Linking Mercury Monitoring with Policy

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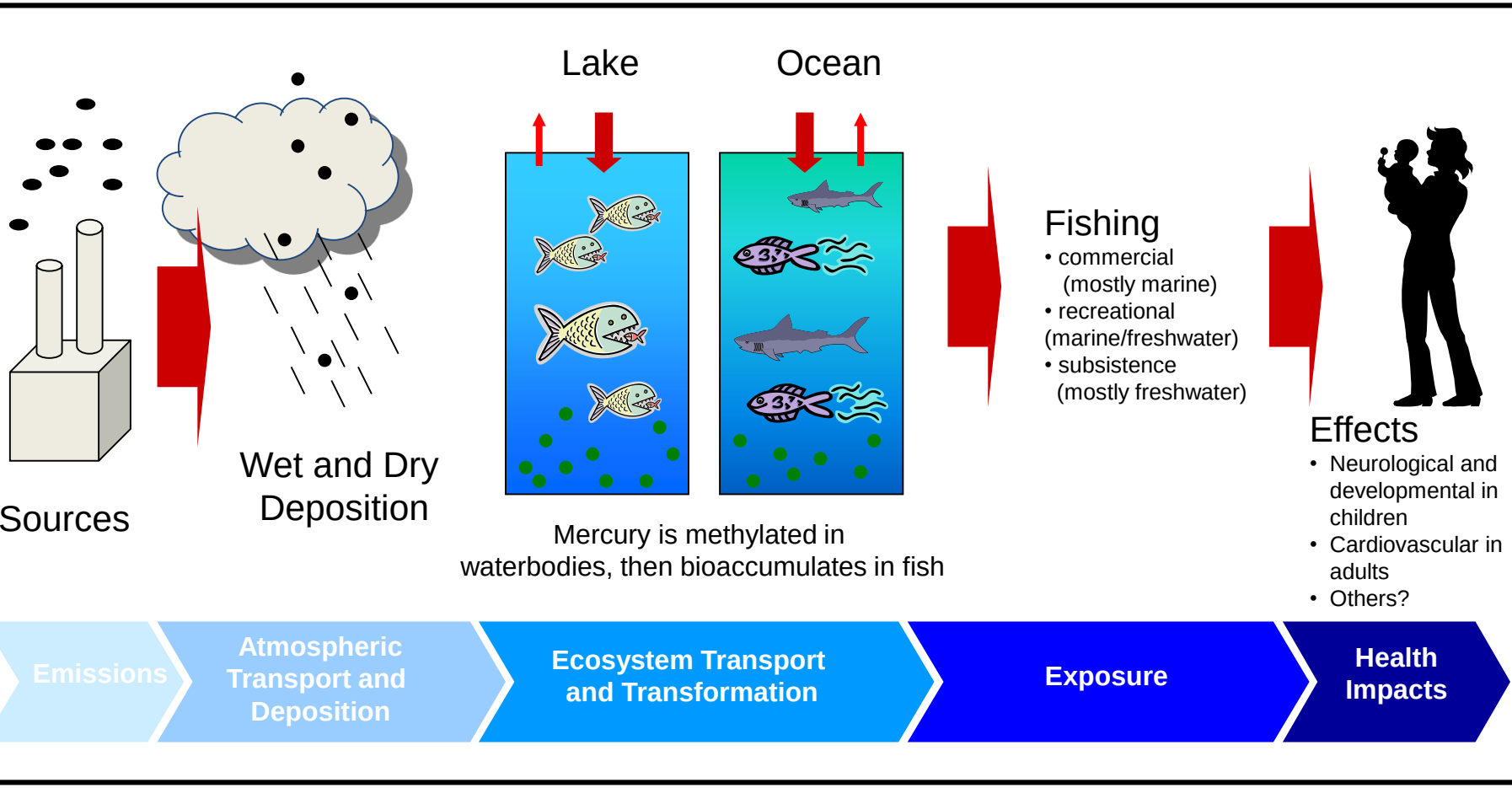
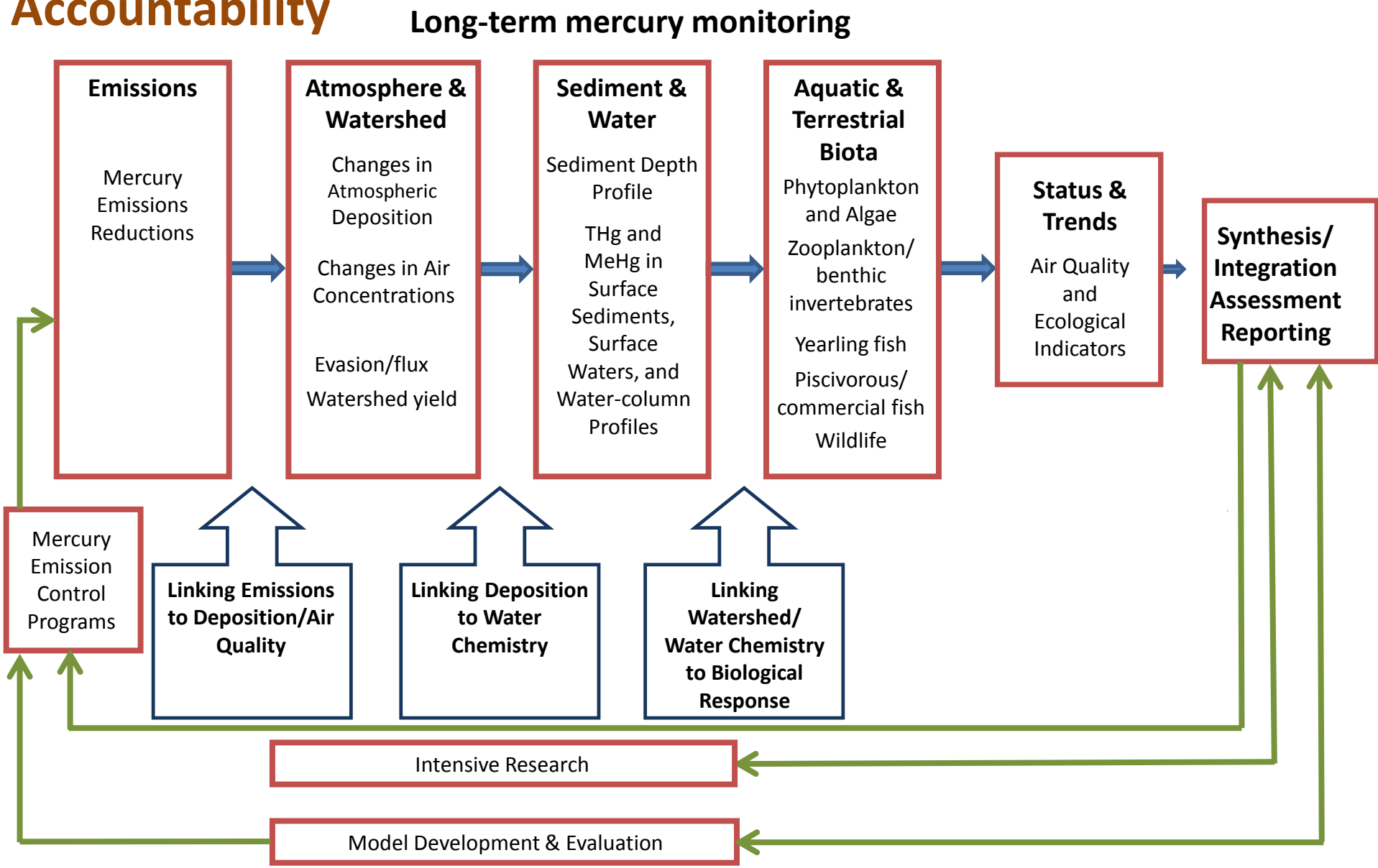
Multiple pieces to the mercury assessment puzzle



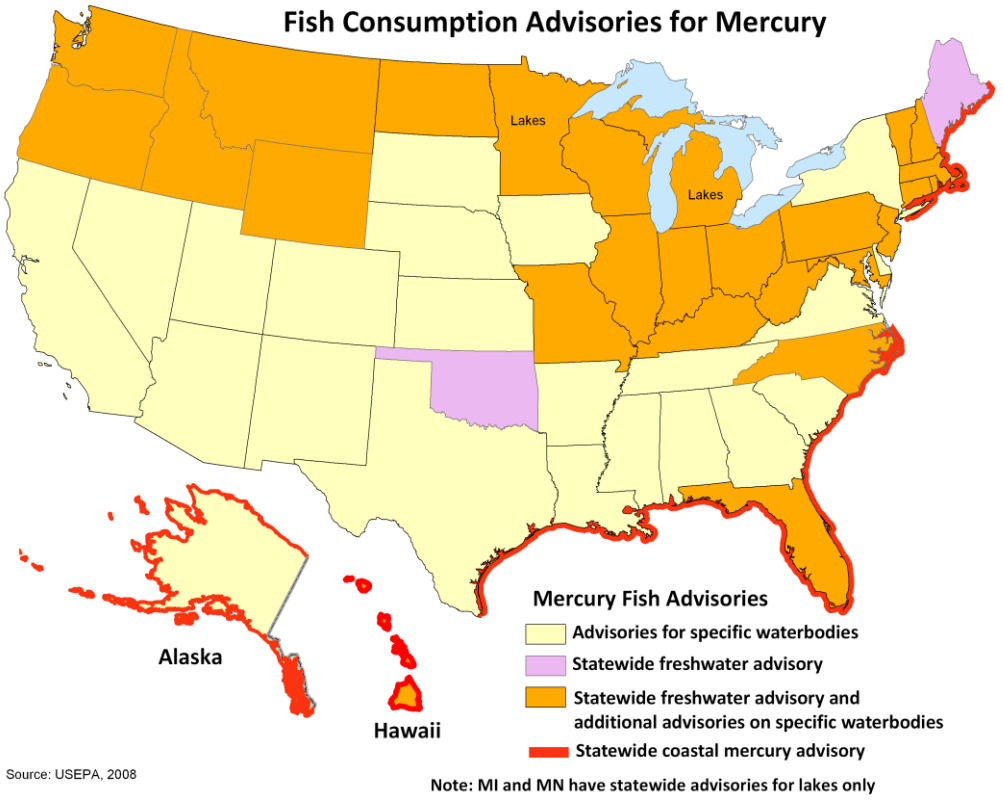
Conceptual Framework for Atmosphere-Ecosystem Mercury Accountability



Schmeltz et al., 2011

The U.S. mercury 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



EPA United States Environmental Protection Agency

Mercury emissions in the U.S.: 1990, 2005, and net emissions changes

Table 1 Mercury emissions by source category for 1990 and 2005, and net emissions changes over this interval

Source category	Emissions (tons/year)		Net changes between 1990 and 2005 (tons/year)
	1990	2005	
Utility coal boilers	58.8	52.3	−6.5 (−11.1%)
Hospital/medical/infectious waste incineration	51	0.3	−50.7 (−99.4%)
Municipal waste combustors	57.2	2.4	−54.8 (−95.8%)
Industrial/commercial/institutional boilers and process heaters	14.4	10.3	− 4.1 (−28.5%)
Mercury cell chlor-alkali plants	10.0	0.3	−9.7 (−97.0%)
Electric arc furnaces	7.5	7.3	−.2 (−2.7%)
Commercial/industrial solid waste incineration (CISWI)[a]	Not available	0.3	
Hazardous waste incineration[b]	6.6	3.2	−3.4 (−51.5%)
Portland cement non-hazardous waste[b]	5.0	7.5	2.5 (50.0%)
Gold mining	4.4	2.5	−1.9 (−43.2%)
Sewage sludge incineration	2.0	1.1	−.9 (−45.0%)
Mobile sources	Not available	1.1	
Other categories[c]	29.5	12.4	−17.1 (−58.0%)
Total (all categories)	246.4	101.0	−145.4 (−59.0%)

a CISWI estimates in Table 1 do not include cement kilns

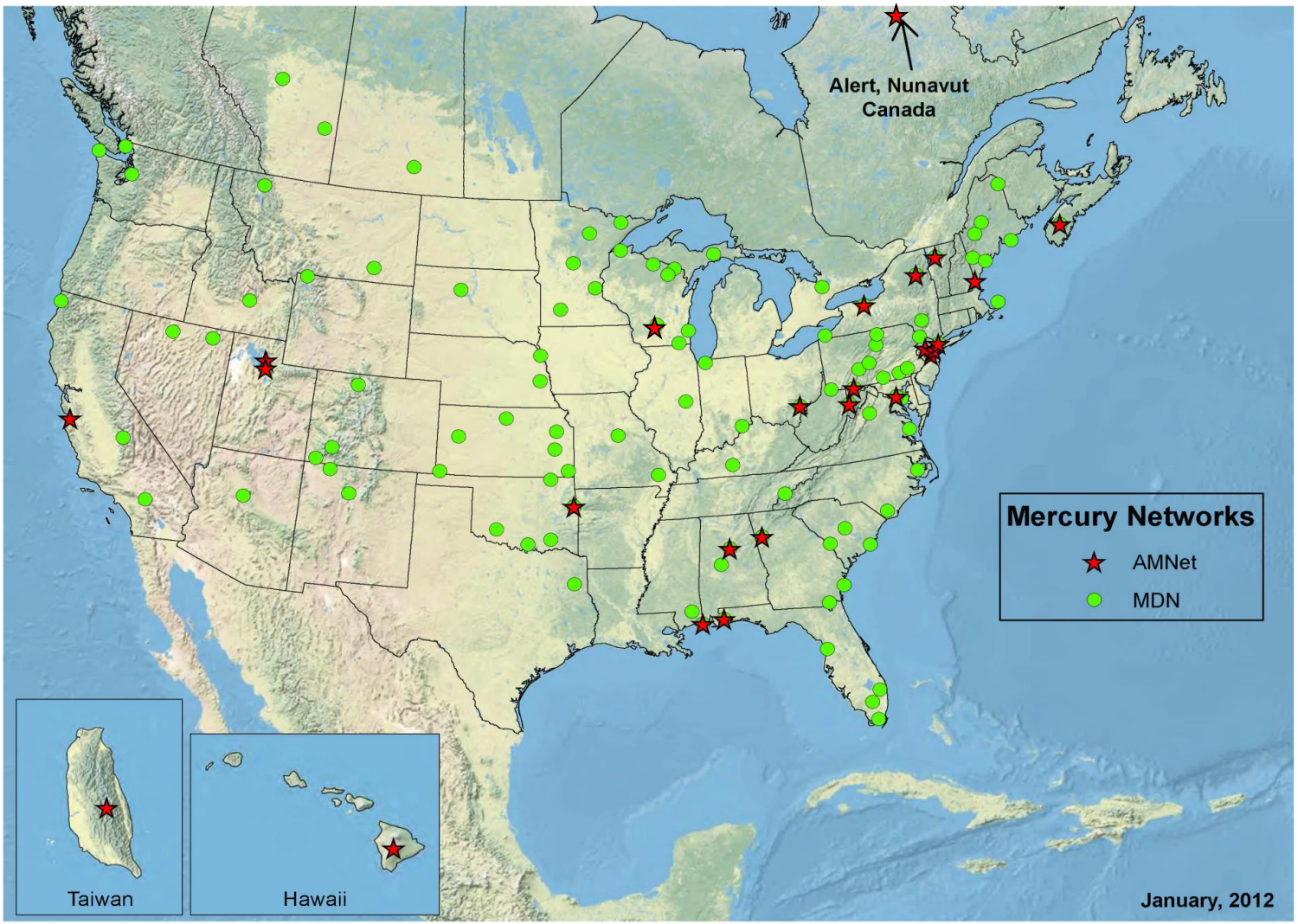
b Hazardous waste incineration category includes Portland cement hazardous waste kilns. 1990 estimates for Portland cement and hazardous waste incineration do not use the same methodology and are underestimated in 1990 based on current data

c Includes other Hg emitting source categories: chemical manufacturing, metal fabrication operations, agriculture mineral processing, cremation, dental amalgam, engine test cells, electrical equip manuf, fluorescent light breakage/recycling, ferroalloys, manufacturing, iron and steel production, landfills, nonferrous metals, oil and gas production, refineries, petroleum product distribution, plywood, pulp/paper, residential heating, and waste disposal

Table is based on data in the 1990 National Emissions Inventory (NEI) for Hazardous Air Pollutants and the 2005 National-scale Air Toxics Assessment (NATA) emissions inventory, provided by Anne Pope U.S. EPA/OAQPS 3/24/11

North American atmospheric mercury networks: wet deposition & speciated concentrations

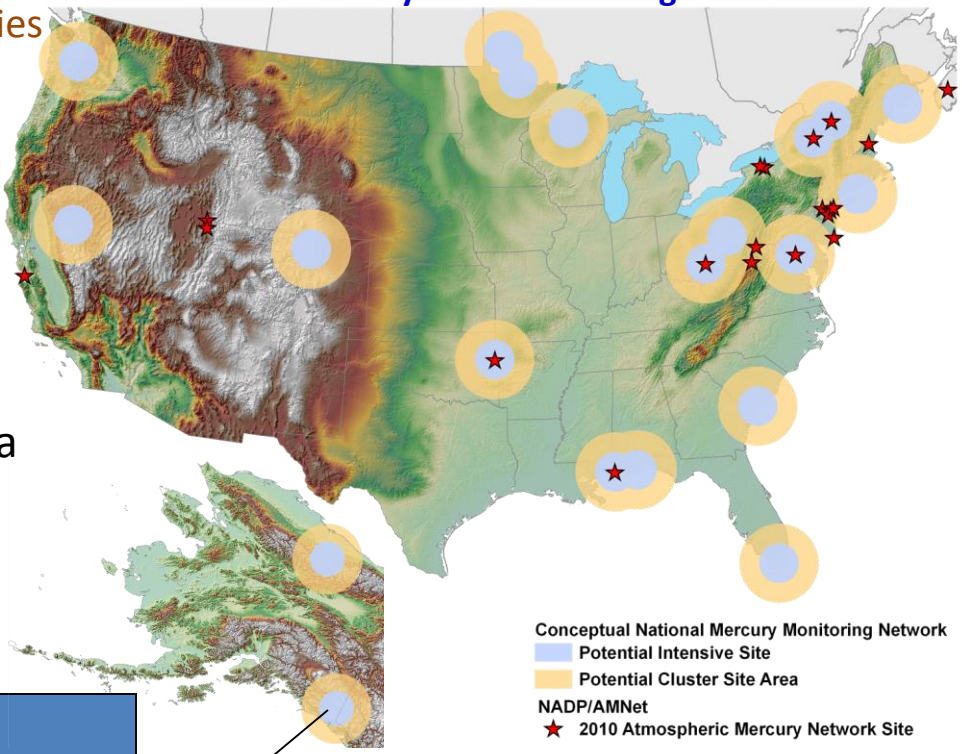
National Atmospheric Deposition Program/ Mercury Deposition Network & Atmospheric Mercury Network



Conceptual national mercury monitoring network design

- Propose combination of intensive and cluster sites:
  - Intensive sites are those where detailed studies will be done to track changes and assess the cause of any changes
  - Cluster sites would be near an intensive site and provide a general understanding of environmental responses for a region or ecosystem type
- MercNet database: ~500,000 Hg multi-media sampling events, 1896-2009
- Regional Hg Summaries (NE, Great Lakes, West)

MercNet: Linking Atmospheric Mercury and Ecosystem Monitoring



Example network indicators


Ambient air and atmospheric deposition


Water and sediment

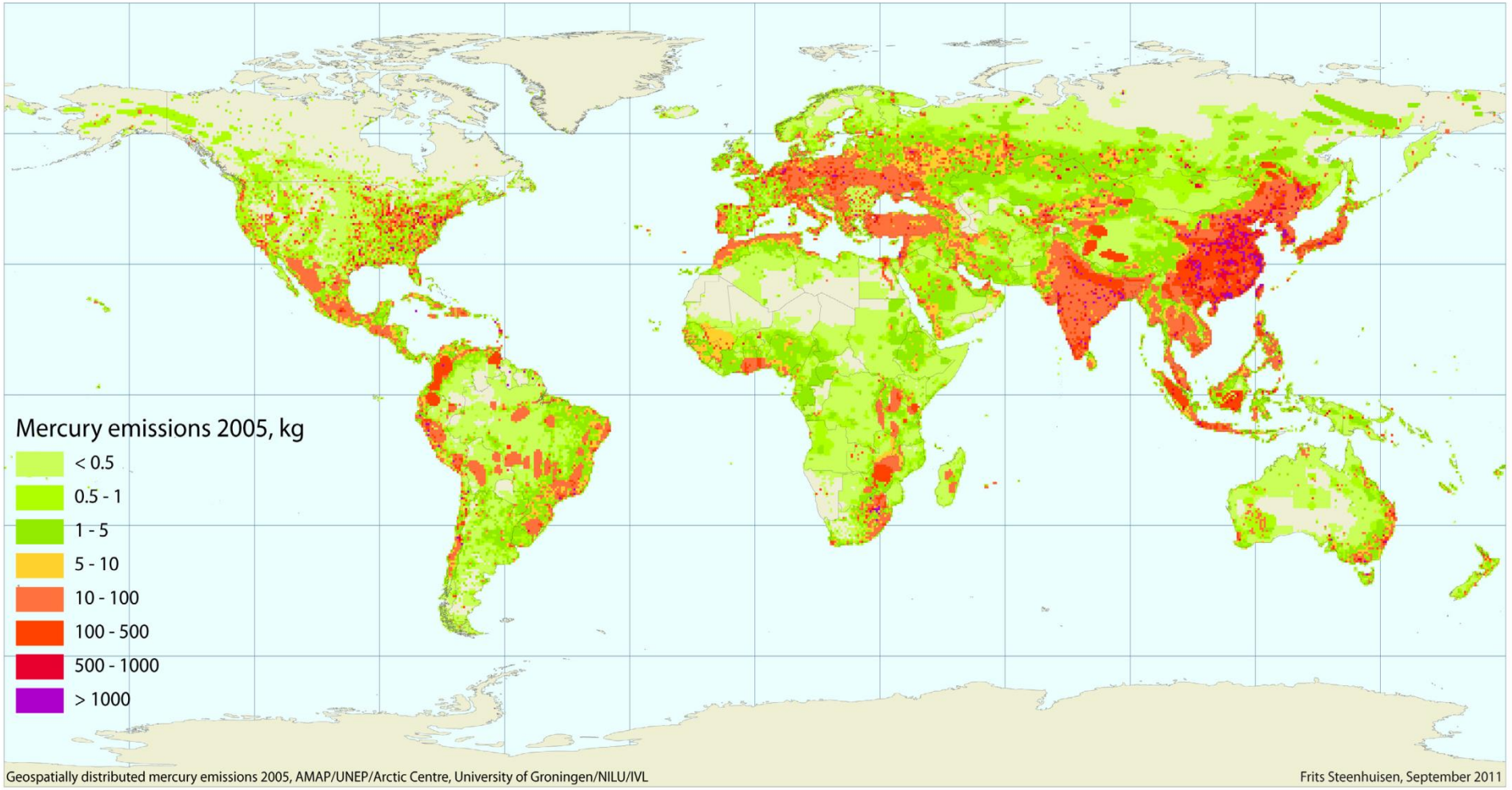

Aquatic biota


Wildlife

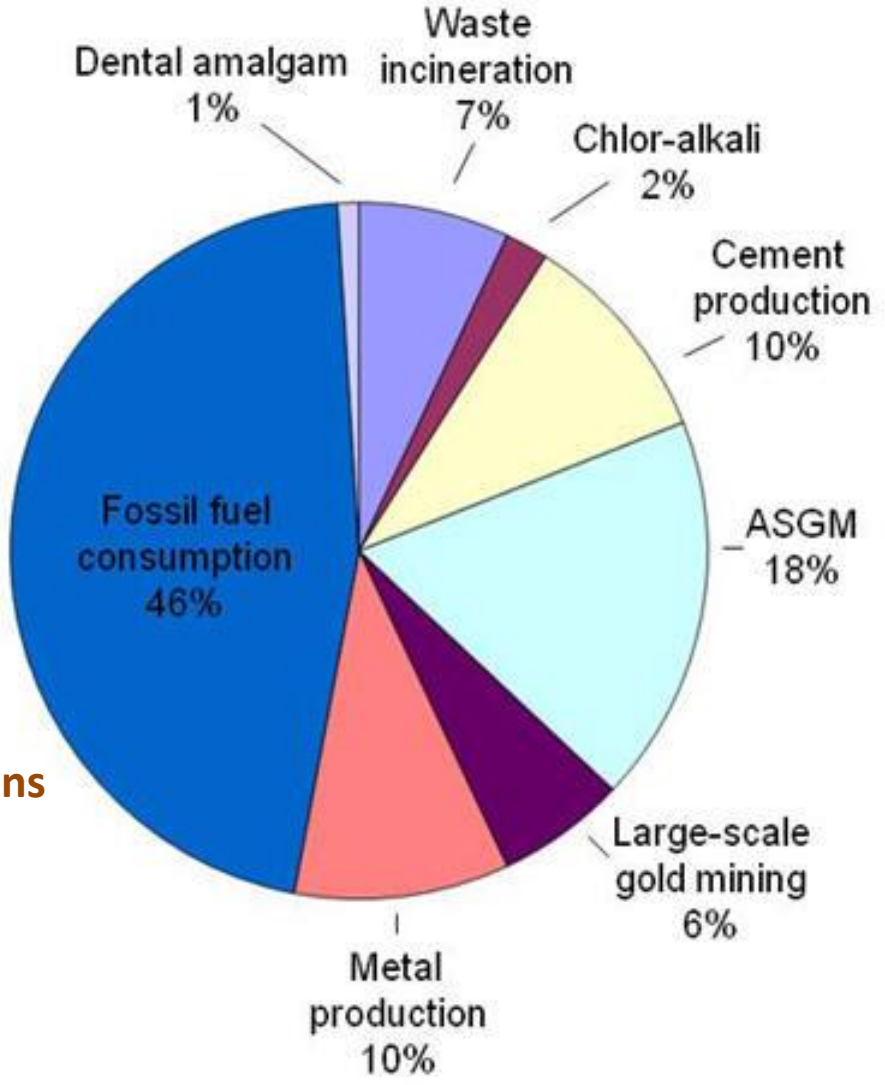
Mason et al, 2005, Harris et al., 2007, Schmeltz et al, 2011

EPA United States Environmental Protection Agency

Global emissions of mercury from anthropogenic sources, 2005



Estimated proportion of global anthropogenic mercury emissions, 2005



(Artisanal &Small Scale Gold Mining)

Total = 1930 metric tons

Source: United Nations Environment Programme (UNEP)
The Global Atmospheric Mercury Assessment: Sources, Emissions and Transport, 2008

Mercury in fish and marine mammals

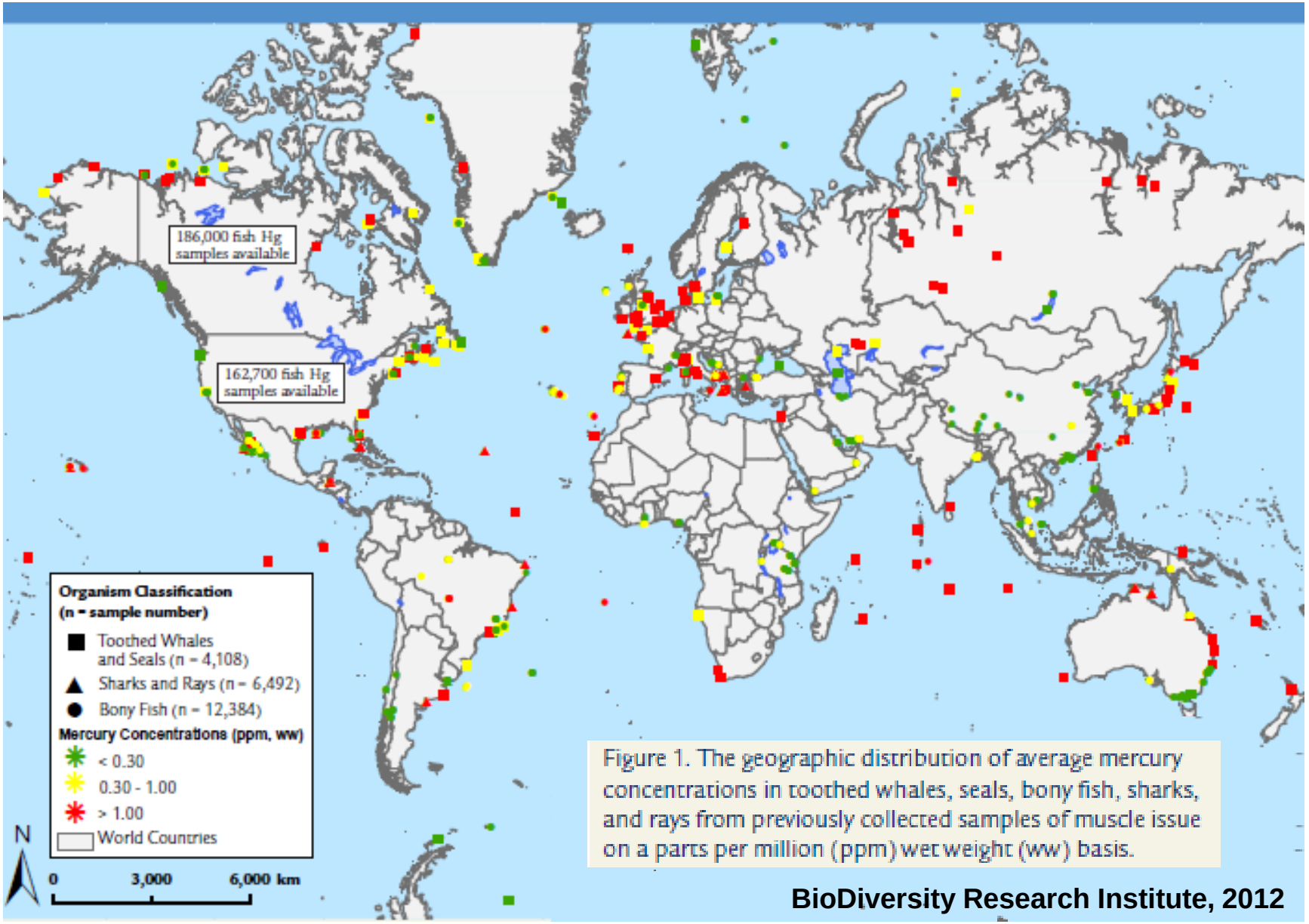


Figure 1. The geographic distribution of average mercury concentrations in toothed whales, seals, bony fish, sharks, and rays from previously collected samples of muscle issue on a parts per million (ppm) wet weight (ww) basis.

BioDiversity Research Institute, 2012

Mercury in tuna

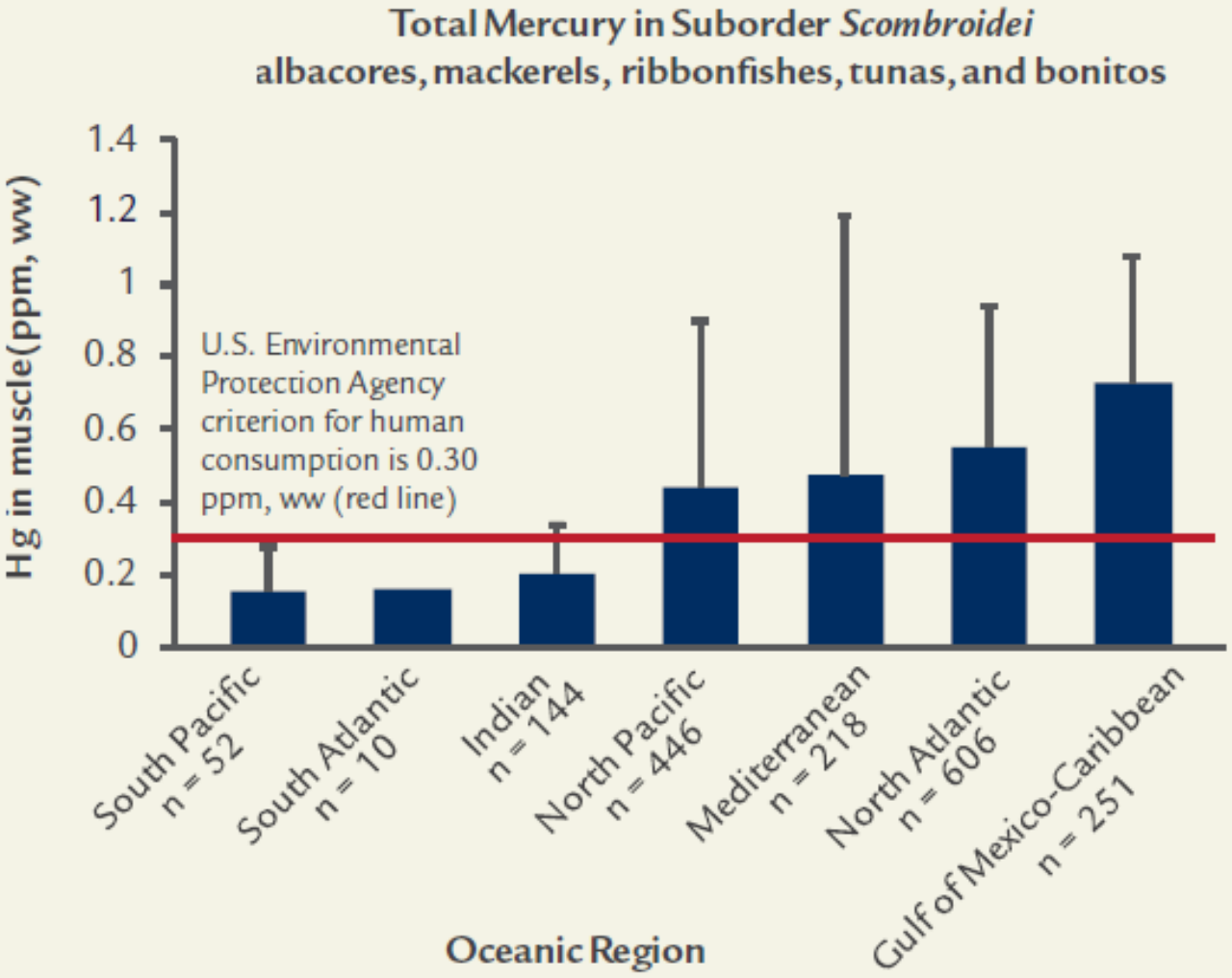


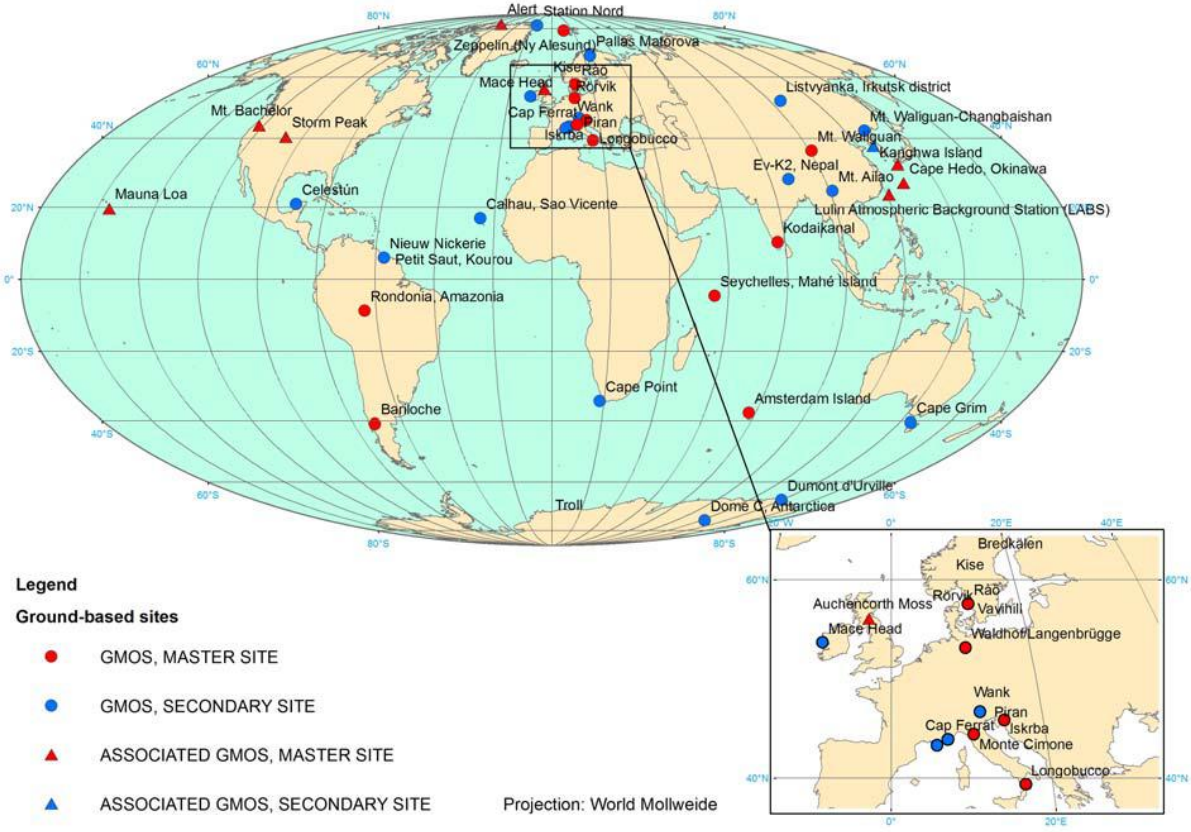
Figure 5. Average mercury (Hg, ppm, ww) ± standard deviation in tuna species by major oceanic region. Total number of references cited was 25 and the total sample size = 1,727.

UNEP mercury policy driver

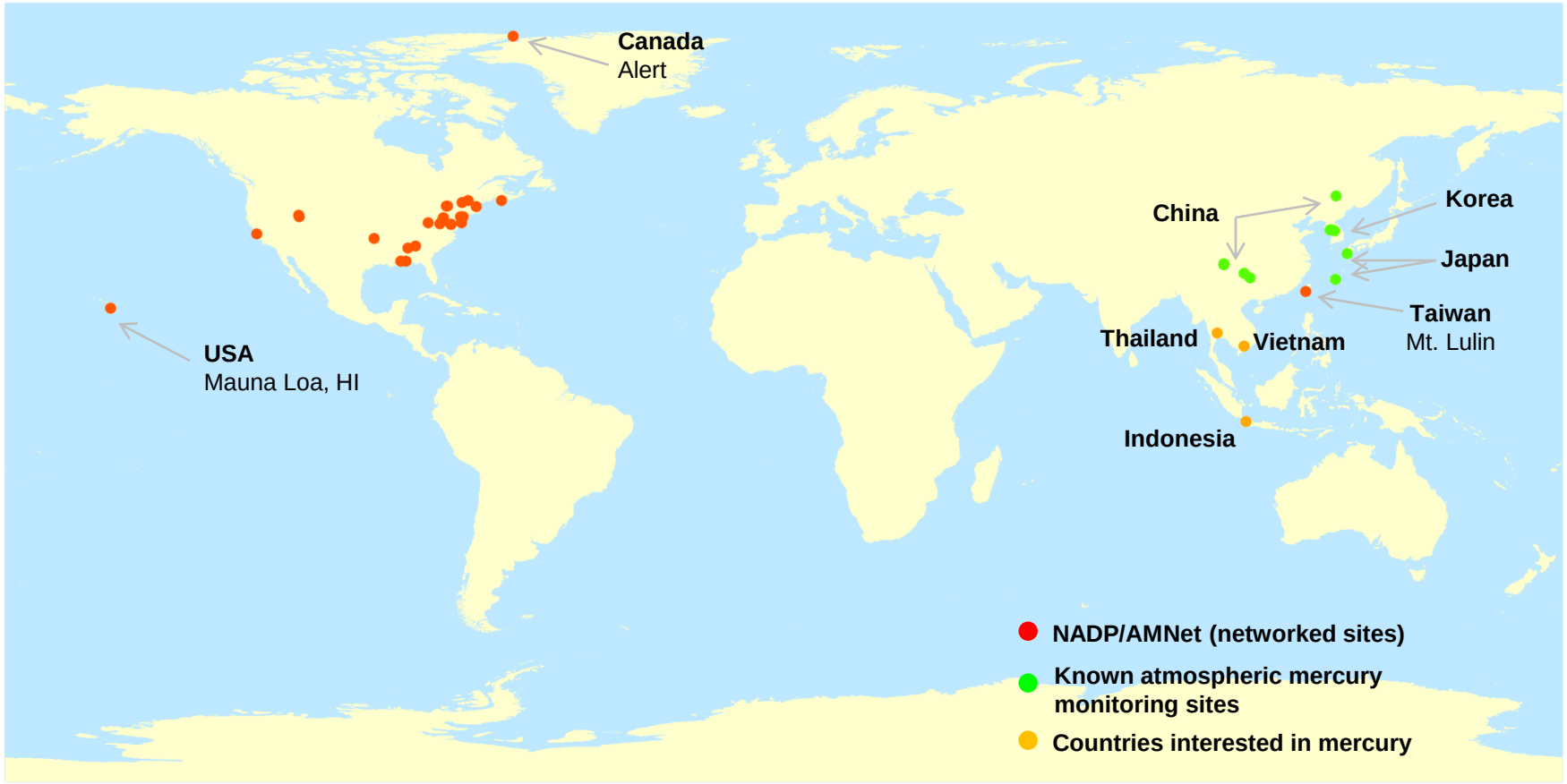
- More than 140 countries negotiating a global, legally binding treaty aimed at slashing the use of mercury
- Final negotiations anticipated in January 2013
- What will mercury reductions mean for mercury deposition to coastal, marine, freshwater, and terrestrial ecosystems?

Global Mercury Observation System

- Year 3 of a 5-year research project funded by the European Commission
- Ground-based monitoring stations, shipboard measurements, and aircraft measurements
  - Atmospheric mercury concentrations and wet deposition
- Remote, hemispheric measurement focus
- NADP a big contributor
  - SOPs
  - Extensive training
  - Historical data



Opportunities for regional cooperation



Keys to success - lessons learned from NADP

- "Build a community" - Share information and data , identify common monitoring objectives, agree to coordinate
- Develop a "vision" for what a network might look like
- Leverage existing monitoring sites, expertise, and resources to minimize cost, when possible
- Consistent, harmonized network-wide field and lab standard operating procedures and quality assurance
- Share responsibilities; develop a multi-stakeholder, participatory system of governance
- Scientific credibility