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Hans Uwe Dahms,
Kaohsiung Medical University, Taiwan

*CORRESPONDENCE
Xiaoguang Ouyang
x.ouyang@gmlab.ac.cn

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# Editorial: Impact of marine debris on marine ecosystems and organisms

Xiaoguang Ouyang[1,2*], Cristina Panti[3], Stefano Canicci[4,5], Ruili Li[6] and Nora Fung-Yee Tam[7,8]

[1]Research Centre of Ecology & Environment for Coastal Area and Deep Sea, Southern Marine Science and Engineering Guangdong Laboratory (Guangzhou), Guangzhou, China, [2]Guangdong Provincial Key Laboratory of Water Quality Improvement and Ecological Restoration for Watersheds, School of Ecology, Environment and Resources, Guangdong University of Technology, Guangzhou, China, [3]Department of Environmental, Earth and Physical Sciences, University of Siena, Siena, Italy, [4]The Swire Institute of Marine Sciences and the Area of Ecology and Biodiversity, School of Biological Sciences, The University of Hong Kong, Pokfulam, Hong Kong SAR, China, [5]Department of Biology, University of Florence, Sesto Fiorentino, Italy, [6]Peking University, Shenzhen Grad Sch, School of Environment & Energy, Shenzhen, China, [7]Department of Chemistry, City University of Hong Kong, Kowloon Tong, Hong Kong SAR, China, [8]School of Science and Technology, Hong Kong Metropolitan University, Ho Man Tin, Hong Kong SAR, China

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Editorial on the Research Topic
Impact of marine debris on marine ecosystems and organisms

## Introduction

Marine debris is persistent solid material that is manufactured or processed and disposed or abandoned in the marine environment. Debris may be transferred to marine ecosystems through sewages, riverine runoffs, local fishing and aquaculture activities, and be exchanged between the ocean and coastal ecosystems (Carson et al., 2013; Chen et al., 2019; Ouyang and Yang, 2022). Marine debris includes many categories such as plastics, metals, glass, rubber, cloth, paper, and paper. In most realms of the ocean, the bulk of marine debris is plastics accounting for 60-79% (Tekman et al., 2019). The amount of microplastics in the ocean also increases in an alarming rate. It has been estimated that microplastics would increase 58.2% in 2050 from 2,510,400 metric tons in 2020 (Lebreton et al., 2019). Similarly, the estimation also showed increases in microplastic amounts in sediments of coastal ecosystems (Yu et al., 2023). Microplastics could be found in the digestive tracts and respiratory organs of marine animals (Foekema et al., 2013; Camedda et al., 2014; Forrest and Hindell, 2018; Not et al., 2020; Xu et al., 2020), which could be transferred to the predators *via* food webs (Fang et al., 2018). Not only microplastics, large debris can also pose threats to marine animals *via* entanglement (Fossi et al., 2018; Curtis et al., 2021). Marine debris is a worldwide problem that arouses widespread concern because of its adverse impact on marine ecosystems and potential threats to human health through commercial fisheries (Ouyang et al., 2022).

This Research Topic collected studies related to the impact of marine debris on marine ecosystems and organisms. The five manuscripts reported the characteristics and patterns of marine debris on different interfaces of marine environment, as well as the effects of microplastics on marine animals.

## Summary of the papers

Seafloor debris can act as vectors for the dispersal of sessile and attached organisms (e.g., anemones) and provide natural habitats for their settlement. Teng et al. determined the trophic characteristics of *Metridum senile* attached to seafloor debris and explored the cascade effects of seafloor debris on the benthic ecosystem of the northern Yellow Sea, China. They found that the isotopic niche of *M. senile* was overlapped with different functional groups and suggested that *M. senile* interacted with other co-occurred organisms (e.g., crustaceans and fishes) due to the cascade effects of seafloor debris.

Microplastics may occur in cetaceans (e.g., finless porpoises) and other animals *via* direct ingestion or trophic transfer. Wang et al. investigated microplastic pollution in surface seawater, and the concentration and characteristics of microplastics ingested by finless porpoises along the Fujian coast of the East China Sea. They found that most intestinal samples of finless porpoises were fibers and transparent, and the main chemicals are polyamide/polyethylene terephthalate, likely originated from textile industry. For the habitats of finless porpoises, the abundance of microplastics was higher in coastal waters than that in offshore waters.

In order to evaluate the potential effects microplastics, an exposure experiment was conducted to assess the potential of the striped barnacle *Amphibalanus amphitrite* as a bioindicator of microplastics by Cheung et al. The barnacles were exposed to either polypropylene fibers or fragments for 8 days to different concentrations of microplastics. The highest number of microplastics in *A. amphitrite* was 21.04 ± 15.22 fragments $g^{-1}$ and 17.60 ± 13.8 fibers $g^{-1}$ wet weight recorded after 4 days of exposure, and the microplastic concentration in the barnacles was positively correlated with the exposure concentration, regardless of the form of microplastics. A regression equation relating the microplastic concentration in the barnacles and that in the water was computed to estimate the microplastic concentration in the coastal waters of Hong Kong. The results suggest *A. amphitrite* as a bioindicator of microplastic pollution.

Microplastics can accumulate in sediments and then ingested by benthic animals. Sandgaard et al. considered sediments as a reservoir rather than the ultimate sink for microplastics. They compiled studies on the effect of microplastics on marine benthos and found that particle-ingesting benthos ingested microplastics in most cases. This implies that marine benthos are affected by microplastics even if they have the evolutionary ability to handle natural particles. Their analysis also indicated that adverse effects of microplastics on marine organisms were observed under ecologically relevant exposure scenarios.

Beaches can receive marine debris from both the land and seas. Ouyang and Yang unravelled the patterns of beach and sea debris using time-series data on the density and accumulation density of marine debris in the Chinese beach-sea continuum and examined the relationships between the density and accumulation density of marine debris on different interfaces of the beach-sea continuum. Significant relationships were found between the density and/or accumulation density of debris on seafloors and that on beaches and sea surfaces. A clear-cut difference in the density and accumulation density of marine debris and plastics on beaches and seafloors was observed between the pandemic and the pre-pandemic periods. The results can be leveraged to estimate the transportation, deposition and aggregation of marine debris from beaches and sea surfaces to sea surfaces.

## Perspectives

This Research Topic provides perspectives for future studies on marine debris, in particular microplastics. Future studies should investigate the fate of microplastics with reference to the effect of resuspension, re-entering the pelagic food web and burial into deeper sediments. The effect of microplastics on benthic invertebrates should be examined to understand the potential risks of long-term microplastic exposure. Marine debris may not only facilitate the vertical mobilisation of marine animals but also their horizontal long-distance migration (e.g., Aliani and Molcard, 2003). Nonetheless, it remains unknown how marine debris contributes to such migration, in particular, the invasion of exotic species due to the migration of debris-attached animals. The relationships between the density of marine debris on different interfaces of the land-sea continuum in marine ecosystems should be incorporated into models used to estimate the fate of marine debris.

## Author contributions

XO wrote the first draft of the ms. NT and CP revised the manuscript. All authors approved the submitted version.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## Publisher's note

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