

Bridging the gap between microplastic research and social awareness of microplastic pollution through science communication: A call for action

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ABSTRACT

The ubiquitous occurrence of microplastics (MPs) in the environmental matrices including soil, water, air, animals, and humans has gained increased attention globally from researchers, the public, industries, and regulators in recent decades. There is an enormous number of studies conducted to determine the presence, fate, behavior, and toxicity of MPs across the countries in the world. However, the gap between scientific evidence and social awareness of the issue of the MPs remains inadequately addressed. This paper aimed to identify the gap between MP research and social awareness of the MP issue while also emphasizing strategies to bridge this gap.

Keywords: general public, microplastic contamination, microplastics, plastic pollution, public perception

INTRODUCTION

Microplastic (MP) pollution, recognized globally, could pose a serious threat to both ecological and human health. Recent scientific research has made notable progress in understanding MPs, particularly their accumulation in soil, water, and air, and subsequent entry to plants, animals and human bodies (Adhikari et al., 2024; Henderson & Green, 2020; Nakakuni et al., 2024; Pradit et al., 2023; Tran et al., 2024; Wu et al., 2024; Zhang et al., 2023). The persistence of MPs in the environment depends on intrinsic factors including polymer composition, density, shape, and purpose of use (Ahmad et al., 2023; Catarino et al., 2021; Geng et al., 2023; Maurizi et al., 2024; Oleksiuk et al., 2022). Microplastics act as vectors for bioaccumulating harmful chemical contaminants along the food chain (Praveena, 2024; Santos et al., 2021; Tumwesigye et al., 2023). Humans are exposed to MPs through inhalation of contaminated air and consumption of contaminated food and water (Vdovchenko & Resmini, 2024; Zuri et al., 2023). Scientific evidence reveals the presence of various chemical contaminants absorbed by MPs in human blood, urine, and breast milk, though the long-term effects on human health are still being studied (Caba-Flores et al., 2023; Güleşir & Gül, 2022; Heidbreder et al., 2019; Leonard et al., 2024; Saraluck et al., 2024). Additionally, MP research plays a vital role in informing environmental policies and regulations aimed at reducing MP pollution (Conti et al., 2021). Policymakers rely on scientific evidence to understand the

scale of the problem, assess potential risks, and determine appropriate mitigation measures (Premarathna et al., 2023; Wootton et al., 2024). However, a substantial gap exists between the knowledge generated by these studies and the level of social awareness regarding MP pollution. This gap significantly impacts our ability to effectively address and mitigate the issue, highlighting the need for changes in public attitudes through education on lifestyle choices, consumption patterns, waste management practices, and active participation in policy implementation (Miguel et al., 2024; Omoyajowo et al., 2022). Recognizing the consequences of limited social awareness, it is crucial to promote increased engagement and collaboration between scientists, policymakers, and the general public to confront the escalating threat of MP pollution. This concept paper aimed to identify the gap between MP studies and social awareness, emphasizing the importance of bridging this gap to drive informed decision-making, foster sustainable practices, ensuring both the environment and human well-being.

THE GAP BETWEEN SCIENTIFIC RESEARCH AND SOCIAL AWARENESS OF THE ISSUE

The search of the keyword “microplastic pollution” in Google Scholar indicated an increasing involvement of scientific investigations in addressing MP pollution across the

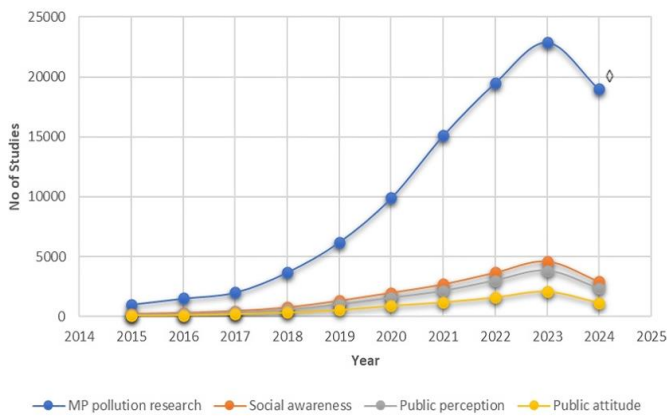


Figure 1. Scientific community involvement in MP research and social awareness of MP pollution across the past decade (keywords including microplastic pollution, social awareness, public attitude, and public perception were used in combination for the search on a Google Scholar search engine & search results for published studies up to the end of the second quarter of the year 2024) (Source: Authors' own elaboration)

past decade (Figure 1). This trend highlights the growing recognition among researchers of the significance of studying and understanding MP pollution, its environmental implications, and its potential effects on human health. However, MP pollution may not be directly observable or relatable to individuals' everyday lives, making it challenging to establish a personal connection and raise awareness effectively. An advanced search was conducted in Google Scholar using specific keywords, including "microplastic pollution," "social awareness," "public attitude," and "public perception," to identify scientific investigations focused on MP pollution and the associated social awareness. This search revealed a notable disparity in scientific engagement concerning the public's awareness of MP pollution (Figure 1). This scarcity of studies focusing on public perception highlights the lack of evidence concerning public attitudes and behaviors towards MP pollution (Garcia-Vazquez et al., 2021; Kramm et al., 2022). Researchers tend to overlook the importance of understanding public perceptions concerning the broader impact of MP pollution. In contrast, the general public is not well-acquainted with science journals, and as a result, they have limited exposure to the research and findings related to MPs (Brownell et al., 2013). For instance, Cammalleri et al. (2020) found a discrepancy in scientific communication with the public when assessing MP pollution awareness among 151 undergraduate and postgraduate students at the Sapienza University of Rome. Only 7.4% of respondents in this study mentioned hearing about MP pollution from scientific journals, suggesting a potential gap in sharing scientific knowledge with a broader audience. Likewise, Hossain (2024) observed that a notable 66% of respondents mentioned being uninformed about MP pollution in Bangladesh, while only 22% of respondents demonstrated poor knowledge of MP pollution. Moreover, another Bangladesh study mentioned that only 12% of respondents had previous knowledge of MP pollution while 63% of respondents were uninformed about MP pollution (Al Masud et al., 2024). A recent study in Portugal by Miguel et al. (2024) found that less

than half of the studied population (47%) had heard of the term "microplastics" before taking the survey. Additionally, a study conducted in Malaysia by Praveena (2024) reported that only 54.2% of respondents had heard of the term "microplastic", and just 50% were aware of the risks associated with MPs. However, the lack of evidence regarding the sources of awareness about MP pollution in previous studies hinders the assessment of how effectively scientific communication reaches the public (Freeman et al., 2020).

Scientific journals are crucial platforms for researchers to share their studies and insights on MP pollution sources (Wu et al., 2022). However, the complex nature of scientific journals, coupled with the technical language and accessibility barriers, makes it challenging for the general public to engage with and comprehend the information presented in these publications (Borgman, 2012; Dwivedi et al., 2024). Therefore, researchers and science communicators face the important task of translating complex scientific concepts and findings into accessible language and formats that resonate with the general public (Bucchi & Trench, 2016; Dwivedi et al., 2024). Consequently, the public remains unfamiliar with the latest scientific advancements, discoveries, and recommendations concerning MP pollution.

Scientific findings are primarily communicated to the general public through the media, and the presentation and framing of this information can significantly shape people's opinions and perceptions (Adams et al., 2023; Catarino et al., 2021). However, there are instances where the media oversimplifies or sensationalizes scientific studies, leading to misconceptions or a distorted understanding of the subject matter (Adams et al., 2023; Ransohoff & Ransohoff, 2001). Besides, MP research may receive limited attention from mainstream media outlets, resulting in inadequate dissemination of information and low public awareness of the issue.

Limited attention from mainstream media outlets to MP research leads to inadequate dissemination of information and low public awareness of the issue (Feezell, 2018; Miguel et al., 2024). This lack of social awareness can hinder policy changes and regulatory measures needed to address environmental issues related to MPs. Without public pressure and demand for action, policymakers may not prioritize MP pollution or implement effective regulations to mitigate its impact (Kurniawan et al., 2023; Mitrano & Wohlleben 2020). Consequently, the gap between MP research and social awareness can hinder the development and implementation of necessary policies and regulations. Insufficient collaboration between scientists, social scientists, policymakers, and communicators further hinders the translation of research findings into accessible information and impedes effective science communication.

The limited comprehension of scientific aspects related to the sources, fate, and transportation of MPs contributes to the absence of effective measures to address MP pollution (Walker, 2022). Public awareness of MP pollution may vary across regions, with certain areas having higher levels of awareness and engagement while others lag behind due to varying levels of exposure and access to information. Additionally, misconceptions and gaps in public understanding about MPs can obstruct effective

communication and impede efforts to drive action (Henderson & Green, 2020). Addressing these misconceptions and providing accurate information through science communication initiatives is crucial. As a result, we can bridge the gap between scientific knowledge and public understanding, enabling informed decisions and actions to tackle MP pollution effectively.

BRIDGING THE GAP BETWEEN MP STUDIES AND PUBLIC AWARENESS

Bridging the gap between MP research and public awareness is crucial for sustainable development while mitigating MP pollution. Science communication is the way forward in achieving progress regarding the social awareness of the issue of MP pollution (Figure 2). The primary approach to bridging the gap between MP research and social awareness is to identify consumer behaviors when purchasing plastic items (De Fano et al., 2022). This could help to identify the purchasing patterns that lead to breaking the patterns of continuing purchase and use of products that contribute to MP pollution including single-use plastics or personal care items containing microbeads (Pahl & Wyles, 2017). It is essential to collect data on the sources of knowledge about MP pollution when conducting a preliminary survey on public awareness to gain a comprehensive understanding. This will help to understand how significant research evidence reaches the general public and how it influences their awareness and understanding of the issue. Moreover, enhancing our understanding of the public's knowledge, attitudes, and perceptions regarding MP pollution is crucial to effectively managing the issue (Deng et al., 2020; Jefferson et al., 2015; Miguel et al., 2024). This understanding can help to develop appropriate priorities for reducing plastic waste influx into the environment and foster motivation among individuals to actively participate in finding solutions.

Emphasizing the importance of collaboration between researchers and science communicators is essential in effectively translating and disseminating MP research findings. Simplifying information without compromising accuracy is crucial for bridging the communication gap. Scientists, educators, and science communicators play an instrumental role in effectively communicating MP research by translating findings, conducting outreach activities, and engaging with different stakeholders (Altman et al., 2021; Mofokeng et al., 2023). Engaging in science outreach programs including public lectures, workshops and interactive exhibitions which enable the interaction with the public directly and disseminate knowledge about MP research (Cooke et al., 2017). When communicating scientific findings, it is important to provide informative context rather than focusing solely on the risks, which could cause public panic. Therefore, effective science communication strategies including utilizing clear and engaging language, visual aids, brochures, infographics, videos, and storytelling techniques are relatable examples to convey the importance of MP research and its implications (Hogan & Urban-Rich, 2024; Miraç & Fatoş, 2024).

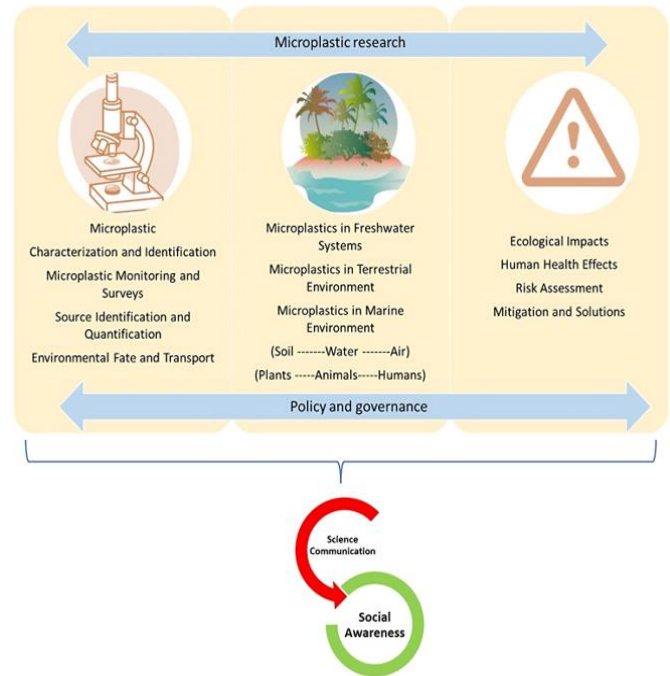


Figure 2. The way forward for bridging the gap between scientific research and social awareness regarding the microplastic issue (Source: Authors' own elaboration)

A collaborative approach with media outlet programs is another important factor when bridging the gap between the scientific community and the public. Building relationships with journalists and media outlets is effective in facilitating accurate and widespread coverage of MP research, increasing public awareness through news articles, interviews, and documentaries. Moreover, utilizing social media platforms including Twitter, Facebook and Instagram can effectively raise awareness regarding MP pollution (Briandana et al., 2022; Gallitelli et al., 2023; Teh et al., 2022). Providing training and resources to science journalists can enhance their understanding of MP research, enabling them to communicate complex scientific concepts accurately and effectively to the public.

Adapting communication strategies to address different demographics and interest groups based on cultural, socioeconomic, and educational backgrounds ensures effective engagement and communication (Henderson & Green, 2020). Moreover, environmental sustainability can be promoted through the value placed on hands-on activities, experiments, and citizen science projects that actively involve students in MP research (Makuch & Aczel, 2018). The influence of youth-led initiatives, including student organizations and activism, is crucial in driving social awareness and inspiring action to address MP pollution. Arranging public forums and debates that bring together scientists, policymakers, environmental activists, and the general public to discuss MP research, its impacts, and potential solutions, is essential facilitating dialogue and knowledge exchange.

Encouraging collaborations between scientists, policymakers, communicators, and social scientists is vital to ensure effective communication of MP research findings and consideration of societal perspectives (Henderson & Green,

2020; Martínez-Laiz et al., 2023). Collaborating with non-governmental organizations and environmental groups is also a way forward to jointly raise awareness about MP pollution, engage in community clean-up activities, and advocate for policy changes. Engaging in activities such as monitoring beach litter or participating in beach cleanings not only enhances environmental awareness but also increases knowledge about the presence of plastic litter in marine and other environments (Locritani et al., 2019; Wyles et al., 2017). Successful specific projects that provide knowledge about MP pollution and encourage the adoption of alternative practices are effective in enhancing social awareness (Kumar et al., 2021). Examples of such initiatives include the “Beat the Microbead” campaign, “The Great Nurdle Hunt”, “Microplastics in Our Waters” exhibition, “Plastic Free July” by the Plastic Free Foundation, and “San Francisco Bay Microplastics Project”. These projects promote environmental sustainability by connecting scientific research with public awareness, and they should be supported for the betterment of ecological and human health.

Working closely with industries, manufacturers, and businesses plays a key role in raising awareness about the environmental impacts of plastic products, promoting sustainable alternatives, and encouraging responsible waste management practices (Chen et al., 2021; Horvath et al., 2018). Highlighting practical solutions and positive actions that individuals, communities, and policymakers can take to reduce MP pollution, empowers the public to make informed choices and drive change. Additionally, regularly assessing the effectiveness of science communication strategies through surveys, focus groups, and analytics helps measure their impact on public awareness, understanding, and behavioral changes related to MP pollution.

CONCLUSION

This paper aimed to identify the critical role of science communication in bridging the gap between MP research and public awareness of the MP pollution issue at the global scale. Communicating the findings of MP research to the general public effectively can be challenging due to its complex and technical nature. Researchers and science communicators are challenged with the responsibility of effectively conveying information to the general public. Findings of the scientific studies required to be accurately simplified and imparted to the society while emphasizing the responsibilities at the individual level. Such communication helps the public grasp the broader implications of MP and its environmental effects. Additionally, more scientific research is required to understand the knowledge, attitudes and behavior of the general public towards the MP issue. Overall, it is crucial to proficiently convey the significance of MP research to achieve a broader societal impact, rather than solely concentrating on investigating the occurrence, fate, behavior, and toxicity of MPs.

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Availability of data and materials: All data generated or analyzed during this study are available for sharing when appropriate request is directed to corresponding author.

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