

Temporal and Spatial Trends of “Legacy” Pollutants in and near the Great Lakes

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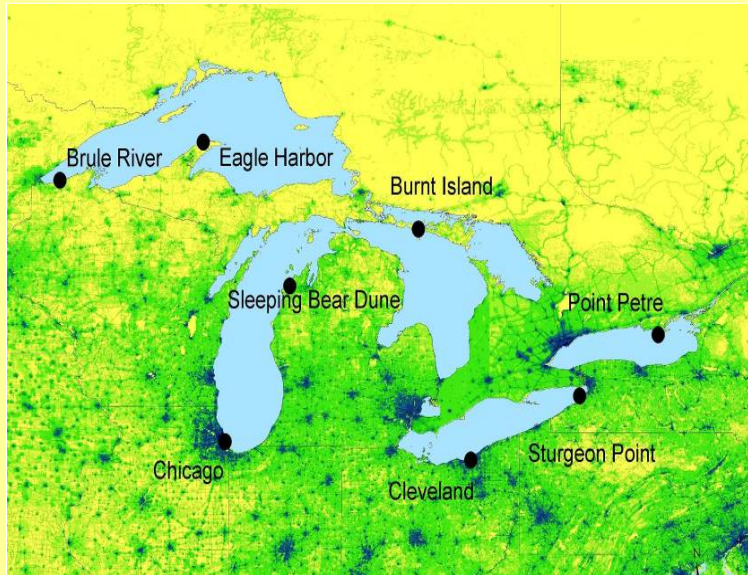
Stockholm Convention – plus some more

- Dieldrin, aldrin, endrin, chlordane, heptachlor, mirex, and endosulfan (all based on hexachloro-cyclopentadiene) **insecticides**
- Hexachlorocyclohexanes (lindane) **insecticide**
- DDT, DDE, DDD **insecticide**
- Toxaphene **insecticide**
- Hexachlorobenzene **fungicide & manufacturing byproduct**
- PCBs **sales banned in 1976**
- PAHs **from combustion**
- Dioxins and furans **from combustion**
- Mercury **burning of fossil fuels, use in products**

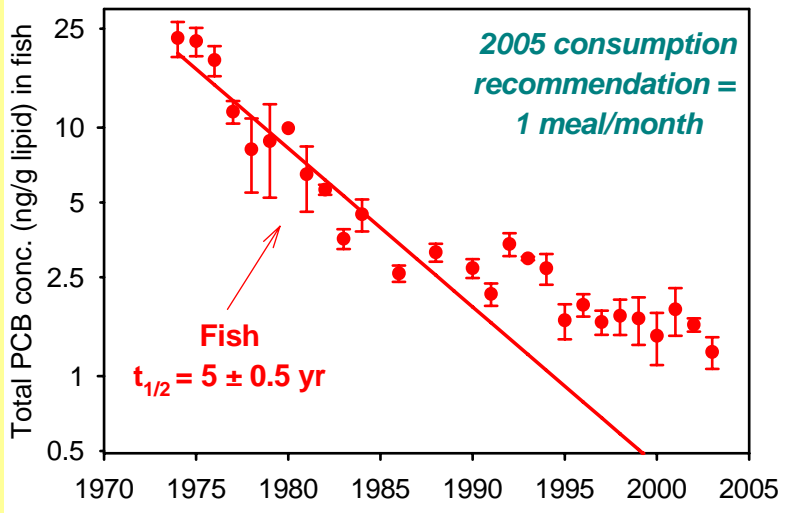
What can we measure to get spatial and temporal trends?

- **Air** – PCBs, PAHs, and pesticides from the Integrated Atmospheric Deposition Network (a joint U.S. & Canadian effort)
- **Fish** – PCBs from the Great Lakes Fish Monitoring Program
- **Gull eggs** – dioxins from the Canadian herring gull egg program
- **Sediment cores** – dioxins in Siskiwit Lake on Isle Royale and PCBs in Lake Ontario

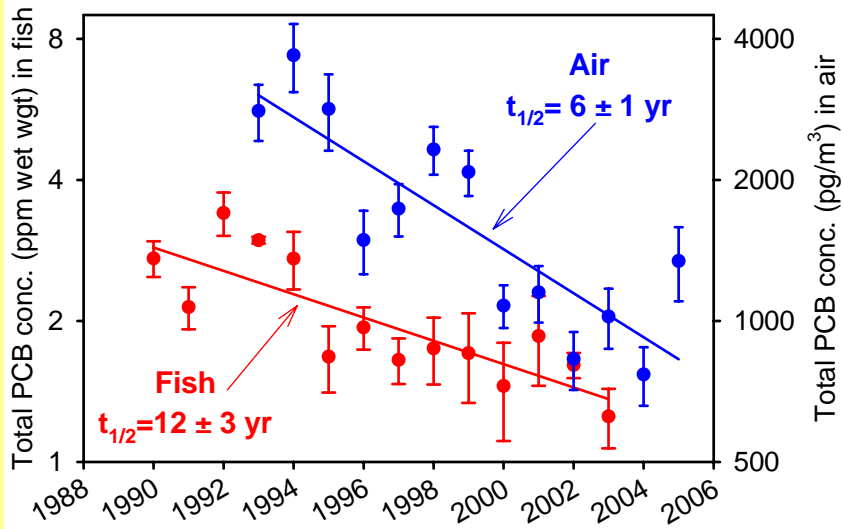
IADN sites on a population map -- one sample every 12 days since ~ 1992



Total PCB conc. in Lake Michigan whole trout (low-hanging fruit effect?)



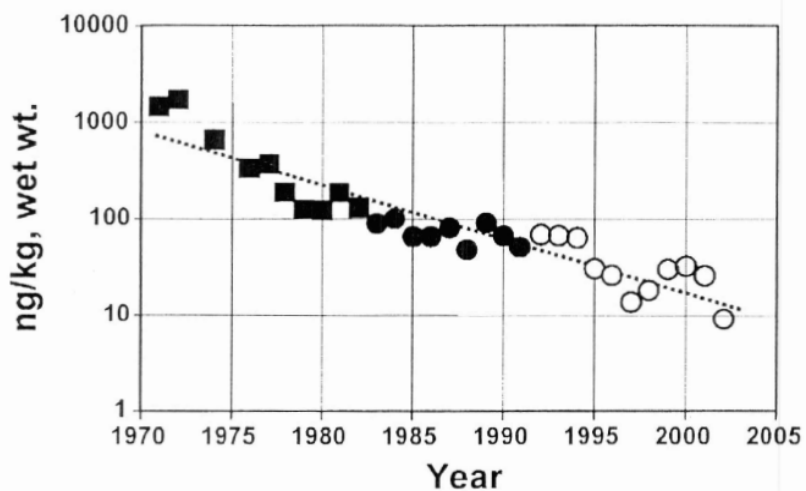
Post-1990 total PCB conc. in L. Michigan whole trout & in Chicago air



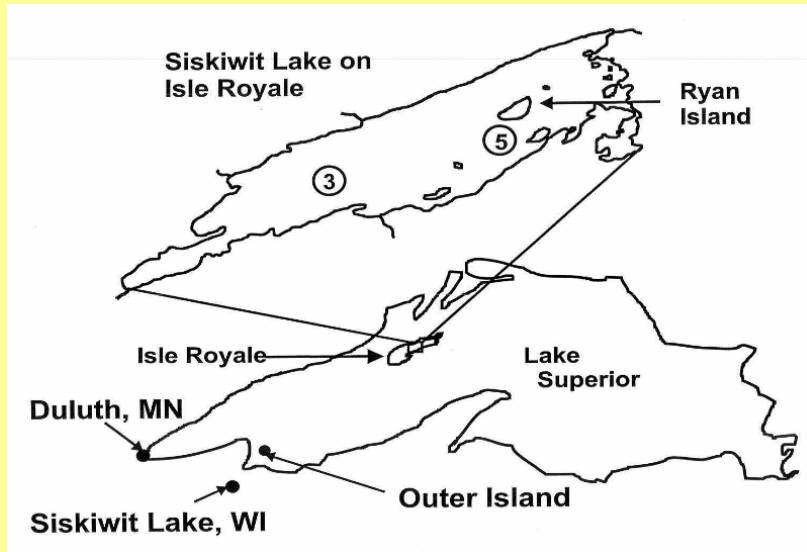
**Herring gull eggs make a
handy sampling media**



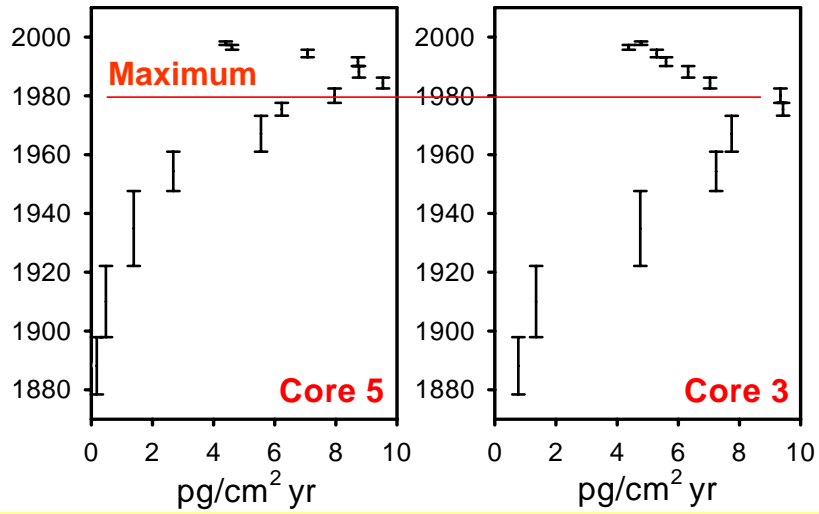
2,3,7,8-TCDD Conc. in herring gull eggs (L. Ontario) over time ($t_{1/2} = 6$ yr)



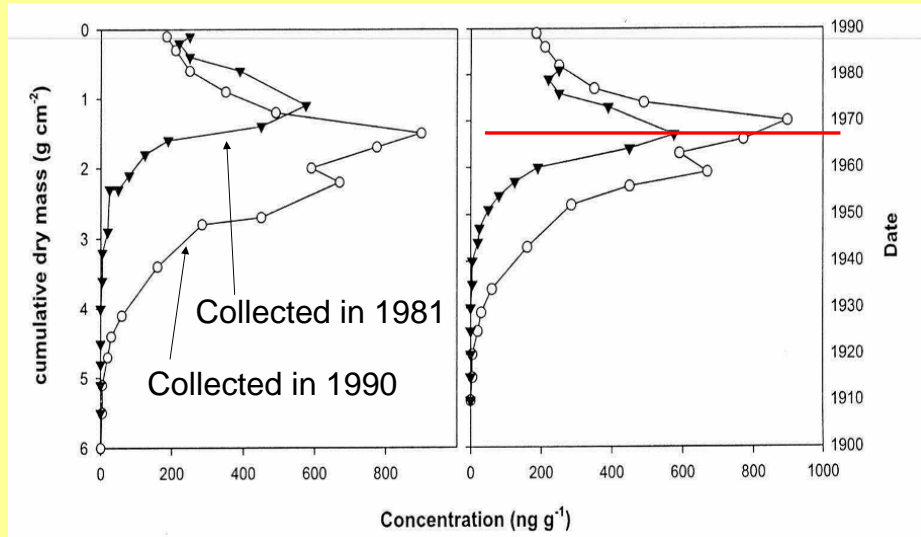
Siskiwit Lake is on Isle Royale



Total dioxin fluxes to the sediment of Siskiwit Lake



PCB conc. in L. Ontario sediment core, showing maximum in 1970



Remaining Sources

- Restricted **OC pesticides** are used in other countries. Endosulfan is still in use in the U.S. Lindane's use ended in Canada in 2004 and will end in the U.S. in 2009.
- Some **PCBs** are still present in "sealed" electrical equipment and some are evaporating from landfills, dumps, and contaminated soils.
- **Dioxins and furans** are still being produced by residential and agricultural trash burning.
- **All legacy pollutants** are present in contaminated sediments. Great Lakes Legacy Act funding is being used to clean up U.S. Areas of Concern.
- Largest remaining domestic sources of **mercury** are coal-fired power plants.

Conclusions

- The concentrations of legacy pollutants in most parts of the Great Lakes ecosystem are decreasing, but the decreases are slow.
- The concentrations of these legacy pollutants decrease by a factor of two every 5-15 years, but these chemicals will be with us for another 10-30 years, despite restrictions on their use (in some cases, 30 years ago).
- Further reductions in the concentrations of PCBs, PAHs, and some pesticides may well depend on emission reductions in cities and clean-up of contaminated sediments.

Acknowledgements

- The Integrated Atmospheric Deposition Network Teams in the U.S. and in Canada
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Canada