A freshwater relocation experiment to investigate *Margaritifera falcata* mortality in Bear Creek

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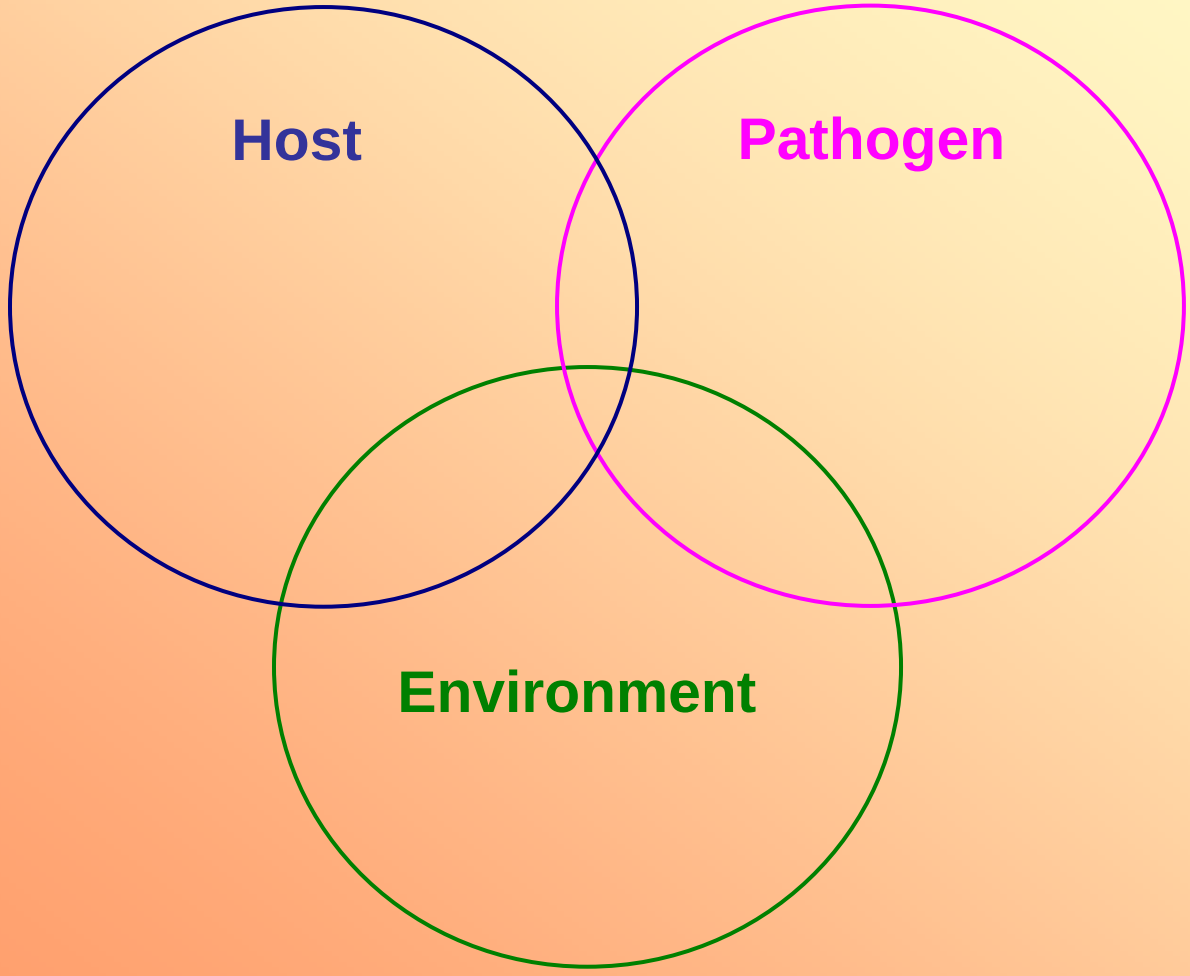
Conditions at Bear Creek

- Catastrophic decline
- Small populations in Cottage Lake Creek suggests die-off isn’t a simple relationship with urbanization
- Histology observations have indicated that the mussels are diseased

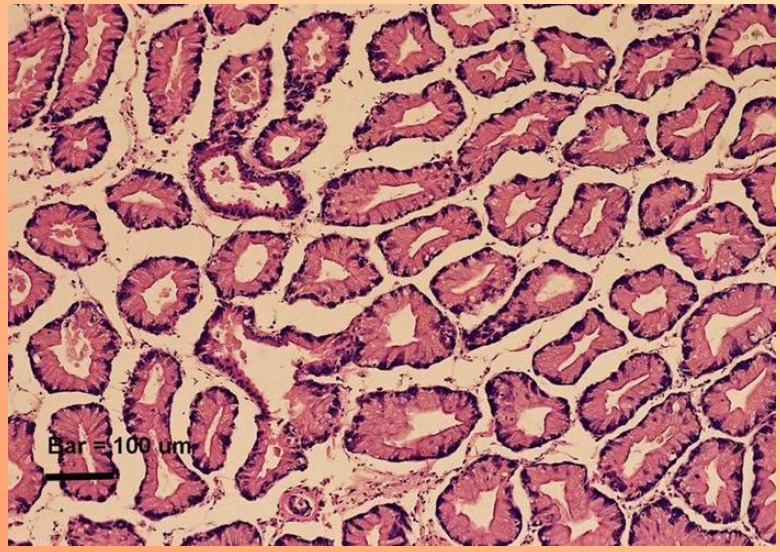
Disease Ecology

- Disease is a departure from normal
- Infectious agents, toxicants, and environmental stressors can all cause disease
- Organisms are normally in association with pathogens

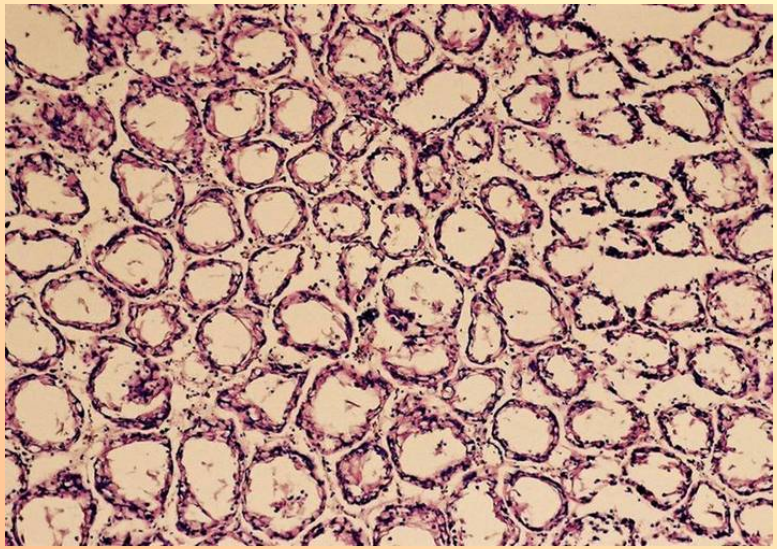
Disease Ecology



Indications of Disease: Digestive Gland



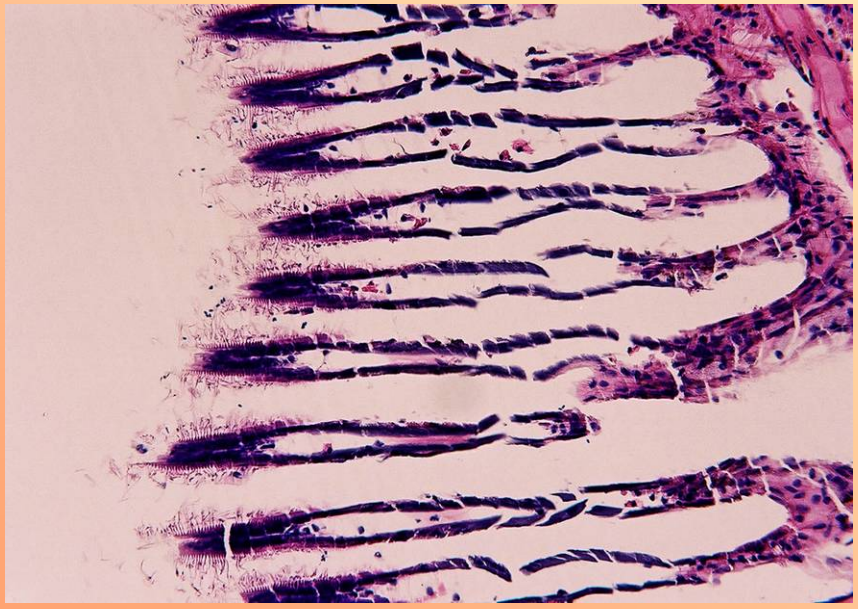
Stossel Creek



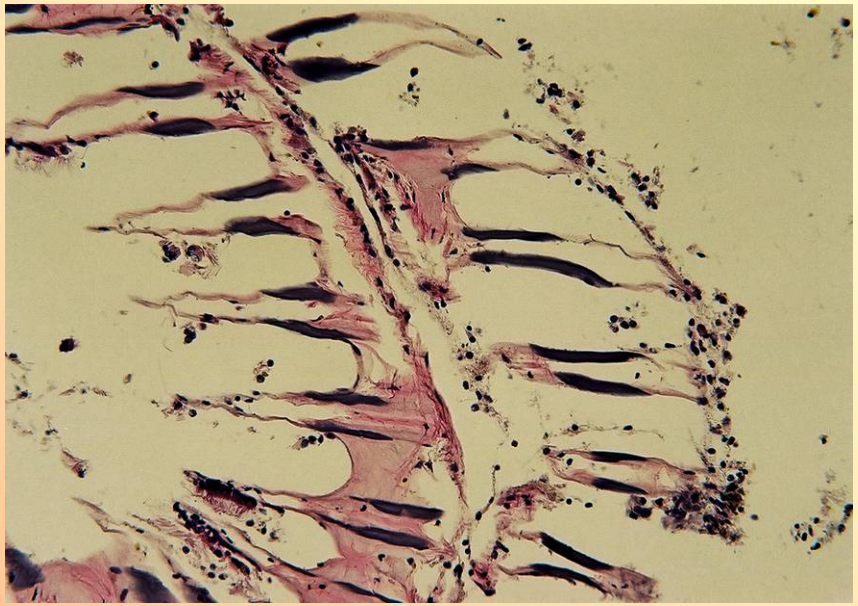
Bear Creek

Photos: Ralph Elston

Indications of Disease: Gill



Stossel Creek



Bear Creek

Photos: Ralph Elston

Research Questions

1) How much mortality has occurred and what is the spatial extent of die-offs along Bear Creek?
2) Do healthy freshwater mussels become diseased when relocated to Bear Creek?
3) Is there a sequence of pathological events that leads to mortality?

Methods

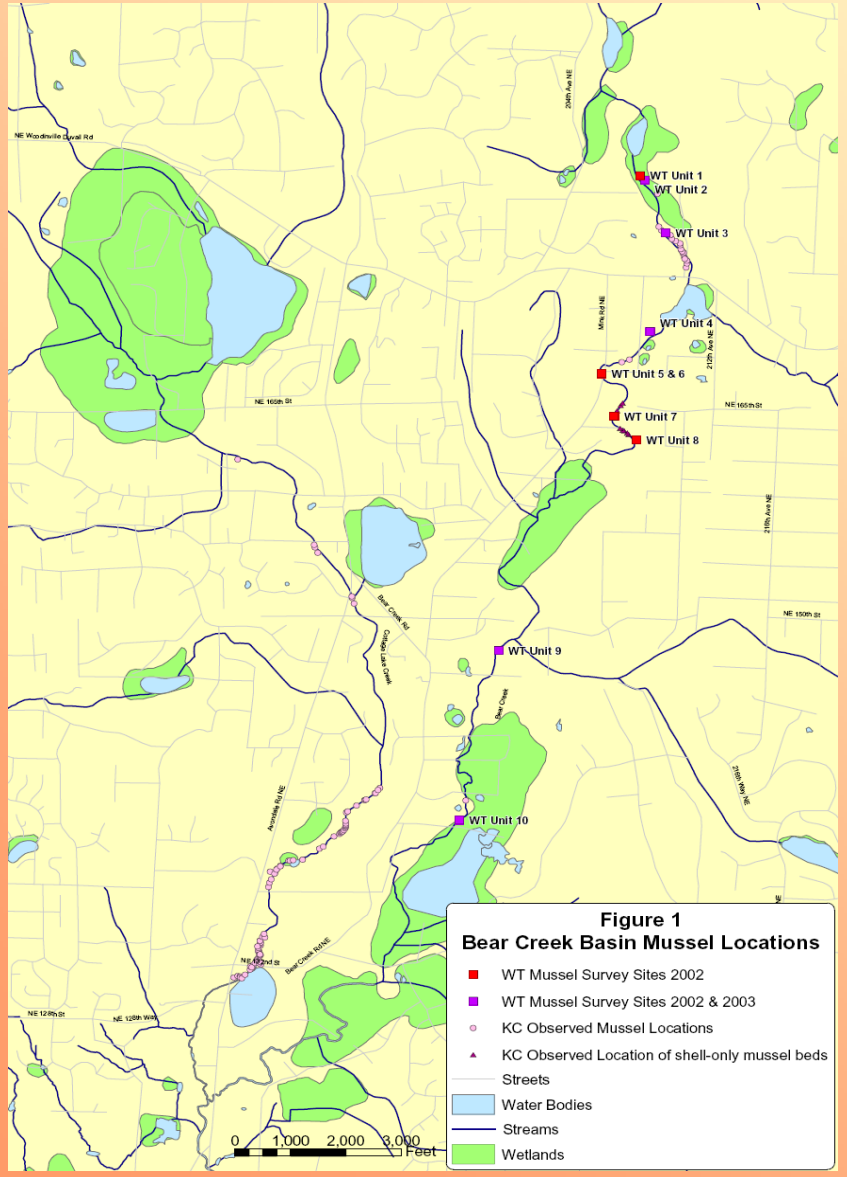


Figure: Washington Trout

How much mortality has occurred and what is the spatial extent of die-offs along Bear Creek?

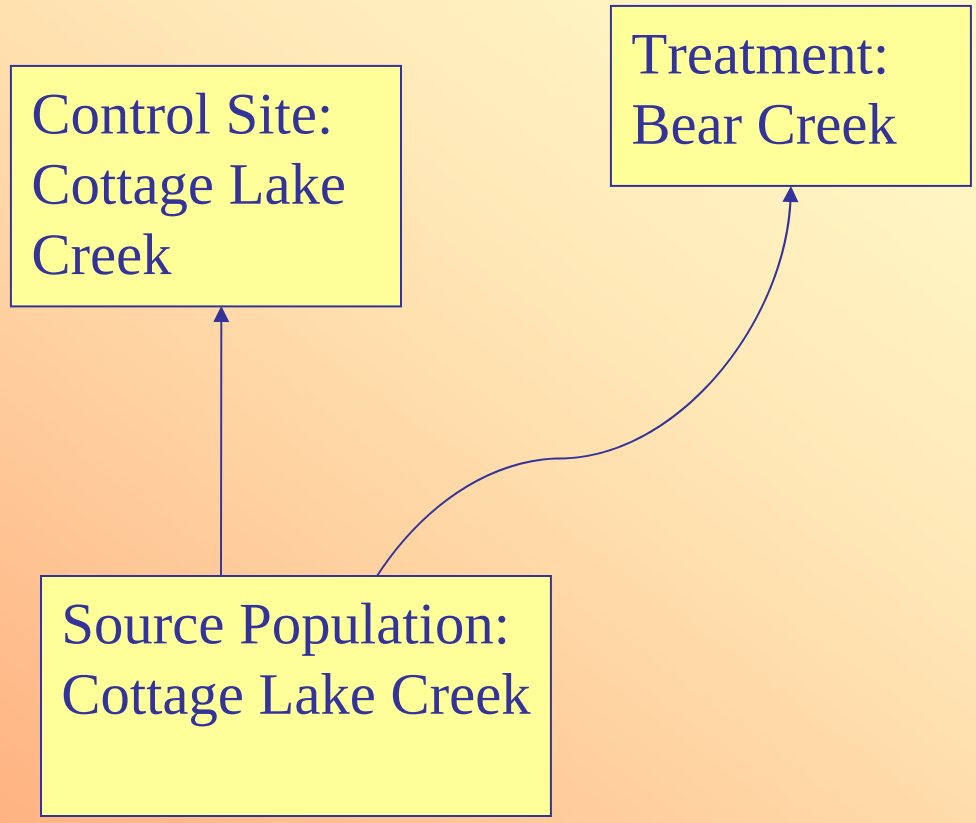
- Replicate surveys conducted by Washington Trout in 2002 and 2003
- Conduct freshwater mussel survey upstream of Paradise Lake in the Paradise Valley Conservation Area

Methods

Do healthy freshwater mussels become diseased when relocated to Bear Creek?

Freshwater Mussel Transplant

- 90 mussels Cottage Lake Creek (control)
- 90 mussels Bear Creek (treatment)
- 10 months monitoring
- Each month sample 3 mussels from each site
- 18 mussels will remain to determine cumulative mortality



Methods

Is there a sequence of pathological events that leads to mortality?

Weekly – check for mortality

Each month determine:

- Tissue Condition
- Immune response
- Reproductive Stage
- Glycogen
- RNA

** Also conducted examinations of uncages mussels from Cottage Lake Creek (n=3) and Bear Creek (n=3 alive, 1 mort)*

Preliminary Observations

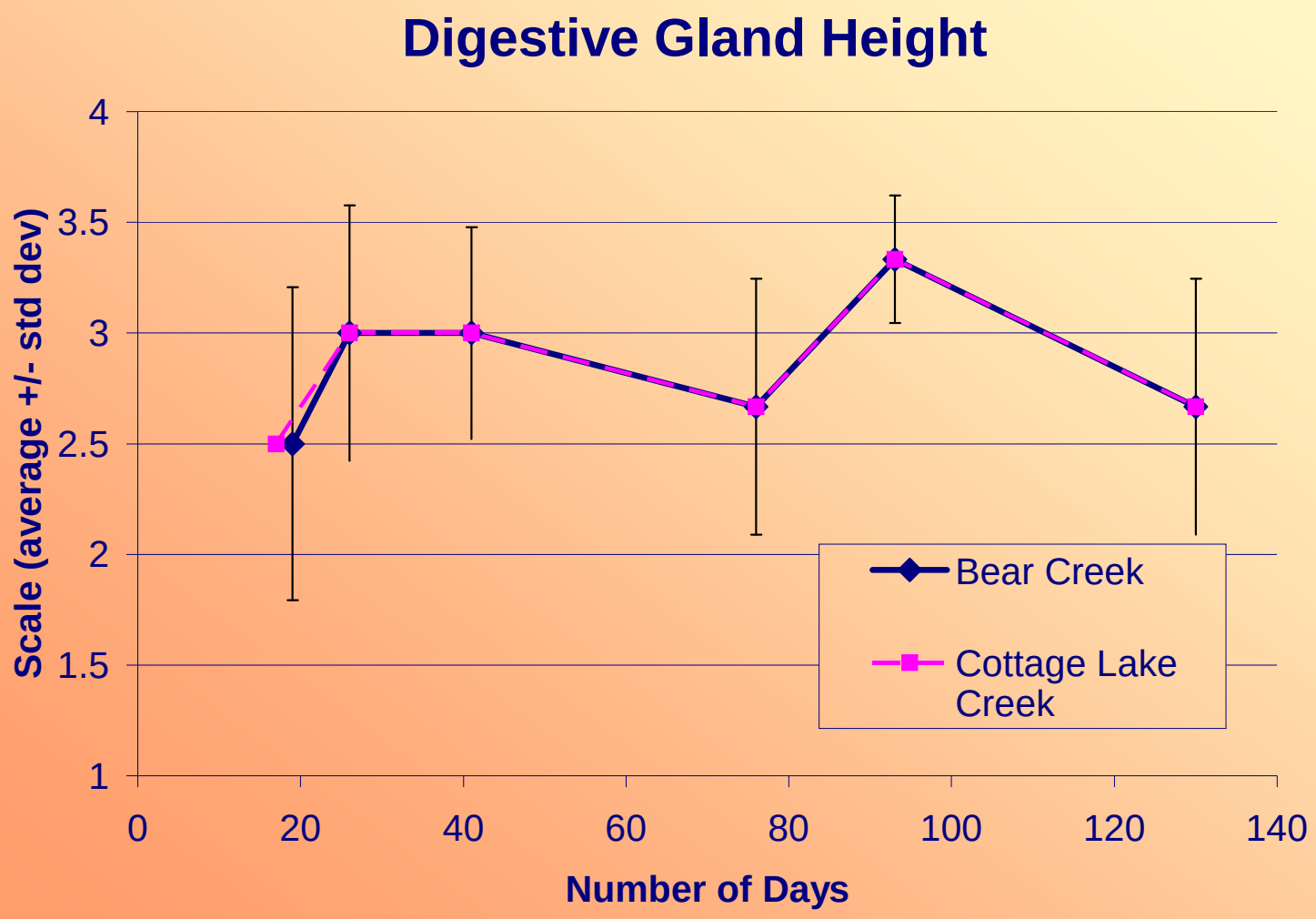
To date, no mortality

36 mussels sampled (biweekly Dec. 2007, monthly January – April).

Consistent behavior:

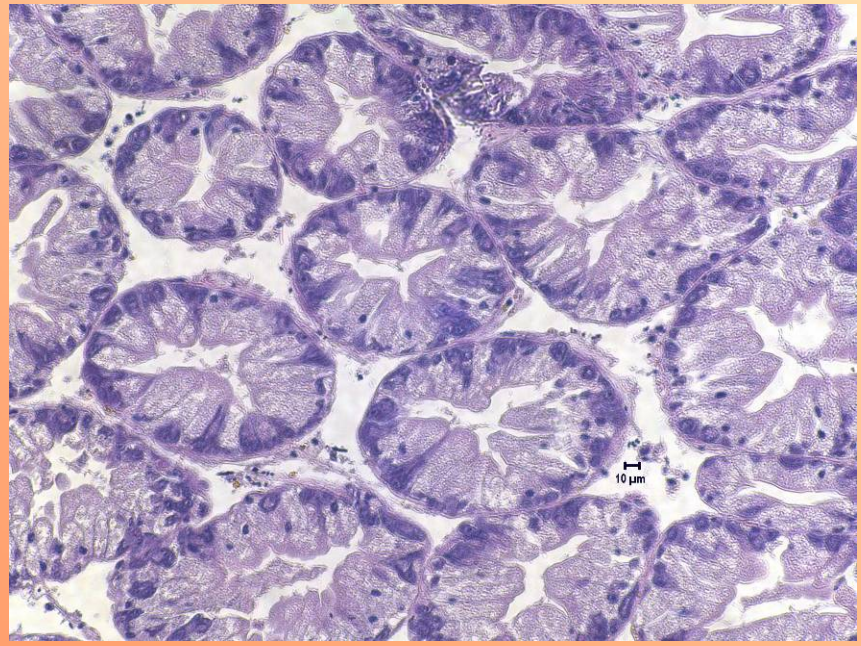
- aggregation at one end of cage
- many mussels are upright
- some mussels siphoning

Preliminary Observations

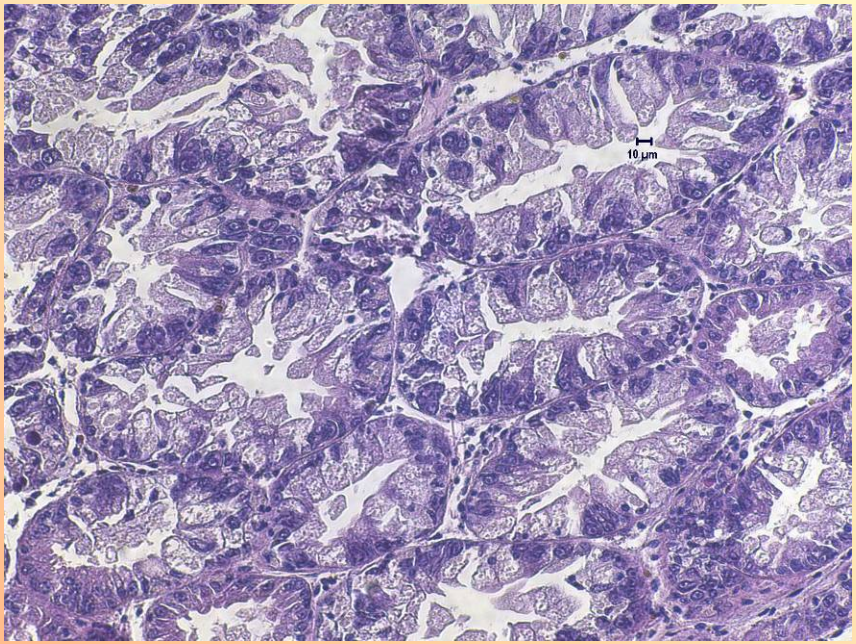


Preliminary Observations

Digestive Gland at 130 days (April 4, 2007)



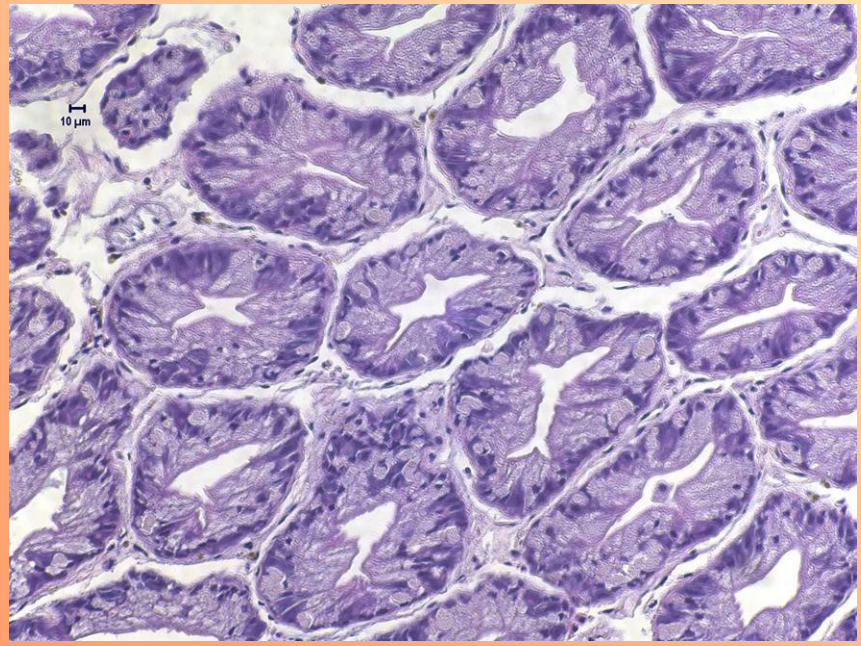
Bear Creek



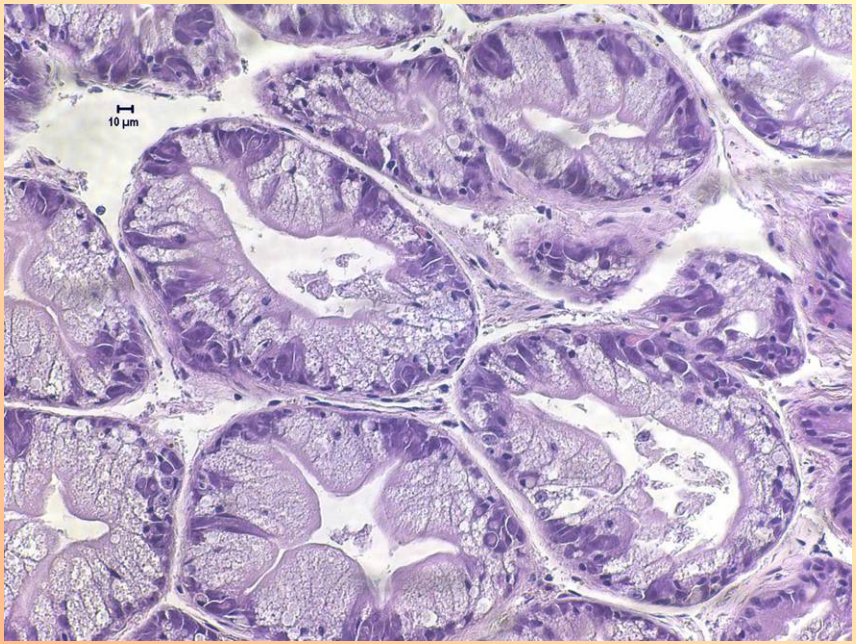
Cottage Lake Creek

Preliminary Observations

Bear Creek Native Mussels – Digestive Gland



Bear Creek Native

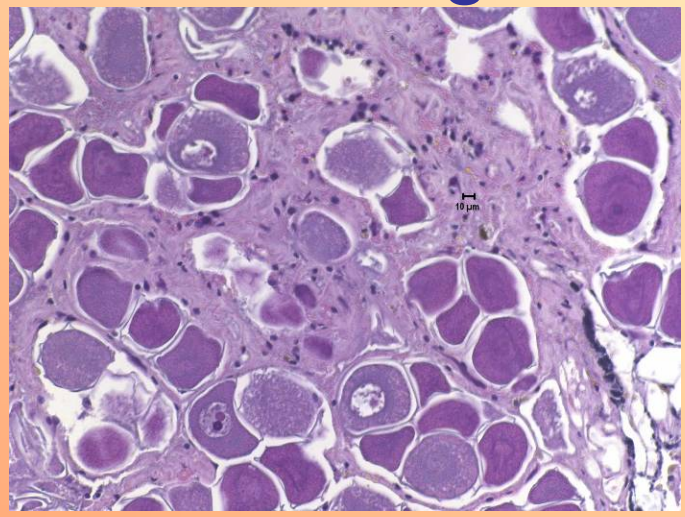


Transplanted Mussels

Preliminary Observations

Reproductive Stages Observed: Female

2



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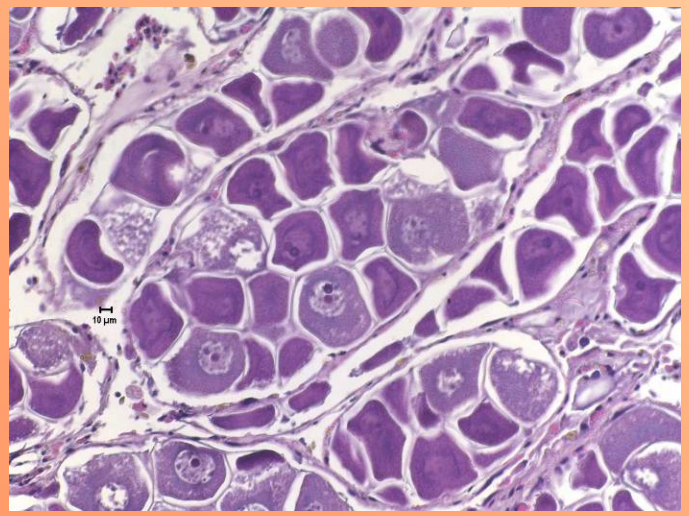

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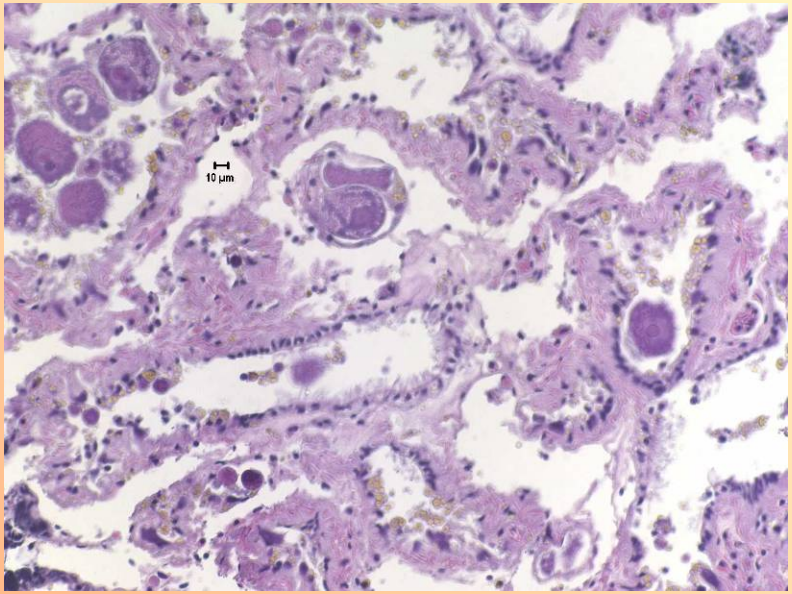
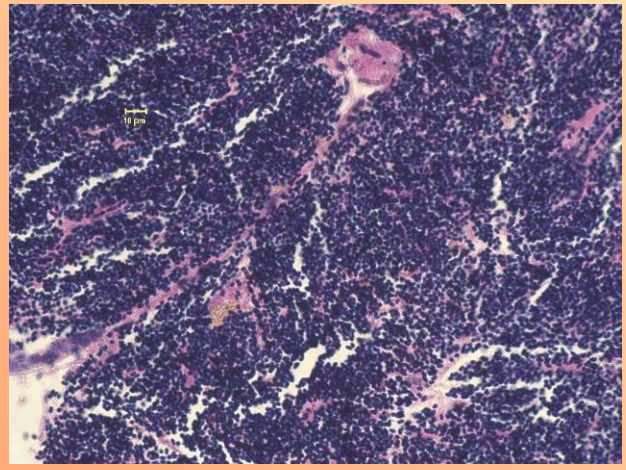


Preliminary Observations

Reproductive Stages Observed: Male

3



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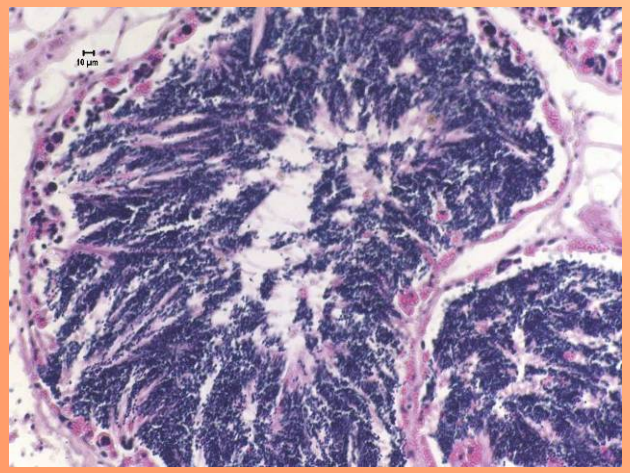

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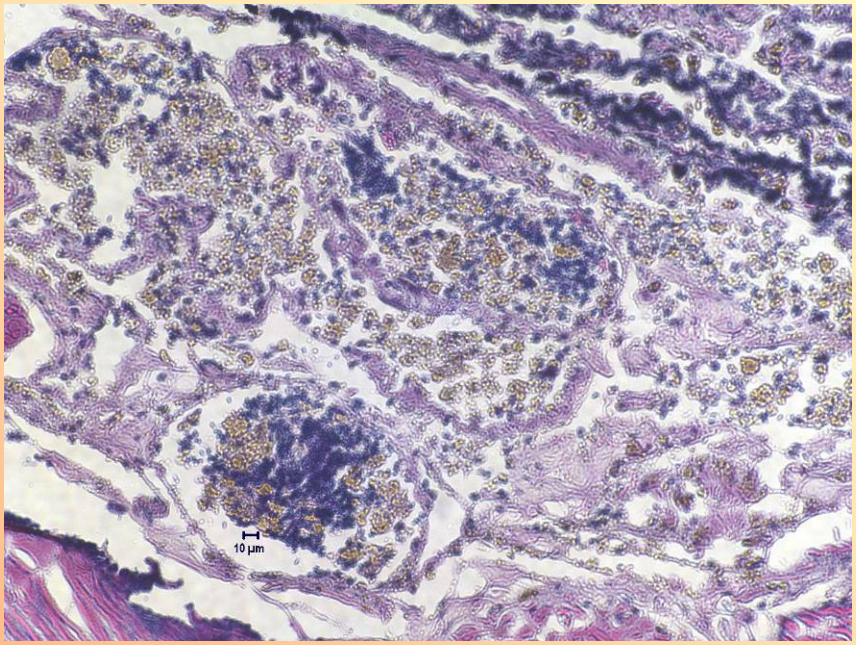
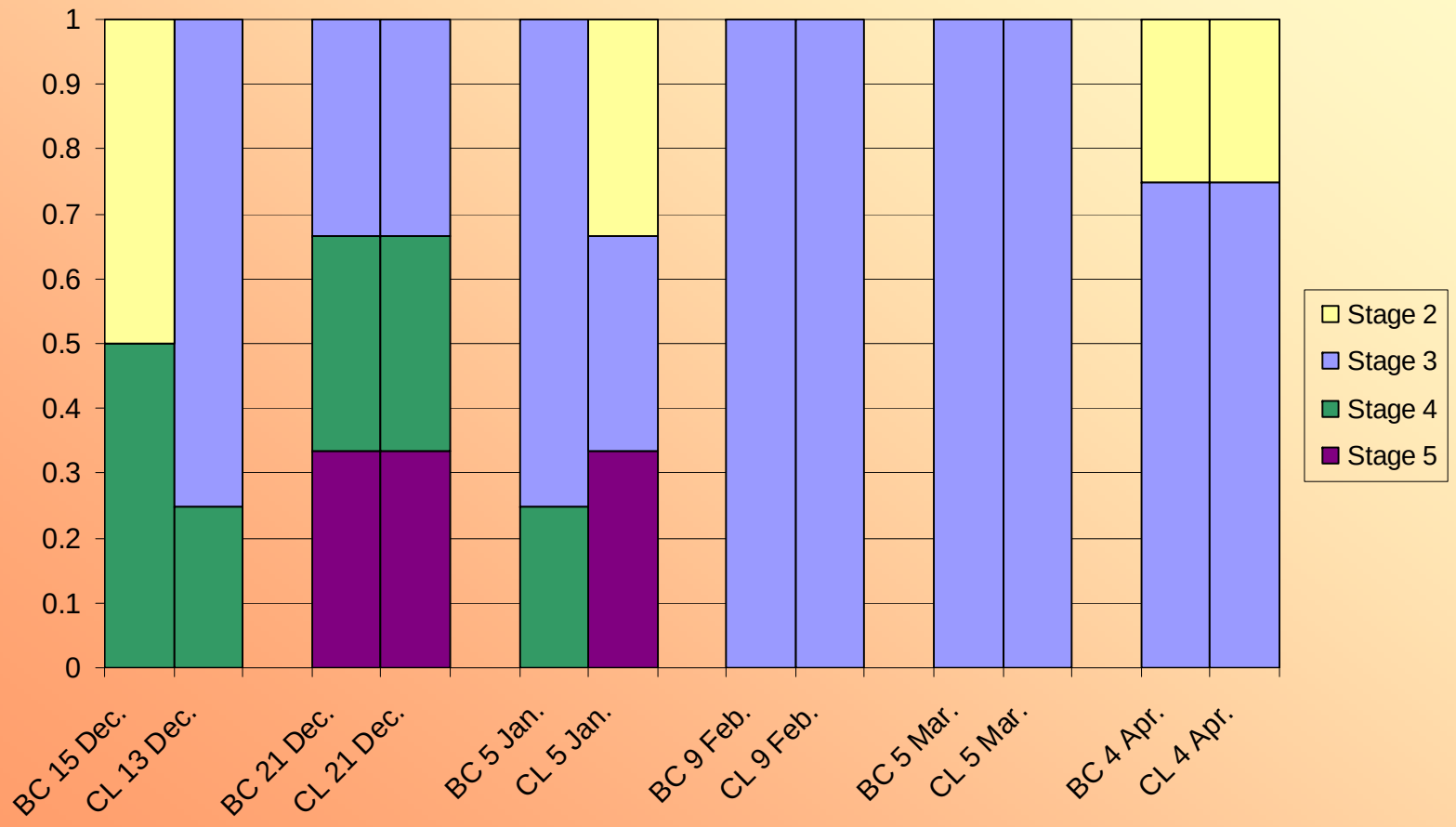


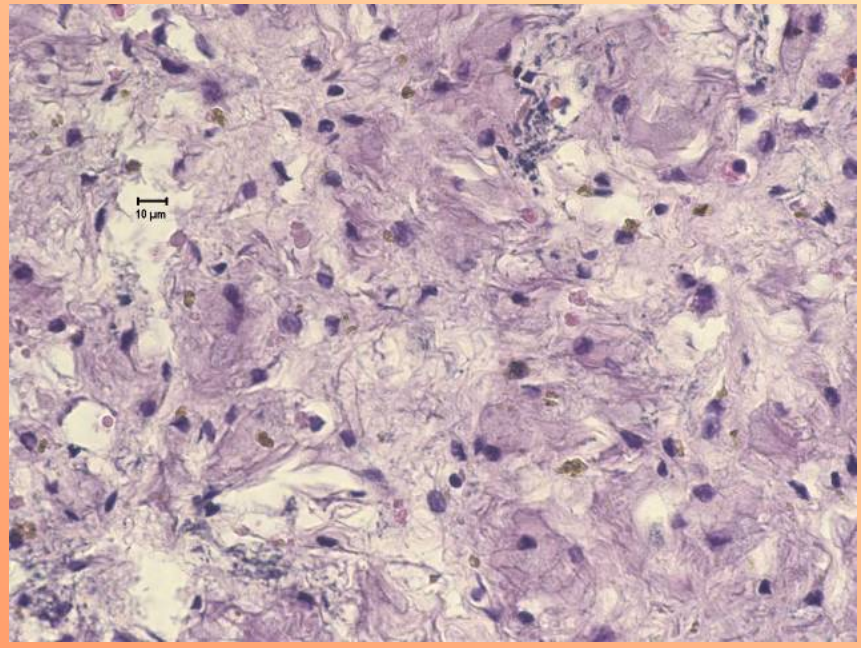
Preliminary Observations

Reproductive Stage



Preliminary Observations

Bear Creek Native Mussels – Stage 0



Mussel 1: 90.4 mm

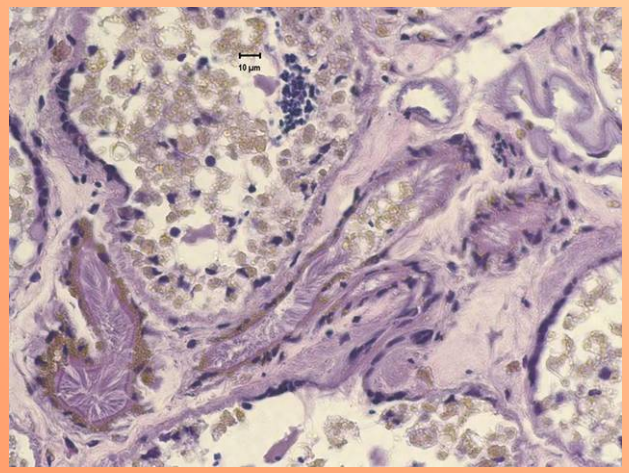
Mussel 2: 82.1 mm

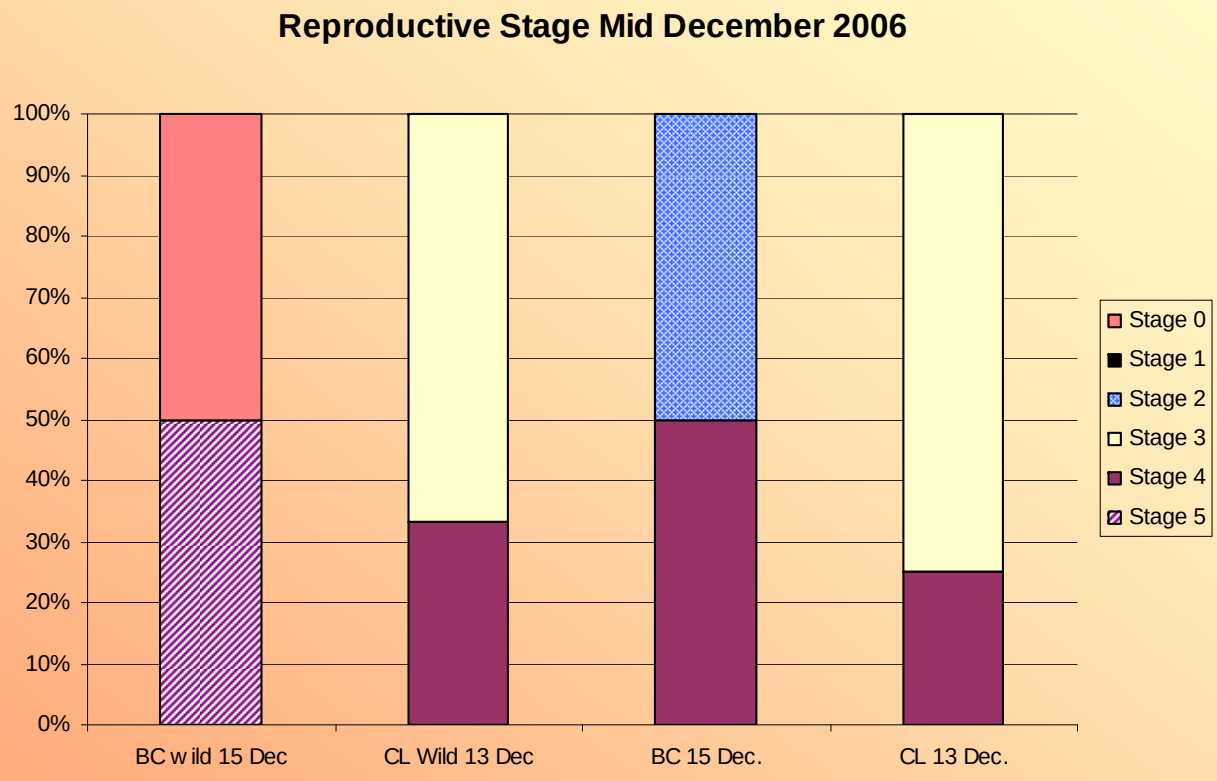
Toy (1997) - average shell length at sexual maturity:

- 45.8 mm (males)
- 48.8 mm (females)

Preliminary Observations

Bear Creek Native Mussels
– Stage 5





Take Home

- After 130 days, no mortality and no indications of disease in relocated mussels.
- Survivors in Bear Creek were characterized by much better digestive gland condition than diseased animals previously examined.
- It is possible that Bear Creek native mussels are not undergoing normal gamete development.
- These are ***very*** preliminary observations and continued monitoring should be more informative.

Thank You!

- Wendy Walsh
- My committee: Carolyn Friedman, Susan Bolton, Mike Brett, Deb Lester
- King County
- Northwest Fisheries Science Center:
  - Mark Myers, Maryjean Willis, Paul Olson
- Frank Morado, Alaska Fisheries Science Center
- Friedman Lab: Nate, Lisa, Chemine, Colleen, Brent

Questions?