

Spatial Patterns of Total and Methyl Mercury in Lakes across the Upper Midwest

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Presentation Outline:

- Overview of the EPA National Lakes Assessment
- Results from the Upper Midwest Survey
- Future directions and discussion

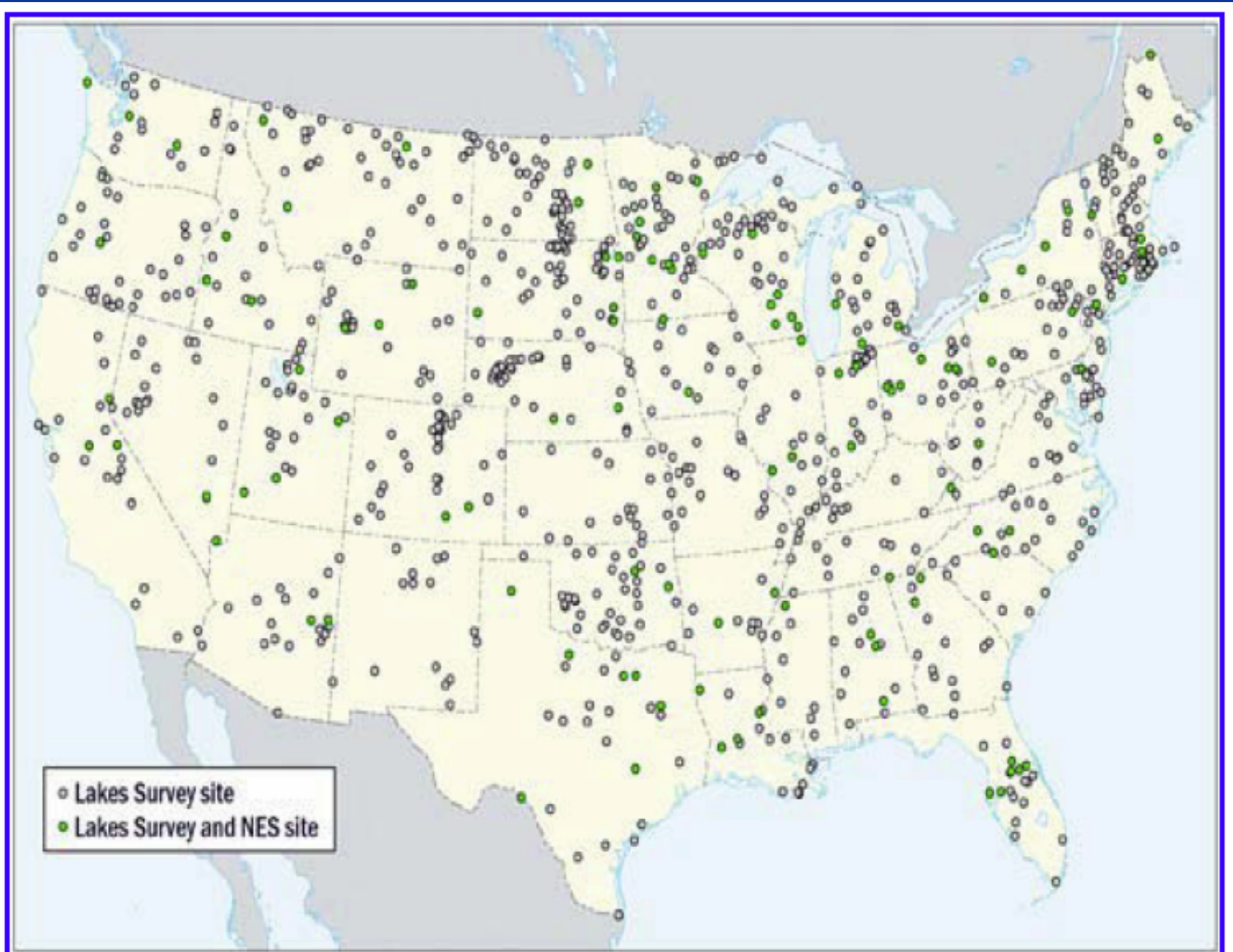


2007 USEPA National Lakes Survey:

- 909 lakes across the coterminous US
- Status of the nations lakes using indicators of indicators of trophic state, ecological health, and recreation
- Provide information on key stressors: nutrients and pathogens (and contaminants)
- Probability-based network to represent conditions of all lakes across each region
- Consistent procedures used across sites to ensure results are comparable



2007 USEPA National Lakes Survey Sampling Sites



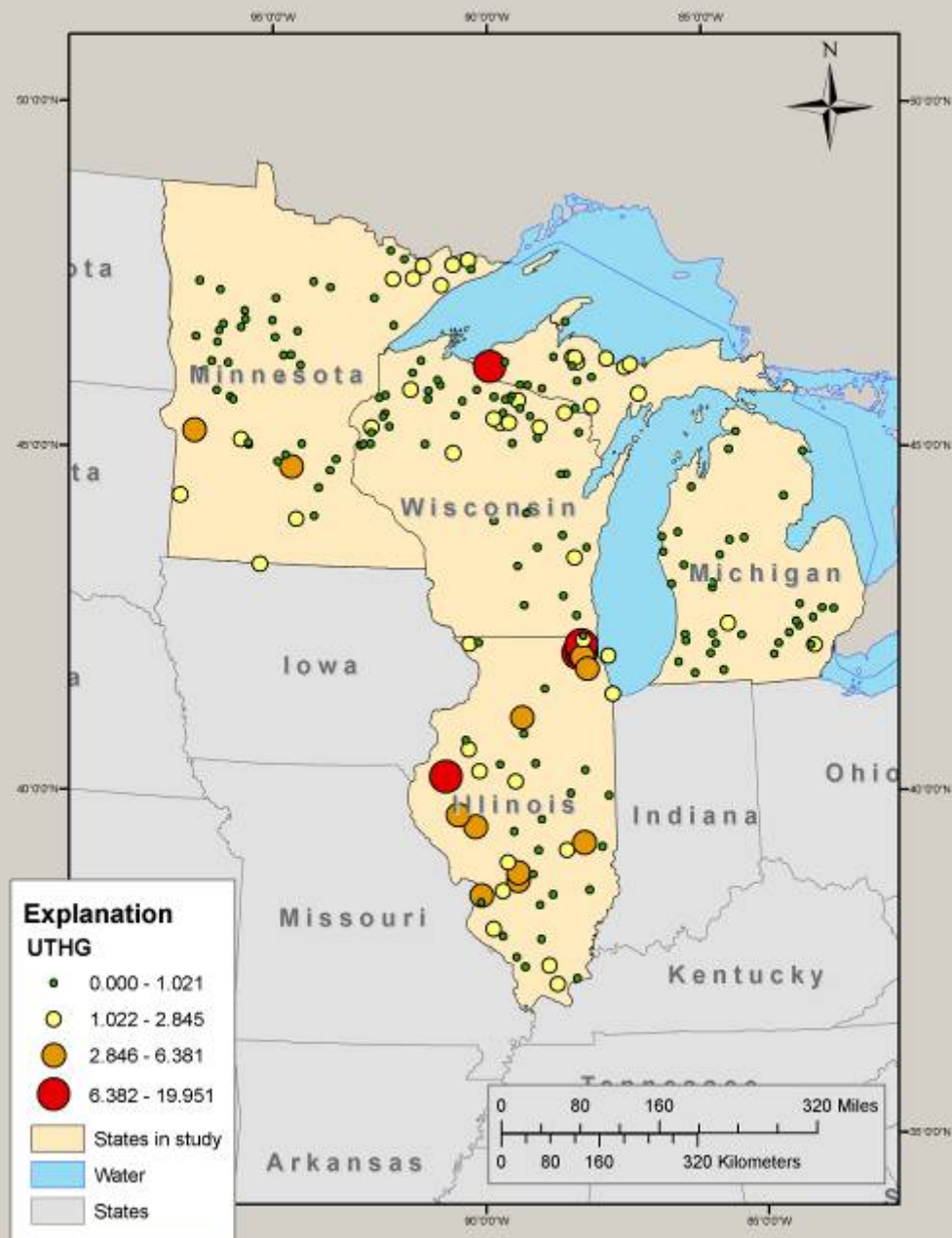
Upper Midwest Lakes Survey Sampling Sites:

- 234 Individual Sites (EPA lakes plus “enhancements”)
- Additional 26 hypolimnion samples taken in Michigan
- Clean sampling techniques used by all sampling crews
- Sample containers, gloves, etc... provided by single source (USGS)
- Sample analysis (THg, MeHg, DOC) all conducted at a single lab – USGS Mercury Research Lab



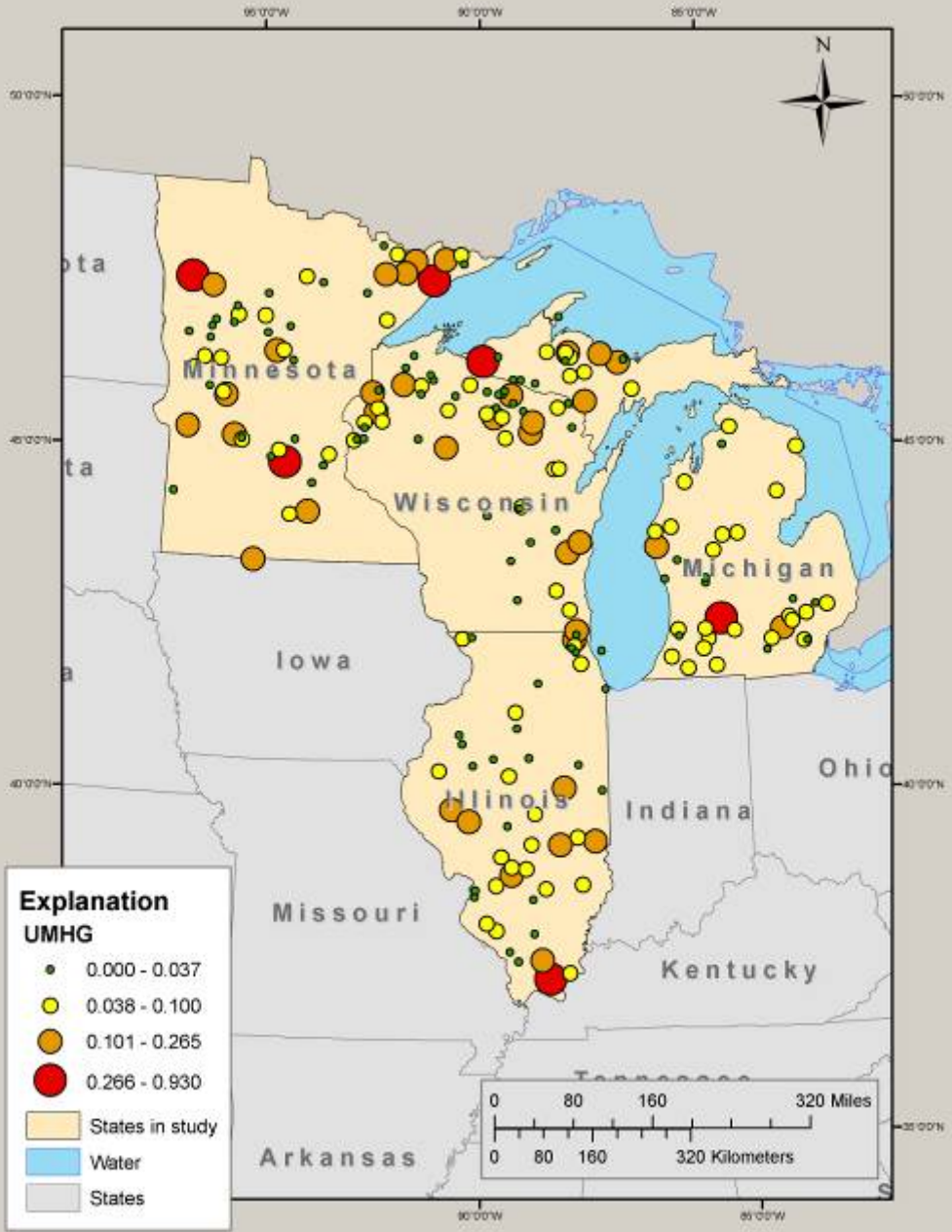
Total Hg Results:

| State | THg (ng/L) | SD |
|-----------|------------|------|
| Illinois | 2.24 | 2.62 |
| Michigan | 1.13 | 2.49 |
| Wisconsin | 0.68 | 0.40 |
| Minnesota | 0.93 | 1.04 |



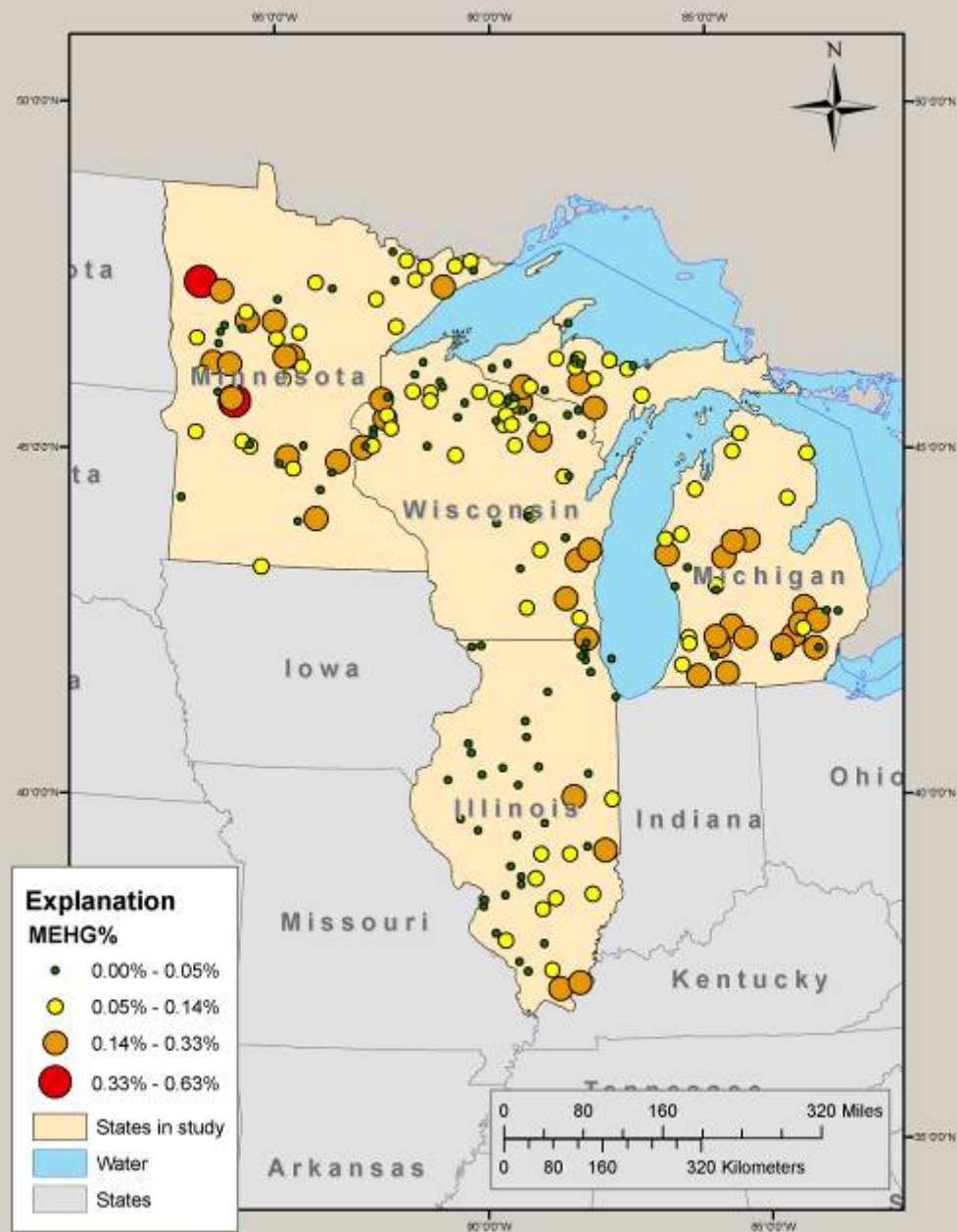
MeHg Results:

| State | MeHg (ng/L) | SD |
|-----------|-------------|------|
| Illinois | 0.07 | 0.08 |
| Michigan | 0.09 | 0.15 |
| Wisconsin | 0.06 | 0.06 |
| Minnesota | 0.09 | 0.10 |

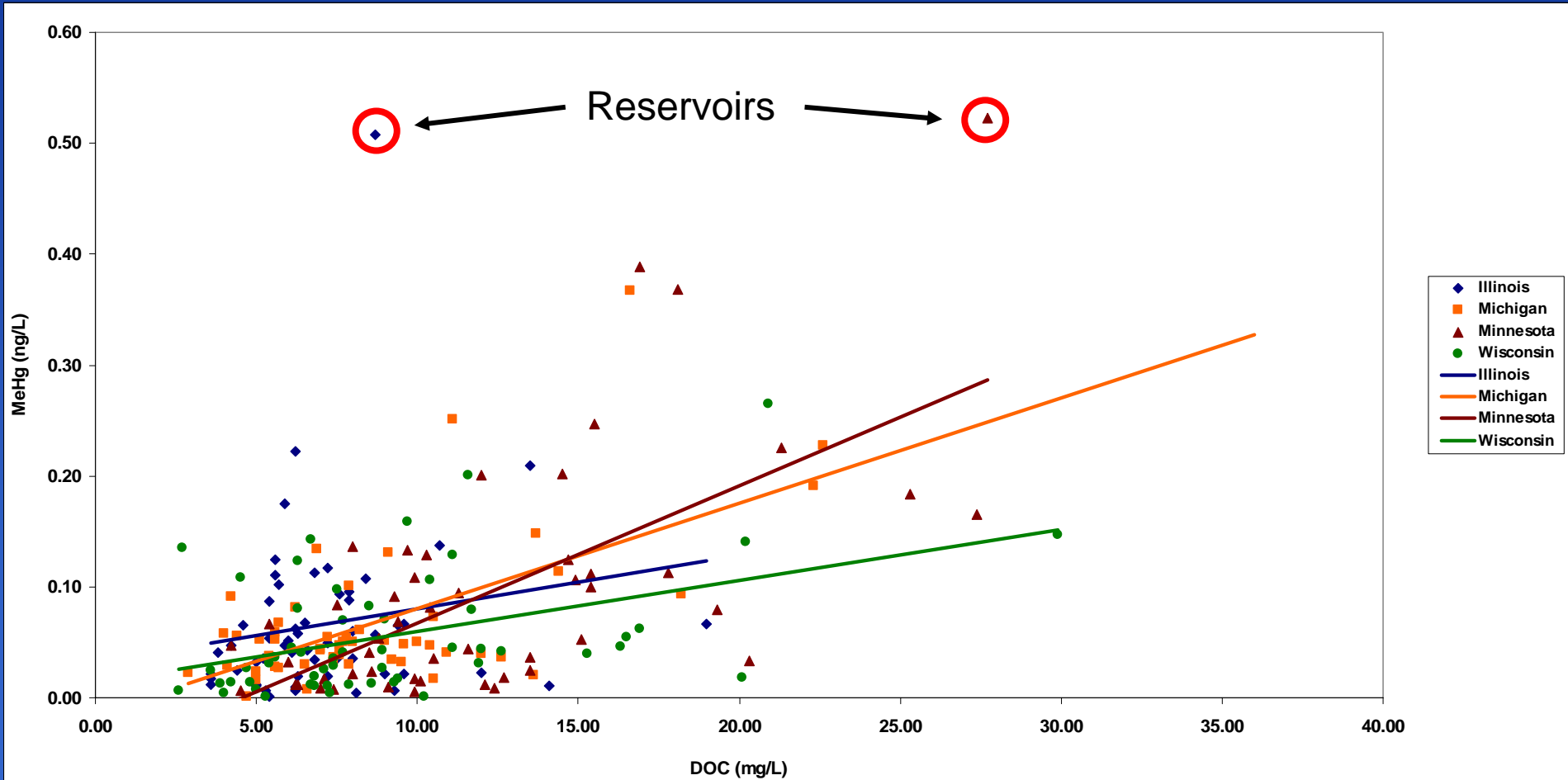


%MeHg Results:

| State | % MeHg | SD |
|-----------|--------|------|
| Illinois | 0.03 | 0.06 |
| Michigan | 0.11 | 0.06 |
| Wisconsin | 0.08 | 0.07 |
| Minnesota | 0.12 | 0.11 |

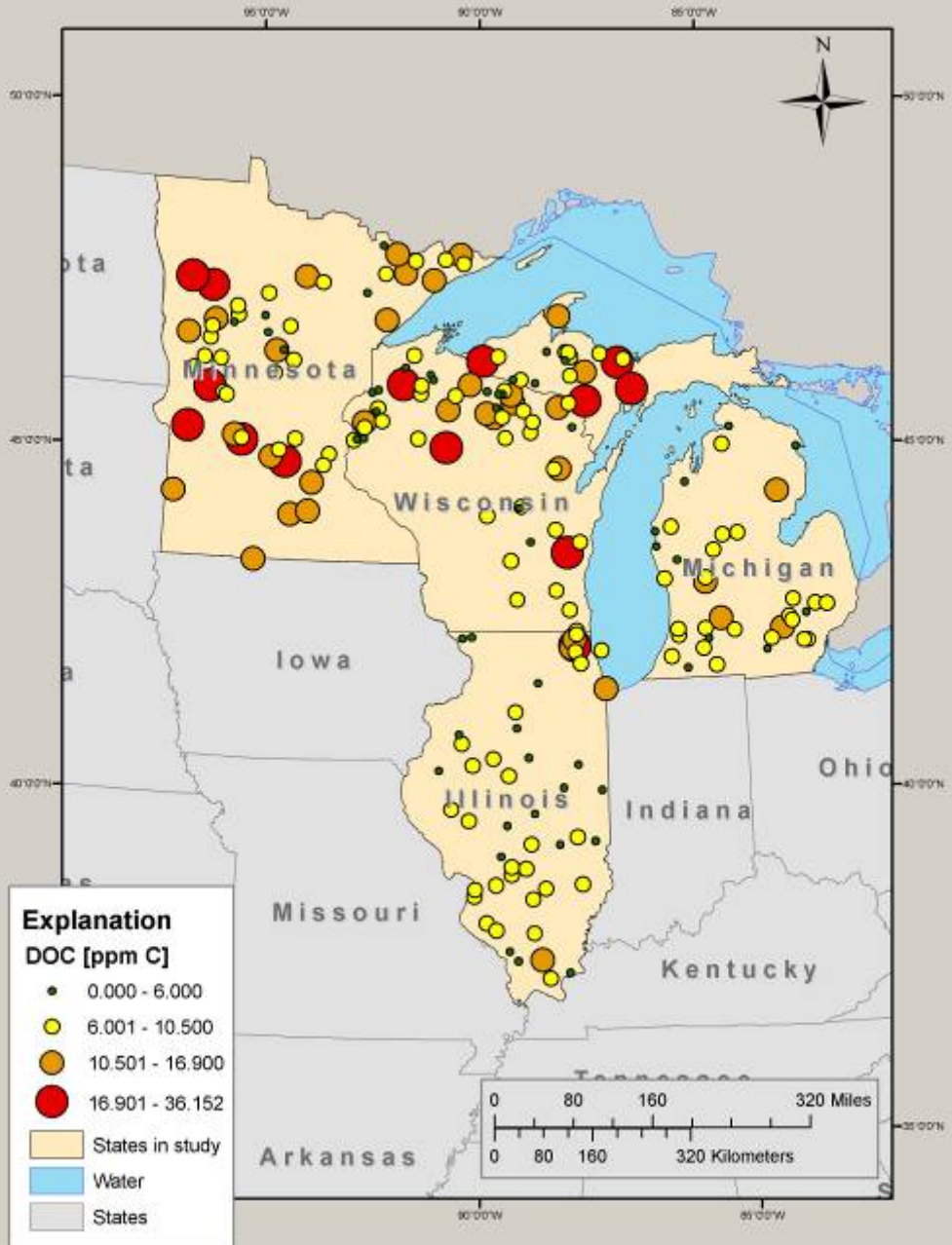


Dissolved Organic Carbon (DOC) A Driver?

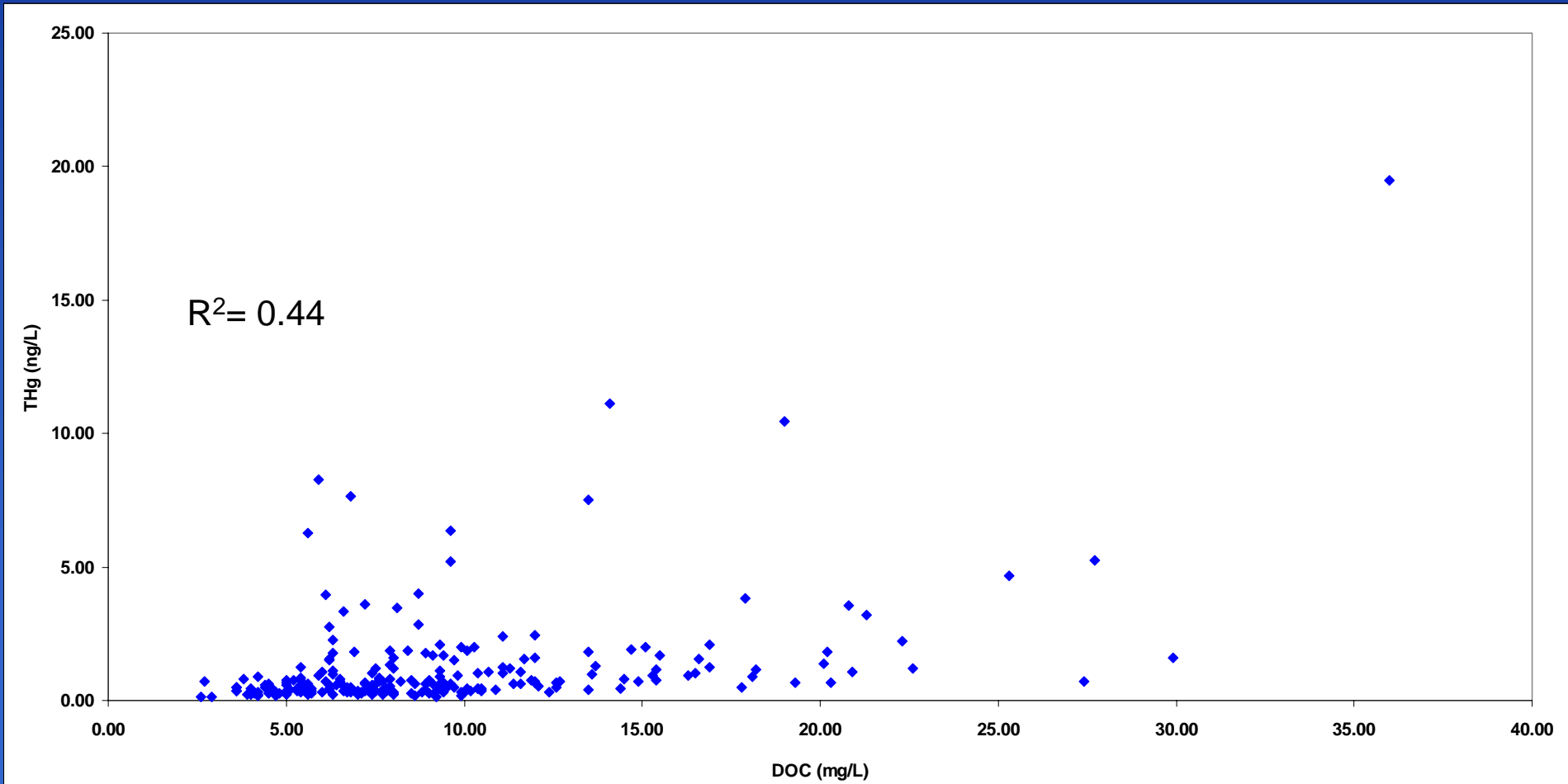


DOC Results:

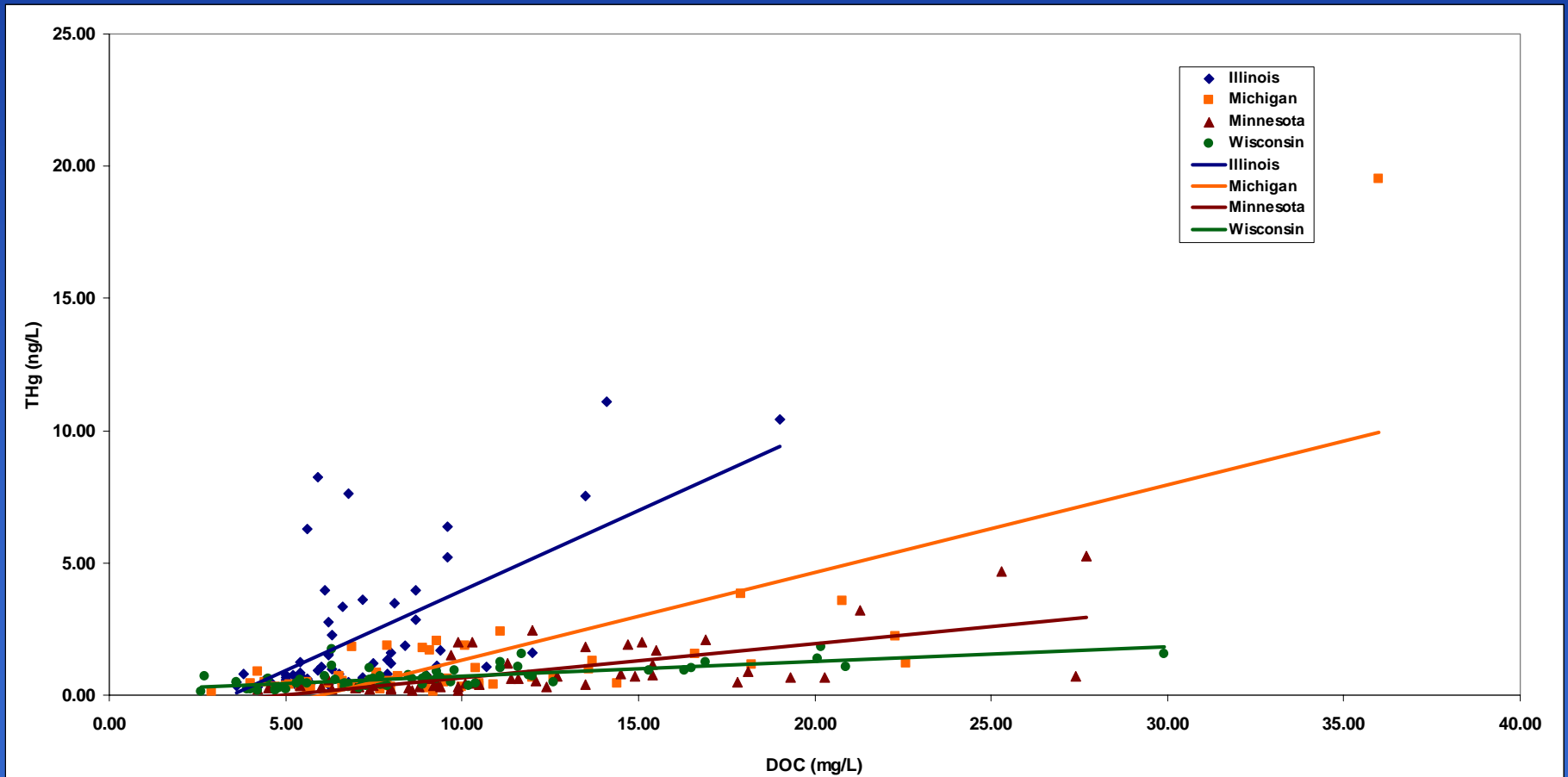
| State | DOC (mg/L) | SD |
|-----------|------------|-----|
| Illinois | 7.1 | 2.8 |
| Michigan | 9.5 | 5.6 |
| Wisconsin | 9.5 | 5.1 |
| Minnesota | 12.1 | 5.4 |



Is DOC Really a Strong Driver?

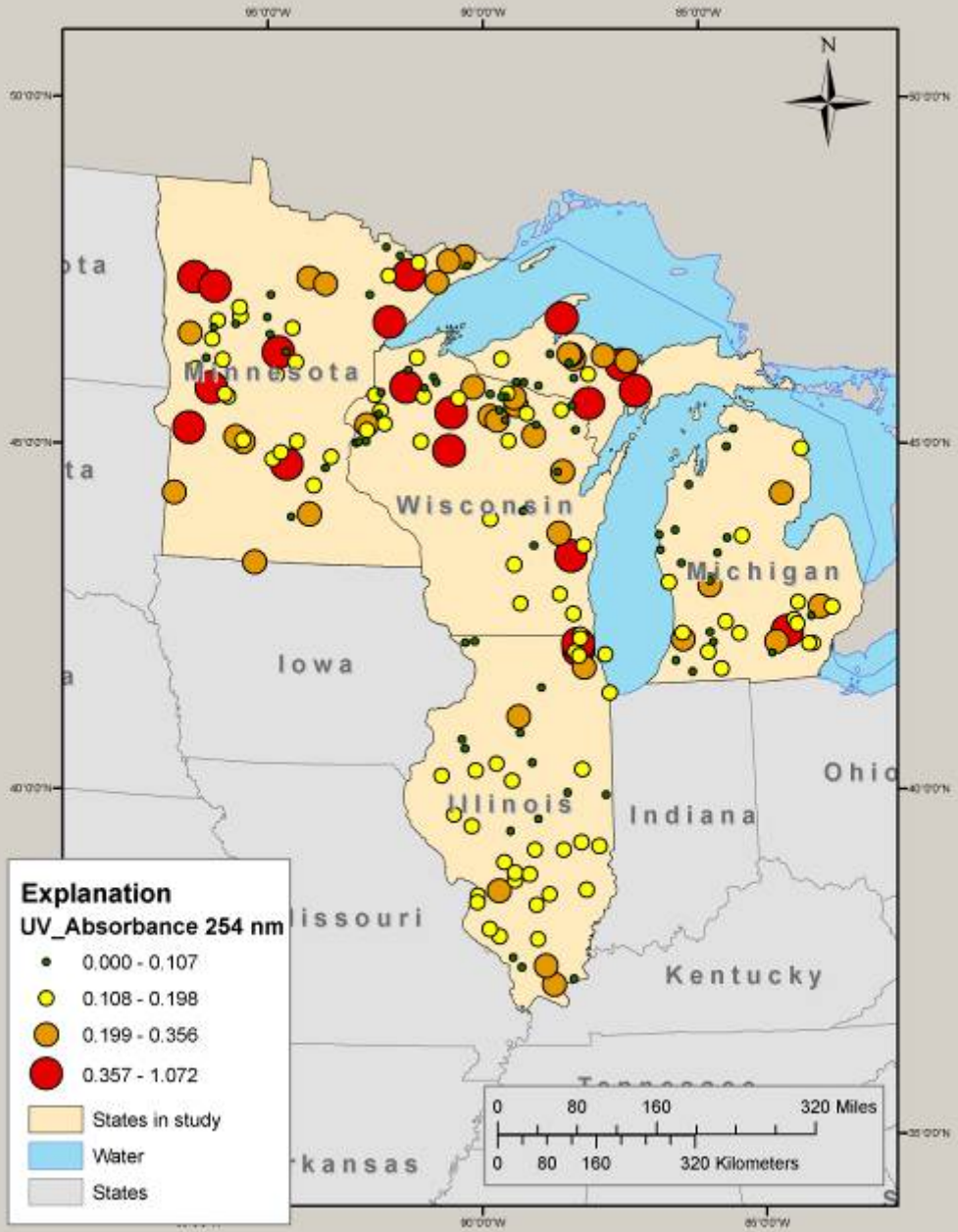


Yes, the answer is in the details!

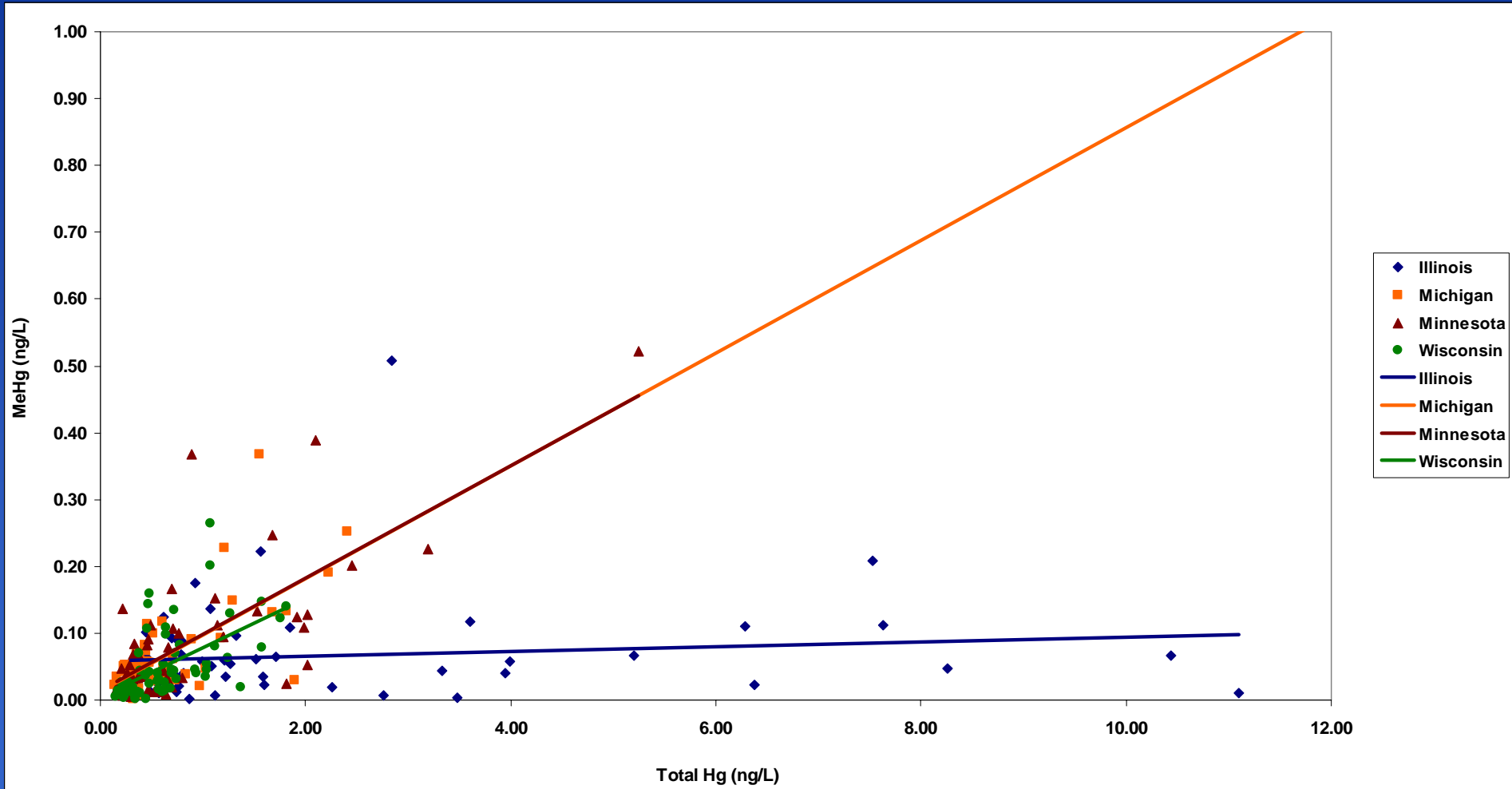


More on DOC:

| State | UV Abs. 254nm | SD |
|-----------|---------------|------|
| Illinois | 0.15 | 0.07 |
| Michigan | 0.22 | 0.25 |
| Wisconsin | 0.20 | 0.19 |
| Minnesota | 0.22 | 0.14 |



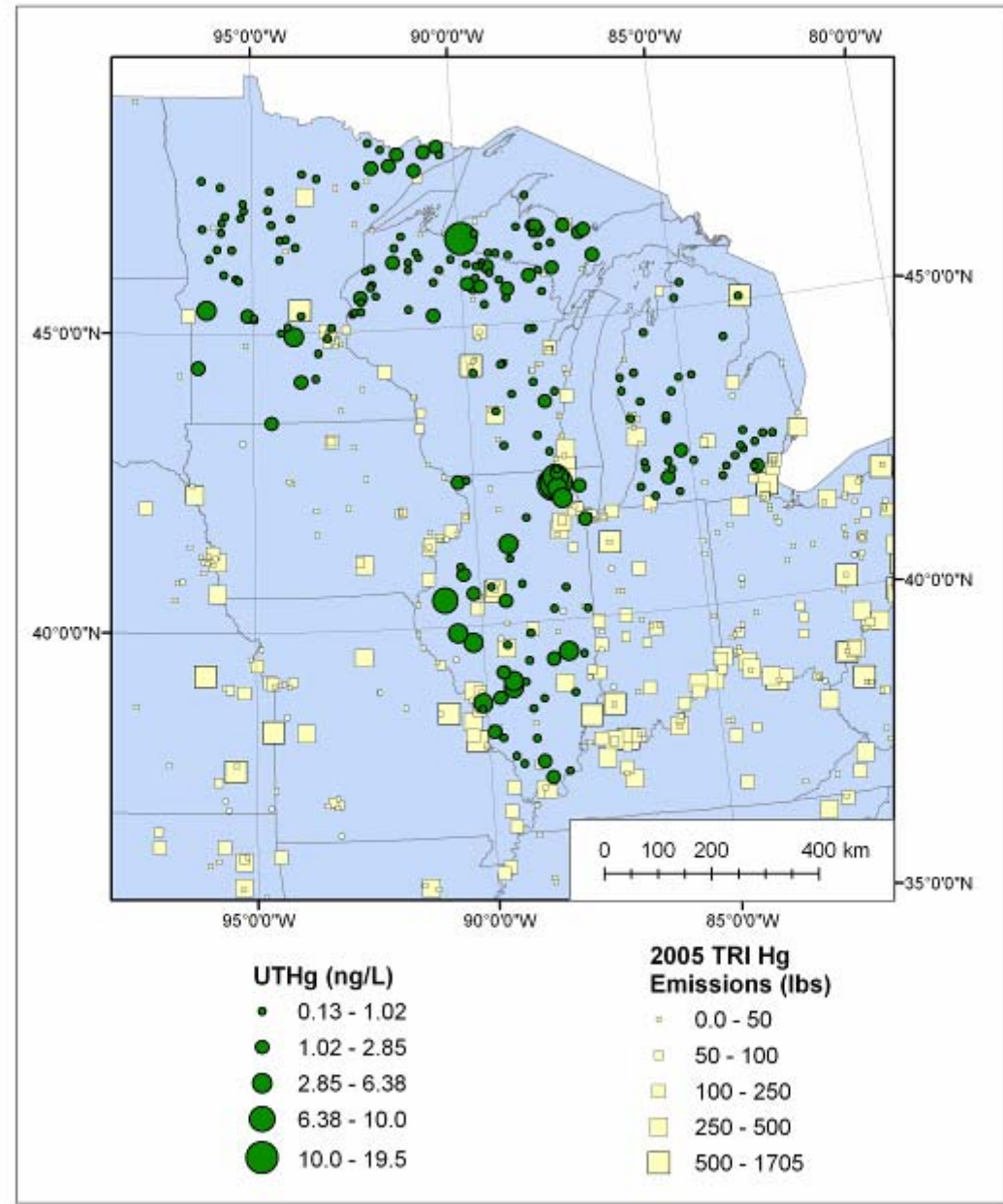
How Important is Mercury Load?



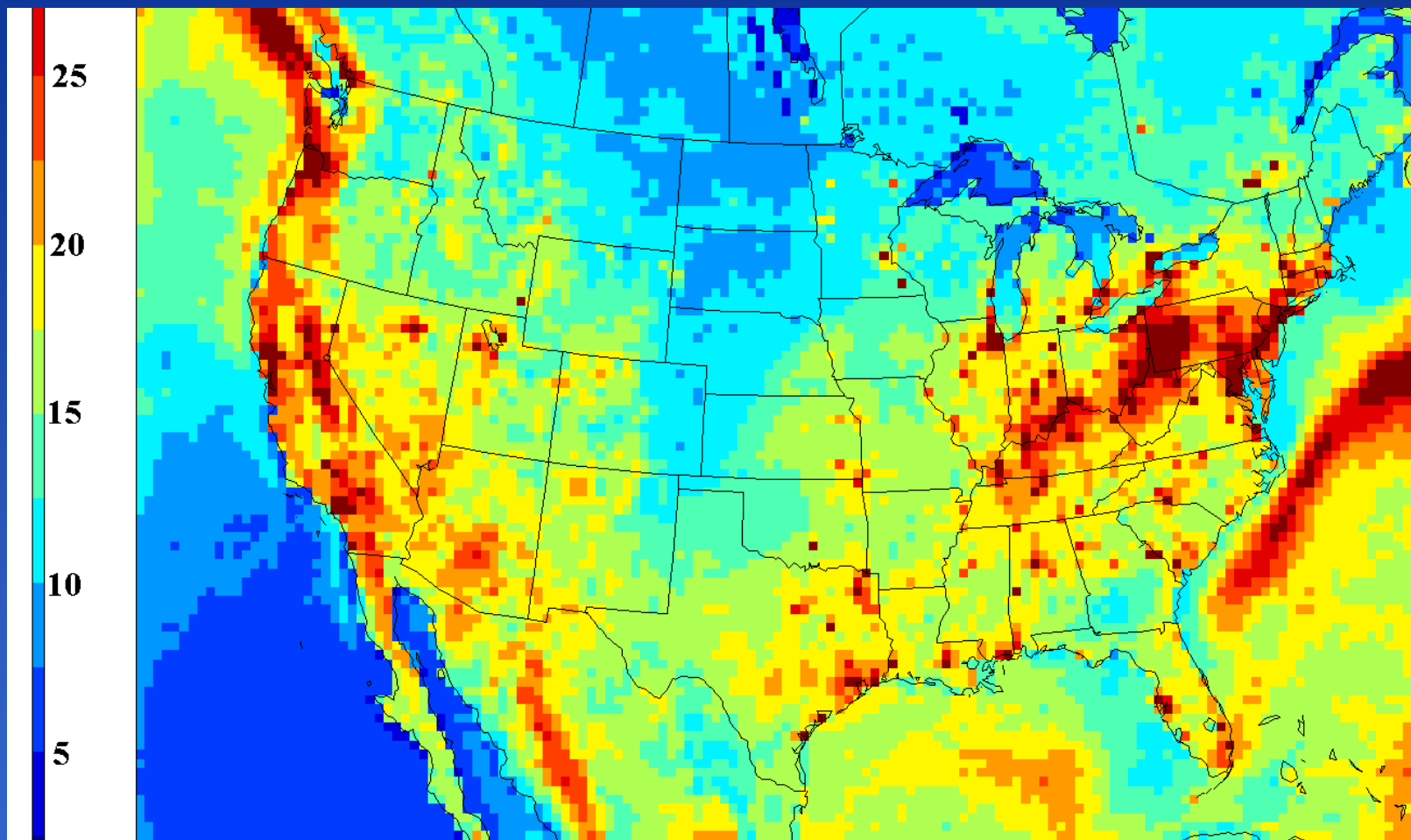
Answer: Depends on where you are!

Does THg in Lake Water Relate to proximity to sources?

A “qualified yes”



Corroborating Evidence from CMAQ Modeling



CMAQ-Simulated (2001) Total Hg Deposition
(in micrograms per square meter)

Summary

- Among the upper Midwest states, clear spatial trends were apparent in THg and MeHg from this “snap shot” sampling effort
- Illinois clearly has elevated THg concentrations compared to the other three states, but did not show MeHg levels
- Proximity to sources and DOC levels (ecosystem factors) are the most significant apparent drivers of THg and MeHg levels
- Source-receptor relations are needed to verify the importance of emissions to observed on-the-ground trends
- This effort lends credence to the suggestion that regional sampling efforts can be conducted and yield information on mercury status and controlling factors

2008-2009 Continuation:

- Sediment samples (top 2 cm) from the 909 lakes across the coterminous US → potentially yielding a map of MeHg & total Hg in lake sediment.
- Bottom 2 cm is may also be available, which could yield a current/historic “mercury augmentation” map.
- An evaluation of THg and MeHg in lake water and sediment will be undertaken to evaluate the agreement between these environmental pools
- Report on the lake water results will be produced in 2009.

