

# Mercury Risk Management in Livestock Ponds on the Cheyenne River Sioux Reservation

Moving Science into Action

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# Objectives

1.Determine the source and quantify patterns of mercury bioaccumulation in fish tissue.

A primary focus is to quantify the sources of mercury in the environment (anthropogenically related to aerial deposition, naturally occurring sources related to geologic formation). In doing so, a prediction of mercury loading and transformation (methylation) will be constructed.

2.Predict bioaccumulation/magnification of methylmercury in aquatic food webs.

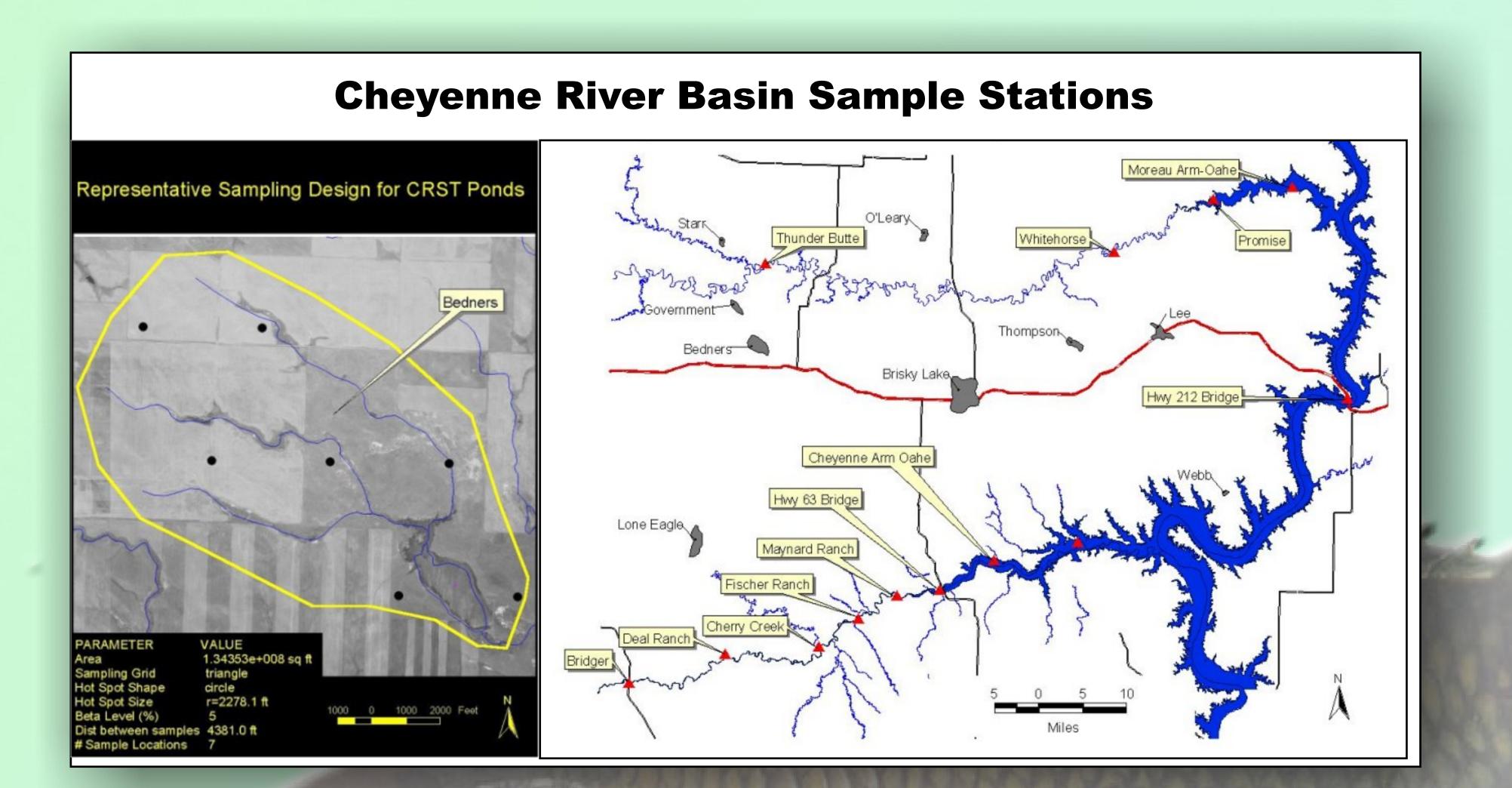
The goal is to model the processes responsible for the patterns of methylmercury accumulation found in managed ponds.

3. Make risk management recommendations to tribal members to reduce mercury exposure.

The goal here is to use the results from the first objective to make future fish stocking recommendations in ponds with the least potential for bioaccumulation of methylmercury.

## Risk Management Processs

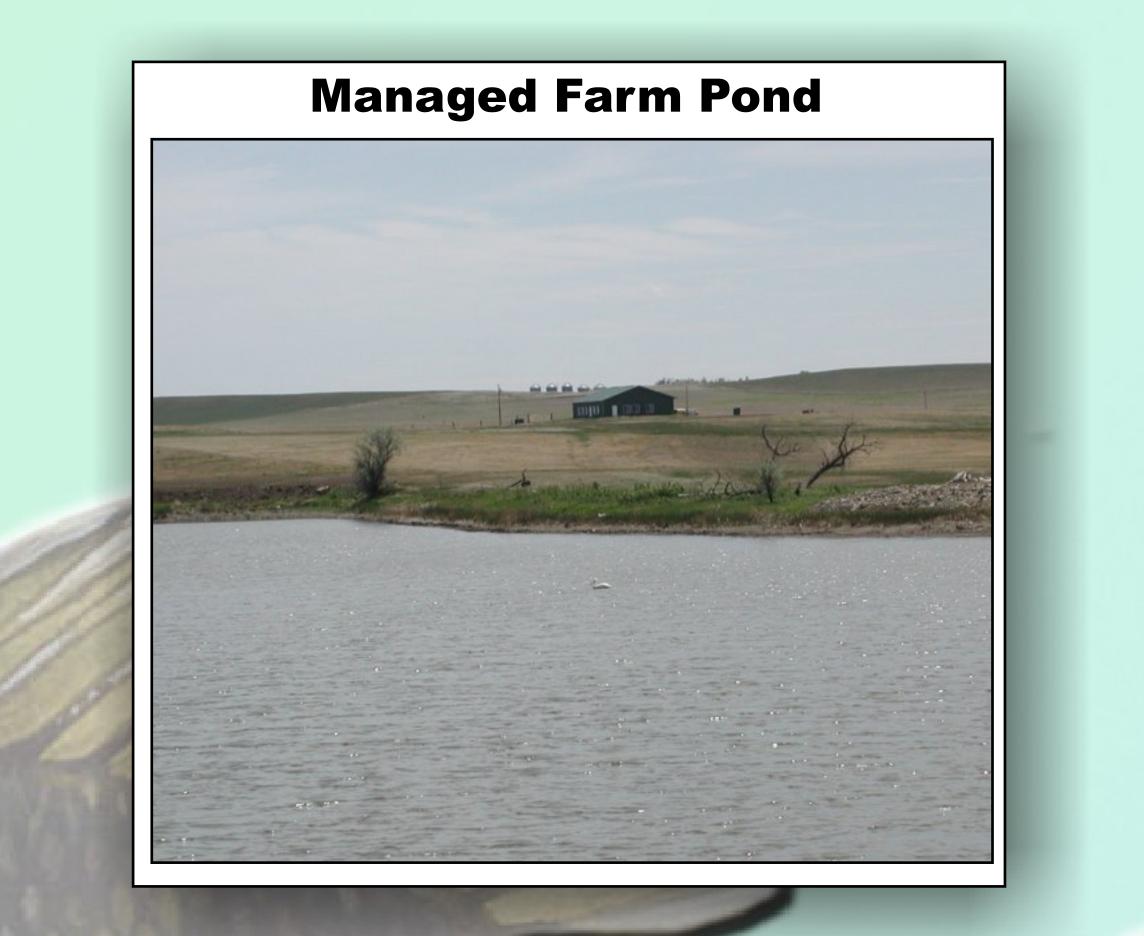
In a prior collaborative 3 year study with the Cheyenne River Sioux Tribe Department of **Environmental Protection (CRST DEP), and** the Agency's Environmental Response Team, Region VIII investigated Hg levels in fish tissues from the Cheyenne River and Lake Oahe in South Dakota. In 2000, the CRST released a fish advisory recommending less consumption of fish, especially for sensitive individuals within their population (pregnant and elderly). One mitigating risk management recommendation from the CRST to its constituents was to consume fish from livestock ponds, which, having no influence from mining related activities, and at the time presumably would have lower concentrations of mercury in fish tissue. However, fish from livestock ponds with seemingly similar outward appearances had significant differences in accumulation in both the same species or among species of the same trophic position.

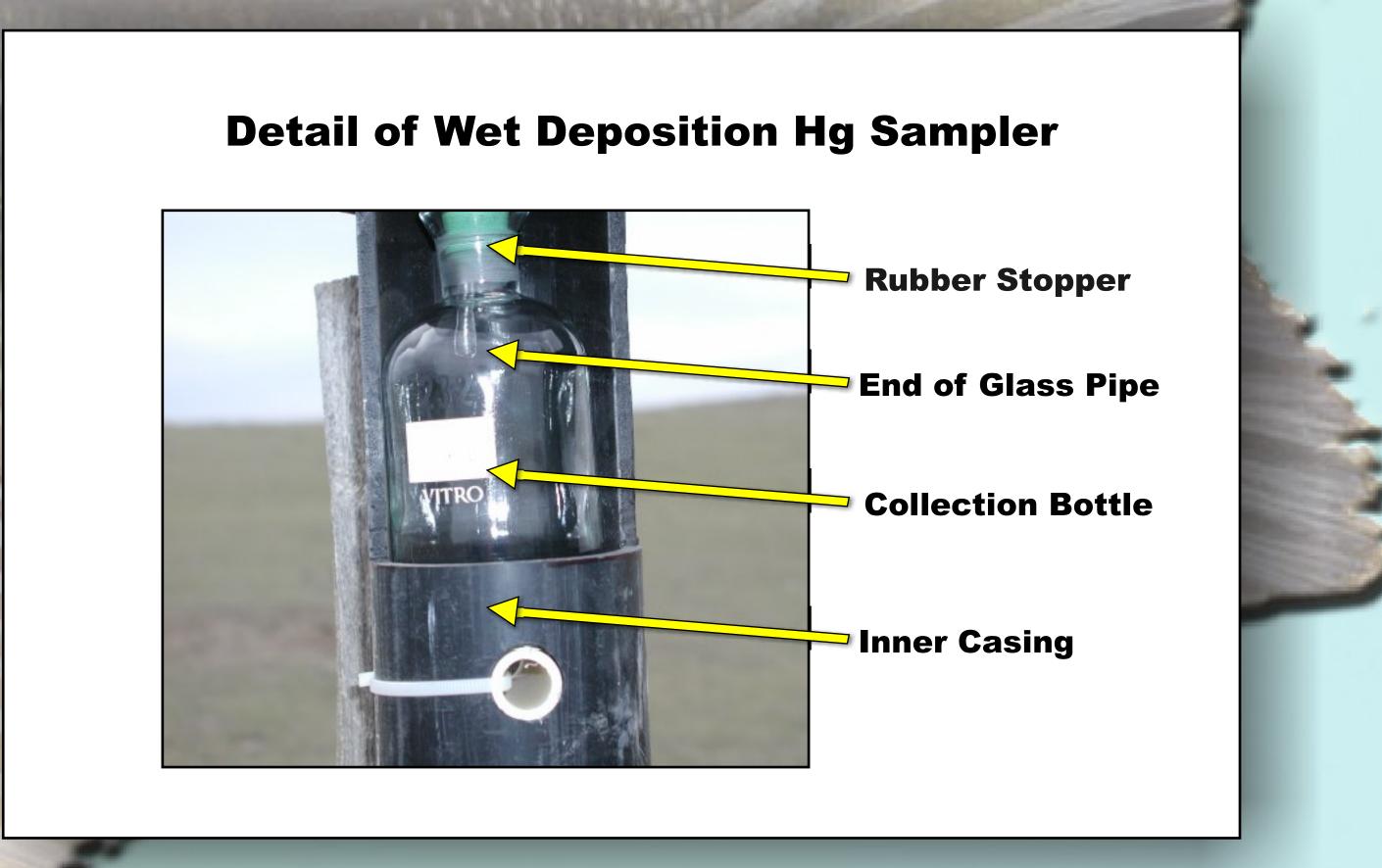


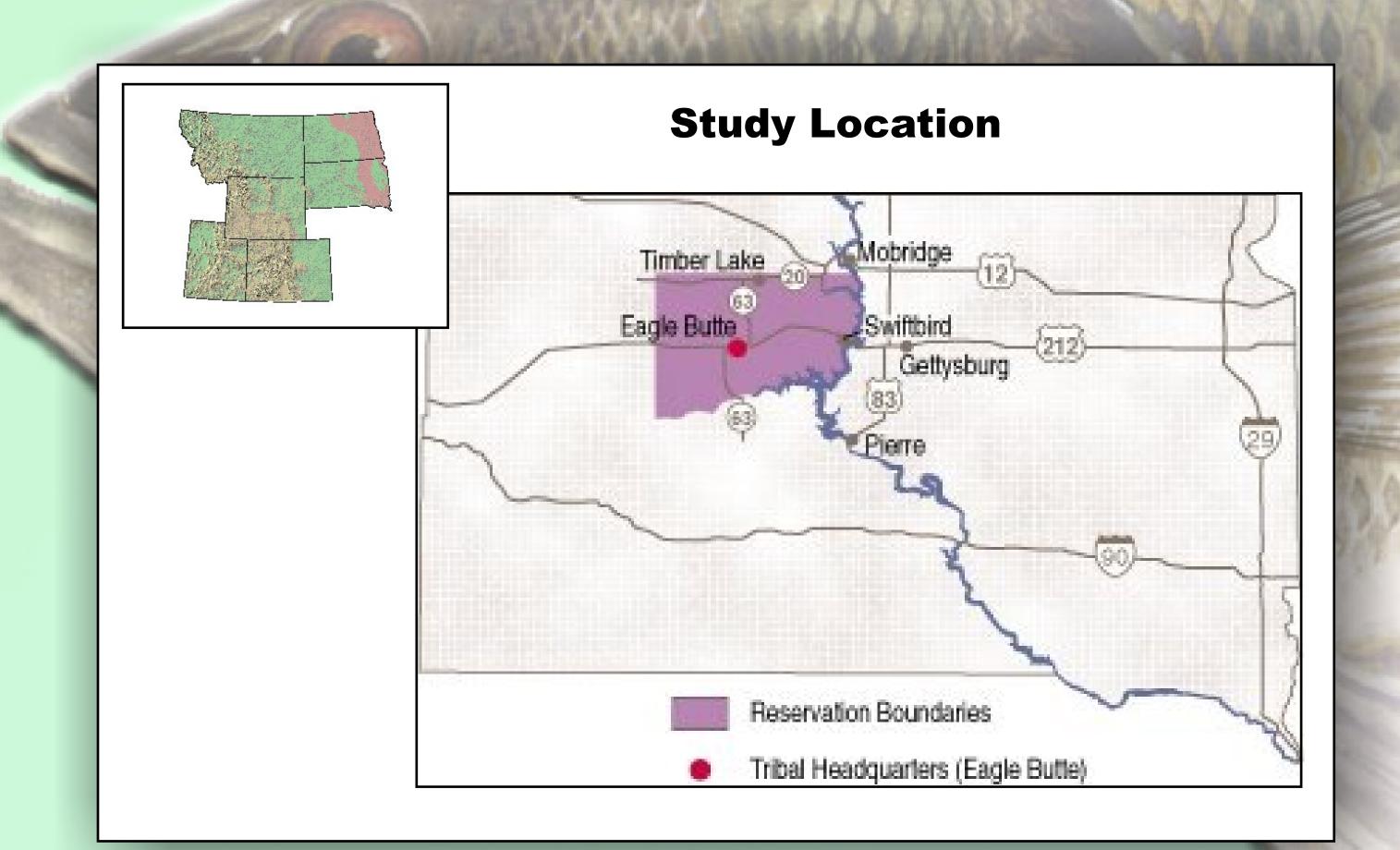
Rotifers

Cladocerans

Copepods

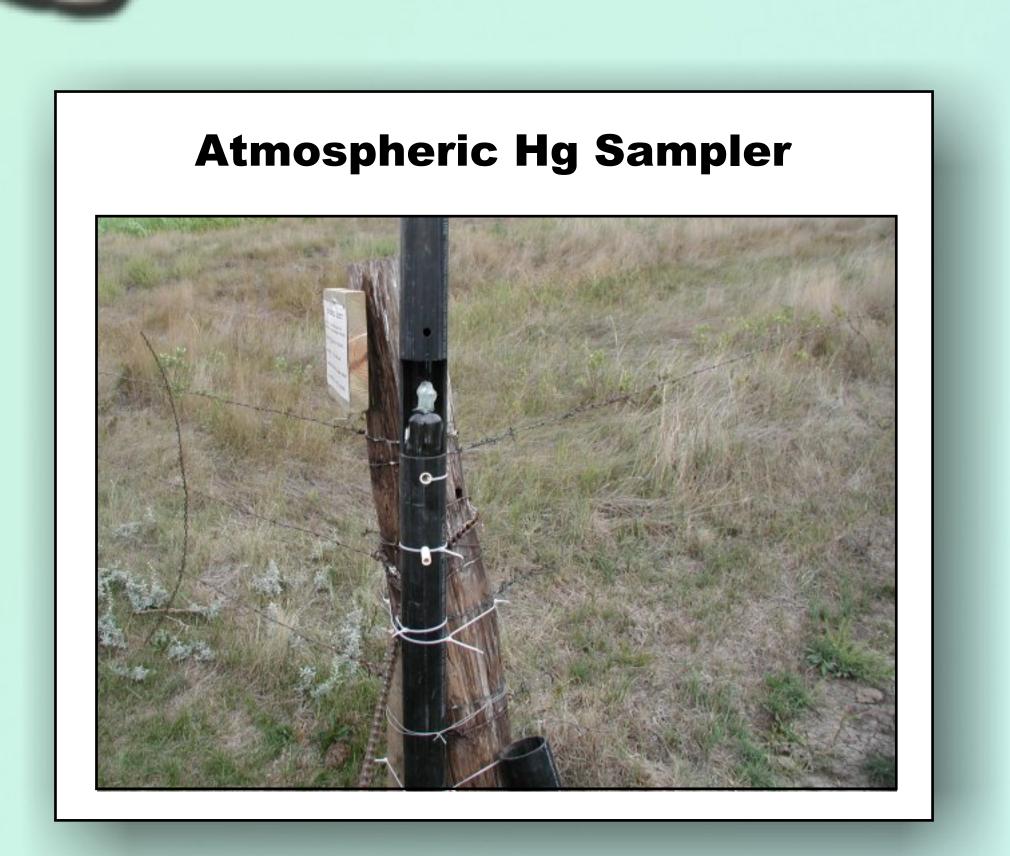






Composition of Pond Invertebrate Communities

Pond ID

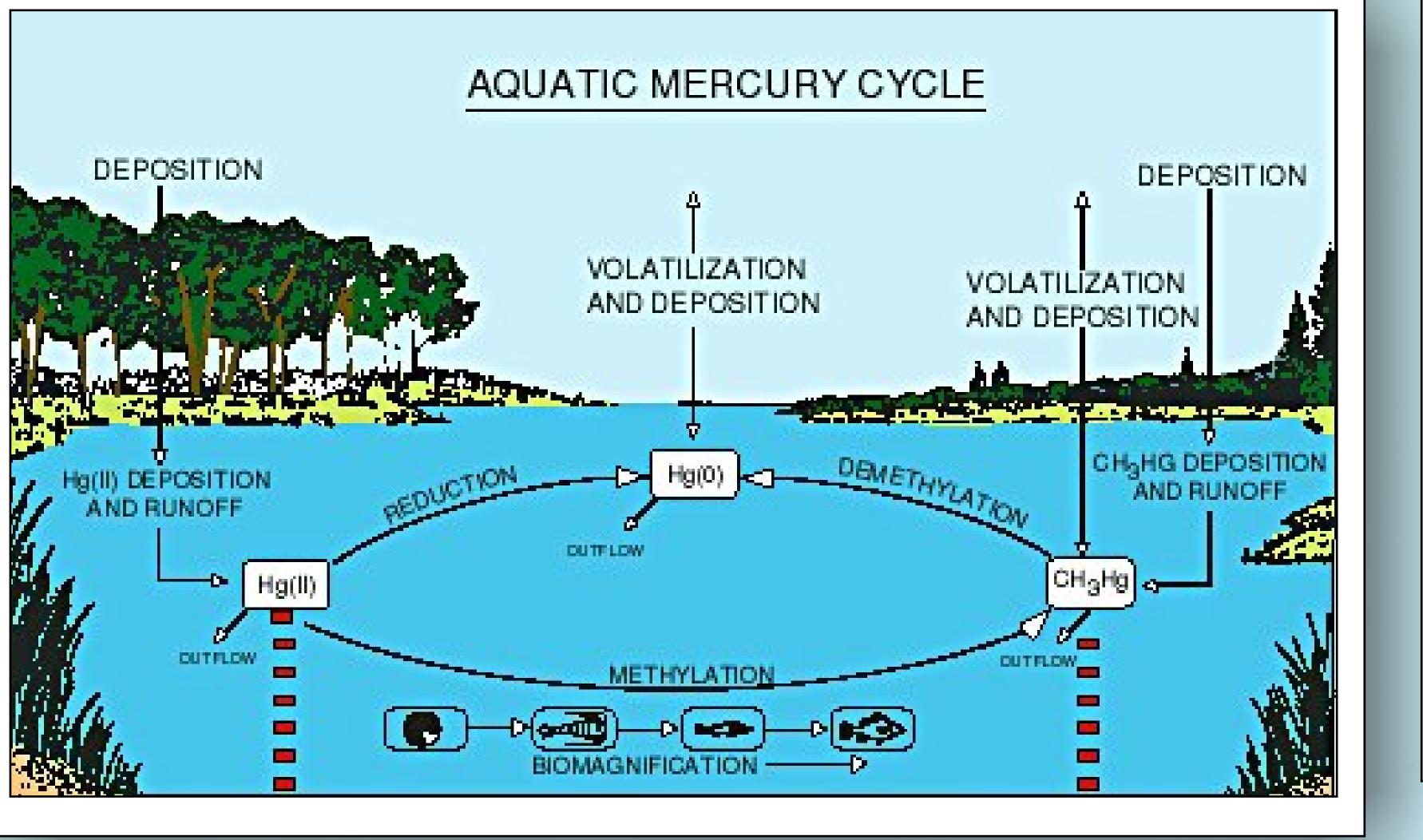


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**Piscivores** 

Mercury Conc. (ppb) Largemouth Bass

Pond size (acres)



#### Results

Sample and data collection from chosen watershed and related ponds:

- Sediment and surface water mercury concentrations:
  - **Sediments:** 1 of 9 detected **Thompson Dam = 0.24 ppm**
  - Water: 1 of 9 detected Lone Eagle = 0.28 ppb
- Soils below detection level of 0.2 ppb

Methyl Mercury found in plankton communities' predators (Copepods) and herbivores (Cladocerans):

- Predators showing high levels of methyl mercury (800 ppb)
- Herbivores not showing elevated levels

### **Further considerations**

Sediments and methylation rates:

- Will be seasonally variable and pose a challenge for model development
- Lower total phosphorus linked to higher methylation rates

#### Wetlands:

• Percentage riparian/wetlands linked to methylation potential

#### **Trophic Status of Ponds:**

• Total phosphorus, dissolved oxygen, dissolved organic carbon

#### Impacts

- Revised fish consumption recommendations.
- Recommended stocking program for sport/subsistence fisheries on larger ponds.
- Identified small ponds source of MeHg risk for humans and piscivorous wildlife.
- Initiated detailed mercury characterization in all managed ponds in monitoring program.

