River discharge as a source of microplastic pollution in the Peter the Great Gulf (Northwest Pacific Russia)

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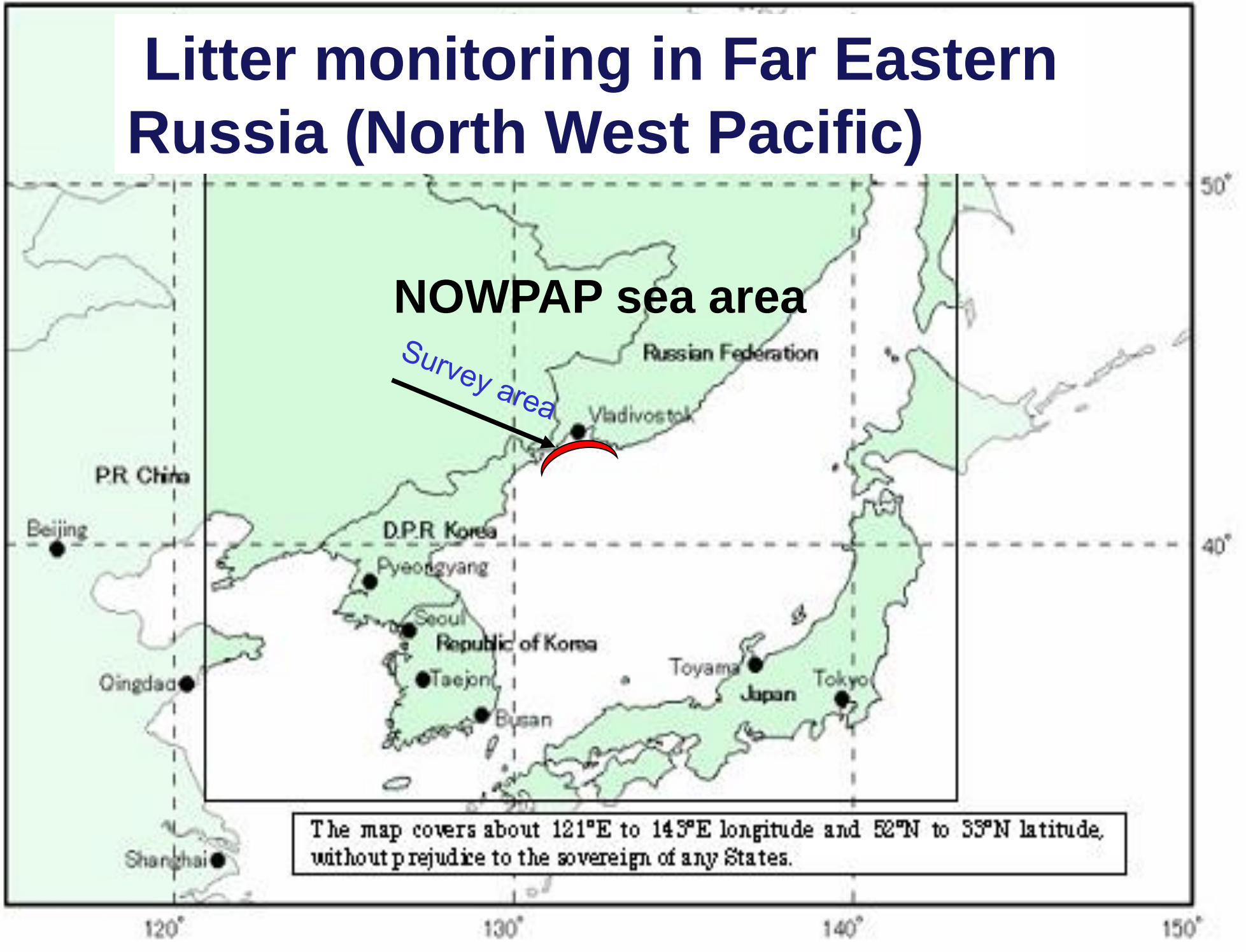
Pacific Geographical Institute FEB RAS

Litter monitoring in Far Eastern Russia (North West Pacific)



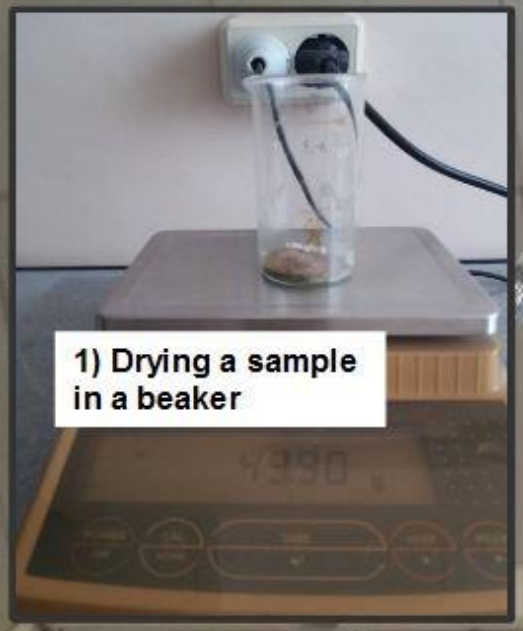
Microplastic survey in the Far Eastern Russia

‘Report on the microplastic content and migration in the Peter the Great Gulf’ to be published in late 2017

Survey methods

- **Sampling of seawater along the coastline using plankton/neuston net (mesh size 0.1 mm)**
- **Treatment of the collected samples.**
- **Defining size and morphological structure of obtained specimens using a microscope;**
- **Determining polymeric structure of plastics based on their FTIR-spectra;**
- **Calculating concentrations of plastic particles in the seawater and mapping.**

❖ Sample preparation



1) Drying a sample in a beaker

2) Adding 20 ml (or more) H_2O_2 + 20 ml of 0.05 M Fe(II) water solution

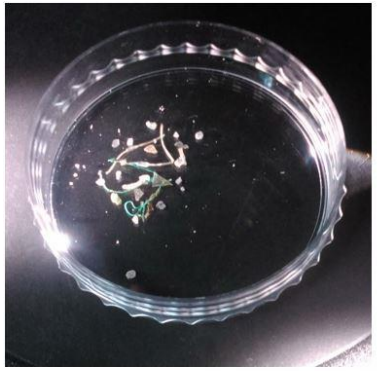
3) Adding 6 g NaCl (per 20ml) after the reaction

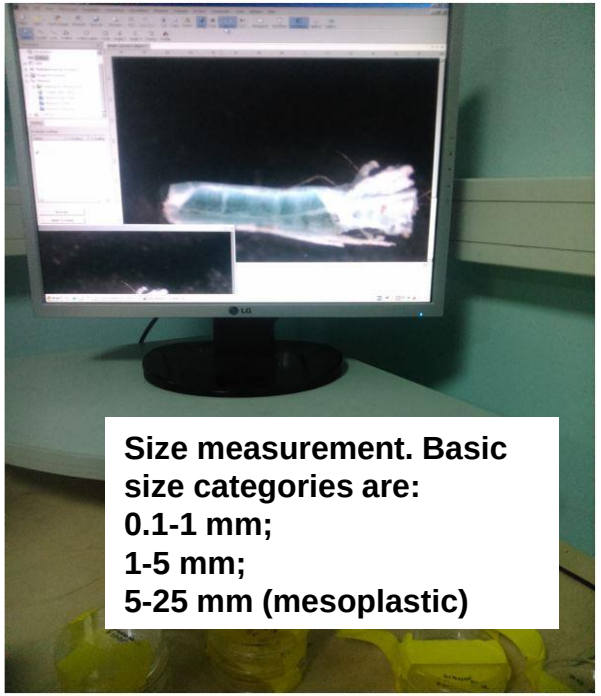
4) Density separation

5) Filtering (filter diameter 47mm, pore size 5 µm)

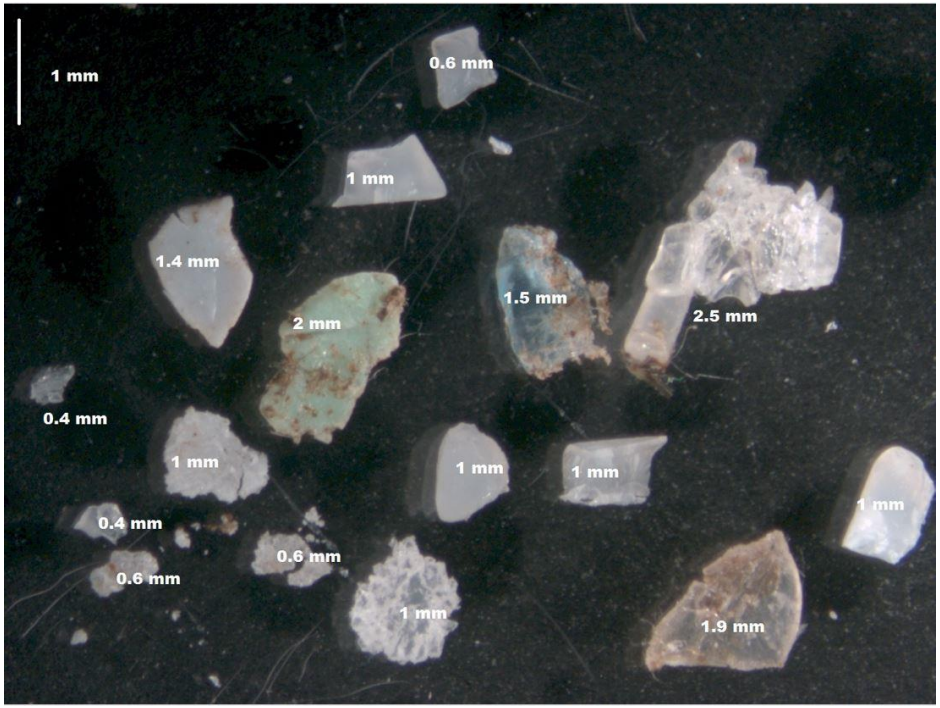
6) Transfer to Petri dish

❖ Type/size identification

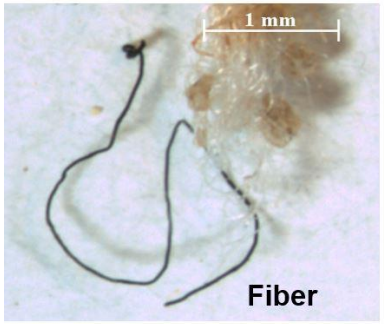


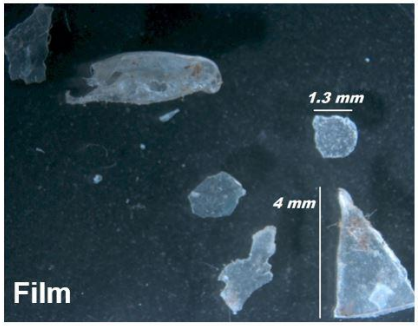


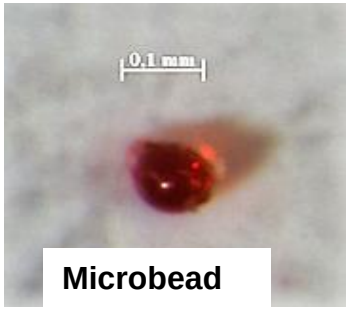
Size measurement. Basic size categories are:
0.1-1 mm;
1-5 mm;
5-25 mm (mesoplastic)

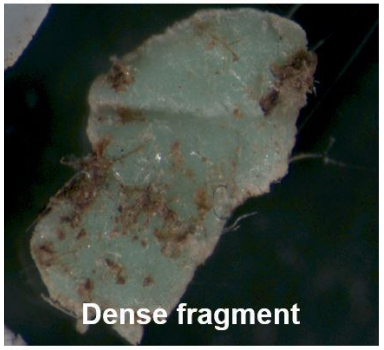


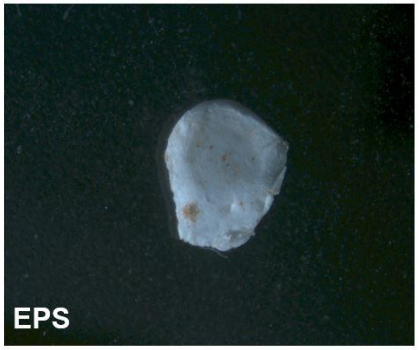
Basic types



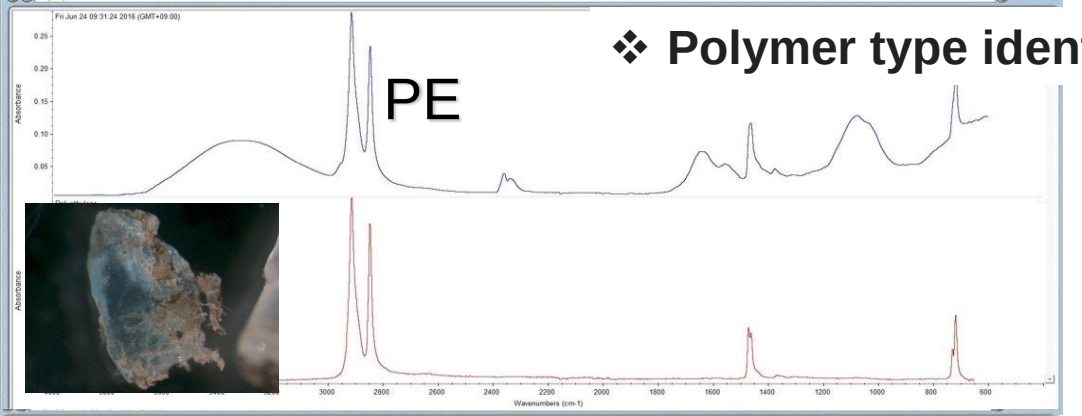


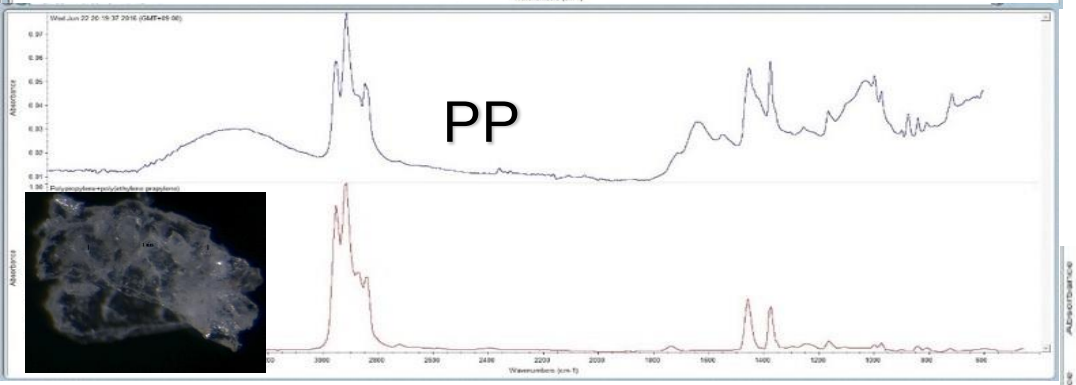


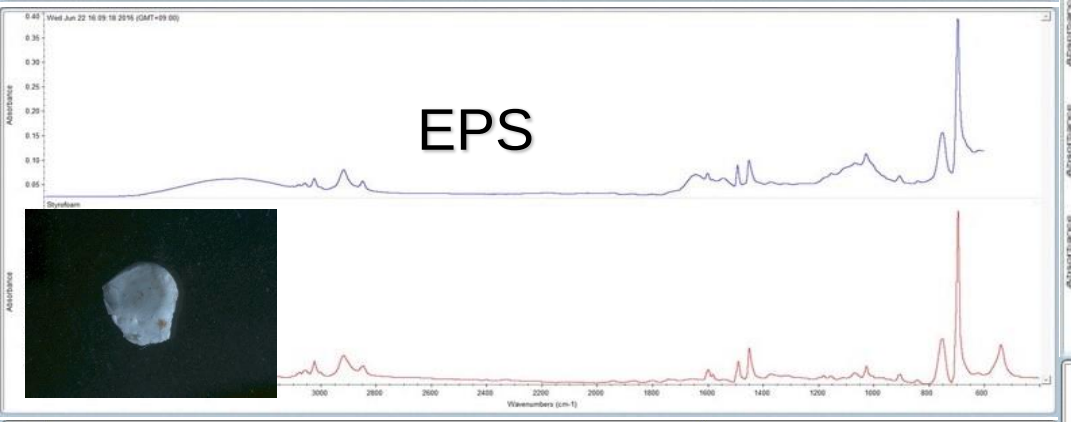


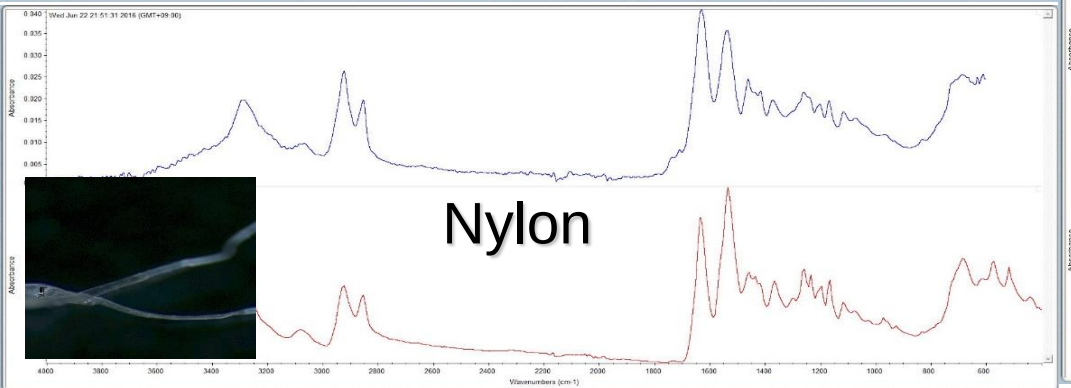


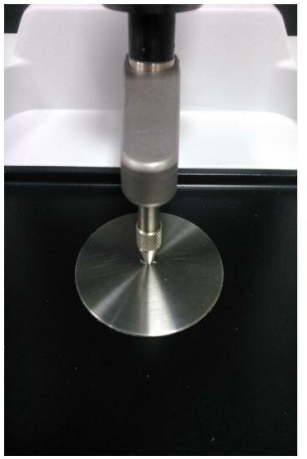
❖ Polymer type identification



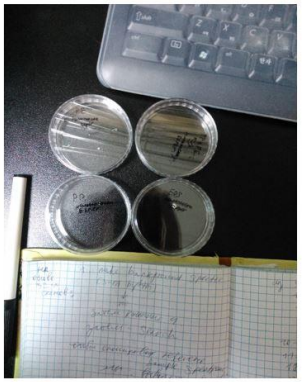


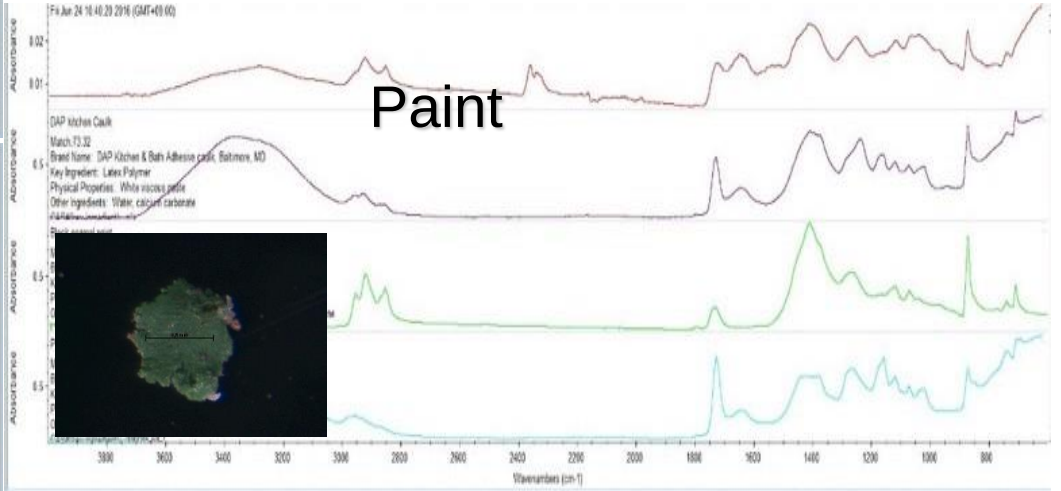


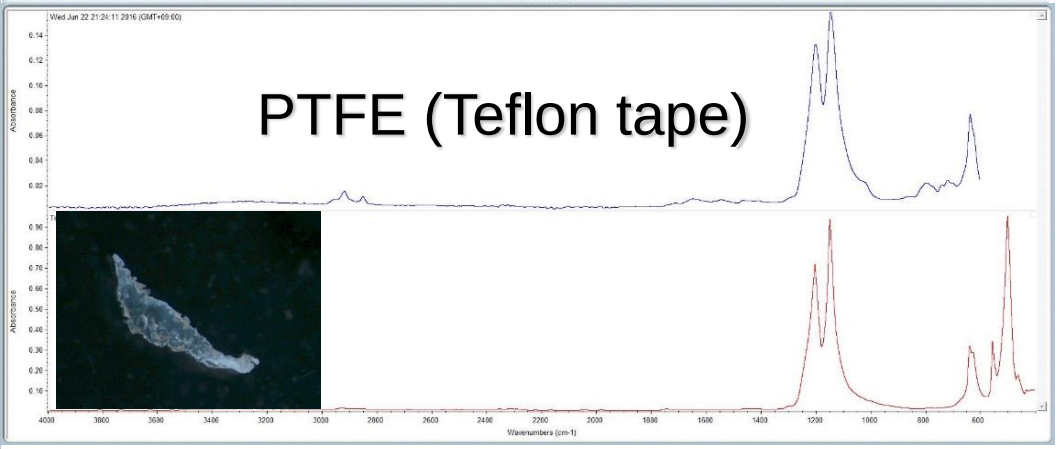


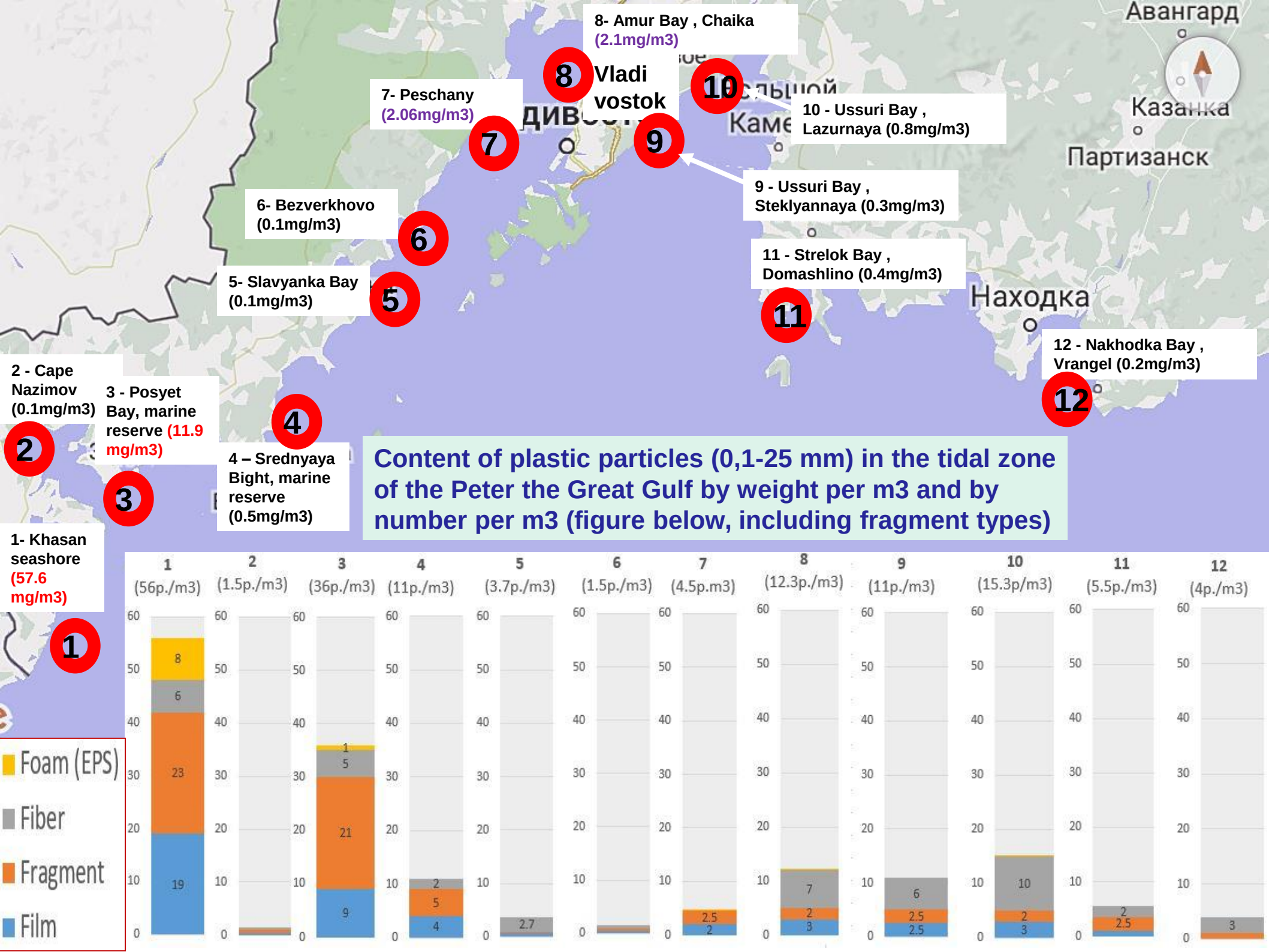


ATR FTIR spectroscopy

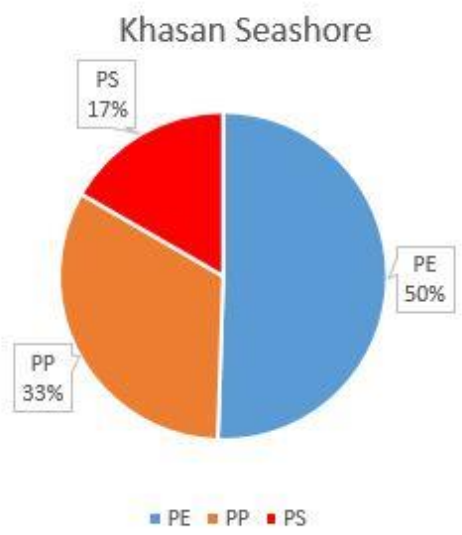


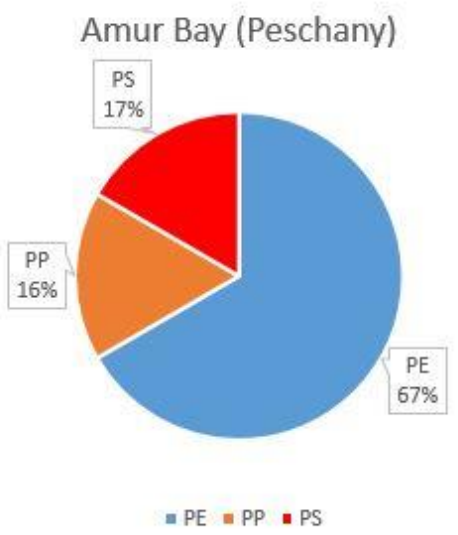


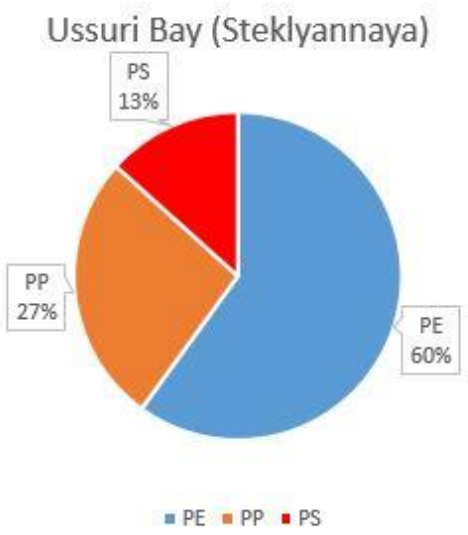


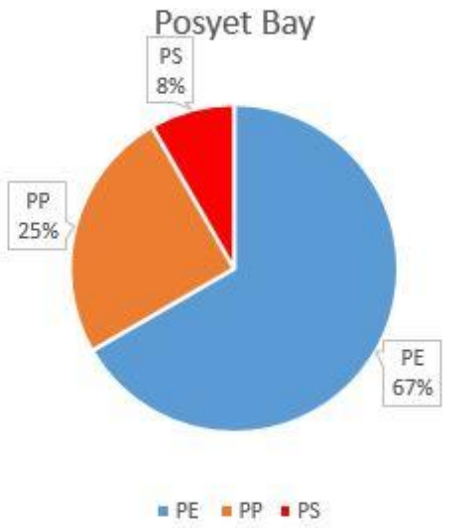

8- Amur Bay , Chaika (2.1mg/m3)
8
Vladi vostok
10
10 - Ussuri Bay , Lazurnaya (0.8mg/m3)
7- Peschany (2.06mg/m3)
7
9
9 - Ussuri Bay , Steklyannaya (0.3mg/m3)
6- Bezverkhovo (0.1mg/m3)
6
11 - Strelok Bay , Domashlino (0.4mg/m3)
5- Slavyanka Bay (0.1mg/m3)
5
11
12 - Nakhodka Bay , Vrangel (0.2mg/m3)
12
2 - Cape Nazimov (0.1mg/m3)
3 - Posyet Bay, marine reserve (11.9 mg/m3)
4
2
3
4 – Srednyaya Bight, marine reserve (0.5mg/m3)
1- Khasan seashore (57.6 mg/m3)
1
Авангард
Казанка
Партизанск
Находка
Content of plastic particles (0,1-25 mm) in the tidal zone of the Peter the Great Gulf by weight per m3 and by number per m3 (figure below, including fragment types)
1 (56p./m3)
2 (1.5p./m3)
3 (36p./m3)
4 (11p./m3)
5 (3.7p./m3)
6 (1.5p./m3)
7 (4.5p.m3)
8 (12.3p./m3)
9 (11p./m3)
10 (15.3p/m3)
11 (5.5p./m3)
12 (4p./m3)
Foam (EPS)
Fiber
Fragment
Film

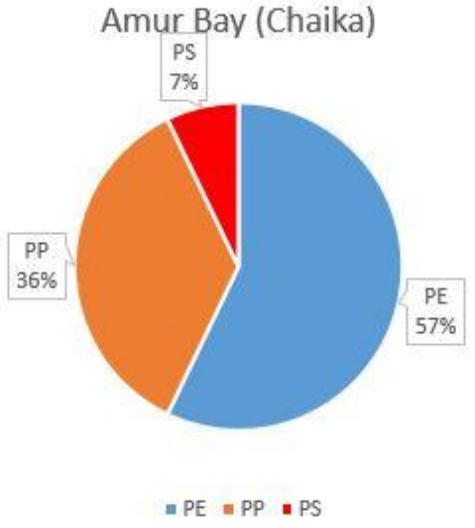
Ratio of basic polymer types of floating MP

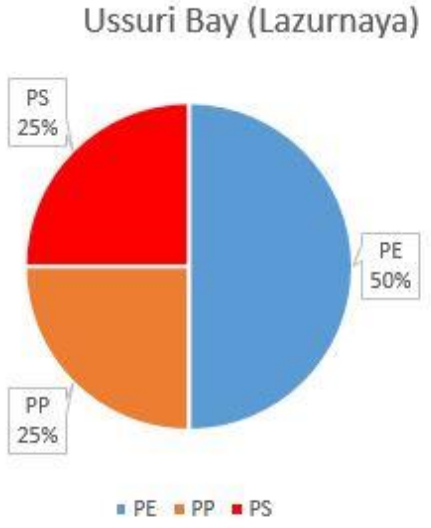












Suggested sources of microplastic contamination in the coastal area of the Peter the Great Gulf

According to the results of this survey, we suggest that the basic sources of microplastic pollution in the study area are as follows:

1)Untreated discharge of domestic water from coastal inhabited localities;

1)Degradation of larger litter, which comes from land, fisheries and aquaculture on beaches (mostly remote);

3) Summer recreation; and

3) Riverine discharge in major rivers

Assessment of river water contamination with microplastic

To figure out the impact of larger rivers on microplastic contamination of sea area, we collected samples from the Tumen River, the Razdolnaya River, and six smaller rivers discharging into the sea. We used gasoline pump with capacity of 15m3 per hour to filter the water through 0.1 mm mesh for sampling from depth below 20 cm, and a neuston net for surface sampling (mesh size 0.1 mm, mouth width 0.5 m).

Sampling sites (rivers discharging into the Northwest Pacific)

Amba

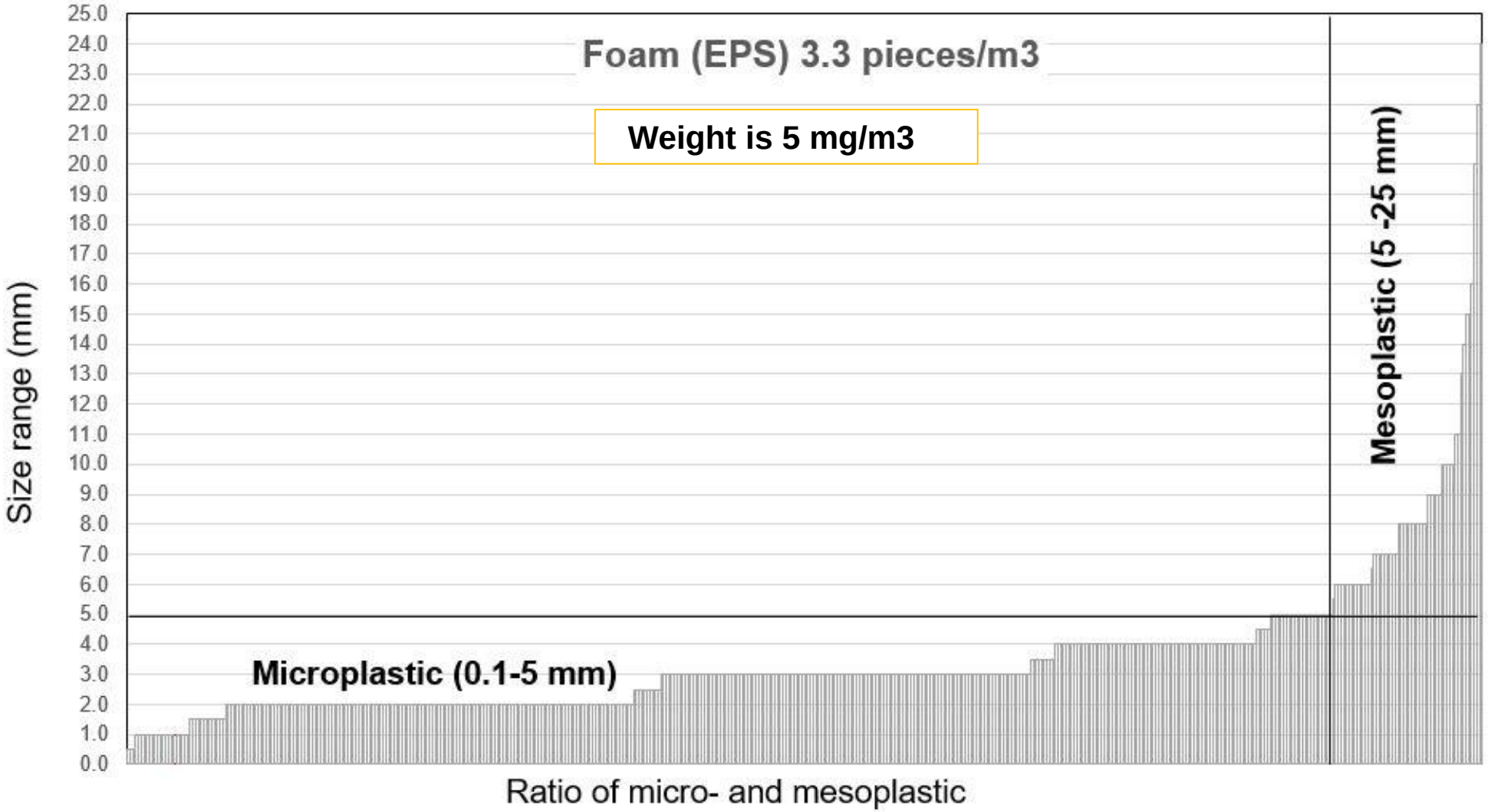
Suifenhe

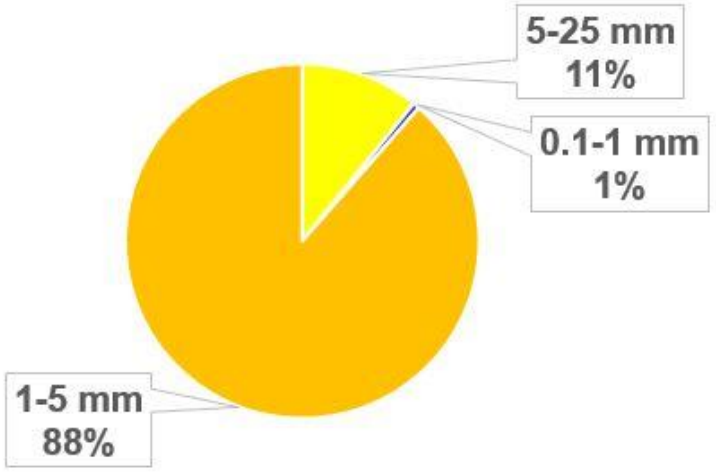
Barabashevka

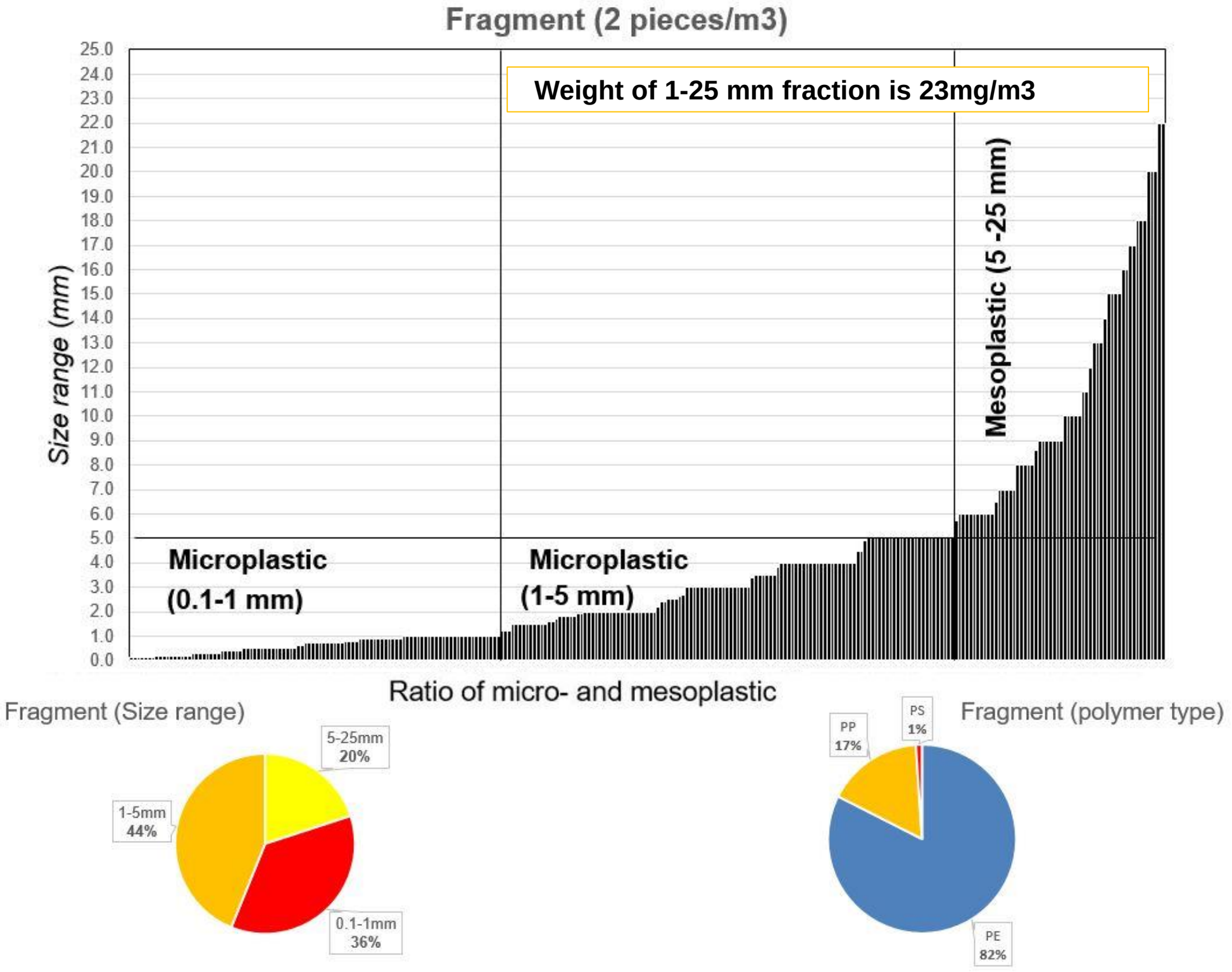
Partizanskaya

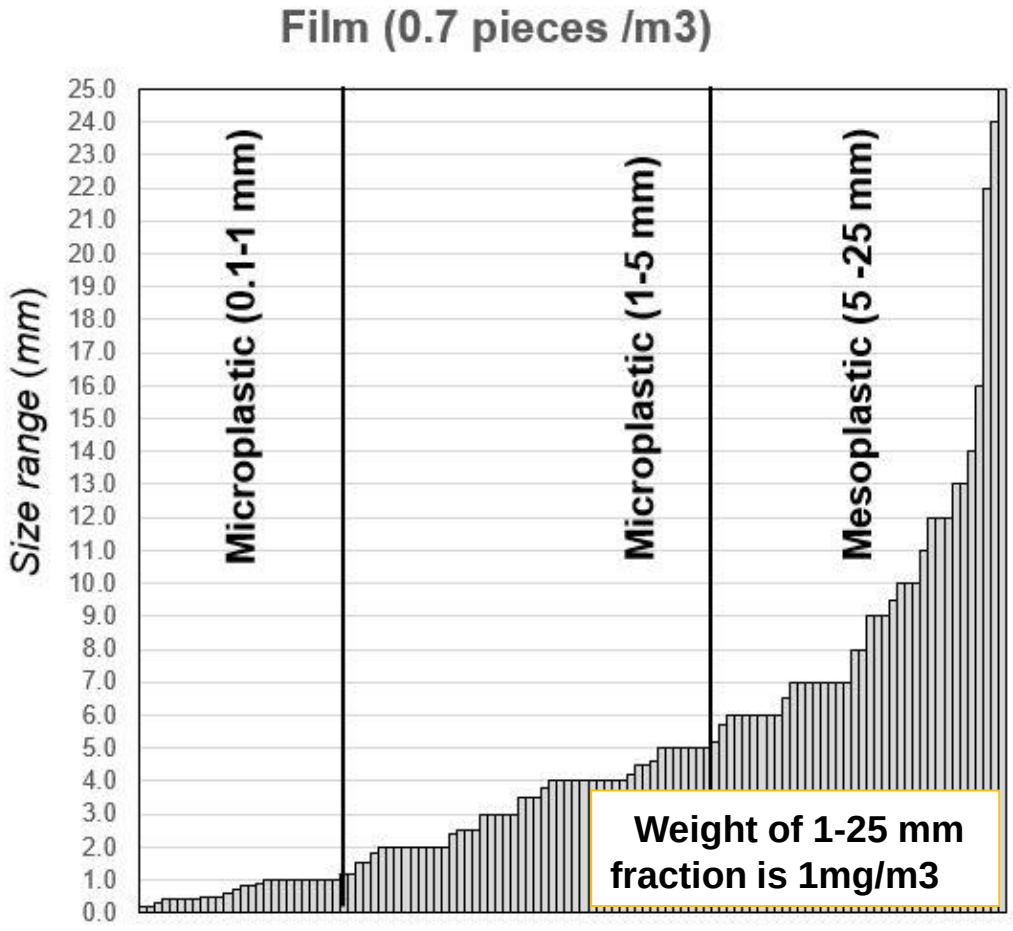
Rivers	Length, km	Drainage basin, km²	Mean annual discharge, m³/s	Volume of filtered water, m³	Presence of micro- and mesoplastics
1)Tumen*	516	33,168	215	152	Yes
2)Tsukanovka	29	175	2.26	63.7	No
3)Narva	38	332	6.24	22	No
4)Barabashevka	68	576	9.10	19.5	No
5)Amba	63	330	4.98	30.6	No
6)Razdolnaya/Suifen*	245	16,830	81.3	68	Yes
7)Partizanskaya	142	4,140	36.9	27	No
8)Kievka	105	3,120	29.8	45.6	No

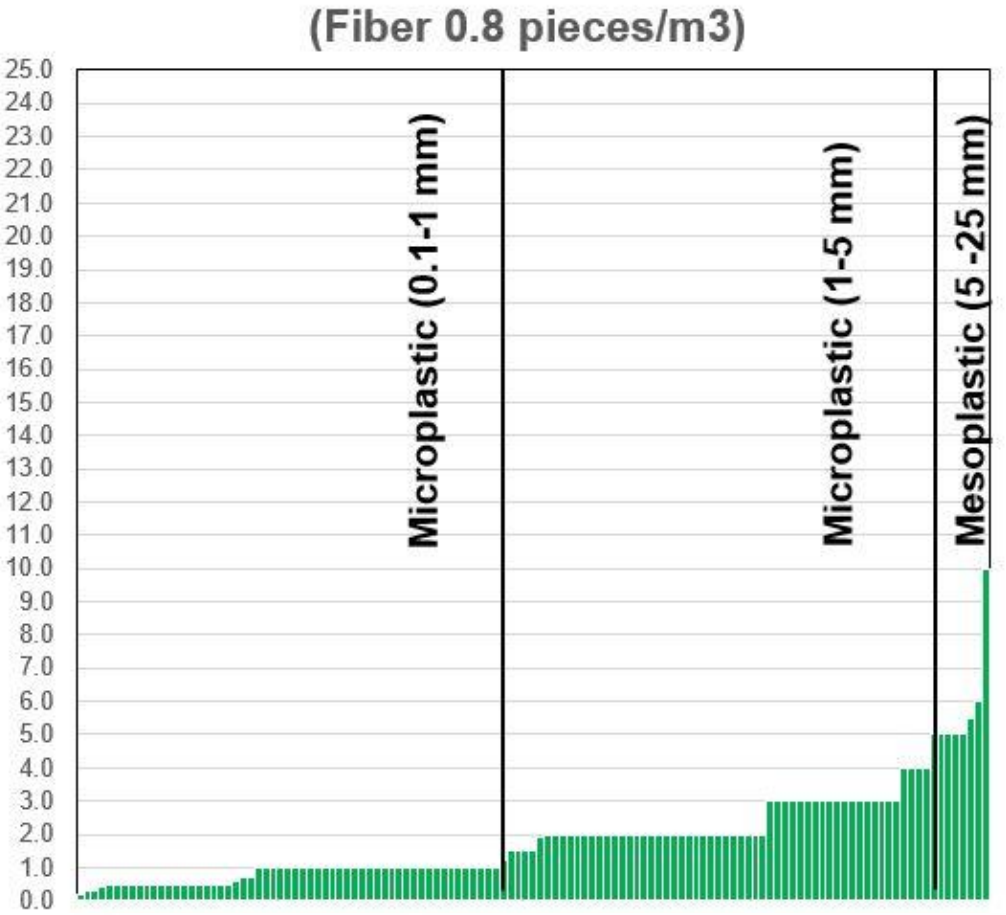
* Transboundary rivers


Foam (EPS) 3.3 pieces/m3
Weight is 5 mg/m3
Size range (mm)
25.0
24.0
23.0
22.0
21.0
20.0
19.0
18.0
17.0
16.0
15.0
14.0
13.0
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Microplastic (0.1-5 mm)
Mesoplastic (5 -25 mm)
Ratio of micro- and mesoplastic

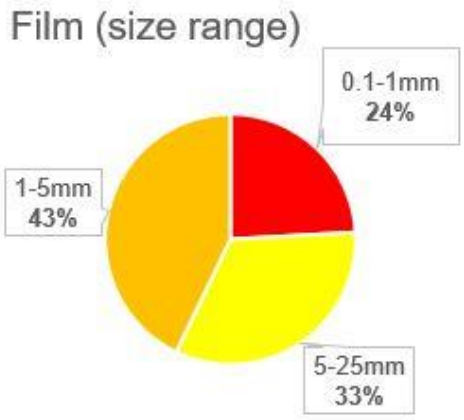

5-25 mm
11%
0.1-1 mm
1%
1-5 mm
88%

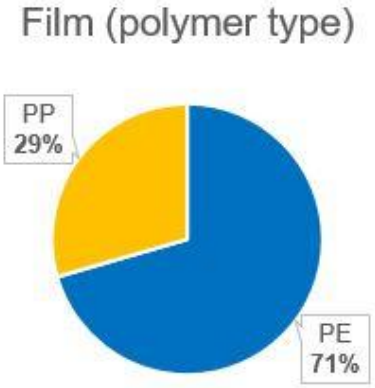

Fragment (2 pieces/m3)
Weight of 1-25 mm fraction is 23mg/m3
Size range (mm)
25.0
24.0
23.0
22.0
21.0
20.0
19.0
18.0
17.0
16.0
15.0
14.0
13.0
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Microplastic
(0.1-1 mm)
Microplastic
(1-5 mm)
Mesoplastic (5 -25 mm)
Ratio of micro- and mesoplastic
Fragment (Size range)
5-25mm
20%
1-5mm
44%
0.1-1mm
36%
Fragment (polymer type)
PP
17%
PS
1%
PE
82%

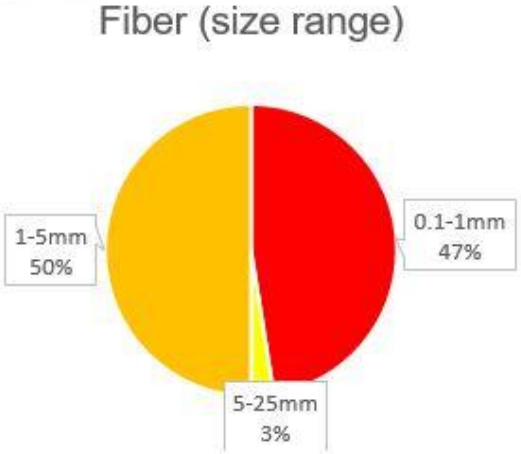




Ratio of micro- and mesoplastic

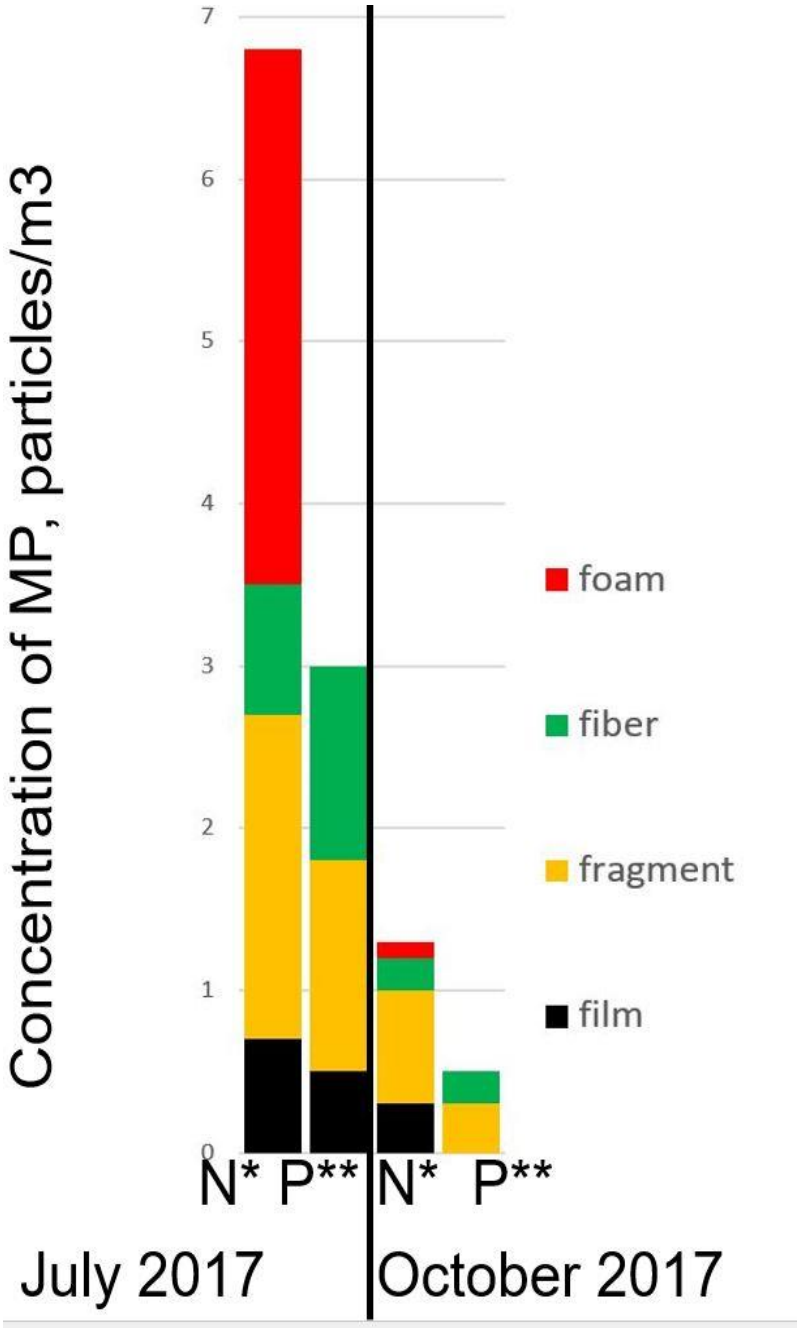




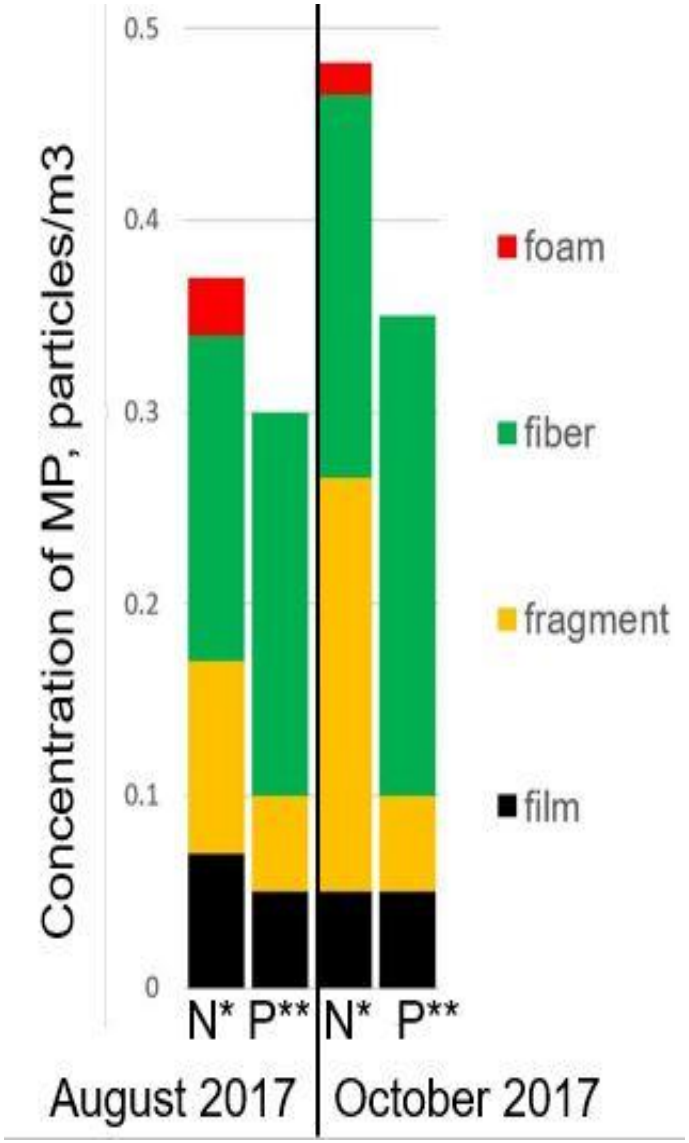


Polymer types:

We registered nylon, polyester, PP, PS, and PE.



Tumen River



Suifen River


Thank you very much
for your attention!!!