Invertivore MeHg exposure and sensitivity: Past assumptions, current findings

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Mercury – no longer just a fish issue

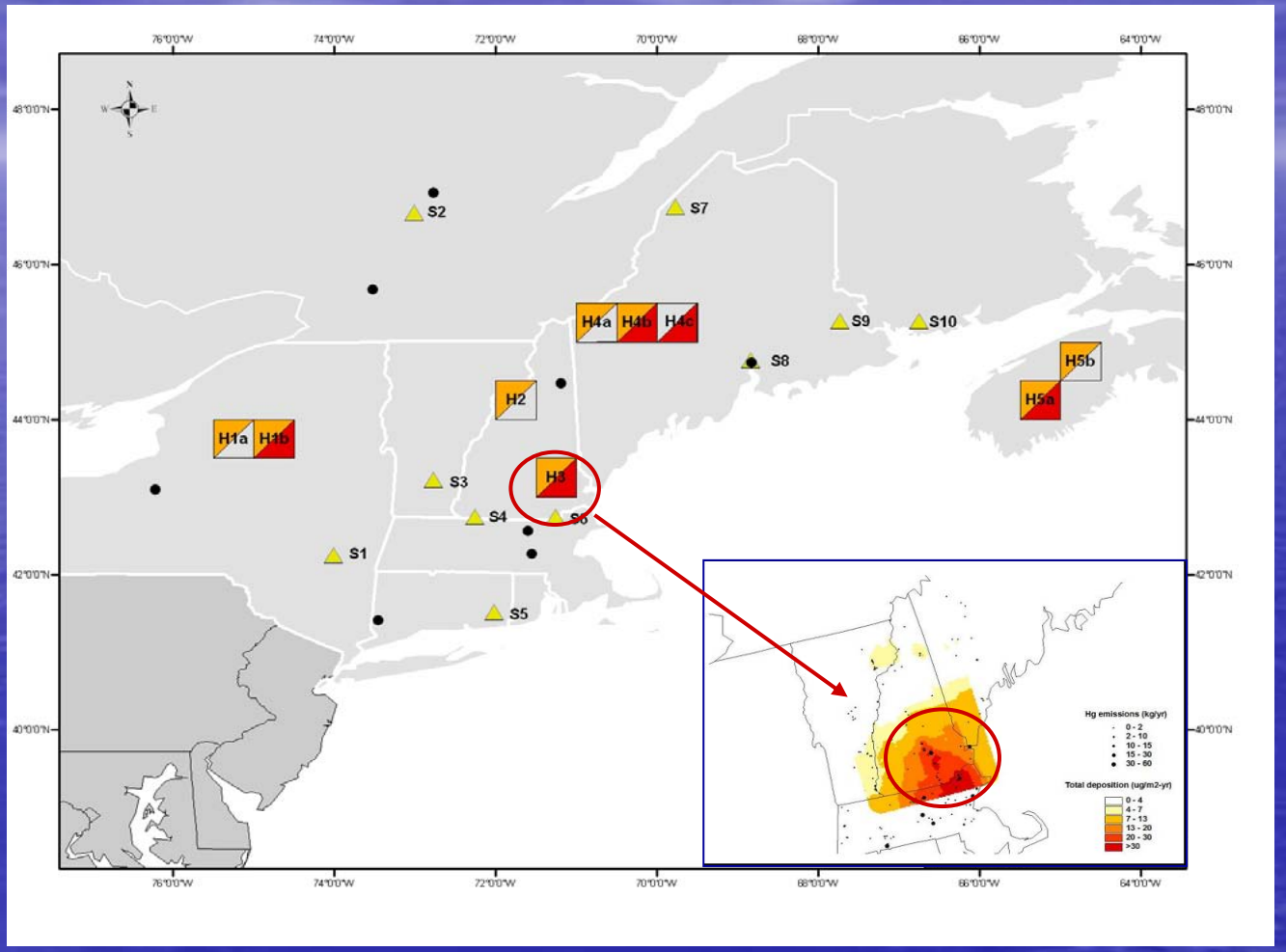
- Where is the availability of MeHg greatest?
- What species are at greatest risk?
- Is biological diversity being impacted?
- How can we track spatial and temporal trends?

Where is the production and availability of MeHg greatest?

Biological Hg hotspots (based on freshwater piscivores)

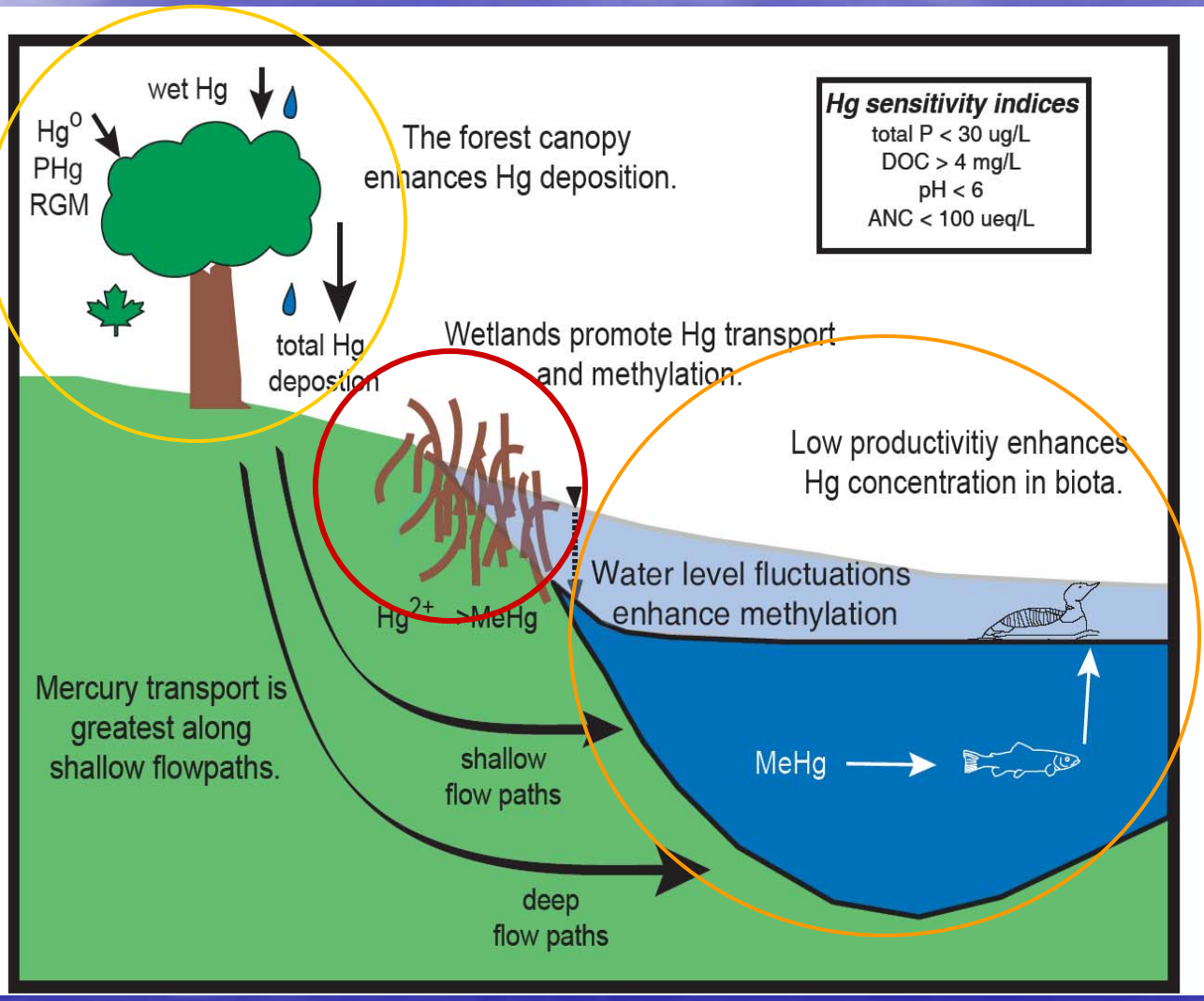
Summary

- Perch-loon based
- 5 hotspots
- Area = 22,500 km^2
- 10 areas of concern
- Sig. finding as the premise of the current US EPA Cap-and-Trade Rule is that hotspots can not be created



Evers et al., 2007 BioScience 56:29-43

Wetlands – MeHg factories



What species are at greatest risk?

Piscivores .....

Invertivores .....

Others?

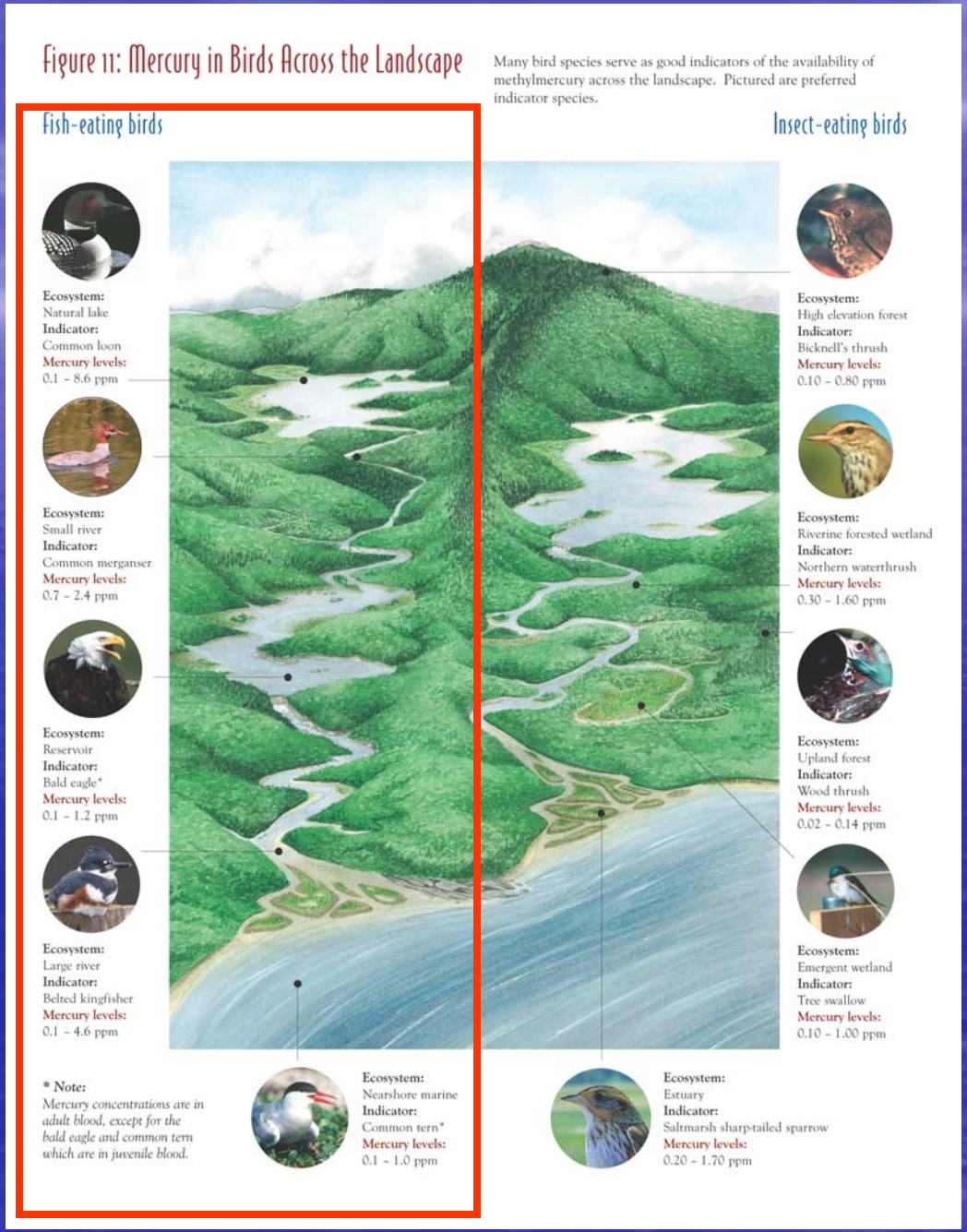
Different stories told by different...

Species

Habitats

Foraging guilds

Geographic areas

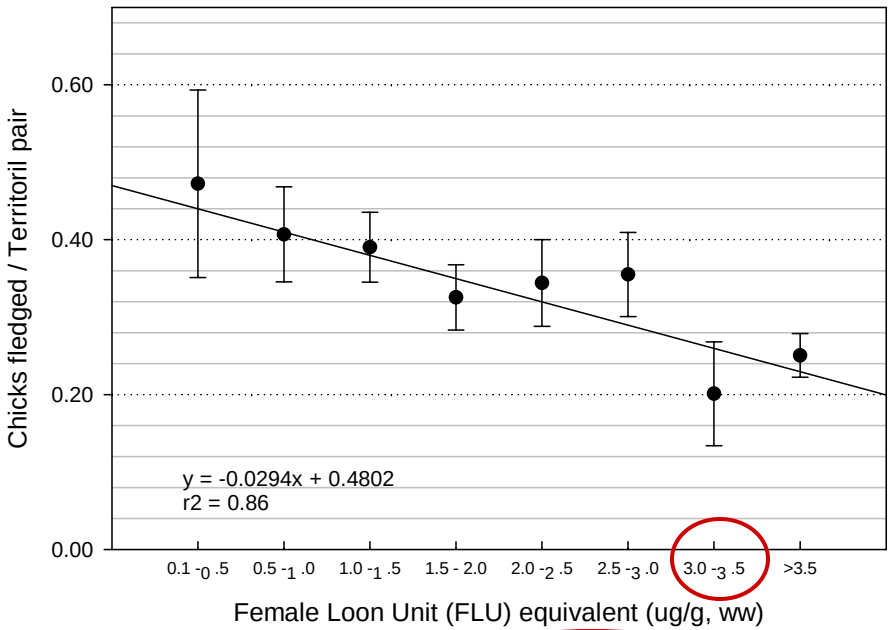


Common Loon – reproductive effects now shown in New England and eastern Canada

A. Recent findings from a 10-year study indicate sig. relationship between increasing Hg levels and:

1. Physiological changes
2. Abnormal behavior
3. Survival
4. Reproductive success

B. <u>Some areas of the Northeast contain population sinks because of Hg</u>



LOAELs
Blood = 3.0 ppm (ww)
Feather = 40 ppm (fw)
Egg = 1.3 ppm (ww)

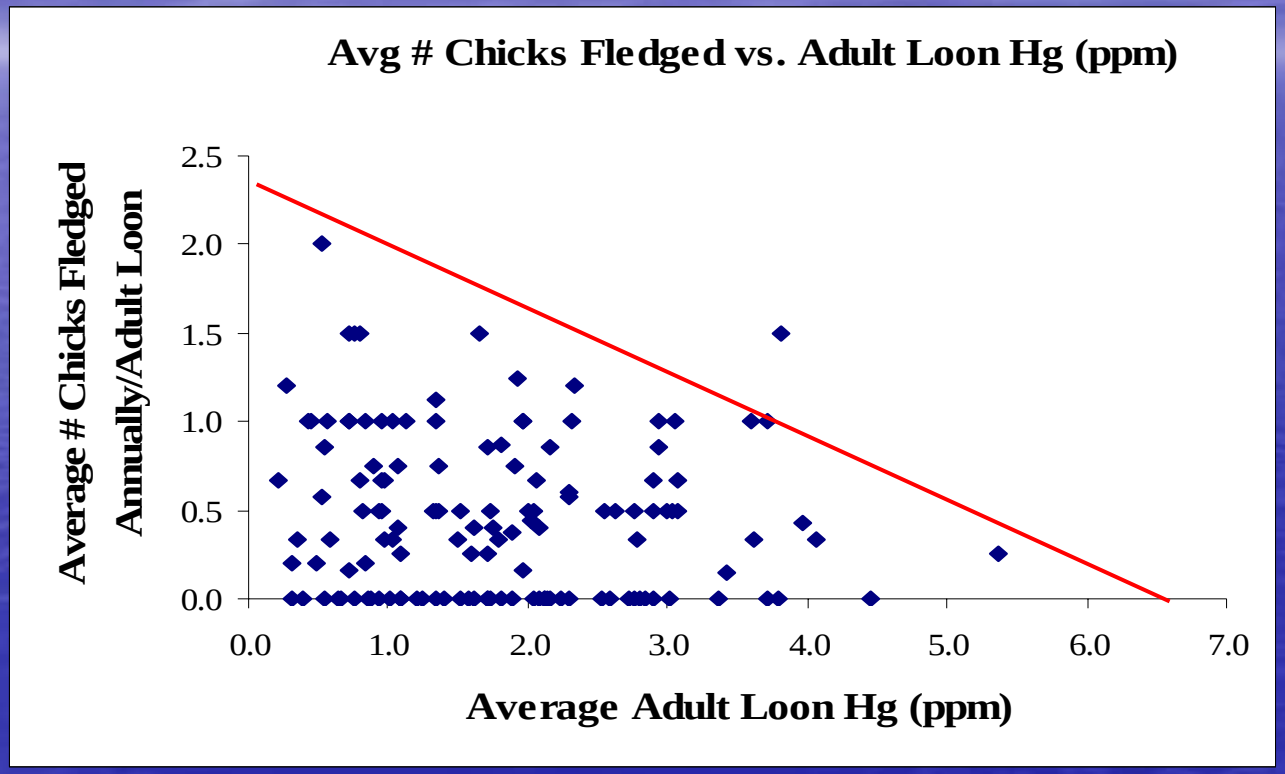
Evers et al., *In Press*, Ecotoxicology; Burgess and Meyer, *In Press*, Ecotoxicology

Common Loon – reproductive effects are also apparent in New York State

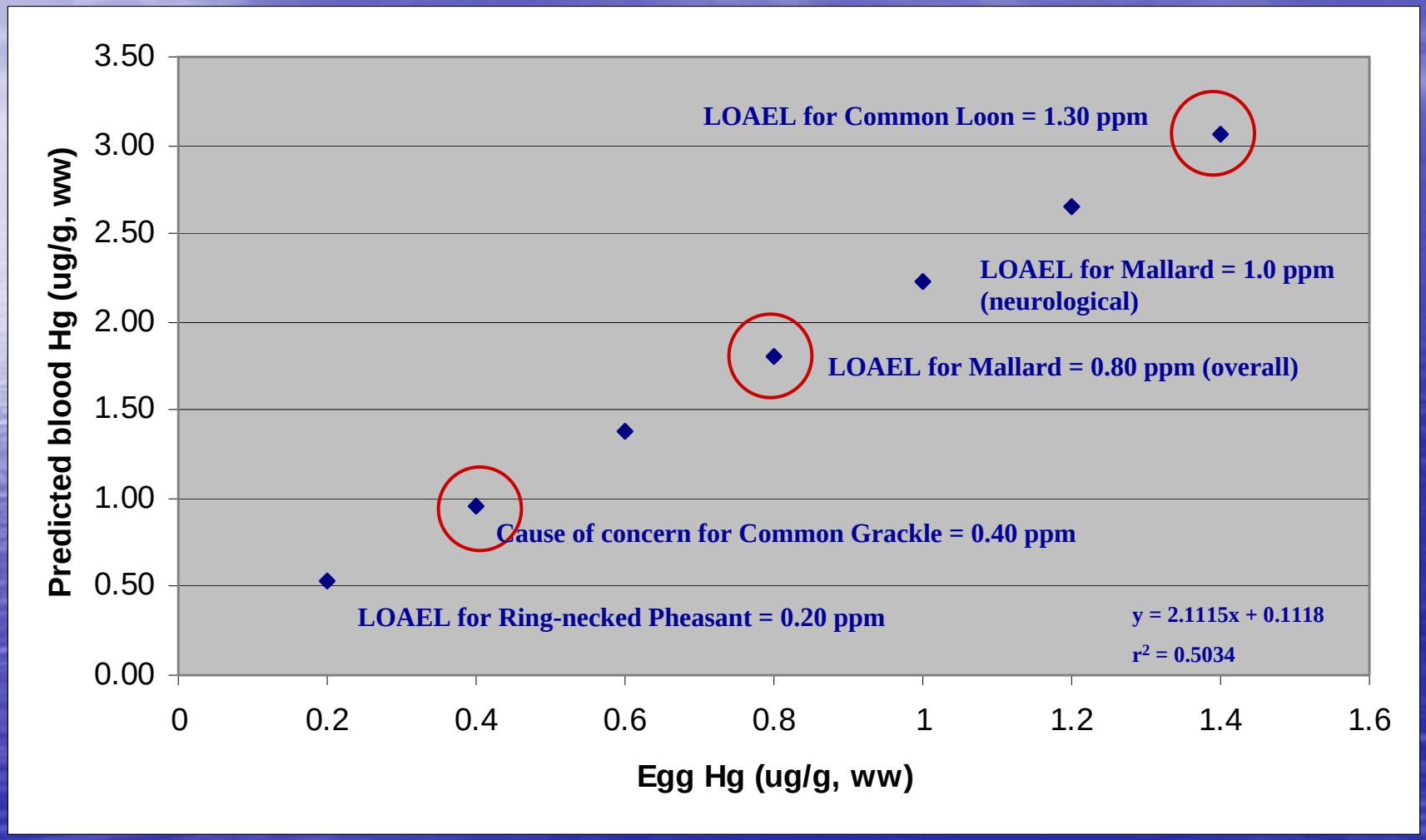
A. Based on a long-term monitoring effort by N. Schoch et al.

B. Analysis based on quartile regression models

C. Pattern of loon productivity and Hg levels in New York is very similar to Burgess and Meyer (In press), where they found 50% fewer young were produced at 3.45 ppm (ww)



Relationship between egg and predicted blood Hg levels



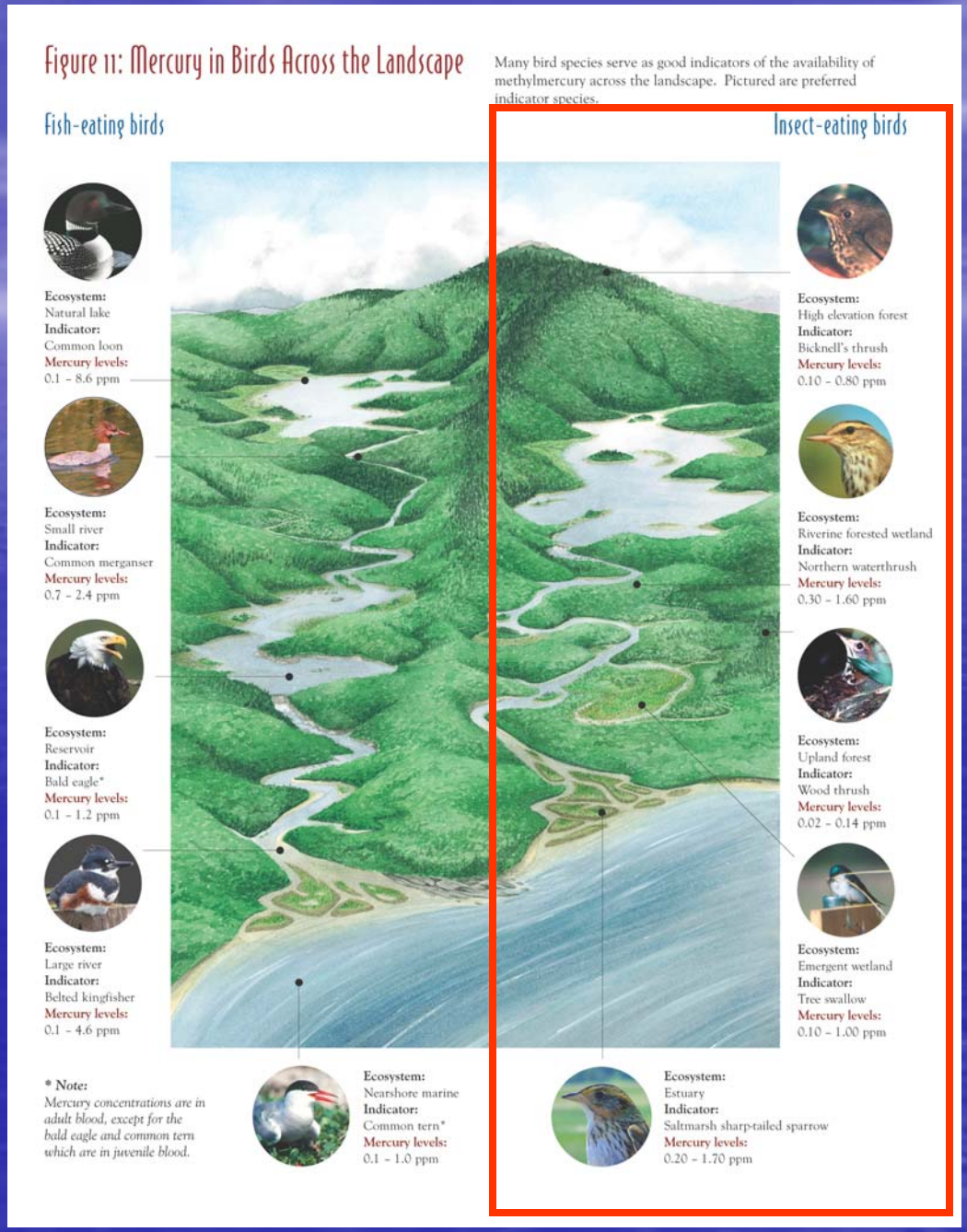
Different stories told by different...

Species

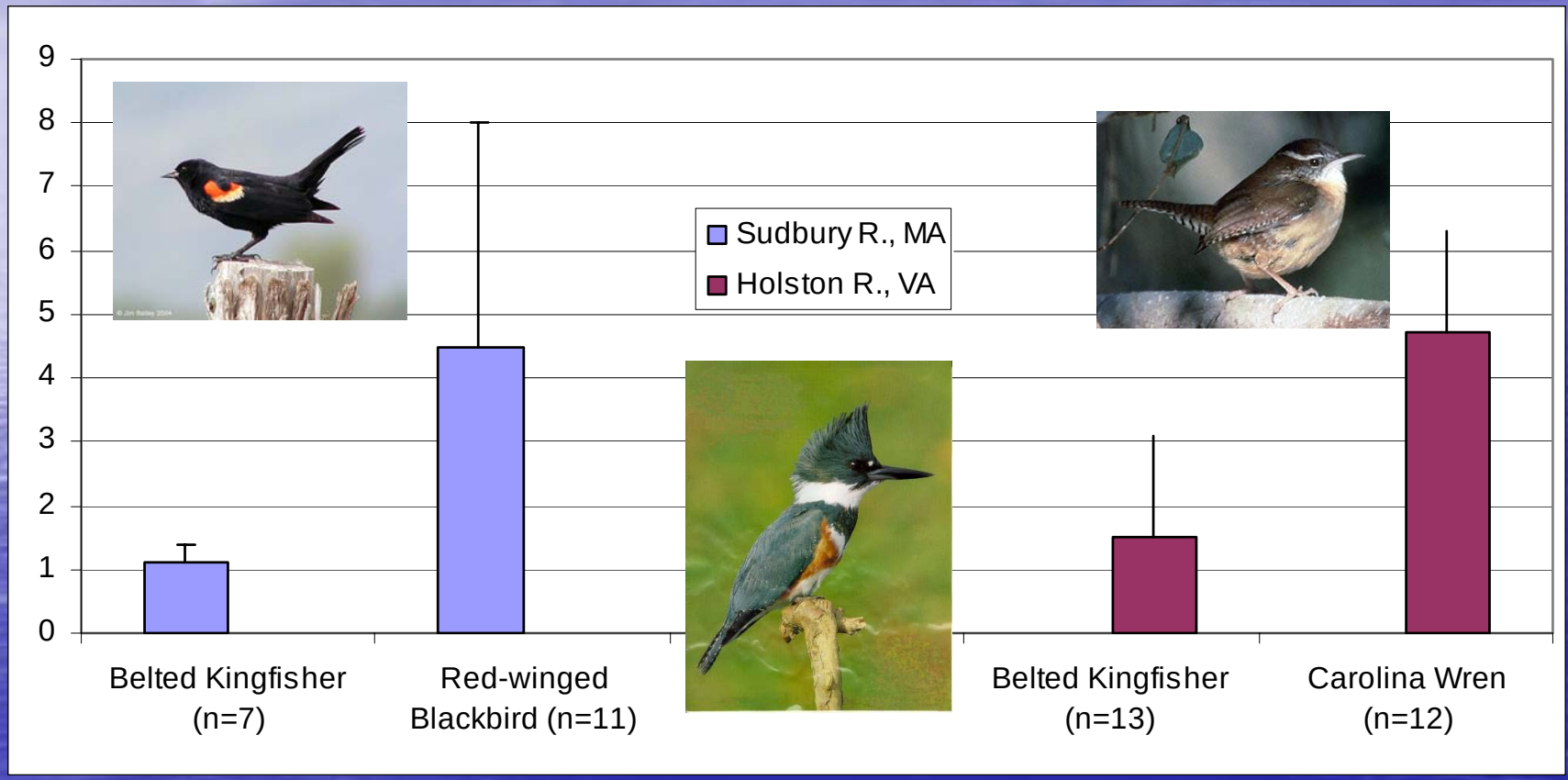
Habitats

Foraging guilds

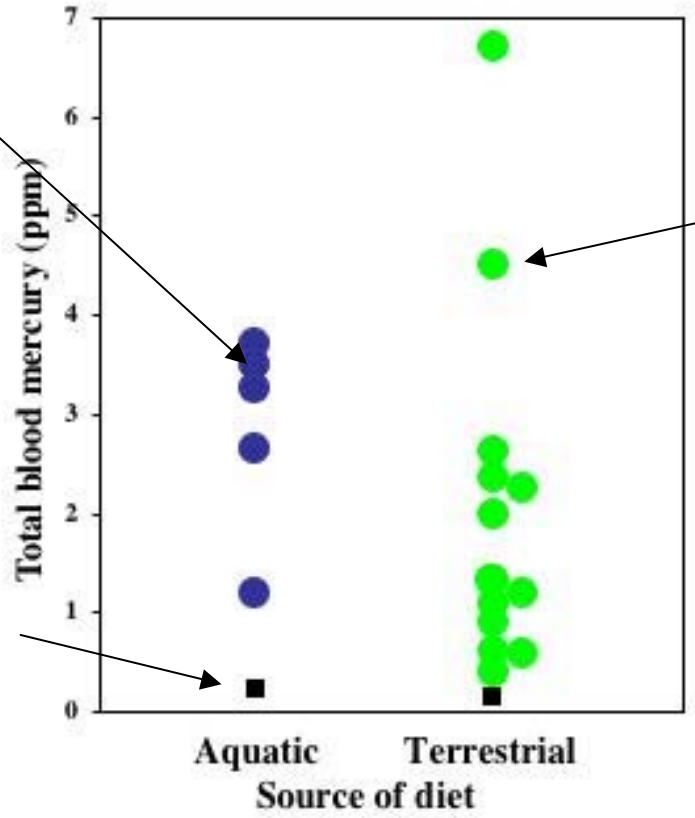
Geographic areas



Some invertivores are 3-4x >> piscivores



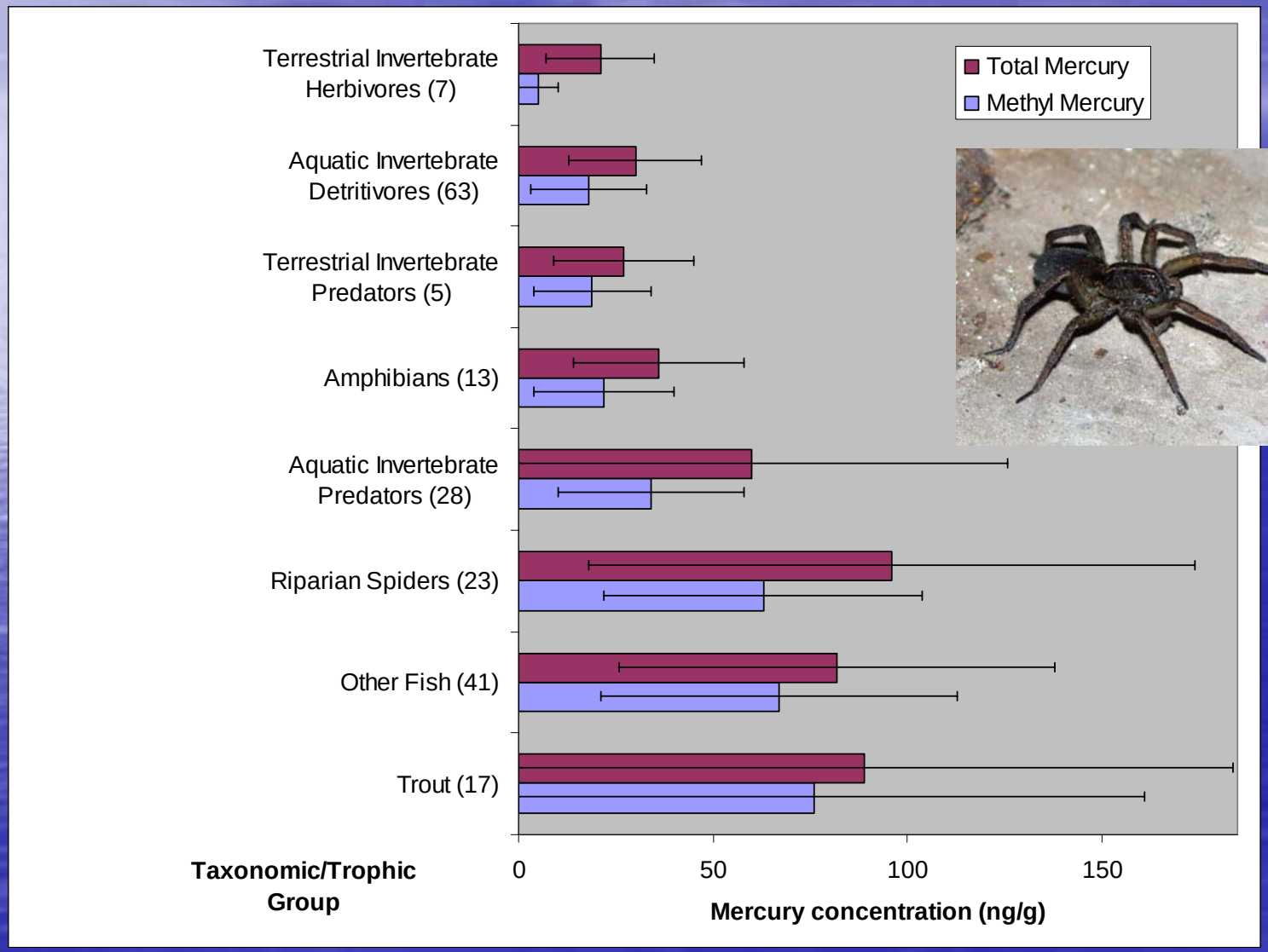
Aquatic versus terrestrial: South River only



Same species
Same samples sizes
Reference sites

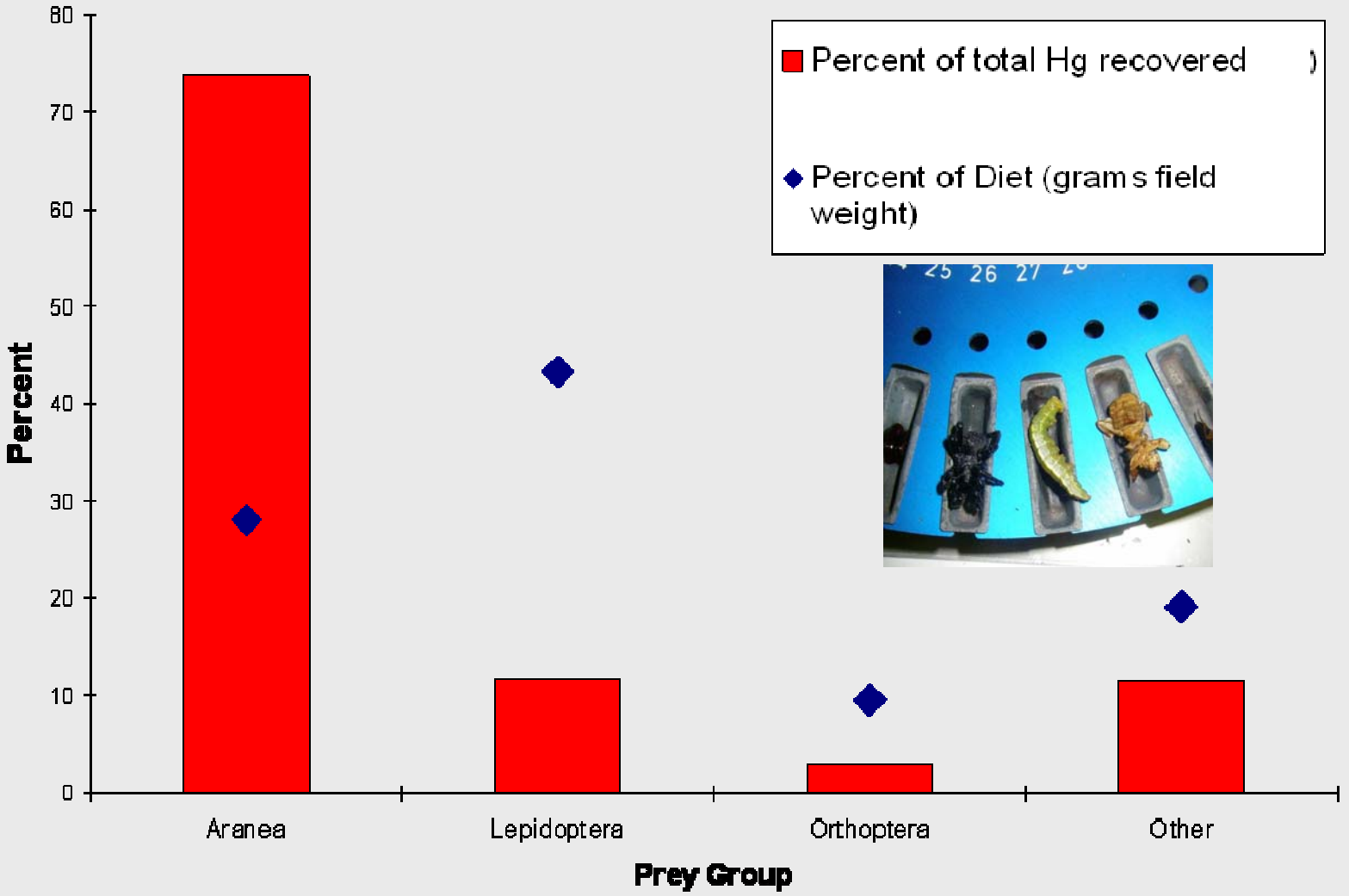
Mercury is not just accumulating in aquatic-feeding birds

How can this be? …….Spiders are the key link



Data from Jeff Loukmas, NYDEC

Spiders are responsible for 74% of Hg in the Carolina Wren (n=206 prey items from nestlings)



Recommended songbird indicators of New York habitats

River Floodplains - Louisiana Waterthrush

Estuaries - Saltmarsh Sharp-tailed Sparrow

Sphagnum bogs – Palm Warbler

Beaver pond wetlands - Rusty Blackbird

Montane areas – Bicknell's Thrush

Northern Hardwoods – Wood Thrush

Emergent Wetlands – Red-winged Blackbird

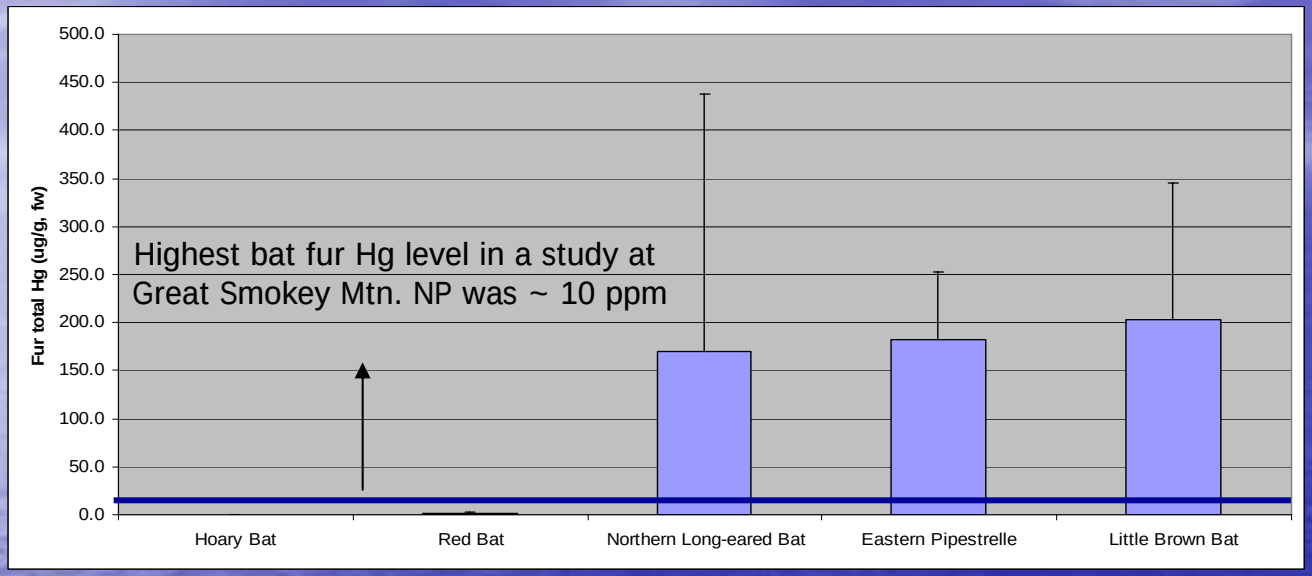
Scrub-shrub/forested Wetlands – Carolina Wren

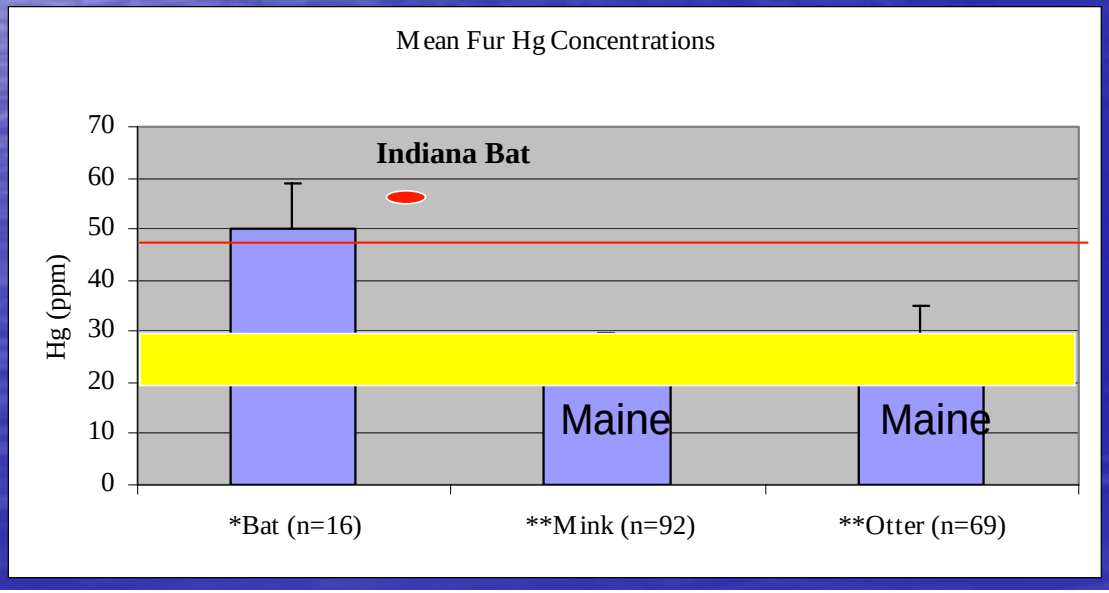







Nocturnal invertivores – bats are likely impacted by Hg as well





Mortality threshold 47.0 ug/g**

Adverse effects threshold 20.0 ug/g**

Is biological diversity being impacted by Hg and other air pollutants?

Yes

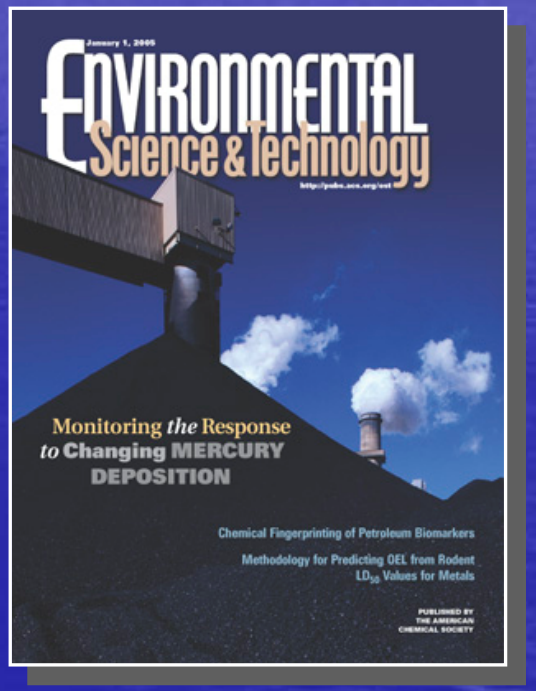
How can we track spatial and temporal trends

New standardized approach: National Mercury Monitoring Plan

- USEPA-sponsored plan recently constructed by external scientists

- Provides a blueprint for tracking spatial and temporal Hg trends

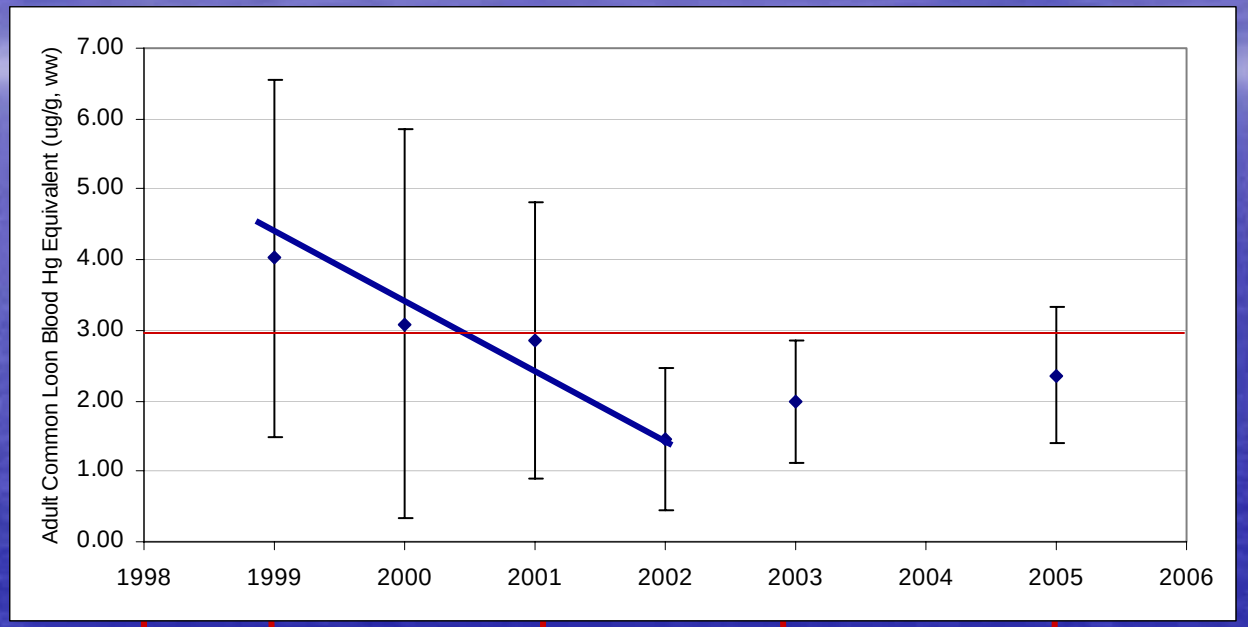
- Two publications
  - ES&T paper
  - SETAC publication "*Monitoring the response to changing mercury deposition*"



Mason et al., 2005, 39(1):14A-22A

Demonstration of rapid recovery in biotic Hg levels in New Hampshire

- Area water chemistry and watershed variables do not indicate > normal methylation (i.e., area similar to control)
- Based on 52 individuals on 10 lakes
- 3 ppm (ww) is LOAEL



~7,000 lbs of Hg emitted w/n 100 miles upwind

~6,600 lbs of Hg removed locally from 1999-2001

??

Legislative Bill for national Hg monitoring introduced in March 2007

Senate bill co-sponsored by Collins, Clinton and Lieberman
House bill co-sponsored by Allen and Walsh

To provide for the establishment of a national mercury monitoring program.

IN THE HOUSE OF REPRESENTATIVES

Mr. ALLEN introduced the following bill; which was referred to the Committee on _____

A BILL

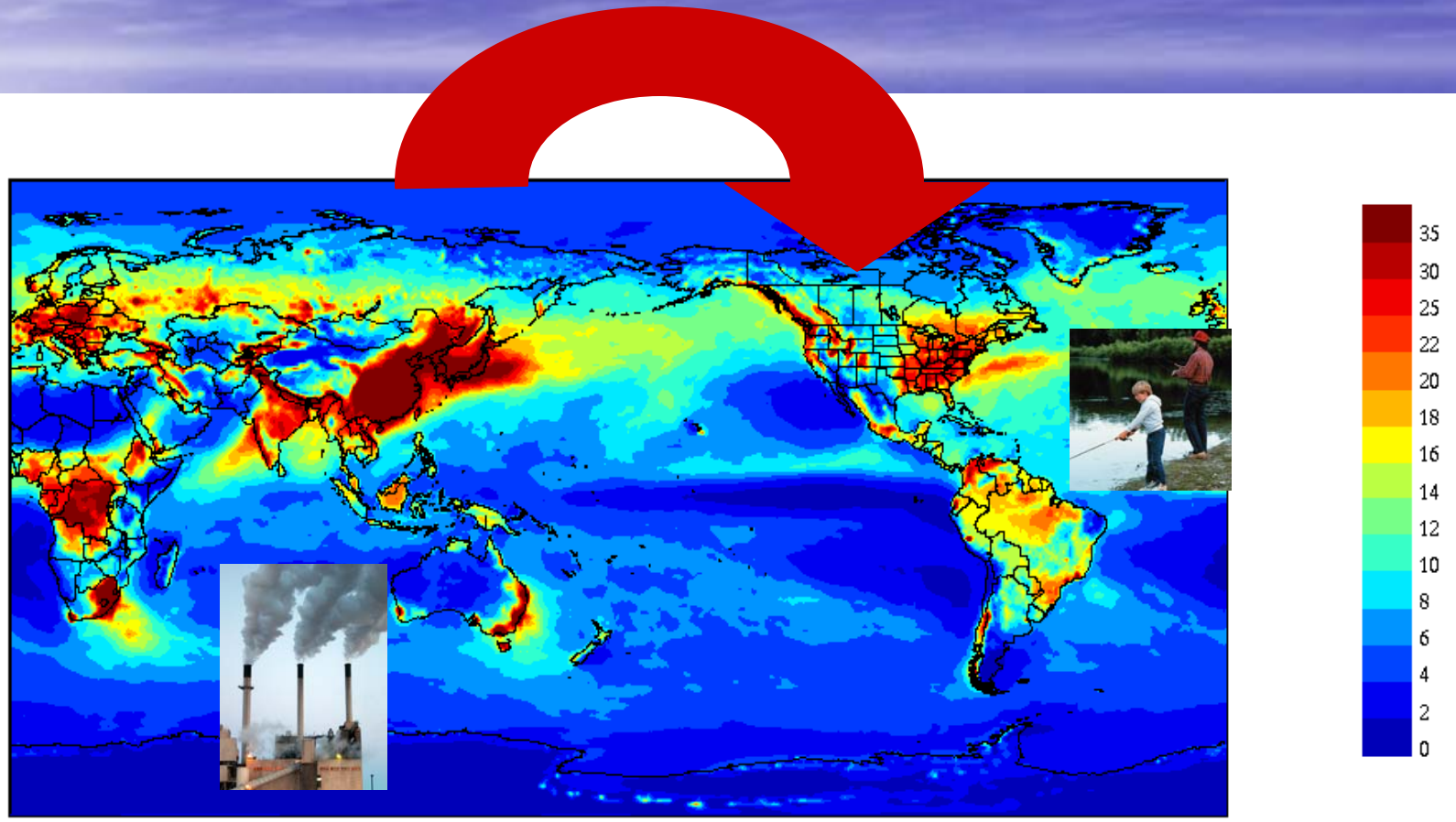
To provide for the establishment of a national mercury monitoring program.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled

SECTION 1. SHORT TITLE

This Act may be cited as the ‘‘Comprehensive National Mercury Monitoring Program Establishment Act’’

Timing is everything.....the global Hg scene is rapidly changing and we are all connected.



From a deposition model developed by Ashu Dastoor, Environment Canada

Thanks to....

- New York State Energy Research and Development Authority

- New York Department of Environmental Conservation

- The Nature Conservancy