

Using benthic macroinvertebrates to assess steelhead reintroduction potential

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Yakima Basin Aquatic
Science and Management
Conference

June 15, 2006

Outline

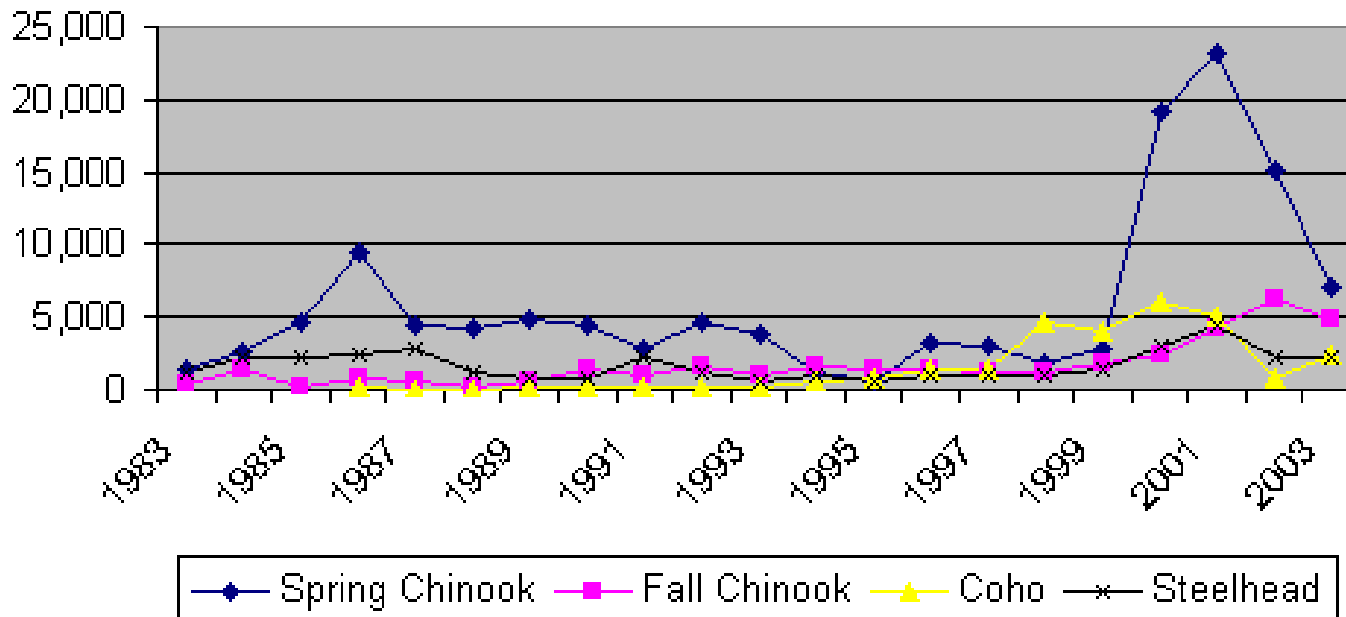
- Steelhead status and background in eastern WA
- Study area: site selection, goals, and justification
- Methods: sampling strategy
 - Benthic invertebrates
 - Physical water quality
 - Wolman pebble counts
 - Large Woody Debris
- Results
- Conclusions and management implications



* Historic steelhead run estimates are incomplete but one reference stated that annual runs of 100,000 in the Yakima River. (NOAA 2006)



Yakima River Salmon Counts 1983 to Present

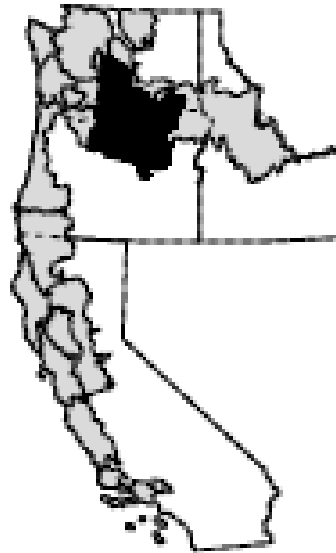


Bonneville
Dam google.com



MIDDLE COLUMBIA RIVER STEELHEAD ESU

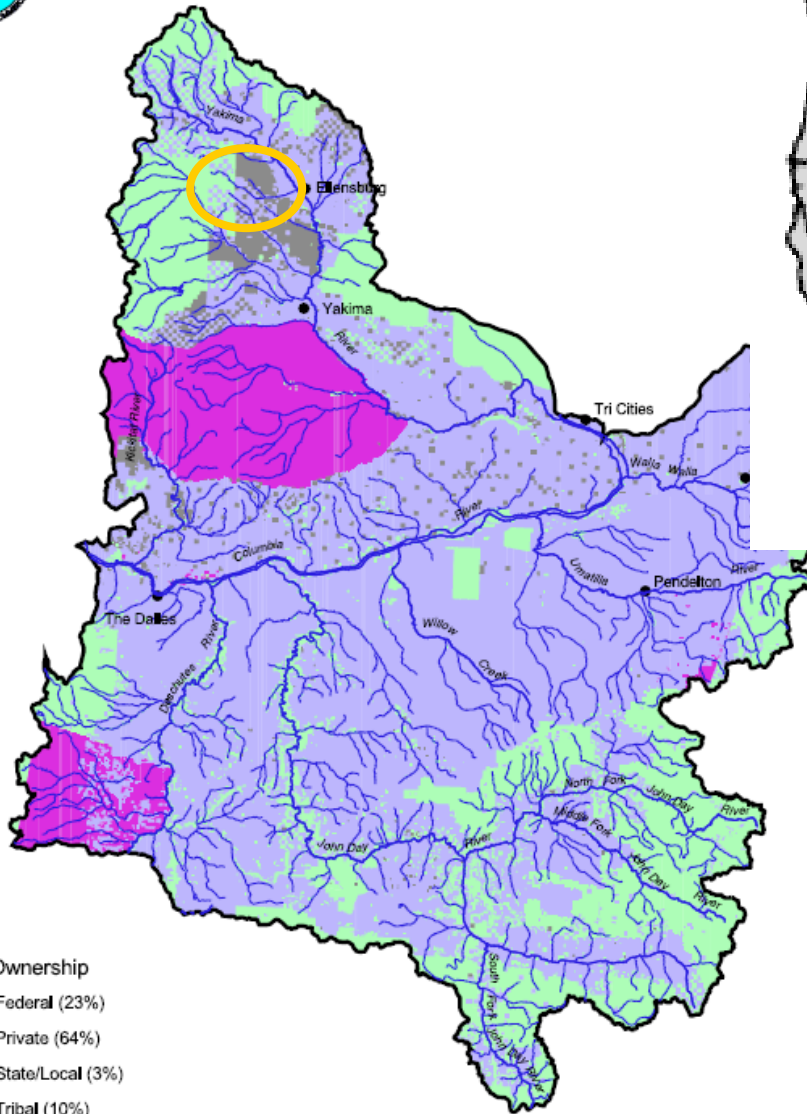
Steelhead ESUs



Middle Columbia River ESU

Designated on 3/25/1999

www.noaa.com

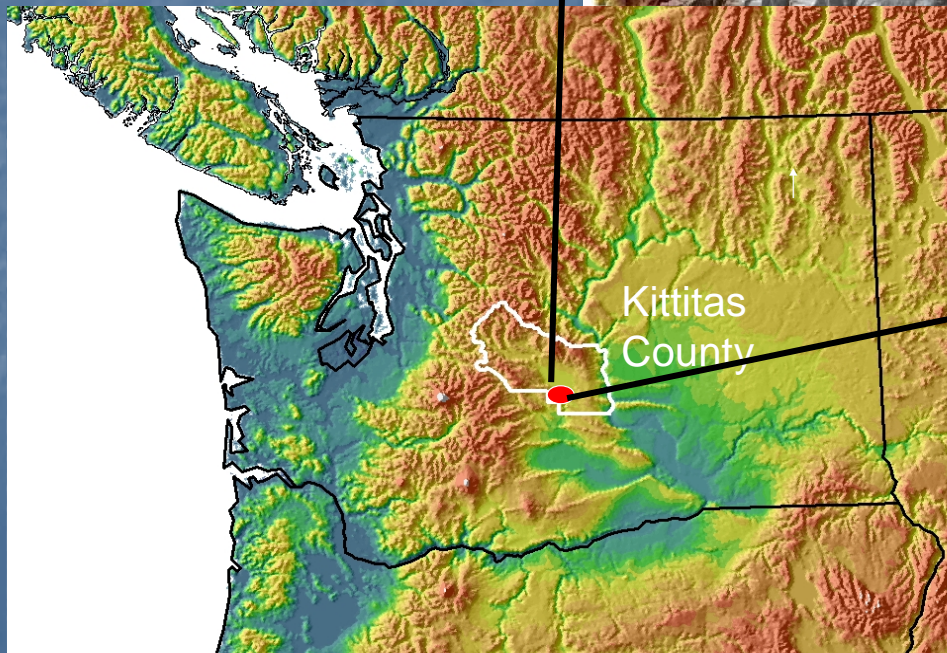
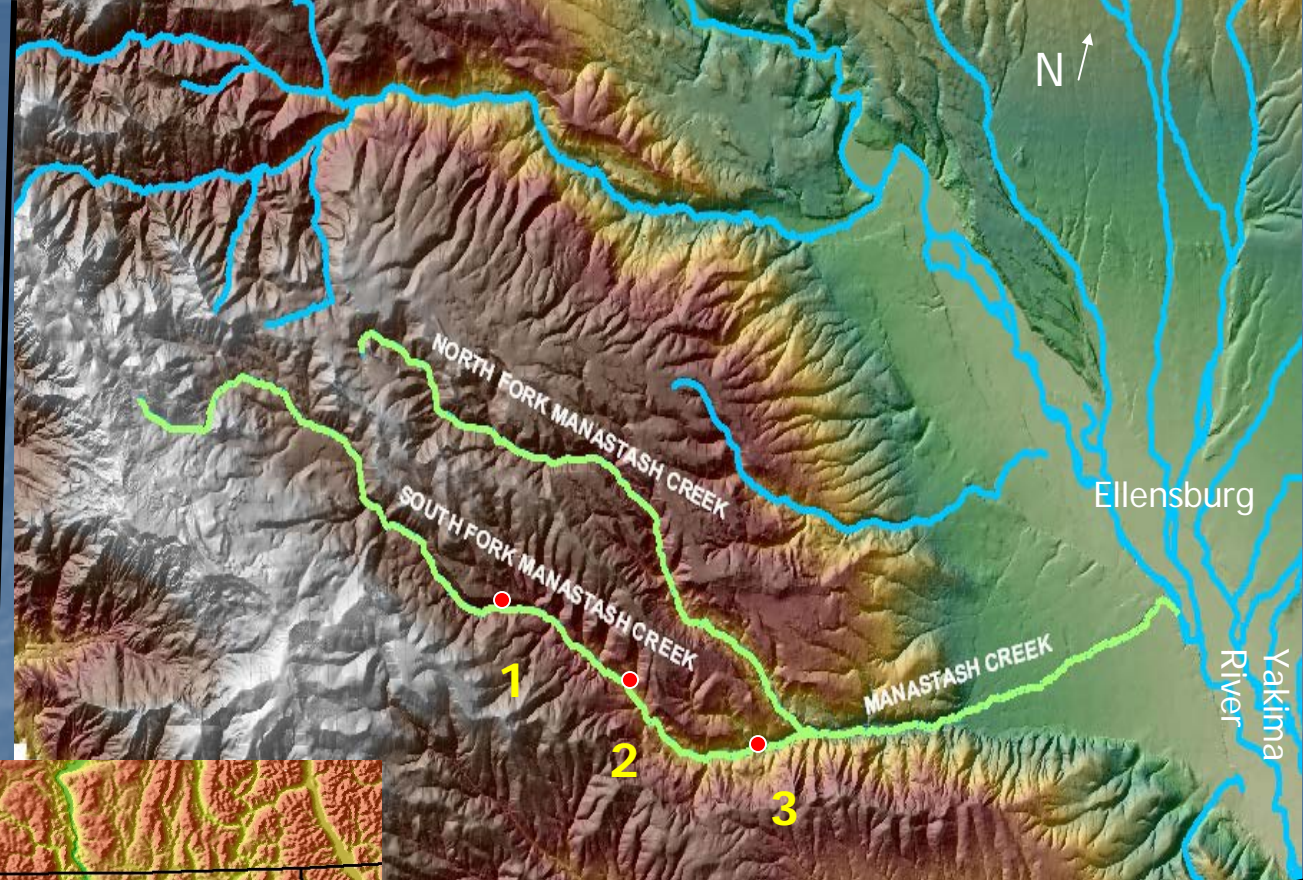


United States Department of Commerce
National Oceanic & Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
HABITAT CONSERVATION DIVISION
525 N.E. Oregon St., Suite 410
Portland, OR 97232
Tel (503) 231-2223

Scale:
0 10 20 30 40 50 Miles
0 10 20 30 40 50 Kilometers

MAP DATE 2/15/99
CREATED BY: D.A. HEDRICK/WALTON/CORP/ATL

Note: Map is for general reference only.



Site 1: 1,286.6m

Site 2: 1,042.4m

Site 3: 804.4m

Study questions

“Is the habitat in the upper reaches of Manastash Creek still able of supporting anadromous fish?”

- My research will aid managers in this decision

a) What is the benthic-macroinvertebrate community structure in the creek?

- Benthic macro-invertebrates are strong indicators of water quality and salmonid habitat suitability (Naiman, DeCamps, and McClain 2005; Karr 1984)

b) What is the condition of other habitat components?

- Determining steelhead habitat quality requires holistic in-stream and riparian evaluation

Benthic macroinvertebrates as biomonitors

"Benthic macroinvertebrates make excellent indicators of overall stream health because they are ubiquitous, abundant and easy to sample, and contain taxa with different responses to a broad range of human activities

(Karr in Naiman & Bilby 1998)."

"BMIs provide the critical linkage in energy flow from the microbial to vertebrate populations in stream ecosystems."

(Hershey and Lambarti in Kantor 1997)



Baetidae



Brachycentridae



Chironomidae



Nemouridae



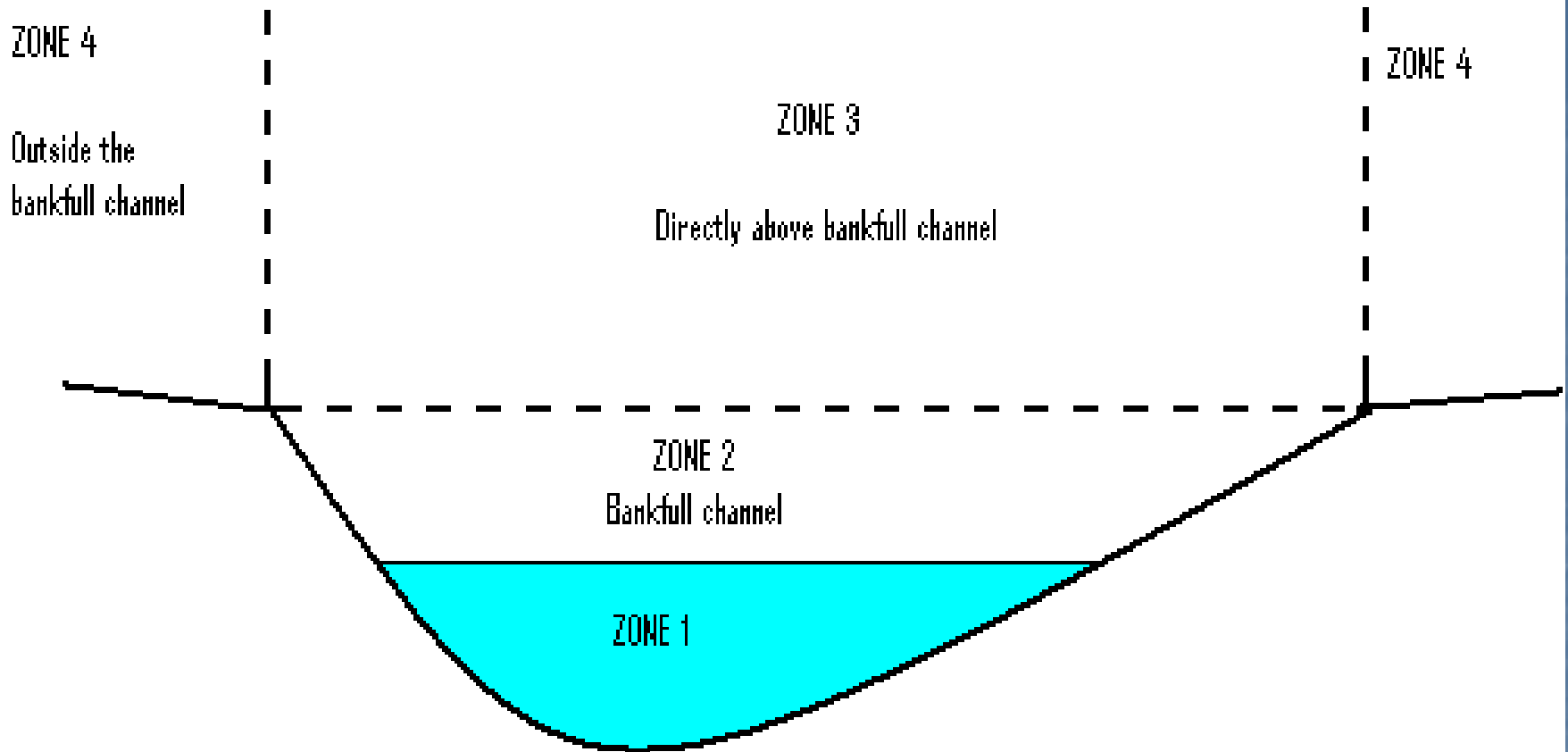
Samples taken

8/24/2005

8/7/2005

9/12/2005

- Surber samples taken at these % of wetted width on these dates
- Physical water parameters were measured in coincidence
- Wolman pebble counts, LWD survey, and bank vegetation were also surveyed at these study sites



Shuett-Hames et al. 1999

rootwads \geq 20 cm	small logs \geq 10 cm - < 20 cm	medium logs \geq 20 cm - < 50 cm	large logs \geq 50 cm	Key pieces
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Timber Fish and Wildlife LWD level 1 survey procedure

Site 1

- 1,286.6m in elevation
- Plane-bed channel morphology
- Study reach was 66 stream meters long
- D-50 pebble size was 74.3mm



LWD is important is an important habitat component for both steelhead ([Cedarholm 1997](#)) and macroinvertebrates ([Kantor 1998](#)). It also influences channel morphology ([Montgomery and Buffington 1998](#)). Site 1 had three pieces of key LWD and a total volume of 25.69 m³.

Site 2

- 1,042.4m in elevation
- Plane-bed channel channel morphology
- Study reach was 67 stream meters long
- D-50 pebble count was 58.8mm



Site 2 had two pieces of key LWD and a total volume of 16.2m^3

This site had the greatest abundance of BMIs (398 individuals)

Site 3

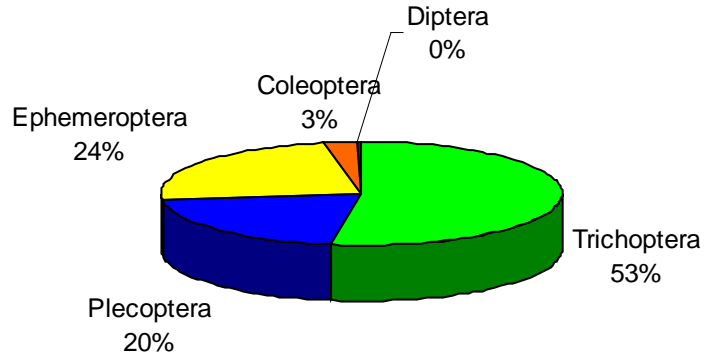
- 804.4m in elevation
- Riffle-pool channel morphology
- Study reach was 41 stream meters in length
- D-50 pebble count was 52.7mm



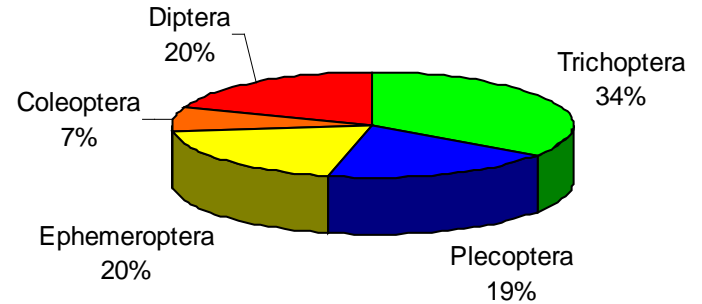
Site 3 had two pieces of key LWD and a total volume of 9.8m^3

This site was the least sinuous of the three, lack of corners to catch LWD may account for a lower value here. Most LWD found was in zone 3 crossing the channel

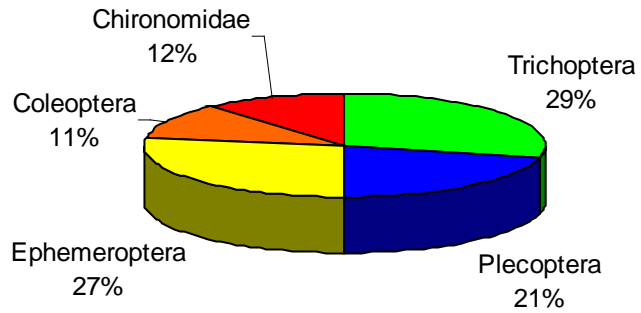
Temporal Summation of BMI Community Structure at Site 1



Temporal Summation of BMI Community Structure for Site 2



Temporal Summation of BMI Community Structure of Site 3



N = 952

Family Biotic Index

Site 1: 2.29

EPT/Chiron. = 13:1

1,286.6m

Site 2: 2.78

EPT/Chiron. = 8.37:1

1,042.4m

Site 3: 3.18

EPT/Chiron. = 5.53:1

804.4m

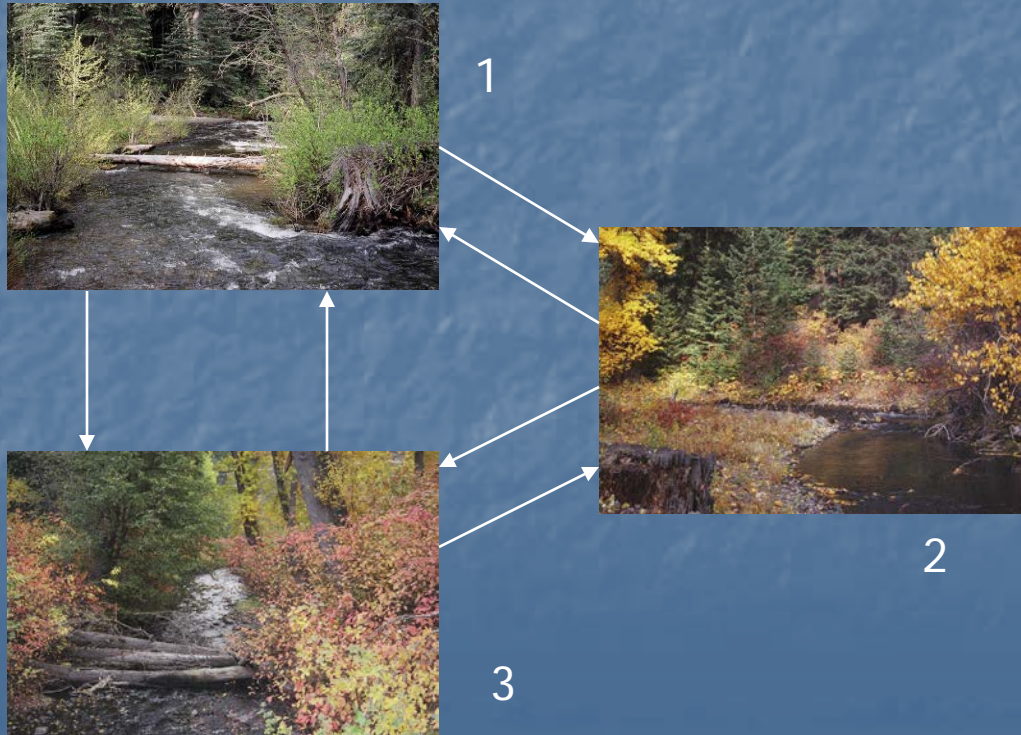
<u>Water Quality</u>	<u>FBI Rating</u>
<i>Excellent</i>	0.00 - 3.75
<i>Very Good</i>	3.76 - 4.25
<i>Good</i>	4.26 - 5.00
<i>Fair</i>	5.01 - 5.75
<i>Fairly Poor</i>	5.76 - 6.50
<i>Poor</i>	6.51 - 7.25
<i>Very Poor</i>	7.26 - 10.00

Chi-square contingency summary table across all sites and samples for BMIs

	T	P	E	C	D	Totals
Site 1	119	60	55	13	24	271
Site 2	175	107	65	7	44	398
Site 3	71	62	72	48	30	283
Totals	365	229	192	68	98	952

Chi-square = 84.76

p = <0.0001



Benthic community relationships

Jaccard's Index

Site 1:Site 2 = 0.808

Site 2:Site 3 = 0.654

Site 1:Site 3 = 0.556

Sorenson's Index

Site 1:Site 2 = 0.894

Site 2:Site 3 = 0.791

Site 1:Site 3 = 0.714

5 – Metric Family Level B-IBI

	Site 1	Site 2	Site 3
Total taxa richness	17.67	18	13.33
Ephem. richness	4.3	4	3.33
Plec. richness	4	5	3
Trich. richness	6.67	8	5.33
% Dom.	45	40	44
N	271	398	283
B-IBI Score	21	21	17

Conclusions and Management Implications

- All physical water quality parameters were stable throughout the sampling period
- Benthic community structure quality shows a qualitatively direct relationship with elevation
- Pebble counts show that riffle heads and tails have substrate that suites steelhead spawning
- LWD is present in the system by natural means and provides cover habitat in combination with bank vegetation and cut banks
- Year-round flows and downstream habitat improvement are necessary before and steelhead could potentially utilize the upper reaches

Acknowledgements

Advisor: Dr. Anthony Gabriel

Committee: Dr. Karl Lillquist and Dr. Paul James

Field assistance: Megan Lahti and Andrew Puls

* References available upon request



**CENTRAL
WASHINGTON
UNIVERSITY**

Funding