Considerations for reducing human exposure to microplastics from consumption of fish

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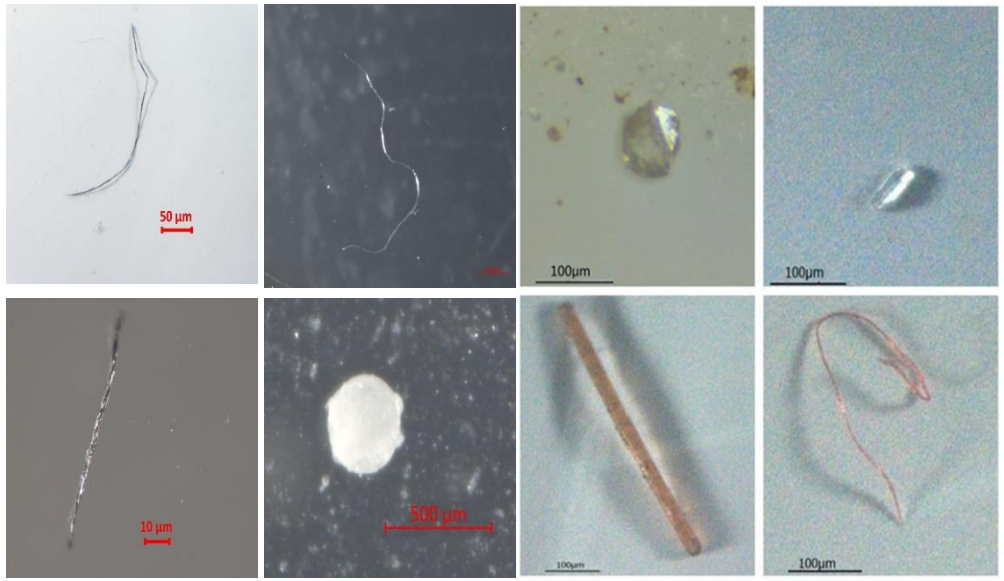
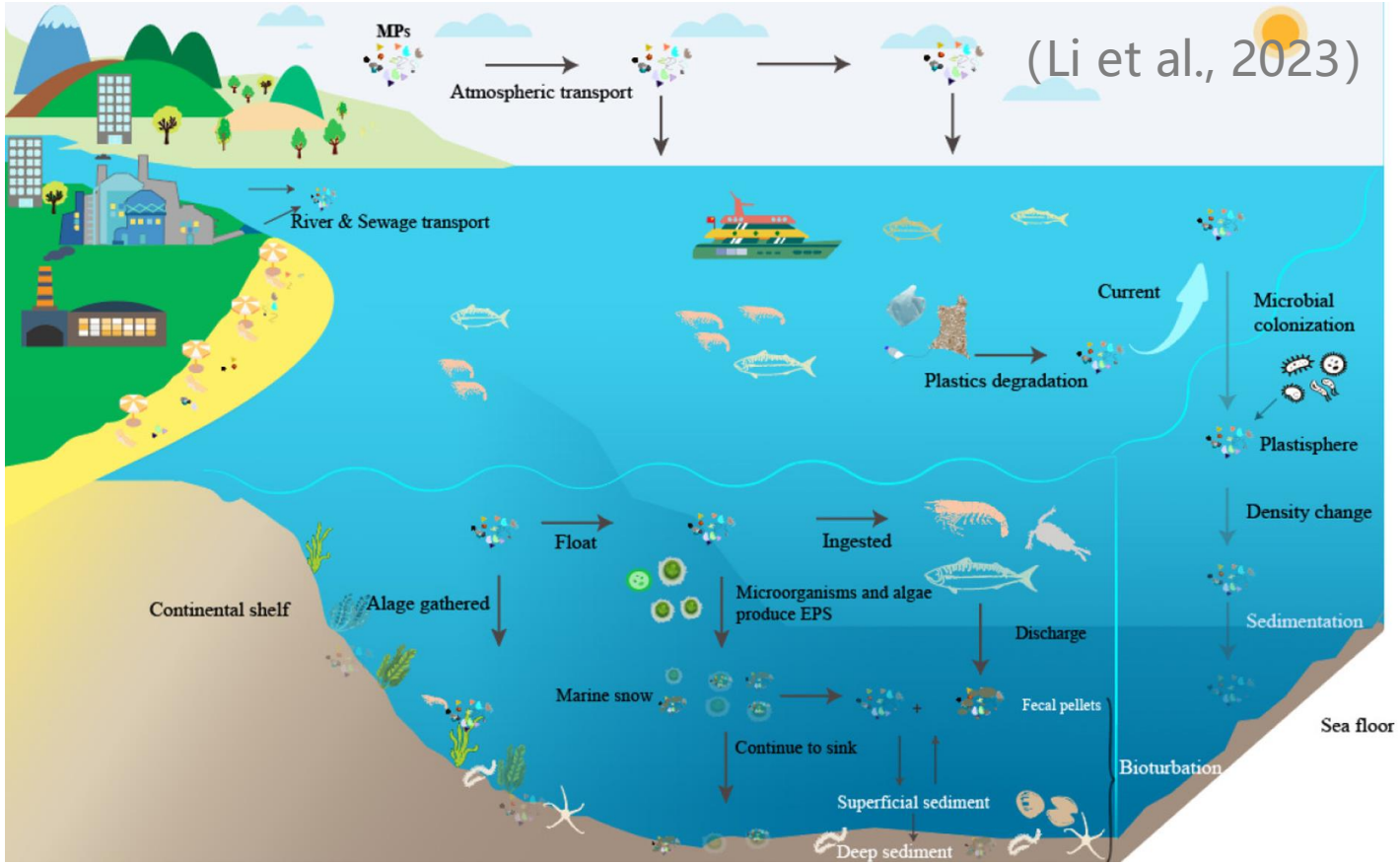
Microplastics: A Hot Environmental Issue of Global Concern

Microplastics (MPs)

Plastic fibers, fragments, and films ranging from 1–5000 μm in size

Mismanaged plastic wastes can be transported into marine environments via various pathways



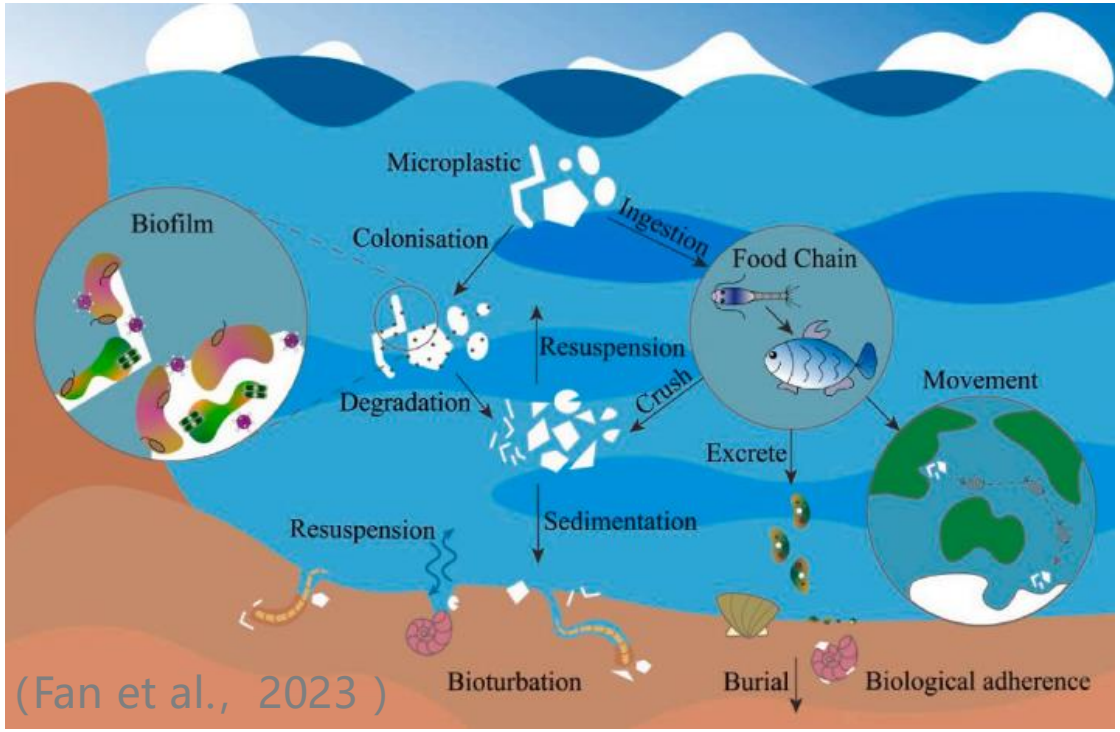


(Li et al., 2023)

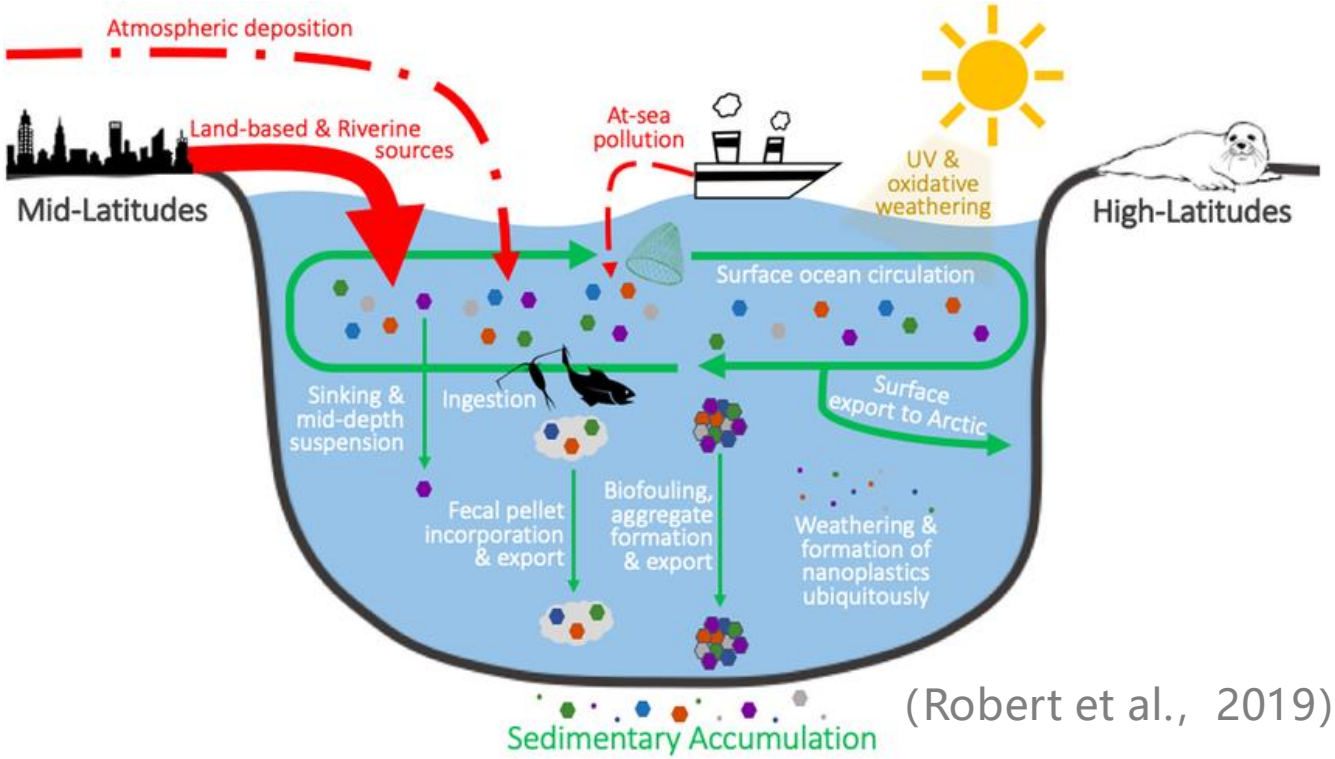
Ocean is a very important sink for plastic pollution

Microplastics: Widely distributed in the ocean

➢ MPs easily disperse across various media within marine ecosystems



(Fan et al., 2023)



(Robert et al., 2019)

Different water layers

Aquatic plants

Sediments

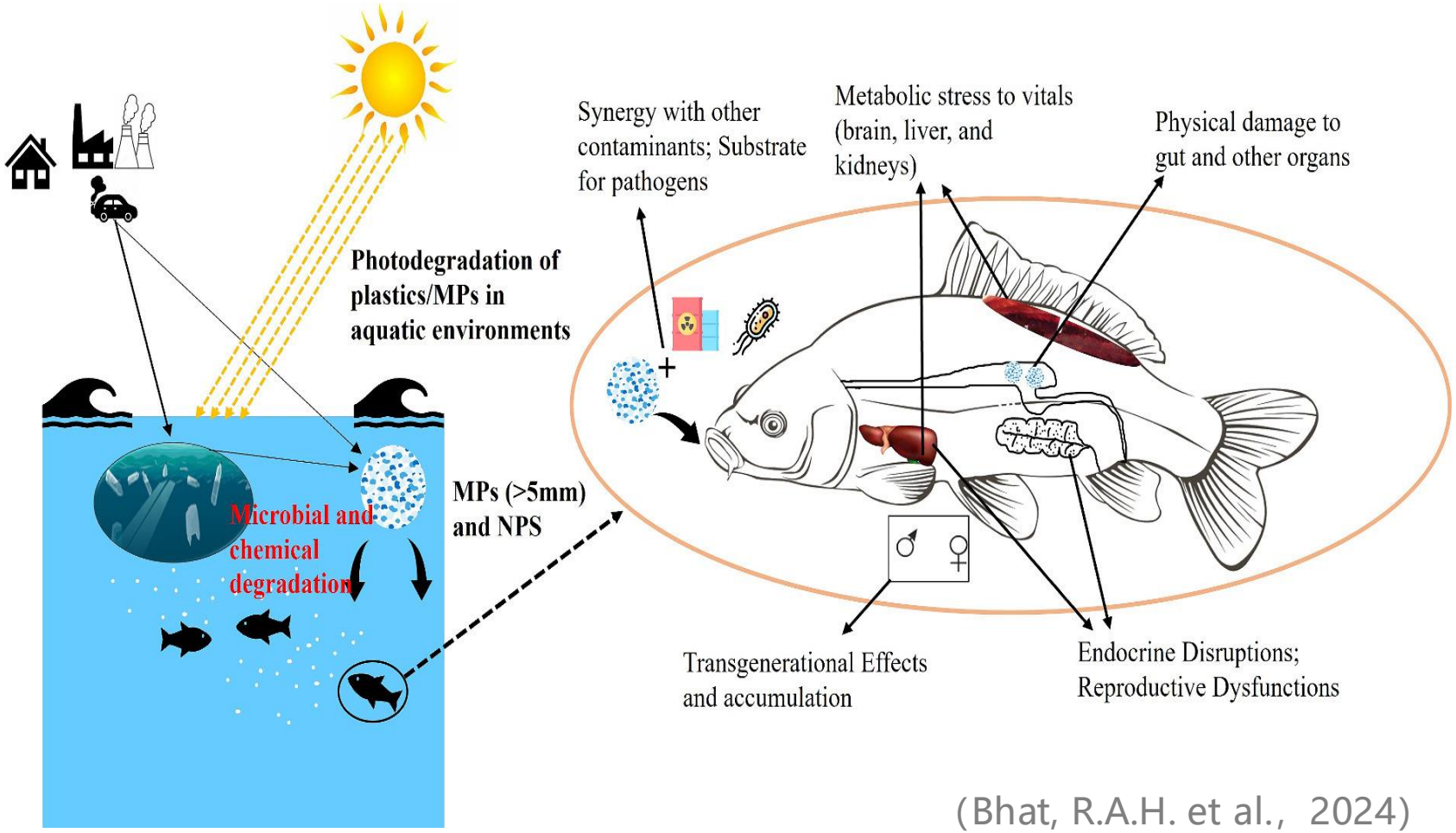
Zooplankton

Fish

Benthos……

Toxic effects of microplastics on marine organisms

➢ Microplastics pose multiple hazards to the health of marine organisms

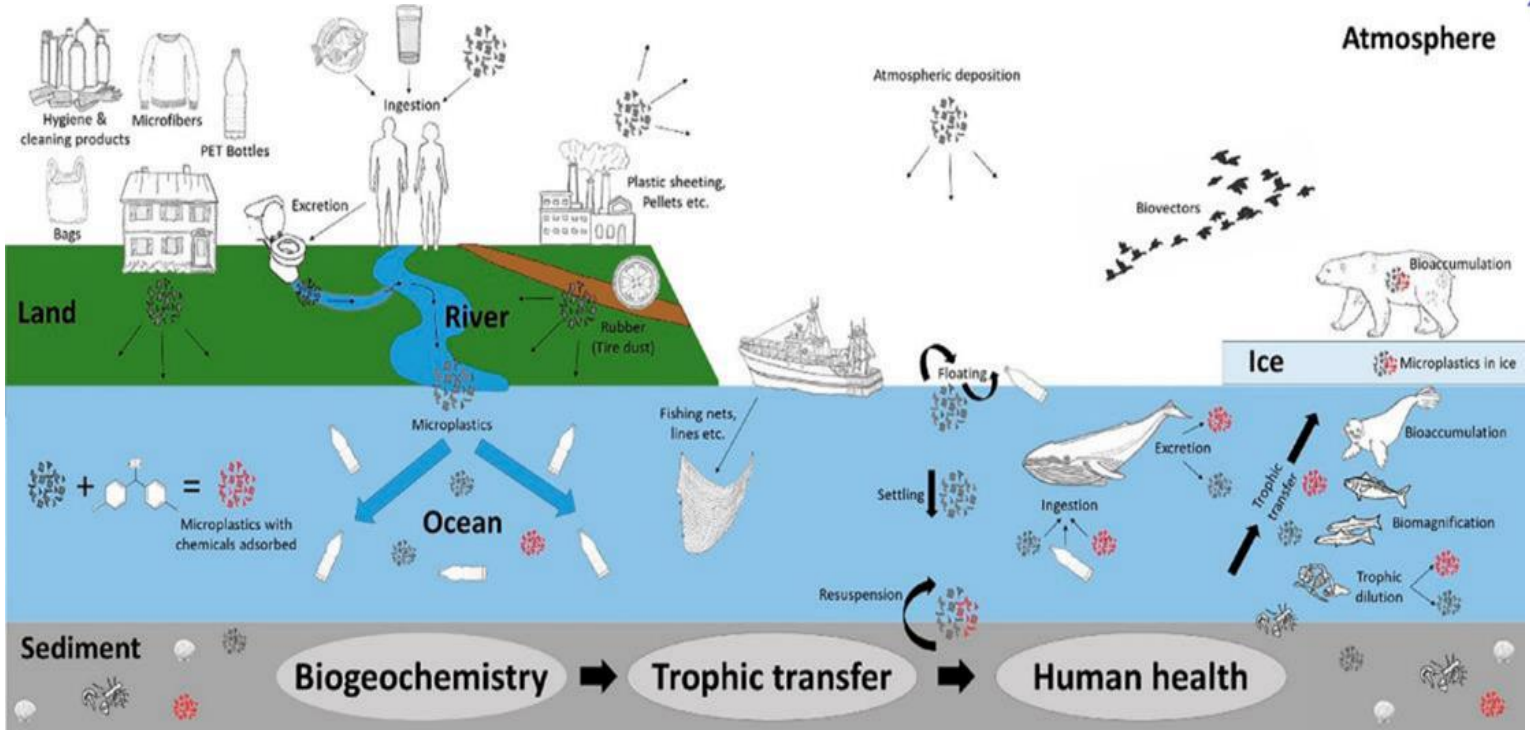


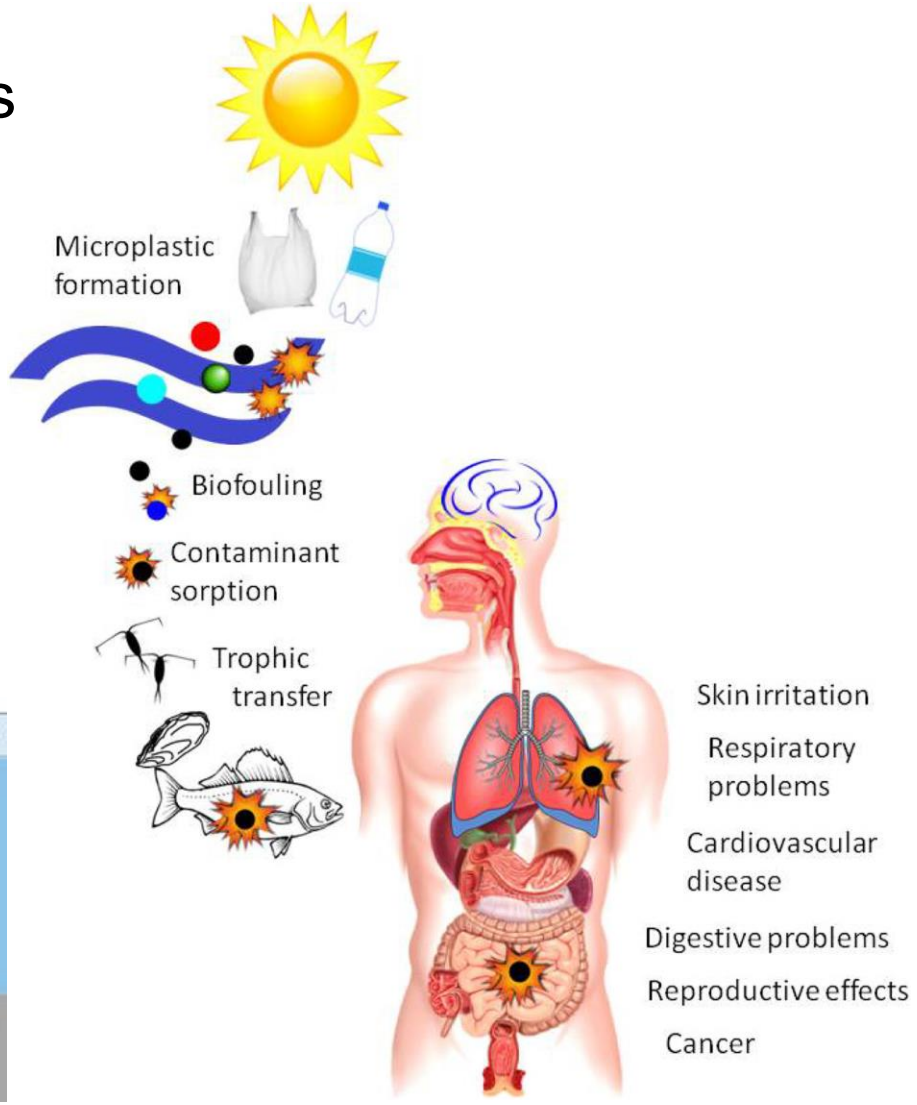
(Bhat, R.A.H. et al., 2024)

- Gastrointestinal injury
- Oxidative stress
- Immune response
- Tissue toxicity
- Neurotoxicity
- ……

Potential risks of microplastics: transfer to people through the food chain

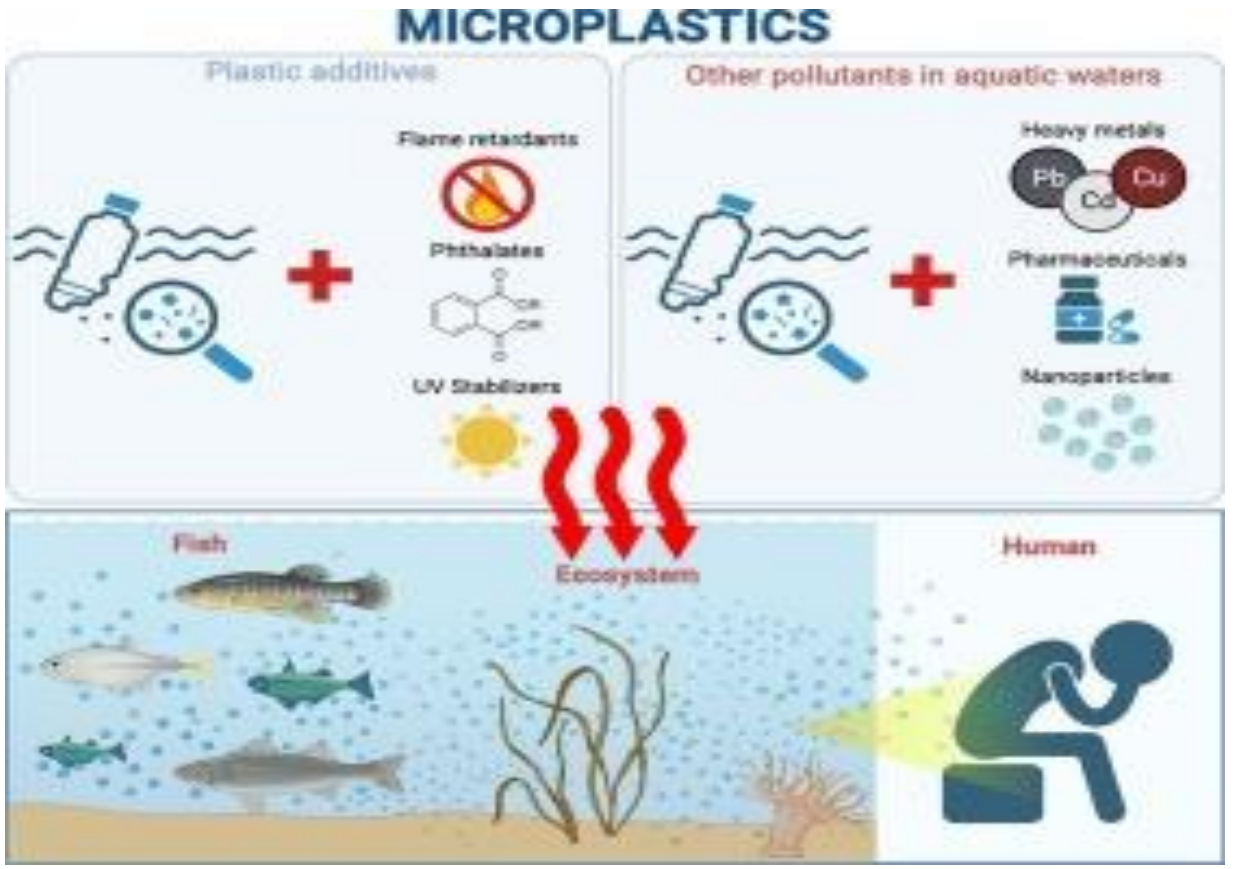
- Microplastics ingested by various marine organisms may be further transferred along the food chain





(Carbery et al., 2018; Bank, M. S.& Hansson, S.V., 2019)

Fish: Species with high risks of microplastic contamination



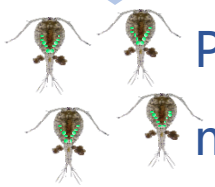
(Banaee, M., et al. , 2025)

Monitoring microplastic pollution levels in key species like fish can further assess their potential food chain transfer risks to human health.

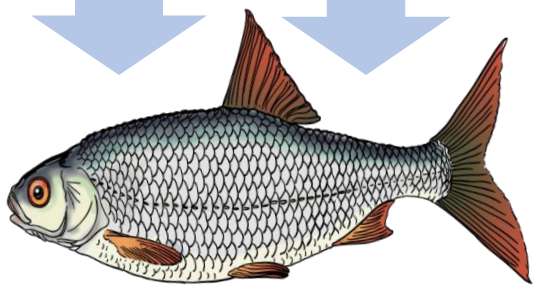
Ingestion of microplastics by fish

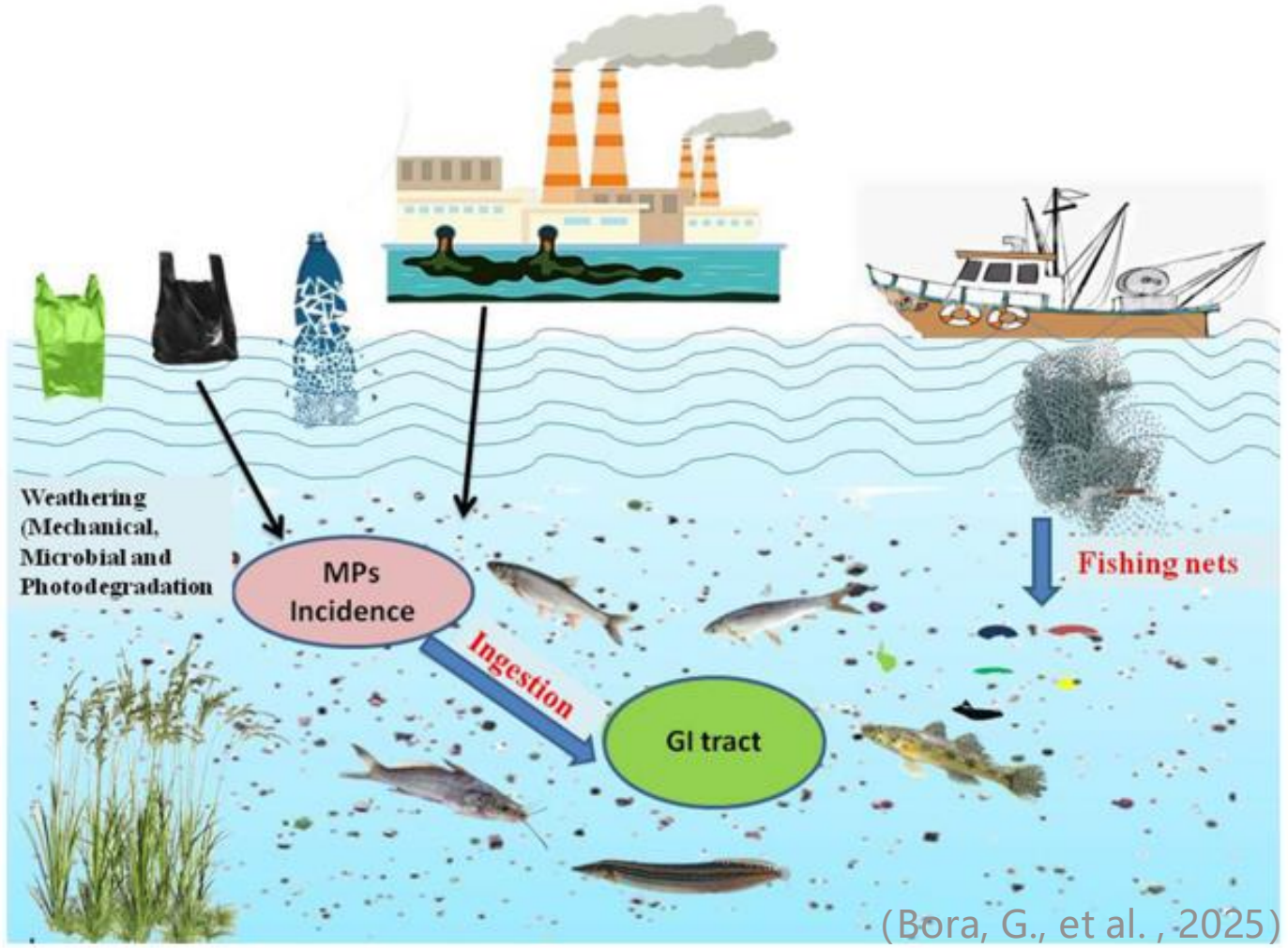
Direct ingestion

Indirect ingestion



Prey containing microplastics

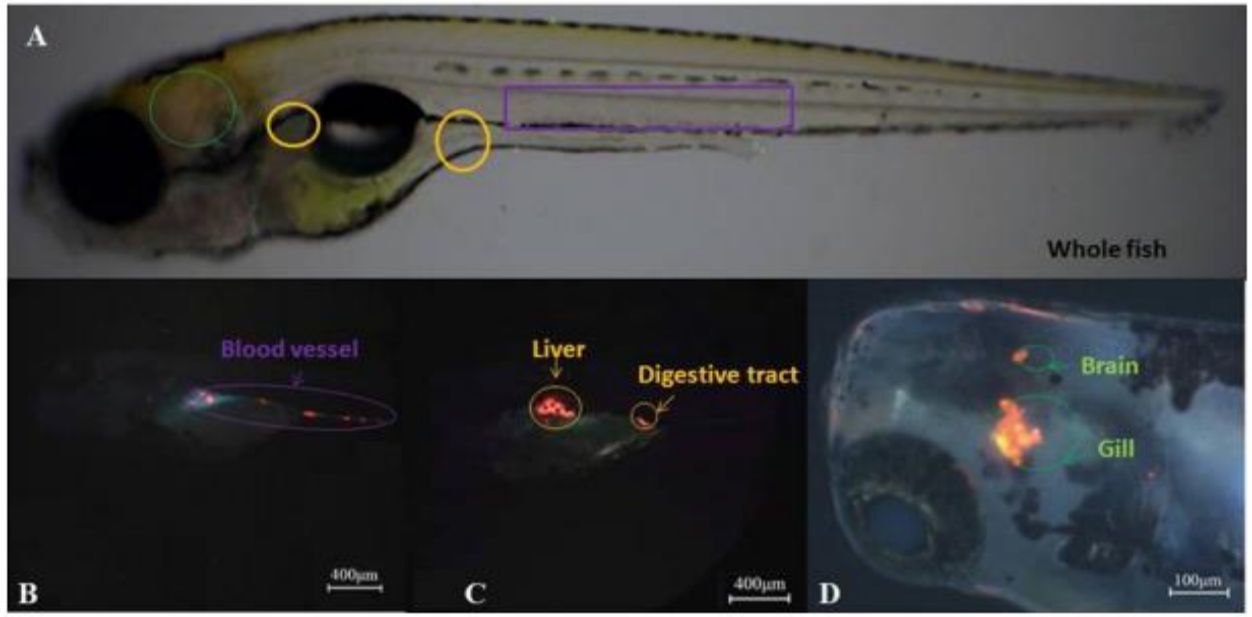


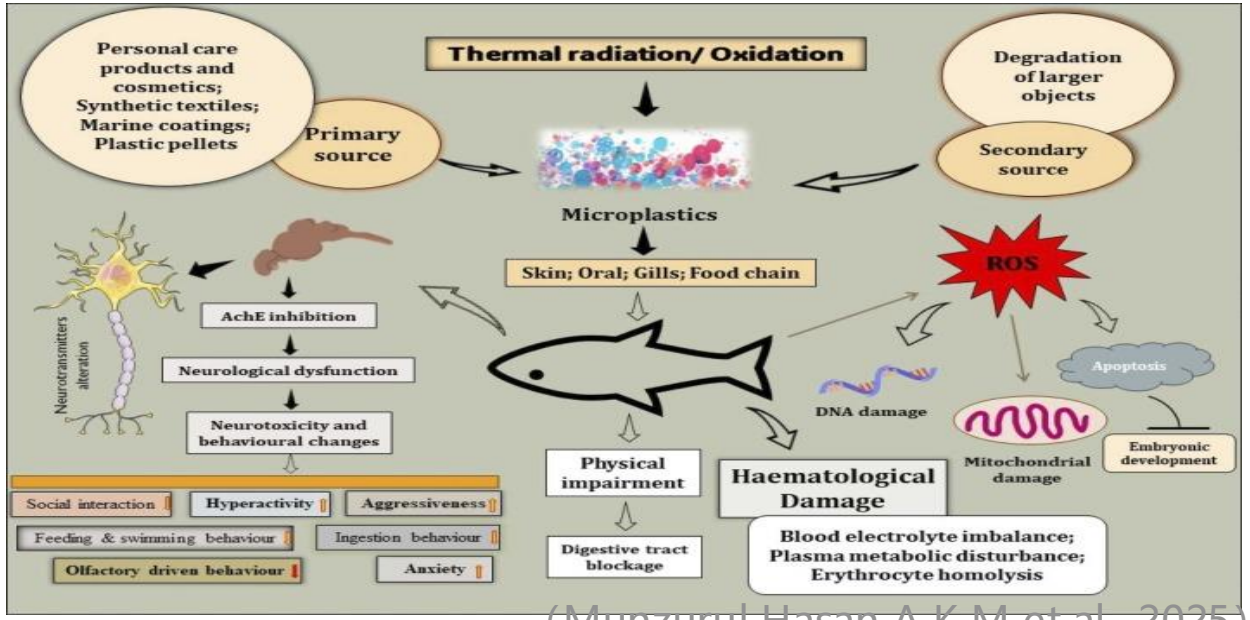


(Bora, G., et al. , 2025)

Most field studies primarily focus on the intestines of fish

Current research status on microplastics in fish





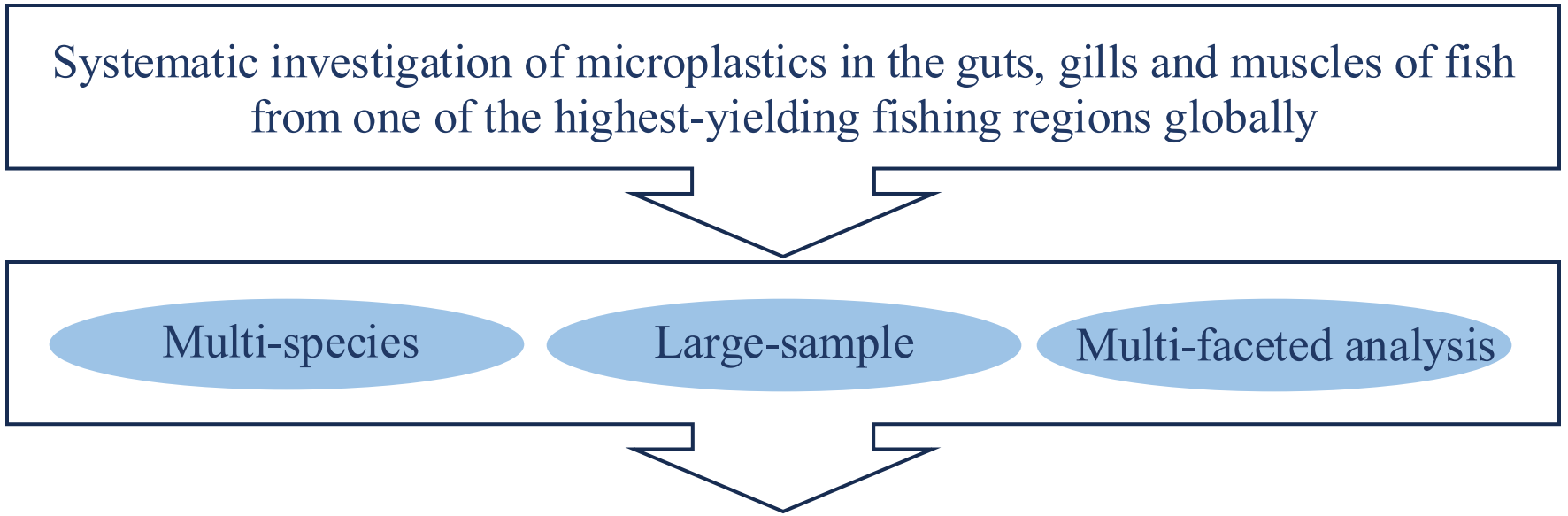
(Munzurul Hasan A K M et al., 2025)

Previous studies have focused on:

- Characteristics of microplastic accumulation in single tissues (intestines)
- Toxic effects of microplastics

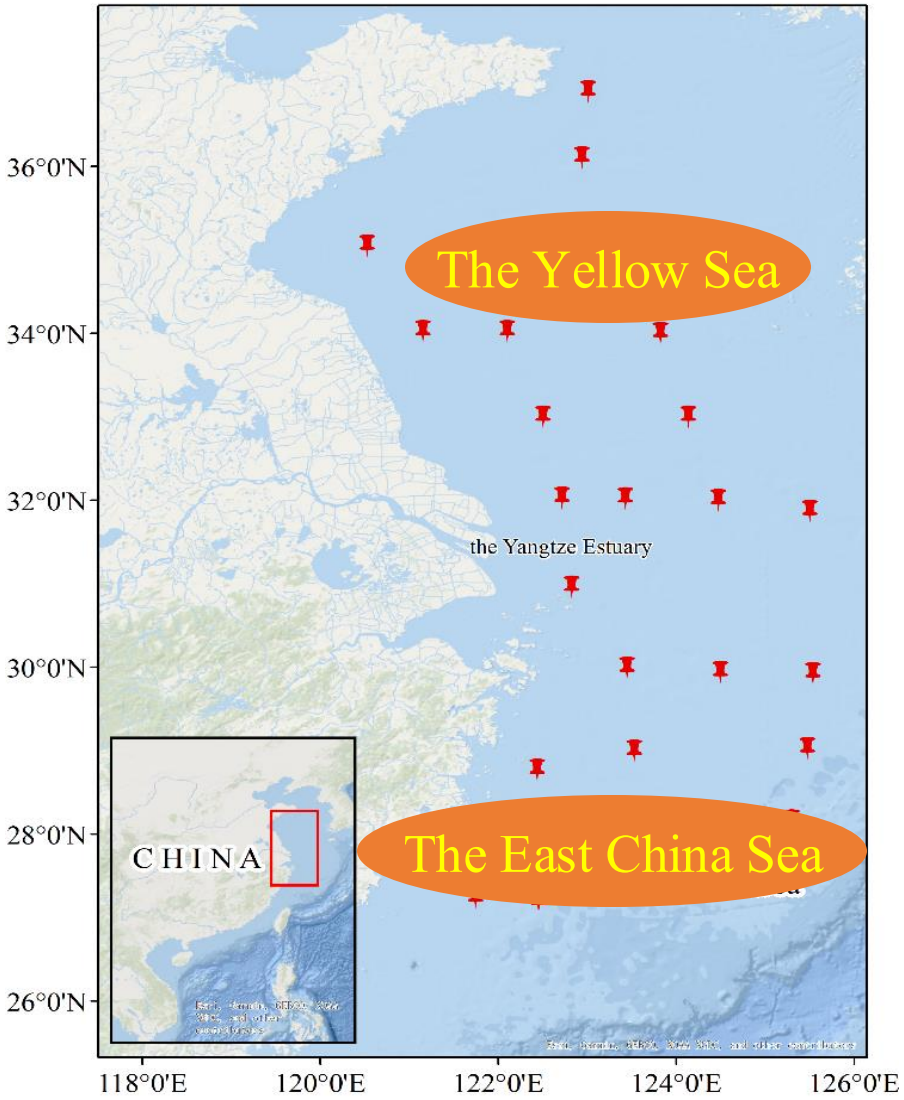
- ➢ Multi-tissue accumulation
- ➢ Influencing factors
- ➢ Food chain transfer
- ➢ Human consumption risks

Objectives



1) to reveal the differences in MP abundance and characteristics across various fish tissues;
2) to systematically analyze the main factors influencing MP accumulation in fish, considering factors such as feeding strategies, habitat, trophic levels, and biological indicators;
3) to calculate the capita MP consumption by humans through the ingestion of MPs in caught fish;
4) to assess the MP exposure risks faced by humans based on different fish consumption habits.

Methods



1,075 fish from 37 species

Gills

Guts

Meat

Microplastic analysis

Stereotype microscope

Fourier transform infrared spectrometer

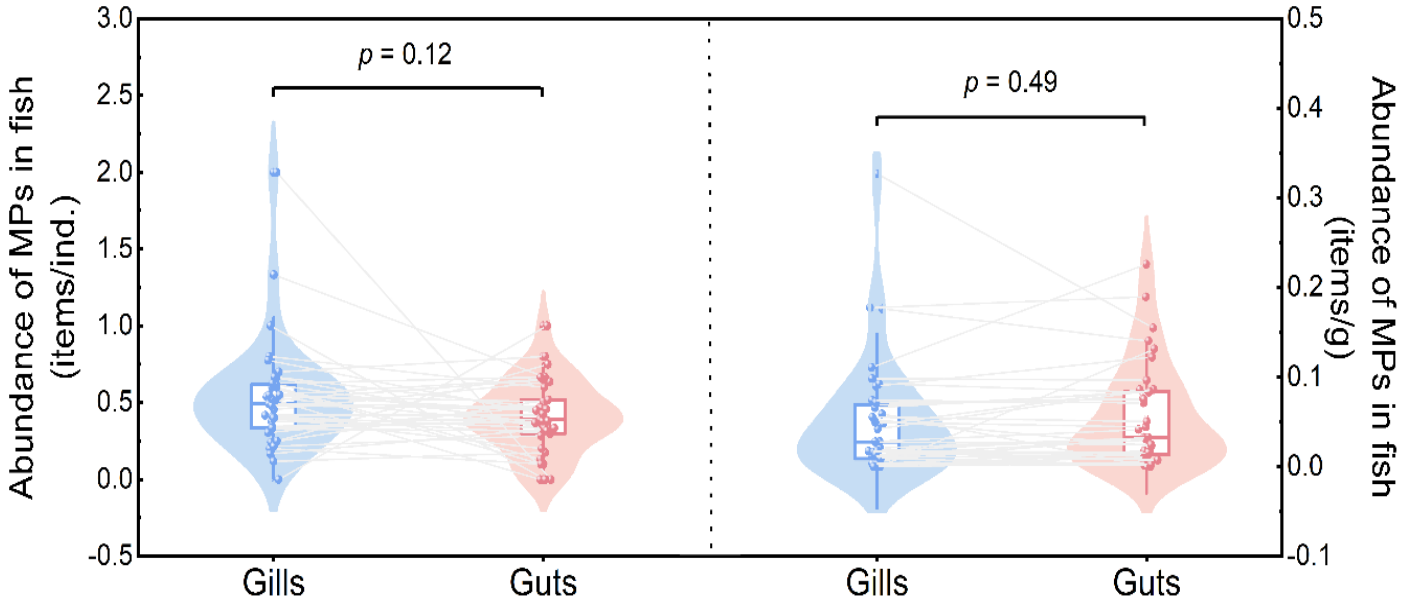
Shape

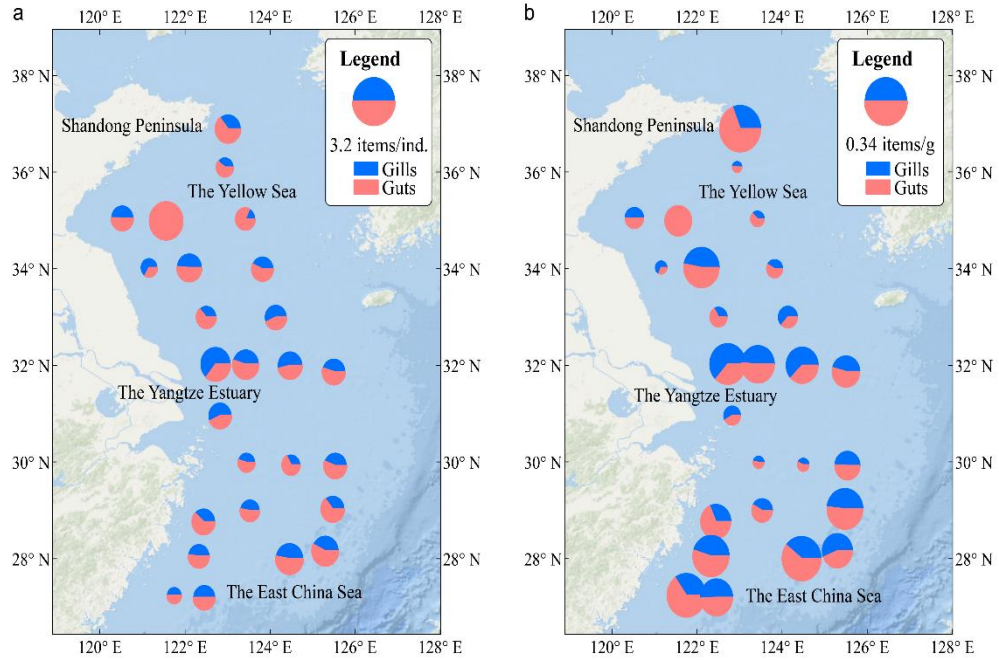
Color

Size

Polymer type

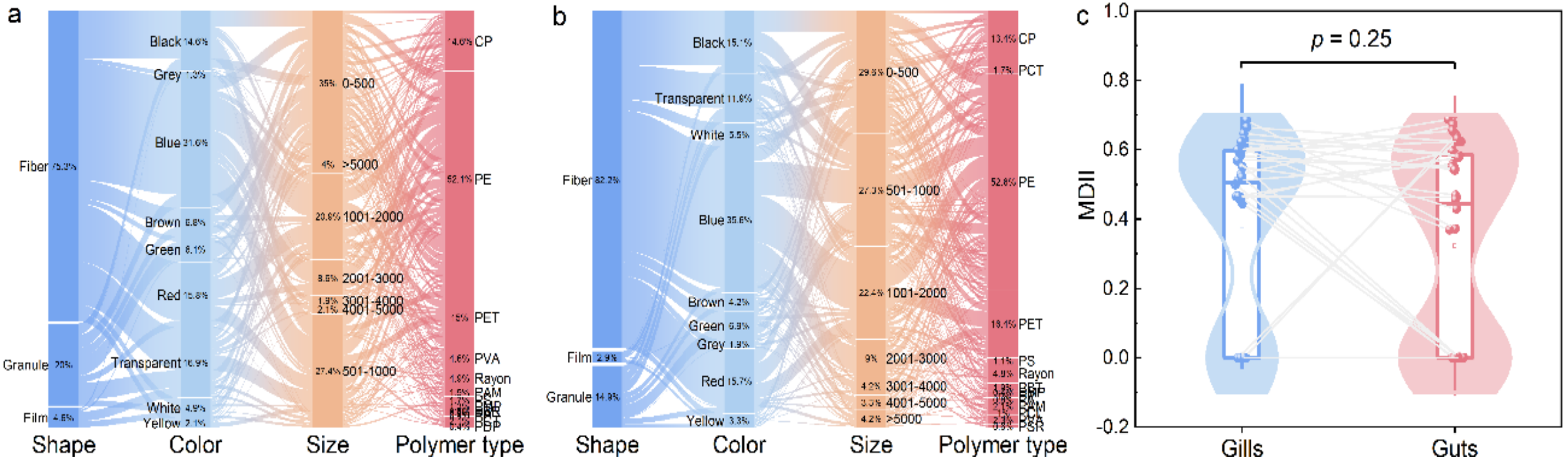
Differences in MP abundance in different fish tissues





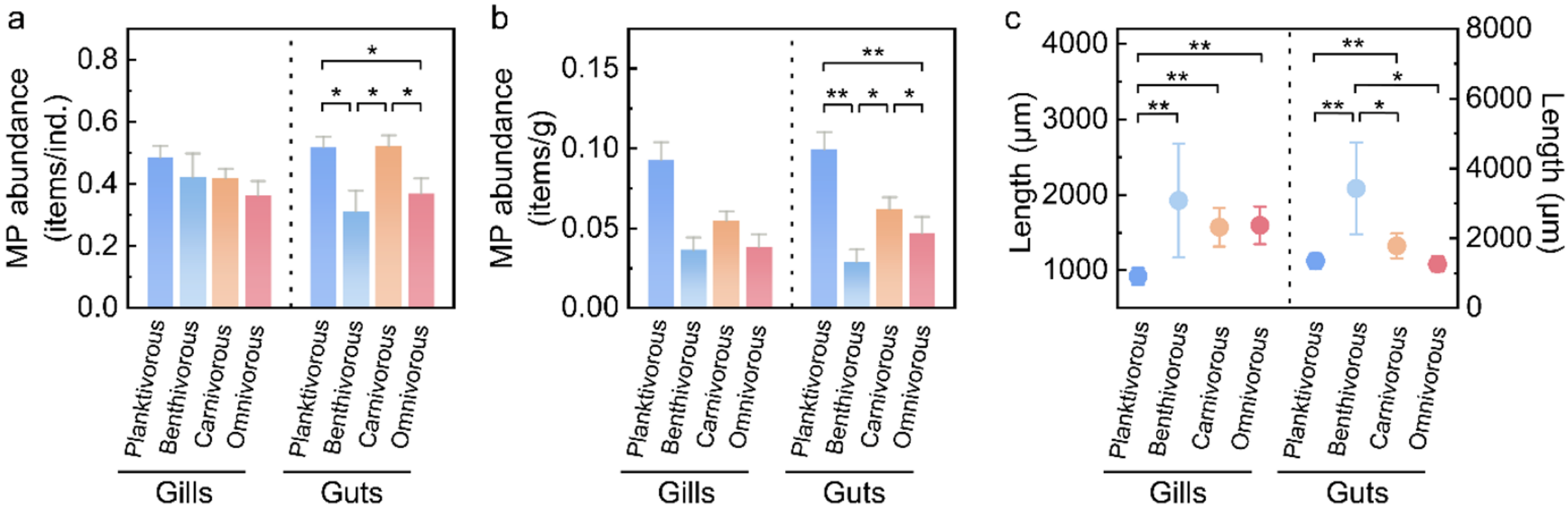
- MPs were detected in the gills of 390 individuals (36.28%) from 34 species and in the guts of 426 individuals (39.63%) from 36 species.
- No MPs were found in the muscle tissues.
- There was no significant difference in MP abundance between the gills and guts.

Differences in MP characteristics in different fish tissues



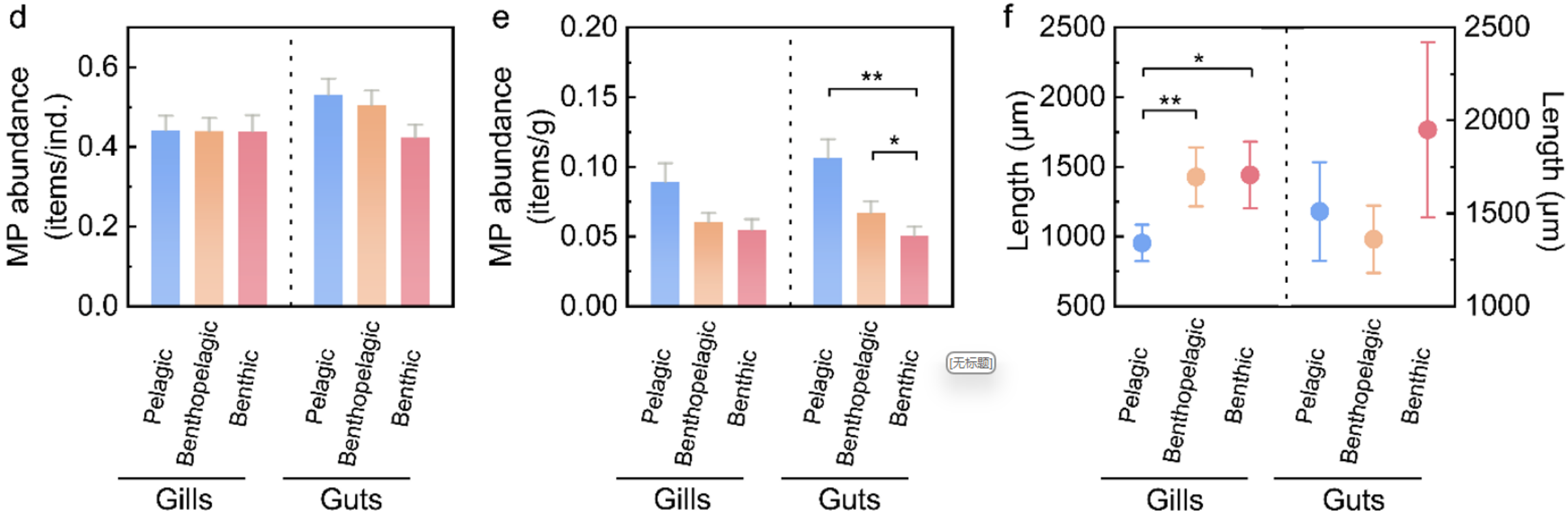
- MP characteristics in the gills and guts were similar.
- Fibrous, blue, and <500 μm microplastics were predominant in fish guts and gills.
- The primary polymer types detected in the gills and guts were polyethylene (PE), polyester (PET), and cellophane (CP).

Differences in MP abundance and characteristics among fish with varying diets



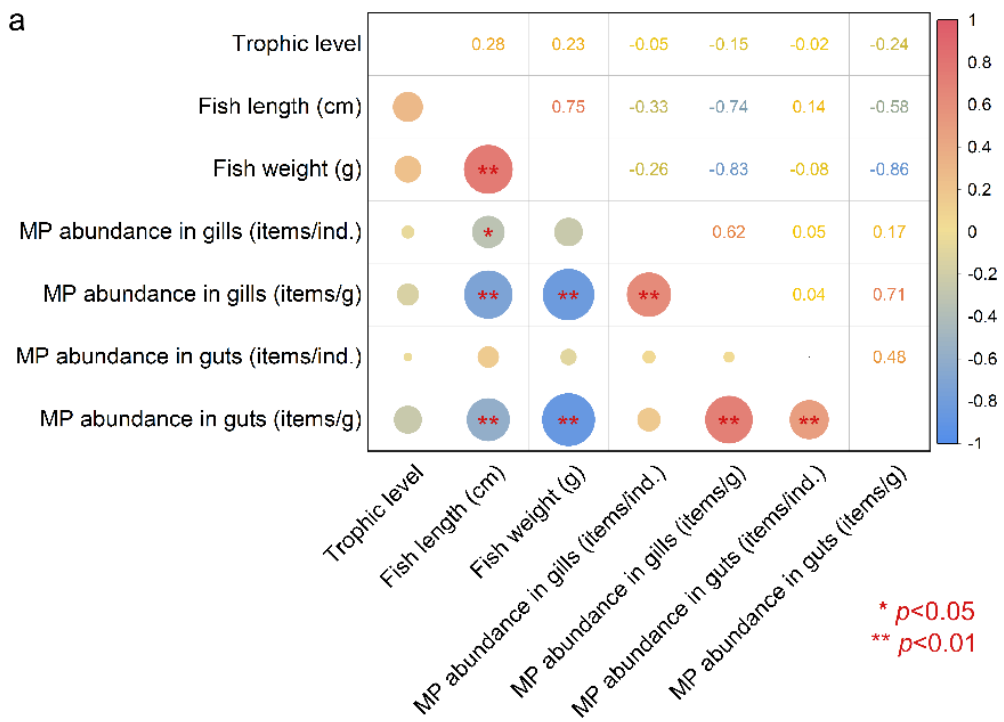
- The MP abundance in planktivorous fish was significantly higher than that in benthivorous fish
- The MP length in the gills and guts of planktivorous fish was significantly shorter than those of benthivorous fish

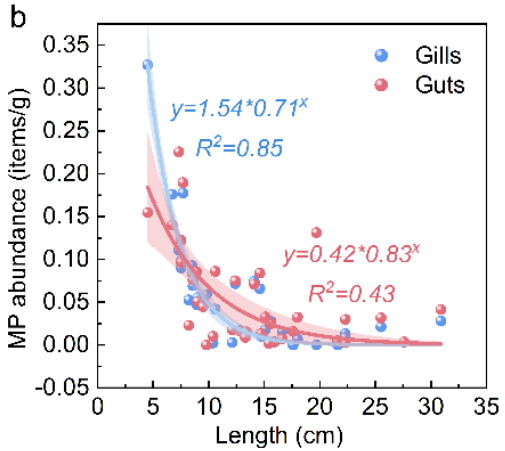
Differences in MP abundance and characteristics among fish with varying habitats

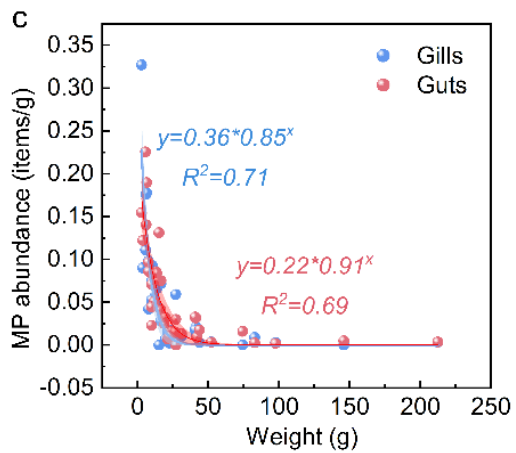


- MP abundance in the gills and guts follows the pattern of planktic > benthopelagic > benthic.
- The MP length in the gills of planktic fish was significantly shorter than that in the gills of benthopelagic and benthic fish

Correlation analysis between MP abundance in fish and their trophic level, length, and weight

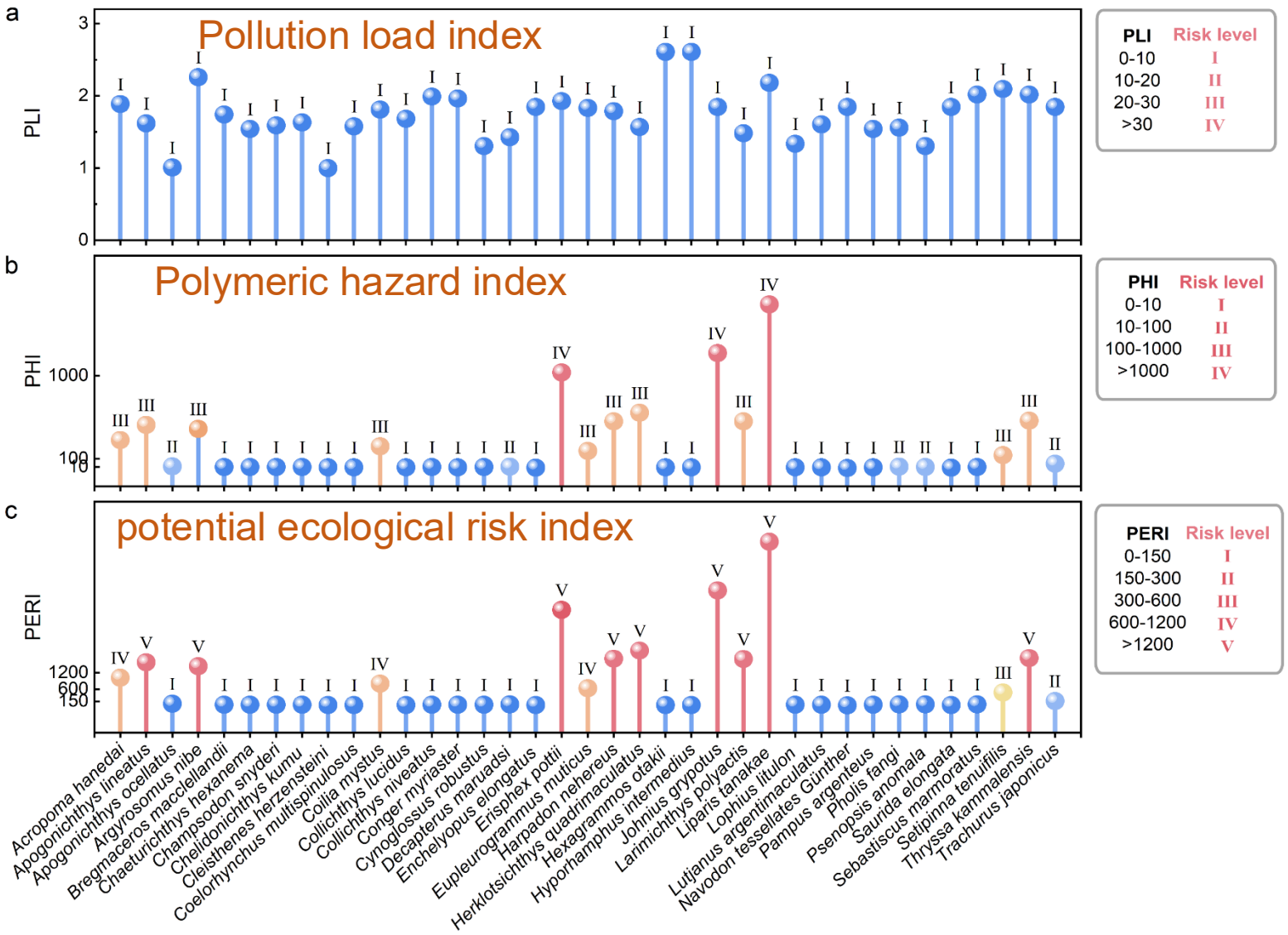






- No significant correlation was found between fish trophic levels with MP abundance in gills and guts of fish.
- The abundance of MPs (items/g) in the gills and guts of fish showed a significant negative correlation with the length and weight of the fish, exhibiting an exponential decline with increasing fish length and weight.

Risk assessment of microplastics in fish



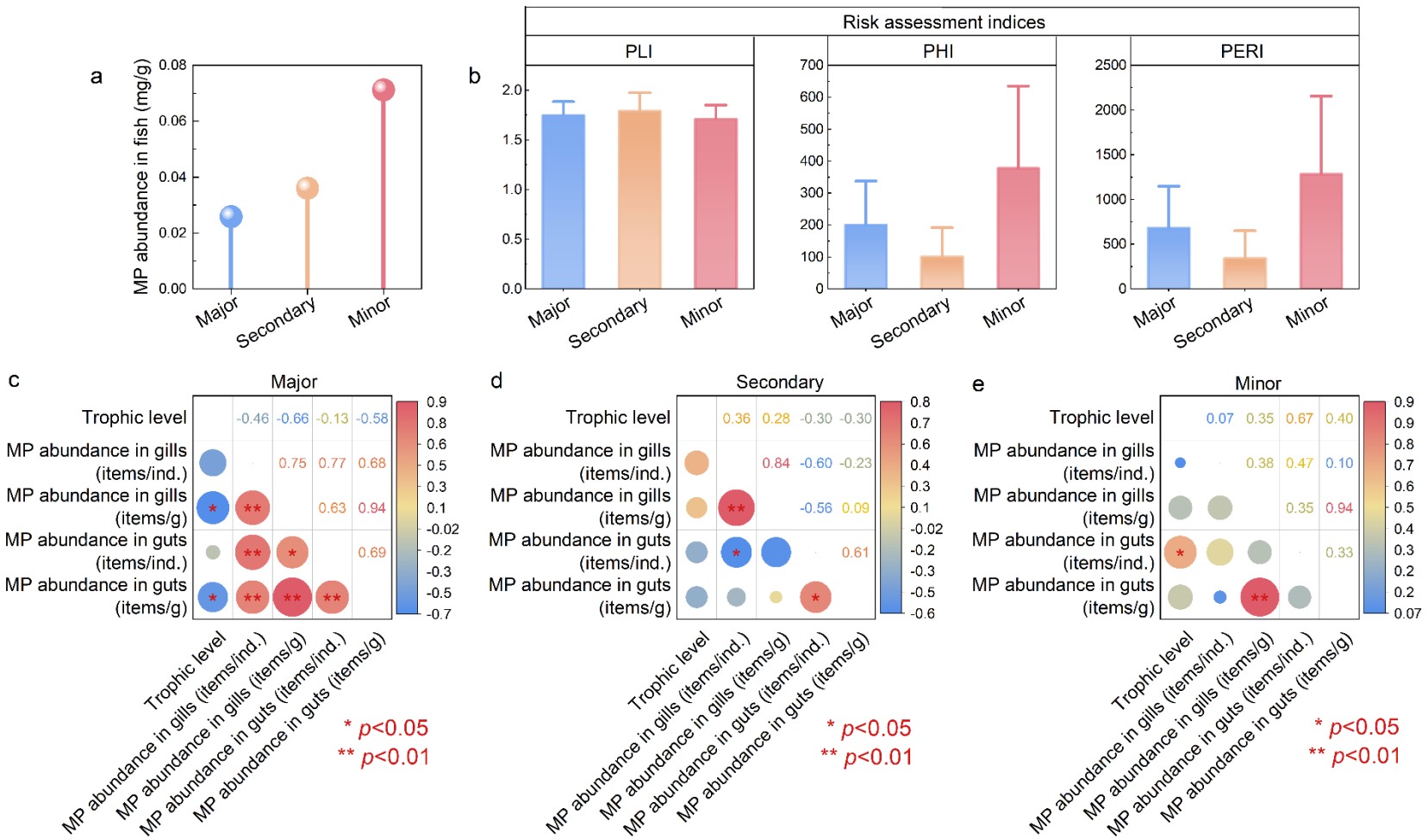
PLI	Risk level
0-10	I
10-20	II
20-30	III
>30	IV

PHI	Risk level
0-10	I
10-100	II
100-1000	III
>1000	IV

PERI	Risk level
0-150	I
150-300	II
300-600	III
600-1200	IV
>1200	V

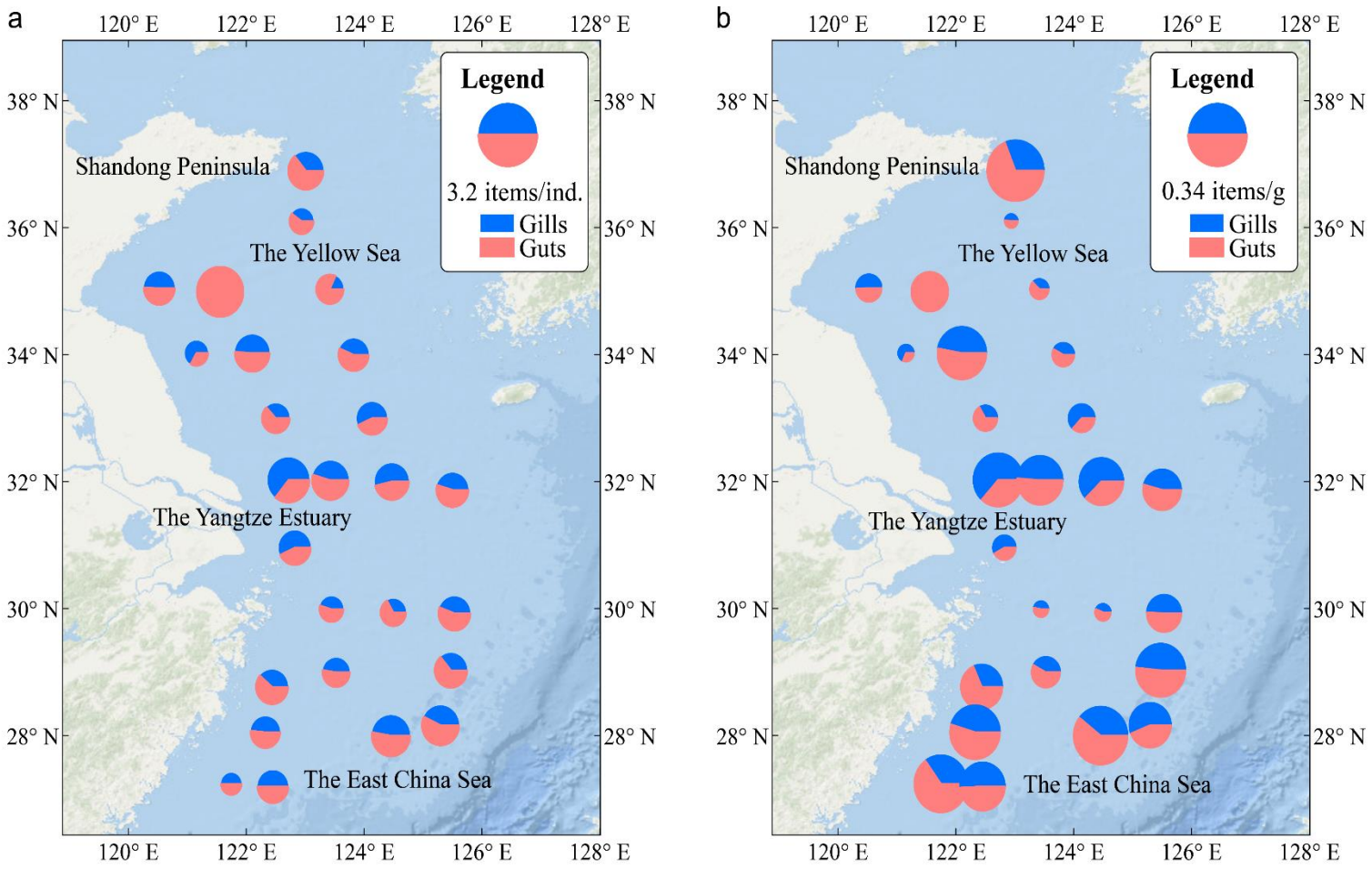
- The overall risk of microplastic load in fish is at a relatively low level
- However, 13 species of fish exhibit relatively high polymeric hazard risks and potential ecological risks

Risk assessment of microplastics in fish of different economic values



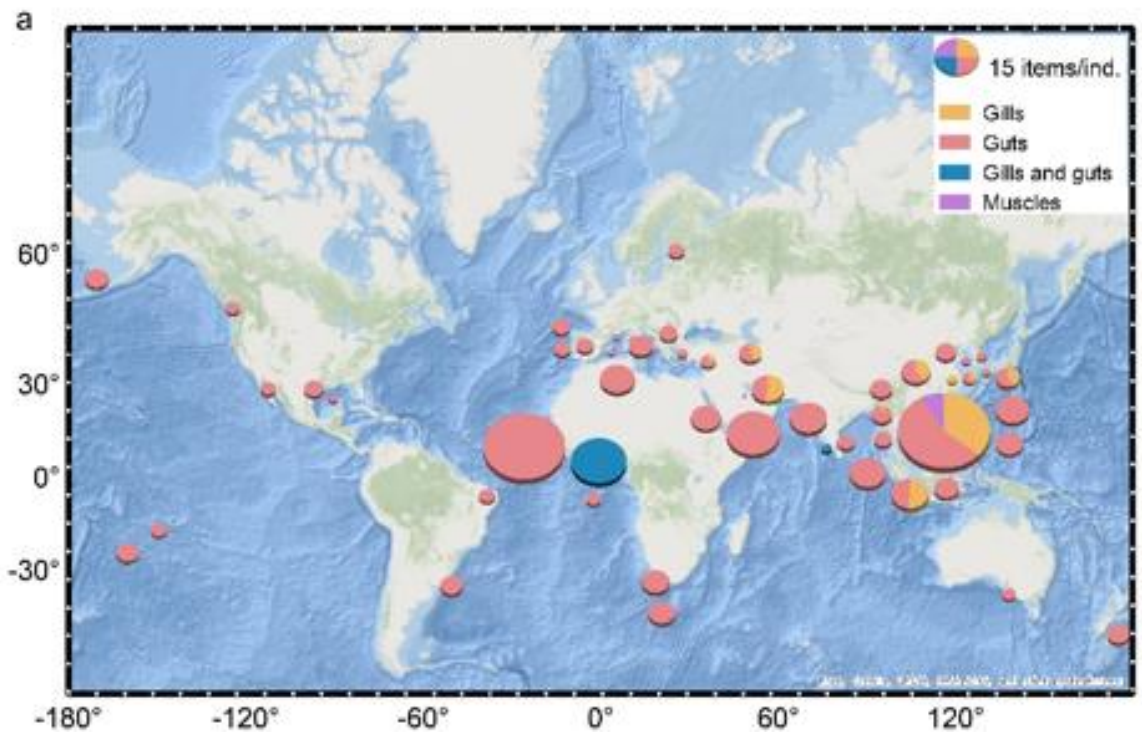
- The abundance of microplastics in fish of different economic values shows the following trend: major economic value fish < minor economic value fish < low economic value fish.
- There is no significant difference in the microplastic risk index among fish of different economic values.
- In major economic value fish, the abundance of microplastics decreases with increasing trophic level, indicating a low risk of food chain transfer.

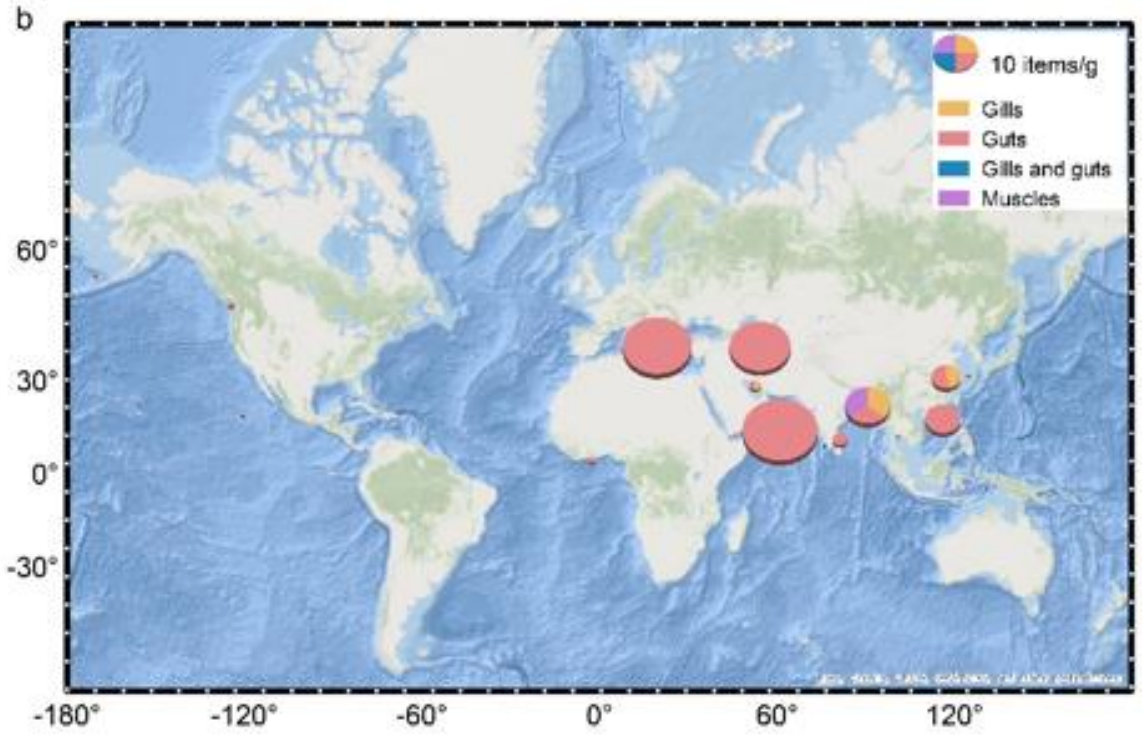
Microplastic load in fish of the Yellow Sea and East China Sea



- The estimated load of microplastics in the gills and guts of fish in the Yellow Sea is approximately 134.86 kg.
- The estimated load of microplastics in the gills and guts of fish in the East China Sea is approximately 799.71 kg.
- Combined, the total estimated load of microplastics in fish from the Yellow Sea and East China Sea is approximately 934.57 kg.

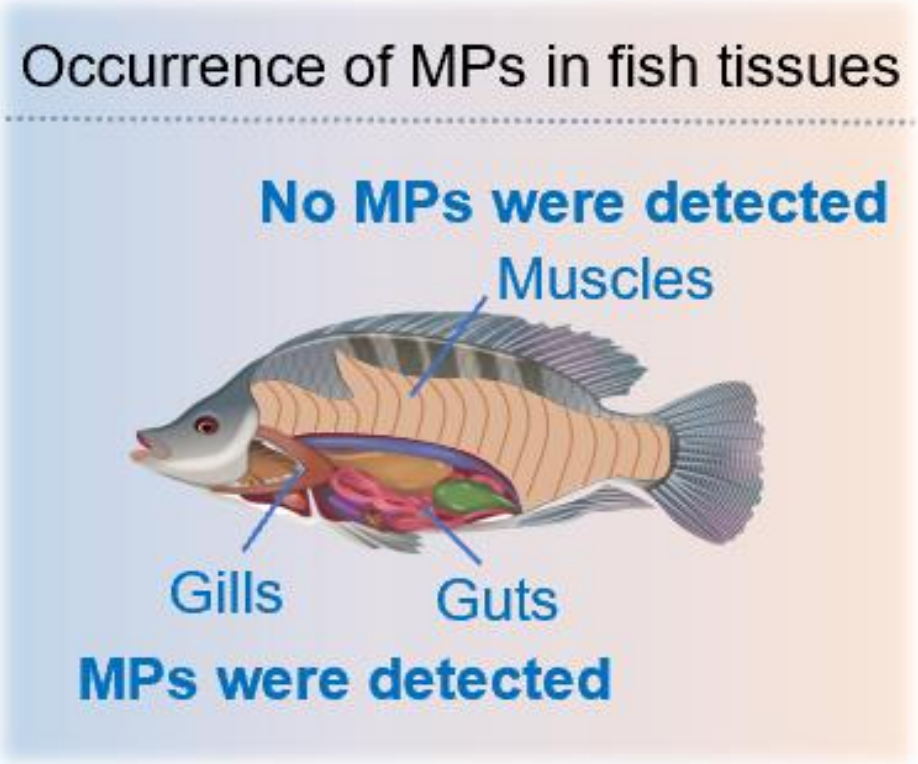
Per capita MP consumption through the ingestion of caught fish

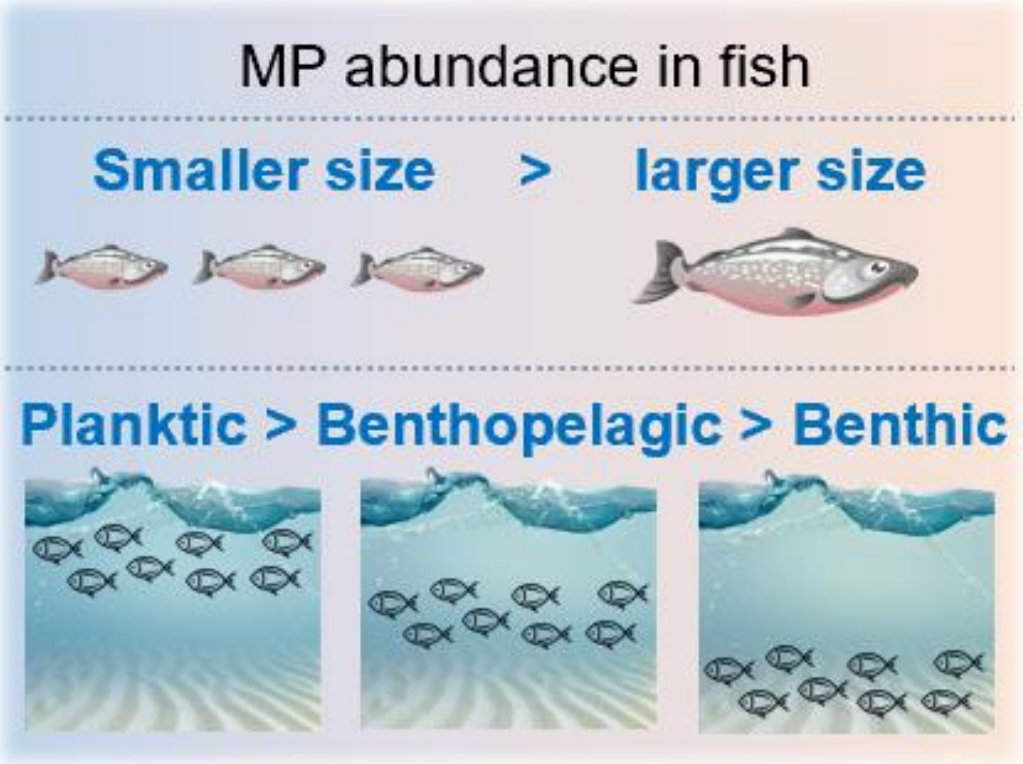




- Based on the abundance of MPs in global marine fish and the 2024 report “The State of World Fisheries and Aquaculture” published by the Food and Agriculture Organization (FAO)
- The global per capita MP consumption through the ingestion of MPs in caught fish was calculated to be approximately 5.60×10^4 items/year.

Main conclusions

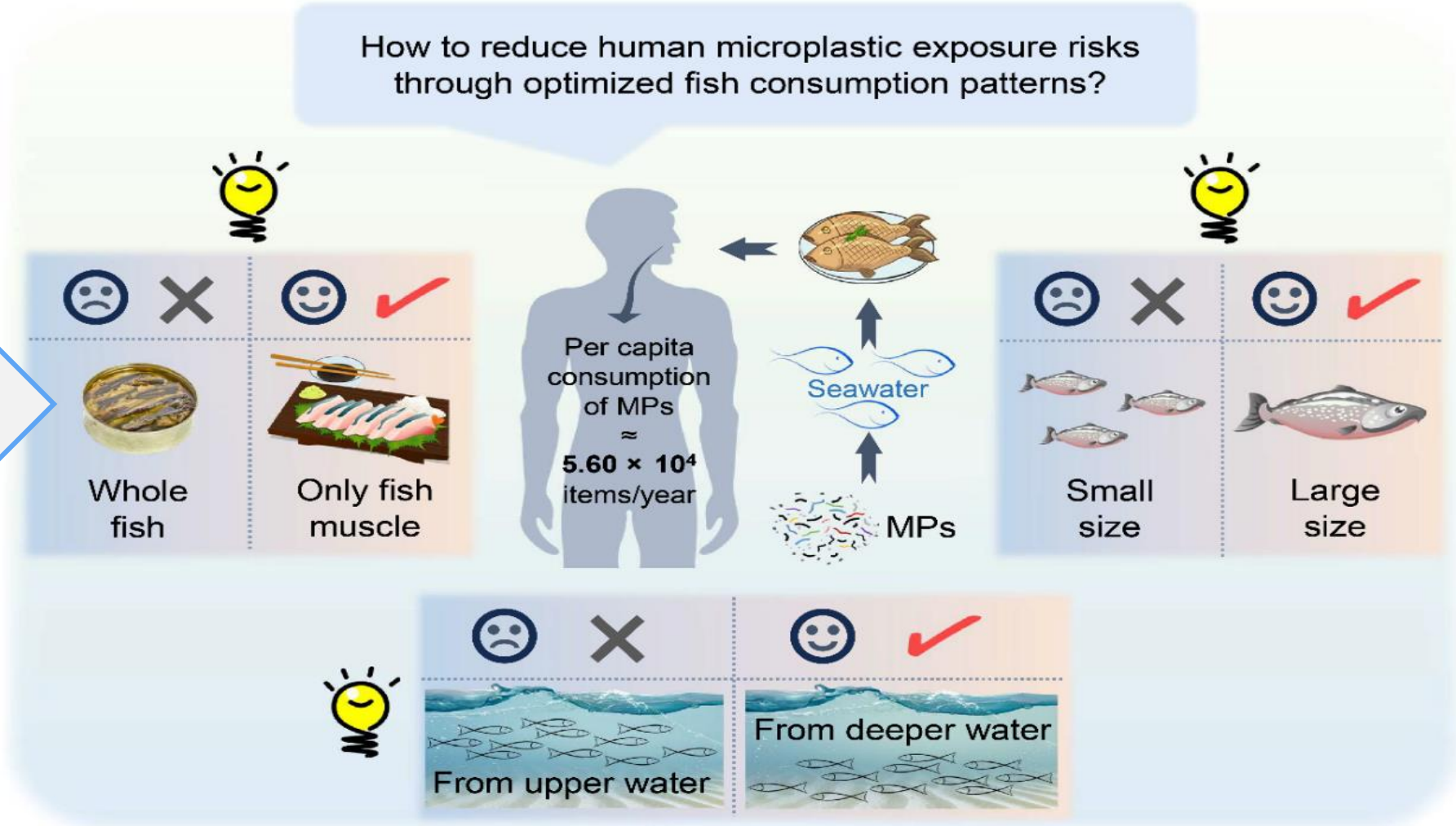




- MPs were detected in the gills and guts but were not detected in meat
- Fish with greater body length and body weight contain fewer MPs
- Compared with those from upper waters, the fish from deeper layers presented fewer MP abundances

Guide to Avoiding Plastics

Canned fish
Smoked fish
Fried fish
Dried fish
.....



To minimize dietary exposure to MPs, humans should prioritize consuming only fish meat and selecting fish from deeper waters and larger sizes whenever possible

Thanks!

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