Environment Canada Environnement Canada

Canada

Monitoring contaminants in fishes from the Canadian waters of the Great Lakes: 1977 to 2013 - PCB to PFCs

7th Binational Meeting of the Lake Erie Millennium Network

Windsor, Ontario

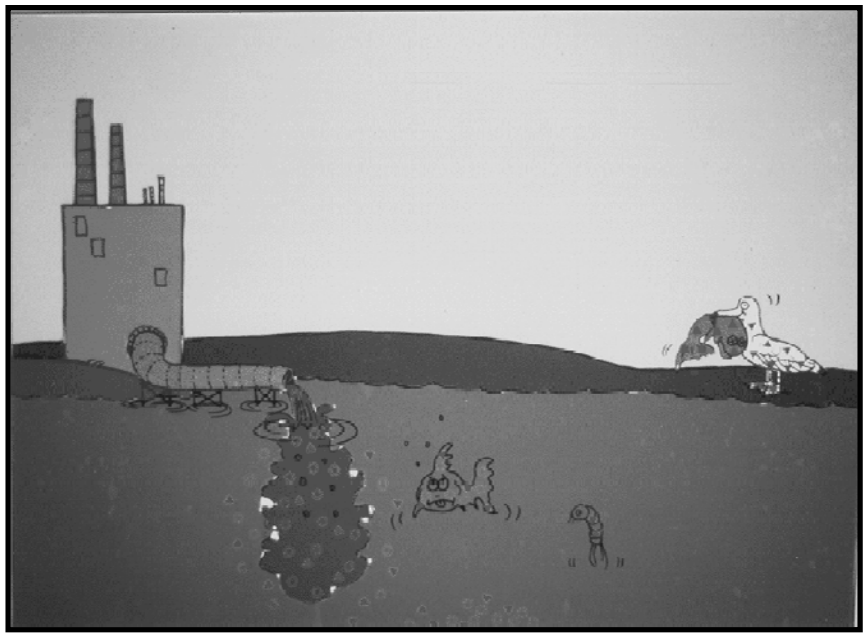
WQMSD-Atlantic

Oct 29-31 2013

Contents

- Monitoring contaminant levels in fish from the Great Lakes
- “Legacy” chemicals
  - Examples: PCBs & Hg
- Other chemical of concern
  - Example: PBDEs & PFOS

Fish Contaminants Monitoring and Surveillance



Thanks to Maria Ruether for this photo
Taken: 1985 in Toronto

- The first samples were collected from the Great Lakes in 1977 ***(36 years and counting)***
- Monitor long-term trends of priority pollutants in fish and other aquatic biota.
- Relate trends to food web structure and changes in loadings
- Screen/identify emerging chemicals of concern
- National Aquatic Biological Specimen Bank

Drivers

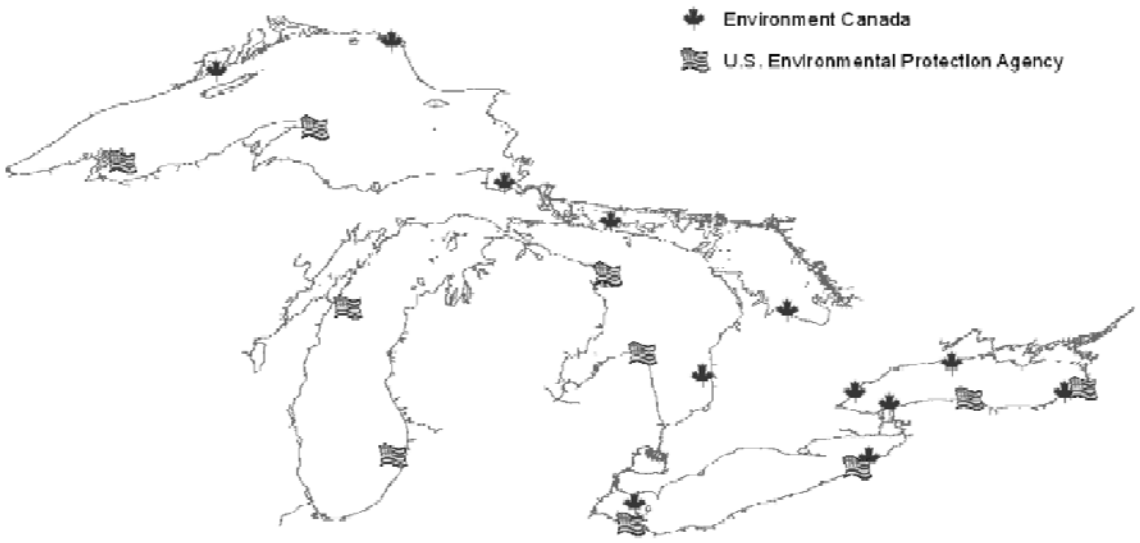
3 major drivers feed the list of analytes monitored by Environment Canada in the Great Lakes:

- National Risk-Based Approach to monitoring threats to water quality to support the protection of water quality

- Chemicals Management Plan (CMP)
  - Monitoring and Surveillance Working Group
  - Priorities integrated with Risk Assessment and Risk Management
  - Includes new, emerged and emerging contaminants
    - PBDEs and other flame retardants, PFCs, Siloxanes, other metals

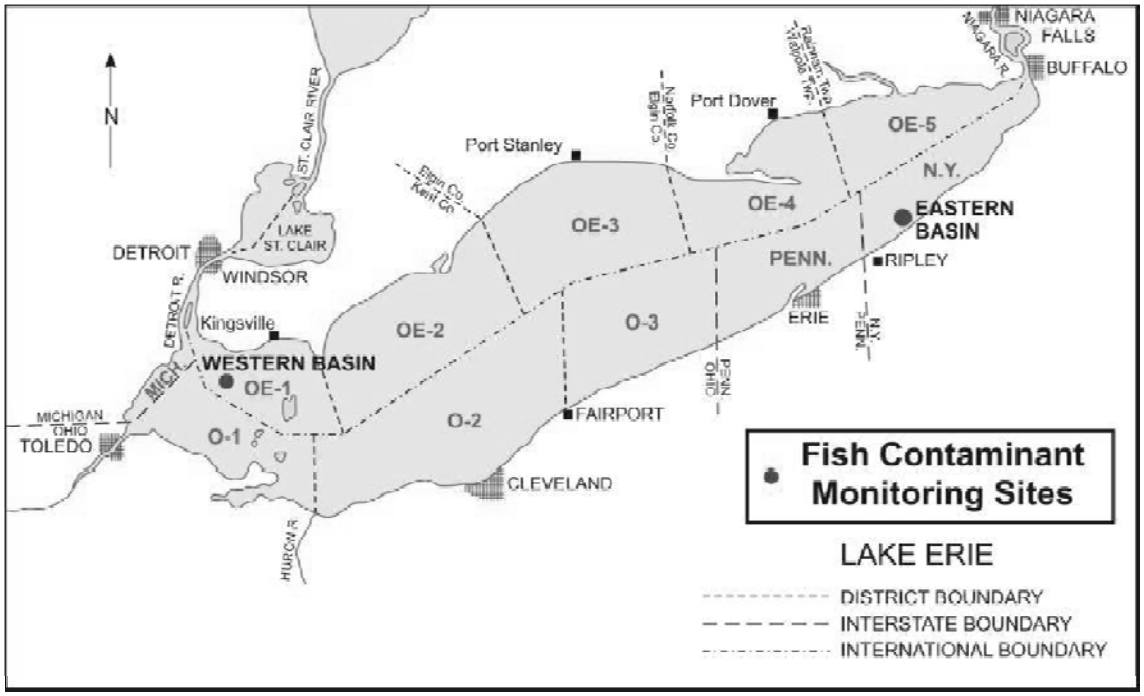
- GLWQA
  - Annex 3 Chemicals of Mutual Concern
  - "New" list of chemicals is in development
  - In previous agreement – included legacy contaminants
    - PCBs, organochlorine pesticides, mercury

Great Lakes Monitoring



- Monitoring stations in US and CAN waters
- Complimentary programs operated by EC and USEPA
- Data combined for biantional reporting in SOLEC indicator

Lake Erie – Environment Canada



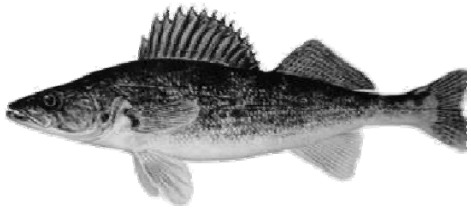
- 2 stations
- Individual fish aged 4 – 6 years
- Collect 25-50 individuals per station
- Whole body homogenates

Key Indicator - predator

Lake Trout
Salvelinus namaycush

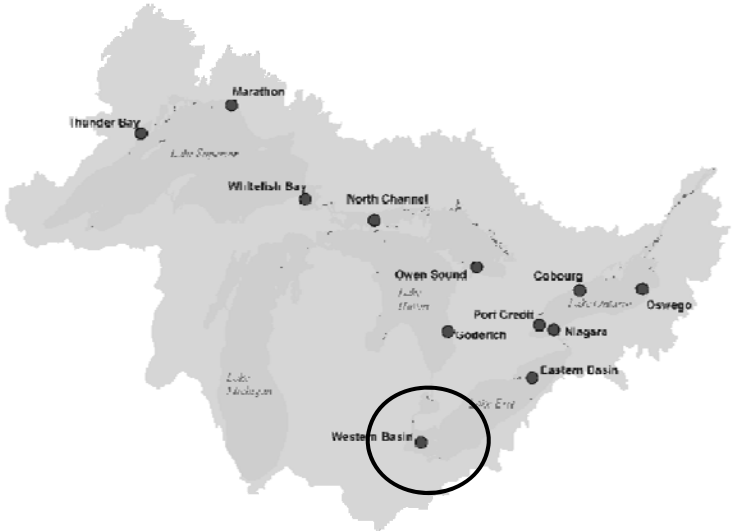
- Well studied
- Are at the top of the pelagic food web
- High lipid content
- Wide ranging and long lived
  - a spatial and temporal integrator of contamination
- Accumulates elevated contaminant levels
- Present in all 5 Great Lakes

One exception…



walleye

Sander vitreus



- lake trout not present in the western basin of Lake Erie
  - shallow, warm water
- walleye occupy a similar trophic level as lake trout

Total PCBs

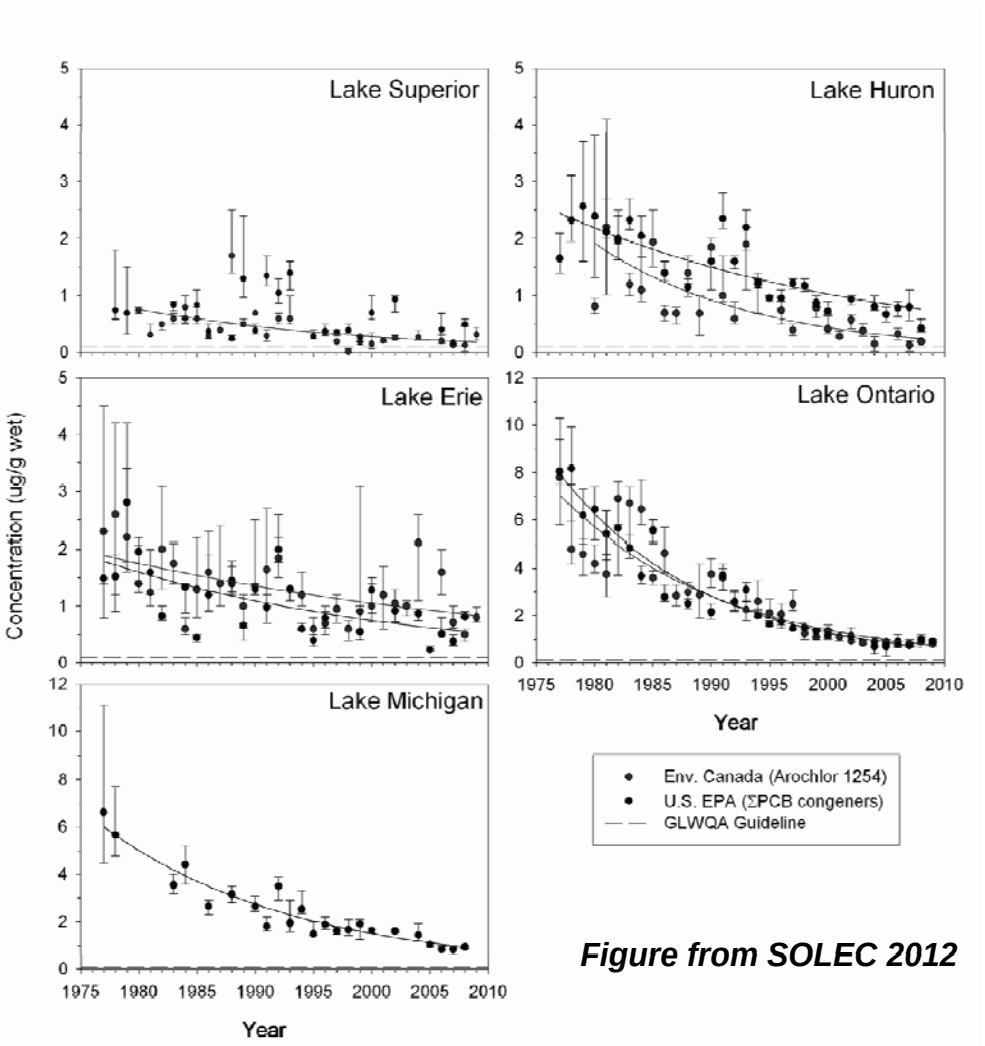


Figure from SOLEC 2012

- Continuous declines in all Great Lakes
- 100% of measurements in Lake Erie Walleye (2006-2009; n=142) are above GLWQA target.
- PCBs in Lake Erie Walleye declining at a rate of 3% per year.

Total Mercury - Walleye

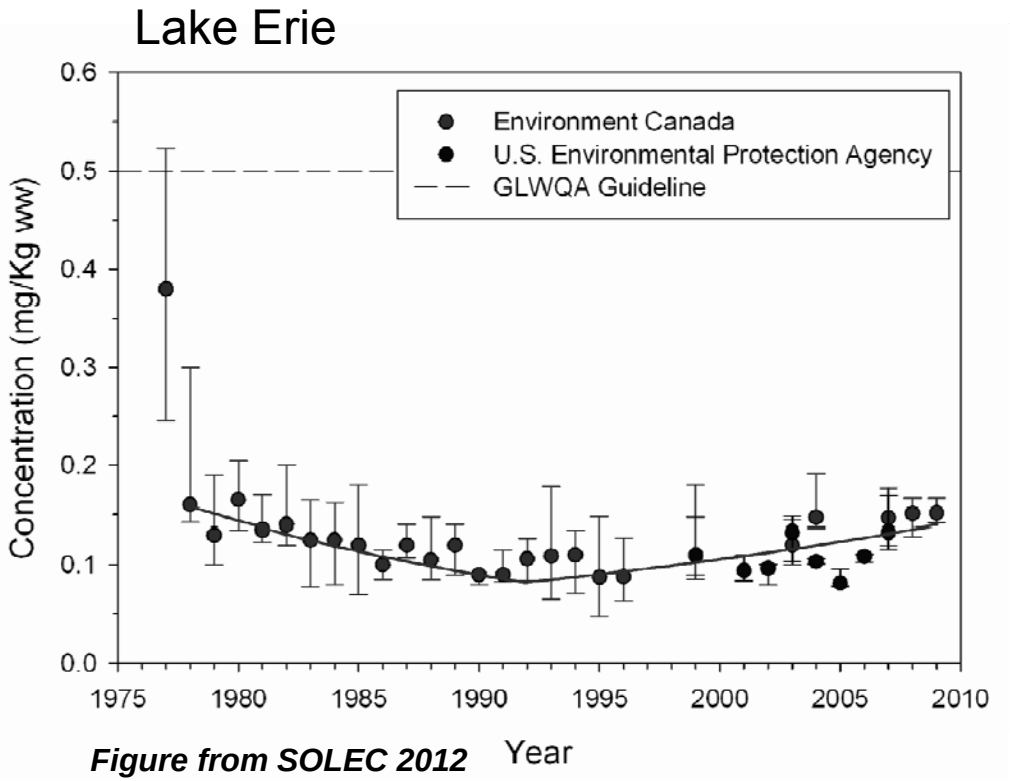
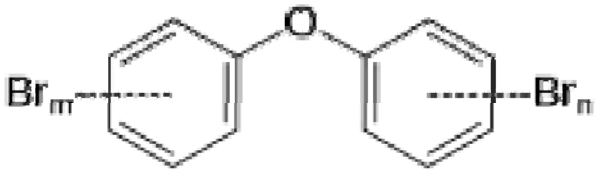


Figure from SOLEC 2012

- Concentrations start to increase post 1990
- Approaching levels observed in late 1970s
- Still well below GLWQA guideline

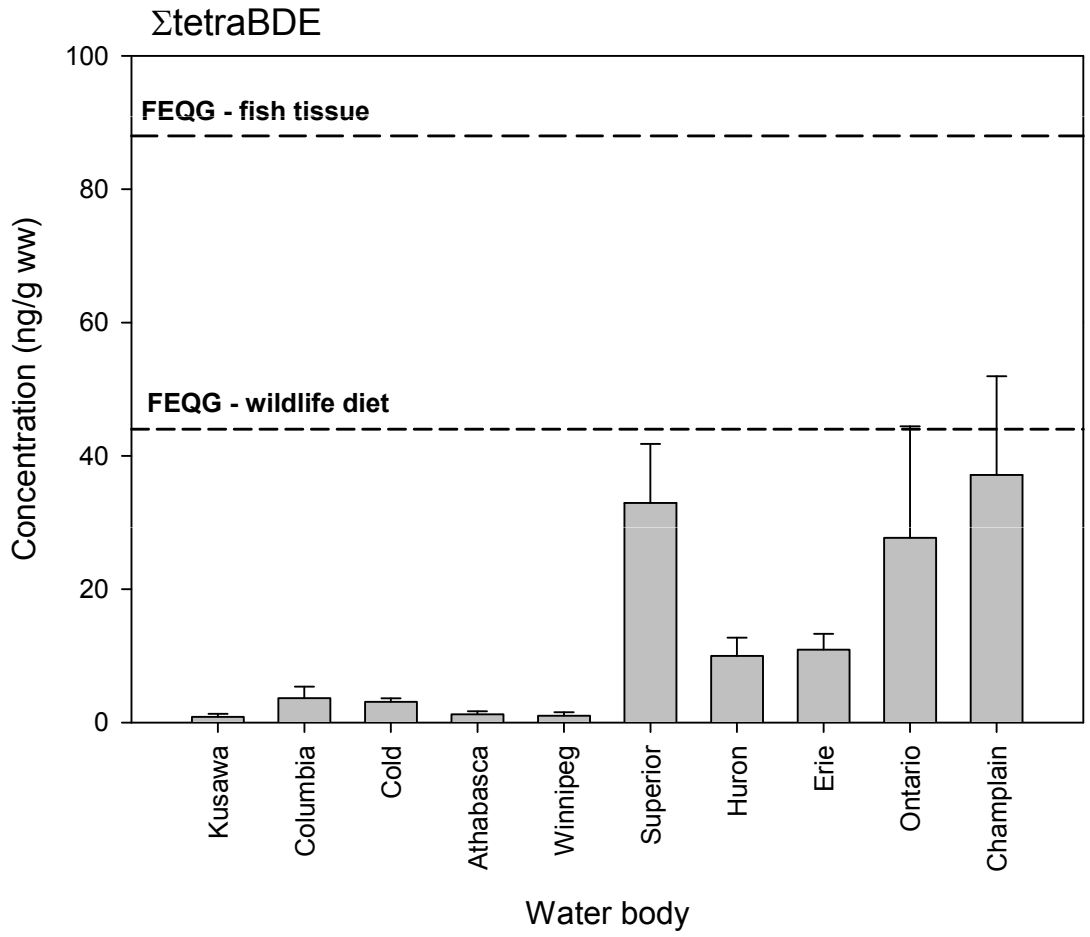
Polybrominated diphenyl ethers (PBDEs)

Widely used flame retardants
Production has been phased-out



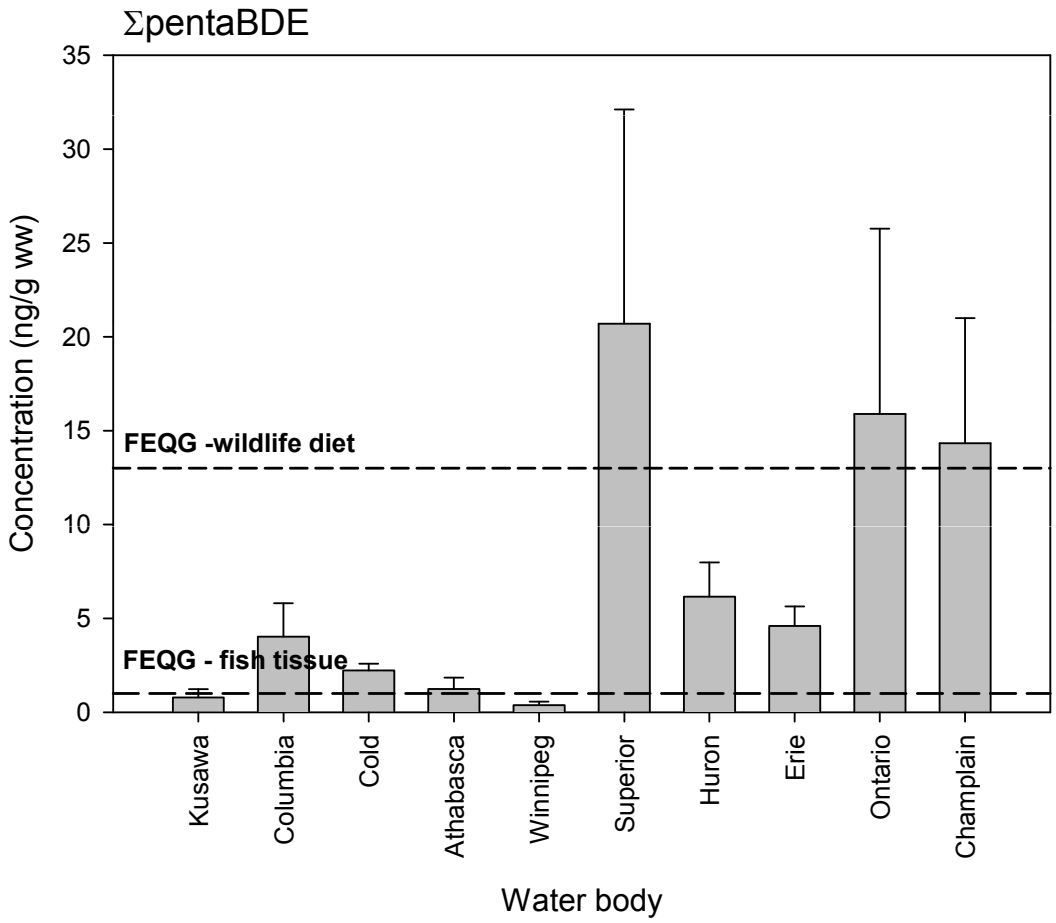
- Top predator species targeted
  - Lake Trout
  - Walleye
  - n = 10
- Whole body homogenate
- Analysis by HR-GC/MS
  - EPA Method 1614

∑TeBDEs – Current status (2011)



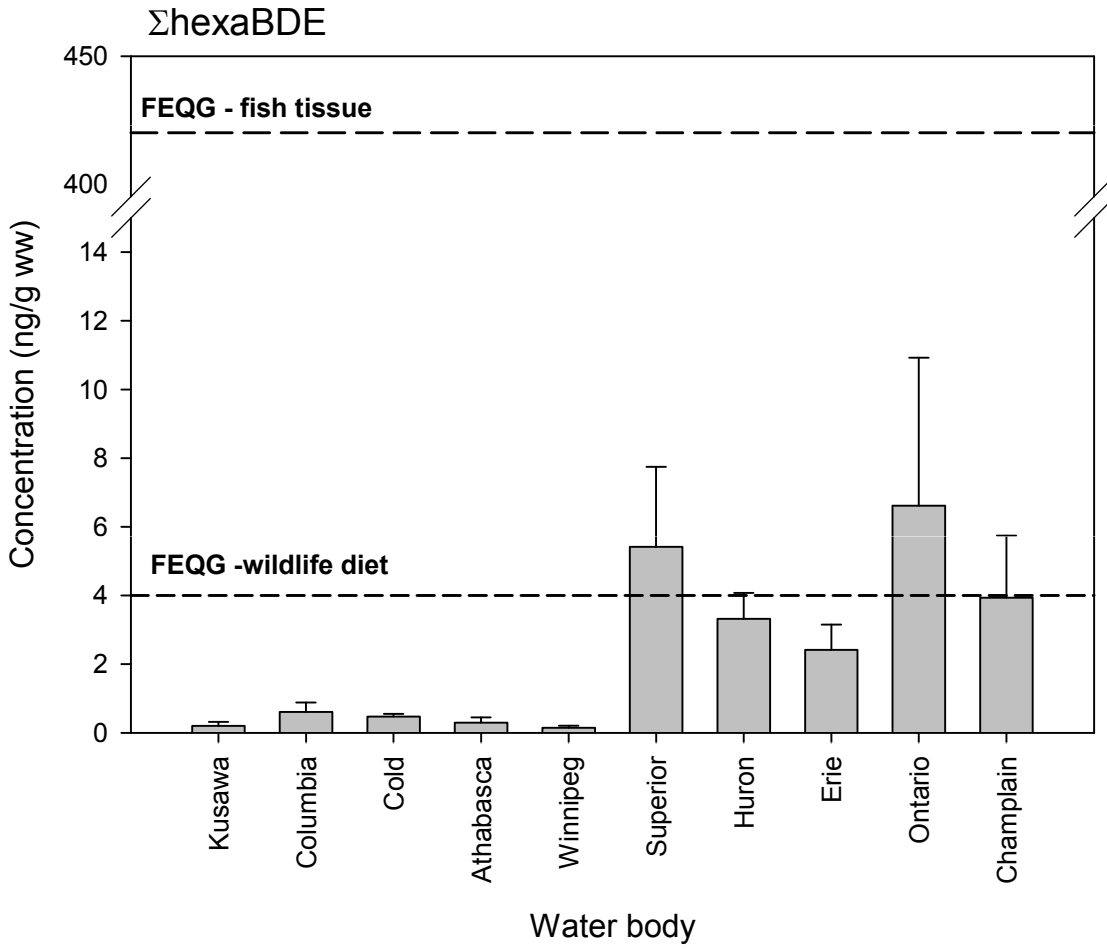
- Concentrations highest in Great Lakes / St. Lawrence
- Concentrations in Erie trout below Federal Environmental Quality Guidelines (FEQGs)
  - 10 Lake Trout
  - East Basin

∑PeBDEs – Current status (2011)



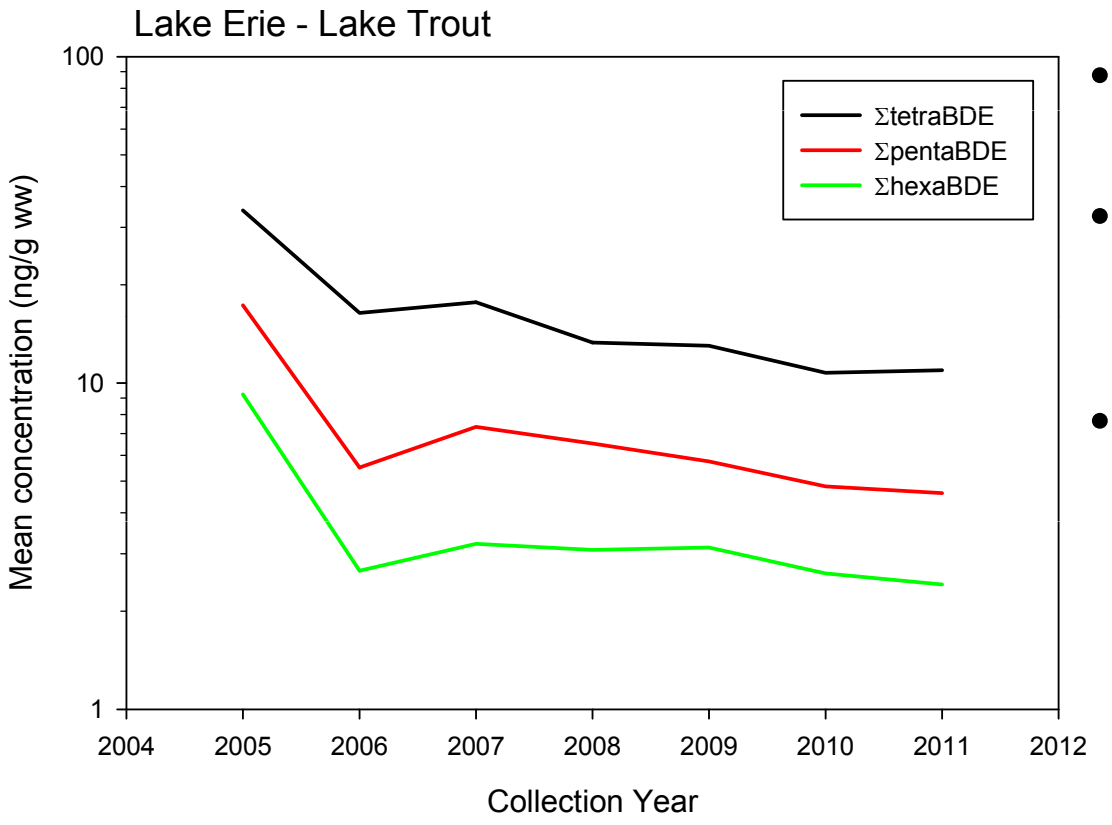
- Concentrations highest in Great Lakes / St. Lawrence
- Concentrations in Erie trout above Federal Environmental Quality Guidelines (FEQGs) for fish tissue
  - 10 Lake Trout
  - East Basin

∑HxBDEs – Current status (2011)



- Concentrations highest in Great Lakes / St. Lawrence
- Concentrations in Erie trout below Federal Environmental Quality Guidelines (FEQGs)
  - 10 Lake Trout
  - East Basin

PBDEs temporal trend - Erie



- 7 years continous data 2005-2011
- Slopes of log-linear regression negative for Te-, Pe-, & Hx-BDEs
- Slopes:
  - TeBDE (-14%)
  - PeBDE (-15%)
  - HxBDE(-14%)

Significantly different from zero ($\alpha = 0.05$)

Perfluorooctane sulfonate (PFOS)

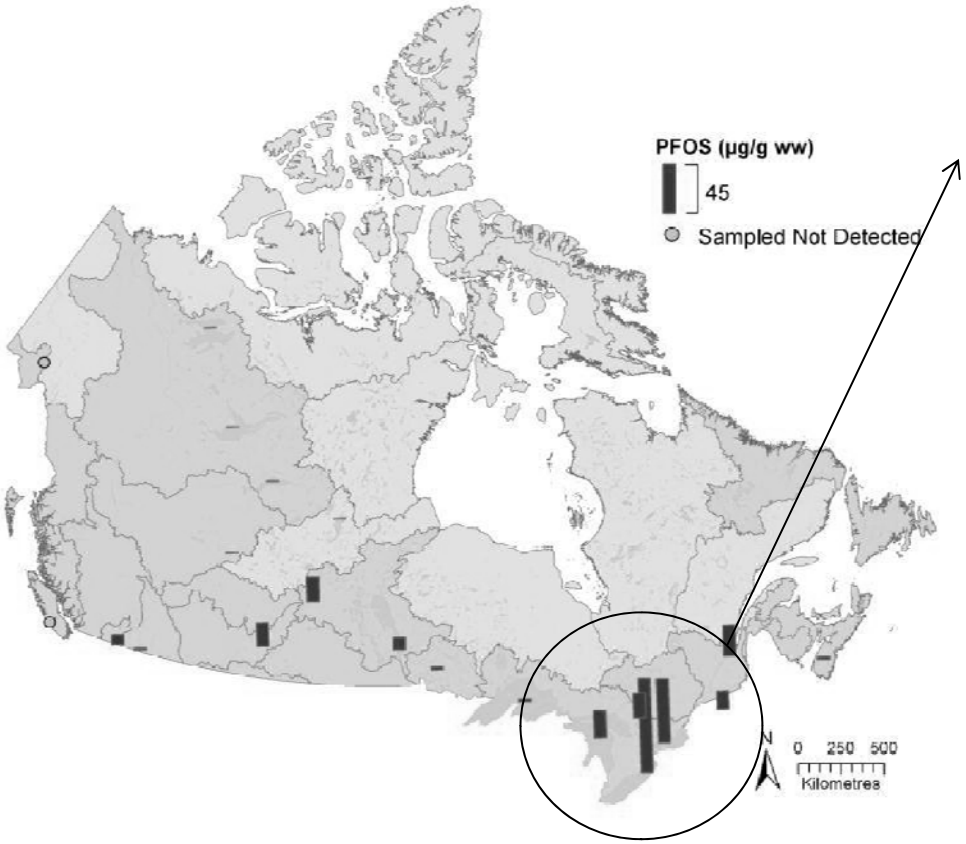
Found in:

- water, oil, soil and grease repellents
- in aqueous fire fighting foams

The use of PFOS and its precursors in Canada is limited to specific products and niche applications

- Top predator species targeted
  - Lake Trout
  - Walleye
  - n = 10
- Whole body homogenate
- Analysis by LC-MS/MS

PFOS – National fish monitoring



- Highest concentration in Lake Erie trout
- Average = 90 ng/g ww
- Max = 189 ng/g ww

- Draft FEQGs:
  - Tissue = 8,300 ng/g
  - Wildlife diet = 4.6 ng/g

Source: Perflurooctane sulfonate in the Canadian Environment
http://www.ec.gc.ca/toxiques-toxics/default.asp?lang=En&n=7331A46C-1

Results Reporting

- State of the Lakes Ecosystem Conference
  - Indicator Report – Contaminants in Whole Fish

- Canadian Environmental Sustainability Indicators
  - Polybrominated Diphenyl Ethers (PBDEs) in Fish and Sediment
    - http://ec.gc.ca/indicateurs-indicators/default.asp?lang=en&n=0970C75C-1
  - Perfluorooctane sulfonate (PFOS) in Fish and Sediment
    - In development

- Scientific Articles

Gewurtz, S.B., A.O. De Silva, et al. 2013. **Perfluroalkyl contaminants in the Canadian environment: Multi-media assessment of current status and trends**. Environment International. 59: 183-200.

Gewurtz, S.B., D.J. McGoldrick, et al. 2011. **Status and trends of PBDEs in Canadian fish and implications for long-term monitoring**. Environmental Toxicology and Chemistry. 30(7):1564-1575.

Bhavsar, S.P., S.B. Gewurtz, D.J. McGoldrick, M.J. Keir, and S.M. Backus. 2010. **Changes in mercury levels in Great Lakes fish between 1970s and 2007**. Environmental Science and Technology. 44: 3273-3279.

Other compounds of interest

- Perfluorinated compounds (incl. PFOS, PFOA)
- Non-BDE flame retardants
- Siloxanes
- Trace metals

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