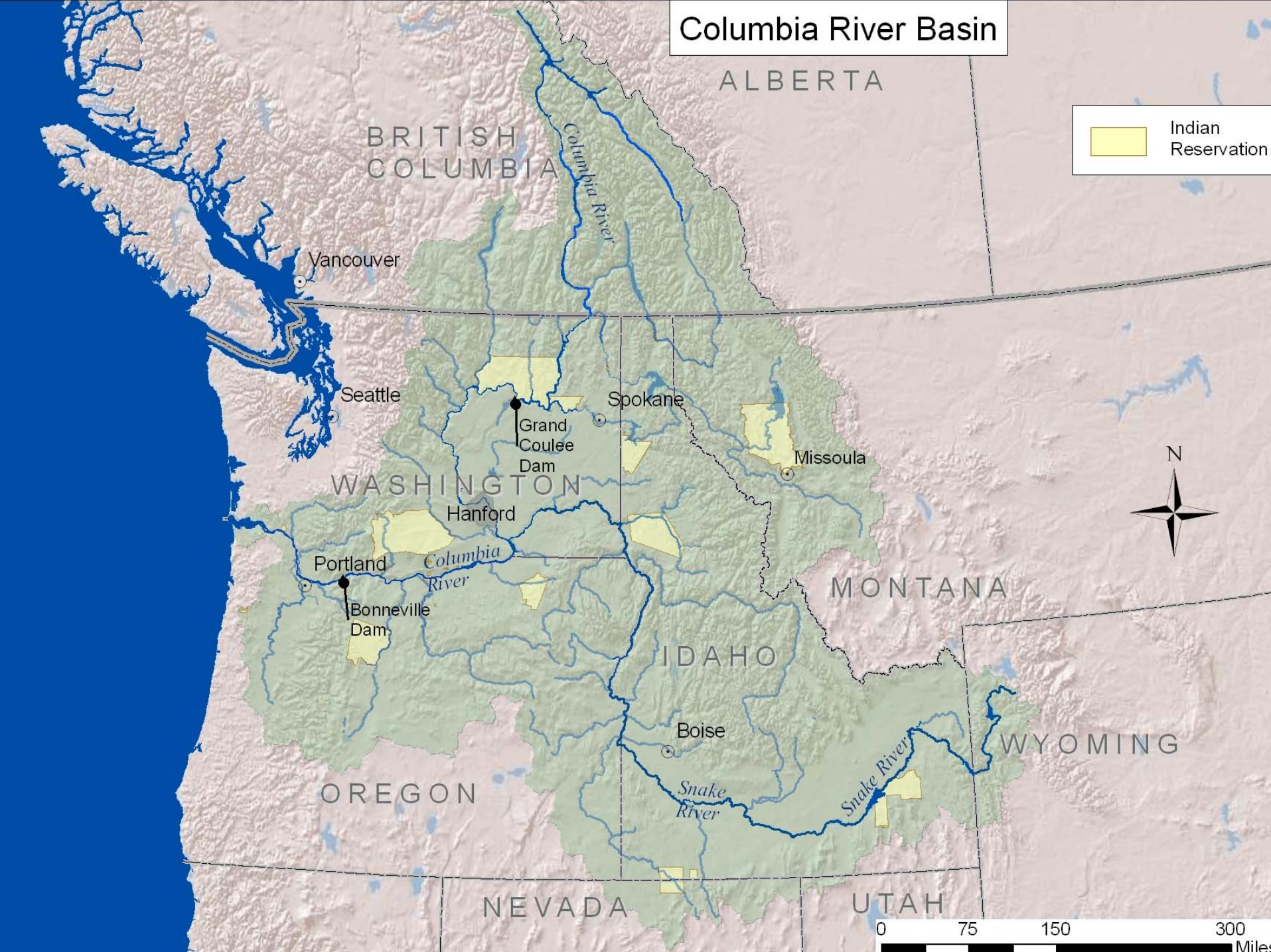
Developing a Monitoring Strategy for the Columbia River

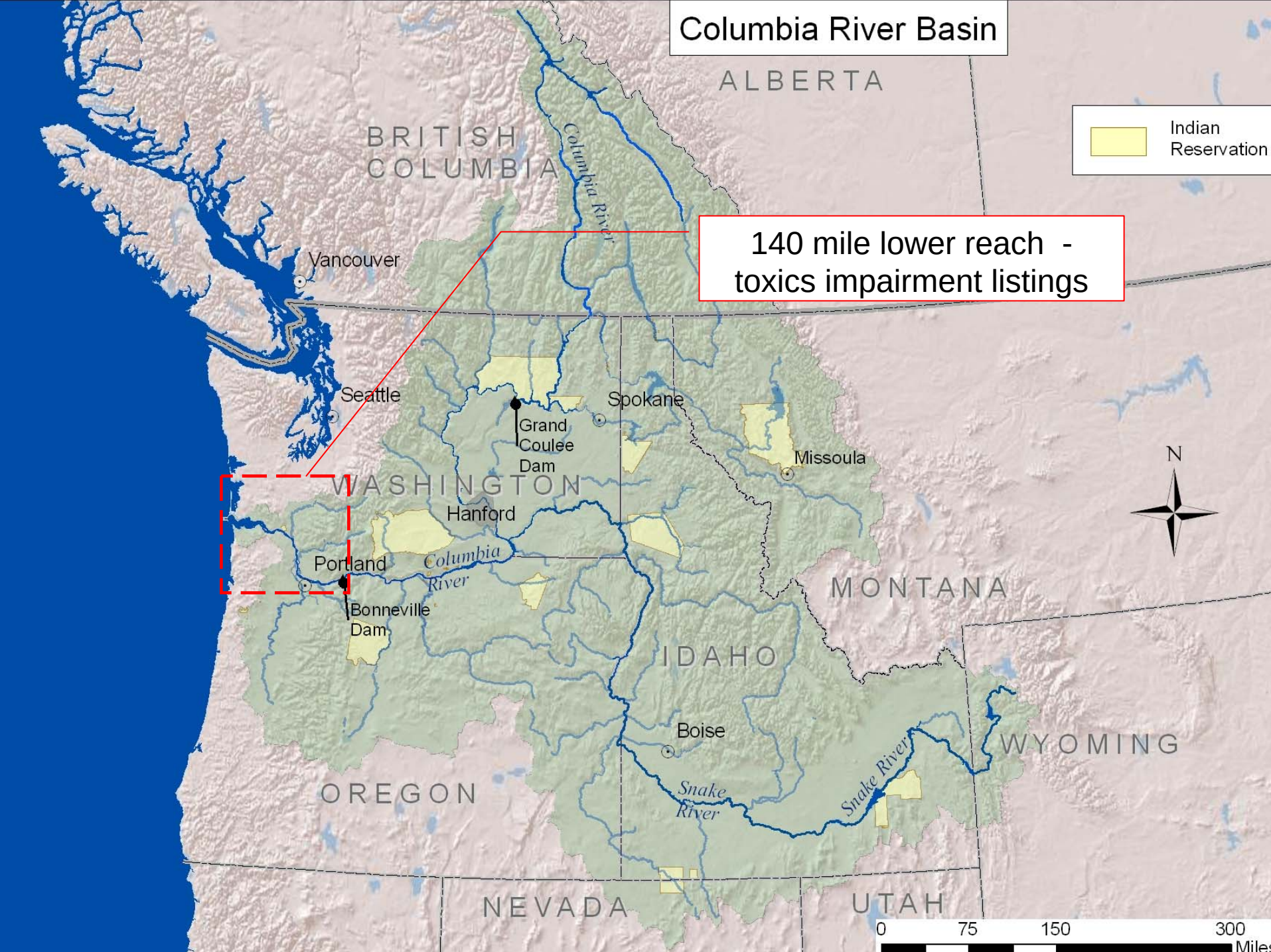
Wednesday July 22, 2009

Portland, Oregon

Columbia River

- 260,000 square mile basin
- 1,200 miles from headwaters to ocean
- 262,000 cfs average flow at mouth
- ~8 million people – 1/3 in the I-5 corridor
- 7 US States & 1 Canadian Province
- 14 Indian Reservations & 6 First Nation’s Lands
- 14 dams on the Columbia River
- 370 major dams in basin
- 330,000 average annual megawatts generated
- 13 salmon runs threatened or endangered


Columbia River Basin
ALBERTA
BRITISH COLUMBIA
Columbia River
Indian Reservation
Vancouver
Seattle
Spokane
Grand Coulee Dam
Missoula
WASHINGTON
Hanford
Portland
Columbia River
Bonneville Dam
MONTANA
IDAHO
Boise
WYOMING
Snake River
Snake River
OREGON
NEVADA
UTAH
N
0
75
150
300
Miles


Columbia River Basin
ALBERTA
BRITISH COLUMBIA
Columbia River
Indian Reservation
140 mile lower reach - toxics impairment listings
Vancouver
Seattle
Spokane
Grand Coulee Dam
Missoula
WASHINGTON
Hanford
Portland
Columbia River
Bonneville Dam
MONTANA
IDAHO
Boise
Snake River
Snake River
WYOMING
OREGON
NEVADA
UTAH
N
0
75
150
300
Miles

Background

- Oregon and Washington 1998 303(d) Impairment listings for toxic contaminants, primarily in the lower Columbia River
  - PCBs & DDT and other legacy contaminants
- 2005 discussion between states and EPA
  - Not enough data to determine source of contaminants
  - Collaborate in addressing the toxics impairments
- Formation of the Columbia River Toxics Reduction Group
  - States - Environmental, Fish and Wildlife and Agricultural Agencies
  - Tribes and Columbia River Intertribal Fish Commission
  - Federal Agencies – USGS, EPA, NOAA, USFWS, USBR, USACE, USDOE, BPA
  - Non-Profits – LCREP, Columbia Riverkeepers
- Columbia River designated one of seven Critical Ecosystems Nationwide in 2006
- Publication of Columbia River State of the River Report for Toxics in 2009

United States
Environmental Protection
Agency

Region 10

EPA 910-R-08-004 | January 2009

Columbia River Basin:
State of the River Report for Toxics
January 2009

www.epa.gov/region10/columbia

State of the River Report

- Purpose of Report
  - Inform people, communities, and decision-makers about toxics problems and solutions
  - Serve as catalyst for increased stakeholder involvement & actions
  - Garner resources for toxics reduction & assessment efforts
- http://yosemite.epa.gov/r10/ecocomm.nsf/Columbia/SoRR/

Next Steps

- Expand toxics reduction activities
- Identify, inventory, and characterize the sources of toxics in the Basin
- **Develop a regional, multi-agency long-term monitoring and research program**
- Develop a data management system that will allow sharing of information on toxics
- Increase public education about the toxics problems and resource needs
- Work with partners to develop workplan by end of 2009: identify short and long-term needs.
- Hold workshops around Basin to get input from public and stakeholders.

Monitoring Subgroup

- **Original plan for monitoring:**
  - Develop a ‘basin-wide’ monitoring plan
  - Prioritize tributaries based on contaminant loads
- **New plan needed- several reasons:**
  - Estimating contaminant loads very difficult and expensive
  - Data need to be easy to interpret and readily available at a basin-wide scale
  - Monitoring programs are already underway or planned: want to enhance existing programs
  - Basin-wide monitoring plan is unrealistic given: size, complexity, jurisdictional interests, and the lack of fiscal resources

Monitoring Subgroup:

Goal of the monitoring plan

- Develop a prioritization process that will identify additional or supplemental toxic monitoring needed to assist water management agencies in the development and evaluation of strategies to reduce the delivery of contaminants to waterways in the Columbia River Basin.
- New plan requires eight steps to fully meet this goal; we are on step three.

Monitoring Sub-Group

New Plan for Monitoring

1. **Divide Columbia Basin into 5 geographic areas; identify the major tributaries in each area**
2. **Use the 'Contaminants of Concern' matrix to target chemicals and media to sample**
3. **Identify the 'Lines of Evidence'**
4. Prioritize tributaries for monitoring in each geographic area utilizing the 'Lines of Evidence' approach
5. Identify the data gaps in each geographic area
6. Design a monitoring plan, by geographic area; conduct new or supplemental monitoring
7. Design and implement toxic reduction strategies
8. Design and implement effectiveness monitoring

Columbia River Basin
Five Monitoring
Evaluation Areas
British Columbia
Saskatchewan
N
W
E
S
Columbia River
Upper Columbia
(Area 4)
Mid-Columbia
(Area 3)
Washington
Montana
Lower
Columbia
(Area 1)
Columbia
Gorge
(Area 2)
Snake River
Basin
(Area 5)
Oregon
Idaho
Wyoming
Snake River
0
50
100
200
300
Miles
California
Nevada
Utah
Great
Salt
Lake

Columbia River Basin
Five Monitoring
Evaluation Areas and
Tributary basins
British
Columbia
Saskatchewan
N
W
E
S
Columbia River
Upper Columbia
(Area 4)
Mid-Columbia
(Area 3)
Washington
Montana
Lower
Columbia
(Area 1)
Columbia
Gorge
(Area 2)
Snake River
Basin
(Area 5)
Oregon
Idaho
Wyoming
Snake River
0
50
100
200
300
Miles
California
Nevada
Utah
Great
Salt
Lake

Monitoring Sub-Group

New Plan for Monitoring

1. Divide Columbia Basin into 5 geographic areas; identify the major tributaries in each area
2. **Use the 'Contaminants of Concern' matrix to target chemicals and media to sample**
3. **Identify the 'Lines of Evidence'**
4. Prioritize tributaries for monitoring in each geographic area utilizing the 'Lines of Evidence' approach
5. Identify the data gaps in each geographic area
6. Design a monitoring plan, by geographic area; conduct new or supplemental monitoring
7. Design and implement toxic reduction strategies
8. Design and implement effectiveness monitoring

Contaminant of Concern Matrix

- Developed by Contaminants Subgroup in 2007
- Setting Priorities for
  - Monitoring
  - Toxics Reduction Efforts
  - Written Status Reports
- Factors Considered in Ranking Toxics
  - Is it recognized as an existing problem?
  - Is it an ecological threat, a human health threat, or both?
  - Is there an implementation plan/reduction strategy in place?

Prioritization of Toxics in the Columbia River[1]

July 17, 2007

The "contaminant and media subgroup" was tasked with identifying the toxics of highest priority for the Columbia River Toxics Reduction Workgroup. The subgroup developed the following tiered list of contaminants of concern, which is meant to serve as a living list with updates made on a yearly basis. For sampling purposes, many of the specific contaminants listed as Tier 1 or II would be analyzed as a part of a larger suite of compounds, which are usually listed in Tier III. For data analysis, however, the specific compounds listed in Tier 1 or Tier II were considered of higher importance for focusing purposes. DDT will most likely be analyzed as a part of Organochlorines; Mercury, Arsenic, Lead, and Copper will be analyzed as a part of Trace elements, and estrogenic compounds will be analyzed as a part of Pharmaceuticals and Personal Care Products and Hormones listed in Tier III. These specific toxics were considered highest priority based on the rationale described below in the Factors Considered in Ranking Toxics.

Tier I

DDT (and metabolites)
PCBs
Mercury (including methylmercury)
PBDEs

Tier II	**Tier III**
PAHs	Organochlorines (examples include alpha BHC, aldrin, dieldrin, chlordane)
Arsenic	Trace elements
Dioxins/furans	Current use pesticides (examples include carbamates, triazine herbicides, fipronil)
Lead	Pharmaceuticals and Personal Care Products
Organophospate Insecticides (azinphos methyl, chlorpyrifos, diazinon)	Other wastewater compounds (plasticizers, detergents, surfactants)
Copper	Hormones
Estrogenic compounds (Bisphenol A, AHTN, natural and synthetic estrogens, Nonylphenol)	Synthetic pyrethroids
	Phthalates

Factors Considered in Ranking Toxics

1. Is it recognized as an existing problem?

Monitoring Sub-Group

New Plan for Monitoring

1. Divide Columbia Basin into 5 geographic areas; identify the major tributaries in each area
2. Use the 'Contaminants of Concern' matrix to target chemicals and media to sample
3. **Identify the 'Lines of Evidence'**
4. Prioritize tributaries for monitoring in each geographic area utilizing the 'Lines of Evidence' approach
5. Identify the data gaps in each geographic area
6. Design a monitoring plan, by geographic area; conduct new or supplemental monitoring
7. Design and implement toxic reduction strategies
8. Design and implement effectiveness monitoring

Lines of Evidence: Questions to ask about tributaries when deciding where monitoring is needed first:

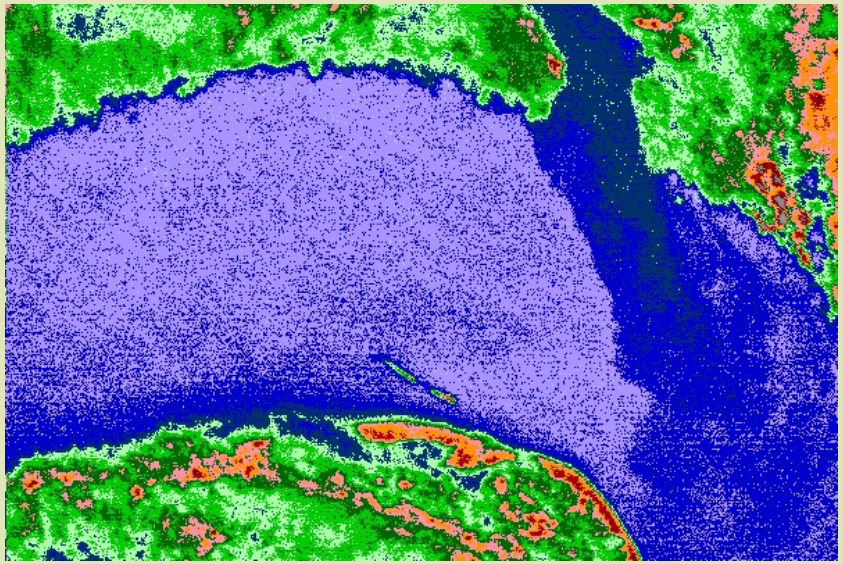
- Stream flow
- Population
- Point Sources
    - WWTPs
    - Industrial
- Pesticide Application
    - Legacy
    - Current
- Mining

Lines of Evidence: Questions to ask when deciding where monitoring is needed first:

"*Delivery likelihood*" based on Stream flow

The "lines of evidence" (LOE) metric for stream flow is:

The stream flow of the tributary as a percentage of the stream flow in the Columbia (or Snake) River immediately downstream of the confluence point.



The pilot project area is the Lower River Estuary Area - below Bonneville Dam

There are 15 Tributaries To the Columbia River in the Estuary

The next couple slides show The Lines of Evidence (LOE) Evaluation for this area

Example of a "Delivery Likelihood" LOE

Tributaries	Evaluation Area	% Columbia Flow at Confluence	Normalized % Flow
Willamette	1	15.45%	1.00
Cowlitz	1	3.98%	0.26
Lewis River	1	2.73%	0.18
Sandy	1	1.34%	0.09
Washougal	1	0.67%	0.04
Youngs	1	0.56%	0.04
Kalama	1	0.51%	0.03
Grays	1	0.41%	0.03
Lake	1	0.22%	0.01
Lewis & Clark	1	0.16%	0.01
Elochoman	1	0.15%	0.01
Skipanon	1	0.09%	0.01
Deep	1	0.06%	0.00
Clatskanie	1	0.04%	0.00

Lines of Evidence: Questions to ask when deciding where monitoring is needed first:

Activity Level based on Human "Disturbance/Stressors"

- Population density
- WWTP or Industrial discharge
- Legacy pesticide use
- Current pesticide use
- Historic/Current Mining

Example of a "Stressor" Line of Evidence

Tributaries	Evaluation Area	WWTP discharge % of stream flow	Normalized WWTP Flow
Lake	1	1.66%	1.00
Willamette	1	1.38%	0.83
Cowlitz	1	0.11%	0.06
Sandy	1	0.07%	0.04
Lewis River	1	0.00%	0.00
Washougal	1	0.00%	0.00
Youngs	1	0.00%	0.00
Kalama	1	0.00%	0.00
Grays	1	0.00%	0.00
Lewis & Clark	1	0.00%	0.00
Elochoman	1	0.00%	0.00
Skipanon	1	0.00%	0.00
Deep	1	0.00%	0.00

Gauging Magnitude of Stress

	Normalized Values						
Tributary	**Population Density**	**Mine Density**	**Agricultural Phosphorus Yield**	**Industrial NPDES Flow**	**WWTP Flow**	**Current Use Pesticides**	**Sum**
Lake	1.00	0.31	0.91	0.21	1.00	0.72	4.16
Willamette	0.10	0.38	0.48	1.00	0.83	0.11	2.90
Washougal	0.03	1.00	1.00	0.00	0.00	0.00	2.03
Grays	0.00	0.00	0.49	0.00	0.00	1.00	1.49
Sandy	0.03	0.06	0.58	0.00	0.04	0.59	1.31
Lewis River	0.01	0.22	0.37	0.00	0.00	0.61	1.21
Cowlitz	0.01	0.60	0.28	0.00	0.06	0.20	1.16
Skamokawa	0.00	0.00	0.67	0.00	0.00	0.07	0.75
Kalama	0.00	0.00	0.11	0.31	0.00	0.01	0.43
Youngs	0.00	0.00	0.33	0.00	0.00	0.02	0.35
Deep	0.00	0.00	0.34	0.00	0.00	0.00	0.34
Lewis & Clark	0.01	0.00	0.32	0.00	0.00	0.00	0.33
Elochoman	0.00	0.00	0.29	0.00	0.00	0.02	0.32

Comparison of “Stressors” and Delivery Likelihood

Tributary	Evaluation Area	Sum of Stressors	Normalized % Flow
Willamette	1	2.90	1.00
Cowlitz	1	1.16	0.26
Lewis River	1	1.21	0.18
Sandy	1	1.31	0.09
Washougal	1	2.03	0.04
Youngs	1	0.35	0.04
Kalama	1	0.43	0.03
Grays	1	1.49	0.03
Lake	1	4.16	0.01
Lewis & Clark	1	0.33	0.01
Elochoman	1	0.32	0.01
Skipanon	1	0.18	0.01
Deep	1	0.34	0.00

Lines of Evidence: Questions to ask when deciding where monitoring is needed first:

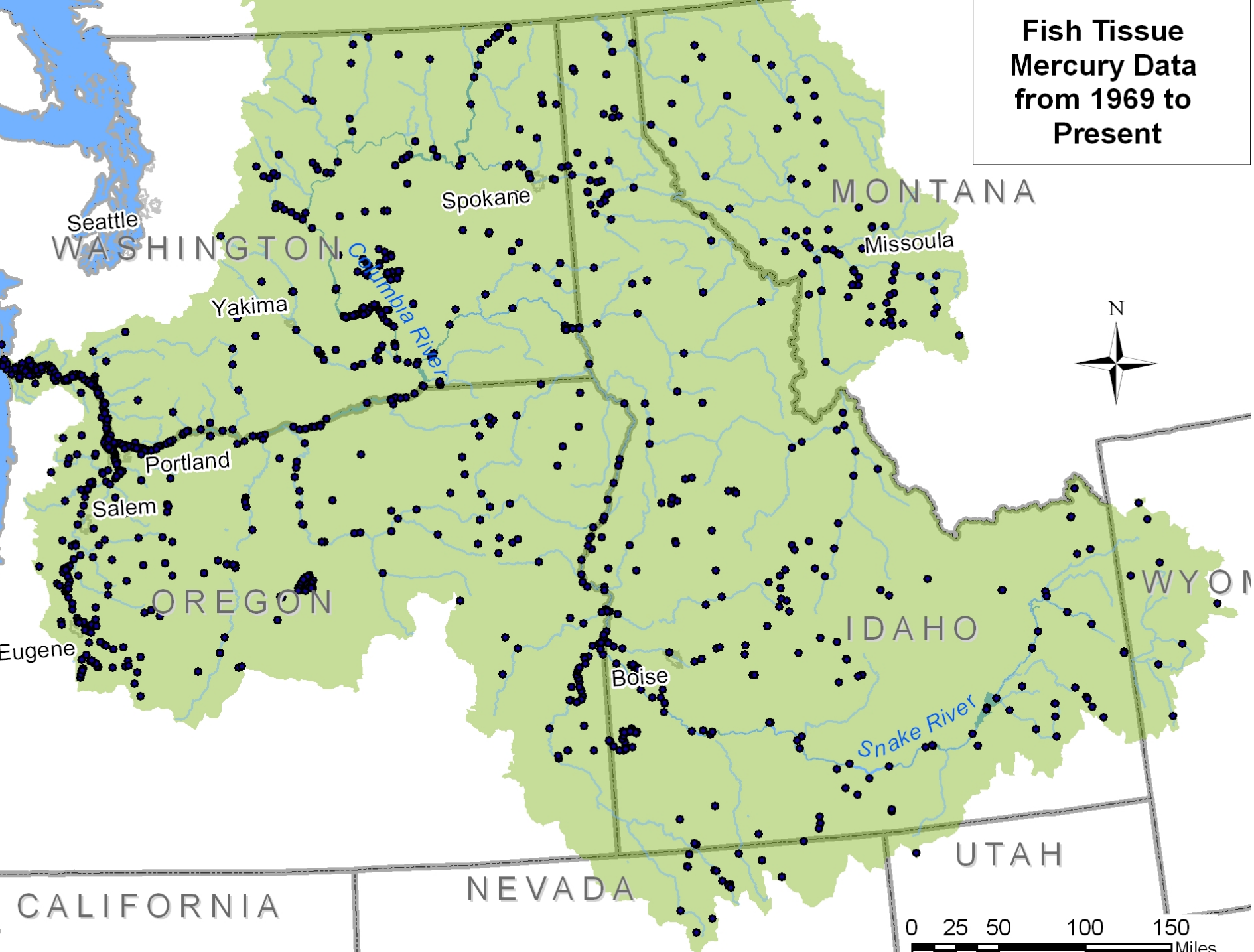
Delivery likelihood based on flow

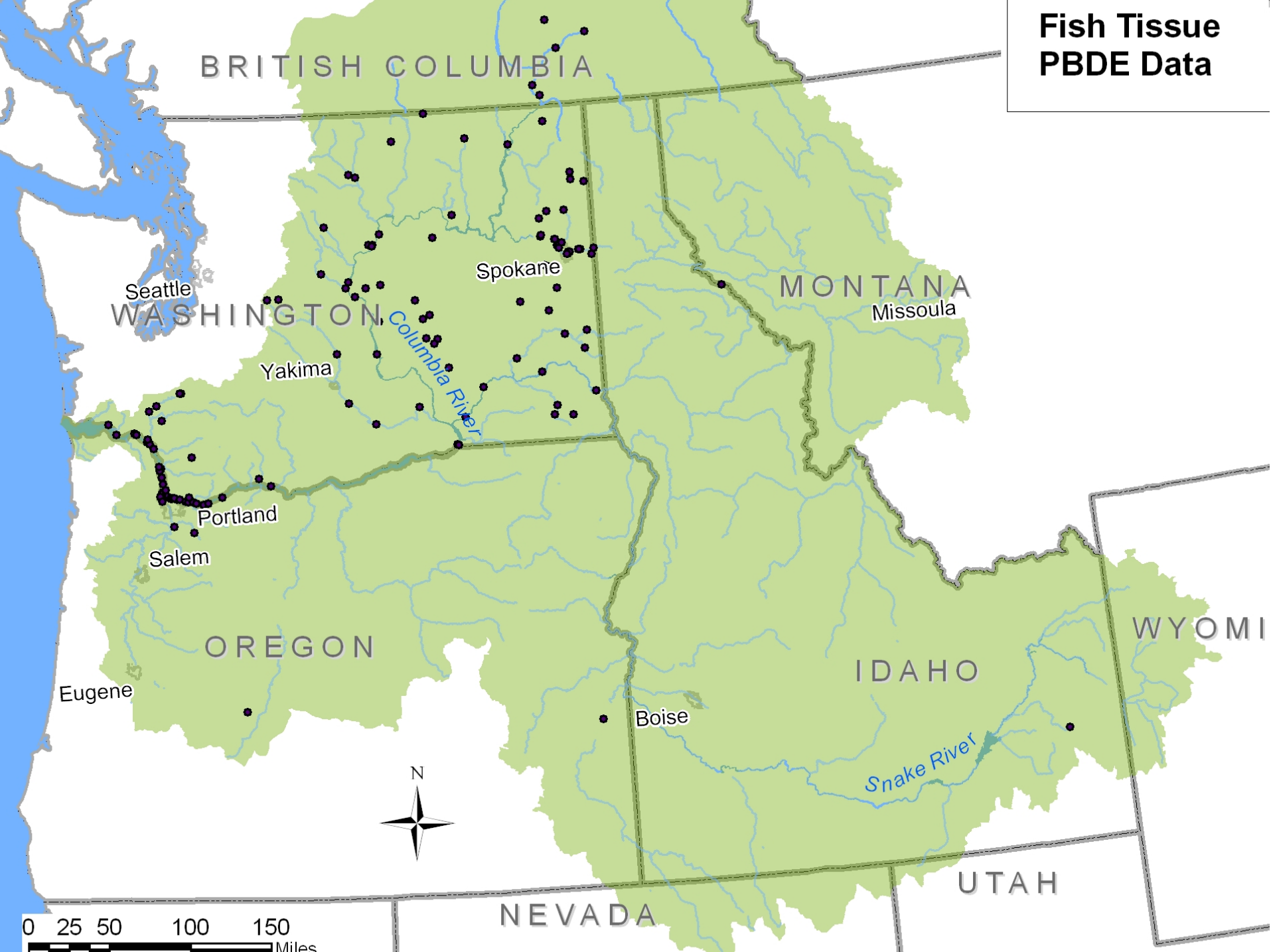
↓

Activity level based on human disturbance factors

↓

Environmental Condition -- monitoring data/ advisories


Fish Tissue Mercury Data from 1969 to Present
MONTANA
Spokane
Missoula
Seattle
WASHINGTON
Columbia River
Yakima
N
Portland
Salem
OREGON
Eugene
IDAHO
Boise
Snake River
WYOM
UTAH
NEVADA
CALIFORNIA
0 25 50 100 150
Miles


Fish Tissue
PBDE Data
BRITISH COLUMBIA
WASHINGTON
OREGON
IDAHO
MONTANA
WYOMI
UTAH
NEVADA
Seattle
Spokane
Missoula
Yakima
Columbia River
Portland
Salem
Eugene
Boise
Snake River
N
0 25 50 100 150
Miles

Monitoring Sub-Group

New Plan for Monitoring

1. **Divide Columbia Basin into 5 geographic areas; identify the major tributaries in each area**
2. **Use the 'Contaminants of Concern' matrix to target chemicals and media to sample**
3. **Identify the 'Lines of Evidence'**
4. Prioritize tributaries for monitoring in each geographic area utilizing the 'Lines of Evidence' approach
5. Identify the data gaps in each geographic area
6. Design a monitoring plan, by geographic area; conduct new or supplemental monitoring
7. Design and implement toxic reduction strategies
8. Design and implement effectiveness monitoring

THANK YOU