

# **Columbia River Invasive Northern Pike - Exploring movements through physical and chemical means**



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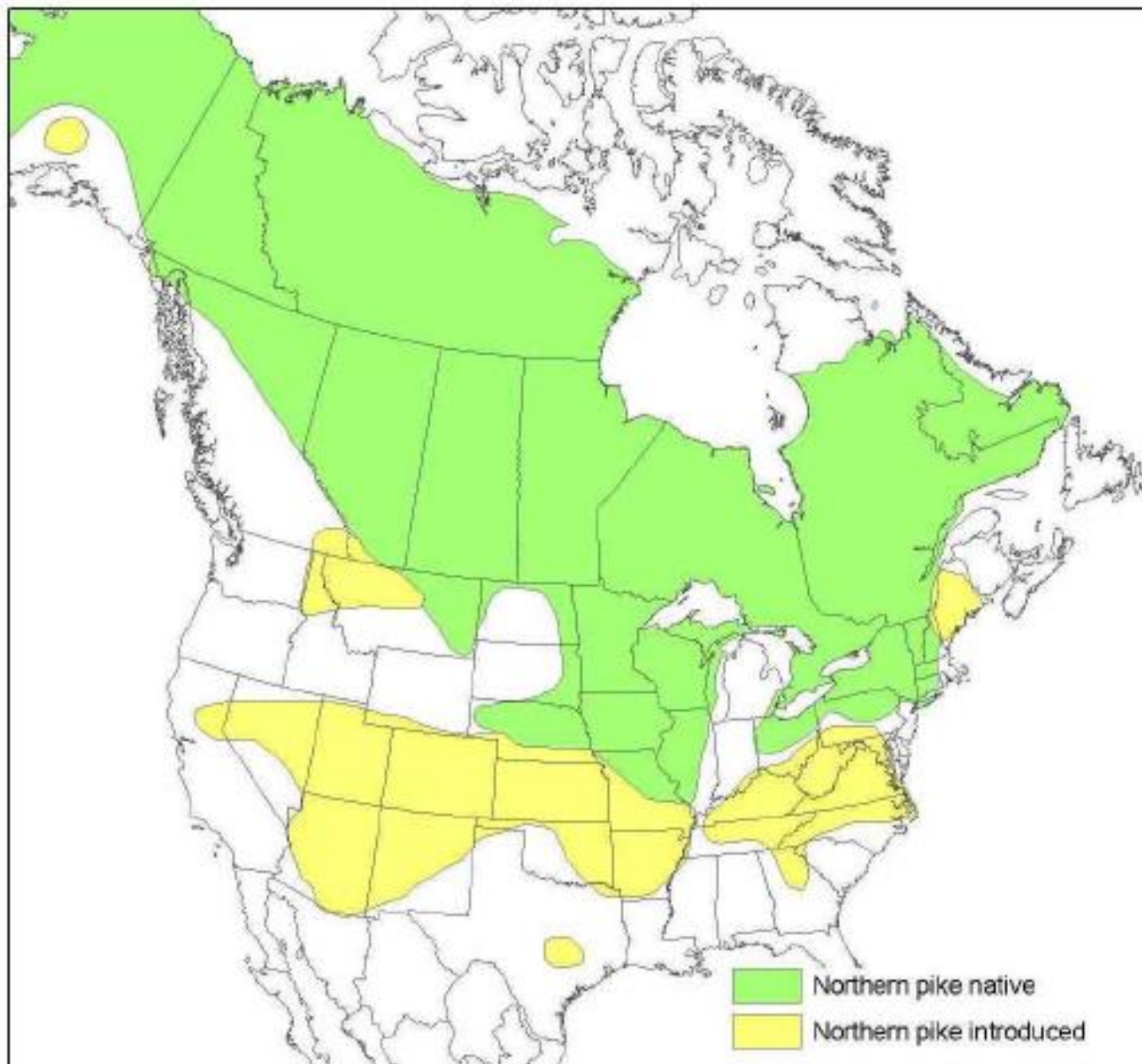


Figure 2. The North American distribution of northern pike from Bradford et al. (2008).





# Current Known Distribution of Northern Pike in the Columbia Basin



Upper  
Columbia  
Watershed

Kootenai-Pend  
Oreille-Spokane  
Watershed

Chief  
Joseph  
Dam

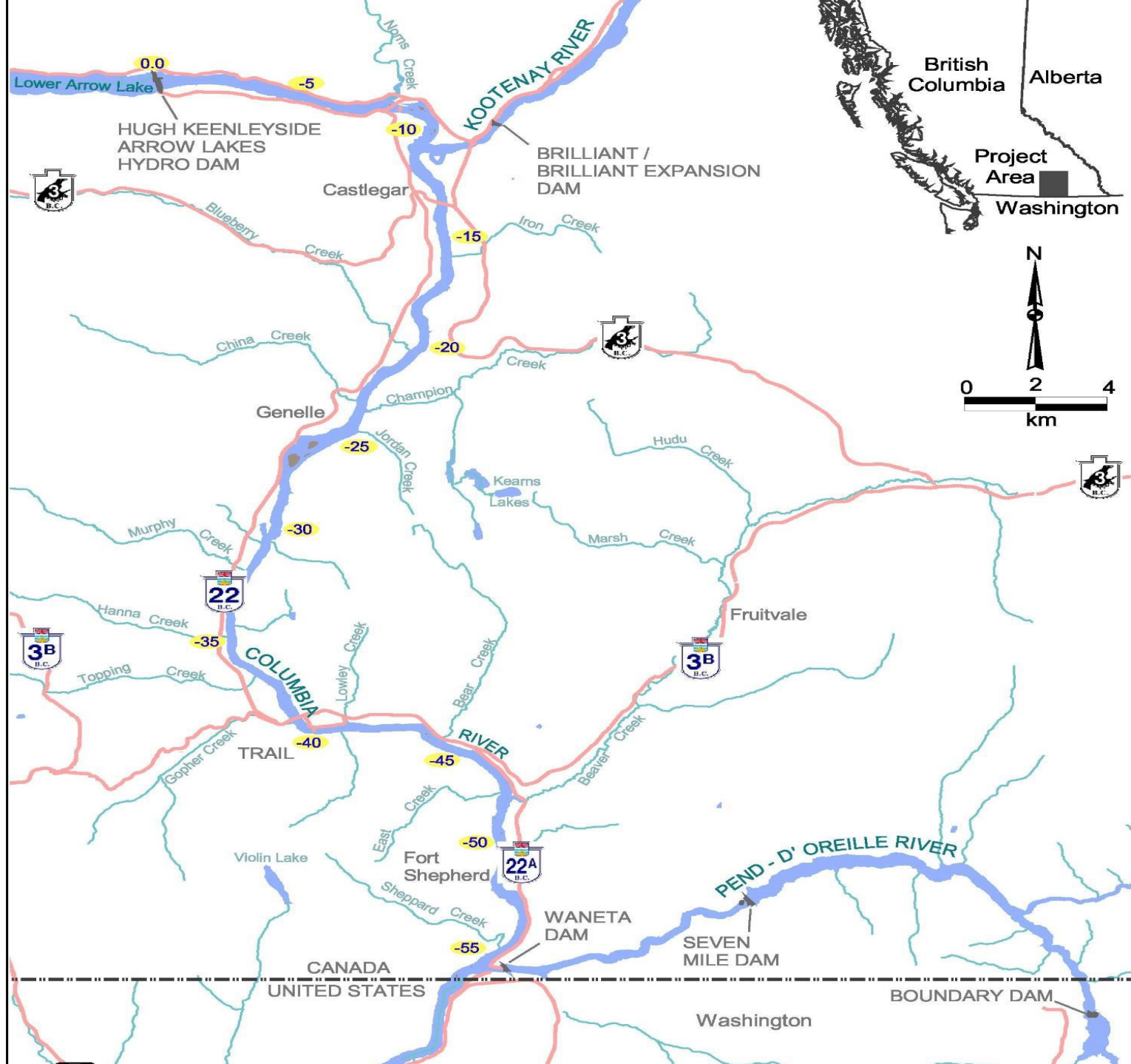
Grand  
Coulee  
Dam

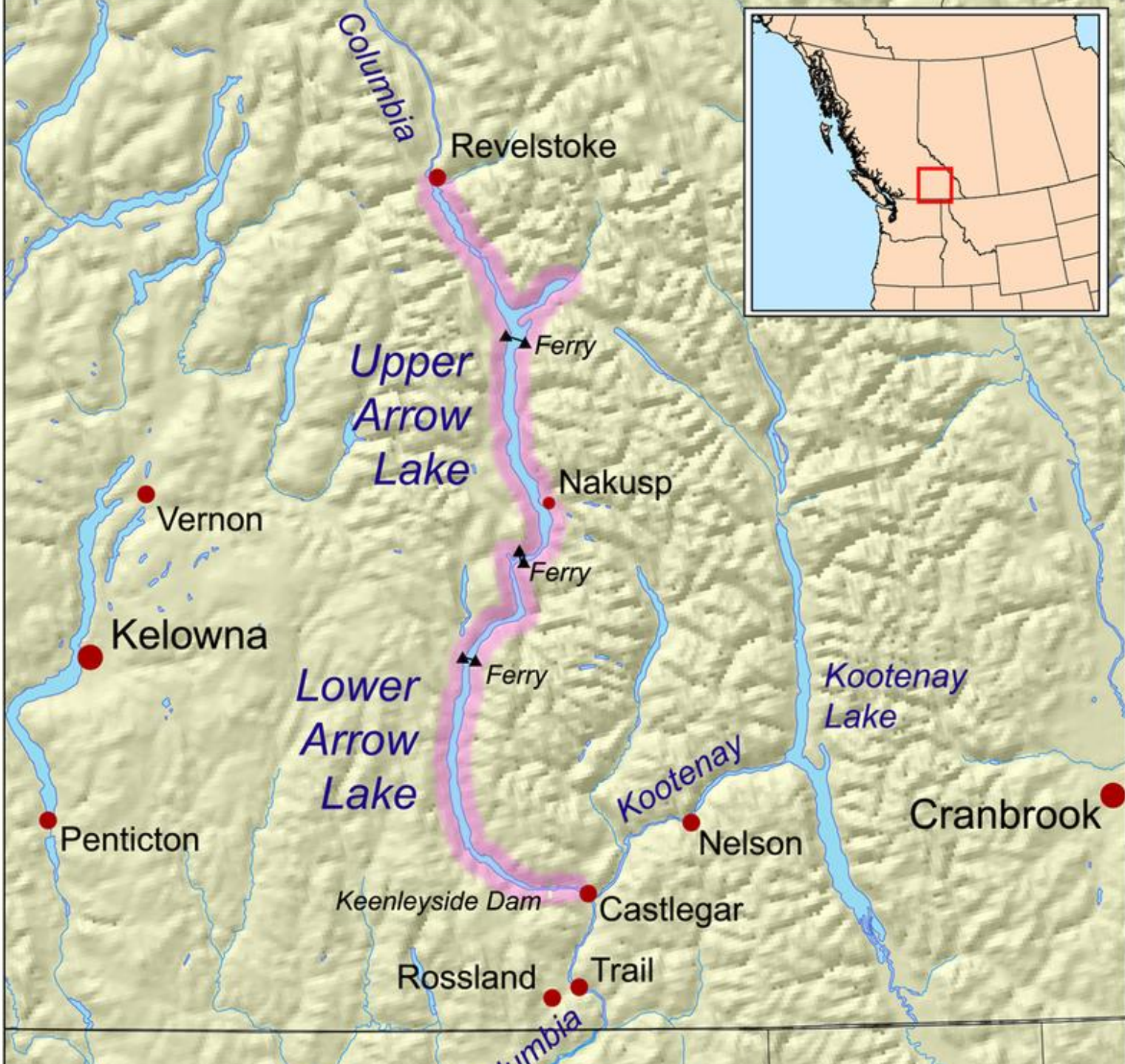
Coeur  
d'Alene  
Lake

Flathead  
Lake



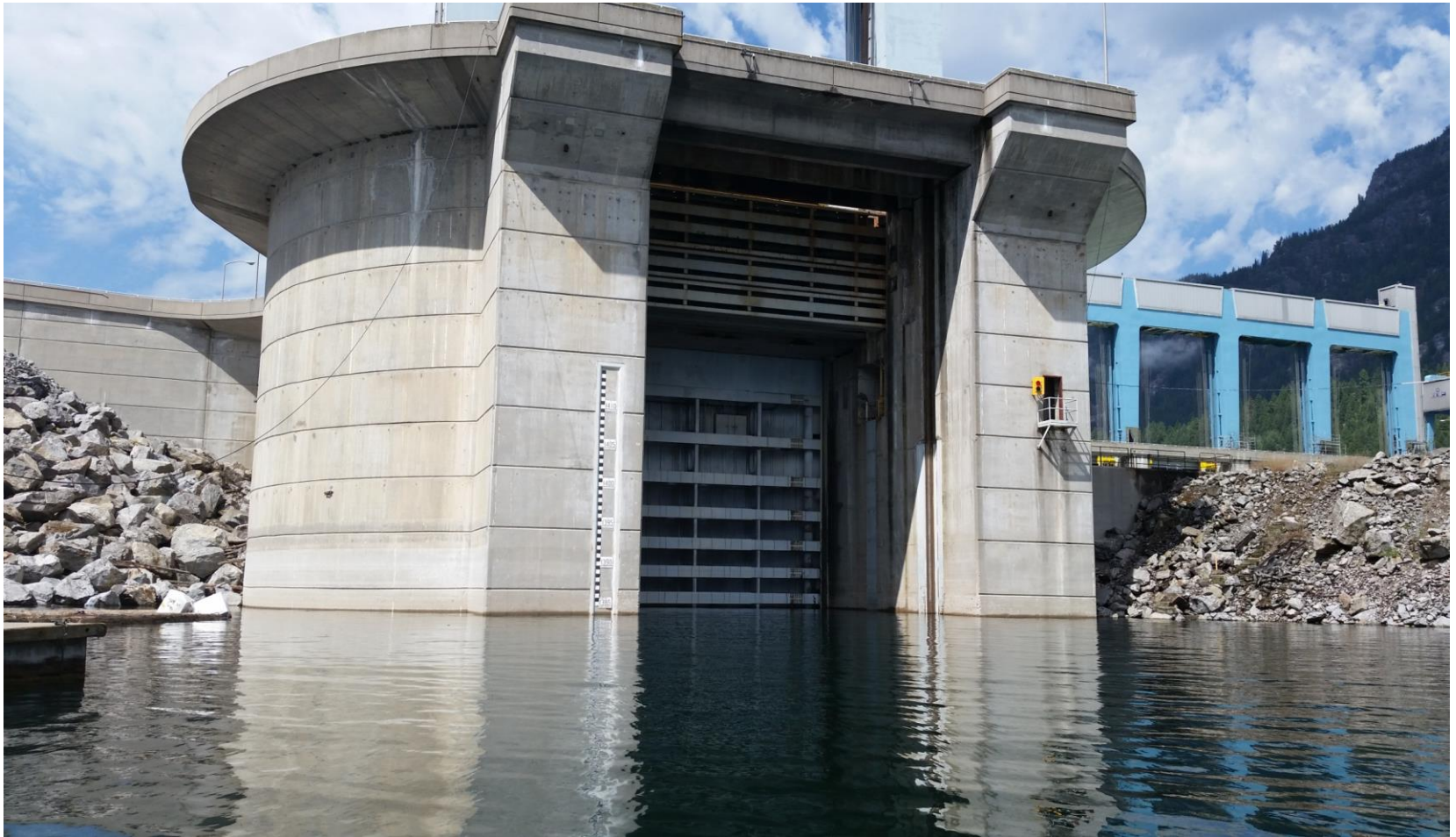
0 50 100 Miles







# HLK Dam Navigational Lock





# Columbia River Suppression Program

- 2014 provincial government initiated suppression efforts to reduce population
  - Gill-netting program
  - Angler reward program
- Our research aims to assist B.C.'s long-term management of pike in the Columbia basin



Photo Courtesy of Jeremy Baxter



to Courtesy of Jeremy Baxter



# Research Questions

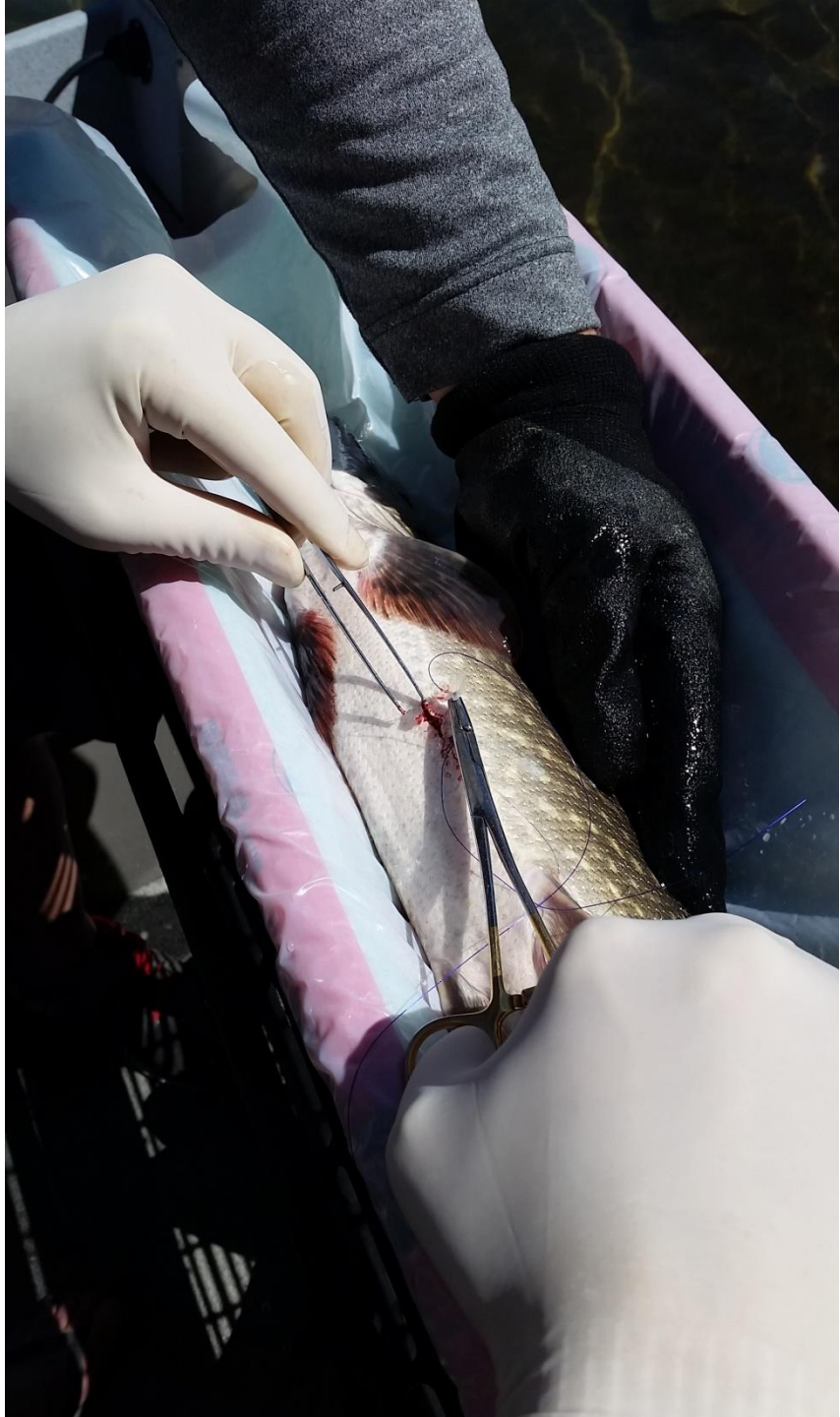
- Spawning habitat?
- Is trans-border migration occurring?
- Movement through HLK navigation lock?
- Source population?

# Acoustic Telemetry

- 15 mature pre-spawn pike (9M, 6F) tagged in May of 2016 with acoustic transmitters
- Movement continually monitored throughout an entire year
- Transmitters will continue to transmit movement data until September of 2017



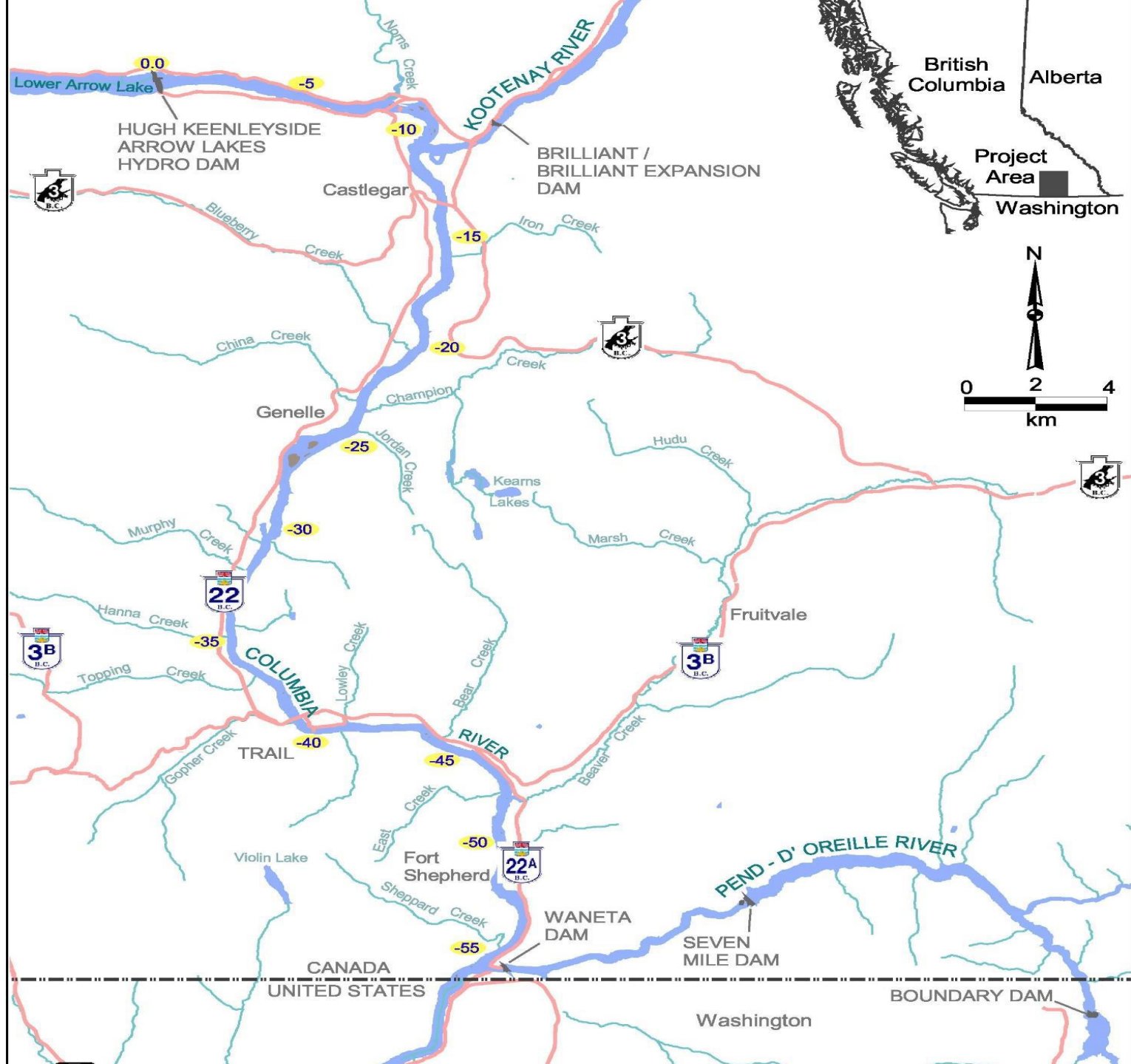








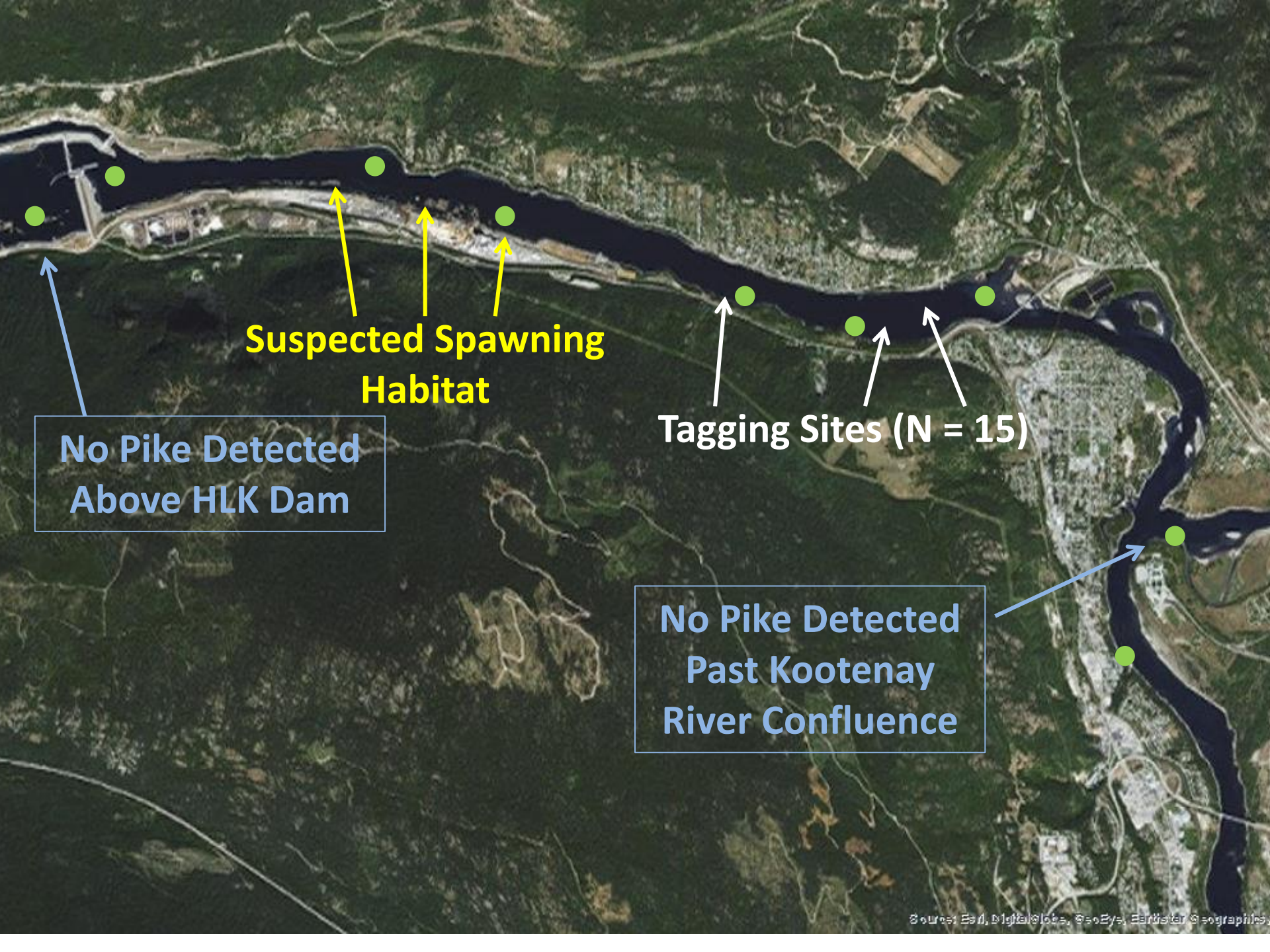




# Northern Pike Spawning

- Occurs following Spring freshet when water temperatures reach 8 – 12°C
- Optimal habitat within grasses and sedges in shallow, sheltered areas
- Eggs released and adhered to submerged substrate until yolk absorbed and larval pike become free-swimming





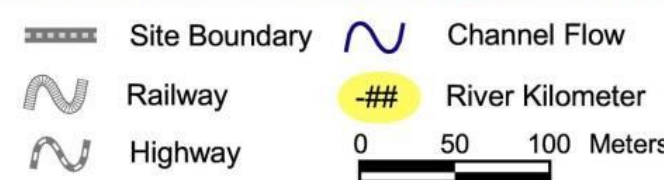
**Suspected Spawning Habitat**

**No Pike Detected Above HLK Dam**

**Tagging Sites (N = 15)**

**No Pike Detected Past Kootenay River Confluence**





# Telemetry Results

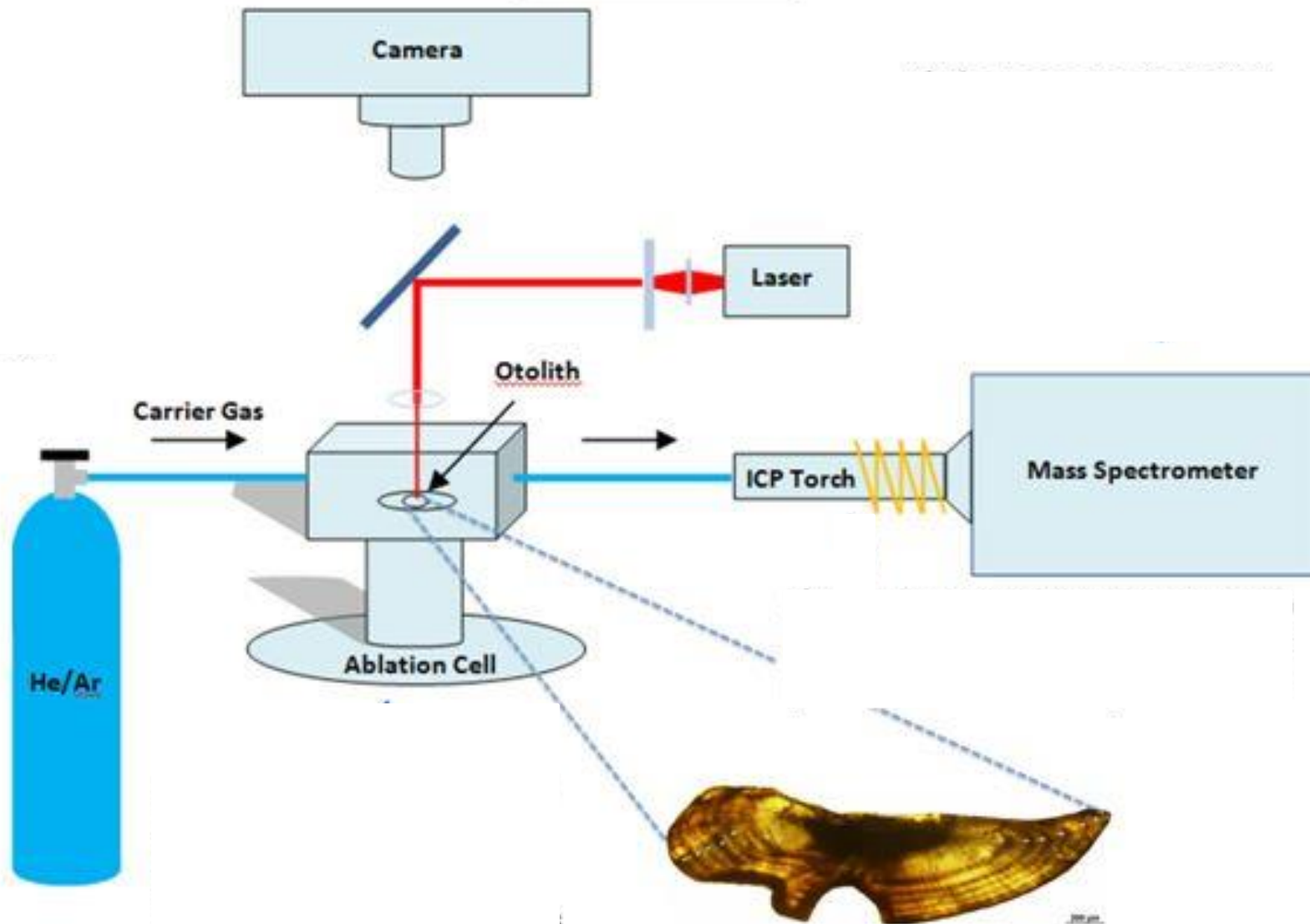
- Appears pike are spawning near the Celgar mill using sunken debris as substrate for eggs
- Movement of tagged pike limited to area between HLK Dam and Kootenay confluence
- Current data shows no movement through HLK navigation lock, new data will be available in coming months

# Otolith Microchemistry

- Paired calcified structures within the inner ear of all teleost (bony) fish
- Permanently retain trace elements from the environment within the matrix
- Provides a geochemical record that can be used to infer movements between areas with distinct water chemistry



# Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS)



**Ablation Line**



# Water Chemistry

- Elemental analysis of water chemistry to determine if significant chemical differences exist between systems
- Inductively coupled plasma optical emission spectrometry (ICP-OES) to measure elemental composition of water samples
- Otolith and water elemental composition can be used to model geographic life history of individual fish

Upstream of Celgar  
Downstream of Celgar  
Kootenay River  
Downstream of Kootenay

Downstream of Genelle

Downstream of Trail

Seven Mile Reservoir (Downstream of Salmo)

Waneta Reservoir

Pend d'Oreille Confluence

Salmo River

Seven Mile Reservoir (Upstream of Salmo)

© 2016 Google  
Image © 2016 Province of British Columbia

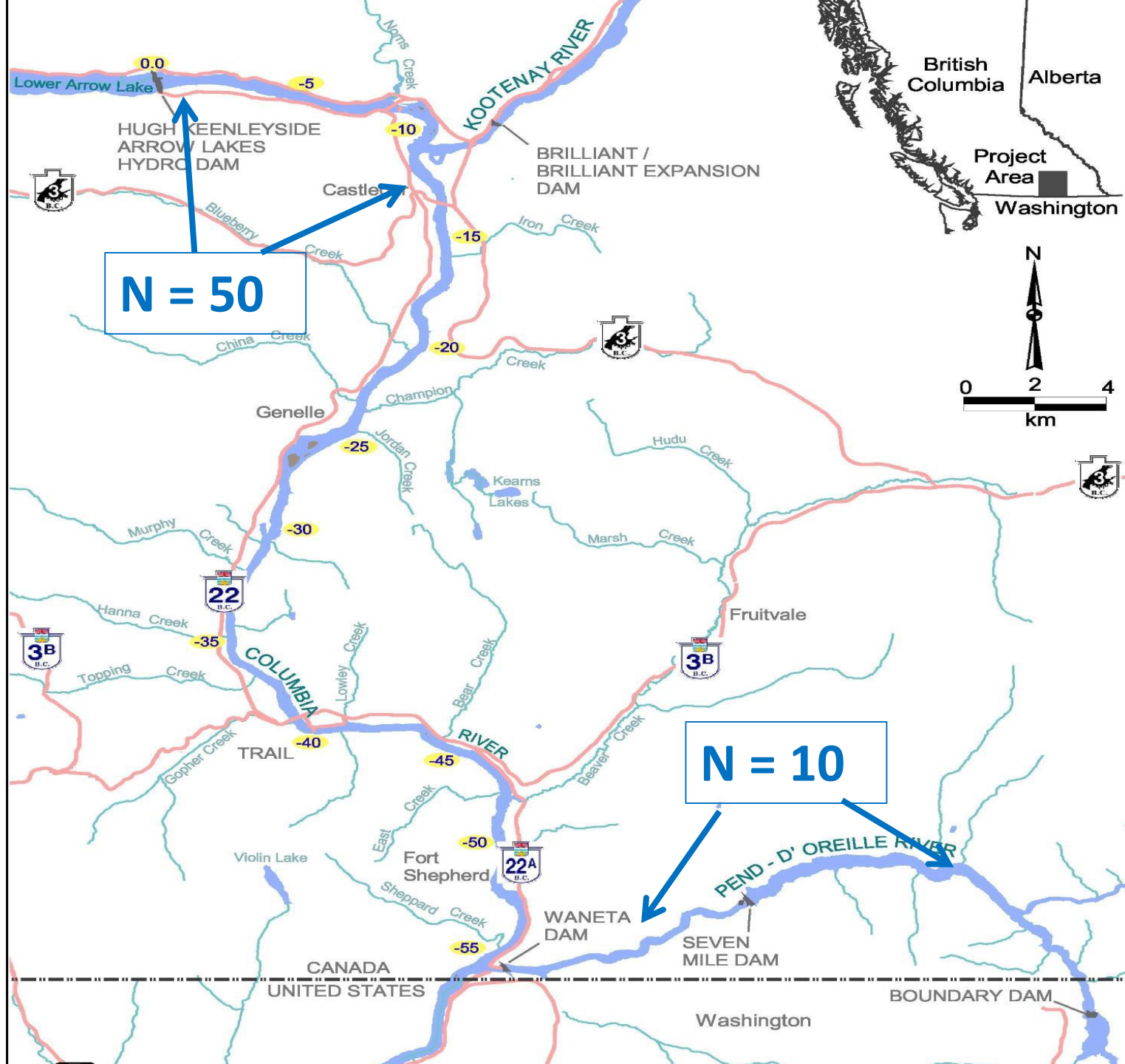
Image © 2016 DigitalGlobe

Imagery Date: 9/27/2012 49°08'55.22" N 117°26'35.39" W

# Water Chemistry Results

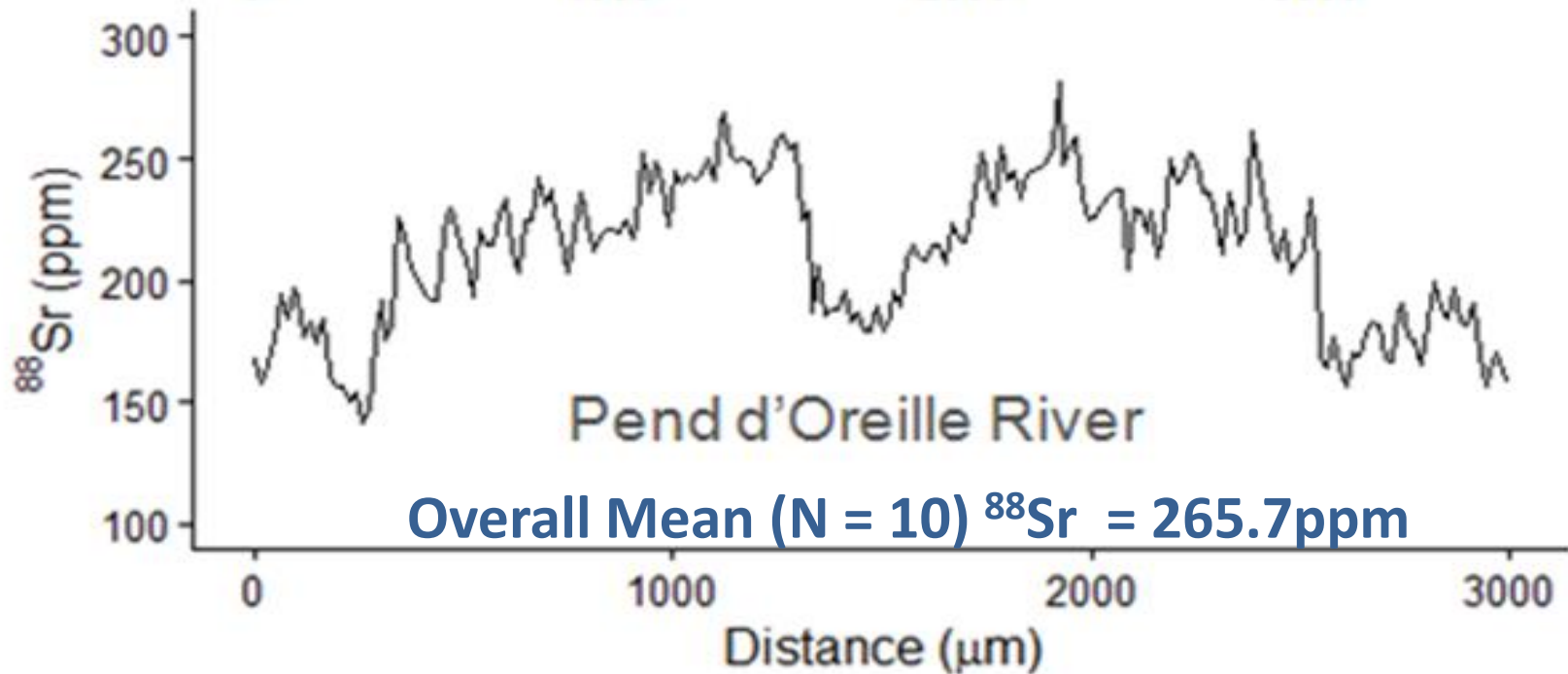
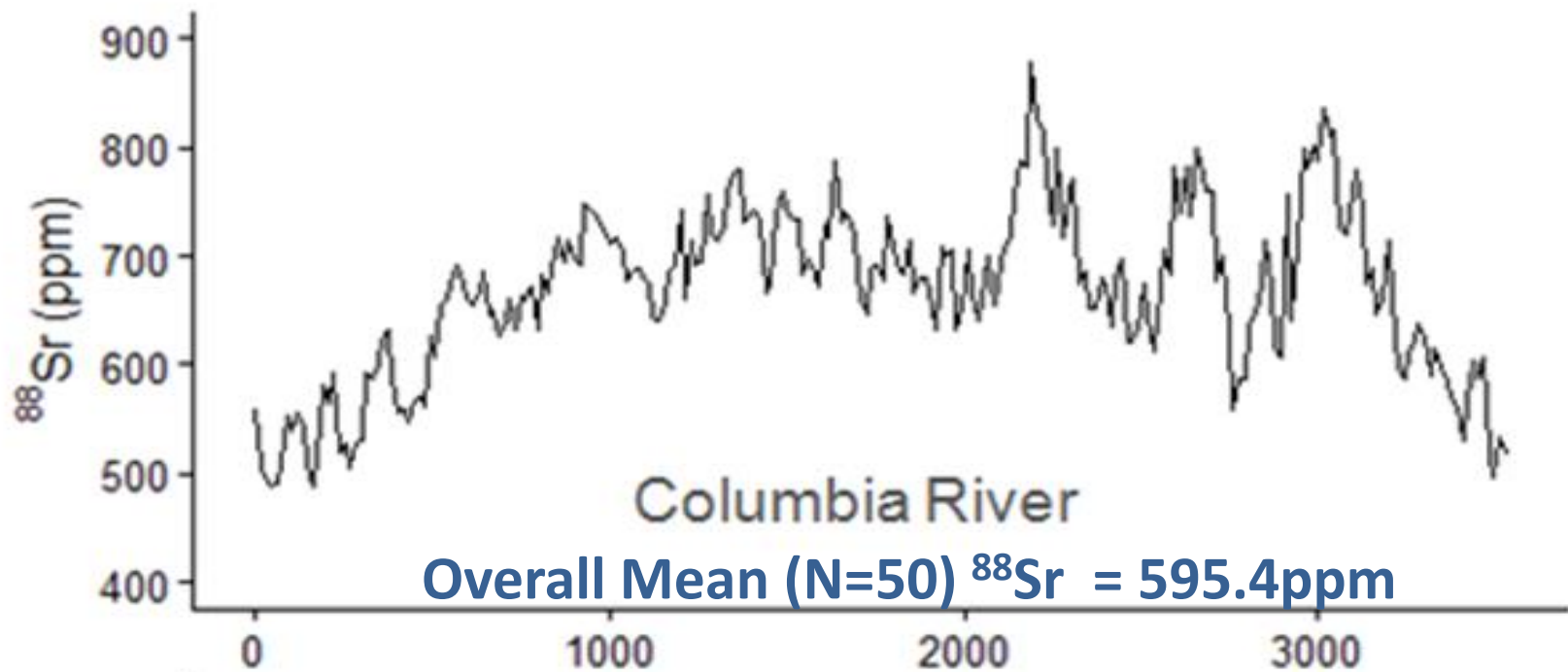
- Water chemistry differs between systems, but not sites
- Discriminate Function Analysis did not separate individual sites within systems
- Predictive accuracy of model approximately 25% - not useful for study

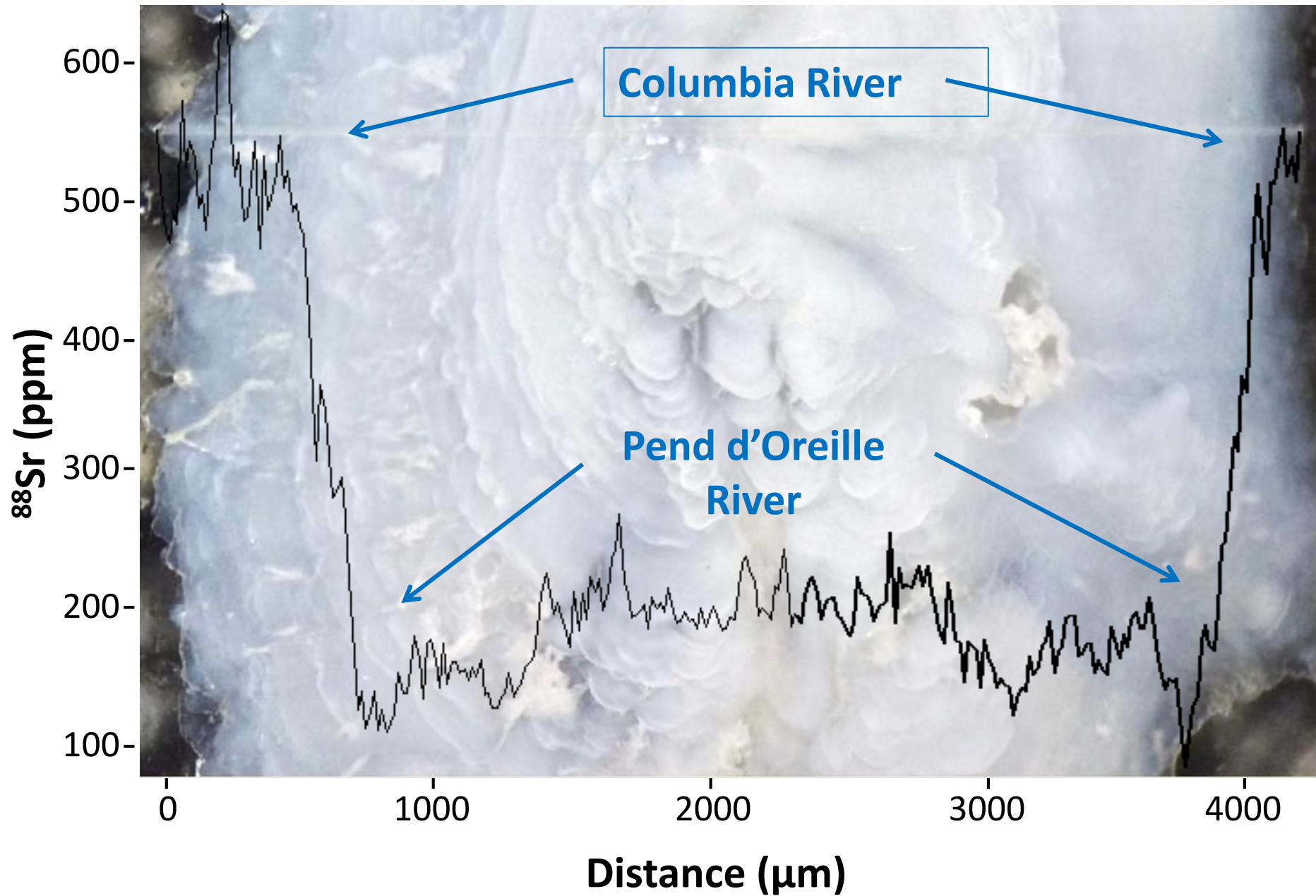


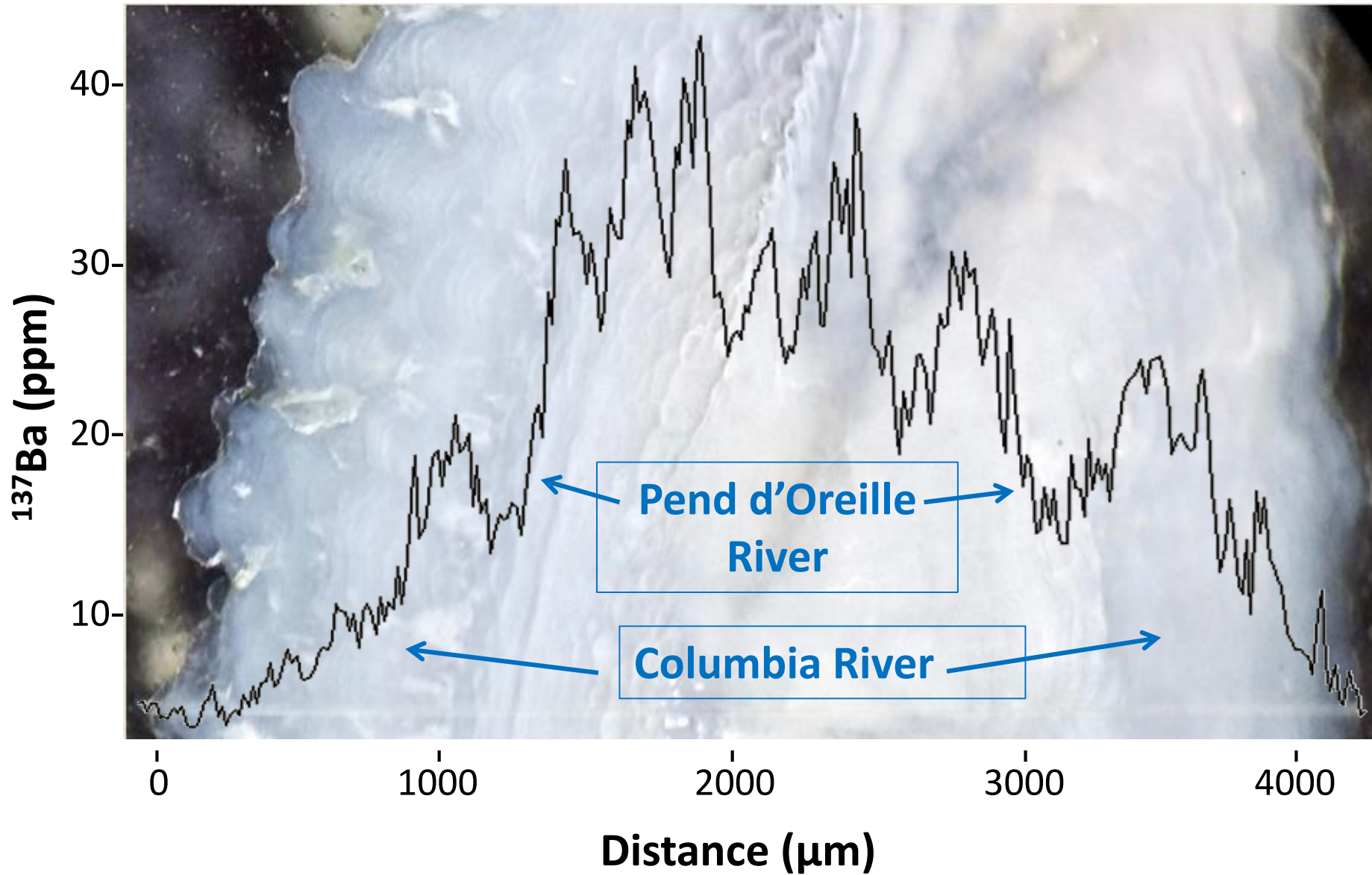


# Elements Analyzed

- $^{88}\text{Sr}$ ,  $^{137}\text{Ba}$ ,  $^{25}\text{Mg}$ ,  $^{55}\text{Mn}$ ,  $^{66}\text{Zn}$ 
  - All above limit of detection within otoliths
- $^{25}\text{Mg}$ ,  $^{55}\text{Mn}$ ,  $^{66}\text{Zn}$  highly variable between systems
- $^{88}\text{Sr}$  and  $^{137}\text{Ba}$  provided good differentiation between systems







# Conclusions

- Evidence of movement from the Pend d'Oreille to the Columbia river either through migration through dam or illegal transport
- Spawning suspected to be occurring near Celgar Mill, using sunken debris and cover provided by logs
- Movement of tagged pike limited to approximately 10 km range near Castlegar
- No movement recorded through the HLK Dam to date, new data pending

# Future Work

- Implementation of Northern Pike environmental DNA monitoring protocol
- Genetic comparison of pike between systems
- Collaboration with US pike researchers on otolith and water chemistry data

# Acknowledgements



BRITISH  
COLUMBIA

Teck



HABITAT  
CONSERVATION TRUST  
FOUNDATION

BC hydro 

Columbia  
Basin  trust





**Questions?**