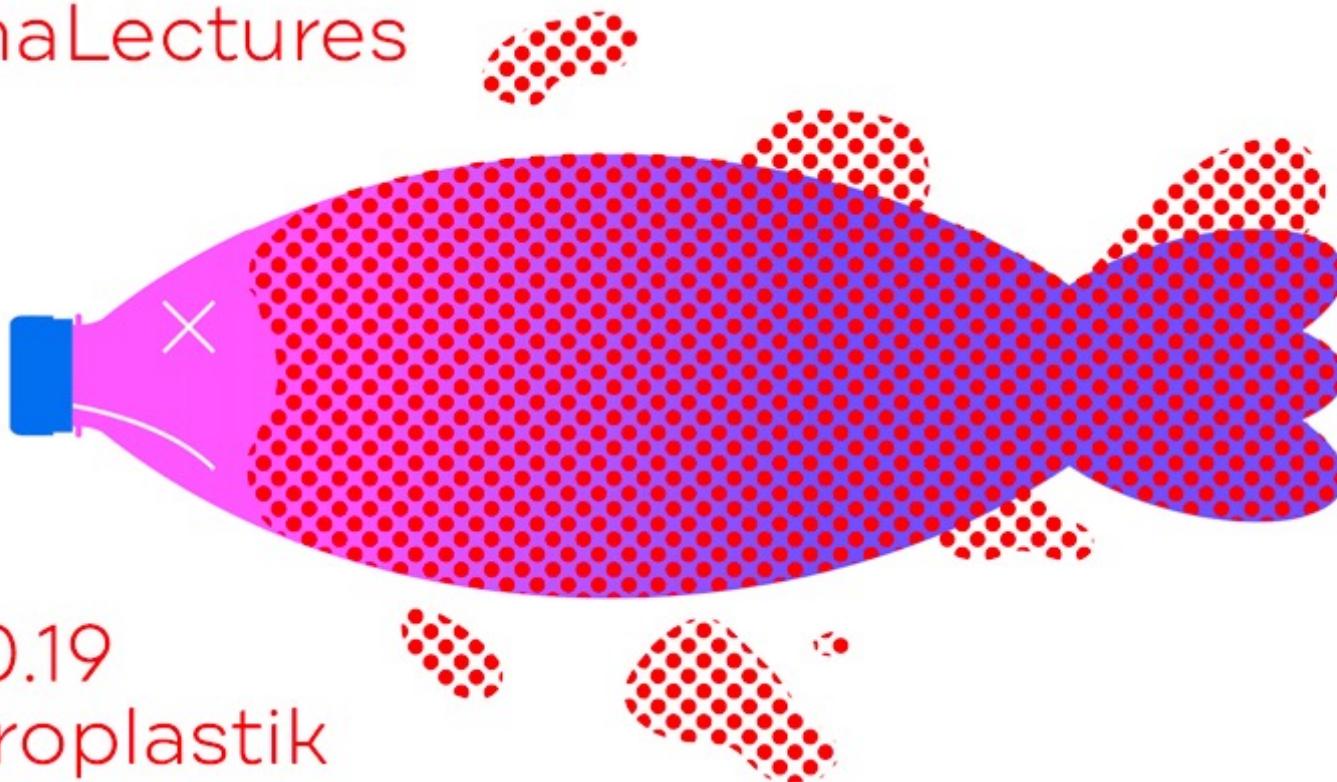




Die Junge Akademie

KlimaLectures #1



18.10.19
Mikroplastik

Aus der Steinzeit in die Plastikzeit?





1907 Bakelite

The robust phenolic resin was used for the production of telephones, radios and light switches for instance.



1850 Celluloid

Versatile and highly inflammable material made of cellulose which was used for the production of the first films but also jewellery.



1939 Nylon

The world's first truly synthetic fibre offering durability.



Courtesy of DuPont

Offering lightweight, high shock absorption and esthetic performance.



2013 Plastic prostheses

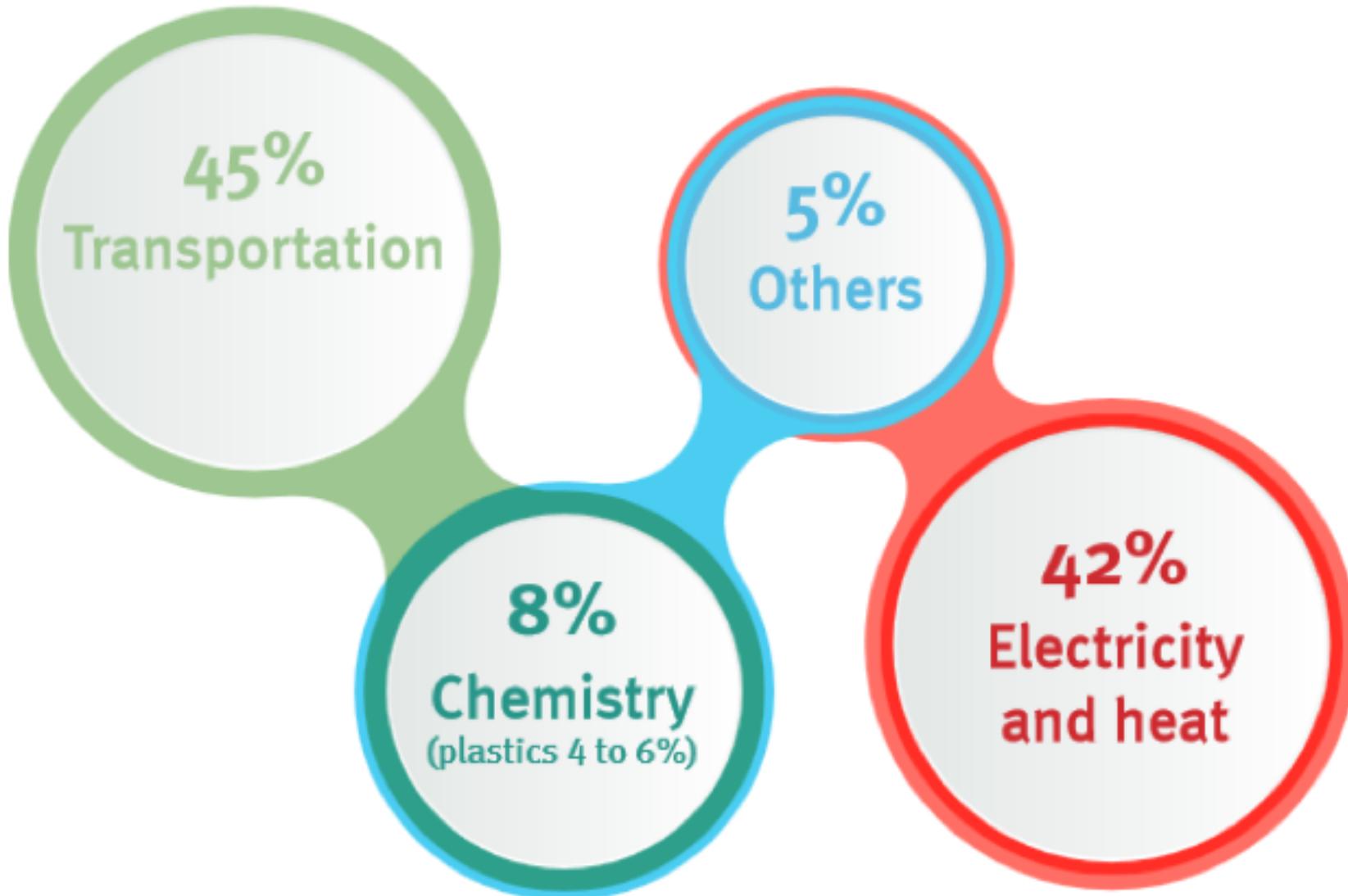
Thanks to plastics, we can push our limits much further.

Plastik – das Material unserer Zeit

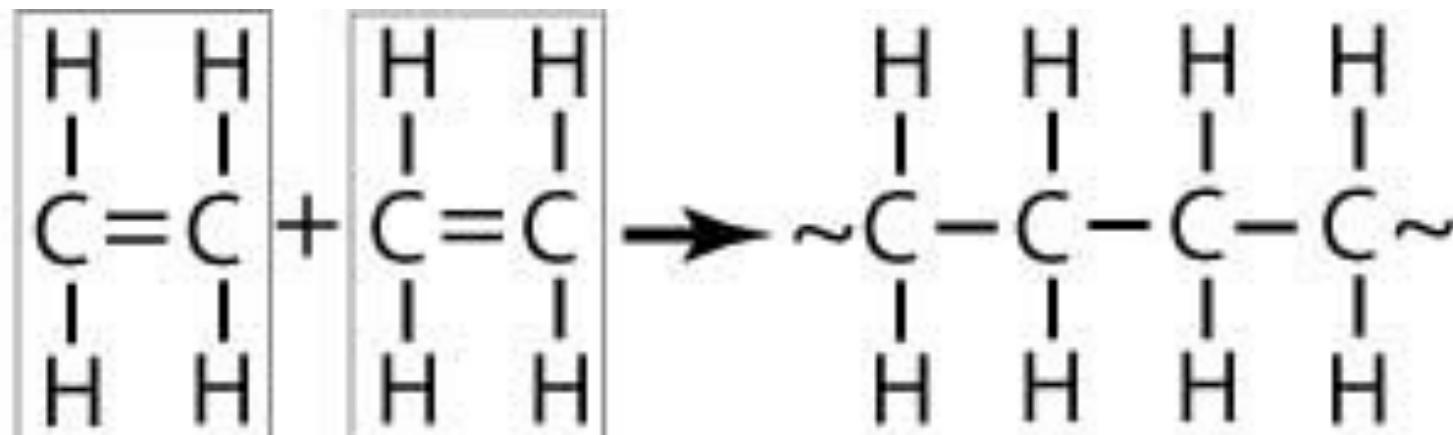


greenpeace.org

Plastik wird aus Erdöl produziert



Polymere – beständig und formbar

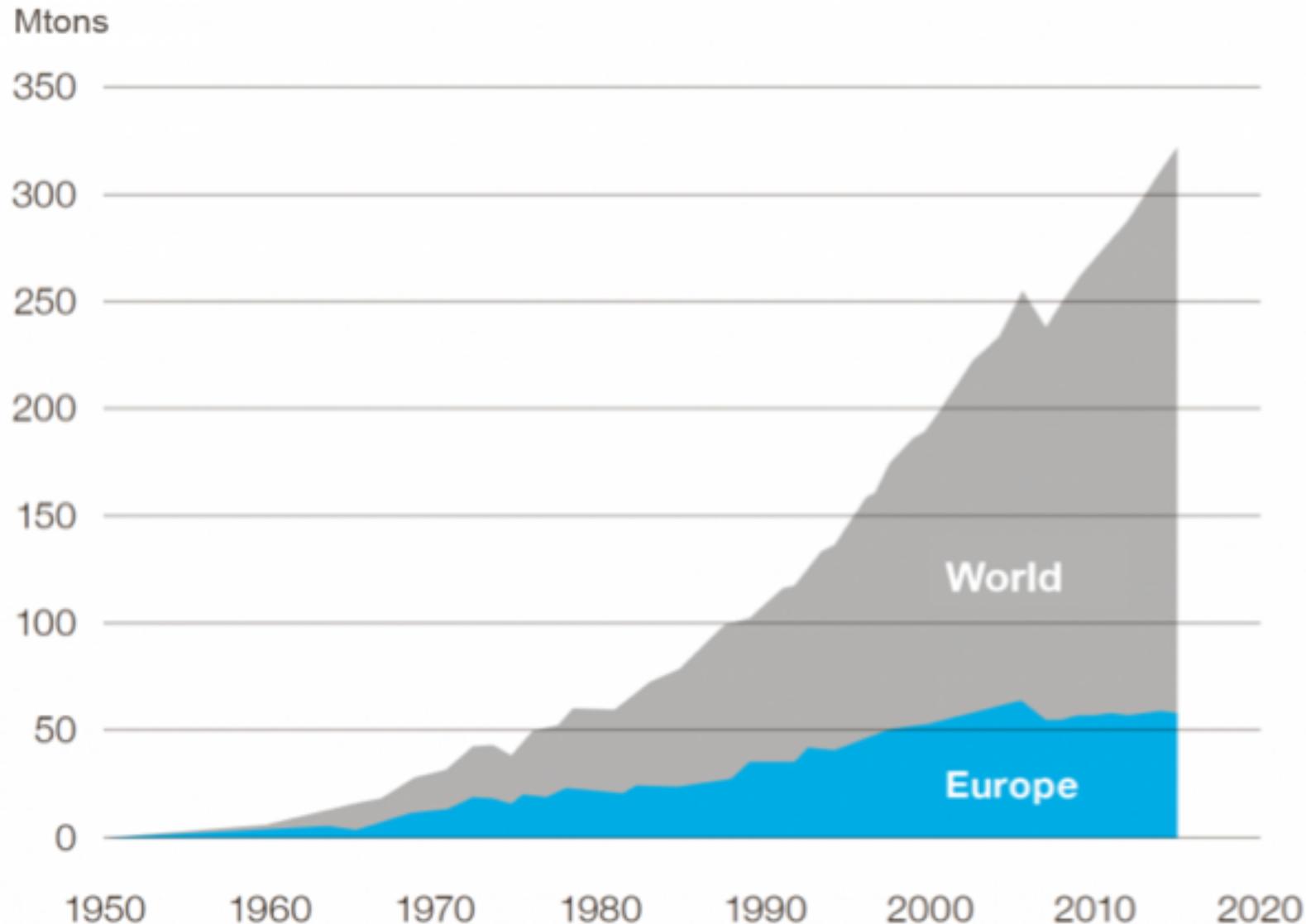


Ethylene mer units

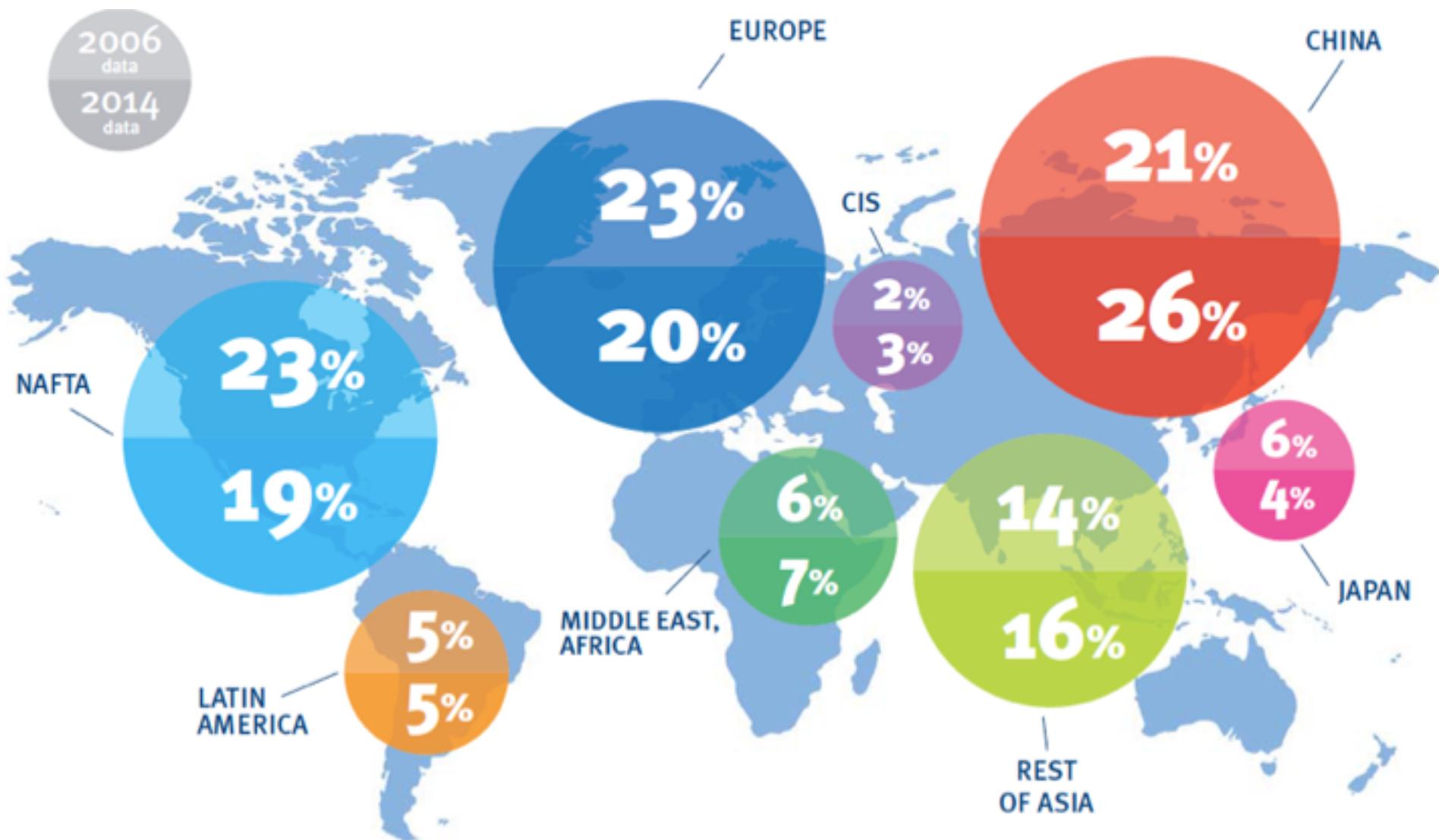
Polymerization
by opening of
double bonds



Globale Plastikproduktion seit 1950



Wo wird das Plastik produziert?



Wo wird Plastik eingesetzt?



39.5%



20.1%



3.4%



5.7%



8.6%

Agriculture

Electrical & electronic

Automotive

Building & construction

Packaging

Others*

22.7%

* Others: include sectors such as consumer and household appliances, furniture, sport, health and safety

Was passiert mit dem Plastikmüll?

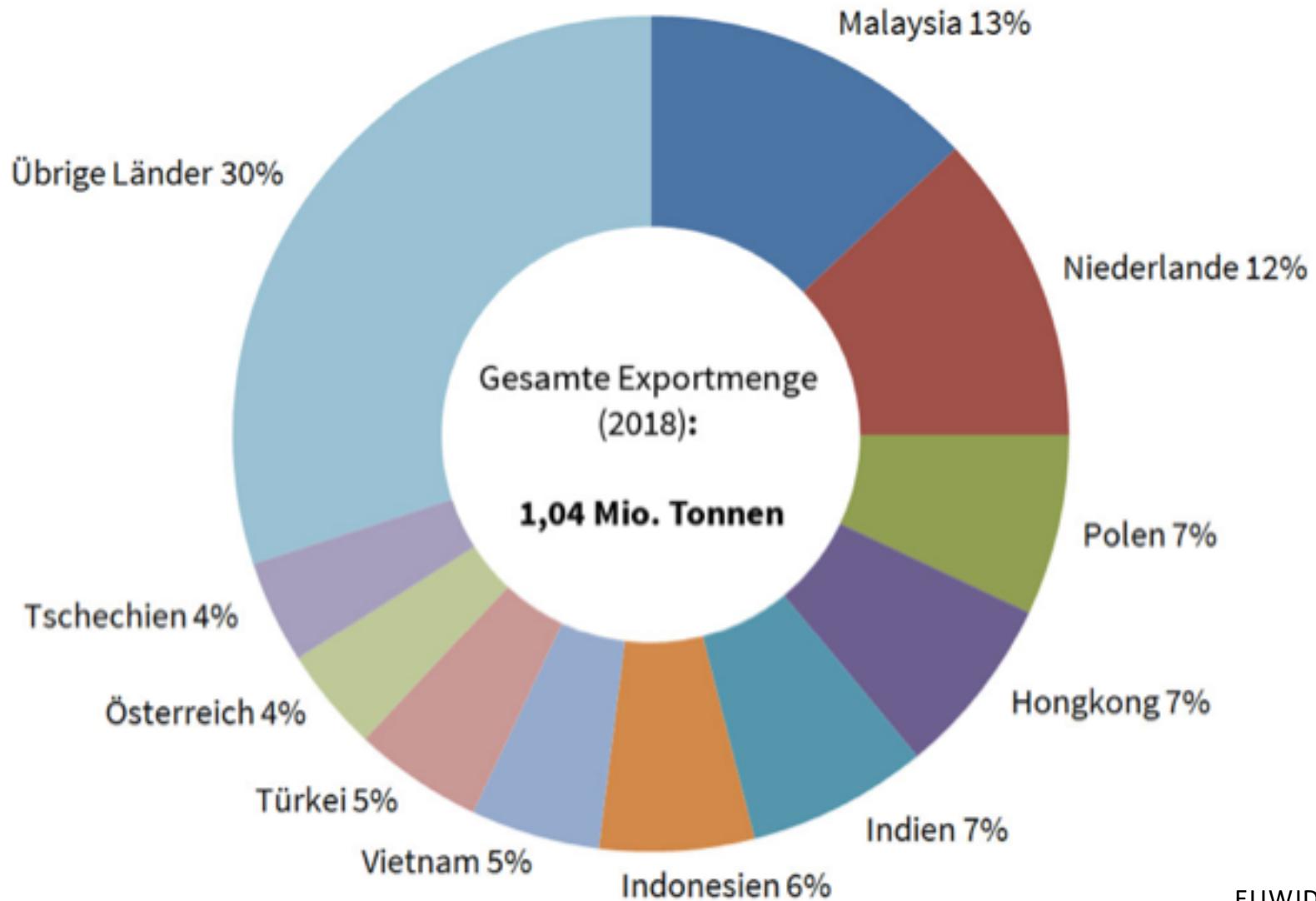


Plastic post-consumer
waste rates of recycling,
energy recovery
and landfill
per country in 2016

PlasticsEurope 2017

- Recycling
- Energy Recovery
- Landfill
- Countries with landfill restriction implemented

Deutscher Plastikmüllexport 2018

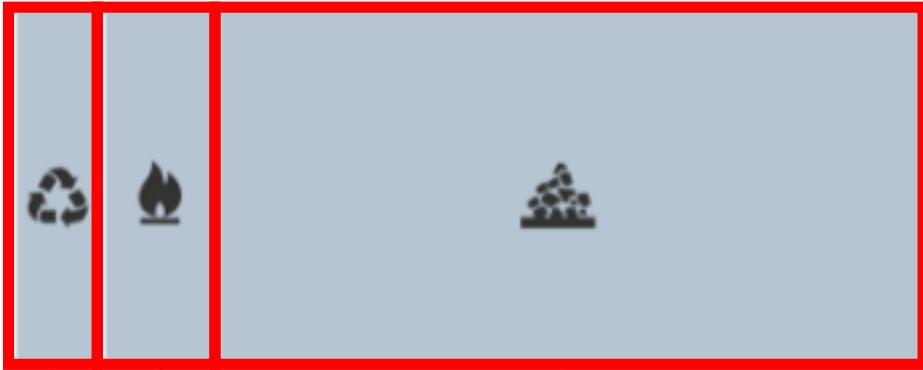


Der grosse Abfall

An estimated **8.3bn tonnes**
of virgin plastic has been produced to date



As of 2015, approximately **6.3bn tonnes**
of plastic waste had been generated

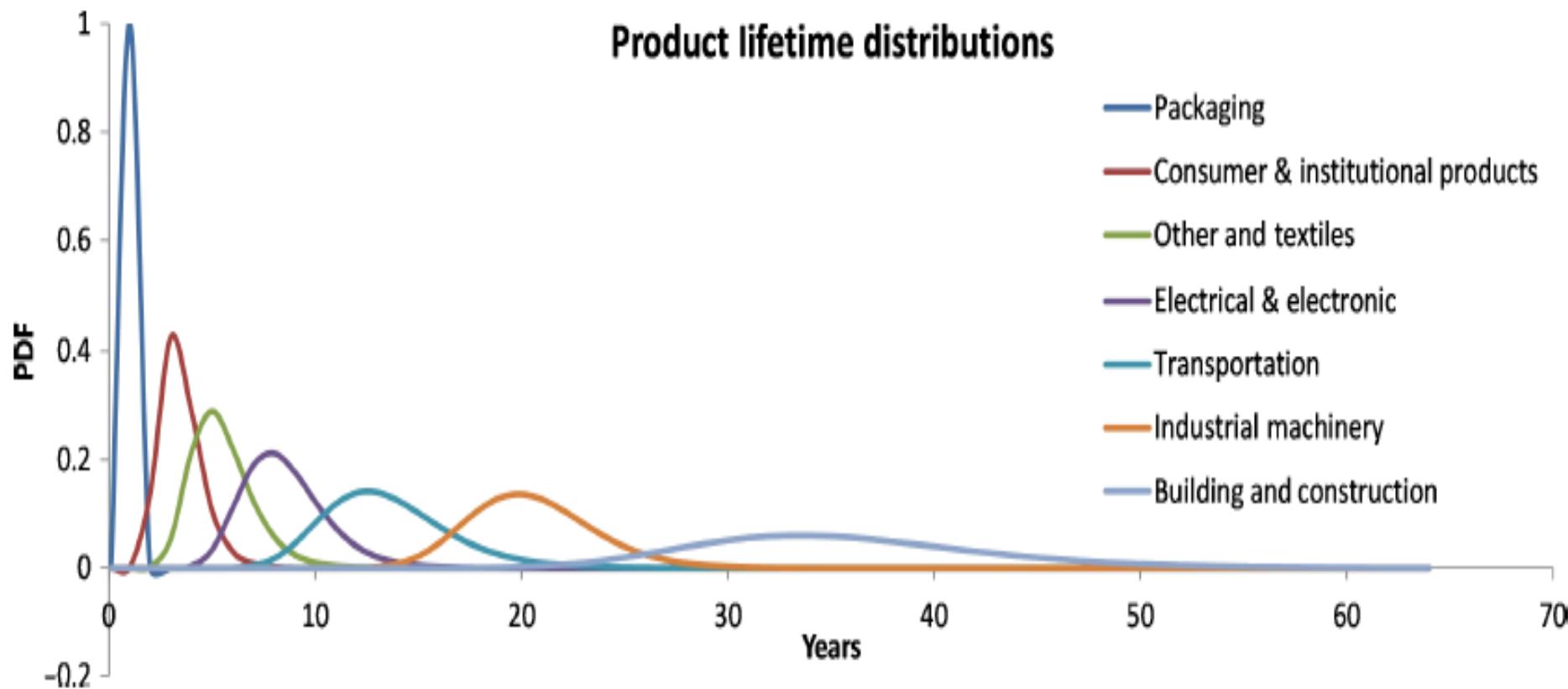


9% recycled

12% incinerated

79% accumulated
in landfills or the natural environment

Nutzungsdauer Plastikprodukte



Was ist Mikroplastik?

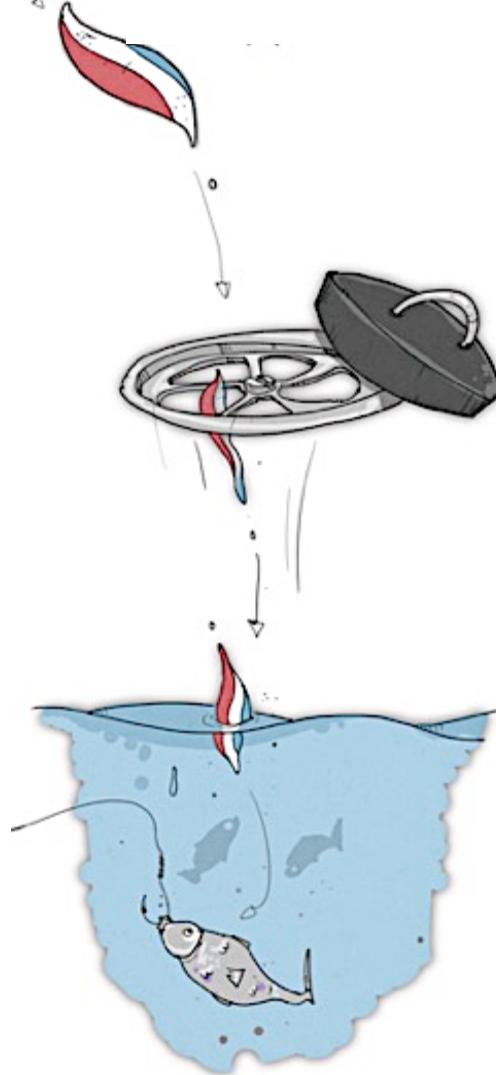


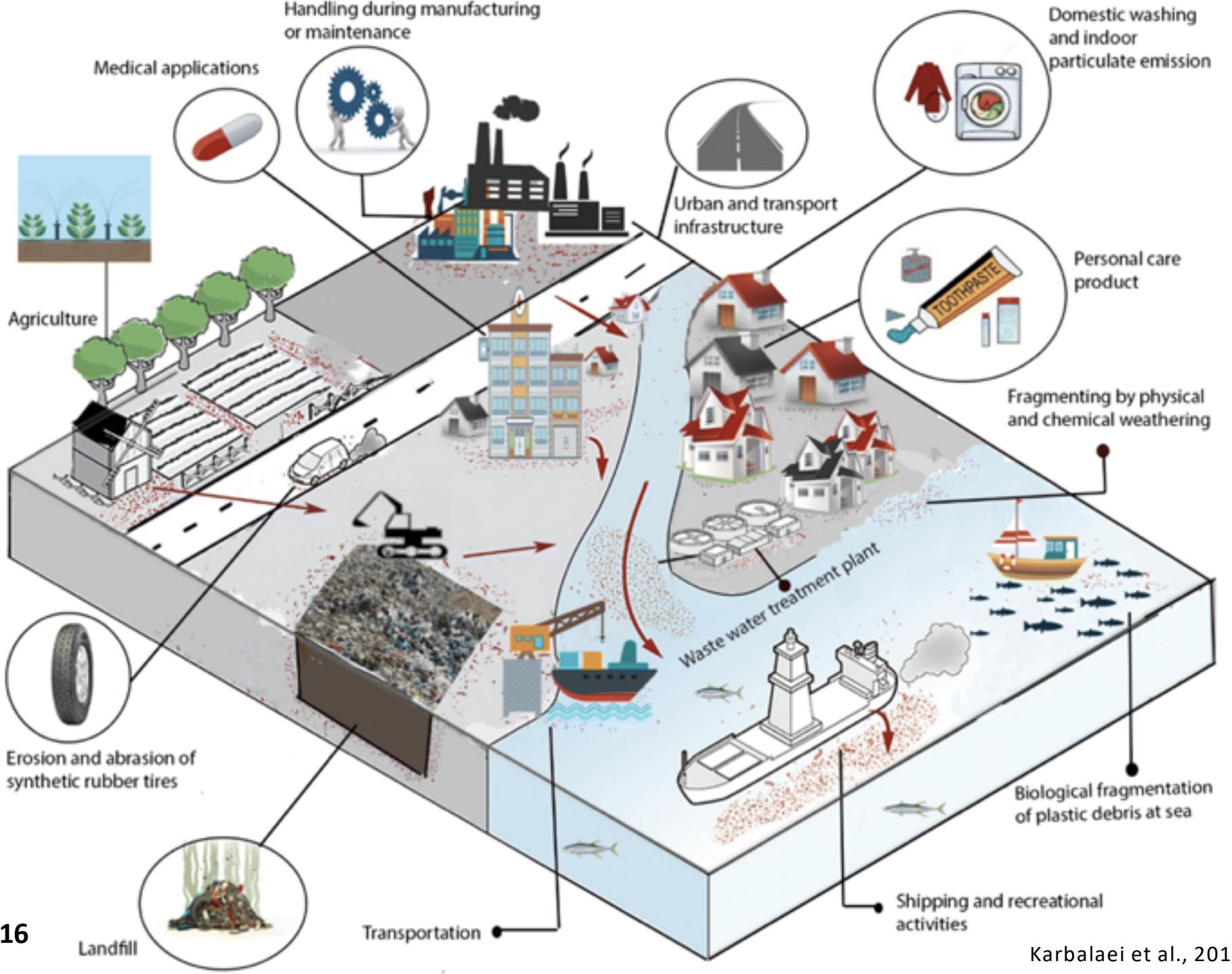
Zwei Mikroplastik-Typen

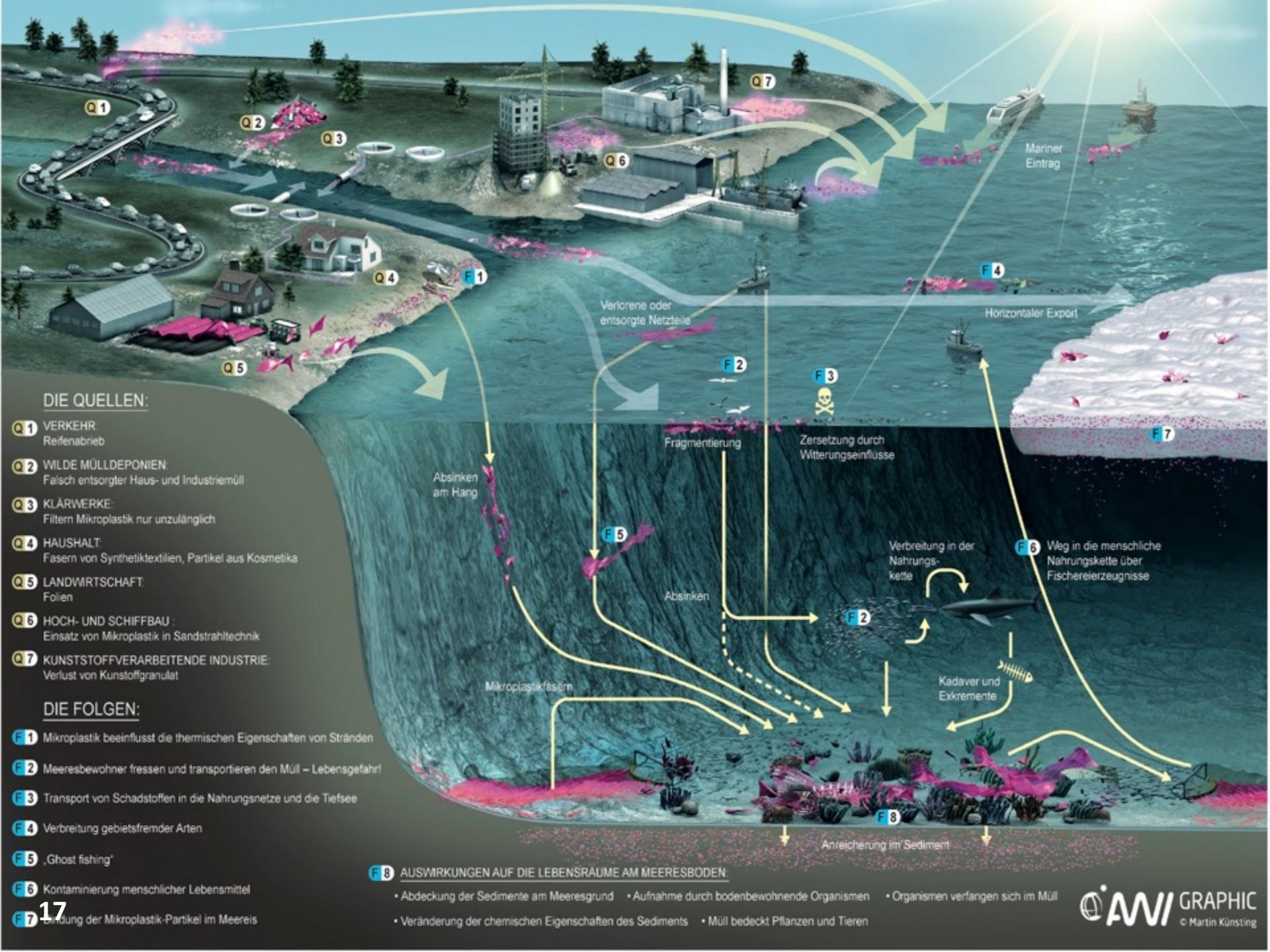
Sekundär



Primär







DIE QUELLEN:

- Q 1 VERKEHR:**
Reifenabrieb
 - Q 2 WILDE MÜLLDEPONIEN:**
Falsch entsorgter Haus- und Industriemüll
 - Q 3 KLÄRWERKE:**
Filtern Mikroplastik nur unzulänglich
 - Q 4 HAUSHALT:**
Fasern von Synthetiktextilien, Partikel aus Kosmetika
 - Q 5 LANDWIRTSCHAFT:**
Folien
 - Q 6 HOCH- UND SCHIFFBAU:**
Einsatz von Mikroplastik in Sandstrah 技术
 - Q 7 KUNSTSTOFFVERARBEITENDE INDUSTRIE:**
Verlust von Kunststoffgranulat

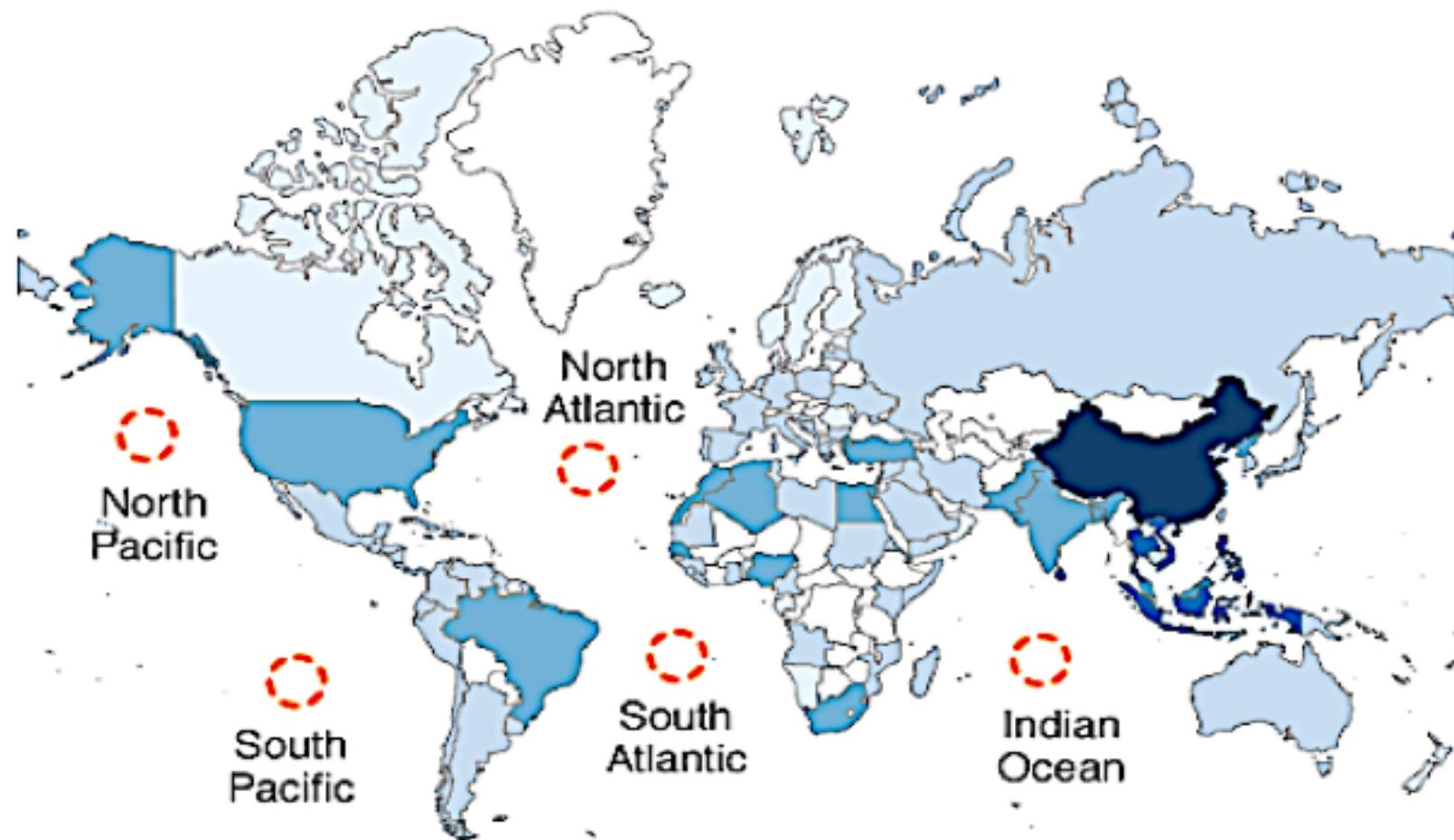
DIE FOLGEN:

- F 1 Mikroplastik beeinflusst die thermischen Eigenschaften von Stränden
 - F 2 Meeresbewohner fressen und transportieren den Müll – Lebensgefahr
 - F 3 Transport von Schadstoffen in die Nahrungsnetze und die Tiefsee
 - F 4 Verbreitung gebietsfremder Arten
 - F 5 „Ghost fishing“
 - F 6 Kontaminierung menschlicher Lebensmittel
 - F 7 Anreicherung der Mikroplastik-Partikel im Meereis

F 8 AUSWIRKUNGEN AUF DIE LEBENS RÄUME AM MEERESBODEN:

- Abdeckung der Sedimente am Meeresgrund
 - Aufnahme durch bodenbewohnende Organismen
 - Organismen verfangen sich im Müll
 - Veränderung der chemischen Eigenschaften des Sediments
 - Müll bedeckt Pflanzen und Tiere

Landteintrag von Plastik in die Ozeane



Jambeck et al., 2015

Mismanaged plastic
waste, tonnes

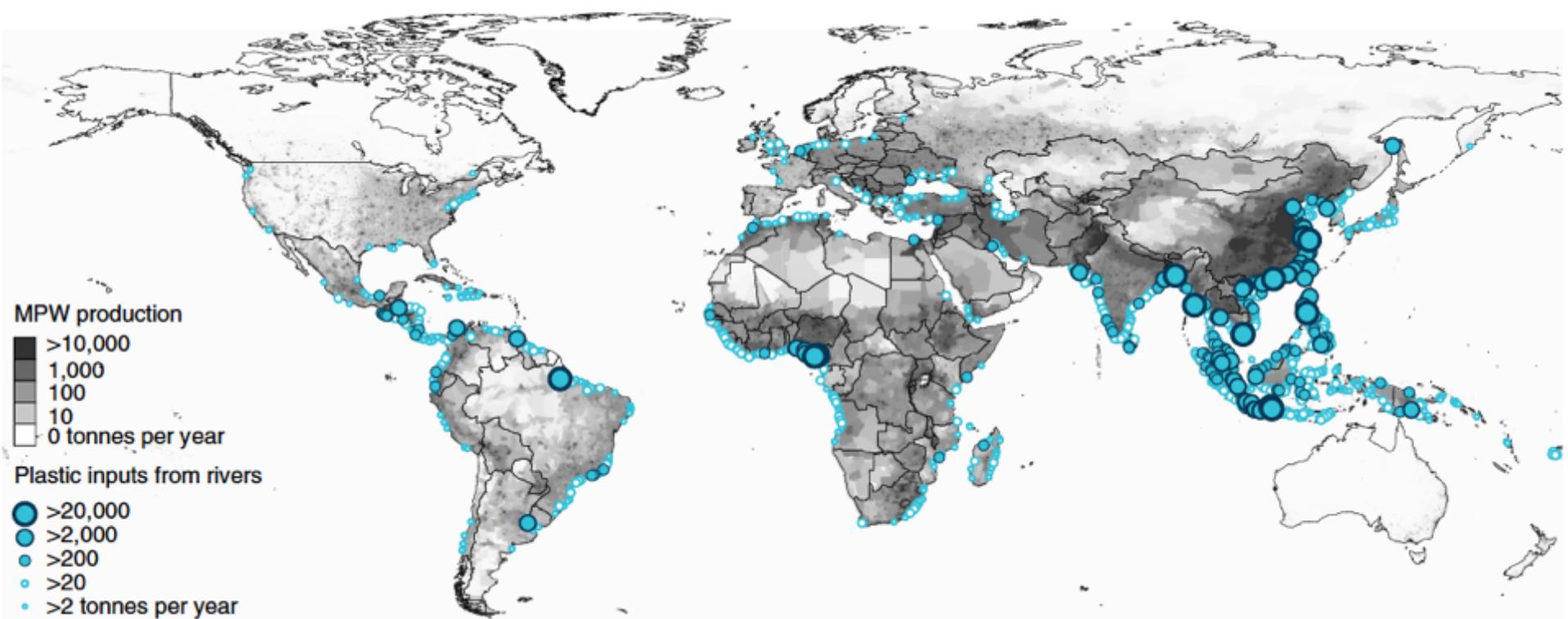
18

0 > 5 million



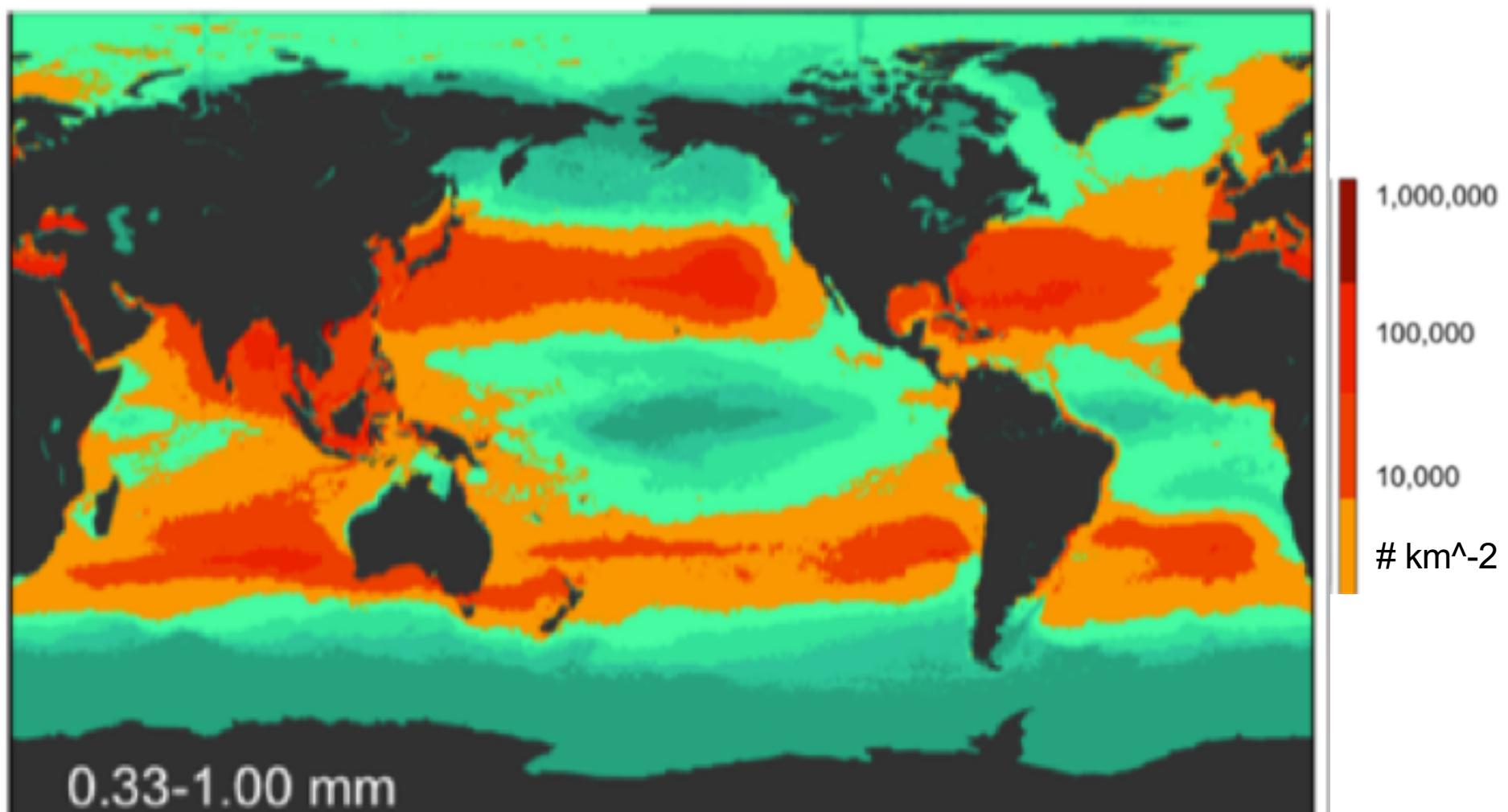
Gyres - Whirlpools of water which trap
huge collections of waste in their currents

Flüsse als Plastikzulieferer



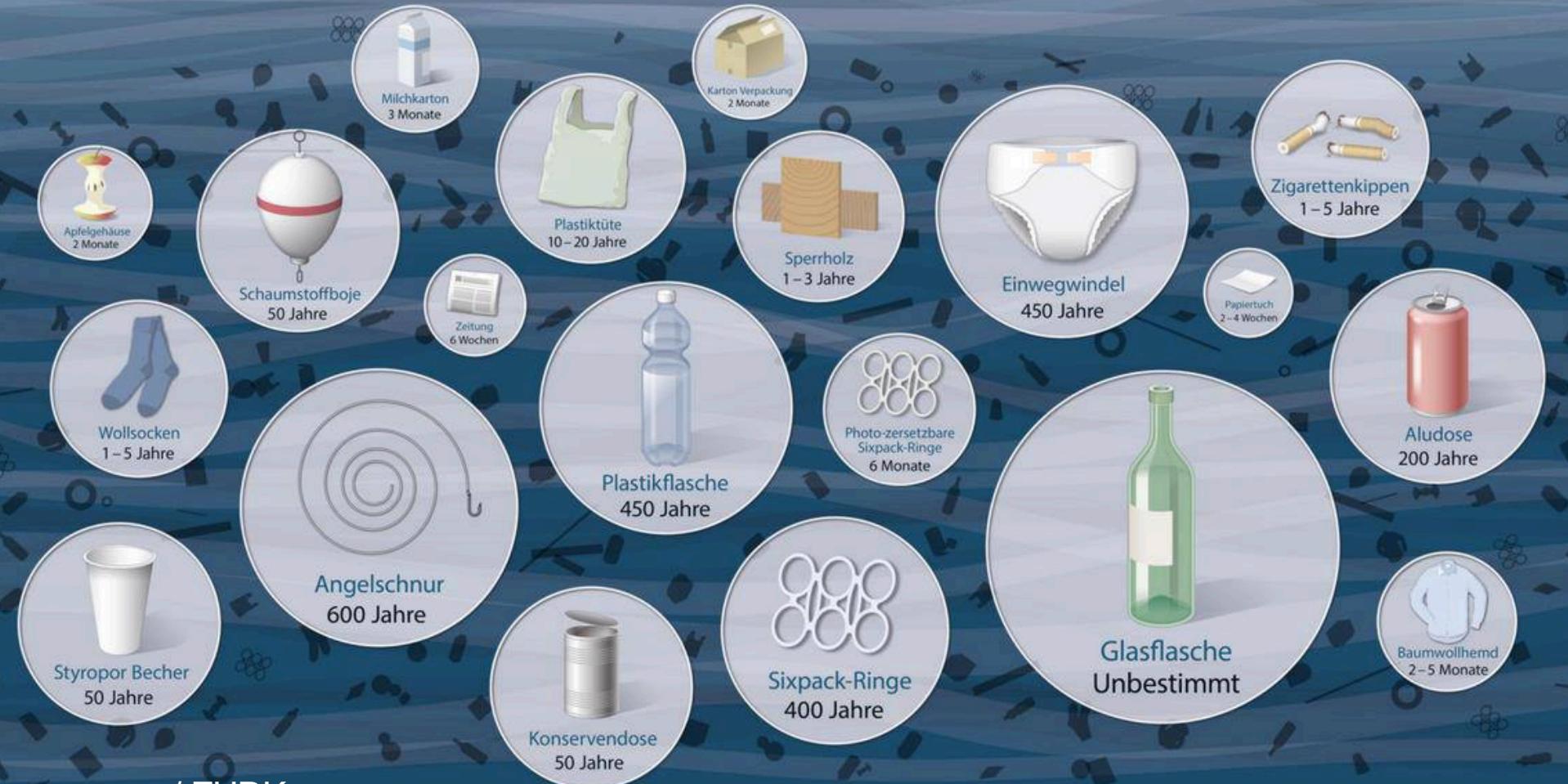
Lebreton et al., 2017

5 250 000 000 000 MP-Partikel in den Weltmeeren



WIE LANGE BLEIBT DER ABFALL?

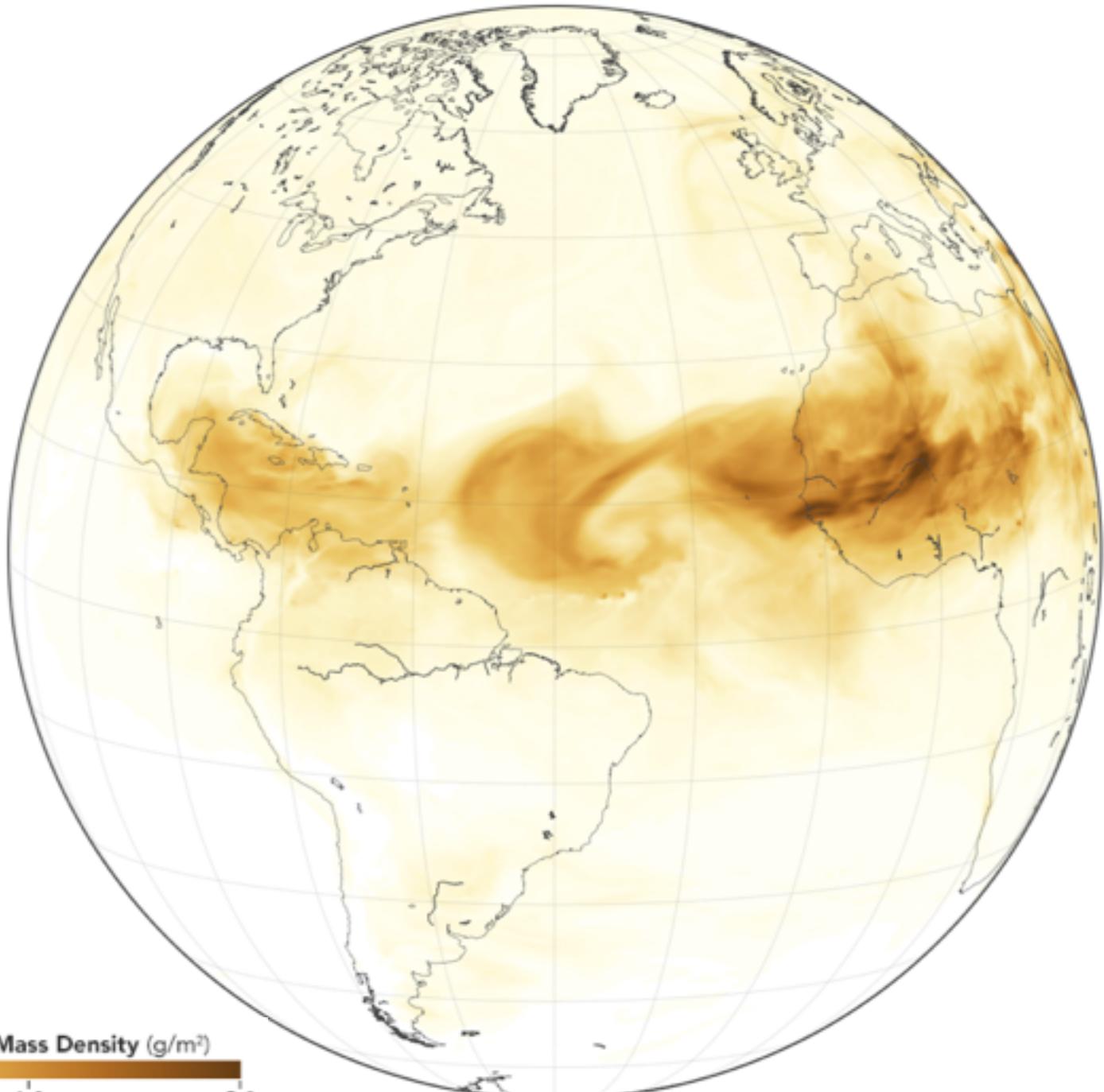
Geschätzte Abbaizeiten von häufigem Schwemmgut



Die geschätzten Abbaizeiten der einzelnen Objekte sind abhängig von der konkreten Materialzusammensetzung und den Umweltbedingungen.

Quelle: NOAA (National Oceanic and Atmospheric Administration), US / Woods Hole Sea Grant, US.
Grafik: Oliver Lüde / Museum für Gestaltung Zürich, ZhdK





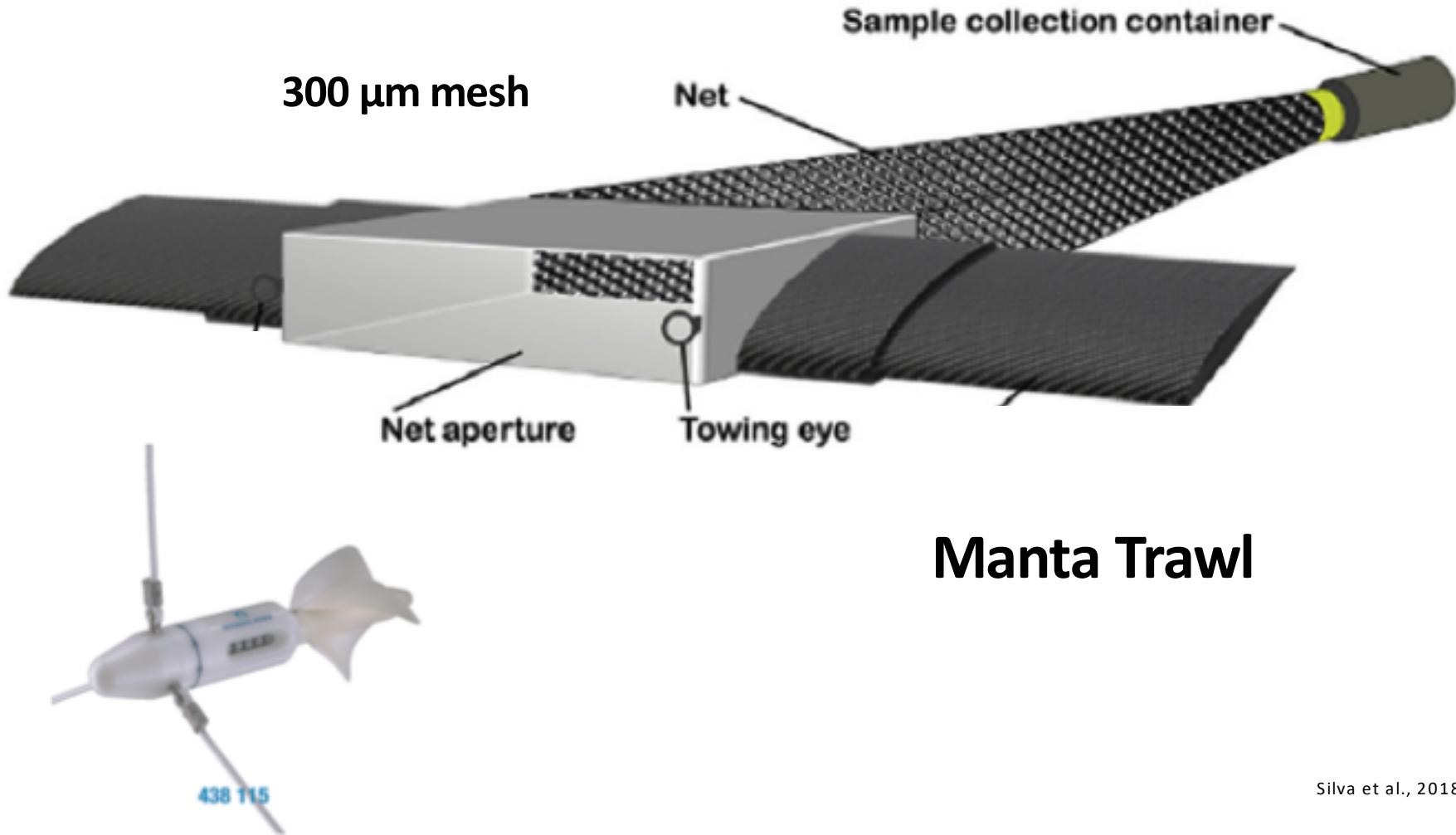
23

Dust Column Mass Density (g/m^2)

0.0 1.0 2.0

NASA, 2018

Wie detektieren wir Mikroplastik in der Umwelt?



Silva et al., 2018

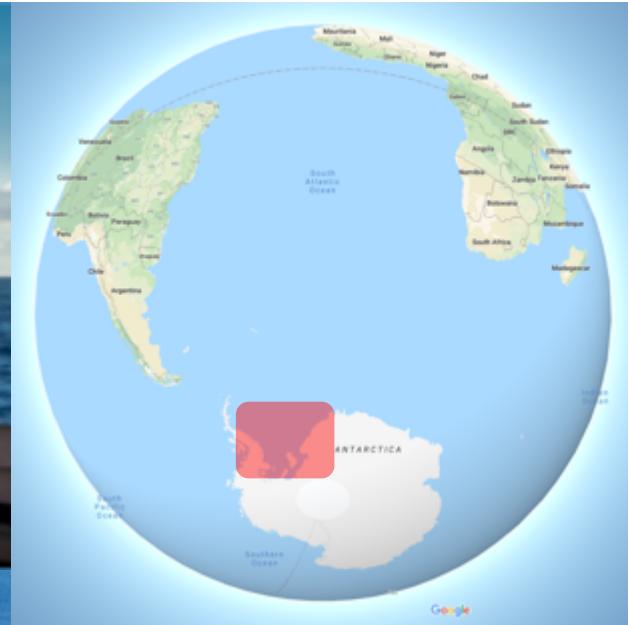
Probenahme auf dem Rhein



Das geht auch in der Antarktis

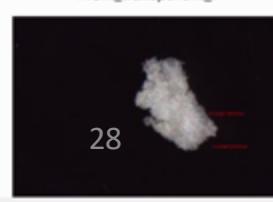
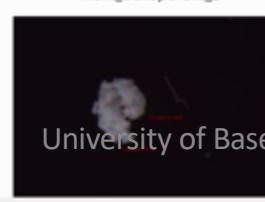
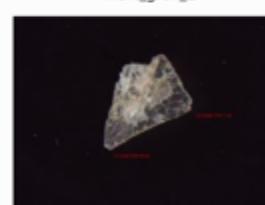
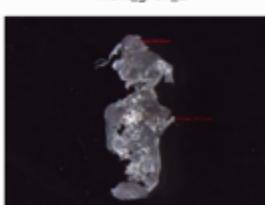
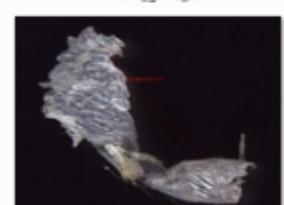
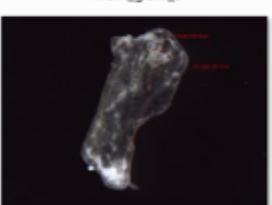
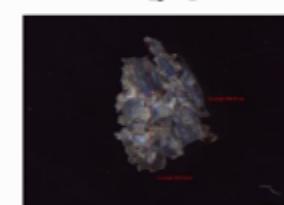
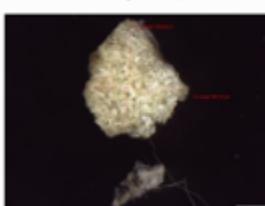
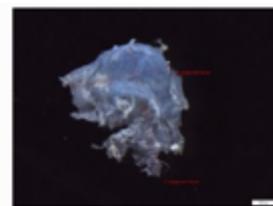
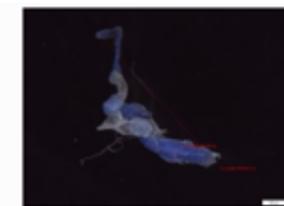
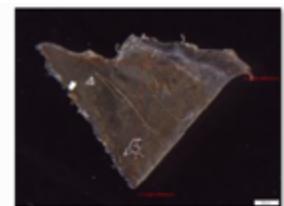
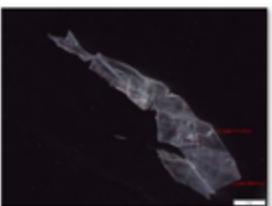


H. Grohe, 2018



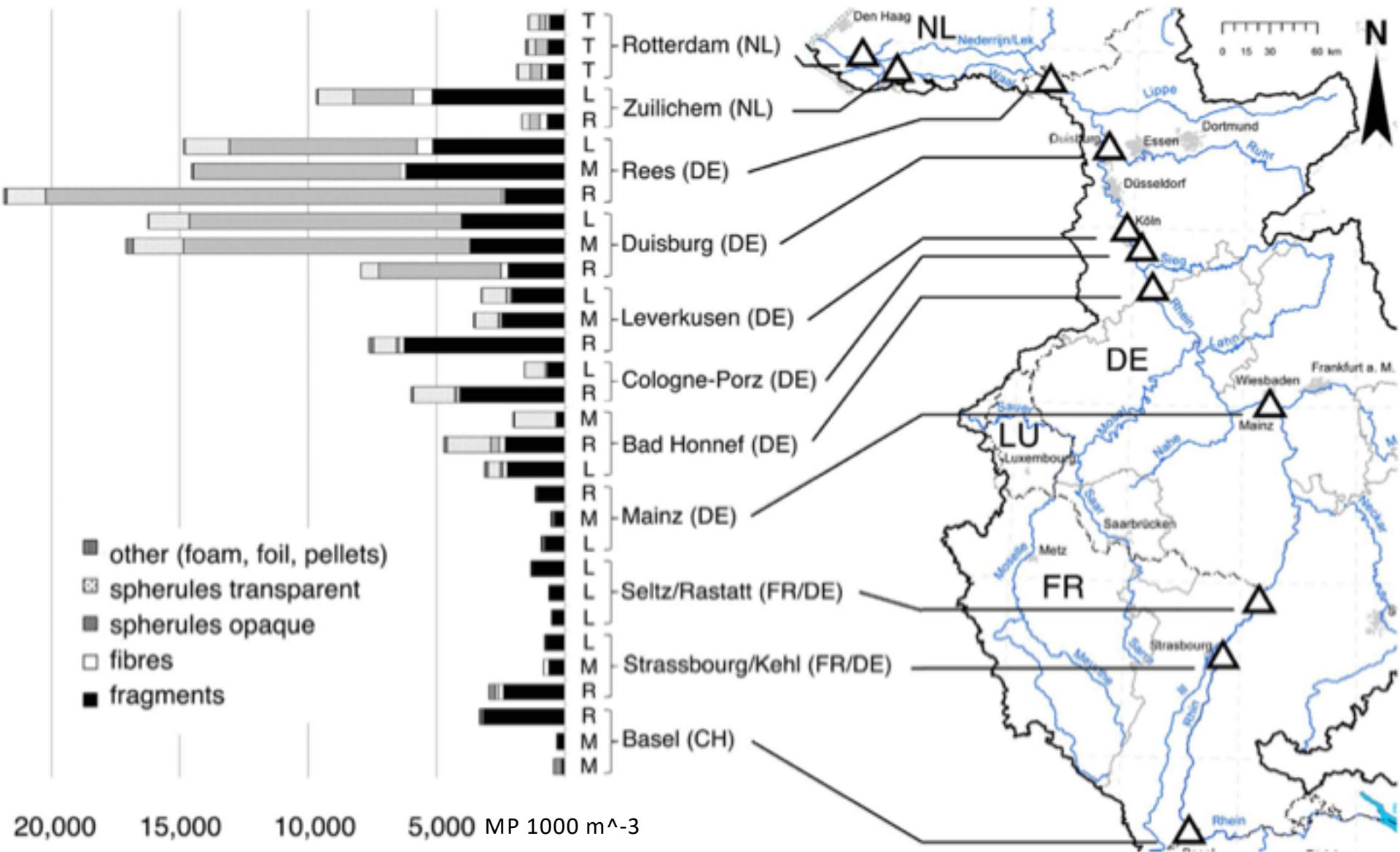


Die Farbenpracht der MP-Fragmente

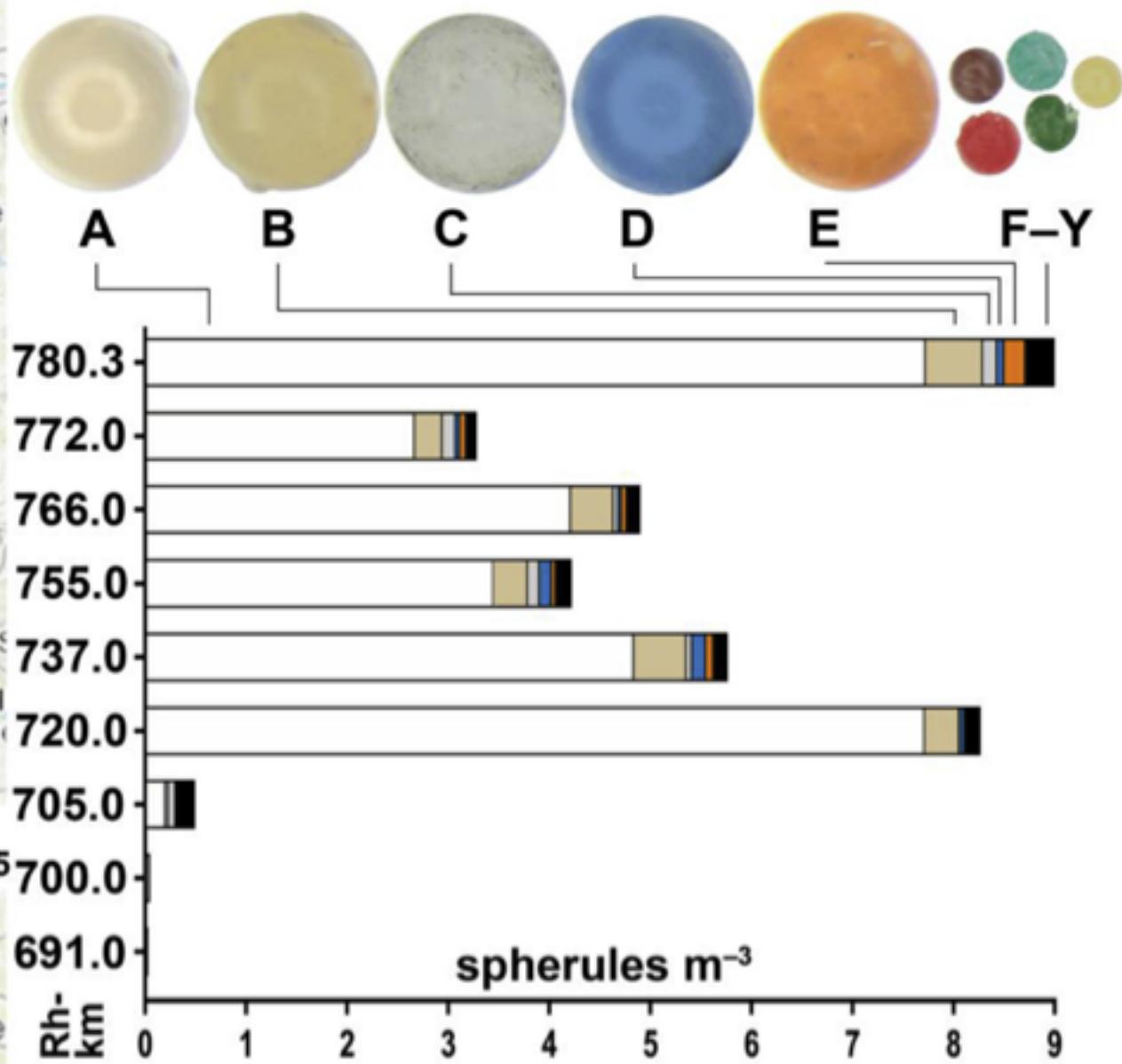


		Binokular	Olympus						
0	PMMA Kugeln, schwimmend mit Gasenchluss			Vorhanden seit Probe 1, Anzahl bewusst N.A.	N.A.				
1	Weiss/Opak Rund Gross Glänzend								
2/3	Weiss / Opak Rund Mitte/Kein								
4	Weiss / Opak Mit Dellen Matt								
5	Grau Rund Glänzend Brüchig								
6	Grau Mit Dellen Matt Porös								
7	Dunkelbraun Mit Dellen Matt								
8	Hellbraun Mit Dellen Matt								
9	Dunkelrot Bordeaux Rund Glänzend							Bild rechts :Unterschied zu transparenter Kugel	
10	Transparent Mit Dellen Matt								
11	Transparent Rund								
12	Weiss Oberlicht, rötlich bei Durchlicht, rund								
13	Hellblau Wenige Dunkelblau								
14	Grün (Gras) Spröde								
		29							

Wenn Detektivarbeit gefordert ist



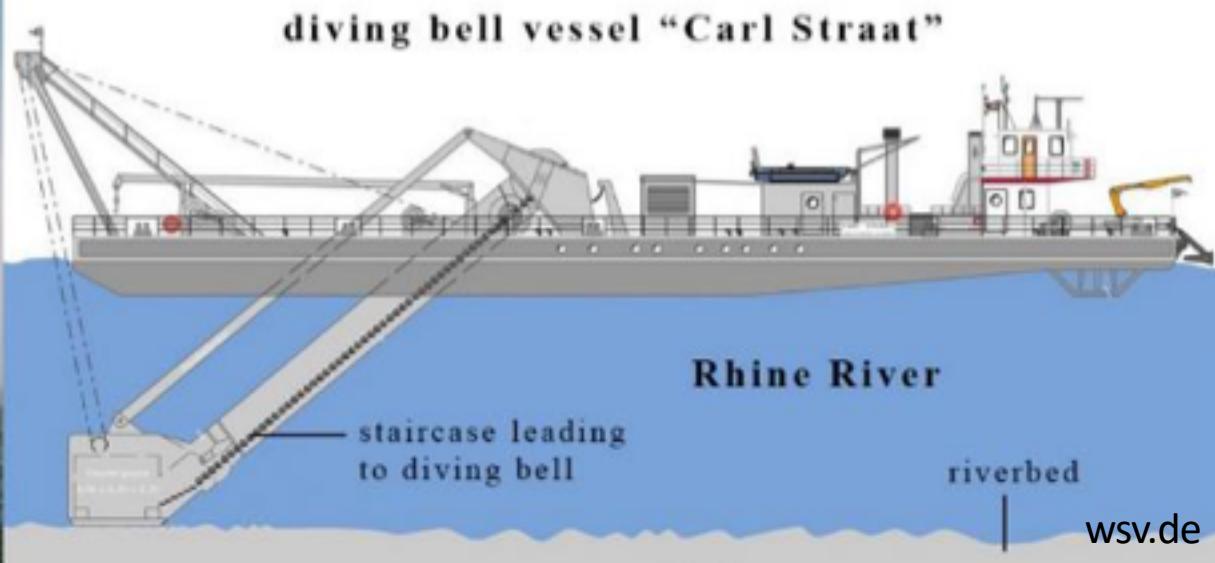
Auf der Suche nach der Quelle



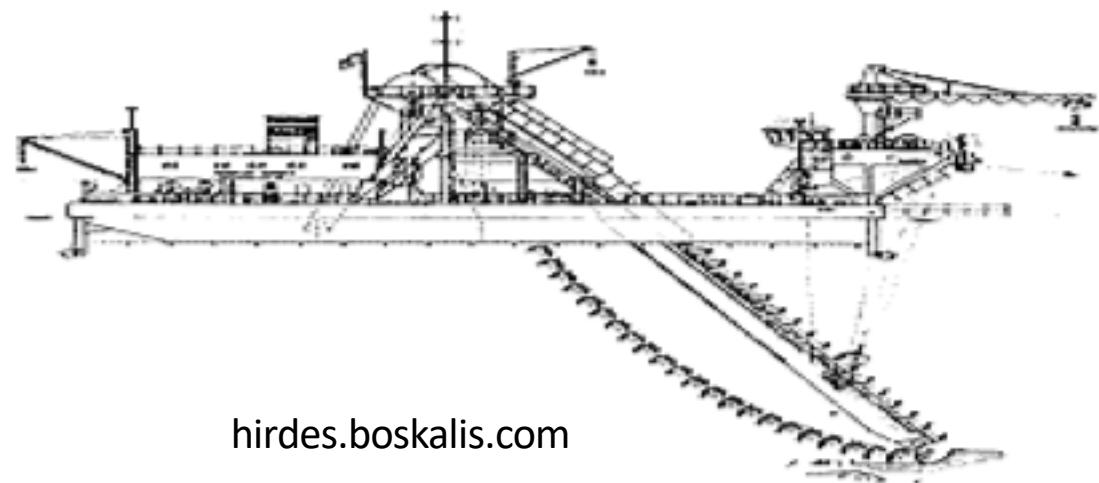
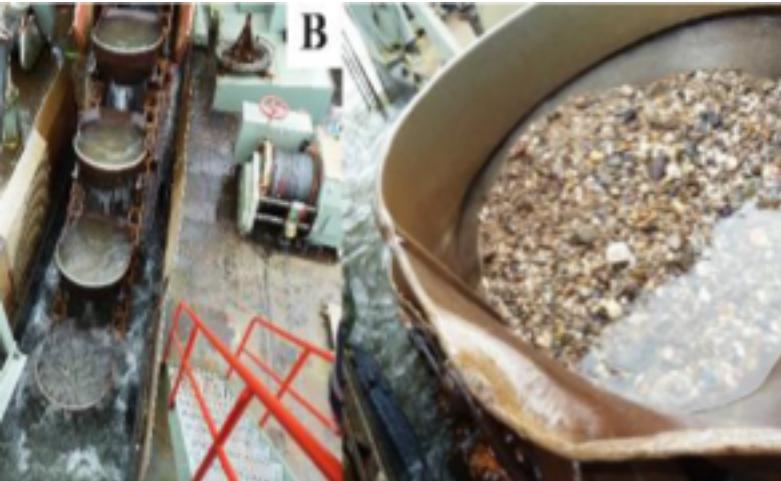
Treppenhaus zum Rheingrund...



wsv.de

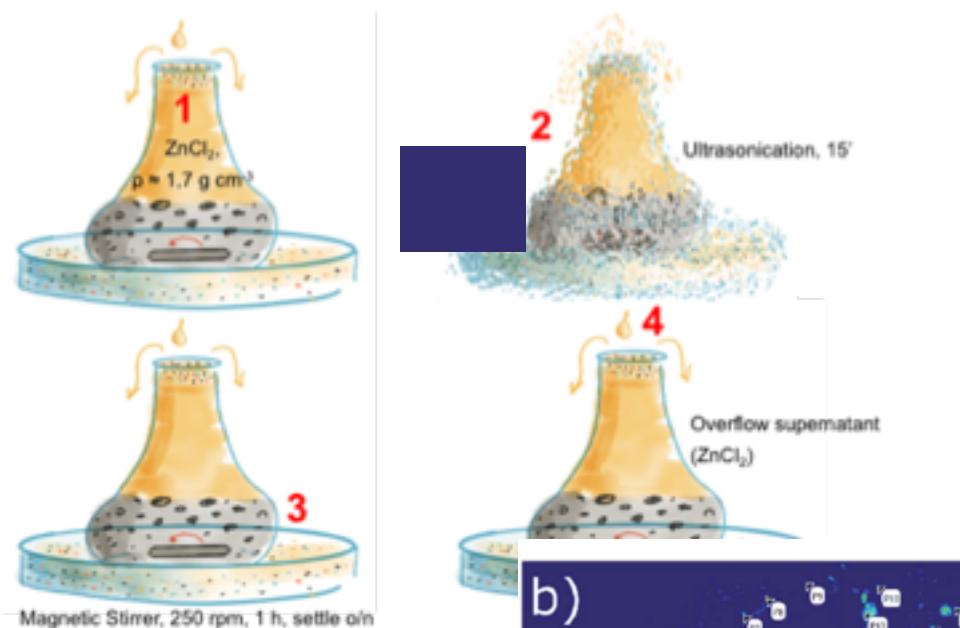


...und Eimerkettenbaggerschiff

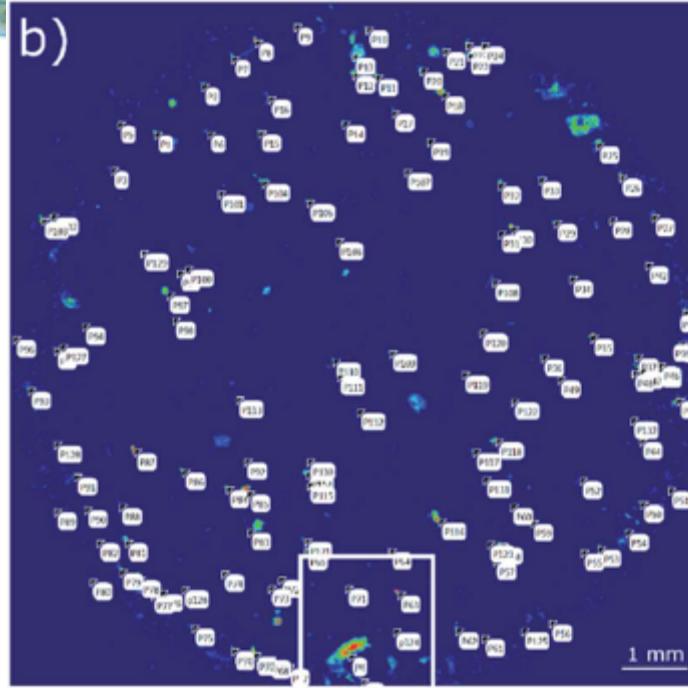
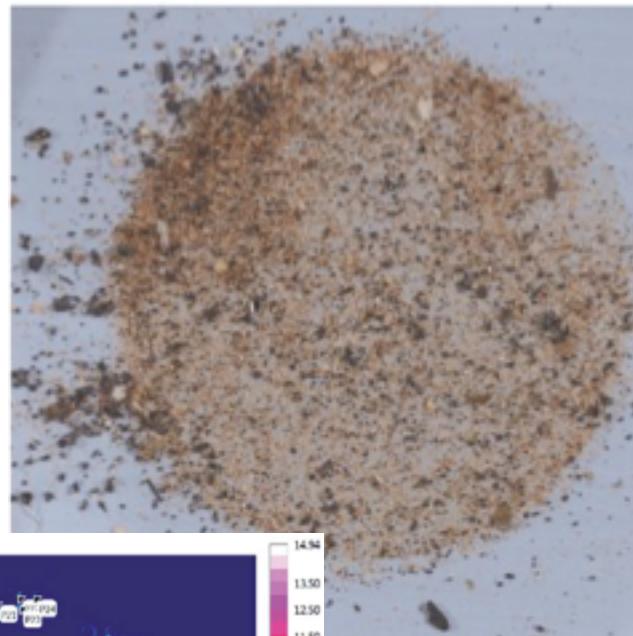




Sedimentaufbereitung und Analyse

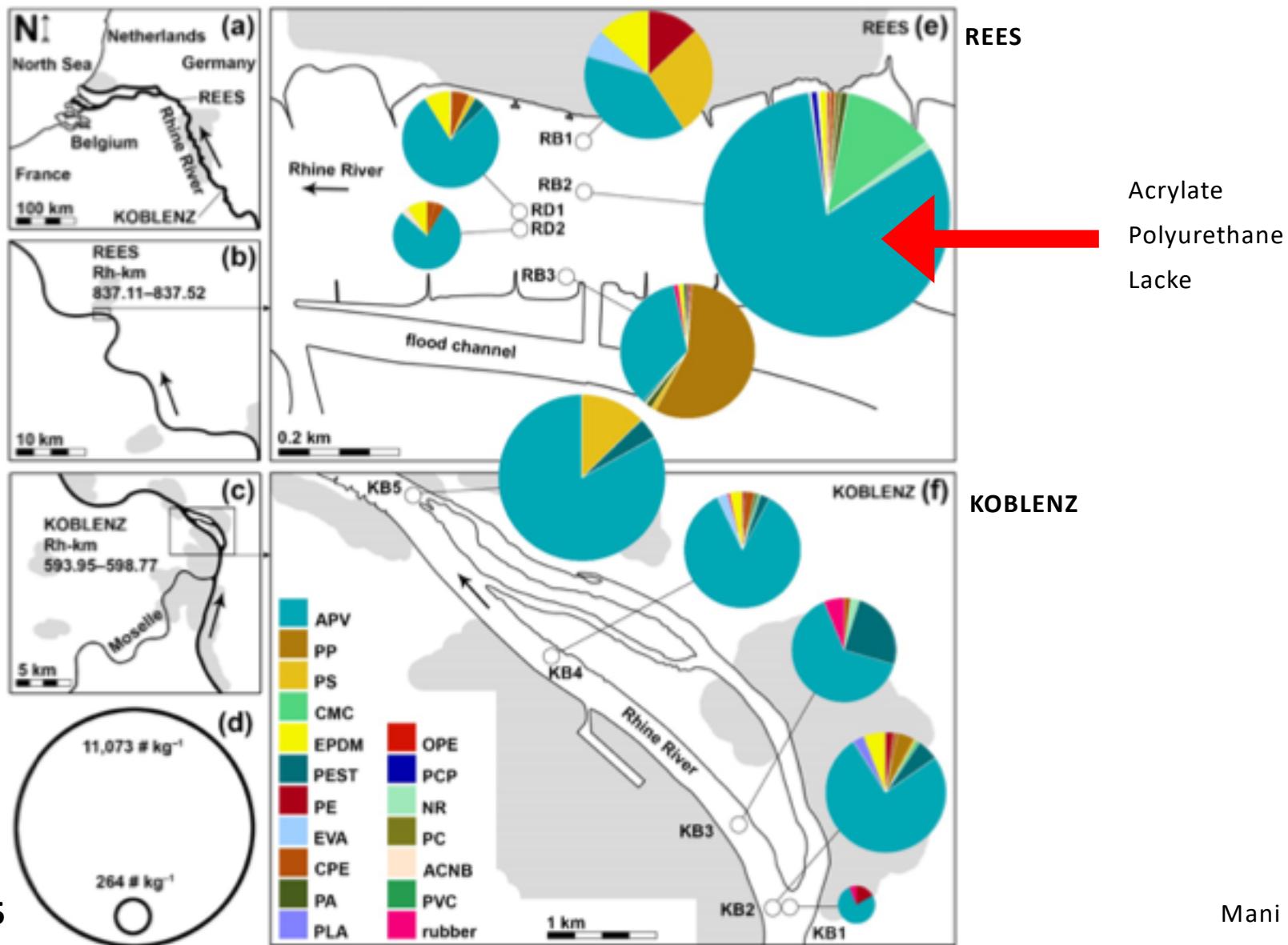


Magnetic Stirrer, 250 rpm, 1 h, settle o/n



Primpke et al., 2017

Acrylate/Polyurethane/Lacke (<75 µm) dominieren die Mikroplastikzusammensetzung auf der Rheinsohle



Ist (Mikro-)Plastik gefährlich?





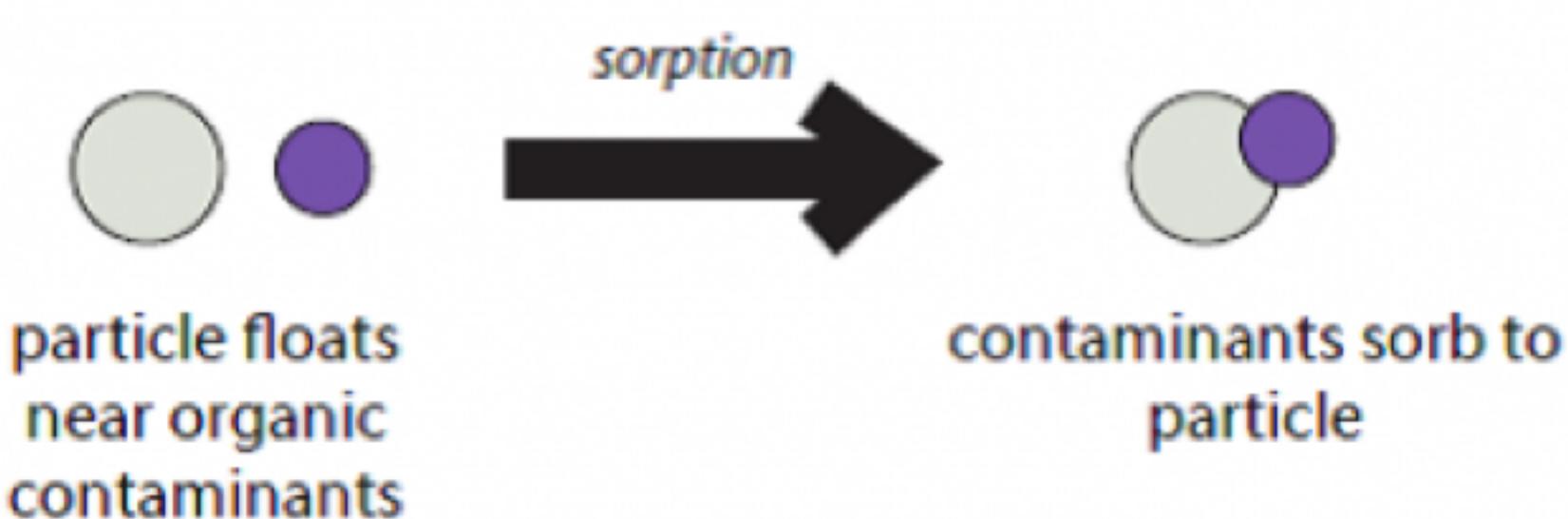
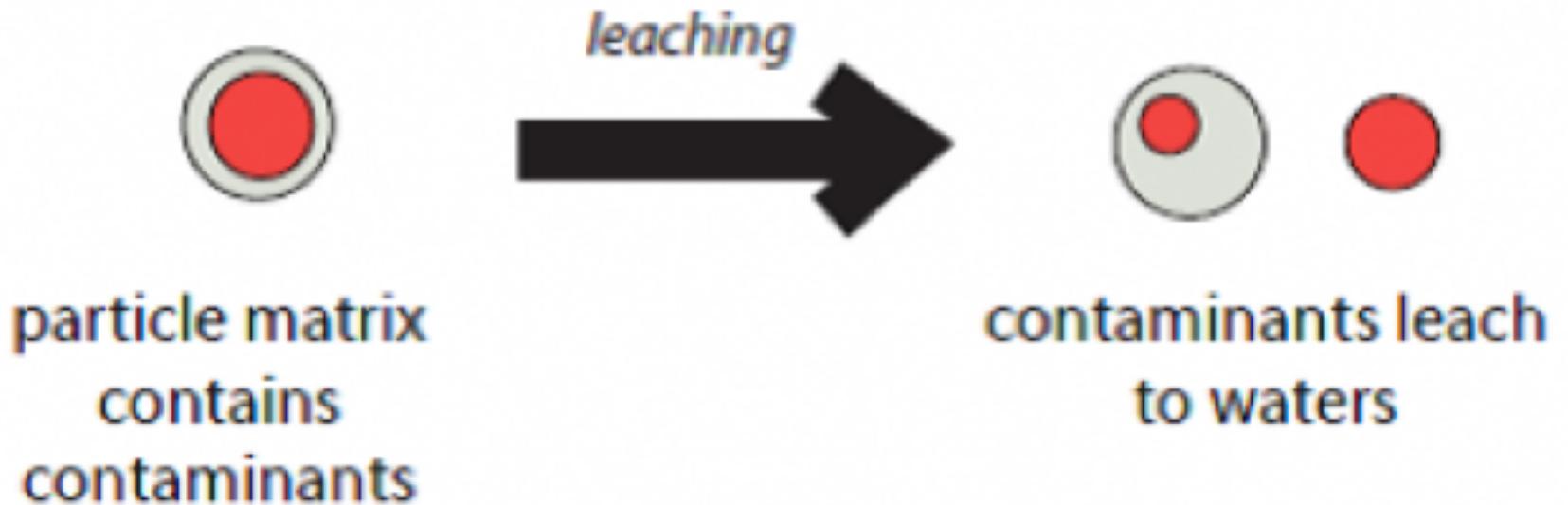




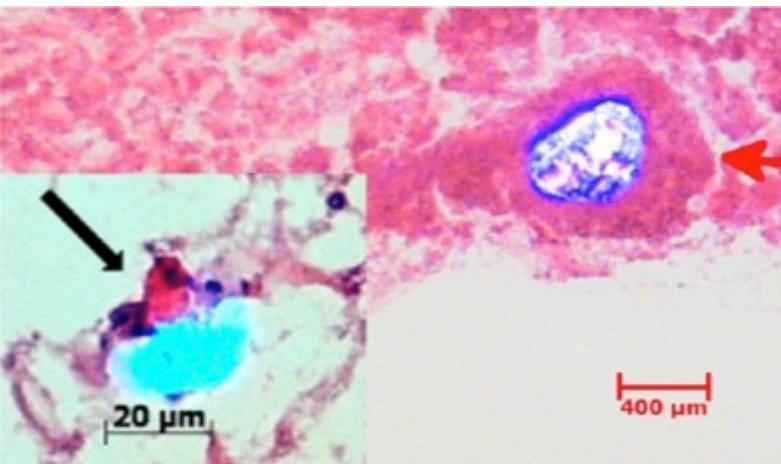




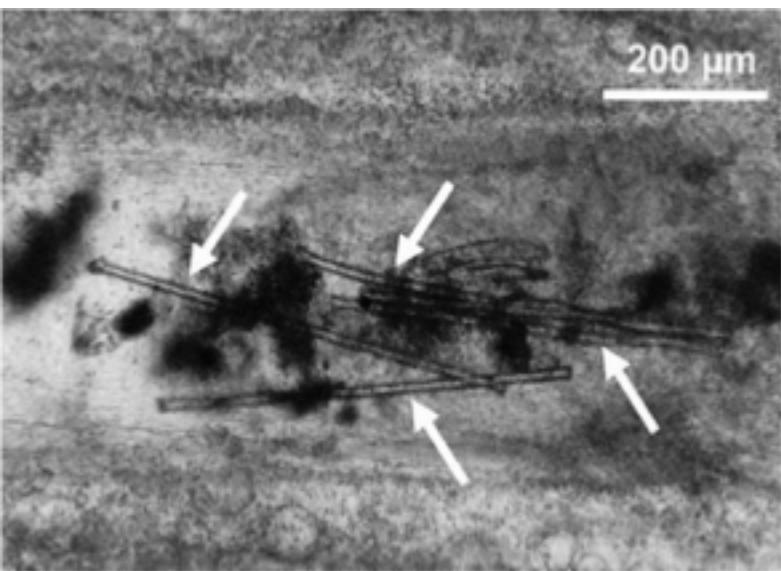
Vektoren für potenzielle Toxine



Aufnahme und Effekte in Organismen

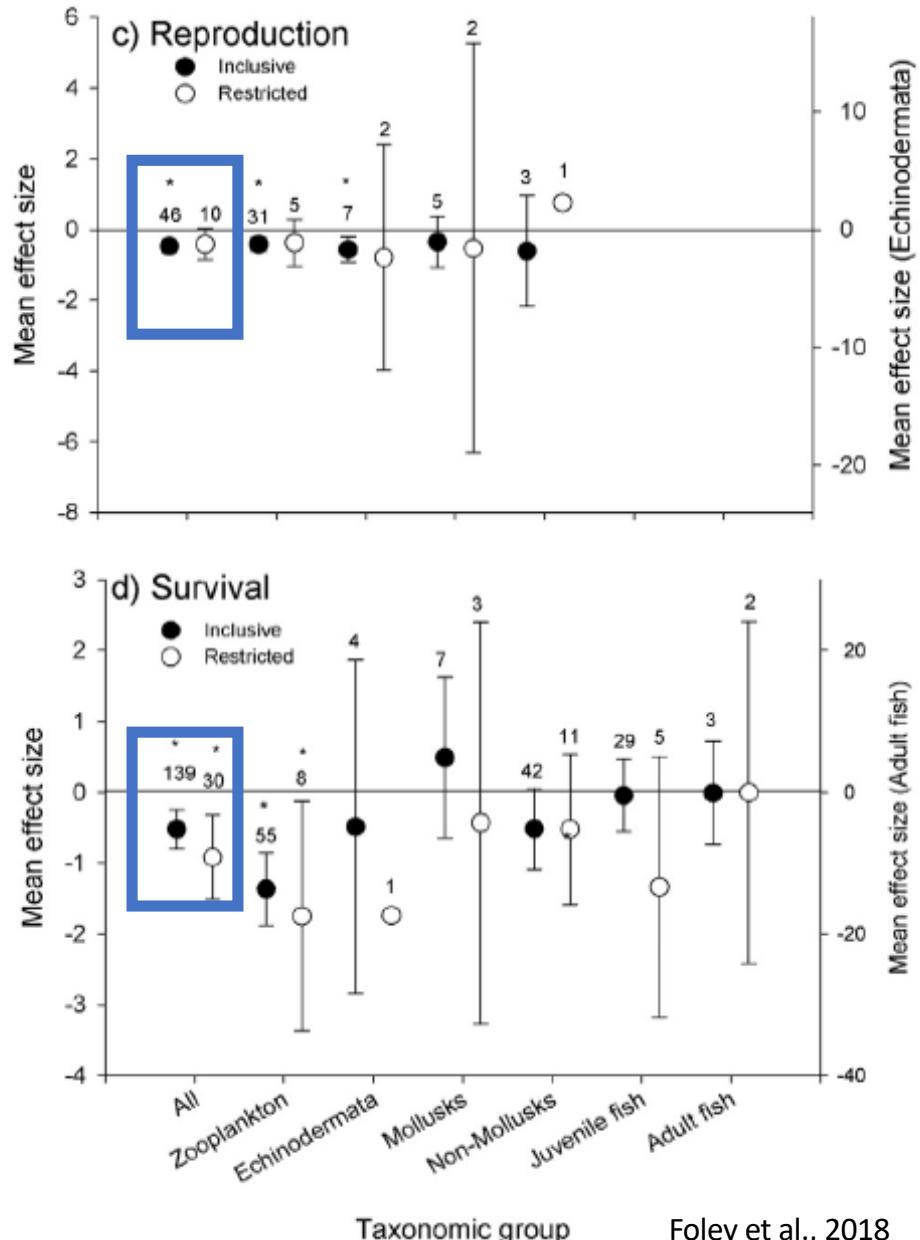
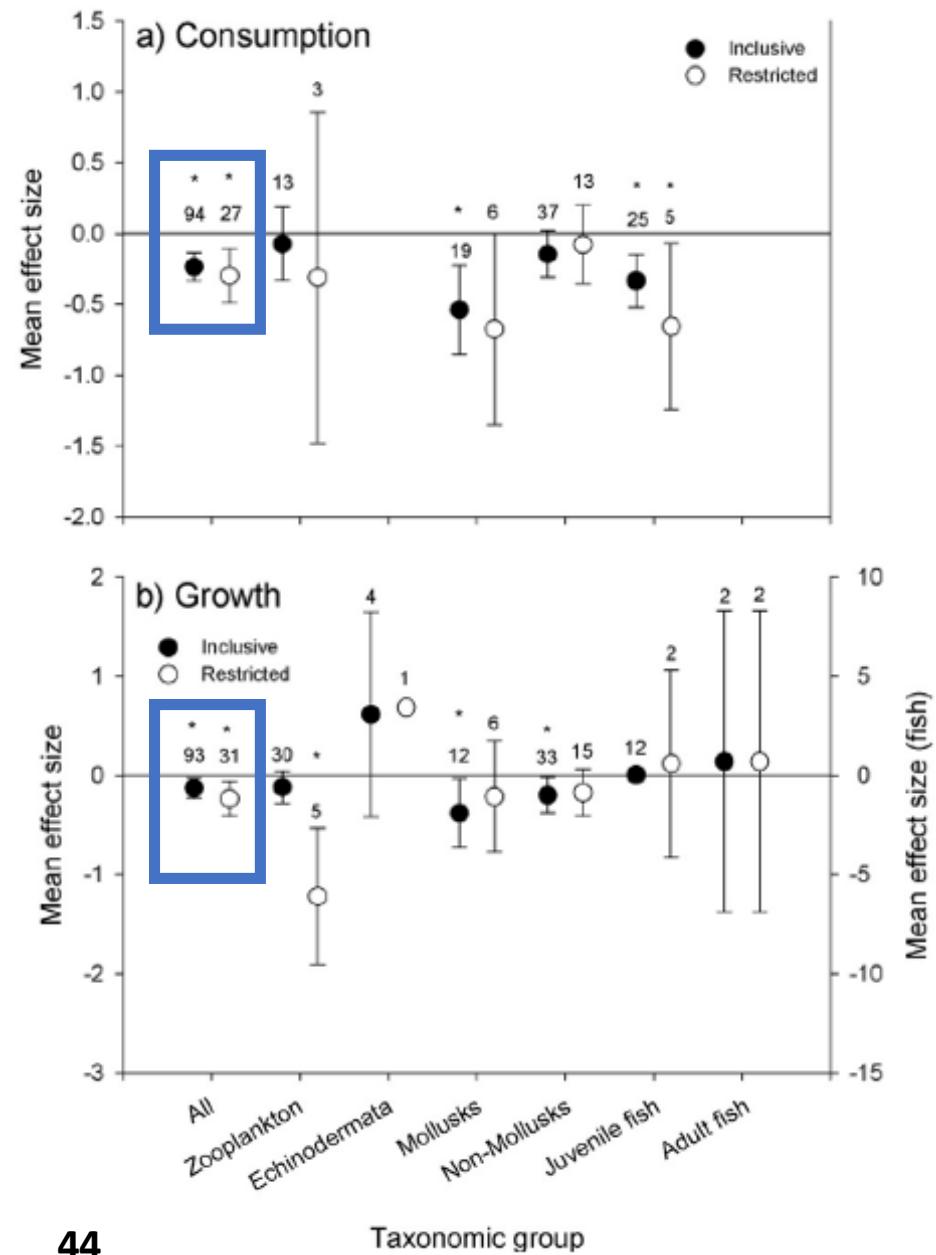


Von Moos et al. 2012



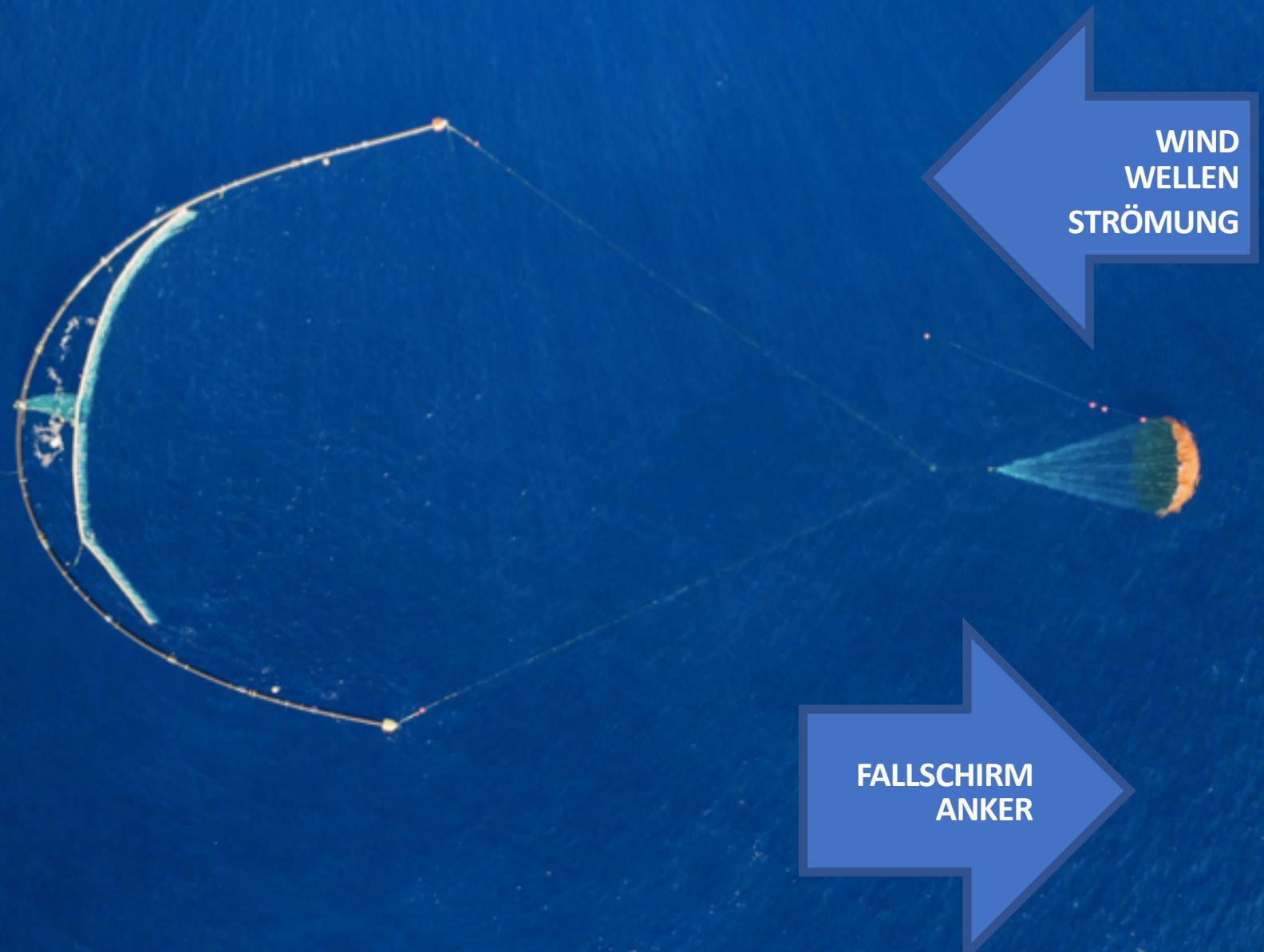
Blarer & Burkhardt-Holm 2016

Biologische Effekte durch Mikroplastik



Wie geht es weiter?

Der grosse Plan im Ozean?



Mehr und effizienteres Recycling?



Unverpackt ein- und verkaufen?



Alternative Materialien?



Plastik(tüten) verbieten?



Zeit für Fragen

Fachliteratur

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