Microplastics Pollution: What can we learn from stormwater pond sediment?

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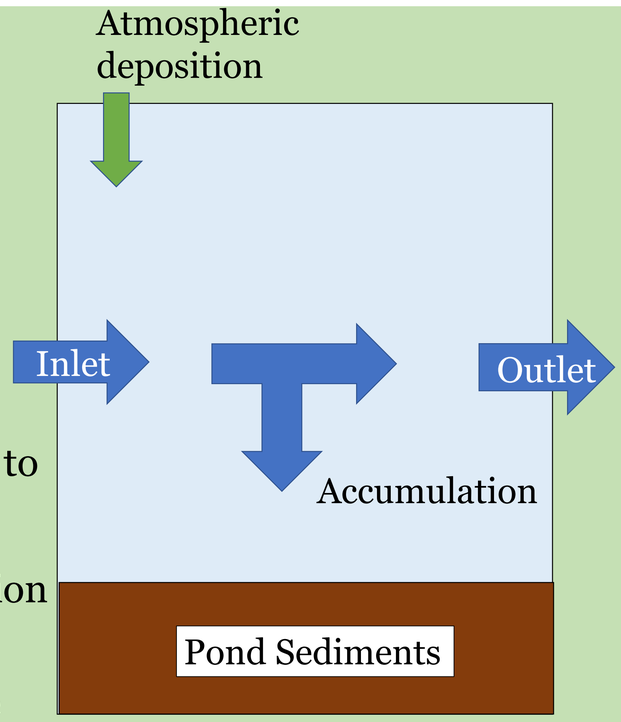
Background

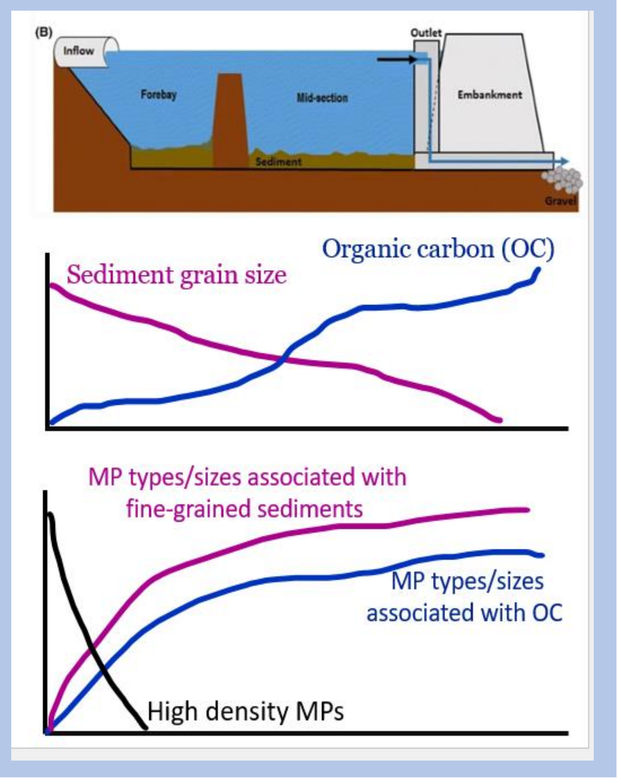
- Stormwater ponds (SWPs) are receivers of land-based microplastics carried by stormwater runoff[1]
- Microplastics accumulated in SWP sediments = archives of historic microplastics delivery to SWPs[2]
- Factors controlling accumulation and spatial variability of microplastics in sediments are understudied[3]



Conceptual model of microplastics particle balance for a SWP

Objectives

- Assess **the variability in microplastics types, sizes, and abundances** in SWP sediments
- Determine **the influence of sediment properties** on microplastics accumulation
- Relate **microplastics loads** in stormwater runoff to **upstream land use**



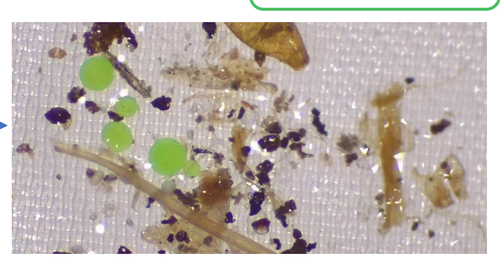
Field sampling: 5 SWPs in the City of Kitchener

Set up transect → Collect sediment, measure sediment depth

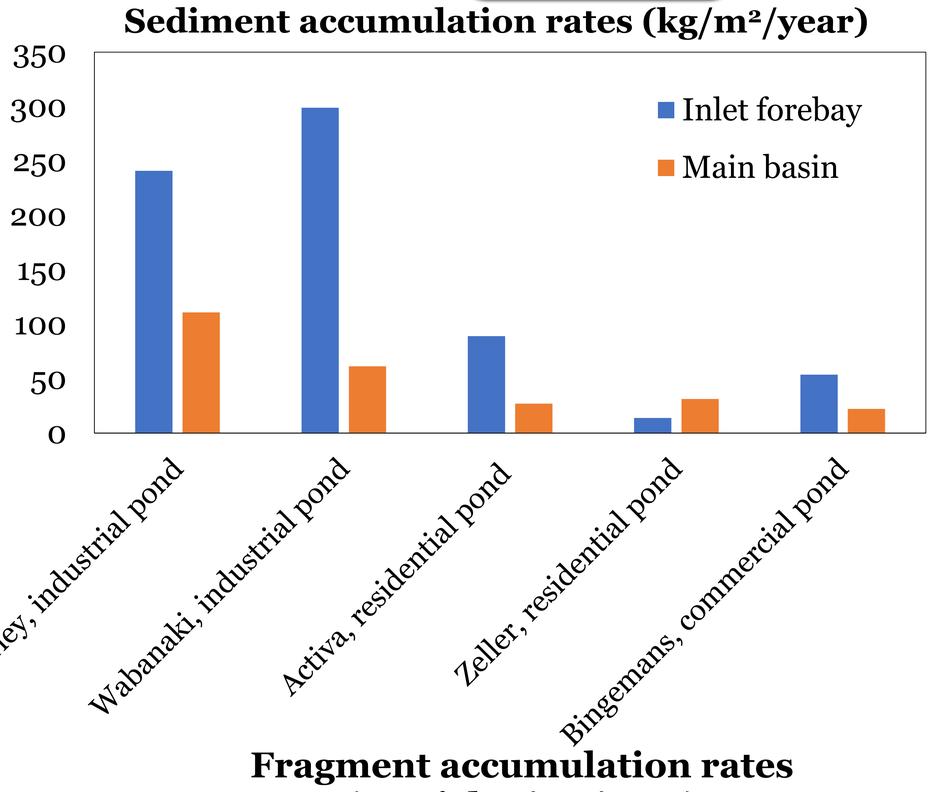
Section sediment cores

Lab Analyses: Ongoing

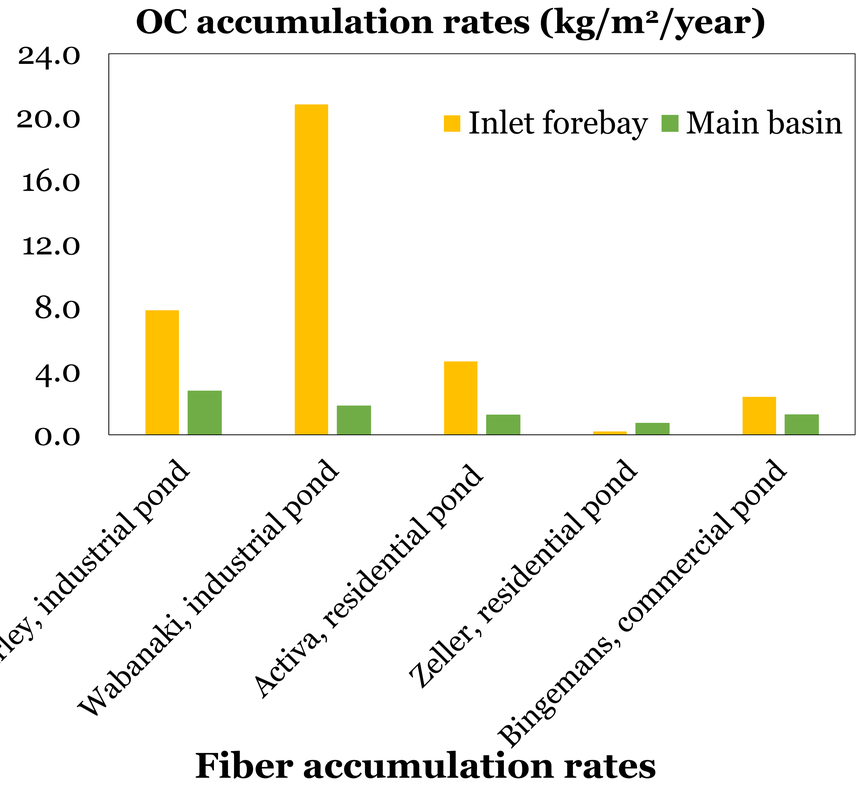
- **Microplastic particles separation:**
  - Density separation with $ZnCl_2$
  - Fenton oxidation
  - Identification: manual counting, LDIR
- **Organic carbon analysis:**
  - CHNS analyzer
- **Grain size analysis:**
  - Organic matter removal
  - Laser diffractometer
- **Mineralogy analysis**
  - Grind and sieve through 63µm sieve
  - X-ray diffractometer



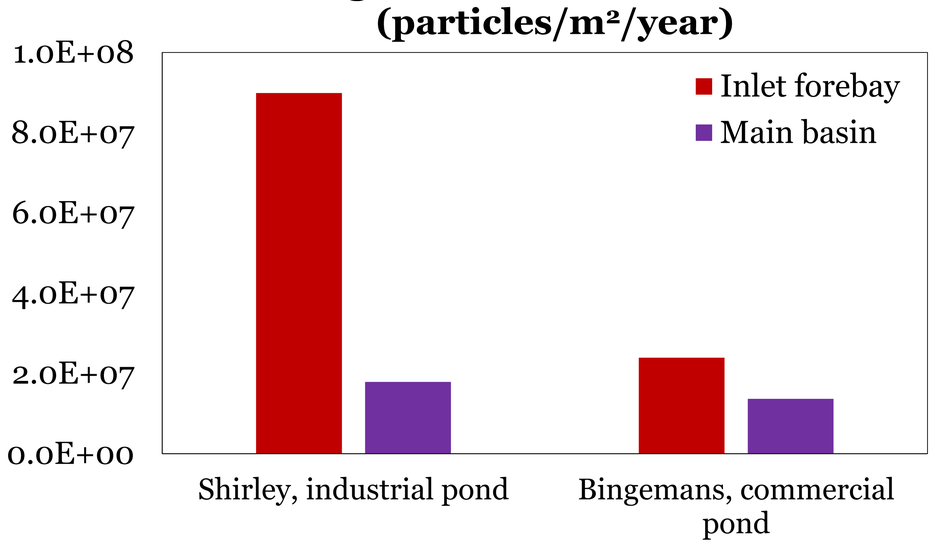
Sediment accumulation rates (kg/m²/year)



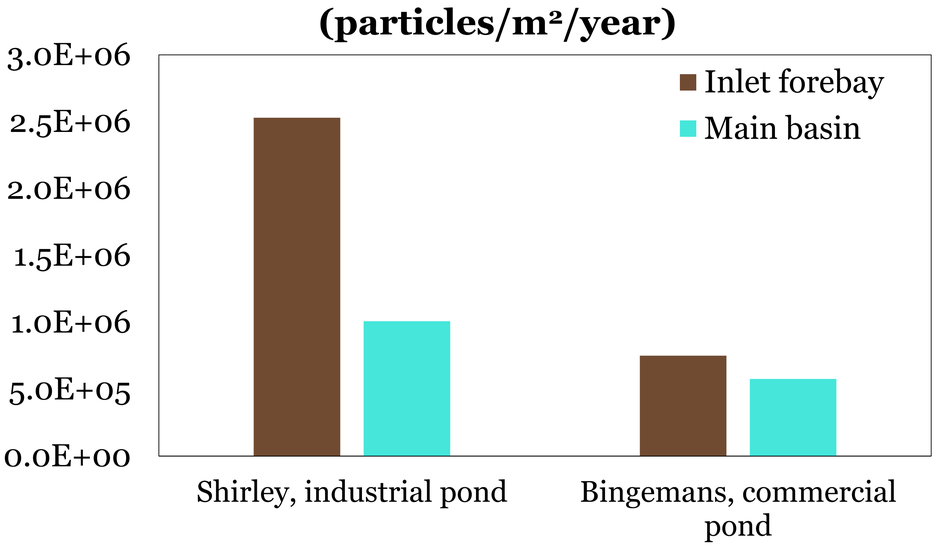
OC accumulation rates (kg/m²/year)



Fragment accumulation rates (particles/m²/year)



Fiber accumulation rates (particles/m²/year)



➢ **Preliminary results show impact of catchment land use on sediment, organic carbon, and microplastic burial rates:**

- Industrial SWPs had highest burial rates, followed by residential and commercial SWPs
- Sediment, organic carbon, and microplastic burial rates higher in inlet forebay than main basin for most SWPs
- Fragment burial rates were considerably higher than fiber burial rates

Reference

1. Cole, M., Lindeque, P., Halsband, C., & Galloway, T. S. (2011). Microplastics as contaminants in the marine environment: a review. *Marine pollution bulletin*, *62*(12), 2588-2597. doi: 10.1016/j.marpolbul.2011.09.025
2. Chen, H., Jia, Q., Zhao, X., Li, L., Nie, Y., Liu, H., & Ye, J. (2020). The occurrence of microplastics in water bodies in urban agglomerations: impacts of drainage system overflow in wet weather, catchment land-uses, and environmental management practices. *Water research*, *183*, 116073. doi: 10.1016/j.watres.2020.116073
3. Olesen, K. B., Stephansen, D. A., van Alst, N., & Vollertsen, J. (2019). Microplastics in a stormwater pond. *Water*, *11*(7), 1466. doi: 10.3390/w11071466