

Monitoring Toxic Contaminants in Washington's Freshwater Fish

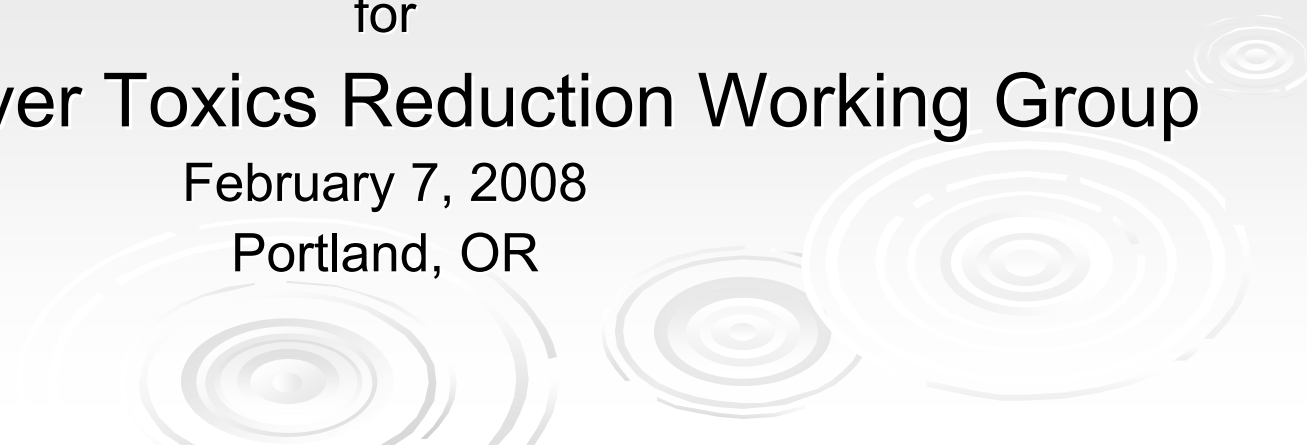
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for

Columbia River Toxics Reduction Working Group

February 7, 2008

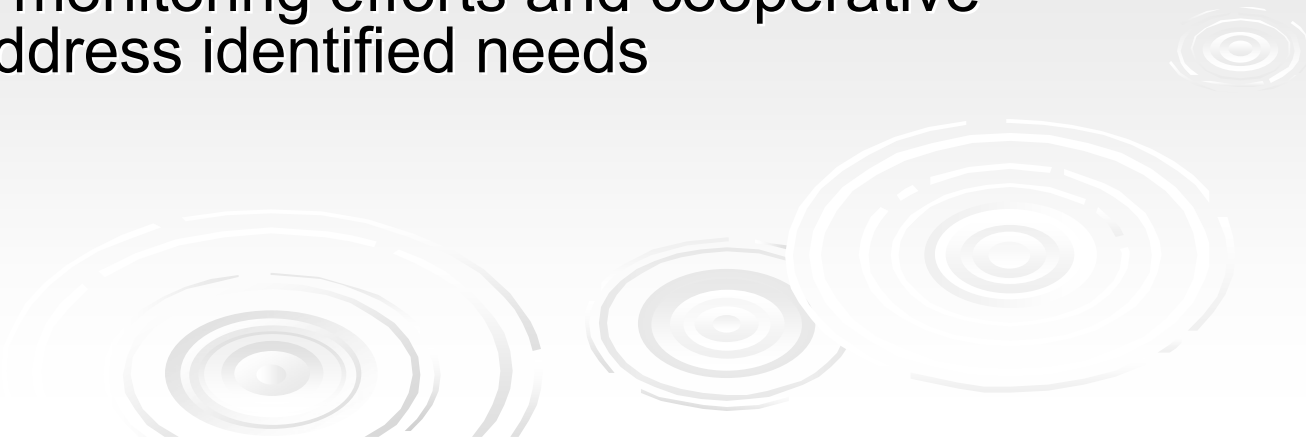
Portland, OR



Washington State Toxics Monitoring Program

Goals:

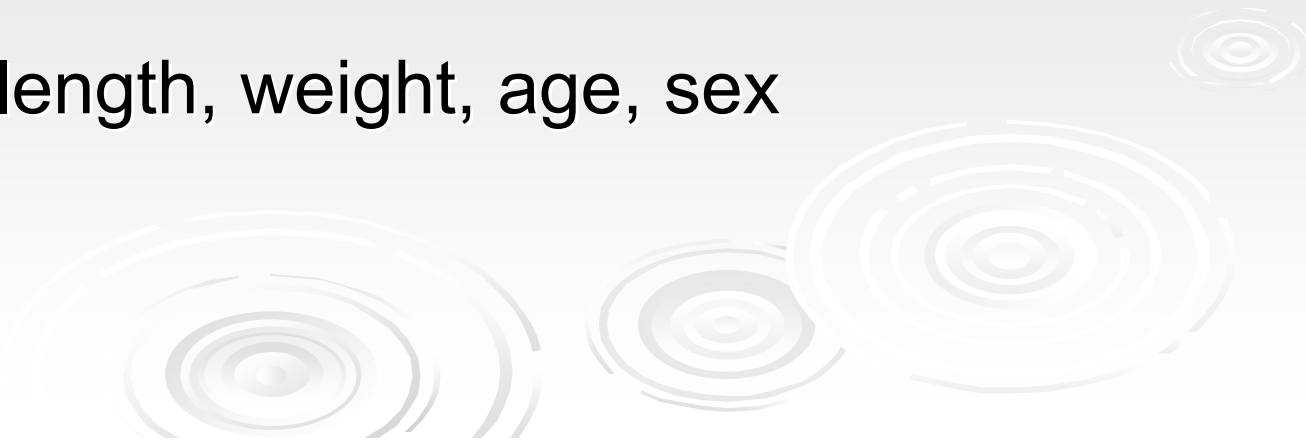
- Conduct exploratory monitoring to identify new instances and locations of toxic contaminants
- Conduct trend monitoring for persistent toxic chemicals
- Establish website featuring toxics monitoring efforts in Washington
- Develop other monitoring efforts and cooperative programs to address identified needs



- Exploratory Monitoring began in 2001
- Website developed in 2003
<http://www.ecy.wa.gov/programs/eap/toxics/wstmp.htm>
- Trend Monitoring for Mercury in Fish began in 2005 (6 sites/yr: 5 yr freq)
- Trend Monitoring for Organics in Water began in 2007 (SPMDs)

What's Being Analyzed in Fish?

- Mercury
- Polychlorinated biphenyls (PCBs)
- Chlorinated pesticides
- Flame retardants (PBDEs)
- Dioxins and furans (PCDD/Fs)
- Lipids, total length, weight, age, sex



Analytical Methods for Fish Tissue Samples, WSTMP.

Parameter	Description	Method	Reporting Limit
PCB Aroclors	GC/ECD	EPA 8082	0.5 ug/kg, wet wt
PCB Congeners	HiRes GC/MS	EPA 1668A	0.02 - 0.08 ug/kg, wet wt
Chlorinated pesticides	GC/ECD	EPA 8081 ¹	0.25 -15 ug/kg, wet wt
PBDEs	GC/MS SIM	EPA 8270 ²	0.5 - 1.0 ug/kg, wet wt
PCDD/PCDFs	HiRes GC/MS	EPA 1613B	0.05 - 1.0 ng/kg, wet wt
Mercury (total)	CVAA	EPA 245.6	0.017 mg/kg, wet wt
		MEL SOP	
Lipids - percent	gravimetric	700009	0.1 percent

1 - MEL 730073, a modification of EPA 8081 and others, was used in sample analyses.

2 - MEL SOP 730096, a modification of EPA 8270, was used in sample analyses.

SOP = Standard Operating Procedure.

GC = Gas Chromatography.

ECD = Electron Capture Detection.

HiRes = High Resolution.

MS = Mass Spectrometry.

SIM = Single Ion Monitoring.

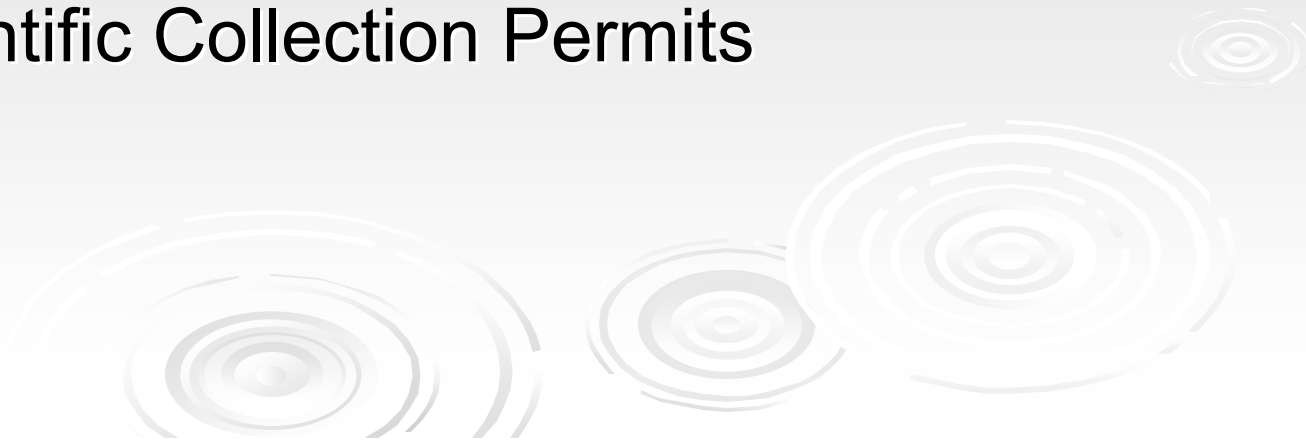
CVAA = Cold Vapor Atomic Absorbance.

Target Analytes for WSTMP Fish Tissue Samples

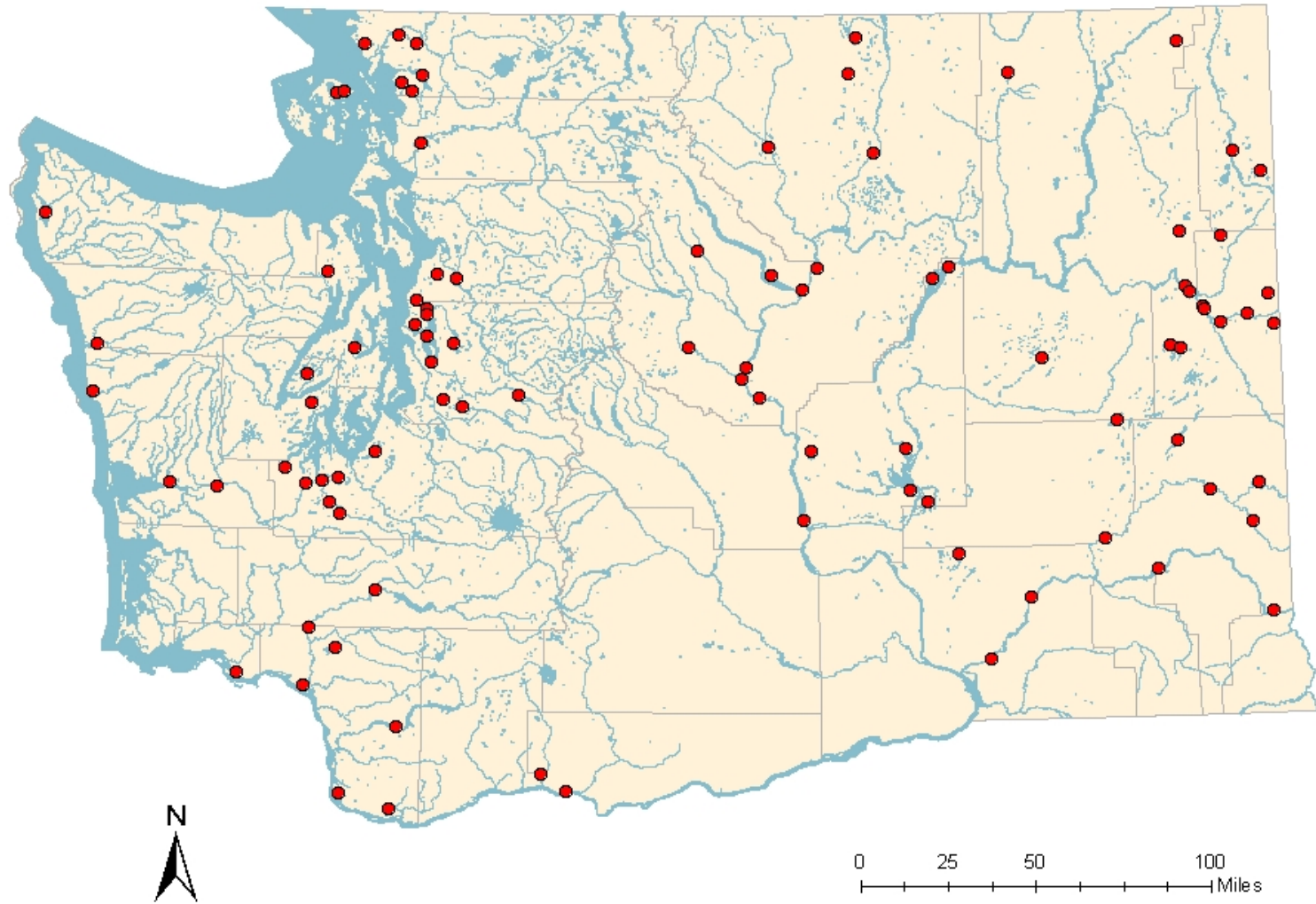
<u>Chlorinated Pesticides</u>	<u>Chlorinated Pesticides</u>	<u>PCB Congeners</u>	<u>PBDEs</u>
2,4'-DDD	gamma-BHC (lindane)	(n = 209)	(polybrominated diphenyl ethers)
2,4'-DDE	Heptachlor		
2,4'-DDT	Heptachlor epoxide	<u>PCDD/PCDFs</u>	PBDE 47
4,4'-DDD	Hexachlorobenzene	<u>(polychlorinated dibenzo-p-dioxins and -furans)</u>	PBDE 100
4,4'-DDE	Methoxychlor		PBDE 99
4,4'-DDT	Mirex	1,2,3,4,6,7,8,9-OCDD	PBDE 154
Aldrin	Oxychlordan	1,2,3,4,6,7,8,9-OCDF	PBDE 153
alpha-BHC	Pentachloroanisole	1,2,3,4,6,7,8-HpCDD	PBDE 66
beta-BHC	Toxaphene	1,2,3,4,6,7,8-HpCDF	PBDE 71
Chlordane (technical)	trans-chlordane (gamma)	1,2,3,4,7,8,9-HpCDF	PBDE 183
Chlorpyrifos	Trans-nonachlor	1,2,3,4,7,8-HxCDD	PBDE 138
Chlorthal-dimethyl (Dacthal)		1,2,3,4,7,8-HxCDF	PBDE 190
cis-Chlordane (alpha)		1,2,3,6,7,8-HxCDD	PBDE 209
Cis-nonachlor	<u>PCB Aroclors</u>	1,2,3,6,7,8-HxCDF	
Dacthal (DCPA)	PCB 1016	1,2,3,7,8,9-HxCDD	
DDMU	PCB 1221	1,2,3,7,8,9-HxCDF	<u>Metals</u>
delta- BHC	PCB 1232	1,2,3,7,8-PeCDD	mercury (total)
Dieldrin	PCB 1242	1,2,3,7,8-PeCDF	
Endosulfan I	PCB 1248	2,3,4,6,7,8-HxCDF	
Endosulfan II	PCB 1254	2,3,4,7,8-PeCDF	<u>Other</u>
Endosulfan Sulfate	PCB 1260	2,3,7,8-TCDD	Lipids (%)
Endrin	PCB 1262	2,3,7,8-TCDF	
Endrin Aldehyde	PCB 1268		
Endrin Ketone			

Site Selection Factors: Fish

- Watershed Scoping Cycle (5 yr)
- Cooperative opportunities
- Nature of historical data
- Nature of fishery and preferred species
- Potential for contamination
- OK for Scientific Collection Permits



WSTMP Fish Collection Sites, 2001-2006



Exploratory Monitoring of Fish Tissue, 2001-2007

Statewide: ~ 240 samples, ~ 105 sites, ~ 20 FW species

Columbia R basin: 36 samples, 22 sites, 11 species

<u>Area</u>	<u># Sites</u>	<u># Samples</u>
Columbia R	6	10
Snake R	4	11
Palouse	4	4
Spokane	3	3
Wenatchee	2	2
Cowlitz, Methow, Entiat	3	6

20 Freshwater Species Sampled for WSTMP: 2001-2006

Species	# Samples Analyzed	% of Total Samples Analyzed
Largemouth bass	35	18%
Yellow perch	22	12%
Rainbow trout	20	11%
Cutthroat trout	19	10%
Northern pikeminnow	17	9%
Mountain whitefish	14	7%
Kokanee	11	6%
Peamouth	11	6%
Smallmouth bass	7	4%
Walleye	7	4%
Brown trout	6	3%
Channel catfish	6	3%
Blue gill	5	3%
Common carp	5	3%
Black crappie	3	2%
Lake whitefish	2	1%
Burbot, Grass carp, Pygmy whitefish, Rock bass	1 ea	4%

Species Sampled at Columbia River Basin Sites: WSTMP 2004-2005.

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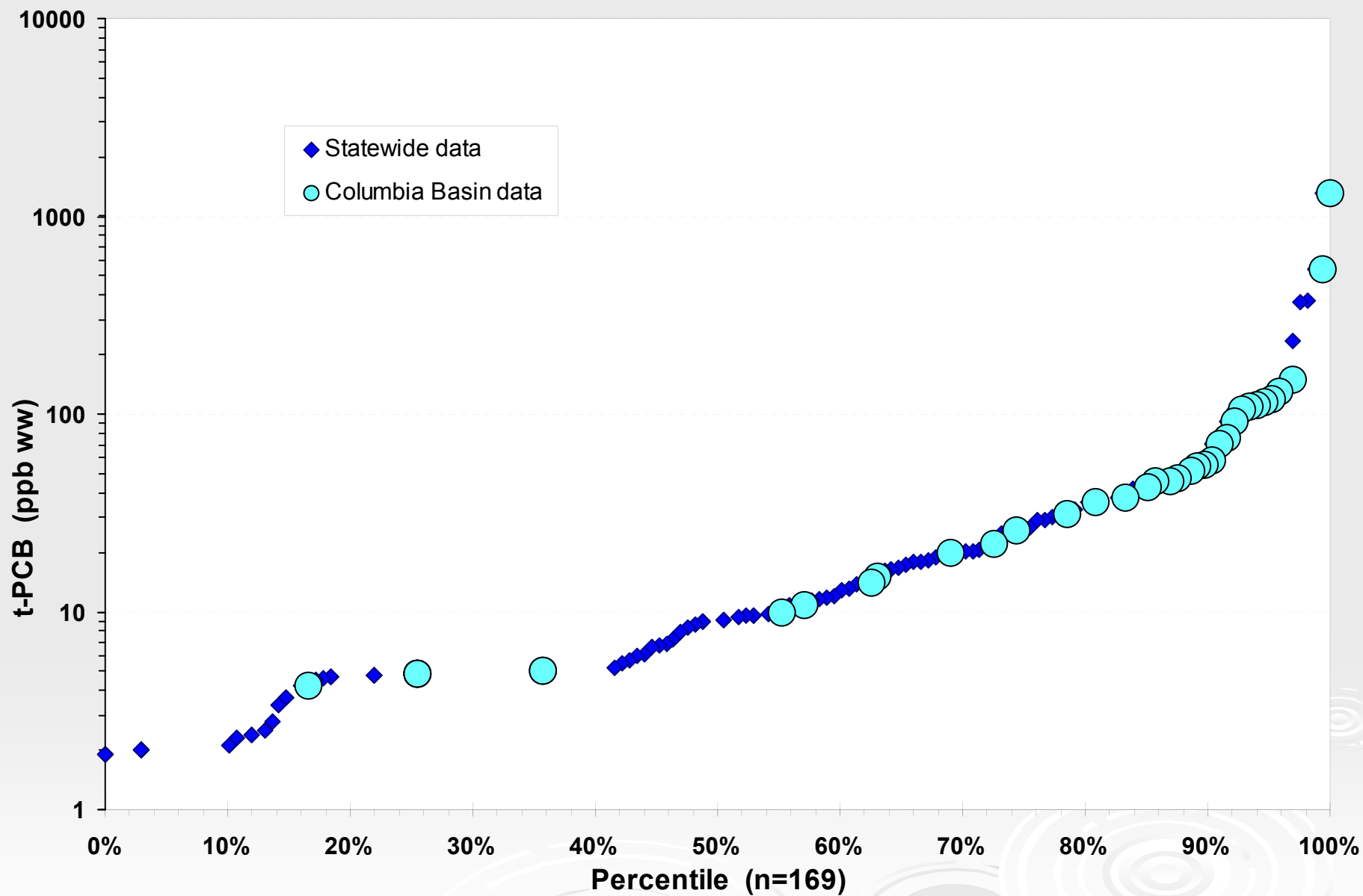
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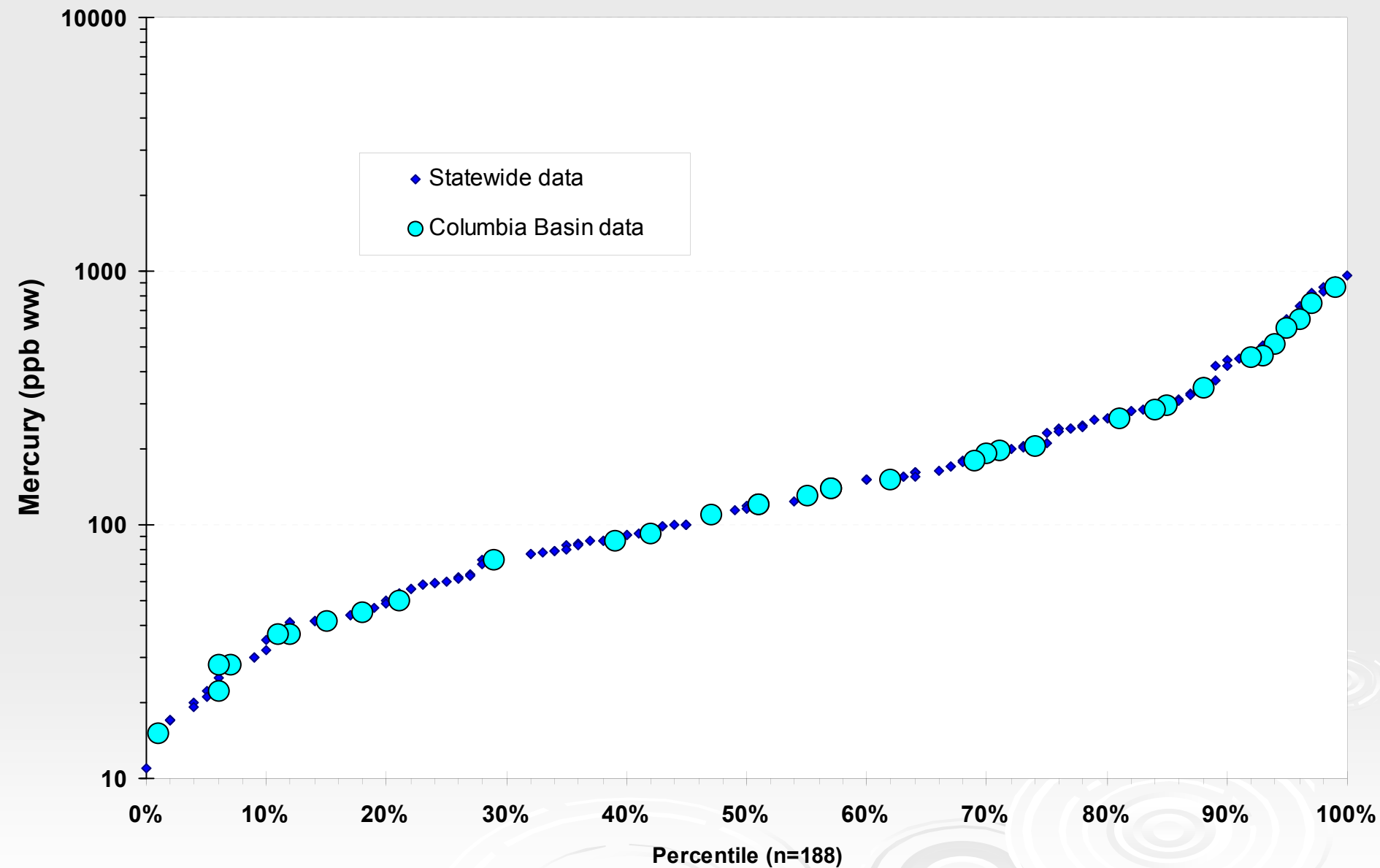
OH YEAH!!!
WELL, I CAUGHT ONE
WITH A MERCURY LEVEL
THAT WAS THIS BIG!!!



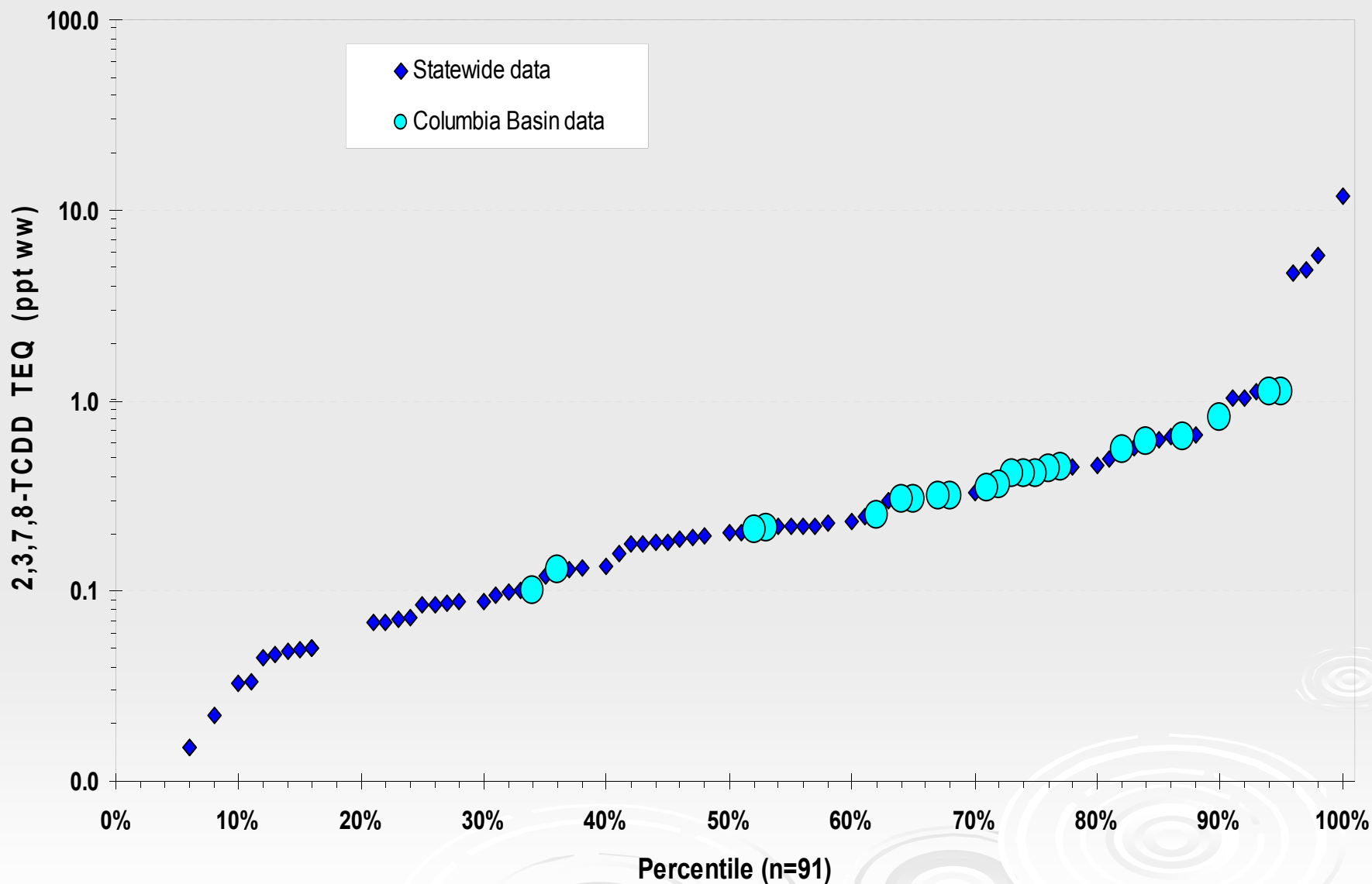
Lake Whatcom Fishing Stories



Total PCBs in Edible Fish Tissue from the WSTMP, 2001-2006.



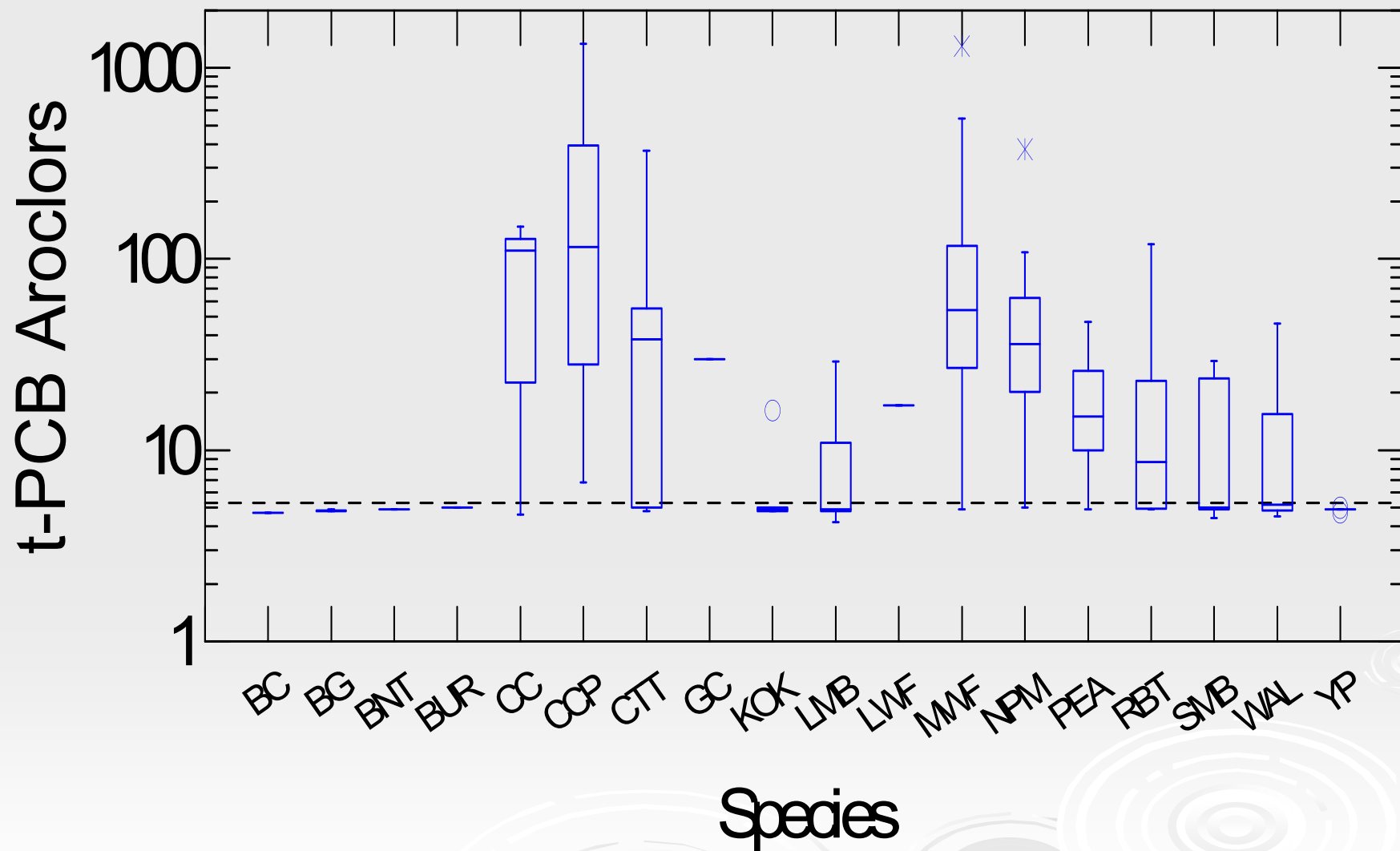
Mercury in Edible Fish Tissue, WSTMP 2001-2006.

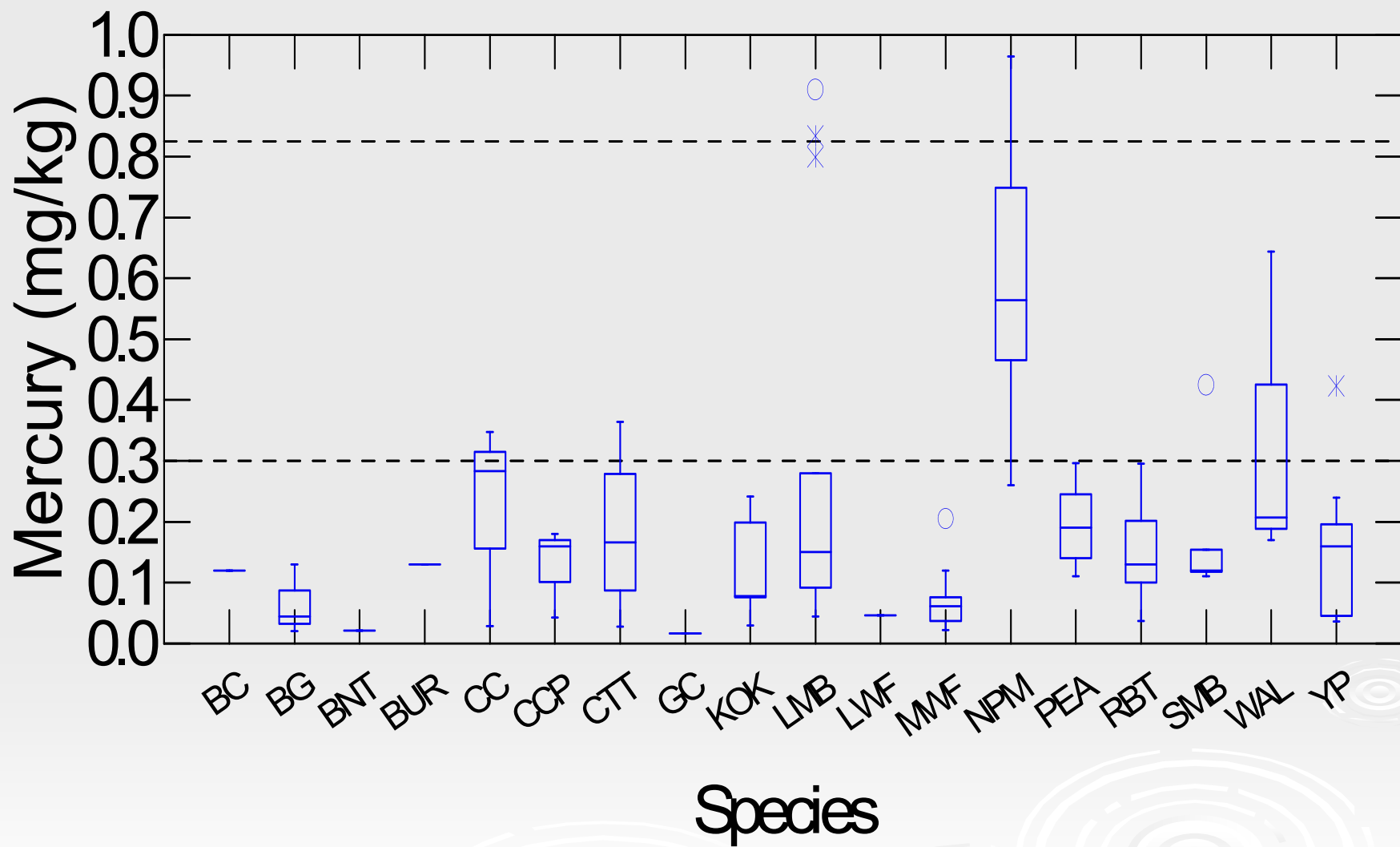


2,3,7,8-TCDD TEQs in Edible Fish Tissue from the WSTMP, 2001-2006.

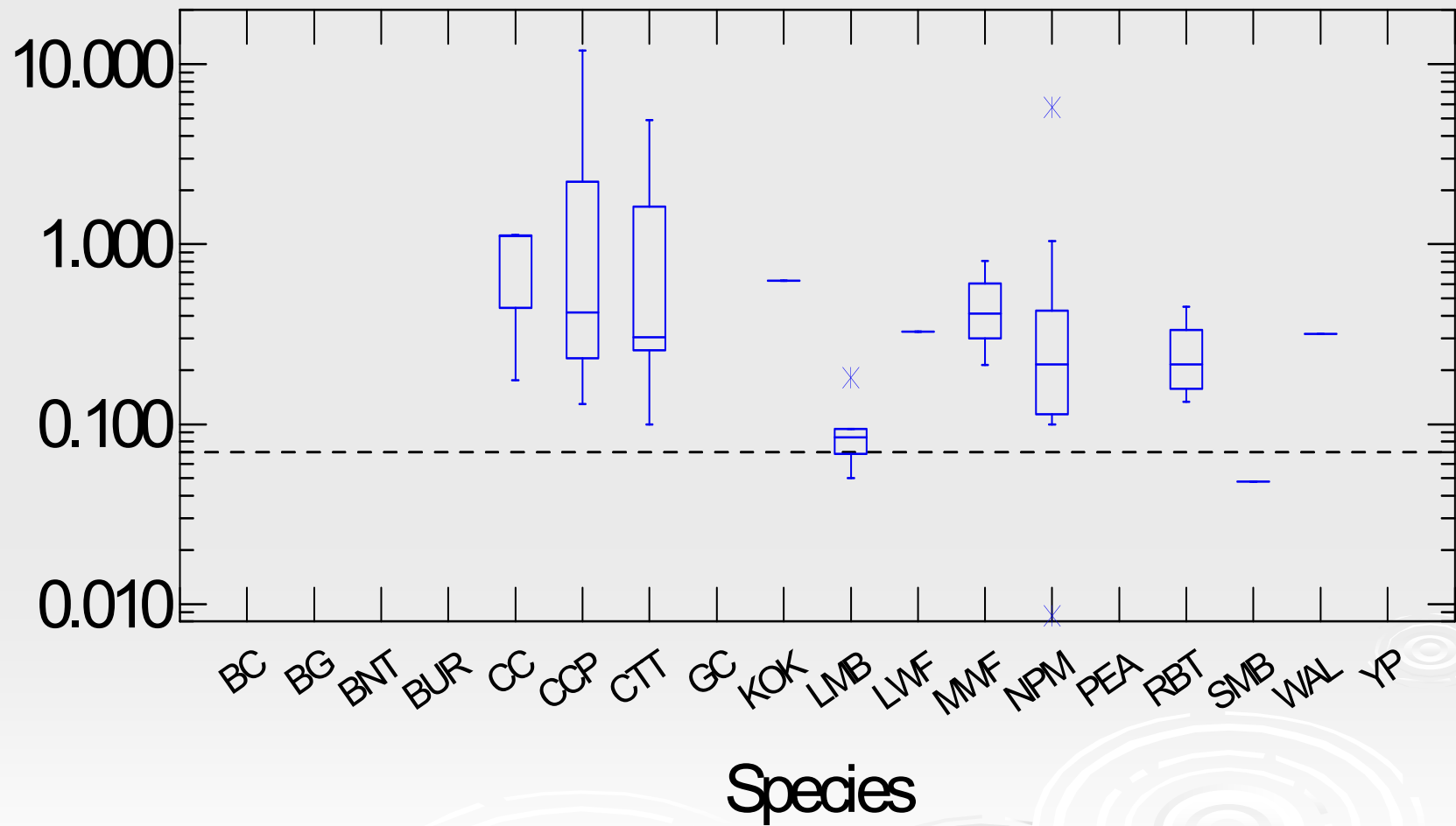
Spatial and Temporal Comparisons Among Samples Challenging

- Species
 - Trophic position
 - Feeding behavior
 - Age, Size, Sex
 - Lipid content
 - Site fidelity
 - Site characteristics
- 





TEQ 2,3,7,8-TCDD (ng/kg)



Comparison of Recent and Historical Walleye Data from the Middle Columbia River Area.

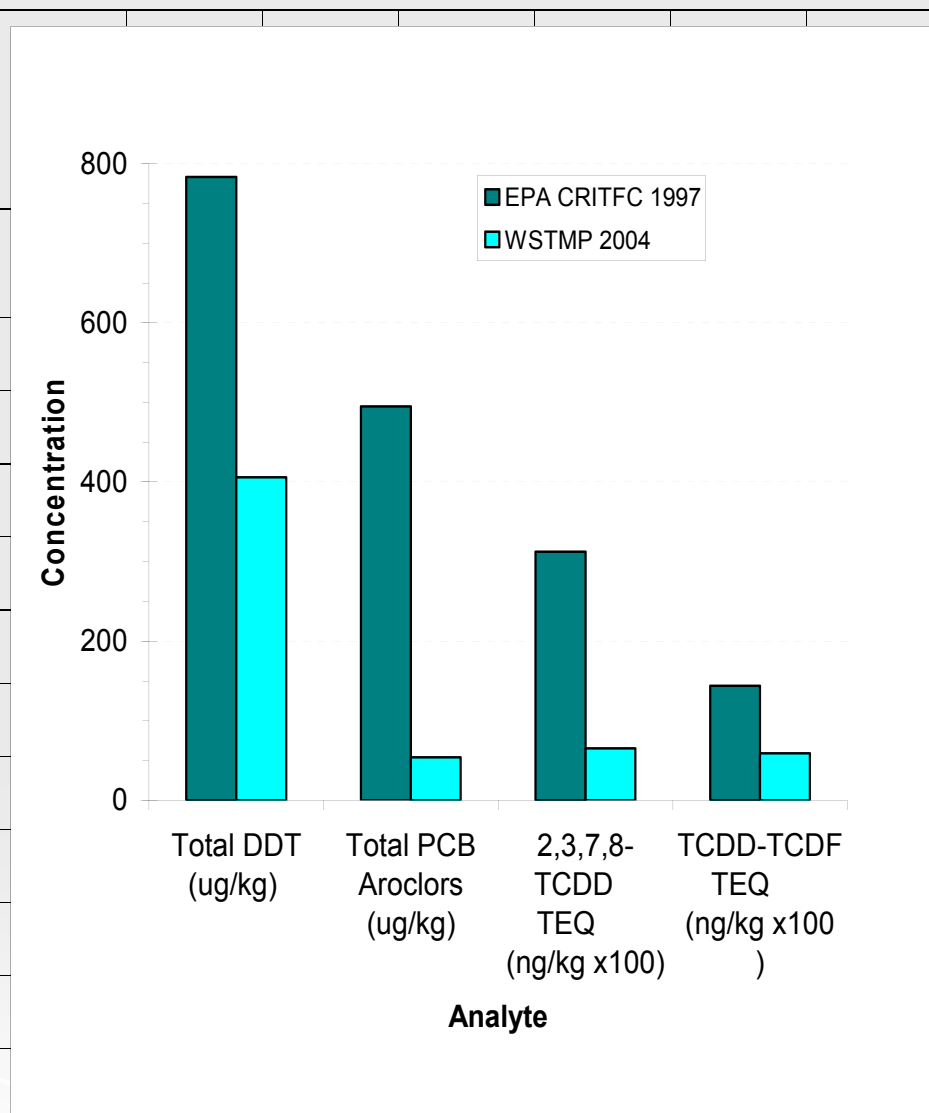
Location	above Rock Island Dam, RM 455	above Rock Island Dam, RM 460
Study and Sample Year	Serdar et al, 1990 ¹	WSTMP 2004 ²
TCDD- TCDF TEQ (ng/kg)	0.25	0.13
2,3,7,8 TCDD TEQ (ng/kg)	-	0.32
Total PCB Aroclors (ug/kg)	-	46
Total DDT (ug/kg)	-	343
mean Lipids (%)	1.8	2.6
mean Total Length (mm)	562	652
mean Weight (g)	2197	3601
mean Age (years)	5.5	9.0

1 - Mean of two multiple-fish composite samples.

2 - Mean value from single multiple-fish composite sample.

Comparison of Recent and Historical Mountain Whitefish Data from the Middle Columbia River Area.

Location	Hanford Reach, RM 390	below Wanapum Dam, RM 415
Study and Sample Year	CRITFC 1997 ¹	WSTMP 2004 ²
Total DDT (ug/kg)	783	406
Total PCB Aroclors (ug/kg)	495	54
2,3,7,8-TCDD TEQ (ng/kg x100)	312	65
TCDD-TCDF TEQ (ng/kg x100)	144	59
TCDD- TCDF TEQ (ng/kg)	1.44	0.59
2,3,7,8 TCDD TEQ (ng/kg)	3.12	0.65
mean Lipids (%)	7.3	6.9
mean Total Length (mm)	360	355
mean Weight (g)	484	472
mean Age (years)	-	3.3



1 - Mean value from three multiple-fish composite samples.

2 - Value from a single multiple-fish composite sample.

Outcomes from WSTMP Efforts

- 133 of 197 (68%) samples don't meet WQS
- 79 of 90 sites (88%) sampled do not meet WQS
- These sites go on WA's 303(d) list and will require further evaluation/monitoring
- Most Columbia/Snake and tributary sites will be on WA's 2008 303(d) list
- WDOH evaluates data for human health risks
- Fish Consumption Advisory for Wenatchee R

➤ Current Fish Consumption Advisories

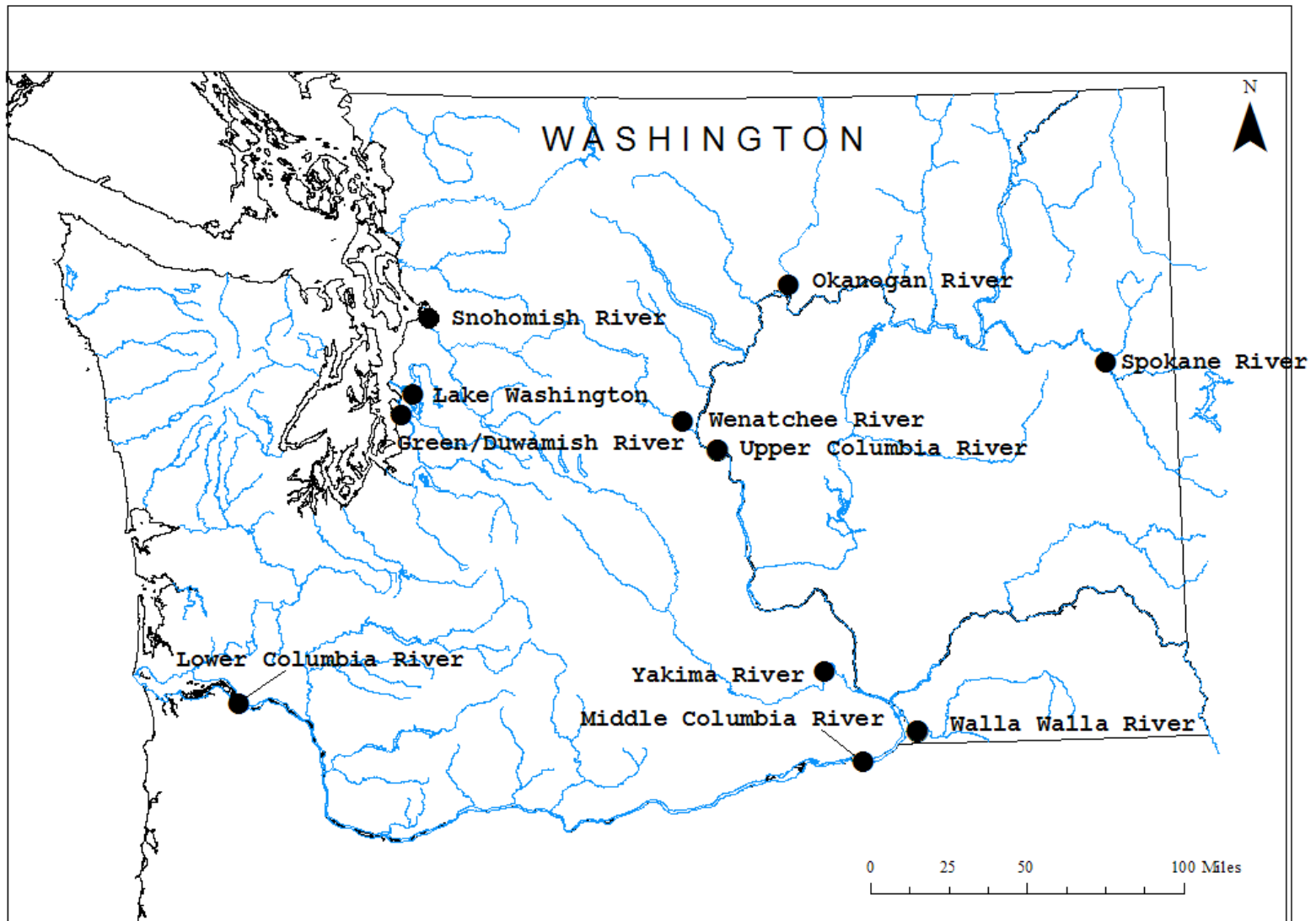


2008 WSTMP Fish Sampling

- Target 15-20 sites: select by April 08
- Basins in Watershed Cycle: Okanogan, Esquatzel, Crab Creek, South Puget Sound, Island/Snohomish
- Possible cooperative efforts with: WDFW, USFWS, EMAP, other Ecology EAP studies



Trend Monitoring Stations for Organic PBTs



Summary of Fish Tissue Sample Results: Columbia Basin mainstem sites, WSTMP 2004-2005.

Site	Species Code	Total PCB aroclors (ug/kg)	q	Total PCB congeners (ug/kg)	q	T-DDT (ug/kg)	q	Total PBDE (ug/kg)	q	Total Chlordane (ug/kg)	q	2378 TCDD TEQ (ng/kg)	q	2378 TCDD (ng/kg)	q	Mercury (mg/kg)	q	Lipid MEL (%)	q	Mean Total Length (mm)	Mean Weight (g)	Mean Age (years)
Columbia R, abv Rock Is Dam	NPM	52		88		415		11		0.78		0.442		0.100	U	0.515		1.8		400	614	8.4
Columbia R, abv Rock Is Dam	PEA	15				151		6.2		0.23						0.110		2.3		257	159	4.0
Columbia R, abv Rock Is Dam	WAL	46		108		343		22		0.84		0.318		0.100	U	0.644		2.6		652	3601	9.0
Columbia R, blw Rocky Reach Dam	MWF	36		75		112		10		0.39		0.550		0.100	U	0.022		3.0		279	187	1.6
Columbia R, blw Wanapum Dam	MWF	54		91		406		50		2.4		0.652		0.150		0.042		6.9		355	472	3.3
Columbia R, blw Wells Dam	MWF	71	m	92	m	430	m	40	m	1.5	m	0.606	m	0.115	U	0.073	m	4.3	m	353	454	3.6
Columbia R, near Cathlamet, RM 38-42	NPM	76		46		32		17		2.5		0.345		0.110		0.596		2.0		466	956	9.2
Columbia R, near Cathlamet, RM 38-42	PEA	47				27		13		1.0	U					0.140		1.6		275	189	6.4
Columbia R, nr Beebe Br	NPM	31		65		509		18		0.51						0.456		2.4		431	766	7.4
Columbia R, nr Beebe Br	PEA	14				197		4.4		0.23						0.130		1.4		259	155	4.3
Snake R, at Central Ferry (L Bryan)	CC	148		65		389		14		9.9		1.12		0.370		0.283		13		565	1842	12.0
Snake R, at Central Ferry (L Bryan)	LMB	11				9.3		0.47		1.0	U					0.092		0.7		295	399	2.1
Snake R, at Central Ferry (L Bryan)	PEA	10				29		2.1		0.91	U					0.264		2.2		284	186	5.1
Snake R, at Central Ferry (L Bryan)	YP	5.0	U			5.9		6.2	UJ	1.0	U					0.196		0.5		258	232	3.3
Snake R, blw Lower Monumental Dam	CC	111	m	165		373	m	26	m	9.1		1.11		0.520	U	0.347	m	7.2	m	491	1162	11.5
Snake R, ds Clarkston at Chief Timothy park	LMB	4.2	U			22		1.8		0.85	U					0.140		0.7		283	346	1.9
Snake R, ds Clarkston at Chief Timothy park	MWF	106		70		38		9.4		0.98	U	0.413		0.100	U	0.120		2.0		299	231	2.5
Snake R, ds Clarkston at Chief Timothy park	PEA	26				86		12		0.47						0.296		1.9		273	155	4.3
Snake R, ups Ice Harbor Dam, RM 11-12	CCP	115		65		146		30		5.1		0.417		0.100		0.180		5.4		675	4207	13.6
Snake R, ups Ice Harbor Dam, RM 11-12	PEA	43				22		2.5		0.98	U					0.190		1.8		286	4207	5.4
Snake R, ups Ice Harbor Dam, RM 11-12	YP	4.9	U			6.7		0.60		0.99	U					0.045		0.6		204	94	1.2

Data Qualifiers and Notes

U = The analyte was not detected at or above the reported value.

m = mean value from analyses of field duplicates where two results are available. Where analysis was not done on only one sample, that sample result is given. Where both values were non-detect, the highest value was used. Where one duplicate was qualified as a non-detect (U, UJ), the reported value was used in determining the mean value.

Species Codes: BC = Black crappie, BG = Bluegill, BNT = Brown trout, BUR = Burbot, CC = Channel catfish, CCP = Common carp, CHK = Chinook salmon, CTT = Cutthroat trout, GCP = Grass carp, KOK = Kokanee salmon, LMB = Largemouth bass, LWF = Lake whitefish, MWF = Mountain whitefish, NPM = Northern pikeminnow, PEA = Peamouth, RBT = Rainbow trout, SMB = Smallmouth bass, WAL = Walleye, YP = Yellow perch.