

Crowd-based observations of Riverine macroplastic pollution

ABSTRACT

Macroplastic pollution (> 0.5 cm) negatively impacts aquatic life and threatens human livelihood on land, in oceans and river systems. Reliable information on the origin, fate and pathways of plastic in river systems is required to optimize prevention, mitigation and reduction strategies. Yet, accurate and long-term data on plastic transport are still lacking. Current macroplastic monitoring strategies involve labor intensive sampling methods, require investment in infrastructure, and are therefore infrequent. Crowd-based observations of riverine macroplastic pollution may potentially provide frequent cost-effective data collection over a large geographical range. We extended the CrowdWater citizen science app for hydrological observations with a module for observations of plastic in rivers. In this paper, we demonstrate the potential of crowd-based observations of floating macroplastic and macroplastic on riverbanks. We analyzed data from two case studies: (1) floating plastic measured in the Klang (Malaysia), and (2) plastic on riverbanks along the Rhine (the Netherlands). Crowd-based observations of floating plastic in the Klang yield similar estimates of plastic transport (2,000–3,000 items h^{-1}), cross-sectional distribution (3–7 percent point difference) and polymer categories (0–6 percent point difference) as reference observations. It also highlighted the high temporal variation in riverine plastic transport. The riverbank observations provided the first data of macroplastic pollution on the most downstream stretch of the Rhine, revealing peaks close to urban areas and an increasing plastic density toward the river mouth. The mean riverbank density estimates are also similar for the crowd-based and reference methods (573–1,033 items km^{-1}). These results highlight the value of including crowd-based riverine macroplastic observations in future monitoring strategies. Crowd-based observations may provide reliable estimations of plastic transport, density, spatiotemporal variation and composition for a larger number of locations than conventional methods.

Keyword: Citizen science; Hydrology; Plastic; Marine litter; Riverbank plastic; Floating debris; Rhine; Klang