Concentration, transportation, and deposition of microplastics along the Savannah River, Georgia (USA).

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Abstract:

Despite extensive research into the transport and fate of oceanic microplastics (MP, <5mm in size), there is comparatively little focus on river systems considered to be pathways for these contaminants. The Savannah River, forming the border between Georgia and South Carolina, provides a unique location to study MP pollution along a variably industrialized river system terminating in the Atlantic Ocean. We investigated spatial variations in MP concentrations along the Savannah River to better understand their transport and deposition in rural to highly developed fluvial systems. Samples of riverbank sediment and suspended particles captured by a <80μm plankton net were collected along a 115 km reach of the river extending from just below the Strom Thurmond Dam to 25km downstream of Augusta, GA. Laboratory MP separation followed NOAA guidelines with a heavy liquid float-sink separation technique and wet peroxide oxidation treatment. Visually identified MPs were counted and photographed using a stereomicroscope; a subset of particles from each sample were examined using a Horiba XploRa Plus confocal microscope system. Average MP concentrations were measured at 3.1 (range: 1.5-4.6) particles/cubic meter in water and 16.8 (range: 6.2-27.4) particles/kg sediment and primarily composed of polyester fibers and polypropylene pellets. Comparison of MP concentrations between sediment samples from the upper bank and water margin suggests that MP particle deposition is dependent on river stage. Preliminary results further indicate that there is no observable relationship between increasing drainage area and MP concentration, suggesting that concentration may be dependent on localized anthropogenic sources rather than cumulative upstream contributions. Measured concentrations of MP in bank sediment in the upper reaches of the Savannah River are an order-of magnitude less than published concentrations at the river's mouth collected over the same sampled cross-sectional area, suggesting tidal action exerts a significant control on MP pollution in coastal and near coastal areas. Future work will focus on quantifying the predicted role of tidally dominated systems in concentrating microplastics around river mouths and identifying river reaches with highly concentrated MP particles for targeted remediation.