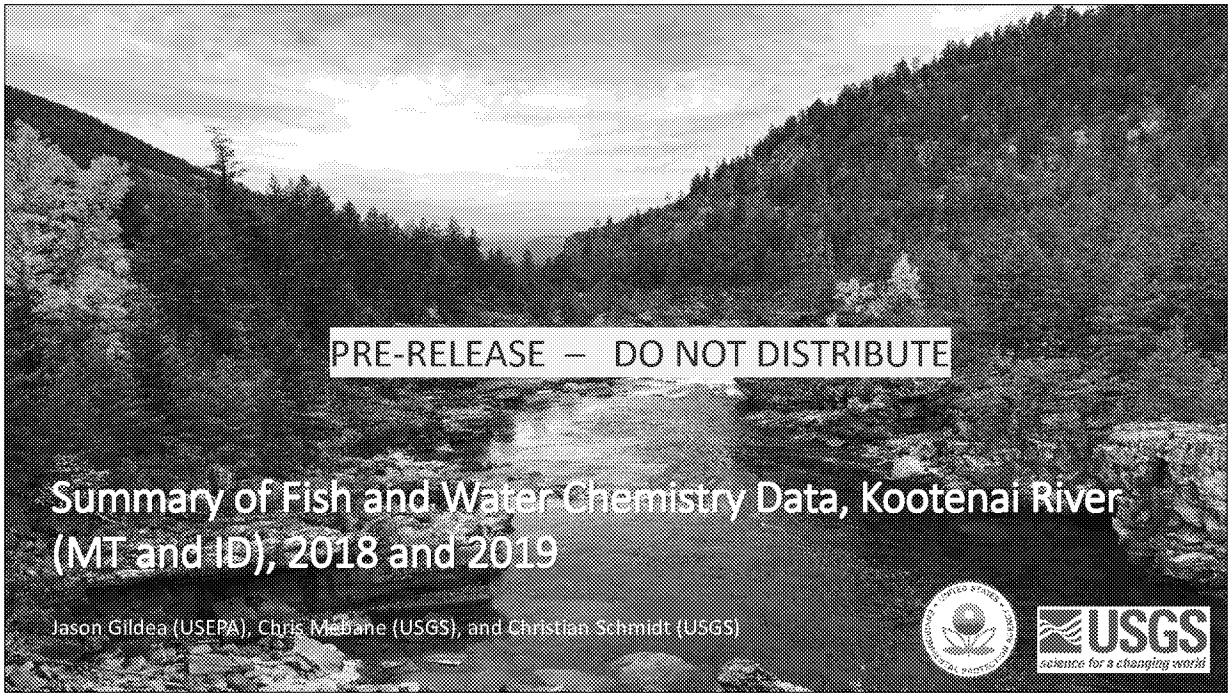


PRE-RELEASE – DO NOT DISTRIBUTE

Summary of Fish and Water Chemistry Data, Kootenai River (MT and ID), 2018 and 2019

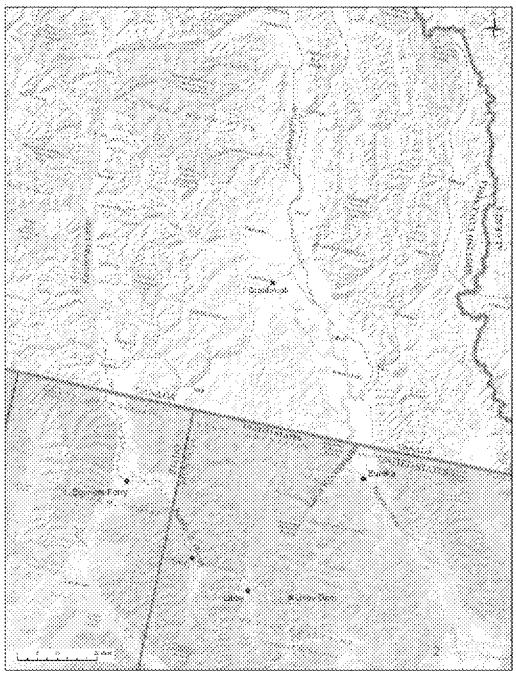
Jason Gildea (USEPA), Chris McBane (USGS), and Christian Schmidt (USGS)

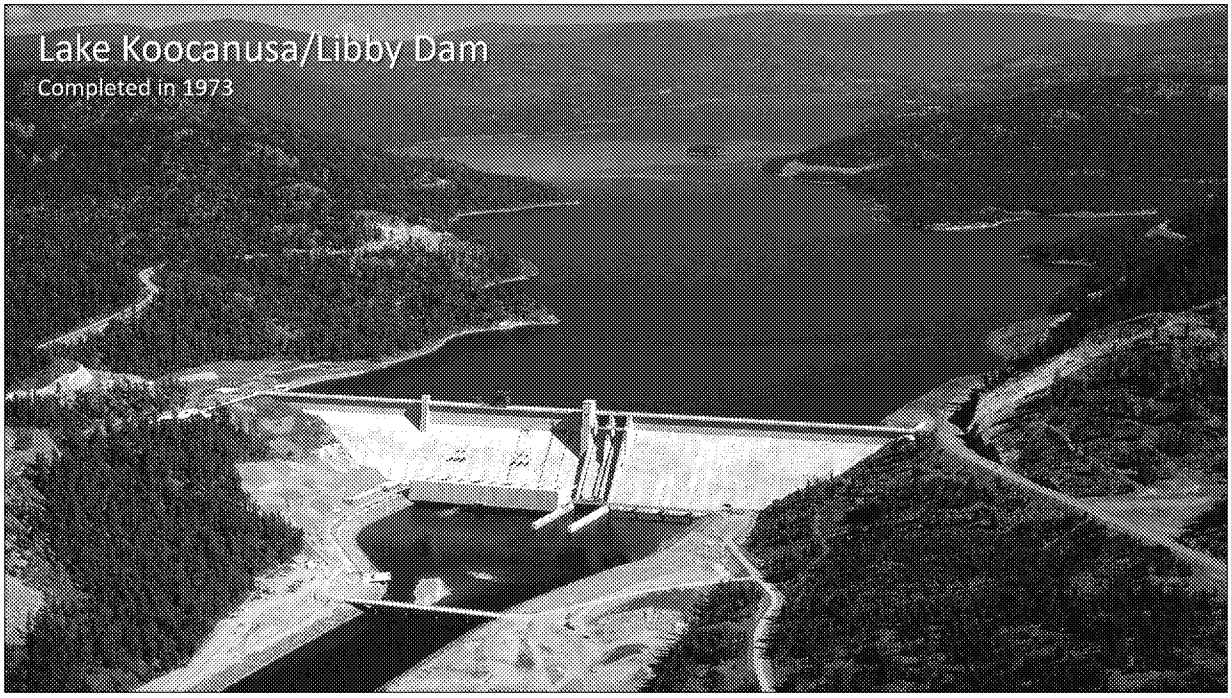
Kootenai/Kootenay River

- Originates in SE British Columbia (B.C.)
- Flows south into Montana, west into Idaho, and then north back into B.C.

Lake Koocanusa

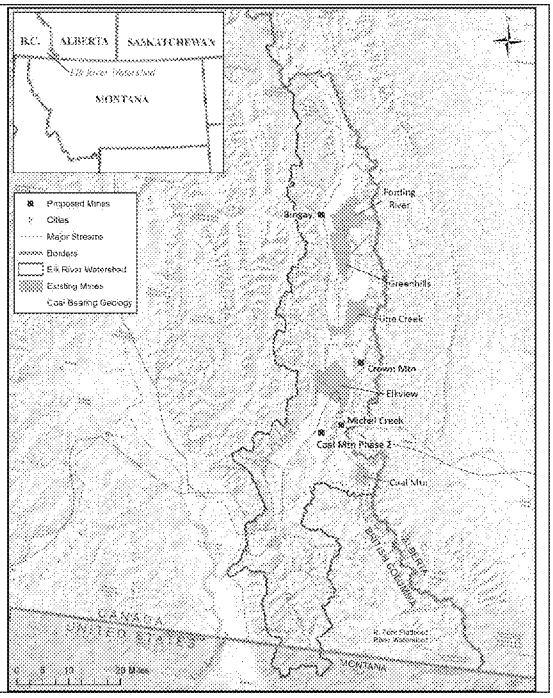
- Reservoir created by Libby Dam
- Located in Montana and B.C.

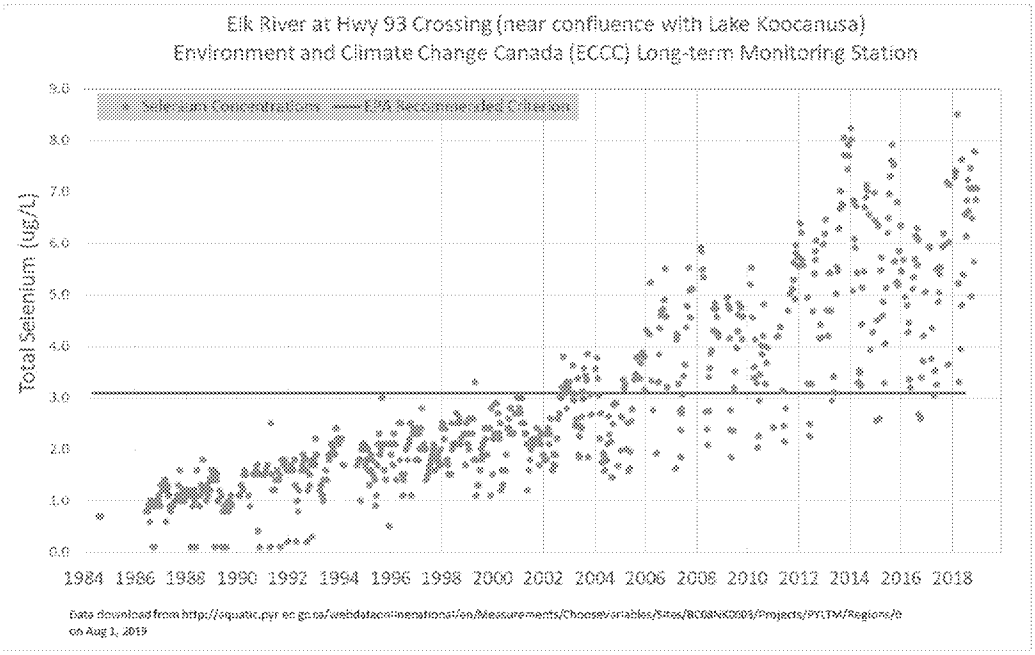


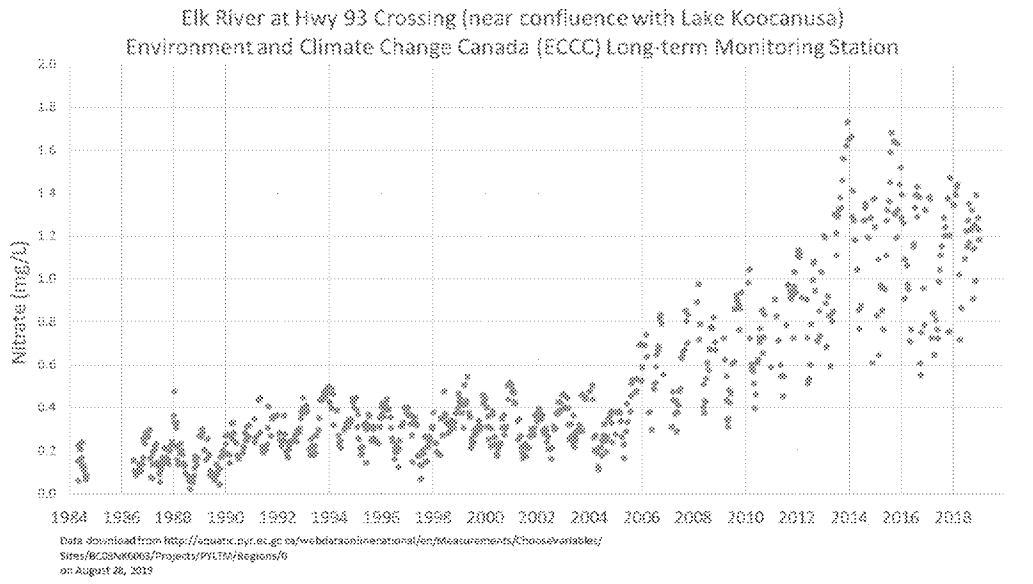

Lake Koocanusa/Libby Dam
Completed in 1973

Water Quality Concerns

- High levels of selenium (Se), sulfate, cadmium, nitrate, and calcium originate from mine spoils in the Elk River valley in British Columbia
- Water column concentrations in the Elk River have increased over time
- The Elk River flows into the Kootenai/Kootenay River/Lake Koocanusa




Elk River at Hwy 93 Crossing (near confluence with Lake Koocanusa)
Environment and Climate Change Canada (ECCC) Long-term Monitoring Station
Total Selenium (ug/L)
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018
Data downloaded from http://aquatic.pyr.ec.gc.ca/webdataonlinenational/en/Measurements/Choosevariables/Sites/BC08NK0003/Projects/PYLTM/Regions/0
on Aug 1, 2019


Elk River at Hwy 93 Crossing (near confluence with Lake Koocanusa)
Environment and Climate Change Canada (ECCC) Long-term Monitoring Station
Nitrate (mg/L)
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018
Data download from http://aquatic.pyr.ec.gc.ca/webdataonlinenational/en/Measurements/ChooseVariables/
Sites/BC08NK0003/Projects/PYLTM/Regions/0
on August 28, 2019

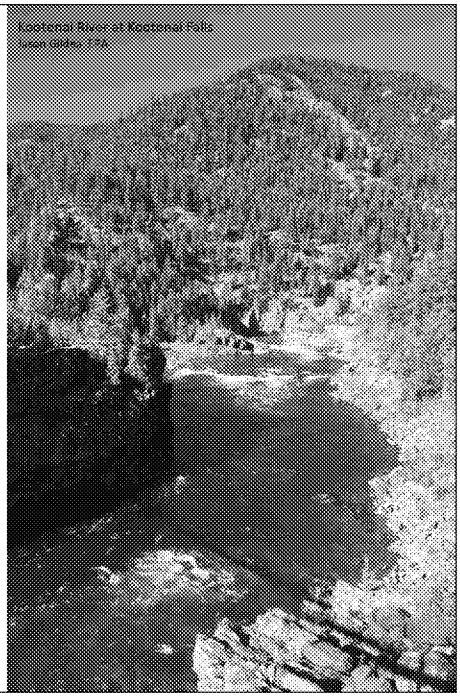
6

Kootenai River Study - Purpose

1. Build on prior studies showing elevated selenium (Se) and nitrate in Lake Koocanusa by evaluating downstream water quality and fish tissue in the Kootenai River between Libby Dam (MT) and the Idaho-Canada border

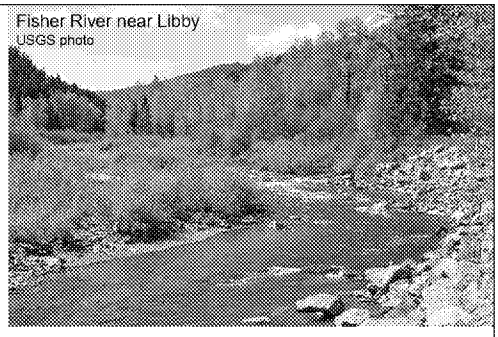
2. Assess Se and nitrate concentrations and loads in the Kootenai River and selected tributaries

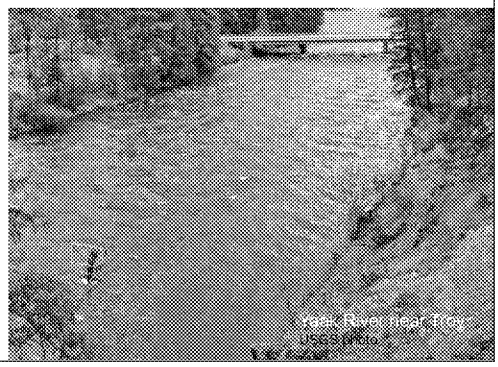
3. Assess mercury (Hg) concentrations in fish tissue in the Kootenai River



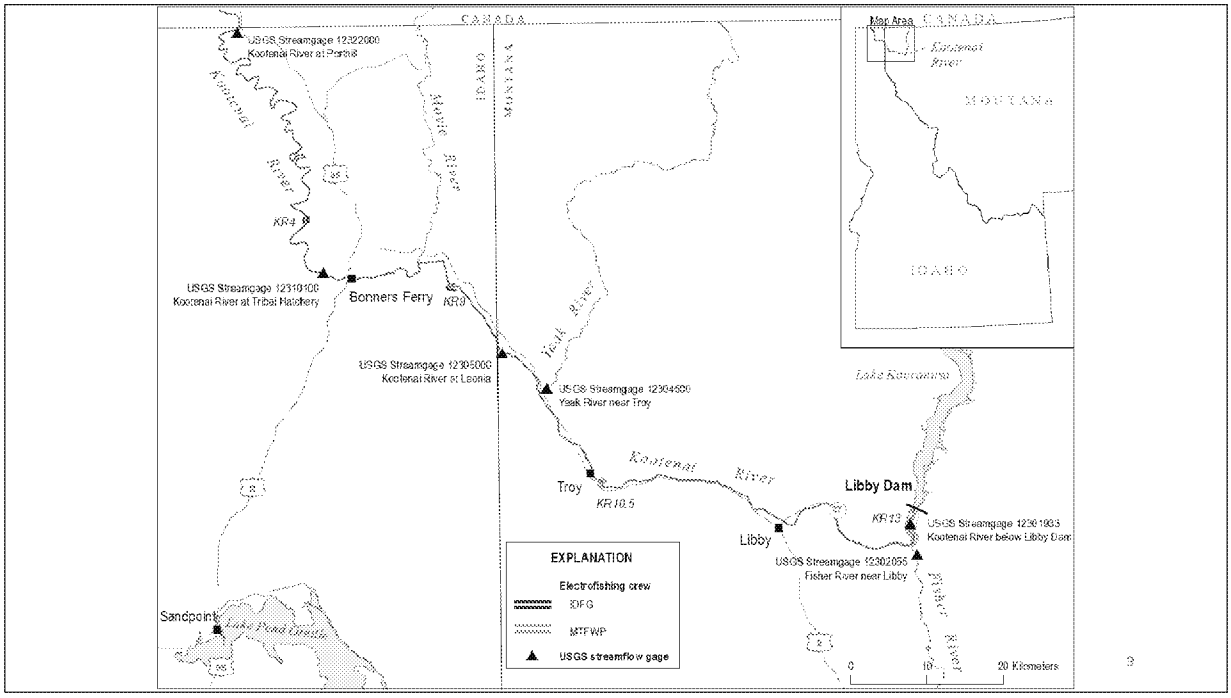
Water Chemistry Study Design

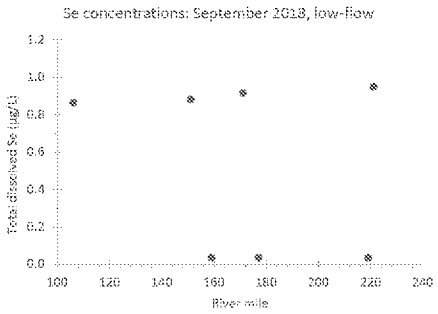
- Study funded by EPA and conducted by USGS to measure synoptic selenium and nutrient loads in the Kootenai River and three major tributaries
- **Kootenai River Sampling Locations:**
  - Kootenai River below Libby Dam (12301933)
  - Kootenai River at Leonia (12305000)
  - Kootenai River at Tribal Hatchery (12310100)
  - Kootenai River at Porthill (12322000)
- **Tributary Sampling Locations:**
  - Fisher River near Libby MT (12302055)
  - Yaak River near Troy MT (12304500)
  - Ungaged tributary: near mouth of Moyie River
- Synoptic sampling conducted three times
  - September 2018
  - December 2018
  - May 2019

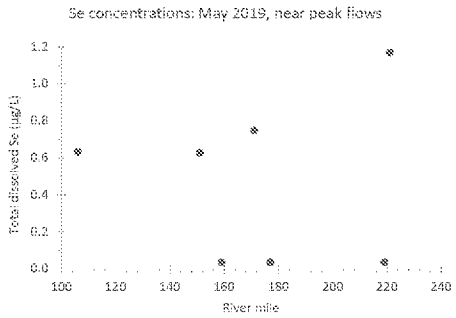


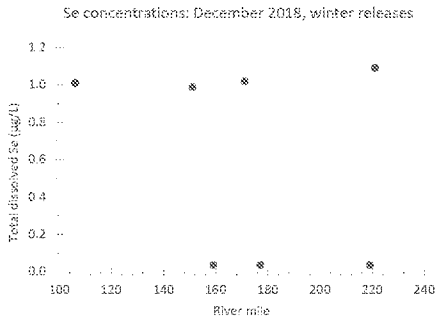


Synoptic sampling done at low and high flow conditions


CANADA
USGS Streamgage 12322000
Kootenai River at Porthill
Kootenai River
Moyie River
IDAHO
MONTANA
KR4.8
USGS Streamgage 12310100
Kootenai River at Tribal Hatchery
Bonners Ferry
KR9
Yaak River
USGS Streamgage 12305000
Kootenai River at Leonia
USGS Streamgage 12304500
Yaak River near Troy
Kootenai River
Troy
KR18.5
Libby
Libby Dam
KR13
USGS Streamgage 12301933
Kootenai River below Libby Dam
USGS Streamgage 12302055
Fisher River near Libby
Fisher River
Lake Koocanusa
Sandpoint
Lake Pend Oreille
EXPLANATION
Electrofishing crew
IDFG
MTFWP
USGS streamflow gage
0
10
20 Kilometers
Map Area
CANADA
Kootenai River
MONTANA
IDAHO



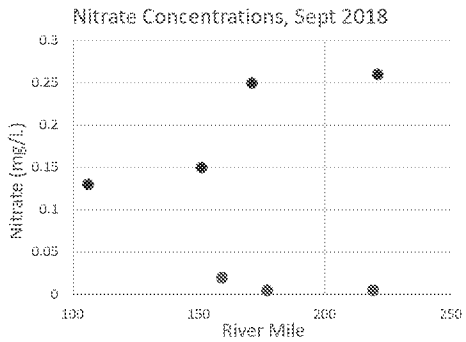


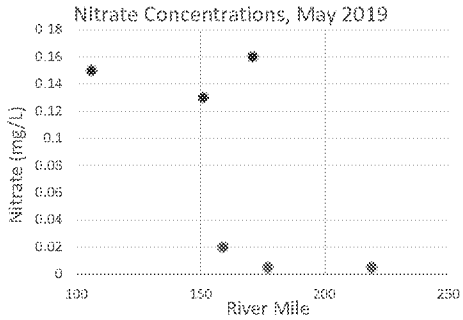


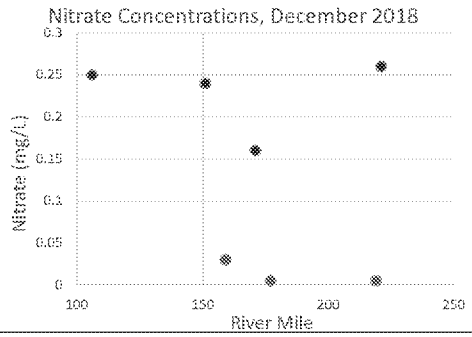
Synoptic Sampling, Selenium Concentrations in the Kootenai River and Selected Tributaries

Site Name	River Mile
Kootenai River, Libby Dam	221
Fisher River near Libby MT	219
Yaak River near Troy MT	177
Kootenai River at Leonia	171
Moyie River near mouth	159
Kootenai River at Tribal Hatchery	151
Kootenai River at Porthill	106

Highlight the VERY low detection limits – 0.037 ug/L.





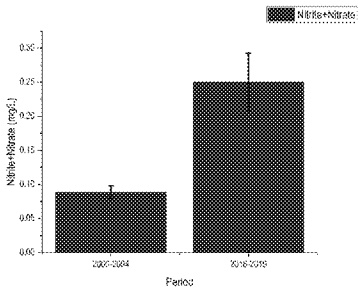


Synoptic Sampling, Nitrate Concentrations in the Kootenai River and Selected Tributaries

Site Name	River Mile
Kootenai River, Libby Dam	221
Fisher River near Libby MT	219
Yaak River near Troy MT	177
Kootenai River at Leonia	171
Moyie River near mouth	159
Kootenai River at Tribal Hatchery	151
Kootenai River at Porthill	106

Chemistry Results - Summary

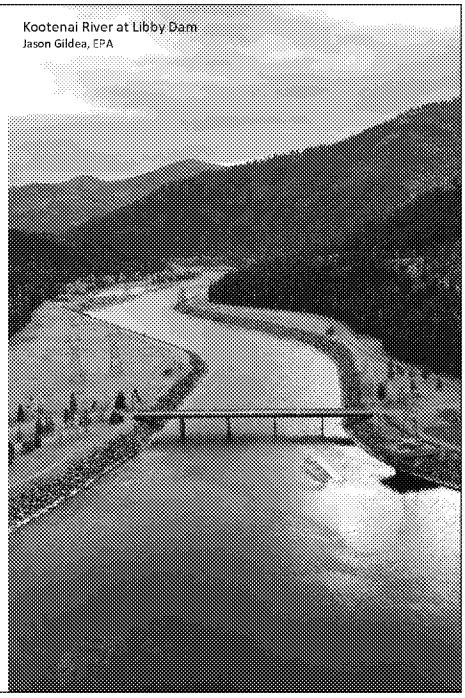
- Most of the selenium in the Kootenai River originates from Lake Koocanusa and it is relatively persistent throughout the river
- The three sampled tributaries contribute no detectable selenium and minimal nitrate (mostly non-detectable concentrations)
- Nitrate concentrations have significantly increased since 2000-2004

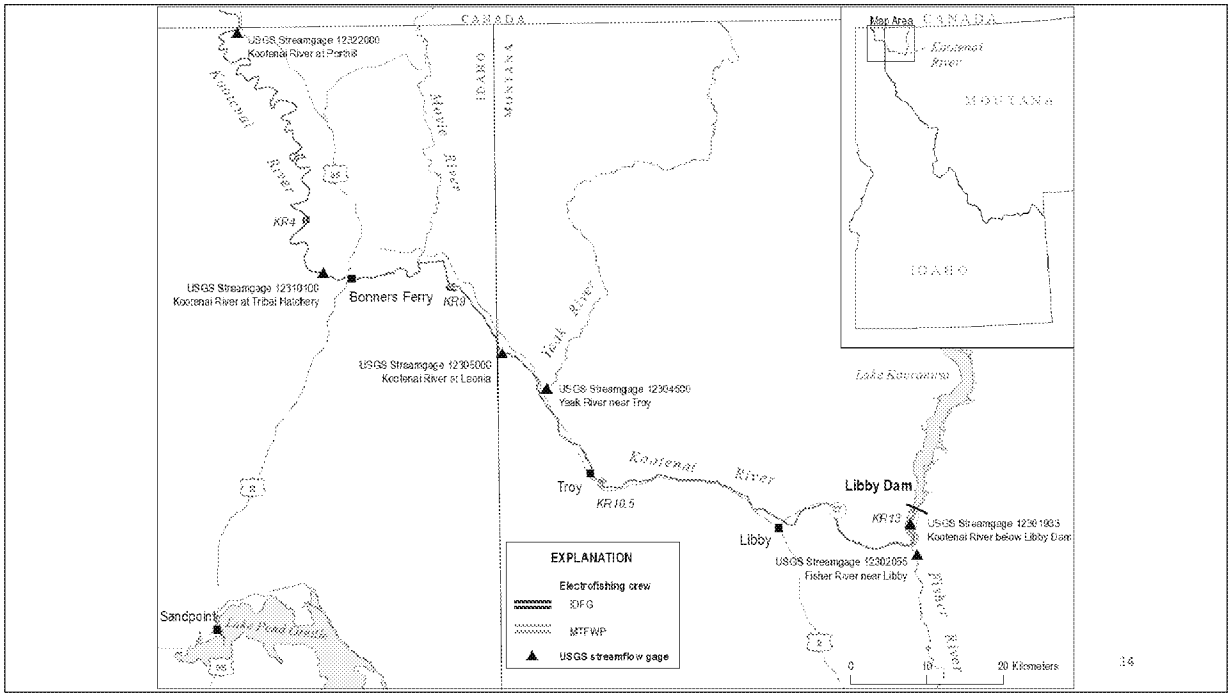


Selenium detection limit is 0.037 ug/L

Fish Tissue Study Design

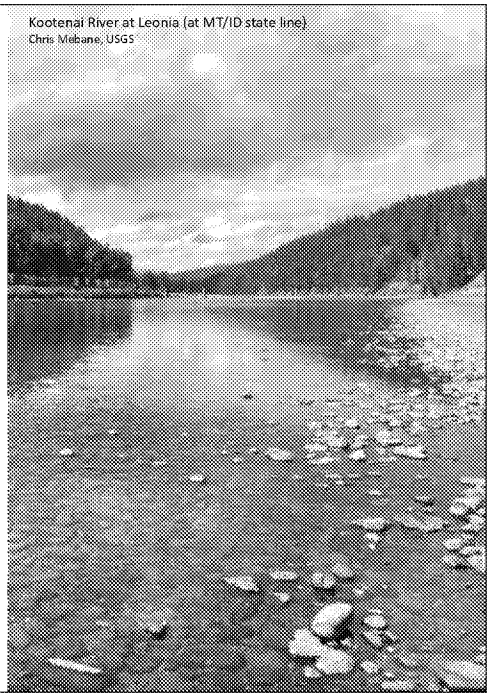
- Study funded by EPA and conducted by USGS in partnership with KTOI, MFWP, and IDFG and EPA Region 10 Laboratory
- Fish tissue sampling was completed in conjunction with fall 2018 MFWP and IDFG fish population survey sampling at 4 sites on the Kootenai River:
  - Below Libby Dam (State agencies ID = KR13)
  - Downstream of Troy, MT (KR10.5)
  - Downstream of ID/MT border (KR9)
  - Shorty's Island (KR4) (Near Bonners Ferry, ID)


Kootenai River at Libby Dam
Jason Gildea, EPA


CANADA
USGS Streamgage 12322000
Kootenai River at Porthill
Kootenai
River
KR4.8
USGS Streamgage 12310100
Kootenai River at Tribal Hatchery
Bonners Ferry
KR9
Moyie
River
IDAHO
MONTANA
Yaak River
USGS Streamgage 12305000
Kootenai River at Leonia
USGS Streamgage 12304500
Yaak River near Troy
Kootenai
River
Troy
KR18.5
Libby
Libby Dam
KR13
USGS Streamgage 12301933
Kootenai River below Libby Dam
USGS Streamgage 12302055
Fisher River near Libby
Fisher
River
Lake Koocanusa
Sandpoint
Lake Pend Oreille
EXPLANATION
Electrofishing crew
IDFG
MTFWP
USGS streamflow gage
0
10
20 Kilometers
Map Area
CANADA
Kootenai
River
MONTANA
IDAHO

Fish Tissue Results

- 142 fish were analyzed for selenium and mercury and compared to EPA's recommended fish tissue criteria and human consumption recommendations
- Muscle fillets or whole body samples were analyzed for each fish
- Obtained fish species include: bull trout, kokanee, largescale sucker, longnose dace, longnose sucker, mountain whitefish, northern pikeminnow, peamouth chub, rainbow trout, redside shiner, slimy sculpin, westslope cutthroat trout, yellow perch
- Eggs were obtained from 10 fall spawning fish (2 kokanee, and 8 mountain whitefish)


Kootenai River at Leonia (at MT/ID state line)
Chris Mebane, USGS

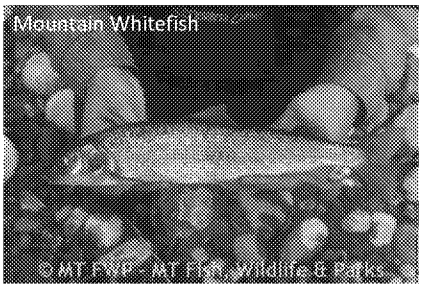
EPA's 2016 Recommended Selenium Criterion to Protect Aquatic Life

	Chronic					Short-term
Criterion Version	Egg-Ovary[1] [mg/kg dw]	Whole Body[1] [mg/kg dw]	Muscle[1] [mg/kg dw]	Water Lentic[1] [µg/L]	Water Lotic[1] [µg/L]	Water[1] [µg/L]
2016 Selenium Criterion	15.1	8.5	11.3	1.5 (30 day)	3.1 (30 day)	Intermittent exposure equation
1999 Selenium Criteria	N/A	N/A	N/A	5 (4 day)	5 (4 day)	Acute Equation based on water column concentration

[1] A note on hierarchy of table: when fish egg/ovary concentrations are measured, the values supersede any whole-body, muscle, or water column elements except in certain situations. Whole body or muscle measurements supersede any water column element when both fish tissue and water concentrations are measured, except in certain situations. Water column values are derived from the egg & ovary concentrations via bioaccumulation modeling. Water column values are the applicable criterion element in the absence of fish tissue measurements, such as waters where fish have been extirpated or where physical habitat and/or flow regime cannot sustain fish populations, or in waters with new discharges of selenium where steady state has not been achieved between water and fish tissue at the site.

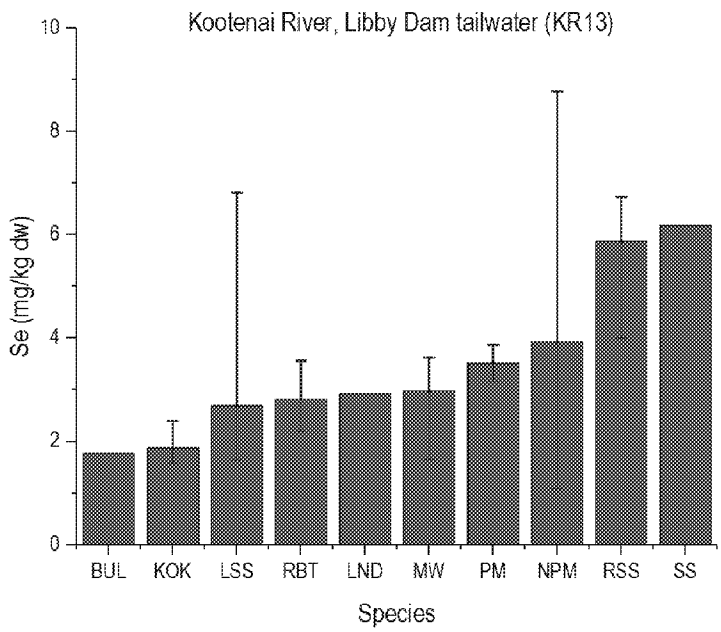
Selenium Fish Tissue Results

- 1 out of 142 fish samples exceeded EPA's recommended whole body or muscle selenium criterion
  - The one sample was for a redside shiner, which exceeded the whole body criterion of 8.5 mg/kg
  - All other samples were lower than EPA's recommended criterion
- 6 out of 8 mountain whitefish eggs exceeded EPA's recommended selenium criterion of 15.1 mg/kg
  - The six samples were obtained from three sites (Libby Dam, Troy, ID-MT Border)
  - Highest value was 24.8 mg/kg, collected at the MT-ID border
- States and tribes may want to review and use data for fish consumption advisories



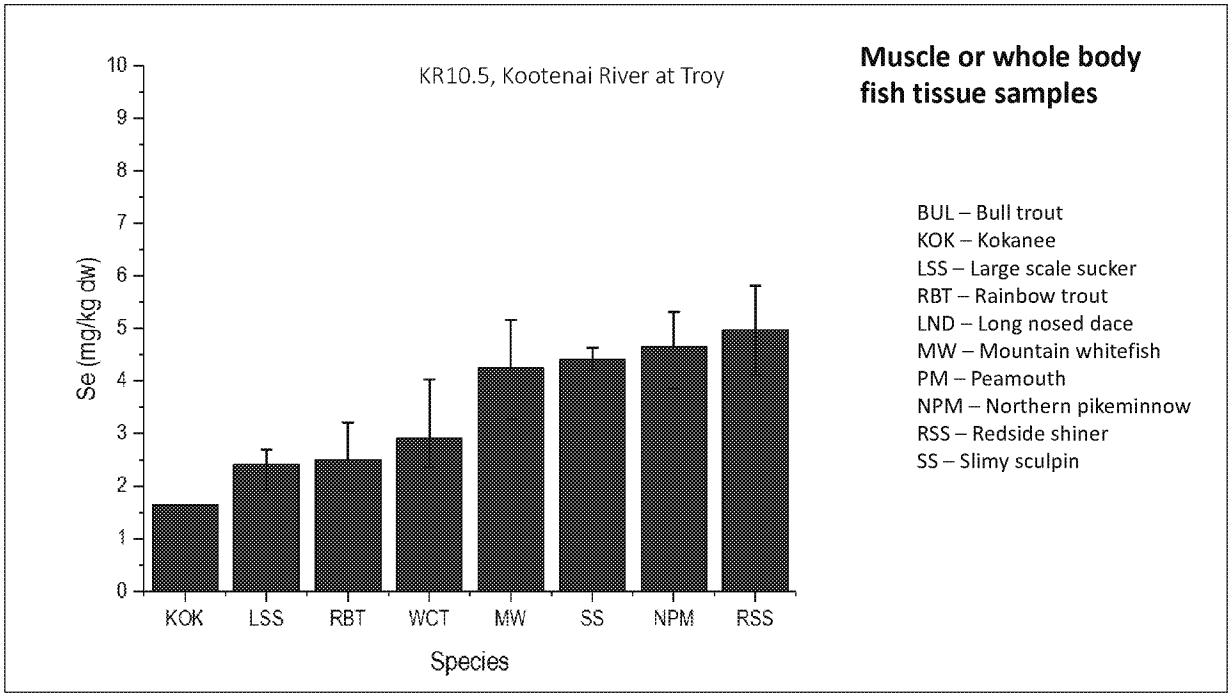
17

EPA is not commenting on fish tissue advisories at this time, but agencies should use the data per their guidelines



Muscle or whole body fish tissue samples

BUL – Bull trout
KOK – Kokanee
LSS – Large scale sucker
RBT – Rainbow trout
LND – Long nosed dace
MW – Mountain whitefish
PM – Peamouth
NPM – Northern pikeminnow
RSS – Redside shiner
SS – Slimy sculpin


KR10.5, Kootenai River at Troy
Muscle or whole body fish tissue samples
Se (mg/kg dw)
0
1
2
3
4
5
6
7
8
9
10
KOK
LSS
RBT
WCT
MW
SS
NPM
RSS
Species
BUL – Bull trout
KOK – Kokanee
LSS – Large scale sucker
RBT – Rainbow trout
LND – Long nosed dace
MW – Mountain whitefish
PM – Peamouth
NPM – Northern pikeminnow
RSS – Redside shiner
SS – Slimy sculpin

Mercury Fish Tissue Results

- 3 out of 142 fish samples exceeded EPA's recommended methylmercury criterion of 0.3 mg/kg
  - Pikeminnow near Libby Dam
- States and tribes may want to review and use data for fish consumption advisories
  - Mercury concentrations ranged from 0.012 to 0.448 mg/kg, with an average of 0.071 mg/kg
  - EPA recommends considering fish consumption advisories for concentrations greater than 0.029 mg/kg

Table 4-3. Monthly Fish Consumption Limits for Noncarcinogenic Health Endpoint - Methylmercury

Risk Based Consumption Limit[a]	Noncancer Health Endpoints[b]
Fish Meals/Month	Fish Tissue Concentrations (*ppm, wet weight*)
Unrestricted (>16)	0 - 0.029
16	>0.029 - 0.059
12	>0.059 - 0.078
8	>0.078 - 0.12
4	>0.12 - 0.23
3	>0.23 - 0.31
2	>0.31 - 0.47
1	>0.47 - 0.94
0.5	>0.94 - 1.9
None (<0.5)	>1.9

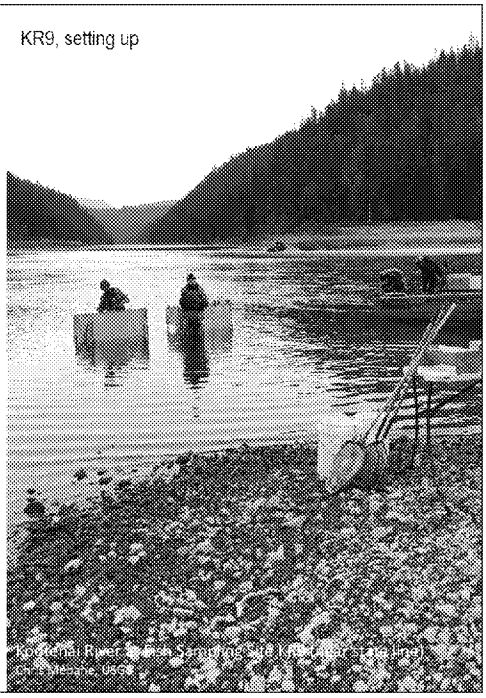
USEPA. 2000. Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories - Volume 2: Risk Assessment and Fish Consumption Limits. Third Edition. EPA 823-B-00-008. Table 4-3

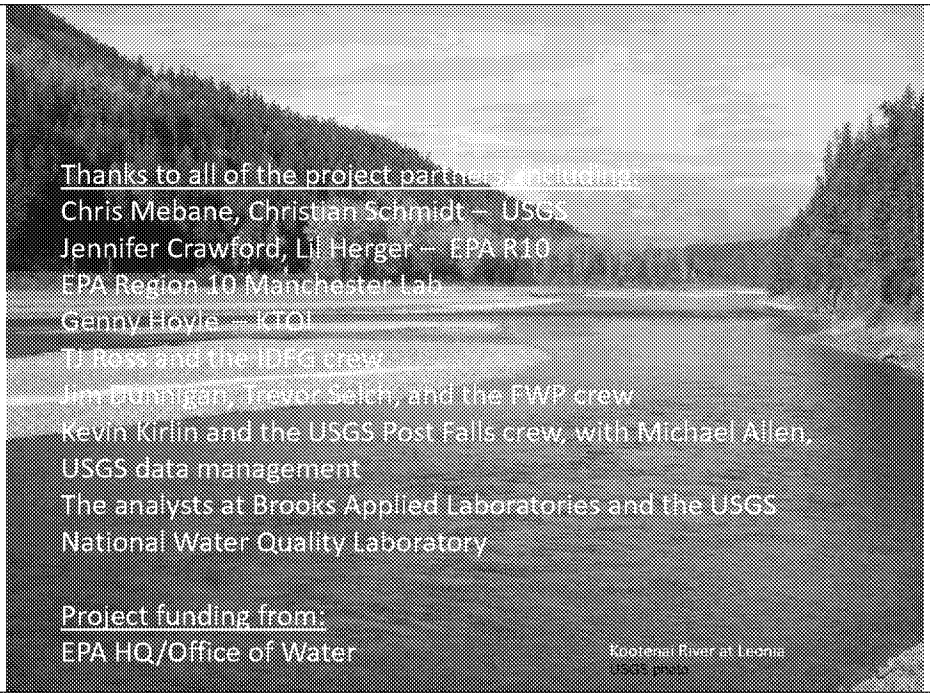
Note that mercury is not a pollutant from coal mining, but from atmospheric deposition
EPA is not commenting on fish tissue advisories at this time, but agencies should use the data per their guidelines

Fish Tissue Results Summary

- These are the first known fish samples in the Kootenai River (U.S.) that exceed EPA's recommended selenium criterion
- The results indicate that selenium originating from the Elk River valley is impacting mountain whitefish in the Kootenai River downstream of Libby Dam
- Mercury results may warrant fish consumption advisories
- Limited data were collected, and follow up studies should be conducted to further corroborate results

KR9, setting up





Thanks to all of the project partners, including:
Chris Mebane, Christian Schmidt – USGS
Jennifer Crawford, Lil Herger – EPA R10
EPA Region 10 Manchester Lab
Genny Hovis – KTOI
Ti Ross and the IDFG crew
Jim Cunnigan, Trevor Selch, and the FWP crew
Kevin Kirlin and the USGS Post Falls crew, with Michael Allen, USGS data management
The analysts at Brooks Applied Laboratories and the USGS National Water Quality Laboratory

Project funding from:
EPA HQ/Office of Water

Kootenai River at Leonia
USGS photo

This study highlights the need for further monitoring …

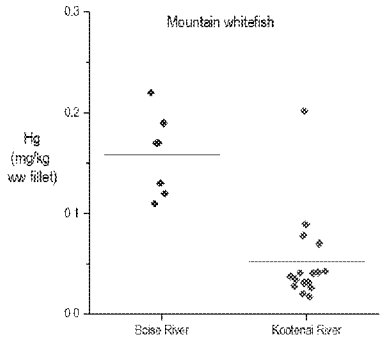
- Selenium and mercury monitoring in water and fish tissue in the Kootenai River between Libby Dam and the U.S.-Canadian border
- Selenium monitoring in eggs from various fish species, including spring spawning fish
  - Target mountain whitefish in collection efforts
- Collect and analyze tissue from various fish species in the Kootenai River to assess trends over time

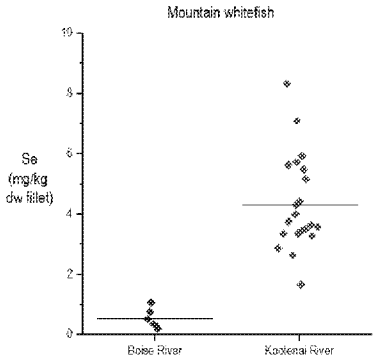
EPA has requested some additional funding to sample during spring spawning.

EXTRA SLIDES

(to be used as needed to address questions)

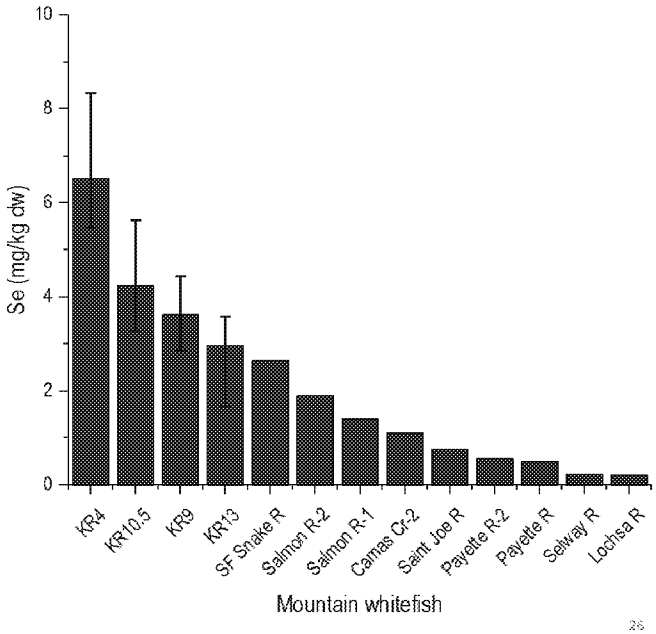
Mercury and Selenium in Mountain Whitefish from the Kootenai and Boise Rivers

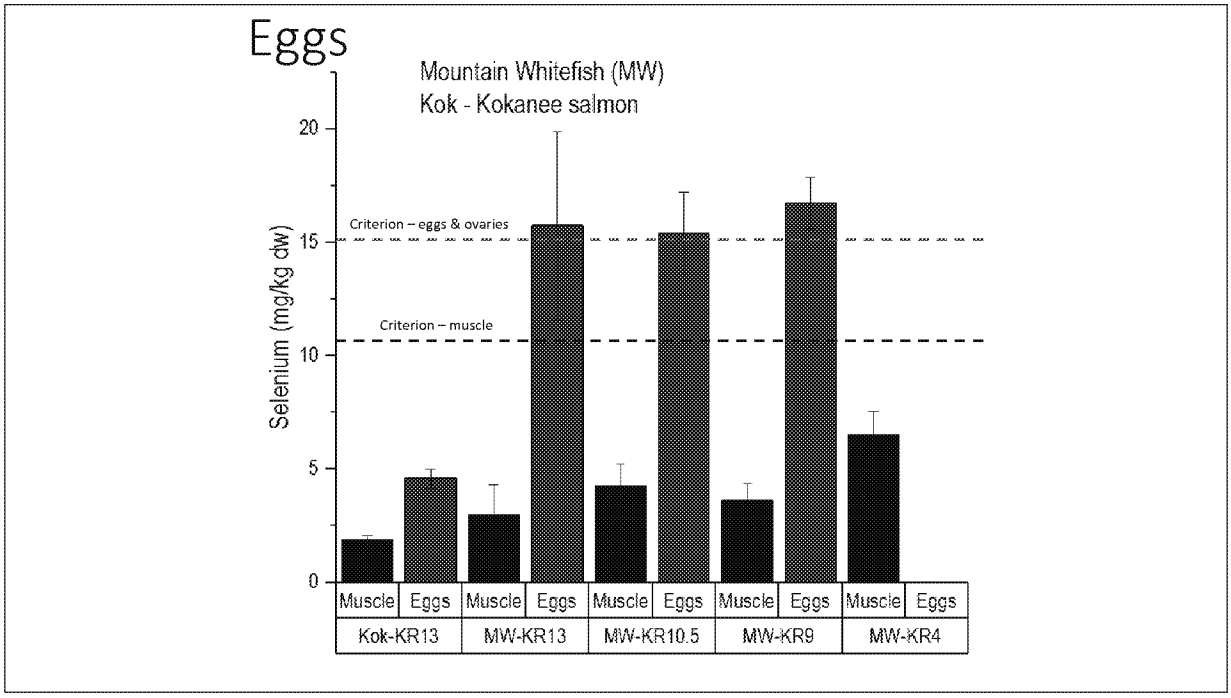




Often monitoring studies find an inverse pattern between Se and Hg in fish tissues. If Se is high, Hg will be low and vice versa,

Muscle selenium concentrations in selected Idaho rivers




Eggs
Mountain Whitefish (MW)
Kok - Kokanee salmon
Selenium (mg/kg dw)
20
15
10
5
0
Criterion – eggs & ovaries
Criterion – muscle
Muscle
Eggs
Muscle
Eggs
Muscle
Eggs
Muscle
Eggs
Muscle
Eggs
Kok-KR13
MW-KR13
MW-KR10.5
MW-KR9
MW-KR4

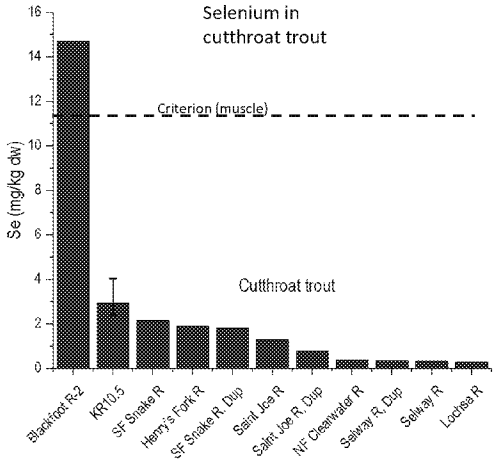
Some comparisons between Kootenai River (KR) samples and other river locations in Idaho

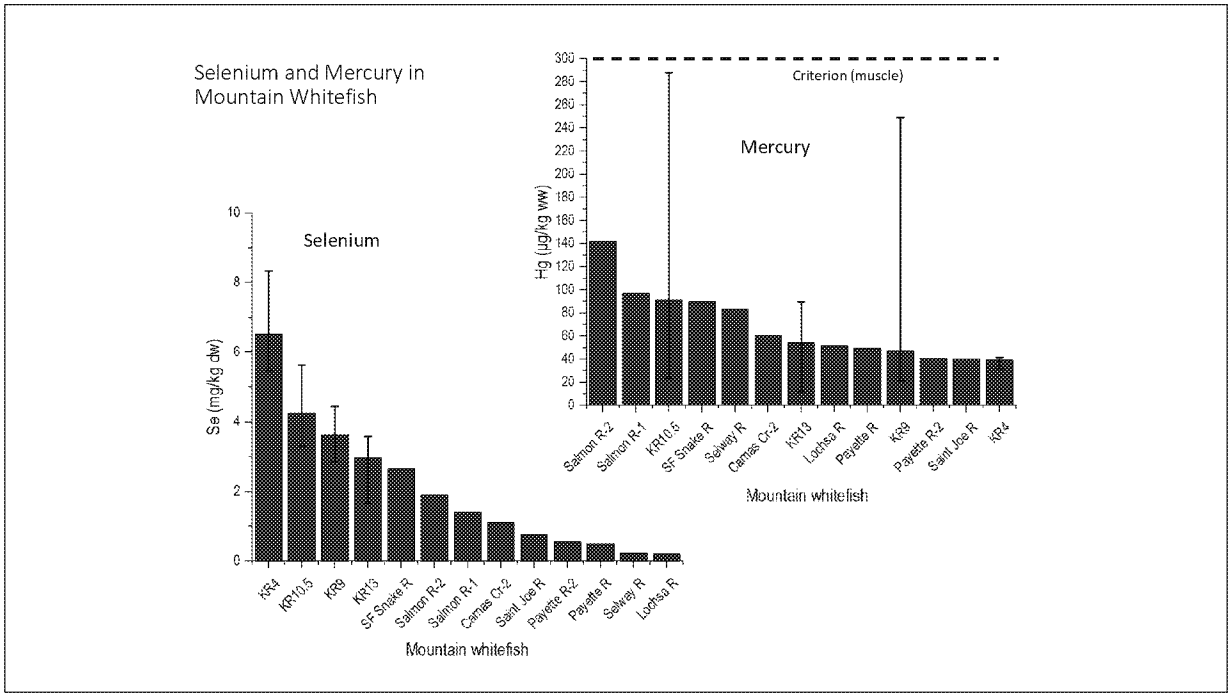
Comparison data are from: **Essig, D.A. 2010. Arsenic, mercury, and selenium in fish tissue and water from Idaho's major rivers: a statewide assessment. Idaho Department of Environmental Quality, Boise, ID.** http://www.deq.idaho.gov/water-quality/surface-water/mercury.aspx (composite samples, ranging from 1 to 10 fish per sample)

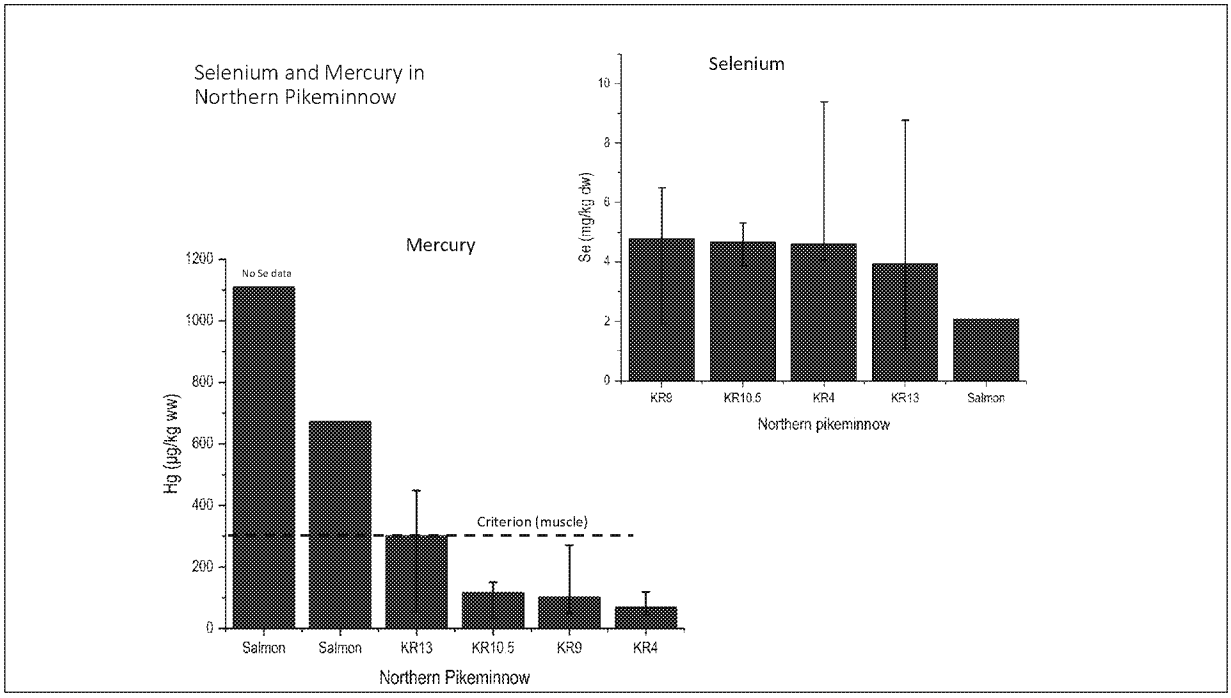
Idaho, statewide (in 2008)

Se in water,
0.14 µg/L median, Range in water, <0.09 µg/L to 1.75 µg/L

Se in fish (all species, dry weight),
median 1.28, min 0.22, max 14.7 mg/kg mg/kg dw




Selenium and Mercury in Mountain Whitefish
Selenium
Se (mg/kg dw)
0
2
4
6
8
10
KR4
KR10.5
KR9
KR13
SF Snake R
Salmon R-2
Salmon R-1
Camas Cr-2
Saint Joe R
Payette R-2
Payette R
Selway R
Lochsa R
Mountain whitefish
Mercury
Criterion (muscle)
Hg (µg/kg ww)
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
Salmon R-2
Salmon R-1
KR10.5
SF Snake R
Selway R
Camas Cr-2
KR13
Lochsa R
Payette R
KR9
Payette R-2
Saint Joe R
KR4
Mountain whitefish


Selenium and Mercury in
Northern Pikeminnow
Mercury
Hg (µg/kg ww)
1200
1000
800
600
400
200
0
No Se data
Criterion (muscle)
Salmon
Salmon
KR13
KR10.5
KR9
KR4
Northern Pikeminnow
Selenium
Se (mg/kg dw)
10
8
6
4
2
0
KR9
KR10.5
KR4
KR13
Salmon
Northern pikeminnow