Summary of Recent Contaminant Monitoring Efforts in the Columbia River Basin

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for the
Columbia River Toxics Reduction Workgroup meeting
May 7, 2019

DEPARTMENT OF ECOLOGY
State of Washington

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Environmental Assessment

Our Environmental Assessment Program's mission is to measure, assess, and communicate environmental conditions in Washington. We work to improve the environment for current and future generations through innovative and excellent science and thriving partnerships.

I want to...

Go straight to the data

We assess Washington's environment

The Environmental Assessment Program is the science arm of our agency. Our scientists measure and analyze environmental conditions. Quality data is our highest priority. We use this data to evaluate and communicate environmental threats and to guide the state's environmental policy decisions.

Taking detailed field notes on a lake.

We engage in new partnership opportunities whenever possible to collaborate on scientific projects to inform environmental policy. We collaborate with state, federal, tribal, and local partners, such as the U.S. Environmental Protection Agency, the state Salmon Recovery Funding Board, local conservation districts, and the state departments of Natural Resources, Health, and Agriculture.

Our scientific services

- Manchester Environmental Laboratory provides governmental laboratory services with a full staff of experienced chemists and environmental scientists.
- Our Laboratory Accreditation unit ensures that Washington's environmental laboratories conduct analyses according to prescribed methods. They can help you find a lab.
- Our Quality Assurance program provides a structured and documented framework for our environmental data operations.

Precise lab work is integral to scientific studies.

Drivers of monitoring

- Risks to human health and aquatic life
- Water quality standards (303d, TMDLs)
- Fish Consumption Advisories
- Chemical Action Plans
- Pollutant source ID
- Trends - spatial and temporal

Chemicals of Concern

- Chlorinated pesticides
- Polychlorinated biphenyls (PCBs)
- Mercury
- Dioxins and furans (PCDD/Fs)
- Flame retardants (PBDEs, BFRs)
- PFAS

Challenges in monitoring COCs

- Negative health effects at low concentrations
- Many target analytes hydrophobic: found at very low concentrations in water
- Analytical methods for water have poor sensitivity
- Must concentrate analytes to measure effectively
  - Natural: sediment, fish, biofilms
  - Artificial: SPMDs, CLAMs, centrifuge

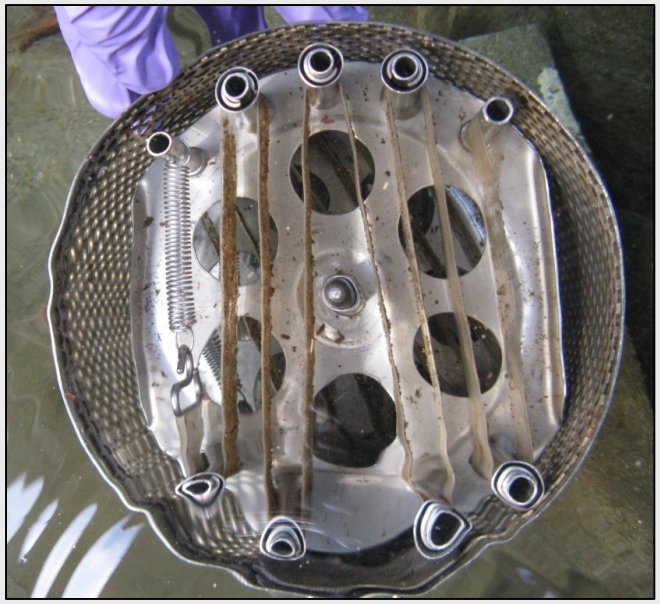
Fish collection

Field processing

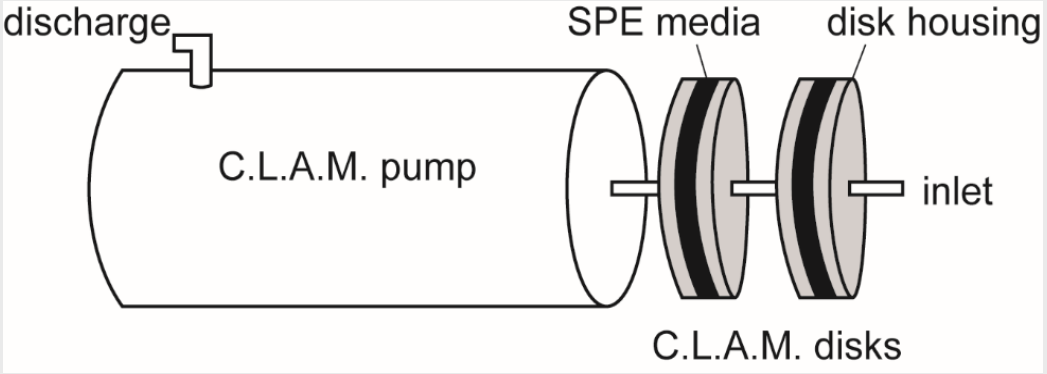
Sample prep

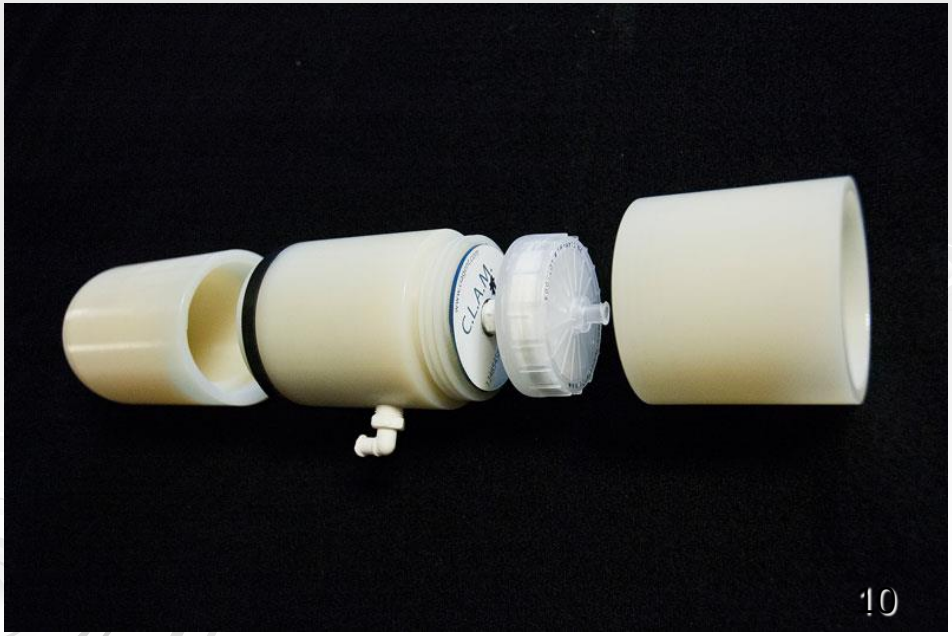
Sediment collection

Semi-permeable membrane device (SPMD)



Continuous low-level aqueous monitoring (CLAM)





Important tool for our monitoring work: Environmental Information Management database (EIM)

- Houses environmental monitoring data collected by Ecology scientists and partners
- Use EIM to search, view, and download data for air, water, soil, sediment, aquatic animals, and plants
- User-friendly search interface; advanced search options available

https://apps.ecology.wa.gov/eim/search/default.aspx

Washington State Department ... | EIM Search

File Edit View Favorites Tools Help

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EIM Search

Environmental Information Management System

Search Home | All | Studies | Locations | Results | Groundwater | Help Center | Contact EIM

EIM News

EIM data last updated on Monday, April 29, 2019

Search:

ALL — Studies + Locations + Results

Studies — Example: Study ID AODE6815

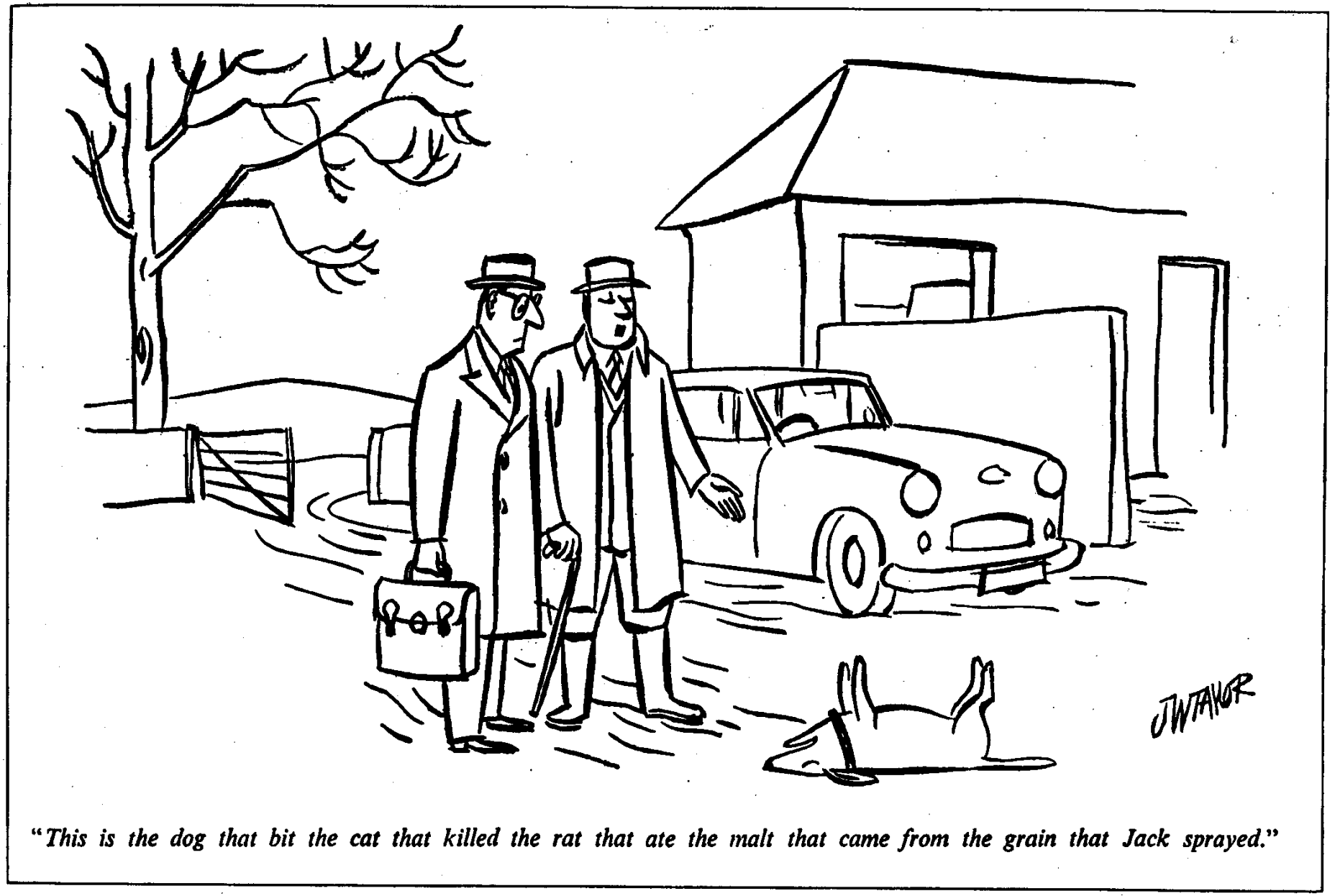
Locations — Example: Nooksack River

Results — Example: Copper

Click to search by map

Search does not include physical habitat data and metrics - see Watershed Health below.

Search Monitoring Programs within EIM Datasets collected by Ecology and affiliates, with specific monitoring objectives and consistent protocols. Most are long-term and regularly-scheduled. Each Monitoring Program has a custom search form and map to help you find data.



"This is the dog that bit the cat that killed the rat that ate the malt that came from the grain that Jack sprayed."

PUNCH, March 6, 1963

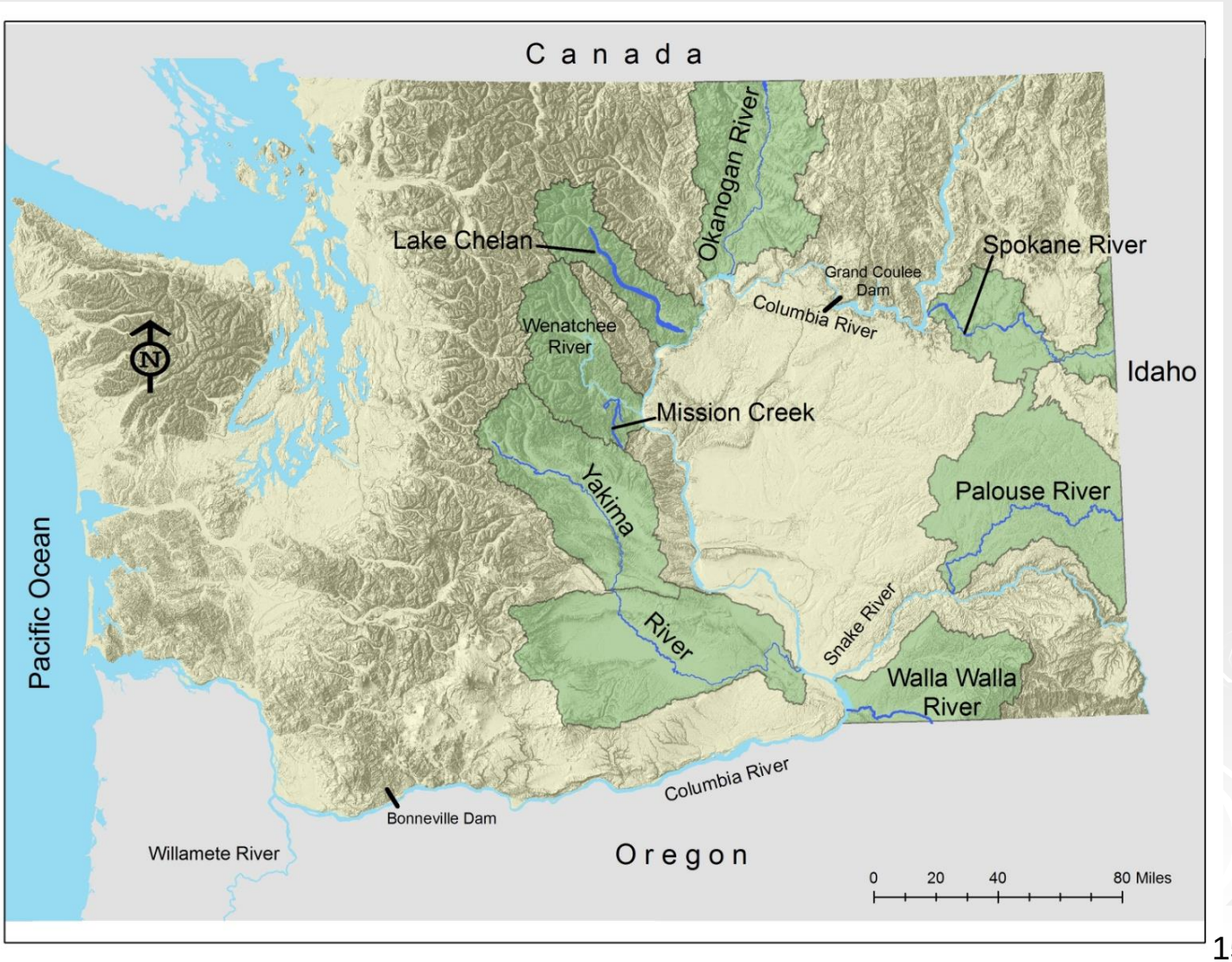
Contaminant Monitoring History

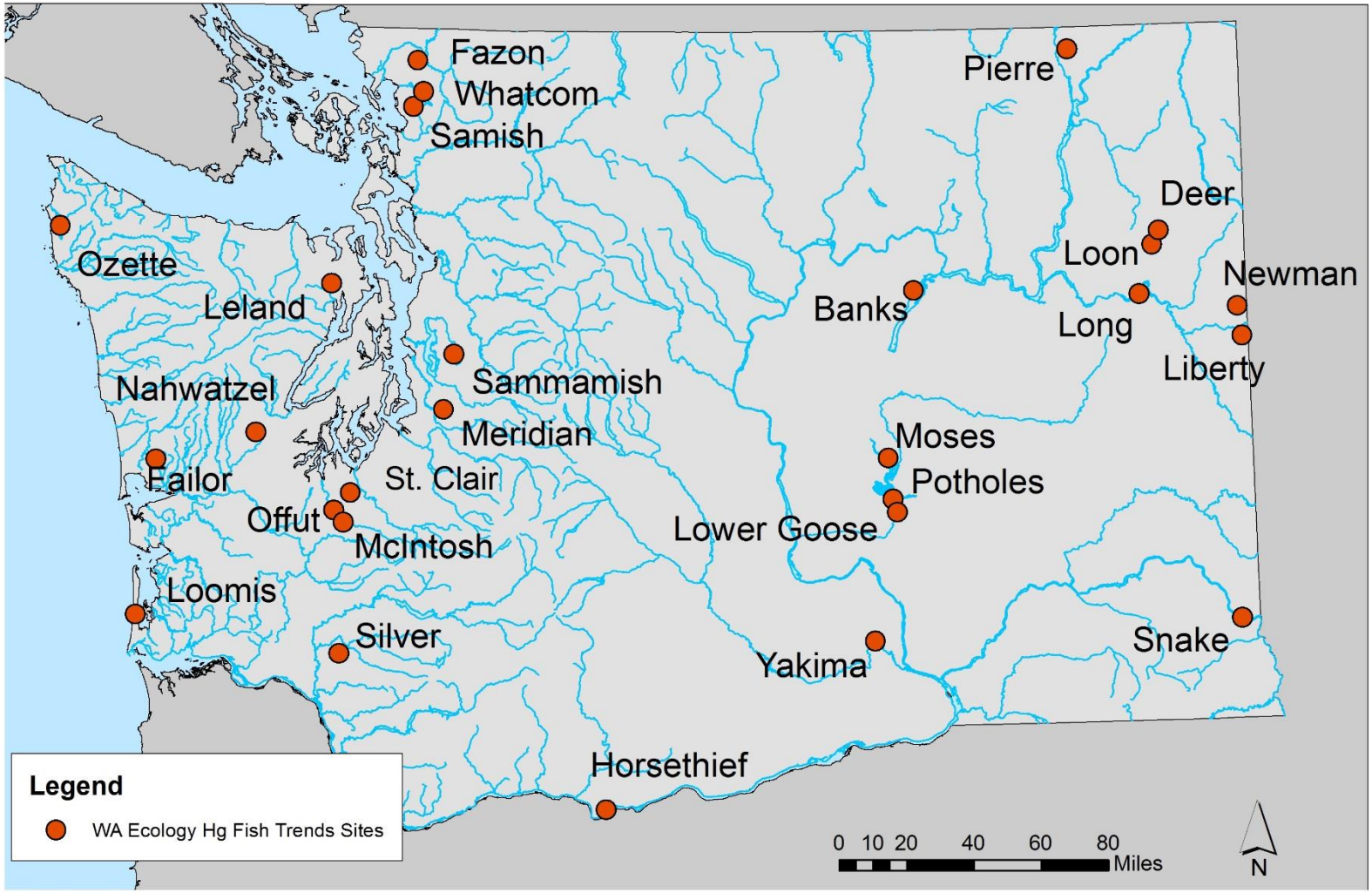
1970's	Columbia, Snake: NCBP-USFWS	Palouse R
1980's	BWMP statewide Roosevelt, Columbia R	Yakima, Spokane
1990's	Yakima, Spokane, Roosevelt Columbia basin - EPA CRITFC 10 Lakes (2x)	WSPMP (6 yrs) Osoyoos, Whatcom, bogs, other Yakima, CCP: USGS NAWQA
2000's	Statewide: Hg, PBDEs, As 303d Verifications, Hatchery Fish Whatcom, Vancouver, Washington Roosevelt: EPA, USGS	EPA Nat'l Lakes, USGS Alpine Lakes TMDLs: Okan, Chel, Wall, Pal, Spok, Yak WSTMP, Hg Trends, SPMD Trends Energy: Hanford Reach
2010's	FFCMP Long Term + Exploratory SAs: Wen, Wall, Spok (htchry, GW)	Hg Trends, PFAS, BFR+other FRs “Background” for PCBs, PCDDFs, CPs

Washington Chlorinated Pesticide and PCB TMDLs/Source Assessments

<u>TMDLs</u>
Yakima R
Lake Chelan
Mission Cr
Okanogan R
Palouse R
Walla Walla R

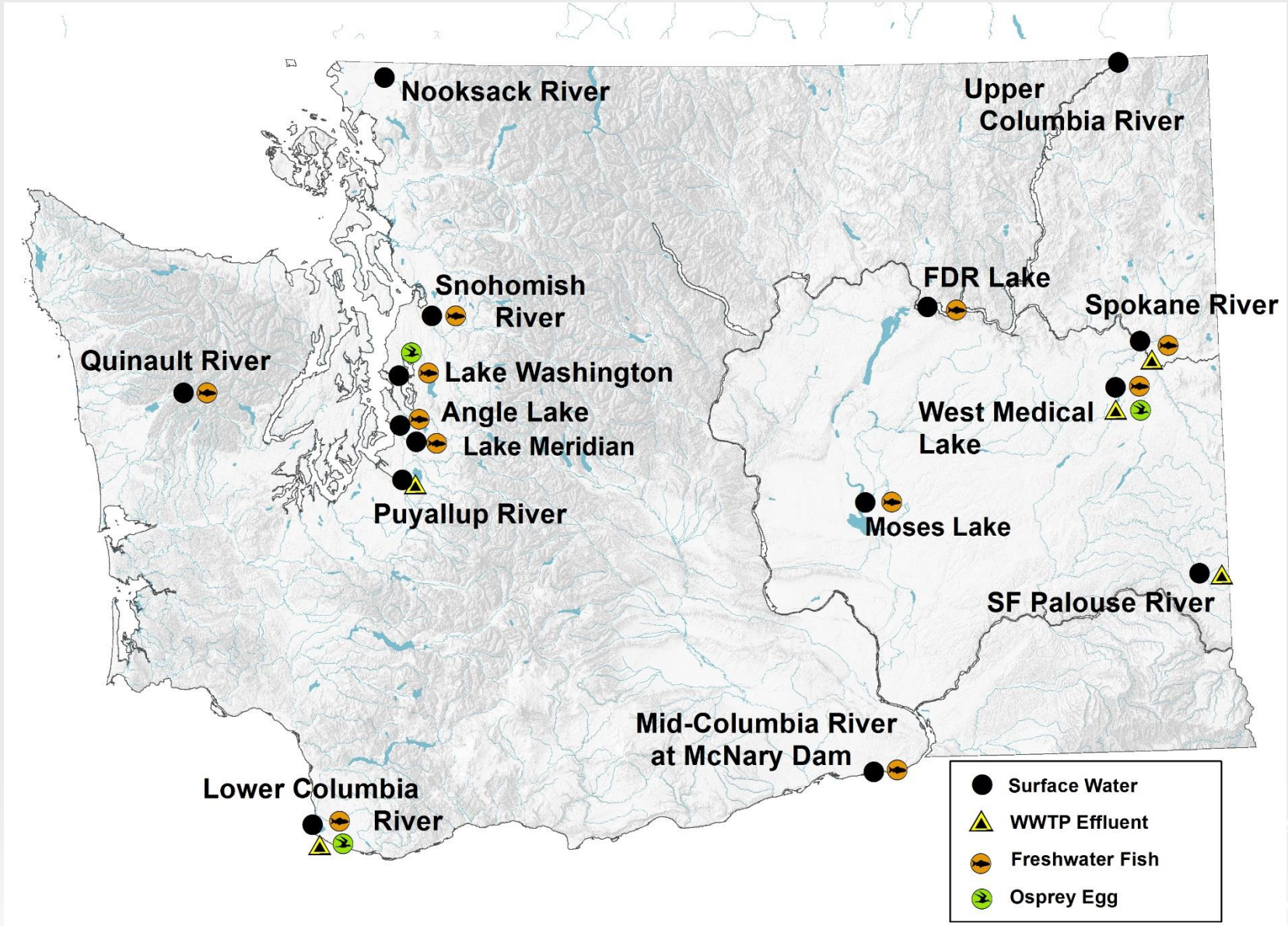
<u>Source Assessments</u>
Spokane R
Wenatchee R





Mercury Trends in Fish sites 2005-2020: 27 sites, ~6 sites/year, 5 yr sampling frequency each site (per Mathieu, 2019)

https://ecology.wa.gov/Research-Data/Monitoring-assessment/toxics-monitoring/Mercury-in-fish-tissue



Sites and matrices for 2016 PFAS study (Mathieu, 2017)

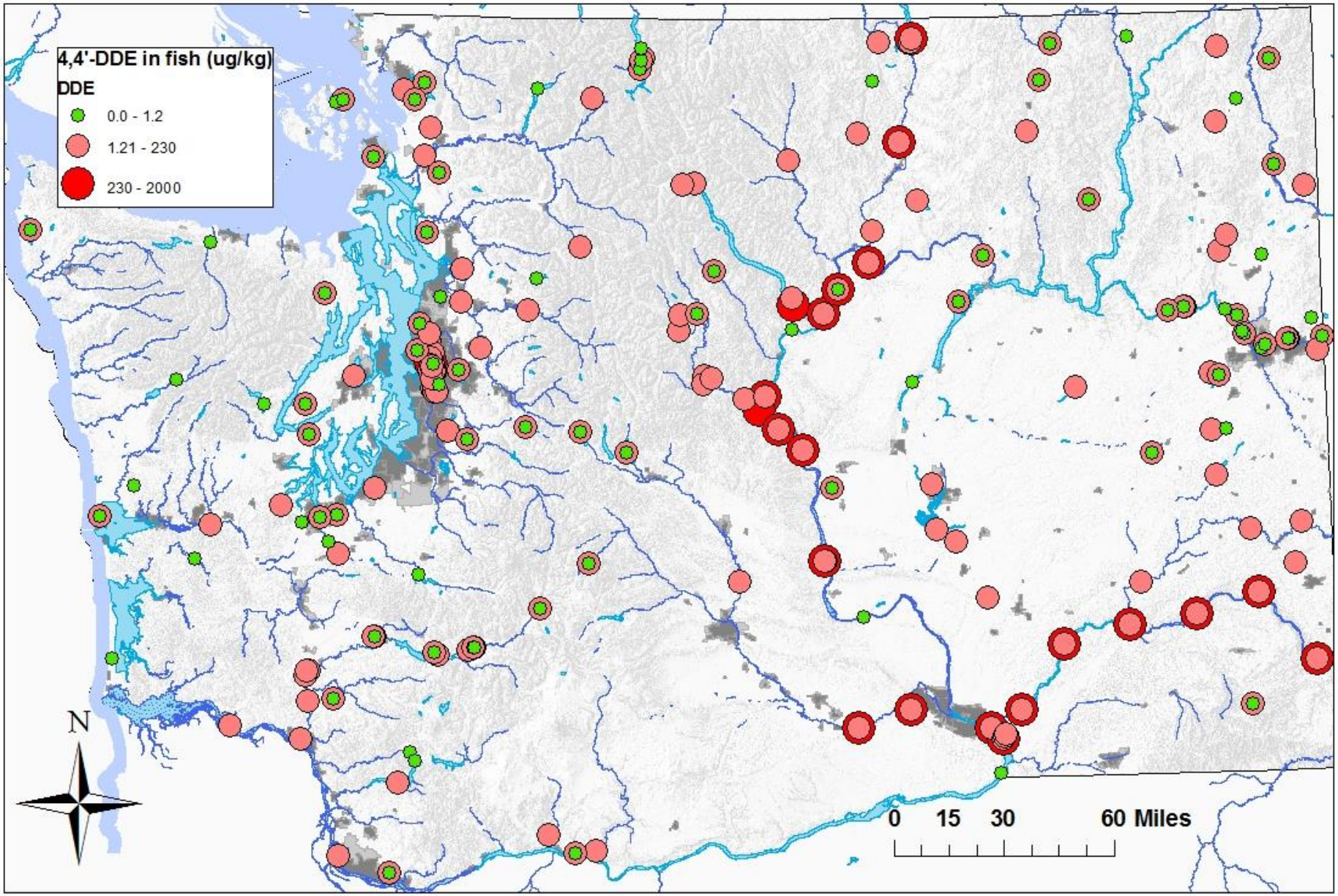
Freshwater Fish Contaminant Monitoring Program (FFCMP)

Goal: Characterize contaminant levels in fish

- Exploratory monitoring
  - Provide new information about sites, species, chemicals
- Long Term trend monitoring
  - Target sites with high levels of PBTs: TMDLs, FCAs

https://ecology.wa.gov/Research-Data/Monitoring-assessment/toxics-monitoring/Freshwater-fish-contaminant-monitoring

FFCMP sites 2001-2018: ~930 samples from ~180 sites since 2001

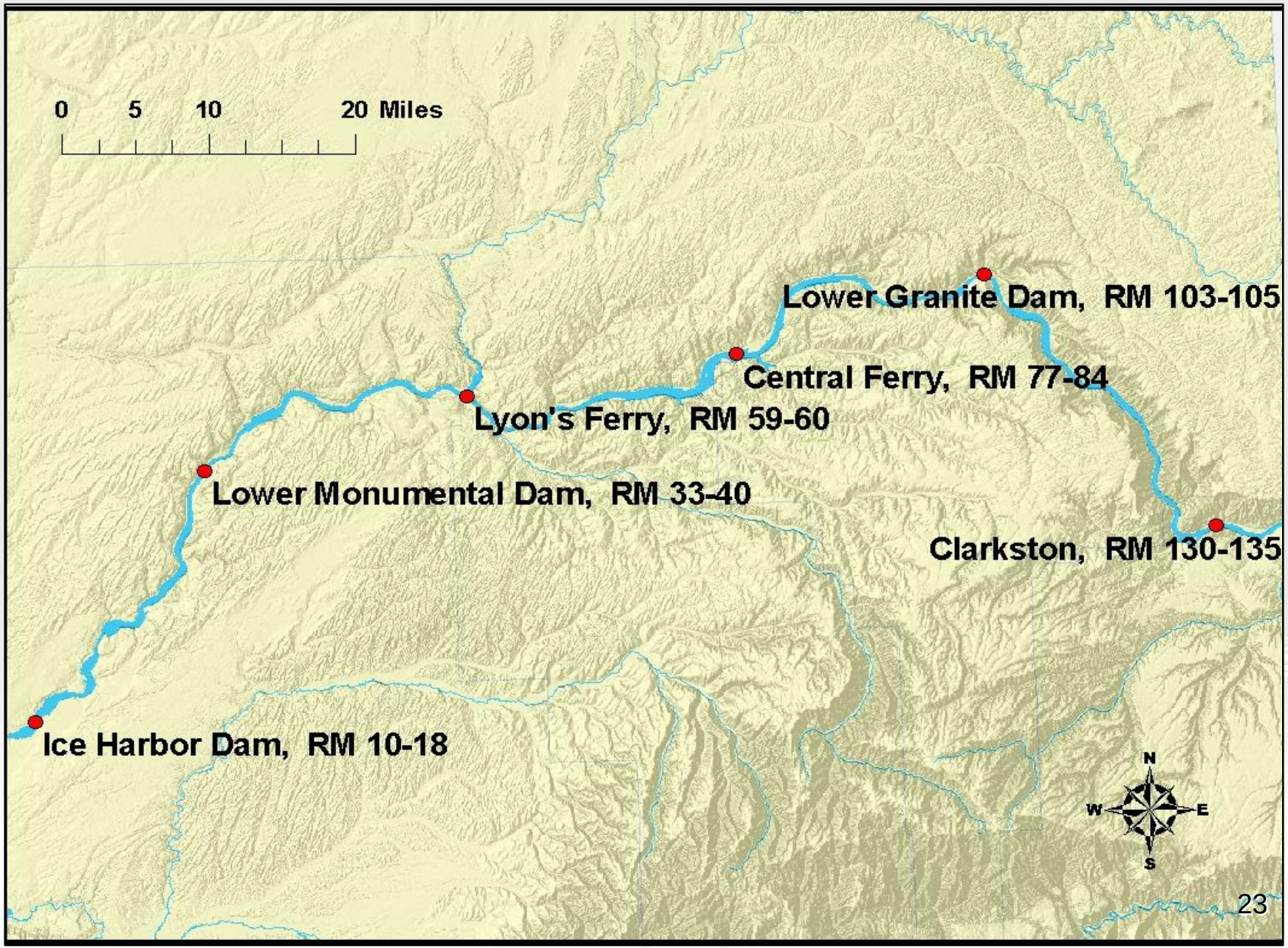


FFCMP Long Term Trend Monitoring Component

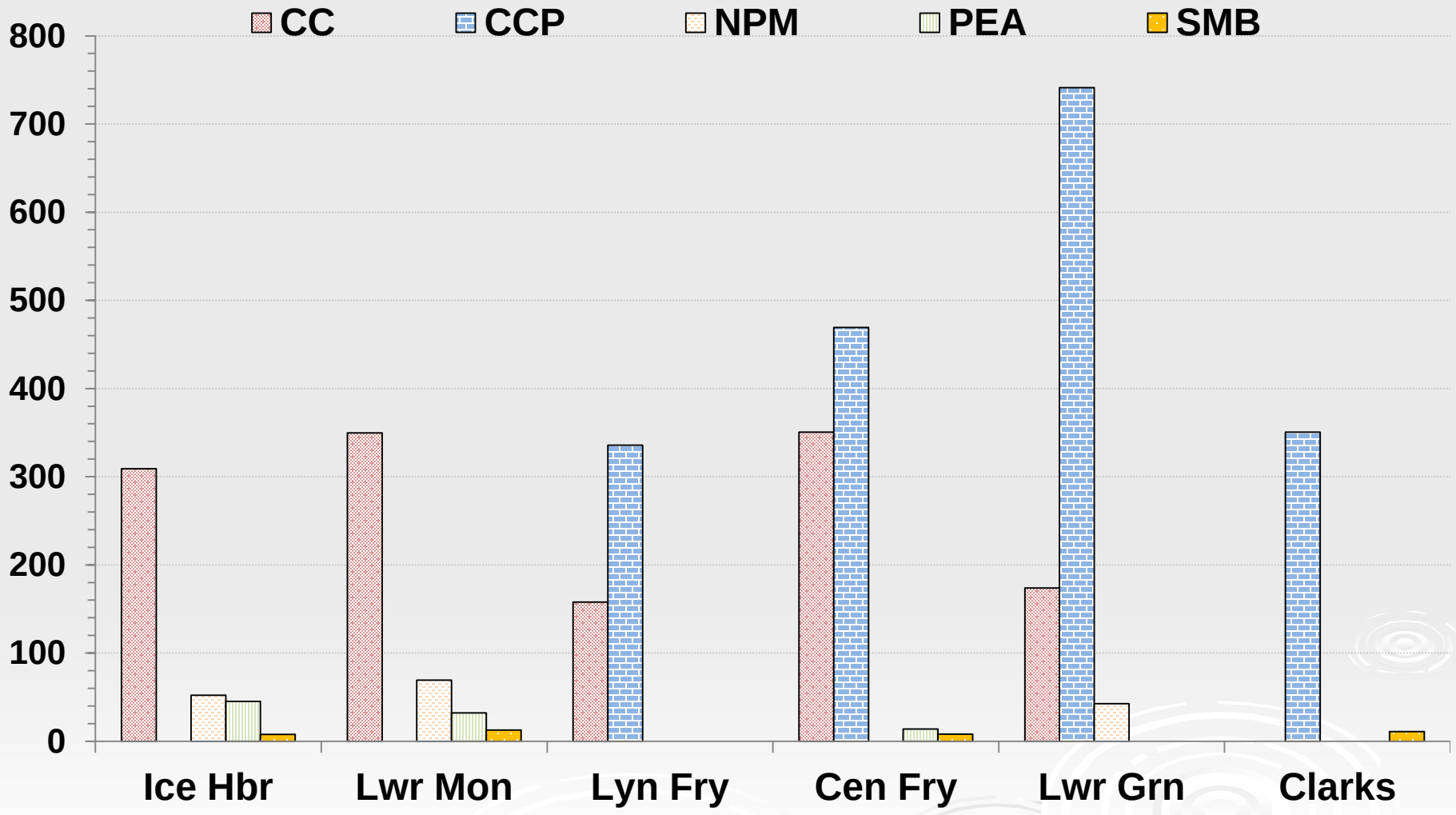
- 2009 – Snake R
- 2010 – Lake Chelan, Wenatchee R
- 2012 – Spokane R
- 2013 – mid-Columbia R
- 2014 – Yakima R
- 2015 – Lake Washington, Green L
- 2016 – Cowlitz R
- 2017 – Okanogan R
- 2018 – Palouse R

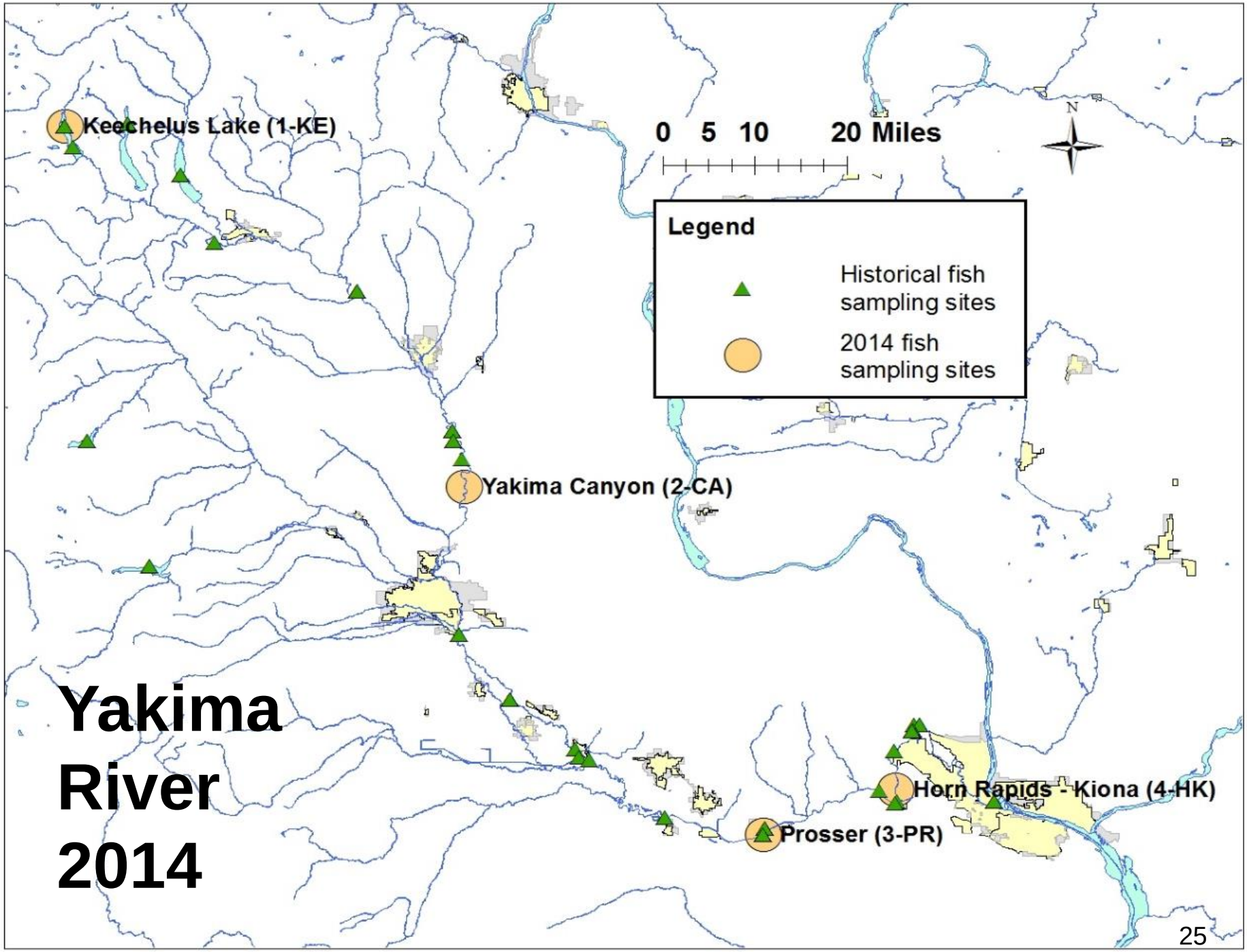

Snake River 2009

Snake River fish sample sites

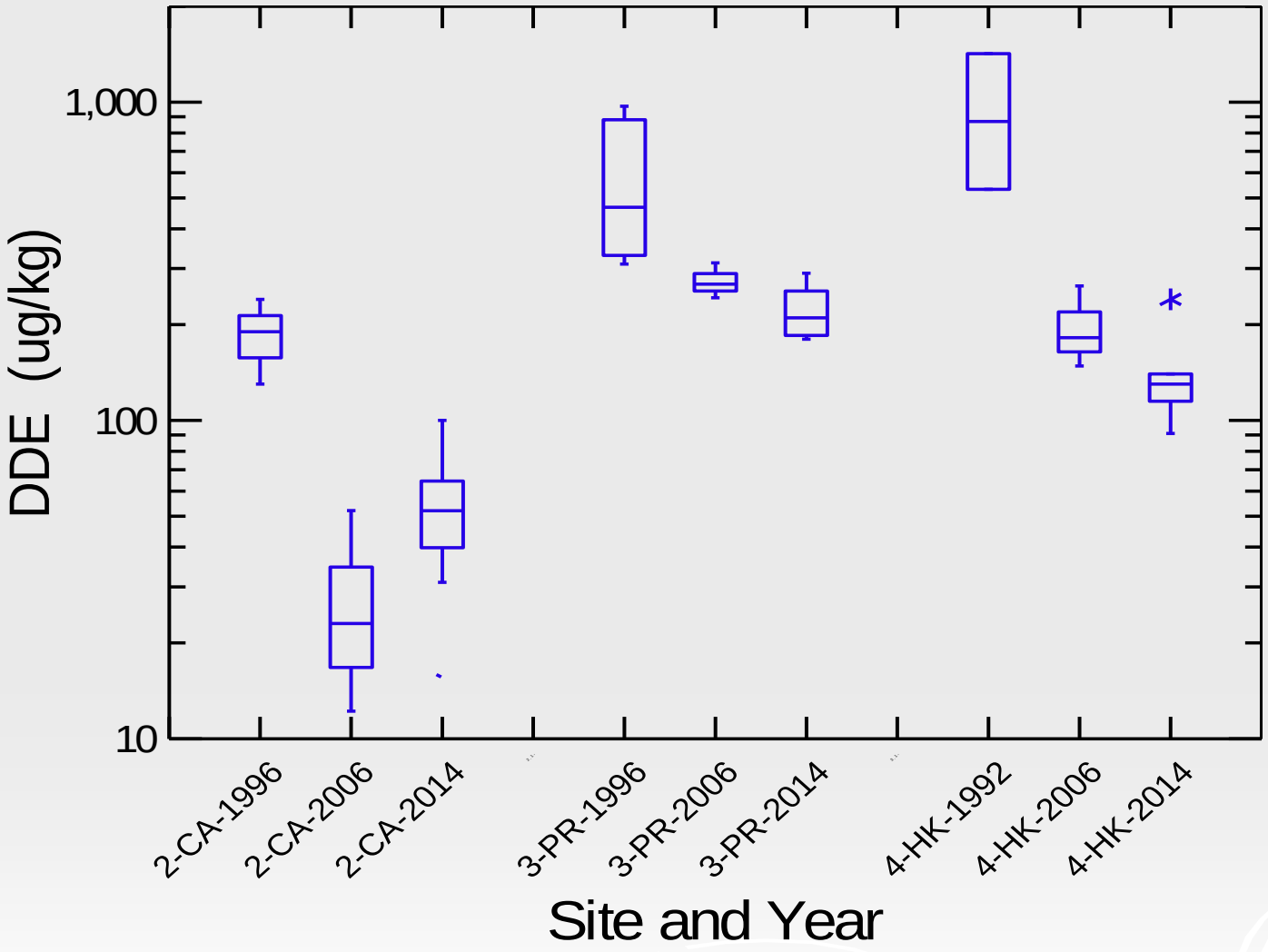


t-DDT (ug/kg) in Snake River fish: 2009




Keechelus Lake (1-KE)
0 5 10 20 Miles
N
Legend
Historical fish sampling sites
2014 fish sampling sites
Yakima Canyon (2-CA)
Horn Rapids - Kiona (4-HK)
Prosser (3-PR)
Yakima River 2014

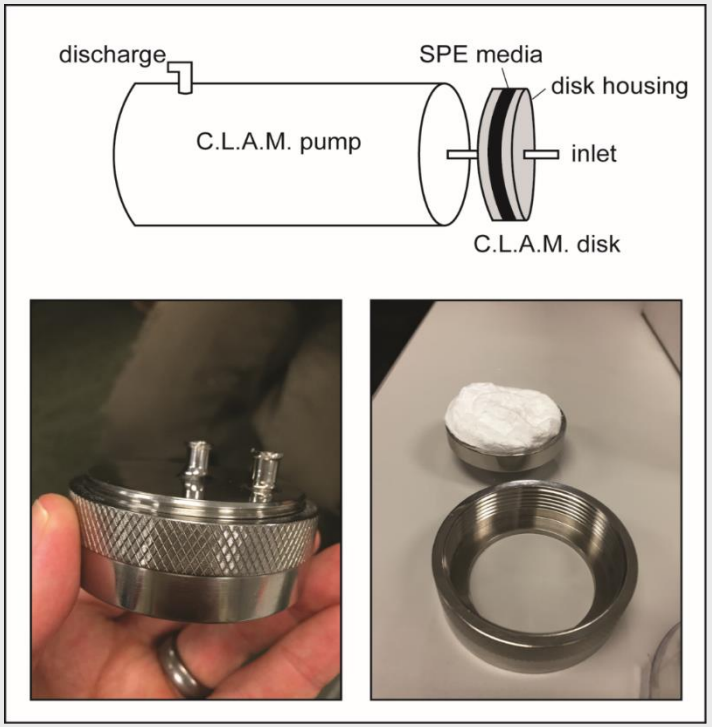
DDE in whole largescale suckers: 1992 to 2014 for three sites in the Yakima River.

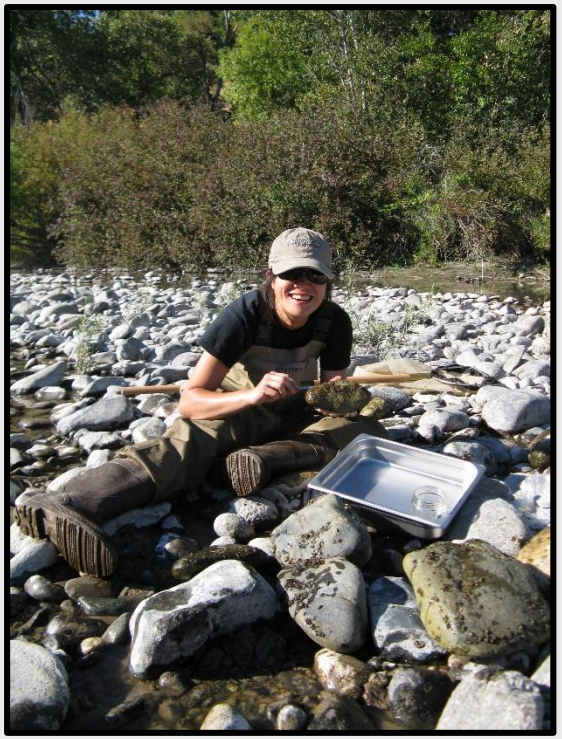


Summary: Yakima River

- Five decades of effort by multiple groups needed to acknowledge problems, craft plans, and implement solutions
- Signs of success seen in decreasing levels of DDT in whole suckers. No clear signal in fillet tissue.
- Monitoring needed for identifying problems, locating pollution sources, and measuring progress
- Likely many more decades to fully realize TMDL goals for clean water

Source Tracking of Toxic contaminants in the Columbia Basin



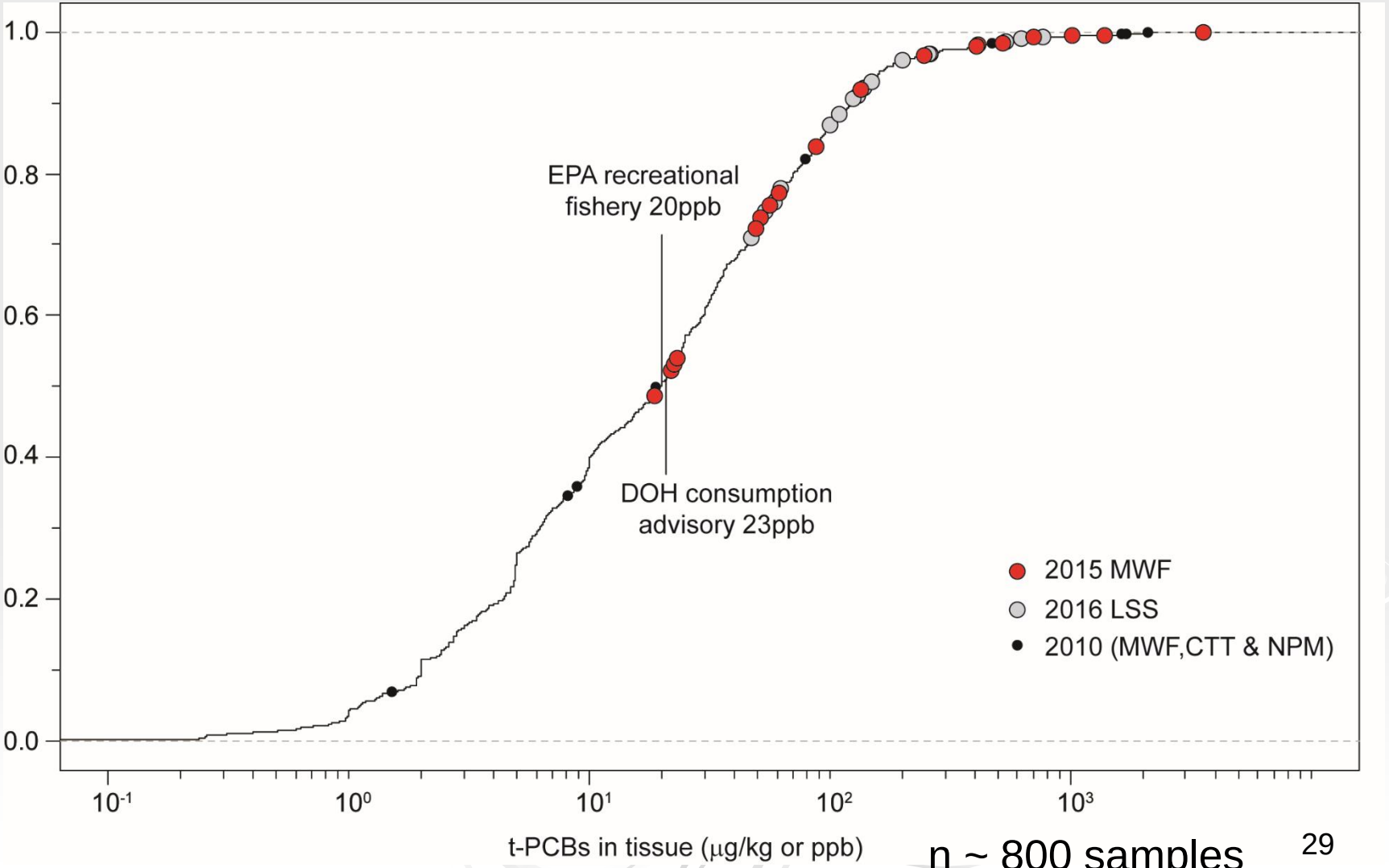


Environmental forensics –tracking of contaminant sources in rivers, streams and lakes

Requires a holistic perspective of aquatic ecology

Wenatchee River - PCBs in fish tissue

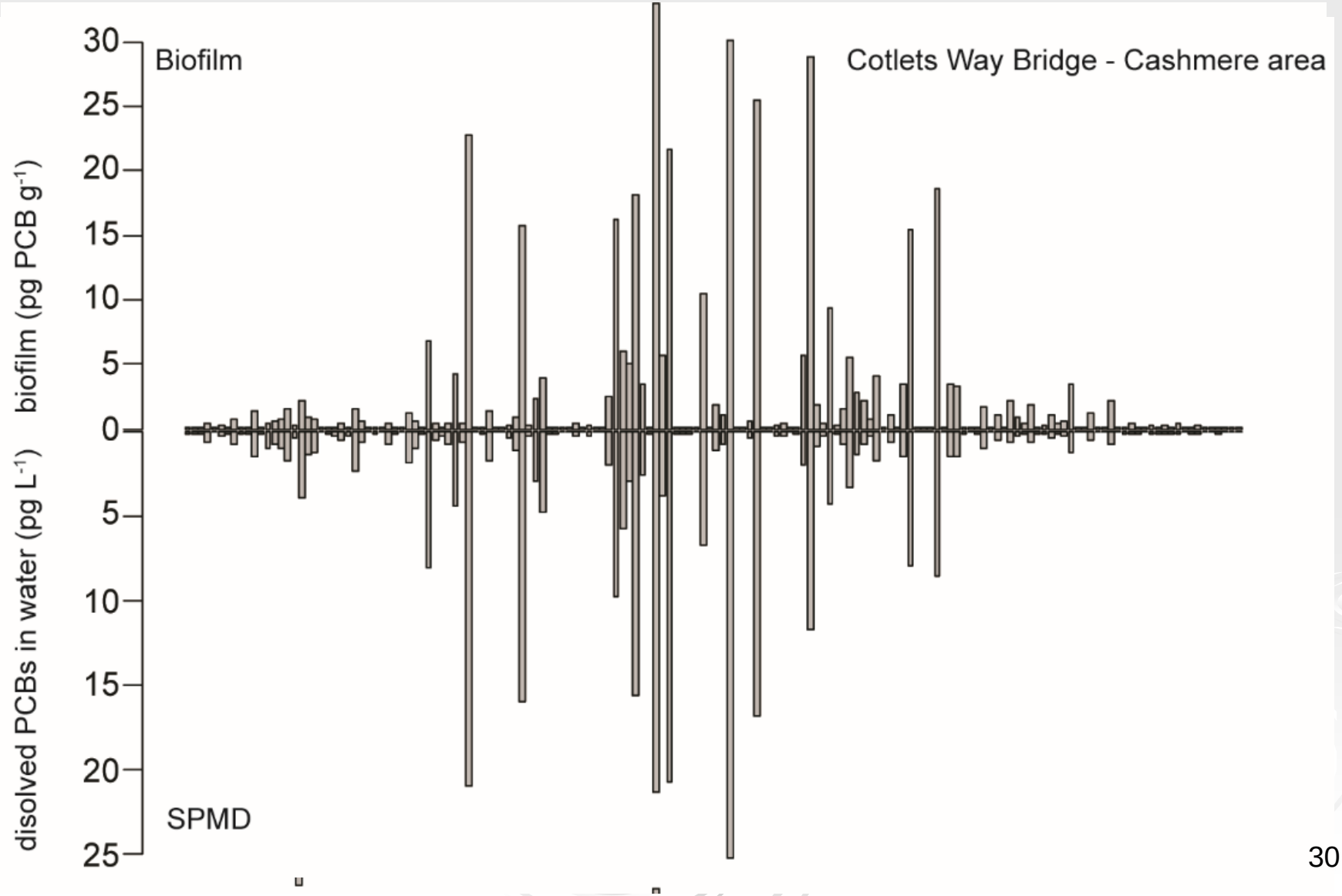
• Mountain whitefish (*Prosopium williamsoni*) from the Wenatchee River have some of the highest PCB concentrations in Washington State



n ~ 800 samples

Two PCB Sources

- Different distribution between upstream and downstream locations = different sources

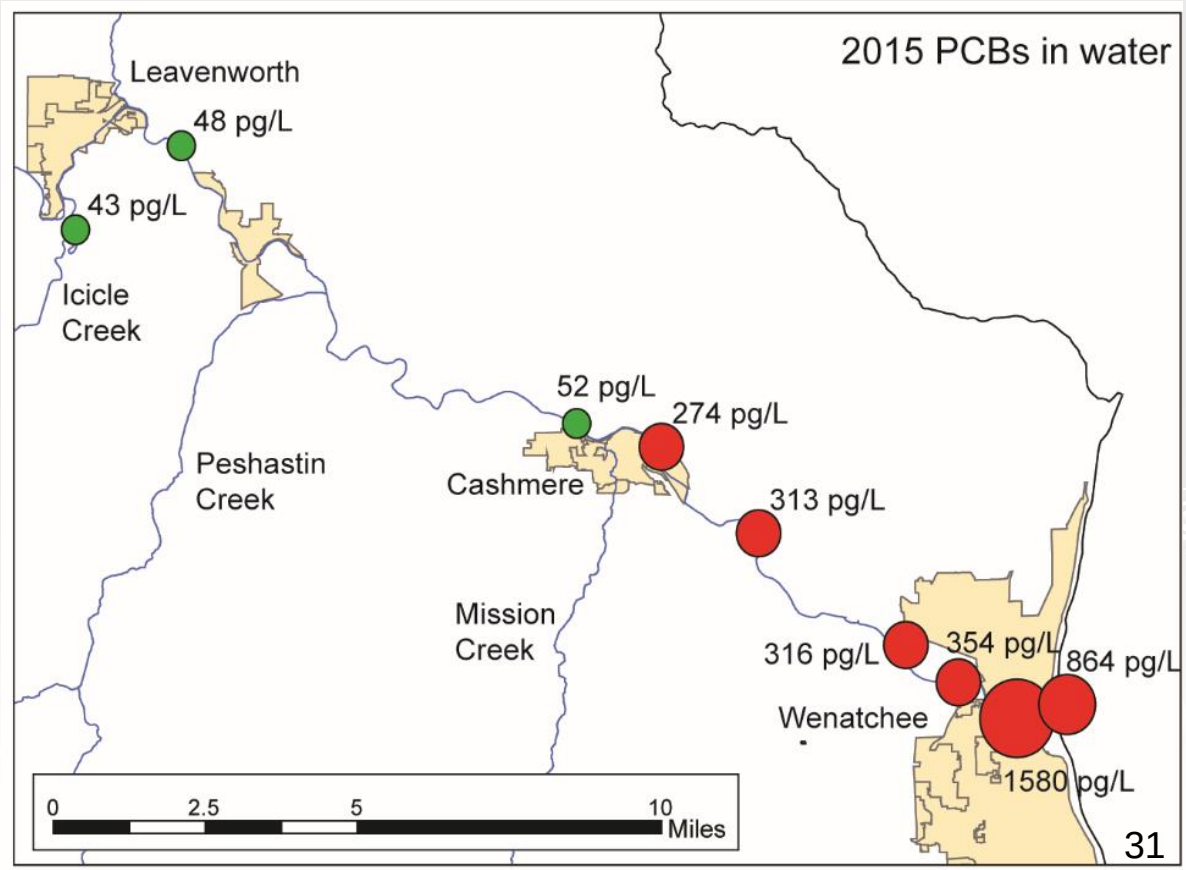


PCB Sources in the Wenatchee

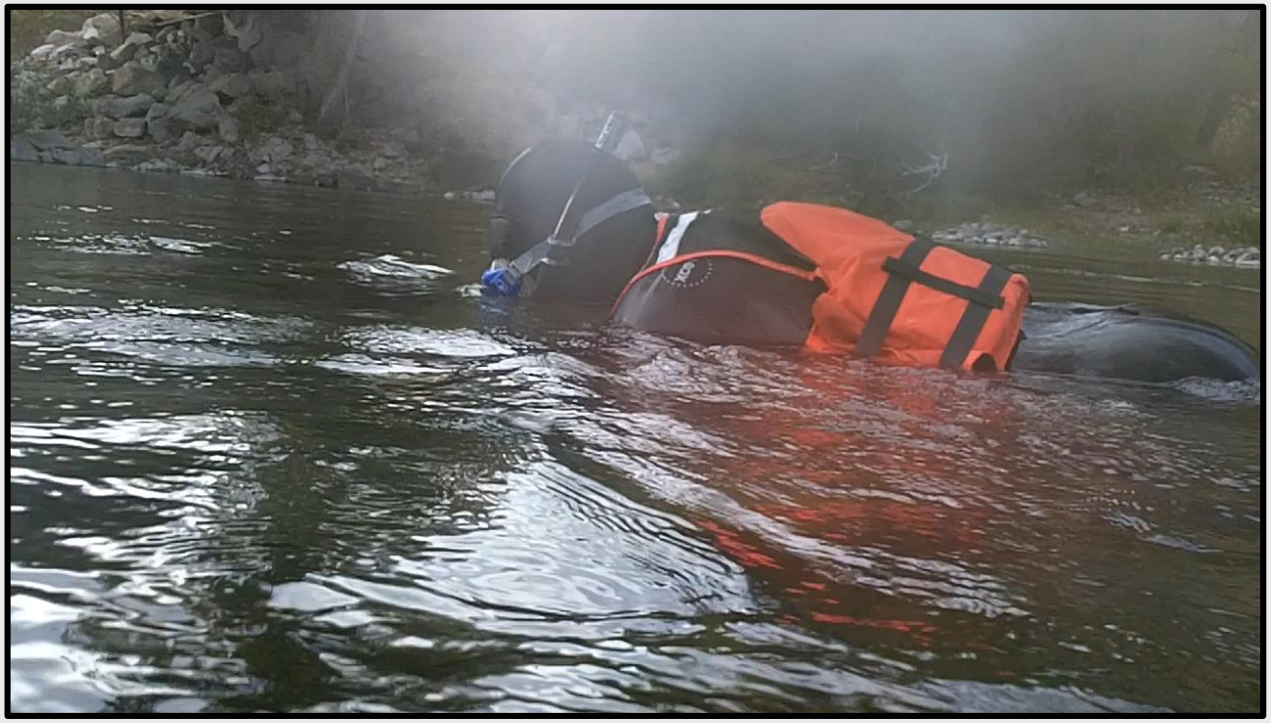
- Two chemically distinct PCB sources
  Upstream Source
  - Congener profile does resemble Aroclor 1254

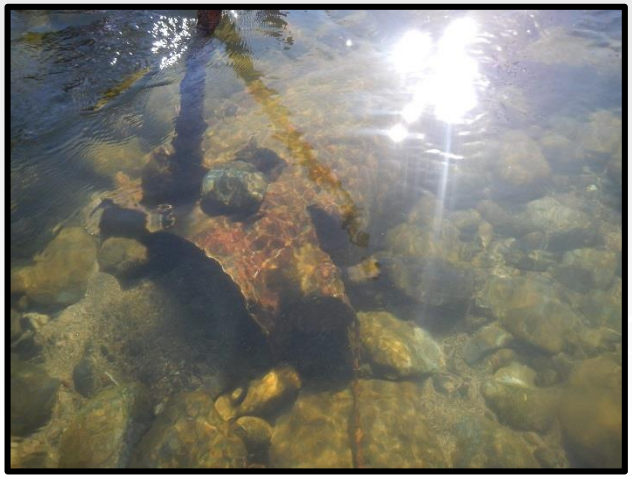
  Downstream Source
  - Congener profile resembles Aroclor 1242/1248 with congeners that suggest microbial dechlorination.

- Same congener profile over time and at low and high flow = **constant source** (i.e. not stormwater); likely groundwater inputs



PCB Sources in the Wenatchee – unlikely to be transformers





Pine Creek - Walla Walla: toxaphene in water

- Walla Walla listed for PCB and chlorinated pesticides in 1996 based on tissue samples from 1993; no toxaphene data
- Pesticides sampled in water in 1997 by Johnson; no toxaphene data
- TMDL for PCBs and chlorinated pesticides showed toxaphene in Pine Cr. – triggered source assessment for toxaphene.

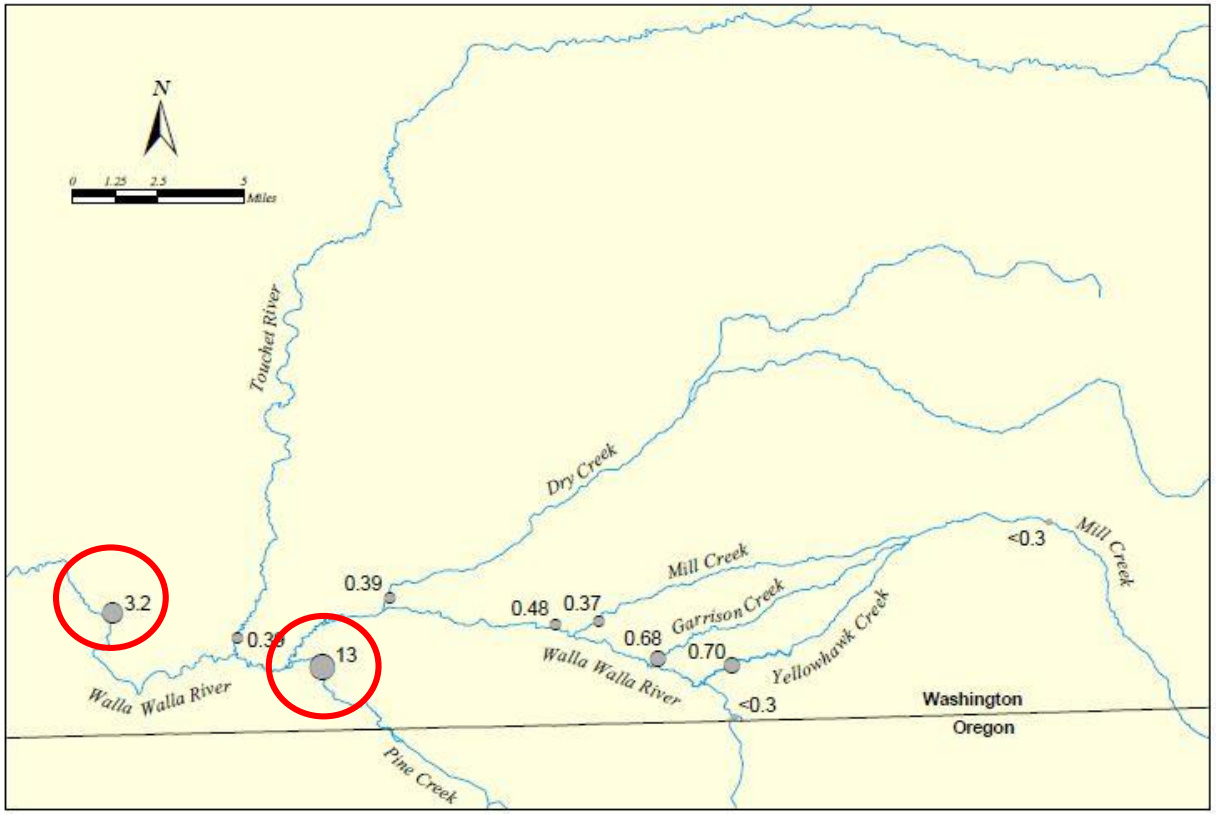


Figure 17. Annual Average Estimated Toxaphene Concentrations Measured in the Walla Walla Drainage (ng/L dissolved; parts per trillion).

Johnson et al. 2004 Pub:04-03-032.

Irrigation over-flow ditch

March 5, 2014

March 6, 2014

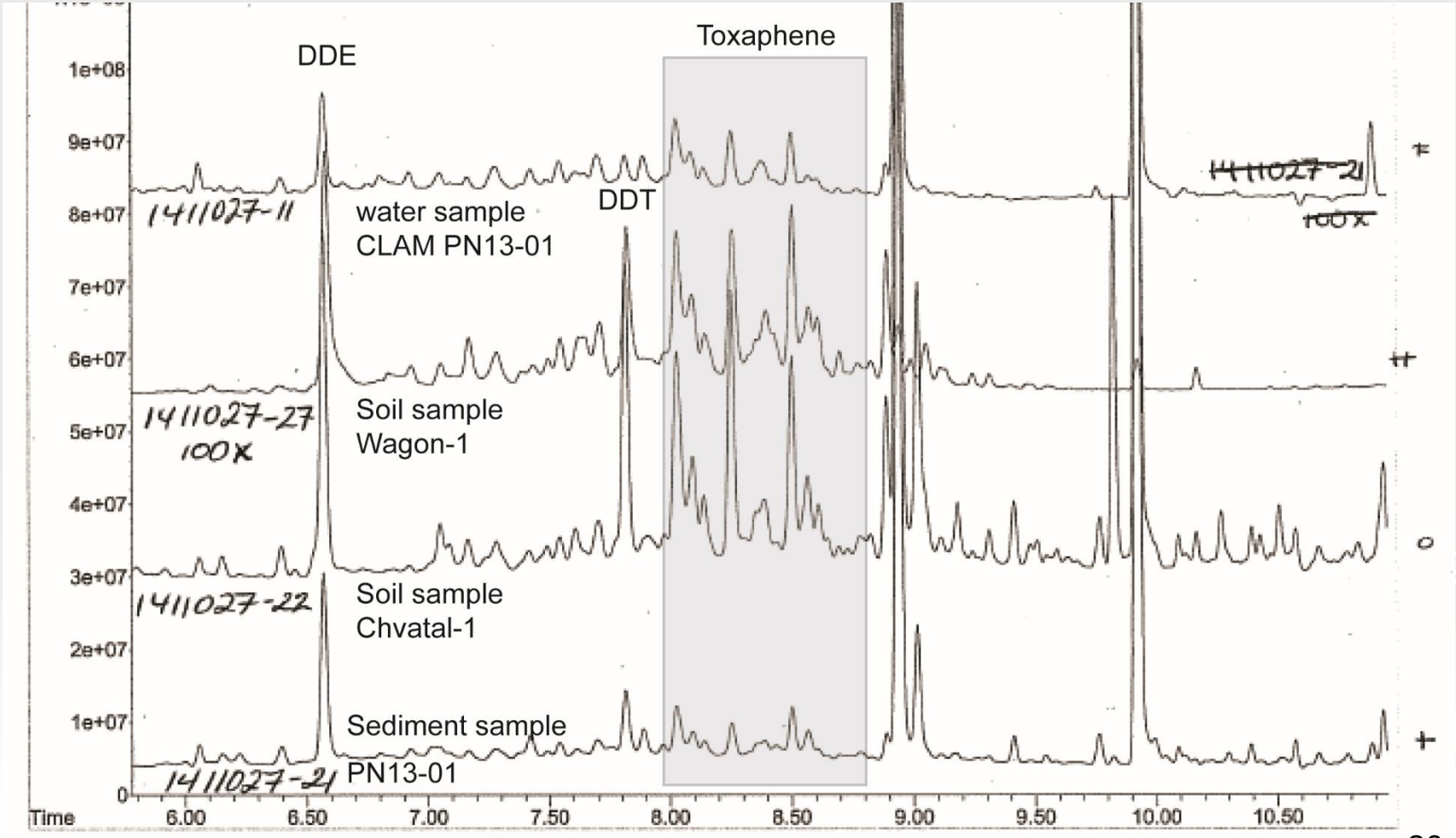
Soil and Sediment survey

• upland sediments and soils in the overflow ditch had higher concentrations than bed sediments
• a number of former dump sites along ditch

• alfalfa field soils where toxaphene was applied had measurable concentrations of toxaphene 40 years after application

Actual Source

- comparison of toxaphene in different media shows similar chromatogram
- different than technical grade (fresh) toxaphene
- watershed inputs of toxaphene from soils and sediments



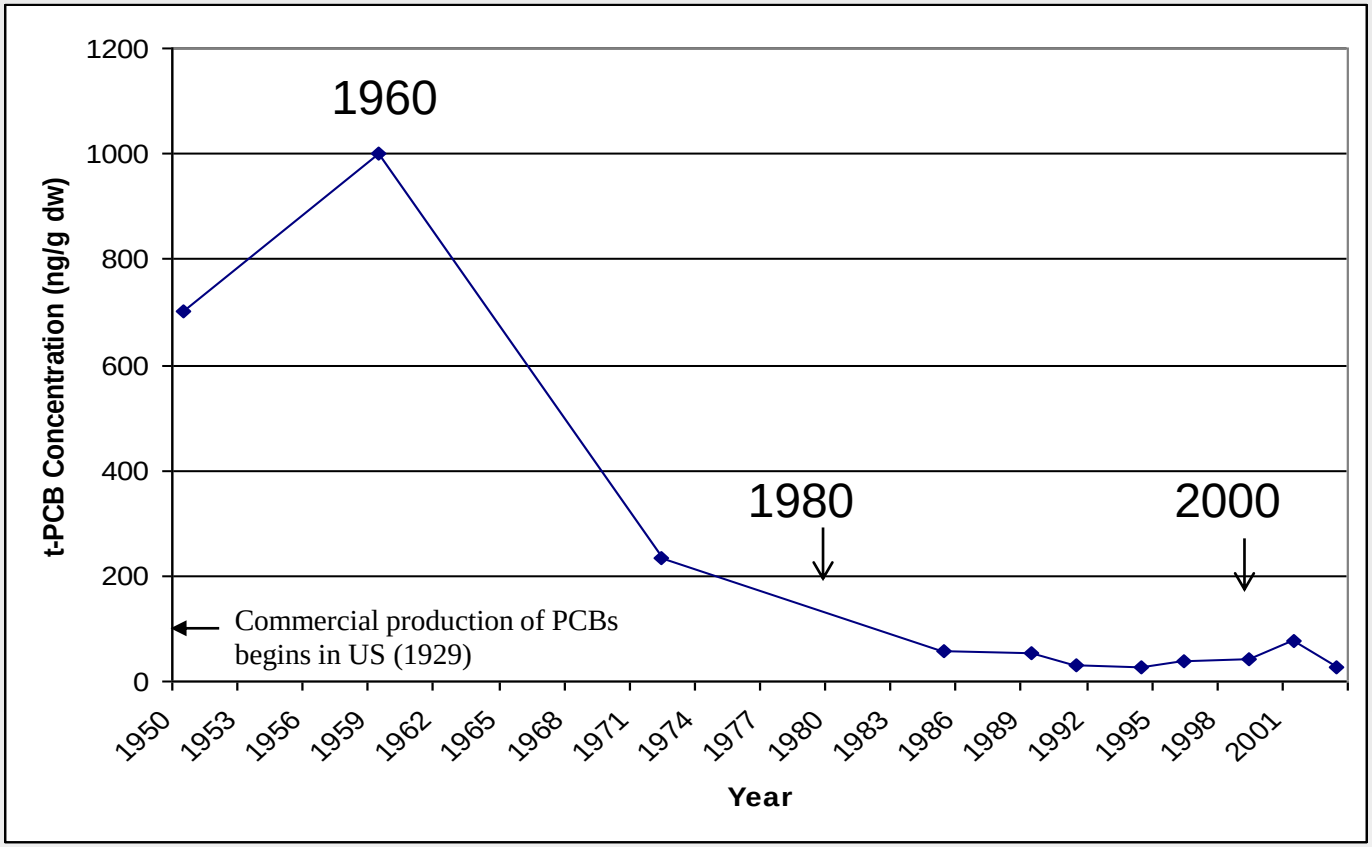
Spokane River - PCBs in fish tissue

- Studies from as early as 1978 showed elevated concentrations of PCBs in fish tissue.
- Has been on the State's 303(d) list since 1996 for fish tissue samples analyzed in 1993.

- Sediment clean-up and capping of sediments behind Upriver Dam

- Kaiser Aluminum and other Toxics Clean-up sites

PCBs History from Sediment Record Lower Lake Spokane



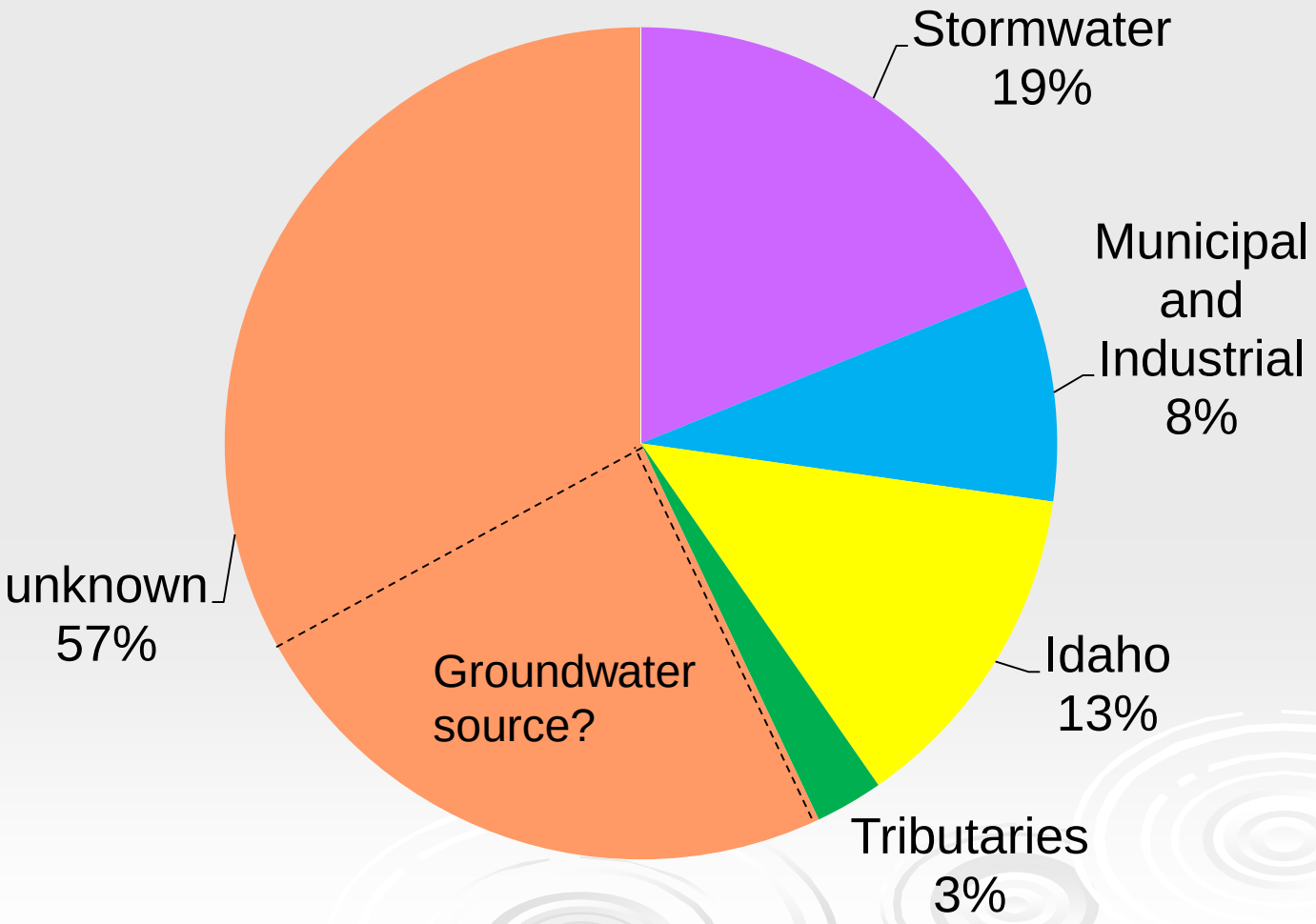
Total PCBs in Age Dated Sediment Core (2003)

- Steep declines from 1960s through mid-1980s
- Approximately 50% decline in 20 years (1980-2000)

PCB Source Assessment 2003-2007

- Majority of the source assessment occurred 2003-2004:
  - SPMD (estimated dissolved fraction of surface water)
  - Suspended sediments (centrifuge)
  - Bottom sediments
  - Sediment cores from Lake Spokane
  - WWTPs and Industrial effluents
  - Stormwater discharges
  - Fish tissue including gut contents (food web modeling)
- Comprehensive fish tissue study in 2005
- Contracted Stormwater Study in 2007
- Published in 2011 (Serdar et al.)

Source assessment could only explain half of the PCB loads in the river.

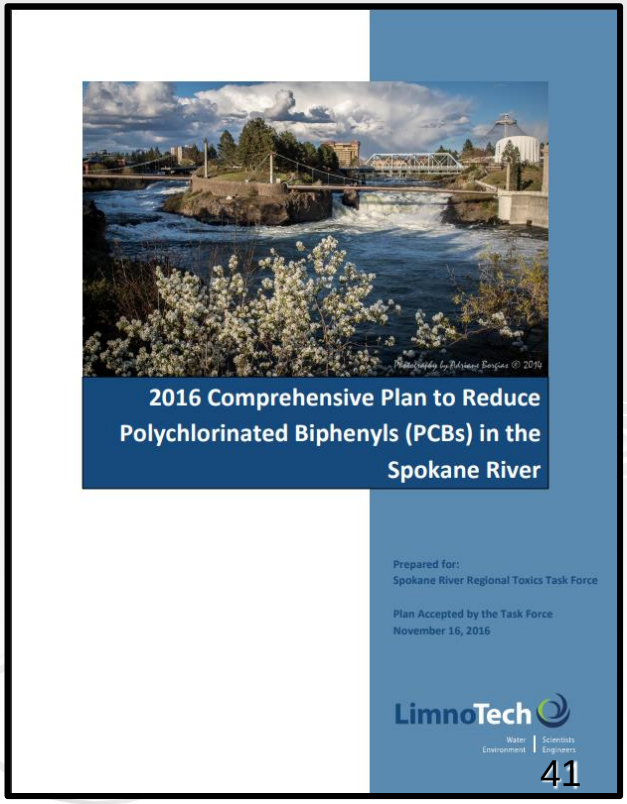


SPOKANE RIVER
REGIONAL TOXICS TASK FORCE

Members of the Community, Stewards of the River

- SRRTTF formed in late 2011 (MOA signed in 2012)
- Comprised of all the Stakeholders who would be involved in the TMDL process
- Permit requirement for dischargers to participate

https://srrttf.org/




Local Source Control (LSC)
Partnership Monitoring
DEPARTMENT OF
ECOLOGY
State of Washington
CLARK COUNTY, WASHINGTON

WHAT IS THE LSC PARTNERSHIP?

SINCE THE PROGRAM BEGAN IN 2008:

19,235
Completed visits

27,763
Problems found

90%
Problems resolved


Whatcom
Skagit
Snohomish
Port Angeles
Jefferson
Kitsap
King
Pierce
Spokane
Clark


LSC (Local Source Control) Monitoring Component

Tributaries to Lower Columbia River Monitored (Clark County) - Mixed Commercial Land Use

- Cold Creek
- Cougar Canyon Creek
- Lake River
- Lower Salmon Creek
- Salmon Creek
- Whipple Creek

Study Parameters

- Inorganic:
  - Conventionals: pH, conductivity, hardness,
  - TOC, DOC, TVS
  - Nutrients
  - Metals

- Organic
  - Oil and Grease
  - Diesel and Gasoline
  - PAHs
  - Phthalates
  - PCBs
  - Flame Retardants
  - Perfluorinated Compounds

Toxics Detected in Stormwater and Sediment

- Lube Oil
- Flame Retardants
- Metals
- PAHs
- Perfluoroalkyl Substances (PFAS)
- Phthalates

Summary

- Ecology continues monitoring efforts in Columbia River basin at different scales
- Monitoring helps meet various objectives: mainly TMDLs and Source Assessments in sub-basins
- Ecology's programs and systems are helping meet many of the 2010 CRBTR Action Plan's 5 initiatives and 61 actions
- Yet…current resources limit pace of progress
- And….most of Columbia River mainstem has little monitoring activity

Contacts

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