



# Mercury Science and Policy

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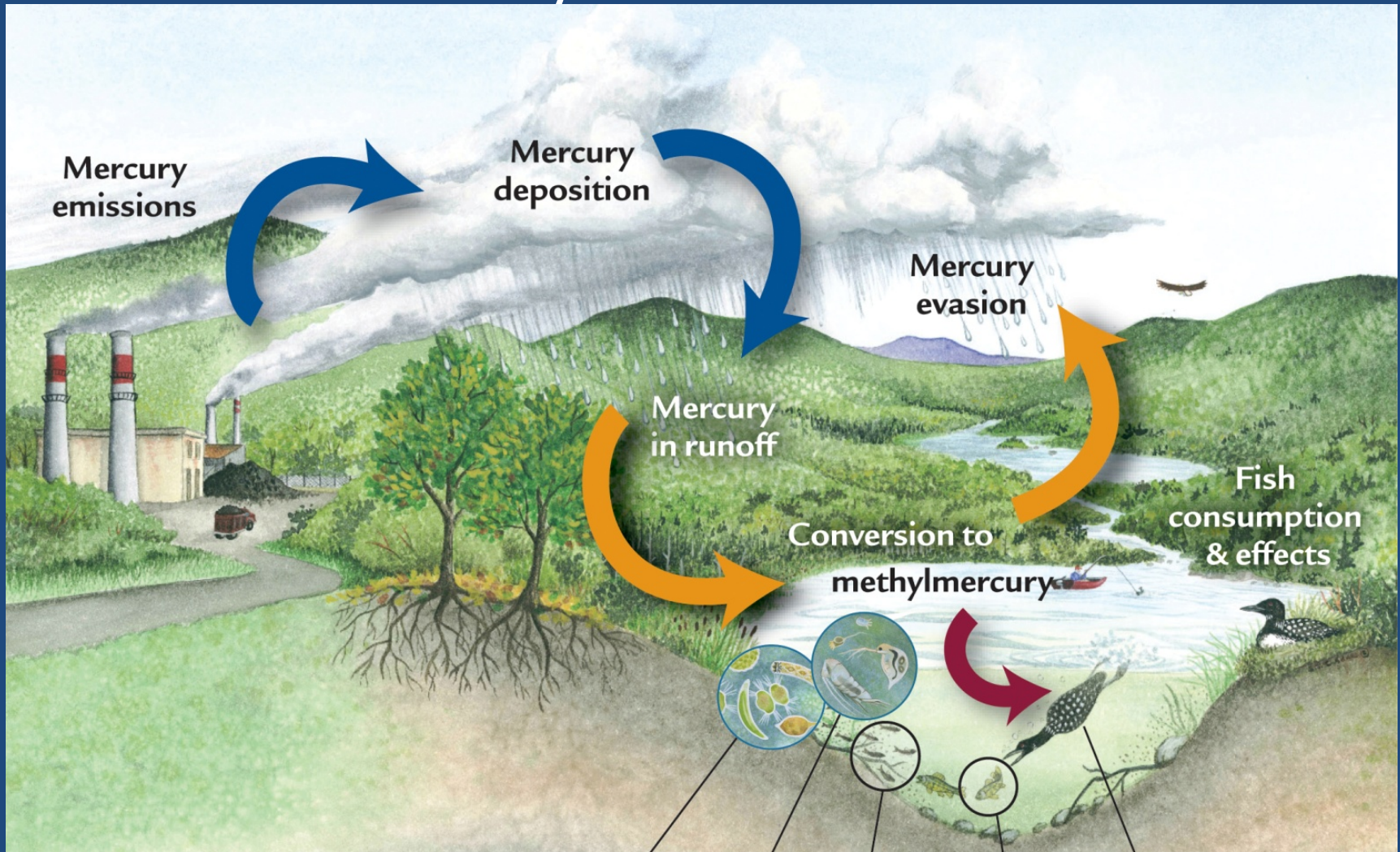


# Outline

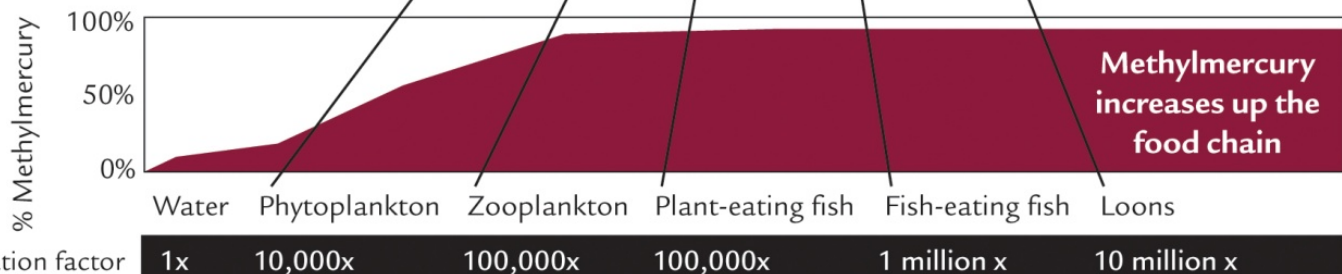
1. Background on Mercury and U.S. Patterns
2. Study of Great Lakes Region
  - Emissions and deposition
  - Fish mercury & risks
  - Wildlife mercury
3. Mercury Policy
4. Take Home Messages and Research Needs

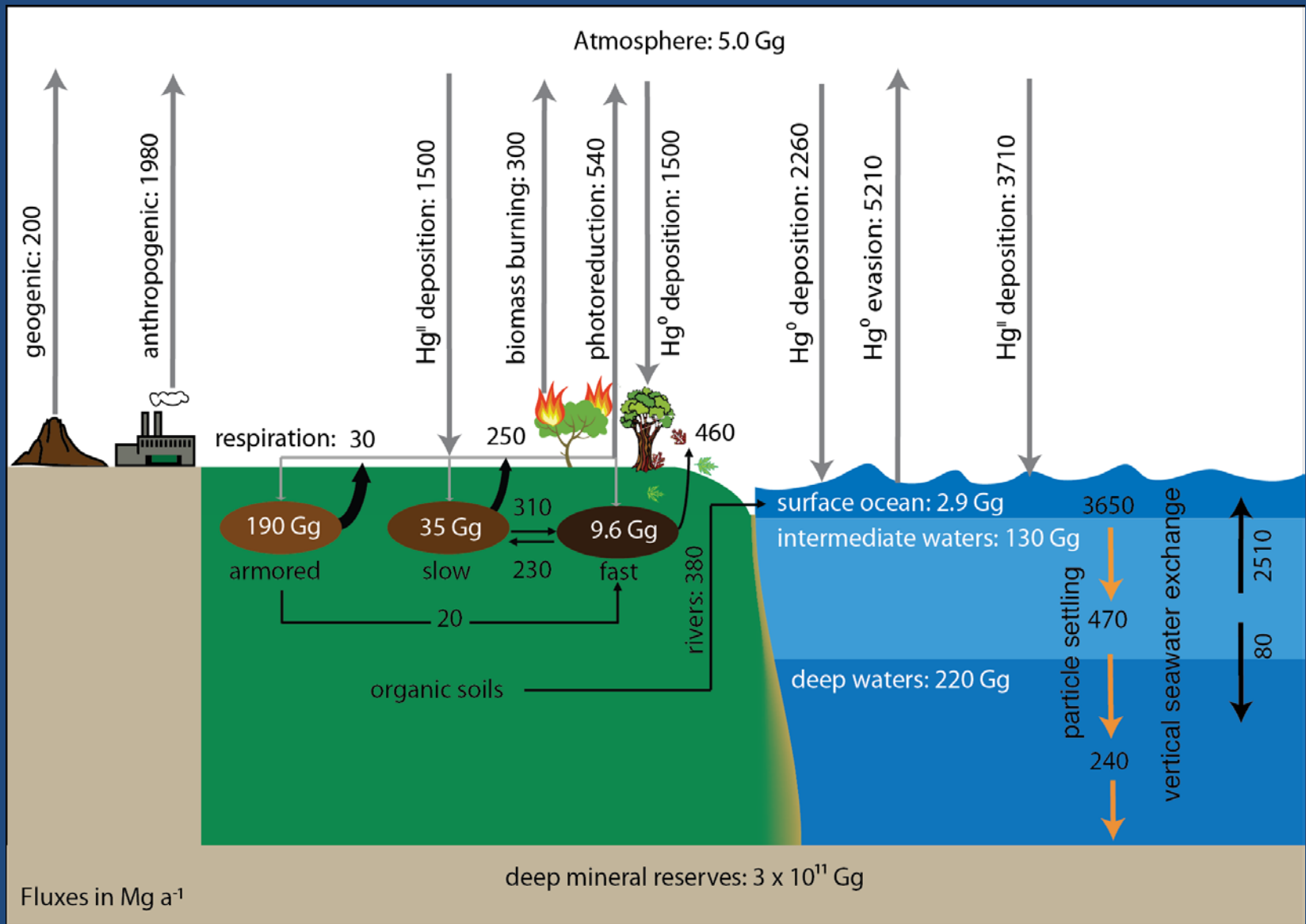


# Mercury in the Environment



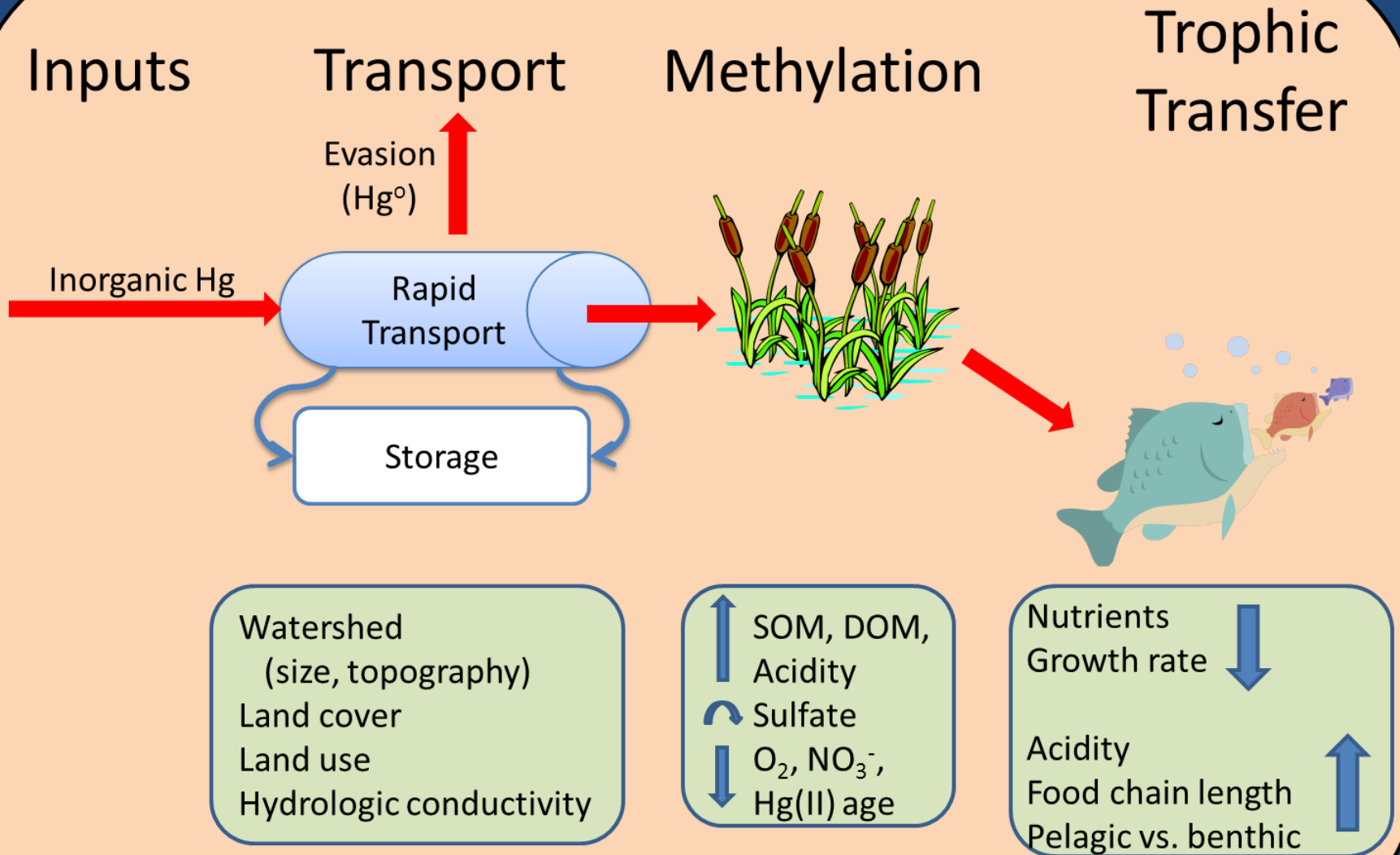
Bioaccumulation  
of methylmercury  
in fish & wildlife



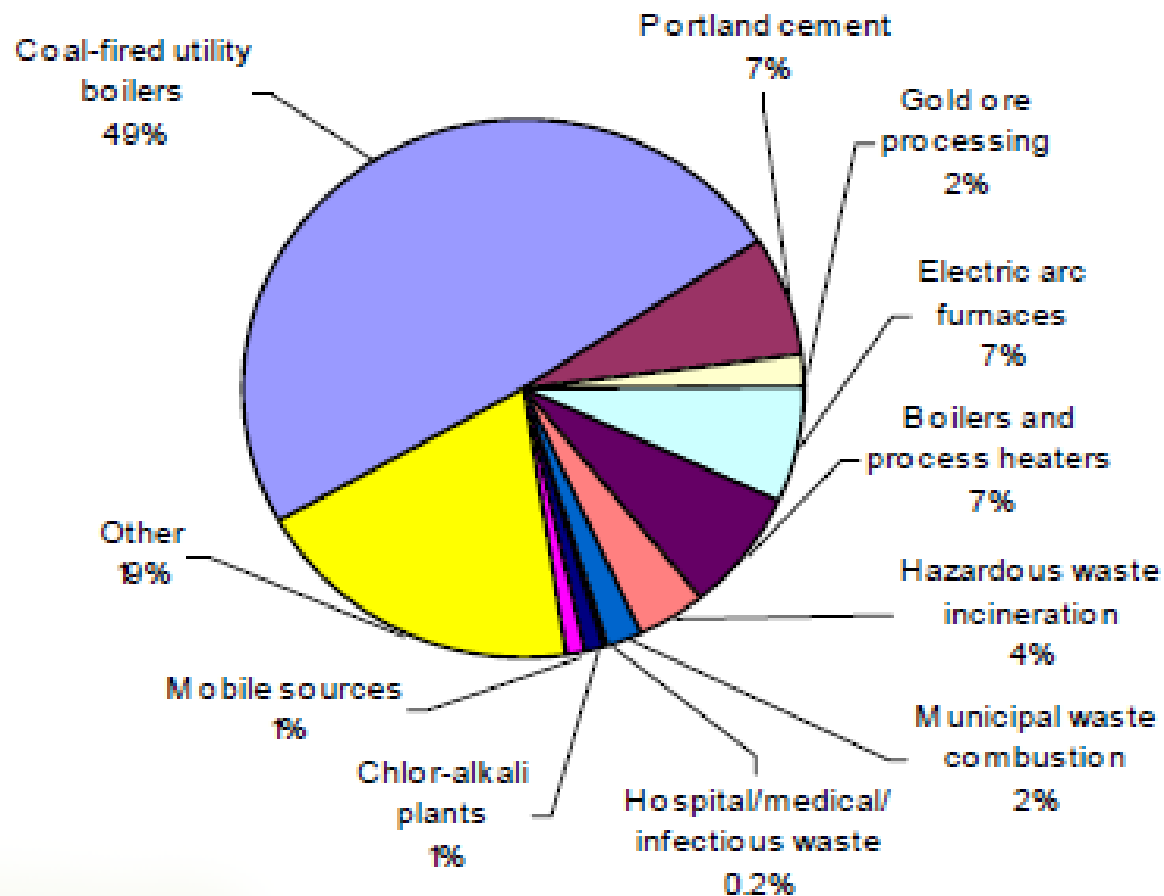


Sunderland *et al.*, in prep., based on Holmes *et al.*, 2010; Soerensen *et al.*, 2010; Smith-Downey *et al.*, 2010 and Sunderland and Mason, 2007

# Watershed Hg Sensitivity



## U.S. Mercury Emissions (2005)

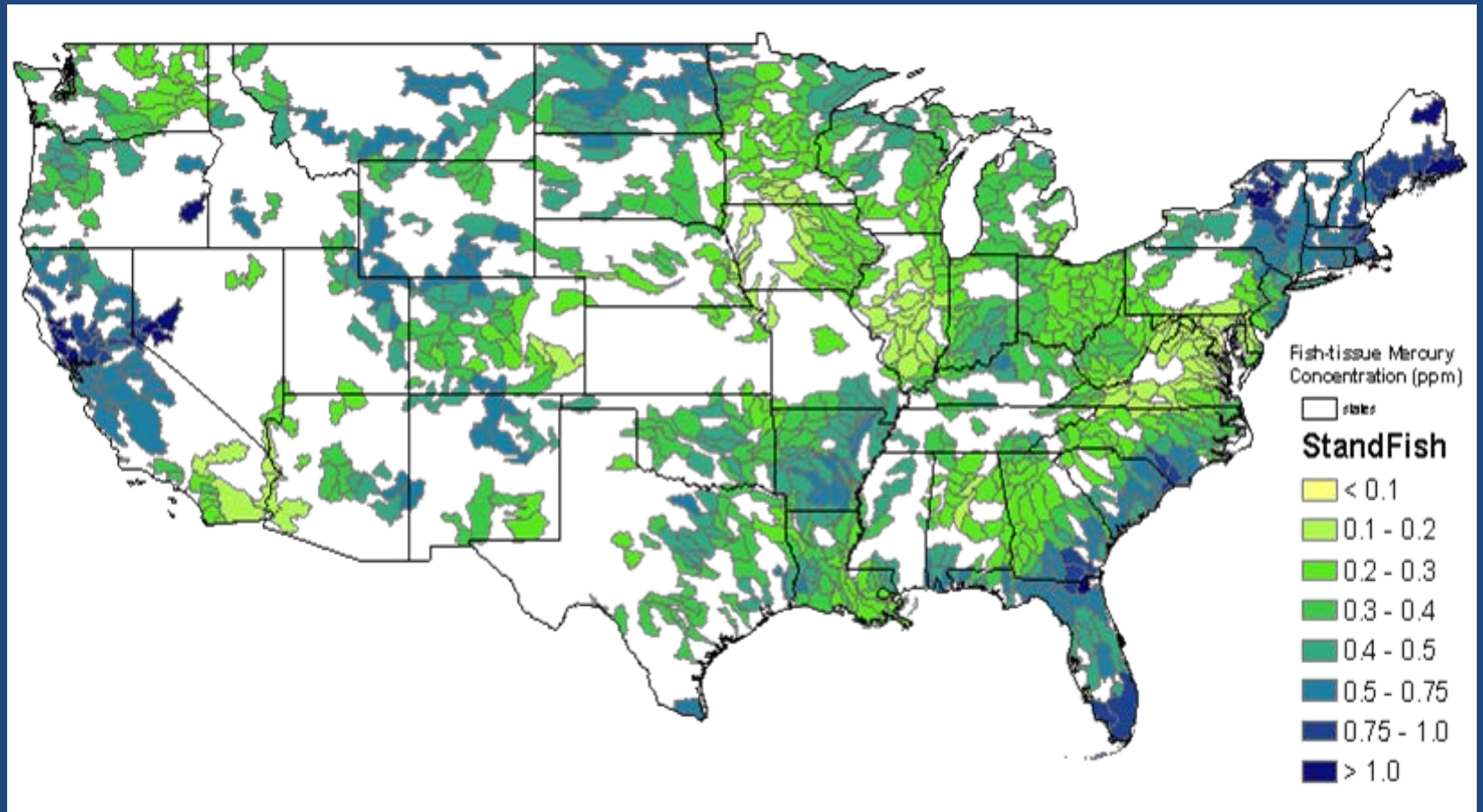


Total: 106 Short Tons

Note: as supplied by Anne Pope, OAQPS on 9/30/09

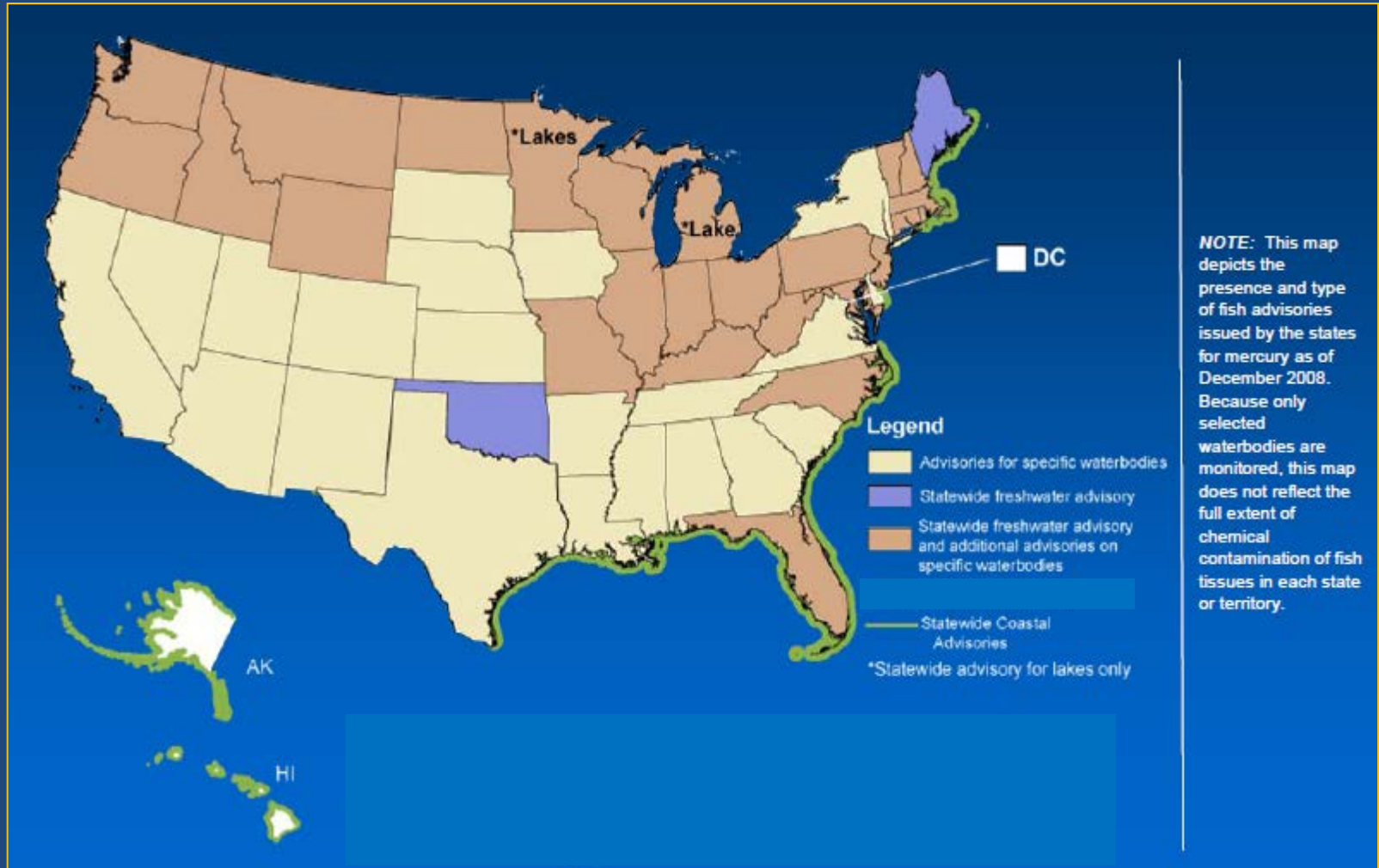


# Fish Mercury across the U.S.



Derived from Wente, S. 2004

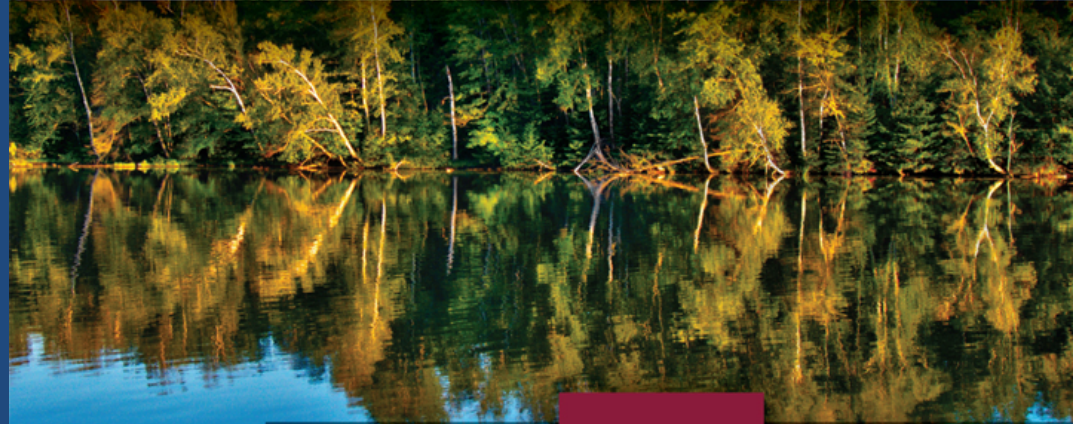
# Fish Advisories for Mercury are Everywhere





# Background

- 35 papers in 2 special issues: Ecotoxicology, Environmental Pollution
- 170+ scientists and managers
- >300,000 measurements
- Supported by Great Lakes Commission EPA-funded Great Lake Air Deposition (GLAD) program

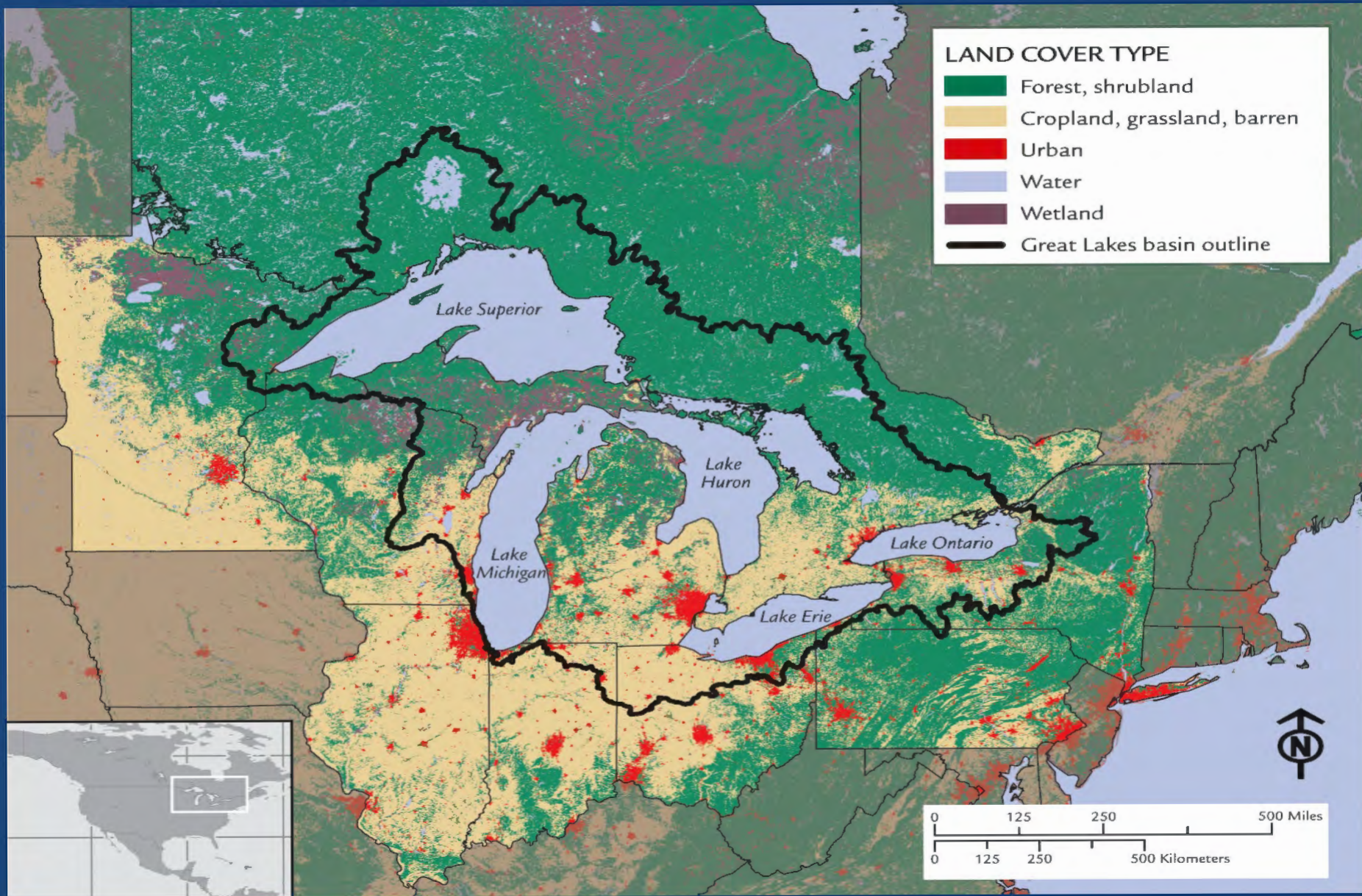


## Great Lakes Mercury Connections

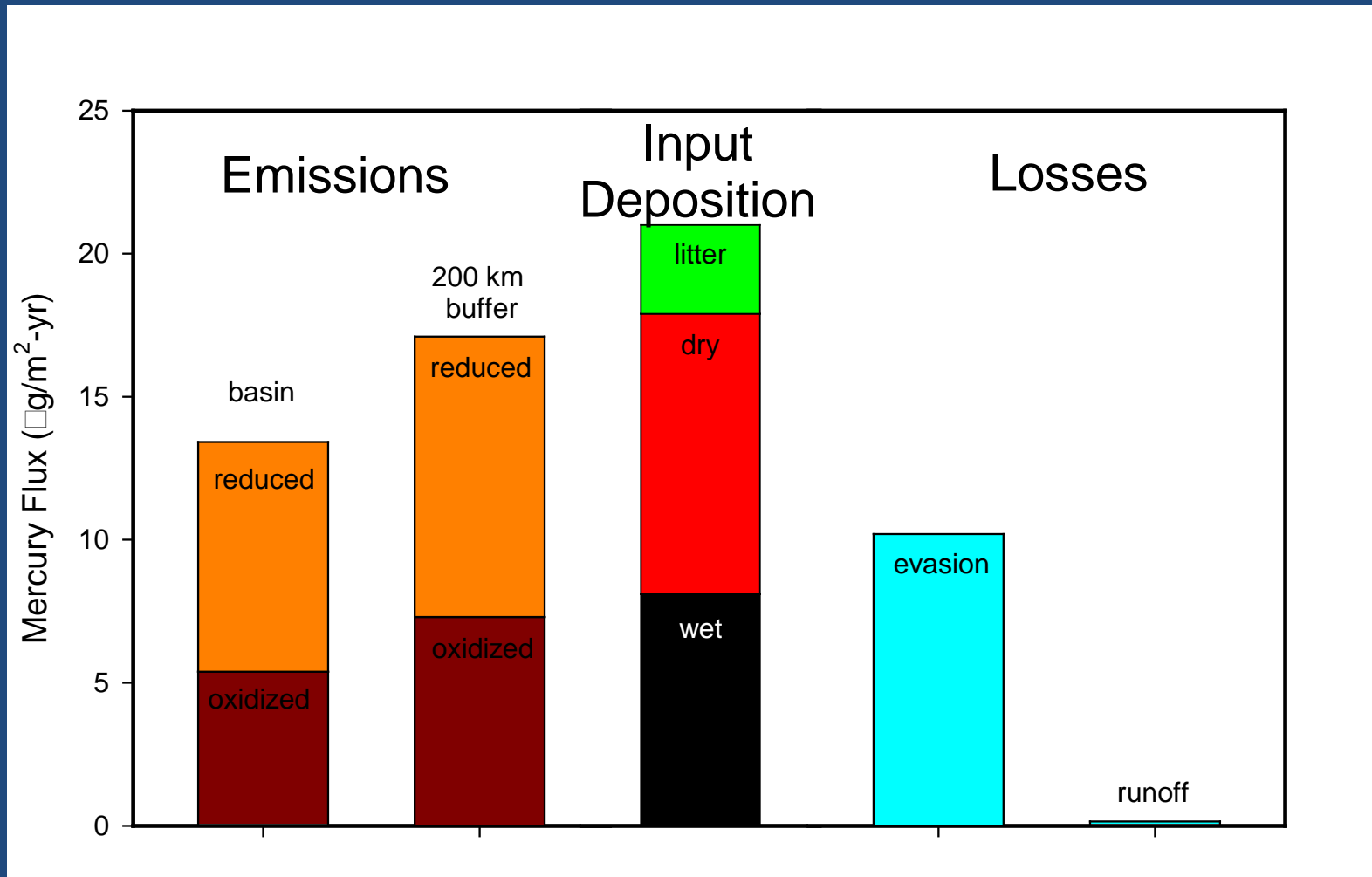
The Extent and Effects  
of **Mercury Pollution**  
in the Great Lakes Region

A publication of the Biodiversity Research Institute  
in partnership with the Great Lakes Commission  
and the University of Wisconsin-La Crosse



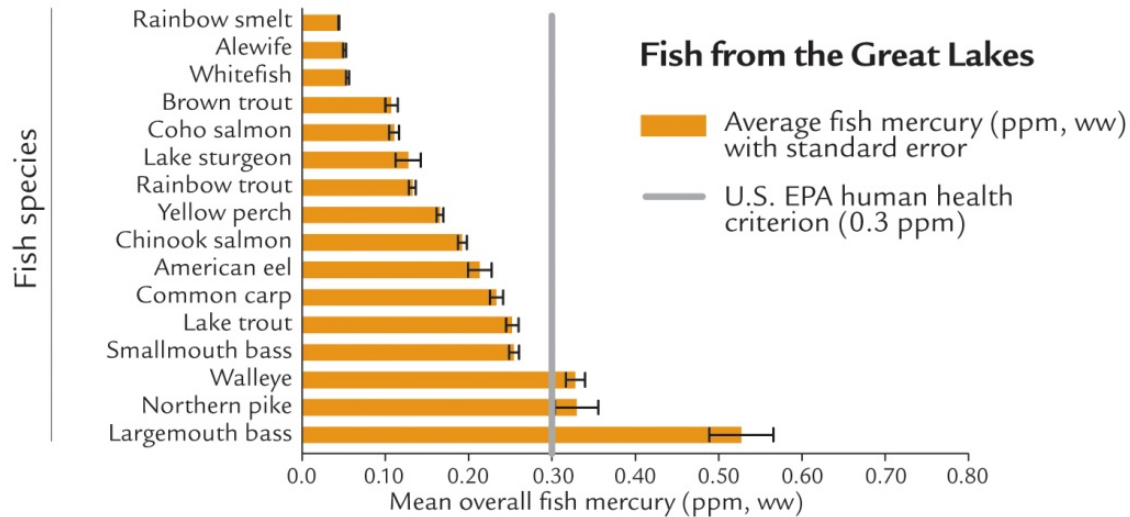
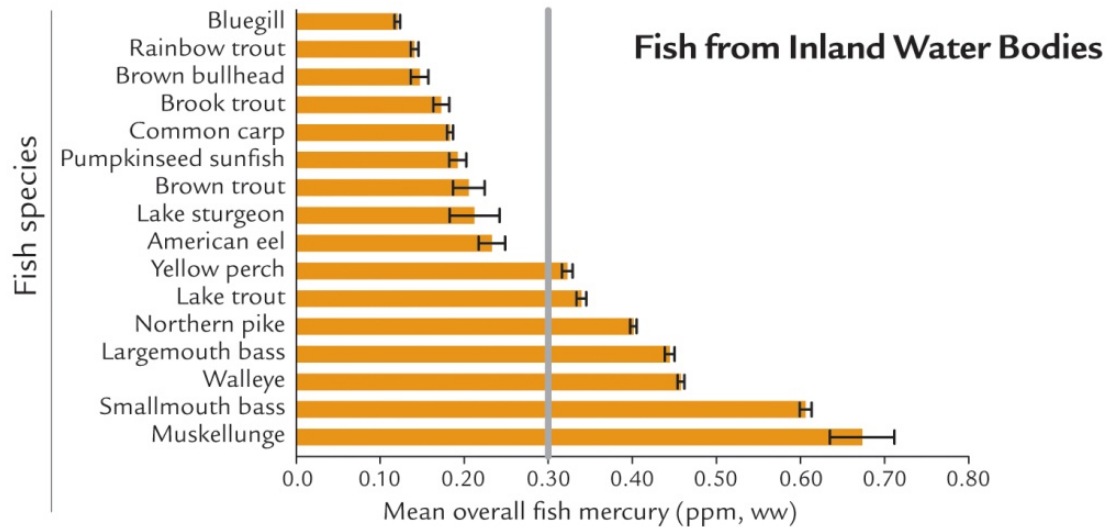


# Emissions Exceed Deposition of Mercury for the Great Lakes Basin, and the Region is a Net Mercury Sink



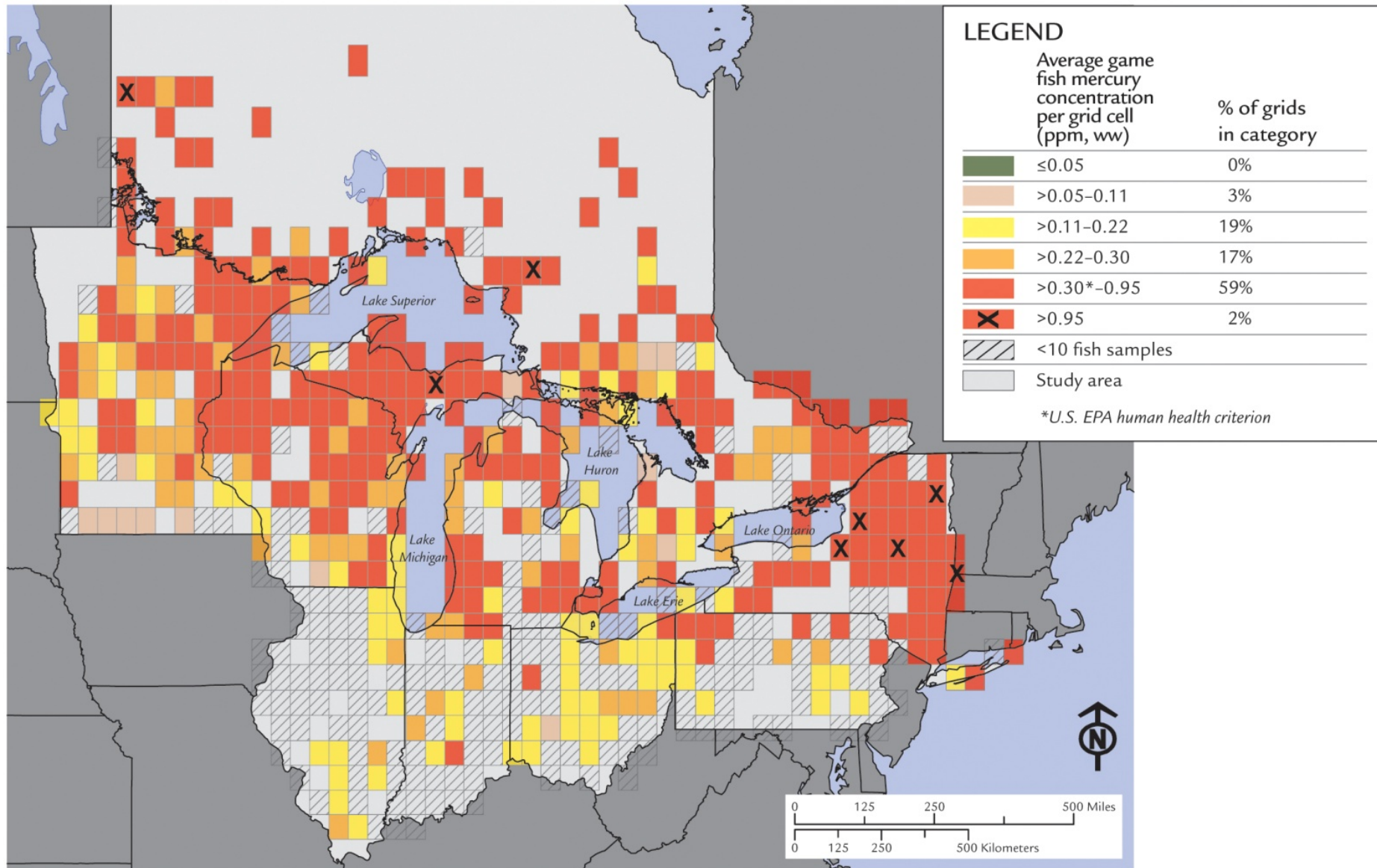
Emissions in the broader GL region are high (26% of total US/Canada emissions) and include a high percentage of oxidized Hg (46%).

# Mercury in Selected Fishes



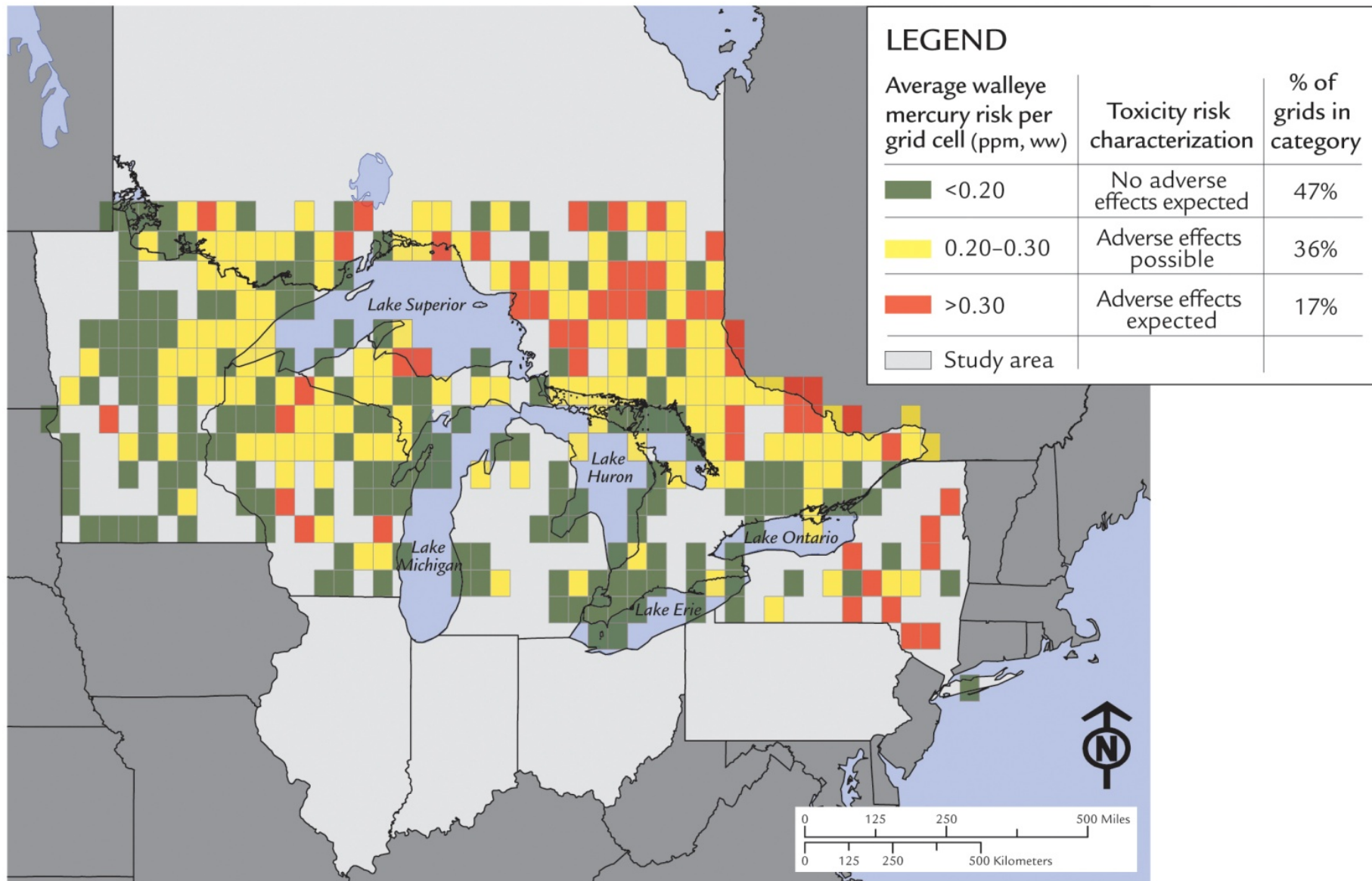


# Mercury in Game Fish

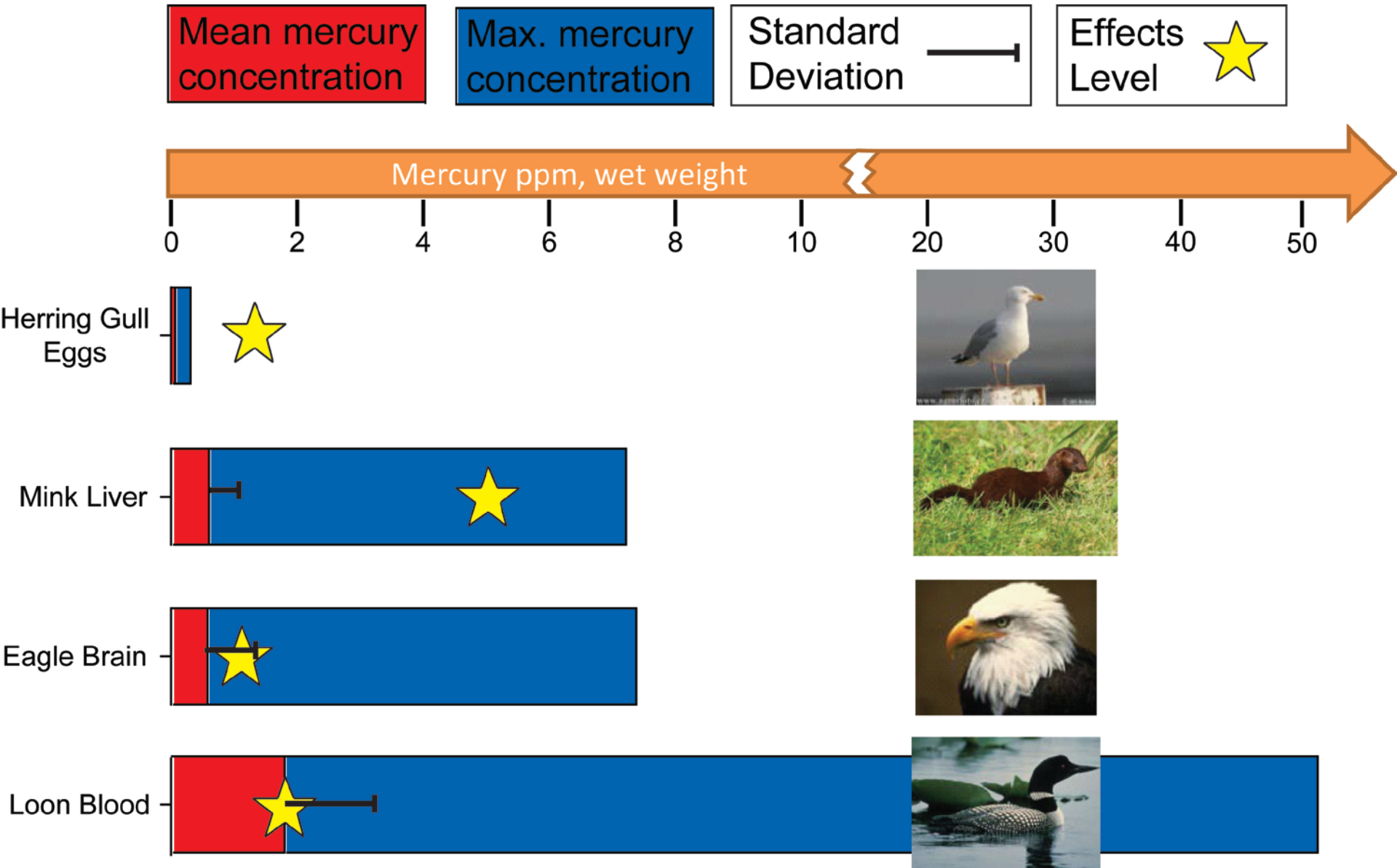


Evers *et al.* 2011 based on Zanaski *et al.* and Monson *et al.* 2011.

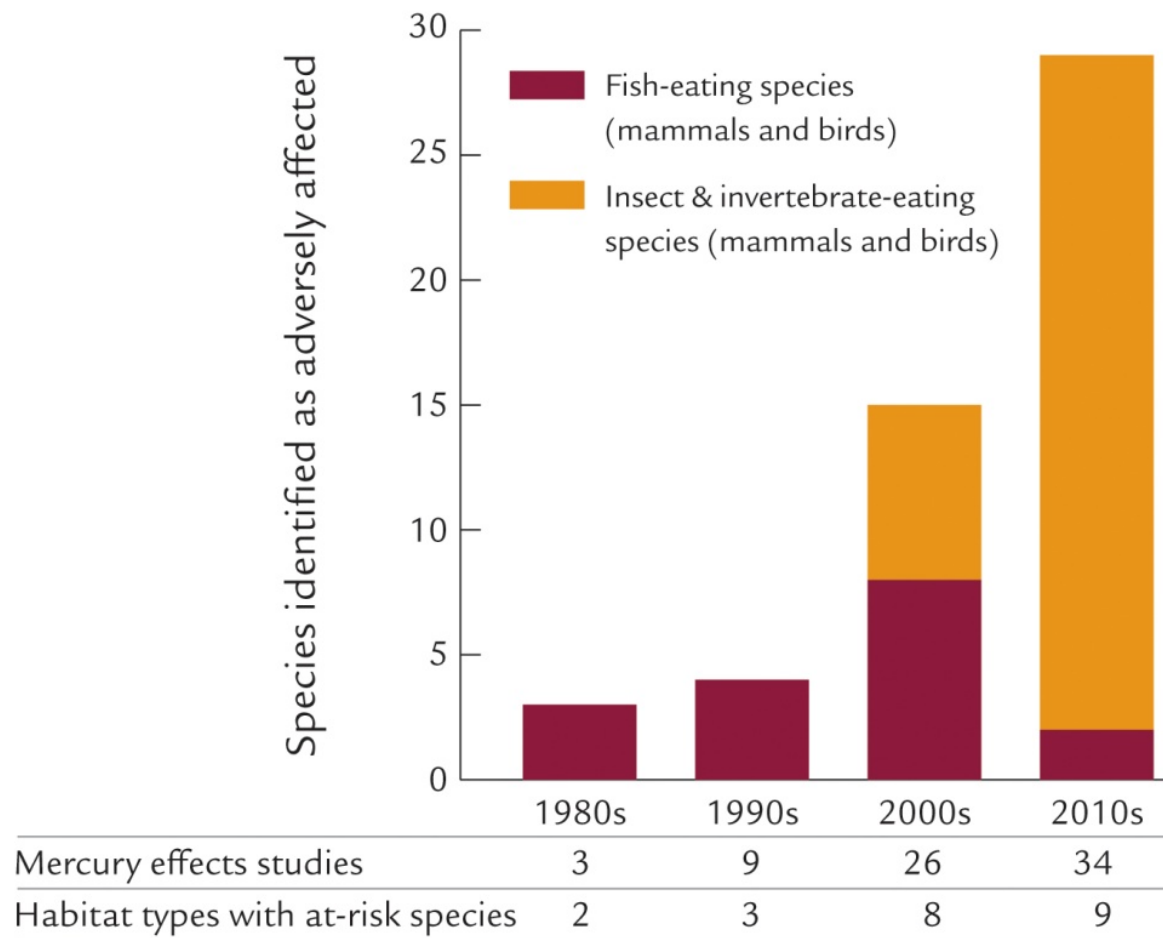
# Mercury and Walleye Health



# Mercury in Great Lakes Wildlife

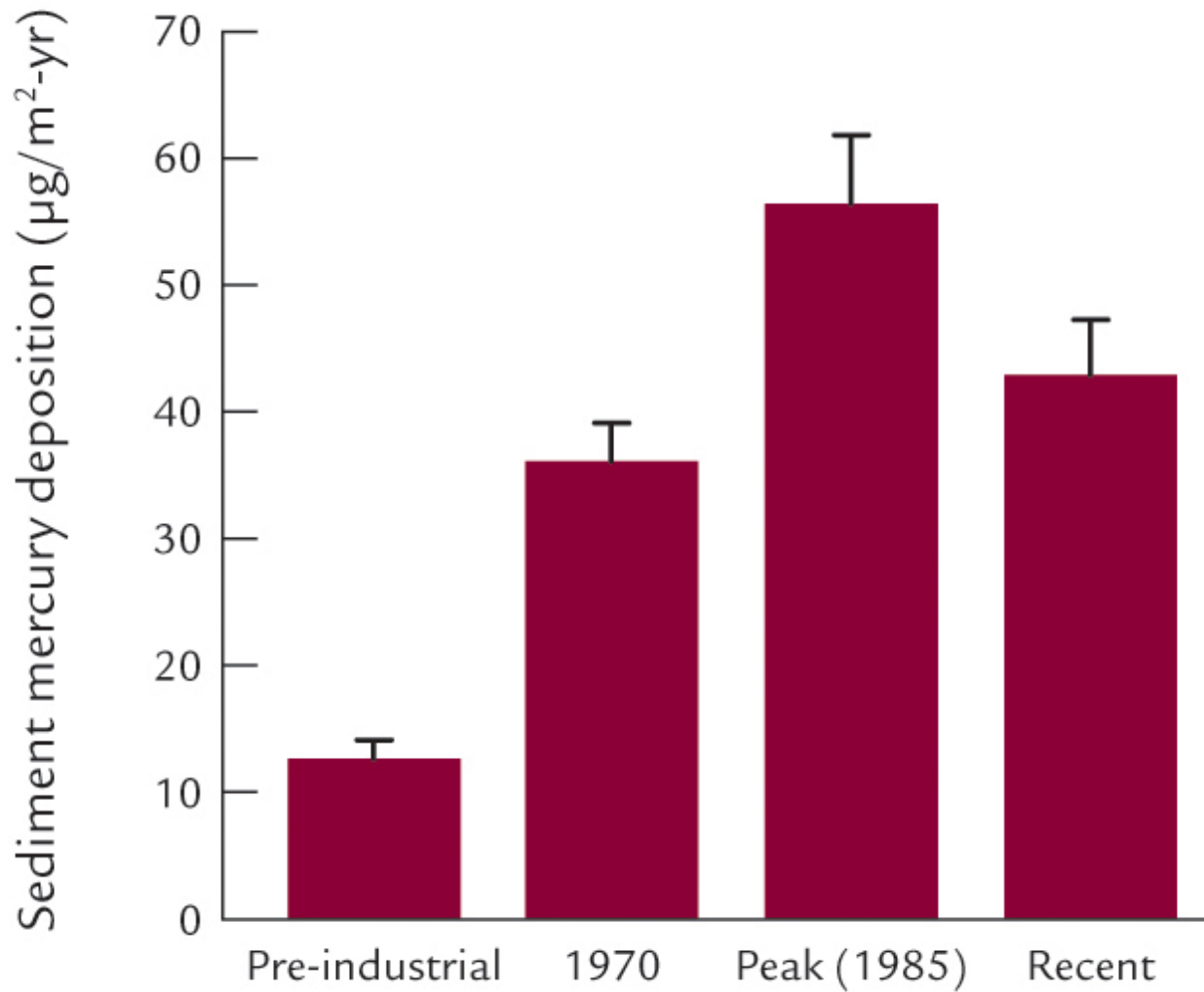


# Literature Accounts of Affected Species



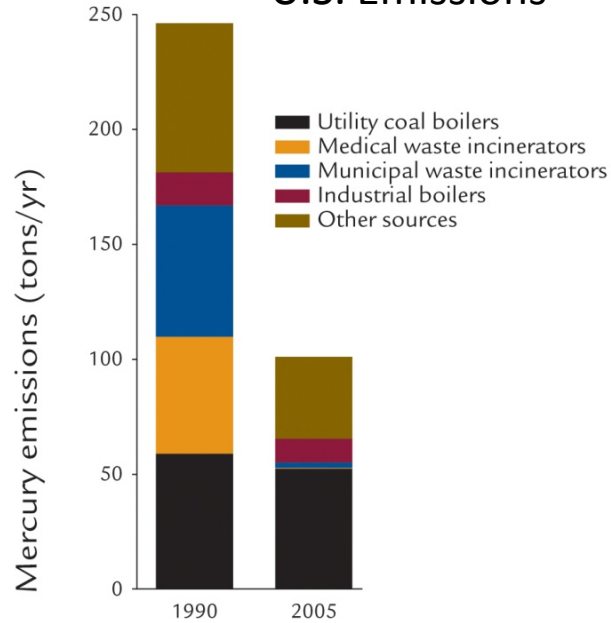


# Mercury Trends – Lake Sediments

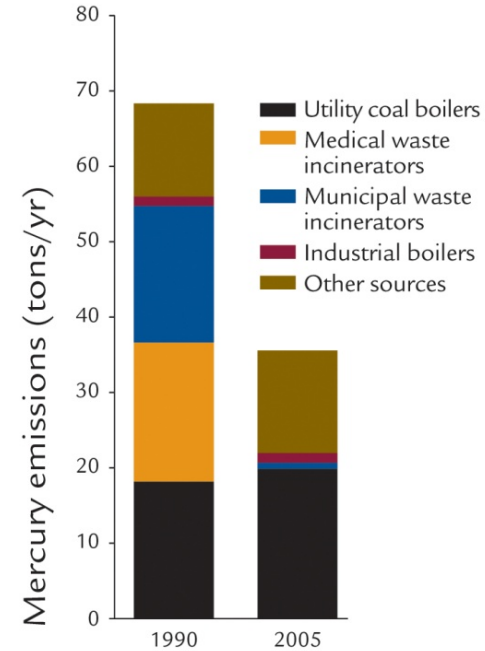


N = 91 lakes

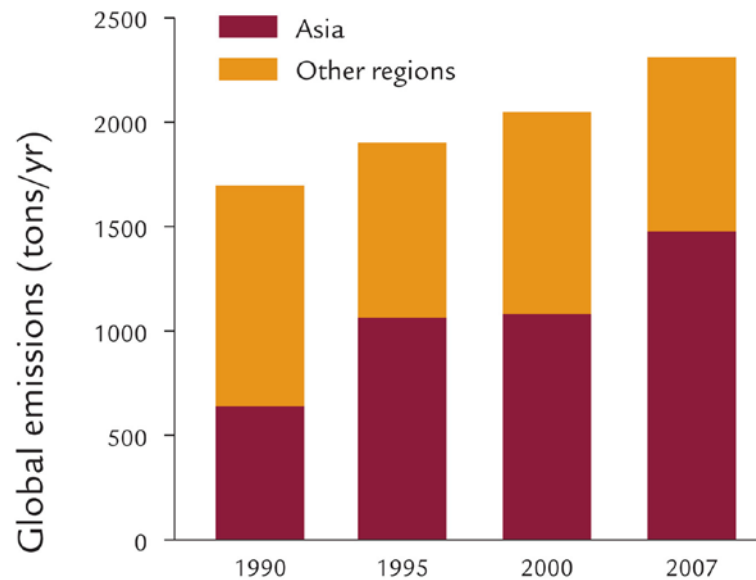
## U.S. Emissions



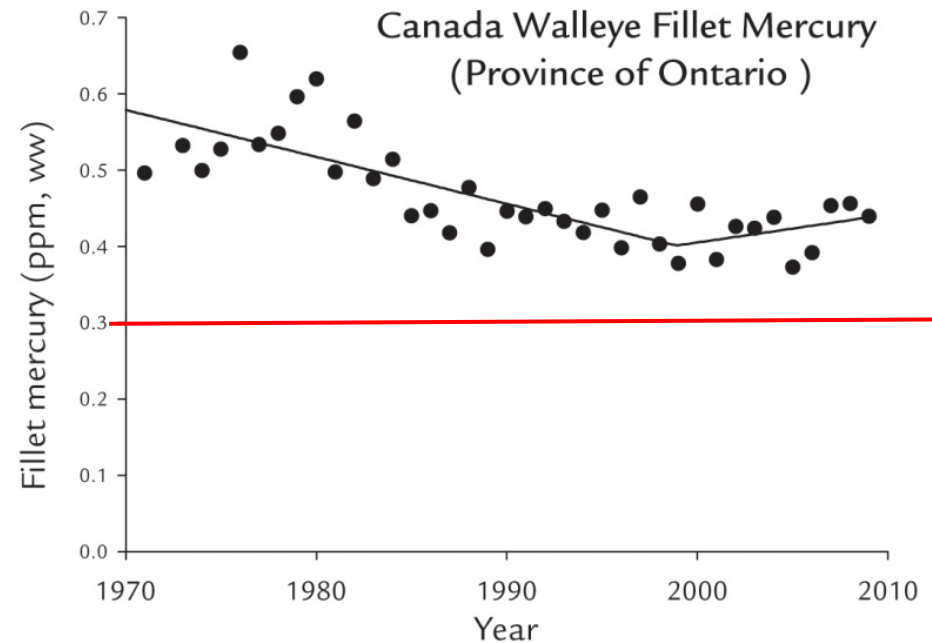
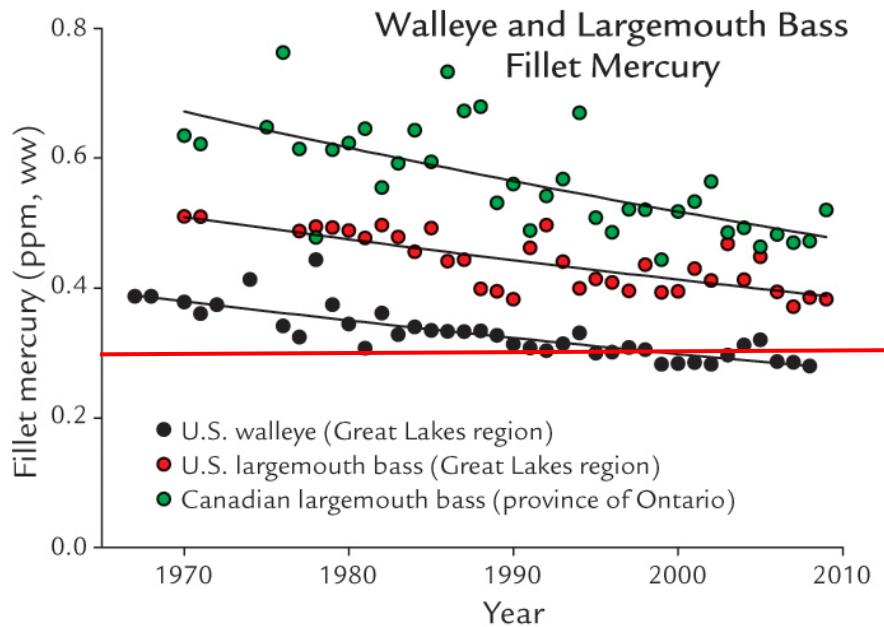
## U.S. Great Lakes States Emissions



## Global Emissions



# Mercury Trends - Fish



Red line = 0.3 ppm – EPA human health criterion

# Mercury Policies

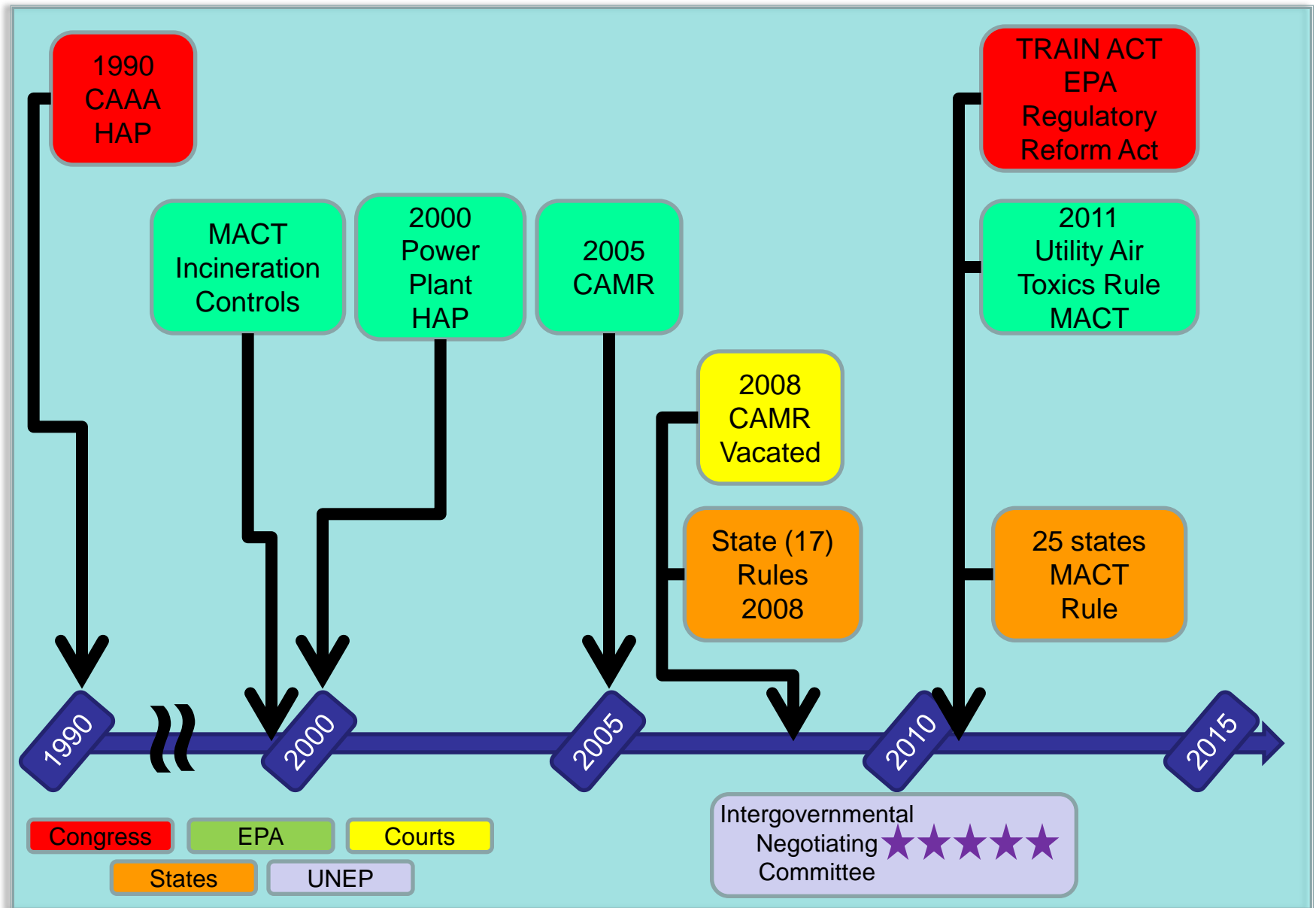
## **Maximum Achievable Control Technology** **Clean Air Act Section 112**

The maximum degree of emissions reduction achievable taking into consideration cost, any non-air quality health and environmental impacts and energy requirements.

- **For existing facilities:**
  - No less stringent than the average emissions limit achieved by the best performing 12% of the sources.
- **For new facilities:**
  - No less stringent than the emissions limit achieved by the best controlled existing source.



# US Mercury Emission Policy Timeline

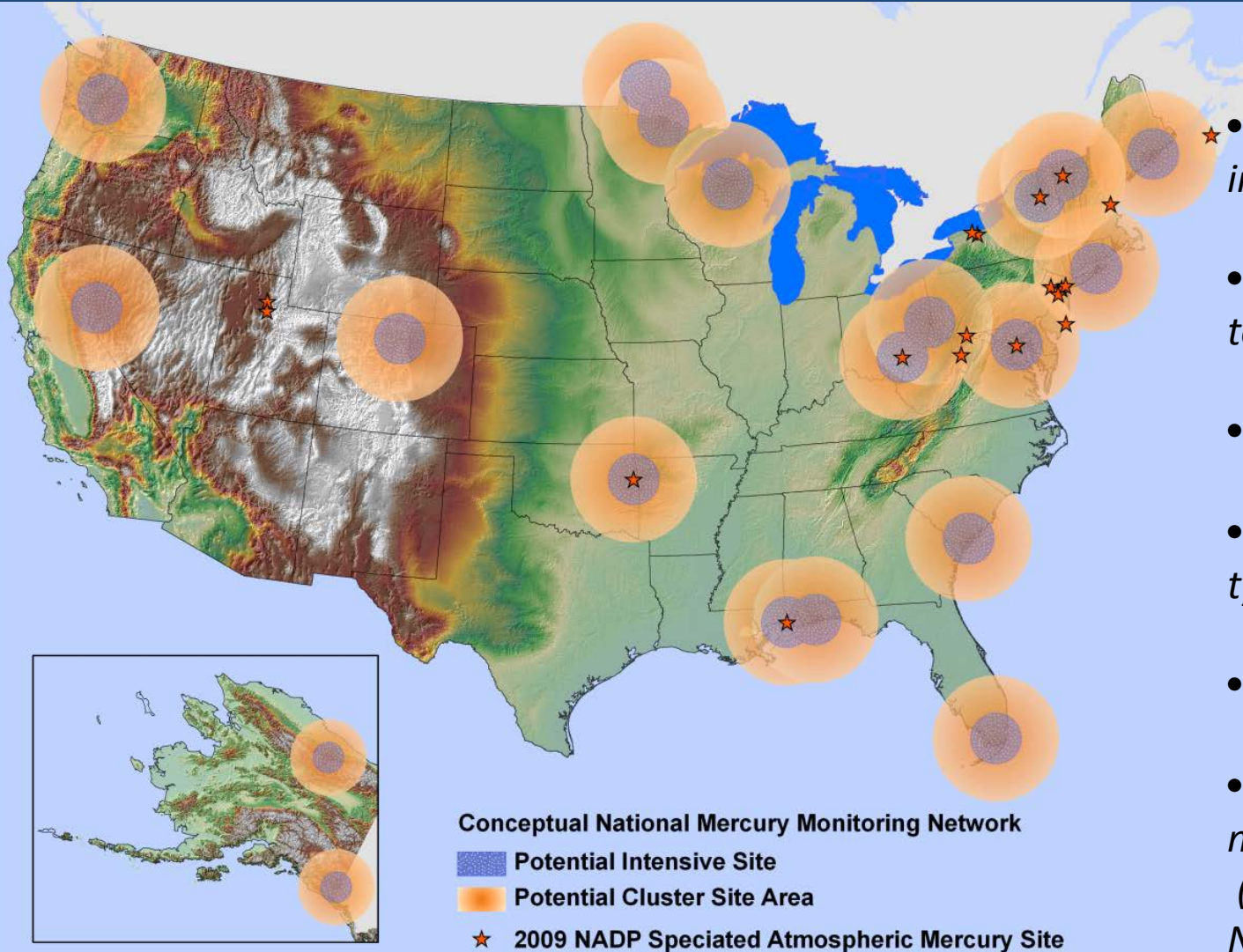


# Policy Drivers

## Upcoming MACT Standards for Sources of Mercury

Source Category	Proposal Date	Final Date
Coal-fired Power Plants	3/2011	11/2011
Industrial Boilers	4/2010	12/2010
Commercial and Industrial Solid Waste Incinerators*	4/2010	12/2010
Hazardous Waste Combustors*	TBD	TBD
Chlor-Alkali Manufacturing	5/2010	TBD
Portland Cement	4/2009	3/2010
Industrial Gold Production	4/2010	12/2010
Taconite Iron Mines	8/2013	10/2014
Electric Arc Furnaces	TBD	TBD
Integrated Iron and Steel	TBD	TBD

# MercNet Provides Comprehensive Geographical Coverage



- ★ *Baseline data and infrastructure*
- Will we see and be able to understand a change?*
- Model evaluation*
- Want a range of site types*
- Global source impacts*
- Collaboration w/Nat. networks  
(NADP, LTER, CASTNET, NEON )*

# Take Home Messages

1. Mercury contamination is more extensive and severe than previously documented.
2. Past mercury controls have been beneficial but mercury in fish and wildlife continue to exceed ecological and human health risk thresholds.
3. Further decreases in mercury emissions from US sources would have additional benefits, roughly in proportion to level of declines.
4. A comprehensive mercury monitoring system would help evaluate trends and effectiveness of policy decisions.

# Research Needs

- Multi-media monitoring of mercury in air, deposition, ecosystem components and biota.
- Improved models to understand and predict the fate and effects of changes in mercury deposition.





# Acknowledgements

- Kathy Lambert, David Schmeltz, Elsie Sunderland, Dave Evers, Jim Weiner, Madeline Turnquist, Kim Driscoll, Maureen Hale
- NYSERDA, U.S.EPA GLAD

**Table 1 Fish Mercury Concentrations and Meal Frequency Guidelines**

Recommended guidelines and criteria for protection of *sensitive populations* (children and women of childbearing age) who eat wild-caught (noncommercial) fish, in relation to mercury concentrations in fish fillets.

Guideline or criterion	Mercury in fish (ppm wet weight)	Fish consumption guidance
Great Lakes Fish Advisory Workgroup <sup>1</sup>	≤0.05	unrestricted
	>0.05-0.11	2 meals per week
	>0.11-0.22	1 meal per week
	>0.22-0.95	1 meal per month
	>0.95	no consumption
U.S. EPA <sup>2</sup>	0.30	2-3 meals per month <sup>3</sup>
Ontario <sup>4</sup>	<0.26	8 meals per month
	0.26-0.52	4 meals per month
	>0.52	no consumption

1 Recommended guidelines by the Great Lakes Fish Advisory Workgroup (2007).

2 A water quality criterion for methylmercury in fish established to protect the health of persons who consume noncommercial fish (Borum et al. 2001).

3 Based on a consumption rate of 17.5 grams of fish per day (equivalent to 0.53 kilogram or 1.2 pounds of fish per month).

4 Guidelines by Ontario Ministry of the Environment (Bhavsar et al. 2011).