POLLUTION

The prevalence of microplastic debris in aquatic ecosystems as a result of anthropogenic activity has received worldwide attention. Although extensive research has reported ubiquitous and directly adverse effects on organisms, only a few published studies have proposed the long-term ecological consequences. The research in this field still lacks a systematic overview of the toxic effects of microplastics and a coherent understanding of the potential ecological consequences. Here, we draw upon cross-disciplinary scientific research from recent decades to 1) seek to understand the correlation between the responses of organisms to microplastics and the potential ecological disturbances, 2) summarize the potential ecological consequences triggered by microplastics in aquatic environments, and 3) discuss the barriers to the understanding of microplastic toxicology. In this paper, the physiochemical characteristics and dynamic distribution of microplastics were related to the toxicological concerns about microplastic bioavailability and environmental perturbation. The extent of the ecological disturbances depends on how the ecotoxicity of microplastics is transferred and proliferated throughout an aquatic environment. Microplastics are prevalent; they interfere with nutrient productivity and cycling, cause physiological stress in organisms (e.g., behavioral alterations, immune responses, abnormal metabolism, and changes to energy budgets), and threaten the ecosystem composition and stability. By integrating the linkages among the toxicities that range from the erosion of individual species to the defective development of biological communities to the collapse of the ecosystem functioning, this review provides a bottom-up framework for future research to address the mechanisms underlying the toxicity of microplastics in aquatic environments and the substantial ecological consequences.