habitats. Microplastics items were present in all sampling site and ranging within 137-703 items/kg d.w. from Mäerl bed habitat to the shoreline. In *C. nodosa* bottoms 170 items/kg d.w. were found, while in Amphioxus sands were recorded on average 194 items/kg d.w. Due to the absence of statistical associations among litter levels and abundance of *B. lanceolatum* in the study area, this research present the needs to develop a new method and more research to for the evaluation of how much the interrelation between sensible habitats and microplastic exist.

1. Short note

Plastic represent a well-known issue impacting different layers of marine water such the surface and the deep sea waters as well the coastal beaches from 70s (Carpenter and Smith Jr, 1972) and only recently the scientific community discovered much more worrisome aspects related to marine ecosystems integrity and conservation and the occurrence of plastic pollution (Barnes et al., 2009). As consequence of poor plastics degradability, bed waste management and growing inputs exponentially increased the needs of the scientists for knowledge and potential associated risks (Eriksen et al., 2014; Sauria and Alani, 2014; Nairobi, 2014). The Marine Strategy Framework Directive in the 2008 (MSFD - Directive 2008/56/EC) introduced the “Marine Litter” within the eleven descriptors to define and targeting the “Good Environmental Status” by 2020 (Galgani et al., 2010; De Lucia et al., 2014), strategy with whom has begun a series of research and an which increased the awareness of the scientific community all over the world. Any effort to study and manage pollution and ecological associated problems requires as starting point, a good knowledge on levels, distributions and dynamics of the plastic litter in the marine ecosystems. A very large number of researches and studies has been made in the past few years and in spite of that, data on plastic litter levels in different ecosystem and environments are incomplete and lacking. To fill this knowledge gaps, researchers and scientists are focused to improve general knowledge and are developing a lot of methods for the isolation and the research on microplastics. As we know the plastic litter took over every branch of our lives and is present more than ever in the sediments (Nuelle et al., 2014) and food (De Witte et al., 2014). Prevails in the environment, digestive systems and tissues (Bockstiegel, 2010; Avio et al., 2015; Van Cauwenberghe and Janssen, 2014). A critical aspect is for sure the fact that microplastic could be a vessel for allochthonous microorganism diffusion in sensible marine ecosystems (Barnes, 2012; Zettler et al., 2013; Collignon et al., 2014) and spreads through the food web (Setala et al., 2014). The consequences of introducing micro-organism into the organism may be different, affecting feeding, breathing and reproduction (Cole et al., 2014).

The aim of this study was to define the plastic litter levels in sediments from different marine ecosystems of the Northern Adriatic Sea and the four studied marine habitats. For the first time the research is based on different sites: shoreline, *C. nodosa* bottoms, Amphioxus sands, and the Mäerl bed habitat. The presence/absence of a statistical relationship between plastic litter, *B. lanceolatum* (Pallas, 1774; Cephalochordate) abundance and Mäerl bed habitats were also checked by Student's *t*-test. Mäerl bed habitats and Amphioxus sands (both included in the biocoenoses “coarse sands and fine gravels under the influence of bottom currents” (Pérès and Picard, 1964) represent key marine ecosystems of great ecological interest (MSFD, 2008; Rota et al., 2009).

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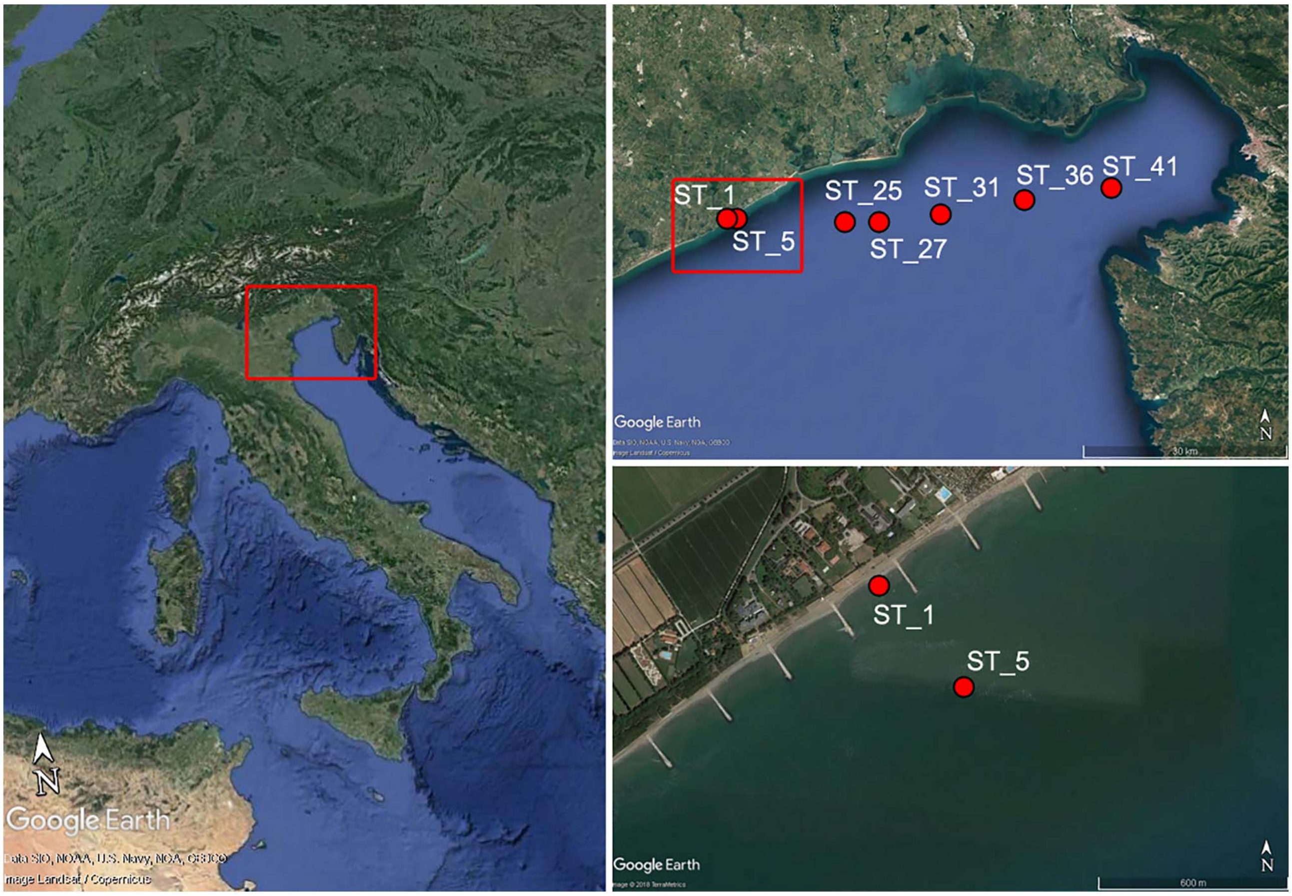

Fig. 1. Sampling sites from Caorle shoreline (ST_1) to Slovenia (ST_41). Notes: Shoreline (ST_1), Caorle (Italy); *C. nodosa* bottoms (ST_5); Amphioxus sands + Mäerl bed habitats (ST_25; ST_31); Amphioxus sands (ST_27); Mäerl bed habitats (ST_36; ST_41).

Table 1
Sampling sites principal features (TERNA Rete Italia, 2016).

ST	Depth m	pH	Eh mV	Gravel %	Sand %	Silt %	Clay %	TOC %	TN %	TP %
1	1.3	7.93	242	0.42	96.19	3.37	0.02	0.137	0.02	0.04
5	3.5	7.81	147	1.66	91.40	6.27	0.67	0.135	0.03	0.04
25	17.3	7.90	16	4.74	92.46	2.57	0.23	0.114	0.02	0.03
27	17.5	7.89	52	4.19	93.60	1.98	0.23	0.131	0.02	0.03
31	14.8	7.79	93	6.83	92.49	0.68		0.108	0.03	0.02
36	19.0	7.55	55	2.48	89.56	7.19	0.77	0.223	0.03	0.03
41	22.2	7.65	−140	3.50	68.86	22.31	5.33	0.378	0.03	0.03

Notes: pH-Eh direct in situ detection by field probe (Hanna); Gravel ≥ 4 mm; Sand = 4–0.063 mm; Mud = 0.063–0.004 mm; Clay ≤ 0.004 mm (detected by Manuale ICRAM, 2001; Sedimenti - scheda 3, LOD = 0.01%); TOC = total organic carbon (detected by DM 13/09/1999 SO n. 185 GU 248 21/10/99 Met. VII.3, LOD = 0.002%); TN = total nitrogen (DM 13/09/1999 SO n. 185 GU 248 21/10/99 Met. XIV.2 + XIV.3 DM 25/03/02 GU n. 84); TP = total phosphorous (US EPA 3051A/2007 e US EPA 6010D/2014).

Table 2
Number of micro-, meso- and macroplastics items for sampling site; mean ± SD for kg of dry sediment analyzed per sampling station (ST).

ST	MacroPs	MesoPs	MicroPs	SD
1	0	10	703	403.02
5	0	10	170	95.39
25	0	0	194	112.01
27	0	5	233	133.10
31	0	0	199	114.89
36	0	0	137	79.10
41	0	0	146	84.29

Table 3
Shape and number of collected plastic items for sampling site; mean ± SD; dimensional range of collected items (mm).

ST	FI	FILM	FR	G	P	FO	SD	Range (mm)
1	676	0	37	0	0	0	273.36	0.5–11
5	132	12	36	0	0	0	51.96	0.4–3
25	163	10	20	0	0	0	64.55	0.5–4
27	172	26	40	0	0	0	66.95	0.5–5
31	189	0	10	0	0	0	76.48	0.5- > 20
36	116	0	11	0	0	11	45.99	0.5–2
41	146	0	0	0	0	0	59.65	0.5–7.5