Marine Pollution Bulletin 152 (2020) 110908

Contents lists available at ScienceDirect

Marine Pollution Bulletin

journal homepage: www.elsevier.com/locate/marpolbul

Making sense of microplastics? Public understandings of plastic pollution

Lesley Henderson*, Christopher Green

Institute for the Environment, Health & Societies, Marie Jahoda Building (MJ144), Brunel University London, Uxbridge UB8 3PH, United Kingdom
Department of Social and Political Sciences, College of Business, Arts and Social Sciences, Marie Jahoda Building (MJ144), Brunel University London, Uxbridge UB8 3PH, United Kingdom

ARTICLE INFO

Keywords:
Plastic
Pollution
Microplastics
Media
Public
Risk

ABSTRACT

This paper explores people's knowledge and understandings of microplastics; the role of media in framing perceptions and socio-cultural dimensions to popular solutions to reduce single-use plastics. We conducted 6 focus groups (2016–17) involving participants with no obvious knowledge of microplastics and some with special interest. Most people were unaware of microplastics though environmentally conscious participants had heard of microbeads due to media reporting concerning regulation. Few made connections between their personal use of plastics and ocean pollution. Plastic pollution was associated with macro-plastic 'islands' in the Great Pacific Garbage Patch and powerful media images of charismatic wildlife entanglement remote from participants lives. The scale of microplastics (not easily detected), poor understanding of the science behind microplastics and cultural ideas about healthy and appropriate behaviour presents barriers to change. Science communicators, NGOs, industry and policy makers must take account of media representations and the culturally embedded nature of plastics in society.

1. Microplastics, marine litter and the marine environment

Microplastic pollution is now in the public domain as an emerging issue of global concern. Microplastics, tiny particles under 5 mm in length are known to be present in air, soil and sediment, freshwaters, seas, oceans, plants, animals and originate from plastic products, textiles, industry, agriculture and general waste (SAPEA, 2019). Most recent work has highlighted the heterogeneity of microplastics (diverse molecules, different structures, sizes, shapes, colours and a multitude of sources) Hartmann et al. (2019) and there have been calls to understand "microplastics" as a diverse suite of contaminants (Rochman et al., 2019). There are estimated to be a minimum of 5.25 trillion plastic particles weighing nearly 269,000 tons in the world's oceans (Eriksen et al., 2014). The discovery of microplastics in the marine food chain has led to concerns for human consumption of seafood (Rochman et al., 2015; Van Cauwenberghe and Janssen, 2014) although adverse effects on human health is "limited, difficult to assess and still controversial" (Barboza et al., 2018).

The marine environment currently faces considerable threats of pollution, overexploitation, habitat destruction and climate change. Loss of marine biodiversity impairs the capacity of the ocean to provide an increasing global population with essential ecosystem services, such as food provision and water quality, and constrains its ability to recover from perturbations (Worm et al., 2006). However it is argued that conservation of our surrounding environment to mitigate these threats is about people and the choices they make (Schultz, 2011). As a result, we are witnessing increasing demands for a major shift in the way that society interacts with the marine environment and there are calls for sustainable management and policy from decision makers to drive the restoration of marine ecosystems (Jefferson et al., 2014; Jefferson et al., 2015; McKinley and Fletcher, 2012; Steel et al., 2005). Influencing consumer behaviour is becoming a priority in European environmental policy (Hartley et al., 2015). In addition it is now widely understood that messages and interventions must be finely tailored to specific audiences and communities (Brennan and Portman, 2017; Jefferson et al., 2014; Steel et al., 2005).

The presence of plastic debris in the global ocean is part of the wider issue of marine litter Depledge et al. (2013). There are documented encounters of 693 wildlife species with marine debris, impacted through ingestion, entanglement, transport and habitat alteration (Gall and Thompson, 2015). This litter presents a navigational hazard, disrupts and reduces the catch of commercial and subsistence fishing activity and degrades environments, threatening life, leading to losses in tourism and economically impacting marine sectors and local communities. Plastics account for an average of 75% of marine litter (OSPAR, 2007), a figure which is underestimated by the public (Hartley et al.,

* Corresponding author.
E-mail address: lesley.henderson@brunel.ac.uk (L. Henderson).

https://doi.org/10.1016/j.marpolbul.2020.110908
Received 29 October 2019; Received in revised form 10 January 2020; Accepted 11 January 2020
Available online 20 January 2020

2015; Hartley, 2013). Importantly, as much as 80% of this plastic in the ocean originates from land based sources and the rest from marine sources such as fisheries and shipping (Andrady, 2011). In 2010 alone it was estimated that between 4.8 and 12.7 million metric tons of plastic entered the ocean from coastal countries (Jambeck et al., 2015). These persistent materials can be transported long distances on ocean currents and resist biodegradation, breaking up into smaller and smaller "microplastic" pieces, which has allowed them to accumulate over time to cause ubiquitous, near permanent contamination of the marine environment (Geyer et al., 2017; Law and Thompson, 2014).

Beaumont et al. (2019) quantified the economic costs of marine plastic, showing these to be significant with negative impacts on the provision of almost all marine ecosystem services; negative human wellbeing impacts, particularly fisheries, heritage, recreation and economic costs conjectured at $3300–$33,000 per tonne of marine plastic per year. The authors caution that the full economic cost is likely to be far greater. Action to manage marine litter has been called for by 2025 (United Nations, 2012). The Global Partnership on Marine Litter led by UNEP encourages governments, business, commerce and society to work together to reduce inputs of marine litter to the ocean (GESAMP, 2015) and the UN Environment Assembly within UNEP adopted a resolution focusing specifically on marine plastic debris and microplastics calling for urgent action (United Nations, 2014). This was echoed by an expert group who recommended precautionary action to reduce plastic input to the environment to minimise the risks to humans and wildlife (UNEP, 2016).

2. Public perceptions of marine pollution, microplastics and the media

As with other anthropogenic threats to the marine environment, there is a need to understand public perceptions of plastics in society and their environmental impacts if we are to develop appropriate interventions to reduce the input of plastic waste into the ocean (Pahl and Wyles, 2017; Hartley et al., 2015). This requires waste disposal by sea farers and a reduction in the use of single use plastics as well as design and manufacture with end of product life (UNEP, 2016). It is now largely recognised that the fight to protect the marine environment requires interdisciplinary approaches and specifically, collaborative research with social and behavioural scientists (Fletcher et al., 2012; GESAMP, 2015; Jefferson et al., 2015; Pahl and Wyles, 2017; SAPEA, 2019; UNEP, 2005).

While there is a developing literature in researching "the public" and marine environment it often highlights 'knowledge gaps' (e.g. the public underestimate the importance of the marine environment to society) with the implicit assumption that increasing public knowledge can lead to behaviour change (McKinley and Fletcher, 2012; Steel et al., 2005). Large-scale quantitative surveys have been undertaken to explore public perceptions of marine litter for example, the MARLISCO survey (involving 3748 respondents from 16 European countries) identified that most people reported seeing marine litter on most or every visit to the coast and saw the situation as deteriorating. Perhaps unsurprisingly environmental groups expressed above average concerns whereas manufacturing and retail stakeholders were less concerned than other groups (Hartley, 2013).

Litter impacts negatively on tourism, blighting environmental aesthetics and presenting a physical hazard (Eastman et al., 2013). This litter is considered to be offensive or disgusting and a threat to human health itself (Jefferson et al., 2014; Tudor and Williams, 2003). Consequently, the presence of litter deters tourists (Ballance et al., 2000; Leggett et al., 2014; Tudor and Williams, 2006) and can result in significant loss of tourist revenue (Jang et al., 2014).

Studies of both commercial and subsistence fisherfolk found a negative perception of marine litter which was linked to propeller entanglement, fouling and damage to fishing gear, affecting their catch

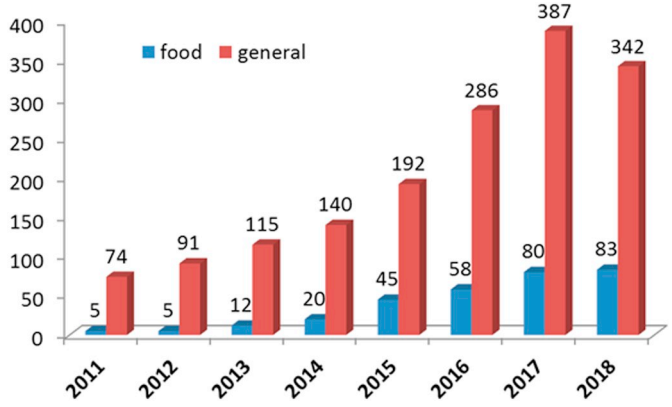

Fig. 1. Scientific publications (including articles, reviews and conference proceedings) on the topic of microplastics generally (red bars) and microplastics in food (blue bars) has been increasing since 2011 (Scopus only). JRC, personal communication and applying their Europe Media Monitor (EMM) and the Tool for Innovation Monitoring (TIM). Reproduced with permission from SAPEA, Science Advice for Policy by European Academies. (2019). A Scientific Perspective on Microplastics in Nature and Society. Berlin: SAPEA. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

and posing a hazard to safety (Nash, 1992; Wallace, 1990). However, understandings of what constitutes 'marine litter' should not be assumed. A valuable qualitative study exploring a group of Arab-Israeli fishermen identified that they did not perceive that their abandoned, lost, or discarded fishing gear were a contributor to marine litter. The participants described a deep emotional connection with the seas and considered clean local beaches to be a source of pride. However, there was anxiety and mistrust in the fishing village regarding its improvement by an outside government authority and fear that intervention would lead to inevitable displacement and dispossession of local fishermen (Brennan and Portman, 2017).

Few qualitative studies have been conducted into public understandings of the risks of microplastics (Anderson et al., 2016; GESAMP, 2015). This is a striking omission given that consumer goods can be sources of microplastic through weathering during their use or after their disposal. In addition, some products such as cosmetics contain intentionally added microplastics such as microbeads (Napper et al., 2015).

Currently microplastics and marine litter are dominating the scientific literature to the extent that there is concern that the hot topic of "plastics" may be displacing other less newsworthy but more pressing issues (Borja and Elliott, 2019). Latest figures indicate that plastic in the sea is set to treble in a decade unless marine litter is tackled which indicates that this is a critical issue (Thompson, 2017). As human behaviour is considered the sole source of marine litter this means that changing perceptions and behaviour is key to tackling litter in the natural environment (Pahl et al., 2017).

Recently in UK media the topic of plastic pollution has attracted considerable attention. Messages warning of the impact of plastic waste have featured not only in news media but also popular media. The impact of these images and messages is assumed to be significant and BBC documentary series, Blue Planet II (first aired in October 2017) in which David Attenborough warned audiences about plastic waste in the ocean is described as a "game changer". The programme was named by the Head of the UN Environment Programme at the time, Erik Solheim, as having "helped spur a wave of action" internationally and a so-called 'Blue Planet effect' was associated with announcements calling for legislation to reduce single use plastics (e.g. by UK Secretary of State for Environment, Food and Rural Affairs, Michael Gove) (SAPEA, 2019). To date there is no peer review evidence to support a change in behaviours in relation to this 'Blue Planet II effect'. A survey commissioned by the

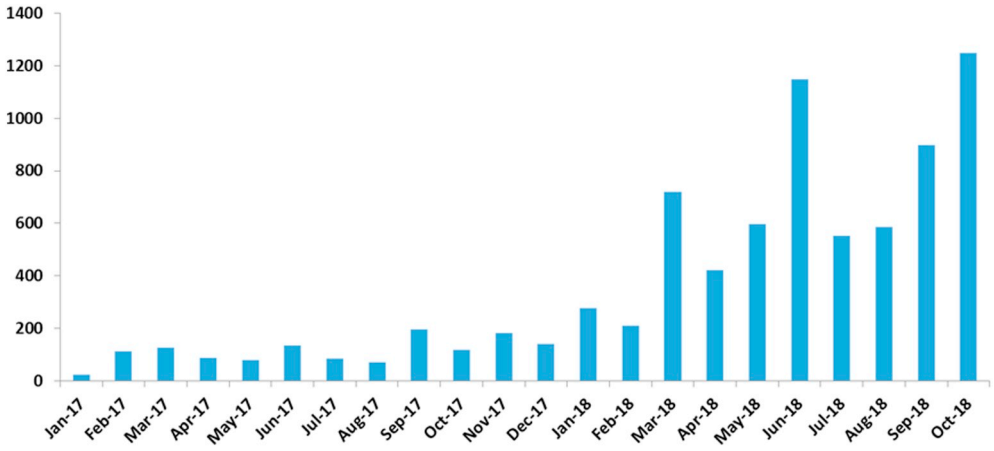

Fig. 2. Monthly number of news items extracted from EMM since January 2017 (JRC, personal communication).
Reproduced with permission from SAPEA, Science Advice for Policy by European Academies. (2019). A Scientific Perspective on Microplastics in Nature and Society. Berlin: SAPEA.

charity, Keep Britain Tidy found that those who had watched the Blue Planet series self-reported being more likely to get involved in a litter pick, would try to purchase less single-use plastics and were more aware of actions taken by people to help tackle litter (Ipsos-MORI, 2019).

The increased attention to microplastics in the scientific literature (Fig. 1) thus appears to be matched by increased focus on the topic across different media (Fig. 2). Media play an important role in alerting public and policy makers to emerging environmental issues (Anderson, 1997). Crucially media can also help shape public and policy discourses with implications for public awareness and political action (Cottle, 2009; Hansen, 2018). Issues do not simply emerge in media and there is a rich literature concerning the ideological processes by which certain issues and problems emerge at certain times and under specific conditions (Hilgartner and Bosk, 1988). Media simplify complex scientific issues for audiences and provide a "storyline" with which audiences can engage in terms of moral responsibility and interpretation (Entman, 1993; Gamson and Modigliani, 1989). The prominence of certain issues reflects societal and media values rather than scientific priorities (Hansen, 2016). Media also legitimise certain viewpoints (Painter, 2013) and are the focus of powerful interests seeking to set the agenda in ways which appear 'natural' and 'common-sense' (Hall et al., 1978; Henderson et al., 2019).

The increasingly fragmented contemporary media landscape presents challenges for environmental communication (Painter et al., 2017). These include more personalised news content and a 'complex interplay' of actors (media, parliament, scientific community, pressure groups and industry) and issues across diverse platforms (Anderson, 2014).

While there is no single body of work in Sociology and Communications which addresses public understandings of microplastics this paper extends interdisciplinary research involving Sociology and Communications specialists which found that microbeads represented an "unnatural" unacceptable risk (Anderson et al., 2016). It also builds upon a well-established research paradigm in media, science and risk (Friedman et al., 1999; Henderson and Kitzinger, 1999; Nelkin, 1995; Völker et al., 2019) and a rich literature concerning Sociology of Consumption; Food and Waste (e.g. Bourdieu, 1984; Evans et al., 2013; Gronow and Warde, 2001; Mylan et al., 2016; Shove et al., 2012).

Our paper contributes to this field by drawing upon insights from Sociology and Communications to explore how audiences engage with the emerging problem of plastic pollution, the tools different publics use to conceptualise new information about microplastics and the cultural dimensions of popular solutions to mitigate against consumption of single-use plastics. We draw upon a larger research project[1] which was structured to examine 1. The nature and frequency of media representations of microplastic pollution 2. Public conversations concerning ocean plastic pollution and microplastics on social media and 3. How different publics engaged with key messages concerning plastic pollution and microplastics using a) a qualitative focus group study and b) in an online quantitative and qualitative digital survey.[2]

3. Materials and methods

Here we present findings from our focus group study. Focus groups are an appropriate research tool to explore attitudes, beliefs, knowledge and behaviour concerning plastic pollution because they can help to access the ways in which people arrive at social knowledge through interaction with their peers (Green and Thorogood, 2009). Focus groups are not designed to be representative statistically; instead this method can elicit rich, deep data about how people make sense of specific issues in everyday life (not simply asking 'what' people know about plastic pollution and microplastics but unpacking 'how' and 'why' they know it, exploring levels of trust in experts as well as people's associations and memories). We conducted 6 focus group sessions in total with 42 people (Fig. 3). Our research sessions lasted around 90 min and were conducted in late 2016 and early 2017 after the plastic bag charge was introduced in England in October 2015 but before the screening of Blue Planet II in September 2017. During this period, the UK Government also announced its intention to ban on microbeads in cosmetics and personal care products following an Environmental Audit Committee Enquiry (September 2016). Ethical approval was awarded by the College of Business, Arts and Social Sciences ethics committee (2227LRFeb/20161686). Protocol followed standard British Sociological Association guidelines. Transcripts were anonymised, data were held securely, and materials were piloted prior to study commencement (Table 1).[3]

[1] "From Plastic Pollution to Solutions: Public Communication of Environmental and Health Risks" (Brunel University London).

[2] Further details are available on request from the corresponding author.

[3] We made some small changes after piloting the material, deciding not to show an additional clip "Midway: Message from the Gyre", part of a film project by photographer Chris Jordan capturing footage of albatross on Midway Atoll that are ingesting plastic. We piloted the new ecological paradigm (NEP) scale to address how pro-environmental our participants were but this proved exceptionally time consuming in addition to the group questionnaires and exercises. Some of our participants found the questions unclear and were uncomfortable giving written or verbal responses.

ID	Focus Group Description	Age	Location	Ethnicity (self-reported)	Participants with Children <16 yrs.	M	F	Vegetarian	News Sources
FG1	Professional women	38-42 yrs	Oxford	White	0	0	4	0	BBC, Guardian, National Geographic, Greenpeace, WWF
FG2	Dance class	30-36 yrs	Oxford	White	0	3	4	0	The Guardian, Facebook, Reddit, University journals
FG3	Arts students	20-22 yrs	London	White (1); Mixed race (1); Black (2); Asian (4)	0	5	3	0	BBC, QQ, Sina, World Green Energy
FG4	Water sports club members	26-40 yrs	West London	White (5); Mixed race (1) Black (1) Asian (2)	5	6	3	2	Geol Soc, Radio 4, Independent, The Guardian, Surfrider, WWF, activists' social media feeds
FG5	Young mothers (in receipt of Government benefits)	17-22 yrs	Greater London	White (6)	6	0	6	0	Facebook posts
FG6	Community centre helpers	19-77 yrs	Greater London	White (8)	4	0	8	0	TV news programmes, websites

Fig. 3. Description of focus group participants.

4. Results

4.1. Media frames: plastic pollution images and messages

Our participants had witnessed the problem of plastic pollution regularly in their everyday life. In their initial questionnaires (Fig. 4) a total of 81% ($n = 34$) of our participants reported witnessing plastic pollution on a 'daily' or 'weekly' basis. When asked what came to mind on hearing the term "plastic pollution" plastic bags in the ocean[4] were most commonly cited with some explaining "lots of plastic bags floating on the sea [which I've seen in] a newspaper or websites" (M3, FG3, Arts students). For news about the environment most of our participants went first to websites (52%, $n = 22$) or television (48%, $n = 20$). A smaller number sought information in newspapers (24%, $n = 10$). Two participants said they were not interested in environmental news (both in young mothers' group, FG5). Just over half of our participants ($n = 27$) said they were concerned about plastic pollution on the grounds that it was "killing off wildlife" and could "threaten marine security especially sea food". Those who were "not worried" said this was because it had never occurred to them, they did not know much about the issue or simply had other things to worry about.

It is striking that so many of our participants recalled images of plastic pollution *in the media* rather than as experienced directly in their everyday life. This suggests that people's associations with plastic pollution may be highly mediated. As our participants did not live near beaches or the ocean but rather in urban areas (London, Oxford) plastic pollution may be more easily conceptualised as a 'far away' problem 'on screen' rather than a local issue. Typical responses from individual questionnaires and focus group sessions (Fig. 5) made reference to the negative impact of plastic waste on charismatic wildlife, "seeing all the plastic in the sea hurting seals and dolphins" (FG1, Professional women); "animals dying" (FG6, Community centre helpers). Media formats including reality television helped make mundane waste remarkable, "I watched Bear Grylls, The Island. There was a load of rubbish on the beach they used to make things. It was really filthy and that was in the middle of nowhere!" (F2, FG1, Female Professionals), "Have you seen Bear Grylls 'The Island'? They get to the beach and find stuff like plug sockets! How does a plug socket end up on an island where people have never set foot on?" (FG3, Arts Students).

Fictional cinema was also a source, "Plastic pollution's in the film Happy Feet…It's like beer can things round the penguins' necks" (F1, FG5, Young mothers) and some participants saw images of plastic pollution through social media petitions "on a Facebook post. They share those stories and you see a whole bunch of plastic, it's just a story to sign a petition …I just go scroll past them" (F3, Young mothers, FG5). This indicates that plastic pollution is a strong feature across a wide range of popular media including television documentary, news, film and popular reality shows.[5] Others noted that rather than discussing hard scientific reports, lay publics draw upon diverse media including

[4] One exception was a male Arts student in FG3, who thought of plastic surgery because, "I was watching a TV show, it was on the news and I saw pollution and plastic and with the word association I [thought of] surgery, polluting the face".

[5] These responses suggest that initial questions about news sources could be extended to other media such as reality television.

Table 1
Focus group descriptors.

Sampling: This was purposive to reflect different perspectives on plastic consumption. We included those who might be expected to have a special interest in the issue (water sports club members) and others who had no obvious interest in the topic but reflected a range of demographic characteristics (young mothers in receipt of government benefits; arts students professional women community centre helpers members of a dance class).[a] Research sessions were conducted in convenient locations including participant homes community centres University premises and workplaces in Greater London and Oxford. The groups were 'naturally occurring' and people knew each other prior to the session. This allowed us to generate quality data about cultural norms and the role of peer communication in audience reception processes. Focus groups can capture participants' views concerning media and plastic in distinct ways that are difficult to reproduce in interviews including general 'banter' and colloquial language that marks discussions between peers (Carter and Henderson, 2005; Kitzinger, 1995).

Analysis: Sessions were audio recorded, with permission, and transcribed verbatim. Transcripts were read closely by the researcher team, LH and CG to identify initial key concepts through open coding and develop preliminary analysis (Strauss, 1987; Silverman, 2011). We then coded the data set systematically paying attention to emerging themes and inter, intra differences and similarities in groups in terms of gender, ethnicity, age and those with reported high/low media consumption and high/low interest in environmental issues. We paid close attention to 'deviant cases' (e.g. exploring why a minority within a single group reacted differently to their peers). Transcripts were uploaded to the qualitative data analysis computer software package NVivo 10 (QSR International) which facilitates deep levels of thematic analysis on data.

Protocol: After completing the consent process, participants were given an individual brief questionnaire where they answered questions about plastic pollution; the risk they believed that plastic pollution posed to wildlife and human health and how valuable they saw plastic (Fig. 4). Participants completed these individually so that we could capture their ideas before the group process began. We then explored perceptions of plastic pollution and microplastics (probing specifically for popular myths such as 'Great Pacific Garbage Patch' and specific terms such as 'microbeads') (Fig. 5). We built on techniques developed in other studies to elicit quality data such as 'brainstorming' participants' associations with the topic under discussion, then having participants to work in smaller groups and produce a 'news script' using images (Fig. 6) taken from news stories about the topic (Happer and Philo, 2015; Henderson, 2014; Hincliffe et al., 2016). Participants then watched two short clips of video material pertaining to plastic pollution. The first was a BBC news bulletin about the introduction of the plastic bag charge in England (Fig. 7), the second a film trailer for adventure documentary 'A Plastic Ocean' (A Plastic Ocean, 2017) (Fig. 8). Data collection was an iterative process with the facilitator following the flow of conversation while ensuring that all groups completed the same exercises in order and were asked the same set of core questions. At the close of the session participants completed a final questionnaire which asked about their perceptions of plastic pollution and risk (Fig. 9).

[a] Fig. 3 shows a list of all news sources identified by participants prior to discussion. It is worth noting that in three groups *The Guardian* newspaper is referenced which may indicate that the sample overall is skewed towards middle-class participants. This may have an impact on some of the themes e.g., acceptance of recycling as 'normal'. Future work could usefully explore participants' media sources in more detail and seek to explicitly include low income participants.

non-news formats to make sense of emerging scientific issues and bring their critical skills to bear on new information (Bates, 2005).

During our group sessions the image of large quantities of floating plastic in the ocean was raised spontaneously across most of our focus groups. One woman described plastic pollution as simply, "big floating islands of plastic" (F1, FG1, Female Professionals) and her friend explained:

> Huge floating expanses of plastic, all linked together. I think they could be hundreds of metres across. I don't know exactly how big but they float around in the Pacific, maybe they all collect together and so I think of it as a floating island of plastic [This comes] from articles I've read, TV images that I've seen on news reports and I think one report where some young guy had worked out a solution.[6]

(F3, FG1, Professional women)

Similarly, a male student (FG3) recounted seeing a mass of plastic 'on screen' and speculated about the impact of this:

> M3: A giant mass of plastic floating in the Pacific. Any fish there I would have thought they would just die basically if they eat a chunk of it.
> M2: Why doesn't the Government take it out?
> M3: It's the size of the United States, it would be so difficult to do. Trying to deal with something that big would take so much money to do it.
>
> (FG3, Arts students)

While some of our participants reported that they had never heard the specific term, "Great Pacific Garbage Patch" many people were clearly making reference to this popular myth. Indeed, the image of an island of solid plastic waste appeared to have a powerful hold on the imagination of our participants. One female participant warned:

> It's something that is going to affect us eventually. There's a giant mass of plastic. I think it's the size of Europe or the continental US floating in the Pacific. A land of plastic bigger than most countries and eventually that's going to just keep getting bigger.
>
> (F2, FG1, Professional women)

When asked about the source of her information she attributed it to media sources, "QI or the David Attenborough show" (F2, FG1). In similar vein, a student said he was concerned about plastic pollution because he had seen it in the media, "There is an island of plastic, bigger than Europe in the Pacific Ocean" (FG3).

There is significant accumulation of micro and macro plastic in the five main sub-tropical ocean gyres including the subtropical convergence zone of the Pacific, the site of the so called "Great Pacific Garbage Patch" (UNEP, 2016; Lebreton et al., 2018). However, the pervasive image of an island of plastic has proved to be an enduring misconception.

There was also a high recall of plastic pollution associated with charismatic wildlife including whales, turtles and sea otters. The most popularly cited image was "the six-pack ring" sea turtle entangled in plastic from beverage cans. Participants gave vivid accounts of how these emotive visual images involved animals "choking and suffering".

> You see it on TV, the bags and fish being killed and all that stuff.
>
> (F1, FG5, Young mothers)

> On the news the other day they'd found a whale and inside it was just full of plastic bags.
>
> (F3, FG6, Community centre helpers)

The responses from the water sports club members reflected their connection to wildlife and the identification with the suffering of animals on-screen,

> Dead animals. That's usually what you hear the most about because everyone feels bad for animals and you see whales who've died because there's been too much plastic … or the turtle with the plastic straw up its nose.
>
> (M2, FG2, Water sports club)

> "You always think of the poor sea otter stuck in the six-pack ring-pull …as a human being you wouldn't want to be in that situation so why should any other animal be?"
>
> (M6, FG4, Water sports club)

By contrast when asked about their associations with microplastics most participants in most groups were uncertain. Indeed, very few of

[6] This refers to Boyan Slat, Dutch inventor and entrepreneur who created the somewhat controversial https://www.theoceancleanup.com/ after a TedX talk he delivered at the age of 17 introducing the concept of a passive system to clean up the Great Pacific Garbage Patch received media attention and support.

When you hear 'plastic pollution' what comes to mind? (an image, word, anything at all)
Are you worried about plastic pollution or not? (please explain)

Where would you say you go to first for environmental news?
TV
Radio
Newspaper Website (which one)
Other (please state)
I'm not interested in environmental news

Please rate the risk you think that plastic pollution poses to wildlife (on a scale of 1 - 100 where 0 is "no threat" and 100 is an "extremely high risk")

Please rate the risk level that you think that plastic pollution poses to human health, wellbeing and prosperity? (on a scale of 1 -100, where 0 is "no threat" and 100 is an "extremely high risk")
Please rate what you think the value of plastic to society is (on a scale of 1 – 100, where 0 is "worthless" and 100 is "precious")

Fig. 4. Individual questionnaire.

our participants had heard of the term "microplastics" and in most groups the facilitator had to prompt explicitly for responses to the term. Other survey studies have identified that the term microplastics is not widely recognised (Hidalgo-Ruz and Thiel, 2013; GESAMP, 2015). Although younger people reported a greater awareness (Greenpeace, 2016).

We followed up by asking about secondary microplastics and invited responses to "microbeads". Here we found that media reporting appeared to have helped create some awareness. As one participant explained "I think of microbeads because that's the thing in the news at the moment" (FG2, Dance class). Other participants recalled that microbeads were identified in hand-wash and toothpaste, though believed that this was not the case for every product. Indeed, microbeads were perceived as being a problem that only affected more affluent consumers who could afford prestigious brands "those expensive produces that I might not buy, Clinique, Loreal" (FG1, Professional women).

> I've heard of [microbeads] in exfoliants […] probably in an article I read about saying "your vanity might be costing the environment" The line of the story explained that the microbeads and some cosmetic companies were voluntarily now advertising that they weren't including these and there were alternatives like bits of walnut pieces and stuff.
>
> (FS1, FG1, Professional women)

Participants cited their source of information about microbeads as news media reports which had highlighted issues around regulation. "It was in the news last year how [microbeads] were entering the water system and wasn't filtered out. I think they've been recently banned". Some participants were aware of specific media campaigns with one student exclaiming "The Daily Mail claim they've got [microbeads] banned from all UK products! A bit of a boast for a newspaper!" (M4, FG3, Arts students).

Conversely in the group of young mothers (FG5) there was no prior knowledge of microbeads and the group fell silent when the facilitator asked what microbeads might be. One of the participants suggested it could possibly be, "something to do with hair accessories?"

Unsurprisingly our more environmentally conscious group of water sports club members had a more detailed understanding of the issue of microplastics. They were also more concerned about their impact, as one male participant explained microplastics are "actual plastic soup in a bowl, really bad, it's really scary" (FG4, Water sports club).

This group was highly motivated to seek out new information and shape their consumption in line with ethical priorities. One woman reported regularly using an app on her mobile phone to identify products containing microbeads before purchase,

> You just scan the bar code of the product and they tell you what's in it if there is microbeads or not.
>
> (FG4, Water sports club)

One small study involving beauticians, environmentalists and students (Anderson et al., 2016) found that regardless of the human health impacts, people were surprised and concerned at the use of microbeads in everyday personal care products. An EU web based flash survey of 26,000 Europeans found that as many as 78% agreed that "the use of micro plastic particles in consumer cosmetic and similar products should be forbidden" (European Commission, 2014) and a Greenpeace survey found over 90% of participants thought that the UK government should "possibly" or "definitely" announce a ban on microbeads as a reaction to being shown material describing the potential environmental impacts (Greenpeace, 2016). Subsequently, a group of NGOs, including Greenpeace, launched a public petition attracting over 300,000 signatures and urged the UK government to ban microbeads in cosmetics. This demonstration of "significant public concern" marked the starting point of the Environmental Audit Committee of the House of Commons inquiry into microplastics in 2016, the outcome of which was a UK ban in 2018 (Environmental Audit Committee, 2016).

The scale of microplastics, particles too small to be easily detected by eye (Law and Thompson, 2014) was challenging for most participants who were more familiar with stories of macroplastic pollution. This became obvious when participants tried to select images to write a news script (Fig. 6). We designed this creative exercise as a way of allowing participants the opportunity to lead the discussion rather than artificially generating affective responses by presenting them with facts and figures. We were interested in the tools they might draw upon to make sense of a story about plastic pollution and how the topic of microplastics would be framed in their own words within these stories. It is worth noting that most groups found it relatively easy to produce a news story quickly concerning plastic pollution and wildlife entanglement. Many struggled with incorporating the issue of microplastics and this appeared to be due to the lack of tangible visuals on which to 'hook' their script, "It was quite hard because I normally think of the reports to do with oil on the birds or plastic bags" (FG1, Professional women).

Interestingly, this was also the case with water sports club members who knew more than other group participants about microplastics yet

still had very powerful associations of plastic pollution with visible identifiable litter "I've got this mental image of [plastic pollution] as just cardboard packaging or bottles floating around…the bigger items" (F2, FG4, Water sports club).

As a result, the image of the sea turtle entangled in the plastic bag (Fig. 6, Image 8) was swiftly incorporated into every news story created by our participants whereas the screen shot of plankton ingesting fluorescent plastic proved very difficult for most of the groups to address. Most people struggled to even verbally describe the image (Fig. 6, Image 6). Popular suggestions included "a microbe", "prawn" and some suggested it was a "toxic shrimp", or even a "plastic eating bug" designed in the laboratory to eat the plastic that was contaminating the ocean. Similarly, very few of our participants could make sense of the image of microplastics (Fig. 6, Image 3) and one described it as, "dirt in the ocean?" (F2, FG1, Professional women).

Participants' perceptions of plastic pollution as macroplastic, highly visible and obviously harmful to wildlife also shaped their views about the origins/sources of microplastics and solutions to the problem. Few people knew how plastics came to be present in the ocean in the first place. Indeed, there was great uncertainty about processes which lie behind the origins of secondary microplastics. Perhaps in consequence no obvious links were made between reducing their personal use of single use plastics and helping to solve the problem of plastic pollution – most participants framed the challenge as a problem of 'recycling'. This lack of understanding was despite watching the BBC news item which had shown graphically how plastic bags break up "into microscopically tiny pieces" (Fig. 7). Focus groups are a useful way of observing how research participants might struggle with how to make

Associations and images of plastic pollution and microplastics

When you hear 'plastic pollution' what comes to mind? (Probe: are you worried or not about it? Why?)
Can you think of any stories you might have read or seen in the press or TV about plastic pollution or not? (Probe: can you describe/ explain)

Have you heard of the Great Pacific Garbage Patch? (Probe: Can you say where/ describe if not raised spontaneously earlier)
Have you heard of microplastics or not? (Probe: where; describe, if not raised spontaneously earlier)
Have you heard of microbeads or not? (Probe: where? describe if not raised spontaneously earlier)
What might these be? What do you think causes them?

Who do you think is responsible for plastic pollution?

Creating a news script on microplastics

We will now give you some images taken from a BBC news story.
Can you make these into a story you might typically see on this topic? (ie not what you want to see but would see). Volunteer one person to present the story

How hard or easy did you find it? (Probe: what did you base your choice of language or images on? Why did you include those pictures? Why did you not include those pictures? Are these the types of stories you typically see? What would you like to see instead?

Engaging with media portrayals of microplastics

Show BBC news bulletin on plastic pollution
"Plastic in oceans 'threatens food chain' (BBC1, Six o Clock news, 1 October 2015)

Was there anything in the news item that surprised you, or not?
Did you agree or disagree particularly with anyone in the clip? (Probe: Can you say why?)

Show adventure documentary trailer
Show "A Plastic Ocean" official trailer.
Have you heard of A Plastic Ocean? (Probe: if so, where?)
Is this the first time you have seen the trailer for this film?
Was there anything in the film trailer that surprised you or not? (probe: please describe)
Did you agree or disagree particularly with anyone in the clip or not? (probe: who? Why?)
Now that you have seen the trailer would you want to see the film?
Which one did you prefer to watch? Can you say why?
Did you think one was more trustworthy than the other or not? Can you say why?

How do you decide if information on plastic pollution is reliable, trustworthy, accurate?
Who or what are you most likely to trust about this topic?

Fig. 5. Focus group protocol.

What would you do if there was conflicting advice on the issue?
What type of information would you need to make up your mind about the risks of plastic pollution?

Engaging with Solutions:

These actions have been suggested as possible solutions to the problem.

After each statement ask "Do you do these already? Would you? (Probe: explain why, why not)

Use soap bars rather than shower gels
Use glass bottles
Don't celebrate with balloon releases
Don't use plastic cutlery
Refuse plastic straws in your drink
Drink tap water
Join a beach clean
Avoid buying products containing microbeads for example skin scrubs
Bring your own bag to stores
Choose fruit and vegetables that are not wrapped in plastic
Raise awareness, talk to people
Sign a petition to lobby manufacturers or governments
Return non-recyclable plastics to the shop you purchased the product from and let them dispose of it

Fig. 5. (*continued*)

sense of new scientific information as this exchange between participants in our group of female professionals illustrates:

> FS1:They sort of cut from one thing to the other [in the BBC report] but didn't explain the in-between process. That's what we were saying, how does it all get there?
> FS3: Because I feel that I put my rubbish in the bin and I feel that it goes to a particular place, hopefully recycled and I pick things up if I drop them.
> FS2: "I don't understand how it gets there. Who is putting it into the ocean? How does it go from dropping your carrier bag in the street to it ending up in the ocean?"
>
> (FG1, Professional women)

This was common across the groups, "Why is [plastic] ending up in the sea because that's just ridiculous? I don't know how it's ending up there" (Focus Group 6). By contrast some of the water sports club members displayed greater knowledge and understanding.

> I always think of it as two ways that they get into the environment. One is through fleeces being washed and toothpaste etc. then also big plastic breaking down over time so becoming small fragments of plastic and then eventually microplastic.
>
> (M4, FG4, Water sports club)

There was a lack of comprehension concerning microplastics and the process by which everyday individual actions could cause the problem. This links to important beliefs that underpin people's relationship with the environment and how 'connected' they saw themselves as being. As one participant said, "I thought it was just bad for the environment. I didn't think it harmed *us*".

The focus group method also allowed us to witness participant reactions to the second phase of our research sessions where we presented images and messages to the groups. Watching the BBC news clip provoked strong affective responses. The informal group setting among friends and colleagues meant that participants openly gasped or shrieked as images came onto the screen. This was particularly the case where people observed scenes of wildlife entanglement and the powerful responses give some indication of the emotion that people experienced when witnessing the impact on animals. However, these images are not new for audiences. Here it is worth noting that it was the message that discussed how plastics could enter the food chain and "can enter the human body" that truly generated surprise. As one participant explains:

> The most surprising thing was the cycle, the fact that because of the plastics in the seas, we're consuming it afterwards. That was surprising.
>
> (M5, FG3, Arts students)

Indeed, most participants were genuinely shocked about the scale of the problem in terms of risk to human health, an angle which they had not previously considered. One participant could scarcely believe they could do little to avoid eating plastics: "I thought if animals are eating plastics they die but if we don't eat [the animals] then [plastics] don't end up on our dinner plates!"

Indeed, most participants discussed the human consumption of plastic as being new and shocking information. The exchange between community centre helpers below illustrates how people responded to the messages in our news and film trailer clips. Participants were asked, "what, if anything surprised you about what you have seen?" This group were unified in their shocked response to the information that plastics can enter the food chain

> FS2: The amount of plastic humans are consuming through their food
> FS4: Yes that's what I was thinking. We might eat the seafood
> FS2: Yes and we're also eating plastic
> FS8: I didn't ever think of it ending up in our food chain as well
> FS6: No I didn't. That's a shocker!
>
> (FG6, Community centre helpers)

The messages in the BBC news report concerning the extent of contamination surprised even those participants who considered themselves to be knowledgeable about the issue, "The fact that every single sample had plastic in it. You'd think that maybe one didn't at least. You'd hope one didn't!" (FG4, Water sports club).

Image	Image description	FG1	FG2	FG3	FG4	FG5	FG6
1 	Scientist in the lab, counting microplastics under the microscope.	X	X	X	X	X	X
2 	BBC Studio presents David Shukman's report on ocean plastics and the plastic bag charge.		X	X	X	X	X
3 	Plastics floating in the ocean just below the sea surface.	X	X	X	X	X	X
4 	Professor Tamara Galloway (University of Exeter) interview.	X	X	X	X	X	X
5 	Scientists on a Plymouth Marine Laboratory research vessel.	X	X		X	X	X
6 	Zooplankton that has ingested fluorescent plastic beads.	X			X	X	X
7 	Albatross chick having plastic removed from its gullet in the Pacific.	X	X	X	X	X	X
8 	Sea turtle ingesting a plastic bag.	X	X	X	X	X	X
9 	Philip Law (British Plastics Federation) interview.	-	X	X	X	X	X
10 	Presenter, David Shukman, with a plastic bag.	X	X	X	X	X	X

Fig. 6. Images used in news script-writing exercise.

4.2. Trust in media messages, formats and individuals – the importance of the lived experience

It is notable that no one in our groups expressed cynicism about the key messages presented in either the film trailer or the news bulletin regarding the problem of plastic pollution. As has been observed elsewhere there was no evidence here of "plastic denial" (SAPEA, 2019). Participants appeared to largely accept reports of the scale of the

problem. They also expressed trust in "the scientist" whose research featured in the news bulletin. Thus, academic scientist Professor Tamara Galloway was considered "unbiased" and "trustworthy" on the issue ("She's a professor studying [microplastics]…it's in your face what's happening, the real story, FG6, Community centre helpers"). This finding links to other work which identified scientists as among the most trusted to provide information on the environment (Gelcich et al., 2014). Audiences also expressed trust for free diver Tanya Streeter who presented key messages in the film trailer. Some of our participants recognised Streeter and others saw her as authentic and credible because she had probably witnessed the problem "first-hand". Perhaps unsurprisingly the water sports club members expressed trust for "surfers and divers".

There is a common theme here where people discussed how close these different actors are in terms of the problem (to the scientific process, to the ocean) and this proximity seems to engender trust for their message. Younger women recognised popular television explorer Ben Fogle and he conferred credibility on the film messages "if he is passionate and bothered about something I'd probably be as well!" (F3, FG1). Participants who watched reality television were more likely than others to see the film as an engaging and exciting way to learn about the issue of plastic pollution. Seeing the problem framed through the eyes of presenters who were on global scientific missions was considered appropriate "it made you care". Indeed, this trailer seemed to engage people at an emotional level because of witnessing by proxy the 'lived experience' of the blight of plastic waste. As one participant explained, "you really saw, how people are living literally on plastic and how animals are getting caught in it" (F2, FG6, Community centre helpers). Another stated simply, "the visual images spoke for themselves" (FG1) with a fellow participant in this group adding "I do like all the dramatic music!"

For others, the television news bulletin was regarded as more trustworthy because, "If it's in the news you kind of just have to trust it" (FG5, Young mothers) and it was considered to be more even-handed in presentation. This of course may reflect a UK specific context with a strong public service broadcasting ethos in which television news is considered free of bias.

4.3. Who is responsible? Perceptions of the role of government and industry

In terms of responsibility for plastic pollution and microplastics our participants gave a range of answers including "the Government", "humans", "China", "industry". It is interesting that there was no unified response and it points again to ambiguity concerning the origins of microplastics.

> I would say the Government's responsible. There's probably laws that they don't regulate it properly.
>
> (FG3, Arts students)

In the session with water sports club members our participants were clear that responsibility did not lie with the consumer but rather "Big industry", the oil industry, the packaging industry. As one male participant explained:

> It is really difficult for individuals to completely stop using some of this plastic because the oil industry and others are driving more and more packaging more and more use of plastic.
>
> (M4, FG4, Water sports club)

Participants appeared to be receptive to the overall messages concerning plastic pollution, however as noted earlier there were several identifiable 'gaps' in terms of participants' knowledge about how microplastics come to be in the ocean. This contrasts with the uncertainty concerning other environmental issues such as climate change where media reports presenting "both sides of the argument" appear to construct uncertainty which does not exist in the scientific community (Happer and Philo, 2013). We were interested in responses to the image of the plastic industry representative (Fig. 6, Image 9). Some of the more environmentally conscious groups such as the water sports club members and some of the dance class participants were highly cynical. One participant said the spokesperson talks about "disposal, but we know every single piece of plastic that's being disposed of never disappears".

> He might be trying to say, "We are doing a lot of work trying to clear up our oceans and the land and reducing plastic consumption and use", probably giving all those poncey examples of what they're doing which probably they aren't and haven't got enough funding to do anyway.
>
> (FG4, Water sports club)

In the dance class group, a participant (who studied environmental science as an undergraduate) expressed the view of the industry as deflecting the problem to the consumer. They saw the following comment as being typical of an industry spokesperson:

> Well, clearly this constant demonization of plastics is counterproductive. The problem is one of proper disposal and removal of unused plastics. There's no reason why we shouldn't be using more and more plastics all the time. They're wonderful materials. We just need to make sure that they're disposed of responsibly and carefully.
>
> (M2, FG2, Dance class)

Many participants were ambiguous about the role of industry and their perspectives on plastic pollution. Whereas some participants (Group 6) assumed industry would be attempting to defend their position others (Group 3) saw industry as leading demands for change:

> FS1: How is he going to stick up for himself? He can't!
> FS2: Or is he part of a team saying, No. It needs to stop!
>
> (FG6, Community centre helpers)

Most participants were unaware of the organisation, the British Plastics Federation and the spokesperson was described by Arts students as "One of the prestigious scholars of plastic pollution, Philip Law" in the assumption that he represented an academic research organisation involved in solving the problem of plastic pollution. The young mothers group similarly saw the industry as "helping to clear up the plastic pollution…the British Plastics Foundation are working alongside the research people". It is also worth noting that even those who expressed cynicism in relation to the motives of industry believed it was important to include industry perspectives:

> I tend to boo hiss! when the guy from the British Plastic Federation appears, but at least it shows there's an attempt to be balanced. They haven't just gone straight for one particular argument. So that always gives me more confidence if there's at least an attempt [at balance].
>
> F3, FG1, Female Professionals

Several groups struggled to include the perspective of the plastics industry. Most had little idea about what the representative might say on the issue which suggests that the industry have a comparatively low presence in the debate about plastic pollution (compared with NGO's and other groups). At the same time when participants watched the BBC news item in full it is worth noting that participants across all the groups were nodding in agreement at the comments made by industry. In particular, the view that plastics are vital to healthcare particularly resonated. The young mothers group immediately responded, "we need baby bottles", other participants mentioned "IV drips" and declared the industry spokesperson to be "absolutely right". Many participants associated plastics with "keeping things clean, hygienic." As well as "useful, durable, strong" and "practical and less dangerous than glass".. As one woman said, "Plastic is vital to our everyday life as long as [products] are recyclable and you can reuse them". Here the materiality of plastics also plays a role as those in our groups who were keen runners were swift to point out the obvious impracticalities of

alternatives to plastic water bottles, “plastic is less dangerous, if you are going to do sport, it's good to have something plastic and light to drink” (FG1). “I can't imagine running my half marathons with a glass bottle!” (FG1).

These ambiguous associations with plastics are important because they shed light on plastics in society and reveal the cultural context in which lay publics encounter risk messaging about plastics. Where plastics were once perceived as a revolutionary material they are now increasingly the subject of negative campaigning and some scientists have even called for plastic waste to be treated as hazardous (Lohmann, 2017; Ryan, 2015; Rochman et al., 2013). Indeed, Science and Technology scholars have described how plastic now symbolises “economies of abundance *and* ecological destruction” (Gabrys et al., 2013: 3). The plastics industry has recognised that plastics have an increasingly negative reputation in relation to the environment which presents a considerable challenge (Plastics Europe, 2013). It is also a strategic challenge to the plastics supply chain (The European House – Ambrosetti, 2013) and a limiting factor to the recruitment of skilled workers (British Plastics Federation, 2016). A European Commission survey of 26,595 respondents, found that 96% of people agreed that more initiatives are needed by industry to limit plastic waste and increase recycling (European Commission, 2014). The Alliance to End Plastic Waste represents a co-ordinated industry response to the challenge and has committed 1.5 billion USD to tackling the issue with involvement from across the plastics value chain (e.g. from chemical and plastic manufacturers to waste management companies).

4.4. Engagement with popular solutions to reduce single-use plastics

4.4.1. Acceptance: cultural norms regarding recycling and reuse

Ambiguities and apparently contradictory positions were apparent when it came to the final phase of our research sessions where participants were given a list of common “solutions” to the problem of plastic pollution. Possible solutions to reducing single use plastics are clearly embedded in everyday life and some solutions have more resonance than others. Most participants were entirely comfortable with the idea of “recycling” which is normalised in UK society. Indeed, most people declared that they did this regularly, some thought it was a legal requirement and though others confessed that they did not always sort their plastics fully there did appear to be a positive commitment to the idea of recycling in private households and the workplace, “Most people do [recycle] in every office now, there's a recycling bin and there's plastics recycling and there's a paper recycling” (FG2, Dance Class).

The exception to this was a couple of Arts students who admitted they did not bother with recycling and some of the young mothers who said, “I just have a bin shed. We don't have any recycling”. Again, there was a distinct difference in responses from the more environmentally conscious water sports club where some participants were critical about the politics of recycling, highlighting that recycling is a highly complex process.

> It's very unclear what should actually go into [recycling]. You have to do quite a lot of work to find out and it's worrying that if you put the wrong thing in [the bin] the whole lot gets landfilled [this is] based on stuff I've read and heard.
>
> (M6, FG4, Water sports club)

The group sessions took place after the introduction of the 5p charge for plastic bags in England and media were carrying high-profile messages about bag reuse in response to the new legislation. Most participants agreed that bringing bags had swiftly become a norm. Some people described doing this for environmental reasons and others “mainly because I don't want to pay!” (Professional women, Group 1). Ironically participants in our lower income group such as students and young mothers in receipt of benefits rarely brought their own bags to a store, “I always forget and paying 5p to me is just okay” (F6, FG5, Young mothers).

As one male student explained:

> M2: In my head now because of the charge I just always think whatever I'm buying is going to cost 5p more anyway
> LH So you have just built it in?
> M2: Yes, it's just part of the tax now!
>
> (M2, FG3, Arts students)

Recent research suggests that pro environmental practices such as bringing a re-usable bag to a shop is highly gendered so some men may be less likely to engage in this because it is considered ‘un-masculine’ (Swim et al., 2019).

4.4.2. Negotiated acceptance of solutions: conflicting understandings of risk and social responsibility

Some popular solutions to reducing use of single use plastics were unlikely to be taken up by our participants. Due to geographical distance there was little enthusiasm for beach cleans apart from the water sports members. There were also solutions which seemed to conflict with pre-existing ideas about health and hygiene. One example is that participants had diverse views on the idea of refusing a plastic straw. Members of the water sports club already did this and found it very easy. As one said, “Well, they say [in a bar] would you like a straw and I say ‘no’, or it's help yourself to a straw and I do not pick up a straw” and another added “Beer doesn't taste good in a straw anyway!”. Others saw this as “a bit over the top” (i.e. ‘excessively worthy’ behaviour) or as undermining other health practices. One participant (FG1) instantly said that refusing straws would risk compromising her dental health

> FS1: You'll get tooth decay.
> FS2: With plastic?
> FS1: The straws help avoid it. So it's the environment versus keeping your pearly whites.

Additional issues concerning the protective properties of straws were raised in different groups including minimising tooth sensitivity “my teeth are really sensitive to cold drinks” (F4, FG2, Dance class) and participants questioned the general advice to abandon straws, “Don't dentists say that drinking through straws is better?” (F2, FG6, Community centre helpers). Dentists could of course provide reusable straws to mitigate the need for straws made of plastic if giving this advice.

There was also a commonly held idea that it was a simple fact that “drinks taste better through a straw”. As one young mother explained:

> I like my straws with my drinks. I like drinking from a straw and my daughter loves straws as well.
>
> (F5, FG5, Young mothers)

The cultural context in which straws are used as part of ‘normal’ everyday life is important because there has been a lot of debate recently about plastic straws and initiatives to reduce or ban them (e.g. https://www.independent.co.uk/topic/plastic). In similar vein, our participants had divergent ideas about the issue of fruit and vegetables in plastic packaging. Whereas some people explicitly looked for loose fruit for environmental reasons (water sports club members); others looked for those wrapped in plastics because they saw these as more ‘hygienic’. One student explained:

> I look for [fruit and vegetables] that are wrapped because I don't want to know who's been touching the stuff. They've just come from the manufacturer ready in a bag [otherwise] you don't know who's picked it up, looked at it and then picked another one.
>
> (FG3)

The convenience and price of plastic wrapped fruit and vegetables appealed to young mothers:

> It depends on the price to me. The stuff in plastic seems cheaper.
>
> (FG5)

> Because it's in a bag its more convenient. I just pick up a bag of oranges I don't have to find nice oranges.
>
> (FG5)

Older participants (FG6) considered that plastic bags were bad for fruit because "they sweat, don't they?". Many of our participants would not re-use plastic bags to transport meat such as chicken because of concerns about hygiene, "chicken juices" and leakage. As one participant explained "You want [raw meat] to be away from the rest of your food and away from your nice bag that you keep in your handbag all the time" (FG1, Professional Women). This suggests that even those who are committed to pro environmental behaviour feel concern about contamination both in terms of food poisoning and protecting their 'nice' reusable bags from leakage.

4.4.3. Rejection of solutions: social opprobrium, respectable behaviour

Few participants were comfortable with returning non-recyclable plastic packaging to the store. In some groups it was considered a fact that "shops won't take them anyway" (FG6, Community centre helpers), "Can you do that? Would they not just look at you and say, yes, put it in your recycling? Or your own bin". Most people felt it was impractical ("it would cost me more to go back to the shop on a bus or in my car" FG6). Some said they had never been in a store where this seemed like a possibility and the return of packaging generated the greatest resistance as pointless or unworkable "What are they supposed to do with it? They're going to do exactly what we do which is throw it in the bin!" Another participant added, "No! I'm not walking all the way back to my shops with their rubbish!" (FG5, Young mothers). At the same time, this act is considered to risk social embarrassment and create additional unnecessary labour for shop assistants on low pay.

> I'm on good terms with all the little dudes in the shop next to my flat. They are miserable because they don't like working there. I don't really want to upset them.
>
> (F4, FG1, Professional women)

> Having worked in a supermarket I would probably murder the person who did that because that is just far too much effort. Why you leave it on me?
>
> (M2, FG3, Arts students)

Perceptions of social embarrassment were clearly paramount in the minds of participants. Some raised the issue of being questioned directly by store employees and forced to justify their actions, "Why are you giving me your rubbish?". Others said staff would be "a bit flabbergasted". A male participant declared, "It's not very British either!". Just one participant admitted to putting fruit and vegetables into her supermarket trolley loose without using a plastic bag. Her actions drew opprobrium even from close family, "I went shopping with my mum, she was absolutely freaked out. You cannot! My boyfriend thinks it is really embarrassing!" (FG2). Social practices are mediated culturally and in other parts of Europe it will be common for shoppers to leave packaging in the store. However, these comments reflect the current norm in the UK. We know from research in public health that anticipated reaction or stigma can serve to act as a powerful deterrent to changes in behaviour (Henderson et al., 2011). Social norms also play an important role in people's willingness to raise awareness of the problem of single-use plastics:

> I do think there's a danger of coming across as preaching. There's certain stereotypes, people who bring up environmental topics…
>
> (FS1, FG1)

This view was also expressed in the water sports club where participants were more overtly 'pro-environment' but still conscious that raising awareness of plastic pollution may not be welcomed. One female participant explained she might raise the issue, "In the right environment" but would avoid "sounding like I'm preaching to people" (F3, FG4). This perception of behaving inappropriately extended to other solutions involving the avoidance of plastic balloons, "Imagine you had a children's party and you banned [balloons]? That would be really weird".

These responses suggest that awareness of the problem is insufficient to tackle deep rooted assumptions about what is considered healthy and culturally appropriate behaviour. Here Sociological approaches may be particularly useful in unpacking the nuances in understandings within and across communities and to examine different public engagements with plastics in everyday life.

5. Conclusion

There have been recent calls for research that engages with solutions rather than documents the extent of marine debris (Gall and Thompson, 2015). Derraik (2002) argued for a combination of legislation and education to mitigate the problem of plastic pollution. As he explains, "since land-based sources provide major inputs of plastic debris into the oceans, if a community becomes aware of the problem, and obviously willing to act upon it, it can actually make a significant difference" (Derraik, 2002: 848). The research presented here explored public understandings of microplastics in the UK-specific context of messages concerning plastics pollution. We showed how different communities or publics related to the problem (or not) and shed light on the complex and often ambiguous nature of public understandings. Our study included groups of people from a variety of social backgrounds with no prior special knowledge of the topic. Participants lived in urban areas without easy access to the coast, however we anticipated that those who pursued water related leisure activities (sports club members) may have direct experience and thus heightened awareness or interest in the issue. Our analysis supports other work which has found that prosocial messages concerning the environment and sustainable living are most effective when the content aligns with audiences' values and daily realities (Kellert, 1996; Reinermann et al., 2014).

Our findings also support the view that audiences/users are certainly not passive recipients of media messages. They bring their cultural identities and existing knowledge, values, social practices to emerging scientific and social issues (Henderson, 2007; Henderson and Kitzinger, 1999). Images and metaphors are culturally embedded (Doyle, 2011) and here we might consider the power and endurance of myths concerning the 'Great Pacific Garbage Patch. Research in public health has identified that audiences' perceptions of what is risky, common sense, shameful or 'normal' come from media and can be powerful barriers to change (Henderson et al., 2011; Henderson et al., 2000).

Media storytelling arguably has a central role to play in shaping public understandings, bringing the topic of plastic pollution to public attention in vivid and powerful ways. At the same time, framing the issue as focused on charismatic wildlife entanglement can help support the idea that the problem lies with macroplastics rather than microplastics and that this issue is remote from most people's lives. These perceptions fuelled by media messages and images therefore may potentially challenge other important messages from policy makers or NGOs which seek to encourage people to make small changes in their daily lives. Perhaps it is unsurprising that the myth of the Great Pacific Garbage Patch continues to capture the imagination of the public. By contrast, microplastics lack visual spectacle, are difficult to comprehend and the links between macro and microplastic litter was for many of our participants, missed entirely.

In a changing media landscape with multiple media platforms, images play a crucial role in environmental communication (Painter et al., 2017). Images are vital to ensure media coverage for pressure groups (Doyle, 2009) and more people use social media as their key source of news (Pew Research Centre, 2016) with millennials already deriving as much as 68% of news from social media (Pew Research Center, 2017). Our participants had little awareness of microplastics

(though research conducted now may find greater public awareness). People had a visceral response to the images used in the research sessions, but shock and disgust does not equate with sustained change. Audiences can become inured to images and 'pollution fatigue' can follow. NGOs, policy makers and industry need to be cautious about mobilising 'fear' and 'disgust' to bring about change as public health research identifies the considerable ethical, moral and political problems (Lupton, 2014).

Our participants were surprised at the sheer scale of the problem and at the idea of plastics in the food chain. No one questioned the veracity of the scale of the problem (though many did express differences in taste, trust and credibility in the news bulletin versus adventure film as a vehicle for the message). These research findings point to the need for greater scientific literacy that uses media to communicate with diverse publics in inventive and creative ways which are scientifically accurate and compelling. The problem of microplastics and the ways in which the issue could be presented needs to take account of how plastics are perceived, scientific comprehension, media tastes and cultural specificity. It was apparent that some groups were more attuned than others to the idea that their everyday actions and the problem of plastic pollution might be connected and this related to their overarching perceptions of important ties between people and the environment (and social capital which is linked to perceptions of one's ability to make a difference).

There may be uncertainty about the absolute risk to human health posed by microplastics but there is already widespread scientific consensus that action needs to be taken now to reduce plastic waste to avoid greater problems in the future (SAPEA, 2019). To date, research into plastic waste and behaviour in the context of marine litter has been led largely by environmental psychologists (Pahl and Wyles, 2017; Pahl et al., 2017; Poortinga and Whitaker, 2018). As cultural anthropologist Mary Douglas argues, risk perception 'depends on shared culture, not on individual psychology' (Douglas and Wildavsky, 1982) and contemporary waste theorists posit that what constitutes 'dirt' is the object of continual cultural struggle and (re)negotiation (Gabrys et al., 2013). Cultural practices and negotiations are of central concern to researchers in Sociology and Communication. In addition to exploring individual behaviours to address plastic pollution we could expand our lens to explore wider socio-cultural dimensions of plastics in society. Plastic pollution relates to the power dynamics of our global industrial economy (Liboiron, 2013) and Sociology and Communications can play a role in examining plastic pollution and waste at a local level and as a structural issue. It is no coincidence that the so called 'top ocean polluters' who 'mismanage' waste are countries which bear the burden of significant health inequalities (Dumbili and Henderson, 2020). Public understandings of plastic pollution and of the emerging topic of microplastics are intertwined with media messages and existing social practices. We are therefore unlikely to develop effective solutions to mitigating plastic waste without first mapping how different social groups engage with plastics in everyday life.

Author contributions

LH conceptualised the study, conducted 5 focus groups, and drew on her research in sociology and communications to analyse the data and write the paper. CG helped conceptualise the study, conducted one focus group and drew on his research in environmental science to help analyse the data and provide policy context to the paper.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

We would like to thank all our participants and those who helped arrange the group sessions. Thanks also to Professor Susan Jobling and Dr. Geoff Brighty. The authors are grateful to Ms Irene Boston for her help with transcription and to Dr. Graham Harris and Dr. Timothy Cribbin for their assistance on our larger project.

Funding

This study was funded by Brunel University London and Plastic Oceans (UK) (1139843). Reference no. 10615.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.marpolbul.2020.110908.

References

A Plastic Ocean, 2017. [Documentary film]. Craig Leeson. dir. Netflix, USA. https://www.netflix.com/gb/title/80164032.
Anderson, A., 1997. Media, Culture and the Environment. Routledge, Abingdon.
Anderson, A., 2014. Media, Environment and the Network Society. Palgrave, Basingstoke.
Anderson, A.G., Grose, J., Pahl, S., Thompson, R.C., Wyles, K.J., 2016. Microplastics in personal care products: exploring perceptions of environmentalists, beauticians and students. Mar. Pollut. Bull. 113 (1–2), 454–460.
Andrady, A.L., 2011. Microplastics in the marine environment. Mar. Pollut. Bull. 62 (8), 1596–1605.
Ballance, A., Ryan, P.G., Turpie, J.K., 2000. How much is a clean beach worth? The impact of litter on beach users in the Cape Peninsula, South Africa. S. Afr. J. Sci. 96 (5), 210–213.
Barboza, L.G.A., Vethaak, A.D., Lavorante, B.R.B.O., Lundebye, A., Guilhermino, L., 2018. Marine microplastic debris: an emerging issue for food security, food safety and human health. Mar. Pollut. Bull. 133, 336–348.
Bates, B.R., 2005. Public culture and public understanding of genetics: a focus group study. Public Underst. Sci. 14 (1), 47–65. https://doi.org/10.1177/0963662505048409.
Beaumont, N.J., Aanesen, M., Austen, M.C., Börger, T., Clark, J.R., Cole, M., Hooper, T., Lindeque, P.K., Pascoe, C., Wyles, K.J., 2019. Global ecological, social and economic impacts of marine plastic. Mar. Pollut. Bull. 142, 189–195.
Borja, A., Elliott, M., 2019. So when will we have enough papers on microplastics and ocean litter? Mar. Pollut. Bull. 146, 312–316.
Bourdieu, P., 1984. Distinction: A Social Critique of the Judgment of Taste. Harvard University Press, Cambridge, MA.
Brennan, R.E., Portman, M.E., 2017. Situating Arab-Israeli artisanal fishermen's perceptions of marine litter in a socio-institutional and socio-cultural context. Mar. Pollut. Bull. 115 (1–2), 240–251.
British Plastics Federation, 2016. Education and Skills Survey 2016 - Report: Skills and Training Needs in the Plastics Industry. British Plastics Federation, London, UK.
Carter, S., Henderson, L., 2005. Approaches to qualitative data collection in social science in. In: Bowling, A., Ibrahim, S. (Eds.), Handbook of Research Methods: Investigation, Measurement and Analysis. Open University Press, Maidenhead, pp. 215–230.
Cottle, S., 2009. Global crises in the news: staging new wars, disasters and climate change. Int. J. Commun. 3, 494–516.
Depledge, M.H., Galgani, F., Panti, C., Caliani, I., Casini, S., Fossi, M.C., 2013. Plastic litter in the sea. Mar. Environ. Res. 92, 279–281.
Derraik, J.G.B., 2002. The pollution of the marine environment by plastic debris: a review. Mar. Pollut. Bull. 44 (9), 842–852.
Douglas, M., Wildavsky, A., 1982. Risk and Culture: An Essay on the Selection of Technological and Environmental Dangers. University of California Press, London.
Doyle, J., 2009. Climate action and environmental activism: the role of environmental NGOs and grassroots movements in the global politics of climate change. In: Boyce, T., Lewis, J. (Eds.), Climate Change and the Media. Peter Lang, New York, USA, pp. 103–116.
Doyle, J., 2011. Mediating Climate Change. Routledge, London.
Dumbili, W.E., Henderson, L., 2020. The challenge of plastic pollution in Nigeria. In: Letcher, T.M. (Ed.), Plastic Waste and Recycling: Environmental Impact, Societal Issues and the Circular Economy. Elsevier, Oxford.
Eastman, L.B., Núñez, P., Crettier, B., Thiel, M., 2013. Identification of self-reported user behavior, education level, and preferences to reduce littering on beaches – a survey from the SE Pacific. Ocean & Coastal Management 78, 18–24.
Entman, R.M., 1993. Framing toward clarification of a fractured paradigm. J. Commun. 43 (4), 51–58.
Environmental Audit Committee, 2016. Environmental impact of microplastics inquiry. https://publications.parliament.uk/pa/cm201617/cmselect/cmenvaud/179/17902.htm?utm_source=179&utm_medium=fullbullet&utm_campaign=modulereports.
Eriksen, M., Lebreton, L.C.M., Carson, H.S., Thiel, M., Moore, C.J., Borerro, J.C., Galgani, F., Ryan, P.G., Reisser, J., 2014. Plastic pollution in the world's oceans: more than 5 trillion plastic pieces weighing over 250,000 tons afloat at sea. PLoS One 9 (12),

e111913.
European Commission, 2014. Attitudes of Europeans Towards Waste Management and Resource Efficiency. European Union.
Evans, D., Campbell, D., Murcott, A. (Eds.), 2013. Waste Matters: New Perspectives on Food and Society. Wiley-Blackwell, Hoboken, NJ, USA.
Fletcher, S., Jefferson, R., Mckinley, E., 2012. Exploring the shallows: a response to 'saving the shallows: focusing marine conservation where people might care'. Aquat. Conserv. Mar. Freshwat. Ecosyst. 22 (1), 7–10.
Friedman, S.M., Dunwoody, S., Rogers, C.L. (Eds.), 1999. Communicating Uncertainty: Media Coverage of New and Controversial Science. Lea's Communication Series Lawrence Erlbaum Associates Publishers, Mahwah. NJ. US.
Gabrys, J., Hawkins, G., Michael, M. (Eds.), 2013. Accumulation: The Material Politics of Plastic. Routledge, London.
Gall, S.C., Thompson, R.C., 2015. The impact of debris on marine life. Mar. Pollut. Bull. 92 (1–2), 170–179.
Gamson, W.A., Modigliani, A., 1989. Media discourse and public opinion on nuclear power: a constructionist approach. Am. J. Sociol. 95, 1–37.
Gelcich, S., Buckley, P., Pinnegar, J.K., Chilvers, J., Lorenzoni, I., Terry, G., Guerrero, M., Castilla, J.C., Valdebenito, A., Duarte, C.M., 2014. Public awareness, concerns, and priorities about anthropogenic impacts on marine environments. PNAS 111 (42), 15042–15047.
GESAMP, 2015. Sources, fate, and effects of microplastics in the marine environment: a global assessment. In: Kershaw, P.J. (Ed.), Imo/FAO/UNESCO-IOC/UNIDO/WMO/IAEA/UN/UNEP/UNDP Joint Group of Experts on Scientific Aspects of Marine Environmental Protection. Rep. Stud. GESAMP No.90, (96pp).
Geyer, R., Jambeck, J.R., Law, K.L., 2017. Production, use, and fate of all plastics ever made. Sci. Adv. 3 (7), e1700782.
Green, J., Thorogood, N., 2009. Qualitative Methods for Health Research. SAGE, London.
Greenpeace, 2016. Microbeads Poll Executive Summary. Greenpeace, London.
Gronow, J., Warde, A., 2001. Ordinary Consumption. Psychology Press, Hove.
Hall, S., Critcher, C., Jefferson, T., Clarke, J., 1978. In: Roberts, B. (Ed.), Policing the Crisis. Mugging, the State and Law and Order. MacMillan, London.
Hansen, A., 2016. The changing uses of accuracy in science communication. SAGE Journals 25 (7), 760–774.
Hansen, A., 2018. Environment, Media and Communication. Routledge, London.
Happer, C., Philo, G., 2013. The role of the media in the construction of public belief and social change. J. Soc. Polit. Psychol. 1 (1), 321–336.
Happer, C., Philo, G., 2015. New approaches to understanding the role of the news media in the formation of public attitudes and behaviours on climate change. Eur. J. Commun. 31 (2), 136–151.
Hartley, B.L., 2013. MARine Litter in European Seas: Social AwarenesS and CO-Responsibility (MARLISCO): D. 1 Baseline Evaluation of Stakeholder Perceptions and Attitudes towards Issues Surrounding Marine Litter. MARLISCO, Plymouth, UK.
Hartley, B.L., Thompson, R.C., Pahl, S., 2015. Marine litter education boosts children's understanding and self-reported actions. Mar. Pollut. Bull. 90 (1–2), 209–217.
Hartmann, N.B., Thorsten, H., Thompson, R.C., Hassellöv, M., Verschoor, V., Daugaard, A.V., Rist, S., Karlsson, T., Brennholt, N., Cole, M., Herrling, M.P., Hess, M.C., Ivleva, N.P., Lusher, A.L., Wagner, M., 2019. Are we speaking the same language? Recommendations for a definition and categorization framework for plastic debris. Environmental Science & Technology 53 (3), 1039–1047.
Henderson, L., 2007. Social Issues in Television Fiction. Edinburgh University Press, Manchester.
Henderson, L., 2014. News for everyone? Perspectives of young people and journalists on political reporting in UK television. Young: Nordic Journal of Youth Research 22 (2), 135–152.
Henderson, L., Kitzinger, J., 1999. The human drama of genetics: "hard" and "soft" media representations of inherited breast cancer. Sociology of Health & Illness 21, 560–578.
Henderson, L., Kitzinger, J., Green, J., 2000. Representing infant feeding: content analysis of British media portrayals of bottle feeding and breast feeding. BMJ 321, 1196–1198.
Henderson, L., McMillan, B., Green, J.M., Renfrew, M.J., 2011. Men and infant feeding: perceptions of embarrassment, sexuality, and social conduct in white low-income British men. Birth 38, 61–70.
Henderson, L., Hilton, S., Green, J., 2019. Media Analysis and Public Health: Contemporary Issues in Critical Public Health. Routledge, London.
Hidalgo-Ruz, V., Thiel, M., 2013. Distribution and abundance of small plastic debris on beaches in the SE Pacific (Chile): a study supported by a citizen science project. Mar. Environ. Res. 87–88, 12–18.
Hilgartner, S., Bosk, C.L., 1988. The rise and fall of social problems: a public arenas model. Am. J. Sociol. 94 (1), 53–78.
Hincliffe, S., Bingham, N., Allen, J., Carter, S., 2016. Pathological Lives: Disease, Space and Biopolitics. John Wiley and Sons, Chichester.
Ipsos - MORI, 2019. New research reveals the power of Blue Planet II and how it's changed attitudes and behaviour. https://www.ipsos.com/ipsos-mori/en-uk/new-research-reveals-power-blue-planet-ii-and-how-its-changed-attitudes-and-behaviour.
Jambeck, J.R., Geyer, R., Wilcox, C., Siegler, T.R., Perryman, M., Andrady, A., Narayan, R., Law, K.L., 2015. Plastic waste inputs from land into the ocean. Science 347 (6223), 768–771.
Jang, Y.C., Hong, S., Lee, J., Lee, M.J., Shim, W.J., 2014. Estimation of lost tourism revenue in Geoje Island from the 2011 marine debris pollution event in South Korea. Mar. Pollut. Bull. 81 (1), 49–54.
Jefferson, R.L., Bailey, I., Laffoley, D.D., Richards, J.P., Attrill, M.J., 2014. Public perceptions of the UK marine environment. Mar. Policy 43, 327–337.
Jefferson, R., McKinley, E., Capstick, S., Fletcher, S., Griffin, H., Milanese, M., 2015. Understanding audiences: making public perceptions research matter to marine conservation. Ocean Coast. Manag. 115, 61–70.
Kellert, S.R., 1996. The Value of Life: Biological Diversity and Human Society. Island Press, Washington.
Kitzinger, J., 1995. Qualitative research: introducing focus groups. BMJ 311, 229.
Law, K.L., Thompson, R.C., 2014. Microplastics in the seas. Science 345 (6193), 144–145.
Lebreton, L., Slat, B., Ferrari, F., Sainte-Rose, B., Aitken, J., Marthouse, R., Hajbane, S., Cunsolo, S., Schwarz, A., Levivier, A., Noble, K., Debeljak, P., Maral, H., Schoeneich-Argent, R., Brambini, R., Reisser, J., 2018. Evidence that the Great Pacific Garbage Patch is rapidly accumulating plastic. Nat. Sci. Rep. 8 (1), 4666.
Leggett, C., Scherer, N., Curry, M., Bailey, R., Haab, T., 2014. Final report: Assessing the economic benefits of reductions in marine debris: a pilot study of beach recreation in Orange County, California. In: Prepared for Marine Debris Division, National Oceanic and Atmospheric Administration. Industrial Economics, Incorporated, USA.
Liboiron, M., 2013. Plasticisers: a twenty-first-century miasma. In: Gabrys, J., Hawkins, G., Michael, M. (Eds.), Accumulation: The Material Politics of Plastic. Routledge, London, pp. 134–149.
Lohmann, R., 2017. Microplastics are not important for the cycling and bioaccumulation of organic pollutants in the oceans—but should microplastics be considered POPs themselves? Integr. Environ. Assess. Manag. 13 (3), 460–465.
Lupton, D., 2014. The pedagogy of disgust: the ethical, moral and political implications of using disgust in public health campaigns. Crit. Public Health 25 (1), 4–14.
McKinley, E., Fletcher, S., 2012. Improving marine environmental health through marine citizenship: a call for debate. Mar. Policy 36 (3), 839–843.
Mylan, J., Holmes, H., Paddock, J., 2016. Re-introducing consumption to the 'circular economy': a sociotechnical analysis of domestic food provisioning. Sustainability 8, 794.
Napper, I.E., Bakir, A., Rowland, S.J., Thompson, R.C., 2015. Characterisation, quantity and sorptive properties of microplastics extracted from cosmetics. Mar. Pollut. Bull. 99 (1–2), 178–185.
Nash, A.D., 1992. Impacts of marine debris on subsistence fishermen: an exploratory study. Mar. Pollut. Bull. 24 (3), 150–156.
Nelkin, D., 1995. Selling Science: How the Press Covers Science and Technology. W.H. Freeman, New York.
OSPAR, 2007. OSPAR Pilot Project on Monitoring Marine Beach Litter: Monitoring of Marine Litter in the OSPAR Region. OSPAR Commission, London, UK.
Pahl, S., Wyles, K.J., 2017. The human dimension: how social and behavioural research methods can help address microplastics in the environment. Anal. Methods 9, 1404–1411.
Pahl, S., Wyles, K., Thompson, R.C., 2017. Channelling passion for the ocean towards plastic pollution. Nat. Hum. Behav. 1, 697–699.
Painter, J., 2013. Climate Change in the Media: Reporting Risk and Uncertainty. University of Oxford: Reuters Institute for the Study of Journalism.
Painter, J., Erviti, M.C., Fletcher, R., Howarth, C., Kristiansen, S., León, B., Ouakrat, A., Russell, A., Schäfer, M.S., 2017. Something Old, Something New: Digital Media and the Coverage of Climate Change. University of Oxford: Reuters Institute for the Study of Journalism.
Pew Research Center, 2016. News Use Across Social Media Platforms 2016. Pew Research Center, Washington.
Pew Research Center, 2017. News Use Across Social Media Platforms 2017. Pew Research Center, Washington.
Plastics Europe, 2013. Plastics – The Wonder Material. Plastics Europe, Auderghem, Belgium.
Poortinga, W., Whitaker, L., 2018. Promoting the use of reusable coffee cups through environmental messaging, the provision of alternatives and financial incentives. Sustainability 10 (3), 873–883.
Reinermann, J., Lubjuhn, S., Boumann, M., Singhal, A., 2014. Entertainment-education: storytelling for the greater greener good. Int. J. Sustain. Dev. 17 (2), 176–191.
Rochman, C.M., Browne, M.A., Halpern, B.S., Hentschel, B.T., Hoh, E., Karapanagioti, H.K., Rios-Mendoza, L.M., Takada, H., Teh, S., Thompson, R.C., 2013. Policy: classify plastic waste as hazardous. Nature 494 (7436), 169–170.
Rochman, C.M., Tahir, A., Williams, S.L., Baxa, D.V., Lam, R., Miller, J.T., Teh, F., Werorilangi, S., Teh, S.J., 2015. Anthropogenic debris in seafood: plastic debris and fibers from textiles in fish and bivalves sold for human consumption. Nat. Sci. Rep. 5, 14340.
Rochman, C.M., Brookson, C., Bikker, J., Djuric, N., Earn, A., Bucci, K., Athey, S., Huntington, A., McIlwraith, H., Munno, K., De Frond, H., Kolomijeca, A., Erdle, L., Grbic, J., Bayoumi, M., Borrelle, S.B., Wu, T., Santoro, S., Werbowski, L.M., Zhu, X., Giles, R.K., Hamilton, B.M., Thaysen, C., Kaura, A., Klasios, N., Ead, L., Kim, J., Sherlock, C., Ho, S., Hung, C., 2019. Rethinking microplastics as a diverse contaminant suite. Environmental Toxicology Chemistry 38, 703–711.
Ryan, P.G., 2015. A brief history of marine litter research. In: Bergmann, M., Gutow, L., Klages, K. (Eds.), Marine Anthropogenic Litter. Springer International Publishing, pp. 1–25.
SAPEA, 2019. A Scientific Perspective on Micro-plastics in Nature and Society. Science Advice for Policy by European Academies, Berlin.
Schultz, P.W., 2011. Conservation means behavior. Conserv. Biol. 25 (6), 1080–1083.
Shove, E., Pantzar, M., Watson, M., 2012. The Dynamics of Social Practice: Everyday Life and how it Changes London. Sage.
Silverman, D., 2011. Interpreting Qualitative Data. Sage Publications, London.
Steel, B.S., Smith, C., Opsommer, L., Curiel, S., Warner-Steel, R., 2005. Public ocean literacy in the United States. Ocean Coast. Manag. 48 (2), 97–114.
Strauss, A., 1987. Qualitative Analysis for the Social Scientist. University Press, New York.
Swim, J.K., Gillis, A.J., Hamaty, K.J., 2019. Gender bending and gender conformity: the social consequences of engaging in feminine and masculine pro-environmental behaviors. Sex Roles 1–23.
The European House – Ambrosetti, 2013. The Excellence of the Plastics Supply Chain in Relaunching Manufacturing in Italy and Europe. The European House – Ambrosetti,

Milan, Italy.
Thompson, R., 2017. Foresight – Future of the Sea: A Report From the Government Chief Scientific Adviser. Government Office for Science, UK.
Tudor, D.T., Williams, A.T., 2003. Public perception and opinion of visible beach aesthetic pollution: the utilisation of photography. J. Coast. Res. 19 (4), 1104–1115.
Tudor, D.T., Williams, A.T., 2006. A rationale for beach selection by the public on the coast of Wales, UK. Area 38 (2), 153–164.
UNEP, 2005. Selection, Design and Implementation of Economic Instruments in the Solid Waste Management Sector in Kenya: The Case of Plastic Bags. United Nations Environment Programme (UNEP), Nairobi, Kenya.
UNEP, 2016. Marine Plastic Debris and Microplastics – Global Lessons and Research to Inspire Action and Guide Policy Change. United Nations Environment Programme, Nairobi, Kenya.
United Nations, 2012. Report of the United Nations Conference on Sustainable Development. Rio de Janeiro, Brazil 20–22 June 2012. United Nations, New York, USA.
United Nations, 2014. Resolutions and Decisions Adopted by the United Nations Environment Assembly of the United Nations Environment Programme at its First Session on 27 June 2014: Resolution 1/6 Marine Plastic Debris and Microplastics. United Nations.
Van Cauwenberghe, L., Janssen, C.R., 2014. Microplastics in bivalves cultured for human consumption. Environ. Pollut. 193, 65–70.
Völker, C., Kramm, J., Wagner, M., 2019. On the creation of risk: framing of microplastics risks in science and media. Global Chall., 1900010. https://onlinelibrary.wiley.com/doi/epdf/10.1002/gch2.201900010.
Wallace, B., 1990. How much do commercial and recreational fishermen know about marine debris and entanglement? Phase 1′. In: Shomura, R.S., Godfrey, M.L. (Eds.), Proceedings of the Second International Conference on Marine Debris. U.S. Department of Commerce. NOAA Tech. Memo. NMFS, NOAA-TM-NMFS-SWFSC-154, Hawaii, US, pp. 1140–1148.
Worm, B., Barbier, E.B., Beaumont, N., Duffy, J.E., Folke, C., Halpern, B.S., Jackson, J.B.C., Lotze, H.K., Micheli, F., Palumbi, S.R., Sala, E., Selkoe, K.A., Stachowicz, J.J., Watson, R., 2006. Impacts of biodiversity loss on ocean ecosystem services. Science 314 (5800), 787–790.