

# Characterization and Source Apportionment of Polycyclic Aromatic Hydrocarbons in Small Craft Harbour Sediments in Nova Scotia, Canada

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**Background/Objectives.** Small craft harbours (SCHs) in coastal Nova Scotia (NS), Canada, are an integral part of the Canadian fishing industry and are managed by Fisheries and Oceans Canada (DFO). SCHs support inshore fisheries, including lobster, and are often located in small, rural communities. Similar to other aquatic environments, SCHs often receive contamination inputs which can pose risks to aquatic biota. Of these inputs, polycyclic aromatic hydrocarbons (PAHs) represent one class of contaminants which sorb to sediments and are produced by a variety of different sources (petrogenic, pyrogenic, natural). PAHs are considered contaminants of concern, given their carcinogenic and mutagenic characteristics, and their ability to bio-accumulate and persist in aquatic environments. SCH sediments in Canada are evaluated for various contaminant concentrations on a site-specific basis by federal custodians, yet few studies have demonstrated detectable concentrations of organic contaminants in NS SCH sediments. This study aimed to complete a comprehensive evaluation of PAHs across 31 SCHs in NS, over a 16-year period (2001-2017).

**Approach/Activities.** To assess PAHs in sediment across NS, 31 SCH sites were selected among the gulf (9), eastern (6), and southwestern (16) regions of the province. A total of 115 federal sediment sampling reports, between 2001-2017, were used for analysis of secondary data, containing 580 individual sediment samples. Sediment PAH concentrations were the focus of previous analyses, but the aim of this study was to provide federal custodians with valuable information to support SCH management. Specifically, this study: (i) assessed PAH sediment concentrations through comparison to sediment quality guidelines (SQGs); (ii) evaluated individual and total PAH contributions; and (iii) identified potential PAH sources by employing PAH diagnostic ratios and Unmix Optimum receptor modelling approaches.

**Results/Lessons Learned.** Most NS SCH sediments exhibited PAH concentrations which were unlikely to impair biota, and many were below both low and high effect level SQGs. However, two SCHs in NS exhibit elevated PAH concentrations which are likely to impair biota and thus should be prioritized by federal environmental managers. Sediments are dominated by high molecular weight PAHs, with these compounds forming nearly 70% of the total PAH concentration among samples. From a source apportionment perspective, NS exhibits an overwhelming combustion signature that is supported by both PAH diagnostic ratios and Unmix Optimum receptor modelling. Unmix has identified four individual sources which best characterize PAH inputs for the entire province. Preliminary identification of these sources suggests a link to local and long-range coal combustion, alongside other non-point source emissions (vehicle emissions, residential heating).