

Toxic Contamination in Lake Erie: Where have we been, where are we now, and where are we going?

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•Ontario Ministry of the Environment: Eric Reiner, Terry Kolic, Karen MacPherson, Patrick Crozier, Corinna Lucaciu, Lisa Richman, Paul Helm

•Environment Canada: Mehran Alaei, Derek Muir, Scott Painter, Alice Dove, Ed Sverko, Paul Klawuun, Robert Letcher, Brad Hill, Jasmine Waltho

•Department of Fisheries and Oceans: Gregg Tomy, Gary Stern

•USGS: Donna Myers, Dan Button

•USEPA: Ron Rossmann

•GLIER: U. of Windsor researchers: e.g., Jan Ciborowski, Doug Haffner, Ken Drouillard



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What's happened in the last 40 years with legacy toxics?

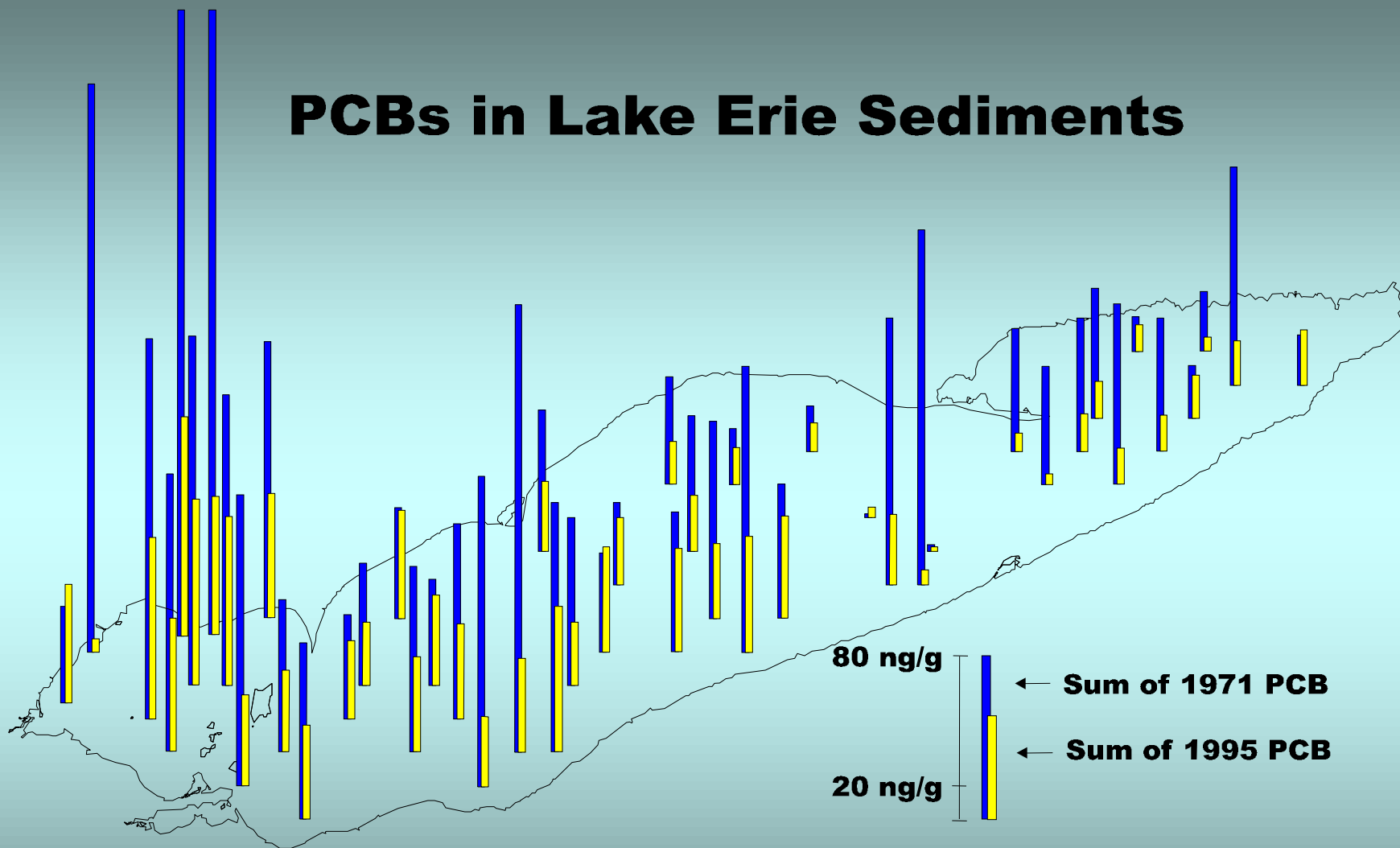
- Significant decreases in contamination in water and sediment over the period 1972 – present; these decreases are expected to continue
- Corroboration with trends in other media



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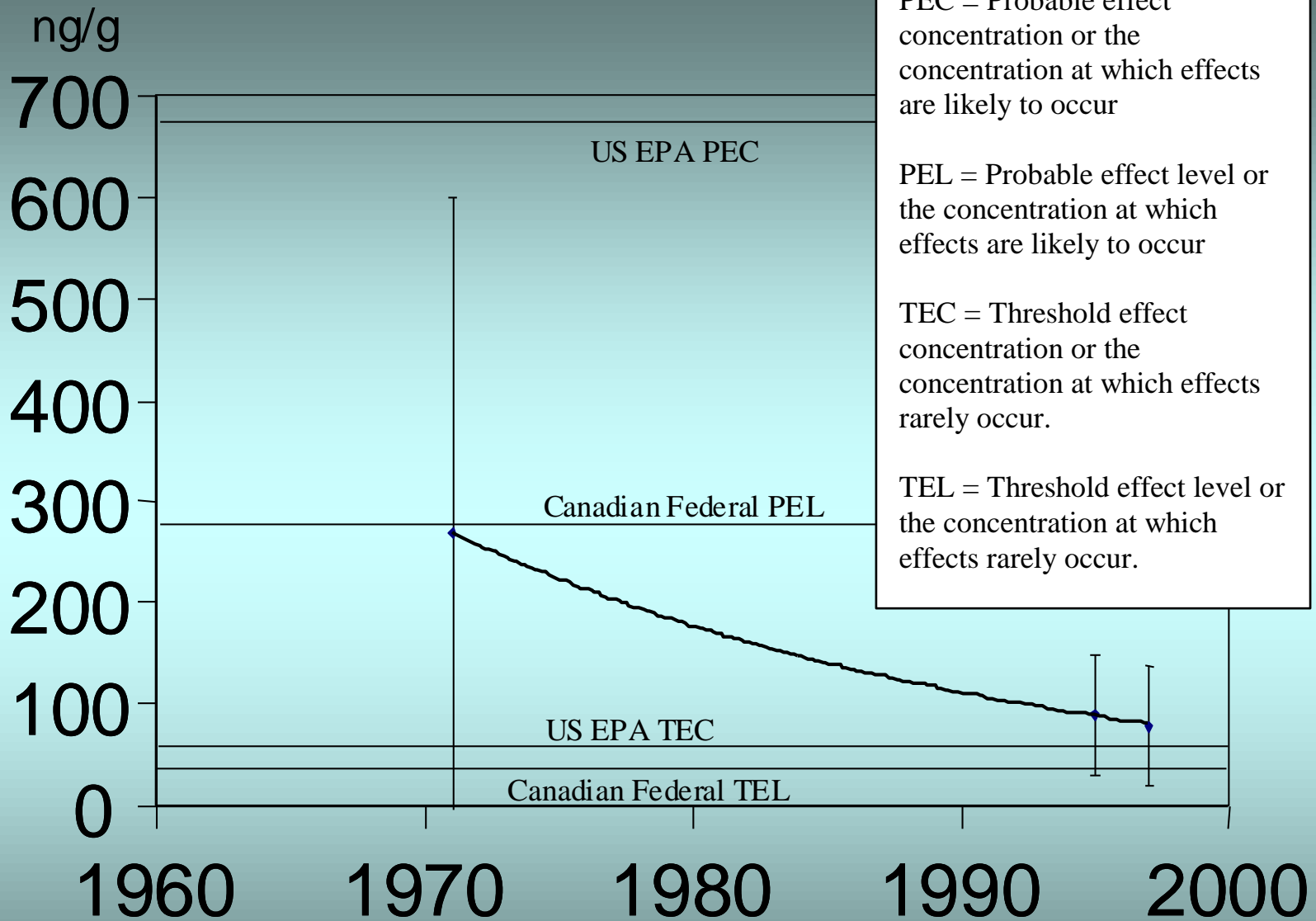
PCBs in Lake Erie Sediments



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Lake Erie PCBs 1972 - 2000



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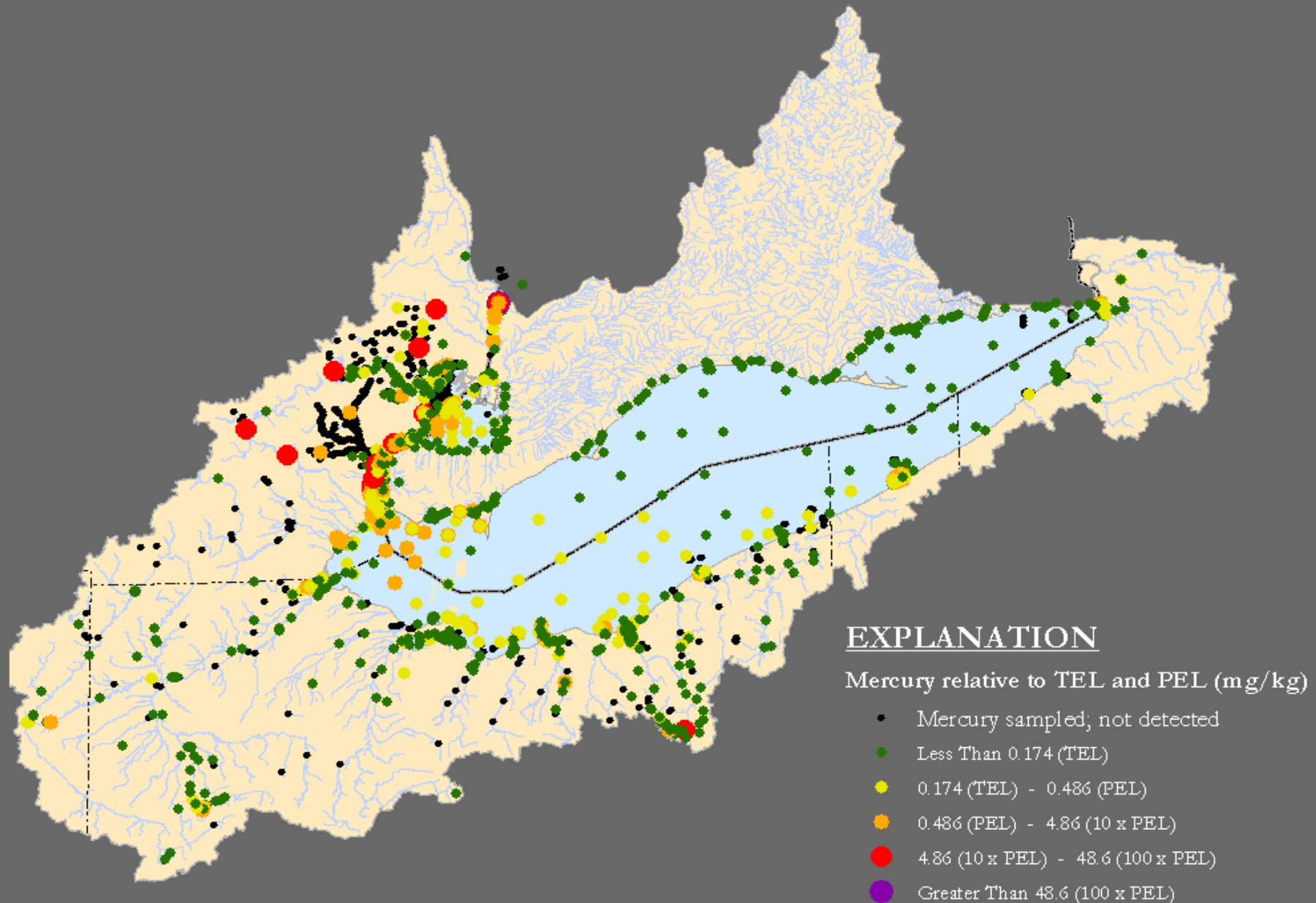
Where are we in terms of multi-
agency coordination in
integrating information on toxics?



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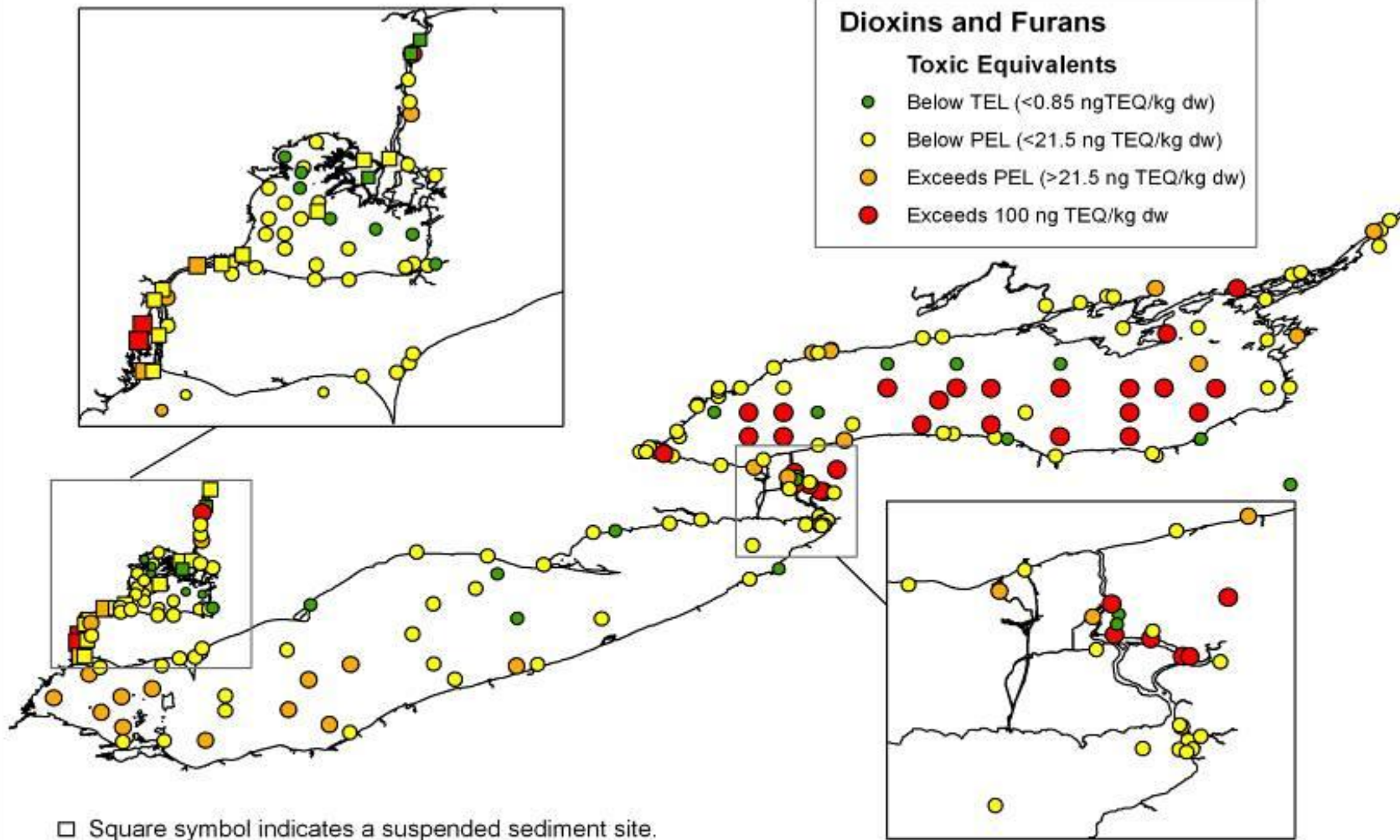
MERCURY in recently deposited bed sediments - Lake Erie Basin 1990-2001



Dioxins and Furans

Toxic Equivalents

- Below TEL (<0.85 ngTEQ/kg dw)
- Below PEL (<21.5 ng TEQ/kg dw)
- Exceeds PEL (>21.5 ng TEQ/kg dw)
- Exceeds 100 ng TEQ/kg dw



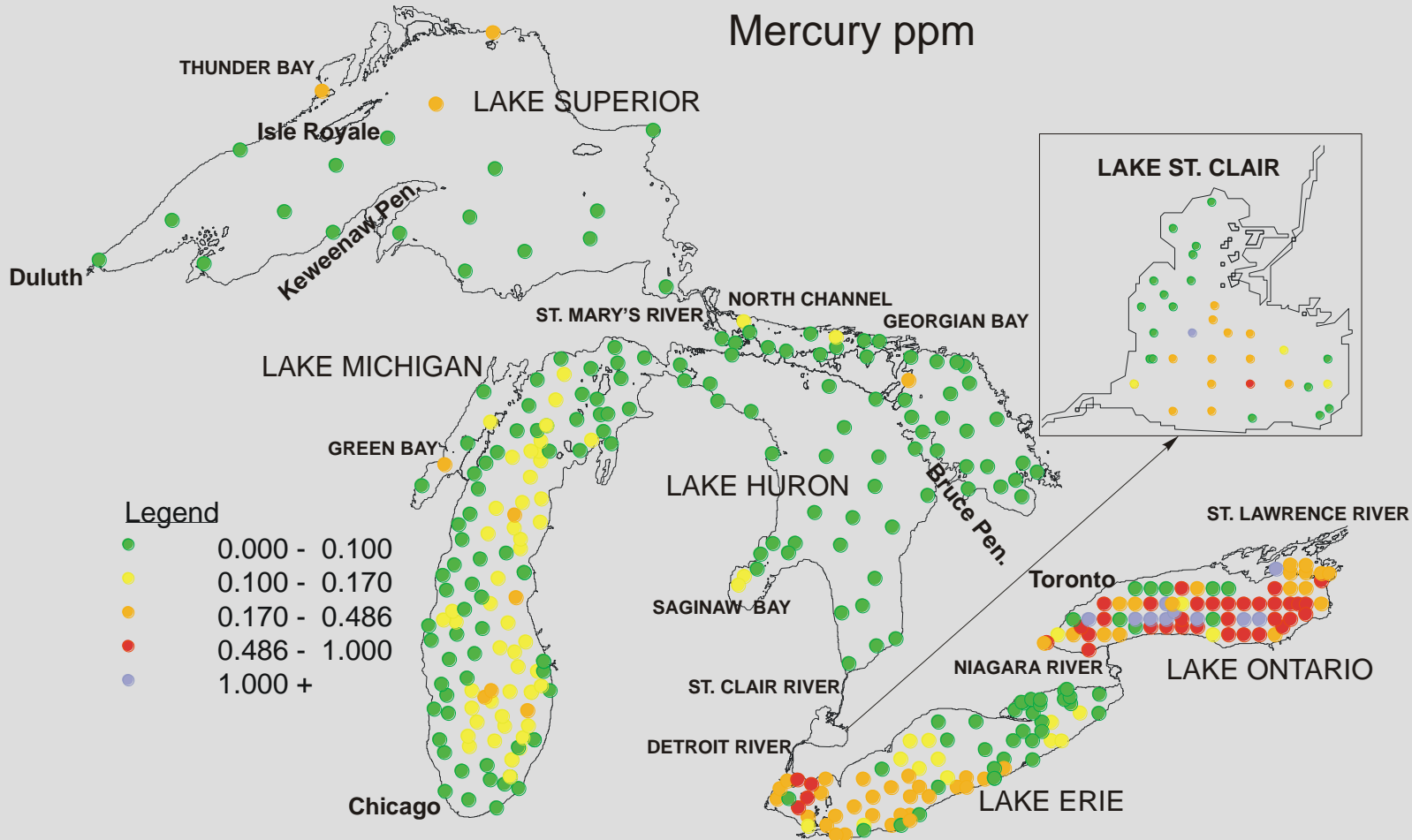
What do we know about the status of legacy toxics in Lake Erie compared to the other Great Lakes?

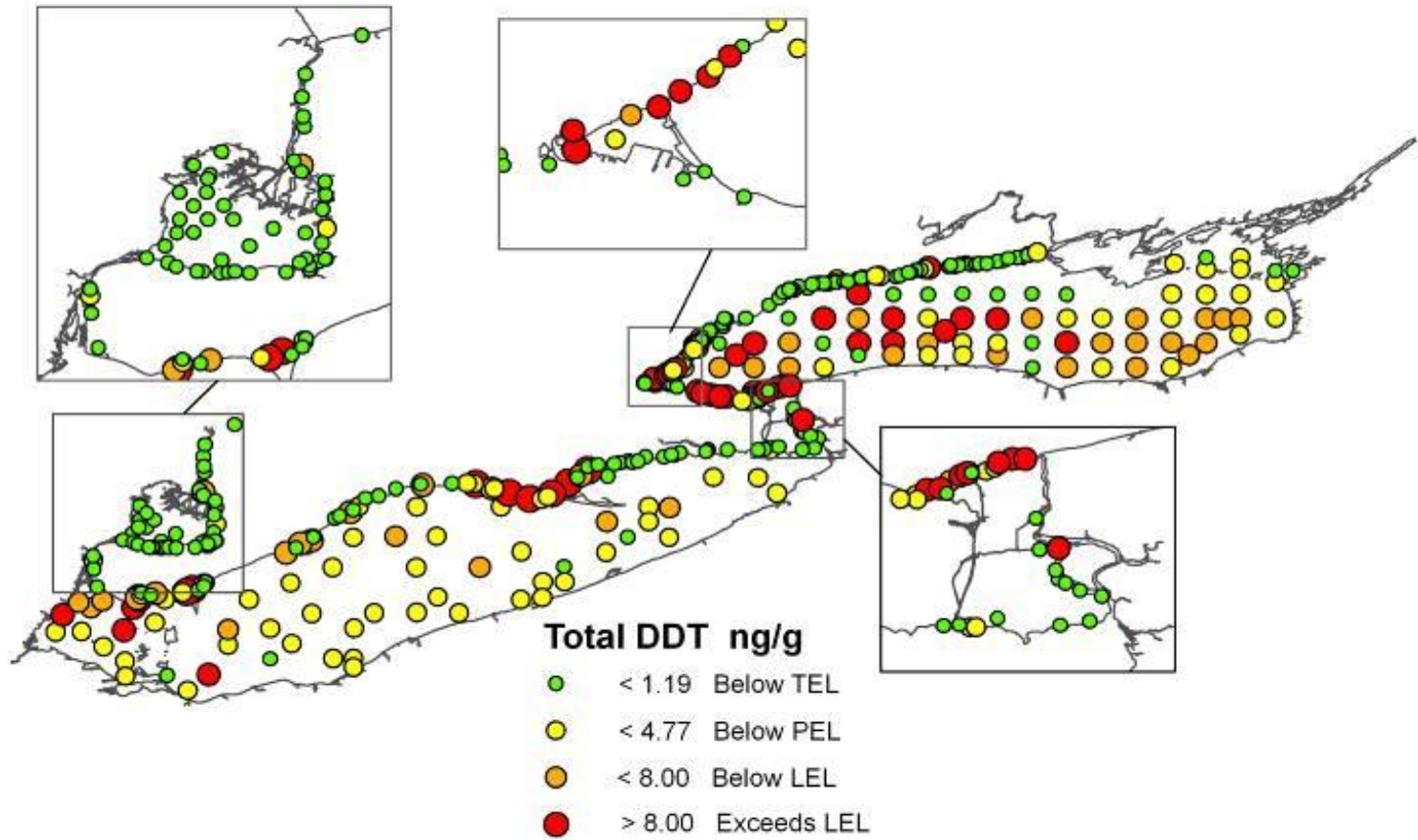


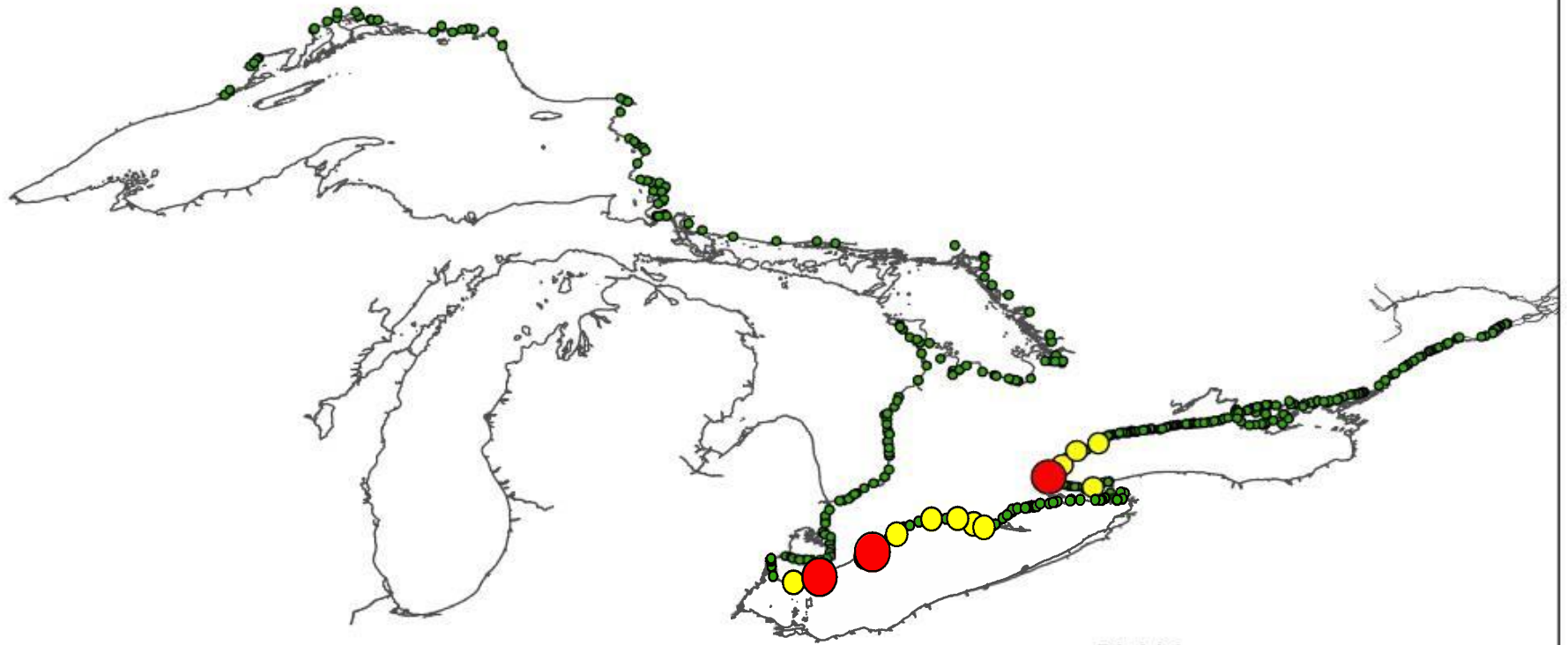
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Marvin et al. 2004 Environmental Pollution
Marvin et al. 2004 Environmental Research



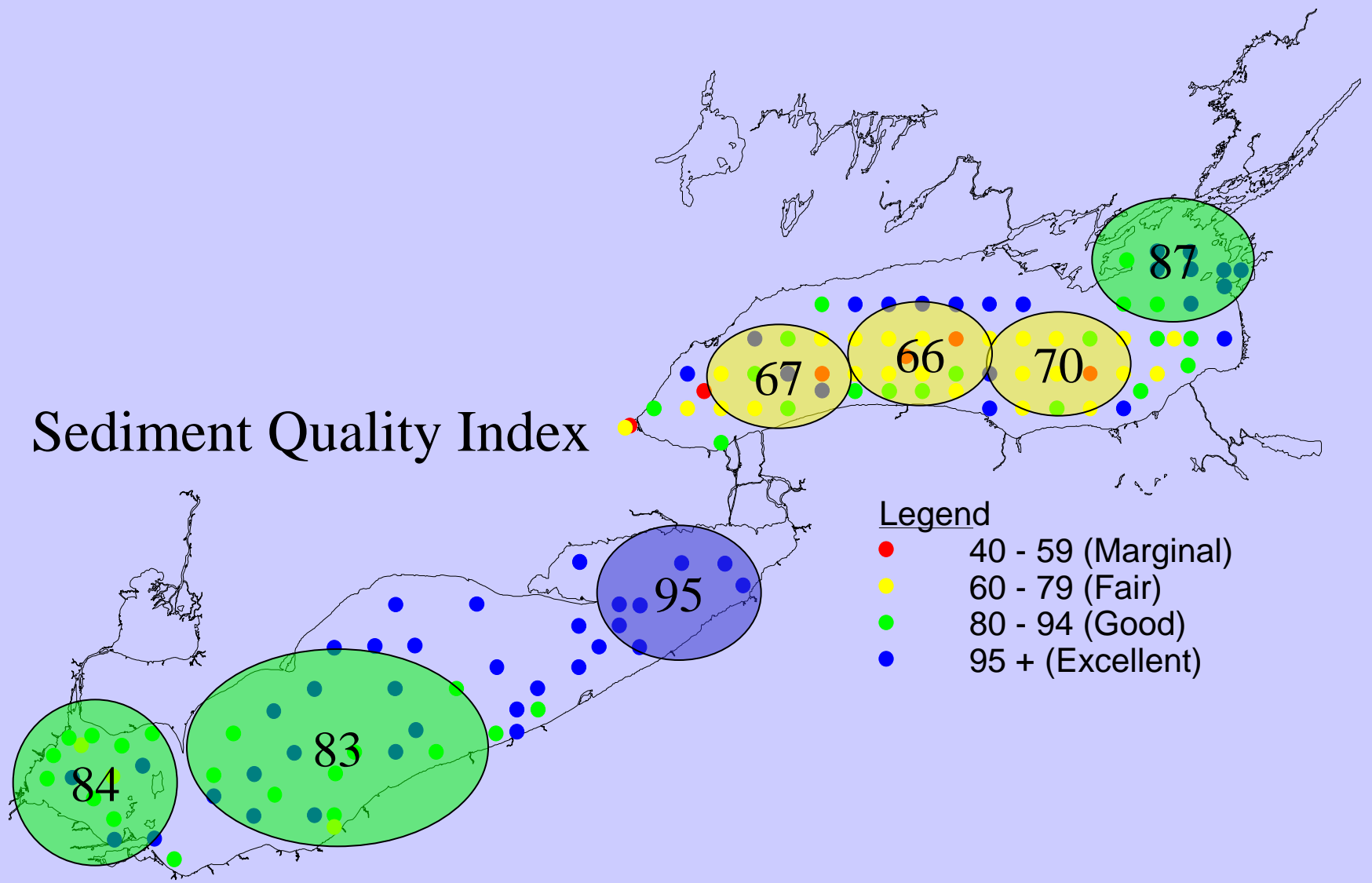




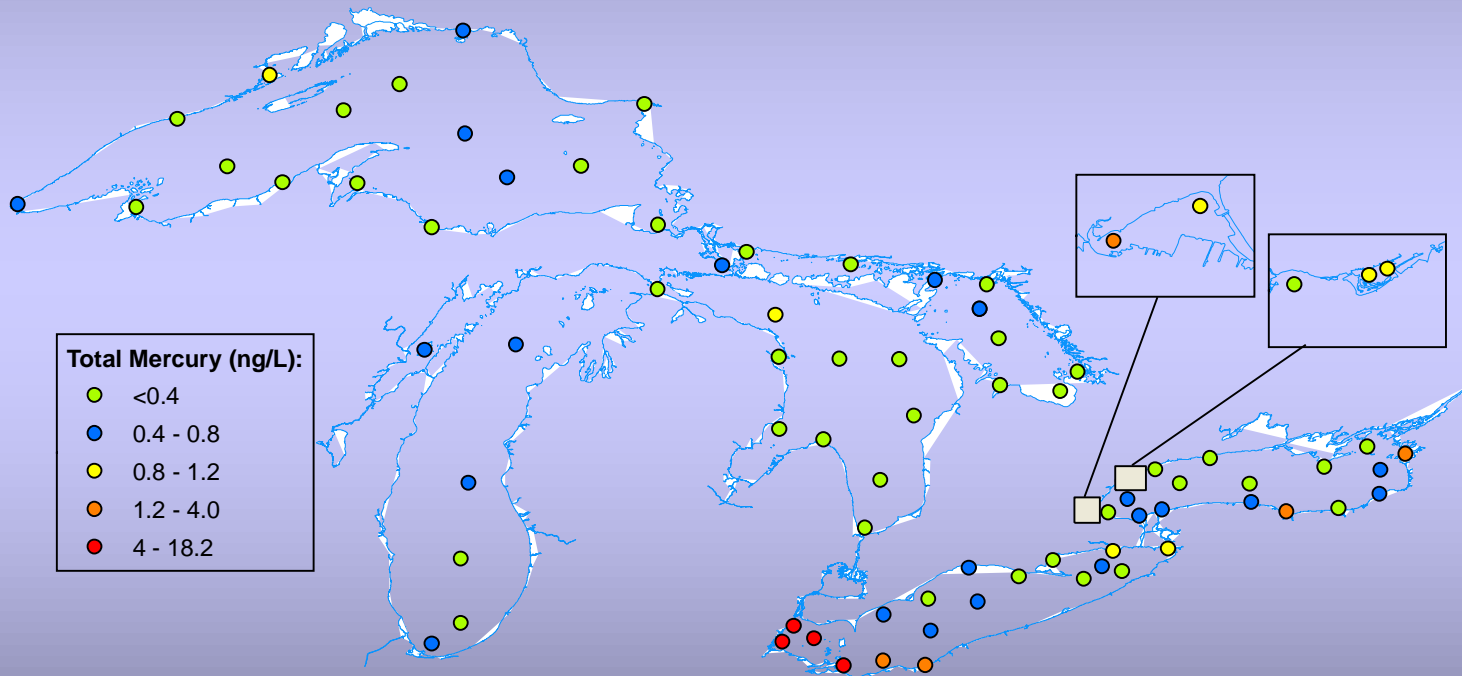
Dieldrin

- Below TEL (<math>< 2.85 \text{ ng/g}</math>)
- Exceeds TEL (>math>> 2.85 \text{ ng/g}</math>)
- Exceeds PEL (>math>> 6.67 \text{ ng/g}</math>)

Sediment Quality Index



Mercury in Water

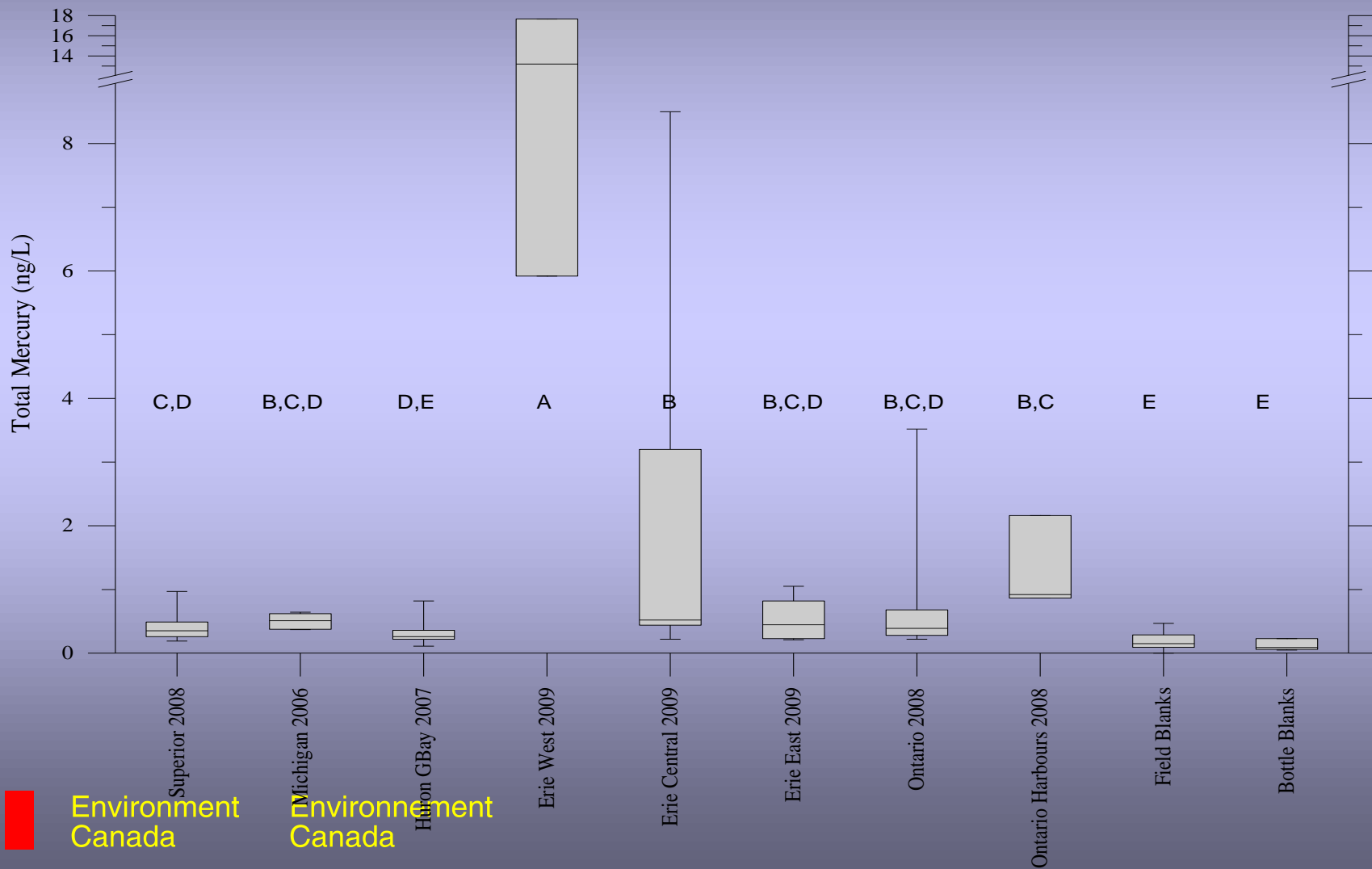


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Recent Whole Water Mercury in the Great Lakes

Levels not connected by same letter are significantly different



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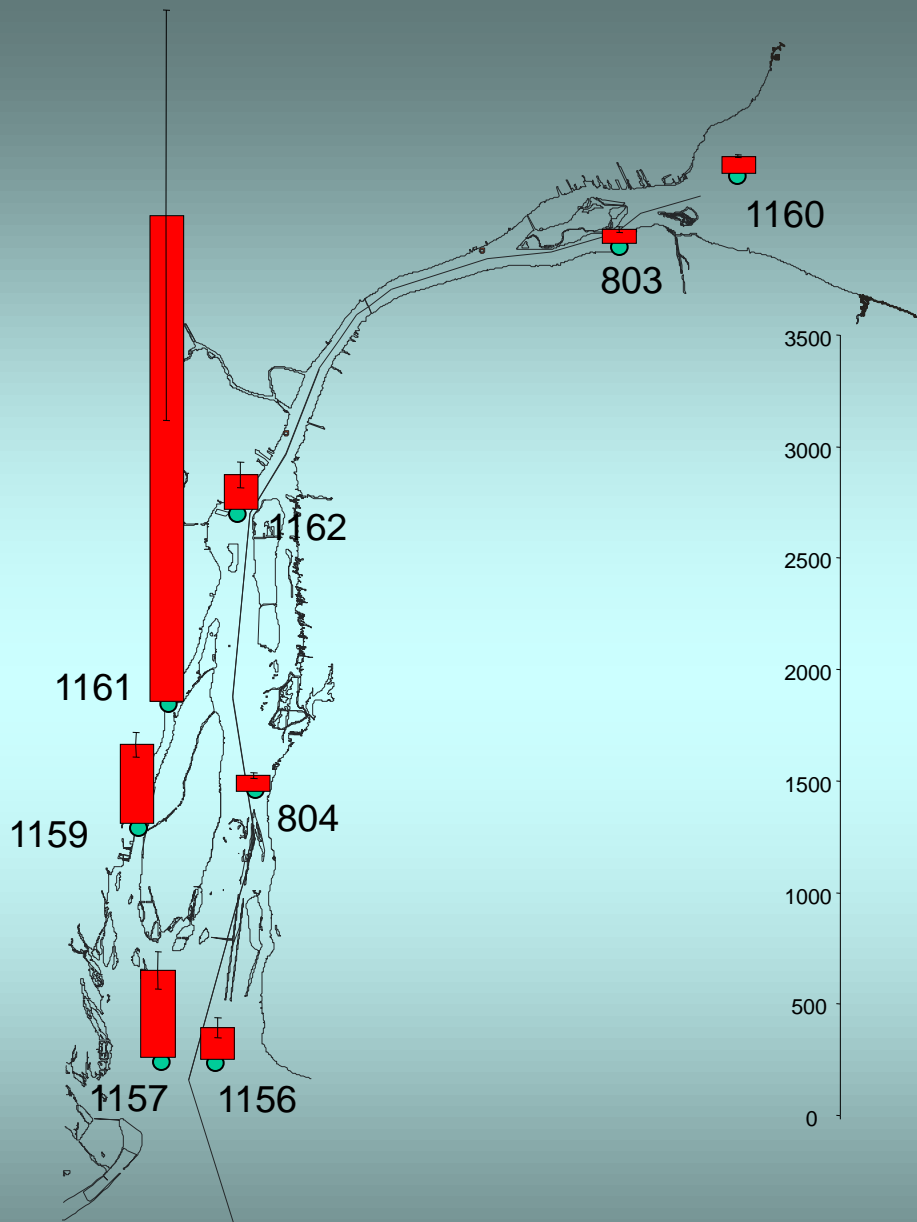
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What do we know about sources of contaminants in Lake Erie?



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Total PCBs (ng/g) In Suspended Sediments

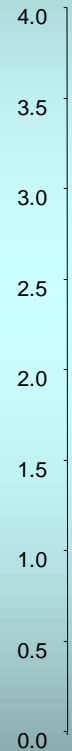
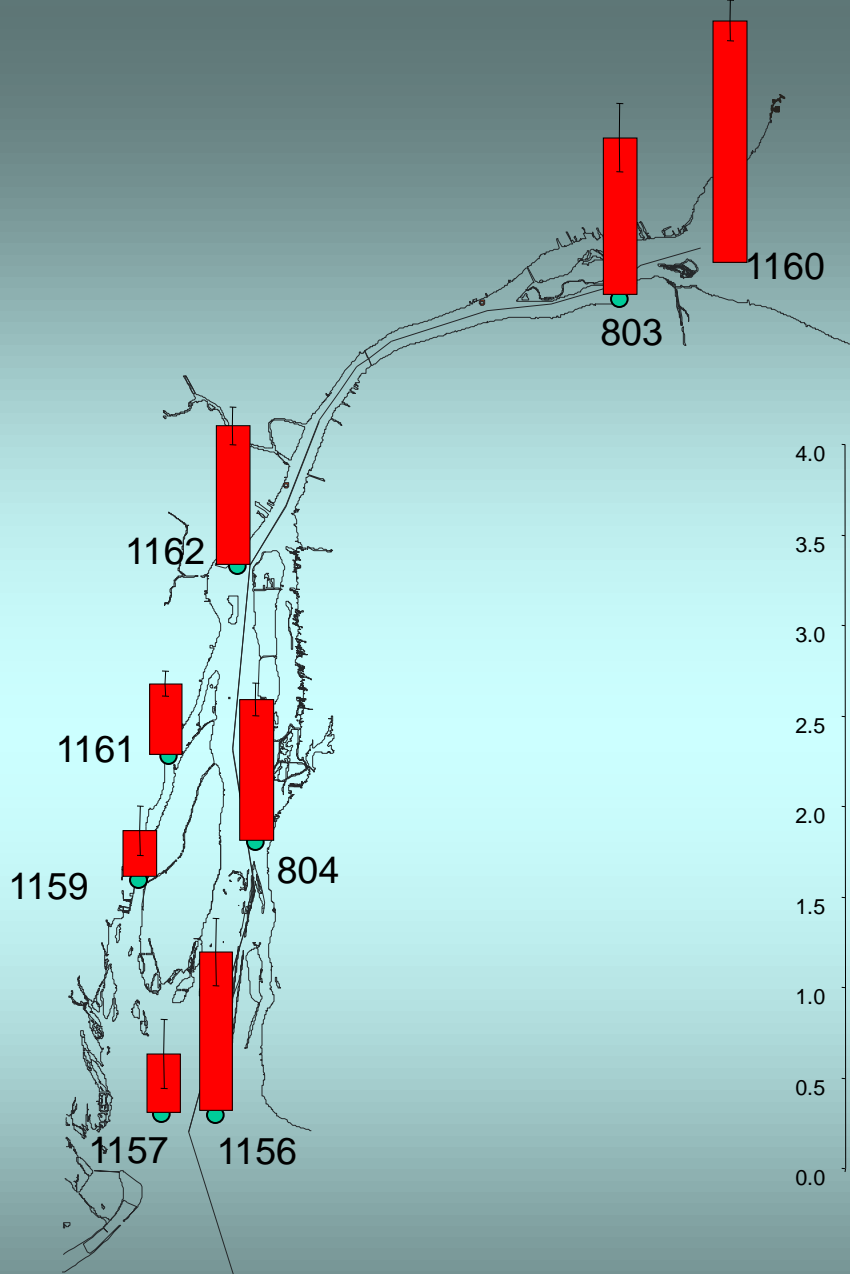


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Octachlorostyrene (ng/g) In Suspended Sediments



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Status of Legacy Toxics

- Significant decreases in contamination over the period 1972 – present;
- Some areas within the Detroit and St. Clair Rivers represent ongoing sources of contaminants to Lake Erie, including PCBs, mercury, dioxins and furans, and polychlorinated naphthalenes;
- Significance of loadings from contaminant sources in the Detroit River, compared to loadings from the upper lakes and connecting channels.



Why assess new toxics in Lake Erie?



Lake Erie most shallow and biologically active/productive of the five Great Lakes;

Detroit River and L. Erie receive considerable amounts of discharge/input from urban, industrial and agricultural activities;

Logical progression of research/monitoring programs in light of phasing out or banning of chemicals;

Long-term research and monitoring programs.



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Contaminants of New and Emerging Concern (Awareness)

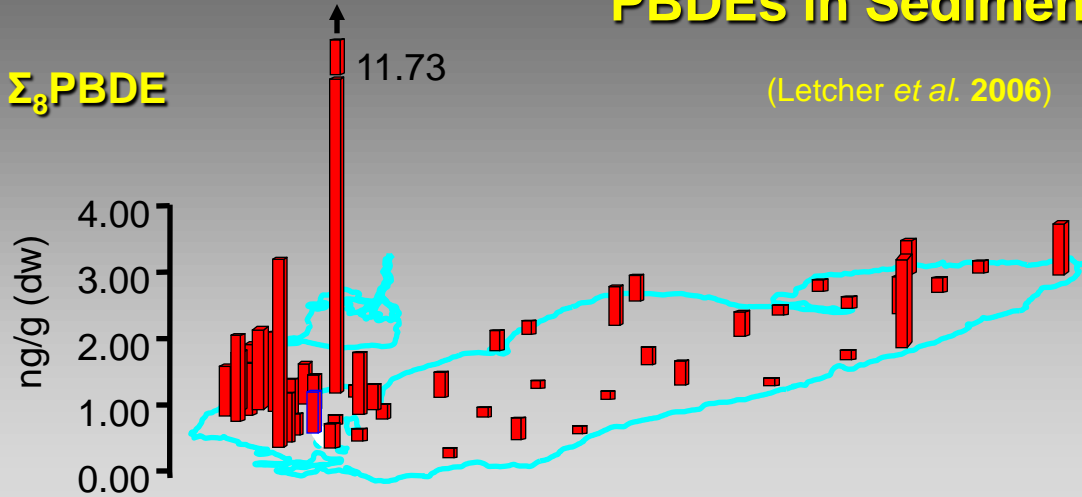
- Brominated Flame Retardants (BFRs)
 - *Polybrominated Diphenyl Ethers (PBDEs)*
- Polychlorinated Alkanes (PCAs)
- Polychlorinated Naphthalenes (PCNs)
- Dioxin-like PCBs (DLPCBs)
- Personal Care and Pharmaceutical Products (PCPPs)
- Endocrine Disrupting Compounds (EDCs)
- Fluorinated surfactants (PFCs)
- Synthetic musks (PTCs)



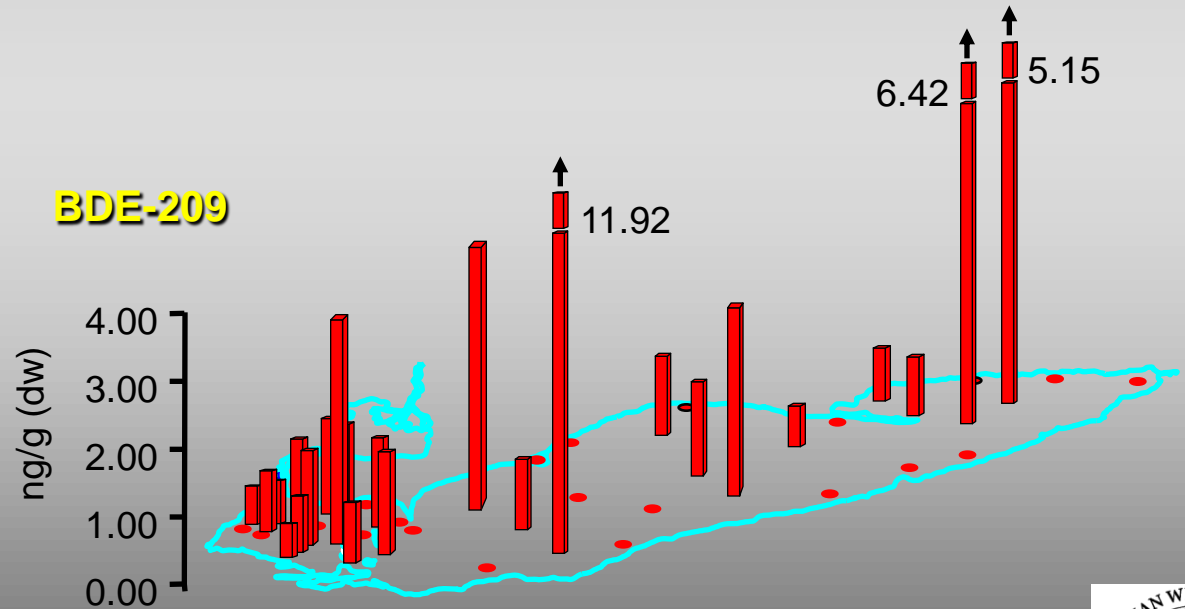
PBDEs in Sediments From Lake Erie

Σ_8 PBDE

(Letcher *et al.* 2006)



BDE-209

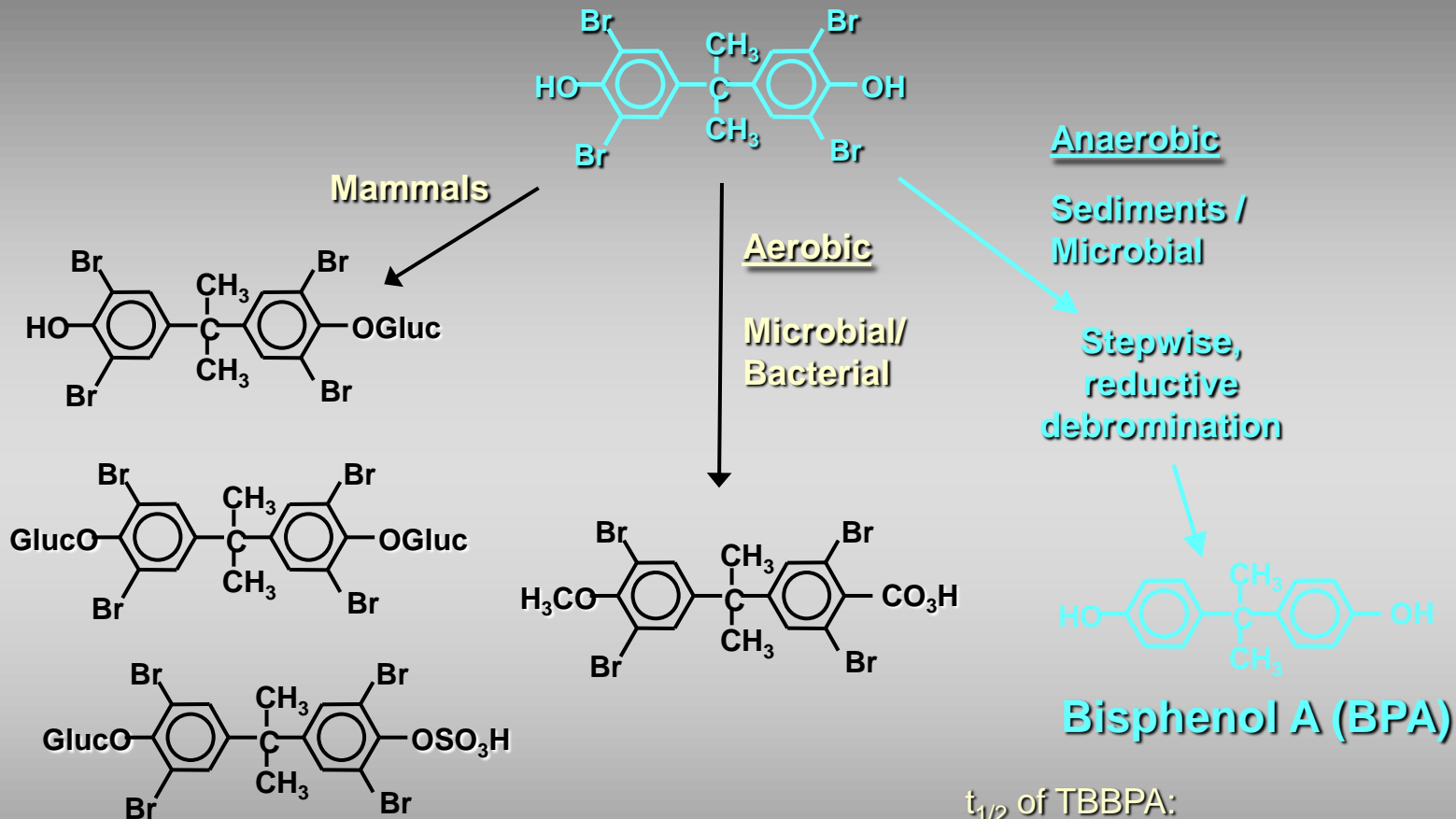


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Degradation Pathways For TBBPA



$t_{1/2}$ of TBBPA:
 water = 6 – 81 days
 sediment = 48 – 84 days

fish = < 1 day
 humans = 2.2 days³

$t_{1/2}$ of BPA:
 humans = 0.25 day⁴

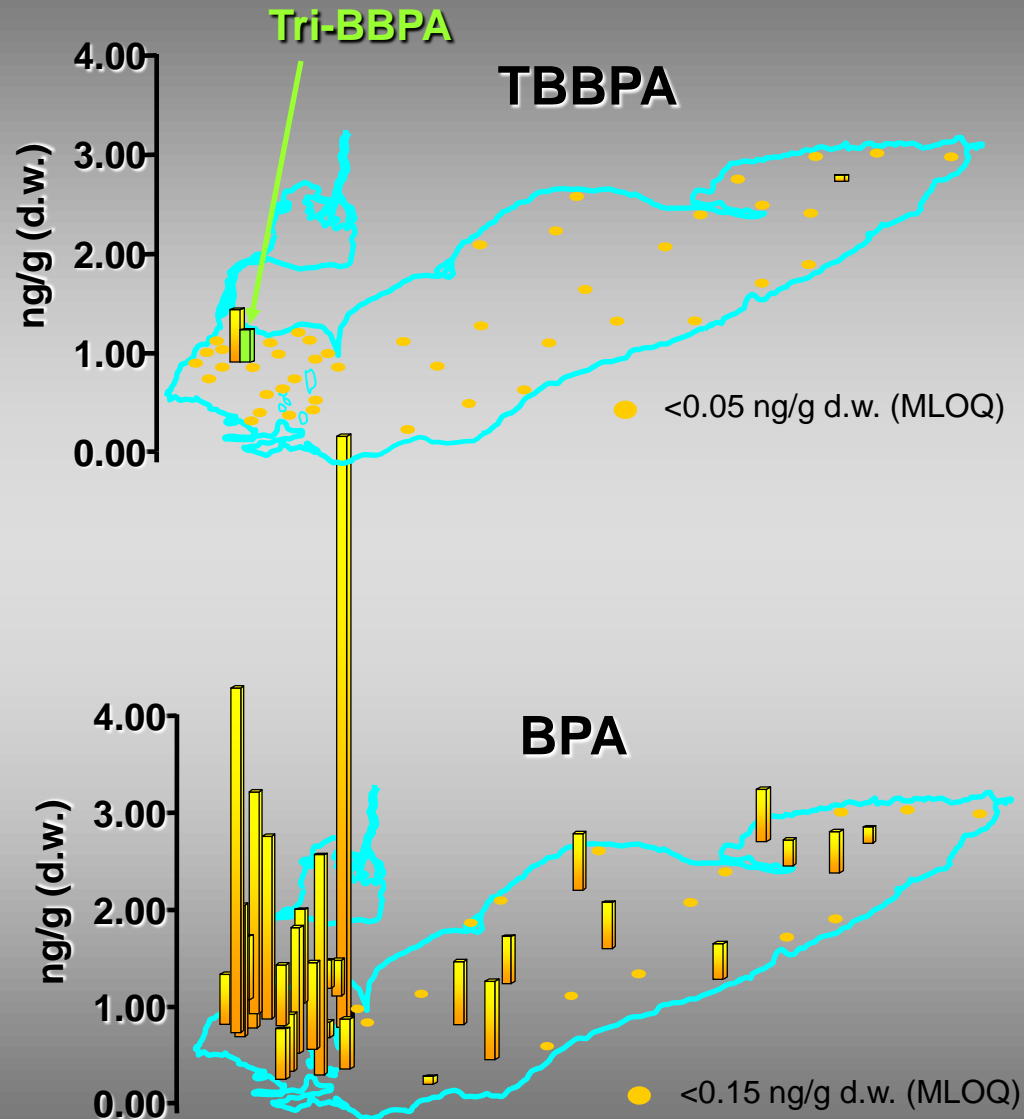


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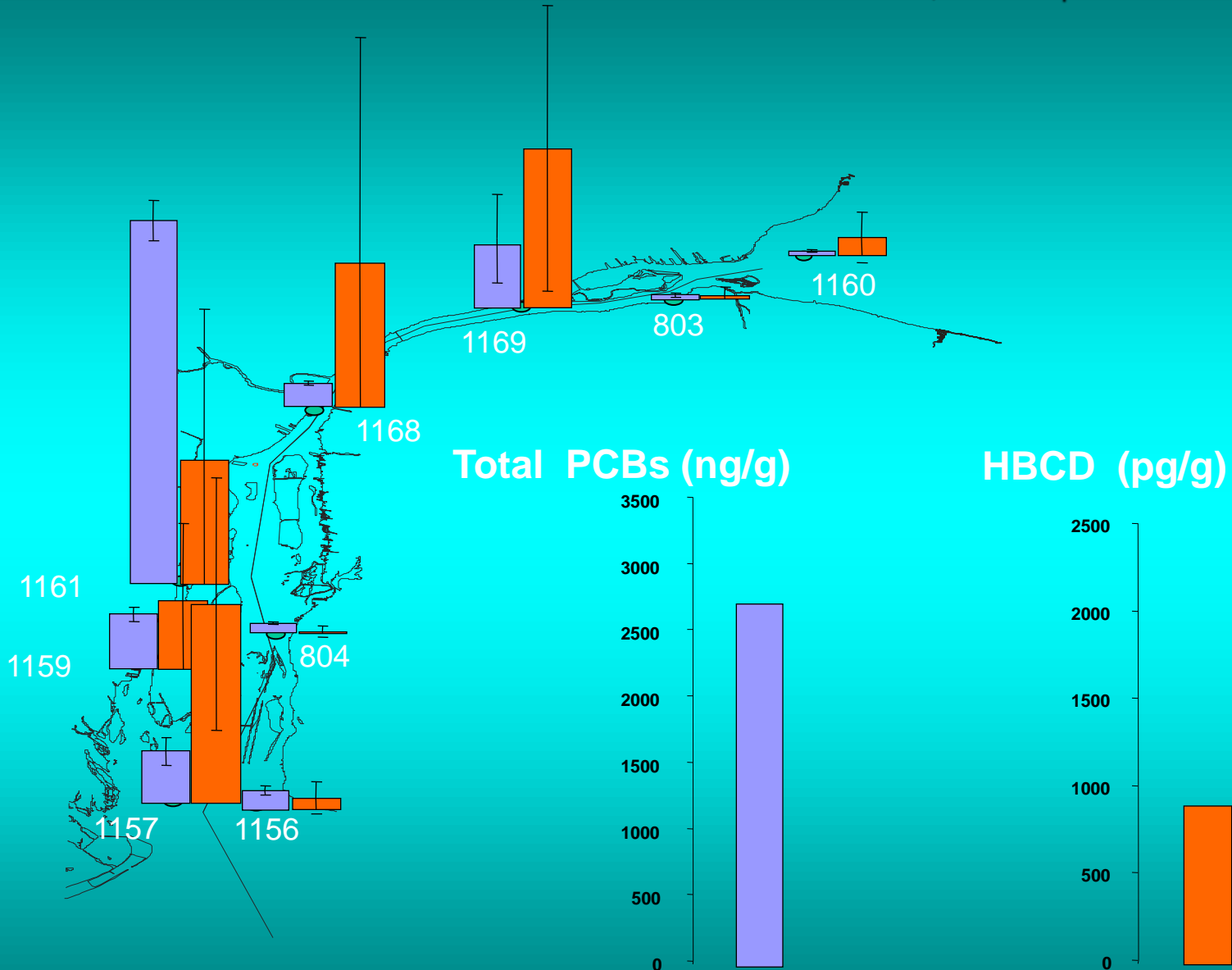
BPA and TBBPA in Sediments From Lake Erie



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Needs and Gaps

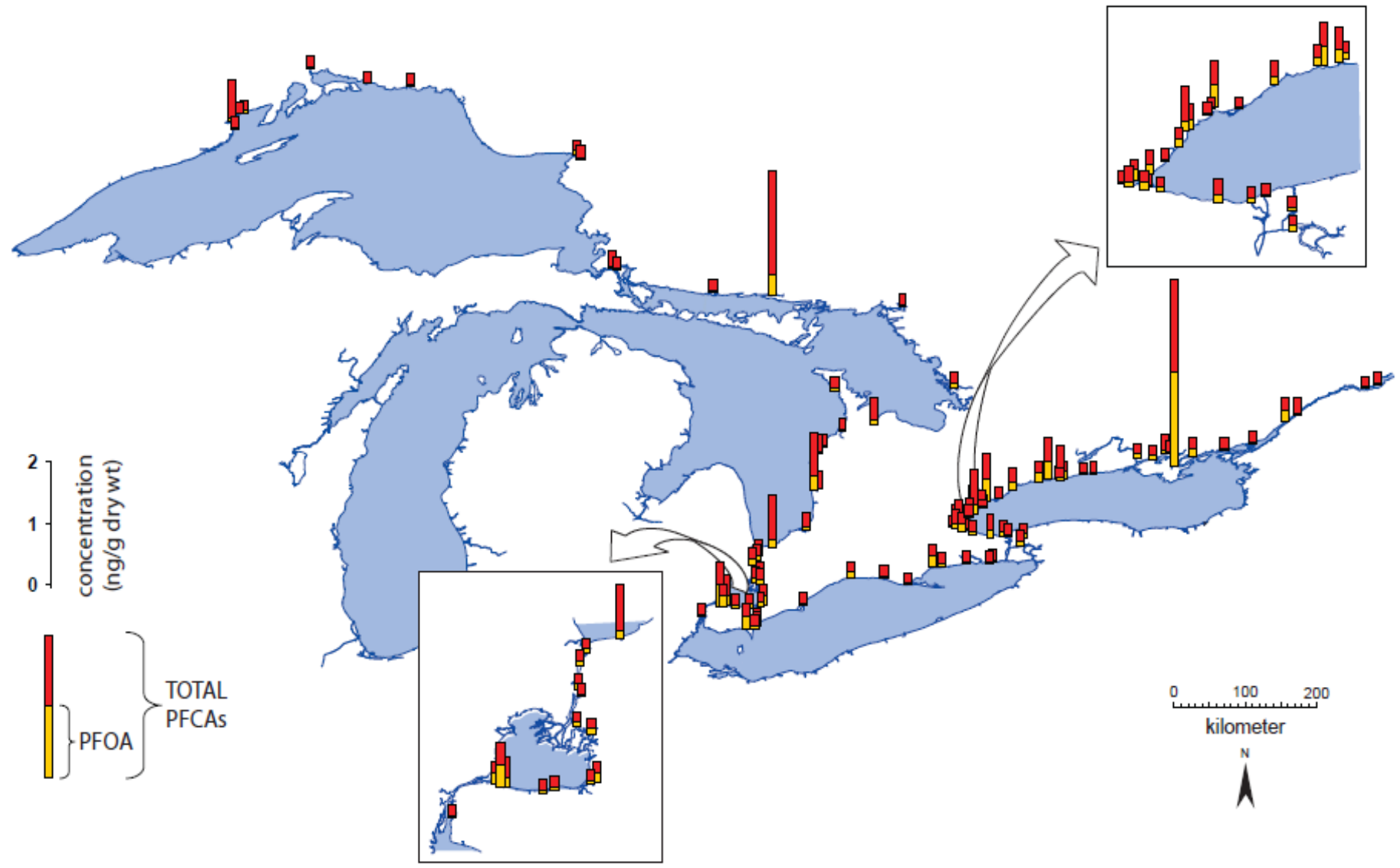
- Erie remains understudied compared to other Great Lakes
- Lakewide data for legacy toxics outdated
- Temporal data
- Detroit River; source or vector??



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Total PFCAs in Lake Erie Tributary Sediments



Total PFCAs in Lake Erie Bottom Sediments

