

Communication

# Marine Pollution by Microplastics in the Mediterranean Sea

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**Abstract:** Worldwide, plastic debris is becoming a great environmental problem, with potentially negative effects also on human health, although currently the topic is highly debated in the scientific community. In the basin, microplastics come mainly from three coastal regions, namely Egypt, Turkey and Italy, in decreasing order. Today, the knowledge about the possible interactions of microplastics in the biotic system is unclear and huge efforts are required to discover their effects on human health. Therefore, it is necessary to reduce the production and use of plastics by investing money in research planning and strengthening any kind of human efforts to solve this new kind of marine pollution.

**Keywords:** Mediterranean Sea; microplastics; marine pollution

In the marine environment, plastic waste is a great environmental problem and is becoming a “world crisis” since it is everywhere, from surfaces to deep waters [1]. Scientific literature estimates the overall amount of plastic waste in marine environments to be variable from 86 to 140 million tons concentrated in five oceanic hotspots, nicknamed “plastic islands” and distributed as follows: two in the Pacific Ocean, two in the Atlantic and one in the Indian [2]. Furthermore, there is a sixth “garbage patch”, invisible and concealed in the Mediterranean Sea, mainly composed of microplastics, which are microscopic particles between 5.0 mm and 0.1  $\mu\text{m}$  in diameter. Microplastics are small plastic fibers originating from the degradation of larger plastics pieces. The possible sources of these particles come from clothes, paints, tire dust, plastic litter and personal care products. In this way, according to an updated analysis, 229.000 tons of plastic flow yearly into the Mediterranean waters [3], and actually, more than 1 million tons of plastics is present in the basin, representing a serious risk for marine ecosystems [4] and for human health [5]. However, the real effects of microplastics on marine biota and on human health are still unclear and huge efforts are required to really assess the impact of microplastics [6,7]. Among the Mediterranean countries, about 70% of this heavy loading comes from three regions, divided as follows: 43.1% Egypt, 19.1% Turkey and 7.6 % Italy (Figure 1), as highlighted by the World Wild Fund Report 2019 [8]. Otherwise, if we consider only the plastic pollution caused by terrestrial sources, such as from coastline populations and river inputs, the relative rate per cent of Mediterranean coastal regions, in decreasing order, are the following: Turkey (97%), Morocco (94%), Israel (90%), Spain (89%), France (86%), Syria (86%), Egypt (84%), Albania (84%), Tunisia (82%) and Italy (80%) [9].

In particular, it has been estimated that there is a loading rate of microplastics variable from 5% to 10%, concentrated in the Mediterranean Sea, in regard to the global one widespread in the Ocean waters [9]. It has been estimated that this heavy environmental loading could reach an amount of 2.576 tons by 2025 [10]. The yearly cost caused by plastic pollution in Mediterranean waters is about EUR 61.7 million, including the economic loss caused by overfishing [3]. So, microplastics, although widely spread in every aquatic environment [8,9], in the basin show a concentration about four times higher than the global one [10]. Indeed, this new kind of marine pollution conceals a serious threat for the good functioning of marine ecosystems. In fact, the particles of this plastic debris enter



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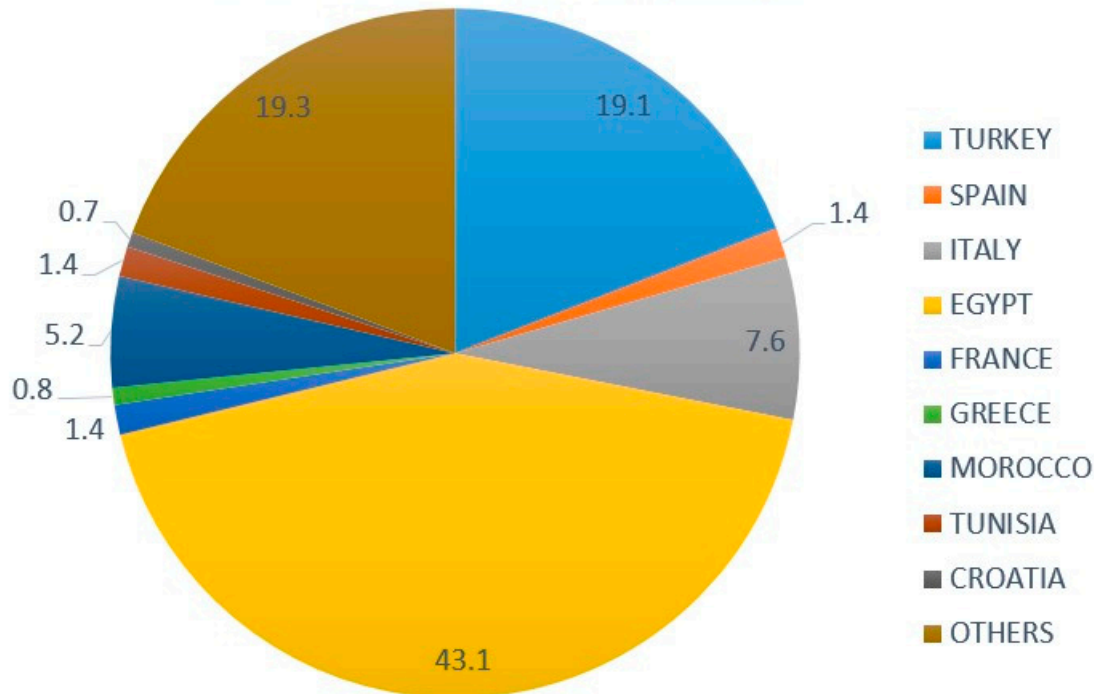
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the trophic system from the first steps of the marine food chain, represented by planktonic biomass, to the last one represented by top predators [4].

### Percent of marine plastic pollution



**Figure 1.** Percentage of plastic leakage into the Mediterranean Sea.

According to a report issued by World Wild Fund [11], in the Mediterranean biota, there are 134 faunal species threatened by the presence of plastic waste in their stomachs, with the following rates: 35% birds, 30% fishes, 20% invertebrates and 15% marine mammals. In particular, the bioaccumulation rates of microplastics in the digestive tracts of the most important marine target species are the following ones: marine turtles (35%), sword fishes (19%) and tuna fishes (18%). Therefore, such a process of biological concentration produces high polluting loadings, especially in some edible species of high commercial value [12], causing serious risks for public health [13]. In this critical state, an international agreement among Mediterranean countries could be envisaged, based on the following statements [14]:

1. Avoid producing plastic waste in natural environments.
2. Develop national plans effective for the prevention, control and removal of plastic litter from marine environments.
3. Ban plastic products from being a real risk for the presence of plastic waste.
4. Prevent the discharge of plastics into rivers and freshwaters.
5. Establish a scientific international committee specialized in plastic pollution.

It is suggested by the European Union [15] to urge Mediterranean countries to undertake all the financial, legal and administrative measures to establish a sound and sustainable waste management system so as to solve the problem of plastic pollution in the sea. Thus, in Greece it has been suggested to perform an experimental trial for the biodegradation of a mixture of plastic films through the microbial activities of bacterial populations. Additionally, in Italy, a novel approach has been proposed to reduce the plastic input, carried by watercourses into the sea, through the realization of floating barriers placed just before river mouths that are able to stop such plastic waste from going to continental collecting sites. Public knowledge is the best way to oppose the negative impacts of plastic pollution in marine environments. In this way, a real public awareness must be included in all the

statements for an effective control strategy of marine pollution in the Mediterranean Sea. In any case, the solution to this environmental problem must be realized at the source, by reducing the production and the use of any kind of plastic. In conclusion, it is necessary to invest money and energy into researching plans to set up effective countermeasures aimed at solving this new type of marine pollution.

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