

# Distribution of microplastics in the Yellow Sea of PR China

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# Heading or Title of section

Body text should be 16 pts and up for readability

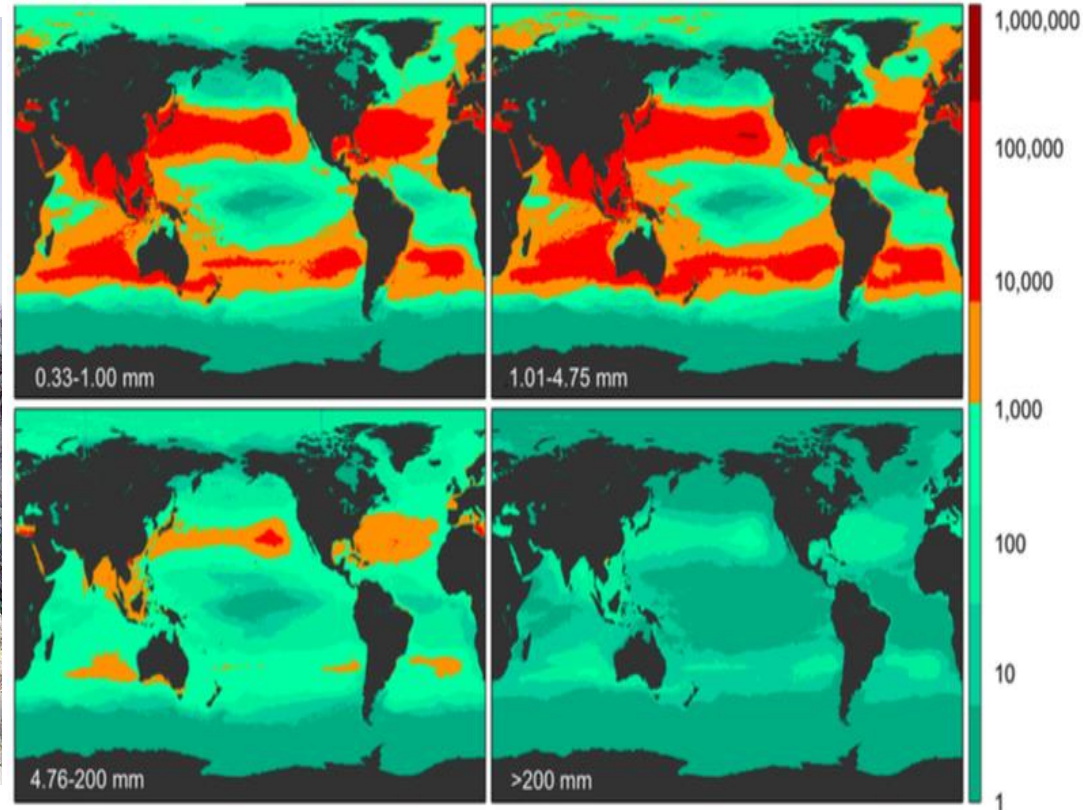
# Outline

- **Background**
- **Microplastics in seawater**
- **Microplastics in zooplankton**
- **Microplastics in fish**
- **Summary**

# Plastic waste input to the ocean is increasing



- Over 9 million tons of plastic waste entering the ocean (Chen et al., 2015)



(Eriksen M, Lebreton LCM, Carson HS, Thiel M, Moore CJ, et al. (2014) Plastic Pollution in the World's Oceans: More than 5 Trillion Plastic Pieces Weighing over 250,000 Tons Afloat at Sea. PLoS ONE )

# Microplastics—the most harmful form of plastics

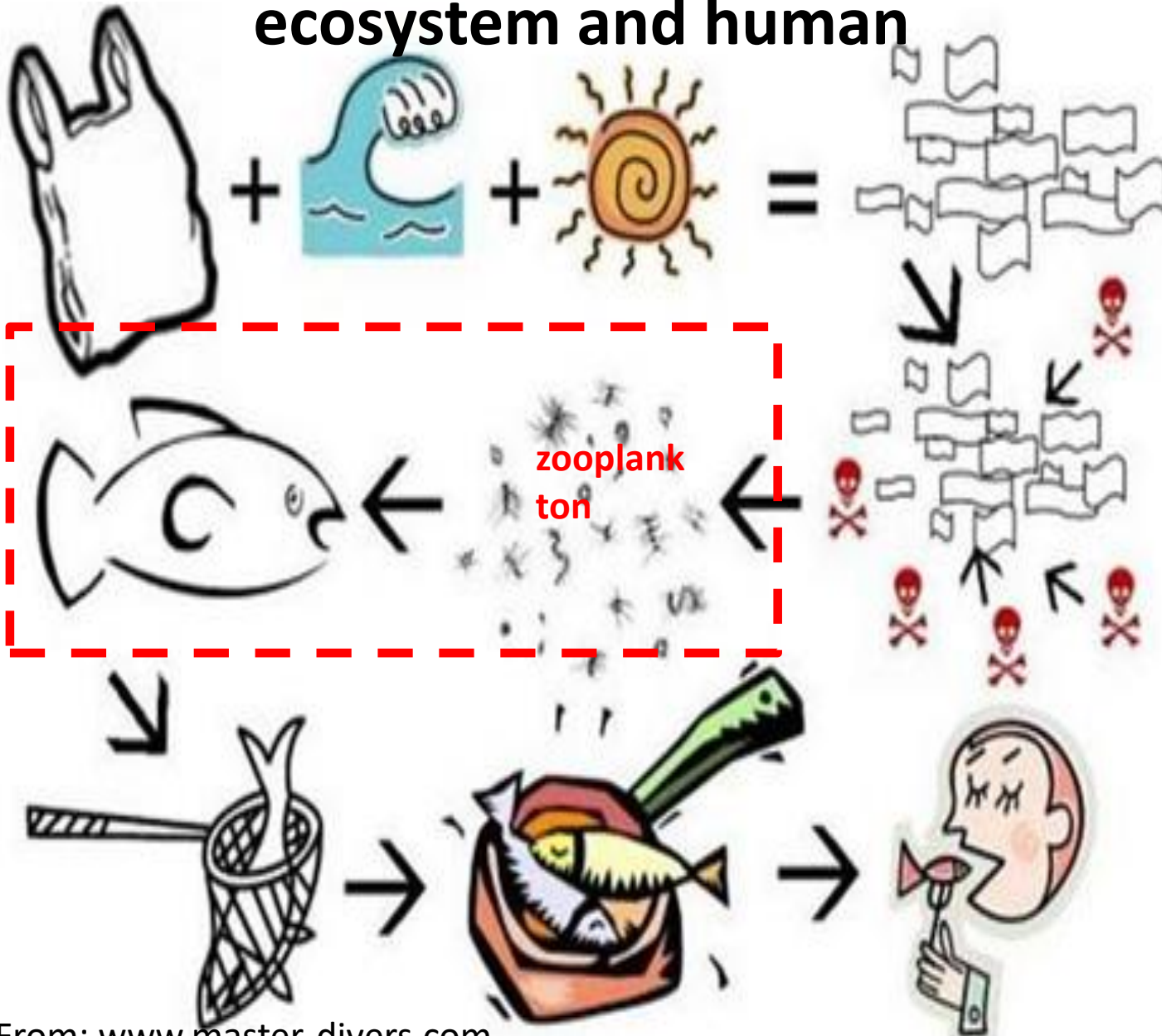


Thompson, R.C., Olsen, Y., Mitchell, R.P., Davis, A., Rowland, S.J., John, A.W.G., McGonigle, D., Russell, A. E. (2004). Lost at sea: Where is all the plastic? *Science* 304 (5672), 838.





# Potential MPs risk on marine ecosystem and human



- Zooplankton and fish is ubiquitous in the marine environment.
- Ingestion of MPs by zooplankton is the fundamental link for MPs entering the food web.
- It's important to know the ingestion of MPs by natural

# Ingestion of MPs by zooplankton

- It has been proved that MPs could be ingested by zooplankton and transferred along the food web.

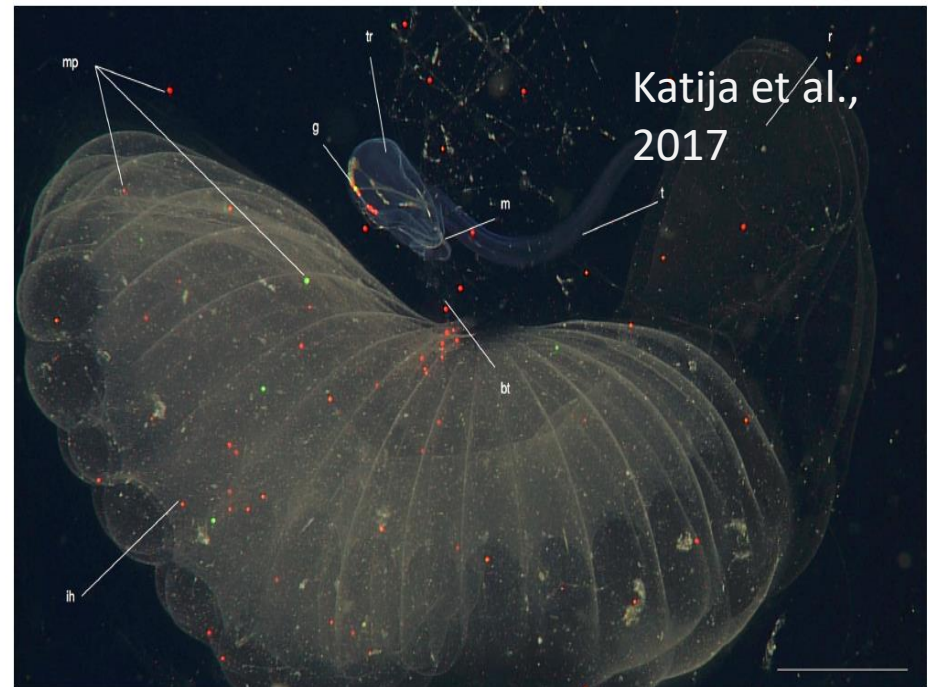
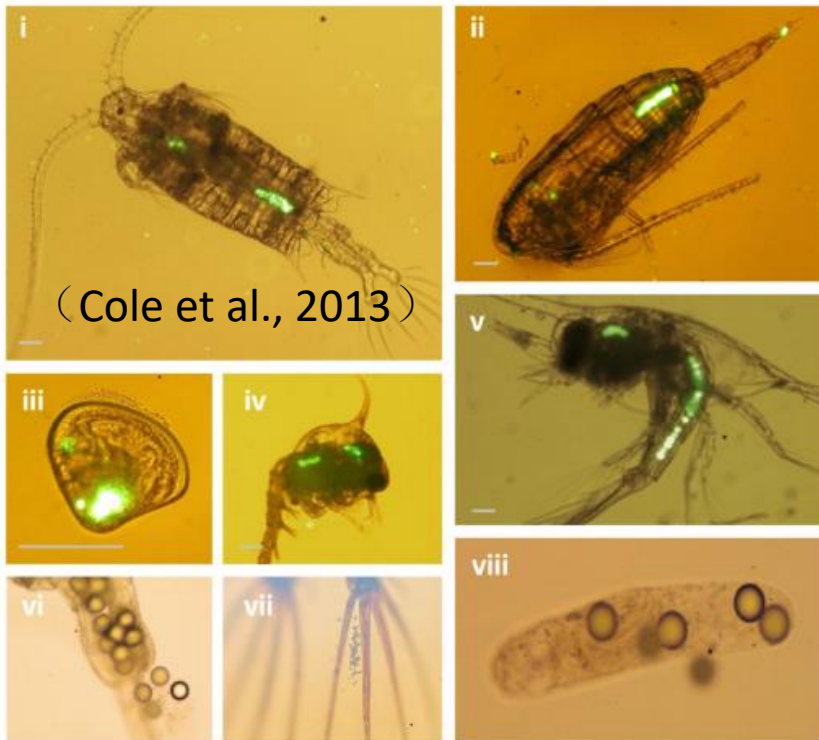


Fig. 2. During feeding experiments, microplastics were observed inside and attached to the inner house and inside the gut of giant larvaceans. Microplastic particles in varying size ranges (from 10 to 600  $\mu\text{m}$ ) are represented by different colors (for example, red, yellow, green, and orange; see table S1 for specific particle sizes). Image corresponds to *B. stygius* specimen D5 from dive D870 (table S1). Scale bar, 2 cm. ih, inner house; bt, buccal tube; mp, microplastics; g, gut; tr, trunk; m, mouth; t, tail; r, ramp of inner house.



# Ingestion of MPs by fish

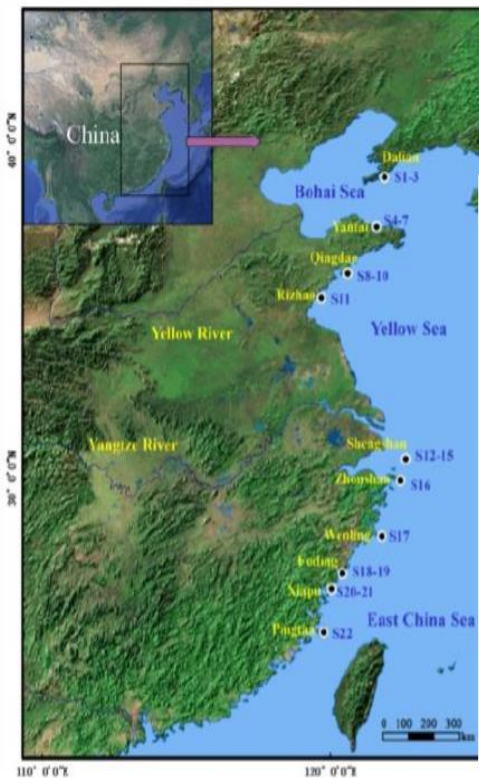
Table 3  
Summary of microplastic ingestion by fish species in their natural habitat reported worldwide and the methods used for extraction and identification of Microplastics; FTIR - Fourier Transform Infrared Spectroscopy.

Location/country	Habitat	# Species (#Individuals)	Individuals with MPs (%)	Fibers (%)
Mallorca Island	Marine	1 (417)	27.3	97
Italy	Marine	5 (125)	28	23
Spain	Marine	3 (212)	17.5	71
North Sea	Marine	7 (1203)	2.6	-
Turkey	Marine	28 (1337)	34	70
North Sea	Marine	4 (400)	0.25	0
China	Marine Freshwater	27 (468)	95.7-100	58.4
Swedish coast	Marine	1 (62)	68	-
England	Marine	10 (504)	36.5	68.3
Northeast Atlantic	Marine	10 (761)	11	93
England	Freshwater Estuarine	2 (66)	75-20	70
Chile	Marine	5 (62)	-	99
Spain	Marine	1 (337)	68	100
Portugal	Marine	26 (263)	19.8	65.8
Coast of Easter Island	Marine	1 (20)	80	0
Argentina	Freshwater Estuarine	11 (87)	100	96
USA	Freshwater	6 (1381)	42.4	86.4
USA	Freshwater Estuarine	50 (535)	8-10	1.3
France	Freshwater	1 (186)	12	-
Brazil	Freshwater	1 (48)	83	46.6
Brazil	Estuarine	69 (2233)	9	90
Japan	Marine	1(64)	77	5.3
Portugal	Estuarine	3 (120)	38	96

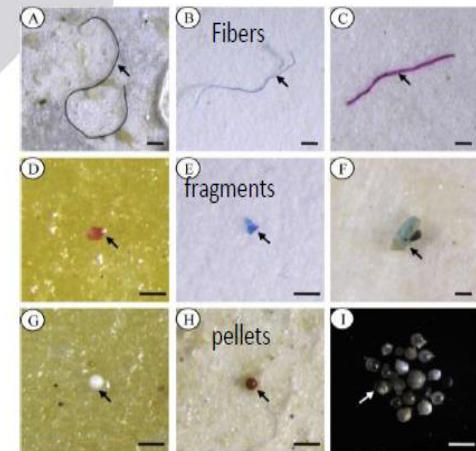
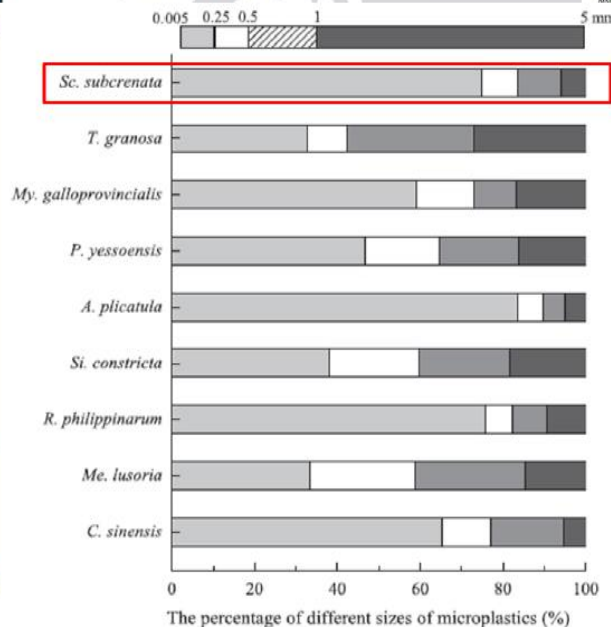
- MPs were detected from fish world wide.
- Highly variable with locations.

# Ingestion of MPs by shellfish

## Microplastic in shellfish along the coasts of China



Sampling sites



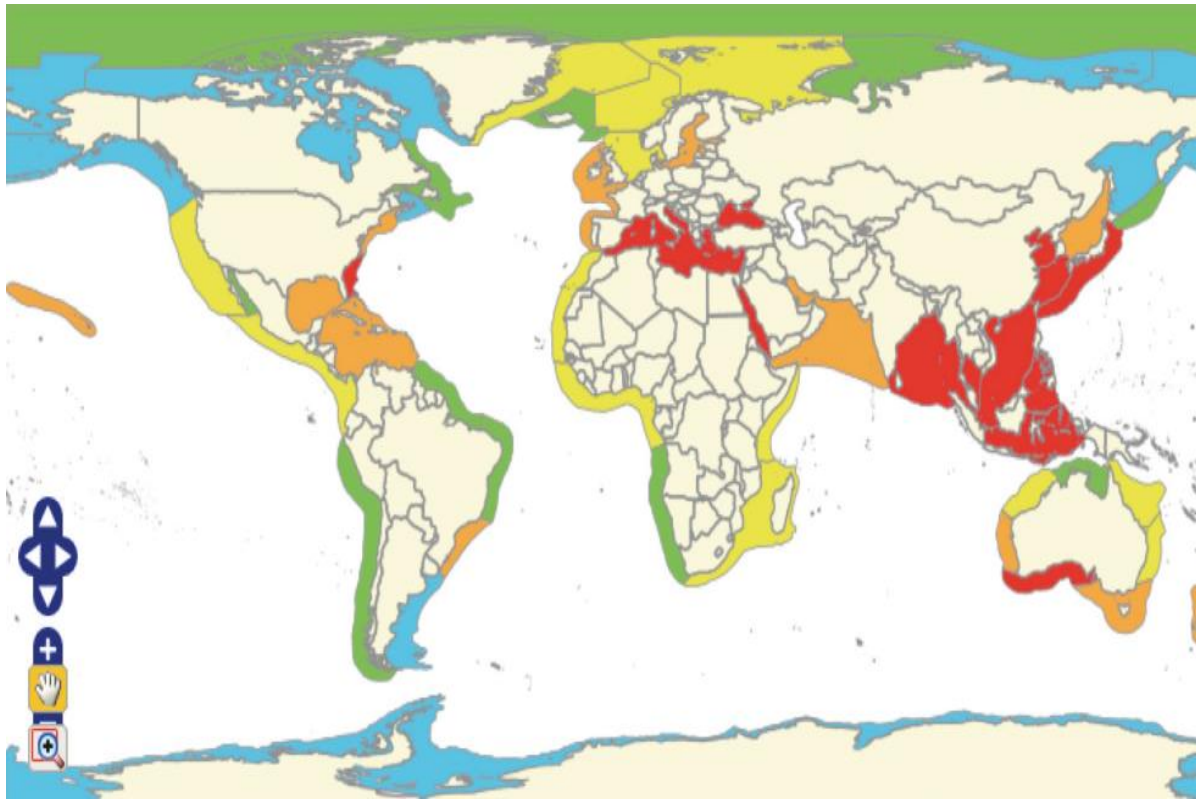
MP Varied 2.1 - 10.5 items/g  
and 4.3 - 57.2 items/individual

# Wide range of marine species from most trophic levels (pelagic and benthic)



Nearly 700 marine species have been found to interact with marine debris to date (Gall & Thompson 2015), with ingestion and entanglement the two main types of interaction.

# The Yellow Sea: high microplastics risk



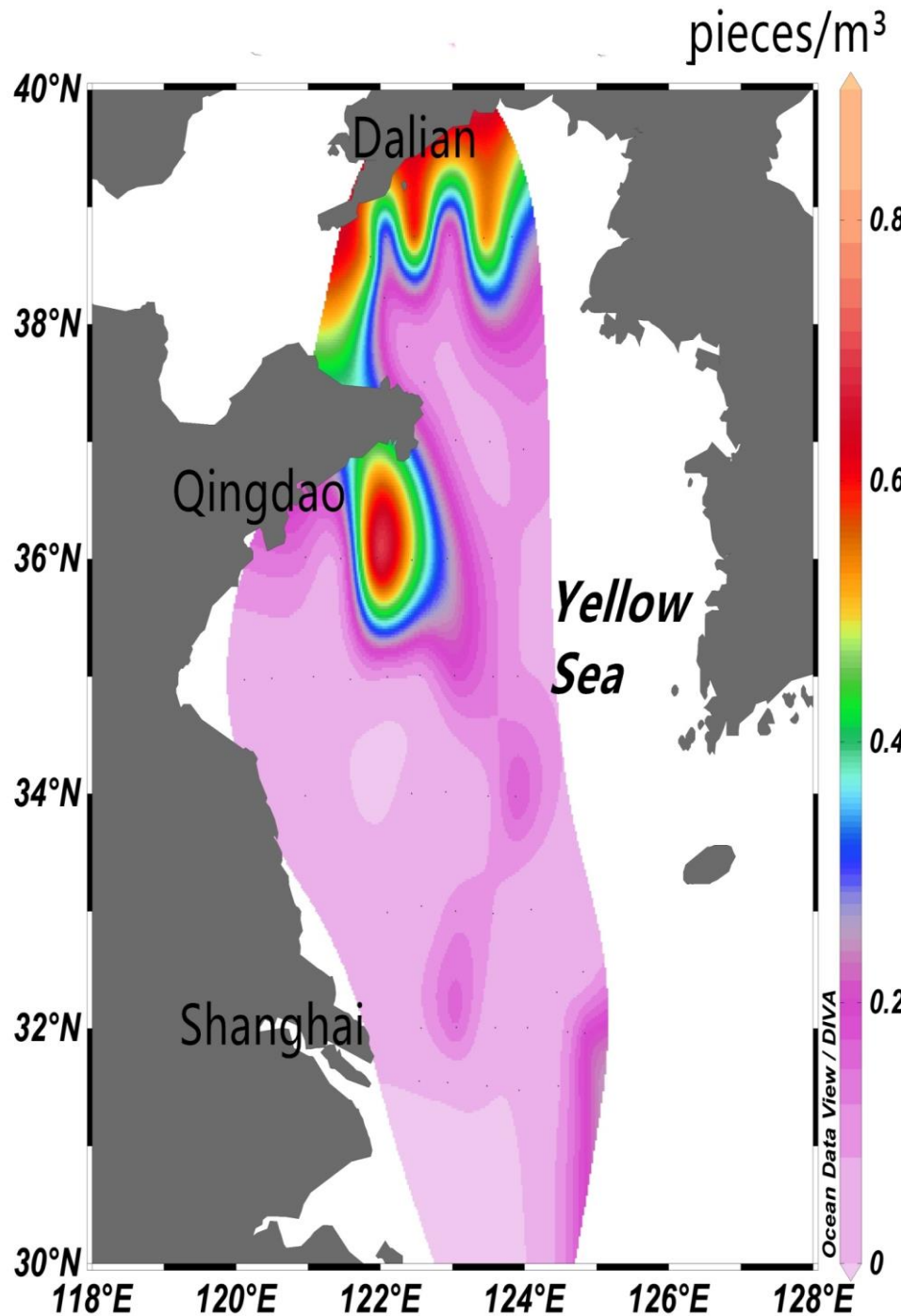
- Intensive human activities
- High interaction of MPs and marine biota

GESAMP, 2017

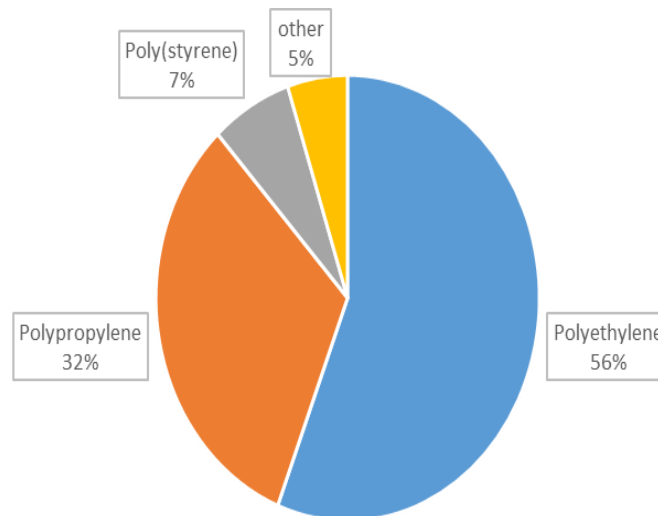
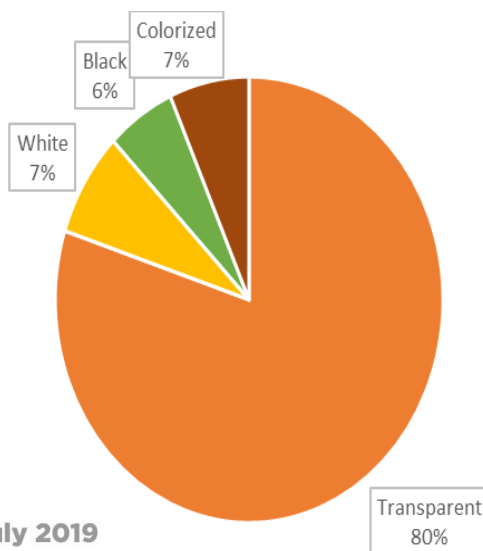
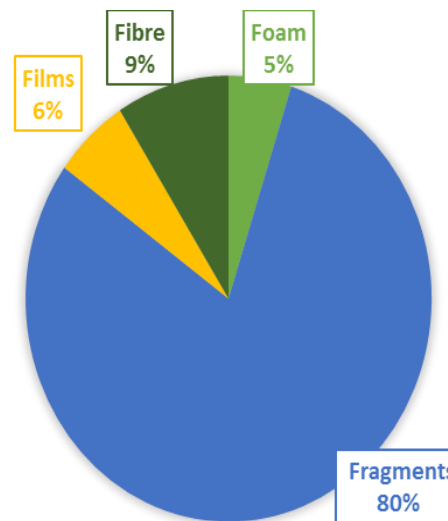
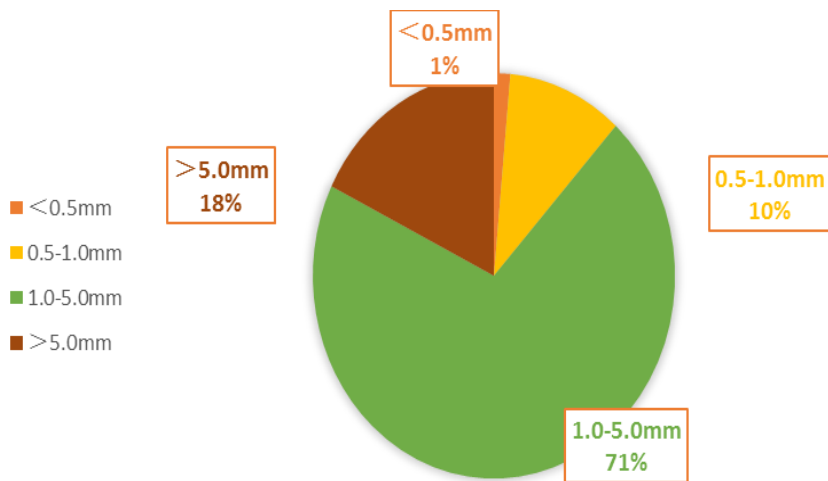
## Distribution of Microplastics in seawater of the Yellow Sea

- The concentration of microplastics was ranged from 0.019 —0.812 pieces/m<sup>3</sup>, the average was 0.134 pieces/m<sup>3</sup>

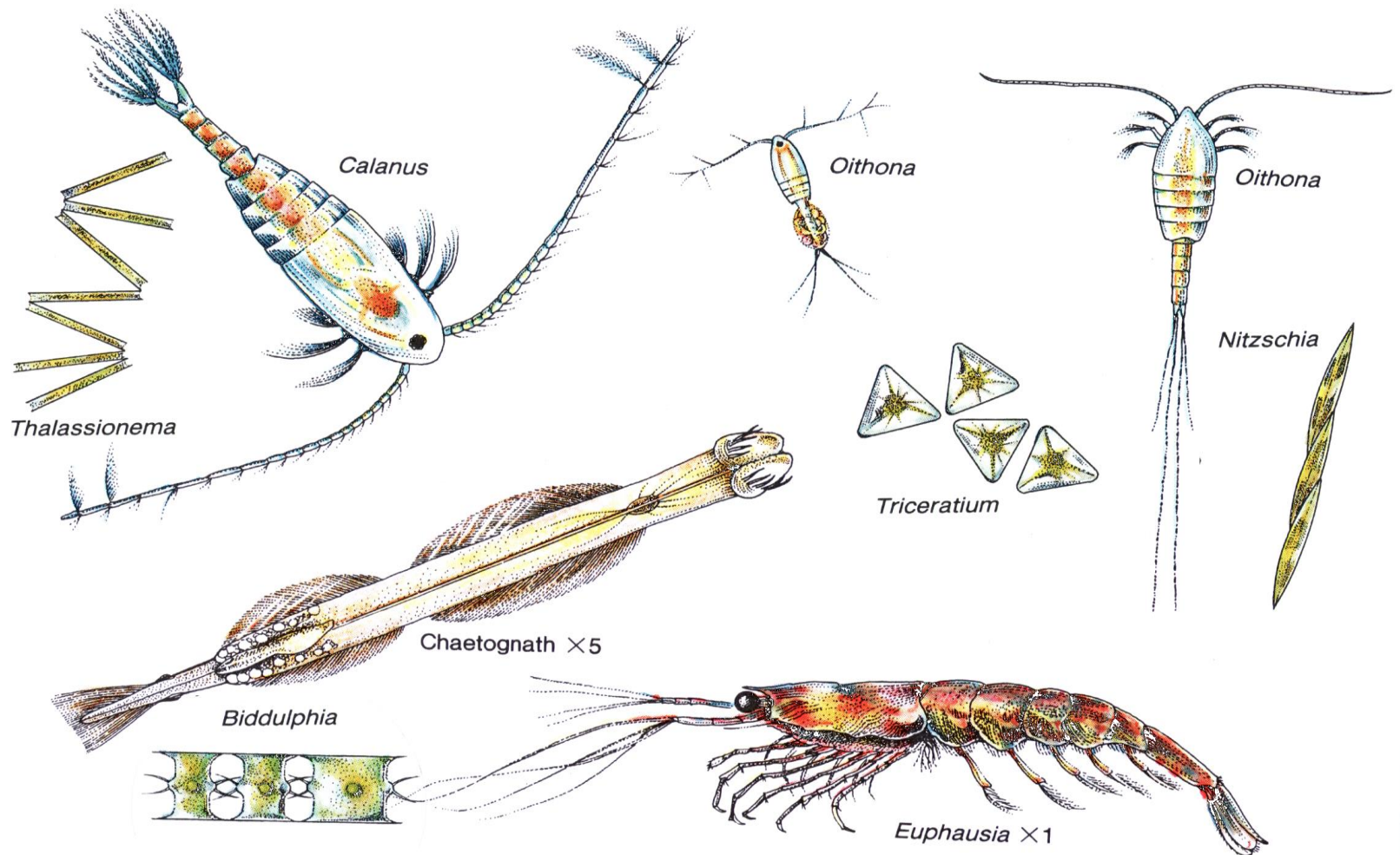
37 Stations(62.8%) <0.1 pieces/m<sup>3</sup>  
14 Stations(27.4%) 0.1—0.6 pieces/m<sup>3</sup>  
5 Stations(9.8%) >0.6 pieces/m<sup>3</sup>



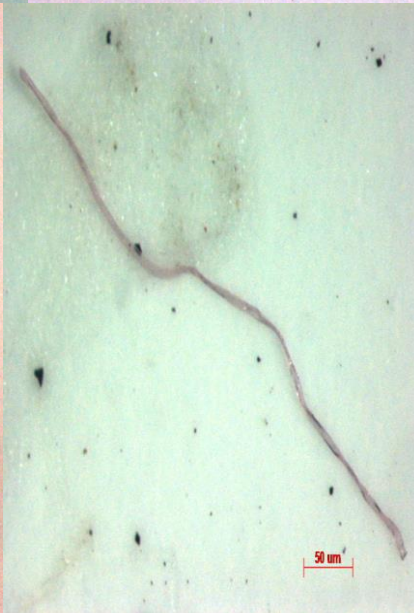
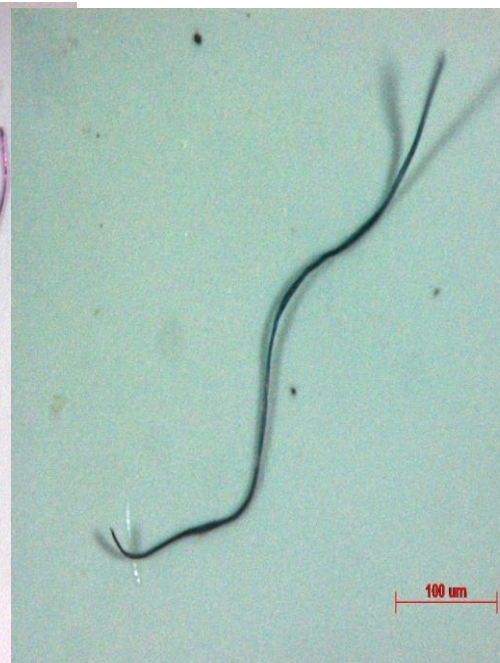
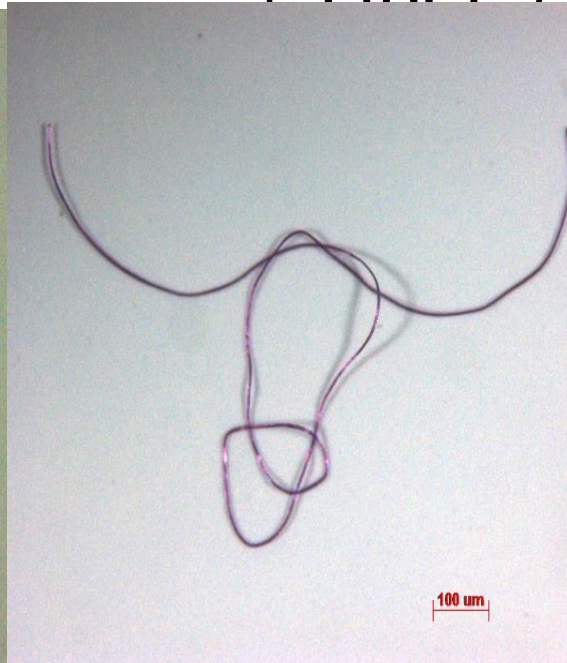
- Shape, color, size and chemical composition of MPs in the Yellow Sea



# Microplastics in zooplankton

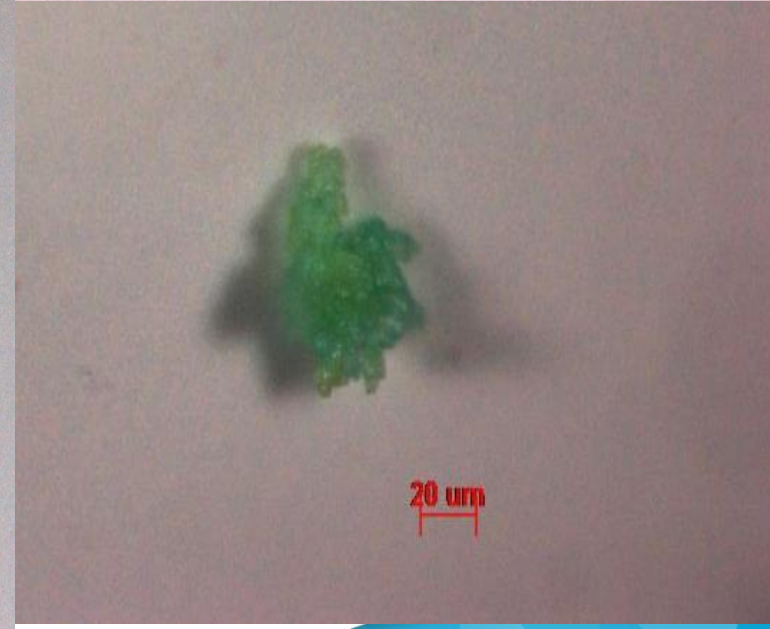


# MPs in Zooplankton in the Yellow Sea ( Fiber )



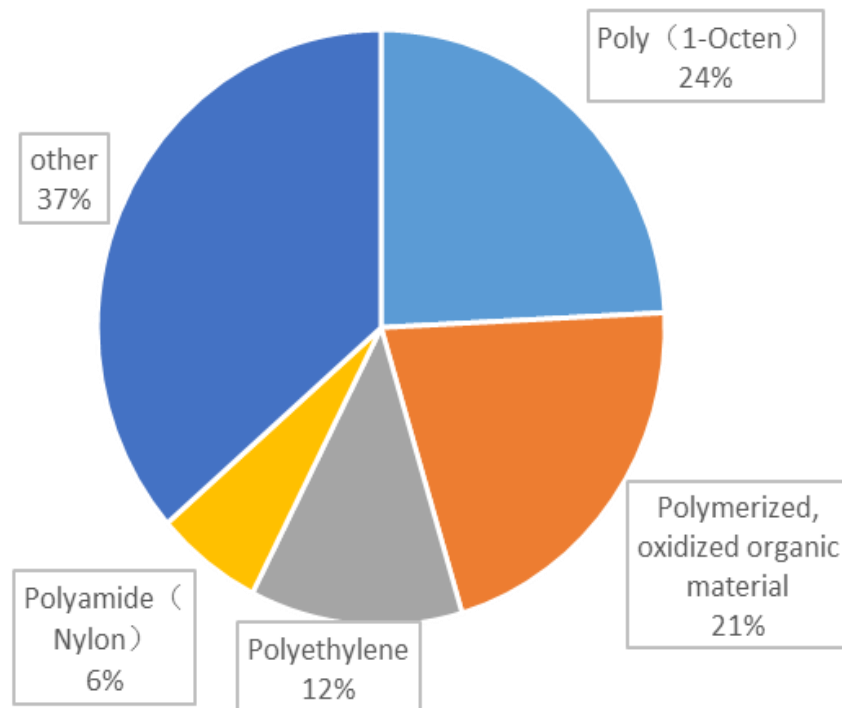
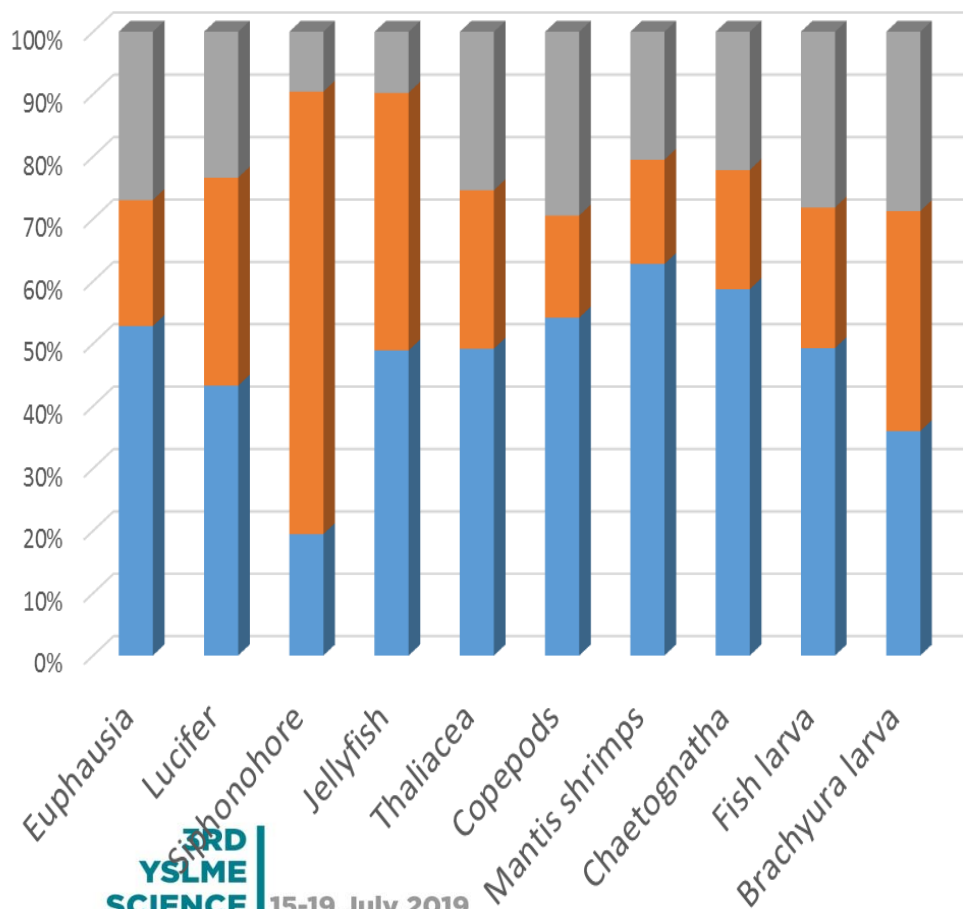


# MPs in Zooplankton (Particles and other shapes)

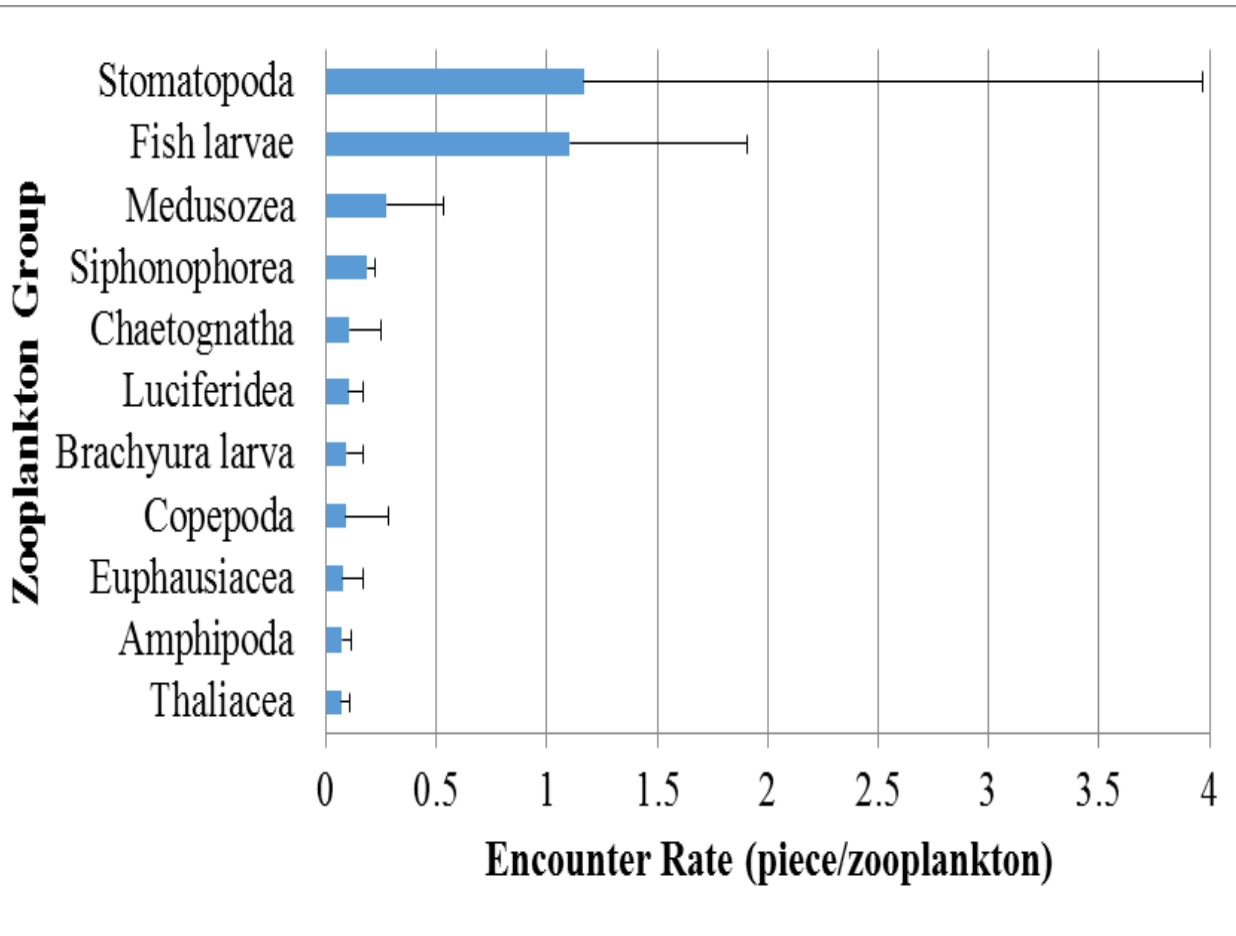


# Shape and chemical composition of MPs in Zooplankton in the Yellow Sea

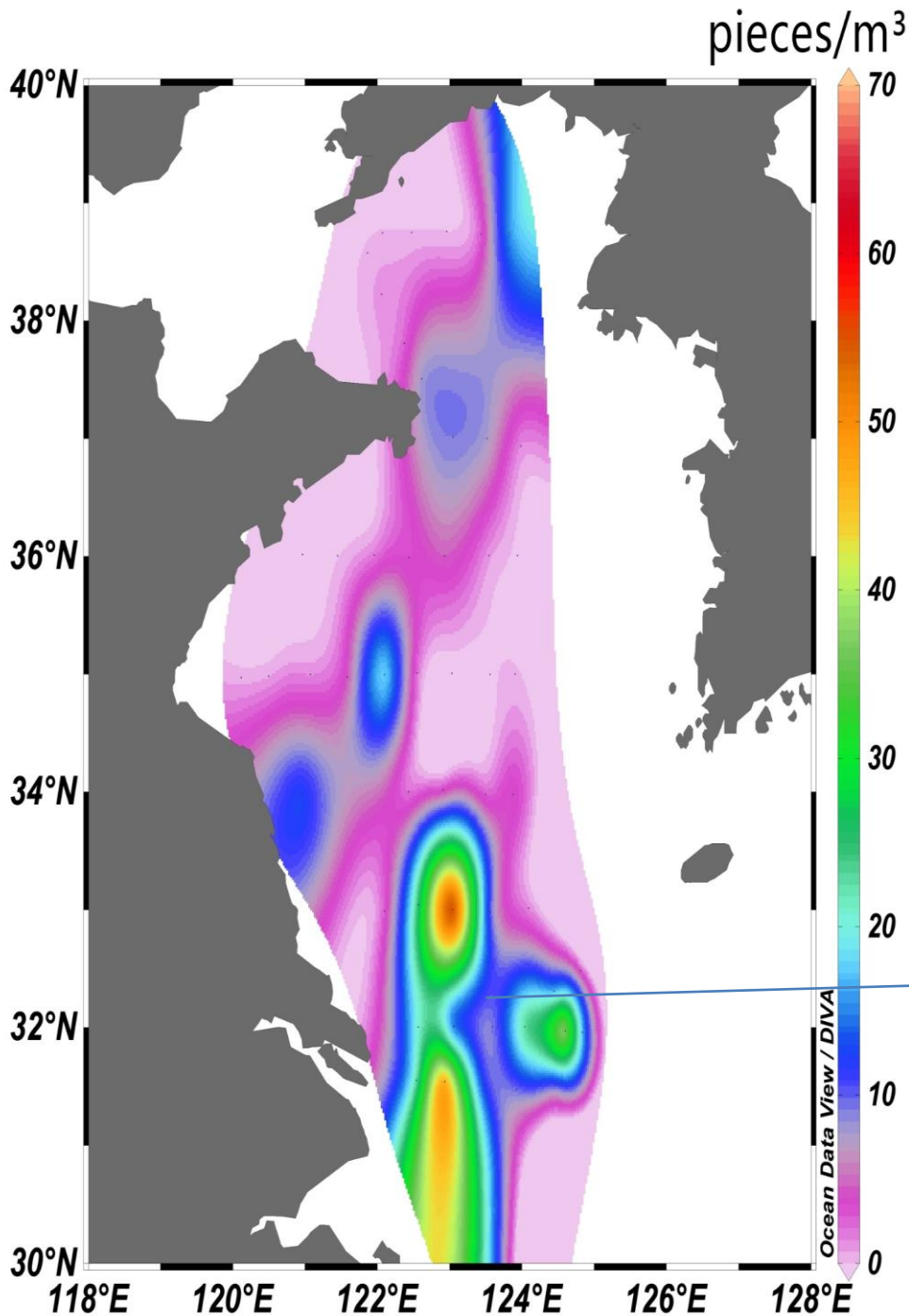
■ Fiber    ■ Particles    ■ Other shapes



# MP/zooplankton



- The MP/zooplankton ranges from 0.07 to 1.17 pieces/zooplankton for different groups.
- The MP/copepod in the Yellow Sea was **3.1 times** of the northeast Pacific Ocean, and **1.8 times** of the northern South China Sea.

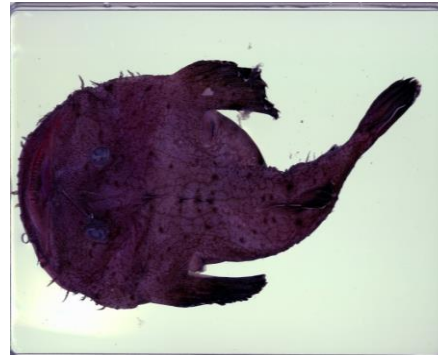
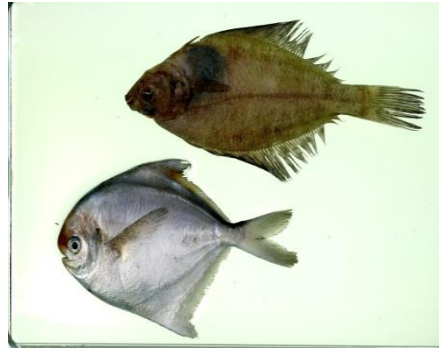
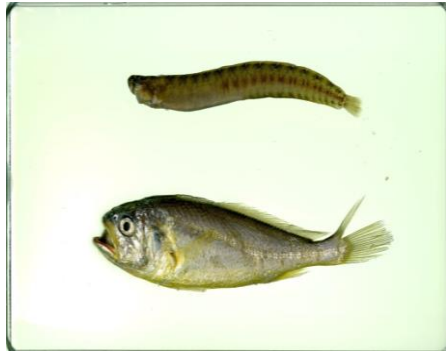


# Distribution of MPs in zooplankton of the Yellow Sea

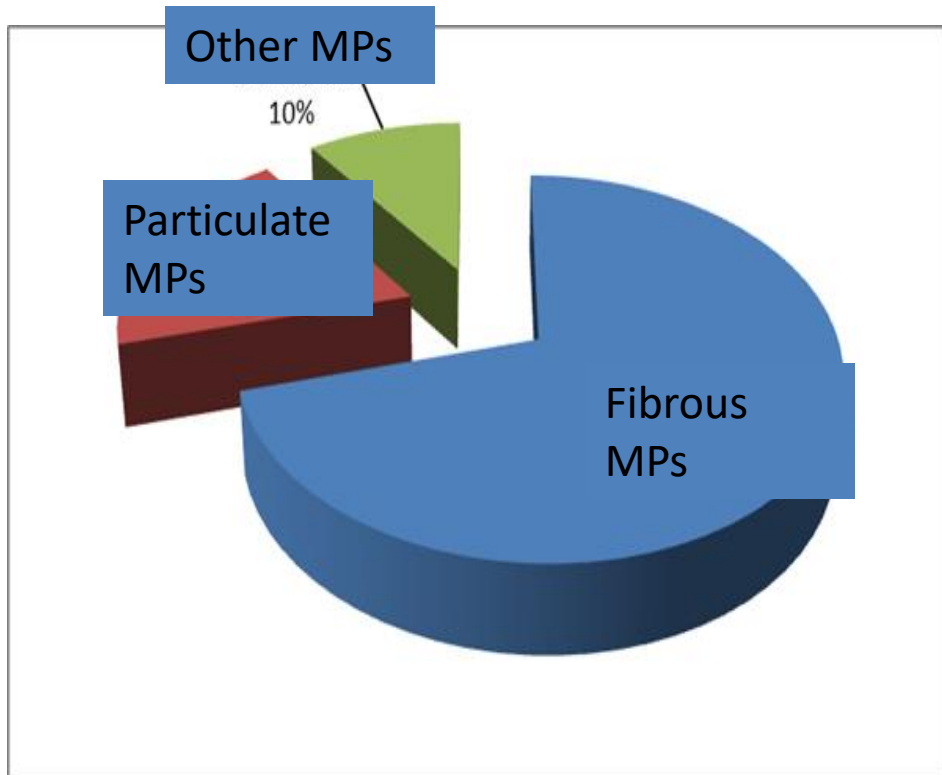
**Average:  $12.24 \pm 25.70$   
pieces/m<sup>3</sup>**

The accumulation  
of MPs in  
zooplankton from  
the sea area  
adjacent to the  
Yangtze Estuary is  
the highest.

# Microplastics in **fish** from the Yellow Sea (19 species)



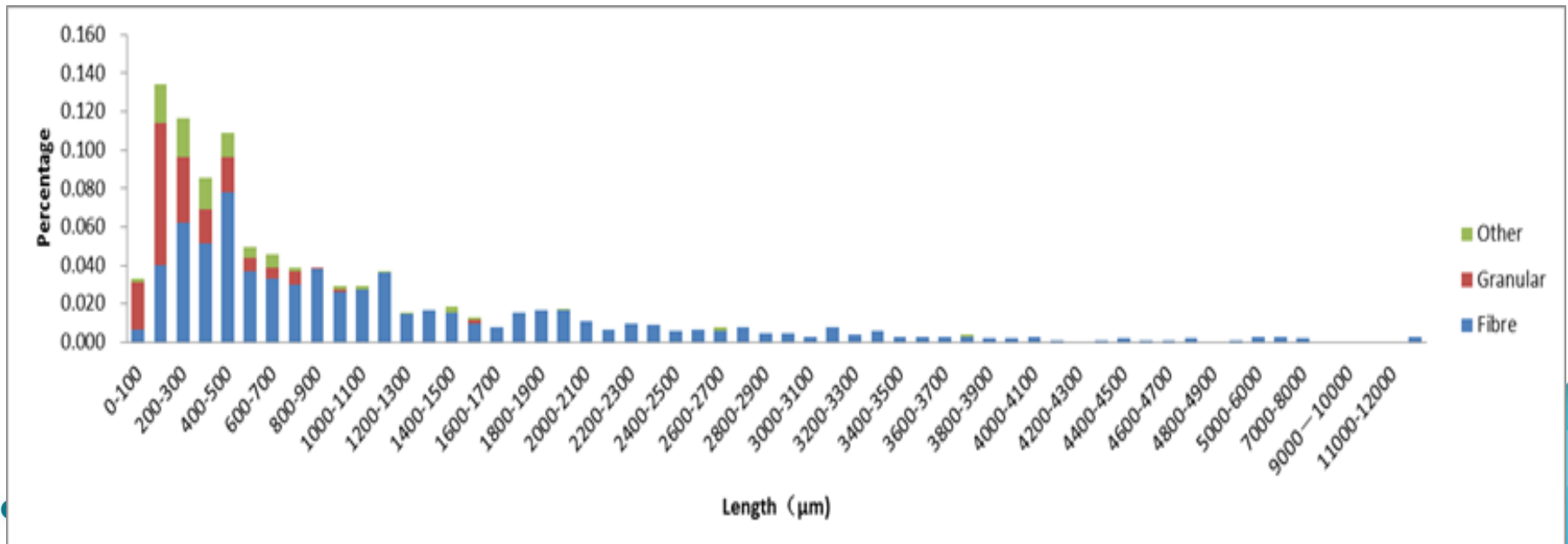
# The shape composition of MPs in the fish



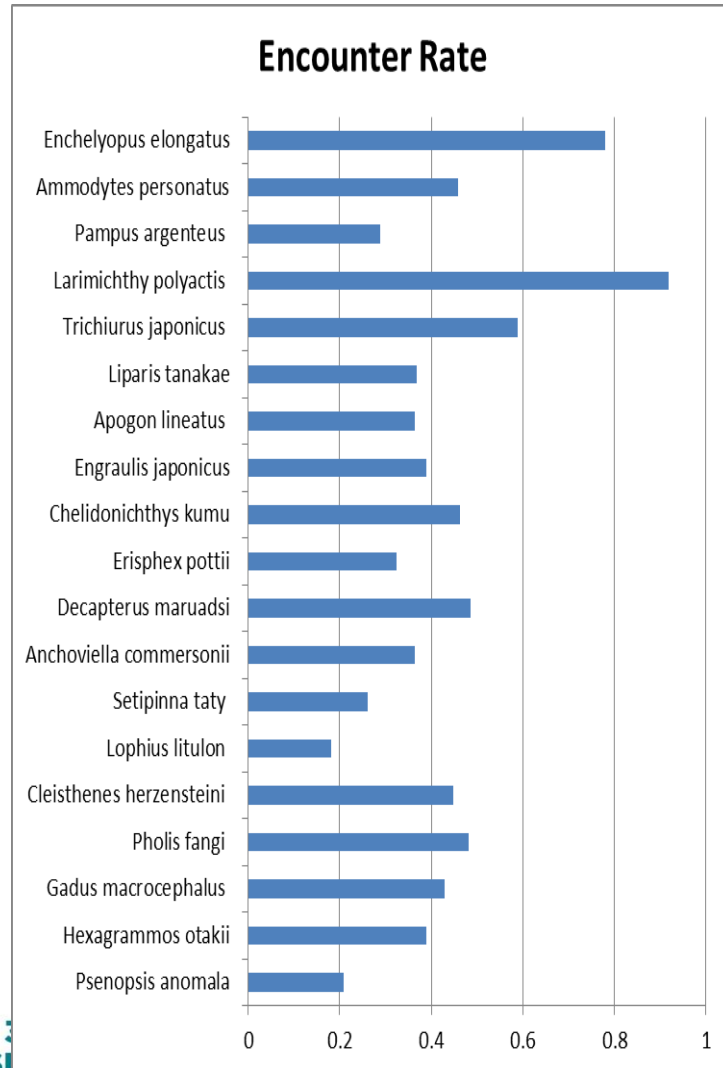
- Fibrous, particulate, and other shapes of microplastics accounted for 71%, 19%, and 10%, respectively, and fibrous microplastics dominated.

# Size composition of MPs from fish gut

- MPs detected in fish gut ranged from 15.94 to 12988.92  $\mu\text{m}$  in length, with an average of **984.02  $\mu\text{m}$** .
- Overall, 75.23% of the MPs were <**1200  $\mu\text{m}$** , and 47.81% were <500  $\mu\text{m}$  in length.
- The smaller the particles, the greater the proportion of particulate microplastics.



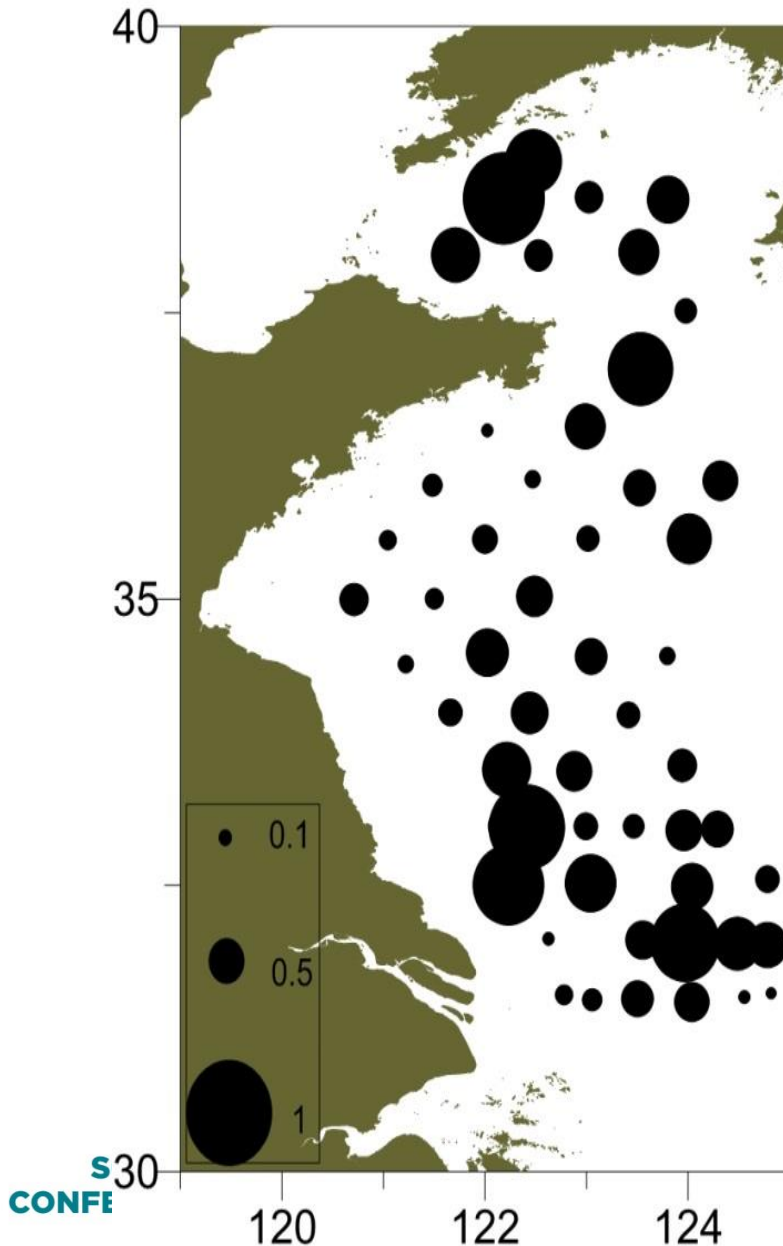
# Number of MPs per fish



- MPs were detected in all fish species sampled.
- Average of 0.42 pieces/fish.
- Range from 0.18 to 0.91 for different species

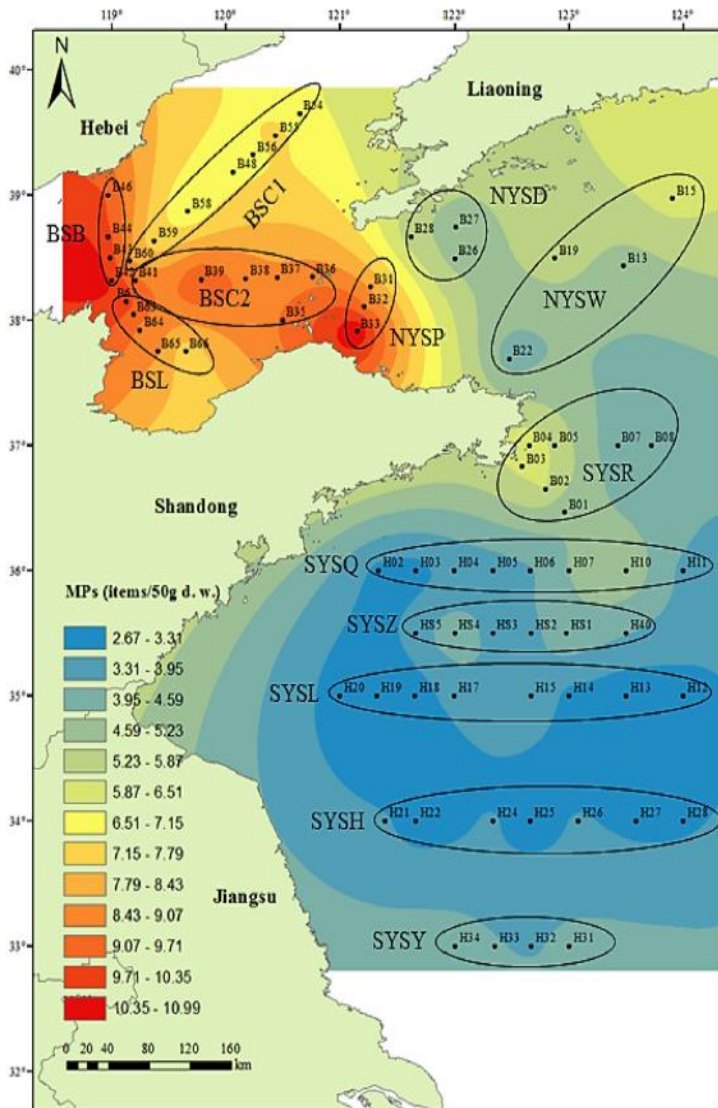


# Spatial variability of MP/fish



- The sea area adjacent to the Yangtze River Estuary and the Bohai Sea showed high values of MP/fish, while the values of MP/fish in the central Yellow Sea are relatively low.
- Consistent with the intensity of human activities.

# MPs in sediment from the Yellow Sea



- The average microplastic abundance was **171.8, 123.6 and 72.0 items per kg of dry weight sediment** for the Bohai Sea, Northern Yellow Sea and Southern Yellow Sea, respectively.
- Among the sampled microplastics, fiber (93.88%) and small microplastics (<1000  $\mu\text{m}$ ) (71.06%) were the most frequent types.
- The main types of microplastics were rayon (RY), polyethylene (PE) and polyethylene terephthalate (PET).

Zhao et al., Microplastic pollution in sediments from the Bohai Sea and the Yellow Sea, China, Science of the Total Environment 640–641 (2018) 637–645

# Summary

- The risk of microplastics in the north and south part of the Yellow Sea is higher than the middle part.
- The characteristics of microplastics in seawater, zooplankton and fish are different. We didn't find evidence on the transfer and accumulation of the microplastics along the food web in natural sea.
- The concentration of microplastics is not high, indicating that the ecologically relevant concentration and characteristics should be considered for further controlled experiments and risk assessment.

An aerial photograph of a city skyline, likely Hong Kong, viewed from across a large body of water. The city features numerous high-rise buildings, including a prominent blue skyscraper with a white top. The water is dark blue with some small boats. The sky is bright blue with scattered white clouds. The text "Thanks for your attention!" is overlaid in the center in a large, bold, yellow font.

Thanks for your  
attention!

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