

Field survey of micro-plastics in two different intertidal sediments of China

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A short review of China's marine
microplastics research...



Environmental Pollution

Microplastic in three urban estuaries, China


Shiye Zhao, Limin Zhu, Danji Li



Marine Pollution Bulletin

Suspended microplastics in the surface water of the Yangtze Estuary System, China: First observations on occurrence, distribution


Shiye Zhao, Limin Zhu, Teng Wang, Danji Li



Regional Studies in Marine Science

Characterization of small plastic debris on tourism beaches around the South China Sea

Shiye Zhao, Limin Zhu, Danji Li



Surface sea water and estuarine water



Surface sediment (0-5 cm) only at high tide line

What China's scientists usually do in laboratories...

- Floating of the plastics on high-density sodium polytungstate solutions (1.4 g/ml);
- Visual examination of the plastics (microplastics and macroplastics) (**no pre-fractionization by size**)
- Pick-up of microplastics with use of callipers for counting under microscopes (**time consuming; experienced staff required**)
- Chemical characterization with micro-Raman Spectroscopy and spectra were compared to reference plastics materials

The objective of this project...

- ✓ The importance of intertidal regions;
- ✓ Sandy vs. muddy sediment;
- ✓ An approach applicable in the field;
- ✓ An approach easy to employ by the public (not scientists in sophisticated laboratories);
- ✓ Involvement of NGOs for outreach

Sampling sites and seasons...





Russia

Sea of Okhotsk

Kazakhstan

Mongolia

Dalian

Sea of Japan

Uzbekistan
Kyrgyzstan

China

South Korea

Japan

Afghanistan

Shanghai

East China Sea

Pakistan

Nepal

India

Myanmar
(Burma)

South
China Sea

Arabian Sea

Bay of Bengal

Thailand

Vietnam

Philippines

Gulf of
Thailand



August 29, 2014

Sandy beach, Fujiazhuang, Dalian



December 26, 2014



January 11, 2015

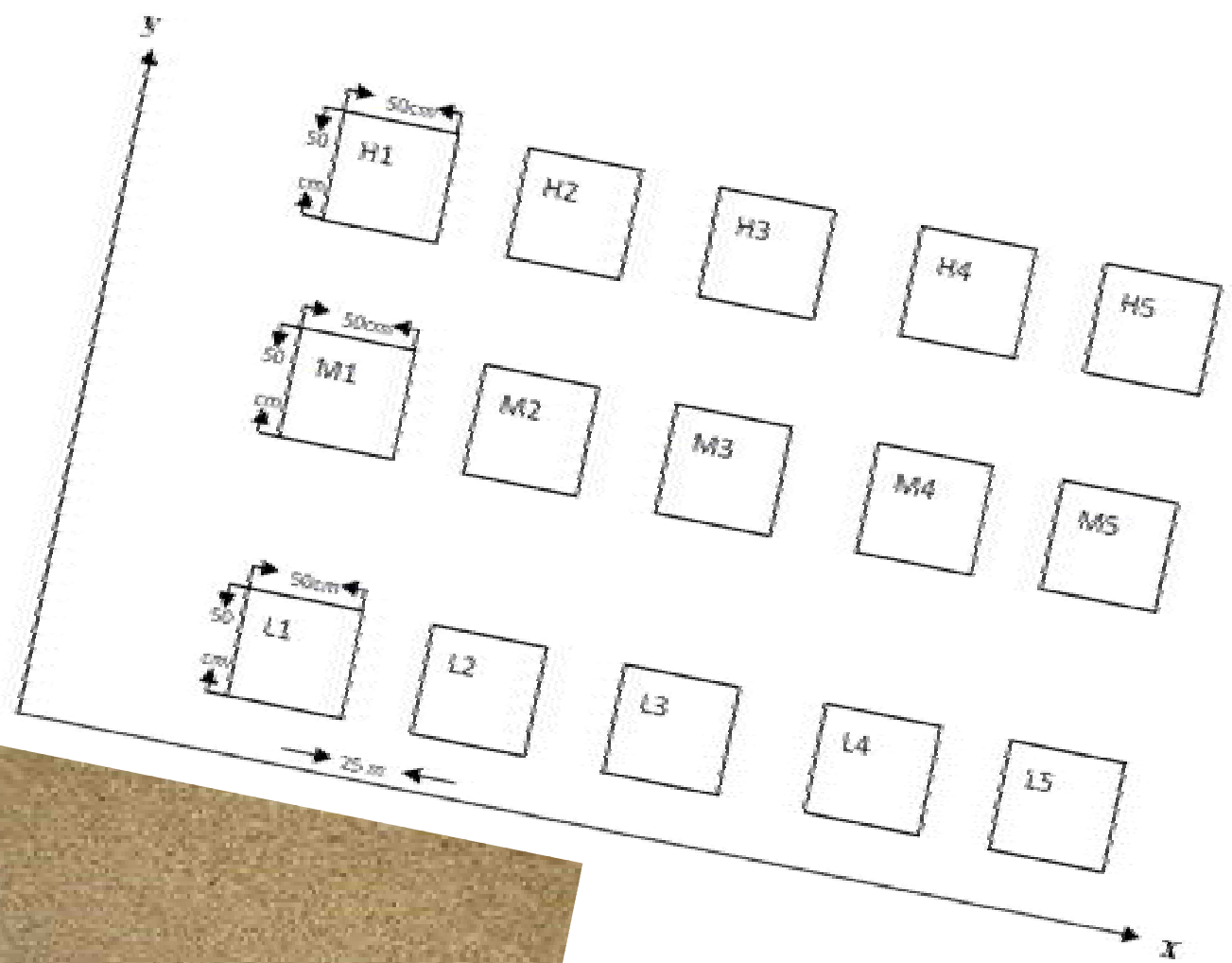


**Muddy flat, Nanhui Park,
Shanghai**

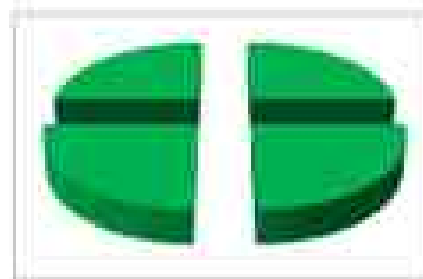
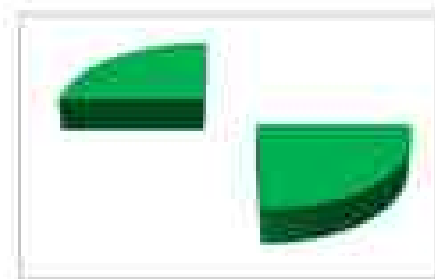
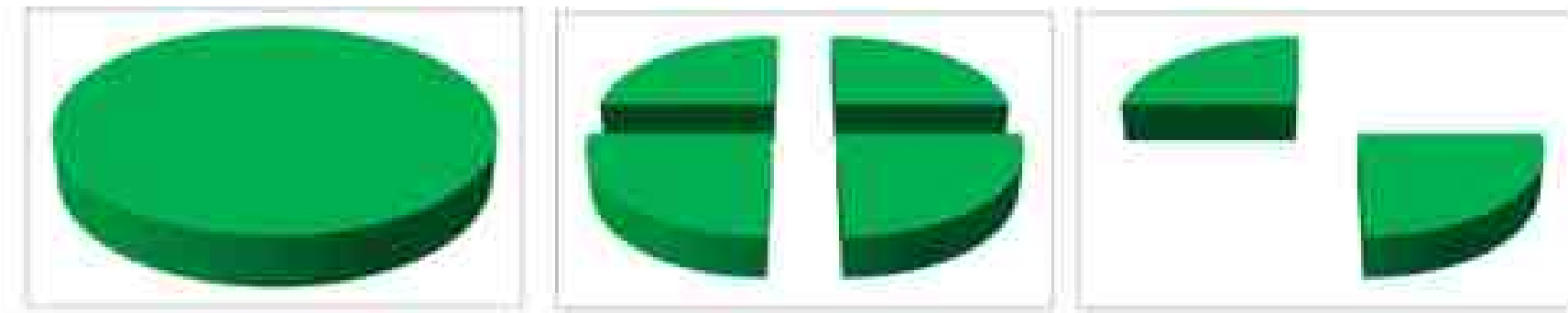
August 23, 2014

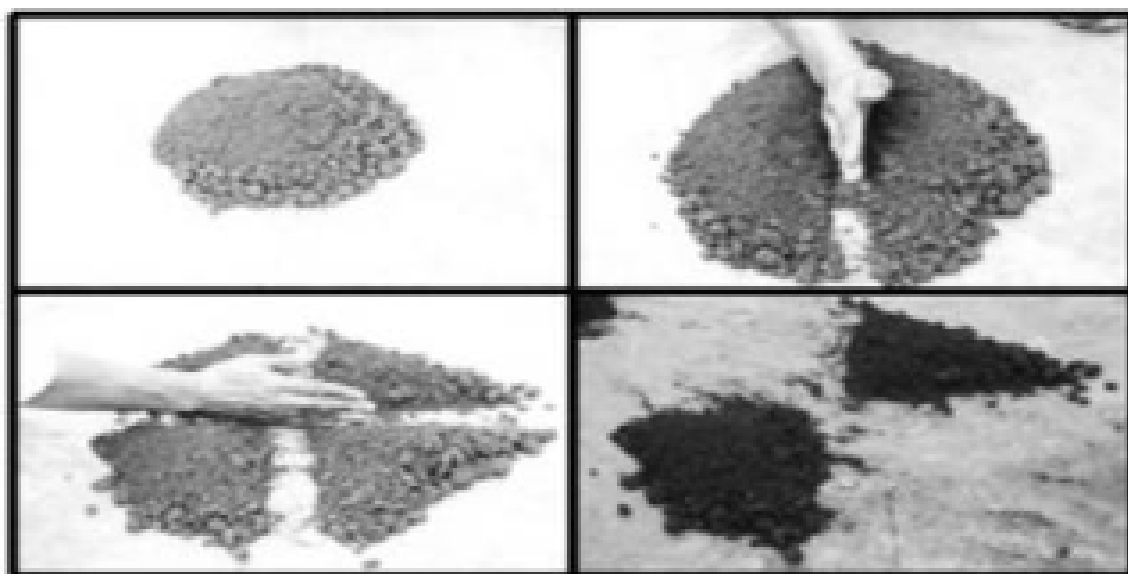
Protocols for sampling...



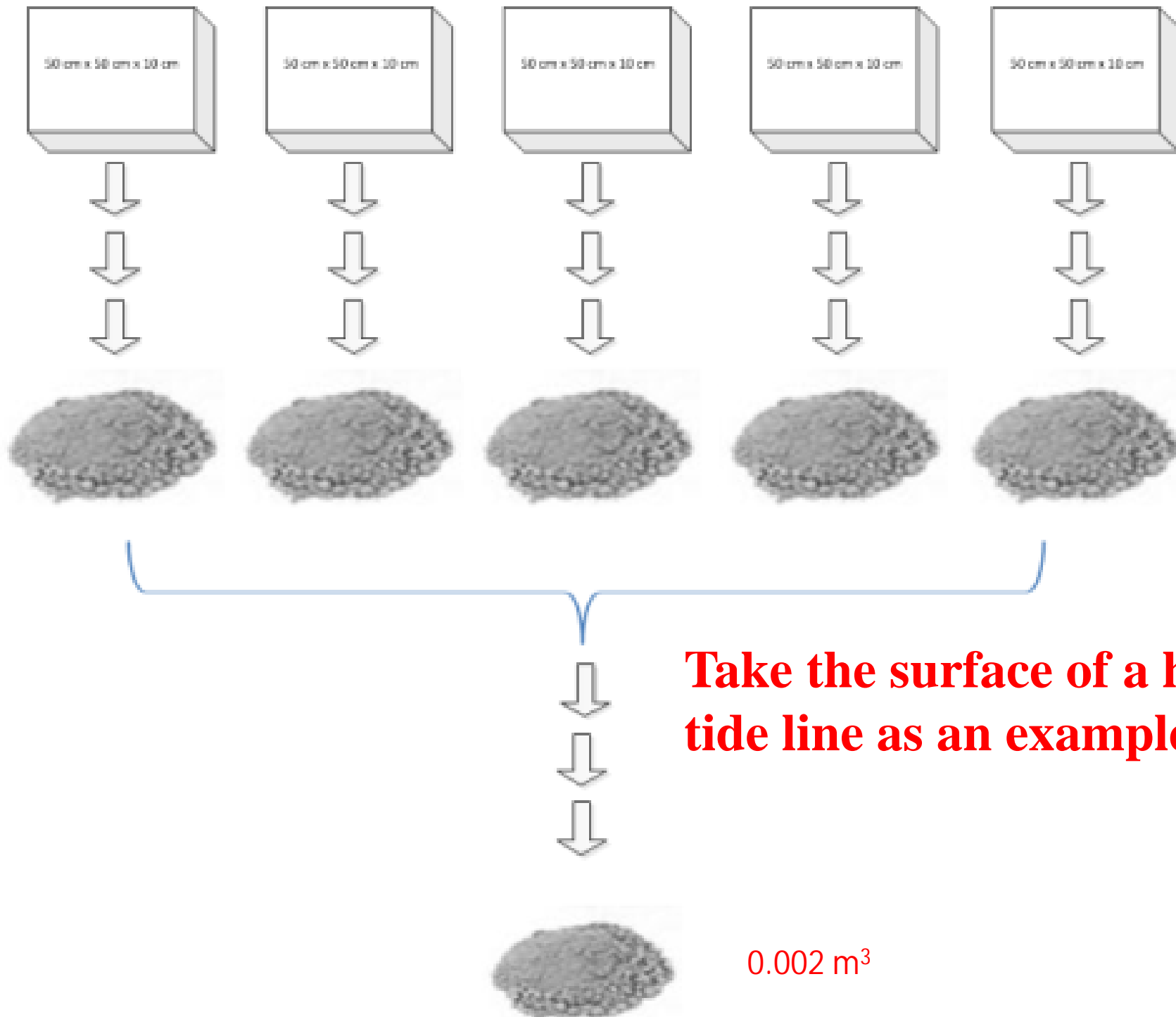








“四分法”分取土样图



Take the surface of a high tide line as an example...

0.002 m³

Sediment + salt solutions



Plastics float



Decant to sieves (1 mm, 2mm, 5mm)

salt solutions

Sodium polytungstate (good, but too expensive)

Sodium chloride (cheap, proper density, $\sim 1.2 \text{ g/cm}^3$)

Sodium iodide?

Sampling in sandy beach in Dalian...























Sampling in muddy flat in Shanghai...







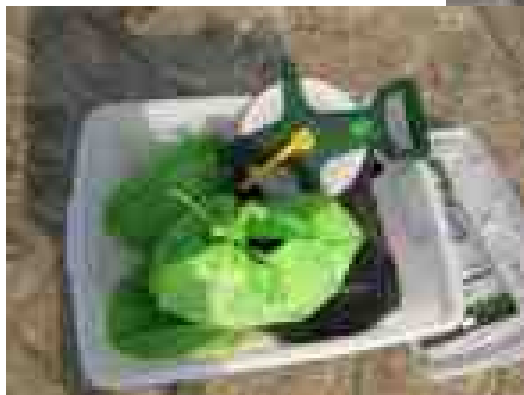
The sediment was water-logged and too muddy at the **low and middle tide lines**; too difficult to collect sediment in a quantitative volume using the sampling metal frame



No plastics found at the high tide line!!

We moved the high tide line further to above the wave defense...













What we observed in the muddy flat samples in Shanghai...





集团有限公司
2260122号 6220
MC





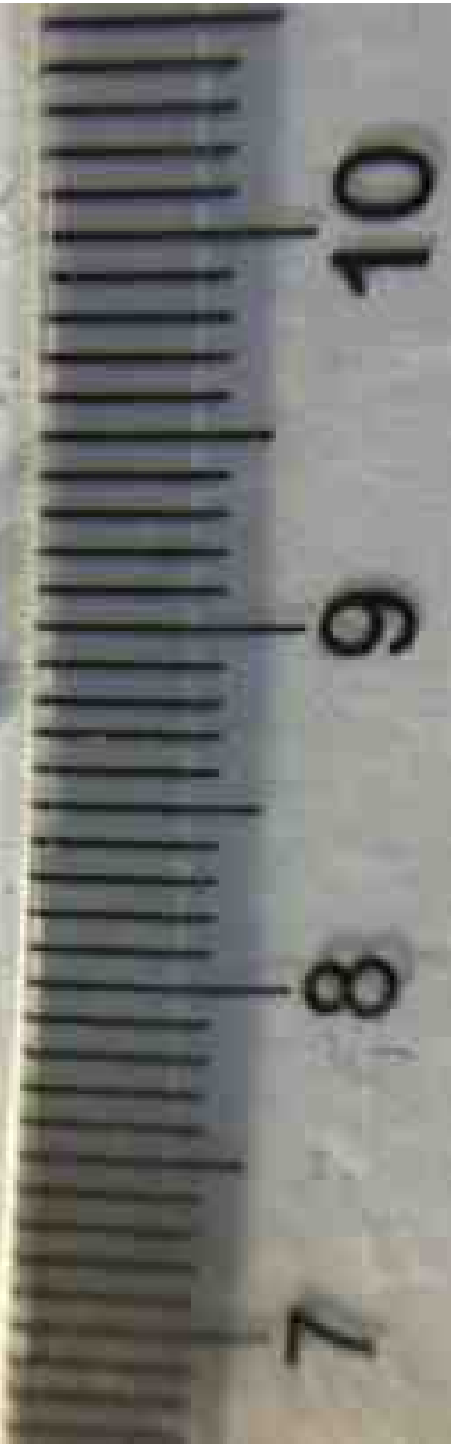






**What we observed in Sandy beach
samples in Dalian...**





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得力集











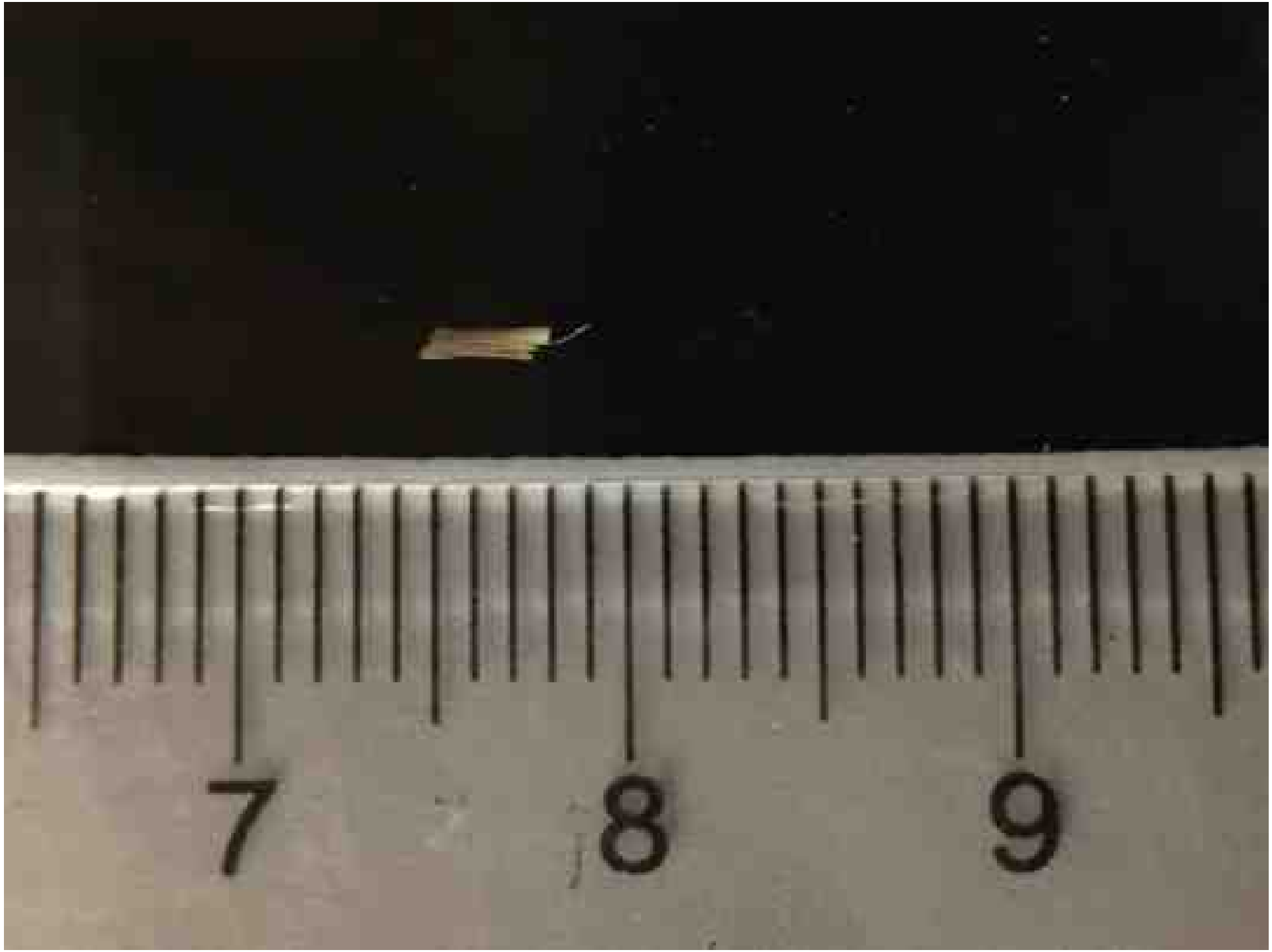














Data summary...



Time	Region and season	Tide line	bottom			surface		
			1-2 mm	2-5 mm	5 mm<	1-2 mm	2-5 mm	5 mm<
August 23, 2014	Shanghai, summer	H	0	0	0	0	0	0
		M						
		L						
January 11, 2015	Shanghai, winter	H	3	5	1	0	0	1
		M						
		L						
August 28, 2014	Dalian, summer	H	0	6	0	8	6	0
		M	17	0	0	1	4	0
		L	0	1	0	0	0	0
December 26, 2014	Dalian, winter	H	0	0	0	1	1	0
		M	0	0	0	0	0	0
		L	2	6	0	9	2	0

➤ In muddy flat, microplastics are accumulated in bottom (10-20 cm) rather than in the surface (0-10 cm), but in both layers of sandy beach

➤ In sandy beach, large variations (seasons, tide lines and layers). Why?

➤ On the whole, the abundance of bottom microplastics is higher than the surface

Public awareness and outreach...





http://blog.sina.com.cn/s/blog_9af1cfc80102vh65.html

<http://www.aiweibang.com/yuedu/5400728.html>

<http://www.douban.com/group/topic/58818539/>

Survey of micro-plastic marine debris in intertidal sediment (Dalian City and Shanghai City) in China

A NCS project (GEFC10-14) report by:

CHEN Hao (PI)

Chinese Research Academy of Environmental Sciences, Beijing, 100012, China

Email: chenhao@craes.org.cn

August 1, 2015

<http://dinrac.nowpap.org/documents/ML/2015-ML-MP-Survey.pdf>

What next?

To improve the sampling and isolation approaches (**short-term goal**)



To streamline terminology and approaches for a national guideline (**long-term goal**)

What can be learned from other nations' approaches?



Laboratory Methods for the Analysis of Microplastics in the Marine Environment: Recommendations for quantifying synthetic particles in waters and sediments

NOAA Marine Science Program
National Oceanic and Atmospheric Administration
U.S. Department of Commerce
Technical Memorandum NMFS CRAM-11
July 2010

- ◆ NOAA's approach does not allow for quantitative sampling in volume of wet sediment in muddy flat (they measured the **dry weight and wt%**)
- ◆ NaCl or lithium metatungstate
- ◆ Natural organic matter (NOM) removal by oxidation with H₂O₂



Thank
you!