



Toxics & Invasive Species: Implications for Habitat Restoration and Effectiveness Monitoring

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Why contaminants & invasive species?

Successful habitat restoration requires consideration of not only habitat structure and function but also:

- *Contaminant effects on biota*
- *Pressures from invasive species*

Lets look at an example from our neighbors to the north...

Stream Restoration



Pre-Spawn Die Off

- Many Puget Sound area streams were restored to enable fish passage in 1990's



- Post-project monitoring, following storm events, revealed widespread die-offs of adult coho returning to spawn in restored-urban streams

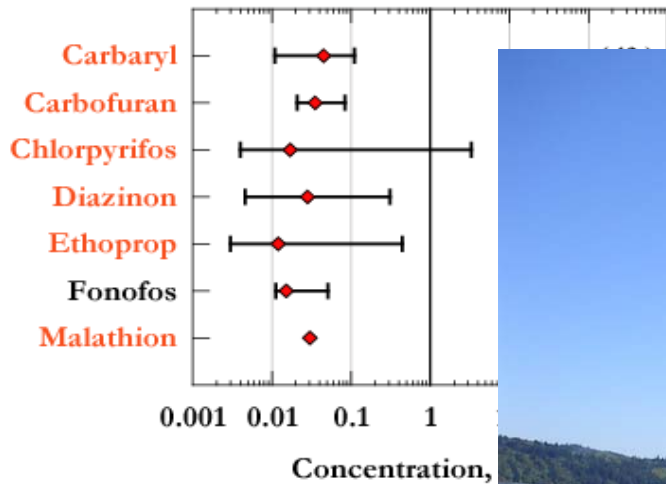


Pre-Spawn Die Off

Contaminants in Columbia River Tributaries --implications to restoration

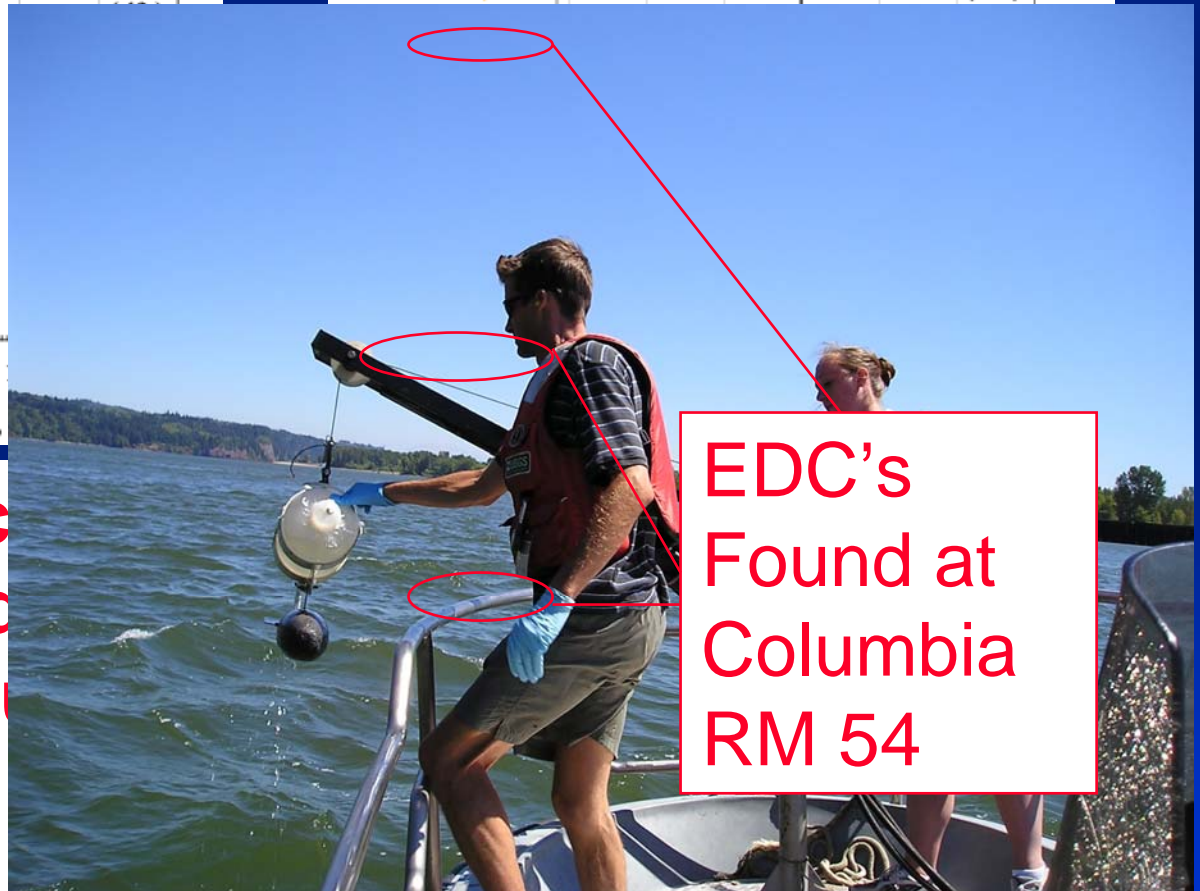


Insecticides



icides and herbicides

2,4-D (20)



EDC's Found at Columbia RM 54

Current use pesticides detected most frequently in the main stem Columbia River

Contaminants in Columbia River Tributaries –implications to restoration

■ Implications

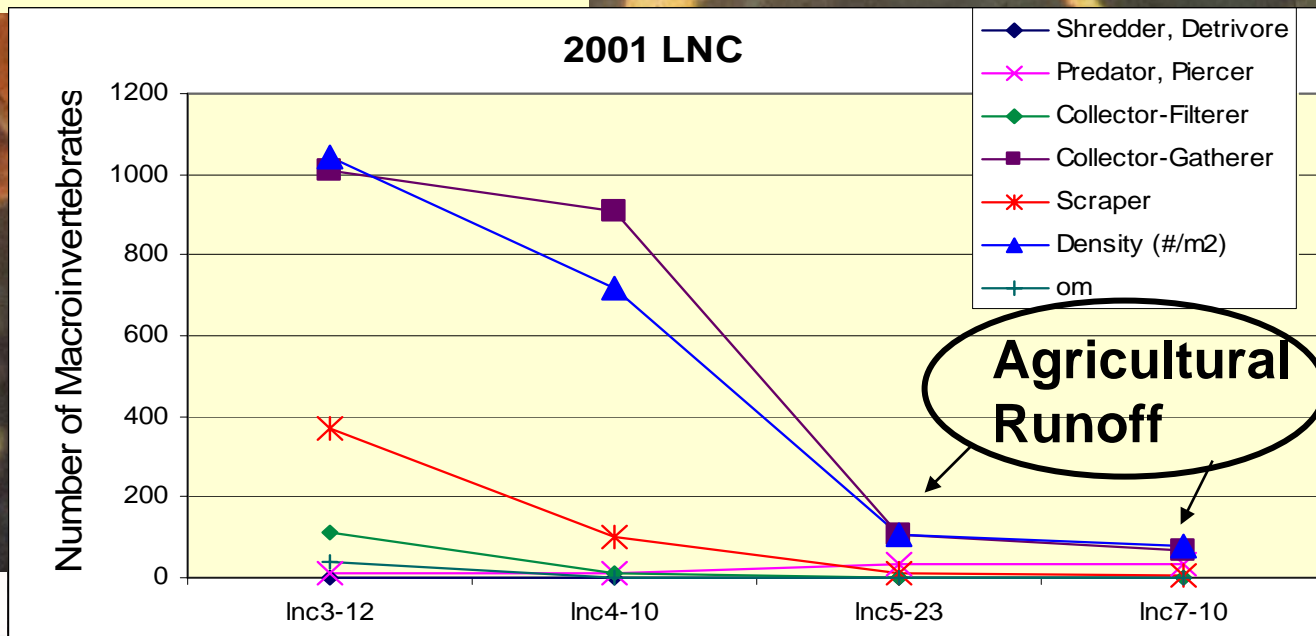
■ Current use insecticides and herbicides

■ Damage to algae & insects

■ Sublethal effects to salmon preferred prey items effected by OP pesticides

■ Endocrine disruption

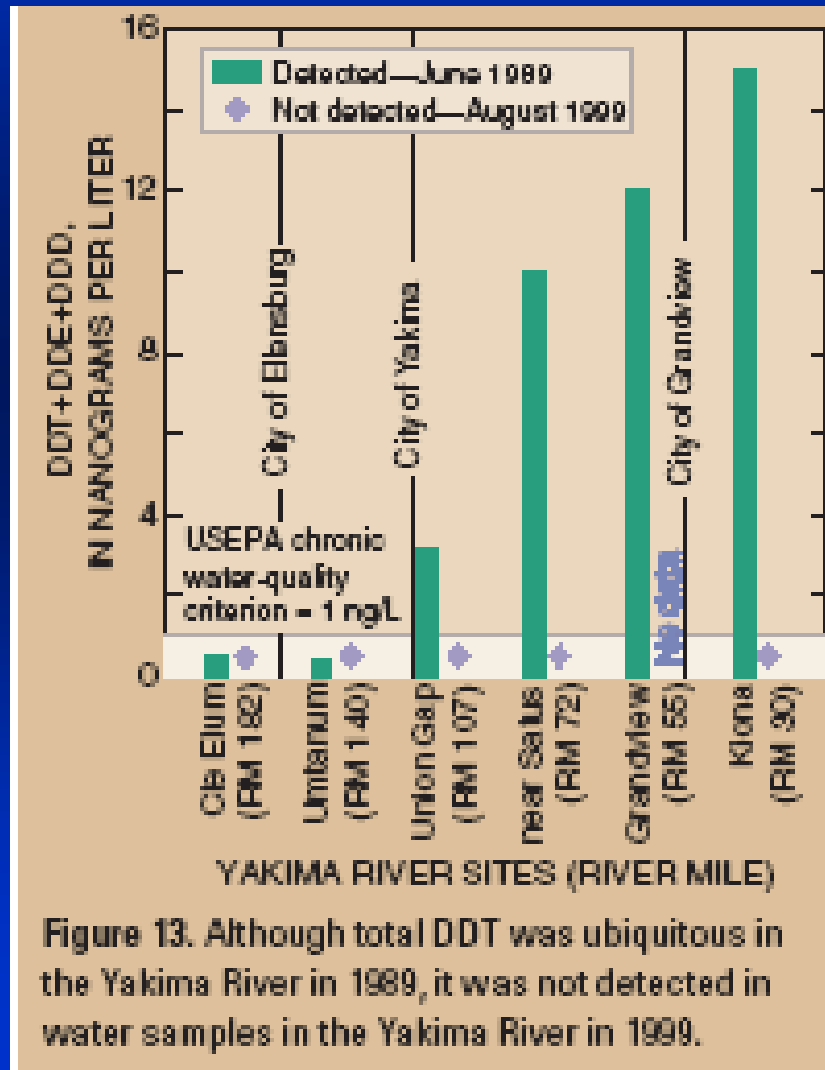
Lower Neil Creek
(ODEQ, Foster and
others, 2007)



Contaminants in Columbia River Tributaries –implications to restoration

Legacy Contaminants

- In water samples from the Yakima River
- Concentrations decreasing as a result of management actions to reduce sediment wash-off from agricultural fields.



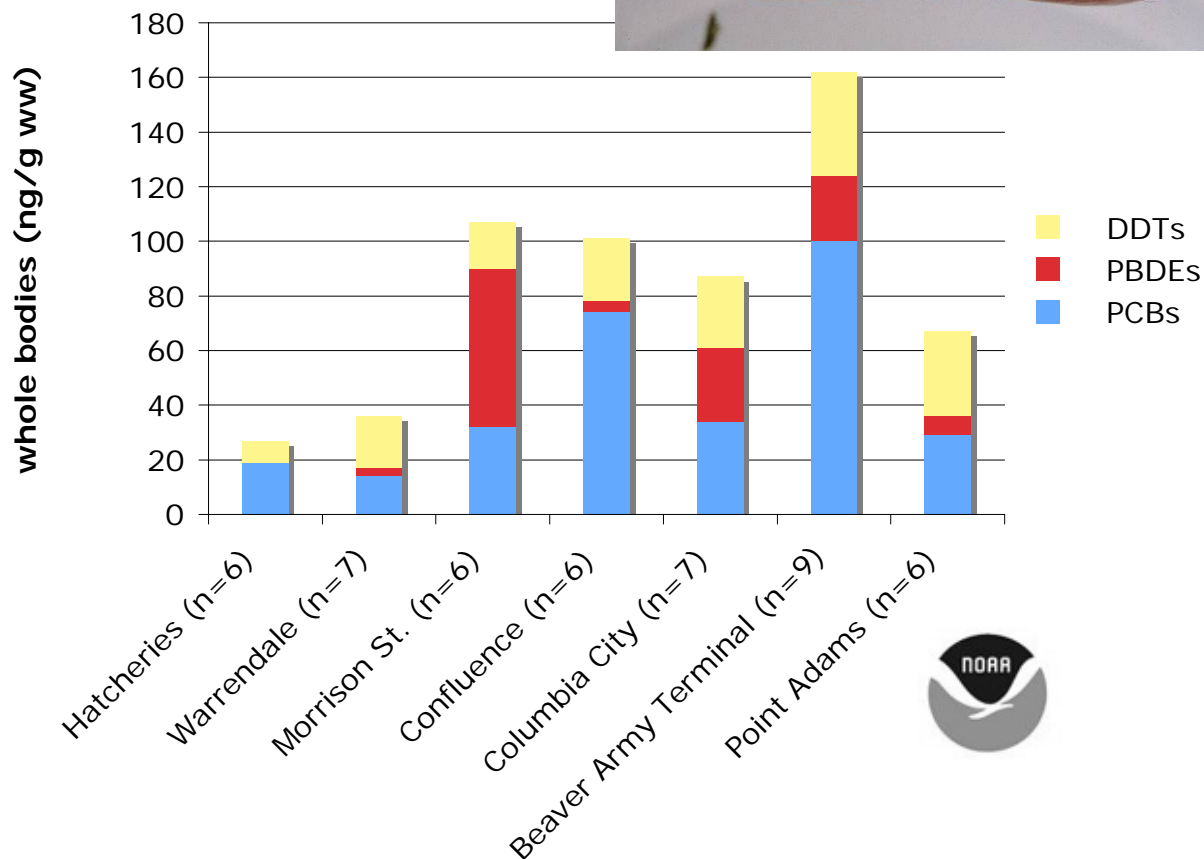
Contaminants in Tributaries –cont.

- Legacy Contaminants
 - In Juvenile Salmon
- Findings:



- Implications:

Main stem sediments play a key role in the movement of “Legacy Contaminants” up the food chain.

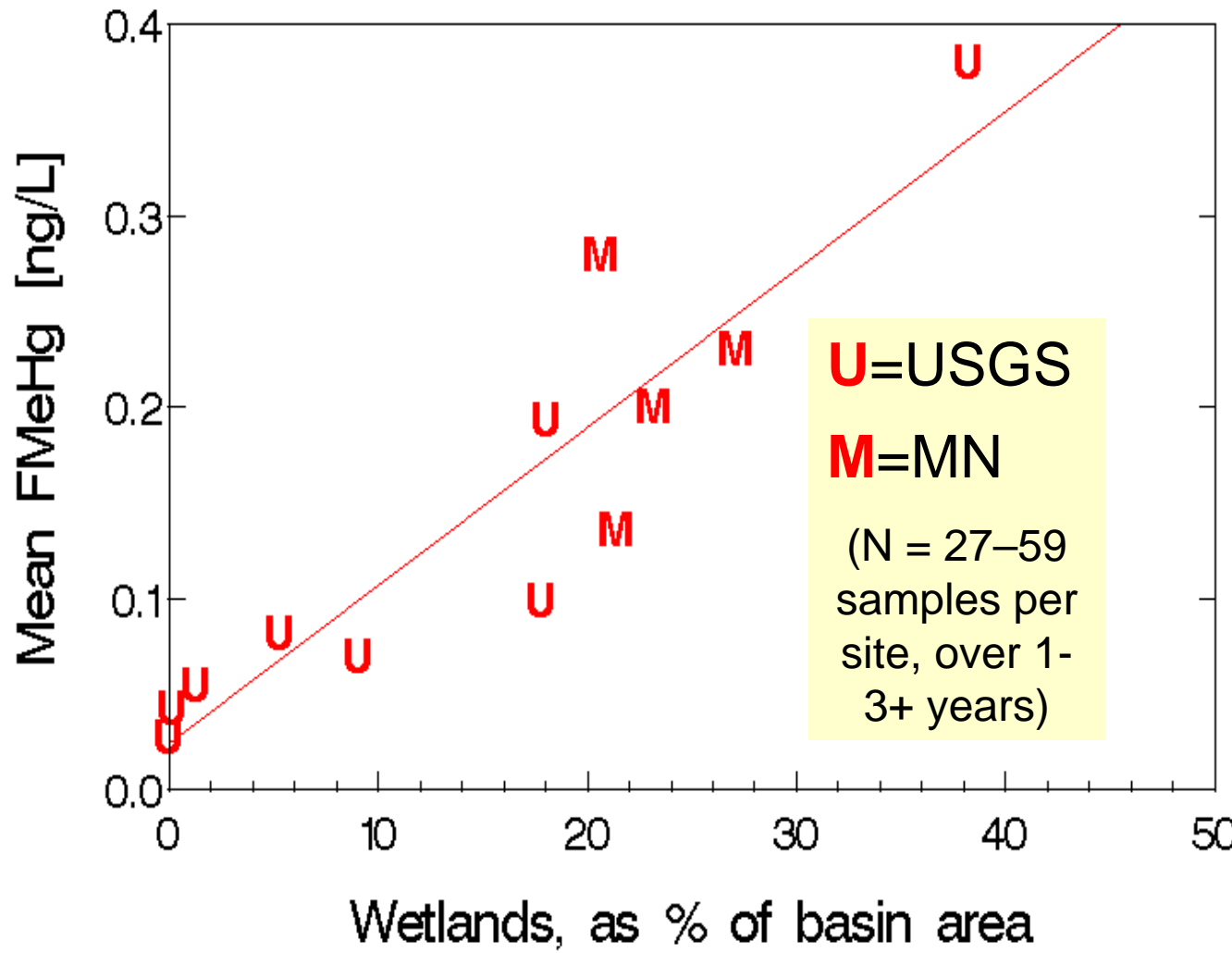


What about Mercury?

Implications

Methyl-mercury production is related to the abundance of wetlands

Wetlands expose lower trophic levels to total and methyl-mercury



What about Mercury?

Comparison of mercury in Osprey eggs by collection years in the Lower Columbia River

Contaminant	1997/98	2004	P
Mercury	0.29 B	0.45 A	0.0028

Note: N=29 for 1997/98 and N=40 for 2004. Mercury in ppm (dw). Value in rows sharing the same letter are not statistically significant

Those Nuisance Pharmaceuticals, Personal Care Products (PPCPs)... Anthropogenic Waste Indicators!



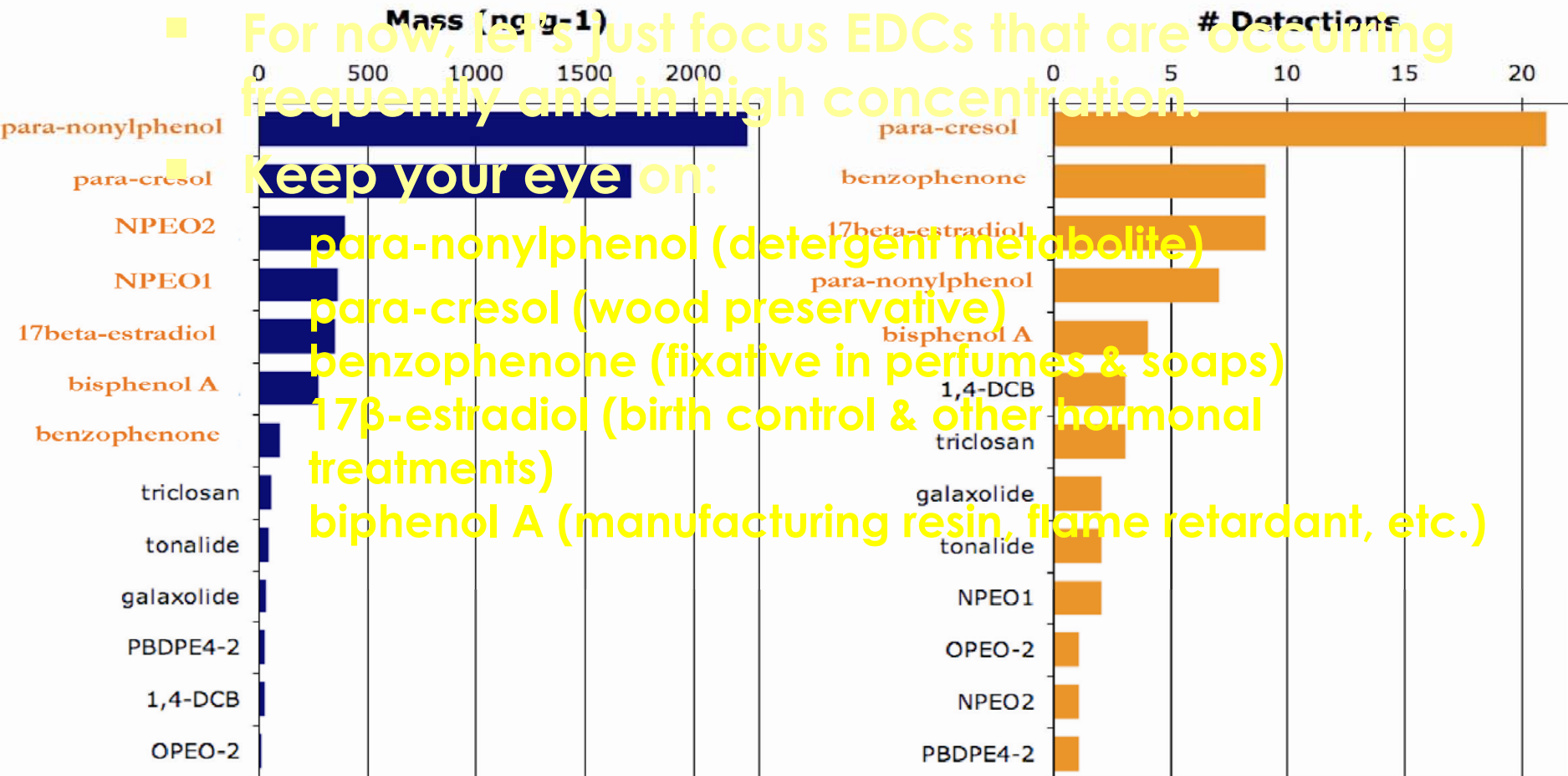
Pharmaceuticals and Personal Care Products

- What's in the water in the Lower Columbia River and the Willamette R. at Portland?
 - Waste Indicators: Caffeine, Bisphenol-A (EDC), Galaxolide (synthetic musk)
 - PPCPs: trimethoprim (antibiotic), anhydro-erythromycin, DEET, acetaminophen, and tylosin (LCREP, 2007)



Pharmaceuticals and Personal Care Products and Waste Indicators –cont.

Known and Suspected EDCs Ranked by Total Mass and by Detection Frequency



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Invasive species in the lower river

Lower Columbia Aquatic Non-indigenous Species Survey (LCRANS), Portland State Univ., 2001-2004

- Established information baseline
- Reviewed studies and sampled 134 sites
- Found 269 aquatic species
 - 92 native
 - 54 introduced
 - 123 unknown origin
- Introduced estimates are conservative

Variety of invasive species

- *Plants*

>100 noxious weeds
(weedmapper.org)

- *Invertebrates*

A new introduced species is
found ~5 months

- *Amphibians*

- *Fish*

- *Mammals*



American shad



Nutria



Bullfrog



Spartina



Purple loosestrife

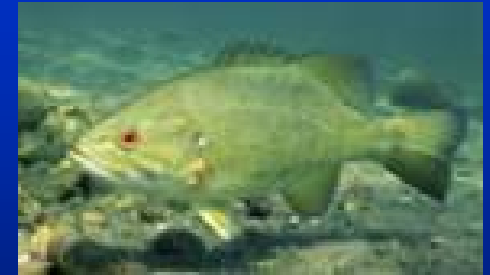
New Zealand mud snail



Corbicula

Invasive species may impact salmon

- *Directly*
 - Competition for space & resources
 - Predation
- *Indirectly*
 - Alter habitat & habitat-forming processes
 - Change food resources
 - Introduce pathogens



Removal of invasive species

- Many restoration projects in the lower river include invasive species removal
- Removal is often necessary for re-establishing native vegetation



Future
invasive
species



Nearby invasive species
populations may be able to
(re) colonize restoration sites



Spread of invasive species: Disturbance

Restoration activities may “disturb” sites



Purple loosestrife

Spread of invasive species: Connectivity

Restoration activities may increase hydrologic or habitat connectivity between previously isolated habitats



Spread of invasive species: Transport

Restoration activities may transport invasive species into new areas

Spartina

- *Likely introduced with native plant material*

Some species can be transported easily in larval stages or as seeds



Typical *S. alterniflora* mats at Willapa Bay, Washington. Photo by: T. Forney, ODA

Effectiveness monitoring and management

- Detection of colonizing invasive species:
 - Requires data with resolution to identify native vs. non-native species
 - May provide new data for lower river
 - *Phragmites*
- Data contributes to site management, method improvement, and sustaining investments



Conclusions: Invasive species

- Restoration may benefit from:
 - Consideration of invasive species & spread via disturbance, connectivity, & transport
 - Effectiveness monitoring for detection and on-going site management of invasive species
- Invasive species monitoring at the landscape scale may provide important context for restoration
 - LCRANS follow-up

Conclusions: Contaminants

- If your restoration planning homework yields some potential stumbling blocks (*past or present urban/agricultural effects*), hedge your bets up front with some contaminant work ...and down the road, gage your success by also considering contaminants as part of an effectiveness monitoring.