

# Marine ecosystems perceived as highly impacted by microplastic pollution: insights from a public awareness survey

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## Abstract

Microplastics, a persistent by-product of global plastic overuse and inadequate waste management, continue to accumulate across environmental compartments. As their large-scale removal remains technically unfeasible, fostering individual responsibility may be crucial to mitigating this pollution. This study assessed public knowledge and awareness regarding microplastic contamination among 407 respondents across various age groups (< 20, 20–40, 40–60, and > 60). The results indicate high awareness of microplastic transport into marine and freshwater systems, as well as its potential harmful effects on biota. However, recognition of atmospheric pollution and domestic sources remains limited. Notably, 91% of respondents acknowledged individual responsibility for reducing plastic waste. These findings underscore the need for targeted education and awareness-raising initiatives to foster behavioural change and safeguard the oceans.

## Keywords

Plastic pollution; Public perception; Environmental education

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1 Microplastics (MPs), originating from the mass produc-  
2 tion and widespread use of plastics from both primary (i.e.,  
3 intentionally produced) and secondary sources (i.e., from  
4 the breakdown of larger plastic fragments), have become  
5 a serious and persistent environmental pollutant. Their ac-  
6 cumulation in the environment, driven by global overcon-  
7 sumption of plastics and inadequate waste management,  
8 continues to rise, while their removal remains technically  
9 unfeasible (e.g., Ziani et al., 2023). It is estimated that  
10 millions of tonnes of plastic waste enter the oceans each  
11 year (e.g., Lebreton et al., 2017). The conservation of ma-  
12 rine environments ultimately depends on human choices,  
13 prompting increasing calls for sustainable management  
14 and policies that promote behavioural change (Hender-  
15 son and Green, 2020). Effective public engagement, how-  
16 ever, requires adequate education and awareness. This  
17 study aimed to assess the level of public knowledge and  
18 awareness of microplastic pollution, and to identify po-  
19 tential gaps that may hinder environmentally responsible  
20 behaviour.

**Table 1.** Characteristics of the respondents (n = 407).

Item	Response	No.	%
Gender	Female	242	59.6
	Male	165	40.4
Age	< 20	137	33.7
	20–40	122	29.9
	40–60	96	23.6
	> 60	52	12.8

21 We applied a quantitative social survey method. The  
22 written questionnaire consisted of 13 questions, of which  
23 nine were single-choice statements rated on a three-point  
24 scale ('Agree', 'Disagree', 'No opinion'), and four were multi-  
25 choice questions, allowing respondents to select more  
26 than one answer from a list of predefined options. Respon-  
27 dents also indicated their gender and age. A total of 407 in-  
28 dividuals (242 females and 165 males) from two southern  
29 Baltic voivodeships (Pomeranian and West Pomeranian)  
30 participated in the survey conducted in 2020. To obtain  
31 insights into different age groups (< 20, 20–40, 40–60,  
32 > 60) (Table 1), the questionnaire was distributed among

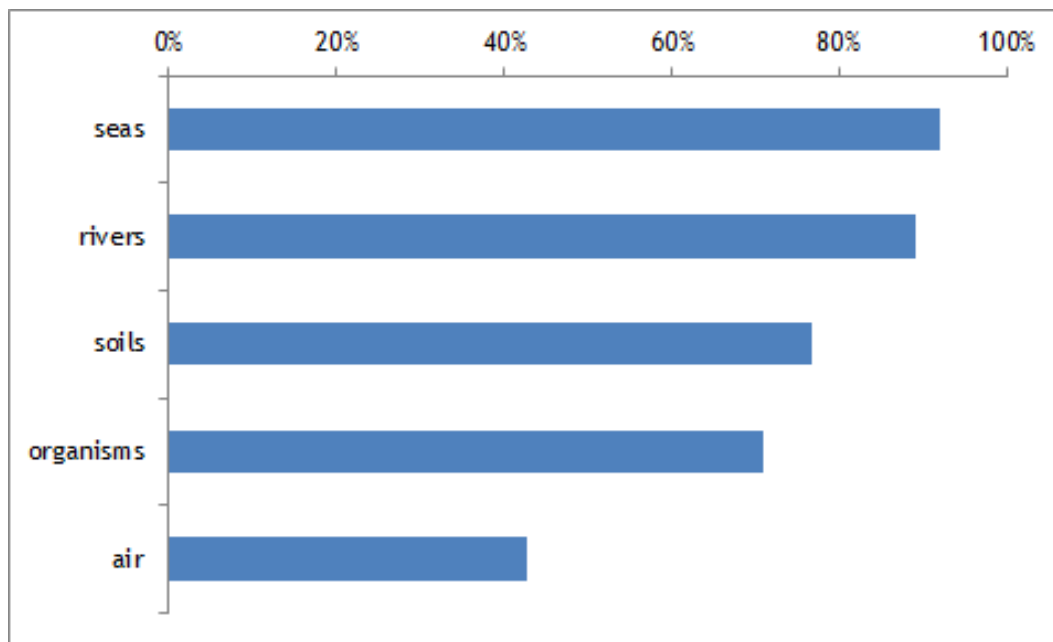


Figure 1. Responses to the question 'Where can microplastics be found?'

33 school pupils, students, working adults, and participants  
 34 of a senior day-care centre. Participants were informed  
 35 about the purpose of the survey, which was to explore their  
 36 perceptions of MPs, including their sources and origins,  
 37 environmental distribution, and potential consequences  
 38 of their release into the environment.

39 Microplastics are ubiquitously distributed across all  
 40 environmental compartments – marine, freshwater, ter-  
 41 restrial, and atmospheric (e.g., Jaszczyszyn et al., 2025),  
 42 but the vast majority of respondents (92%) representing  
 43 all age groups primarily associated MP pollution with ma-  
 44 rine ecosystems. This perception aligns with other find-  
 45 ings (e.g., Deng et al., 2020; Felipe-Rodriguez et al., 2022;  
 46 Khorsandi et al., 2025) and likely stems from the predomi-  
 47 nance of microplastic research conducted in marine envi-  
 48 ronments, amplified by strong media narratives framing  
 49 microplastics as primarily an 'ocean problem', while other  
 50 environmental compartments have received less attention  
 51 (Deng et al., 2020; Khorsandi et al., 2025). Nevertheless,  
 52 as many as 89% of our respondents associated MPs with  
 53 rivers and 79% with soils (Figure 1).

54 These results are consistent with other findings from  
 55 Poland, where 91% and nearly 66% of respondents at-  
 56 tributed MPs pollution to waters and soils, respectively  
 57 (Oleksiuk et al., 2022). Although our participants demon-  
 58 strated broad awareness of MPs in aquatic and terrestrial  
 59 environments, their relatively limited recognition of the  
 60 atmosphere as a relevant compartment for MPs pollution  
 61 is noteworthy. Less than half of our respondents (43%)  
 62 identified air as an environmental sphere where MPs can  
 63 be found, compared to 60% in the industrialised Silesia  
 64 region (Oleksiuk et al., 2022). This difference in public

65 perception likely reflects local conditions – people in heavi-  
 66 ly industrialised areas such as Silesia may be generally  
 67 more sensitive to air pollution than those living along the  
 68 sea coast. An illustrative example comes from Shanghai,  
 69 where, probably due to severe air pollution caused by res-  
 70 pirable particulate matter, air was more often perceived  
 71 as MP-polluted than rivers or soils (Deng et al., 2020).

72 A relatively high proportion of survey participants de-  
 73 monstrated a high level of awareness of the potential harm-  
 74 ful effects of MPs on fauna. Awareness of MPs in the biota  
 75 was substantial, with almost three-quarters of respondents  
 76 (71%) recognising their presence in various organisms.  
 77 The majority of participants indicated that MPs may be  
 78 ingested when mistaken for food (91%), block digestive  
 79 tracts (85%), impair respiration (74%), and cause other  
 80 effects (71%). Although the current state of knowledge  
 81 (e.g., de Ruijter et al., 2025) does not allow for unequivocal  
 82 confirmation of MPs' toxic effects on fauna at naturally oc-  
 83 ccurring concentrations, only four per cent of respondents  
 84 perceived MPs as potentially having no harmful effect on  
 85 fauna.

86 Most participants (83%) identified the degradation  
 87 of larger plastic debris as the main source of MPs. This  
 88 perception largely agrees with the opinions of the scien-  
 89 tific community, which considers the breakdown of larger  
 90 plastic fragments as the biggest source of plastic pollution  
 91 (Andrady, 2017; Ajith et al., 2020). A smaller proportion  
 92 of respondents (68%) was aware of intentional industrial  
 93 production of MPs as raw materials for plastic manufactur-  
 94 ing or as additives in cosmetics and personal care products.  
 95 The majority of respondents (87%) agreed that MPs occur  
 96 in households, from where they can be transported via

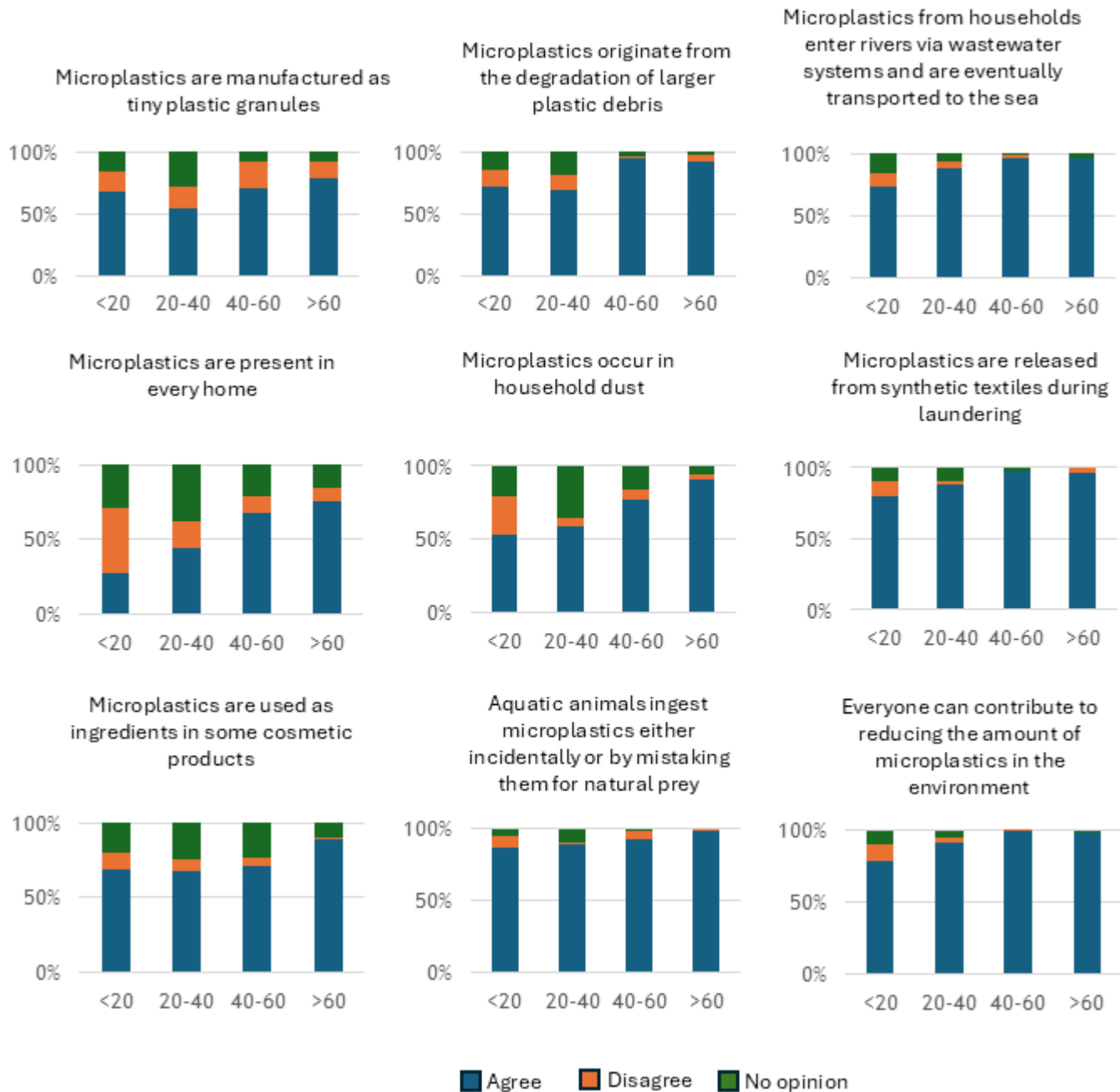


Figure 2. Distribution of responses and opinions across different age groups.

97 wastewater to rivers and ultimately to the sea. Among everyday  
 98 items listed in the questionnaire, disposable tableware,  
 99 plastic bags, and plastic straws were most frequently  
 100 recognised as MP sources (87%, 85%, and 82% of respon-  
 101 dents, respectively). In contrast, only about half of the par-  
 102 ticipants were aware of MPs in household dust. Awareness  
 103 of MPs in synthetic textiles was moderate: 57% acknowl-  
 104 edged fleece garments as a potential source, while 67%  
 105 were aware that fibres are released during washing.

Regarding cosmetic products, 73% of respondents re-  
 106 cognised that MPs may be present in personal care items.  
 107 Exfoliating scrubs (63%) and nail polishes (64%) were the  
 108 most frequently identified products. However, despite pro-  
 109 viding 13 examples of cosmetic items, most participants  
 110 identified only three to five, and 7% did not select any.  
 111

In conclusion, although the public demonstrated a rela-  
 112 tively high level of awareness regarding microplastic pol-  
 113 lution across various environmental compartments and  
 114

its potential ecological impacts, their knowledge about the sources and origins of MPs was less comprehensive and incomplete. Interestingly, the summary of all responses indicates the highest level of awareness among the oldest participants (40–60, > 60 years old). Younger respondents (< 20 and 20–40) more often gave the wrong answers or had no opinion on the given topic, suggesting that educational efforts should be focused primarily on these age groups (Figure 2).

Surprisingly, awareness of individual responsibility was remarkably high: on average, 92% of respondents agreed that each of us can help reduce the amount of MPs in the environment (only 11% of respondents < 20 years old disagreed, while 10% had no opinion). These findings are encouraging; however, for the public to contribute effectively to reducing microplastic pollution, targeted education, thoughtful awareness-raising initiatives, and the development of environmental literacy are essential.

Although individual responsibility for microplastic pollution is limited, as individuals have little influence on plastic waste management or on the atmospheric transport of microplastics, they can nevertheless take action to reduce plastic use in their everyday lives. Therefore, interventions aimed at enhancing public awareness of plastic pollution are crucial and should be implemented thoughtfully and consistently to protect the environment and safeguard the oceans.

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### Conflict of interest

None declared.

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