



**MercNet -
A National Framework for Monitoring
Spatial and Temporal Changes in
Environmental Mercury Loads**

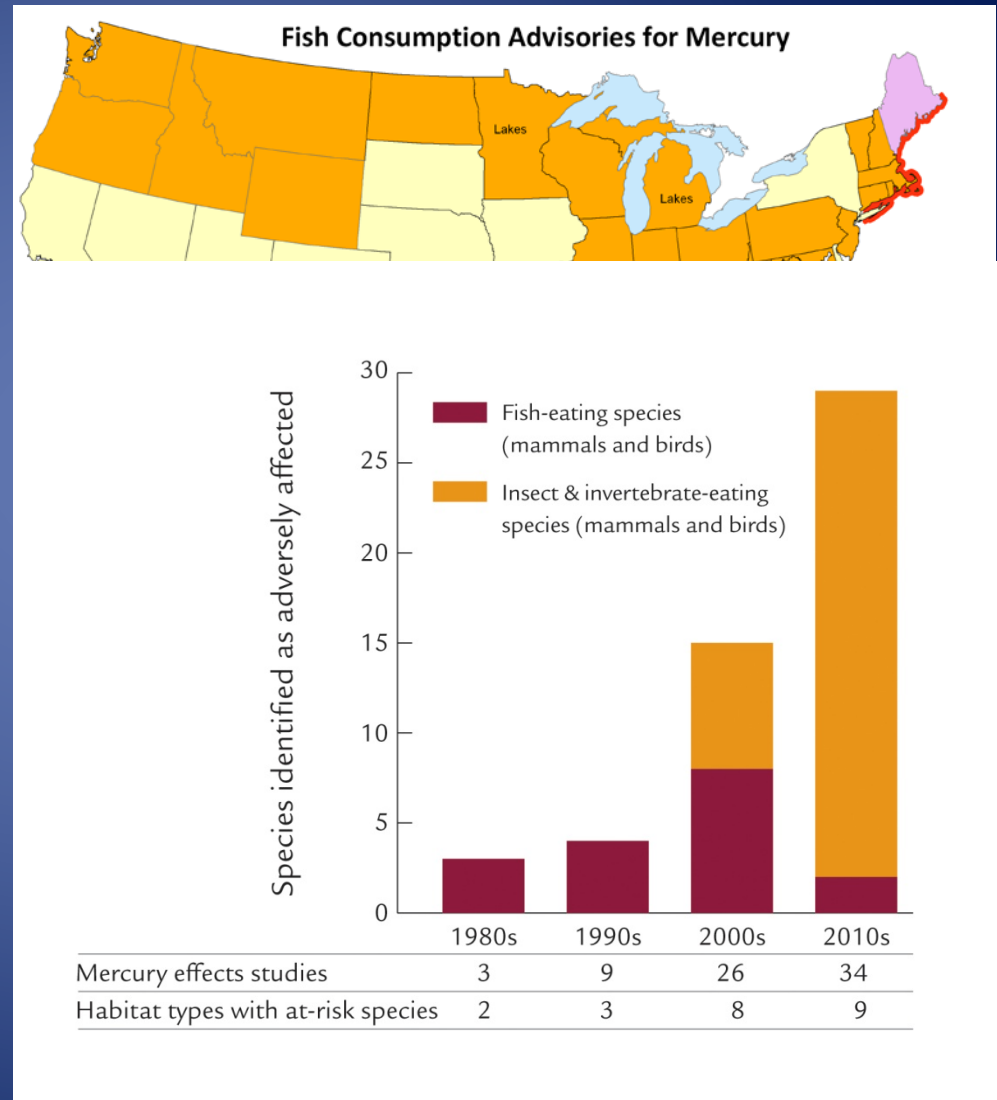
David Evers,
Biodiversity Research Institute, Gorham, Maine

Mercury monitoring network goal

- “Establish an integrated, national network to systematically monitor, assess, and report on policy-relevant indicators of atmospheric mercury concentrations and deposition, and mercury levels in land, water, and biota in terrestrial, freshwater, and coastal ecosystems in response to changing mercury emissions over time”

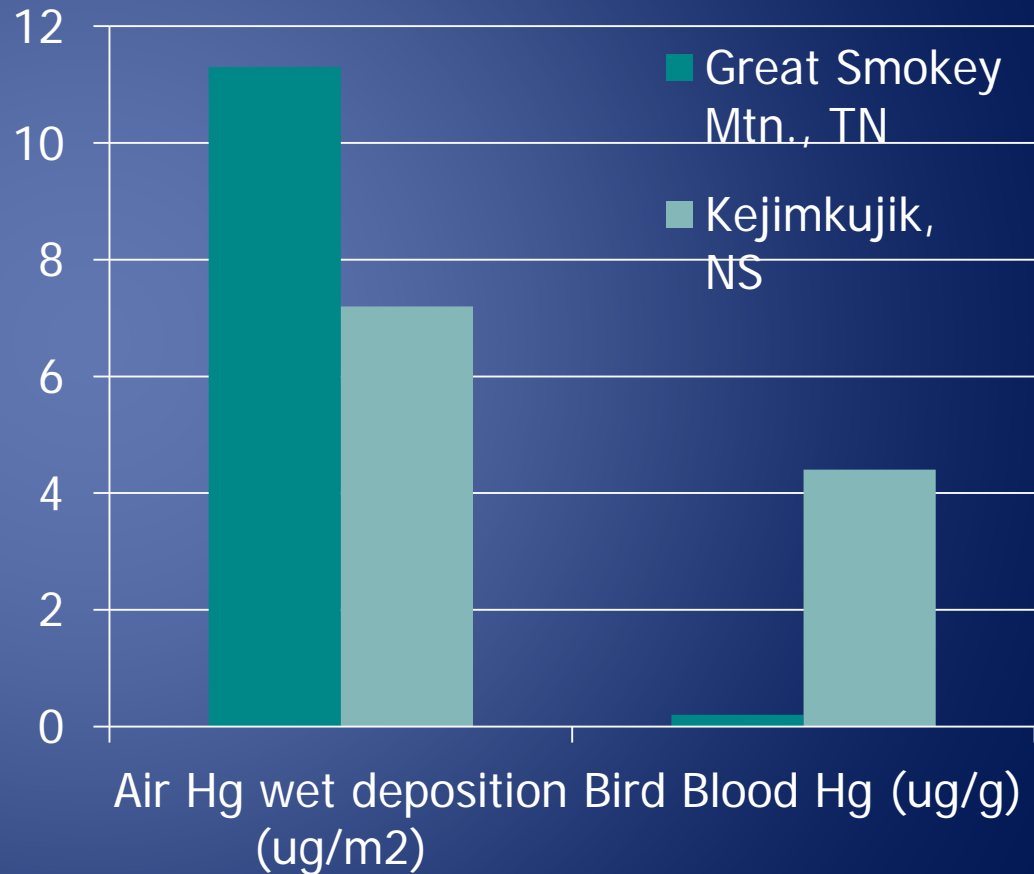
Problem

- Mercury is a naturally occurring element, yet industrial activities, such as power generation from coal-fired power plants, release mercury to the atmosphere where it can be transported and deposited locally, regionally, and globally
- Mercury is widely distributed throughout waterbodies of the U.S.
- Methylmercury concentrations in fish and wildlife in the U.S. now routinely exceed dietary thresholds that can harm people and wildlife in significant ways



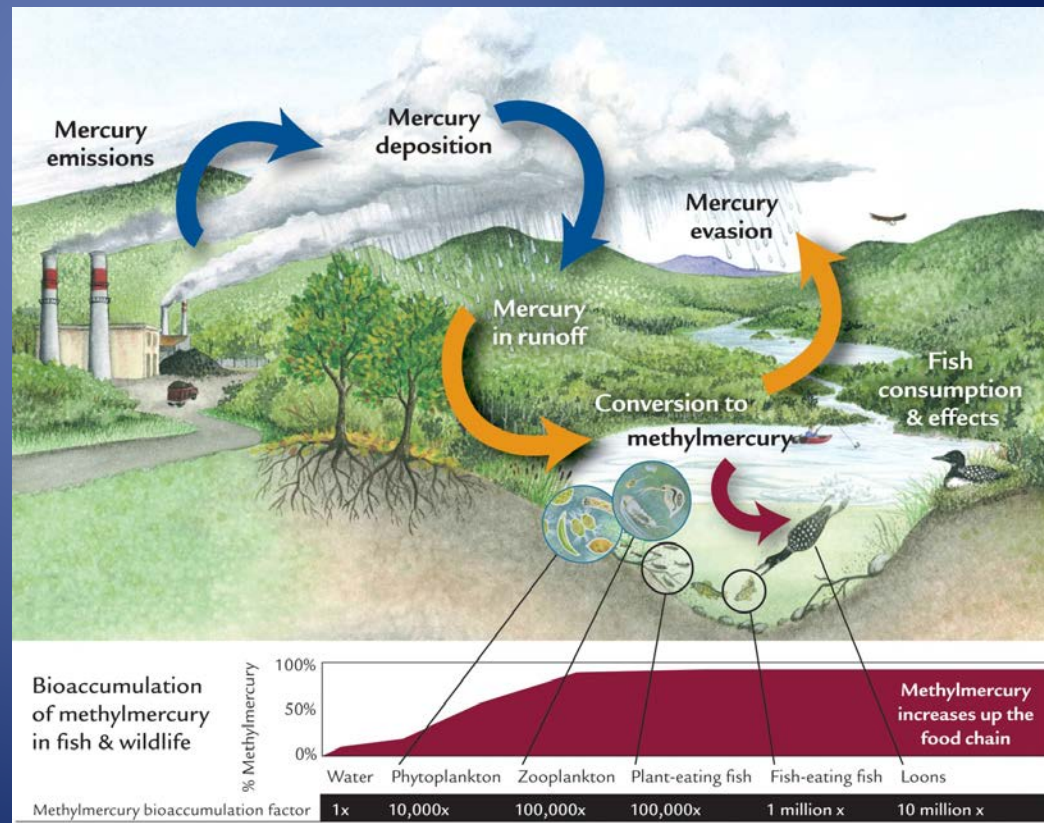
Why Assess Biota vs. only Air Deposition?

- Fish and wildlife are good indicators of spatial gradients and temporal trends within an ecosystem;
- Fish and wildlife are regularly consumed by some human communities;
- Endangered species and species of conservation concern are impacted, sometimes at a population level
- Relationships between Hg deposition and biotic uptake, especially at higher trophic levels remain undefined



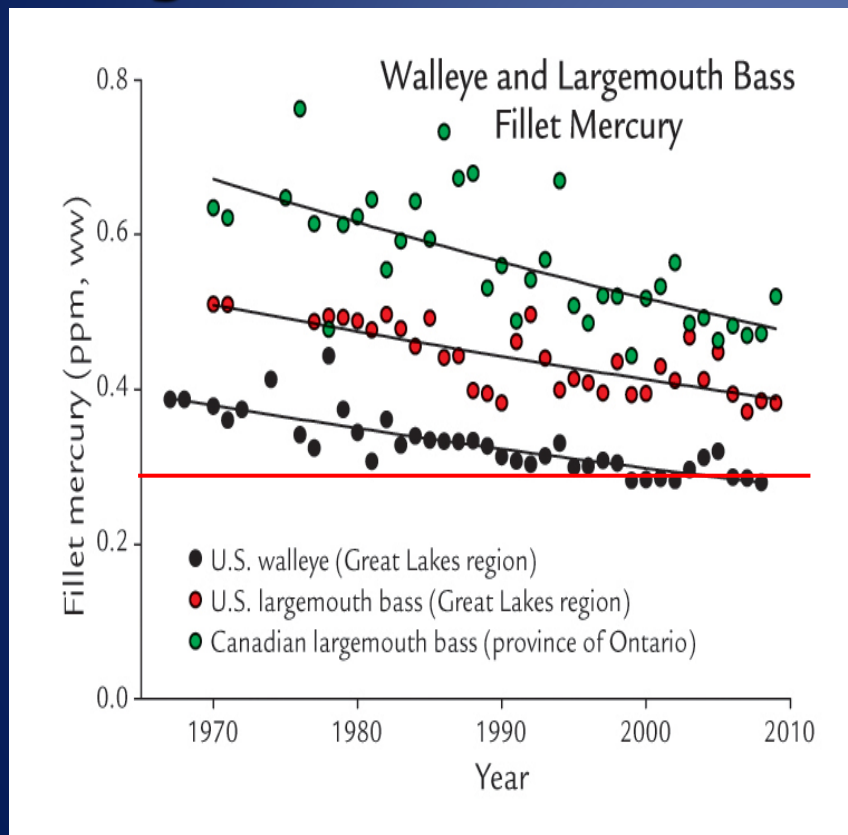
Why do we need comprehensive, long-term mercury monitoring information?

- ❖ Current programs monitor portions of the mercury cycle;
 - But major data gaps and limited coordination exists
- ❖ Insufficient information for many areas of the U.S. to fully and accurately assess the benefits and effectiveness of mercury reduction measures
- ❖ Need to assess the linkages between emissions and deposition with:
 - fish,
 - wildlife and
 - people;
- ❖ Need to determine spatial and temporal trends

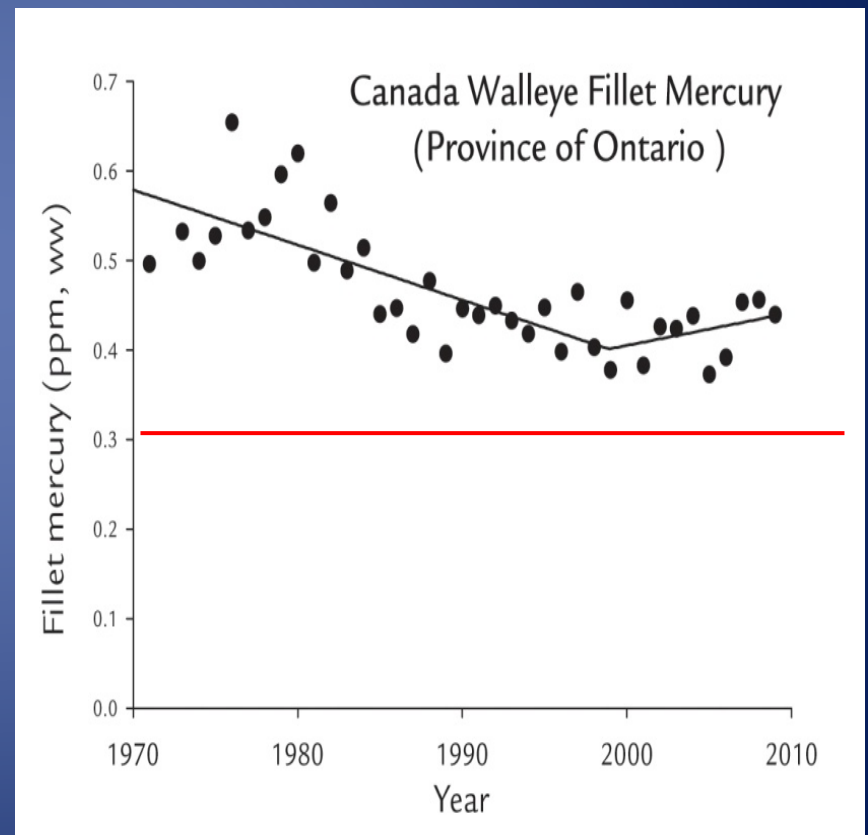


Mercury Trends - Fish

Long-term declines



Recent reversal




Red line = 0.3 ppm – EPA human health criterion

Milestones for the National Mercury Monitoring Network: Meetings and Methods Publications

EPA/SETAC
North American Workshop on
Mercury Monitoring and
Assessment, Pensacola, FL

EPA Office of
Inspector General Report on
mercury "Hotspots"



**National Mercury
MONITORING WORKSHOP**
Tracking mercury concentrations in air, land, water, and biota

May 5 - 7, 2008, Annapolis, MD

2000

2001

2002

2003

2004

2005

2006

2007

2008

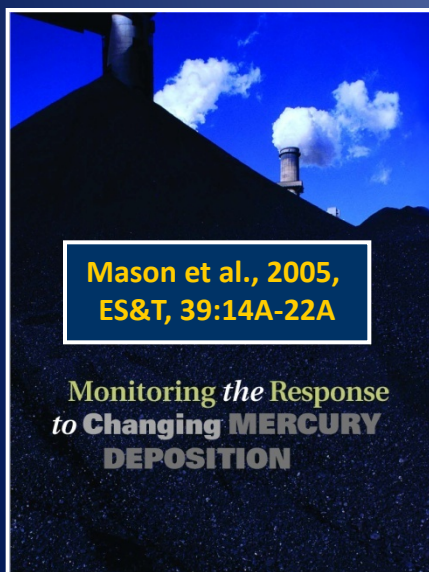
2009

2010

2011

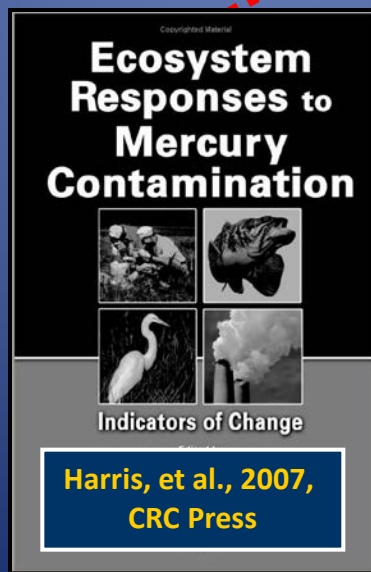
2012

2013



Mason et al., 2005,
ES&T, 39:14A-22A

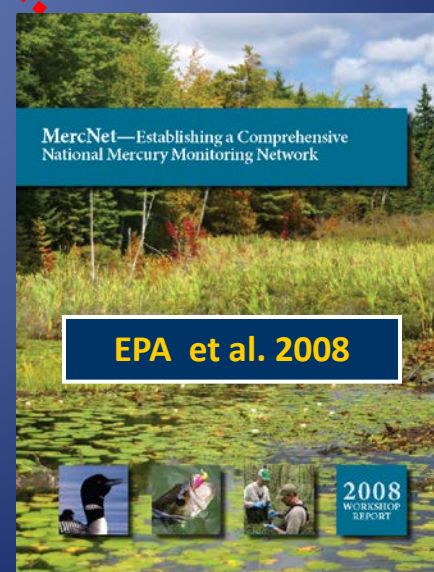
Monitoring *the* Response
to **Changing MERCURY
DEPOSITION**



**Ecosystem
Responses to
Mercury
Contamination**

Indicators of Change

Harris, et al., 2007,
CRC Press



MercNet—Establishing a Comprehensive
National Mercury Monitoring Network

EPA et al. 2008

2008
WORKSHOP
REPORT

Major design elements

- National distribution of sites
- A network of approximately 20 intensive sites, accompanied by ~ 10 cluster sites for each intensive site
- Monitoring sites would be multi-media (e.g., air, water, fish, wildlife)
- Network must run for an extended period to quantify the range of responses expected in many ecosystem types
- Network should build on existing monitoring efforts, where possible

The Indicators

Air & Deposition

- Continuous speciated atmospheric concentrations
- Total wet and dry Hg deposition & flux
- Total Hg weekly wet deposition/flux
- Total and MeHg in throughfall
- Total and MeHg in litterfall
- Total Hg in snowpack
- Mercury evasion/flux
- Watershed inputs/yields



Indicators in yellow would be monitored at intensive sites only. Black would be monitored at cluster sites, when feasible

Water & Sediment

- Total and MeHg in soil
- Forest floor surveys
- Total and MeHg, %MeHg in sediments (seasonal)
- Instantaneous sediment methylation/demethylation rate
- Total and MeHg accumulation in cores
- Total and MeHg in surface water (seasonal)
- Water column Hg & MeHg profiles



The Indicators, cont.

Aquatic Biota

- Total and MeHg in phyto/zooplankton
- Total and MeHg in estuarine benthic invertebrates
- Total and MeHg in whole prey fish (YOY)
- Total Hg in muscle of piscivorous fish



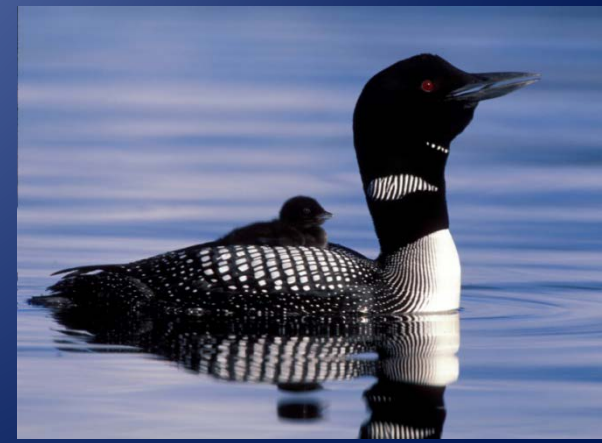
Wildlife

Total Hg in blood, feathers, eggs (as appropriate)

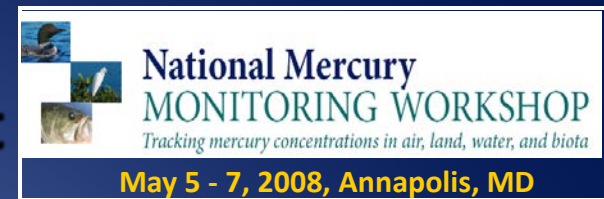
Potential Indicator Species

- Comparison across habitats: Belted kingfisher
- Terrestrial: Raccoon, Bicknell's thrush
- Riverine: Mink
- Lake: Common loon
- Lake/coastal: Herring gull, Common tern
- Wetland: Tree swallow
- Estuarine: Sharp-tailed & seaside sparrows
- Marine nearshore: Harbor porpoise
- Marine off-shore: Storm petrel

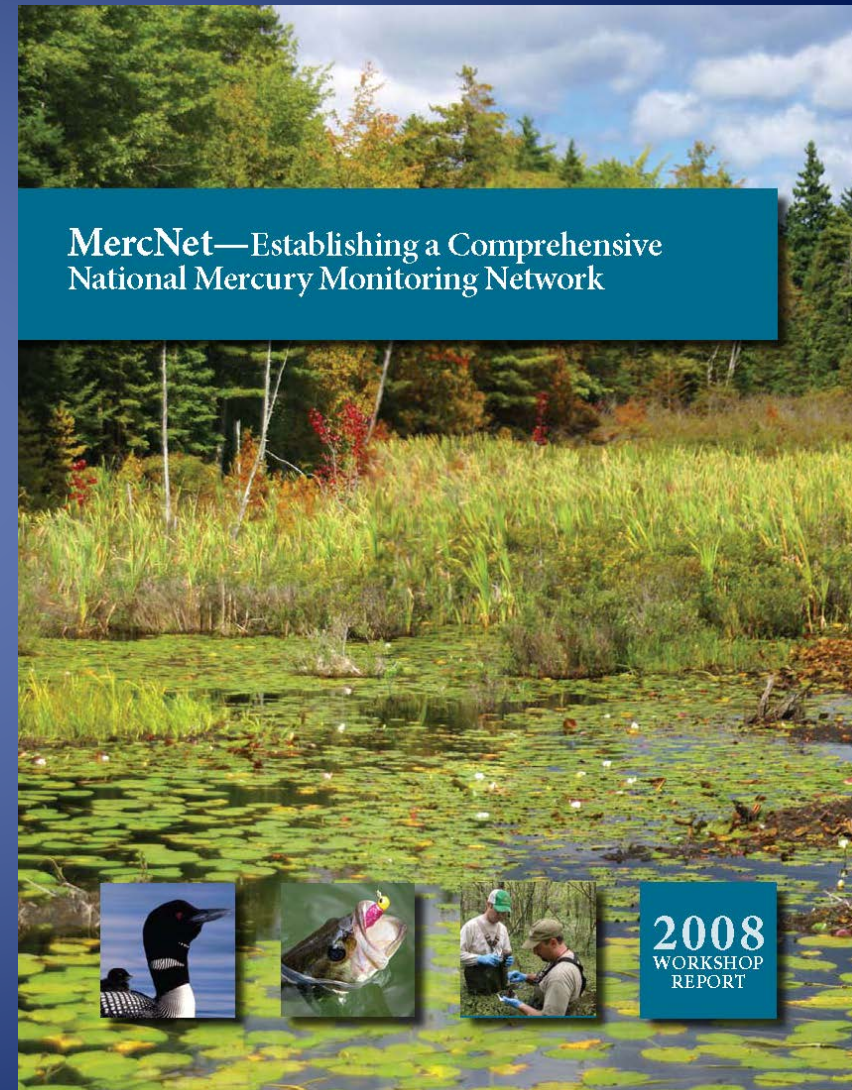
Indicators in yellow would be monitored at intensive sites only. Black would be monitored at cluster sites, when feasible



Mercury Monitoring Workshop Report



- Collaborative effort led by Steering Committee consisting of representatives of federal, state and tribal agencies, academic scientists, and research and monitoring organizations
- Highlights major areas of agreement for a national mercury monitoring network
 - Goal, Objectives, Major Design Elements
- Posted on the BRI Website
<http://www.briloon.org/about/staff/MercNetTheNationalMercuryMonitoringProgram.php>



Milestones for the National Mercury Monitoring Network: Legislation and Publications

H.R. 1533

A BILL

1. To amend the Clean Air Act to require the Administrator to establish a national mercury monitoring network.

S.843

A BILL

1. To amend the Clean Air Act to require the Administrator to establish a national mercury monitoring network.

S.2913

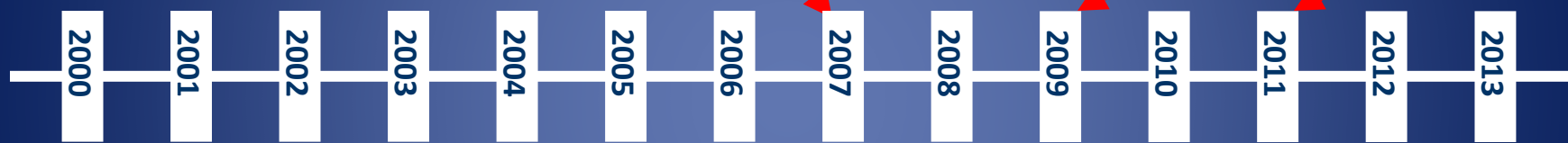
A BILL

1. To amend the Clean Air Act to require the Administrator to establish a national mercury monitoring network.

New Bills to be introduced to the Senate and House in 2011

Comprehensive Mercury Monitoring Bills introduced in House and Senate

Comprehensive Mercury Monitoring Bills introduced in Senate



Ecotoxicology

Mercury Connections

The extent and effects of mercury pollution in northeastern North America

Comprehensive Publications on characterizing Great Lakes mercury.

Articles

Biological Mercury Hotspots in the Northeastern United States and Southeastern Canada

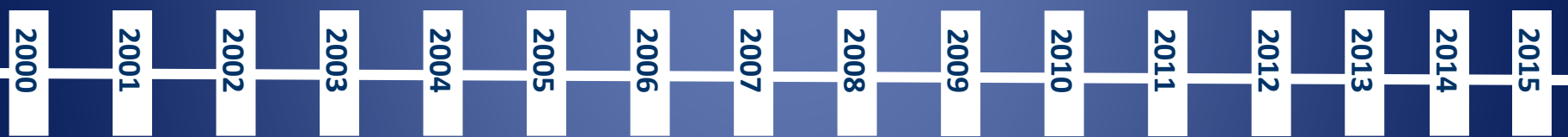
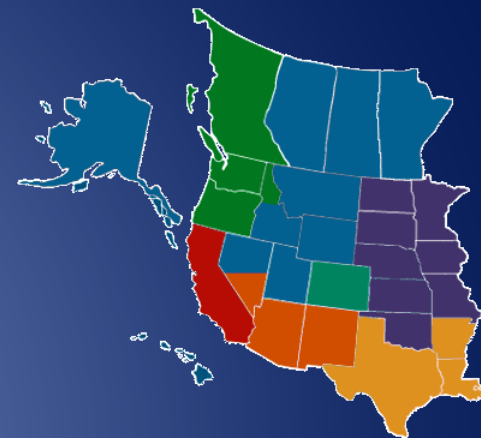
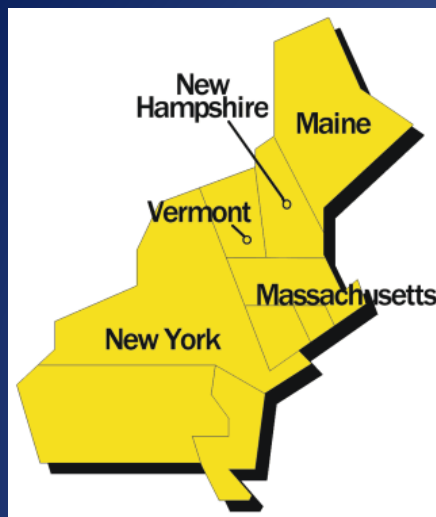
DAVID C. EVERIS, YOUNG-J HAN, CHARLES T. BRISCOLL, NEIL C. KAMMAN, M. NING GOODALE, KATHLEEN FALLON LAMBERT, THOMAS M. HOLSEN, CELIA Y. CHEN, THOMAS A. CLAIR, AND THOMAS BUTLER

Northeastern mercury scientists published two papers in Bioscience on mercury in the environment. Both papers indicated the need for a comprehensive and integrated, nationwide mercury monitoring program.

EcoHEALTH

Extension of methodologies for Hg monitoring in marine ecosystems.

Milestones for the National Mercury Monitoring Network: Regional Hg Summaries



Northeast

Co-PI
David Evers, BRI
Tom Clair, Environment Canada

72 scientists, 21 papers

Great Lakes

Co-PI
David Evers, BRI
Jim Wiener, Univ. of Wisconsin

172 scientists, 35 papers

Western North America

Co-PI
David Evers, BRI
Collin Eagles-Smith, USGS
Mark Marvin-DiPasquale, USGS
Jim Wiener, Univ. Wisc.
Elsie Sunderland, Harvard Univ.

MercNet Database: Online Library

MercNet | Tracking mercury in air, water, land, fish and wildlife - Windows Internet Explorer

http://mercnet.brilon.org

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Google Search

Biodiversity Research Institute

HOME SCIENCE & CONSERVATION BR WEBCAMS RESOURCE LIBRARY ABOUT US SUPPORT BR

MercNet Monitoring Inventory: Online Library (in BETA)

Welcome to the MercNet monitoring inventory, a meta-database of mercury datasets from the United States and Canada. Explore the database using the search options below. Source datasets may be available through this website, or by using the MercNet data request form.

The MercNet monitoring inventory is maintained by the Biodiversity Research Institute.

Search by Keyword

HINT: Start with a basic search and refine it on the next page.

Search by Medium

[atmospheric deposition](#) (2) [birds](#) (9) [fish](#) (20) [invertebrates](#) (8) [herptiles](#) (4) [mammals](#) (1) [plants](#) (1) [sediment cores](#) (5) [water](#) (7)

Search by Region

To view projects within a specific region, select from the list or map below.

- 1 Region 1 (10)
- 2 Region 2 (13)
- 3 Region 3 (10)
- 4 Region 4 (8)
- 5 Region 5 (31)
- 6 Region 6 (4)
- 7 Region 7 (3)
- 8 Region 8 (6)
- 9 Region 9 (5)
- 10 Region 10 (5)
- 11 Region 11: Pacific and Yukon (0)
- 12 Region 12: Prairie and Northern (1)
- 13 Region 13: Ontario (8)
- 14 Region 14: Quebec (2)
- 15 Region 15: Atlantic (2)
- 16 Region 16: Other (0)



[Region Glossary](#)

Internet 75%

MN PCA - Minnesota Fish Contaminant Database | MercNet | Tracking mercury in air, water, land, - Windows Internet Explorer

http://mercnet.brilon.org/projects/MN_PCA_-_Minnesota_Fish_Contaminant_

File Edit View Favorites Tools Help

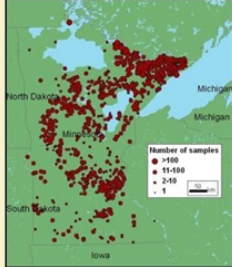
Google Search

MN PCA - Minnesota Fish Contaminant Database | Me...

[Search for Another Project](#)

MercNet Monitoring Inventory: Online Library

MN PCA - Minnesota Fish Contaminant Database



Overview

Minnesota state fish contaminant database, a cooperative effort from the Minnesota Department of Natural Resources, Minnesota Department of Health, and Minnesota Pollution Control Agency. Initiated 1967. THg and ancillary data on sportfish fillets, with emphasis on northern pike and walleye.

Source Agency: Minnesota Department of Natural Resources, Minnesota Department of Health, Minnesota Pollution Control Agency
Agency/Project Website: <http://www.pca.state.mn.us/>
Medium: fish
Start Date: 1967

Contact

Bruce Monson, Environmental Information and Reporting
bruce.monson@state.mn.us

Address
520 Lafayette Rd. N
St. Paul, MN 55155
Phone: 651-757-2579 **Fax:** 651-297-8676

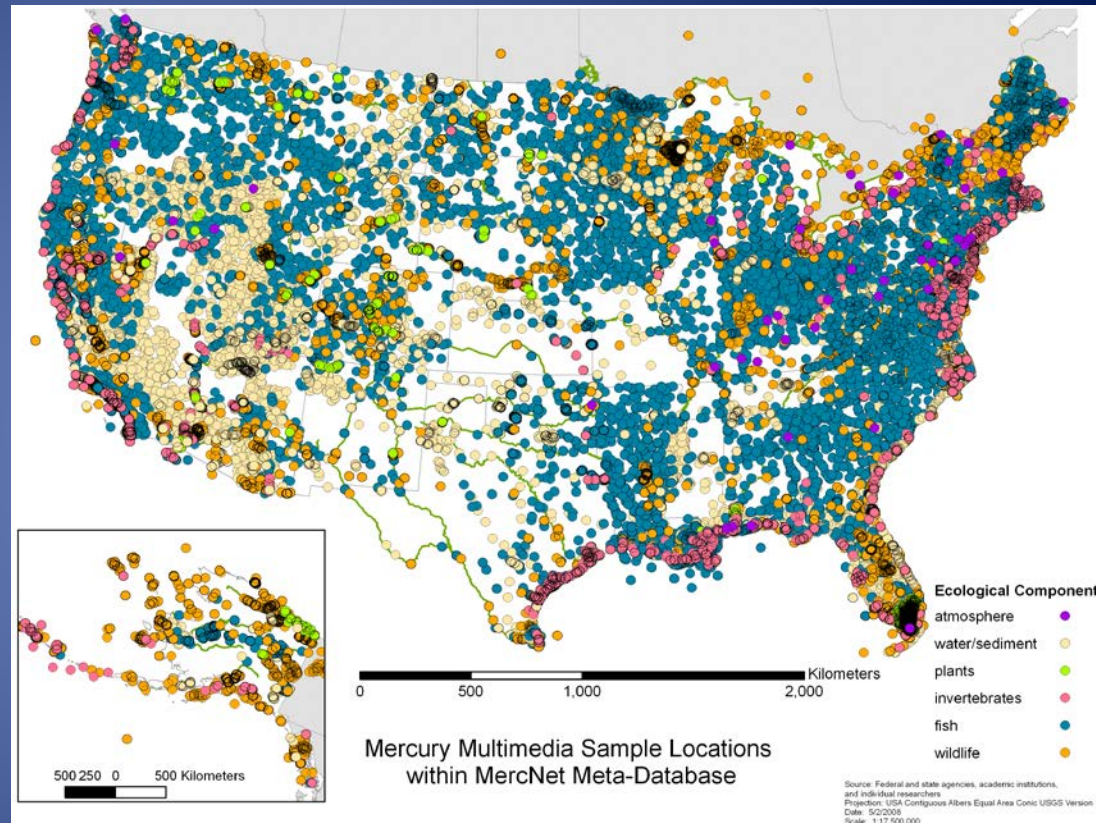
Click map for larger view

Summary	Collection Details	Data Details	Datasets
Name of dataset	Minnesota Fish Contaminant Database		
Geographic area	Minnesota		
State/Province	MN		
Activity Category	Monitoring		
Medium	fish		
Focal species	all sportfish, but emphasis on northern pike and walleye		
Tissue Types	fillet		
Approximate size of dataset	31000		
Positional data available?	yes		
Start Date	1967		
End Date	2008		
Status	Ongoing		

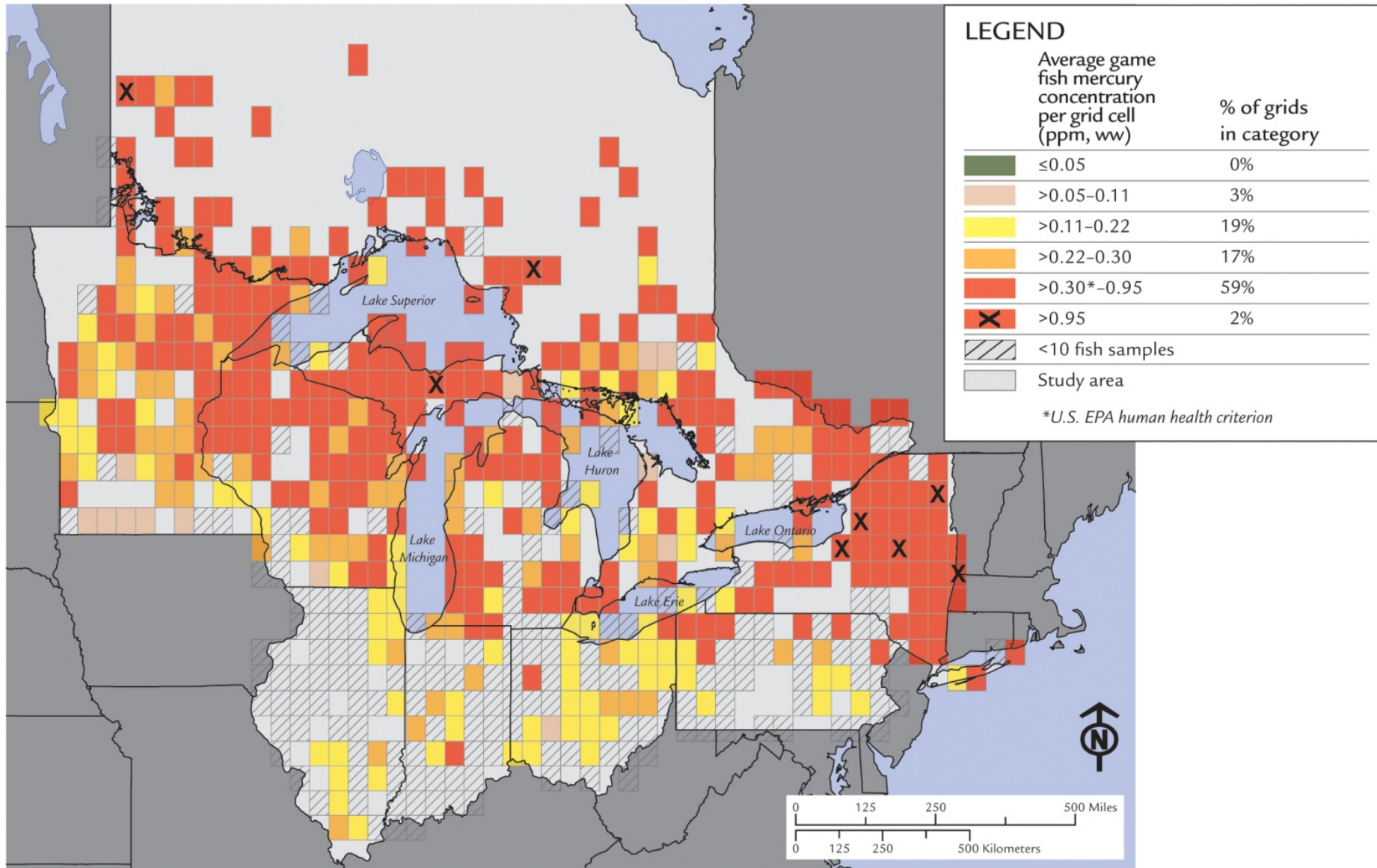
Internet 75%

MercNet database: A broad mix of Hg data

- Based on major environmental monitoring databases from EPA, USGS, USFWS, NOAA Biodiversity Research Institute
- > 700,000 mercury sampling events across the U.S.
- Various media: Atmosphere, Water, Sediment and soil, Vegetation, Invertebrates, Fish, Birds, Reptiles and Amphibians, Mammals
- Time span of records is from 1896 to 2009



Mercury in Game Fish



Current list of site selection considerations

**Baseline data
and infrastructure**



- Longer-term mercury data
- Existing facilities and infrastructure to support the monitoring program

**Will we see
and be able
to understand
a change?**



- Sensitive to mercury inputs
- Expected to exhibit large changes due to changes in Hg deposition
- Near emission sources and may receive elevated Hg deposition
- Clearly defined response – few if any confounding factors

Model evaluation



- Useful testbed for evaluation of atmospheric Hg models
- Useful testbed for evaluation of ecosystem Hg models

**Want a range
of site types**



- Overall, want nationwide geographical distribution
- Overall, want range of characteristic response times
- Overall, want some background sites for characterizing global Hg inputs

Other site issues



- Endangered, threatened or candidate species at risk to Hg

Conceptual National Mercury Monitoring Network Design -- preliminary intensive sites discussed

Ohio River Valley

Steubenville, OH
Frostburg, MD
Canaan Valley Institute, WV
Athens, OH

Upper Midwest

Voyageurs National Park, MN
Experimental Lakes Area, Canada
Dexter, MI
Marcell Experimental Forest, MN
Northern Highland Forest, WI

West

Rocky Mountain National Park, CO
Toolik, AK
Glacier Bay, AK
Stillwell, OK
Sierra Nevada, CA/NV
Mt. Ranier, WA
Four Corners-Mesa Verde, CO
Mt. Bachelor, OR as a "global background" site

Southeast

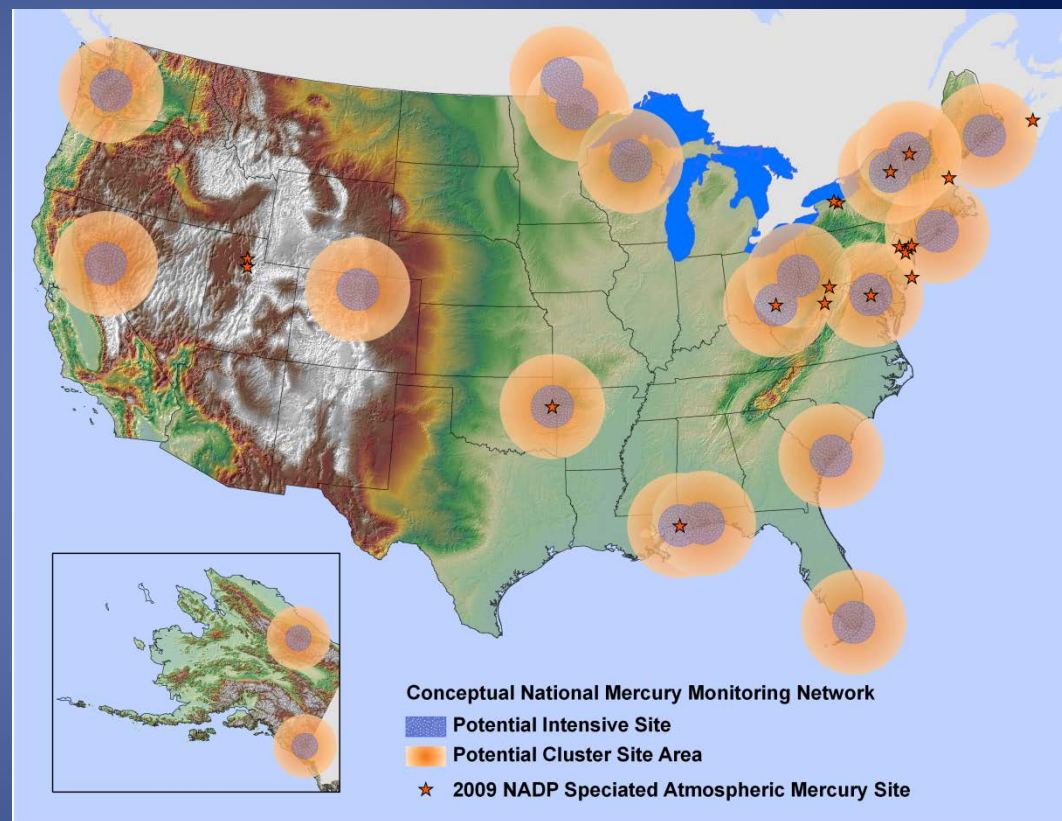
Everglades National Park, FL
Coastal South Carolina [Ace Basin]
Northern Gulf Coast
Grand Bay NERR, MS
Pensacola, FL
Atlanta/Yorkville, GA

Mid Atlantic

Chesapeake Bay [Beltsville, SERC]

Northeast

Huntington Wildlife Forest, NY
Acadia, National Park, ME
Proctor Center, Underhill, VT
Neversink Watershed, NY
Cape Code National Seashore, MA
Long Island Sound, NY
Mt. Washington, NH
Kejimikujik, NS



Demonstration stations proposed in Great Lakes, NY and Maine

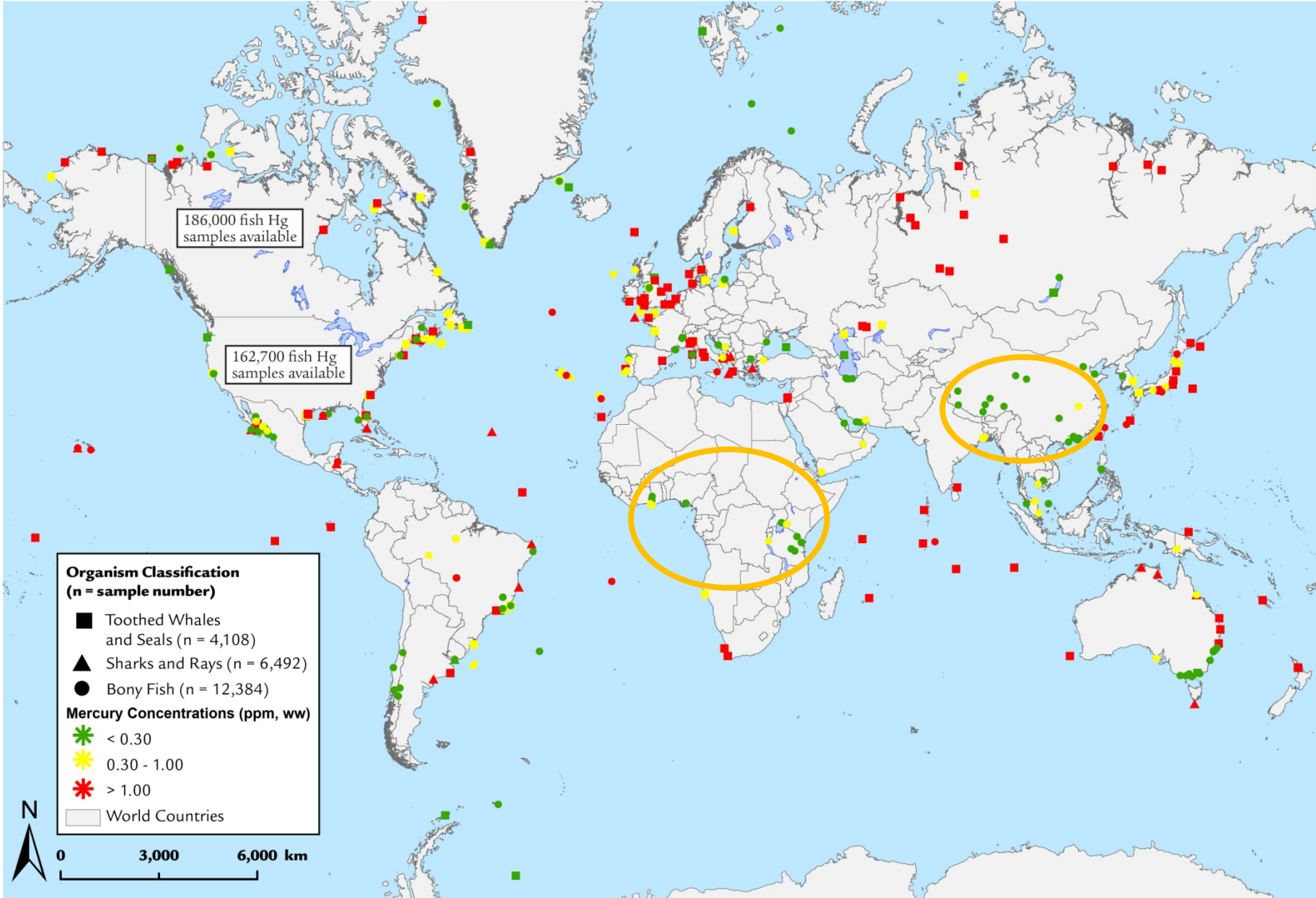
UNEP Global Mercury Programme

- Global Legally-binding Instrument on mercury
 - Need agreed in 2009 by the General Council
 - First treaty for UNEP in a decade
- Eight Partnership Areas
 - Transport and Fate Research Partnership Area Group
 - Biodiversity Research Institute is a member

MercNet as a Template

- Interest in using MercNet as a template for evaluating the effectiveness of the Treaty (for monitoring and for the database).
 - Further deliberations with the Intergovernmental Negotiating Committee (INC) will be made with the UNEP Mercury Secretariat
 - INC5 will be in late January 2013 in Geneva, Switzerland
 - Signing of Treaty in Minamata, Japan in 2013
 - A joint effort between UNEP and BRI is the development of a global biotic Hg database

GLOBAL BIOTIC MERCURY DATABASE



11th International Conference on
Mercury as a Global Pollutant
(ICMGP)

Edinburgh, Scotland

July 28 to August 2, 2013

<http://www.mercury2013.com/>