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Macroinvertebrate Food Webs of a Metal-Contaminated River: Importance of Algal Blooms

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1) Introduction:

- The Upper Clark Fork River (UCFR) is associated with significantly low trout abundance, mid-summer algal blooms, and metal contamination.
- Low trout abundance may be due to declines in prey from metals or algal blooms.
- Assessment of food webs using stable nitrogen isotopes is needed before trout restoration practices can be implemented.

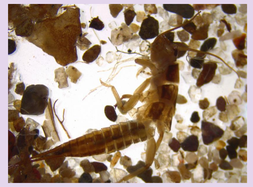
Question: What are the trophic relationships in metal-contaminated rivers associated with algal blooms?

2) Stable Nitrogen (N) Isotopes:

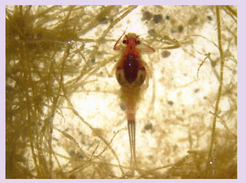
- Heavier N isotopes accumulate up a food web.
- Higher $\delta^{15}N$ = organism higher up in a food chain (predator).
- Lower $\delta^{15}N$ = organism lower in a food chain (prey).[1]
- $\delta^{15}N$ of predator = $\delta^{15}N$ of prey + 3.33.[2]
- Can use N isotopes to determine trophic levels and outline a food web.
- Can compare food webs to determine changes in prey for trout.

3) Methods:

- Macroinvertebrate, trout, and algal samples were collected before (pre-bloom, April) and after (post-bloom, July) the large mid-summer algae bloom.
- Samples were tested for stable isotopes and metals. Additional macroinvertebrate samples were counted to determine family abundance.



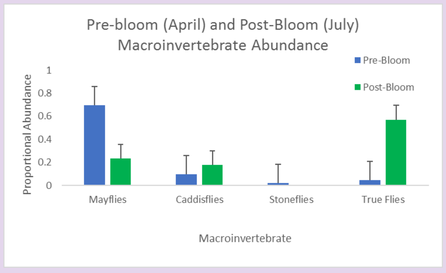
Stonefly

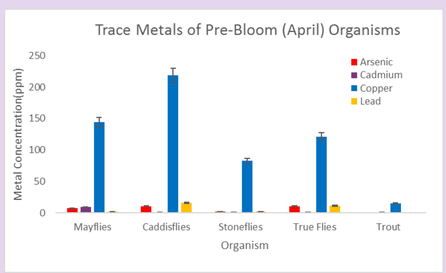


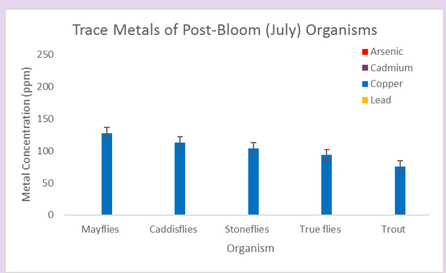
Mayfly

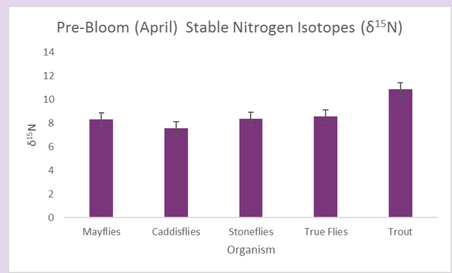
4) Results:

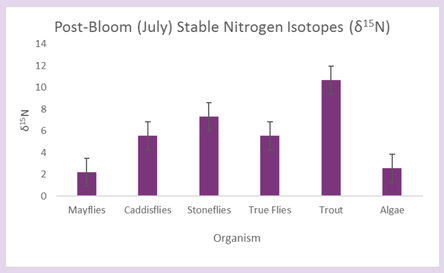
- **Comparison of pre-bloom (April) and post-bloom (July) macroinvertebrate abundance, organismal trace metal concentration, and organismal δ^{15} N. Error bars represent standard deviation of the mean.**











5) Conclusions:

- Mayfly and stonefly abundances declined after mid-summer algal bloom, while true fly and caddisfly abundances increased.
- Arsenic, cadmium, and lead concentrations in all macroinvertebrates and trout decreased following bloom. Copper concentrations decreased in mayflies, caddisflies, and true flies from April to July. Copper concentrations increased in stoneflies and trout.
- According to stable N isotopic data, trout are a top predator in the UCFR. Stoneflies are prey for trout in April and July.
- **Increases of post-bloom copper concentration in stoneflies, a food source for trout, may lead to late-summer decline in stoneflies and contribute to the low trout abundance of the UCFR.**

Acknowledgements:

- Marc Peipoch for assistance with stable isotope and metals analysis.
- Jessica Jenne for macroinvertebrate identification.
- H. Maury Valett for use of lab space.

References: [1] Angradi, T.R. 1994 [2] Fry et al. 1991