

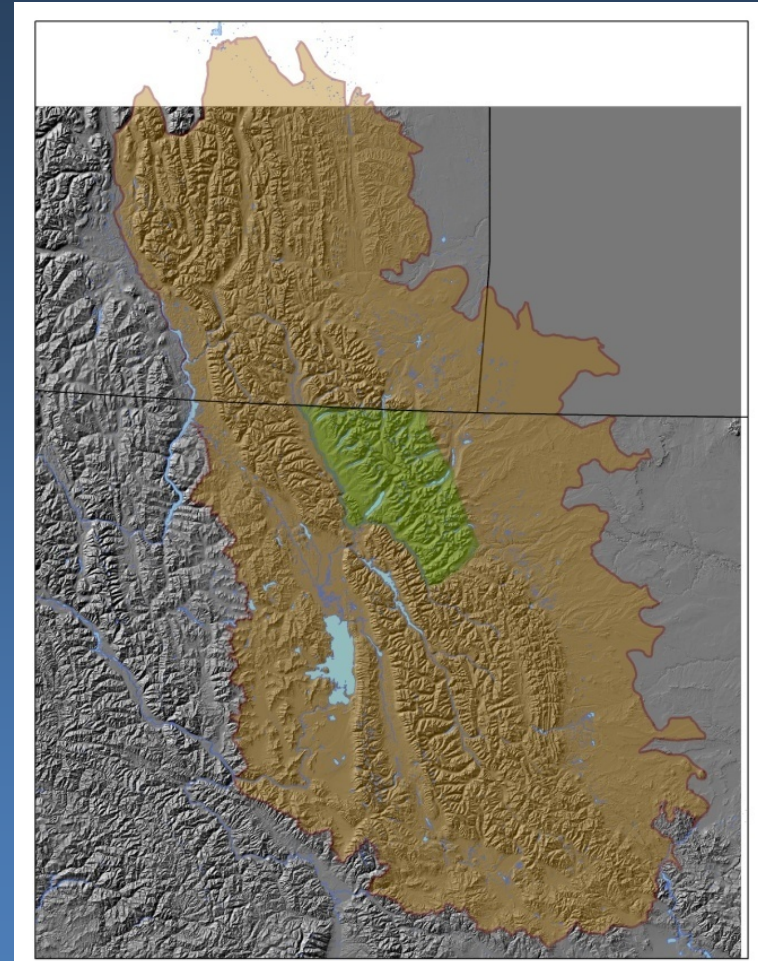
# Invasive Fish: Control Efforts and Impacts to Native Species in the Northern Rockies

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# Crown of the Continent Ecosystem

*A native species stronghold*





# Invasive Species



# Hybridization

- Loss of co-adapted gene complexes and ecological adaptations
- Threatens the persistence of many rare and endangered species



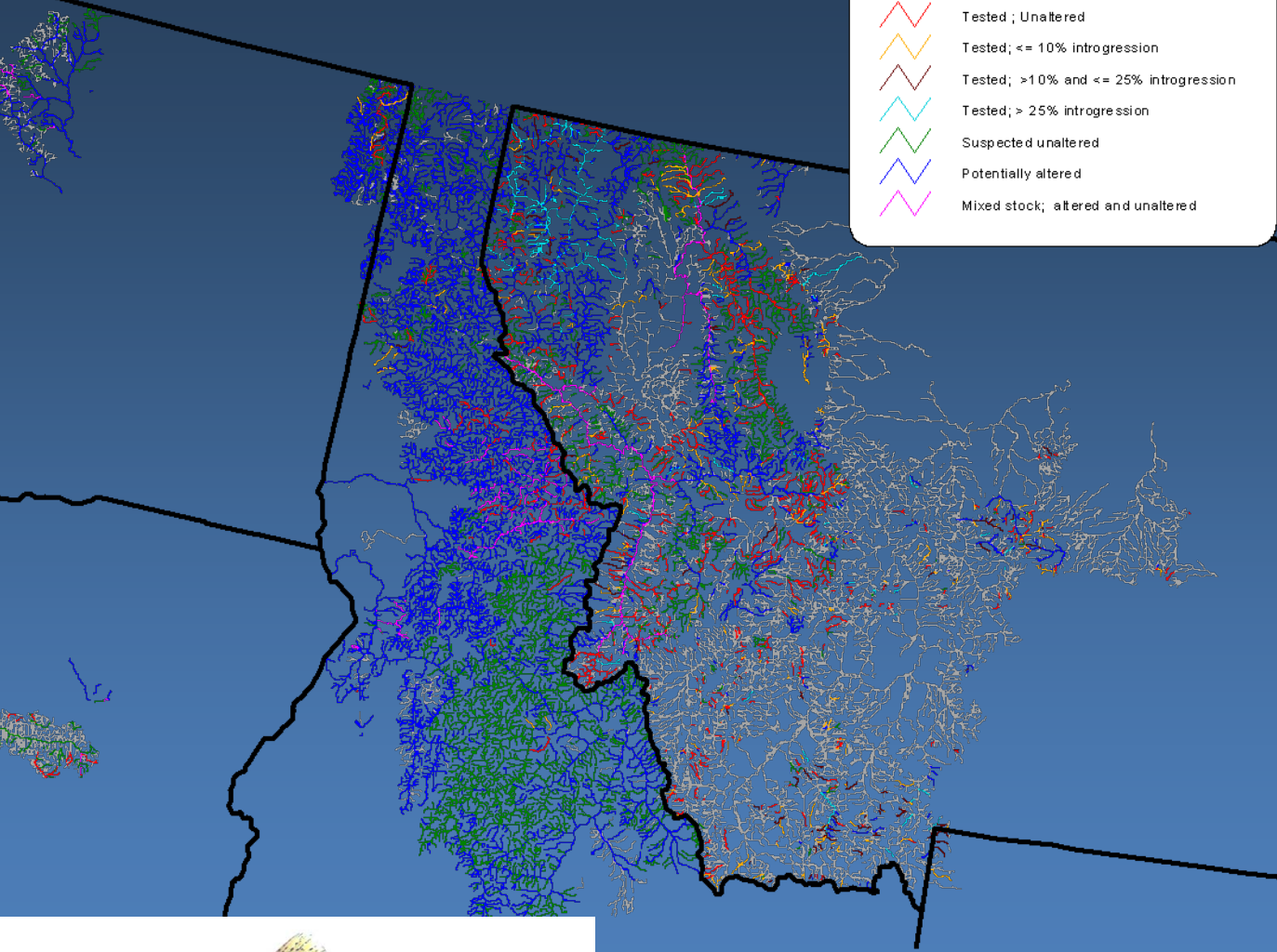


# Westslope Cutthroat Trout





# Westslope Cutthroat Trout (*Oncorhynchus clarkii lewisi*)



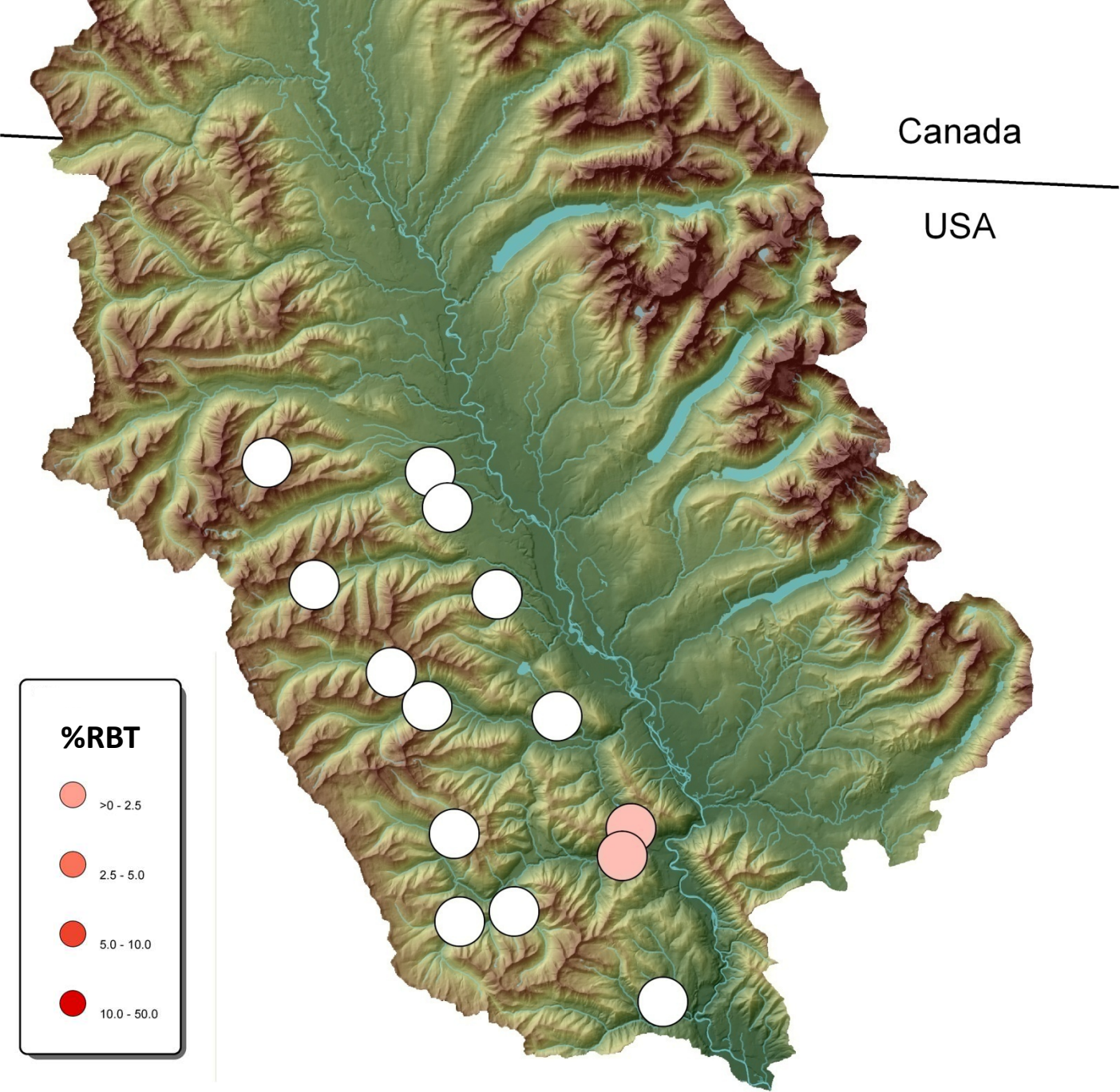
- One of four major subspecies of cutthroat trout

- Distribution: Columbia, Fraser, Missouri, and Hudson Bay drainages of the US and Canada

- Non-hybridized (red) populations occupy <10% of their historic range in the USA

- Hybridization with introduced rainbow trout is the leading factor in their decline

Shepard et al. (2005)



Canada

USA

# 1984

- Low levels of introgression in 2 of 14 sites (14%)

**%RBT**

- >0 - 2.5
- 2.5 - 5.0
- 5.0 - 10.0
- 10.0 - 50.0

**Hitt et al. (2003)**



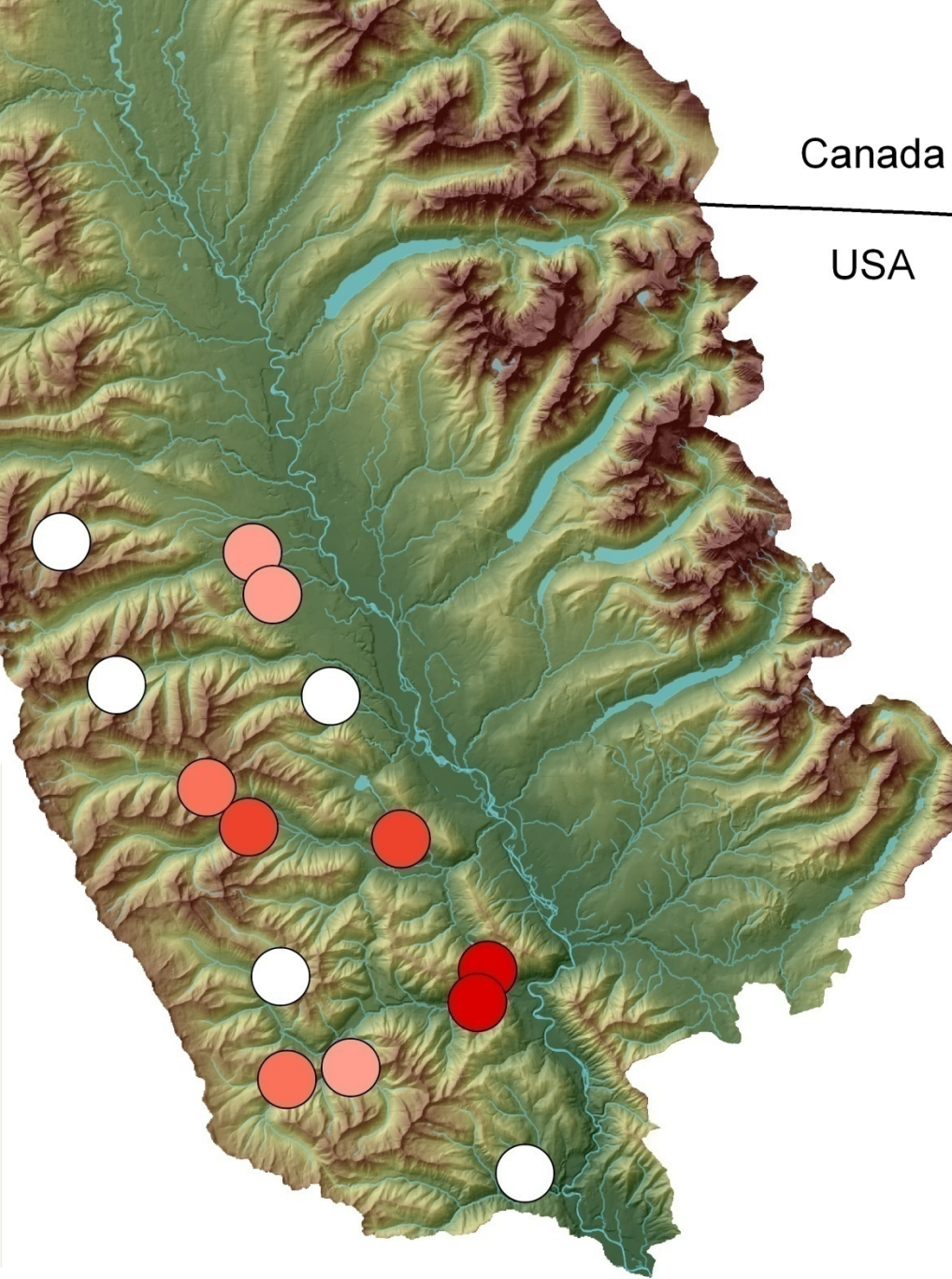
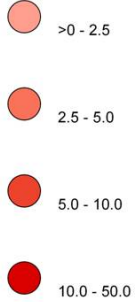
Canada

USA

2002

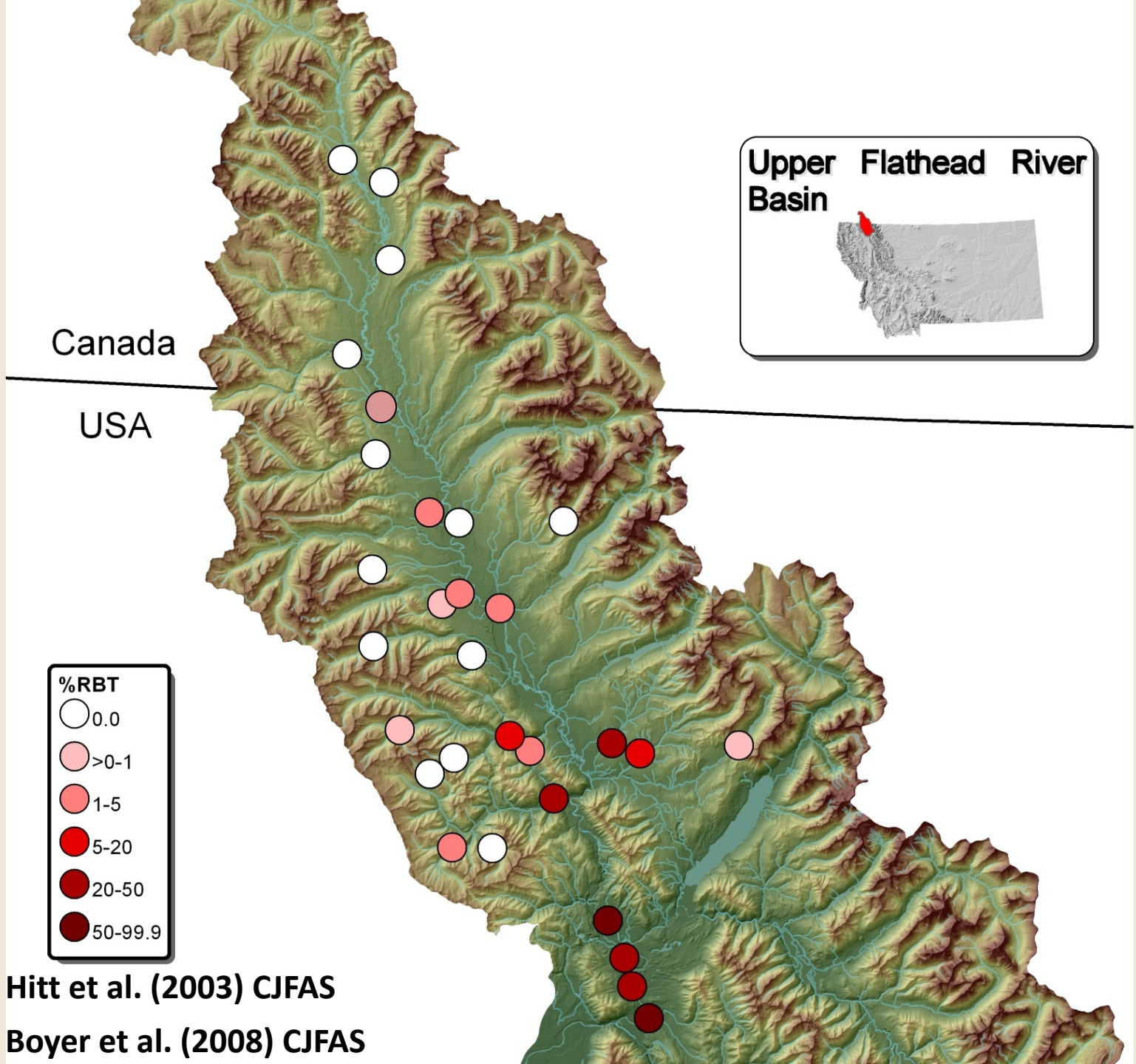
- New introgression in 7 of 12 sites (58%)

**%RBT**



Hitt et al. (2003) CJFAS



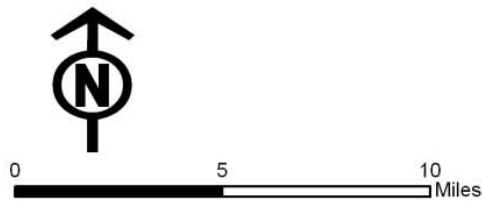


Hitt et al. (2003) CJFAS

Boyer et al. (2008) CJFAS



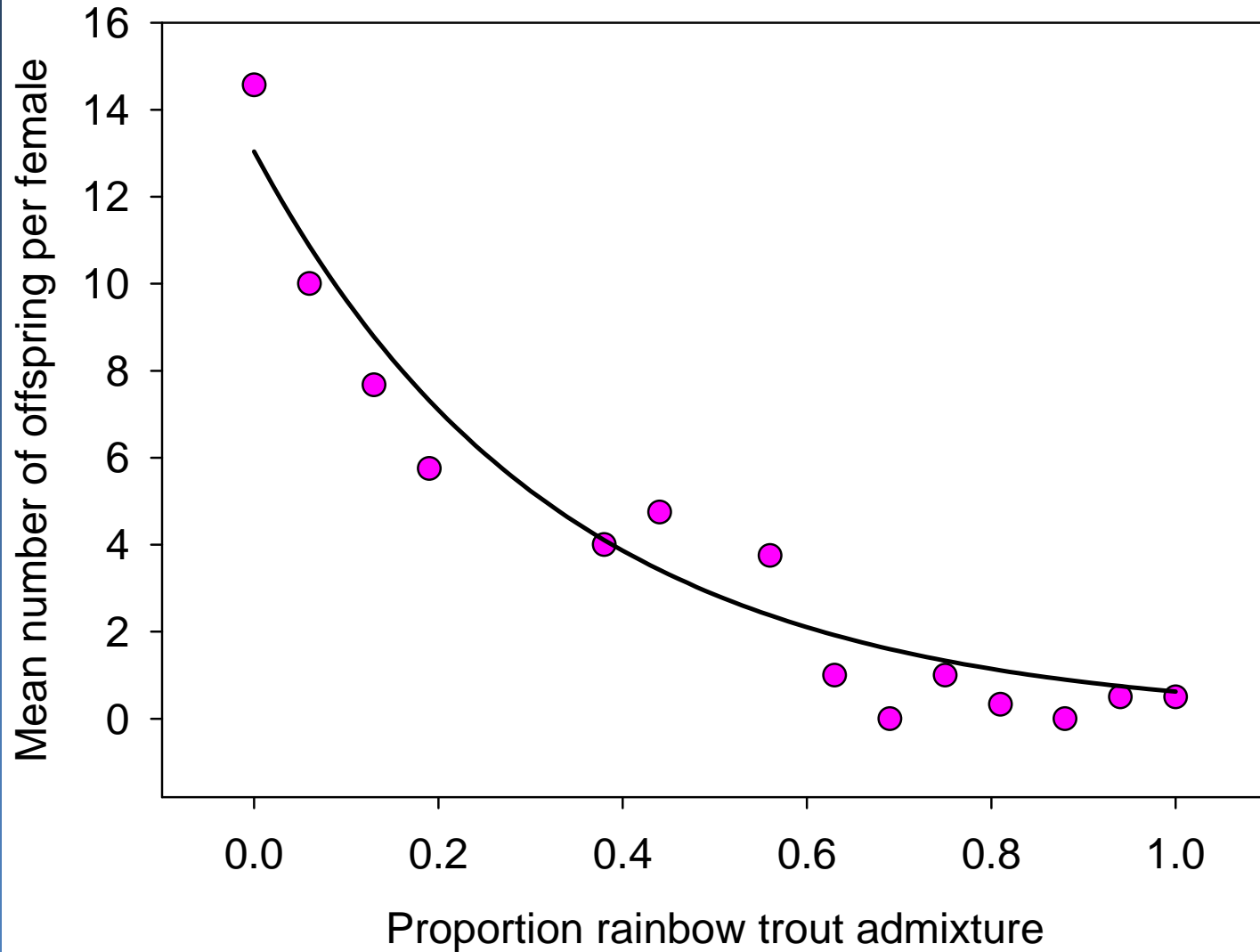
- Hybrids have greater straying rates
- Hybridization is spreading via continent island and stepping stone invasion
- Hybridization greater in degraded, warm streams, close to the source
- Abbot is the major source



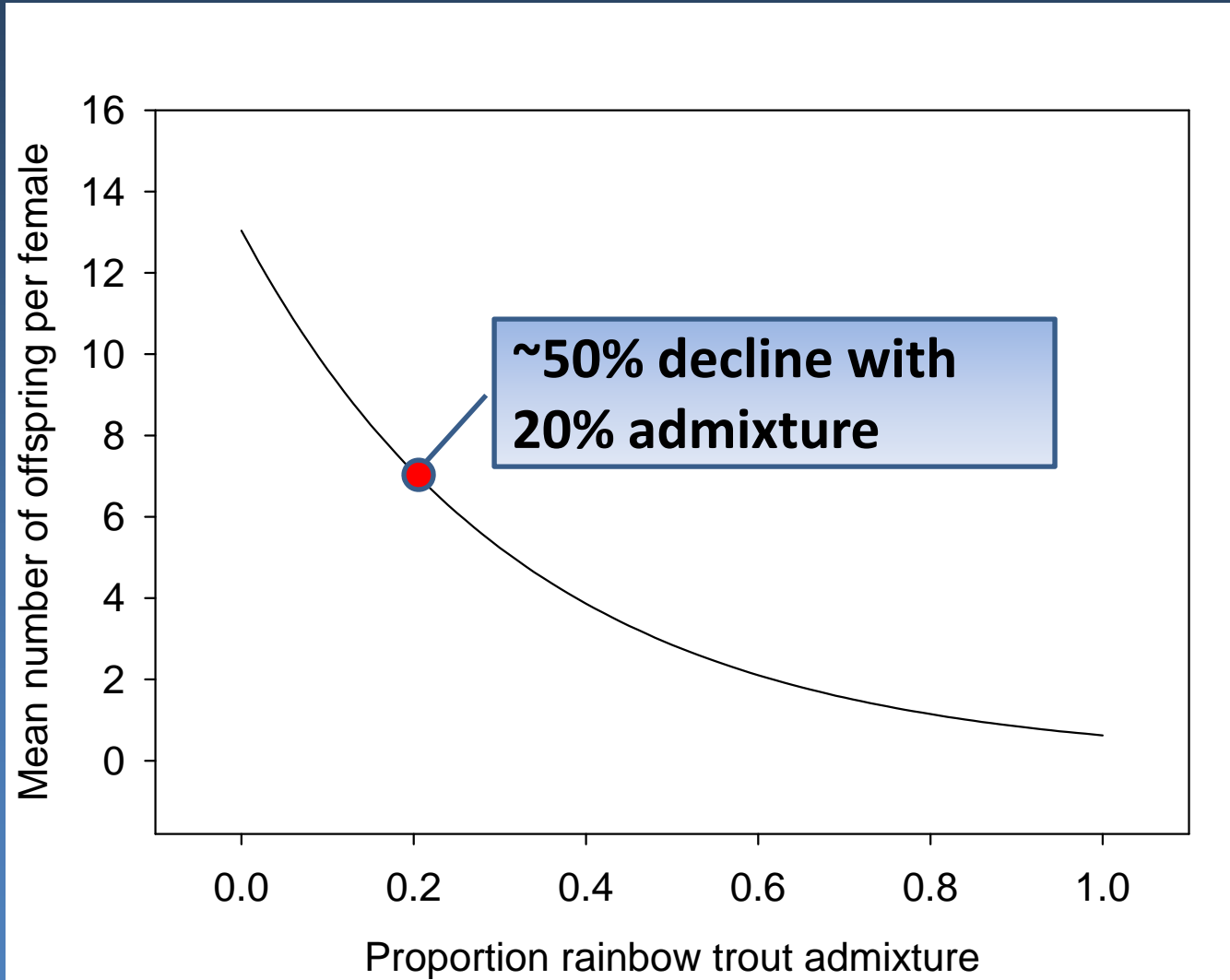
Boyer et al. (2008)



# Hybridization Rapidly Reduces Fitness

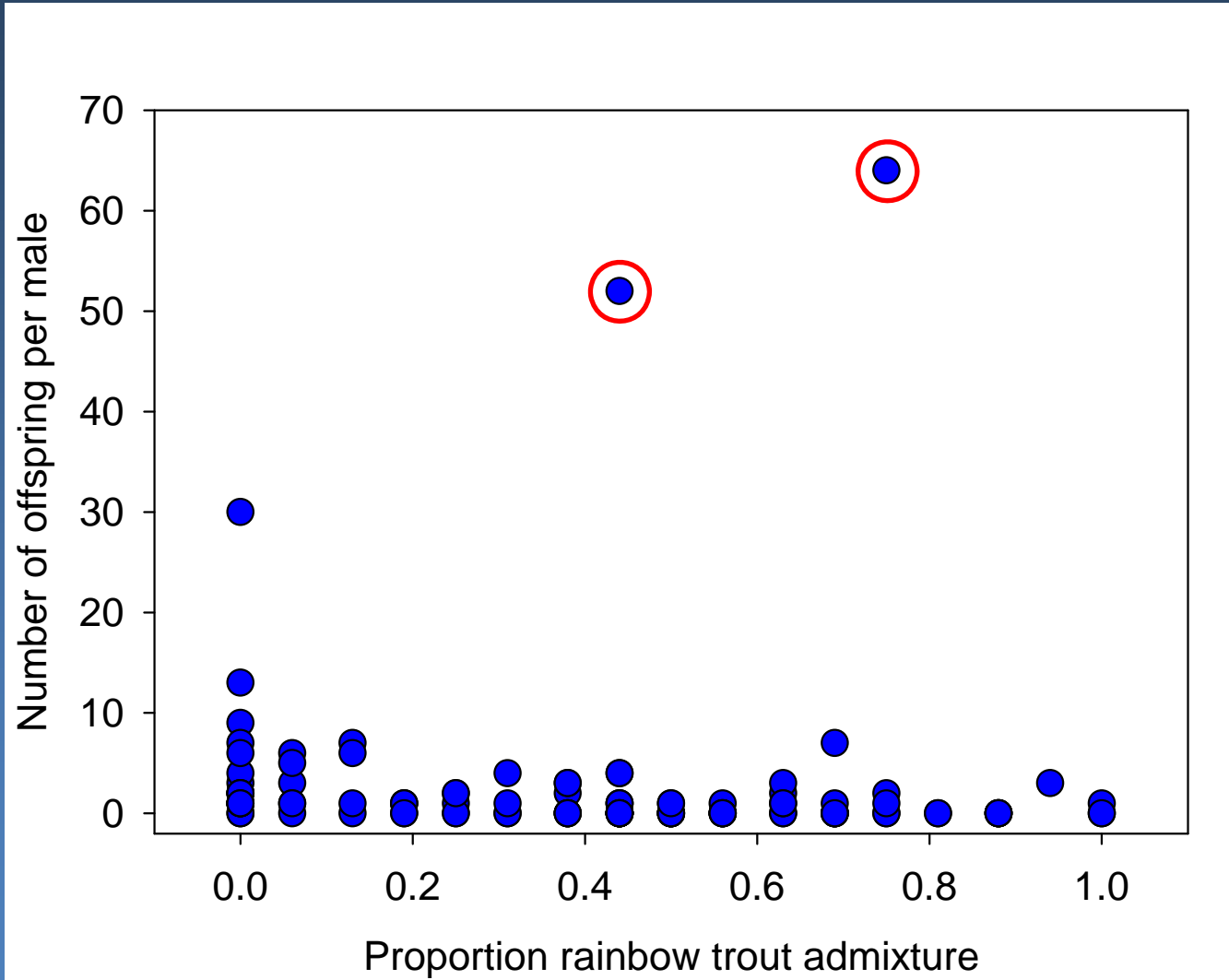


# Hybridization Rapidly Reduces Fitness

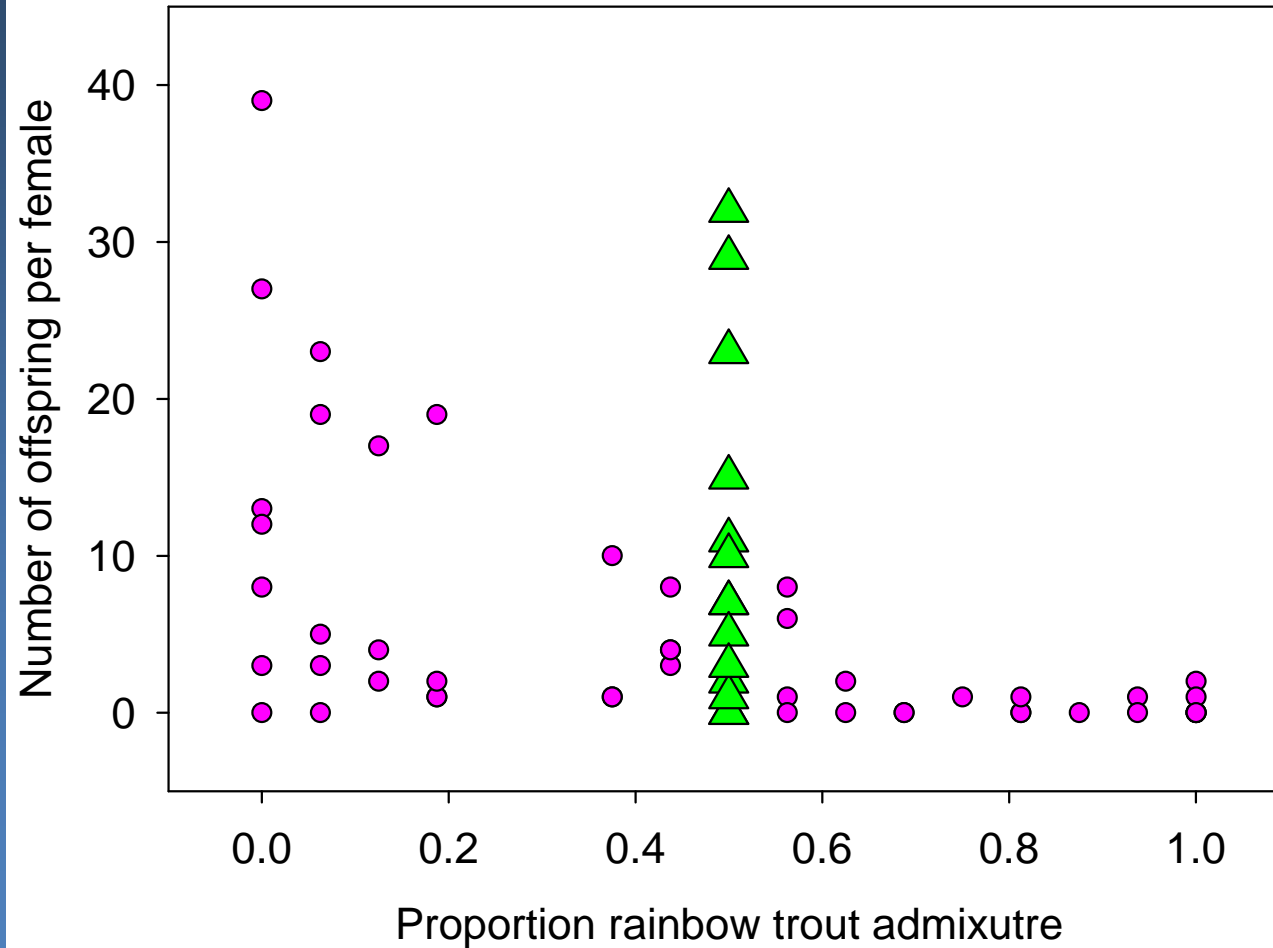




# Fitness Results – Males



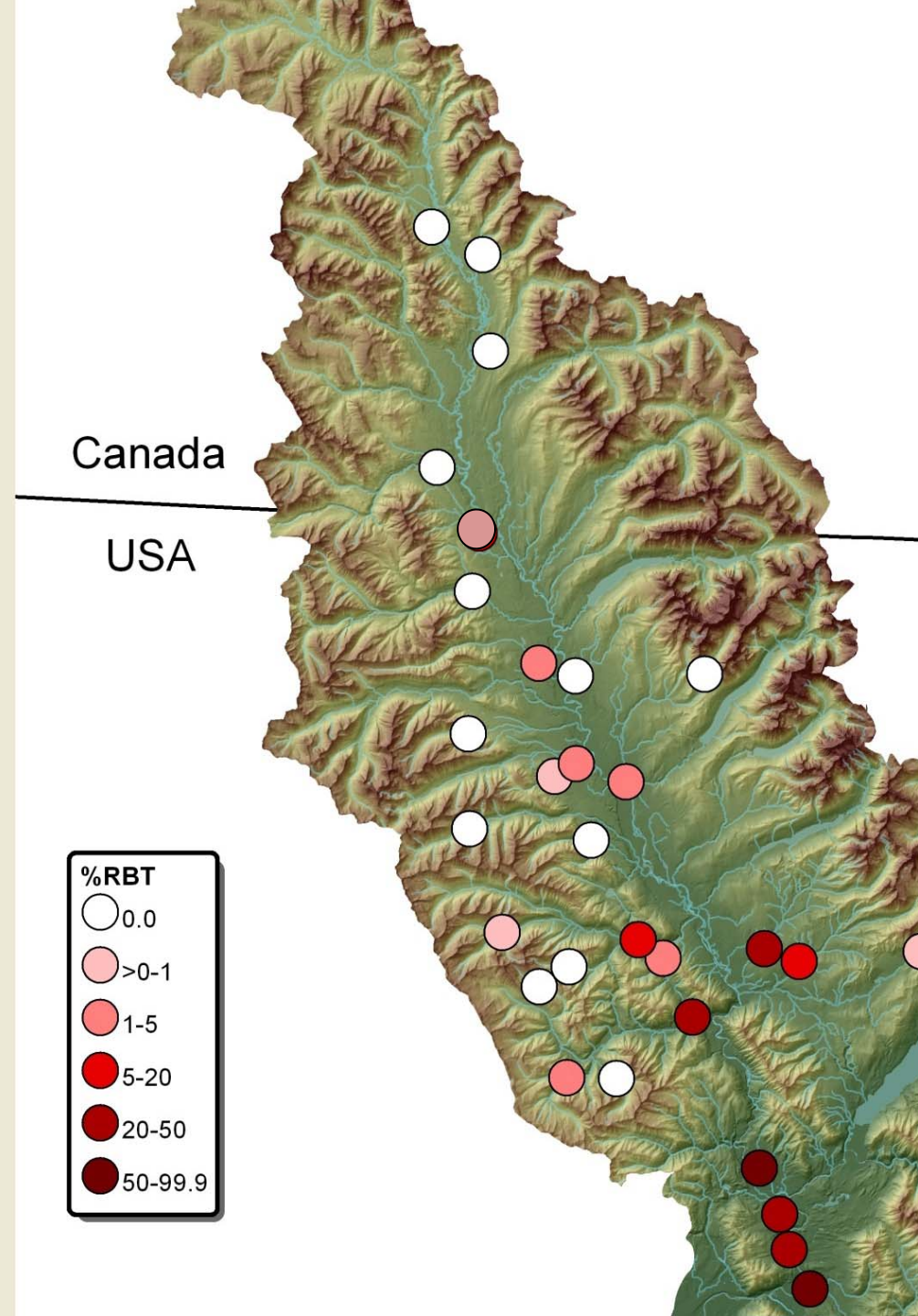
# Fitness Results – $F_1$ s





# Conservation

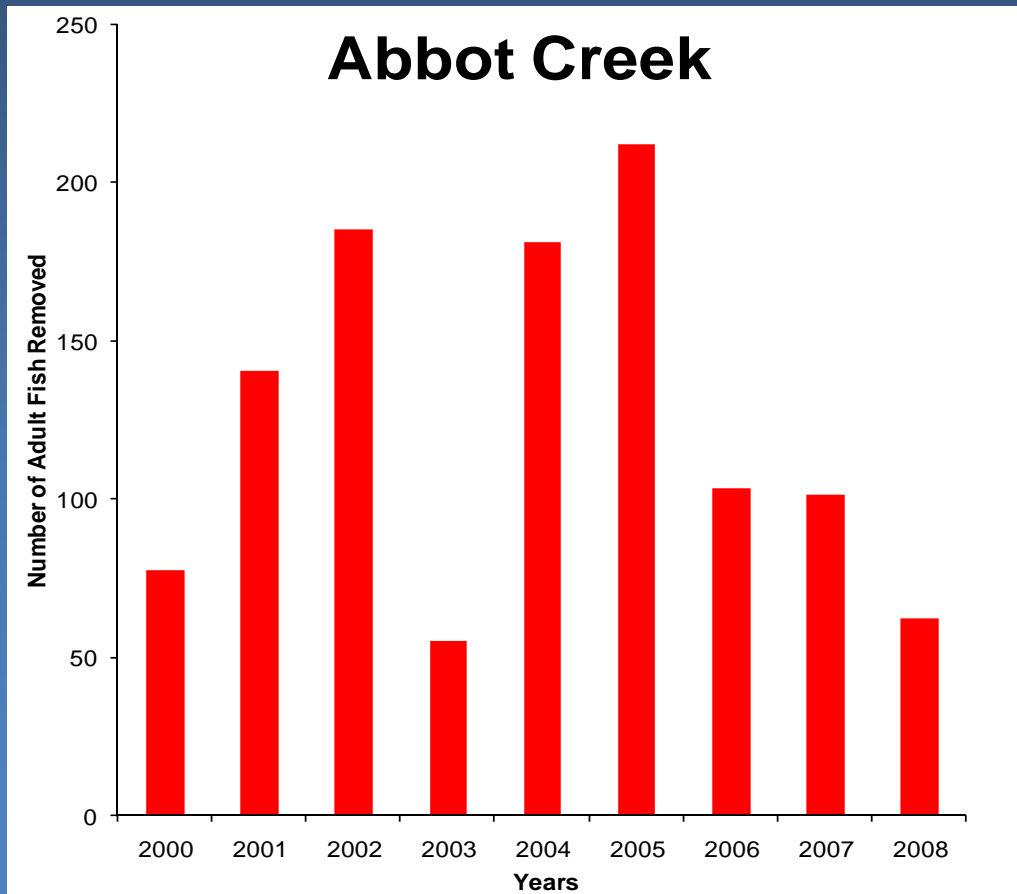
- Hybridization changes genetic, ecological and behavioral characteristics
- Policies that protect hybrids need reconsideration
- Eradicate hybrid sources and protect non-hybridized populations



# Hybrid Suppression

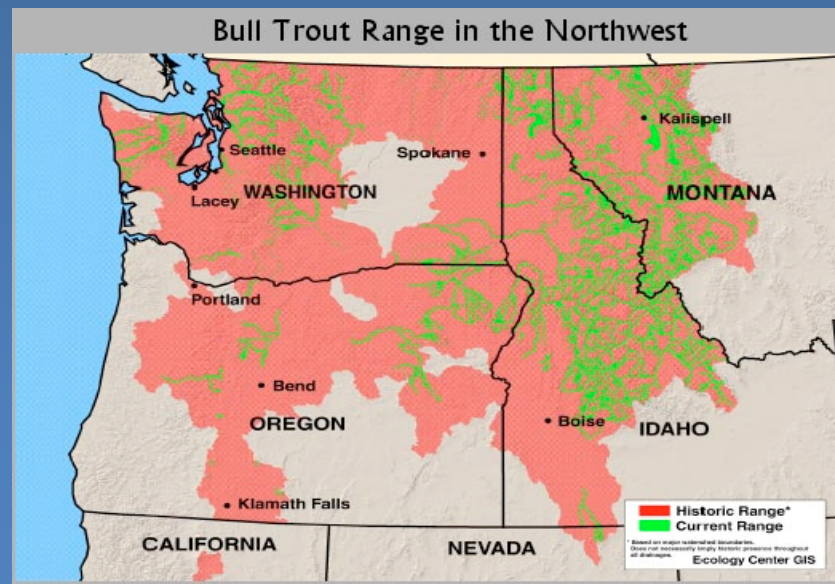
## *Strategy: Eliminate sources*

- Barrier installation
- Manual and chemical removal
- Protect/enhance habitat complexity





# Bull Trout





# Northern Pike Bioenergetics Study



	<u>Prey items</u>	
<u>Season</u>	<u>WCT</u>	<u>BULL</u>
Winter	686	380
Spring	2,015	2,922
Summer	9,428	0
Fall	1,250	156
<b>Totals</b>	<b>13,379</b>	<b>3,457</b>

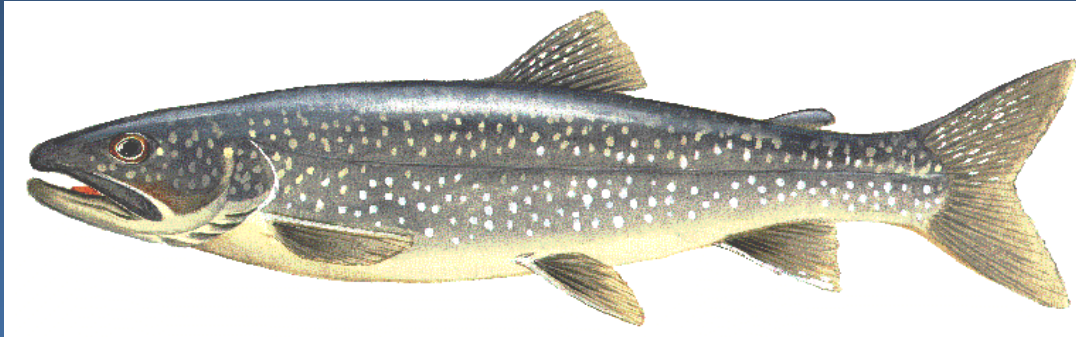


Muhlfeld et al. (2008) *NAJFM*

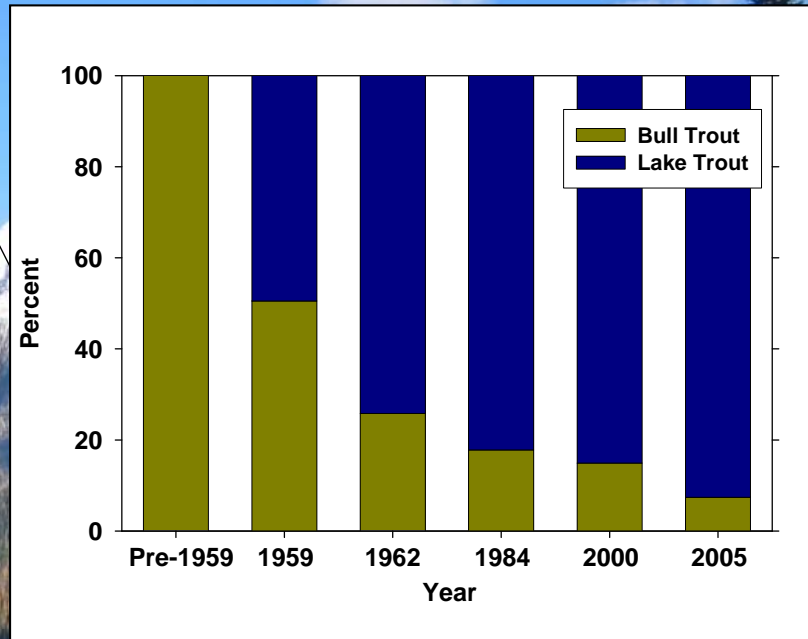
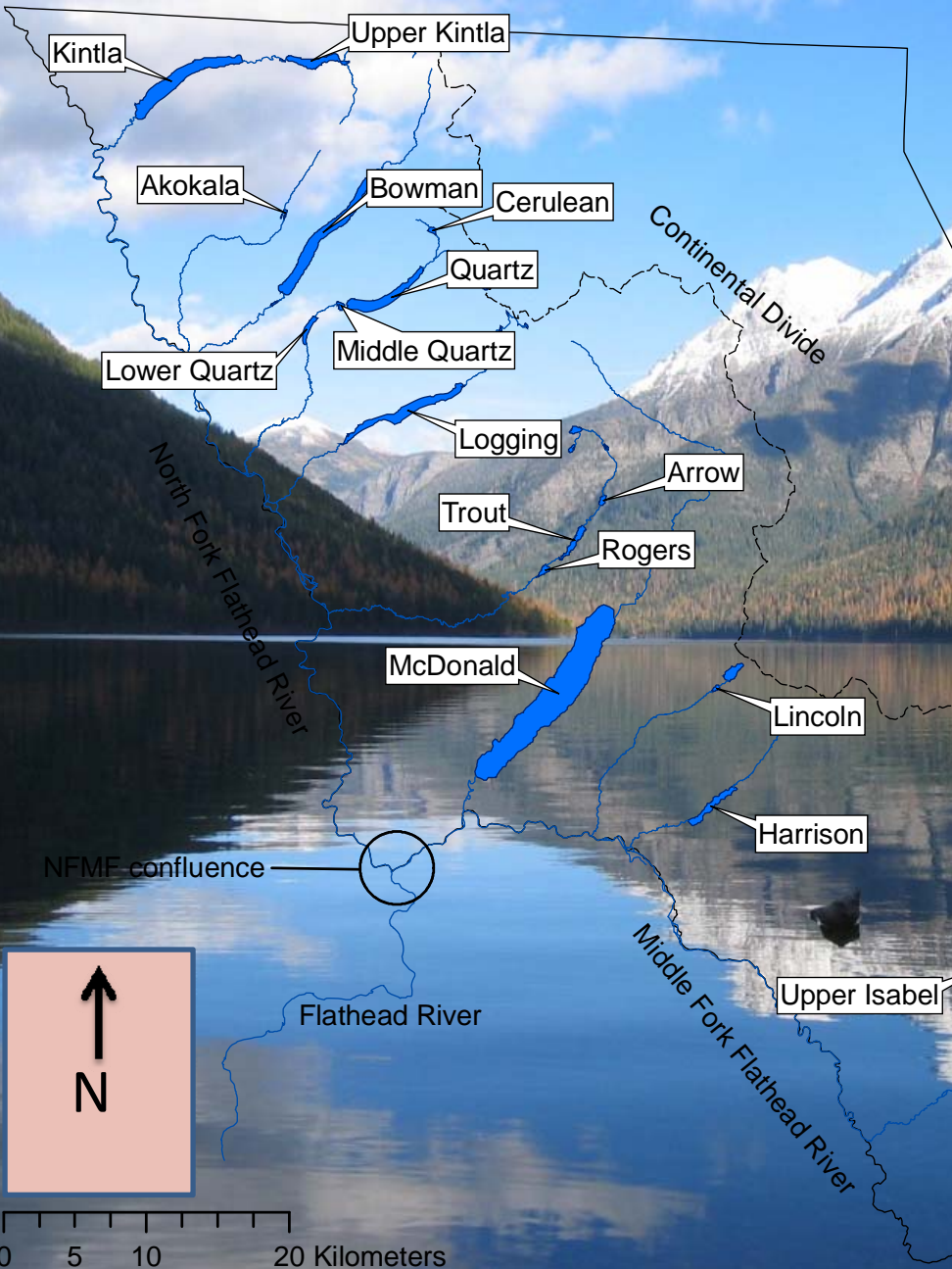


# Major Threat: Non-native Lake Trout Invasion

Suppression Efforts: Yellowstone Lake (WY), Lake Pend Oreille, Priest Lake, Upper Priest Lake (ID), Swan Lake (MT)



# Glacier National Park



## 17 lakes:

- 10 invaded
- 2 at risk
- 5 secure



# Lake Trout Suppression- Upper Quartz

**The likelihood of success is good:**

- **Small lakes that lack complexity**
- **Recently invaded**
- **Isolated from downstream sources**
- **No mysis shrimp**





# Lake Trout Suppression- Upper Quartz



## Objectives:

- Assess lake trout demographics
- Identify timing and location of lake trout spawning
- Implement a removal program and assess effectiveness
- Participate in experimental and innovative suppression techniques