PCBs in Puget Sound's Food Web

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PSAMP In a Nutshell

- An extensive network of regional scientists who monitor key indicators of ecosystem health.
- Formed in 1988 to assess status and trends of Puget Sound health.
- State funds, coordinated by the Puget Sound Partnership
- Science linked to Management

Puget Sound Partnership's *Dashboard of Indicators*

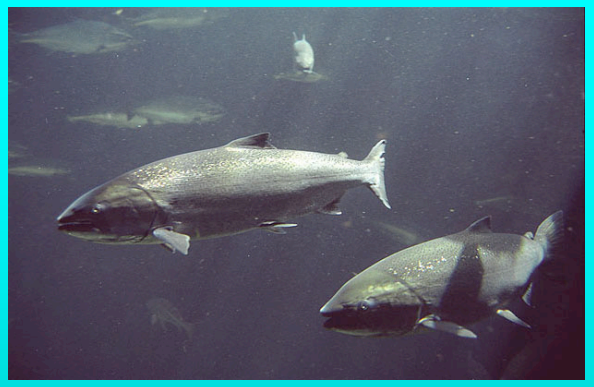
Status and trends in Puget Sound's *Vital Signs*

Source: http://www.psp.wa.gov/

This morning I will…

- Describe contaminant monitoring in Puget Sound
- Discuss factors that determine how fish accumulate PCBs
- Summarize extent of PCB contamination in PS fish
- Compare actual tissue levels with tissue standards

PSAMP monitors toxics in sentinel species:



Coho, chinook

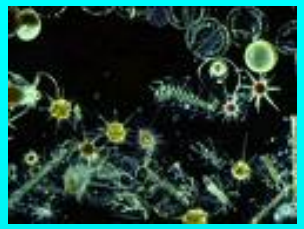
herring

3 spp of rockfish

English sole

PSAMP has also assessed:

- Plankton
- Mussels
- Pacific cod
- Lingcod
- Sixgill shark
- Herring eggs
- Dungeness crab

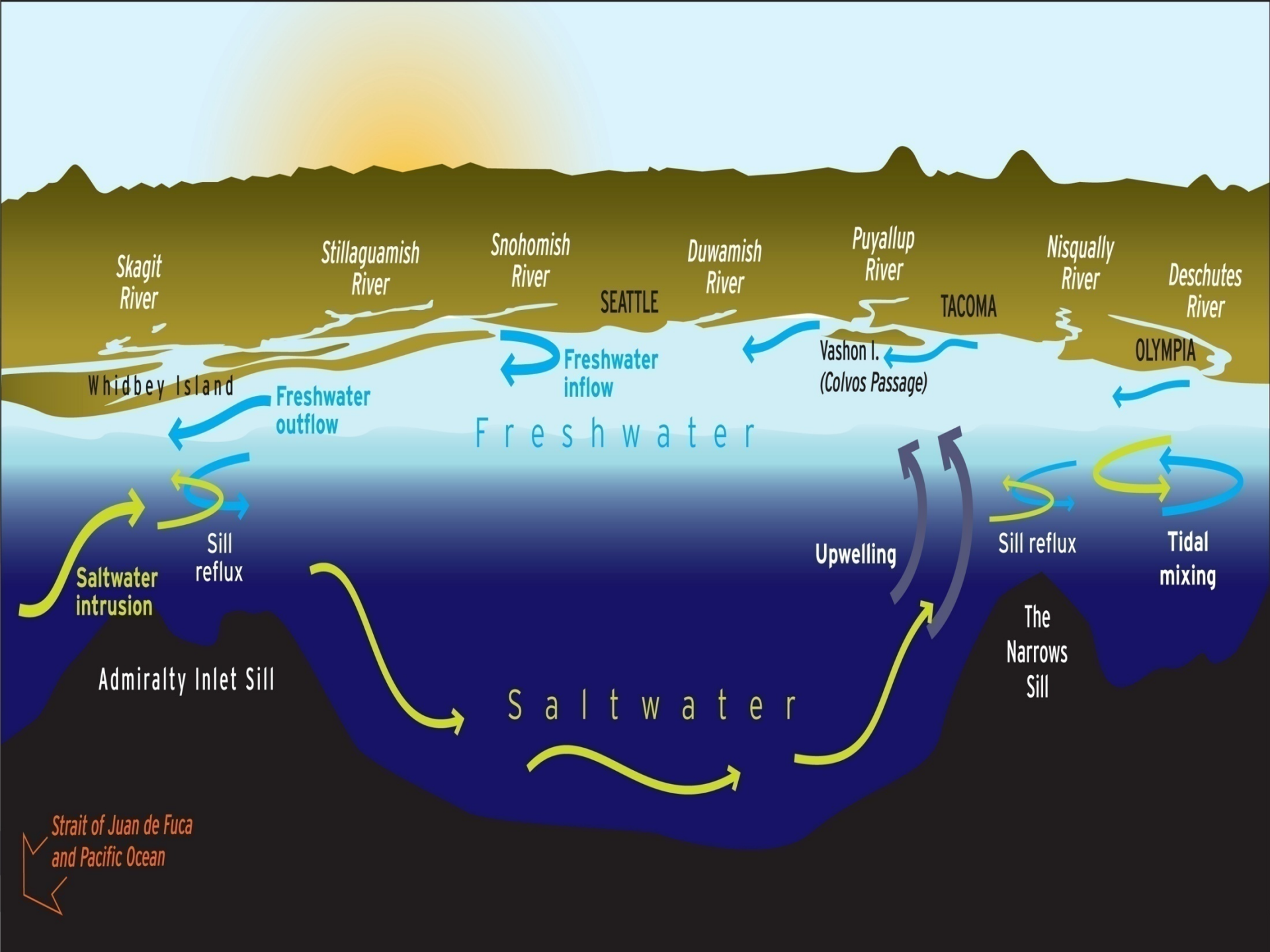


Factors related to accumulation of PBTs

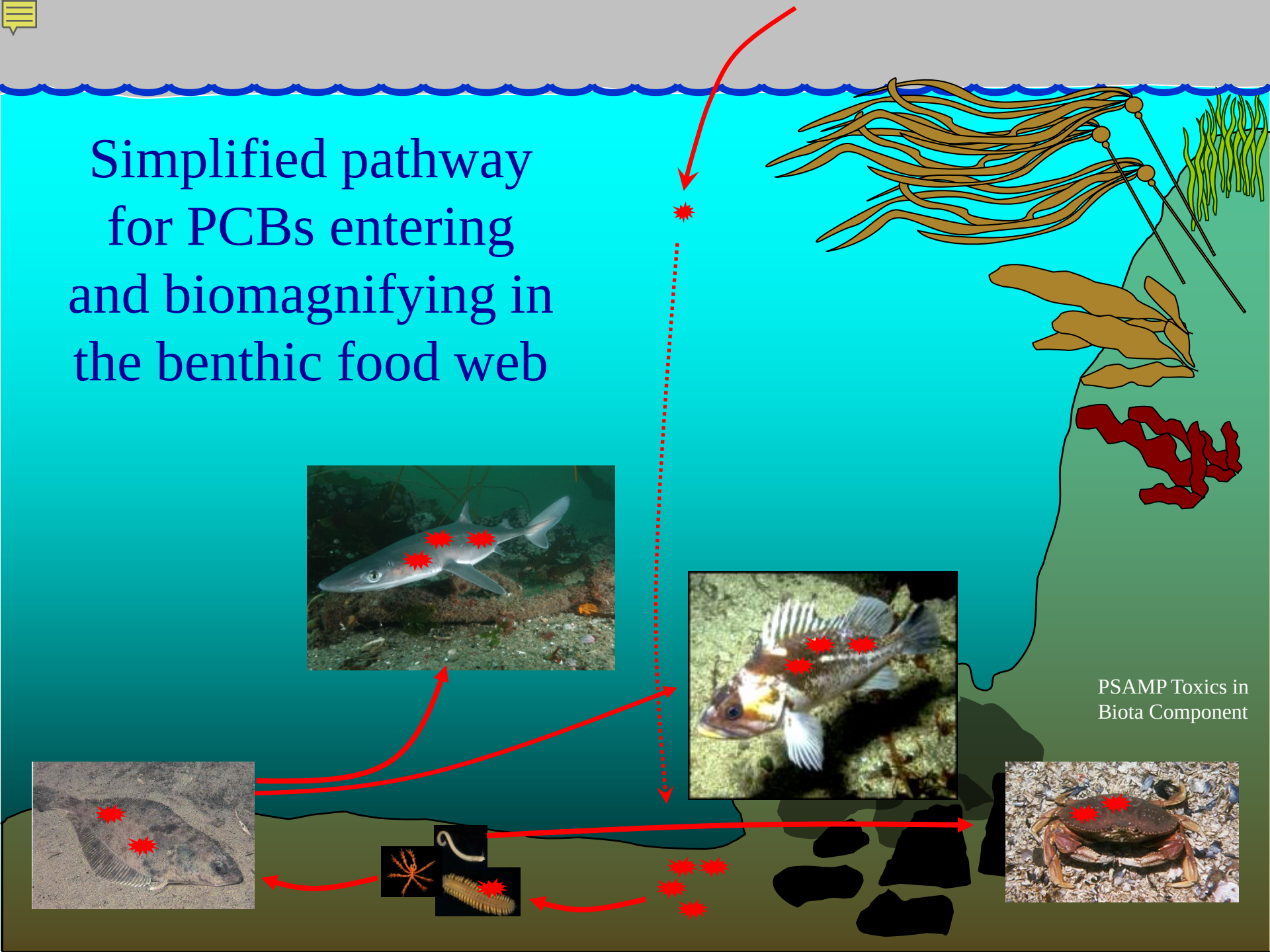
- proximity to PBT sources
- migration patterns/mobility
- trophic level/food source
- gender
- lifespan (duration of exposure)
- tissue lipid levels

Oceanographic factors to consider

- restricted circulation
- wide range of conditions
- proximity to urban sources

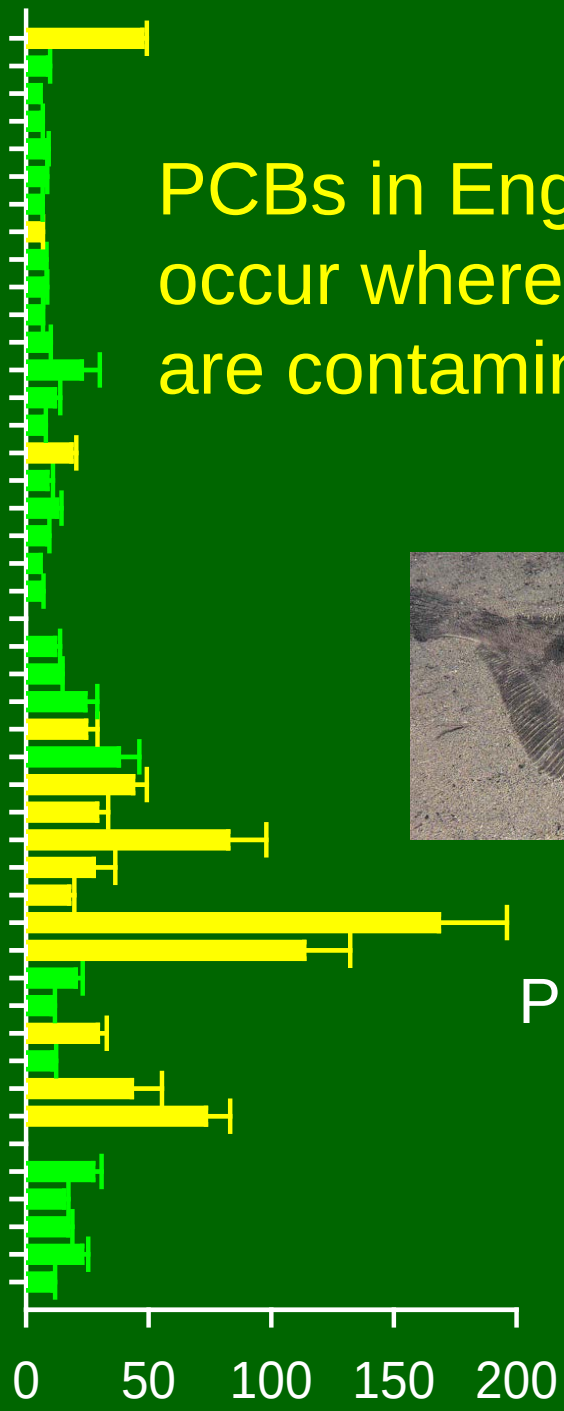

Skagit River
Stillaguamish River
Snohomish River
SEATTLE
Duwamish River
Puyallup River
TACOMA
Nisqually River
Deschutes River
OLYMPIA
Vashon I.
(Colvos Passage)
Whidbey Island
Freshwater inflow
Freshwater outflow
Freshwater
Saltwater intrusion
Sill reflux
Upwelling
Sill reflux
Tidal mixing
The Narrows Sill
Admiralty Inlet Sill
Saltwater
Strait of Juan de Fuca and Pacific Ocean

Simplified pathway for PCBs entering and biomagnifying in the benthic food web



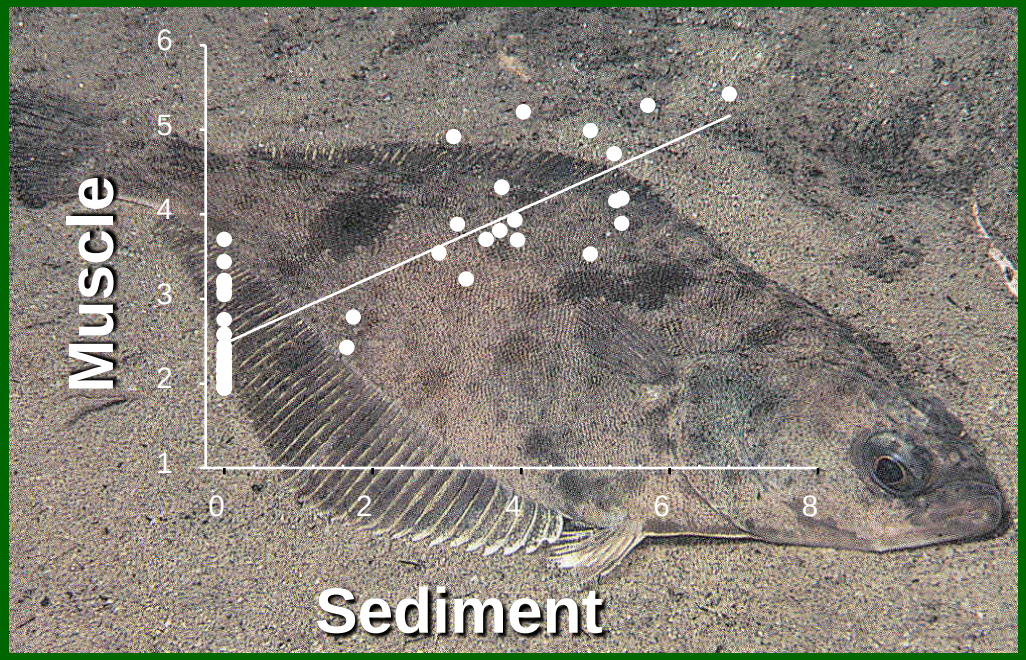
PSAMP Toxics in Biota Component

Source: adapted from Puget Sound Update '98 Figure 25.



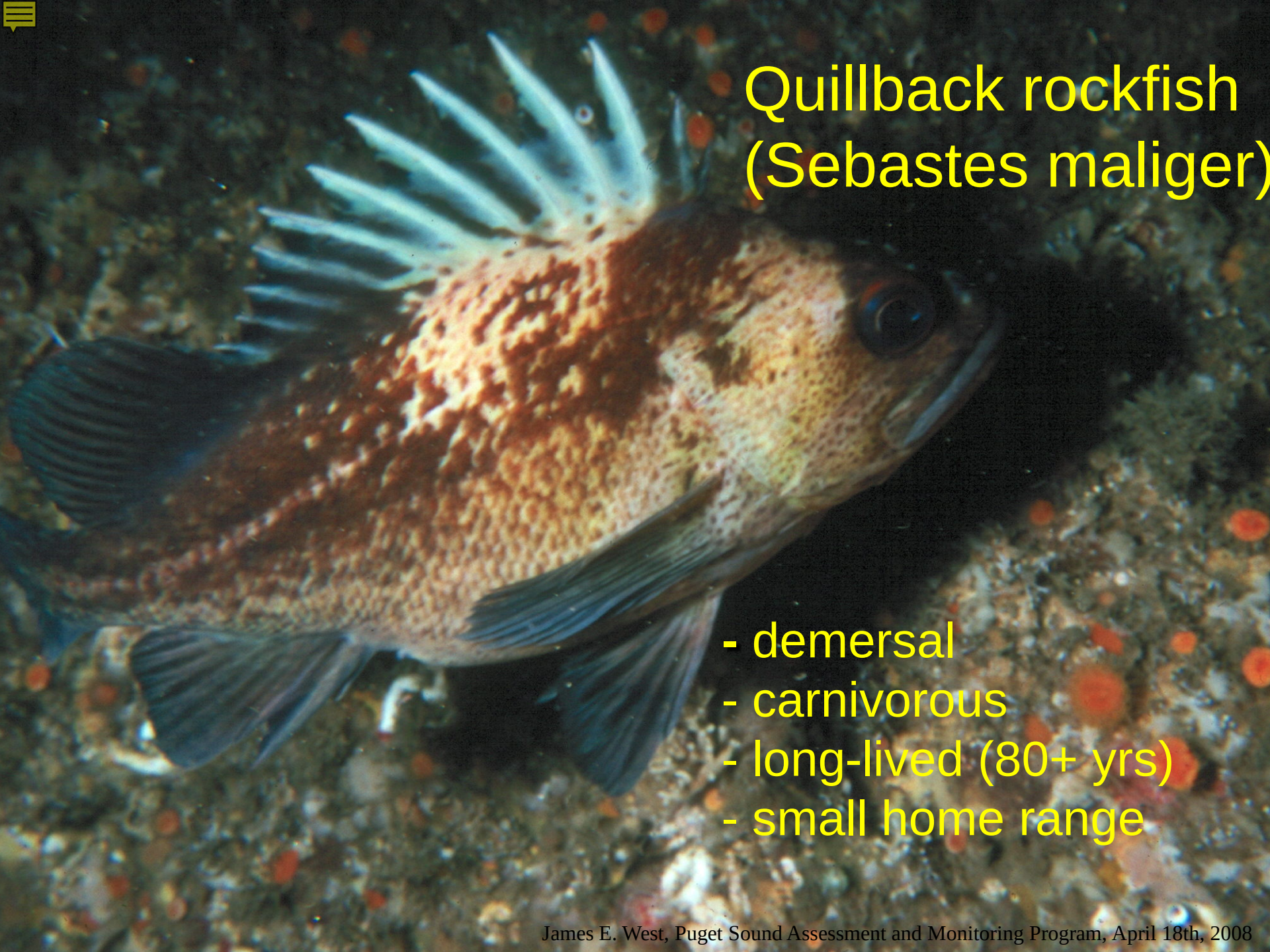
PCBs in English sole occur where sediments are contaminated

PCBs (ng/g wet wt., muscle tissue)



PCBs
in English sole reflect conditions in the sediments where they live

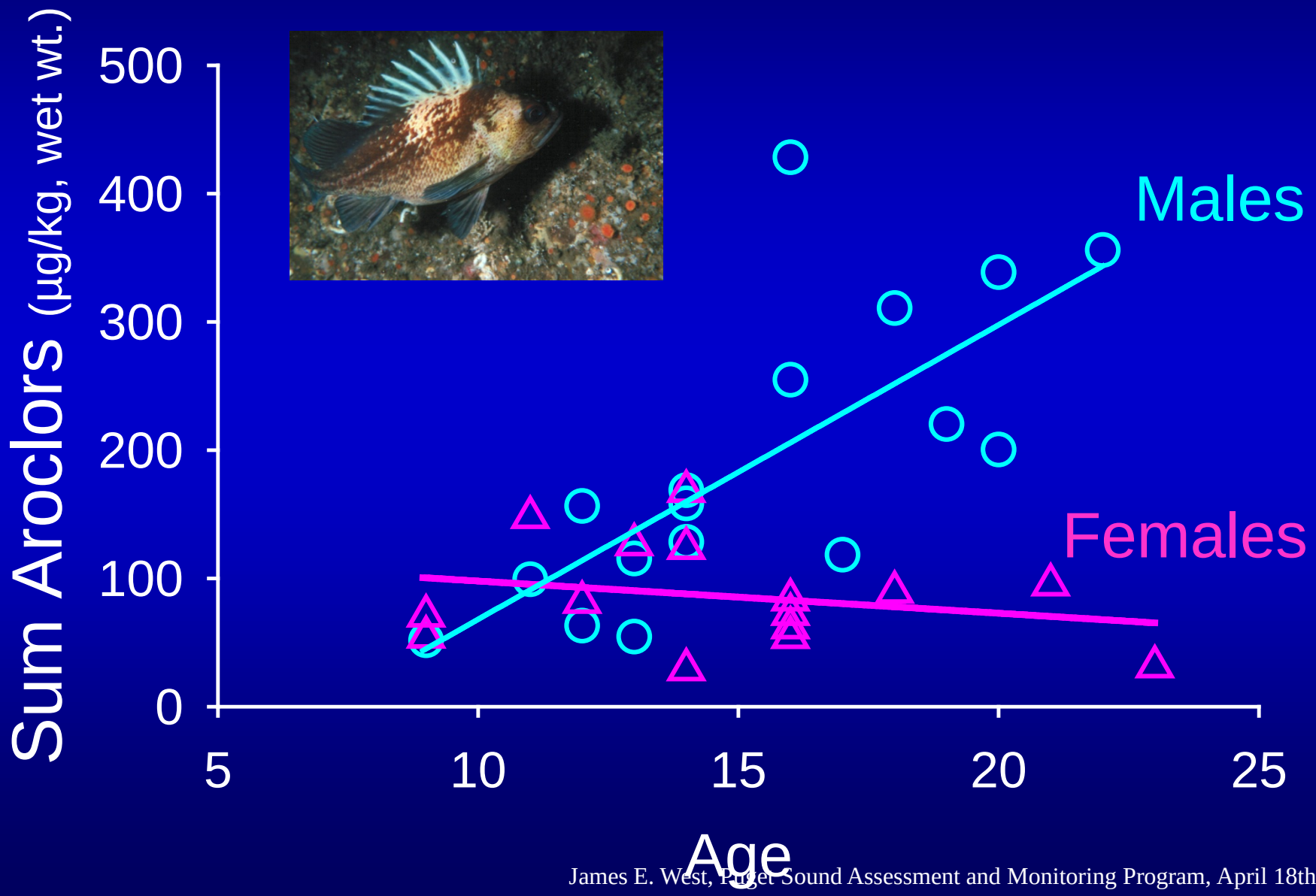
Source: S.M. O'Neill and J.E. West
Puget Sound Update '98 Figure 25.



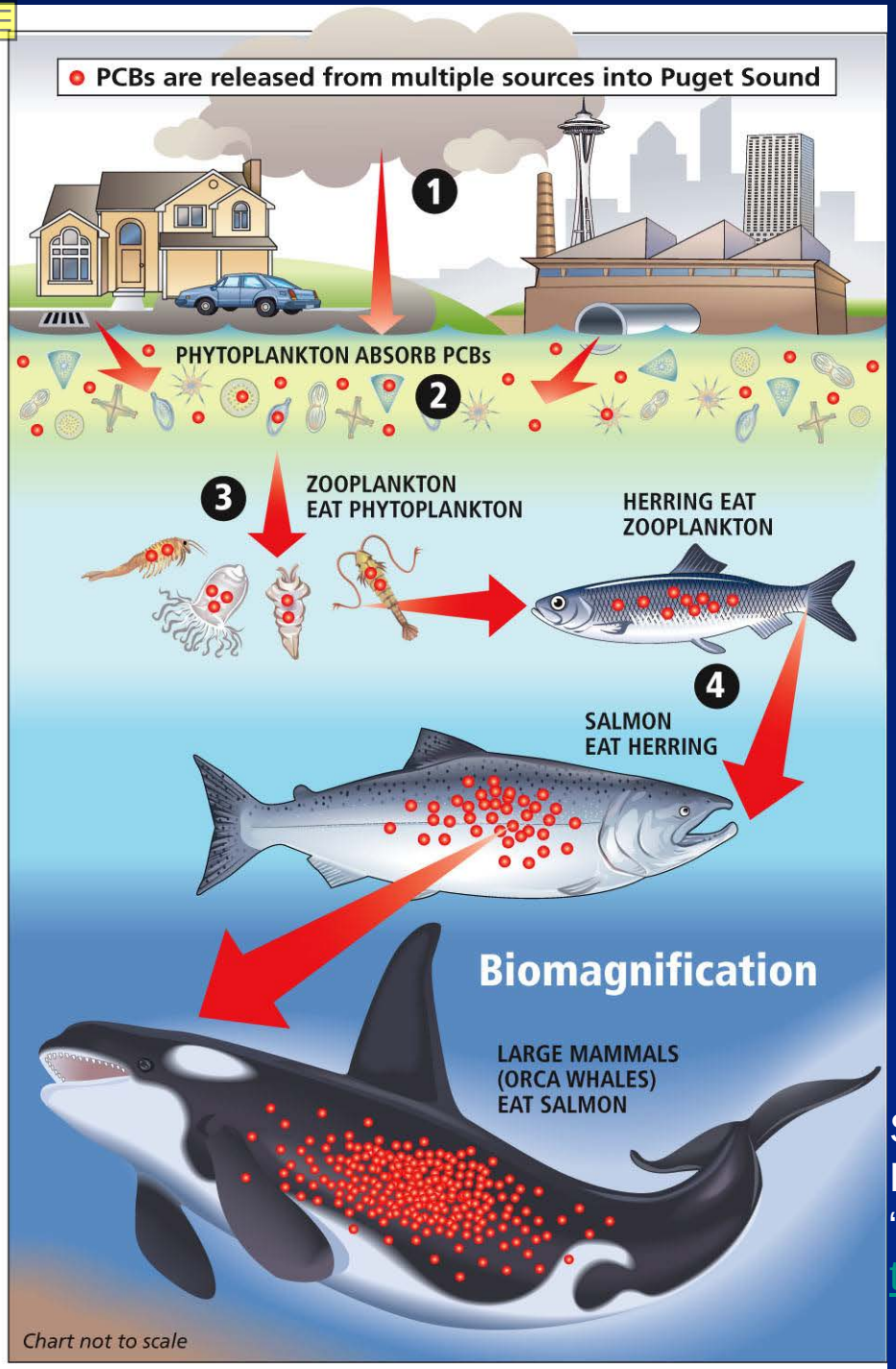
Quillback rockfish (Sebastes maliger)

- demersal
- carnivorous
- long-lived (80+ yrs)
- small home range

PCB Accumulation by Gender - Quillback Rockfish



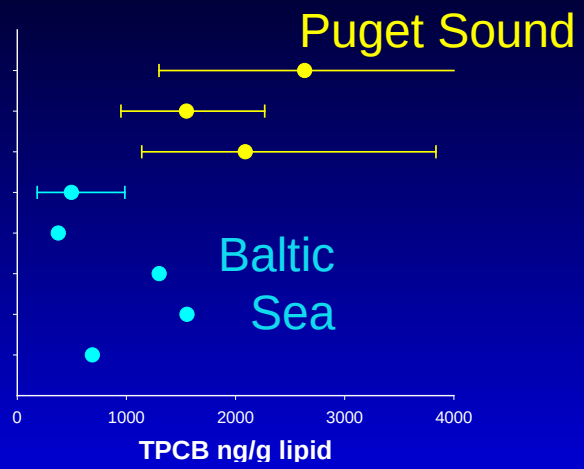
Simplified pathway for PCBs entering and biomagnifying in the pelagic food web

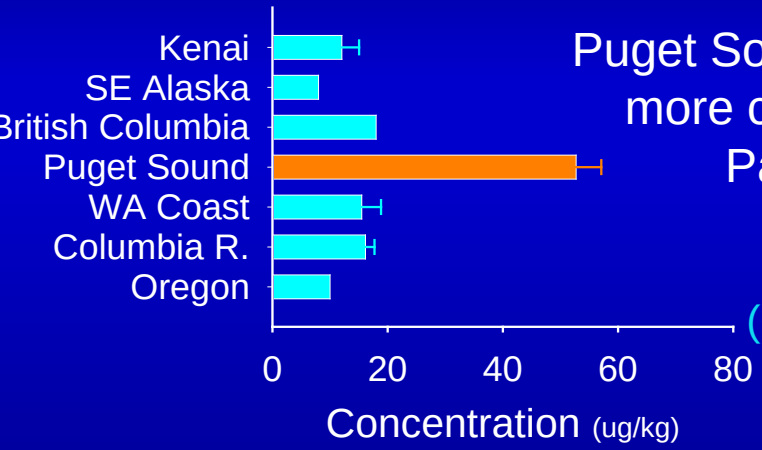


Source: Seattle Post-Intelligencer "The Zone" thezone@seattlepi.com

PCBs in the Pelagic Food web

Puget Sound herring are as contaminated as Baltic Sea herring
West, et al. 2008





Puget Sound Chinook 3 to 5x more contaminated than Pacific Coastal

(O'Neill and West 2009)

2006 WA DOH Report: recommends only 1 meal/week Puget Sound Chinook salmon

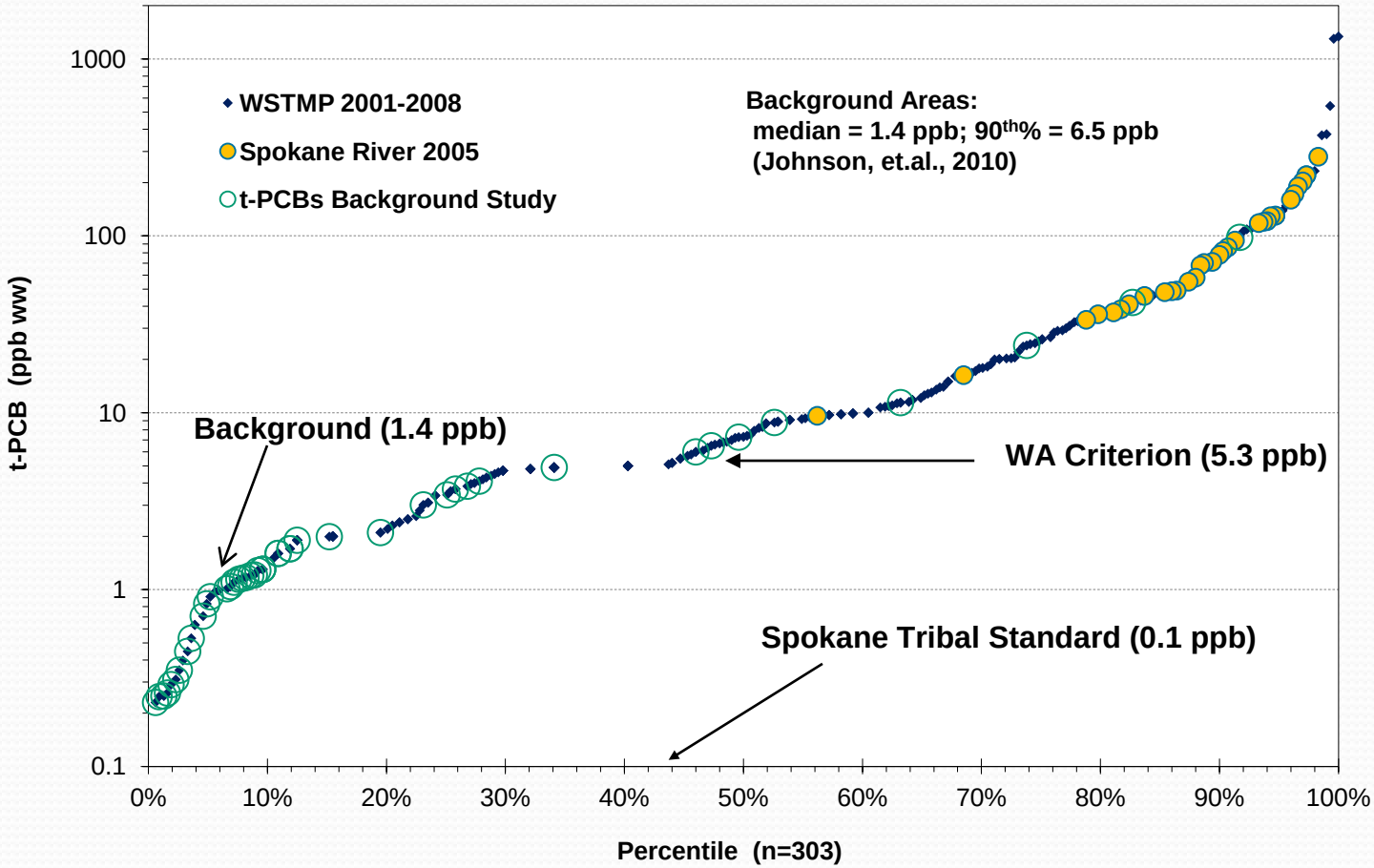
PCB levels in Puget Sound salmon may impair the health of killer whales
Hickie et al. 2007

Summary of PCB Standards

Regulation or Guidance	Aquatic Life - Water		**Human Health** [bc]		Fish Tissue Consumption Rate (g/day)
	chronic (pg/l)	Acute (pg/l)	Water (pg/l)	**Tissue (ng/g)**	
Washington Water Quality Standards (Ch. 173-201A WAC)	14,000	2,000,000			
National Toxics Rule (40 CFR 131)	--	--	170	**5.3**	6.5
Spokane Tribe Water Quality Standards (Resolution 2003-259)	14,000	2,000,000	3.37	**0.1**	86.3

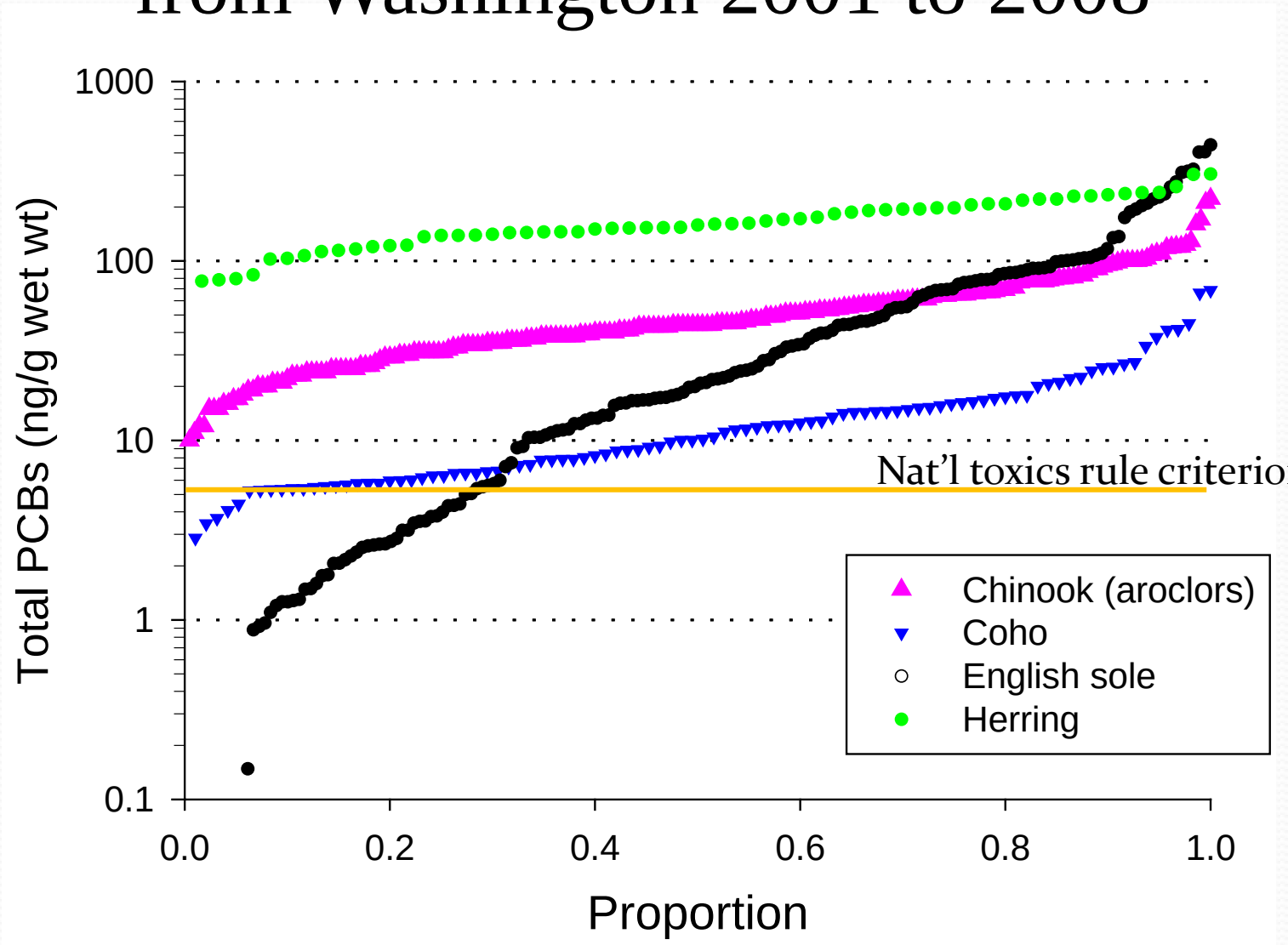
Slide courtesy of Dale Norton, WA Dept. of Ecology

PCB Levels in Freshwater Fish from Washington 2001 to 2008



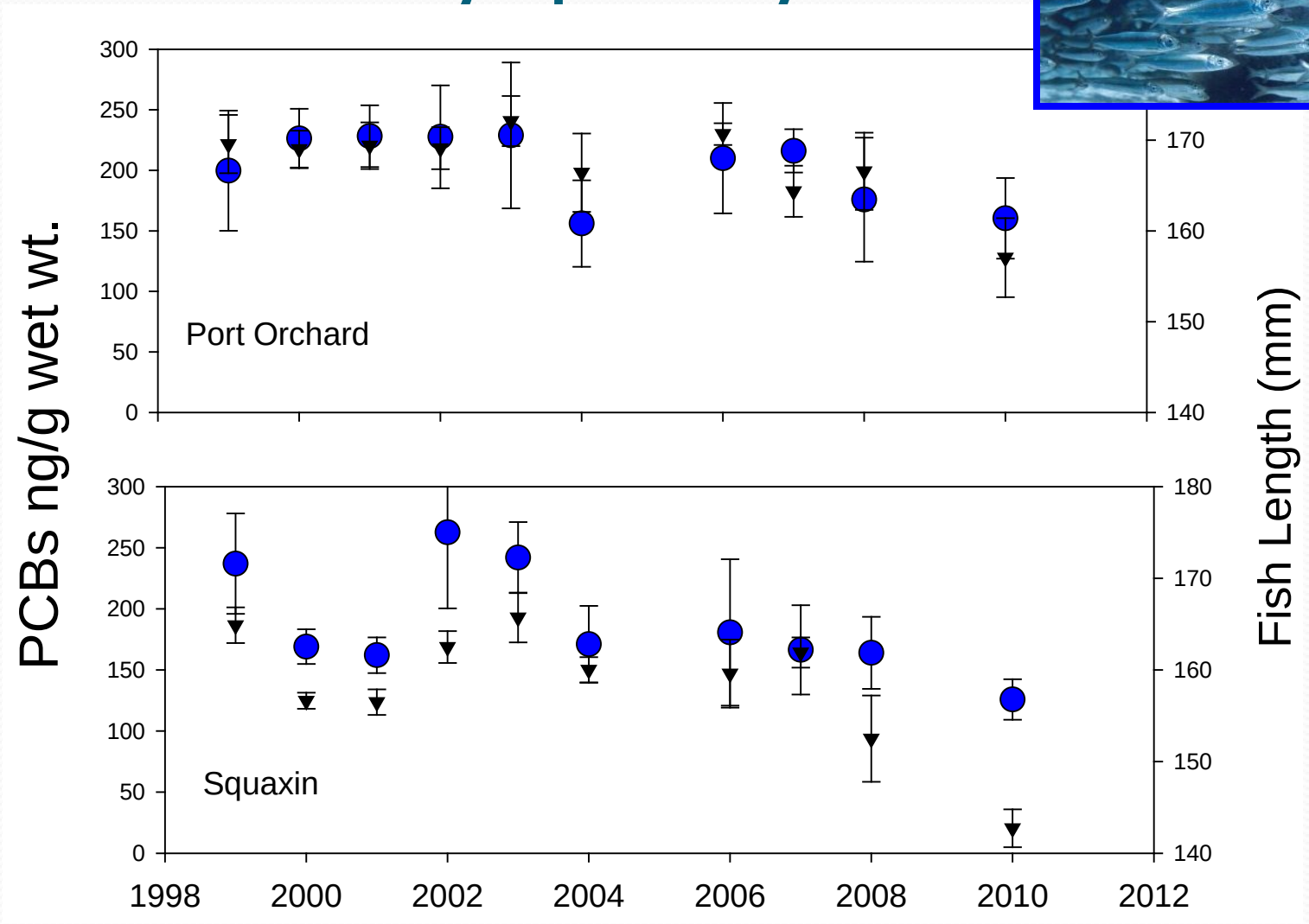
Slide courtesy of Dale Norton, WA Dept. of Ecology

PCB Levels in Marine & Anadromous Fish from Washington 2001 to 2008



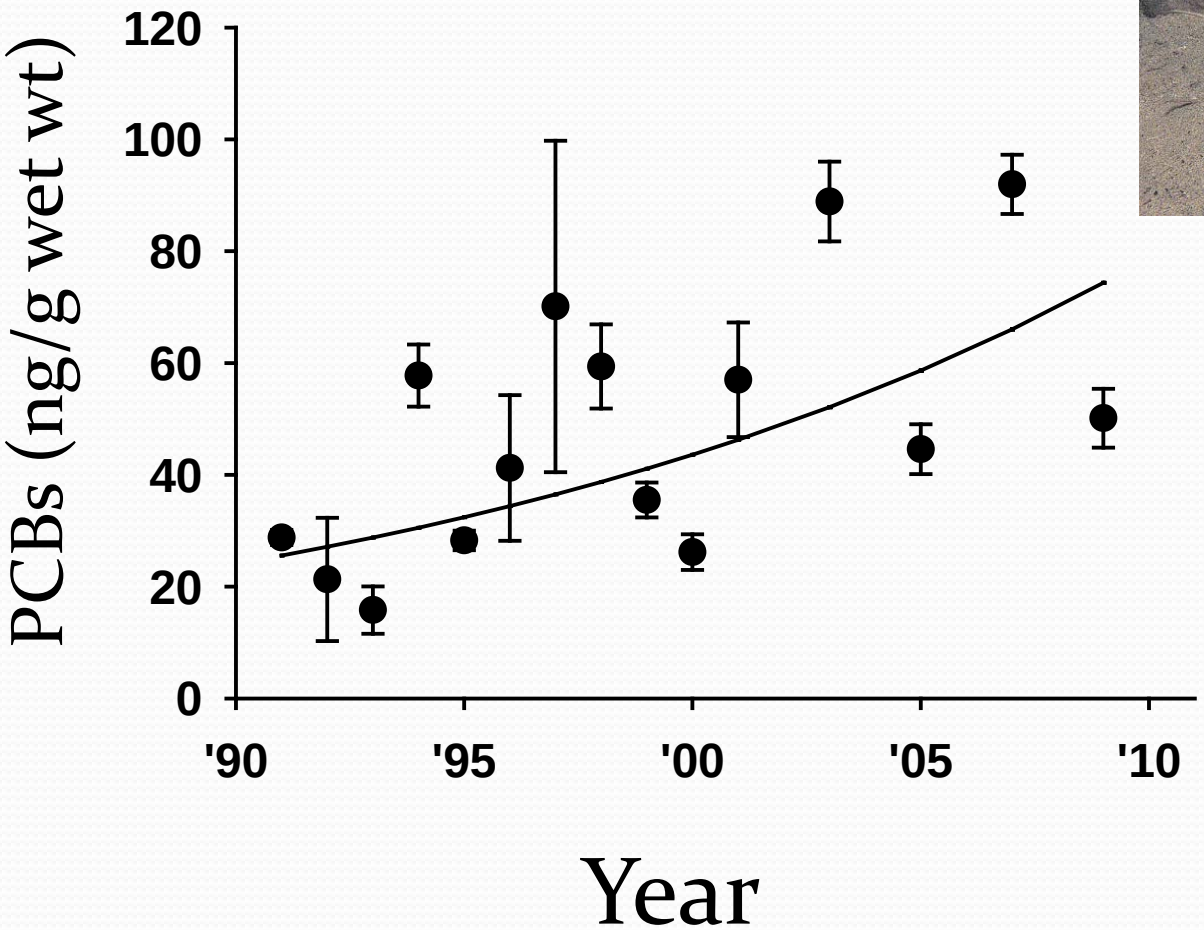
PSAMP, WA Dept. of Fish and Wildlife

Are PCBs going away?
...not very quickly



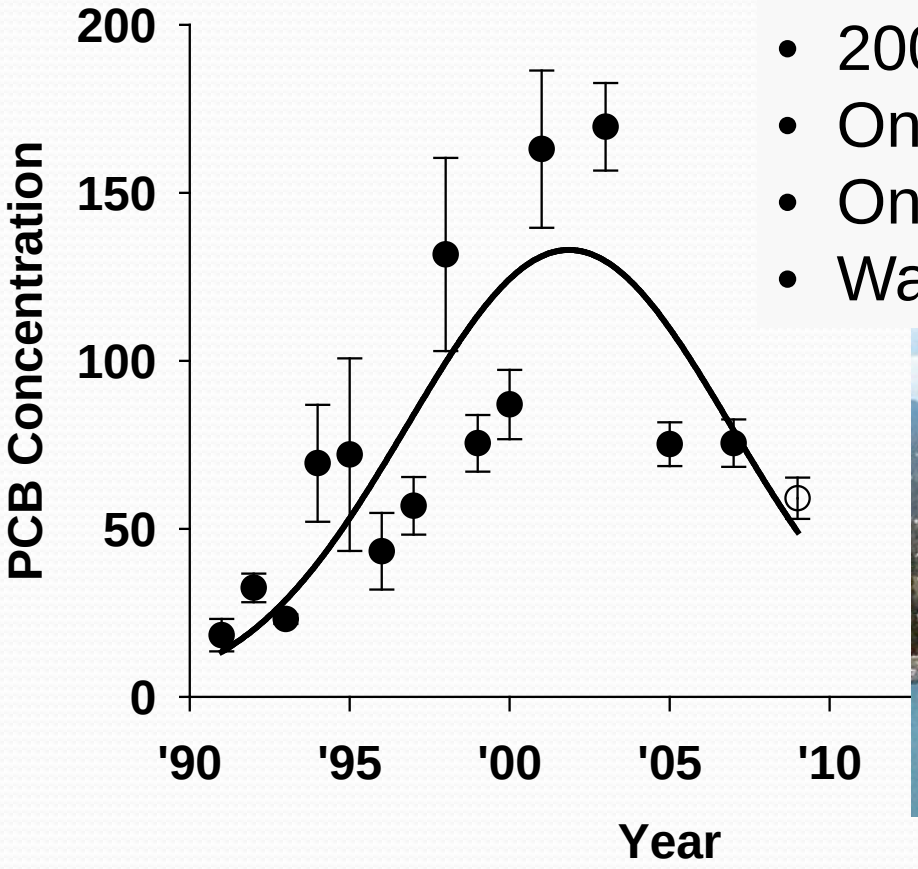
PCB Time Trends

Elliott Bay English sole



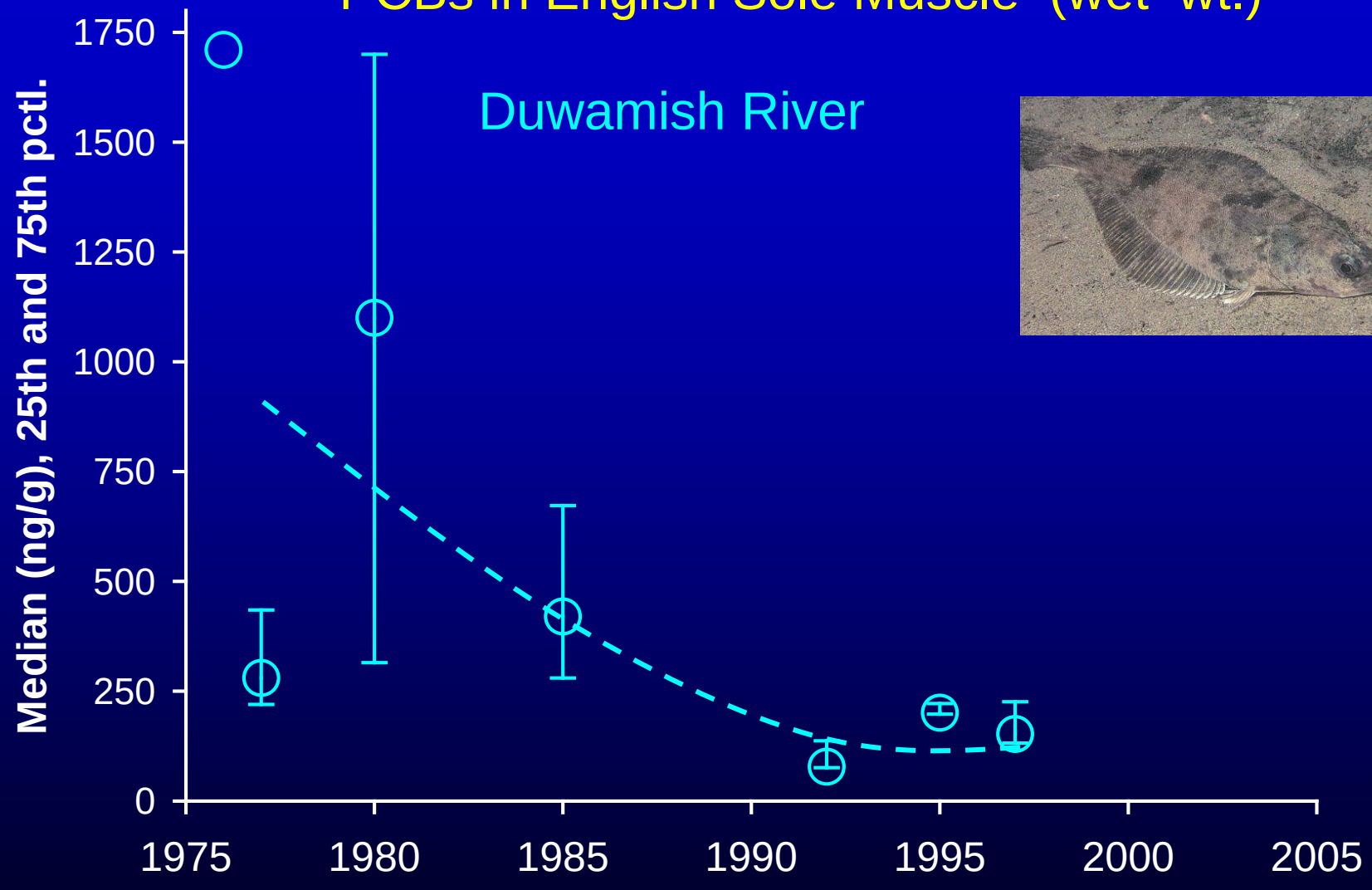
PCB Time Trends

Sinclair Inlet English sole



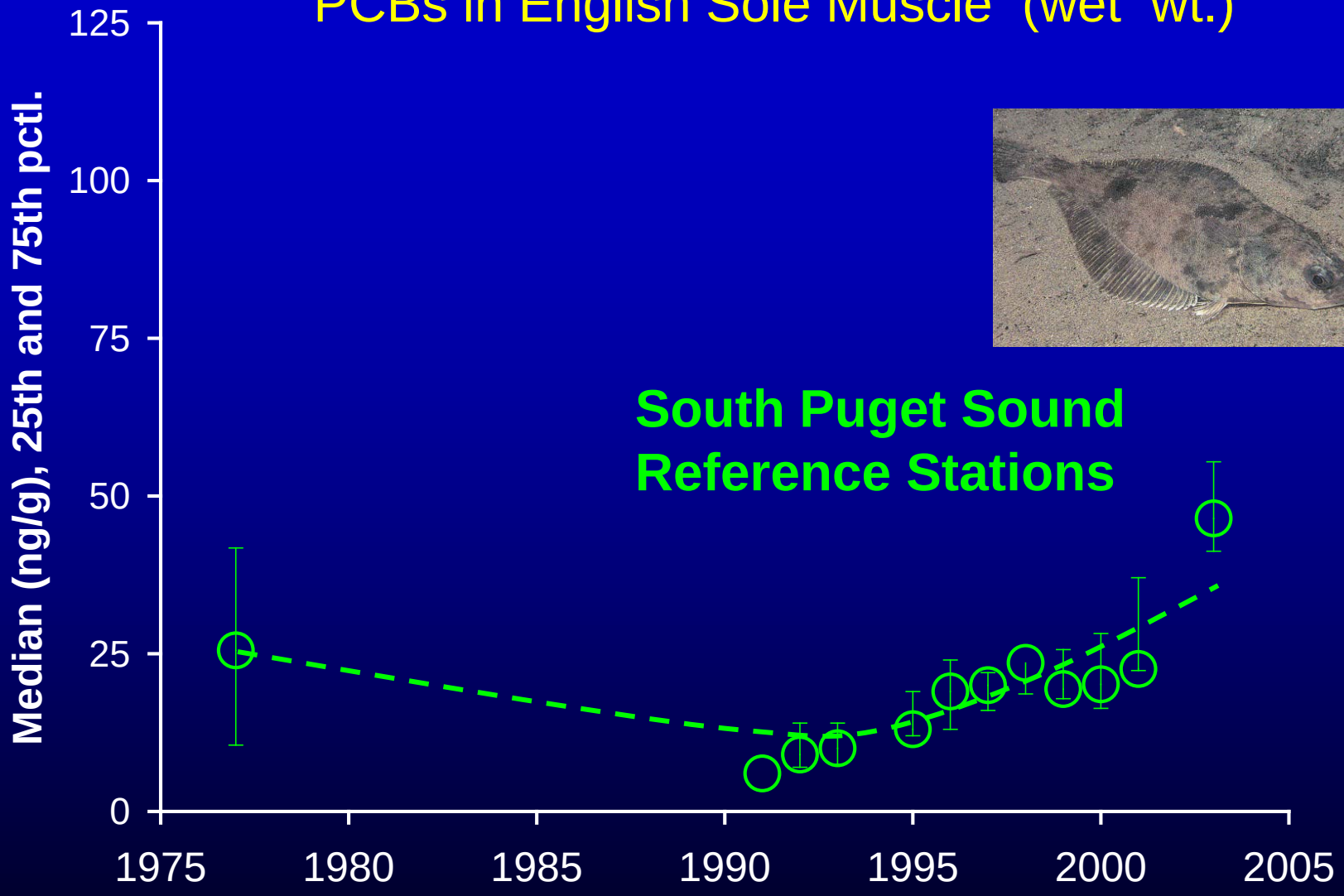
- 2000-2001 dredge & cap
- On-site upland restoration
- Onsite stormwater retrofits
- Watershed CSO retrofits

PCBs in English Sole Muscle (wet wt.)



West and O'Neill, Puget Sound Assessment and Monitoring Program

PCBs in English Sole Muscle (wet wt.)



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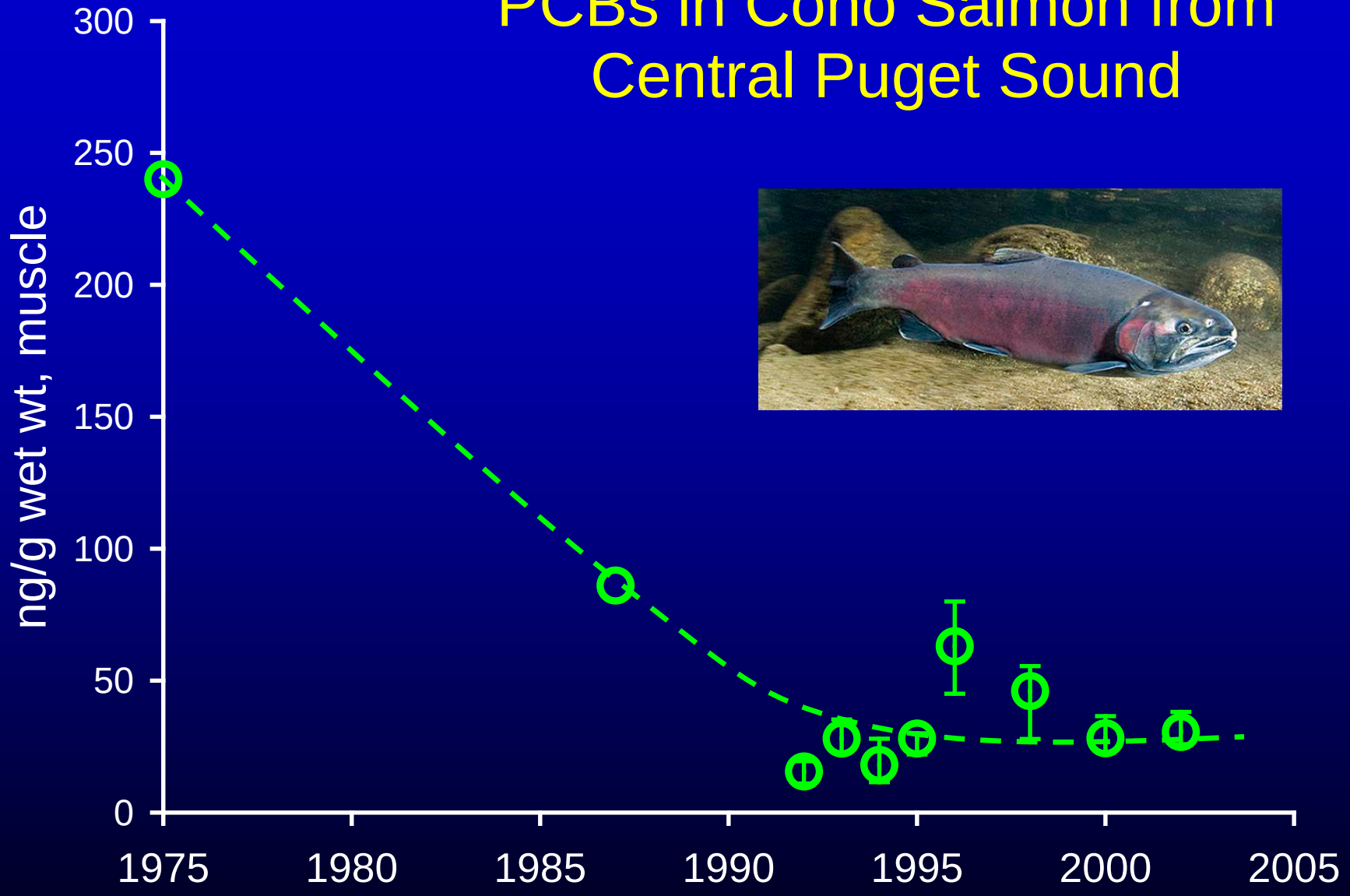
PCBs in Coho Salmon from Central Puget Sound



West and O'Neill, Puget Sound Assessment and Monitoring Program

In Summary

- Biota in Puget Sound are still substantially exposed to PCBs
- Levels have declined from the 1970s but have remained stable over the past 20 years
- 72-100% of marine fish and salmon sampled by PSAMP exceeded the NTR PCB criterion
- 53% of FW fish sampled by Ecology exceeded the NTR criterion