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Plastic pollution in water ecosystems: A bibliometric analysis from 2000 to 2020

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ABSTRACT

Previous researchers have broadly studied plastic pollution in the water ecosystem worldwide, but the research topics development and performance trends in this study area are still insufficient and unclear. A bibliometric analysis was conducted to explore research trends regarding plastic pollution in the water ecosystem. Data of publications output was identified based on the Web of Science (WoS) database's research articles from 2000 to 2020. This study used VOSviewer to analyse collaboration networks among authors, countries, institutions, and co-occurrence analysis of keywords in three defined periods. A total of 2182 papers in plastic pollution in water ecosystem research were identified. The USA has been in a top position in plastic pollution in water ecosystem research moving from 2 output publications in 2000 to 68 output publications in 2020. Centre National De La Recherche Scientifique (CNRS) was ranked first in terms of the total publication output (105 publications, 4.81%). Most previous studies in Phase I (2000–2006) and Phase II (2007–2013) emphasise plastic pollution studies in marine environments compared to freshwater ecosystem-focused research. However, in Phase III (2014–2020), researchers more focused on plastic pollution in freshwater ecosystems such as rivers, lakes, estuary and inland water. The valuable results obtained from this study can help scholars better understand the research development trends and research hotspots in the field of plastic pollution in the water ecosystem and provide direction for future research.

1. Introduction

The small scale plastics manufacturing began in the 1950s, and plastic waste was comparatively manageable (Zhang, 2019). To date, the production of virgin plastics estimated at around 8300 million metric tons (Geyer et al., 2017). Plastics are categorised into four types based on their size: nano plastics (<100 nm), microplastics (<5 mm), mesoplastics (5–25 mm) and macroplastics (>25 mm) (Stock et al., 2019). Up to 99% of plastics are made from non-renewable resources such as coal, oil and natural gas. If current production trends continue, 20% of global total oil consumption could account for the plastic industry by 2050. Furthermore, in recent years plastic waste has become a universally significant environmental problem and has gained significant attention (Milad et al., 2020; Zhao et al., 2021). In worldwide, every year, more than 5 trillion single-use plastic bags are used, and one million plastic drinking bottles are bought every minute (UN Environment, 2018). Only 9% and 12% of plastic waste have been recycled and incinerated, while the rest of 79% of plastic waste ends up in landfills (UN Environment, 2018).

Furthermore, previous studies estimate that up to 10% of plastic debris generated ends up in the ocean (Thompson, 2006), and 88% of the sea surface is contaminated with plastic waste (Condor Ferries, 2020). Almost 80% of plastic debris ends up at the marine from land-based sources (Li et al., 2016) due to the mismanaged waste along the supply chain, starting from production until the end of the plastic life cycle. If current generation plastic waste trends continue, the ocean's ecosystem could have more plastic than fish by 2050. Apart from natural processes (rain, humidity suspension, tides, predominantly the wind and snow), freshwater (including river) is also a driving force in transporting mismanaged land-based plastic waste into the marine. Plastic pollution

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