Development of a sampling and analyses module for microplastic for the FerryBox

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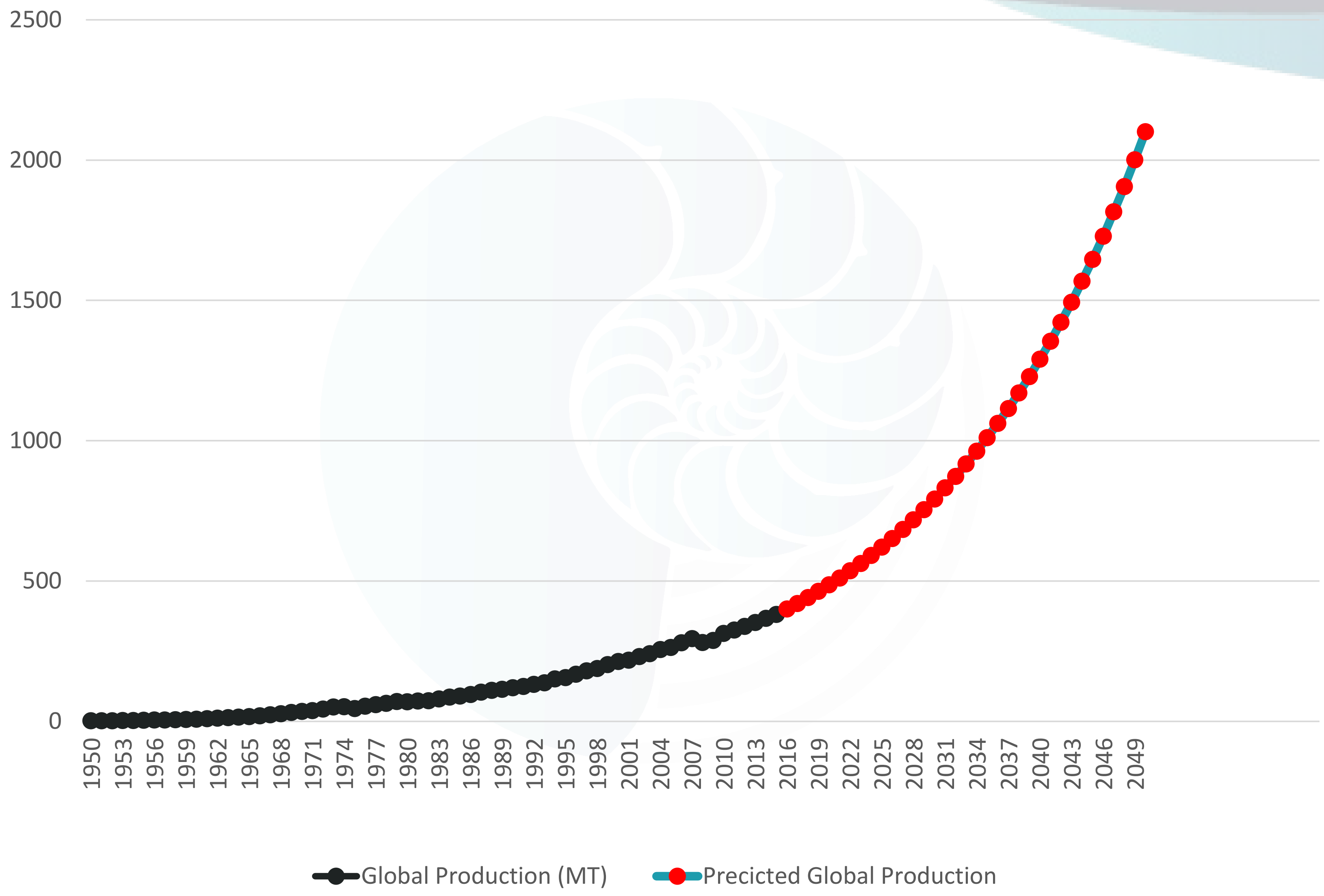
NIVA Norwegian Institute for Water Research

subCtech

csem

Plastic production and prediction



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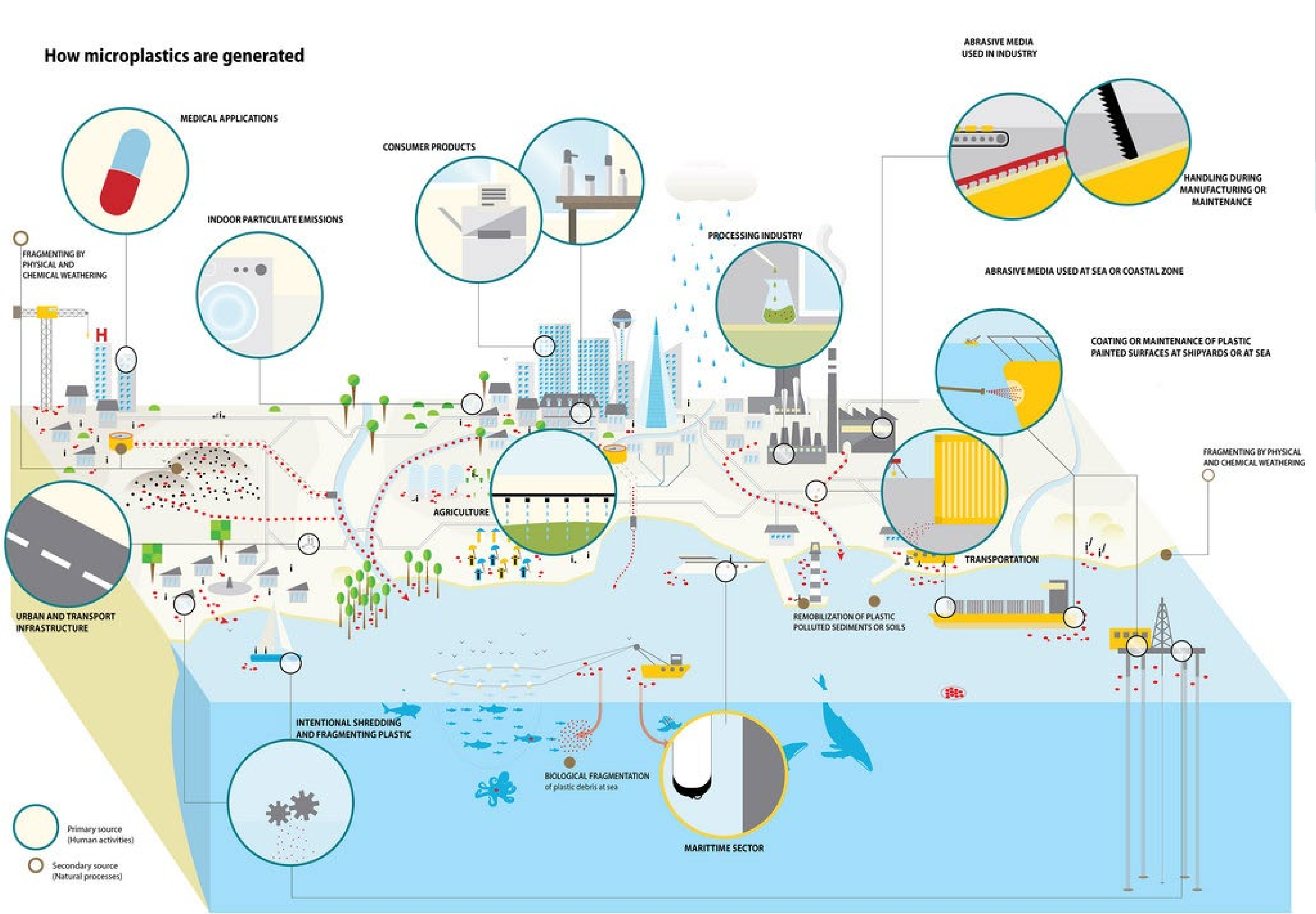
How microplastics are generated



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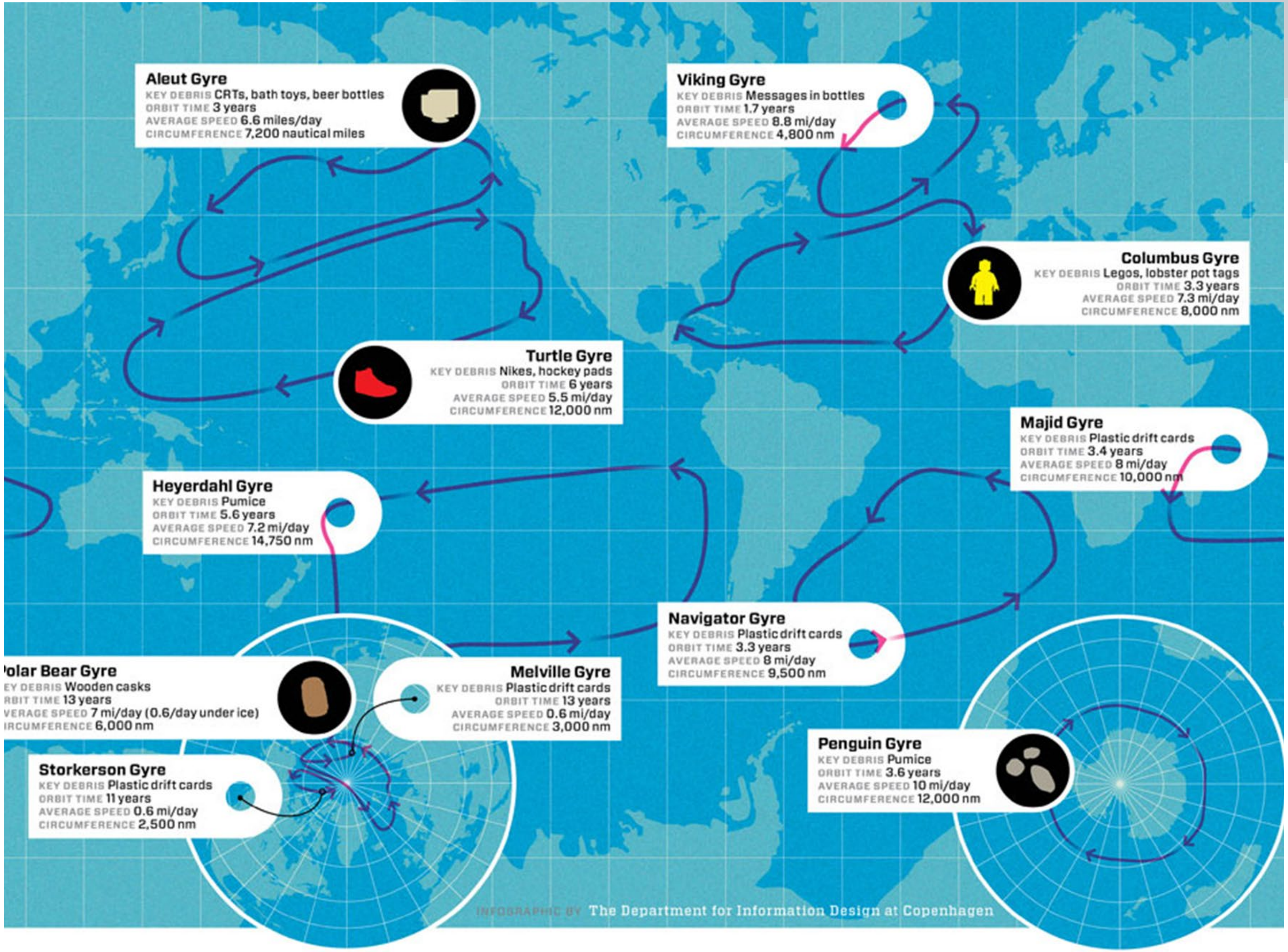
Global accumulation zones or gyres



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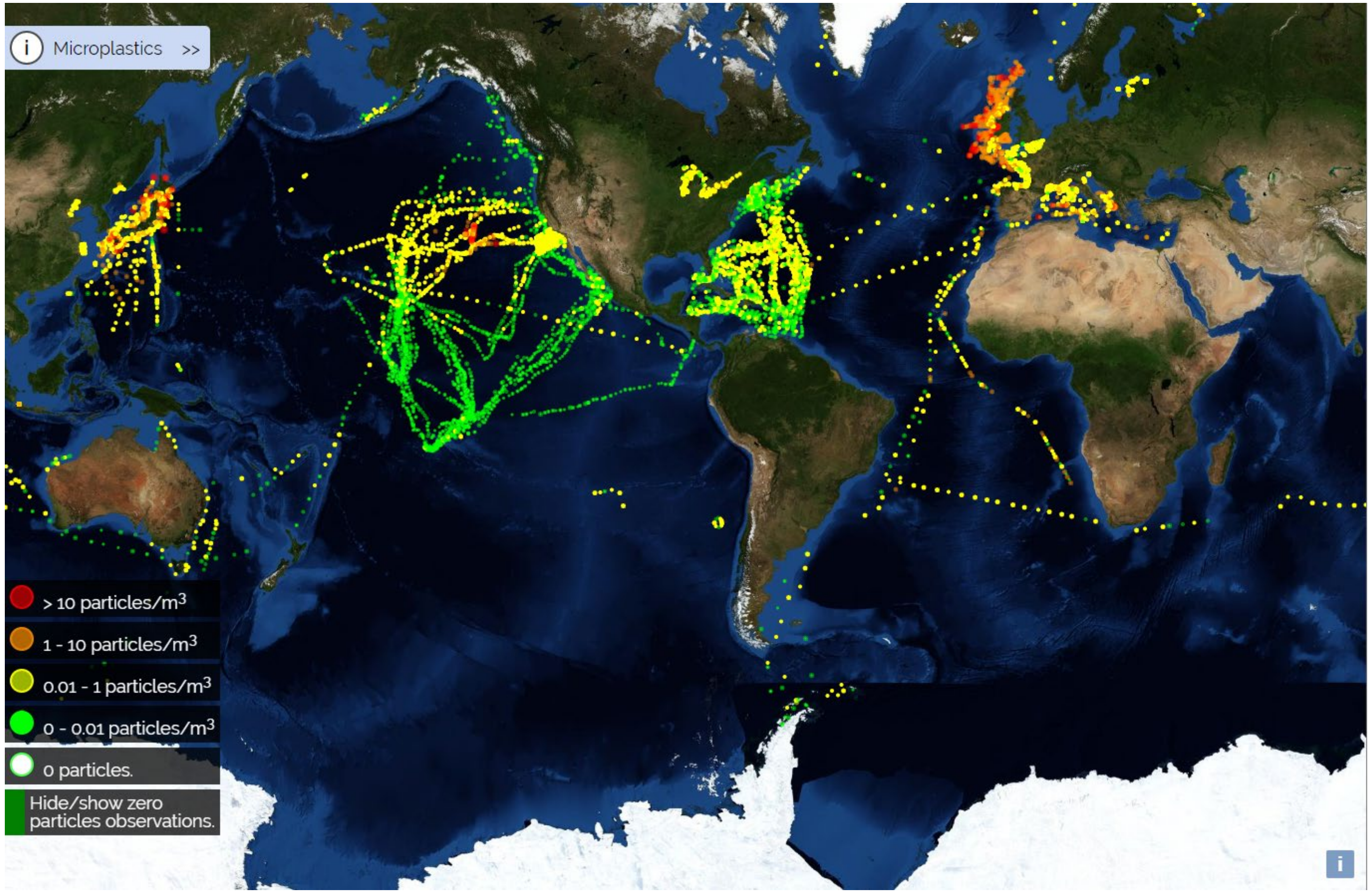
Global map of microplastic based on including FerryBox samples



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Microplastics

- On average 2.5 particles (333 um) in 1000 L

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Microplastics in Arctic polar waters: the first reported values of particles in surface and sub-surface samples

Amy L. Lusher[1], Valentina Tirelli[2], Ian O'Connor[1] & Rick Officer[1]

Plastic, as a form of marine litter, is found in varying quantities and sizes around the globe from surface waters to deep-sea sediments. Identifying patterns of microplastic distribution will benefit an understanding of the scale of their potential effect on the environment and organisms. As sea ice extent is reducing in the Arctic, heightened shipping and fishing activity may increase marine pollution in the area. Microplastics may enter the region following ocean transport and local input, although baseline contamination measurements are still required. Here we present the first study of microplastics in Arctic waters, south and southwest of Svalbard, Norway. Microplastics were found in surface (top 16 cm) and sub-surface (6 m depth) samples using two independent techniques. Origins and pathways bringing microplastic to the Arctic remain unclear. Particle composition (95% fibres) suggests they may either result from the breakdown of larger items (transported over large distances by prevailing currents, or derived from local vessel activity), or input in sewage and wastewater from coastal areas. Concurrent observations of high zooplankton abundance suggest a high probability for marine biota to encounter microplastics and a potential for trophic interactions. Further research is required to understand the effects of microplastic-biota interaction within this productive environment.

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Microplastic pollution in the Northeast Atlantic Ocean: Validated and opportunistic sampling

CrossMark

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ABSTRACT

Levels of marine debris, including microplastics, are largely un-documented in the Northeast Atlantic Ocean. Broad scale monitoring efforts are required to understand the distribution, abundance and ecological implications of microplastic pollution. A method of continuous sampling was developed to be conducted in conjunction with a wide range of vessel operations to maximise vessel time. Transects covering a total of 12,700 km were sampled through continuous monitoring of open ocean sub-surface water resulting in 470 samples. Items classified as potential plastics were identified in 94% of samples. A total of 2315 particles were identified, 89% were less than 5 mm in length classifying them as microplastics. Average plastic abundance in the Northeast Atlantic was calculated as 2.46 particles m^{-3}. This is the first report to demonstrate the ubiquitous nature of microplastic pollution in the Northeast Atlantic Ocean and to present a potential method for standardised monitoring of microplastic pollution.

Microplastic sampler

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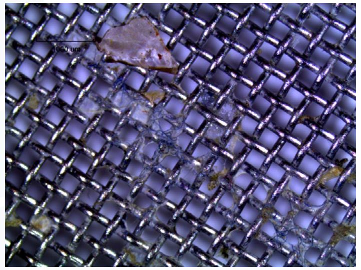
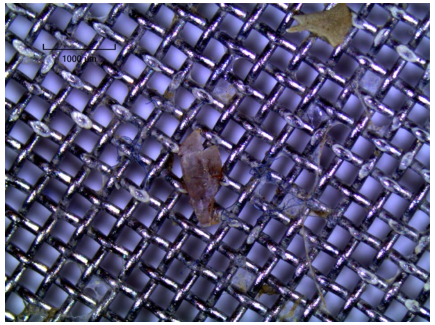
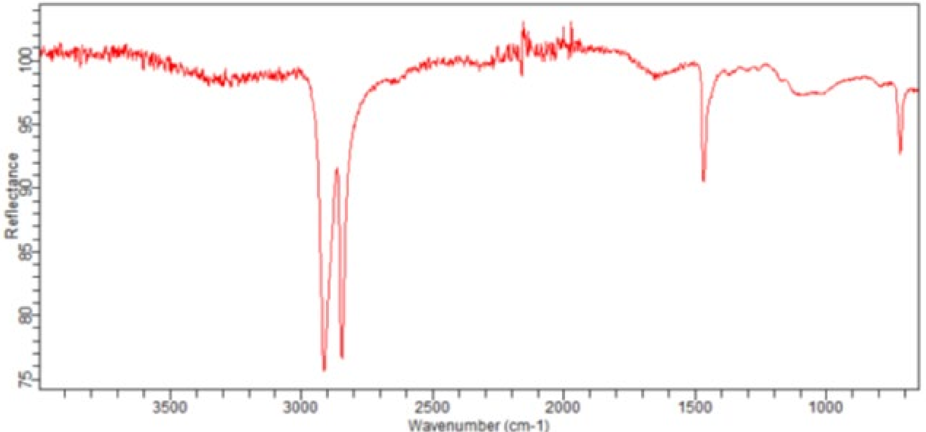
Samples Roald Amundsen

Microplastic samples to be analyzed in NIVAs microplastic lab (µFTIR)







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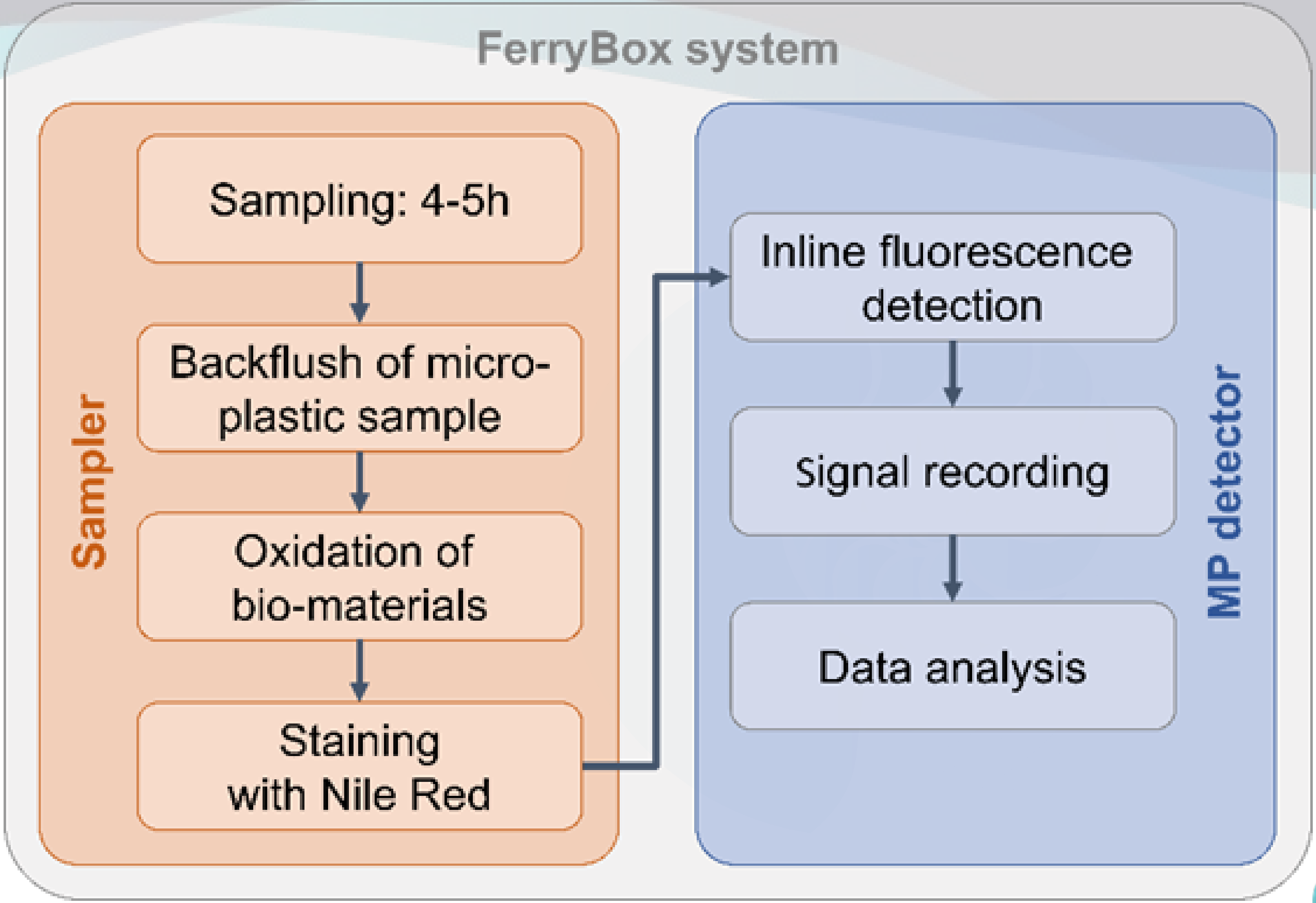
FerryBox system
Sampler
Sampling: 4-5h
Backflush of micro-plastic sample
Oxidation of bio-materials
Staining with Nile Red
MP detector
Inline fluorescence detection
Signal recording
Data analysis

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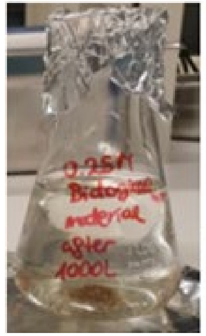
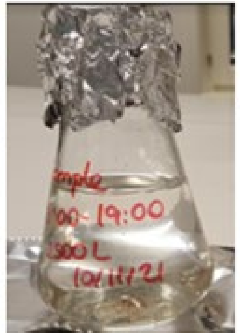
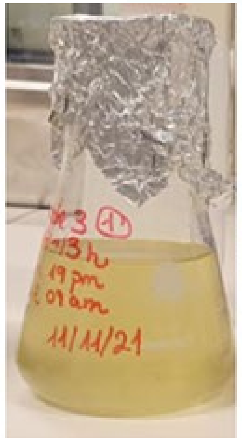
Low cost sampler 50 µm- 500 µm

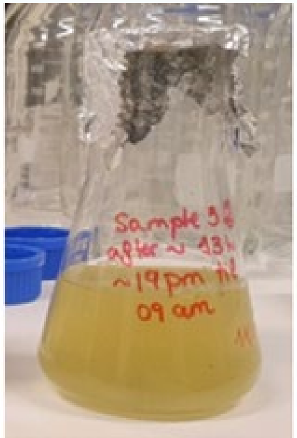
Low cost sampler 50 µm- 500 µm

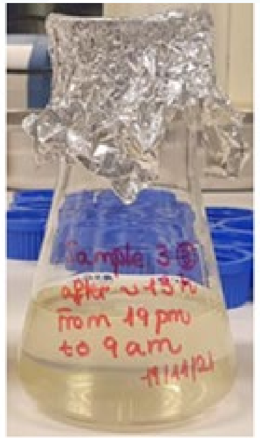


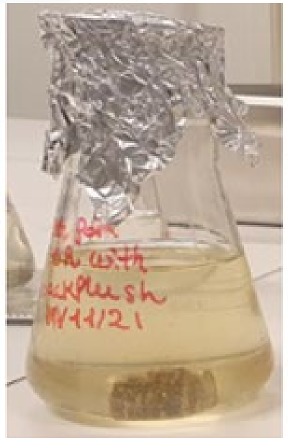
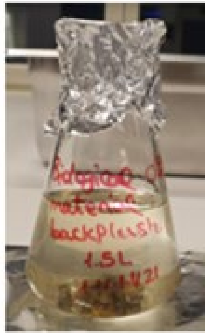





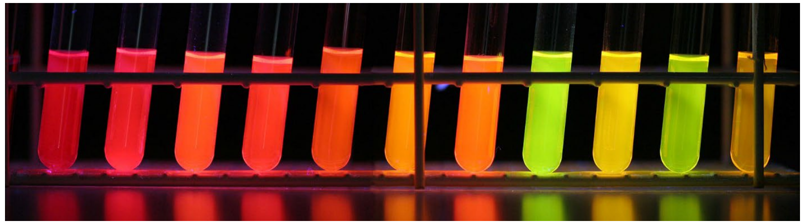


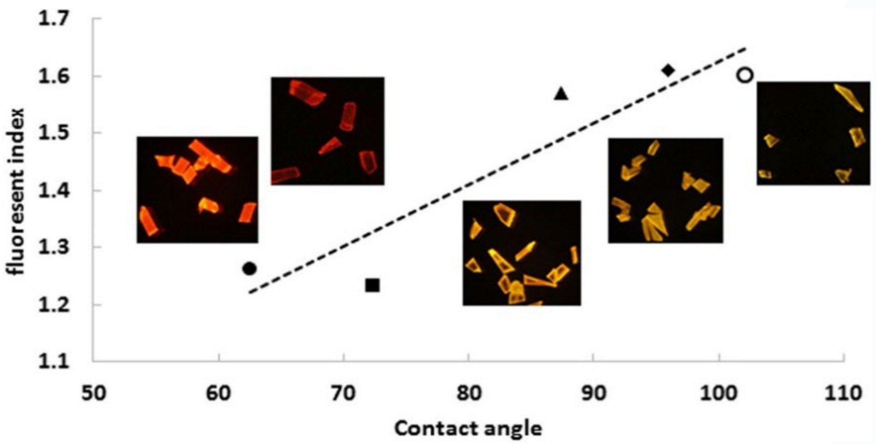


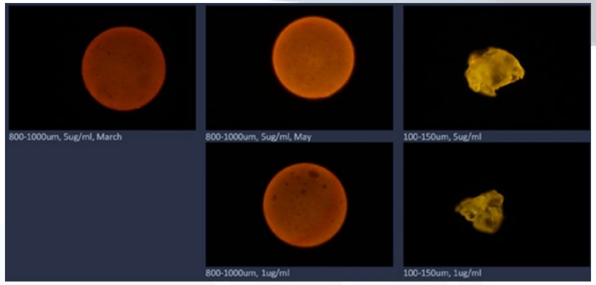


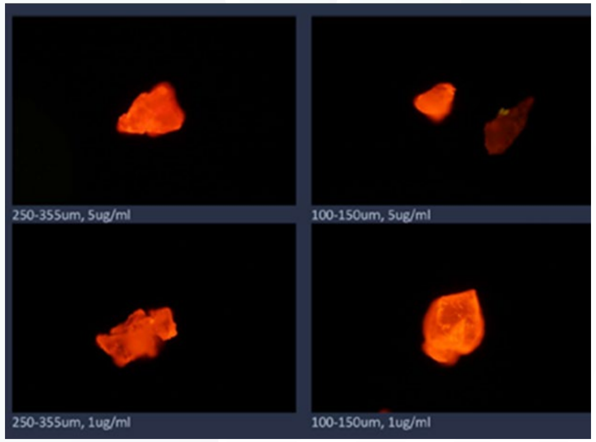



Nile Red staining for Fluoresence detection









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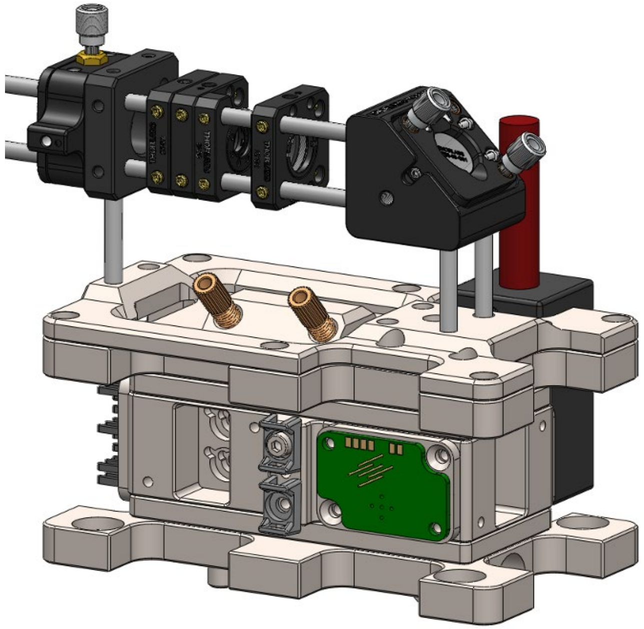
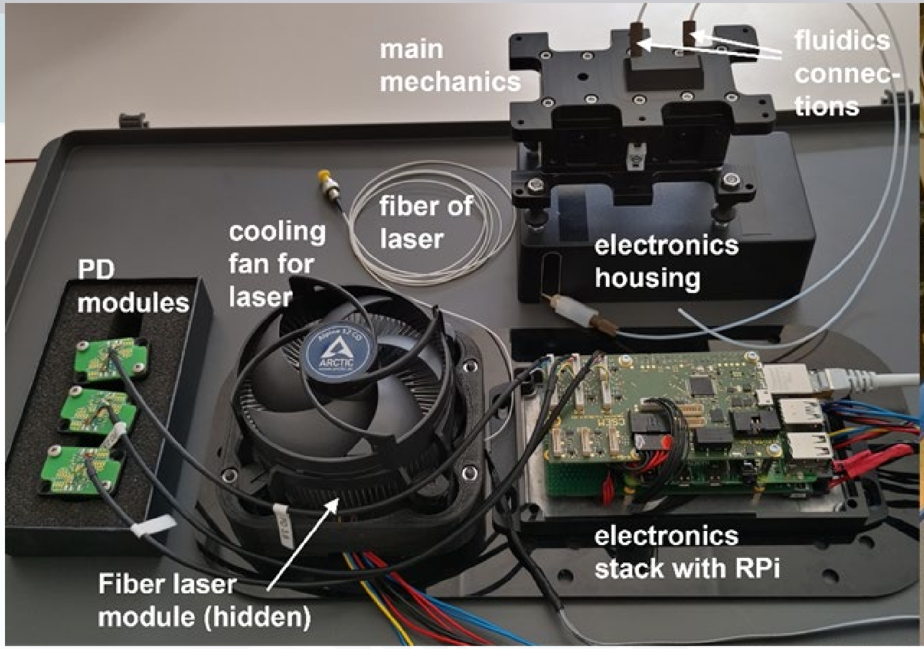
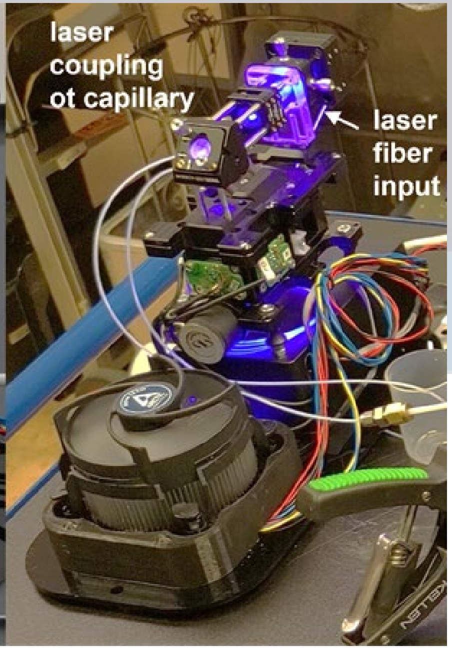
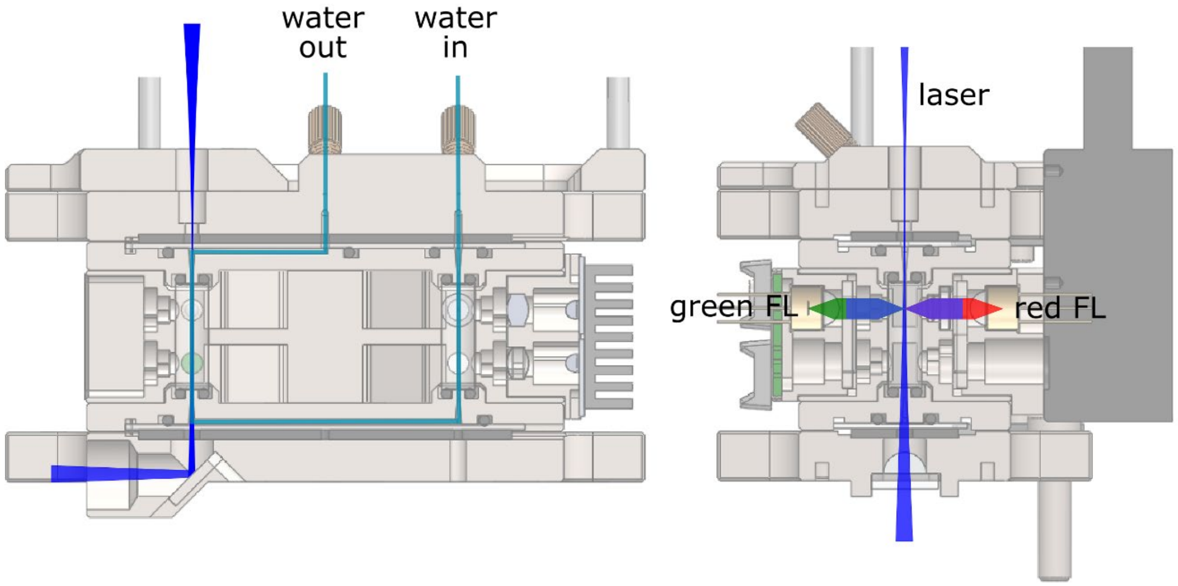
Laser detection

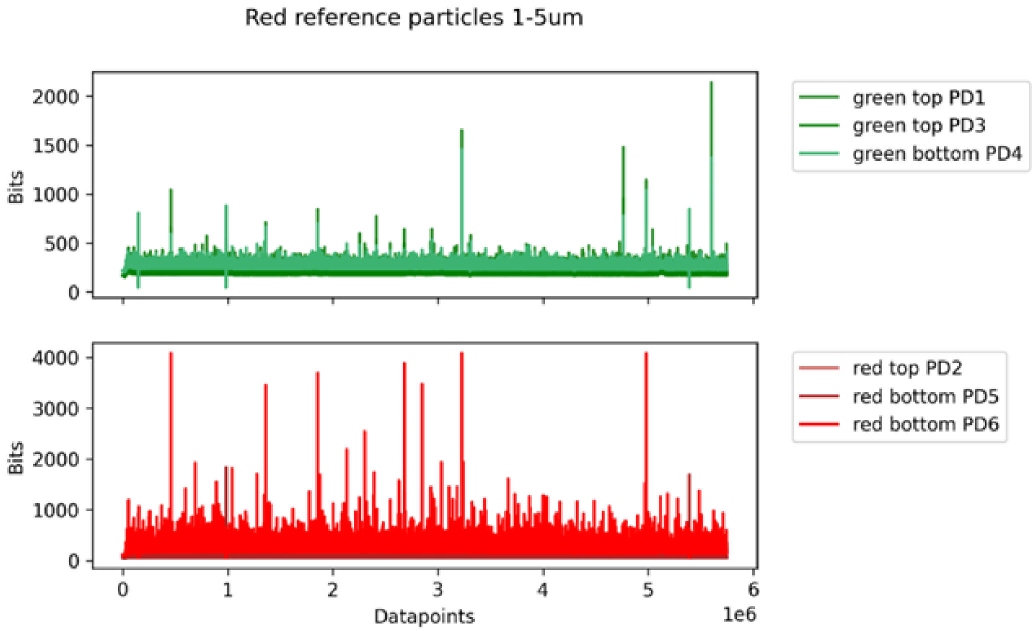


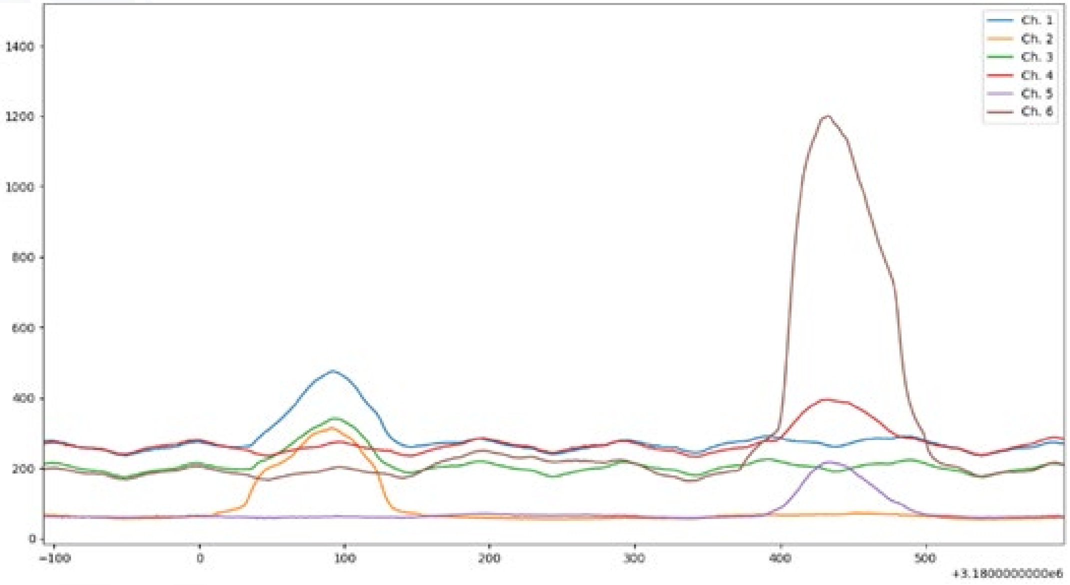




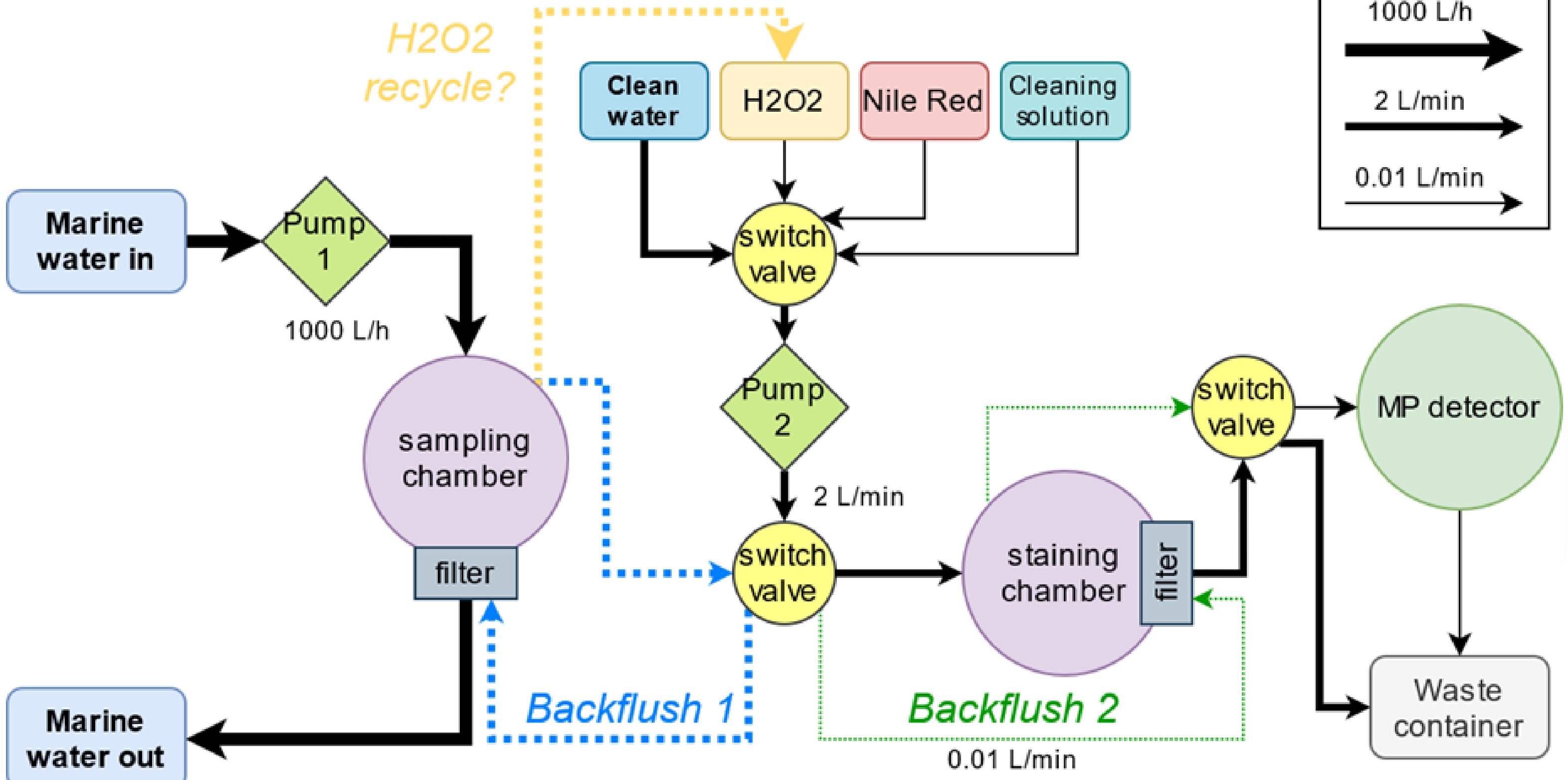


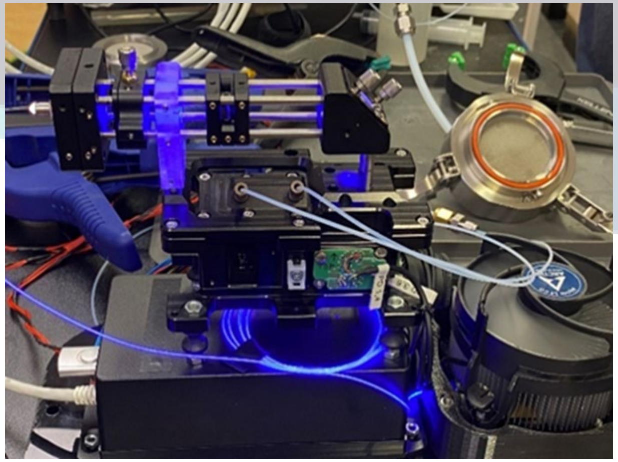
Red fluoresence particles 1-5 µm



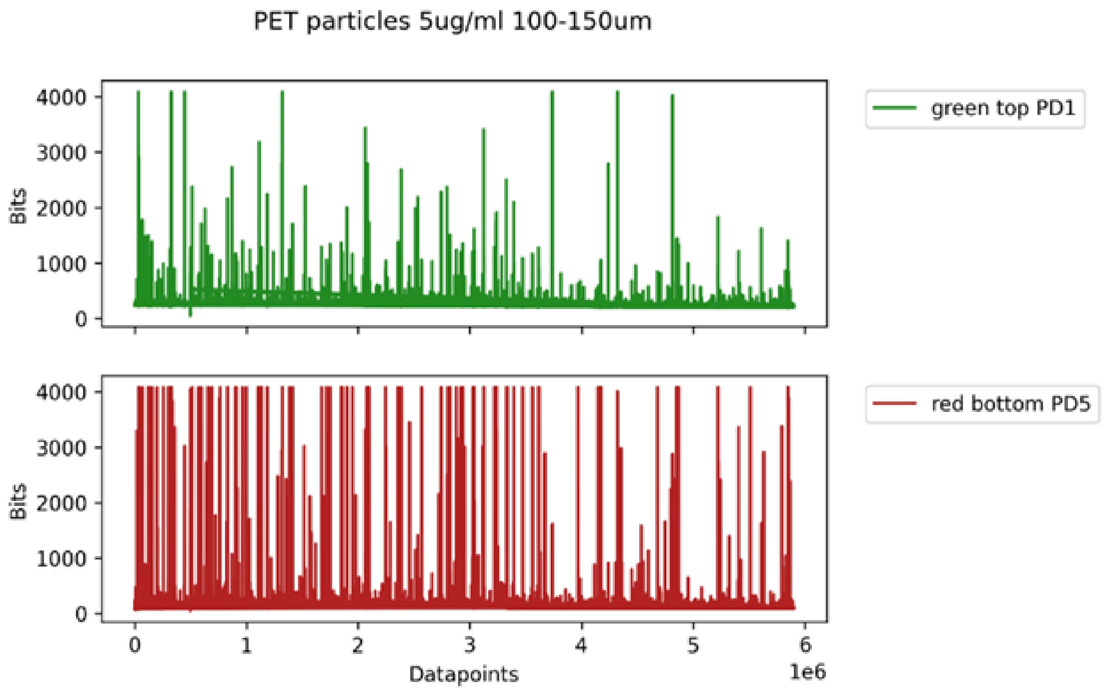


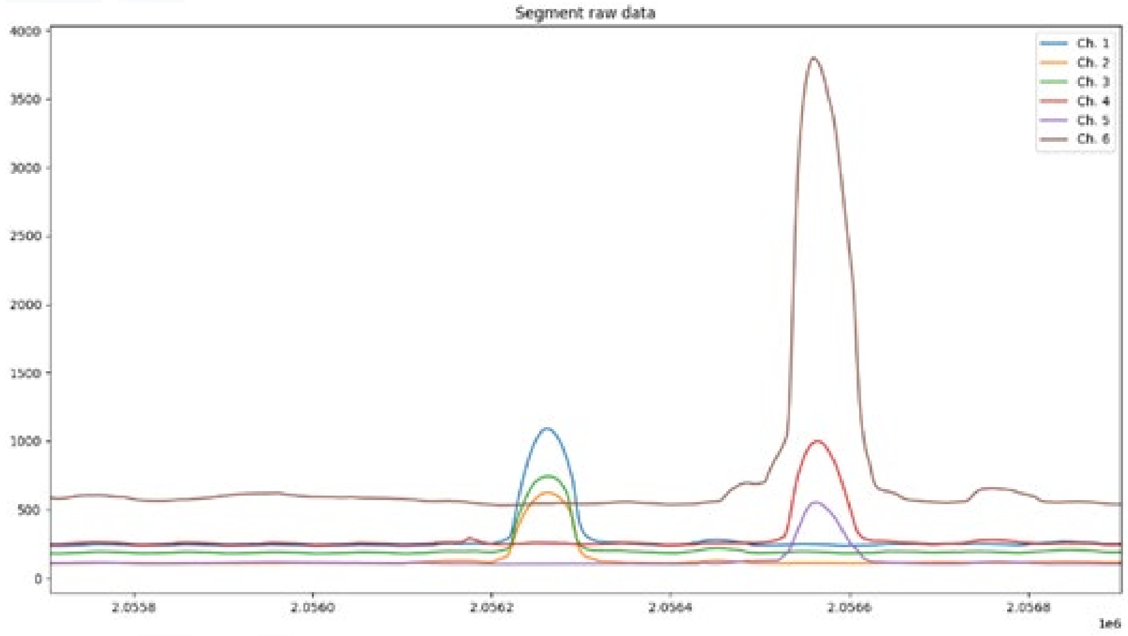
Connecting it all together





PET 100-150 µm





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Conclusion

- All units work (but not yet together)
  - Oxidation step depending on amount of biological / organic material
    - Regulate amount or concentration oxidation agent (KOH, H_2O_2)
    - Or temperature
  - Staining step more efficient at 40-50 °C
    - Step will take too long time at room temperature
  - Macro flow to micro flow
    - Redesign the ’staining chamber´ to facilitate low flow into the capilairs of the laser detector.

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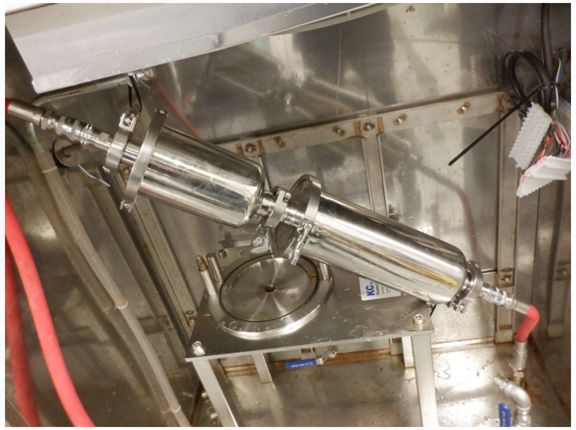
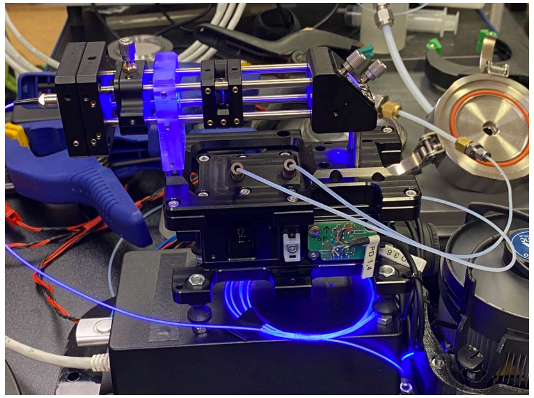
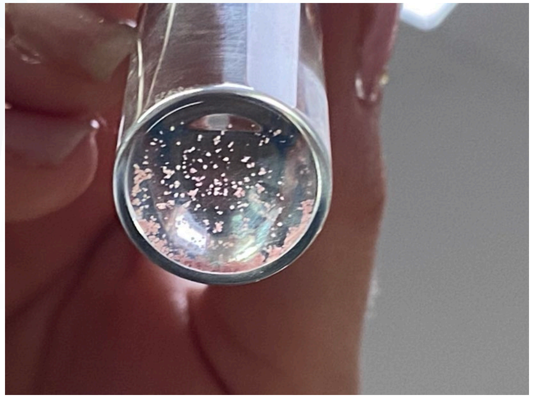
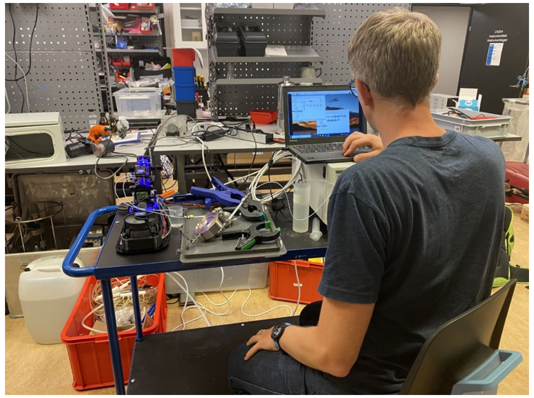
Thanks







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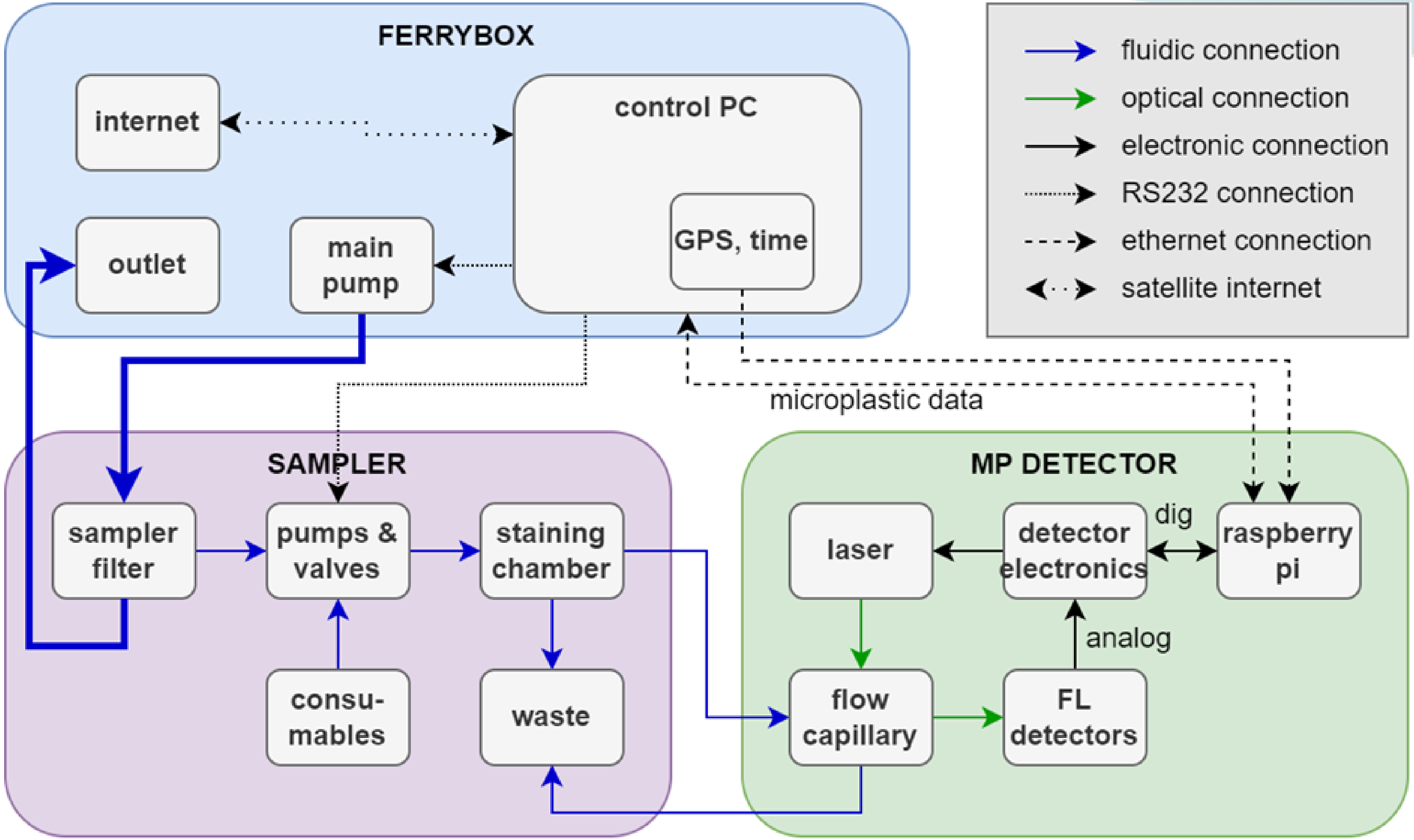
Flow schedule sampler, oxidation, staining, laser detection



Connecting it all together