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How fast, how far: method diversification for measuring microplastic in environmental samples?

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Abstract

A diverse array of methods exist to quantify microplastic (MP) in environmental samples, however, the proliferation of new methods has accelerated in recent years. This has resulted in a wide variety of complimentary but also competing approaches to MP sampling, extraction and characterisation. While there is an obvious need for a suite of methods for different purposes, for example the precision required by research and the efficiency needed in monitoring, it has repeatedly been criticised that data are not comparable. Furthermore, the degree to which new methods are acknowledged and adopted and the reasoning behind it are currently unclear. We therefore need to determine the relative usefulness of the increasing number of available methods versus an aggravation of comparability.

A systematic review of method use in the MP literature was undertaken, covering five common processing steps: sampling of water for MP, MP extraction from water samples, MP extraction from sediment samples, MP extraction from biota, and MP characterisation. By approaching the literature in reverse chronological order, we identified the first occurrence of a method. New methods were categorised by their "degree of novelty" into: highly novel methods, secondary adaptations of existing methods and smaller, tertiary adaptations of existing methods. Apparent interest in new methods was determined by assessing the average number of citations per month of each publication. The proportional use of methods across all articles as well as the use of reporting units are also reported.

Based on this dataset, we 1) assess the rate of method diversification, 2) identify key developments and points of diversification, and 3) analyse the level of interest in new methods and their apparent spread and adoption. The implications of method selection (accuracy, efficiency, and impacts on reporting and comparability) are highlighted and recommendations specific to both academic research and environmental monitoring are given.

Keywords: Sampling, extraction, characterization, methodology

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