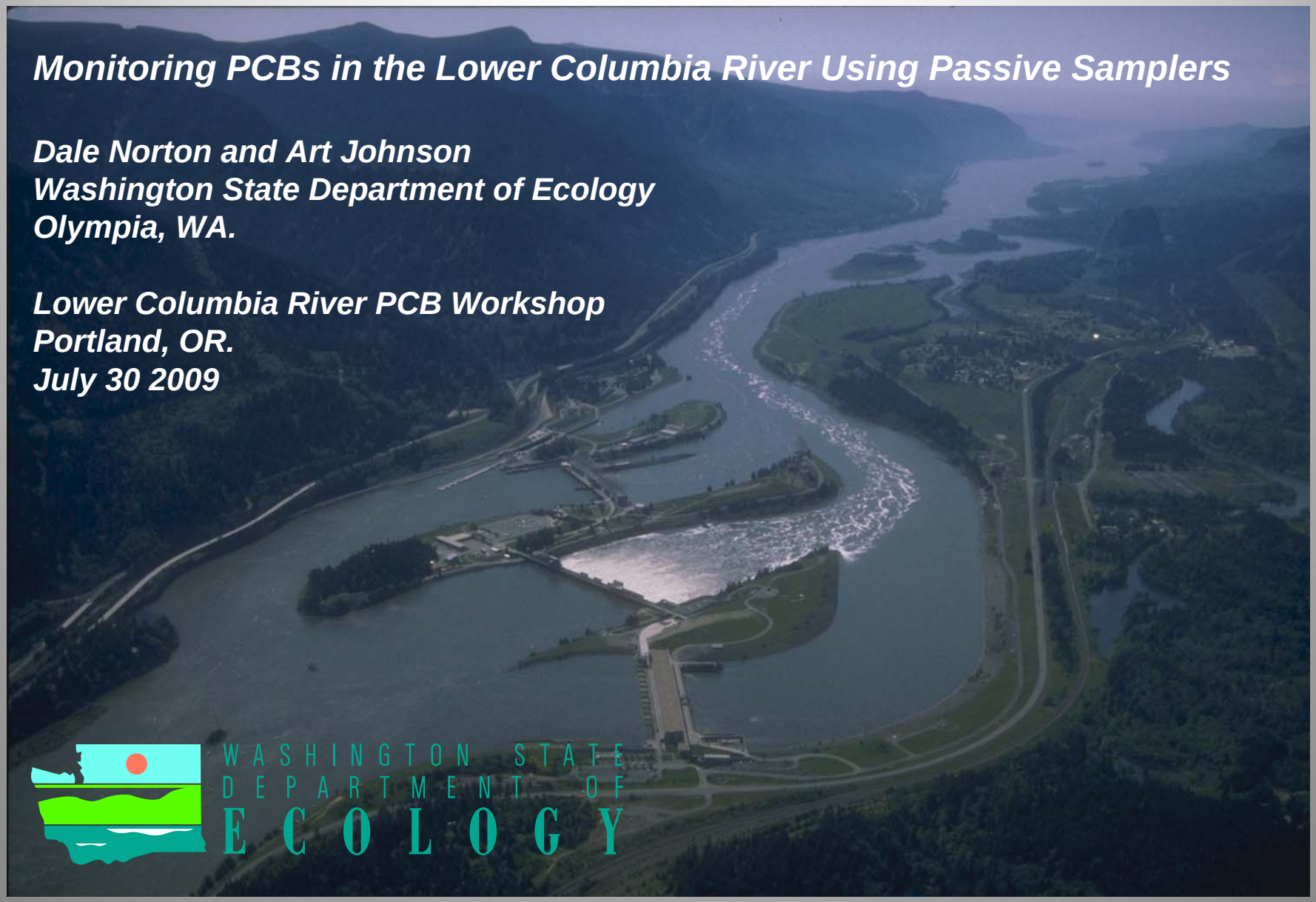


Monitoring PCBs in the Lower Columbia River Using Passive Samplers

Dale Norton and Art Johnson
Washington State Department of Ecology
Olympia, WA.

Lower Columbia River PCB Workshop
Portland, OR.
July 30 2009

WASHINGTON STATE DEPARTMENT OF ECOLOGY

Washington and Oregon 303(d) Organics Listings in Lower Columbia during Study Development in 2002

Washington (draft 2002/2004 List)

RM	Media	Parameter	Reference
20	Tissue	DDE	Laflamme and Gilroy, 1996
20	Tissue	Total PCBs	Laflamme and Gilroy, 1996
30	Tissue	Total PCBs	Laflamme and Gilroy, 1996
49	Tissue	Dieldrin	Tetra Tech, 1993
49	Tissue	Total PCBs	Tetra Tech, 1993
75	Tissue	Dieldrin	Tetra Tech, 1993
75	Tissue	Total PCBs	Tetra Tech, 1993

1 additional arsenic listing in tissue

4 addition arsenic on 1998 list in water

Oregon (2002 List)

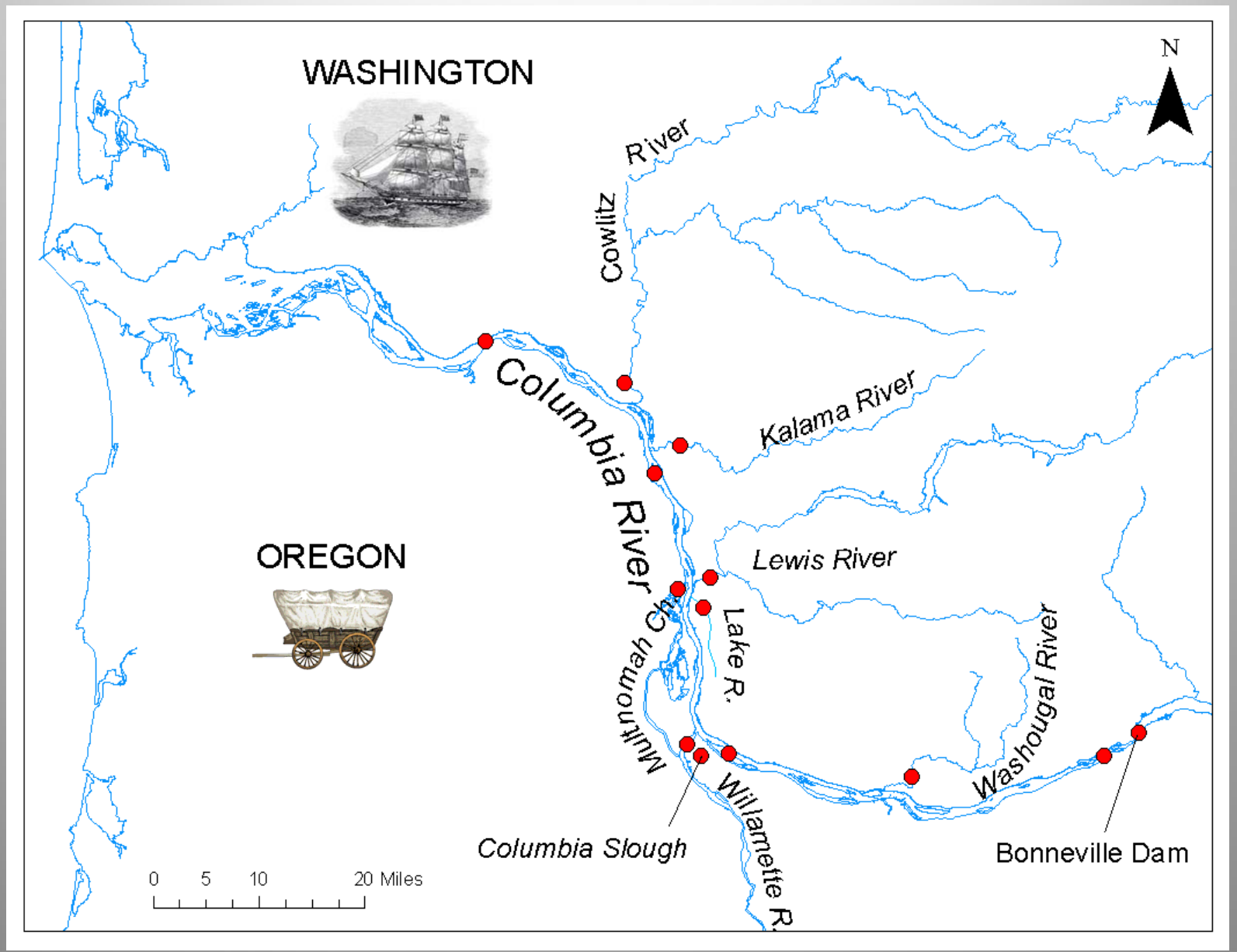
RM	Media	Parameter	Reference
0-35.2	Tissue	DDE	Laflamme and Gilroy, 1996
0-35.2	Tissue	PCB	Laflamme and Gilroy, 1996
35.2-98	Tissue	DDE	Laflamme and Gilroy, 1996
35.2-98	Tissue	PCB	Laflamme and Gilroy, 1996
142-188.6	Water and Tissue	PCB	USGS, 1999
98-142	Tissue	DDE	Laflamme and Gilroy, 1996
98-142	Tissue	PCB	Laflamme and Gilroy, 1996
98-148	Water	PAH	USGS, 1999

3 additional arsenic listings

Study Objectives

- Measure ambient concentrations and estimate loadings of 303(d) listed organic compounds at 13 sites in the Lower Columbia River between Bonneville Dam (rm 147) and Beaver Army Terminal (rm 47).
- Evaluate seasonal differences in contaminant loadings.
- Identify and rank sources of these contaminants to the main stem Columbia.

Lower Columbia River Monitoring Stations



List of Sampling Sites

Site No.	River Mile (approx.)	Location
1	**147**	**Above Bonneville**
2	**142**	**Below Bonneville**
3	121	Washougal River
4	**103**	**Above Willamette River**
5	102	Columbia Slough
6	102	Willamette River
7	88	Lake River
8	87	Lewis River
9	86	Multnomah Channel
10	**75**	**Above Kalama River**
11	73	Kalama River
12	68	Cowlitz River
13	**54**	**Below Longview**

Bold= Main Stem Sites

SPMD Components

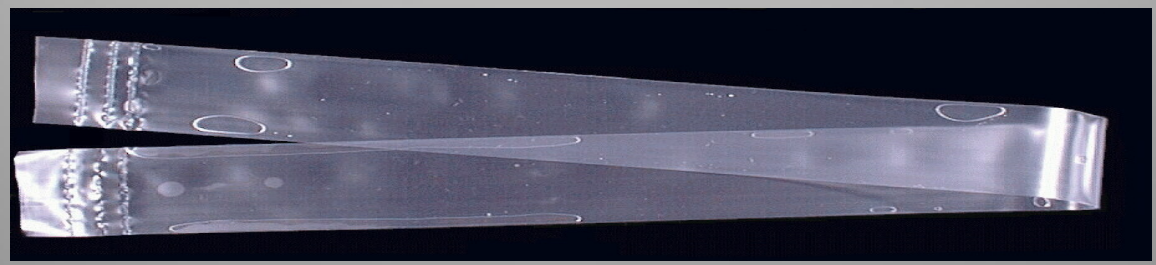
Bottom Mooring

Shipping and Storage

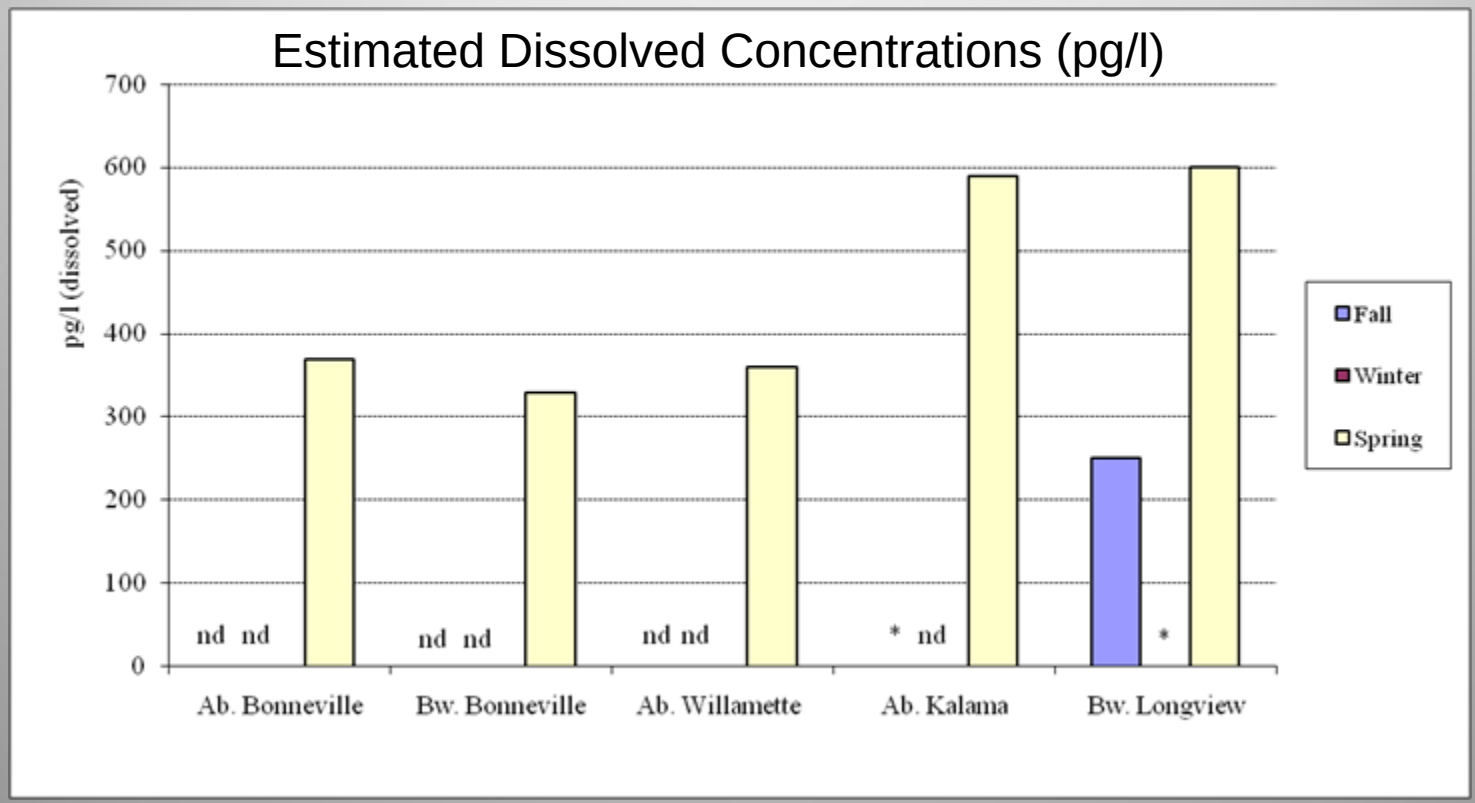
Loading in Canister

Arrays Loaded
in Canister

Membrane

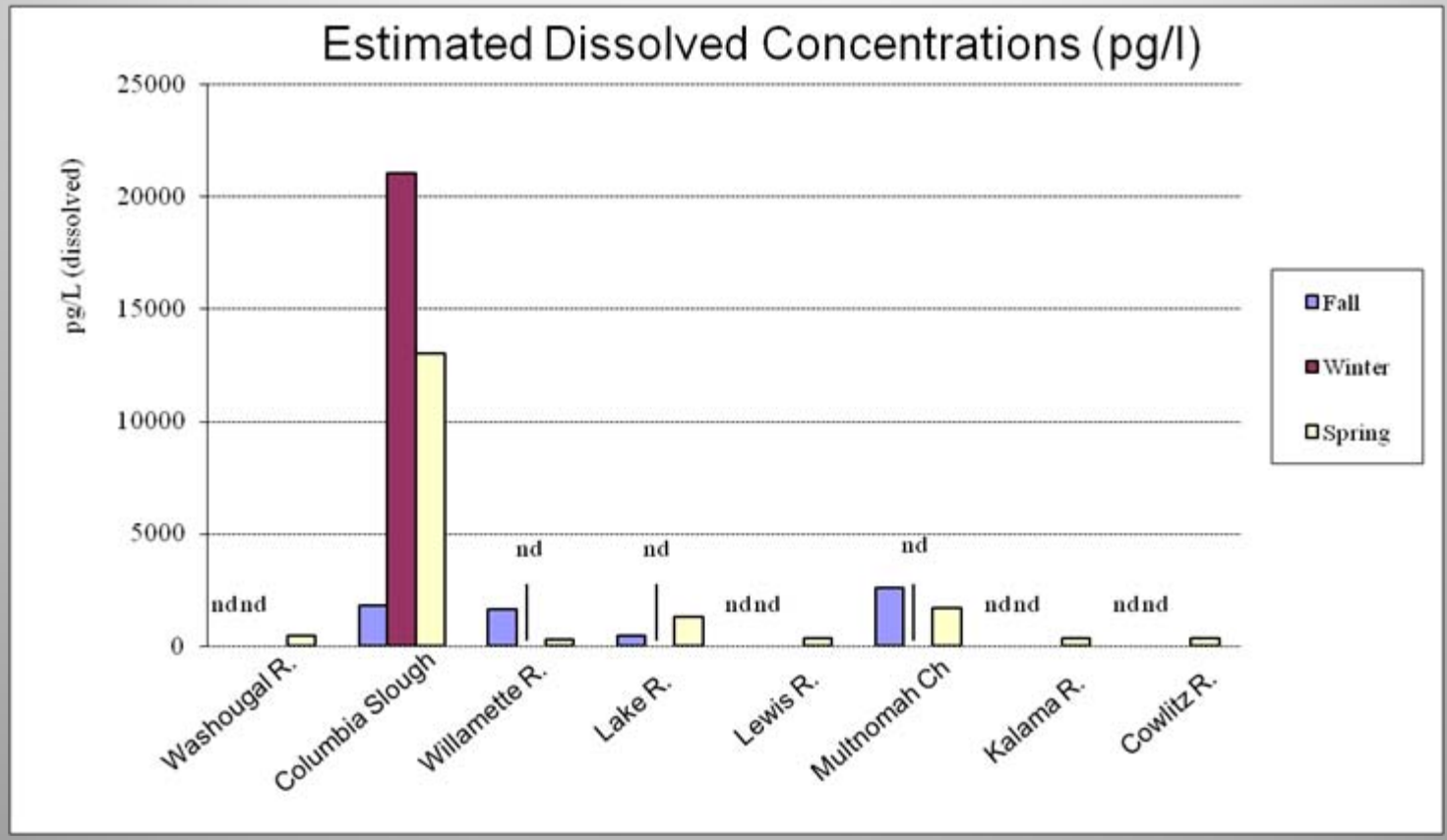


Total PCB Concentrations in Mainstem Columbia River Below Bonneville Dam



- T-PCB levels <u>increase</u> moving downstream (based on Ecology spring data)

Total PCBs in Tributaries



- Columbia Slough, Willamette River and Multnomah Channel are sources of PCBs
- No consistent seasonal pattern,

Ranking of Tributaries for PCBs

Based on Concentration

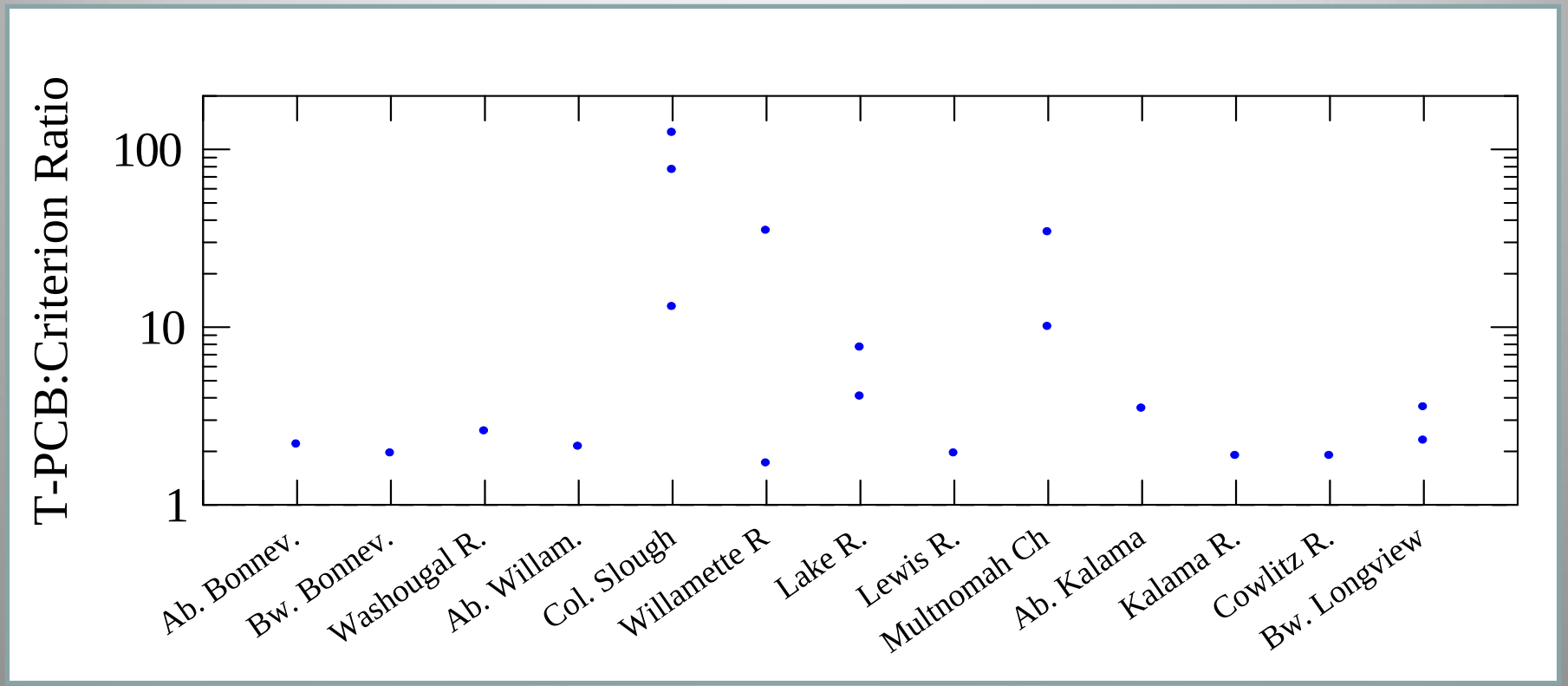
Rank	Location
1	Columbia Slough
2	Multnomah Channel
3	Lake River
4	Willamette River
5	Washougal River
6	Lewis River
7	Kalama River
8	Cowlitz River

Based on Load

Rank	Location	[1]Load (g/day)
1	Multnomah Channel	140
2	Willamette River	14
3	Cowlitz River	12
4	Lewis River	7
5	Columbia Slough	4
6	Washougal River	1
7	Kalama River	0.5
8	Lake River	(?) NF

1= Based on Spring Congener data
NF= No Flow Information

Comparison of Total PCB Levels with WA Human Health Water Quality Criteria (170 pg/l)



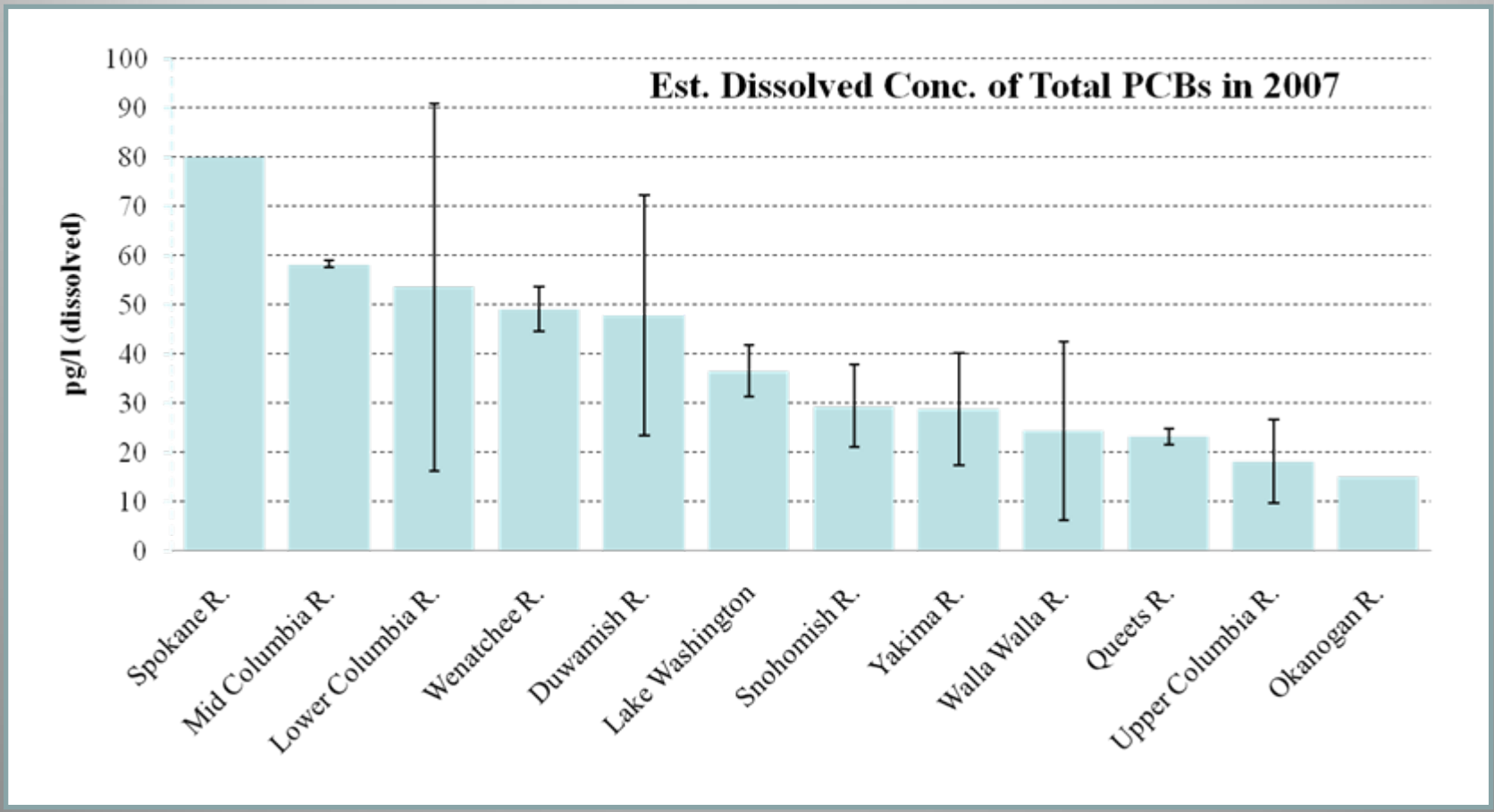
Comparison of PCB Levels between Studies at Beaver Army Terminal Determined Using SPMDs

		Residual		Estimated Diss. Conc.	
Study	Year	Spring (ng)	Fall (ng)	Spring (pg/l)	Fall (pg/l)
ECY PBT Trends	2008	280	160	81	75
ECY PBT Trends	2007	255	162	91	16
USGS Lower Columbia	2005	135-145	230	nc	nc
ECY Lower Columbia	2004	184	110[1]	600	250[1]
USGS Columbia River	1998	575-615	600	300	500

Ng= residuals for 5 SPMDs
Pg/l= Estimated dissolved concentration
Nc= Not calculated
1= Aroclor method

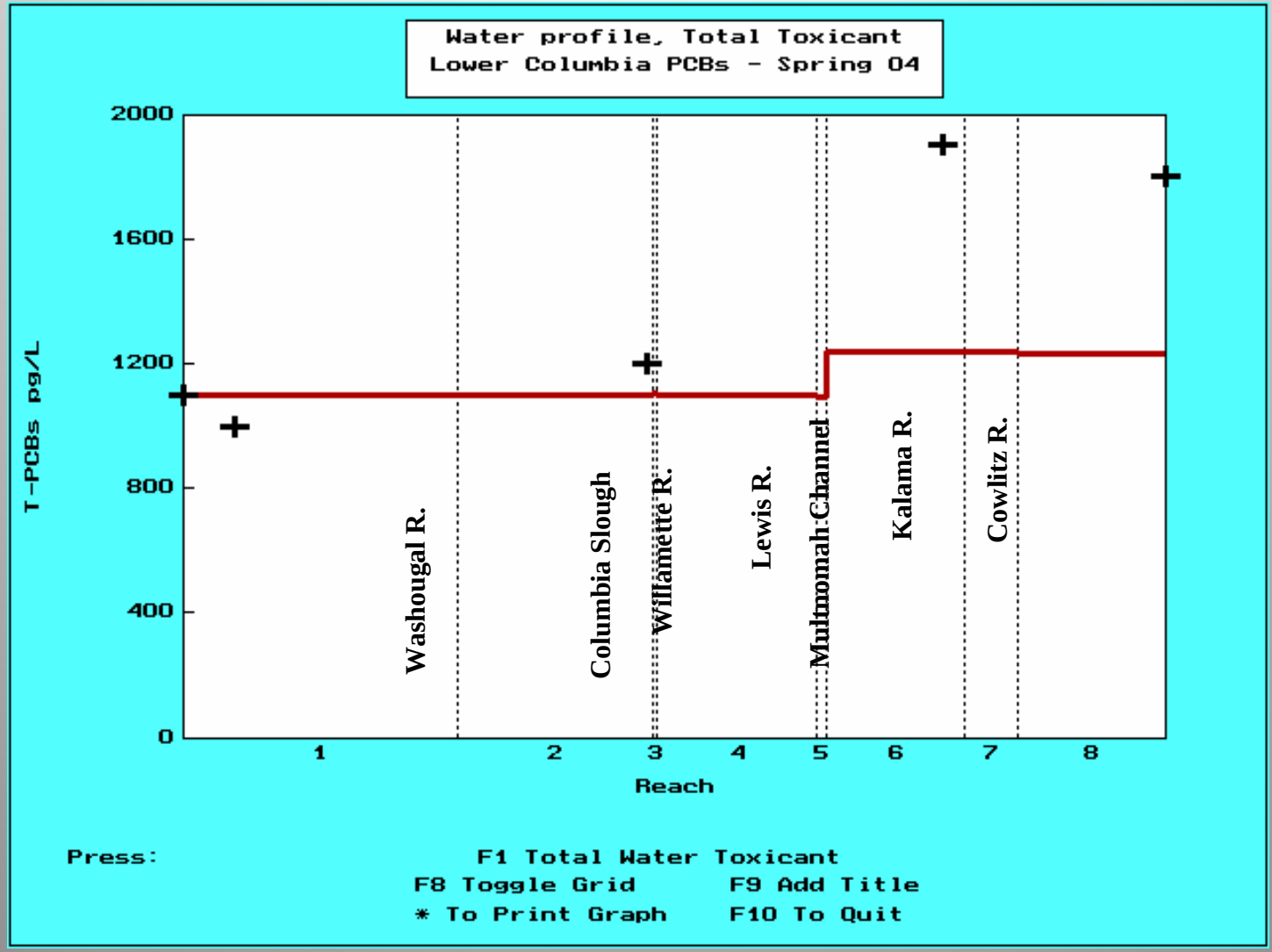
References
ECY PBT Trends= Sandvik, 2009
ECY Lower Columbia= Johnson and Norton , 2005
USGS Lower Columbia= LCREP, 2007
USGS Columbia River= McCarthy et al, 1999

Comparison of Total PCB Levels in Freshwater Areas of Washington



Data from Sandvik, 2009

Total PCB Simulation in Lower Columbia



Predicted vs. Measured Fish Tissue Concentrations

Chemical	Mean Water Column Concentration* (pg/L)	Mean Water Column Concentration* (ug/L)	EPA BCF	Predicted Fish Tissue Concentration (ug/Kg, wet)	Mean Concentration in Fillets† (ug/Kg, wet) Common Carp[1]	Largescale Sucker[2]	White Sturgeon[3]	3 Species Mean
T-DDT	1,900	0.0019	53,600	102	137	34	49	73
Dieldrin	190	0.00019	4,670	0.9	<0.02	<0.02	<0.01	<0.02
T-PCBs	**470**	**0.00047**	**31,200**	**15**	**188**	**40**	**58**	**95**
T-HMW PAH	250	0.00025	30	0.01	<5	<5	<5	<5

*Dissolved data from present study; PCB mean for spring 2004 only.

†Tetra Tech (1996)

[1]One composite of seven individual fish

[2]Nine composites of eight individual fish

[3]Twelve individual fish

Summary of Findings

- The Willamette River and Multnomah Channel are significant sources of PCBs to the mainstem Columbia River.
- A screening-level loading assessment suggests there are other important PCB sources to the lower river that were not monitored in this study. These sources appear to be located primarily between Vancouver and Longview.
- Human health criteria are commonly exceeded for PCBs (based on congener data from Ecology and USGS) in the lower Columbia.
- PCBs exceed human health criteria above Bonneville Dam due to upstream sources

Recommendations

- Comprehensive source loading data (municipal/industrial discharges and stormwater) is lacking in the lower Columbia.
- Any efforts to reduce PCB levels in the lower Columbia should eventually include controls on sources upstream of Bonneville Dam as well.
- Source tracing for PCBs should be conducted upstream in priority watersheds and discharges.
- Since much of the resident fish tissue data is 10 years old re-sampling of fish tissue is recommended.
- Establish additional long-term monitoring stations in Lower Columbia River to track changes in PCBs overtime. Consistent sampling and analysis methods should be employed.
- Managing and controlling toxics in the lower Columbia River is going to require a different approach than traditional control strategies used for conventional pollutants

Johnson, A., and D. Norton, 2005. *Concentrations of 303(d) Listed Pesticides, PCBs, and PAHs Measured with Passive Samplers Deployed in the Lower Columbia River.* ECY Publication: 05-03-006

Sandvik, P., 2009.*Trends Monitoring for Chlorinated Pesticides, PCBs, and PBDEs in Washington Rivers and Lakes, 2007.* ECY Publication: 09-03-013