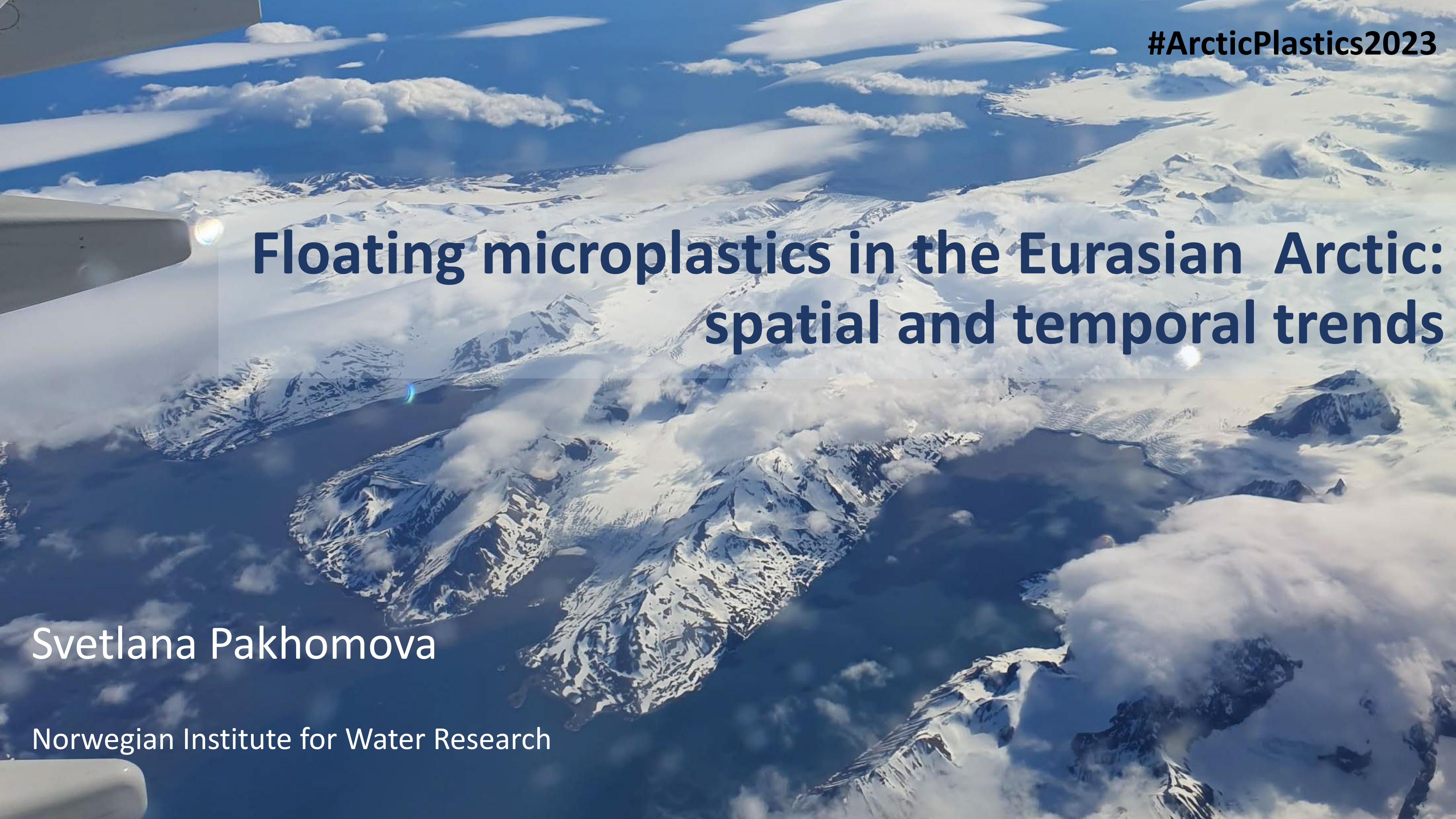


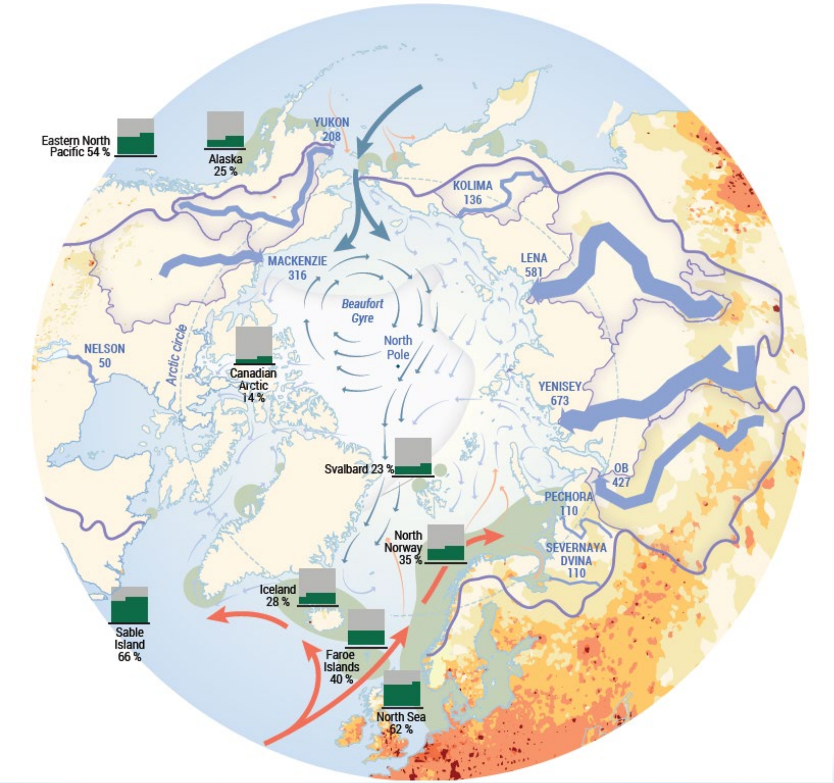
#ArcticPlastics2023

Floating microplastics in the Eurasian Arctic: spatial and temporal trends

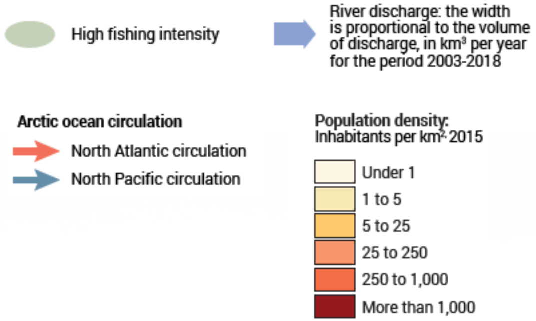
Svetlana Pakhomova

Norwegian Institute for Water Research

Sources of plastic in the Eurasian Arctic



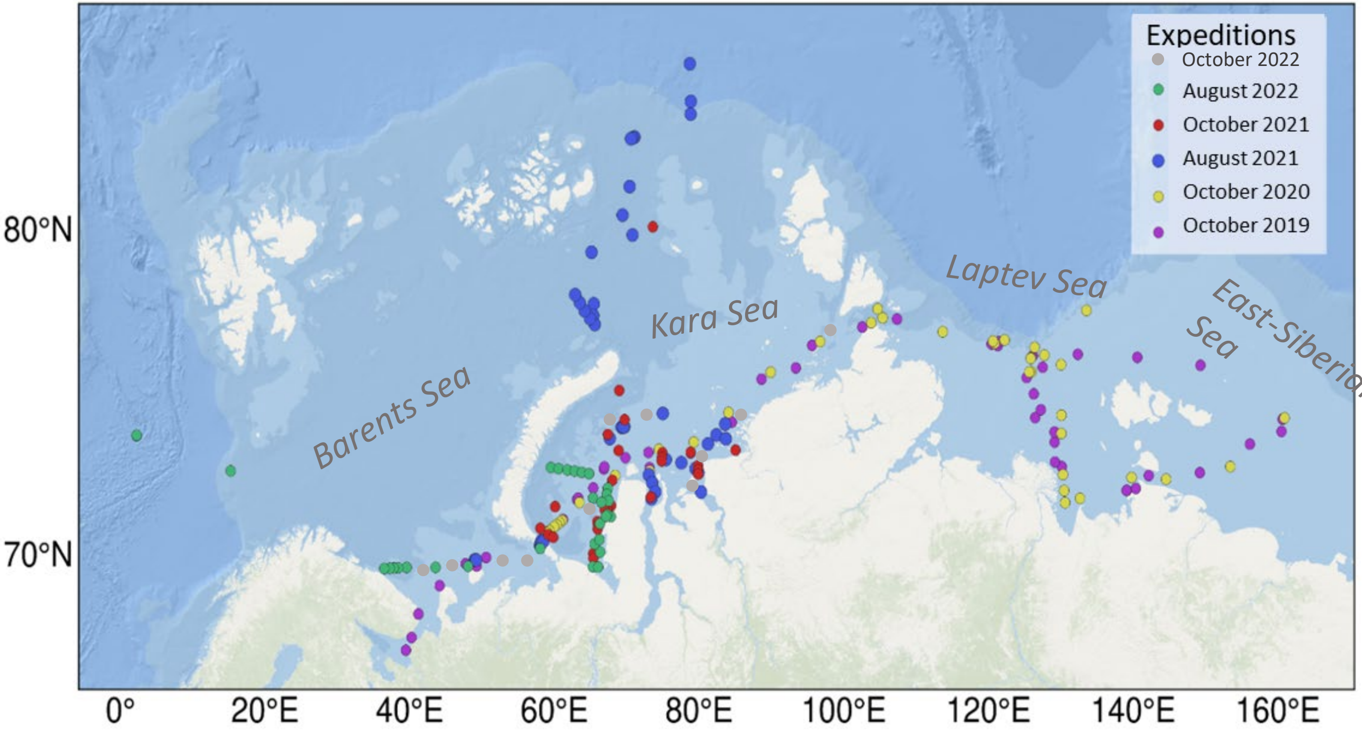
- Rivers
- Atlantic waters
- Local sources (marine traffic/fishery)



Global Linkages – A graphic look at the changing Arctic (rev.1). 2019. www.grida.no

About 240 stations in Eurasian Arctic Seas in 6 cruises 2019-2022

- Sampling of floating MPs with a neuston net (0.5-5 mm)
- Sampling of subsurface MPs with a pump from 3-5 m depth (0.1-5 mm)
- Identification of all potential plastic particles on FT-IR
- Abundance + Mass concentration

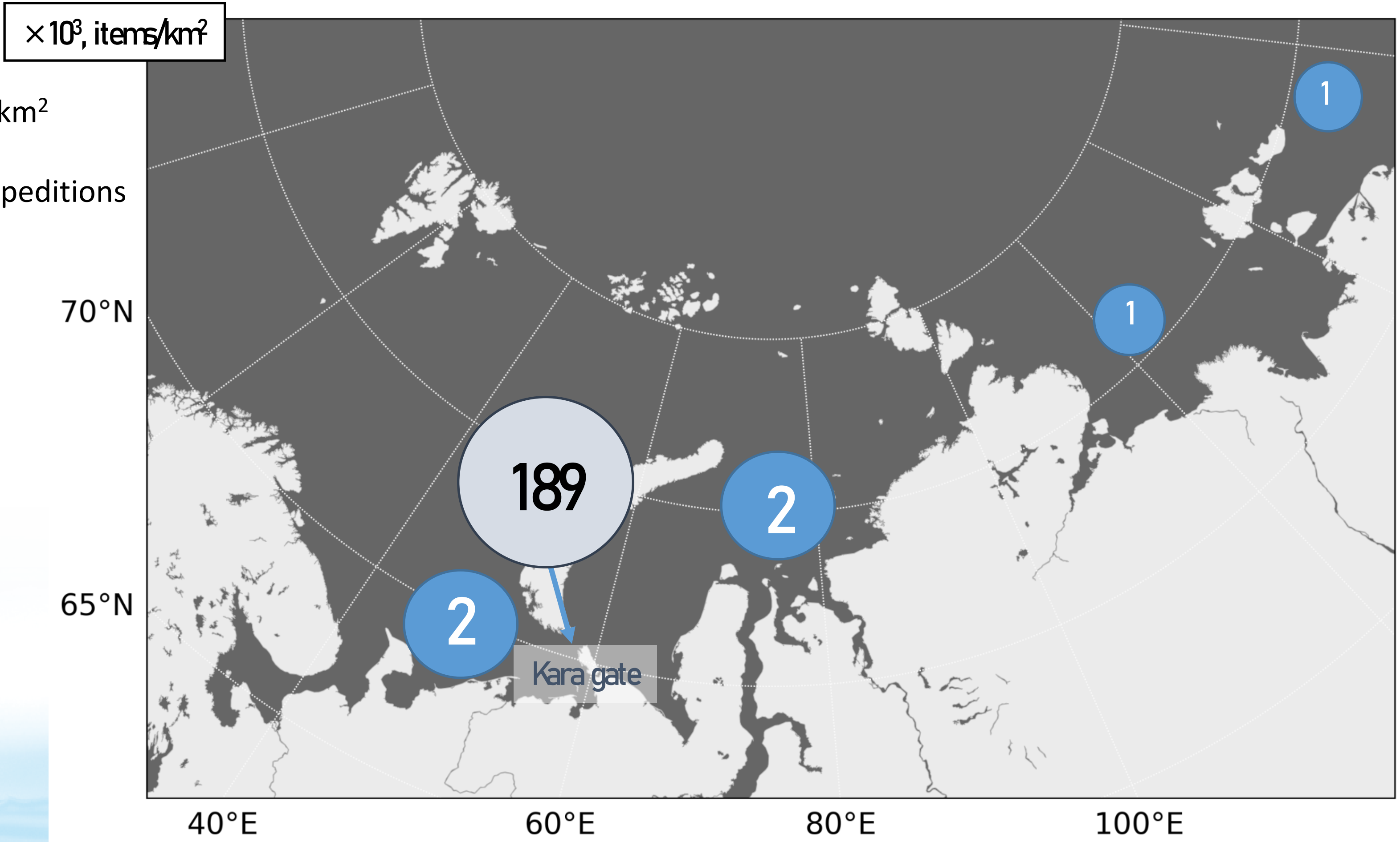


Distribution of floating microplastics in the Eastern Arctic (2019-2022)

0 – 19000 items/km^2

Average for all expeditions

2000 items/km^2
0.01 items/m^3



Distribution of floating microplastics in the Eastern Arctic (2019-2022)

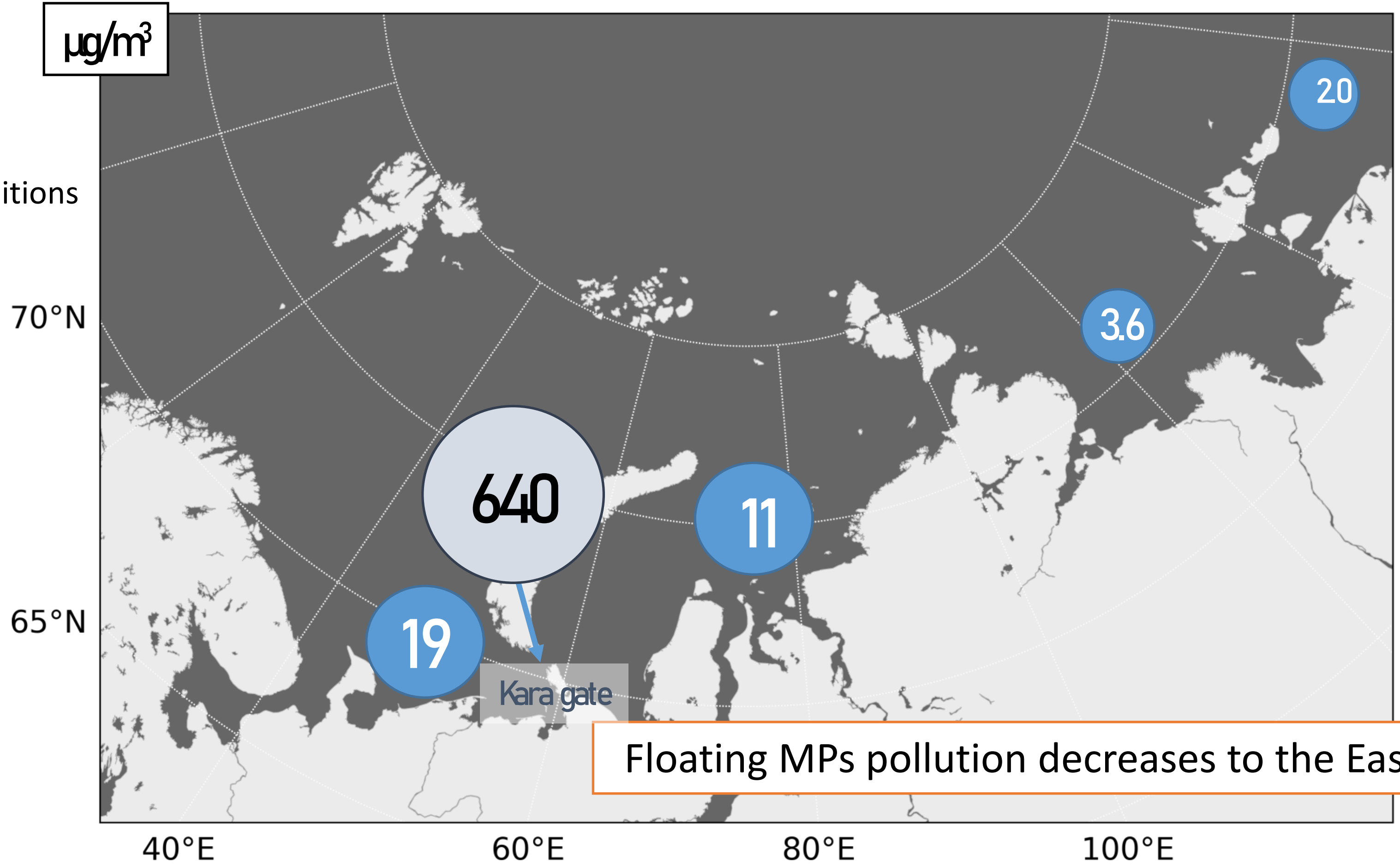
0 – 19000 items/km^2

Average for all expeditions

2000 items/km^2
0.01 items/m^3

10.7 µg/m^3

SPM in seawater
40-400 mg/m^3



Floating MPs pollution decreases to the East

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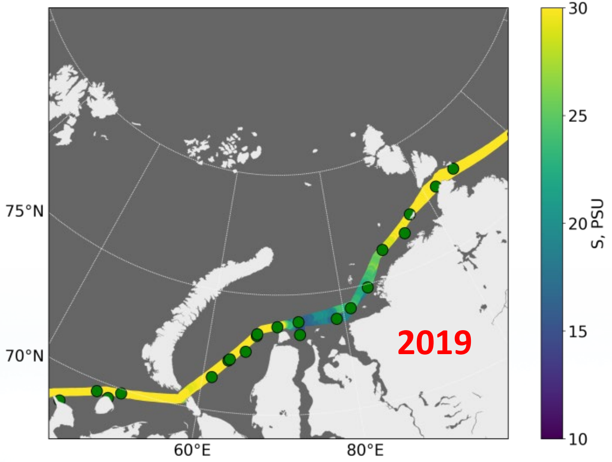
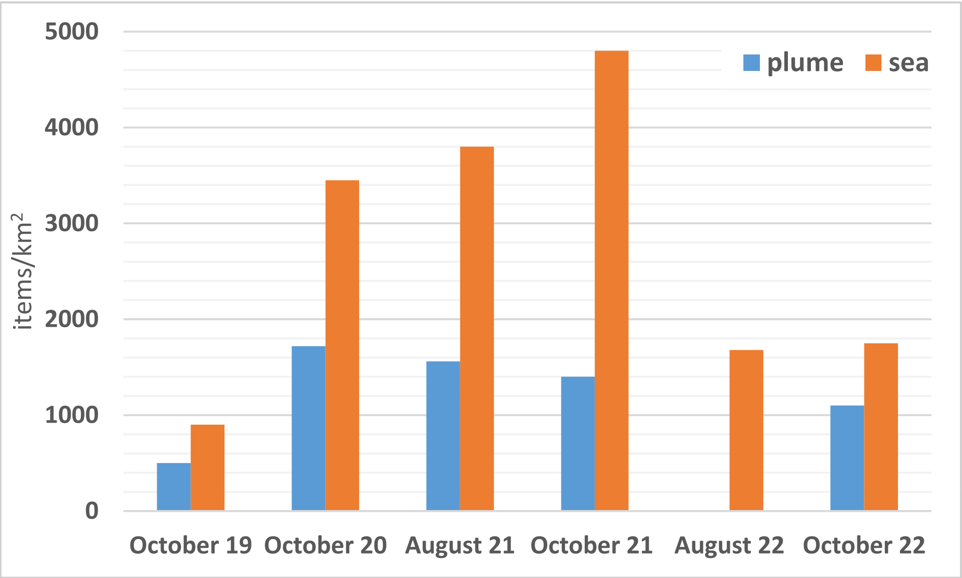
Abundance of MPs in the Kara Sea in accordance with water masses

Highly saline Atlantic/Barents Sea waters (S>28)
Plume of the Ob' and Yenisei (S<28)





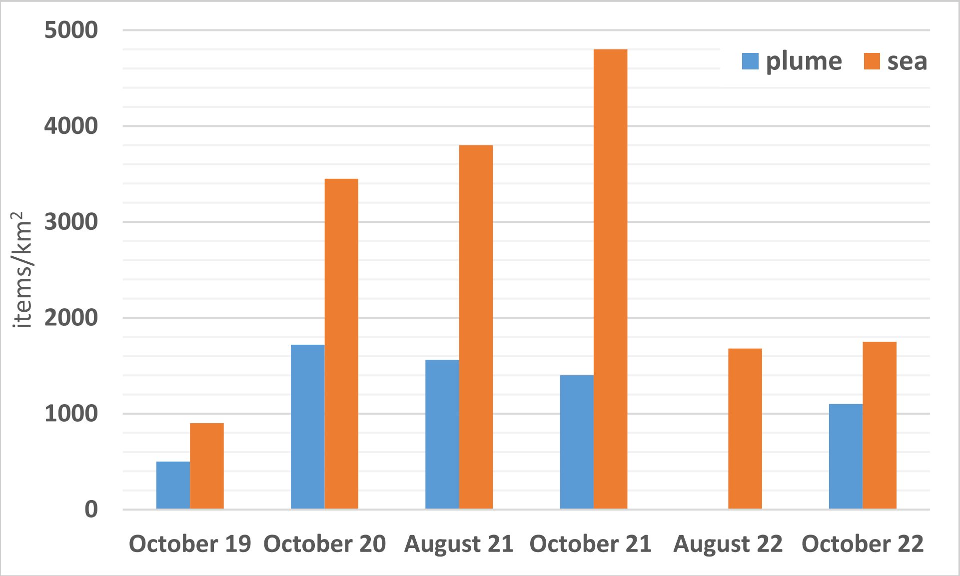
- River plumes contain less MPs than seawater
- River plumes work as a barrier to the transfer of MPs to the Siberian Arctic

Temporal variability of MPs in the Kara Sea

Highly saline Atlantic/Barents Sea waters (S>28)
Plume of the Ob' and Yenisei (S<28)

Is the increase true (greater release to the ocean) or

is it caused by different hydrophysical conditions affecting plastic transfer to the Kara Sea?

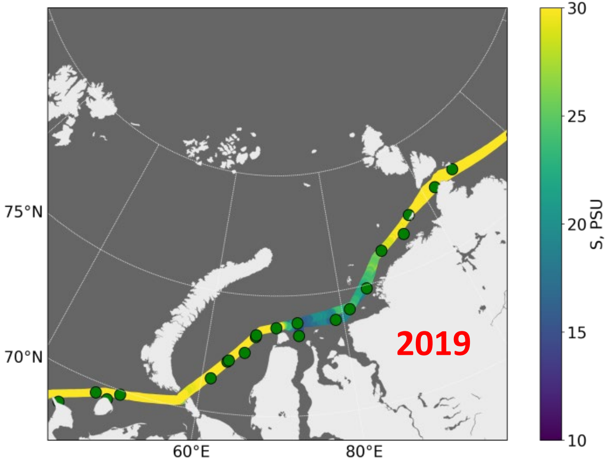


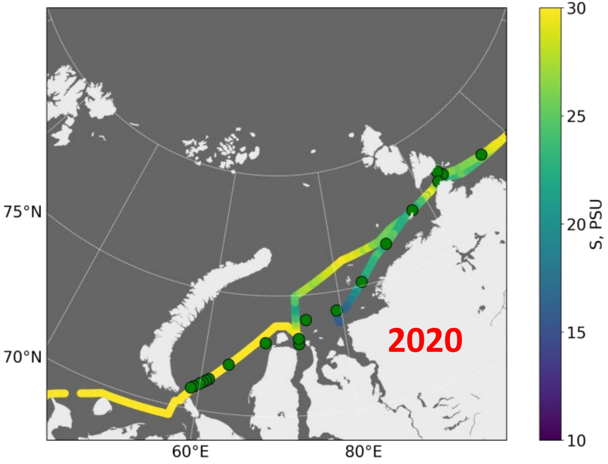
Need to compare:

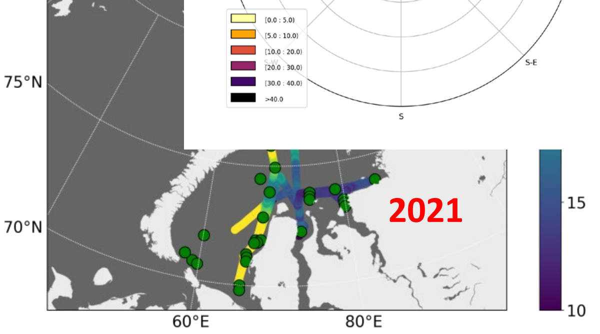
- River discharge
- Ice conditions
- Inflow of waters from the Barents Sea
- Shipping activity

Interannual variability in the Kara Sea

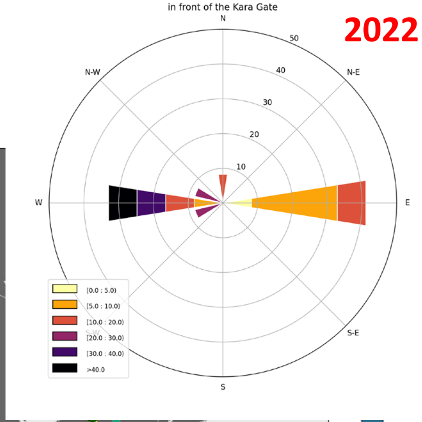
Sampling stations and surface salinity

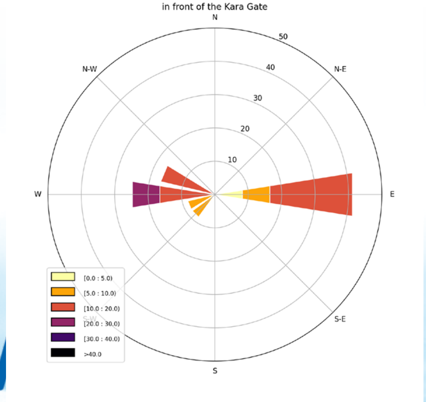


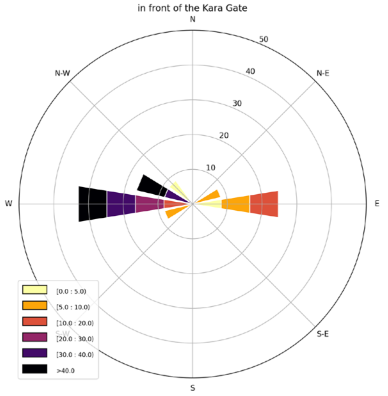


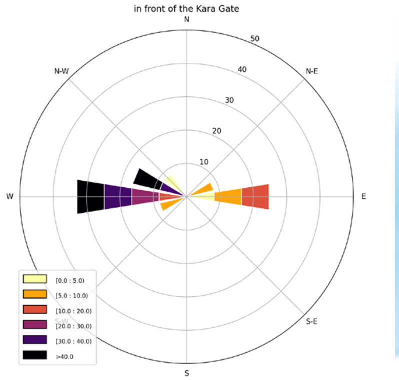


2022



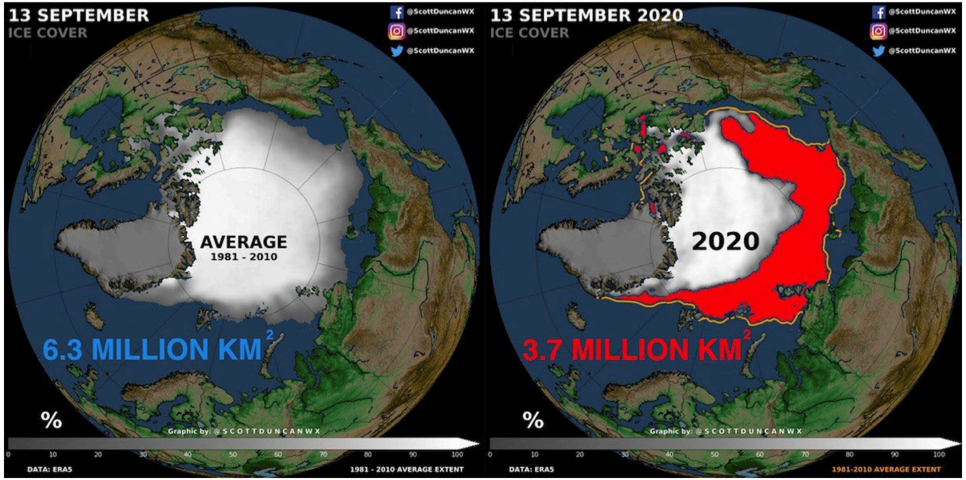






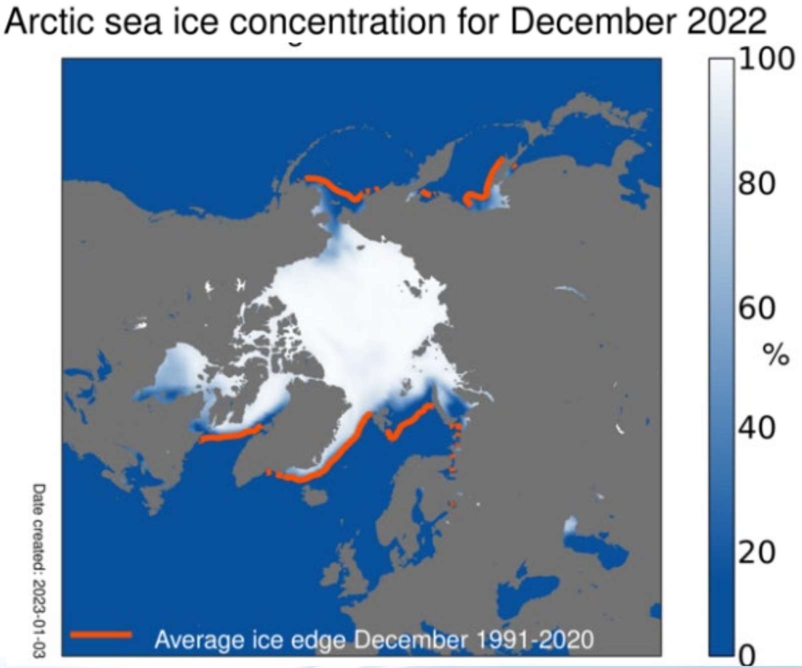
Ice conditions

- Plastics can cling to the edge of the ice, freeze and transfer to the other Arctic areas
- Large fragments can be crushed to the size of microplastics under freezing
- Plastics accumulated in the ice during cold years can release to the water during warm years
- **2020 ice extent anomaly coincides with observed sharp increase in MPs concentration**

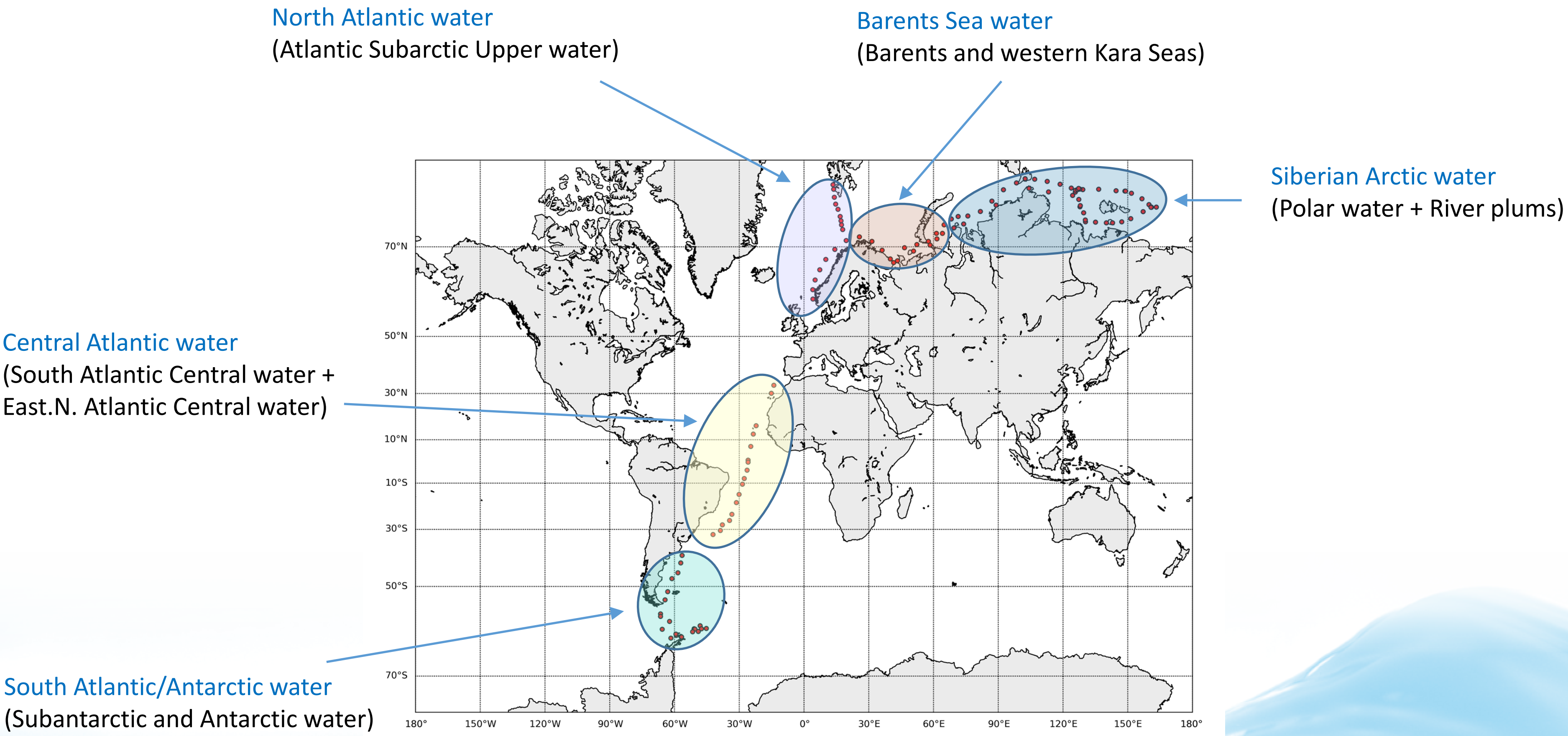


Inflow of waters from the North Atlantic/Barents Sea

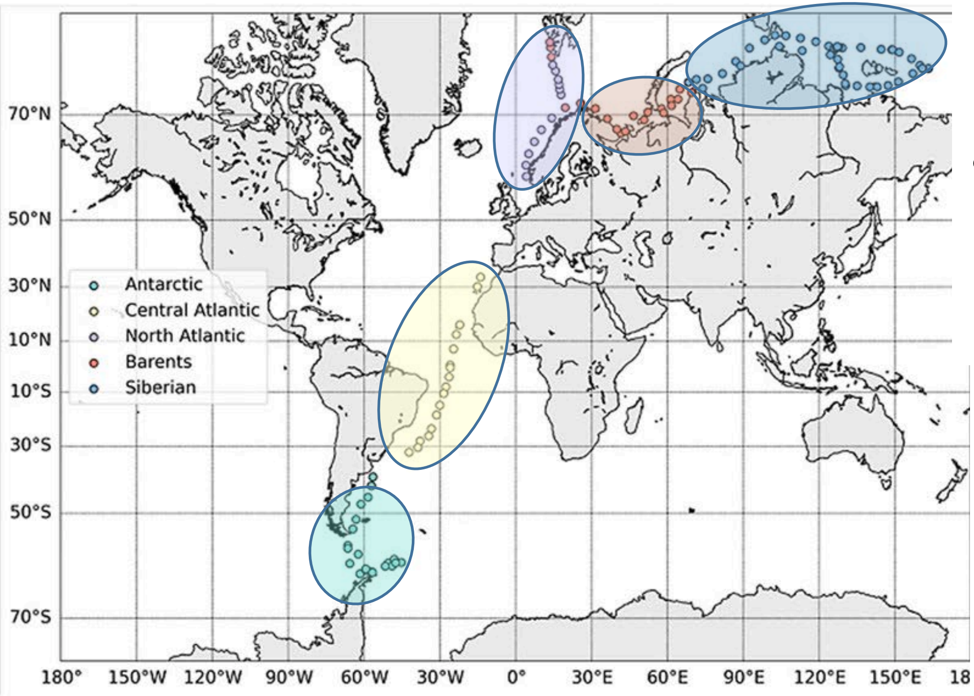
- Kara Sea is highly affected by Atlantification – deeper penetration of Atlantic waters into the Arctic Ocean
- The ice edge is shifting from the Barents to the Kara Sea, allowing MPs to penetrate into the Kara Sea for a longer period and accumulate there



https://climate.copernicus.eu/sea-ice



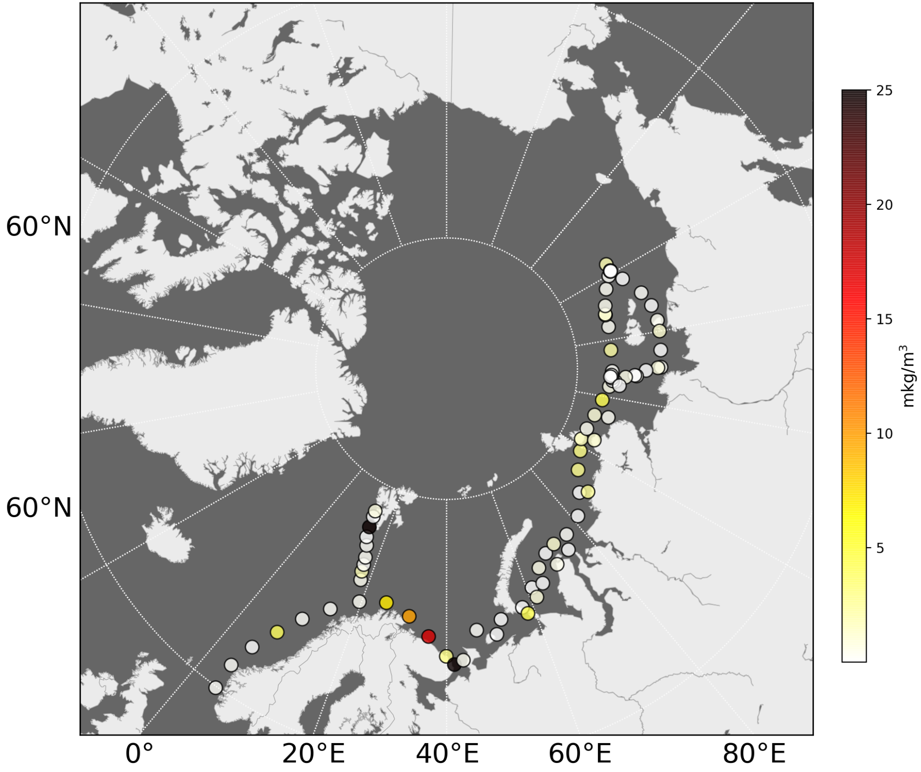
Sampling stations of **subsurface water** in 5 cruises in 2019



Water sampling positions during the 5 research cruises

- **Weight concentration was maximum in the C. Atlantic and the W. Barents Sea** (8 μg/m³ and 5 μg/m³) and minimum in the Siberian Arctic (0.6 μg/m³)
- **Maximum fibre abundance in the polar regions and the Siberian Rivers plumes.** Northern Hemisphere more polluted with synthetic fibers
- **Subsurface MPs had almost the same abundance in all studied regions (0.45-0.9 items/m³)**,
- Slightly higher values in the C. Atlantic and the Barents Sea compared with the Antarctic .

Weight concentration



Maximum weight concentration of microplastics was found in the western part of the Barents Sea

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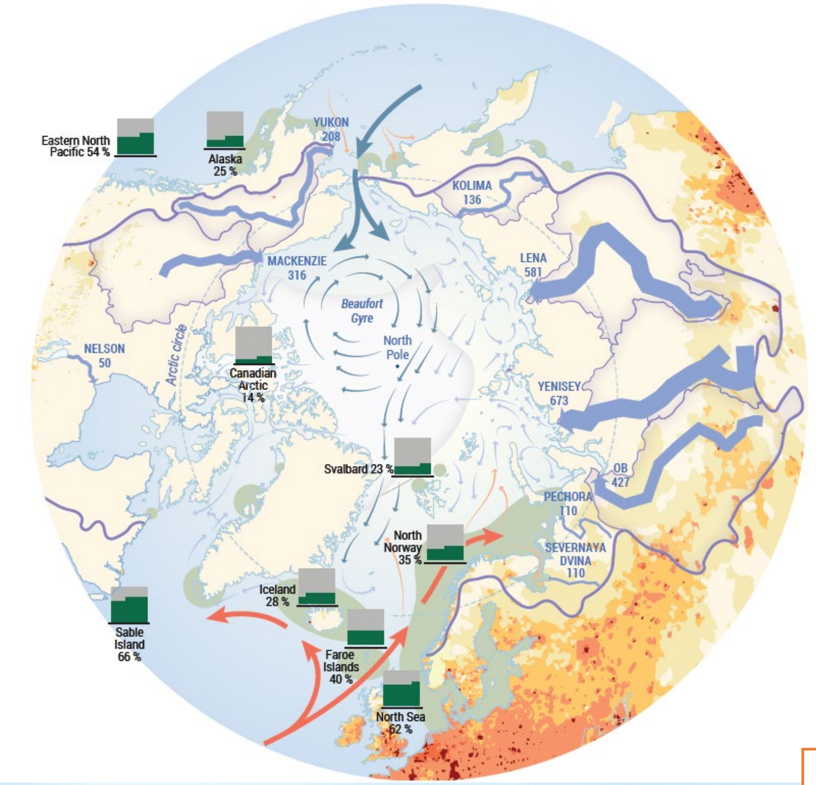
Sources of plastic in the Eurasian Arctic



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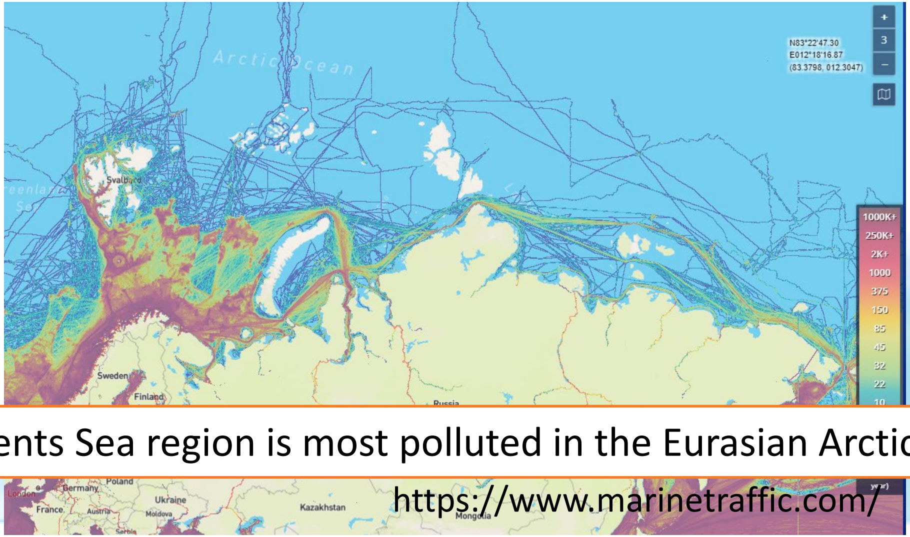
- Rivers
- Atlantic waters
- Local sources (marine traffic/fishery)

Rivers are not the main source of MPs in Arctic



Barents Sea region is most polluted in the Eurasian Arctic

https://www.marinetraffic.com/

Conclusions

- Level of floating microplastics pollution in Eurasian Arctic decreases to the East, from the Barents Sea to the East-Siberian Sea
- Siberian rivers bring less microplastics to the Arctic than it is found in the surrounding high-saline water that can be true for most of Arctic rivers
- No clear tendency in level of microplastics concentration was found in 2019-2022 in the Kara Sea. Observed changes were likely caused by changes of hydrophysical conditions in the studied area, which define microplastics transfer here
- Melting of ice could result in release of microplastics into the Arctic seas
- Atlantification of Arctic facilitates the transport of MPs from polluted Atlantic waters to the Siberian Arctic

Thank you

svp@niva.no

Evgeny Yakushev
Anfisa Berezina
Igor Zhdanov
Tatyana Polivanova
Amy Lusher
Bert van Bavel

frontiers | Frontiers in Marine Science

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National Research Council (CNR), Italy

Surface microplastics in the Kara Sea: from the Kara Gate to the 83°N

Anfisa Berezina[1*], Svetlana Pakhomova[1], Igor Zhdanov[2], Olga Mekhova[2,3], Tatiana Polivanova[2,4], Matvei Novikov[2,5], Maria Pogojeva[2,6,7], Alexander Osadchiev[2,8], Natalia Stepanova[2] and Evgeniy Yakushev[1]

COMMUNICATIONS EARTH&ENVIRONMENT

ARTICLE

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Microplastics distribution in the Eurasian Arctic is affected by Atlantic waters and Siberian rivers

Evgeniy Yakushev[1,2✉], Anna Gebruk[3,4✉], Alexander Osadchiev[2,5], Svetlana Pakhomova[1,2], Amy Lusher[1], Anfisa Berezina[6], Bert van Bavel[1], Elena Vorozheikina[7], Denis Chernykh[8], Glafira Kolbasova[9], Ilia Razgon[9] & Igor Semiletov[8,10]

ELSEVIER

Environmental Pollution
Volume 298, 1 April 2022, 118808

ENVIRONMENTAL POLLUTION

Microplastic variability in subsurface water from the Arctic to Antarctica ☆

Svetlana Pakhomova [a, b], Anfisa Berezina [b, c], Amy L. Lusher [a, d], Igor Zhdanov [b], Ksenia Silvestrova [b], Peter Zavialov [b], Bert van Bavel [a], Evgeniy Yakushev [a, b, e]

Norwegian Ministry of Climate and Environment projects “ESCIMO” and “MAMBA”

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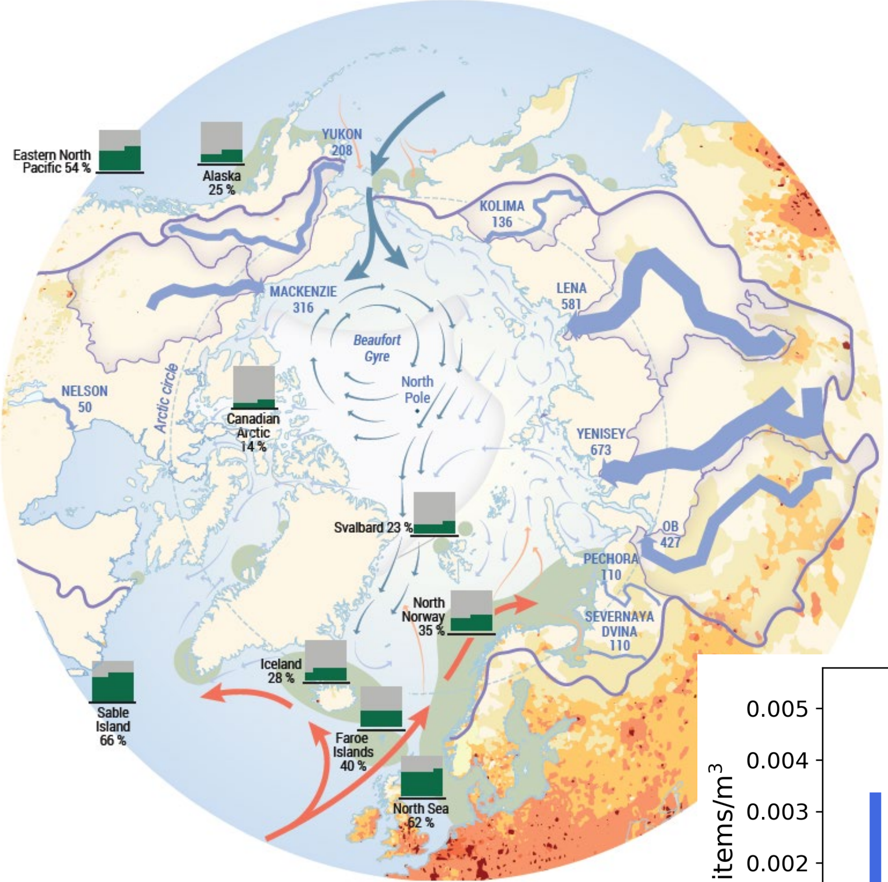
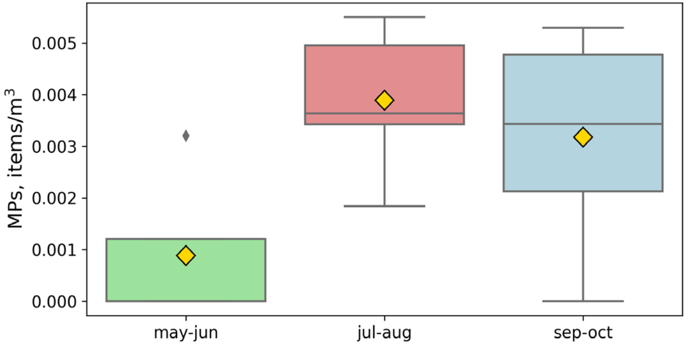
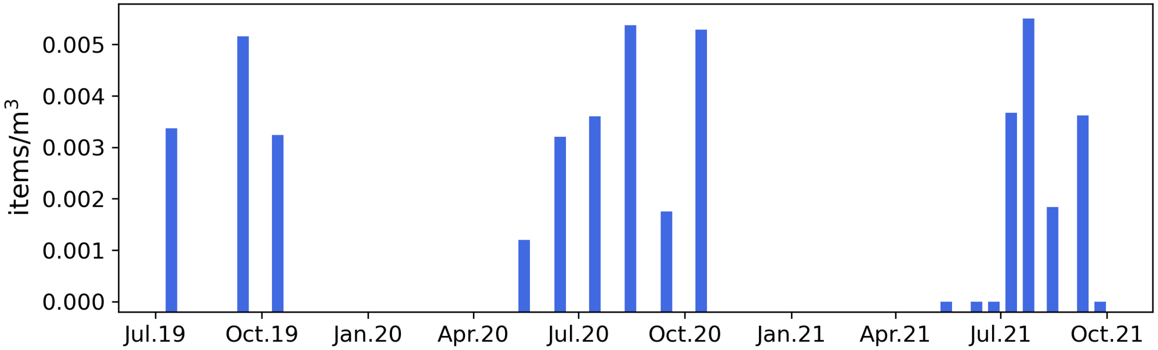
Miljø-direktoratet

- **Northern Dvina is the 6th main Arctic river and a single one flowing through populated region.**







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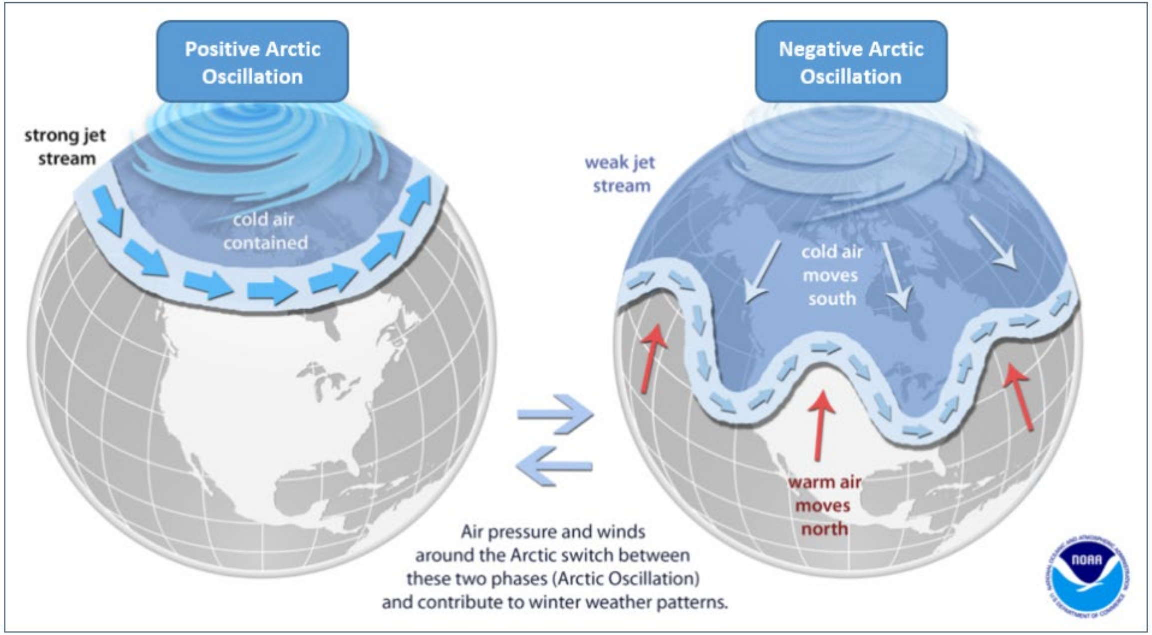

Fig. 2: A schematic diagram showing the characteristics of the polar jet during the positive and negative phases of the North Atlantic Oscillation

2019	-0.71	1.15	2.12	-0.26	-1.23	-0.60	-0.89	-0.72	0.31	0.08	-1.19	0.41	-0.13
2020	2.42	3.42	2.64	0.93	-0.03	-0.12	-0.41	-0.38	0.63	-0.07	2.09	-1.74	0.78
2021	-2.48	-1.19	2.11	-0.20	-0.16	0.84	0.63	-0.22	-0.25	-0.14	0.10	0.20	-0.06
2022	0.85	1.56	0.25	-0.61	1.22	-0.08	0.02	-0.18	-0.66	1.35	0.34	-2.72	0.11

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