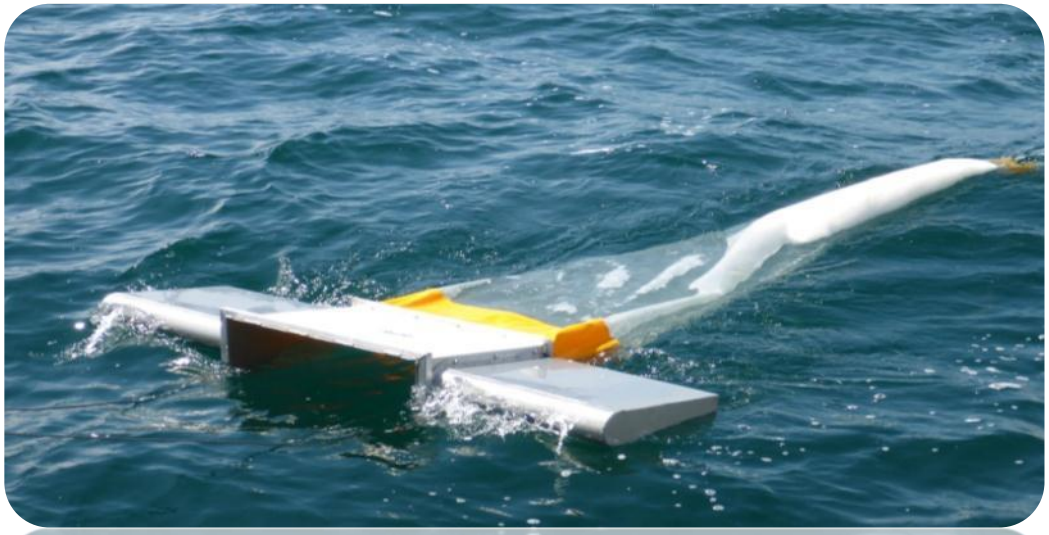
Monitoring and Assessment of Emerging Contaminants in the Toronto Area



Paul Helm

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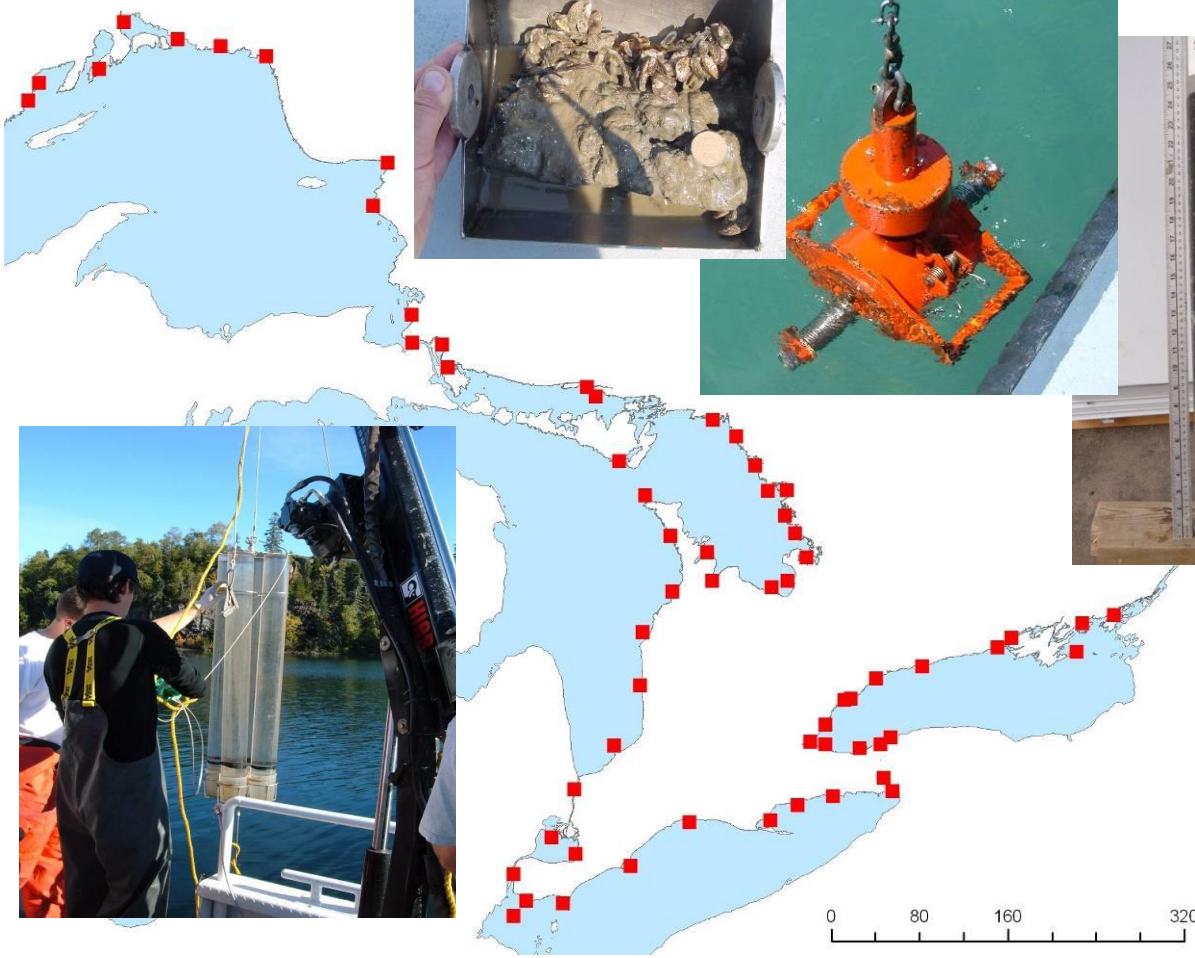
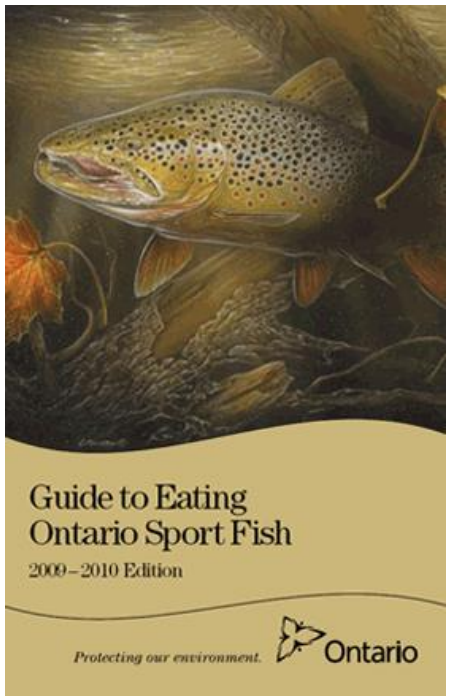
Ontario Ministry of the Environment & Climate Change

Ontario

MOECC Great Lakes Contaminant Monitoring





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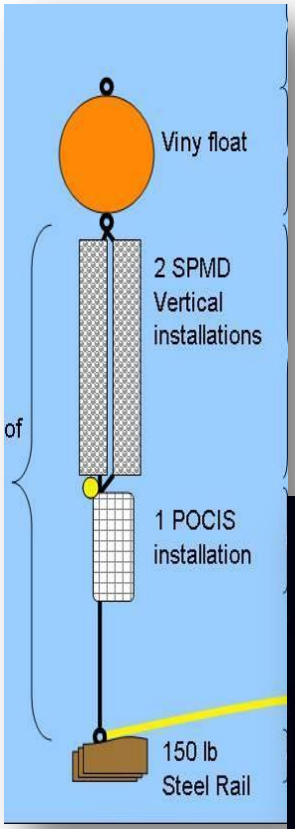
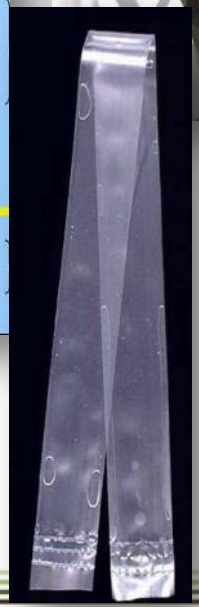
MOE Passive Sampling





SPMD, PE

POCIS

- **Broad range of chemicals**
- **Bioavailable compounds & exposure assessment**
  - **Hydrophobic / Bioaccumulative (SPMD/PE)**
    - PCBs, PAH
    - BFRs, fragrances, surfactants
  - **Soluble in Water (POCIS)**
    - Pharmaceuticals
    - Hormones
    - Current-use pesticides
    - Fungicides

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Emerging Contaminants Monitoring / Studies

- **Legacy & current-use persistent organic pollutants and wastewater-related compounds**
  - Ontario Great Lakes nearshore waters
  - Urban watersheds, receiving zones
  - Non-target analyses (e.g. break-down products?)

- **Microplastics**
  - Types of particles / sources to the Great Lakes from Ontario
  - Great Lakes water, streams, wastewater, sediment, fish
- **Potential Impacts**
  - Effects studies (sediment, water, wastewater), “omics” (**SDB**)
  - Microplastic ingestion and effects

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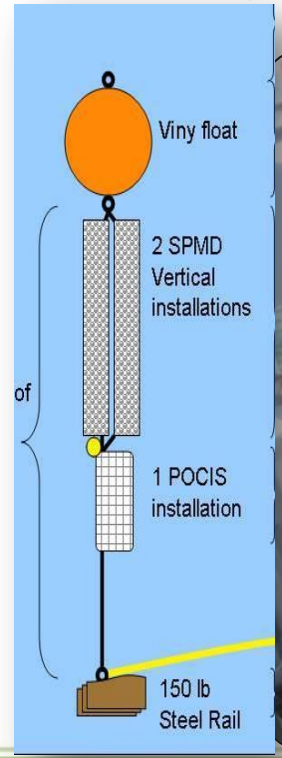
Passive Deployments



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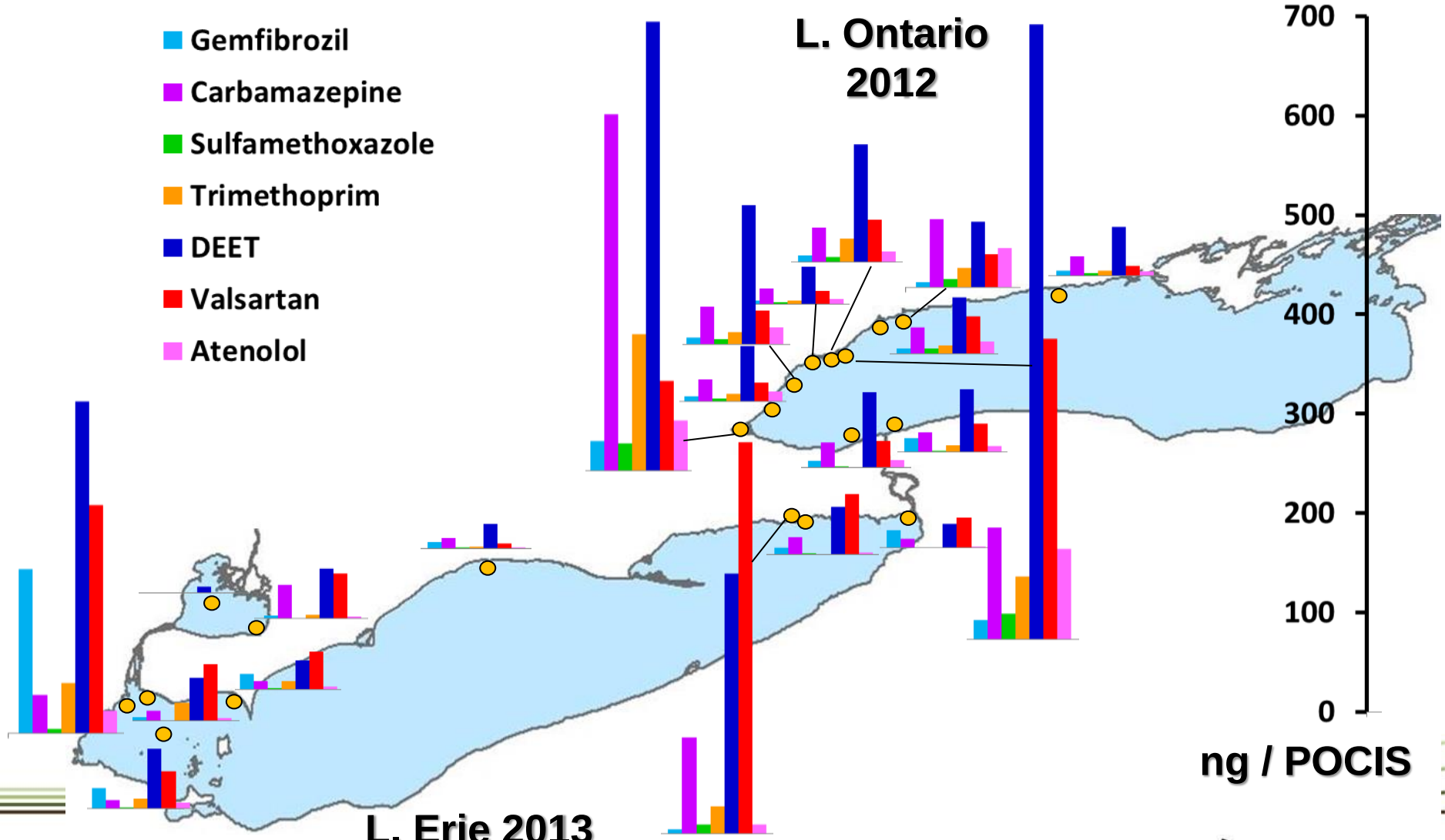
Pharmaceuticals in POCIS



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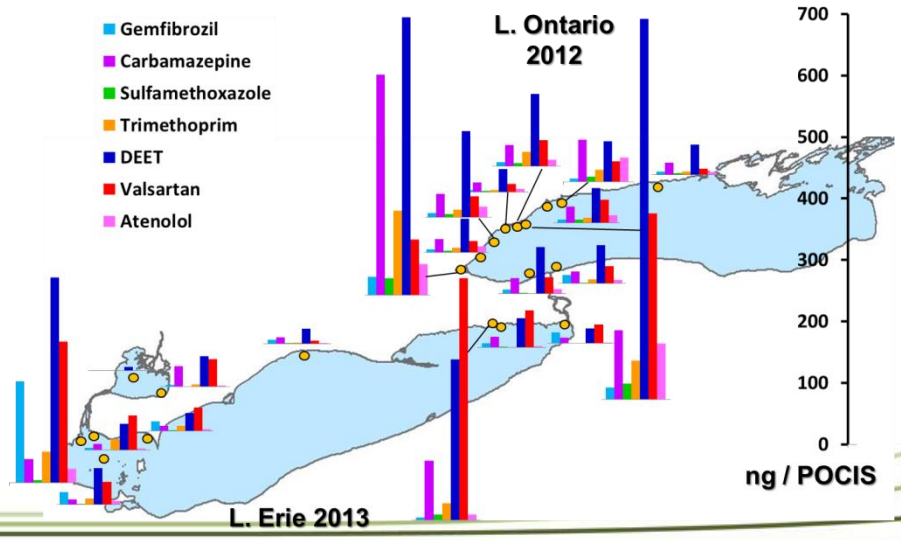
Pharmaceuticals in POCIS

In GL POCIS:

- **38 of 160 compounds with detection frequency >25%**
- **14 of the 38 compounds have no R_S determined for POCIS**
- **Presence of a low concentrations**

Estimated Maximum Concentrations (ng/L; near WWTPs):

DEET	**110**
Valsartan	**70**
Atenolol	**82**
Carbamazepine	**37**
Ibuprofen	**47**
Cocaine	**4**



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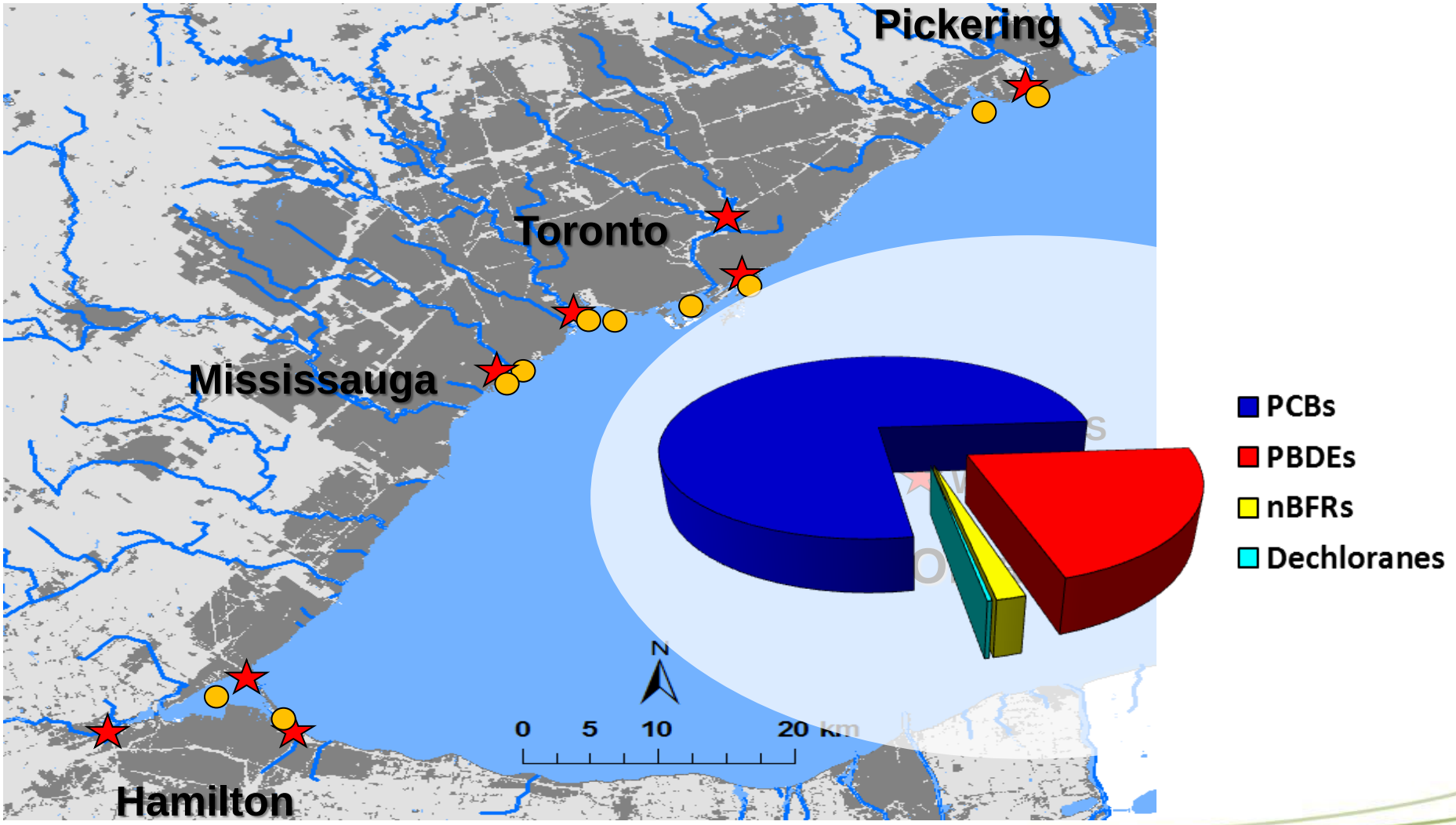
Halogenated Compounds in PEDs



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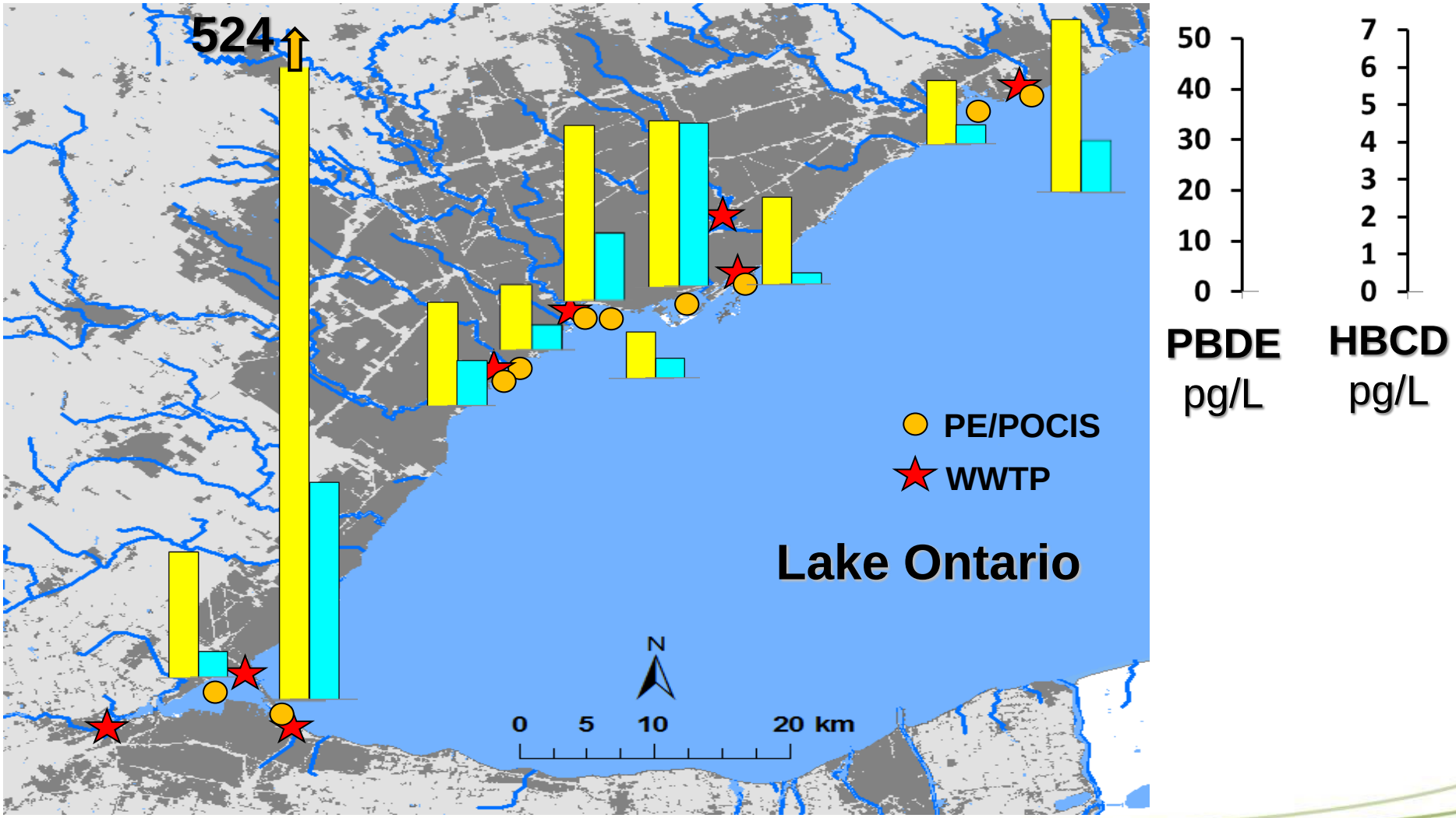
L. Ontario – PBDEs & HBCD in Water



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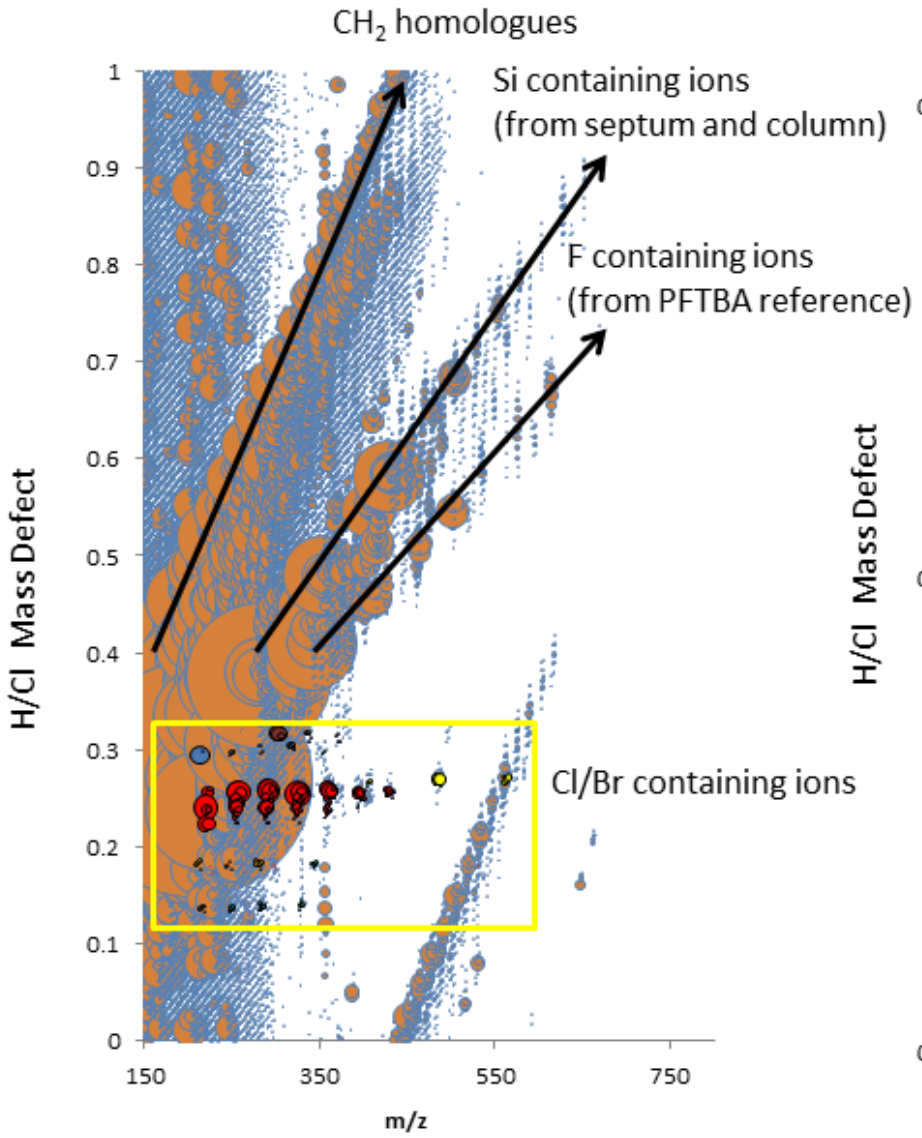
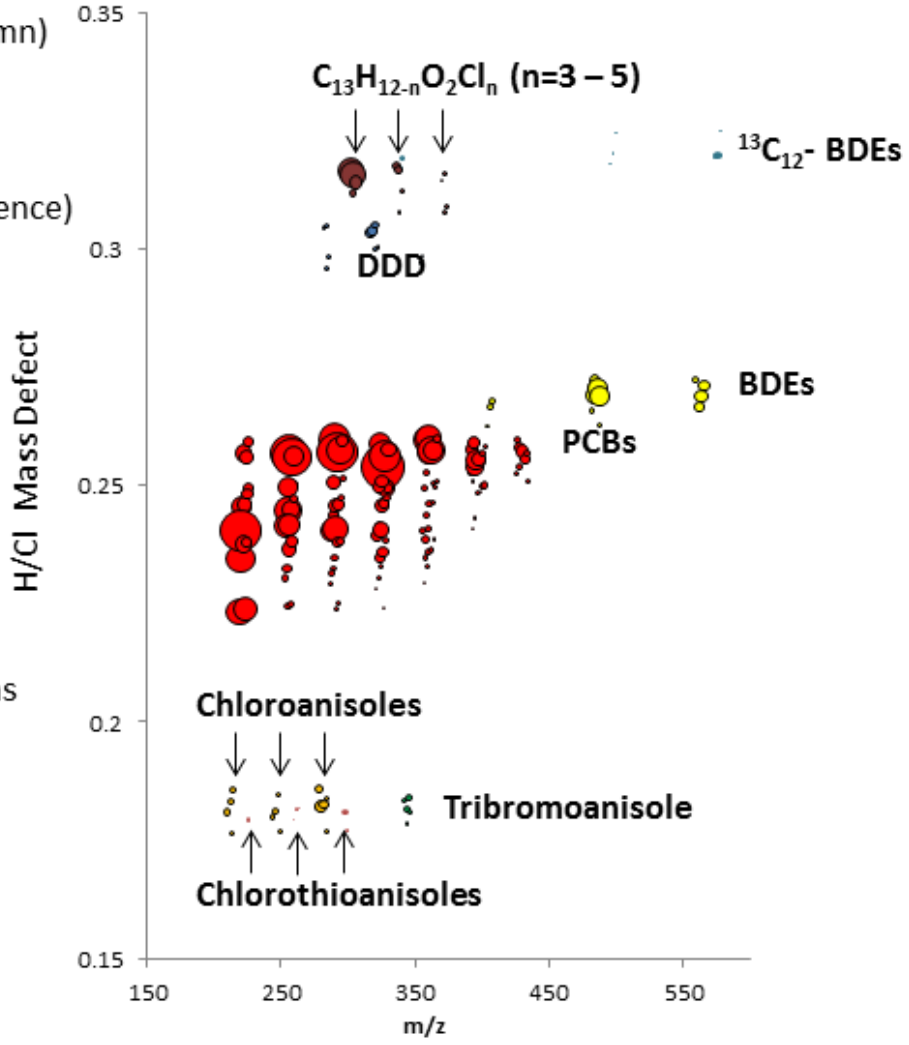
GC-HRTOF Screening of PEDs





What are Microplastics?

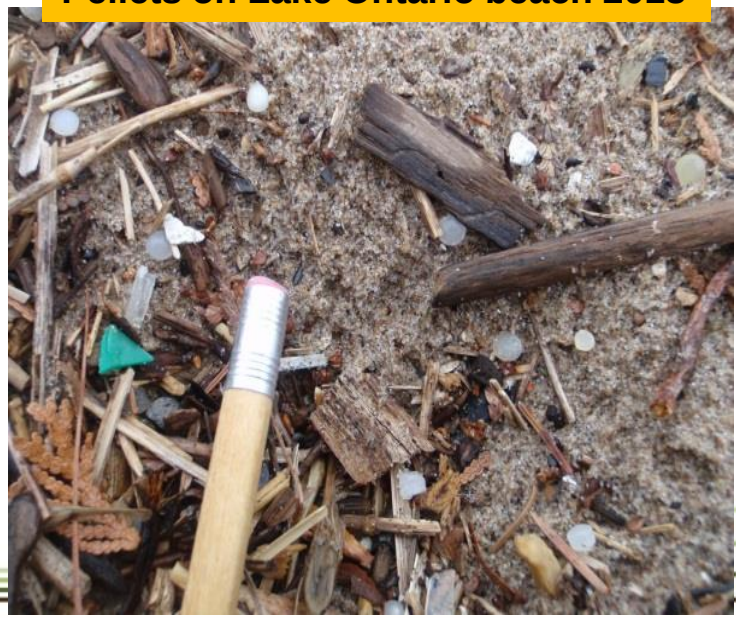
Microplastics:

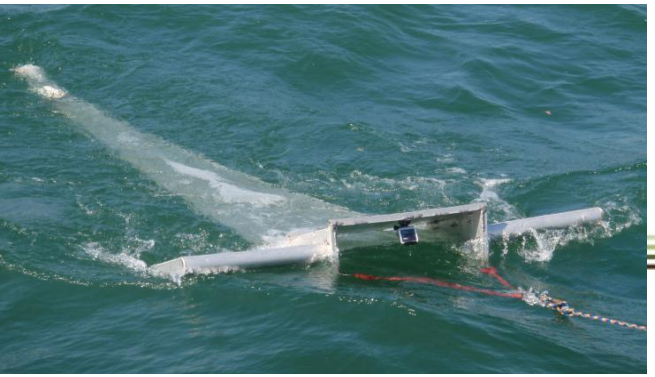
- particles of plastic generally < 5 mm across
- operationally-defined (net/seive size; e.g. 0.3 mm to 5 mm
- smaller particles possible (< 1 to 10's of micrometers)

Sources:

- raw feed stock polymer pellets
- fibers (clothing), line, rope
- degraded / abraded debris / litter
- beads from personal care products

Pellets on Lake Ontario beach 2013





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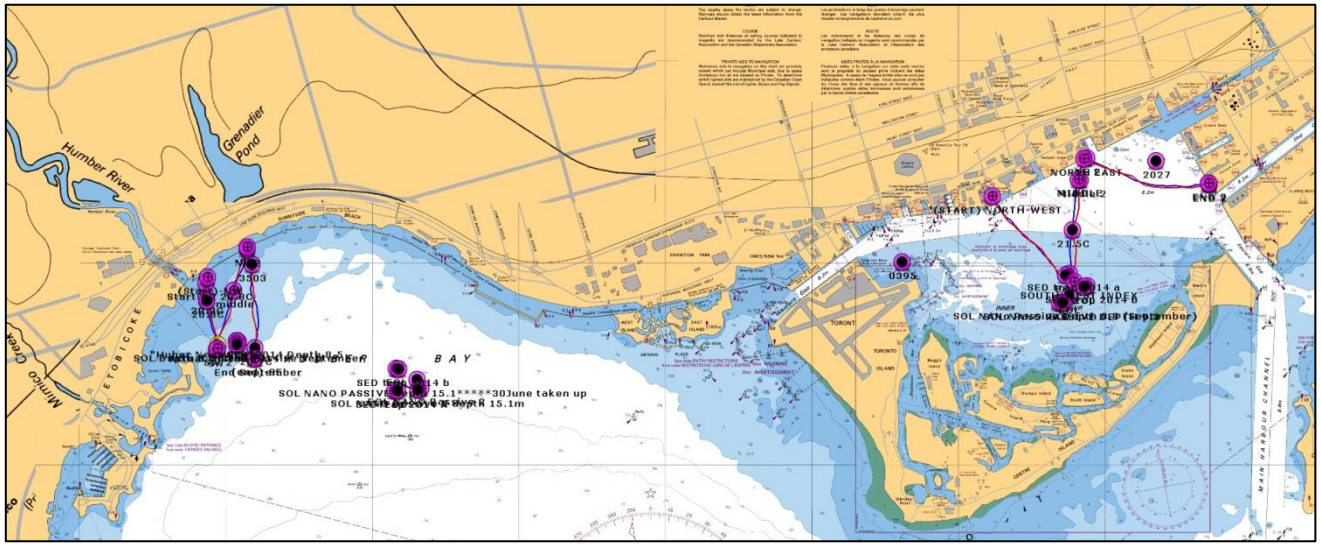
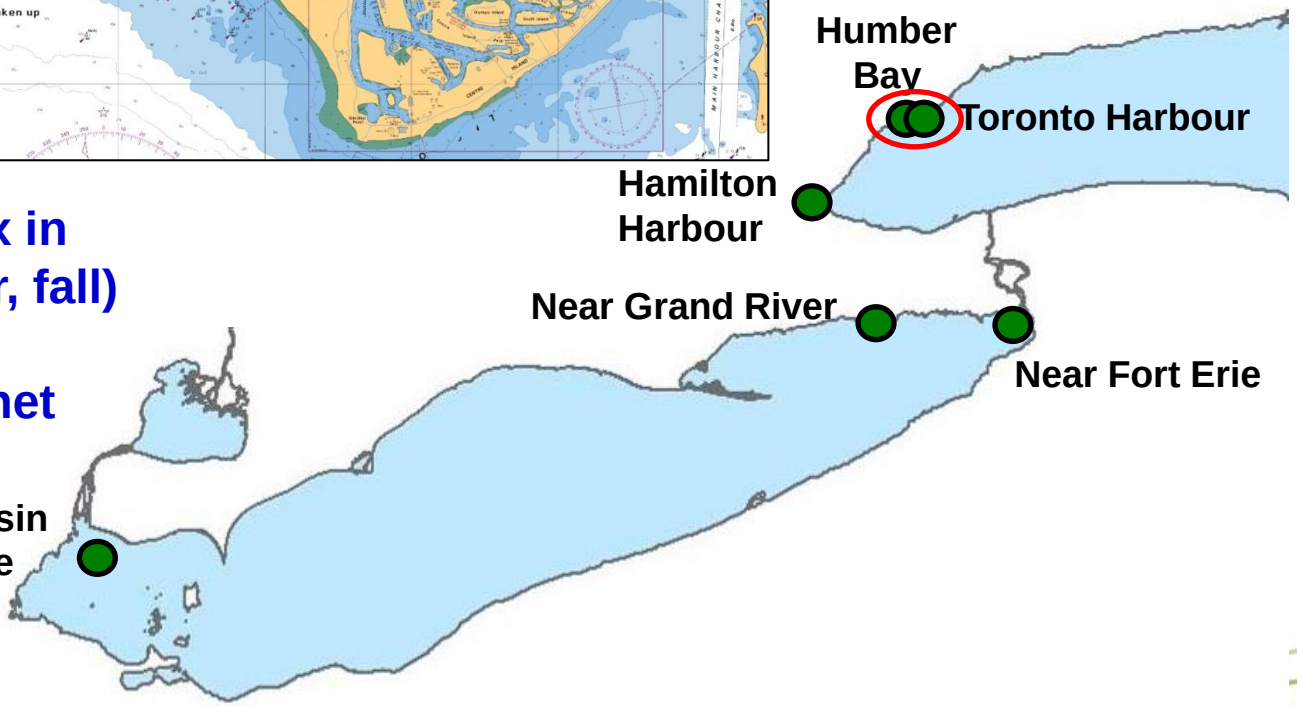
Manta Trawl Locations





- **Each site sampled 3 x in 2014 (spring, summer, fall)**
- **335 μm mesh manta net**

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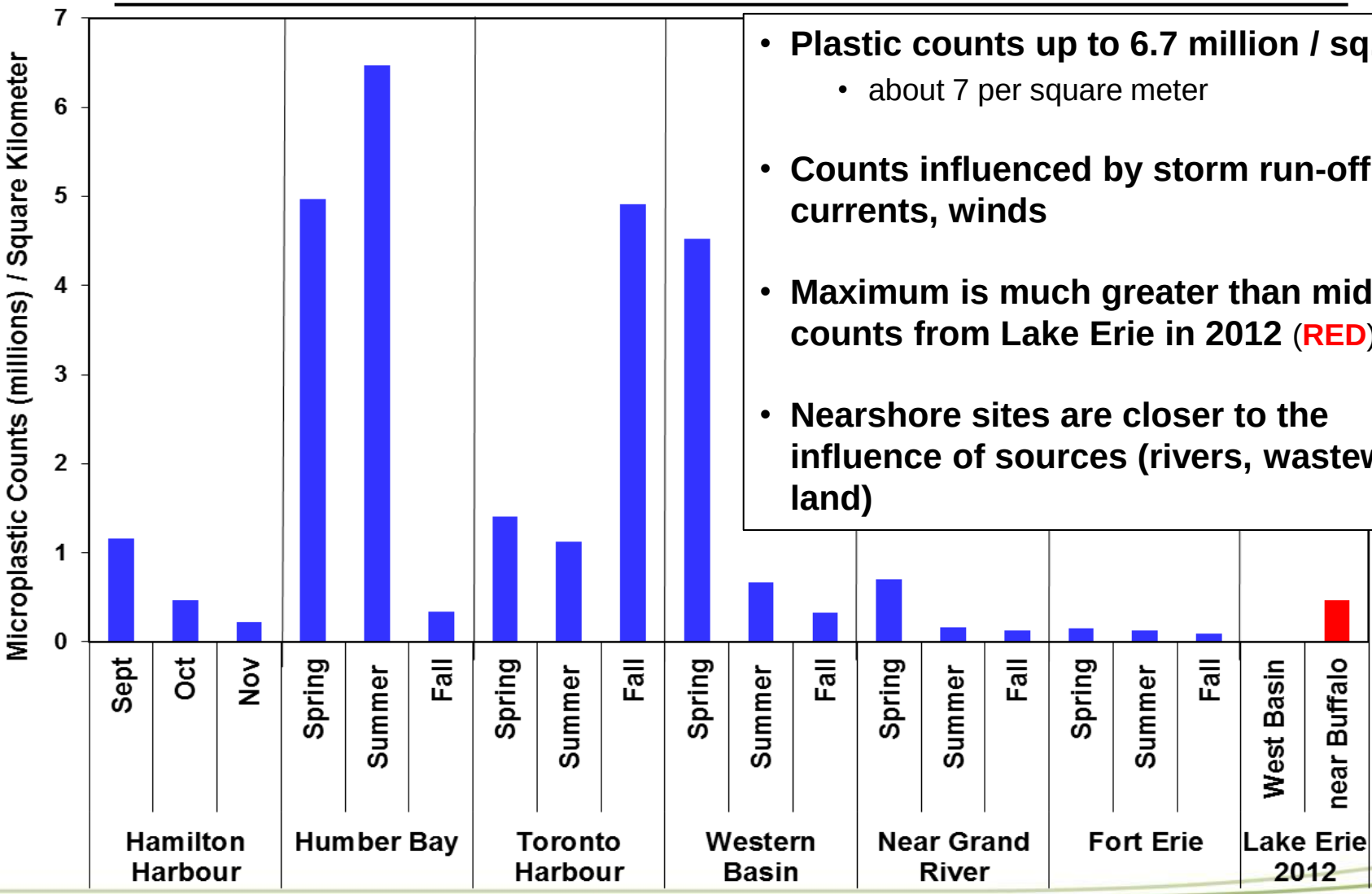
Microplastics in Great Lakes Nearshore Waters



- **Plastic counts up to 6.7 million / sq. km**
  - about 7 per square meter
- **Counts influenced by storm run-off, currents, winds**
- **Maximum is much greater than mid-lake counts from Lake Erie in 2012** (**RED**)
- **Nearshore sites are closer to the influence of sources (rivers, wastewater, land)**

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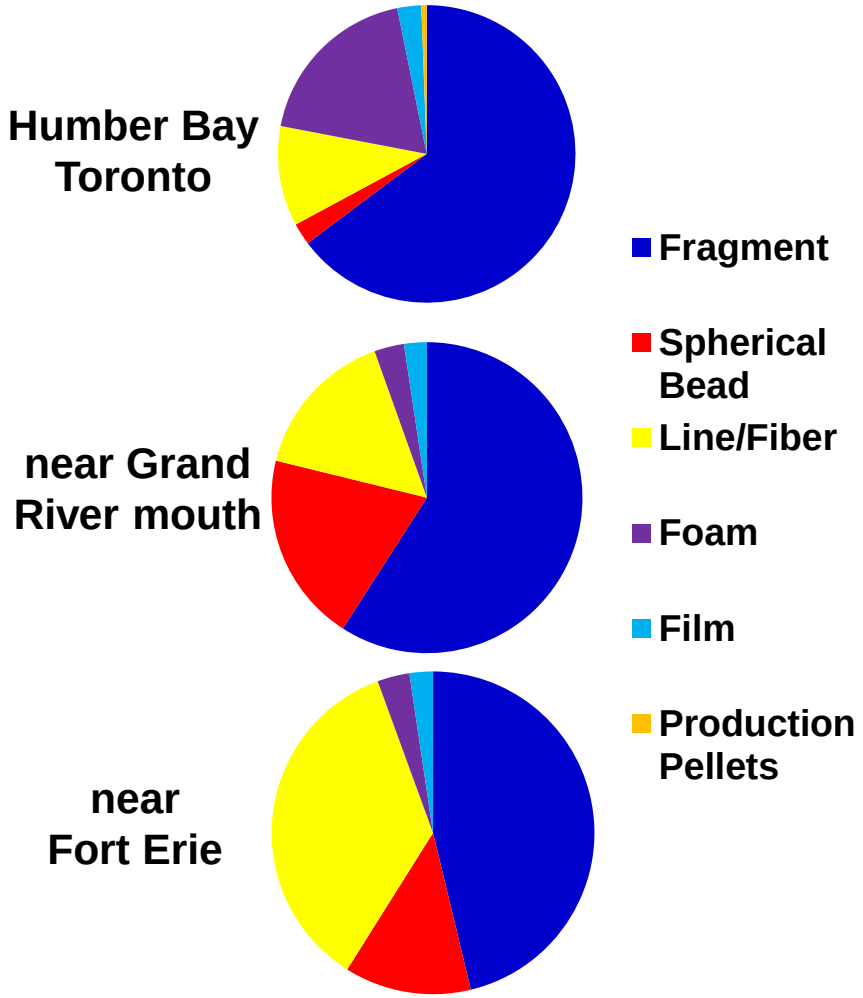
Average Percent Particle Type – Lake Samples



- **Plastic found in Humber Bay consisted mostly of fragments (including twistings, shavings, droplets)**
  - **Indicates other industrial / commercial sources**

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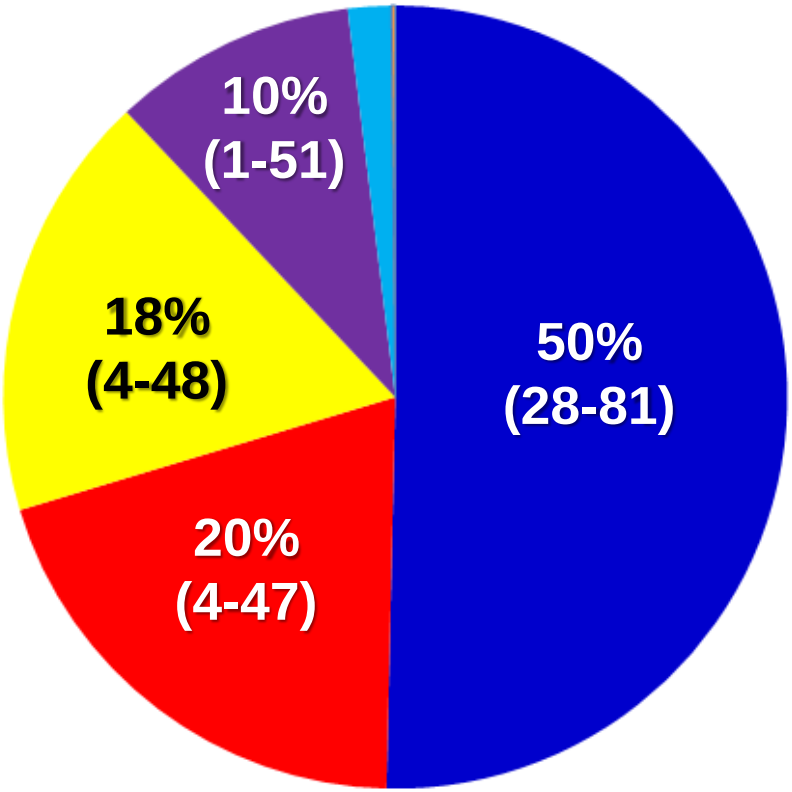
Microplastic Categories – Great Lakes



- **Average microplastics composition found in trawls of nearshore Lake Ontario and Lake Erie surface waters by MOECC in 2014**
- **Microbeads are a portion of the microplastics present of similar sizes**
  - Subjectivity in categorizing

Categories (potential sources)

- **Fragments** (litter, plastics molding industry)
- **Microbeads** (personal care products)
- **Line/Fibers** (rope, line/net, clothing, cig butts)
- **Foam** (packing, food containers, insulation)
- **Film** (plastic bags, wrapping)
- **Production Pellets**

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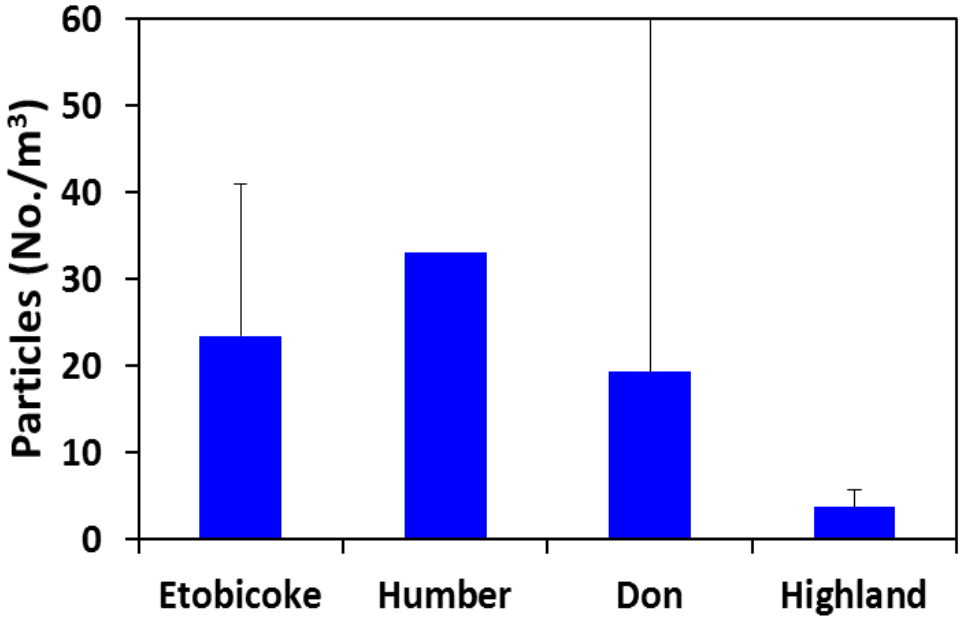
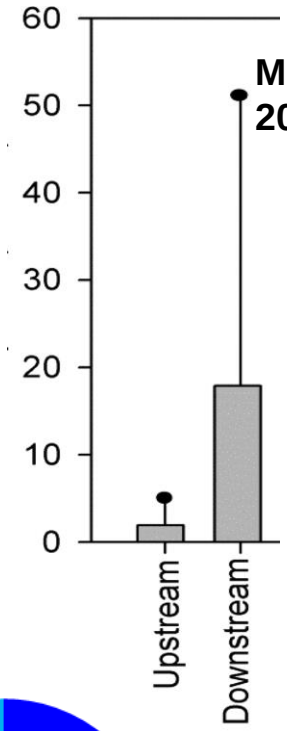
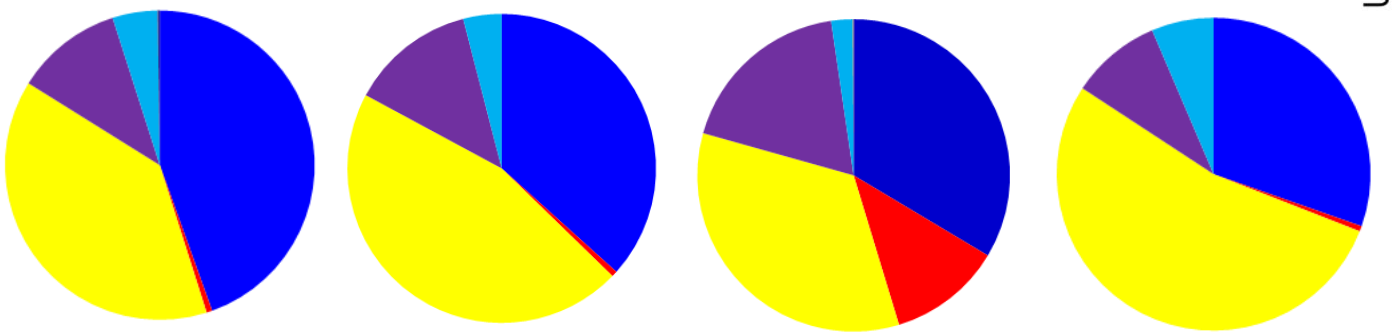
Microplastics in Urban Streams





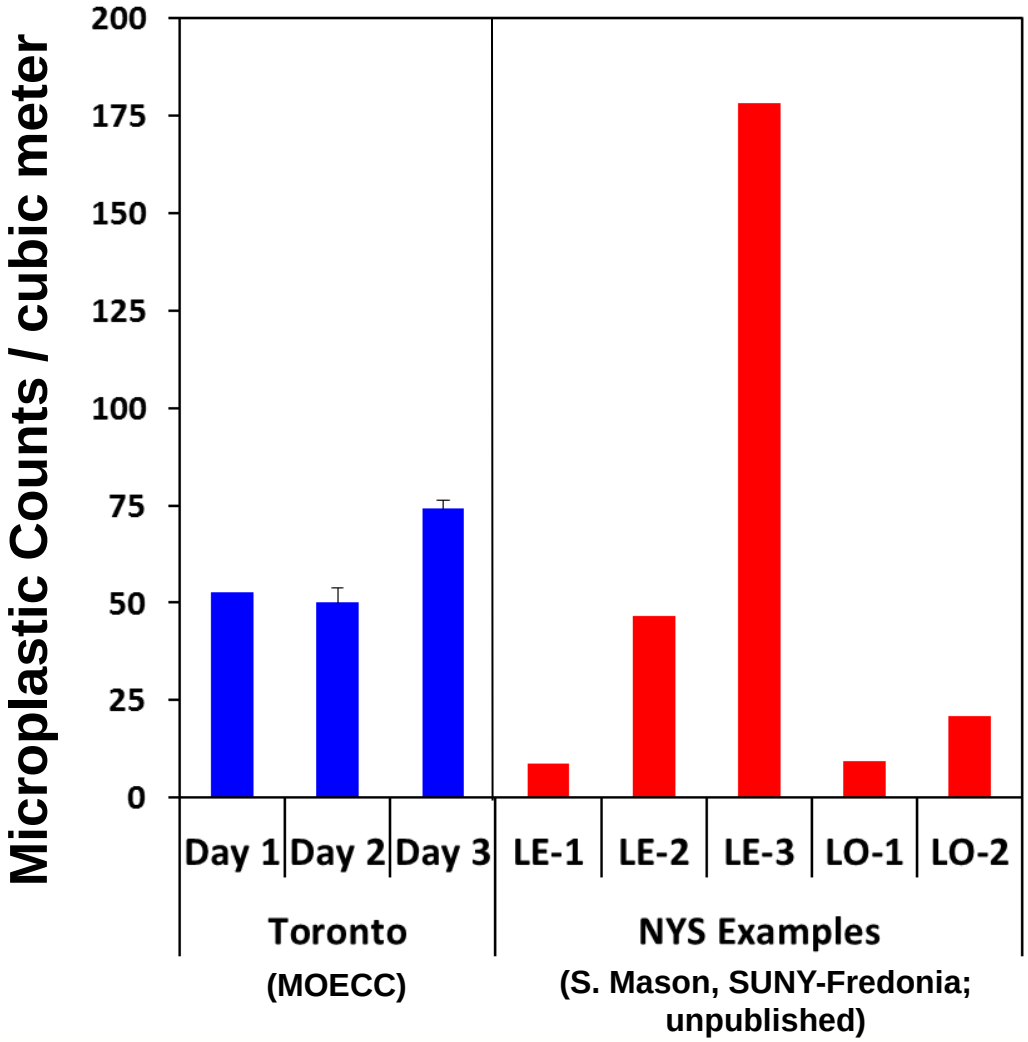
McCormick et al 2014 ES&T

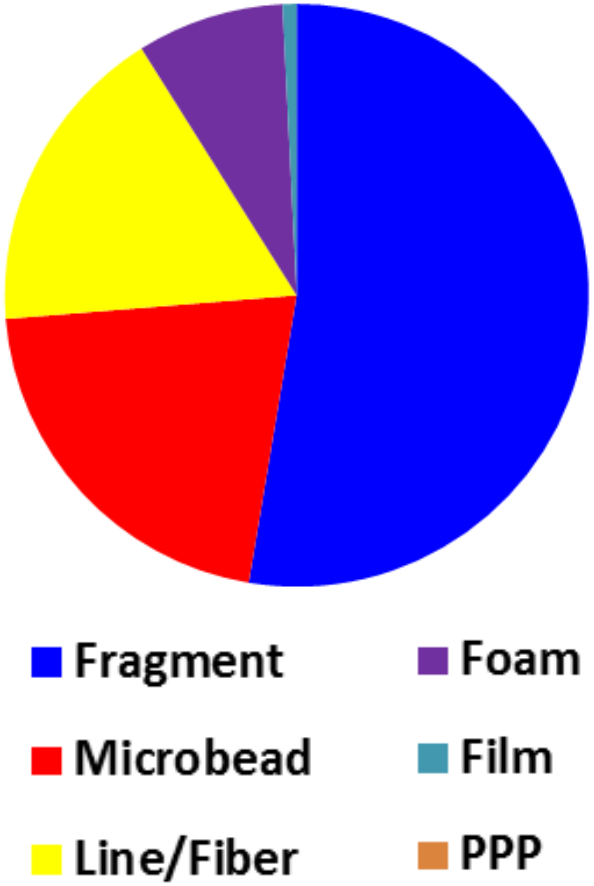


Fragment
Spherical Microbead
Line/Fiber
Foam
Film
PPP

Ontario

Microplastics in WWTP Effluent





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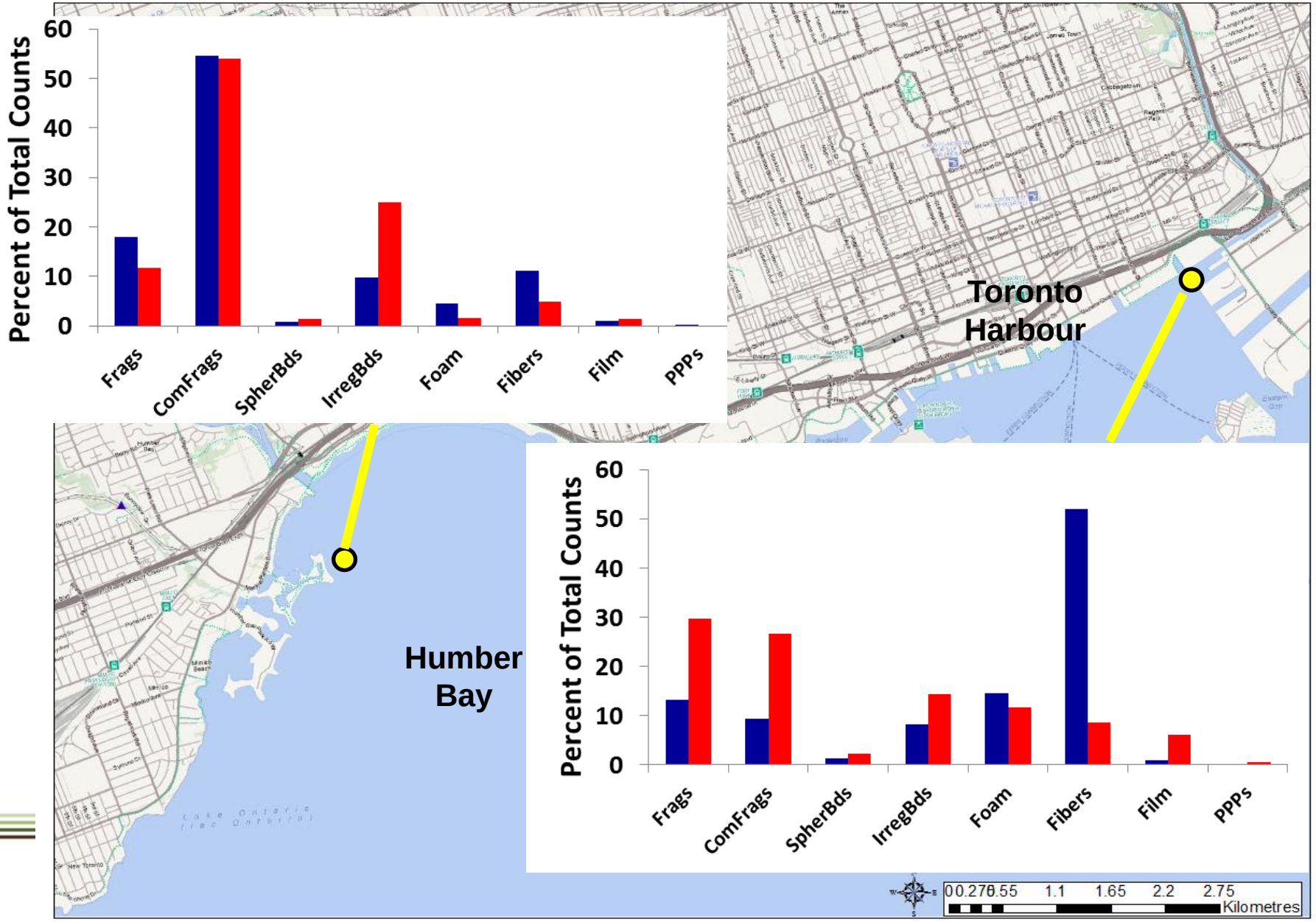
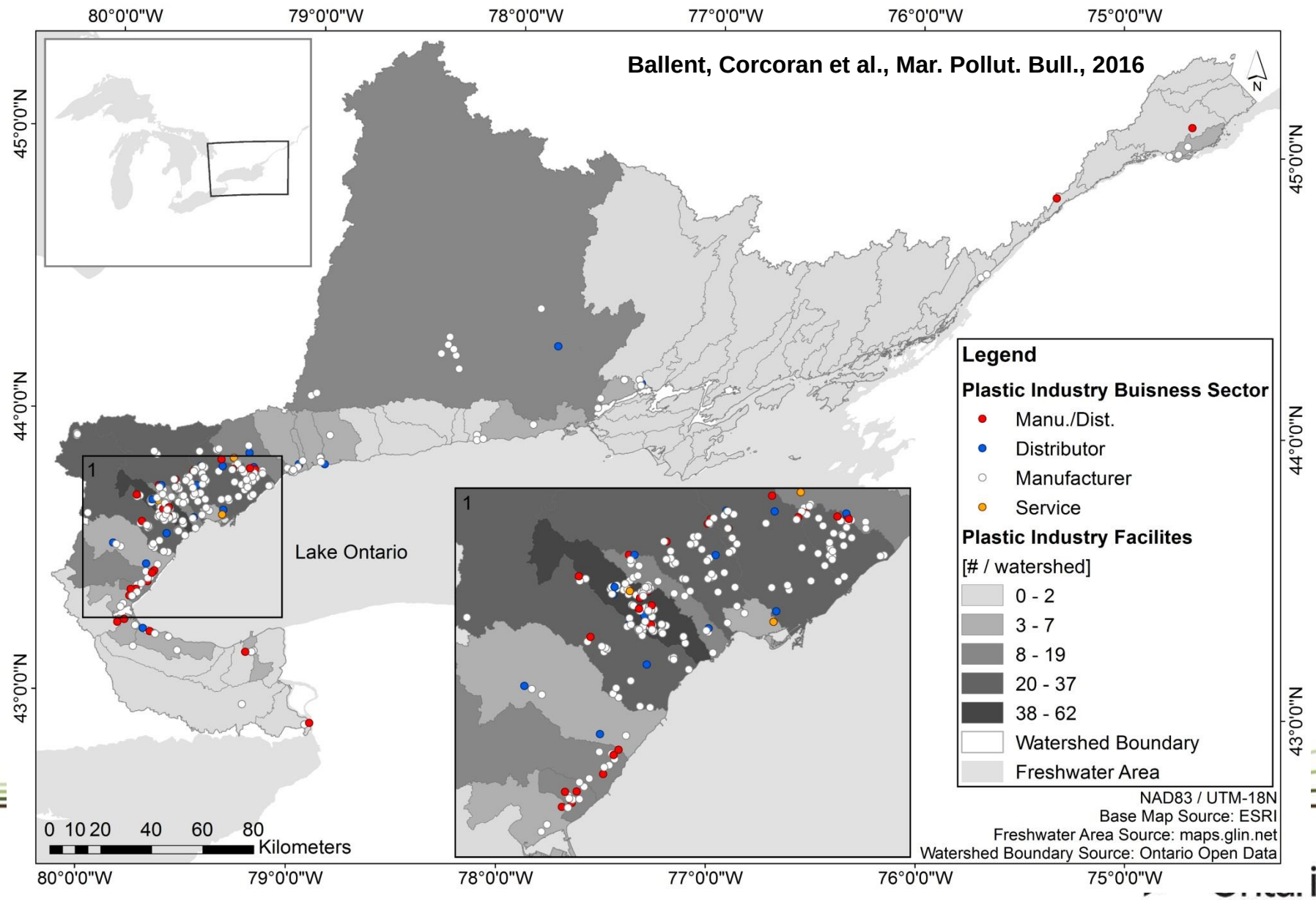
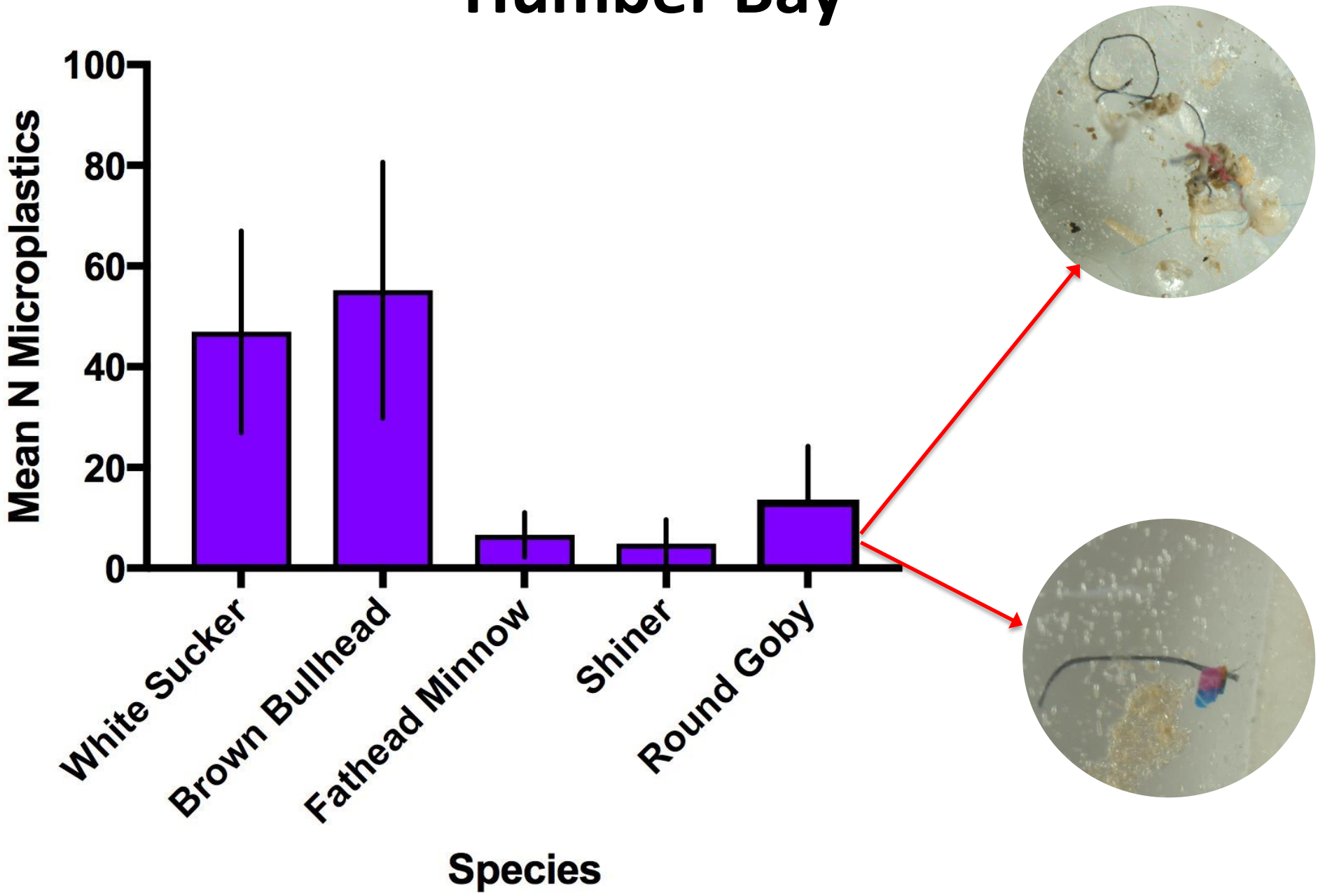
Percent by Microplastic Category



Microplastics in Nearshore Sediments



Humber Bay


Mean N Microplastics
100
80
60
40
20
0
White Sucker
Brown Bullhead
Fathead Minnow
Shiner
Round Goby
Species


Thank You!
Questions?