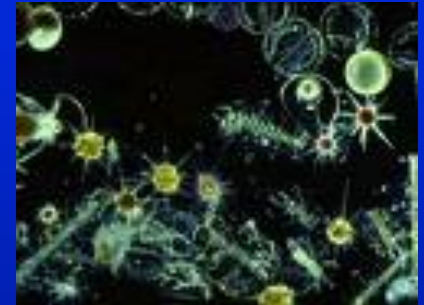




Toxic Contaminants in Puget Sound's Pelagic Food Web



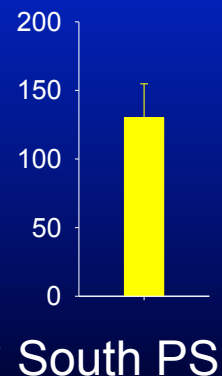
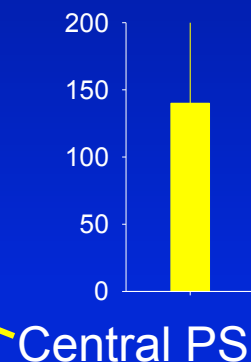
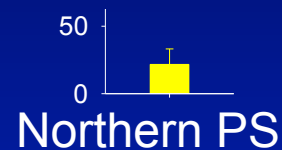
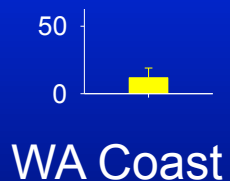
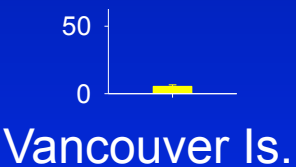
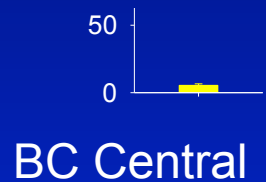
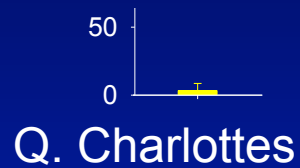
James E. West

Puget Sound Ecosystem Monitoring Program,
Washington Department of Fish and Wildlife

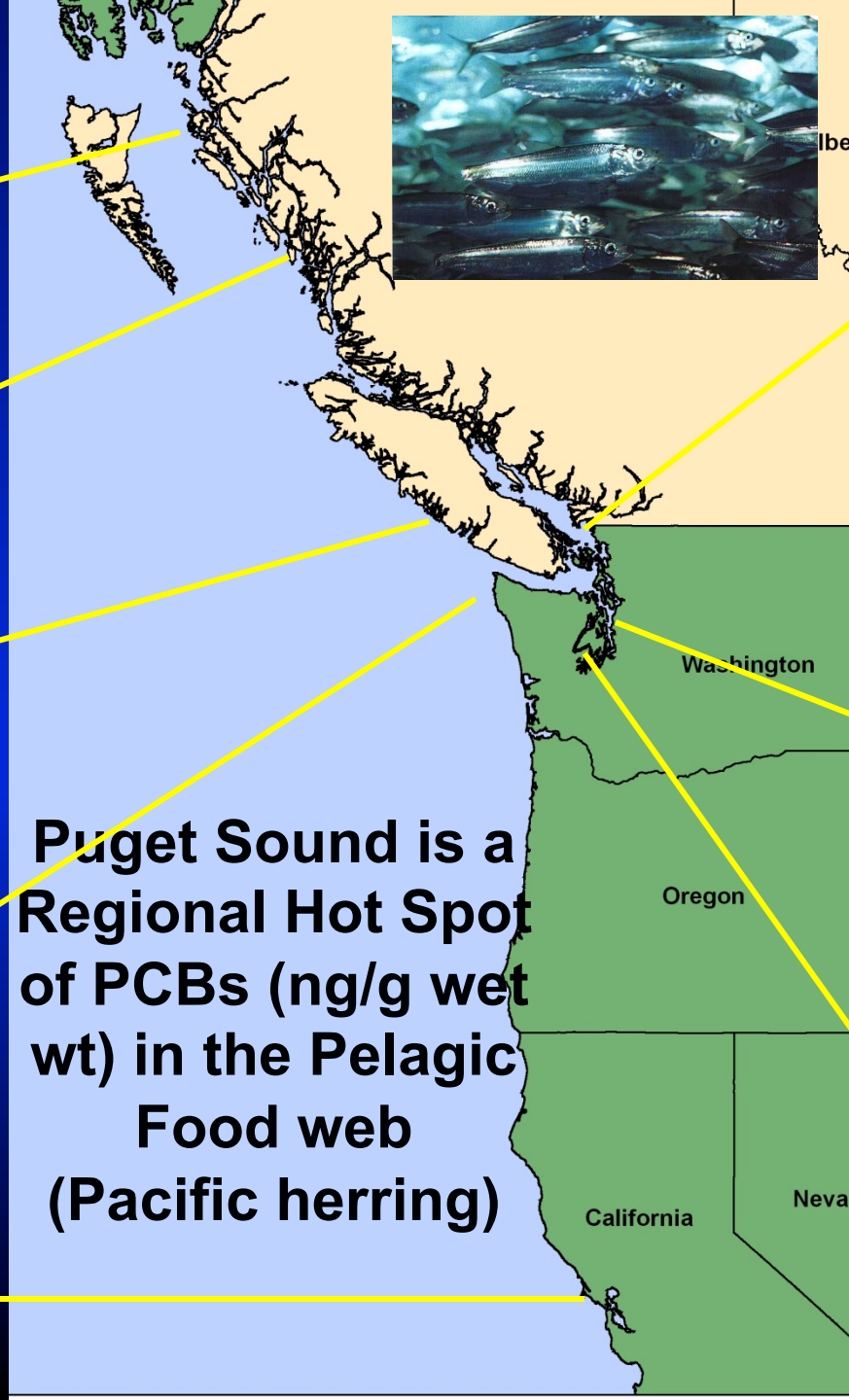
Sandra M. O'Neill, Gina M. Ylitalo, NOAA Fisheries,
Northwest Fisheries Science Center, Seattle, WA

Exposure to toxics is a risk to the health of Pacific herring throughout their life cycle

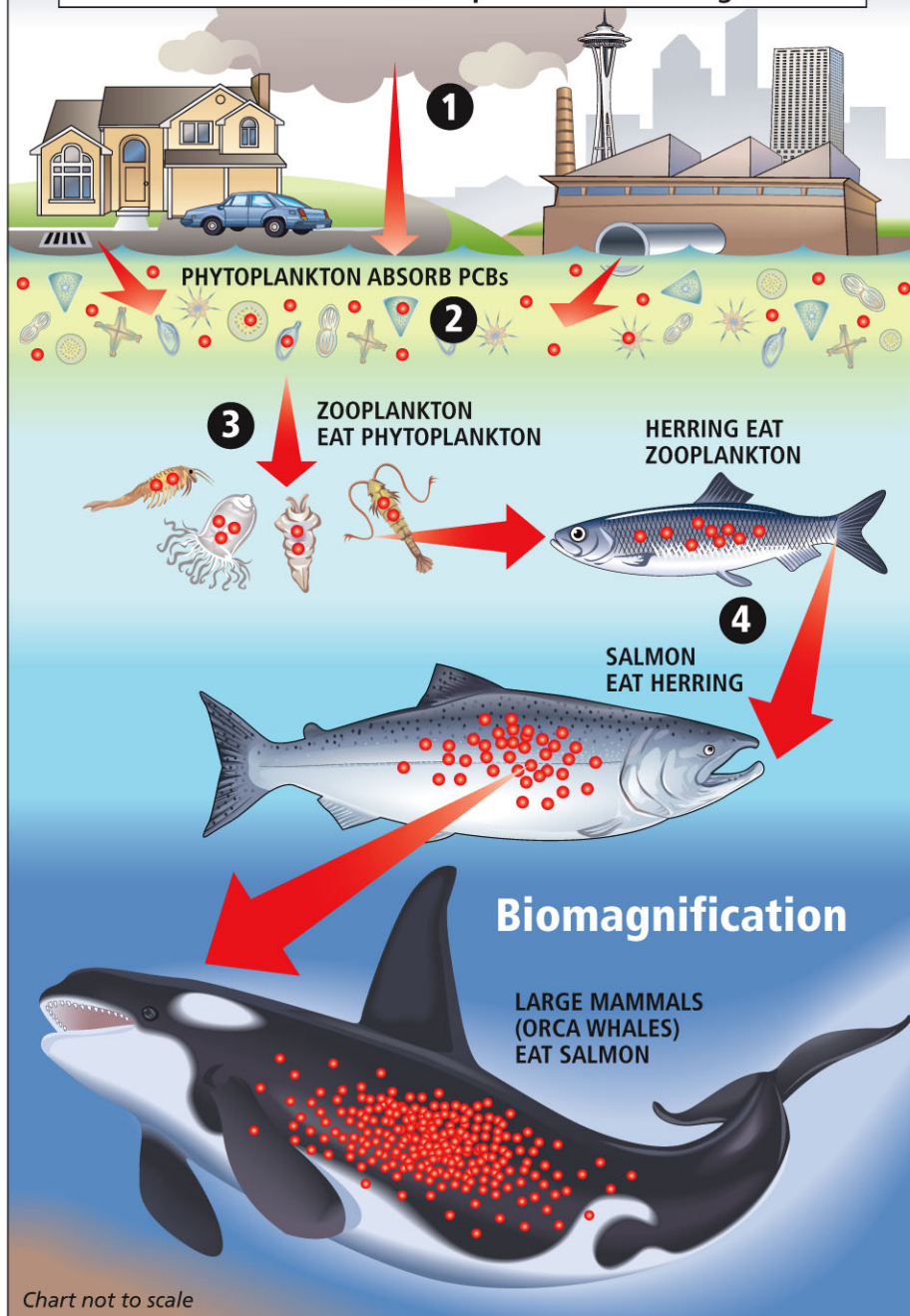
- Persistent bioaccumulative toxics (PBTs) in *adult herring*
 - Using PCBs as an example
 - Trophic transfer of PCBs in the PS pelagic FW as source of risk
- Hydrocarbons in *spawned herring eggs*
 - Compare PAHs in embryos across PS
 - Source of PAHs to embryos?



**Puget Sound is a
Regional Hot Spot
of PCBs (ng/g wet
wt) in the Pelagic
Food web
(Pacific herring)**



● PCBs are released from multiple sources into Puget Sound



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

Source: Seattle Post-Intelligencer
"The Zone"

thezone@seattlepi.com

This page is part of a curriculum developed for the Newspapers in Education program by the PI Public Affairs Department.

theZone
for students with active brains

SAVING PUGET SOUND

Pop quiz:
What is the most common source of PCBs in Puget Sound?
A. Factories B. Homes C. Cars D. Sewage treatment plants
Answer: A. Factories

How humans' pollution affects Puget Sound
The old Olympic village in Puget Sound was a hotbed of pollution. Factories, homes, cars, and sewage treatment plants all poured pollutants into the water. Now, thanks to the Puget Sound Cleanup Act, the water is cleaner and safer.

Step 1: PCBs are released from multiple sources into Puget Sound
Factories, homes, cars, and sewage treatment plants all pour pollutants into the water. Now, thanks to the Puget Sound Cleanup Act, the water is cleaner and safer.

Step 2: PCBs are absorbed by phytoplankton
Phytoplankton absorb PCBs from the water. They are then eaten by zooplankton, which are eaten by herring, which are eaten by salmon, which are eaten by orcas.

Step 3: PCBs are biomagnified
As PCBs move up the food chain, they become more concentrated in each organism. This is called biomagnification.

Step 4: PCBs are biomagnified in orcas
Orcas are at the top of the food chain. They have the highest concentration of PCBs in their bodies.

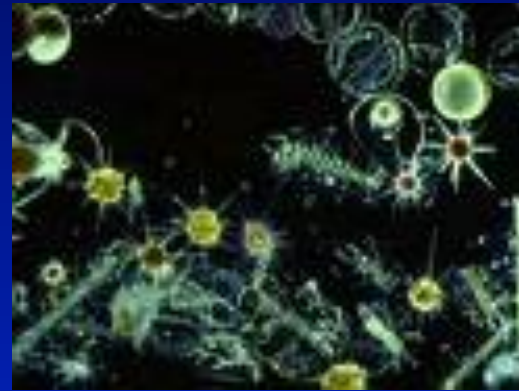
A cold water concert
Q: What is the most common source of PCBs in Puget Sound?
A: Factories

Answers to Dec. 18's Zone puzzle:
1. B 2. C 3. A 4. D 5. B 6. C 7. A 8. D 9. B 10. C 11. A 12. D 13. B 14. C 15. A 16. D 17. B 18. C 19. A 20. D

Schedule
January 8: Puget Sound overview
January 15: Puget Sound
January 22: Puget Sound
January 29: Puget Sound

Fun Quiz
1. What is the most common source of PCBs in Puget Sound?
A. Factories B. Homes C. Cars D. Sewage treatment plants
2. What is the most common source of PCBs in Puget Sound?
A. Factories B. Homes C. Cars D. Sewage treatment plants

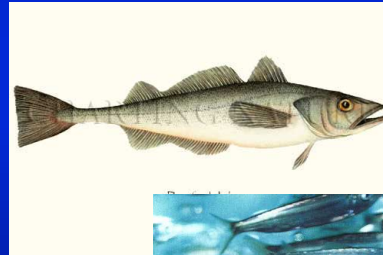
Groups I'll cover today for the trophic transfer story....



Primary producer
Phytoplankton (POM)



Primary consumer
Krill (*Euphausia pacifica*)



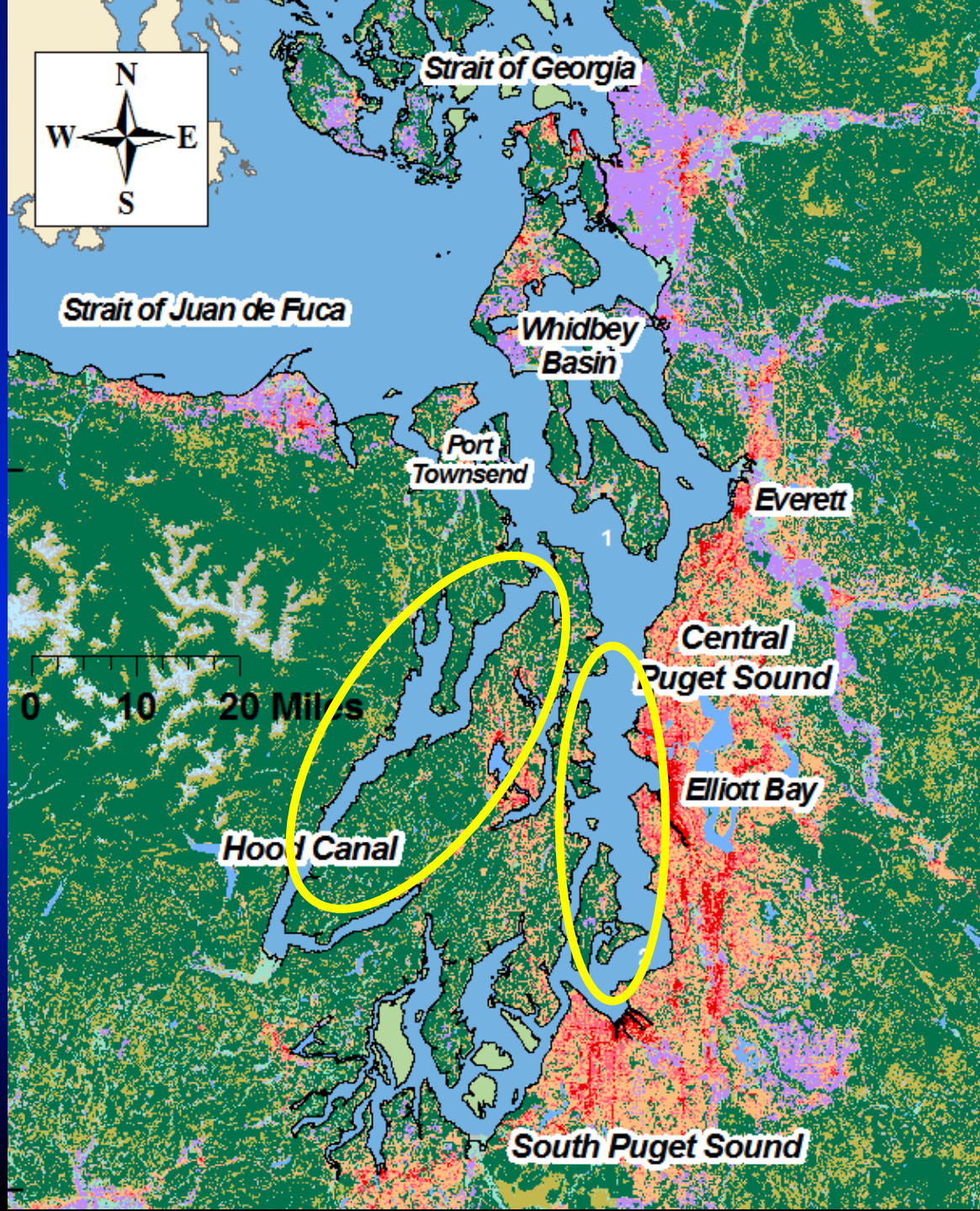
“resident” predators

Pacific hake (*Merluccius productus*)

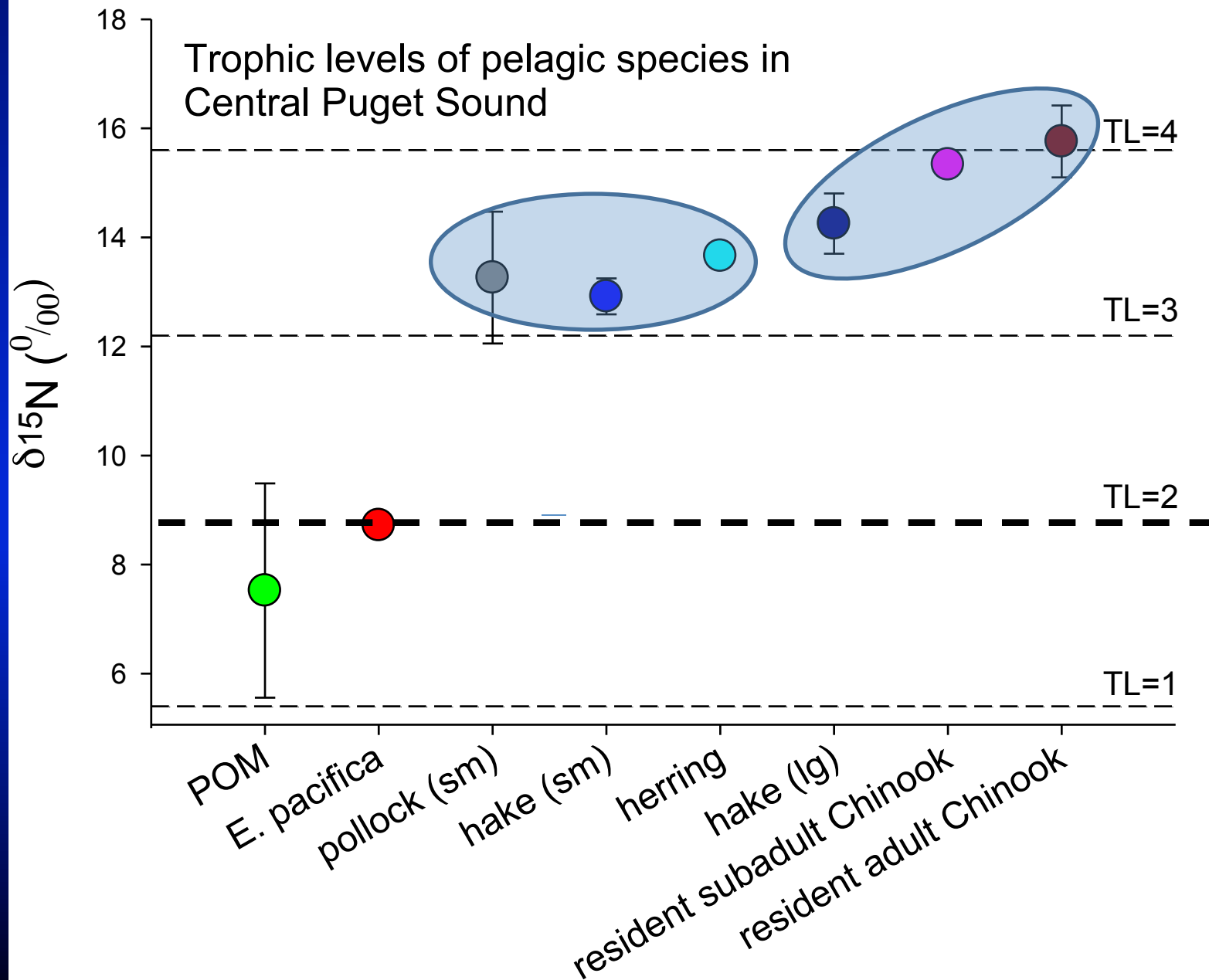
Walleye pollock (*Theragra chalcogramma*)

Pacific herring (*Clupea pallasii*)

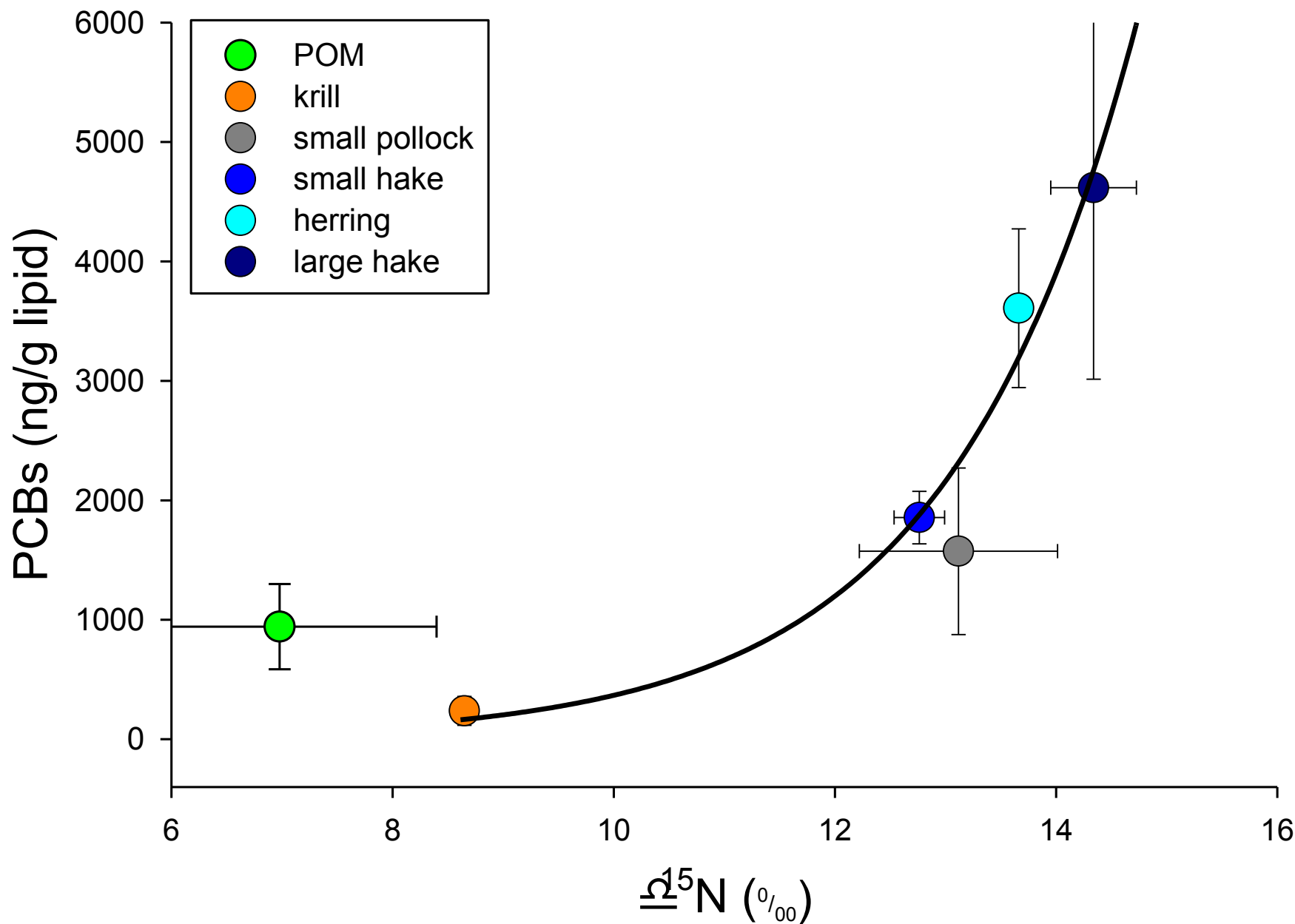
Chinook salmon (*Oncorhynchus tshawytscha*)

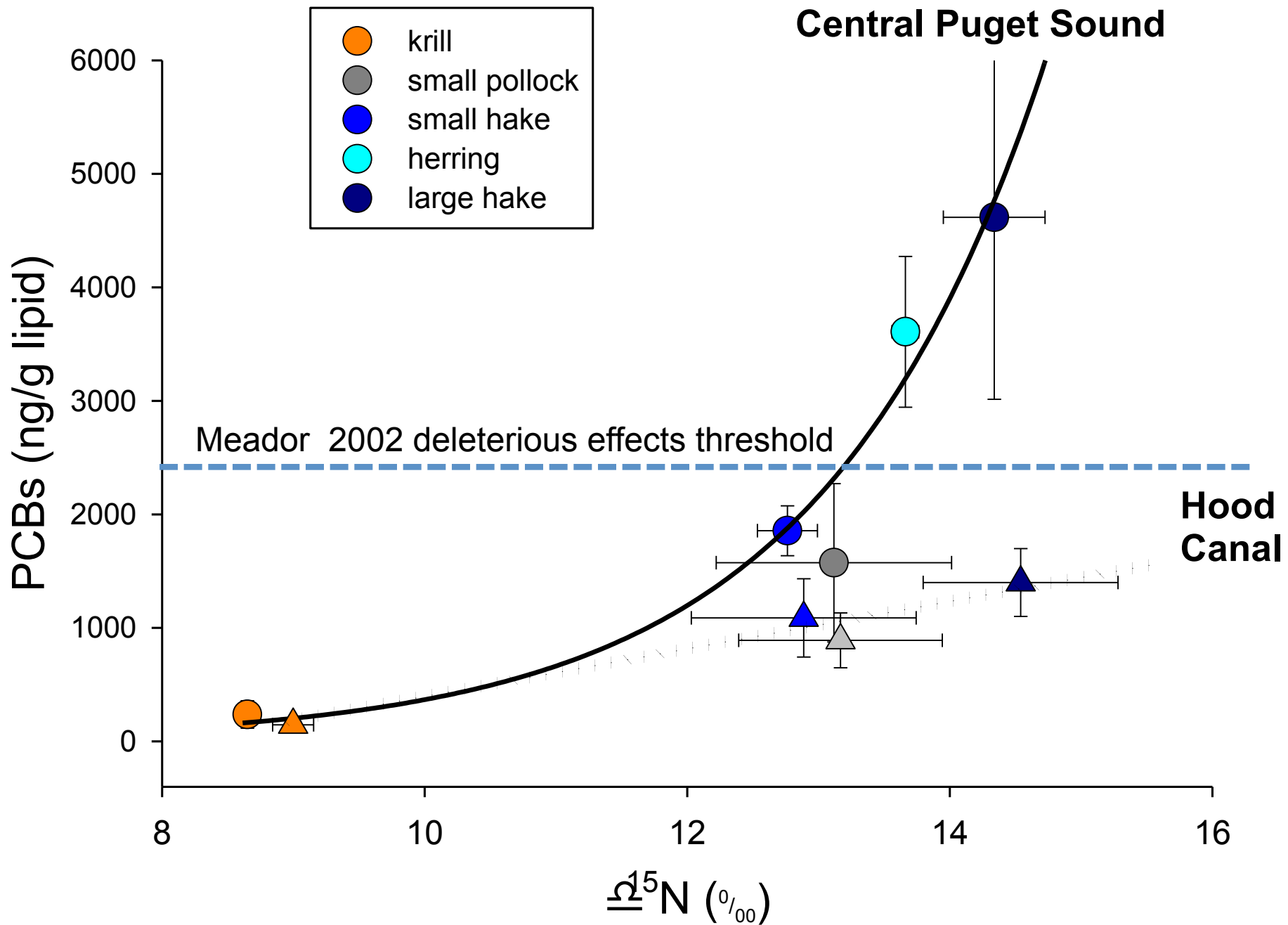


Compare
trophic
transfer of
PCBs
between two
Basins

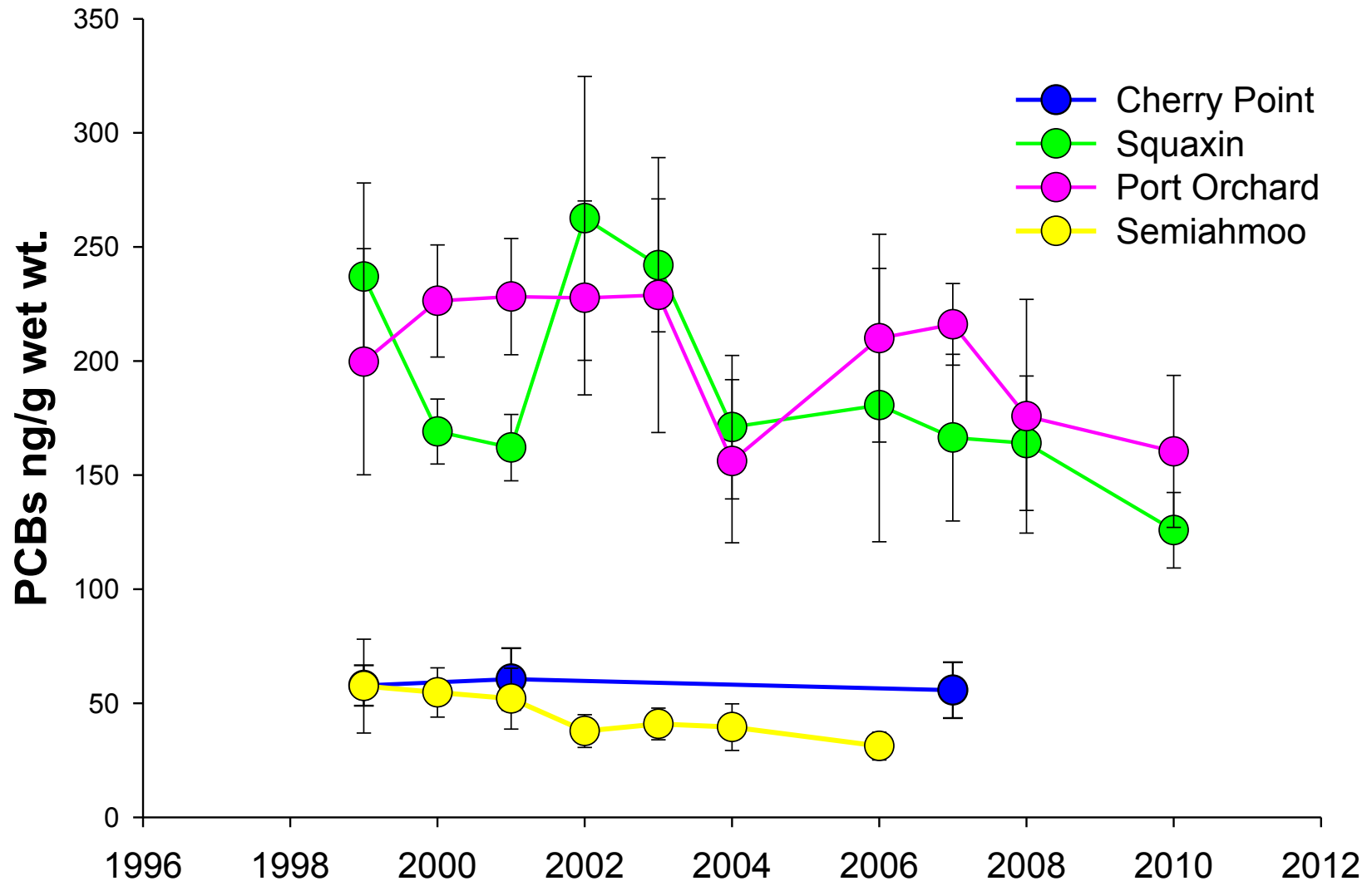


Central Puget Sound





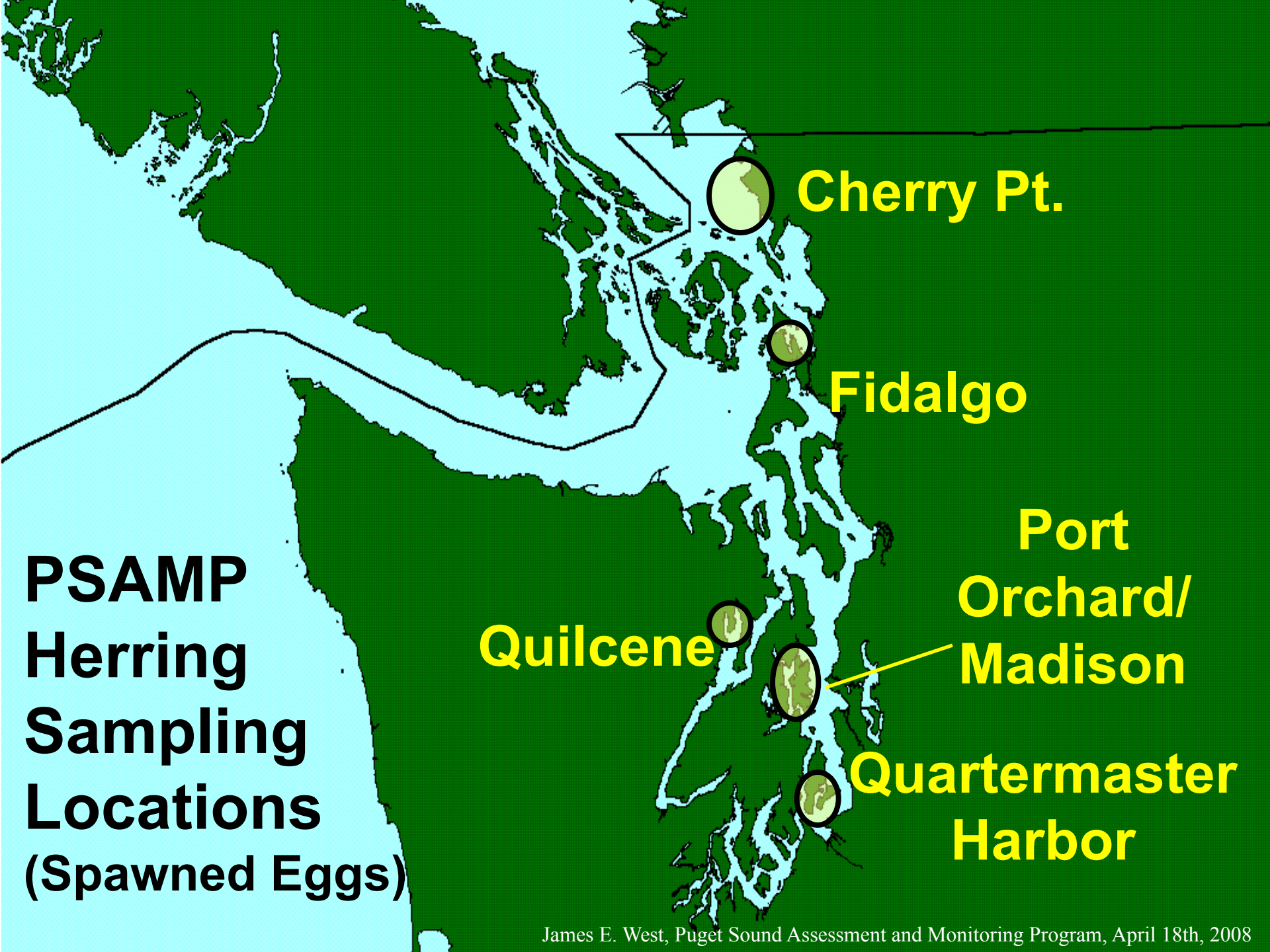
PCB levels are not changing (much) in Puget Sound herring



Conclusions (PBTs)

- Basin-specific magnification patterns
- Trophic transfer of PBTs in pelagic predators to concentrations above effects thresholds
- Three factors highly correlated w/ PBTs
 - Residency in CPS (proximity to source)
 - exposure time (age)
 - trophic level

**PSAMP
Herring
Sampling
Locations
(Spawned Eggs)**



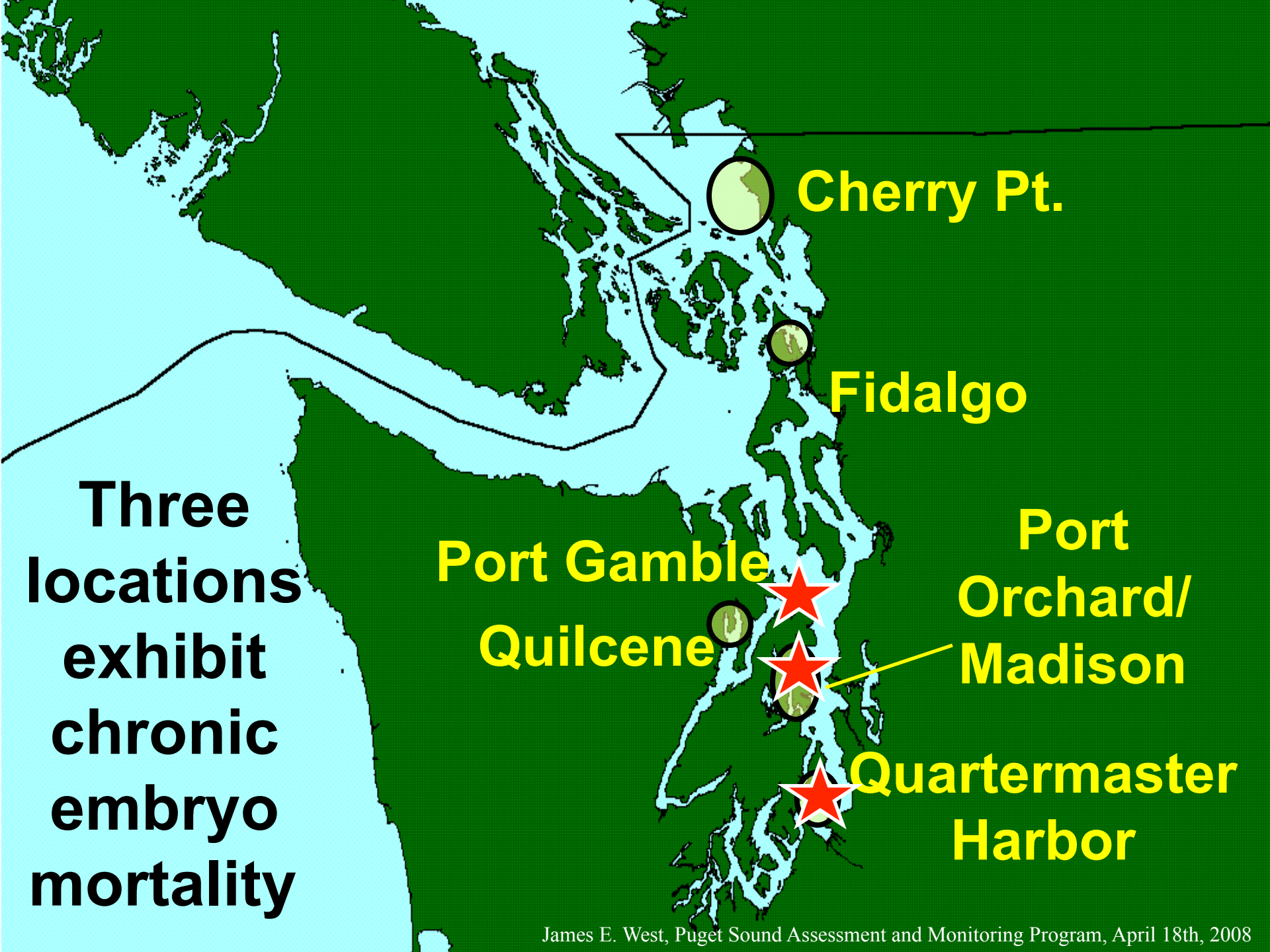
Cherry Pt.

Fidalgo

Quilcene

**Port
Orchard/
Madison**

**Quartermaster
Harbor**



**Three
locations
exhibit
chronic
embryo
mortality**



Cherry Pt.



Fidalgo



Port Gamble

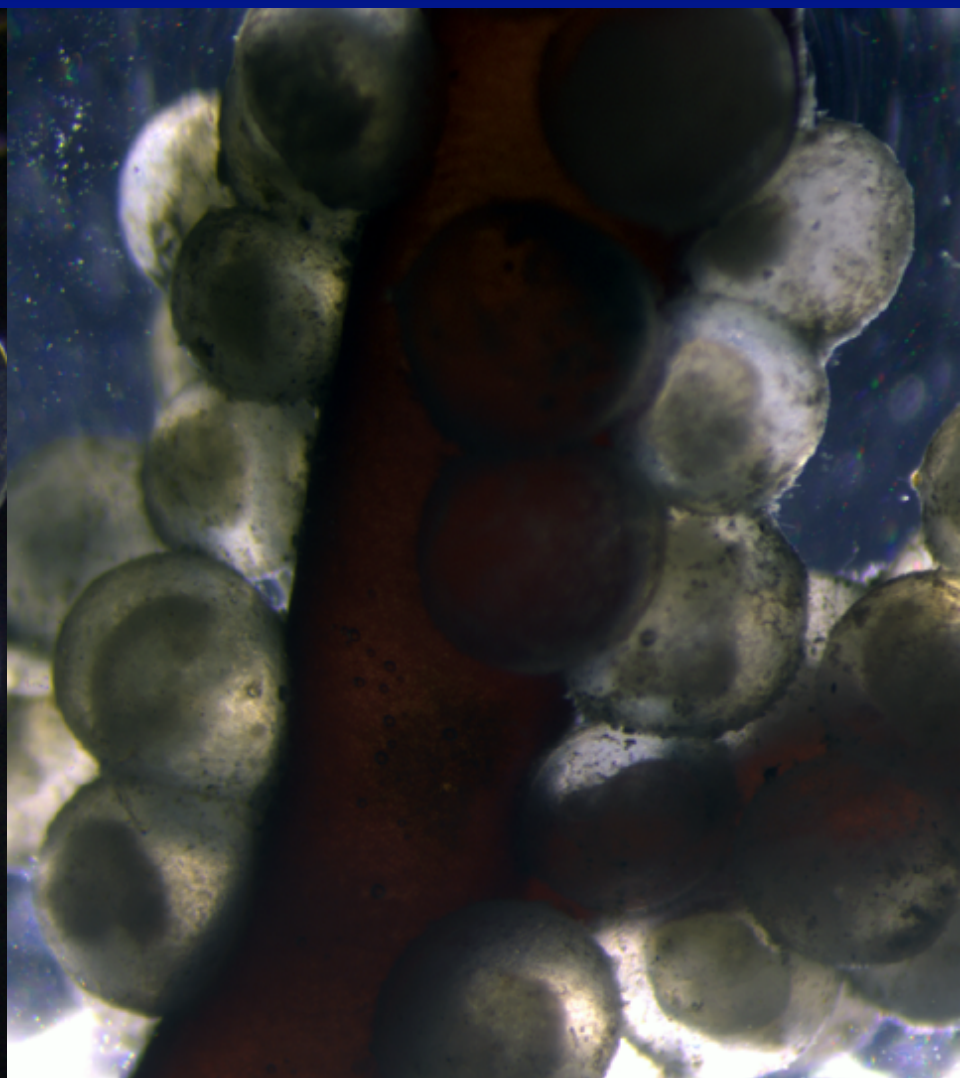
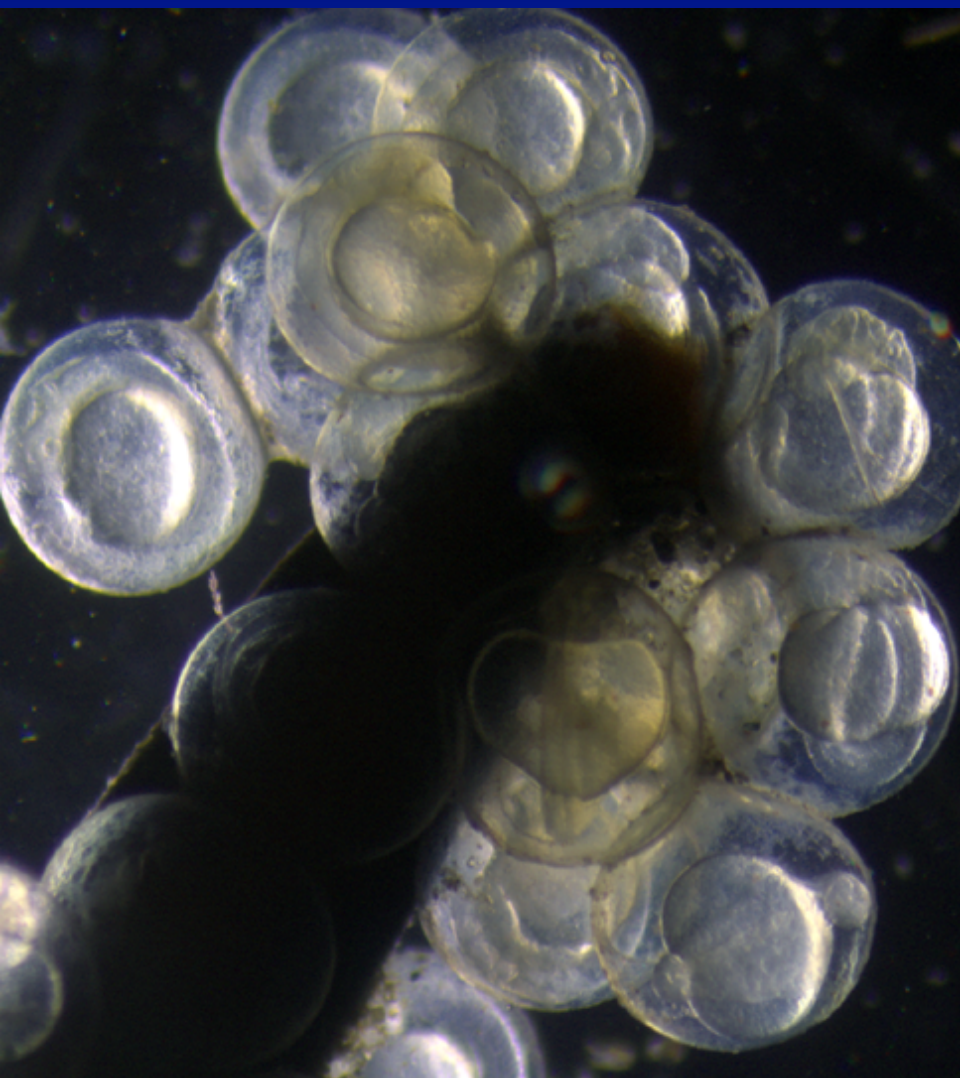
Quilcene



**Port
Orchard/
Madison**



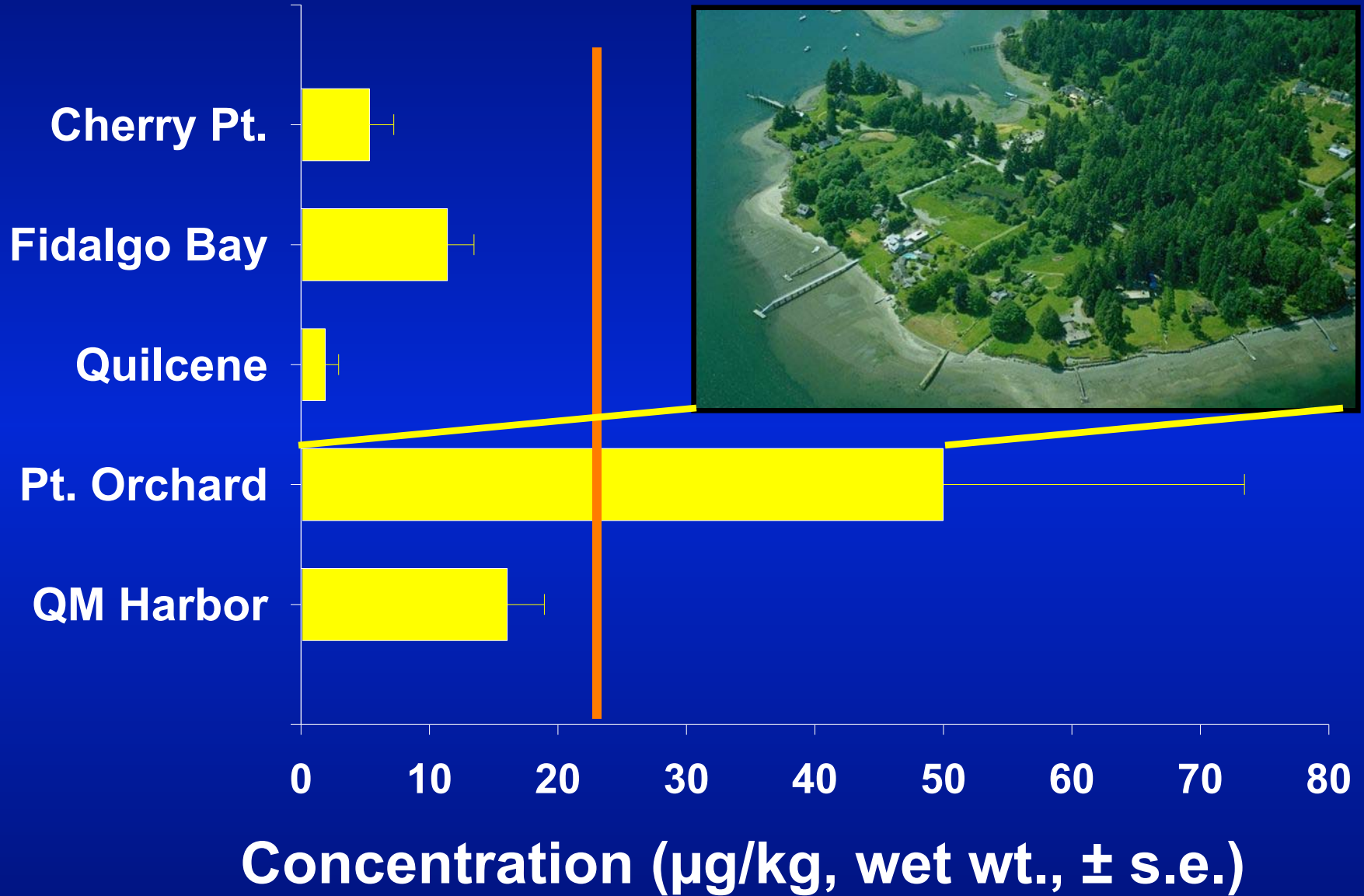
**Quartermaster
Harbor**

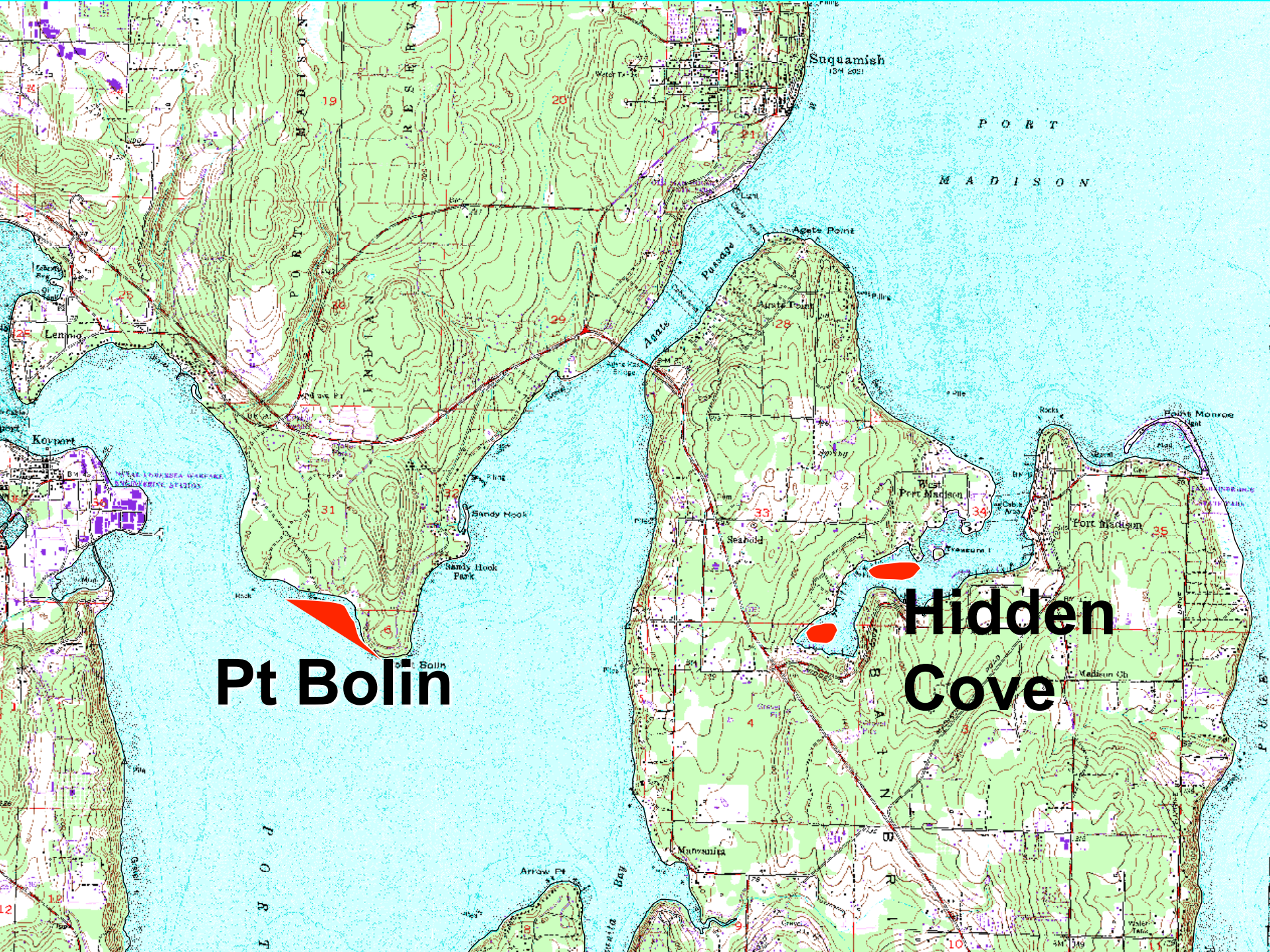




James E. West, Puget Sound Assessment and Monitoring Program, April 18th, 2008

TPAH in Spawned Herring Eggs

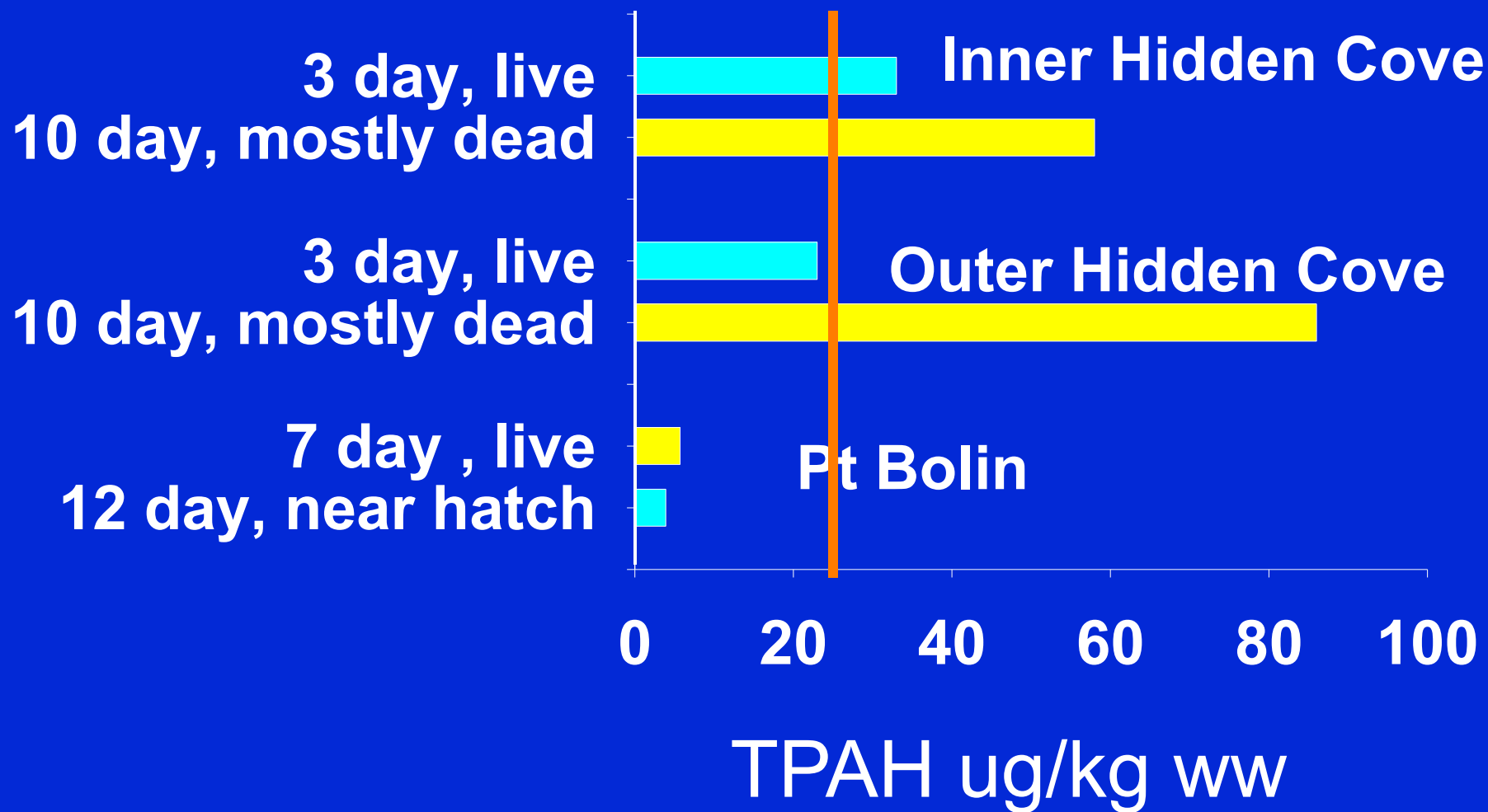




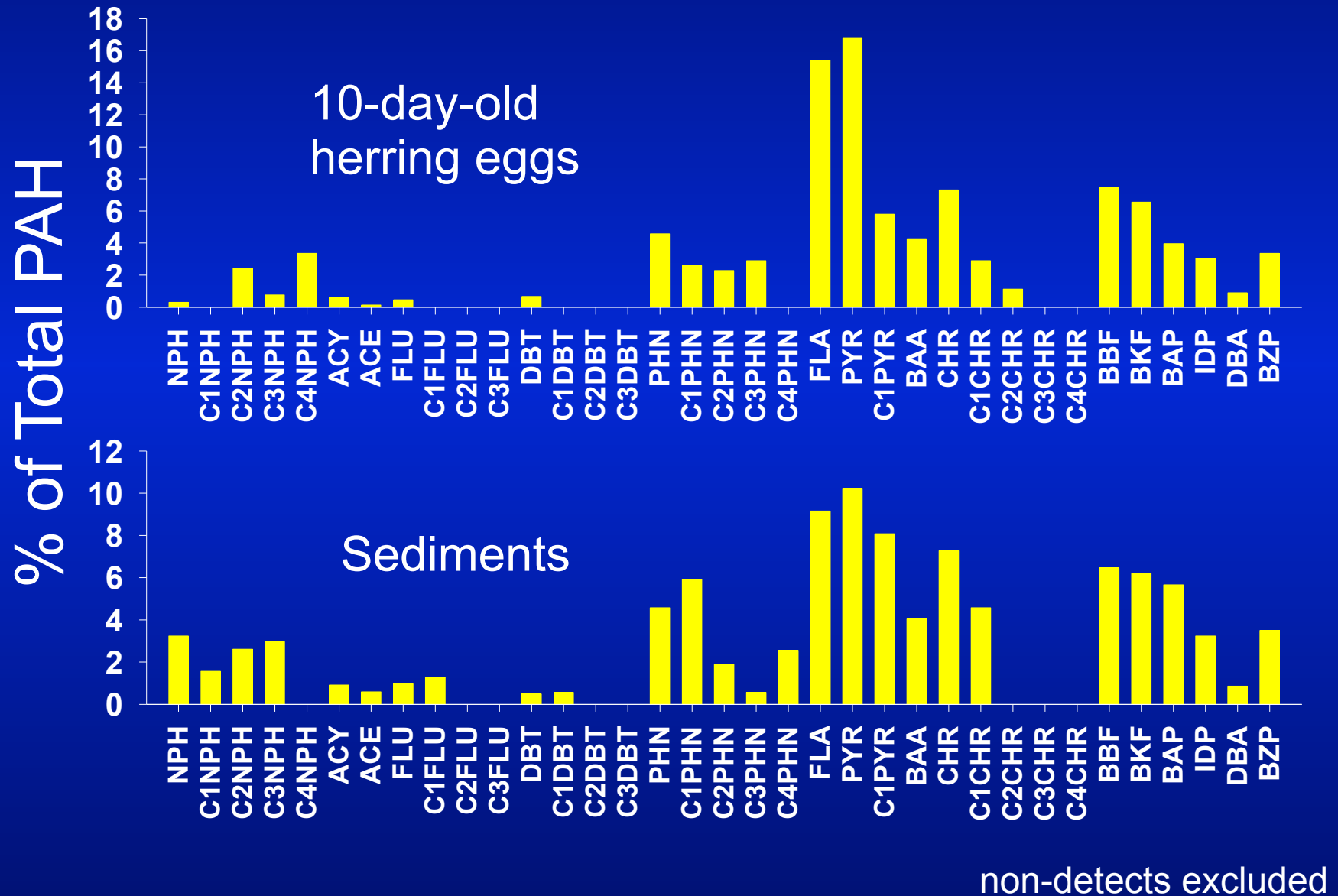
Pt Bolin

**Hidden
Cove**

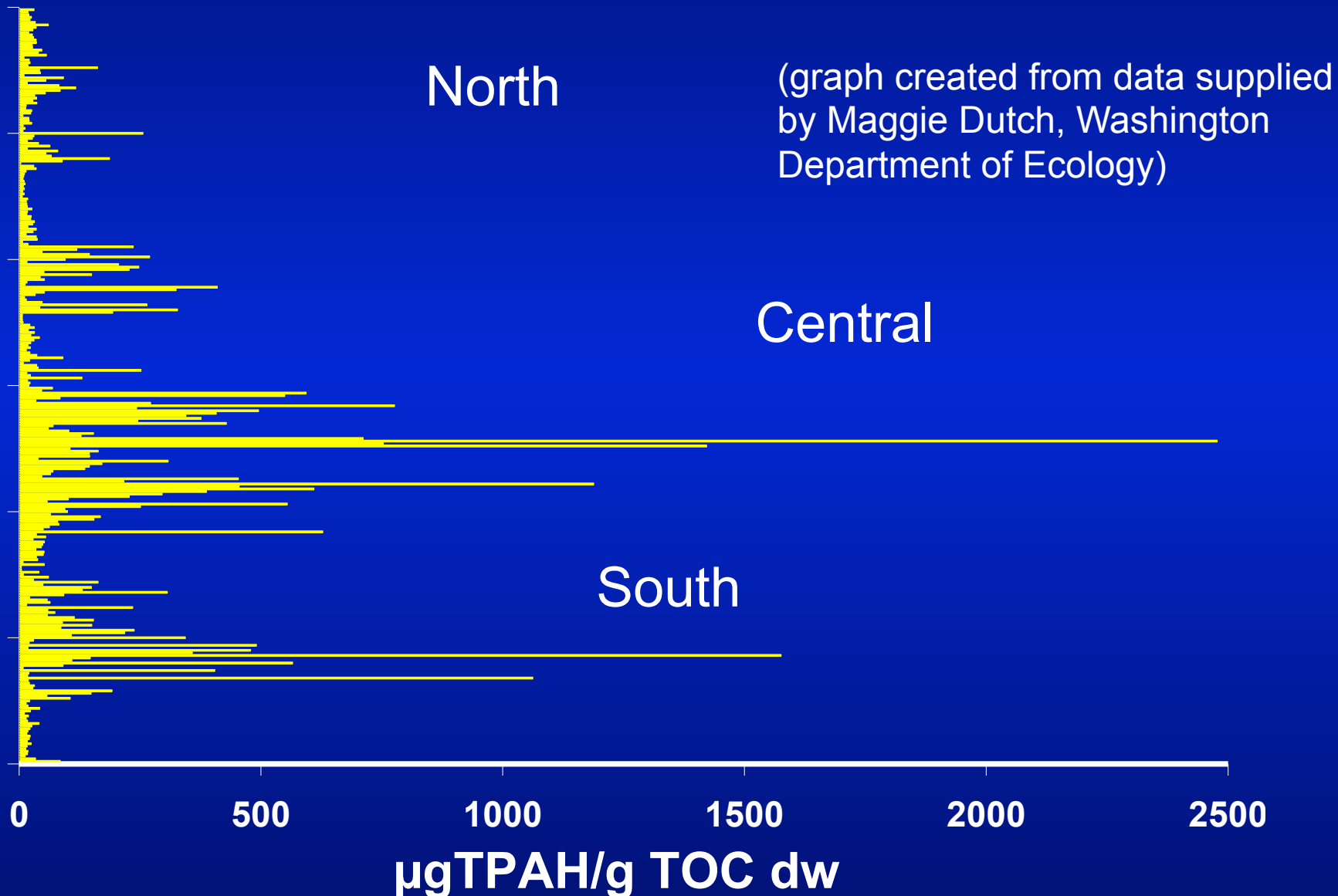
TPAH uptake over time by spawned herring eggs



Are sediments the source of PAHs in Embryos?

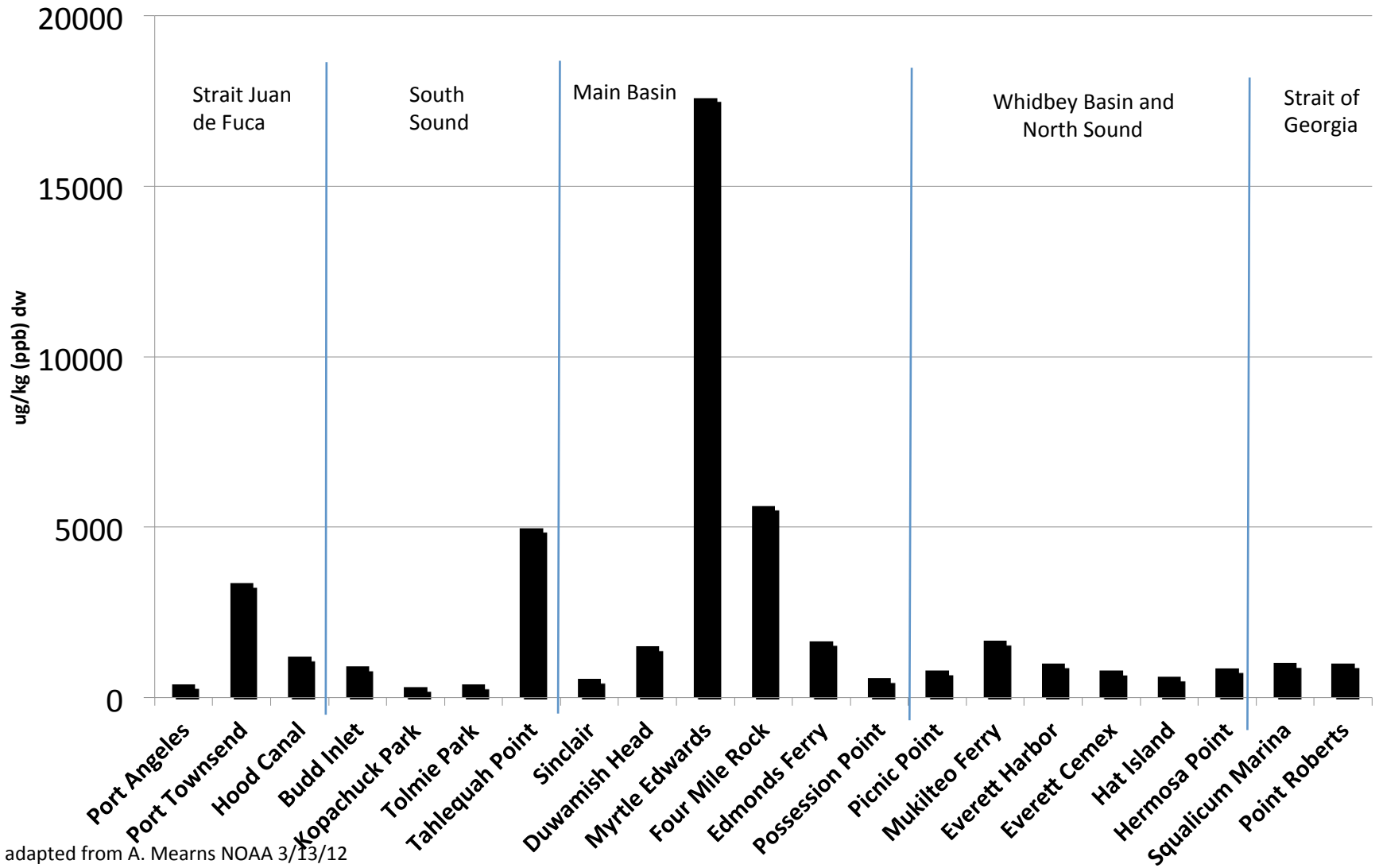


PAH in Sediments from 300 Puget Sound Locations



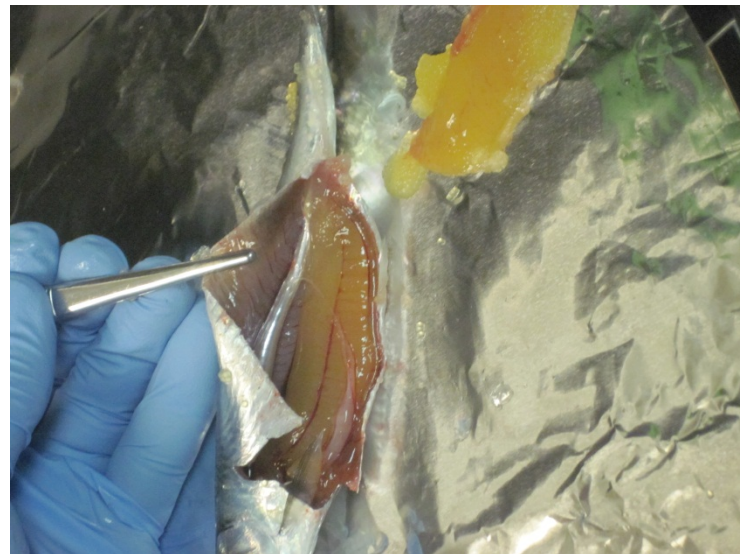


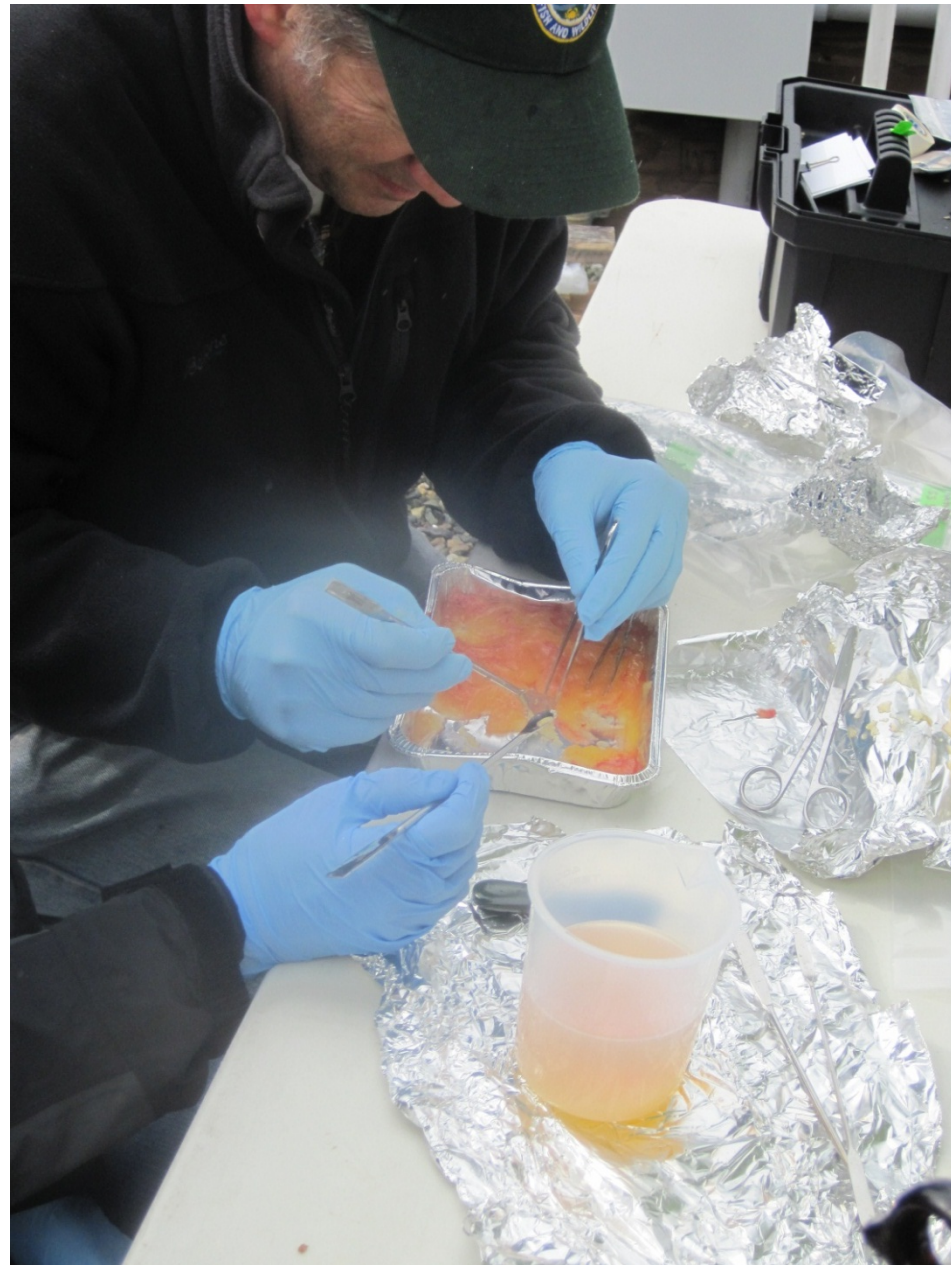
2010 Washington Mussel Watch - Total PAHs

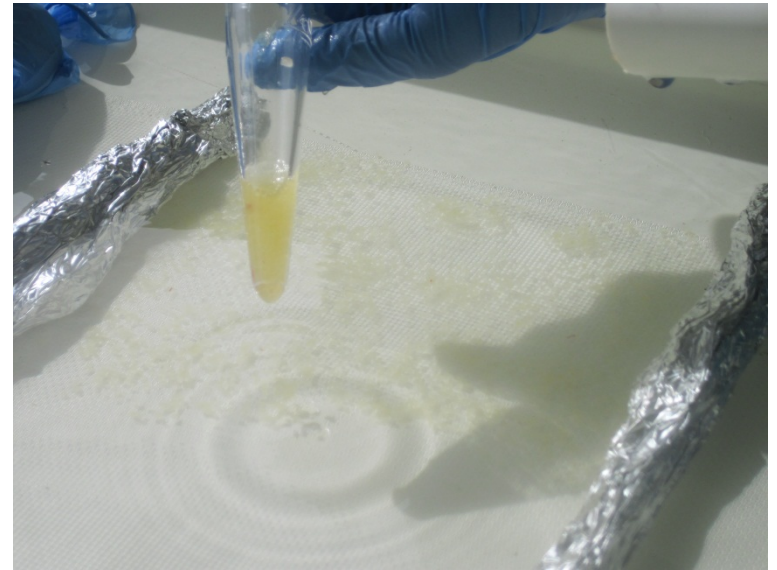


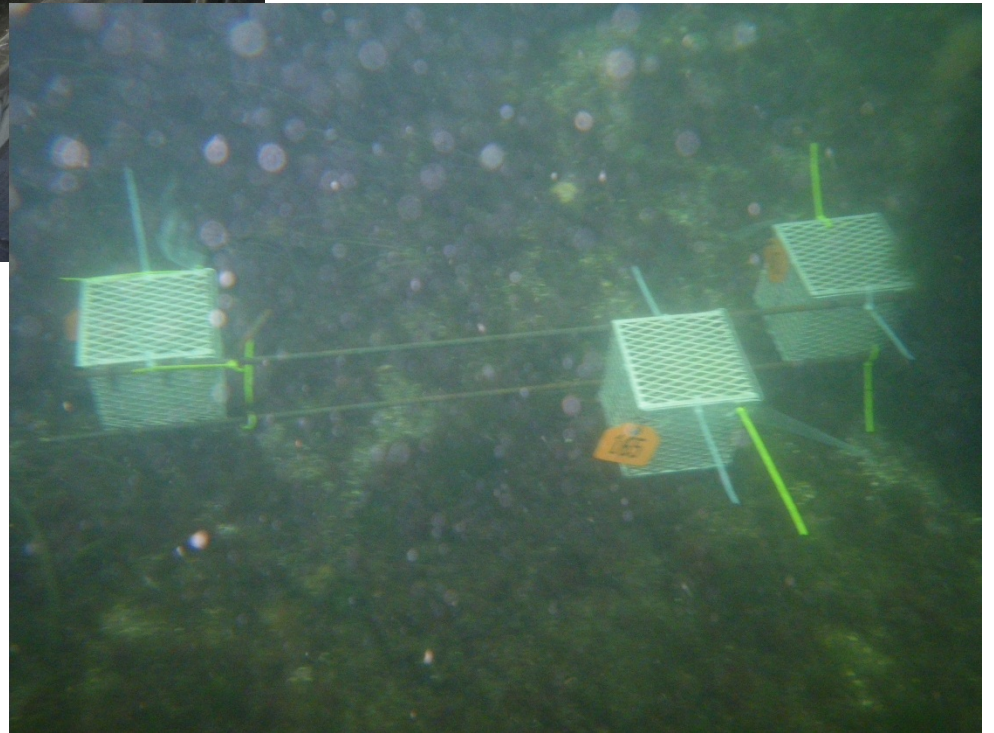
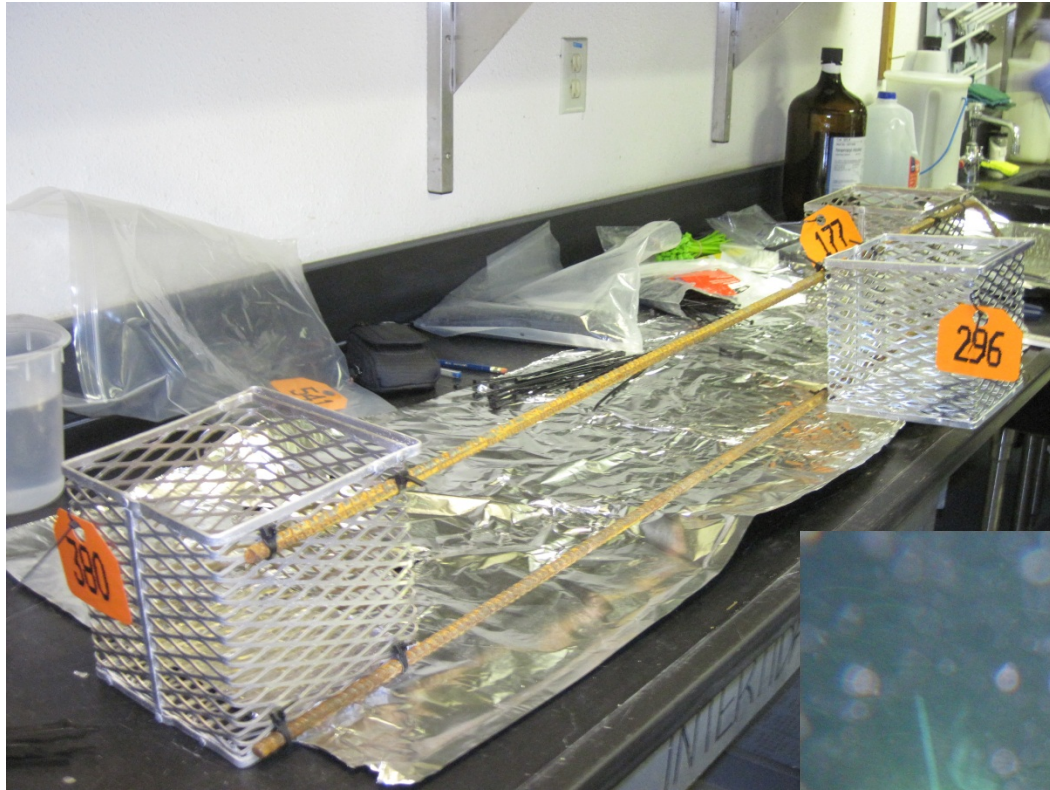
adapted from A. Mearns NOAA 3/13/12

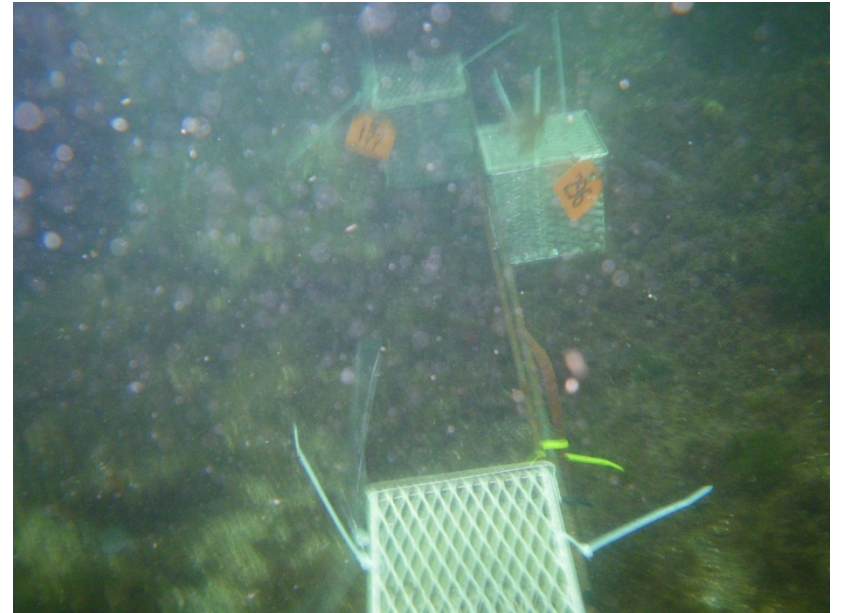


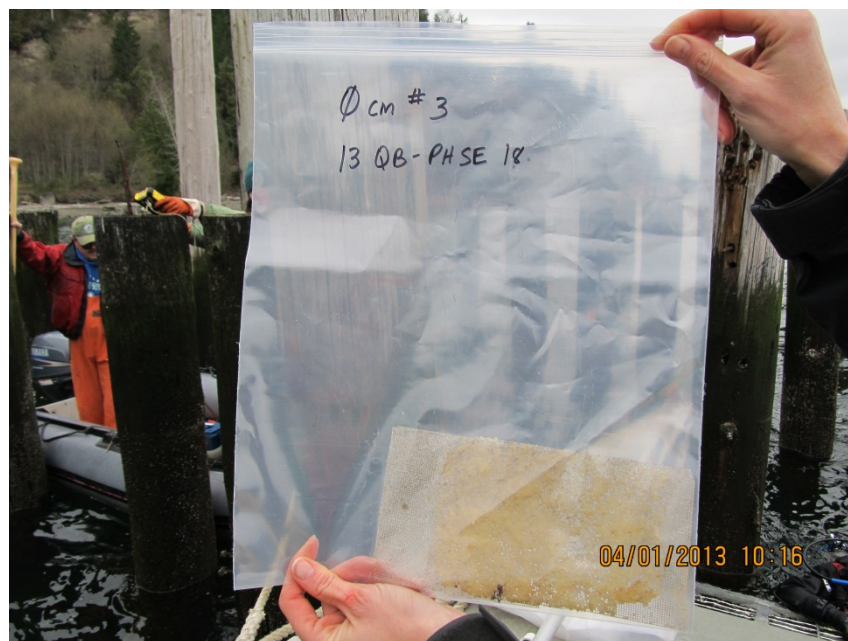












Conclusions (PAHs)

- Herring embryos in a location where chronic mortality occurs exhibited PAH burdens above an effects threshold
- Possible link between environmental PAHs and herring embryo survival
- Herring typically spawn along unpolluted shorelines in Puget Sound – what if they spawn in urban areas where PAHs are very high?