MPs in the Danube region – towards standardised routine analysis

Gabor Bordos, PhD

Microplastics

< 5mm

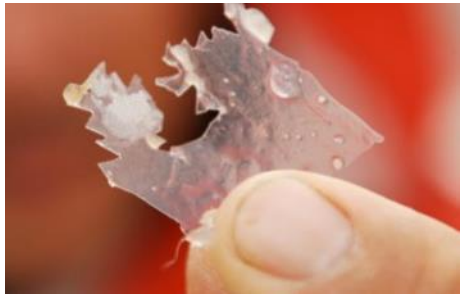
Occurrance

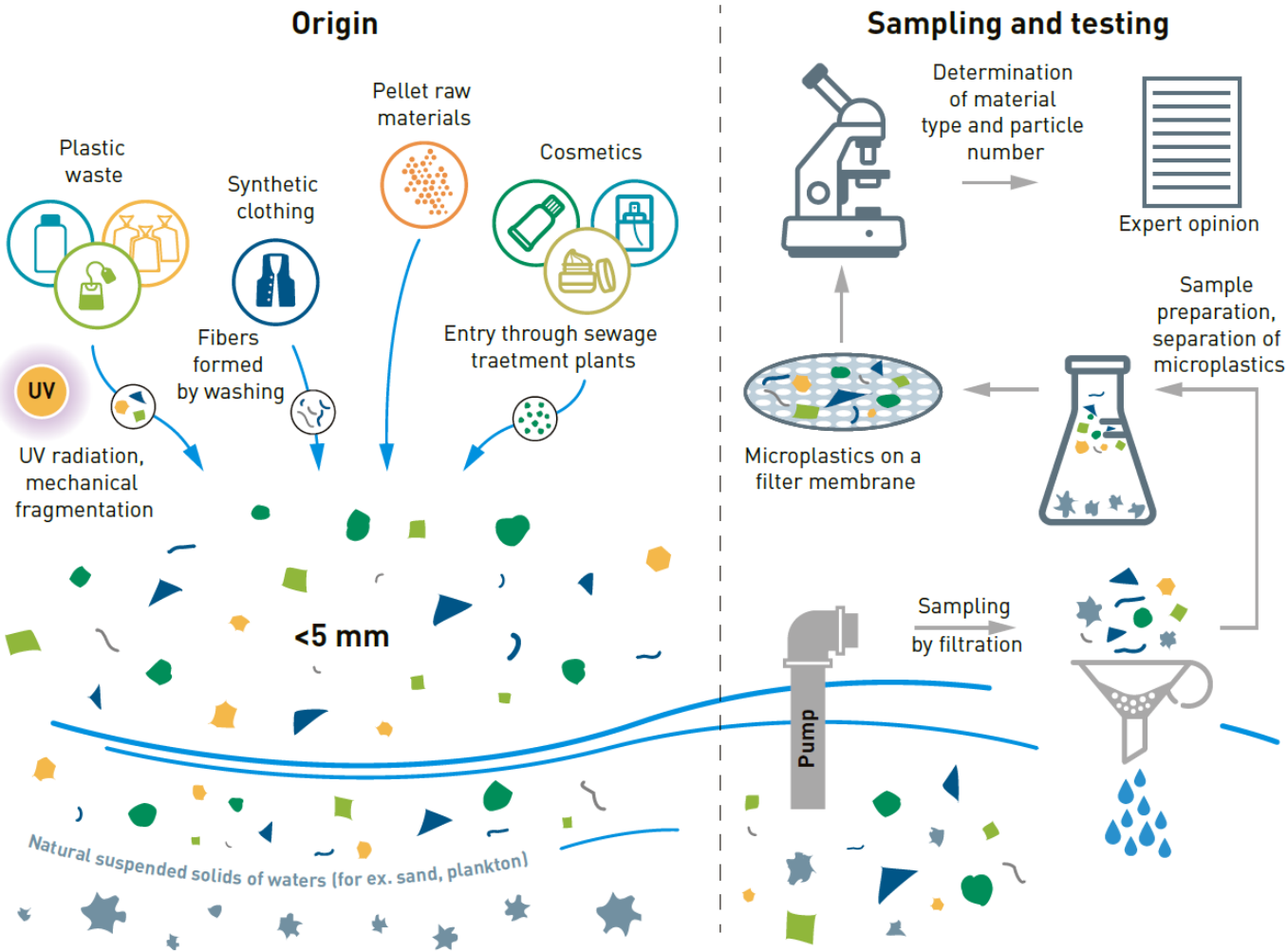
water, sediment, biota

Effects

uptake by organisms

transport of chemicals




Origin
Plastic waste
Synthetic clothing
Pellet raw materials
Cosmetics
Fibers formed by washing
Entry through sewage traetment plants
UV
UV radiation, mechanical fragmentation
<5 mm
Natural suspended solids of waters (for ex. sand, plankton)
Sampling and testing
Determination of material type and particle number
Expert opinion
Sample preparation, separation of microplastics
Microplastics on a filter membrane
Sampling by filtration
Pump

Some data from the past

River Rhein (Mani et al., 2015)

- 15-20 particles/m^3
- 300 µm cutoff

Danube, Austria (Lechner et al.,2014)

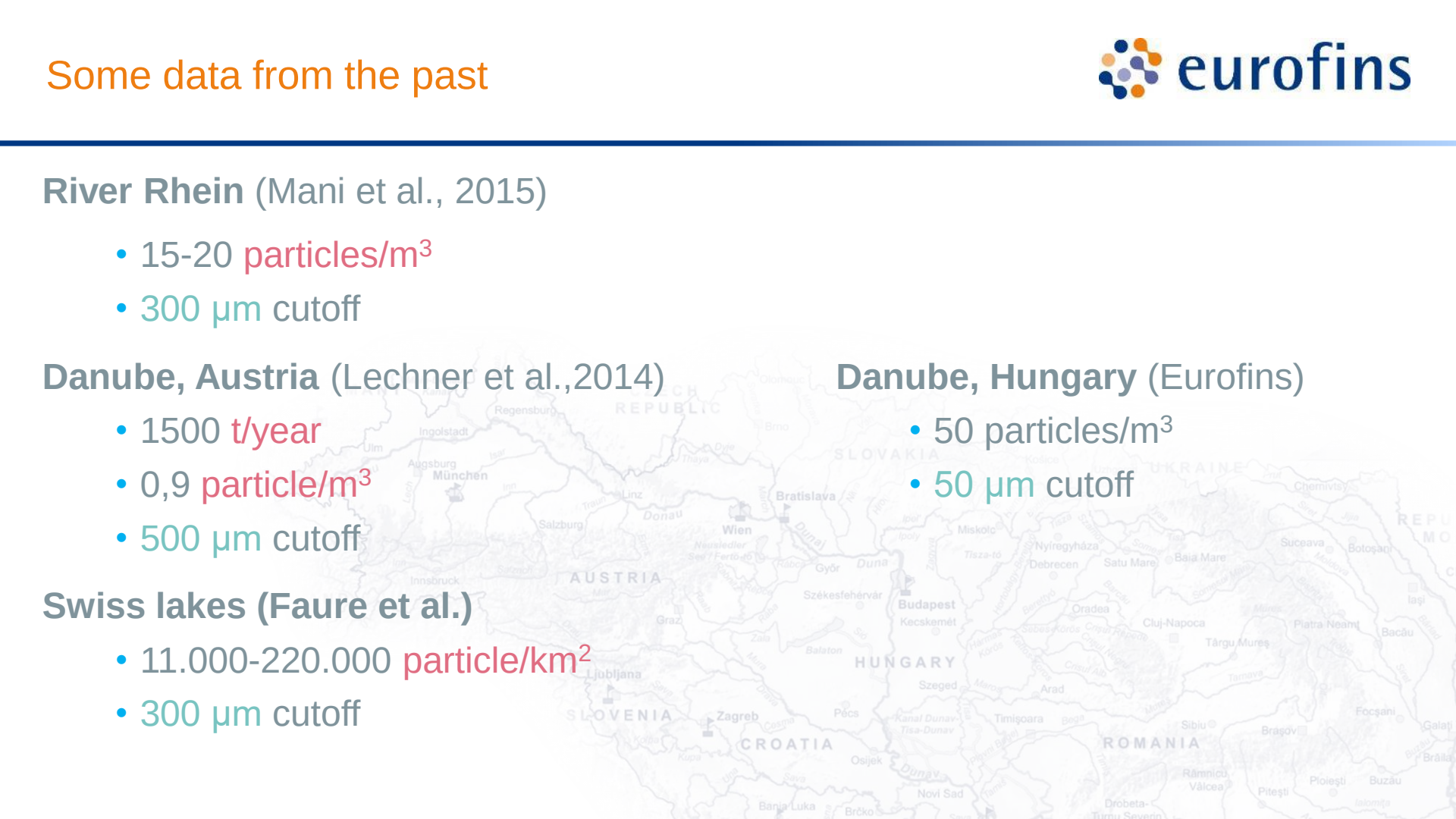
- 1500 t/year
- 0,9 particle/m^3
- 500 µm cutoff

Swiss lakes (Faure et al.)

- 11.000-220.000 particle/km^2
- 300 µm cutoff

Danube, Hungary (Eurofins)

- 50 particles/m^3
- 50 µm cutoff



Diverse methods

Study for EUSDR PA4 (2021)

Country	Sampling method	Sampled particles size (µm)	Sample volume (L)	Sample treatment	Analysis method	Type of detected microplastics	Material type of detected microplastics	Influent MP concentration (MP per m^3)	Effluent MP concentration (MP per m^3)	Reference
Denmark	Filtration device; glass bottle	20-500	INF: 1 EFF: 4.1-81.5	ED, O, separation ($ZnCl_2$; 1.7 g/cm^3)	FTIR microscopy	n.d.	PA/nylon; PE; PP; PVC	130 000 000	5 800 000	Vollertsen et al., 2017
Sweden	Filtration	>300	n.d.	n.d.	VIS, FTIR spectroscopy	Fibres, fragments	n.d.	15 000	8 300	Wagner et al., 2014
France	Autosampler (24h)	100-1000	n.d.	filtration (1,6 µm)	Visual observation	Fibres	n.d.	260 000 – 320 000	1 400 – 5 000	Dris et al., 2015
Finland	Filtration device	20–200	INF: 0,3 EFF: 30-285	n.d.	Visual observation	Synthetic particle, textile fibres	n.d.	610 000	14 000	Talvitie et al., 2015
Netherlands	Glass bottle	10–5000	2	filtration; separation (NaCl 1.2 g/cm^3)	VIS, FTIR spectroscopy	Fibres	n.d.	6 800 – 910 000	5 200	Leslie et al., 2017
Germany	Filtration device	50–100	390-1000	ED, O, separation ($ZnCl_2$ 1.7 g/cm^3)	VIS, FTIR microscopy	Fibres	PE, PP, PS, PA, SAN, PEST, PVC, PUR, PET, ABS, PLA	n.d.	10 - 9 000	Mintenig et al., 2017
Finland	Filtration device	-	2-140	n.d.	VIS, FTIR spectroscopy	Fibres	polyester, PE, PP, PS, PU, PVC, PA, EVA	7 000	10	Talvitie et al., 2017
Poland	Plastic canisters	109–>300	n.d.	n.d.	VIS	Fibres	n.d.	1 900 – 552 000	28-960	Iyare et al., 2020
Italy	Steel bucket and sieve	10–5000	30	separation (NaCl 1.2 g/cm^3); O	VIS, FTIR microscopy	Fibres	polyesters, polyamide	3 000	400	Magni et al., 2018
Hungary (Pécs)	Bucket	0,45-5000	1	separation (NaCl); O	VIS	Fibres, fragments, spheres	n.d.	3 588 000	442 000	Parrag & Kátai, 2020
Hungary (South-West)	Fractionated filtration	25-77	8-1970	n.d.	VIS, hot needle test	n.d.	n.d.	n.d.	0-7,5	Németh, 2018

https://dunaregiostrategia.kormany.hu/download/f/2e/d2000/Microplastics-in-wastewater_report_2021.pdf

- **Need for harmonisation to obtain comparable data**
- Regulation based on harmonised methods
- Standardised, routine analysis to serve legislative goals

MP workflow – sampling

Bordós et al. (2021) – Water Research

https://doi.org/10.1016/j.watres.2020.116572

MP workflow – analysis

Preparation

- density separation (Mári et al., 2021)
- oxidation
- filtration

Analysis

- Thermo Nicolet in10MX
- linear array detektor, 25 µm pixel
- transmission
- 1 filter is 8-10 hours, 2 GB data
- siMPle software

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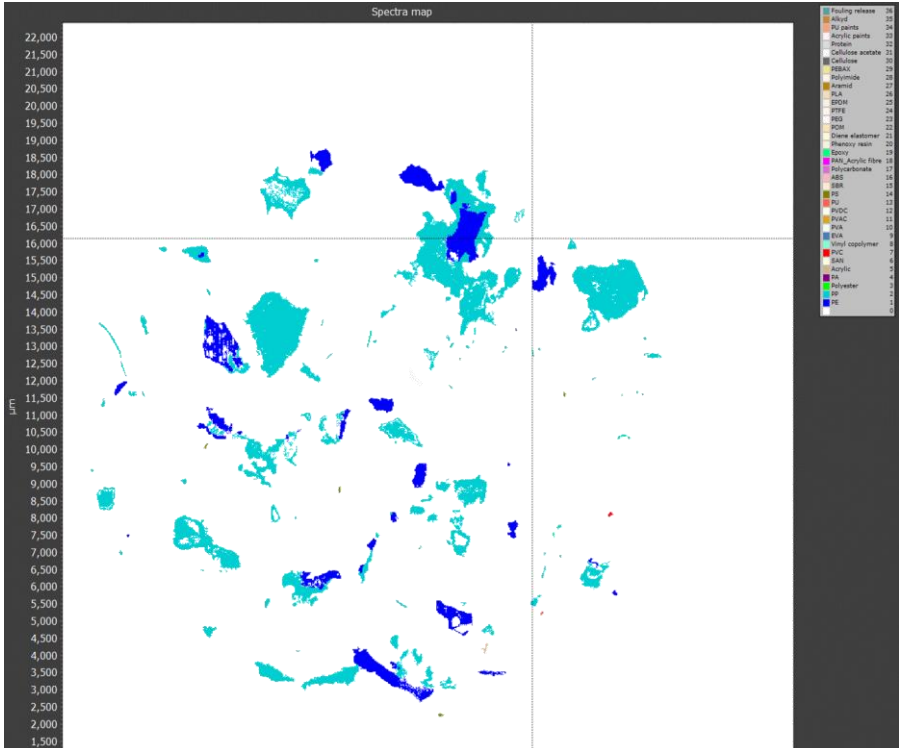


MP workflow – analysis

Particle number

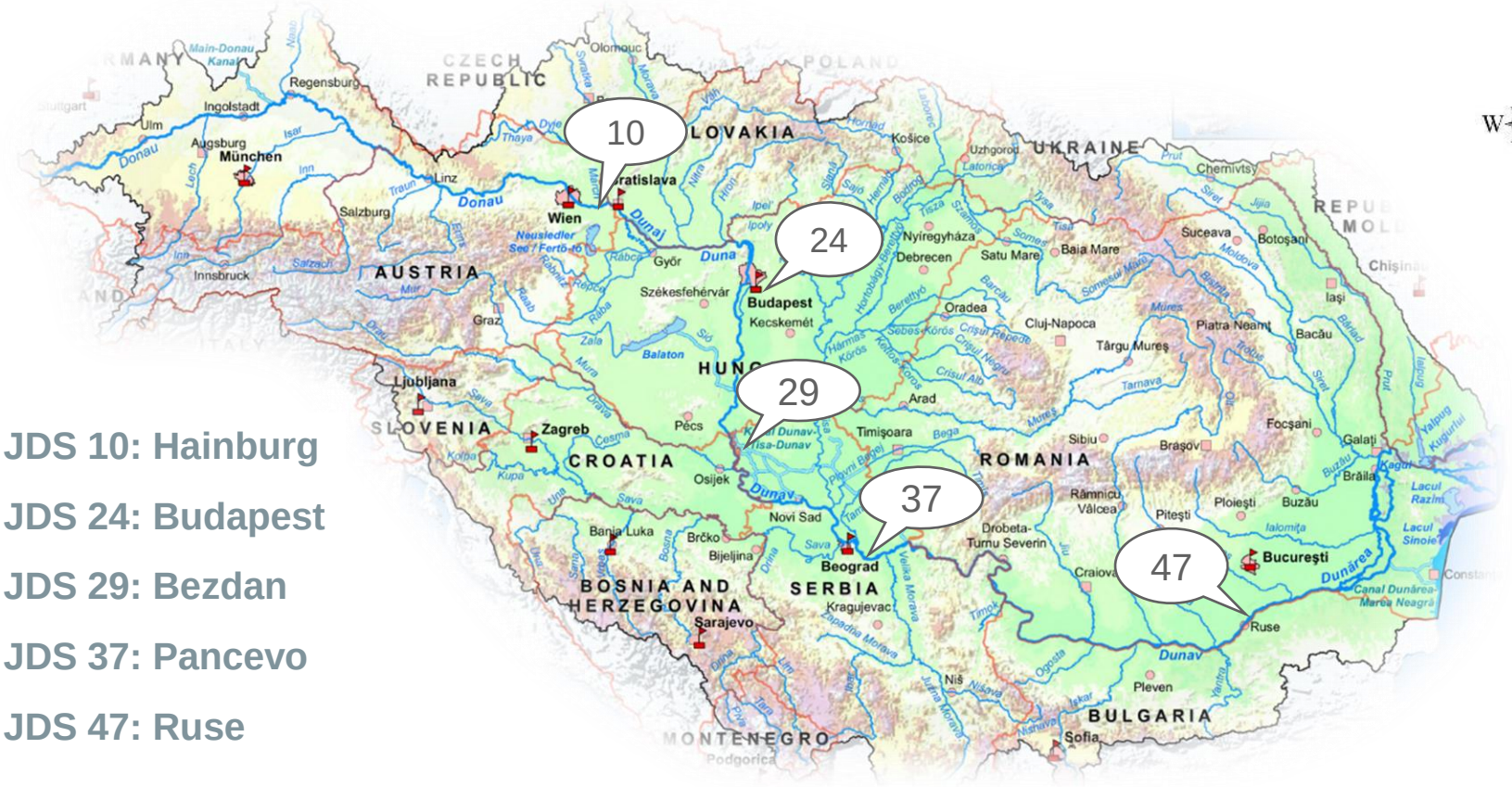
Polymer mass

Projects – Tidy Up (2021)

https://www.youtube.com/watch?v=nK-dzYqCQaw

Experiences from JDS 4 sampling

Projects – Tidy Up (2021)



JDS 10: Hainburg

JDS 24: Budapest

JDS 29: Bezdan

JDS 37: Pancevo

JDS 47: Ruse

Projects – waterworks (Western Balkans)

Ministry of Foreign Affairs and Trade – call for export boosting projects in the water sector

Used thermo Nicolet iN10 MX procurement

Concept: central lab – sampling knowledge transfer

Projects – waterworks

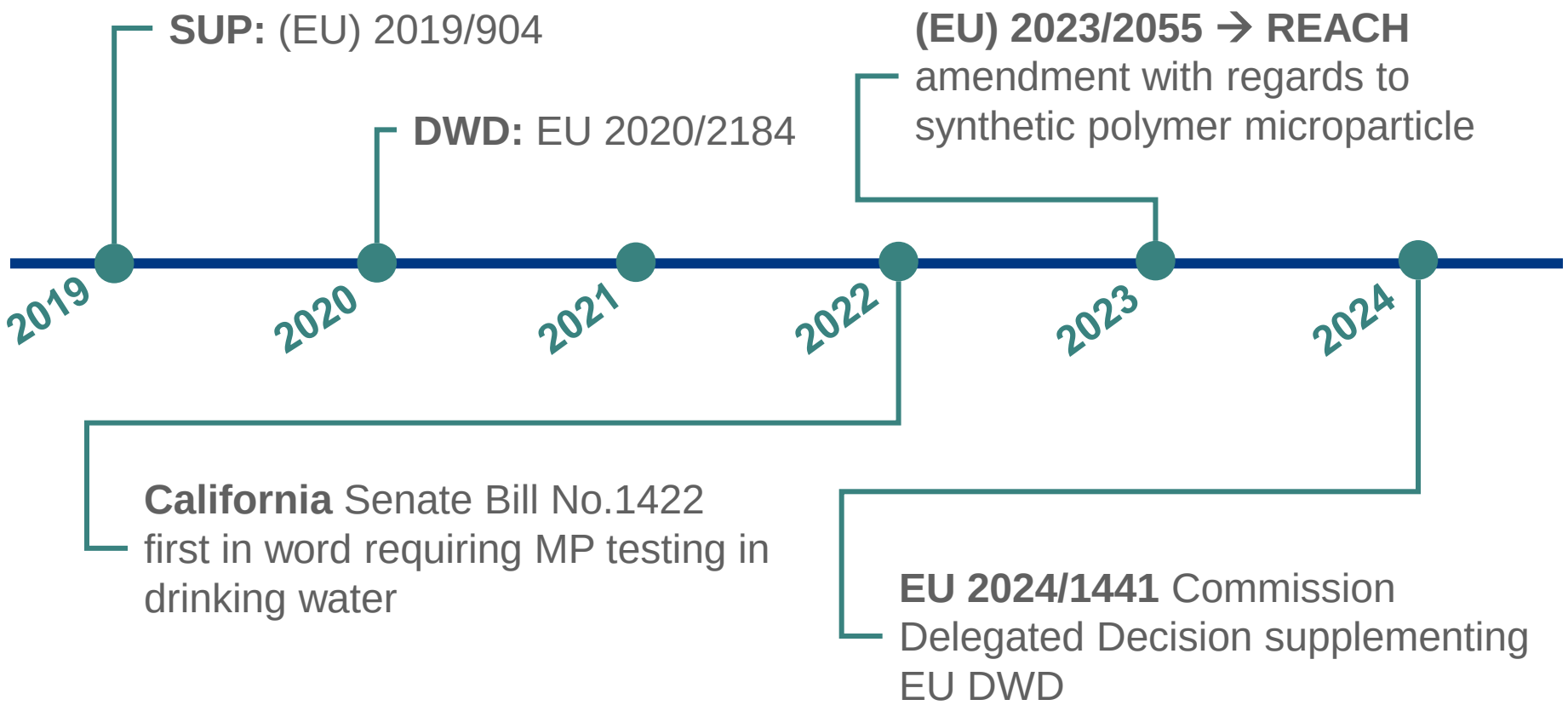
Interreg
Danube Region

Co-funded by
the European Union

MicroDrink

- Need for harmonisation to obtain comparable data
- **Regulation based on harmonised methods**
- Standardised, routine analysis to serve legislative goals

Regulation


SUP: (EU) 2019/904
DWD: EU 2020/2184
(EU) 2023/2055 → REACH amendment with regards to synthetic polymer microparticle
2019
2020
2021
2022
2023
2024
California Senate Bill No.1422 first in word requiring MP testing in drinking water
EU 2024/1441 Commission Delegated Decision supplementing EU DWD

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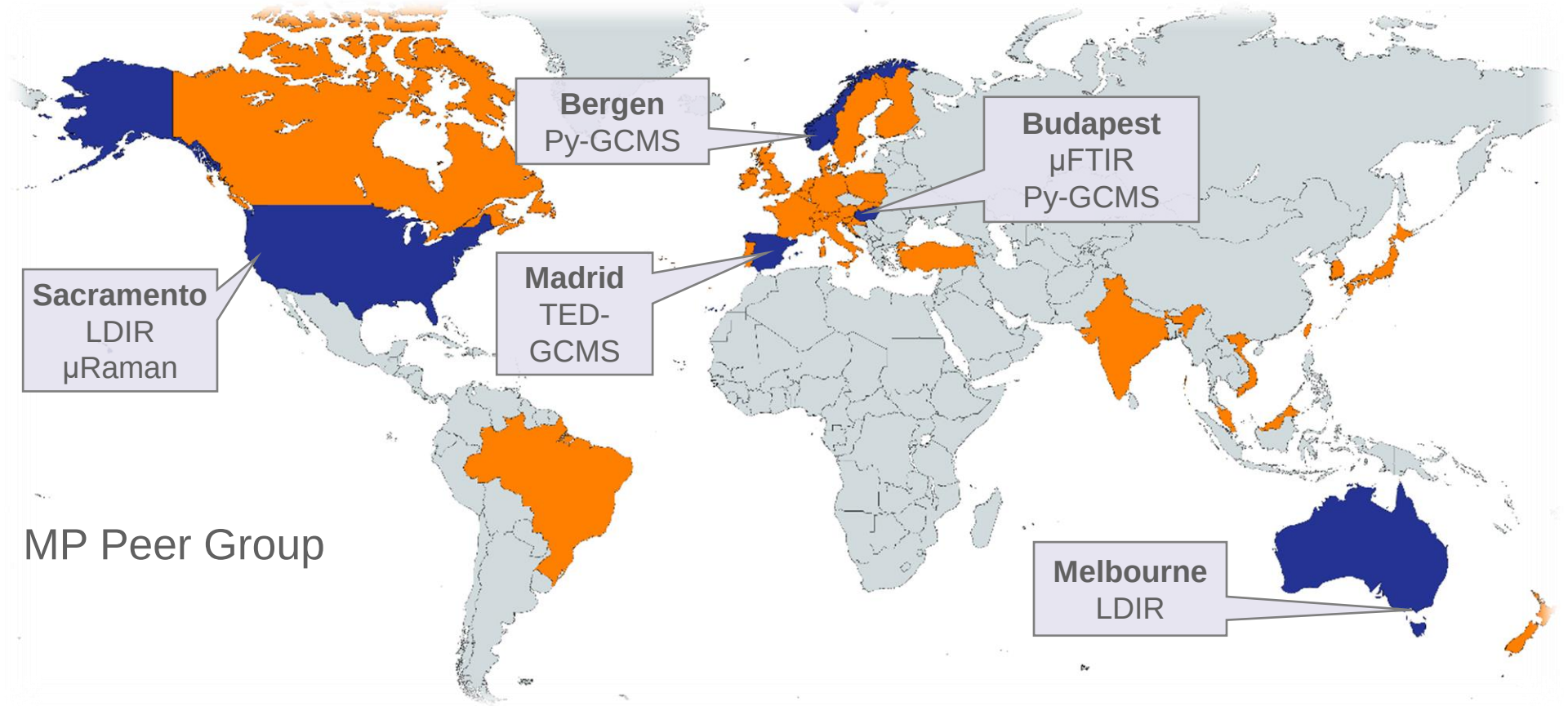
Microplastics @ Eurofins



MP Peer Group

Accredited sampling & analysis in Hungary

Water

- Drinking water
- Surface water
- Wastewater

Solids matrices

- Soil
- Sediment
- Sludge
- Compost

Thank you

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