



Hrönn Ólína Jörundsdóttir

Microlitter in sewage treatment plants - Microplastic



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
 - Mátis, Icelandic Food and Biotech R&D

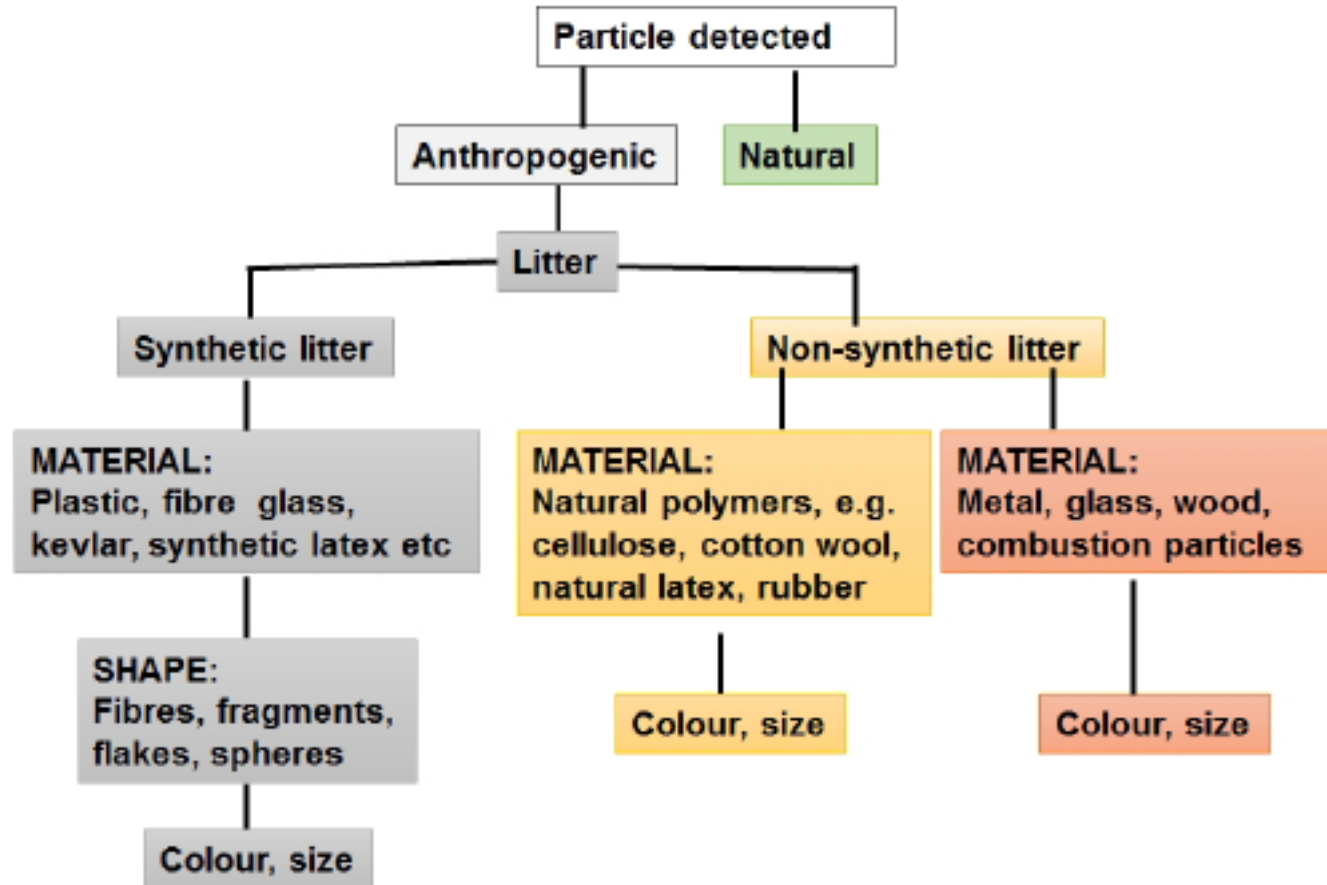


Two year project with the following aims:

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

Can we trace the particles in the recipient



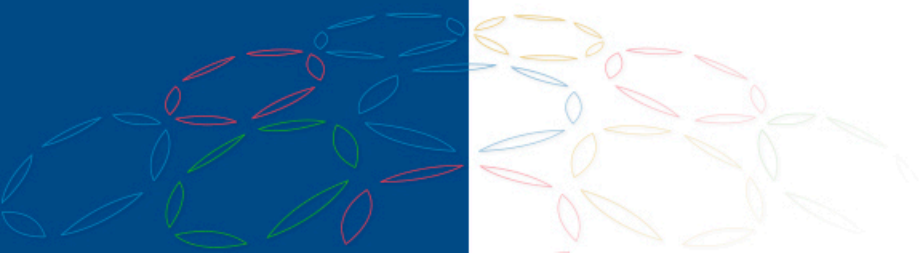


STP sampling location

| STP | Person equivalent | Standard | Additional treatment | Flowrate m ³ /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 |

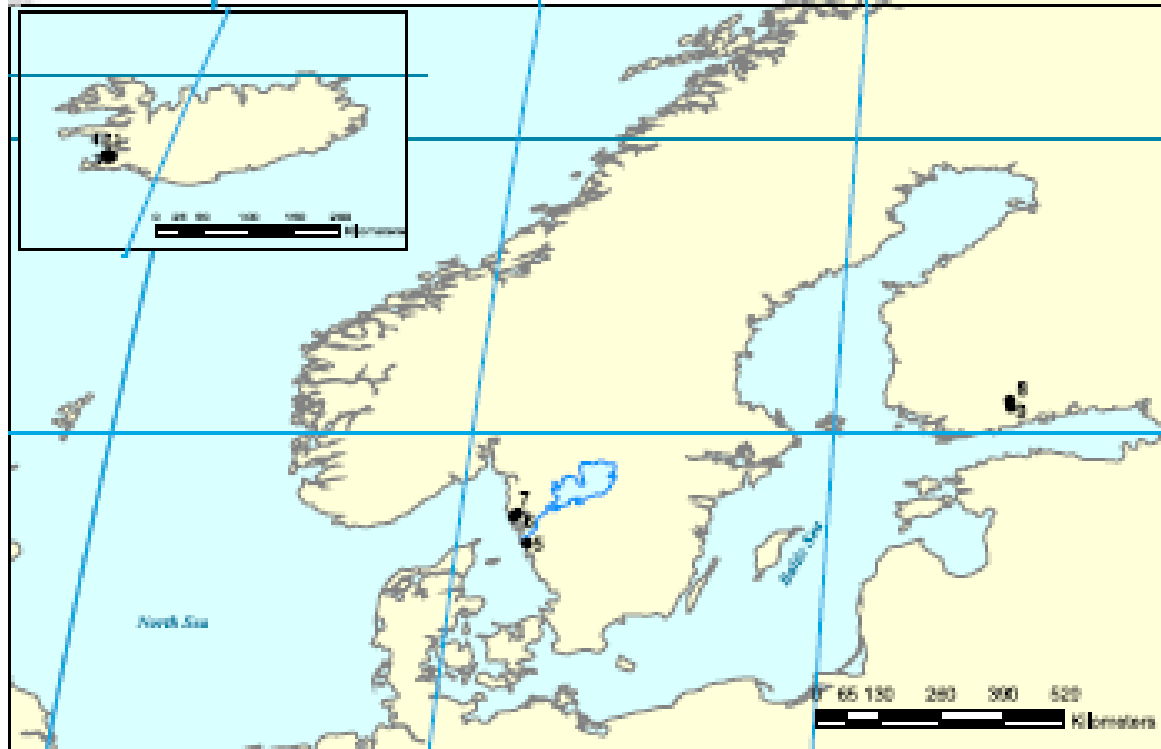




Retention efficiency of microlitter in STP

| | 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.

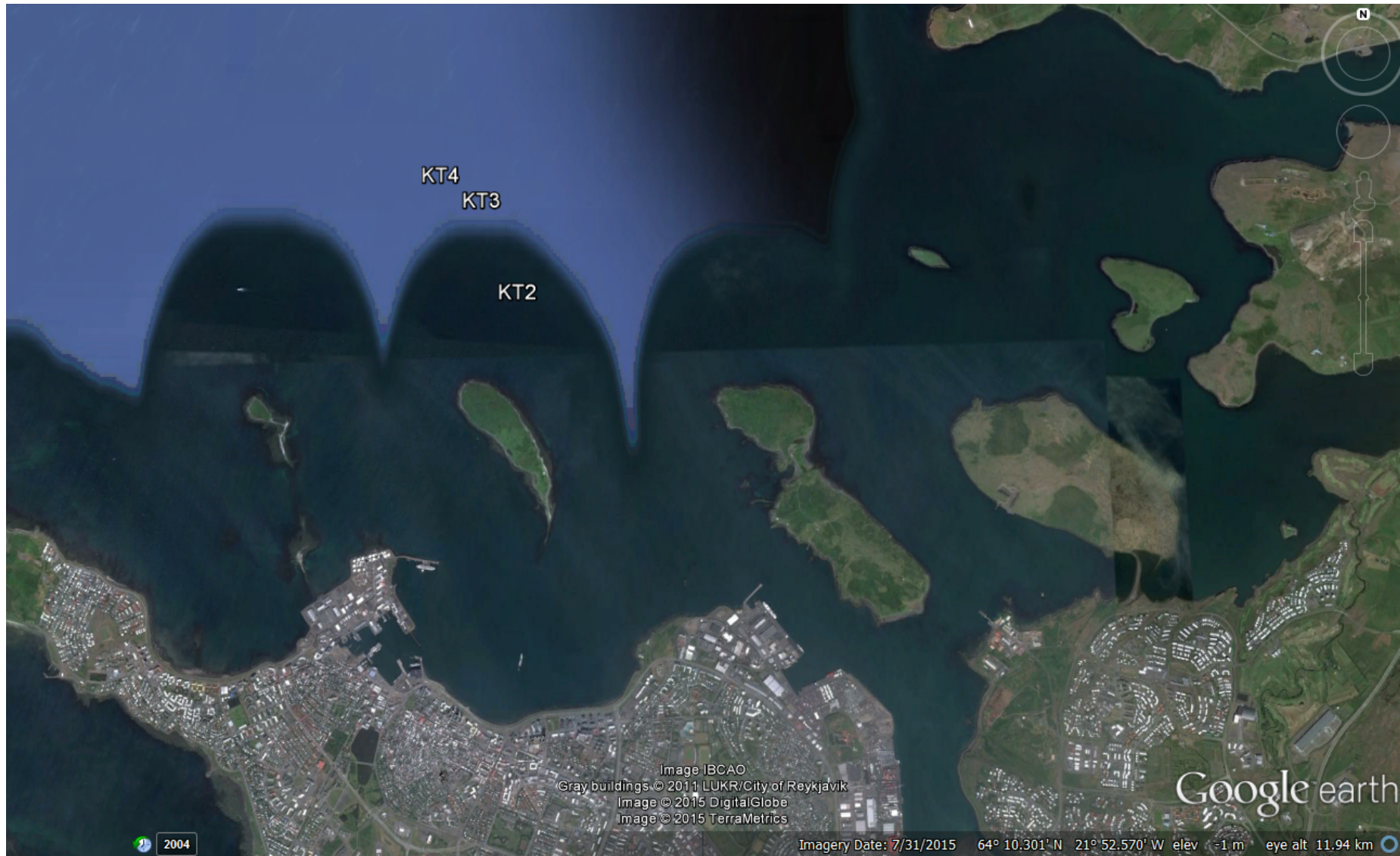
Finland: 8 is the STP recipient site and 9 the reference site



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 |
| Kärjäkoski 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 |









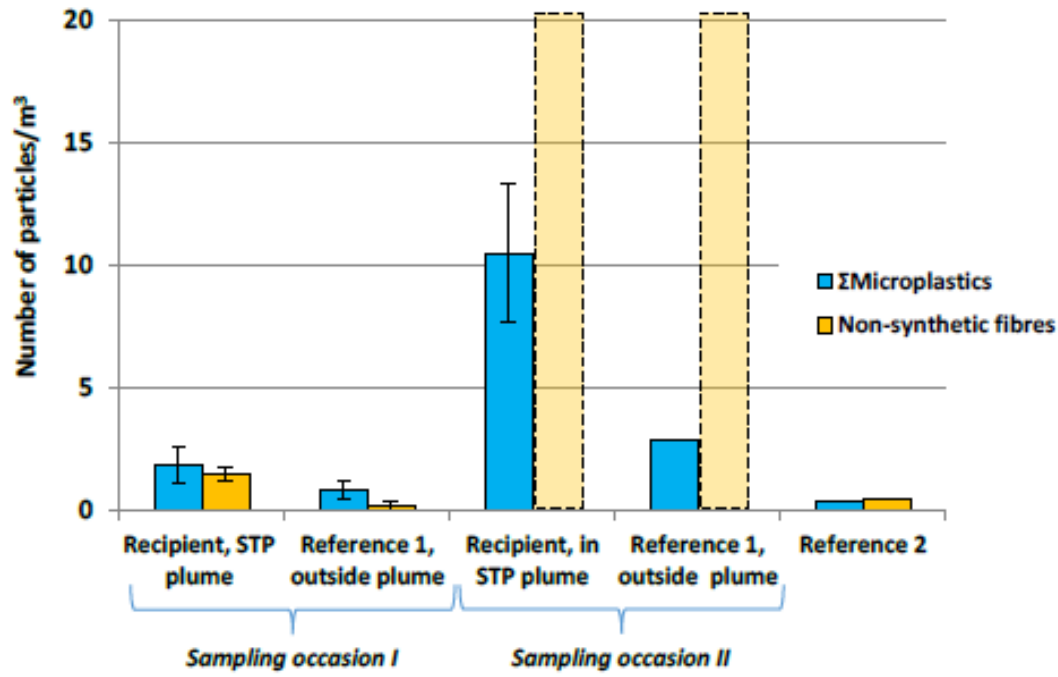




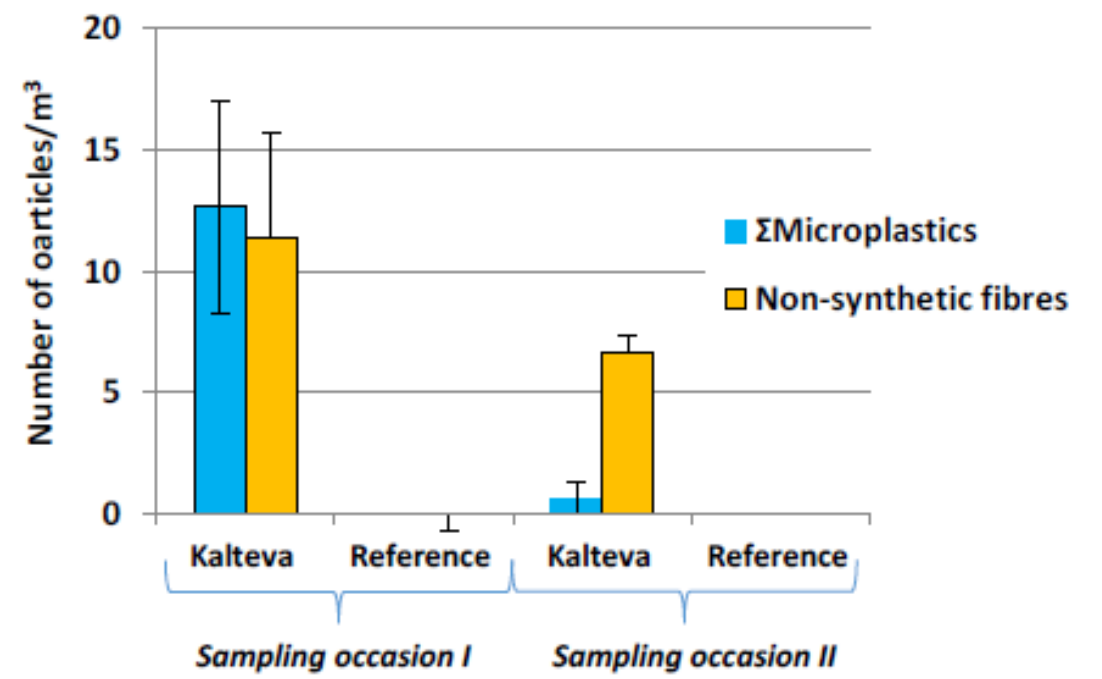
Hrónn Jörundsdóttir

©Matis

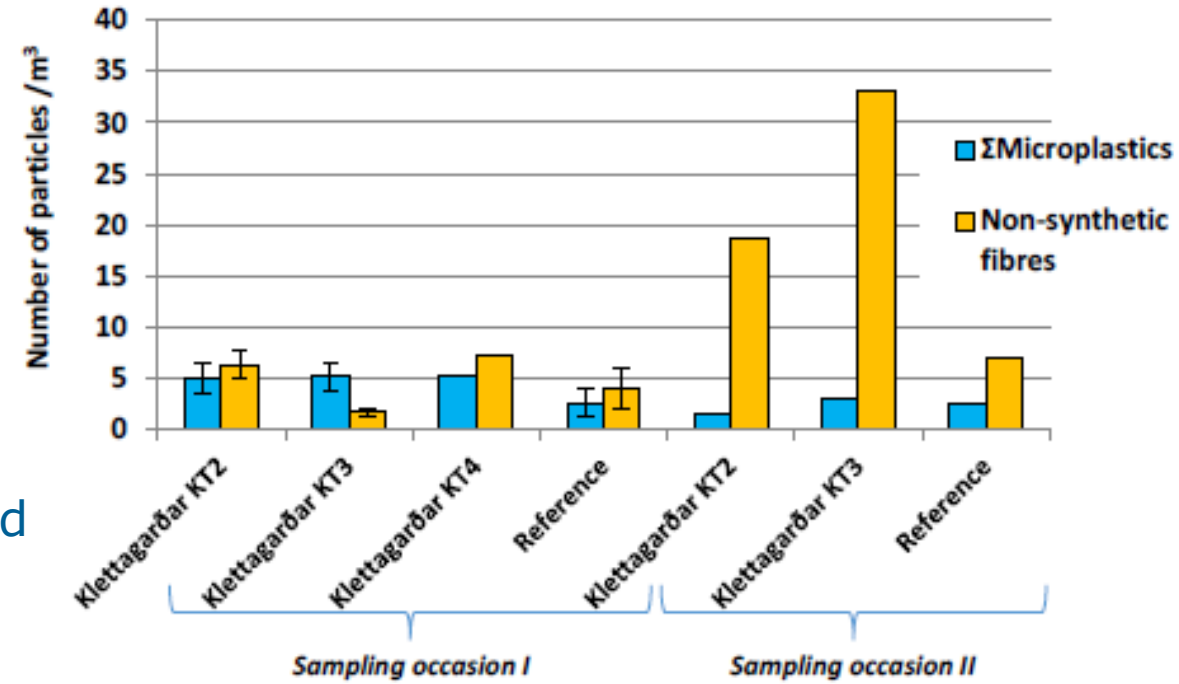




Recipient Sweden



Recipient Finland



Recipient Iceland



Biota, all results are in no/individual

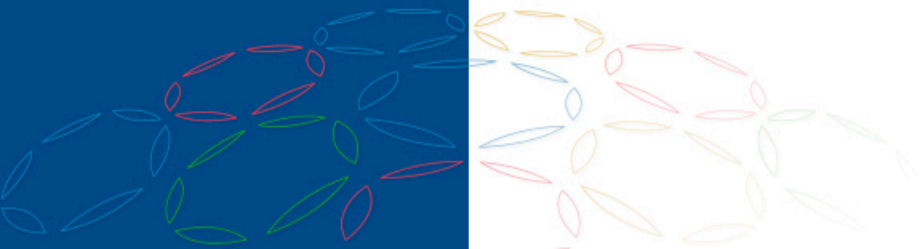
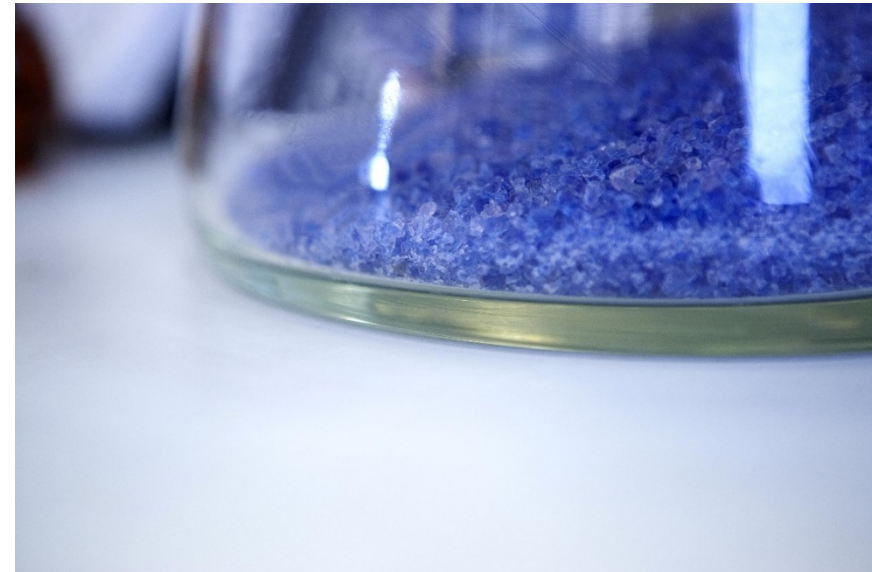
| | Plastic fibre | Plastic fragment | Plastic flakes | Sum | Non-synt fibre |
|------------------------|---------------|------------------|----------------|-----------|----------------|
| Sweden | | | | | |
| Blue mussels Ryaverket | 2,5 ± 0,6 | 0,06 ± 0,06 | 0,1 ± 0,1 | 2,7 ± 0,7 | 1,9 ± 0,5 |
| Blue 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 og Svíþjóð 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

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?

