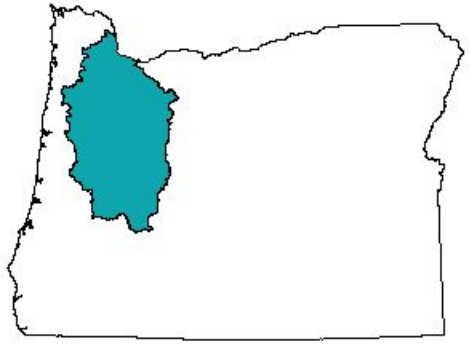
Willamette Basin Mercury TMDL

Agnes Lut
Columbia River Coordinator
Oregon Department of Environmental Quality

Presented April 9, 2007

Willamette Basin Mercury TMDL



Columbia River: Toxics Reduction Working Group
@ WDOE
April 9, 2007

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Willamette Mercury TMDL / Columbia River Coordinator

Willamette Basin Mercury TMDL: Unique Features

- Water quality impairment (303(d) listing) based on *fish consumption advisory*, as opposed to *standard* exceedance.

- Basin-wide TMDL for mercury

- Stakeholder involvement via Willamette River TMDLs Council.

- Strong collaborative relationship with USEPA on mercury monitoring and TMDL development.

- DEQ pursued a '**Phased'** approach for TMDL.

Willamette Basin Mercury Fish Consumption Advisories

Willamette Basin Mercury Background

- Entire mainstem Willamette is ‘listed’ for mercury due to the consolidated fish consumption advisory.

- Average levels of mercury in bass and Northern pikeminnow from the Willamette exceed 0.35 ppm.

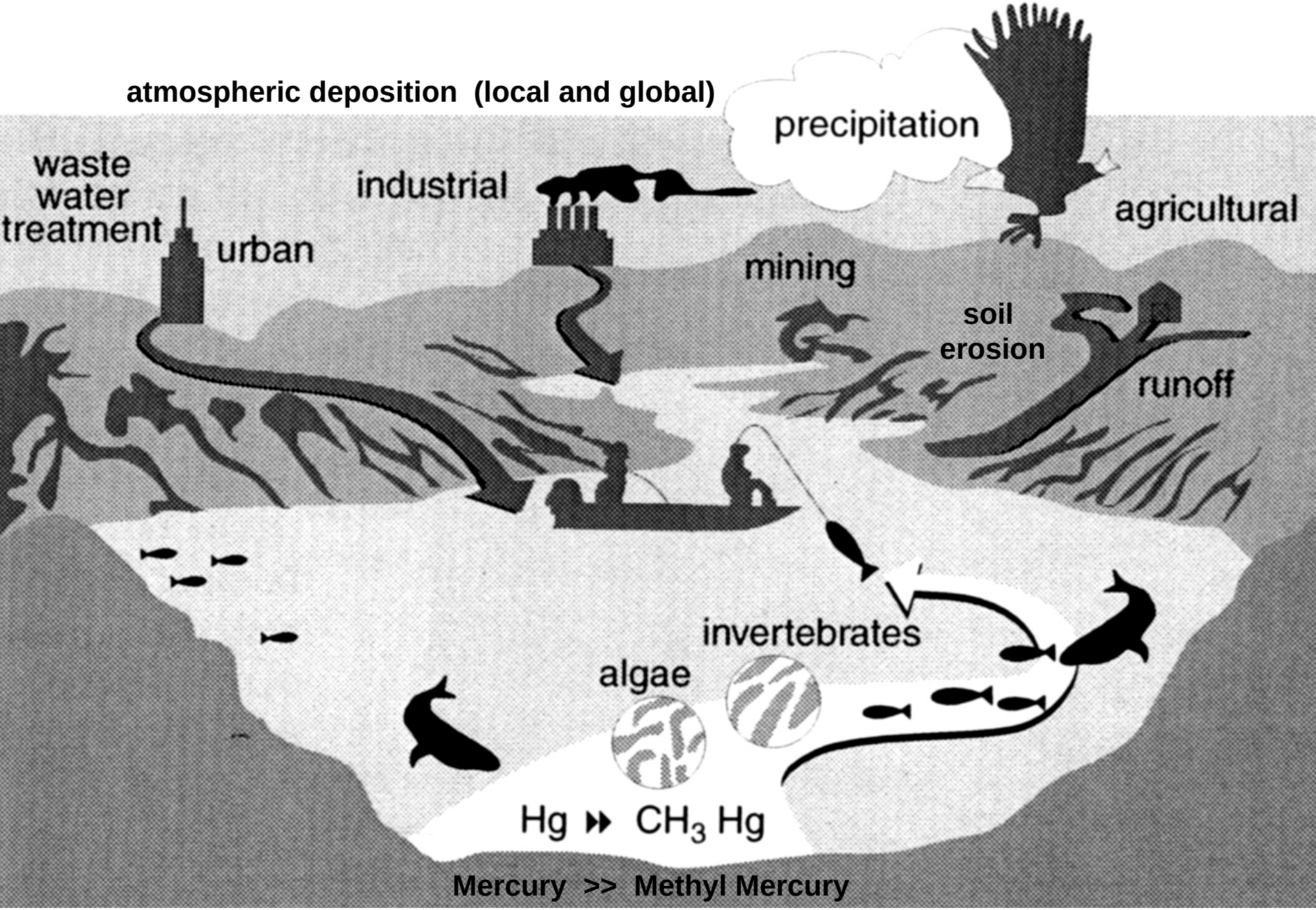
- Nearly all of the mercury present in fish tissue is in the methylated form.

Mercury is…

- Naturally occurring metal found in:
  - Volcanic rocks
  - Cinnabar
  - Geothermal water (hot springs)

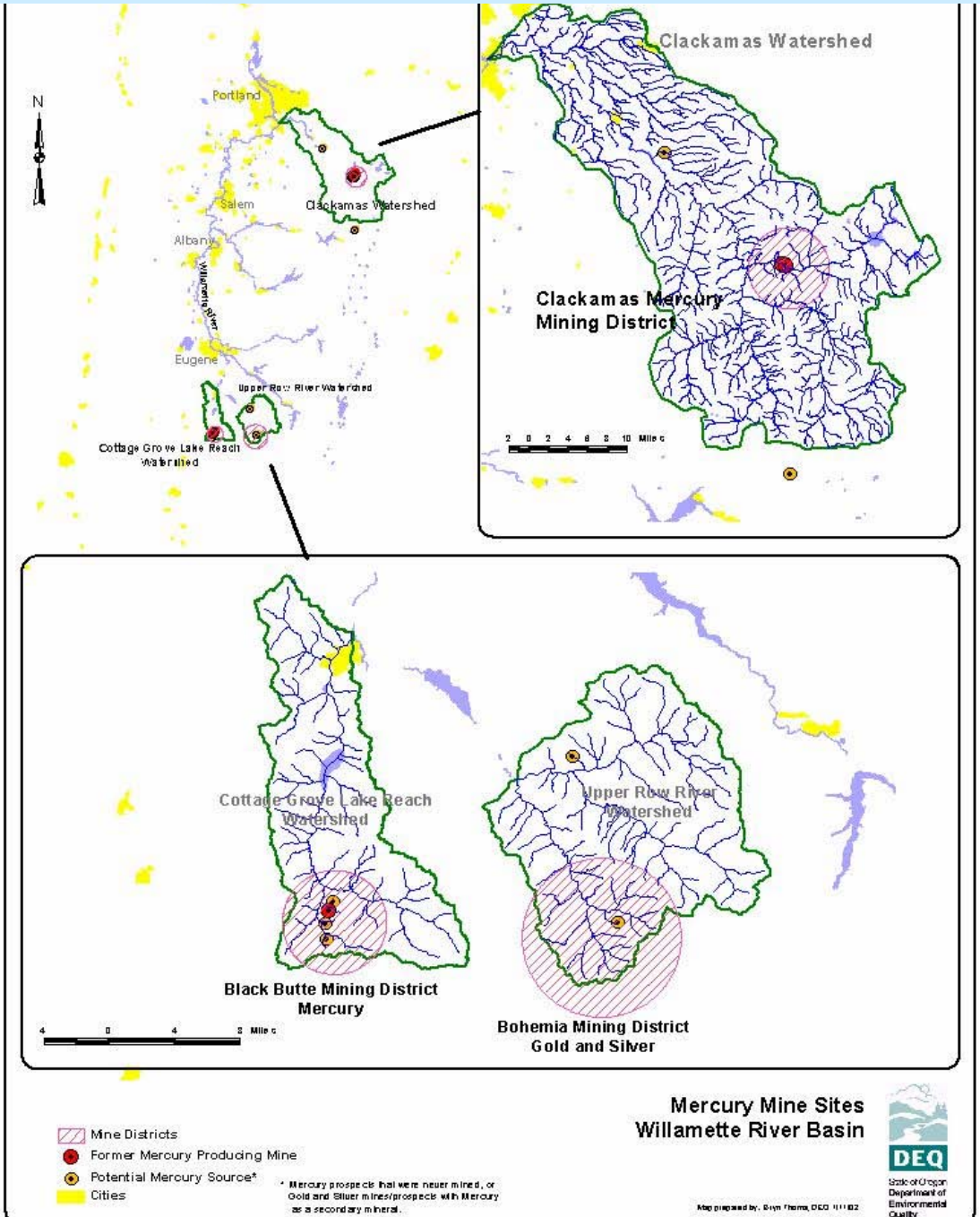
- Naturally present in:
  - Trees
  - Fossil fuels such as coal, natural gas, diesel fuel and heating oil

Sources of Mercury in the Willamette Basin



Mining Sources of Mercury in the Willamette Basin

Mercury mined in both the Clackamas and the Coast Fork Willamette Subbasins



Mercury used in gold and silver mining in the Bohemia Mining District in the Coast Fork Willamette

Willamette Basin Mercury TMDL: Phase 1 Sampling Plan

•One year sampling period: 2002 – 2003

•18 sites

•3 Analytical Labs (US EPA, ODEQ, Battelle)

Water column: October, December, March, June
Willamette River, mouths of major tributaries, Coast Fork Willamette Sub-Basin

Sediment: August, September (2002)
Willamette River, mouths of major tributaries, Coast Fork Willamette Sub-Basin

Fish: July, August, September (2003)
Willamette River
Largescale sucker
Smallmouth bass
Largemouth bass
Northern pikeminnow

Willamette Basin Mercury TMDL: Phase 1 Sampling Sites

18 Willamette Basin Locations

- 5 Mainstem sites
- 2 Tributaries
- 2 Reservoirs
- 9 sites US/DS Reservoirs
- Background sites

Using EPA Method 1669

Clean Hands / Dirty Hands

Willamette Basin Mercury TMDL: Phase 1

- **Monitored** to measure total and methylmercury in water column, fish tissue and sediment.

- **Utilized a Model** to establish a water column target that is protective of human health.

- Characterized the various **sources** of mercury in the Willamette Basin.

- Established interim **reduction goals** and allocations.

- Developed a **strategy** to implement mercury reduction activities with the overall goal of attaining water column targets.

Willamette Basin Mercury TMDL: Phase 1 Water Column Guidance Value

- Interim Water Column Guidance Value = **0.92 ng/l** of *total* Hg

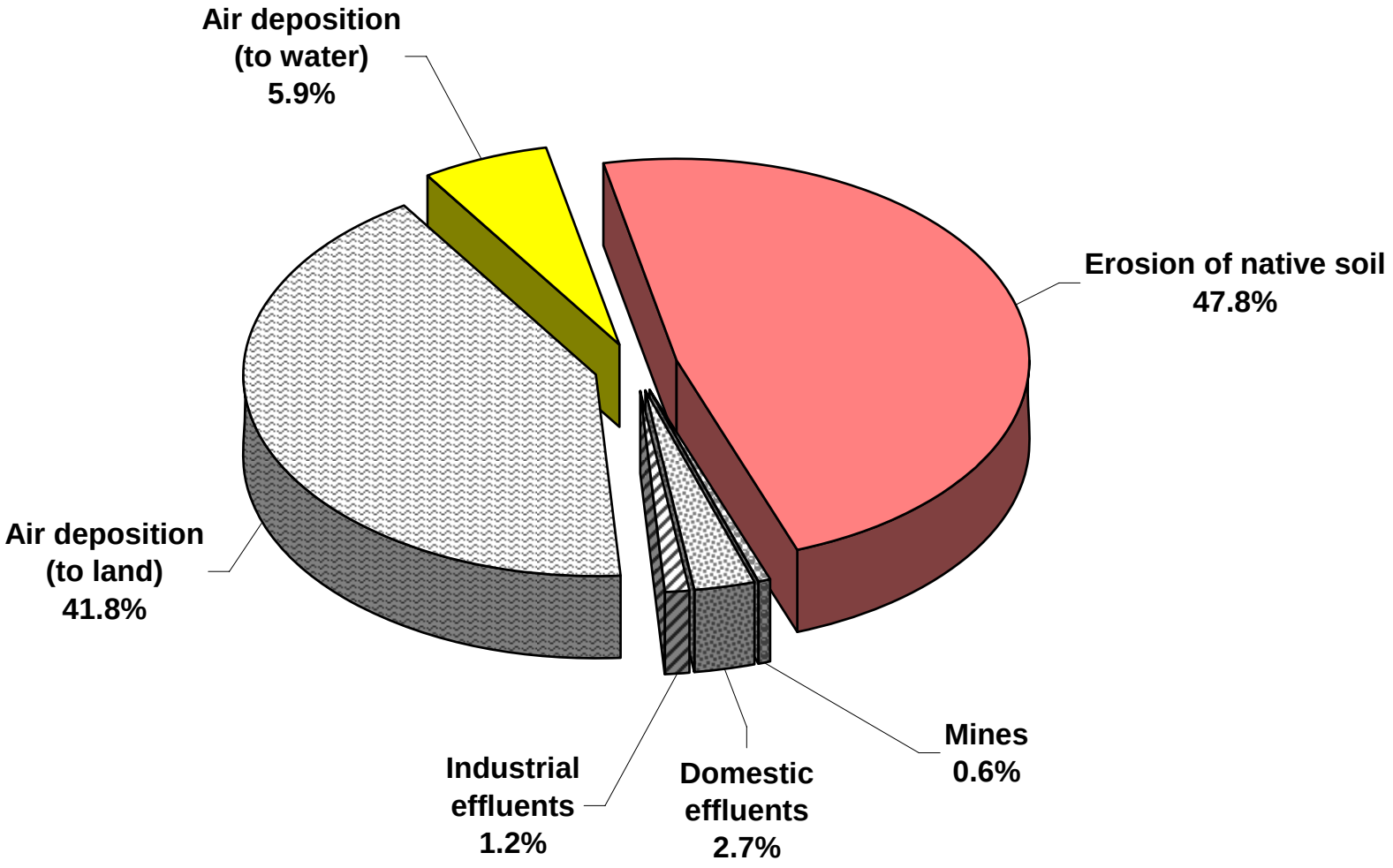
- Percent reduction necessary to attain the interim water column guidance value in:

  - **Mainstem Willamette River = 27%**
  - **Cottage Grove Watershed = 68%**
  - **Dorena Watershed = 30%**

Phase 1 Mercury TMDL submitted and approved by US EPA on September 29, 2006.

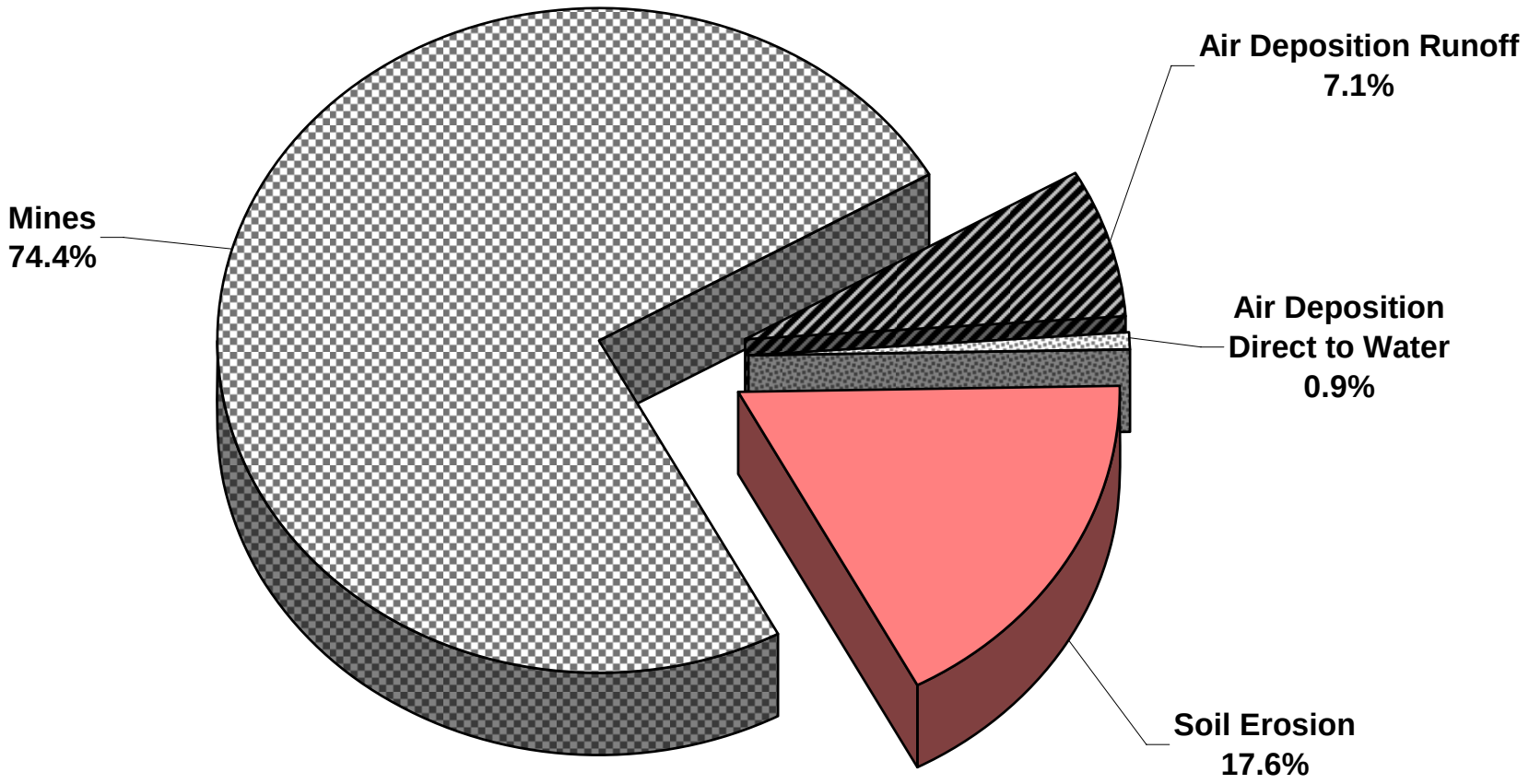
Willamette Basin Mercury TMDL: Phase 1 Sources Willamette River

(Total Load = 128.5 kg/yr). 27% reduction



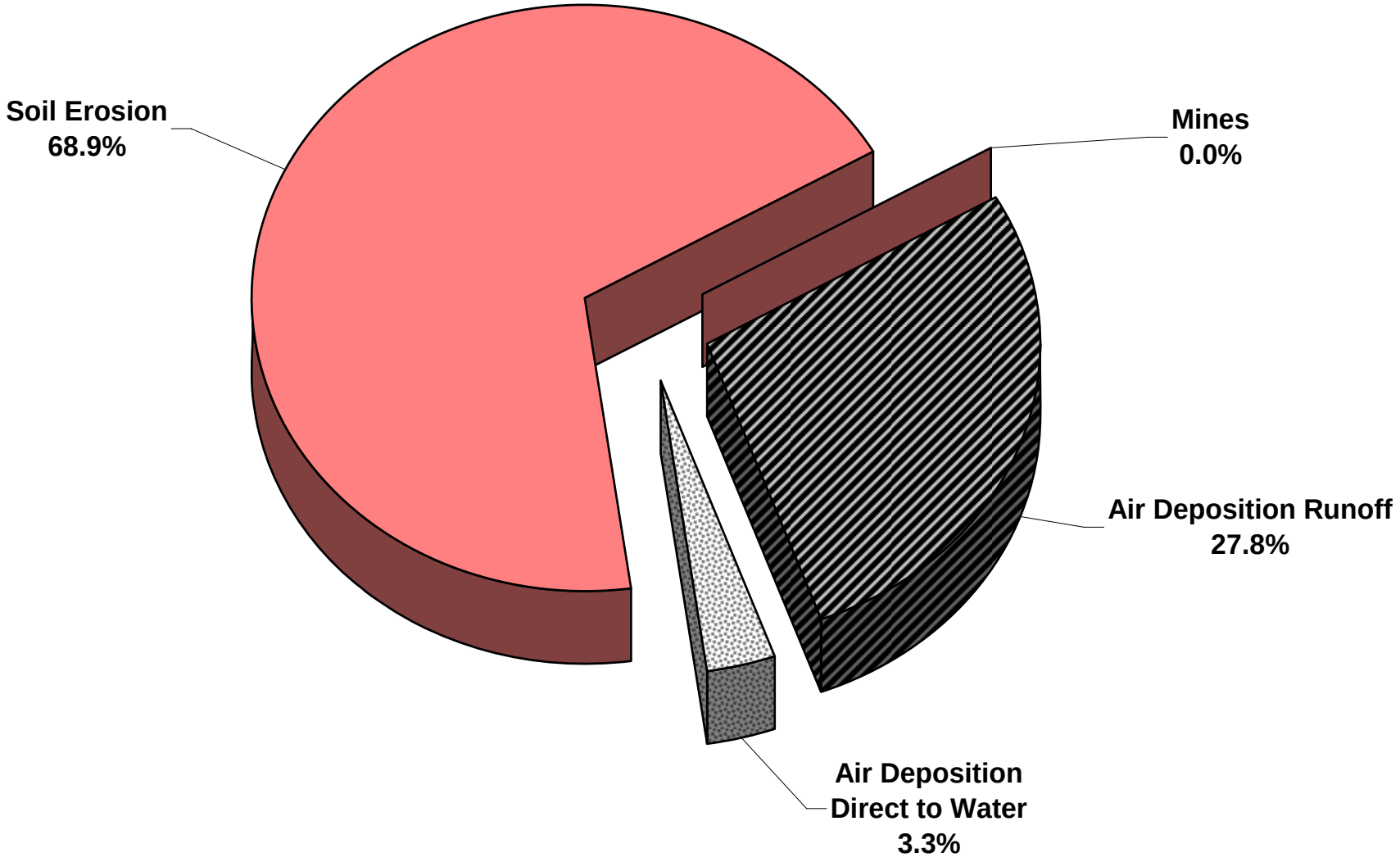
Willamette Basin Mercury TMDL: Phase 1 Sources Cottage Grove Watershed

(Total Load = 3.13 kg/yr) 68% reduction



Willamette Basin Mercury TMDL: Phase 1 Sources Dorena Watershed

(Total Load = 2.08 kg/yr) 30% reduction



Willamette Basin Mercury TMDL: Phase 2

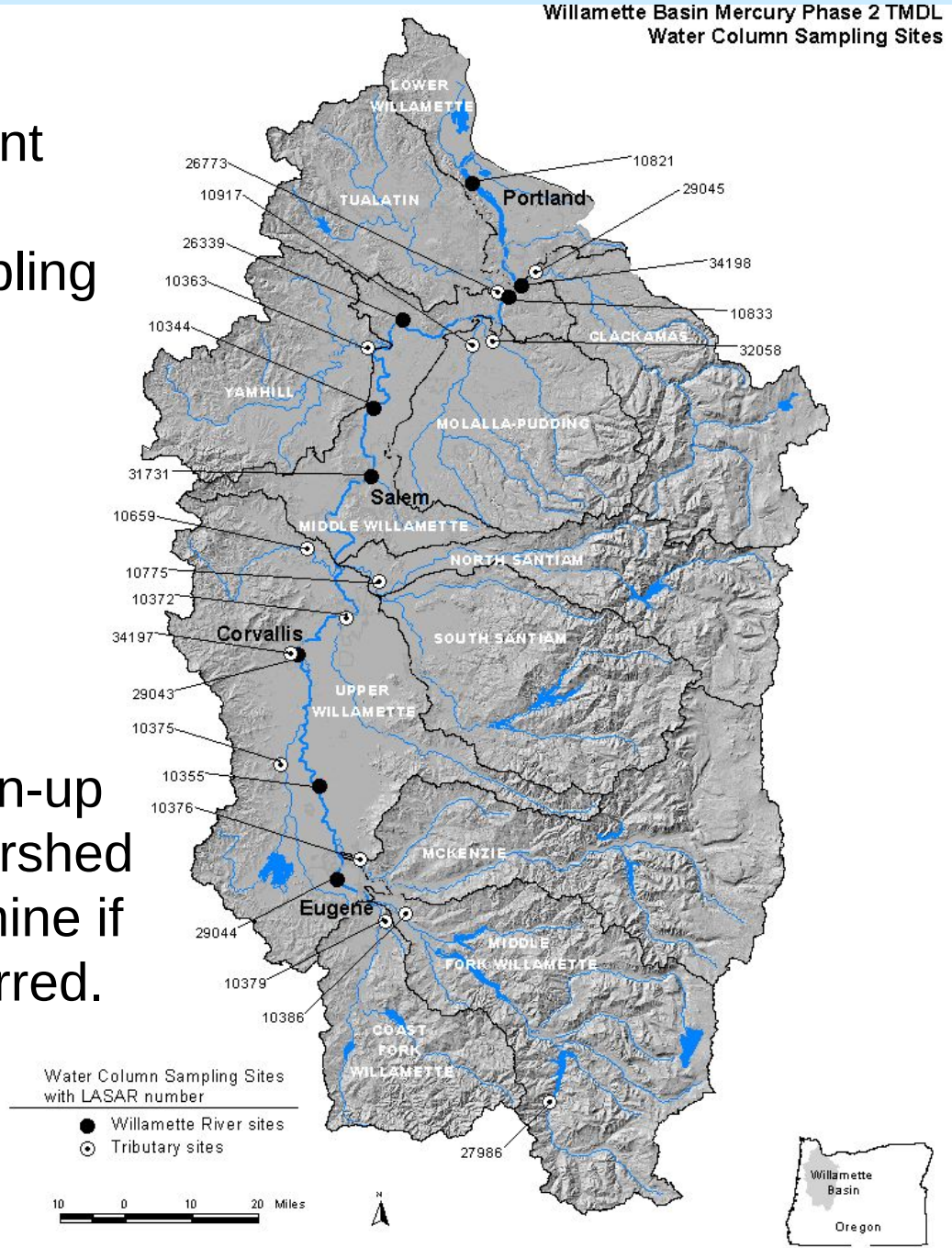
- Complete necessary **monitoring** (DEQ and Point Sources)
- Generate **site-specific information** on mercury loadings, rate of MeHg formation, and bioaccumulation
- **Refine** the loading capacity and the percent reduction needed based on the site-specific information
- **Allocate reductions** needed to the various sectors/sources
- Expand and refine the **implementation plan** for achieving the reductions needed
- Scheduled for Completion in 2011

Willamette Basin Mercury TMDL: Phase 2

DEQ received a US EPA Grant
to conduct
5 quarters of water quality sampling

- 9 mainstem sites
- 13 tributary sites
- 1 background site

DEQ Land Quality Orphan Clean-up
Will monitor Cottage Grove Watershed
Pre and Post Clean-up to determine if
a reduction of mercury has occurred.



Willamette Basin Mercury TMDL: Phase 2

DEQ began monitoring the week of March 26,
Using Clean Hands / Dirty Hands (EPA Method 1669):

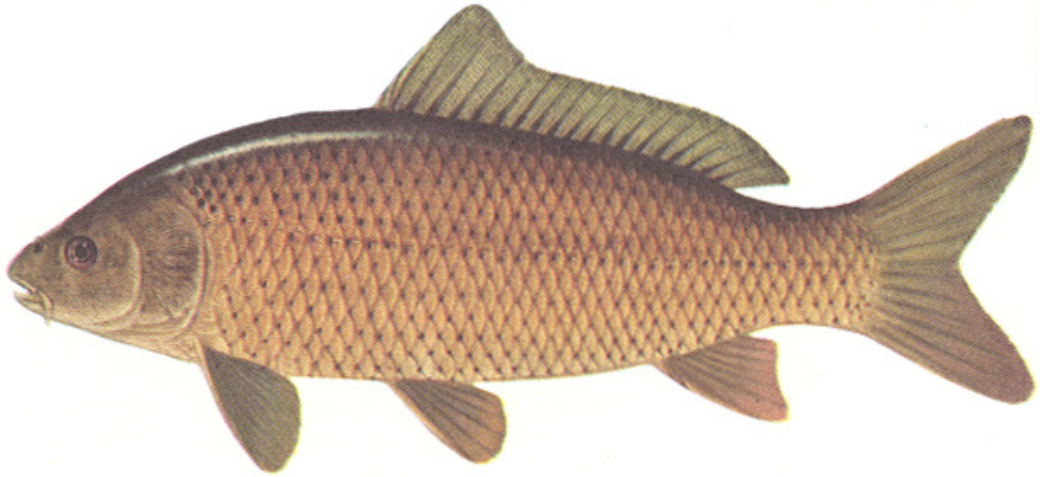
1. Total Mercury
2. Dissolved Mercury
3. Total Methyl Mercury
4. Dissolved Methyl Mercury
5. Hardness
6. Dissolved Organic Carbon
7. Total Organic Carbon
8. Temperature
9. pH
10. Redox
11. Dissolved Oxygen
12. Alkalinity
13. Conductivity
14. Sulfate

DEQ is / has ALSO…..

- Requested money from US EPA for additional monitoring
- Will be working with Point Sources to Develop Mercury Minimization Plans
- Updating the Agency Mercury Reduction Strategy

Questions?

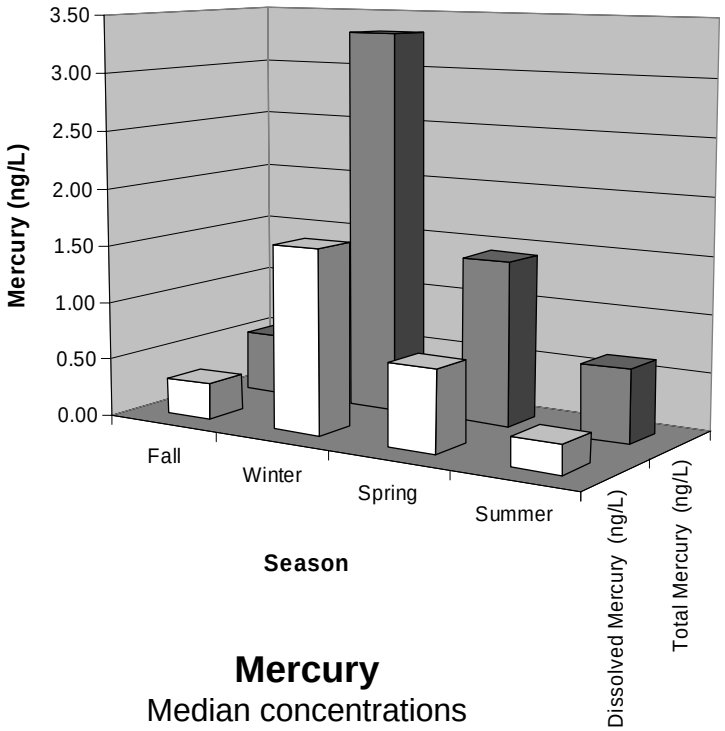
Comments?



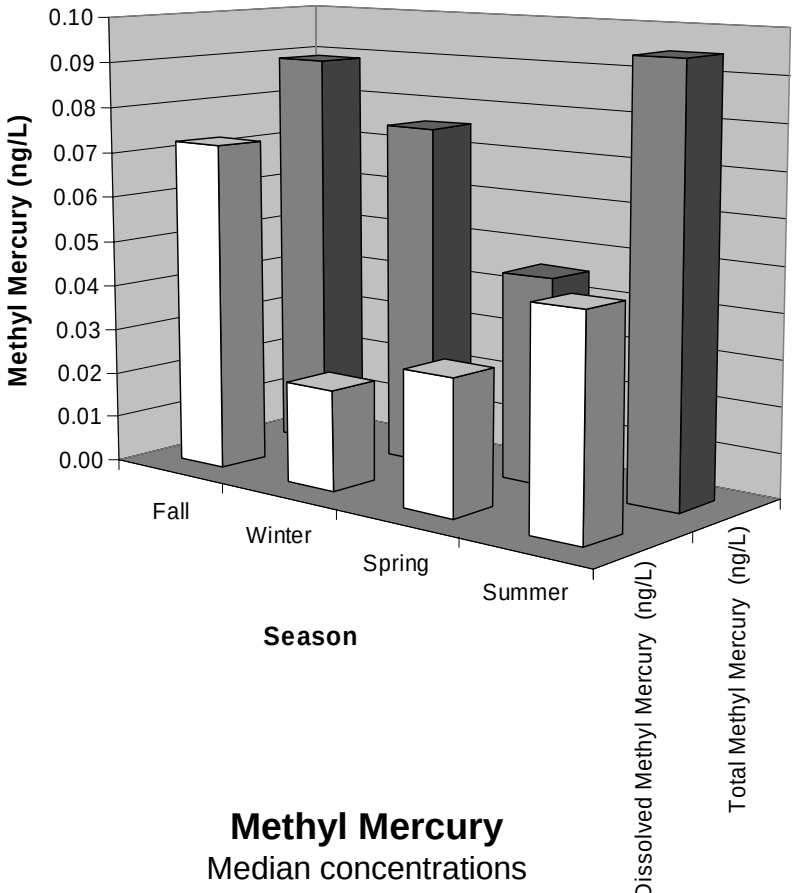
Thank you….

Agnes

Water Column Results

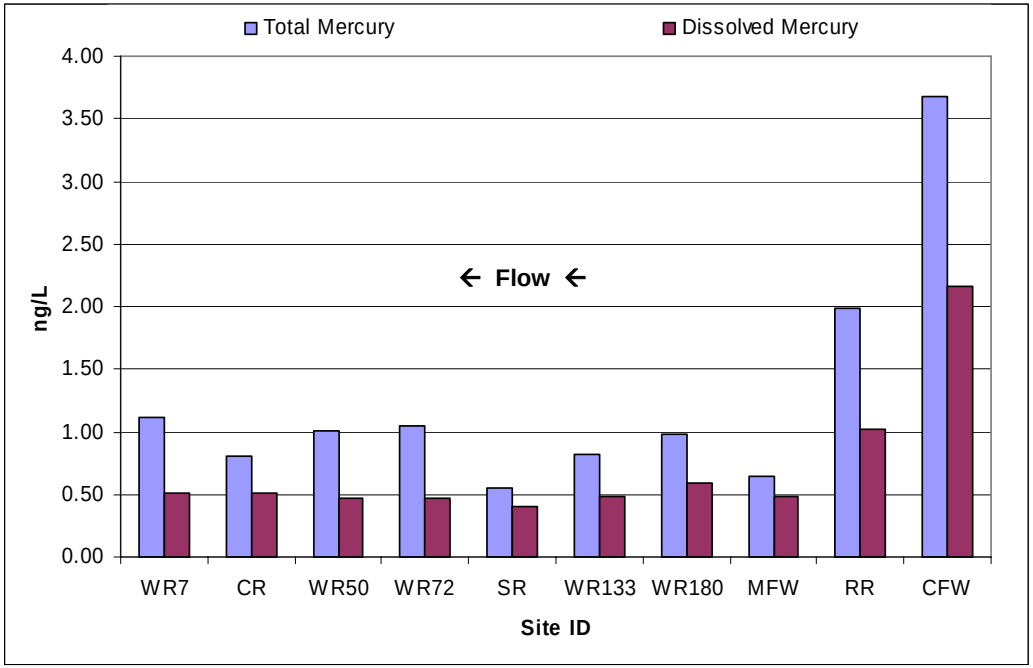


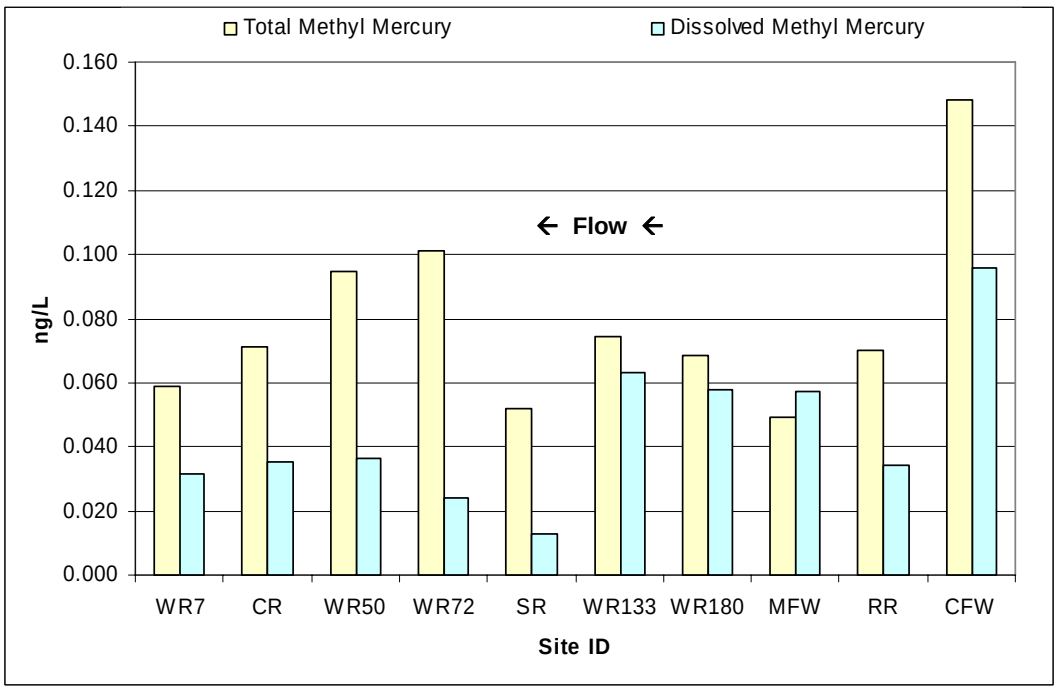
Mercury
Median concentrations



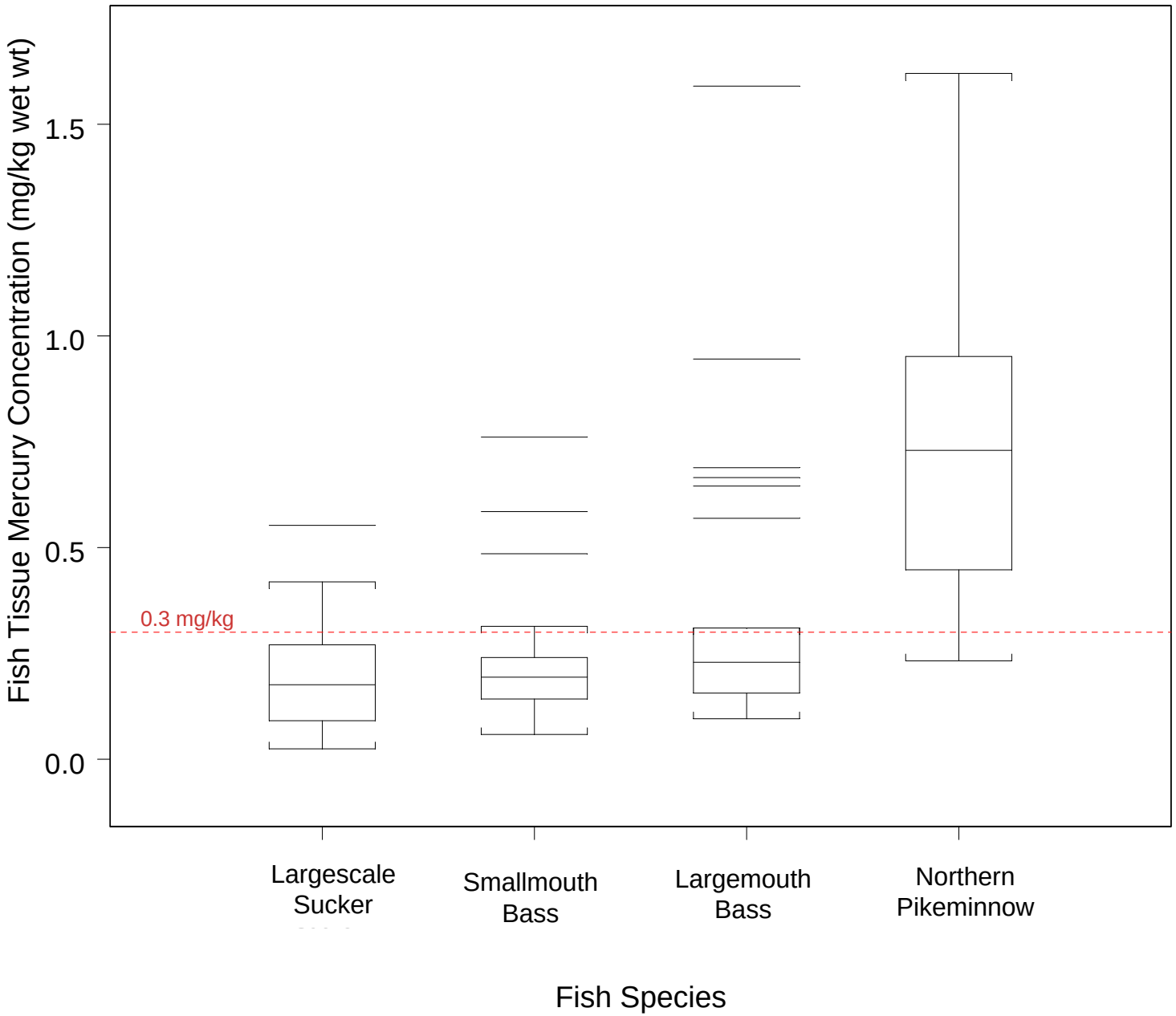
Methyl Mercury
Median concentrations

Water Column Spatial Median Concentrations

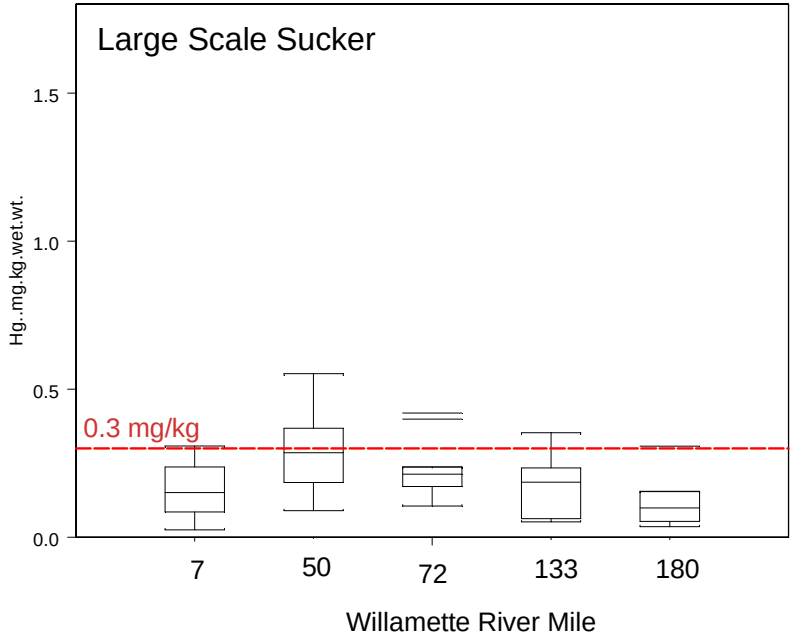


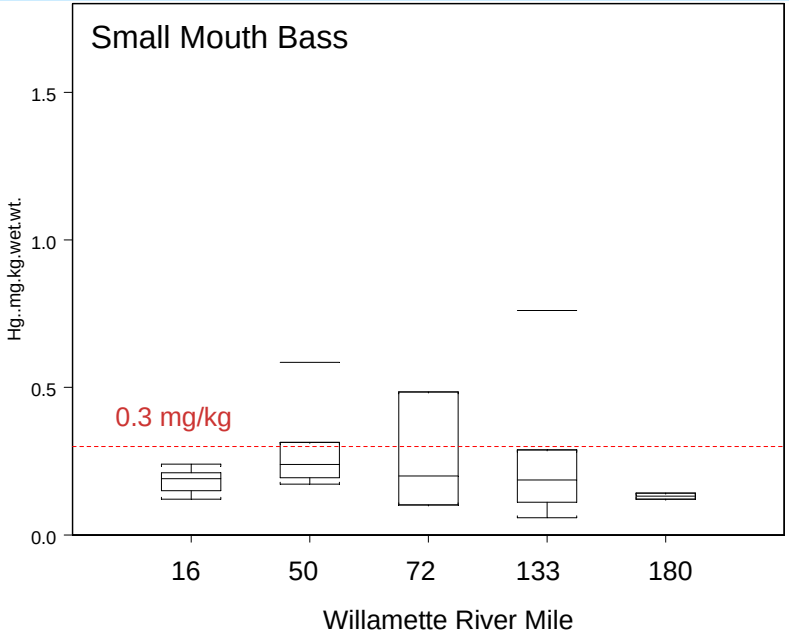


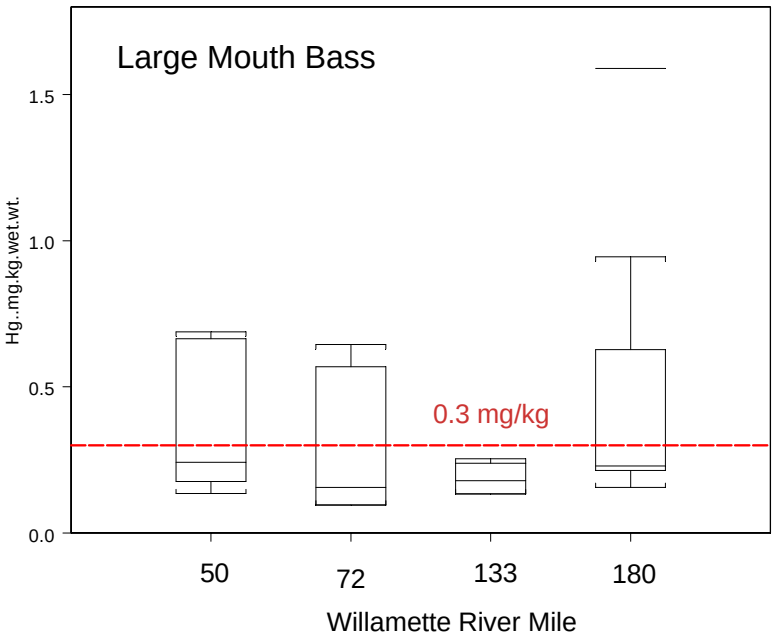
Fish Tissue Results

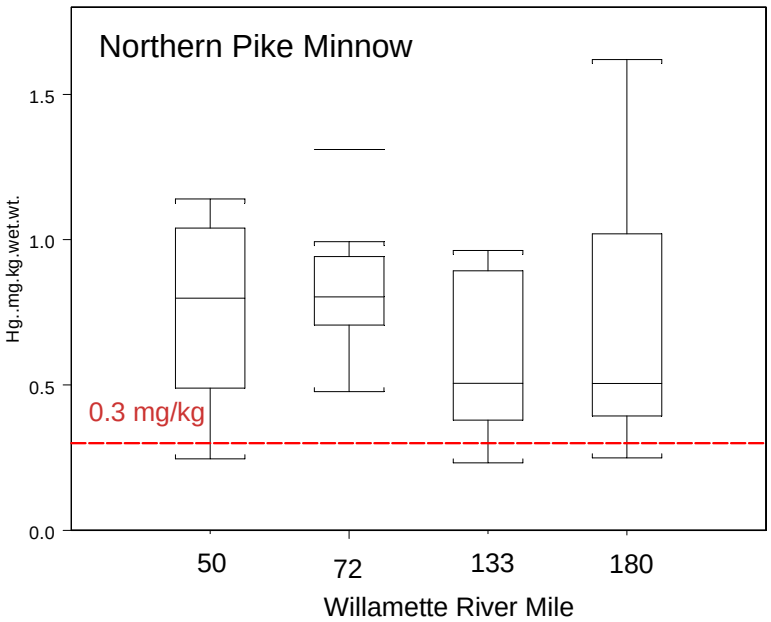


Fish Tissue Spatial Results

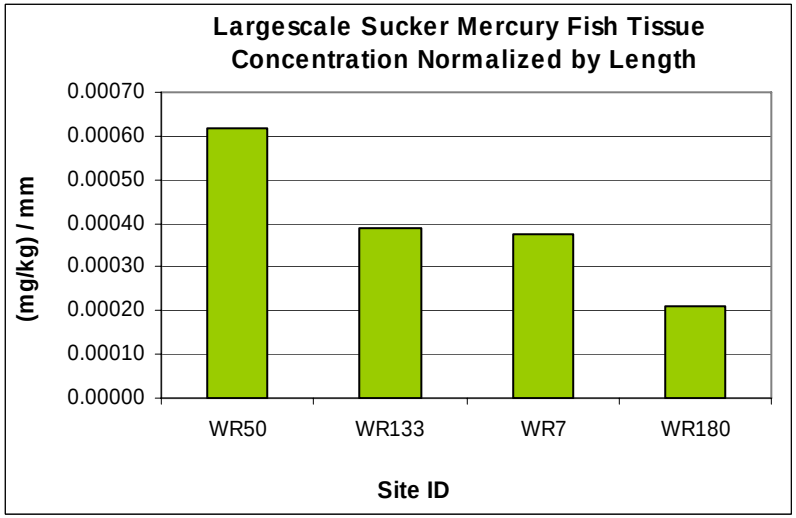


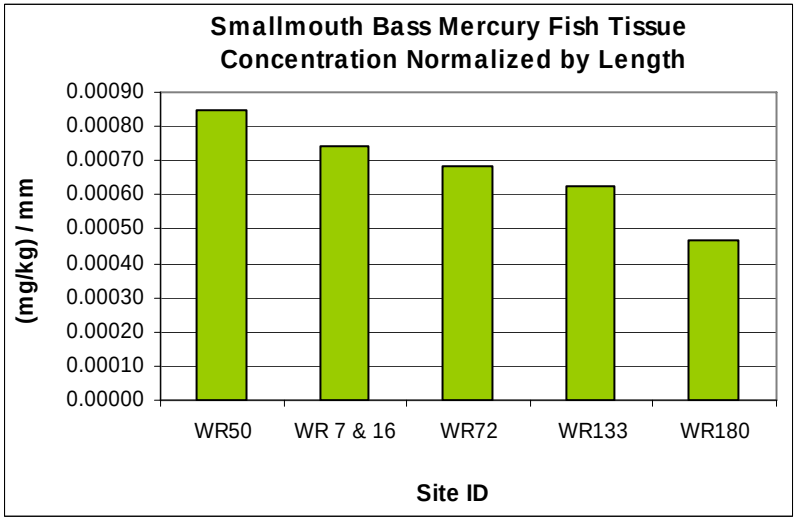


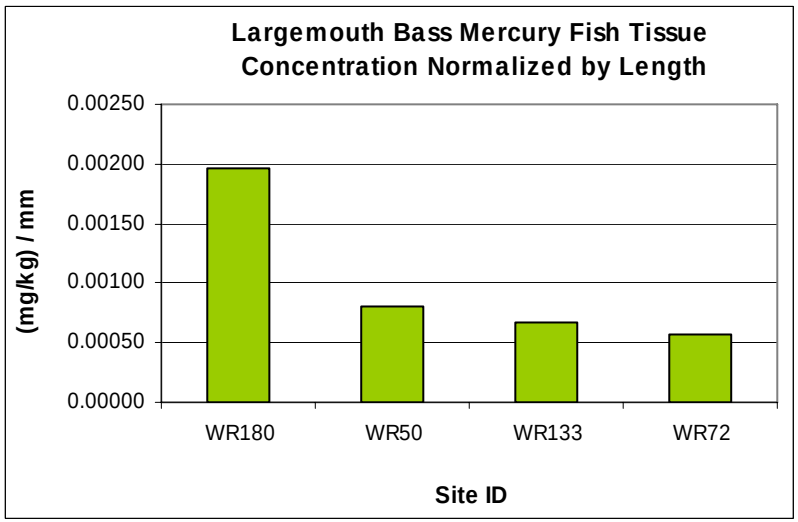


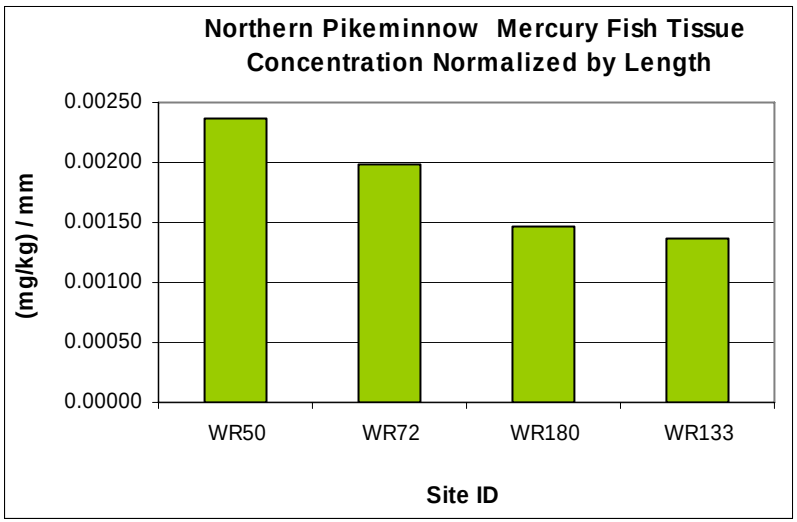


Fish Tissue Spatial Results

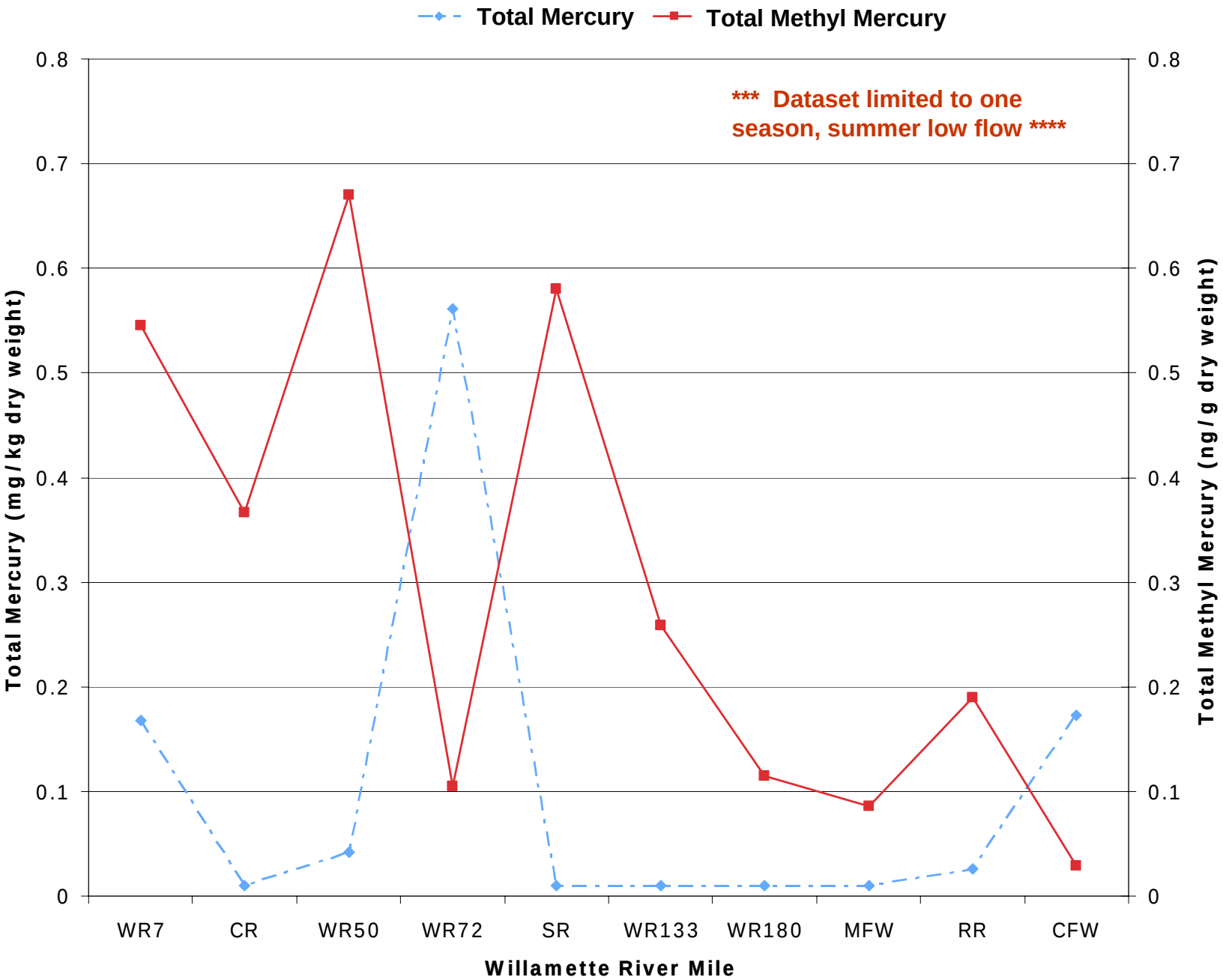




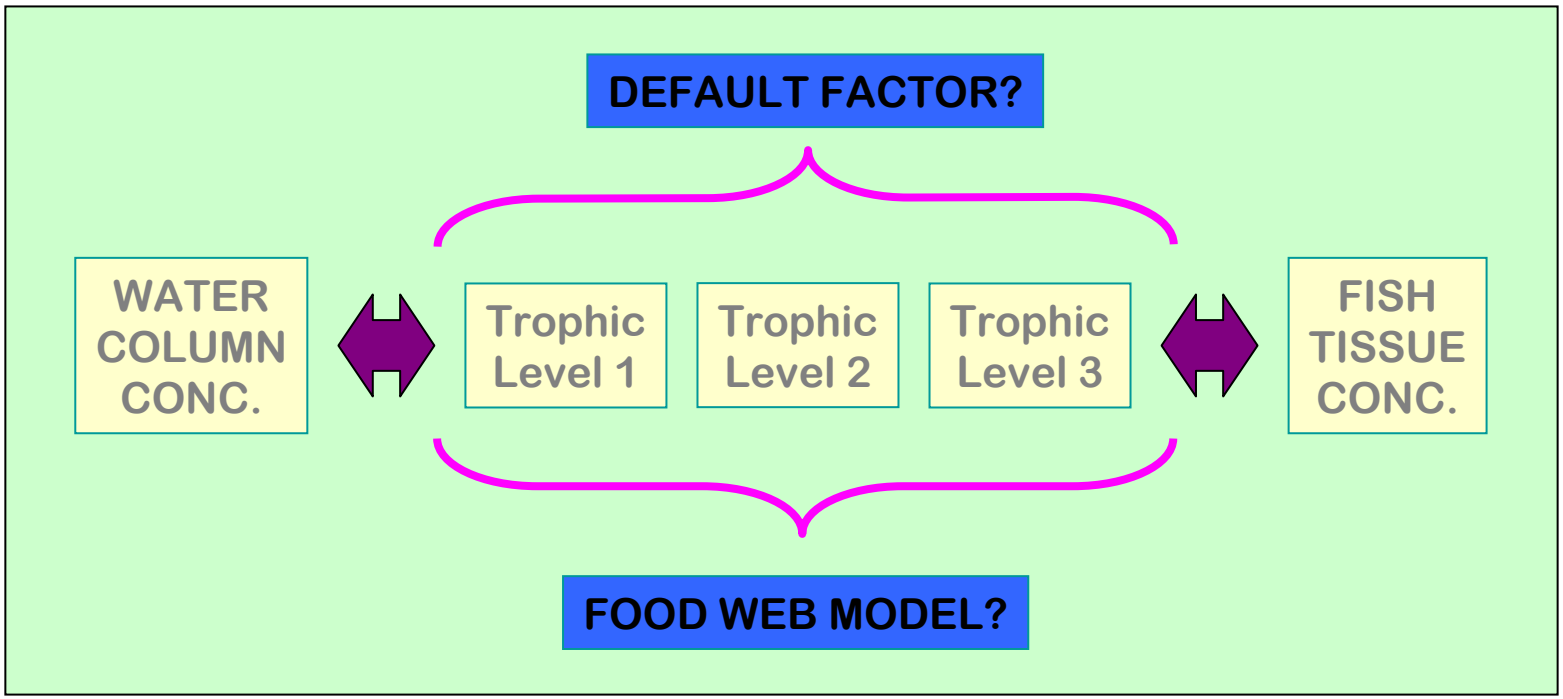




Sediment Spatial Results



Food Web Biomagnification Model

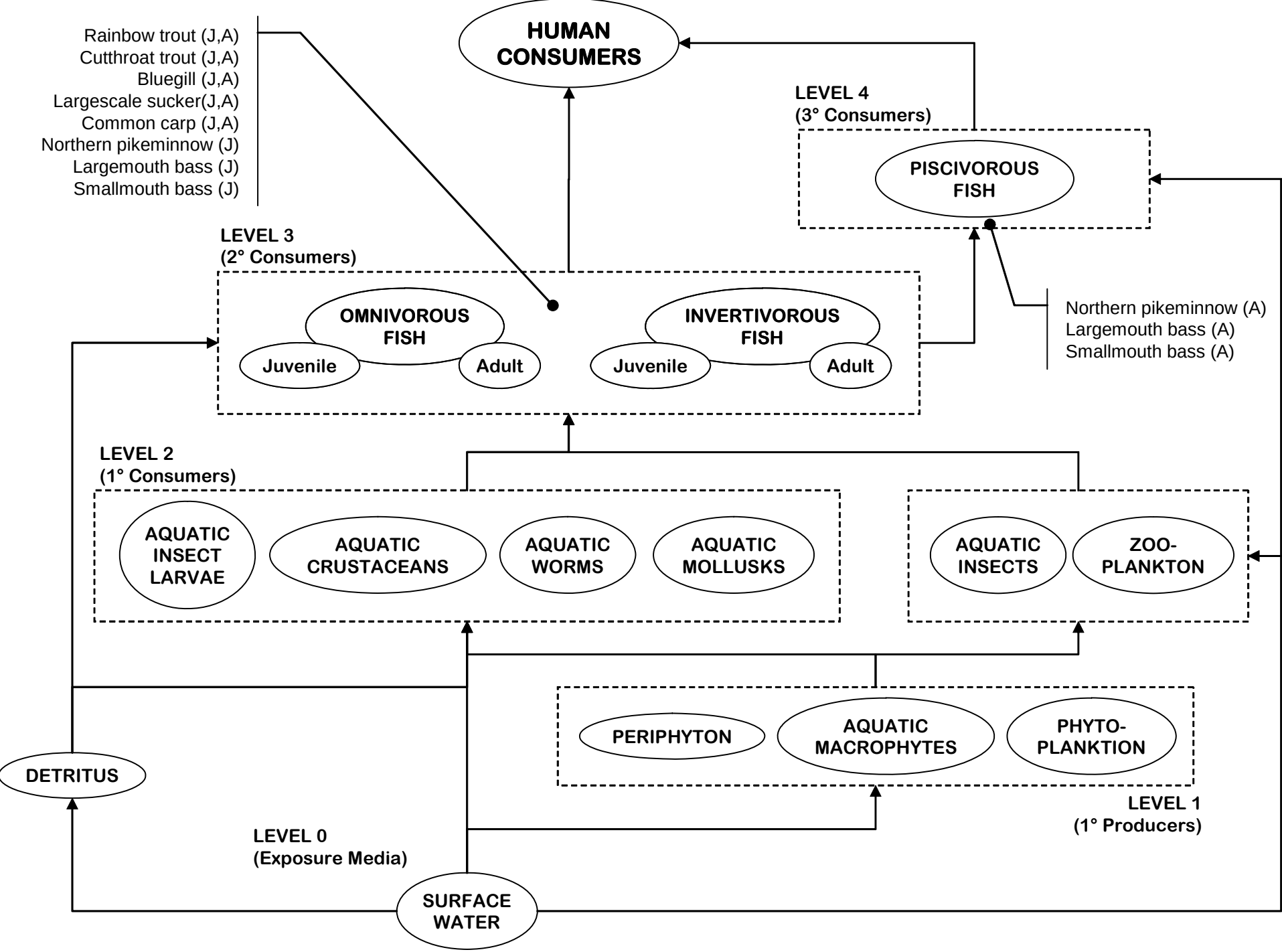


Food Web Biomagnification Model

- Considers eight fish species of interest representative of distinct trophic levels

- Variables are consistent with those used in other published Hg bioaccumulation models

- Model calibrated with fish tissue, sediment and water column data collected in 2002 and 2003


Rainbow trout (J,A)
Cutthroat trout (J,A)
Bluegill (J,A)
Largescale sucker(J,A)
Common carp (J,A)
Northern pikeminnow (J)
Largemouth bass (J)
Smallmouth bass (J)
HUMAN CONSUMERS
LEVEL 4
(3° Consumers)
PISCIVOROUS FISH
LEVEL 3
(2° Consumers)
OMNIVOROUS FISH
Juvenile
Adult
INVERTIVOROUS FISH
Juvenile
Adult
Northern pikeminnow (A)
Largemouth bass (A)
Smallmouth bass (A)
LEVEL 2
(1° Consumers)
AQUATIC INSECT LARVAE
AQUATIC CRUSTACEANS
AQUATIC WORMS
AQUATIC MOLLUSKS
AQUATIC INSECTS
ZOO-PLANKTON
PERIPHYTON
AQUATIC MACROPHYTES
PHYTO-PLANKTION
DETRITUS
LEVEL 1
(1° Producers)
LEVEL 0
(Exposure Media)
SURFACE WATER

Food Web Biomagnification Model

Model Outputs:

- Surface water target levels for *total* mercury

Target levels vary according to:

- Fish species selected
- Degree of protectiveness

Selected interim water column target based on the *median* value of protectiveness for the Northern Pikeminnow (the most efficient bioaccumulator of Hg considered in the model).