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Aquatic Research and Monitoring in the Crown of the Continent Ecosystem

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U.S. Department of the Interior
U.S. Geological Survey

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U.S. Department of the Interior
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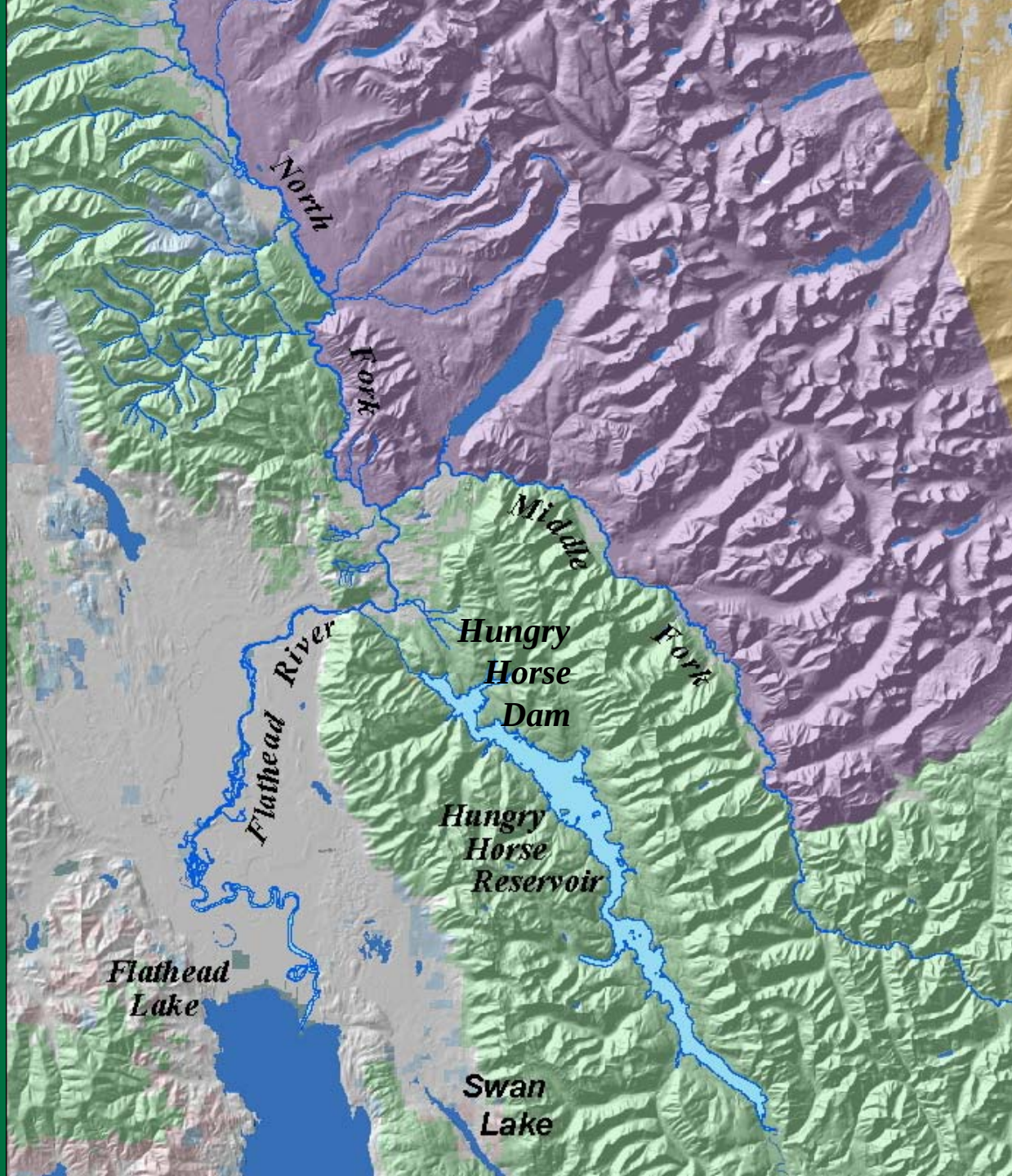
Flathead River Drainage

A native species stronghold



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Bull Trout Migratory Life History

Spawning and incubation

Juvenile rearing

Adult movements

Subadult rearing

Westslope Cutthroat Trout

Westslope cutthroat trout display both *migratory* and *resident* life history strategies in the upper Flathead

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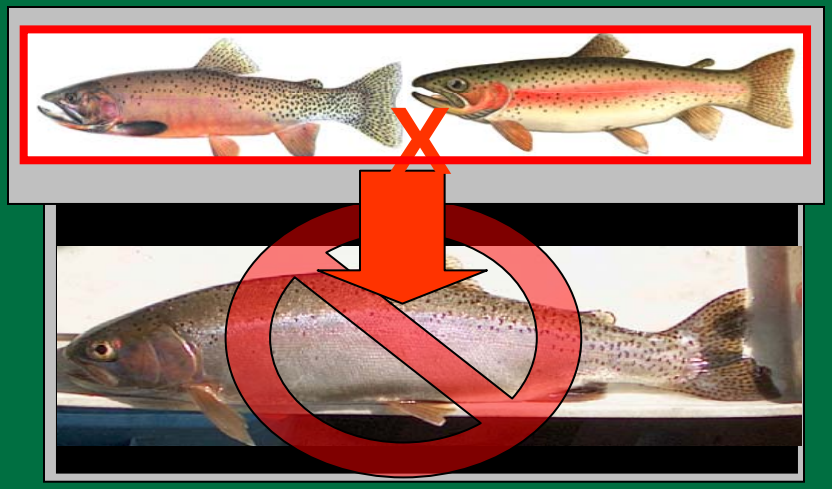
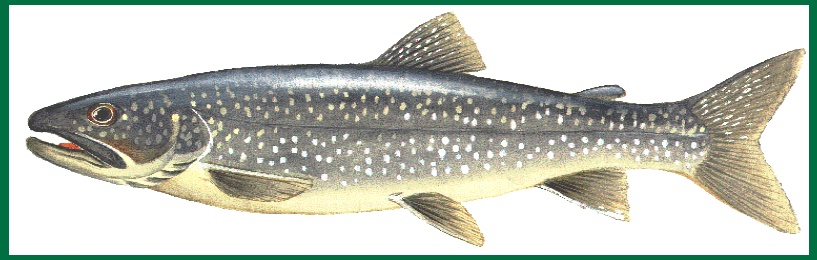
Native Species Declines





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Westslope Cutthroat Trout

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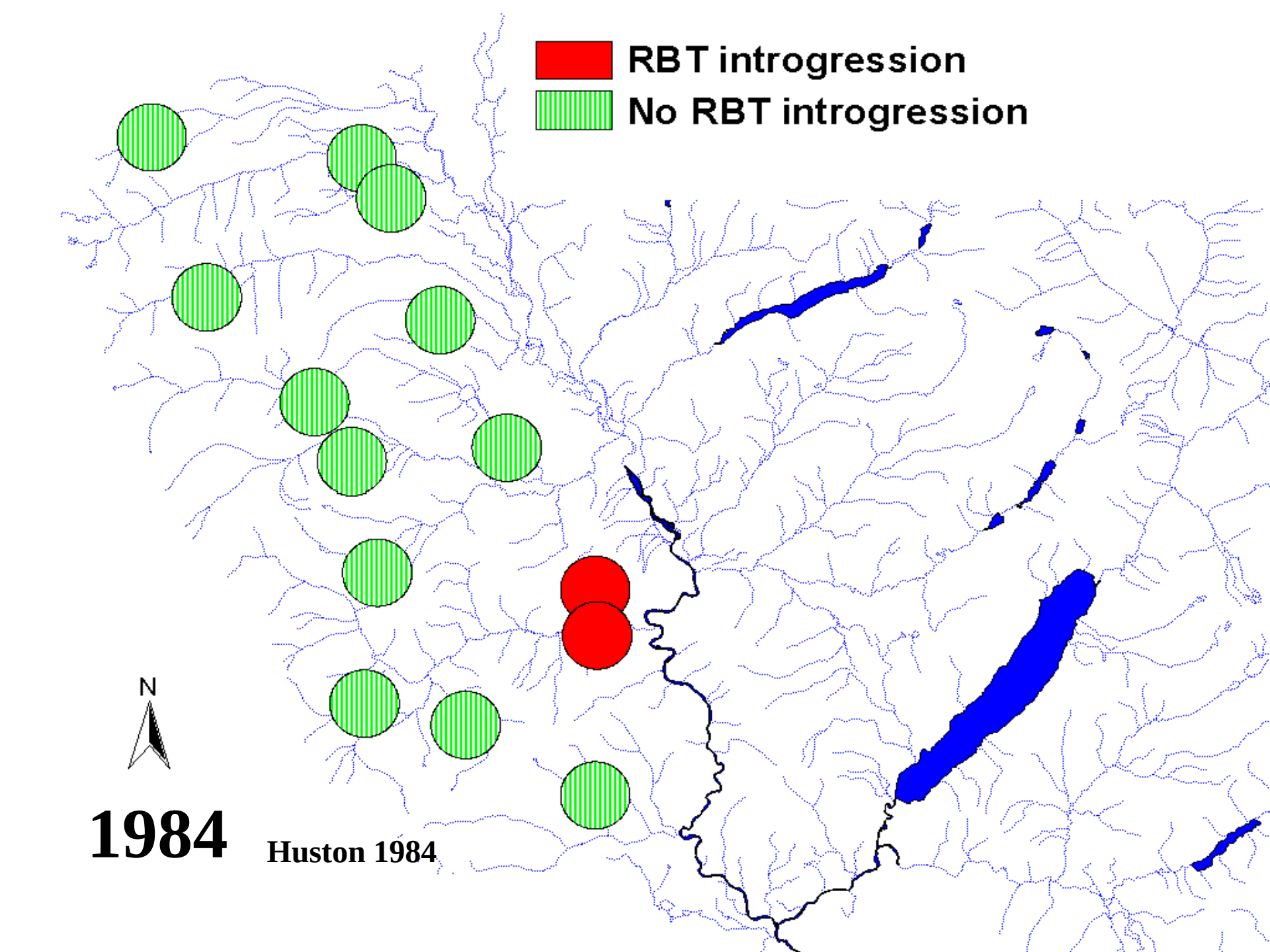
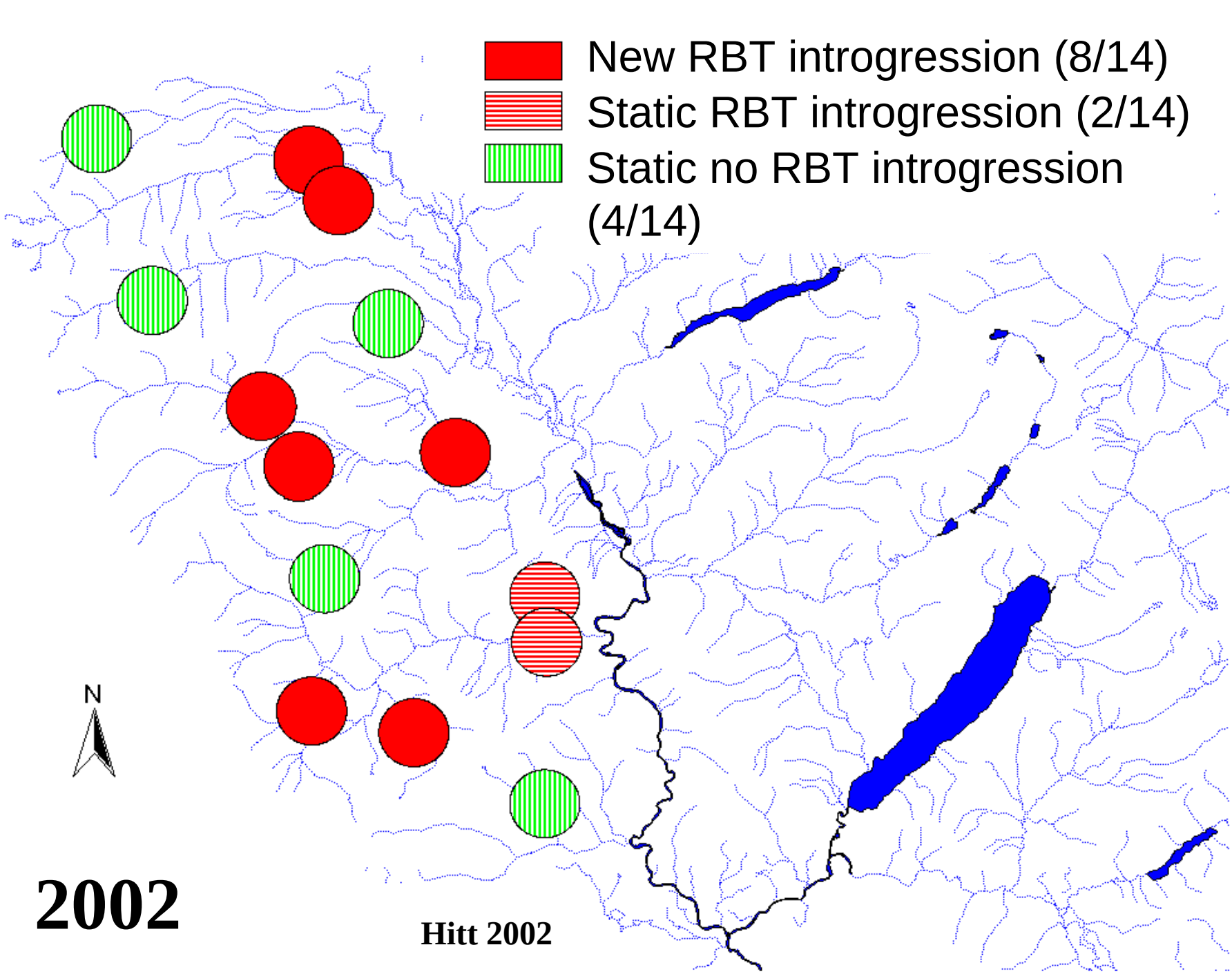
Hybridization

- Loss of locally adapted gene complexes and ecological adaptations in native populations

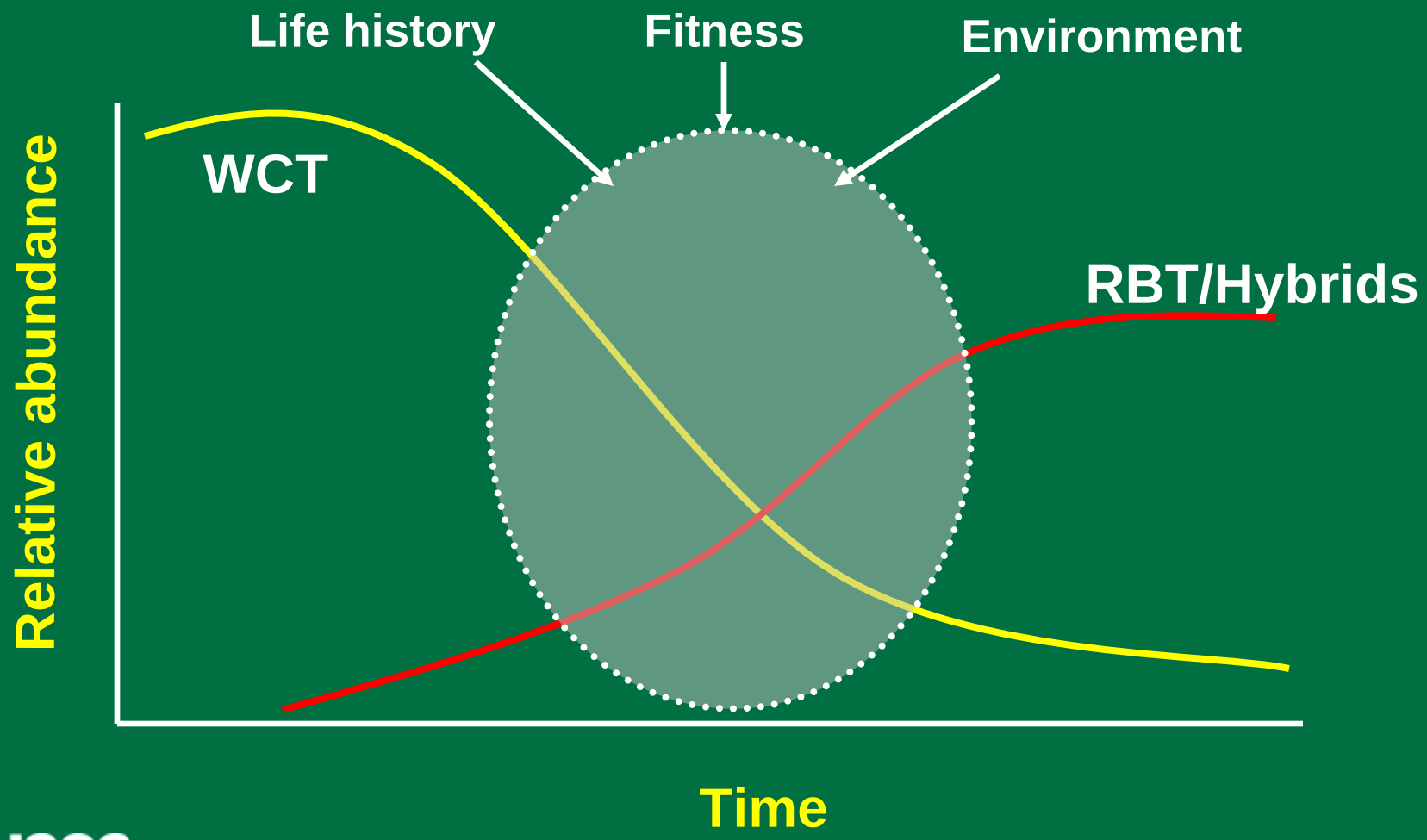
- Threatens the persistence of many rare and endangered species

HYBRIDS?


RBT introgression
No RBT introgression
N
1984
Huston 1984


New RBT introgression (8/14)
Static RBT introgression (2/14)
Static no RBT introgression (4/14)
N
2002
Hitt 2002

What factors influence successful invasion of hybrids?



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Radiotelemetry

Objectives: Identify timing and location of spawning

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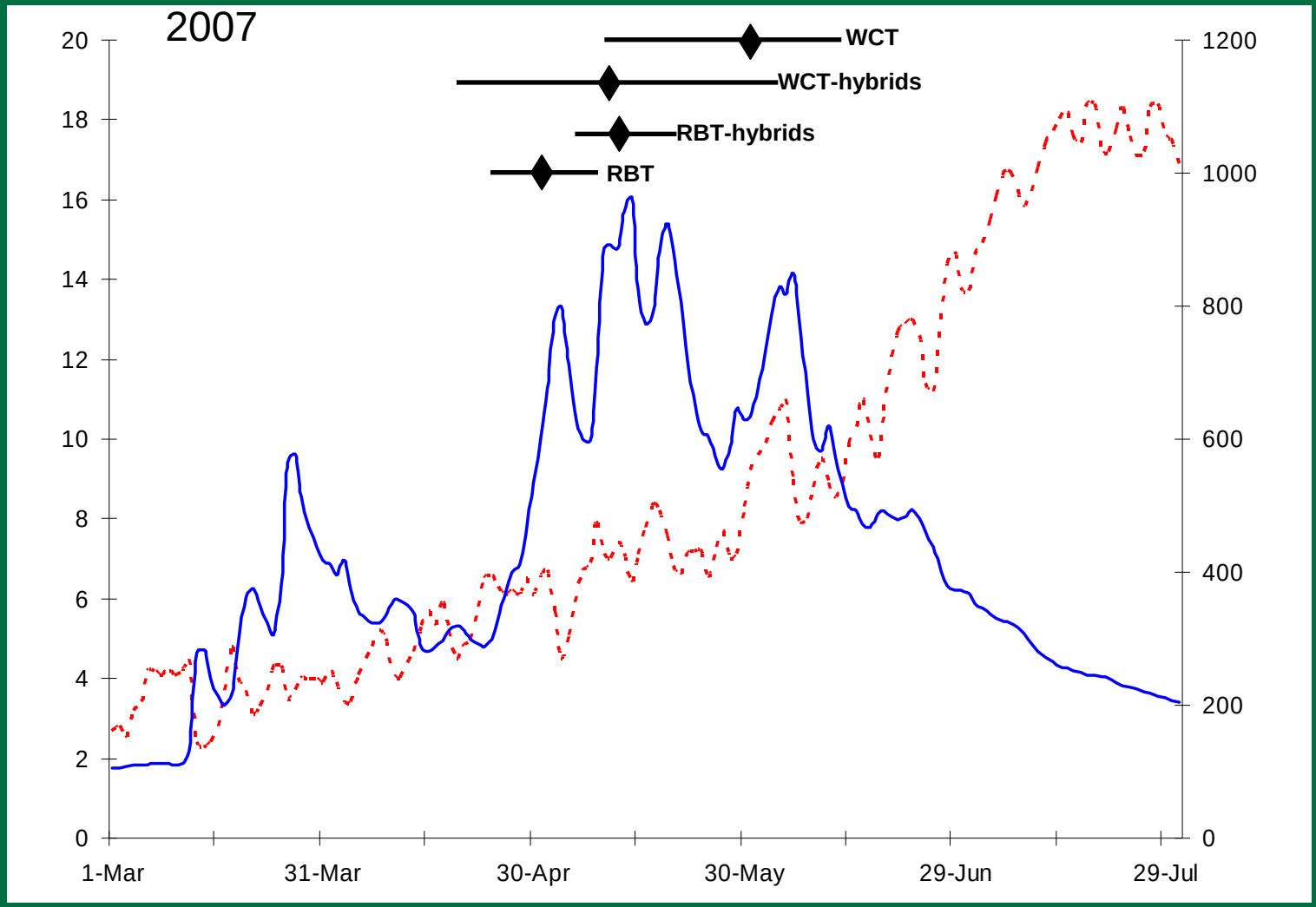
Timing of Spawning



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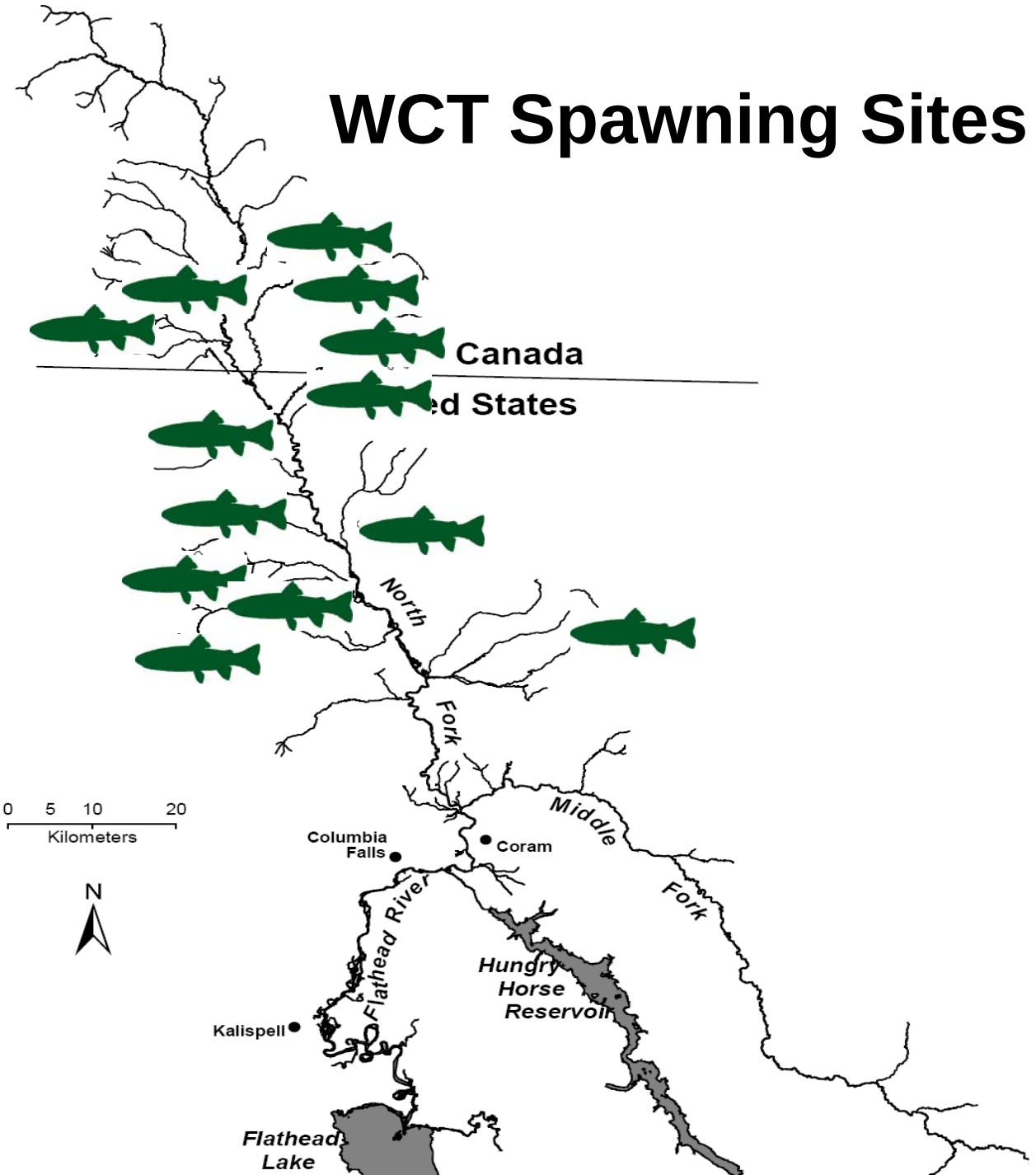
WCT Spawning Sites



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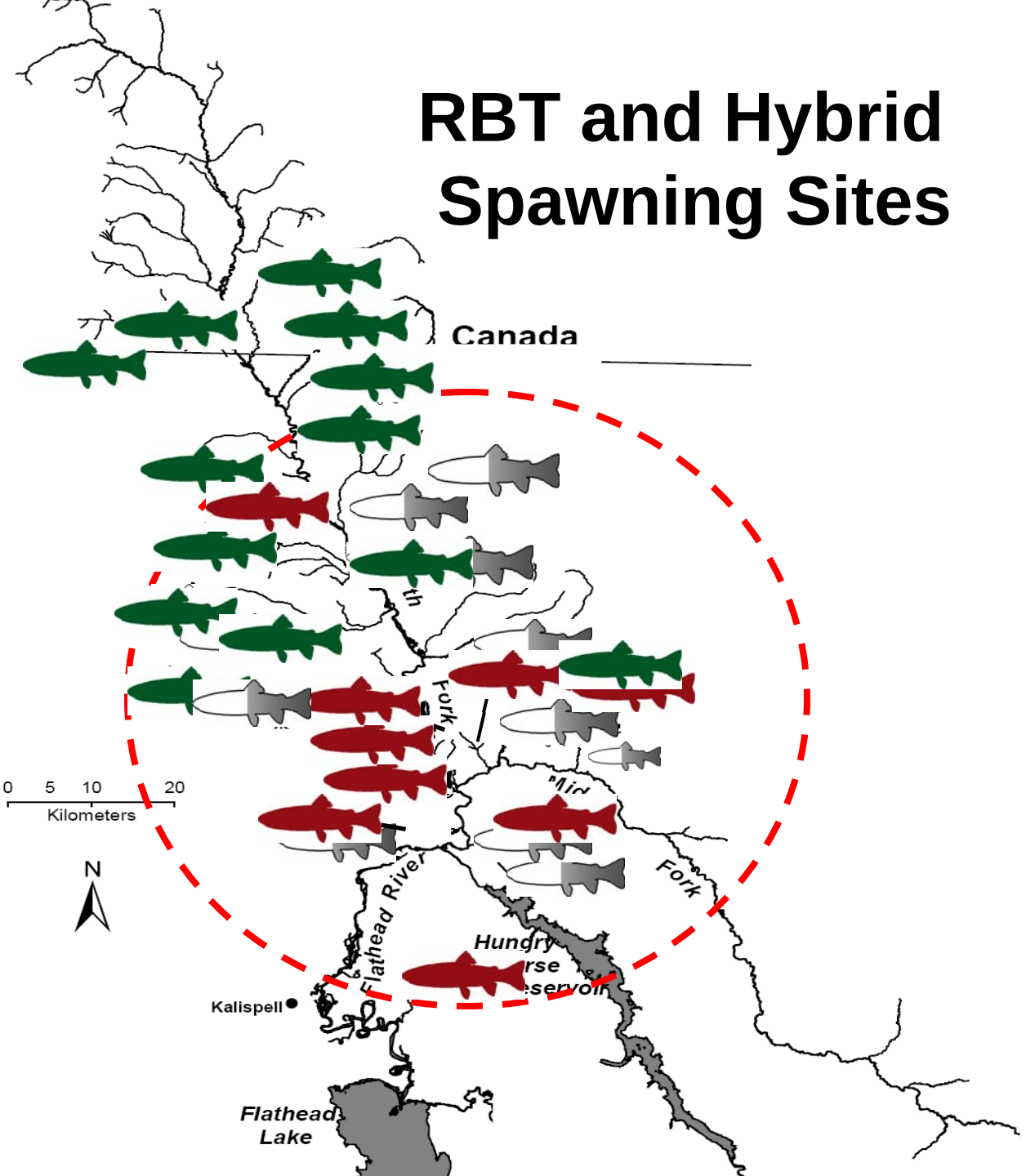
RBT and Hybrid Spawning Sites



Objective 1: Compare spawning dynamics and dispersal

Ho_2: *There are no differences differences in straying rates, and there are no differences due to sex.*

Predictions:

- Hybrid and RBT exhibit greater straying rates
- Males have a greater propensity to stray
- Origin of straying fish will be related to the proximity of source RBT populations

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Methods

- Collect adult fish from spawning streams (2006-2007)

- Sample water (base flows/ seasonally)

- Microelemental analysis of otoliths and water (Woods Hole Laboratory)

- Predict the natal stream of origin based on the relationship between the otolith and water chemistries

- MANOVA (with sex); DFA; Linear regression

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Study Streams in the upper Flathead River system

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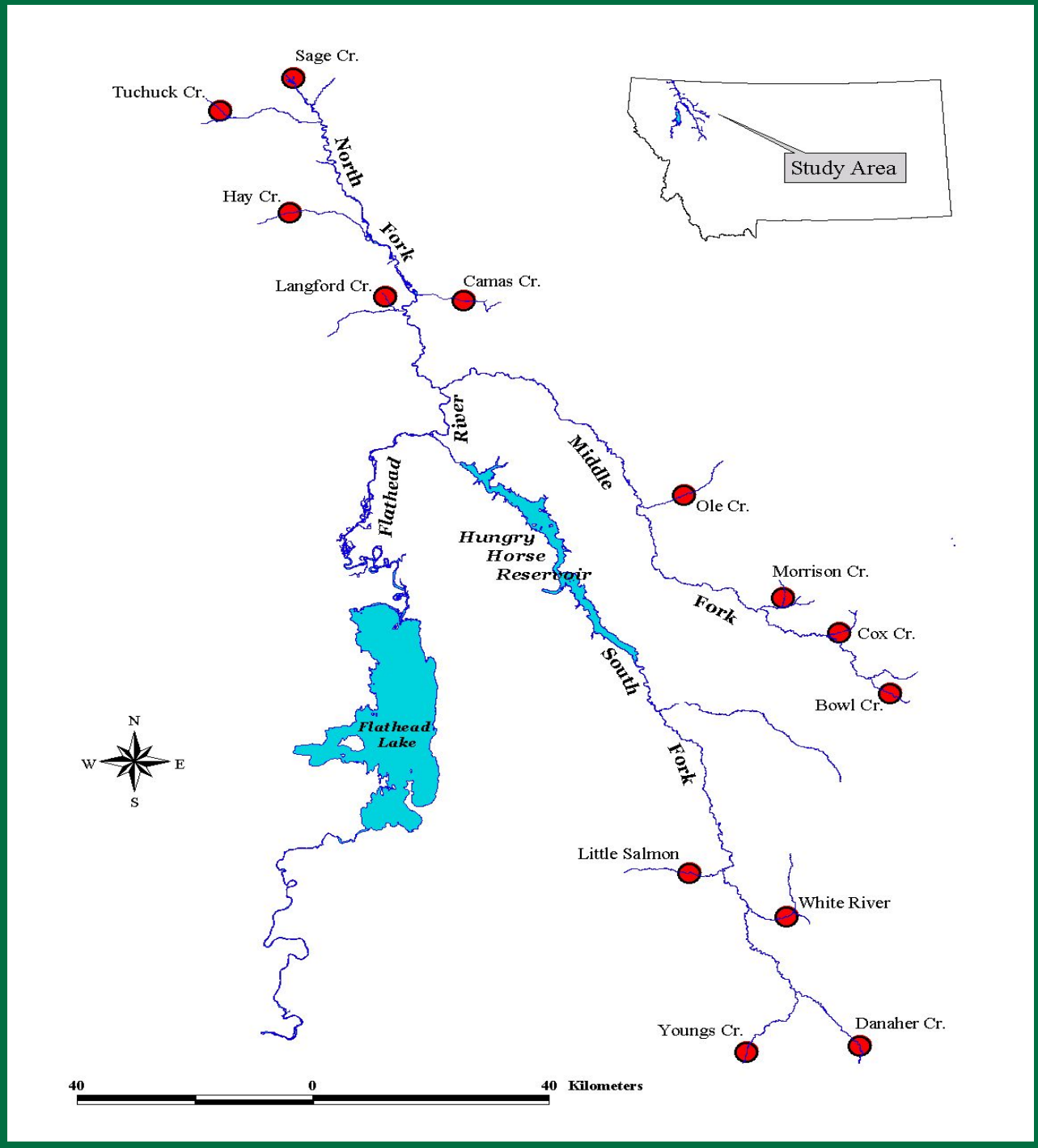
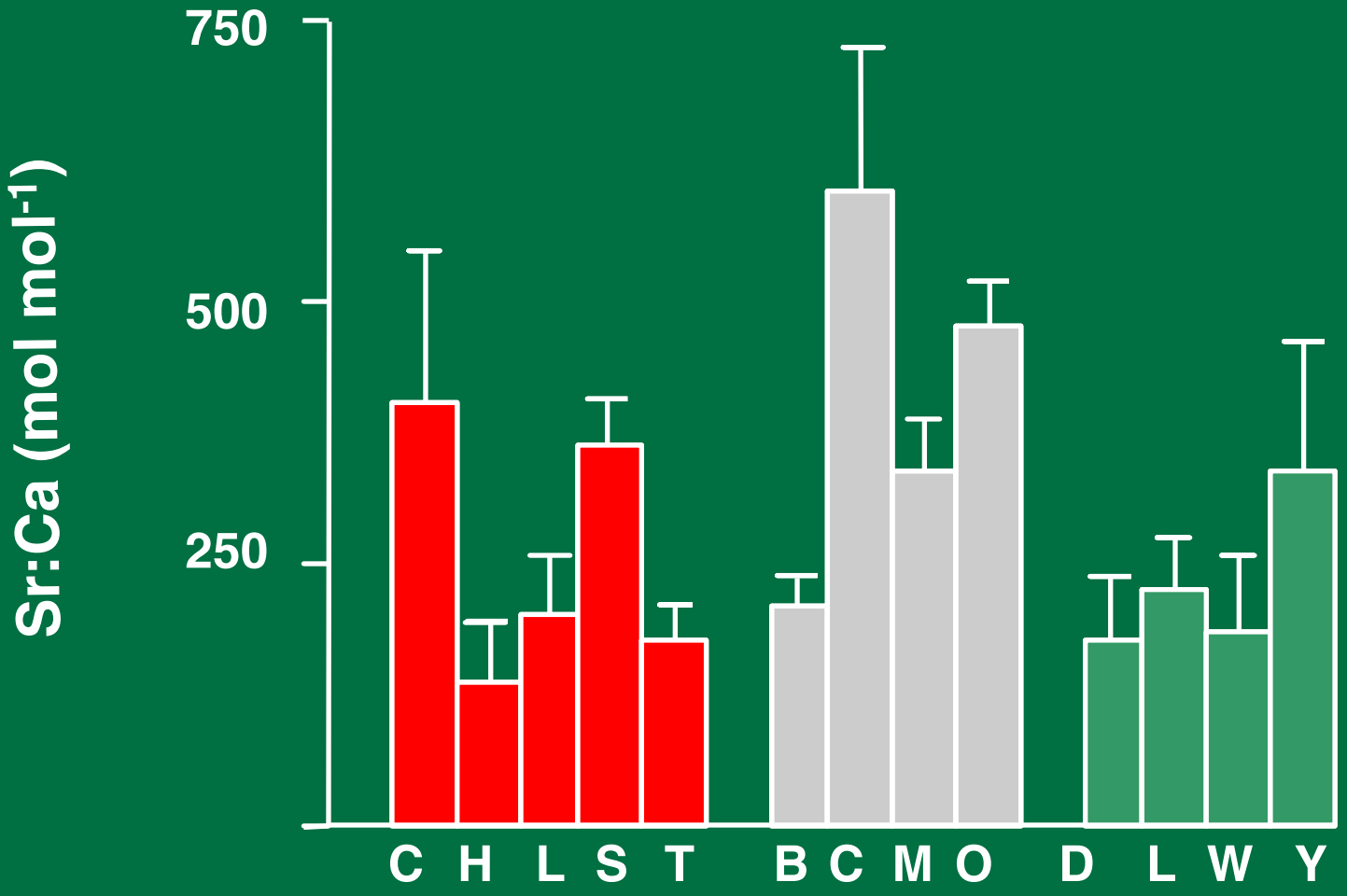


Sr:Ca



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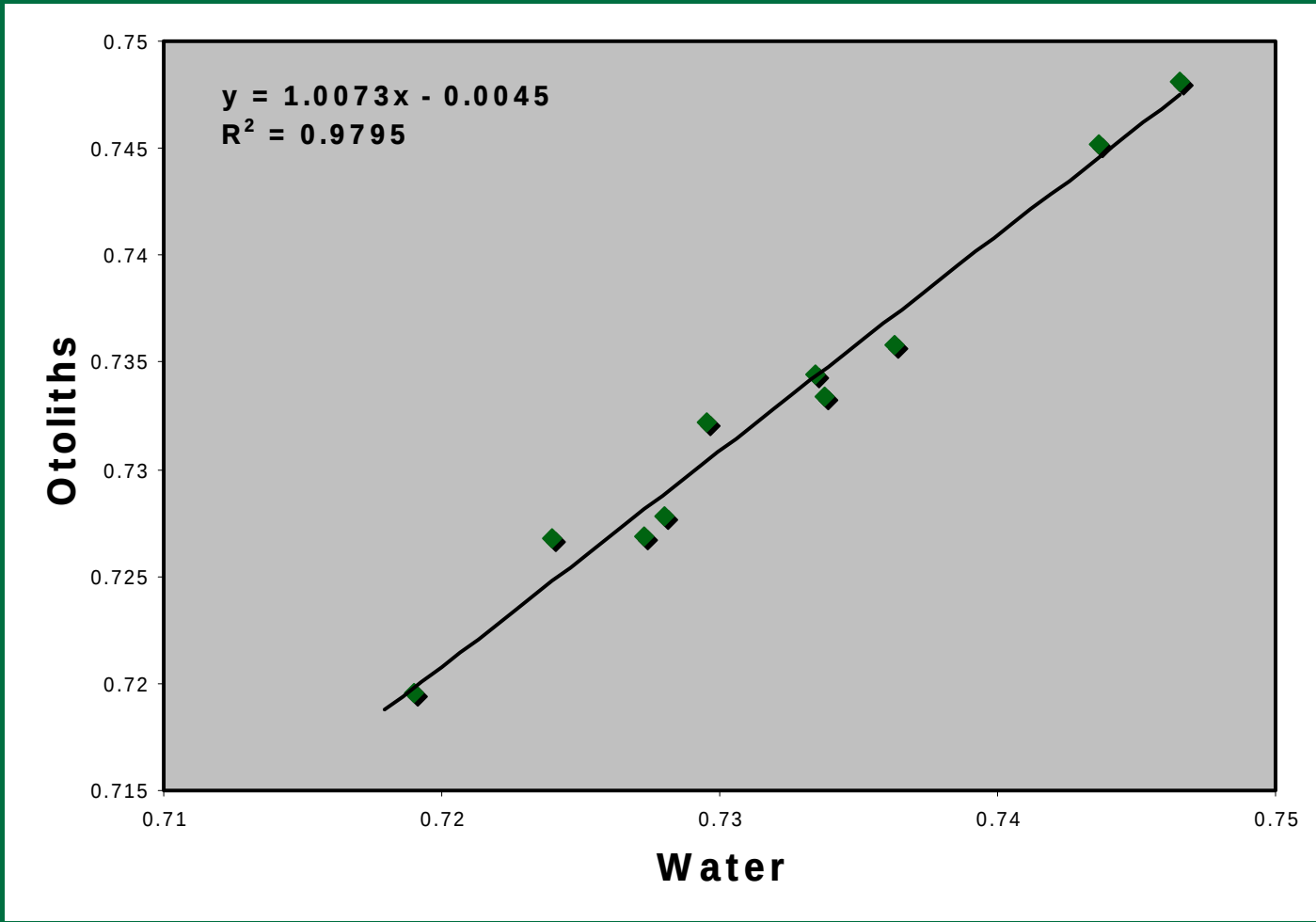
Muhlfeld et al. (2005)

Strontium Isotopes (water vs otoliths)



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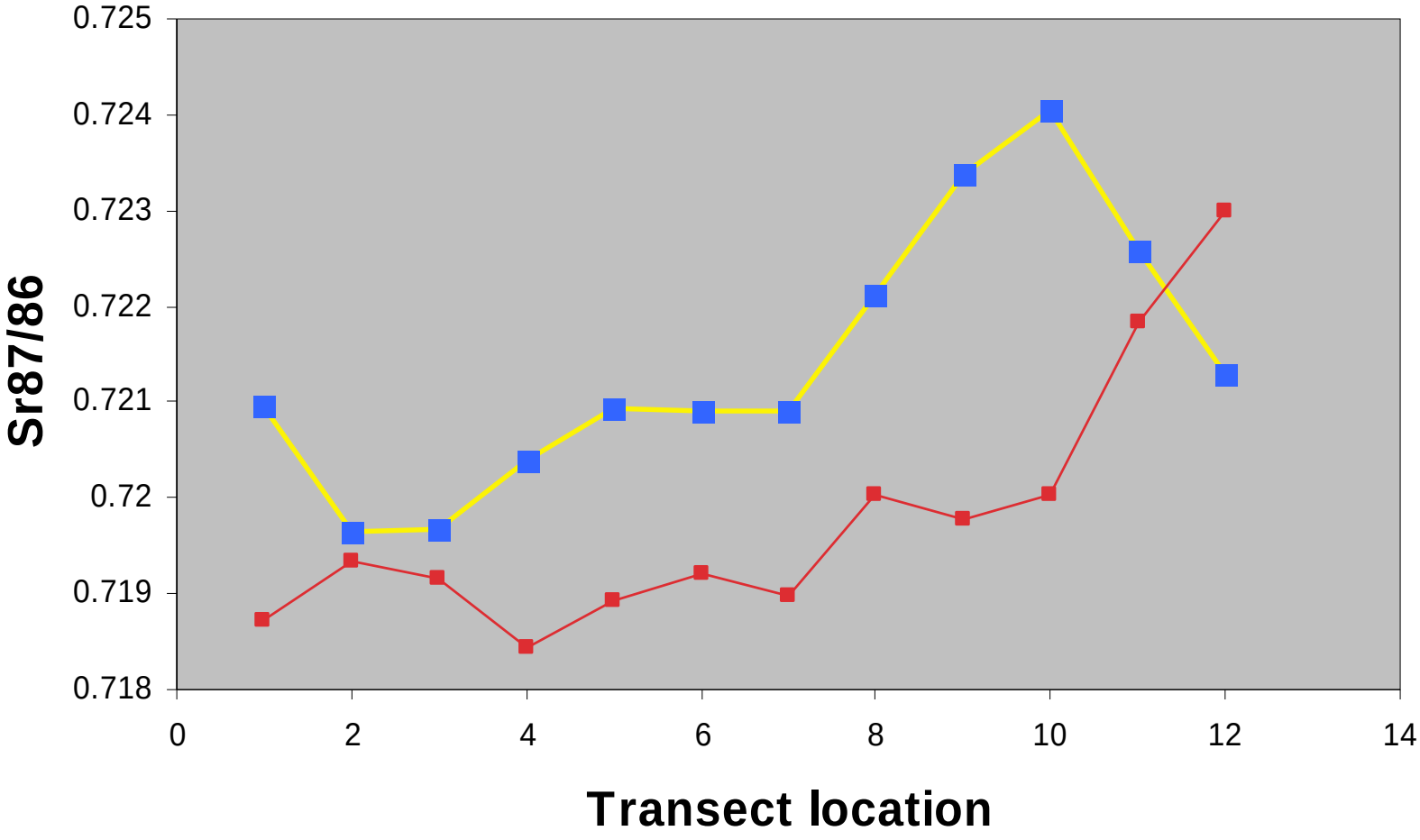
Thorrold and Muhlfeld (In prep)

Otolith Transects



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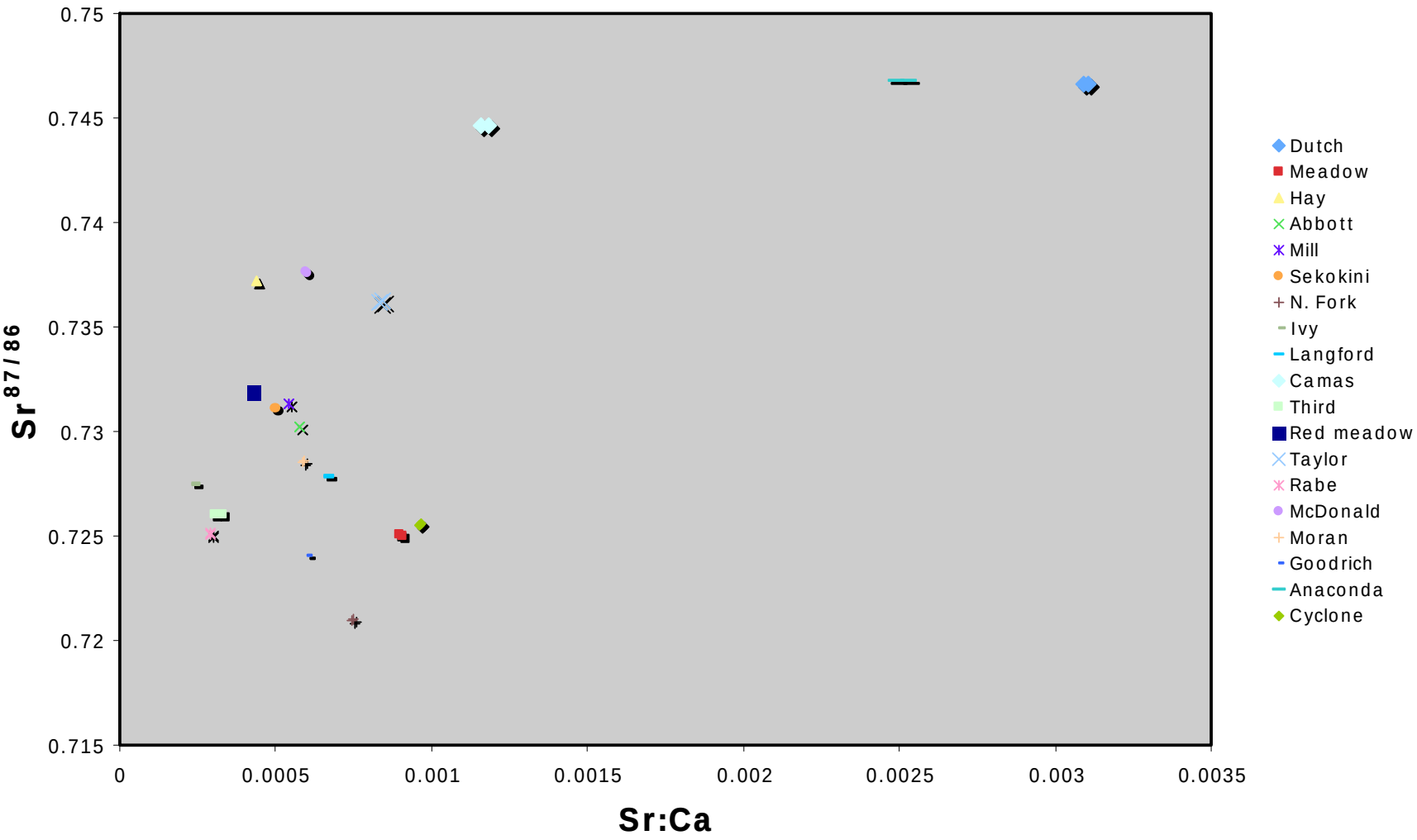
Thorrold and Muhlfeld (In prep)

Water Chemistry



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Muhlfeld and McMahon (In prep)

Study Streams

Langford And Cyclone creeks

- **2003-present**
- Migrant traps and PIT tag detection weirs
- All adults and juveniles tagged and genotyped

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Stream

River

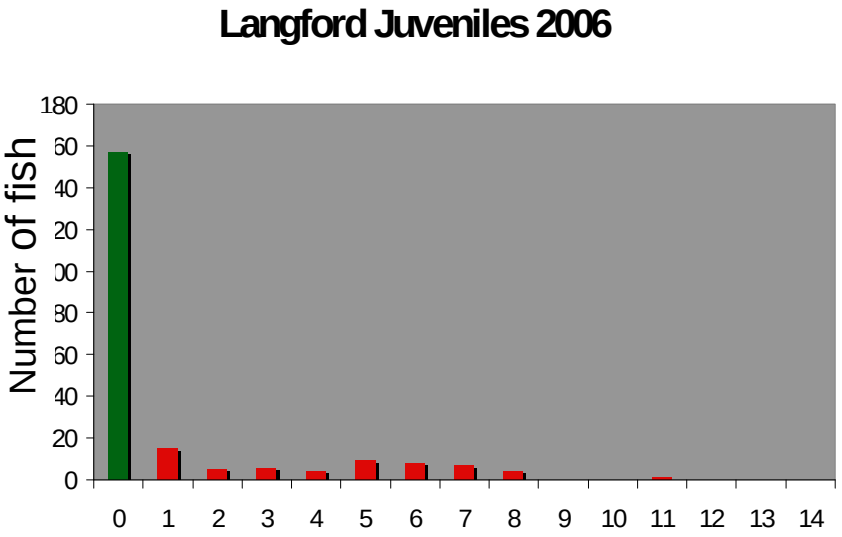
USGS

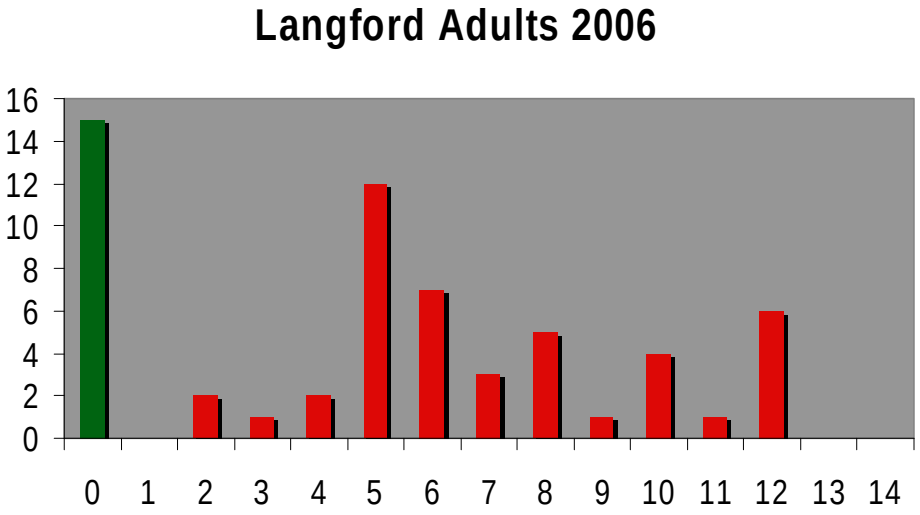
Lake

Methods

Reproductive Success:

- Genotype individuals using 7 diagnostic microsatelite loci (U of M) to estimate individual admixture (hybrid index)





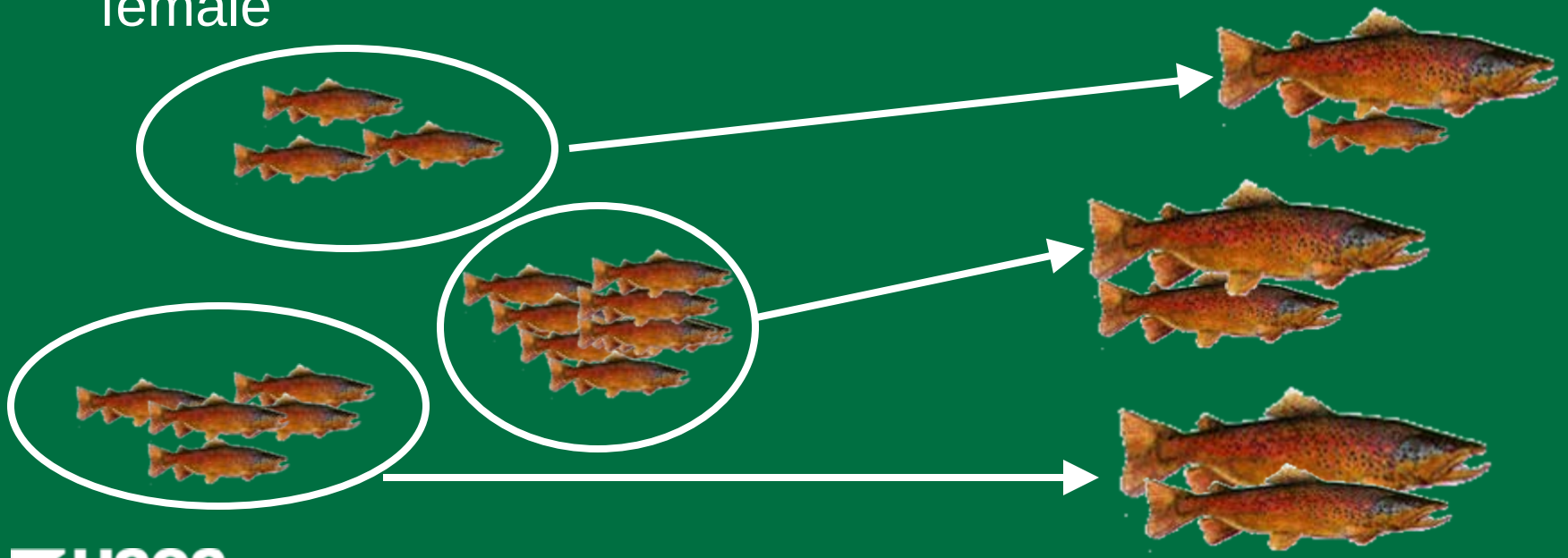
Hybrid Index Score (0=WCT; 14=RBT)

Methods

- Paternity analysis using 14 microsatelite loci

to estimate the parents of each offspring

- Reproductive success = number of offspring per female



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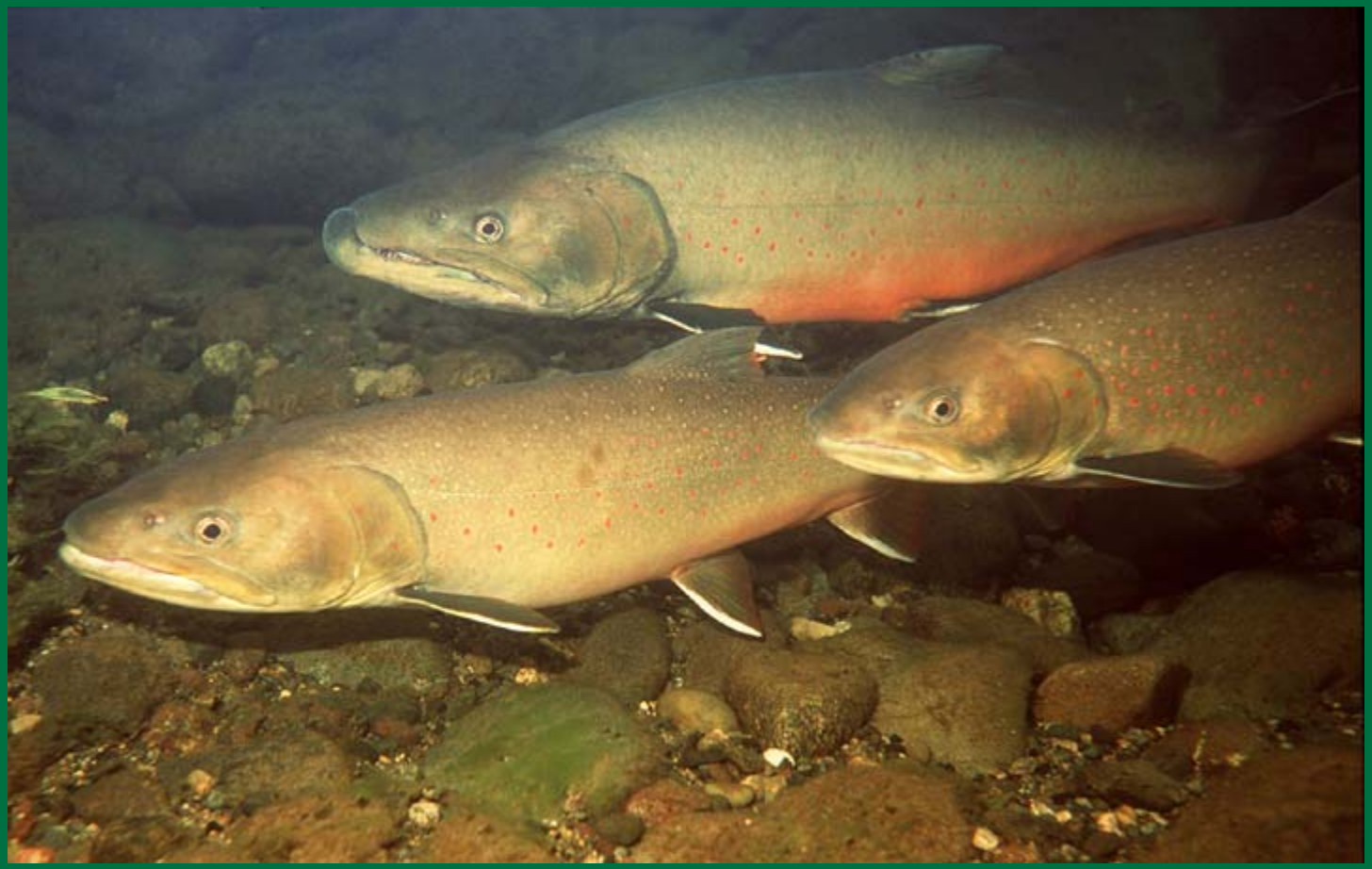
Bull trout research



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Bull trout redd counts

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Bull Trout Redd Counts

INDEX STREAMS - FLATHEAD RIVER

2000
1500
1000
500
0

1980 1985 1990 1995 2000 2005

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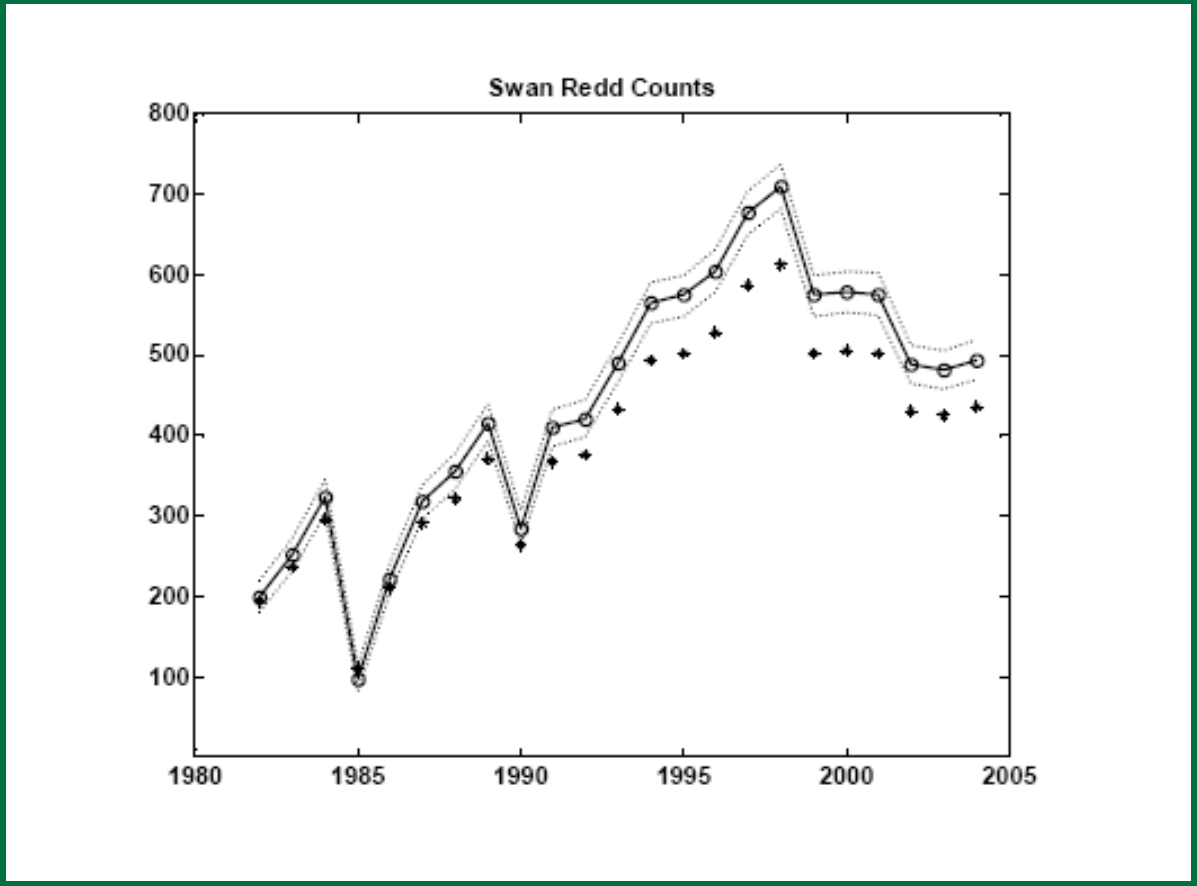
Observer Error Structure in Bull Trout Redd Counts



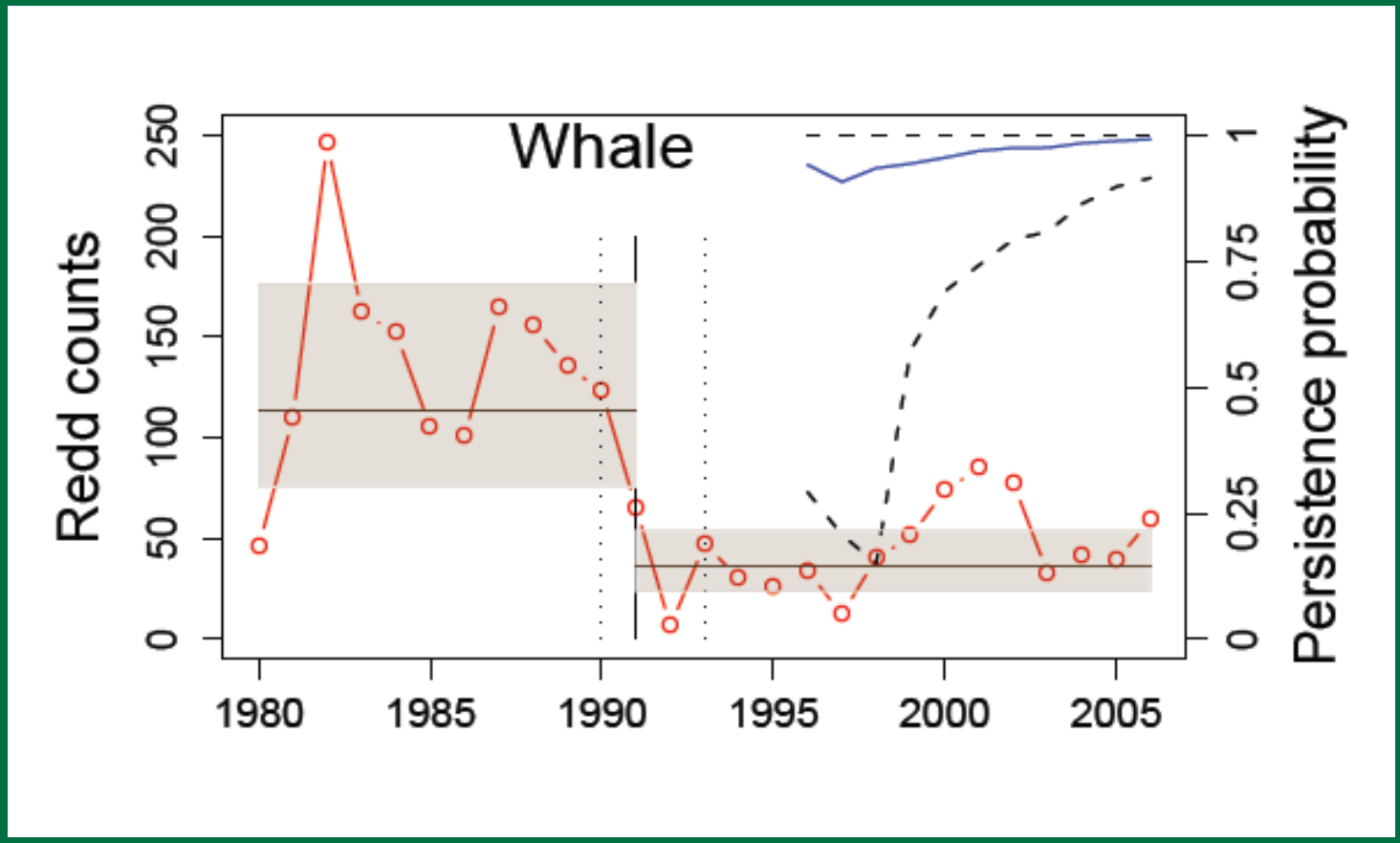
True Counts = T ~ Binomial (*N*,*p*)

False Counts = F ~ Poisson (λd)

$R_{obs} = T + F$

Muhlfeld et al. (2006)

Viable Population Monitoring (VPM)



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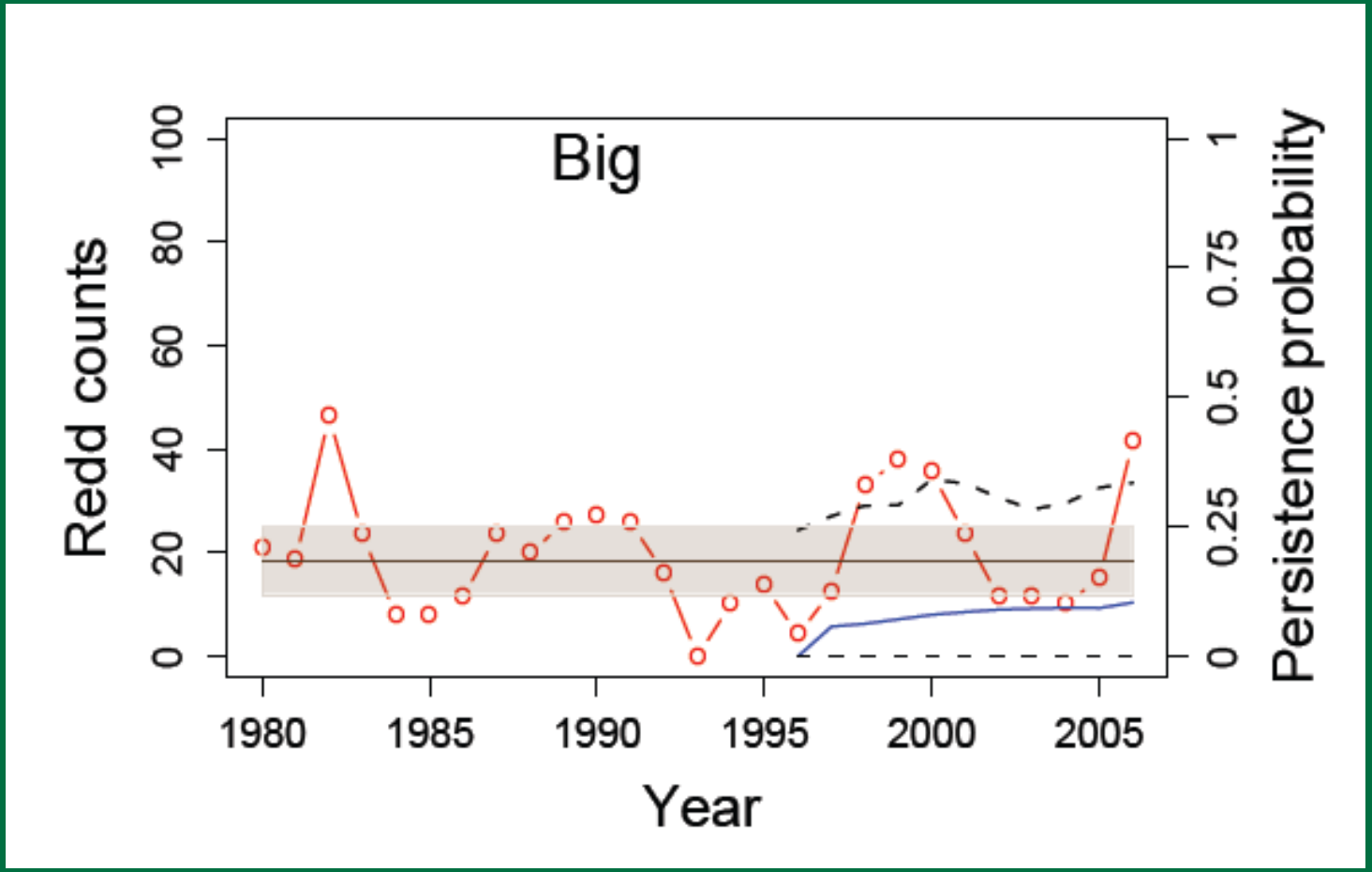
Taper et al. (In-review)

Viable Population Monitoring (VPM)



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Movement Studies

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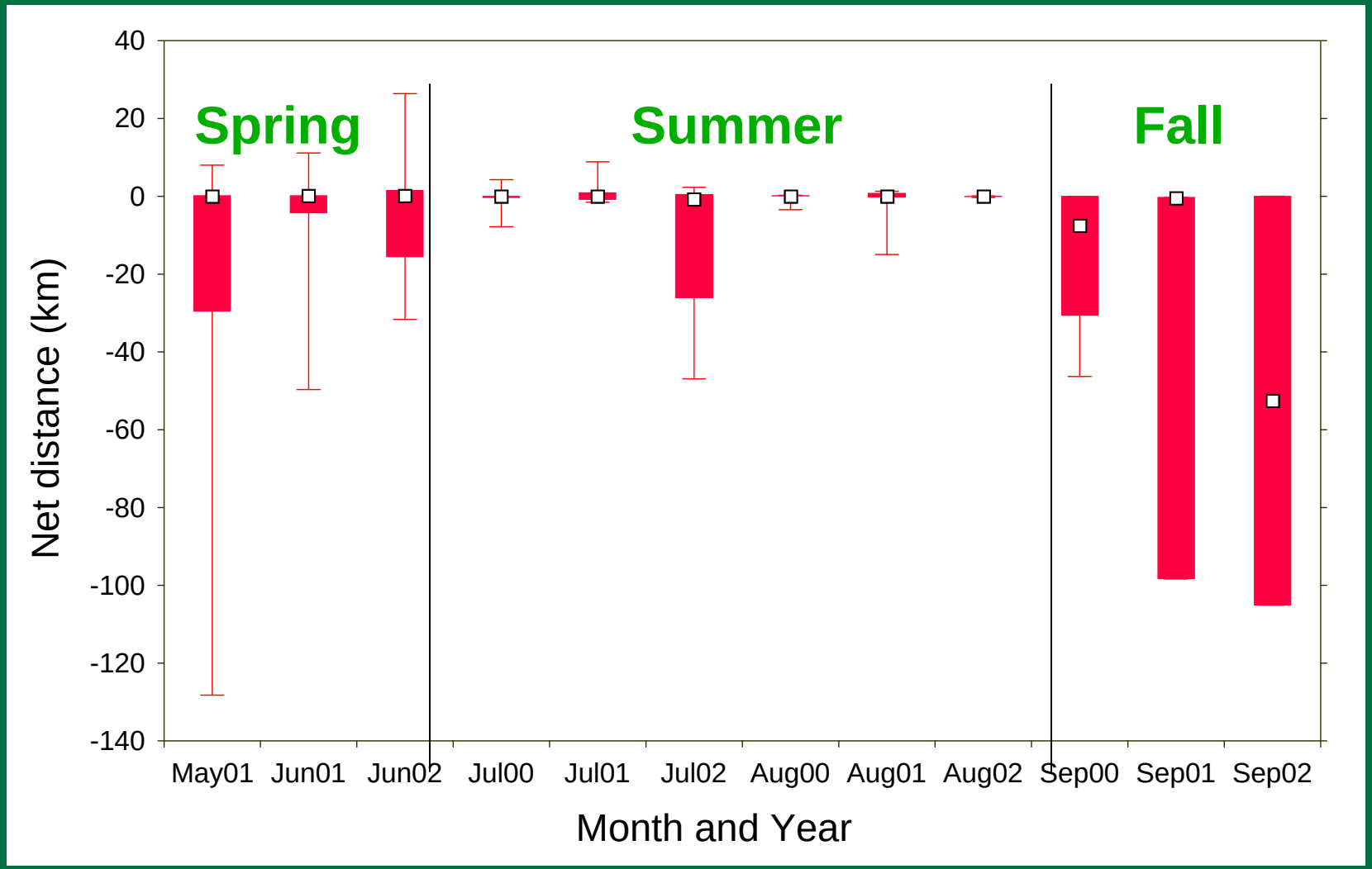
Sub-adult Bull Trout Movements

North Fork Flathead River



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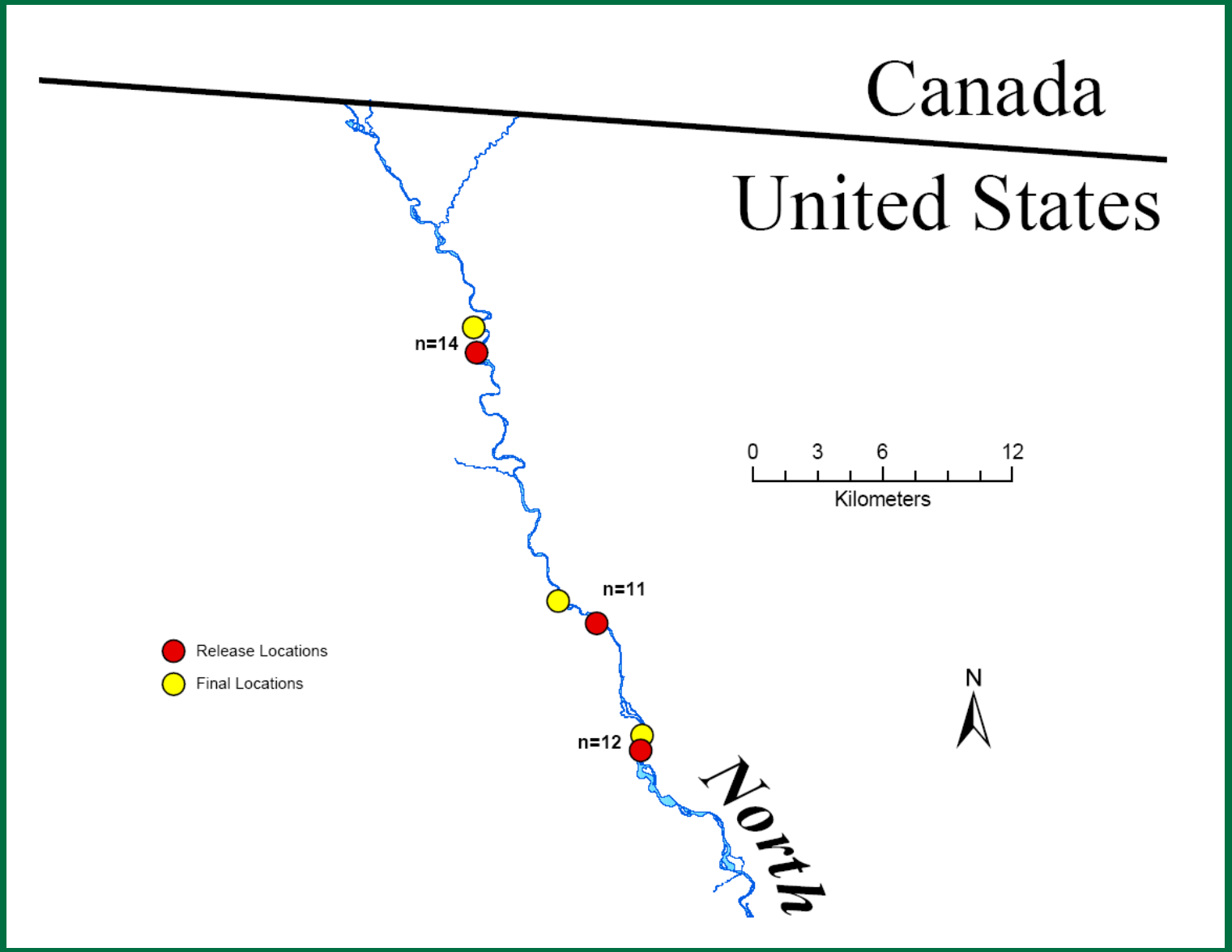

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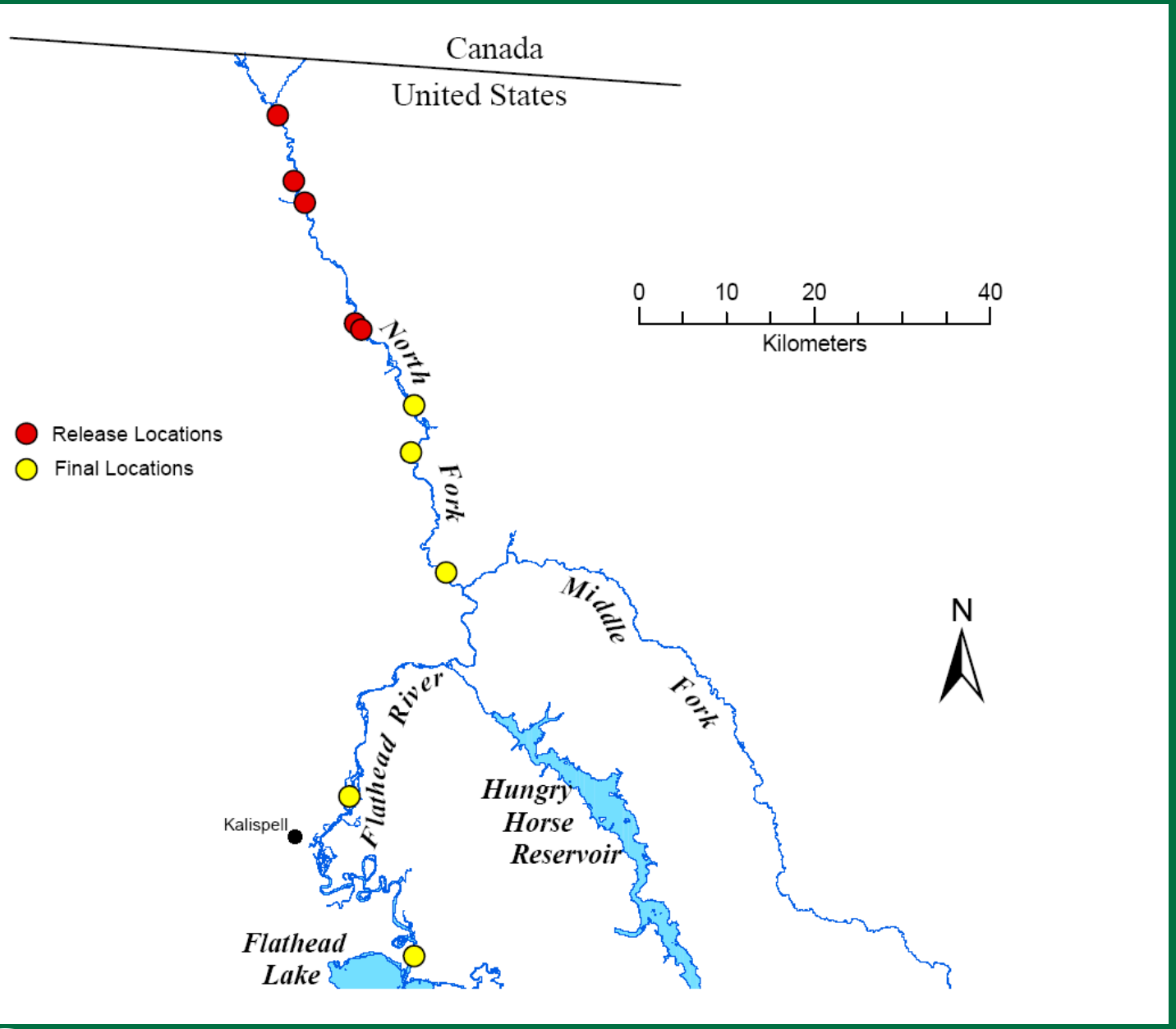
Muhlfeld and Marotz (2005)



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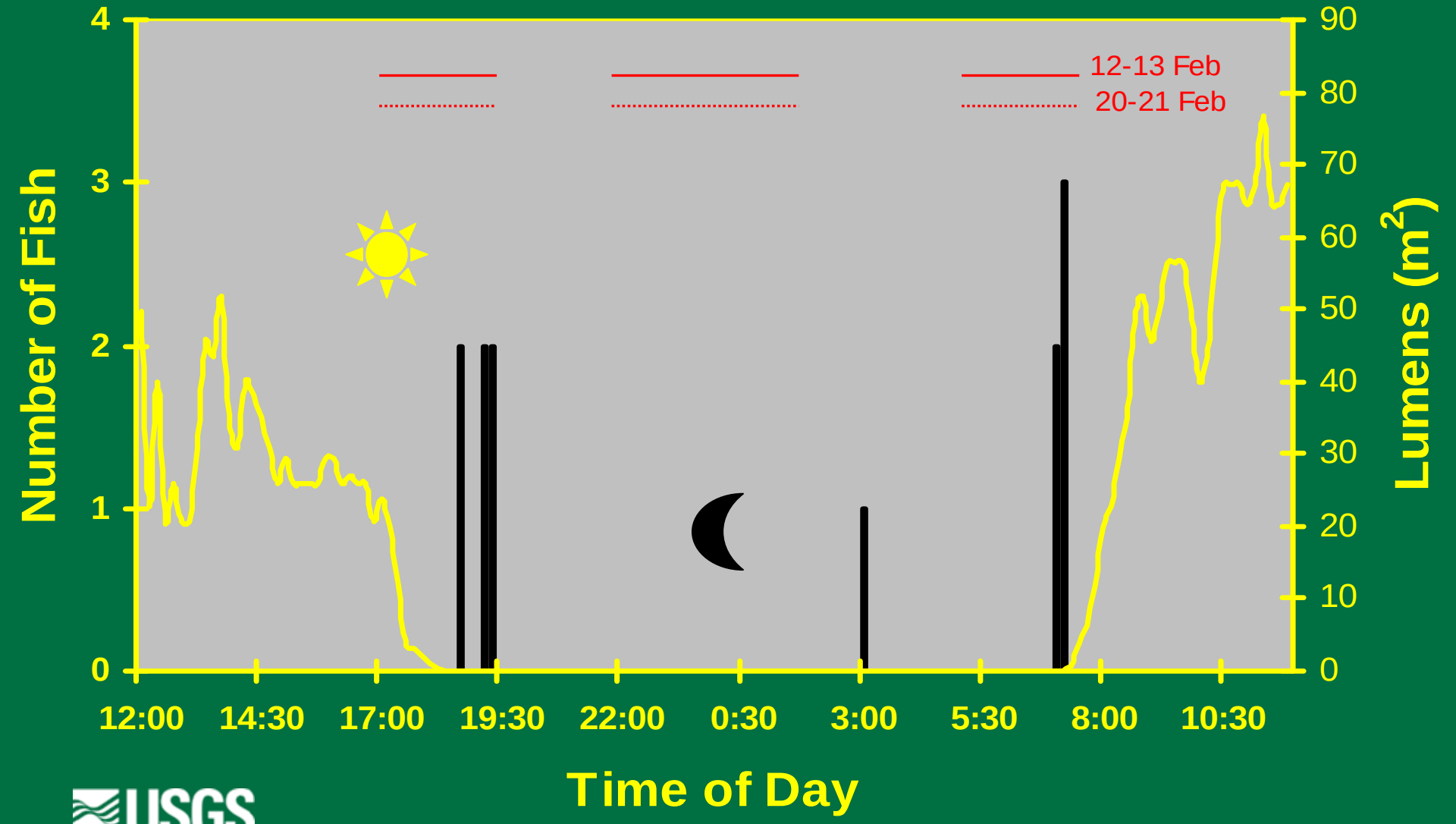
Muhlfeld and Marotz (2005)

Diel Movements



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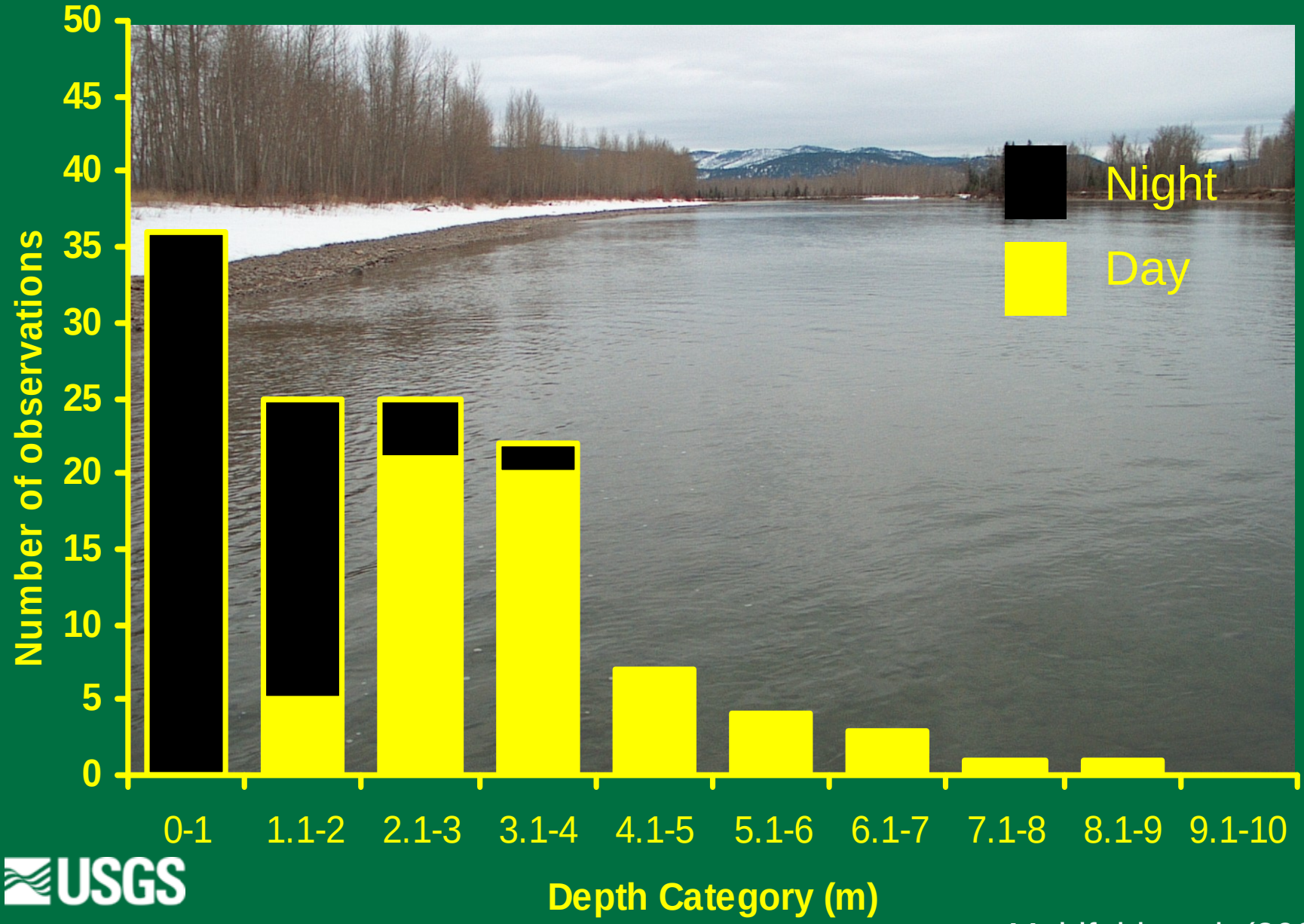
Muhlfeld et al. (2003)

Diel Habitat Use



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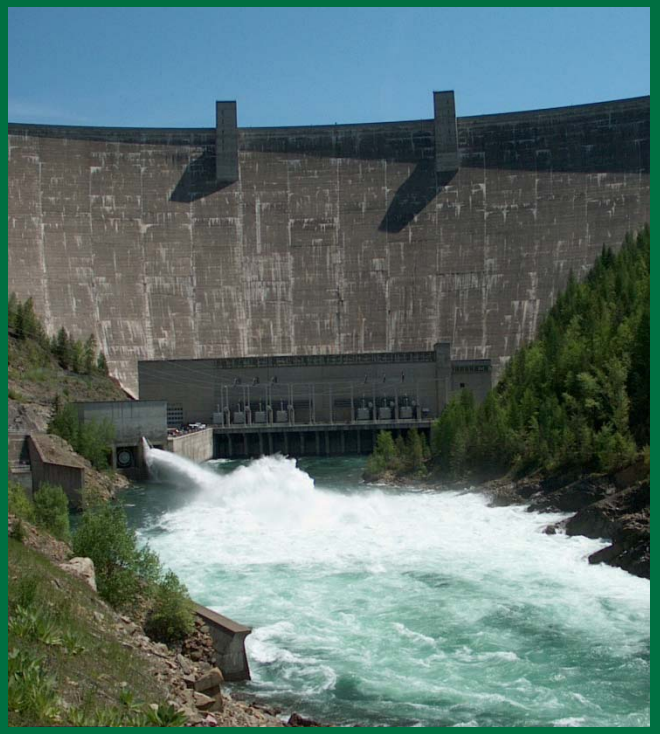
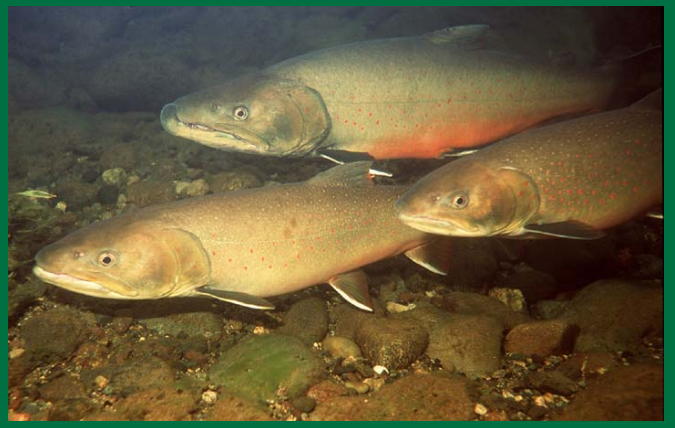
Muhlfeld et al. (2003)

Flathead River Instream Flow Investigation

Objectives:

- Quantify habitat-flow relationships for native salmonids
- Analyze impacts of alternatives and compare results
- Implement flow management strategies that minimize impacts to native fish





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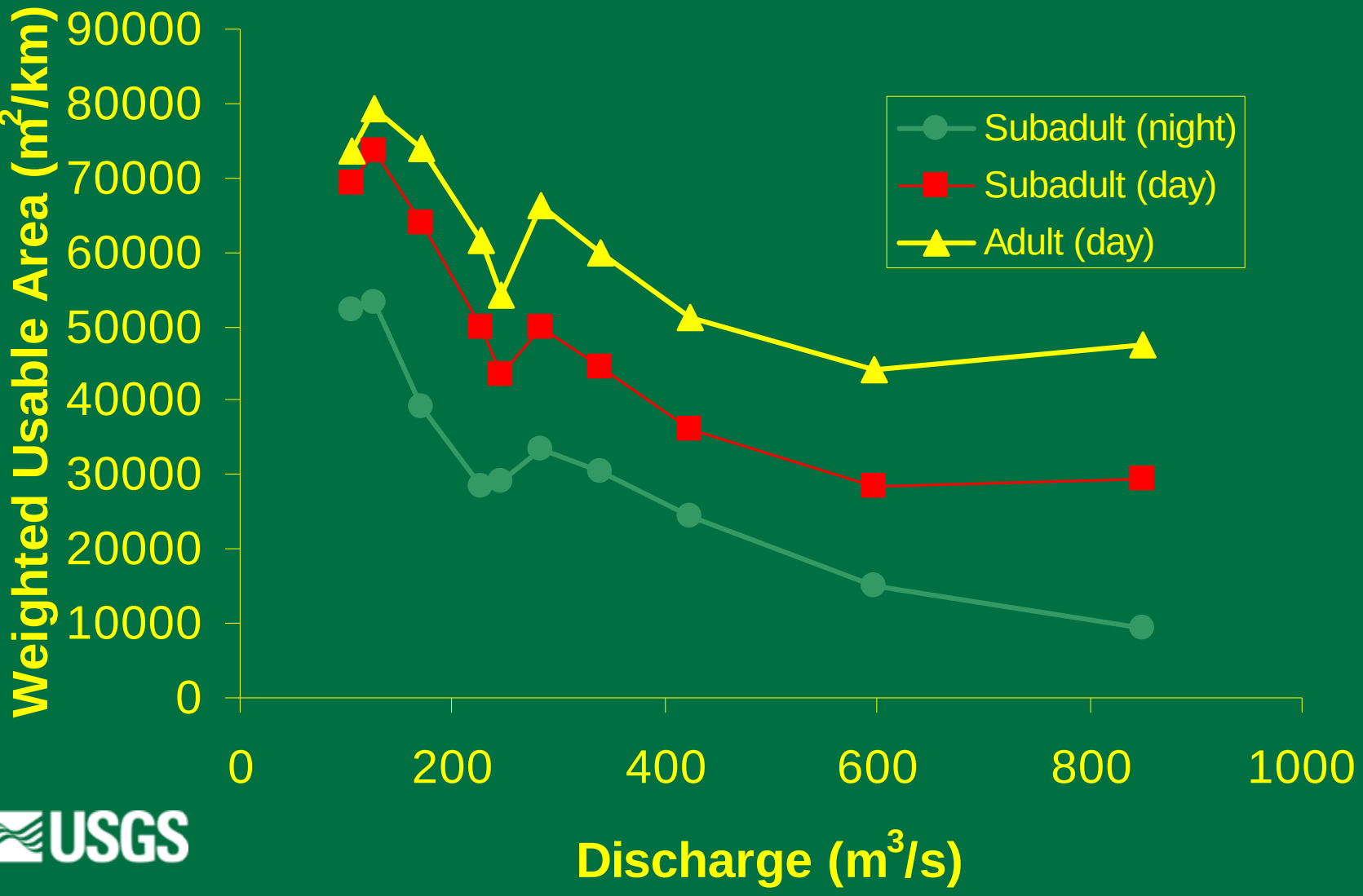
Habitat vs. discharge



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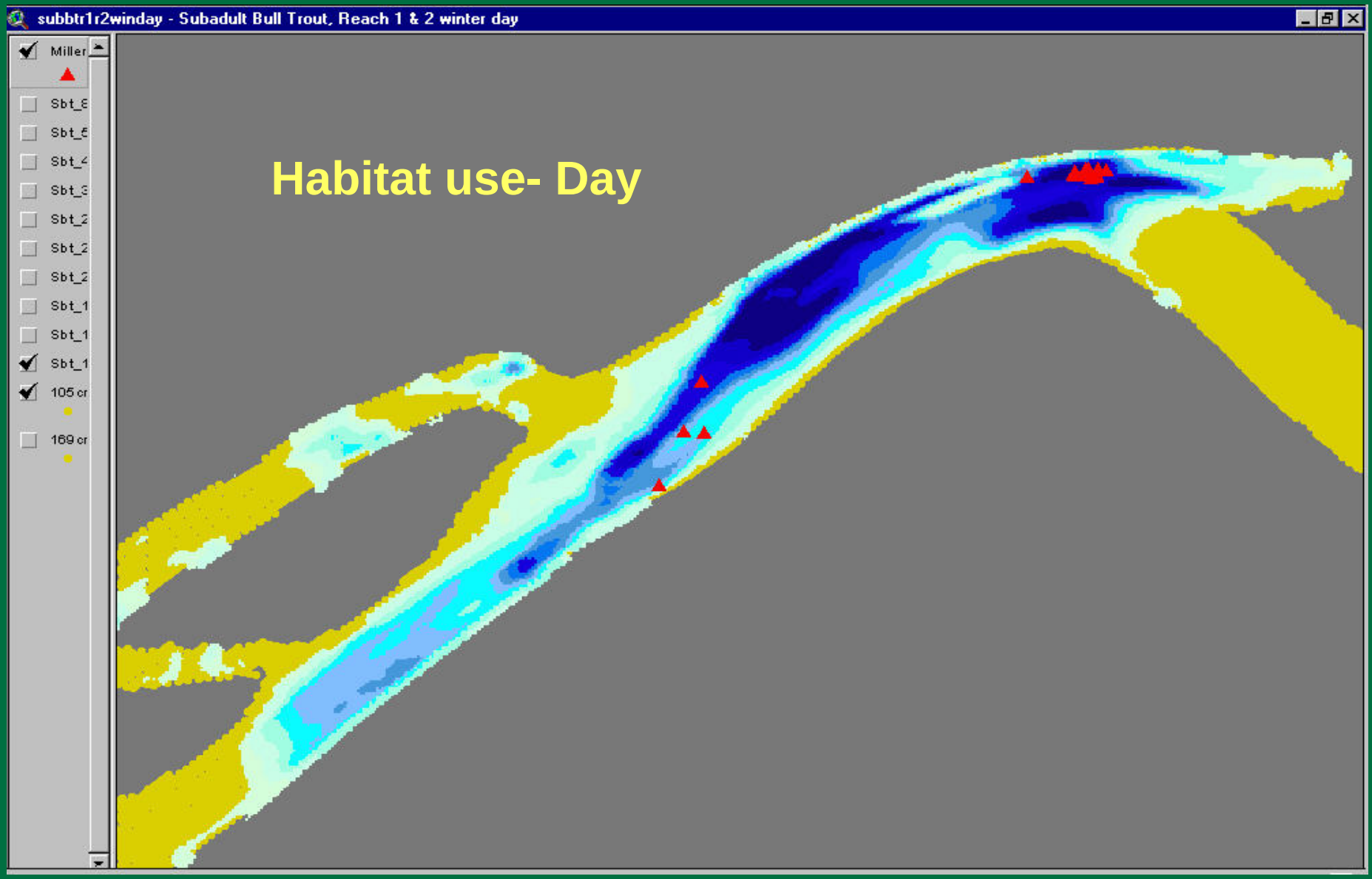
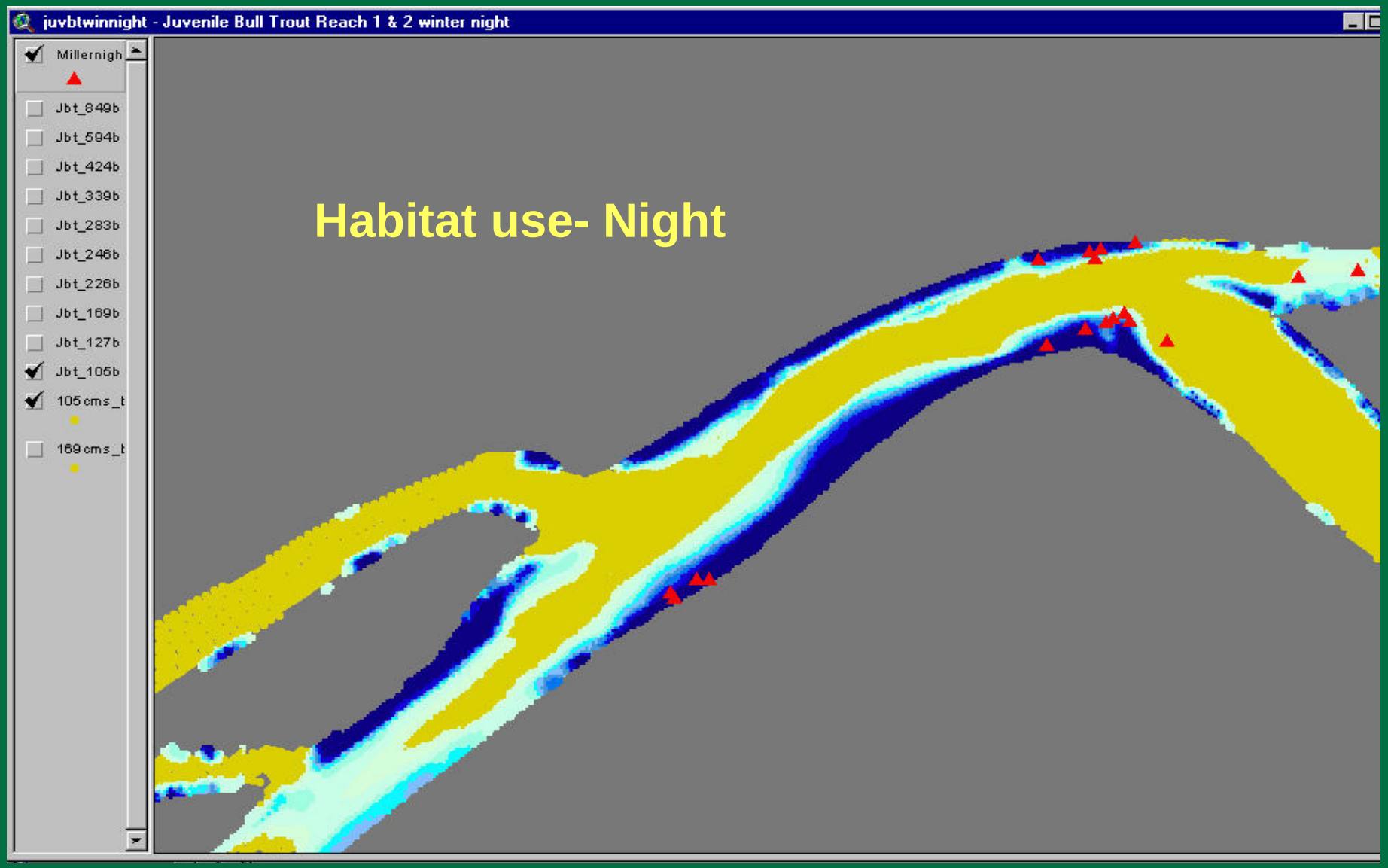
Graphic results



Graphic results



Northern Pike Bioenergetics Study

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

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Muhlfeld et al. (In press)

North Fork BC Research

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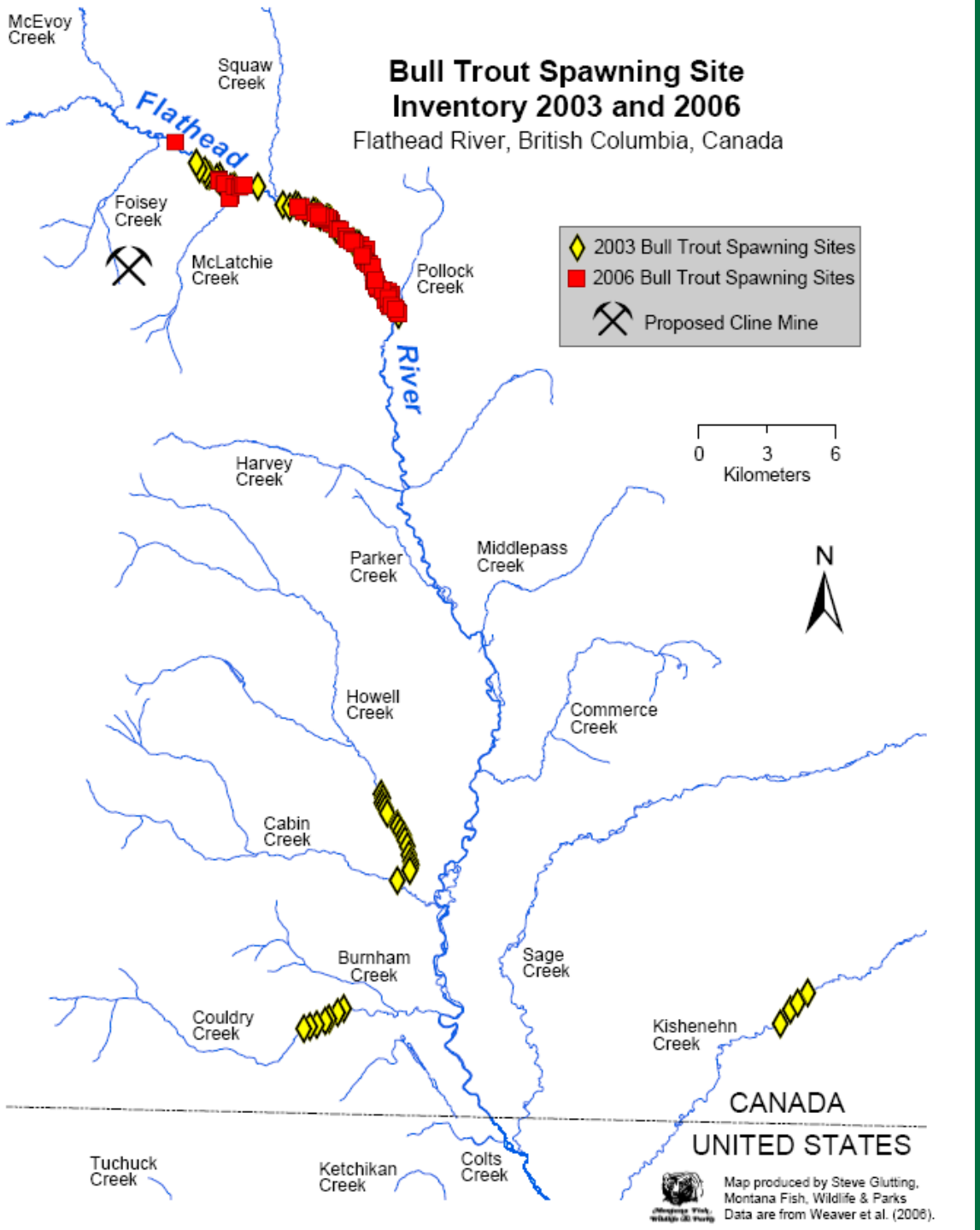
Habitat Degradation


Bull Trout Spawning Site
Inventory 2003 and 2006
Flathead River, British Columbia, Canada
McEvoy Creek
Squaw Creek
Flathead River
Foisey Creek
McLatchie Creek
Pollock Creek
2003 Bull Trout Spawning Sites
2006 Bull Trout Spawning Sites
Proposed Cline Mine
0 3 6
Kilometers
N
Harvey Creek
Parker Creek
Middlepass Creek
Howell Creek
Commerce Creek
Cabin Creek
Burnham Creek
Sage Creek
Couldry Creek
Kishenehn Creek
CANADA
UNITED STATES
Tuchuck Creek
Ketchikan Creek
Colts Creek
Map produced by Steve Glutting, Montana Fish, Wildlife & Parks
Data are from Weaver et al. (2006).

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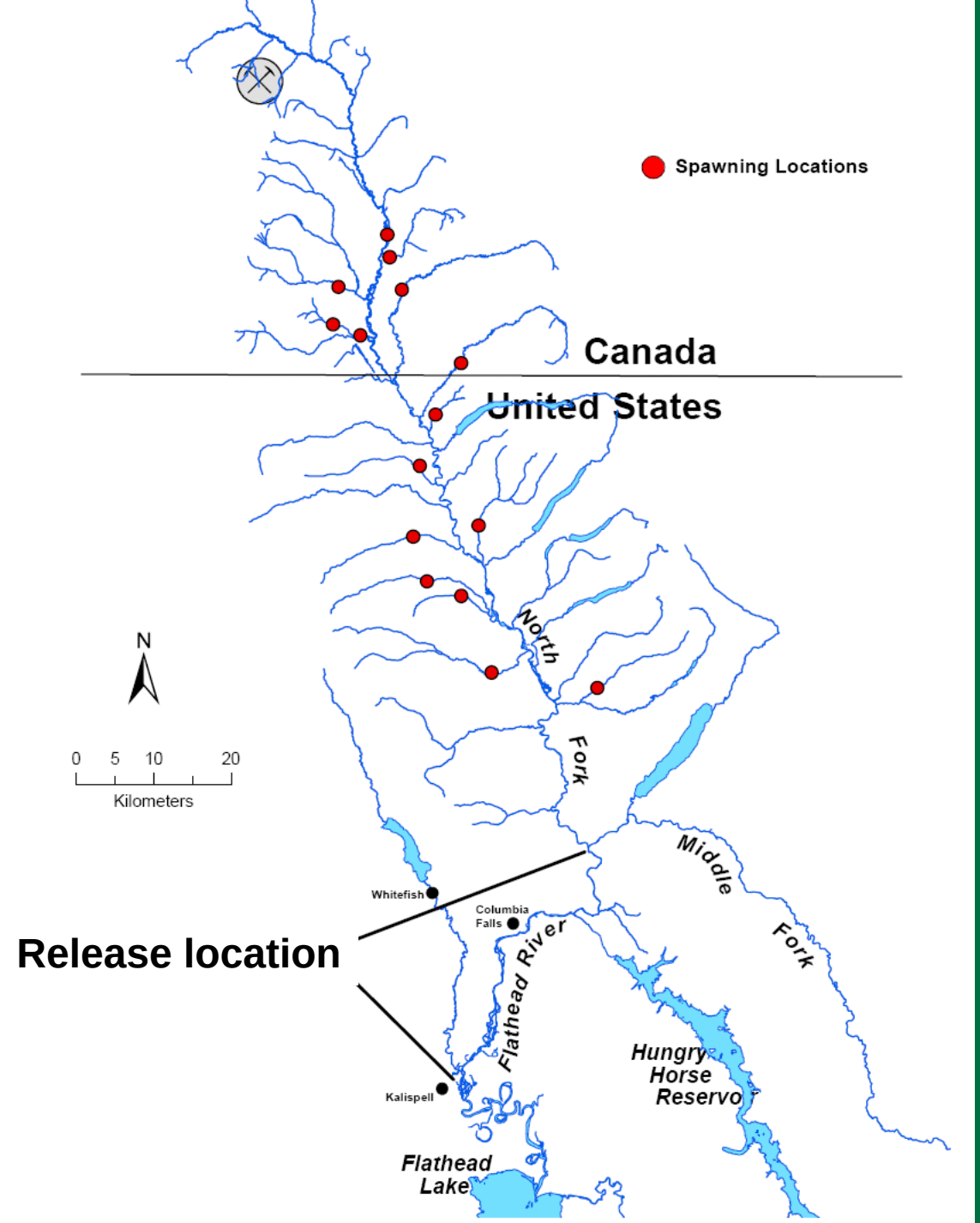

WCT Spawning Study

- Tracked 25 adult WCT into the North Fork during spawning
- 10 (40%) are known to have spawned in several BC tributaries
- 2 additional fish moved upstream of Polebridge and were lost
- Need a better understanding of the movements of transboundary fish populations

Fish distribution, genetics and habitat in the Foisey Creek drainage, British Columbia

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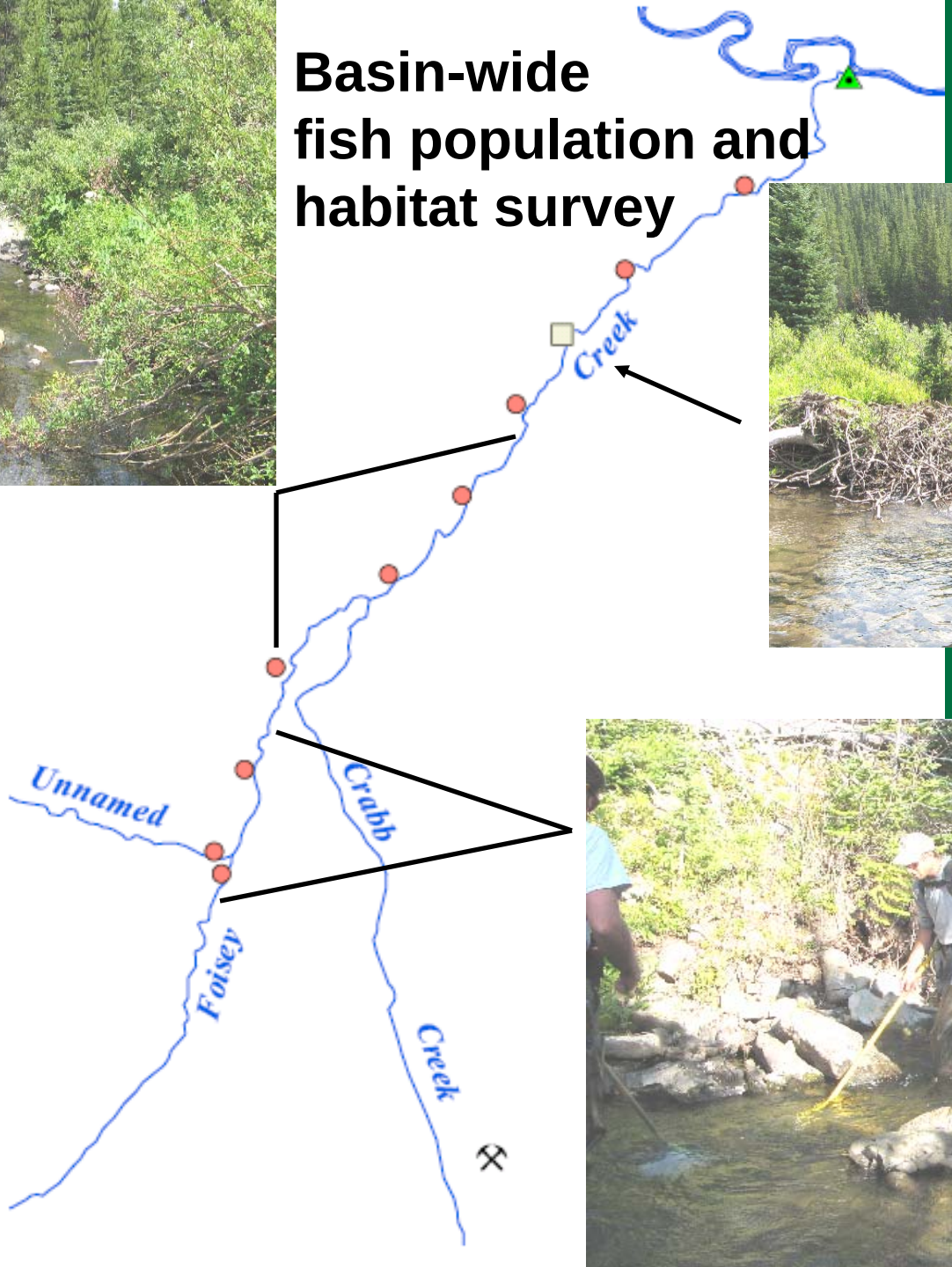
2006

Basin-wide fish population and habitat survey



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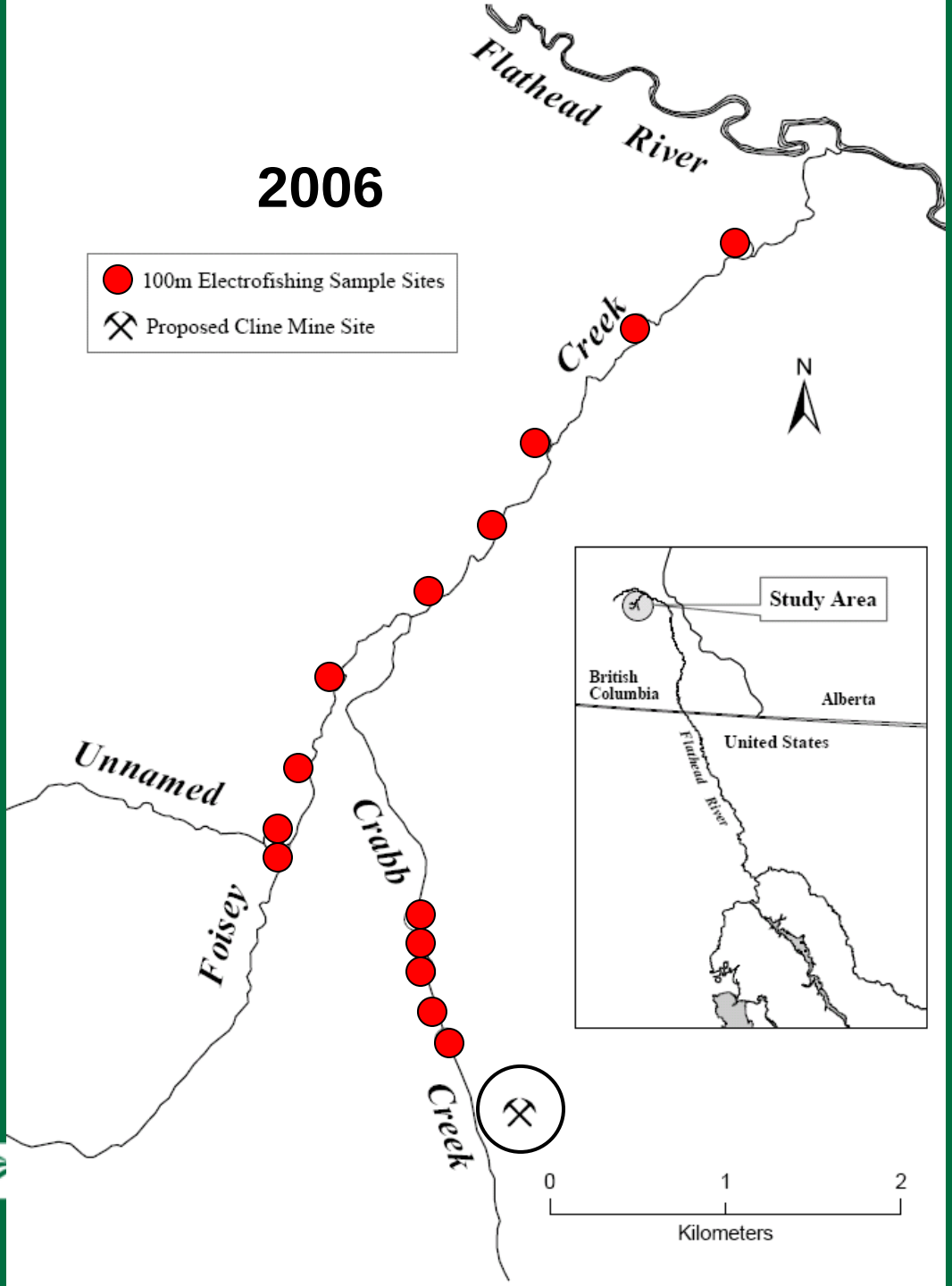

- At the mine site there is an intact native fish community
- In 2006, surveys found bull trout, westslope cutthroat trout and sculpin in Foisey Creek
- Westslope cutthroat trout were found in Crabb Creek