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Abundance, Composition and Spatial Distribution of Marine Plastic Litter in Sea Surface Waters Around Cap Corse

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Abstract

Marine litter is a widespread problem affecting all the oceans of the world. Plastics represent around 90% of marine litter, and it is estimated that there are between 15 and 51 trillion plastic particles floating on the surface of the oceans. The objectives of this study are to: (i) identify and characterize the main categories of floating items sampled in surface waters off the Cap Corse peninsula, (ii) provide estimates of the occurrence of floating items in this area, and (iii) get an overview of the potential areas of litter accumulation. We highlighted a heterogeneous distribution of floating litter as the plastic density characterizing the area between Bastia and Macinaggio (27 027 items/km^2) was, on average, 2.31 times higher than the density estimated between Macinaggio and Pino (11 688 items.km^2). Several studies highlighted that spatio-temporal variability of plastic densities and sizes of plastics (micro, meso, macroplastics) could be tightly linked with hydrodynamics and wind regime, distance to land, coastal human population and maritime traffic. Beyond the need to further raise awareness, providing more evidences and information regarding such marine pollution may hopefully foster urgent management strategies, whereby the most effective mitigation strategy implies reducing the input at its source.

Keywords: *Plastic, marine litter, manta-net, Mediterranean Sea.*

Introduction

Marine litter is a widespread problem affecting all the oceans of the world. Plastic pollution has gained attention by scientists and public perception in the last decade [1, 2]. Plastics represent around 90% of marine litter [3], and it is estimated that there are between 15 and 51 trillion plastic particles floating on the surface of the oceans [4]. Global plastic production increased from 5 million tonnes in 1950 to 322 million tonnes in 2015 [5]. It is considered that, on average, around 80–90% of ocean plastic comes from land-based sources, including via rivers, with a smaller proportion arising from ocean-based sources such as fisheries, ships and aquaculture. Plastic inputs from land to ocean was estimated to represent at least 4.8 to 12.7 million tonnes in the year 2010 [6]. Because of their abundance, durability and persistence, marine plastics constitute today a major threat to the marine environment [7].

The most visible impacts of marine plastics are the ingestion, suffocation and entanglement of hundreds of marine species, including species listed on the IUCN Red List as near threatened or above [8]. Microplastics (less than 5 mm in diameter), in particular, have recently become a source of concern, as their ingestion has been observed in a wide variety of taxa including zooplankton, marine invertebrates, fish, turtles, seabirds, and marine mammals [9–11]. Once ingested, microplastics can cause starvation, alterations in intestinal functions, a reduction in feeding capacity, energy reserves and reproductive output [12]. Also, contaminated preys can be consumed by predators leading to the transfer of plastics accross trophic levels [13]. Moreover plastics are polymers that may contain a large variety of chemical additives and contaminants, including organic pollutants and endocrine disruptors, that pollute the environment [14] and can be harmful to marine biota [15, 16].

Floating marine litter also plays an important role in the spread of marine or terrestrial organisms, including the dispersal of invasive species that may pose a threat to local ecosystems [17]. Also, the hydrophobic nature of plastics stimulates the formation of biofilms and allows the establishment of numerous organisms, called "epiplastic" organisms, which constitute a new marine ecosystem called "plastisphere" [18]. It can host different groups, in particular microbial organisms including pathogenic viruses or bacteria but also fungi, algae, molluscs, cnidarians, and crustaceans [19–21]. The surge in the number of litter introduced into the marine environment currently offers a great variability of objects that may serve as « novel habitat » or as « hitch-hiking raft » [22, 23].

In addition to causing harm and threatening marine ecosystems, marine litter, especially plastic, can also negatively affect human wellbeing, food security and socioeconomic sectors such as tourism, aquaculture, fishing and navigation [24-26].

The Mediterranean Sea is considered as a biodiversity hotspot [27], besieged by multiple human pressures. Indeed, its shores are home to around 10% of the world's coastal population and around 100 million people live within 10 km of the coast [28]. Moreover, the Mediterranean basin is one of the busiest shipping routes in the world and receives the waters of densely populated watersheds, e.g. the Nile, the Ebro, the Po [29]. It is therefore not surprising that the basin is nowadays described as one of the areas most affected by marine litter in the world, whereby the average density of plastic as well as its frequency of occurrence throughout the basin were comparable to accumulation zones in ocean gyres [29–31]. In Europe, various regulatory directives have been put in place to limit and reduce this pollution, such as the Marine Strategy Framework Directive (MSFD). In order to define the concept of « Good Environmental Status », the MSFD proposed 11 descriptors including descriptor n° 10 describing good status for marine litter as follows: "Properties and quantities of marine litter do not cause harm to the coastal and marine environment" [32]. Also new knowledge on this topic may have impact in the implementation of other environmental regulations such as the new European Strategy for Plastics in a Circular Economy (COM/ 2018/028 final), which has recently agreed on banning certain single use plastic (SUP) items.

To develop and validate indices of ecosystem status or pollution, it is necessary to have access to areas with low human impact and then validate them along local pressure gradients [33]. Corsica, is a privileged area in the North-Western Mediterranean. It is at the centre of one of the most touristic regions in the world still sheltered from heavy pollution of anthropic origin. This area should come closer to the concept of Good Ecological Status in terms of pollution by plastic marine litter. Our study intends to provide further information on marine litter regarding the northeastern waters of Corsica, part of the Cap Corse and Agriate Marine Natural Park (PNMCCA). This area is also comprised within the Pelagos Sanctuary, a large marine area subject to an agreement between Italy, Monaco and France for the protection of marine mammals.

In detail, the objectives of this study are to: (i) identify and characterize the main categories of floating items sampled in surface waters off the Cap Corse peninsula, (ii) provide estimates of the occurrence of floating items in this area, and (iii) get an overview of the potential areas of litter accumulation.

Material and method

In August 2019, the Corsican Blue Project team carried out a marine litter sampling campaign within the perimeter of the Cap Corse and Agriate Marine Natural Park (PNMCCA). A total of six manta-net tows were conducted along the coast of the Cap Corse peninsula between Bastia and Pino, including three transects along the eastern coast (Bastia-Macinaggio) and three transects along the northwestern coast (Pino-Macinaggio). The manta-net, characterized by a rectangular opening of 86 x 46 cm and a net opening of 330 µm, was deployed at the surface beyond the boats' wake at an average speed of 2.2 to 2.4 knots and for about 30 min per tow. General characteristics of each transect were recorded. After each sampling, the entire net was thoroughly rinsed with seawater from the opening to the collection bag to ensure that all the debris were concentrated in the cod end before being retrieved.

Collected samples were sent for analysis to the STARESO (STAtion de REcherches Sous-marines et Océanographique) research station. In the laboratory, the samples were rinsed with seawater on a 300 µm sieve. Then the mesh was rinsed with tap water and the sample was collected. Sampling consists of direct extraction from the environment of items that are recognizable by the naked eye. Several steps have been taken to separate the litter from the biological matrix and water [34]. Litter was manually separated from natural debris by removing the largest pieces of biological material (leaves, algae, wood ...) and rinsing them with water that underwent a second sorting to avoid any loss of debris [35]. Items that were visually identified as litter were collected using fine forceps and then counted. To avoid misidentification and underestimation of microplastics it is necessary to standardize the plastic particle selection, following certain criteria to guarantee proper identification [34]. Plastics were identified according morphological characteristics and physical response features (e.g. response to physical stress; microplastics were bendable or soft, colors) [34, 36]. Identified plastic items were measured over their largest cross-section (total length) in order to be classified into three categories: microplastics (<5 mm), mesoplastics (5-200 mm) and macroplastics (> 200 mm) [37]. Plastic items were also classified, as proposed by [21], into six categories according to their visual characteristics:

1. Fragment: this category is generally the most abundant. They are rigid, thick, with sharp, pointed edges and an irregular shape. They can be of different colors.
2. Film: they also appear in irregular shapes, but compared to the fragments, they are fine and flexible and generally transparent.
3. Pellet: they are generally from the plastics industry. These are irregular round shapes, about 5 mm in diameter. They are generally flat on one side and can be of different colors.
4. Granule: they have a regular round shape and generally smaller, around 1 mm in diameter. They appear in natural colors (white, beige, brown).
5. Filament: these are, with the fragments, the most abundant type of particles. They can be short or long, with different thicknesses and colors.
6. Foam: they most often come from large particles of polystyrene foam. They have a soft, irregular shape and are white to yellow in color.

The surface of the surveyed area was estimated by multiplying the observation width by the transect distance, and litter density (items/ km^2) was calculated by dividing the items count with the surveyed area surface [29].

Results and discussion

In this study, plastic litter was encountered in 100% of the hauls made off Cap Corse, representing a total of 238 items and a mean density of 19 357 items/ km^2.

We highlighted a heterogeneous distribution of floating litter as the plastic density characterizing the area between Bastia and Macinaggio (27 027 items/km^2) was, on average, 2.31 times higher than the density estimated between Macinaggio and Pino (11 688 items.km^2) (Fig.1). Several studies highlighted that spatio-temporal variability of plastic densities and sizes of plastics (micro, meso, macroplastics) could be tightly linked with hydrodynamics and wind regime [31, 38], distance to land [29, 39], coastal human population [40, 41] and maritime traffic [23]. In our case, the difference in densities found between the regions Bastia-Macinaggio and Macinaggio-Pino, could be consistent with coastal human population pressure whereby the area with an estimated higher density is located close to Bastia, a city of more than 44 000 inhabitants. As an example, a sampling campaign conducted in the Ligurian Sea, mainly along the French continental coast, reported that highest densities were found in front of Nice [40]. Corsica has been identified as a reference area where contamination by microplastics was lower compared to other regions off the French Mediterranean coasts (e.g. Antibes, Marseille, Toulon) [42].

Moreover, the area between Corsica and Elba has been identified as displaying the highest natural marine debris concentration throughout the Central Western Mediterranean, suggesting therefore that the area is under great influence of terrigenous input [43]. However, the identification of the source of the collected litter remains challenging without the consideration of dispersion models, and items being subject to surface water circulation [44] may drift from their source of input. Indeed, studies investigating on debris transport and dispersion due to marine circulation strongly suggest that floating litter might drift during periods ranging from a few weeks to several years before eventually sinking or beaching [45]. Taking into account that the Tyrrhenian Sea has been identified as an important accumulation zone [23] and that the eastern coast of Corsica is under the influence of the Tyrrhenian sea current which flows along the Italian coast before entering the Corsica channel [46] it is very likely that the area between Bastia and Macinaggio is supplied by debris drifting northwards.

It remains particularly challenging to compare our litter concentrations with those reported in other studies given the large variety of sampling methodologies. However, based on the same sampling methodology, sampled in the northern coast of Corsica, at the same season and at a rather similar distance to land, and concentrations were found to be in a same order of magnitude, ranging from tens of thousands to hundreds of thousands of items per square kilometer [30, 31, 40] (Table 1). However, in our case, densities were overall lower, and higher densities in the Bay of Calvi might

Table 1. Literature data on floating plastic densities for stations along the northen Corsican coast.

Site (Northern Corsica)	Method	Mesh size (µm)	Density (items / km²)	Source
Calvi	Manta trawl	333	400 000	[30]
Cap Corse			80 000	
Cap Corse			40 000 – 80 000	[31]
Calvi			20 000 – 150 000	[40]

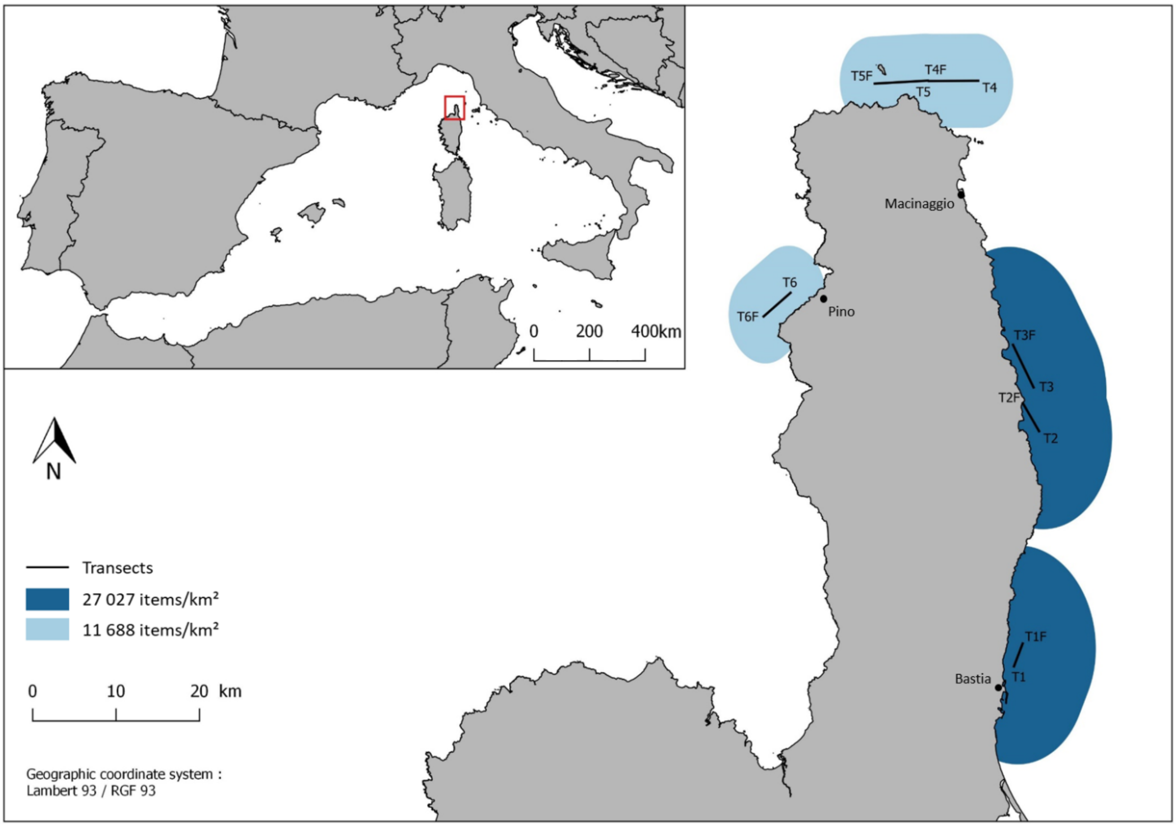

Fig. 1: Average concentration of plastic litter, expressed as debris per km2, in surface water off Cap Corse.

be linked to the different demographic pressures. Indeed, during summer season, population in Calvi may rise up to 60 000 inhabitants while the northwestern part of Cap Corse does not have such large population centre. However, these densities might also be linked to the difference in wind stress during the sampling campaign [38], and also, as previously mentionned, to the water circulation properties of the considered coastal areas.

Regarding size classes, 62% of the total number of items was smaller than 5 mm (microplastics), 26% measured between 5 and 200 mm (mesoplastics), and 12% was bigger than 200 mm (macroplastics) (Fig.2). In other words microplastics were 2.4 times more abundant than mesoplastics, and 5.3 times more abundant than macroplastics (> 200 mm). Such proportion is very similar to the study carried out in the Bay of Calvi, reporting that microplastics, mesoplastics and macroplastics accounted for 54%, 28% and 18% of total collected items, respectively [38].

Beyond the size-based classification, items were additionnaly classified according to their shape and appearance and it was found that fragments were largely predominant (62%), followed by films (26%), filaments (9%), foams (2%) and pellets (1%) (Fig.3). No

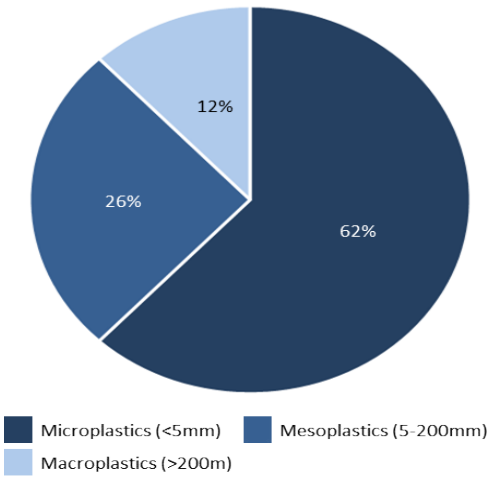

Fig.2: Size class of the litter found during the sampling campaign.

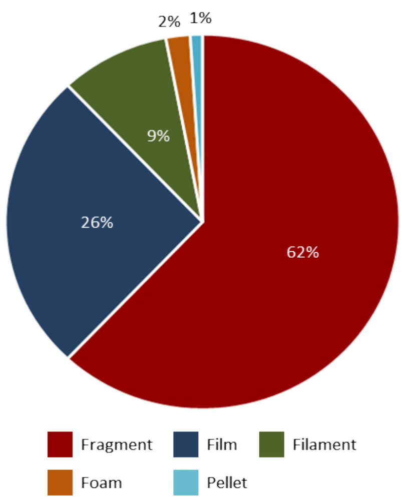

Fig.3: Main categories of litter found during the sampling campaign.

granule was found. Such proportion is consistent with previous results reported [39] and it was highlighted that the proportion of fragments was especially important in the north of Corsica compared to other stations throughout the Western Mediterranean Sea [31].

While on land, the island of Corsica is currently facing a major litter crisis, due to overloaded garbage dumps, its coastal marine waters are not exempted from marine litter pollution. In this context and despite a relatively small sampling effort compared to other major sea campaigns, our study provides information regarding the type and occurrence of marine litter and plastics in the local coastal waters off the Cap Corse peninsula. While the average density and types of litter items were in agreement with other comparable studies, we highlighted a potential heterogeneous distribution within the Cap Corse marine waters, with higher densities found in the transects of the eastern coast than in those from the northwestern area of the peninsula. To this, different explanations were proposed, such as terrestrial inputs and the influence of large population centres or the influx of debris through the marine circulation and wind forcing.

Conclusion

We highly advise further marine litter sampling campaigns to be conducted within these waters that are positionned at a bio-geogaphical crossroad where several major currents meet. Moreover such study would be scientifically supported and potentially technically facilitated given the fact that the Cap Corse waters are included within the Cap Corse and Agriate Marine Natural Park and the Pelagos Sanctuary. Field information could, for example, be useful in the risk assessment of whale or mammals exposure to microplastics by validating simulated plastic distribution, in parallel to whale habitat models [47]. Moreover, Corsica is also subject to high tourist flows during summer which also translates into an increment of boating, maritime shipping and passengers transport. It would therefore be advisable to conduct sampling all year round, to highlight any annual variability. This study also intends to promote and encourage further « participatory sciences » by which citizens are involved in data collection, in association with the scientific world.

Beyond the need to further raise awareness, providing more evidences and information regarding such marine pollution may hopefully foster urgent management strategies, whereby the most effective mitigation strategy implies reducing the input at its source.

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References

1. De-la-Torre GE (2019) Microplastics: an emerging threat to food security and human health. *J Food Sci Technol.*

2. Gabriel EnriqueDe-la-Torrea, Diana CarolinaDioses-Salinas, Jasmin MarlithCastro, RosabelAntay, Naomy YupanquiFernández, et al (2020) Abundance and distribution of microplastics on sandy beaches of Lima, Peru. *Marine Pollution Bulletin* 151: 110877.

3. Laurent C.M. Lebreton, Joost van der Zwet, Jan-Willem Damsteeg, Boyan Slat,

Anthony Andrady, et al (2017) River plastic emissions to the world's oceans. *Nat Commun* 8: 15611.

4. Van Sebille E, Wilcox C, Lebreton L, Maximenko N, Denise Hardesty B, et al (2015) A global inventory of small floating plastic debris. *Environ Res Lett* 10: 124006.
5. Plastics Europe E (2016) Plastics-the facts 2016. An analysis of European plastics production, demand and waste data. Brussels Belgium.
6. Jambeck JR, Geyer R, Wilcox C, Theodore Siegler R, Perryman M, et al (2015) Plastic waste inputs from land into the ocean. *Science* 347: 768-771.
7. Gregory MR (2009) Environmental implications of plastic debris in marine settings—entanglement, ingestion, smothering, hangers-on, hitch-hiking and alien invasions. Philosophical Transactions of the Royal Society B. *Biological Sciences* 364: 2013-2025.
8. Gall SC, Thompson RC (2015) The impact of debris on marine life. *Marine pollution bulletin* 92: 170-179.
9. Amélineau F, Bonnet D, Heitz O, Mortreux V, Harding AMA, et al (2016) Microplastic pollution in the Greenland Sea: Background levels and selective contamination of planktivorous diving seabirds. *Environmental Pollution* 219: 1131-1139. [Crossref]
10. Duncan EM, Broderick AC, Fuller WJ, Galloway ST, Godfrey HM, et al (2019) Microplastic ingestion ubiquitous in marine turtles. *Global change biology* 25: 744-752.
11. Lusher AL, Hernandez-Milian G, O'Brien J, Berrow S, O' Connor I et al (2015) Microplastic and macroplastic ingestion by a deep diving, oceanic cetacean: the True's beaked whale Mesoplodon mirus. *Environmental Pollution* 199: 185-191.
12. Guzzetti E, Sureda A, Tejada S, Faggio C (2018) Microplastic in marine organism: Environmental and toxicological effects. *Environmental toxicology and pharmacology* 64: 164-171.
13. Setälä O, Fleming-Lehtinen V, Lehtiniemi M (2014) Ingestion and transfer of microplastics in the planktonic food web. *Environmental pollution* 185: 77-83.
14. Gallo F, Fossi C, Weber R, Santillo D, Sousa J, et al (2018) Marine litter plastics and microplastics and their toxic chemicals components: the need for urgent preventive measures. *Environmental Sciences Europe* 30: 13. [Crossref]
15. Hellmann JJ, Byers JE, Bierwagen BG, Dukes JS (2008) Five Potential Consequences of Climate Change for Invasive Species. *Conservation Biology* 22: 534-543. [Crossref]
16. Orsi AH, Whitworth III T, Nowlin Jr WD (1995) On the meridional extent and fronts of the Antarctic Circumpolar Current. *Deep Sea Research Part I: Oceanographic Research Papers* 42: 641-673.
17. Miralles L, Gomez-Agenjo M, Rayon-Viña F, Gyraite G, Garcia-Vazquez E (2018) Alert calling in port areas: Marine litter as possible secondary dispersal vector for hitchhiking invasive species. *Journal for Nature Conservation* 42: 12-18.
18. Zettler ER, Mincer TJ, Amaral-Zettler LA (2013) Life in the "Plastisphere": Microbial Communities on Plastic Marine Debris. *Environ Sci Technol* 47: 7137-7146.
19. Quero GM, Luna GM (2017) Surfing and dining on the "plastisphere": Microbial life on plastic marine debris. *Advances in Oceanography and Limnology.*
20. Reisser J, Shaw J, Hallegraeff G, Proietti M, David Barnes KA, et al (2014) Millimeter-Sized Marine Plastics: A New Pelagic Habitat for Microorganisms and Invertebrates. *PLoS ONE* 9.
21. Viršek M, Palatinus A, Koren Š, Peterlin M, Horvat P, et al (2016) Protocol for Microplastics Sampling on the Sea Surface and Sample Analysis. *JoVE* 16: 118. [Crossref]
22. Aliani S, Molcard A (2003) Hitch-hiking on floating marine debris: macrobenthic species in the Western Mediterranean Sea. *Hydrobiologia* 503: 59-67.
23. Mansui J (2015) Observation et modélisation des macro-déchets en mer Méditerranée, de la large échelle aux échelles côtière et littorale.
24. Rochman CM, Browne MA, Halpern BS, Hentschel BT, Hoh E, et al (2013) Classify plastic waste as hazardous. *Nature* 494: 169-171.
25. Sheavly SB, Register KM (2007) Marine debris & plastics: environmental concerns, sources, impacts and solutions. *Journal of Polymers and the Environment* 15: 301-305.
26. Werner S, Budziak A, Van Franeker JA, GALGANI Francois, HANKE Georg, et al (2016) Harm caused by marine litter.
27. Giorgi F (2006) Climate change hot-spots. *Geophysical research letters* 33.
28. Richards LM (2008) CIESIN, Center for International Earth Science Information Network at Columbia University. Reference Reviews.
29. Cózar A, Sanz-Martín M, Martí E, Ignacio González-Gordillo J, Bárbara Ubeda, et al (2015) Plastic accumulation in the Mediterranean Sea. *PLoS One* 10.
30. Amandine Collignon, Jean-Henri Hecq, François Glagani, Pierre Voisin, France Collard, et al (2012) Neustonic microplastic and zooplankton in the North Western Mediterranean Sea. *Marine pollution bulletin* 64: 861-864.
31. Faure F, Saini C, Potter G, Galgani F, de Alencastro LF, et al (2015) An evaluation of surface micro-and mesoplastic pollution in pelagic ecosystems of the Western Mediterranean Sea. *Environmental Science and Pollution Research* 22: 12190-12197. [crossref]
32. EU Commission (2010) On criteria and methodological standards on good environmental status of marine waters. *Official Journal of the European Union, L* 232: 14-24.
33. Gobert S, Richir J (2019) Des indices pour la définition de l'état des masses d'eau en milieu marin: mises au point, applications et aide à la gestion. *Geo-Eco-Trop* 353-364.
34. Hidalgo-Ruz V, Gutow L, Thompson RC, Thiel M (2012) Microplastics in the Marine Environment: A Review of the Methods Used for Identification and Quantification. *Environ Sci Technol* 46: 3060-3075.
35. Herrera A, Garrido-Amador P, Martínez I, María Dolores Samper, Juan López-Martínez, et al (2018) Novel methodology to isolate microplastics from vegetal-rich samples. *Marine pollution bulletin* 129: 61-69.
36. Desforges J-PW, Galbraith M, Dangerfield N, Ross PS (2014) Widespread distribution of microplastics in subsurface seawater in the NE Pacific Ocean. *Marine Pollution Bulletin* 79: 94-99.
37. Ana Lacerda LdF, Rodrigues lds, Erik van Sebille, Fábio Rodrigues L, Lourenço Ribeiro, et al (2019) Plastics in sea surface waters around the Antarctic Peninsula. *Scientific reports* 9:1-12.
38. Collignon A, Hecq J-H, Galgani F, et al (2014) Annual variation in neustonic micro- and meso-plastic particles and zooplankton in the Bay of Calvi (Mediterranean–Corsica). *Marine Pollution Bulletin* 79: 293-298.
39. Zeri C, Adamopoulou A, Varezić DB, Fortibuoni T, Kovač Viršek M, et al (2018) Floating plastics in Adriatic waters (Mediterranean Sea): From the macro-to the micro-scale. *Marine pollution bulletin* 136: 341-350.
40. Pedrotti ML, Petit S, Elineau A, Bruzaud S, Crebessa JC, et al (2016) Changes in the floating plastic pollution of the Mediterranean Sea in relation to the distance to land. *PloS one* 11.
41. Ruiz-Orejón LF, Sardá R, Ramis-Pujol J (2016) Floating plastic debris in the Central and Western Mediterranean Sea. *Marine Environmental Research* 120: 136-144. [crossref]
42. Gérigny O, Maryvonne H, Tomasino C, Galgani F (2018) Rapport Indicateur Microplastiques dans le cadre des campagnes Directive Cadre Eau Méditerranée Occidentale (DCE) 2018.
43. Suaria G, Aliani S (2014) Floating debris in the Mediterranean Sea. *Marine Pollution Bulletin* 86: 494-504.
44. Millot C, Taupier-Letage I (2005) Circulation in the Mediterranean sea. *The Mediterranean Sea* 29-66.
45. Zambianchi E, Trani M, Falco P (2017) Lagrangian transport of marine litter in the Mediterranean Sea. *Frontiers in Environmental Science* 5: 5.
46. Gerigny O (2010) Hydrologie et hydrodynamisme dans les bouches de Bonifacio: mesures in-situ, modélisation, influence sur la biomasse. 441.
47. Fossi MC, Romeo T, Baini M, Cristina Panti, Letizia Marsili, et al (2017) Plastic debris occurrence, convergence areas and fin whales feeding ground in the Mediterranean marine protected area Pelagos sanctuary: A modeling approach. *Frontiers in Marine Science* 4: 167.

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