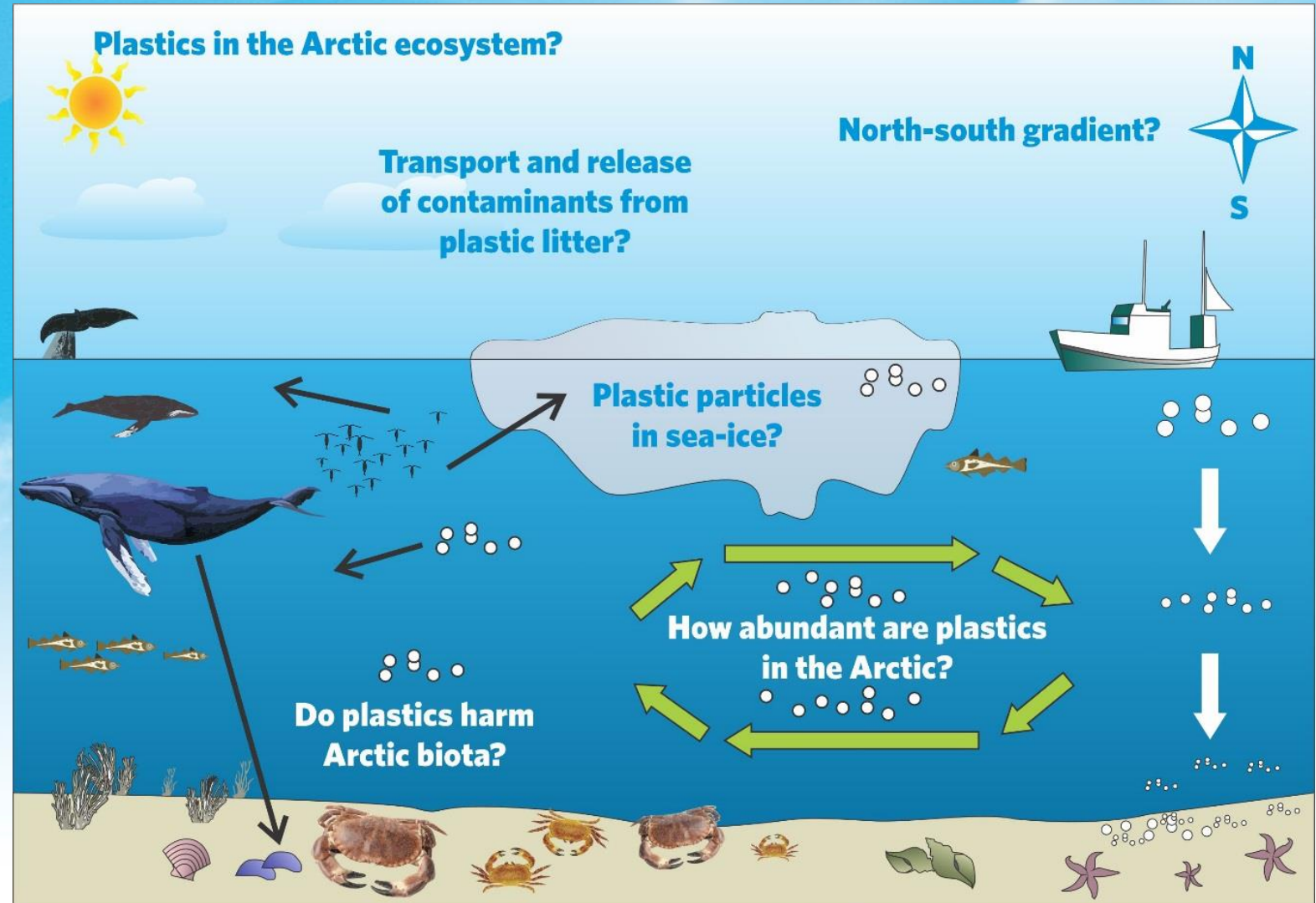


# Plastic and microplastic in the Northern Arctic; Svalbard: A quest for reliable methods

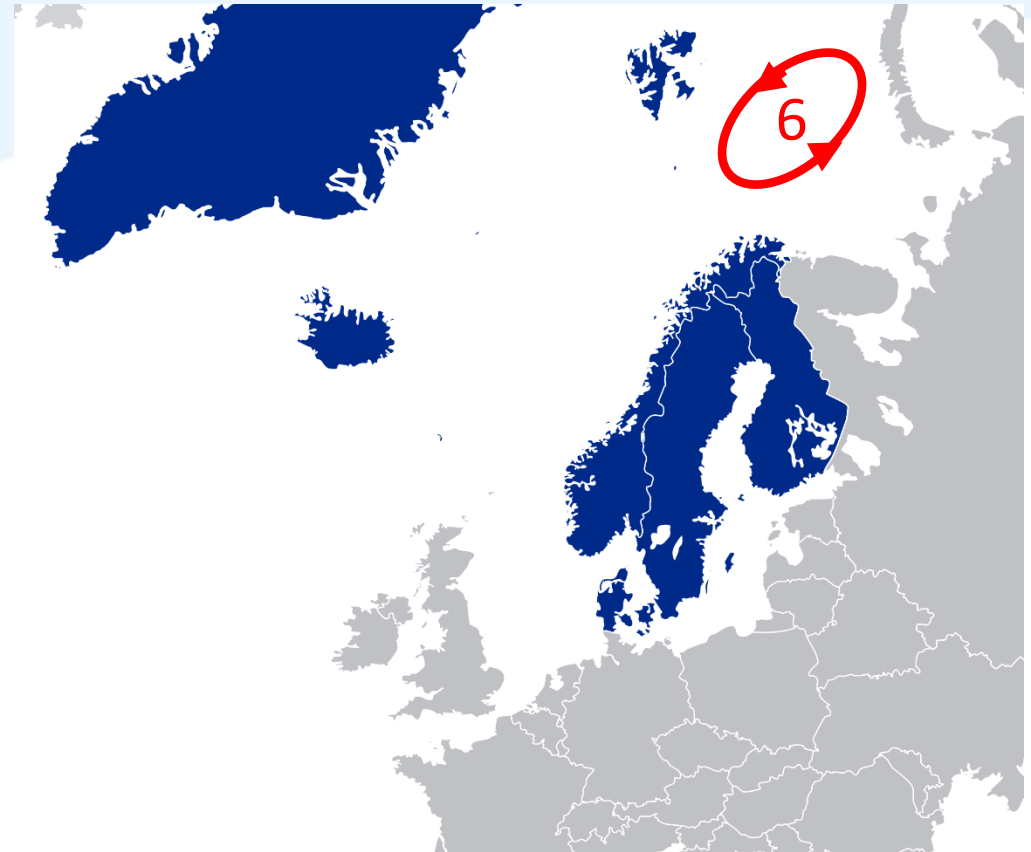
Dorte Herzke; Jan Sundet

dhe@nilu.no



# Why?

- Investigate the occurrence of marine plastic and microplastic in the marine environment of Svalbard
- Improve sampling and sample treatment methods for water, sediment and biota





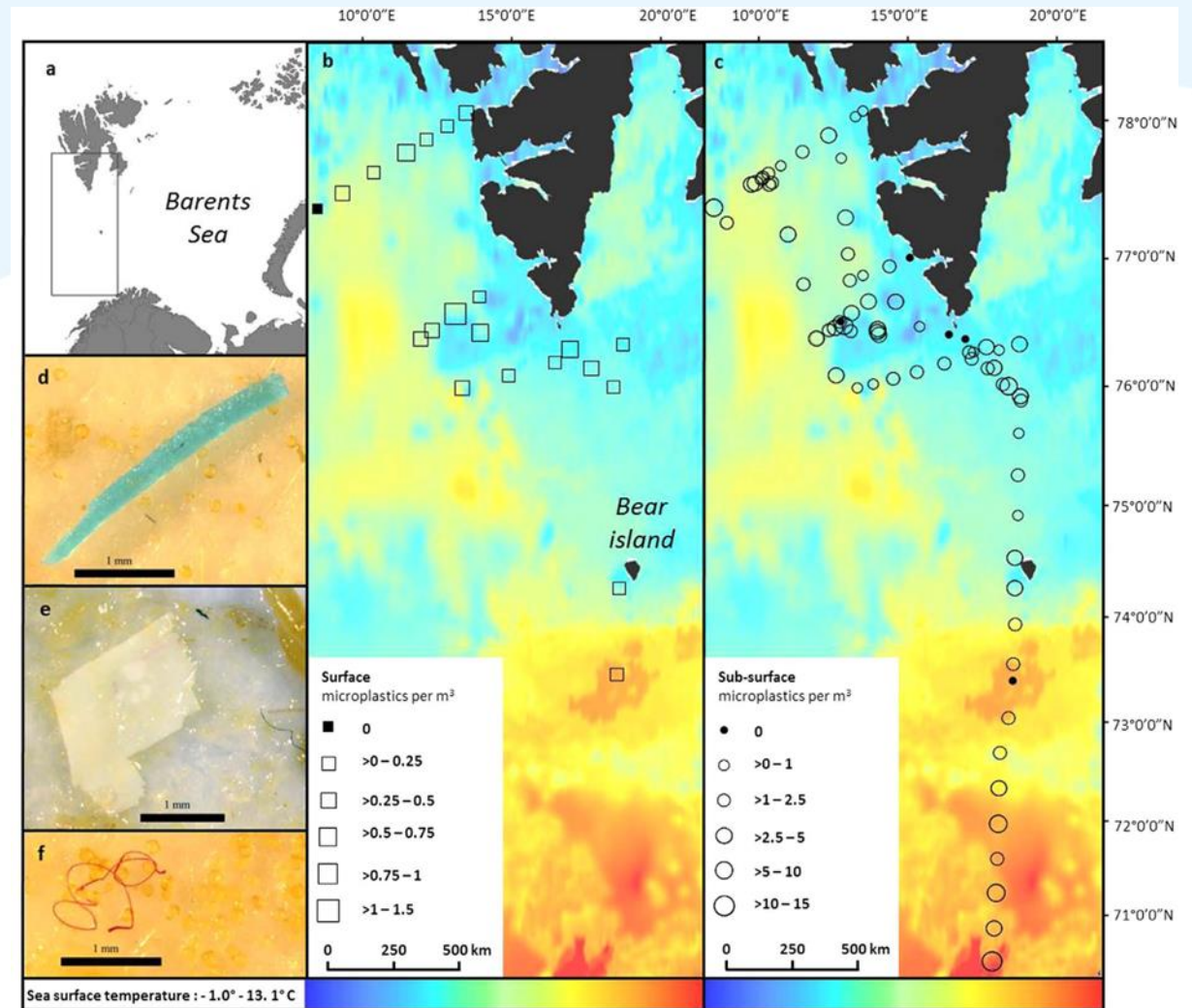
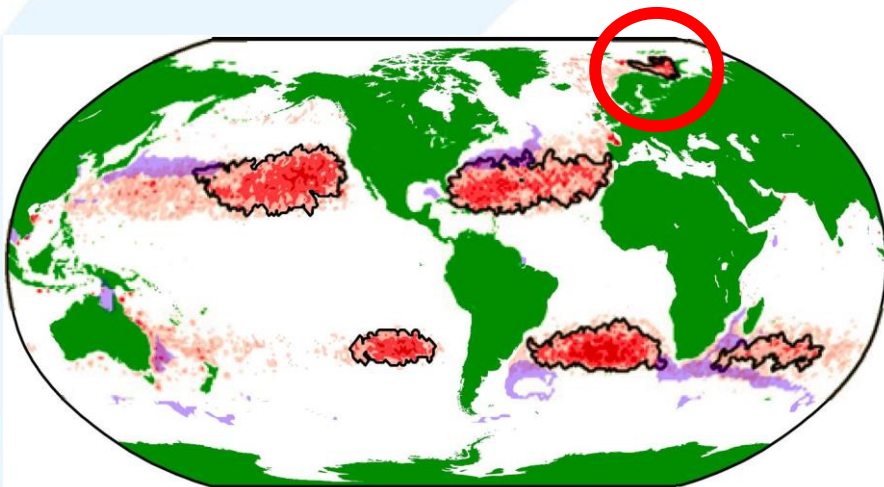
# How much plastic is present in the Arctic?

## Seawater

0 – 11.5 particles  $m^{-3}$   
(Lusher et al. 2015)

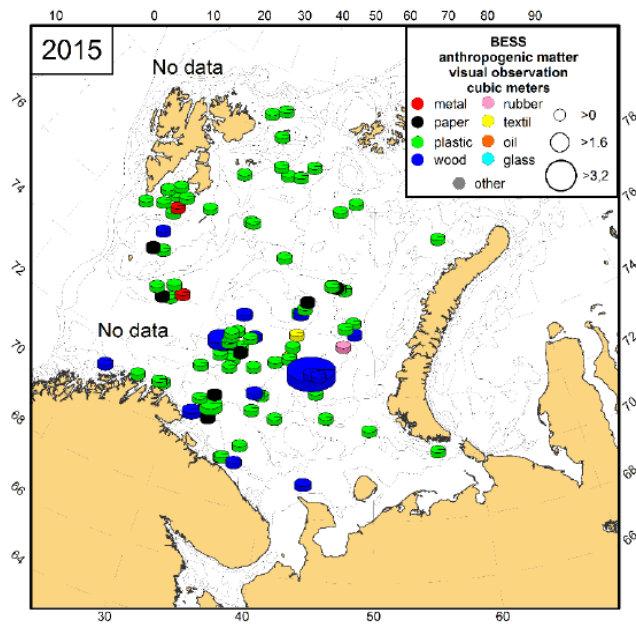
0.004 (Barents Sea) and 0.006 (Fram Strait) items  $km^{-1}$  floating plastic  
(Bergmann et al. 2016)

Modeling study: a sixth garbage patch may be forming in the Barents Sea  
(van Sebille et al. 2012)

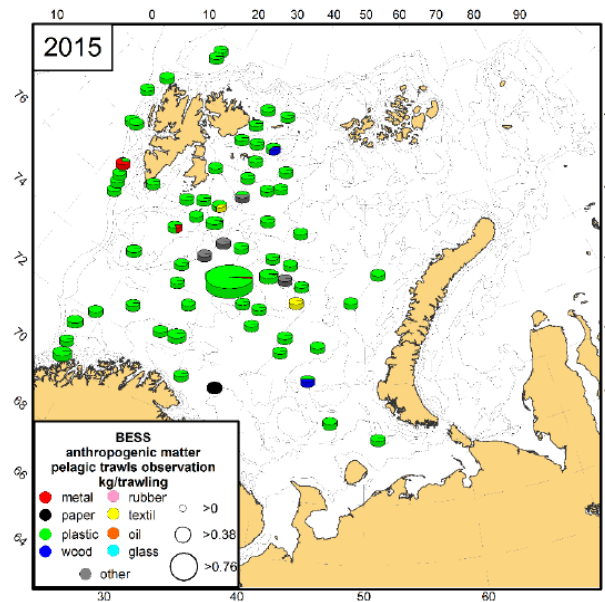


# How much plastic is present in the Arctic?

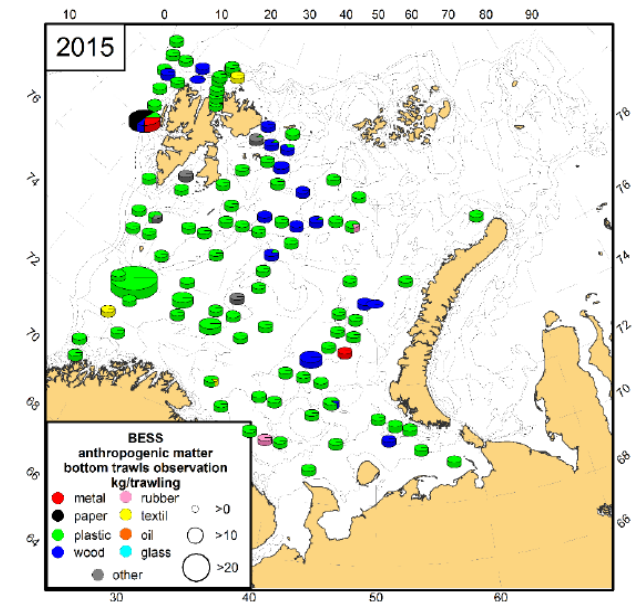
## Observations



Surface



Water column



Seafloor

# How much is transported to the Arctic?

RESEARCH ARTICLE

## Plastic Pollution in the World's Oceans: More than 5 Trillion Plastic Pieces Weighing over 250,000 Tons Afloat at Sea

Marcus Eriksen<sup>1\*</sup>, Laurent C. M. Lebreton<sup>2</sup>, Henry S. Carson<sup>3,4</sup>, Martin Thiel<sup>5,6,7</sup>, Charles J. Moore<sup>8</sup>, Jose C. Borerro<sup>9</sup>, Francois Galgani<sup>10</sup>, Peter G. Ryan<sup>11</sup>, Julia Reisser<sup>12</sup>



click for updates



Marine Pollution Bulletin 60 (2010) 1810–1814

Contents lists available at ScienceDirect

Marine Pollution Bulletin

journal homepage: [www.elsevier.com/locate/marpolbul](http://www.elsevier.com/locate/marpolbul)



Are marine plastic particles transport vectors for organic pollutants to the Arctic?  
Christiane Zarfl, Michael Matthies\*

Estimated transport of 62 000 to 105 000 tons plastic per year to the Arctic Ocean →  $\frac{1}{4}$  of the global amount?

«Old» data, based on very general/ non-Arctic data

Processes in arctic conditions not considered (seasonal light cycle → UV, low temperatures)



# First campaign in 2015 (Pilot)



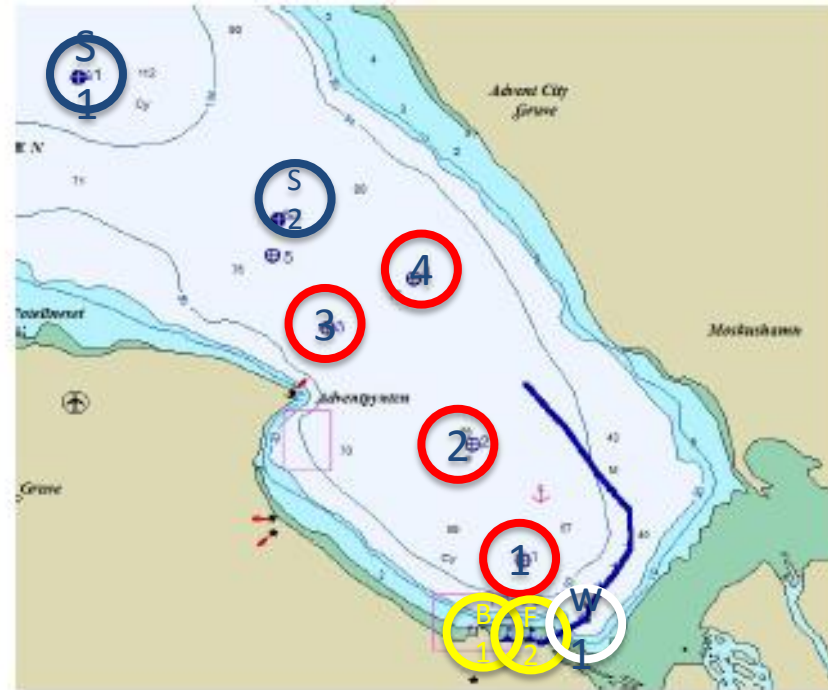
SVALBARD  
MILJØVERN FOND

SLUTTRAPPORT

Forekomst og kilder av mikroplastikk i sediment, og konsekvenser for bunnelvende fisk og evertebrater på Svalbard.

RIS-prosjekt nr. 10495

Jan H. Sundet, Havforskningsinstituttet  
Dorte Herzke, NILU  
Maria Jensen, Havforskningsinstituttet



Map showing stations in Adventfjord; Stations 1 – 5 are sediments, S1 and S2 for shells and B1 and B2 show beach samples; W1 shows wastewater sample



# Sample treatment in 2015

Sediment, beach sand, WWTP water:

- 3 x 1 kg of sediment collected by grab; beach sand 50 cm x 50 cm
- 500 ml saturated NaCl solution added and shaken for 5 hours, settle over night
- Filtration with vacuum using burned glassfibre filters
- Filters dried over night, covered by alumina foil
- Only coloured particles counted

QA/QC: blank samples from all steps, except drying of filters

- Visual analyses with Stereomicroscope Leica M 205 C (475 nm visible structure width)

# First snapshot

Sediments



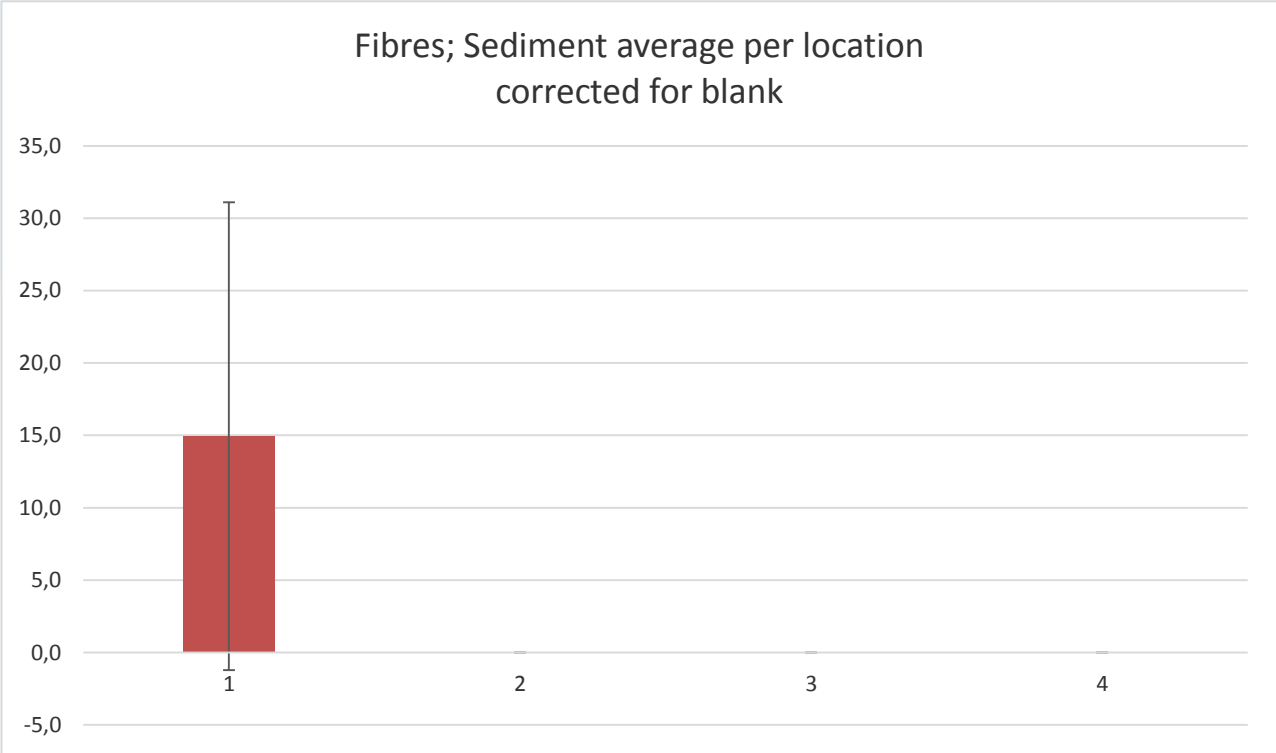
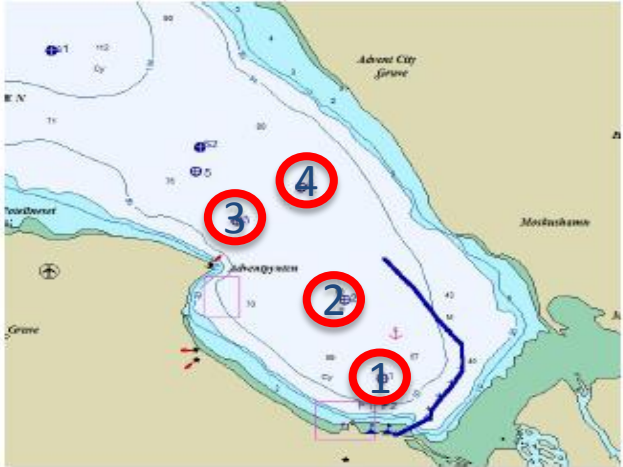
- All samples incl. Blanks contained > 30 particles
- Mostly fibres were found
- Methods for PCP analyses were used to deal with contamination during sample treatment



# Data treatment

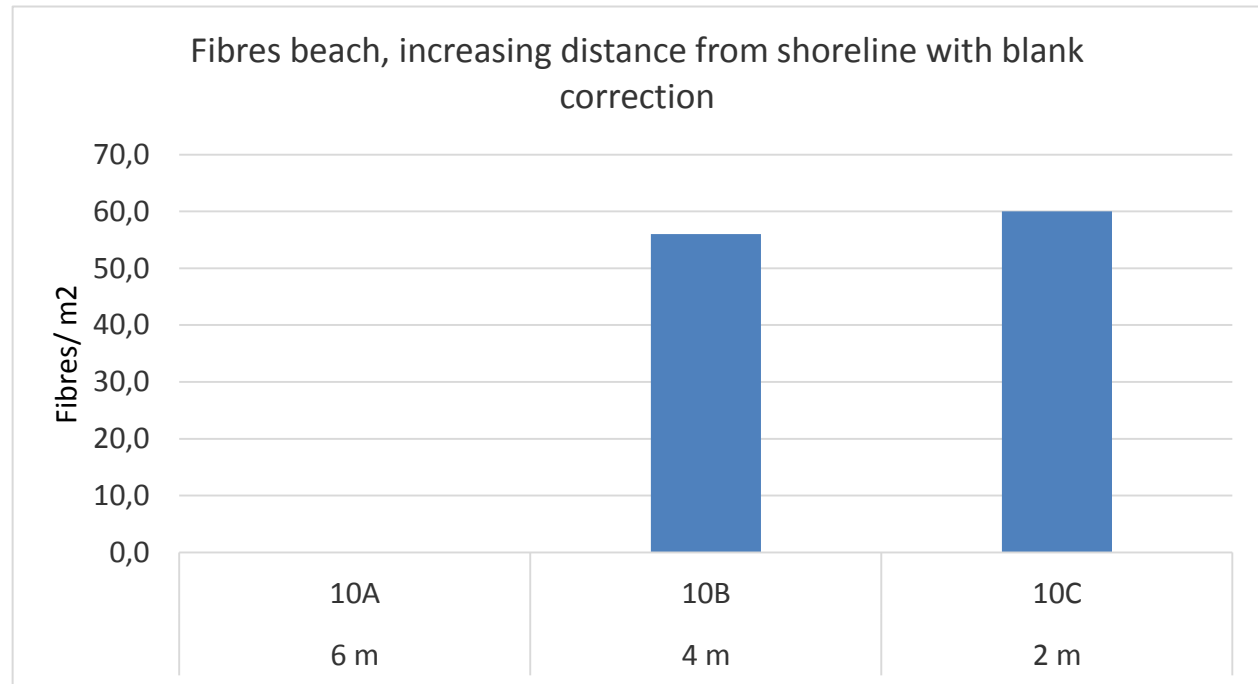
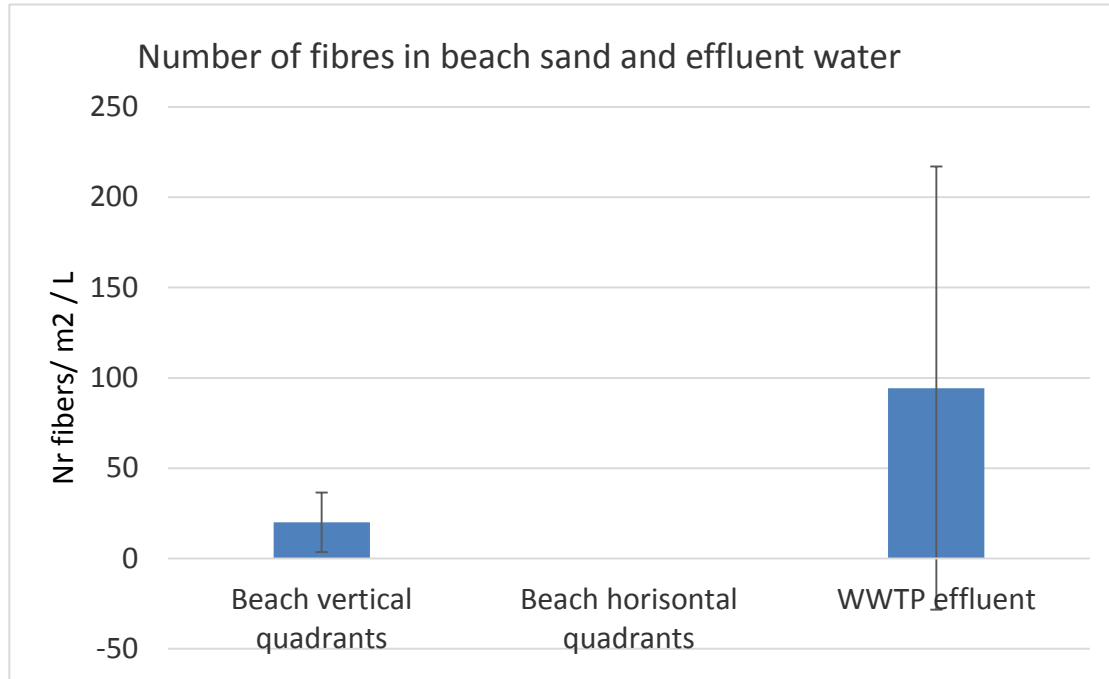
- Average of triplicates of samples
- Average of Blank samples
- $MDL = \text{Average blank} + 2 \times STDEV$
- All samples were MDL corrected

# Sediments 2015

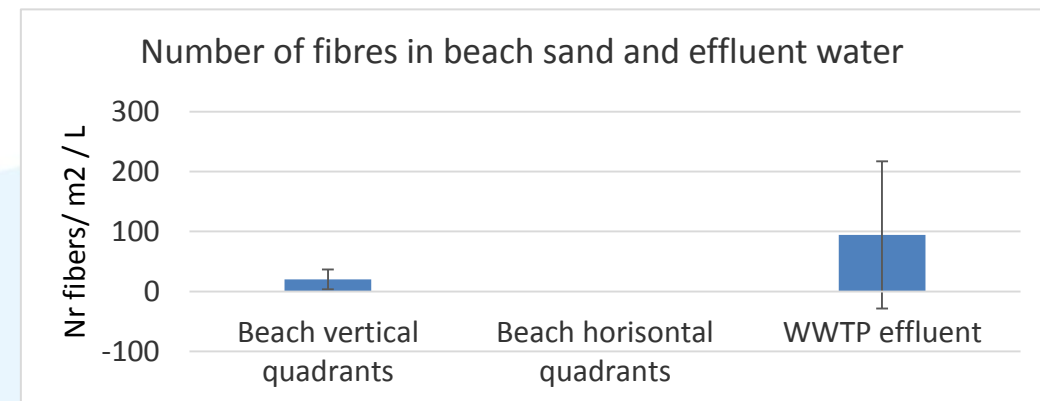


Station 1: average of 13 fibres/ kg

# Beaches and WWTP effluent 2015



## WWTP effluents in Longyearbyen as direct source of MPs



→ an average of 100 fibres/litre in untreated WW was found in 2015.

This WWTP is treating ca 200 000 m<sup>3</sup>/year (2000 inhabitants)

→ resulting in approximately **20 000 million fibres** emitted every year into pristine Arctic waters by that settlement alone.

→ In 2017 we carried out a new campaign covering 2 times a week of effluent emissions to assess variations and total discharges



# Sampling 2016



- In general:
  - All sample treatment and preparations done in a Clean cabinet
- Sediment and mussels as before
- Water:
  - Use method by Lusher et al., in 4 different fjords
  - 2000 l pumped through a 250  $\mu\text{m}$  sieve and filtered through a glassfibre filter (1.2  $\mu\text{m}$ )



# QA/QC protocol in 2016

- Sediments and beach sand:
  - Blank samples for density separation
  - Blank samples filtration
  - Blank filter drying
- Biota:
  - Blank samples for dissolution
  - Blank samples filtration
  - Blank filter drying



# 2016 results



## QA/QC:

- Still fibres and fragments found in ALL blank samples, but largely reduced



| Biota | LOD                            | 2015<br>Fibres | 2015<br>Fragment | 2016<br>Fibres | 2016<br>Fragment |
|-------|--------------------------------|----------------|------------------|----------------|------------------|
|       | LOD (blank average + 2x stdev) | 38,8           | 16,0             | 15,7           | 6,2              |



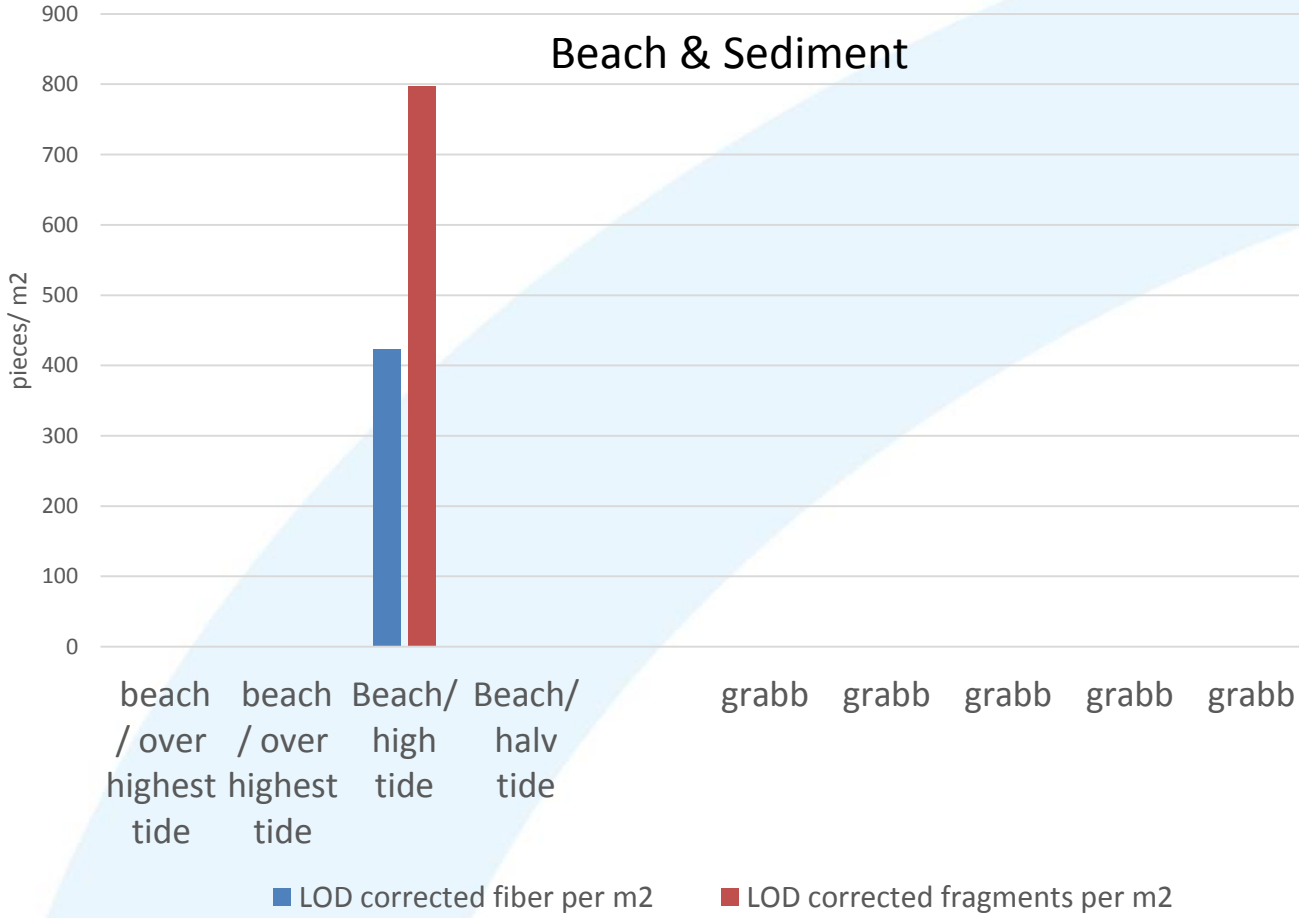
| Sediment | LOD                            | 2015<br>Fibres | 2015<br>Fragment | 2016<br>Fibres | 2016<br>Fragment |
|----------|--------------------------------|----------------|------------------|----------------|------------------|
|          | LOD (blank average + 2x stdev) | 36,0           | 0,0              | 16,6           | 19,1             |

| Filter drying blank | LOD                            |  |  | 2016<br>Fibres | 2016<br>Fragment |
|---------------------|--------------------------------|--|--|----------------|------------------|
|                     | LOD (blank average + 2x stdev) |  |  | 3.8            | 0                |

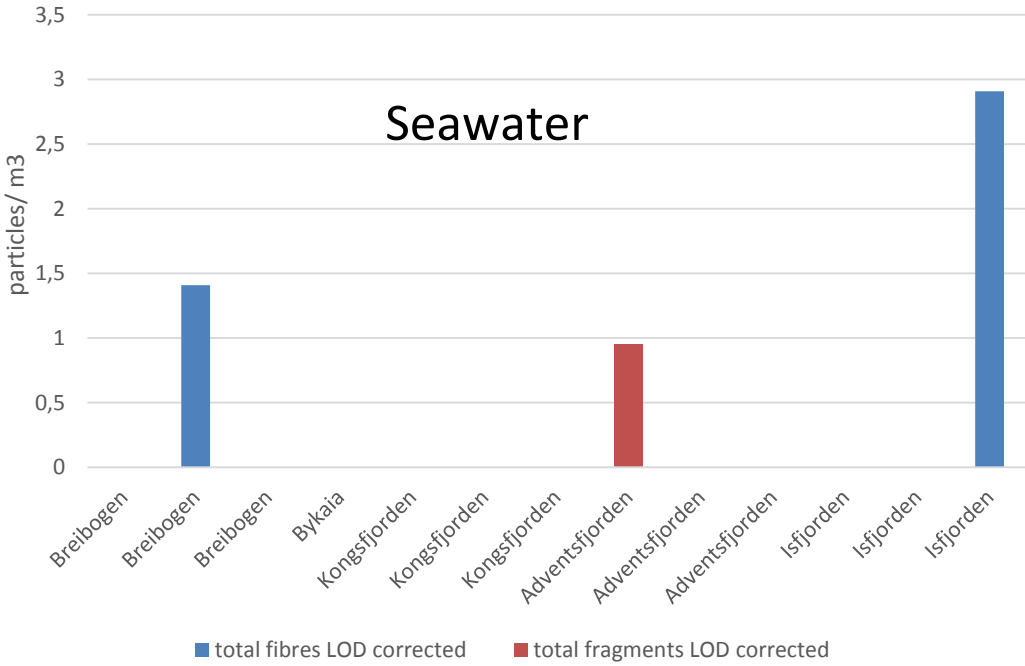
# Sediment, Beach & Seawater 2016



Beach & Sediment

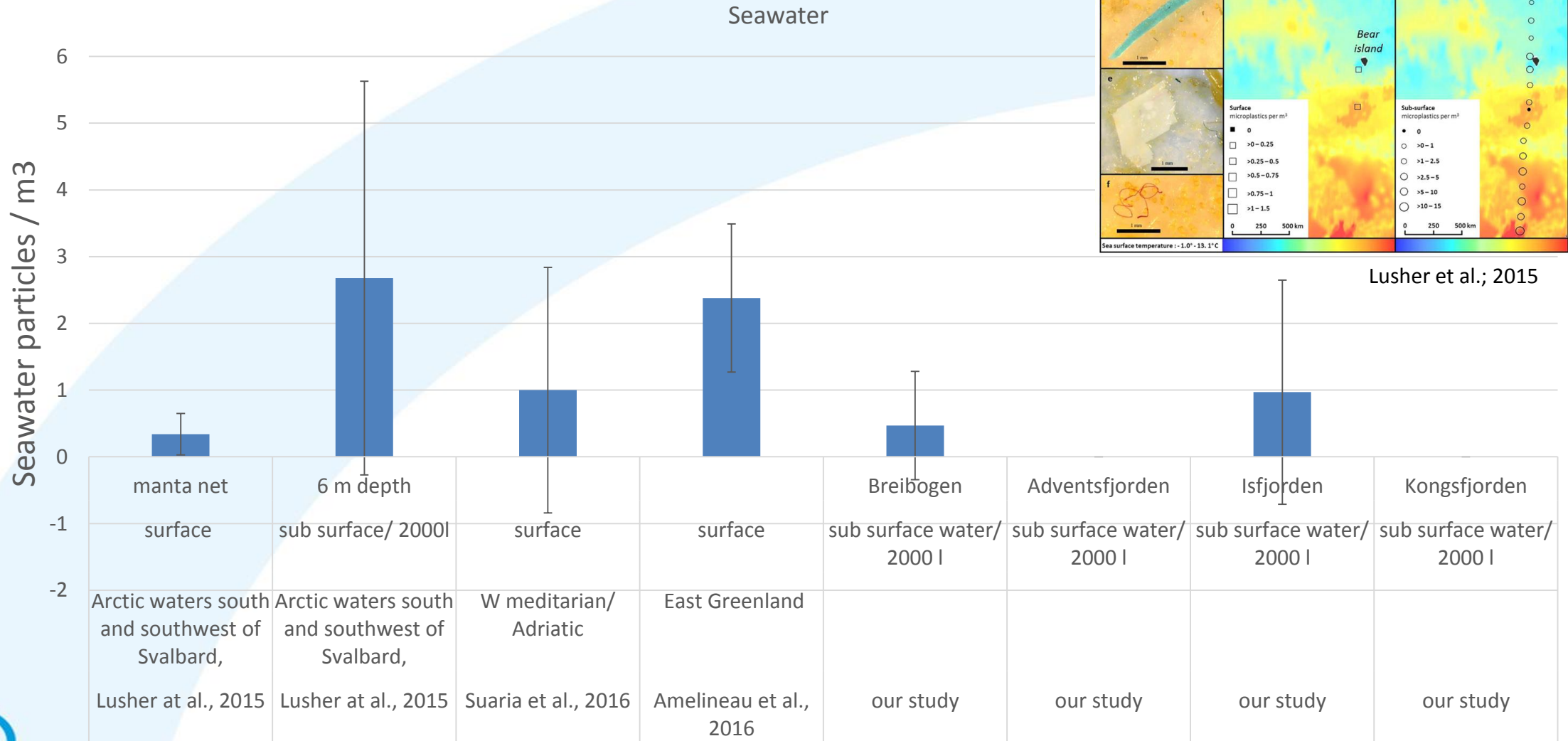


Seawater





# Comparison with other findings



Lusher et al.; 2015

# Limitations

- Limited samples available; small project
- No particle identification besides visual identification was possible within the frame of the project
- However, participation in interlab exercises are ongoing for QA/QC → input to JPI BASEMAN

# Conclusions

- Microplastics including fibres are a problem in Arctic marine ecosystems and require further monitoring and research
- Existing data are difficult to compare; lack of standardized methodologies and QA/QC strategies
- High throughput methods for identification of particle composition are needed
- Few findings in seawater and beaches, but none in sediments
- Many more samples are needed for a better picture
- WWTP effluent seems to be a major source
- Beaches show uneven distribution of MPs (tidal zone)
- Advanced QA/QC is required incl. controlled lab facilities
- Control samples, control samples, control samples, control samples, control samples.....





## Plastic Pollution in the Arctic what do we need to know?



 [Arena](#)

 Thursday 26th January 2018

 12:15 - 15:00

 [UiT - Room 1,343](#)

[Add to Calendar](#)

Photo: © Dorte Herzke, NILU