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Salish Sea Ecosystem Conference

2014 Salish Sea Ecosystem Conference
(Seattle, Wash.)

May 1st, 1:30 PM - 3:00 PM

The Lake Washington PCB/PBDE Study: Development and testing of a PCB fate model

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DeGasperi, Curtis and Pelletier, G. J., "The Lake Washington PCB/PBDE Study: Development and testing of a PCB fate model" (2014). *Salish Sea Ecosystem Conference*. 181.
<https://cedar.wwu.edu/ssec/2014ssec/Day2/181>

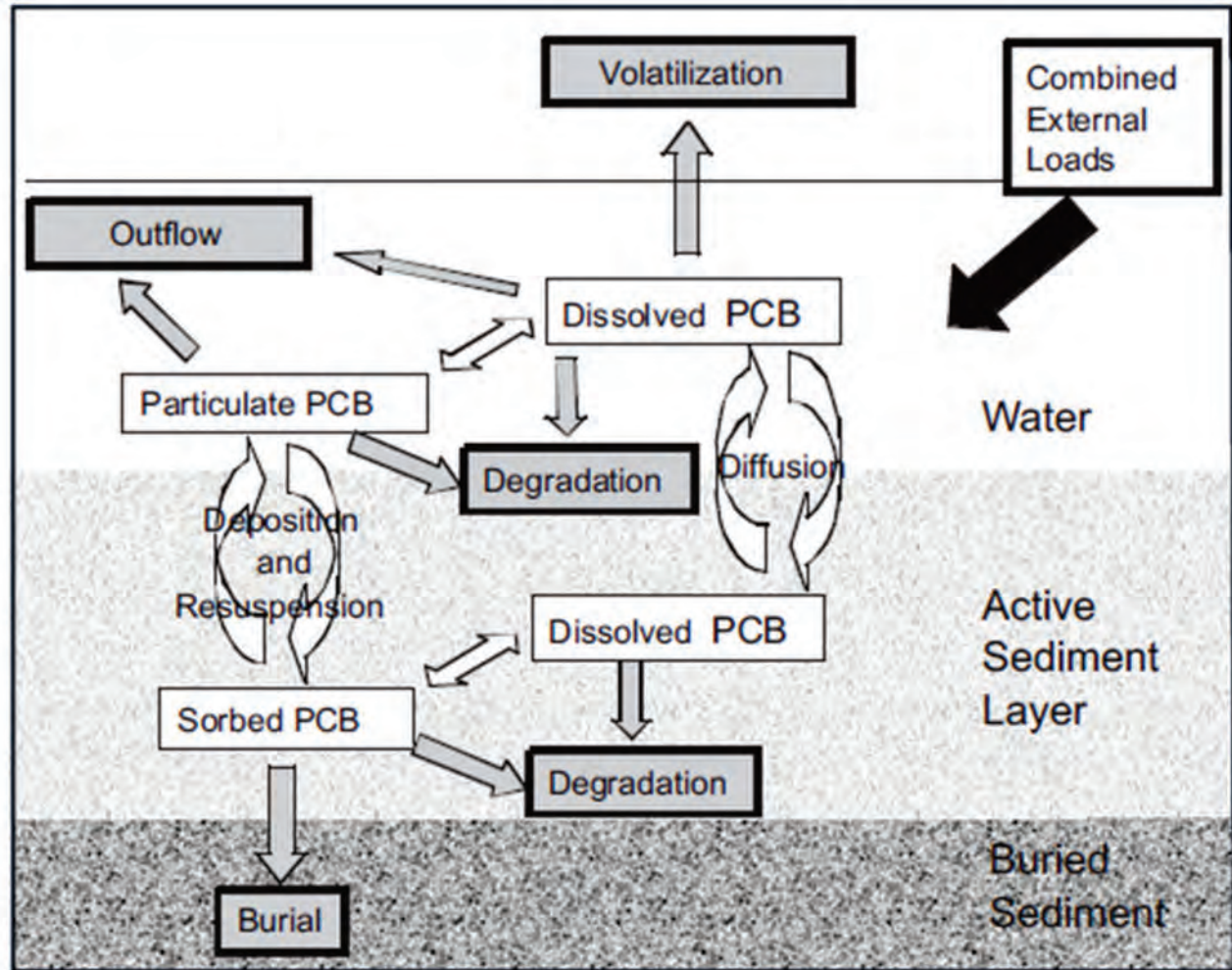
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Lake Washington PCB/PBDE Study Development and testing of a PCB fate model

Curtis DeGasperi and Greg Pelletier
King County Water and Land Resources Division
and Washington Department of Ecology

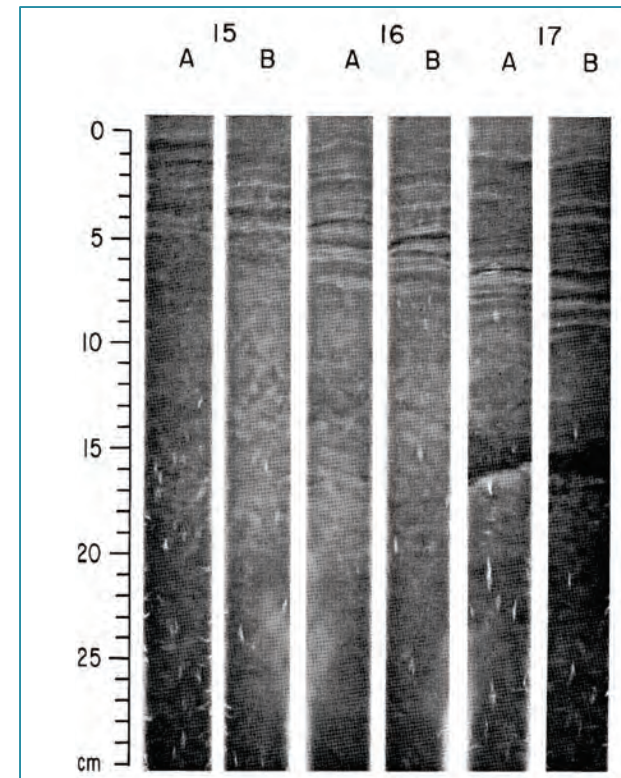
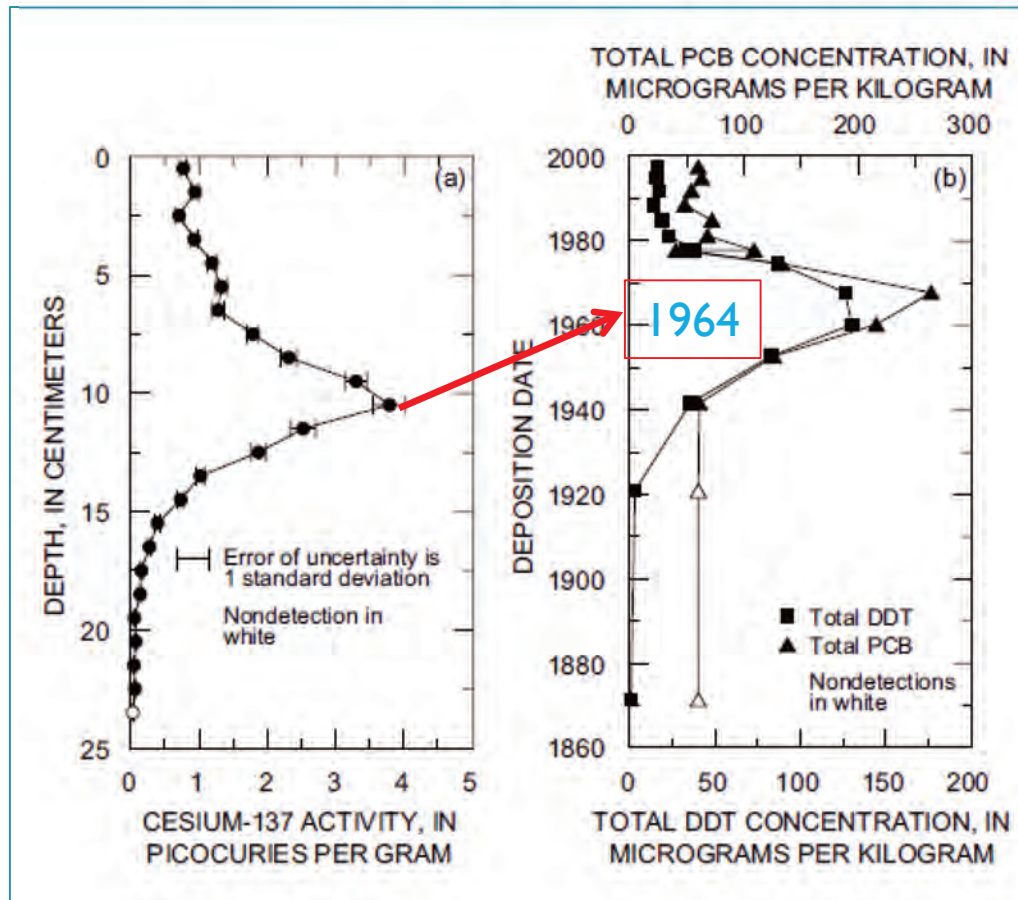
2014 Salish Sea Ecosystem Conference
May 1, 2014

Fate Model Conceptual Diagram



Source: Davis (2004)

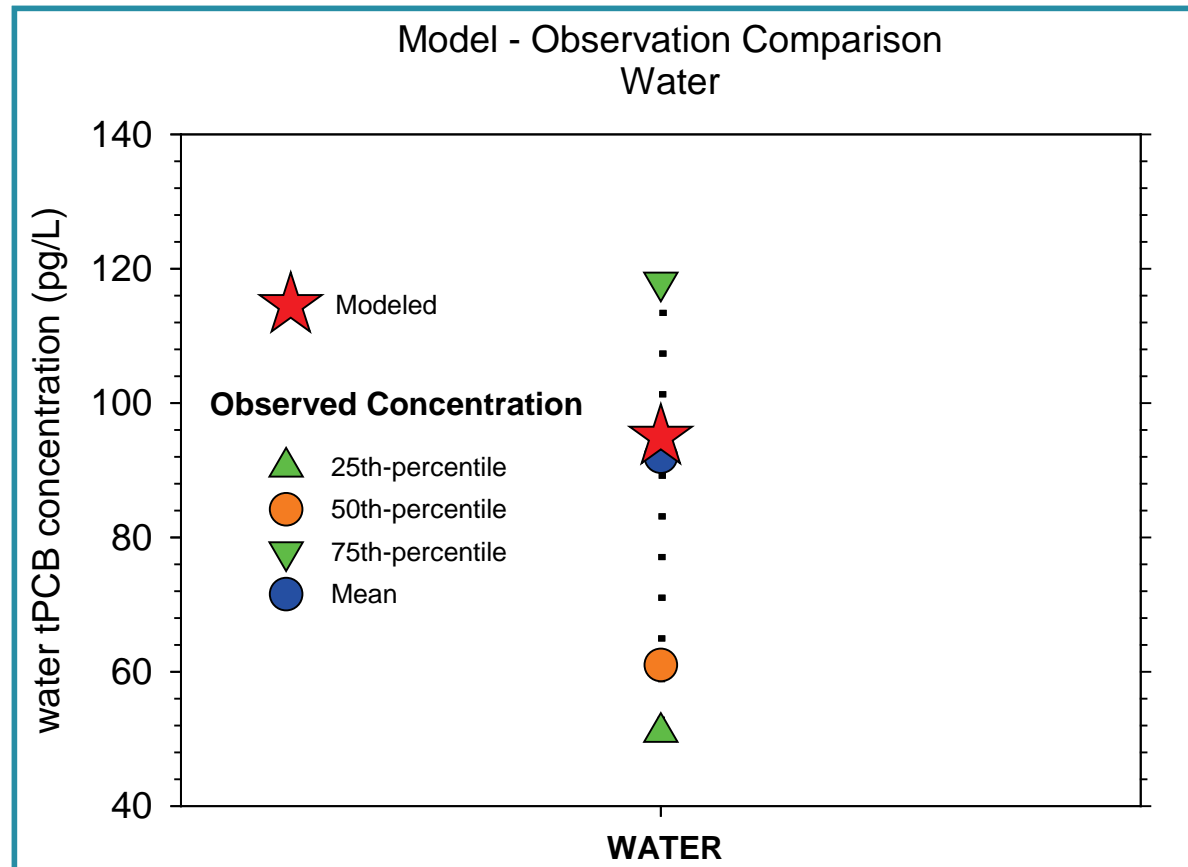
Active Sediment Layer



Fate Model Hindcast

Hindcast Model Performance
(tPCB loading = 672 g/yr)

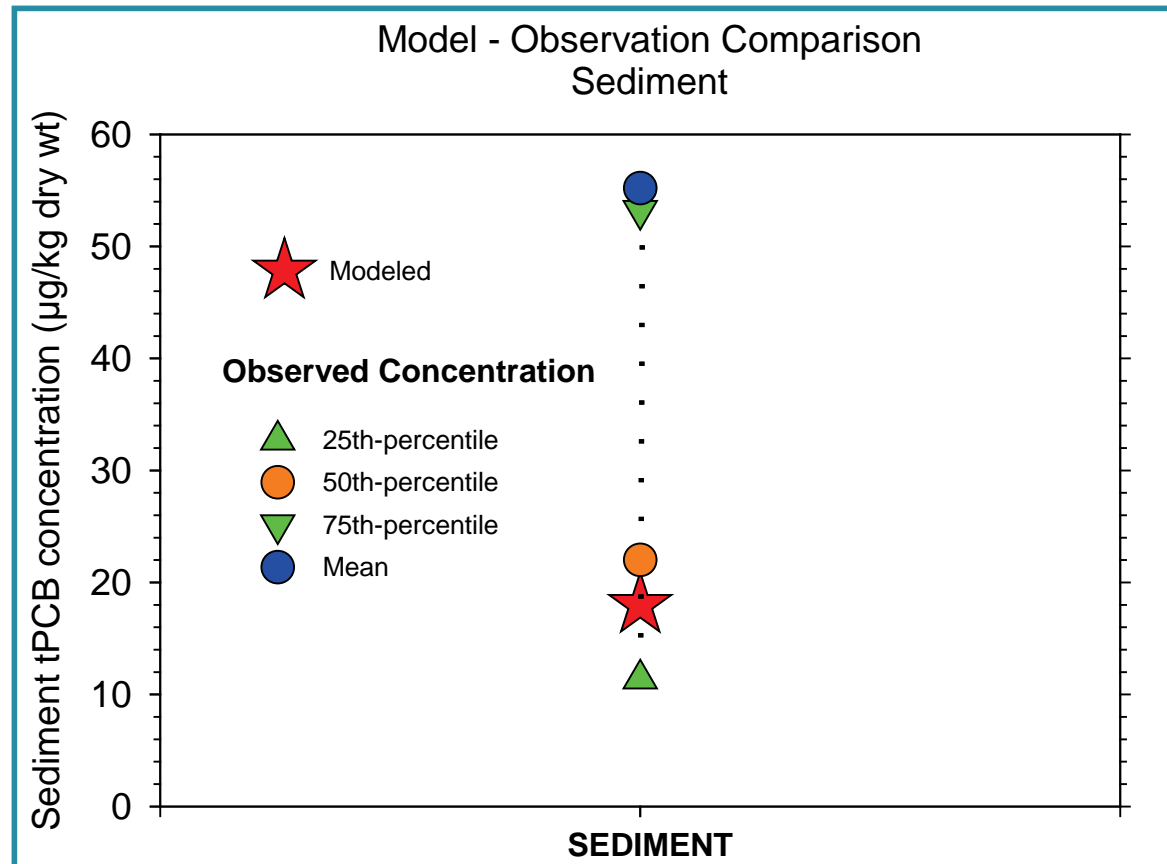
Concentration in Lake Water



Fate Model Hindcast

Hindcast Model Performance
(tPCB loading = 672 g/yr)

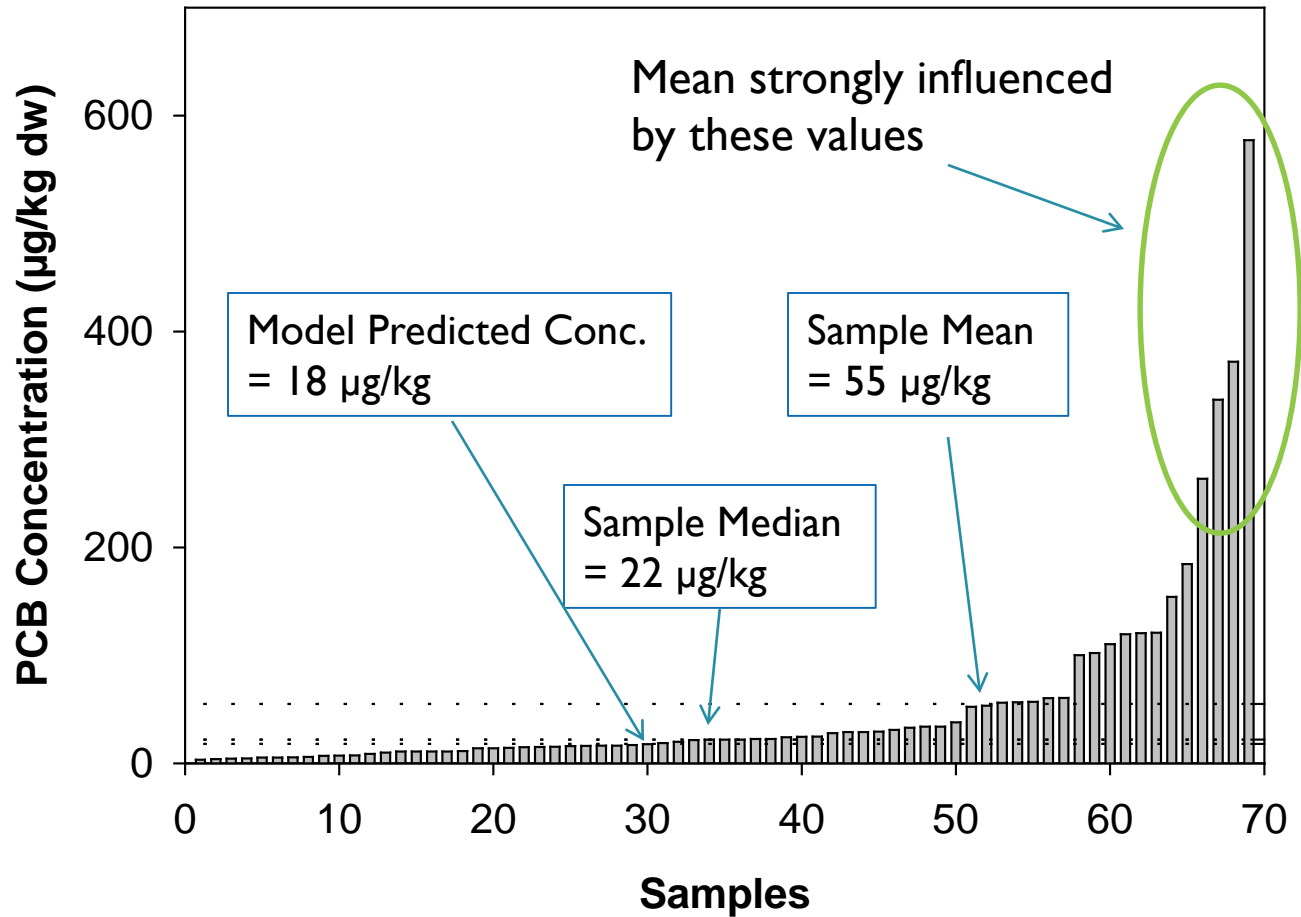
Concentration in Lake Sediment



Fate Model Hindcast

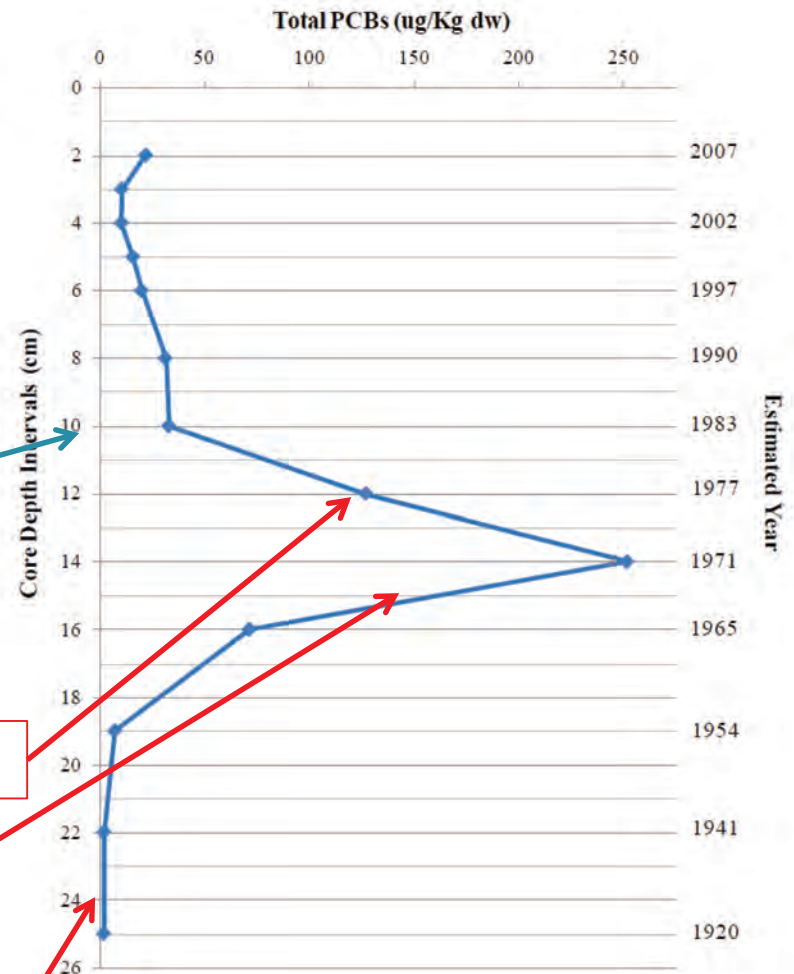
Hindcast Model Performance
(tPCB loading = 672 g/yr)

PCB Concentration in Lake Sediment



Historical Sediment Concentrations

- Most 0-10 cm, some 0-2 cm sample depth
- Mean = 55 ug/kg dry weight
- 2008 core shows rapid increase around 10 cm



Production and use of PCBs restricted by EPA (1977)

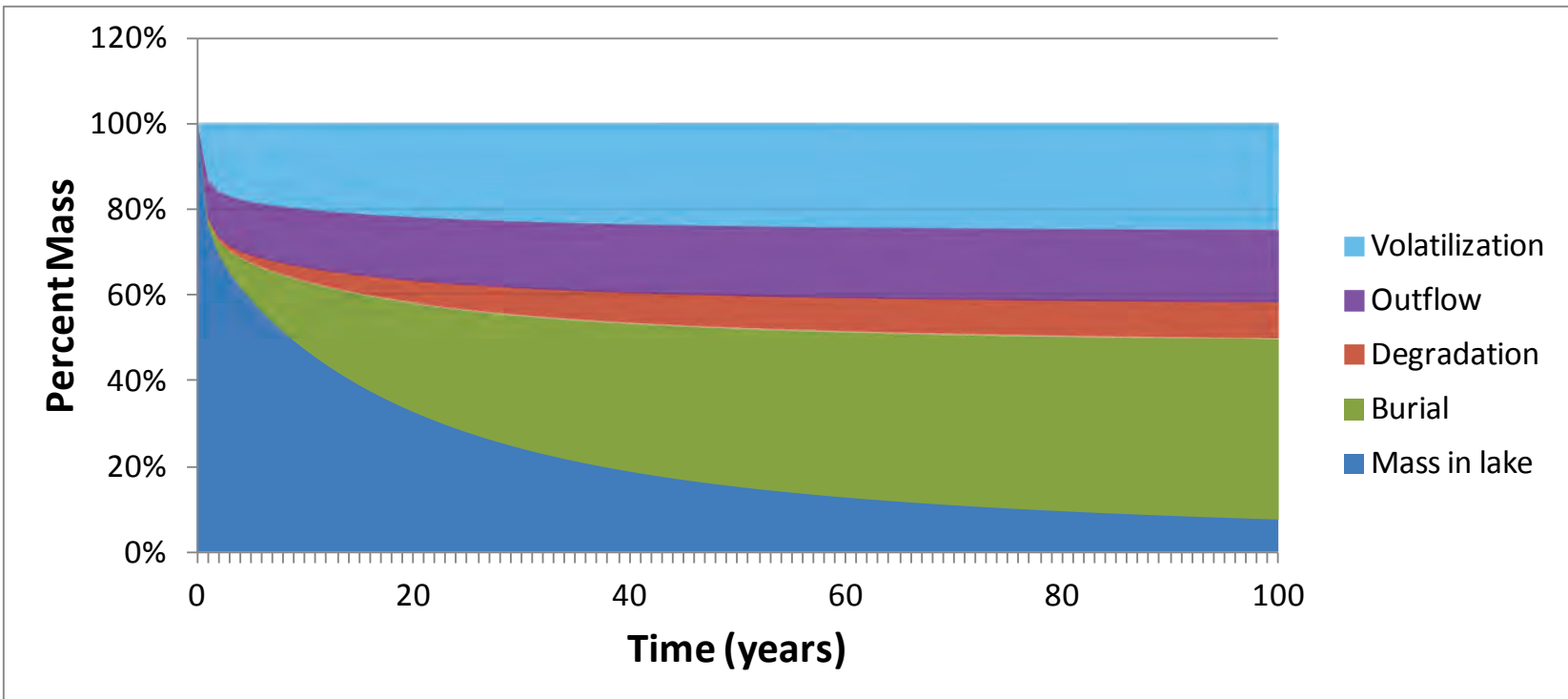
Diversion of Secondary Wastewater Discharges

Commercial Production of PCBs begins in US (1929)

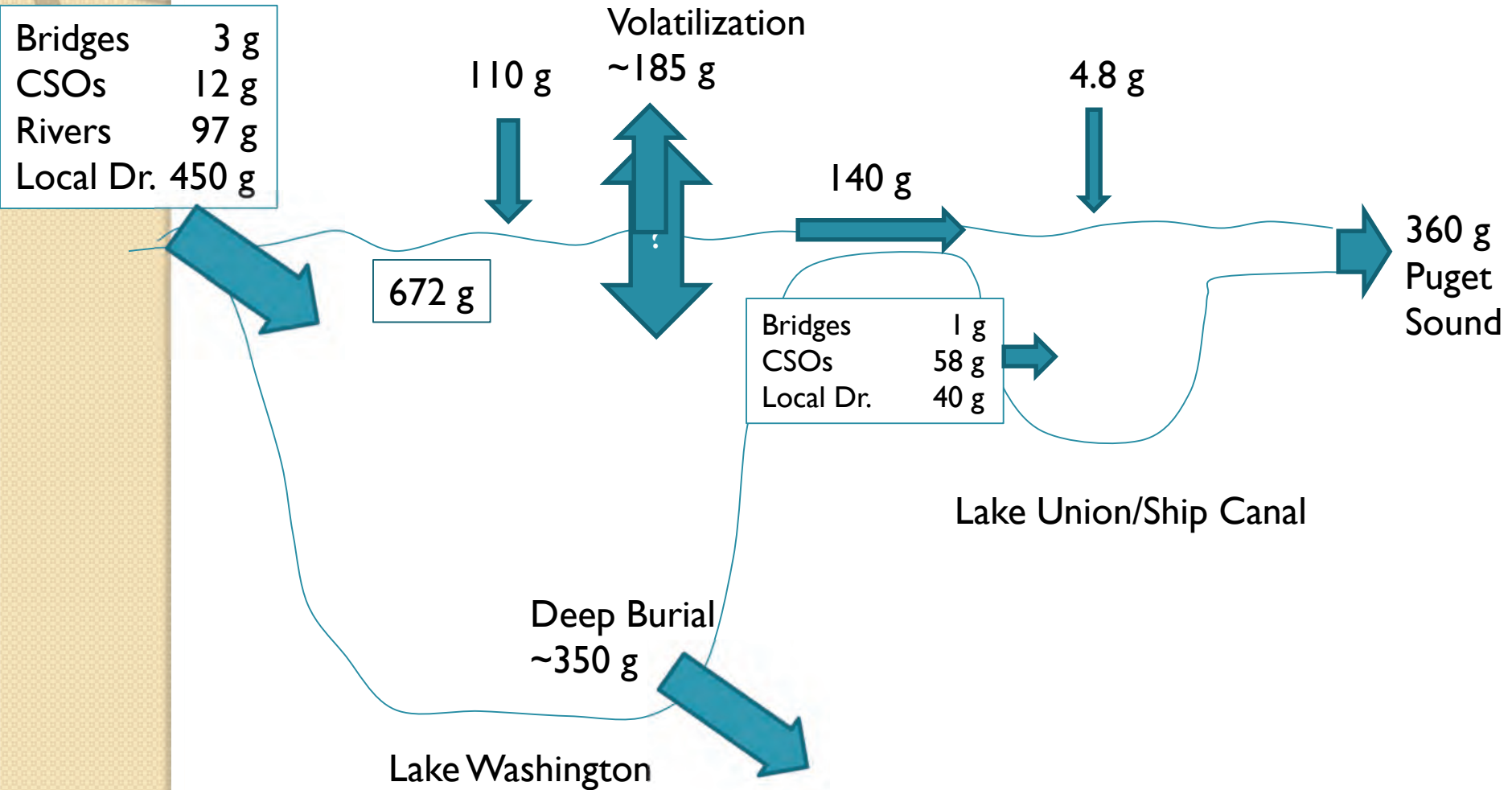
Fate Model Hindcast

Hindcast Model Performance
(tPCB loading = 672 g/yr)

Fate Pathways



PCB Loading Summary



Fate Model Sensitivity Analysis

- Sensitivity Analysis
 - Overall, model most sensitive to octanol-water partition coefficient (K_{ow})
 - Water column concentration/mass most sensitive to PCB loading rate
 - Water column concentrations also sensitive to a number of other variables – e.g., concentration of solids in water and sediment

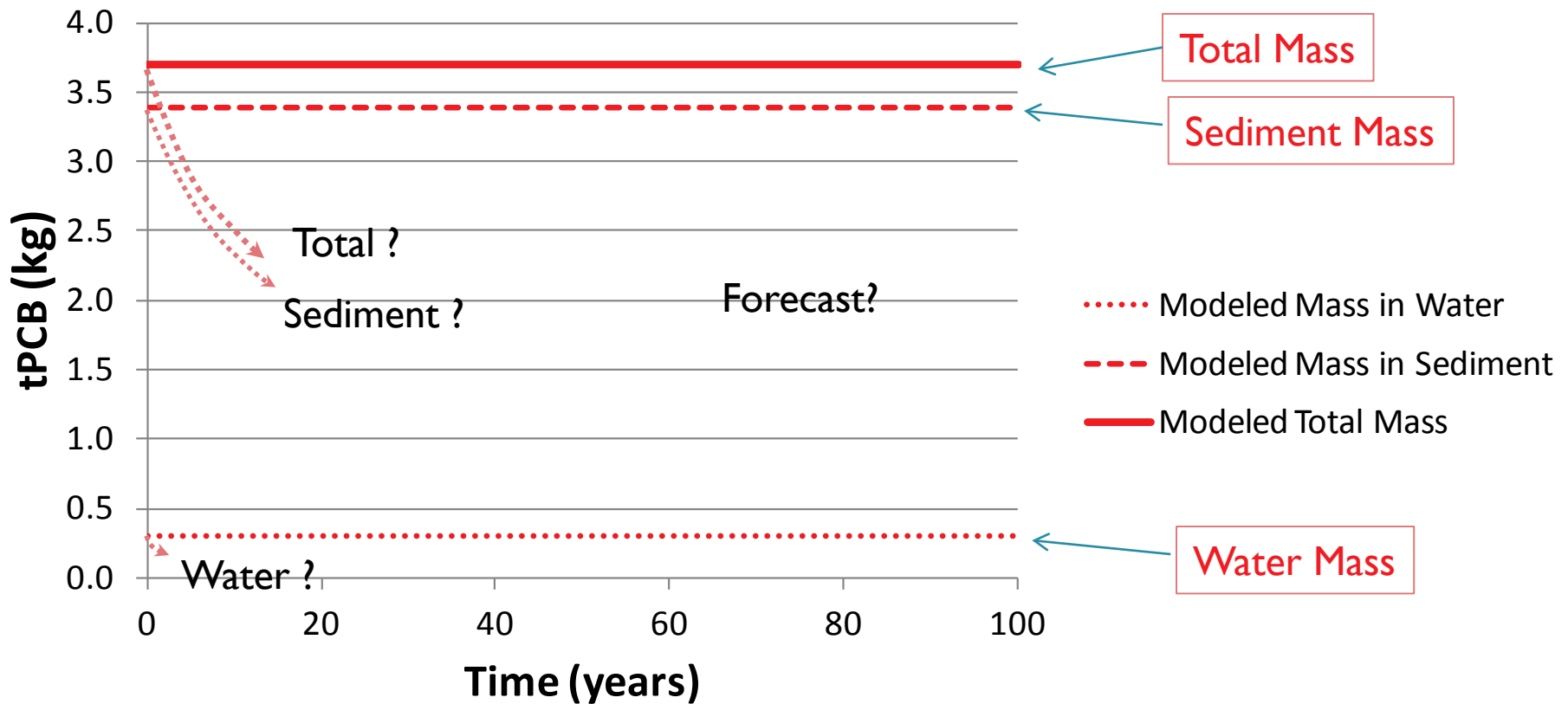
Fate Model Uncertainty Analysis

- Uncertainty Analysis
 - Low and high $\log_{10}(K_{ow})$ – 6.01 and 6.86 (PCB-66 and PCB-153)
 - Low and high tPCB loading rate – 0.333 and 0.889 kg yr⁻¹
 - Model relatively more sensitive to tPCB loading uncertainty

Fate Model Forecast

Forecast Model Performance
(tPCB loading reduction
From 672 g/yr to ????)

tPCB mass in lake into future?



QUESTIONS?

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Cedar River - Lake Washington

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Cedar River - Lake Washington Watershed

Toxics loadings

May Creek

Public access

Unusually Earthquake, Cedar River Landslide

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Site map

To offer a suggestion or report an error on the Water and Land Resources' Web site, please contact [Ed Banler](mailto:Ed.Banler@washnet.edu), washmaster.

Estimating toxics loadings to the Lake Washington Watershed

Project location: Lake Washington Watershed, King County, Washington
Project period: September 2010 through March, 2014
U.S. EPA grant amount: \$698,646

Problem
Fish containing polychlorinated biphenyls (PCBs) can pose a health risk to people who consume them. Lake Washington, the largest freshwater lake in King County, Washington, has fish with some of the highest concentrations of polychlorinated biphenyls (PCBs) measured across the state. PCBs were historically used in commercial products and industry but their manufacture was banned in 1977. No one knows exactly where PCBs in Lake Washington fishes originate. This project is intended to help answer the following questions:



- What input pathways contribute PCBs to Lake Washington?
- Do ongoing sources of PCBs entering the lake need to be reduced?
- Are fish accumulating PCBs just from historical pollution present in lake sediments?
- To what extent do PCBs exit the Ship Canal and contaminate Puget Sound?

Please refer to the [EPA's PCB website](#) (external link) for background information on PCBs.

Project objectives
This project will develop quantitative tools to inform water quality managers of the major PCB and polybrominated diphenyl ether (PBDE) pathways to the Lake Washington watershed and Elliott Bay. Pathways that will be evaluated include combined sewer overflows (CSOs), stormwater discharges, road runoff, river input, and air deposition.

NOTE: Because brominated flame-retardants behave similarly to PCBs and may cause health effects, this project collects field data on PBDEs to investigate if they may also pose a risk to people consuming Lake Washington fish.

Project components
Field study: The field study will collect data needed to estimate PCB and PBDE loadings (total mass per year) entering Lake Washington and Elliott Bay (via the Ship Canal). These data include total organic carbon, PCB and PBDE congener concentrations and associated flow rates for each pathway (tributaries, atmospheric deposition, stormwater runoff, CSO discharge, and road runoff). These data will be collected over a year.
Model development: Historical and new data will be used to estimate the loadings for each pathway and the total for Lake Washington and Elliott Bay. Also, a fate and transport model and a bioaccumulation model will be developed to allow simulation or testing of Lake Washington fish tissue response to different PCB reduction scenarios. This latter step will not be conducted for PBDE's because too little data are available for



Related information

- Lake Washington
- Environmental monitoring data
- Salmon and trout

Related agencies

- Dept. of Natural Resources and Parks
- Public Health, Seattle and King County
- Water and Land Resources Division

News and announcements

Sept 5, 2004
External article, Seattle Times
Industrial past takes toll on Lake Washington

Sept 1, 2004
External article, Seattle Times
High level of PCBs taints Lake Washington fish

Fish consumption advisories:

- In 2003, the Washington Department of Health (WDOH) issued a fish consumption advisory (external link) for polychlorinated biphenyls (PCBs) in Lake Washington which includes yellow perch, cutthroat trout, carp, and northern pike minnow. Fish consumption advisories also exist across Puget Sound for multiple fish species due to health risks from PCBs and mercury (external link). Limited consumption of yellow perch and cutthroat trout (common recreational species) is advised in Lake Washington, and WDOH

Search: lake washington pcb study

<http://www.kingcounty.gov/environment/watersheds/cedar-river-lake-wa/pcb-pbde-loadings.aspx>