Hrönn Ólína Jörundsdóttir

Microlitter in sewage treatment plants - Microplastic

Sjávarútvegsráðstefnan 2018, 15.-16. nóvember í Hörpu.

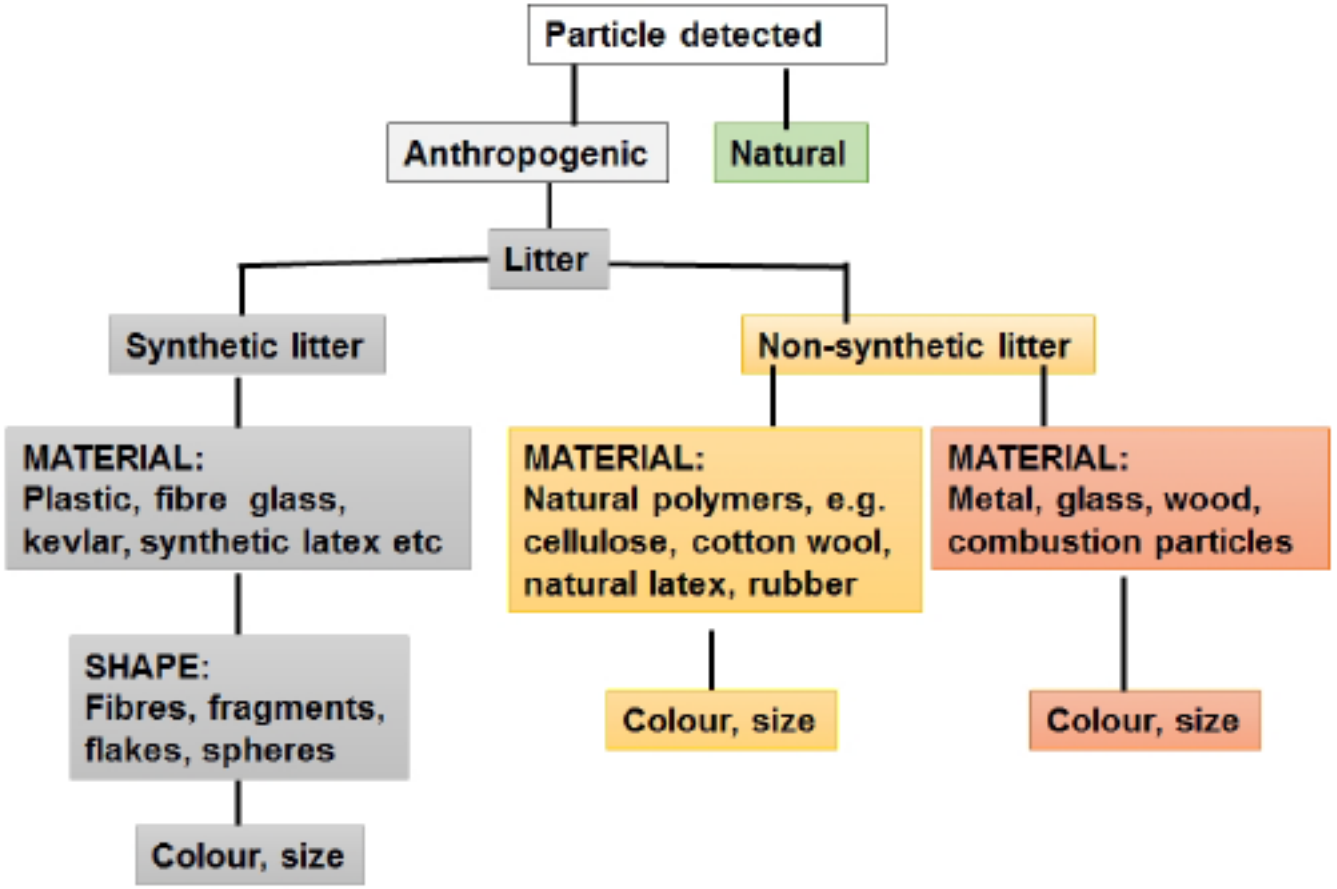
Collaboration between three Nordic countries
Financed by The Nordic Council of Ministers, HAV group

- **Sweden**
  - IVL, Swedish Environmental Research Institute
- **Finland**
  - SYKE (Finnish Environment Institute)
  - Aalto University
- **Iceland**
  - Matís, Icelandic Food and Biotech R&D

Two year project with the following aims:

Investigate if Sewage Treatment Plants (STP) are an important rout for small particles to the marine environment

Can we trace the particles in the recipient


Particle detected
Anthropogenic
Natural
Litter
Synthetic litter
Non-synthetic litter
MATERIAL:
Plastic, fibre glass, kevlar, synthetic latex etc
MATERIAL:
Natural polymers, e.g. cellulose, cotton wool, natural latex, rubber
MATERIAL:
Metal, glass, wood, combustion particles
SHAPE:
Fibres, fragments, flakes, spheres
Colour, size
Colour, size
Colour, size

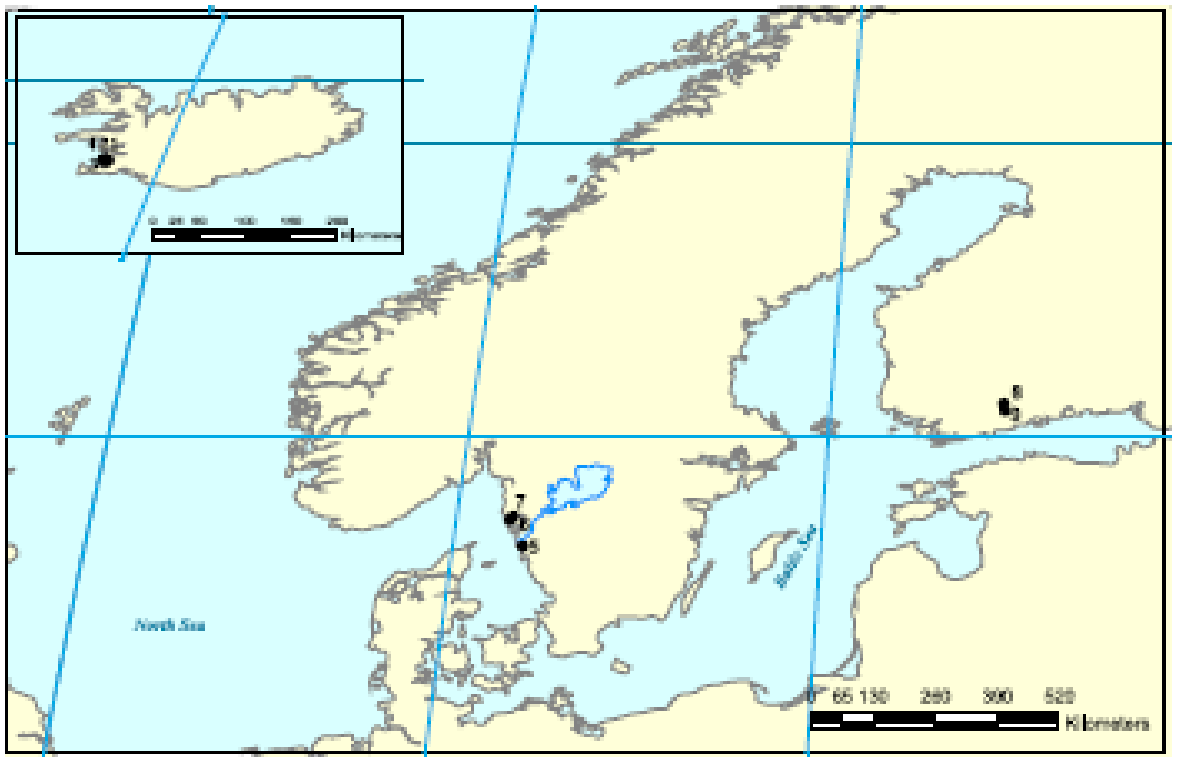
STP sampling location

STP	Person equivalent	Standard	Additional treatment	Flowrate m3/hour	Sampling occasions	Sampling volume influent (L)	Sampling volume effluent (L)
Ryaverket SWE	740,000	Highest national standard	Disc filter 15 um	12,900-15,400	2	1,5-4	1,000
Långevik SWE	14,000	Average national standard	-	340-440	2	1-2,7	600-1,000
Vikinmäki FI	800,000	Highest national standard	-	10,500-17,500	2	0,1	1,000
Kalteva FI	40,500	Average national standard	-	190-510	2	0,1	330
Klettagarðar ICE	97,000	Average national standard	-	4,600	1	0,7-1,9	0,7-1,5
Hafnarfjörður ICE	26,000	Average national standard	-	1,100	2	2,5	0,25-31,2

	Microlitter in STP effluent water (number particles/hour)		Microlitter in STP effluent water adjusted to PE (number particles/hour and PE)	
	Microplastic particles	Non-synthetic fibres	Microplastic particles	Non-synthetic fibers
Ryaverket	120.100	54.400	0,16±0,14	0,07±0,03
Långevik	9.100	24.700	0,65±0,06	1,76±0,67
Viikinmäki	468.400	319.600	0,41±0,41	0,28±0,32
Kalteva	11.700	15.700	0,29±0,29	0,39±0,37
Klettagarðar	6.348.800	52.224.000	65,2	53,8
Hafnafjörður	2.232.000	4.104.000	10,9±5,7	65,2±45,5

	Retention efficiency of microlitter in STP	
	Total	Non-synthetic fibres
Ryaverket	99,89%	99,99%
Långevik	99,71%	99,81%
Viikinmäki	99,93%	99,99%
Kalteva	99,97%	99,99%
Klettagarðar	(-118,23%)	(-16,46%)
Hafnafjörður	(50,17%)	(57,59%)

Recipient Locations



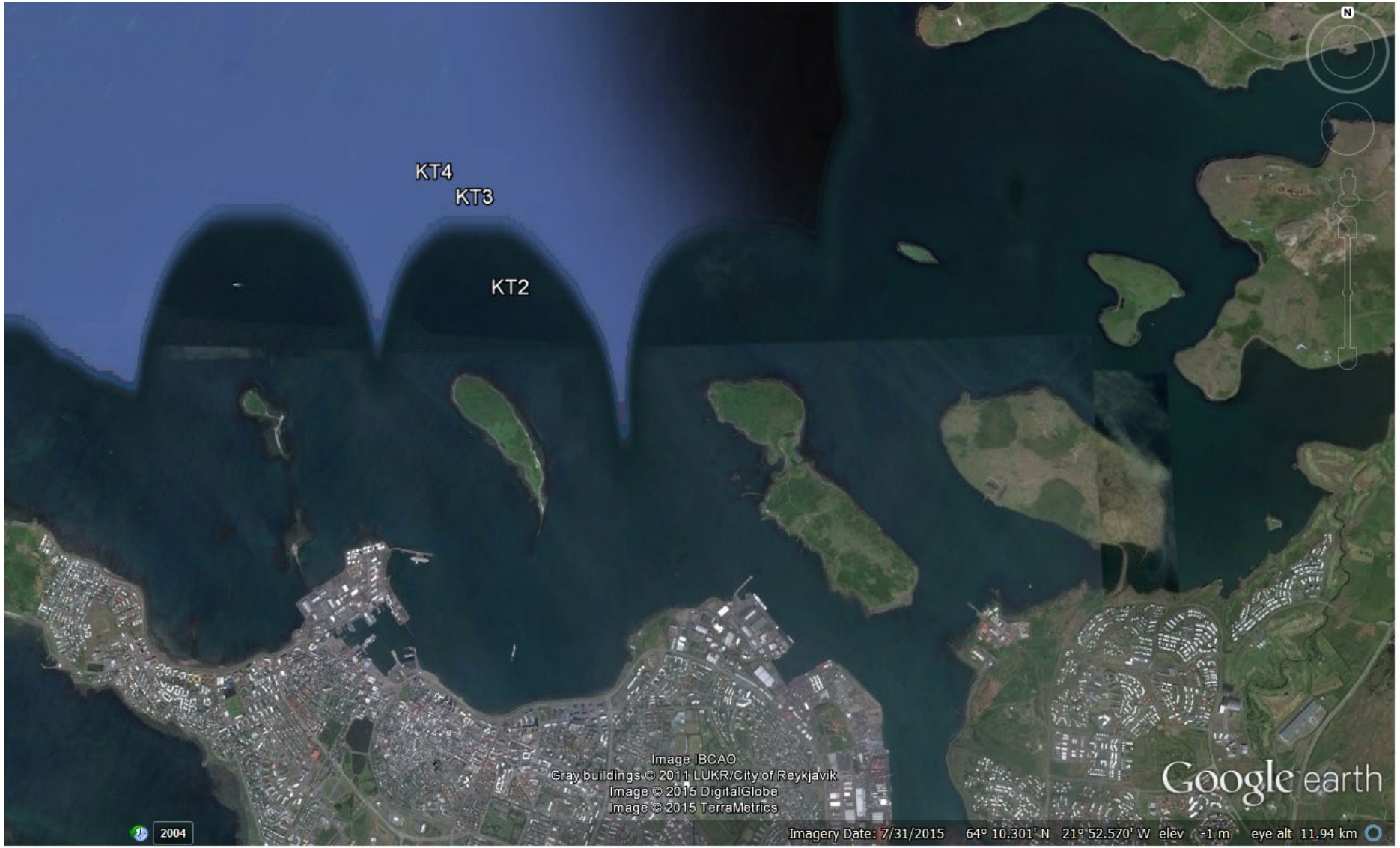
Iceland: 1-3 are STP recipient sites and 4 the reference site.

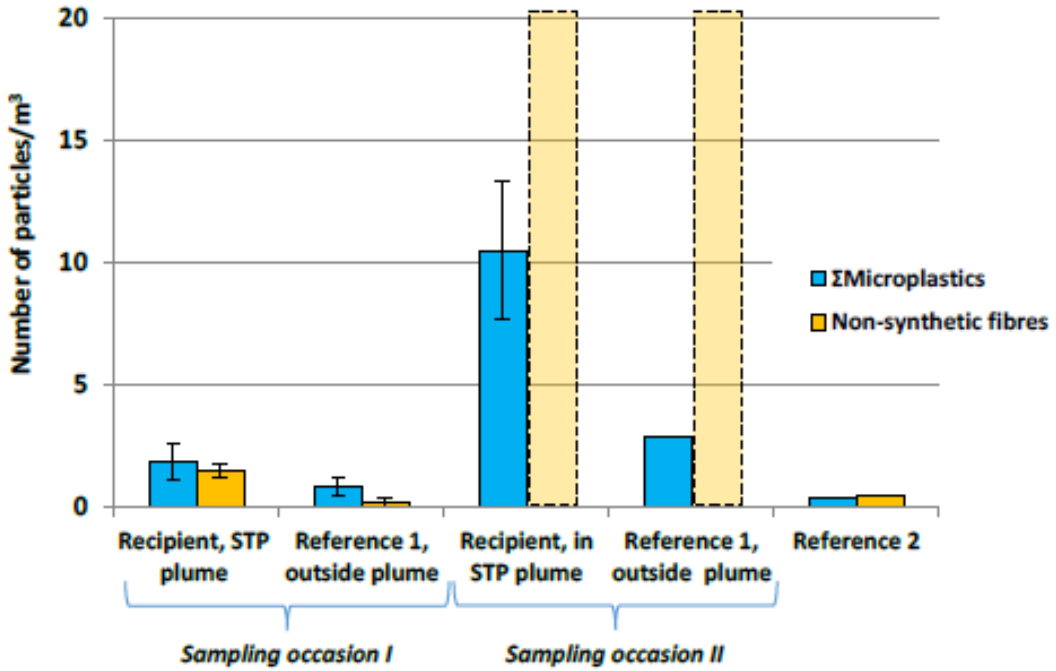
Sweden: 5 is the STP recipient site, 6 reference site 1 and 7 reference site 2.

Finland: 8 is the STP recipient site and 9 the reference site

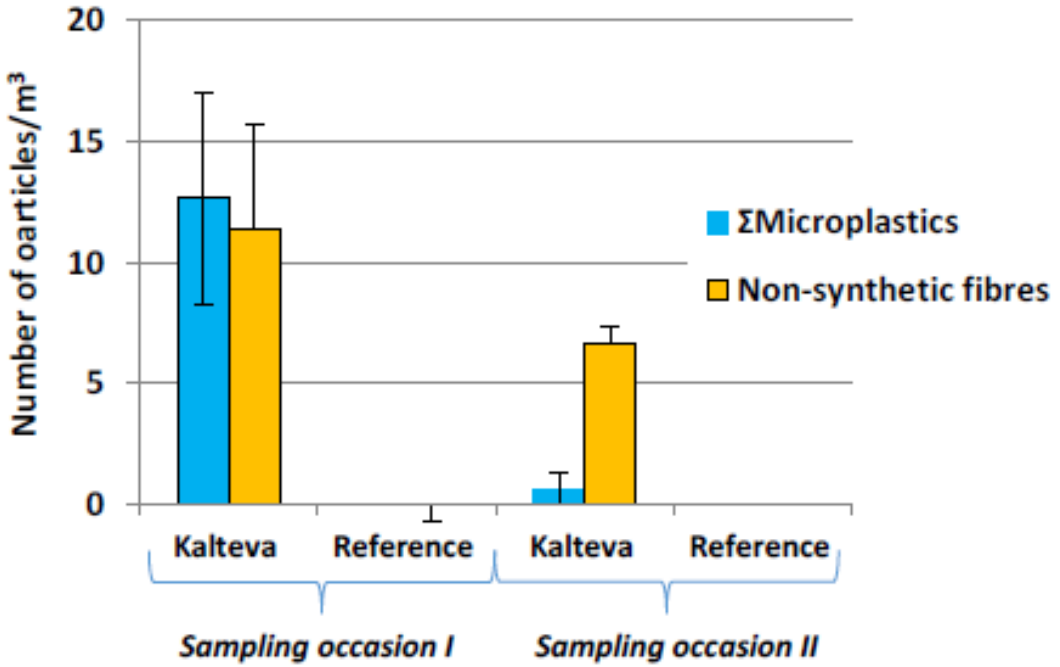
Recipient sampling

Location	Water sampling/ mesh size	Sediment sampling	Biota sampling
Sweden			
Recipient water for Ryaverket, in the effluent plume	Manta trawl/ 333 um – surface	Dredging	Blue mussels
Recipient water for Ryaverket, outside the effluent plume, Reference site 1	Manta trawl/ 333 um – surface	Not collected	Not collected
Gullmarfjord Reference site 2	Manta trawl/ 333 um – surface	Sediment grab	Blue mussels
Finland			
Recipient water for Kalteva	Pump with filter/ 300 um – river	Portable tube sampler	Fish
Käräjäkoski reference site	Pump with filter/ 300 um – river	Portable tube sampler	Not collected
Iceland			
Recipient water Klettagarðar, Tree sites round the effluent pipe end	Plankton net/ 100 um – column	Sediment grab	Fish
Hvalfjörður reference site	Plankton net/ 100 um – column	No sediment available	Fish

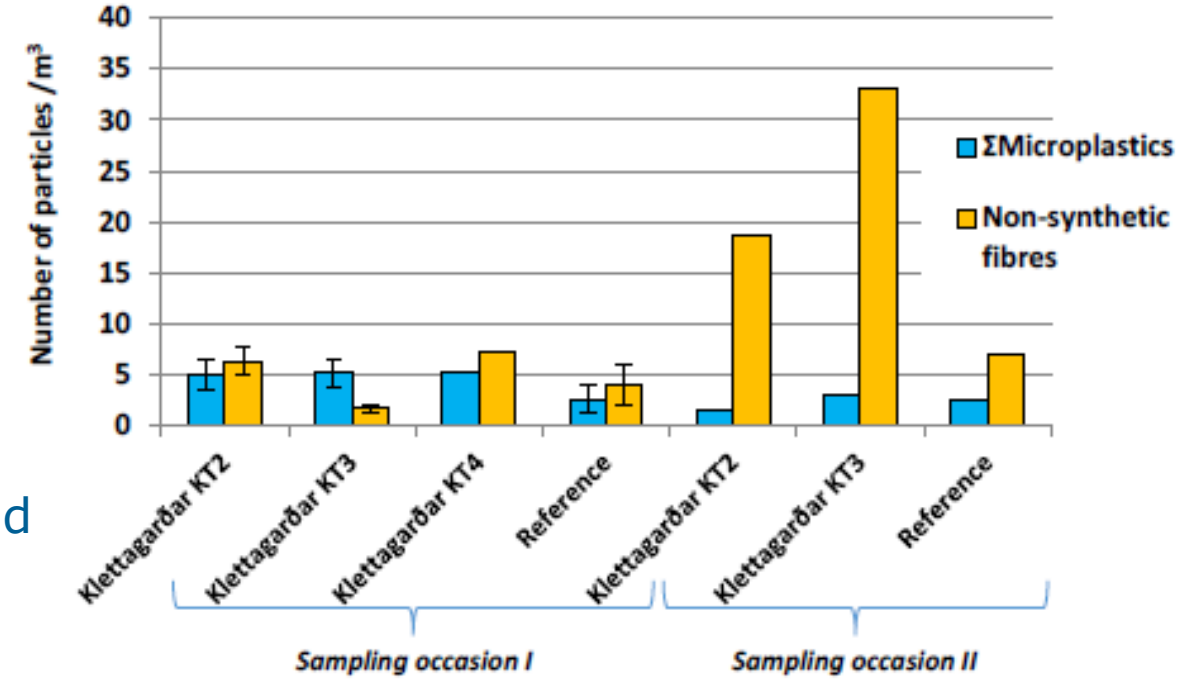

KT4
KT3
KT2
Image IBCAO
Gray buildings © 2011 LUKR/City of Reykjavik
Image © 2015 DigitalGlobe
Image © 2015 TerraMetrics
2004
Imagery Date: 7/31/2015 64° 10.301' N 21° 52.570' W elev -1 m eye alt 11.94 km
Google earth



Recipient Sweden



Recipient Finland



Recipient Iceland

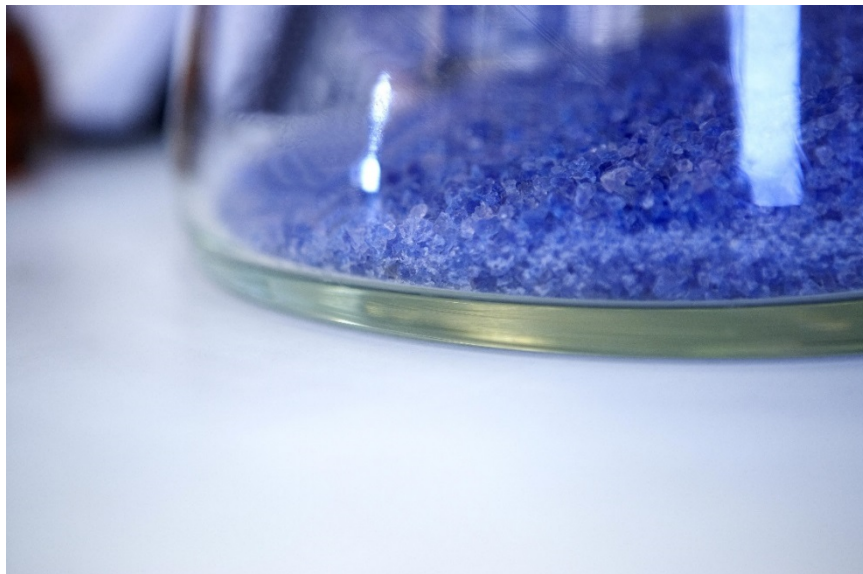
Biota, all results are in no/individual

	Plastic fibre	Plastic fragment	Plastic flakes	Sum	Non-synt fibre
Sweden					
Blue mussels Ryaverket	2,5 ± 0,6	0,06 ± 0,06	0,1 ± 0,1	2,7 ± 0,7	1,9 ± 0,5
Blue mussels reference	0,4 ± 0,2	0,1 ± 0,1	0	0,5 ± 0,2	1,3 ± 0,4
Finland					
Bulhead Kalteva	0	0	0	0	0
Gudgeon Kalteva	0,1 ± 0,1	0	0	0,1 ± 0,1	0
Roach Kalteva	0,2 ± 0,2	0,2 ± 0,2	0	0,4 ± 0,2	0,2 ± 0,2
Iceland					
Plaice Klettagarðar	0	0	0	0	0
Haddock Klettagarðar	1,8 ± 0,6	2 ± 1	4 ± 1	8 ± 2	0
Cod Klettagarðar	1	0	0	1	0
Cod reference	0,1 ± 0,3	5 ± 5	0	6 ± 5	0

Main results

Iceland:

- **Coarse cleaning of sewage in Iceland – limited cleaning**
- **No difference in number of particles in influent and effluent**



Main results

Finland and Sweden

- **Finland and Sweden more extensive cleaning – disc filter in Sweden**
- **99% microparticles in the sludge**
- **Still microparticles escape the Finish and Swedish STP, up to 500.000 particles/hour but >6 milj particles/hour in Iceland**
- **Polypropylene most common plastic particle**

norden

Microlitter in sewage treatment systems

A Nordic perspective on waste water treatment plants as pathways for microscopic anthropogenic particles to marine systems

Impact – further discussion

- **Ecotoxicology – human toxicology, micro vs nano???**

- **Impact on fisheries**
  - Economic and cultural loss – what about food safety?
  - How does marine plastic impact food safety?
  - How do micro and nanoparticles impact food safety?
    - 70% of the planet covered by water, only 4% of food produced from marine/aquatic
  - Increasing population, marine food source becoming more important
  - How does plastic impact aquaculture?