Characteristics of microplastics in different matrices in Chinese typical coastal area

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Background

- Healthy oceans and sustainable development are global concerns. Healthy oceans and marine ecosystem services provide critical life support functions for human life.
- Microplastics (MPs) are recognized as emerging pollutants and represent a great risk for marine ecosystems, society and human health.
- Congnitions on the distribution and characteristics of plastic pollution in multiple matrices are required to help design effective plastic reduction and mitigation strategies.
- Complete path research based on regional Characteristics allows for the overall management and planning of land and sea.

## Research Site

Jiaozhou Bay

- Hotspot of MP accumulation, surrounded by Qingdao city, intensive human activities.
- Sources of pollutions: urbanization, ports, tourism, aquaculture, domestic and industrial sewage.
- One of the typical bays with moderate capacity of seawater exchange.
- A typical and exemplary role for MP prevention and control.
- ➤ MPs in seawater, sediment, and biota were analyzed Based on long-term observation conducted by Jiaozhou Bay National Marine Ecosystem station.

Results & Discussion

1. MPs in Seawater
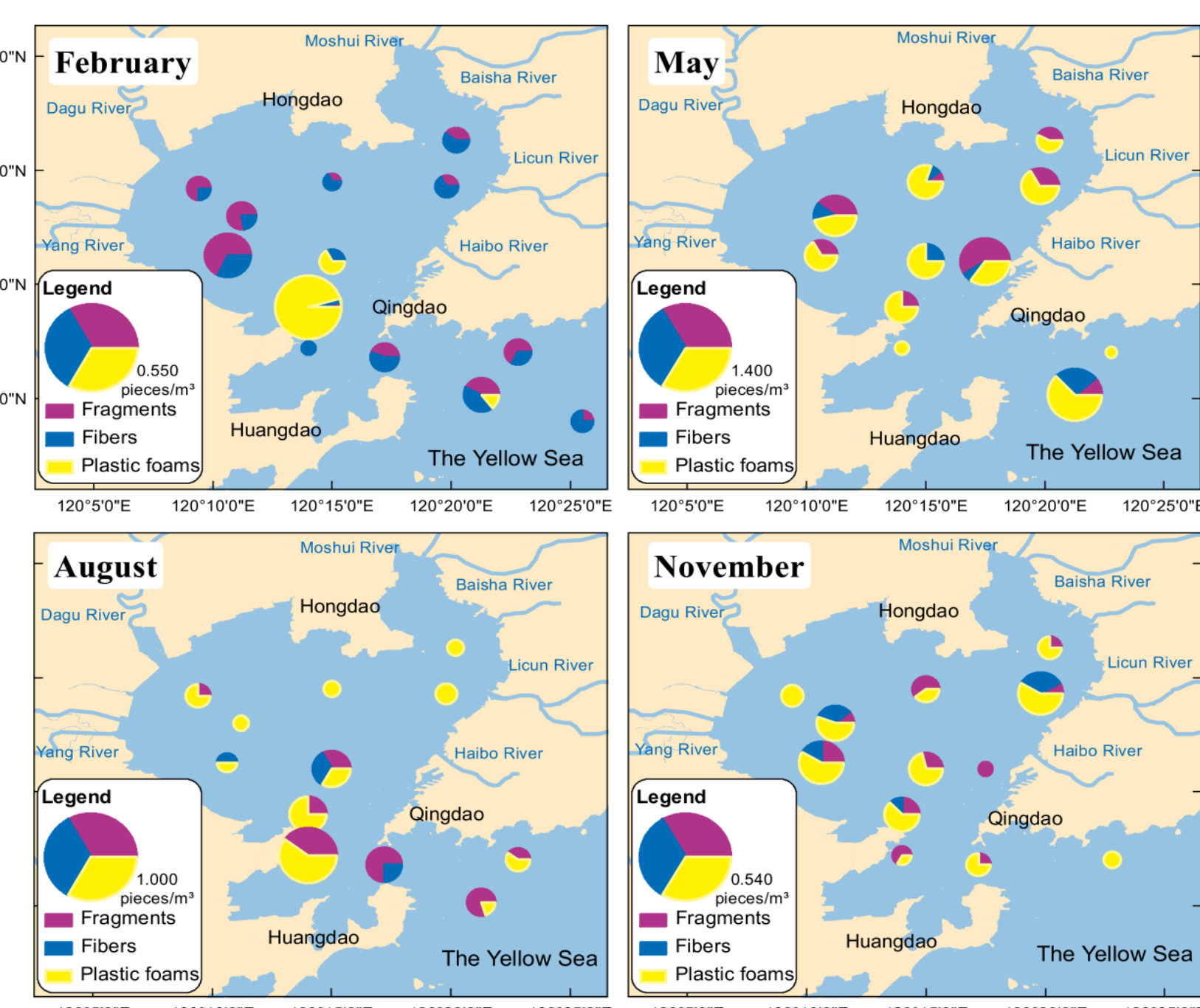
- Average abundance: 0.1pieces/m³ (Sampling with a 500 μm-mesh-size Bongo net), a low level by comparing with other coastal areas.
- ➤ Strong rainfall, winds and eddies significantly affected the spatial distribution of plastics in Jiaozhou Bay.
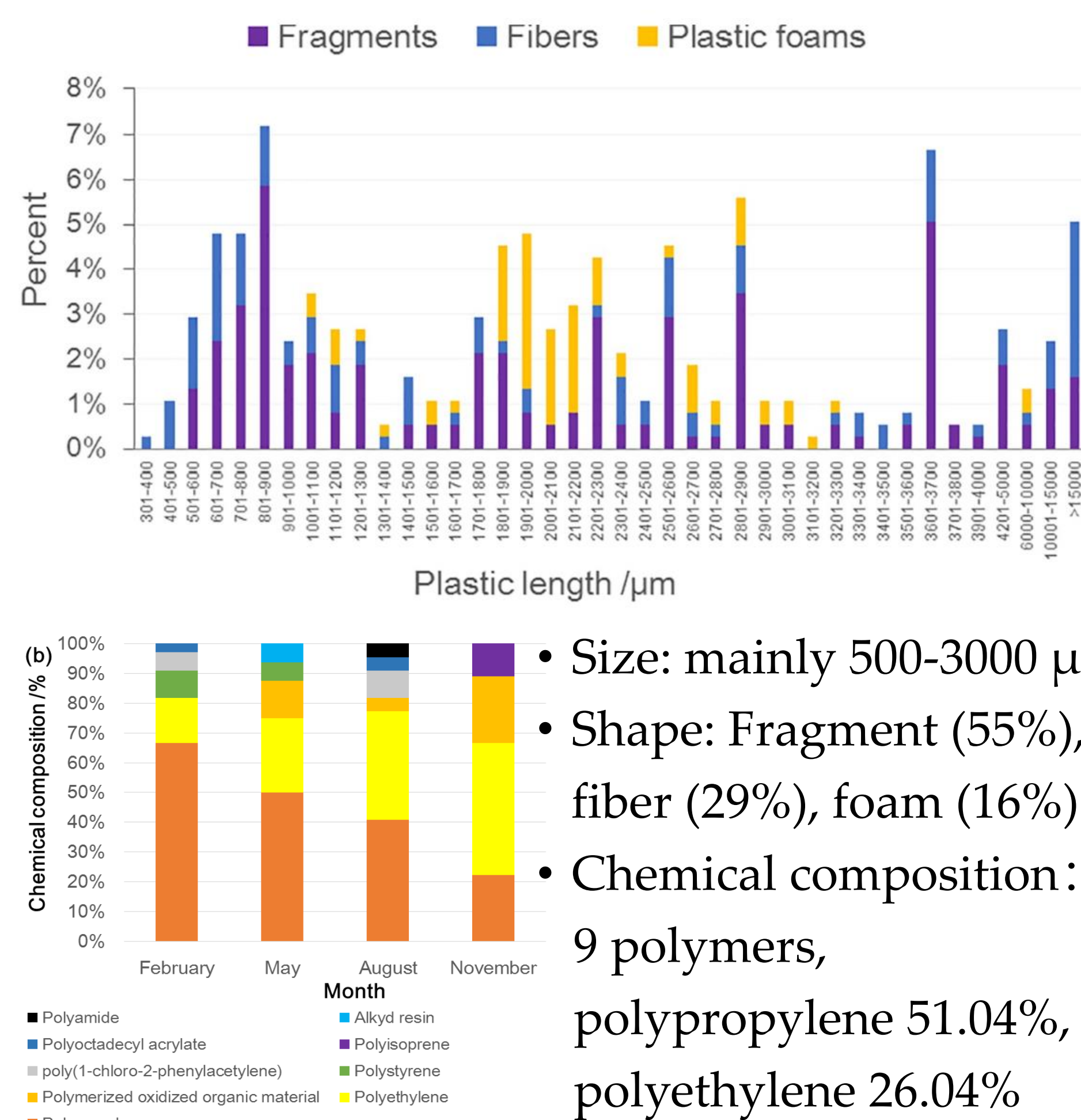
- Size: mainly 500-3000 μm
- Shape: Fragment (55%), fiber (29%), foam (16%)
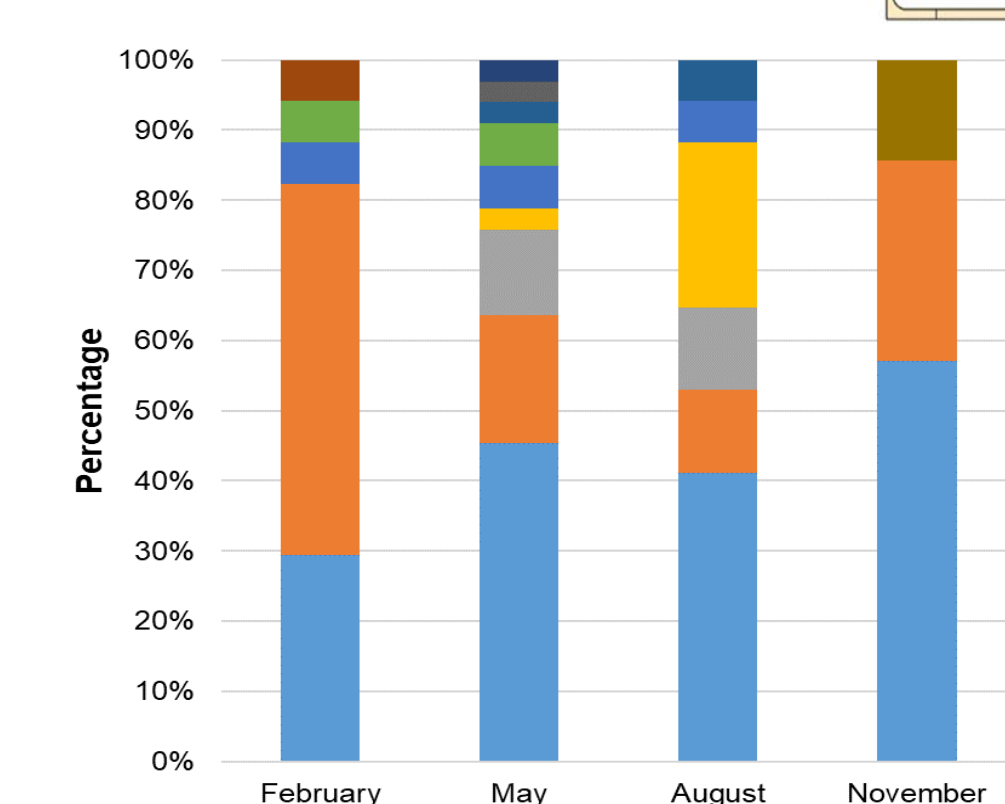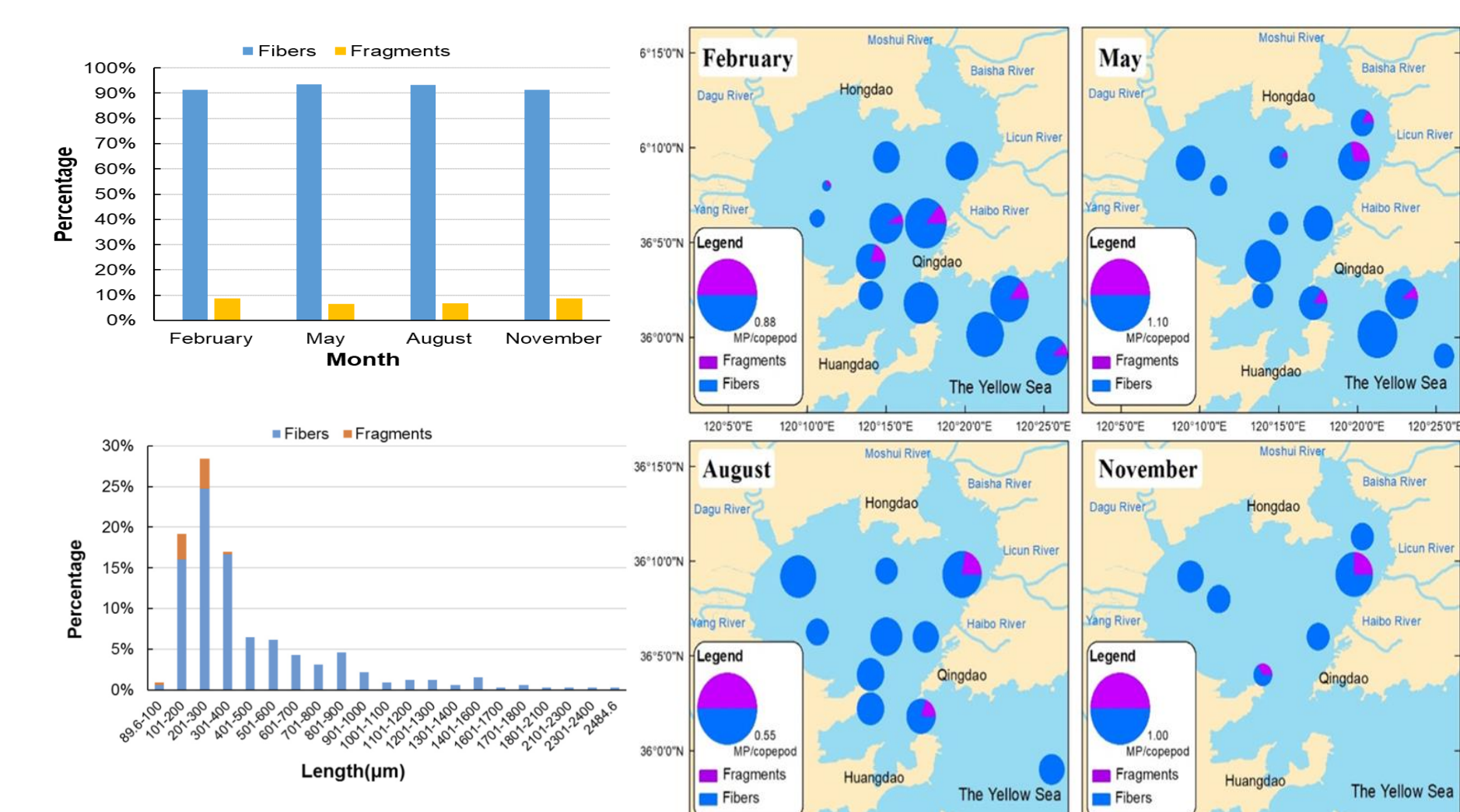- Chemical composition：9 polymers, polypropylene 51.04%, polyethylene 26.04%

2. MPs in Surface Sediment
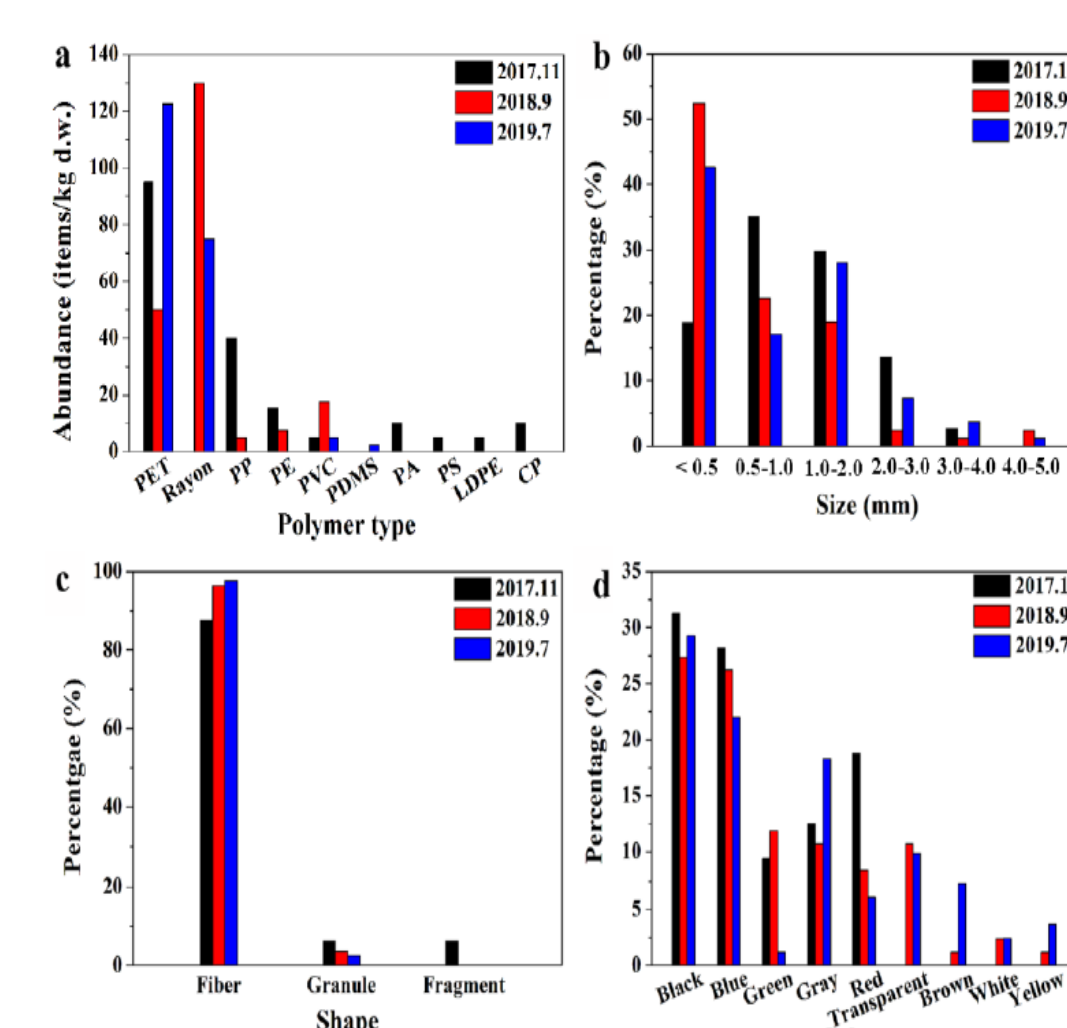
- Abundance: 2.5-27.5 items/kg d.w
- Size: mainly < 2000 μm
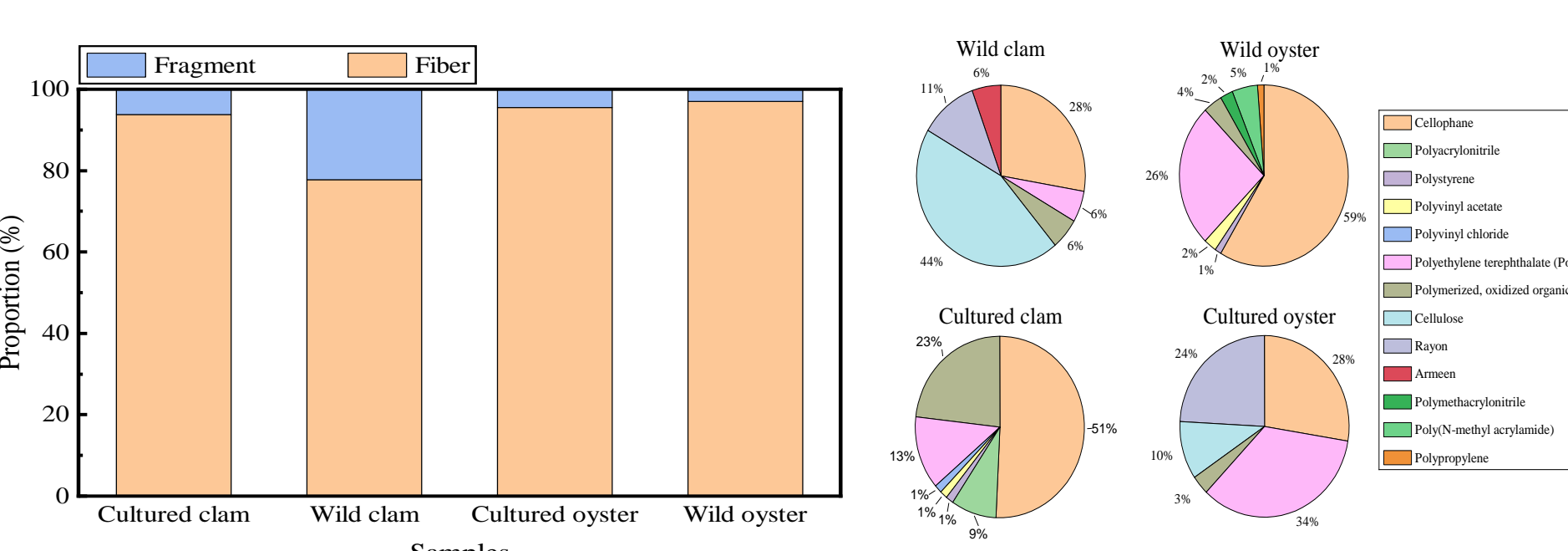- Shape: mainly fiber
- Polymer type: PET, rayon, PP

➤ It is estimated that at least 3.71 tons of microplastics have accumulated in Jiaozhou Bay

3. MPs Ingested by Zooplankton

- Shape: Fiber (92%)
- Major polymer components: Polyester and cellophane

4. MPs Ingested by Shellfish

- MPs ingested by shellfish were mainly fibers in Jiaozhou Bay.
- ➤ Morphological characteristics and chemical composition of microplastics in biota and the source are consistent.

Microplastic ingestion by shellfish (items/g)

Species	cultured	wild	Total
Oysters (*Crassostrea gigas*)	0.95±0.72	0.91±0.87	0.92
Clams (*Ruditapes philippinarum*)	1.77±2.32	0.92±0.62	1.51

- The average abundance of the ingested microplastics was 1.21 items/g in all shellfish, with the ranged from 0.16 to 12.09 items/g.
- Average microplastic consumption through the Chinese diet: 1.27×10³ items/capita/year
- ➤ lower healthy risk than other intake patterns.

5. MPs in wastewater in WWTPs
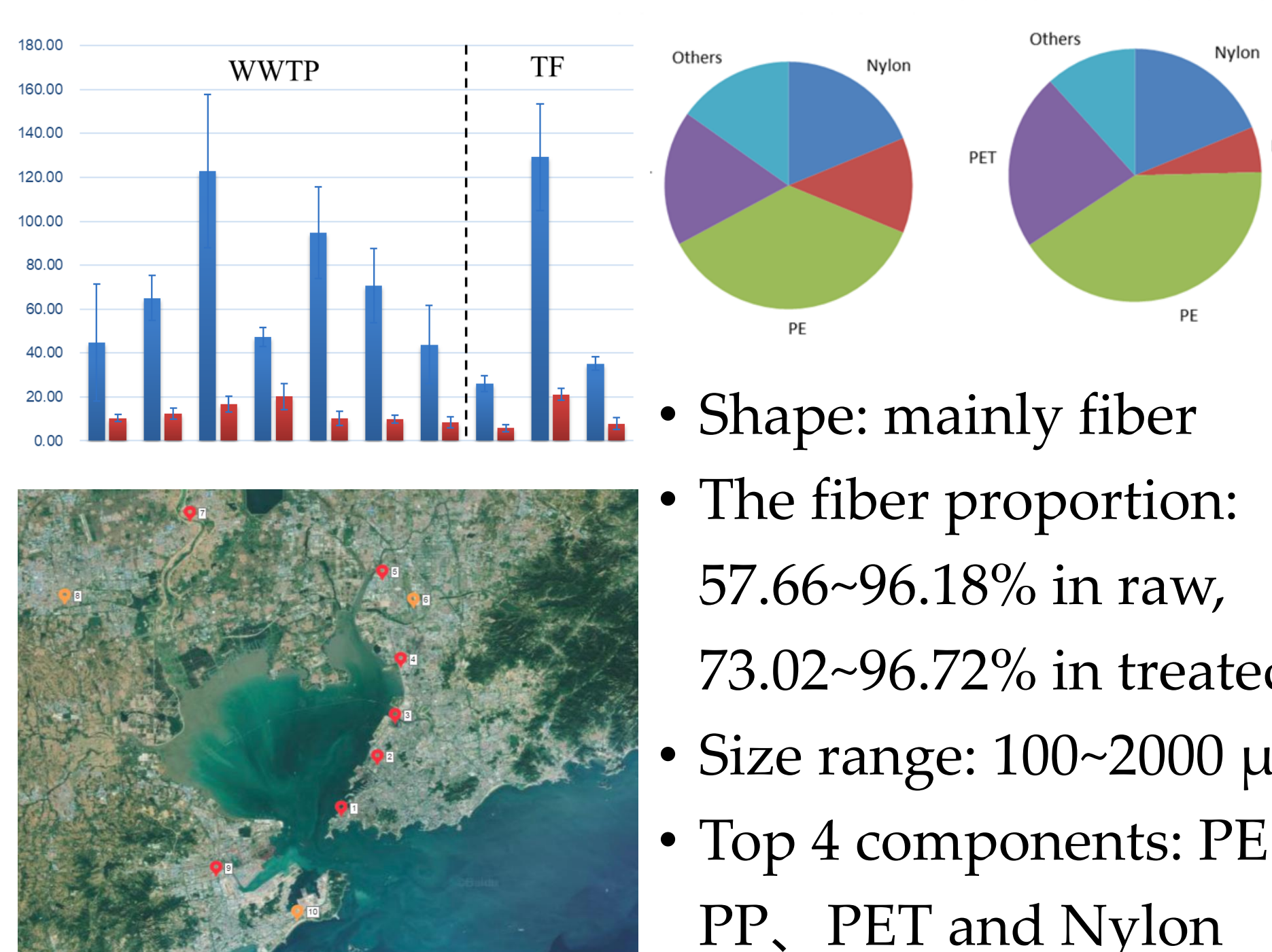
- Shape: mainly fiber
- The fiber proportion: 57.66~96.18% in raw, 73.02~96.72% in treated.
- Size range: 100~2000 μm
- Top 4 components: PE、PP、PET and Nylon

- **MP Complexity Index (MCI)**

- ➤ MCI value reflect the contrast of microplastics complexity in different matrices.
- ➤ It can be used for quantitative analysis of microplastic traceability process.
- ➤ It provides new ideas for source apportionment and ecological assessment of microplastics.

Prospect for the Future

- The variety of methods regarding all these mentioned points makes a comparison of different studies and their results nearly impossible. Hence, uniform sampling and analytical methods should be established and the expression method of microplastics abundance indifferent environments.
- Regional dynamic processes and driving mechanisms of microplastic transport should be explored, especially those mediated by marine organisms, as well as numerical simulation of dynamics of microplastics migration.
- Assess the depletion of microplastics from land to sea and the potential ecological risks based on different sources of microplastics.

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