Effects of MTM on Benthic Communities

This document provides a summary of the article: "Downstream effects of mountaintop coal mining: comparing biological conditions using family and genus level macroinvertebrate bioassessment tools" by: G.J. Pond, M.E Passmore, F.A. Borsuk, L. Reynolds and C.J Rose, from the US EPA's Wheeling field office. The paper was published in the Journal of the North American Benthological Society,

Surface coal mining with valley fills has impaired aquatic life in numerous streams of the central Appalachian Mountains. This study characterizes the macroinvertebrate communities from riffles in 37 West Virginia streams (10 un-mined and 27 mined sites with valley fills) sampled in the spring index period. The results are compared using family and genus level taxonomic data. Specific conductance µ/cm (low < 500; medium 500-1000; high > 1000) was used to categorize levels of mining disturbance in mined watersheds. Mining activities impair biological communities by:

- Shifting species assemblages;
- Loss of Ephemeroptera taxa
- Changing community composition and diversity; and
- Altering water chemistry.

Results were consistent whether family or genus level data were used. Using both data types mined sites were significantly separated from un-mined sites, indicating that shifts in community structure was caused by mining. Several Ephemeroptera genera and their families (Ephemerellidae and Heptageniidae) were eliminated from most mined sites. Total Ephemeroptera richness and relative abundance declined with increasing mining disturbance.

Several other metrics were also effective in discriminating un-mined versus mined sites. Most family level metrics performed well and approximated the strength of genus-based metrics. A genus-level multi-metric index called the Genus-Level Index of Most Probable Stream Status (GLIMPSS) rated more mined sites as impaired, than did the family-level WV Stream Condition Index (WVSCI). Water quality variables were more strongly correlated to changes in the macroinvertebrate communities than typical RBP habitat variables. Results show that mining activities have had subtle to severe impacts on benthic macroinvertebrate communities, and that the biological condition most strongly correlates with a gradient of ionic strength.

The table below provide the percent relative frequency of (Ephemeroptera, Plecoptera and Trichoptera) occurrences among mining categories; and also the family-level metric values among mined and un-mined sites. **CLICK-HERE** to download the full article

Mayfly families	Genus	None	Low	Medium	High	Mayfly families	Genus	None	Low	Medium	High
Ameletidae	*Ameletus*	90	71	25	0		*Acentrella*	60	43	25	8
	Drunella	90	57	0	0	Baetidae	*Baetis*	70	71	63	17
Ephemerellidae	*Ephemerella*	100	86	25	8		*Diphetor*	10	0	0	0
	Eurylophella	20	0	0	0		*Plauditus*	10	43	13	25
	Cinygmula	80	43	0	0	Ephemeridae	*Ephemera*	20	0	0	0
	Epeorus	100	43	0	0	Isonychiidae	*Isonychia*	0	14	0	0
Heptageniidae	*Stenacron*	30	0	0	0	Leptophlebiidae	*Paraleptophlebia*	90	43	0	0
	Stenonema	30	14	0	0						
Stonefly families	Genus	None	Low	Medium	High	Stonefly families	Genus	None	Low	Medium	High
Capniidae	*Paracapnia*	10	0	0	0	Leuctridae	*Leuctra*	90	29	25	17
	Alloperla	0	14	0	0		*Amphinemura*	100	100	88	75
Chloroperlidae	*Haploperla*	30	14	25	0	Nemouridae	*Ostrocerca*	10	0	0	0
	Sweltsa	20	14	0	0		*Prostoia*	10	43	13	0
Peltoperlidae	*Peltoperla*	0	29	13	0		*Clioperla*	0	0	0	0
	Acroneuria	30	29	13	8	Perlodidae	*Diploperla*	0	14	13	8
Perlidae	*Eccoptura*	0	0	0	0		*Isoperla*	20	29	25	25

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	Hansonoperla	10	0	0	0		*Malirekus*	10	0	0	0
Pteronarcyidae	*Pteronarcys*	60	43	13	0		*Remenus*	30	29	0	8
Taeniopterygidae	*Taenionema*	10	14	0	0		*Yugus*	60	14	0	0
Caddisfly families	Genus	None	Low	Medium	High	Caddisfly families	Genus	None	Low	Medium	High
Glossosomatidae	*Agapetus*	10	0	0	0		*Ceratopsyche*	10	43	38	50
	Glossosoma	0	14	0	8	Hydropsychidae	*Cheumatopsyche*	0	86	88	92
	Hydroptila	10	0	0	8		*Diplectrona*	80	71	75	42
Hydroptilidae	*Ochrotrichia*	0	0	0	8		*Hydropsyche*	10	57	88	67
	Stactobiella	0	0	13	0	Lepidostomatidae	*Lepidostoma*	10	0	0	0
Limnephilidae	*Pycnopsyche*	20	0	0	0	Polycentropodidae	*Polycentropus*	30	29	13	8
	Chimarra	0	29	13	33	Psychomiidae	*Lype*	10	0	0	0
Philopotamidae	*Dolophilodes*	20	43	13	8	Rhyacophilidae	*Rhyacophila*	70	57	50	17
	Wormaldia	20	0	0	0	Uenoidae	*Neophylax*	70	71	13	8

Metrics	Mined	Un-mined	RPD
Total Taxa	12	20	50.0
EPT Taxa	6	13	73.7
Ephemeroptera Taxa	2	5	85.7
Plecoptera Taxa	4	2	66.7
Family Biotic Index	4.3	3.4	23.4
% EPT Abundance	51.1	77.9	20.8
% Ephemeroptera	7.4	45.6	144.2
% Plecoptera	27.3	23.8	13.7
% Chironomidae	27.1	13.5	67.0

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