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Global Perspective

Examining Misconceptions about Plastic-Particle Exposure from Ingestion of Seafood and Risk to Human Health

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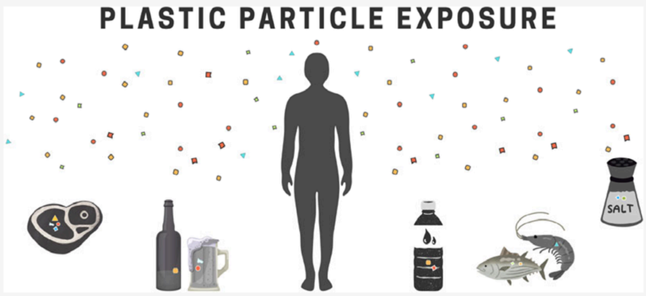

ABSTRACT: Plastic particles (PPs; ≤5 mm diameter) are ubiquitous environmental contaminants, and concerns exist about their potential to impact human health negatively. Public perceptions about seafood contamination by PPs have been shaped by media communications rather than scientific evidence, and these perceptions can inform behavior and public policy inappropriately. Our objective is to challenge perceptions with evidence and to discuss the extent to which concerns of PP contamination of seafoods are justified. Evidence indicates that levels of PPs in seafoods are consistent with those of other foods and beverages and that human exposure to PPs is higher via indoor air and dust than by ingestion of foods and beverages. While uncertainties remain, there is currently minimal evidence of dietary toxicity of PPs and no consumption advisories for PPs. The levels of substances (e.g., toxic contaminants) associated with PPs that may be released upon PP ingestion are often orders of magnitude below levels of toxicological concern. Overattention on PP contamination of seafoods (>70% compared to all other foods combined) in scientific media communications is unjustified and must be rebalanced to avoid misconceptions and loss of beneficial health effects of seafood consumption.

KEYWORDS: *plastic particles, misconceptions, ingestion, media communications, seafood*

INTRODUCTION

The presence of contaminants in seafood can affect consumer perceptions of seafood quality and decisions about consumption. Edible tissues of finfish and shellfish can accumulate chemical contaminants, such as dioxins and methylmercury, and lead to human exposure and risk of toxicity from these substances.[1] Regulations and guidance [e.g., (EC) No. 1881/2006][2] have set maximum limits for certain contaminants in seafood, and these limits impact processing, marketing, and human consumption of these products. While these regulations are evidence-based, reports of just the presence of a contaminant in seafoods can affect consumer perceptions, even if exposure is actually minimal. Plastic debris have emerged as a contentious environmental pollutant with which seafood products, along with many other foods and beverages, can become contaminated, and this has generated concerns regarding potential for negative effects on human health.[3] However, given the beneficial health effects of seafood,[4,5] it is important that decisions about consumption are based on accurate information on the presence and impact of PPs on human health.

Because of their dimensions, particles, including plastic particles (PPs), do not behave like dissolved chemicals, and this has presented technical challenges for establishing critical aspects of toxicology including exposure, absorption, distribution, tissue accumulation, metabolism, and excretion.[6] Small PPs either deliberately manufactured or resulting from environmental fragmentation of larger pieces of plastics have been classified by their size as microplastics (between 1 μm and 5 mm; MPs) or nanoplastics (<1 μm; NPs),[6] although there is no standard definition of MPs and NPs.[7] Absorption of PPs across endothelia with distribution and accumulation within internal tissues and organs is a prerequisite for direct toxic action of particles in cells of internal tissues; however, simply the presence of PPs in the lumen of the gastrointestinal tract (i.e., if PPs are not absorbed) could negatively affect the digestive system physiology without particle absorption. Numerous substances, including chemical toxicants, have been found sorbed to MPs collected from the environment,[8−10] and plastics can also contain substances added during manufacturing (e.g., Pb)[11] that may pose a risk to health if these substances are released into the body in sufficient amounts after particle ingestion.[12]

The detection of PPs in food and beverages, their presence in human tissues, and their effects in model systems are now widely

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reported in the public media. The inferences from some of the scientific publications on which these reports are based are not always commensurate with the evidence presented. This can generate concerns and speculation that are not warranted, in terms of risks to human health. The visible presence of plastic debris in the environment and images of entanglement of charismatic marine animals (e.g., birds and marine mammals) impact public perception differently compared to other contaminants.[13] Seafood products were among the first foods to be assessed for the presence of MPs. There were several reasons for this, including the (not necessarily correct) assumption that as aquatic species they would be exposed to the highest levels of MPs in the environment and the relative ease of the analysis of MPs in seafood samples.[14] This resulted in many reports focusing only on seafood because information on other foods and beverages as sources of MP exposure was lacking. However, as information on the levels of MPs in other foods and beverages is now becoming available, it is important to put exposure via seafood into context with these, together with their relative benefits, to facilitate consumer choice. Our overall aim is to contextualize human exposure to PPs from seafood and to provide perspective on the evidence for potential effects on human health after ingestion. Specifically, the objectives are to (1) examine science communication regarding exposure and health risk of PPs from seafood, (2) assess the amounts and characteristics of MPs reported in seafood products along the supply chain and contextualize this relative to other food products and sources of exposure, (3) consider the presence of substances associated with PPs and the potential exposure to these substances in humans upon ingestion of PPs, and (4) evaluate the evidence of PPs and associated substances regarding their bioavailability, absorption, tissue accumulation, effects on digestive system physiology, and potential hazard effects and risk to human health.

Communications and Perceptions of PP Exposure and Health Risk from Seafood. Based on media reports there is a view in the public that MPs pose a specific threat to human health through the ingestion of seafood.[15−17] Indeed, as with other hazards, people that receive negative communications about MPs are found to have a higher risk perception associated with MPs.[18] In their media analysis, Völker et al.[16] showed that the complex issue of MPs is simplified to provide a "storyline" and they are often addressed as toxic, posing a risk to the environment and human health. This pattern, also called "concept of popularization",[19] is frequently observable in the news media and pursued to tell recognizable stories.[20] As Henderson and Green[15] point out, these media frames reflect societal values rather than scientific accuracy[21] and aim at moral engagement.[22,23] Rather than explaining the uncertainty and knowledge gaps, the findings in some scientific publications on human exposure to MPs by ingestion of seafood and health risks are reported as facts.[16]

For many scientific issues, authors of some scientific communications will speculate on the policy implications of their findings, sometimes taking a precautionary view, but such speculation is not always clearly distinguished from the scientific evidence presented by those commenting on the publication. The topic of seafood contamination and human health is no exception. It is important that members of the scientific community use risk terminology appropriately in scientific communications.[24] For example, the presence of PPs in food, leading to titles of scientific publications that include "human consumption"[25,26] is often equated with risk in media communications. It is important to distinguish between the laudable goal of seeking to reduce environmental contamination by PPs and ensuring that consumers are provided with accurate scientific information to enable informed decisions.

Reports of human exposure to PPs along with exaggerated statements about potential implications for human health are impacting human behavior and government policy. The presence of PPs in fish and seafood is a notably powerful narrative in shaping the public discourse about these contaminants,[18] and public perception that seafoods are a prominent source of PP exposure has been reported in numerous studies.[15,18,27] This perception has real impacts as survey respondents in China[27] and in the United Kingdom[28,15] indicated that they are inclined to consume less seafood; and the presence of MPs in seafood is consistently raised as among the greatest concerns to consumers.[29] Due to the degree of public attention and concern about MPs in seafood, government agencies have commissioned reports and peer-reviewed scientific articles[30−35] and issued panel statements such as from the Panel on Contaminants in the Food Chain of the European Food Safety Authority.[36] Recently, the World Health Organization (WHO) issued a report on human exposure to PPs that highlighted current uncertainties in risks to human health.[14] Despite a lack of evidence of human health effects, or appropriate contextualization of PP exposure from seafood, extrapolations from legislative texts on different aspects of PP exposure have contributed to the narrative [e.g., the New Zealand Waste Minimisation (Microbeads) Regulations (2017):[37] *They* (microbeads) *can harm both marine life and life higher on the food chain including humans*]. While authoritative reports on MPs in food underscore the need for further research and caution, with few exceptions, exposure assessments have perforce been very much centered on seafood ingestion, as there have been little data on other sources. Evidence-based science with appropriate inclusion of uncertainties and recognition of knowledge gaps is necessary to foster transparent communications that are essential to maintain public trust in science.[38]

Contextualizing PP Contamination of Seafood with Other Foods and Sources of Exposure. While it is evident that exposure to MPs in humans can occur from ingestion of a wide variety of foods and beverages,[39−41] and through breathing both outdoor and indoor air,[41] the majority (70%) of studies have focused on seafoods (Figure 1). There are a number of reasons for this, such as the early detection of MPs in the marine environment in the first studies on the occurrence of MPs and analytical practicality, but not because there is a specific reason these sources should be prioritized by food safety authorities for risk to human health (the information for such a determination was lacking as there was no information about other sources of exposure). Subsequent studies have shown PP contamination in virtually all foods and beverages investigated including chicken,[42,43] salt,[44] honey,[45] alcoholic beverages,[46] and vegetables.[47] Further studies on the transfer of MPs in terrestrial food chains leading to potential human exposure are emerging,[14,40] but such (terrestrial) studies are still underrepresented, causing an imbalance in the information available to assess human exposure to MPs via ingestion from different sources.

The presence of PPs in marine organisms within their natural environment can be influenced by the biology and, particularly, the feeding habits of the organism. Shellfish such as bivalves that filter large volumes of water have the potential to accumulate PPs and have consequently generated concerns for human

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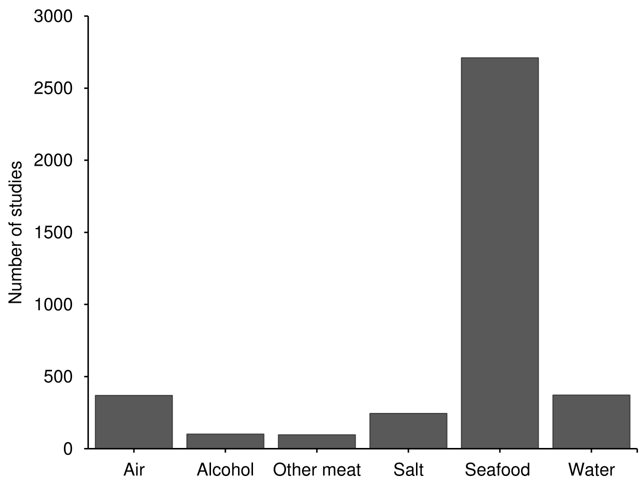

Figure 1. Number of studies that reported the presence of microplastics in different sources of human exposure. The systematic search of the peer-reviewed literature was completed through Web of Science on August 8, 2025. Search terms can be found in Table S1 (Supporting Information). Note that the number of studies reflects the total unique hits recorded for the specific search terms (and excludes replicates).

exposure because the entire soft tissue of the organism is consumed.[48] The most commonly consumed commercial bivalves, mussels, oysters, clams, and scallops, have been reported to accumulate MPs, either from the field or from aquaculture sources, with concentrations from 0 to 10 MPs per gram wet weight in mussels[49] and from 0.033 to 7 MPs per gram wet weight in oysters.[50] Microplastics, mostly of sizes > 100 μm, have also been detected in commercially important gastropods,[51] and crustaceans, including crabs and prawns.[52] Plastic particles smaller than 100 μm have been reported less frequently because of technical limitations regarding detection; however, laboratory-based studies report that bivalves can ingest MPs < 100 μm[53] as well as 20 nm-sized polystyrene NPs.[54] Evidence from wild caught organisms indicates that smaller size classes of MPs can be dominant (in abundance) including in mussels, in which MP sizes from 20 to 40 μm and from 40 to 80 μm have been found,[52] and also in salmon[55] and cod.[56] It is evident that concentrations of MPs in shellfish and finfish vary among studies due to a combination of factors including levels of particle contamination (e.g., bivalves from different locations), challenges in techniques for particle detection and quantification, and because of inadequate controls for PP contamination (i.e., false positives).[57,56] Although shellfish ingest PPs, these particles can be depurated when the organisms are placed in clean water,[54] a practice that is frequently employed by shellfish fishers to remove mineral particulates (e.g., sand and grit) prior to taking to market. In shellfish, it was estimated that depuration significantly reduces MP concentrations in both wild and farmed mussels by 47 and 29%, respectively,[58] and in farmed oysters by 49−73%.[50,59]

Reports of PP contamination of finfish indicate low abundances within the gastrointestinal tract in some species and even lower detection in skeletal muscles (i.e., fillets).[60,62] While direct ingestion of MPs or consumption of prey that have accumulated MPs can explain the presence of MPs within the intestinal lumen of finfish,[60−63] deposition within fillets (as opposed to false positives through subsequent contamination in the laboratory) appears to be minimal and requires that MPs are absorbed and transported by the vasculature to accumulate in skeletal muscle.[64] Recent investigations using rigorous contamination controls have documented MPs in the edible tissues of less than 35% farmed and wild fishes, and, when detectable, the average level was 4.5 MPs per 100 g fish fillet. Most particles found were <100 μm, but some larger particles did occur.[56] Across all investigations, the number of MPs reported per gram of fish consumed is generally less than that of bivalves (indicated above, 0−10 MPs/g) based on a systematic review and meta-analysis.[2] The U.S. Food and Drug Administration advise a maximum intake of 227−340 g of seafood per week (∼50 g per day) for pregnant mothers (www.FDA.gov/fishadvice).[65] Consumption by the rest of the population will likely be higher. EFSA (2016)[36] used a figure of 225 g of mussels per day in their exposure estimates. Based on the high end of the range of contamination level of 10 MPs/g for mussels, these values will be significant overestimates of MP exposure.[14,36] EFSA (2016)[36] estimated that ingestion of 225 g of mussels would lead to MP exposure equivalent to 7 μg of plastic per day (assuming ingestion of 900 particles with an average diameter of 25 μm and a density of 0.92 g/cm^3).

While PPs are widely reported to be present in the marine environment, the procedures for capture, cultivation, processing, shipping, marketing, and preparing seafood for consumption are all highly dependent on plastic materials, and these are all potential sources for PP contamination of seafoods. A relevant consideration for contextualization is whether the procedures for capture and processing of seafood are sufficiently different compared to those for other foods to lead to greater concern for PP exposure from seafood. Contamination of surrounding water or sediment may contribute to the total PP exposure of both farmed and wild seafood species.[66] Plastic materials are used to capture wild fish or used in aquaculture activities, including nets and cages and could be sources of MPs upon material deterioration in both freshwater and marine farms (e.g., as reported for cultured oysters).[50] Some aquaculture feeds have been found to be contaminated by MPs,[67] and the feedpipes used to supply fish meal may generate MPs through mechanical degradation.[68]

Cultivation and processing of all food types occur in environments that frequently contain plastics, and potential PP contamination during processing is not limited to seafoods. Habib et al.[42] reported PPs in market-purchased fish, chicken, and meat originating from the plastic chopping boards used in supermarkets, demonstrating that plastic utensils used for processing may introduce MPs to food. Seafoods (and other foods) are commonly displayed in shops in plastic containers, covered in plastic wrap, and sold in plastic bags, all of which can contribute to plastic contamination.[69] During cooking and meal preparation, commonly used kitchen utensils such as PTFE coated pans, spatulas, bowls, and plastic chopping boards, as well as cloths containing synthetic textile fibers can be sources of MPs in food.[70] Catarino et al.[48] found a higher number of MPs landed on a dinner plate from the atmosphere during a meal than were originally present in mussels directly collected from the field.

Human Exposure to MPs via Food. Although documentation of PP contamination among foods and beverages is far from complete, and there is a lack of comparable information, it is possible to place seafood contamination into some sort of context with other sources of exposure. Recent models, based on an updated review since EFSA 2016,[36] have estimated a median ingestion of MPs via shellfish consumption (molluscs and crustaceans) of between 1 and 10 particles/adult/day.[71] Plastic

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particle ingestion via water consumption is estimated to be between 10 and 100 MPs/adult/day for tap water and around 10 particles/adult/day for bottled water.[71] Salt, honey, sugar, beer, and milk can also be sources of MP exposure with around 10 particles/adult/day each, which is similar to MP contamination of seafood.[39,71] Contamination of 16 protein products (seafoods, terrestrial meats, and plant-based proteins) showed MP contamination of meats and seafood at <1 MP/g and that products with higher levels of processing (e.g., breading of products) led to greater numbers of MPs.[72] Plastic particles can be present in high numbers in agricultural fields and in cattle feed meal,[73] and contamination of meats by PPs through the supply chain, processing, and cooking are unlikely to be different than for seafoods given similar procedures and use of plastic materials. Estimates of MP exposure indicate air is the major source with 39000−52000 particles per year,[39] human stool has been estimated to contain 20 MPs (50−500 μm) per 10 g,[74] and Wright and Kelly[75] estimated that humans egest 20000−1500,000 MPs per year.

Contextualizing the Major Sources of Human Exposure to PPs. The major source of dietary exposure to MPs by humans is estimated to be via fallout of airborne particles and dust indoors.[39,71,76−78] Estimated rates of indoor dust ingestion range between 2.2 mg/day for teenagers and 41 mg/day for toddlers[79] and urban dust has been reported to comprise 33% MPs.[77] Plastic particle deposition (in dust traps) has been observed during meal preparation,[48] and of intake range from 100 to 1000 particles/adult/day, which is orders of magnitude higher than estimated via seafood consumption (i.e., between 1 and 10 particles/day/adult).[39,71] Furthermore, there is a significant positive association between PPs in dust fallout and the amount of textile per unit area of room, suggesting a higher exposure of humans to airborne fibers in households where floors are carpeted.[77] Humans are also exposed to a multitude of other particles deliberately added to their food, such as titanium dioxide and silicon dioxide which can account for 40 mg/person/day (in the U.K),[80] while MP ingestion represents in total only 0.001% of these particles.[71] Overall, the evidence suggests that dietary exposure to MPs from the contamination of food represents only a small fraction of the total human exposure to MPs. The levels of MPs in seafood appear to be similar to those in other foods and beverages, and a disproportionate focus on seafood contamination by MPs as a source of exposure and potential risk to human health would not appear to be supported, at least in terms of risk mitigation.

Plastics and Associated Substances in the Context of Seafood Contamination. The processes used in the manufacture of plastics, the physicochemistry of the resulting materials, and the environmental processes after release all influence the nature of the PPs to which humans are exposed. Approximately 80% of the plastics produced globally are made up of six polymer types (polyethylene, polypropylene, polyvinyl chloride, polyurethane, polyethylene terephthalate, and polystyrene), and during plastic manufacturing, substances [remnants of catalysts, UV and oxidation stabilizers, colorants (dyes or pigments), plasticizers, fillers, processing aids, and other plastic polymers] are frequently added to influence plastic properties.[14] Some plastic materials can contain high amounts of additives, for example polyvinyl chloride can contain as much as 80% by weight of phthalates in some applications.[81,82] Historically there was little control of the additives in commercial plastics, and these legacy plastics continue to be present in the environment and can contain compounds that are now banned (such as various phthalate plasticizers and bisphenol A (BPA)).[82] These additives can be released from plastics to varying degrees during the lifetime of the material depending on conditions (temperature, chemical exposure, and water) and additive type (e.g., Pb from polyvinyl chloride pipe[11]). Indeed, there are thousands of substances connected with the manufacture and use of plastics, and the toxicity of many of these substances has not been investigated.[83] Assessing the hazard and risk to health of these substances is necessary; however, it is important to distinguish this issue of plastics in general with the topic of MP contamination of seafoods, in which the concentrations of these substances are exceedingly low and consistent with that of other food MP contamination levels.

Considering the level of exposure to MPs via ingestion of a seafood meal (i.e., 0.007 mg of plastic as estimated above based on EFSA 2016)[36] the amounts of substances associated with plastics either during manufacturing or subsequently by sorption from environmental sources can be estimated to indicate potential exposure levels to these substances upon ingestion. Substances (e.g., contaminants) that have been found sorbed to MPs collected from the environment are detected at low concentrations and complete desorption of these substances is unlikely to occur upon ingestion. For example, Pb reached sorption equilibria with MPs at <0.01 μg of Pb/(mg of plastic) when MPs were collected from a metals contaminated environment.[9] At this concentration, a 0.007 mg MP exposure (i.e., mass of MPs estimated above to contaminate a 225 g seafood meal) would contribute less than 0.0007 μg of Pb (if Pb completely desorbed from the MP), which is considerably lower than the maximum permitted levels for Pb contamination of seafood (i.e., 300 μg of Pb/(kg of fish)) in the EU.[84]

Persistent organic pollutants (POPs) including polychlorinated biphenyls (PCBs), polybrominated diphenyl ethers (PBDEs), and alkylphenols have been detected on MPs collected from oceans (North Atlantic, South Atlantic, North Pacific, and Indian), and the presence of these substances has raised concern for effects on human health.[10] However, the POP with maximum reported levels was for total PCBs at 589 pg/mg MP among numerous investigations of MPs collected from these ocean samples,[10] and this corresponds to 4.1 pg of total PCBs for a typically sized seafood meal of 225 g estimated to contain 0.007 mg of MPs. Fish consumption advisories for PCBs are based on the sum of dioxin-like PCBs (DL-PCBs), which are <0.04% of total PCBs,[85] and computation of toxic equivalency factors (TEFs) for the DL-PCBs.[86,87] Accordingly, 4.1 pg of total PCBs corresponds to 0.0016 pg of DL-PCBs and a 0.000008 pg sum of dioxins [based on a TEF of 0.005 for PCB-126 (the most toxic DL-PCB)[86,87]]/(225 g seafood meal), which is orders of magnitude lower than the maximum permitted sum of dioxins and DL-PCBs value that would trigger a fish consumption advisory in the EU.[84]

Contextualizing Effects and Risks of Ingestion of PPs from Seafood. Current evidence on the uptake and depuration/elimination kinetics of PPs after exposure via ingestion indicates very low levels of absorption and accumulation of particles within internal tissues. The techniques for analysis of small PPs in tissues from environmental exposures are developing and will eventually enable detection at lower levels and validate or refute the results of recent reports of PPs in internal tissues (e.g., human brain)[88] based on methods that appear to be especially vulnerable to false positives (e.g., pyrolysis gas chromatography).[89] In a recent study,[90] in which

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mice were exposed (oral gavage) to different MPs (1−5 μm), polystyrene MPs were detected (but not quantified) in internal tissues (brain, liver, and kidney) indicating absorption and translocation; however, it is not clear whether the MPs remained within the vasculature (e.g., associated with blood cells) of these tissues or translocated into the parenchyma. Other studies with murine (rodent) models report very low numbers of MPs in tissues (below quantification),[91,92] and no changes in inflammatory activity or oxidative stress.[93] Because of the technical difficulties of NP detection within tissue samples, evidence of absorption is perhaps best indicated by controlled animal studies that have used ^{14}C-labeled monomers integrated into the polymers of plastic particles.[94] Based on a study with ^{14}C-labeled polystyrene NPs (20−200 nm in diameter), NPs rapidly associated with external tissue surfaces of scallops (integument, gills, and digestive tract) and particles depurated swiftly at the end of exposure (half-life < 5 days).[54] The best evidence of translocation of ^{14}C-labeled polystyrene NPs was the presence of the particles within the adductor muscle of the scallops at detection levels that returned to nondetectable within 8 days of transfer to clean water.[54] Rapid depuration was also reported in another study with NPs in which particles were detected in multiple body organs and the carcass of rainbow trout *Oncorhynchus mykiss* a short time after oral exposure, but after 14 days were not detectable, suggesting complete depuration.[95] Rapid uptake (albeit minimal) and distribution throughout internal tissues in a manner consistent with tissue vascularization followed by rapid depuration suggest that most PPs remain within the vasculature (e.g., blood vessels) prior to elimination rather than translocating and accumulating within internal tissue parenchyma cells. Although current evidence indicates minimal levels of PP absorption after ingestion, further investigation (including chronic exposures) is required to fully understand the processes of absorption, transport, and depuration of PPs within the vasculature.

Despite considerable speculation about the potential for PPs to induce widespread toxic effects within internal tissues, there is minimal evidence for these effects. As indicated above, the levels of PPs that have been found in internal tissues are very low, and those PPs present may be only, or at least largely, within the vasculature and not associated with cells of internal tissues. In vitro studies with various cell lines have documented inflammatory responses; however, these studies have used concentrations that are many orders of magnitude higher than are environmentally relevant (100s to 1000000s of PPs per cell).[96,97] At these concentrations investigators have demonstrated effects of particle characteristics (e.g., size, shape, surface features) on uptake into cell and activation of inflammatory cell responses.[96−98] Similar effects have been reported for airborne particles.[99] A large meta-analysis reported that MPs were marginally (3−8 times) more toxic than natural particles across a wide range of aquatic species, although the authors cautioned that results were largely inconclusive due to high uncertainty.[100] The authors emphasized the need for directly comparable studies, further investigations to address gaps in knowledge, and study designs to exclude experimental artifacts and false positives as has occurred in previous investigations with engineered nanomaterials.[101,102]

Ingestion of PPs from contaminated food and beverages and via inhaled dust results in the presence of these particles within the lumen of the gastrointestinal tract (gut) and hence the potential for effects on digestive system processes and on the intestinal microbiome. High exposure to polystyrene nanospheres (7g/L in single oral bolus) was reported to cause a reduction in microbiome biodiversity in mice.[103] Egestion of MPs from the digestive system has been found to be efficient and complete within a wide range of species.[104] An exception to efficient egestion of PPs could be evidence from marine invertebrates in which shrimp have been reported to have elevated levels of plastic fibers in the intestine[105] with the shape of fibers relative to the diameter of the intestinal lumen offered as an explanation for possible difficulty in egesting these types of PPs.[106] There is abundant evidence that humans egest PPs but no evidence that PPs accumulate within the intestine.[107] Given that the above estimate of exposure to 0.007 mg of MPs from consumption of a typically sized seafood meal is an overestimate, that it is only a minor fraction of the total daily human exposure to MPs (i.e., from all other sources of MP exposure), and that MPs are a small fraction of the total particulate matter entering the lumen of the gut from the diet, the potential for any specific effects of MPs from seafood on digestive system processes is extremely low. There is little information on the effects of MPs on human intestinal microbiome at dietary relevant levels.[108]

Currently there are no PP advisories on the consumption of seafood or any other food or beverage, and based on current evidence, the present position is that there is minimal risk to human health from ingestion of PPs. In the United Kingdom, the Committee on Toxicity (COT) assessed the risks of MPs at the request of the Food Standards Agency (FSA), Department of Health and Social Care (DHSC), and U.K. Health Security Agency (UKHSA) among other agencies.[7,40,41] The COT concluded that there was no reliable evidence that dietary exposure to PPs was harmful to health but that this was based on very limited information. Chemicals present in PPs or adsorbed to them were not expected to increase adverse health effects in humans as their contribution to overall exposure from other sources is very small. Due to the lack of data on exposure and effect, it was not possible for the COT to perform a complete assessment for the potential risks from exposure to MPs and NPs via oral (or inhalation) route of exposure. A similar conclusion has been reached by other authoritative bodies, and that further research is required to better identify target tissues, threshold doses, and the toxic mode(s) of action for any toxicity observed.[36,14,104,109−111]

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Key Messages

1. Plastic particles (≤5 mm) are ubiquitous environmental contaminants for which perceptions about their potential to impact human health have been driven by scientific and public media communications that are not always informed by scientific evidence.
2. While uncertainties remain, currently there is minimal evidence of dietary toxicity from plastic particles at relevant exposure levels and the focus on seafoods is unjustified as seafood contamination by plastic particles is consistent with that of other foods and beverages, and exposure is considerably higher via indoor air and dust than by ingestion of food.
3. Thousands of substances are involved in the manufacture and use of plastics and other substances may associate with plastics after they are released into the environment; however, these substances are present at exceedingly low concentrations in plastic particles that contaminate food, and the importance of investigating the toxicities of these substances is a separate issue.
4. Scientific and public media communications about plastic particle contamination of foods and health effects have led to biased perceptions of health risks and loss of the beneficial health effects of seafood consumption.

■ ASSOCIATED CONTENT

Supporting Information

The Supporting Information is available free of charge at https://pubs.acs.org/doi/10.1021/acs.estlett.5c00551.

Web of Science search terms used to determine number of peer-reviewed articles that reported on presence of plastic particles in different sources of human exposure (PDF)

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Notes

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