Transport, fate, and exposure to selenium from the Elk Valley British Columbia, Canadian coal mines into ecosystems of the Upper Columbia River Basin, United States.

Travis S. Schmidt, PhD.
Wyoming-Montana Water Science Center, Helena, MT

MT Water Science Hydro-bio-geochemistry team

Collaborators

USGS

"This information is preliminary and is subject to revision"

Why is the USGS working on Canadian Coal Mines?

Congress directed: "…*the Survey to expand its monitoring of transboundary watersheds and to work with the Environmental Protection Agency to ensure the relevant equipment is deployed to the Kootenai watershed to support the Agency's work...*"

Cooperative fish sampling with Tribes and State agencies

Autonomous lake sampling platform on Lake Koocanusa

Water quality sampling from a streamgage on the Kootenai River

USGS

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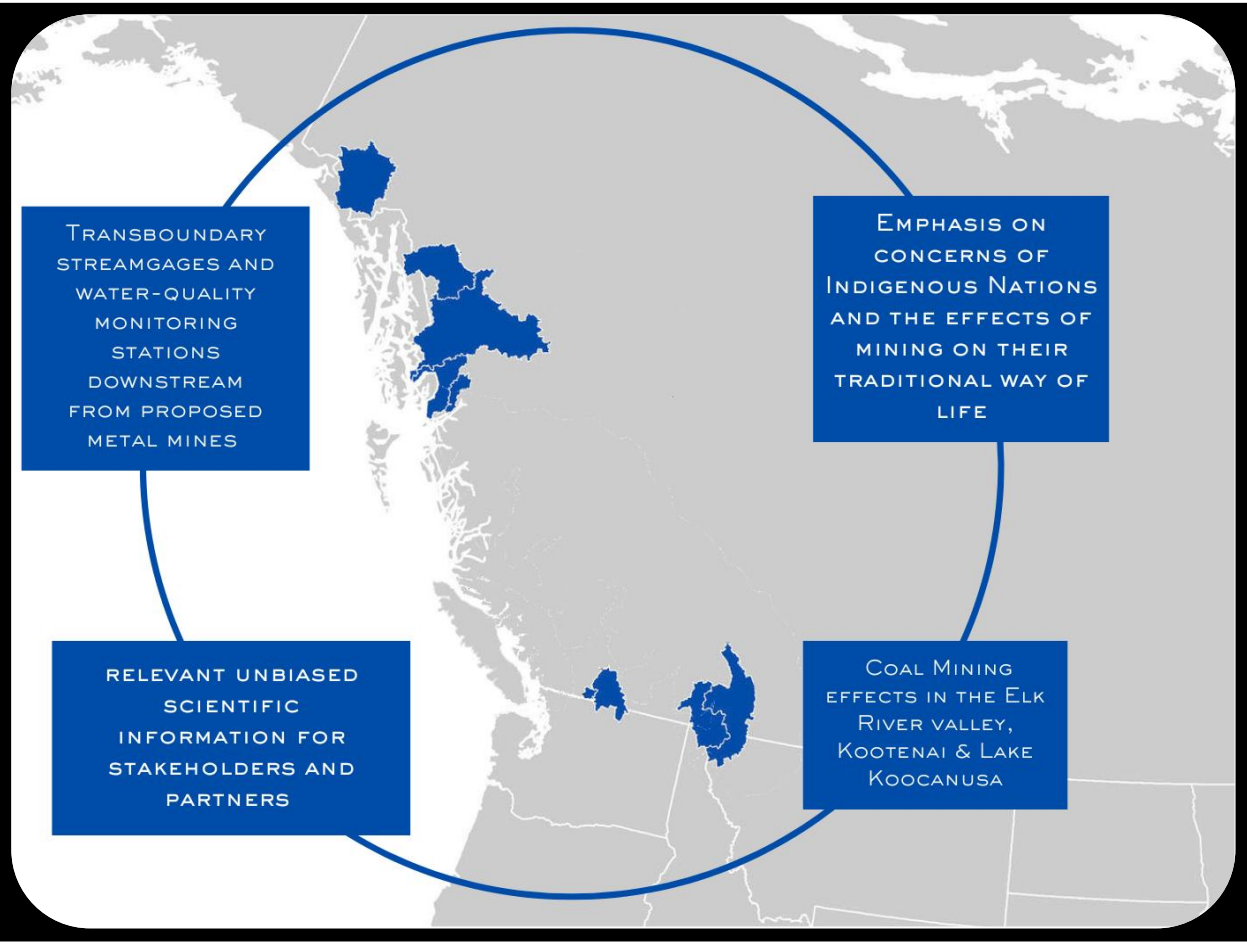
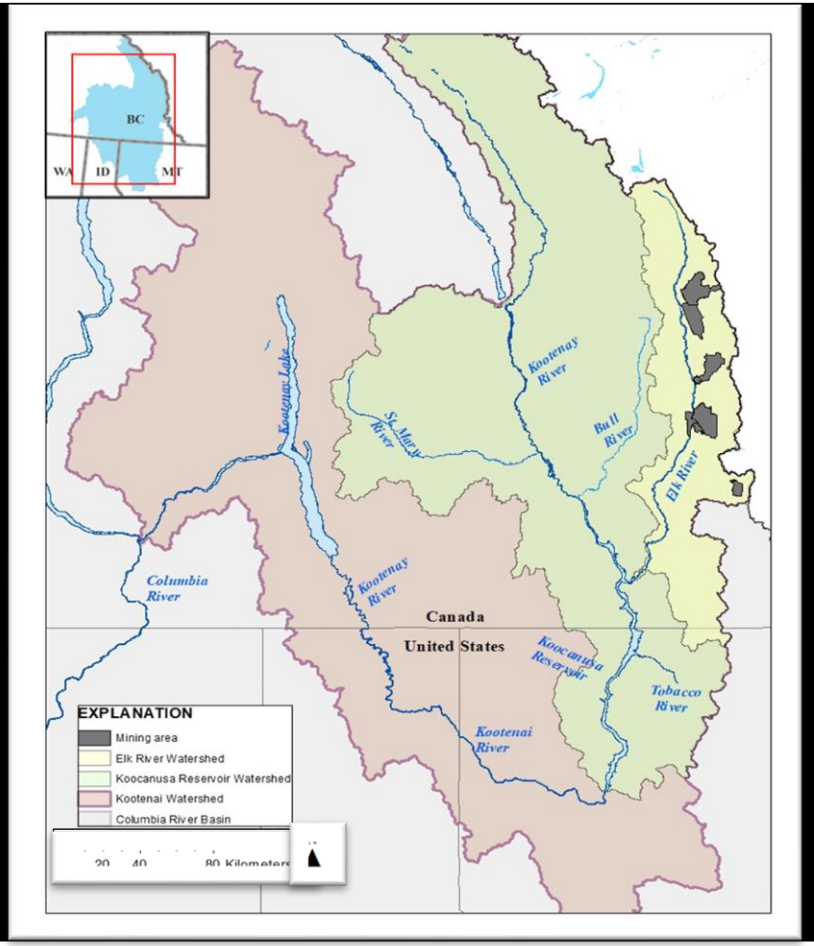
The USGS Transboundary Water Quality Project Watersheds





USGS

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Why the USGS?

The USGS mission is to monitor, analyze and predict current and evolving dynamics of complex human and natural Earth system interactions and to deliver actionable information at scales and timeframes relevant to decision makers.

USGS

Why the USGS?

USGS

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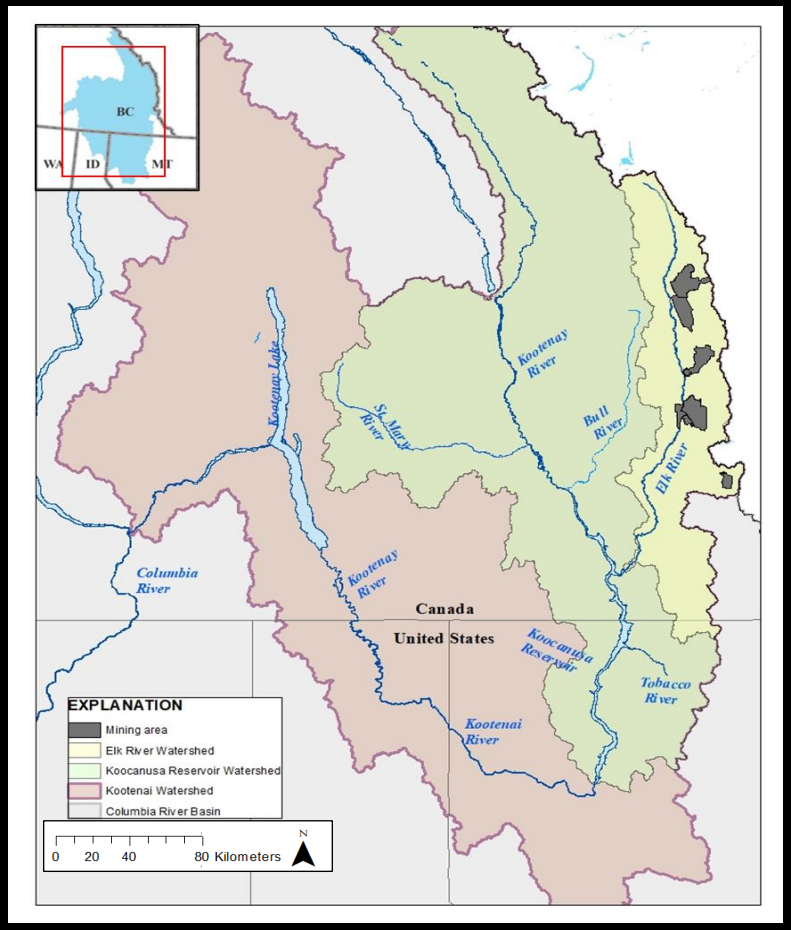
Elk River Watershed, British Columbia



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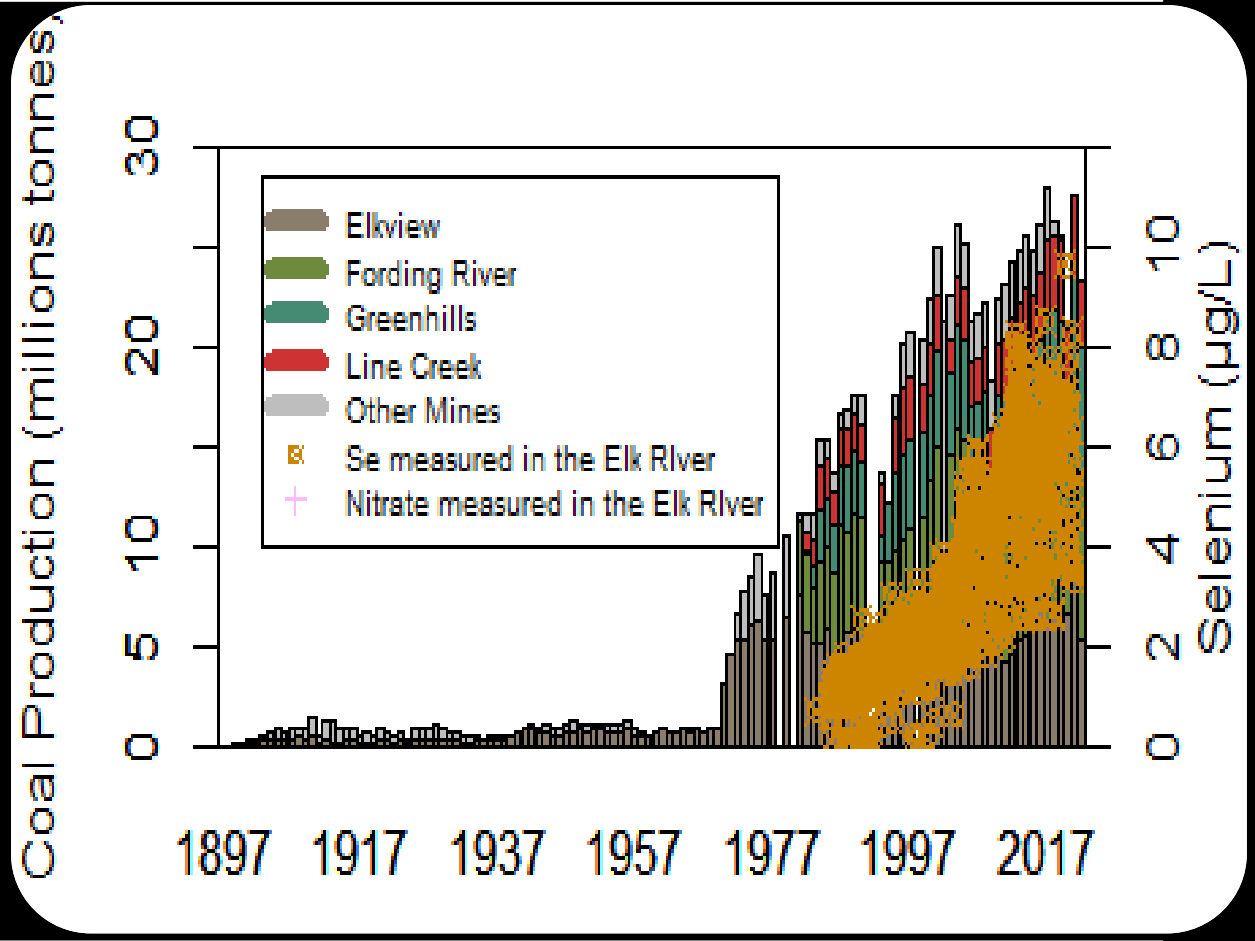
History of coal mining in the Elk Valley

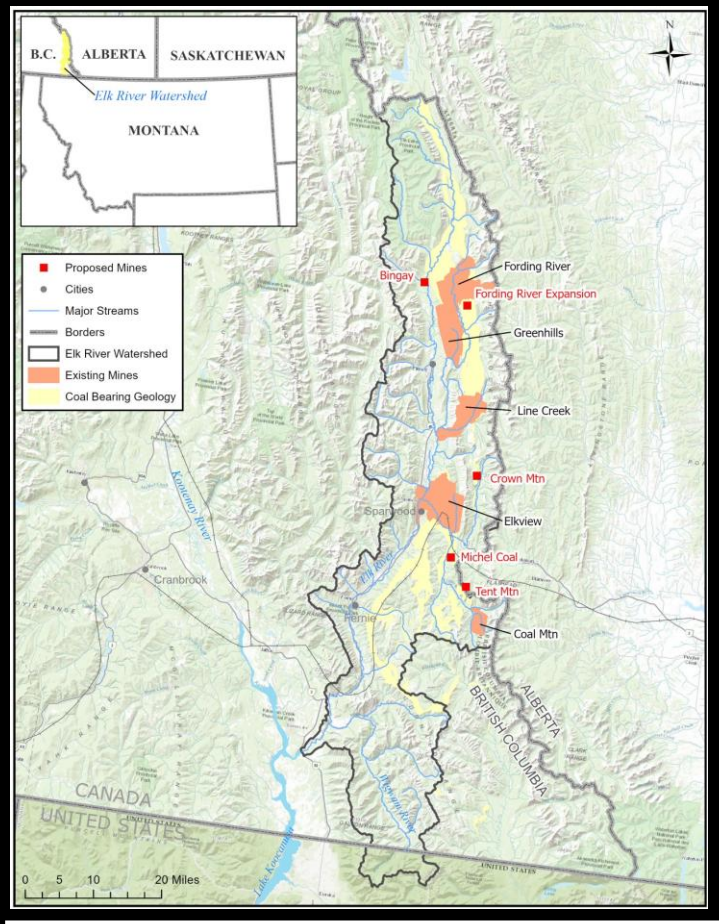


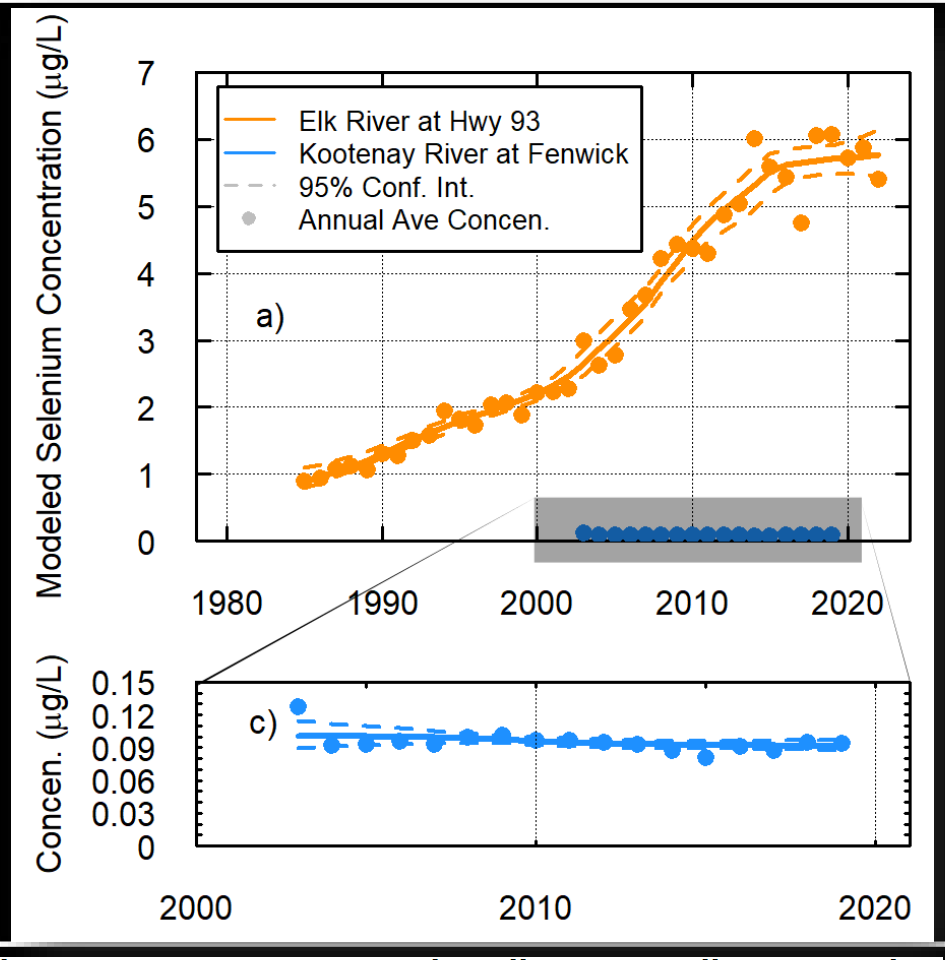
USGS

Growth of Coal Mining Operations in the Elk River Valley (Canada) Linked to Increasing Solute Transport of Se, NO_3^-, and SO_4^{2-} into the Transboundary Koocanusa Reservoir (USA–Canada)

Meryl B. Storb,* Ashley M. Bussell, Sara L. Caldwell Eldridge, Robert M. Hirsch, and Travis S. Schmidt

Trends in concentration, Elk & Kootenay Rivers





USGS

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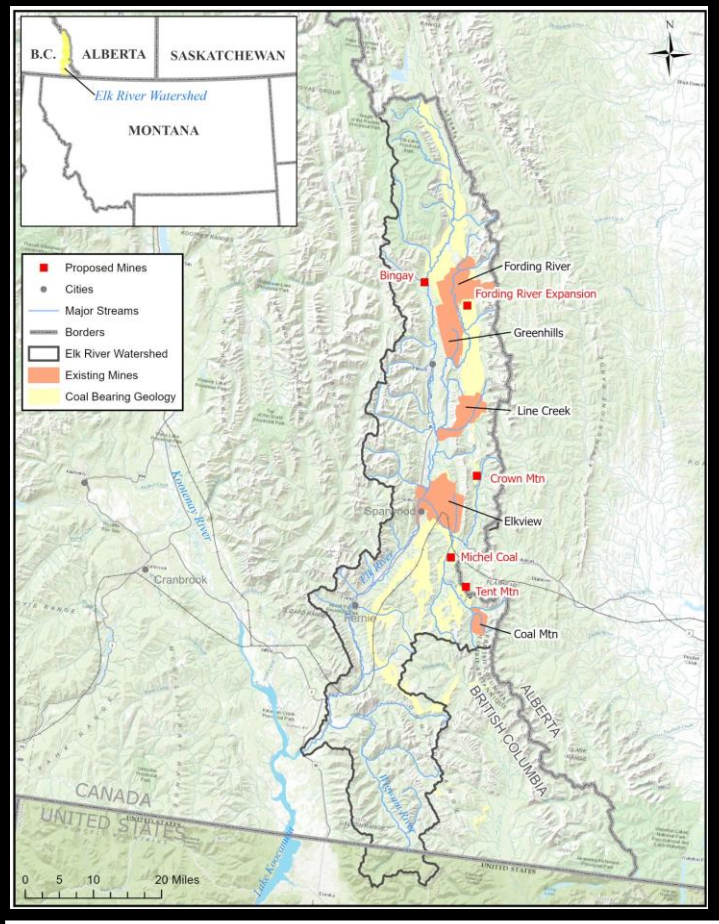

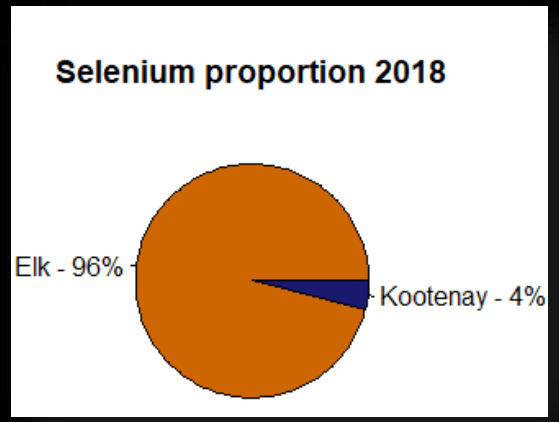

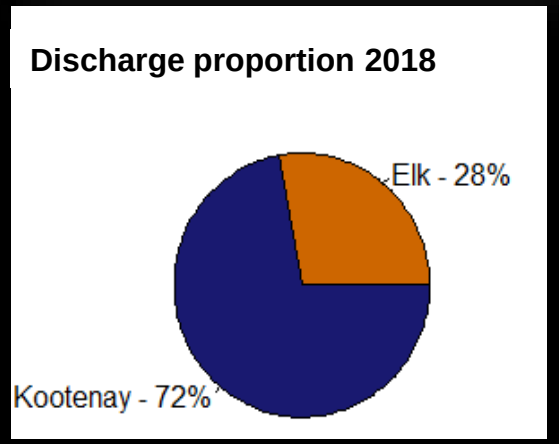

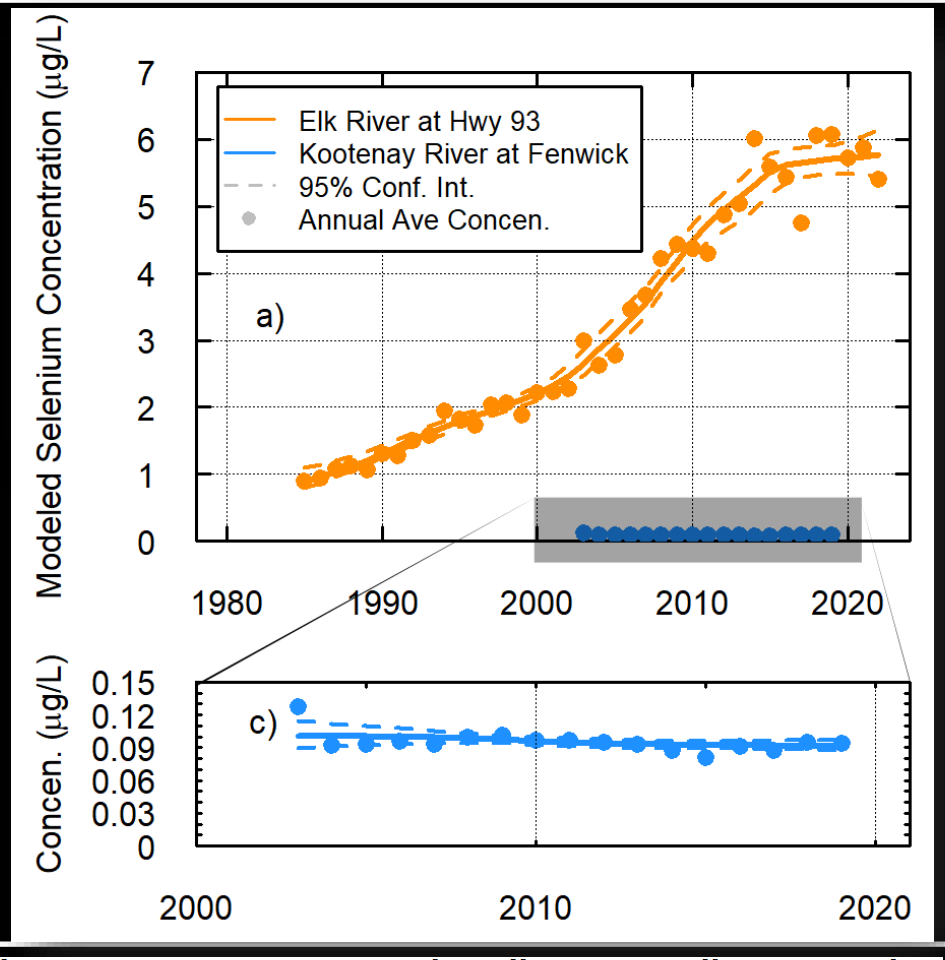

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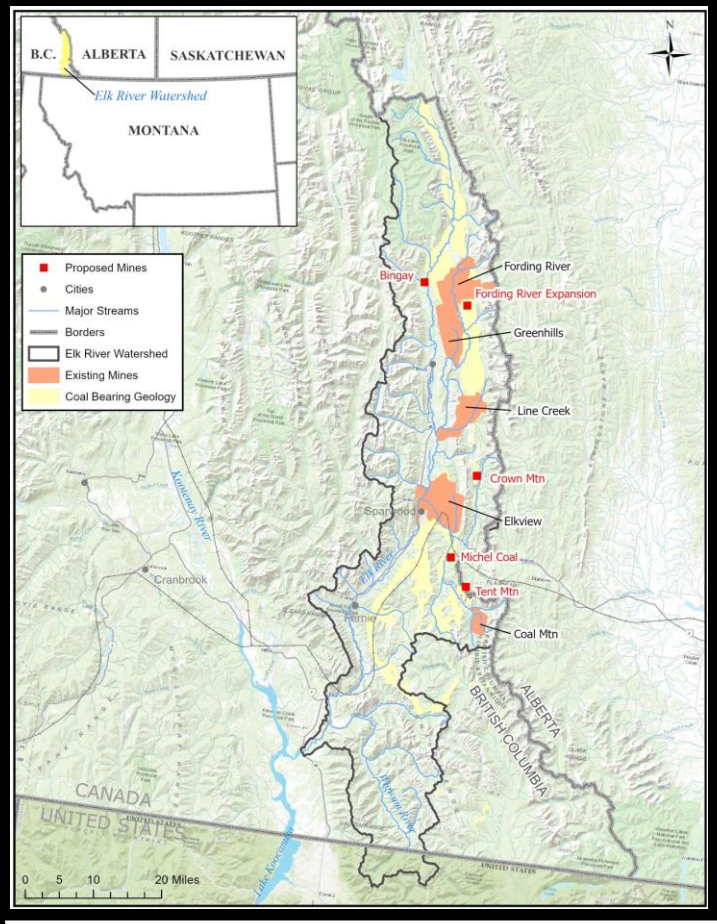

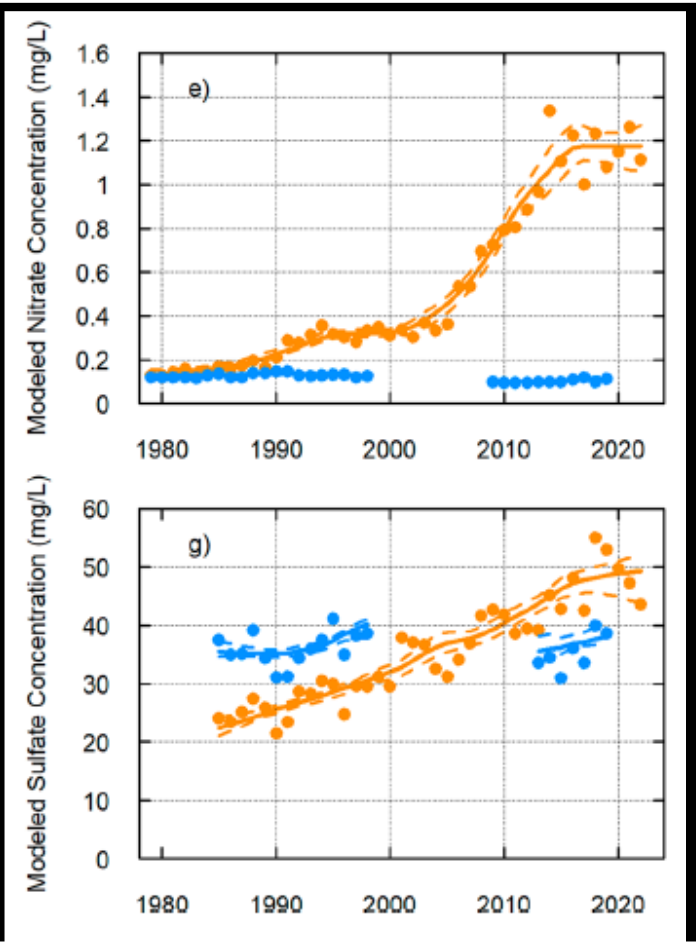

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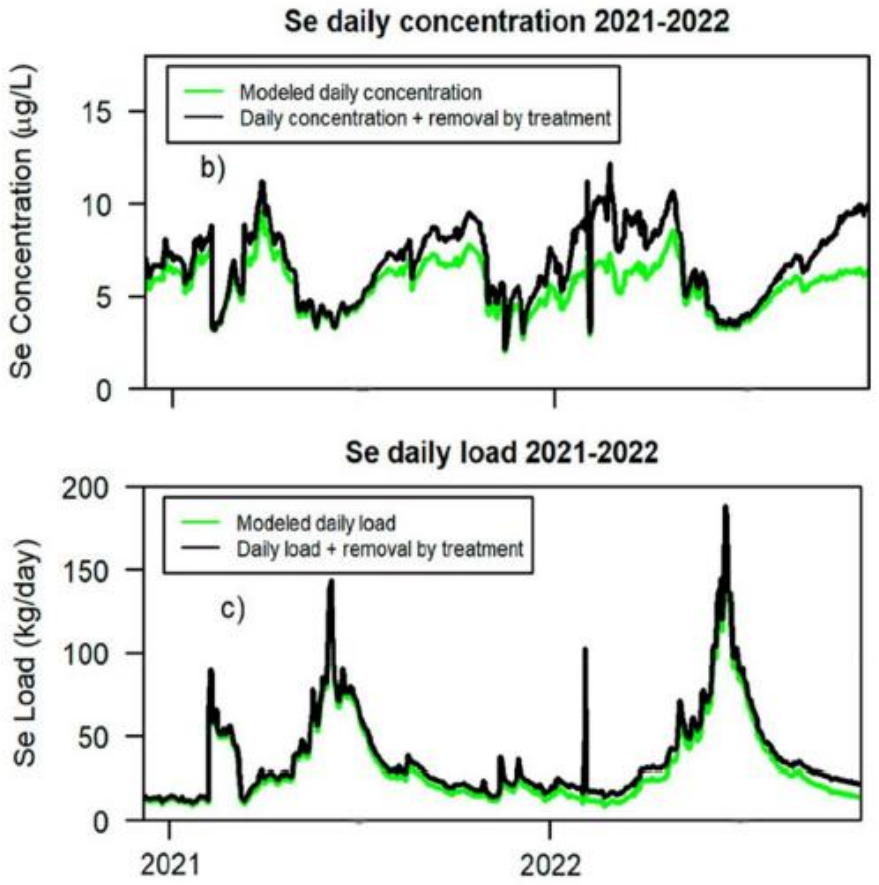

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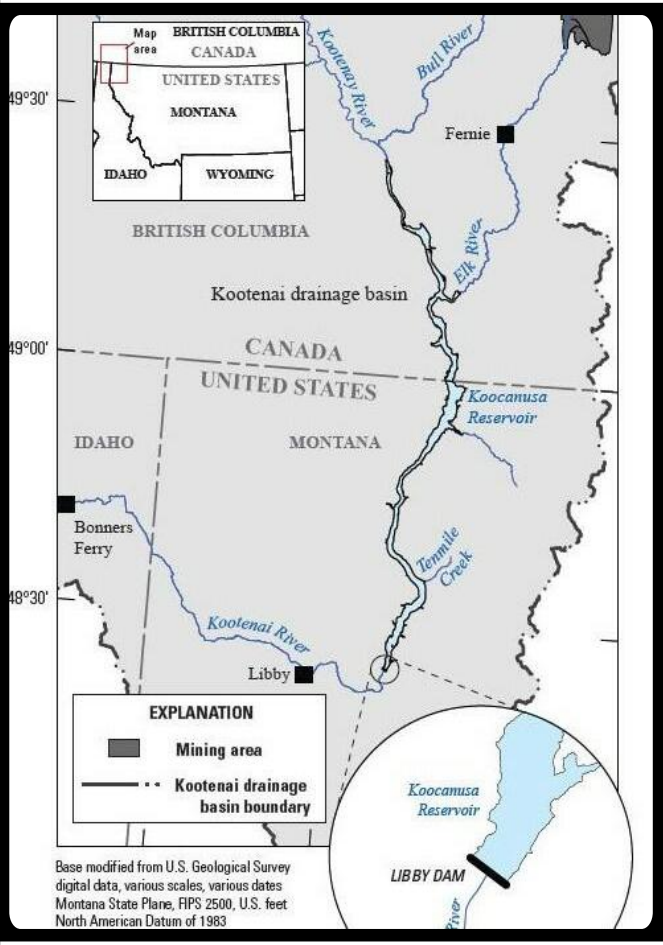
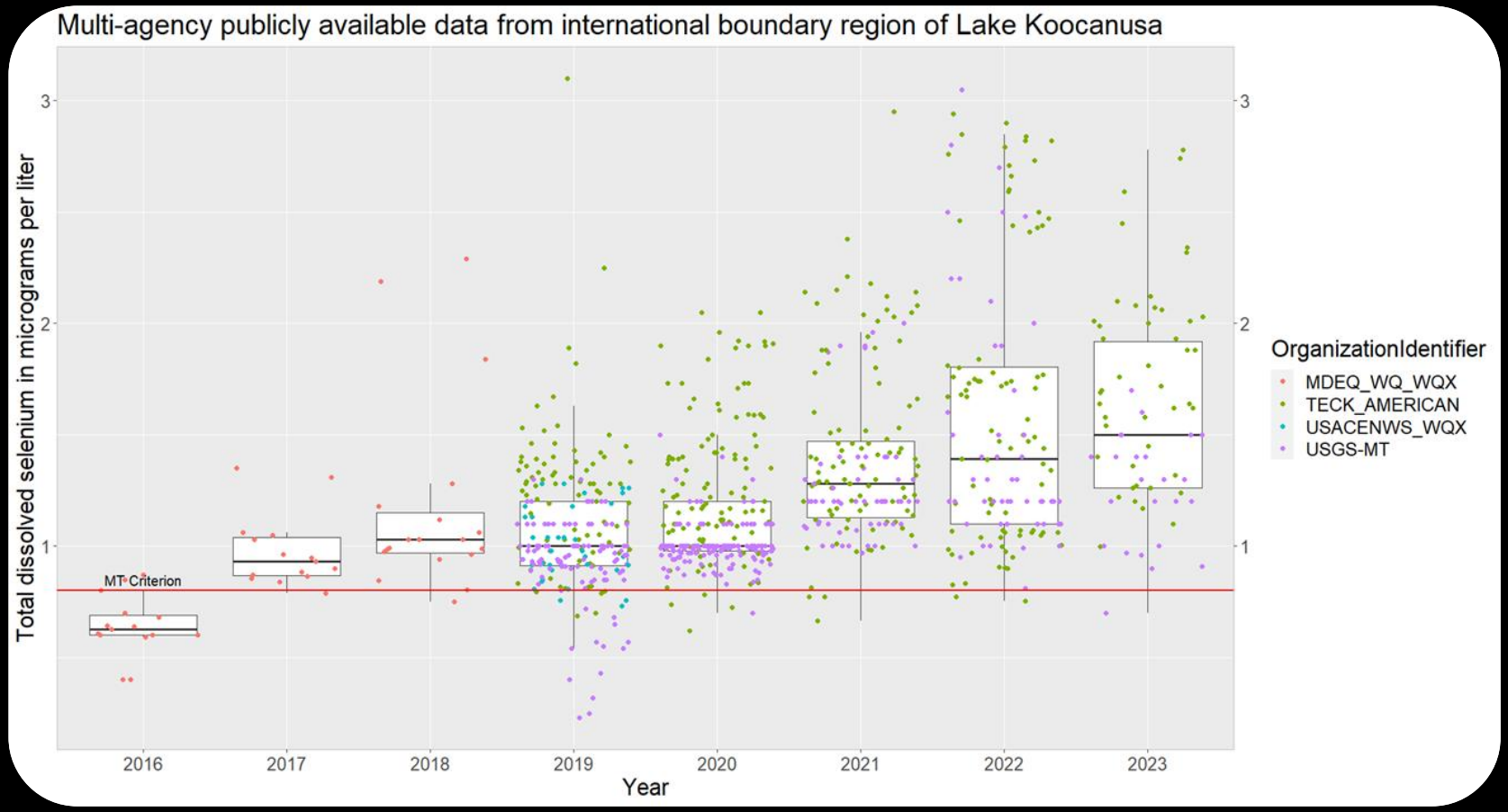
Conditions in Lake Koocanusa, USA





USGS

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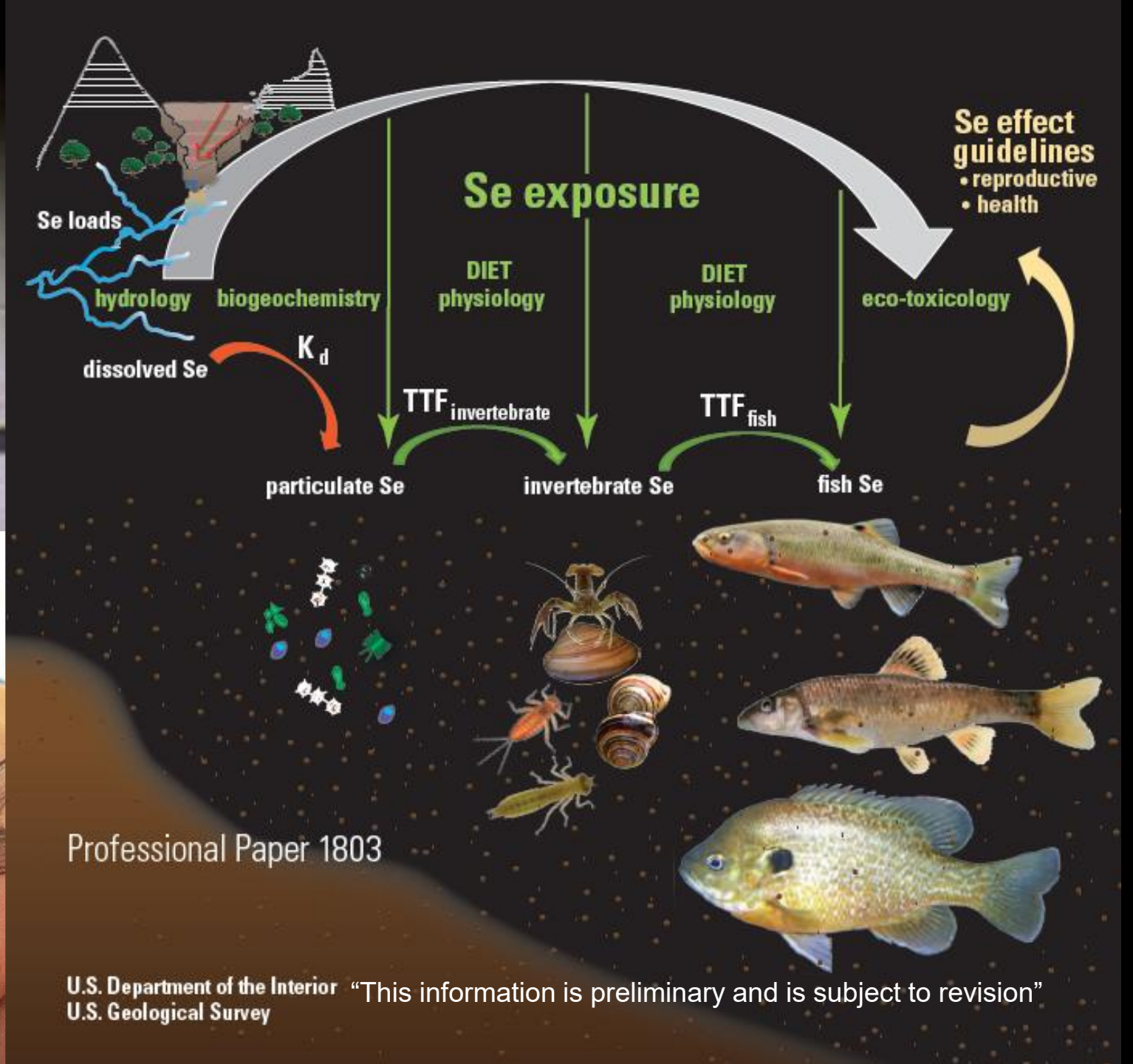
Simplot

USGS



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Is there cause for concern for fish populations?

Westslope cutthroat trout, Elk River 2022

Kootenai River, MT 2022

USGS

Environmental Health Program

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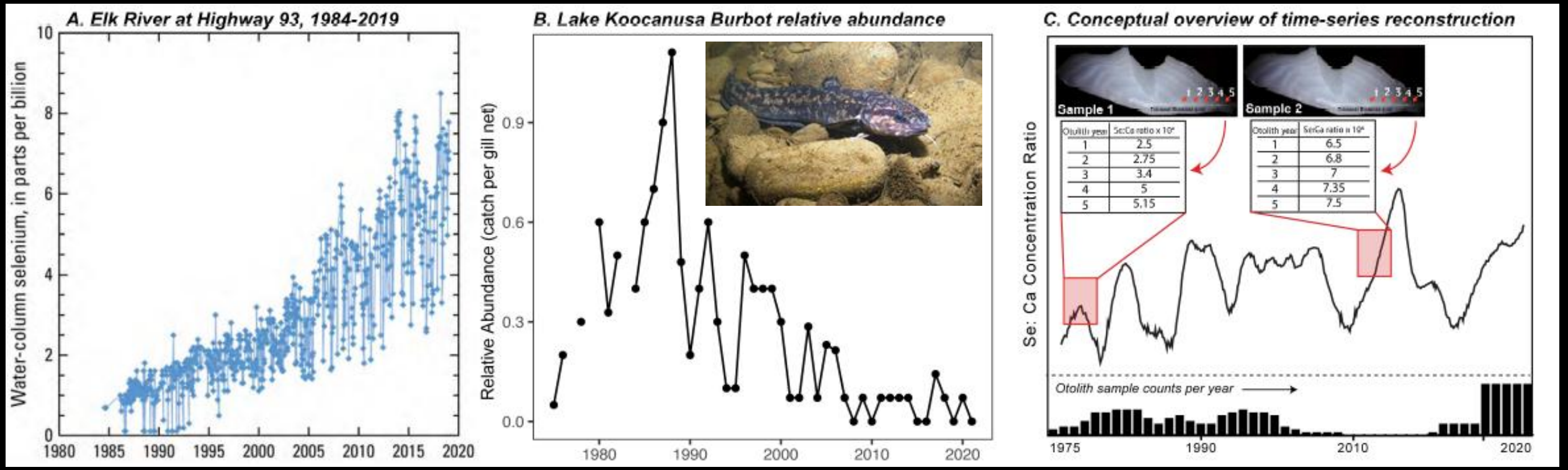
Is there cause for concern for fish populations?



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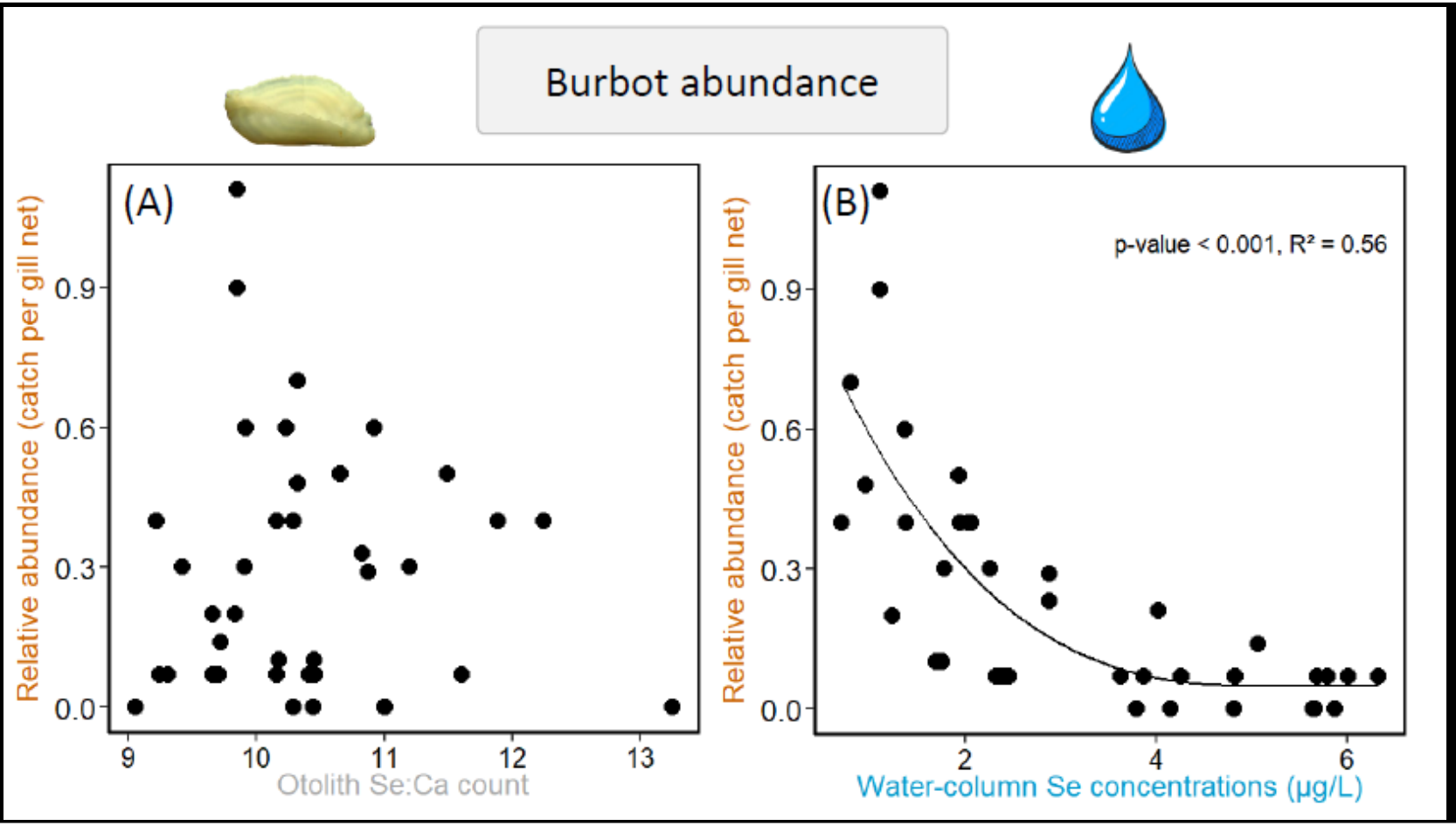
Is exposure to elevated selenium cause for concern for fish populations?



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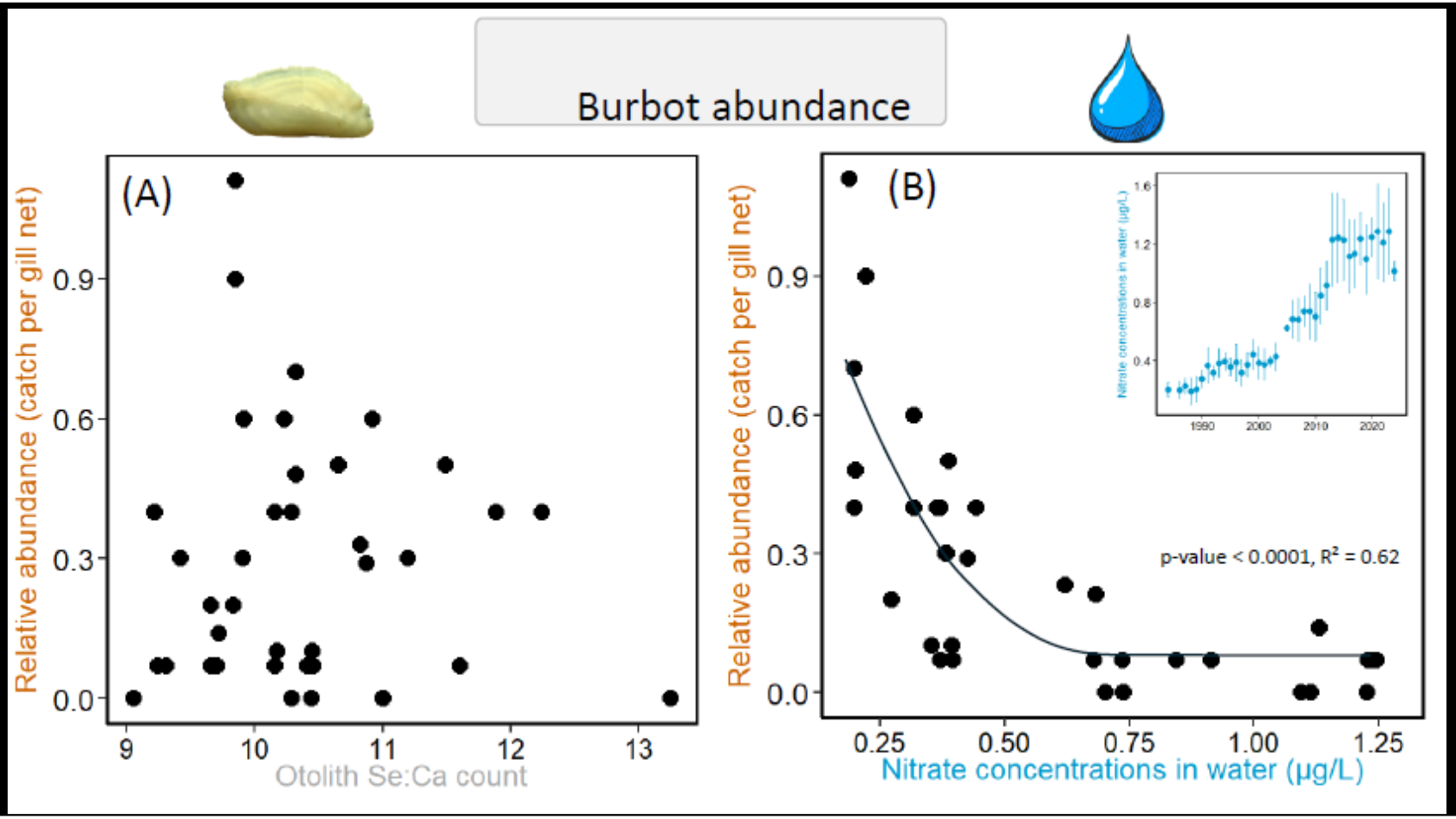

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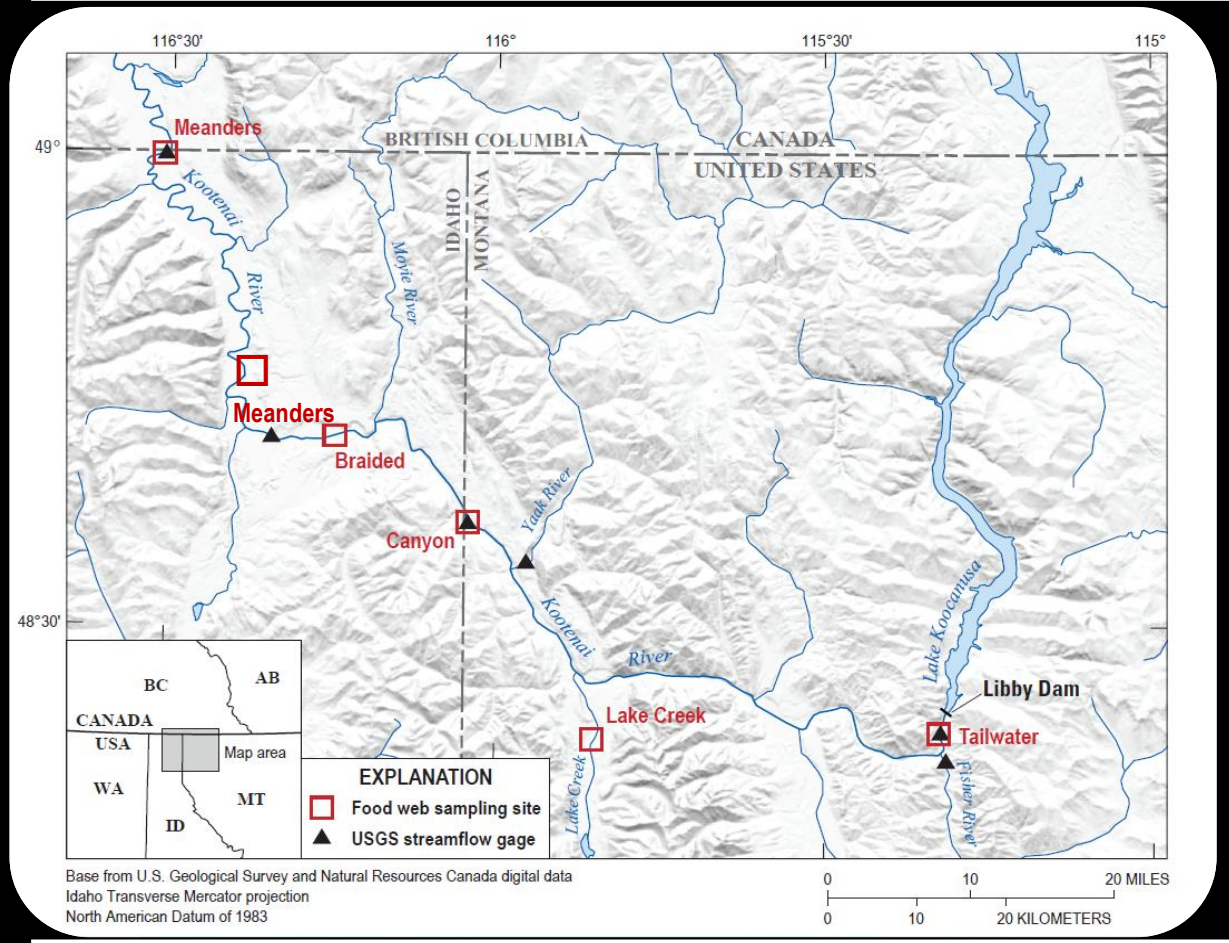
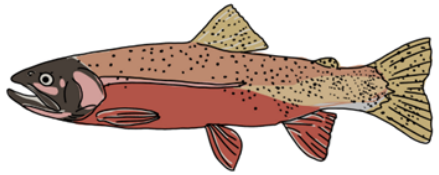


EPA AQUATIC LIFE CRITERION

15.1 ppm selenium concentration levels is the baseline that can be found in tissue and eggs to maintain healthy selenium levels that have minimal impact on aquatic life.

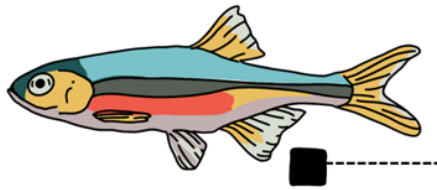


WESTSLOPE CUTTHROAT TROUT

Selenium concentrations found in their ovary tissue and eggs regularly exceeded EPA's Aquatic life criterion.

PEAMOUTH CHUB

Selenium concentrations found in their ovary tissue and eggs regularly exceeded EPA's aquatic life criterion.



REDSIDE SHINER

Selenium concentrations vary throughout the sample timeline and are primarily found above criterion. Accumulate the highest levels of Selenium.

VARIABILITY

Selenium concentrations are found to be variable throughout species in Lake Koocanusa and are increasing over time.

USGS

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

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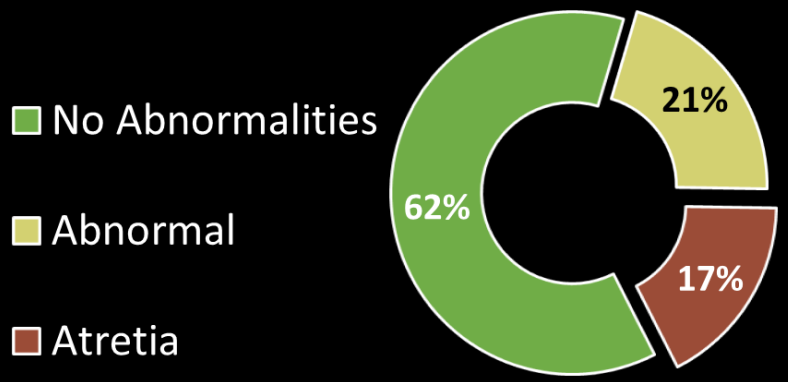
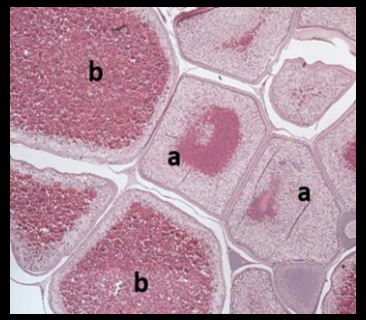
Is there cause for concern for fish populations?

Redside Shiner

RSSH, n = 29

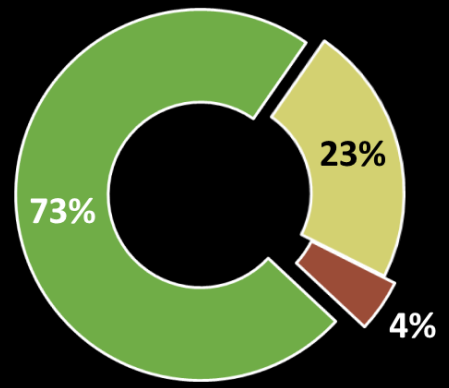


No abnormalities

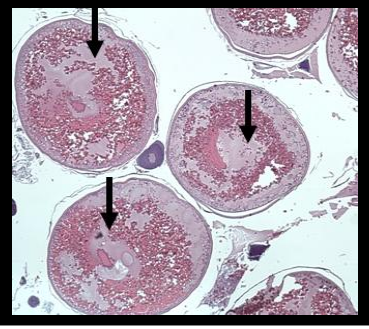


Peamouth Chub

Peamouth, n = 22

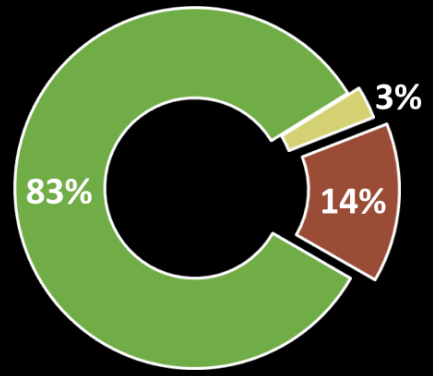


Abnormal

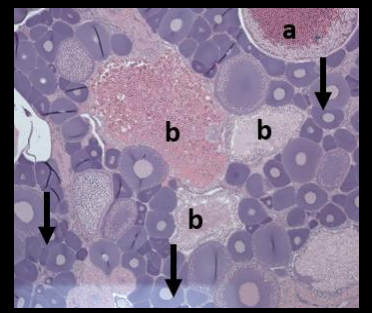


Northern Pikeminnow

N PMN, n = 35



Atretia



USGS

Environmental Health Program

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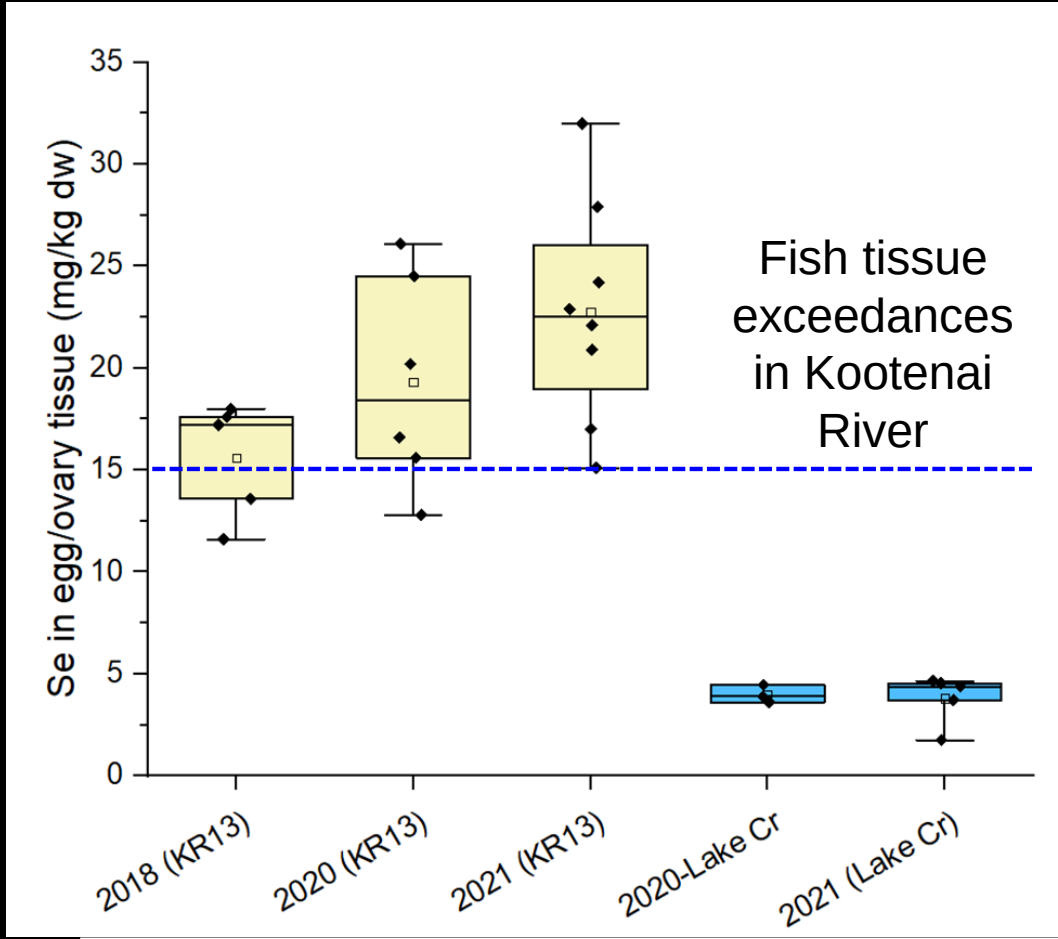
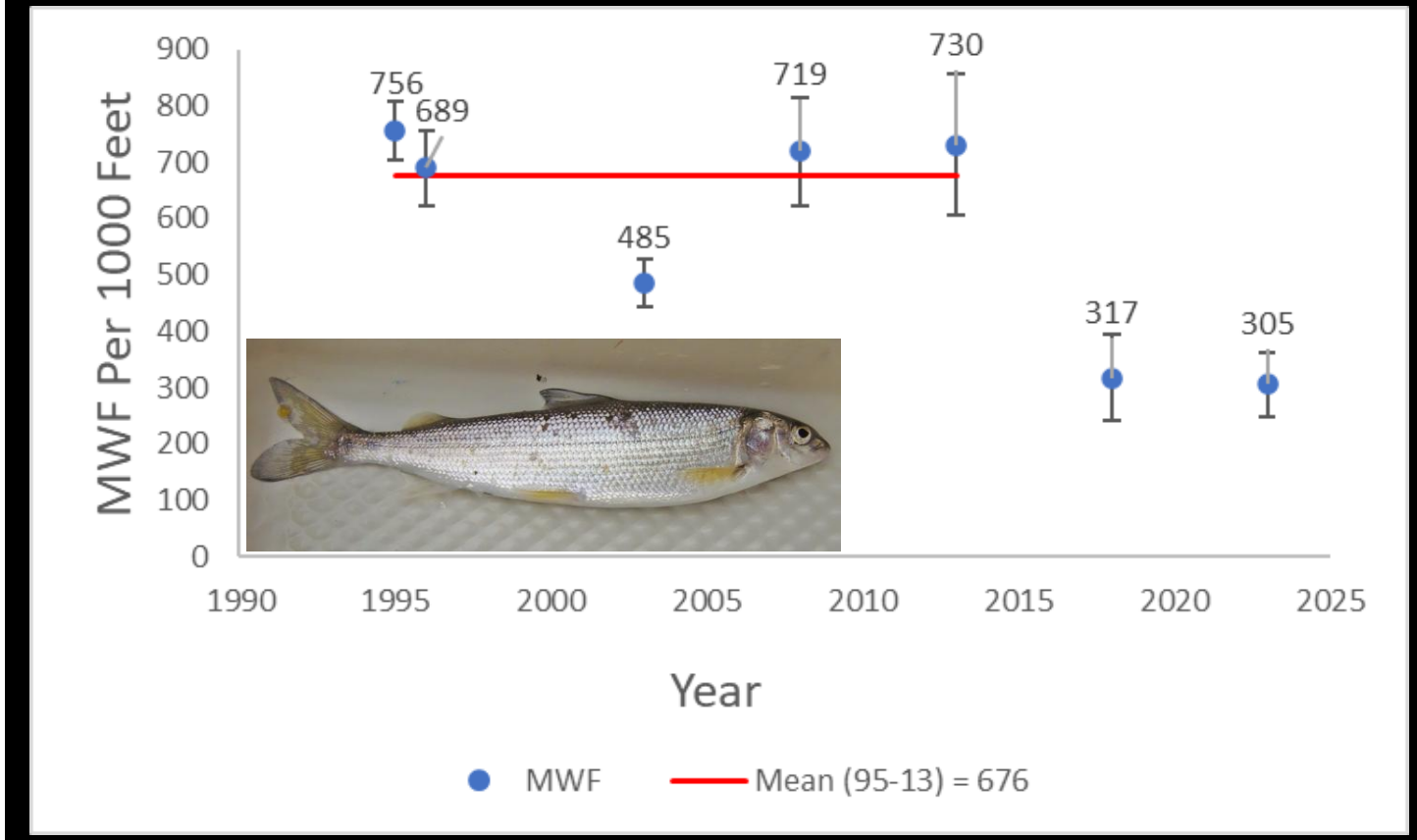
Is there cause for concern for fish populations (Kootenai River)?



Mountain whitefish (MWF)



USGS

Data resources: MT FWP 2023, USGS 2022

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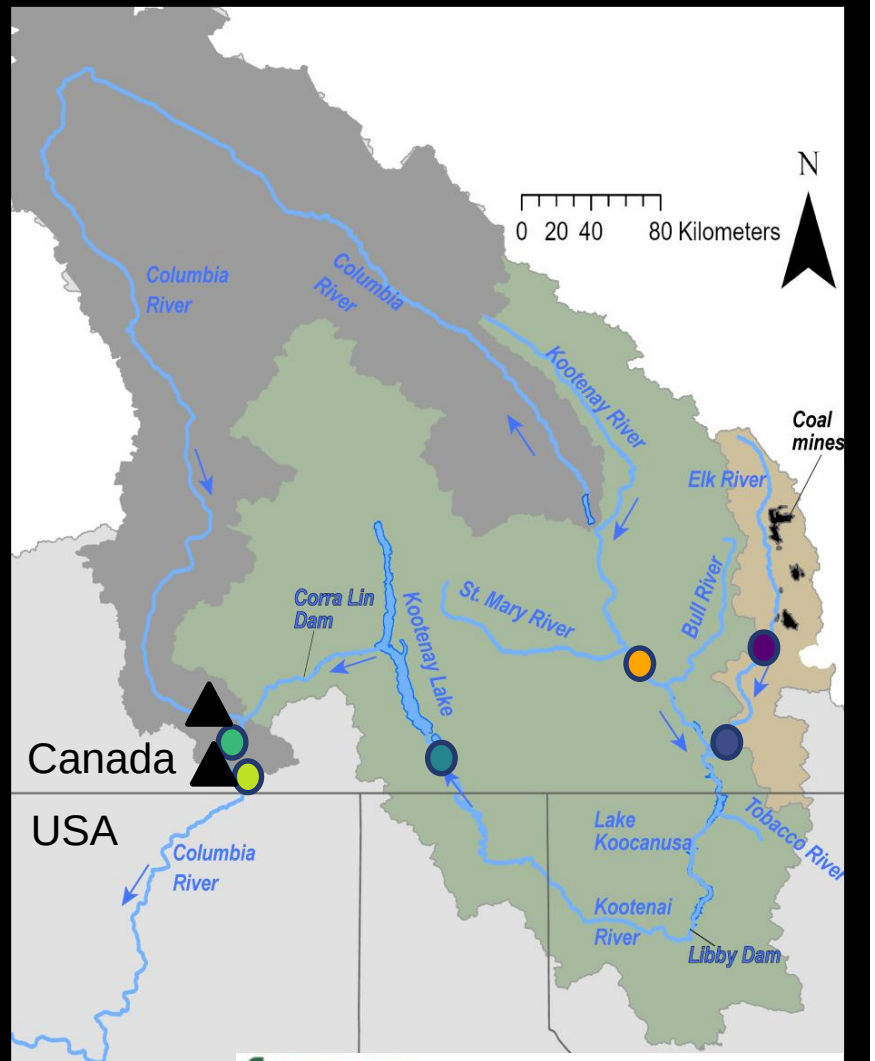
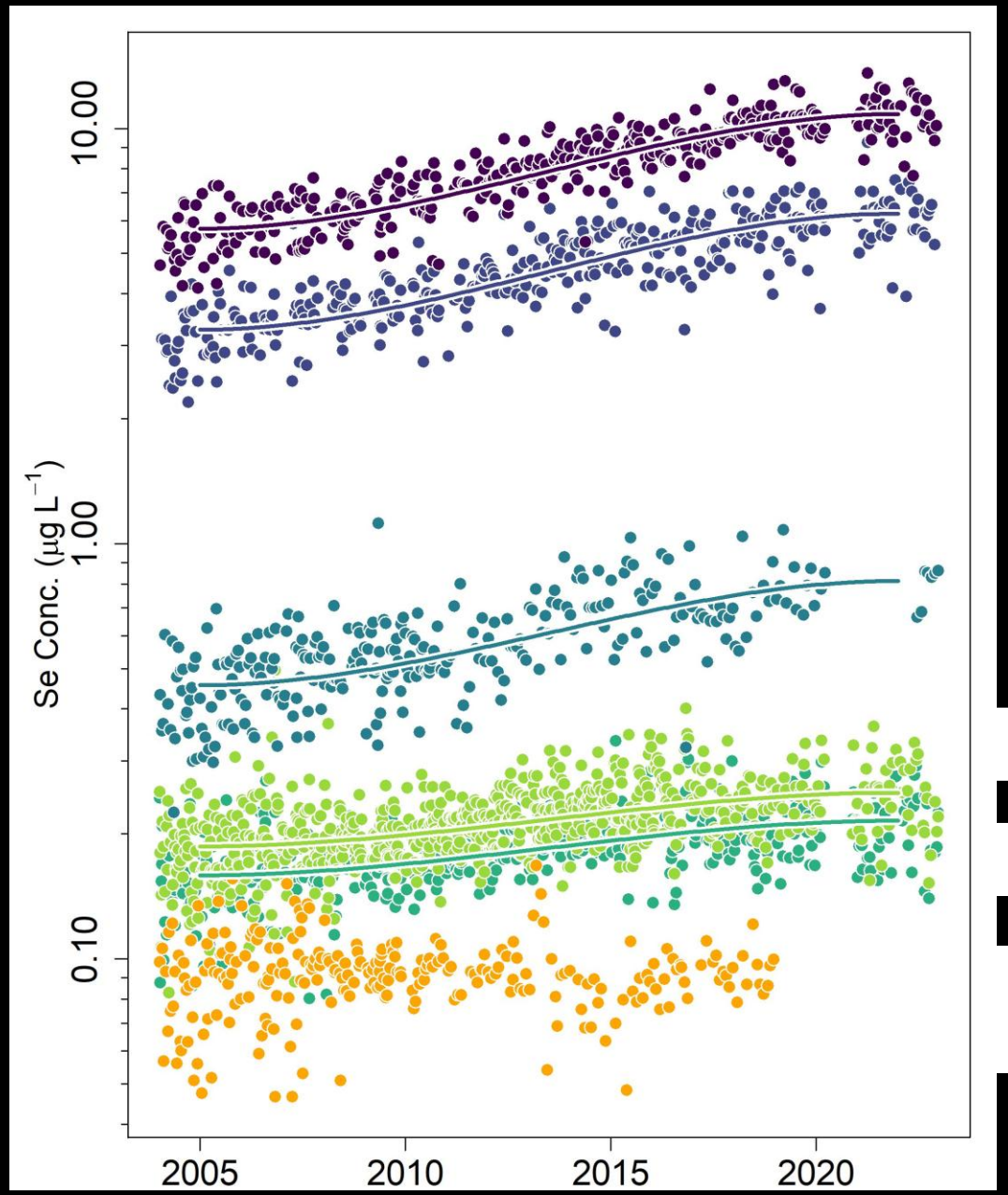
Trends and transport of selenium to the Columbia R.





Elk R at Sparwood
+89%

Elk R at Highway 93
+90%

Kootenay R at Creston
+78%

Columbia R at Waneta
+35%

Columbia R at Birchbank
+35%

Kootenay R near Fenwick (Reference)
p-value = 0.9

Data resources: ECCC

USGS science for a changing world

ENVIRONMENTAL Science & Technology LETTERS

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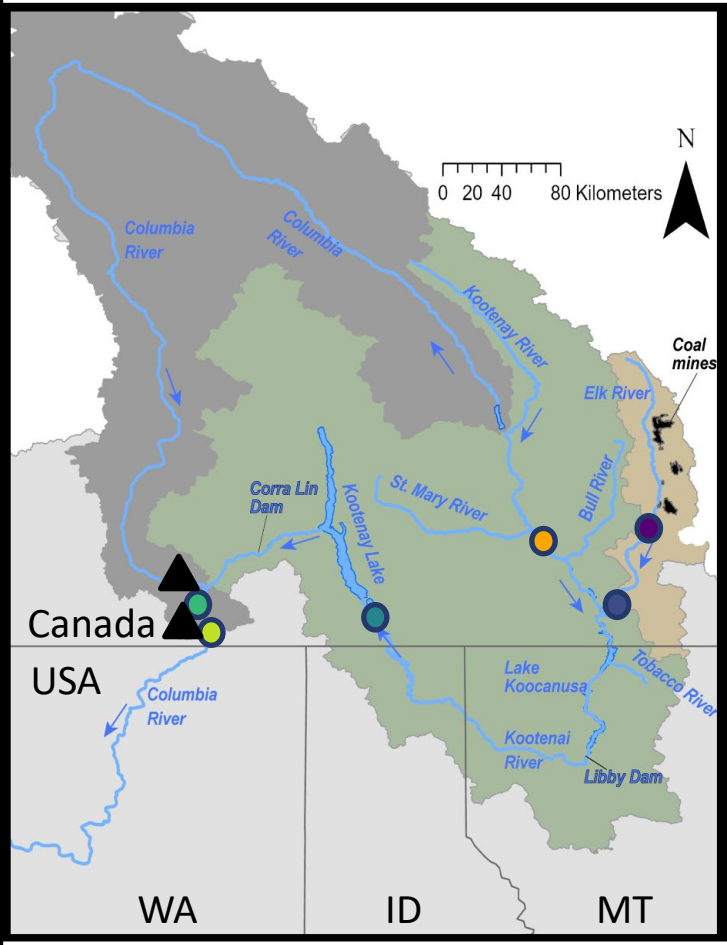
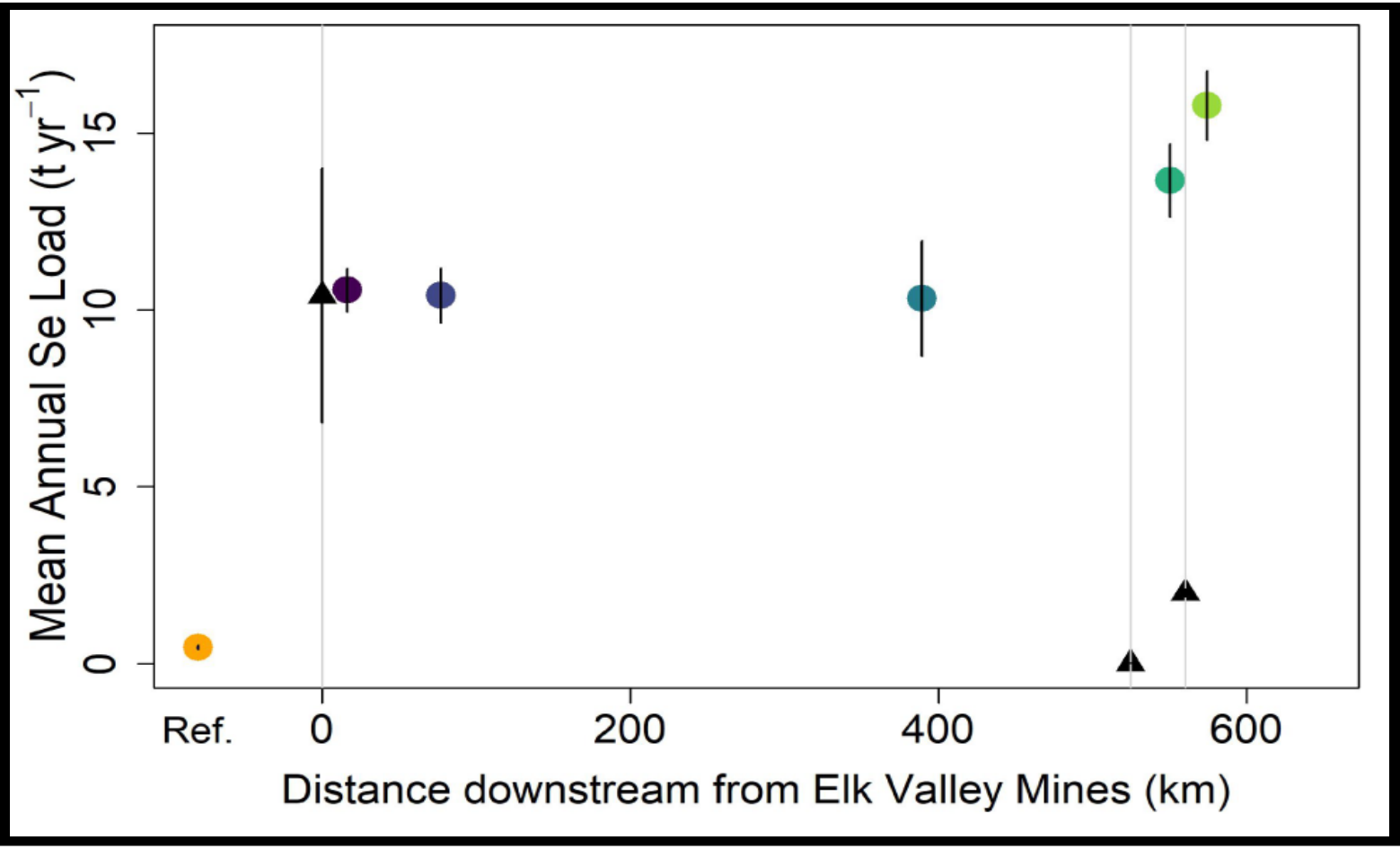
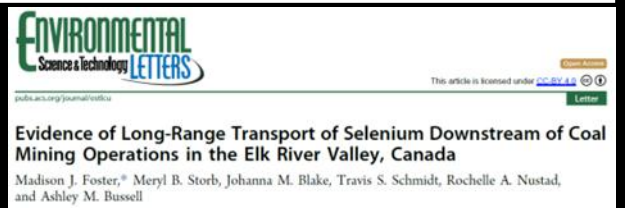
Selenium loads suggest conservative transport from mines





USGS

Data resource: Government of Canada. *National Pollutant Release Inventory data search*. 2023.



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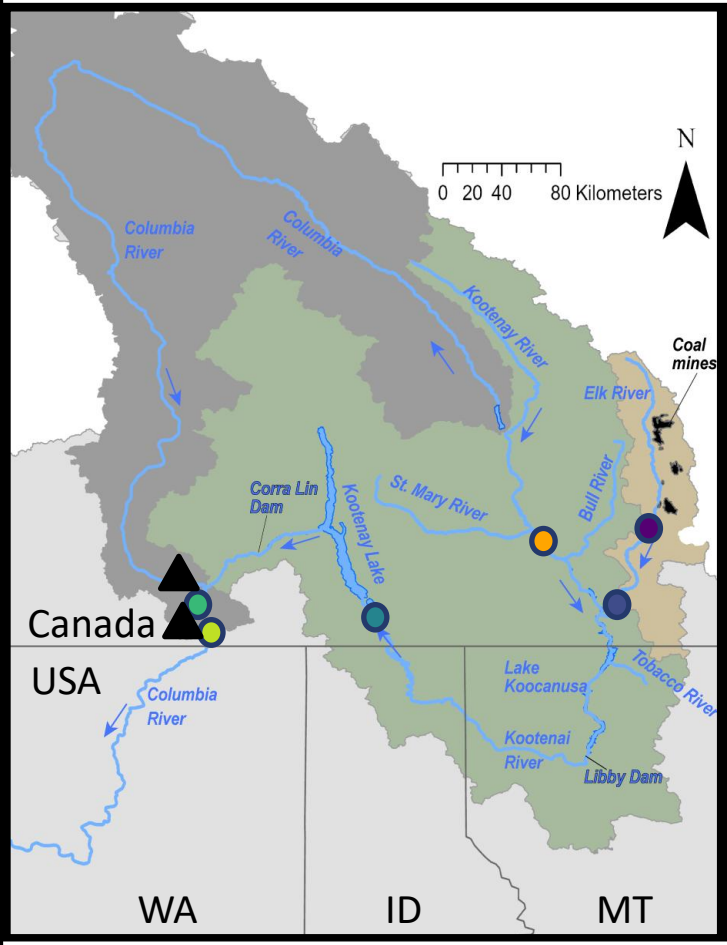

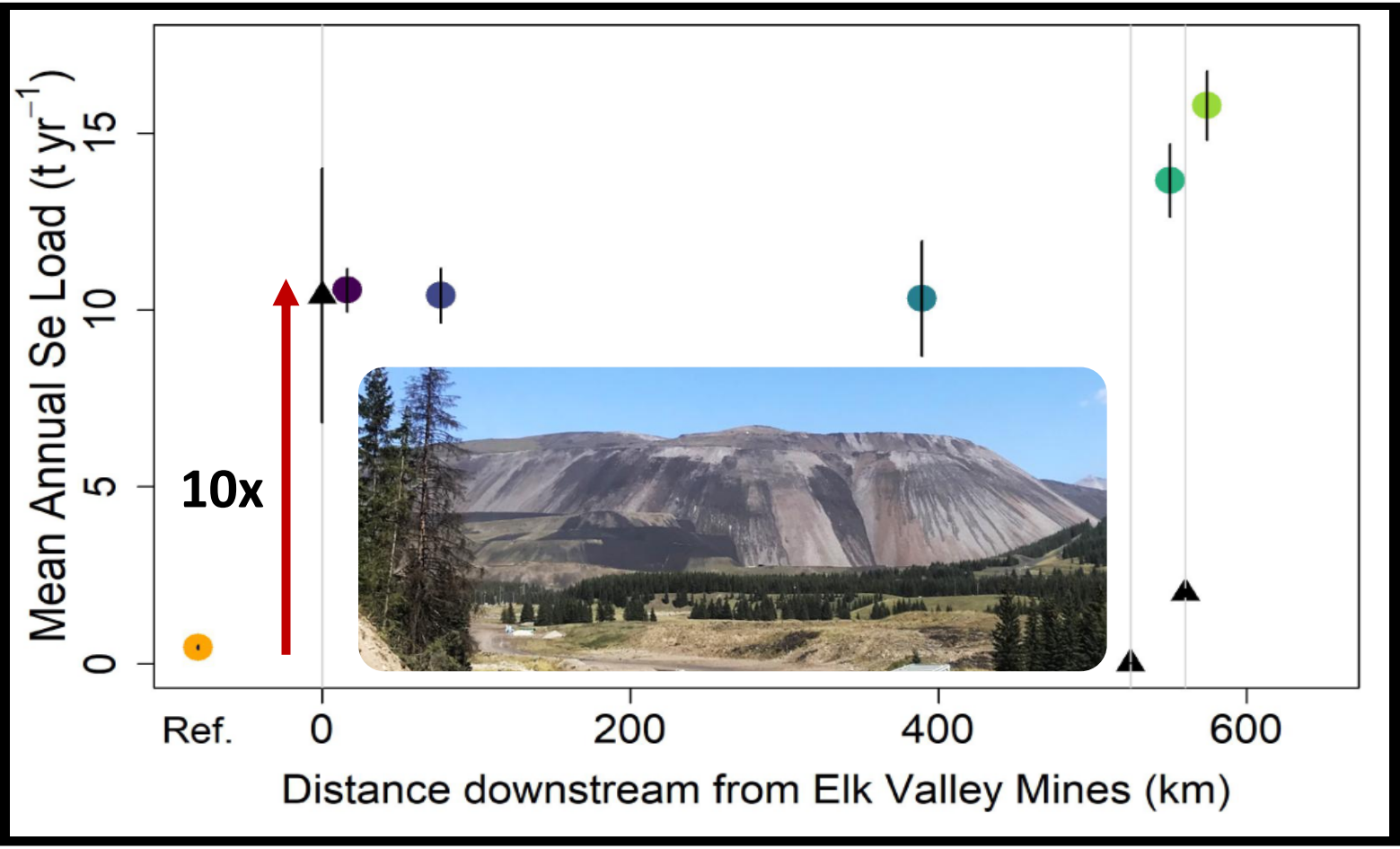

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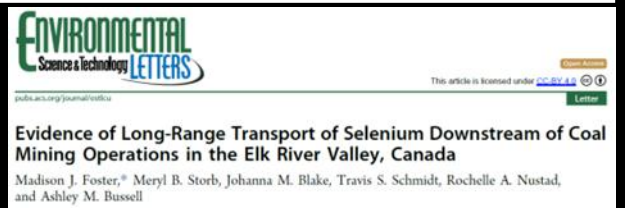
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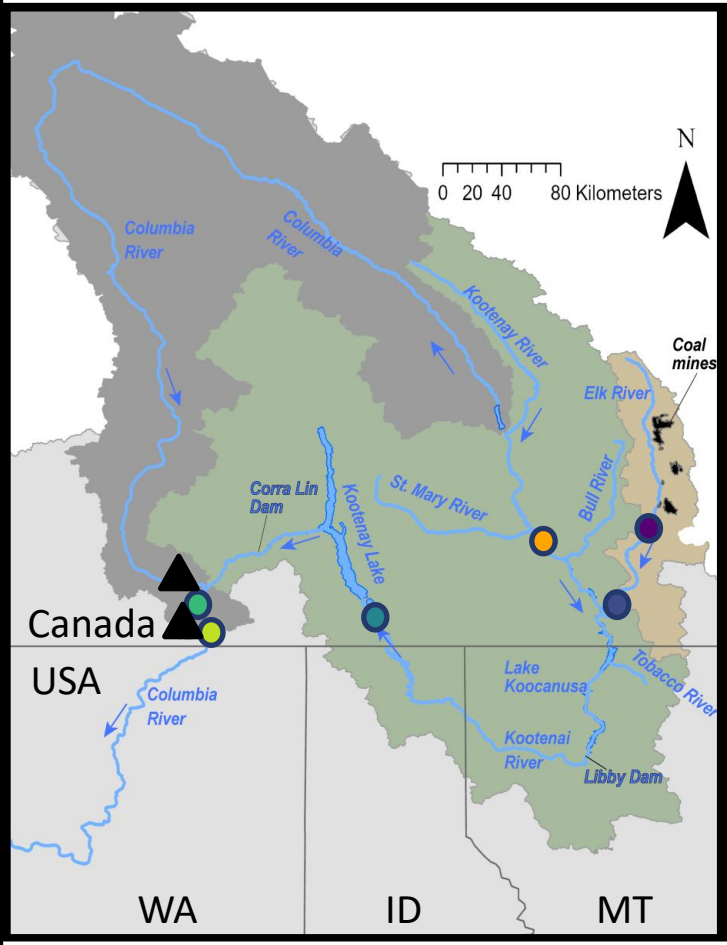

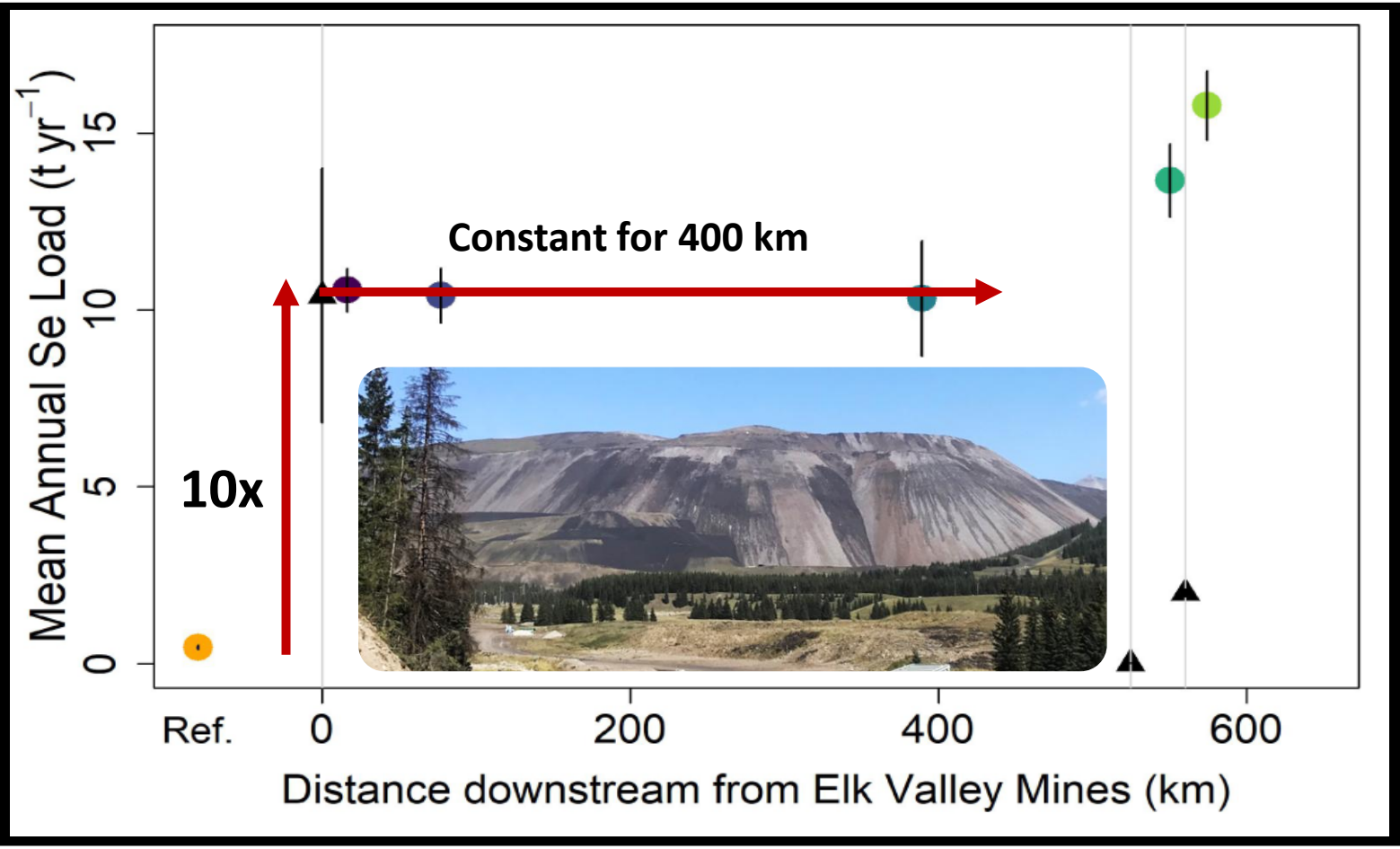

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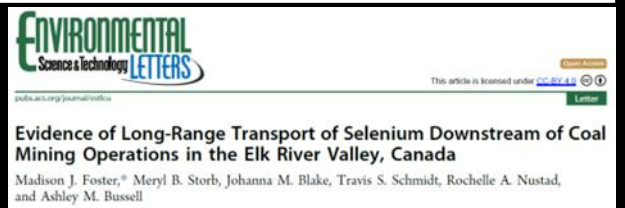
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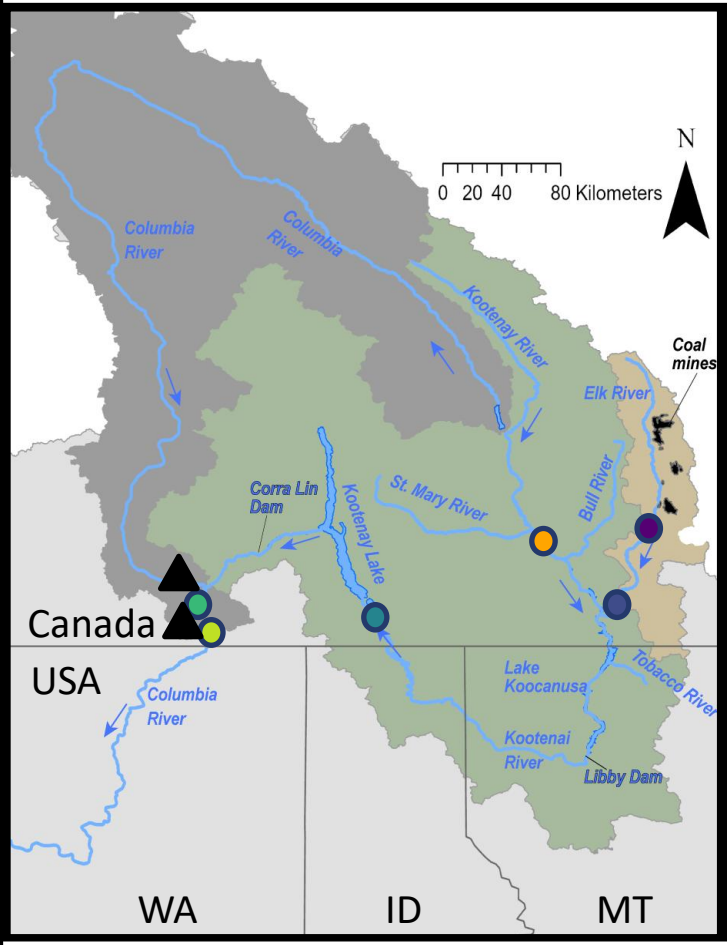

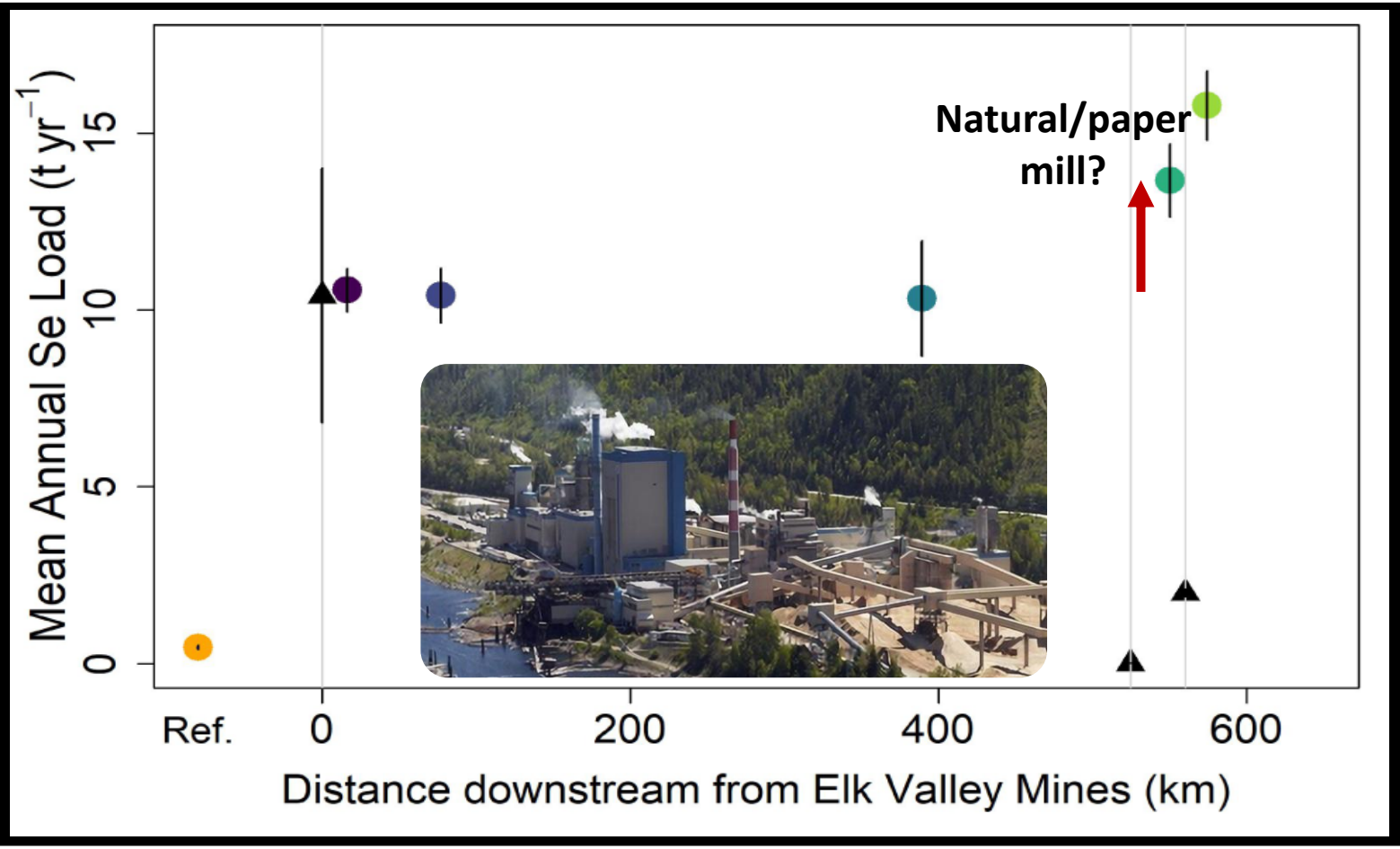

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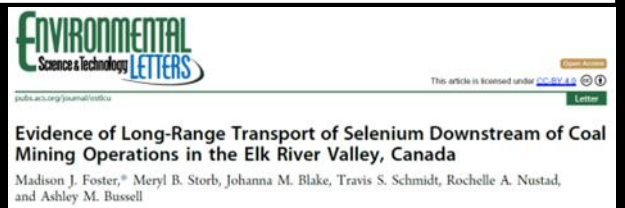
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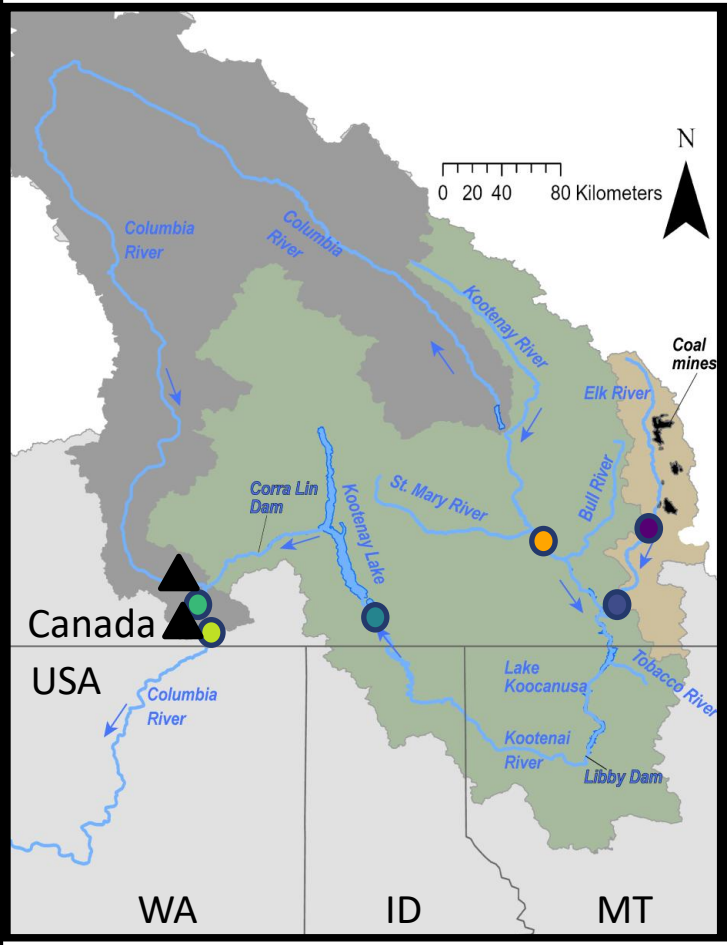
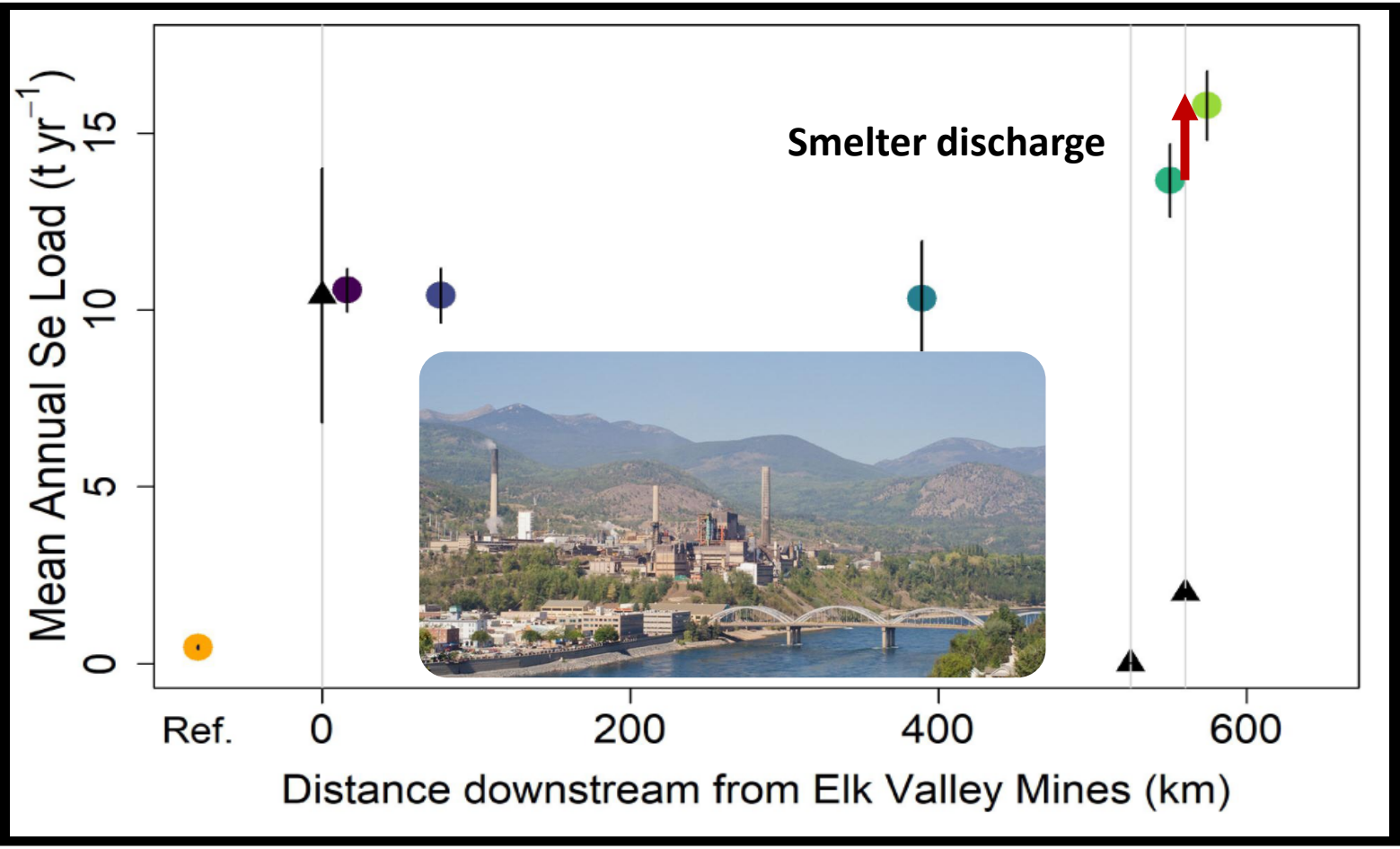
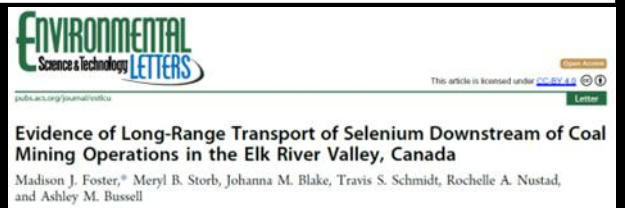




USGS

Data resource: Government of Canada. *National Pollutant Release Inventory data search*. 2023.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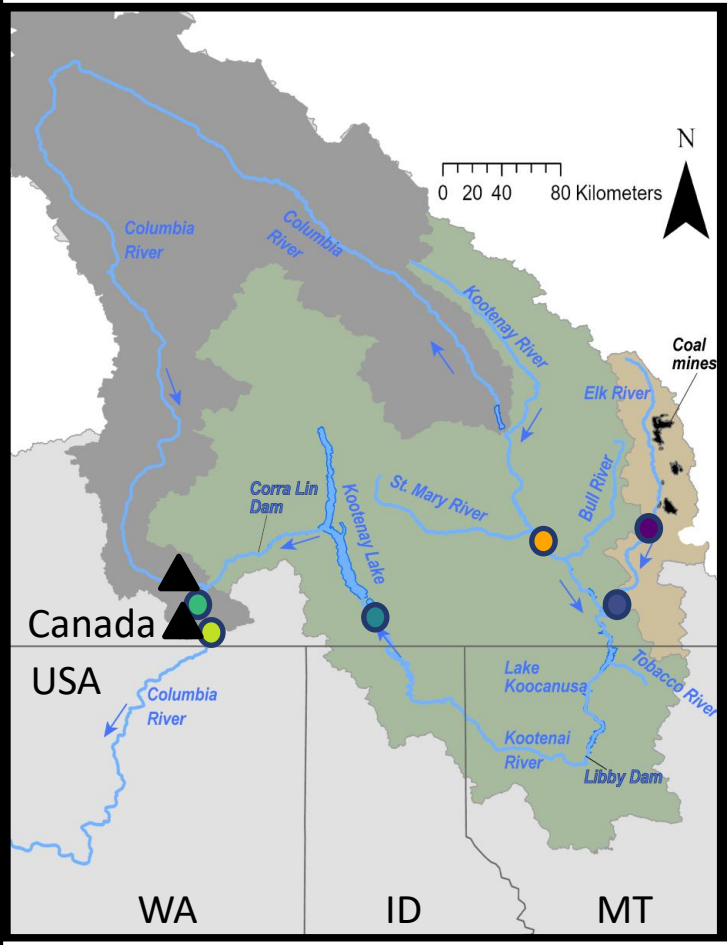
How can elevated concentrations of selenium persist for over 575 km downriver?



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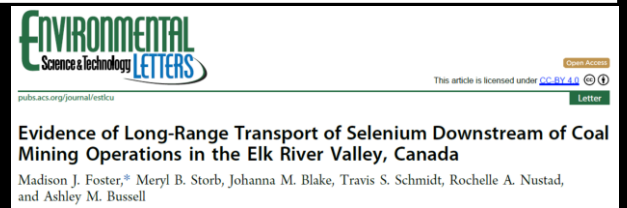
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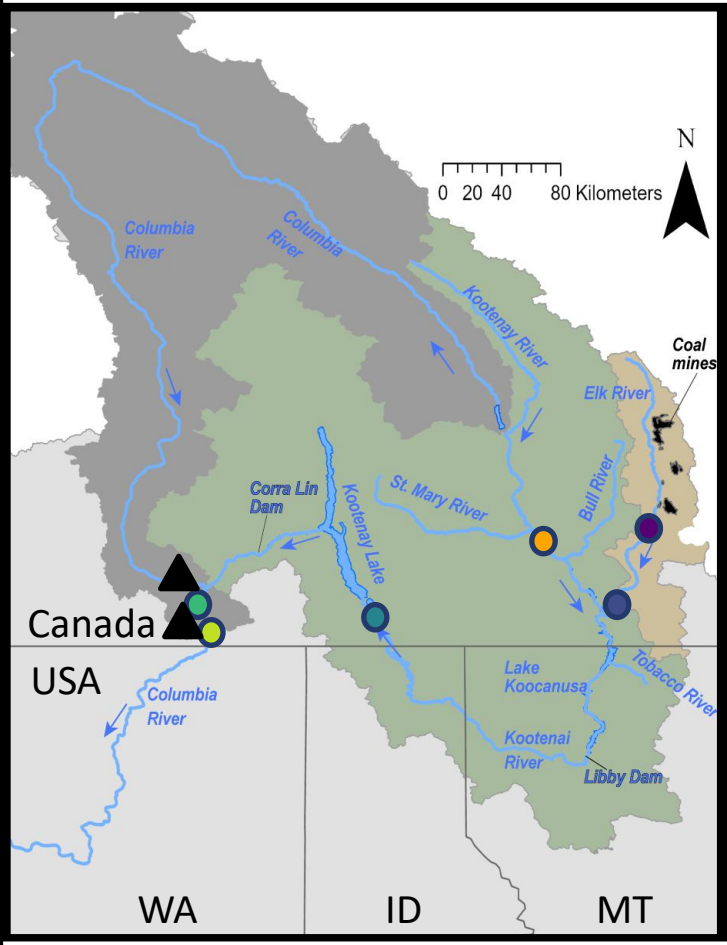

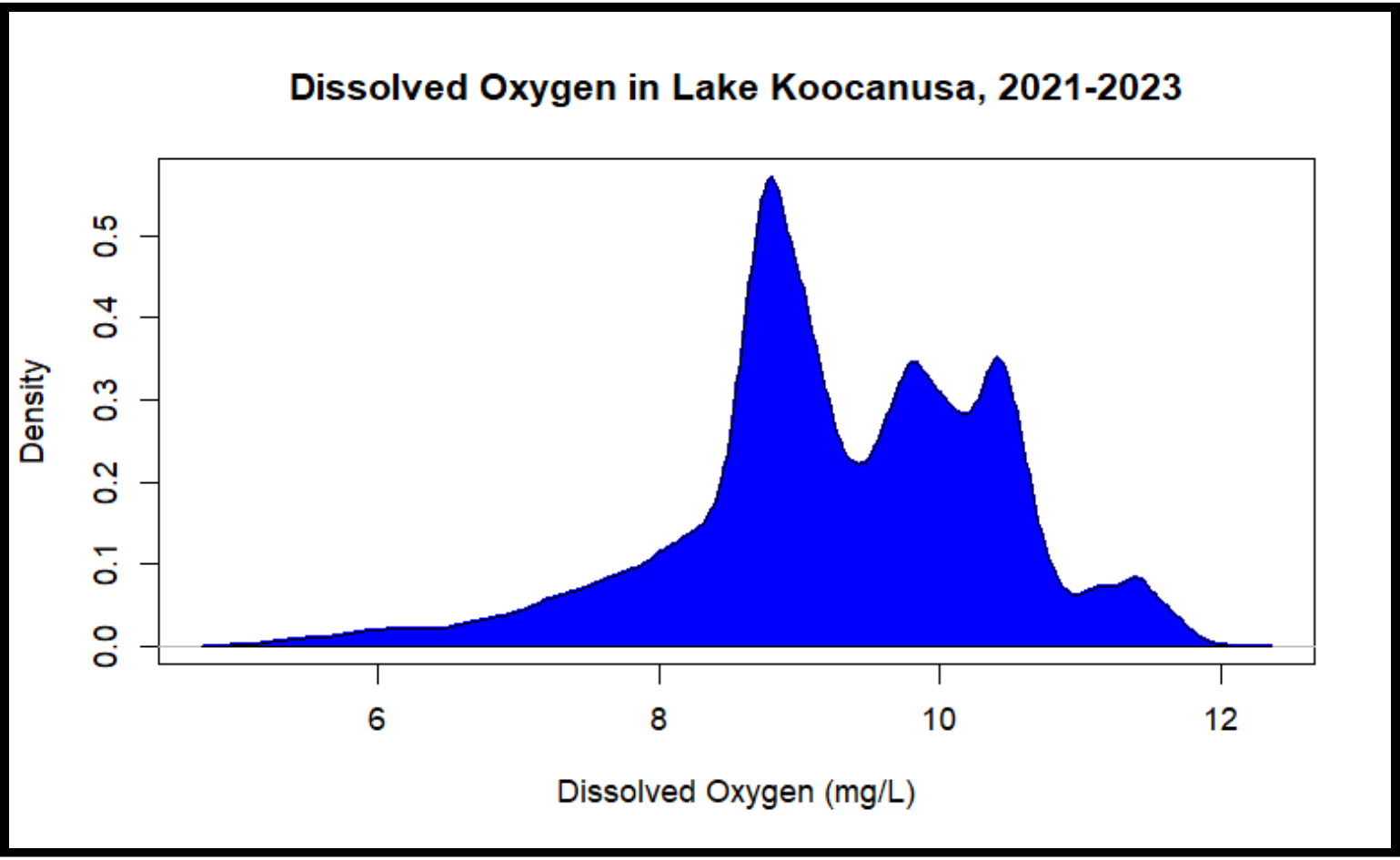

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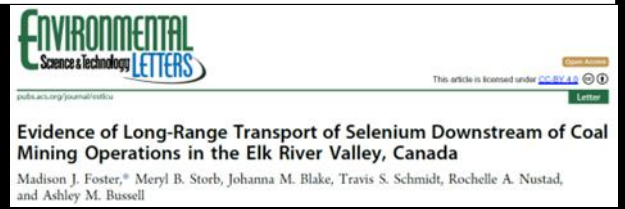
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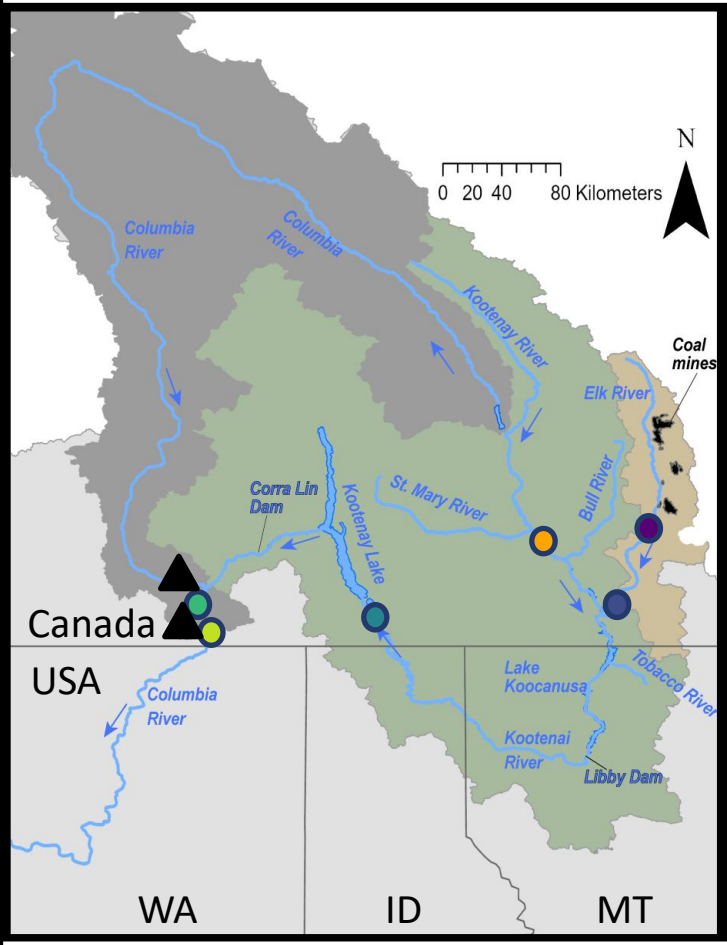

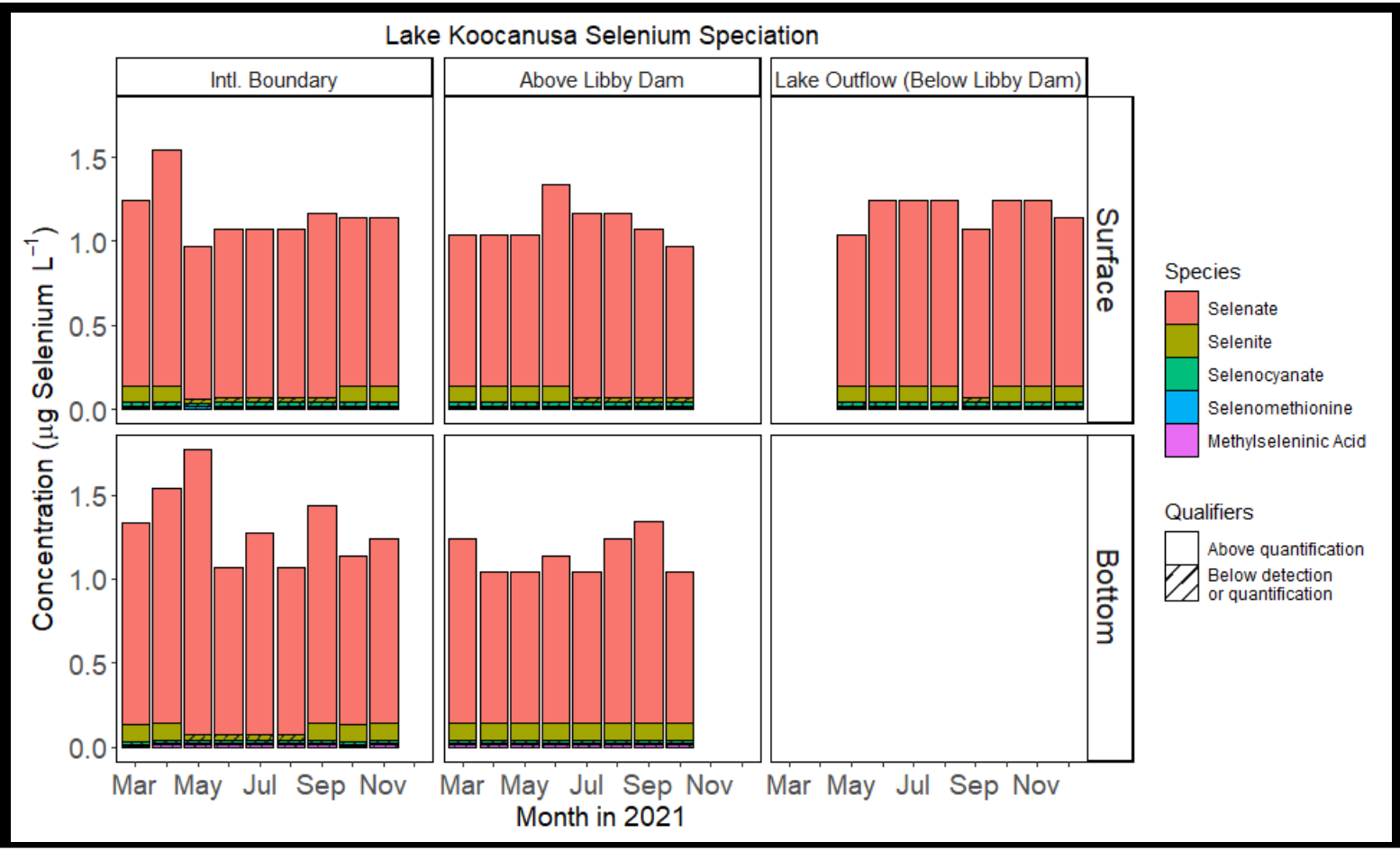

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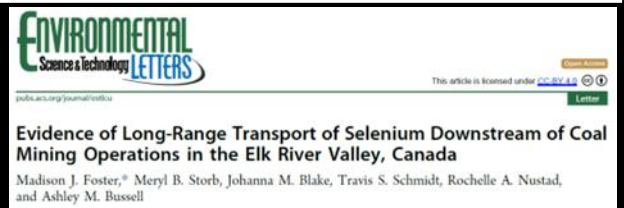
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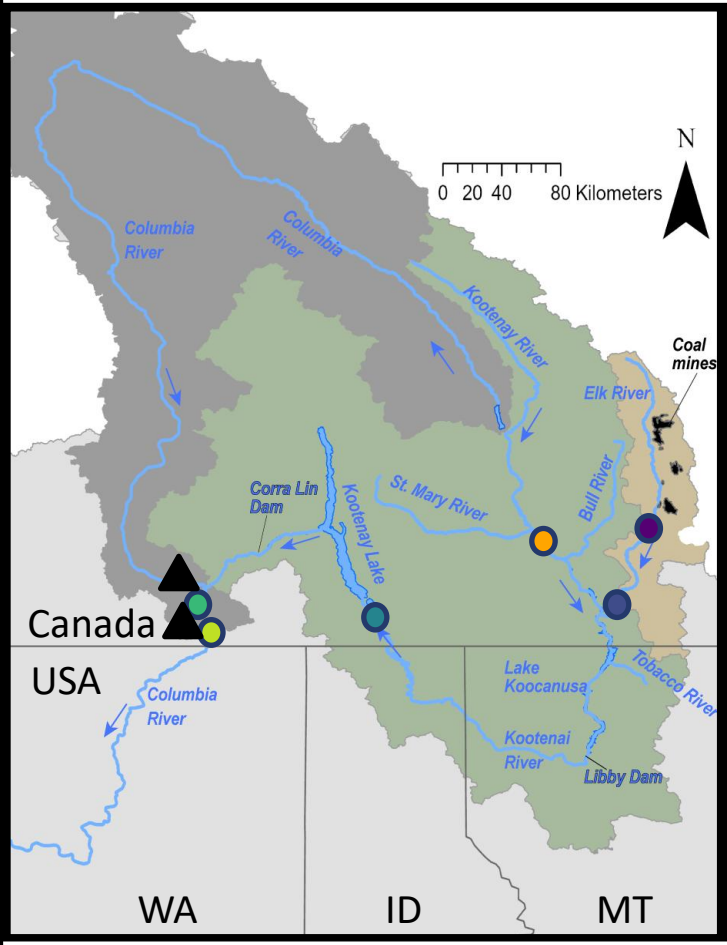

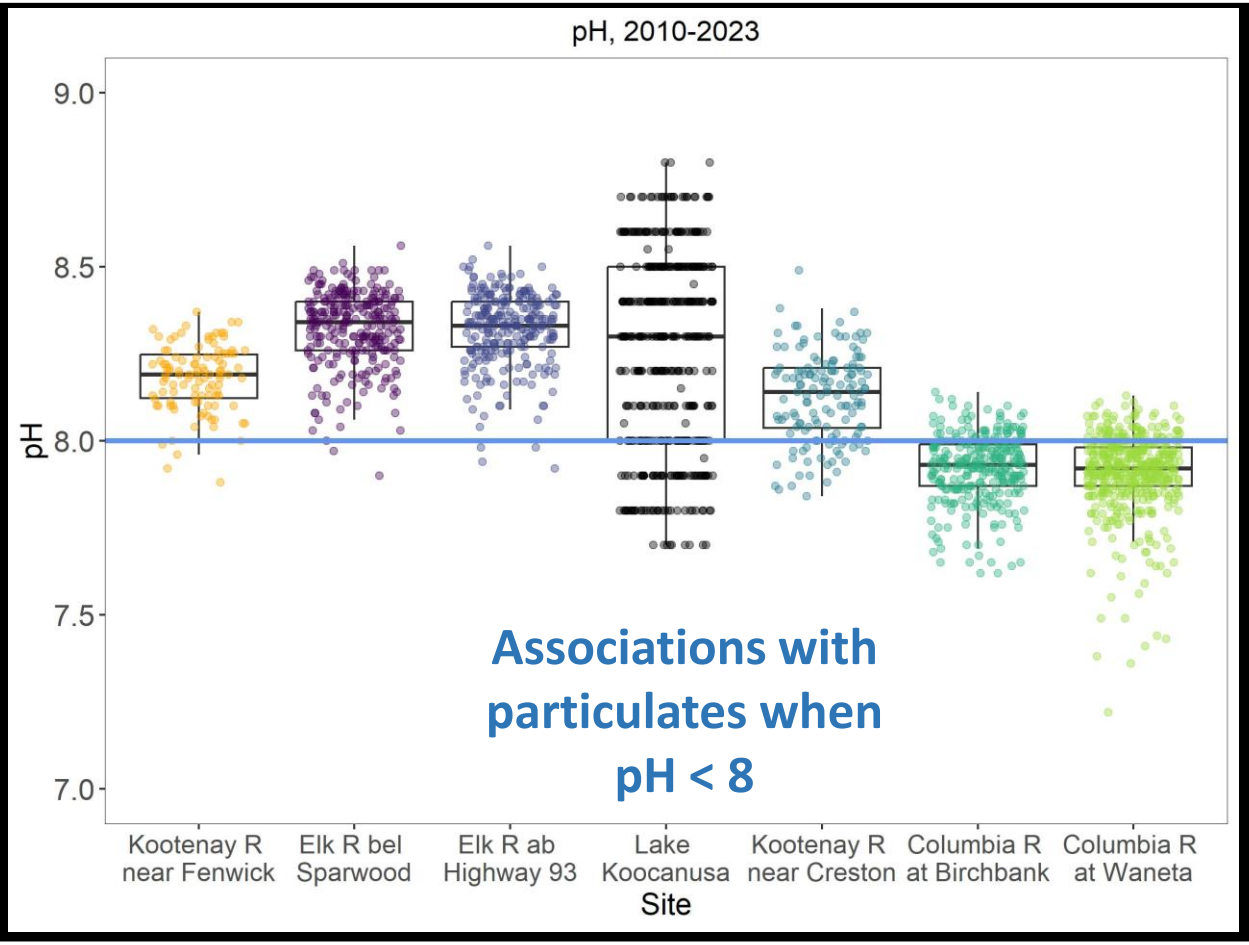

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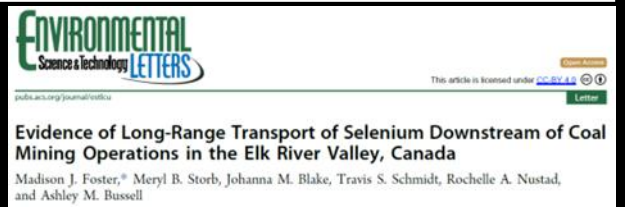
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Salmonid fishery restoration at risk

USGS

"This information is preliminary and is subject to revision"

Salmonid fishery restoration at risk

OPB SEPT. 25, 2023

In The News | Norovirus | Solar eclipse | Fall foliage | Electric vehicles | Homelessness | Quagga mussels

Biden administration promises $200 million to help reintroduce salmon in Columbia River

By Tony Schick (OPB)
Sept. 21, 2023 4:16 p.m.

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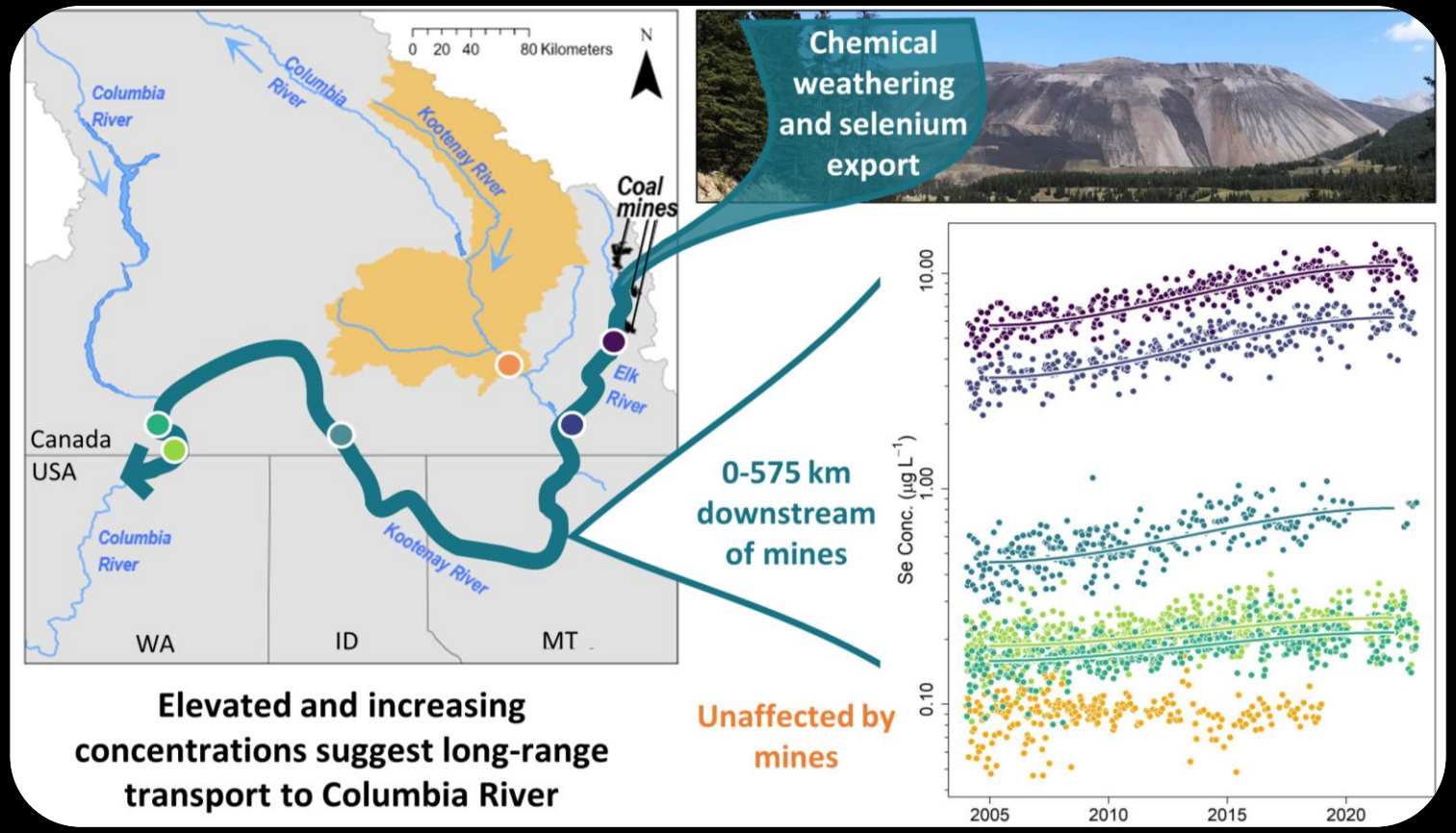
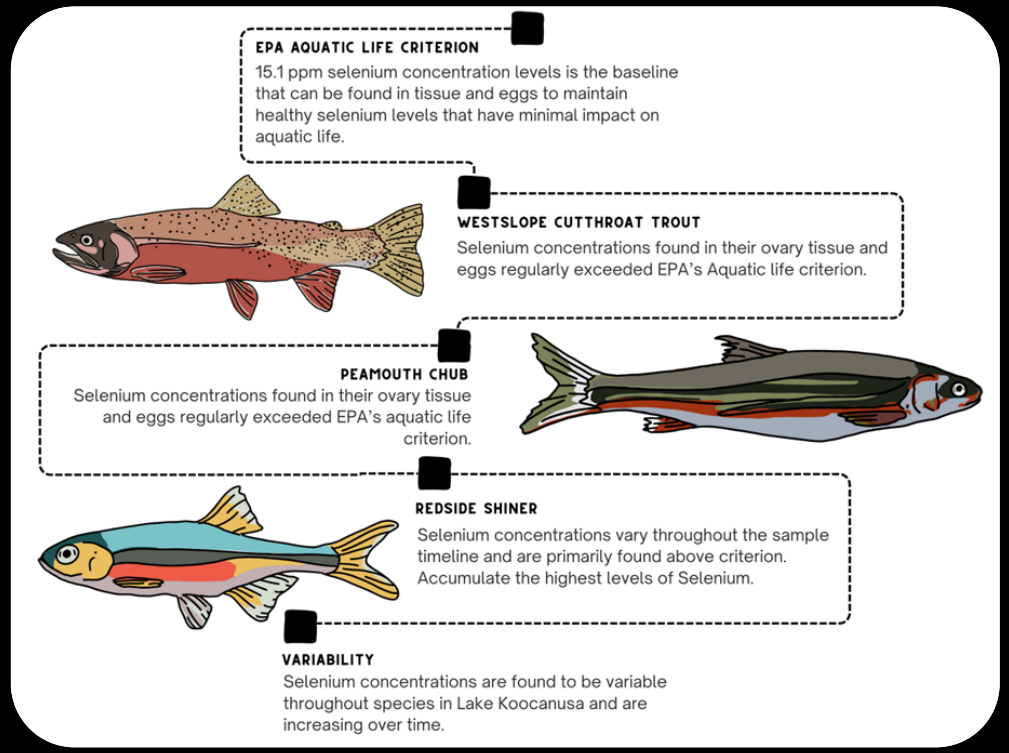
Selenium take homes





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Kootenai River Watershed Coordination and Partnerships

USGS Transboundary Information

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