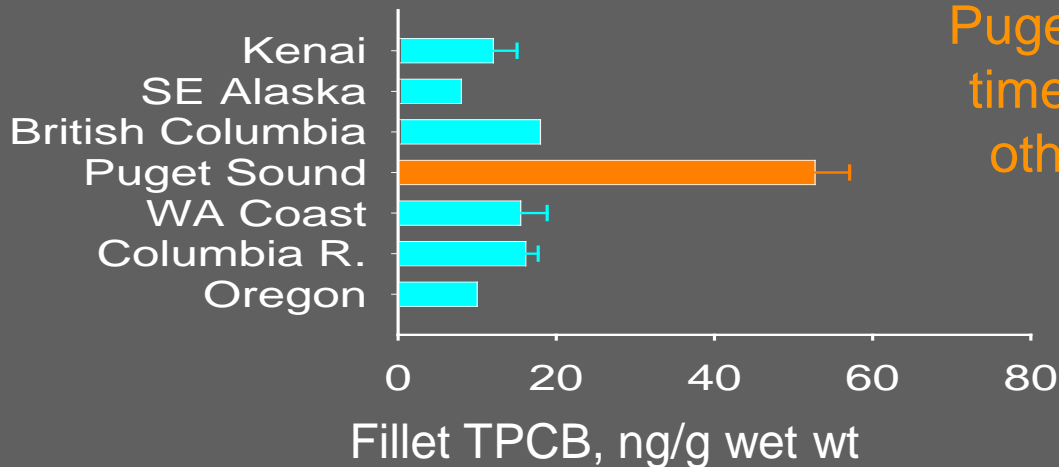


# Elevated contaminants in resident Chinook salmon: a threat to the health of salmon, and to the people and whales that eat the salmon



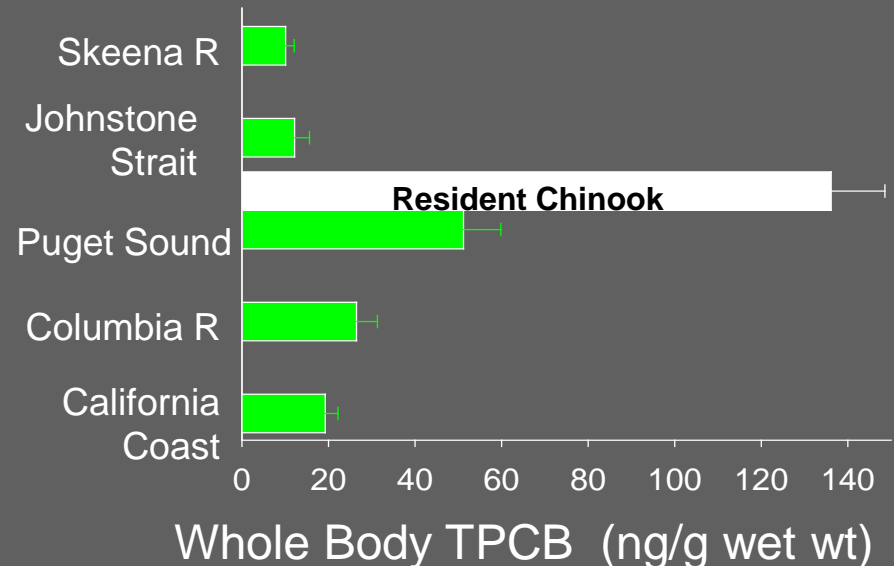
Sandra O'Neill, Andrea Carey and James West  
Washington Department of Fish and Wildlife  
Toxics-focused Biological Observing System (T-BiOS)

# PCBs in adult Chinook salmon



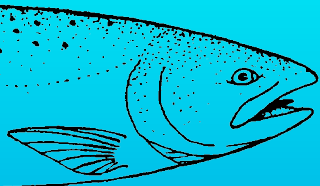
Puget Sound Chinook are 3 to 5 times more contaminated than other west coast populations

About one-third of Puget Sound Chinook are resident, where they are exposed to high PCB levels in their contaminated prey



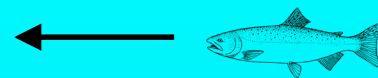
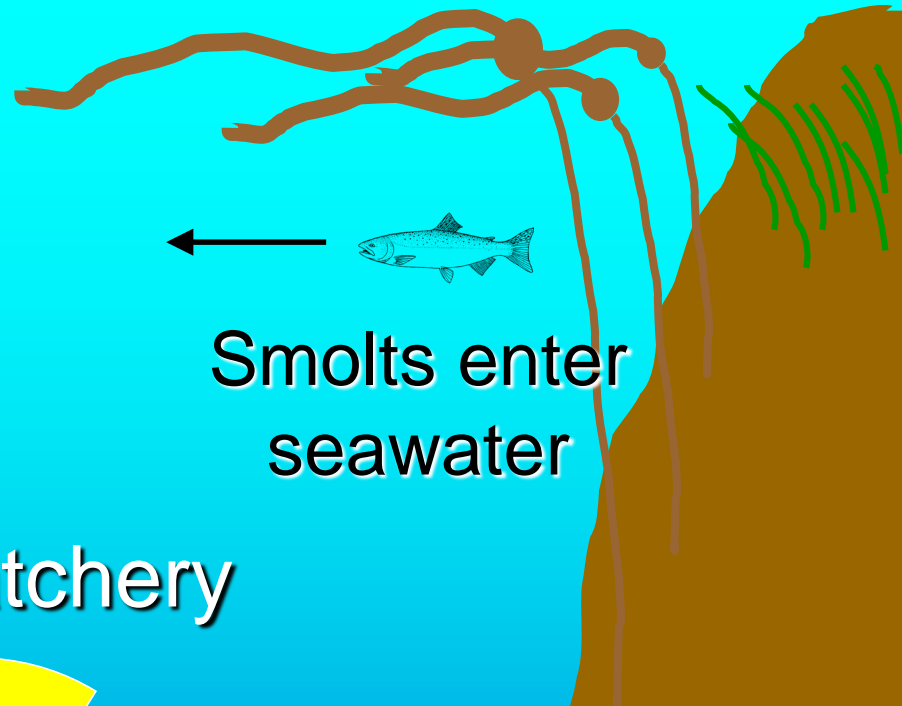
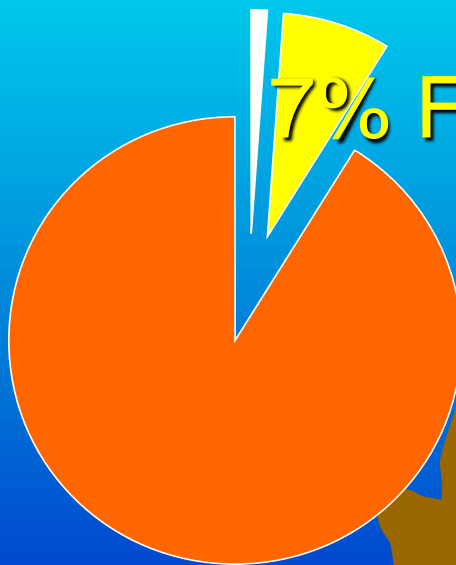
# Sources of PCBs to adult Chinook

Adults return to rivers



1% Hatchery

92% Saltwater  
(Puget Sound  
and ocean)



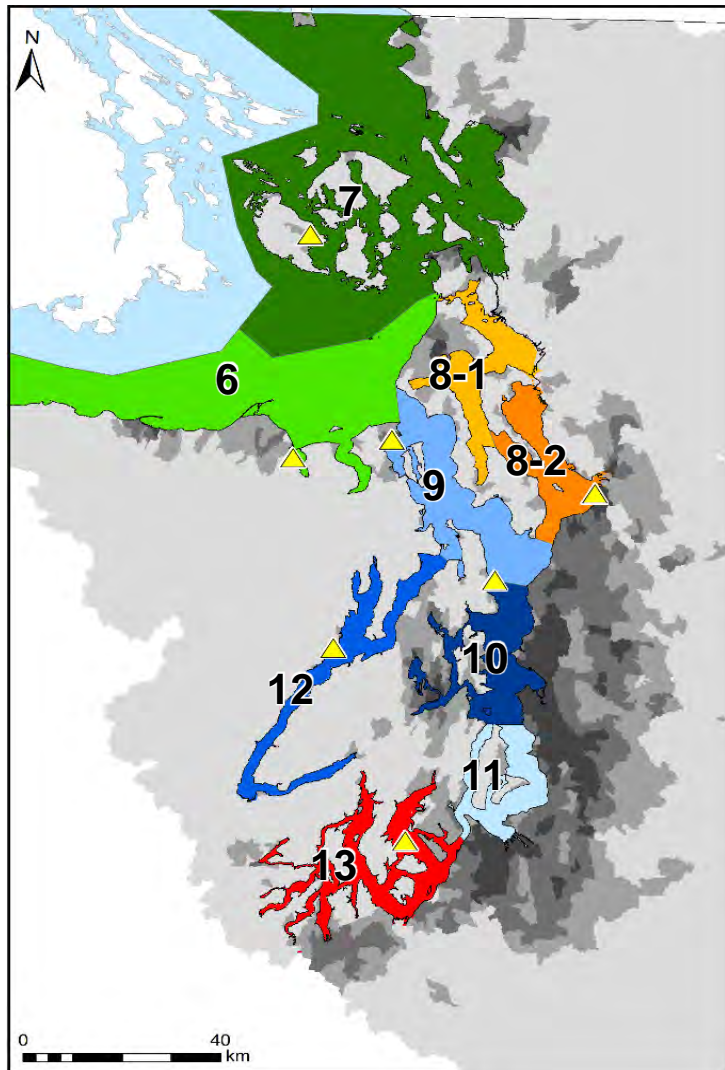
Smolts enter  
seawater

# Study Objective

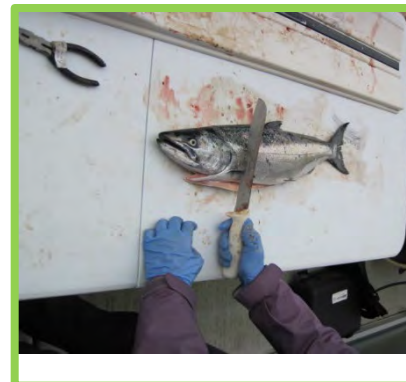
Assess spatial variation in levels of persistent bioaccumulative toxic contaminants in edible tissue of resident Chinook salmon caught by recreational anglers



# Methods

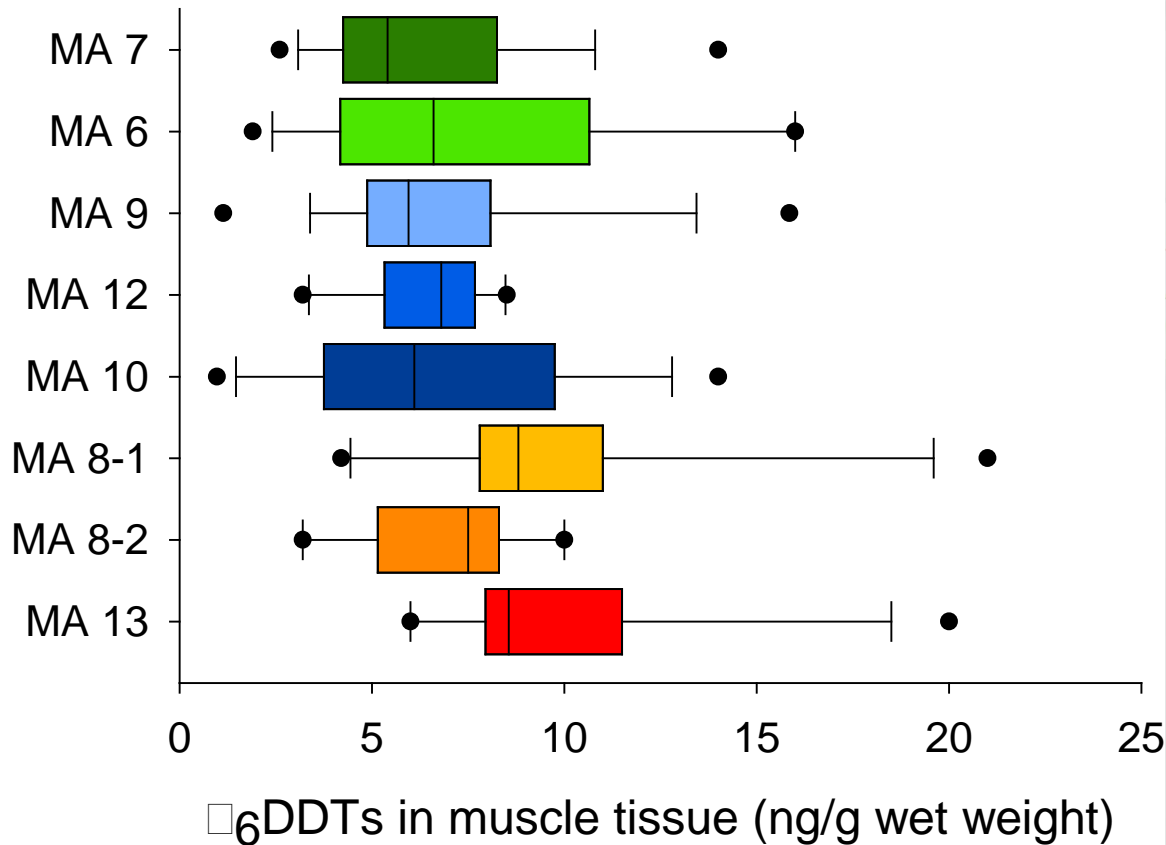


- Donated samples from winter sport fishery in 2016/17 and commercial test fishery in 2016
- 8 Marine Areas
- muscle tissue analyzed for PCBs, PBDE, DDTs



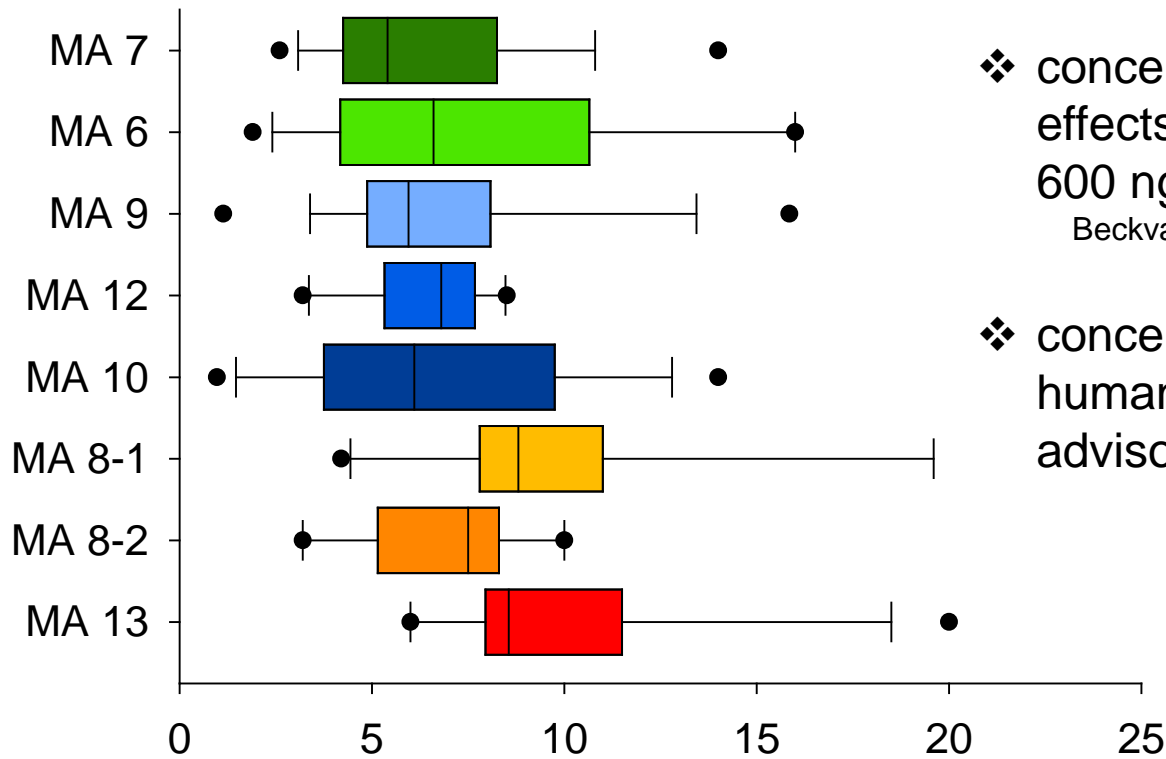
# DDTs in Resident Chinook

Uniformly low levels of DDTs in all marine areas



Are DDT concentrations high enough to be a concern for human health or salmon health?

# DDTs in Resident Chinook



❖ concentrations below adverse effects threshold for fish health - 600 ng/g

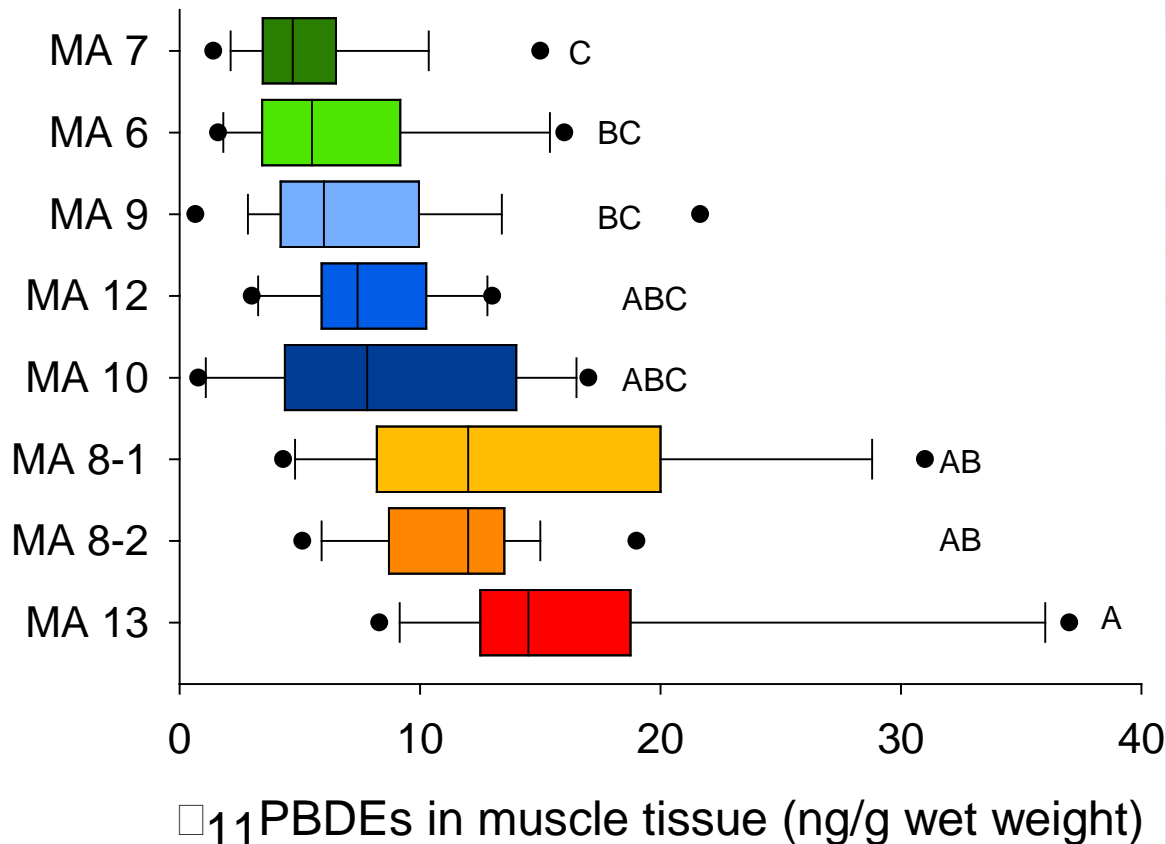
Beckvar et al. 2005, EC&T 24: 2094-2105

❖ concentrations not a concern for human health – no consumption advisories by DOH

□ <sub>6</sub>DDTs in muscle tissue (ng/g wet weight)

# PBDEs in Resident Chinook Salmon

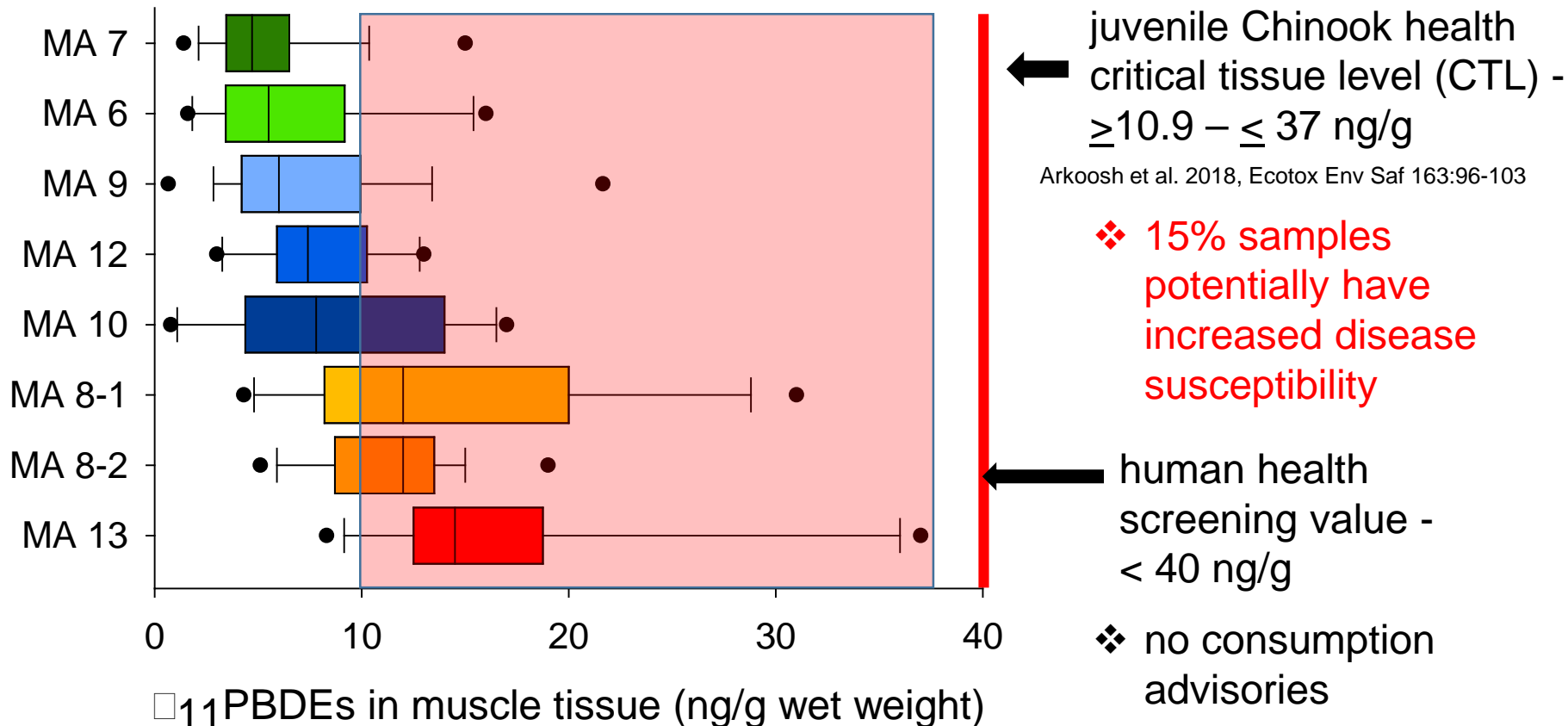
Highest levels in Whidbey & South Sound Basins



Are PBDE concentrations high enough to be a concern for human health or salmon health?

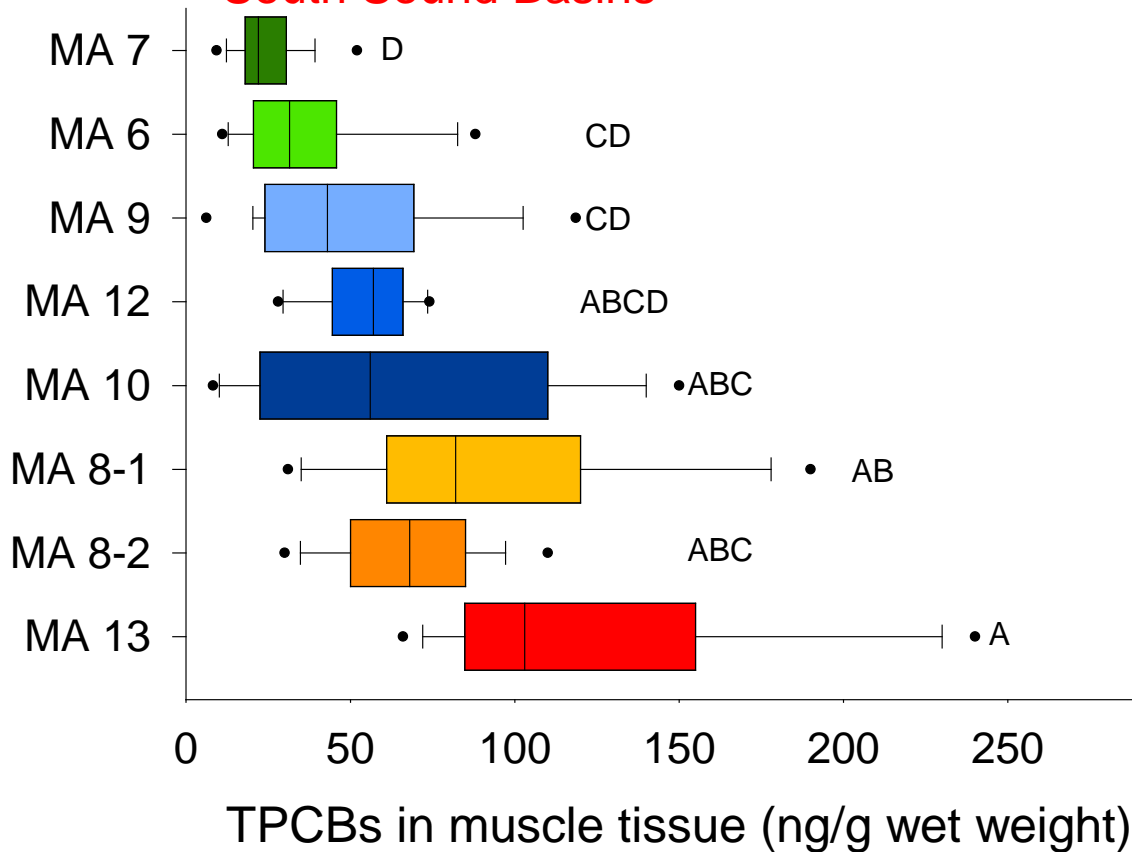


# PBDEs in Resident Chinook Salmon



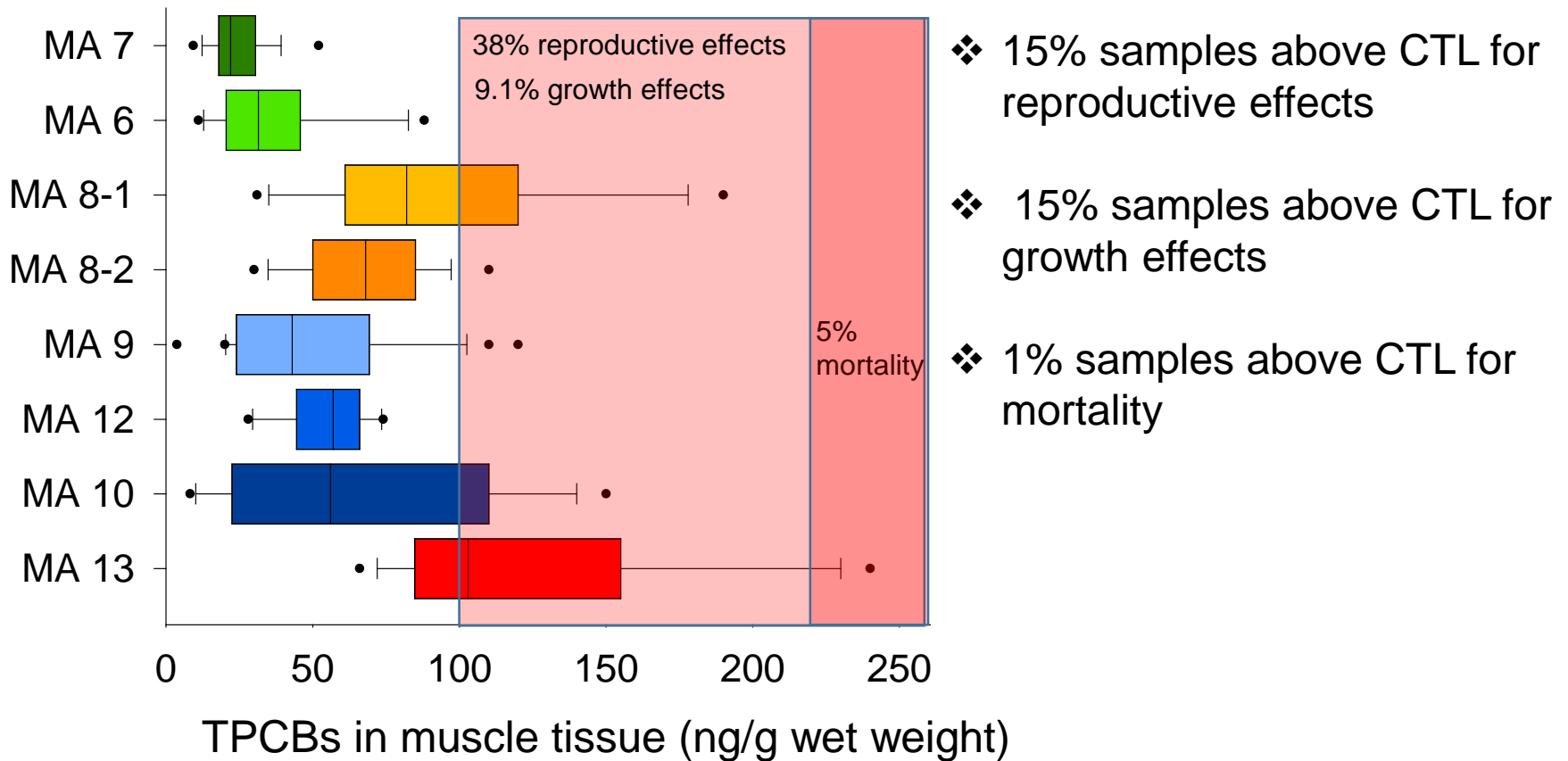
# PCBs in Resident Chinook salmon

Highest levels in Whidbey, Central & South Sound Basins

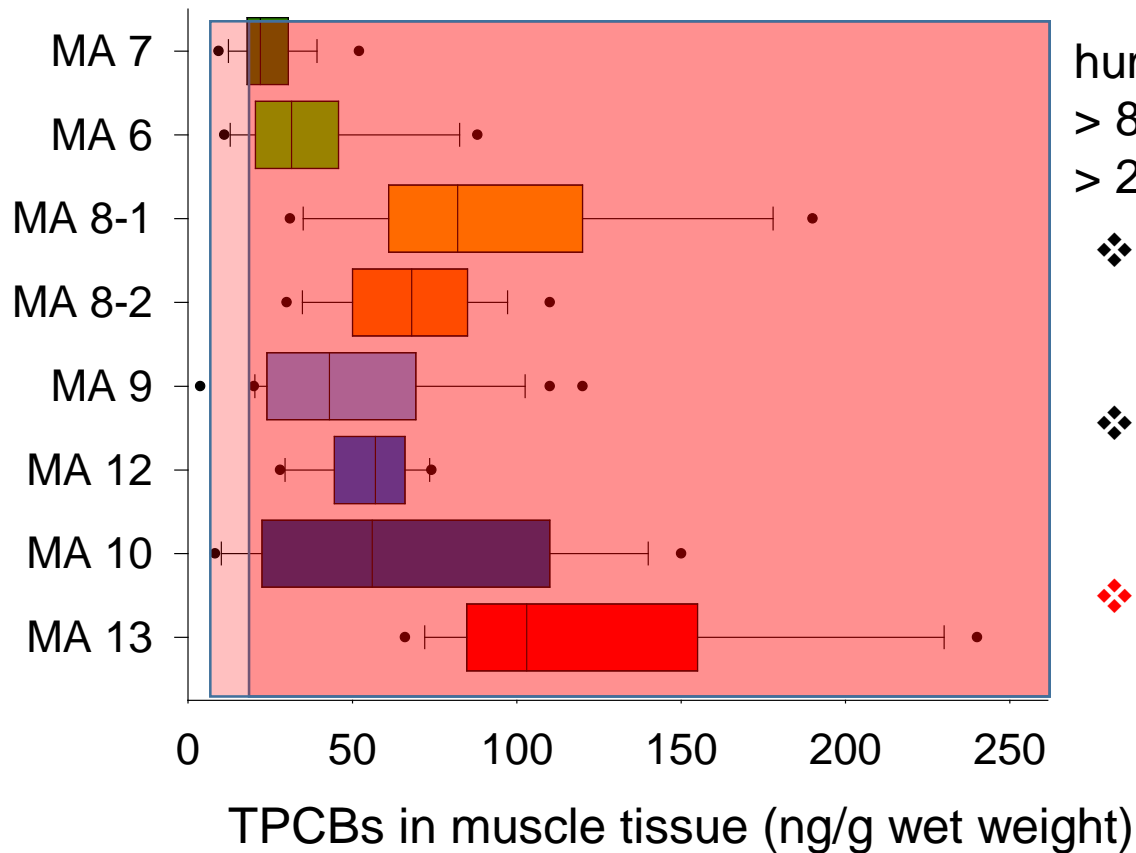


Are PCB concentrations high enough to be a concern for human health or salmon health?

# PCBs in Resident Chinook salmon

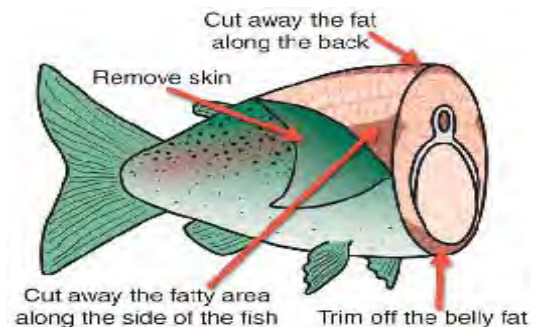


# PCBs in Resident Chinook salmon



human health screening value -  
> 8 ng/g subsistence consumer  
> 23 ng/g average consumer

- ❖ 99% samples above screening values for subsistence consumers
- ❖ 85% samples above screening values for average consumers
- ❖ **current consumption advice - maximum of 2 meals/month**



# Conclusions: Salmon Health

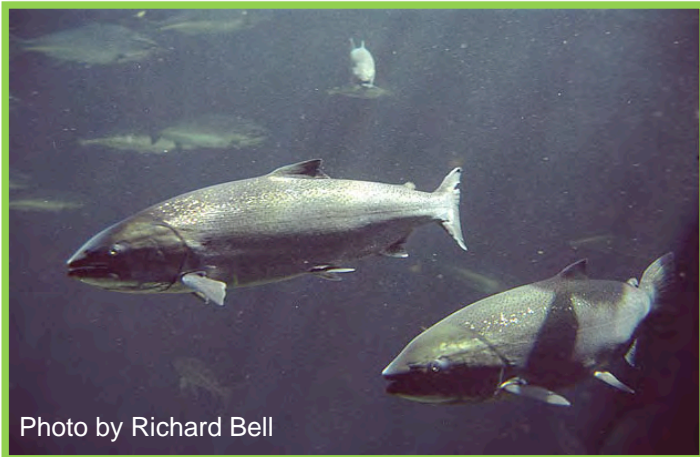


Photo by Richard Bell

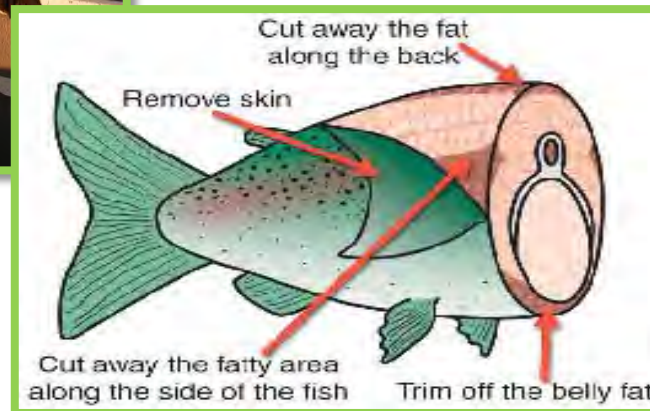


- ❖ **PCBs & PBDEs in resident Chinook high enough to impair their health**
  - ❖ 15% above PCB concentration predicted to cause reproductive and growth effects
  - ❖ 1% above PCB concentration predicted to cause mortality
  - ❖ 15% above PBDE concentration known to cause increased in susceptibility to disease
- ❖ **Percent of fish impaired likely higher**
  - ❖ Resident fish will spend another 5 – 24 months feeding in Puget Sound prior to spawning
  - ❖ Mature fish will have higher contaminant concentration
  - ❖ Cumulative effects of PCB and PBDEs are likely greater than individual contaminants.

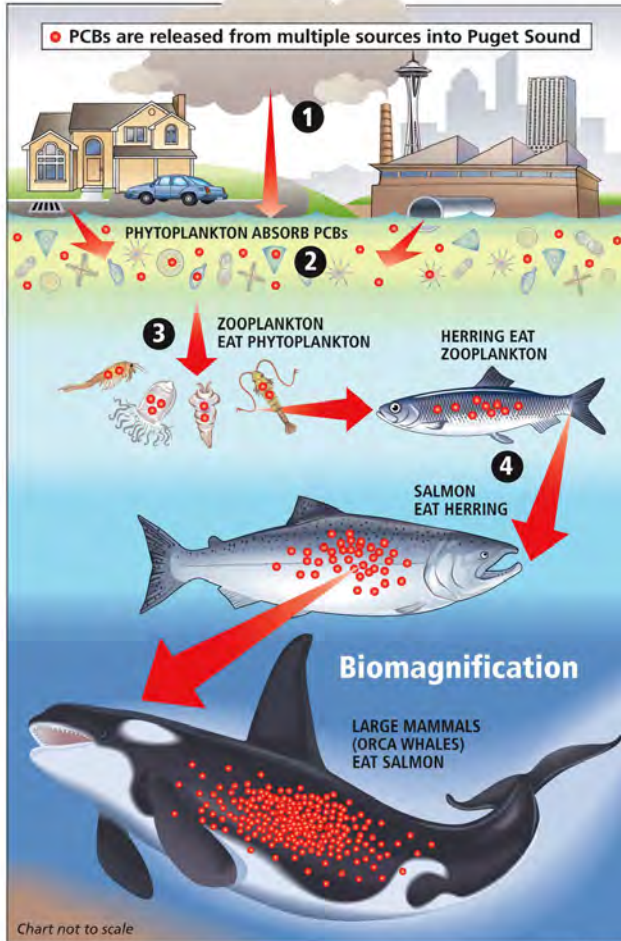
# Conclusions: Human Health



- ❖ PCBs in resident Chinook salmon high enough to potentially affect human health
- ❖ Recommended maximum meal limit = two per month
- ❖ PBDE and DDTs below levels of concern for human health



# Conclusions: Whale Health



- ❖ Prey availability, contaminants and vessel interactions are key threats to conservation of southern resident killer whales
- ❖ PCBs and PBDEs in Puget Sound Chinook salmon bio-magnify in southern resident killer whales, especially for J-pod, to levels high enough to reduce their immunity to disease and cause reproductive disruption
- ❖ PCBs, PBDEs likely contributing factor to low survival of Chinook salmon in Puget Sound, thereby reducing the availability of prey to whales

