Microplastics in Marine Environments, China

Daoji Li

Director, Professor
Plastic Marine Debris Research Center
EAST CHINA NORMAL UNIVERSITY

28 September 2017, Vladivostok, Russia

Contents

1. Recent MP Researches in China

The Numbers of Microplastic Research Programs Since 2014:

- ***20 Programs of National Natural Science Foundation of China (2014-2021)***
- ***One Major Scientific Cultivating Program of ECNU (2016)***
- ***Two of Scientific Development Programs of CAS (2015-2020)***
- ***Annually Monitoring Program of SOA (first stage: 2016-2020)***
- ***One of National Key Research and Development Project of China, Ministry of Science and Technology (2016-2020)***

New Research Center for MP:

"Plastic Marine Debris Research Center, ECNU"
founded in East China Normal University in 2015, which is the first center for plastic research in China

2. National Key Research Project of Marine MP

Research Goals

- ***To understand the source, fate and spatiotemporal variations of microplastics***
- ***To reveal the effects of microplastics on the safety and health of the marine ecosystems***
- ***To set up national standard methods for monitoring and analysis of microplastics***
- ***To set up plastic drift diffusion models and source-analysis techniques***
- ***To develop microplastic risk assessment technology***
- ***To develop source control and management technology , policies and measures***

The Project Team

East China Normal University，Ministry of Education, The Leader of the Project

National Marine Environmental Monitoring Center, State Oceanic Administration (SOA)

Institute of Coastal Zone Research, Chinese Academy of Science (CAS)

Nanjing University, Ministry of Education (MEC)

Chinese Research Academy of Environmental Sciences, Ministry of Environmental Protection (MEPC)

Jinan University

Ningbo University

East China Sea Environment Monitoring Center, SOA

Institute of Seawater Multipurpose Utilization, SOA

“Marine Microplastic Monitoring and Ecological Risk Assessment Technological Research” launched by CAST in 2016

Key scientific and technological questions

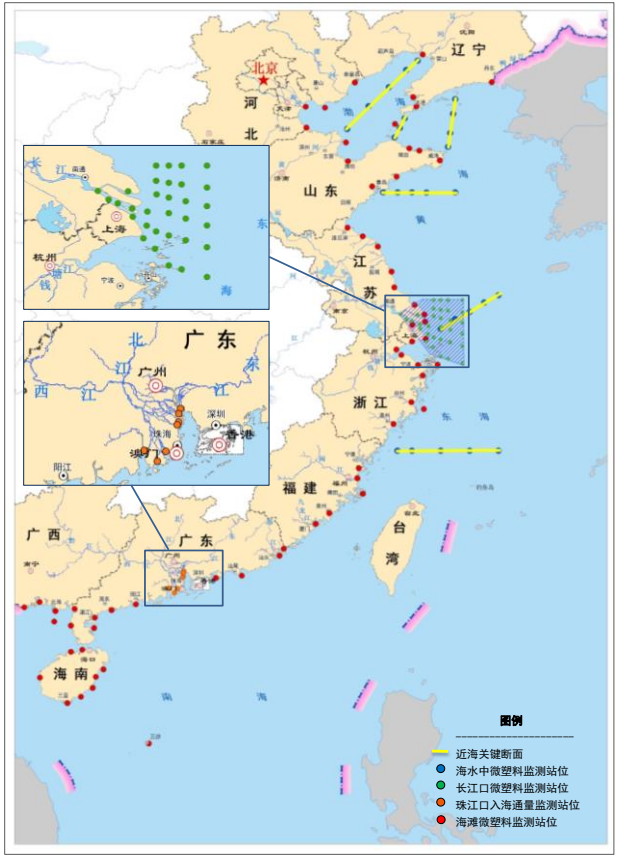
- *Spatiotemporal variations of microplastics in estuaries and coastal areas*
- *Effects of microplastics on the safety and health of the marine ecosystems*
- *Monitoring methods, standards and source-analysis*
- *Risk assessment method for microplastics*

Assess the impact of microplastic pollution on marine ecosystems

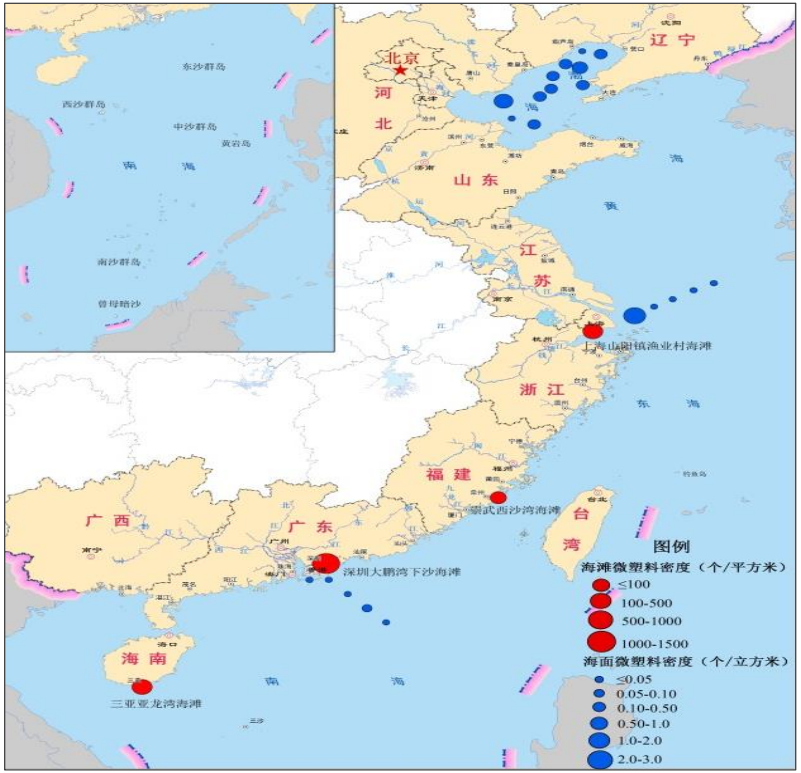
PMDRC
Plastic Marine Debris Research Center
East China Normal University

Research Areas

Survey area	➢ *Estuaries: Changjiang Estuary, Pearl River Estuary* ➢ *The Bohai Sea, Yellow Sea and East China Sea* ➢ *48 stations for beaches along the coastline and 6*
Sampling frequency	➢ *Four seasons for seas* ➢ *Dry seasons and flood seasons for estuaries*



3 Recent Research Results



MPs distribution in 2016 (SOA)

MPs in surface waters

Density：0.29 (0.001-2.35) particles/m^3
Component: PE, PP and PS;
Color: white, blue;
Shape：line, film, fragment, foam spherules.

MPs on beaches

Density：100 - 1208 particles/m^2
Component: PE, PP, PS, PET, PVC.
Shape：fragment, film, fiber.

MPs in shellfish: 0.26 particle/g

Sinonovacula constricta: 0.16 particle/g
Ruditapes philippinarum: 0.49 particle/g
Perna viridis: 0.12 particle/g

Plastic Marine Debris Research Center
East China Normal University

Environmental Pollution 214 (2016) 722–730

Contents lists available at ScienceDirect

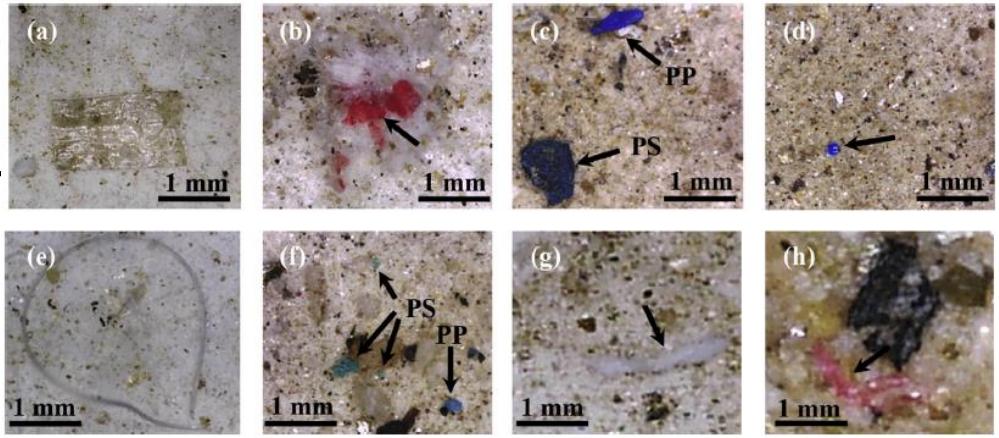
Environmental Pollution

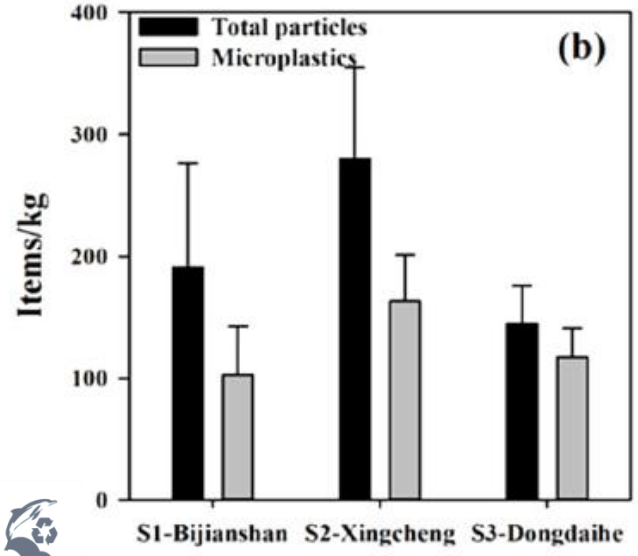
journal homepage: www.elsevier.com/locate/envpol

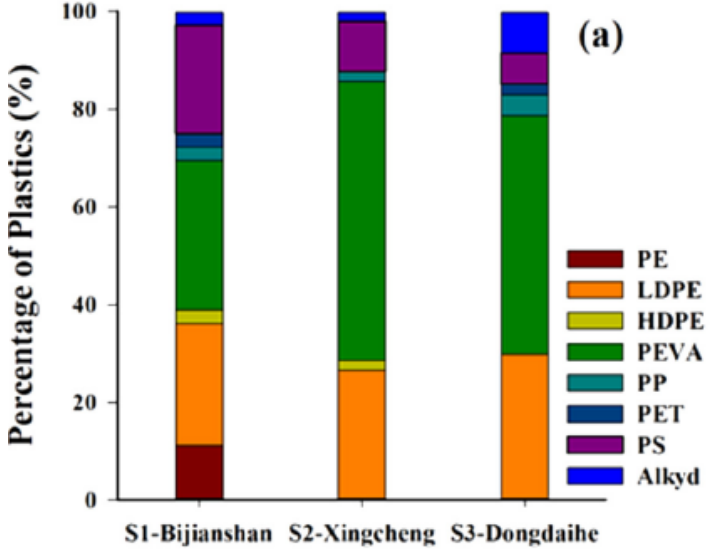
Occurrence of microplastics in the beach sand of the Chinese inner sea: the Bohai Sea☆

Xubiao Yu [a, *], Jinping Peng [b], Jundong Wang [b], Kan Wang [a], Shaowu Bao [c]

[a] Faculty of Architectural, Civil Engineering & Environment, Ningbo University, Ningbo, 315211, PR China
[b] Faculty of Chemical Engineering & Light Industry, Guangdong University of Technology, Guangzhou, 510006, PR China
[c] The School of Coastal and Marine Systems Science, Coastal Carolina University, Conway, SC, 29528, United States







- ***MPs abundance ranged from 102.9 to 163.3 n/kg***
- ***Surface samples (2 cm) contained higher MPs concentrations than deep samples (20 cm)***
- ***MPs pollution probably resulted from tourism activity***

MPs in Estuary Sediments

Environmental Pollution 225 (2017) 283–290

Contents lists available at ScienceDirect

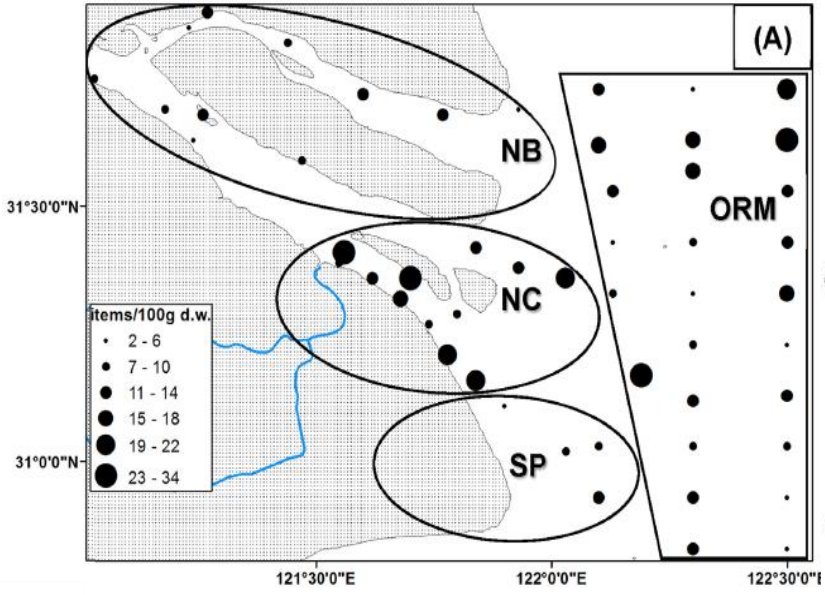
Environmental Pollution

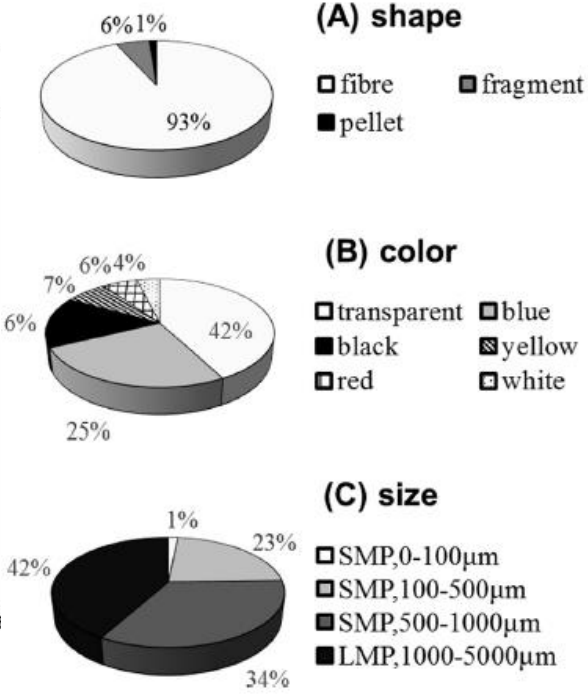
journal homepage: www.elsevier.com/locate/envpol

Microplastics in sediments of the Changjiang Estuary, China☆

Guyu Peng [a], Bangshang Zhu [b], Dongqi Yang [a], Lei Su [a], Huahong Shi [a], Daoji Li [a,*]

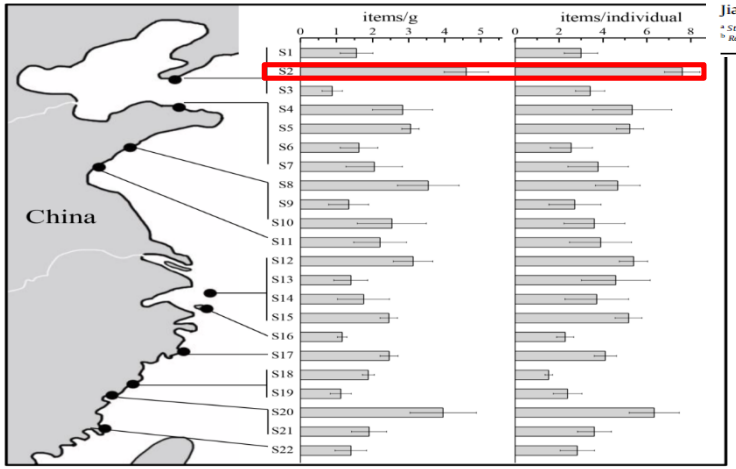
[a] State Key Laboratory of Estuarine and Coastal Research, East China Normal University, 200062 Shanghai, China
[b] Instrumental Analysis Center, Shanghai Jiao Tong University, 200240 Shanghai, China





- ***MPs abundance varied from 20 to 340 n/kg***
- ***Fiber (93%), trans-parent (42%) and small MPs (<1 mm) (58%) were the most abundant types***
- ***Main source of MPs in the Changjiang Estuary was from washing clothes***

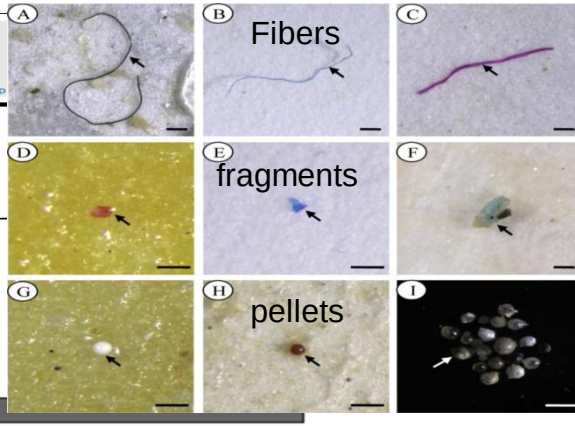
MPs in Shellfish

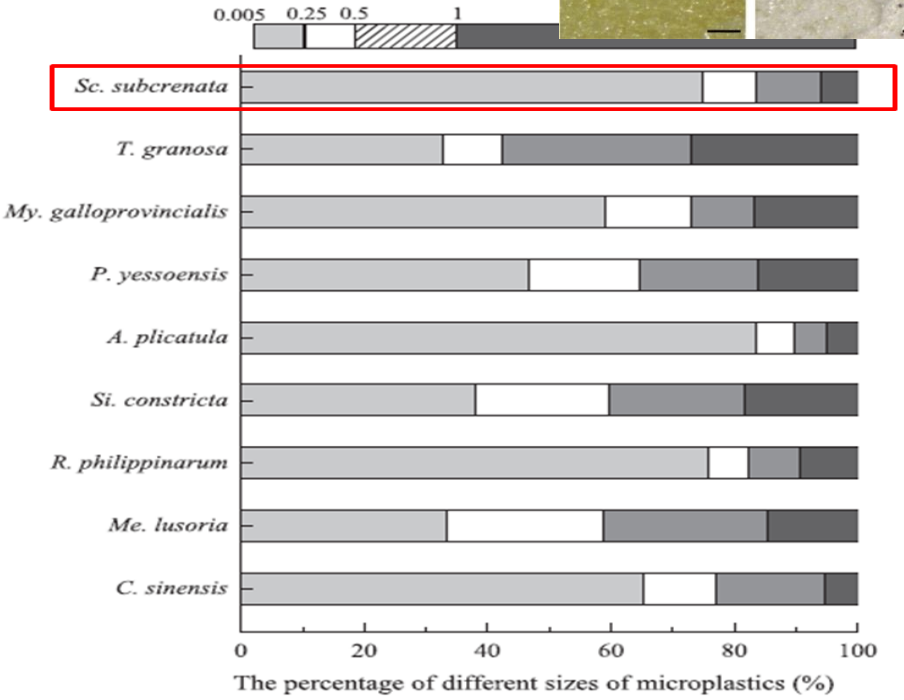


Contents lists available at ScienceDirect
Environmental Pollution
journal homepage: www.elsevier.com/locate/envp

Microplastics in commercial bivalves from China

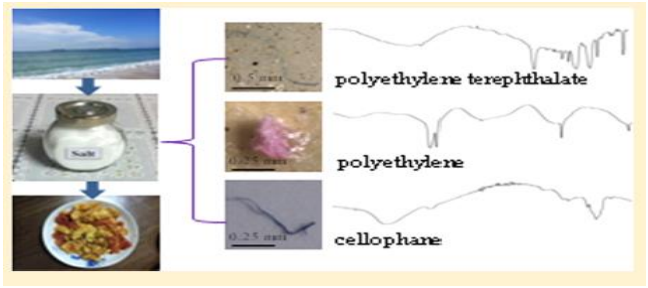
Jiana Li [a], Dongqi Yang [a], Lan Li [b], Khalida Jabeen [a], Huahong Shi [a,*]
[a] State Key Laboratory of Estuarine and Coastal Research, East China Normal University, Shanghai 200062, China
[b] Research Center for Analysis and Measurement, Donghua University, Shanghai 201620, China





- ***Variation Range:***
  0.9 - 4.6 items/g;
  1.5 - 7.6 items /individual
- ***Average Density:***
  2.2 items/g;
  4.0 items/individual

MPs in Table salt



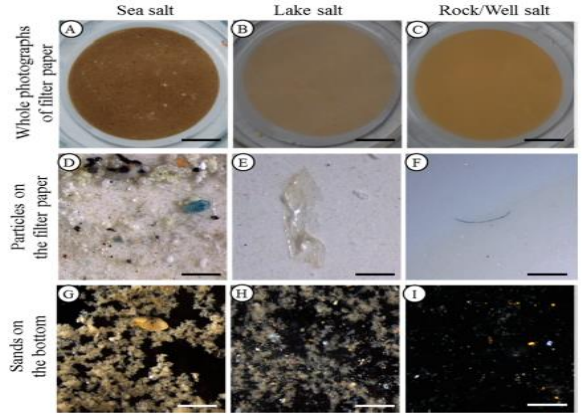


Figure 1. Photographs of the total particles isolated from table salts. A–C, the particles in the salt solution without separation; D–F, the particles in the supernatant of the salt solutions. More particles were observed in sea salts (D) than lake salts (E) and rock/well salts (F); G–I, the particles at the bottom of the bottle after removal of the supernatant. Scale bar = 10 mm (A–C) or 0.2 mm (D–I).

MPs: 550−681 particles/kg in sea salts

ENVIRONMENTAL Science & Technology

Article

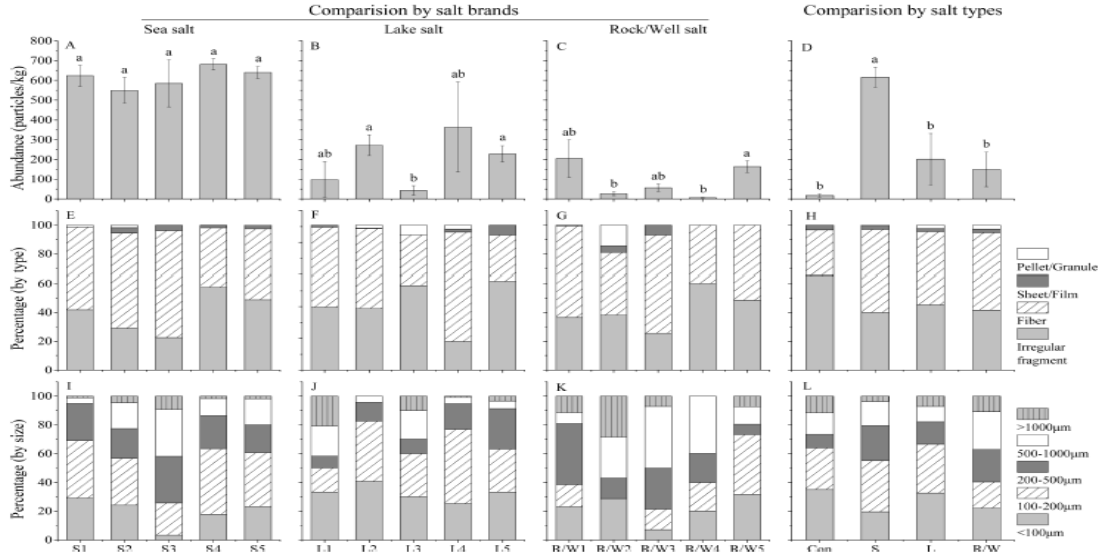
pubs.acs.org/est

Microplastic Pollution in Table Salts from China

Dongqi Yang,[†] Huahong Shi,[*,†] Lan Li,[‡] Jiana Li,[†] Khalida Jabeen,[†] and Prabhu Kolandhasamy[†]

[†]State Key Laboratory of Estuarine and Coastal Research, East China Normal University, Shanghai 200062, China

[‡]Research Center for Analysis and Measurement, Donghua University, Shanghai 201620, China



POPs carried on MP

Marine Pollution Bulletin 99 (2015) 28–34

Contents lists available at ScienceDirect

Marine Pollution Bulletin

journal homepage: www.elsevier.com/locate/marpolbul

Persistent organic pollutants carried on plastic resin pellets from two beaches in China

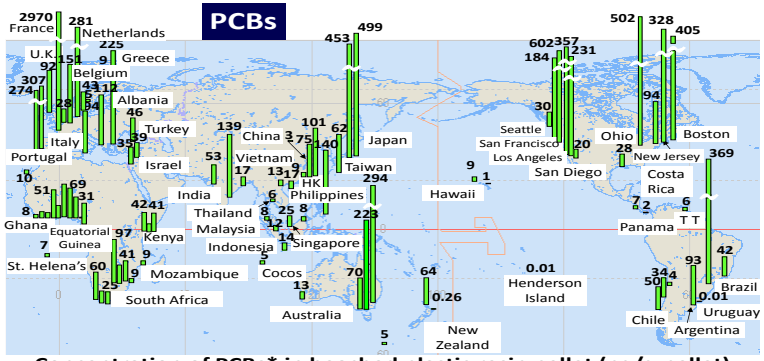
Weiwei Zhang [a,b], Xindong Ma [b], Zhifeng Zhang [b], Yan Wang [b], Juying Wang [b], Jing Wang [c], Deyi Ma [d,*]

[a] Ocean University of China, Songling Road 238, Qingdao 266100, China
[b] National Marine Environmental Monitoring Center, Linghe Street 42, Dalian 116023, China
[c] China Protection Association of Environment al Industry, Building A-4, Kouzhongbeili, Xicheng District, Beijing 100037, China
[d] First Institute of Oceanography, State Oceanic Administration, China, No. 6, Xianxialing Road, Qingdao 266061, China

The collected pellets were analyzed for PAHs, PCBs, HCHs, DDTs, chlordane, heptachlor, endosulfan, aldrin, dieldrin and endrin.

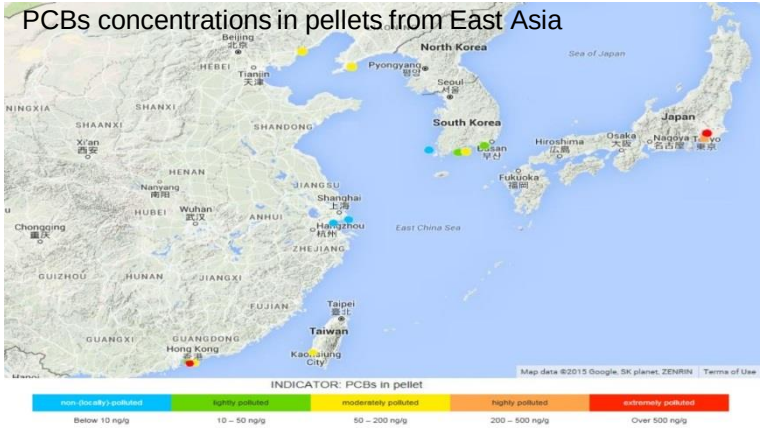
Microplastics collected om beaches

Plastic Marine Debris Research Center
East China Normal University



Concentration of PCBs* in beached plastic resin pellet (ng/g-pellet)

"International Pellet Watch" (Takada, 2015)



PMDRC

Assessment of marine MPs in surface water

Area	References	Analysis /Concentration
Taihu Lake, China	*Su et al., 2016*	Plankton net samples: 0.01×10^6 ~ 6.8×10^6 n/km² Surface water: 3.4 ~ 25.8 items/L
Three Gorges Dam, China	*Zhang et al., 2015*	Main stream: 3407.7 $\times10^3$ to 13,617.5 $\times10^3$ n/km² Tributary: 192.5 $\times10^3$ to 11,889.7 $\times10^3$ n/km²
Yangtze Estuary, China	*Zhao et al., 2014*	4137.3 ± 2461.5 n/m³
Estuaries, China	*Zhao et al., 2015*	Jiaojiang: 955.6 ± 848.7 n/m³ Oujiang: 680.0 ± 284.6 n/m³ Minjiang: 1245.8 ± 531.5 n/m³

Location	item/m³	Reference
N. Pacific SG	32.76	*Goldstein et al., 2012*
N. Pacific G	2.23	*Moore et al., 2001*
N. Pacific offshore	0.43-2.23	*Moore et al., 2005*
N. Pacific inshore	5-7.25	*Moore et al., 2005*
Southern Californian	3.92	*Lattin et al., 2004*
East Asian Seas	3.7	*Isobe et al., 2015*
NE Atlantic	2.46	*Lusher et al., 2014*
N. Atlantic (accumulation area)	1.7	*Reisser et al., 2015*
Italian Coast	0.62	*Fossi et al., 2012*
Plymouth, UK	<0.04	*Thompson et al., 2004*
Seto Inland sea	0.39	*Isobe et al., 2014*
Bohai Sea, China	0.33	*Zhang et al., 2017*
Arctic polar waters	0.34	*Lusher et al., 2015*
East China Sea, China	0.167	*Zhao et al., 2014*
Mediterranean Sea	0.15	*De Lucia et al., 2014*
N. Pacific	0.12	*Goldstein et al., 2012*
Southern Oceans	0.099	*Isobe et al., 2016*

4 Conclusion

- ***At present, the Chinese government and some research institutes have pay great attention to the pollution of marine plastic waste and marine microplastics, and begin to support a lot of funds to study and deal with the problem of marine plastic pollution***
- ***China now has many research teams engaged in the study of plastic pollution issues, and some of research achievements have been made (China's coasts, coastal waters, inland rivers and lakes; Sediments and Biota)***
- ***China has begun to study and formulate policies and measures for plastic pollution, and hope to work with the international communities to tackle the problem of marine plastic pollution***

Thanks for Your Attention !