



Western Washington University
Western CEDAR

Salish Sea Ecosystem Conference

2014 Salish Sea Ecosystem Conference
(Seattle, Wash.)

May 2nd, 10:30 AM - 12:00 PM

What Goes Down the Drain Eventually Reaches the River: Characterizing Contaminants of Emerging Concern (CECs) in the Columbia River Basin

Jennifer Morace
Geological Survey (U.S.), jlmorace@usgs.gov

Elena Nilsen
Geological Survey (U.S.)

Follow this and additional works at: <https://cedar.wvu.edu/ssec>



Part of the [Terrestrial and Aquatic Ecology Commons](#)

Morace, Jennifer and Nilsen, Elena, "What Goes Down the Drain Eventually Reaches the River: Characterizing Contaminants of Emerging Concern (CECs) in the Columbia River Basin" (2014). *Salish Sea Ecosystem Conference*. 65.

<https://cedar.wvu.edu/ssec/2014ssec/Day3/65>

This Event is brought to you for free and open access by the Conferences and Events at Western CEDAR. It has been accepted for inclusion in Salish Sea Ecosystem Conference by an authorized administrator of Western CEDAR. For more information, please contact westerncedar@wvu.edu.

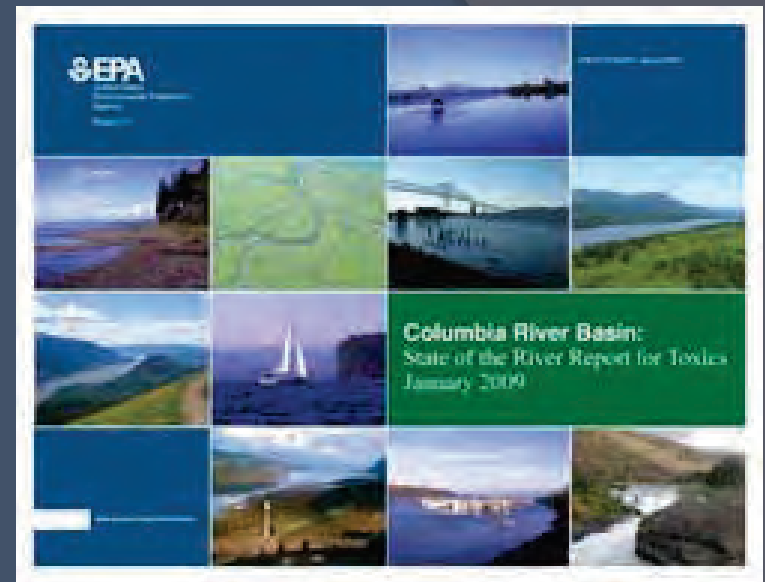


WHAT GOES DOWN THE DRAIN EVENTUALLY REACHES THE RIVER: CHARACTERIZING CONTAMINANTS OF EMERGING CONCERN IN THE COLUMBIA RIVER BASIN

Jennifer Morace, USGS Oregon Water Science Center

First Steps...

- Targeted at known knowledge gaps
- Characterize important pathways of contaminant transport to Columbia River
- Begin to offer information on a broad suite of toxics that will help water managers and policy makers make informed decisions



EPA 910-R-08-004 / January 2009

Columbia River Inputs Study

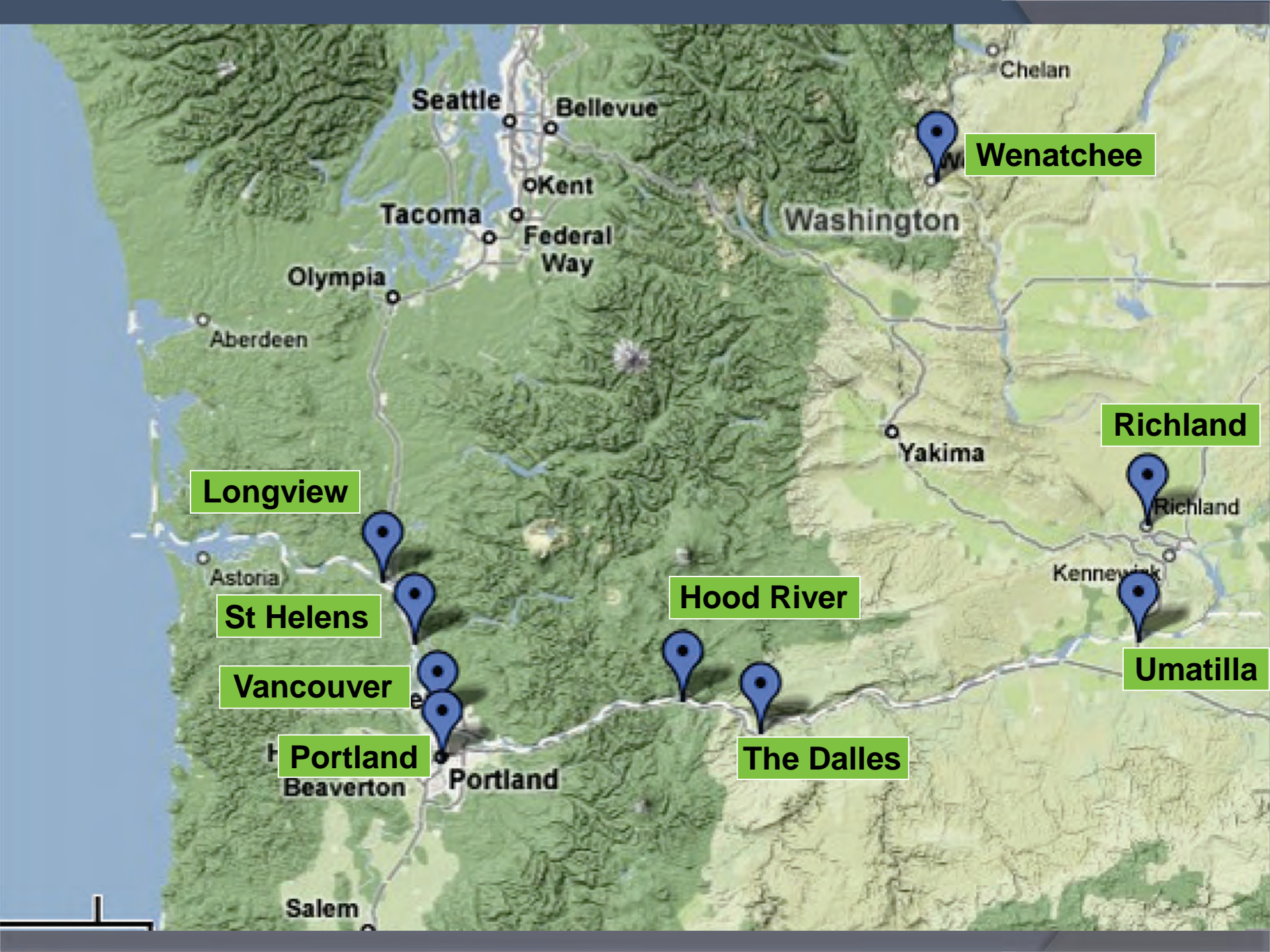
- Characterize pathways contributing directly to the Columbia River



- WWTP effluent



- Stormwater runoff



Longview

St Helens

Vancouver

Portland

Hood River

The Dalles

Wenatchee

Richland

Umatilla

Seattle

Bellevue

Kent

Tacoma

Federal Way

Olympia

Aberdeen

Astoria

Beaverton

Portland

Salem

Washington

Chelan

Yakima

Kennewick

Richland

Contaminants analyzed in WWTP effluent

- Pharmaceuticals
- Anthropogenic-indicator compounds
- Organochlorine compounds
- PCBs
- PBDEs
- Mercury
- Currently used pesticides
- Estrogenicity



Hood River Wastewater Treatment Plant

Contaminants measured in WWTP effluents

Percent of compounds detected

0 10 20 30 40 50 60 70 80 90 100



Percent of detection at each WWTP sampled

	Total # analyzed	Wenatchee	Richland	Umatilla	The Dalles	Hood River	Vancouver	Portland (am)	Portland (noon)	Portland (pm)	St. Helens	Longview
plasticizers	4	100	50	25	50	25	50	25	75	50	100	100
steroids	4	100	100	75	75	75	75	75	75	75	100	100
detergent metabolites	8	50	38	0	50	50	38	63	63	63	63	63
pharmaceuticals	59	53	34	41	54	47	47	46	47	47	42	59
personal care products	15	60	33	47	47	53	40	47	53	47	53	80
PAHs	9	0	11	0	11	0	0	11	11	11	22	44
flame retardants	17	82	76	76	82	82	82	82	82	82	82	65
miscellaneous	17	47	24	29	35	24	24	35	35	47	35	53
PCBs	18	44	0	0	0	0	0	0	0	0	6	11
pesticides	104	12	12	18	15	13	16	9	13	9	13	15
overall	255	37	25	28	33	29	30	29	32	30	33	40

Compounds found at all WWTPs

maximum concentrations shown in micrograms per liter (ppb)

- Tri(2-chloroethyl)phosphate – 0.65
- Tri(dichloroisopropyl)phosphate – 0.69
- Benzophenone – 0.28
- 1,4-Dichlorobenzene – 0.88
- Galaxolide (HHCB) – 2.5
- Cholesterol – E 6.3
- 3-*beta*-Coprostanol – E 5.8
- *beta*-Sitosterol – E 3.2
- PBDE congeners (47, 66, 85, 99, 100, 153, 154)
- *trans*-Chlordane – 0.00019

Pharmaceuticals found at all WWTPs

maximum concentrations shown in micrograms per liter (ppb)

- Iminostilbene – 0.4
- Citalopram (Celexa, Cipramil) – 0.5
- Diltiazem – 0.4
- Lidocaine – 0.4
- Methocarbamol (Robaxin)– 13
- Phenobarbital – 0.2
- Tramadol (Ultram) – 0.4
- Carbamazepine – 0.12
- Phenytoin (Dilantin) – 0.6
- Diphenhydramine (Benadryl, Motrin PM, ...) – 0.11

Diphenhydramine

- Antihistamine
- Uses
 - Relieves allergy and cold symptoms
 - Prevents and treats motion sickness
 - Treats insomnia
 - Controls abnormal movements (Parkinson's syndrome)
- Products
 - 89 different brand names
 - 112 brand names for combination medications



Loadings to the Columbia

- Diphenhydramine in Portland
 - 49 mgd from WWTP
 - Average concentration of 0.064 $\mu\text{g/L}$
 - 10 g/day of diphenhydramine
 - 1 tablet = 25 mg
 - 400 tablets/day (16 boxes)
- Could lead to Columbia concentration of 0.001 $\mu\text{g/L}$

Idea of "pseudo-persistence"

Lessons learned

- The actions of society have an effect on the ecosystem.
- What goes down the drain reaches the river and the biota that rely on it. Not everything is cleaned up by the WWTP.
- Most stormwater is not treated.





Prepared in cooperation with the Columbia River Inter-Tribal Fish Commission and the Lower Columbia Estuary Partnership

Reconnaissance of Contaminants in Selected Wastewater-Treatment-Plant Effluent and Stormwater Runoff Entering the Columbia River, Columbia River Basin, Washington and Oregon, 2008-10



Scientific Investigations Report 2012-5068

U.S. Department of the Interior
U.S. Geological Survey



NEDC Northwest Environmental Defense Center



Jennifer Morace
jlmorace@usgs.gov
503.251.3229

Report available at
<http://pubs.usgs.gov/sir/2012/5068>

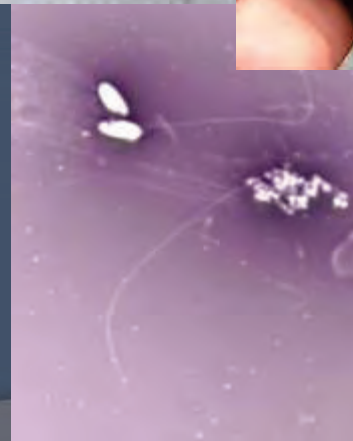


Columbia River Contaminants and Habitat Characterization

<http://www.youtube.com/watch?v=S2RRIbPIGHg>



EDCs
and
PBDEs



Foodweb Sampling Design

Sediments



- contaminant analyses
- sediment transport modeling

Invertebrates



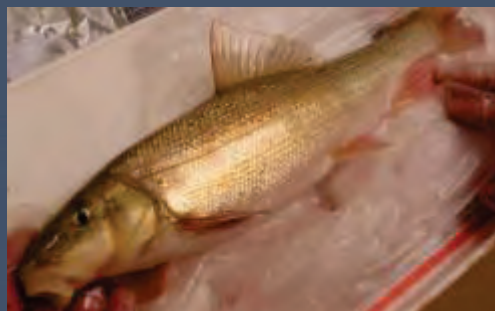
- contaminant analyses
- community assessment

Passive samplers



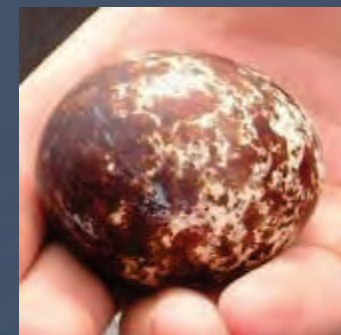
- contaminant analyses
- estrogen screen

Largescale Suckers



- contaminant analyses
(organs and whole bodies)
- biomarkers

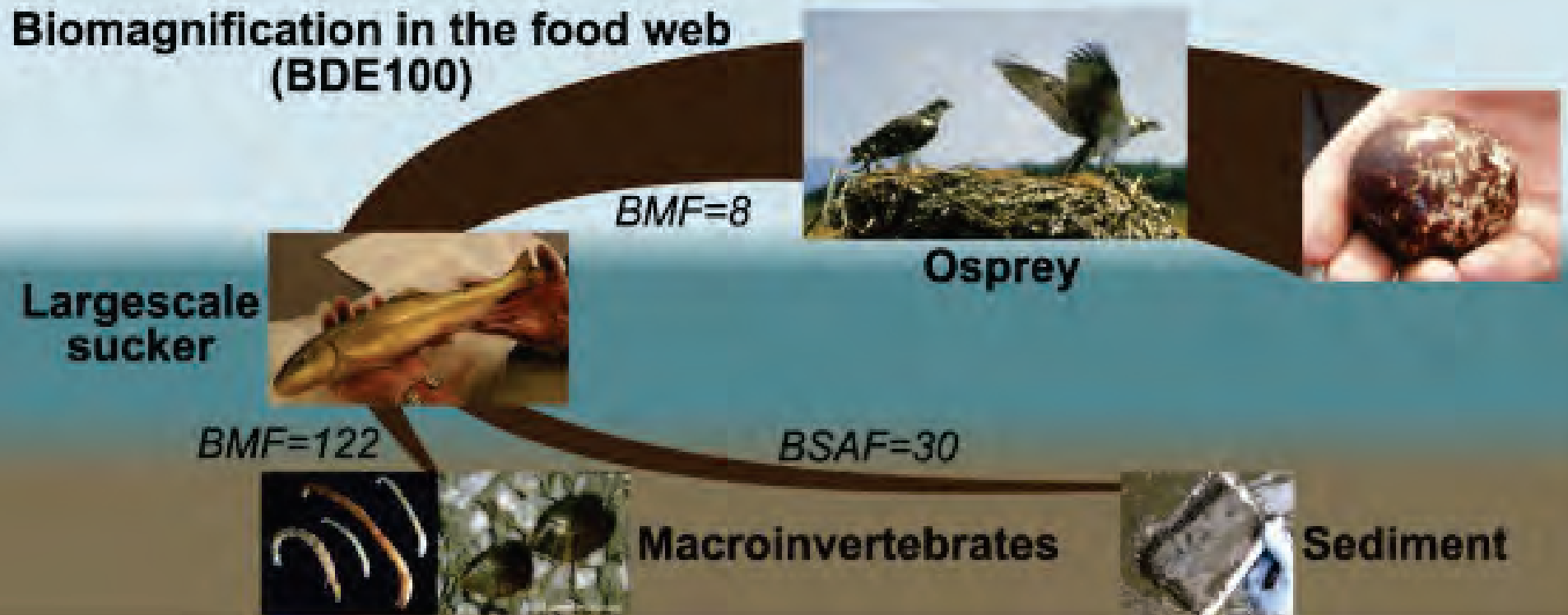
Osprey



- contaminant analyses
- productivity assessment
- well bird blood analyses

Biomagnification in the food web

Biomagnification in the food web (BDE100)



Science of the Total Environment, v. 484, pp. 319-389

Special Section: Foodweb Transfer, Sediment Transport, and Biological Effects of Emerging and Legacy Organic Contaminants in the Lower Columbia River, Oregon and Washington, USA



Jack Ohman, *The Oregonian*, May 2007

Questions?



Jennifer Morace
jlmorace@usgs.gov
503.251.3229