

Metals in the Benthic Macroinvertebrates in Coal Creek, Crested Butte, CO

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Overview

- Motivation
- Background
- Hypotheses
- Methods
- Results
- Conclusions
- Comparisons to Water and Sediments



Motivations

- Coal Creek Watershed Coalition
- Standard Mine is an EPA Superfund Site
- Coal Creek is a drinking water supply
- Recreation is a major contributor to the economy

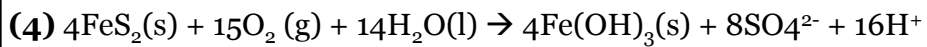
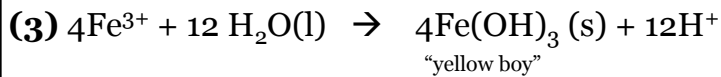
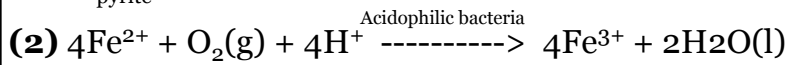
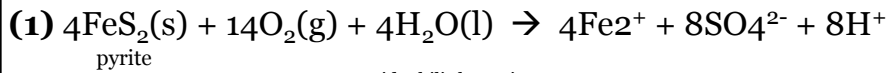


Acid Mine Drainage (AMD)

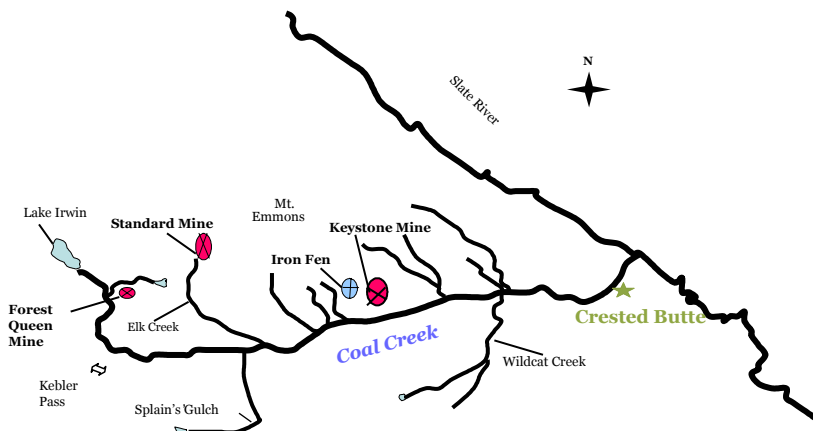
- 1/3 of EPA Superfund Sites in Colorado are devoted to cleaning up abandoned mines.
- Characteristics:
 - low pH
 - high metal concentrations
 - elevated sulfate levels
 - excessive suspended solids
- Heavy Metals: Fe, Mn, Al



Geochemical processes:



Coal Creek Watershed Gunnison County, CO



Benthic Macroinvertebrates

- **Stoneflies**, Order Plecoptera: sensitive



- **Caddisflies**, Order Trichoptera: moderately tolerant



- **Mayflies**, Order Ephemeroptera: sensitive



Past Research

- Will Clements, CSU: mayflies.
- Susan Bautts, 2005 and Drew Bryenton, REU 2004: Lefthand Creek.
- Brianna Shanklin, 2005: Coal Creek.



Hypotheses

- Elevated metal concentrations and reduced diversity and abundance of macroinvertebrates after Elk Creek Tributary, Iron Fen Drainages, and Mt. Emmons Effluent.
- Correlations between sediments and benthic macroinvertebrate metal content.
- Differences between water and macroinvertebrate metal concentrations.



Sample Sites along Coal Creek

Methods: Sampling

- June 14 & 15 2006 simultaneously with sediments.
- 13 sampling sites along 9.5km, starting point: 2005/Shanklin Injection Site.
- In Stream: kick and overturn rocks while dragging mess net behind.
- Emptied nets into buckets and trays and sorted stoneflies
- Stored in 60 ml bottles on ice until reached the lab



*Frrrannnnnieeee,
give that back!*

Methods: Digestion

- Rinsed with Milli-Q water
- Dried in oven
- Measured dry weight
- Added Digestion solution: 1:1 soln. of 15.8M HNO_3 and 30% $\text{H}_2\text{O}_2 + \text{H}_2\text{O}$
- Shook in hot water bath
- Allowed to settle and supernatant removed and filtered with $0.45\mu\text{m}$ nylon filters.



Methods: ICP-OES



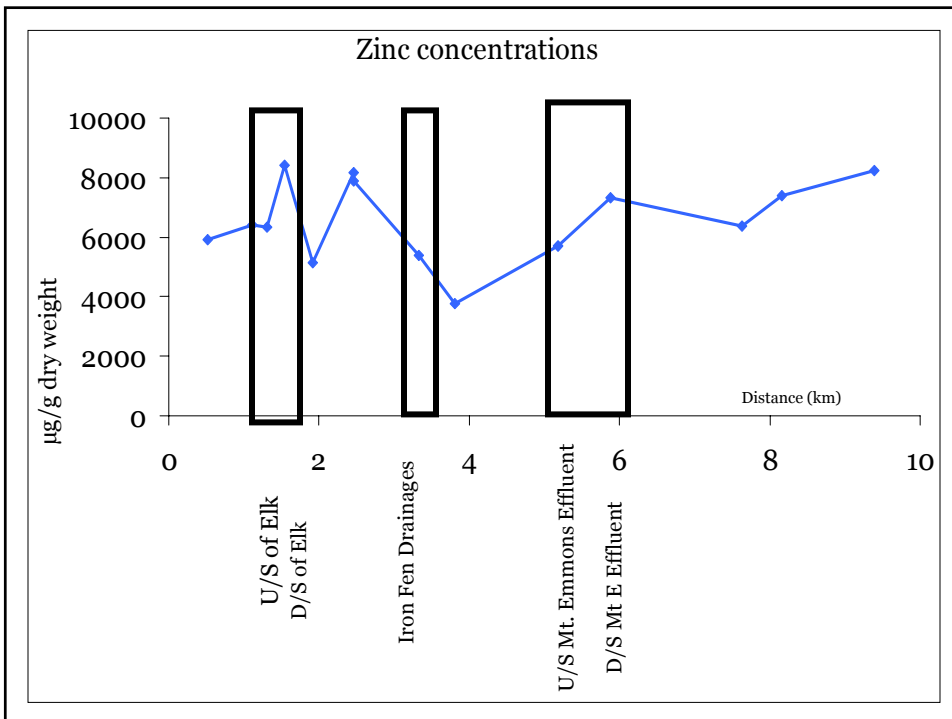
- Diluted 9:1 solution
- Measured Metal Content with ICP-OES (ARD, Model 3410+) in the LEGS Lab, CU Boulder
- Measured Al, Cd, Cu, Fe, Mn, Pb, Zn concentrations in ppm.

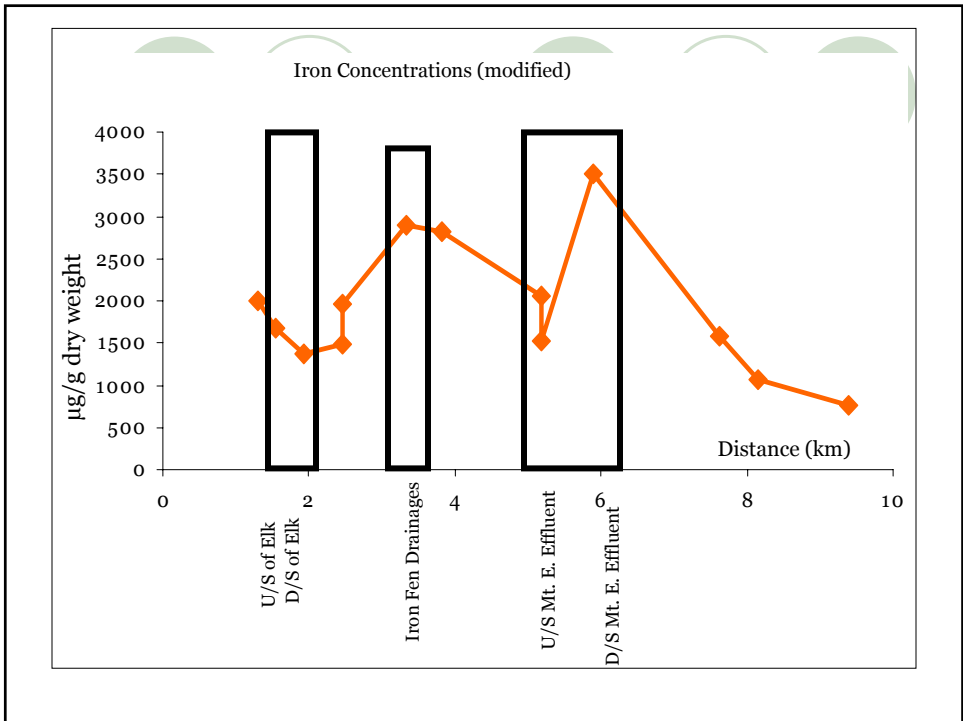
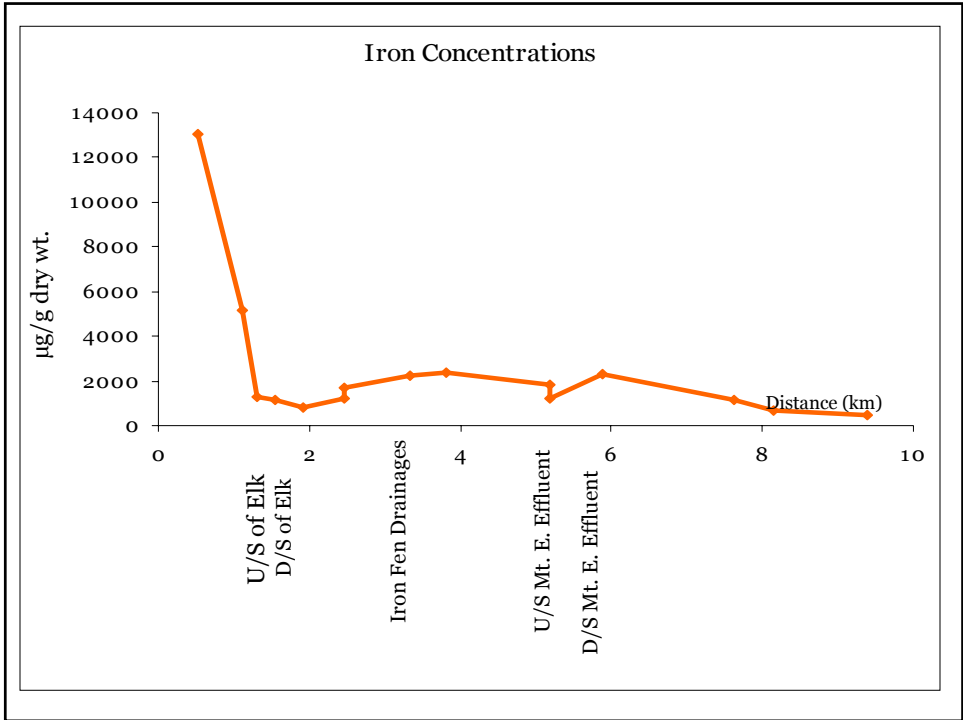
Results

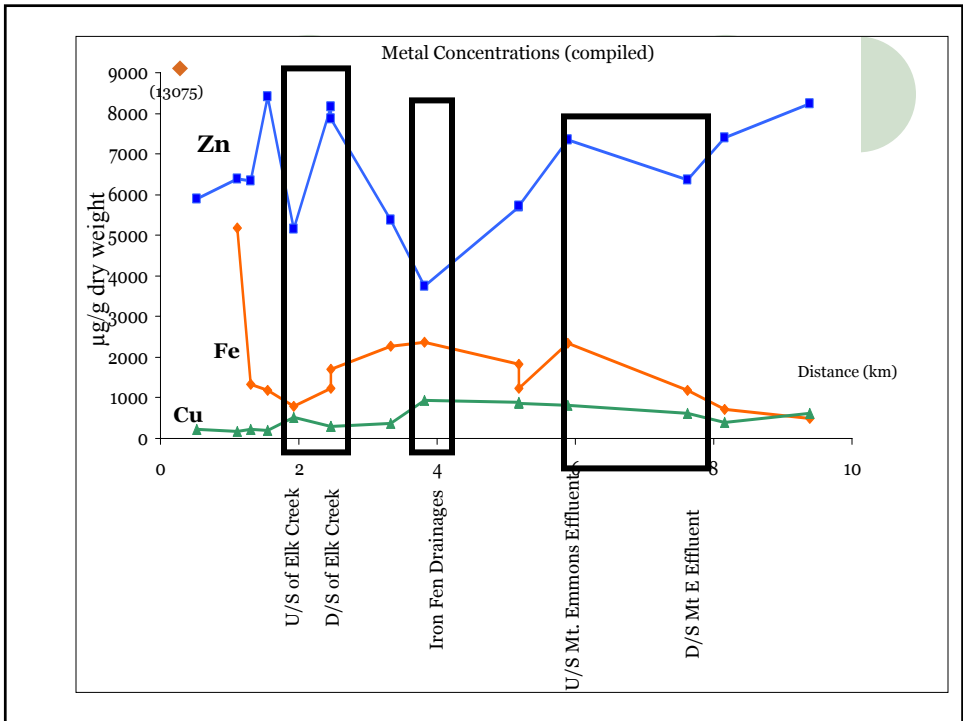
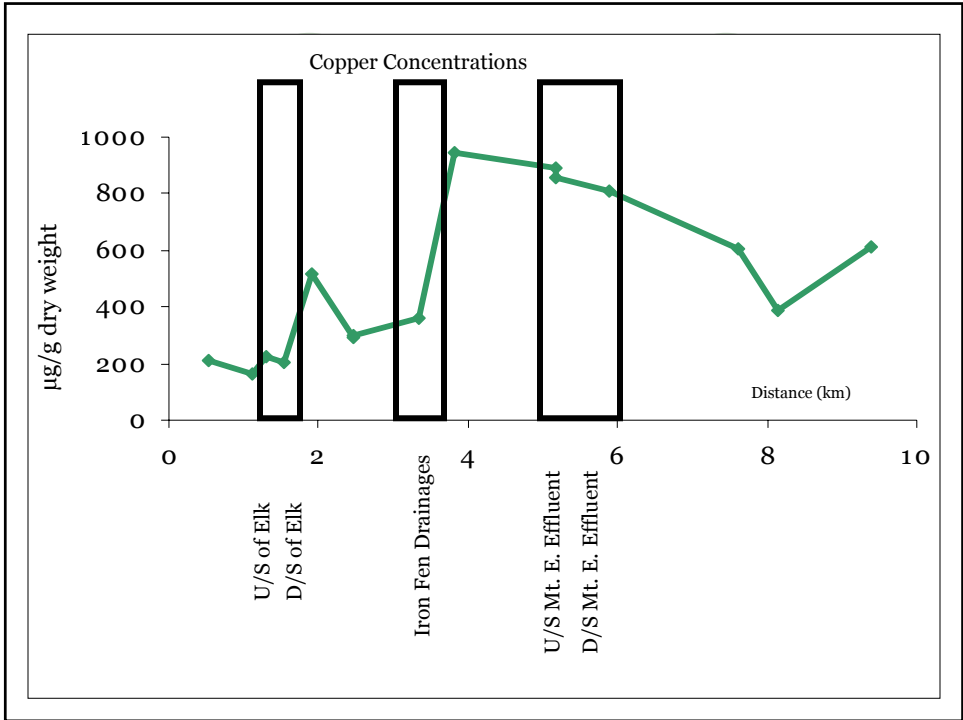


Results

Sample Site Description	Distance D/S relative to 09/05 Injection (km)	Approx count of stoneflies	Mass of Stoneflies (g)	Approx count of others
Above Injection Site	0.519	5 medium	0.0826	3 worms, 2 mayflies
CC-203	1.11	2 large, 1 small	0.1689	6 worms, 1 mayfly
U/S of Elk	1.302	2 med., 5 small	0.1458	3 worms, 2 mayflies
D/S of Elk	1.547	2 med, 2 small	0.2085	4 mayflies, other small stuff
CC-207-5	1.922	5 large, 1 med.	0.178	5 worms, 2 mayflies, 4 caddis flies
CC-210	2.467	4 large, 6 med., 15 small	0.7595	4 caddisflies, 2 worms, 1 mayfly and others
Iron Fen Drainages	3.335	2 med, 6 small	0.1602	2 worms, 4 mayflies, 5 caddisflies, and others
CC-218	3.811	2 med., 1 small	0.2142	5 mayflies, 3 worms, 1 caddisfly and others
U/S of Mt. Emmon's affluent	5.177	10 large, 10 med.	0.7639	3 caddisflies, and others
D/S of Mt. Emmon's affluent	5.177	2 med., 4 small	0.0865	4 mayflies, 4 caddisflies
CC-119	7.625	1 large, 5 med., 5 small	0.2471	2 worms, 1 mayfly, and others
D/S of drinking H2O reservoir inflow	8.156	1 large, 3 med., 15 small	0.2885	3 worms, 4 mayflies, 5 caddis, and other stuff
D/S of Crested Butte	9.387	9 large, 2 med., 8 small	0.3943	50 mayflies, 4 worms

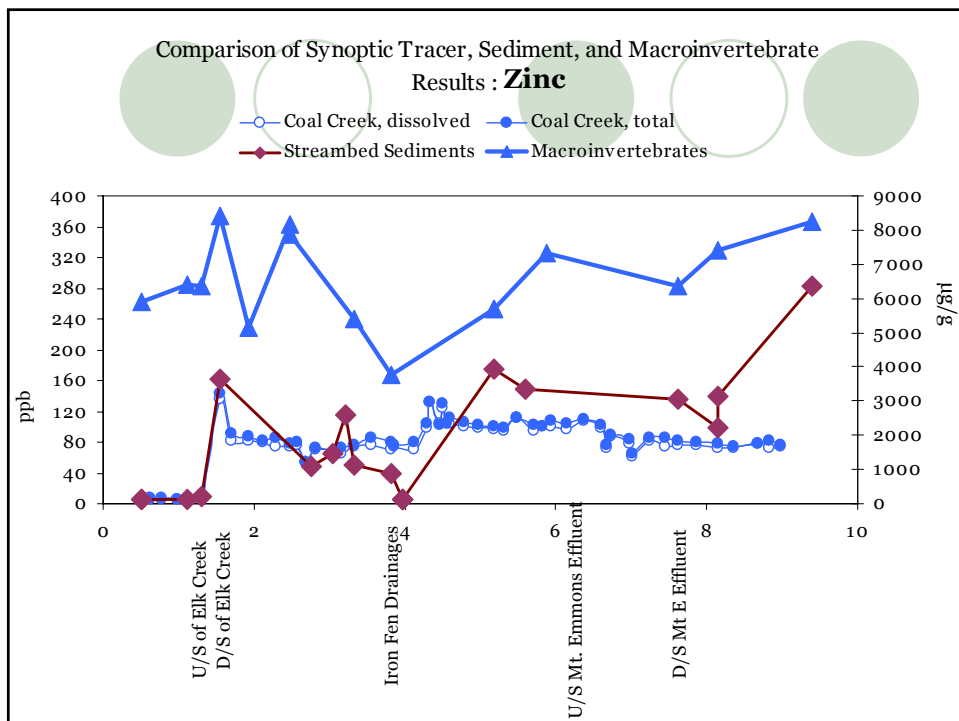


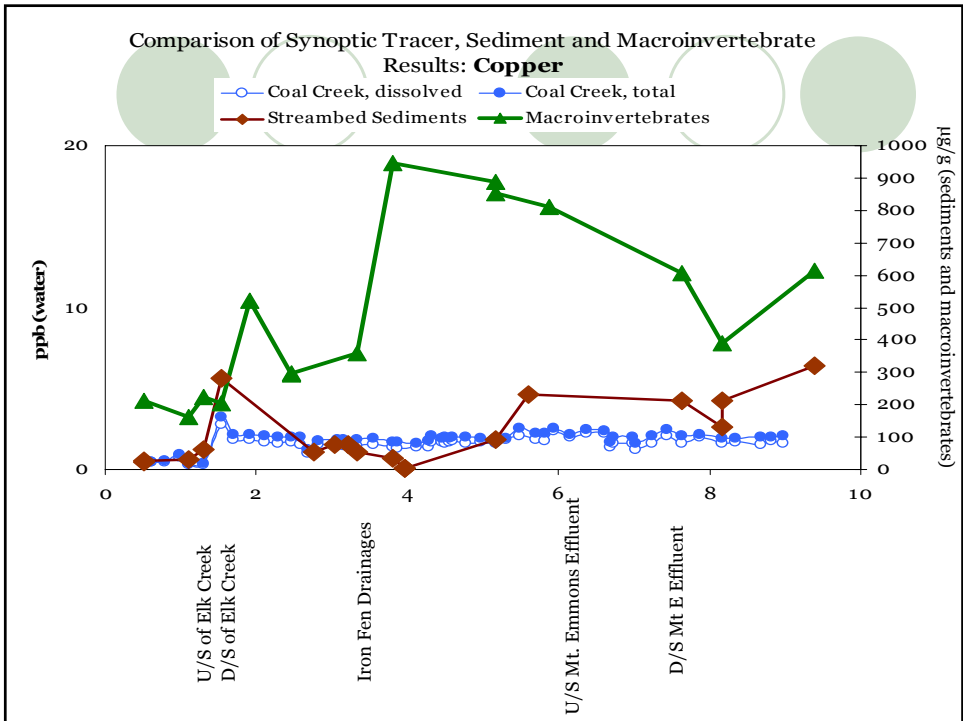
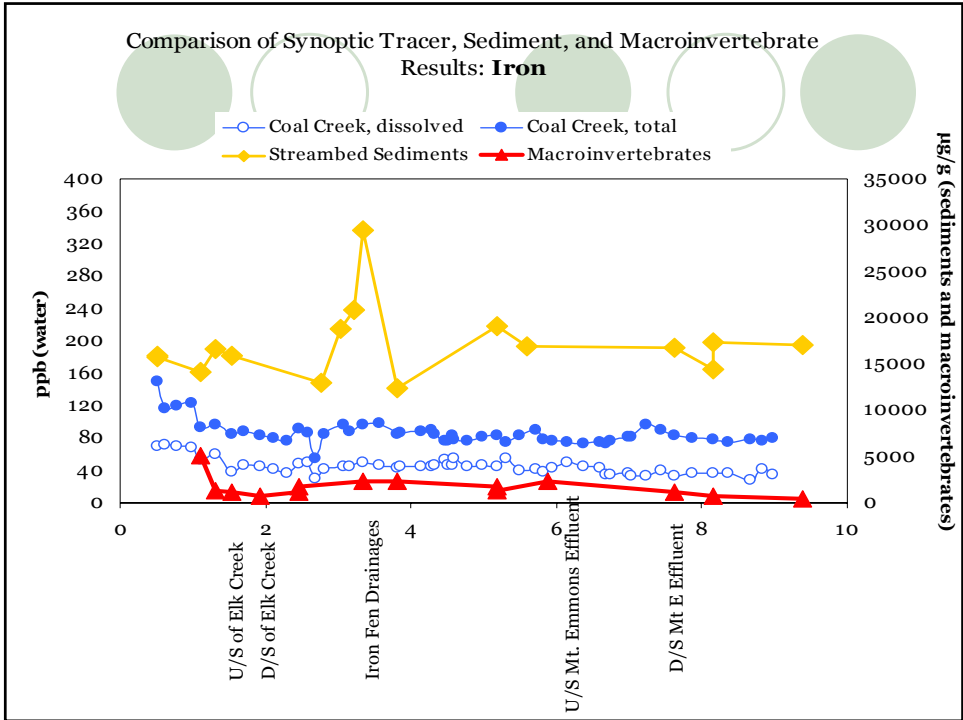




Conclusions: Macroinvertebrates

- Elevated metal concentrations occur after Elk Creek, Mt. Emmons treatment plant effluent
- Benthic Macroinvertebrate populations not that affected.
- High concentrations of iron in background site of stream.





Further Study

- Data: metal speciation trends
- Do some practice runs of the macroinvertebrate sampling before actually starting.
- Investigate fish populations
- Use ICP-MS for other metals found below detection limit.

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Questions



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