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Editorial: Plastic Pollution in the Bay Areas

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Editorial on the Research Topic

Plastic Pollution in the Bay Areas

MOTIVATION

Bays are special portions of the ocean partly enclosed by the land, varying in size, shape, and depth. Bay areas are characterized by high productivity and rich biodiversity of species and habitats, with high economic and cultural values. More than half of the world's population are living in estuarine, coastal or bay areas, in which the resources, environment and space have formed the important material basis for the sustainable development of human society. The bay ecosystem is relatively fragile and has become one of the most sensitive and concerned ecosystems. In recent decades, the bay ecosystem has been increasingly subject to a large amount of plastic waste which has caused a worldwide problem today. Mass production of plastic products and inappropriate disposal lead to the accumulation of plastic waste in the bay, and thus the bay areas have been acted as one of sinks for plastics. Upon entering the marine environment, plastics will be gradually fragmented and/or degraded into microplastics (generally < 5 mm) and even nanoplastics (generally < 1 μm), greatly increasing the ingestion potential by marine species and causing ecological consequences in the bay areas.

A Research Topic in the Frontiers in Marine Science with the topic "Plastic Pollution in the Bay Areas" was therefore designed, in which 13 papers have been included, covering detection, occurrence, distribution, environmental fates, and ecological effects of plastics in bay areas has thus produced.

SOURCES, OCCURRENCE, DISTRIBUTION, AND ECOLOGICAL EFFECTS

Plastics have been discharged into bay areas from a wide range of sources including runoff, sewage discharge, industrial effluents, and atmospheric deposition. Particularly, surface runoff is considered one major pathway for plastics transport to coast (Okoffo et al., 2019). This is corroborated by the

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study of Li et al. showing the flux of microplastics into the Jiulong River (a small-/medium-sized river in China) and then into the Xiamen Bay (Xiamen, China). Interestingly, the riverine flux of small microplastics (0.044–5 mm) was found to be about eight times greater than that of large particles (0.33–5.0 mm) (Li et al.). Human activity is undoubtedly deemed for this blame for plastics pollution, which was supported by a significant positive correlation between microplastic abundance and both population density and per capita gross domestic product in Chinese coastal seawaters (Zhu et al.).

Given the concerns of massive inputs of plastics into marine environment, local to middle and large-scale investigations on plastics occurrence and distribution in sea water, sediment, beaches, mangroves or organisms have been actively carried out based on diverse detection technologies (Adyel and Macreadie; Chai et al.; Lei et al.; Li et al.; Liu et al.; Zhang et al.; Zhu et al.). These studies demonstrated that plastics, especially those with small sizes, seem to be ubiquitous and have a wide concentration range in marine environments. In particular, the authors pointed out that mangrove forest is under immense threat of plastic pollution. The world's largest single mangrove forest, the UNESCO Marine World Heritage-listed Sundarbans between Bangladesh and India, is becoming plastic cesspit. In addition, it has been found that weather plays an important role in controlling the distribution of plastics in coastal waters. For example, extreme storms, such as tropical cyclones, are responsible for a significant portion of the plastic debris transported from land to the sea (Nakajima et al.).

In addition to the widespread presence in surface water and sediments, plastics were also detected in the body of various marine organisms, such as corals (Lei et al.). barnacles and bivalves (Zhang et al.). The considerable quantity of plastic found in wild organisms greatly raises the concern of ecological risk and encourages the studies on plastic toxicity effects, which are diverse, including growth inhibition, oxidative stress, metabolic changes, and DNA damage (Su et al.; Zhang et al.). The toxicity mechanisms of plastic are also complicated because plastics are not only an exogenous foreign body but also a vector or carrier for metals and persistent organic pollutants (Han et al.; Han et al.; Su et al.). For instance, a synergistic effect was found between microplastics at 100 mg/L and benzo[a]pyrene (BaP) at 150 μg/L on the microalgae, *Chaetoceros muelleri* (Su et al.). However, most present ecological impact assessments today merely focus on the individual organism level under simplified conditions, further efforts are needed to understand the effects of plastics on complex ecosystems.

CONTRIBUTION AND PERSPECTIVES

In this special issue, we introduce the Research Topic "Plastic Pollution in the Bay Areas" covering the estimation of riverine fluxes, spatio-temporal distribution, toxicity, and environmental behaviors of plastics in the bay areas. New sampling and analytical methodologies for microplastic identification are also discussed. Through the 13 papers adopted, the special issue provides a better understanding of the status, fate, and potential risks of plastics in the bay areas. We hope that this special issue can provide a scientific support for the formulation of prevention and control measures of plastic pollution.

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

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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.