AQUATIC MACROINVERTEBRATE MONITORING AT THE VERMONT MONITORING COOPERATIVE SITE UNDERHILL, VERMONT

by the
Vermont Department of Environmental Conservation

INTRODUCTION

The Vermont Department of Environmental Conservation (DEC) maintains a Statewide monitoring program, the Ambient Biomonitoring Network (ABN), which samples aquatic biological communities in rivers and streams at 50-70 sites annually. There is a core of 30-40 sites that are sampled every year during the late summer/fall period for the purpose of evaluating temporal variability and tracking long-term trends in biological integrity at those sites. Other sites are sampled on a one time basis for the purpose of making site-specific water quality/habitat evaluations related to some specific watershed disturbance. In 1991, DEC added two sites, located in the vicinity of the Vermont Monitoring Cooperative (VMC) research area on the west slope of Mount Mansfield, to the core sites sampled as part of the ABN. These sites will be integrated into the Statewide long-term biological monitoring program.

LOCATION

The two sampling sites are located in the upper reaches of the Brown's River watershed - one on Stevensville Brook and one on the Brown's River upstream of its confluence with Stevensville Brook (Figure 1). Both sampling sites are located at an elevation of 1400 feet. The Stevensville Brook site is located about 50m above the bridge at the parking lot for the Nebraska Notch trail (lat 44 30 21:long 72 50 45) and drains approximately 5.2 km^2 of forested watershed. The Brown's River site is located about 100m above the last bridge before the State Park gate (lat 44 51 09:long 72 31 28) and drains approximately 6.1 km^2 of forested watershed.

METHODS

Duplicate samples of aquatic macroinvertebrates were collected from riffle areas using a standardized "kick-net" procedure used by DEC at all ABN sites. The use of standardized sampling methods results in an equal sampling effort applied to all sites sampled, providing a quantitative basis for making comparisons between sites. The sampler holds a 500u mesh D-frame net in the stream and vigorously disturbs the substrate immediately above the net, dislodging macroinvertebrates associated with the substrate and allowing them to be carried into the net by the current. A sample consists of all the organisms and detritus that are dislodged from the substrate during two minutes (as timed by a stopwatch) of active substrate disturbance. Organisms are removed from the net, placed in labeled jars, and preserved in alcohol or formalin. A habitat evaluation of the sample site is conducted at the time of sampling. Temperature, pH, alkalinity, and specific conductance of the water column are measured at the time the sample is collected. Samples are returned to the DEC laboratory in Waterbury where organisms are separated from the detritus, sorted into taxonomic groups, and identified to the lowest possible taxonomic levels using appropriate identification keys. Data are tabulated and entered into a computer data management system using Paradox software and IBM-compatible PC systems. Data can be outloaded in a variety of formats, including ASCII, dBase, and Lotus.

RESULTS

36 and 35 taxa of aquatic invertebrates were identified from Browns River and Stevensville Brook respectively (Tables 1 and 2). In general, the composition of the invertebrate communities was typical of high elevation oligotrophic streams draining steep forested watersheds and were dominated by species of mayflies, stoneflies, and caddisflies. There were some differences between the two streams.

Stevensville Brook had lower pH and alkalinity than Browns River and had fewer organisms per unit sampling effort. Distribution of species among the mayflies, stoneflies, and caddisflies was much more even in Browns River, with Stevensville Brook being dominated (76%) by filipalpian stoneflies. The mayflies Baetis tricaudatis and Epeorus sp. and the caddisfly Dolophiloides sp. were present in both streams but were much more dominant in the Browns River community then in Stevensville Brook. Stevensville Brook was dominated by organisms dependent upon course organic material as an energy (food) source while Browns River was dominated by organisms dependent upon fine organic particulate material as a source of energy.

DISCUSSION

The aquatic macroinvertebrate communities in these two adjacent watersheds show some compositional differences that may reflect differences in water quality/watershed character. While both communities reflect generally high quality conditions, the distribution of species within the communities suggests that Stevensville Brook may be subjected to more acidic conditions than Browns River. The overwhelming dominance of filipalpian stoneflies, which are relatively tolerant of acidic conditions, in Stevensville Brook is unique among the more than 300 sites in the DEC database. Differences in the functional structure of the two communities suggest that energy dynamics in the two streams may be different. These differences may be due to differences in acidity or perhaps land use/riparian vegetation differences in the two watersheds.

DEC will continue monitoring these sites on an annual basis. More intensive sampling could perhaps lead to some clearer definition of the observed differences in community structure between the two watersheds and provide some information relative to the factors causing these differences. However, DEC has no plans at this time to intensify its effort at this site.

SUMMARY

Aquatic macroinvertebrates were sampled at two sites in the upper Brown's River drainage basin using standardized sampling methods. The macroinvertebrate communities were dominated by mayflies, stoneflies, and caddisflies and were fairly typical of high-qaulity, high-elevation, high-gradient streams in the Green Mountains. Slight differences in community structure suggest potential differences in watershed character.

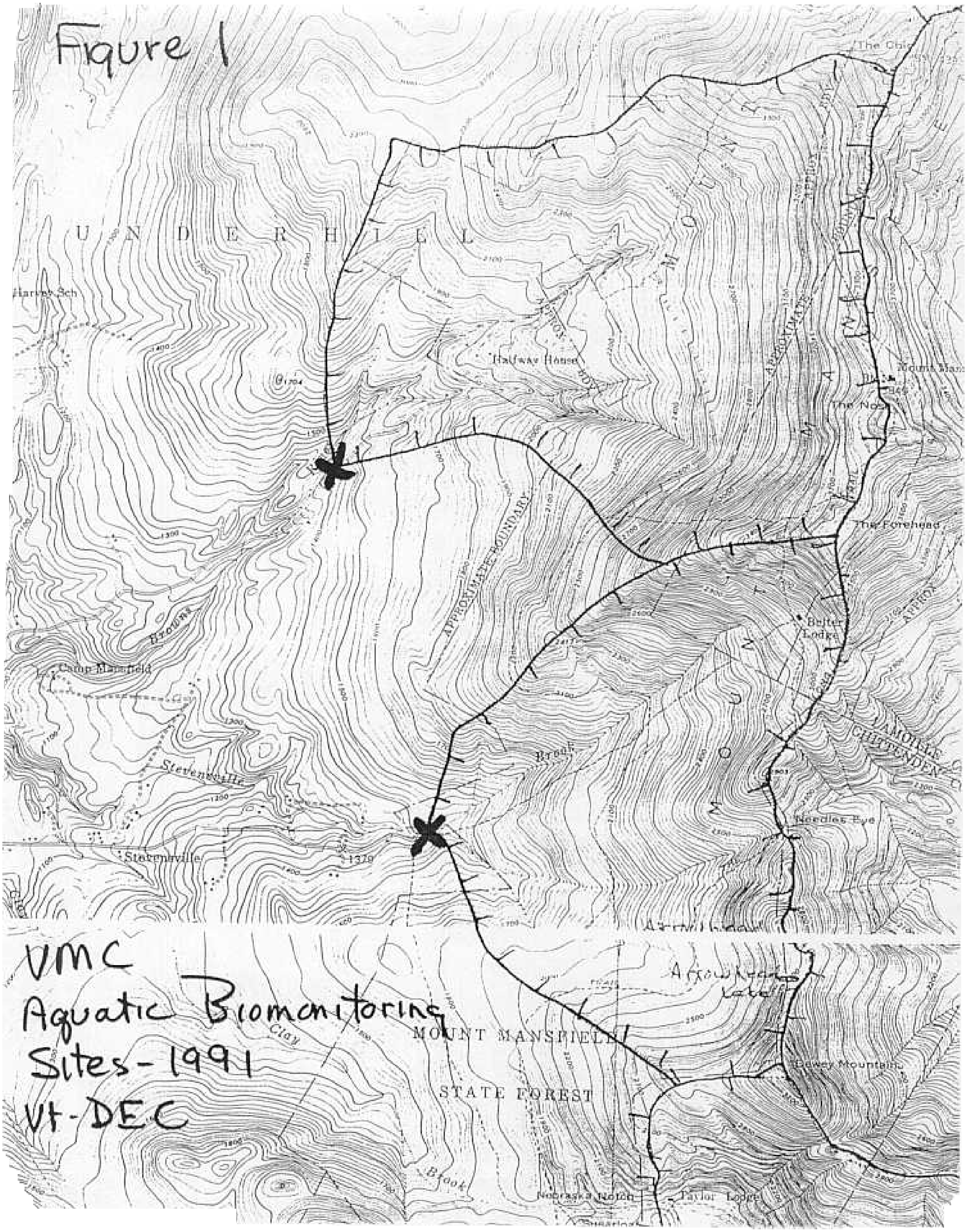

Figure 1

VMC Aquatic Biomonitoring Sites - 1991 VT-DEC

Table 1

Location: Stevensville Brook # 2.1 Town: Underhill Site Id: 46114300002
Device: Kick Net mposites/Rep: 1

Lab Id: 91.087 Date: 10/30/91 Area 1.00 m2 Number of Reps 2
Comments:

Physical/Chemical Habitat Conditions:

pH: 6.05 Alk (mg/l): 1.01 Conductivity: 25.0

Embeddedness: 5 Canopy % 90.0 Velocity (fps): 1.0 Depth (m):
(5->1: Excellent->Poor)

Bedrock % 5.0 Cobble % 40.0 Gravel % 10.0 Silt:
Boulder % 30.0 Course Gravel % 15.0 Sand % Clay:

Biometrics by Replicate

Rep #	Abunda.	EPT Abun.	EPT Rich.	Diver sity	Old BI	New BI	EPT/ Chiro	Spec/ Gen	Scrap/ Sc&Fi	Coll Gath	Coll Filt	Pred	Plank	Shred detri	Shred herbi	Scrap	Pierc Carni	Pierc Herbi	Un- Class
1	182.0	169.0	23.0	16.0	3.21	.53	.70	24.14	12.00	.11	3.3	4.4	18.7	0.0	71.4	1.6	.5	0.0	0.0	0.0
2	356.0	316.0	33.0	21.0	3.42	.52	1.01	10.19	5.25	.19	10.1	5.9	18.0	0.0	64.6	0.0	1.4	0.0	0.0	0.0

Community Metrics

Relative Abundance	=	269.0
Total Richness	=	37.0
Mean Richness	=	28.0
Total EPT Richness	=	23.0
Mean EPT Richness	=	18.5
Mean EPT/Mean Rich.	=	.66
Diversity	=	3.32
Old Bio-Index (0-5)	=	.52
New Bio-Index (0-10)	=	.85
(# EPT)/(# Chiro)	=	12.76
Dominant Taxa %	=	38.48
# Ephemeroptera	=	3
# Plecoptera	=	7
# Trichoptera	=	11

Percent Composition Major Groups

Coleoptera %	=	.4
Diptera %	=	9.5
Ephemeroptera %	=	2.0
Plecoptera %	=	76.2
Trichoptera %	=	11.9
Oligocheata %	=	0.0
Other %	=	0.0

Percent Composition by Functional Groups

Collector Gatherer	=	7.8
Collector Filterer	=	5.4
Predator	=	18.2
Shredder - Detritus	=	66.9
Shredder - Herbivore	=	.6
Scraper	=	1.1

Table 1 (cont)

Location: Stevensville Brook # 2.1 Town: Underhill Site Id: 461143000021
Device: Kick Net Composites/Rep: 1

Lab Id: 91.087 Date: 10/30/91 Area: 1.00 m2 Number of Reps: 2

Order	Genera	Species	Density	% Comp	Std Err	Minimum	Maximum
COLEOPTERA			1.0	.37	1.00	0.0	2.0
	OULIMNIUS	latiusculus	1.0	.37			
DIPTERA			25.5	9.48	12.50	13.0	38.0
	BRILLIA	sp	1.5	.56			
	EUKIEFFERIELLA	brehmi	1.5	.56			
	PARACHAETOCLADIUS	sp	2.5	.93			
	POLYPEDILUM	illionoense	.5	.19			
	POLYPEDILUM	aviceps	2.5	.93			
	THIENEMANNEMYIA	sp	.5	.19			
	TVETENIA	bavarica	1.5	.56			
	MICROPSECTRA	sp	8.5	3.16			
	EMPIDIDAE	unid	.5	.19			
	PROSIMULIUM	mixtum	1.5	.56			
	DICRANOTA	sp	3.5	1.30			
	HEXATOMA	sp	.5	.19			
	TIPULA	sp	.5	.19			
EPHEMEROPTERA			5.5	2.04	2.50	3.0	8.0
	BAETIS	tricaudatus	1.0	.37			
	EPEORUS	sp	3.0	1.12			
	STENONEMA	sp	.5	.19			
	STENONEMA	luteum	1.0	.37			
TRICHOPTERA			32.0	11.90	16.00	16.0	48.0
	PARAPSYCHE	apicalis	4.5	1.67			
	SYMPHITOPSYCHE	alhedra	2.0	.74			
	SYMPHITOPSYCHE	macleodi	2.5	.93			
	LEPIDOSTOMA	sp	3.0	1.12			
	HYDATOPHYLAX	sp	4.5	1.67			
	NEOPHYLAX	nacatus	.5	.19			
	DOLOPHILODES	sp	4.0	1.49			
	RHYACOPHILA	fuscula	3.5	1.30			
	RHYACOPHILA	manistee	4.0	1.49			
	RHYACOPHILA	vibox	.5	.19			
	RHYACOPHILA	carpenteri	3.0	1.12			
PLECOPTERA			205.0	76.21	55.00	150.0	260.0
	CAPNIIDAE	unid	17.0	6.32	2.00	15.0	19.0
	CHLOROPERLIDAE	unid	32.0	11.90	8.00	24.0	40.0
	LEUCTRIDAE	unid	103.5	38.48	43.50	60.0	147.0
	AMPHINEMURA	sp	6.5	2.42			
	PELTOPERLA	sp	26.0	9.67	4.00	22.0	30.0
	ACRONEURIA	sp	.5	.19			
	ACRONEURIA	carolinesis	.5	.19			
	TAENIONEMA	sp	19.0	7.06	3.00	16.0	22.0
TOTAL			269.0	100.00	87.00	182.0	356.0

Table 2

Location: Browns River # 20.8 Town: Underhill Site Id: 461100000208
Device: Kick Net Composites/Rep: 1

Lab Id: 91.086 Date: 10/30/91 Area: 1.00 m2 Number of Reps
Comments:

Physical/Chemical Habitat Conditions:

pH: 7.05 Alk (mg/l): 6.41 Conductivity:

Embeddedness: 5 Canopy % 90.0 Velocity (fps): 1.0 Depth (m) 2
(5->1: Excellent->Poor)

Bedrock % 10.0 Cobble % 30.0 Gravel % 5.0 Silt:
Boulder % 35.0 Course Gravel % 20.0 Sand % Clay:

Biometrics by Replicate

Rep #	Abunda.	EPT Abun.	EPT Rich.	Diver sity	Old BI	New BI	EPT/ Chiro	Spec/ Gen	Scrap/ Sc&Fi	Coll Gath	Coll Filt	Pred	Plank	Shred detri	Shred herbi	Scrap	Pierc Carni	Pierc Herbi	Un- Class
1	1372.0	1128.0	30.0	21.0	3.96	.74	1.80	5.53	1.22	.09	35.6	9.3	15.2	0.0	38.5	.3	.9	0.0	0.0	.3
2	764.0	658.0	32.0	21.0	3.83	.67	2.20	7.48	.97	.13	45.3	5.5	16.0	0.0	31.4	1.0	.8	0.0	0.0	0.0

Community Metrics

Relative Abundance	=	1068.0
Total Richness	=	37.0
Mean Richness	=	31.0
Total EPT Richness	=	24.0
Mean EPT Richness	=	21.0
Mean EPT/Mean Rich.	=	.68
Diversity	=	3.89
Old Bio-Index (0-5)	=	.71
New Bio-Index (0-10)	=	2.00
(# EPT)/(# Chiro)	=	6.12
Dominant Taxa %	=	22.57
# Ephemeroptera	=	5
# Plecoptera	=	8
# Trichoptera	=	9

Percent Composition Major Groups

Coleoptera %	=	.8
Diptera %	=	15.5
Ephemeroptera %	=	26.2
Plecoptera %	=	42.9
Trichoptera %	=	14.5
Oligocheata %	=	0.0
Other %	=	0.0

Percent Composition by Functional Groups

Collector Gatherer	=	39.0
Collector Filterer	=	8.0
Predator	=	15.4
Shredder - Detritus	=	36.0
Shredder - Herbivore	=	.6
Scraper	=	.8

Table 2 (cont)

Location: Browns River # 20.8 Town: Underhill Site Id: 461100000208
Device: Kick Net Composites/Rep: 1

Lab Id: 91.086 Date: 10/30/91 Area: 1.00 m2 Number of Reps: 2

Order	Genera	Species	Density	% Comp	Std Err	Minimum	Maximum
COLEOPTERA			9.0	.84	3.00	6.0	12.0
	OULIMNIUS	latiusculus	9.0	.84			
DIPTERA			166.0	15.54	66.00	100.0	232.0
	BRILLIA	sp	6.0	.56			
	EUKIEFFERIELLA	brehmi	1.0	.09			
	PARACHAETOCLADIUS	sp	14.0	1.31			
	PARAMETRIOCNEMUS	sp	8.0	.75			
	POLYPEDILUM	aviceps	42.0	3.93	22.00	20.0	64.0
	SYNORTHOCLADIUS	sp	2.0	.19			
	ZAVRELIMYIA	sp	1.0	.09			
	MICROPSECTRA	sp	72.0	6.74	32.00	40.0	104.0
	EMPIDIDAE	unid	2.0	.19			
	PROSIMULIUM	mixtum	1.0	.09			
	DICRANOTA	sp	15.0	1.40			
	HEXATOMA	sp	2.0	.19			
EPHEMEROPTERA			280.0	26.22	12.00	268.0	292.0
	BAETIDAE	unid	72.0	6.74	32.00	40.0	104.0
	BAETIS	tricaudatus	75.0	7.02	21.00	54.0	96.0
	EPHEMERELLA	sp	1.0	.09			
	HEPTAGENIIDAE	unid	2.0	.19			
	EPEORUS	sp	112.0	10.49	8.00	104.0	120.0
	PARALEPTOPHLEBIA	sp	15.0	1.40			
	AMELETUS	sp	3.0	.28			
TRICHOPTERA			155.0	14.51	77.00	78.0	232.0
	PARAPSYCHE	apicalis	1.0	.09			
	SYMPHITOPSYCHE	slossonae	5.0	.47			
	LEPIDOSTOMA	sp	14.0	1.31			
	HYDATOPHYLAX	sp	7.0	.66			
	PYCNOPSYCHE	sp	2.0	.19			
	DOLOPHILODES	sp	78.0	7.30	42.00	36.0	120.0
	RHYACOPHILA	fuscula	34.0	3.18			
	RHYACOPHILA	fenestra	1.0	.09			
	RHYACOPHILA	carpenteri	13.0	1.22			
PLECOPTERA			458.0	42.88	146.00	312.0	604.0
	CAPNIIDAE	unid	23.0	2.15			
	CHLOROPERLIDAE	unid	76.0	7.12	4.00	72.0	80.0
	LEUCTRIDAE	unid	241.0	22.57	99.00	142.0	340.0
	AMPHINEMURA	sp	12.0	1.12			
	PELTOPERLA	sp	20.0	1.87			
	ISOPERLA	sp	4.0	.37			
	MALIREKUS	hastatus	17.0	1.59			
	TAENIONEMA	sp	65.0	6.09	3.00	62.0	68.0
TOTAL			1068.0	100.00	304.00	764.0	1372.0