

# Environmental Concerns and Key Issues for PCBs

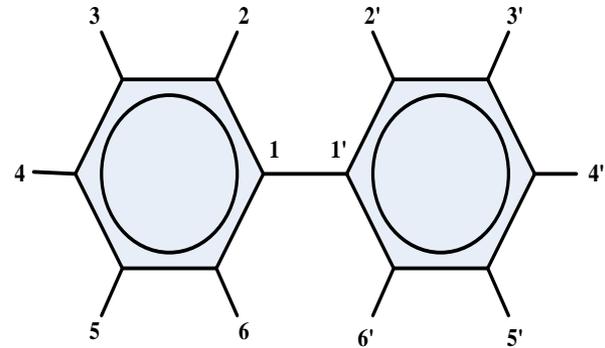
Holly Davies

PCB CAP Advisory Committee

Dec. 16, 2013

# What are PCBs?

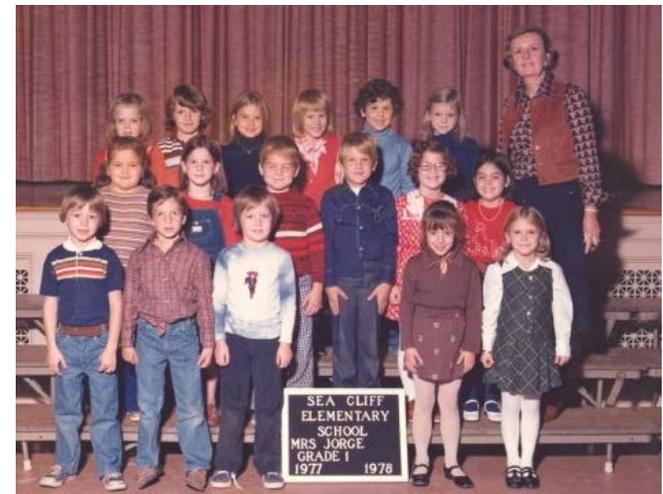
- 209 organic compounds
- Two benzene rings
- 1-10 chlorines
- Lipophilic
- Mixtures



- Non-essential for plants, animals, or humans

# Major Regulations

- Federal
  - Toxics Control Substances Act (TSCA)
  - Clean Water Act (CWA)
  - Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)
- State
  - Dangerous waste
  - Model Toxics Control Act (MTCA)
- Other
  - Stockholm Convention



# Wildlife toxic effects

- Mortality
  - Reproduction
  - Development
  - Cancer
  - Immunological
  - Neurological/behavioral
  - Hepatic effects
- 
- Acute and chronic
  - Aryl hydrocarbon (Ah) receptor mediated
    - TEFs for dioxin-like PCBs
  - Endocrine disruption



# Environmental Concentrations

- Ubiquitous in environment
- Mixture of congeners
- Sediment and biota
  - Water 10-100 pg/L
  - Sediment 1-100 ug/kg (dw)
  - Fish 1-1,000 ug/kg
- Mixed time trends

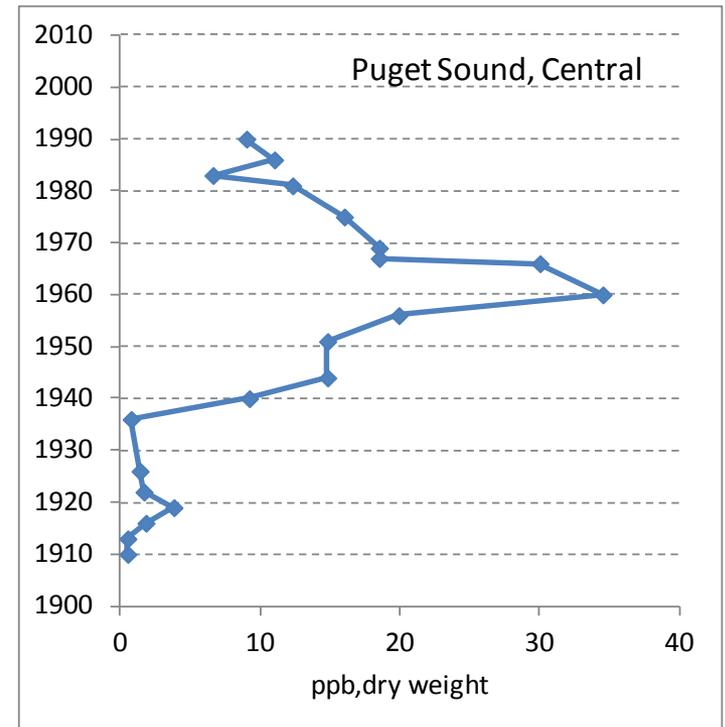


Figure 13: Total PCBs in Age-Dated Sediment Cores from Puget Sound

# Puget Sound fish

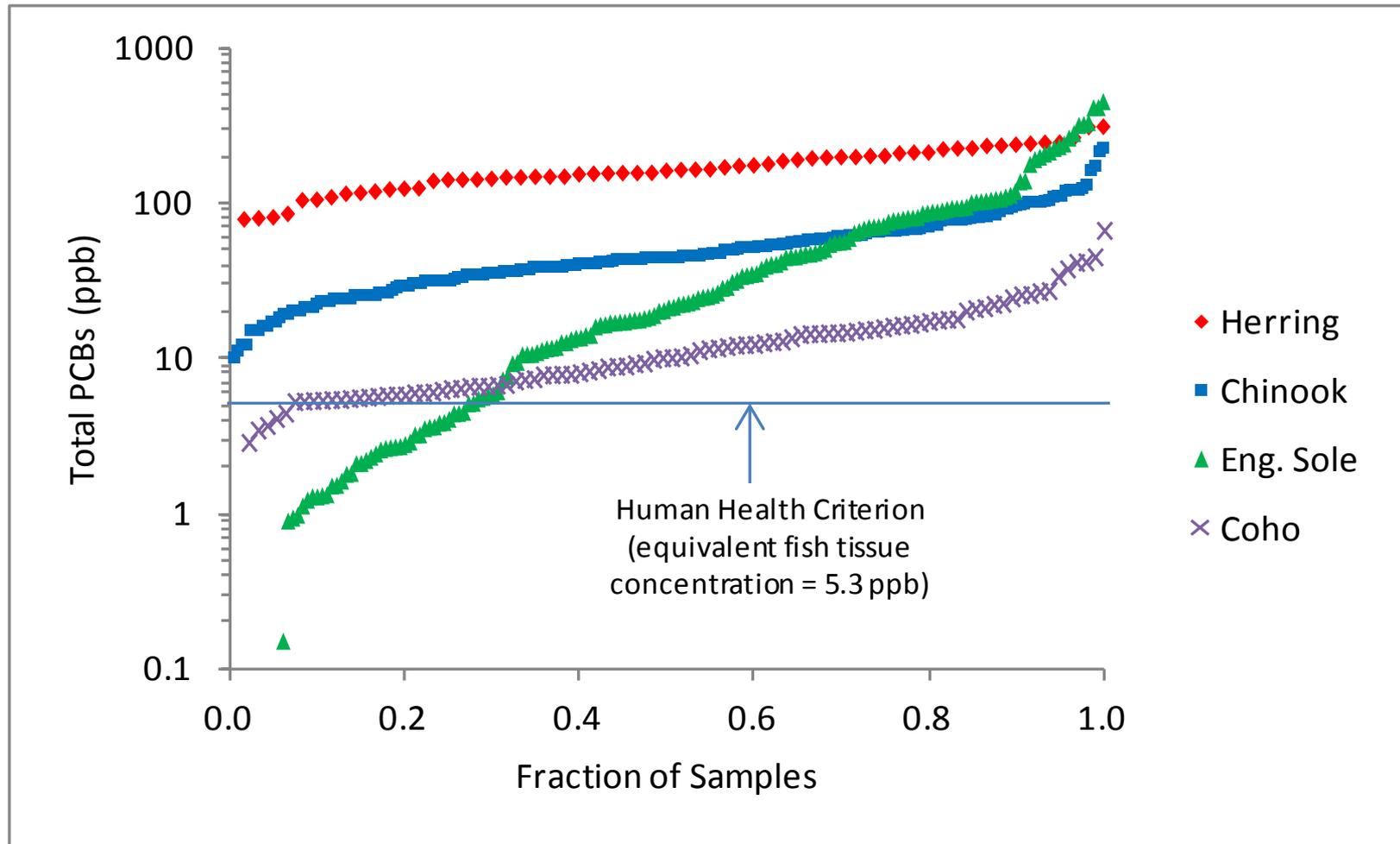


Figure 19: PCBs in Edible Tissues of Four Species of Puget Sound Fish (1992-2010 data provided by James West, WDFW; N =60 – 210)

# Pacific Herring

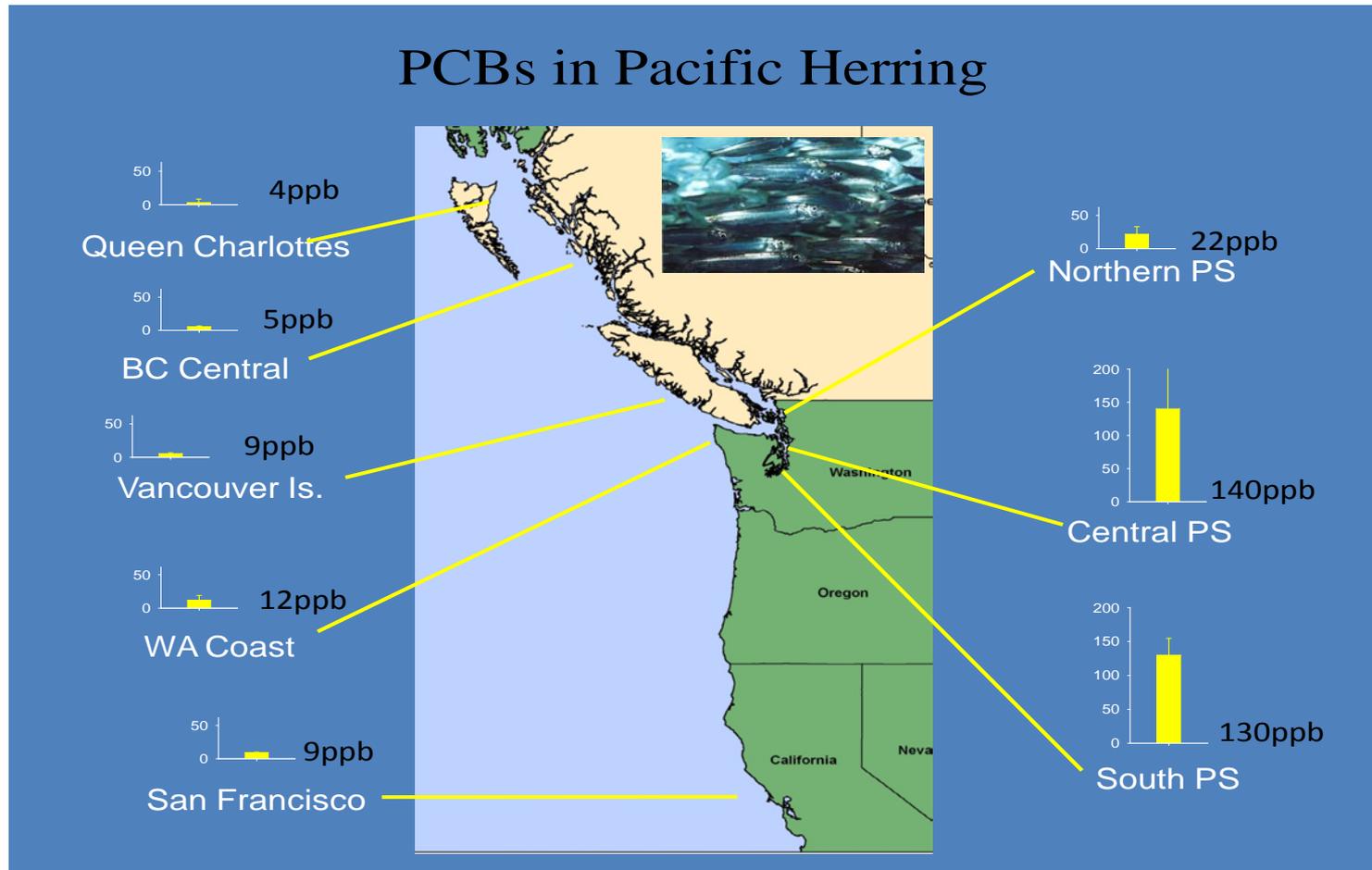


Figure 20: PCB Spatial Patterns in Herring: British Columbia, Washington, and California (prepared by James West, WDFW, and Sandie O'Neill, NOAA-NWFSC)

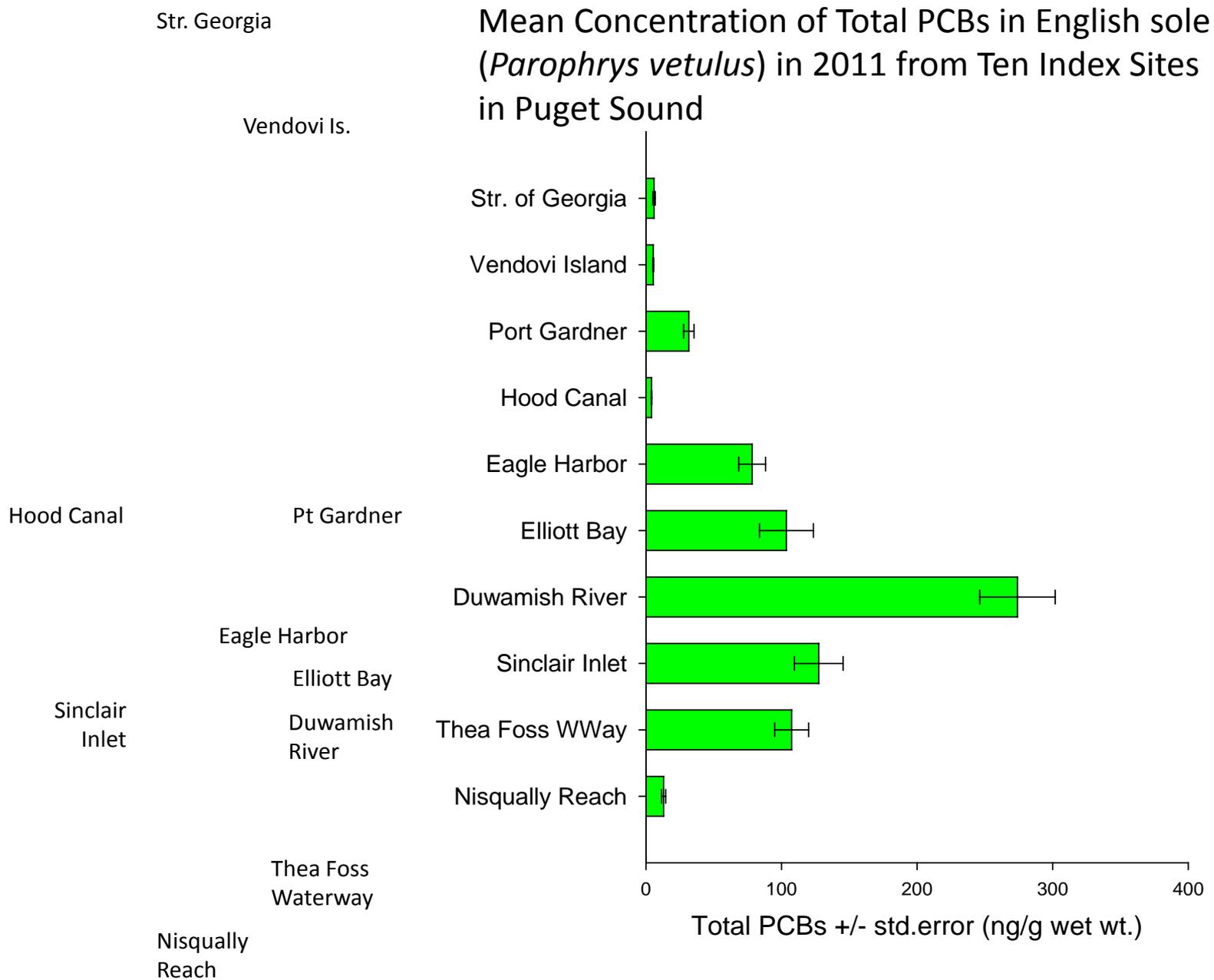


Figure 21: PCB Spatial Patterns in English Sole Muscle: Puget Sound and Vicinity (prepared by James West, WDFW; parts per billion).

# Statewide Fish

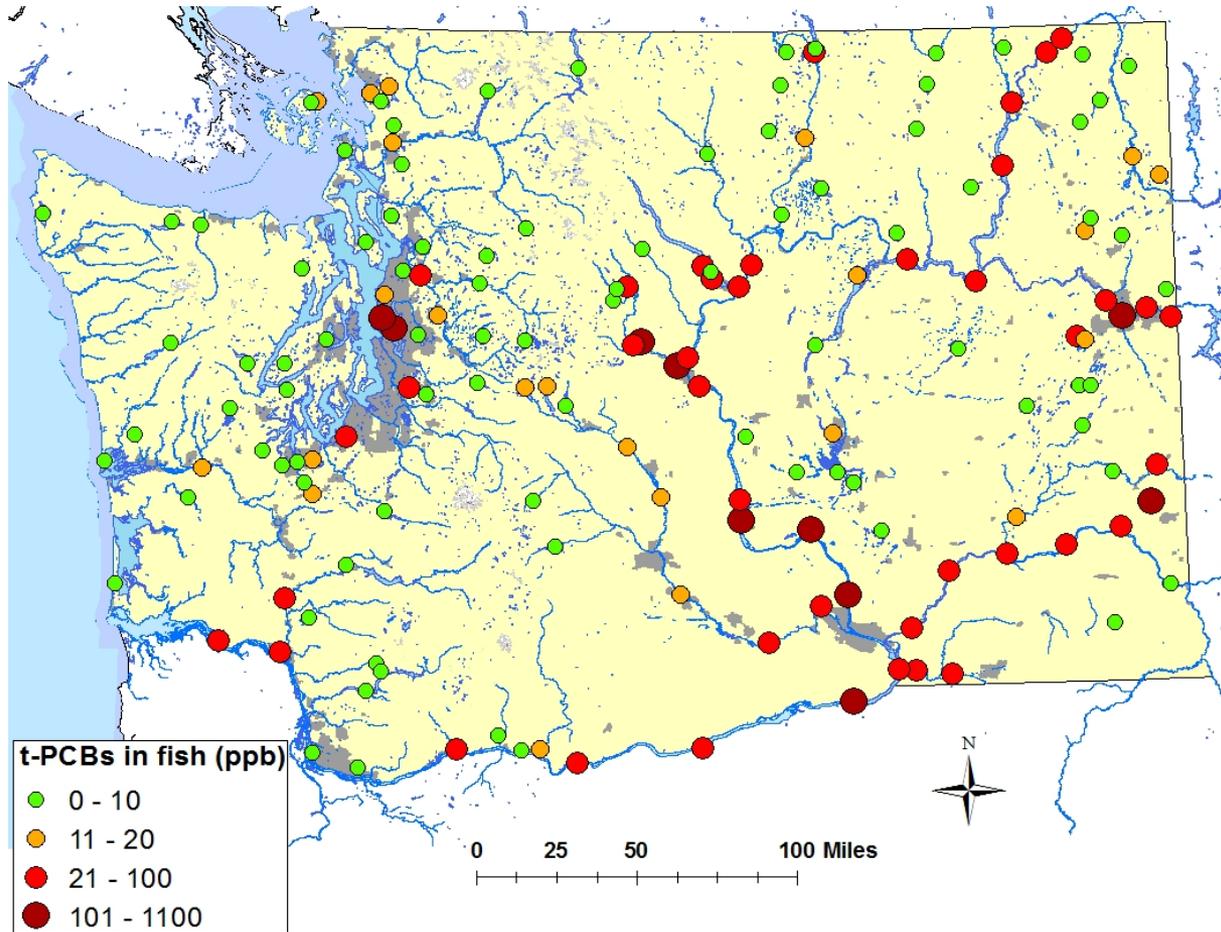
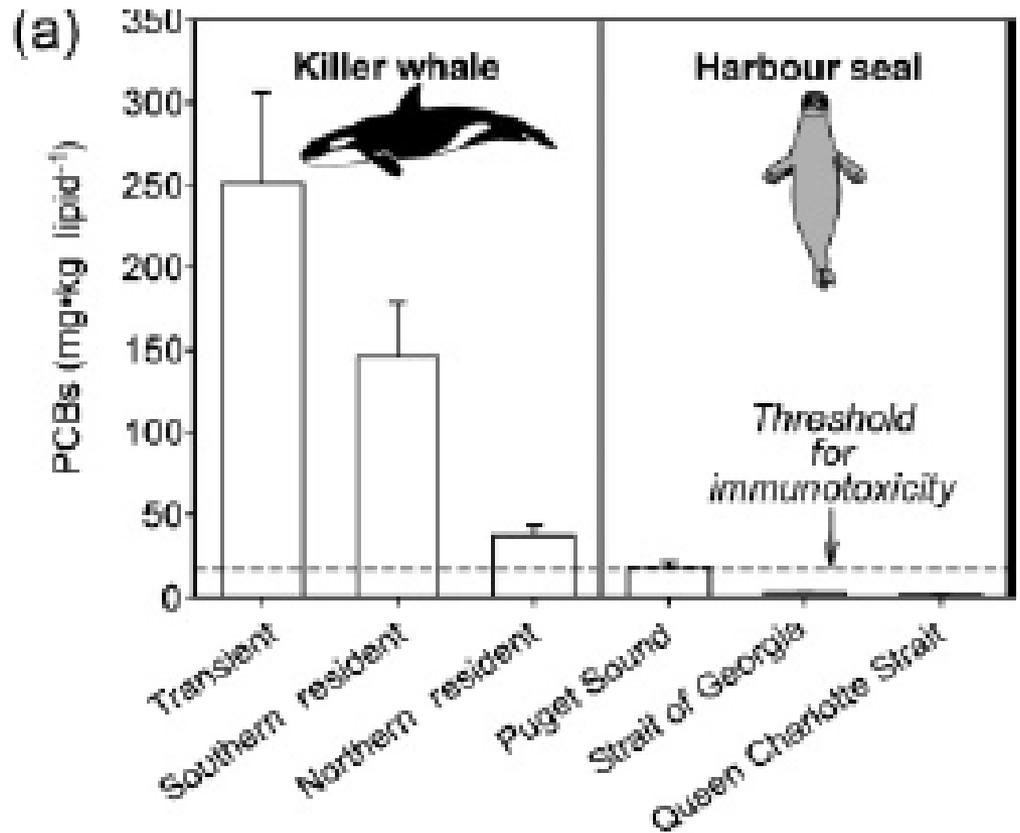


Figure 22: Average PCB Concentrations in Fish Muscle Samples from Washington Rivers and Lakes (prepared by Keith Seiders, Ecology Environmental Assessment Program; 1997-2010 data, N = 587).

# Mammals

- Fish eating
- Puget Sound resident killer whales



# Where do PCBs come from?

## Legacy uses

**Table 11: Industrial Uses of PCBs (1929-1975) from EPA 1997**

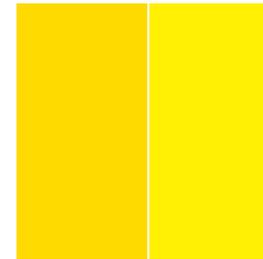
	<b>PCB Use</b>	<b>Pounds (millions)</b>	<b>Percentage of Total</b>
Closed	Capacitors	630	50.3%
	Transformers	335	26.7%
Partially closed	Hydraulics and lubricants	80	6.4%
Open	Plasticizer uses	115	9.2%
	Carbonless copy paper	45	3.6%
	Heat transfer fluids	20	1.6%
	Petroleum additives	1	0.1%
	Miscellaneous industrial uses	27	2.2%
	<b>TOTALS</b>	<b>1,253</b>	<b>100.0%</b>

# Where do PCBs come from?

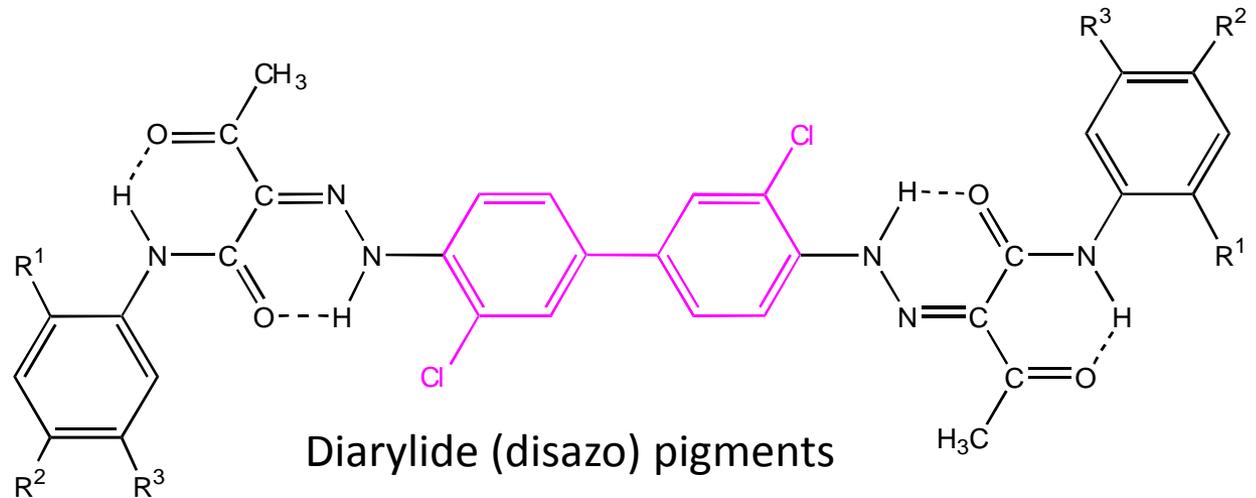
## Current

- Inadvertent generation

- Pigments and dyes
- Titanium dioxide
- Other



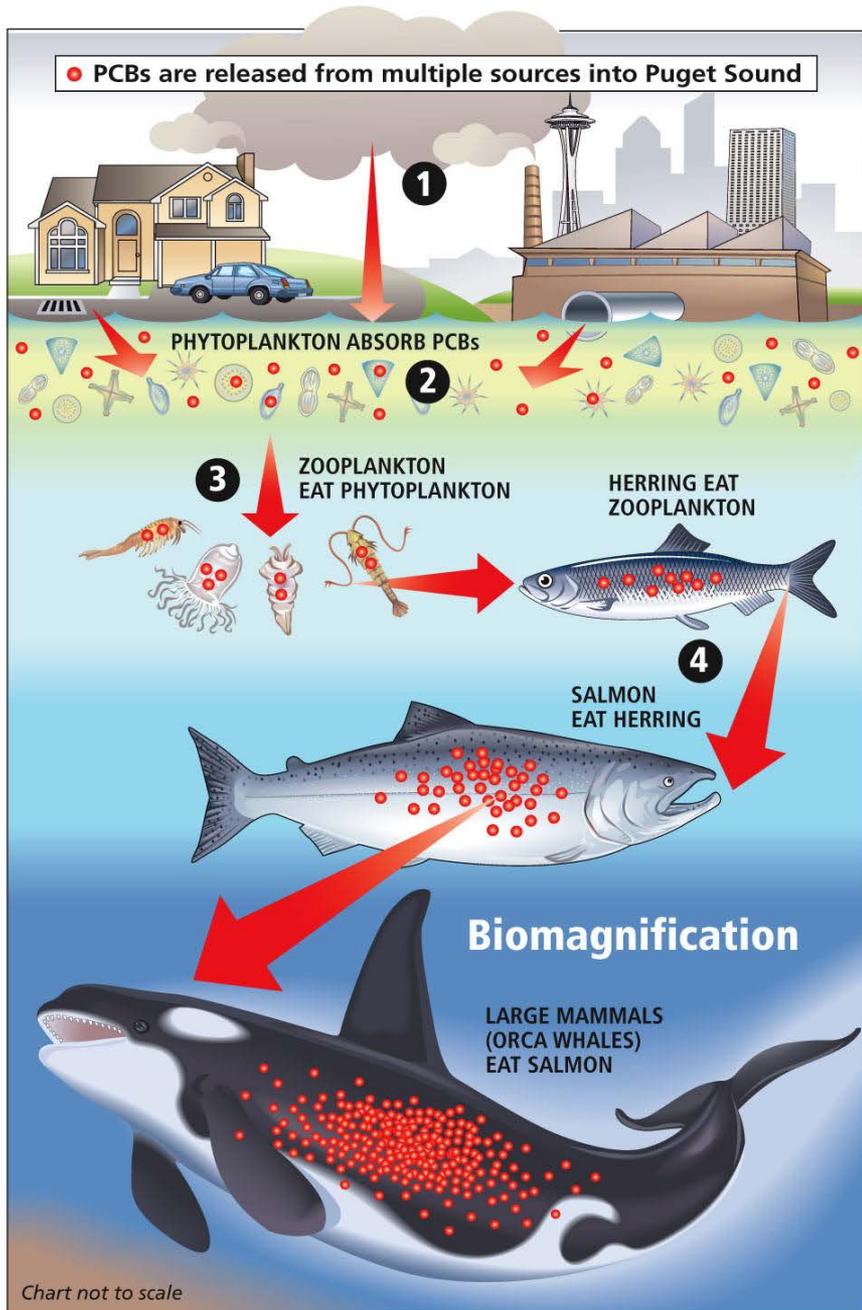
- Combustion



# Washington statewide sources

**Table 16: Summary of Uses and Releases for Washington State**

Source		reservoir (metric tons)	annual releases (kg/yr)
<b>Closed Uses</b>	transformers	86-580	30-300
	large capacitors	310	1100-1700
	small capacitors	1-350	3-1,500
	other closed uses		unknown
<b>Partially closed uses</b>			unknown
<b>Open uses</b>	caulk	87	160
	other open uses		unknown
<b>Current generation</b>	pigments and dyes		0.02-31
	other inadvertent generation		900
	residential waste burning		199
	commercial marine vehicles		0.4



THE ZONE

# Pathways

- Air deposition
- Surface runoff/stormwater
- WWTP
- Industrial discharges

# Pathway estimates

- Puget Sound
  - Surface runoff (74-76%)
  - Atmospheric deposition (18-20%)
  - POTWs (4-8%)
- Spokane River
  - CSO/stormwater (19%)
  - Idaho (13%)
  - Treatment plants (8%)
  - Little Spokane River (3%)
  - Unknown (57%)

# Summary

- Anthropogenic group of chemicals
- Reservoir of legacy uses
- New generation
- Stormwater is a major pathway
- Sediment
- Fish and mammals are important receptors