

Oklahoma Mercury in Fish



Oklahoma Department of Environmental
Quality

Background

ODEQ has been analyzing fish flesh and issuing consumption advisories since 1978

One lake specific CA for mercury has been issued: McGee Creek Reservoir 1988-96

Statewide advisory for mercury issued in 2005

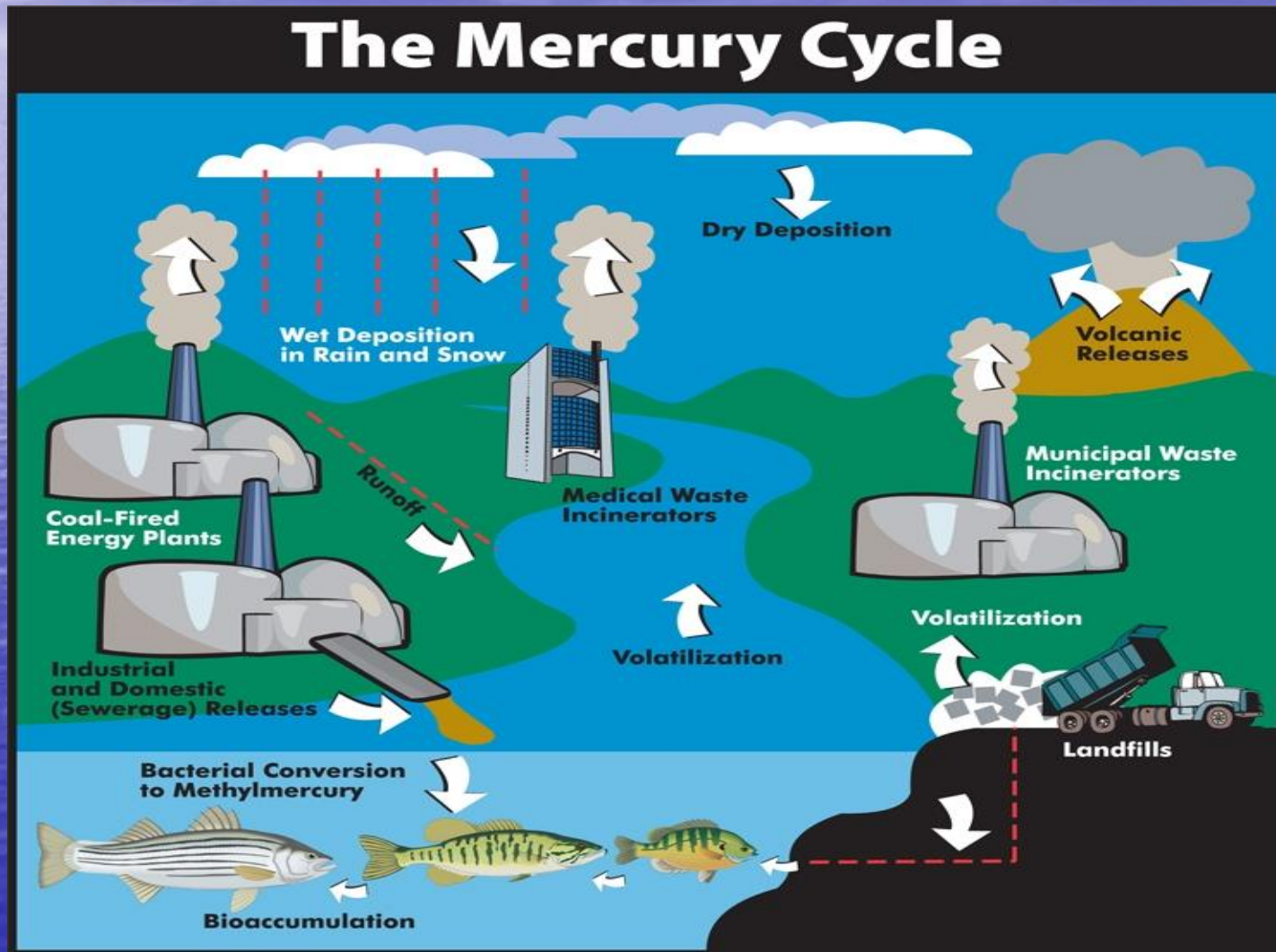
Background

Mercury is a neurotoxin

Sensitive population is unborn babies and children up to 15 years old

99% of exposure from ingestion of commercial and locally caught fish

How Do Fish Accumulate Mercury?



Factors Affecting Mercury Concentration in Fish

Mercury Load

The amount of mercury entering a waterbody.

Methylation Rate

The amount of mercury converted to the biologically available form.

Biomagnification Rate

The efficiency of the foodweb to increase mercury concentrations at higher trophic levels.

Mercury Load

Sources

Natural – volcanoes, geothermal areas, mineral deposits, forest and range fires

Anthropogenic – coal-fired utilities and industry, incinerators, mining and smelting, common usage and disposal, barrel burning

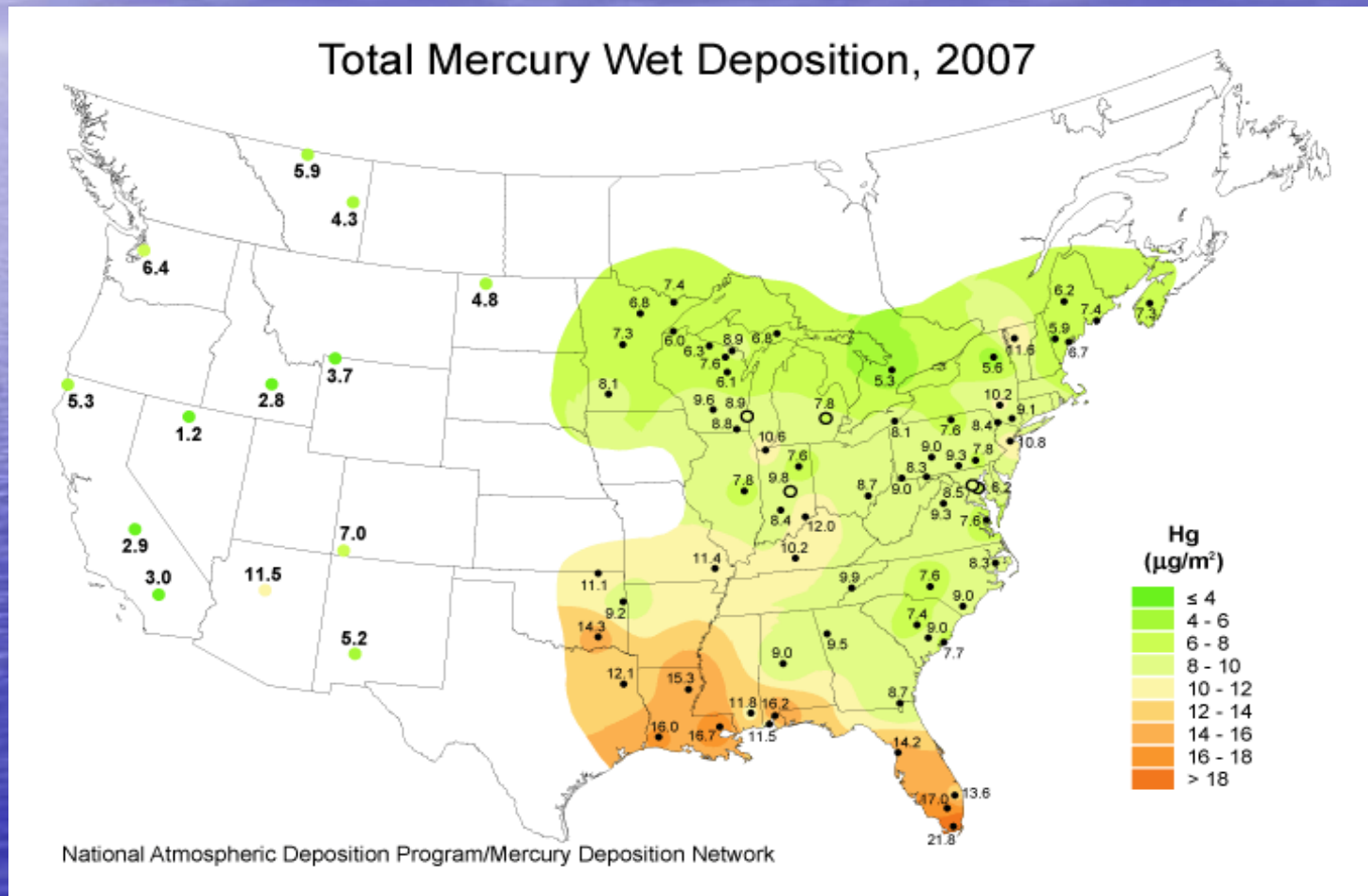
Mercury Load Sources

25% natural, 75% anthropogenic

Hg deposition peaked in the 1980s at 5X
pre-industrial levels

Currently about 3X pre-industrial levels

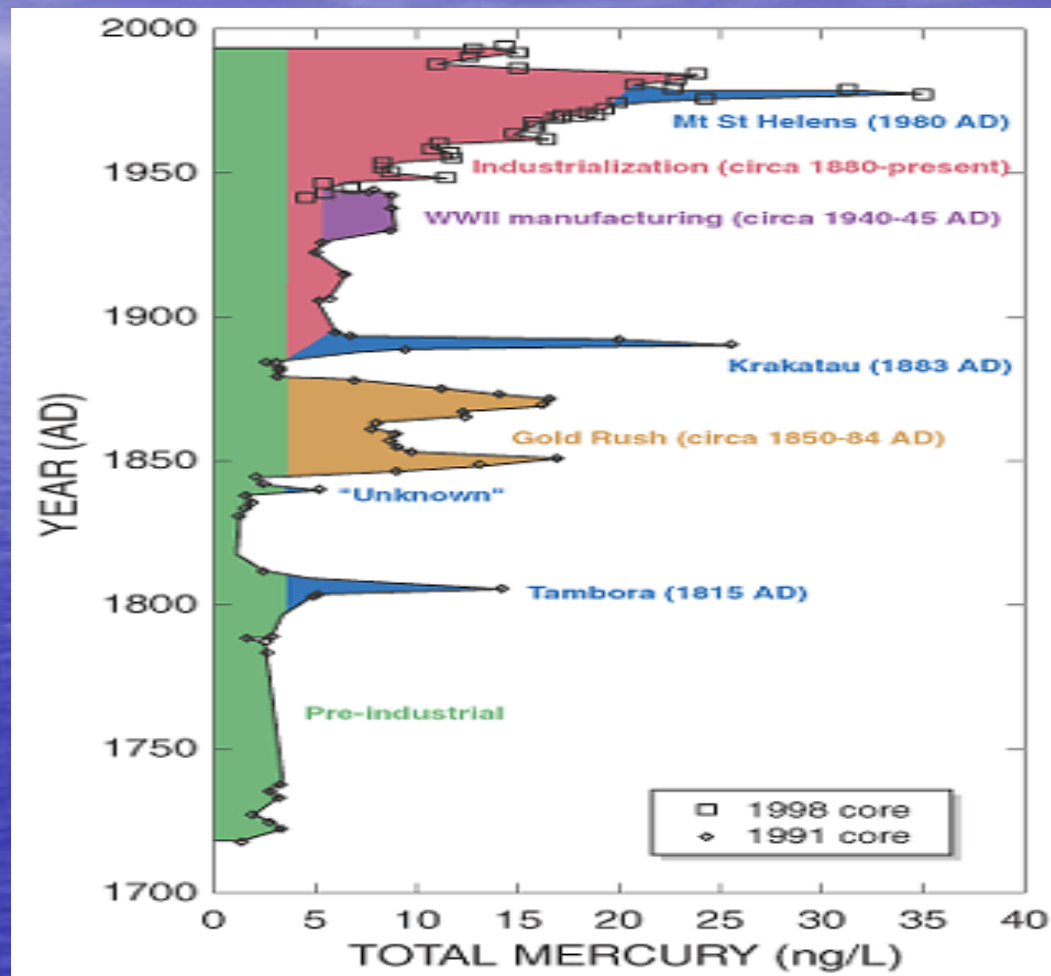
Mercury Load Deposition



Source: NADP

<http://nadp.sws.uiuc.edu/mdn/maps/map.asp?imgFile=2007/07MDNdepo.gif>

Mercury Load Concentration in Precipitation



Source: USGS

<http://toxics.usgs.gov/pubs/FS-051-02/index.html>

Mercury Load Deposition

Chemical and Physical Forms

Hg^{II} Vapor (RGM) – half life of hours, local effects (tens of kilometers)

Hg^0 Particulates – half life of days to weeks, regional effect (hundreds of kilometers)

Hg^0 Vapor – half life of months to years, global effect

Methylation Rate

Production of Methylmercury

Occurs at the sediment/water interface

Facilitated by a few species of sulfate-reducing bacteria

Requires a source of light and carbon

Methylation Rate Contributing Factors

Water Conditions:

pH ↓

Alkalinity ↓

Dissolved Oxygen ↓

Turbidity ↓

Sulfate ↓

DOC ↑

Methylation Rate

Indicators of Enhanced Methylation

Newly impounded lakes

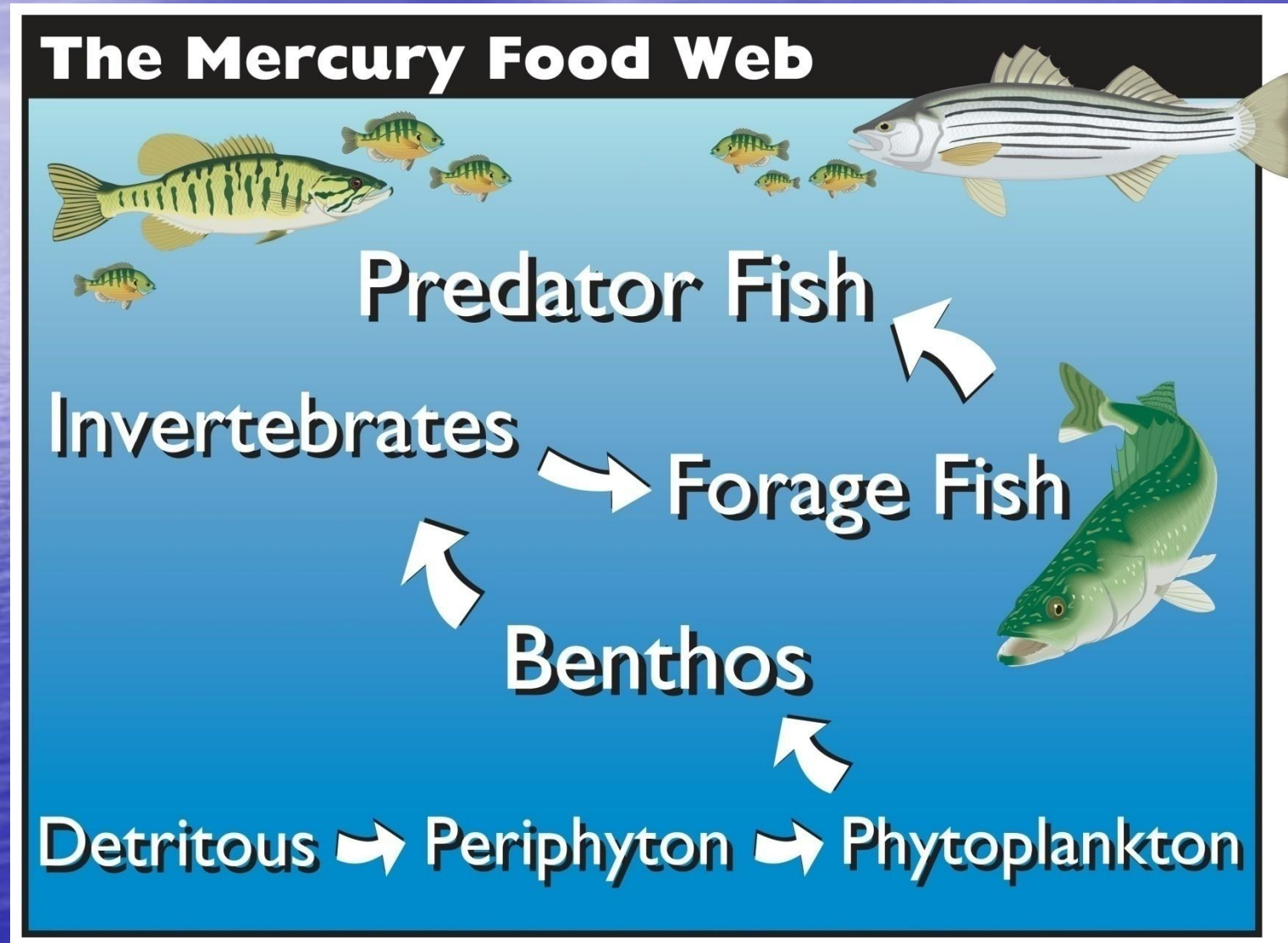
Lakes with extended elevation changes

Lakes with a higher proportion of shallow areas

Watershed Effects:

Wetlands, wet soils, forested areas

Biomagnification Rate



Biomagnification Rate

Foodweb effects:

Length of the foodchain

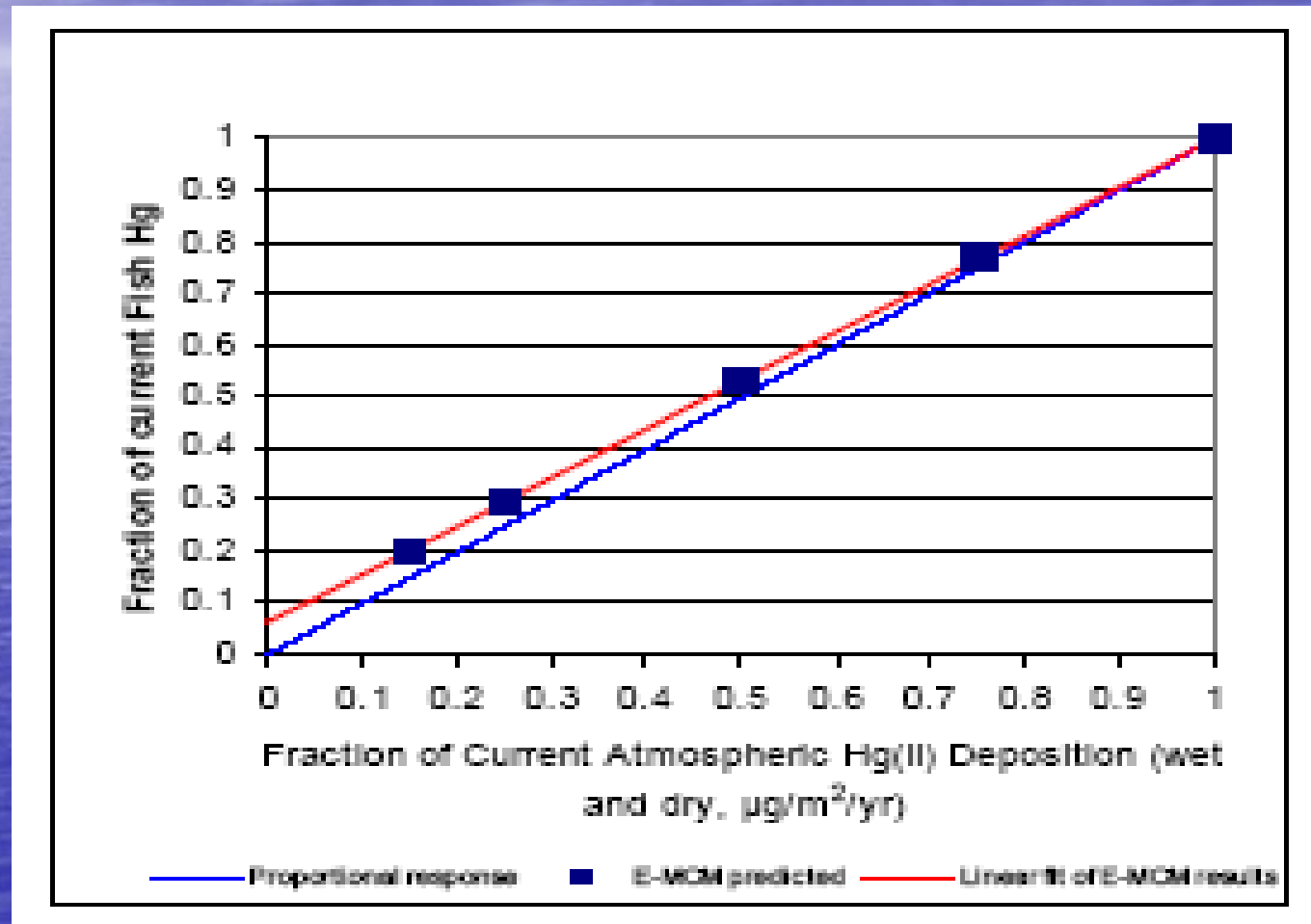
Age of piscivory

Availability of crayfish

Types of fish – predators and carnivores

Length of the fish

Mercury Load Deposition



Source: Florida DEP mercury TMDL

Oklahoma Consumption Advisory Levels for Mercury

Fish Tissue Concentrations (mg/kg)	Consumption Rate (Meals per Month) Sensitive Population	Consumption Rate (Meals per Month) General Population
< 0.5	No Restriction	No Restriction
0.5 – 1.0	2 meals per month	No Restriction
1.0 – 1.5	No Consumption	2 meals per month
> 1.5	No Consumption	No Consumption

Sensitive population is defined as children less than 15 and women of childbearing age (15-45). General population is men older than 15 and women older than 45.

Meal size is 8 oz. with the assumption that younger children will eat smaller meals.

Oklahoma Statewide Consumption Advisory For Mercury

In order to protect the most sensitive populations, pregnant or nursing women, women of childbearing age and children younger than 15 years of age are advised to eat no more than one meal per week of predator fish.

Predator species of fish in Oklahoma include all species of black bass (largemouth, smallmouth and spotted), striped bass, white bass, hybrid striped bass, walleye, saugeye, and flathead catfish.

ODEQ 2008 Mercury in Fish Survey

Target 50 lakes based on historical data, proximity to emission sources, proximity to deposition samplers

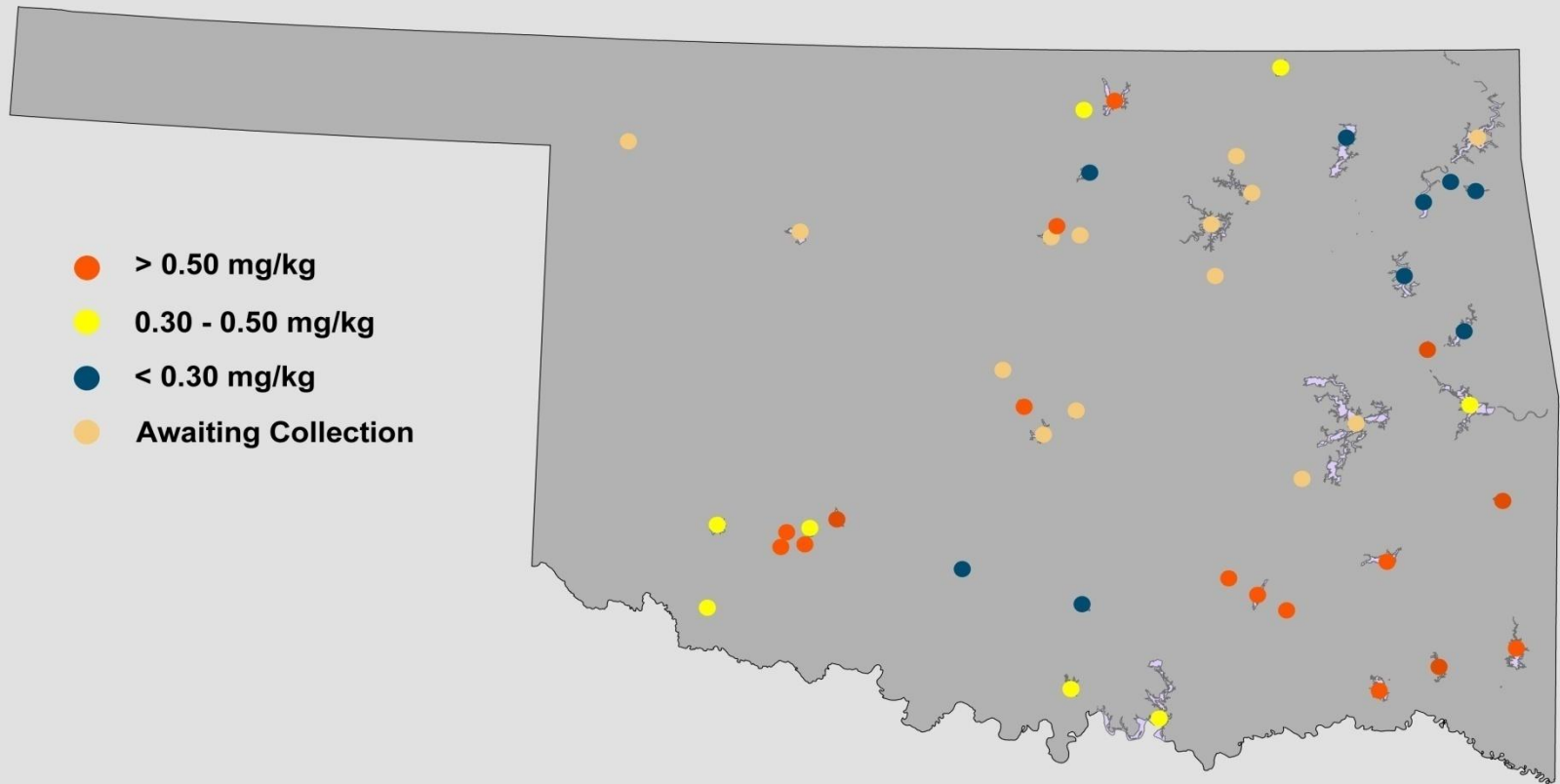
Target Largemouth Bass and other typical predator species

Use data as a screen to guide more intensive sampling and lake-specific consumption advice

Use data as a baseline to evaluate the effects of changes in deposition over time

Mercury in Fish - 2008

Predator Species



ODEQ 2008 Mercury in Fish Survey

Finish collecting 15 lakes by May 1, 2009

Resample available species in lakes that exceeded 0.50 mg/kg

Issue consumption advisories

Compare normalized data to deposition data

Resources

ODEQ Statewide Mercury Advisory Webpage

<http://www.deq.state.ok.us/factsheets/land/fishmerc.pdf>

EPA Fish Consumption Webpage

<http://www.epa.gov/waterscience/fish/>

EPA Fish Consumption Guidance

<http://www.epa.gov/waterscience/fish/guidance.html>