

**Camp Resources XXII, Aug. 2015**

Center for Environmental and Resource Economic Policy (CEnREP) at NC State University

# **Measuring the Value of Hg and Acid Pollution in New York State through Property Values**

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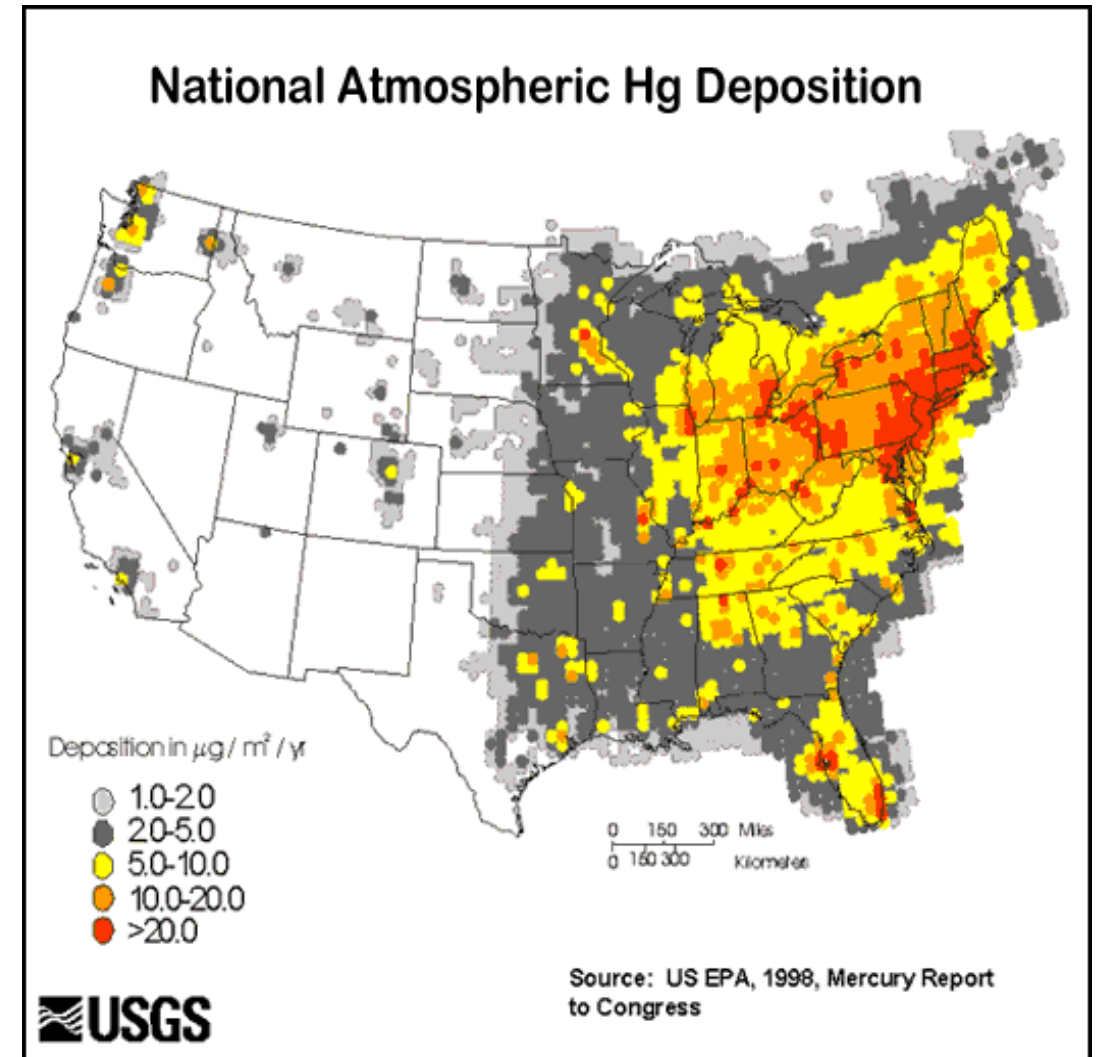
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*Civil Environmental Engineering*

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# Why Mercury?

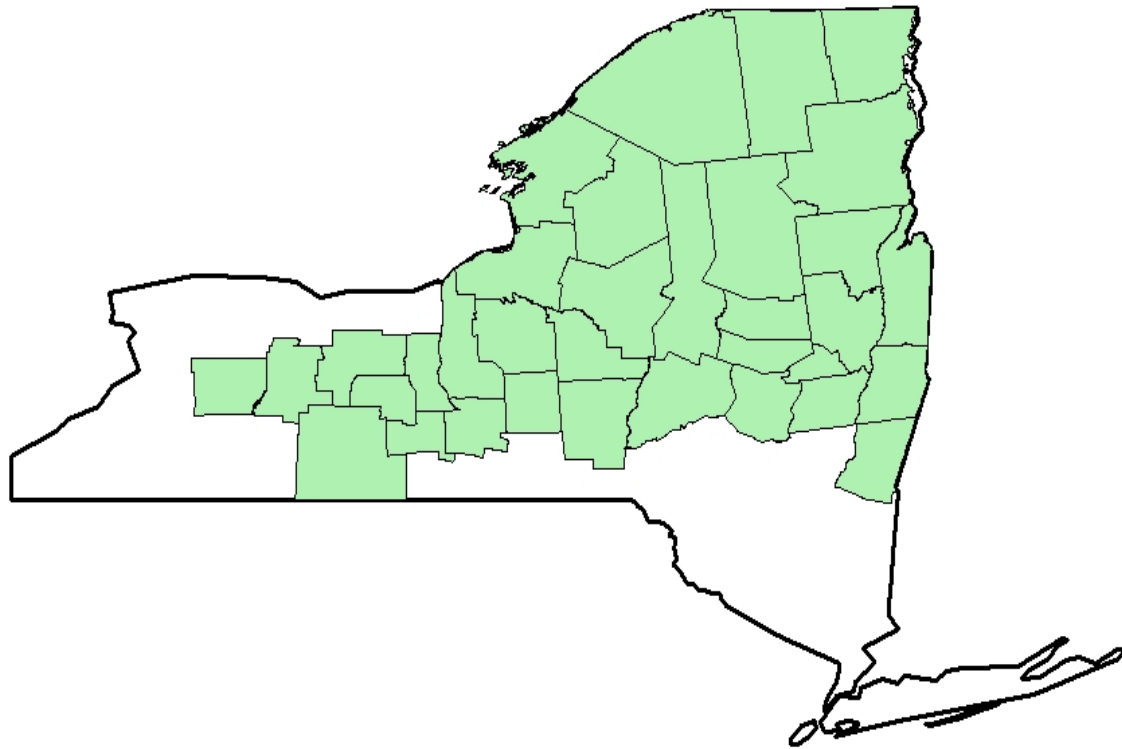


# Research Questions & Challenge

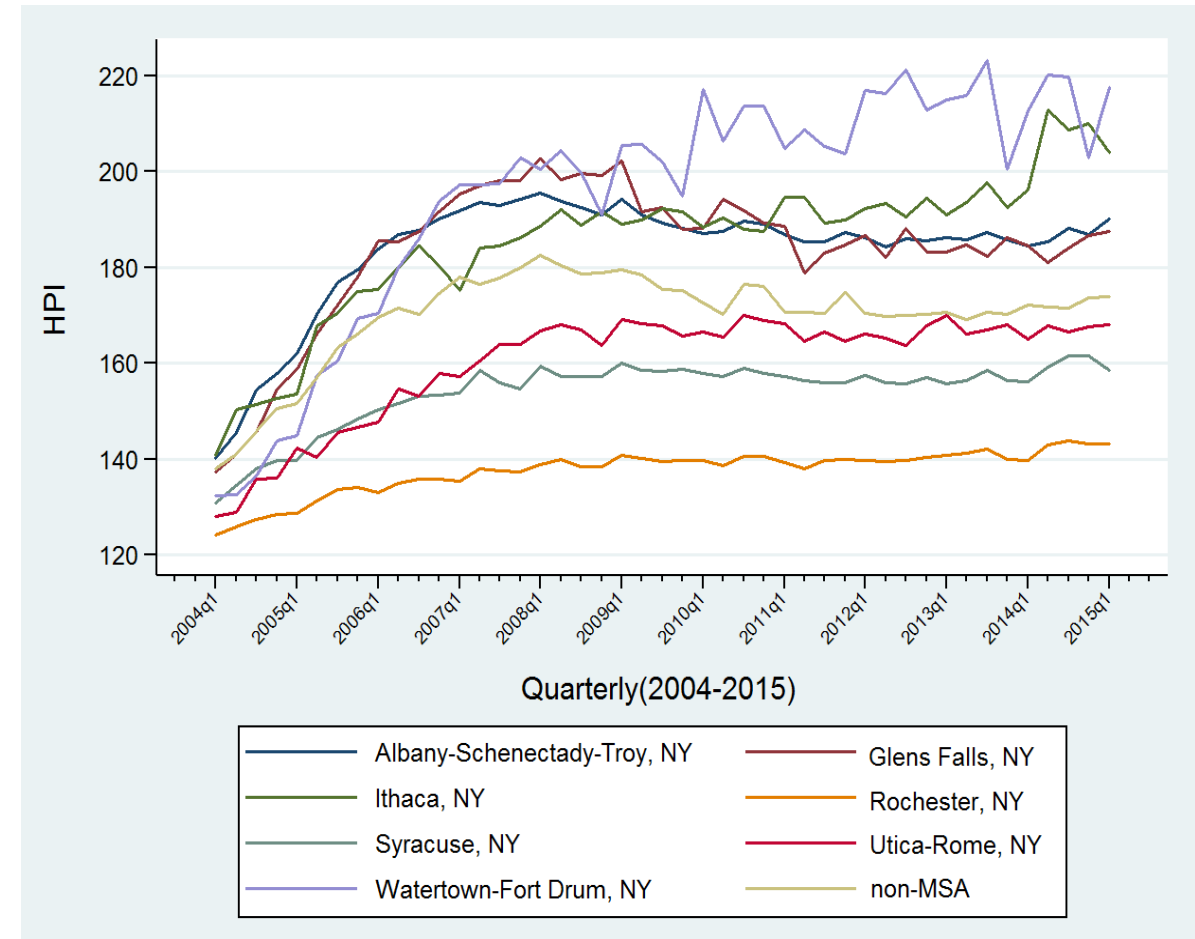
- ❖ To measure the cost for lessening aqueous environmental pollution caused by global pollutant in wide geographical area.
- Whether non-waterfront house owners value the environmental amenities of bigger lakes nearby?
- To what extent can large sample size be of help to facilitate the hedonic analysis technique?



# Transaction Data

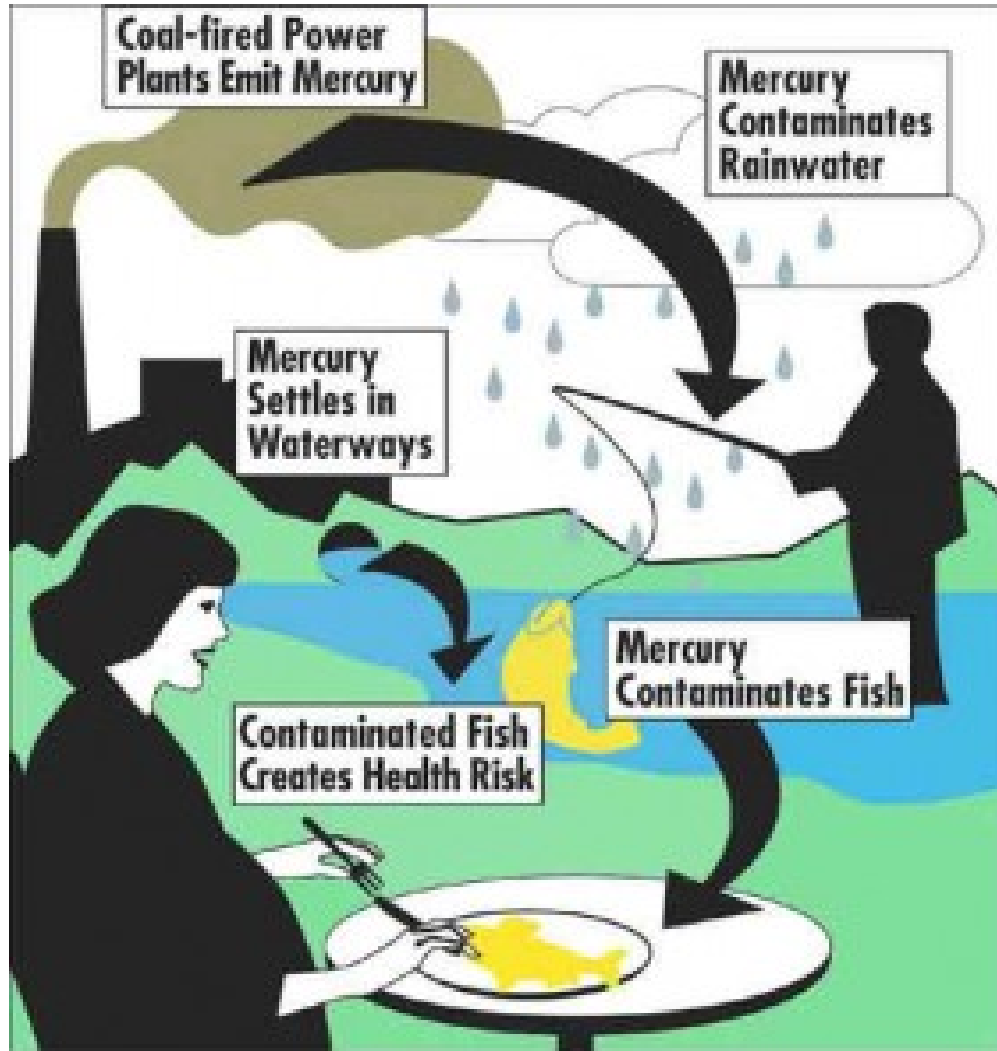


Study Boundary: 34 counties in northern New York State  
Time Frame: 2004 ~ 2013  
Total: 180,000 transaction



Transaction data are normalized to the same level of year 2004 using FHFA House Price Index (HPI).

# Fish Mercury as an indicator

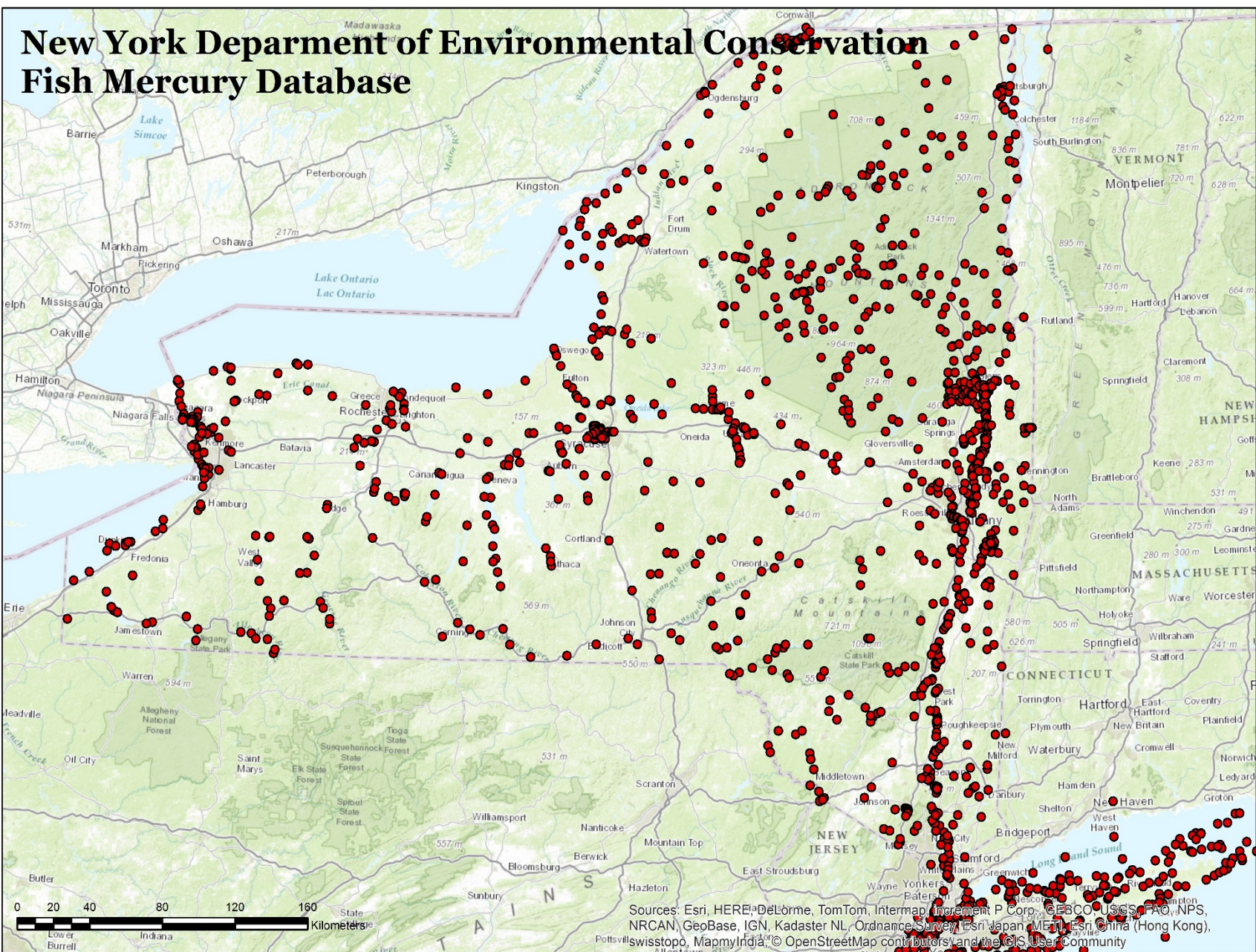


Fish Mercury Data Descriptive Statistics

	Summary
Yearly Fish Mercury Observation	9825
Fish Species	56
Avg. Fish Length (mm)	309
Time Frame	1990-2009
Sampled Lakes	147
Avg. Lakes Size (sq km)	32.3



# New York Department of Environmental Conservation Fish Mercury Database



# New York State Department of Environmental Conservation Fish Mercury Database

Data Provider:  
**NYSDEC**

Type of Data: Total mercury in fish tissue  
Number of Sites: 1851 sampling sites state-wide

Data period: Back from 1970 to 2011, but not consistent



# Model Specification

Categorical:  
High (  $\geq 0.4$  ppm)  
Medium (  $\geq 0.26$  &  $< 0.4$  ppm)  
Low (  $< 0.26$  ppm)  
Unknown

Interaction between lake pH and  
dummy indicating lakes in ADK

$$\ln(\text{price}_{ijt}) = b + \lambda_t + \alpha_j + \psi \text{Structure}_{ijt} + \delta \text{Distance}_{ij} + \beta \text{FishHg}_{ijt} + \theta \text{pH}_{ijt} + \xi \text{pH}_{ijt} * \text{ADK}_{ij} + \omega_{jt} + \sigma_{ijt}$$

Categorical:  
Poor pH (  $\leq 6.5$  &  $\geq 8.0$ )  
Normal pH  
Unknown

*Fixed Effect Level: Census Block Group*

**Table. Hedonic Analysis Result on Fish Mercury and pH for Lakes of Different Sizes Categories**

	Model 1 (Lakes larger than 27 ha)		Model 2 (Lakes larger than 73 ha)		Model 3 (Lakes larger than 282 ha)	
	<i>OLS</i>	<i>Fixed Effect</i>	<i>OLS</i>	<i>Fixed Effect</i>	<i>OLS</i>	<i>Fixed Effect</i>
<i>Medium Fish Hg Conc.</i> ( $\geq 0.26$ & $< 0.4$ ppm)		-0.0180*** (0.00511)		-0.0174*** (0.00515)		-0.0133** (0.00602)
<i>High Fish Hg Conc.</i> ( $\geq 0.4$ ppm)		0.00509 (0.00741)		-0.00497 (0.00717)		-0.0172*** (0.00569)
<i>Fish Hg Conc.</i> (unknown)		0.0262*** (0.00682)		0.0644*** (0.00730)		0.0931*** (0.0111)
<i>pH Poor</i> ( $\leq 6.5$ or $\geq 8$ )		0.00360 (0.00633)		0.0234*** (0.00807)		-0.0185 (0.0135)
<i>pH unknown</i>		-0.0327*** (0.00750)		-0.0110 (0.00894)		-0.0264** (0.0111)
<i>pH Poor in ADK area</i> ( $\leq 6.5$ or $\geq 8$ )		-0.000658 (0.0146)		-0.0473*** (0.0142)		-0.0415** (0.0188)
<i>pH unknown in ADK area</i>		0.00324 (0.0126)		-0.0467*** (0.0141)		-0.0376** (0.0184)
<i>Constant</i>		8.635*** (0.103)		8.560*** (0.104)		8.676*** (0.106)
<i>R-squared</i>		0.363		0.365		0.364
<i>Year &amp; Month Dummy</i>		Yes		Yes		Yes
<i>Observations</i>		179164		179164		179164
<i>Sampled Lake/All lake</i>		133/331		101/182		53/76

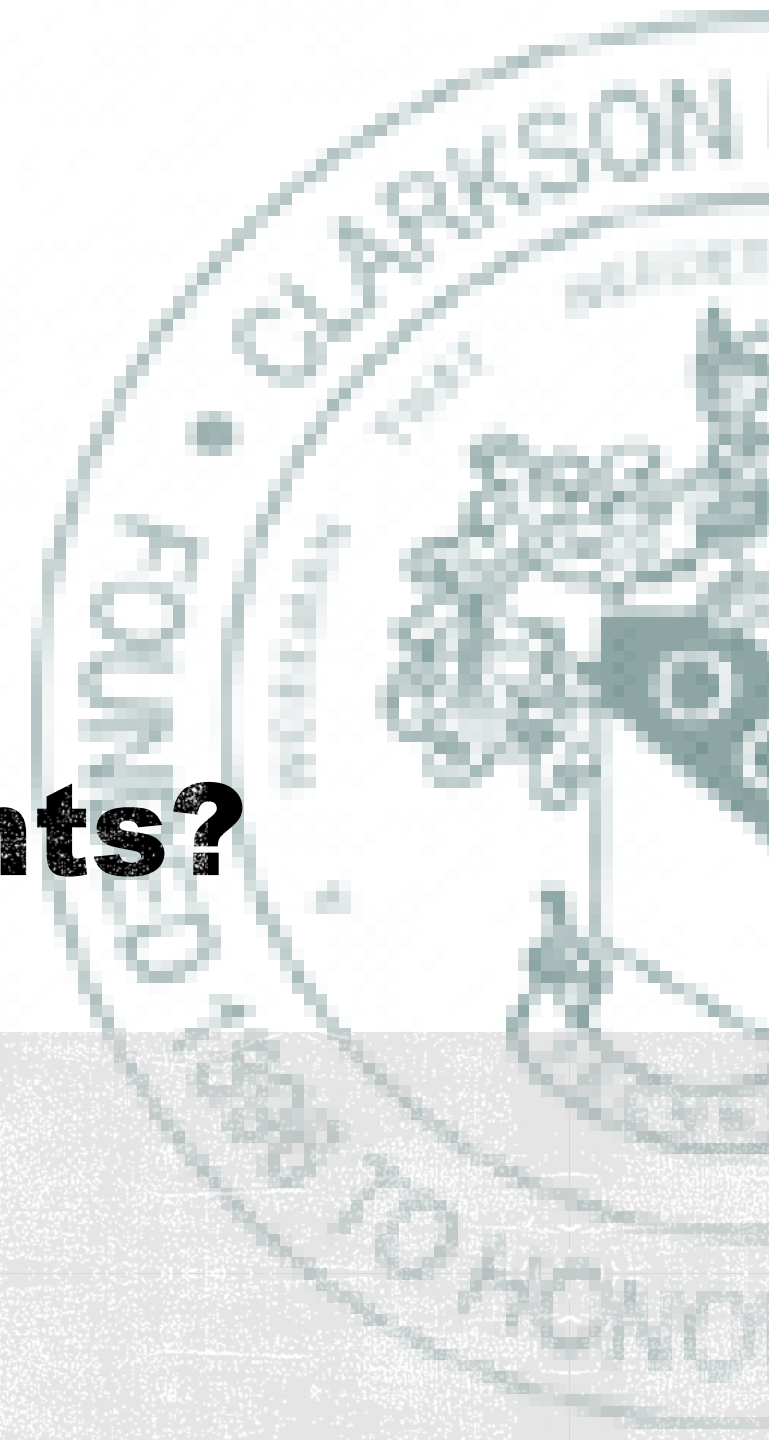


# Next Step

- Applying bootstrapping technique to verify current analysis results and to test assumptions;
- Perform model simulation integrating various pollution scenarios;
- Predict the effects of proposed policy relating to mercury reduction.

**Thank you!**

**Questions and Comments?**



# Fish Mercury Data Problem

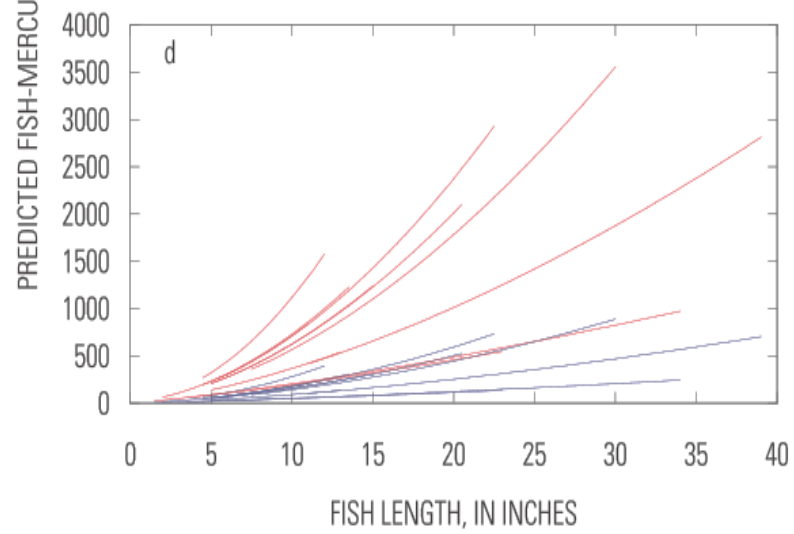
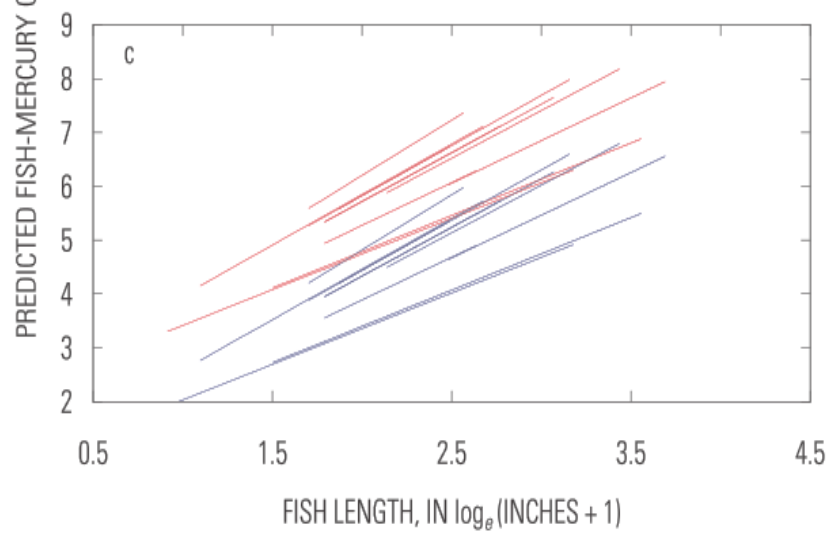
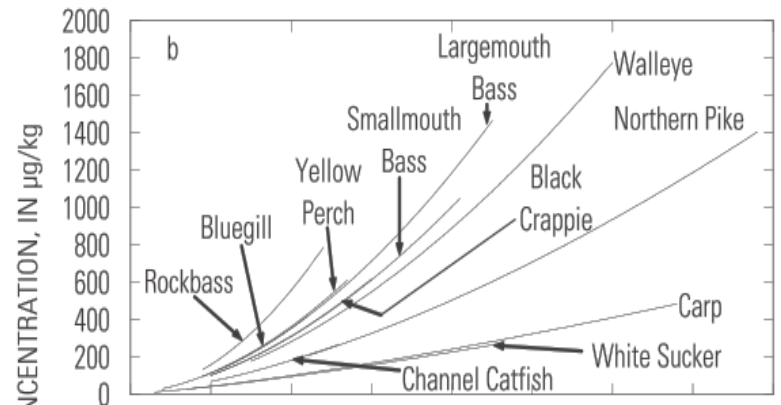
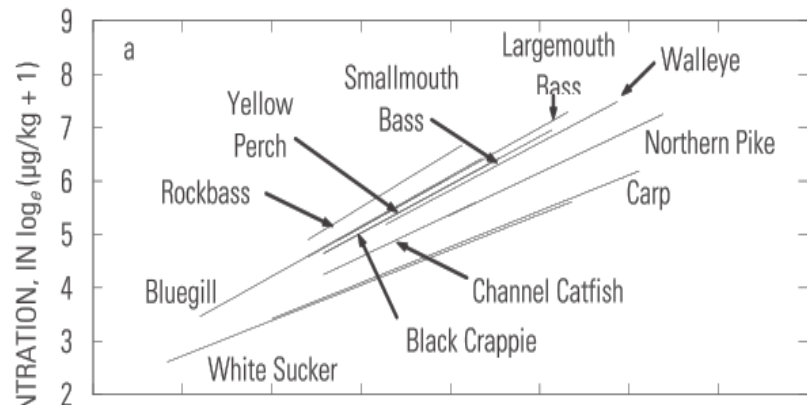
- ❑ Collected fish mercury data from different sources cannot be used directly to compare the mercury pollution in different lakes due to the inconsistency of sample's characteristics (e.g., species, length, tissue part, etc.);
- ❑ Variation in fish mercury concentrations due to differences in the characteristics of samples collected over time or across space can be misattributed to temporal or spatial trends;
- ❑ Actual trends in fish mercury concentration can be misattributed to differences in sample characteristics.

Species	Size Class1	Size Class2	Size Class3
A	?	Sampled	?
B	Sampled	?	Sampled
C	?	Sampled	?
D	?	?	Sampled

Species	Sampling Event 1	Sampling Event 2	Sampling Event 3
A	X	X	NA
B	X	NA	X
C	NA	X	NA
D	NA	NA	X



$$Hg_{std} = Hg_{obs} / \left( f_{HgY} + f_{HgW} W^{\frac{2}{3}} \right)$$



1-kg pike standardization model:

$Hg_{std}$  is the standardized mercury concentration while  $Hg_{obs}$  is the observed mercury concentration;  $f_{HgY}$  is a parameter representing the concentration ratio between newly hatched young fish and 1-kg pike, and  $f_{HgW}$  is a species-specific empirical coefficient;  $W$  is the wet weight of fish sample.

Specifically, 9722 fish mercury observations over 20 years (1990 – 2009) from 147 lakes within our study area were standardized to correspond to a 1-kg pike in the same lake.

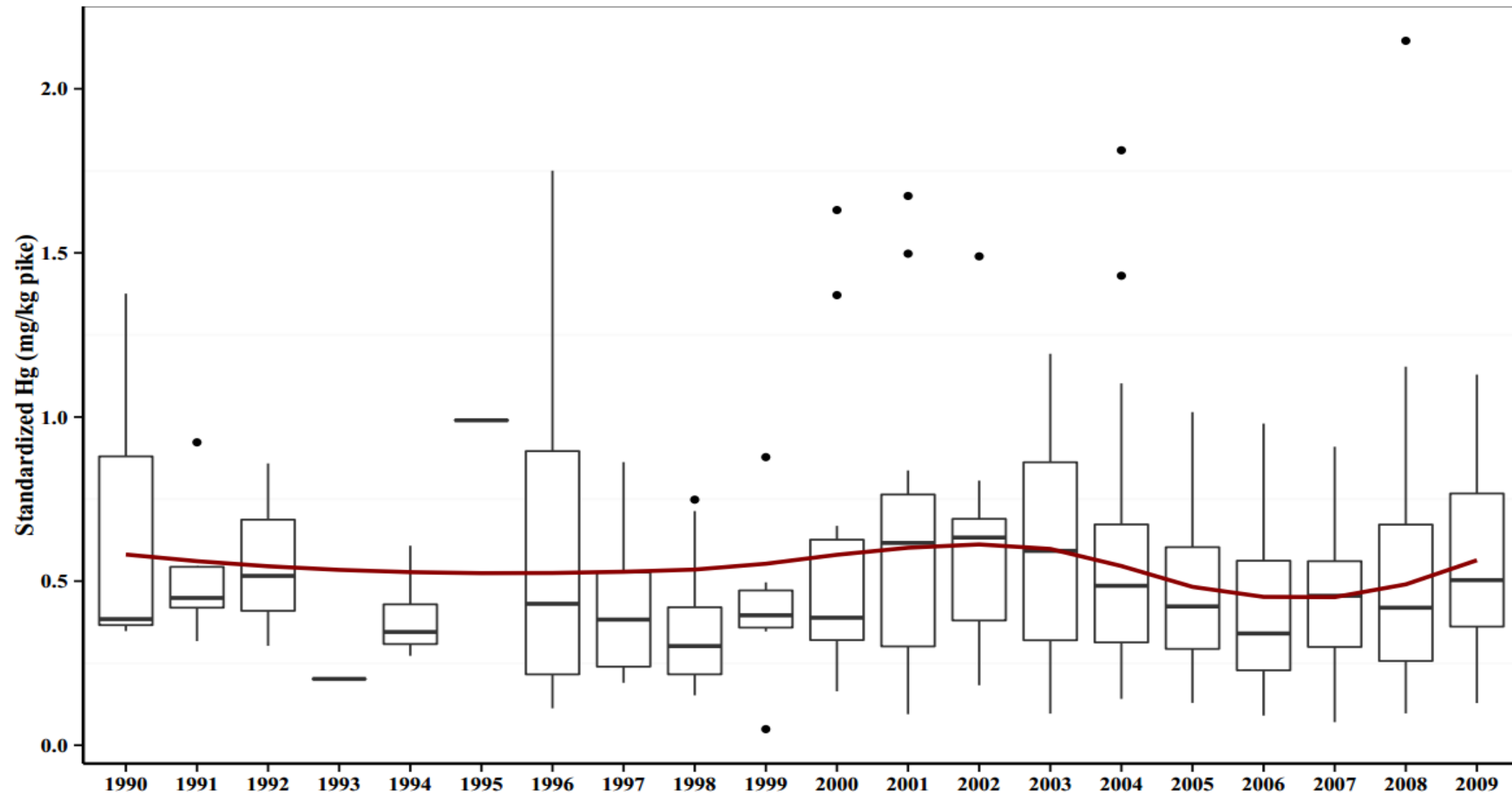


Fig. 1 Temporal Trend of Fish mercury (Standardized to 1 kg pike equivalent) from 1990 through 2009 in 147 lakes within study boundary.