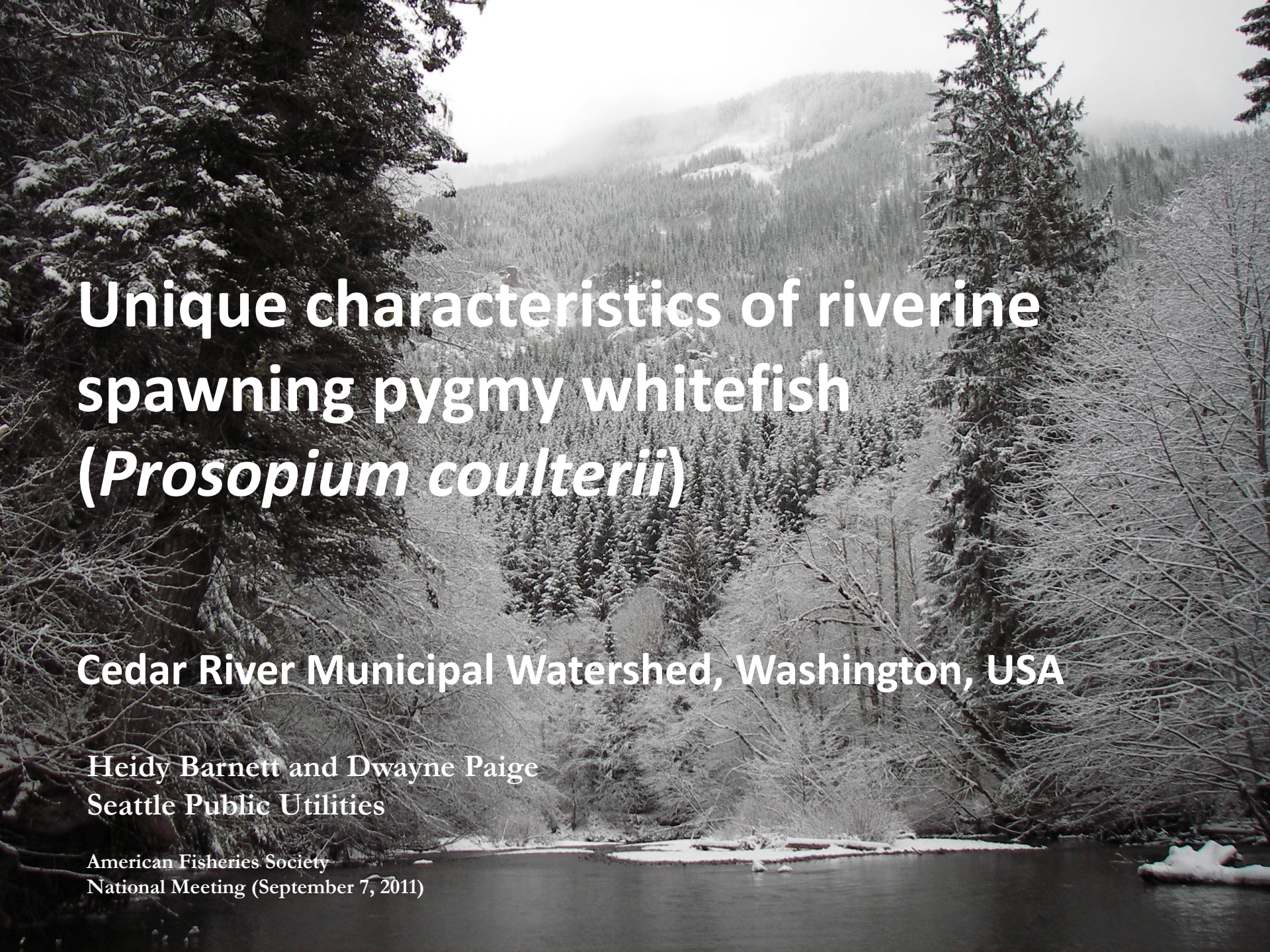
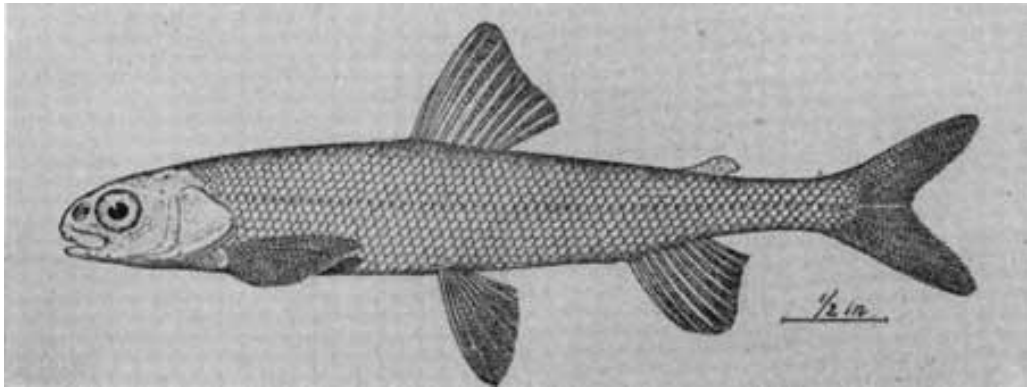


Unique characteristics of riverine spawning pygmy whitefish (*Prosopium coulterii*)

Cedar River Municipal Watershed, Washington, USA

Heidy Barnett and Dwayne Paige
Seattle Public Utilities

American Fisheries Society
National Meeting (September 7, 2011)



PYGMY WHITEFISH (*Prosopium coulterii*)

- Occur in deep lakes across North America – remnants of the last Ice Age
- Most often in oligotrophic lakes with temperatures <10°C.
- Max age = 9 yrs (typically less than 5 yrs)
- Mature 2-3 yrs of age
- Lake spawning and riverine spawning known

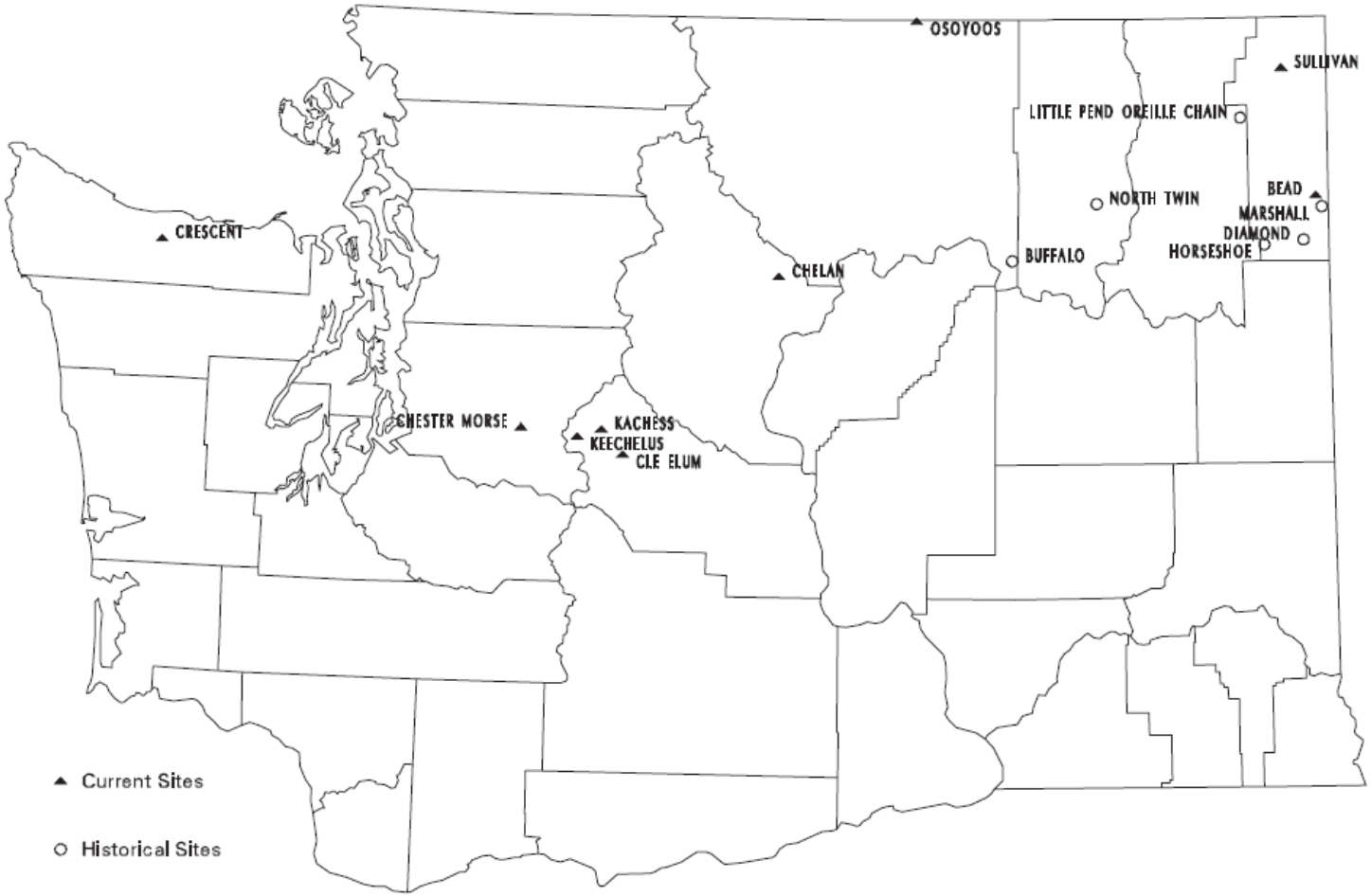
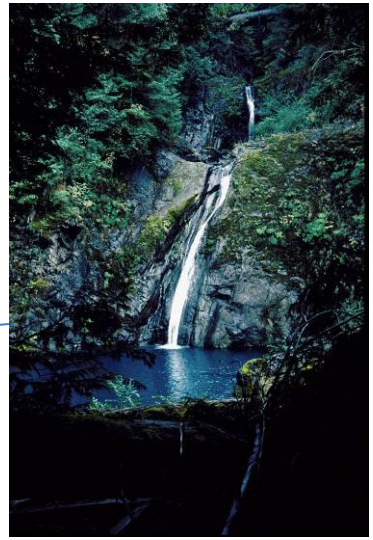


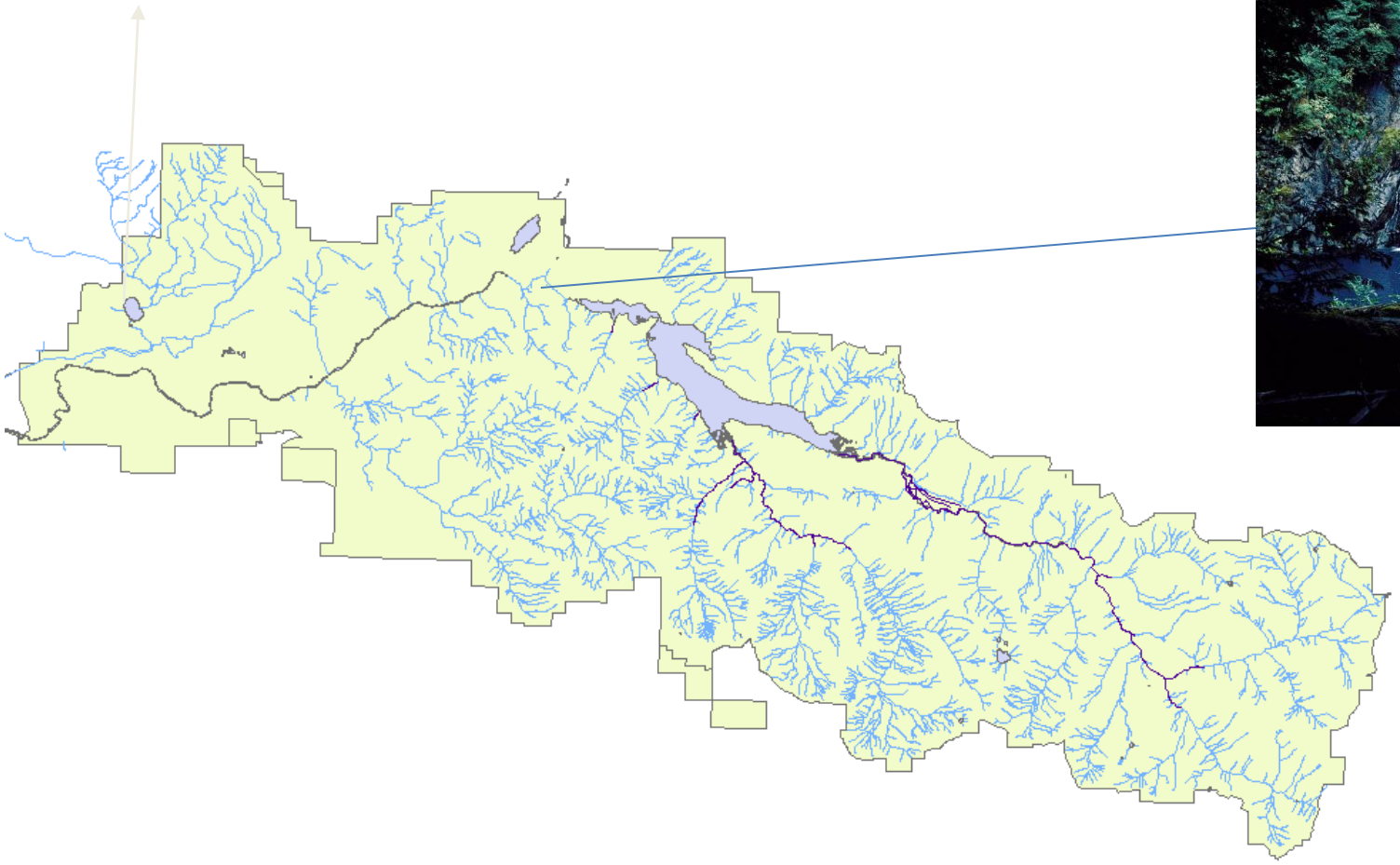
Figure 1. Historical and current distribution of pygmy whitefish in Washington.

Eliminated from a minimum of 40% of range in Washington

(From WA State Status Report for the Pygmy Whitefish Hallock and Mongillo, 1998)

Cedar River Municipal Watershed





- Managed to provide drinking water to Seattle and has a 50-year HCP (signed 2000)
  - No commercial harvest, active restoration (forest, aquatic, road decommissioning)
- Natural falls barrier downstream of Chester Morse Lake blocks anadromous/migratory species

Chester Morse Lake Fish Community

- Bull trout

- Rainbow trout

- **Pygmy whitefish – food source for adfluvial bull trout**

- Shorthead sculpin – food source for bull trout, distributed around shoreline

Project Objectives

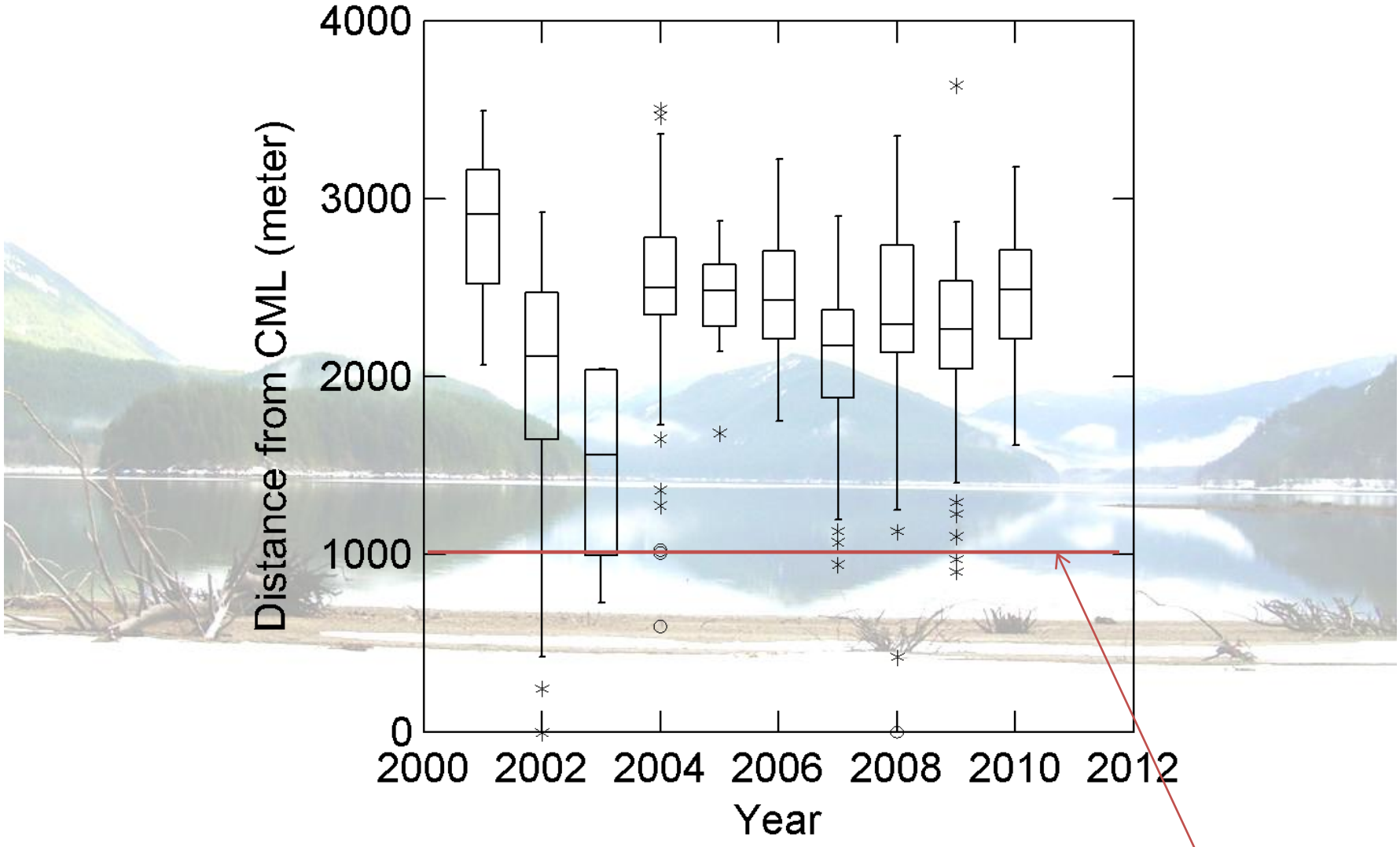
- Develop survey for approximating the number of spawners each year
  - Determine location of riverine spawning
  - Determine timing of the spawning run

- PIT tag individual fish to investigate individual characteristics
  - Residence time (♂ vs. ♀)
  - % return after one year
  - Number of yrs individual returns

Pygmy Whitefish Spawning School

Spawning Index Surveys

- Survey river at least twice weekly during spawning season
- Collect data
  - Location of school
  - Estimate of number of fish in each school
- Calculate area-under-curve index for annual spawning estimate (needed residence time)


4000
3000
2000
1000
0
Distance from CML (meter)
2000
2002
2004
2006
2008
2010
2012
Year
PIT tag antenna array

Between 12,000 to 25,000 spawners

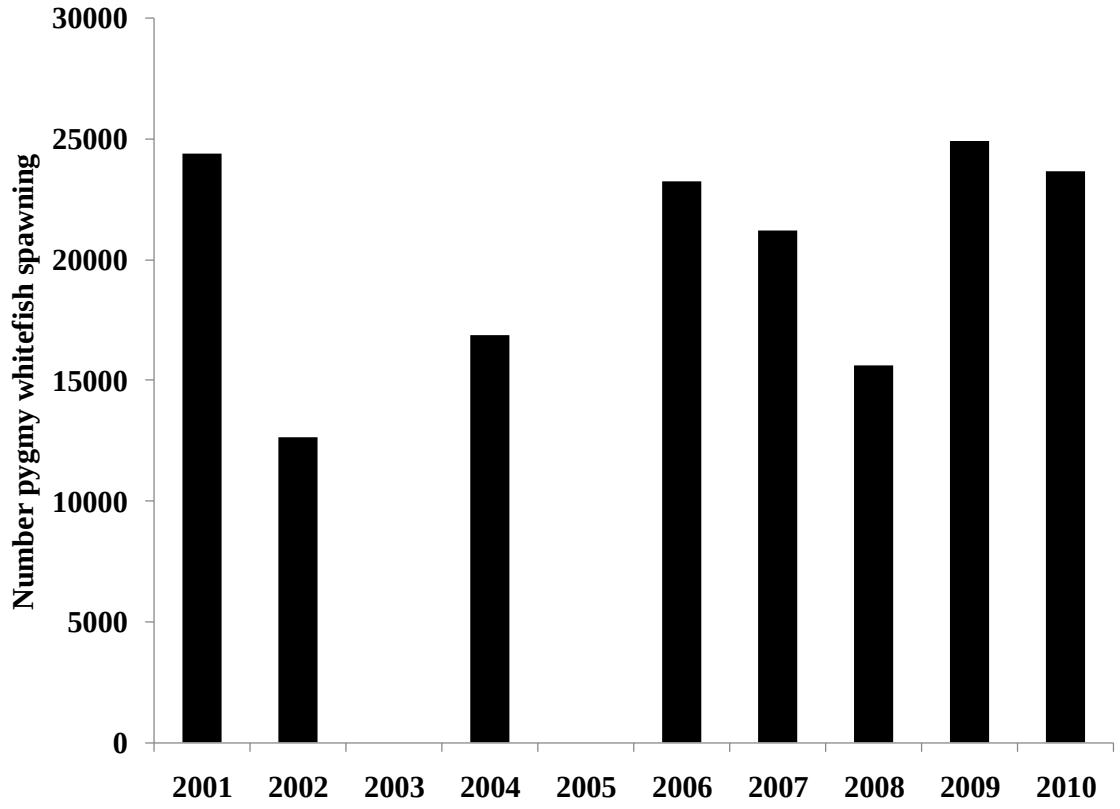


Figure 7.—Area-under-curve calculation using index count surveys of pygmy whitefish present in the Cedar River at the peak of the spawning run, 2001 - 2010. Access to the field site was blocked for much of the pygmy whitefish spawning run during 2003 and 2005.

Spawning – General Characteristics

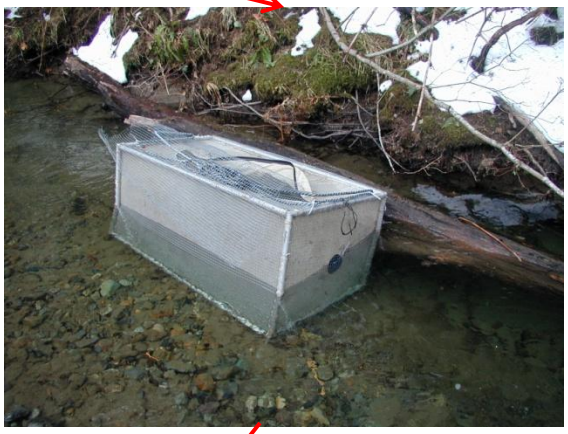
Year	Date start	Days in run	Temp at initiation (°C)	Avg. Temp during run (°C)	Range of Temp (°C)
2007	12/8	12	4	3.7	2.9 to 4.2
2008	12/1	15	2.7	3.0	1.5 to 4.0
2009	11/30	15	5.7	4.5	2.0 to 5.7
2010	11/29	10	4.9	3.3	1.6 to 4.9
AVERAGE		***13***		***3.7***	

Individual Spawning Behavior

- Timing of run – how long does an individual remain in the river (needed for AUC)
- What are sex ratios in schools?
- How many seasons do individuals return to spawn?

…..use PIT tag technology to address these questions.

Capture – Seine schools



Pygmy Whitefish PIT tagging

2006 = 424
2007 = 486
2008 = 580
2009 = 499
2010 = 523

TOTAL
PIT tagged= 2,512

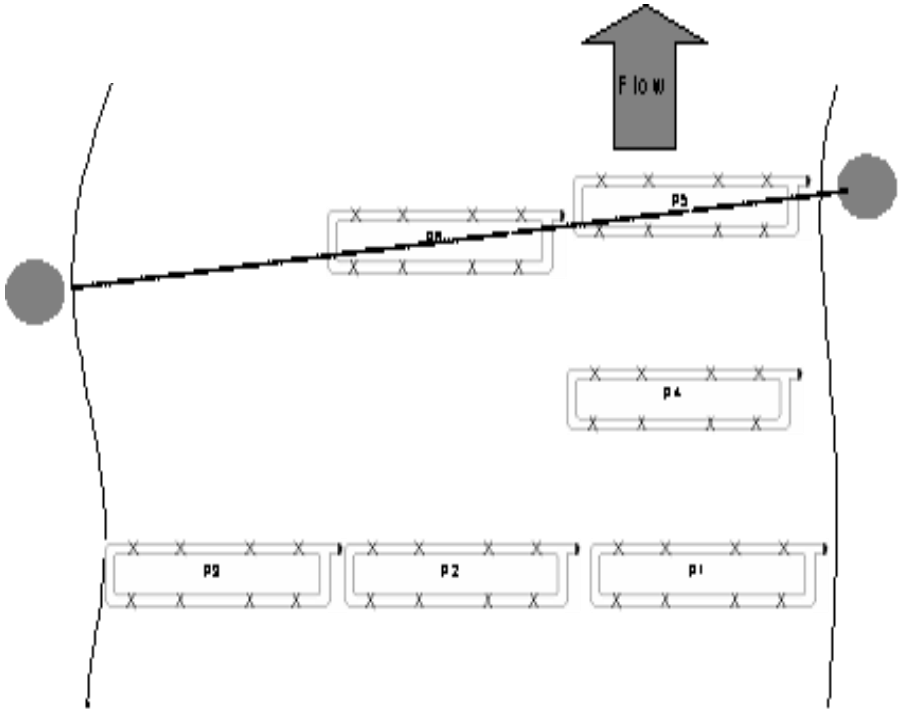
Sex Ratio in Schools

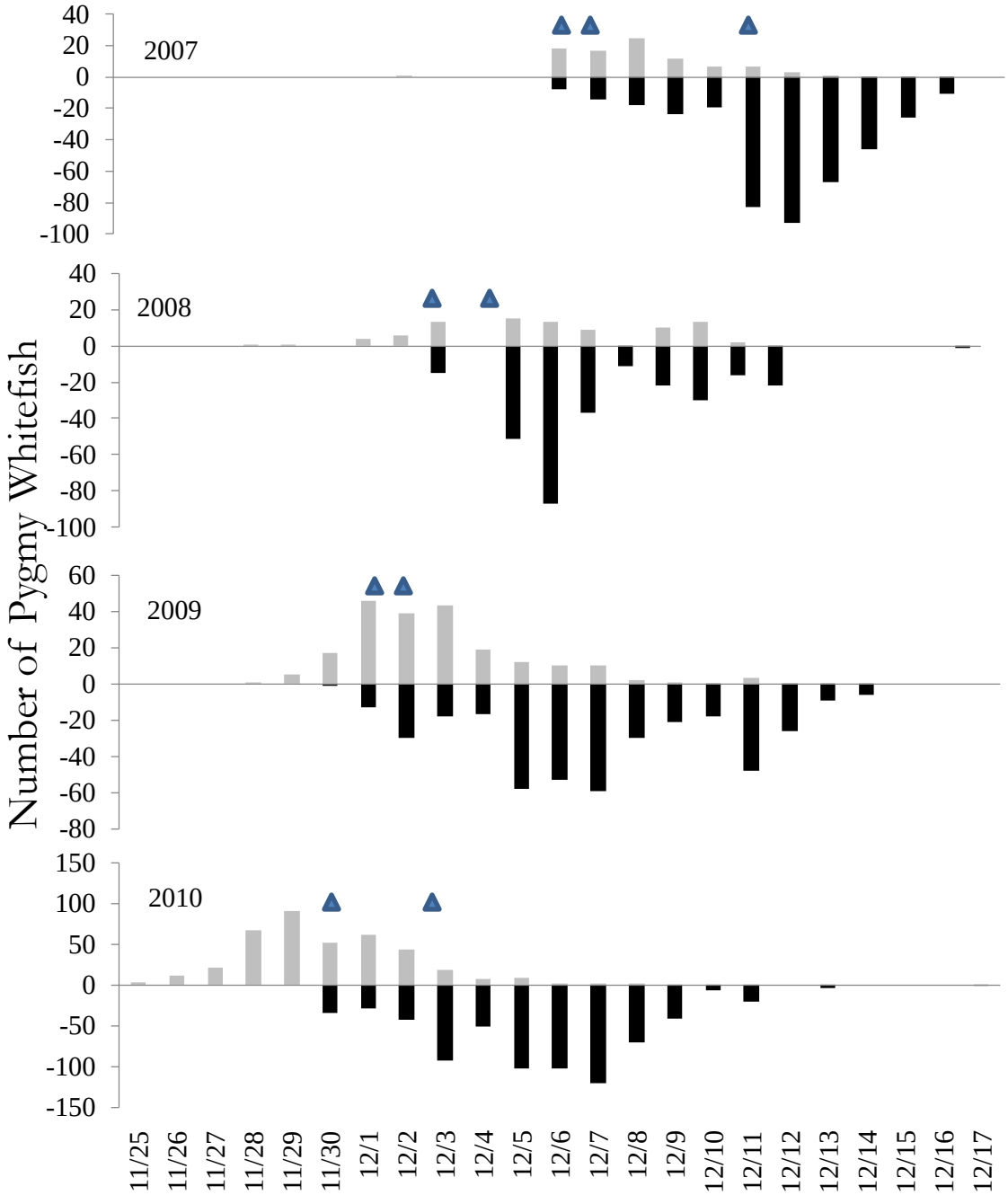
Sex ratios of pygmy whitefish collected from spawning schools in the Cedar and Rex rivers by year, 2007 - 2010.

Year	Fish Handled	Percent Female	Percent Male	Number of schools collected
2007	1,803	9.6	90.4	9
2008	1,595	3.2	96.8	12
2009	966	3.1	96.9	5
2010	678	5.8	94.2	5

PIT Tag Antenna array

~1km to Chester Morse Lake





- Allowed us to look at RESIDENCE TIME for an individual

– upstream movement

- downstream movement

- Tagging days

Females vs. Male?

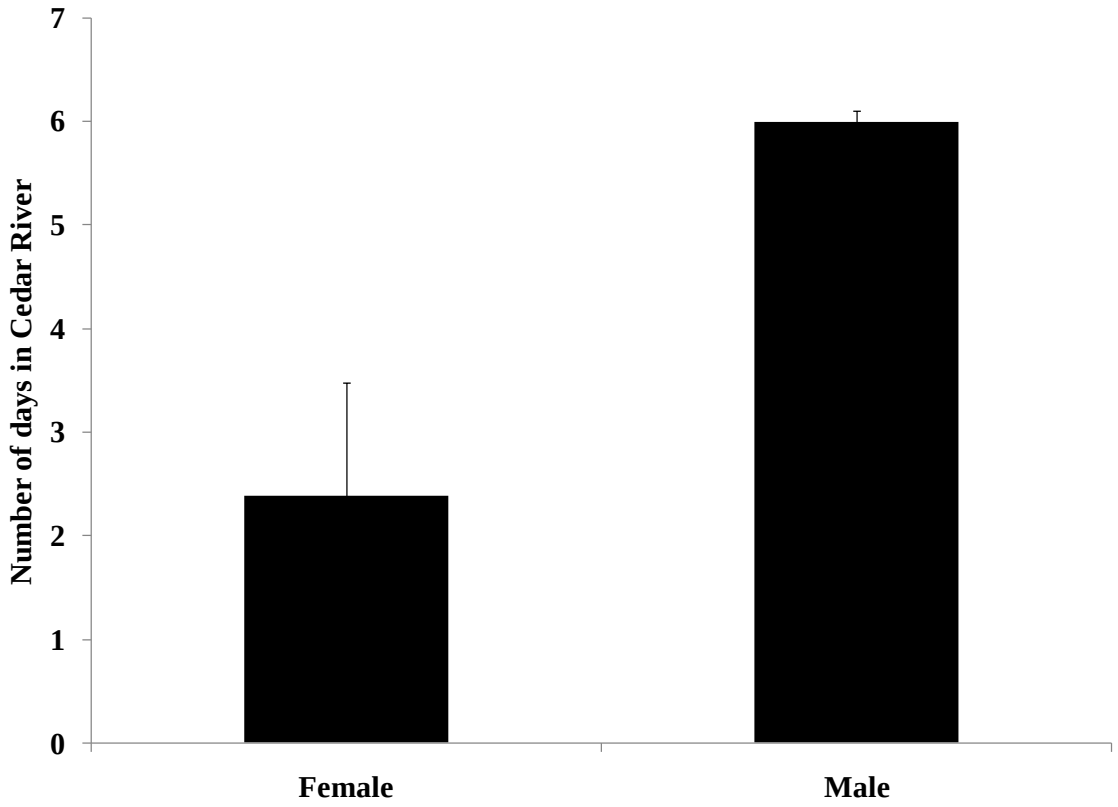
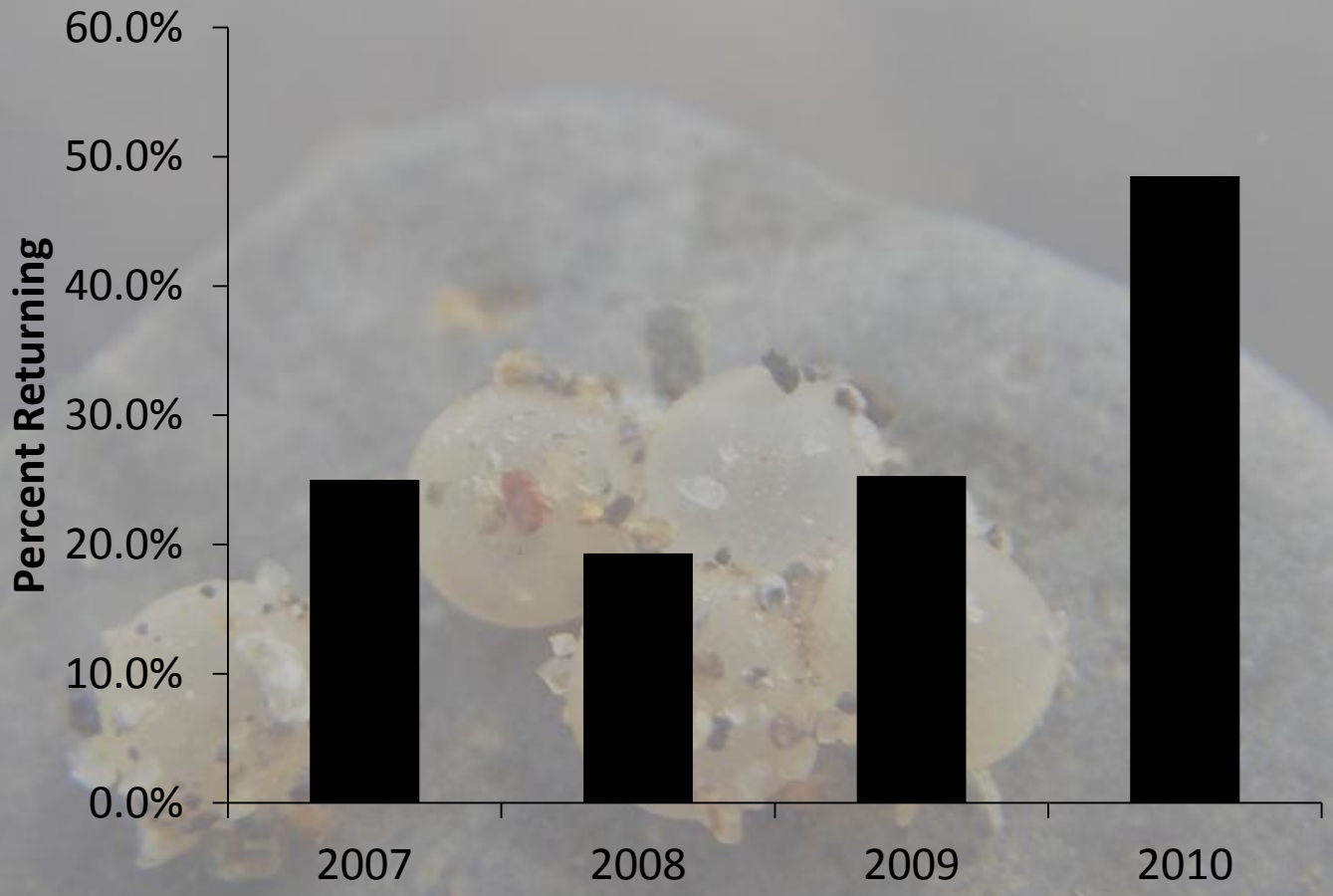


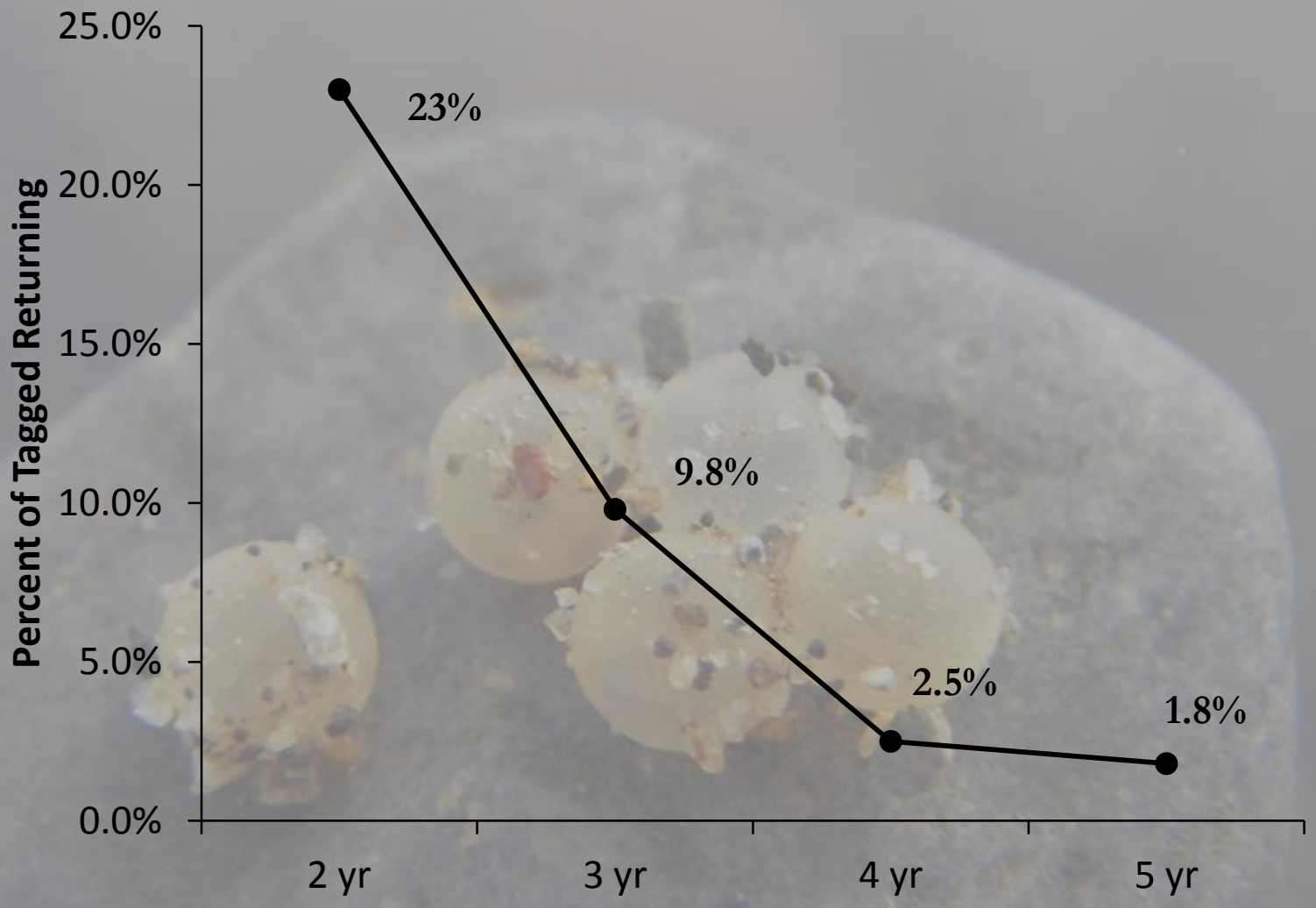
Figure 5.—Mean number of days (+SE) spent in Cedar River by PIT tagged female and male pygmy whitefish, 2007 – 2010 (data from all years combined).

Returning Individuals – 1 year post tagging



Study Average = 30%

Number of Years – Individual Return



Scale analysis = 3 to 4 most common age

Summary

- Developed index to assess spawning population
- Spawning Surveys
  - Within 3 km of lake system
  - Duration = ~2 weeks
- Individual
  - Residence time = 4.5 days
  - Sex ratio heavily skewed toward males
  - Individuals can spawn in at least 5 years

Acknowledgements

- Jim Erckmann, (SPU retired)
- Kyle Meier, Neil Slifka, Ryan Simmons, and Phil Peterson (Forest and Channel Metrics)
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