# MICROPLASTICS

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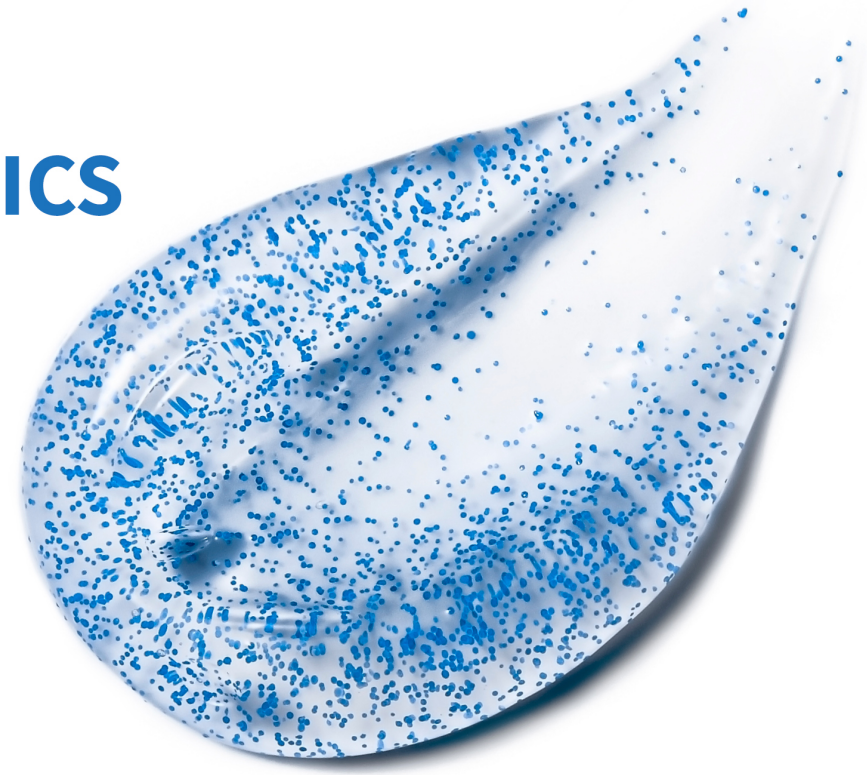
ADA 412 – PRESENTATION 2

# WHAT ARE MICROPLASTICS?

- Microplastics, small pieces of plastic, less than 5 mm (0.2 inch) in length, that occur in the environment as a consequence of plastic pollution. Microplastics are present in a variety of products, from cosmetics to synthetic clothing to plastic bags and bottles. Many of these products readily enter the environment in wastes.

WHAT ARE **MICROPLASTICS** ANYWAY?

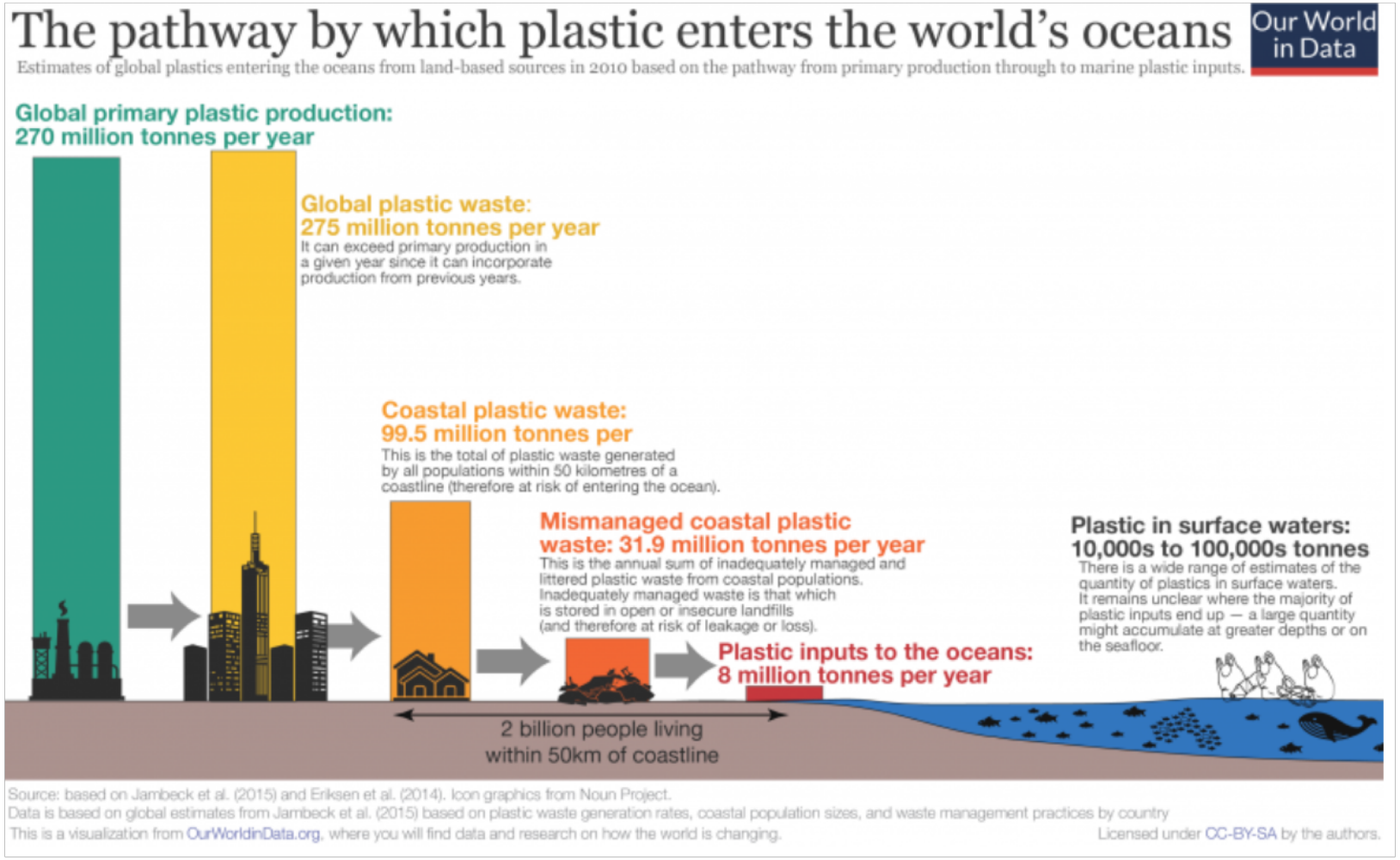


# WHAT ARE MICROPLASTICS?

- Microplastics are divided into two types: primary and secondary.
- Primary microplastics enter the environment directly through any of various channels—for example, product use, unintentional loss from spills during manufacturing or transport, or abrasion during washing.
- Secondary microplastics form from the breakdown of larger plastics; this typically happens when larger plastics undergo weathering, through exposure to, for example, wave action, wind abrasion, and ultraviolet radiation from sunlight.

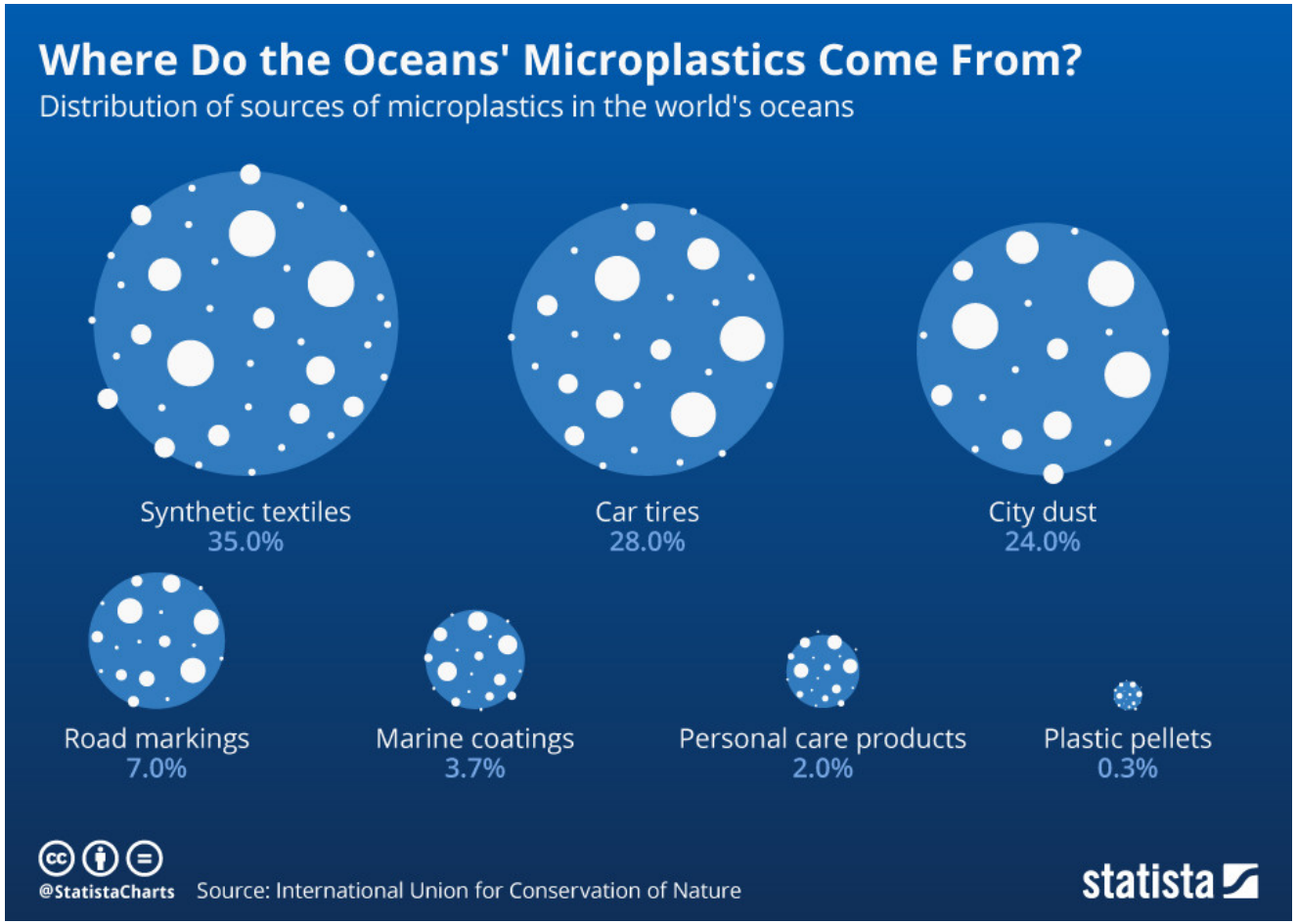

# WHERE DO WE FIND THEM? - OCEANS

- Microplastics are not biodegradable. Thus, once in the environment, primary and secondary microplastics accumulate and persist. Microplastics have been found in a variety of environments, including oceans and freshwater ecosystems.



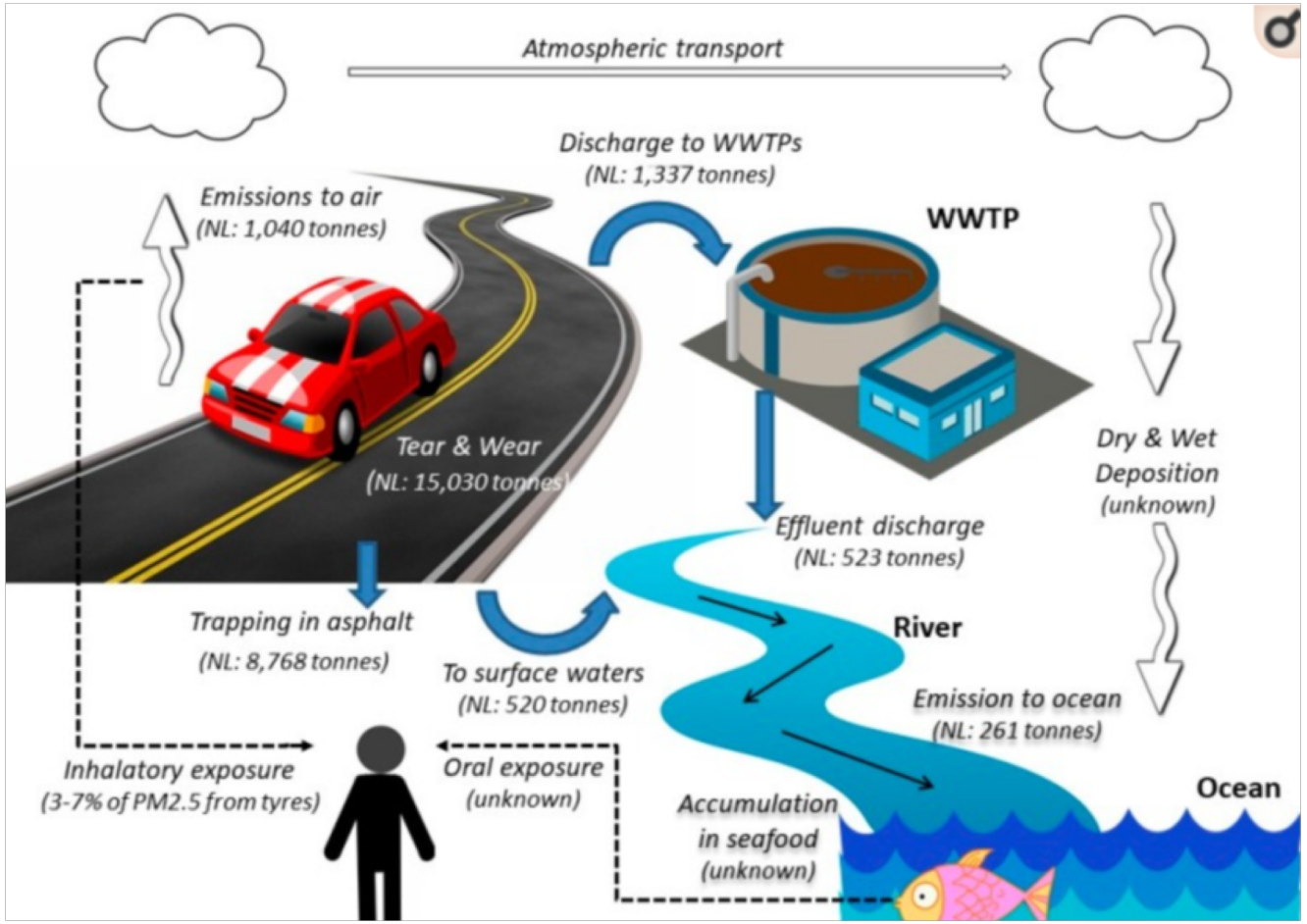
# WHERE DO WE FIND THEM? - OCEANS

- In oceans alone, annual plastic pollution, from all types of plastics, was estimated at 4 million to 14 million tons in the early 21st century.
- By 2018, in marine and freshwater ecosystems combined, microplastics had been found in more than 114 aquatic species.
- Sythetic textiles, car tires and city dust are main sources of oceans' microplastic pollution.



# WHERE DO WE FIND THEM? – CAR TIRES & ROAD MARKINGS

- About 140,000 tonnes of these road microplastics could be transported by the wind into the oceans each year, according to the team of researchers from the Norwegian Institute for Air Research.



# WHERE DO WE FIND THEM? - AIR

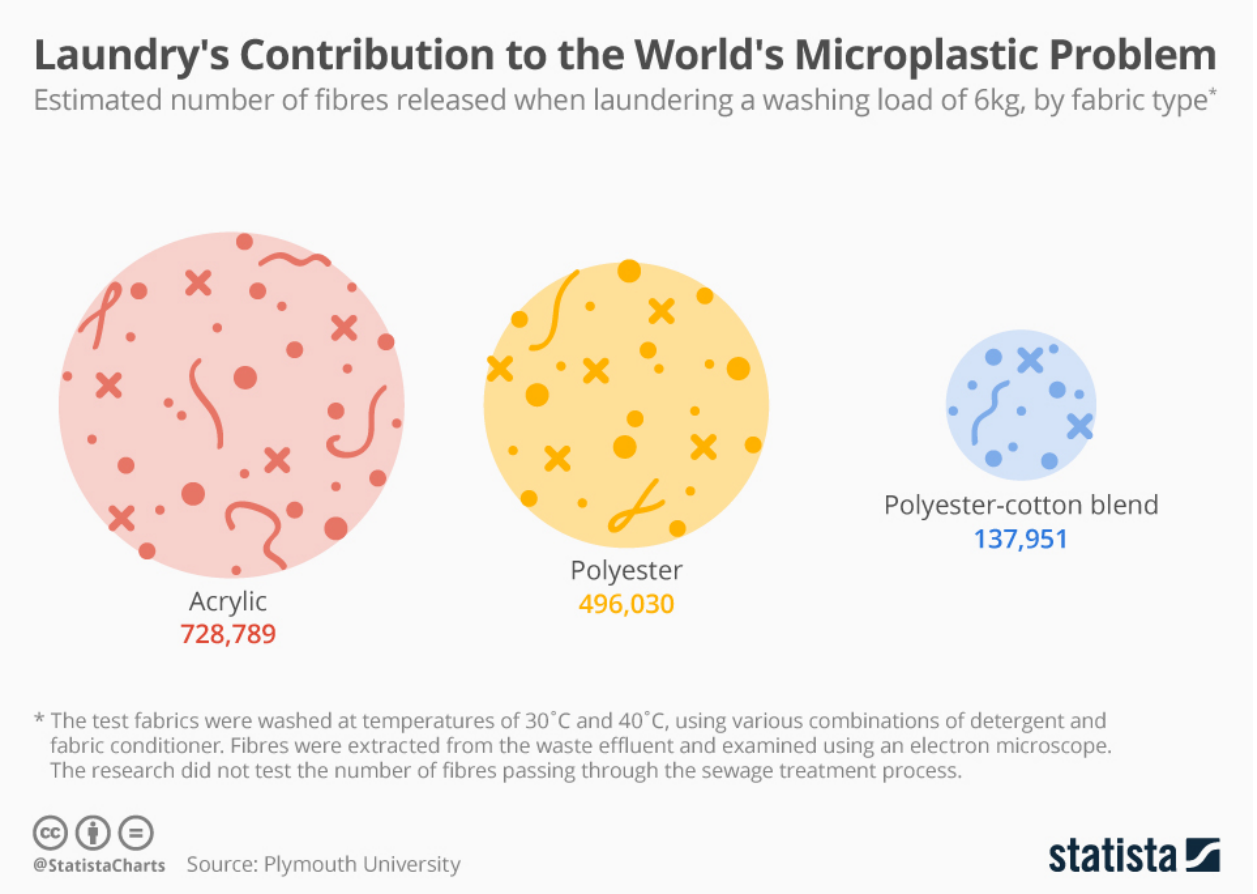
- If you saw 120 plastic bottles fall from the sky, you'd be right to feel concerned. But what if that number was multiplied by a million? That's equivalent to the amount of microplastics that fall on just 11 national parks and wilderness areas in the United States annually, according to new research – more than 1,000 tonnes in those areas alone.
- The team of researchers, found unexpectedly large quantities of microplastics had fallen in the rain and were being carried in the air. Over the course of the year, 98% of the samples they collected contained tiny, sometimes microscopic particles of plastics.

# WHERE DO WE FIND THEM? - COSMETICS

- Microbeads, a type of microplastic, are very tiny pieces of manufactured polyethylene plastic that are added as exfoliants to health and beauty products, such as some cleansers and toothpastes.
- According to the United Nations Environment Programme, plastic microbeads first appeared in personal care products about fifty years ago, with plastics increasingly replacing natural ingredients.

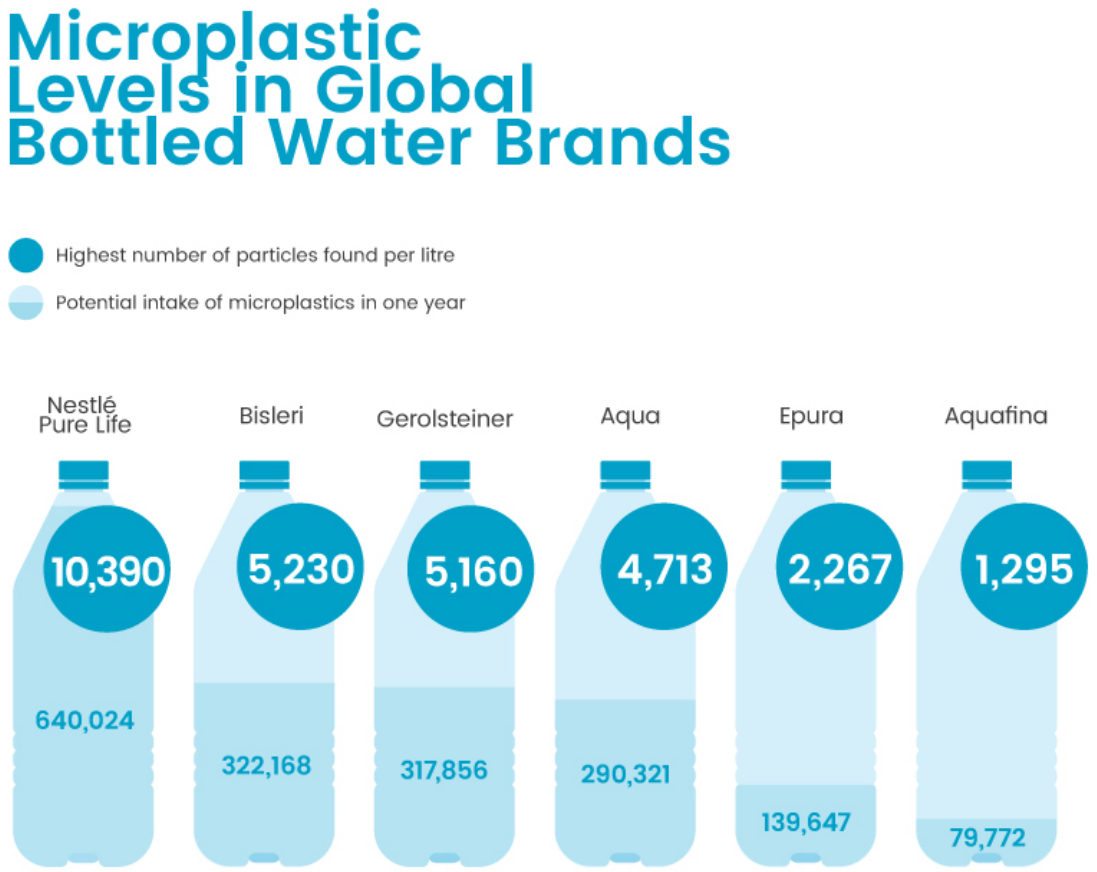
# WHERE DO WE FIND THEM? - LAUNDRY

- Globally, microplastics from laundry represent the largest primary source of such pollution.
- Every time we wash our clothes, tiny plastic fibres are released into the water. But while these microfibres are small, they're amounting to a big problem. About 60% of material made into clothing is plastic. And as many as 729,000 fibres could be released from a single 6 kg laundry load of synthetic materials, according to one report.



# WHERE DO WE FIND THEM? – BOTTLED WATER

- Perhaps the biggest known source of microplastics that we consume is bottled water. When researchers examined a variety of types of glass and plastic water bottles, they found microplastics in most of them. Single-use water bottles contained between two and 44 microplastics per litre, while returnable bottles (designed for collection under a deposit scheme) contained between 28 and 241 microplastics per litre.



# WHERE DO WE FIND THEM? – HONEY AND BEER

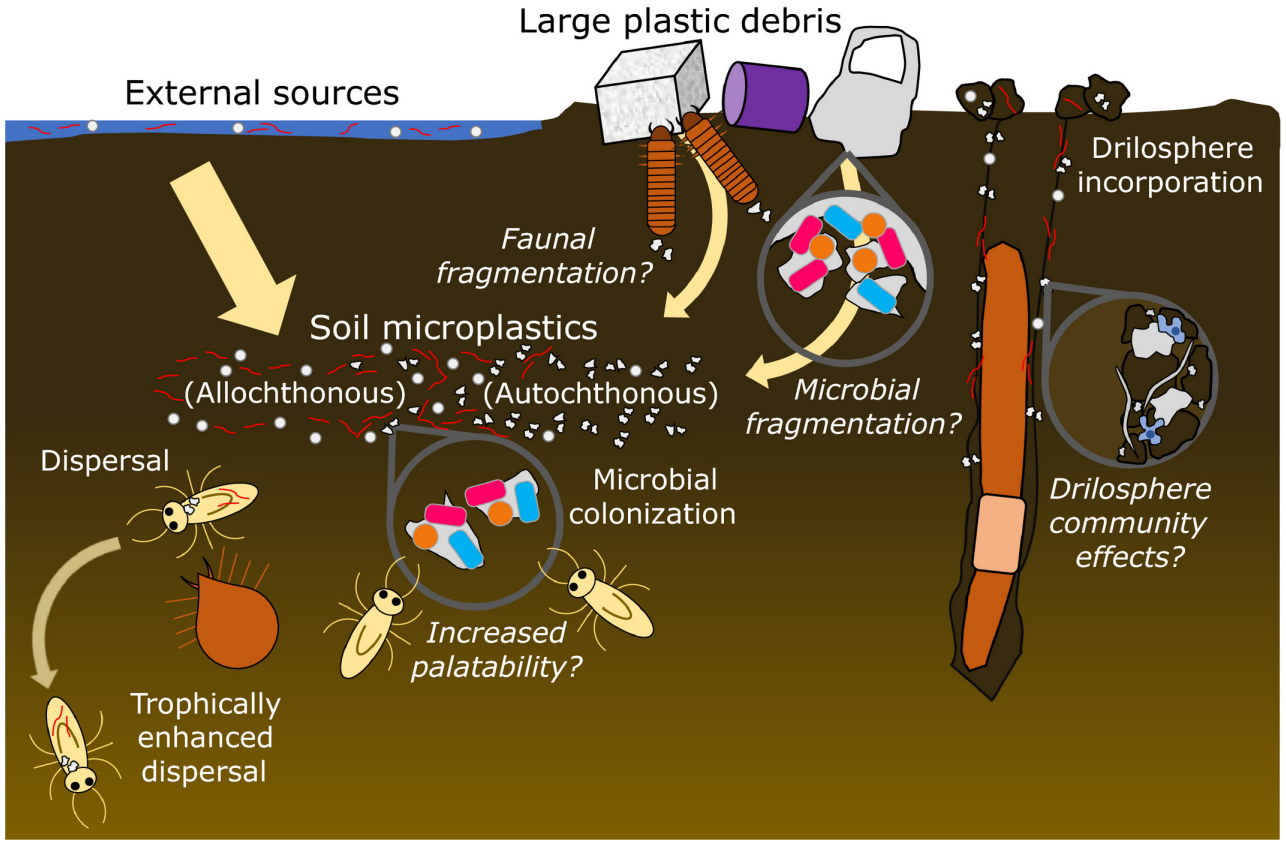
- Scientist have also found microplastics in honey and beer. We might be swallowing tens of microplastics with each bottle of the latter.
- A total of 24 German beer brands was analysed for the contents of microplastic fibres, fragments and granular material. In all cases contamination was found.
- A total of 47 honeys and 22 flowering plants was analysed for their load of synthetic fibres and fragments.

# WHY DOES IT MATTER? - BIODIVERSITY

- We already know that microplastics can accumulate in the gut of seabirds and fish, and our current understanding is that the smaller nanoplastic particles could even penetrate cells and tissues where their effects could be much harder to predict.
- The WWF says plastic is "choking our oceans", and that around 700 marine species are threatened. One in two sea turtles has ingested plastic, it says, while 90% of sea birds have it in their stomachs.

# WHY DOES IT MATTER? – NUTRIENT CYCLE

- Microplastic pollution causes significant damage to populations of soil-dwelling mites, larvae and other tiny creatures that maintain the fertility of the land, research has found.
- Although bacteria and fungi were relatively unaffected, the paper concludes "the effects of microplastics strongly cascade through the soil food webs, leading to the modification of microbial functioning with further potential consequences on soil carbon and nutrient cycling".

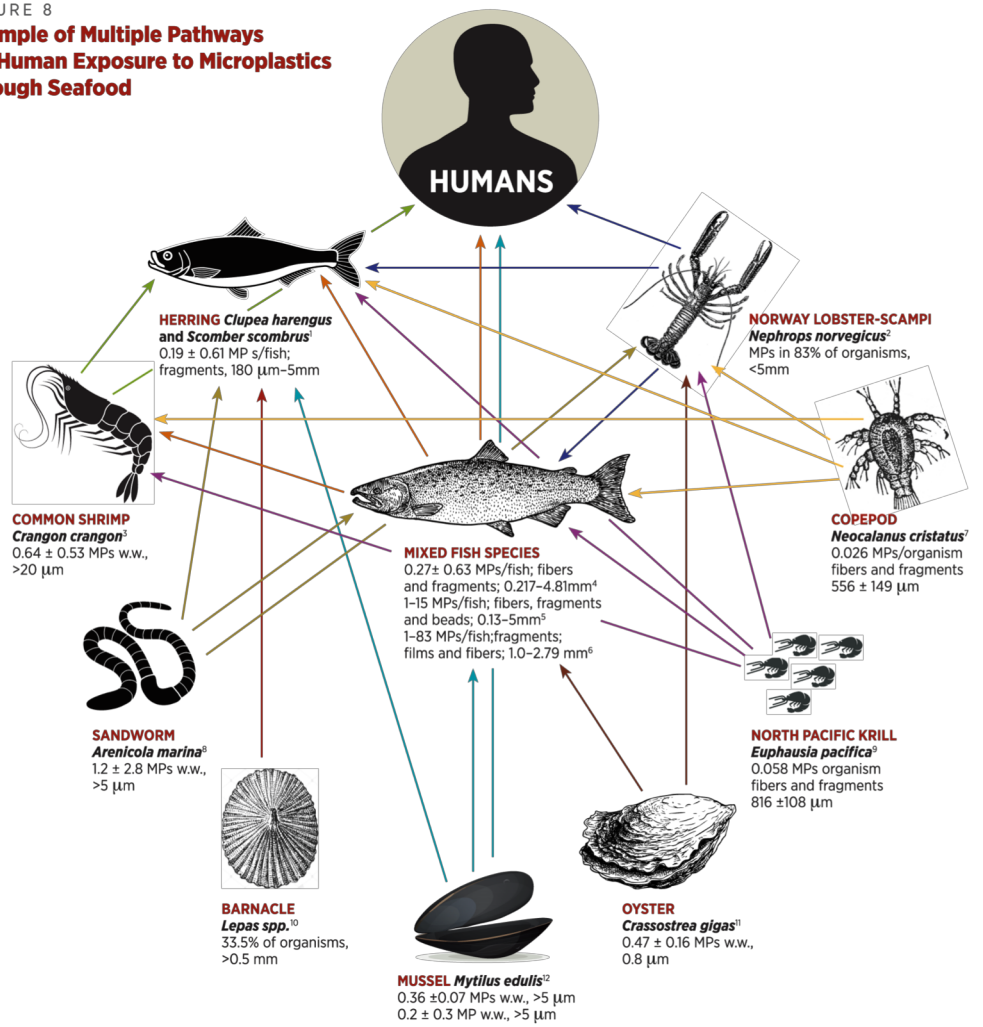


# WHY DOES IT MATTER? – HUMANS

- All 8 stool samples tested positive for microplastics. A median of 20 microplastics (50 to 500 µm in size) per 10 g of human stool were identified. Overall, 9 plastic types were detected, with polypropylene and polyethylene terephthalate being the most abundant.
- "We never want to be alarmist, but it is concerning that these non-biodegradable materials that are present everywhere [may] enter and accumulate in human tissues, and we don't know the possible health effects," said Varun Kelkar of Arizona State University.
- "We urgently need to know more about the health impact of microplastics because they are everywhere - including in our drinking-water," says Dr Maria Neira, Director, Department of Public Health, Environment and Social Determinants of Health, at WHO.[5]

FIGURE 8

**Example of Multiple Pathways for Human Exposure to Microplastics through Seafood**



# WHAT CAN BE DONE ABOUT IT? - LEGISLATIONS

- On December 28 2015, President Obama signed the Microbead-Free Waters Act, which prohibits the manufacture and distribution of rinse-off cosmetics products that contain plastic microbeads. Many other countries also placed bans on microbeads. These include Canada, United Kingdom, France, Sweden, Taiwan, South Korea and New Zealand.

# WHAT CAN BE DONE ABOUT IT? – TECHNOLOGY

- So, rather than using ever-finer grades of mesh, scientists at Japan's Shinshu University have suggested another approach: using what's known as a bulk acoustic wave system.
- Their system applies sound waves to wastewater before it leaves the machine, from either side of a central stream. This creates an acoustic wave in the centre, which traps microplastic fibres and other small particles.

# WHAT CAN BE DONE ABOUT IT? – INNOVATION

- Irish teenager Fionn Ferreira developed a technique to remove microplastics from water using oil and rust. A magnetic liquid.
- He used a magnet to extract the plastic from the water – the microplastic had bound itself to the rust powder, meaning that when the rust clung to the magnet the plastic was carried along too.

# WHAT CAN BE DONE ABOUT IT? – AWARENESS

- We need greater awareness of this problem on the part of environmental regulators, and a willingness to enforce existing anti-pollution laws.

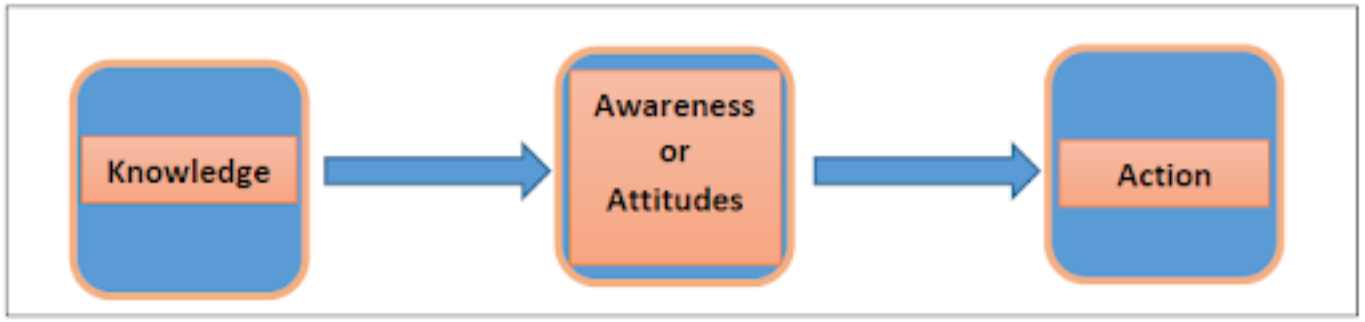



Figure 1: Behavioural Change Model [7].

# THANK YOU FOR YOUR ATTENTION!

# REFERENCES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