

# The growing threat of marine litter

**Geir Wing Gabrielsen**  
**The Norwegian Polar Institute**



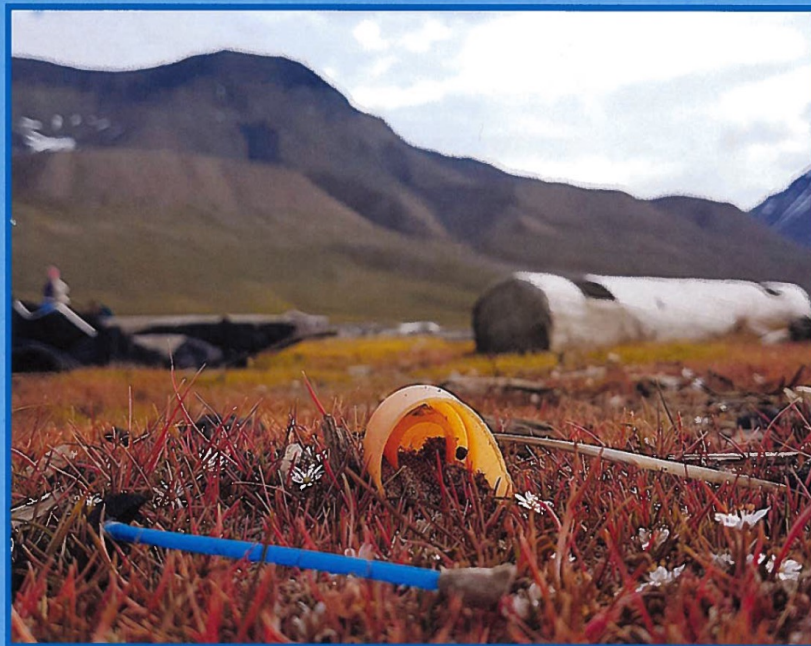
Foto: Bo Eide



Foto; Sussane Kühn

Ingeborg G. Hallanger and Geir W. Gabrielsen

## Plastic in the European Arctic



Alice M. Trevail, Susanne Kühn & Geir W. Gabrielsen

## The State of Marine Microplastic Pollution in the Arctic







Photo; Solveig Egeland



# Microplastic in fulmars from Svalbard



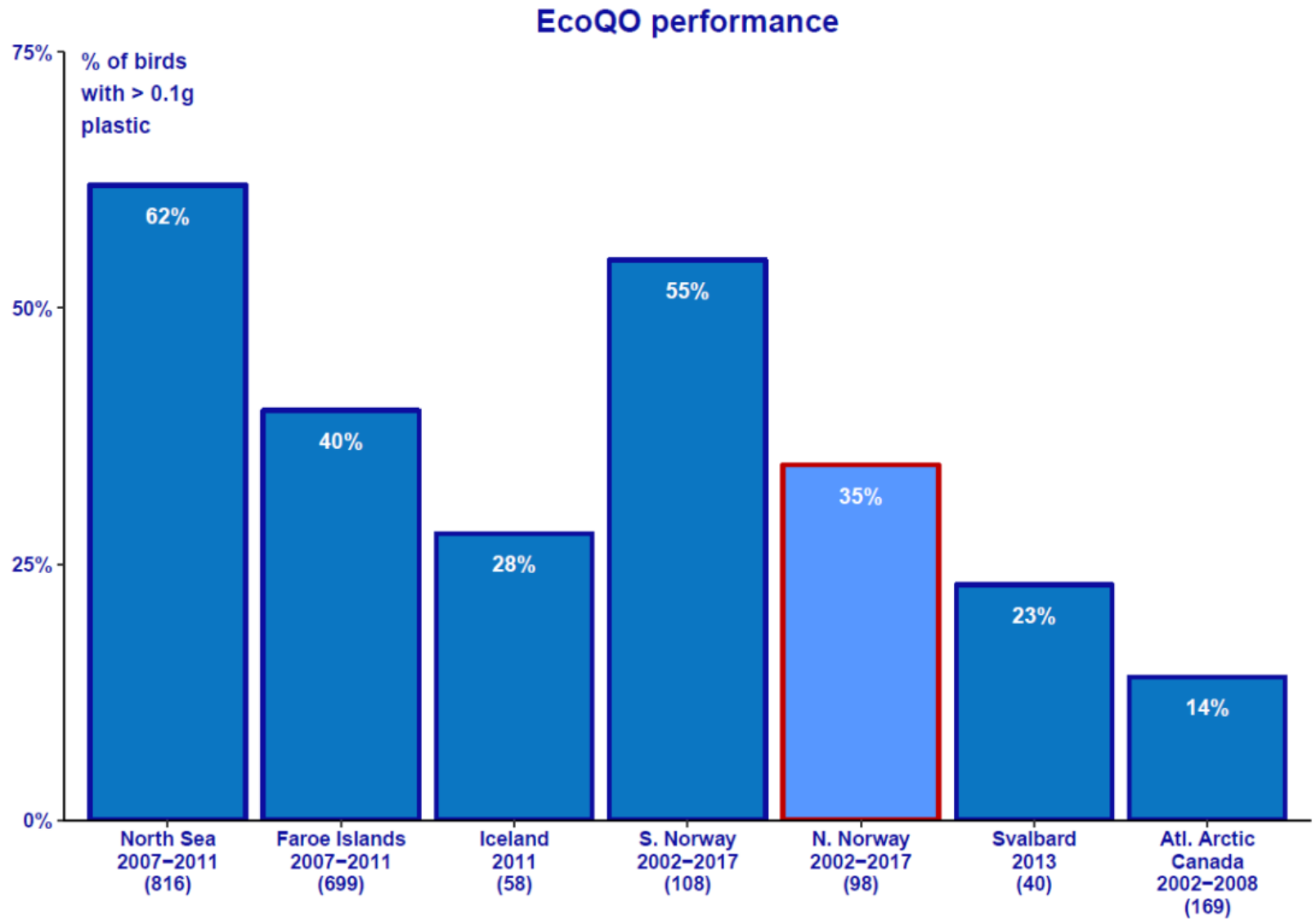
**In 1983; 29 % of 62 fulmars had microplastic in their stomach (average of 0.75 plastic pieces per individual)**

**In 2013; 88 % of 40 fulmars had microplastic in their stomach (average 15.3 plastic pieces per individual and 0.08g per bird)**

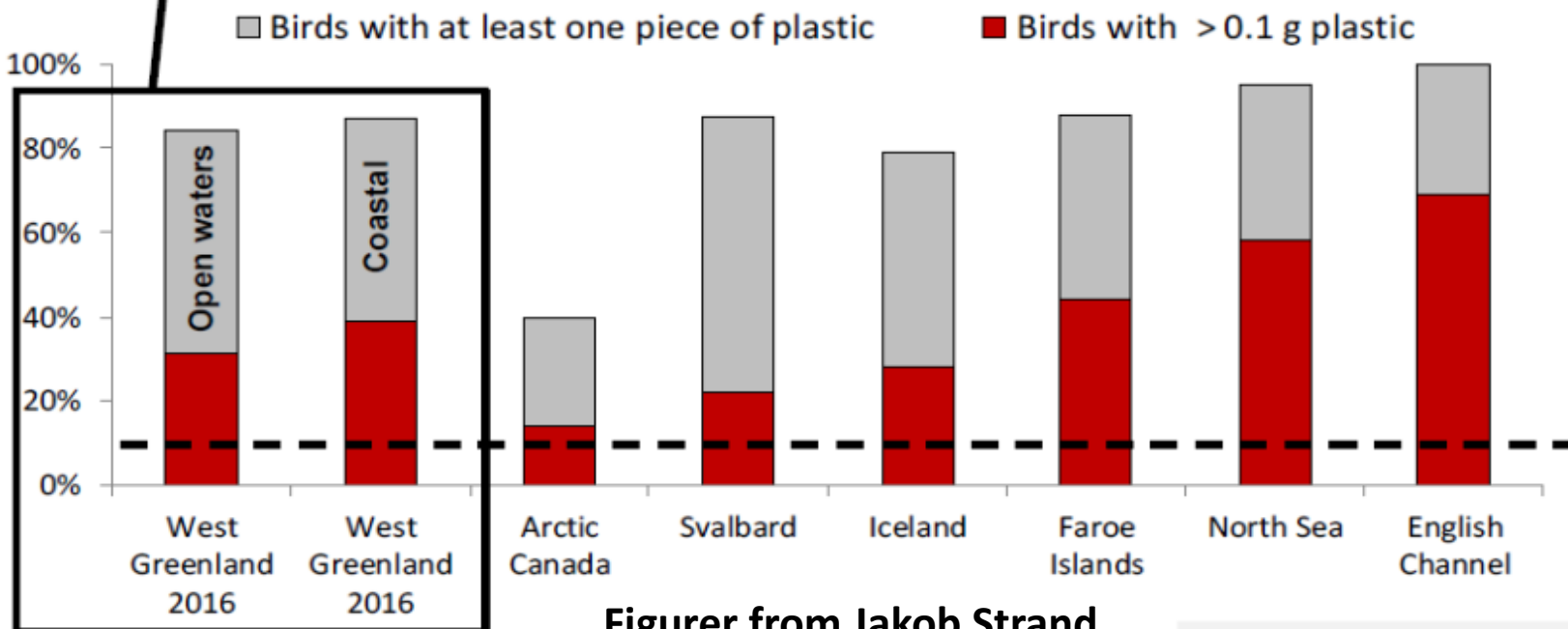
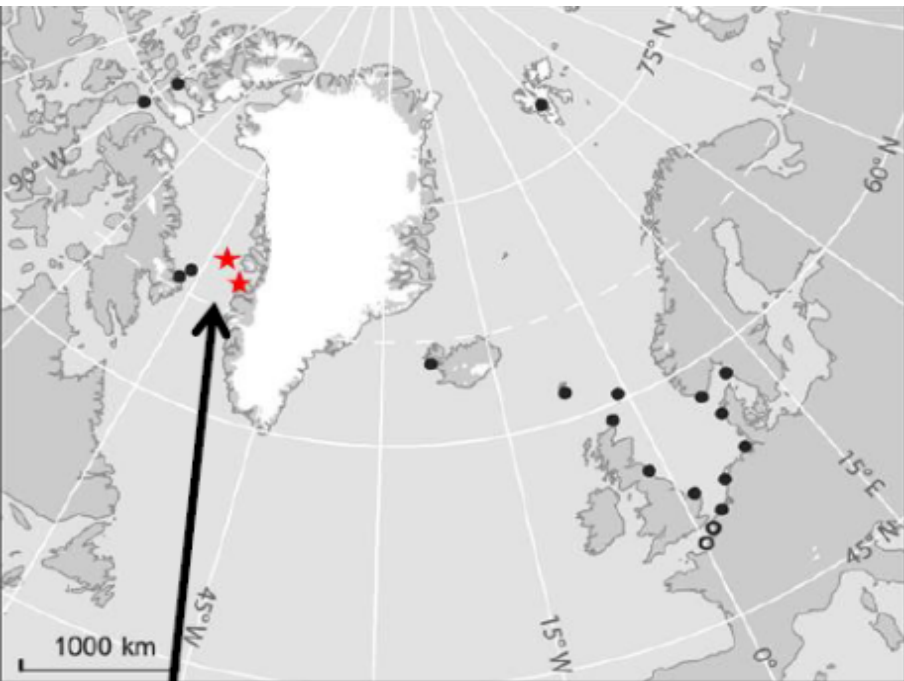
**(Trevail et al. 2015)**



# Distribution of microplastic (above 0,1 g) in fulmar stomachs from different areas



Source: Trevaill et al. 2015



OSPAR  
EcoQO =  
kun  
10% > 0.1g

Figurer from Jakob Strand

(Kort og data fra Trevail et al. 2015 og OSPAR)



# Plasticized animal species - Ingestion

Number of species with documented records of marine debris ingestion



UNEP 2016

# Plasticized animal species - **Entangled**

Number of species with documented records of entanglement in marine debris





# Bearded seal from Svalbard



Photo: Stig Onarheim





Bilde fra svalbardposten  
Verdens nordligste avis



## **Ringed seal from Svalbard**

Source; Governor of Svalbard





# GHOST NETS

Source; Christian Svarstad,  
Governor of Svalbard







# Beach cleaning studies from Svalbard show that 70-80 % of plastic waste comes from fishery and shipping



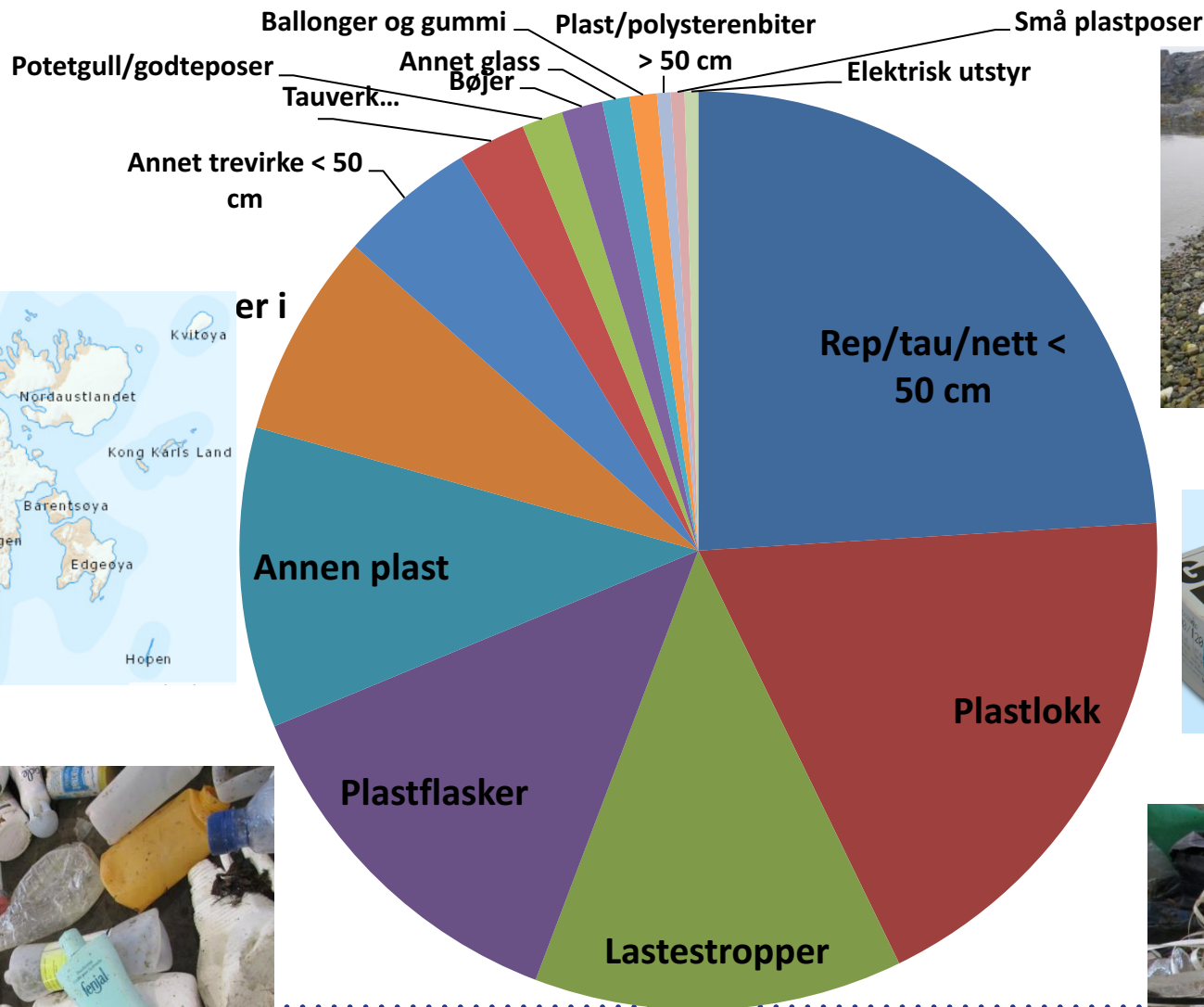


# MARP Workshop in Longyearbyen





# Beach cleaning on Svalbard



Source: MARP project

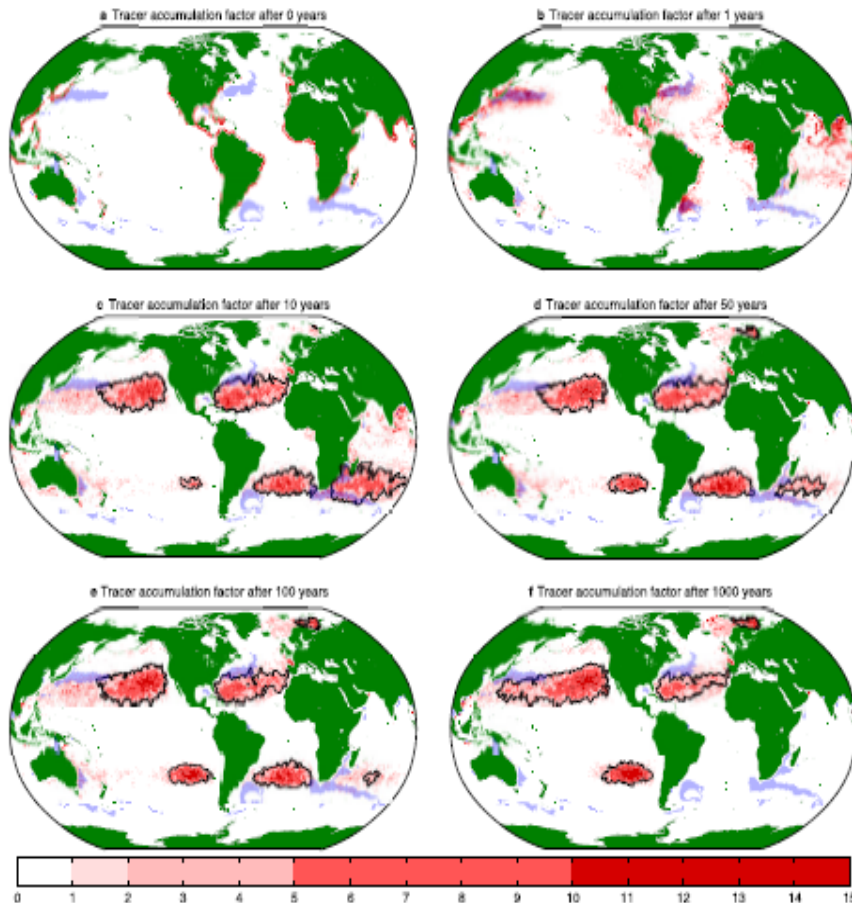




# Origin, dynamics and evolution of ocean garbage patches from observed surface drifters

Erik van Sebille<sup>1,3</sup>, Matthew H England<sup>1</sup> and Gary Froyland<sup>2</sup> (2012)

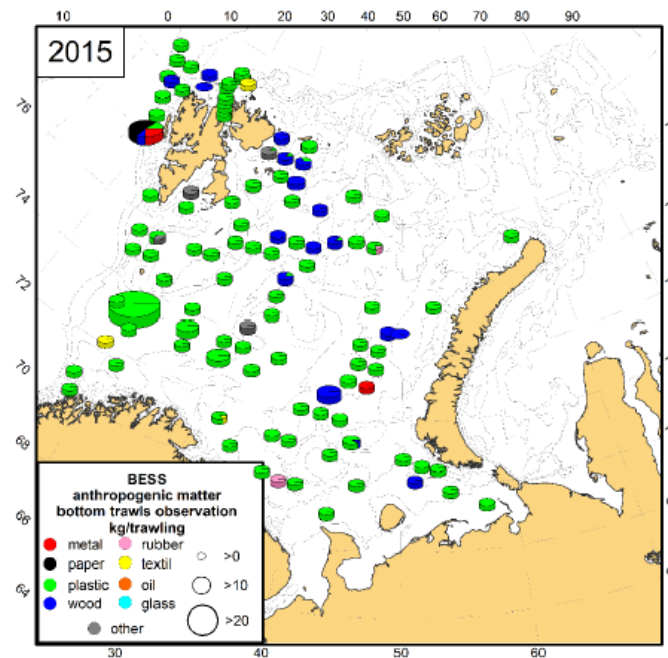
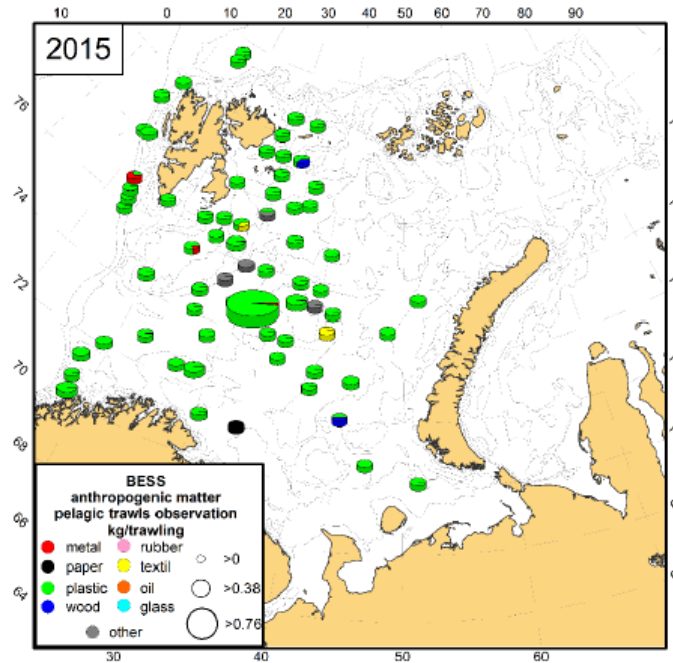
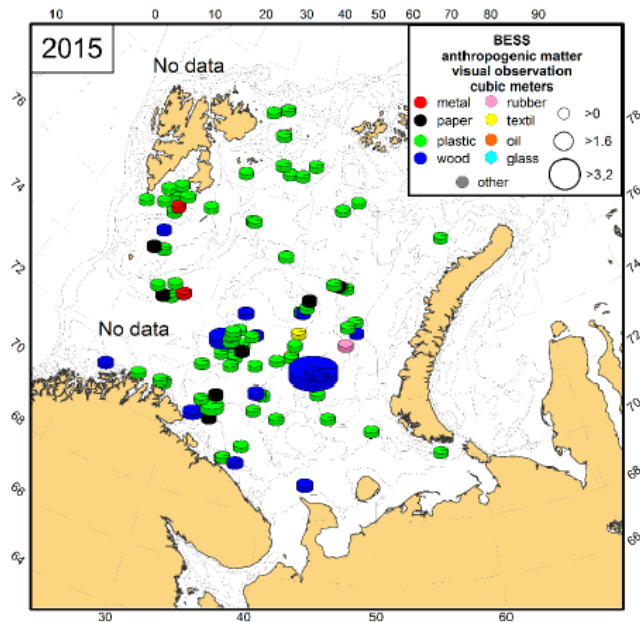
The formation of the 6<sup>th</sup> gyre in the Barents Sea?



# Barents Sea

Plastic in  
sea water

Plastic at the sea surface



Plastic on the  
bottom of the  
sea

Source: The Marine Institute in Bergen

# **Snow- and kingcrabs from the Barents Sea**



**According to Jan Sundet (The Marine Institute) a total of 20 % of kingcrabs and 40 % of snowcrabs from the Barents Sea have microplastic in their stomachs**





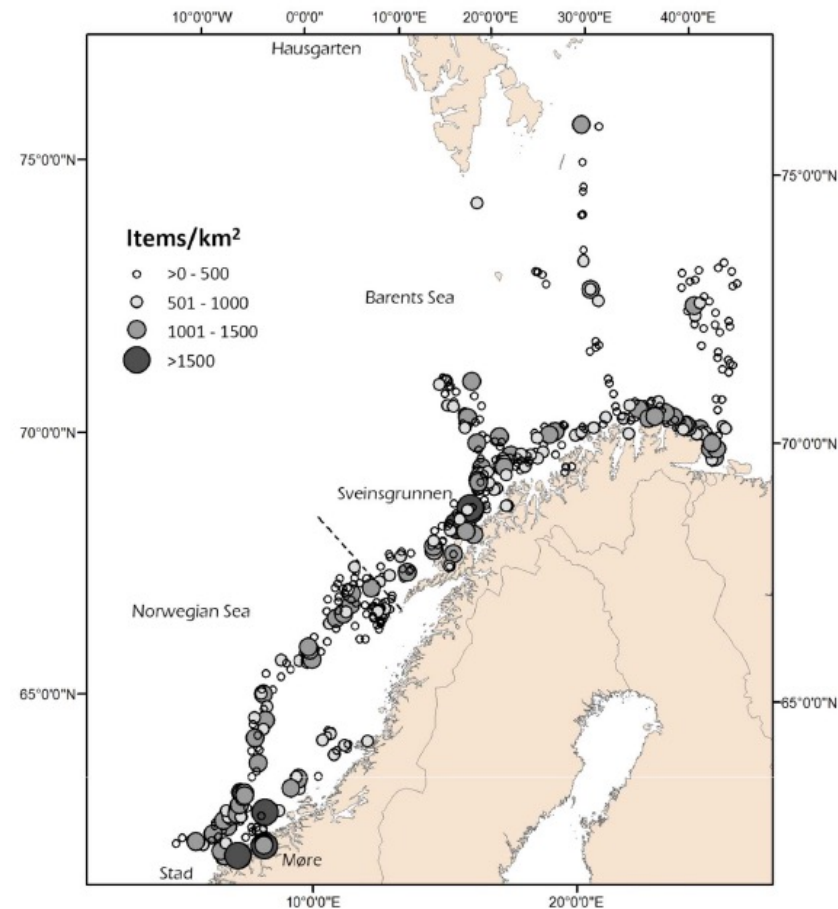
## Marine litter in the Nordic Seas: Distribution composition and abundance

Lene Buhl-Mortensen\*, Pål Buhl-Mortensen (2017)

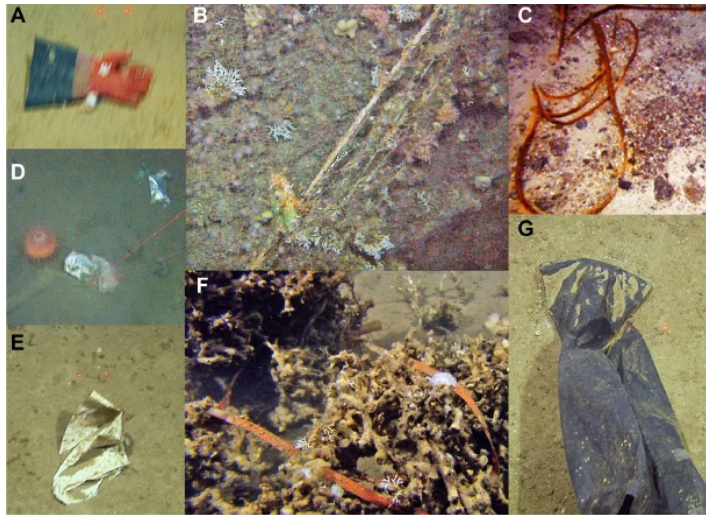
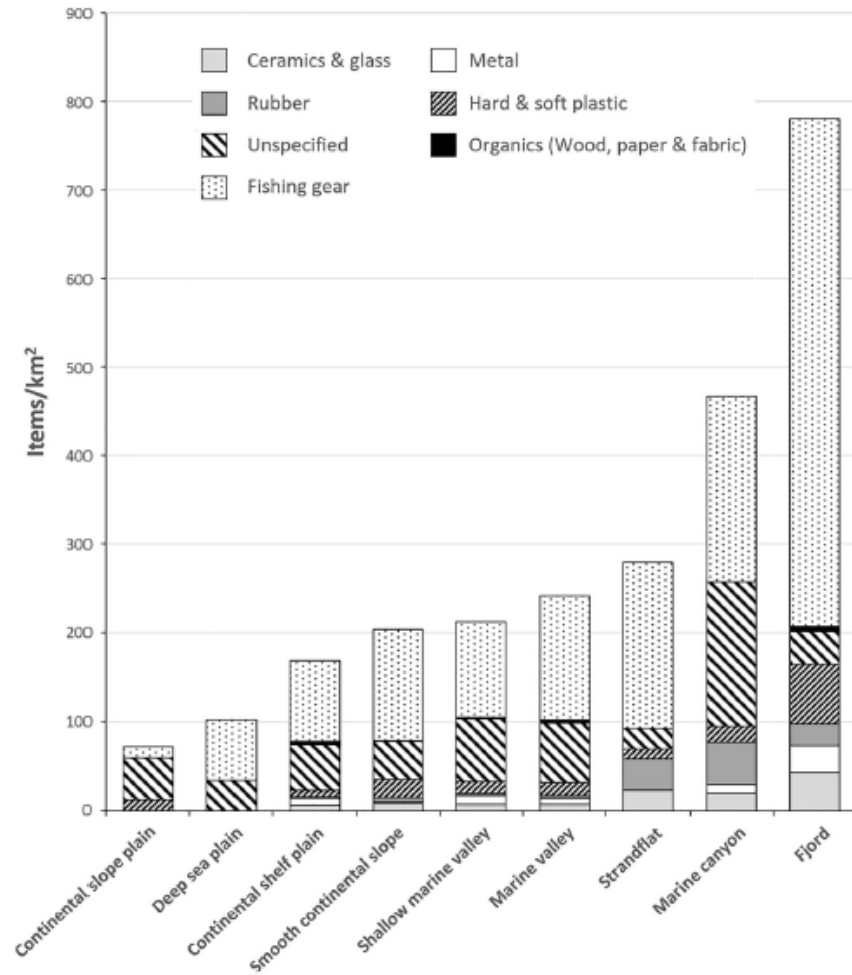
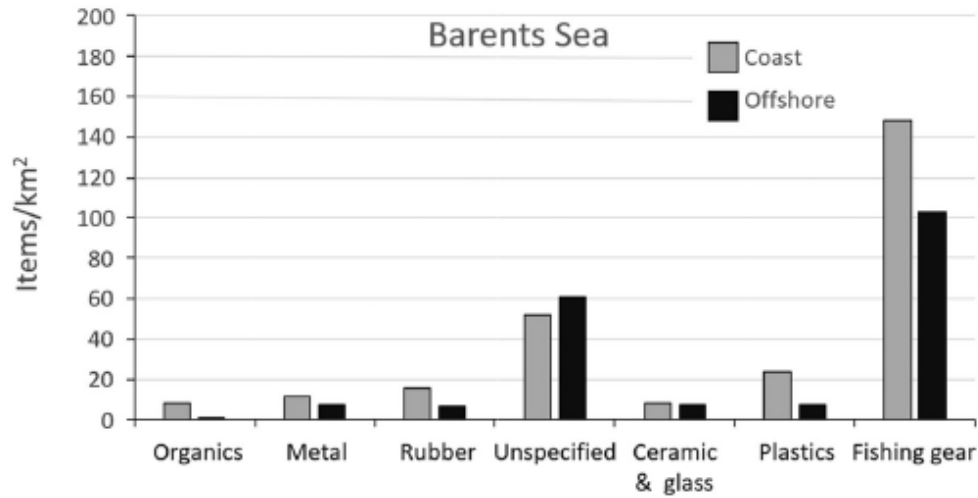
*Institute of Marine Research (IMR), Nordnesgaten 50, 1005 Bergen, Norway*

**Total amount of litter;**

**Barents Sea;  
around 101 million litter items  
corresponding to 79 thousand tons  
(mainly plastic).**



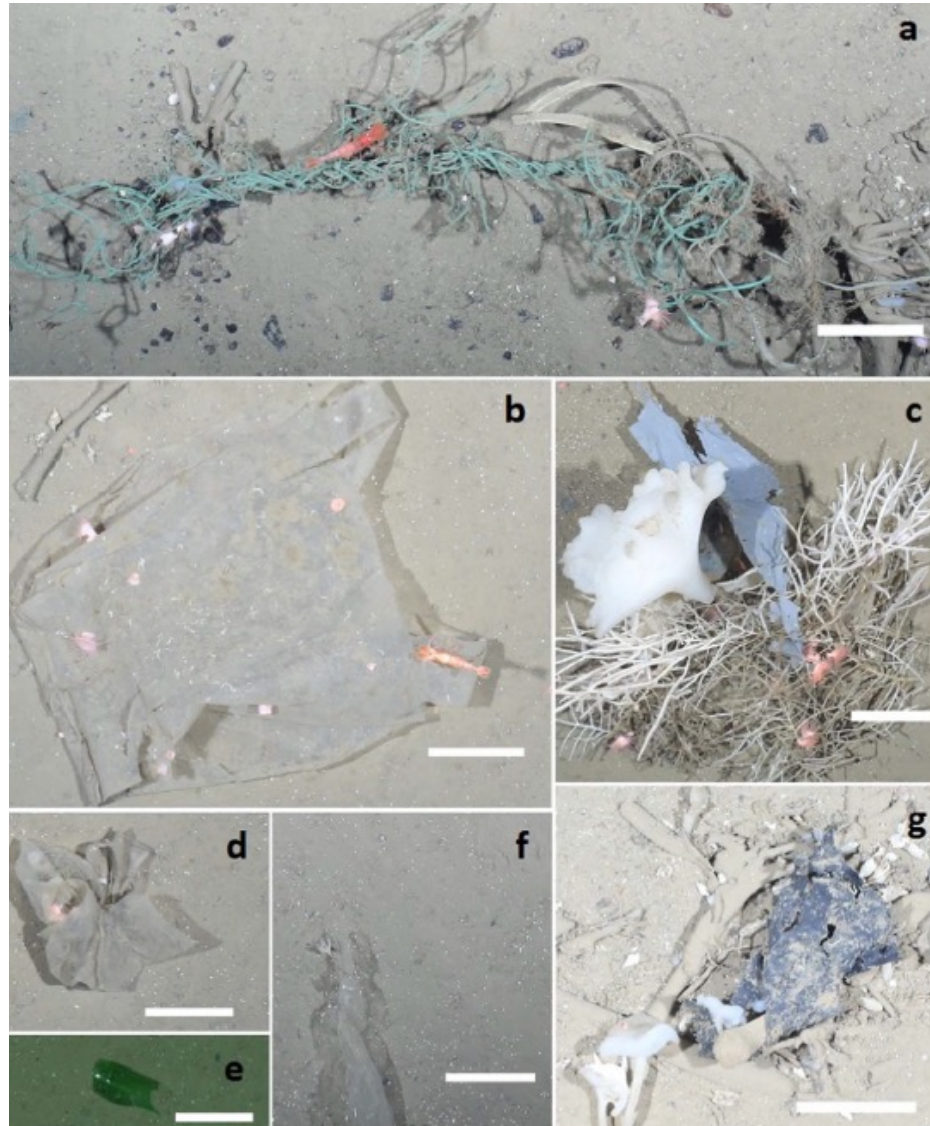
# Buhl-Mortensen study (2017)



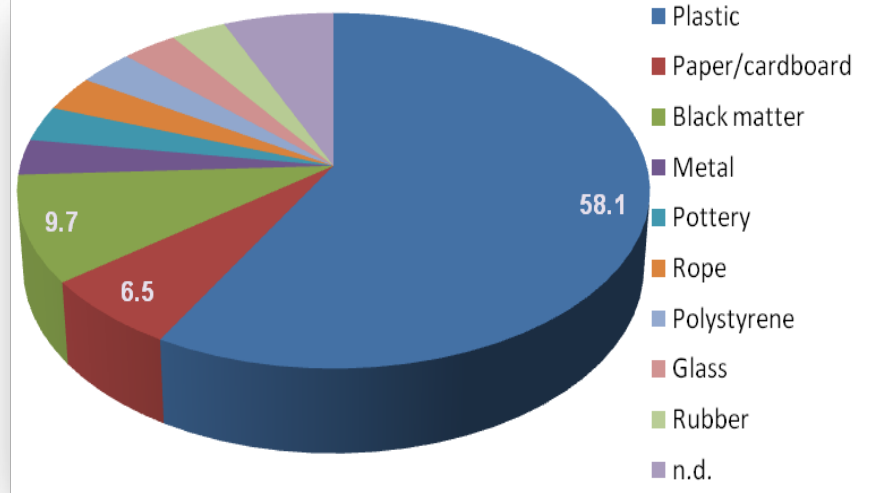


# Marine litter on deep Arctic seafloor continues to increase and spreads to the North at the HAUSGARTEN observatory

Mine B. Tekman<sup>a,\*</sup>, Thomas Krumpen<sup>b</sup>, Melanie Bergmann<sup>a</sup> (2017)

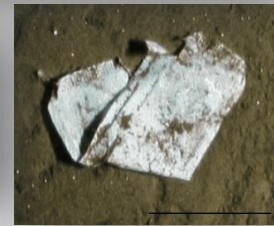


# What was found on the bottom of the sea (2000-2500 m) ?



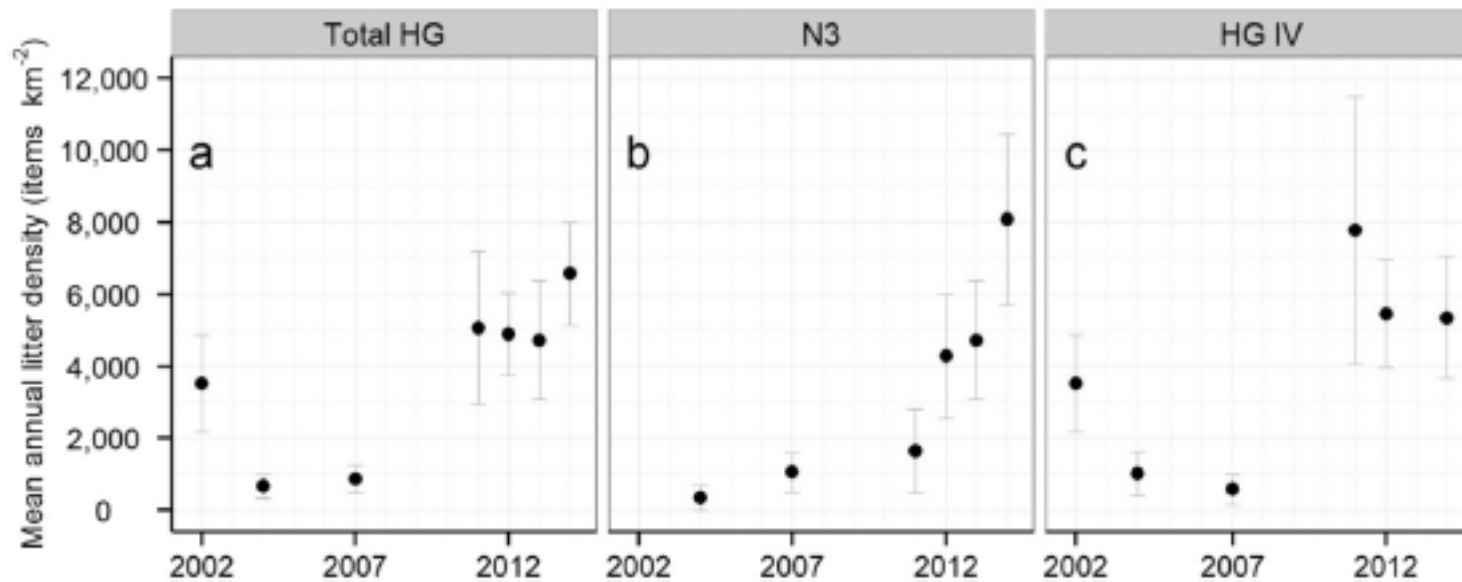
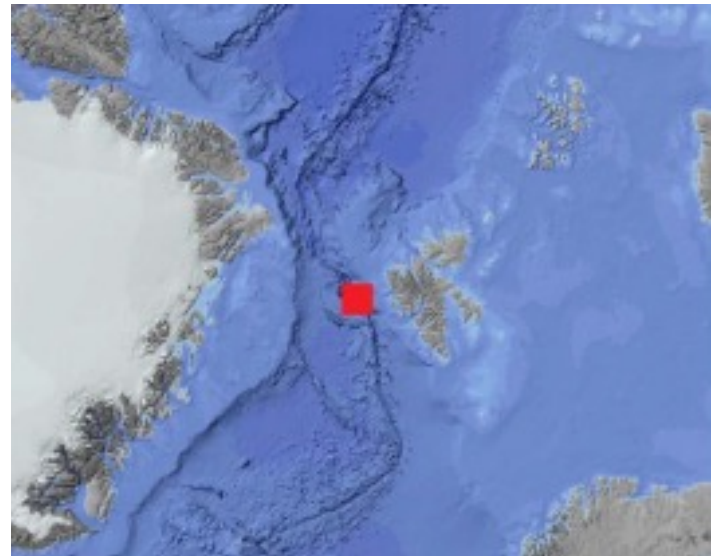
Bergmann & Klages, 2012

**Majority of litter was plastic which was 10 - 50 cm in size**





# Amount of plastic at 3 stations in the Hausgarten project

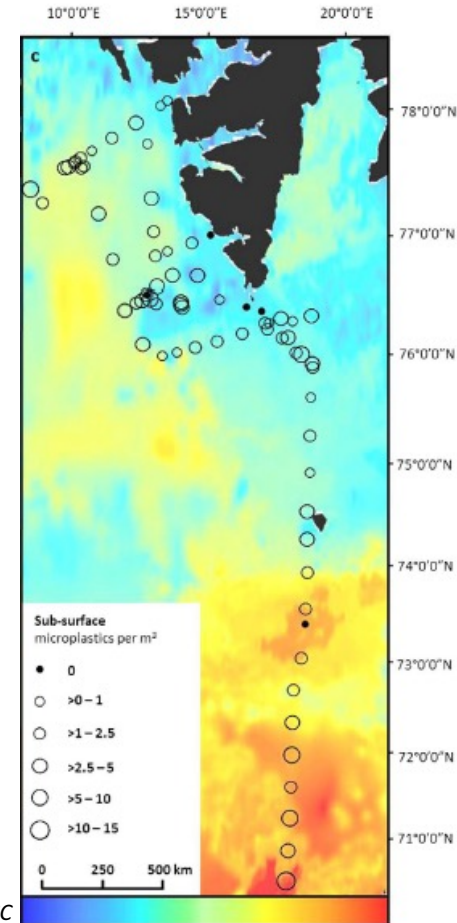
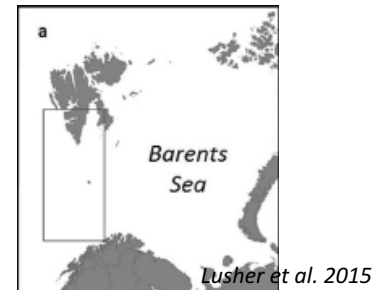


**Lisboa Canyon litter density 9000 items per km<sup>2</sup> (2011)**

# Microplastic in seawater

Study by Lusher et al. 2015 of surface water in a transect from the coast of northern Norway to the western coast of Svalbard

Location	n/m <sup>2</sup>	n/m <sup>3</sup>	Particle abundance
Arctic waters (This study)	0.028	0.34	0–1.31/m <sup>3</sup>
Bering Sea <sup>48</sup>	.	0.004–0.19	.
North Pacific subtropical gyre <sup>49</sup>	.	0.116	.
North Pacific subtropical gyre <sup>28</sup>	0.02–0.45	.	.
South Californian current system <sup>50</sup>	.	0.011–0.033	0.00–3.14/m <sup>3</sup>
South Pacific <sup>29</sup>	0.027	.	0–0.40/m <sup>2</sup>
North Atlantic <sup>51</sup>	.	0.01–0.04	.
North Atlantic subtropical gyre <sup>27</sup>	0.0015	.	0–0.2/m <sup>2</sup>
Portuguese coast <sup>52</sup>	.	0.02–0.036	.
Equatorial Atlantic <sup>53</sup>	.	0.01	.
South Atlantic <sup>54</sup>	.	0.03	.
Mediterranean <sup>37</sup>	0.12	.	0–0.89/m <sup>2</sup>
Mediterranean <sup>55</sup>	0.25	.	.
Mediterranean <sup>56</sup>	.	0.15	0.01–0.35/m <sup>3</sup>



Sea surface temperature: -1.0° – 13.1°C



## WATER POLLUTION

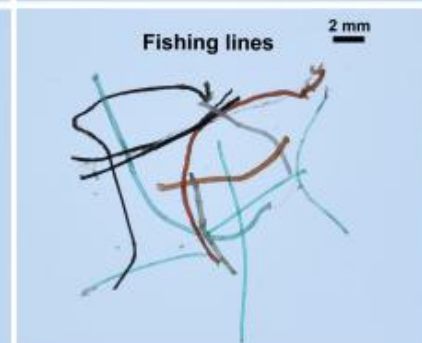
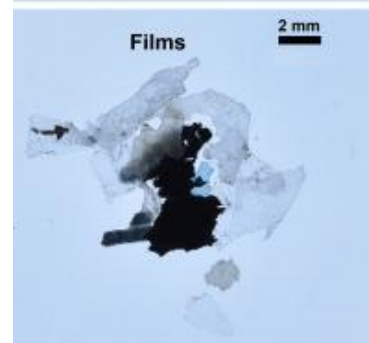
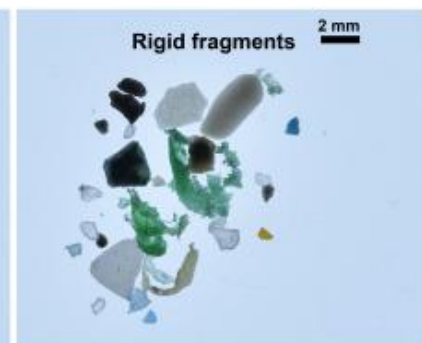
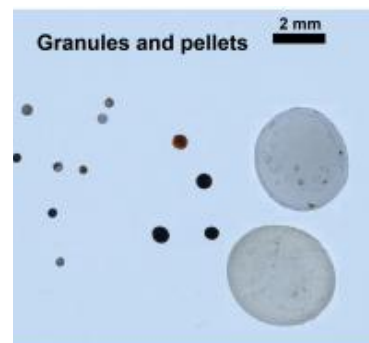
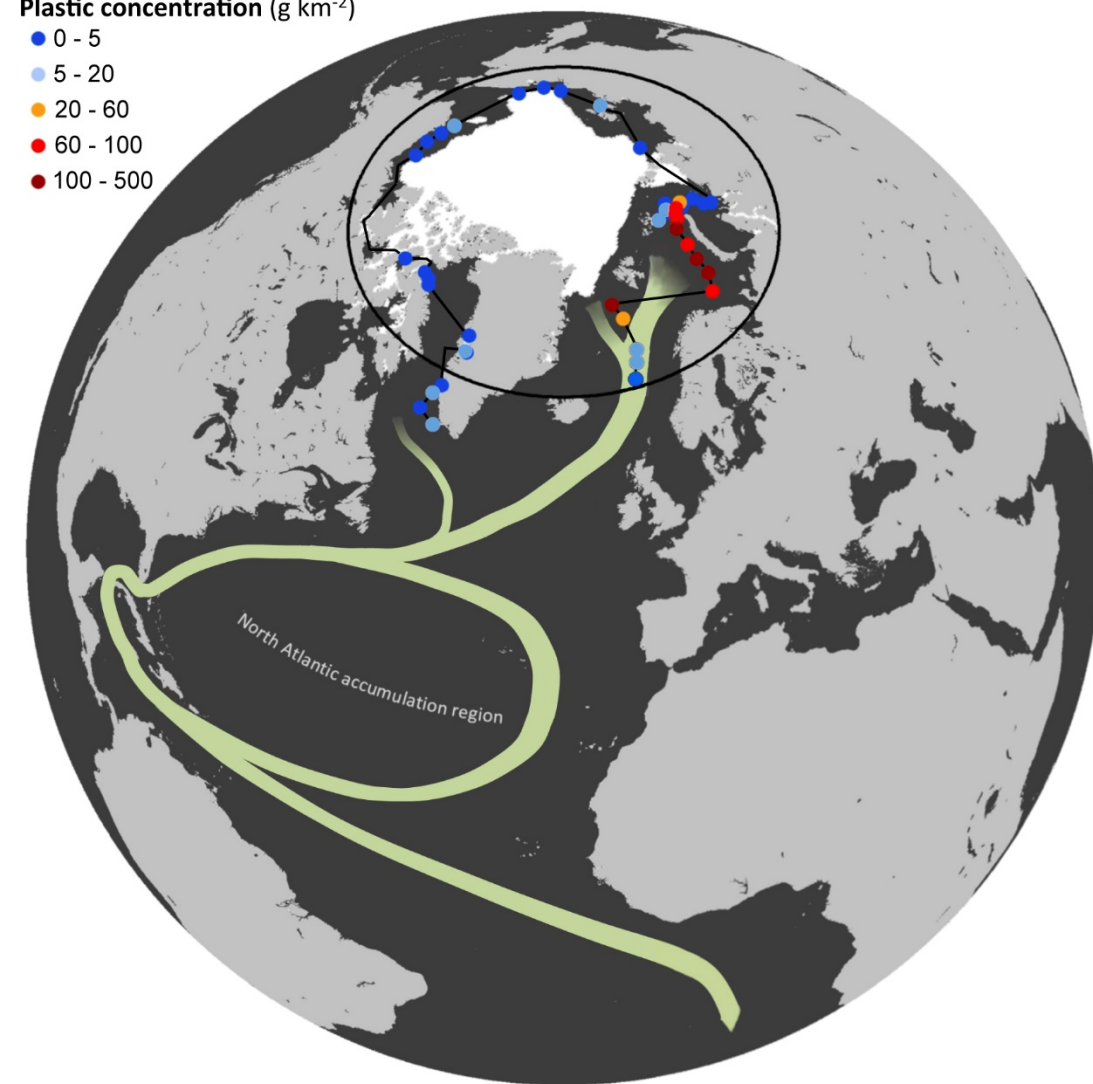
# The Arctic Ocean as a dead end for floating plastics in the North Atlantic branch of the Thermohaline Circulation

April 2017

Andrés Cózar,<sup>1\*</sup> Elisa Martí,<sup>1</sup> Carlos M. Duarte,<sup>2,3</sup> Juan García-de-Lomas,<sup>1</sup> Erik van Sebille,<sup>4,5</sup> Thomas J. Ballatore,<sup>6,7</sup> Víctor M. Eguíluz,<sup>8</sup> J. Ignacio González-Gordillo,<sup>1</sup> Maria L. Pedrotti,<sup>9</sup> Fidel Echevarría,<sup>1</sup> Romain Troublé,<sup>10</sup> Xabier Irigoien<sup>11,12</sup>

Plastic concentration (g km<sup>-2</sup>)

- 0 - 5
- 5 - 20
- 20 - 60
- 60 - 100
- 100 - 500





**FULL AV PLAST:** Denne isen kan være full av plast om man skal tro forskerne bak en ny studie, som anslår at så mye som 1 trillion plastbiter kan bli frigjort innen det neste tiåret hvis nåværende smeltetrender vedvarer.

FOTO: SYLVINEZ LUEGREN / NRK

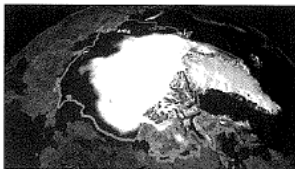
## Denne isen kan være full av plastbiter

Når isen på Arktis smelter kan det medføre at mer enn en trillion plastpartikler frigjøres, viser nytt studie. – Urovnkende, sier seniorforsker.

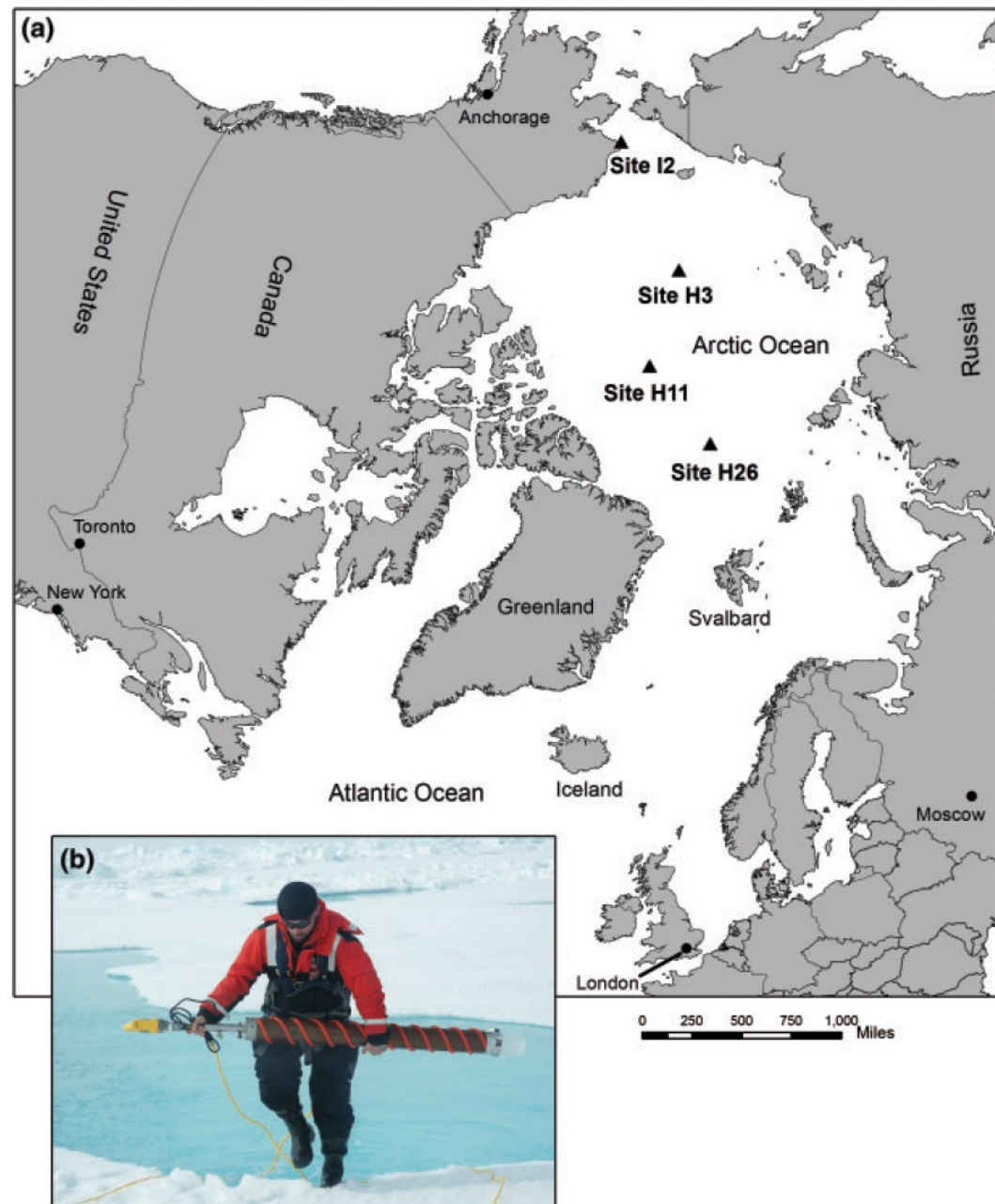
Markus Thonhaugen  
Journalist

Publisert 25.05.2014, kl. 16:40

I fjor ble det produsert nærmere 300 millioner tonn plastikk. Mens noe av dette ender opp som flytende avfall i verdenshavene, viser en ny studie at deler av plasten også ender opp i isen i Arktis, skriver det vitenskapelige nettstedet [sciencemag.org](http://sciencemag.org).



**In icecores from the polar basin Obbard et al. (2014) found between **38 and 234** plastic particles per liter of water analyzed.**



Obbard et al. 2014



# Study of microplastic in sea-ice by Peeken et al. 2018

- ~10 times higher content of plastic particles when compared to Obbard et al. 2014
- The sea-ice from the Fram Strait had content of 12000 plastic particles per liter of water analyzed
- Russian rivers may be a source of nano- and microplastic to the Arctic



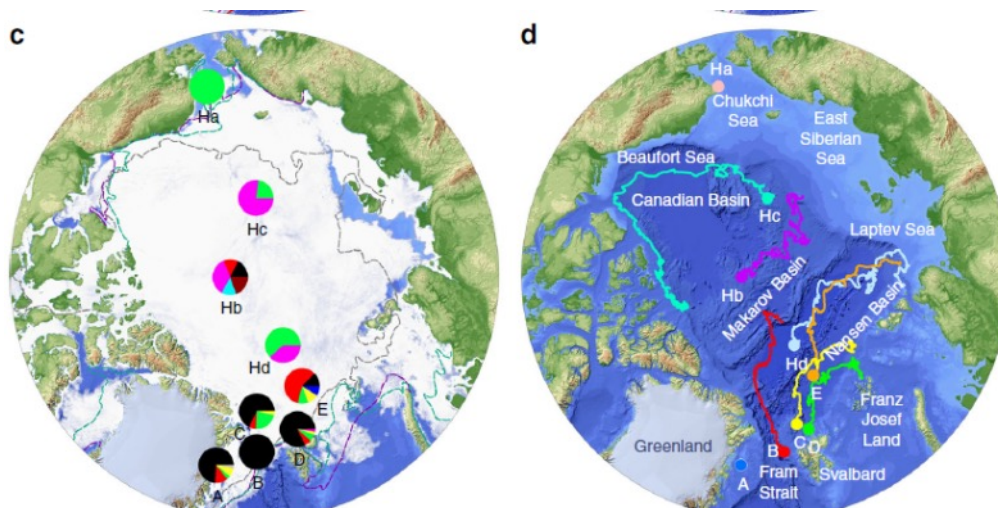
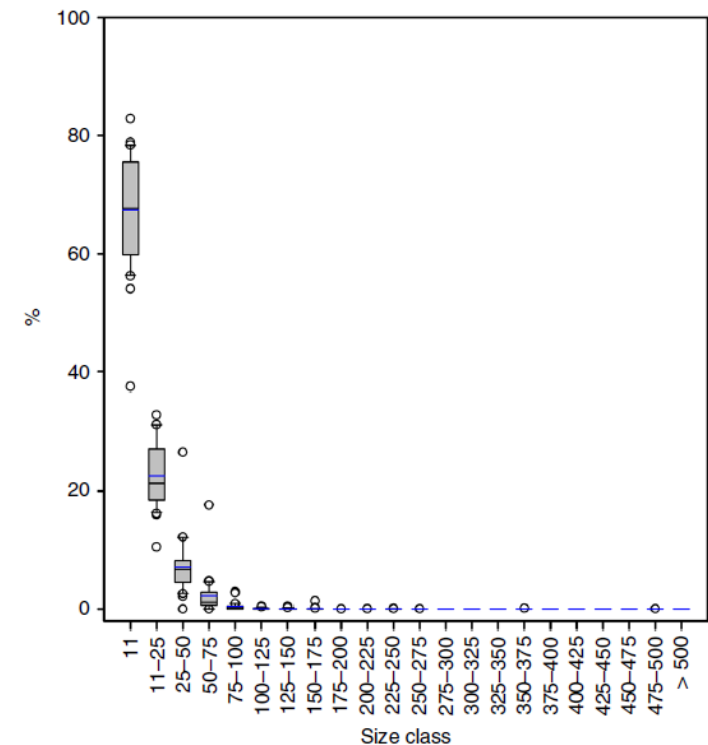
ARTICLE

DOI: 10.1038/s41467-018-0385-5

OPEN

Arctic sea ice is an important temporal sink and means of transport for microplastic

Illa Peeken<sup>1</sup>, Sebastian Primpke<sup>1</sup>, Birte Beyer<sup>1</sup>, Julia Gütemann<sup>1</sup>, Christian Katlein<sup>1</sup>, Thomas Krumpen<sup>1</sup>, Melanie Bergmann<sup>1</sup>, Laura Hehemann<sup>1</sup> & Gunnar Gerdts<sup>1</sup>



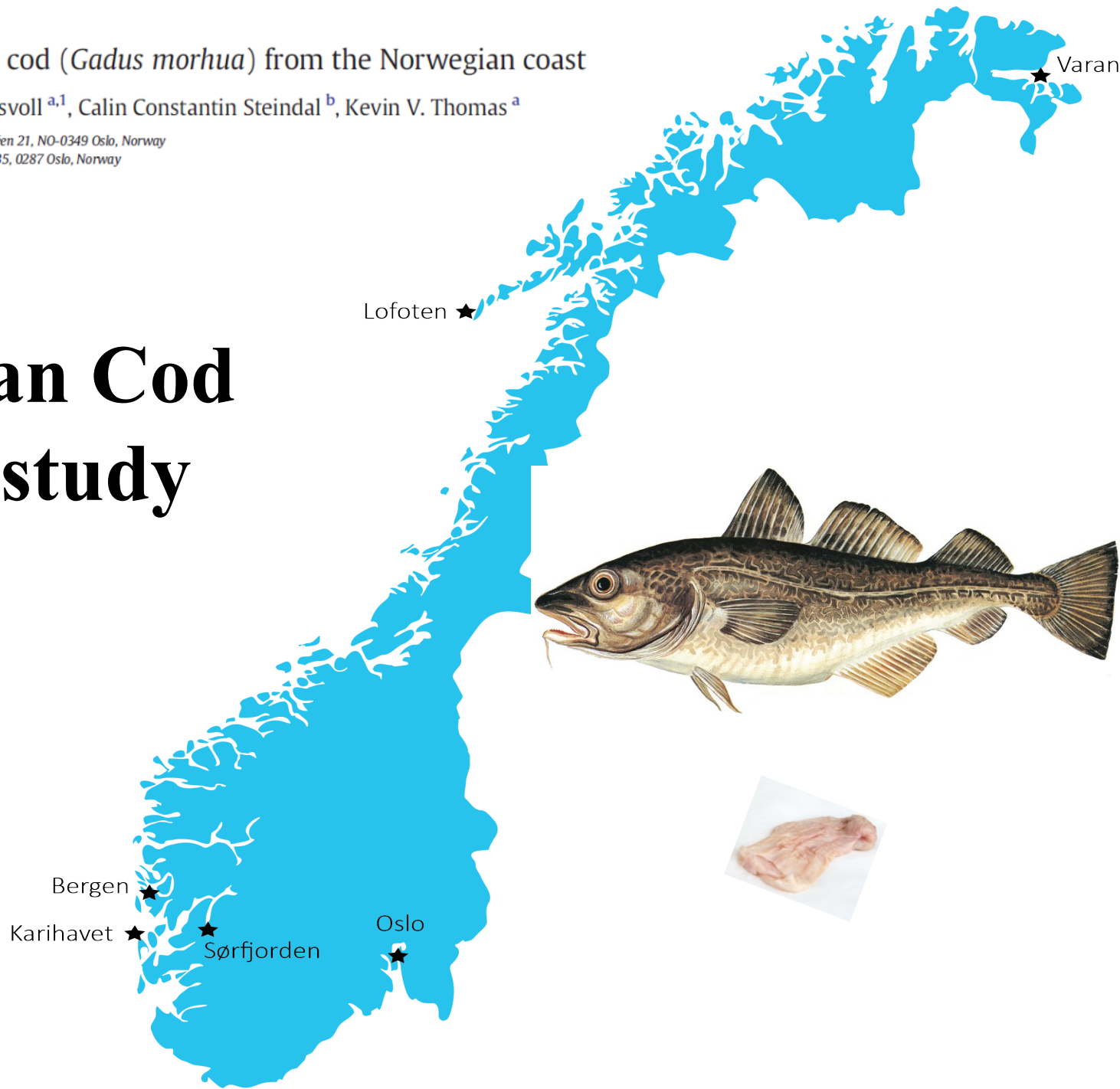
Plastic ingestion by Atlantic cod (*Gadus morhua*) from the Norwegian coast

Inger Lise N. Bråte<sup>a,\*,1</sup>, David P. Eidsvoll<sup>a,1</sup>, Calin Constantin Steindal<sup>b</sup>, Kevin V. Thomas<sup>a</sup>

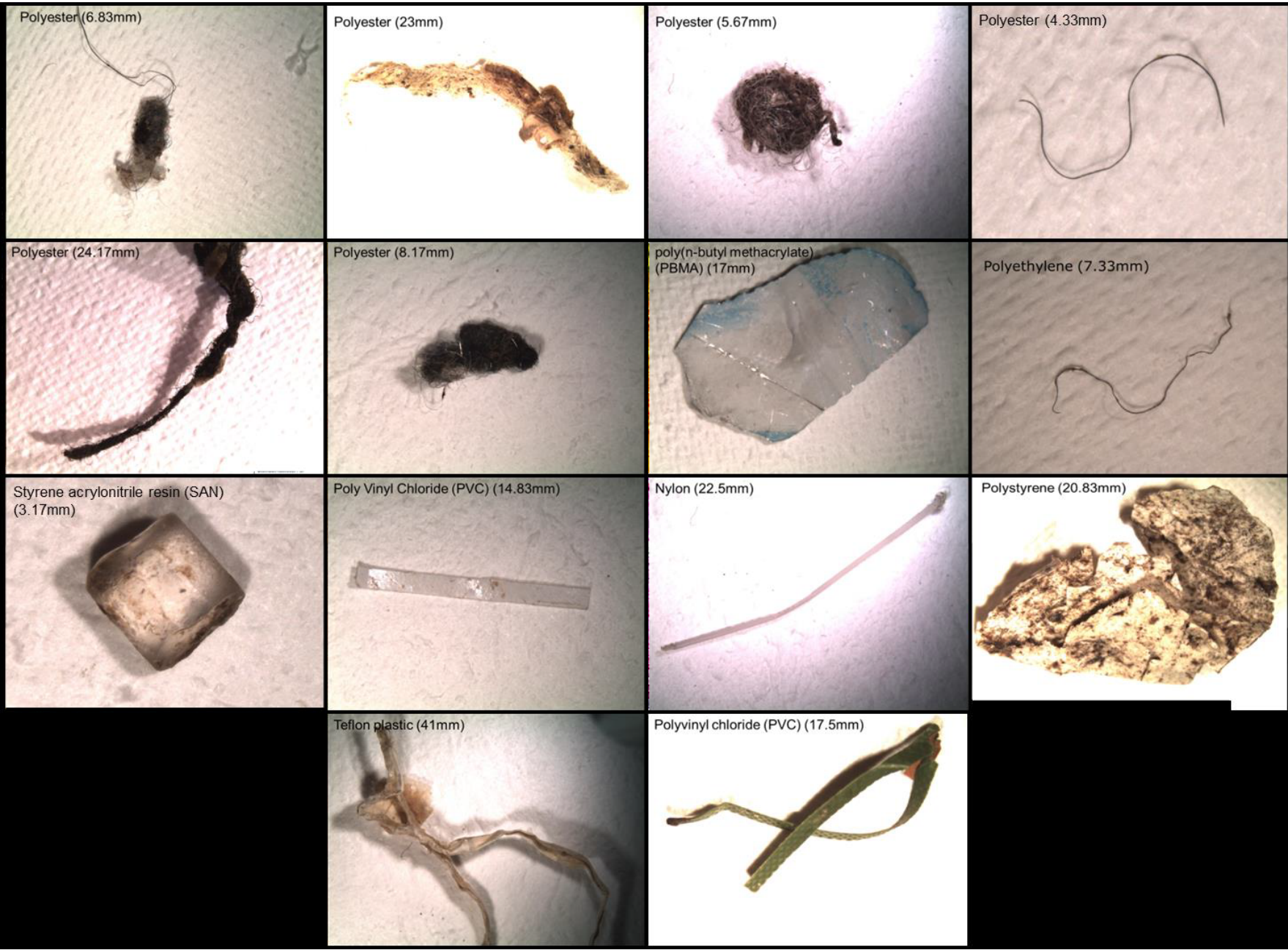
<sup>a</sup> Norwegian Institute for Water Research (NIVA), Gaustadalléen 21, NO-0349 Oslo, Norway

<sup>b</sup> Museum of Cultural History, University of Oslo, Huk Aveny 35, 0287 Oslo, Norway

# Norwegian Cod stomach study (n=302)







OPEN

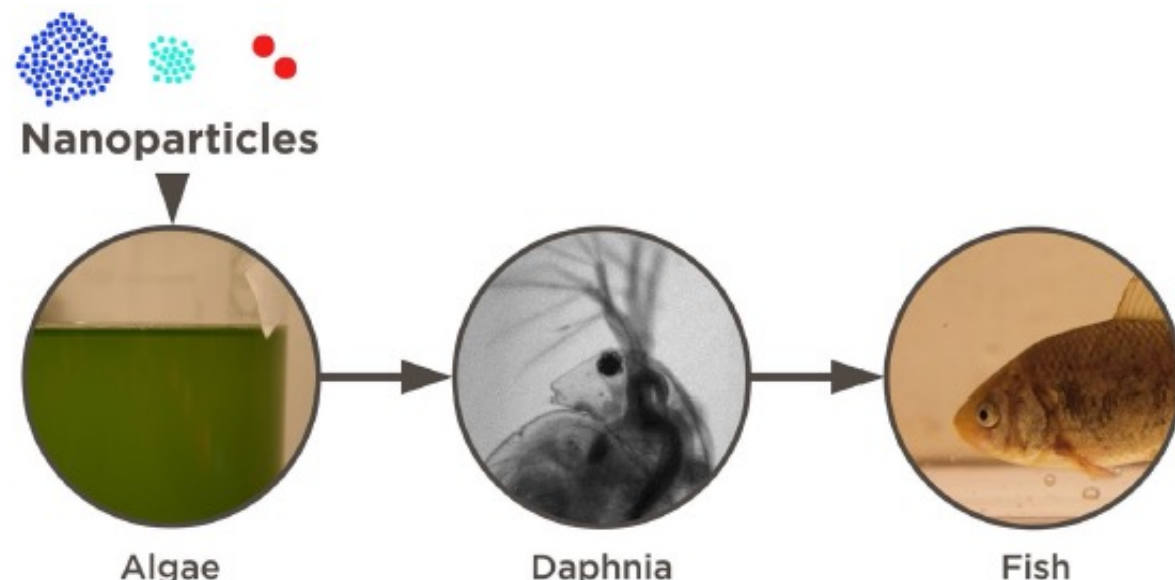
## Brain damage and behavioural disorders in fish induced by plastic nanoparticles delivered through the food chain

Karin Mattsson<sup>1,2</sup>, Elyse V. Johnson<sup>3</sup>, Anders Malmendal<sup>1</sup>, Sara Linse<sup>1,2</sup>, Lars-Anders Hansson<sup>2,4</sup> & Tommy Cedervall<sup>1,2</sup>

Received: 9 June 2017

Accepted: 14 August 2017

Published online: 13 September 2017





**The problem of plastic in seas is widespread**

**Plastic is a threat and are influencing marine organisms**

**New parameters are needed for monitoring of plastic in the sea, in sea ice and in sediments**

**We need more studies on the effects of plastic pollution on marine animals**

**Can pollutants, which are associated with plastic, have an effect on the health of marine animals and humans?**

# Thank you for your attention!



Ferdi Rizkiyanto - 2011

Image: Ferdi Rizkiyanto 2011