Velkomstslide før seminaret starter kl. 09:00

Program

Programmet oppdateres løpende. Endringer kan forekomme.

09:00	Velkommen v/Kjersti Løvseth Ruud, NGU Fysisk ikke powerpoint	
09:05	Mareano og mikroplast v/Terje Torsnes, NGU Fysisk Powerpoint	
09:15	(Micro)plastic pollution and efforts to combat it in the arctic v/Thomas Maes and Helene Svendsen	Digitalt
	PRØVETAKING	
09:40	Sedimentprøvetaking i Mareano kjemiprogram v/Stepan Boitsov, Havforskningsinstituttet	Fysisk
	ANALYSEMETODER	
10:05	Havforskningsinstiuttets mikroplastlaboratorium og analyse av sedimenter med mikroplast v/Fred-Olav Libnau og André Bienfait, Havforskningsinstituttet	Fysisk
10:30	* * **Pause** * *	
10:45	Pyrolyse GC/MS analyseteknikk og analytiske utfordringer v/Dorte Herzke, NILU	Digitalt
11:10	TBA v/ Stefania Piarulli, Sintef Ocean AS	Digitalt
11:35	Size matters: the significance of the size fraction for a realistic assessment of the MP particles occurrence in marine sediments v/Alessio Gomiero, NORCE	Digitalt
12:00	* * **Lunsj** * * Lunsjen er kl. 12 – 13.	

MIKROPLAST I MILJØET

13:00	Kystnær jord som kilde for mikroplast i det marine miljøet v/Jakob Bonnevie Cyvin, NTNU	Fysisk
13:25	Bildekkpartikler og annen mikroplast i norske sedimenter - erfaringer fra MIKRONOR v/Elisabeth Rødland, NIVA	Digitalt
13:50	Microplastic pollution in sediments around Svalbard: from sea-ice-covered areas on the continental shelf to deep-slope gullies v/France Collard, NIVA	Digitalt
14:15	Resultater fra Mareano mikroplast kartleggingen i norske havområder v/Henning K.B. Jensen, NGU	Fysisk
14:40	Hva har dagens mikroplastseminar lært oss? v/Terje Thorsnes, NGU	Fysisk

MAREANO seminar -
Mikroplast i marine sedimenter

4. Mars 2024 – Norges Geologiske Undersøkelse

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(Micro)plastic pollution and efforts to combat it in the Arctic

Helene Svendsen | Senior Expert, GRID-Arendal
helene.svendsen@grida.no

Introduction

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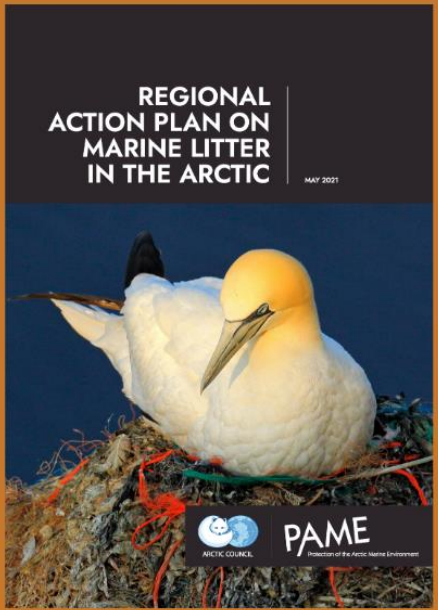
The Arctic Council

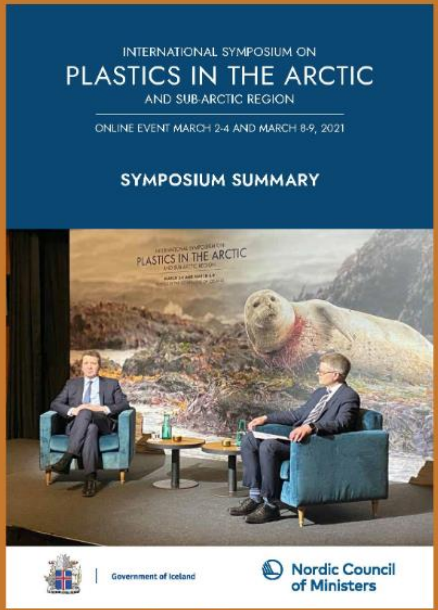
- PAME
  (Protection of the Arctic Marine Environment)
- AMAP
  (Arctic Monitoring and Assessment Programme)



Regional Action Plan on Marine Litter in the Arctic

Desktop Study on Marine Litter, including Microplastics in the Arctic


Plastic in a bottle: Live map



International Symposium on Plastics in the Arctic

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KEY FINDINGS

HARMONISATION, COLLABORATION AND CO-ORDINATION

- There is an abundance of data, but harmonising it through standardised collection and management is essential. Achieving a comprehensive understanding of the current situation and identifying effective pathways forward requires harmonised methods across different geographical contexts. This was a message that was repeated frequently during the symposium.
- Plastic litter is pervasive, but research into it is relatively recent, and the lack of long-term monitoring poses challenges.
- Plastic arrives in the Arctic through various pathways: by air, embedded in sea ice, and carried by ocean currents and rivers. This underscores the need for international collaboration on monitoring, research and policy implementation.
- Microplastics reach the Arctic predominantly from the European mainland and the North Atlantic, but local sources are a significant source as well, and this points to a need to focus on household-waste management and the fishing industry in Arctic communities.
- Plastic pollution is a global human-rights issue because it threatens traditional ways of life, food security and health. In addition, it disproportionately affects vulnerable communities.
- Indigenous communities and young people should not bear the sole responsibility for cleaning up plastic waste.
- Consumers should have a right to refuse certain plastics, and there should be limits on plastic production.
- Some 30% of beach litter in the North-east Atlantic can be traced back to the fishing industry, suggesting there is a need for best practices and policy solutions involving stakeholders across the fishing industry. The agriculture industry should also be engaged.
- Bridging the gap between scientists, decision-makers and young people is crucial for implementing effective policies.

Supporting work

- UArctic Thematic Network on Arctic Plastic Pollution
- The Barents Sea Leadership Training on Marine Litter, building on the United Nations Environment Programme's Massive Open Online Course (MOOC) on marine litter

Rivers as a plastic pollution pathway to the Arctic Ocean

https://www.grida.no/publications/1009

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Remote Arctic Communities

The Arctic: a vast and sparsel... | What challenges do the communi... | Backhaul Alaska program: Hazar... | Greenland waste management: fr... | Kola waste Project clean-up | Conclusion →

The vast majority of settlements (90 per cent) have less than 5000 inhabitants, and these communities are spread across a vast territory equivalent to the size of China. The remaining 10 per cent of settlements are much larger, mostly administrative centres where about three million people, or three quarters of the total population of the Arctic live (Wang et al., 2021).

Population more than 5000
Population less than 5000

02 / 05

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Displaced by Plastics

https://www.grida.no/publications/879

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Environmental Knowledge for Change

grida.no

Mareano seminar: Microplastics in marine sediments

(Micro)plastic pollution and efforts to combat it in the arctic

Dr Thomas Maes

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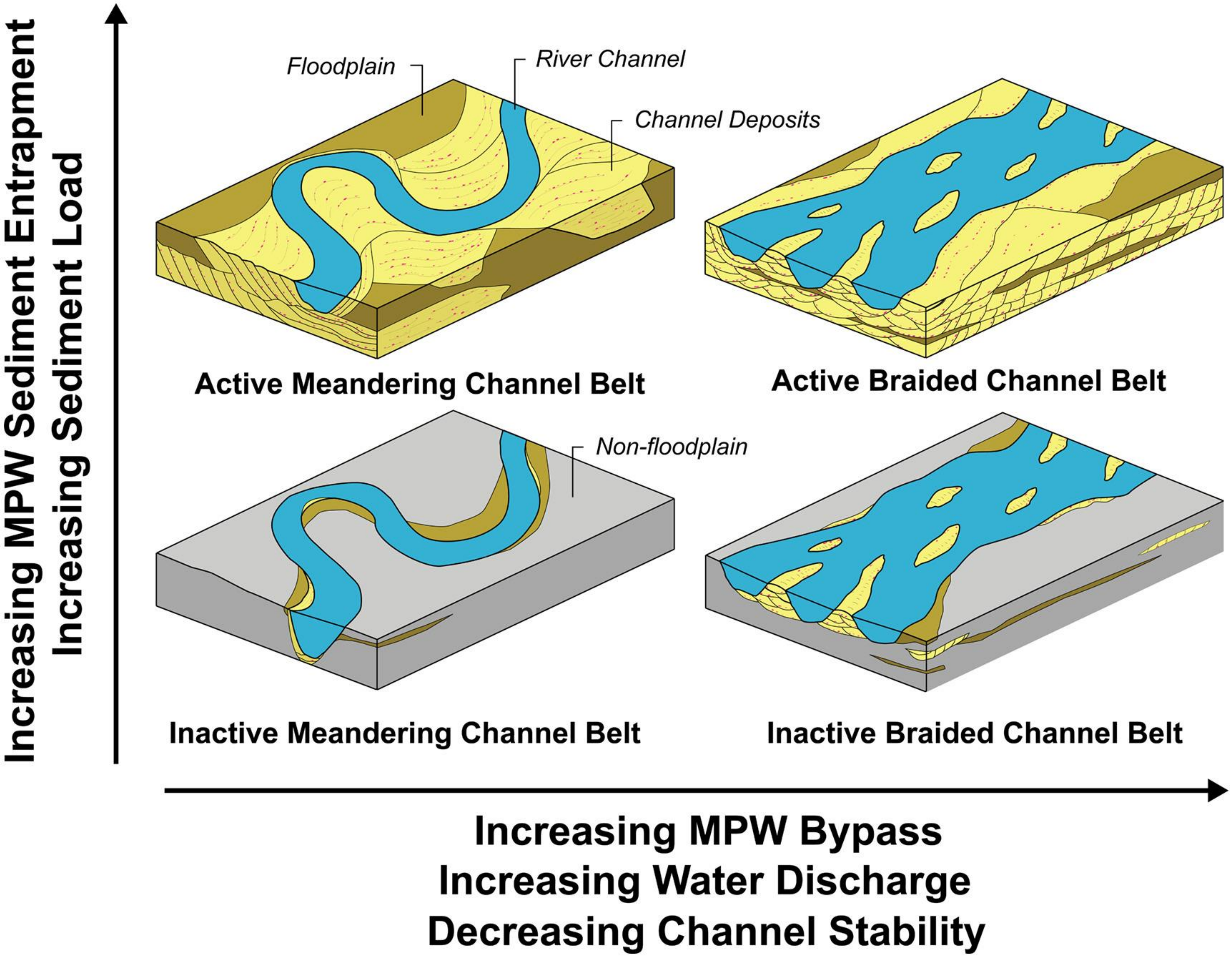
Leaving a plastic legacy: Current and future scenarios for mismanaged plastic waste in rivers

Björn Nyberg, Peter T. Harris, Ian Kane and **Thomas Maes**

Science of The Total Environment
Volume 869, 15 April 2023, 161821

https://doi.org/10.1016/j.scitotenv.2023.161821

The datasets: doi.org/10.5281/zenodo.6894684
The interactive map: https://bit.ly/3rYPnkz.



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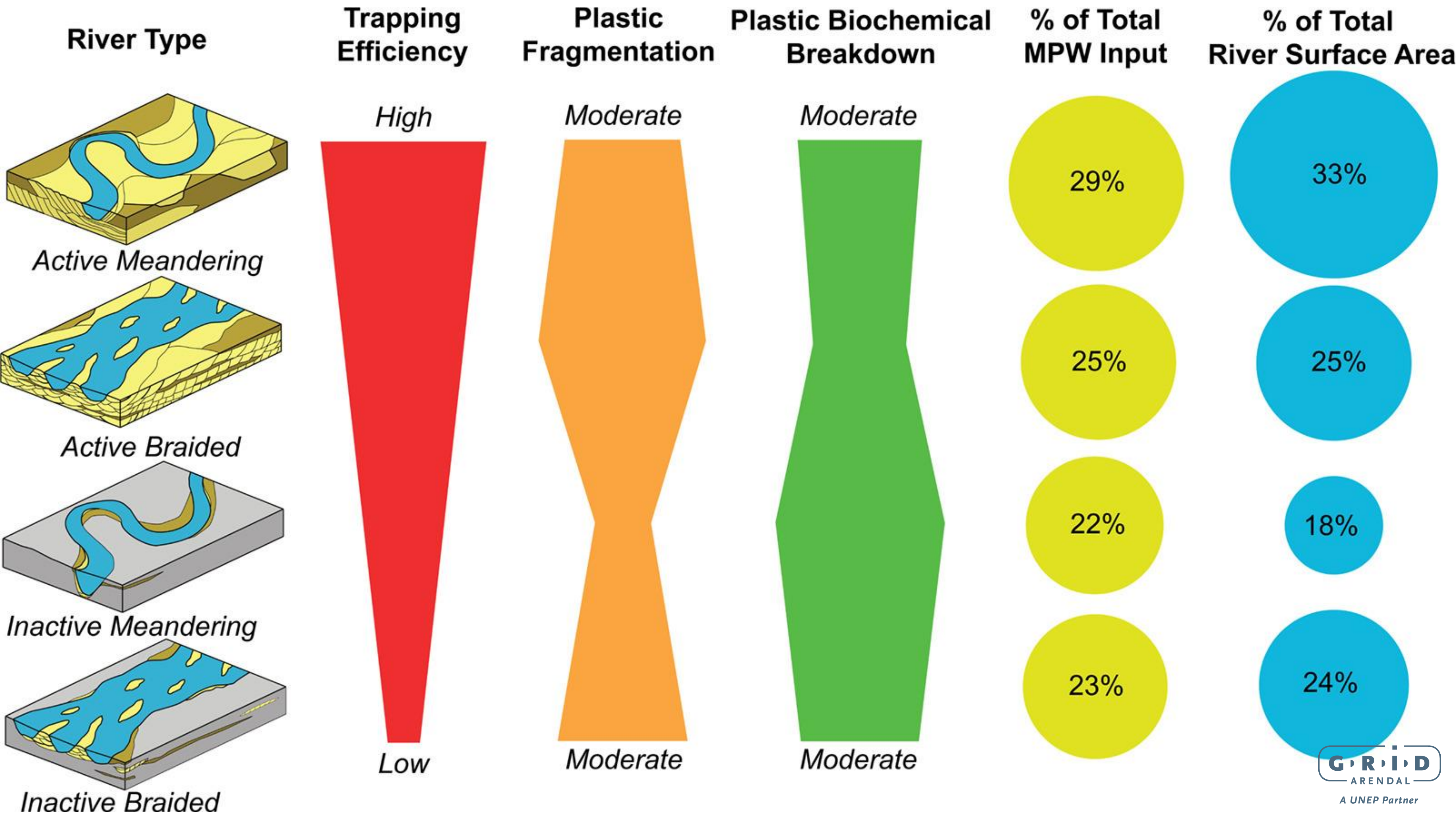
River Type
Trapping Efficiency
Plastic Fragmentation
Plastic Biochemical Breakdown
% of Total MPW Input
% of Total River Surface Area
Active Meandering
Active Braided
Inactive Meandering
Inactive Braided
High
Low
Moderate
Moderate
Moderate
Moderate
29%
25%
22%
23%
33%
25%
18%
24%
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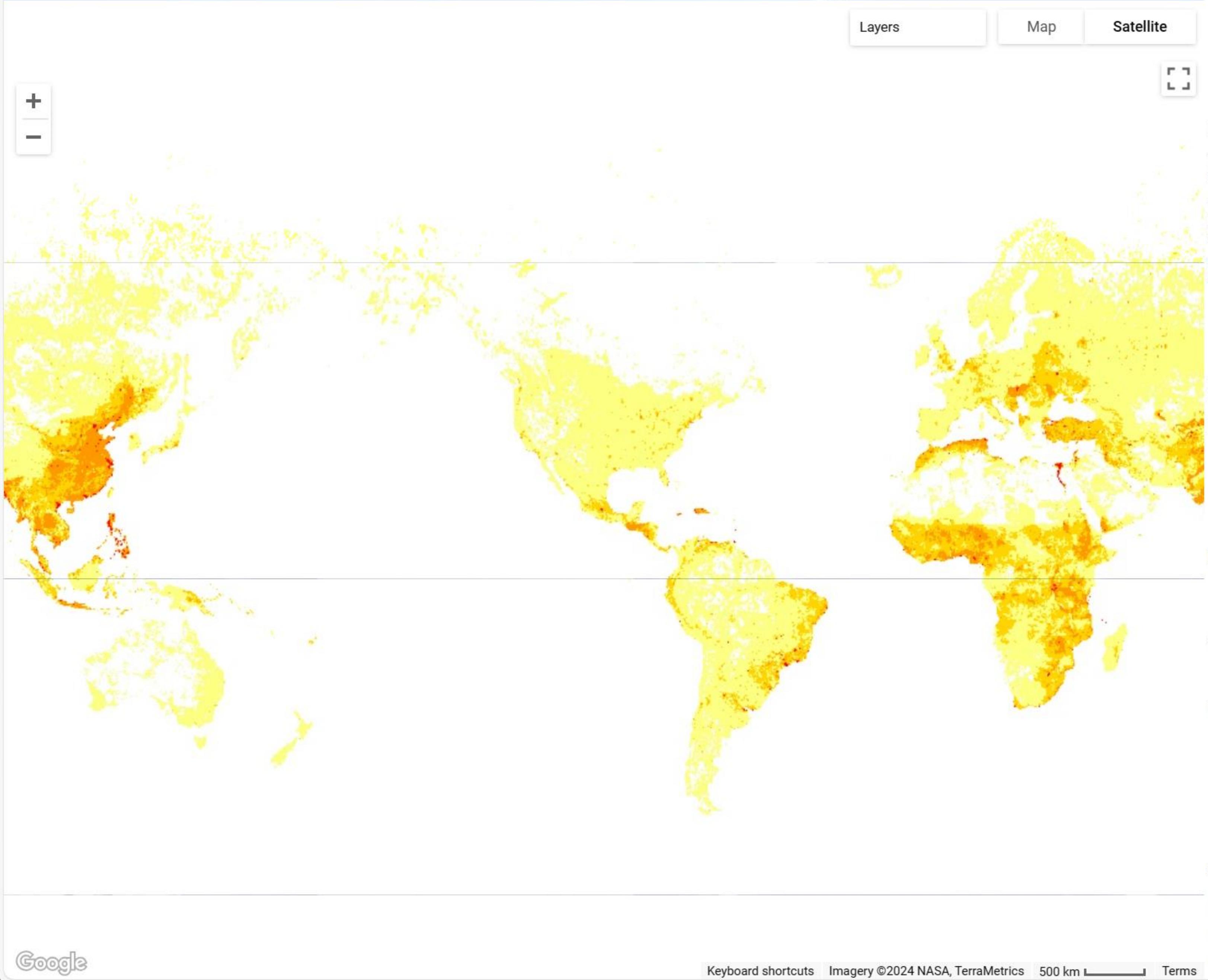
Earth Engine Apps

Search places



Exposure of Mismanaged Plastic Waste in Rivers

Björn Nyberg, Peter Harris, Ian Kane, Thomas Maes

Background

This interactive map shows the exposure of global rivers to mismanaged plastic waste (MPW) in 2015 and its projected impact in 2060.

The different scenarios for 2060 are A: business as usual, B: improved plastic recycling, and C:improved plastic recycling and reduced plastic use projection.

Select a dataset below to view MPW distributions and for summary statistics. Use the layers panel to activate and/or deactivate layers.

MPW input in 2015

Click on the map to generate summary charts of MPW exposure for the different sedimentary environments by administrative region and country.

Plastic Impact

- None | 0 t/yr/km2
- Low | < 0.1 t/yr/km2
- Medium | < 1 t/yr/km2
- High | < 10 t/yr/km2
- V. High | > 10 t/yr/km2

Environment

- Meandering / Single-threaded River
- Braided / Multi-threaded River
- Lake / Wetland

System Migration

- Non-migrating
- Migrating

Free Flowing State

- Free Flowing
- Impacted Flow

☐ Include lakes in summary statistics.

Data Download

The datasets are available for download as cloud optimized geotiff files or as a GEE asset using the links provided below.

Download Link

Sample Code

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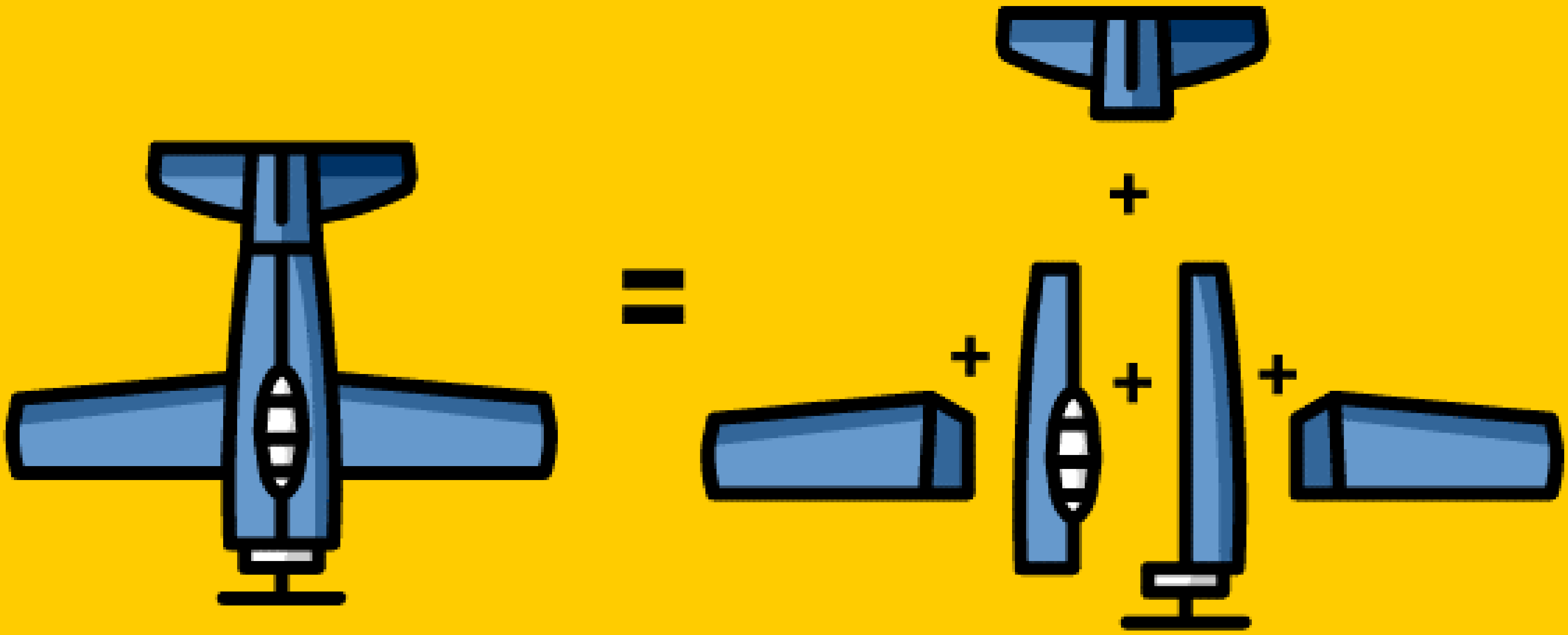
A marine plastic cloud - Global oceanic plastic pollution mass balance

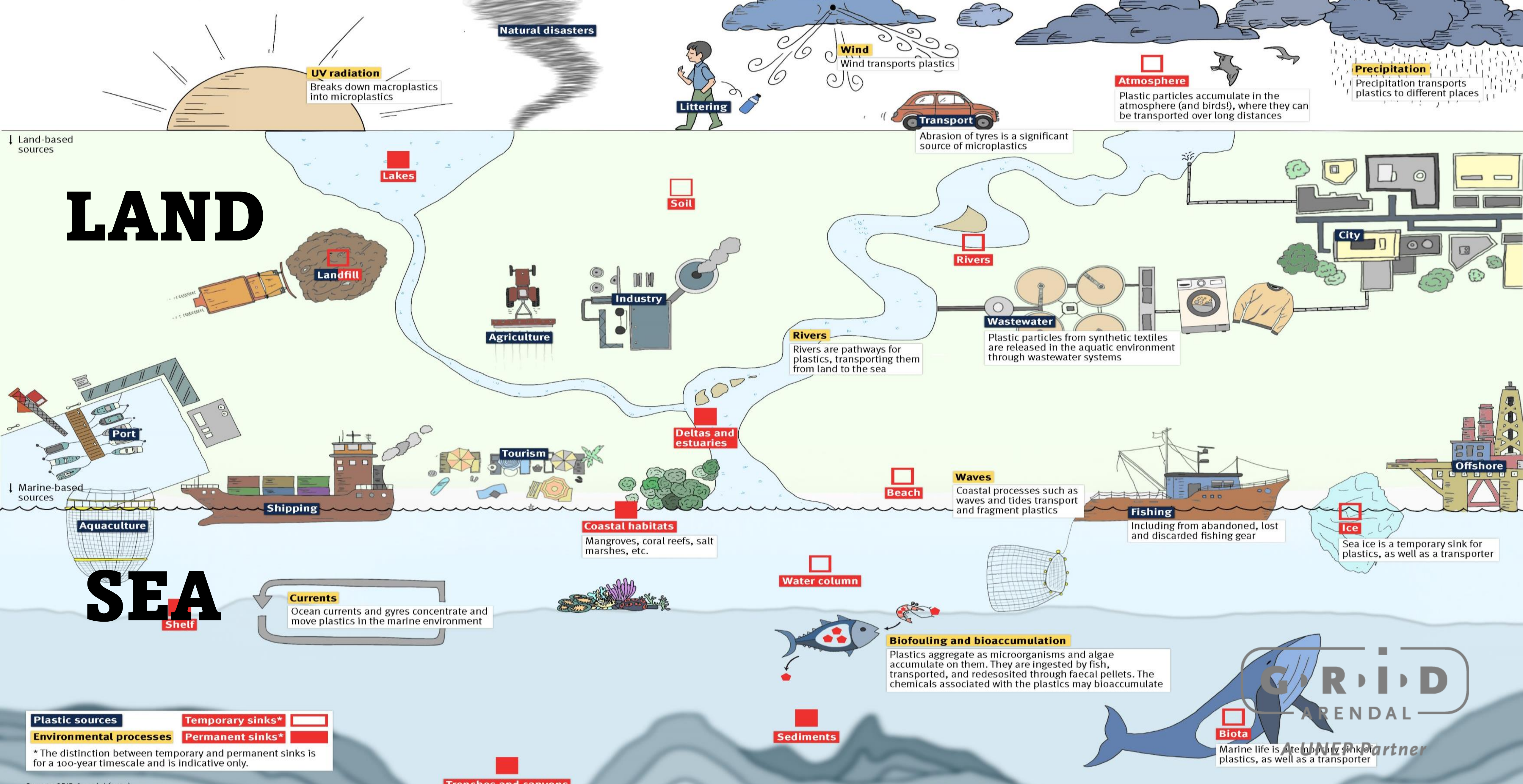
Peter T. Harris, **Thomas Maes**, Karen Raubenheimer, J.P. Walsh

Continental Shelf Research
Volume 255, 15 February 2023, 104947

https://doi.org/10.1016/j.csr.2023.104947

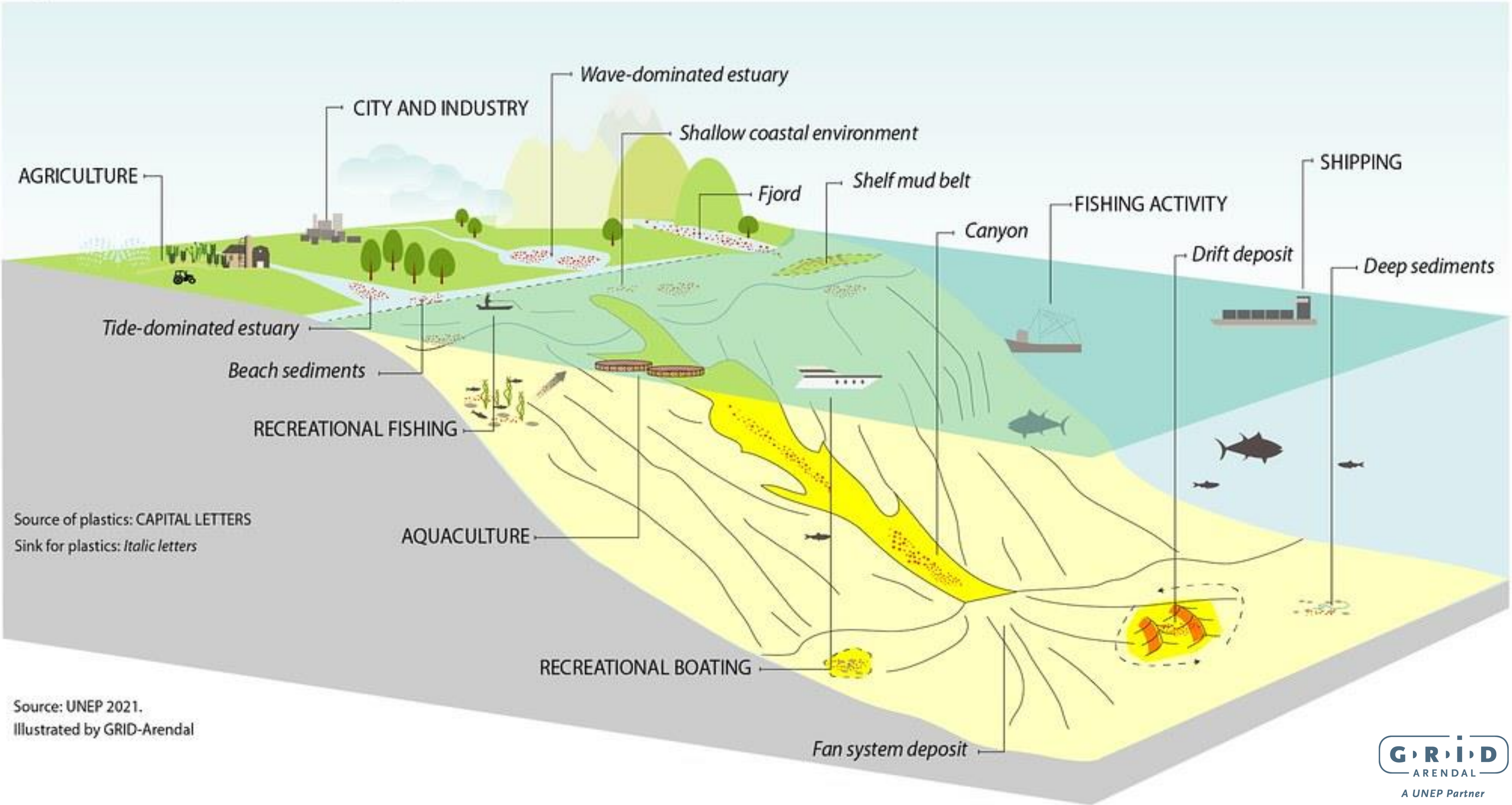


Sources, pathways and sinks of plastics



Source: GRID-Arendal (2021).
UNEP (2021). Drowning in plastics – Marine Litter and Plastic Waste Vital Graphics.

Major sources and sinks of microplastics and marine litter



Source: UNEP 2021.
Illustrated by GRID-Arendal

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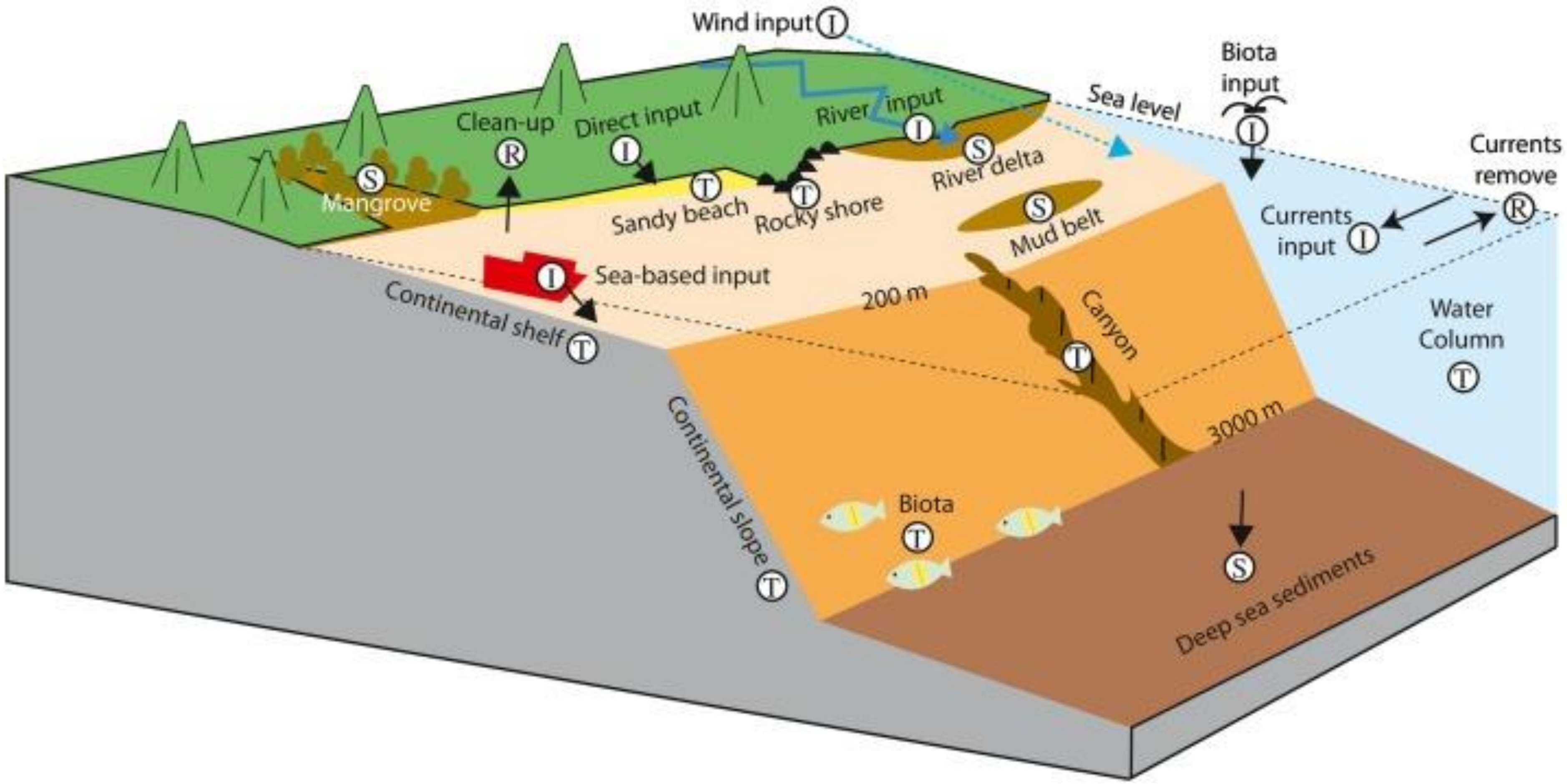
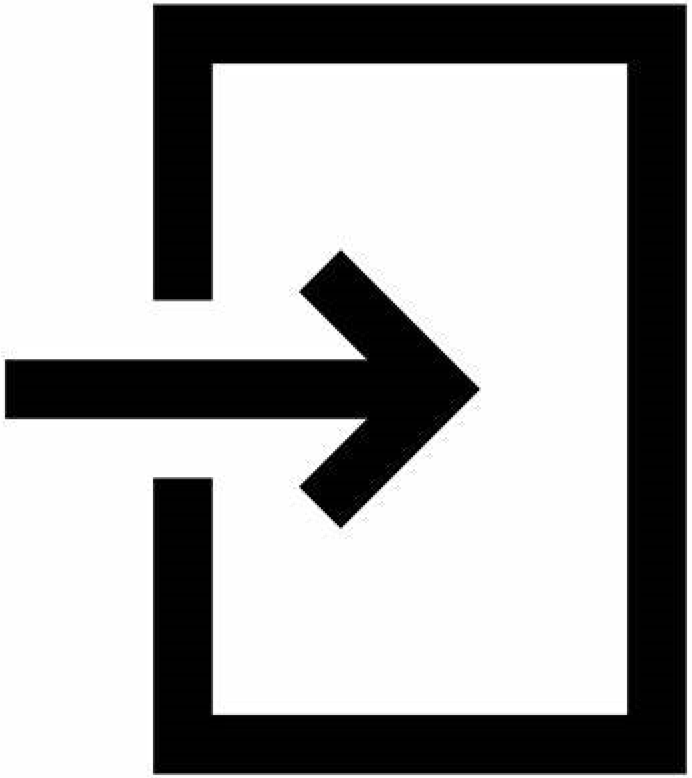


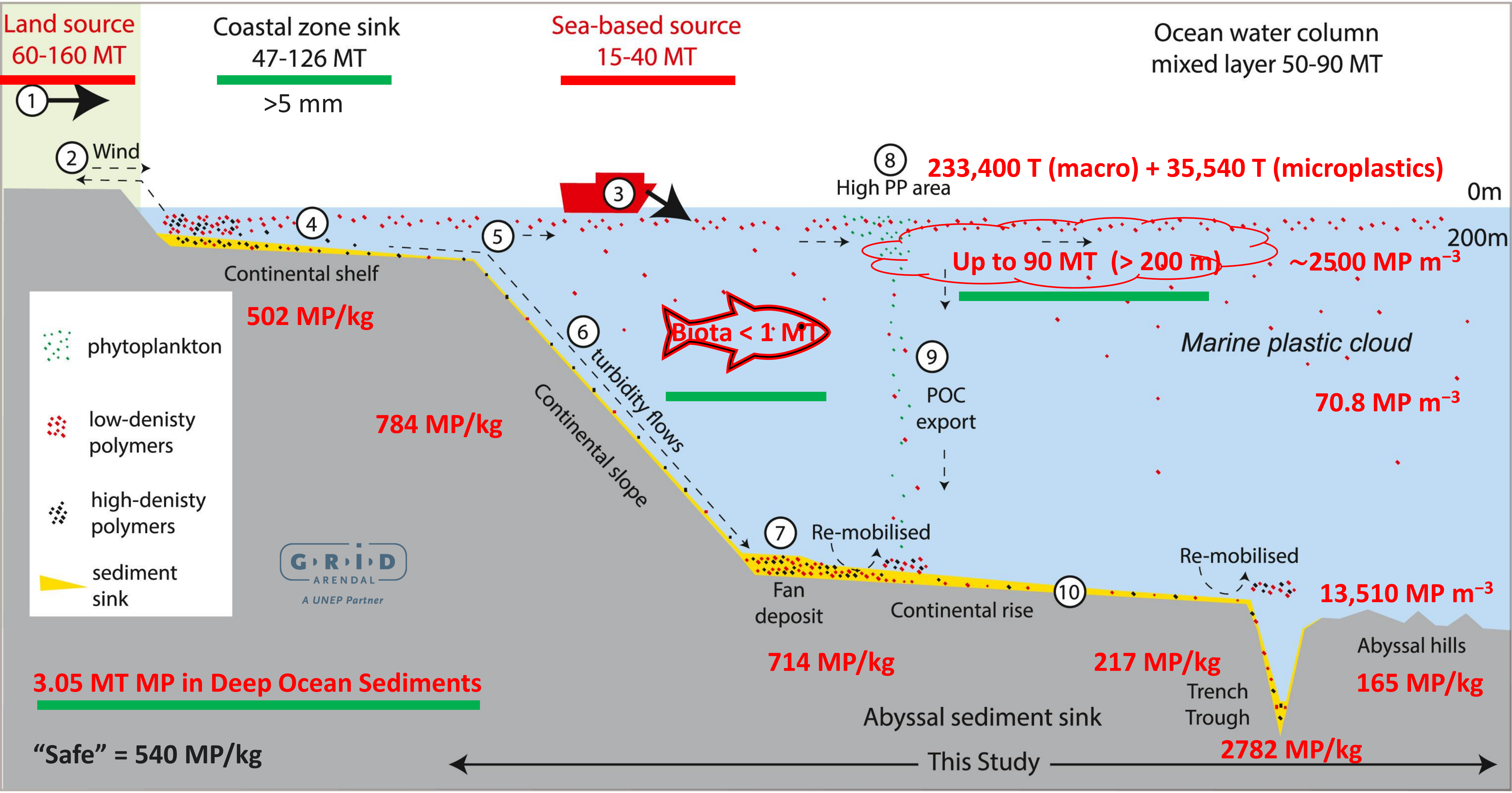
$$I_{land-based} + I_{sea-based} + I_{river} + I_{wind} + I_{biota} \; (+\, I_{currents}) = T_{watercolumn} + T_{coast} + T_{biota} + T_{shelf} + T_{deepsea} + S_{coast} + S_{shelf} + S_{deepsea} - R_{cleanup} \; (-\, R_{currents})$$

DIRECT PLASTIC INPUTS | INDIRECT PLASTIC INPUTS | TRANSITORY PLASTIC | PLASTIC SINKS | PLASTIC REMOVAL

Harris et al., 2021 - Taking a mass-balance approach to assess marine plastics in the South China Sea



~200 (75-199) million tons



Land source
60-160 MT
Coastal zone sink
47-126 MT
>5 mm
Sea-based source
15-40 MT
Ocean water column
mixed layer 50-90 MT
1
2 Wind
3
4
5
8
High PP area
233,400 T (macro) + 35,540 T (microplastics)
0m
200m
Up to 90 MT (> 200 m)
~2500 MP m^{-3}
Continental shelf
502 MP/kg
phytoplankton
low-denisty polymers
high-denisty polymers
sediment sink
6
turbidity flows
Continental slope
784 MP/kg
Biota < 1 MT
9
POC export
Marine plastic cloud
70.8 MP m^{-3}
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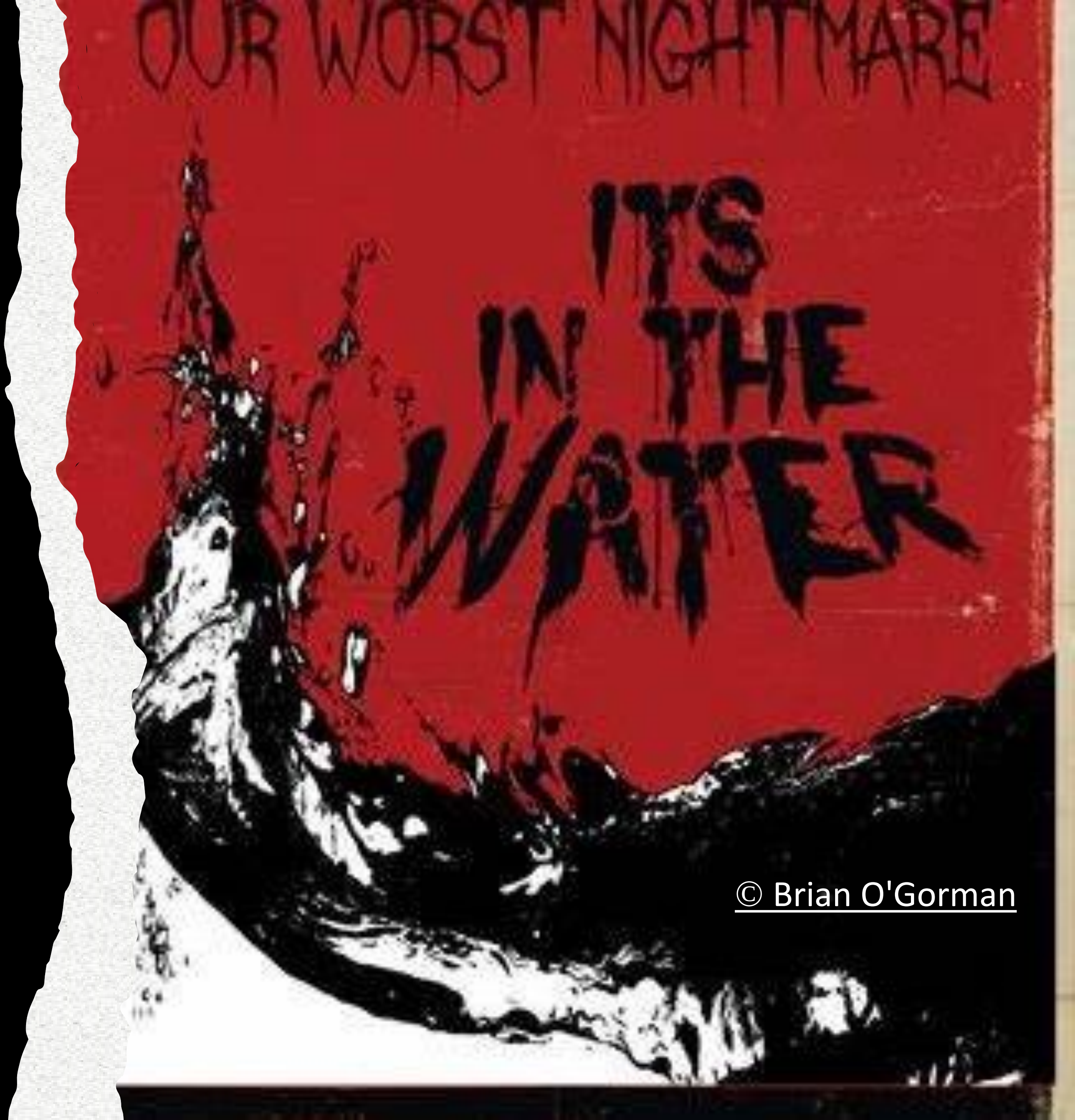
7
Re-mobilised
Fan deposit
Continental rise
10
Re-mobilised
13,510 MP m^{-3}
Abyssal hills
3.05 MT MP in Deep Ocean Sediments
714 MP/kg
217 MP/kg
165 MP/kg
Trench
Trough
Abyssal sediment sink
"Safe" = 540 MP/kg
2782 MP/kg
This Study



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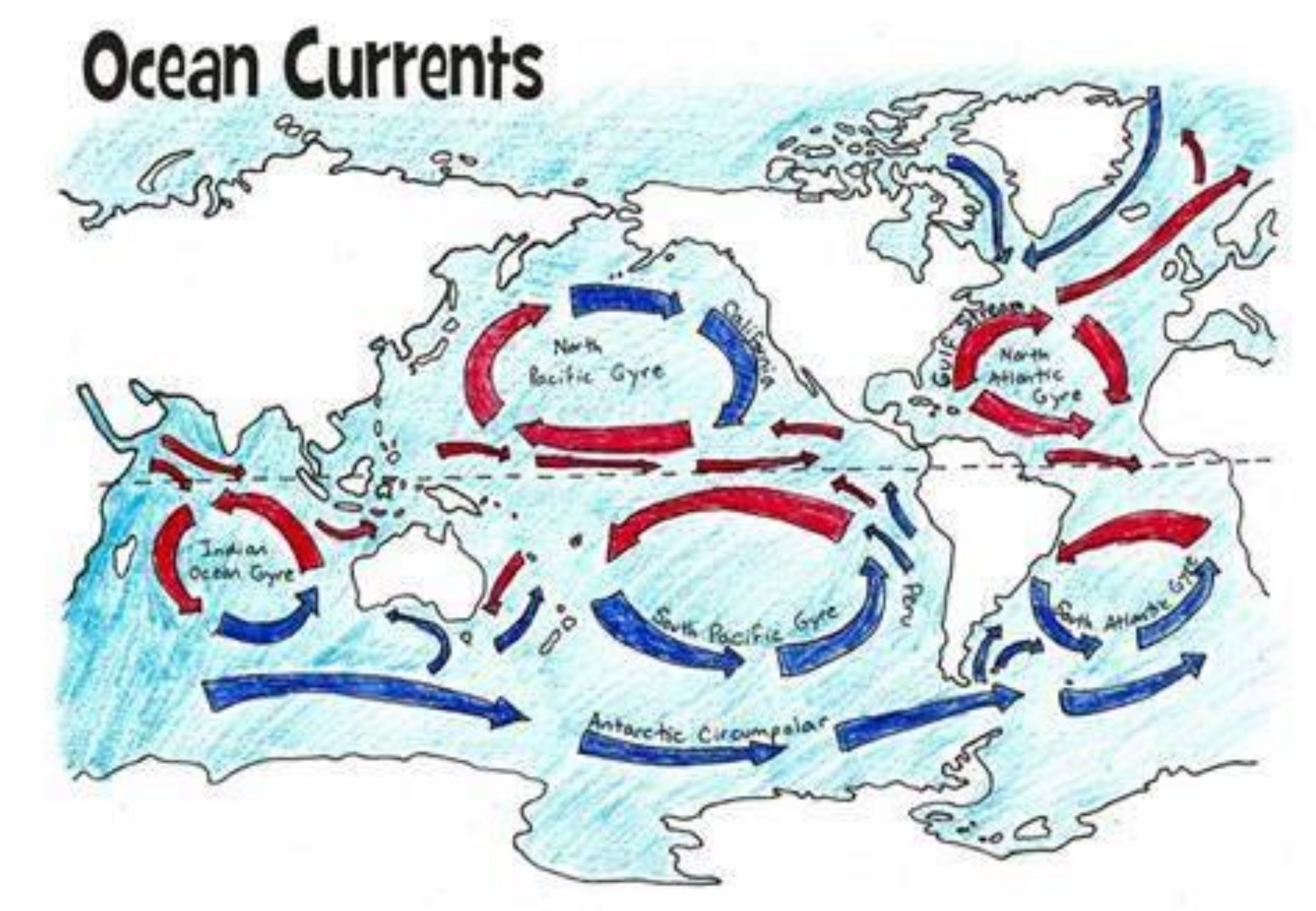
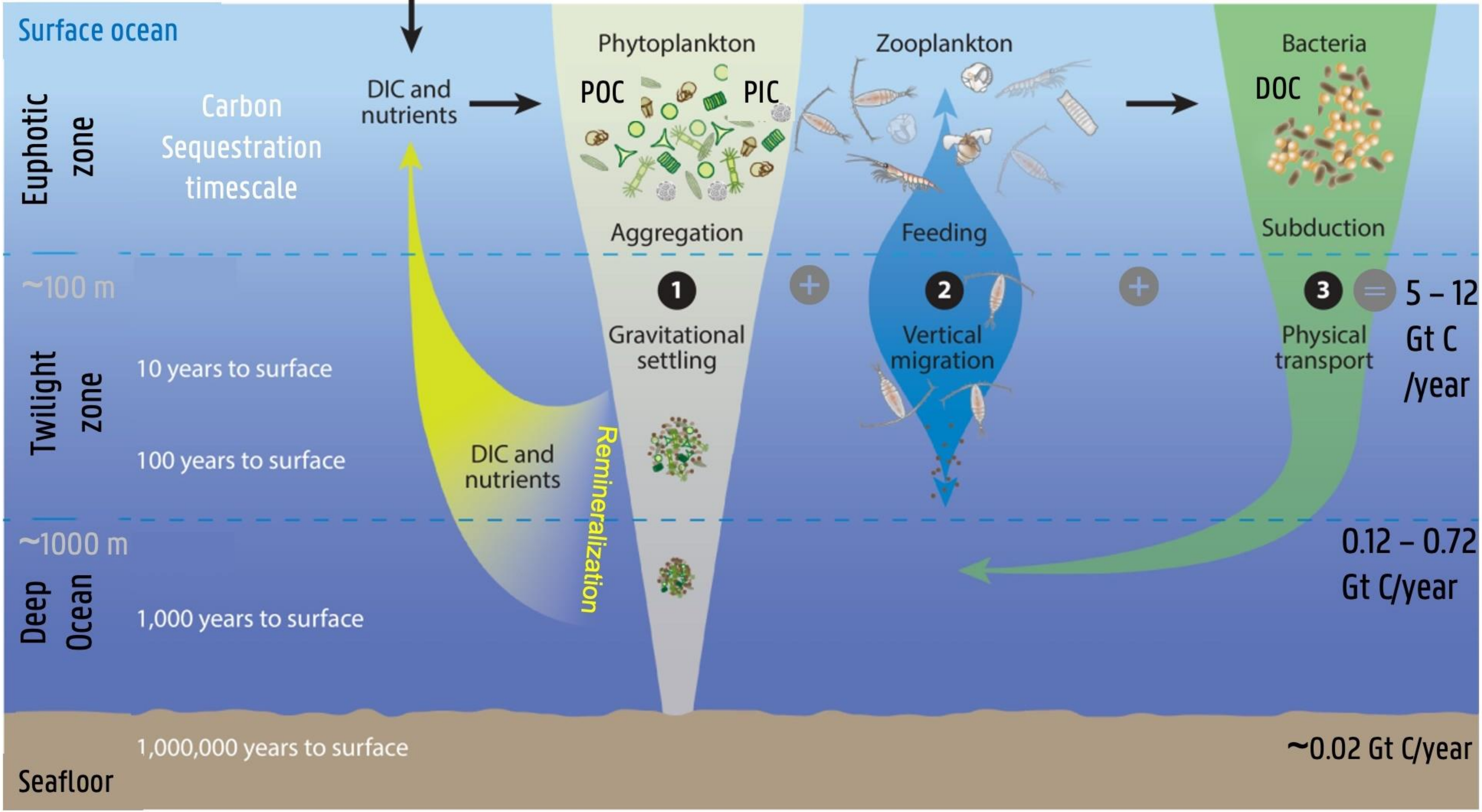
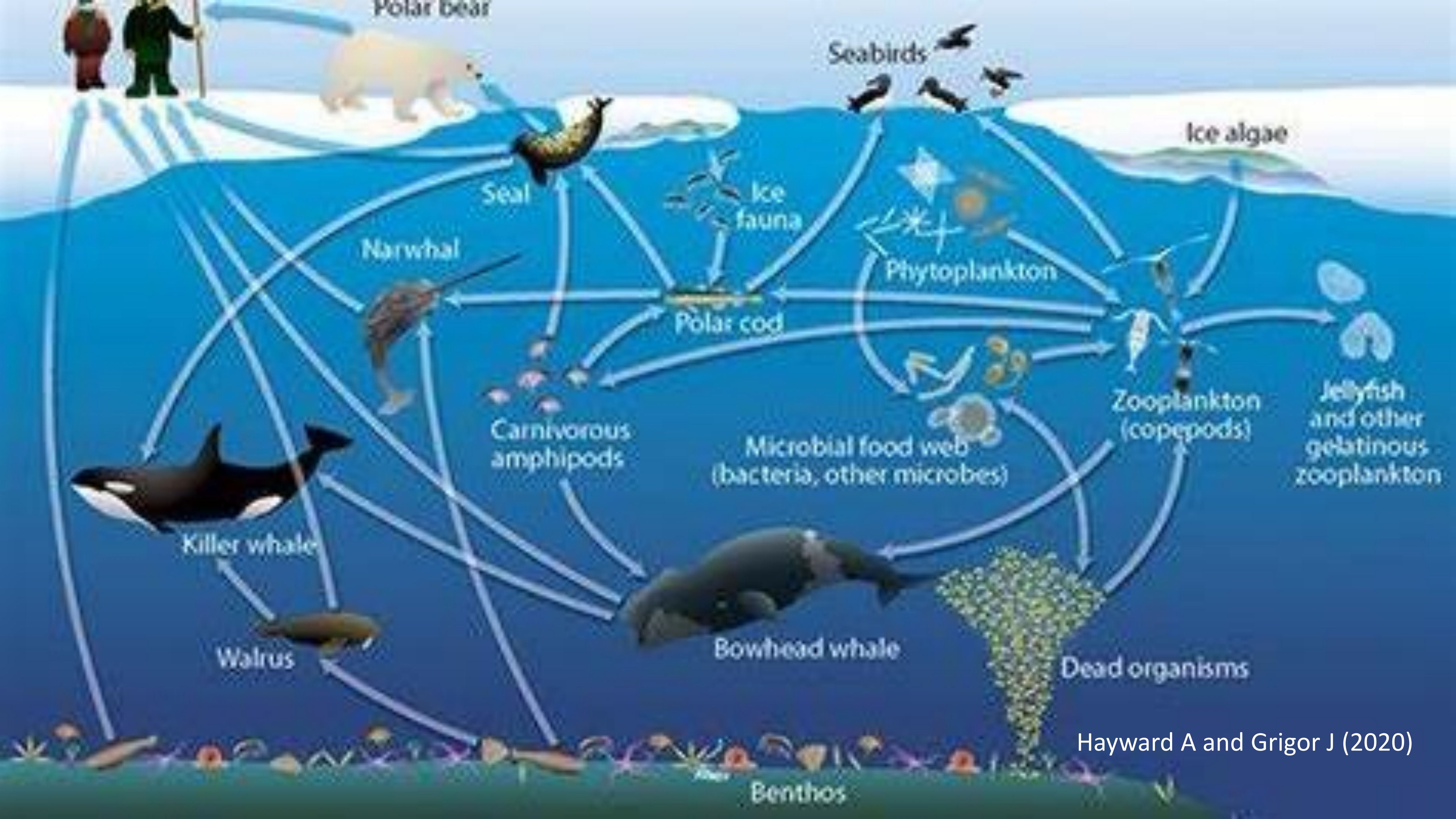

Ocean Currents
North Pacific Gyre
California
Gulf Stream
North Atlantic Gyre
Indian Ocean Gyre
South Pacific Gyre
Peru
South Atlantic Gyre
Antarctic Circumpolar


Surface ocean
Euphotic zone
Carbon Sequestration timescale
DIC and nutrients
Phytoplankton
POC
PIC
Aggregation
Zooplankton
Feeding
Bacteria
DOC
Subduction
~100 m
1
Gravitational settling
2
Vertical migration
3
Physical transport
5 – 12 Gt C /year
Twilight zone
10 years to surface
100 years to surface
DIC and nutrients
Remineralization
~1000 m
0.12 – 0.72 Gt C/year
Deep Ocean
1,000 years to surface
1,000,000 years to surface
Seafloor
~0.02 Gt C/year



Hayward A and Grigor J (2020)

Conclusions

Leaving a plastic legacy:

Inactively meandering and braided river systems deliver plastic to the ocean

A Marine Plastic Cloud:

The ocean water column behaves as a transitory, temporary storage area for plastic

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Want to find out more?

- **Nyberg et al., 2023 - Leaving a plastic legacy: Current and future scenarios for mismanaged plastic waste in rivers**
- **Harris et al., 2023 - A marine plastic cloud - Global mass balance assessment of oceanic plastic pollution - Continental Shelf Research**
- **Harris et al., 2021 - Taking a mass-balance approach to assess marine plastics in the South China Sea – Marine Pollution Bulletin**

Thank you for your attention!

thomas.maes@grida.no

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Sediment sampling in the MAREANO program

With a focus on sampling procedures for microplastics

Stepan Boitsov, IMR

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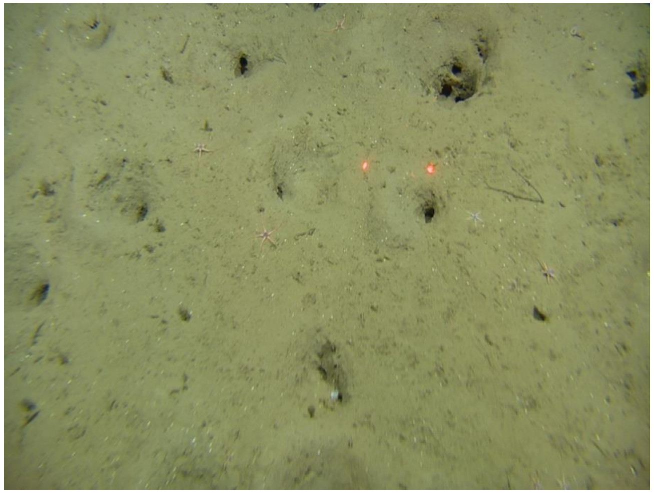
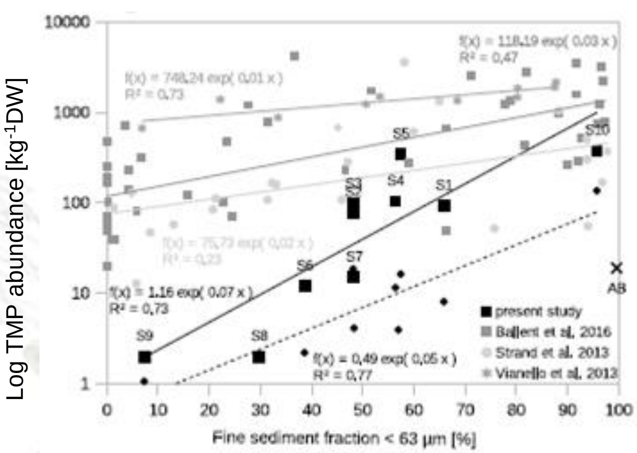
Sediments

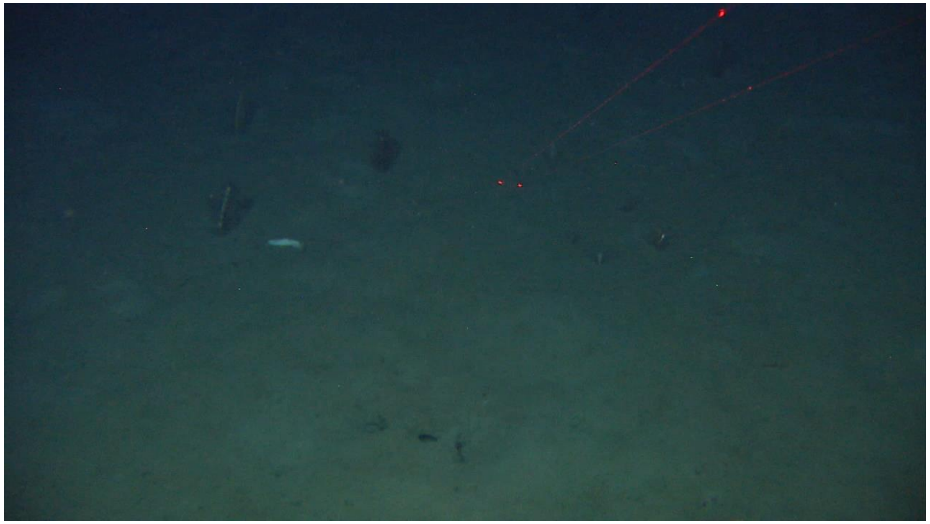
- Sediments may accumulate contaminants
- Particularly fine-grain sediments are relevant
  - High contents of silt and clay, <63 µm
  - Low sand contents



- Correlations between microplastics and grain size



Enders et al. 2019. *Nature. Scientific Reports* 9, 15207.



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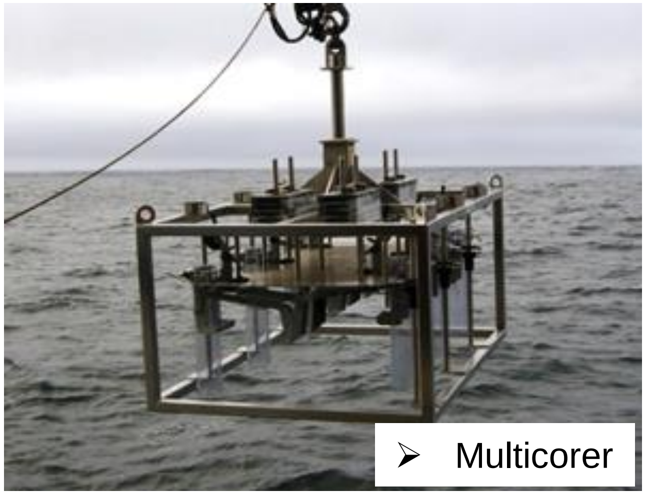
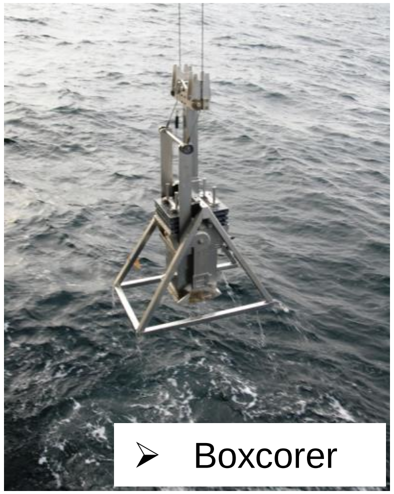
Sediment sampling equipment

➢ **Used by MAREANO:**



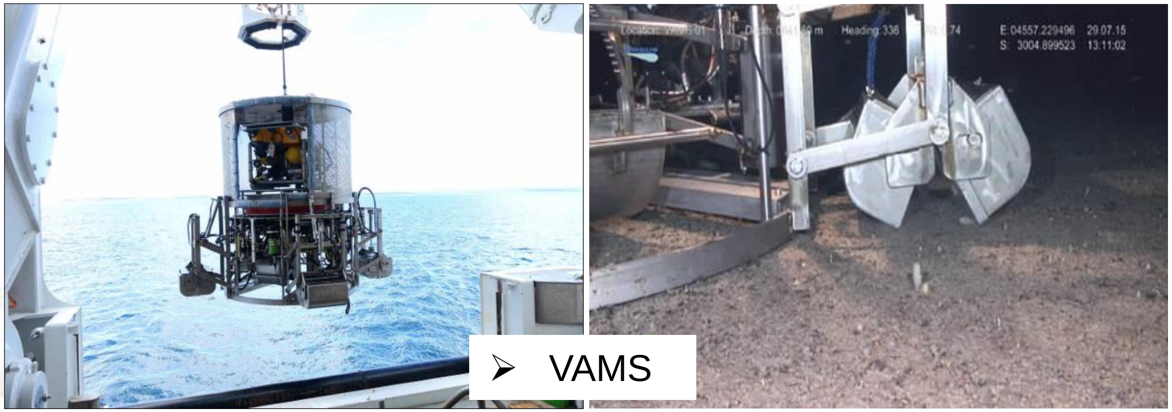
➢ Multicorer



➢ Boxcorer

➢ Van Veen Grab

➢ **Used by IMR and NGU in other projects:**

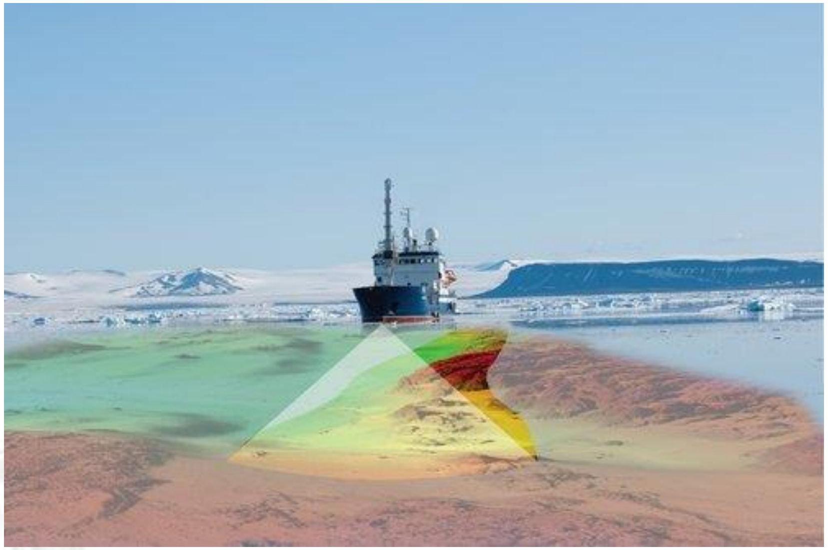


➢ VAMS

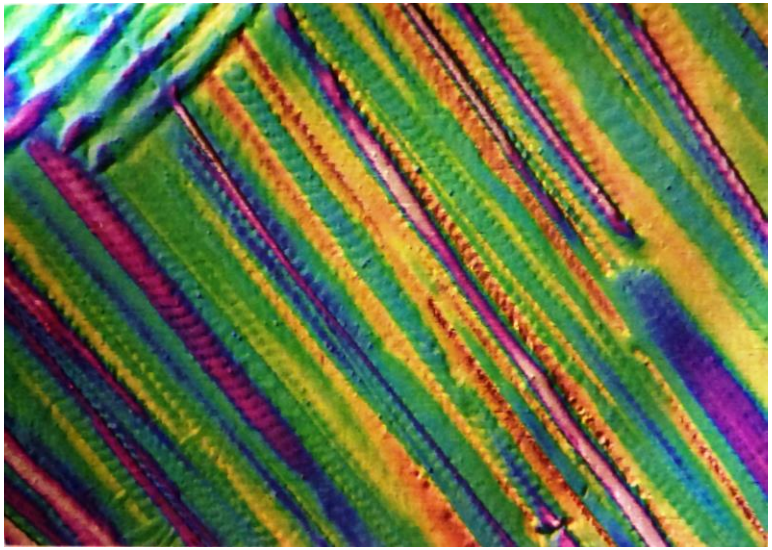
➢ Mini-multicorer

MAREANO: Before sampling

Kartverket



- Multibeam maps



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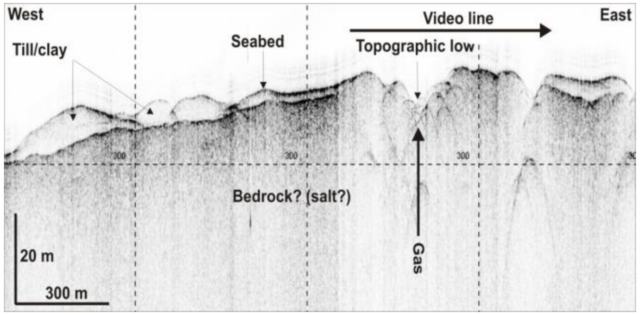
MAREANO: Sampling cruises

- Sediment echosounder (TOPAS)

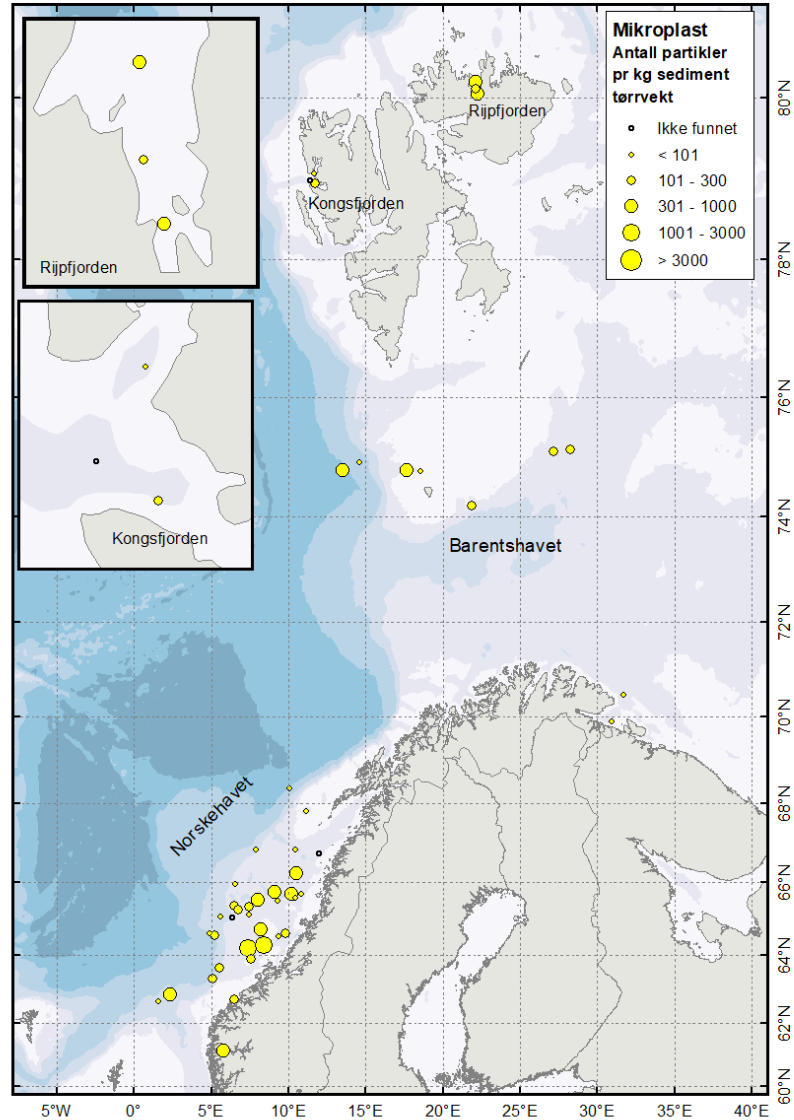


- High-res video filming

- Benthos sampling

Experience from the MAREANO program

- Multicorer (above) used for sampling
- Over 300 sediment sampling locations in 2006-2023
- Over 50 locations for microplastics (MP)
- Samples from 100 - >2000 m depth
- Low levels of MP make avoiding contamination during sampling critical



Map: Kjell Bakkeplass

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Experience from the MAREANO program

- **Pilot project 2016-2017** *http://www.ngu.no/upload/Publikasjoner/Rapporter/2017/2017_043.pdf*
  - Surface sediments from 10 locations in the Norwegian Sea and off the coast of Finnmark
  - Sampled in 2011-2015 after the regular procedure for contaminants
  - Analysed at GhEnToxLab, University of Ghent, Belgium
  - *Probably some contamination, especially with fibers*
- **Sampling 2018** *https://www.ngu.no/upload/Publikasjoner/Rapporter/2019/2019_027.pdf*
  - Surface sediments from 10 locations off Bear Is. and the fjords of Svalbard
  - Sampled in 2018 specifically for microplastics
  - Analysed at Norwegian Geotechnical Institute (NGI)
  - *Test samples to check for contamination*
  - ***New sampling procedure developed based on the results***
- **Sampling 2020 and onwards**
  https://www.ngu.no/upload/Publikasjoner/Rapporter/2021/2021_028.pdf
  https://www.mareano.no/resources/Rapport_2022_023.pdf
  - Sampled after an adjusted procedure
  - *Minor adjustments to the sampling procedure after 2020-sampling*

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Sampling – sediment cores

- **Sources of contamination**
  - During sampling

- <u>Tube contact blanks</u>: **PVC + more**
- <u>Field blanks</u>: **PVC + more**

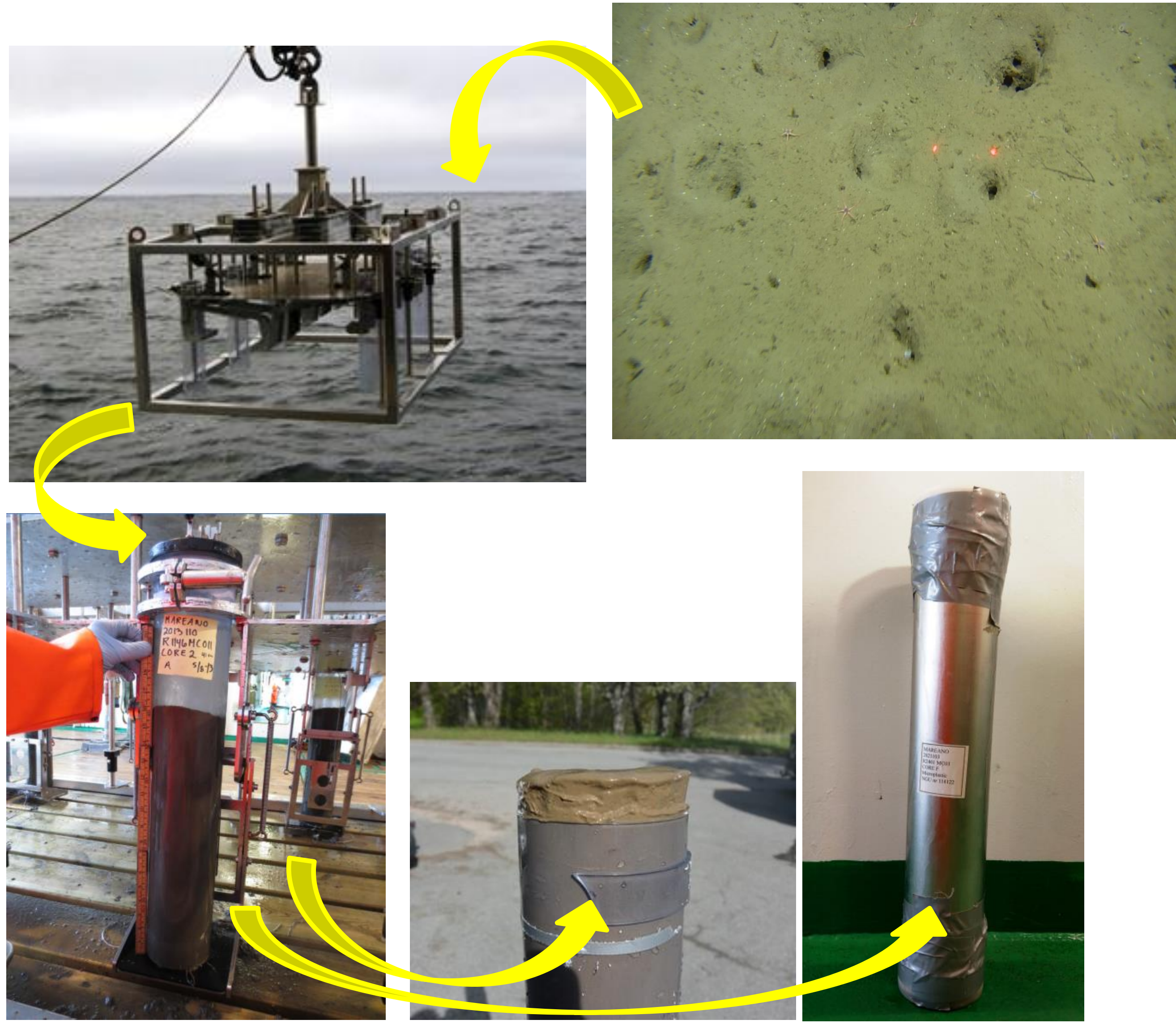
  - During sample recovery

- Onboard: <u>Sampling blanks</u>: **little**
- On land: <u>No control</u>: **tire rubber?**

  - During sample preparation at the lab.

- <u>Method & recovery blanks</u>: **PTFE + more**

- **New protocol for sampling developed**



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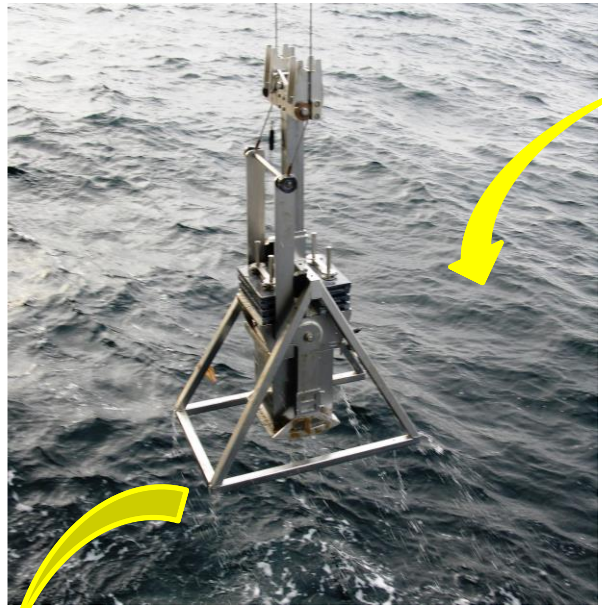
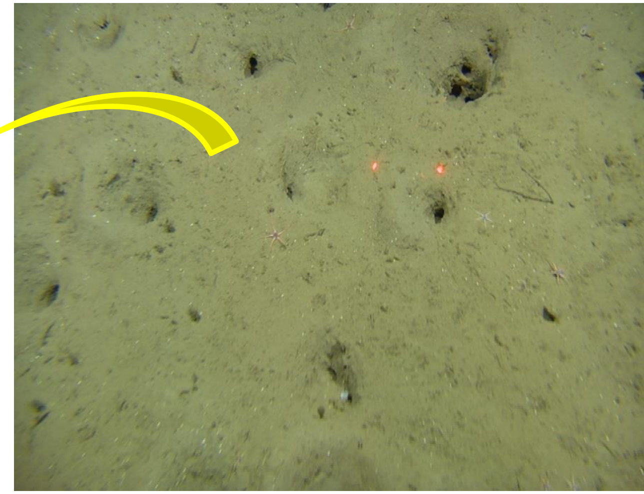
Sampling – surface sediments

- Boxcorer delivers undisturbed surface
- Upper 2 cm may be taken out
- Sampling blanks necessary due to exposure to the surroundings





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Preparing for the sampling

Measures	Sediment cores	Surface sediments
Clothes	Synthetic material should be avoided. Preferred material is cotton or wool. **Fleece clothes must be avoided**. Usual oilskins, rubber boots and plastic helmets are allowed.	
Place	All sample handling onboard should take place on deck or in open hangar (**outdoor air** and temperature). The samples are not to be exposed to indoor environment.	
Sampling personnel	Two specialists take out the sample. The crew and everyone else are asked to **keep away during sampling**.	One specialist takes out the sample. The crew and everyone else are asked to **keep away during sampling**.
Sample packaging	**Metal tubes**. Before use, keep sealed.	**Aluminium foil**
Sample acceptance criterion	**Two whole, undisturbed, closed cores** of any length	**Undisturbed surface, 2 cm** upper layer

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Sampling protocol

Step	Sediment cores	Surface sediments
1. Opening the sample	1. The top **lid of the core is opened** (simultaneously with a field blank placed close to it). The core is **immediately covered** ~~by Al foil~~ (and the field blank is closed).	1. Boxcorer/grab **lid is opened** simultaneously with a field blank and **surface water is removed** with glass pipette inserted into the rubber hose. Only glass comes in contact with the water.
2. Taking out the sample	2. The **core is taken out** by means of a metal spade and **is covered with** plastic lids.	2. The **sample is taken out** by means of a metal spade, and **placed into Al foil**. The foil and the field blank are closed.
3. Sealing the sample	The core is sealed by tape, labeled and registered in the log and **placed in vertical position on the deck outdoors**	The sample is labeled and placed into a plastic bag, registered in the log and **placed to storage**
4. Sample transport to the lab	The core is transported to the lab as it is and **actual samples are taken out at the lab**	The samples are transported to the lab and **whole sample may be analysed**

Summary

- Sampling procedure is critical for avoiding contamination of the samples
- MAREANO has developed a protocol for sediment sampling for microplastics analysis
- Multicorer is equipment of choice, particularly for sediment core sampling
- Boxcorer or Van Veen grab may be used for surface sediment sampling

Thank you for your attention!


A naked snail, the Barents Sea. MAREANO

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Havforskningsinstituttets mikroplastlaboratorium og analyse av sedimenter med mikroplast

Andrè Marcel Bienfait og Fred Olav Libnau


www.lifeinnorway.net

Mikroplastlab

Tetthetsseparasjon av mikroplast fra sediment

Separasjon baseres på metode og utstyr innkjøpt fra NGI.

Sentralt her er det som er kalt bauta, om ikke akkurat Stonehenge-størrelse

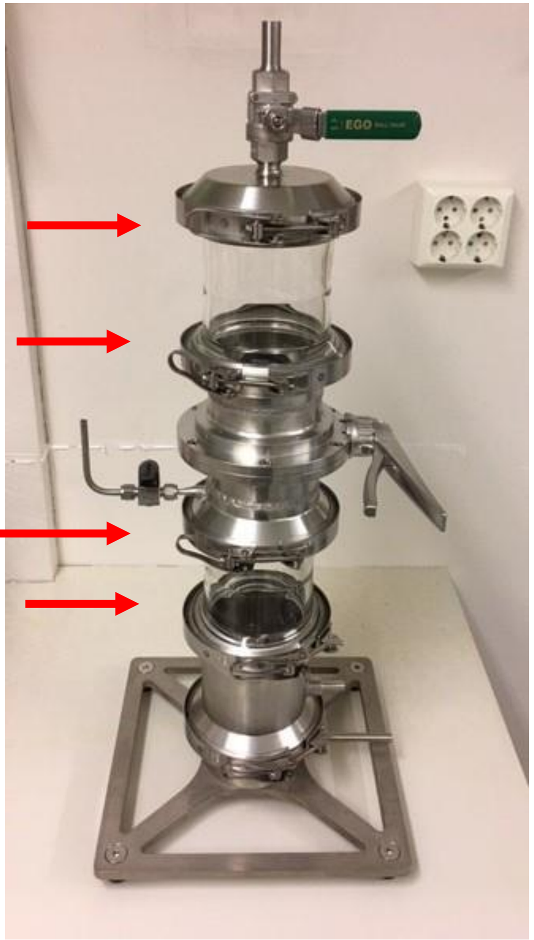
så skjønner en jo navnevalget

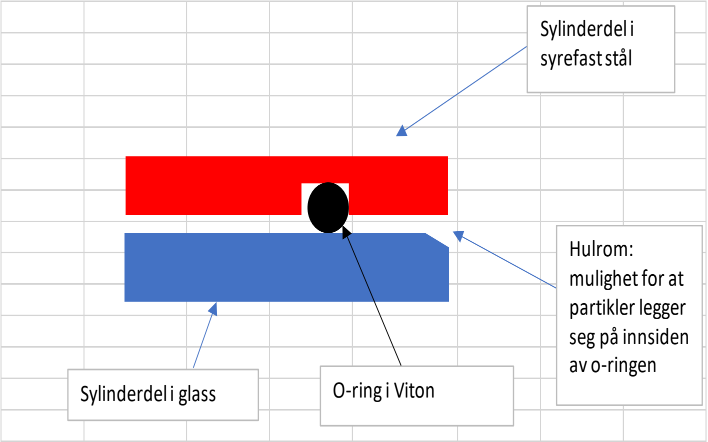
Separasjonskammer

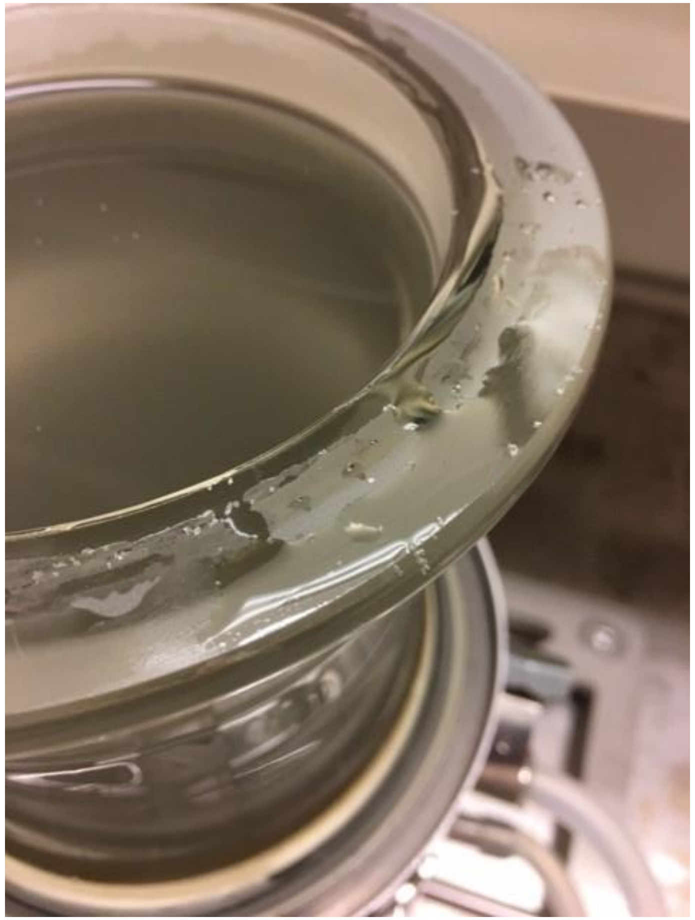
Sedimentasjonskammer

Separasjon på bauta

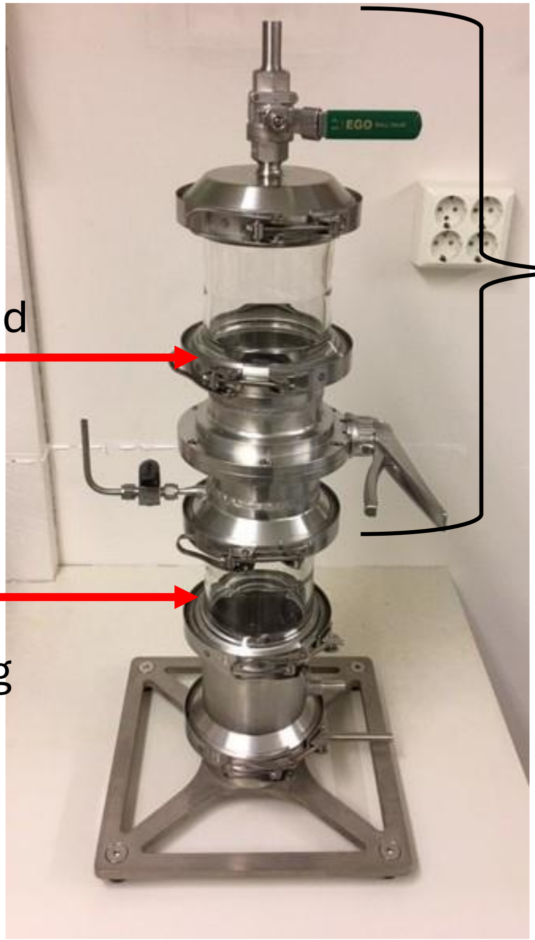
Hulrom







Tilsetning av sediment på bauta
NGI-prosedyre

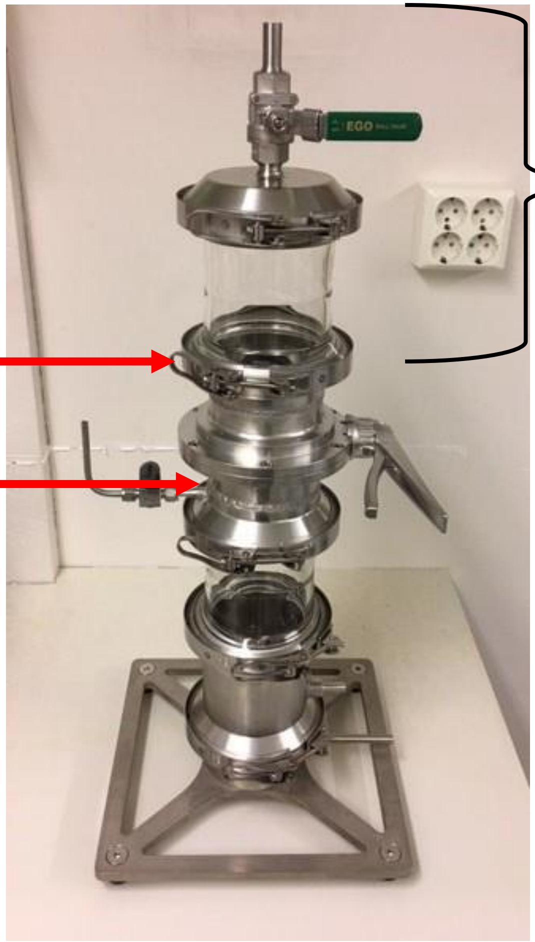


Tas av før tilsetning av sediment

Nivå ved henstand

Nivå før tilsetning av sediment

Vår prosedyre

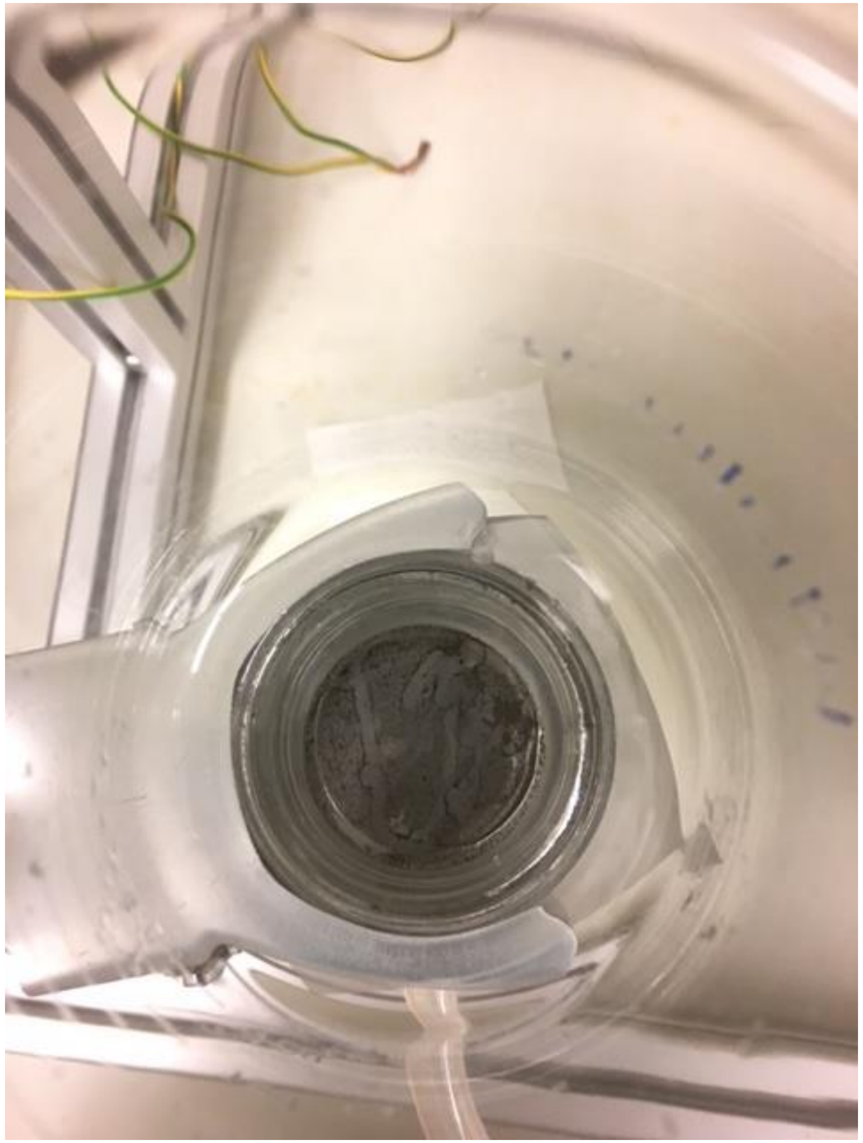


Tas av før tilsetning av sediment

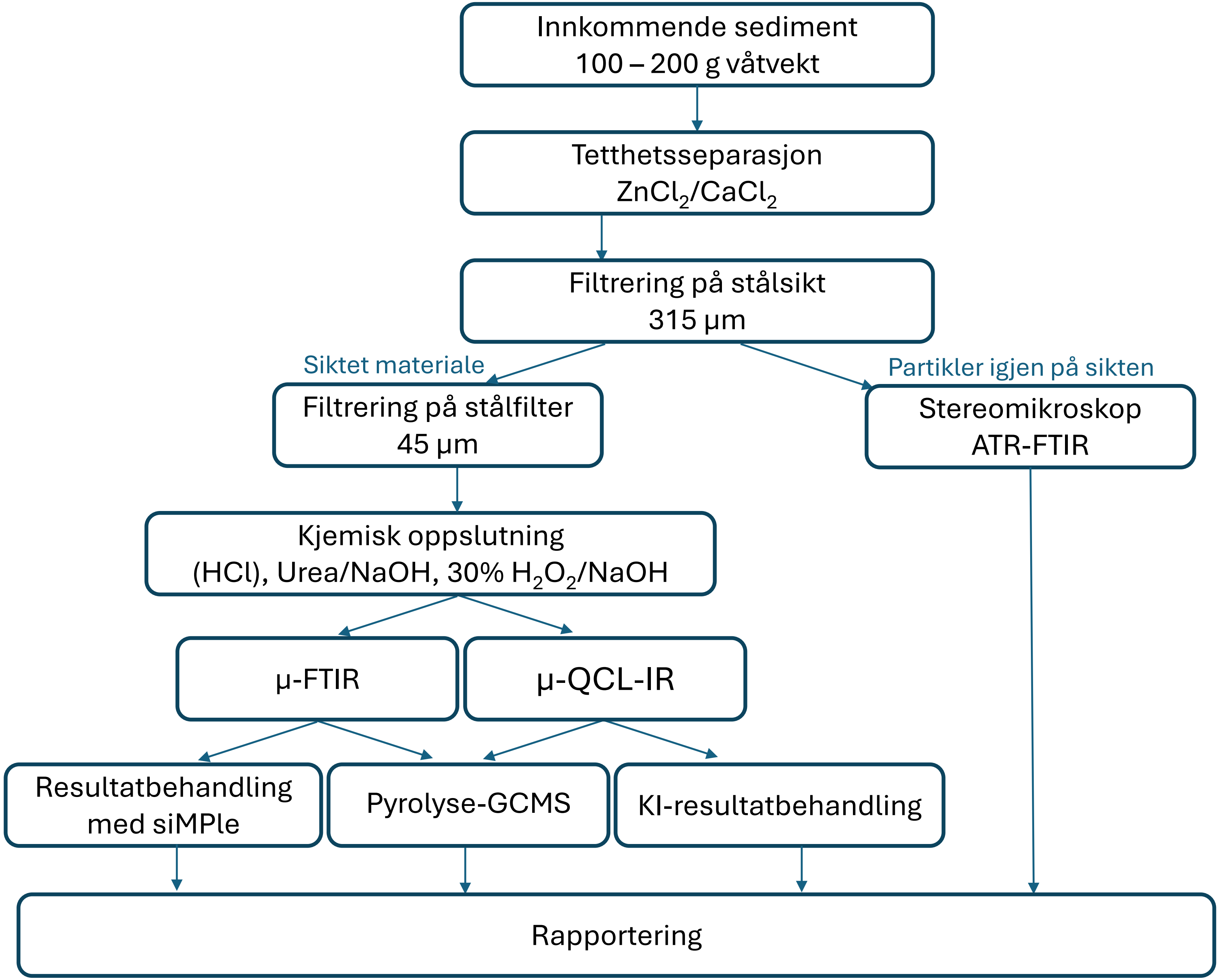
Nivå før tilsetning av sediment

Typisk 45 mm stålfilter før og etter endringer

Før



Etter


Innkommende sediment
100 – 200 g våtvekt
Tetthetsseparasjon
$ZnCl_2/CaCl_2$
Filtrering på stålsikt
315 µm
Siktet materiale
Partikler igjen på sikten
Filtrering på stålfilter
45 µm
Stereomikroskop
ATR-FTIR
Kjemisk oppslutning
(HCl), Urea/NaOH, 30% H_2O_2/NaOH
µ-FTIR
µ-QCL-IR
Resultatbehandling
med siMPle
Pyrolyse-GCMS
KI-resultatbehandling
Rapportering

Forutsetninger for gjennomføring

-Elementene skal kunne gjennomføres på en normal arbeidsdag

-Håndtering av bauta skal ikke medføre slitasjeskader på personell

- Brettet filter holder partikler på plass under kjemisk oppslutning

- Men filtrene må holdes på plass gjennom oksidasjonsreaksjonen

Kvalitetssikring

-Begrenset tilgang til lab
-Bevisst valg av klær
-Renhold – vask, vask og atter vask

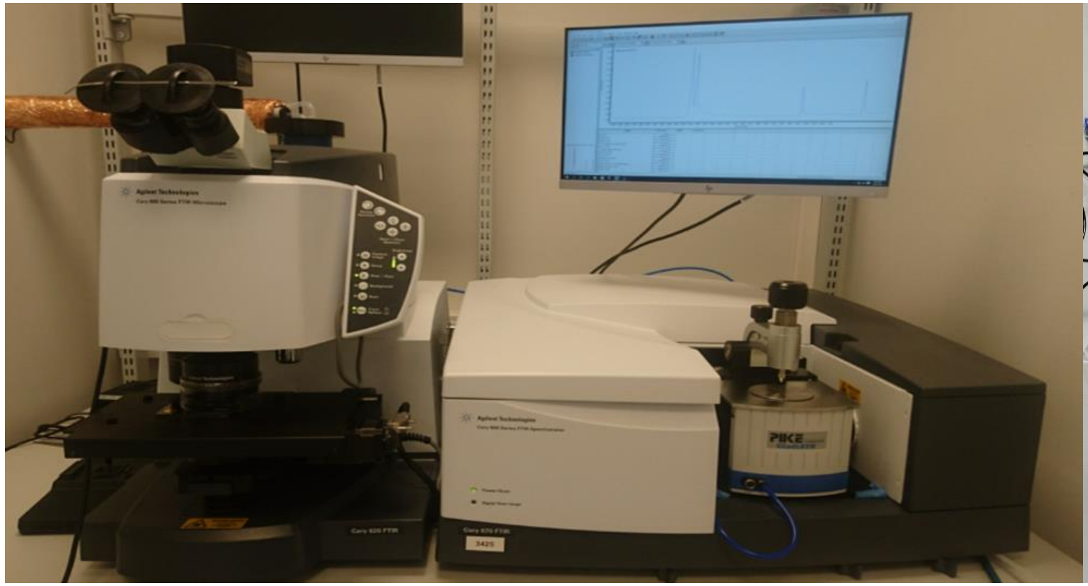
*Metodeblank kjøres tidlig og seint i gjennomføring av prosjektet

*Luftblank kjøres ukentlig under prosjektets gjennomføring
To luftblanke samles inn, en som skal representere forurensing ved filtreringsrack/håndtering av bauta, og en som skal representere forurensing ved håndtering av sediment før overføring til bauta.

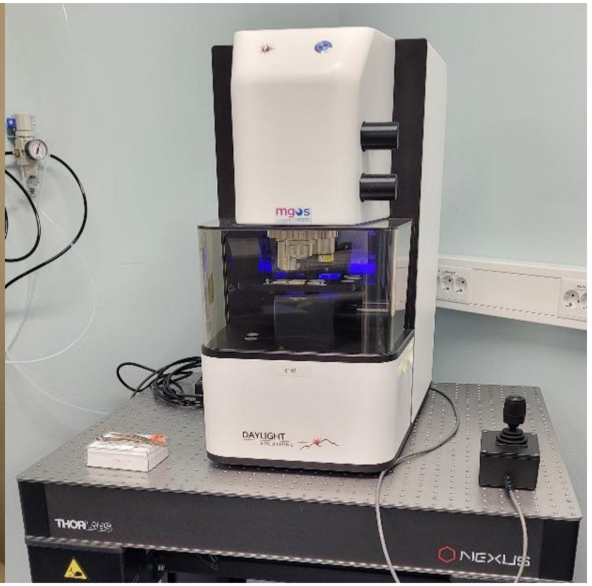
*Test på tetthetsseparasjonens effekt kjøres på et utvalg tetthetsseparerte sedimenter

*Gjenfinning kjøres hovedsakelig mellom prosjektene.

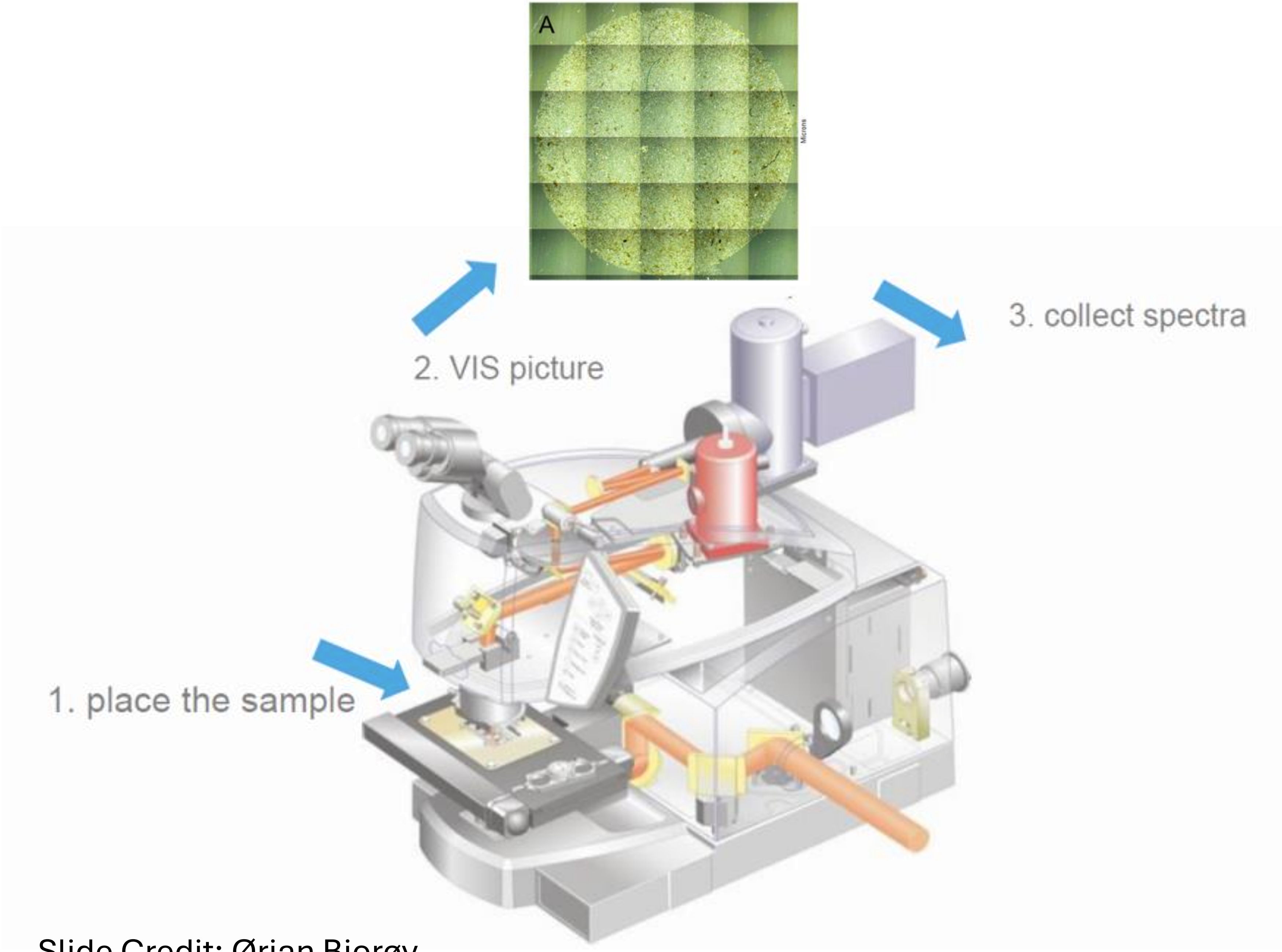
IR-mikroskopisk Analyse

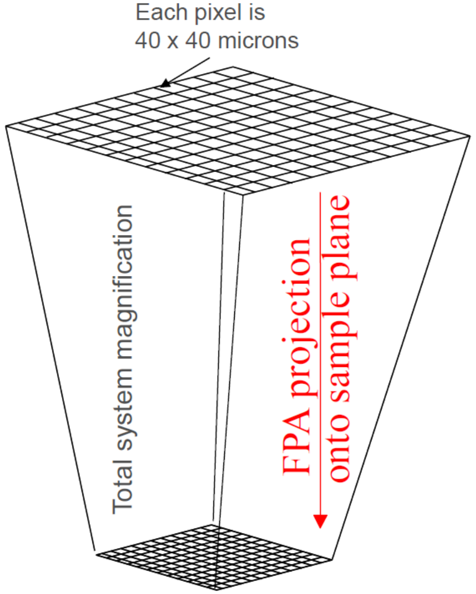


Agilent Cary 620/670

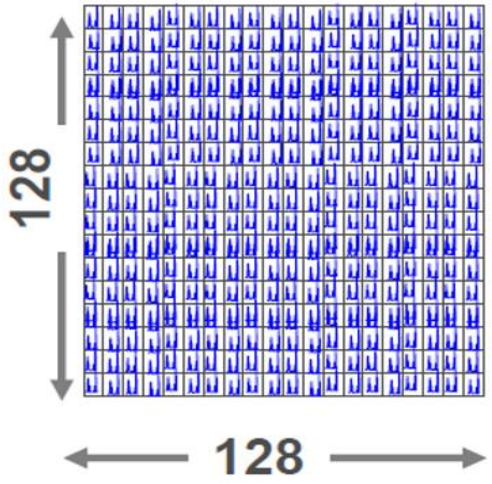


Daylight Solutions
SperoQT 340

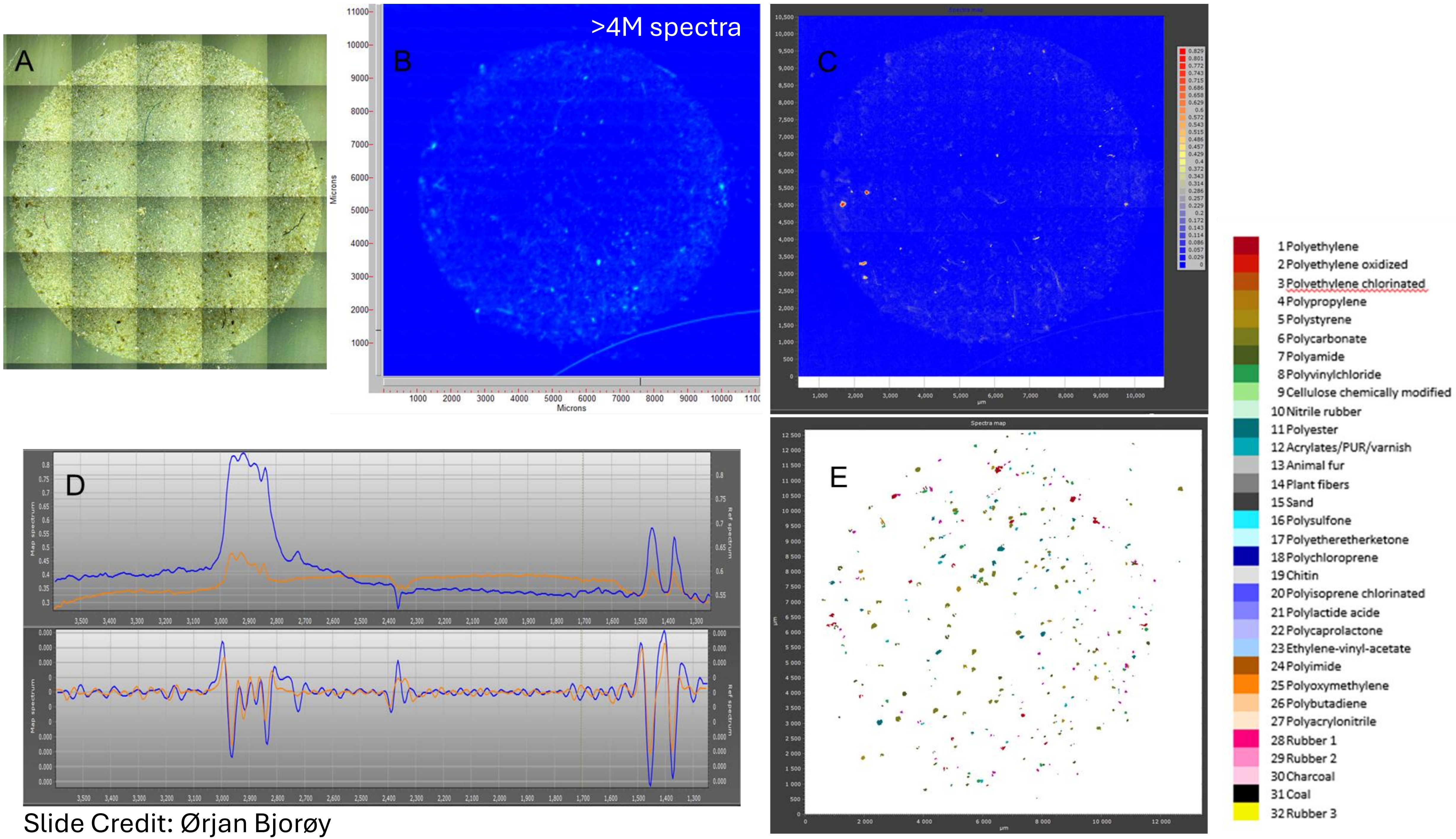




700 x 700 μm
16384 spectra simultaneously



Slide Credit: Ørjan Bjorøy



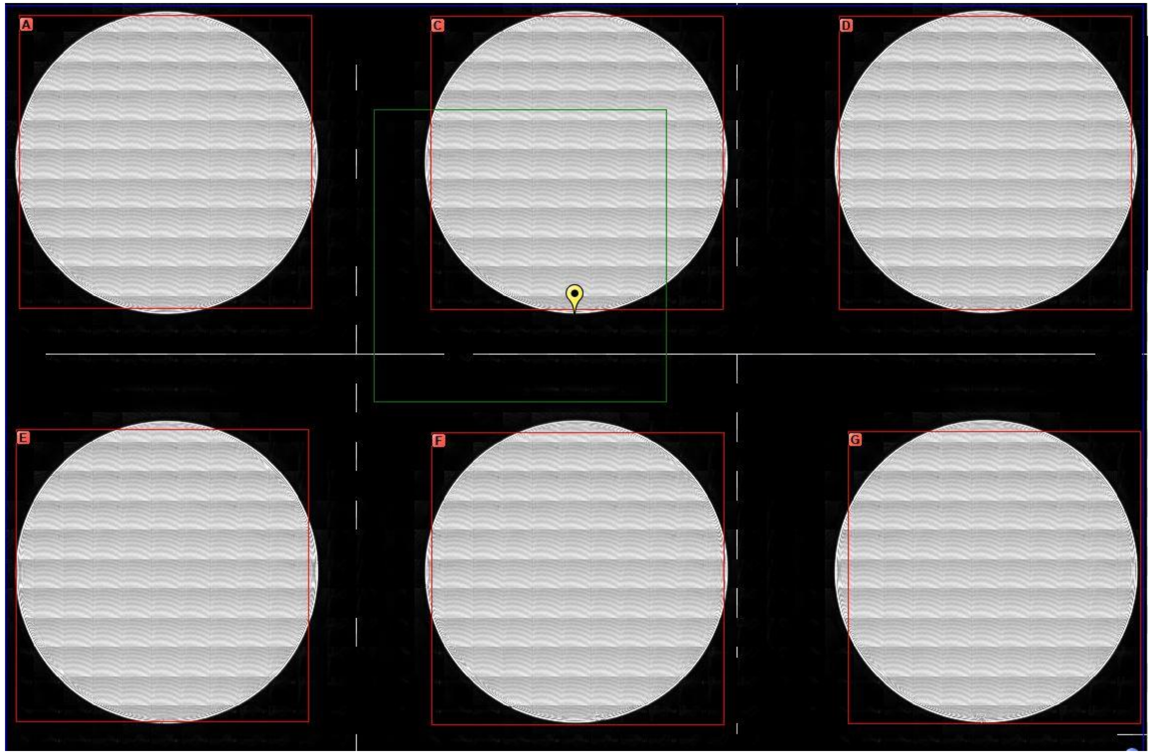
Slide Credit: Ørjan Bjorøy

Automatisering

Stage-modifikasjon vellykket (water-jet-cutting)
→ Alle 6 posisjoner fult analyserbar

Automatisering implementert (skript, rutiner, automatisert backup)
→Per i dag 9 prøver per døgn (3 dagtid + 6 kveld/natt)

Tidsbruk påsetting ≤15 min/prøve



Oversiktsbilde over de 6 måleposisjoner

Databehandling

Vellykket implementering av machine learning algorithm basert på Hufnagl et al. 2019

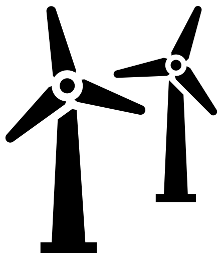
- Mange «hovedpolymere» (PE, PP, PVC, PET, PS, PC, PA, PMMA, PTFE…)
- Mange naturlige partikler/kontaminanter (tre, sediment, chitin, hud…)
- Videreutvikling for flere substrater/filter, matriser og polymerer!
- Automatisert startup

Men selvfølgelig finnes det noen utfordringer!

DOI: 10.1039/C9AY00252A

Accounting for a neglected component of microplastics: Methods to quantify and characterise coating particles from marine infrastructures in sediments

Stefania Piarulli[1], Andy M. Booth[1], Lisbet Sørensen[1], Stephan Kubowicz[2]
[1]SINTEF Ocean, Trondheim, Norway; [2] SINTEF Industry, Oslo, Norway;



SINTEF

Plastic research at SINTEF Ocean

> 30 projects and > 50 papers and book chapters since 2015

microfibre
PLASTOX
ANDROMEDA
MicroLEACH
SOS ZEROPOL 2030
REVEAL
PLASTICENE
PERFECOAT
PlasticTrace
SMARTER
μ-DETECT

2015 — **2023->**

Environmental Fate & Effects

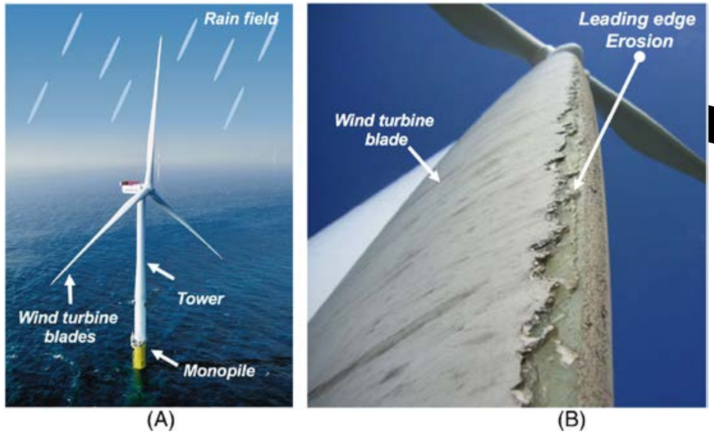
Microplastic | Nanoplastic | Plastic Chemicals | Plastic | 'Degradable' plastic

Analytical methods and monitoring

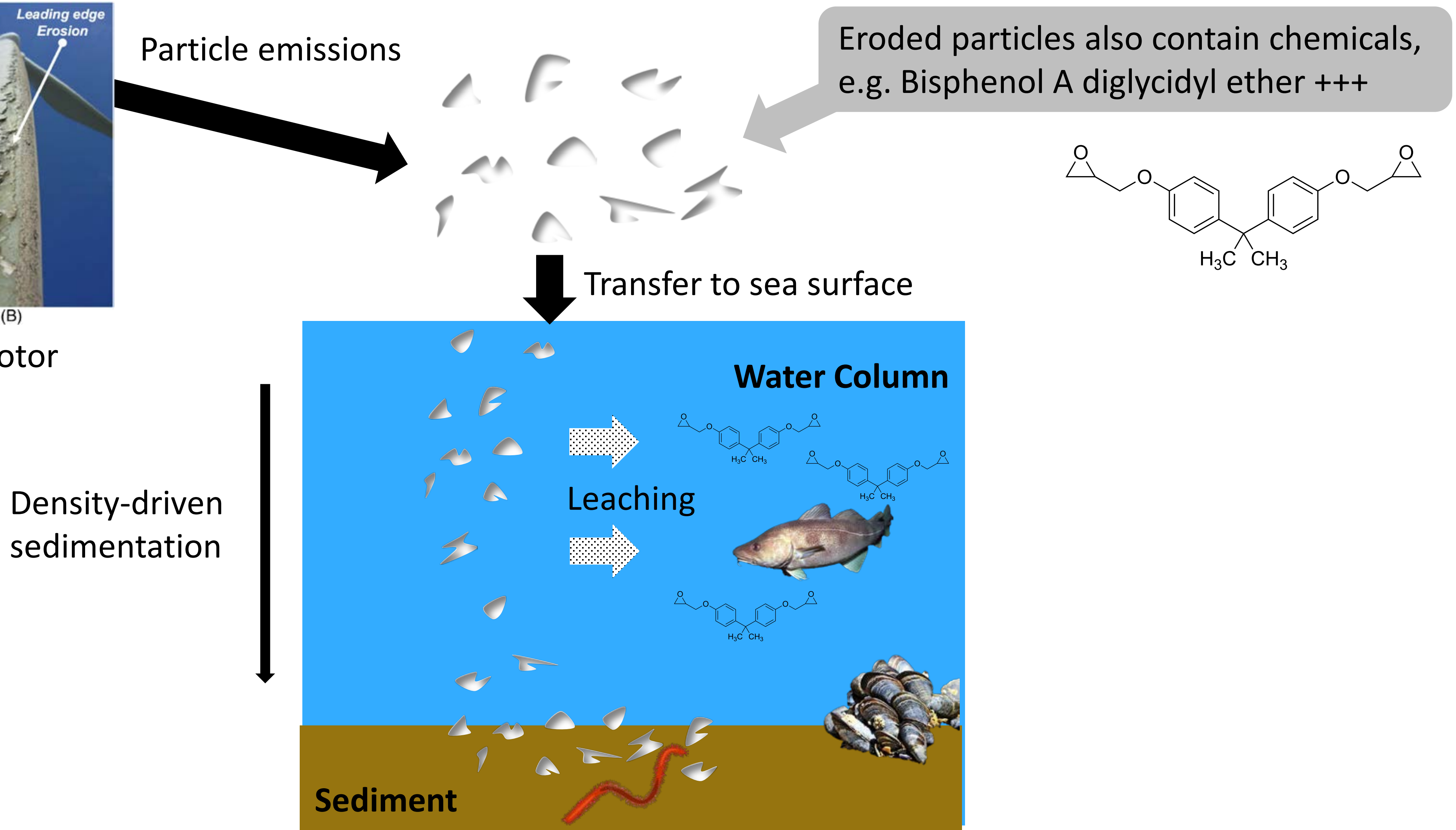
Material selection | Mitigation | Policy

ICES CIEM · KYSTVERKET · cen EUROPEAN COMMITTEE FOR STANDARDIZATION · AMAP · Handelens Miljøfond · JPI OCEANS · The Research Council of Norway · Fram Centre · European Commission · MILJØ-DIREKTORATET

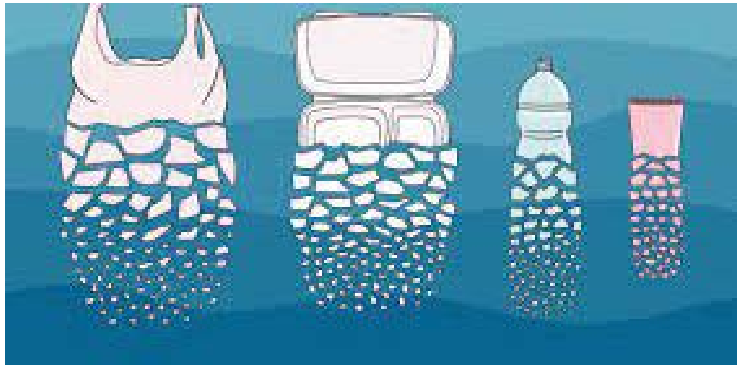
Synthetic particle and associated chemical emissions from off-shore wind



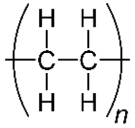
Leading edge erosion of rotor



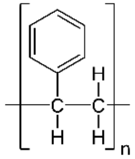
From thermoplastics to coatings



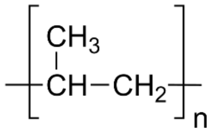
Polyethylene (PE)



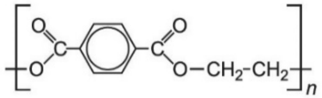
Polystyrene (PS)



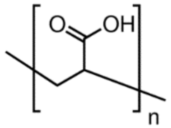
Polypropylene (PP)



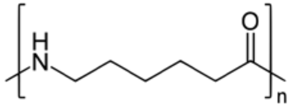
Polyester (PES)



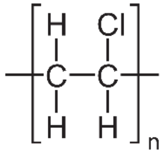
Polyacrylic (PAA; acrylic)

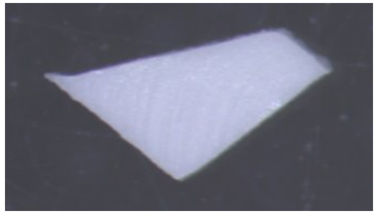


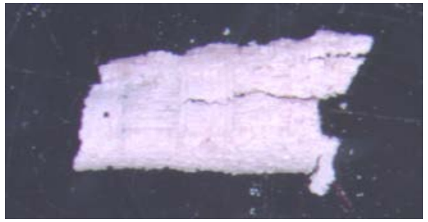
Polyamide (PA; nylon)



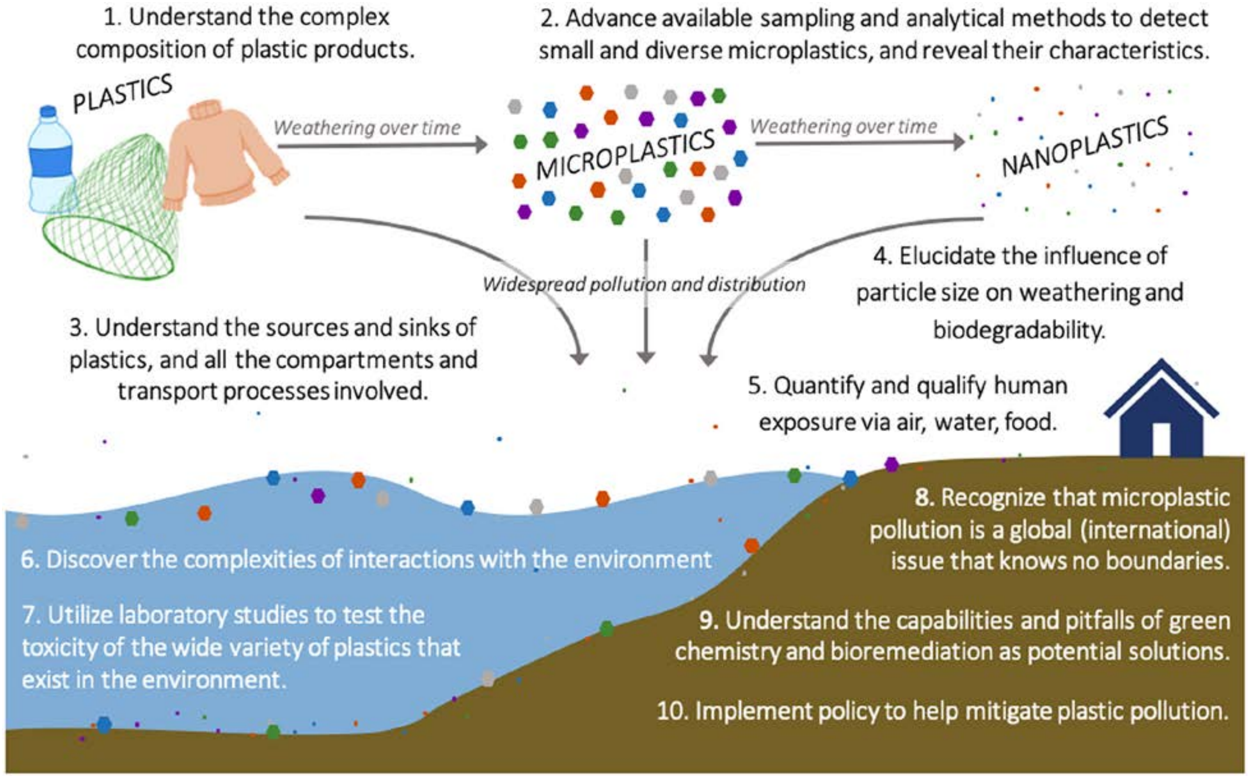
Polyvinylchloride (PVC)

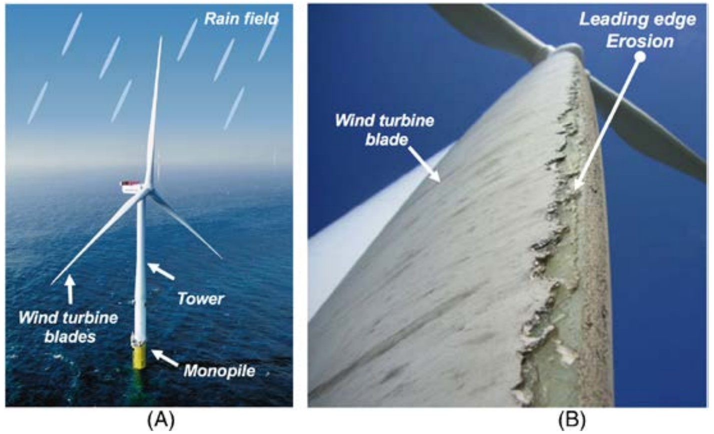




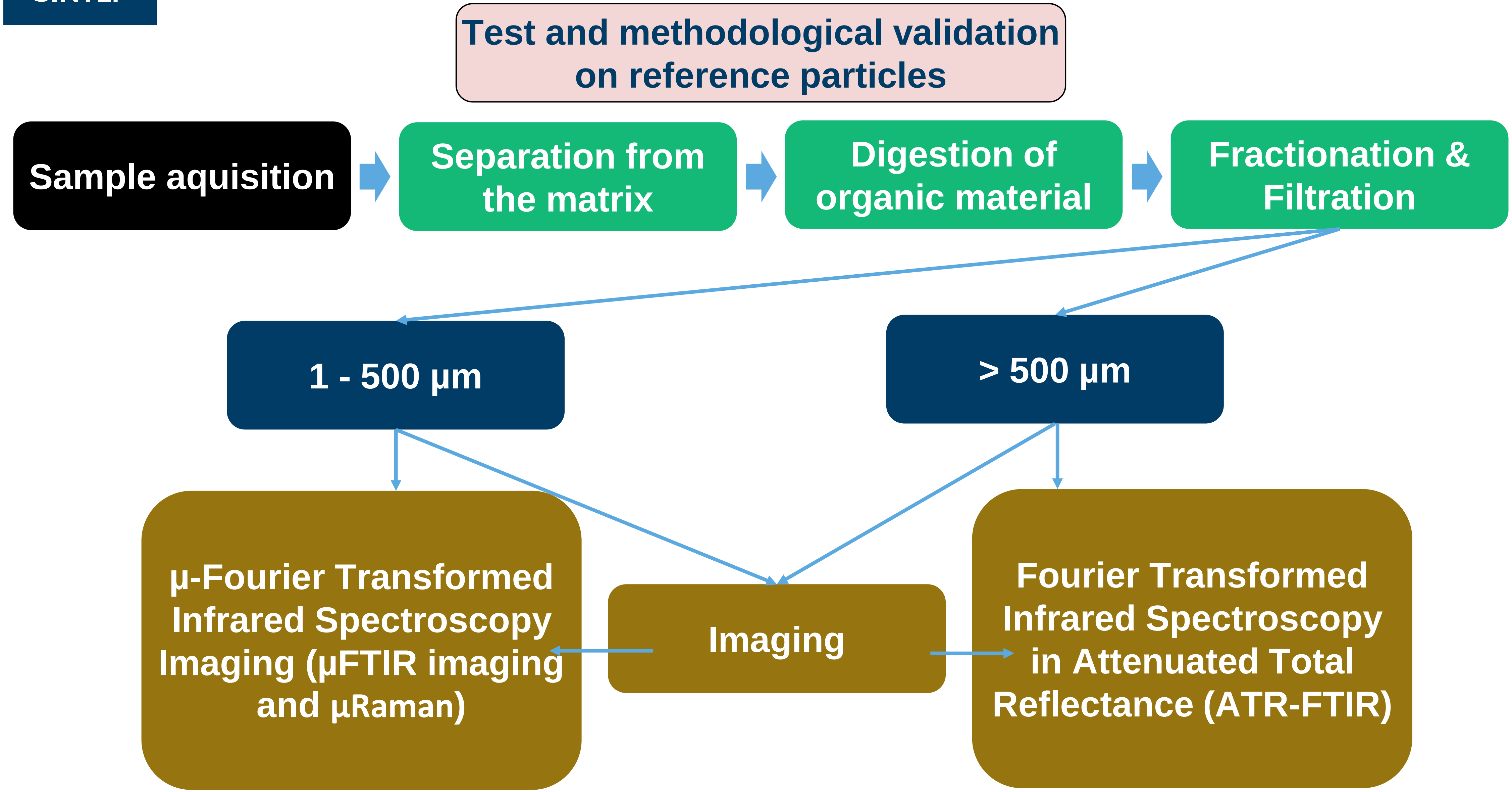


Detection, characterisation and quantification of synthetic particles in the environment



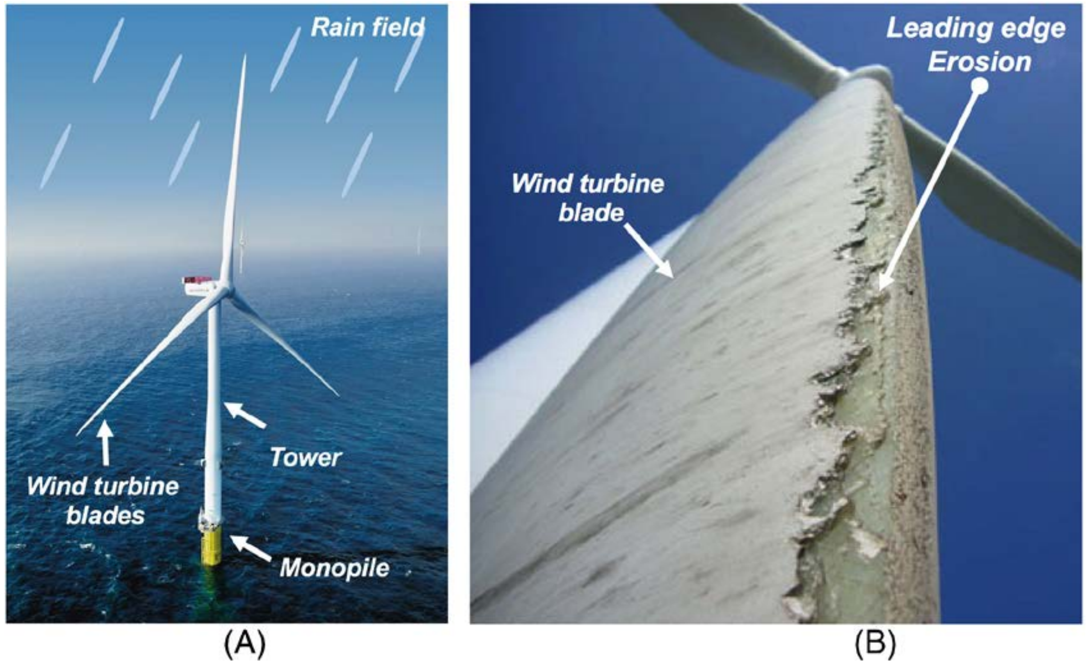


Detection, characterisation and quantification of synthetic particles in the environment



Analysis of microplastics in sediments from the Hywind Scotland floating wind farm (ASTORIA)

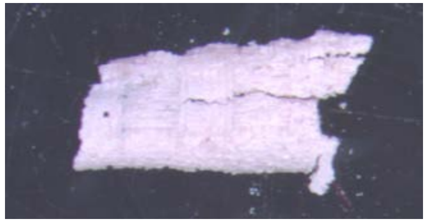
- Quantify and characterise the MP (>300 µm) content in sediment samples collected from an OWF area
- Define the proportion of the MP derived directly from plastic constituents and materials used in the OWF infrastructure (i.e. the coatings of the rotor blades)
- Determine the background MP levels of traditional thermoplastic polymers (e.g. PE, PP, PS, PET, PVC).

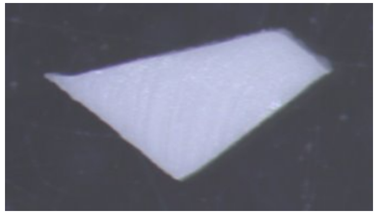


Project partners: SINTEF Ocean and Equinor AS

Particle analysis-**Validation of the extraction procedures on particles from reference materials**

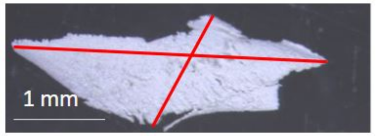
Aim: verification that the selected pre-processing and purification steps have negligible impacts on the pristine reference materials



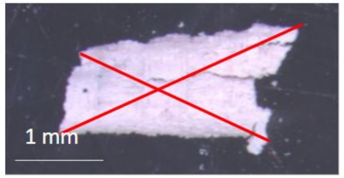


$ZnCl_2$

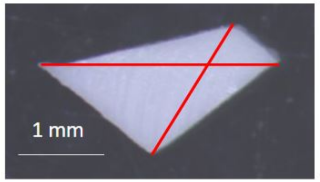
Density separation	N particles	Weight (mg)	Dim1 (±SE) (mm)	Dim2 (±SE) (mm)
Before	25	6.95	4.35 (±0.2)	2.1 (±0.2)
After	39	7.35	2.96 (±0.2)	1.19 (±0.2)



Density separation	*N particles*	*Weight (mg)*	*Dim1 (±SE) (mm)*	*Dim2 (±SE) (mm)*
Before	25	4.4	3.13 (±0.2)	1.09 (±0.1)
After	36	1.62	2.01 (±0.1)	0.74 (±0.1)



Density separation	N particles	Weight (mg)	Dim1 (±SE) (mm)	Dim2 (±SE) (mm)
Before	25	38.34	2.25 (±0.1)	2.23 (±0.1)
After	25	42.35	2.19 (±0.1)	2.06 (±0.1)



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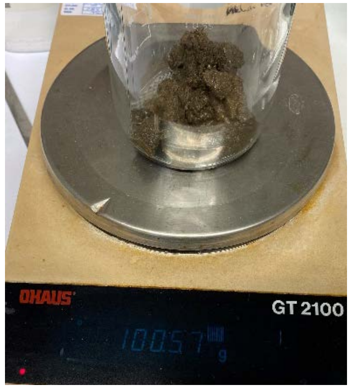
Particle analysis-**Separation from the sample matrix, purification and fractionation**

Aim: separation of the particles from the sample matrix (<u>separation</u>), digestion of exceeding organic material (pufirification) and separation of particles of different sizes (fractionation)



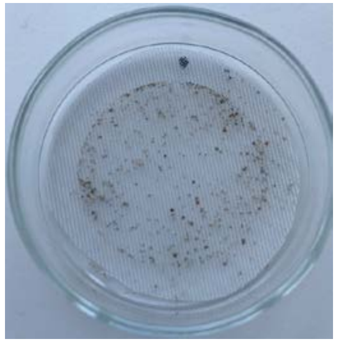
~1-300/500µm

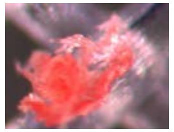
> 300/500µm

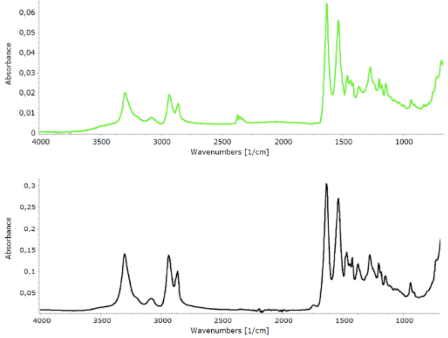
Particle analysis-**Characterisation and quantification**

Aim: physico-chemical characterisation of the particles and quantification

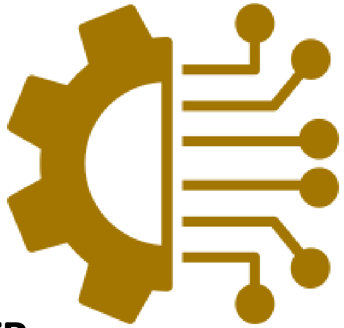
> 500 µm





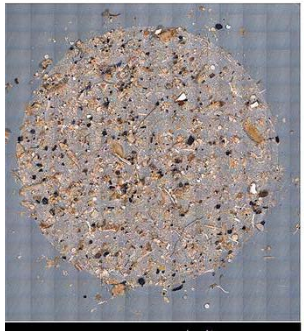


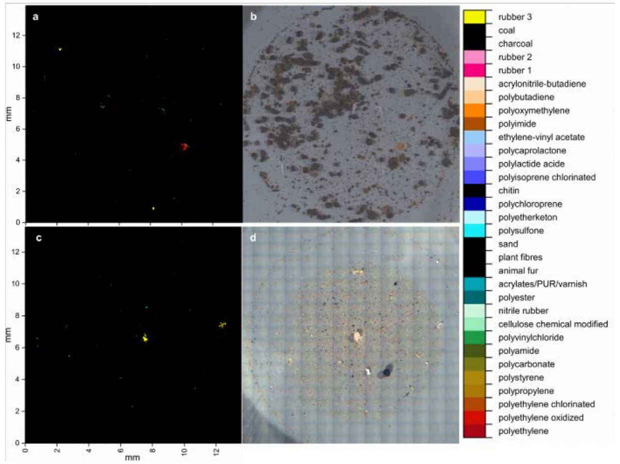
Point-based analysis with **ATR-FTIR** or **Raman**



1 - 500 µm

µ-FTIR/µ-Raman





- Automated imaging analysis of particles (**number of particles**)
- pyrolysis GC-MS (**mass-based quantification**)

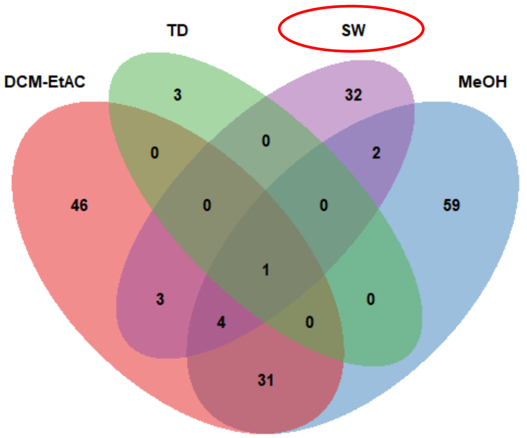
SINTEF

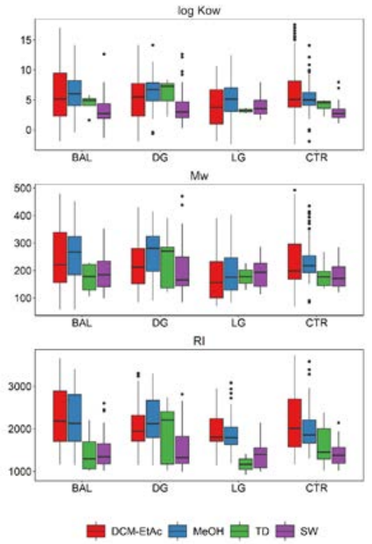
What is a microplastic particle really?

Polymer + Chemicals= **Unique** and **customised** physical-chemical properties

- Added to the material to impart desirable properties
- Include: plasticisers, antioxidants, UV stabilisers, flame retardants, colorants, antimicrobials & residual chemicals.
- Additives are not covalently bonded to polymer – potential for mobility

Methods to assess leaching of chemicals





- Chemical analysis directly on the coating/solid sample gives insight into chemical composition, but does *not* foreshadow the composition of chemicals leaching into (e.g.) seawater
- Leachate 'cocktail' composition is comprised of more polar compounds, typically of lower molecular weight.
- Chemicals present in low % in material may dominate leachates due to their properties.
- Intra-particle diffusion *and* environmental parameters determine leaching of chemicals

- Leaching studies will be performed under realistic and relevant environmental conditions (natural seawater, low temperature, gentle agitation…) using coated surfaces as test matrix.
- Analysis of leachates using a multitude of analytical techniques is necessary to capture full spectrum of leaching chemicals; GC-MS (volatile and semi-volatiles), LC-MS (polar organics) and ICP-MS (metals and other inorganics)

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Plastic monitoring team at SINTEF Ocean

Thank you for your attention!

Size matters: the significance of the size fraction for a realistic assessment of the MP particles occurrence in marine sediments

Gomiero Alessio, Veslemøy Navrestad, Adrián Jaén-Gil, Alan le Tressoler, Christian Hansen, Helena Hauss

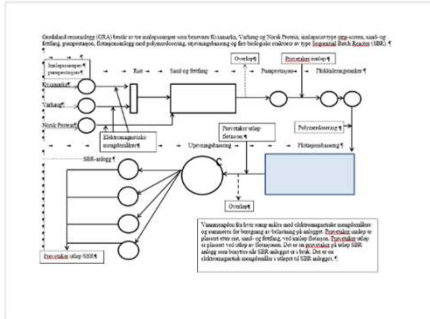
Norwegian Research Centre (NORCE) AS

Mikroplast i marine sedimenter, 4 mars 2024, Trondheim

NORGES GEOLOGISKE UNDERSØKELSE - NGU -

Currently analysed matrices in ongoing projects

- Marine and freshwater sediments
- Marine water
- Sewage sludge
- Edible plants
- Snow and ice cores
- Drinking water
- Indoor/outdoor air
- Soil
- Road dust
- Marine and freshwater biota
- Aquaculture raw materials and end products



NORCE fokusområder og nettverk: Plast, miljø og mennesker

- Miljøkartlegging
  Macro – Micro - Nano
- Prøvetakning og mikroplast-analyser i jord, vann, planter
- Eksponering og effekter
- Lovgivning og regulering

Offentlig forvaltning

Vann- og avløpsetaten

Bergen Havn

Jæren Friluftsråd

IVAR

Næringsliv og industri

NCE Seafood Innovation Cluster

SKRETTING

AVINOR

Statens vegvesen

LERØY

MOWI

Miljømyndigheter

NORCE

Vestland fylkeskommune

MARINTMILJØ Senter for oljevern og marint miljø

Ideelle organisasjoner og skoler

Norges Jeger- og Fiskerforbund 1871

REV Ocean

SOGNEFJORDEN REN

CLEAN SHORES

SEAS ECO

Akademisk samarbeid og utveksling

NIVA

SINTEF OCEAN

NILU

NTNU

Aalborg Universitet

Woods Hole Oceanographic Institution 1930

JPI OCEANS

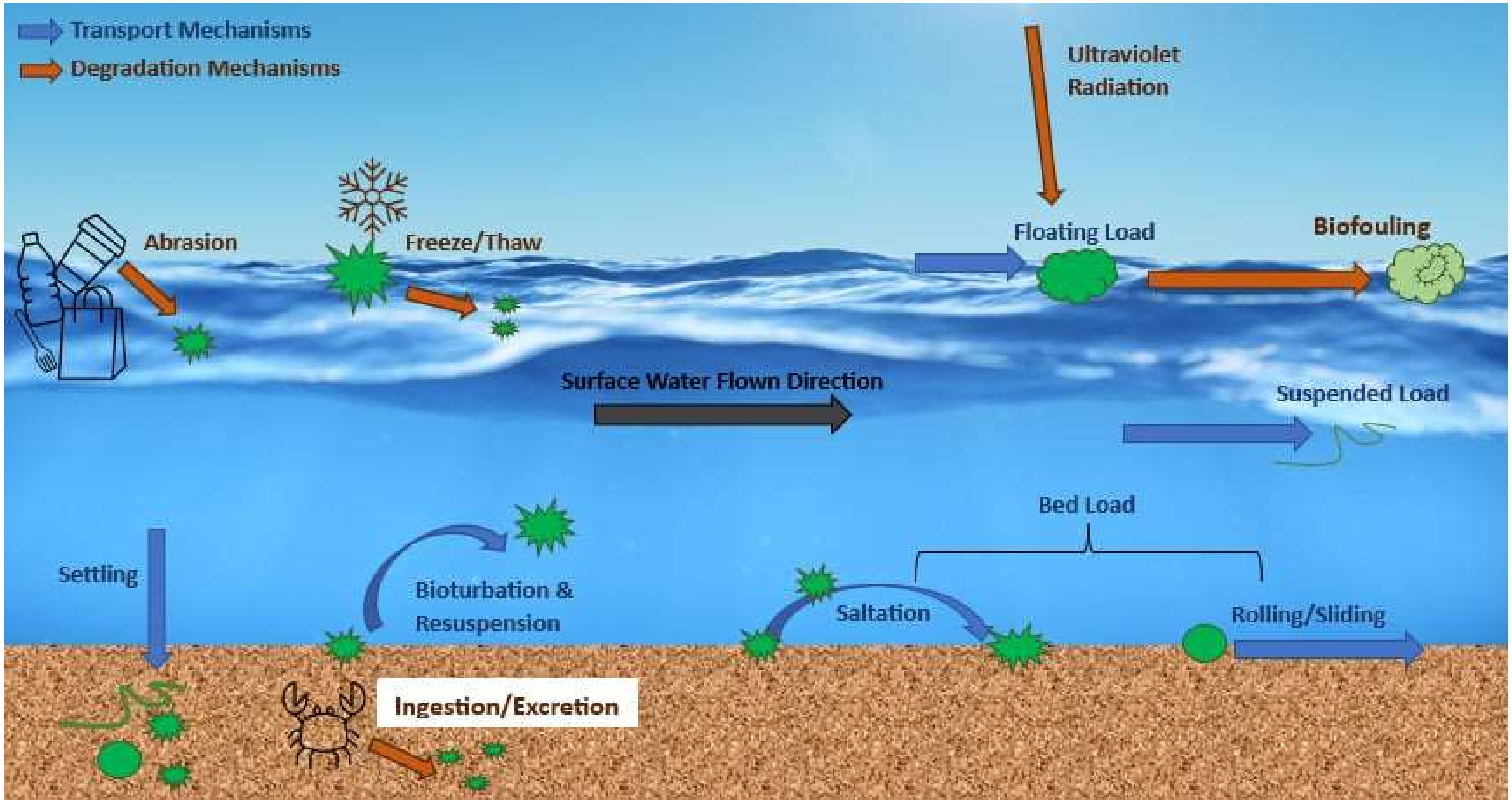
Háskólinn á Akureyri University of Akureyri

University of Stirling

PML Plymouth Marine Laboratory

Universitas Bergensis

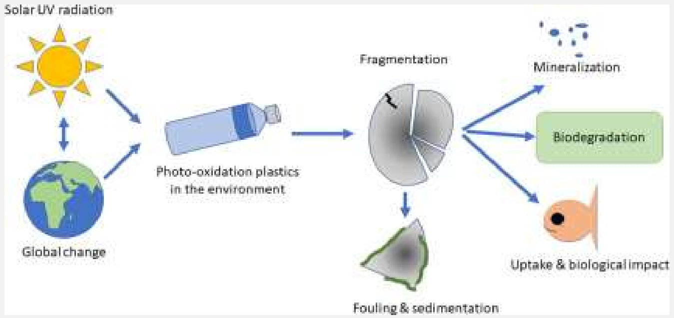
Sedimentary environment: a complex world

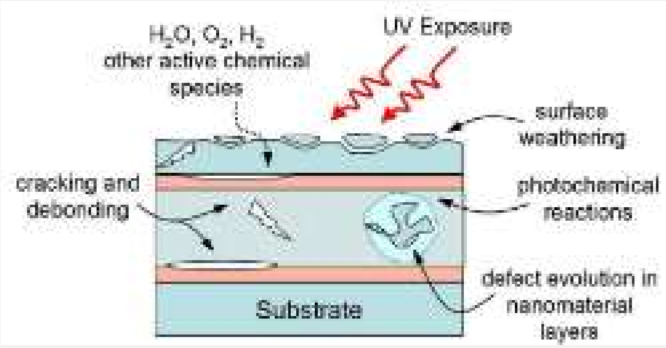


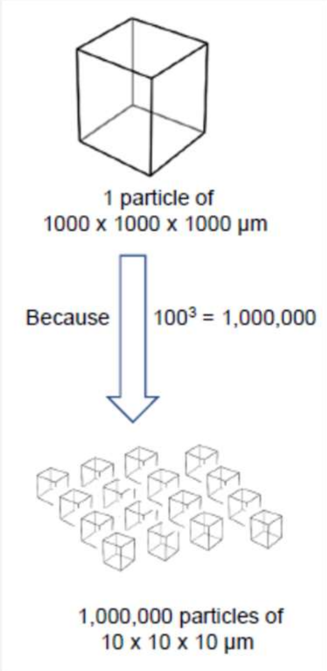
Credit: TRC; https://www.trccompanies.com/insights/understanding-microplastics-in-sediments/

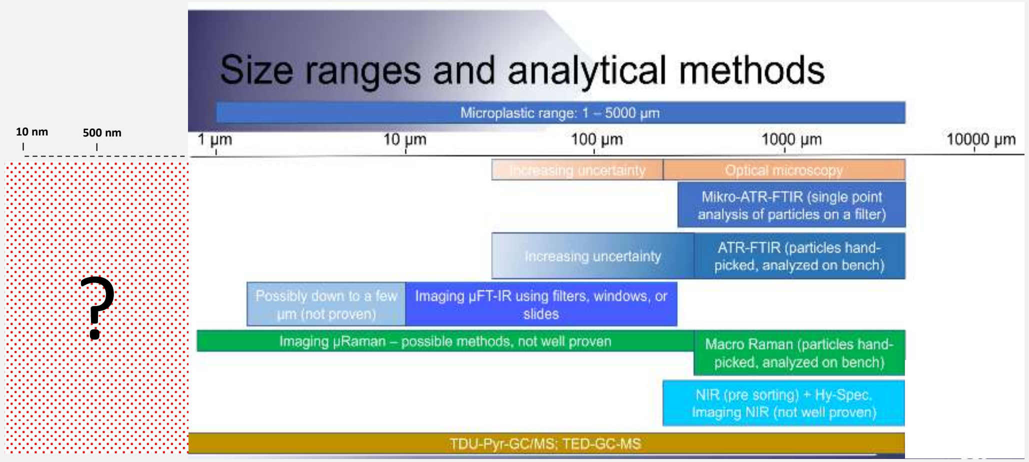
Plastic litter: size matters ….

Fragmentation: natural, ongoing and **unstoppable** process









micro ≅ nano?

Good quality data from good quality infrastructure

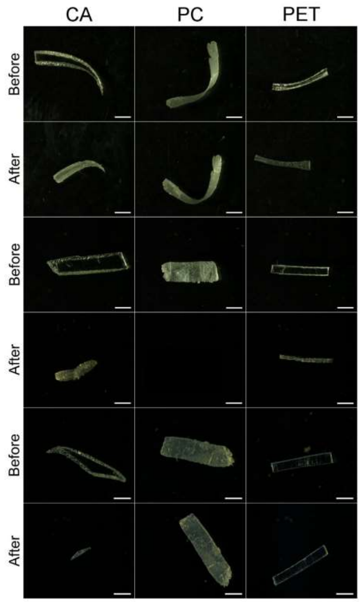
Plastlaben er utstyrt med et høyeffektiv ultra-lav gjennomtrengings HEPA-14H luftfiltreringssystem med >99% effektivitet mot innslipp av partikler ned til størrelsesorden 0.1-0.5 µm.

Laboratoriet har overtrykks- og luftlåssystem som begrenser kontaminering av luftbåren plast under prøvebearbeiding og analyse. Laboratoriepersonellet bruker lav-slitasje sko og bomullsbaserte laboratoriefrakker.

Visual flow chart of sample's preparation

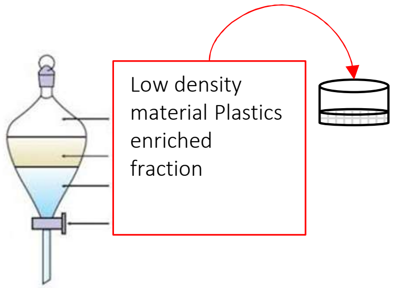
NORCE

Flotation → Permeation by a dispersant agent → Enzyme degradation → Fenton's reaction →



A. Dehaut et al. / Environmental Pollution 215 (2016) 223e233

Density based flotation



Size fractionation

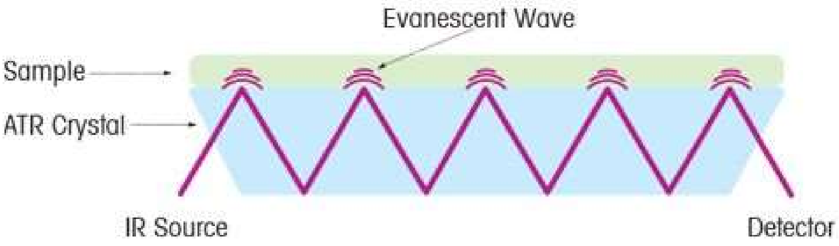
> 300 µm

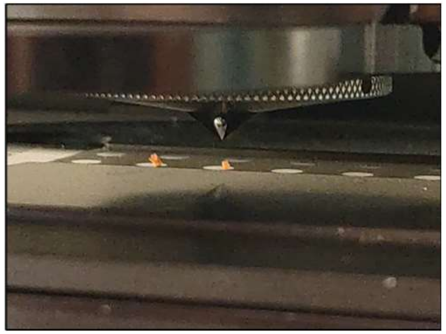
300 - > 10 µm

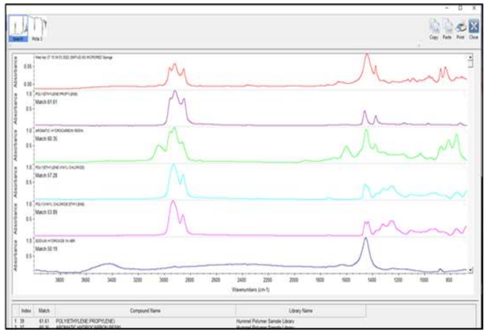
Chemical characterization

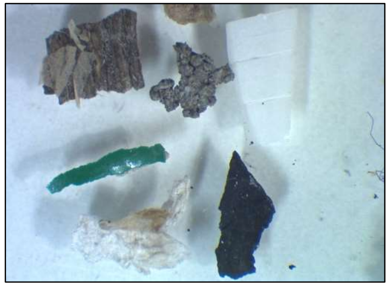
Microplastics > 300 µm

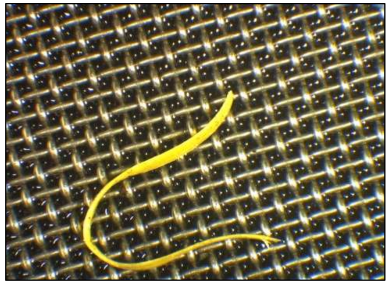
Attenuated Total Reflectance (ATR)

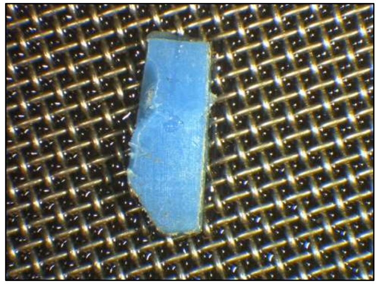






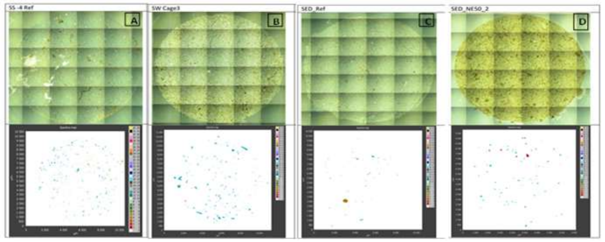


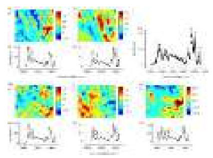




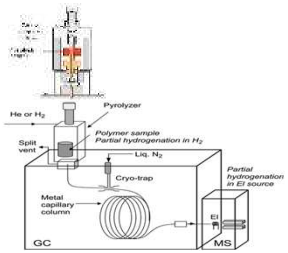
Polymers characterization and quantification analysis

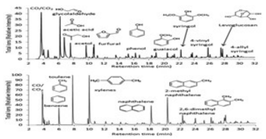
μ-Fourier Transformed Infra Red analysis (μ-FTIR)





Thermal degradation analysis (GCMS-Pyr),



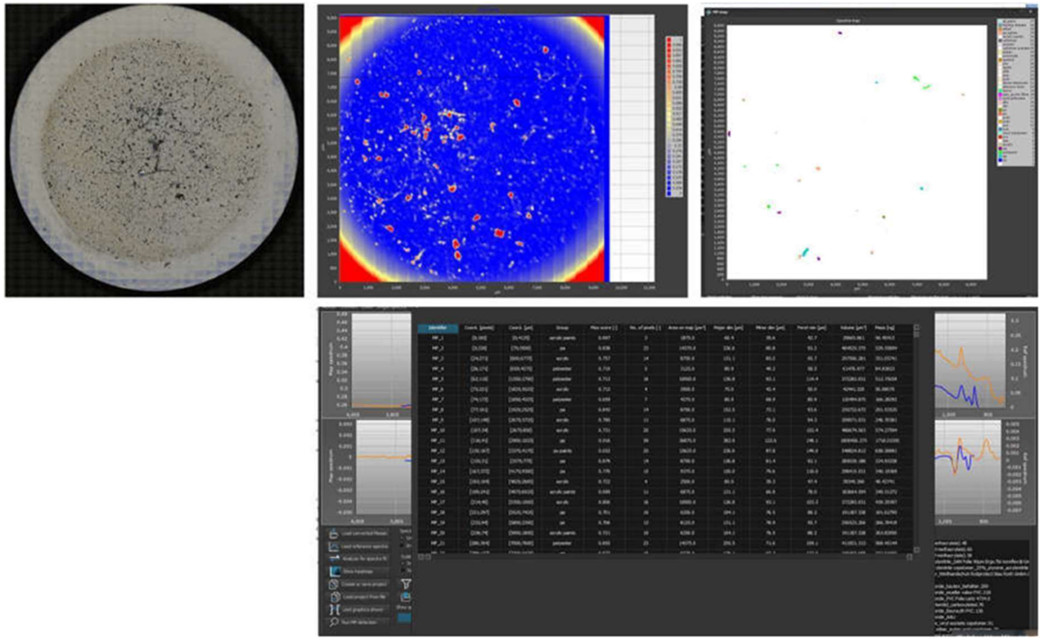


Targeted: TWPs

Data collection and analysis

NORCE

Systematic Identification of MicroPLastics in the Environment



- no of plastic plastic particles
- shape, size
- chemical composition
- ………… particles masses (?)

Particles masses estimation by a «2D visualization»?

NORCE

ELSEVIER
Water Research
Volume 188, 1 January 2021, 116519

Drinking plastics? – Quantification and qualification of microplastics in drinking water distribution systems by µFTIR and Py-GCMS

Inga V. Kirstein [a], Fides Hensel [a], Alessio Gomiero [b], Lucian Iordachescu [a], Alvise Vianello [a], Hans B. Wittgren [c], Jes Vollertsen [a]

Analytical and Bioanalytical Chemistry (2020) 412:8283–8298
https://doi.org/10.1007/s00216-020-02979-w

PAPER IN FOREFRONT

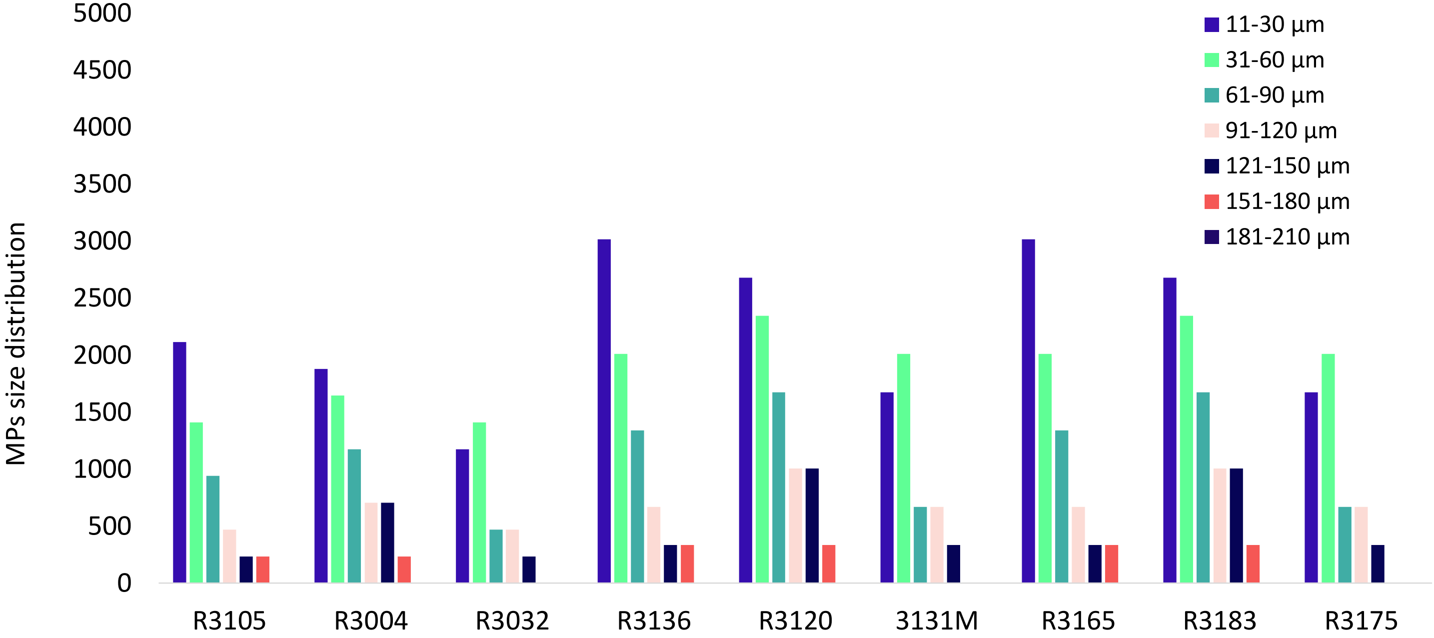
Check for updates

Comparison of pyrolysis gas chromatography/mass spectrometry and hyperspectral FTIR imaging spectroscopy for the analysis of microplastics

Sebastian Primpke [1] · Marten Fischer [2] · Claudia Lorenz [1,3] · Gunnar Gerdts [1] · Barbara M. Scholz-Böttcher [2]

- ✓ Matrix dependent behaviour
- ✓ Good observed size vs measured mass correlation: > 10 µm

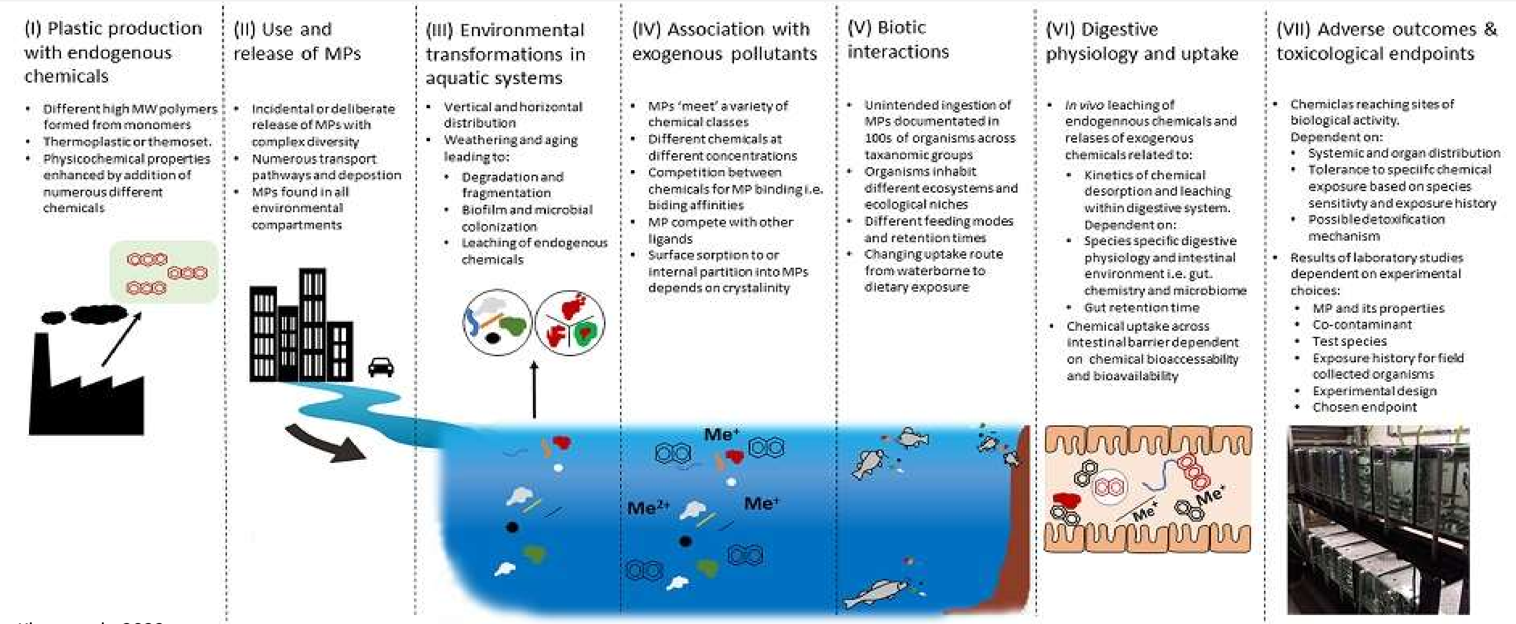
MAREANO 2023: Outlook of the size distribution



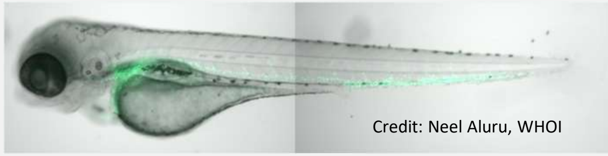
The MP concentrations reported by this study can only in part be compared to previous studies, due to differences in methods and reported size classes.

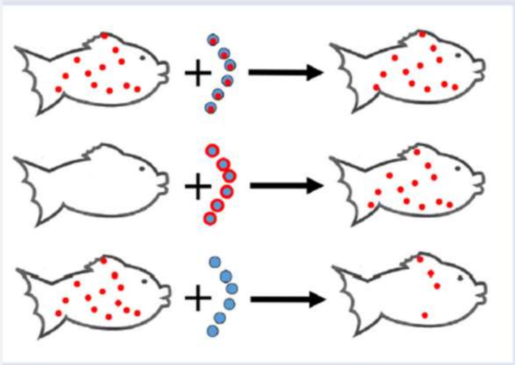
The MAREANO project at the Norwegian Continental Shelf (NCS) reported concentrations of MP>100 µm from the Norwegian continental shelf. The highest concentration reported by MAREANO was 391 MP kg-1 dw of sizes up to 450 µm (Jensen and Cramer, 2017).

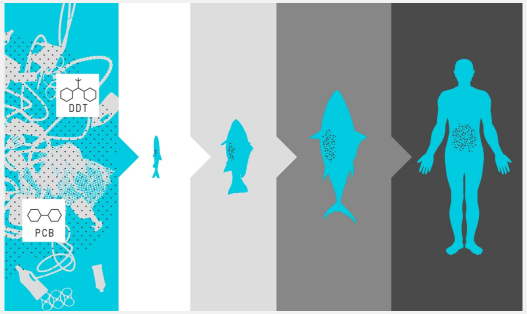
Plastic litter toxicity: why so variable?



Khan et al., 2022



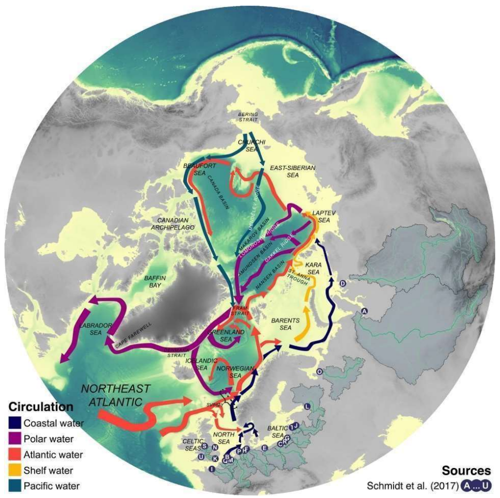




Some final considerations

The results from our experience in the MAREANO program indicate that variations in MP concentrations follow expected patterns of deposition, based on correlation analysis with current systems and historic patterns of deposition of organic matter

The Norwegian Coastal Current (NCC) is a potentially important transport route of microplastics that links the population dense areas of northern Europe to the Barents Sea and the Arctic Ocean. The NCC consists of multiple water sources, mixed in on the way towards the high Arctic. Perhaps the most important water mass in the Atlantic water, flowing into the Nordic Seas between Shetland and the Faroes and arriving at the Arctic flowing along western Svalbard. Other water masses that mix into the NCC originate from the Baltic, German Bight, and Norwegian rivers (https://jpi-oceans-facts.eu/)



Huserbråten, M. B., Hattermann, T., Broms, C., & Albretsen, J. (2022). Trans-polar drift-pathways of riverine European microplastic. *Scientific reports*, *12*(1), 3016.

Final remarks

Based on the current results, we argue the importance of quantifying particles below 100 µm for a full understanding and representative description of MP in sediment samples

Kystnær jord som kilde for mikroplast i det marine miljø

Jakob Bonnevie Cyvin, PhD-candidat
Dep. of Geography
NTNU

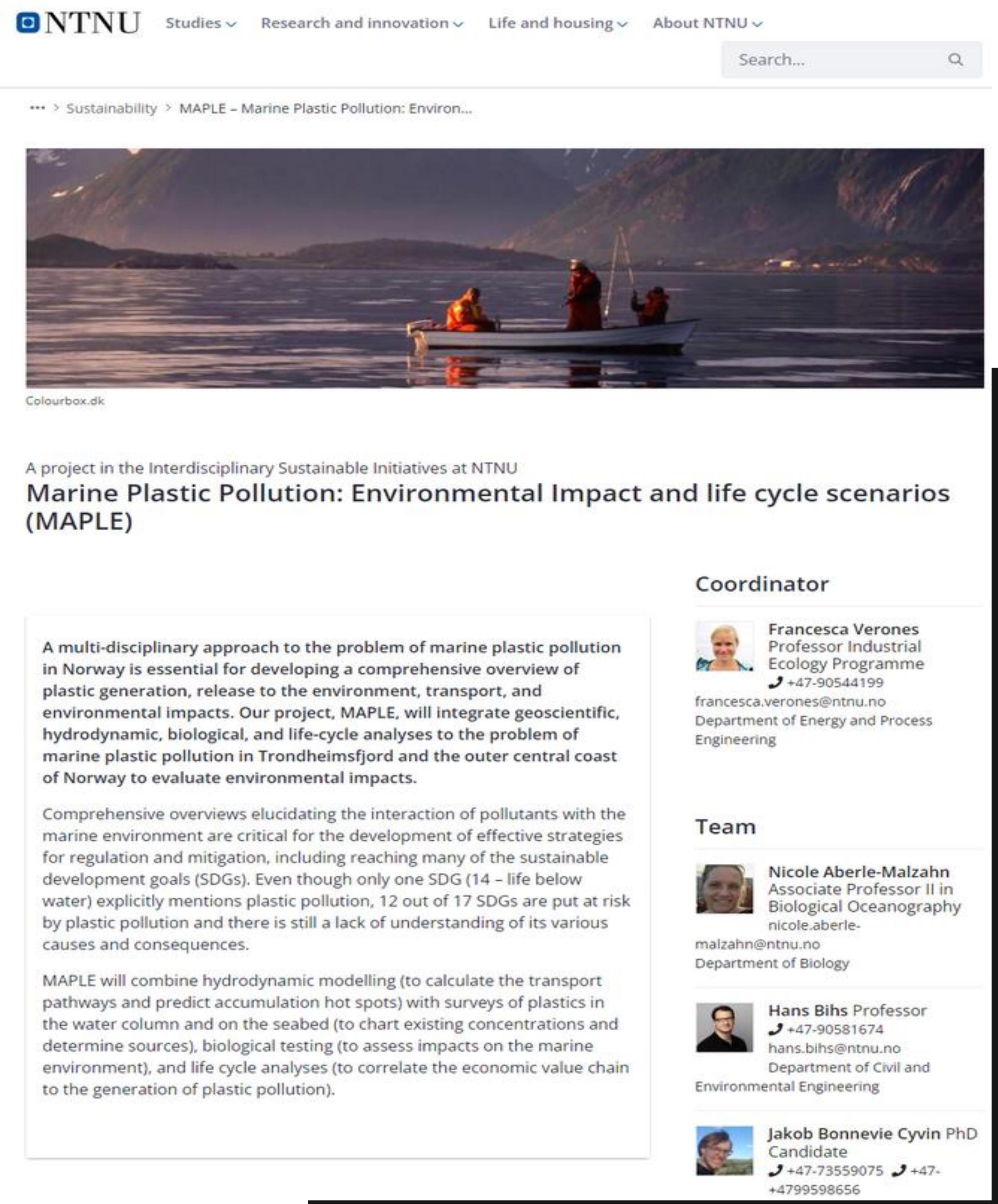
Photo by: Zuzanna Maria Sledz

MAPLE

Marine Plastic Pollution:
Environmental Impact and life cycle scenarios

2022-2026

- **“A multi-disciplinary approach** to the problem of marine plastic pollution in Norway**”**
- Across several departments of NTNU
- **Aim:** Contribute to developing a more “comprehensive overview of plastic generation, release to the environment, transport, and environmental impacts” of marine plastic pollution in Norway



MAPLE- forskjellige metoder

to find answers to complex questions

Modelering

Transport av mikroplast (fysikk)

Plast I fjordsedimenter og Kystnær jord

Kilder, konsentrasjon og metodikk

Biofouling

Biologi og vekst av mikropbiologi på plast

LCA-analyse

Verdikjeder, focus på klær

Source: Official MAPLE website (NTNU, 2022) | Photos: From Canva stock

NTNU

Del av et større prosjekt – MAPLE

Min del av prosjektet fokuserer nå på hvordan makro og mikroplast endrer jorda og lekasjen av mikroplast

August 2023
Amanda Hausken (Master's student)
Department of Geography

Feltarbeid til Smøla og Mausun (Frøya)

Kase-studie av hot-spot områder.

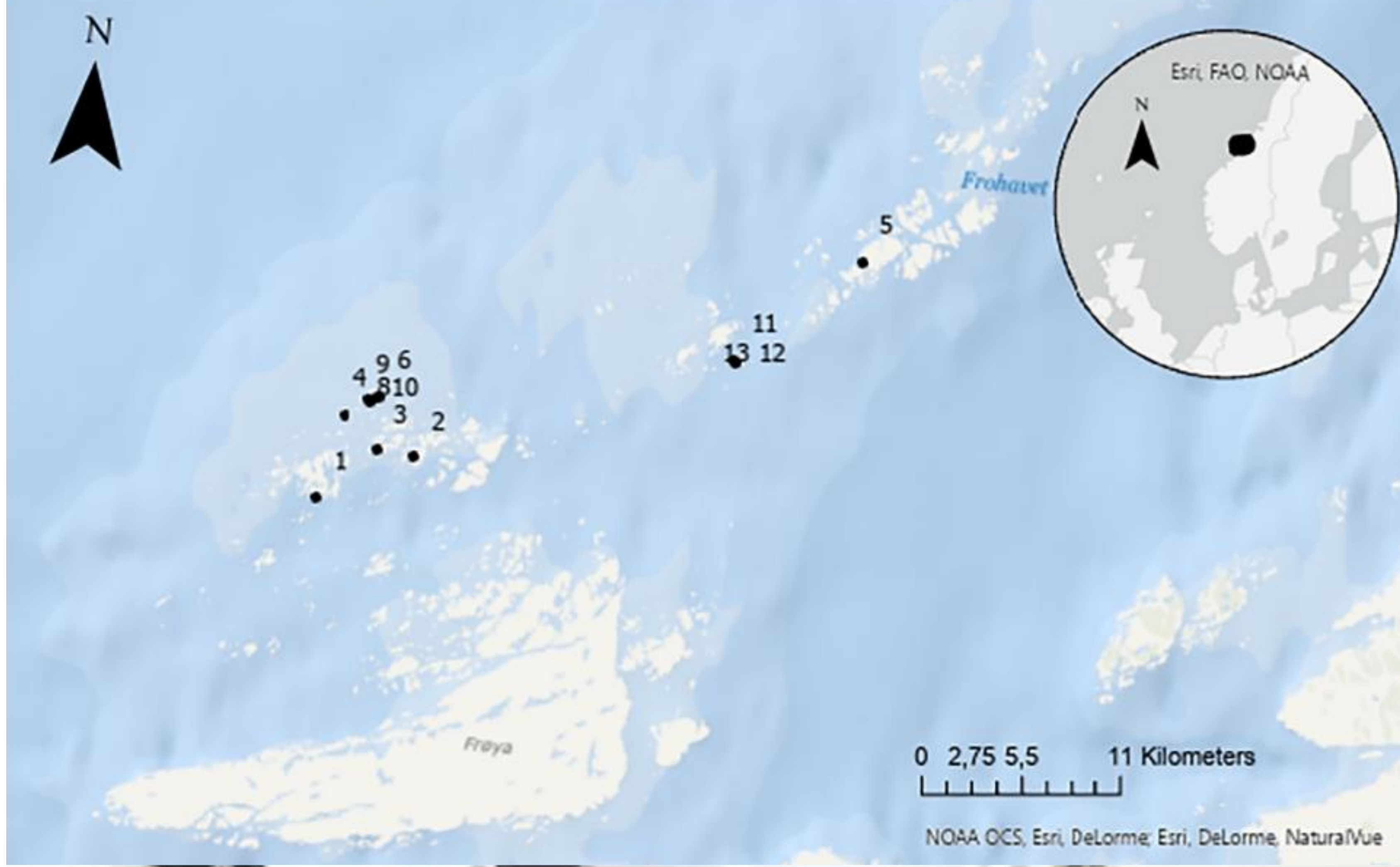
Photos by: Zuzanna Maria Sledz (left), Amanda Hausken (right)

Mausund (Frøya)

- 13 jordprøver (totalt ca 350liter jord
- Kvantifisering av mikroplast og makroplast

Funn

- **Høy kamkroplastkonsentrasjon: 3 to 72 %** (dry weight (dw) plastic / dw soil samples).
- **Mikroplast-konsentrasjon I snit ca 84 000 partikler/kg jord** (dw) (30µm-5mm).
- Observert sammenheng mellom Mikroplastkonsentrasjon og makroplastkonsentrasjon



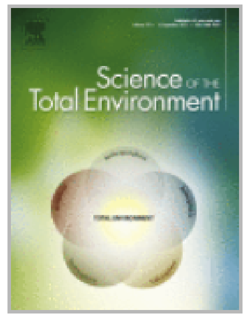
Source: (Aasen Kveberg, 2021; Cyvin et al., 2021) | Photo & Map by: Jakob Cyvin

View PDF

Download full issue

Science of The Total Environment

Volume 787, 15 September 2021, 147547



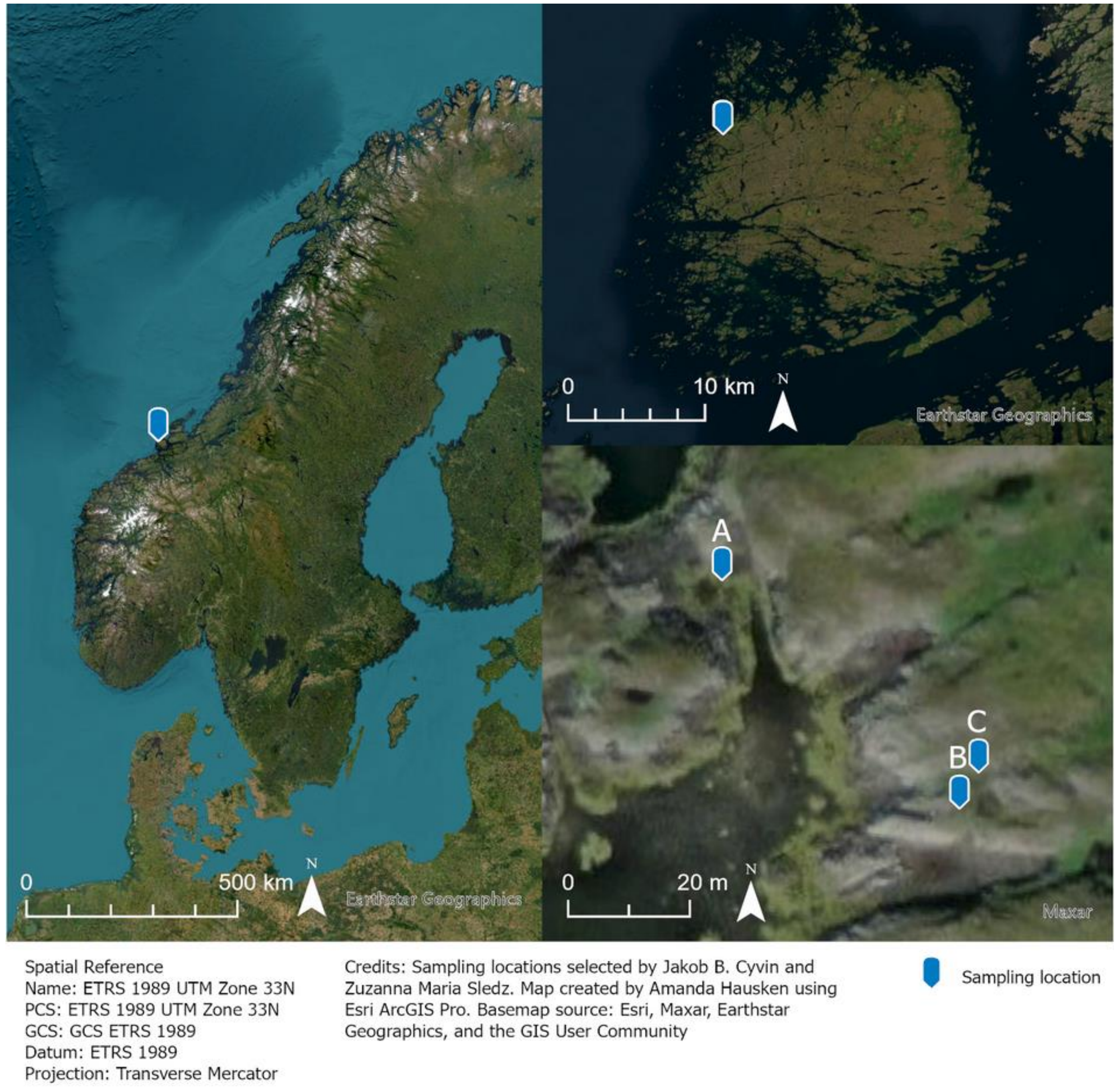
Macroplastic in soil and peat. A case study from the remote islands of Mausund and Froan landscape conservation area, Norway; implications for coastal cleanups and biodiversity

Jakob Bonnevie Cyvin [a, b], Hilde Ervik [a], Anne Aasen Kveberg [b], Christina Hellevik [c]

Show more

- Dette fikk meg til å tenke på om dette er en endestasjon for plasten, eller bare en mellomstasjon

SMØLA 2023. Prøvetagning for infiltrasjonsstudie, og Bacheloroppgave for Hausken



Have collected in the field:

3 soil cores (1, 2, 3) collected per site at 3 different sites (A, B, C), 9 soil cores total.

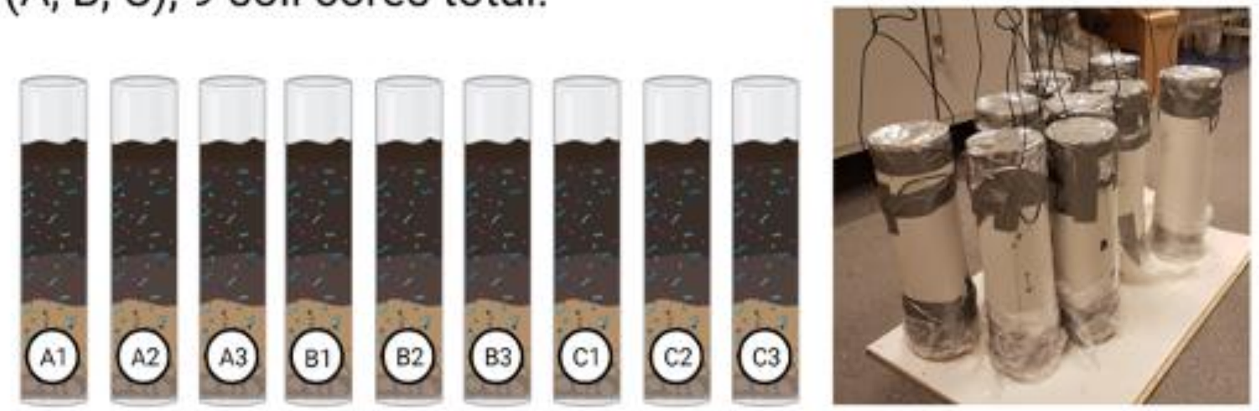
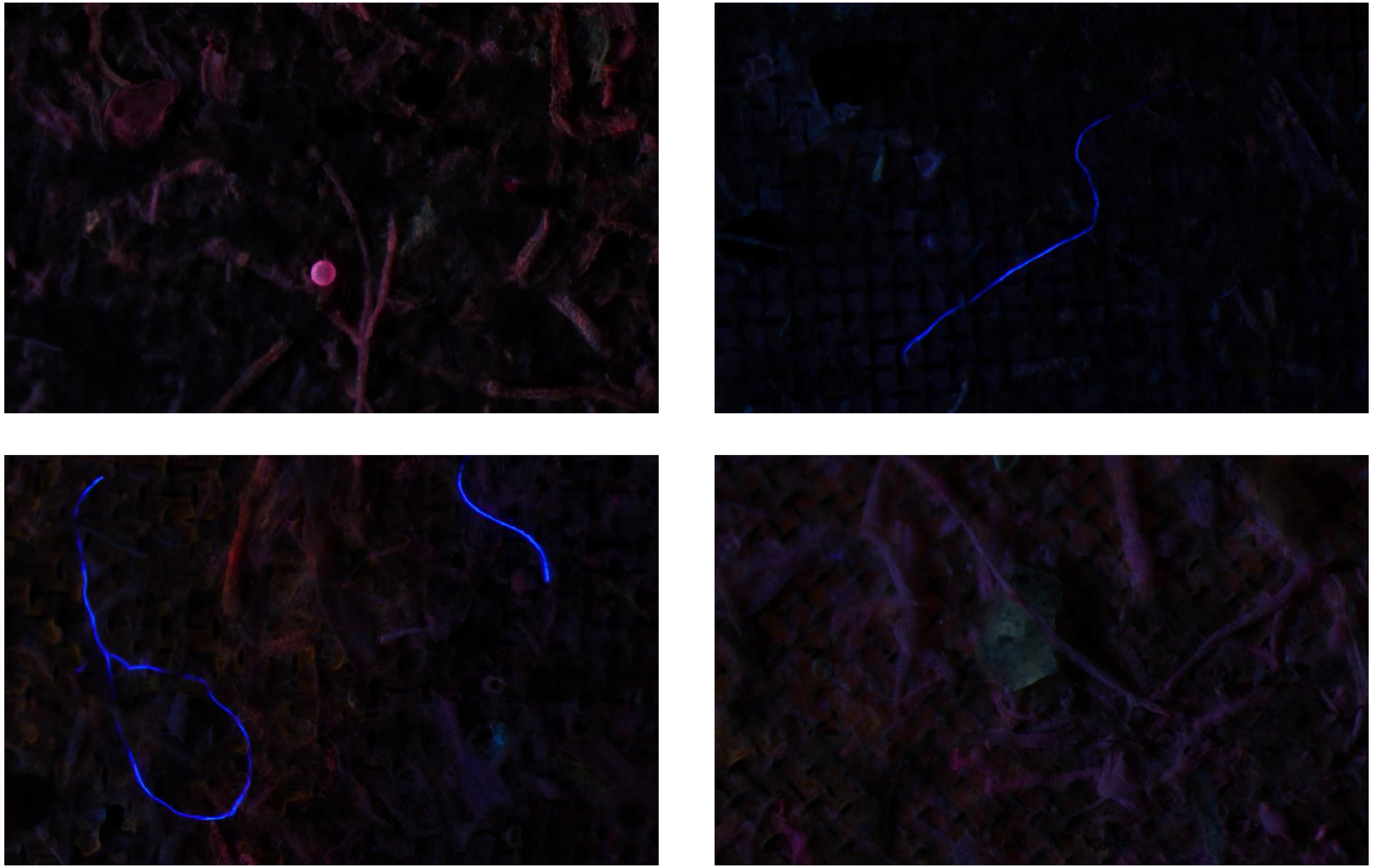


Photo by: Amanda Hausken

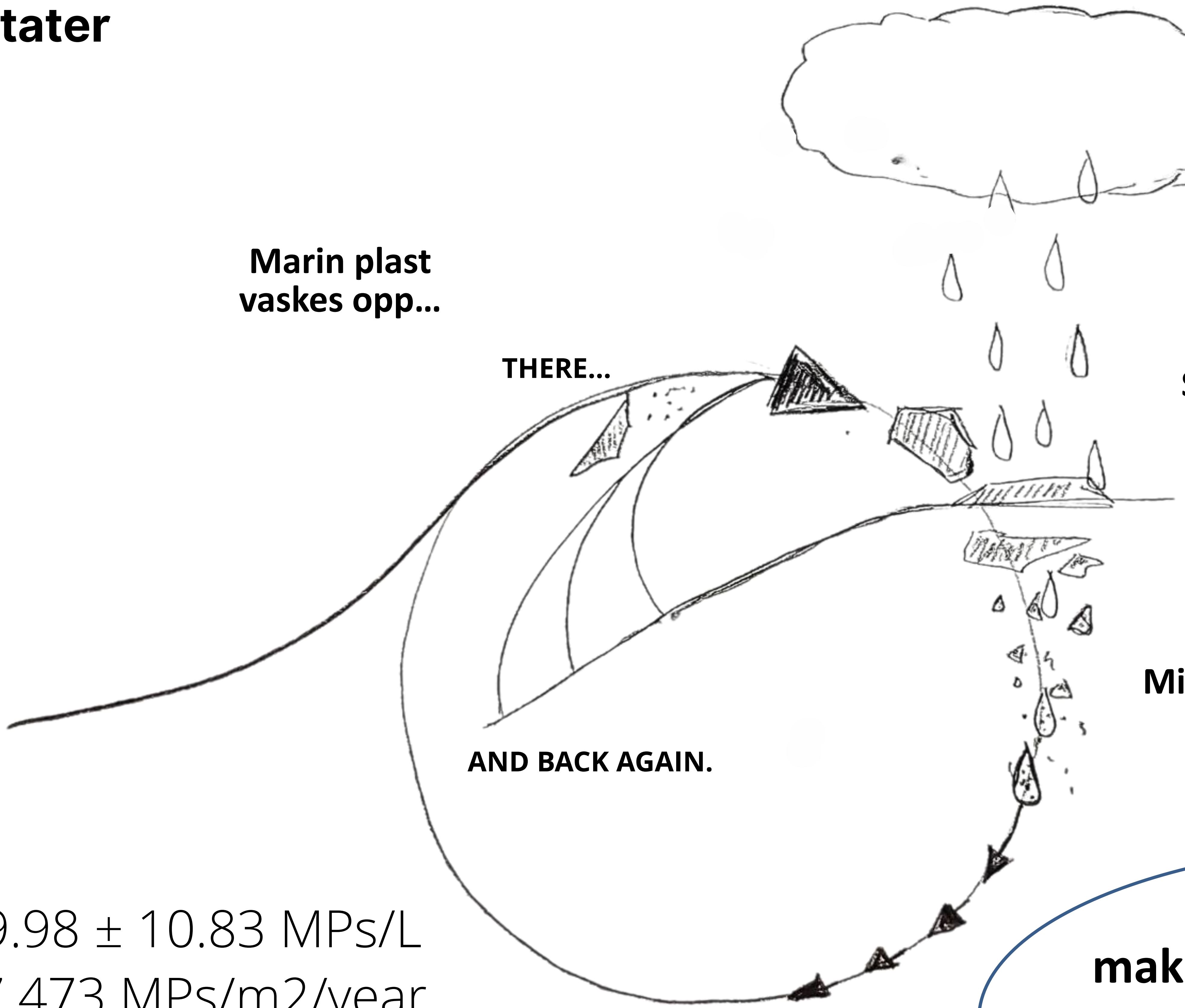
Local rainwater from the same area which the soil core samples were collected from.

29X Forstørrelse



Source: (Hausken, 2023) | Figures by: Amanda Hausken

Resultater



19.98 ± 10.83 MPs/L
27 473 MPs/m2/year

Trend: Høyere makroplastkonsentrasjon ➤ mere lekasje (signifikant p=0,04 til p=0,012)

Source: (Hausken, 2023) | Illustration by: Amanda Hausken

Hva betyr dette

...kystnær jord virker **å bidra som en hittil ikke-inkalkulert kilde til sekundær mikroplast.** Omfanget er så langt usikkert. Feltprøver er ønsket og analyse med FTIR-eller Pyrolyse GC-MS er nødvendig for verifikasjon av inneværende resultater.

Infiltrasjonstester tilsier også at plast endrer infiltrasjonen, også ved lave konsentrasjoner (under 3% dw/dw). Men endringen virker å være forskjellig i tørr jord, ved feltkapasitet og mettet.

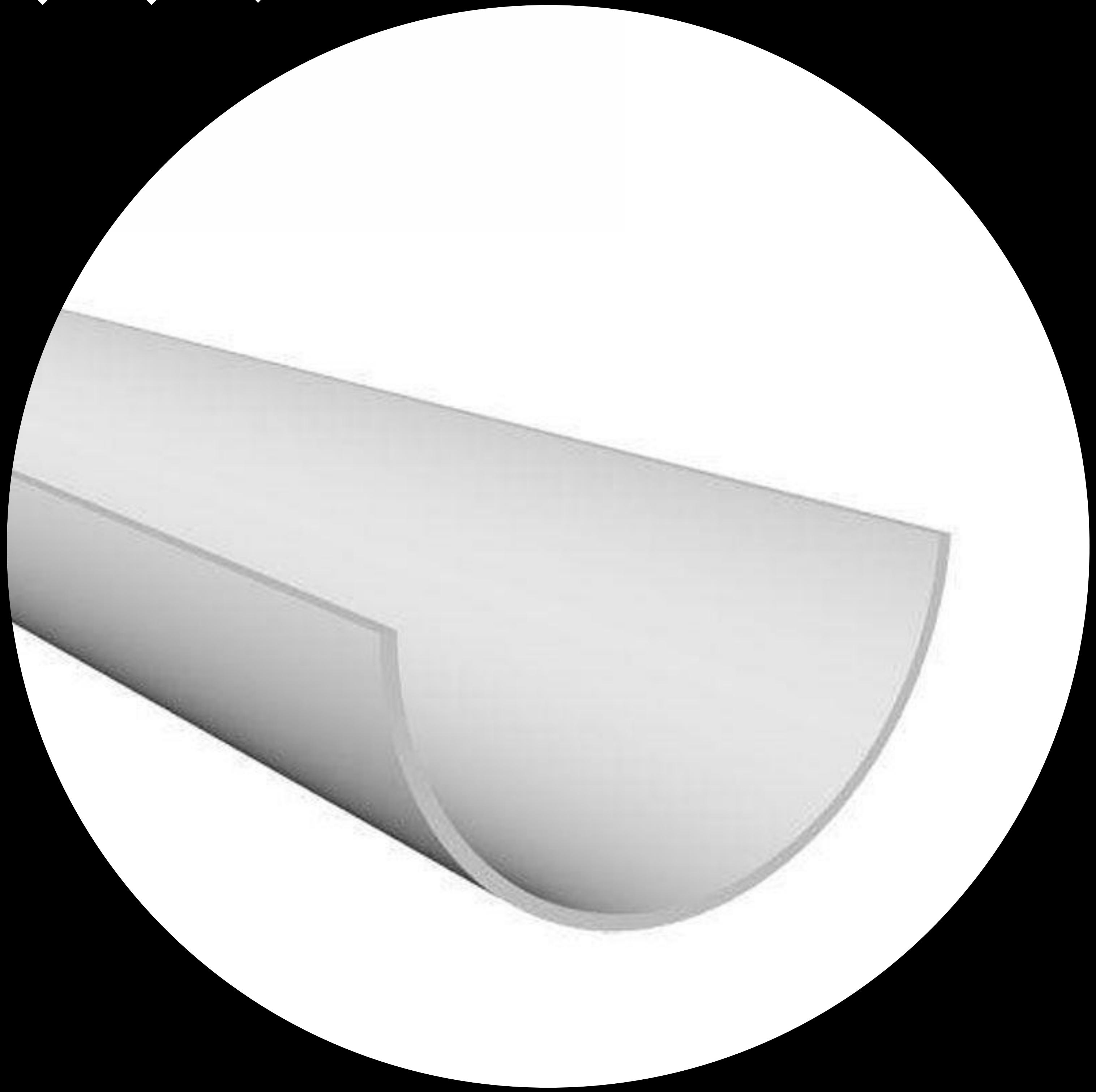
Mangler forskning på hvordan plast påvirker jord, og hvordan MP ender tilbake I havet

Hvorfor trenger vi kunnskap om dette?

Det pågår store diskusjoner langs kysten om hva vi skal gjøre med jorsmonnet som er infiltrert med plast……

Department of Geography

Photo by: Amanda Hausken



- **Hva har vi?**
  -Metodikk for prøvetaking i felt – ta ut jordsøyler
  -Rimelig metodikk for rask kvantifisering av plast vs. Ikke-plastOppsett for

- **Hva mangler vi**
  -Et større prosjekt, med ressurser til et stort antall laboratorietester for å gjenta lekkasje-testene
  -Feltstudier på lekkasje av mikroplast fra jorda
  -Bruk av analytiske metoder for polymeranalyse
  -Replikasjon av infiltrasjonstester (pågår) for å se på hvordan makroplastkonsentrasjon påvirker infiltrasjonshasigheten

NTNU

Takk til NTNU Bærekraftsatsning for finansiering av PhD-konsortiet MAPLE

Tusen takk!

Tusen takk til Amanda Hausken, og hennes Bachelorprosjekt!

Tusen takk til Førsteamanuensis **Chantel Nixon** (tidligere her på NGU) for fantastisk flott veiledning av bade meg, master og Bachelorstudenter.

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*all unmarked photos are from Amanda Hausken´s private collection

MIKRONOR

MIKROPLAST I NORSKE KYSTOMRÅDER, INNSJØER OG ELVER

Bildekkpartikler og annen mikroplast i norske sedimenter - erfaringer fra MIKRONOR

Vanja Alling (Project Manager, MIKRONOR)

Elisabeth Rødland (TWP responsible)

NIVA

Norway's first microplastic monitoring program (2021-2024) - funded by the Norwegian Environment Agency

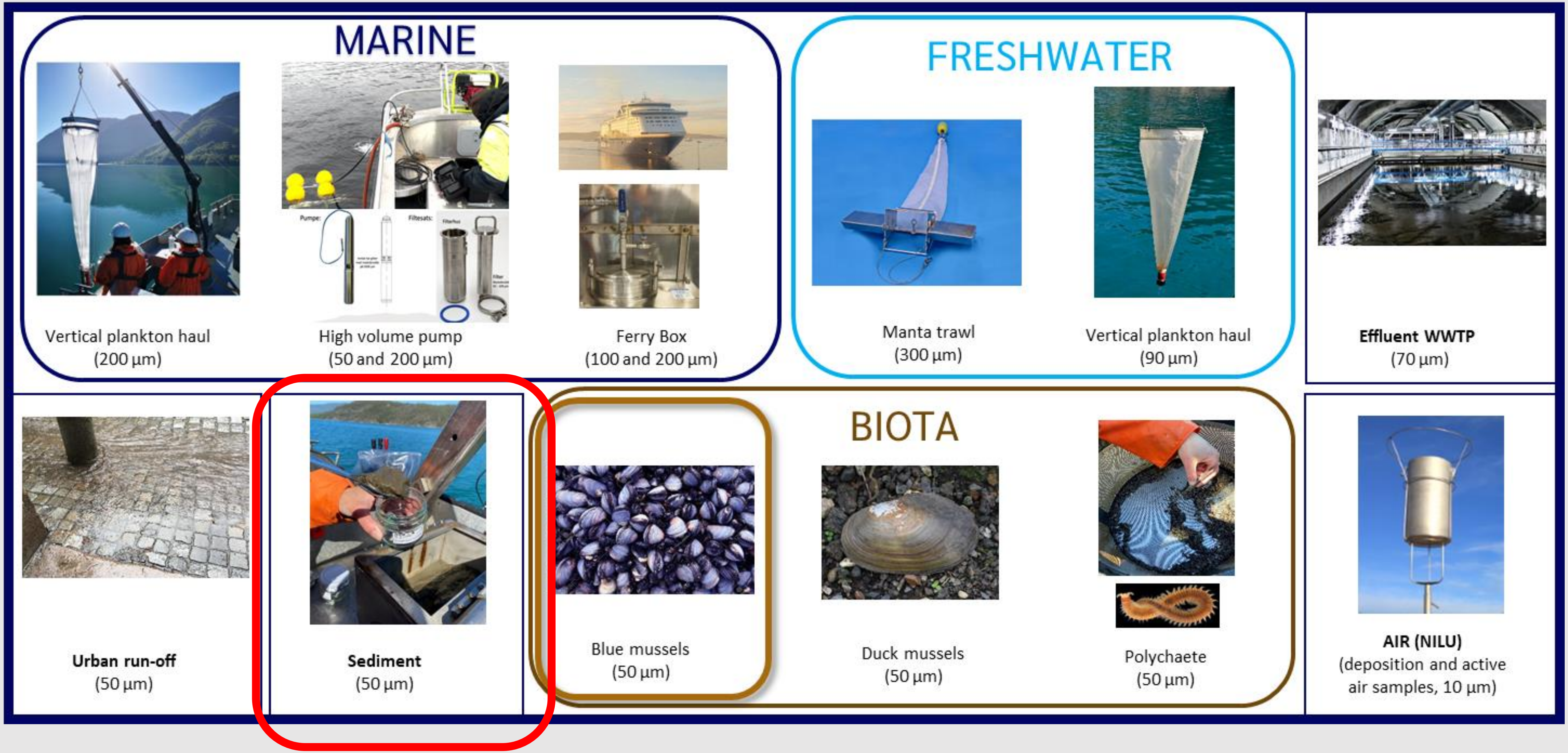
AIMS

- Quantify levels and types of microplastics (MPs) in the Norwegian environment
- Identify variations in MPs concentration between sample types and geographical areas
- Contribute to knowledge of sources and pathways of microplastics into the Norwegian environment
- Contribute to international harmonization of microplastic monitoring programs (EU and OSPAR)
- Give a foundation for further national monitoring programs of microplastics

MIKRONOR

MIKROPLAST I NORSKE KYSTOMRÅDER, INNSJØER OG ELVER

Sample collection in different matrices



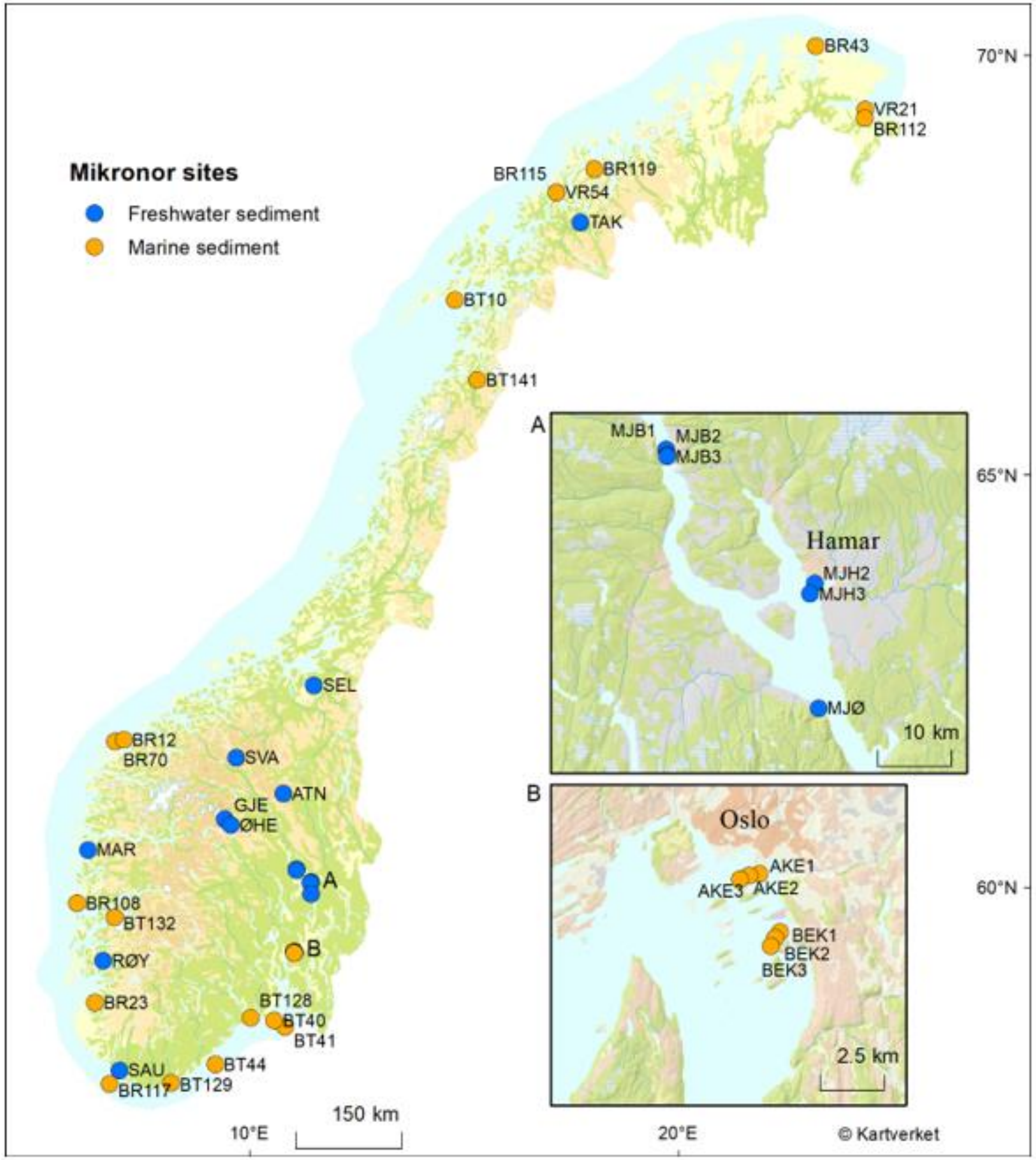
Sediment sampling

24 marine sediment stations,
6 in Inner Oslofjord

15 FW sediment stations,
6 in Mjøsa

FTIR:
21 polymerer

PYR-GC/MS: TWP



Sediment sampling

Field
- Grab sampling
- Three replicates (three separate grabs)

Field manual describes contamination control measures
- Field blanks: atmospheric blanks (3 per station)
- Samples of potential contamination sources: clothes, ropes, paint, samplers or other

Uncertainty: Mikronor receives samples from other monitoring programs and do not have control of the field work

NIVA

Lab contamination reduction

High focus on contamination control

- MP lab with under-pressure and HEPA filter (H13)
- No synthetic clothes allowed (cotton scrubs and cotton lab coats)
- Continuous monitoring of MP contamination with strategically placed lab blank samples
- RO water is filtered (0.22µm Milipak membrane)
- All chemicals are filtered (1.6µm GF filter)
- LAF-benches used when preparing samples

Sample pretreatment for FTIR analysis

Freeze dried and homogenized

40-50gr dw

Acetic acid+ KOH/Fentons

NaI density separation

Sample pretreatment for FTIR analysis

Freeze dried and homogenized

↓

40-50gr dw

↓

Acetic acid + KOH/Fentons

↓

NaI density separation

- **50-300µm** → **µFTIR scanning**
- **>300µm** → **Microscope and FTIR per particle**

NIVA: Perkin Elmer FTIR, Purency/SiMPLE

Sample pretreatment TWP analysis

Freeze dried and homogenized

40-50gr dw

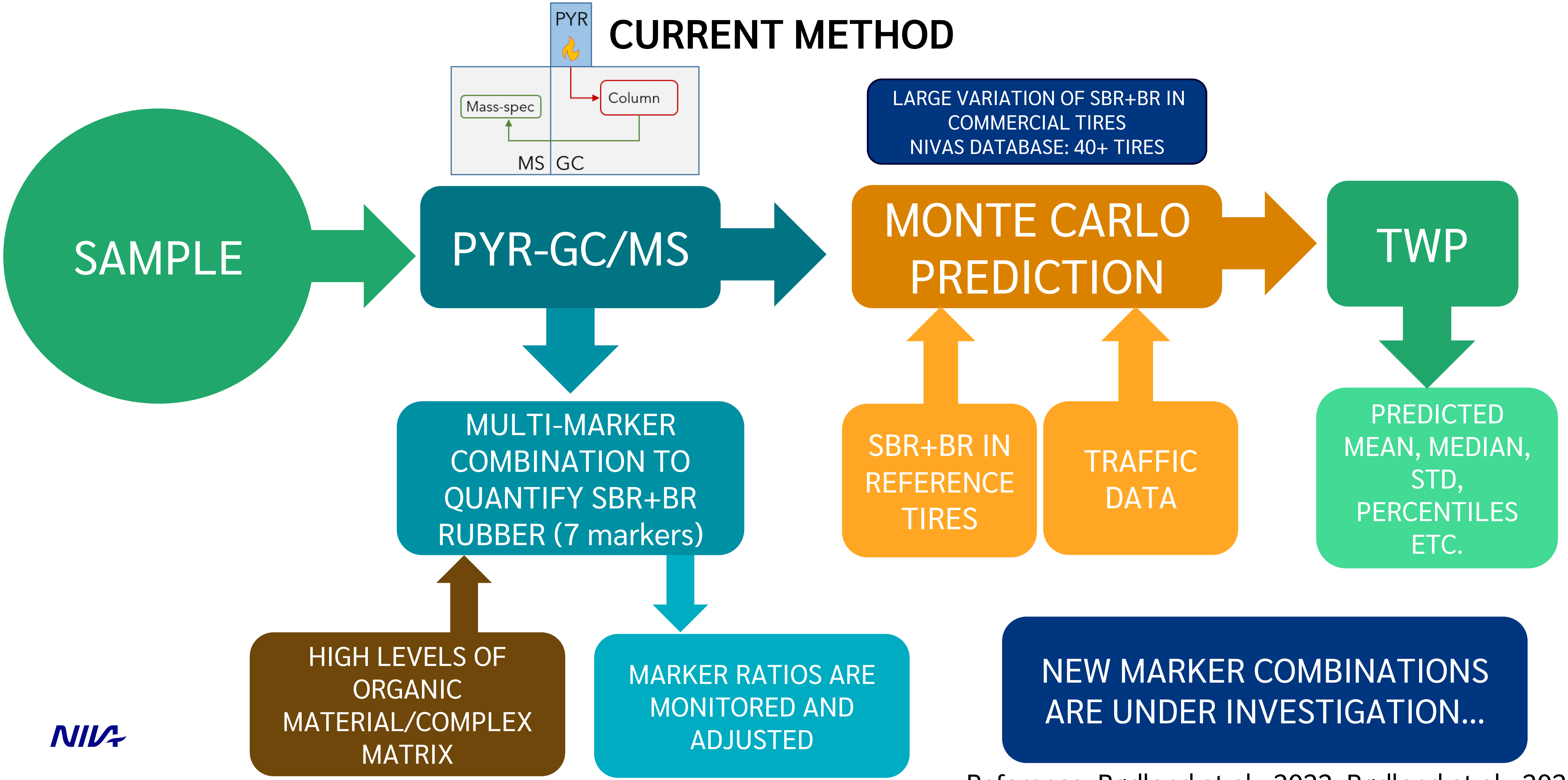
<500µm sieved and homogenized

6-10mg → PYR-GC/MS

NIVA: Frontier Multi-shot Microfurnace Pyrolyzer, Agilent GC/MS (5977B MSD, 8860 GC)

NIVA

CURRENT TRWP QUANTIFICATION AT NIVA (PYR-GC/MS)



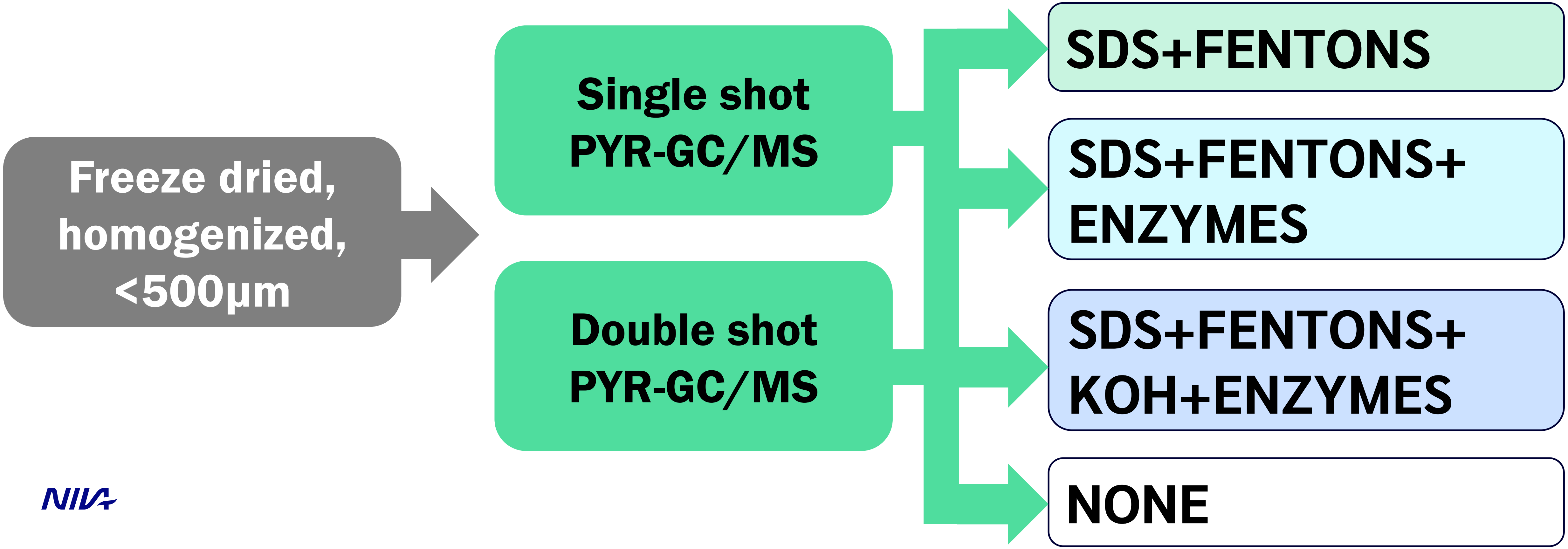
NIVA

Reference: Rødland et al., 2022, Rødland et al., 2023

Sample pretreatment TWP analysis

Spike-recovery testing on freshwater samples

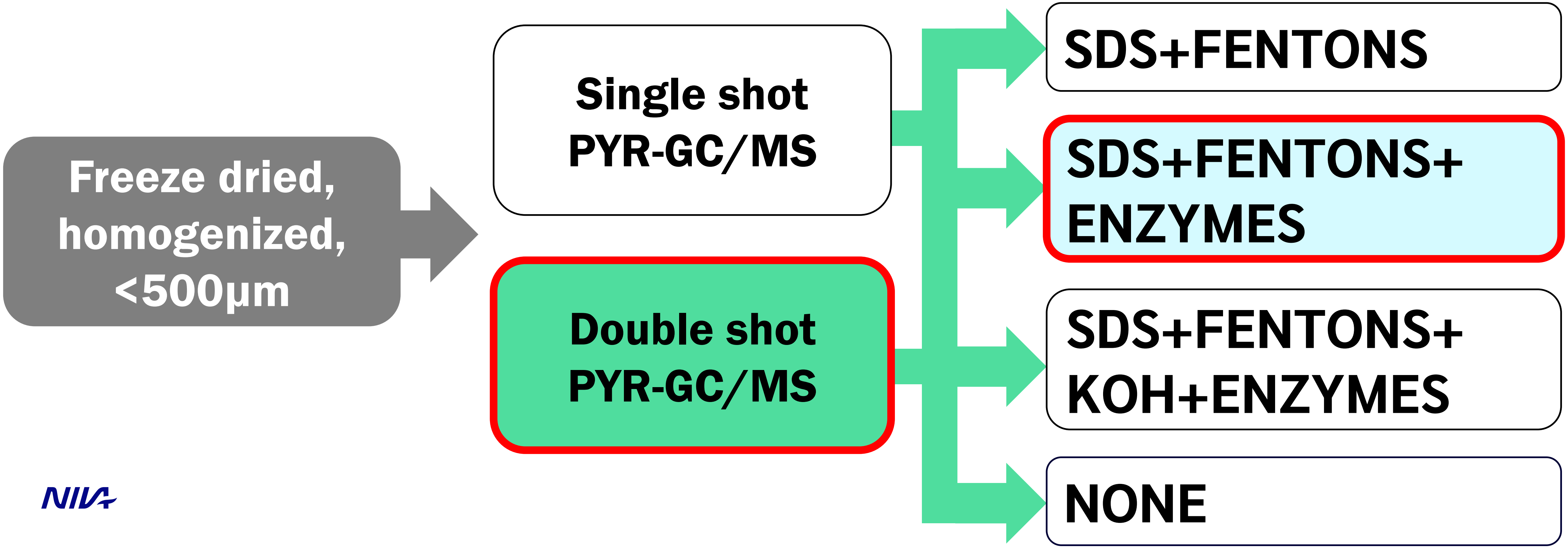
Heimdalsvatnet
TOC 69 mg/g



Sample pretreatment TWP analysis

Spike-recovery testing on freshwater samples

Heimdalsvatnet
TOC 69 mg/g



QA/QC - FTIR

All samples

- Three field blanks accompanied each three replicates of samples
- In addition, three lab blanks followed the samples in the lab
- LOD: the mean number of microplastics in the lab blanks for that sample type + 3 x SD
- LOQ: the mean number of microplastics in the lab blanks for that sample type + 10 x SD

QA/QC – PYR-GC/MS

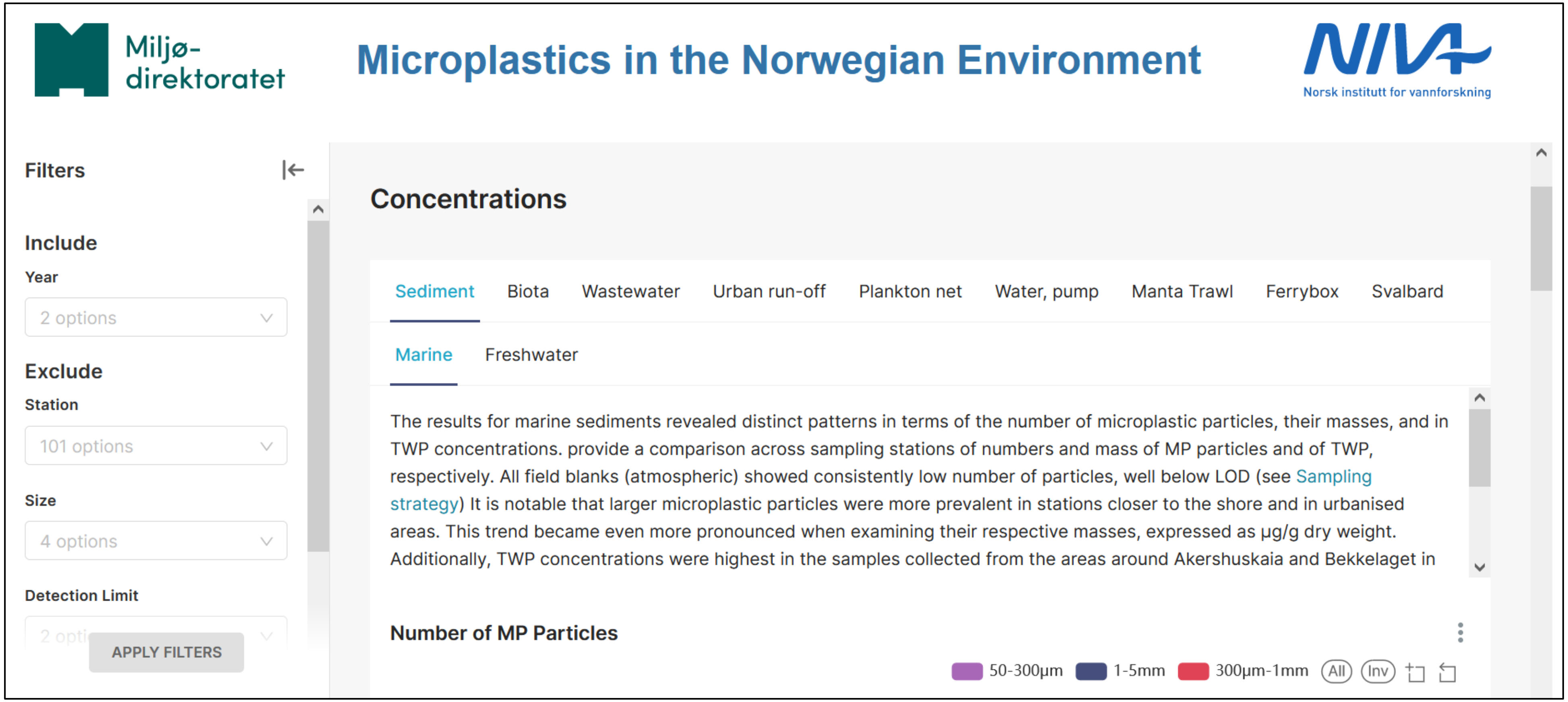
Sediments

- Blank cups and QC samples (SBR 20µg/cup) monitor signal response and background levels
- The LOD (3 x S/N) using the sum of markers were 0.043µg SBR
- The LOQ (10 x S/N) were 0.188 µg SBR

Results

NIVA has developed an interactive website for data visualization

[Mikronor Data (mikronor-data.no)](https://mikronor-data.no)



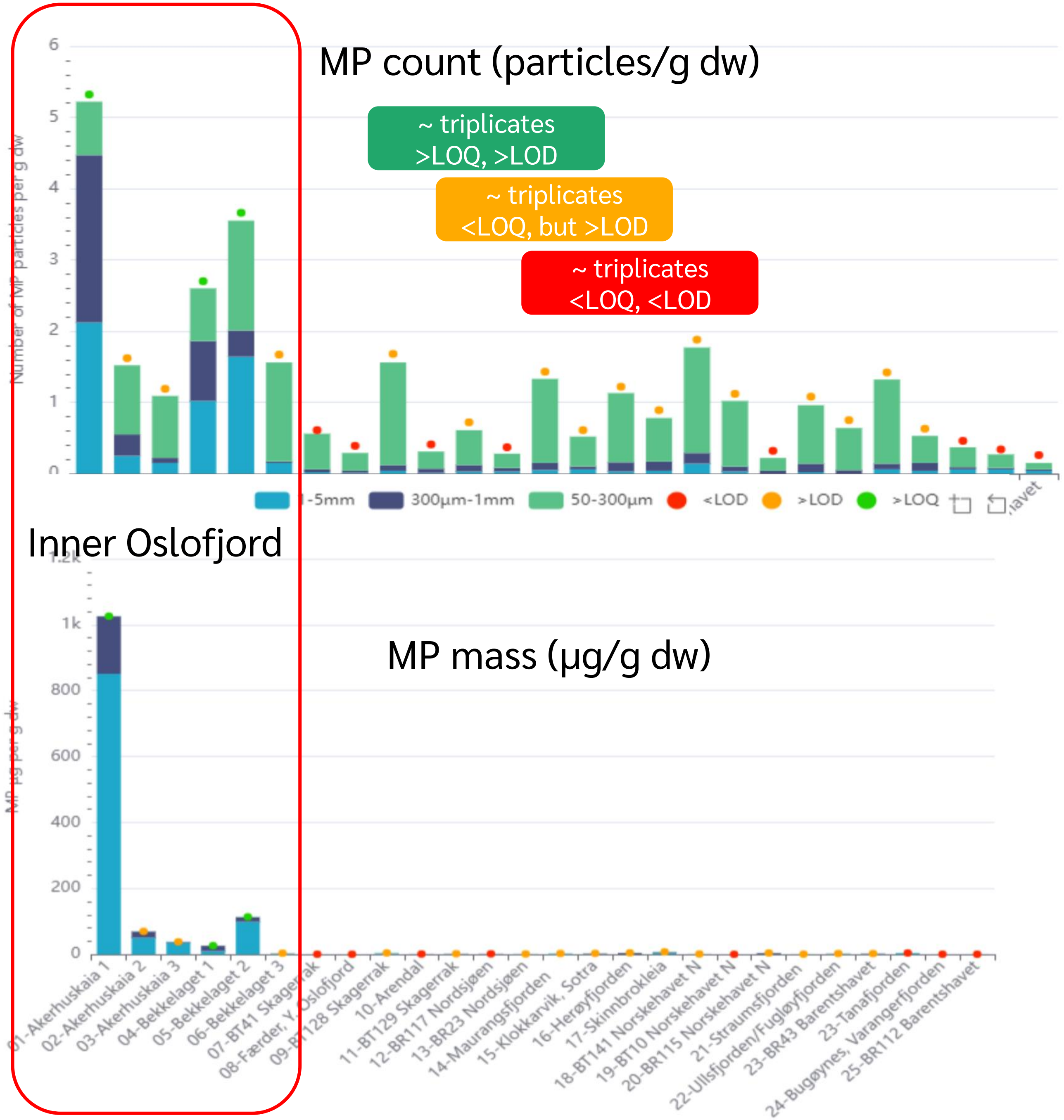
Results Marine sediments

MP count and mass:
21 polymer types

- **Count of polymer particles 50 µm to 5 mm: <LOD to 5 MP/g dw**
- **Mass: <LOD to 1000 µg/g dw**

- **Highest count and mass found in inner Oslo fjord**

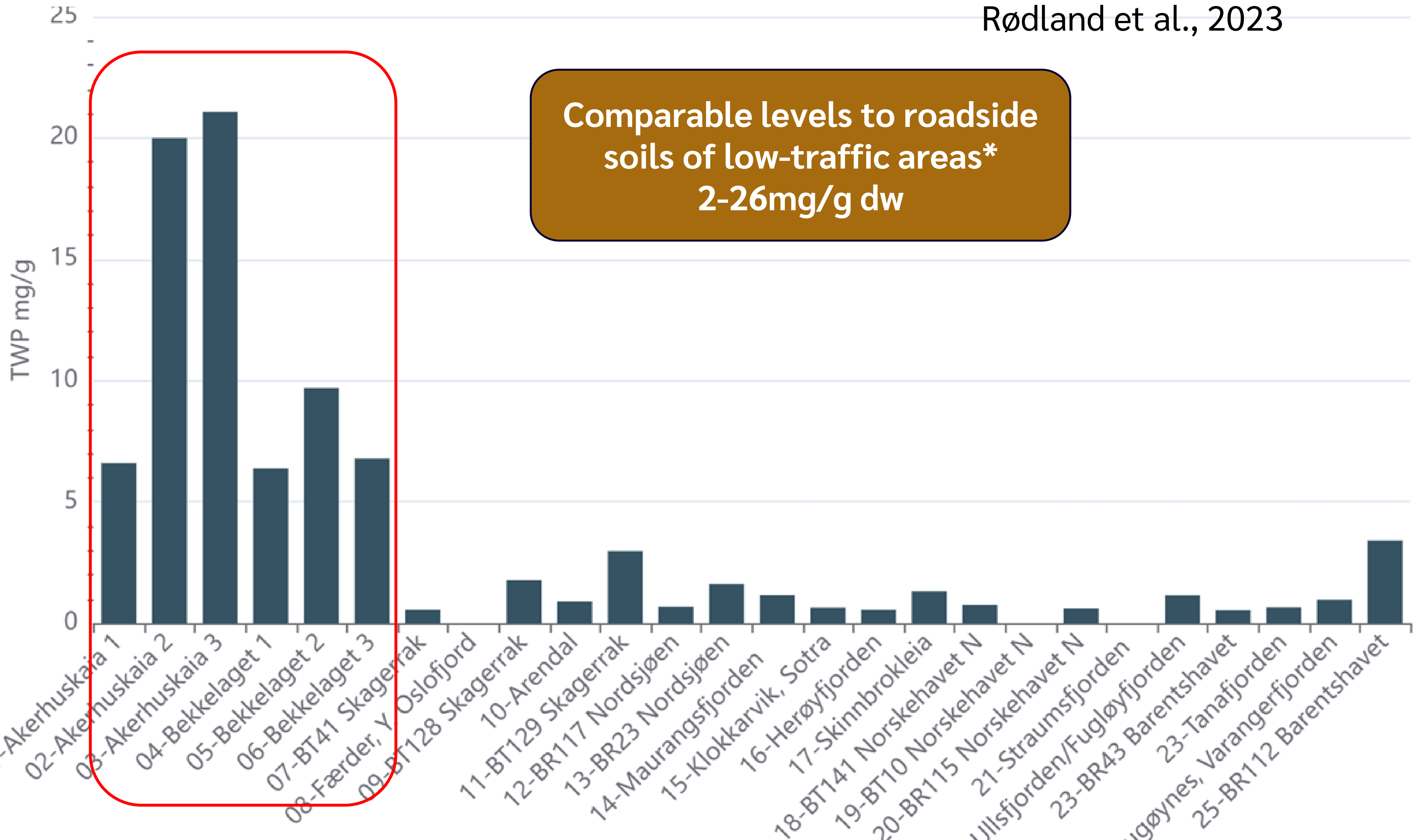
- **Relatively high numbers of small particles also in remote areas**



NIVA

Results Marine sediments

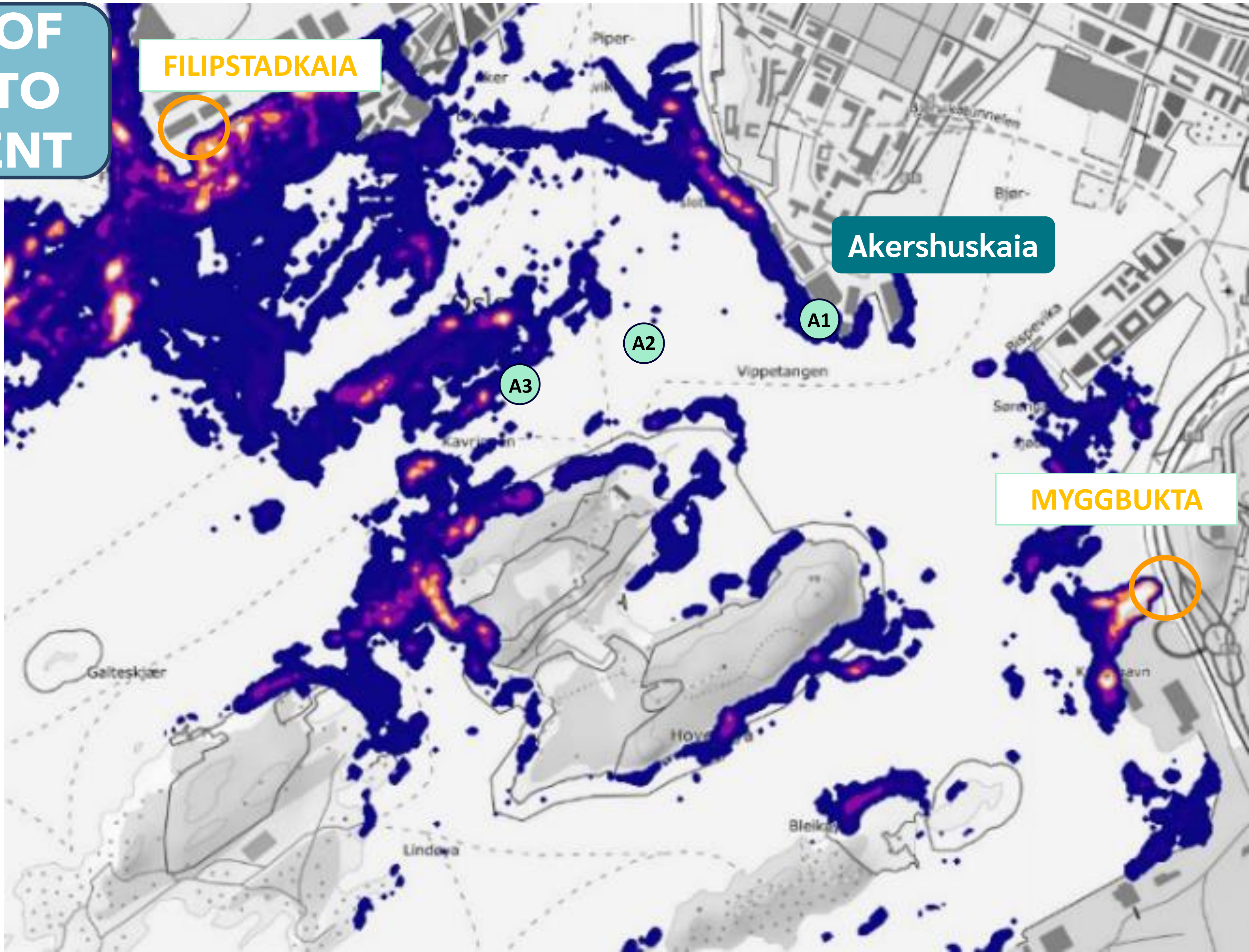
Tire wear particles TWP mass mg/g



NIVA

TRANSPORT OF TRWP AND TAC TO THE ENVIRONMENT

TRWP in the Oslofjord: tunnel wash water



Sedimentation of TRWP in shallow areas of the Oslofjorden

Modelled from outlet of tunnel wash water from Filipstadkaia og Myggbukta

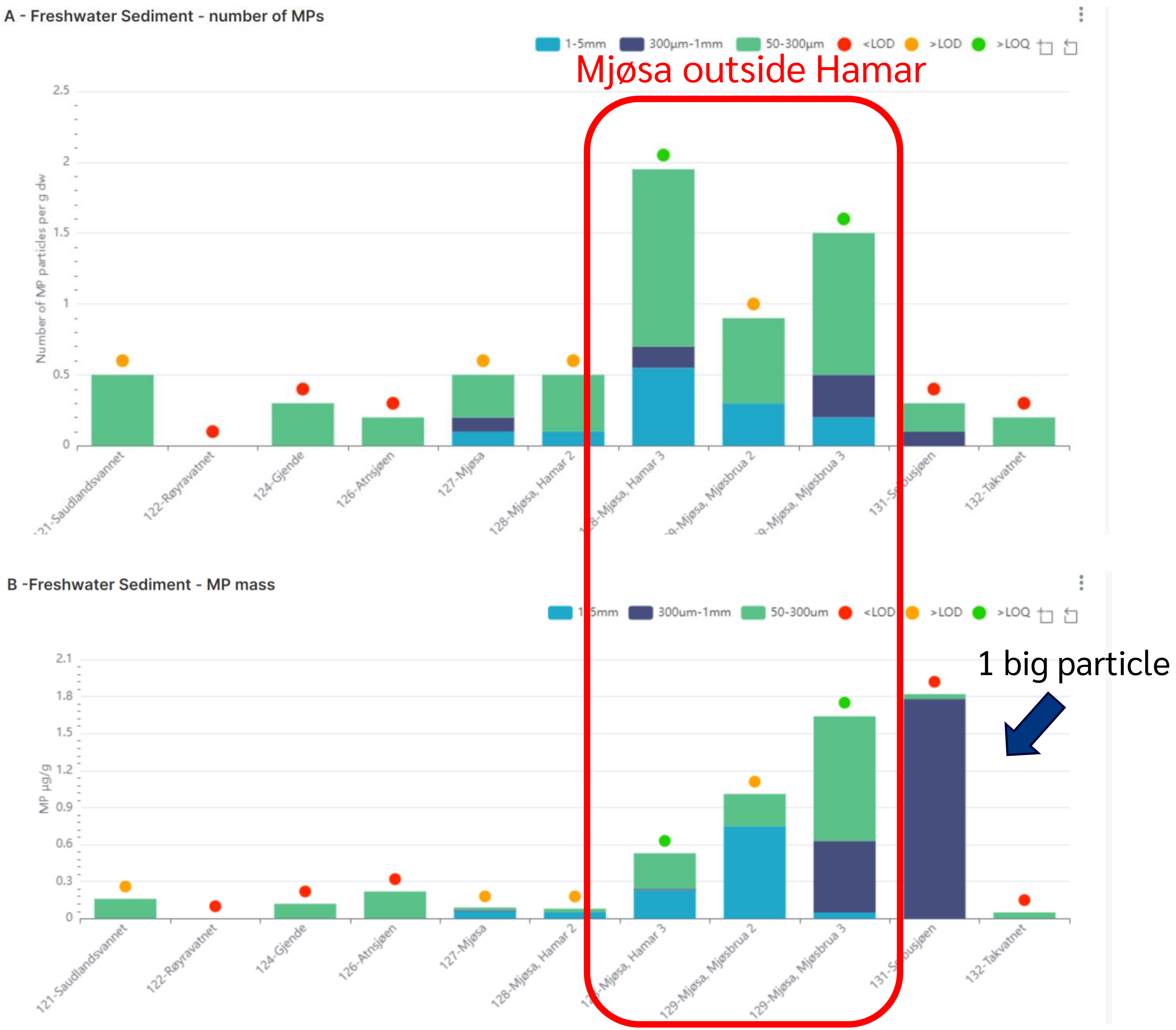
NIVA

Project DAFT 2022-2023
Acona IKM og NIVA

Results FW sediments

MP count and mass: 21 polymer types

- Count of polymer particles 50 µm to 5 mm: <LOD to 2 MP/g dw
- Mass: <LOD to 2 µg/g dw
- Highest in Mjøsa
- Low numbers compared to Oslo fjord, both mass and numbers

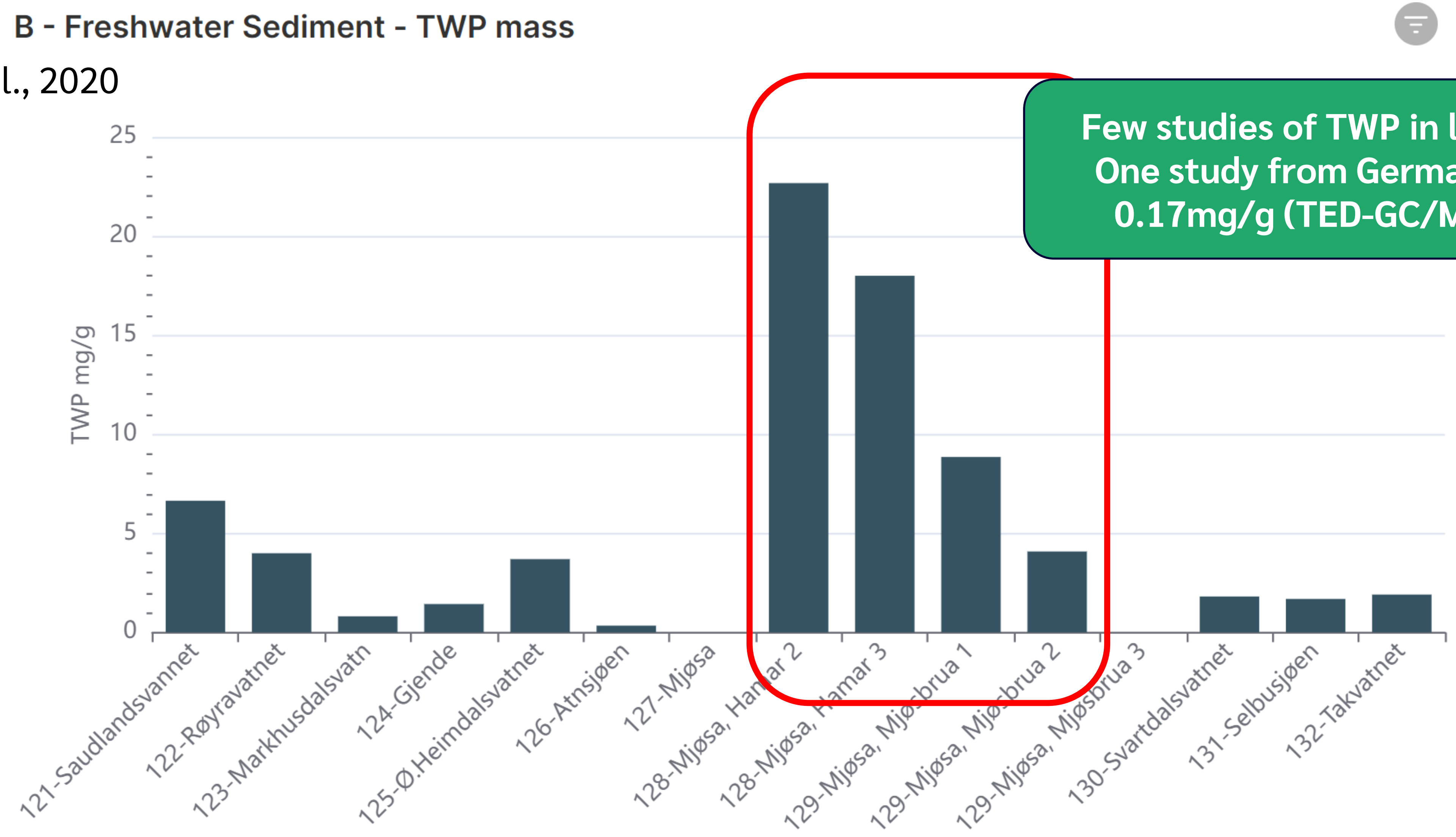


NIVA

Results FW sediments

Tire wear particles TWP mass mg/g

*Klöckner et al., 2020



Few studies of TWP in lakes
One study from Germany*
0.17mg/g (TED-GC/MS)

Summary

- Mass and count data will give different information
  - →Including single particle data is valuable, especially in areas with lower concentrations
- TWP analysis on sediments is challenging and extensive pretreatment is needed for some sediment samples
- Higher levels of MP and TWP found close to urban areas, especially Oslofjord
- TWP levels in inner Oslofjord were especially high compared to other sediment samples

Blue mussel collection (NIVA)

NIVA

Takk for oppmerksomheten!

elisabeth.rodland@niva.no

Resultater fra Mareano mikroplast kartleggingen i norske havområder

presentert av Henning Jensen, NGU

mareano
samler kunnskap om havet

Litt historikk: Mikroplast analyser og rapportering fra 2016 – 2023

2016 – 2017:	Ughent, Belgia, utvalgte kjerneprøver fra lager fra Mareano-tokt
2018 - 2020:	NGI – prøver fra 2018, 2019 og 2020
2022	NIVA og Eurofins Norge AS – prøver fra Mareano-tokt 2021
2023	NORCE – prøver fra Mareano-tokt 2022
2024 -	HI – prøver fra 2023 Mareano-tokt: analyser pågår

I den samme periode har det skjedd en utvikling mht. analysemetoder og kvantifisering.

Det vises eksempler fra hele perioden med MP-analyser.

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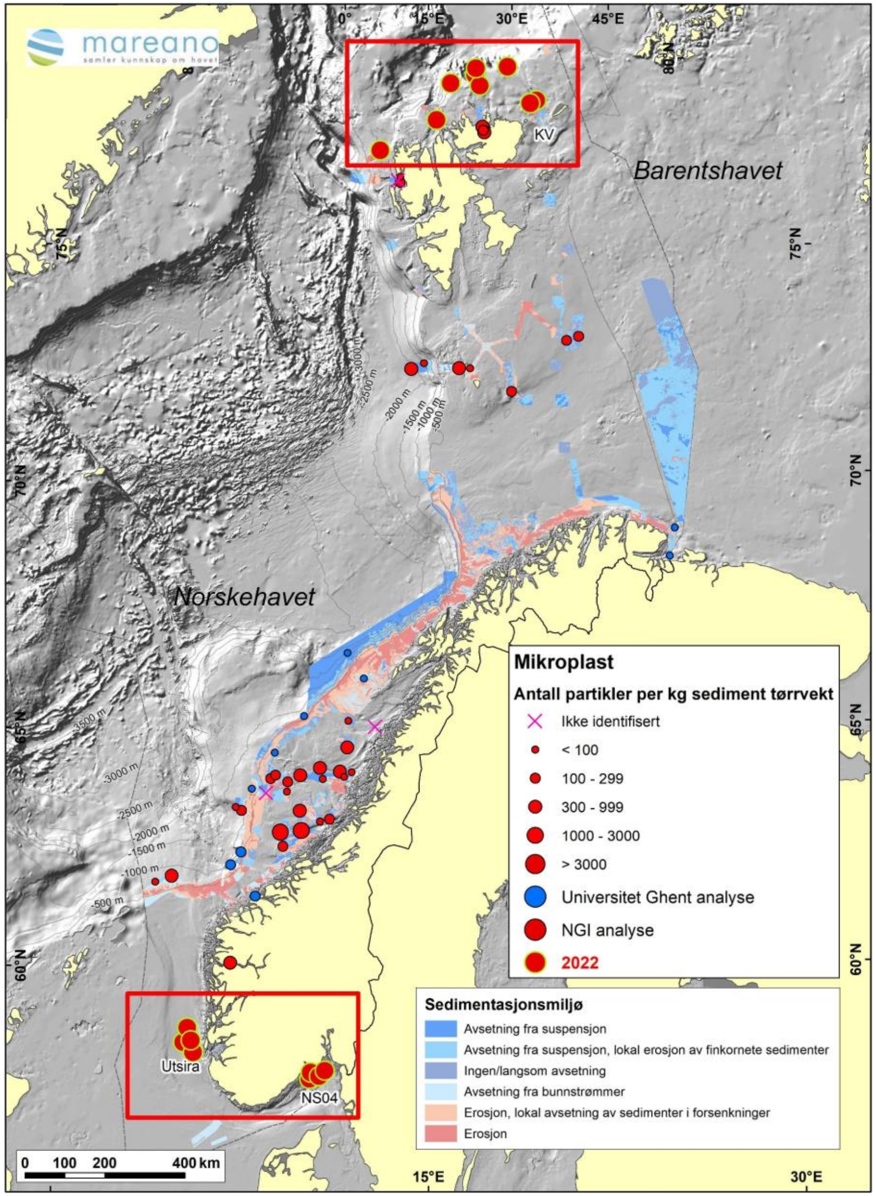
Fordeling av mikroplast i overflatesedimenter.

- Samtlige analyserte overflateprøver tilgjengelig på www.ngu.no og www.mareano.no
- Totalt 63 lokaliteter i norske havområder
- 60 lokaliteter: kvantifisert MP
- 3 lokaliteter: ikke kvantifisert MP.

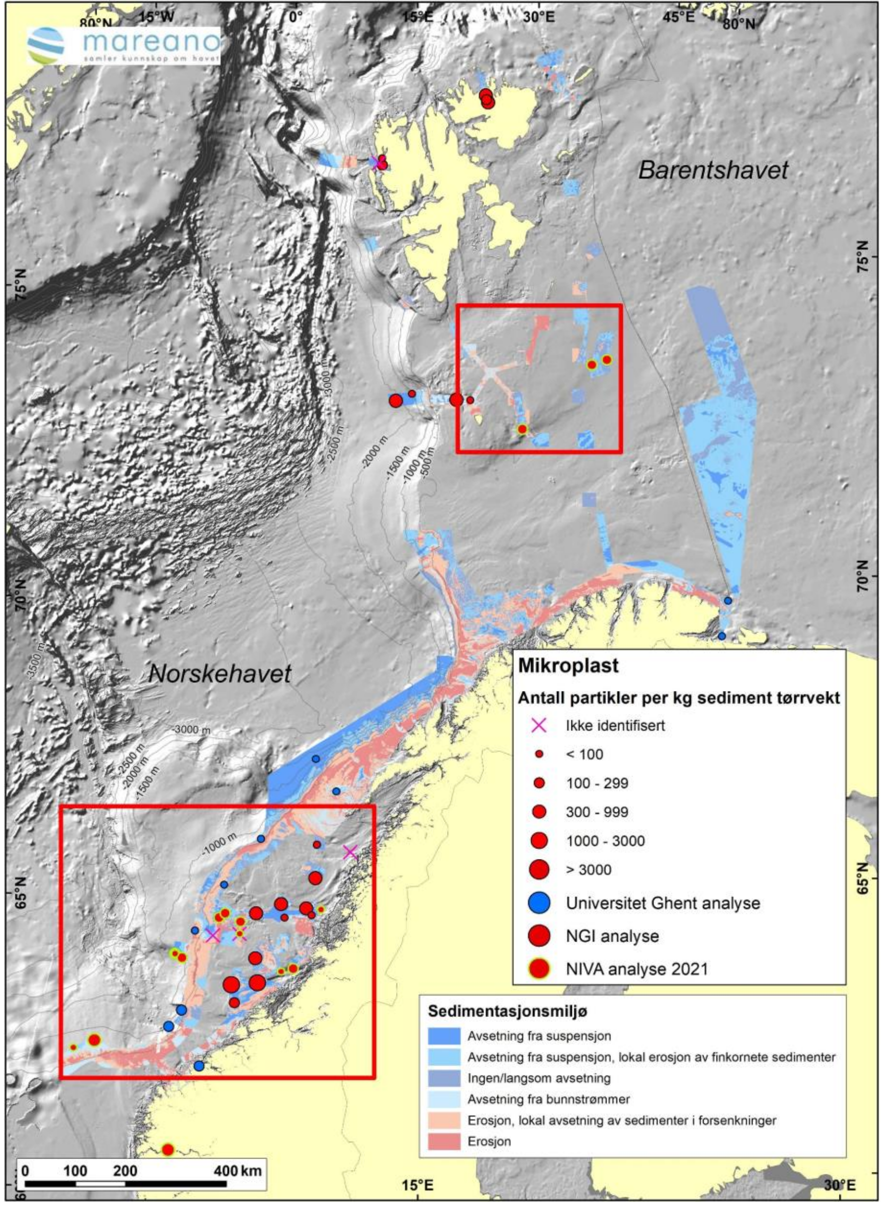
- 0 – 14 780 partikler/kg sediment



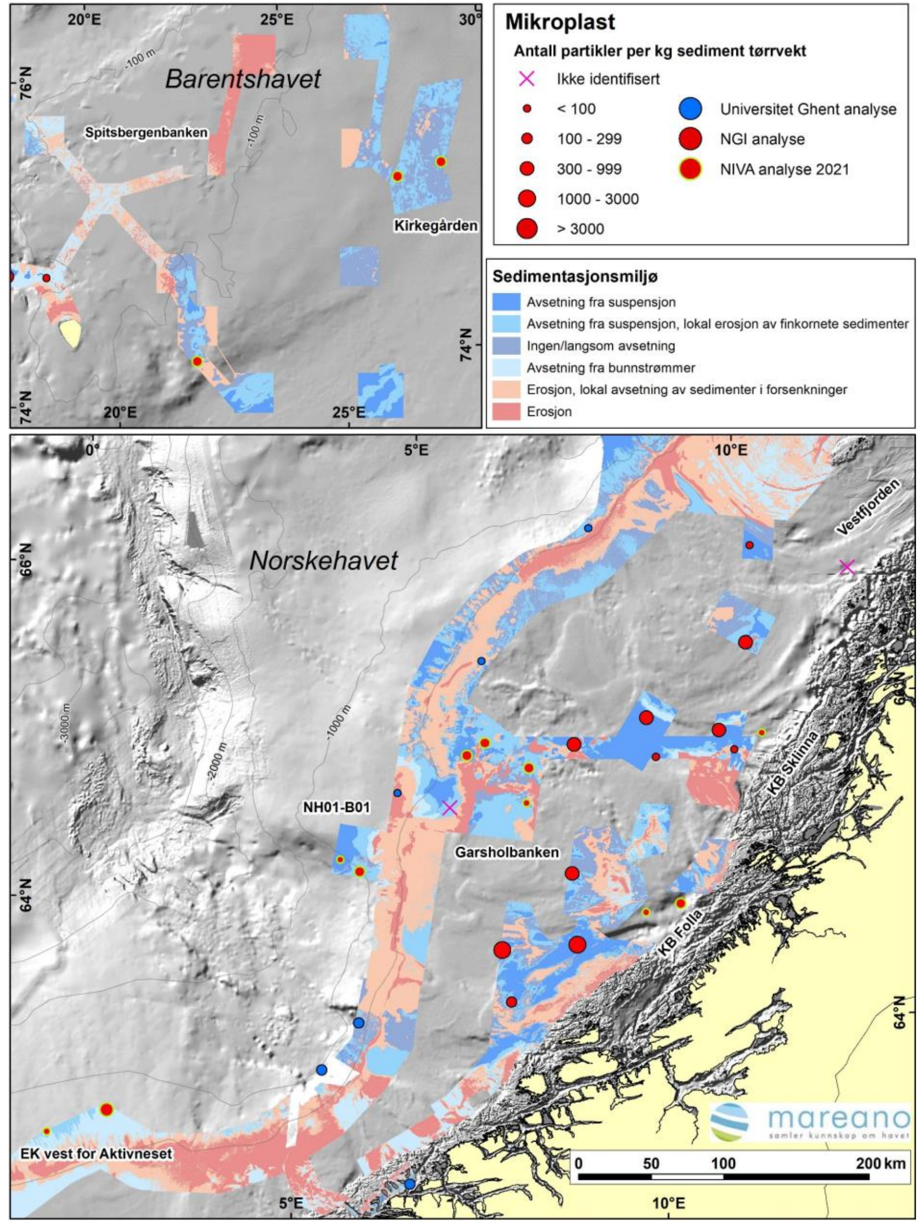
Eksempler fra mikroplastanalyser fra 2016 - 2022

- Geografisk fordeling
- Spiller sedimentasjonsmiljø og andre forhold en rolle i MP-fordeling?
- Pyrolyse GC-MS: hvilke muligheter har vi?
- Daterte sedimentkjerner: fordeling av MP i dypere (og eldre) lag i sedimentene. Når kommer MP inn i sedimentene?

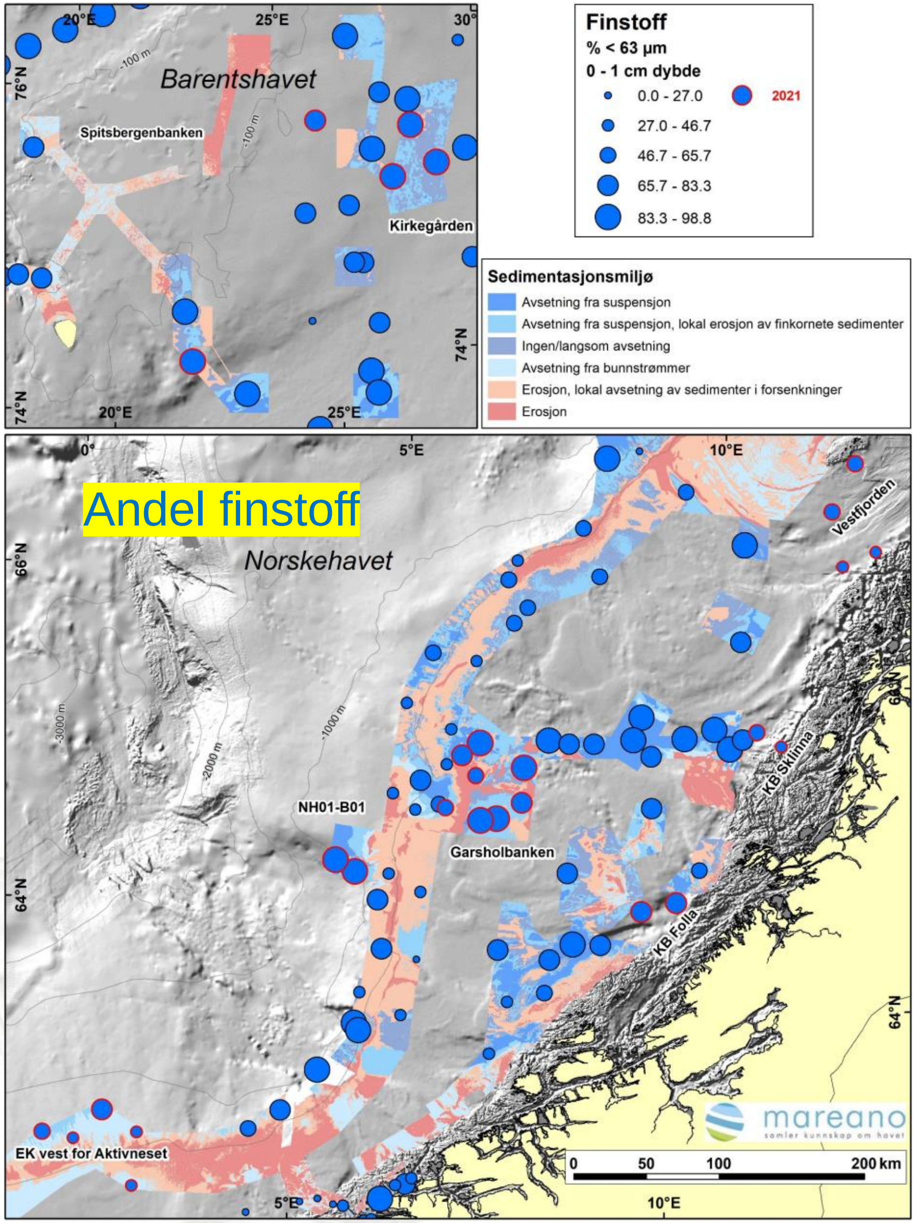
Geografisk nære lokaliteter

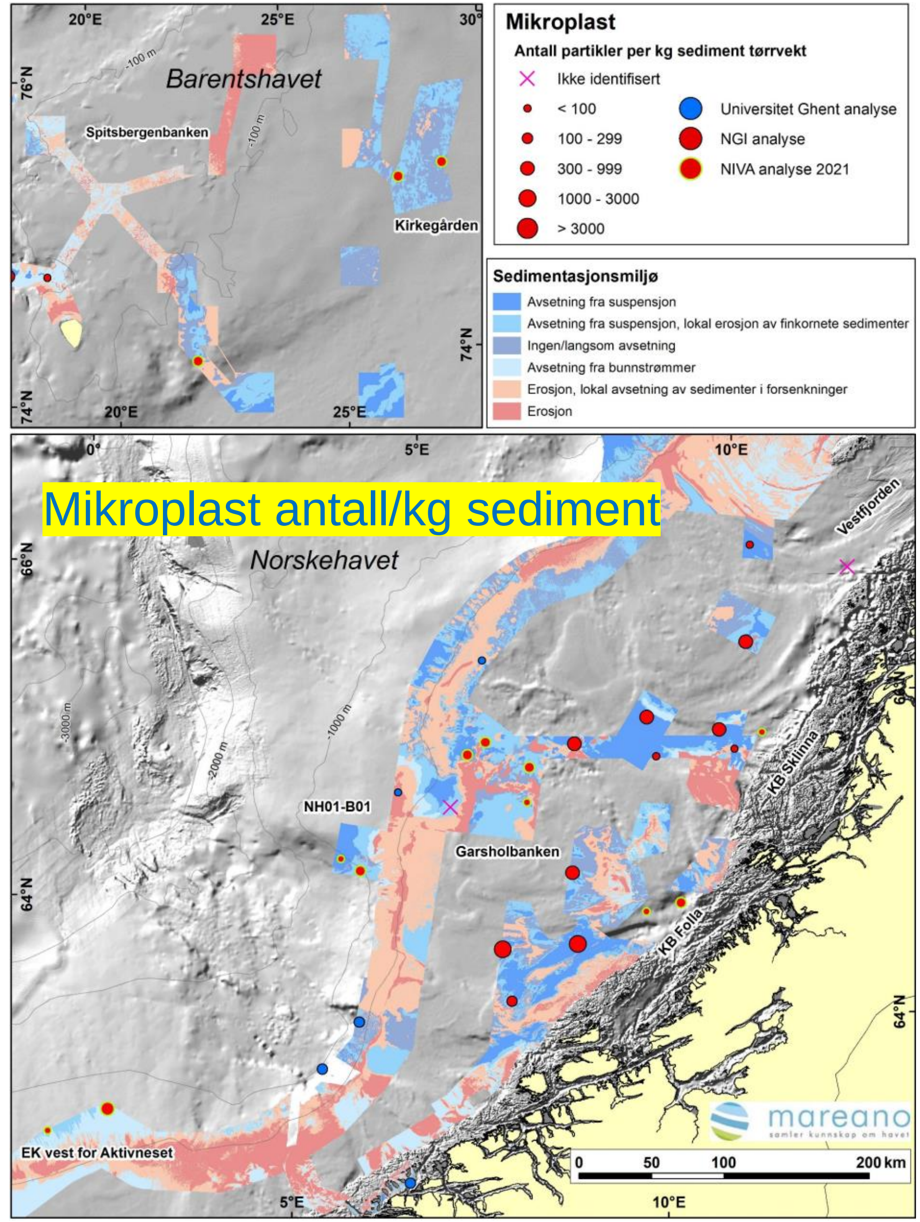


Geografisk nære lokaliteter
Eksempel 1.



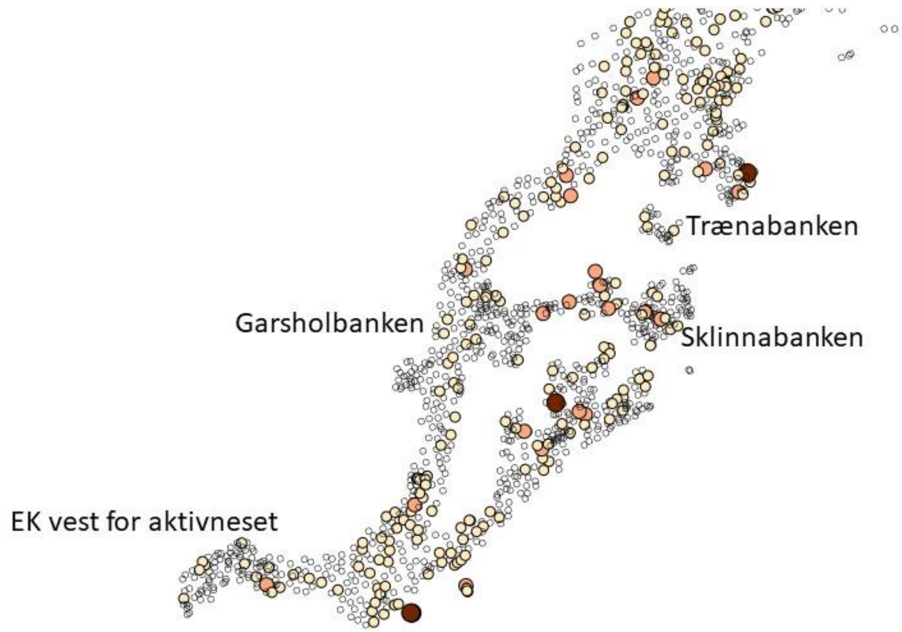
MAREANO samler kunnskap om havet

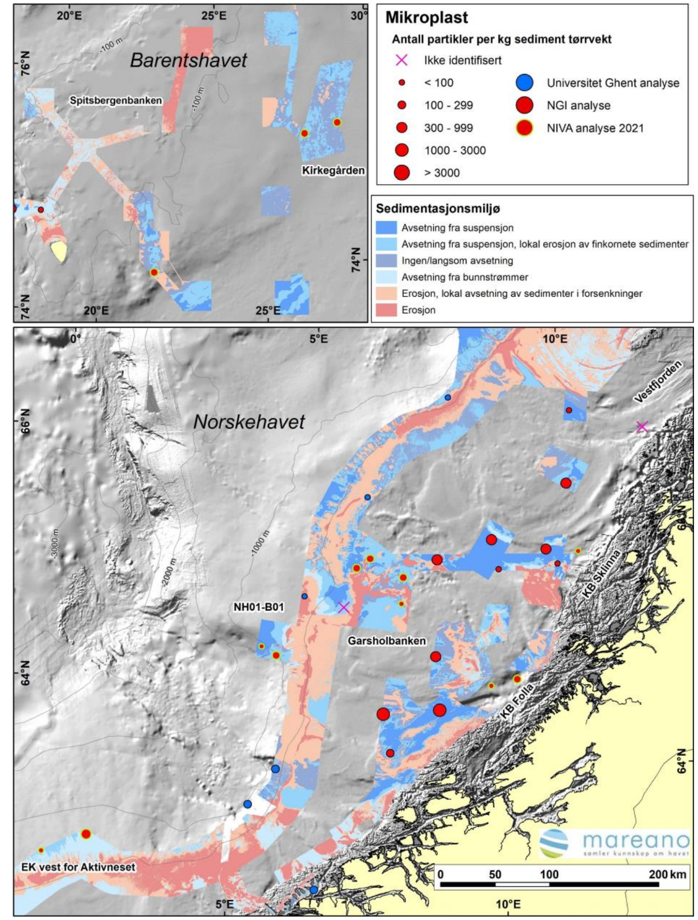

Andel finstoff
Finstoff
% < 63 µm
0 - 1 cm dybde
0.0 - 27.0
27.0 - 46.7
46.7 - 65.7
65.7 - 83.3
83.3 - 98.8
2021
Sedimentasjonsmiljø
Avsetning fra suspensjon
Avsetning fra suspensjon, lokal erosjon av finkornete sedimenter
Ingen/langsom avsetning
Avsetning fra bunnstrømmer
Erosjon, lokal avsetning av sedimenter i forsenkninger
Erosjon
Barentshavet
Spitsbergenbanken
Kirkegården
Norskehavet
Vestfjorden
NH01-B01
Garsholbanken
KB Skilnna
KB Folla
EK vest for Aktivneset
0 50 100 200 km


Mikroplast antall/kg sediment
Mikroplast
Antall partikler per kg sediment tørrvekt
Ikke identifisert
< 100
100 - 299
300 - 999
1000 - 3000
> 3000
Universitet Ghent analyse
NGI analyse
NIVA analyse 2021
Sedimentasjonsmiljø
Avsetning fra suspensjon
Avsetning fra suspensjon, lokal erosjon av finkornete sedimenter
Ingen/langsom avsetning
Avsetning fra bunnstrømmer
Erosjon, lokal avsetning av sedimenter i forsenkninger
Erosjon
Barentshavet
Spitsbergenbanken
Kirkegården
Norskehavet
Vestfjorden
NH01-B01
Garsholbanken
KB Skilnna
KB Folla
EK vest for Aktivneset
0 50 100 200 km

Geografisk nære lokaliteter
Eksempel 1.

Antall søppelregistrering





søppelregistreringer per videostasjon i Norskehavet. Symbolstørrelse og farge er i henhold til HIs tegnforklaring [Presentasjonsregler - Søppel pr Mareano-stasjon (geonorge.no)](). Åpen sirkel: ingen registreringer pr. 100 m; gul sirkel: 0 – 0,5 registreringer pr. 100 m videolinje; oransje sirkel: 0,5 – 1,0 registreringer pr. 100 m; svart sirkel: >1 registrering pr. 100 m. Kilde: http://www.mareano.no/kart/mareano.html#maps/3250.

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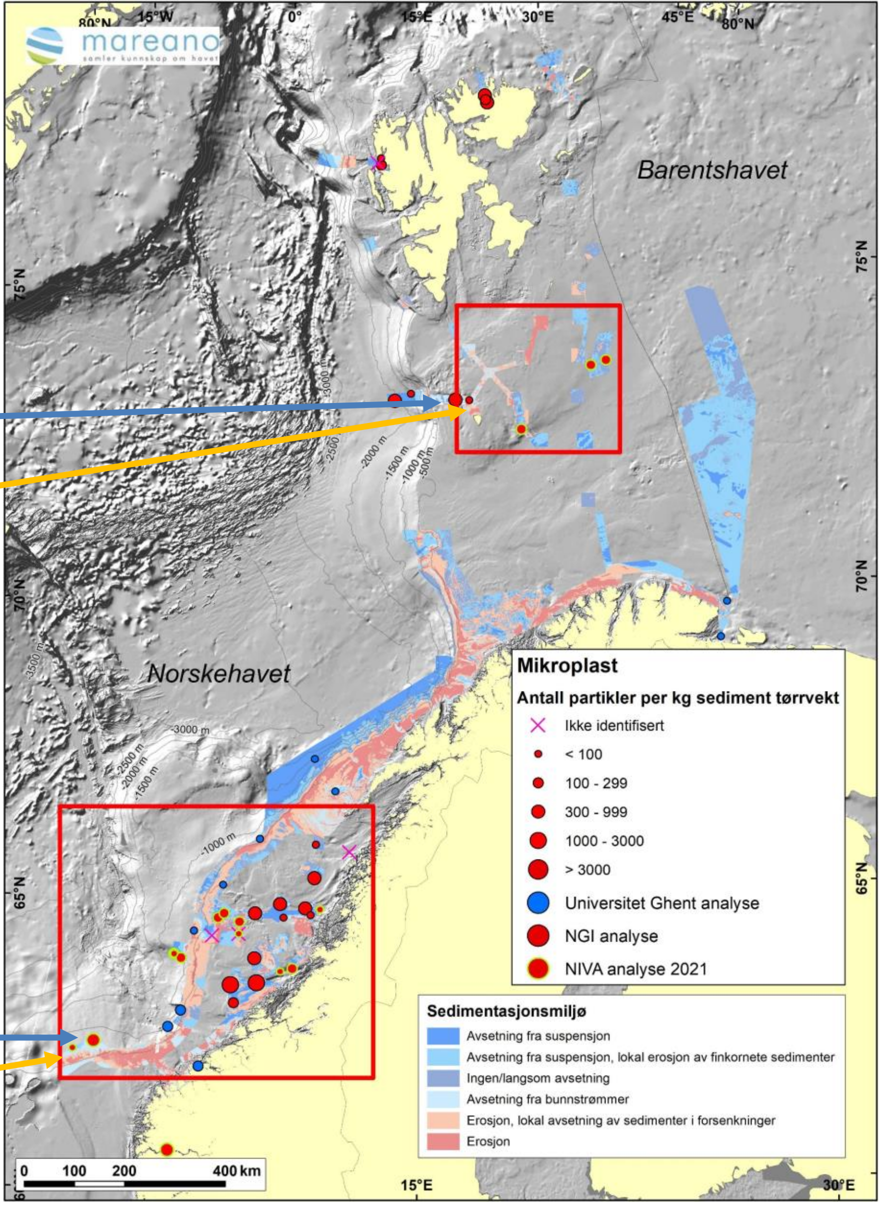
18 58

MILJØ-DIREKTORATET

Geografisk nære lokaliteter
Eksempel 2

R1965: 322 MP, 82 % <63 µm
R1951: 46 MP, 74 % <63 µm

R2486: 341 MP, 70 % <63 µm
R2524: 41 MP, 29 % <63 µm



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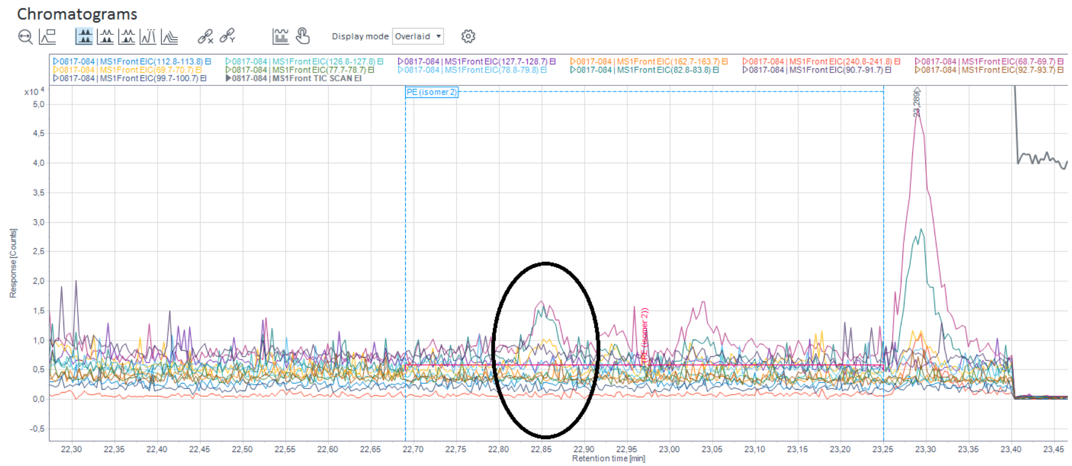
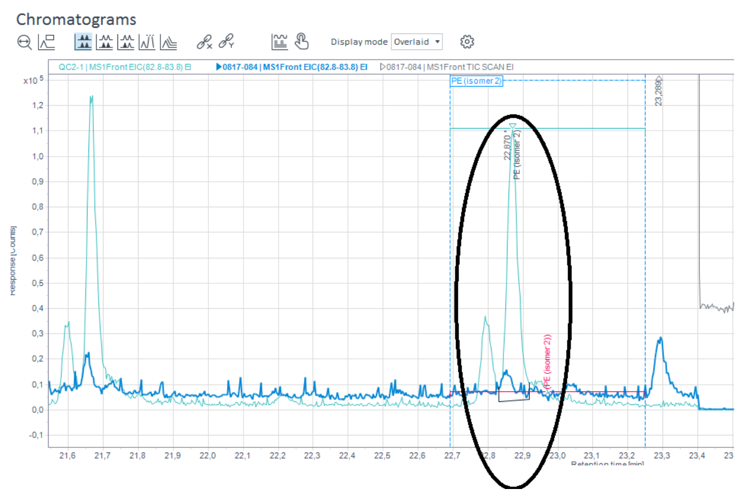
Pyrolyse GC/MS

- Enkelte resultater basert på analyser av 2021 prøver:

få 2021 prøver med svakt utviklet spekter for polyetylen, men ikke bra nok for kvantifisering

Pyrolyse GC/MS rapportert i:
https://mareano.no/resources/Rapport_2022_023.pdf





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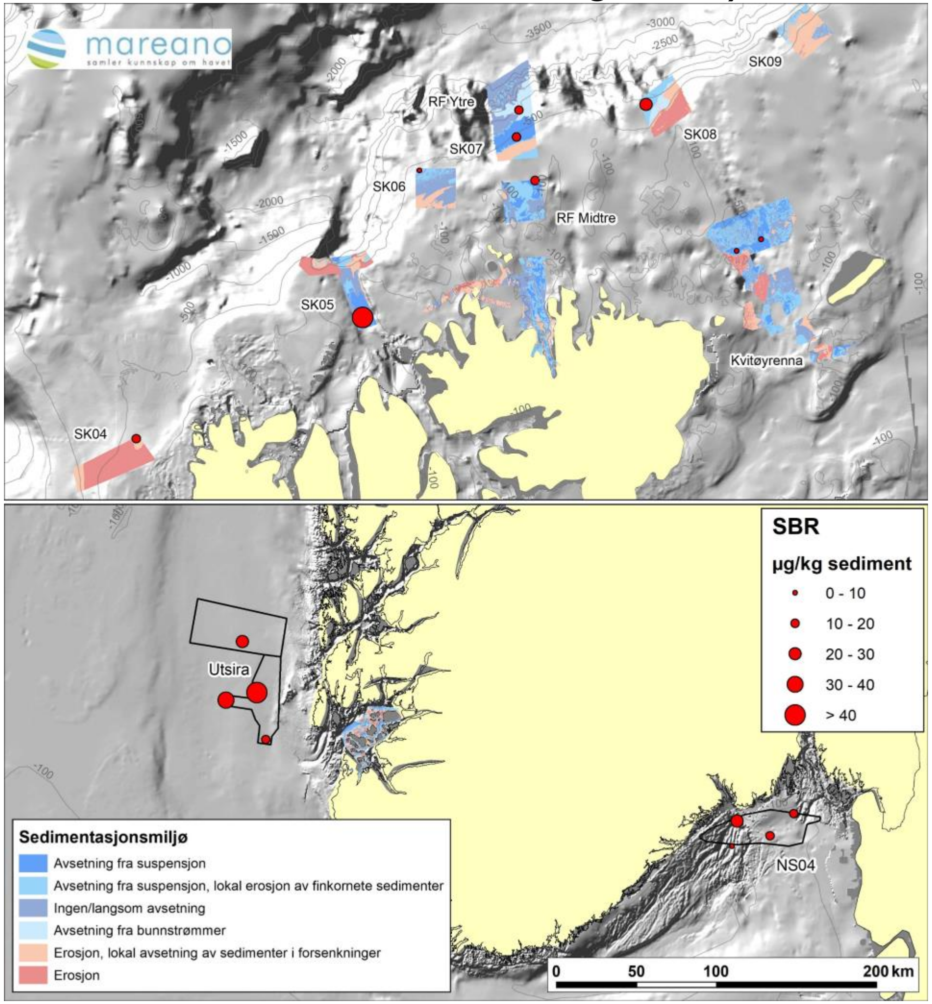
Pyrolyse GC/MS

- samtlige 2022 prøver (SBR = styrene butadiene rubber, bildekkgummi)

SBR er registrert i samtlige overflateprøver.
Enhet: µg/kg sediment

https://mareano.no/resources/Rapport_2023_020.pdf



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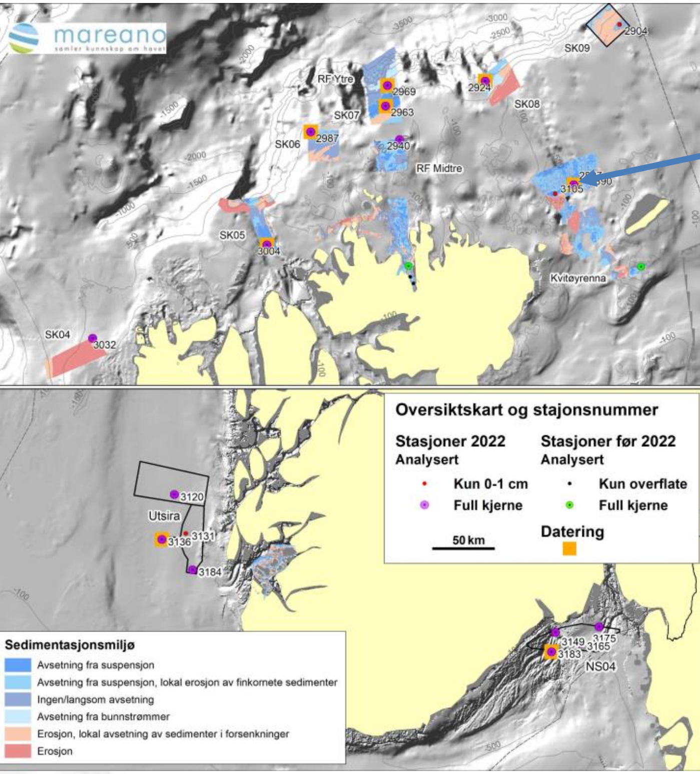
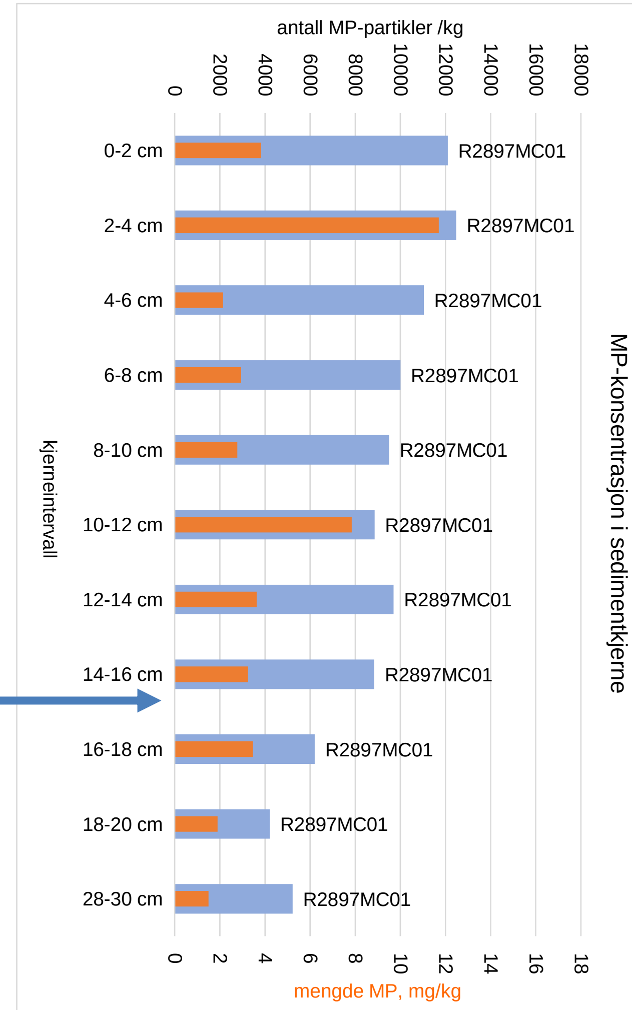
Mikroplast i Pb-210 datert sedimentkjerne fra Kvitøyrenna, NØ for Svalbard



R2897MC01
Kvitøyrenna



Pb-210: 1950

Mikroplast i sedimenter under 1950 – hvorfor er ikke godt forstått.

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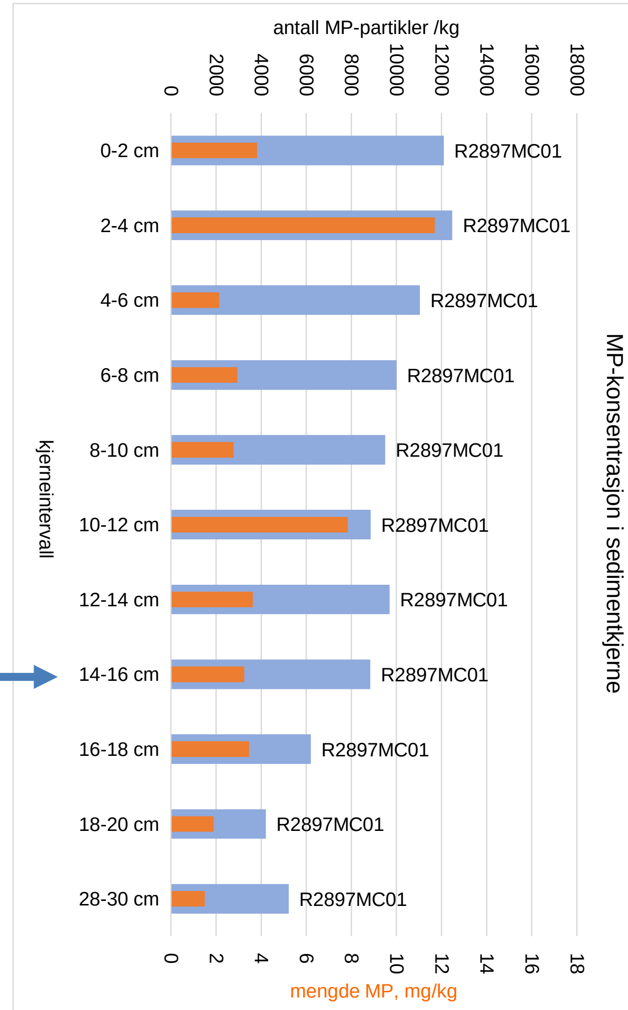
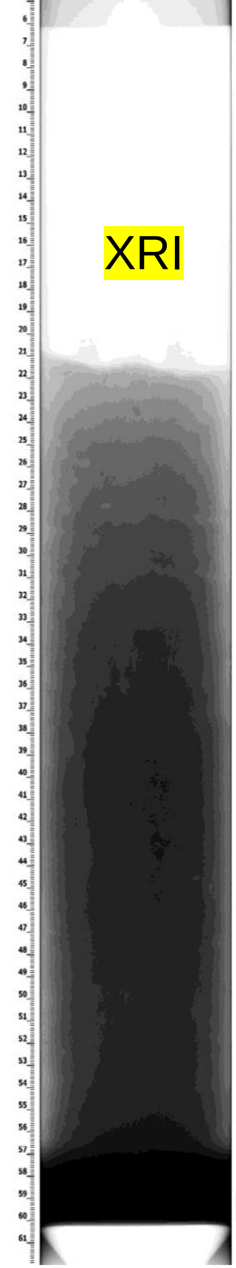
MILJØ-DIREKTORATET

Mikroplast i sedimenter under 1950 – ikke godt forstått hvorfor.

Kan forbedret XRI hjelpe her?

Pb-210 datering: 1950





samler kunnskap om havet

Oppsummering - 1

- Mikroplast finnes i omtrent alle analyserte lokaliteter i norske havområder.
- Årsaker til observerte variasjoner i geografisk fordeling:
    - Havstrømmer spiller en rolle i fordeling av MP i alle norske havområder (Nordsjøen, Norskehavet, Barentshavet)
    - Antall partikler/kg sediment (µFTIR): avhengig av filterstørrelse – en utfordring å sammenlikne forskjellige MP-undersøkelser.
    - Sedimentasjonsmiljø (lokale variasjoner): mer MP akkumulasjon hvor det er mer sedimentasjon enn hvor det er mindre sedimentasjon.
    - Regionale variasjoner: mulig at forsøpling på havbunn har betydning for hvor mye MP som finnes (nedbryting lokalt)

Oppsummering -2

- **Pyrolyse GC-MS:** gir svar (SBR), hvor ikke µFTIR fungerer, samt identifikasjon av MP i enkelte prøver, men ikke kvantitativt for en rekke polymerer. Forbedring av opparbeidingen av prøver til Pyr-GC/MS?
- **Mikroplast finnes i dypere lag**. Daterte sedimentkjerner viser at MP finnes i kvantifiserbare konsentrasjoner i lag eldre enn **1950**, og vel så det! mulig forklaring kan være bioturbasjon: bedre karakteristikk av sedimentene med XRI?
- Både lokale og regionale forhold kan påvirke hvor mye MP som finnes i sedimentene: sjekke marin forsøpling, sediment sammensetning (kornstørrelsesfordeling, TOC m. m.). **Mekanismer for avsetning av MP i sedimentene**