North Nashua River 2003 Biological Assessment

Larva of the caddisfly, *Hydropsyche betteni*, a ubiquitous resident of the North Nashua River.

Robert M. Nuzzo
Massachusetts Department of Environmental Protection
Division of Watershed Management
Worcester, MA

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INTRODUCTION

Biological monitoring using aquatic macroinvertebrates is an integral part of watershed assessments conducted by the Department of Environmental Protection's (MassDEP) Division of Watershed Management (DWM). The biological monitoring data are useful in evaluating the status of the health of aquatic communities and rating how well the waterbody is supporting its aquatic life.

In September 2003 biological monitoring was conducted by DWM in the North Nashua River at five locations. Figure 1 shows sampling locations within the watershed, while Table 1 lists the locations and provides a brief description of each. The Quinapoxet River site has been used in the past to serve as a reference for Nashua River watershed biomonitoring data and was selected for reference in 2003 as well.

Table 1. Sampling station descriptions and sampling dates.

Station ID	Station Description	Sampling Date
QP00	Quinapoxet River downstream from lower River Street crossing (in vicinity of "Canada Mills"), Holden, MA	17 Sept. 2003
NN03	North Nashua River downstream from "Mill #9" bridge, Fitchburg, MA	3 Sept. 2003
NN09	North Nashua River downstream from Airport Road, Fitchburg, MA	3 Sept. 2003
NN10A	North Nashua River downstream from Route 2, Leominster, MA	3 Sept. 2003
NN13	North Nashua River upstream from Ponakin Road bridge (in vicinity of "Ponakin Mill"), Lancaster, MA	3 Sept. 2003

METHODS

As described in the standard operating procedures (Nuzzo 2003), aquatic macroinvertebrates were collected from wadable riffle habitat sites by kicking bottom substrates to dislodge the organisms. A kick-net with a 500 μm mesh bag, pressed firmly against the stream bottom just downstream from the kicked area, was used to capture the organisms released to the current. Samples were composites of 10 kicks taken from approximate 0.46 m by 0.46 m areas (about 2 m^2 total) of riffle habitat within a 100 m reach. Samples were preserved in the field with denatured 100% reagent alcohol, then brought to the DWM lab for processing. Before leaving the sample reach, habitat data were recorded on field sheets and habitat qualities were scored using a modification of the evaluation procedure in Plafkin, et al. (1989).

Processing the benthos samples entailed extracting a count-based subsample (Nuzzo 2003). To accomplish this, the sample was distributed across the bottom of a sorting pan and materials were removed from grids based on a randomized sequence. A dissecting microscope set on low power was used to separate specimens from the other materials in the sample until approximately 100 organisms (±10%) were extracted.

Specimens were identified to genus or species, as allowed by available keys, specimen condition, and specimen maturity. Taxonomic data were analyzed using a modification of Rapid Bioassessment Protocol III (RBP) metrics and scores (Plafkin, et al. 1989). The modifications were: substitution of "reference site affinity" (RSA) for the Community Loss Index and elimination of the shredder/total ratio (no separate leaf-pack material was collected). The reference site affinity metric is a modification of Percent Model Affinity (Novak and Bode 1992). Instead of using the model's percentages for Oligochaeta, Ephemeroptera, Plecoptera, Trichoptera, Coleoptera, Chironomidae, and "other," these percentages were taken from the reference site data. The RSA score is then calculated as:
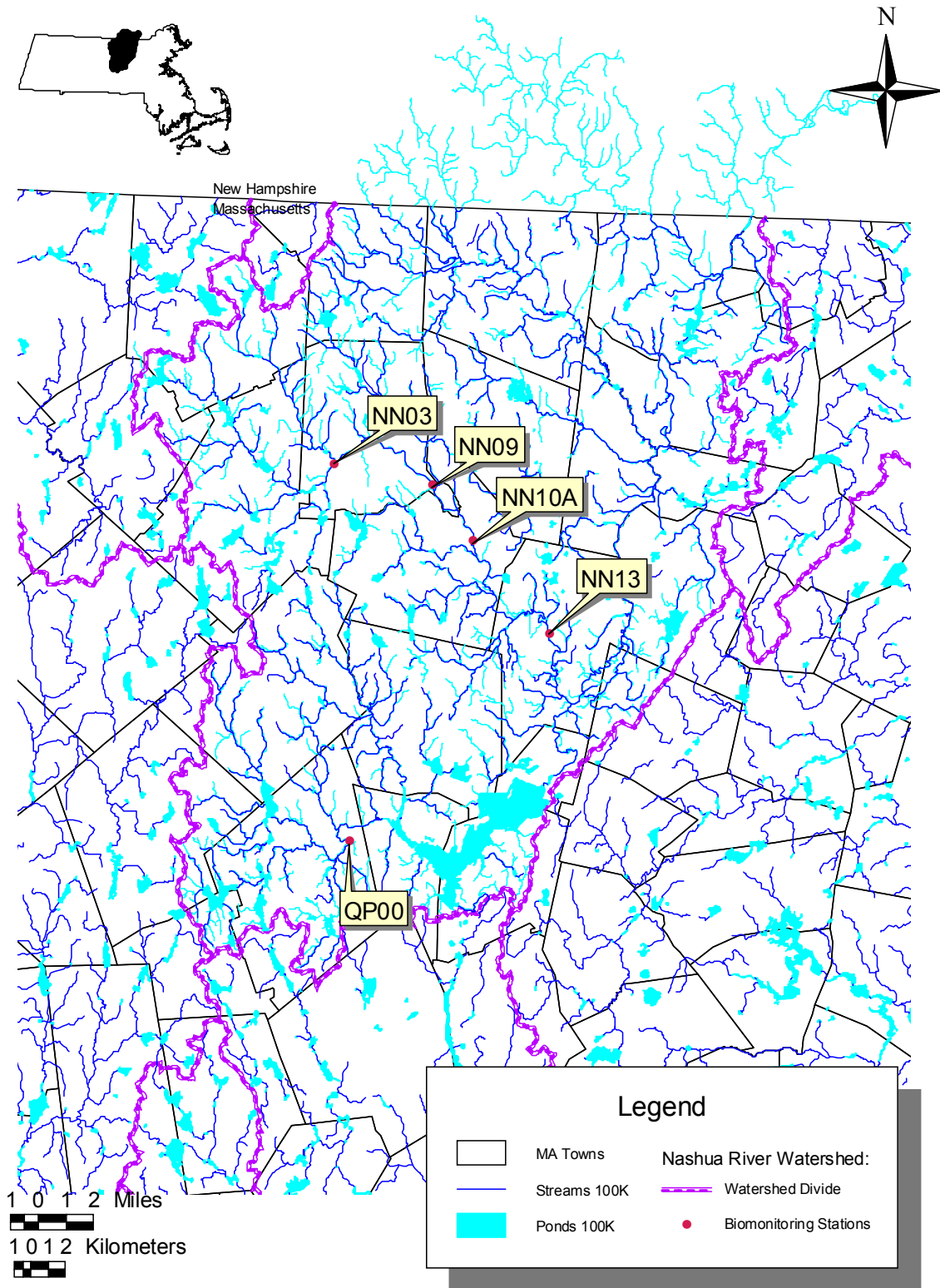
$$100 - \Sigma \left(\delta \times 0.5 \right)$$

Figure 1. Map of the Nashua River watershed showing the location of the 2003 biomonitoring stations.

where δ is the difference between the reference percentage and the sample percentage for each taxonomic grouping. RSA percentages convert to RBP III scores as follows: 0 points for <35%; 2 points in the range from 35 to 49%; 4 points for 50 to 64%; and 6 points if ≥65%. The entire suite of metrics used for the analysis was:

- Richness—the total number of different species present in the subsample plus those detected from a "large/rare" search of the whole sample (those taxa missed in subsampling);

- HBI—Hilsenhoff Biotic Index, as modified in Nuzzo (2003); HBI is the sum of the products of each taxon's abundance and its corresponding pollution tolerance value, divided by the total count in the subsample;

- EPT—sum of richness among the orders Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) as determined from the specimens in the subsample plus those detected in a "large/rare" search of the whole sample; these orders tend to be dominated by species generally considered to be pollution sensitive;

- $EPT_a/Chiro_a$—ratio of total abundance among EPT taxa to total abundance among Chironomidae taxa;

- SC/FC—ratio of the proportion of sample that is represented by individuals that predominantly feed by scraping to those that are primarily filter-feeders;

- % Dominant—most abundant taxon as a percent of the assemblage; >20% is generally considered hyperdominant and indicative of a stressor impact;

- RSA—reference site affinity (described above).

RESULTS

Habitat scores showed all sites to be comparable to the reference site (QP00) in overall habitat quality. The habitat scores are shown in the Appendix, Table A-1. A common feature of the macroinvertebrate community at all the sites was the preponderance of filtering collectors. The taxa found at each site are listed in Appendix Table A-2. Each site had taxa added to total richness and EPT based on the "large/rare" search results, as shown in Table A-3. The RBP metrics are shown in Appendix Table A-4.

QP00—Quinapoxet River, Holden, MA.

Habitat
Situated in the southern, upper reaches of the Nashua River watershed, this site on the Quinapoxet River is a popular trout fishing access point in a forested setting adjacent to the historical site of Canada Mills. About 80% of the area above the stream channel was covered by tree canopy. The sample reach was about 10 m wide and dominated by fast-flowing riffles and runs where large boulders figured prominently into the structure of the streambed (boulder, 40%; cobble, 20%; pebble, 5%; gravel, 5%; and sand 30%). All of the organic matter encountered within the reach was as coarse particulates (CPOM—coarse particulate organic matter).

Erosion along the banks was slight to moderate. The adjacent roadway and the upstream road crossing were identified as potential sources of nonpoint source (NPS) pollution inputs. The sediments did not have any abnormal odors or oils but there were deposits of sand in places. Water odors were normal, there was no turbidity detected, and only slight tannic color (comparable to weak tea) was evident.

It was estimated that about 80% of the riparian zone area had tree cover, 10% shrub cover, and 10% herbaceous cover. Trees recorded at this site were *Pinus* sp. (pine), *Tsuga canadensis* (eastern

hemlock), *Quercus rubra* (red oak), *Acer* sp. (maple), and *Carpinus caroliniana* (American hornbeam). Chief among the shrubs was a *Viburnum* sp. The herbaceous layer was mostly ferns. Aquatic vegetation covered only about 30% of the instream area, and that was all moss attached to large boulders. Algal cover within the reach was judged to be less than 1%.

Generally the habitat scores reflect high quality habitat for aquatic organisms. Some features were less than optimal and may be somewhat limiting. These include: embeddedness, sediment deposition, and the presence of only three of four velocity-depth combinations. The total habitat score was 161 out of 200 (161/200).

Benthos

Though there was slight hyperdominance by one of the hydropsychid caddisfly species, the high EPT index and total richness and relatively low HBI reflect a generally healthy aquatic system. These findings for the aquatic macroinvertebrate community were consistent with the expectations for this site because of its habitat, the relatively low human population density upstream, and the lack of significant discharges upstream. The large/rare search turned up three taxa not acquired in the subsample: Ancylidae, *Isonychia* sp., and *Psephenus herricki*. These additions raised the total richness from 36 to 39 and EPT from 14 to 15. After deducting two points from % Dominant for the slight hyperdominance, this site's total RBP score of 40 served as the reference value in evaluating the degree of water quality impacts at the North Nashua River stations.

NN03—North Nashua River at Mill #9, Fitchburg, MA

Habitat

This was the most upstream site sampled in the 2003 survey. There are two channels here: one more-or-less isolated when the dam upstream (about 60 m upstream from bridge to the mill) breached, leaving a channel that often holds pools of standing water and catches some stormwater; and the main channel, carrying the main flow of the river. All sampling was done in the riffles of the main channel. Riprap lined both edges of the main channel. The depth in the riffles and runs was from 10-30 cm and the width through the reach was estimated to be 6-7 m. The riparian zone along the reach was about 98% wooded and 2% commercial/industrial. The tree canopy over the river channel was about 50%.

Slight erosion was recorded at this site and road sand input was identified as a potential source of NPS pollution. Bottom sediments in the reach lacked abnormal odors and lacked signs of oil contamination. There were deposits of sand, however, and a reddish-brown floc covered boulders instream. Bottom substrates were characterized as 50% boulder and 50% sand. About 20% of the organic substrate components were in the form of fine particulate organic matter (FPOM), the rest as CPOM. The water itself had a slight effluent odor but appeared to be free of surface oils. The water was colorless but was very slightly turbid.

Sparse stands of trees in the riparian zones were mostly birch (*Betula* sp.) and maple (*Acer* sp.). No shrub cover was recorded and the herbaceous layer was heavily dominated by ferns. Less than 1% of the reach had aquatic vegetation, all as rooted submergent forms. Mats of green algae occurred in less than 5% of the reach.

The habitat quality at this site, though generally good, received the lowest score of the sites sampled in this survey. While instream cover for fish, epifaunal substrate, and vegetative bank protection scored in the optimal range, embeddedness, channel alteration, sediment deposition, velocity-depth combinations, channel flow status, and bank stability all scored as suboptimal. The zone of undisturbed riparian vegetation was less than 12 m on both banks, earning each bank a riparian vegetative zone width score only sufficient to place them in the marginal category. The total habitat score was 149/200.

Benthos

Five of the seven RBP metrics indicated water quality impacts. Total richness and EPT index each were less than half their respective values at the reference station, even after adding taxa from the large/rare search (richness +3, EPT +0). The HBI was moderate and the high percentage of filtering collectors contributed to a very low SC/FC ratio. Hydropsychid caddisflies accounted for most of the filtering collectors. The total RBP score was 24, to give a rating of *Slightly Impacted* for this site.

NN09—North Nashua River, Airport Road, Fitchburg, MA

Habitat

This sample reach was about 10-12 m wide, with depths of about 10 cm in riffles and 10-60 cm in the runs. About 5% of the riparian zone land use was commercial/industrial and the rest was forested. An estimated 5% of the stream channel had tree canopy hanging over it. There were indications of slight bank erosion, and an ATV trail adjacent to the west bank stood out as an obvious source of NPS pollution. Stream sediments had normal odors and no oils, but sand deposits in the reach were noted. Streambed composition was characterized as 80% cobble and 20% sand. Organic substrate materials were mostly as CPOM (90%) but there were FPOM deposits (10%) as well. The water had the odor of wastewater effluent, surface oils were absent, and there was no detectable color. Though the shallow riffles appeared clear, turbidity could be observed in the deeper areas.

None of the riparian vegetation was recorded except Japanese knotweed (*Polygonum cuspidatum*). Habitat records from the 1998 survey, however, identified white birch (*Betula papyrifera*), ash (*Fraxinus* sp.), red maple (*Acer rubrum*), willow (*Salix* sp.), sycamore (*Platanus occidentalis*), catalpa (*Catalpa speciosa*), and black locust (*Robinia pseudoacacia*) as the prominent tree species in the woods along this reach. Instream there were no aquatic macrophytes and less than 25% of the streambed was covered with filamentous algae. Only about 20% of the reach had stable fish cover, giving this habitat feature a marginal rating. Likewise, velocity-depth combinations scored in the range for marginal for having only two of the four combinations accounted for (missing slow-shallow and slow-deep). All of the other habitat attributes in the habitat assessment scored in the optimal range. The overall habitat score was 164/200, slightly higher than the habitat score for the reference site.

Benthos

Duplicate samples were collected at this site and processed and analyzed separately. Both sets had moderate HBIs and were comparable in both EPT and total Richness (both before and after adding in large/rare taxa). The difference in the HBIs generated was enough to score differently between the two samples. Scrapers were so rare in both samples that a difference of just two individuals (2 vs. 4) resulted in a scoring difference. A further difference in scoring between the duplicate samples came from a much higher relative abundance of midges in one sample than the other. Collectively these made a big enough difference in the final score that the ranking based on the first sample was *Moderately Impacted* (18) and based on the duplicate was *Slightly Impacted*.

NN10A—North Nashua River, Leominster, MA

Habitat

This segment of the river, immediately downstream from Route 2 and adjacent to the Searstown Mall, was about 10-15 m wide and 0.2 to 0.9 m deep in the riffles and runs. Even so, only 10% of the riparian zone is in commercial use, the other 90% is wooded. There were indications of moderate erosion on the banks. Route 2 was cited as a potential source of NPS pollution and a flowing stormwater pipe downstream of the sample reach was identified as an obvious source. Tree canopy over the stream channel was estimated at 5%. No odors or oils were detected from the sediments. Deposits of sand were noted in the reach. Inorganic substrate composition was characterized as 80% boulder and 20% sand, organic substrate as 90% CPOM and 10% FPOM. The water had the odor of sewage effluent but had no surface oils or color, and only slight turbidity.

The only vegetation recorded at the time of the survey was the Japanese knotweed (*Polygonum cuspidatum*) that lined the east bank. Riparian zone trees recorded from the 1998 survey at this site included sycamore (*Platanus occidentalis*), silver maple (*Acer saccharinum*), poplar (*Populus* sp.), and catalpa (*Catalpa speciosa*). Moss was the only aquatic vegetation present and covered only about 5% of the reach. Thin-film green algae coverage was more extensive, about 70%. Instream cover for fish, epifaunal substrate, and sediment deposition were all optimal based on their assessment scores. All the other instream parameters scored in the range for suboptimal. The riparian zone parameters all ranked as optimal on the east side of the river, but on the west side the bank vegetative protection and riparian vegetative zone width were both marginal, while bank stability was suboptimal. The overall habitat score was 159/200.

Benthos

The RBP metrics here were very comparable to those at NN03. Total and EPT richness each were less than half that of the reference station, even after adding taxa from the large-rare search (richness +4, EPT +1). The HBI was moderate and the predominance of filtering collectors (75%) contributed to a very low SC/FC ratio. Hydropsychid caddisflies accounted for 93% of the filtering collectors. The total RBP score was 22, for a rating of *Slightly Impacted*.

NN13—North Nashua River, Lancaster, MA

Habitat

Adjacent to the former site of Ponakin Mills the current surrounding land use was characterized as 99% forested and 1% residential. This channelized section of the river was approximately 20 m wide and averaged about 15 cm deep in the riffles and runs. Some erosion was noted, but no evidence of NPS pollution or potential sources was found. About half the river channel was under tree canopy. The sediment did not have detectable odors or oils, but sand deposits were noted in the reach. The riverbed composition was estimated as 90% boulder and 10% sand. Organic substrate components were 95% CPOM and 5% FPOM. The water had normal odors, but the air smelled of effluent. The water had no evidence of surface oils or color but was slightly turbid. No riparian zone vegetation was recorded, but habitat records from the 1998 survey recorded sycamore (*Platanus occidentalis*), silver maple (*Acer saccharinum*), and red maple (*Acer rubrum*) as the dominant trees. Mosses were the only aquatic vegetation found, and they covered 80% of the reach. About 40% of the reach had thin-film algal coverage.

The habitat scores generally rated the aquatic habitat here as optimal. The only suboptimal scores were for velocity-depth combinations (slow-deep and slow-shallow absent or very limited) and bank stability (at least 5% of the west bank had areas of erosion). The overall habitat score was 178/200, the highest in this survey.

Benthos

The HBI was moderate here and comparable to NN03 and NN10A, as was richness (with large-rare included: +4) and EPT (with large-rare included: +1). This site had the most extreme hyperdominance (*H. morosa* gr., 58%), and filtering collectors were again the dominant functional component (80%) of the assemblage. The total RBP score of 22 ranked this site as *Slightly Impacted*.

DISCUSSION AND CONCLUSIONS

Because of some of the inconsistencies in the results between the duplicate samples taken at NN09 some caution is required in interpreting the RBP results. The NN09 samples produced both the lowest and highest RBP scores in the survey. Therefore, none of the survey results should be interpreted as indicating more than slight impairment of aquatic life uses. Yet even with these inconsistencies there are clear signals of pollution stress at all the North Branch Nashua River stations: reduced richness, reduced EPT, and increased HBI. In nearly all cases these resulted in reduced scores for those metrics (the exception was HBI for the duplicate NN09 sample).

The North Nashua River sites were all similar with respect to the number of EPT taxa present and each was dominated by filtering collectors. Along with the moderate HBI values, these indicate that the North Nashua is carrying a significant load of particulate organics. Hyperdominance at NN03, NN10A, and NN13 is further evidence of pollution stress at these stations.

For NN03, the 2003 results actually represent substantial improvements in water quality since 1985 (Johnson, et al. 1990), but little difference from the 1993 (Nuzzo, et al. 1997) and 1998 (Nuzzo 2000) surveys. Looking at macroinvertebrate data from past watershed surveys (Table 2) where RBPs were used to assess the benthic community, NN03 stands out as having strong indications of impairment in 1985 that were likely the result of extremely low dissolved oxygen or toxicity, or both. Those results stand in sharp contrast to subsequent biomonitoring survey data in 1993, 1998, and 2003 that, though they don't indicate complete recuperation of the aquatic ecosystem, signify an improvement. There is no clear

Table 2. Comparison of RBP metrics and selected ratios for North Nashua River biomonitoring stations for different sample years. (No large/rare search results included in the richness and EPT index values for these comparisons.)

Station	NN03	NN03	NN03	NN03	NN09	NN09	NN09	NN09(D)
Year	1985	1993	1998	2003	1993	1998	2003	2003
Total	111	105	97	106	106	102	111	93
Richness	13	14[a]	24	15	8[a]	19	23	29
HBI	7.08	3.93[a]	5.37	5.71	4.38[a]	5.55	5.54	5.41
EPT	0	8[a]	11	6	4[a]	4	5	5
$EPT_a/Chiro_a$	0.00	18	1.50	4.37	4.611	1.43	0.49	1.02
SC/FC	5	0.07	0.30	0.07	0.06	0.02	0.03	0.06
% Dominant	32%	56%	20%	28%	66%	28%	14%	13%
hydropsychids % of total	0%	68%	24%	52%	66%	55%	23%	39%
hydropsychids % of FCs	0%	88%	41%	82%	100%	86%	43%	54%
FC midges % of FCs	100%	***[b]	45%	4%	***[b]	14%	48%	36%
FC % of total	1%	77%	58%	63%	66%	64%	54%	72%
chironomid % of total	92%	5%	37%	18%	17%	39%	62%	46%
Station	**NN10A**	**NN10A**	**NN10A**	**NN10A**	**NN13**	**NN13**	**QP00**	**QP00**
Year	1985	1993	1998	2003	1998	2003	1998	2003
Total	111	98	103	108	97	105	105	101
Richness	19	9[a]	15	14	19	14	34	36
HBI	5.96	4.64[a]	5.28	5.78	5.44	5.73	4.24	4.62
EPT	4	2[a]	8	6	8	7	18	14
$EPT_a/Chiro_a$	1.17	3.0	2.88	3.77	1.61	11.88	2.30	2.64
SC/FC	0.02	0.02	0.5	0.05	0.6	0.14	0.298	0.23
% Dominant	20%	55%	17%	31%	27%	58%	17%	24%
hydropsychids % of total	34%	66%	37%	69%	32%	71%	30%	28%
hydropsychid % of FCs	86%	98%	100%	93%	89%	89%	66%	65%
FC midges % of FCs	14%	***[b]	0%	6%	11%	5%	21%	21%
FC % of total	40%	67%	37%	75%	36%	80%	45%	43%
chironomid % of total	41%	22%	25%	20%	37%	8%	26%	22%

[a] Metric data based on family identifications; generic/species make-up not determined.
[b] Chironomidae genera/species not determined.

indication of a trend since 1993 from these data, except the emergence of filtering collectors (half of which were hydropsychid caddisflies) as the dominant functional feeding group. Overall, the 2003 results for the North Branch Nashua River are suggestive of a benthic assemblage favored by a rich supply of organic suspended solids for food and able to withstand less-than-optimal dissolved oxygen.

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APPENDIX

Table A-1. Habitat scores for North Nashua River biomonitoring sites sampled in 2003.

Habitat Feature	NN03	NN09	NN10A	NN13	QP00
Instream Cover	17	8	19	16	17
Epifaunal Substrate	17	18	20	20	19
Embeddedness	14	16	15	19	13
Channel Alteration	15	16	15	19	19
Sediment Deposition	15	19	17	16	15
Velocity-Depth Combinations	12	10	13	13	12
Channel Flow Status	15	18	14	19	18
Bank Vegetative Protection-Left Bank	10	10	10	10	8
Bank Vegetative Protection-Right Bank	10	10	5	9	8
Bank Stability-Left Bank	8	10	10	9	9
Bank Stability-Right Bank	8	10	6	8	8
Riparian Vegetative Zone Width-Left Bank	5	10	10	10	9
Riparian Vegetative Zone Width-Right Bank	3	9	5	10	6
Total	149	164	159	178	161

Table A-2. List of taxa from the biomonitoring collections in 2003 in the Nashua River watershed; "large/rare" taxa included.

Taxa	FFG	TV	QP00	NN03	NN09	NN09(D)	NN10A	NN13
Ancylidae			X[a]					
Physidae							X[a]	
Pisidiidae	FC	6					1	
Oligochaeta						X[a]		
Naididae					X[a]			
Lumbriculidae	GC	7	9	2	1			X[a]
Caecidotea communis	GC	8						1
Gammaridae				X[a]			X[a]	
Lebertia sp.	PR	6				1		
Sperchon sp.	PR	6	3		2			
Baetis sp.	GC	6	4				6	4
Baetidae (w/ cerci only)					X[a]			
Baetidae (subeq. term.)	GC	6		14	3	1		
Ephemerellidae						X[a]		
Serratella sp.	GC	2	6					
Maccaffertium sp.	SC	3	1		X[a]	X[a]	1	
Maccaffertium pudicum	SC	2		4				3
Isonychia sp.			X[a]					
Leptophlebiidae	GC	2	3					
Argia sp.						X[a]		
Acroneuria sp.	PR	0	1					
Paragnetina media	PR	5		2				
Nigronia serricornis	PR	0	1					
Sialis sp.	PR	4	1					
Brachycentrus appalachia	FC	0	1					
Micrasema sp.	SH	2	3					
Glossosoma sp.	SC	0	3			X[a]		X[a]
Helicopsyche borealis	SC	3	1					
Cheumatopsyche sp.	FC	5	1		5	12	11	2
Hydropsyche betteni	FC	6	3	30	11	12	31	12
Hydropsyche morosa gr.	FC	6	24	25	10	12	33	61
Leucotrichia sp.	SC	6					1	8
Chimarra obscura	FC	4	4	8	5	7	X[a]	5
Rhyacophila sp.	PR	1	3					
Elmidae (L+A)					X[a]			
Optioservus sp.	SC	4	2					
Oulimnius latiusculus	SC	4	2					
Promoresia elegans	SC	2	1					
Promoresia tardella	SC	2		1				
Stenelmis sp.	SC	5		X[a,b]			2	2	1
Psephenus herricki	SC	4	X[a]		2	2	X[a]	
Microtendipes pedellus gr.	FC	6			4	11		

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Taxa	FFG	TV	QP00	NN03	NN09	NN09(D)	NN10A	NN13
Polypedilum flavum	SH	6	1	2	5	3	5	
Stenochironomus sp.	GC	5						1
Rheotanytarsus exiguus gr.	FC	6	3	2	15	4	5	3
Rheotanytarsus pellucidus	FC	5	3	1		1		
Sublettea coffmani	FC	4	3		10	8		1
Diamesa sp.	GC	5					1	
Potthastia longimana gr.	GC	2			1			
Orthocladiinae	GC	5			2			
Brillia sp.	SH	5	1					
Cardiocladius obscurus	PR	5	1		10	8	1	2
Corynoneura sp.	GC	4	1					
Cricotopus sp.	SH	7			2	3		
Cricotopus bicinctus	GC	7			1	1		
Cricotopus tremulus gr.	SH	7			8	1		
Cricotopus trifascia	SH	6			1			
Cricotopus vierriensis	SH	7		8				
Eukiefferiella sp.	GC	6	1					
Orthocladius sp.	GC	6	1	5	2		4	
Rheocricotopus robacki	GC	5	1					
Thienemanniella sp.	GC	6			2			1
Tvetenia paucunca	GC	5	4					
Tvetenia vitracies	GC	5	1	1	5	3	6	
Conchapelopia sp.	PR	6	1		1			
Hemerodromia sp.	PR	6	1	X[a]	2	1		
Simulium sp.	FC	5	1	1				X[a]
Antocha sp.	GC	3			1	X[a]		X[a]
Total			101	106	111	93	108	105
Added to Richness			3	3	4	6	4	4
Added to EPT index			1	0	2	3	1	1

[a] Detected in "large/rare" search of sample and counted toward Richness and EPT index.

[b] Adults

Table A-3. RBP metrics and scores.

[metric values]	QP00	NN03	NN09	NN09(D)	NN10A	NN13
Richness[a]	39	18	27	25	18	18
HBI	4.62	5.71	5.54	5.41	5.78	5.73
EPT[a]	15	6	7	8	7	8
EPT/chir.	2.64	4.37	0.49	1.02	3.77	11.88
SC/FC	0.23	0.07	0.03	0.06	0.05	0.14
% Dominant	24%	28%	14%	13%	31%	58%
Reference Affinity	100%	79%	60%	72%	72%	59%
[% of Ref.]	QP00	NN03	NN09	NN09(D)	NN10A	NN13
Richness	100%	46%	69%	64%	46%	46%
HBI	100%	81%	83%	85%	80%	81%
EPT	100%	40%	47%	53%	47%	53%
EPT/chir.	100%	166%	19%	39%	143%	450%
SC/FC	100%	32%	14%	26%	21%	61%
% Dominant	24%	28%	14%	13%	31%	58%
Reference Affinity	100%	79%	60%	72%	72%	59%
[scores]	QP00	NN03	NN09	NN09(D)	NN10A	NN13
Richness	6	2	4	4	2	2
HBI	6	4	4	6	4	4
EPT	6	0	0	0	0	0
EPT/chir.	6	6	0	2	6	6
SC/FC	6	2	0	2	2	6
% Dominant	4	4	6	6	2	0
Reference Affinity	6	6	4	6	6	4
Total Score	40	24	18	26	22	22
Impact Category[b]	Ref.	SI	MI	SI	SI	SI

[a] Richness and EPT index include counts of the "large/rare" taxa.
[b] Ref. = reference site; SI = slightly impacted; MI = moderately impacted