Assessment of Benthic Macroinvertebrates from Two-Mile Run

Cody Bliss

Introduction:

Abandoned mine drainage (AMD) or acid mine drainage, is the leading cause of water pollution in Pennsylvania (Zink et al.2008). Pennsylvania is home to some of the most spectacular natural habitats and countryside's however, many of these landscapes have been scarred due to AMD pollution. AMD impairs 4600 miles of rivers and streams throughout Pennsylvania and continues to be one of the most widespread and expensive water pollution challenges to date (Wolfe 2009). Two-mile run is a stream that is polluted by AMD from an abandoned surface mine and underground coal mine.

Two-mile run is a class A brook trout stream above the AMD pollution that eventually flow into Kettle Creek which is a healthy river that connects with the Susquehanna river. AMD is introduced into two-mile run from four tributaries: middle branch, robbins hollow, huling branch, and an unnamed tributary (Fig. 2). Because AMD impacts not only the smaller streams but the larger rivers, it is often vital to first understand the overall health of the headwaters. Because of limited mobility and a relatively long life span, benthic macroinvertebrates often reflect the streams water quality thus allowing the stress within the stream to be further investigated and analyzed. In this study, macroinvertebrates were sampled at four locations on two-mile run and were used to further explore the quality of the stream.

Two-mile run near sample site 2

Materials and Methods:

In November 2009, macroinvertebrate samples were collected from four different collection sites on two-mile run. The first collection site was located above any AMD pollution in a class A brook trout stream. All of the other sites were located below the influx of AMD pollution. The second collection site was directly below the first AMD polluted unnamed tributary, the third site was below the middle branch tributary and the last collection site was between the huling branch tributary and kettle creek (Fig. 2). A reach was established where there was no direct tributary input. The reach was 100 meters long and was photographed at each site. Sampling locations at each site where established and assessed before entering the water. D-frame nets were used in a combination with pre-established sampling locations in both riffles and runs. Combinations of both were used to get a broader understanding of the habitat in faster and slower moving waters. Placing the opening of the net towards the current, a kick was performed. A kick includes overturning rocks and disrupting the substrate while wading through the water in efforts of exposing the macroinvertebrates and collecting them in the D-nets. Three kicks were performed at each collection site for 45 seconds a kick. In addition, habitat assessment field data sheets were completed for each site.

The samples were preserved in individual bottles for each site in ethanol. The samples were then identified using a dissection scope and identification keys and separated into individual bottles to be further analyzed.

Performing kicks using a D-net for collection at two-mile run

Results:

The first site had a total of 35 collected macroinvertebrates from five different orders and one unknown order (Fig. 1). The most dominant order was the *Ephemeropterans* or the mayflies primarily from the *Heptageniidae* family (Table 1). The second site had a total of seven collected macroinvertebrates from three different orders (Fig. 1). The most prevalent order was tied between the *Plecopterans* (stoneflies) and the mayflies (Table 2). The third site had a total of five organisms from four different orders (Fig. 1). The most prevalent order was the *Coleopterans* (Table3). The fourth site had two collected organisms both from the same order of *Trichopterans* or the caddisflies (Table 4). Furthermore, the first sample site was the only site to contain all three of the "EPT's", the *Ephemeropterans* (mayflies), *Plecopterans* (Stoneflies), *and Trichopterans* (caddisflies).

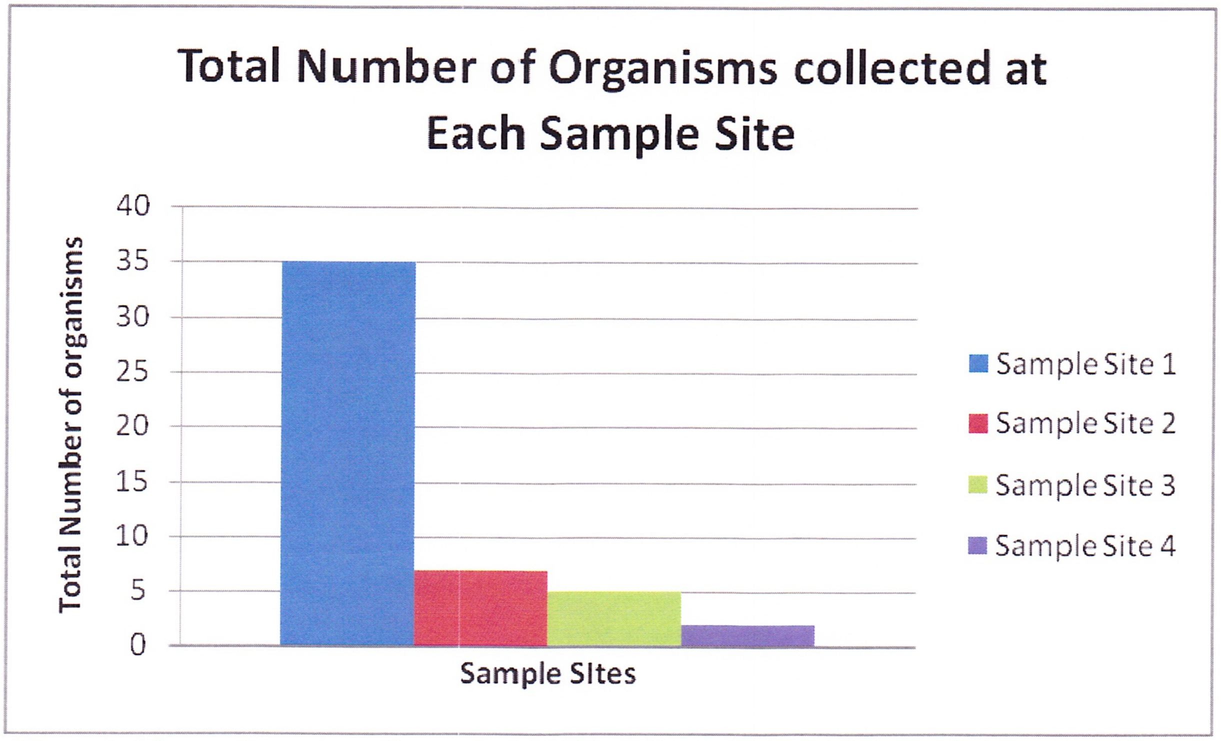
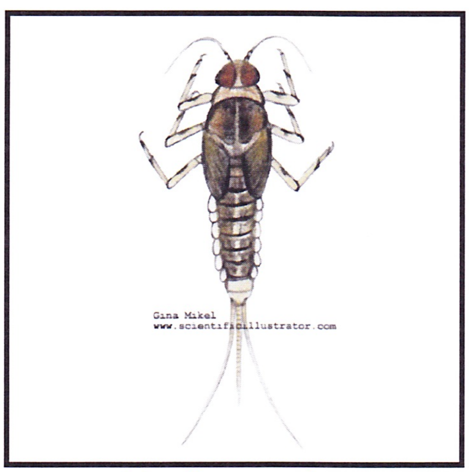
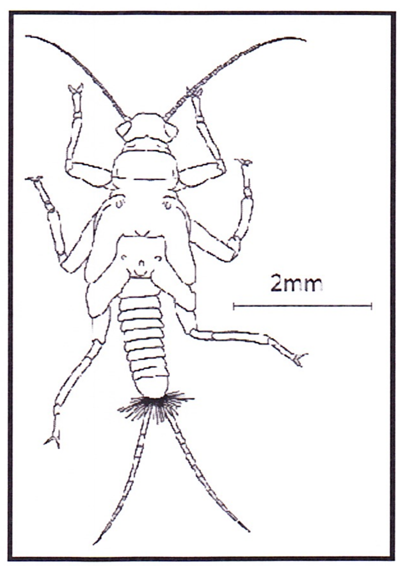


Figure 1: The total number of organisms collected at each of the sample sites in two-mile run.



Mayfly nymph



Stonefly nymph

Discussion:

Sample site 1 had by far the greatest overall biomass with 35 species which was overwhelmingly more then the next closest at sample site 2 that had 28 less individuals (Fig. 1). It continues to decrease the further down two-mile run. In addition, sample site 1 was the only site to contain all three of the EPT's where as sample site 2 and 3 had two out the three and site 4 only had one out of the three of the EPT's (Tables 1,2,3,4).

Sample site 1 appeared to be the healthiest portion of the stream. This is clearly due to the fact that it is above the AMD polluted tributary. All of the sites beyond the first unnamed tributary are exposed to the consequences of AMD such as lowered pH levels and increased levels of dissolved metals such as iron. Very few species can withstand the drastic changes in the pH levels due to the AMD. Furthermore, the iron precipitate from the dissolved metals settles on the substrate. This removes the benthic environment that many of the macroinvertebrates heavily rely on to survive.

The EPT's are typically sensitive to changes in pH and cannot survive at pH levels below 4.5(Earle and Callaghan 2009). While the water chemistry was not surveyed, it can be speculated that the majority of two-mile run most likely had a pH level around or above 4.5 because at each site an EPT was collected. Furthermore, it seemed as though the health of the stream decreased downstream closer to Kettle Creek. This is supported not only by the decrease of biomass but also by the absence of the extremely sensitive mayflies at sites 3 and 4. This decreasing health of the stream could be due to the increased amount of AMD influx from additional tributaries. In addition, while doing the habitat assessment field data sheets, the first two sites ranked in the optimal levels for bank vegetation protection while site 3 was in the suboptimal level and site 4 dropped into the marginal category. This could imply that in addition to the water chemistry, the surrounding habitat or more specifically the vegetation over the stream banks, are correlated with the presence of the benthic organisms. The patterns of decreased stream health are evident however further statistical analysis would need to be done to determine the significance of the differences at each site.

Overall life is still present throughout two-mile run. It is evident that AMD is extremely detrimental to the total abundance and biomass of benthic macroinvertebrates. It is also seen that certain orders and families of macroinvertebrates can tolerate various ranges of pH levels. Furthermore, it seems that while the changes in water quality are the most damaging consequences of AMD, the alteration of the surrounding vegetative habitat could also play a significant role and could be further explored.

Literature Cited

Earle, J. and T. Callaghan. 2009. Impacts of Mine Drainage on Aquatic Life, Water Uses, and Man-Made Structures. Department of Environmental Protection. 4:1-12.

Wolfe, A. 2009. Cleaning Up Abandoned Mine Drainage in the West Branch Susquehanna Watershed. Trout Unlimited. Lock Haven, Pa.

Zink, T., A. Wolfe and K. Curley. 2008. Restoring the Wealth of the Mountains: Cleaning Up Appalachia's Abandoned Mines. Trout Unlimited. Lock Haven, Pa.

Appendix:

Sample Site 1			#
Common Name	**Order**	**Family**	
Stonefly	Plecoptera		3
Water Penny	Coleoptera	Psephenidae	1
	Diptera	Chironomidae	2
	Diptera		4
	Coleoptera		1
Caddisfly	Tricoptera		3
Stonefly	Plecoptera		3
Caddisfly	Tricoptera	Hydropsychidae	4
Mayfly	Ephemeroptera		4
Mayfly	Ephemeroptera	Heptageniidae	9
Unknown			1
SUM			**35**
Prevalence by Order	**Total #**		
Plecoptera	6		
Coleoptera	2		
Diptera	6		
Tricoptera	7		
Ephemeroptera	13		
Unknown	1		

Table 1: Number of collected organisms at the first site and the prevalence of each order.

Common Name	Order	Family	#
	Diptera	Chironomidae	1
Stonefly	Plecoptera		3
Mayfly	Ephemeroptera	Baetidae	2
Mayfly	Ephemeroptera	Leptophlebiidae	1
SUM			**7**
Prevalence By Order	**Total #**		
Diptera	1		
Plecoptera	3		
Ephemeroptera	3		

Table 2: Number of collected organisms at the second site and the prevalence of each order

Sample Site 3		
Common Name	**Order**	**#**
	Diptera	1
	Coleoptera	2
Stonefly	Plecoptera	1
Caddisfly	Tricoptera	1
SUM		**5**
Prevalence By Order	**Total #**	
Diptera	1	
Coleoptera	2	
Plecoptera	1	
Tricoptera	1	

Table 3: Number of collected organisms at the third site and the prevalence of each order

Sample Site 4			
Common Name	**Order**	**Family**	**#**
Caddisfly	Tricoptera		2

Table 4: Number of collected organisms at the fourth site and the prevalence of each order