

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?

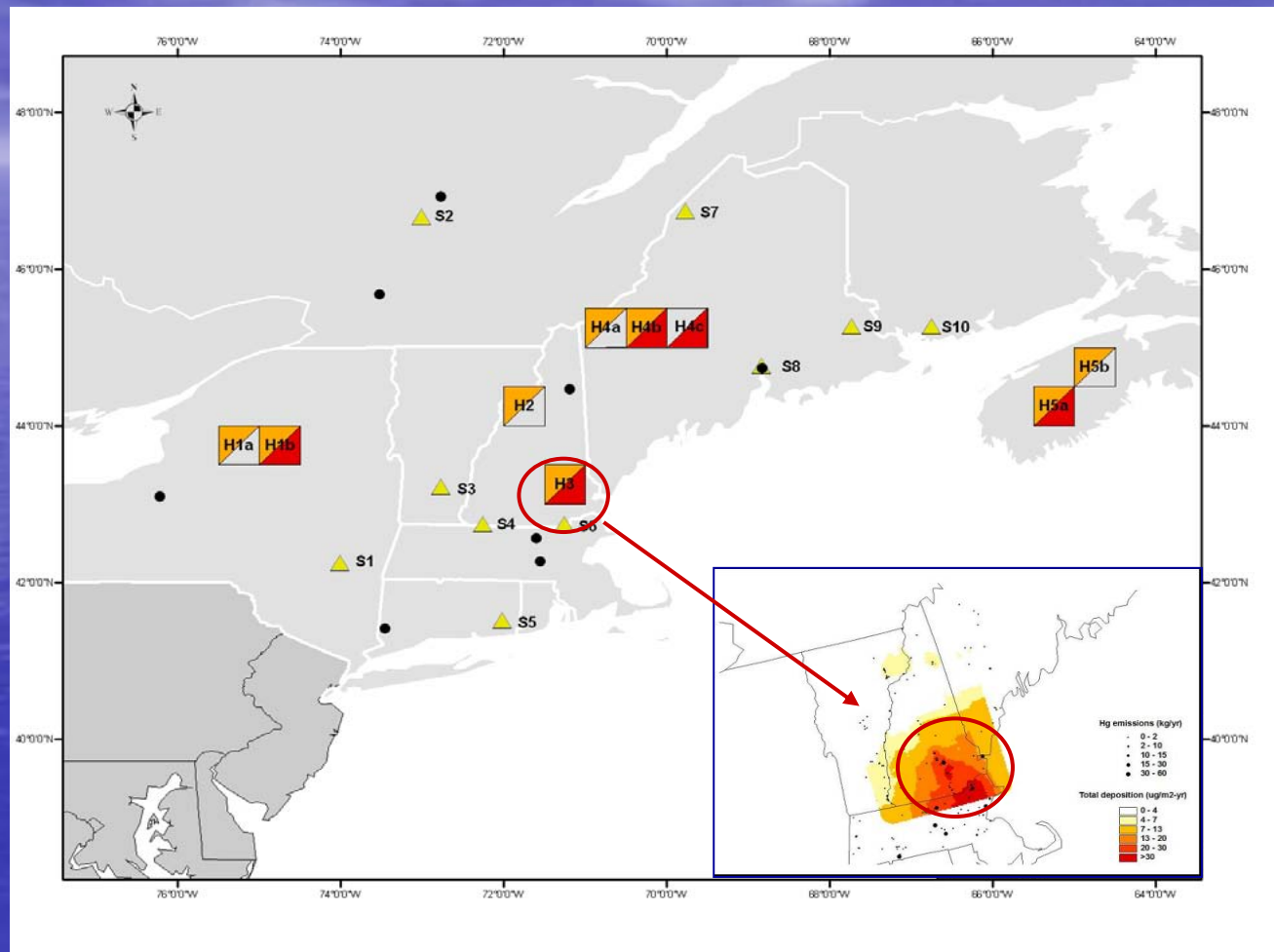


Where is the production and availability
of MeHg greatest?

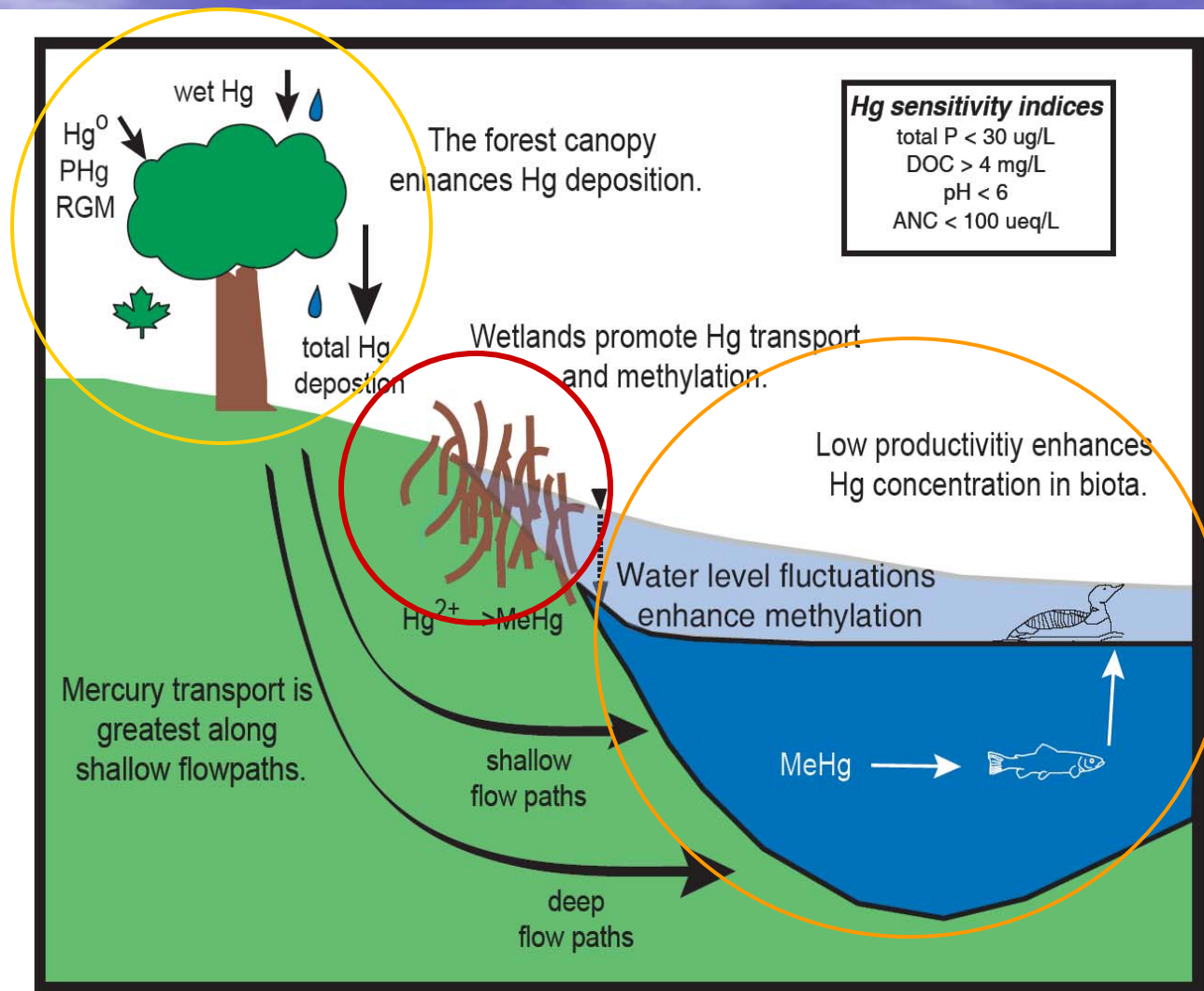
Biological Hg hotspots (based on freshwater piscivores)

Summary

- Perch-loon based
- 5 hotspots
- Area = 22,500 km²
- 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



Wetlands – MeHg factories





What species are at greatest risk?

Piscivores

Invertivores

Others?

Different stories
told by different...

Species

Habitats

Foraging guilds

Geographic areas

Figure 11: Mercury in Birds Across the Landscape

Many bird species serve as good indicators of the availability of methylmercury across the landscape. Pictured are preferred indicator species.

Fish-eating birds



Ecosystem:
Natural lake
Indicator:
Common loon
Mercury levels:
0.1 - 8.6 ppm



Ecosystem:
Small river
Indicator:
Common merganser
Mercury levels:
0.7 - 2.4 ppm



Ecosystem:
Reservoir
Indicator:
Bald eagle*
Mercury levels:
0.1 - 1.2 ppm



Ecosystem:
Large river
Indicator:
Belted kingfisher
Mercury levels:
0.1 - 4.6 ppm

* Note:
Mercury concentrations are in
adult blood, except for the
bald eagle and common tern
which are in juvenile blood.



Ecosystem:
Nearshore marine
Indicator:
Common tern*
Mercury levels:
0.1 - 1.0 ppm

Insect-eating birds



Ecosystem:
High elevation forest
Indicator:
Bicknell's thrush
Mercury levels:
0.10 - 0.80 ppm



Ecosystem:
Riverine forested wetland
Indicator:
Northern waterthrush
Mercury levels:
0.30 - 1.60 ppm



Ecosystem:
Upland forest
Indicator:
Wood thrush
Mercury levels:
0.02 - 0.14 ppm



Ecosystem:
Emergent wetland
Indicator:
Tree swallow
Mercury levels:
0.10 - 1.00 ppm



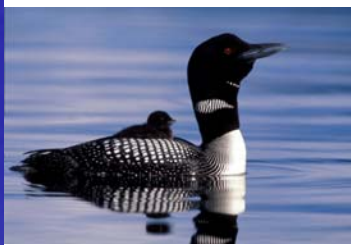
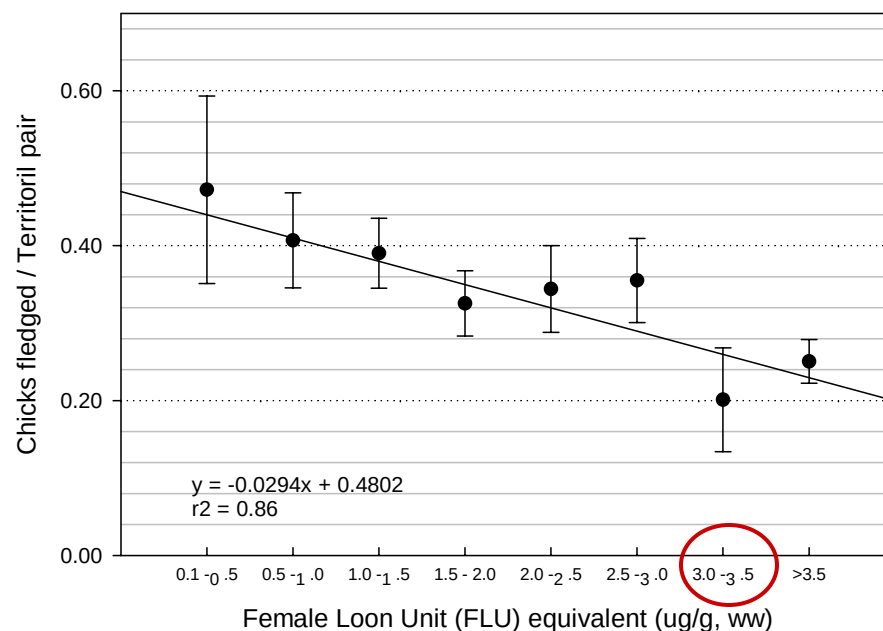
Ecosystem:
Estuary
Indicator:
Saltmarsh sharp-tailed sparrow
Mercury levels:
0.20 - 1.70 ppm

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. Some areas of the Northeast contain population sinks because of Hg



LOAELs

Blood = 3.0 ppm (ww)

Feather = 40 ppm (fw)

Egg = 1.3 ppm (ww)

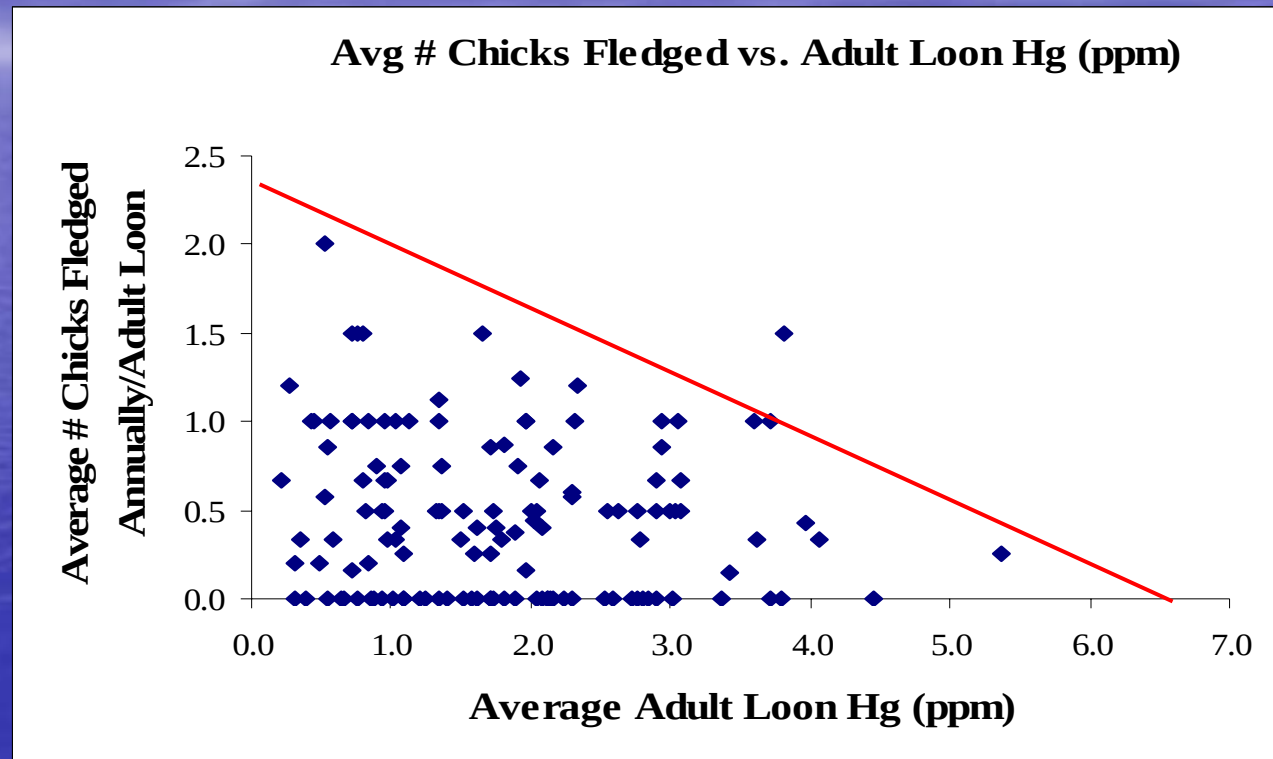
Evers et al., *In Press*, Ecotoxicology; Burgess and Meyer, *In Press*, Ecotoxicology

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

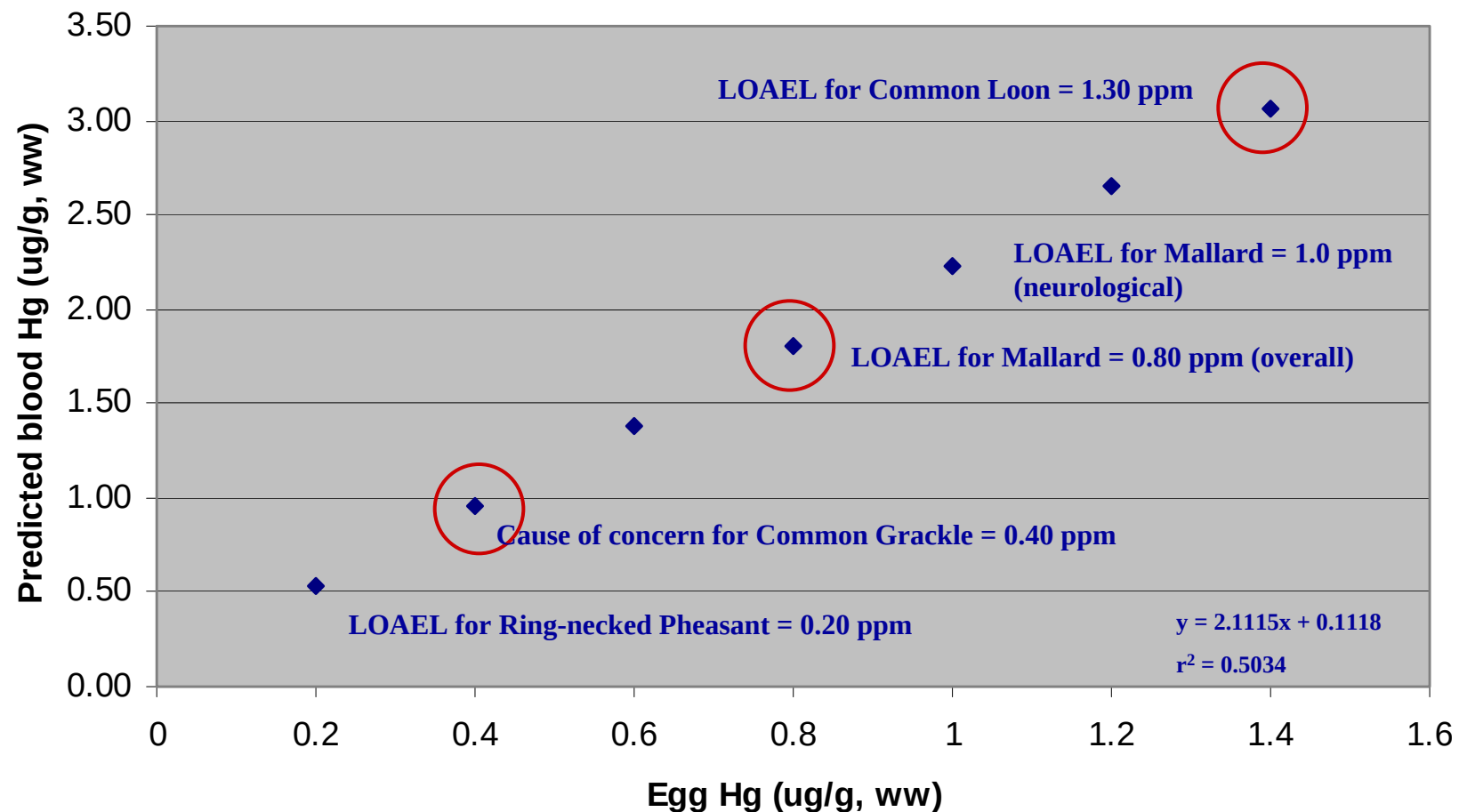
A. Based on a long-term monitoring effort by N. Schoch et al.

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



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told by different...

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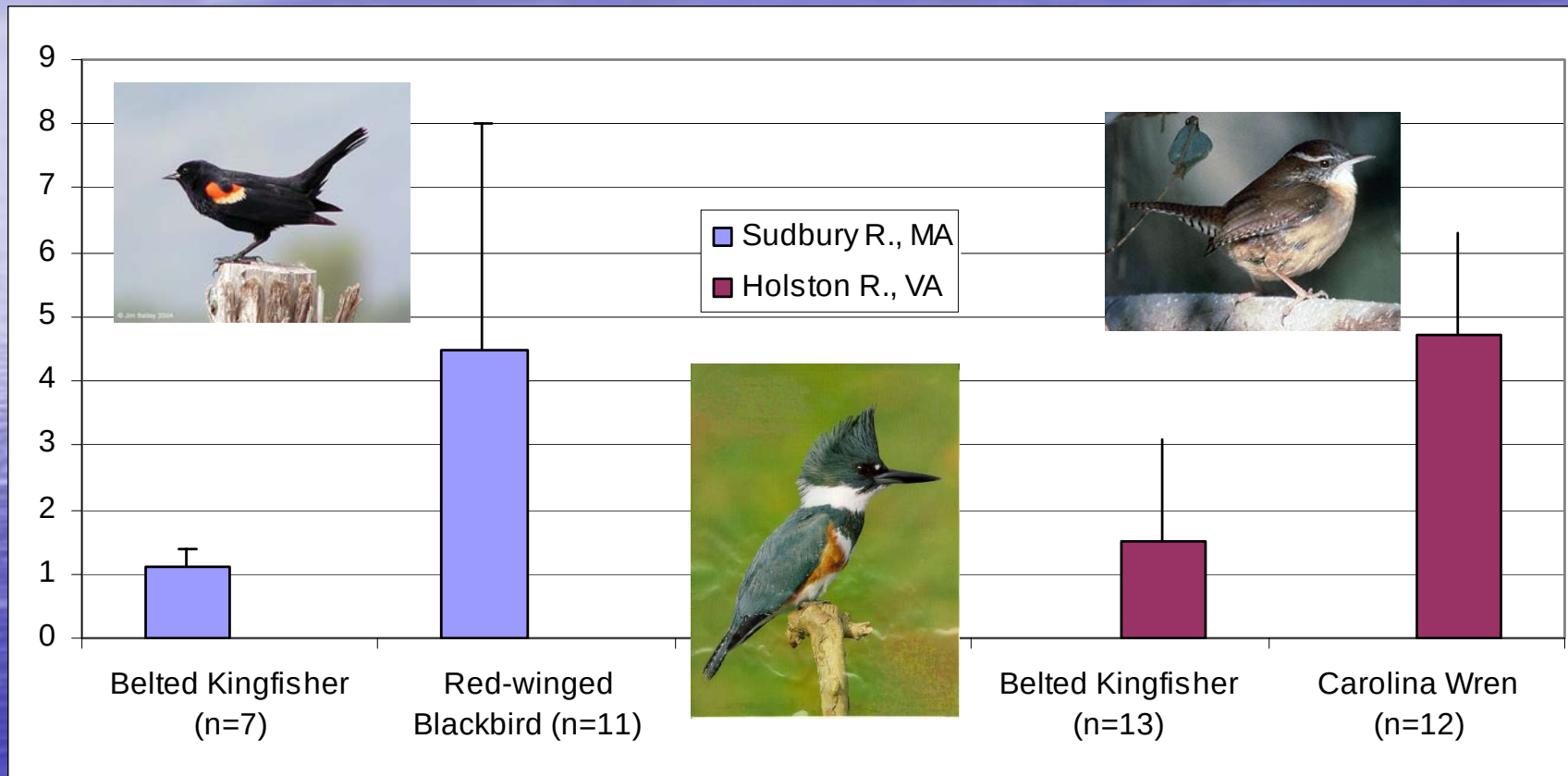


Ecosystem:
Emergent wetland
Indicator:
Tree swallow
Mercury levels:
0.10 - 1.00 ppm



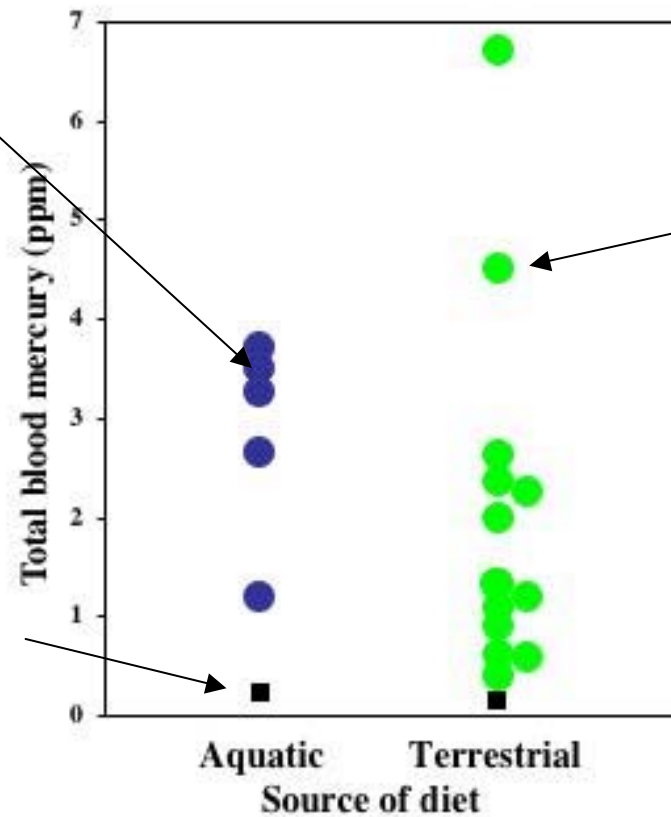
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Some invertivores are 3-4x >> piscivores





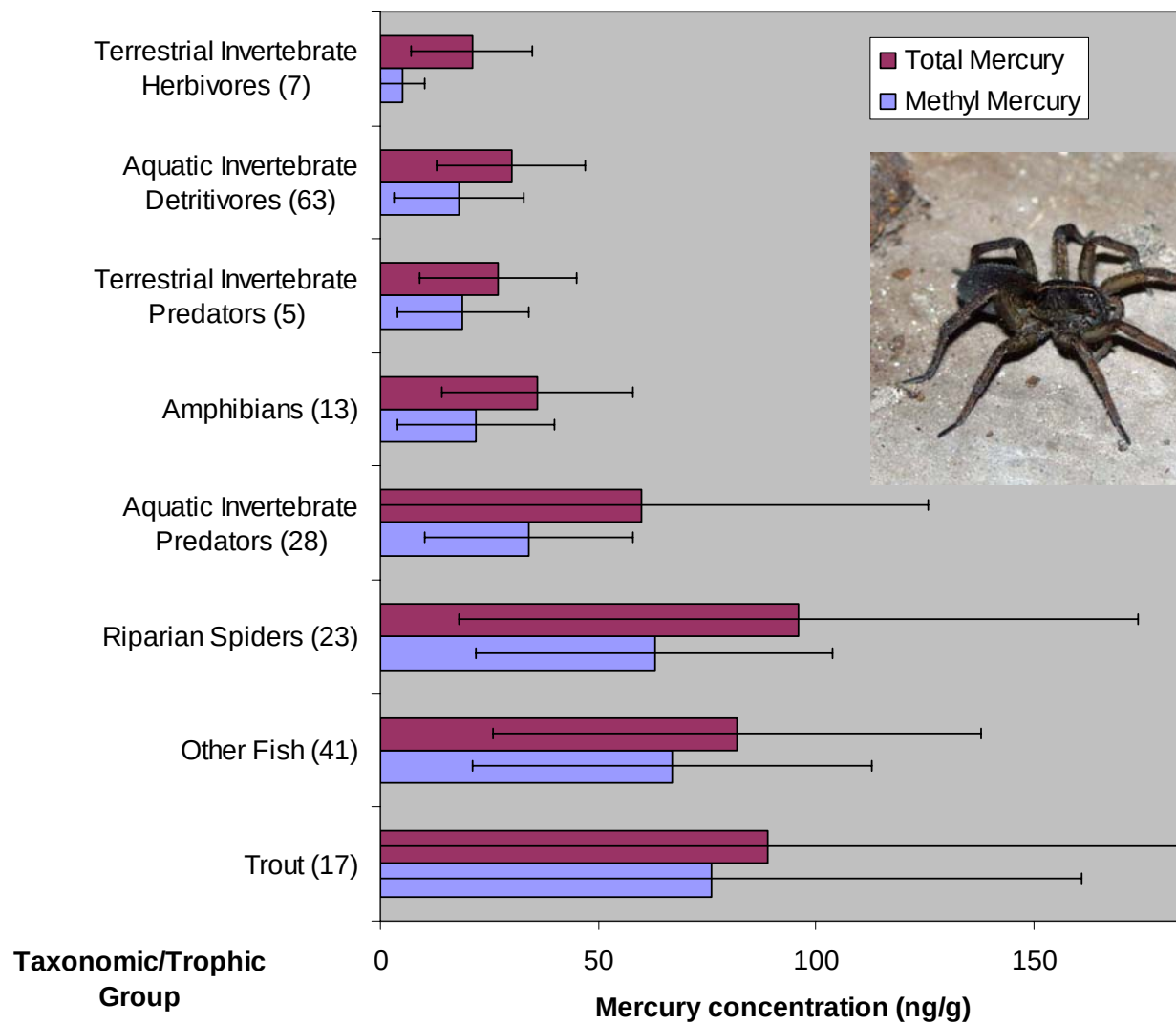
Aquatic versus terrestrial: South River only



Same species
Same samples sizes
Reference sites

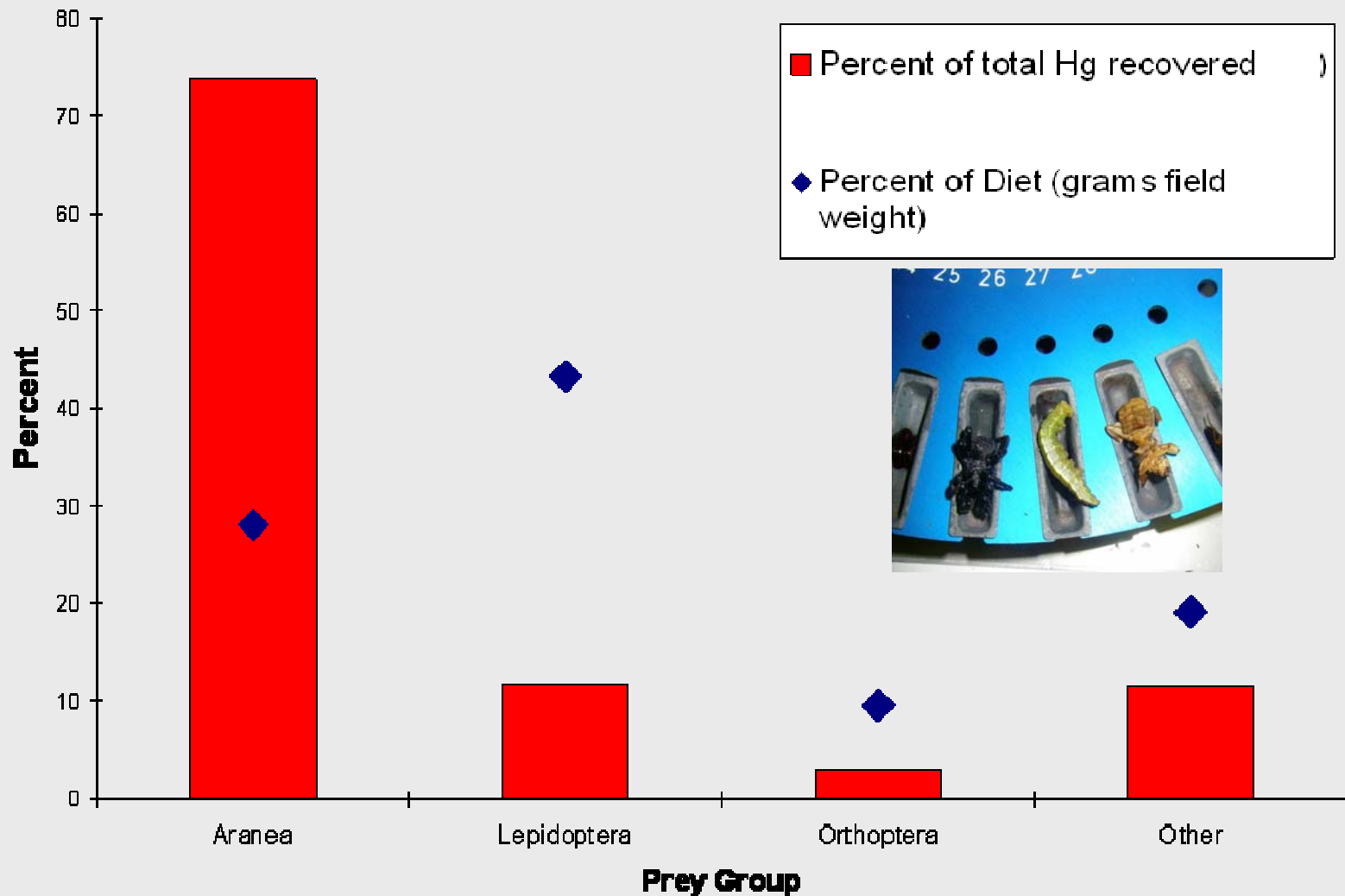
Mercury is not just accumulating in aquatic-feeding birds

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



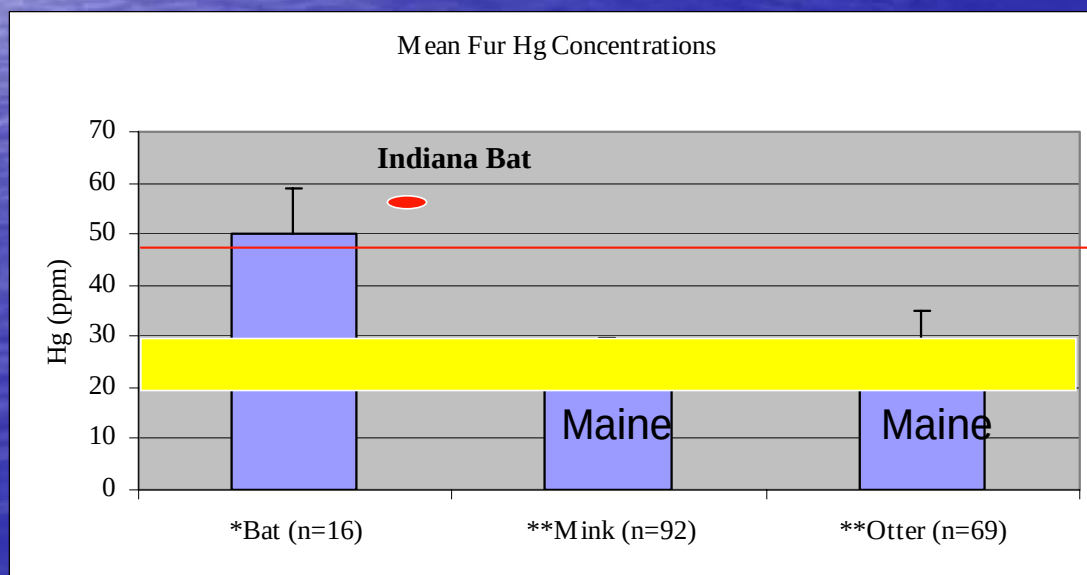
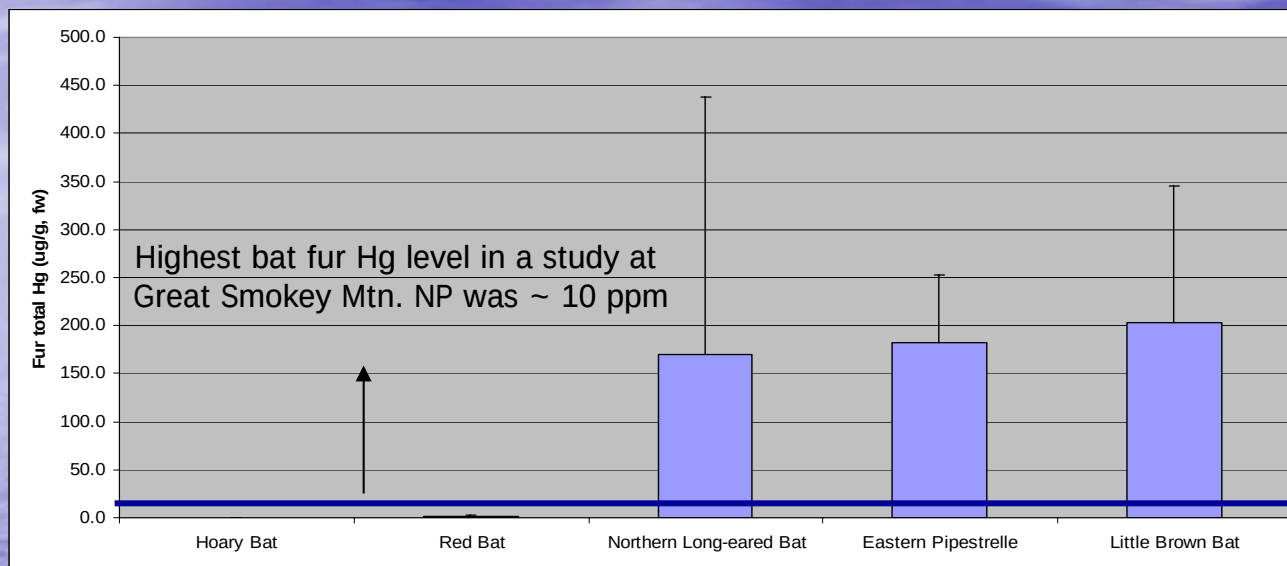
Emergent Wetlands – Red-winged Blackbird



Scrub-shrub/forested Wetlands – Carolina Wren



Nocturnal invertivores – bats are likely impacted by Hg as well

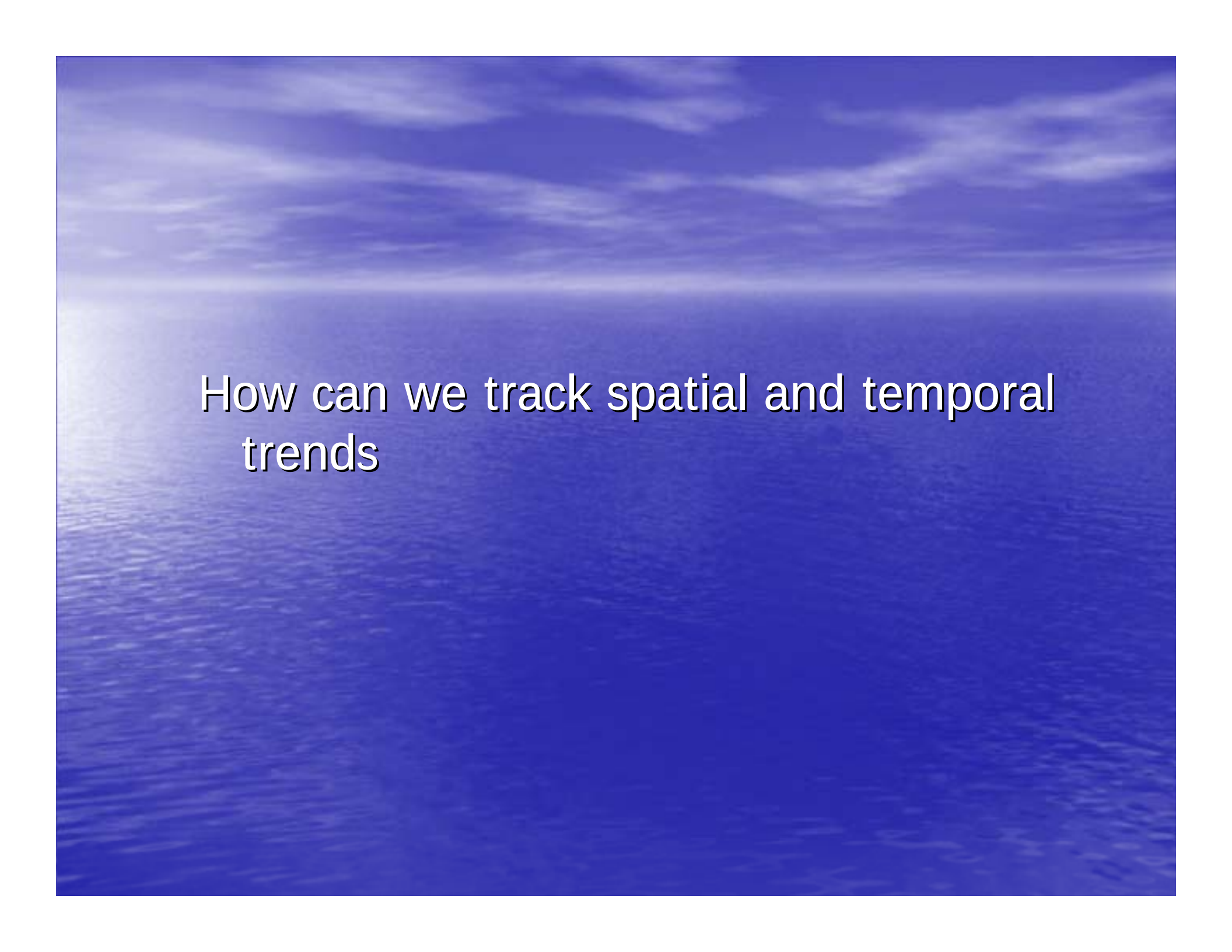




Is biological diversity being impacted by
Hg and other air pollutants?

A full-page background image of a vast blue ocean under a blue sky with wispy white clouds. The sun is visible on the left side of the horizon, creating a bright reflection on the water's surface.

Yes

A blue-tinted photograph of a calm ocean under a cloudy sky. A bright light source, likely the sun, is visible on the left horizon, creating a shimmering reflection on the water's surface. The text "How can we track spatial and temporal trends" is centered in the image.

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*”

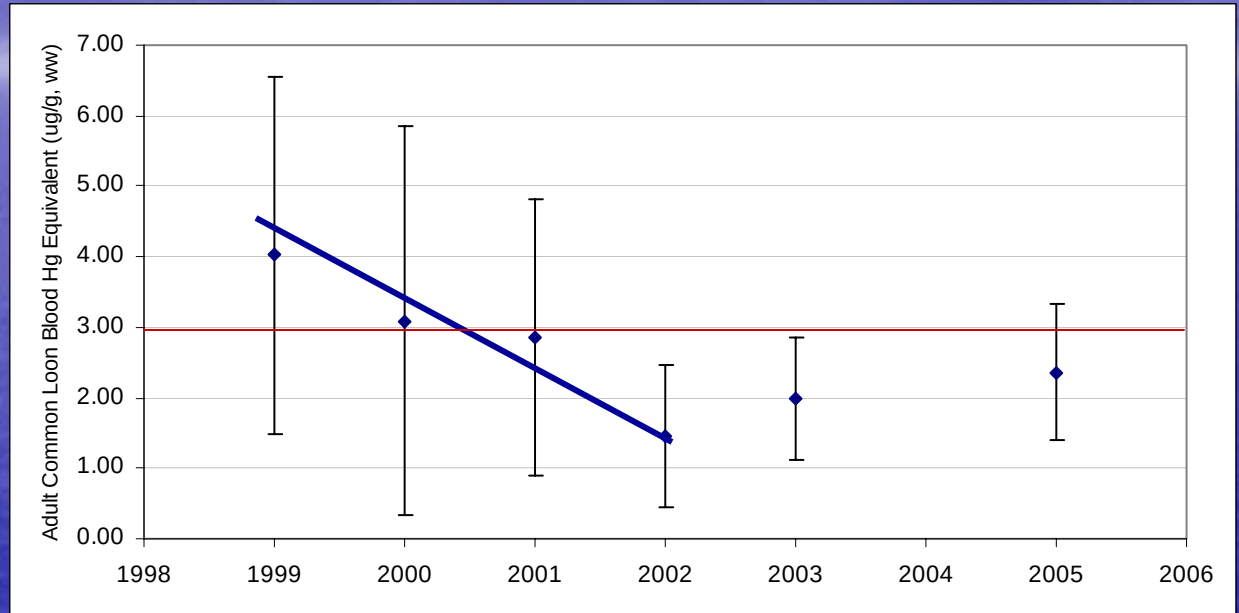


Mason et al., 2005, 39(1):14A-22A

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

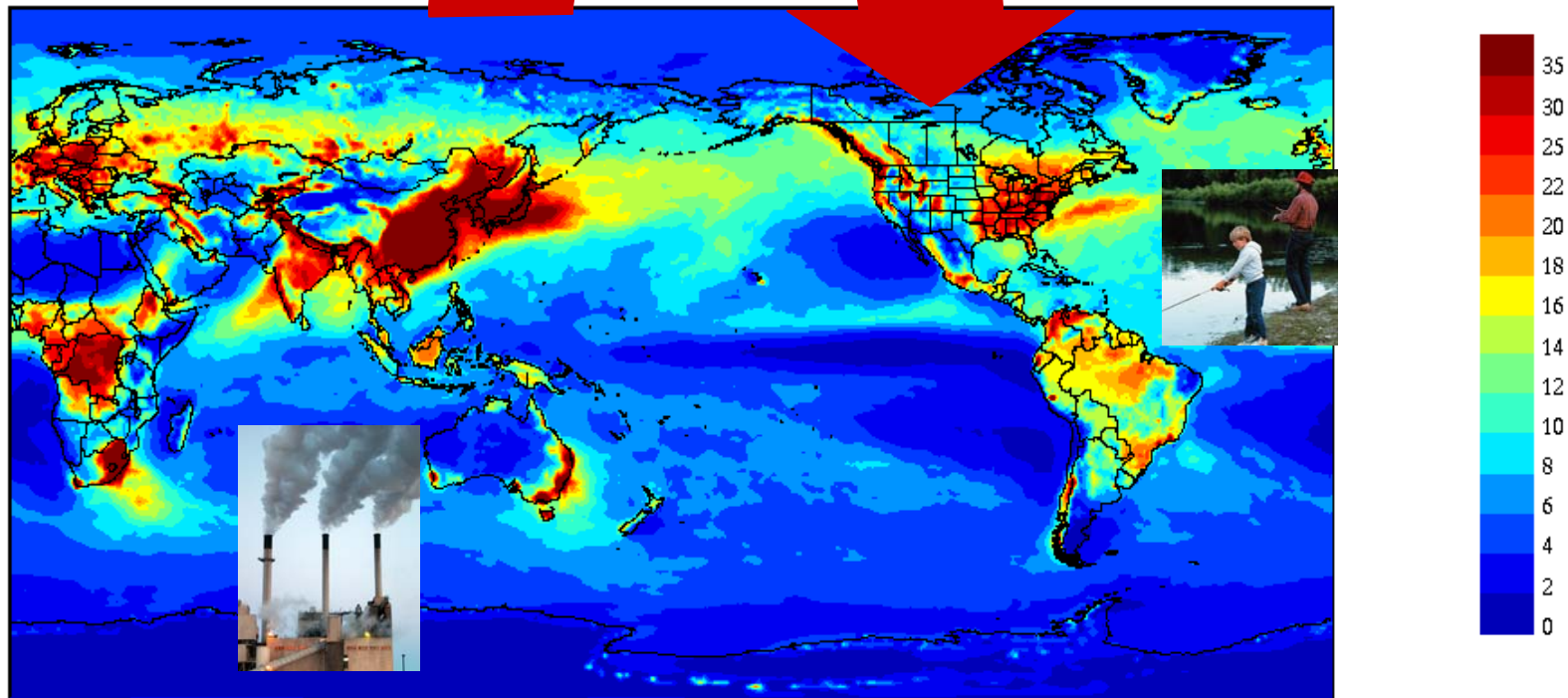
To provide for the establishment of a national mercury
monitoring program.

*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