

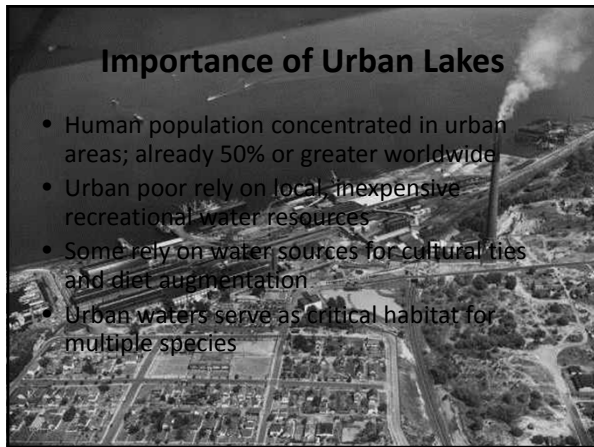
The Long-Term Impact of Metal Smelting Operations on Arsenic Availability in Urban Lakes of the South-Central Puget Sound Region

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 Environmental Science and Studies



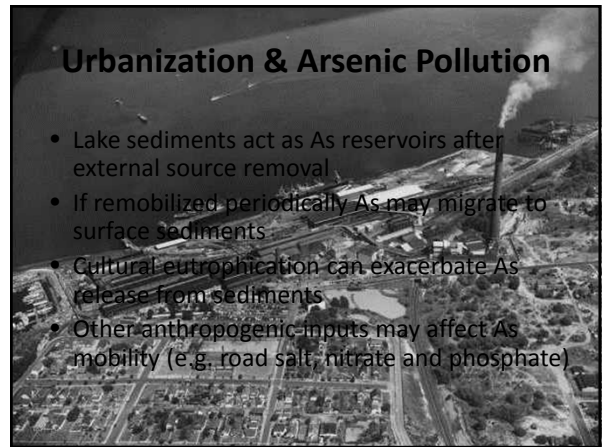
Research Team

- UWT Undergraduates: Lindsay Tuttle, Sarah Burdick, Michelle Miller, Jessica Asplund, Shawna Peterson, Kara Ziegler and Alexandra Ehle
- Ballarmino High School: Amanda Tollefson and Brian Runk
- UW Seattle Faculty: Becca Neumann



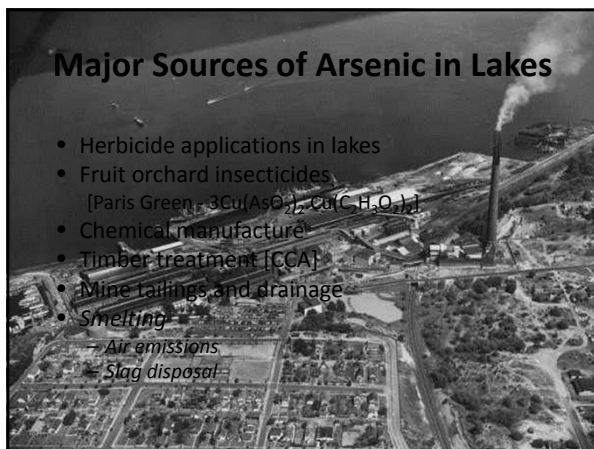
Importance of Urban Lakes

- Human population concentrated in urban areas; already 50% or greater worldwide
- Urban poor rely on local, inexpensive recreational water resources
- Some rely on water sources for cultural ties and diet augmentation
- Urban waters serve as critical habitat for multiple species



Urbanization & Arsenic Pollution

- Lake sediments act as As reservoirs after external source removal
- If remobilized periodically As may migrate to surface sediments
- Cultural eutrophication can exacerbate As release from sediments
- Other anthropogenic inputs may affect As mobility (e.g. road salt, nitrate and phosphate)



Major Sources of Arsenic in Lakes

- Herbicide applications in lakes
- Fruit orchard insecticides [Paris Green - $3\text{Cu}(\text{AsO}_2)_2 \cdot \text{Cu}(\text{C}_2\text{H}_3\text{O}_2)_4$]
- Chemical manufacture
- Timber treatment (CCA)
- Mine tailings and drainage
- Smelting
 - Air emissions
 - Slag disposal




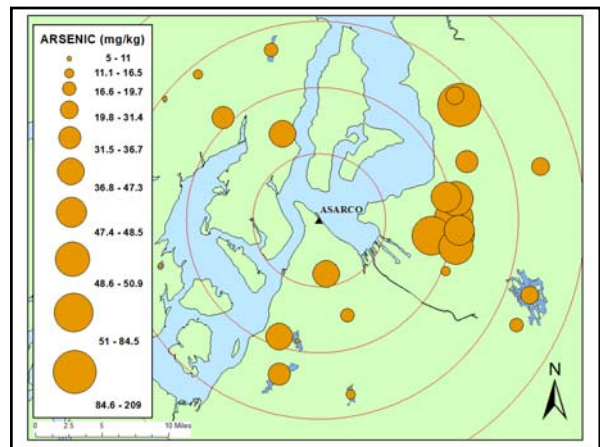
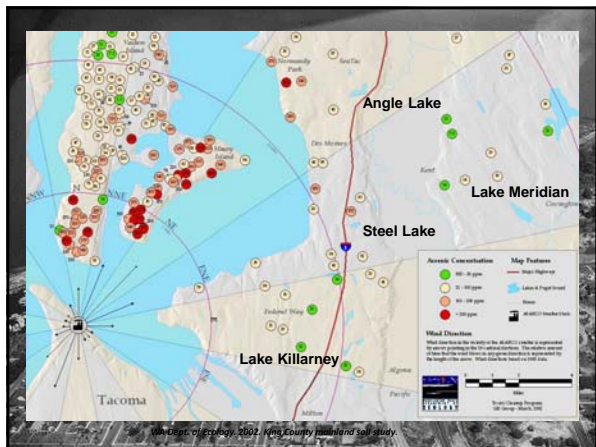
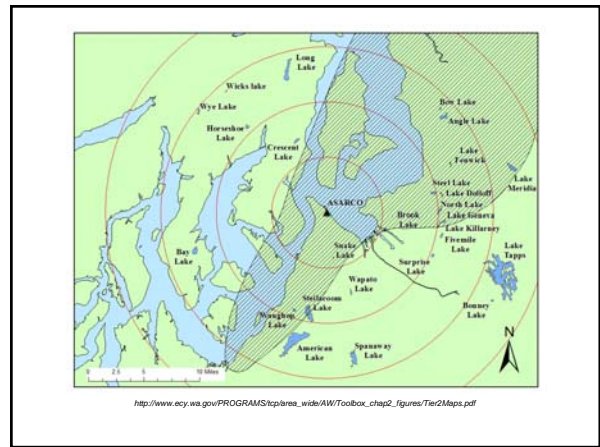
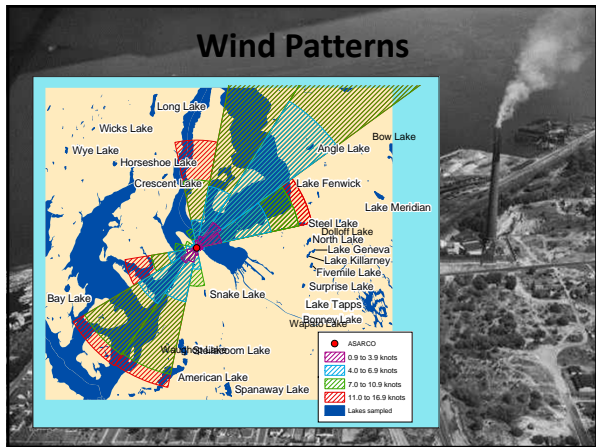
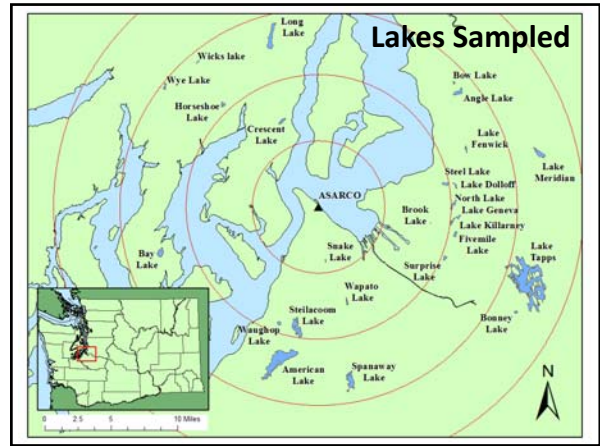
ASARCO

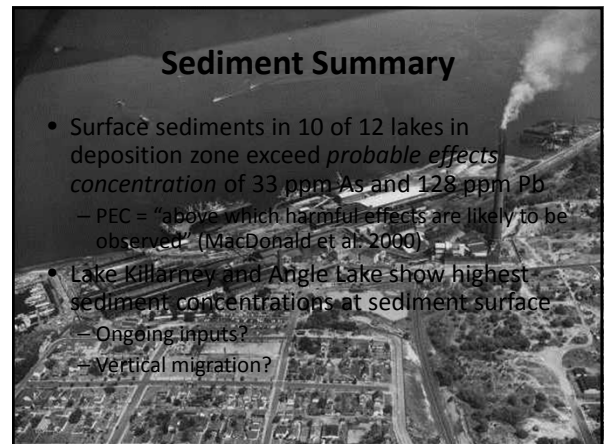
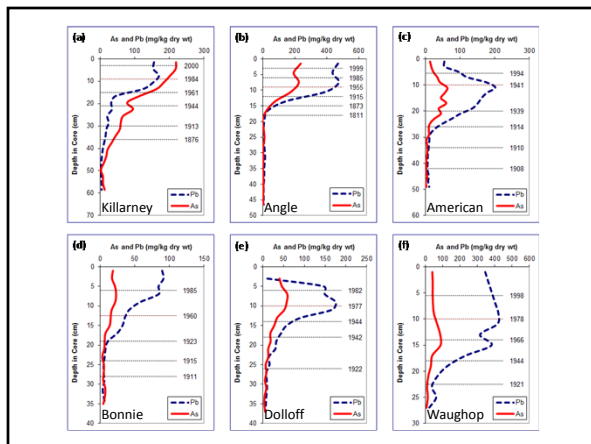
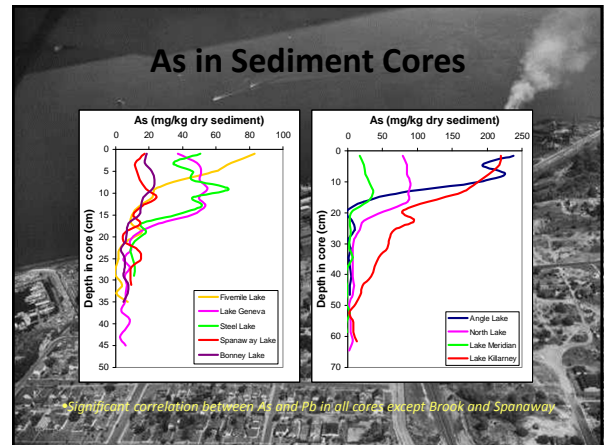
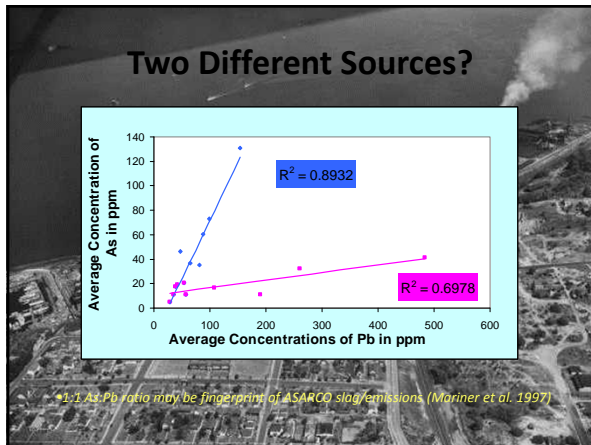
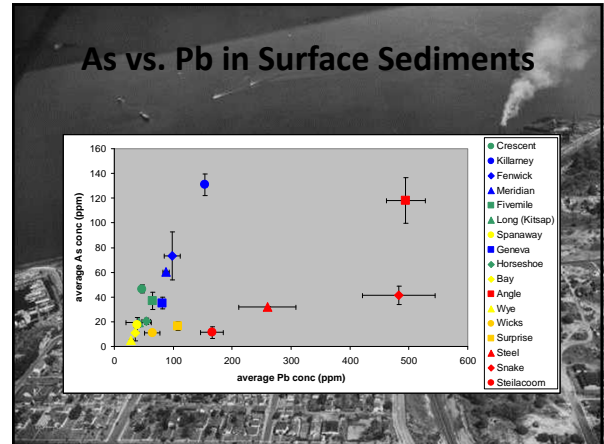
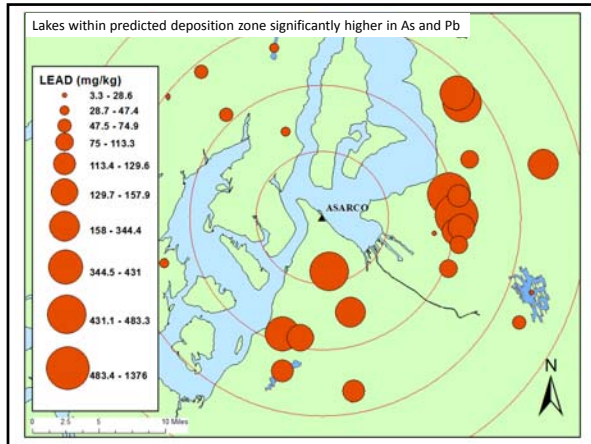
- 1890 Lead smelting begins
- 1905 Conversion to copper smelter
- 1912 Arsenic recovery begun in Tacoma
- 1917 Tall stack constructed (700 ft asl) + electrostatic precipitators
- 1970 Meteorological Curtailment Program
- 1986 AB smelting operations cease

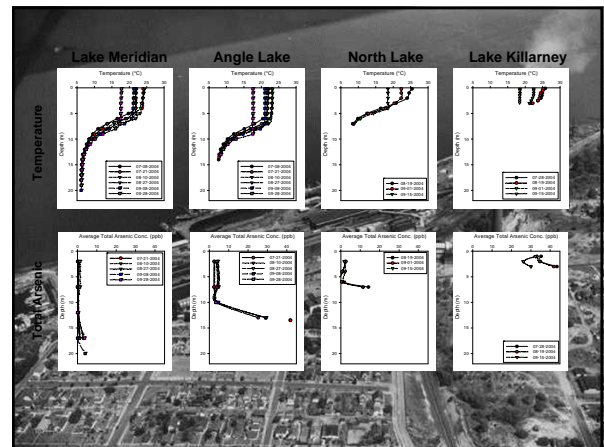
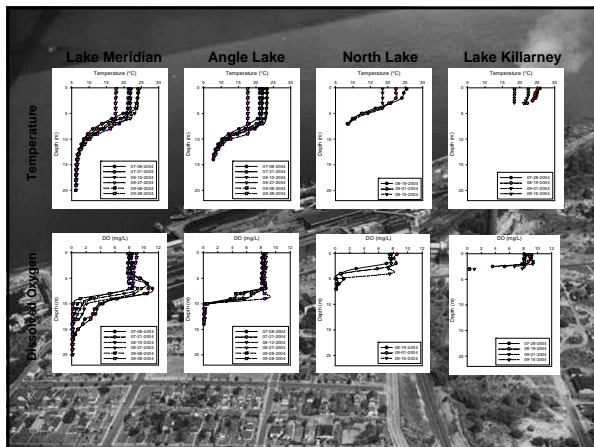
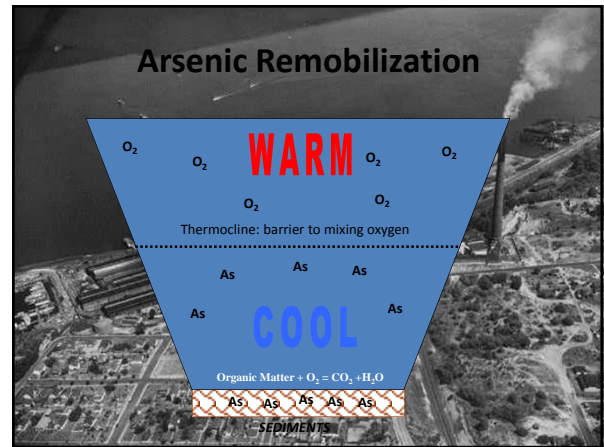
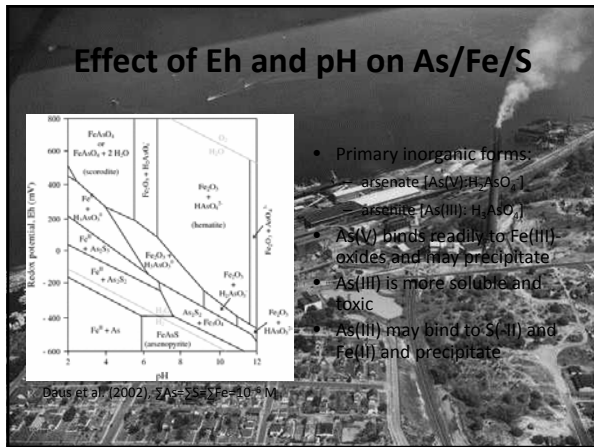
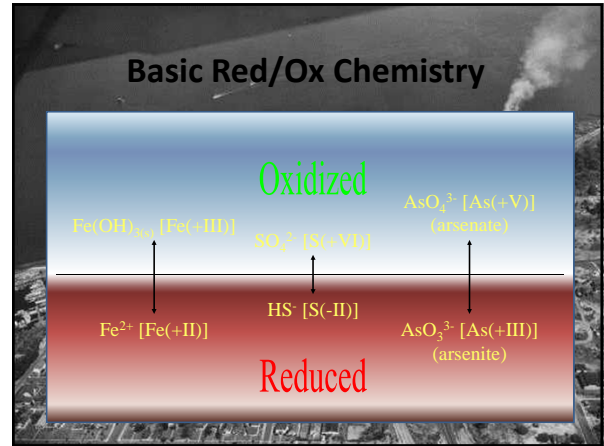
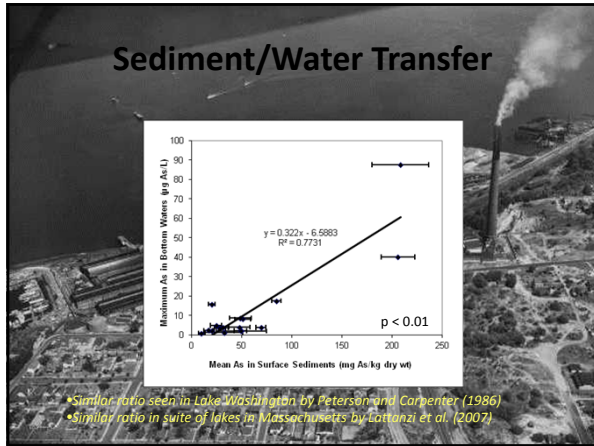
Ongoing Study Breakdown

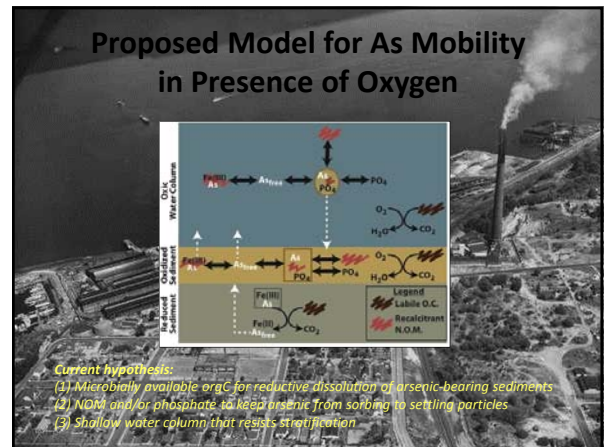
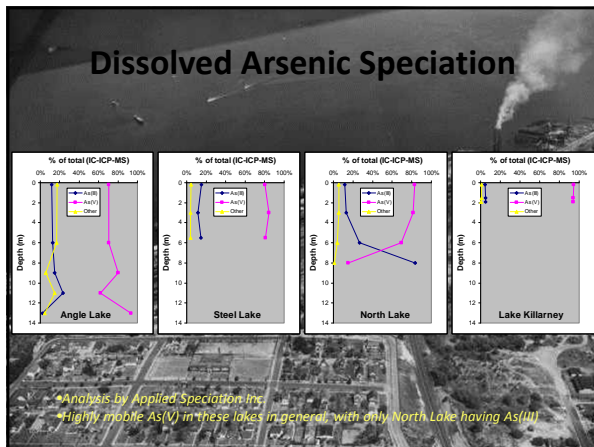
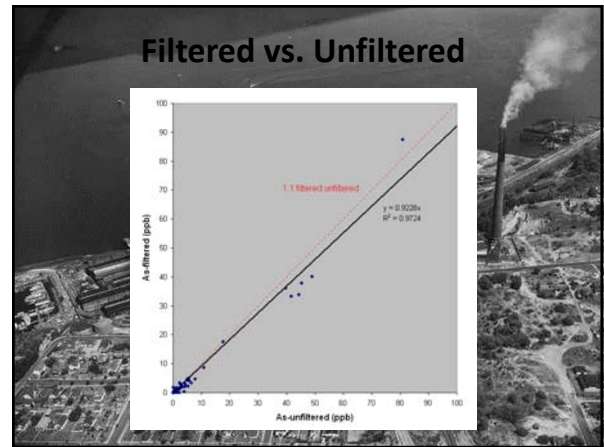
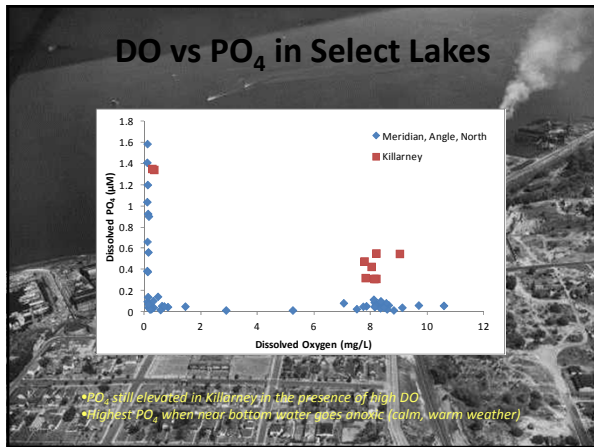
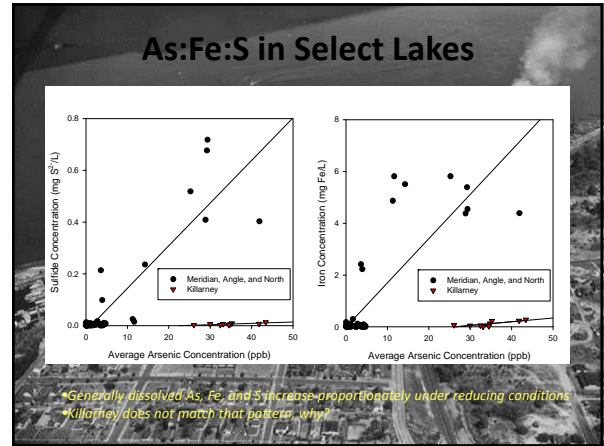
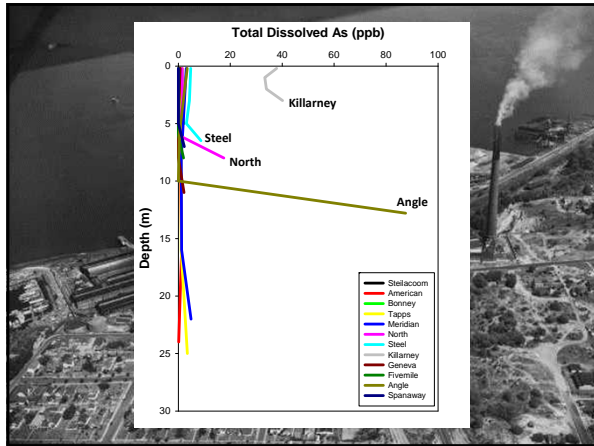
- Spatial distribution of As and Pb in lake sediments
- Temporal distribution in sediments
- Arsenic mobility and release to water column

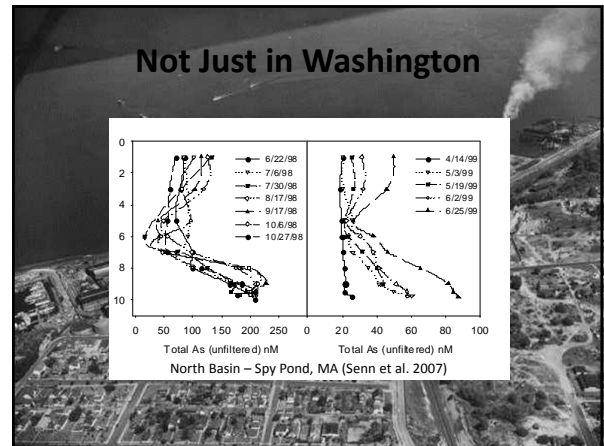
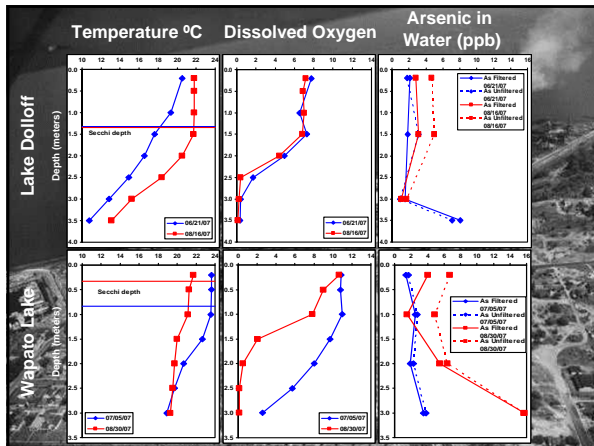
Chemical, biological, and physical controls on As mobility, bioavailability and toxicity



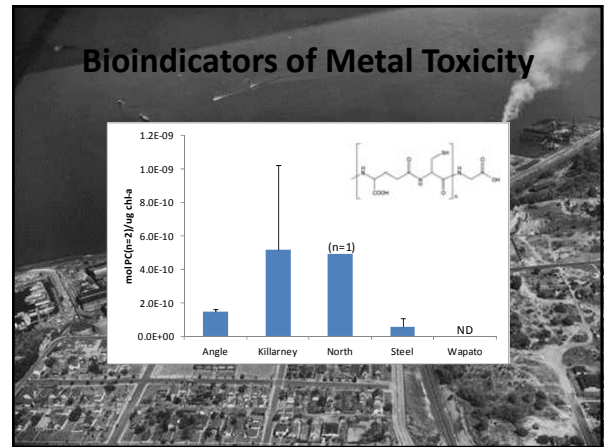






Questions to Address in Research

- What is the mix of water quality parameters to measure to predict As mobility in urban lakes?
- Does the presence of high levels of dissolved As in surface waters increase biotic uptake by phytoplankton, zooplankton, and fish?
- Would fish bioaccumulation become an issue under these conditions?
- How might this be important to freshwater sediment criteria development?



Acknowledgements

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Links page

- Dr. Jim Gawel (jimgawel@uw.edu)
- Environmental Sciences and Studies at University of Washington Tacoma:
<http://www.uw.edu/taacoma/academic/library-arts-sciences/courses/environmental-studies>
- University of Washington Superfund Research Program:
<http://shrs.washington.edu/sfund/>
- US EPA Region 10:
<http://www.epa.gov/aboutepa/region10.html>
- Dr. Bruce Duncan, Regional Science Liaison, US EPA Region 10
(duncan.bruce@epa.gov)
- Superfund Research Program- National Institute of Environmental Health Sciences(NIEHS)
<http://www.niehs.nih.gov/research/supported/srp/>

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