Invasive Fishes in BC: Current problems and solutions, including research on Northern Pike in the Columbia and Pend d'Oreille Rivers

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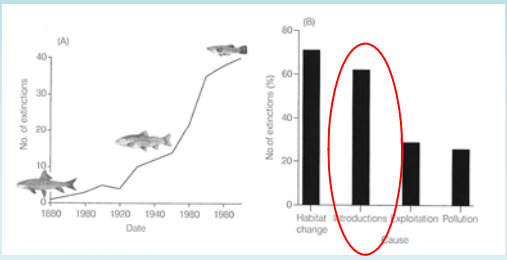
Overview of Invasive Fishes in BC :

1. Why should we care about invasive fish?
2. Invasive fishes in BC, and the problems
3. Invasive fishes in BC: the solutions
4. Current research on Northern pike in the Columbia
5. Conclusions

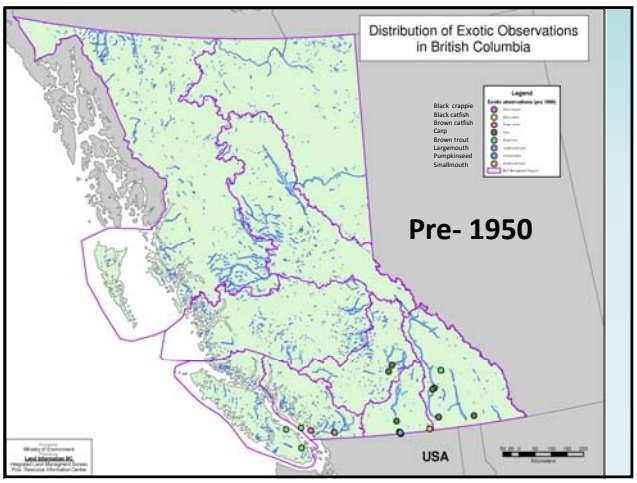
❶ Why should we care about invasive fish?

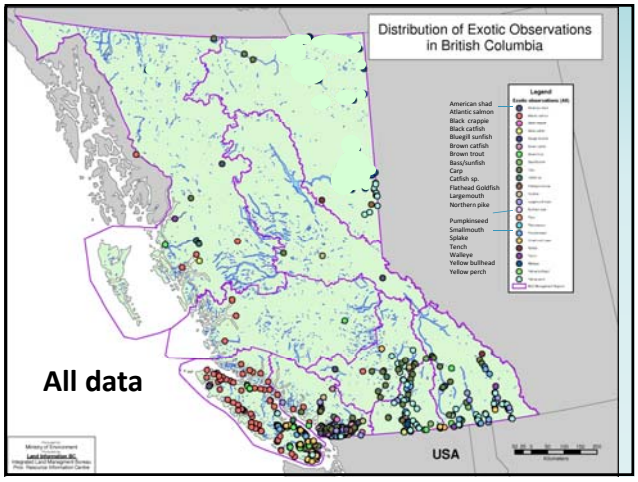


Fish extinctions in North America (left), and major causes of fish extinctions worldwide (right).

From Helfman et al. 2009

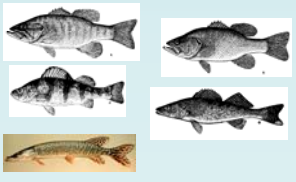
Source: Steve Maricle





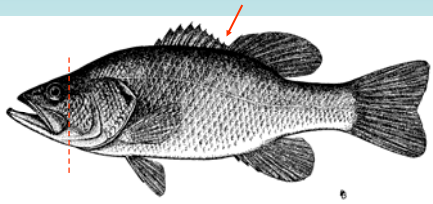
❷ Invasive fishes in BC, and the problems:

1. Smallmouth bass
2. Largemouth bass
3. Yellow perch
4. Walleye
5. Northern pike

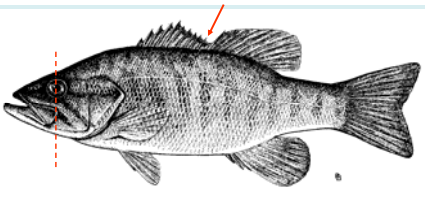


Family Centrarchidae

Largemouth bass



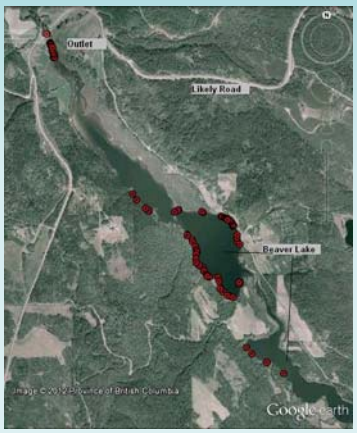
Smallmouth bass



Smallmouth bass

Vertical bars of color (sometimes faint)

Eyes red or orange



Source: Tom Wilkinson 2012

Location of bass nests in Beaver Lake, Quesnel watershed

Problems with Smallmouth bass:

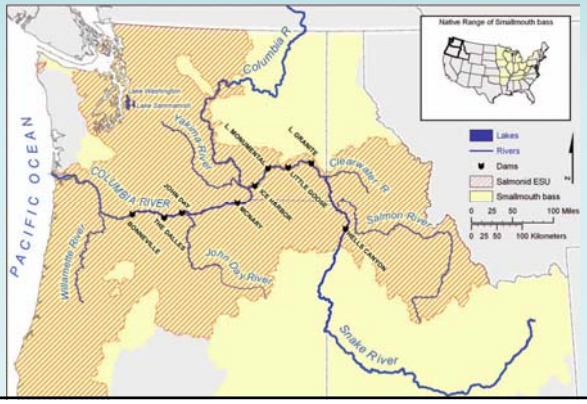
-efficient carnivores that eat invertebrates (reducing food for native fishes), and are piscivorous (at age 2), eating our local fish

-e.g., they are estimated to eat 35% of outmigrating juvenile salmon in some areas of the Pacific Northwest

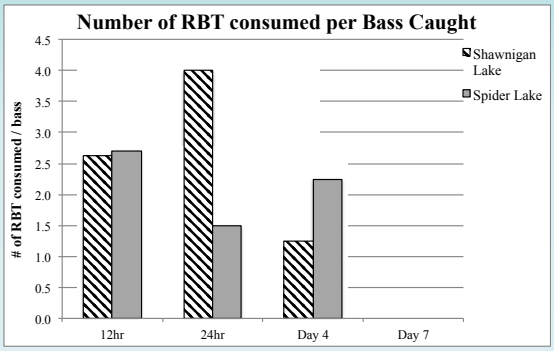
-concern that bass may affect listed fish such as the Umatilla Dace

-there is a conflict between the desire to have smallmouth bass as a sportfish, and the desire to reduce bass numbers to reduce the loss of salmonids

Overlap of evolutionary significant units (ESU) of salmon with that of smallmouth bass in the Columbia River system (Source: Carey et al. 2011)

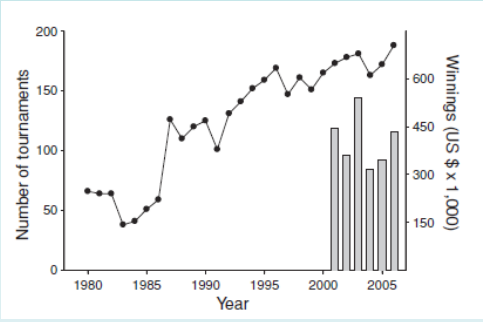


Rainbow trout stocking experiment



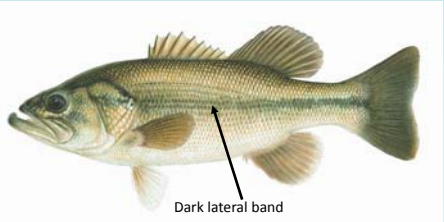
Source: Martina Beck M.Sc. 2013 U.Vic.

The number (dots) and prize money (bars) of bass tournaments in Washington state



Carey et al. 2011 Reviews Fish. Sci.

Largemouth bass

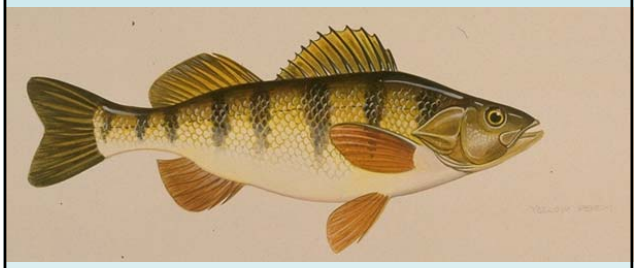


Problems with Largemouth bass:

-very efficient carnivores that eat invertebrates (reducing food for native fishes), and are piscivorous, eating anything smaller than their mouth gape

-again, bass fishing is very popular; it generates a large amount of money in the United States, and there are active bass clubs in BC

Yellow Perch



Problems with Yellow perch

-efficient carnivores that eat invertebrates (reducing food for native fishes), and piscivorous, eating our local fish

-spines on fins and operculum (gill covers) makes them difficult for other fish to eat perch

-as well, these fish are also popular with some anglers (we see a wide range in attitude in the Okanagan…)

Photos: MoE

We compared the diet of rainbow trout and yellow perch in Forest Lake

Photo: Brian Heise

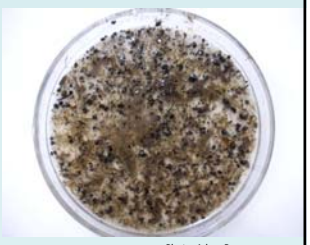


Photo: Adam Bruno

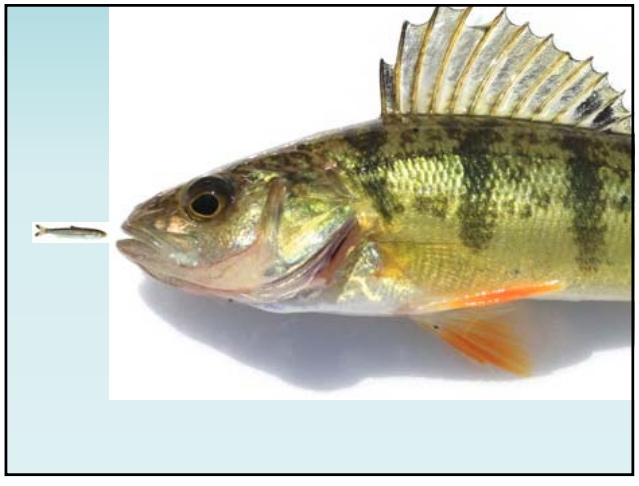
Perch ate aquatic invertebrates, but trout had shifted to terrestrial insects!

Photos: Adam Bruno

Recent research on perch biology:

We studied feeding ecology and movements in 7 Okanagan lakes

Perch diets (plankton, invertebrates, fish) varied depending on presence of predatory fish in the lake, and the amount of cover (hiding places)



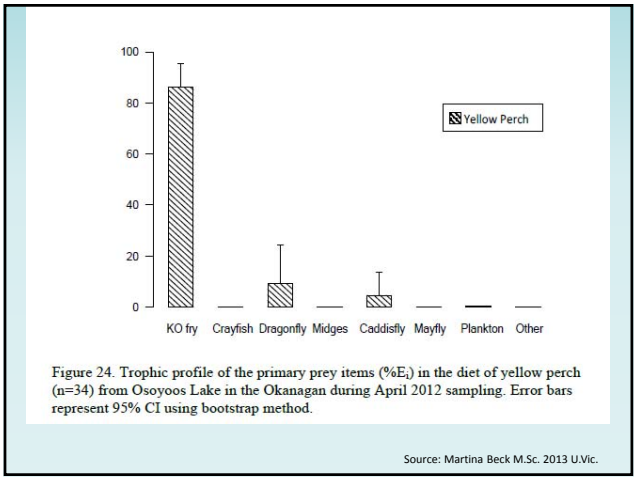
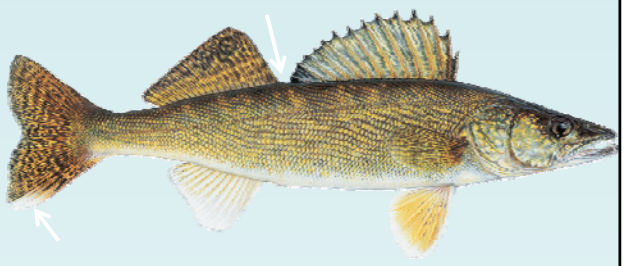


Figure 24. Trophic profile of the primary prey items (%E_i) in the diet of yellow perch (n=34) from Osoyoos Lake in the Okanagan during April 2012 sampling. Error bars represent 95% CI using bootstrap method.

Source: Martina Beck M.Sc. 2013 U.Vic.

Walleye



Problems with Walleye:

-these fish are very efficient carnivores that are highly piscivorous, eating our local fish

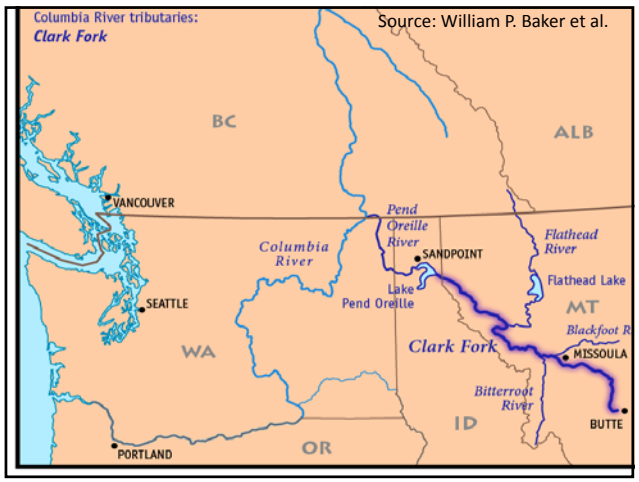
-walleye appear to have caused a decline in densities of Rainbow Trout and Mountain Whitefish in the Columbia River

-sturgeon stocking in walleye waters now uses larger fish to deal with walleye predation

Northern pike

Problems with Northern pike :

1. Predation (consuming large numbers of fish daily with preference for soft-bodied fish such as rainbow trout)
2. Introduction of a wide variety of parasites and diseases (e.g., *Triaenophorus* tapeworm is a high risk, not native to the Columbia system, and significantly affects table quality of salmonids)
3. Competition with other species for common food resources (reducing growth and survival)
4. Potential to impact opportunities to recover SARA listed species such as white sturgeon and shorthead sculpin in the Columbia River



Northern pike containing a 40 cm rainbow trout

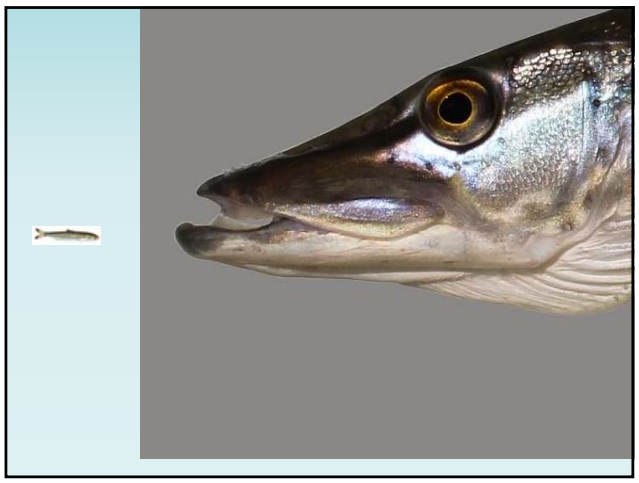
Source: Ford et al. 2014

Risk summary for these fishes

Species	Ecol. Consequence Small Water Bodies	Ecol. Consequence Large Water Bodies
Largemouth bass	Very High	Moderate
Smallmouth bass	Very High	High
Yellow perch	Very High	Medium
Northern pike	Very High	Very High
Walleye	High	High

Very high risk = Extirpation of native populations likely

Results from a DFO MoE risk assessment conducted in 2008



Largemouth bass and northern pike diets include:

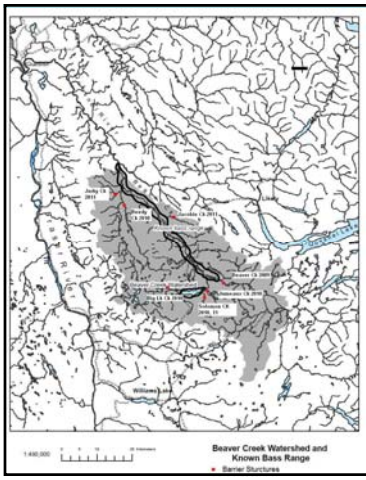
❸ Solutions to invasive fishes in BC: Smallmouth bass

-in small lakes, use rotenone to kill all fish (also kills local fish)

-kill bass on nests (chlorine, electroshocking; note that removing defending males from nests not effective)

-in larger system: don't let anglers put them there in the first place (public education crucial)

-fish barriers are being used in Beaver Lake system to block spread into the Fraser River (Tom Wilkinson: gabian weirs, culverts to create 80 cm waterfall, looking at electrical barrier)



Beaver Creek barriers

Courtesy Matthias Herborg

Largemouth bass

-in small lakes, use rotenone to kill all fish (also kills local fish)

-in larger system: don't let anglers put them there in the first place (public education crucial)

Yellow perch

-in small lakes, use rotenone to kill all fish (also kills local fish)

-in larger system: don't let anglers put them there in the first place (public education crucial)

-artificial spawning substrates can be used to remove egg masses

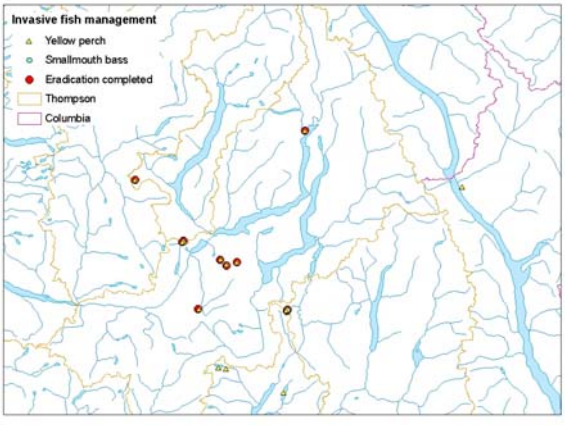
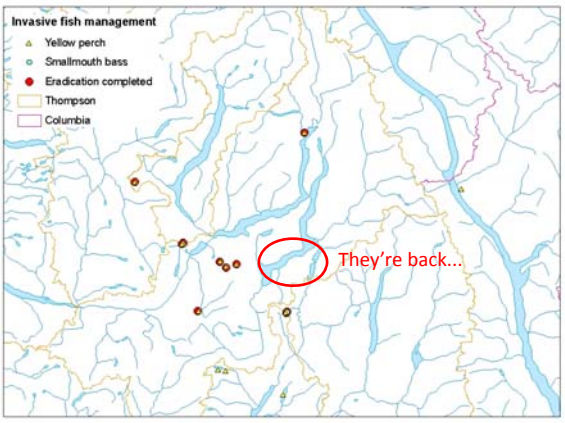



Photo: Brian Heise


CBCradio
Quirks & Quarks



Larch Pond, near Salmon Arm

Photo: Brian Heise

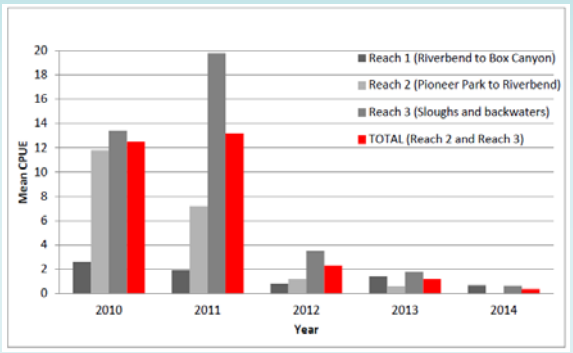
Northern pike

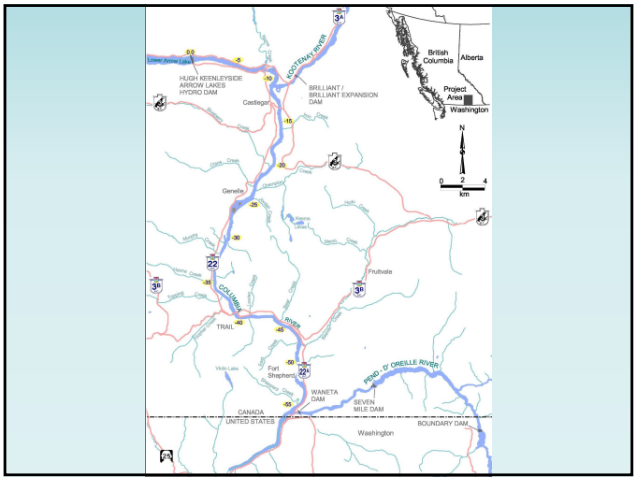
-prevent anglers from moving fish

-rotenone small lakes

-in the Columbia River, gill netting to **reduce** population size

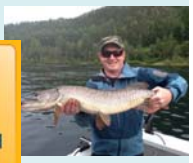
Northern pike catches in gill nets in the Box Canyon Reservoir, Pend Oreille River, WA





BC Pike policy for the Columbia River

- Implemented a change to angling regulations (unlimited daily quota) in 2011
- This required a change from the Regional policy around invasive species fisheries; all invasive species in Kootenay Region are "Closed to Fishing" with exceptions for previously established species.



Northern pike daily quota = **UNLIMITED**
Anglers are encouraged to kill all captured pike

REGIONAL DAILY CATCH QUOTAS
(See tables for exceptions)

Trout/char: 5 but not more than
- 1 rainbow trout or cutthroat trout over 50 cm
- 2 from streams
- 1 bull trout of any size

Bass (largemouth & smallmouth combined): CLOSED TO FISHING (See tables for exceptions)
Burbot: 2
Crayfish: 25
Kokanee: 15 (none from streams)
Northern pike: CLOSED TO ALL FISHING
Walleye: CLOSED TO FISHING (See tables for exceptions)
White Sturgeon: CLOSED TO ALL FISHING
Whitefish: 15 (all species combined)
Yellow perch: CLOSED TO FISHING (See tables for exceptions)

Courtesy Matt Neufeld

Tag Return Program

NOTICE TO ANGLERS
$500 REWARD
OFFERED FOR NORTHERN PIKE HEADS

Tags have been placed in the head of a number of pike throughout the Columbia River and each pike head returned with a tag will be worth $500. These **tags will not be visible to anglers**, so anglers are encouraged to return the heads of all captured pike.

Pike heads should be presented at the FrontCounter BC in Castlegar at 845 Columbia Ave. (Mon – Fri, 8:30 a.m. - noon, 1:00 p.m. – 4:30 p.m.) to determine if they are eligible for the reward. **This reward program will be in effect from August 21, 2013 until at least March 15, 2014.**

This program is part of an effort to reduce pike numbers, gain information on the distribution and abundance of this non-native invasive predator, and assess the impact on native fish populations.

Northern pike daily quota = **UNLIMITED**
Anglers are encouraged to kill all captured pike

BRITISH COLUMBIA
For further information contact the Ministry of Forests, Lands and Natural Resource Operations: 250-354-6333

- 19 Northern Pike heads were submitted by anglers; none of the submitted heads contained PIT tags (Figure 4).

Figure 4. A $500 award was offered to any angler that submitted a PIT-tagged Northern Pike head (left); one of 19 heads submitted under the program (above).

Source: Ford et al. 2014

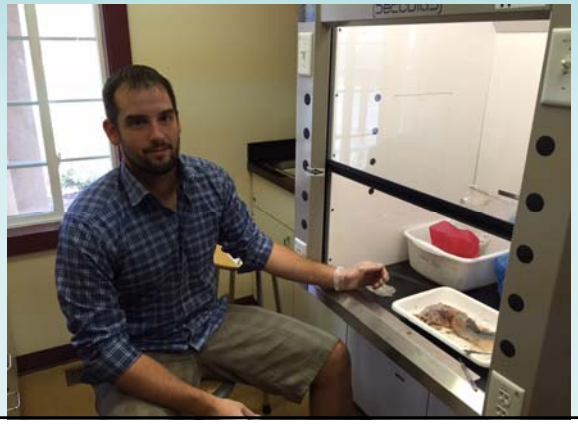
❹ Our research on Northern pike

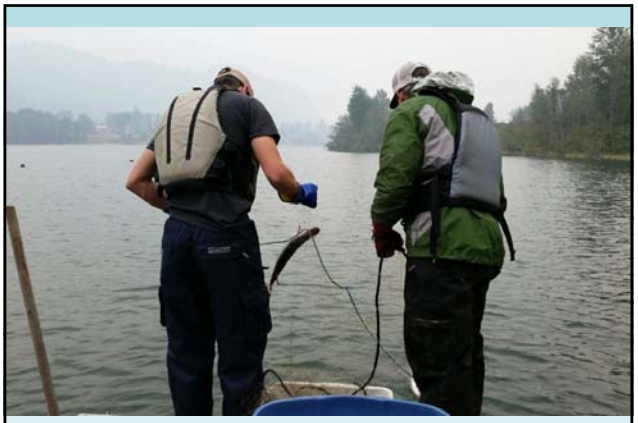
1. Assess population size, age of fish (cleithrum), and feeding via gill netting
2. Use eDNA to determine where pike are present, including above dams on Columbia, Pend d'Oreille, and Salmo rivers
3. Use microchemistry of otoliths to determine origins of pike in Columbia (compare to water samples in various sites)
4. Assess ability of pike to get past dams and barriers

Our partners on Northern pike research

1. BC Ministry of Forests, Lands and Natural Resource Operations (Matt Neufeld, Nelson)
2. BC Ministry of Environment (Matthias Herborg, Victoria)
3. Teck Metals Ltd. (David Derosa, Trail)
4. Jeremy Baxter, Mountain Water Research
5. Okanagan Nation Alliance (Michael Zimmer, Castlegar)
6. Habitat Conservation Trust Foundation (funding)

M.Sc. Student Dan Doutaz with Northern pike stomach contents (yum!)





Gill netting in the Robson Reach of the Columbia River, Aug. 2015

❺ Conclusions:

1. Once invasive fishes are established in a **large** watershed population reduction, rather than eradication, is the only option

2. The best management option is to stop invasive fishes at national and provincial borders, and enforce an aggressive boat inspection program (for fish, invertebrates and plants)

Acknowledgements

Matthias Herborg (bass, pike)

Carmen Tattersfield, Adam Bruno, Sophie Michaelsen (perch)

Dan Doutaz (pike graduate student)

Jacque Sorensen (lab support)

David DeRosa, Matt Neufeld, Jeremy Baxter, Jason Connor (pike)

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