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15-19 July 2019
Qingdao, PR China

Status of marine litter in YSLME:

consolidated baseline report supported by UNDP/GEF YSLME Phase II Project

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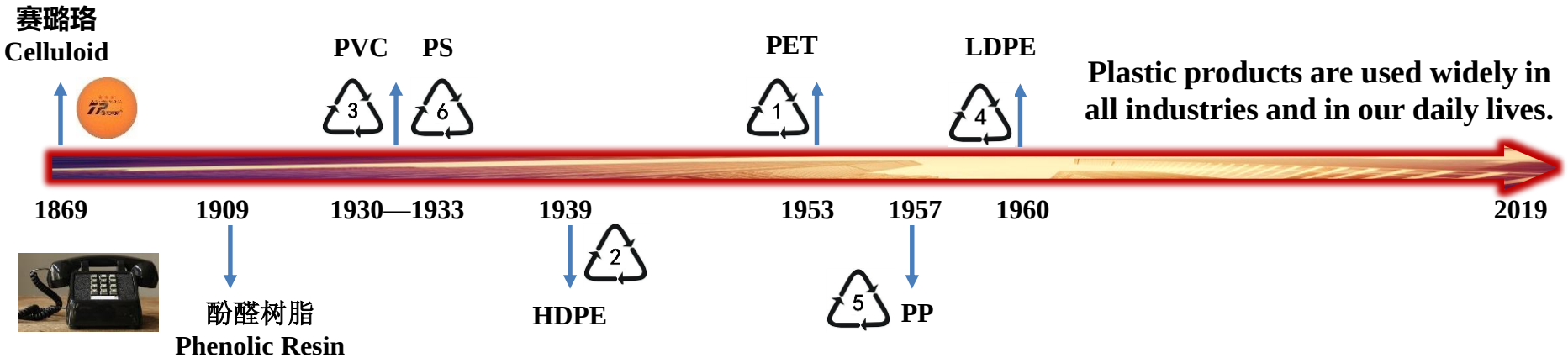
Plastics: Uses & Benefits

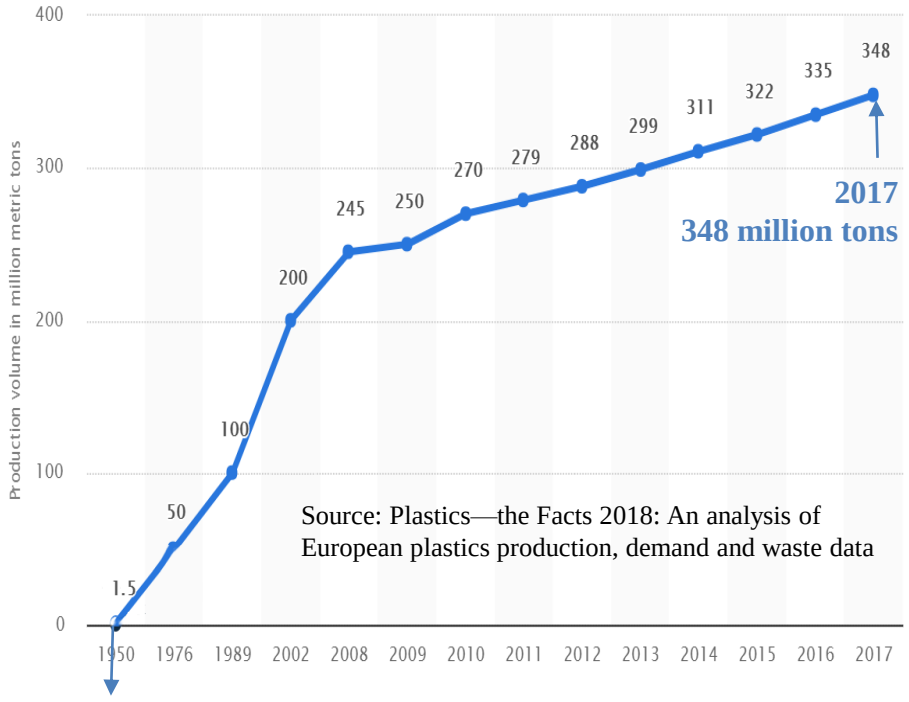


A world without plastics seems unimaginable today, yet their large-scale production and use only dates back to ~1950. The ensuing rapid growth in plastic production is extraordinary, surpassing most other man-made materials.

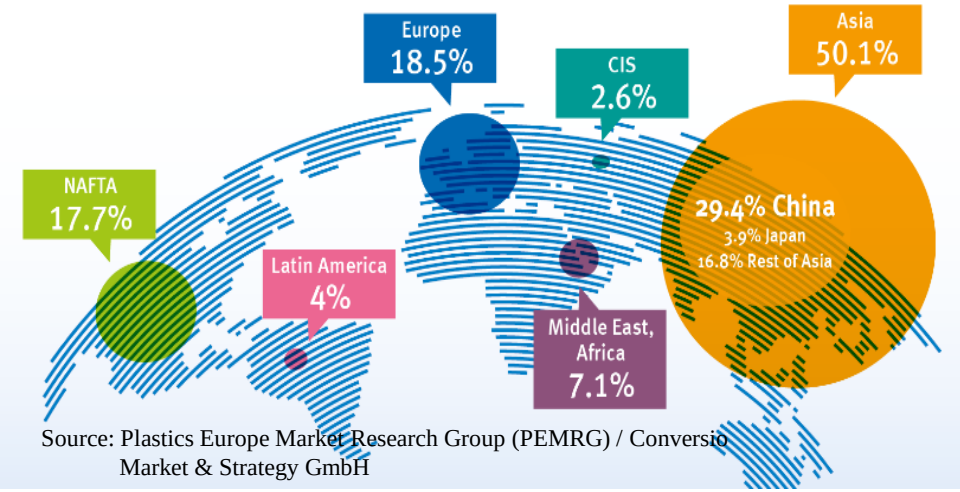
一个没有塑料的世界在今天看来是不可想象的，然而塑料的大规模生产和使用只能追溯到1950年左右。随之而来的塑料生产的快速增长是非同寻常的，超过了大多数其他人造材料。

Plastics: Production, use, and fate

Growth in global plastic production from 1950 to 2012



Source: Plastics—the Facts 2018: An analysis of European plastics production, demand and waste data



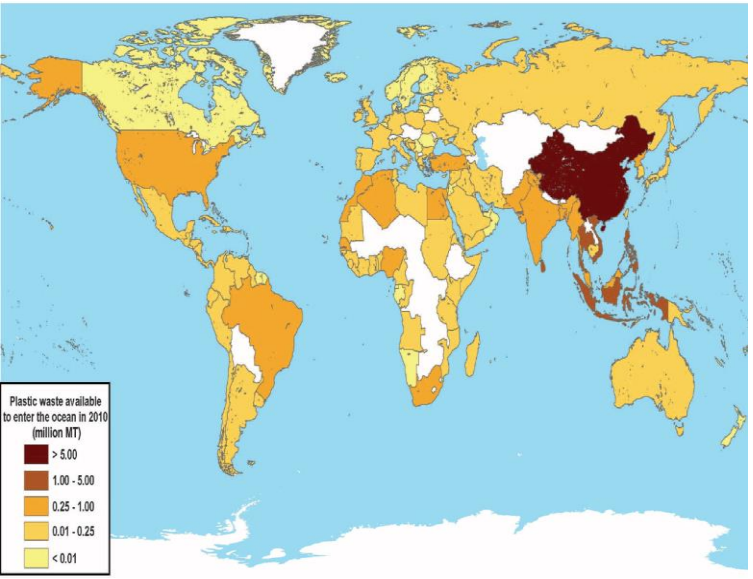
Source: Plastics Europe Market Research Group (PEMRG) / Conversio Market & Strategy GmbH

China is the largest producer of plastics, followed by Europe

Their versatility has seen the amount of plastic produced annually increase rapidly over the last few decades to an estimated 348 million tons in 2017, and this total continues to grow at about 4% per year.

在过去的几十年里，塑料的多样性使得塑料的年产量迅速增长，2017年预计将达到3. 48亿吨，而且这一数字还在以每年4%的速度增长。

Plastic waste inputs from land into the ocean



Rank	Country	Econ. classif.	Coastal pop. [millions]	Waste gen. rate [kg/ppd]	% plastic waste	% mismanaged waste	Mismanaged plastic waste [MMT/year]	% of total mismanaged plastic waste	Plastic marine debris [MMT/year]
1	China	UMI	262.9	1.10	11	76	8.82	27.7	1.32–3.53
2	Indonesia	LMI	187.2	0.52	11	83	3.22	10.1	0.48–1.29
3	Philippines	LMI	83.4	0.5	15	83	1.88	5.9	0.28–0.75
4	Vietnam	LMI	55.9	0.79	13	88	1.83	5.8	0.28–0.73
5	Sri Lanka	LMI	14.6	5.1	7	84	1.59	5.0	0.24–0.64
6	Thailand	UMI	26.0	1.2	12	75	1.03	3.2	0.15–0.41
7	Egypt	LMI	21.8	1.37	13	69	0.97	3.0	0.15–0.39
8	Malaysia	UMI	22.9	1.52	13	57	0.94	2.9	0.14–0.37
9	Nigeria	LMI	27.5	0.79	13	83	0.85	2.7	0.13–0.34
10	Bangladesh	LI	70.9	0.43	8	89	0.79	2.5	0.12–0.31
11	South Africa	UMI	12.9	2.0	12	56	0.63	2.0	0.09–0.25
12	India	LMI	187.5	0.34	3	87	0.60	1.9	0.09–0.24
13	Algeria	UMI	16.6	1.2	12	60	0.52	1.6	0.08–0.21
14	Turkey	UMI	34.0	1.77	12	18	0.49	1.5	0.07–0.19
15	Pakistan	LMI	14.6	0.79	13	88	0.48	1.5	0.07–0.19
16	Brazil	UMI	74.7	1.03	16	11	0.47	1.5	0.07–0.19
17	Burma	LI	19.0	0.44	17	89	0.46	1.4	0.07–0.18
18*	Morocco	LMI	17.3	1.46	5	68	0.31	1.0	0.05–0.12
19	North Korea	LI	17.3	0.6	9	90	0.30	1.0	0.05–0.12
20	United States	HIC	112.9	2.58	13	2	0.28	0.9	0.04–0.11

*If considered collectively, coastal European Union countries (23 total) would rank eighteenth on the list

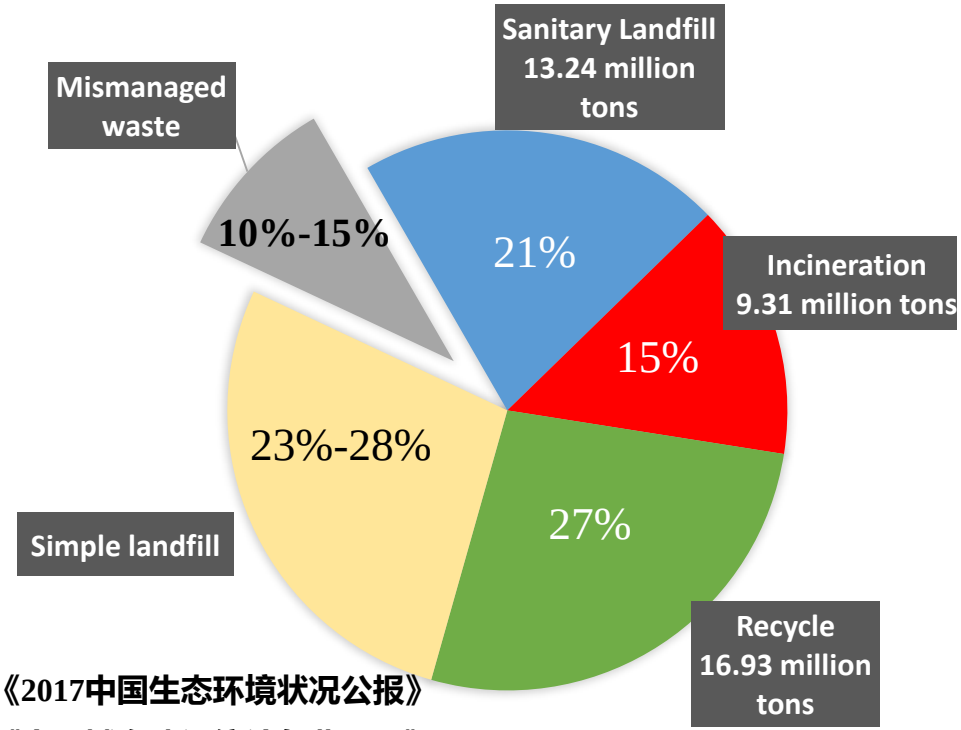
Source: Jambeck J R , Geyer R , Wilcox C , et al. Plastic waste inputs from land into the ocean[J]. Science, 2015, 347(6223):768-771.

A research indicated that 4.8 to 12.7 million tons of plastic waste was discarded into the ocean in 2010.

As the largest emitter, China accounts for 28%. The mismanaged waste fraction in China is 76%.

一项研究表明，2010年有480万到1270万吨塑料垃圾被丢弃到海洋中。作为最大的排放国，中国占28%。中国垃圾管理不善的比例为76%。

Waste management in China



《2017中国生态环境状况公报》

《中国城乡建设统计年鉴2017》

《中国再生资源回收行业发展报告2018》

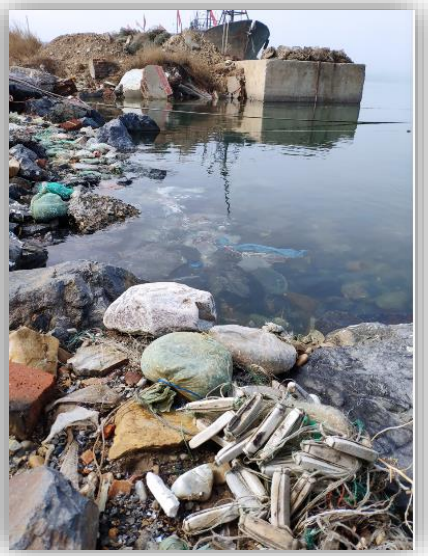
Source: What a waste? : a global review of solid waste management[J]. World Bank, 2014.

According to the statistical data, waste management in China has gradually improved. In 2017, most of the plastic waste was harmless treated through sanitary landfill, incineration and recycling. The mismanaged waste only account for 10% to 15%. A World Bank report indicated that the waste collection rate in upper middle-income countries, including China, was about 85%. We consider that these datas are closer to reality.

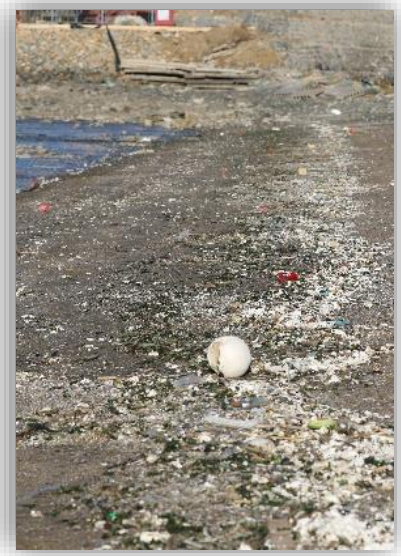
据统计数据显示，我国的垃圾管理工作已逐步完善。2017年，大多数塑料垃圾通过卫生填埋、焚烧和回收处理实现了无害化处理，垃圾失控的比例约为10%至15%。世界银行的一份报告显示，中高收入国家（包括中国）的垃圾收集率约为85%。我们认为这些数据更接近现实。

Waste management in China

Household waste from land and fishing



Abandoned fishing gear



Beach litter

Plastic waste on the riverbed

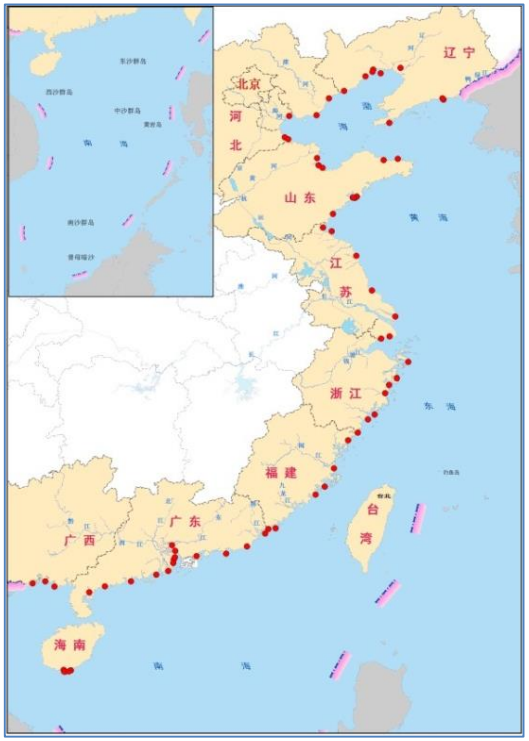
Mismanaged plastic waste, such as household waste from land and fishing, abandoned fishing gear, beach litter, floating debris in the river, is the major source of marine litter.

In order to prevent and reduce marine litter pollution, marine litter and microplastics monitoring is an aim of revealing the real extent of the problem to society and decision makers, as well as suggesting possible solutions for a ubiquitous environmental problem.

管理不善的塑料垃圾，如来自土地和渔业的生活垃圾、废弃的渔具、海滩垃圾、漂浮在河里的碎片等，是海洋垃圾的主要来源。

为了预防和减少海洋垃圾污染，海洋垃圾和微塑料监测的目的是向社会和决策者揭示问题的真实程度，并为普遍存在的环境问题提出可能的解决办法。

Marine litter Monitoring Program



中国海洋垃圾监测站位

The monitoring stations of marine litter along the coastal areas of China

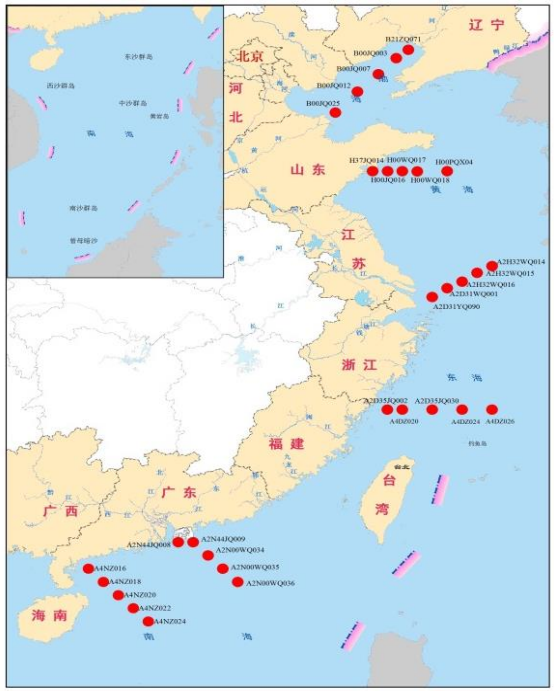
黄海区域海洋垃圾监测站位

The monitoring stations of marine litter along the coastal areas of Yellow Sea of China

Since 2007, National Marine Litter Monitoring Programme was carried out by State Oceanic Administration of China. 50 survey locations were set along coastal areas, and 11 of them were located at Yellow Sea.

2007年启动海洋垃圾监测，在50个站位开展海水、海滩和海底垃圾监测

Microplastics Monitoring Program



中国海洋微塑料监测站位

The monitoring stations of microplastics of China

黄海区域海洋微塑料监测站位

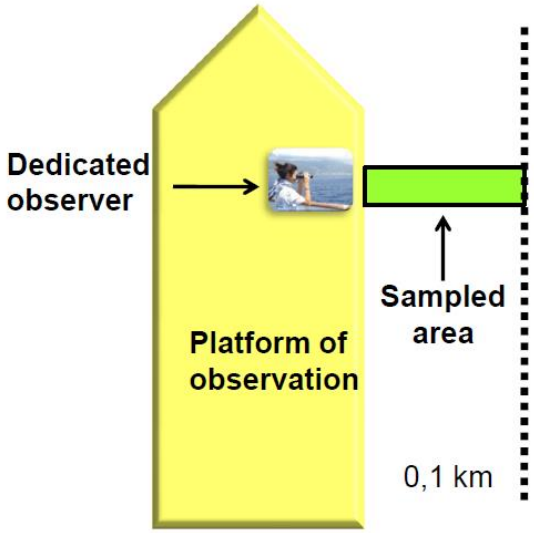
The monitoring stations of microplastics of Yellow Sea of China

In 2016, Marine Microplastic Pilot Monitoring Programme was launched. The microplastics was monitored in 17 stations in the Yellow Sea.

2016年启动微塑料监测，在黄海区域布设了17个微塑料监测站位。

Macro-debris Monitoring Program

Main focus areas



- *Coastal recreational waters* 滨海休闲水域
- *Harbors and ports* 港口
- *Mariculture zones* 海水养殖区域
- *Marine protection areas* 海洋保护区

Frequency

- *Once/year , in wet season*

The main focus areas of Macro-debris monitoring program are Coastal recreational waters, Harbors and ports, Mariculture zones and Marine protection areas. The monitoring frequency is once/year, in wet season. In China, the marine litter monitoring time is from September to October.

大块海洋垃圾监测的重点区域主要是滨海休闲水域、港口、海水养殖区和海洋保护区。监测频率为一年一次，在丰水期。在中国，海洋垃圾监测的时间为9月至10月。

Macro-debris Monitoring Program

Monitoring items

Items	Observing Methods
Floating debris >10cm 漂浮垃圾 <10cm	Sighting survey 目视法 Trawling survey 拖网式
Beach debris 沙滩垃圾	Sighting survey 目视法
Seafloor debris 海底垃圾	Diving survey/Trawling survey 拖网式、潜水式

The monitoring content and methods were shown in this table.

For floating litter shipboard survey, sighting survey and trawling survey methods were used according to the debris size. If the debris size were greater than 10cm, belt/line transect sighting survey method were used.

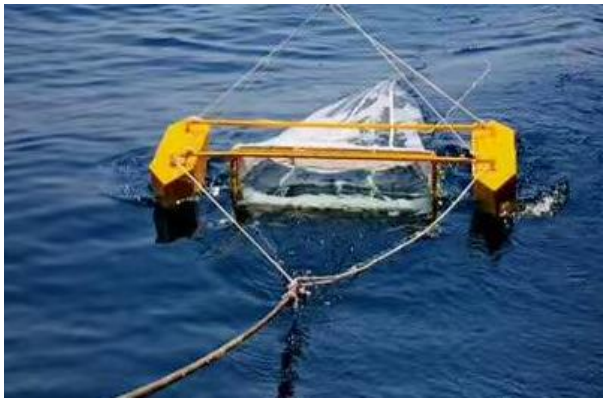
监测内容和方法见表所示。

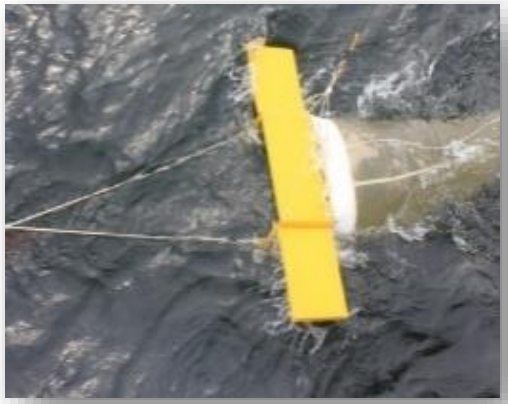
采用目测法和拖网法对漂浮垃圾进行调查，并根据垃圾的大小，采用目测法和拖网法对浮砂船进行调查。当碎片大小大于10cm时，采用样带法/样线样目测观测。

Microplastics Monitoring Program

In 2016, guideline for marine microplastic debris monitoring was released. For the microplastics floating on the surface of the water, trawling survey methods were used.

2016年，《海洋微塑料监测指南》发布。对漂浮在水面上的塑料微粒，采用拖网法进行测量。

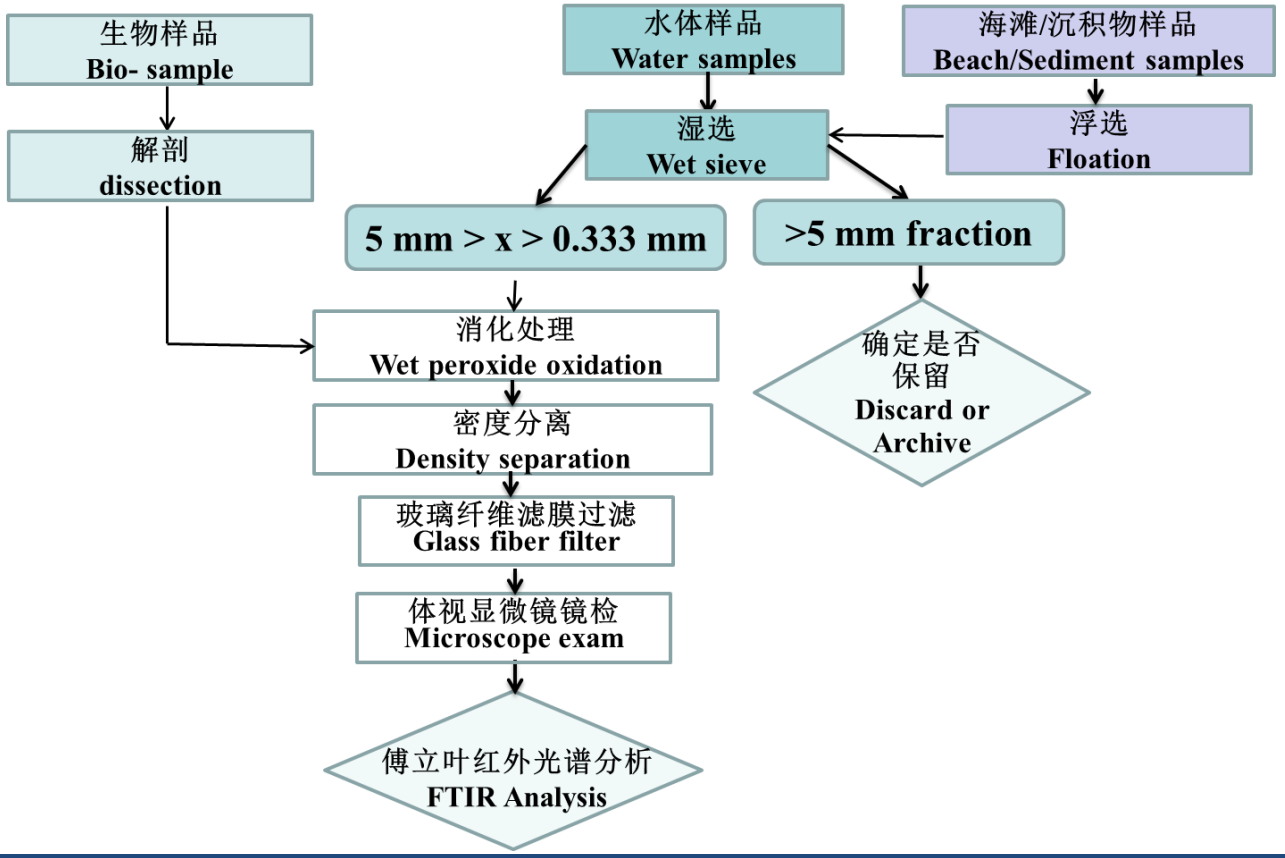




To make our data more comparable with other studies, a manta net, with a body that was composed of 330 mm mesh and approximately 3m in length, was towed horizontally at the surface.

为了使我们的数据与其他研究更具有可比性，采样过程使用了manta网，孔径330mm，网衣长3m。

Microplastics Monitoring Program



Four monitoring sections (one section in the south and three sections in the north) were arranged in the yellow sea. The towing speed was 1-3 knots, sampling time lasts about 15 min.

在黄海布置了4个监测断面(南黄海1个断面，北黄海3个断面)。拖网速度为1-3节，采样时间约为15分钟。

Microscope Exam and FTIR Analysis

Stereoscopic microscope (Leica, M205FA)

Fourier Transform Infrared Spectroscopy (Thermo Fisher IN10MX)

All the plastic samples were analyzed.

For the plastics with a diameter greater than 2 mm, size was measured directly using a ruler; diameter, shape, and color were recorded based on visual observations.

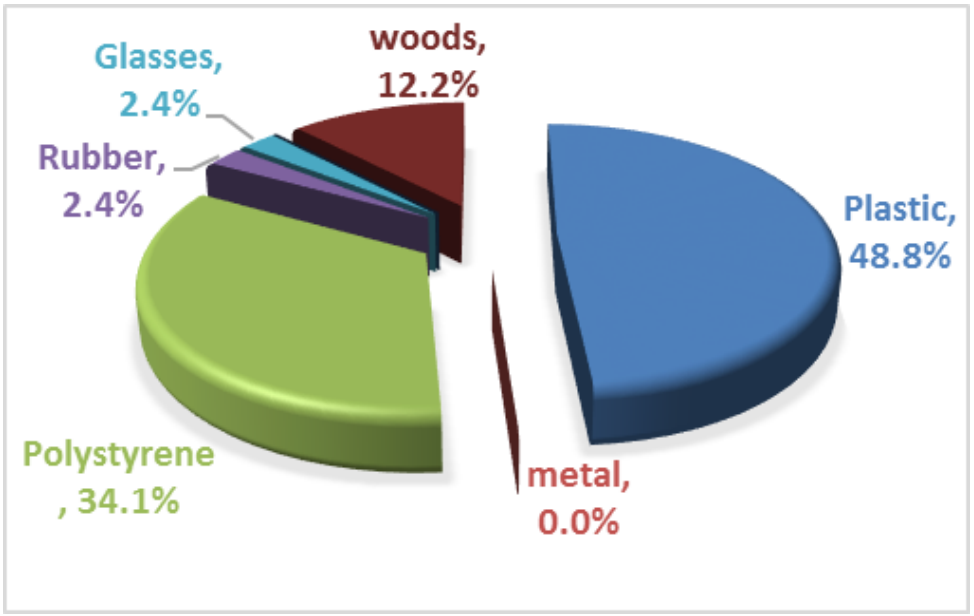
For plastics with a diameter less than 2 mm, the samples were observed under a stereomicroscope to record diameter, shape, and color. The components were identified using micro-Fourier transform infrared spectroscopy.

对所有塑料样品进行了分析。

对于直径大于2mm的塑料，直接用直尺测量尺寸;直径、形状和颜色是根据视觉观察记录的。

对于直径小于2毫米的塑料，在立体显微镜下观察样品，记录直径、形状和颜色。采用微傅立叶变换红外光谱法对其成分进行了鉴定。

Distribution of marine litter in the Yellow Sea



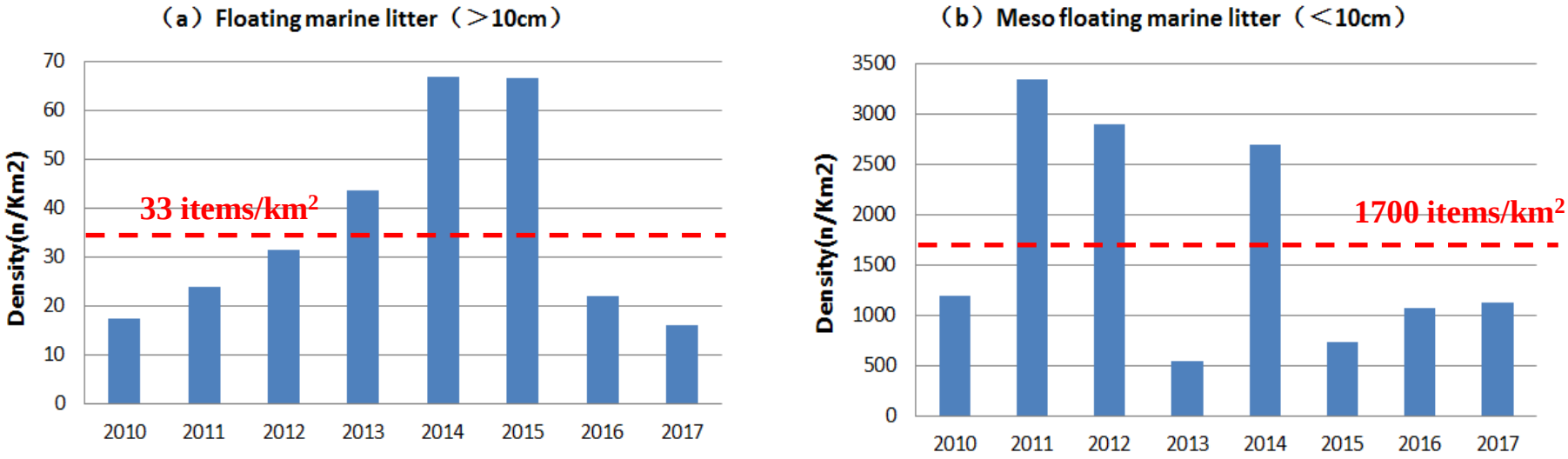
Types of floating litter in surface water of Yellow Sea of China
中国黄海表层海水漂浮垃圾类型

根据2017年国家海洋环境状况公报，中国黄海沿海漂浮垃圾的主要类型是塑料、聚苯乙烯泡沫塑料、木头、橡胶、玻璃。主要的塑料垃圾是聚苯乙烯泡沫塑料，塑料袋，塑料瓶和香烟过滤嘴。90.4%的漂浮垃圾来自陆地，9.6%来自海上活动。

According to National Marine Environmental Status Bulletin in 2017, the main types of floating litter along the coast of Yellow Sea of China were plastic, polystyrene (PS) foam, woods , rubber, glasses.

Main plastic litters are PS foam, plastic bags, plastic bottles and cigarette filters. 90% of floating litter comes from land and 10% from sea activities.

Distribution of marine litter in the Yellow Sea

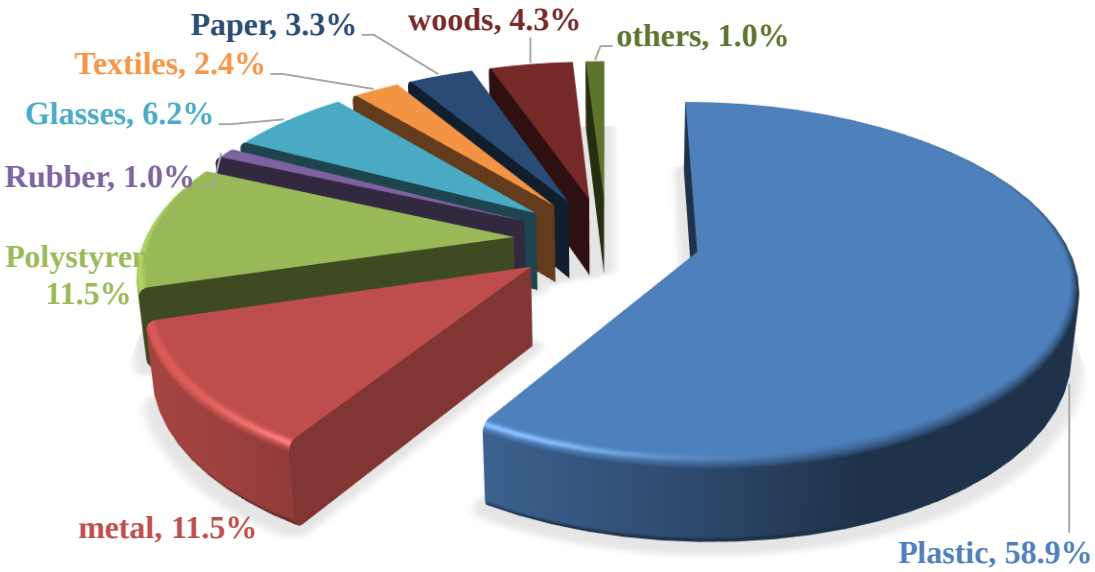


Floating litter in surface water of Yellow Sea of China in 2010 to 2017
2010-2017年 中国黄海表层海水漂浮垃圾变化情况

From 2011 to 2017, the mean density of large size litter floating on the sea surface of the Yellow Sea was 33 items/ km^2, and the average density of small and medium trash was 1700 items/ km^2. The mean density of marine litter in sea surface increased from 2010 to 2014, and then decreased from 2015 to 2017. The results show that the average density of floating litter in the Yellow Sea in 2017 is obviously lower than the average level in recent years.

2011年至2017年，漂浮在黄海海面的大块垃圾平均密度为33个/km^2，中小快垃圾密度为1700个/km^2。海洋垃圾的平均密度在2010至2014年期间逐年上升，然后从2015至2017年下降，结果显示，2017年黄海漂浮垃圾平均密度低于近年平均水平。

Distribution of marine litter in the Yellow Sea

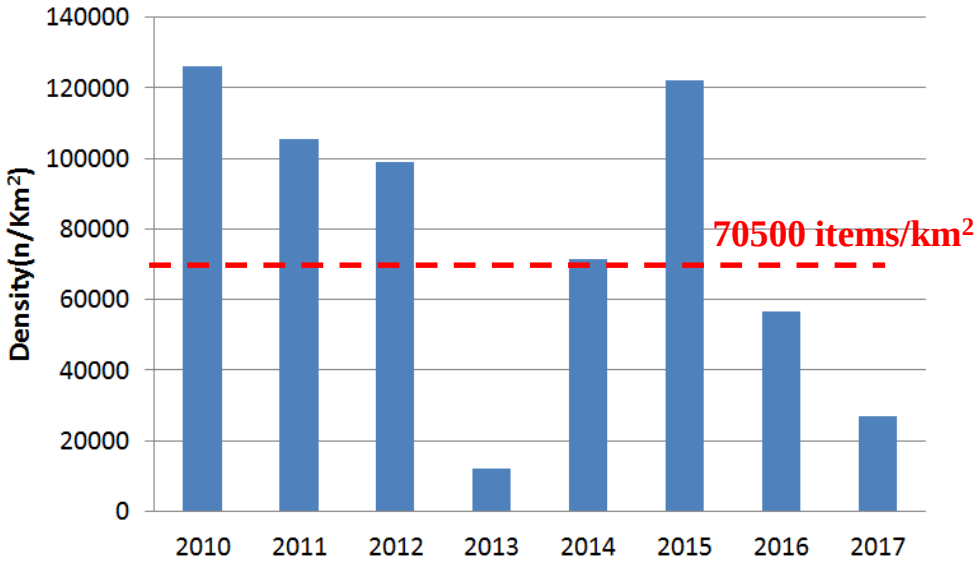


Types of litter in beaches of Yellow Sea of China
中国黄海海滩垃圾类型

The main types of beach litter of Yellow Sea of China were plastic, metal and PS foam, accounting for 59%, 11.5% and 11.5% of the total amount of collected litter respectively. Results showed that 95% of beach waste comes from land and 5% from sea activities.

我国黄海海滩垃圾的主要类型为塑料、金属和PS泡沫塑料，分别占垃圾收集总量的59%、11.5%和11.5%。结果显示，94.7%的海滩废物来自陆地，5.3%来自海洋活动。

Distribution of marine litter in the Yellow Sea



Beach litter along coast of Yellow Sea of China in 2010 to 2017

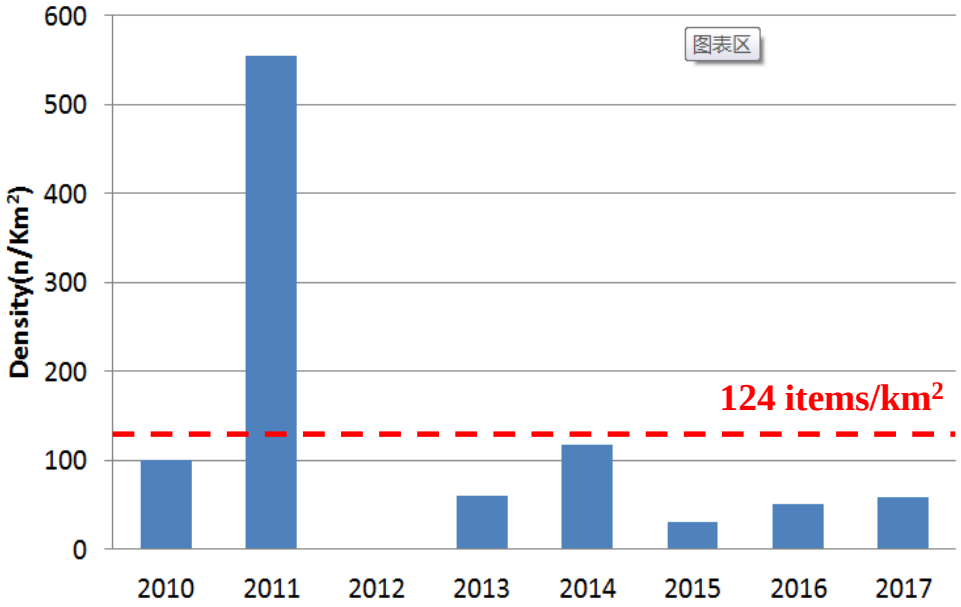
中国黄海海滩垃圾变化情况（2010-2017）

From 2011 to 2017, the average density of beach litter of the Yellow Sea was about 70500 items/ km^2. In 2017, the density of beach litter of the Yellow Sea was 27000 items/ km^2.

For beach litter, the average density decreased from 2015 to 2017, and the results show that the density of beach litter of the Yellow Sea in 2017 is obviously lower than the average level in recent years

2011年至2017年，黄海海滩垃圾的平均密度约为70500个/平方公里。2017年，黄海海滩垃圾密度为27000个/平方公里。对于海滩垃圾，2015年至2017年平均密度有所下降，结果表明，2017年黄海海滩垃圾密度明显低于近年来的平均水平

Distribution of marine litter in the Yellow Sea



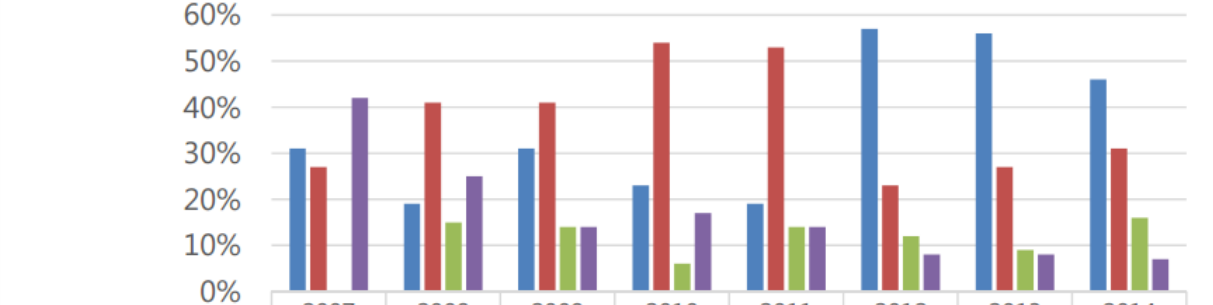
Benthic litter of the Yellow Sea of China in 2010 to 2017

中国黄海海底垃圾变化情况（2010-2017）

In 2017, the density of benthic litter of the Yellow Sea was about 58 items/ km^2, and the majority of the litter were metal and woods. It was comparable to that in 2016. From 2011 to 2017, the mean density of benthic litter of the Yellow Sea was about 124 items/ km^2

2017年黄海海底垃圾密度约为58个/平方公里，其中金属和木头居多。这与2016年的情况相当。2011年至2017年，黄海海底垃圾密度约为124个/平方公里。

Comparison of marine litter of China and Korea



	2007	2008	2009	2010	2011	2012	2013	2014
Polystyrene foam	31%	19%	31%	23%	19%	57%	56%	46%
Plastic waste	27%	41%	41%	54%	53%	23%	27%	31%
Wood garbage	0	15%	14%	6%	14%	12%	9%	16%
Others	42%	25%	14%	17%	14%	8%	8%	7%

Composition ratio of the number of floating marine litter in China (NOWPAP)

中国漂浮垃圾组成变化情况（2007-2014）

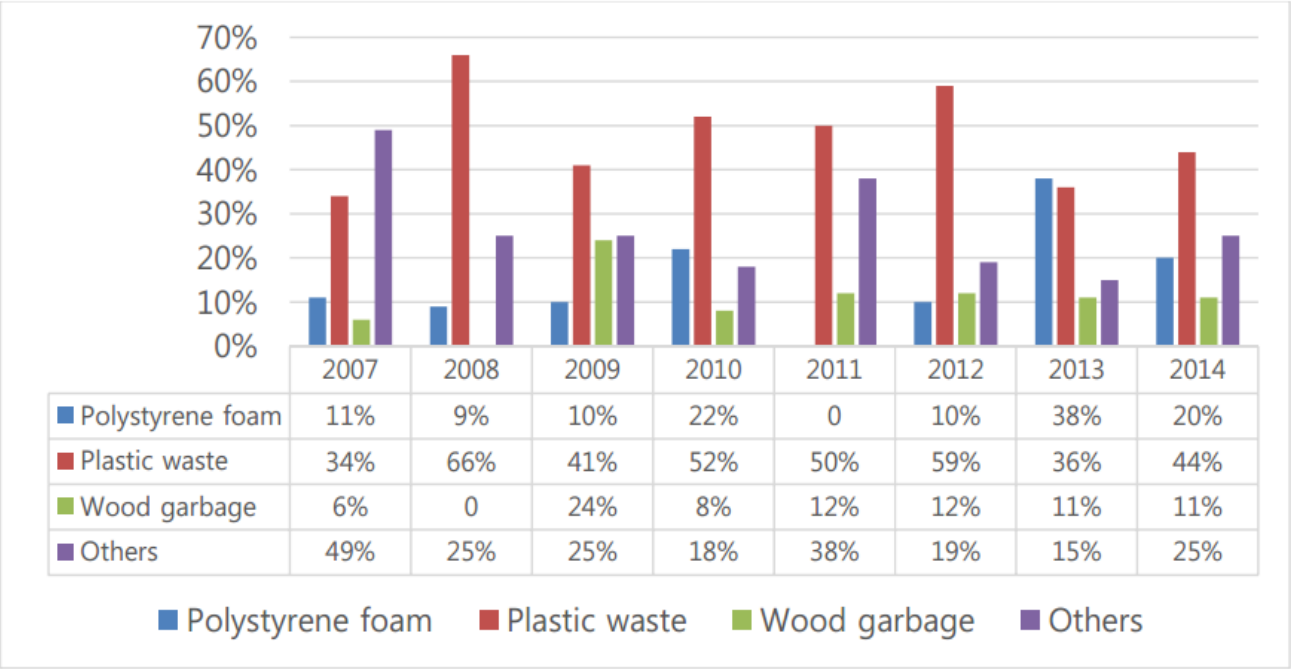
From 2007 to 2014, the majority of floating marine litter in China was plastic waste accounting for 37%, followed by PS foam and wood.

It was estimated that the main composition of plastic litter were plastic bags, and bottles, and about 80% of the floating litter is discharged from land and the remaining 20% originates from various marine activities.

2007年至2014年，中国海洋漂浮垃圾以塑料垃圾居多，占37%，其次是PS泡沫塑料和木材。

据估计，塑料垃圾的主要成分是塑料袋和瓶子，约80%的漂浮垃圾来自陆地，其余20%来自海洋的各种活动。

Comparison of marine litter of China and Korea



	2007	2008	2009	2010	2011	2012	2013	2014
Polystyrene foam	11%	9%	10%	22%	0	10%	38%	20%
Plastic waste	34%	66%	41%	52%	50%	59%	36%	44%
Wood garbage	6%	0	24%	8%	12%	12%	11%	11%
Others	49%	25%	25%	18%	38%	19%	15%	25%

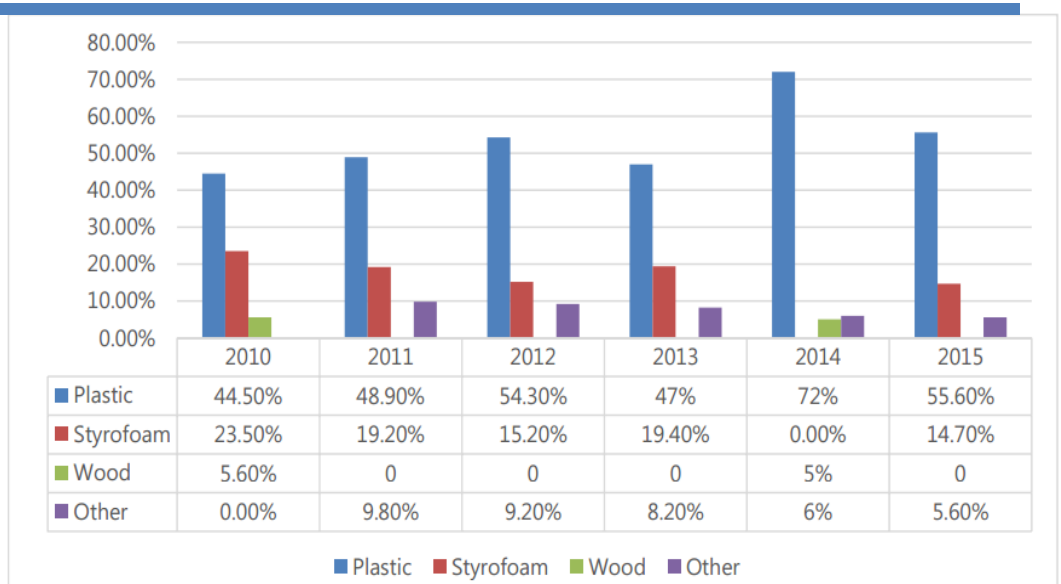
Composition ratio of the number of litter on beach in China (NOWPAP)

中国海滩垃圾组成变化情况（2007-2014）

For the beach litter, it was identified that the majority of litter was also comprised of plastic waste accounting for 48%, followed by PS foam and wood. The average number of the litter was 43,000 items /km^2. The main composition of plastic litter included plastic bags, bottles as well as plates and ropes.

海滩垃圾中，塑料垃圾占48%，其次是聚苯乙烯泡沫塑料和木材。垃圾的平均数量为43000个/平方公里。塑料垃圾的主要成分包括塑料袋、瓶子以及盘子和绳子。

Comparison of marine litter of China and Korea



	2010	2011	2012	2013	2014	2015
Plastic	44.50%	48.90%	54.30%	47%	72%	55.60%
Styrofoam	23.50%	19.20%	15.20%	19.40%	0.00%	14.70%
Wood	5.60%	0	0	0	5%	0
Other	0.00%	9.80%	9.20%	8.20%	6%	5.60%

Total number of collected marine litter and its composition ratio(%) during 2010-2015 in Korea (NOWPAP)

韩国海洋垃圾组成变化情况（2010-2015）

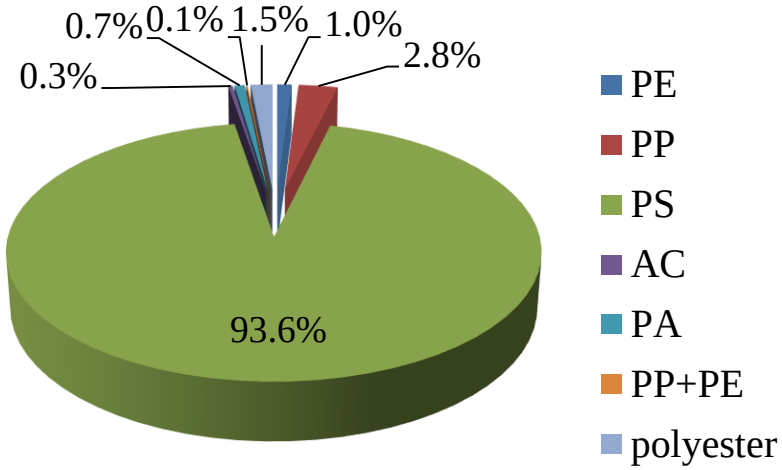
In Korea, the number of marine litter decreased from the year 2010 to 2014, but increased sharply in 2015, maybe due to the number of monitoring sites increased.

The results showed that plastic waste and PS foam took the first and second place with taking almost half of the marine litter in most of the years. Around 20-30% of marine litter was found to be fishery-related waste. On the other hand, the rest was originated from land-based activities

在韩国，海洋垃圾的数量从2010年到2014年下降，但在2015年急剧增加，可能是由于监测点的数量增加。

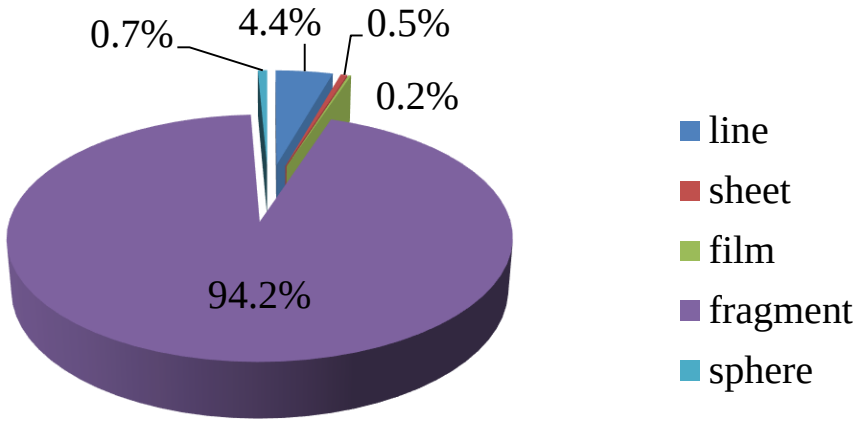
结果表明，塑料垃圾和聚苯乙烯泡沫塑料分别居首位和第二位，占海洋垃圾总量的近一半。约20-30%的海洋垃圾被发现是与渔业有关的废物。另一方面，其余的则来自陆上活动。

Floating marine microplastic in the yellow sea of China



Composition of microplastics of the southern Yellow Sea of China in 2017

2017年中国南黄海微塑料组成



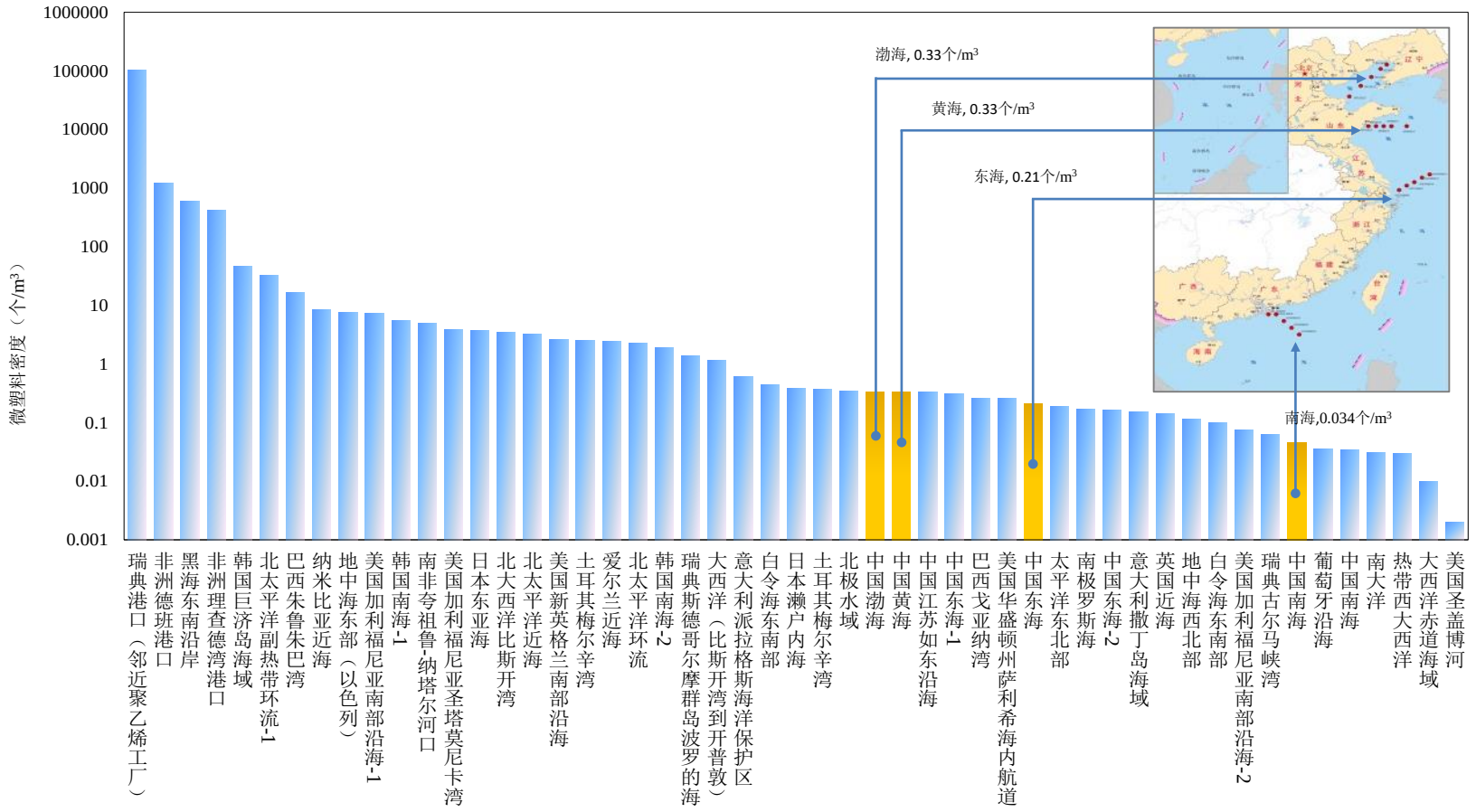
Shapes of microplastics of the southern Yellow Sea of China in 2017

2017年中国南黄海微塑料形态分布

The average density of floating microplastics in the south yellow sea of China is 0.33 items/ m^3. The main type of microplastics is polystyrene, accounting for 93% of the total amount of microplastics. The main shape is fragments.

我国南黄海漂浮微塑料的平均密度为0.33个/ m^3。微塑料的主要类型是聚苯乙烯，占微塑料总量的93%。微塑料主要的形状是碎片。

Conclusion



Although China was considered a hot spot of plastic debris pollution, comparison of our data with those of other published reports shows that the microplastic density in the Yellow Sea was in the lower-middle level.

虽然中国被认为是塑料碎片污染的热点地区，但我们的数据与其他已发表的报告相比，黄海的微塑料密度处于中下水平。

Thanks you for listening!