

# Mercury in New Jersey

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NJ Department of Environmental Protection

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# Mercury - PBT

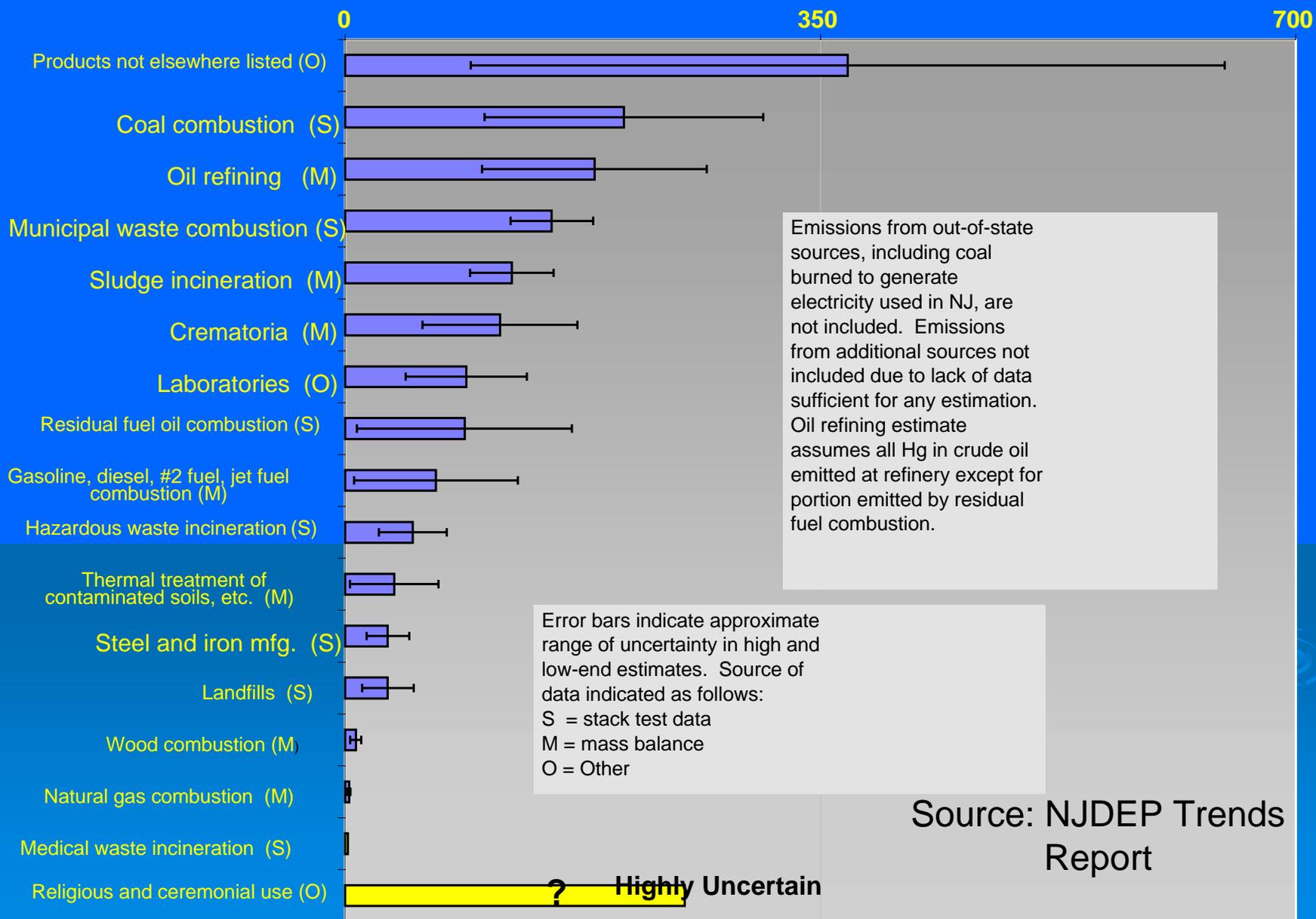
- Persistent
  - Bioaccumulative
  - Toxic
  - Inorganic Hg  $\Rightarrow$  Methylmercury
  - Food Chain Biomagnification
- 

# Mercury

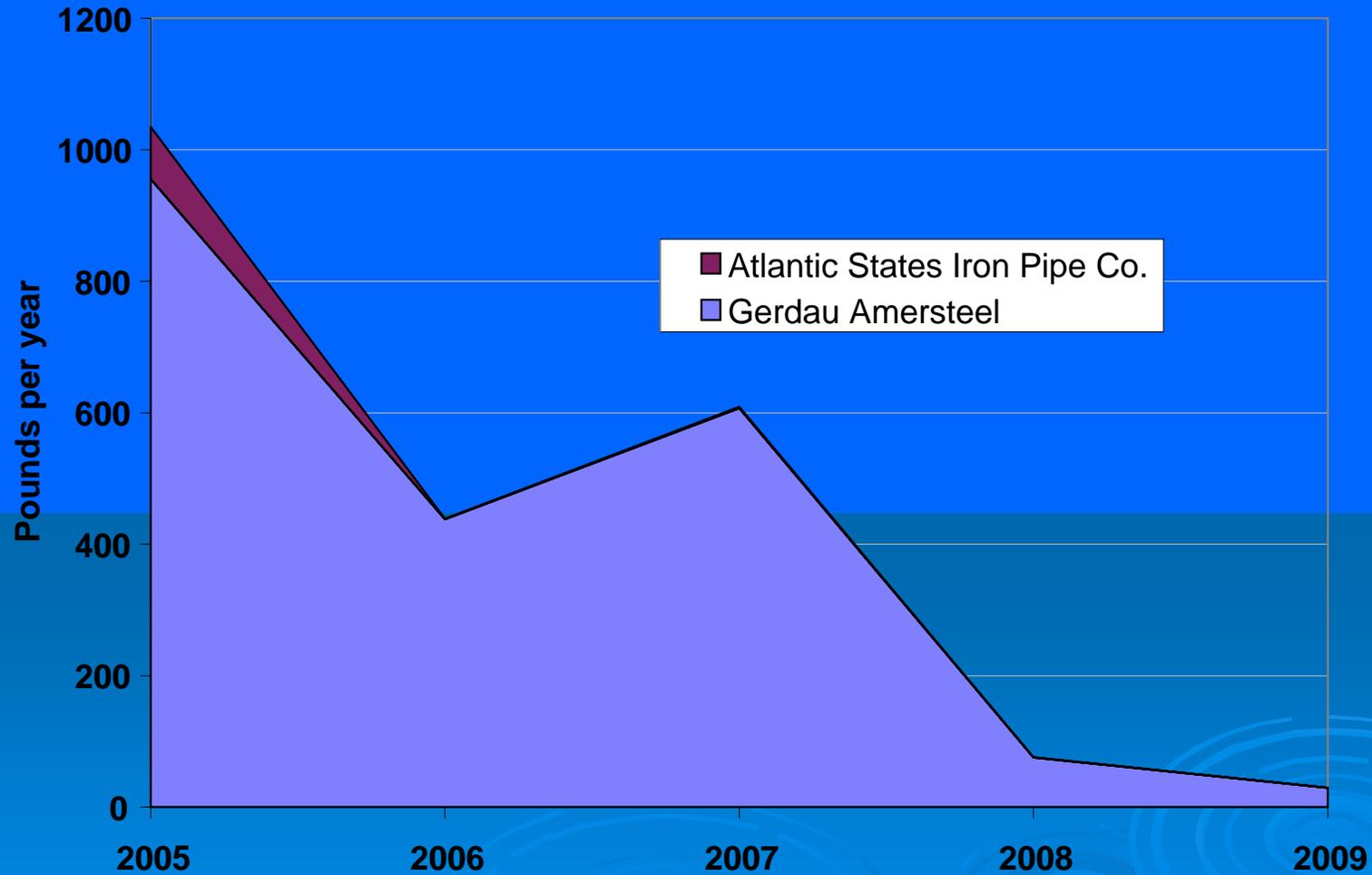
- Concerns with Impacts on Fish and Wildlife
- Concerns with Human Health
- Fish Advisories
- Control Efforts Reducing Hg?

# Estimated Mercury Emissions to Air NJ Sources, lbs/yr

Based on most recent source-specific data & estimates as of 2009



## Annual Mercury Emissions from Active New Jersey Iron & Steel Plants

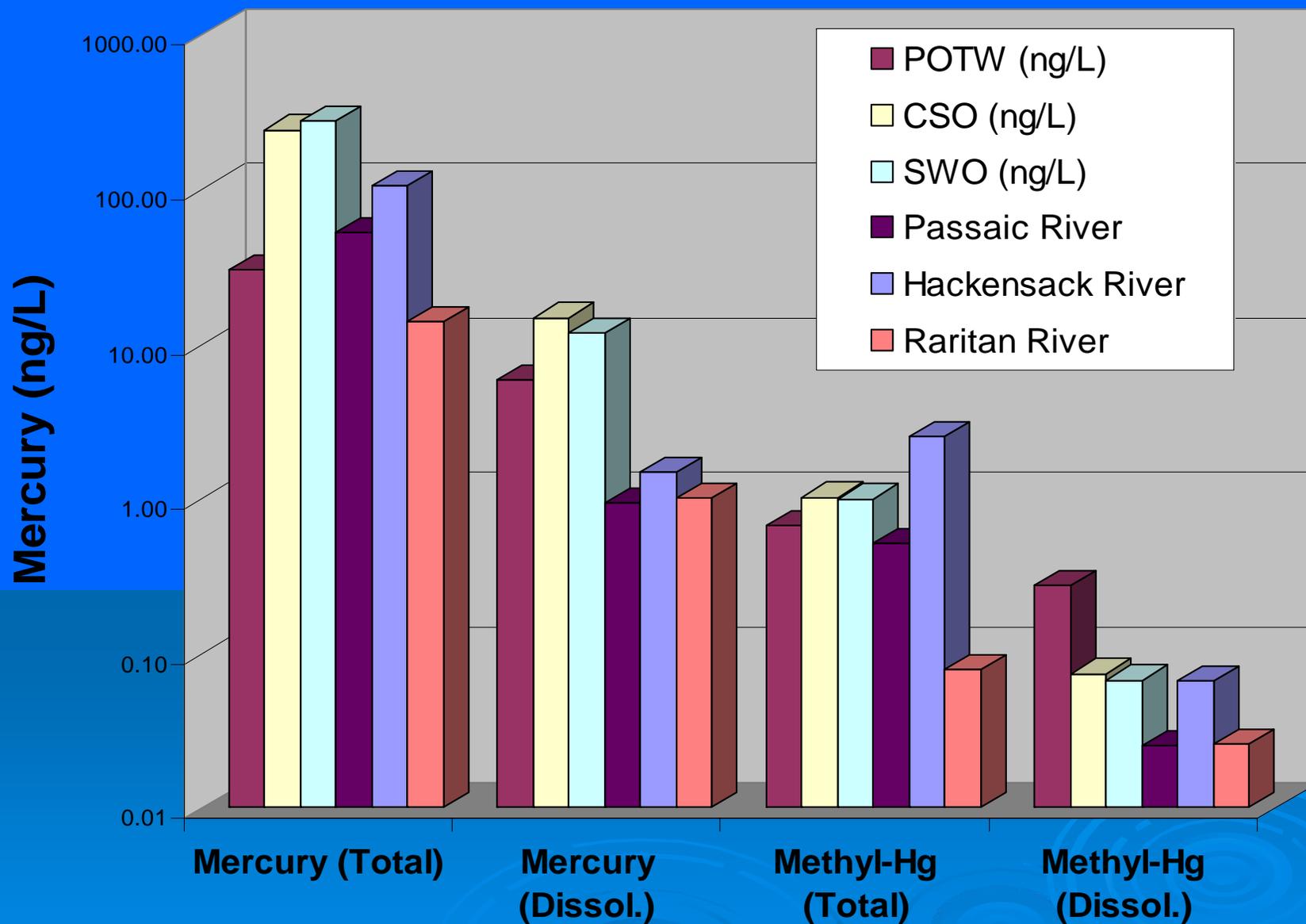


Source: NJDEP Trends Report

## Mercury in Surface Water - NJ Lake

Date	Location	Total Diss. Hg (ng/L)	Dissolved Methyl Hg (ng/L)
April	Impacted	1.59	0.062
	Reference	1.32	0.066
	Brook	56.6	0.104
August	Impacted	10.3	0.280
	Reference	1.3	0.030
	Brook	103	0.307

## Average Mercury in NJ's Tidal Waters



# Bioaccumulation

- Accumulation from food, water
- Bioaccumulation Factors (BAFs):
  - Total Hg (EPA, 1995)
    - TL 3 - 27,900 L/Kg
    - TL 4 - 140,000 L/Kg
  - Methyl Hg (EPA, 1997)
    - TL 3 -  $1.6 \times 10^6$  L/Kg
    - TL 4 -  $6.8 \times 10^6$  L/Kg

# Biomagnification

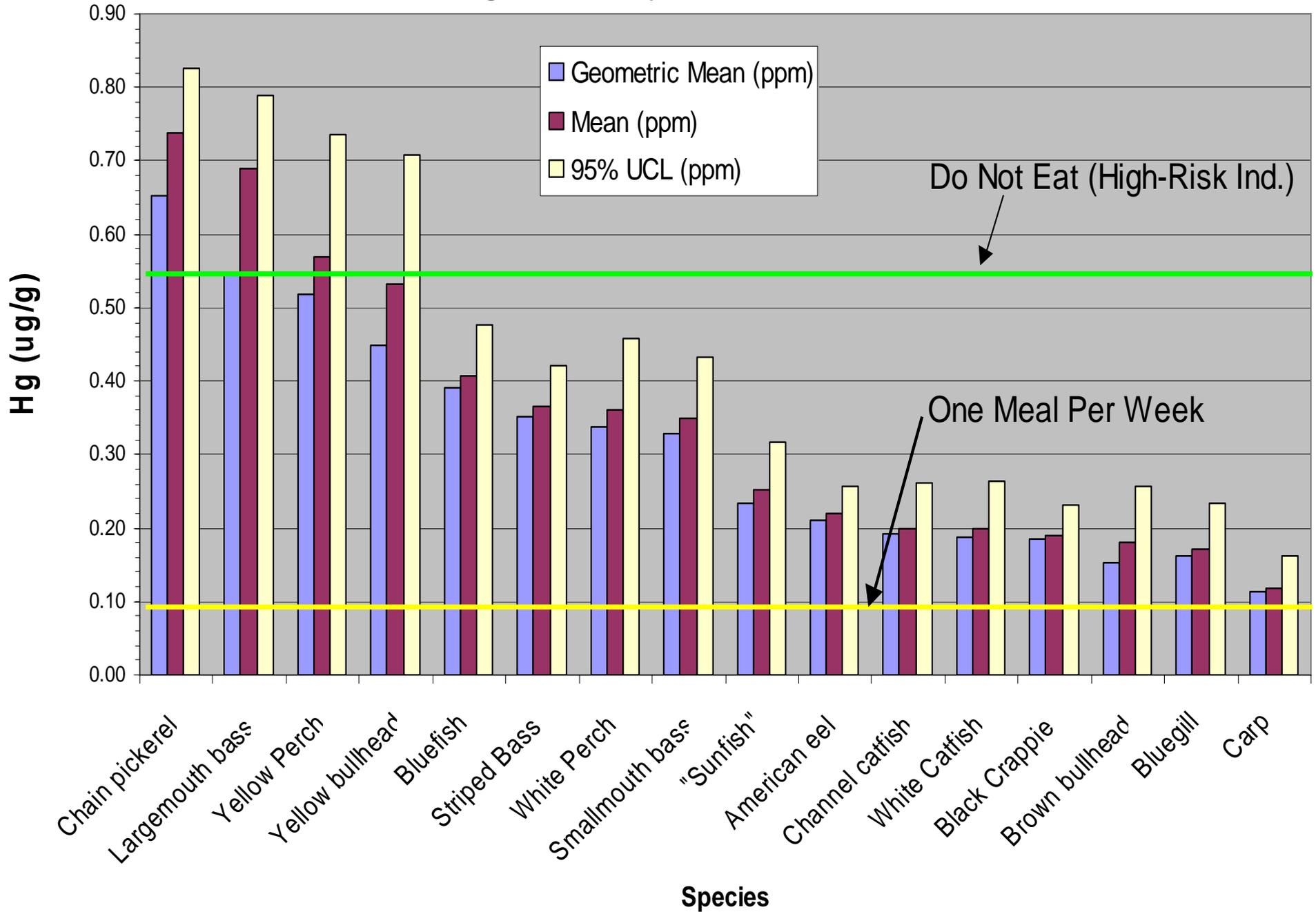
(concentrations are illustrative approximations)

<b>Trophic Level</b>	<b>Concentration of Mercury</b>
Water	1 ng/L = 1 ppt
Bacteria and phytoplankton	10 pg/g of water
Protozoan/zooplankton	100 pg/g
Insect larvae	1 ng/g = 1 ppb
Fish fry	10 ng/g
Minnows	100 ng/g
Medium-sized fish	1 $\mu$ g/g = 1 ppm
Large predators (fish, birds, humans)	10 $\mu$ g/g

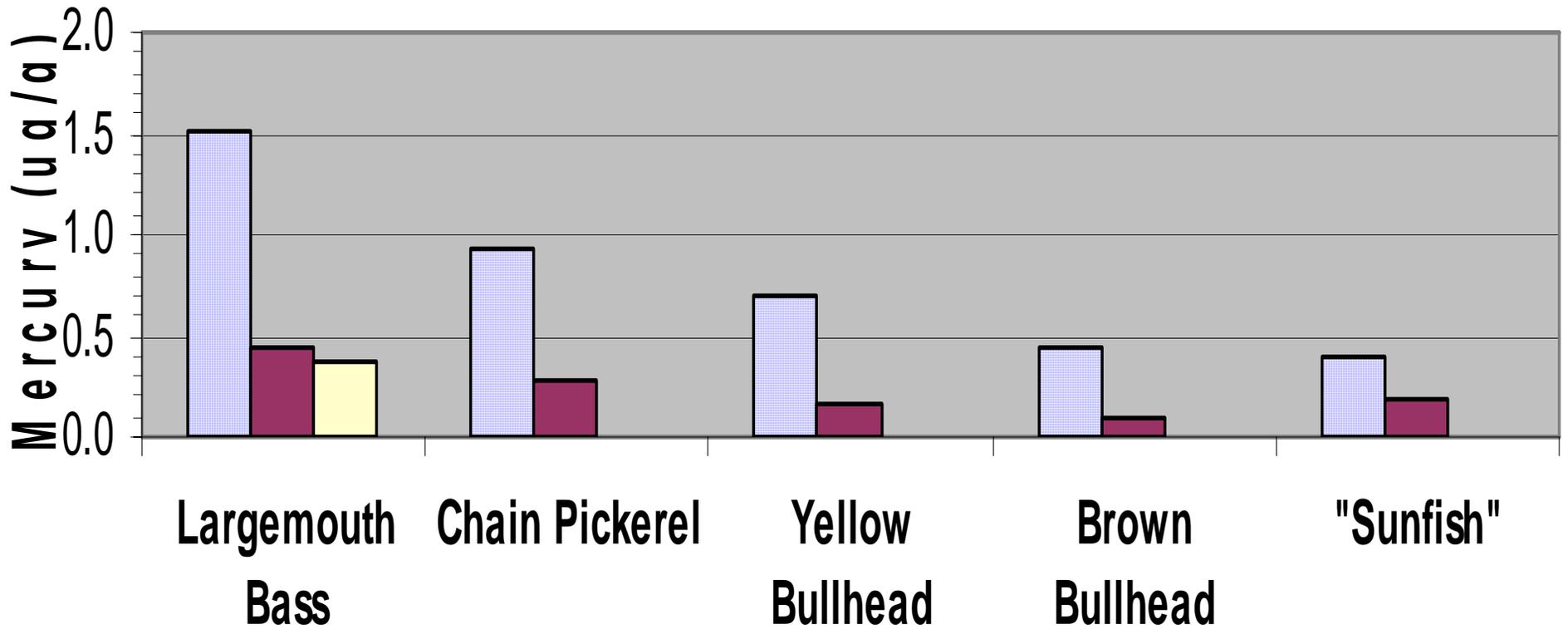
# Wildlife

- Top of the Food Chain - greatest exposure = Piscivorous avian and mammalian species
- Neurotoxicity
- Teratogen, mutagen
- Embryocidal, Cytochemical & Histopathological effects (Eisler, 1987)

# Statewide Average Mercury Concentrations in NJ Fish



# Average Mercury in Fish from Pinelands and Non-Pinelands Waters



Pinelands Water Bodies Non-Pinelands Water Bodies National Average

# Average Hg Concentrations in Freshwater Fish in NJ

- **Statewide:**
  - 0.36  $\mu\text{g/g}$  (26 Species; range ND - 8.9)
  - 0.35  $\mu\text{g/g}$  (14 freshwater species; n>20)
- **Pinelands: 0.80  $\mu\text{g/g}$  (5 species)**
  - Range 0.05-8.9  $\mu\text{g/g}$
- **Non-Pinelands: 0.23  $\mu\text{g/g}$  (5 species)**
  - Range 0.01-3.9  $\mu\text{g/g}$
- **Nationwide: All Fish: 0.26  $\mu\text{g/g}$**

# Human Effects

- Exposure primarily through fish consumption
- Unborn and Young Children
  - Central Nervous System
    - Learning & Developmental Delays
- Older Children and Adults
  - Subtle neurological effects
  - Neurological damage

# Statewide Mercury Advisory for Freshwater Recreational Fish

## ➤ **General Population**

- **Eat No More Than One Meal Per Week**

## ➤ **High-risk Individual**

- **Eat No More Than One Meal Per Month**

# Methylmercury WQC

- USEPA issued MeHg WQC in 2001
- Draft Implementation Guidance in 2006
- Final Guidance in January 2009
- Human Health WQC = 0.3 mg/kg in fish  
(wet wt. basis)

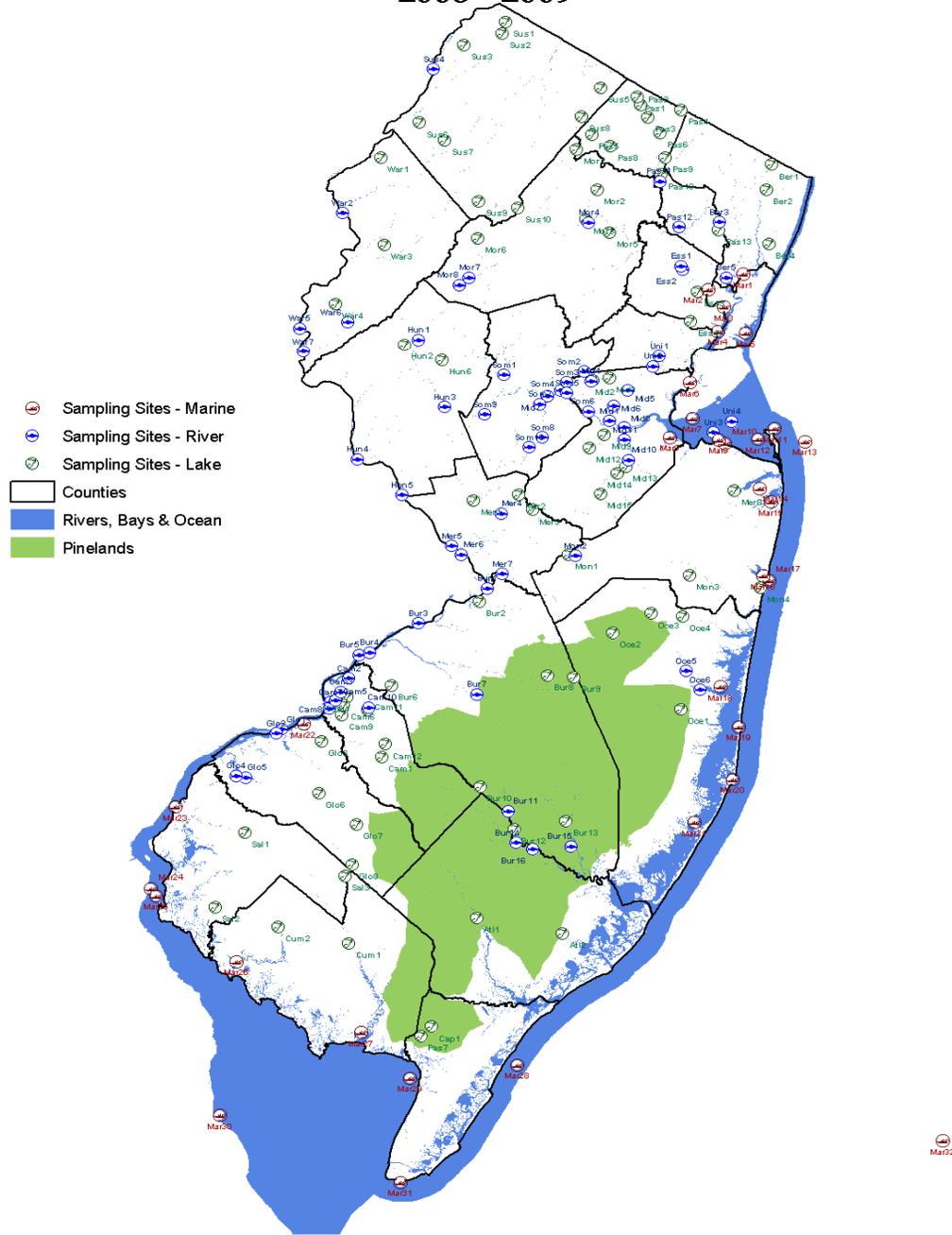
# USEPA Options

- Use Fish Tissue value
- Translate to a water column value –  
3 Options:
  - Site Specific
  - Bioaccumulation Models
  - EPA draft default national MeHg BAFs
- Both

# NJ

- Looked at available data (fish and water) for Hg and MeHg
- Current water monitoring mostly total Hg
- NJDEP Low Level Hg data
- USGS National Water Quality Assessment Program (NAWQA) data
- Few other data sets (e.g., NJTRWP)

# New Jersey Fish Tissue Sampling Sites 2008 - 2009



# NJ

- Estimate MeHg concentrations in water by using translators (ratios)
- Example: Total Hg → Dissolved MeHg
  - Limited NJ data – translators ranged from 0.005 to 0.059
  - USEPA (2000) – 0.014 (lentic) & 0.032 (lotic) geometric mean

# NJ BAFs

- BAF, L/kg = mercury in fish, mg/kg  
dissolved MeHg in surface water, mg/L
- Estimated BAFs – limited data!
- Ranged from 5x less to 6x greater than  
USEPA draft national (geometric mean)  
BAFs
- Varied by region
- Tidal Waters

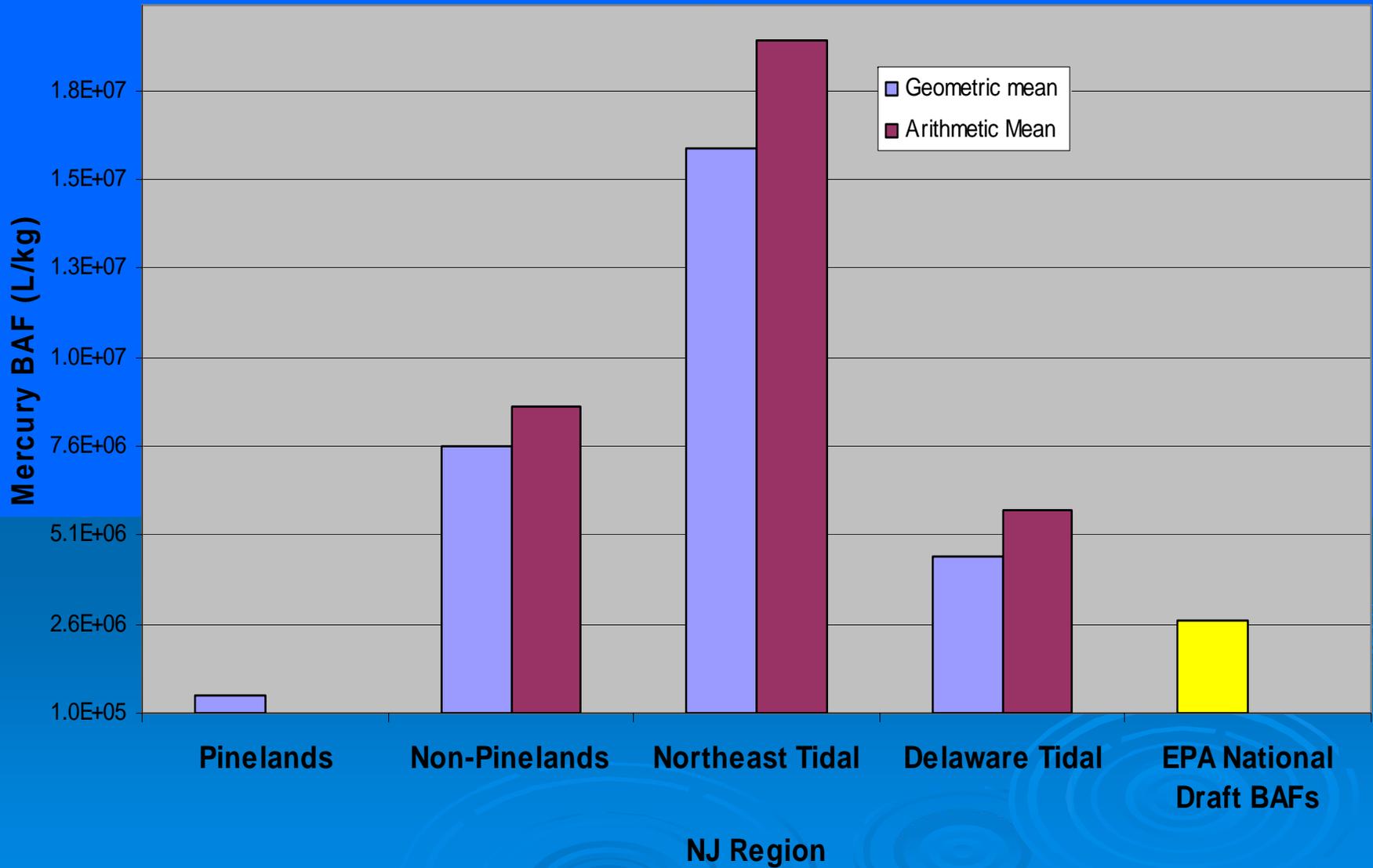
# Ambient Water Quality Criterion

- $AWQC = TRC/BAF$
- TRC = tissue concentration-based ambient WQC (USEPA = 0.3 mg/kg) for MeHg
- BAF = bioaccumulation factor for trophic level 2 (herbivores), 3 (omnivores) and 4 (carnivores) fish
- Humans eat primarily TL 3 and 4

# Results

- Translators and BAFS vary by region in NJ
- Different than Draft National BAFs
- Tidal Waters
- Site specific or regional data
- Provide some insight for other states

# Dissolved Methylmercury - Trophic Level 4 BAFs based on Site-Specific Data



# Current Research

- Development of Bioaccumulation Factors (BAFs)
- Support Water Quality Criteria development
- Pinelands Region – 2009
- Non-Pinelands Region – 2010
- Three species in several lakes per region
- Multiple collections of water for MeHg

# Current Research

- Long-Term Study: *Examination of Local Mercury Concentrations during Reductions in Mercury Emissions in New Jersey*
- Examining levels in fish, water and leaves downwind of plants following shutdown/reductions in Hg emissions
- 2007, 2009 complete
- 2011, 2013 planned

# Private Well Testing Act

Data from September 2002 - April 2009

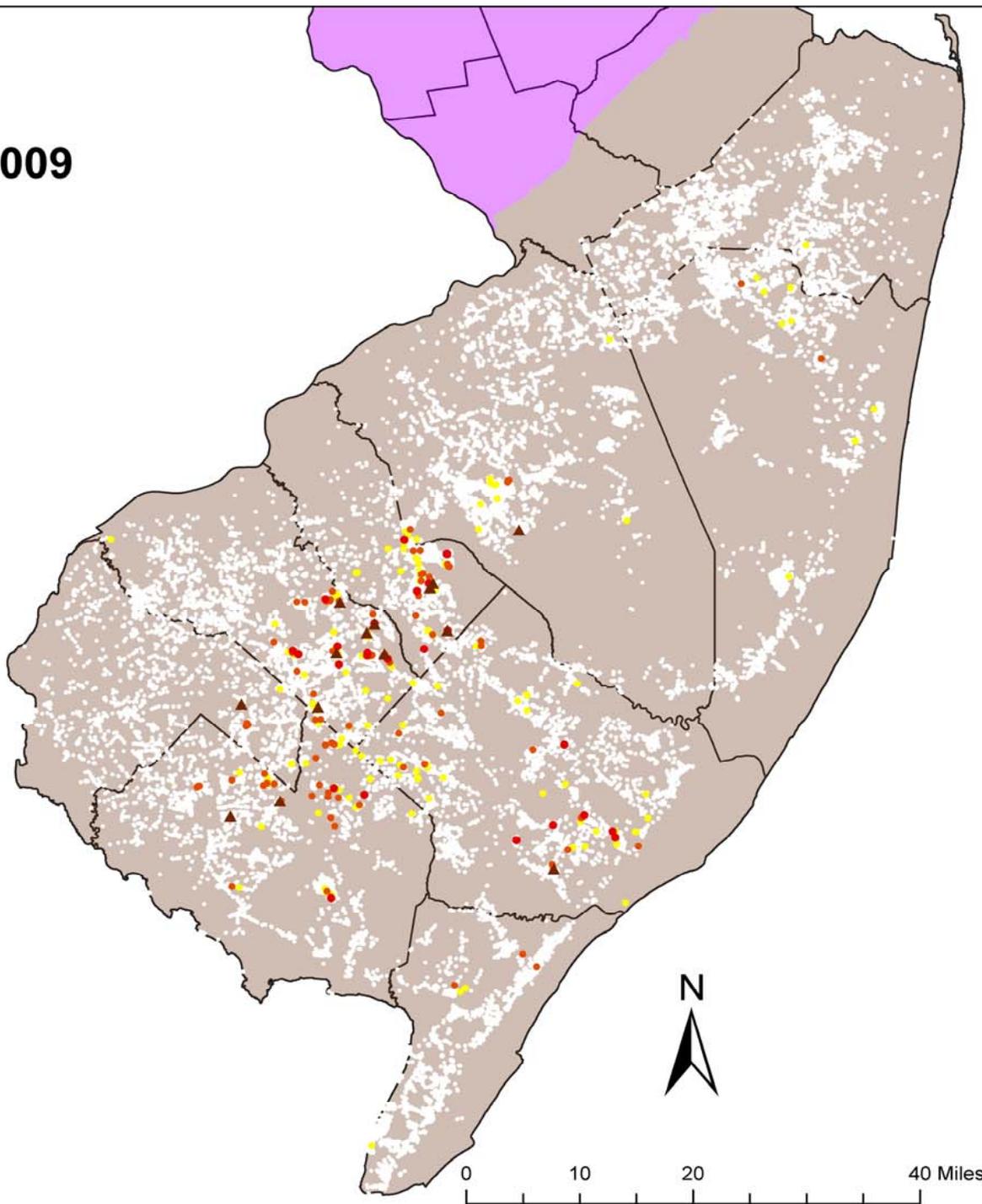


**PWTA Data - Mercury**  
**31,412 Wells**  
**September 2002 - April 2009**

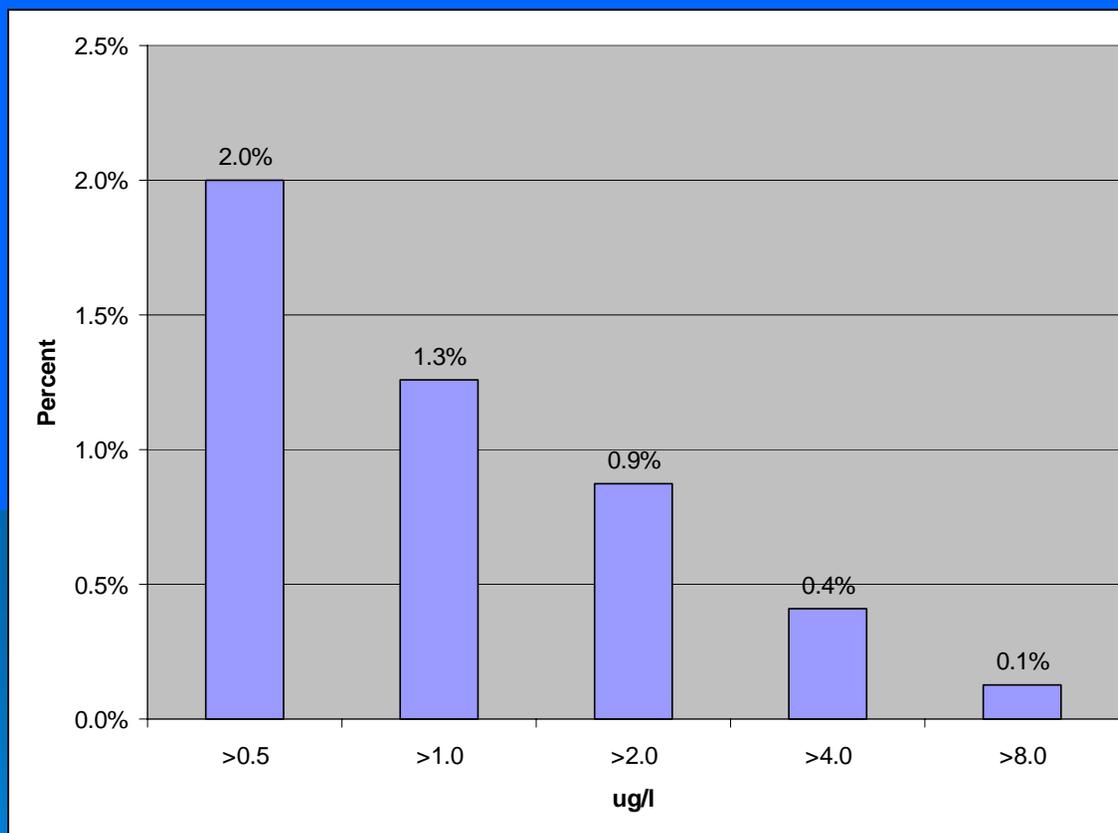
**Mercury Concentration**

**MCL - 2 ug/l**

- ND - 2 ug/l
- >2 - 4 ug/l
- >4 - 8 ug/l
- >8 - 16 ug/l
- ▲ >16 ug/l



# Concentrations of Mercury in Private Wells (n = 31,411)



# Mercury Exceedances

- 290 out of 31,635 wells (0.9%) exceeded the mercury standard of 2  $\mu\text{g/l}$
- Range - ND to 83.3  $\mu\text{g/l}$

# Additional Information

➤ Office of Science:

<http://www.state.nj.us/dep/dsr/mercury/>

➤ New Jersey Fish Consumption Advisories:

• [www.FishSmartEatSmartNJ.org](http://www.FishSmartEatSmartNJ.org)

➤ NJ Mercury Task Force Report:

• [www.state.nj.us/dep/dsr/mercury\\_task\\_force.htm](http://www.state.nj.us/dep/dsr/mercury_task_force.htm)

# Acknowledgements

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