



Jornada

Indústria tèxtil i sostenibilitat

MICROPLASTICS' CONTAMINATION: STATE OF THE ART



UNIVERSITAT POLITÈCNICA DE CATALUNYA
BARCELONATECH

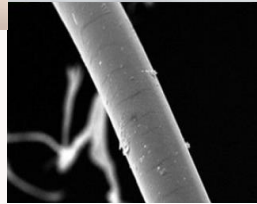
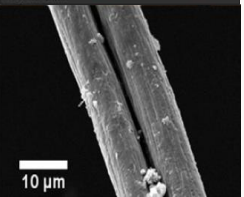
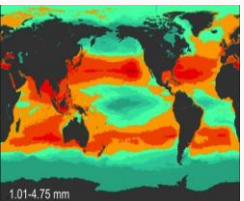
Institut d'Investigació Tèxtil
i Cooperació Industrial de Terrassa

INDITEX

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Terrassa 22 June 2018



Introduction

Recommendations

- Small plastics' fragments
- Everywhere → Pollutants (recently)
- Ubiquity in the Oceans → More than “macroplastics” (by number)
- Microfibers (textile)

Hypotheses

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Microfibers

4. Conclusions

Definitions

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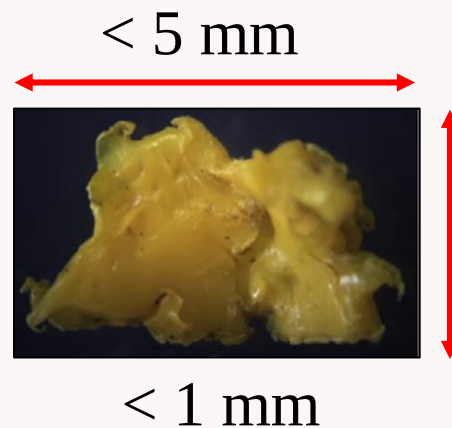
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• Length



Most accepted (NOAA*)

No minimum

d? l?

< 5 mm in longest dimension

Sub-groups: 1-5 mm; 0,1-0,9 mm...

• Synth polymers



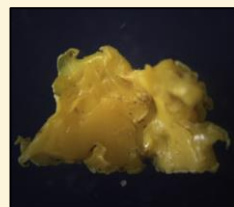
polyester, polyethylene, polypropylene...

All kind of polymers!

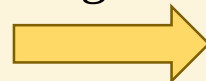
* National Oceanic and Atmospheric Administration

Definitions

- Shapes



Fragment



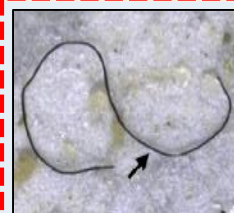
Fragmented plastics



Film



Fragmented plastics



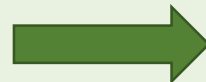
Fiber



“Microfibers”



Granulate



Pellets, Microbeads

- Examples



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• Primary

Manufactured in a MP length



• Secondary

Fragmented



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- **Primary**

Released **TO the environment** in a MP length



- **Secondary**

Generated **IN the environment** (fragmentation)



Mismanaged Plastic Waste

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- **Primary**

Released **TO the environment** in a MP length



- **Secondary**

Generated **IN the environment** (fragmentation)



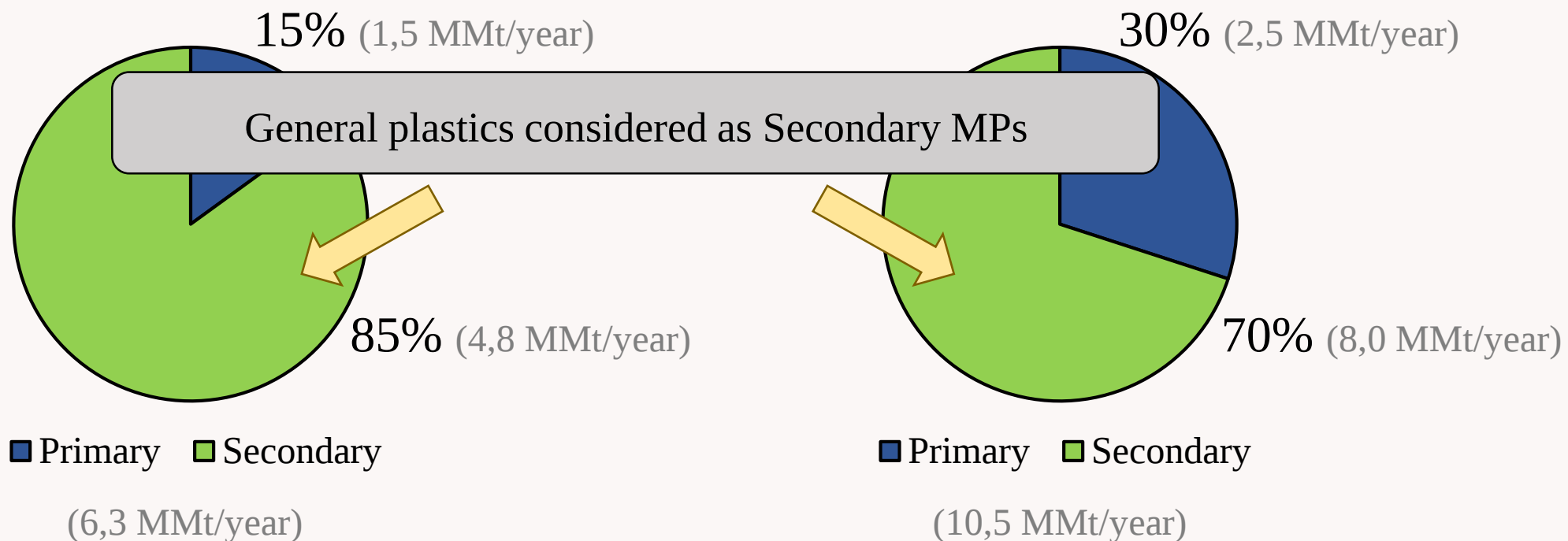
Potential Secondary MPs

Before & After Environment
→ Recommended Definition

Sources' Estimations

- **Primary vs. Secondary**

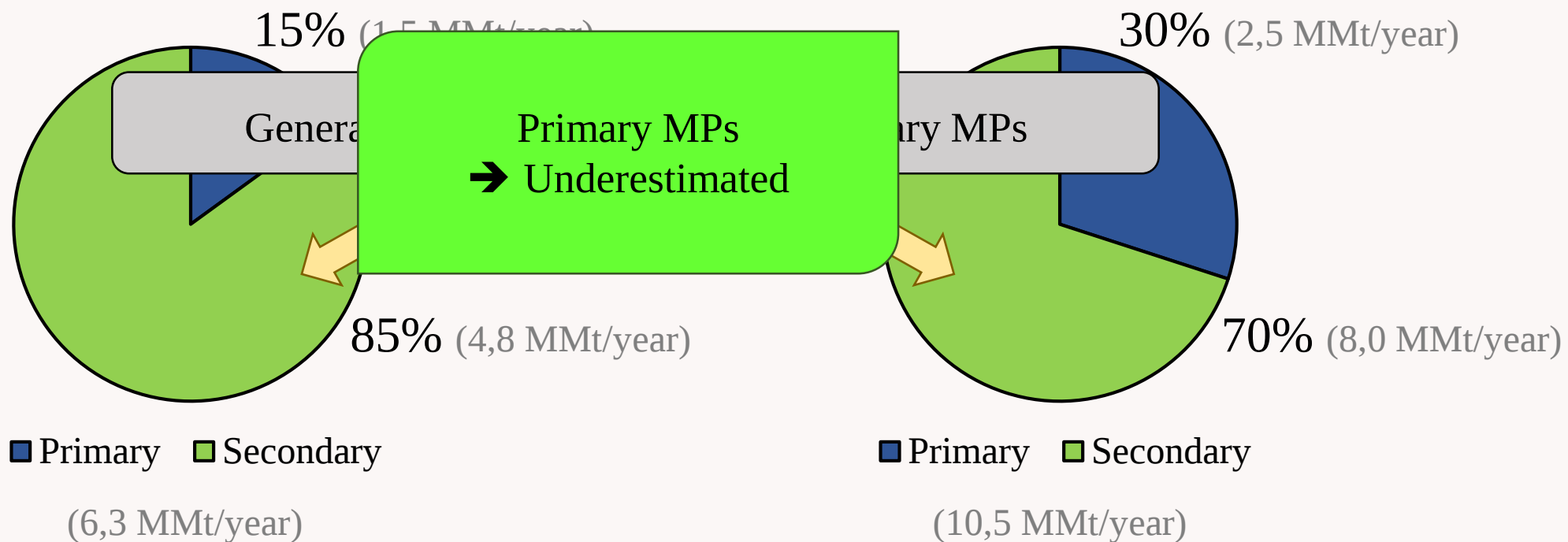
NO normalized
methodologie**S**!!!



Sources' Estimations

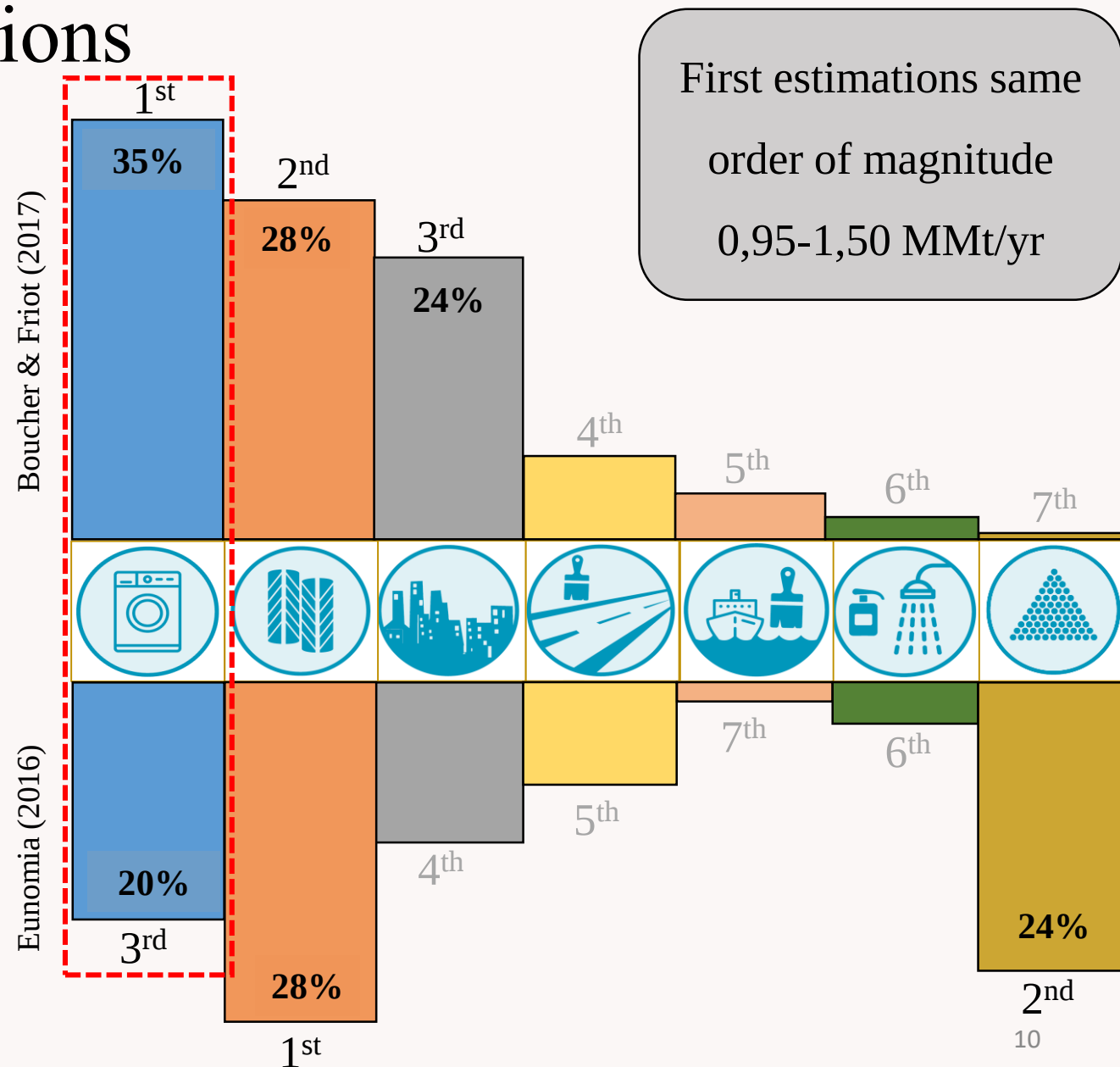
- Primary vs. Secondary**

NO normalized
methodologie**S**!!!



Sources' Estimations

- **Primary MPs**
7 Main contributors



Sources' Estimations

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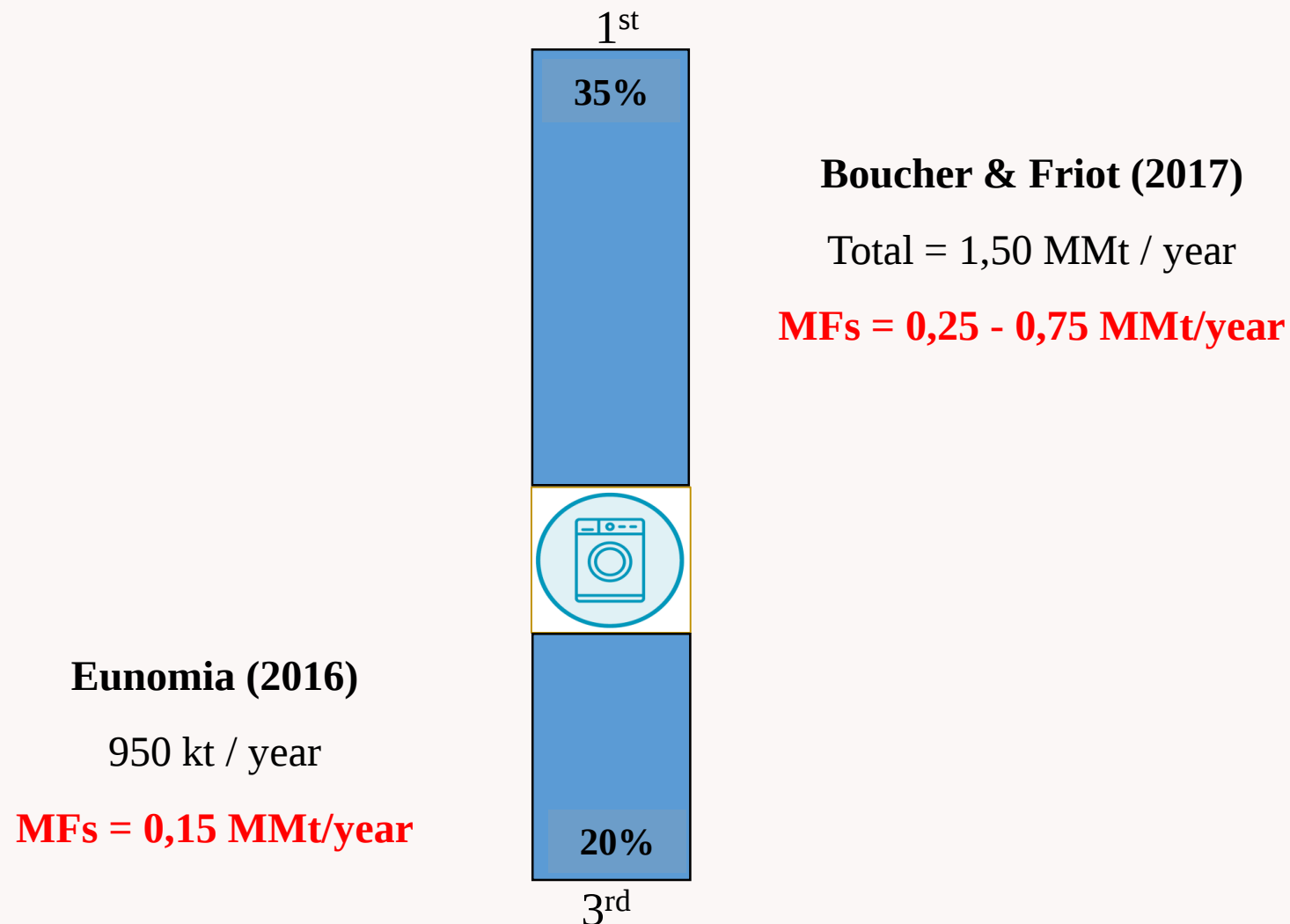
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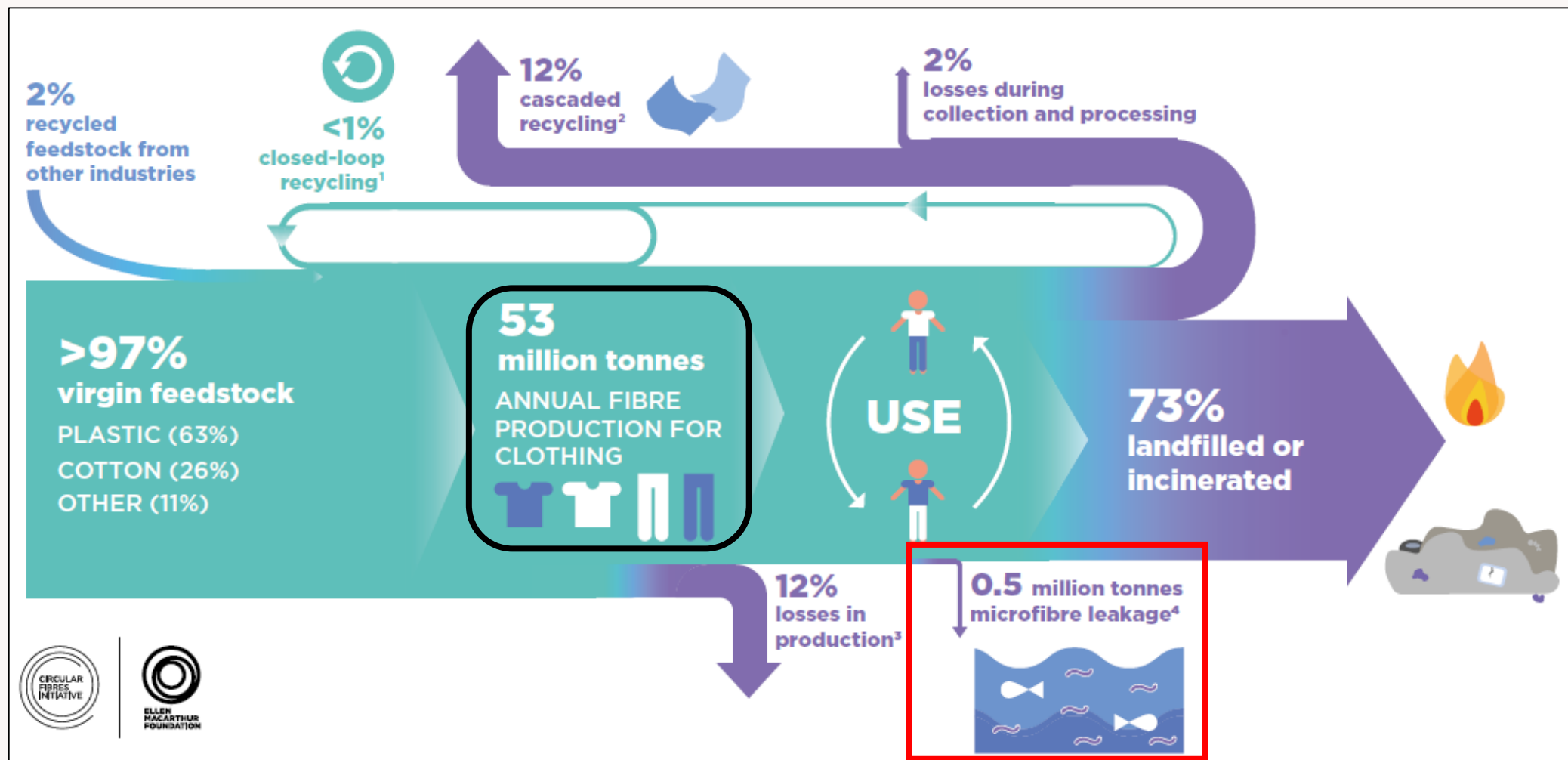


Sources' Estimations

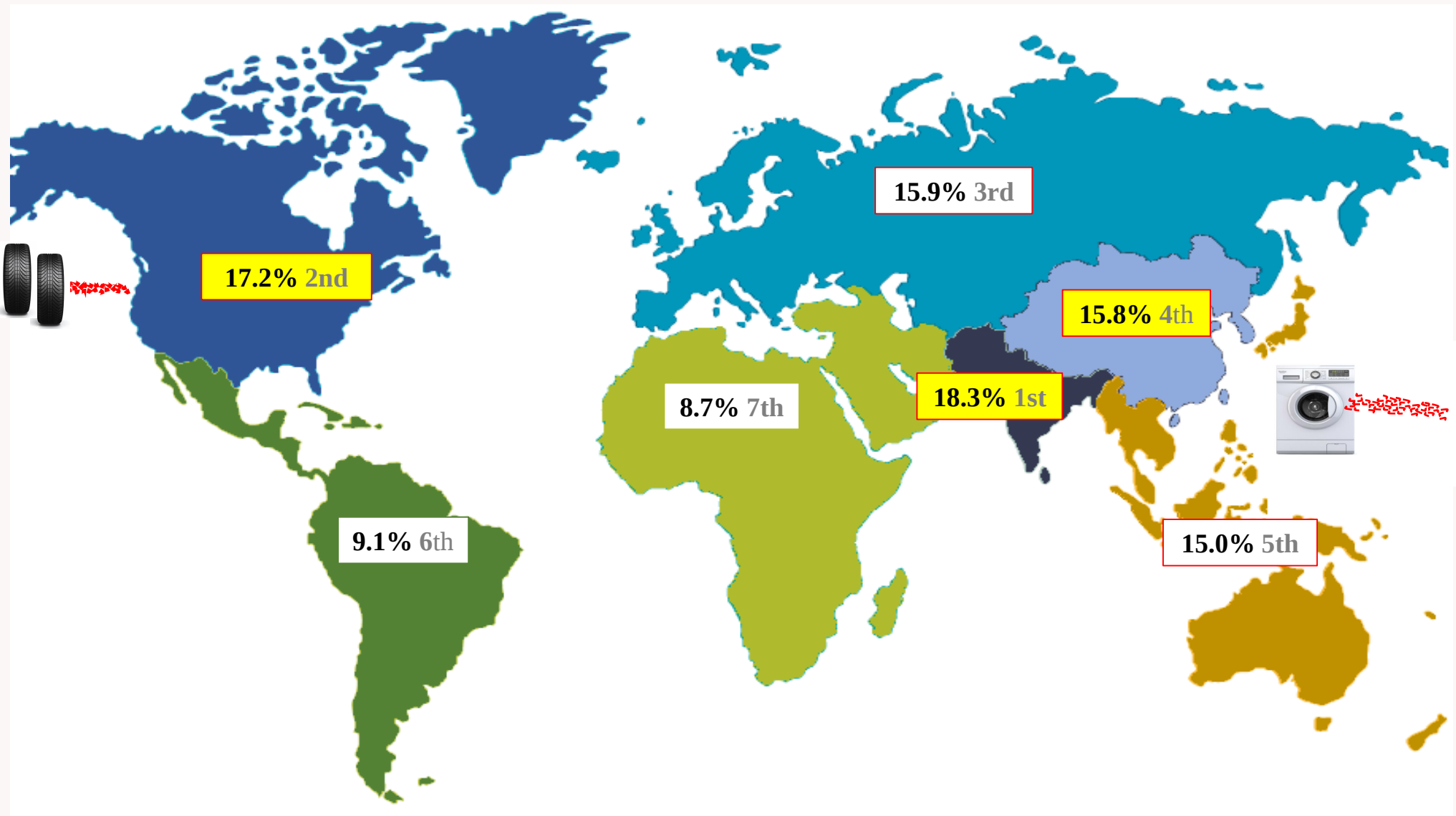
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State of the Art



Sources' Estimations



Source: Boucher & Friot (2017)

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- **Potential Secondary MPs**

Source	Plastic waste to the Oceans in Million tons/year
Jambeck et al. (2015)	4,80 – 12,70
Sherrington et al. (2016)	5,42 – 19,70
Eunomia (2016)	11,25

Jambeck et al. (2015)

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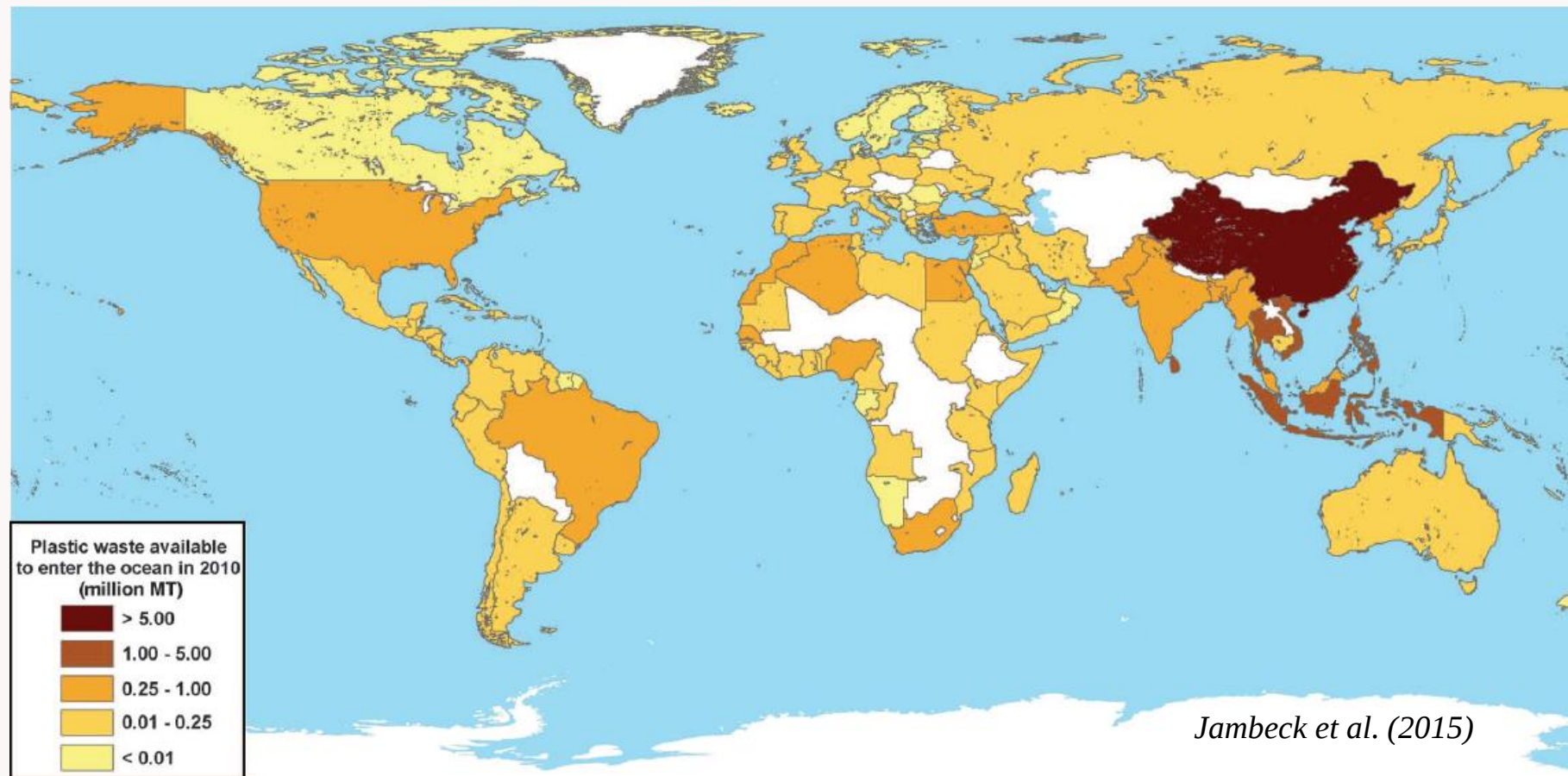
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- **Potential Secondary MPs**



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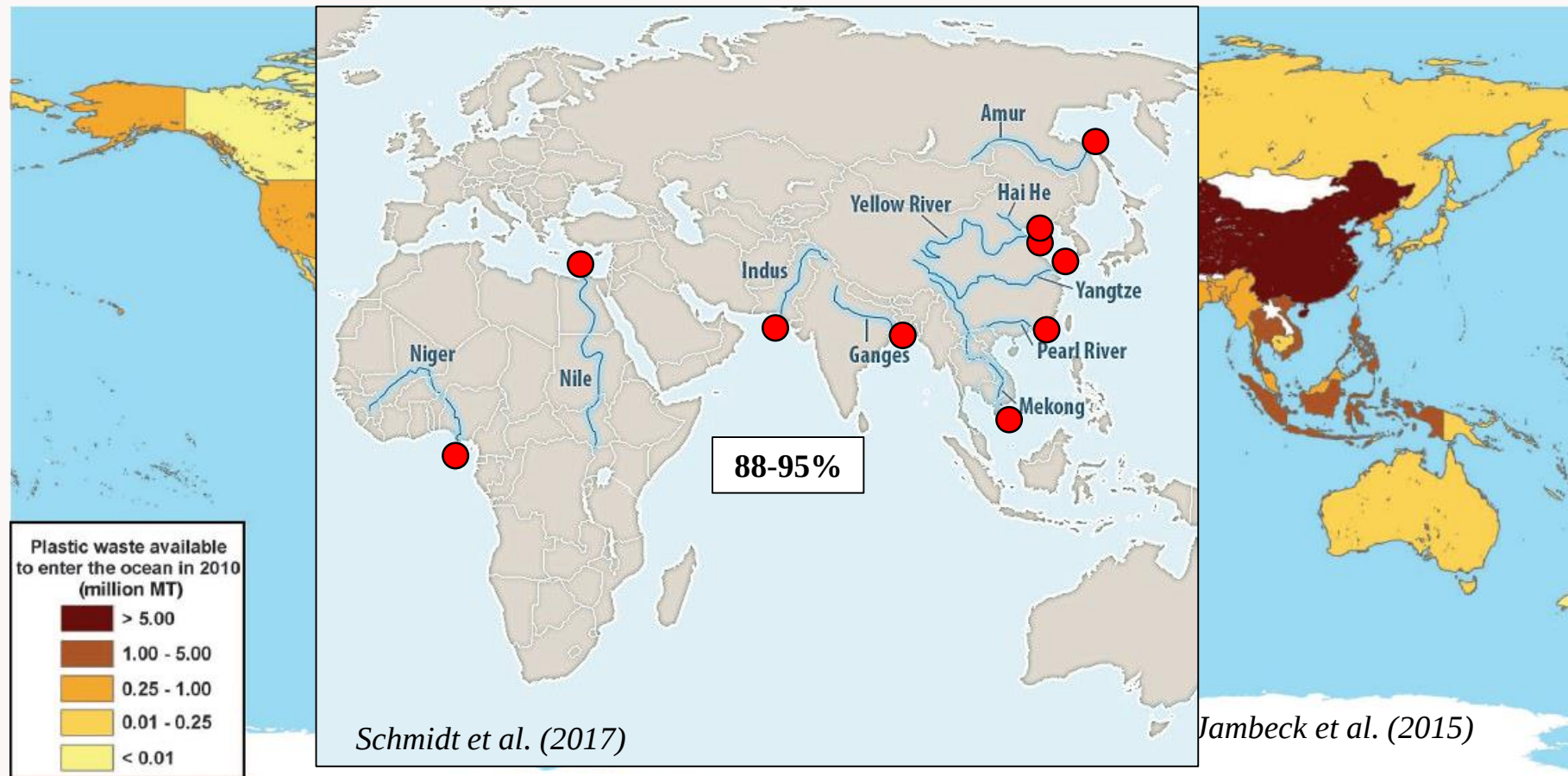
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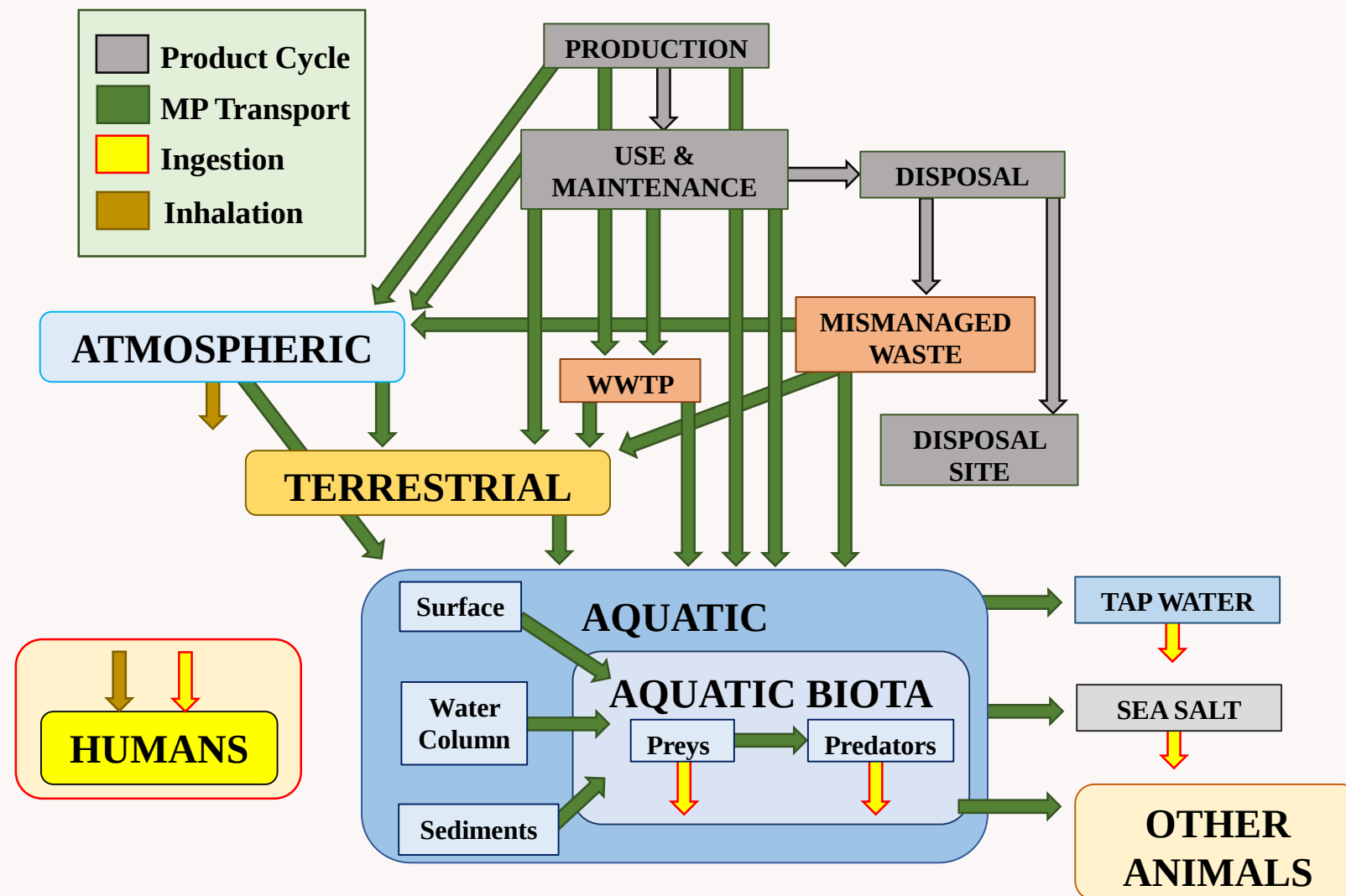
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- **Potential Secondary MPs**



Distribution (General Pathways)

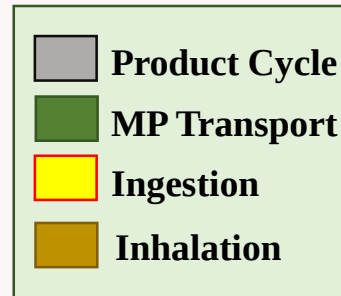


(Arrows' sizes do not reflect flow rates)

Distribution (e.g.)

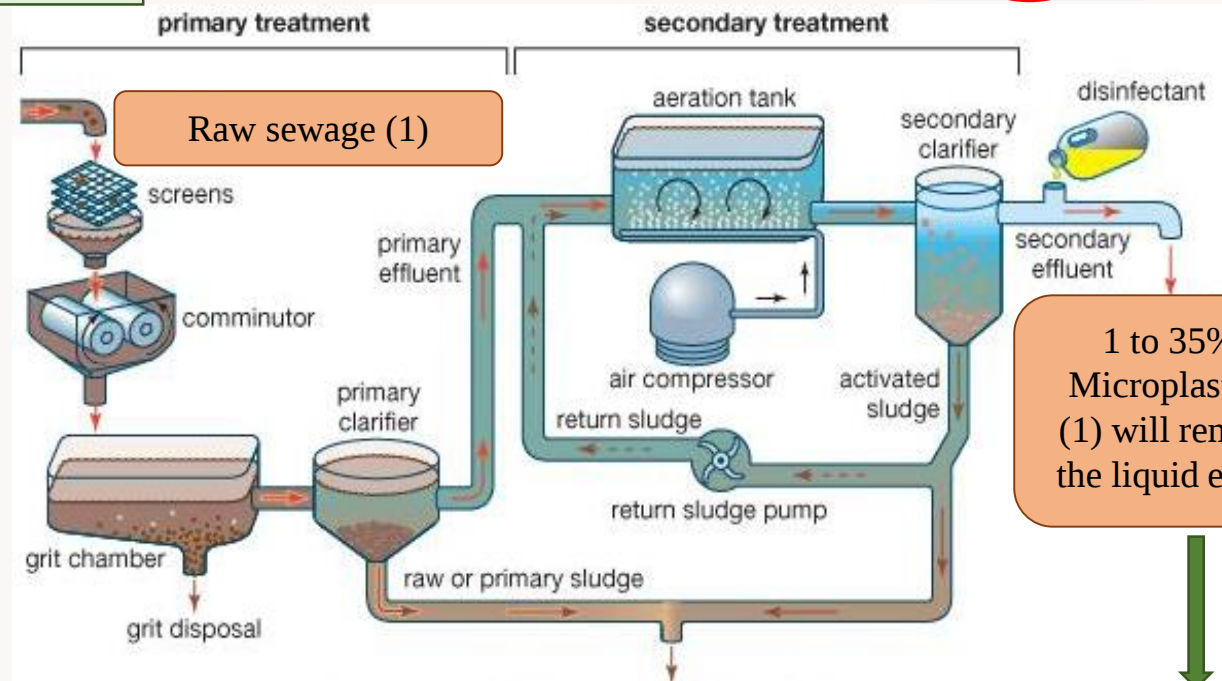


ATMOSPHERIC



USE & MAINTENANCE

WWTP



TERRESTRIAL

Most microplastics will be transferred to the sludge

AQUATIC

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Distribution

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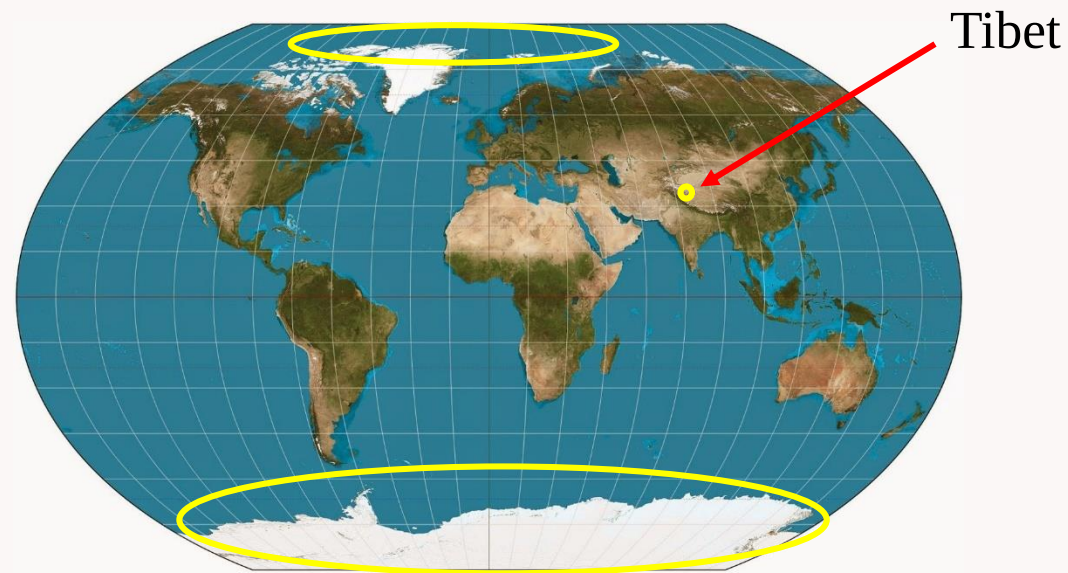
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4. Conclusions

- **Aquatic**
 - In almost every sample
 - Remote places



- **Marine Environments**

- Small
- Ubiquitous



Potential
BIG Problem

Distribution

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• Marine Environments

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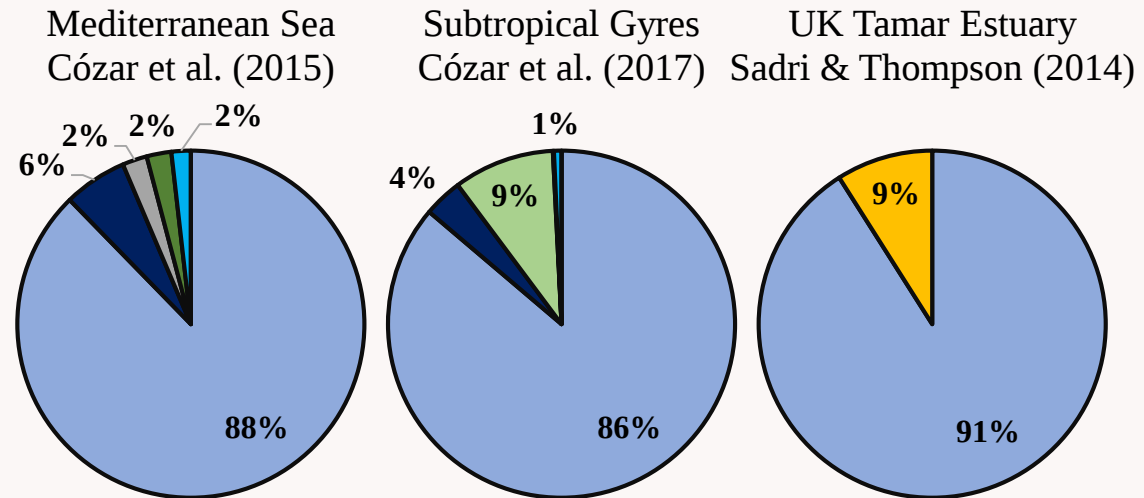
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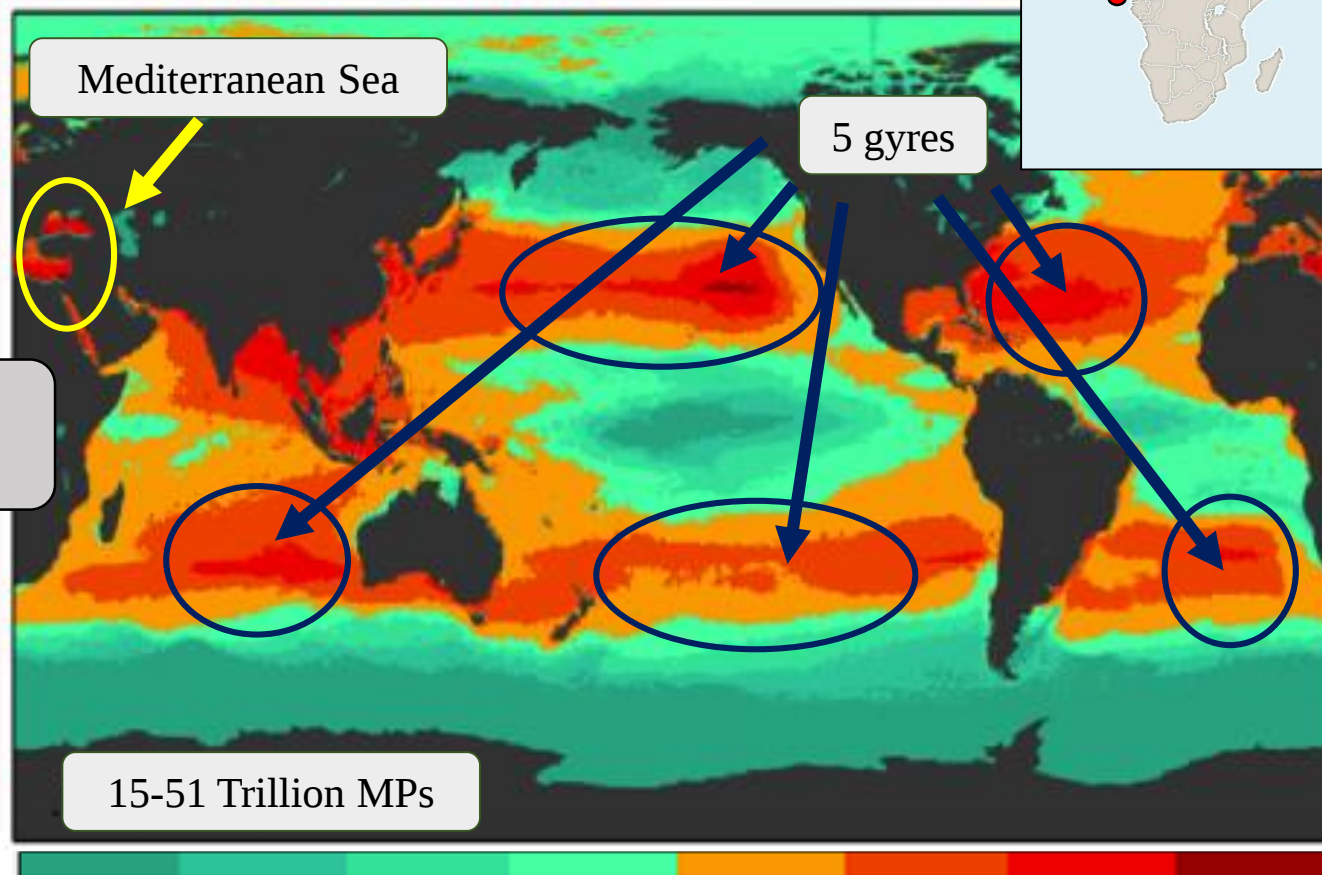


Floating MPs



Distribution

- **Marine Environments**



Items per km²: 10^0 10^1 10^2 10^3 10^4 10^5 10^6

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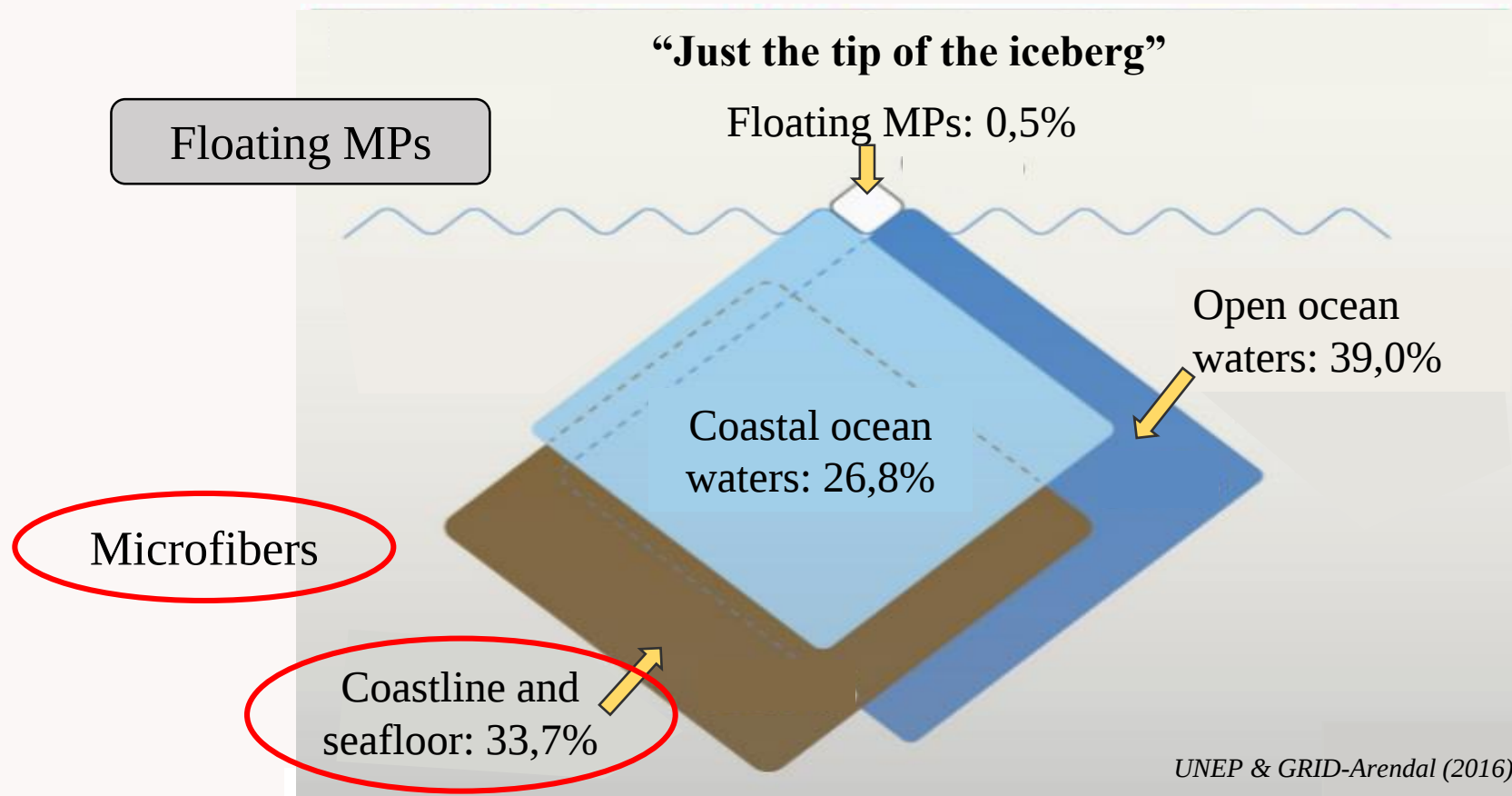
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Distribution

- **Marine Environments**



Distribution

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- **Marine Environments**

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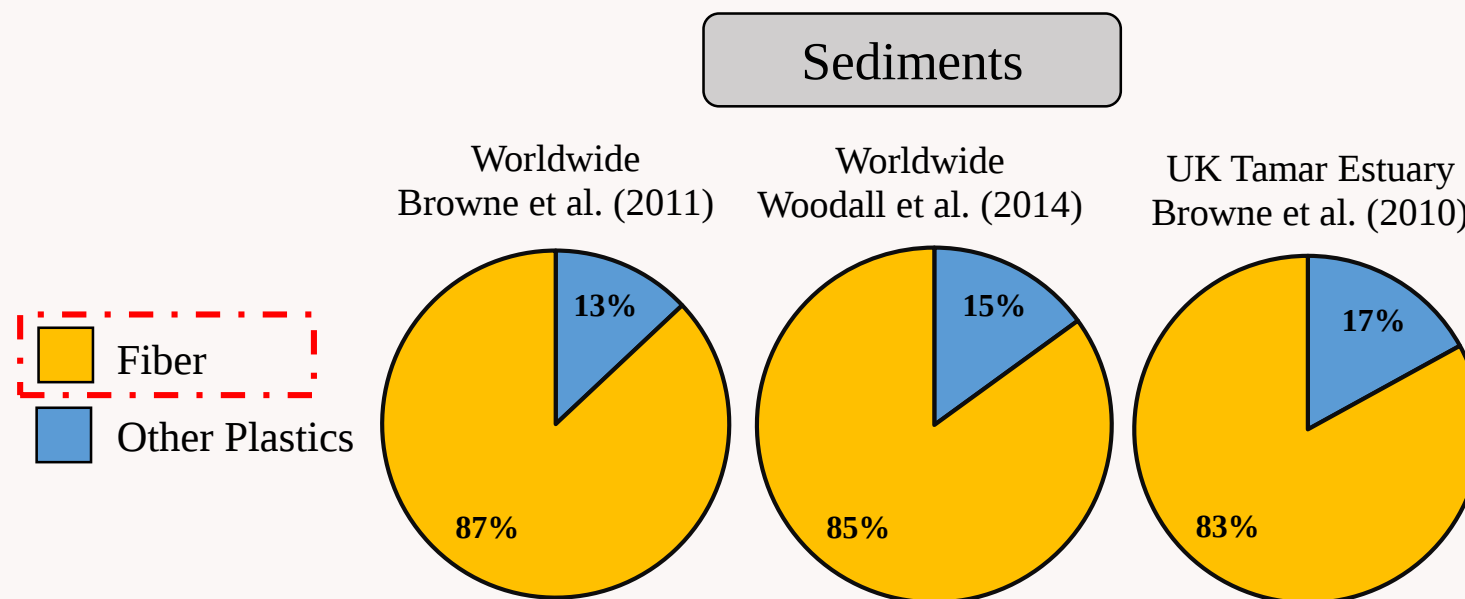
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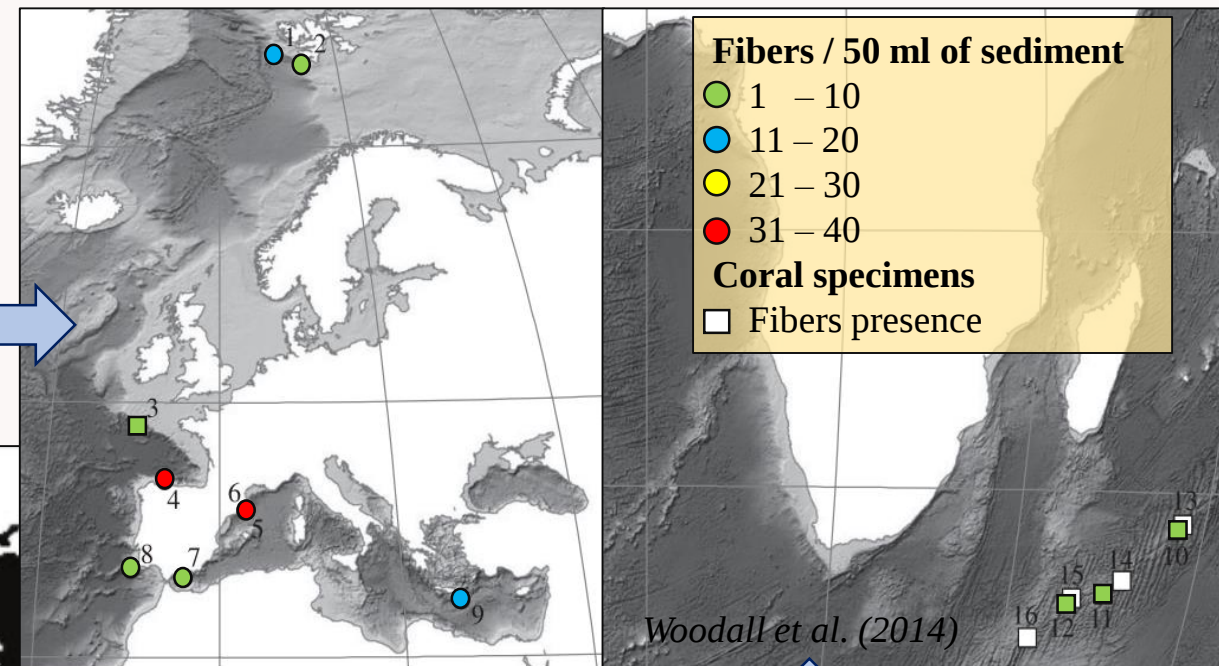
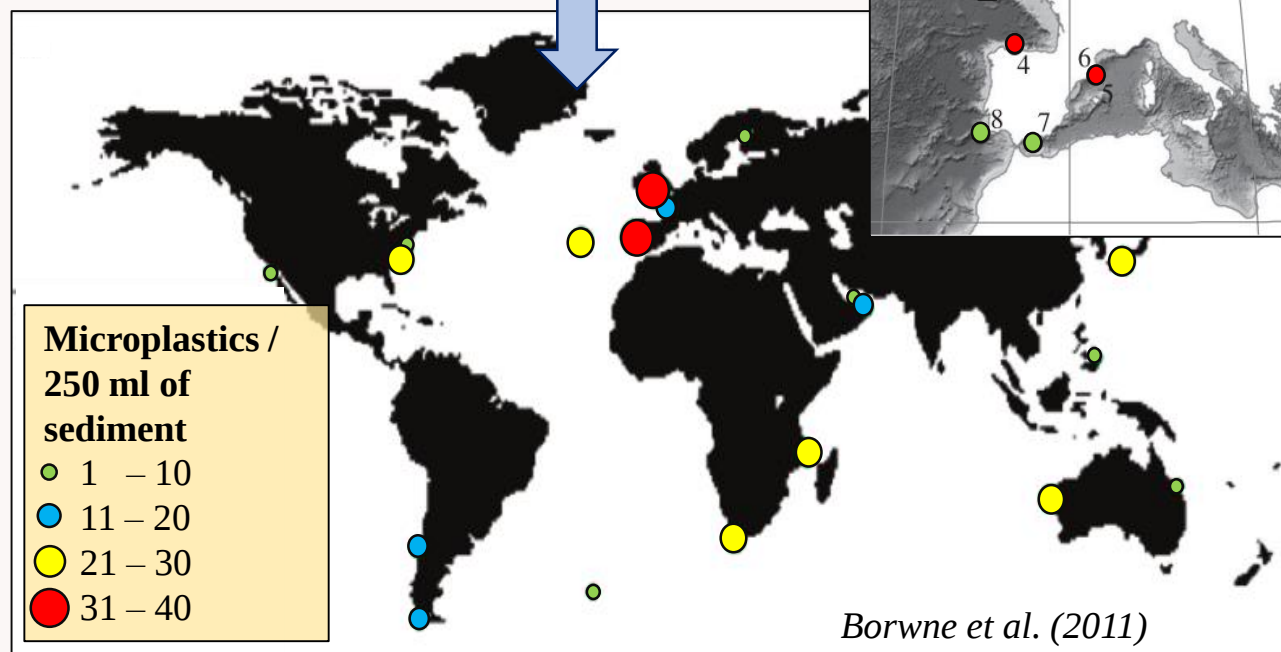
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• Marine Environments

Sediments

Fibers: most abundant (x4)



Mostly “rayon”

Distribution

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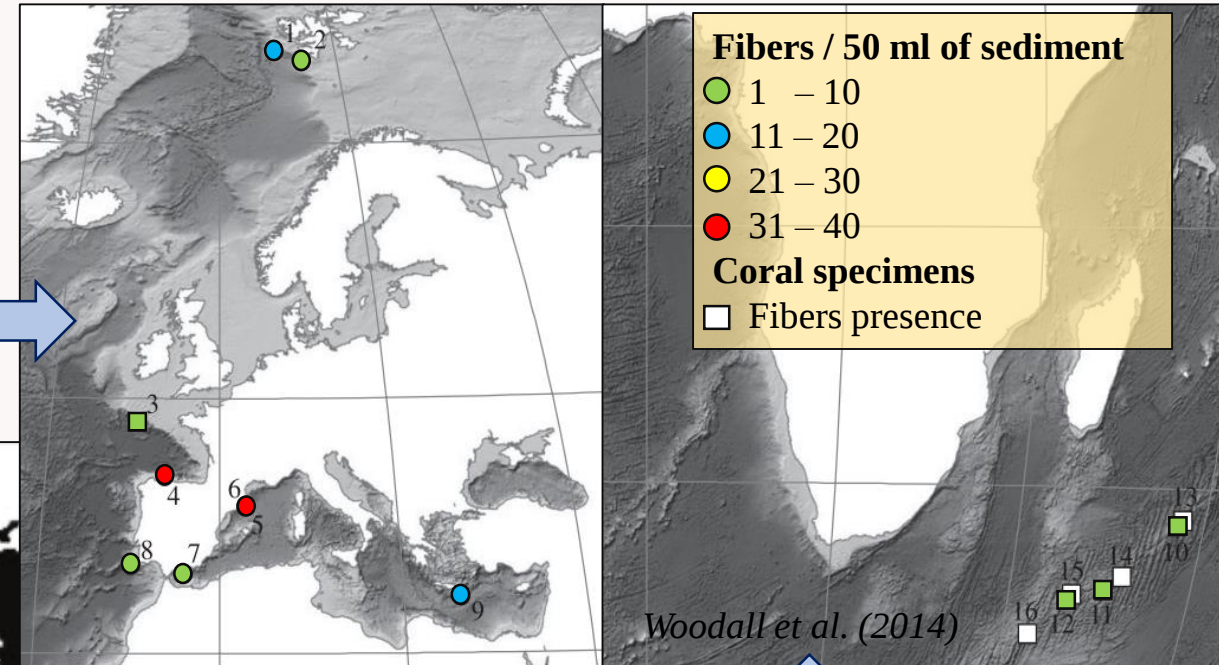
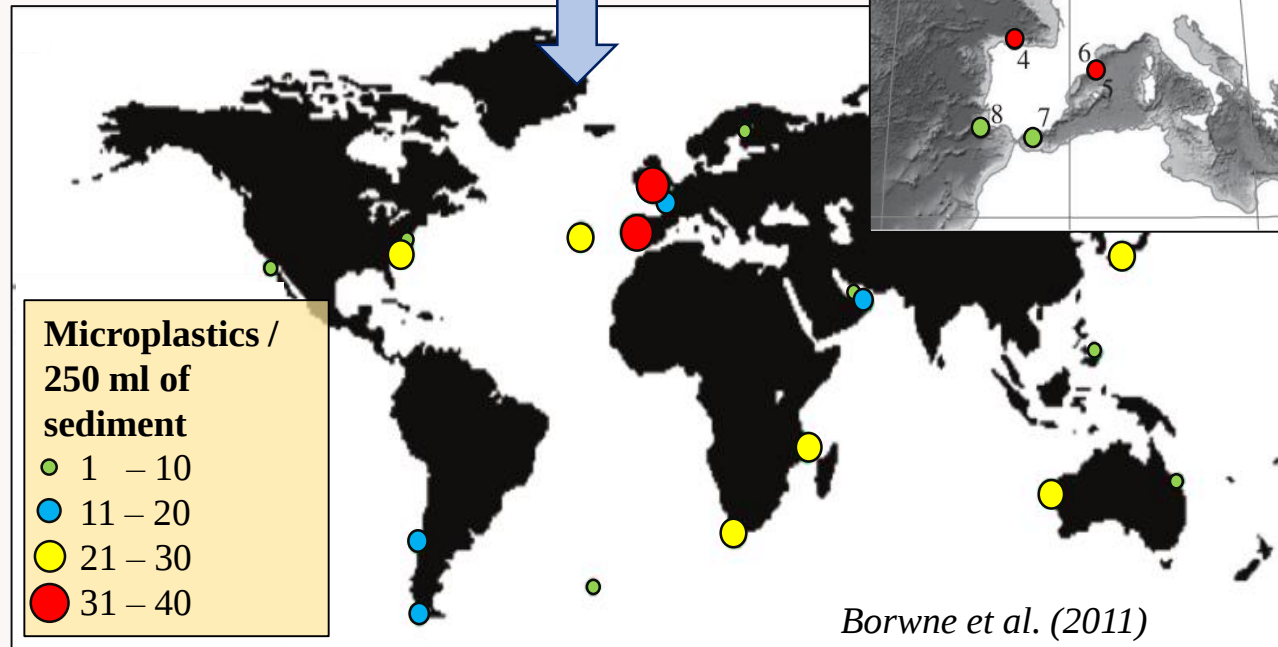
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Proximity to cities



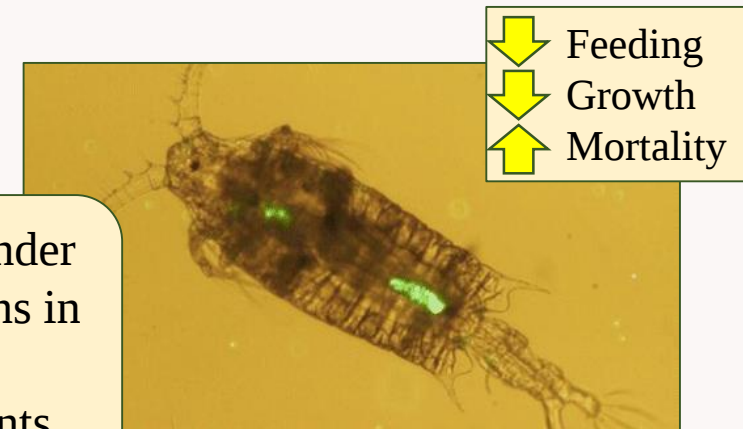
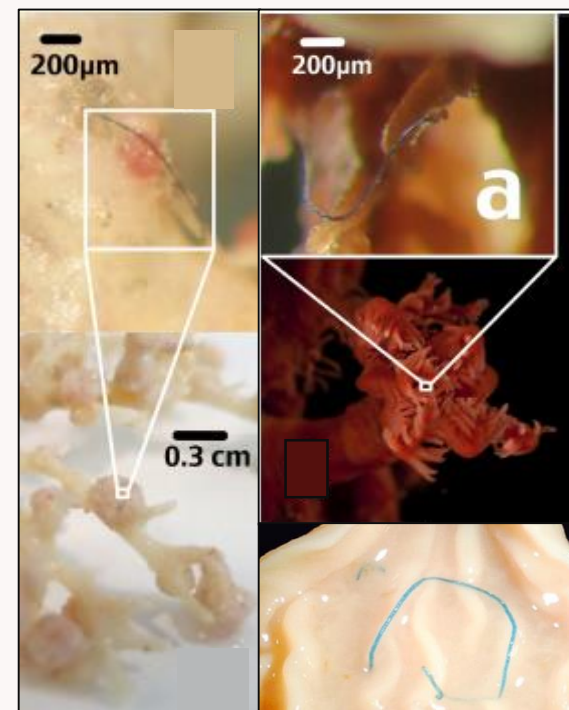
Cellulose: toilet paper

Impacts

- **Marine organisms**

MPs > 100 species [plankton to whales]

- Gastrointestinal blockages
- Starvation
- Immobilization
- Decreased growth
- Increased mortality
- Translocation
- Chemical transfer
- ...



Measured under
lab conditions in
critical
environments

Impacts

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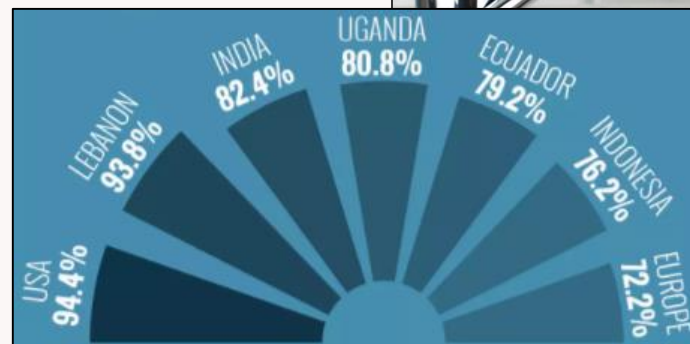
• Humans

Impacts: no studies made

- In fish and shellfish for human consumption
- Tap water
- Sea salt
- Air
- ...



4-10 MF/l



11,000 MPs per year
from eating shellfish!



Impacts

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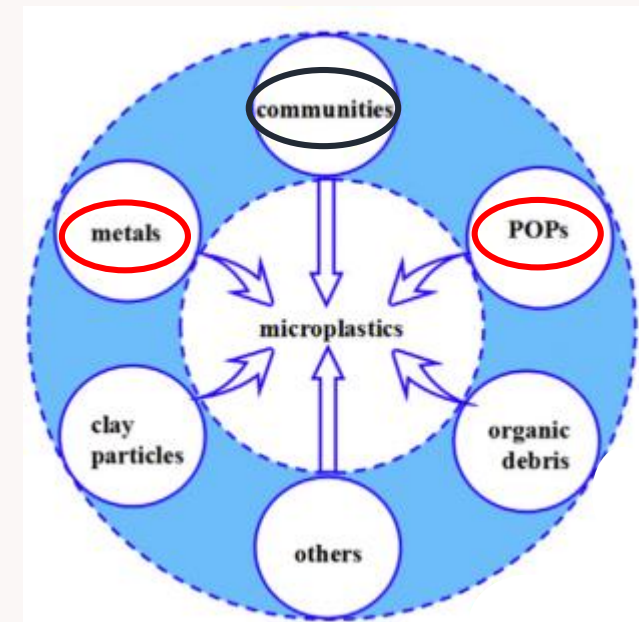
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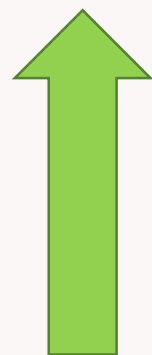
4. Conclusions

- **Other impacts**

- Adsorption of chemical compounds
- Space for alien species
- Change in physical properties of beach sediments



J. Wang et al. (2016)



Non-synthetic polymers also!



Textile Microfibers

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• Measured Microfibers' Detachment

Work	Results	
Browne et al. (2011)	170	MF / l
Napper & Thompson (2016)	500.000	MF / 6 kg of garment washed
Pirc et al. (2016)	135.000	MF / 6 kg of garment washed
Bruce et al. (2016)	8.500 – 250.000	MF / garment washed
Astrom (2016)	7.360	MF / m ² l

Textile Microfibers

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- **Measured Microfibers' Detachment**

- Direct
- Replicability: $E = 8\%$; $CV = 11\%$

A- PES



B- PES/EL



C- PES



D- EL/PA



E- PES/EL



Textile Microfibers

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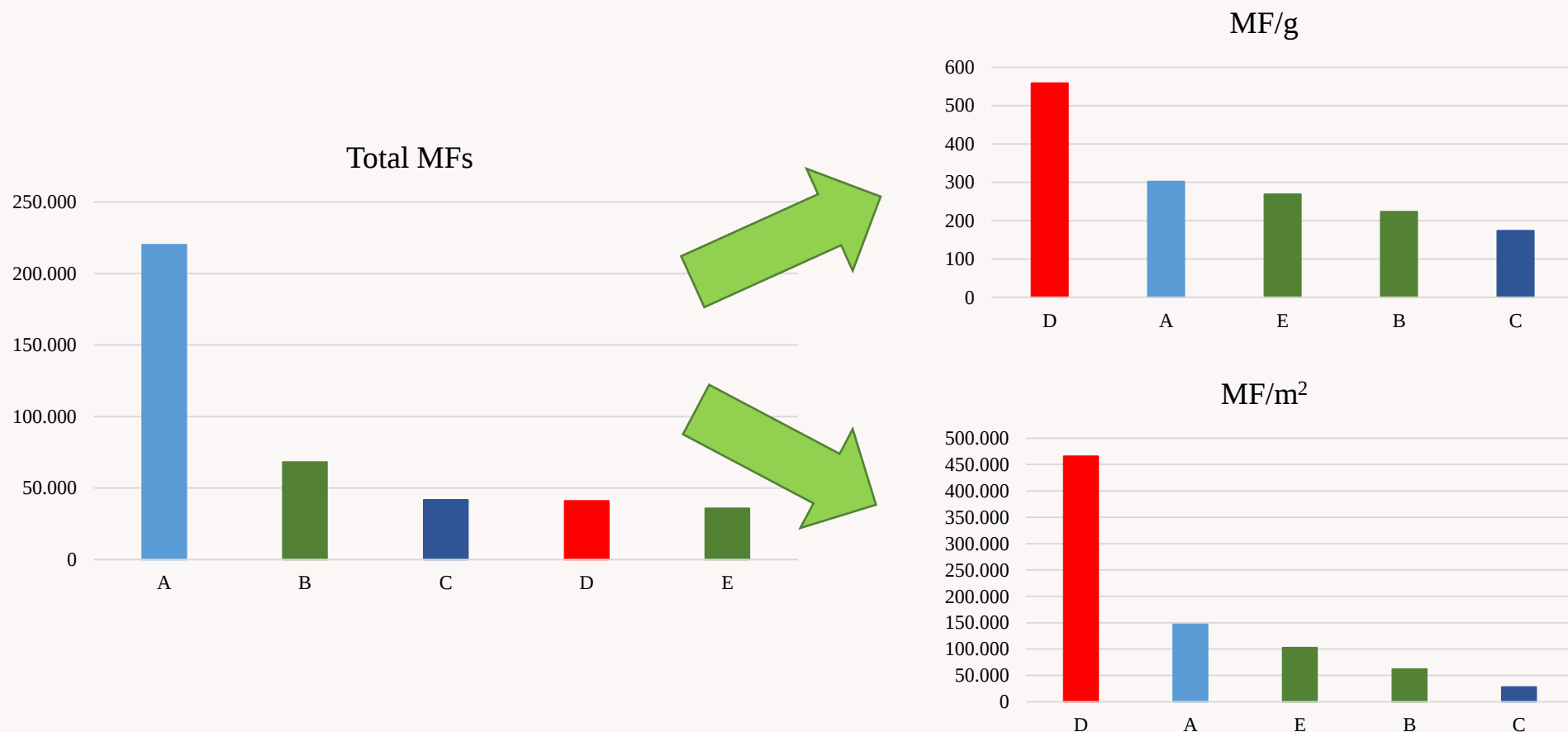
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- **Measured Microfibers' Detachment**



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- “Solutions”



Better practices

- Less synthetic
- Full washing machine
- Liquid soap
- Colder water
- Front-loading
- ...

(plasticpollutioncoalition.org)

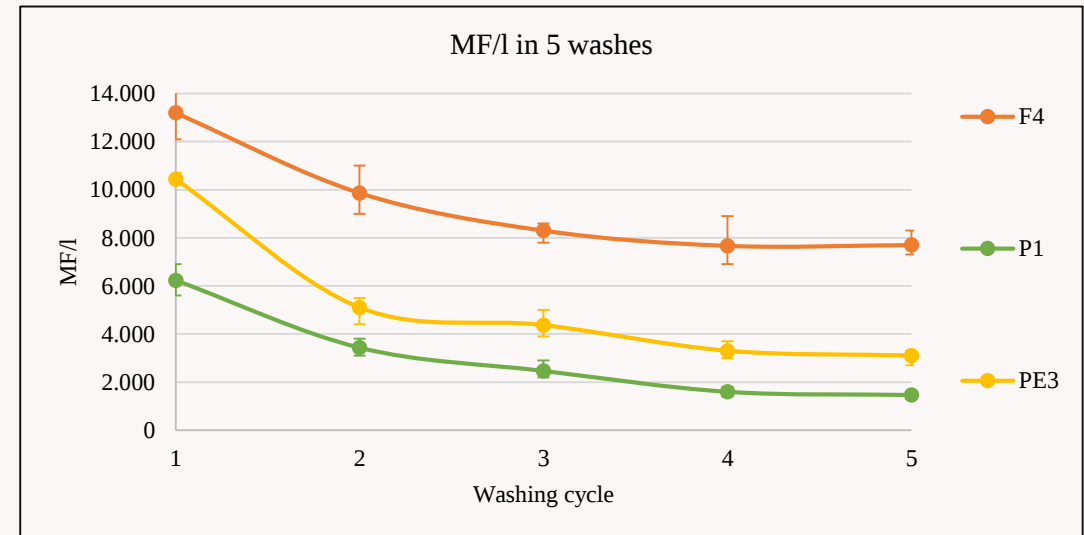
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- **INTEXTER Future works**

- Normalized methods
- Indoor microfibers
- Industrial, evaluate:
 - Quantity
 - Solutions



Conclusions

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- Not well defined
- Presented everywhere, ubiquitous in marine environments
- High potential risks for organisms
- Risks for humans? Food, tap water,...
- Main primary: textile, tires, city dust
- Fibers are the most abundant?

Conclusions – Questions

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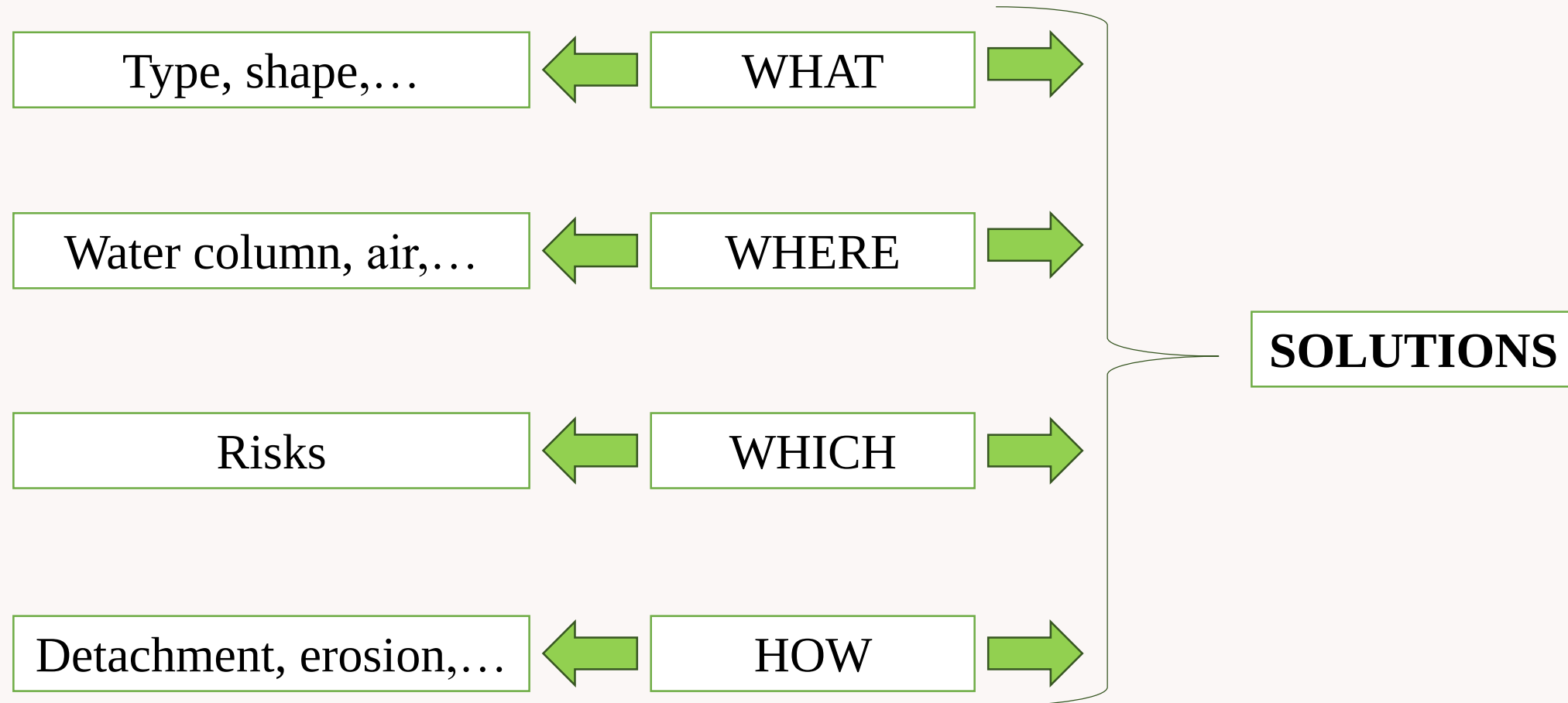
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THANKS!

