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Uptake of Microplastics in the Wedge Clam *Donax trunculus*: First Evidence from the Mediterranean Sea

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Abstract: The Mediterranean Sea is affected by microplastic contamination, and several methods have been developed to investigate the degree of environmental plastic pollution. Among these, the use of bioindicators is strongly suggested, and in particular bivalves are sensitive sentinel organisms of the level of microplastic contamination. The wedge clams *Donax trunculus* is an important edible species for the Mediterranean, area but only rudimentary knowledge is available about microplastic contamination in this species, and no data are available about this topic in the Mediterranean Sea. Therefore, the main aim of this study was to investigate the microplastic accumulation in the wedge clam and in different water samples (seawater and purged water) in the Tyrrhenian Coast from September to June. The microplastics found were characterized by color, shape, and polymer type through micro-FTIR. For the first time, the microplastic contamination in wedge clams of the Mediterranean Sea was recorded. In September was recorded the highest concentration of microplastics in wedge clams (0.56 MPs/individual). Only microfiber shapes of different colors and types of polymers were found in both wedge clams and water samples. Polyethylene terephthalate was the most common polymer in wedge clams, while a diversified composition was found in water samples. The most common size both in wedge clams (42.8%) and water samples (≥50%) was in the range 0.1–1 mm. Our results highlight the presence of microplastics in an edible species widely commercialized in the Mediterranean Basin and the possibility of using this species to assess microplastic pollution.

Keywords: marine litter; plastic pollution; bivalves; bioaccumulation; Tyrrhenian coast

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1. Introduction

The Mediterranean Sea is exposed to several types of threats including overfishing, climate change, habitat deterioration due to the use of trawls, by-catch, and pollution from various human activities [1–3]. Another threat to the Mediterranean Sea, though no less important than the others, is the dumping of plastic in this marine ecosystem [4–6]. In fact, it has been demonstrated that the Mediterranean Sea has high concentrations of litter, especially plastic, that cause an extremely negative impact on species distribution and biodiversity [7–10]. Plastic is produced in large quantities, so much so that in 2019, about 368 million tons of plastic were produced [11], and in coastal countries, millions of tons of plastic litter have been generated, about 25% of which was mismanaged, easily reaching the open sea [12]. The issue with plastic is that this material is not able to degrade and consequently persists in the environment, often at the size of microplastics (MPs 0.001–5 mm), which are widespread in the most diverse ecosystems (e.g., aquatic, terrestrial and atmospheric) and impact many organisms (e.g., fish, worms, and birds) [13–15]. These particles enter the marine environment through different routes, such as wastewater, rivers, runoff, and wind currents, and the sources can be land-based (e.g., domestic, industrial, and touristic activities) or sea-based (e.g., shipping, fishing activities, and other offshore activities) [16,17]. Among the several shapes of MPs, microspheres and microfibers are very common, the latter being present in clothes, which, being washed in water, can be easily transported to the marine environment and dispersed through ocean currents [18]. The large amount of MPs in the sea has detrimental effects on many marine species, causing ingestion and toxic effects that result in internal abrasions, feeling of satiety, carcinogenesis, growth delays, and fertility reduction [19–21]. Moreover, MPs can play a role as vectors of toxic substances, pathogens, and alien species, increasing the impacts on marine ecosystems and organisms [22]. Indeed, whether isolated or combined with other toxic substances, the MPs are transferred along the food chain through bioaccumulation and biomagnification processes [23].

The spread of MPs in the marine environment has also been demonstrated through their presence within commercial bivalves [12,24]. MPs can adversely affect bivalves, both directly and indirectly, by impairing their filtration activity and causing genotoxic effects [25]. The MPs have been detected in gills, digestive glands, stomach, and the circulatory system of bivalves [26–29], suggesting the suitable use of bivalves as bioindicators of MP pollution [30–32]. Evidence for the accumulation of MPs by commercial bivalves reported in the literature is of concern to human health, as these organisms are consumed without removing their intestines [12,33]. MPs can even lead to the development of microbes in the human body, thus causing gastroenteritis and diarrhea reactions [34].

Among the edible species, *Donax trunculus* (Linnaeus, 1758) is a bivalve living along sandy beaches in tropical and temperate zones [35]. The presence of *D. trunculus* has been verified in the Mediterranean Sea, Black Sea, and East Atlantic. *D. trunculus*, being a bivalve, plays an important role in filtering the aquatic environment by removing particles from the water column and the interstitial spaces of the substrate [36]. Moreover, *D. trunculus* is employed as a sentinel species to assess marine pollution in coastal areas [37]. Given these important characteristics and the rudimentary knowledge of MP contamination in the wedge clam *D. trunculus*, this organism could be employed also to investigate MP contamination. Indeed, only two studies are available regarding the contamination by MPs in wedge clams, and no research exists about this topic in the Mediterranean Sea area. Therefore, this study aimed to evaluate the accumulation of MPs in wedge clams on the west coast of the Mediterranean Sea where the species is an important resource for the economy of the area and to acquire data about the degree of environmental MP pollution.

2. Materials and Methods

2.1. Study Area

The sampling activity was carried out on Passoscuro Beach (41°53′52.6″ N 12°09′30.2″ E), an inhabited center located on the Tyrrhenian Coast of the Lazio Region, northwest of Rome (Central Italy), from September 2020 to June 2021, with an interruption of 2 months corresponding to the heavy sea period, for a total of 10 samplings.

This beach is located within the State Nature Reserve "Litorale Romano", a protected natural area established by the Ministerial Decree of 29 March 1996 by the Ministry of the Environment and extends from Castel Porziano to the Dune of Passoscuro (Figure 1). Passoscuro is an area where many anglers practice clams fishing every year. This activity is highly developed because of the quality and fineness of the substrate that favors the survival and growth of *D. trunculus* populations in these areas. Given these environmental factors, the municipality of Passoscuro has organized a clam festival every year for more than 40 years, where hundreds of kilograms of wedge clams, which are caught directly on Passoscuro Beach, are sold and cooked. In the months prior to the festival, many residents and traders catch as many wedge clams as possible to sell during the festival.

Moreover, during the summer, this shoreline is subject to great exploitation due to summer bathing, while during the winter all the waste circulating in the sea accumulates on the beach, which is subject throughout the year to unauthorized building and sewage, leading to the big issue of pollution by plastics, and therefore probably also by MPs.

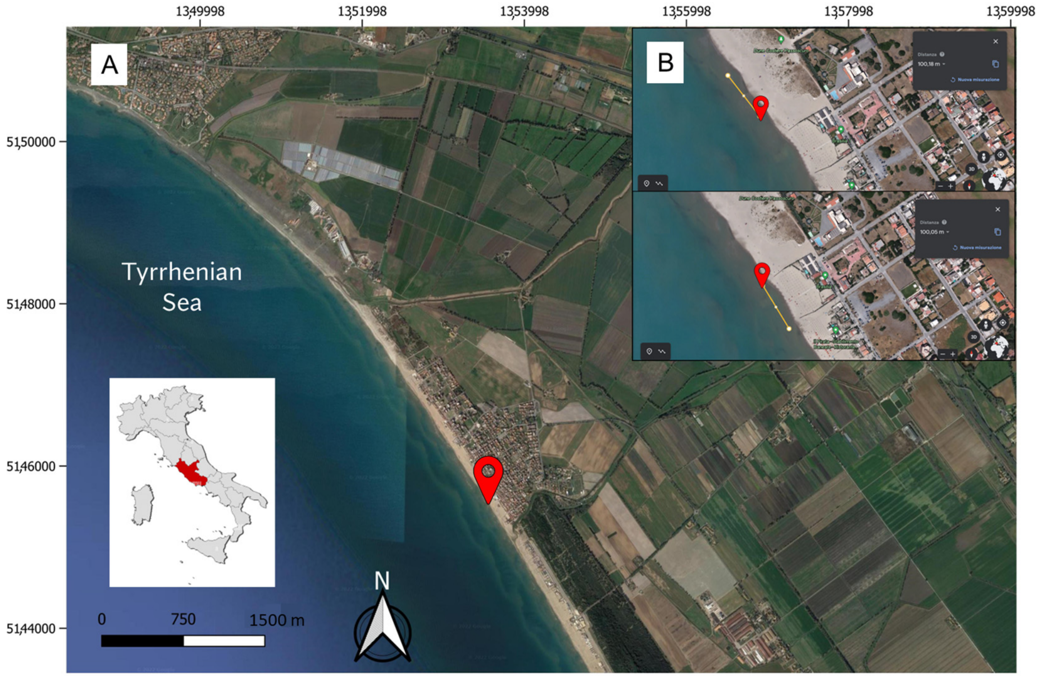

Figure 1. (**A**) Location of the sampling site along Passoscuro Beach on the Tyrrhenian Coast (Central Italy). In red, the position of Lazio Region on the Italy map. (**B**) Transects conducted to collect samples, 100 m north and 100 m south from the starting point.

2.2. Sample Collection

2.2.1. Wedge Clams

The wedge clams were sampled using a specific net for clams (94 × 56 × 27 cm) with a mesh size of 12 cm. Samplings were carried out a few meters from the shore, parallel to the coastline, by soaking the net to a depth of about 1–2 cm. The collections were conducted 100 m north and 100 m south from the starting point, and the transects were repeated 5 times each for a total of 10 transects each day of sampling (Figure 1B). During each sampling, 15 adult individuals (>2 cm) were placed in an aluminum container for transport to the laboratory.

2.2.2. Water

To evaluate the possible accumulation of MPs in the bivalves by comparing the MP concentration in the seawater, 15 additional individuals of *D. trunculus* purged in 1 L of artificial water and 1 L of seawater were analyzed. Wedge clams were left to purge in a glass container in artificial water (1 L) composed of distilled water and commercial NaCl salt. Every 3 h, the purge water was collected, and the container was completely renewed with new artificial water for a total of 9 h (3 h, 6 h, and 9 h). The initial concentration of MPs contained in the artificial water was unknown; therefore, the same composition of artificial water (1 L) was also analyzed without wedges to evaluate the possible accumulation of MPs. Three possible results were expected: (i) the amount of MPs in the purge water remained the same over time; (ii) the concentration of MPs decreased in the purge water and accumulated in the wedge clams; or (iii) the concentration of MPs increased in the purge water, and consequently clams released the MPs. The seawater sample was manually collected from about 30 cm below the surface using a 1 L glass bottle.

2.3. Analysis of Microplastics

The shell lengths of the specimens collected were measured. The valves were opened by bistoury, and the soft tissue was weighed. Subsequently, 5 specimens pooled in a glass Petri dish were digested with 30 mL of 30% H_2O_2 using a hot plate at 50 °C for approximately 6 h to remove organic matter, like the protocol of Suepbala et al. [38]. Once the oxidation process was completed, each Petri dish containing the oxidized samples was observed under a Nikon C-LEDS stereomicroscope (0.8×–3.5×; Made in China) to collect possible MPs. When a suspected MP was found, it was isolated, and its physical characteristics, such as shape (fiber, pellet, bead), color (primary colors, black and clear) and size (0.1–1, 1.1–2, 2.1–3 mm, 3.1–4 mm, 4.1–5 mm), were marked. In order to assess their size, the particles were placed on graph paper, placed under the stereomicroscope, and photographed to acquire their dimensions later measured using the ImageTool 3.00 program.

Next, the observed MPs were pooled within a single clean Petri dish for a further oxidation process, as previously described, to avoid residual organic matter as interference during the micro-Fourier Transform Infrared (FTIR) analysis to confirm and identify the plastic polymers. The micro-FTIR analyses were carried out using a Nicolet iN10 infrared microscope (Thermo Fisher Scientific IT, Milano, Italy) equipped with a mercury–cadmium–telluride (MCT-A) nitrogen-cooled detector in ATR mode. Spectra were collected in the 4000–650 cm^{-1} range with 8 cm^{-1} resolution. The collected spectra were compared to the reference spectra of known polymers using OmnicPicta software version 2.03 libraries provided by Thermo Fisher Scientific IT. The collected spectra with a match percentage of 65% to the reference spectra were accepted [39]. The same analytical process was followed for the different water samples using 4 Petri dishes for every 300 mL of each water tested.

2.4. Quality Control

To avoid contamination by MPs, all instruments were observed under the stereomicroscope before use to check that they were sterile; otherwise, the surfaces were cleaned with distilled water. In addition, all work surfaces were sterilized with 90% ethanol before their use. To avoid airborne contamination as much as possible, each person involved in handling the samples wore a pure cotton lab coat and latex gloves, and the procedures were carried out under a laminar flow hood.

2.5. Statistical Analysis

To analyze the MPs accumulated in specimens, the MP concentrations between different months were compared using the Chi-square test with Yates correction.

To verify the existence of a correlation between the average size and weight of the individuals, month by month, and the concentrations of MPs analyzed, a Spearman correlation and Pearson correlation were conducted, respectively.

The p-value of statistical tests was set at 0.05, and the nonsignificant p-values were reported as ns. All statistical analyses were computed in Past 4.02 [40].

3. Results

3.1. Microplastics in Wedge Clams

A total of 50 MPs was found in the *D. trunculus* specimens, sampled in different months from September 2020 to June 2021. Specifically, in September was found the highest average value of MPs (0.56 ± 0.1 MPs/individual), followed by October (0.34 ± 0.09 MPs/individual) and April (0.31 ± 0.08 MPs/individual) (Figure 2). The lowest average concentrations were found in November (0.07 ± 0.05 MPs/individual), February (0.17 ± 0.07 MPs/individual), March (0.11 ± 0.02 MPs/individual), and May (0.06 ± 0.03 MPs/individual), and no MPs were found in June. The only shape found in each sample examined was fiber (Figure 3).

Regarding color, little variability was observed; indeed, black and blue were the most abundant color found, namely, 59.7% and 29.9%, respectively, while a small number of red MPs (9%) and transparent MPs (1.4%) was found (Figure 4A).

Regarding size, most MPs were in the range of 0.1–1 mm (42.8%), whereas the 1.1–2 mm and 2.1–3 mm dimension ranges were present in the same percentage (28.6%) (Figure 4B).

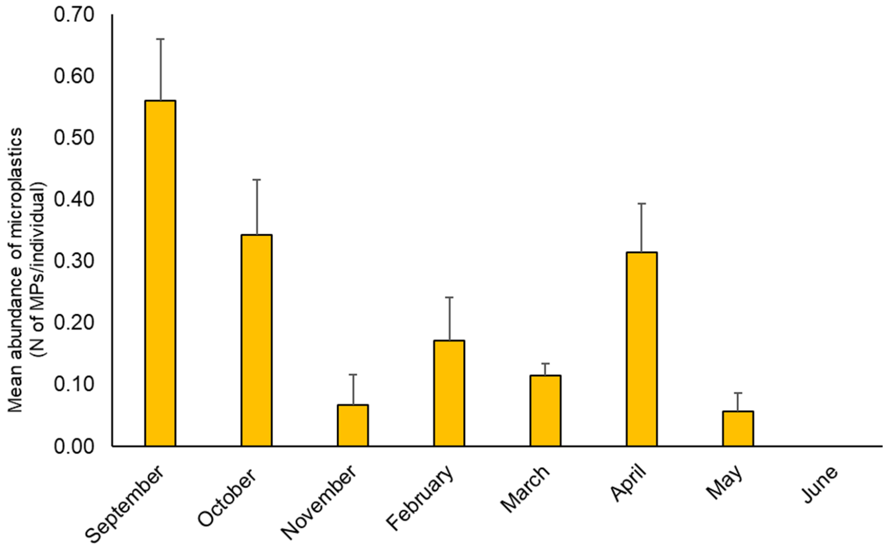

Figure 2. Mean abundance of microplastics (number of MPs/individual) accumulated in wedge clams sampled during each monthly sampling.

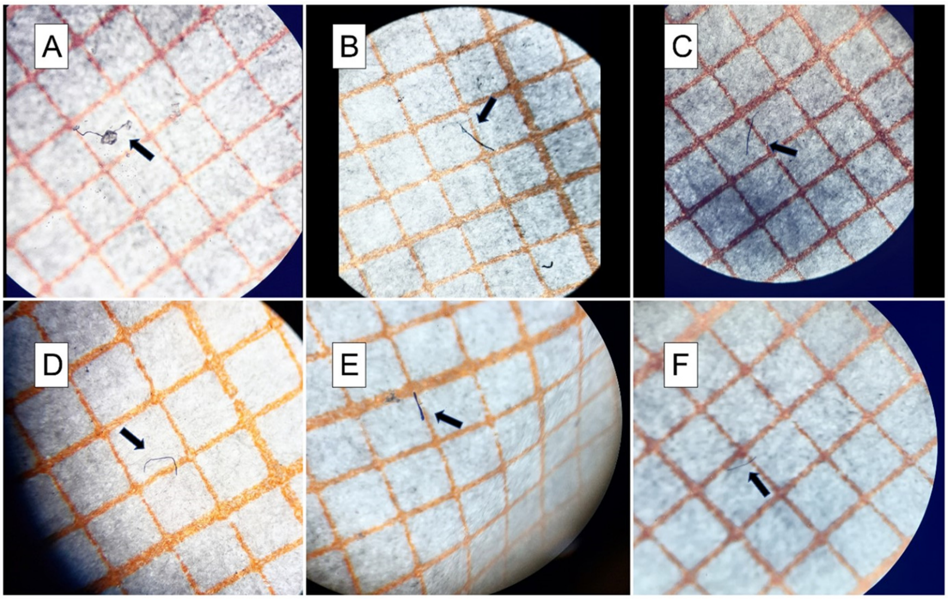

Figure 3. Example of microfibers found in wedge clams observed under stereomicroscope: (**A**–**C**) the largest microfibers (>1 mm), and (**D**–**F**) the smallest microfibers (<1 mm).

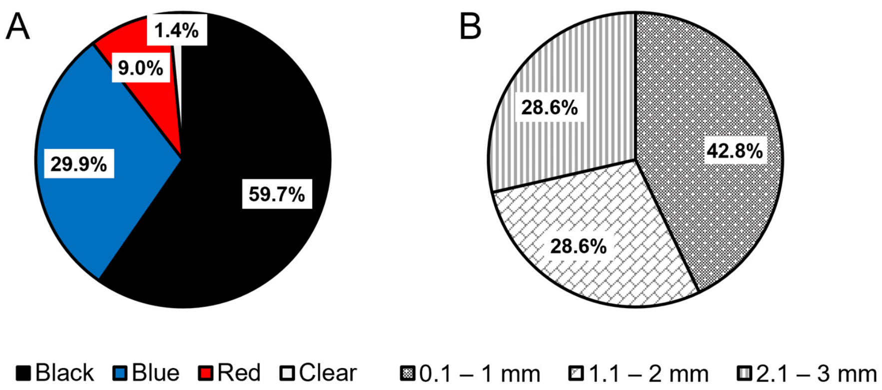

Figure 4. Microplastic composition (%) regarding color (**A**) and size (**B**) accumulated in wedge clam specimens.

The results of the χ^2 test for assessing the differences in MP concentrations observed between months are shown in Table 1. Finally, using Spearman's correlation test, no significant relationship between the size of *D. trunculus* samples and the concentration of MPs was found (R = 0.29; p = ns). The same result was obtained by analyzing the correlation between the weight of wedge clams and the concentration of MPs using Pearson's correlation test (r = −0.51; p = ns).

Table 1. Results of χ^2 test and relative *p*-values; bold indicates statistically significant results.

χ^2/p	September	October	November	February	March	April	May
September		0.7	**0.0027**	**0.074**	**0.018**	0.71	**0.0027**
October	0.65		**0.0075**	0.16	**0.045**	0.45	**0.0075**
November	**0.000014**	**0.000041**		0.16	0.41	**0.00018**	0.0019
February	**0.039**	0.11	0.061		0.53	**0.033**	0.16
March	**0.003**	**0.013**	0.27	0.44		**0.007**	0.41
April	0.67	0.42	**0.00000003**	**0.012**	**0.00042**		**0.012**
May	**0.000014**	**0.000041**	0.62	0.061	0.27	**0.00019**	

3.2. Microplastics in Water

The water sample containing NaCl was characterized by the highest concentration of MPs (60 MPs/L), followed by the seawater sample (10 MPs/L) and purged water samples. A linear trend between the amount of MPs and the purging time of the samples was highlighted. In fact, the amount of MPs was higher in the sample of water with clams purged in the first 3 h (31.6%) than in the sample of water with specimens purged in the next 6 h (10.5%), which in the same way contained a higher concentration of MPs than the water with clams purged in 9 h (5.3%) (Figure 5).

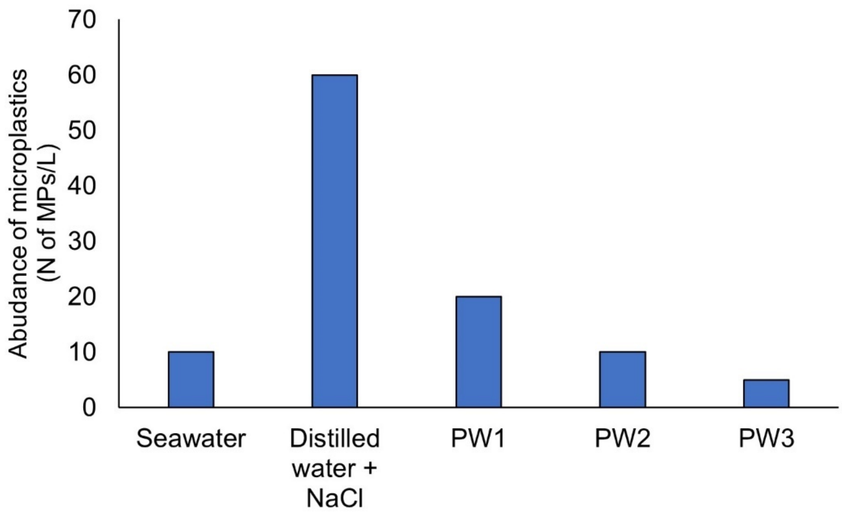

Figure 5. Abundance of microplastic (number of MPs/L) in different water samples: seawater, distilled water + NaCl, purged water every 3 h (PW1, PW2, PW3).

Only blue-colored fibers were found in the seawater and in the purged water after 9 h, and blue and black fibers were found in purged water after 6 h, while in the water with NaCl and in the purged water after 3 h, the variability of the colors was greater (Figure 6).

Regarding size, the range in water samples was 0.1–1 and 1.1–2 mm, while no MPs in the range 2–3 mm found in wedge clams were observed (Figure 7). Only MPs in the range 0.1–1 mm were found in the sample of purged water after 6 h, while in the sample of purged water after 9 h, the size varied between 1 and 2 mm.

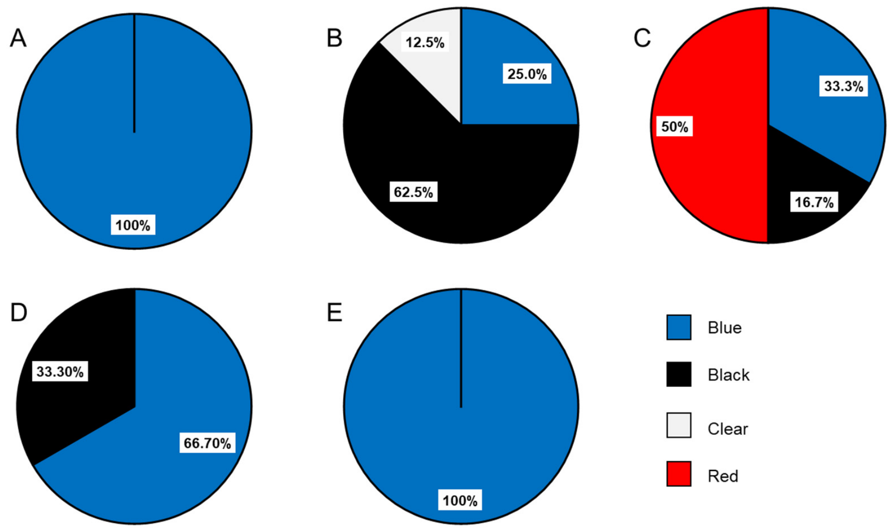

Figure 6. Microplastic frequency (%) of colors found in (**A**) seawater, (**B**) distilled water + NaCl, (**C**) purged water in 3 h, (**D**) purged water in 6 h, (**E**) purged water in 9 h.

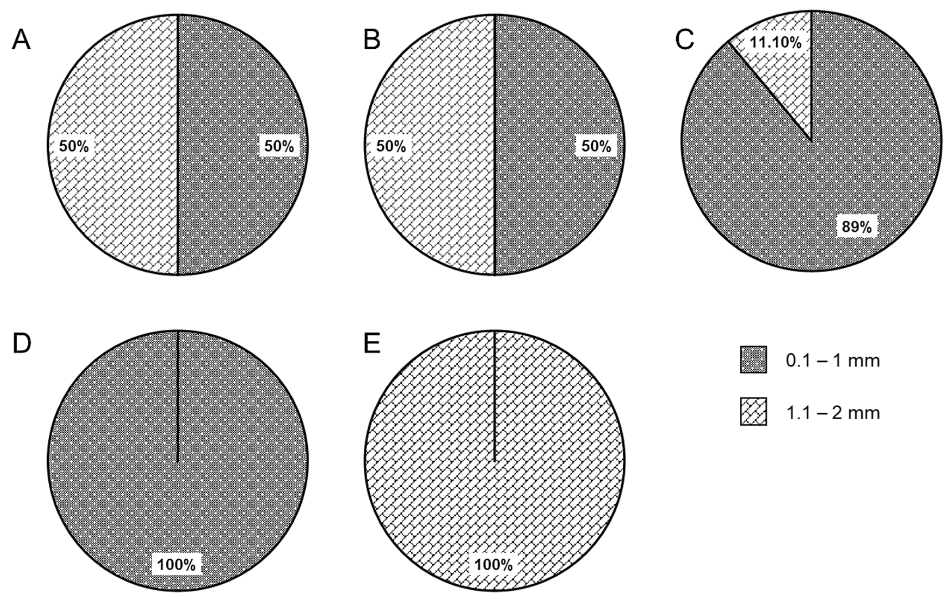

Figure 7. Size classes (%) of microplastics found in (**A**) seawater, (**B**) distilled water + NaCl, (**C**) purged water in 3 h, (**D**) purged water in 6 h, (**E**) purged water in 9 h.

3.3. Micro-FTIR Characterization

Finally, Fourier Transformed Infrared Spectroscopy (micro-FTIR) was used to verify the polymeric diversity of the microfibers. The diversity of microfiber polymers in the *D. trunculus* samples was greater than the polymeric diversity of microfibers found in the water samples, especially considering the water samples purged at three different times. Some of the acquired spectra are presented in Figure 8. Specifically, in clam samples, a high quantity of polyethylene terephthalate (PET) (60%) was found, followed by polyvinylidene chloride (PVDC) and nylon (both 20%) (Figure 9). In water samples, a different composition was found between each sample: polyacrylamide (PAM) in seawater, polyether in distilled water containing commercial NaCl, and rubber and PET in purged water (Figure 9). Some particles identified with micro-FTIR were found to be other materials. For example, a large number of microfibers in water samples was determined to be rubber (Figure 9).

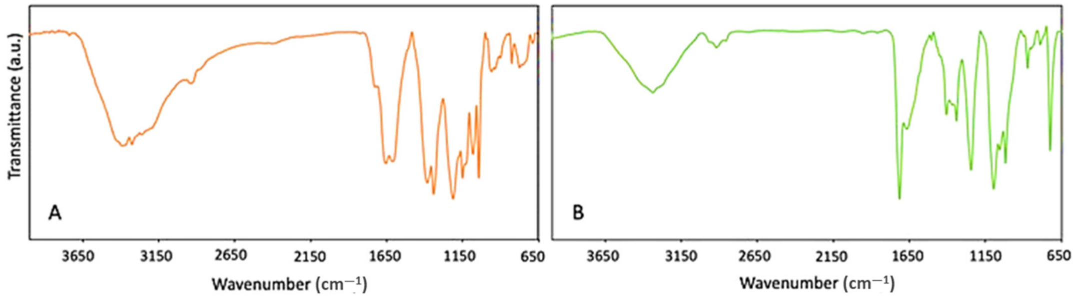

Figure 8. Example of micro-FTIR spectra of polymers found in wedge clams. Polyvinylidene chloride (**A**) and polyethylene terephthalate (**B**).

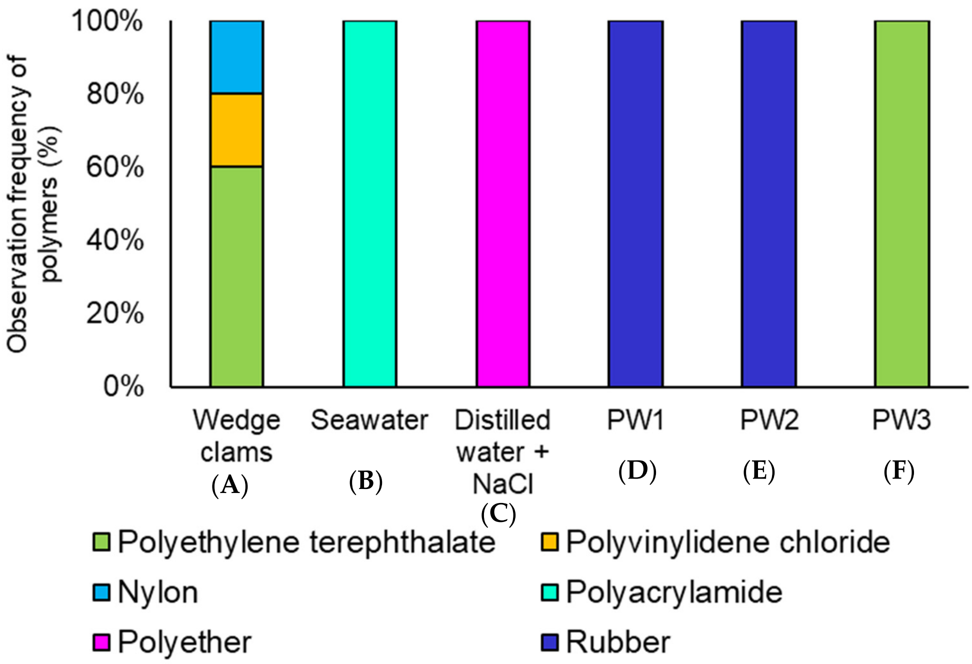

Figure 9. Frequency of polymers (%) identified using micro-FTIR in wedge clam specimens (**A**), seawater (**B**), distilled water + NaCl (**C**), purged water in 3 h (**D**), purged water in 6 h (**E**), purged water in 9 h (**F**).

3.4. Comparison of Studies about Microplastics in Wedge Clams

Table 2 shows the results of research conducted worldwide about MP contamination in wedge clams.

Table 2. Microplastic contamination in the species *Donax trunculus* across worldwide coasts. The data reported regarding the study area, microplastic abundance, and dominant color, shape, size, and polymer. NA = not available; PET = polyethylene terephthalate; PE = polyethylene.

Reference	Study Area	MPs Abundance	Dominant Color	Dominant Shape	Dominant Size	Dominant Polymer
Present study	Tyrrhenian Coast (Mediterranean Sea)	0–0.56 MPs/individual	Black Blue	Fiber	0.1–1 mm	PET
[41]	Bulgarian Coast (Black Sea)	0.31–4.46 MPs/individual	NA	Pellet	≤25 µm	NA
[42]	Atlantic Coast of Morocco (Atlantic Ocean)	1.75–5.93 g·ww^{-1}	Blue	Fiber	0.1–0.5 mm 0.5–1 mm	PE

4. Discussion

This study was the first contribution to the assessment of MP accumulation in wedge clams in the Mediterranean Sea. The findings highlight the hazards of MPs in widely commercialized edible species by assessing the accumulation of microplastics in wedge clams. Indeed, this species represents an important seafood product for the Italian economy and is widespread in the Mediterranean area. Although the importance of this species is recognized as a sentinel organism for environmental monitoring and seafood resource [37], few studies are available on this topic, and the only data collected are in the Atlantic Ocean [41] and along the Bulgarian Black Sea coast [42] using *Donax trunculus* as bioindicators of MPs.

Since the wedge clam is a coastal species, it can be impacted by plastic pollution that is both land-based (wastewater, urban, agriculture, and recreational activities) and sea-based (fisheries, shipping, and offshore oil) [5]. The analyses showed the highest concentration of MPs in the wedge clams sampled in September, i.e., a period following the summer months during which the stretch of beach examined is subjected to excessive use by bathers. For this reason, it can be assumed that the intensified touristic activities during the summer months could have caused a high abundance of MPs found in the following period in the bivalve *D. trunculus*.

Considering the concentration of MPs worldwide, it has been verified that this concentration tends to be extremely different in bivalves from diverse marine areas. Indeed, other studies analyzing *D. trunculus* found higher concentrations compared to the present studies (0–0.56 MPs/individual). Ben-Haddad et al. [41] reported a concentration ranging between 1.75 and 5.93 MPs per $g \cdot ww^{-1}$ along the central Atlantic Coast of Morocco, and Alexandrova et al. [42] found a mean value of 0.31–4.46 MPs/individual along the Bulgarian Black Sea coast. While considering other bivalve species, different concentrations were found such as *Mytilus edulis* (1.5–7.6 items/individual) [26] or *Ruditapes philippinarum* (0.87–3.60 items/individual) [43]. A market survey assessed that the bivalves coming from the Italian coast had the highest number of MPs accumulated (3–12.4 items/individual) [24]. Most likely, all these differences in the concentrations of MPs within organisms can be explained by the different sources and the degree of urbanization of their areas of origin and their mode of life (i.e., wild or cultivated) [41,44].

In addition to different levels of pollution, however, it could also be caused to a small extent by diverse methods of analysis of MPs in the laboratory [12]. Indeed, there is currently no standardized protocol for the analysis of MPs in the laboratory, so much so that different types of analysis are used, including the use of different digestion reagents (H_2O_2, HNO_3, HCl) and different identification methods (visual and chemical), which can influence the results obtained [15]. In this study, through the H_2O_2 digestion and the identification of MP particles, first visually and then by micro-FTIR, the exclusive presence of microfibers of different sizes was verified. The absence of spherical MPs or granules could be because these shapes can be more easily expelled from the digestive tract of bivalves than microfibers [45]. Several studies found the predominance of fibers in bivalve samples [41,46–48]. Moreover, this difference between the various species may also depend on the number of replicates considered (for each different species), as these numbers could affect the results of laboratory tests [41], along with the different types of plastic particles digested, as the size of MPs is inversely proportional to their number (i.e., the larger the particles, the lower the concentration of the MPs ingested) [49]. In this study, the most common size was in the range of 0.1–1 mm, as in another study that investigated the same species [41]. There is a correlation between the size of the organism and the size of the MPs ingested [50]. Indeed, bivalves of higher dimensions ingested MPs of higher sizes, such as *Crassostrea gigas* and *Perna perna*, in which MPs reaching 5 mm were found [51,52].

In our study, a large amount of black MPs, a small amount of blue and red MPs, and only a few clear-colored particles were found in wedge clams. These results are very similar to some obtained in other studies carried out in the Mediterranean Sea where other organisms (fishes) were considered [53–55]. Considering only fish species, it could be assumed that these coincidences are due to the type of feeding of each species [56], but the studies also included the *D. trunculus* species, which has a completely different feeding mechanism, so it could be assumed that these concentrations of MP staining are mainly due to local concentrations of MP sources [57].

For the water samples, the concentration of MPs in seawater and purged water was lower than for the distilled water containing commercial NaCl. From this result, it is possible to understand how the problem of MP pollution is not exclusive to the marine environment, but these particles have now colonized different environments, even being found in salt for commercial use [17]. After 9 h, *D. trunculus* was able to accumulate MPs, as highlighted by the different concentrations found in the initial purged water. Regarding color and size, the results of MPs found in water samples were in line with those found in wedge clams. These findings corroborate the use of wedge clams in environmental monitoring to evaluate different types of pollution [37,41,58,59].

The MPs accumulated in the wedge clams belonged to different categories, with PET being the most abundant, followed by nylon and PVDC. PET is a type of resin (polyester) that is used in the production of various commercial items, starting with bottles and food containers [60]. Nylon is a synthetic polyamide that is mainly used in the form of textile fibers and has therefore become a key element in the production of clothing and furniture [61]. Finally, PVDC is used for packaging and for the production of household items such as cleaning cloths and filters [11]. In *D. trunculus*, other research reported different polymers, such as polyethylene (PE) and polypropylene (PP) [41], while in other clam species were found PE, PET, PP, and polystyrene (PS) [43,62]. The presence of synthetic polymers in wedge clams poses a risk to sea fauna predators of clams and humans, as this species is consumed whole without the removal of organs where MPs mainly accumulate [63].

In seawater, PAM was found; this polymer is commonly used as a flocculant in water and wastewater treatment [64]. Therefore, it is possible to understand that MPs result from the degradation of plastics mainly from domestic sources, such as washing machines, and it has even been shown that more than 1900 microfibers are produced during a single wash [65]. In addition to washing machines, other main sources of MPs are wastewater treatment plants. This is because very often the purification treatments applied to wastewater are not able to totally remove the pollutants present, as is the case of MPs, be they fibers or beads [66].

It is interesting to remark that in the water samples purged after 3 and 6 h, the type of particles was the same (rubber), unlike the particles found after 9 h (PET). This may suggest that *D. trunculus* tends to accumulate different types of polymers and retained them for different times. Wedge clams release material such as rubber more easily into the surrounding water and retain plastics such as PET in their tissues for longer. The accumulation of synthetic polymers can cause several detrimental effects on bivalves, as highlighted by laboratory studies [67–69]. Specifically, in *D. trunculus*, an MP mixture of PE and PP at a concentration of 0.06 g/kg of sand caused oxidative stress and neurotoxicity, and gills were found to be the first target organ of MP accumulation [70]. In addition to polymers, additives and plasticizers can also cause toxicological effects, and future studies should analyze their presence, as their presence could be considered as a proxy for MP pollution [39,71]. The study corroborates the suitable use of wedge clams to assess marine plastic pollution and the importance of continuing to monitor MPs through bioindicators, providing data on environmental bioavailability.

5. Conclusions and Future Perspectives

The present study reported for the first time the presence of MPs in *D. trunculus* living in their natural habitat on the Tyrrhenian Coast of the Mediterranean Sea. The conducted analyses highlighted MP contamination in the marine aquatic environment and the ability of wedge clams to uptake and accumulate MPs in tissues. Although the level of pollution is lower than in other worldwide areas, the findings still raise concern given the common human consumption of this seafood resource. The exclusive presence of microfibers was assessed, but MPs can also have different shapes, such as beads, which tend to be released from the organism much more easily than fibers. Further research must be conducted to confirm the accumulation of specific MP shapes in wedge clams.

Moreover, the research highlighted the lack of standardized methods and classification to investigate MP pollution and compare data worldwide. For instance, there is no clear classification of which polymers are considered plastic, such as cellulose. This point is extremely important for a clearer analysis of plastics in the marine environment, as the incorrect identification of particles can cause underestimation or overestimation of the environmental concentration of plastic.

In conclusion, this study represents a first step regarding the topic of contamination by MPs in a species still under investigation despite the ecological and economic importance that covers the Mediterranean Sea area. In the future, this study can provide a basis for conducting further field research so as to acquire more data, at both spatial and temporal scales, and laboratory studies to investigate possible effects due to the accumulation of MPs in wedge clams. Future perspectives could be carried out on the investigation of the relationship between the degree of deformation of the clam and the MP concentration to find a proxy of the level of contamination.

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