



APPENDIX F

BENTHIC MACROINVERTEBRATE REPORT

Big Walnut Creek Watershed Bioassessment 2007

Introduction

Macroinvertebrate monitoring is a valuable tool to measure the ecological health of a stream. Because they are considered to be more sensitive to local conditions and respond relatively rapidly to change, benthic (bottom-dwelling) organisms are considered to be the primary tool to document the biological condition of the streams [1]. The numbers and kinds of animals present at a study site can be compared to an unimpacted reference site. For example, mayflies, stoneflies, and caddisflies (EPT taxa) are considered to be relatively sensitive to environmental disturbances. This bioassessment technique results in a single biotic index value; the higher the value, the more ecologically healthy the stream.

Methods

Habitat Evaluation

Habitat was evaluated at each site according to the Ohio EPA method [2]. This method assigns numerical scores to various stream features (e.g. substrate type, pool depth), which are then summed into a final Qualitative Habitat Evaluation Index (QHEI) score. The maximum possible score with this method is 100.

Sample Collection (Macroinvertebrates)

Macroinvertebrate samples in this study were collected by dipnet in riffle areas where current speed approached 30 cm/sec. All samples were preserved in the field with 70% isopropanol. Spring samples were collected on April 23 and 24, and fall samples were collected on November 12 and 14, 2007. For each sampling event, duplicate samples were collected at two sites for quality control. No sample was collected from Site 11 (Heritage Lake East Inlet) in the fall because of low to no-flow conditions during the summer and fall.

Laboratory Analysis (Macroinvertebrates)

In the laboratory, a 100 organism subsample was prepared from each site by evenly distributing the animals collected in a white, gridded pan. Grids were randomly selected and all organisms within grids were removed until 100 organisms had been selected from the entire sample.

Each animal was identified to the lowest practical taxon (usually genus or species) using standard taxonomic references [4,5,6]. As each new taxon was identified, a representative specimen was preserved as a “voucher.” All voucher specimens will ultimately be deposited in the Purdue University Department of Entomology collection. The list of animals found is listed by site number in the appendix.

Data Analysis (Macroinvertebrates)

Following identification of the animals in the sample, “metrics” were calculated for each site. These metrics are based on knowledge about the sensitivity of each species to changes in environmental conditions. The macroinvertebrate data from this study were analyzed by two sets of metrics. Data were analyzed with the mIBI protocol developed by the Indiana Department of

Environmental Management [3], and an adaptation of the Ohio EPA protocol [2]. The mIBI is based on taxonomic identification to the family level, while the Ohio EPA scores are based on genus/species level of taxonomic identification. To facilitate comparisons with the QHEI, both are expressed as a percentage of the maximum possible score.

Results

A total of 50 macroinvertebrate genera were collected during the spring, and 65 macroinvertebrate genera during the fall. Dominant forms during the spring were midges (Chironomidae), blackfly larvae (Simuliidae), and riffle beetles (primarily *Stenelmis*). Dominant forms during the fall were caddisflies (Trichoptera), mayflies (Ephemeroptera) and midges (Chironomidae). The sediment-tolerant midge *Orthocladius obumbratus* was common and widespread during both spring and fall collections. Miller Creek (Site 12) had abundant numbers of an uncommon caddisfly (*Helicopsyche borealis*) in the fall sample. Bioassessment scores are presented in Table 1.

Table 1. Ohio EPA and mIBI bioassessment scores for macroinvertebrate data listed by site number. Included are scores for spring and fall samples, and their mean values. Scores are expressed as a percentage of the total possible score.

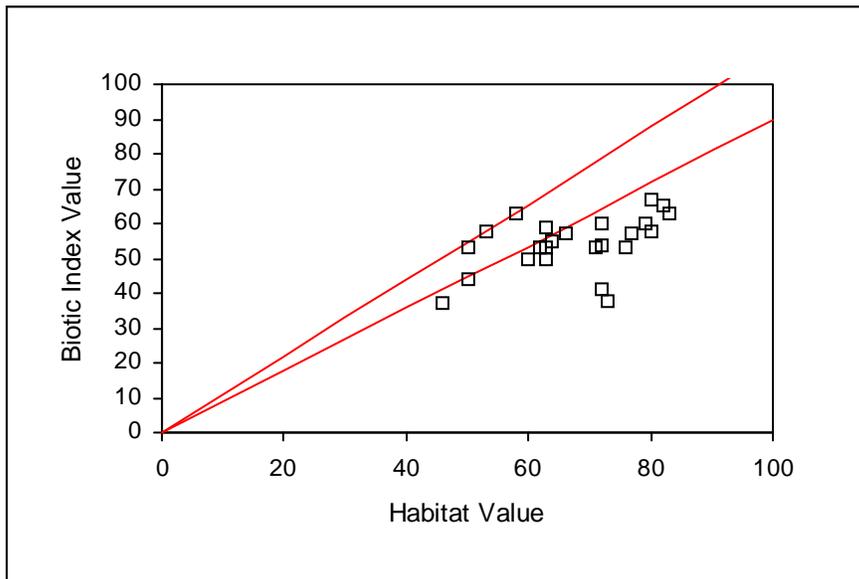
Site Number	QHEI	Spring Ohio EPA	Fall Ohio EPA	Ohio EPA Mean Value	Spring mIBI	Fall mIBI	mIBI mean value
1	46	47	27	37	53	33	43
2	50	50	37	44	55	40	48
3	64	50	60	55	53	70	62
4	66	53	60	57	65	83	74
5	63	53	53	53	60	60	60
6	82	57	73	65	83	88	86
7	80	43	73	58	70	85	78
8	77	70	43	57	78	75	77
9	79	60	60	60	83	70	77
10	76	67	40	53	75	45	60
11	62	53	No sample	53	50	No sample	50
12	60	50	50	53	65	70	68
13	63	57	60	59	60	73	67
14	53	53	63	58	50	68	59
15	72	47	73	60	70	80	75
16	71	53	53	53	68	55	62
17	72	27	50	41	45	53	49
18	58	57	70	63	63	85	74
19	80	63	70	67	80	73	77
20	63	43	57	50	58	80	69
21	72	57	50	54	70	80	75

22	73	57	23	38	65	10	38
23	50	43	63	53	50	70	60
24	83	53	73	63	63	80	72

Discussion

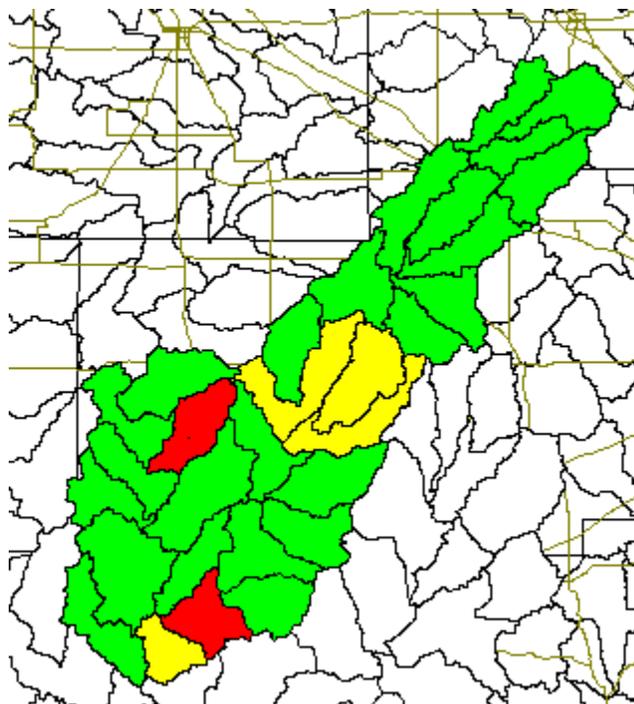
Macroinvertebrate bioassessment can indicate whether a site is biologically impaired, while the types of organisms present can give clues as to the nature of the impairment. In some cases, the cause of impairment is poor habitat quality. Aquatic life cannot thrive where habitat is lacking. The expectation is for the biotic score to be within 10% of the habitat score. If the difference is greater than 10%, water quality problems are suspected (Figure 1).

Figure 1. Relationship between Ohio EPA bioassessment scores (mean of spring and fall) and habitat scores. Sites outside of the lines may have degraded water quality.



See Figure 1a at end of document for a larger version of this Figure.

Figure 2. Map of sub-watersheds within the study area. The sites with the most severe biological impairment are red; sites with moderate biological impairment are yellow.



Two sites fall the farthest away from expected biotic scores and are considered to be high priority. These sub-watersheds are colored red on Figure 2. Limestone Creek (Site 22) had an average biotic index score of 38, despite this site having good habitat (QHEI score of 73). Abundance of organisms was very low in the fall. Diversity of organisms was low, with tolerant midges being dominant. Water quality at this site may be impacted by quarries within the watershed. Jones Creek (Site 17) had low scores for both spring and fall collections, although the habitat score was good (QHEI score of 72). The spring collection had low diversity, being dominated by blackfly larvae (Simuliidae), while the fall collection was elevated numbers of tolerant midges. This site experienced low-flow conditions and decreased dissolved oxygen levels during the summer of 2007.

Figure 1 illustrates that several other sites have moderately degraded biotic communities despite good to excellent habitat. These sub-watersheds are colored yellow on Figure 2. Big Walnut Creek at County Road 300 North and at Oakalla Bridge (Sites 7 and 8) both had biotic integrity score considerably lower than what would be expected. Site 7 had decreased diversity in the spring collection, with the sample being dominated by blackfly larvae. Site 8 had decreased diversity in the fall, with few mayflies present. The north inlet to Heritage Lake (Site 10) had a habitat score of 76, but had impaired biotic integrity in the fall collection, with a complete absence of caddisflies. Lower Deer Creek (Site 24) had the best habitat score (83) but had

impaired biotic integrity in the spring collection. The sample was dominated by midge larvae (primarily the sediment tolerant *Orthocladius obumbratus*), while only one caddisfly was present.

At the upper portion of the watershed, Edlin Ditch (Site 1) and North Fork (Site 2) both had low scores for the fall collections. Both sites had large numbers of midges (*Chironomus* and *Stictochironomus*) that are tolerant of low dissolved oxygen concentrations. Although the spring scores were close to what would be expected based on the habitat values, the collections for both sites contained large numbers of riffle beetles (*Stenelmis* spp.), which can be indicative of nutrient enrichment, lack of riparian shading, or both.

Decreased habitat quality appears to be the primary influence on the biotic integrity scores of several sites. Site 14 (Plum Creek) and Site 23 (Deweese Creek) had fair habitat, with substrate embeddedness and severe bank erosion being noted. The abundance of organisms was very low for the spring collection at Plum Creek. Site 18 (Long Branch) also had fair habitat, with severe bank erosion and low channel stability. Site 11 (East Inlet to Heritage Lake) experiences no-flow conditions during dry weather.

Conclusions

The habitat in the Big Walnut watershed is good to excellent at most sites. Habitat could be enhanced in the upper portion of the watershed by planting riparian vegetation. Severe bank erosion is a problem at several sites. Intolerant EPT taxa were well-represented in the macroinvertebrate collections, but sediment-tolerant midges and riffle beetles associated with nutrient enrichment were also widespread. Periodic low dissolved oxygen may occur in some locations. While this may be caused by low-flow conditions resulting from dry weather, it may also be due to high water temperatures where shade is lacking.

References

1. Plafkin, J.L., M.T. Barbour, K.D. Porter, S.K. Gross, and R.M. Hughes. 1989. Rapid Bioassessment Protocols for use in Streams and Rivers: Benthic Macroinvertebrates and Fish. US Environmental Protection Agency, Office of Water, Washington, D.C. EPA/444/4-89-001.
2. Ohio EPA. 1987. Biological criteria for the protection of aquatic life: Vol. II. Users manual for biological field assessment of Ohio surface waters. Div. of Water Quality Monitoring and Assessment, Columbus, OH.
3. Indiana Department of Environmental Management, 1999. Metrics for analysis of benthic macroinvertebrate samples collected from artificial substrates. PowerPoint Presentation to the Ohio Valley Chapter of SETAC. Office of Water Management, Biological Studies Section, Indianapolis, IN.
4. Simpson, K.W. and R.W. Bode. 1980. Common Larvae of Chironomidae (Diptera) from New York State Streams and Rivers. Bull. No. 439. NY State Museum, Albany, NY. 105 pp.

5. Schuster, G.A. and D.A. Etnier. 1978. A manual for the identification of the larvae of the caddisfly genera *Hydropsyche* and *Symphitopsyche* in Eastern and Central North America. U.S. EPA Environmental Support Laboratory, Cincinnati, OH (EPA-600/4-78-060).

6. Merritt, R.W. and K.W. Cummins. 1996. An Introduction to the Aquatic Insects of North America. Third Edition. Kendall/Hunt Publishing Company, Dubuque, Iowa. 862 pp.

Spring and Fall 2007 macroinvertebrate data listed by site number

Spring 2007 macroinvertebrate data

		SITE #	1	2	3	4	5	6	7	8	9
Diptera (flies)											
	Chironomidae (midges)										
	Orthocladus obumbratus		5	7	12	9	15	6	8	14	3
	Cricotopus bicinctus			1	5	6	9		3	10	5
	C. tremulus				5						
	Cardiocladius spp.								2		
	Nanocladius spp.									2	
	Rheocricotopus robacki										
	Parametricnemus lundbecki				1						
	Eukiefferiella pseudomontana										
	Dicrotendipes nervosus		2								
	Polypedilum convictum		3		1		2	2		2	
	Thienemanninia sp.		8				2				2
	Rheotanytarsus spp.		2	4							2
	Simuliidae (blackflies)		4	6	29	35		6	43	12	3
	Tabanidae (horse & deerflies)				1		1			1	
	Empididae (aquatic dance flies)										
	Hemerodromia spp.		2								
	Tipulidae (craneflies)										
	Tipula spp.				2						
	Hexatoma spp.										
	Antocha spp.								1		
	unknown diptera pupa							1	1		
Ephemeroptera (mayflies)	Isonychia spp.									6	
	Baetis amplus				6	8	7	15	4	1	5
	B. inetercalaris						3	1			
	B. flavistriga		4	2					4		
	B. hageni					3					
	Stenonema vicarium		1		3	2		25		13	3
	S. femoratum										
	S. pulchellum							1		3	6
	S. terminatum									1	
	Stenacron interpunctatum			5		1		1	3		3
	Tricorythodes spp.								3	3	45
	Caenis spp.		1			1	3	1		1	1
	Ameletus spp.										
	Potamanthus spp.										
Trichoptera (caddisflies)	Hydropsyche betteni		1	1	3	2		1			
	Ceratopsyche sparna			1	1			1			1

	C. bifida						1		3	12	16	1
	Cheumatopsyche spp.		2	2	10	7					5	5
	Chimarra obscura				1	1						
	Neureclipsis spp.					3						
	Brachycentrus spp.	1										
	Neophylax spp.											
	Ochrotrichia spp.											1
Plecoptera (stoneflies)	Amphinemura spp.				4		5	3	5	3	5	1
	Isoperla spp.		3		1	2	2	4	2	4	2	6
	Acroneuria spp.					1		1				
	Chloroperlidae											
Coleoptera (beetles)	Stenelmis spp.	60	64	29	14	33	29	8	3	5	5	
	Macronychus glabratus				2	4						2
	Psephenus herricki											
	Ectopria spp.											
	Hydrophilidae	1										
Odonata (damselfly & dragonflies)	Argia spp.	1	1									
	Boyeria spp.											
Megaloptera (fishflies & dobsonflies)	Corydalus cornutus											
Annelida	Oligochaetes (worms)	2	1			7						
Crustacea	Isopoda (aquatic sowbugs)											
	Decapoda (crayfish)											
Mollusca	Spaheridae		2									
	Corbicula	2										
	TOTAL	100	100	100	100	100	100	100	100	100	100	100

Spring 2007, cont

	SITE #	10	11	12	13	14	15	16	17	17-D	18
Diptera (flies)											
	Chironomidae (midges)										
	Orthocladus obumbratus	25	36	23	22	16	10	25	10	10	35
	Cricotopus bicinctus	1	4	12	10	6	1	2	1	1	4
	C. tremulus									3	
	Cardiocladius spp.		7					2			4
	Nanocladius spp.										
	Rheocricotopus robacki										
	Parametrioctenus lundbecki										
	Eukiefferiella pseudomontana				8						1
	Dicotendipes nervosus					2					
	Polypedilum convictum										
	Thienemanninia sp.			2				2		1	1
	Rheotanytarsus spp.										

	Simuliidae (blackflies)	7	3	1	14	8	33	2	73	56	12
	Tabanidae (horse & deerflies)							1			
	Empididae (aquatic dance flies)										
	Hemerodromia spp.										
	Tipulidae (craneflies)										
	Tipula spp.	3	1	1		1					
	Hexatoma spp.	2	1			1					
	Antocha spp.										
	unknown diptera pupa										
Ephemeroptera (mayflies)	Isonychia spp.									1	
	Baetis amplus	3	8	30	5	4	3		12	11	7
	B. inetercalaris	1		9				45		1	
	B. flavistriga		1		1	1		3			
	B. hageni	4				1					1
	Stenonema vicarium	23		1	2						6
	S. femoratum		8	1	3	2		3			1
	S. pulchellum										1
	S. terminatum										
	Stenacron interpunctatum		2	4		1					1
	Tricorythodes spp.					1					
	Caenis spp.	1			1	7					2
	Ameletus spp.		3								
	Potamanthus spp.										1
Trichoptera (caddisflies)	Hydropsyche betteni						16	1			
	Ceratopsyche sparna	4					3				
	C. bifida				1	2					
	Cheumatopsyche spp.	1			2	2	18				1
	Chimarra obscura	3			1		8				
	Neureclipsis spp.	4	2	4	6		1	4	2	6	3
	Brachycentrus spp.										
	Neophylax spp.							1			1
	Ochotrichia spp.										
Plecoptera (stoneflies)	Amphinemura spp.	10	5	3	3	4	4	1	1	6	11
	Isoperla spp.			3	2						2
	Acroneuria spp.				3	1					
	Chloroperlidae			1							
Coleoptera (beetles)	Stenelmis spp.	6	18	5	8	6	3	1	1	4	3
	Macronychus glabratus					3					
	Psephenus herricki	2			7			5			
	Ectopria spp.							1			
	Hydrophilidae										
Odonata (damselfly & dragonflies)	Argia spp.										
	Boyeria spp										1

Megaloptera (fishflies & dobsonflies)	Corydalus cornutus													
Annelida	Oligochaetes (worms)													
Crustacea	Isopoda (aquatic sowbugs)		1		1				1					1
	Decapoda (crayfish)													
Mollusca	Spaheridae													
	Corbicula													
	TOTAL		100	100	100	100	69	100	100	100	100	100	100	100

		SITE #	19	20	21	22	22-D	23	24
Diptera (flies)									
	Chironomidae (midges)								
	Orthocladus obumbratus		17	6	12	23	17	14	25
	Cricotopus bicinctus		4		17	2	7	10	6
	C. tremulus					6		2	2
	Cardiocladius spp.			3					
	Nanocladius spp.								
	Rheocricotopus robacki			1	2				
	Parametriocnemus lundbecki								
	Eukiefferiella pseudomontana								
	Dicrotendipes nervosus								
	Polypedilum convictum				2				2
	Thienemanninia sp.		5	2	3		1		
	Rheotanytarsus spp.								
	Simuliidae (blackflies)		4	60		14	26	32	20
	Tabanidae (horse & deerflies)								
	Empididae (aquatic dance flies)								
	Hemerodromia spp.			2					
	Tipulidae (craneflies)								
	Tipula spp.								
	Hexatoma spp.			2					
	Antocha spp.			1					
	unknown diptera pupa								
Ephemeroptera (mayflies)	Isonychia spp.				1	3			1
	Baetis amplus		29	10	2	11	5	8	11
	B. inetercalaris		1			25	27	17	7
	B. flavistriga					2		1	
	B. hageni					2			
	Stenonema vicarium		1	3	3	4			3
	S. femoratum				8				
	S. pulchellum								
	S. terminatum								
	Stenacron interpunctatum		1		5				

	Tricorythodes spp.									9
	Caenis spp.				9					
	Ameletus spp.									
	Potamanthus spp.									
Trichoptera (caddisflies)	Hydropsyche betteni									
	Ceratopsyche sparna									
	C. bifida									
	Cheumatopsyche spp.	2	1	8	2	2				1
	Chimarra obscura	3	1	2						
	Neureclipsis spp.	2	3			1				
	Brachycentrus spp.									
	Neophylax spp.									
	Ochotrichia spp.									
Plecoptera (stoneflies)	Amphinemura spp.	15	5	2	4	7	2	2		
	Isoperla spp.	1				2				
	Acroneuria spp.	9		8			1	1		
	Chloroperlidae									
Coleoptera (beetles)	Stenelmis spp.	6		13	1	1	13	8		
	Macronychus glabratus			1						
	Psephenus herricki									
	Ectopria spp.									
	Hydrophilidae									
Odonata (damselfly & dragonflies)	Argia spp.									
	Boyeria spp.									
Megaloptera (fishflies & dobsonflies)	Corydalus cornutus				1	2				2
Annelida	Oligochaetes (worms)			1						
Crustacea	Isopoda (aquatic sowbugs)			1		1				
	Decapoda (crayfish)					1				
Mollusca	Spaheridae									
	Corbicula									
	TOTAL	100	100	100	100	100	100	100	100	100

Fall 2007 Macroinvertebrate Data

	SITE #	1	2	3	4	5	6	7	8	9
Diptera (flies)										
	Chironomidae (midges)									
	Procladius spp.	11	5							
	Thienemanninia spp.			2	9	7		1		6
	Orthocladus obumbratus		3	8		32	10	9	7	15
	Corynoneura spp.									
	Cricotopus bicinctus									10

	Nanocladius spp.				2	5					
	Eukiefferiella pseudomontana				1	1					
	E. bavarica										
	Parakiefferiella spp.						2				
	Parametriocnemus spp.										
	Rheocricotopus robacki										
	Thienemanniella xena					1					
	Dicrotendipes neomodestus	8				1					
	Chironomus spp.	28	8			2					11
	Stictochironomus spp.	17	50			2	2				
	Cryptochironomus fulvus	3									
	Microtendipes caelum	3									
	Polypedilum convictum				1	1	2				1
	P. fallax										
	Microspectra polita							2	1		
	Rheotanytarsus exiguus										
	Tanytarsus spp.										
	Paratanytarsus spp.										
	Simuliidae (blackflies)					1					
	Ceratopogonidae (biting midges)										
	Tabanidae (horse & deerflies)										
	Empididae (aquatic danceflies)										
	Hemerodromia								1		
	Tipulidae (crane flies)										
	Tipula			1	2		3				
	Hexatoma										
	Pseudolimnophila										
	Antocha										
Ephemeroptera (mayflies)	Isonychia spp.					10	1	18	3	3	3
	Baetis spp.										
	B. inetercalaris										
	B. flavistriga				1						
	Stenonema vicarium		2	3	8			18	22		5
	S. femoratum		3	1			3	2			
	S. pulchellum									1	1
	S. terminatum							3	2		9
	Stenacron interpunctatum		9				1	4	2		3
	Tricorythodes spp.							1	17		8
	Caenis spp.	5	2	1	3	15	1				3
	Potamanthus spp.								1		
Trichoptera (caddisflies)	Hydropsyche betteni				12						
	Ceratopsyche sparna				1						
	C. bifida	1	1	4				3	20	49	
	Cheumatopsyche spp.		3	54	22	15	22	9	28		2
	Chimarra obscura			3	31	6	8	6	8		1
	Polycentropis spp.										1

	Helicopsyche borealis											
	Limnephilidae											
	Ochrotrichia spp.											2
Plecoptera (stoneflies)	Taeniopteryx spp.				2			1	1	1		7
Coleoptera (beetles)	Stenelmis spp.	20	11	2			3	5	5			2
	Dubiraphia spp.	1										
	Macronychus glabratus											3
	Psephenus heriicki						1					
	Berosus spp.	1	1				1					
Odonata (damselfly & dragonflies)	Argia spp.	1	1		1	1	1					5
	Hetaerina spp.										1	
	Platelmis lydia											1
	Erpetogomphus designatus											1
Megaloptera (dobson & fishflies)	Corydalis cornutus							1				
	Sialis spp.											
Oligochaetes (worms)												
Turbellaria (planarians)				2			1				1	
Amphipoda (scuds)							4					1
Isopoda (aquatic sowbugs)	Lirceus spp.											
	Caecedotea spp.											
Hirudinea (leeches)		1										
Mollusca	Physella											
	Sphaeridae											
TOTAL		100	100	100	100	100	100	100	100	100	100	100

Fall 2007, cont.

	SITE #	10	12	13	14	15	16	17	18
Diptera (flies)									
	Chironomidae (midges)								
	Procladius spp.								
	Thienemannimyia spp.	8	3		12	1	4	18	4
	Orthocladius obumbratus		9	26	21	5	2	9	
	Corynoneura spp.	9				1	4	3	
	Cricotopus bicinctus								
	Nanocladius spp.	14		4	2				
	Eukiefferiella pseudomontana					1			2
	E. bavarica						8		
	Parakiefferiella spp.								
	Parametriocnemus spp.					4	26	21	2
	Rheocricotopus robacki	11							
	Thienemanniella xena		4		2				

	Dicrotendipes neomodestus				1					
	Chironomus spp.									
	Stictochironomus spp.	8			2			3		
	Cryptochironomus fulvus				2					
	Microtendipes caelum	8						9	1	
	Polypedilum convictum				2					
	P.fallax	3								
	Microspectra polita									
	Rheotanytarsus exiguus									
	Tanytarsus spp.			1	2					
	Paratanytarsus spp.									
	Simuliidae (blackflies)									
	Ceratopogonidae (biting midges)							3		
	Tabanidae (horse & deerflies)				1					
	Empididae (aquatic danceflies)									
	Hemerodromia									
	Tipulidae (craneflies)									
	Tipula	4			5			4	2	
	Hexatoma	1								
	Pseudolimnophila	2								
	Antocha					1			1	
Ephemeroptera	Isonychia spp.				1	5	3	1	4	
(mayflies)	Baetis spp.				1			1		
	B. inetercalaris					2				
	B. flavistriga									
	Stenonema vicarium	6		1	6	16	4	4	20	
	S. femoratum	2		1	1	15		1	4	
	S. pulchellum									
	S. terminatum									
	Stenacron interpunctatum	2		1		8	4	4	4	
	Tricorythodes spp.					1				
	Caenis spp.	2			9	1		1	2	
	Potamanthus spp.									
Trichoptera	Hydropsyche betteni				1		2			
(caddisflies)	Ceratopsyche sparna						3			
	C. bifida			5	3					
	Cheumatopsyche spp.			4	21	13	33	24	8	36
	Chimarra obscura			23	10	6	2	9	2	11
	Polycentropis spp.					1				1
	Helicopsyche borealis			35						
	Limnephilidae						2			
	Ochrotrichia spp.									
Plecoptera	Taeniopteryx spp.	3			16	3			1	
(stoneflies)										

Coleoptera	Stenelmis spp.		6	1	3	1	1	2	4	1
(beetles)	Dubiraphia spp.			1						
	Macronychus glabratus				2					1
	Psephenus heriicki		10	13	2	1		3	1	3
	Berosus spp.									
Odonata	Argia spp.			1	1	1				
(damselfly & dragonflies)	Hetaerina spp.				1					
	Plathelmis lydia									
	Erpetogomphus designatus									
Megaloptera	Corydalis cornutus								1	1
(dobson & fishflies)	Sialis spp.				1					
Oligochaetes (worms)			1		1	1			1	
Turbellaria (planarians)					1					
Amphipoda (scuds)										
Isopoda (aquatic sowbugs)	Lirceus spp.							8		
	Caecedotea spp.									
Hirudinea (leeches)										
Mollusca	Physella							1		
	Sphaeridae								1	
TOTAL			100	100	100	100	100	100	100	100

Fall 2007, cont.

		SITE #	19	20	21	22	23	24	20 D	24 D
Diptera (flies)										
	Chironomidae (midges)									
	Procladius spp.									
	Thienemannia spp.		2	1			4	4	2	2
	Orthocladius obumbratus		28		5	18	16	7		12
	Corynoneura spp.					2		1		
	Cricotopus bicinctus		3			4				3
	Nanocladius spp.									
	Eukiefferiella pseudomontana									
	E. bavarica						4			
	Parakiefferiella spp.									
	Parametriocnemus spp.			1		5	6	1	5	4
	Rheocricotopus robacki									
	Thienemanniella xena		1	1		3			1	
	Dicrotendipes neomodestus						2	2	3	1
	Chironomus spp.		1							
	Stictochironomus spp.									
	Cryptochironomus fulvus									
	Microtendipes caelum			1				1	4	
	Polypedilum convictum									
	P. fallax									
	Microspectra polita									

	Rheotanytarsus exiguus					4	1		
	Tanytarsus spp.								
	Paratanytarsus spp.		2		2				1
	Simuliidae (blackflies)					3			
	Ceratopogonidae (biting midges)								
	Tabanidae (horse & deerflies)							1	
	Empididae (aquatic danceflies)								
	Hemerodromia						1		1
	Tipulidae (craneflies)								
	Tipula		1		2				
	Hexatoma								
	Pseudolimnophila								
	Antocha								
Ephemeroptera (mayflies)	Isonychia spp.		9	1	4		38	1	2
	Baetis spp.								
	B. inetercalaris								
	B. flavistriga								
	Stenonema vicarium		12	6	5	1	21	5	16
	S. femoratum		1	4	2			3	9
	S. pulchellum		2						
	S. terminatum						7		
	Stenacron interpunctatum		4	3	1	2	3	29	2
	Tricorythodes spp.		1				3		16
	Caenis spp.		1						
	Potamanthus spp.								
Trichoptera (caddisflies)	Hydropsyche betteni		1			1	1		
	Ceratopsyche sparna								1
	C. bifida		3		2				2
	Cheumatopsyche spp.		5	39	43	12	4	23	3
	Chimarra obscura		1	38	26	1		22	
	Polycentropis spp.					1	2		3
	Helicopsyche borealis								
	Limnephilidae								
	Ochrotrichia spp.						4		1
Plecoptera (stoneflies)	Taeniopteryx spp.		9					16	9
Coleoptera (beetles)	Stenelmis spp.		6		7	2	3	9	5
	Dubiraphia spp.								
	Macronychus glabratus						1	1	3
	Psephenus heriicki		5		1		1		
	Berosus spp.								
Odonata (damselfly &	Argia spp.		1		2				1
	Hetaerina spp.								

dragonflies)	Plathelmis lydia										
	Erpetogomphus designatus										
Megaloptera	Corydalis cornutus		1					1		2	
(dobson & fishflies)	Sialis spp.										
Oligochaetes (worms)			2	3		4	1	8		1	
Turbellaria (planarians)											
Amphipoda (scuds)											
Isopoda (aquatic sowbugs)	Lirceus spp.									1	
	Caecedotea spp.						1				
Hirudinea (leeches)											
Mollusca	Physella										
	Sphaeeridae					1					
TOTAL			100	100	100	41	100	100	100	100	100

Figure 1a

Macroinvertebrate Data - OEPA

