



# An investigation of Western Pearlshell Mussel (*Margaritifera falcata*) mortality in Bear Creek



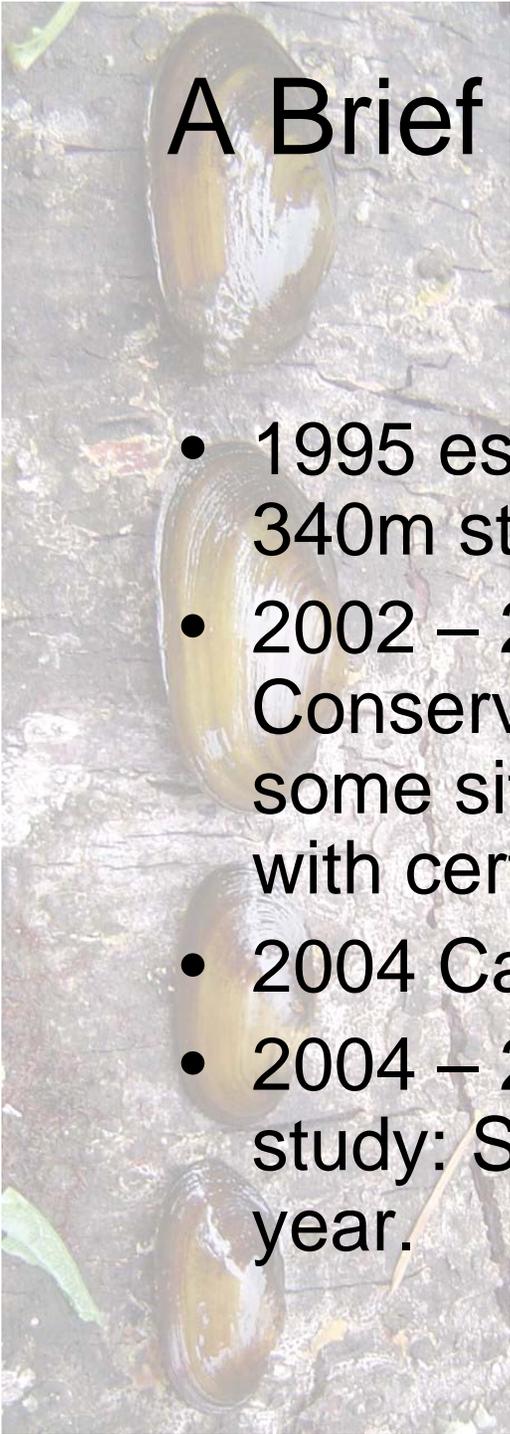
Arden Thomas, University of Washington  
King County Science Seminar  
October 31, 2007

# A quick introduction to the Western Pearlshell Mussel (*M. falcata*)



Photo: by CTUIR  
[www.xerces.org/aquatic/freshwater\\_mussels.htm](http://www.xerces.org/aquatic/freshwater_mussels.htm)

- Long lived > 100 years old
- Late sexual maturity
- Require a freshwater fish host (salmonids) for larval development and dispersal
- Cold, well oxygenated water
- Provide important ecosystem functions:
  - Water quality and nutrient cycling.  
Increase benthic productivity.



# A Brief History of Mussels in Bear Creek

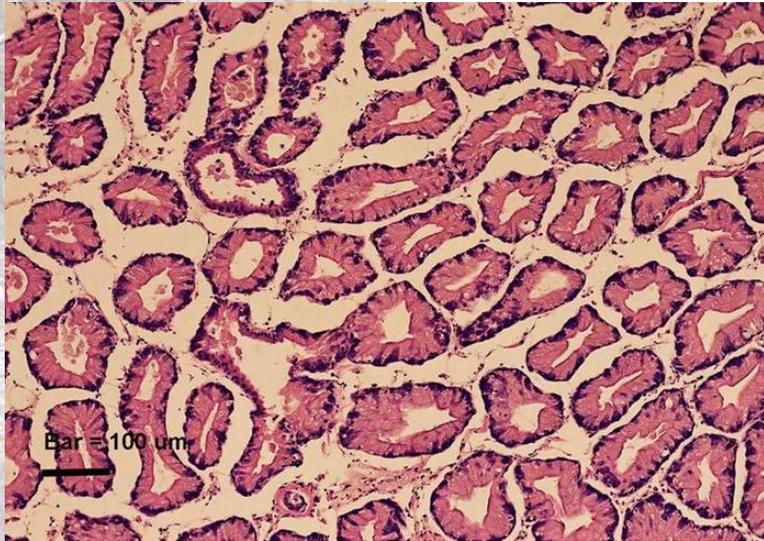
- 1995 estimated population size: 290,940 in a 340m study reach (Toy, 1998)
- 2002 – 2003 survey by Wild Fish Conservancy Northwest found decline at some sites, but not significant enough to say with certainty that numbers were decreasing.
- 2004 Caged Mussel Tissue Chemistry Study
- 2004 – 2005 King County mark recapture study: Small sample size, 93% mortality in 1 year.

# Conditions at Bear Creek

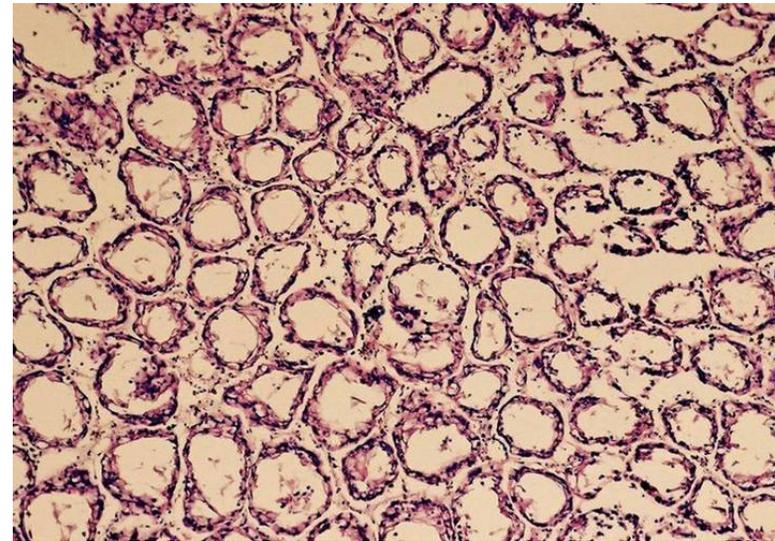
- Catastrophic decline
- Populations in Cottage Lake Creek suggests die-off isn't due to a simple relationship with urbanization
- Histology observations (2005) have indicated that the mussels are diseased



# Indications of Disease: Digestive Gland



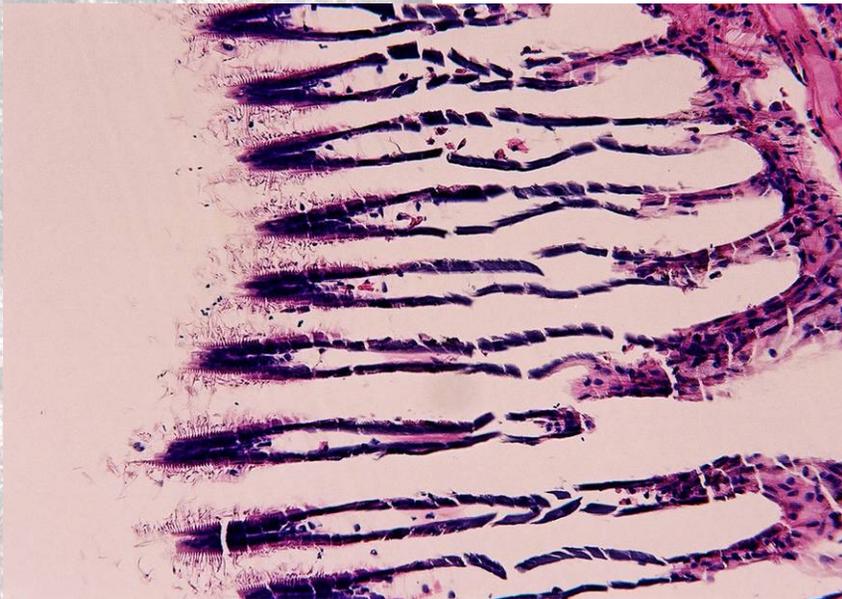
Stossel Creek



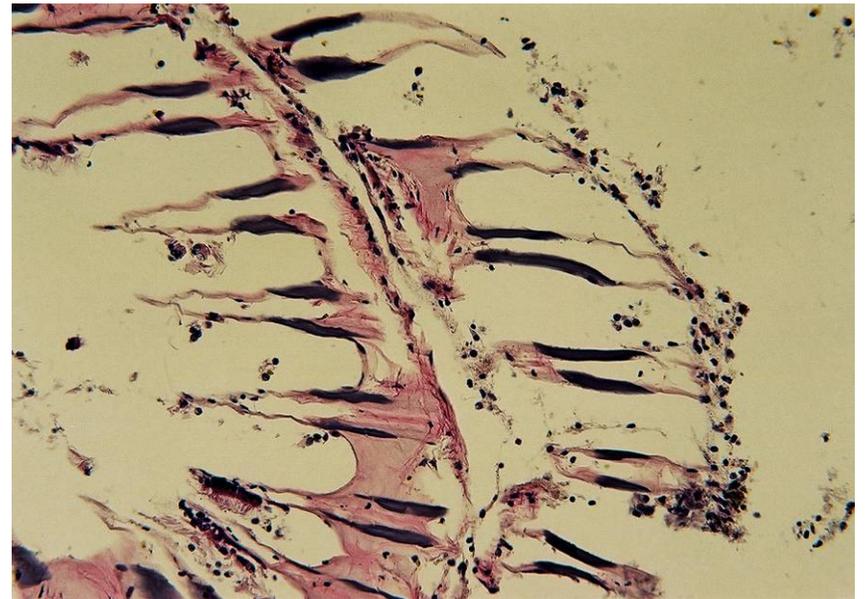
Bear Creek

Photos: Ralph Elston

# Indications of Disease: Gills

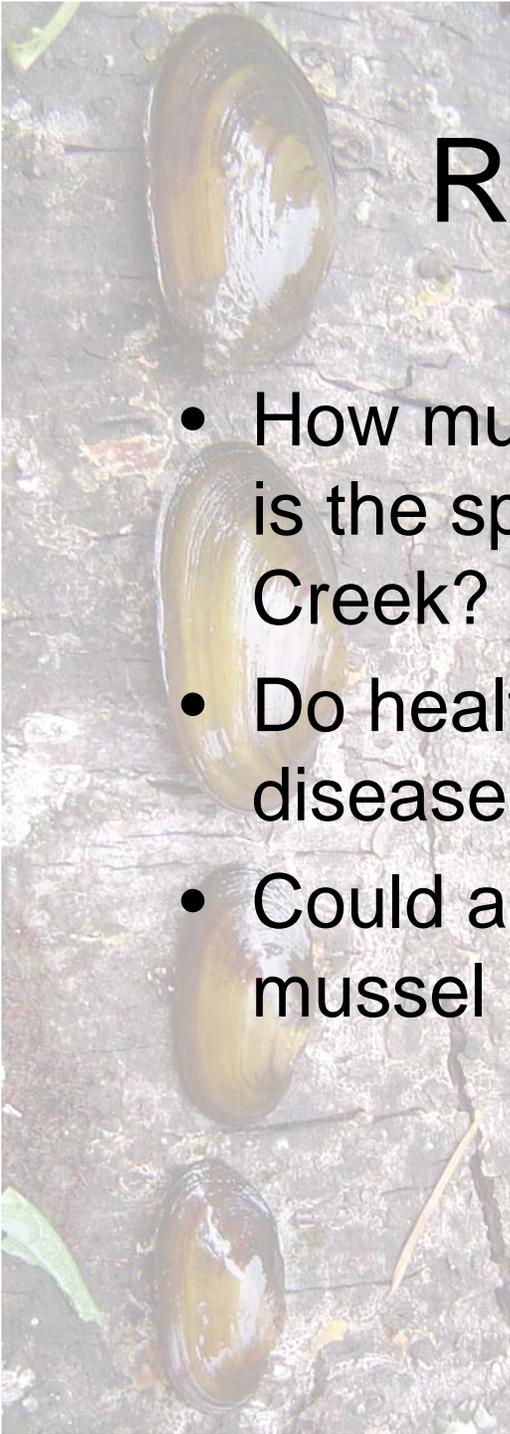


Stossel Creek



Bear Creek

Photos: Ralph Elston

A vertical photograph on the left side of the slide shows four freshwater mussels attached to a dark, textured rock surface. The mussels are arranged vertically, with their shells facing upwards. The shells are dark brown and have a slightly glossy appearance. The rock surface is uneven and has some small green algae or moss growing on it.

# Research Questions

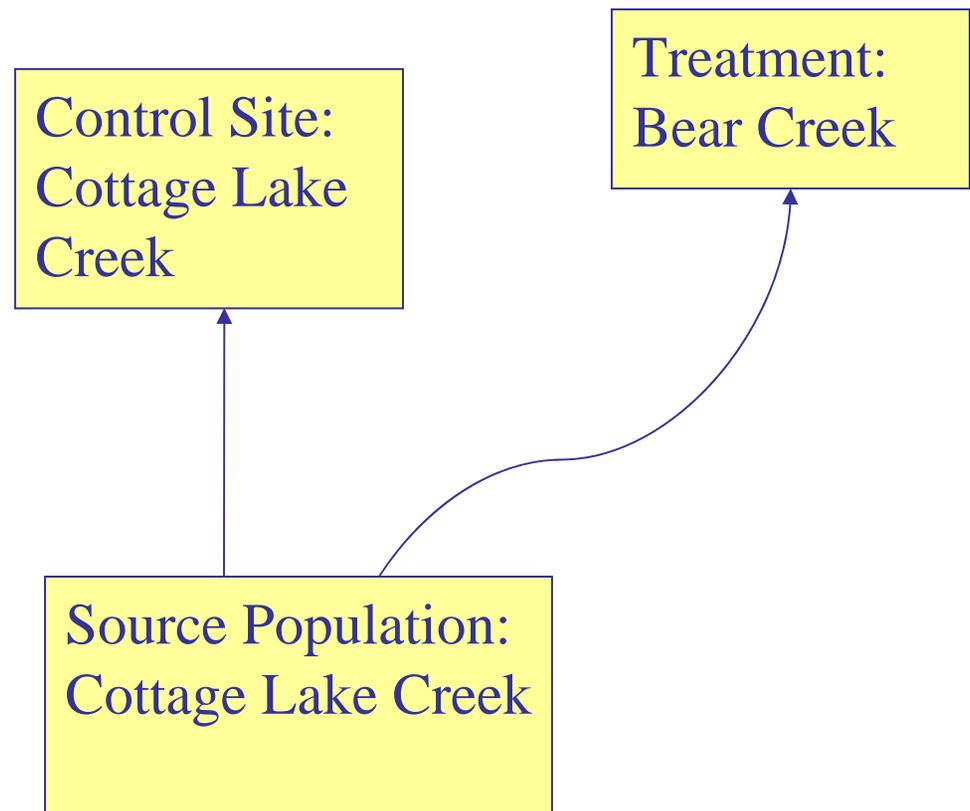
- How much mortality has occurred and what is the spatial extent of die-offs along Bear Creek?
- Do healthy freshwater mussels become diseased when relocated to Bear Creek?
- Could a toxic algae be responsible for mussel mortality?



# Freshwater Mussel Transplant

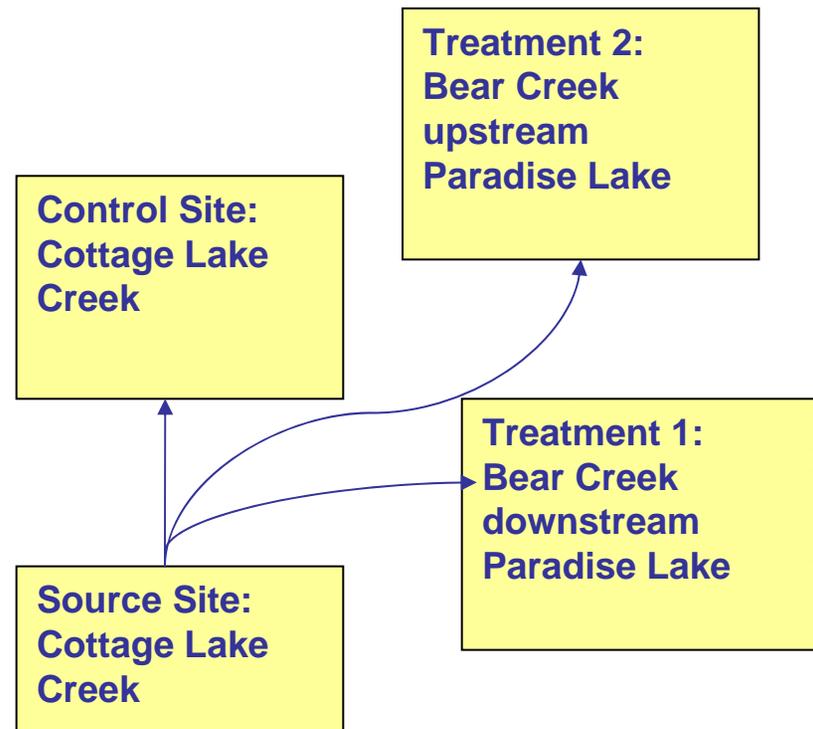
## Phase 1 – Dec. 2006

- 90 mussels Cottage Lake Creek (control)
- 90 mussels Bear Creek downstream of Paradise Lake (treatment)
- 11 months monitoring
- Each month sample 3 mussels from each site



# Freshwater Mussel Transplant Phase 2 – May 2007

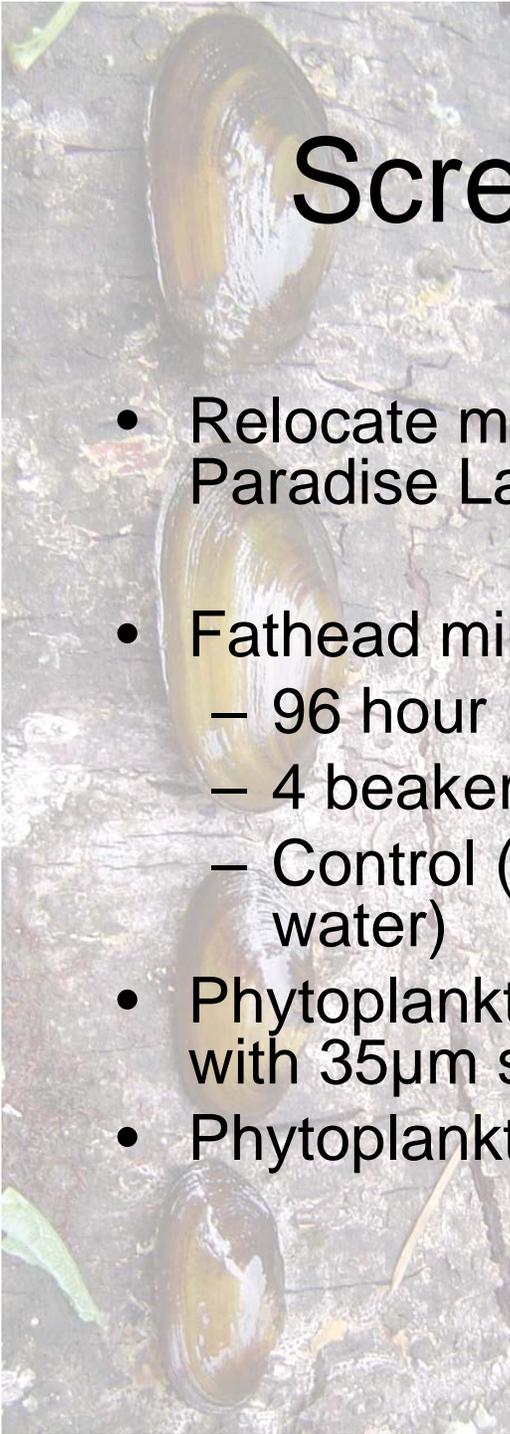
- 45 mussels Cottage Lake Creek (control)
- 45 mussels Bear Creek downstream of Paradise Lake (treatment 1)
- 45 mussels Bear Creek upstream of Paradise Lake (treatment 2)
- 5 months monitoring
- Each month sample 3 mussels from each site



# Freshwater Mussel Transplant

- Mortality
- Histology Observations
  - Digestive Gland
  - Gill Structure
  - Reproductive Stage
  - Indication of a Parasite
- Glycogen Levels



The image shows three mussels attached to a dark, textured rock surface. The mussels are brownish-grey with a slightly iridescent sheen. They are arranged vertically, with one at the top, one in the middle, and one at the bottom. The background is a light, slightly blurred white.

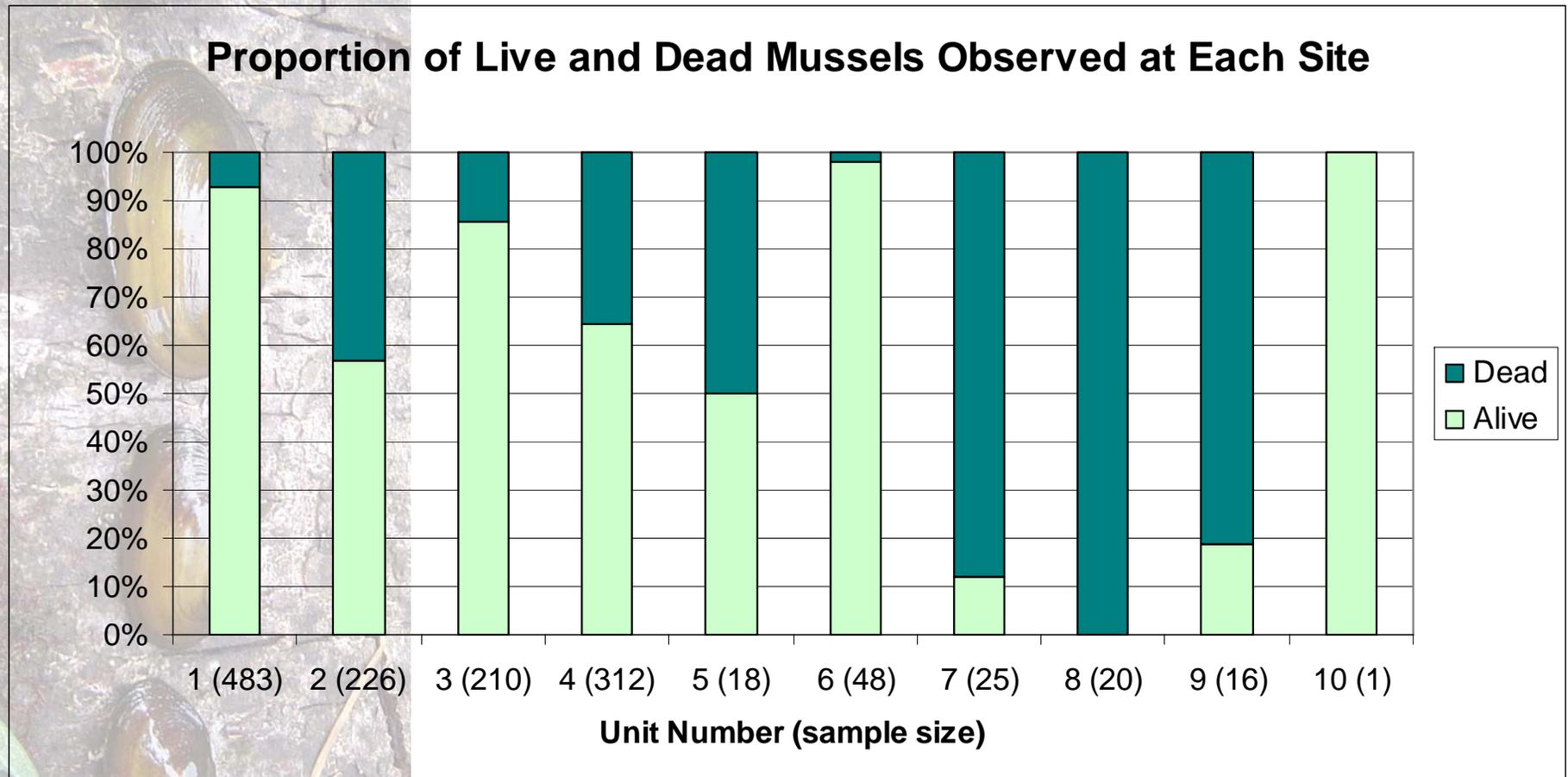
# Screening for Toxic Algae

- Relocate mussels both upstream and downstream of Paradise Lake
- Fathead minnow toxicity testing July – September
  - 96 hour
  - 4 beakers: 10 fish each
  - Control (well water) and treatment (Paradise Lake water)
- Phytoplankton in Paradise Lake sample concentrated with 35 $\mu$ m sieve.
- Phytoplankton analysis

# Preliminary Observations

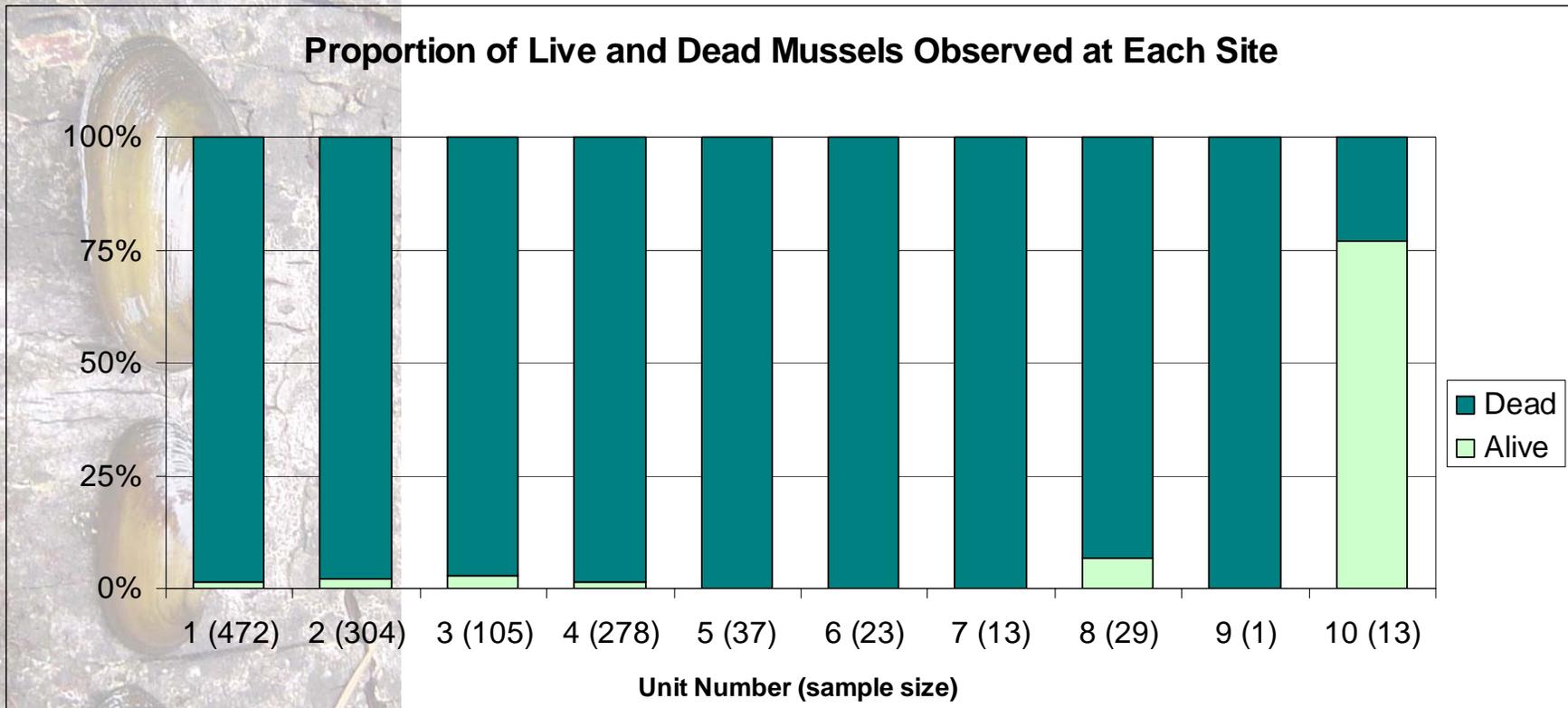


# Preliminary Observations: Baseline Data

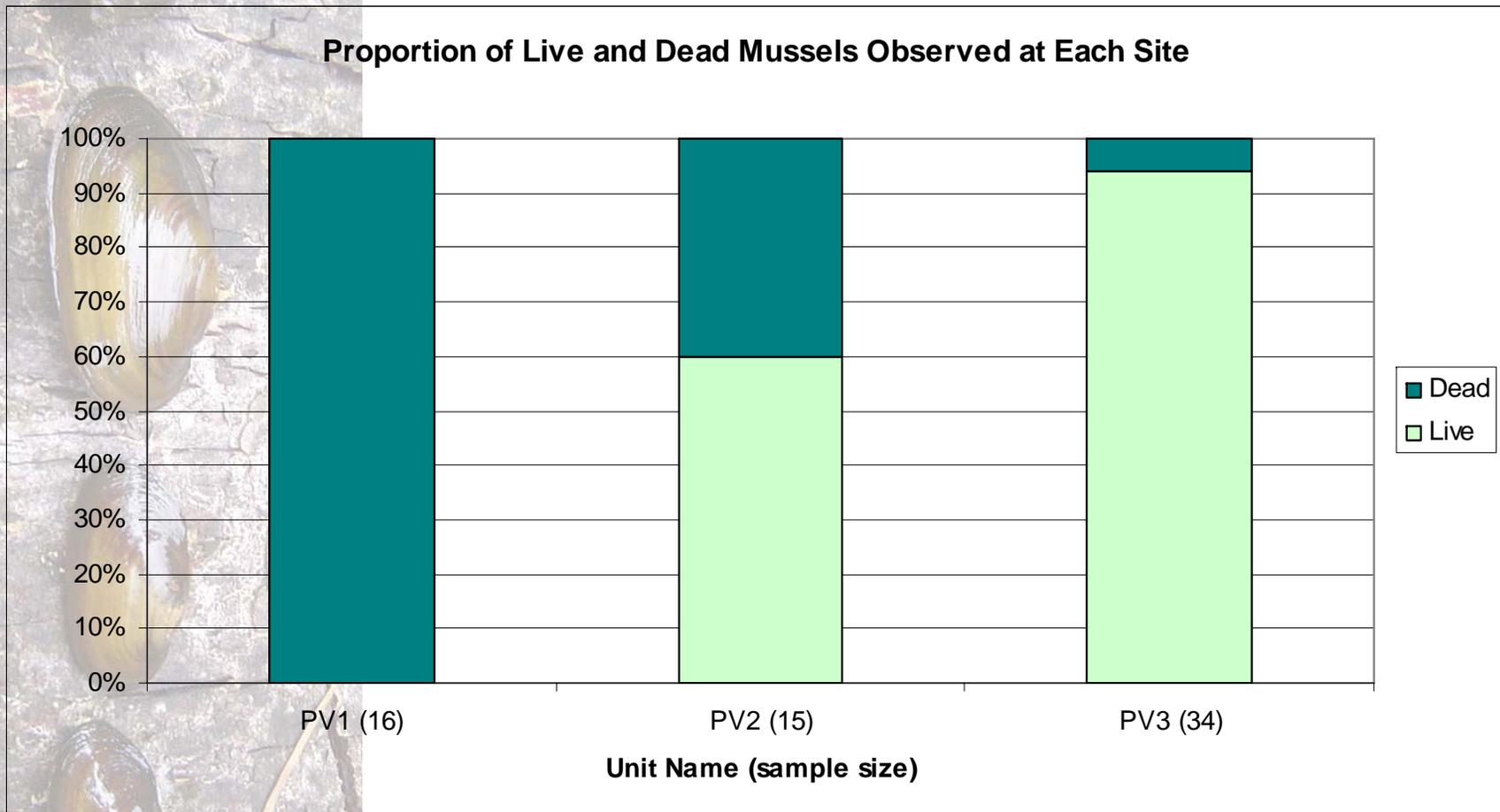


Data from Wild Fish Conservancy Northwest

# Preliminary Observations: 2007 Mussel Survey



# Preliminary Observations: Mussel Survey Upstream Paradise Lake

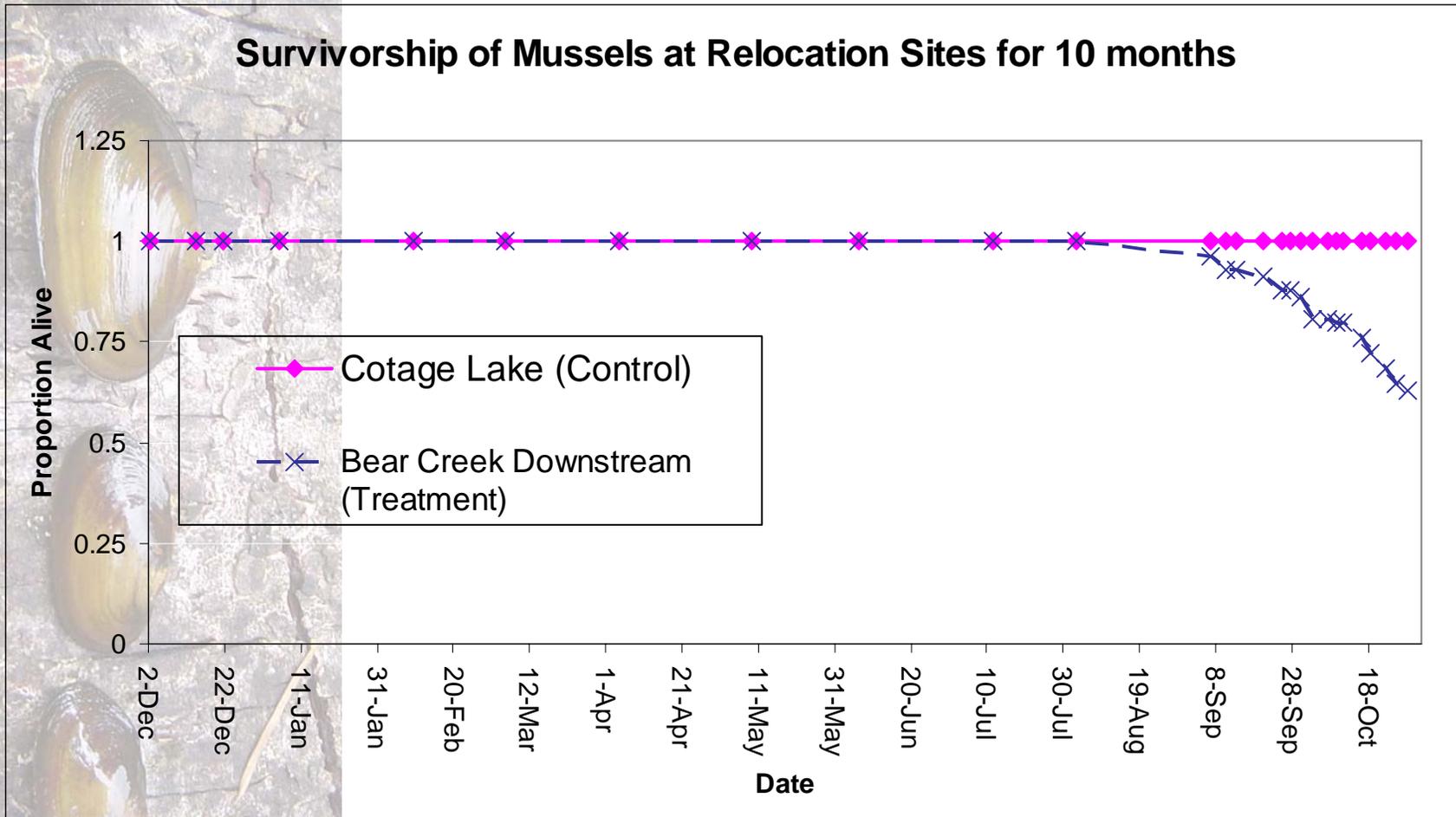


# Preliminary Observations: Mussel Survey

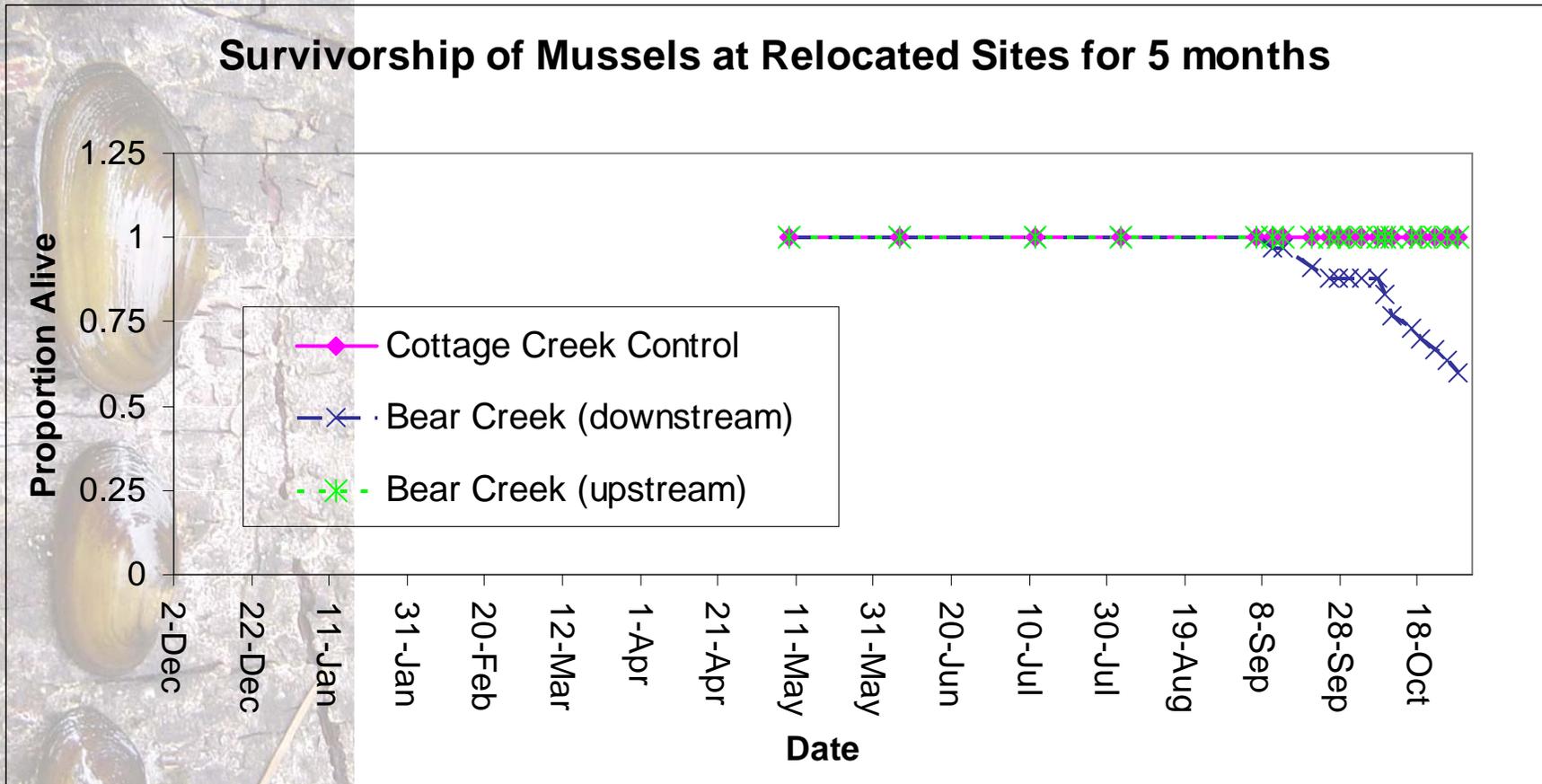
- The most upstream mussel bed was composed exclusively of shells.
- There were many indications of predation
  - Shells in piles on bank
  - Scratch marks



# Preliminary Observations: Mussel Relocation



# Preliminary Observations: Mussel Relocation





# Preliminary Observations: Lake Monitoring

## **Fathead Minnow Testing**

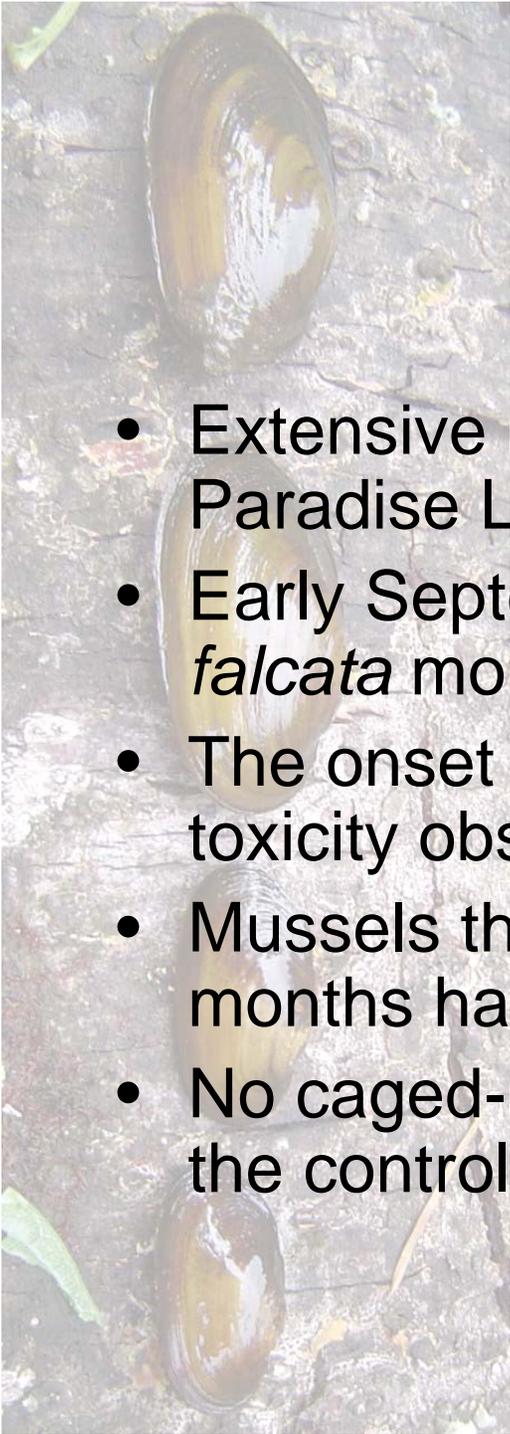
July: 16, 30

August: 6, 13, 20, 27

September: 4\*, 10, 11, 17

*\* 100% mortality observed,  
microcystin test: not detected*

Mussel samples are being tested for Euglena toxicity.



# Take Home Mussel Relocation

- Extensive mortality in Bear Creek downstream of Paradise Lake
- Early September marked the onset of *Margaritifera falcata* mortality downstream of Paradise Lake.
- The onset of mussel mortality corresponded with toxicity observed in Paradise Lake.
- Mussels that have been in the site for both 5 and 10 months have experienced mortality.
- No caged-mussel mortality has been observed at the control site or upstream of Paradise Lake.

# Thank You!

- My committee: Carolyn Friedman, Susan Bolton, Mike Brett, Deb Lester
- King County – Bob Brenner, Jim Simmonds, Mary Maier, Dean Wilson
- King County Environmental Lab; Aquatic Toxicology Section
- Sally Abella, King County
- Northwest Fisheries Science Center:
  - Mark Myers, Maryjean Willis, Paul Olson
- Frank Morado, Alaska Fisheries Science Center
- Bear Creek Residents: Wendy Walsh, Shirley Doolittle-Egerdahl, Dick Schaezel, Jonathan Morrison
- Wild Fish Conservancy Northwest: Jamie Glasgow
- Friedman Lab and KC interns: Nate, Lisa, Chemine, Colleen, Brent, Glenda, Mehgan, Kate



A photograph of a forest stream. The water is dark and still, reflecting the surrounding greenery. Several large, moss-covered logs are scattered across the stream and along the banks. The forest is dense with various types of trees and ferns. The word "Questions?" is written in white text across the middle of the image.

Questions?