Solutions to marine litter: the importance of the circular economy

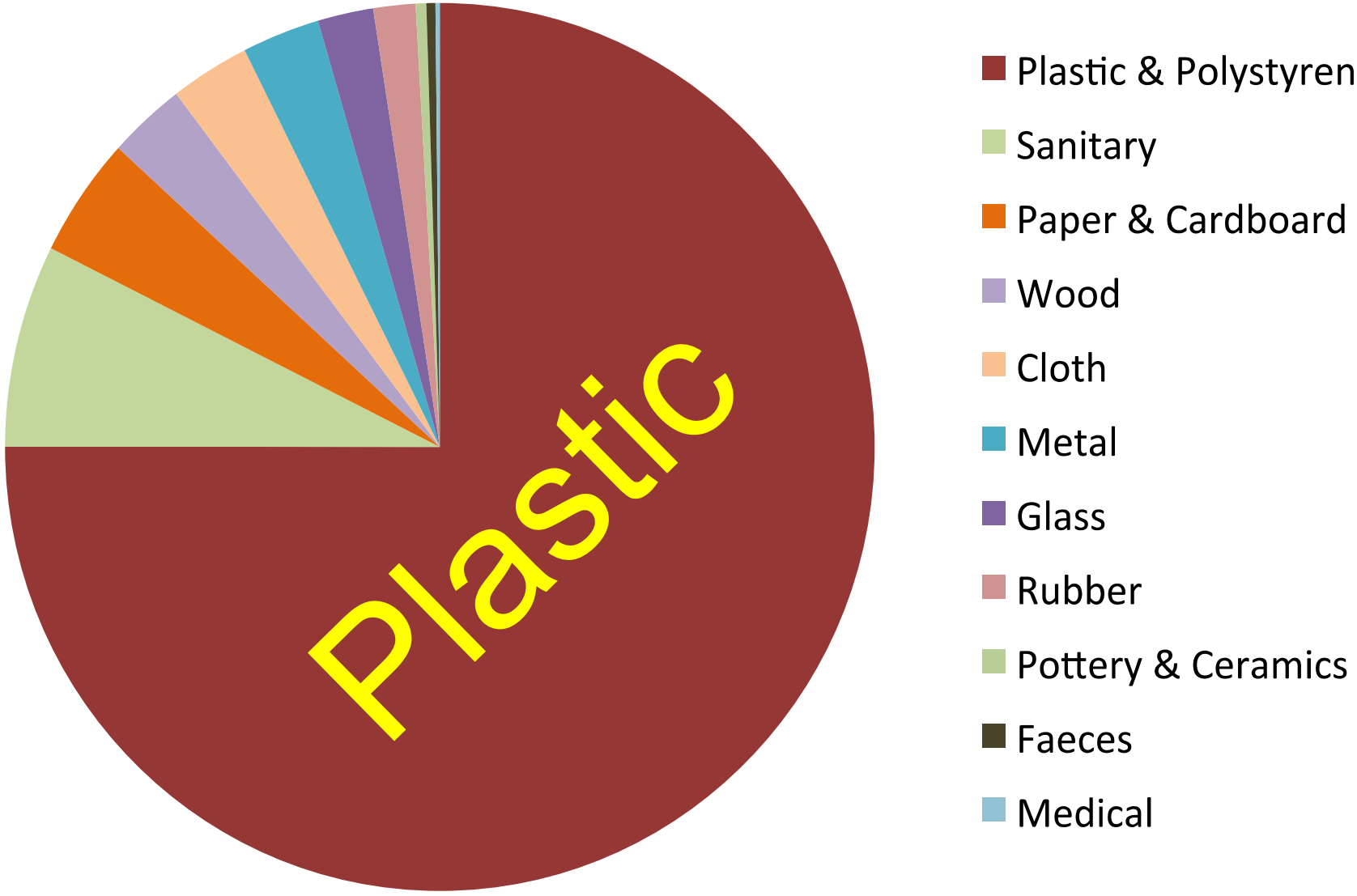
Richard Thompson, Plymouth University, UK

Image credit B. Frymire


Slovenia

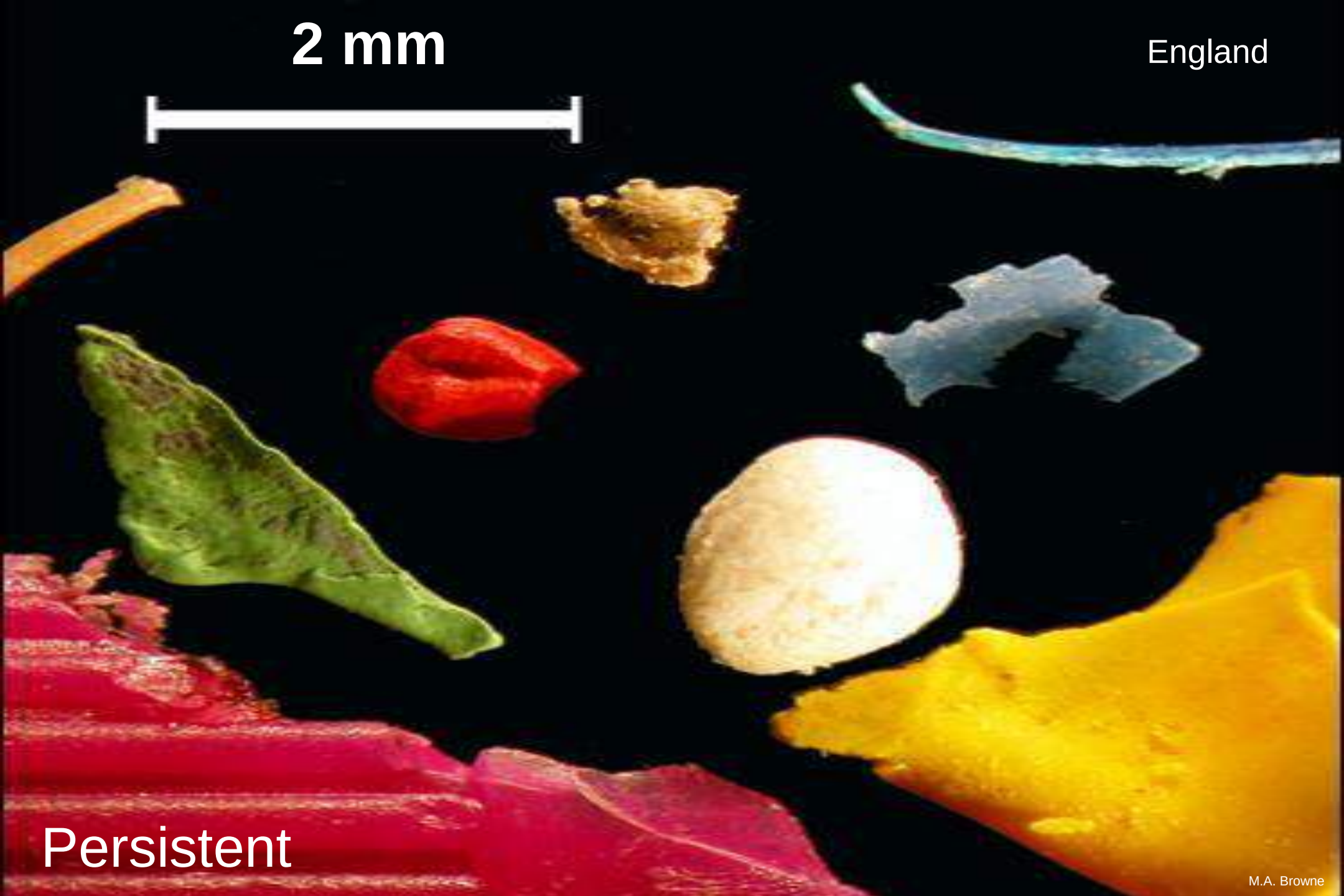

Mediterranean Sea, 1000m
F. Galgani

Mostly plastic



Proportion of marine debris found on reference beaches (2001-2006) OSPAR, 2007


R. C. Thompson


2 mm
England
Persistent
M.A. Browne

Economic consequences

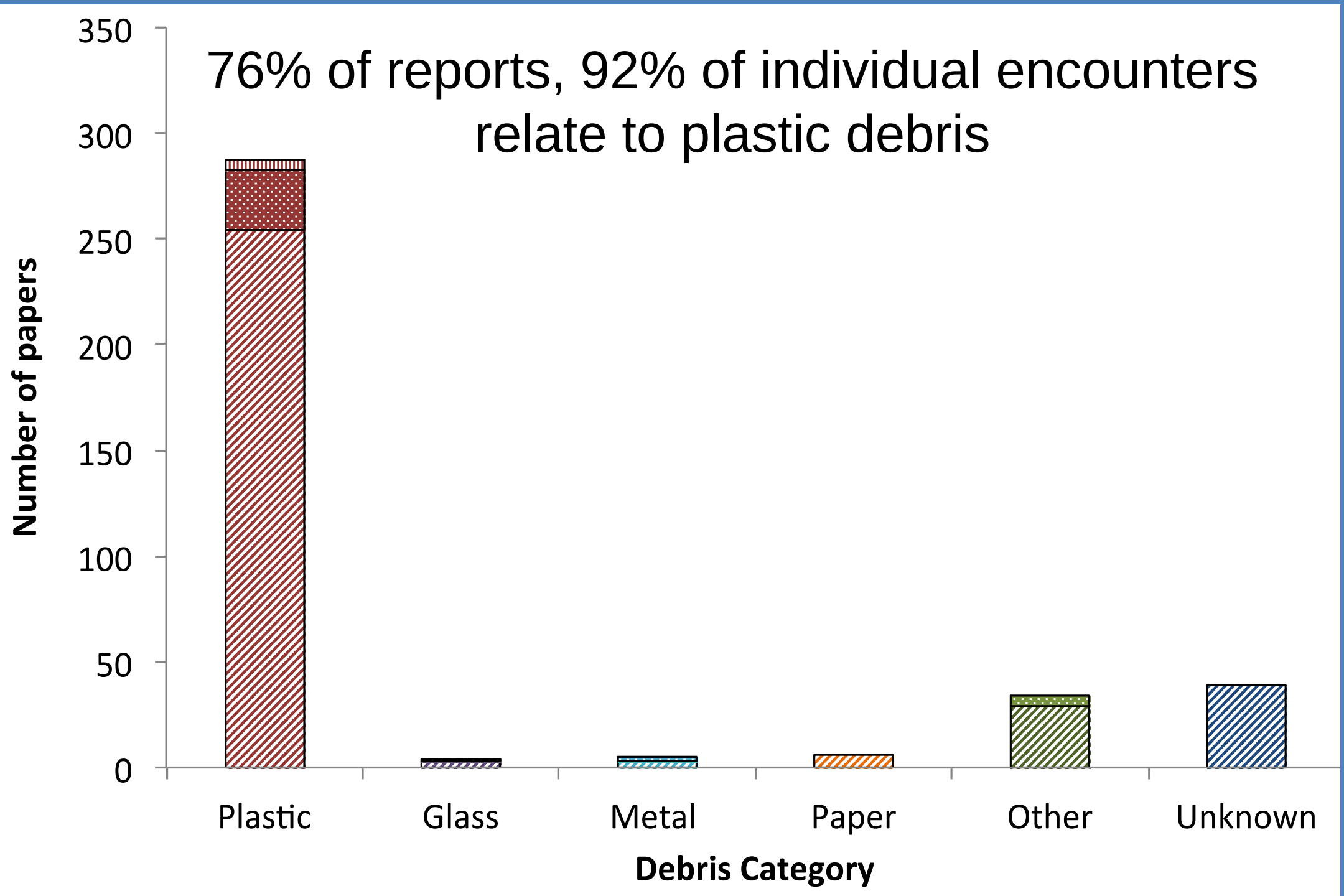
England

Hazard to mariners

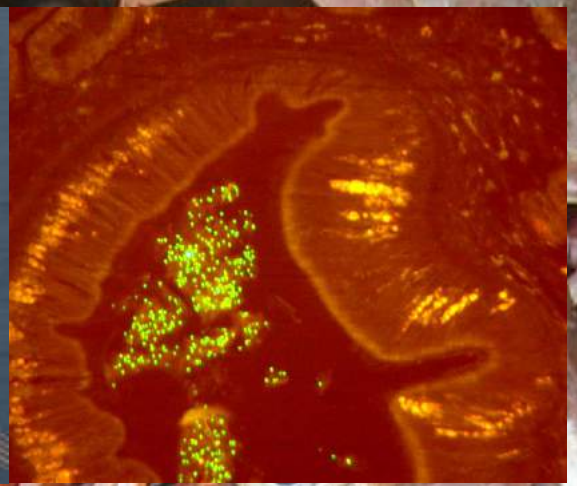
Consequences for wildlife

~ 700 Species

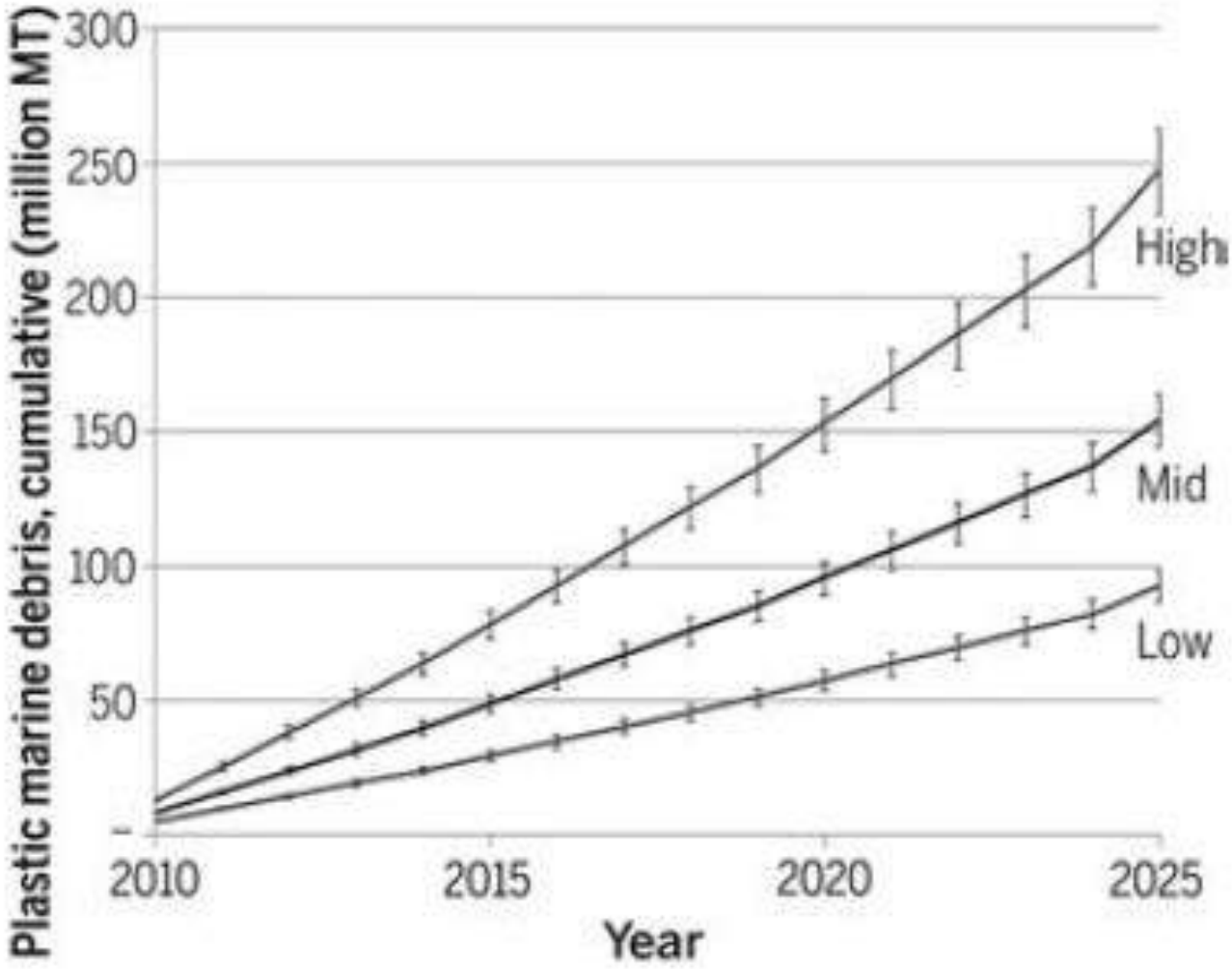
17 % threatened
or near threatened
IUCN status


76% of reports, 92% of individual encounters relate to plastic debris
Number of papers
350
300
250
200
150
100
50
0
Plastic
Glass
Metal
Paper
Other
Unknown
Debris Category

Microplastics: numerous species ingest some retain, ~ 10% of published reports and increasing



Key research:
Thompson / Browne / Murray /Cowie



Plastic debris cumulative

Oceans could contain 250 million tonnes by 2025

Fig. 2. Estimated mass of mismanaged plastic waste (millions of metric tons) input to the ocean by populations living within 50 km of a coast in 192 countries, plotted as a cumulative sum from 2010 to 2025. Estimates reflect assumed conversion rates of mismanaged plastic waste to marine debris (high, 40%; mid, 25%; low, 15%). Error bars were generated using mean and standard error from the predictive models for mismanaged waste fraction and percent plastic in the waste stream (*12*).

Jambeck *et al.* 2015


Enough about problems
what can be done?

Source. Tanya's Travel

Keep the benefits – without the debris

60 years of research and development
60 years of behavioural training - to throw away

40% of the plastic we produce is for single use applications

There is no *'away'* this is not sustainable

Sources of debris

Around 50% is single-use items (plastic packaging, convenience)

Together with Rope and netting, Cigarette buts

Redirect the flow

Block the holes

Clean-up

Photo sources:
Success hacker, jschneid,

Redirect the flow

Block the holes

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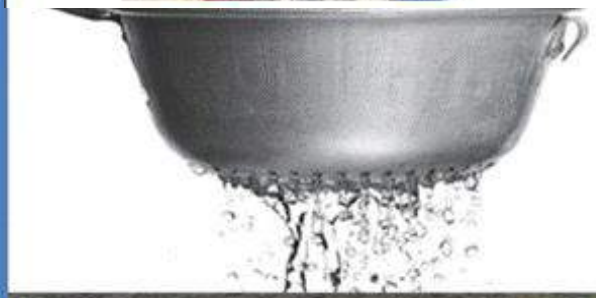

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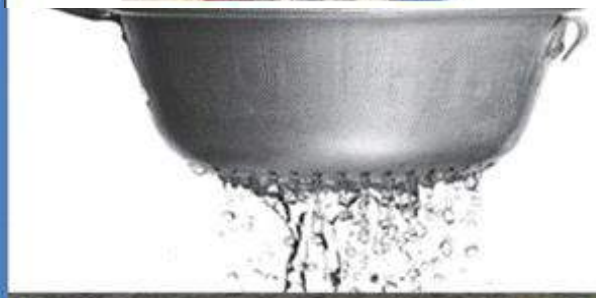

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Conflicting drivers

Redirect the flow

Block the holes

Clean-up

Photo sources:
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Potentially conflicting drivers

Will bioplastics reduce litter / waste?

‘*This new packaging is fully recyclable, and is said to reduce carbon emissions by as much as 25% over the product lifecycle*.’

Resource IN

Waste OUT

Potentially conflicting drivers

Can biodegradables reduce litter impacts?

‘Biodegradables ?’

(EN 13432, ASTM D6400-99) = pre shredded plastic degrades in commercial composting plant in 180 days, 56 – 71 ºC, 50-60% humidity, aerobic, pH 7-8

Resource IN

Waste OUT

Towards a more circular economy

1) Design for product life, and end-of-life 2) label accordingly

Minimum material	√ yes		X no
Easy to recycle	√ yes		X no
Recycled content	√ yes		X no

Resource IN

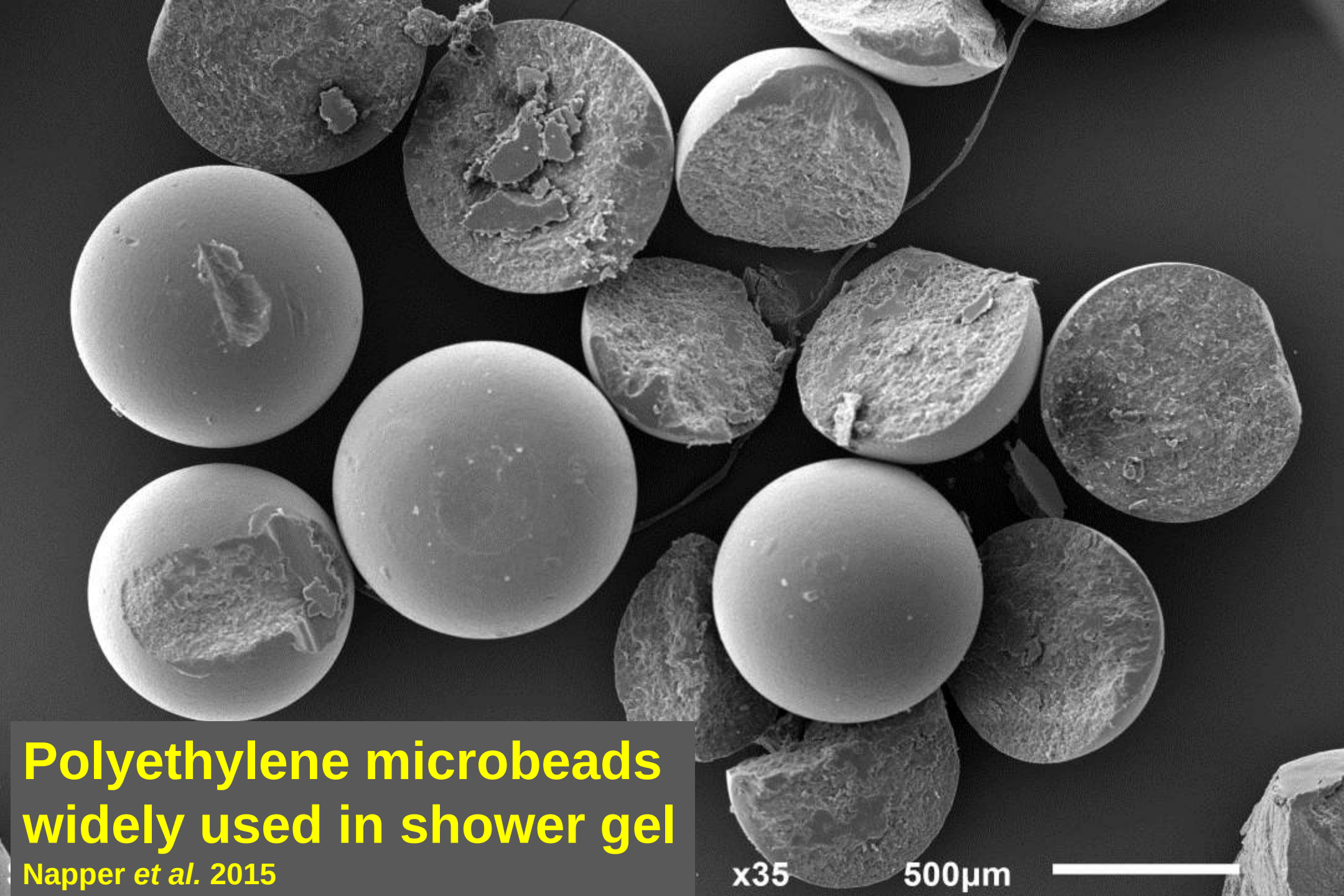
Waste OUT

Marine litter:

1) is a symptom of inefficient outdated business model
2) is not directly coupled to societal benefits
3) damages resources (economy, wildlife, services)
4) Synergistic benefits (resource efficiency / waste reduction) achieved by product re-design
5) Solutions exist – but there is no single solution
6) is a highly visible, accessible, **emotive** problem – harness this interest and focus it on better product design and waste management

Richard Thompson - Thank you

SEA CHANGE WITH PLYMOUTH UNIVERSITY



Polyethylene microbeads widely used in shower gel

Napper *et al.* 2015