Improved spatio-temporal polycyclic aromatic hydrocarbon (PAH) characterization and assessment in small craft harbour sediments in Nova Scotia, Canada

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Small craft harbours (SCHs) are crucial for the fishing industry which is vitally important for the Canadian culture and economy. Nearly 90% of all fishing landings in Canada (worth $1.6 B CAD), occur at SCHs. Sediments in these SCHs regularly require maintenance dredging for navigation but are commonly contaminated from various anthropogenic activities. In terms of pollutant inputs, polycyclic aromatic hydrocarbons (PAHs) represent one class of contaminants commonly found in marine environments. PAH compounds can accumulate in both aqueous and sediment fractions of harbour systems, creating "hot spots" for sediment contamination. Anthropogenic PAH inputs are produced from various sources, including petrogenic sources associated with petroleum inputs and pyrogenic sources from the combustion of wood, coal, and other organic substances. PAH sources are important to consider as they differ in their ecological impacts in the marine environment. Current assessment of PAHs in SCHs (sediment sampling), relies heavily on bulk sediment PAH concentrations to determine their inherent risk to organisms, water, or sediment quality, with source apportionment often neglected. Source apportionment may provide useful background information for SCH decision makers with respect to source control and remedial options for harbour systems. This research aimed to understand the temporal and spatial variation of PAH concentrations in 31 SCHs across Nova Scotia over a seventeen-year period (2001–2017), while also considering source apportionment to help determine PAH sources. Preliminary results indicate that the three regions of Nova Scotia (Gulf, Eastern and Southwest) differ in the extent and magnitude of PAH contamination among harbours, with certain harbours demonstrating extremely high PAH concentrations that exceed federal sediment quality guidelines. In terms of sourcing, an overwhelming combustion signature has been identified among all three regions, suggesting that the majority of PAH inputs are from pyrogenic sources and likely from both localized activities and potential long-range transport processes.

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