

The plastic pandemic

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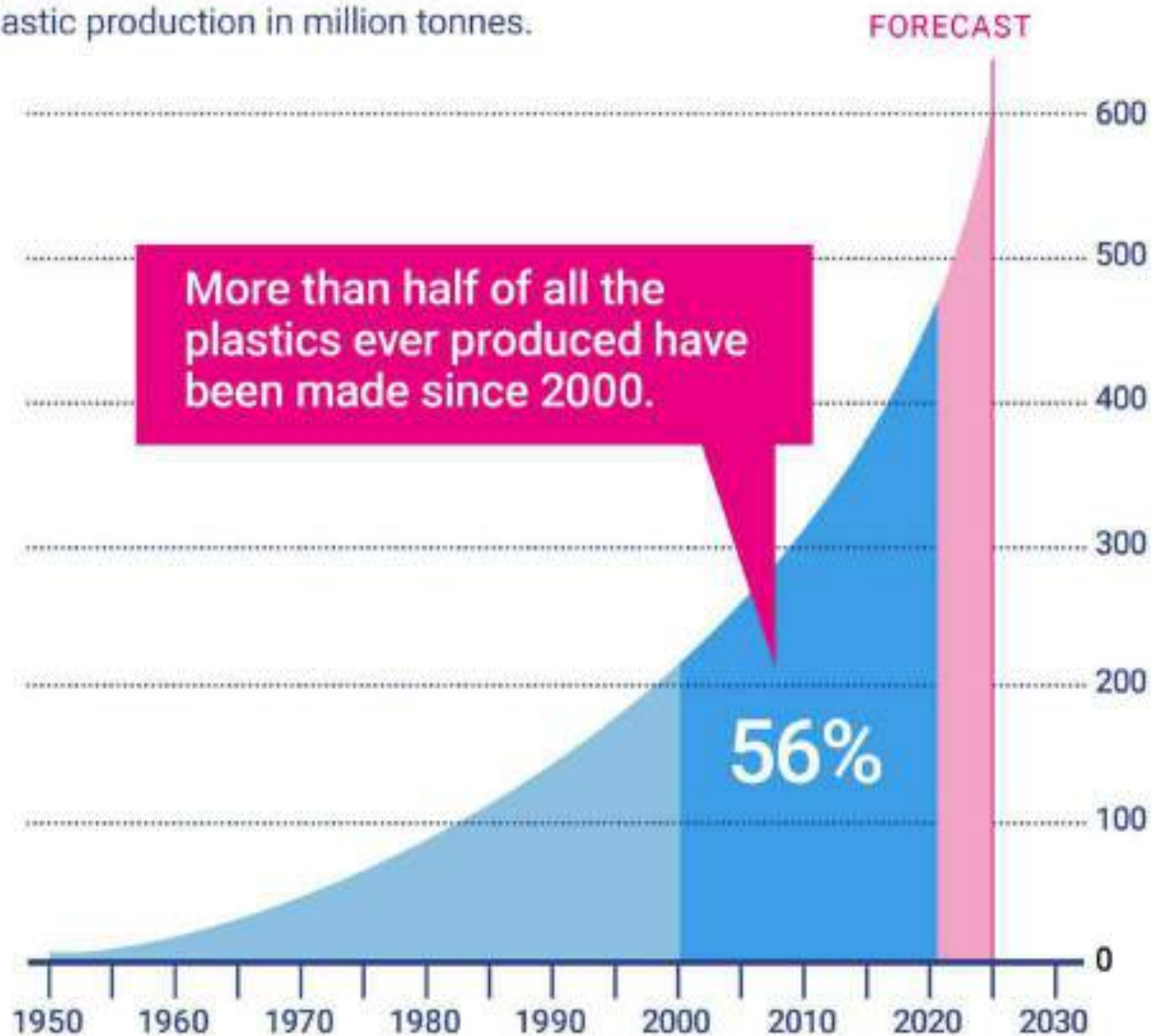
Global plastics crisis



Since COVID-19, the use of multiple types of plastic-based PPEs increased tremendously
Use of PPEs during the pandemic is worsening plastic pollution in the aquatic environment

PRODUCTION OF PLASTIC

Global annual plastic production in million tonnes.



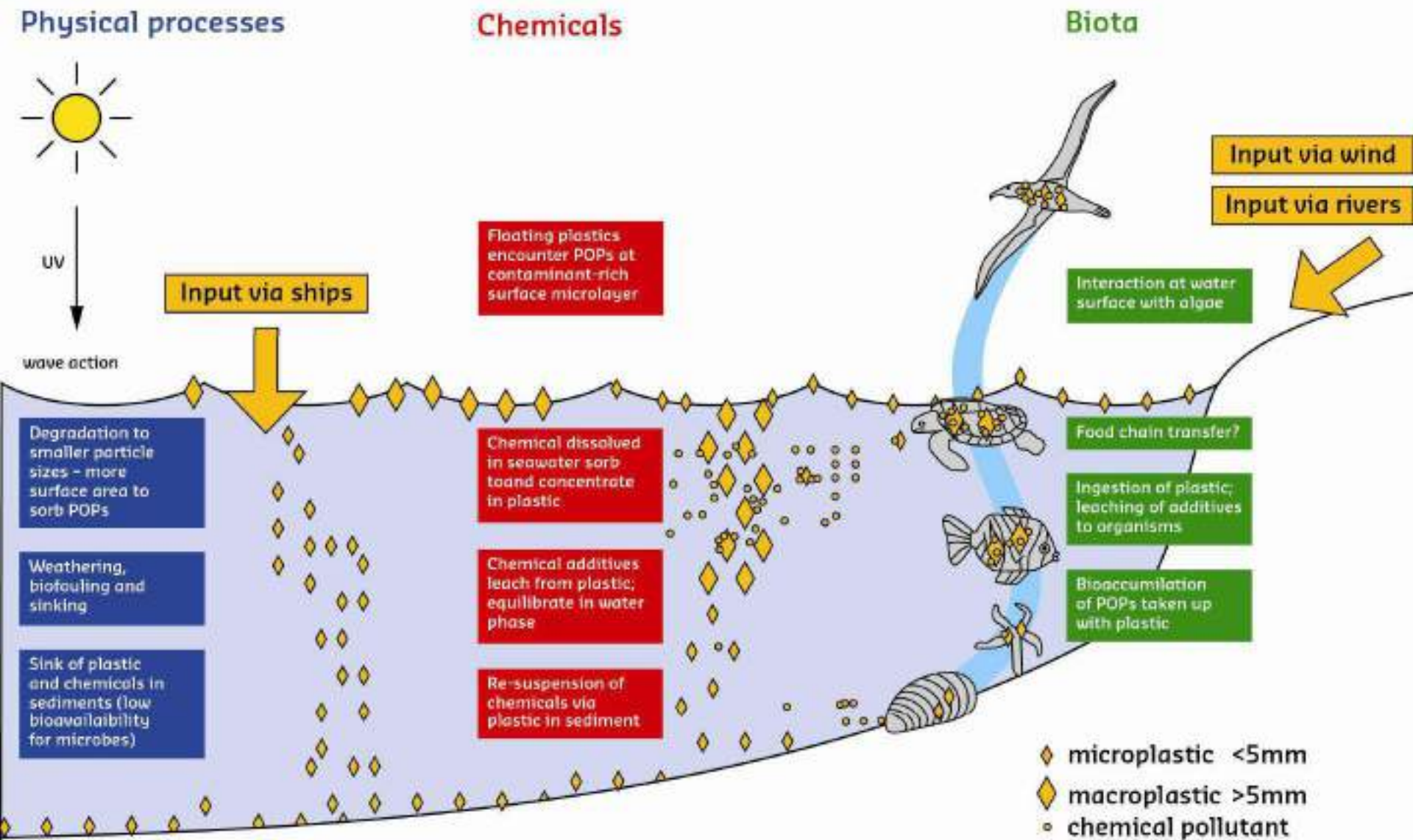
Miraculous materials

- Less than 25% of plastic is recycled worldwide today
- 9% of plastic ever made has been recycled, 12% has been burnt, remaining 79% ended up in soils, oceans and landfills

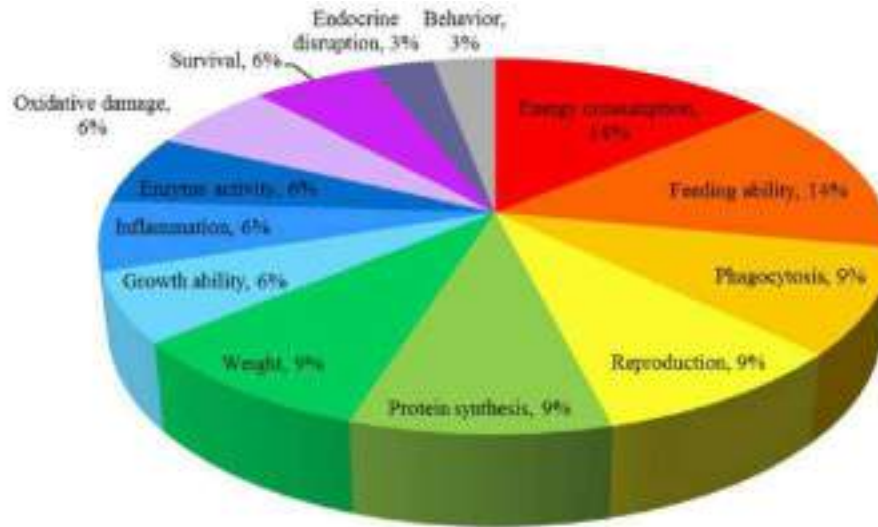


- Ireland - highest producer of plastic waste per person in the EU and the fourth worst in recycling rate, according to the latest data released by Eurostat

Microplastic behaviour



Toxicity of microplastics and nanoplastics



- Physical ingestion
- Feeding disruption
- Reproductive performance
- Planktonic level disrupt algal feeding
- Disrupt filtering mechanisms in molluscs
- Changes in liver physiology
- Source and vector of organic and inorganic contaminants
- Vector of invasive species and pathogens

Understanding the sources is key..

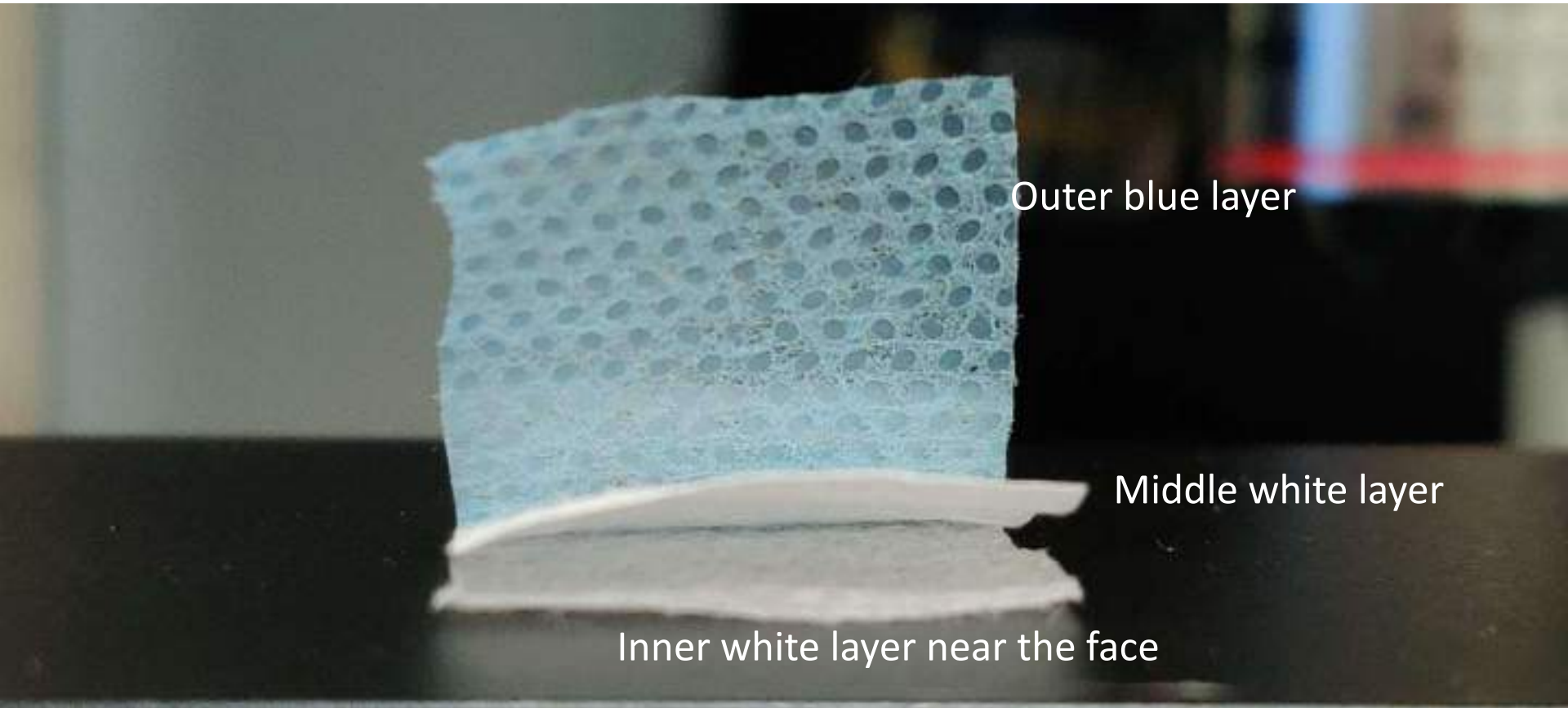
- Grey water
- Tyre and road wear particles
- Fishing gear
- Packaging
- Cosmetics
- Personal care products
- Landfills
- WWTP
- Biosolids
- Litter



PPE as a source of microplastics

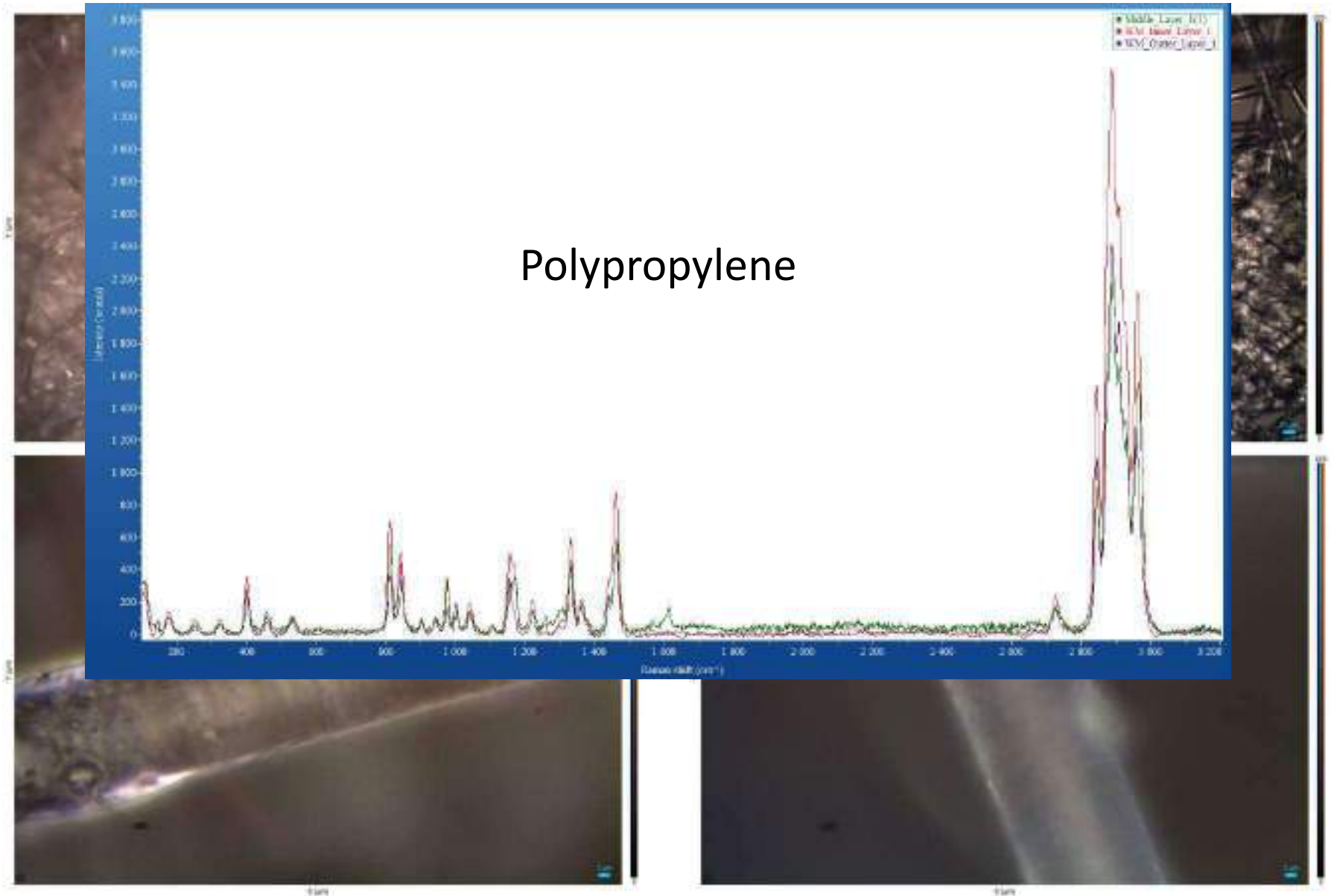


Blue face masks — 3 layers



White layers

Blue layer



What we know....

- In England alone, 2.3 billion items of single use PPE were distributed to health and social care services between Feb and Jul 2020, the same amount distributed throughout the whole of 2019
- Globally, 129 billion face masks and 65 billion gloves are estimated to have been used every month during the covid-19 pandemic
- Disposable face mask market was estimated to have increased from \$800m in 2019 to \$166bn in 2020
- If usual patterns of disposal continue, around 75% of plastic PPE waste related to covid-19 will end up in landfills or ocean environments

Extensive usage of PPE during the pandemic together with poor disposal practices is shifting aquatic pollution to this type of plastic debris as one of the main sources



Potential of releasing polypropylene microplastic fibers into the environment

To flush or not to flush –
sanitary wipes as a source of
microplastics in the ocean



European production of non-woven textiles for hygiene and sanitary products exceeded one million tonnes in 2016, frequently cause blockages in sewage systems globally



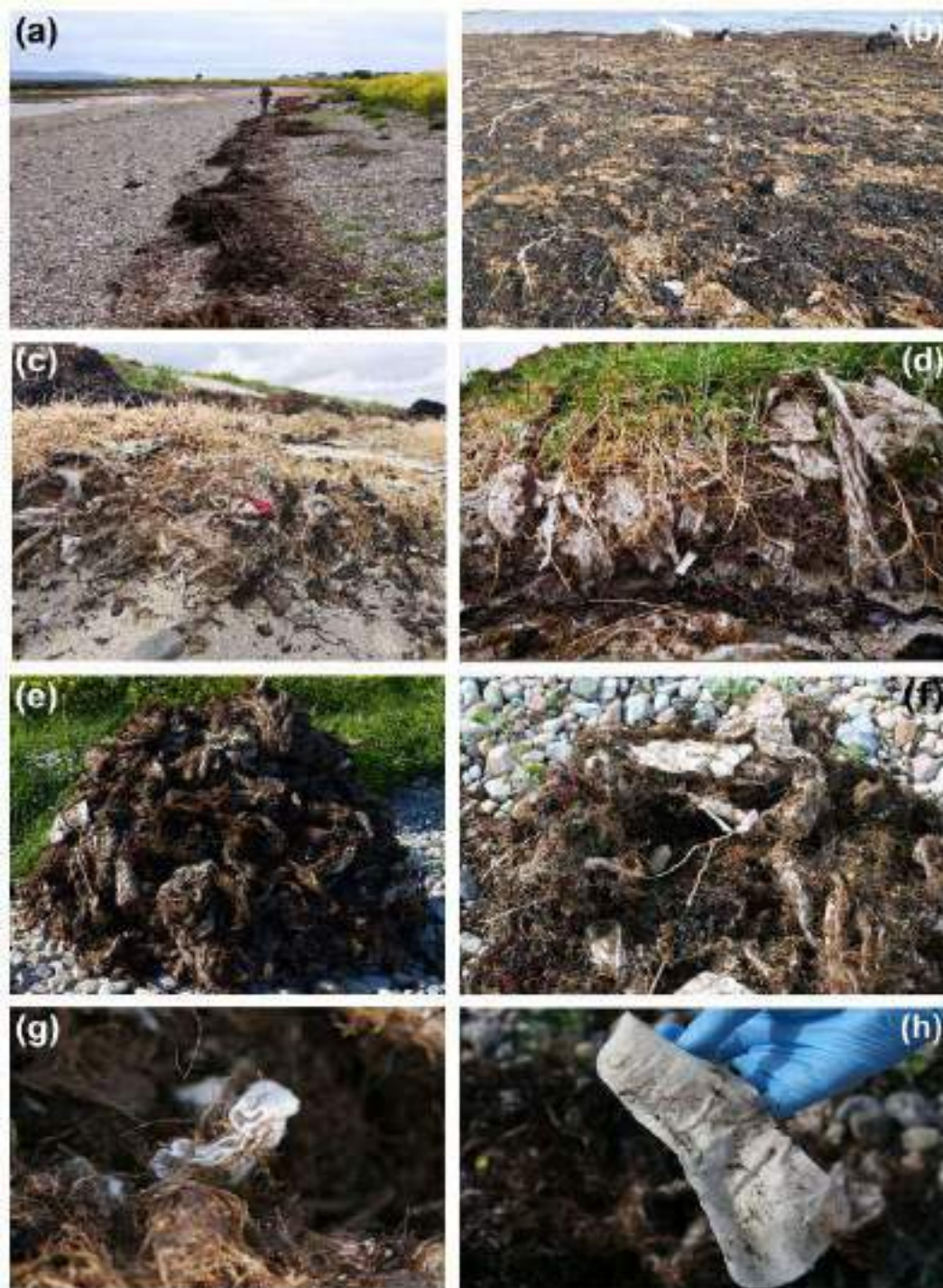
Consistent feature of global plastic pollution surveys

MP fibres from clothing are generally coloured or multi-coloured

Quantities of wet wipes washing up on beaches in the EU has increased 400% in the last decade



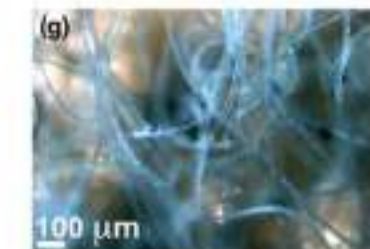
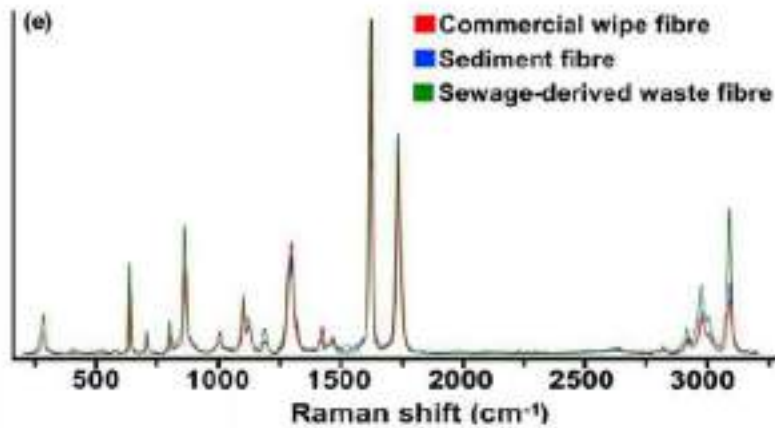
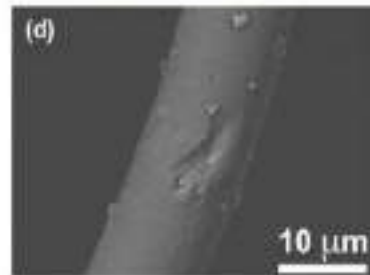
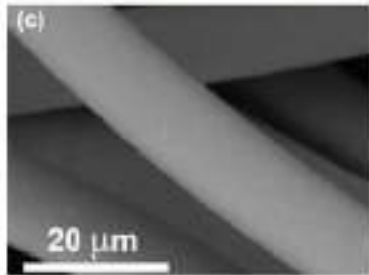




Washed up deposit of Sewage-derived debris intertwined with seaweed biomass littering the coastline in the vicinity of Mutton Island, including wipes and sanitary pads

91% of microplastic fibres at Mutton Island are likely derived from wet wipes and personal care products





(a) Commercial wipe

(b) MF extracted from intertidal sediments

(c) SEM of a commercially available wipe

(d) SEM of MF from intertidal sediments

(e) Raman spectra of commercially available wipes, sediment and field sample identified as white PET fibres

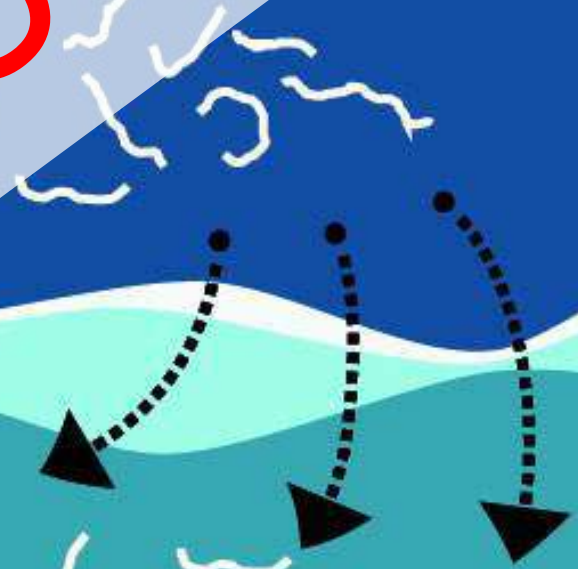
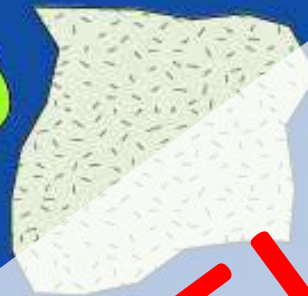
(f, g) Macro and micro image of field sample of wipe from the washed-up deposit of sewage derived waste, identified as white PET fibres.

Code	Description	Non-flushable	Flushable	Raman ID
Commercially available sanitary products				
P1	Flushable toilet wipes		✓	Cellulose
P2	Flushable moist toilet tissue wipes		✓	PET & Cellulose
P3	Toilet wipes (fragrance free)		✓	Cellulose
P4	Toilet wipes		✓	PET & Cellulose
P5	99% water, organic cotton wipe	✓		PET & cellulose
P6	Ultra-soft wipes	✓		PET
P7	Baby wipes	✓		PET & cellulose
P8	Baby wipes, 100% biodegradable	✓		Cellulose
P9	Baby wipes, chemical free	✓		PET & cellulose
P10	Baby wipes, Cotton soft fragrance free	✓		PET
P11	Baby wipes	✓		PP
P12	Sanitary Pad 1	✓		PP
P13	Sanitary Pad 2	✓		PE
P14	Sanitary Pad 3	✓		HDPE & PP
P15	Sanitary Pad 4	✓		PP
P16	Sanitary Pad 5	✓		PP
P17	Sanitary Pad 6	✓		HDPE & PP
P18	Control clothing item 1	✓		PES
P19	Control clothing item 2	✓		PES
Sewage-derived samples				
Ev1	Washed-up wipe			PET & Cellulose
Ev2	Washed-up wipe			PET
Ev3	Washed-up wipe			PET
Ev4	Washed-up wipe			PET
Ev5	Washed-up wipe			PP
Ev6	Washed-up wipe			PET
Ev7	Washed-up sanitary towel			PET
Ev8	Washed-up sanitary towel			PP

- Sanitary-related macro debris (wipes and sanitary towels) from the beach near Mutton Island were mostly comprised of the plastic polyethylene terephthalate (PET),
- 25% were a mix of PET and cellulose
- >80% of the wipes on the beach were identified as composition following the International Water Services Flushability Group and non-woven textile industry guidelines (INDA/EDANA, 2018; IWSFG, 2018).
- Wet wipes and sanitary towels are a source of unaccounted white microplastic fibres in the marine environment
- 50% of the wipes labelled “flushable” in this study were shown to contain microplastics
- Lack of regulation results in a failure to clearly identify the plastic composition
- Demonstrates the consequences of misleading labelling of non-woven textile personal care products.

Sanitary Towels and Wipes

White Microplastic Fibres



Water Column

Sediments

DO NOT FLUSH

Conclusion

In preventing the spread of COVID-19, we can expect a continued use of PPE despite the rollout of vaccination programmes

Public health is priority, but better management strategies required to mitigate environmental impacts of the pandemic

Thank you

