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Microplastic Accumulation and Spatial Variability in Mussels and Clams: Species-Specific Trends in the Saguenay–St. Lawrence River-Estuary System

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Our reliance on plastics has made them ubiquitous environmental contaminants, with microplastics increasingly detected in freshwater and marine systems. Their distribution and potential for pollutant transport and bioavailability have made them a global research priority. Although global marine studies commonly report polyethylene terephthalate (PET) and polyethylene (PE) as dominant polymers, large-scale surveys may overlook regionally prevalent types. Targeted studies in freshwater–estuarine systems integrating upstream anthropogenic inputs before marine export are therefore essential for resolving localized polymer profiles and understanding microplastic fate and transport. The Saguenay–St. Lawrence River system is a major North American watershed receiving inputs from the Great Lakes, shaped by anthropogenic activity, and exporting freshwater to the Atlantic Ocean. We conducted a spatially structured assessment across 10 riverine and estuarine sites to capture geographic and hydrodynamic variability. Two bivalve species were investigated: blue mussels (*Mytilus edulis*), representing suspension feeders, and soft-shell clams (*Mya arenaria*), which interact closely with sediments. Soft tissues were digested using hydrogen peroxide and sequentially filtered into >100 µm, 10–100 µm, and <10 µm fractions. Suspected particles >100 µm were morphologically characterized and polymer identity confirmed using optical photothermal infrared (O-PTIR) spectroscopy. Microplastics were detected in over 95% of individuals, averaging ~5 particles per organism (~2 particles g^{-1} wet weight), with minimal spatial variability. Clear interspecies differences were observed: mussels predominantly contained smaller particles (<1 mm; ~80%), whereas clams exhibited a higher proportion of larger particles (>1 mm; ~55%). Fibers dominated in both species, with cellulose-based materials comprising 60–70% of detected particles, and synthetic polymer composition differed between taxa. Given the limitations of O-PTIR, our ongoing work evaluates pyrolysis–gas chromatography–mass spectrometry (Py-GC-MS) to potentially differentiate natural cellulose from semi-synthetic derivatives in the >100 µm fraction and to quantify smaller size fractions on a mass basis. These findings highlight species-specific accumulation patterns between epifaunal and infaunal bivalves, and demonstrate the value of multi-species biomonitoring in hydrodynamically complex freshwater–estuarine systems.