EPA's Aquatic Ecological Monitoring in the Pacific Northwest Lakes

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EPA Region 10 - Seattle

Background

1972 - National Eutrophication Study

- Nationwide--800 lakes selected as likely influenced by nutrients from wastewater treatment facilities.
- Nutrients and other indicators of trophic status.

1987 - First National Fish Tissue Study

- Nationwide--388 lakes selected as likely influenced by point and non-point sources of pollution.
- Fish tissue from game fish and bottom-dwellers.
- 60 target analytes, including PCBs, pesticides and herbicides, mercury and other organic compounds.

Background

2000-2003 - National Lake Fish Tissue Study

• Nationwide -- 500 lakes and reservoirs selected randomly in the lower 48 states. **I'll present these results today.**

2007 - National Aquatic Resource Survey for Lakes

• Nationwide survey 1,028 randomly selected lakes.

• Indicators of biological condition, recreational suitability, and trophic status.

• Part of a series of annual National surveys for different surface water types.

2012 – National Aquatic Resource Surveys for Lakes

• Similar to 2007 survey with addition of fish tissue (we hope…based on budgets, etc.).

National Lake Fish Tissue Study

Purpose:

• Estimate distribution of persistent, bioaccumulative, and toxic chemical residues in freshwater fish tissue.

• Defined a national baseline for assessing progress of pollution control activities.

Scope:

• National scale, lakes and reservoirs in the lower 48.

• 500 sites sampled using a statistical random design.

• Data collected 2000-3 by EPA and State agencies.

National Study Design and Methods

Samples drawn from six size categories of lakes ranging 1 to > 5,000 ha with varying probabilities

- Ensures sampling of rare (big) size classes
- Ensures spatial distribution of sites (across states)

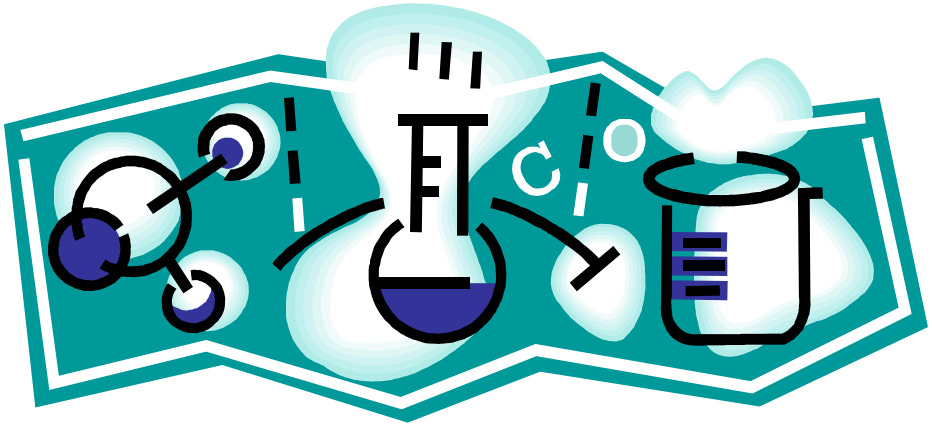
Two fish species composites of 5 similar-sized adults per site

- Human health endpoint - predator species (fillets)
- Ecological endpoint – bottom-dweller (whole fish)

Analytes

The study analyzed fish tissue for 268 chemicals:

- 2 metals (mercury and 5 forms of arsenic)
- 17 dioxins and furans
- 159 PCB measurements (209 congeners)
- 46 pesticides
- 40 other semivolatile organics (e.g., phenols)

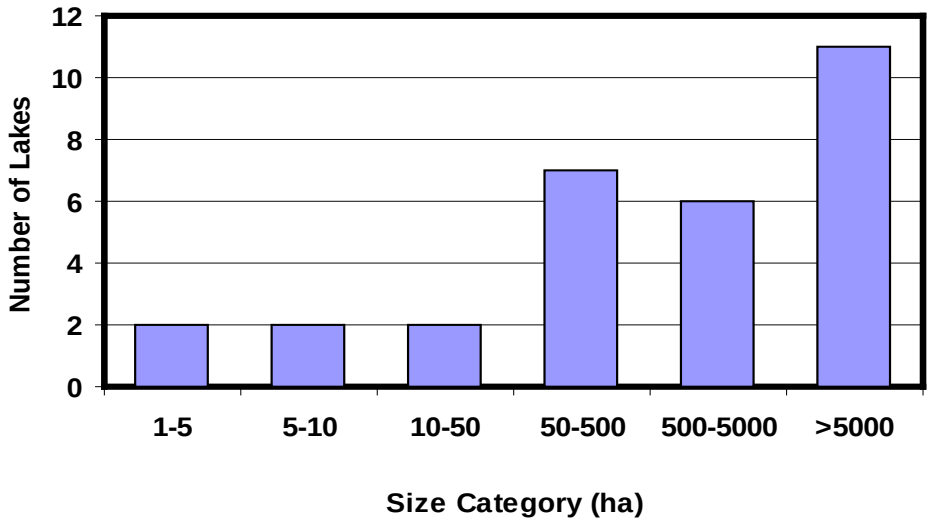


EPA Region 10 Lake Survey

- Very diverse set of lakes in sample from pristine high elevation lakes… to low elevation working reservoirs

EPA R10 Sampling

- Total of 30 sites sampled in the region
- 7 ID, 9 OR, and 14 WA
- 28 sites with predators
- 19 sites with bottom-dwellers
- Some sites in all size categories but most in over 50 ha size



Highlighted Contaminants

- **Mercury:** elemental metal that is toxic at low levels, affecting the nervous system and brain. Atmospheric deposition is the largest source of mercury in the environment (84%).

- **PCBs:** Polychlorinated biphenyls are synthetic compounds that were widely used in electrical/industrial equipment. Highly persistent in the environment. These bioaccumulate in body fat and biomagnify in the food chain.

- **DDT:** an organochlorine pesticide used widely in agriculture. DDT is highly persistent in the environment and bioaccumulates in the food chain.

Reporting the Results

- Mercury –total Hg (ppb)
- Total PCBs—combined congeners (ppb)
- Total DDT—combined congeners (ppb)

These three were commonly detected in the regional samples:

Chemical	Predators	Bottom Dwellers
Mercury	100%	100%
PCBs	100%	100%
Total DDT	83% (78% nationwide)	90% (98%nationwide)

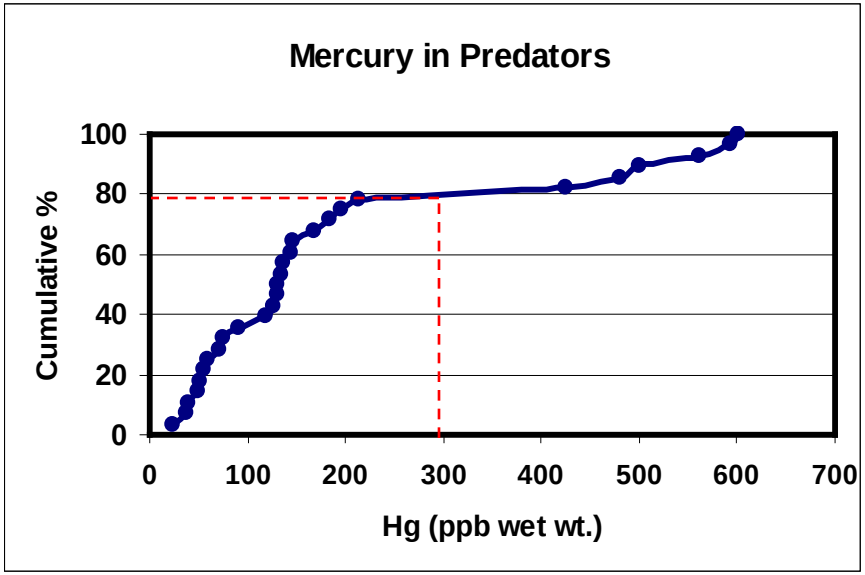
Summary of Screening Value Exceedances

Chemical	Human Health Screening Value*	Ecological Health Screening Value**
Mercury	300 ppb	100-300 ppb
PCBs	12 ppb	110-480 ppb
DDTs	69 ppb	150-3,000 ppb

*from EPA national reporting

** from Hinck et al. 2008

Results – Region 10--Mercury



Mean= 198.2

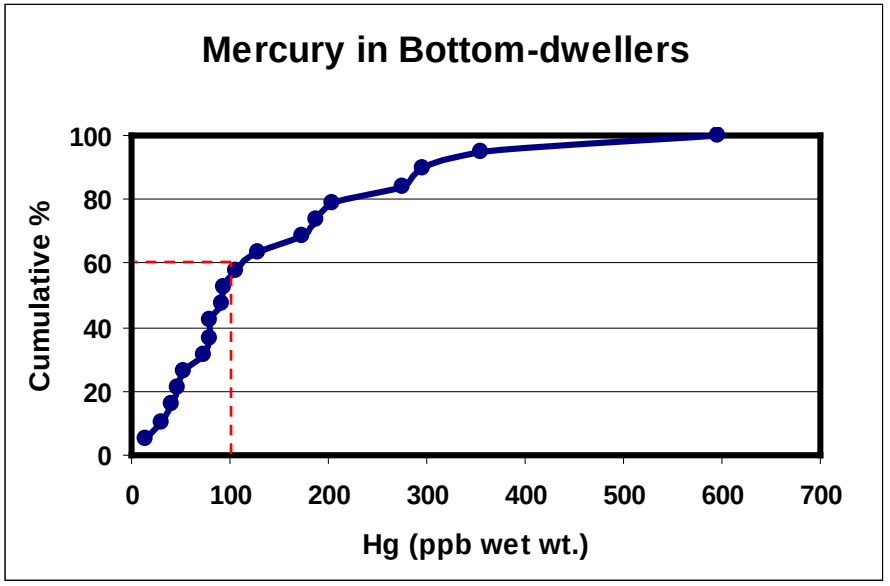
Range= 23.2 - 601.0

N= 28

Mean= 153.9

Range= 14.5 - 596.0

N= 19



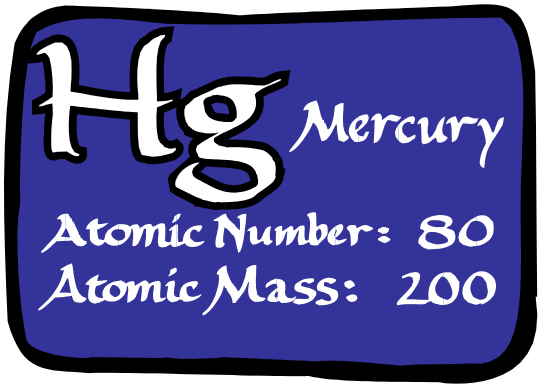
Summary – Mercury Results – Region 10

- Mercury levels were generally higher in predators

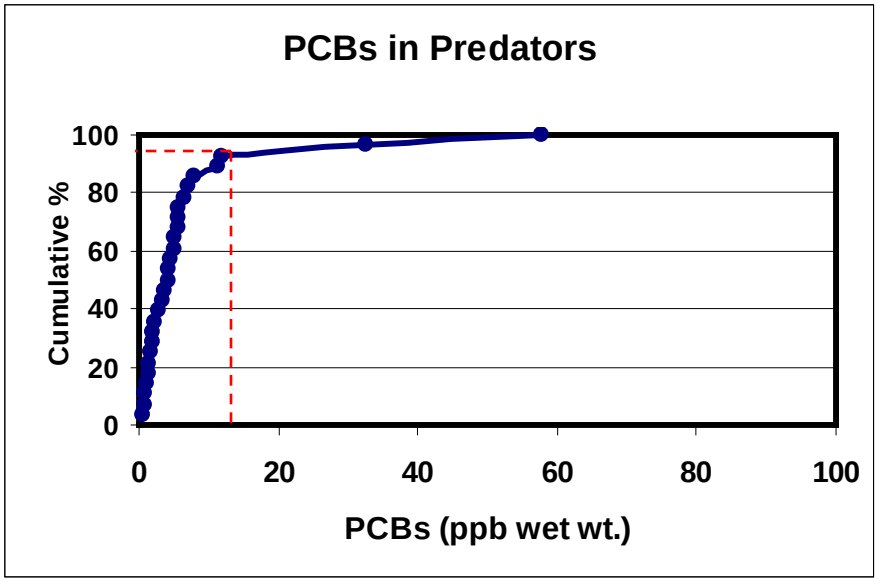
- 20% of predator composites exceeded Human Health screening level (6 lakes).

- 50% of bottom-dweller composites exceeded low range of ecological endpoint (9 lakes).

- Mercury levels were not substantially related to lake size.



Results – Region 10--PCBs



Mean= 7.1

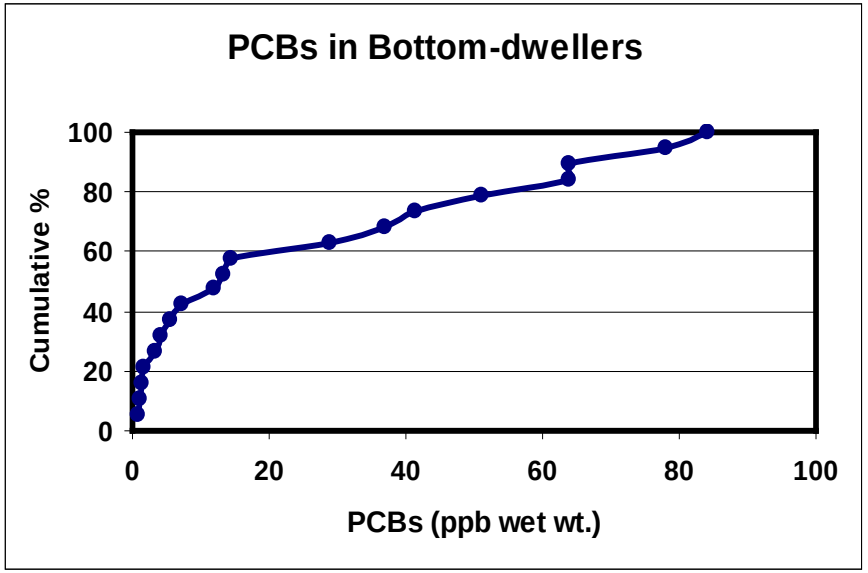
Range= 0.5 - 57.7

N= 28

Mean= 27.0

Range= 0.8 - 84.1

N= 19



Summary – PCB Results – Region 10

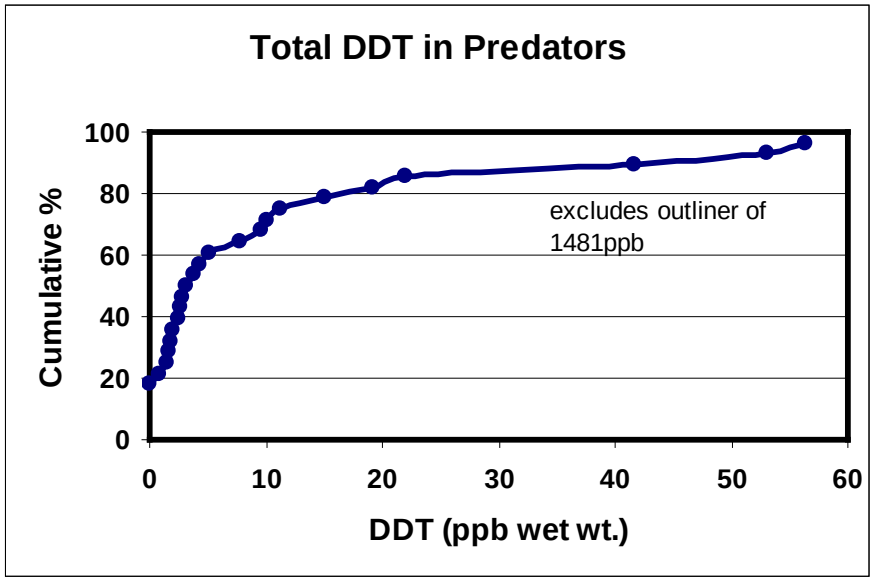
- PCBs detected in all composites but levels were substantially higher in bottom-dwellers than in predators.

- Human health screening level of 12ppb exceeded in 7% of the lakes sampled (2 lakes).

- Ecological screening level was not exceeded.

- Fish of both categories had more PCBs in the larger lakes.

Results – Region 10--DDT



Mean= 62.8

Range= 0 - 1481.0

N= 28

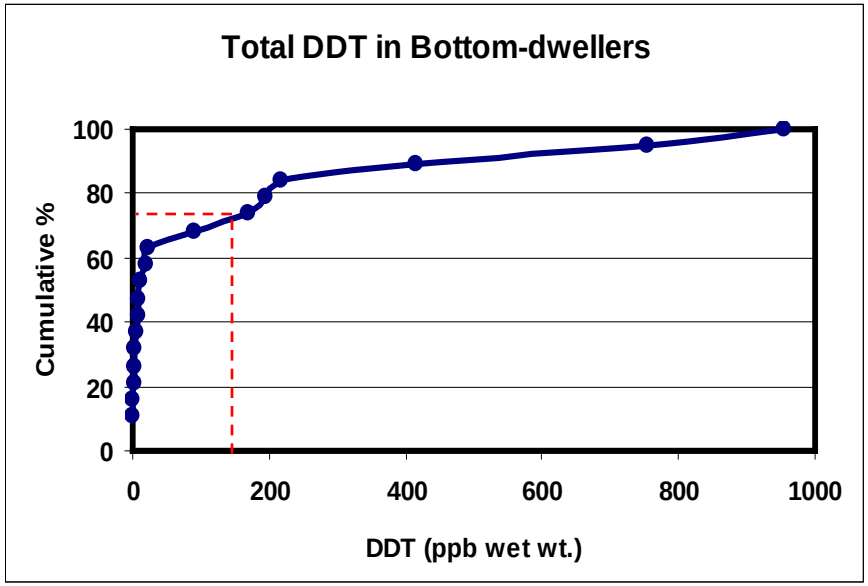
Non-detects= 5

Mean= 151.7

Range= 0 - 955.9

N= 19

Non-detects= 2



Summary – DDT Results – Region 10

- DDTs in predator composites were below the human health screening level except for one very high value (Lake Chelan).

- DDTs in bottom-dweller composites were generally higher than the predators.

- 32% of the bottom-dweller composites exceeded the lower ecological screening value (6 lakes).

- Levels in neither sample type were substantially related to lake size.

Comparison to National picture

% of lakes exceeding HH thresholds

Chemical	Region 10	National Survey
Mercury	20%	49%
Total PCBs	7%	17%
Total DDT	<4%	2 %

The Next National Lakes Survey in 2012 --Recommendations

- Add Fish Tissue as a Core Indicator.
- Continue to sample across the same range of lake sizes—Keep the small lakes as in the Fish Tissue Survey.
- If only budget for one fish tissue endpoint chose Human Health Predator species.
- If budget is limited for analytes, then mercury is the highest priority, followed by PCBs, then legacy pesticides.
- Larger sample size across range of lake sizes to ensure ability to make inferences to the greater population of lakes in the region.

Questions?