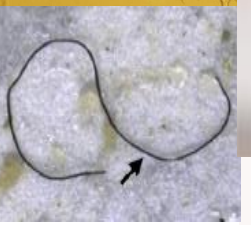
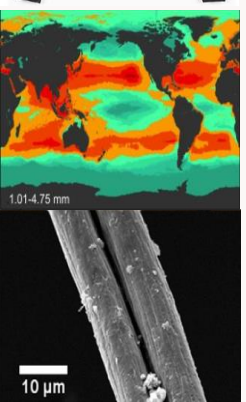
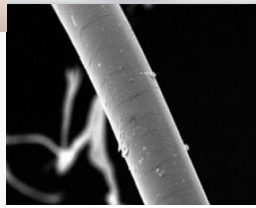





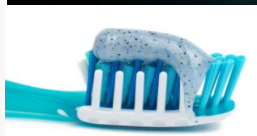
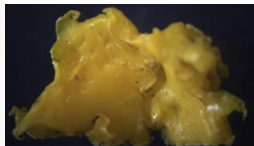


Jornada

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

Francisco Belzagui Elder

francisco.belzagui@gmail.com

Terrassa 22 June 2018

Index

Introduction

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

Recommendations

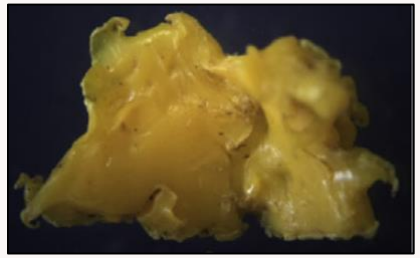
Hypotheses

Definitions

Index

- Length →

< 5 mm



< 1 mm

→ Most accepted (NOAA*)

No minimum

d? l?

< 5 mm in longest dimension

Sub-groups: 1-5 mm; 0,1-0,9 mm…

- Synth~~e~~tic polymers → polyester, polyethylene, polypropylene...

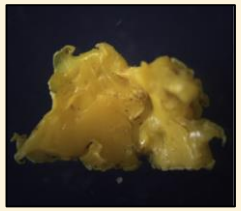
All kind of polymers!

* National Oceanic and Atmospheric Administration

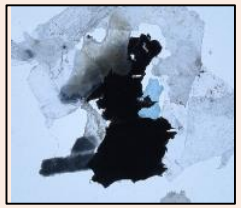
Index

Definitions

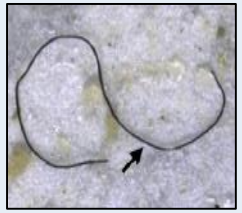
- Shapes
- Examples



Fragment → Fragmented plastics

Film → Fragmented plastics

Fiber → "Microfibers"


Granulate → Pellets, Microbeads


Definitions

Index

- **Primary**

Manufactured in a MP length

- **Secondary**

Fragmented

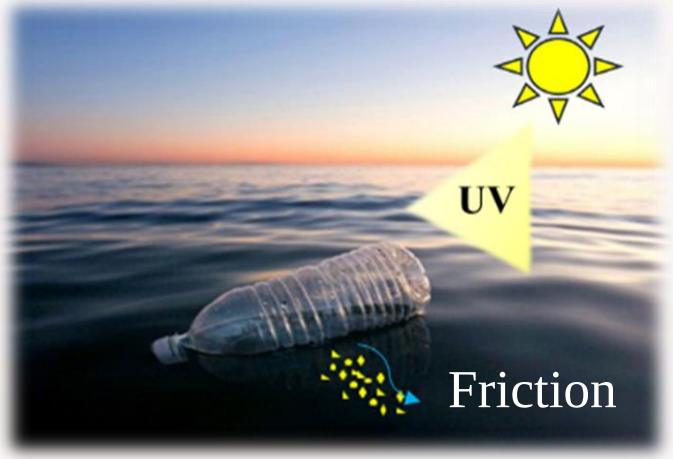
Definitions

- **Primary**

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

- **Secondary**

Generated **IN the environment** (fragmentation)

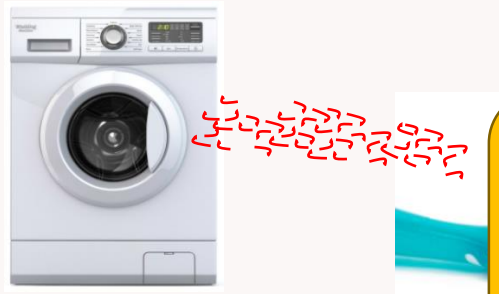


Mismanaged Plastic Waste

Definitions

- **Primary**

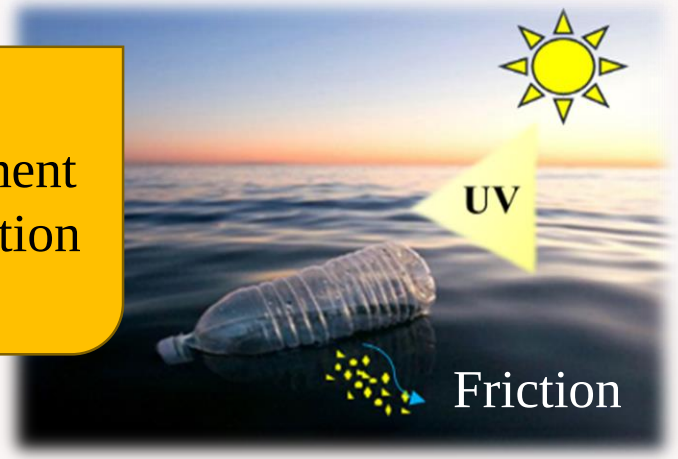
Released **TO the environment** in a MP length



Before & After Environment
➔ Recommended Definition

- **Secondary**

Generated **IN the environment** (fragmentation)



Potential Secondary MPs

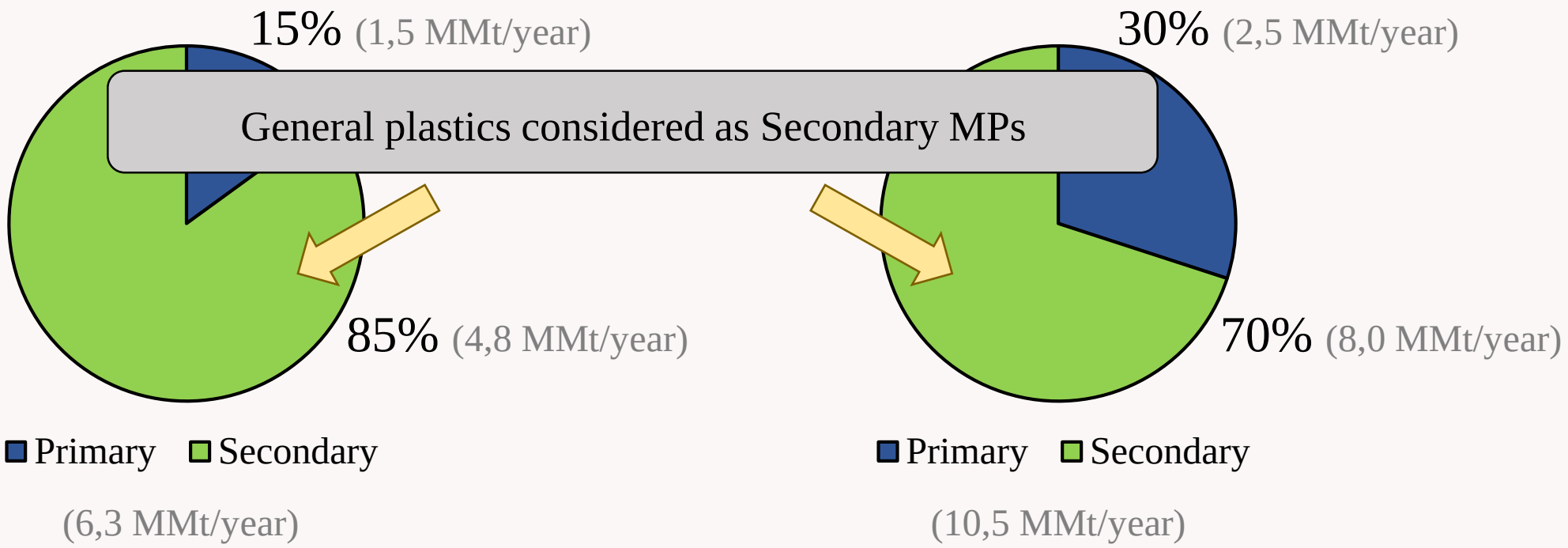
Index

Sources' Estimations

NO normalized methodologie**S**!!!

- **Primary vs. Secondary**

General plastics considered as Secondary MPs

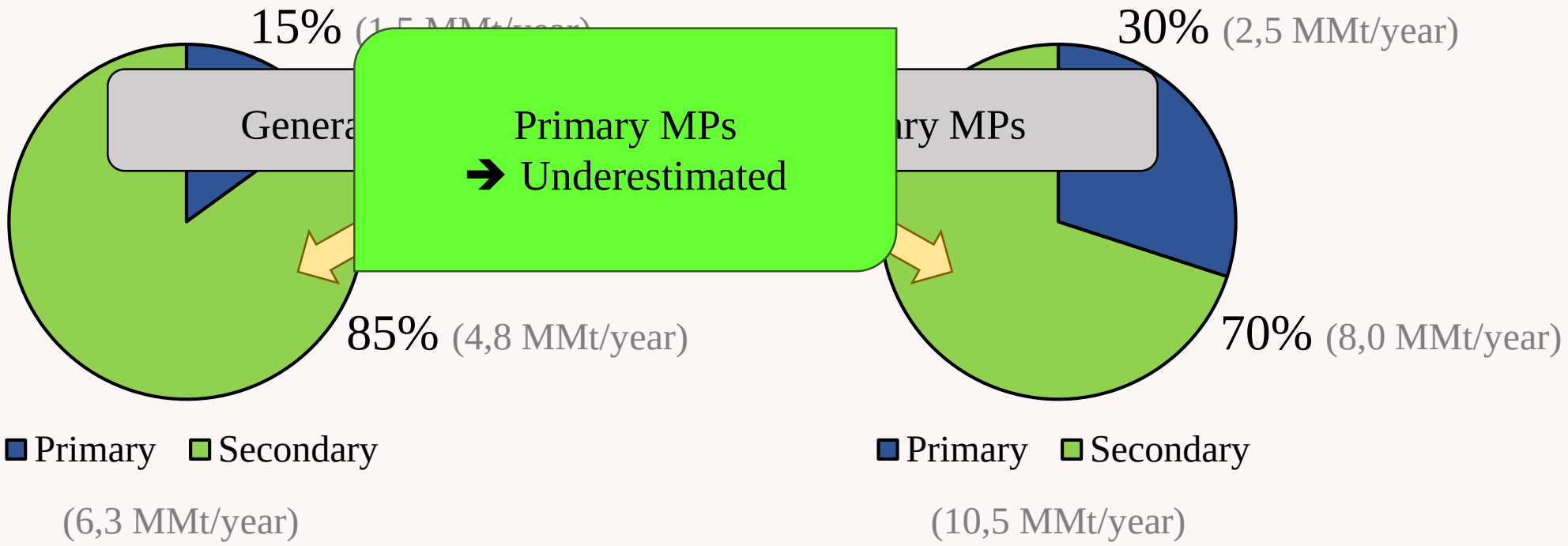


Index

Sources' Estimations

NO normalized methodologie**S**!!!

- **Primary vs. Secondary**



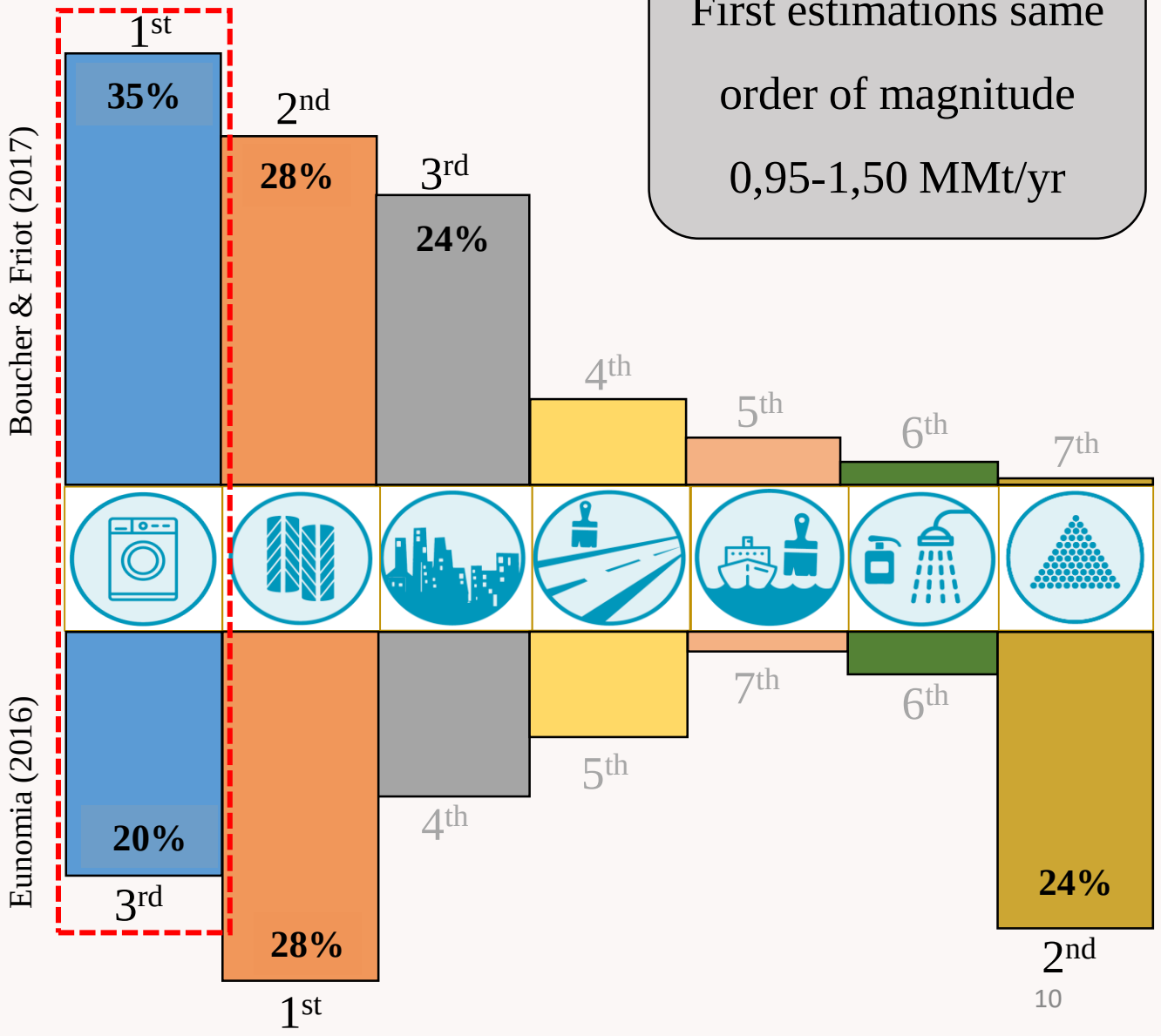
Index

Sources' Estimations

- **Primary MPs**

7 Main contributors

- Synthetic Textiles
- Tire Dust
- City Dust
- Road Markings
- Marine Coatings
- Personal Care Products
- Pellet Spills



First estimations same order of magnitude 0,95-1,50 MMt/yr

Sources' Estimations

Index

1st

35%

20%

3rd

Boucher & Friot (2017)

Total = 1,50 MMt / year

MFs = 0,25 - 0,75 MMt/year

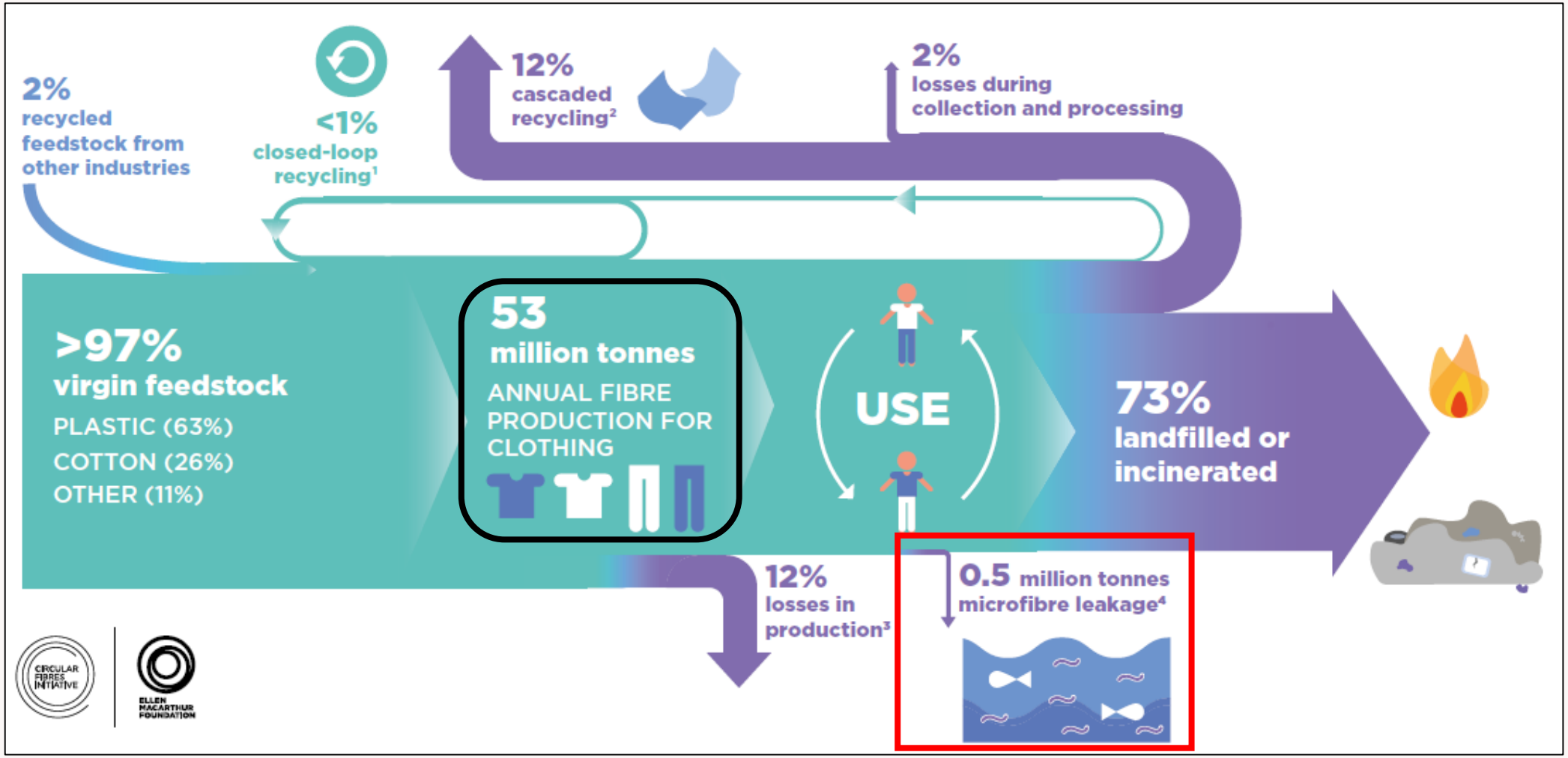
Eunomia (2016)

950 kt / year

MFs = 0,15 MMt/year

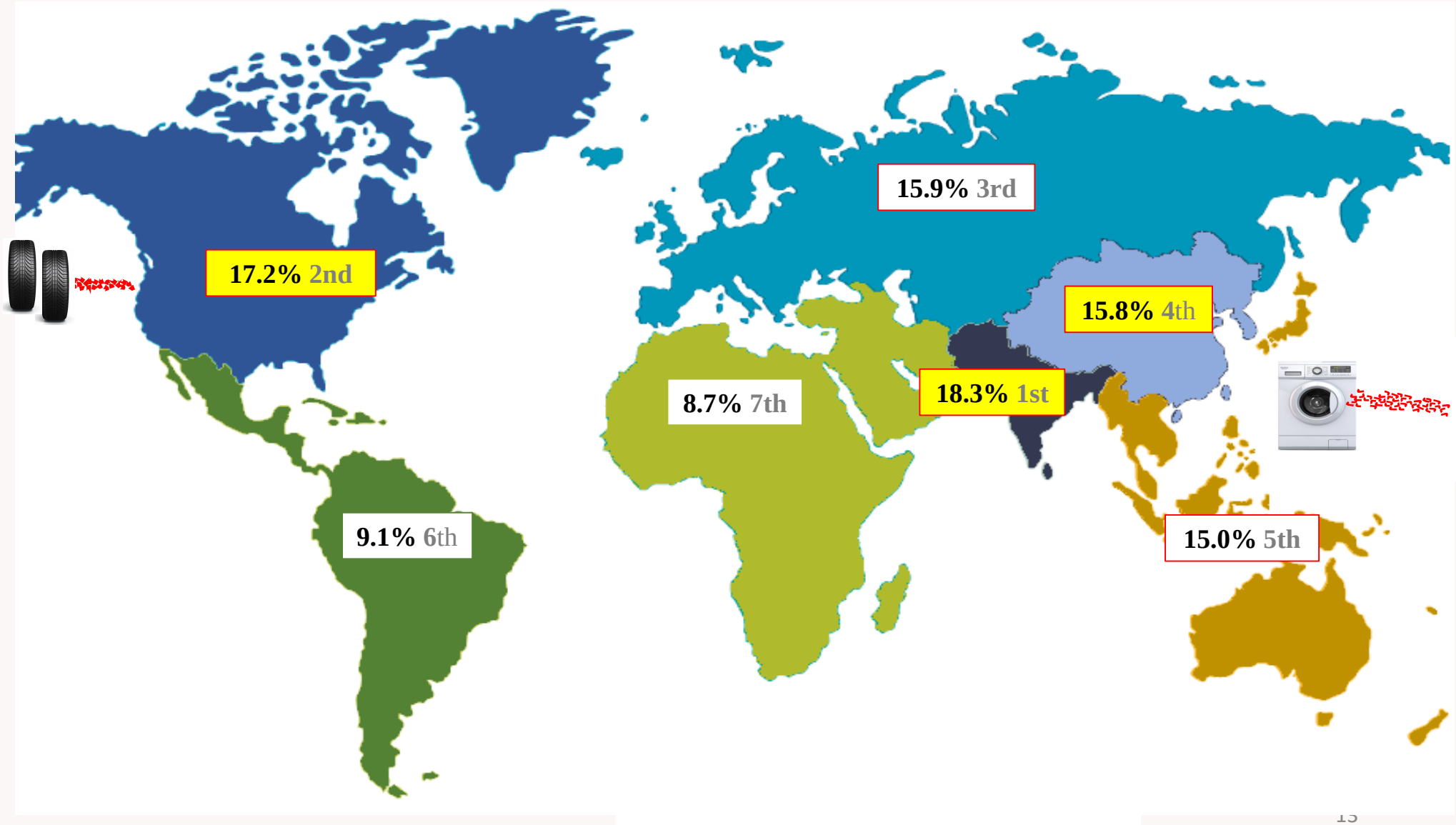
Sources' Estimations

Index



Sources' Estimations

Index



Source: Boucher & Friot (2017)

Sources' Estimations

- **Potential Secondary MPs**

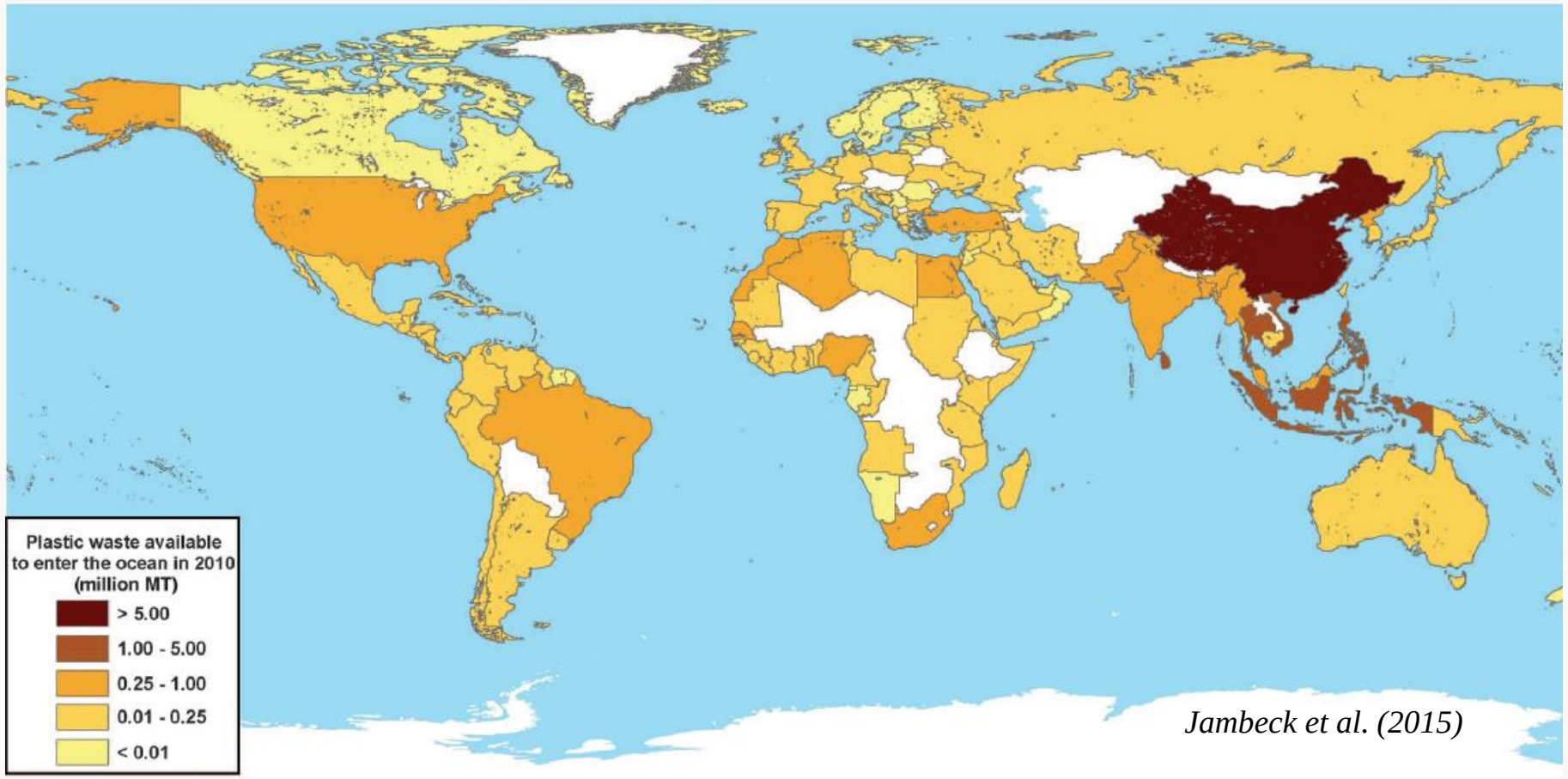
Source	Plastic waste to the Oceans in Million tons/year
Jambeck et al. (2015)	4,80 – 12,70
Sherrington et al. (2016)	5,42 – 19,70
Eunomia (2016)	11,25

Jambeck et al. (2015)

Sources' Estimations

Index

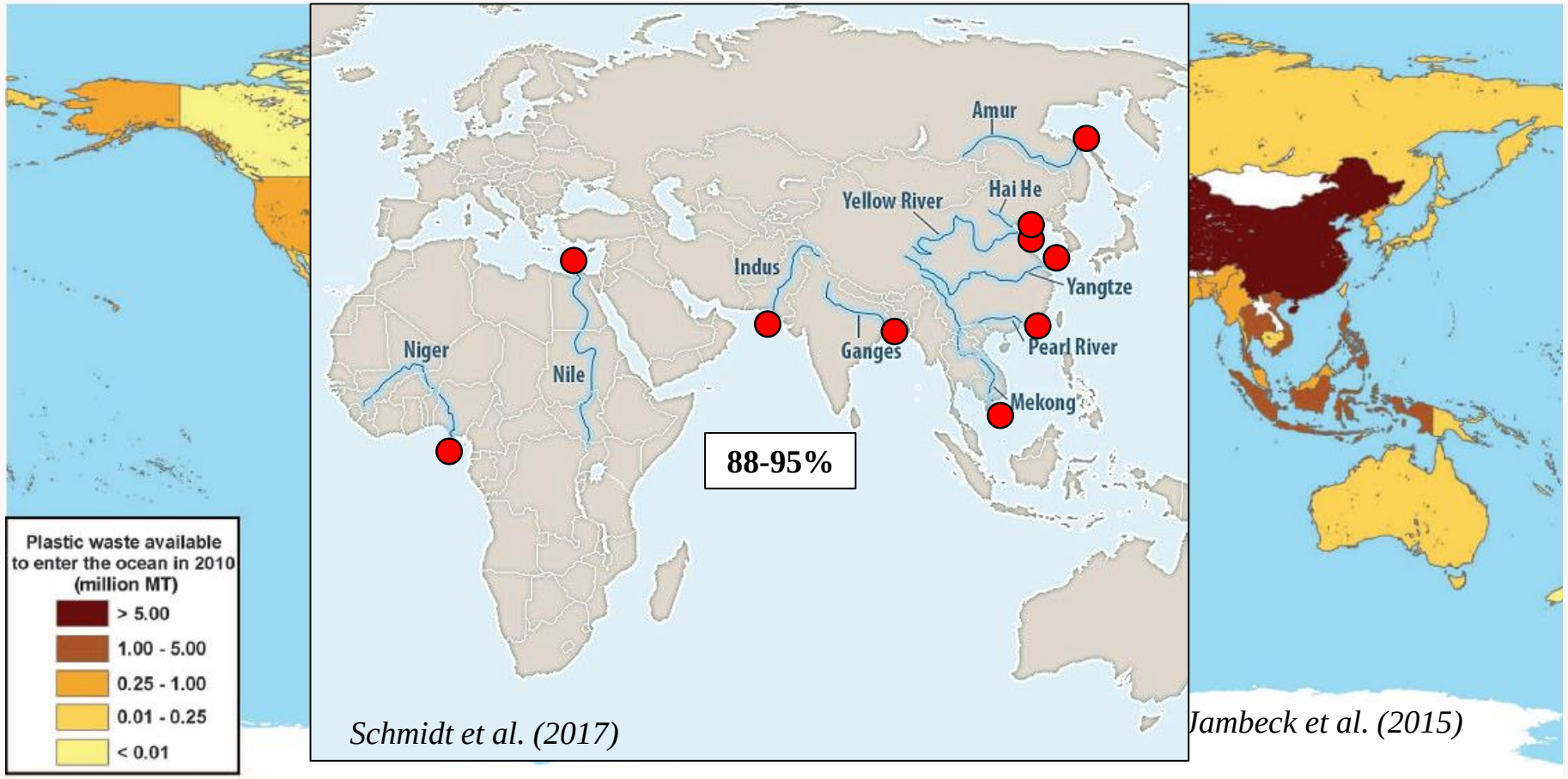
- **Potential Secondary MPs**



Jambeck et al. (2015)

Sources' Estimations

- **Potential Secondary MPs**

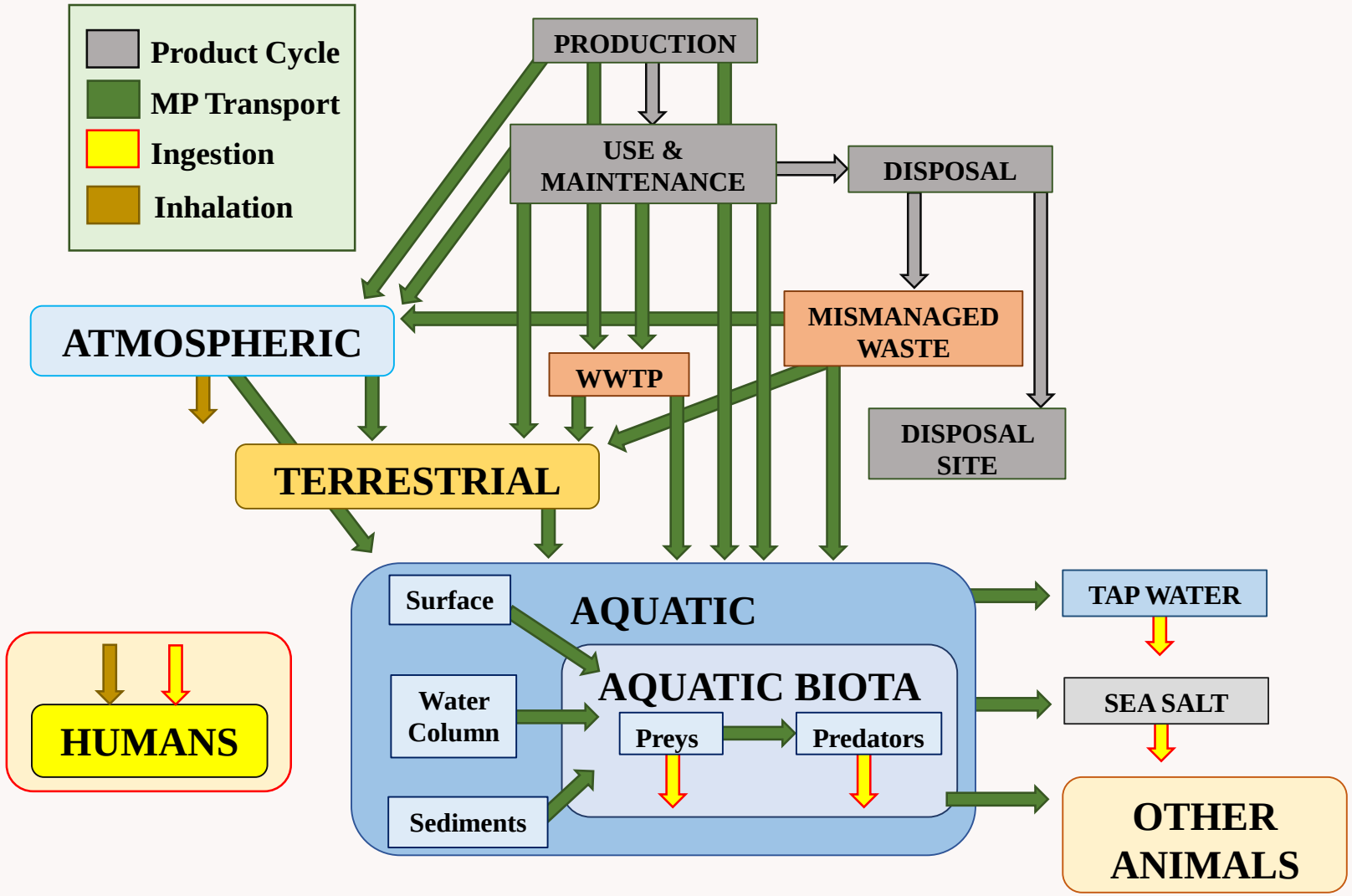


Sources' Estimations

Index

- **Potential Secondary MPs**

Distribution (General Pathways)



(Arrows' sizes do not reflect flow rates)

Index

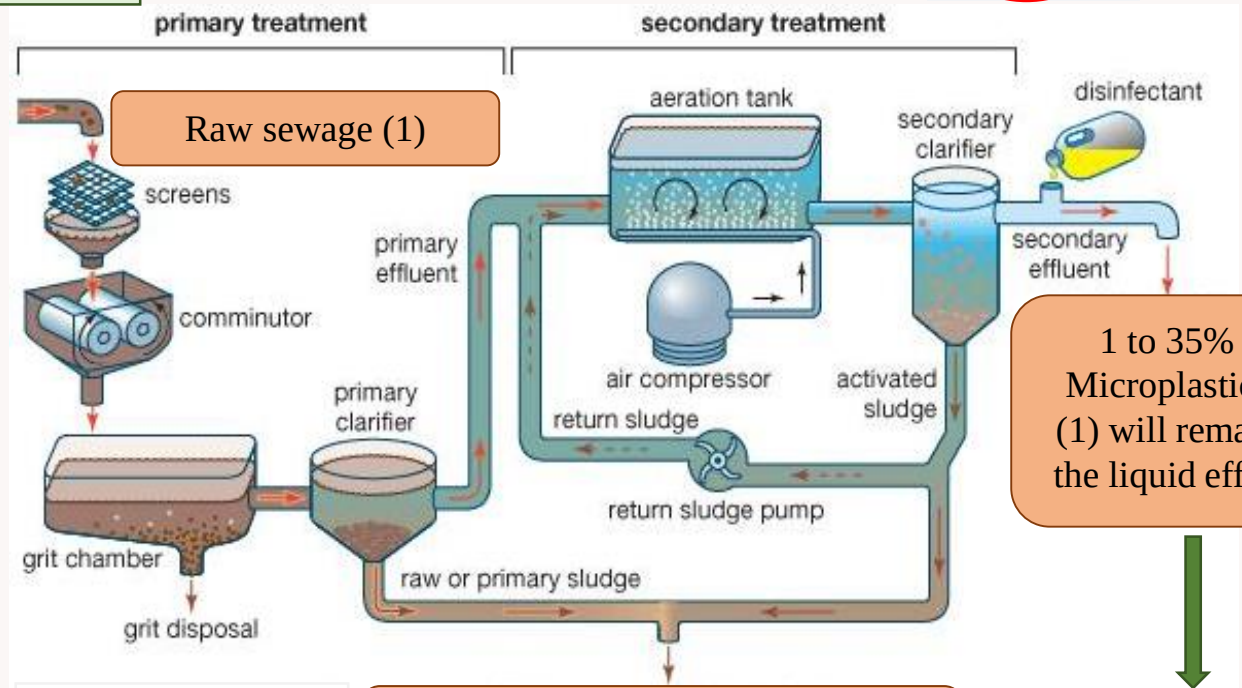
Distribution (e.g.)

ATMOSPHERIC

Product Cycle
MP Transport
Ingestion
Inhalation

USE & MAINTENANCE

WWTP



1 to 35% of Microplastics in (1) will remain in the liquid effluent

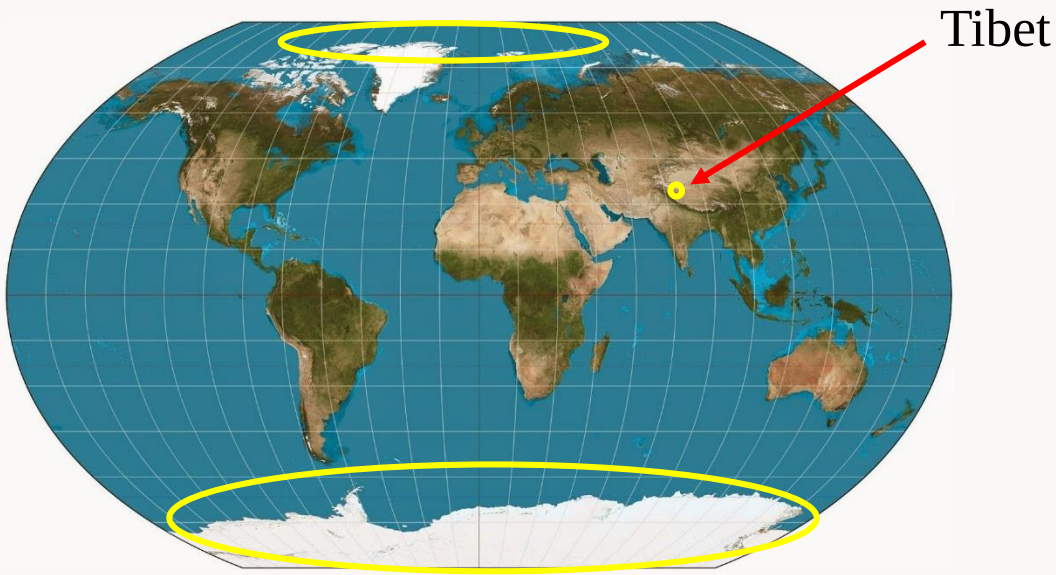
AQUATIC

Most microplastics will be transferred to the sludge

TERRESTRIAL

Distribution

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

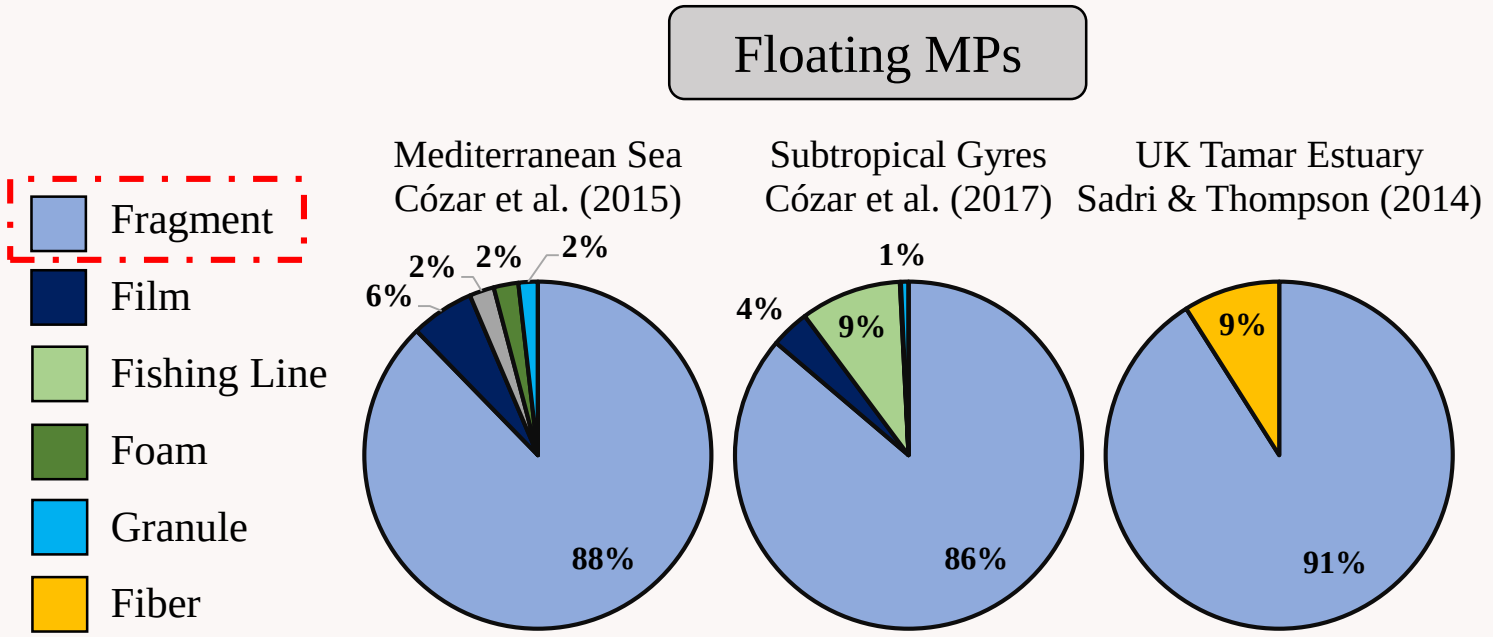


- **Marine Environments**
  - Small
  - Ubiquitous

→ Potential **BIG** Problem

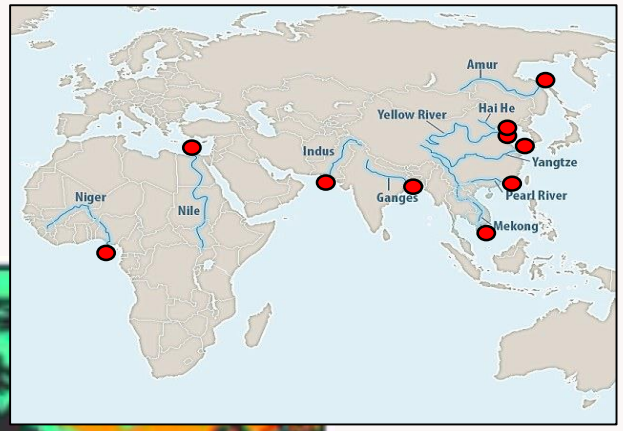
Distribution

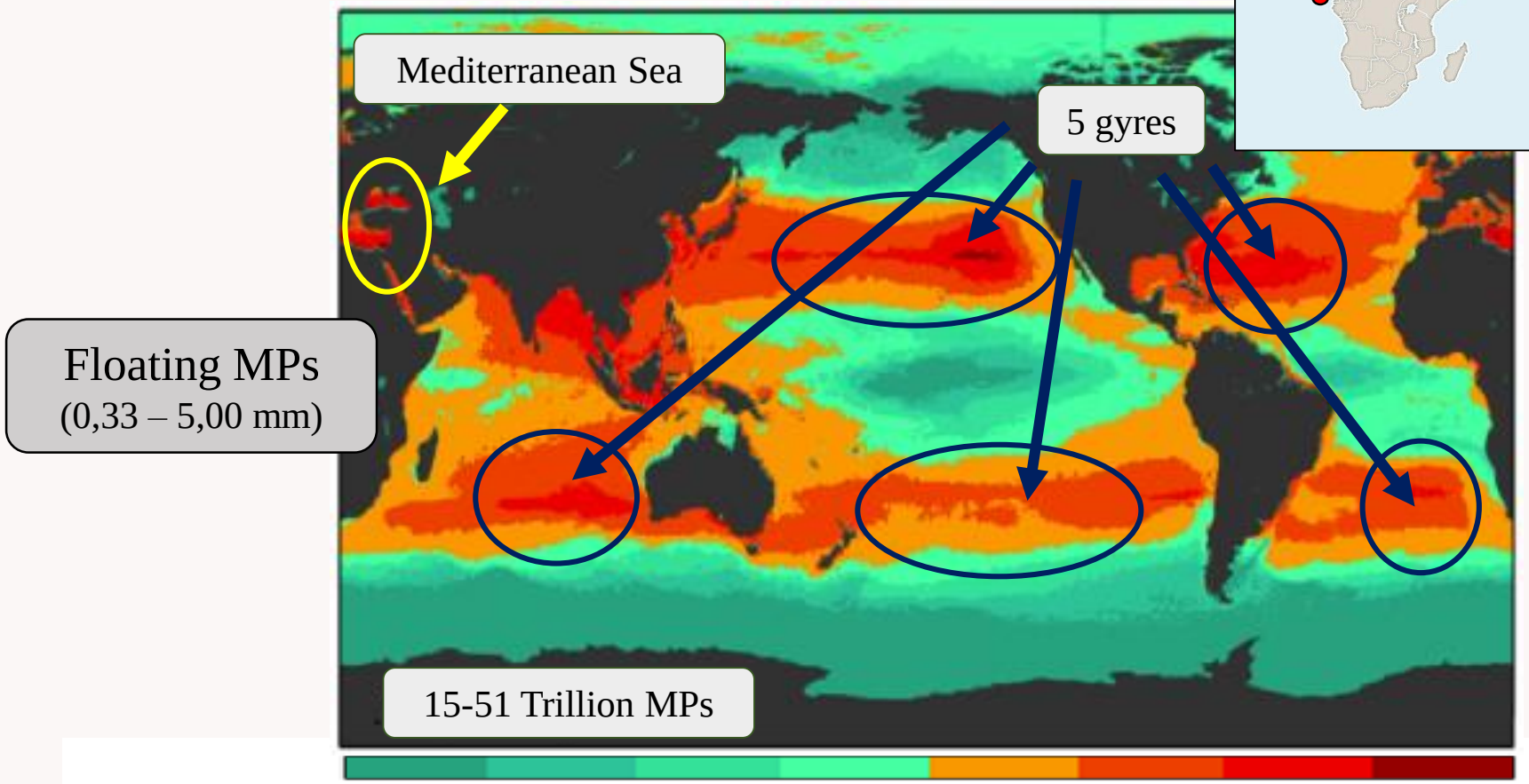
- **Marine Environments**



Distribution

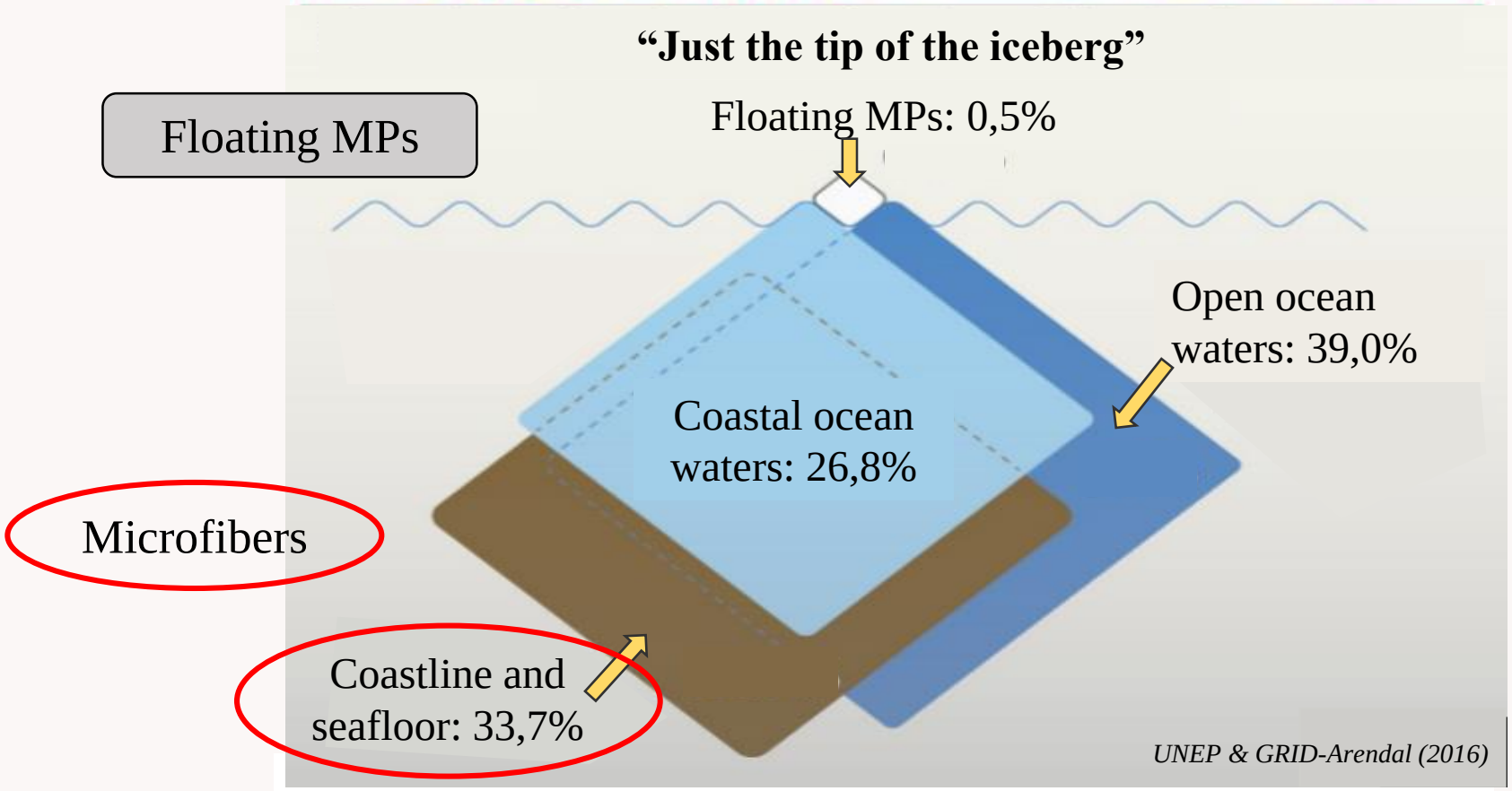
- **Marine Environments**





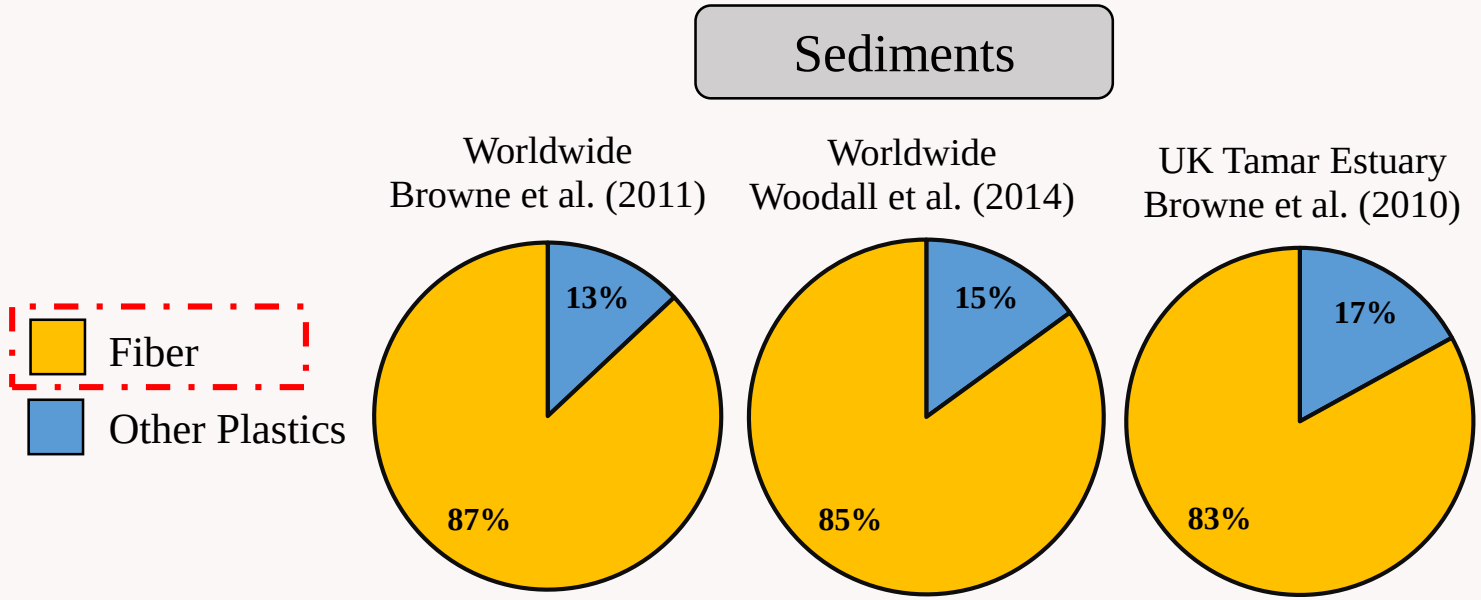
Distribution

- **Marine Environments**



Distribution

- **Marine Environments**

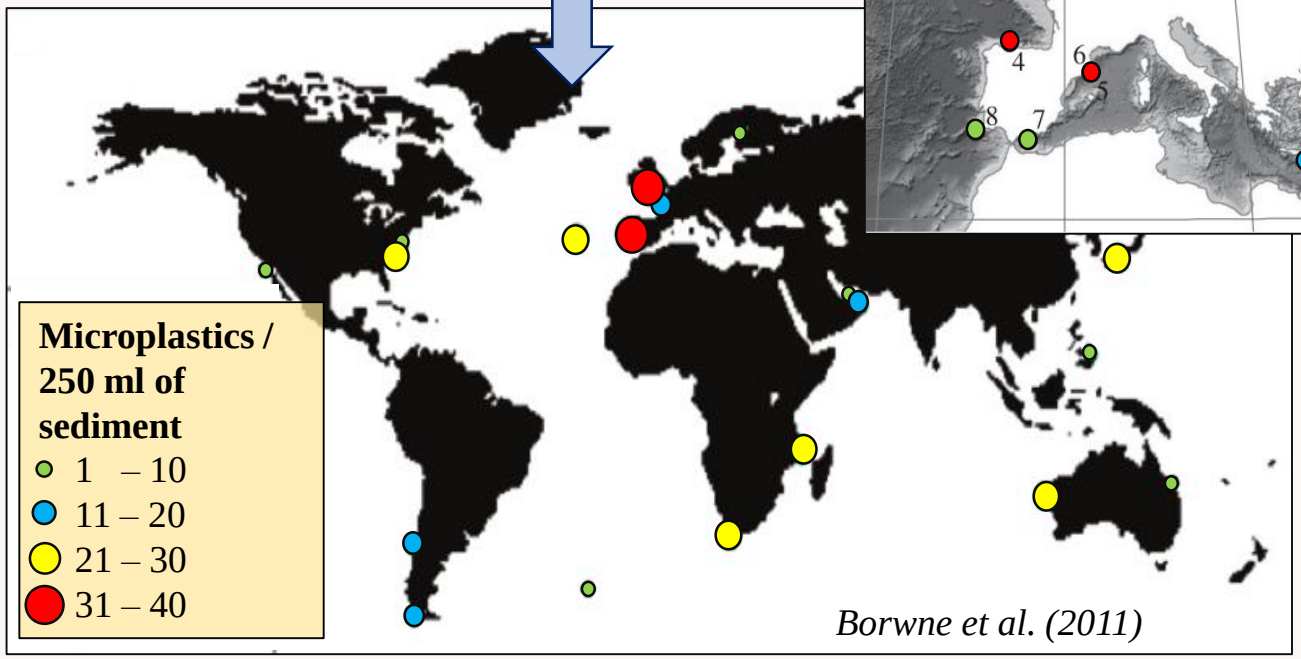


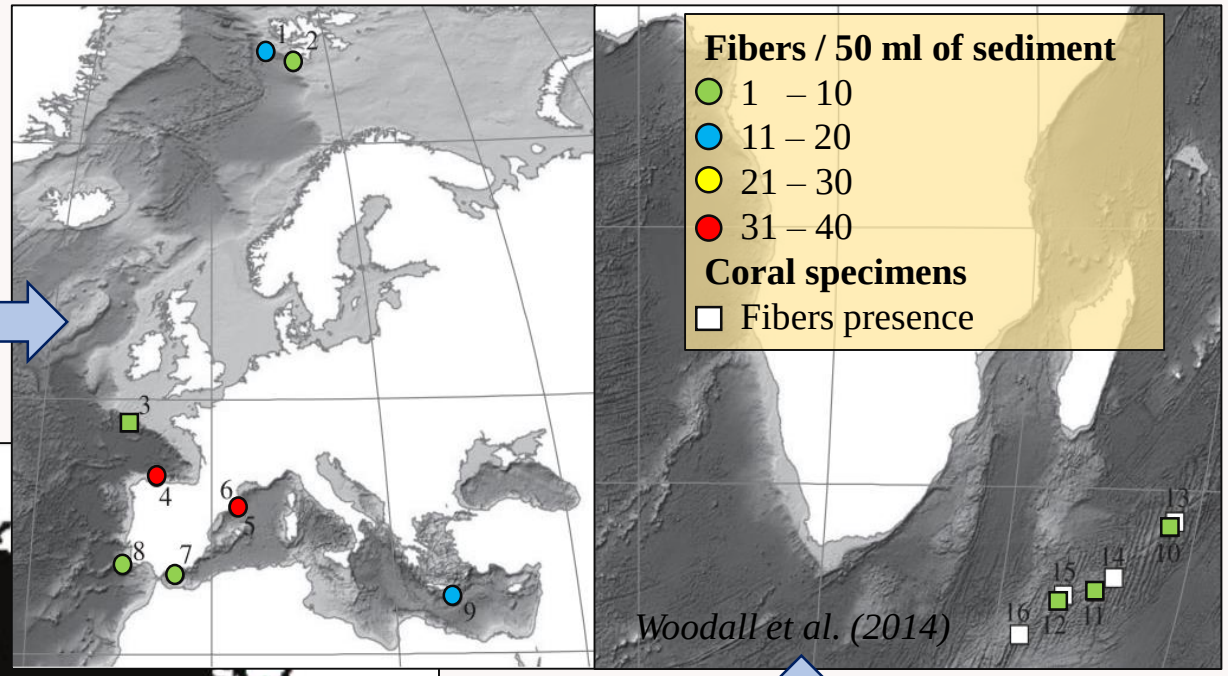
Distribution

- **Marine Environments**

Sediments

Fibers: most abundant (x4)





Mostly "rayon"

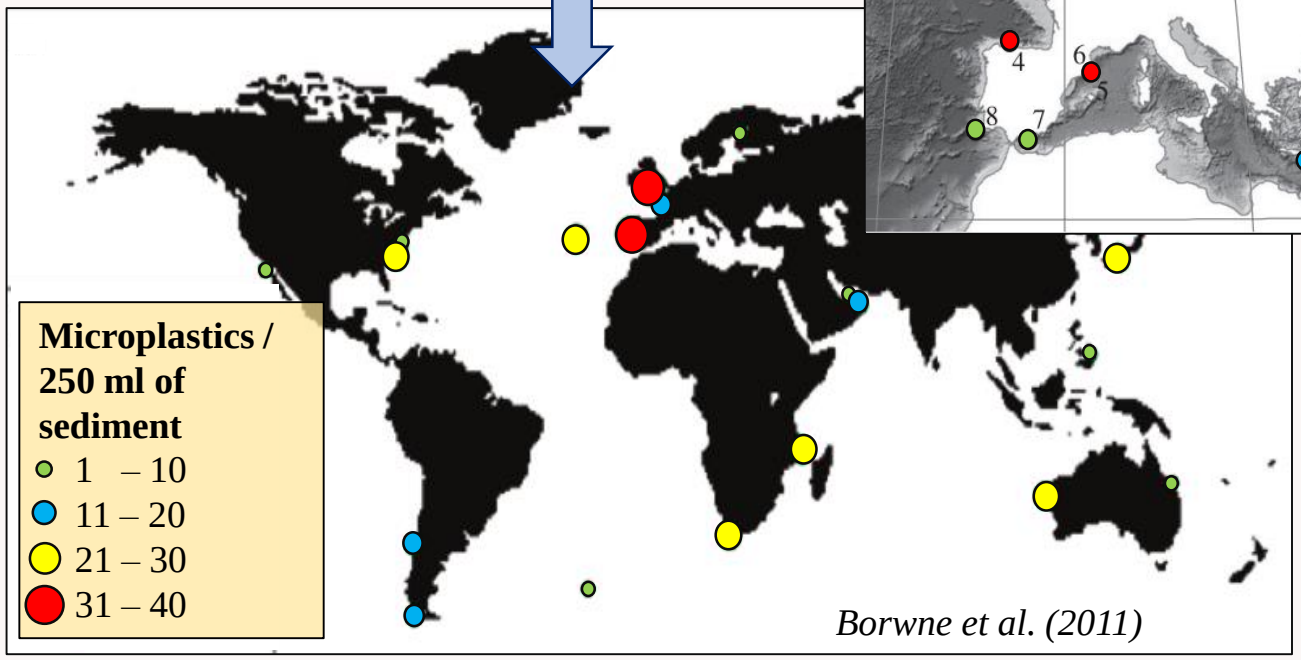
Index

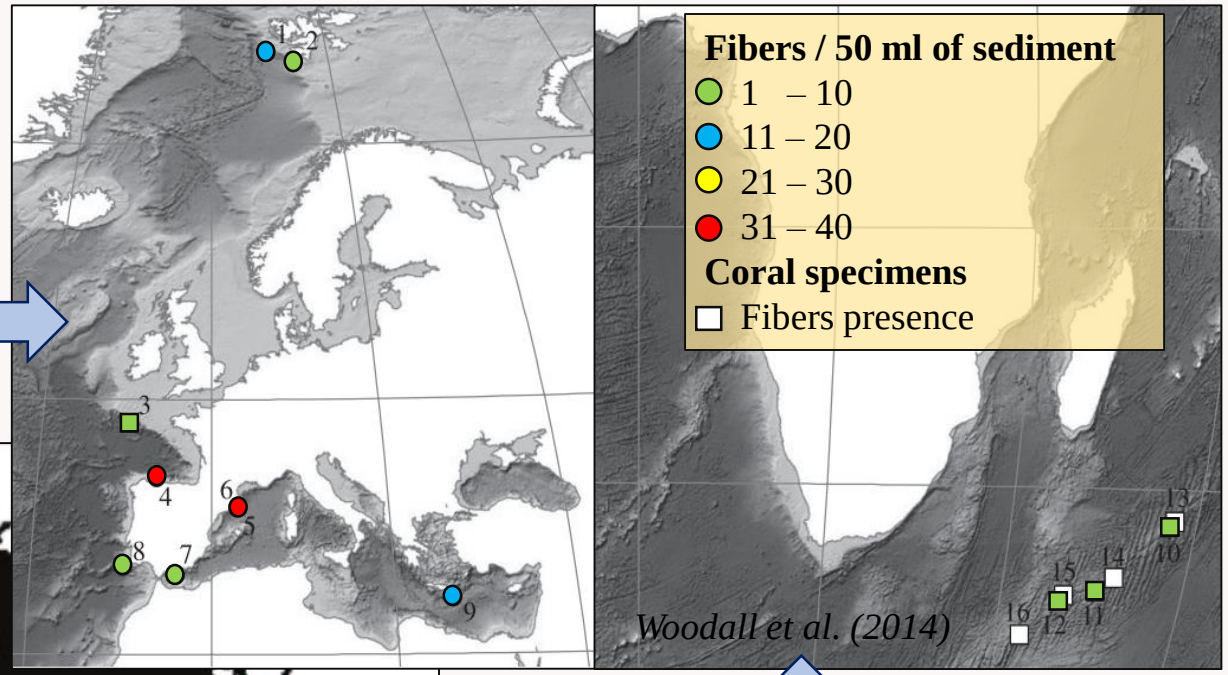
Distribution

- **Marine Environments**

Sediments

Proximity to cities





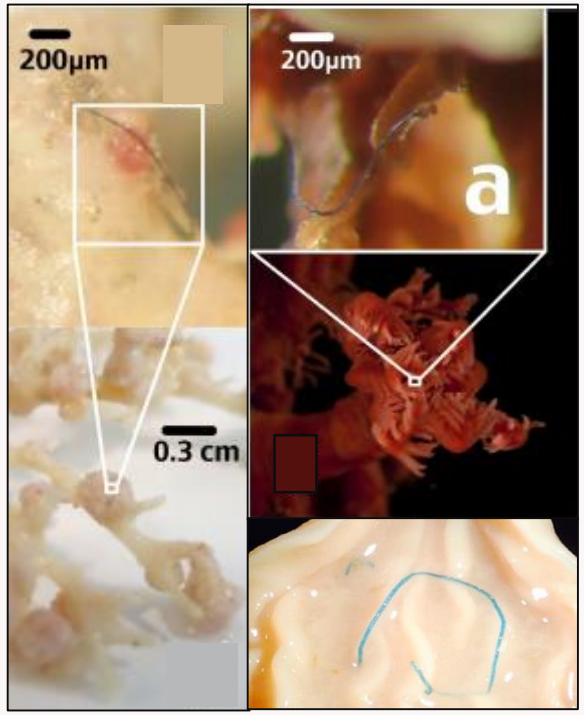
Cellulose: toilet paper

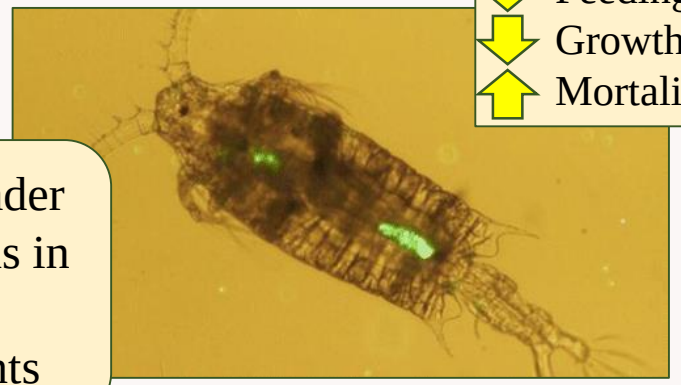
Impacts

- **Marine organisms**

MPs > 100 species [plankton to whales]

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





Feeding
Growth
Mortality

Measured under lab conditions in critical environments

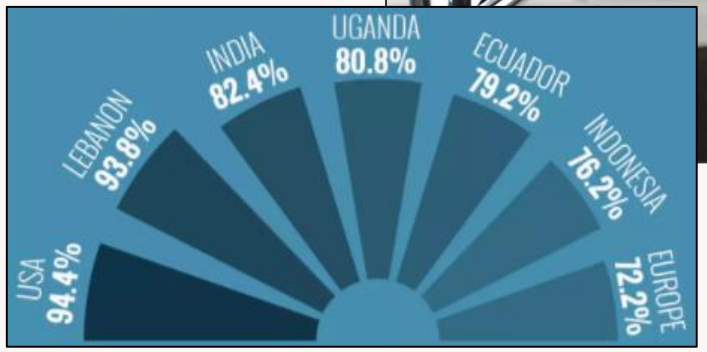
Index

Impacts

- **Humans**

Impacts: no studies made

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



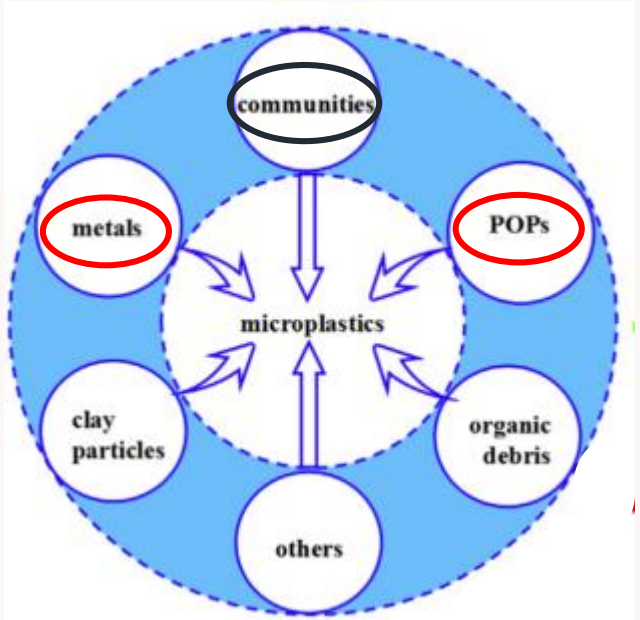
4-10 MF/l

11,000 MPs per year from eating shellfish!

Index

Impacts

- **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

- **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

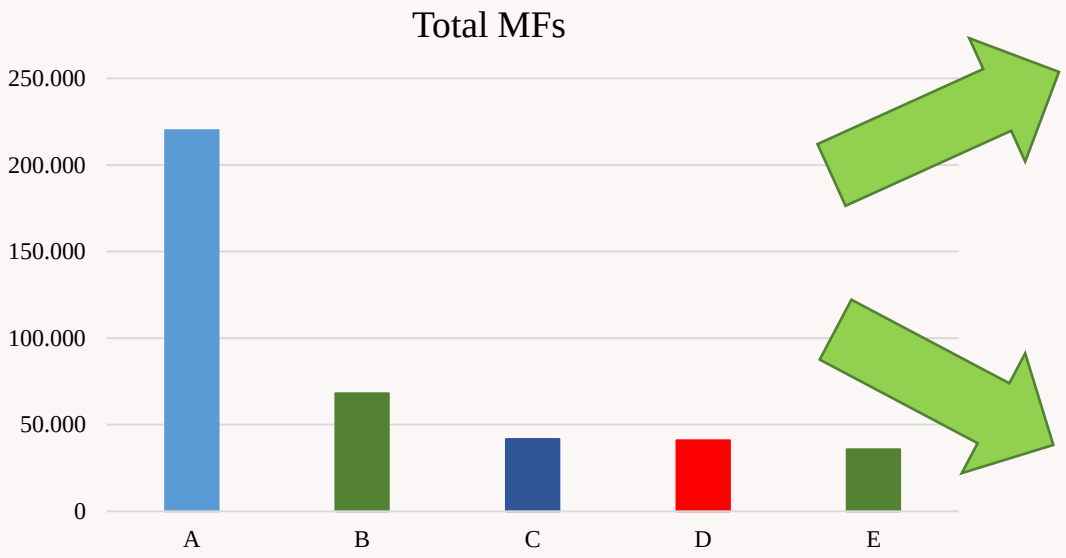
- **Measured Microfibers' Detachment**
  - Direct
  - Replicability: E = 8%; CV = 11%

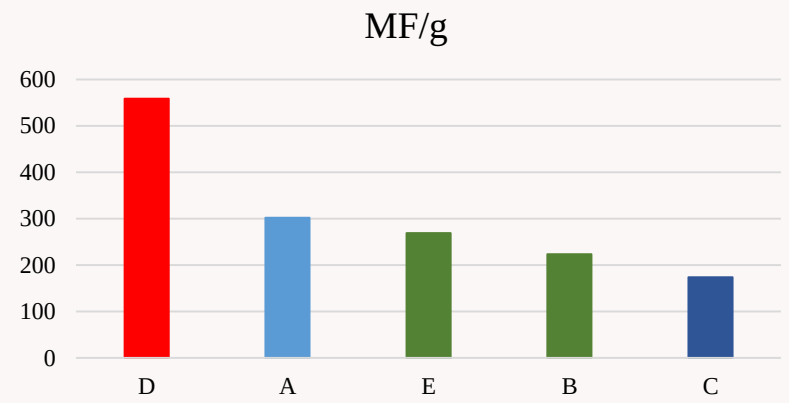
A- PES | B- PES/EL | C- PES | D- EL/PA | E- PES/EL

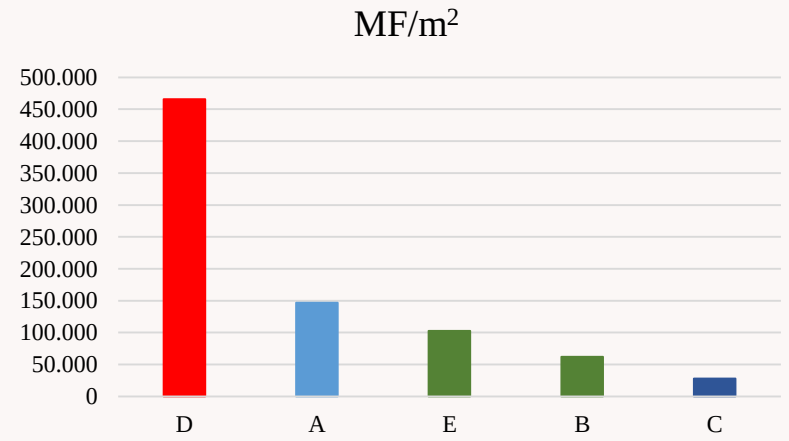
Index

Textile Microfibers

- **Measured Microfibers' Detachment**







Index

Textile Microfibers

- **"Solutions"**

Better practices

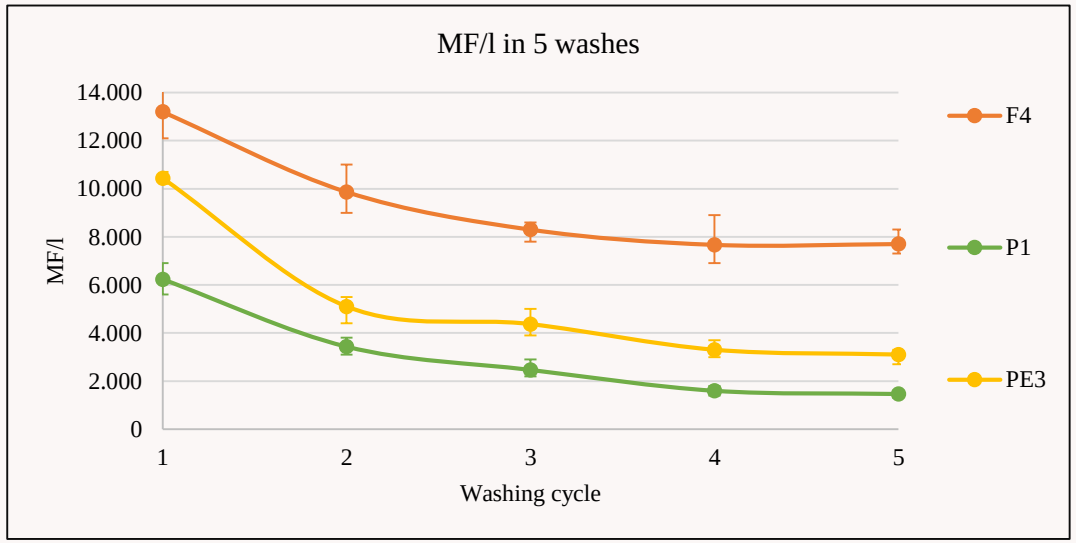
- Less synthetic
- Full washing machine
- Liquid soap
- Colder water
- Front-loading
- …

(*plasticpollutioncoalition.org*)

Index

Textile Microfibers

- **INTEXTER Future works**
  - Normalized methods
  - Indoor microfibers
  - Industrial, evaluate:
    - Quantity
    - Solutions



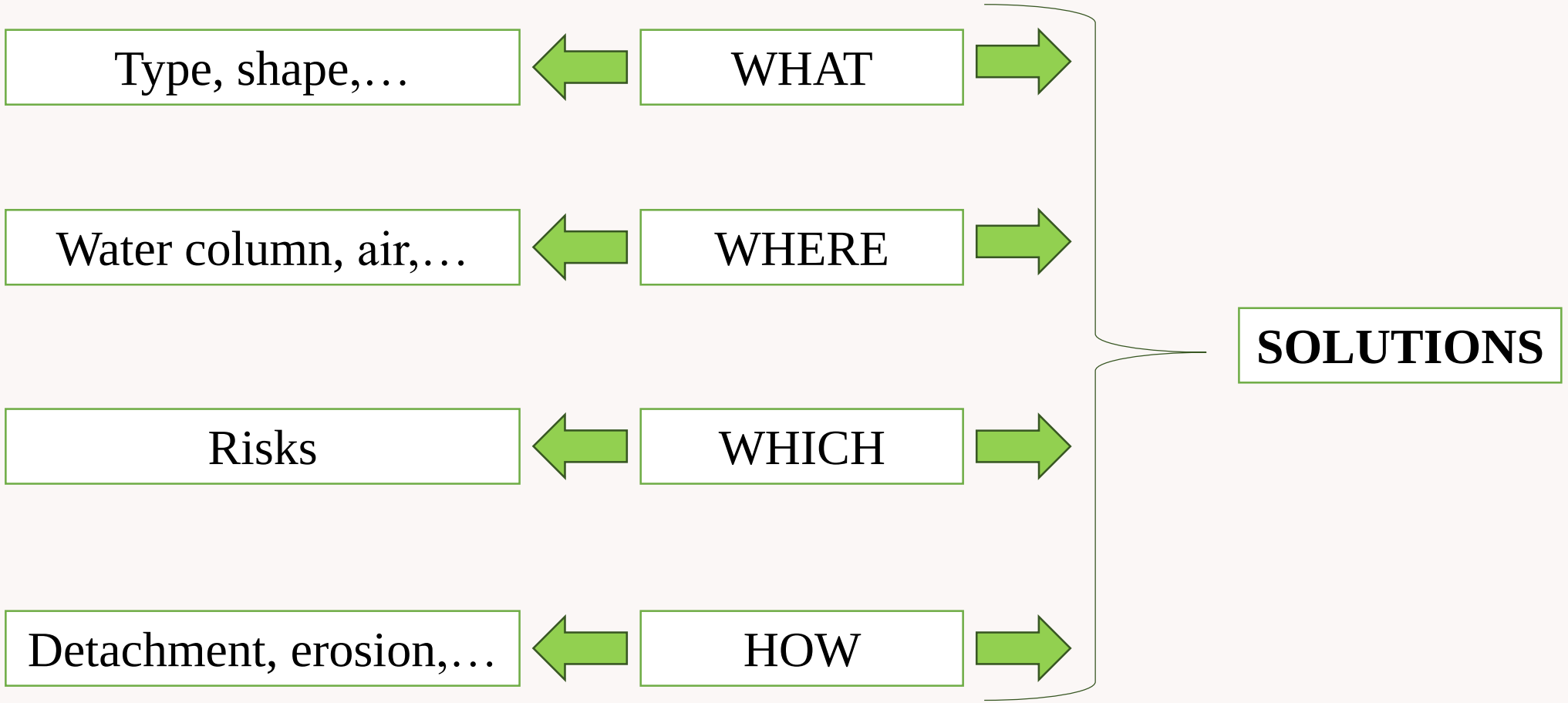
Index

Conclusions

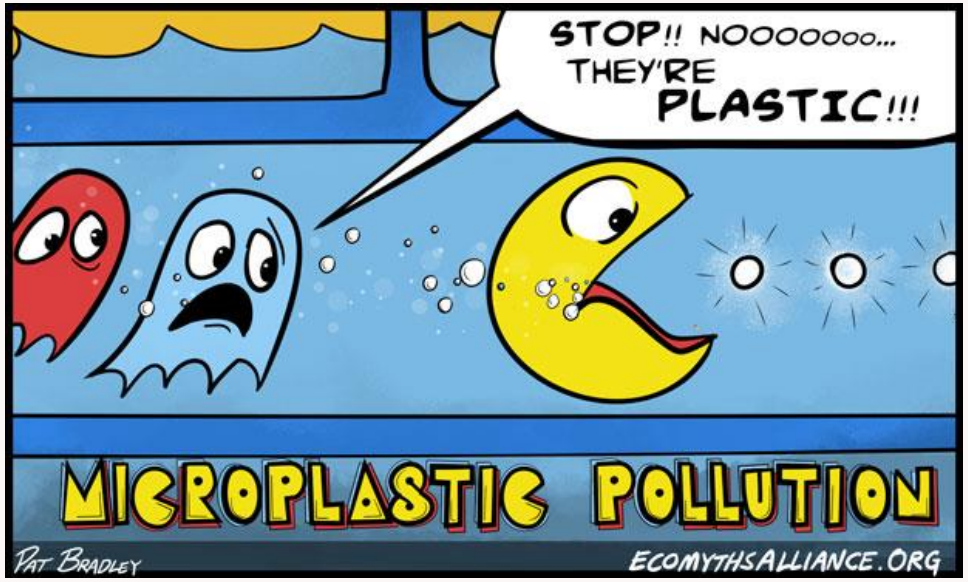
- Not well defined
- Presented everywhere, ubiquitous in marine environments
- High potential risks for organisms
- Risks for humans? Food, tap water,…
- Main primary: textile, tires, city dust
- Fibers are the most abundant?

Conclusions – Questions

Index



THANKS!


STOP!! NOOOOOOO... THEY'RE PLASTIC!!!
MICROPLASTIC POLLUTION
PAT BRADLEY
ECOMYTHSALLIANCE.ORG