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TECHNICAL MEMORANDUM

Macroinvertebrate Biomonitoring Results for Cold Spring Brook

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Introduction

On 19 May 2008 MassDep/Division of Watershed Management (DWM) biologists collected samples in Cold Spring Brook (referred to by U.S. EPA as "Lower Cold Spring Brook") in response to a request from MassDEP's Bureau of Waste Prevention/Devens Group and U.S. EPA for data on the macroinvertebrate communities in the brook. Portions of Cold Spring Brook were previously assessed as having contamination by toxic substances and possible biological impairment (ABB 1995). It was intended that the macroinvertebrate data would supplement the sediment chemistry and sediment toxicity data from analyses planned by the U.S. EPA to determine the need for further clean-up actions at the site.

A qualitative survey designed to detect gross signs of aquatic life impairment was carried out. It was expected that these data would demonstrate the presence or absence of macroinvertebrate populations at sites of interest in Cold Spring Brook. Further, by comparing the macroinvertebrate community results to those from comparable habitat in nearby Bowers Brook, a major tributary to Cold Spring Brook, a cursory evaluation of the relative health of the communities could be made.

Sample Procedures

Wetland Sweep

Because Cold Spring Brook is a low-gradient stream flowing through a marsh wetland, a sampling method was developed based on standard wetland biomonitoring protocols used by the Minnesota PCA and the Maine DEP (http://proteus.pca.state.mn.us/water/biomonitoring/bio-wetlands-invert.html and http://www.maine.gov/dep/blwq//docmonitoring/biomonitoring/sampling/bugs/wetlands.htm, respectively). Samples were collected by sweeping (wetland sweep) with an aquatic net in areas of less than 1 m depth. Three sweeps were performed by reaching forward approximately 1 m and vigorously pulling the net through the vegetation and water column toward the biologist's body while bumping the net along the sediment surface. This procedure was completed at five points within the waterbody. Kicks from the short riffle stretch at station 03X were included as one of the five "points" in the composite sample at that site. The contents of the net were emptied into deep trays for sorting.

Sample Processing

Macroinvertebrates were extracted from the samples while on site. Picking through the sample was continued until no new taxa were being detected; each search lasted more than 60 minutes. The orders/families present were recorded while in the field, and voucher specimens were placed in labeled jars and preserved in 70% EtOH. The frequency with which a taxon was encountered in the sample was characterized as "rare" or "common," (none seemed to be "hyperabundant"). Voucher specimens were brought back to the DWM laboratory for detailed taxonomy (species, where possible).

Sampling Locations

The sampling locations are plotted on the map in Figure 1 and described below.

03X

This station was the most upstream Cold Spring Brook site sampled. It was chosen to correspond with sample point 03X on the Devens site map (ABB 1995) and was just downstream from a beaver dam in the vicinity of the Devens site 02X. The first 10 m or so below the beaver dam had riffles before the grade decreased, flow became laminar, and velocity diminished. Pools were gravelly but also had an abundance of woody coarse particulate organic matter (CPOM).

MWE11/13

This site was downstream from 03X and upstream from CW00. The GPS fix placed it more precisely about 175 m downstream from the ABB (1995) station 08X and midway between stations 11X and 13X (along the wetland edge—hence mid-wetland edge between 11X and 13X or MWE11/13). MWE11/13

was a flooded marsh, with no hint of the Cold Spring Brook channel discernible during the spring of 2008. The wetland was broad and open, with cattails, shrubs, and sedge hummocks. The bottom was very soft but with overlying woody CPOM and leaf CPOM (whole and pieces). The sediments were so soft they would not support the weight of the sampler so sampling had to be conducted from the water's edge.

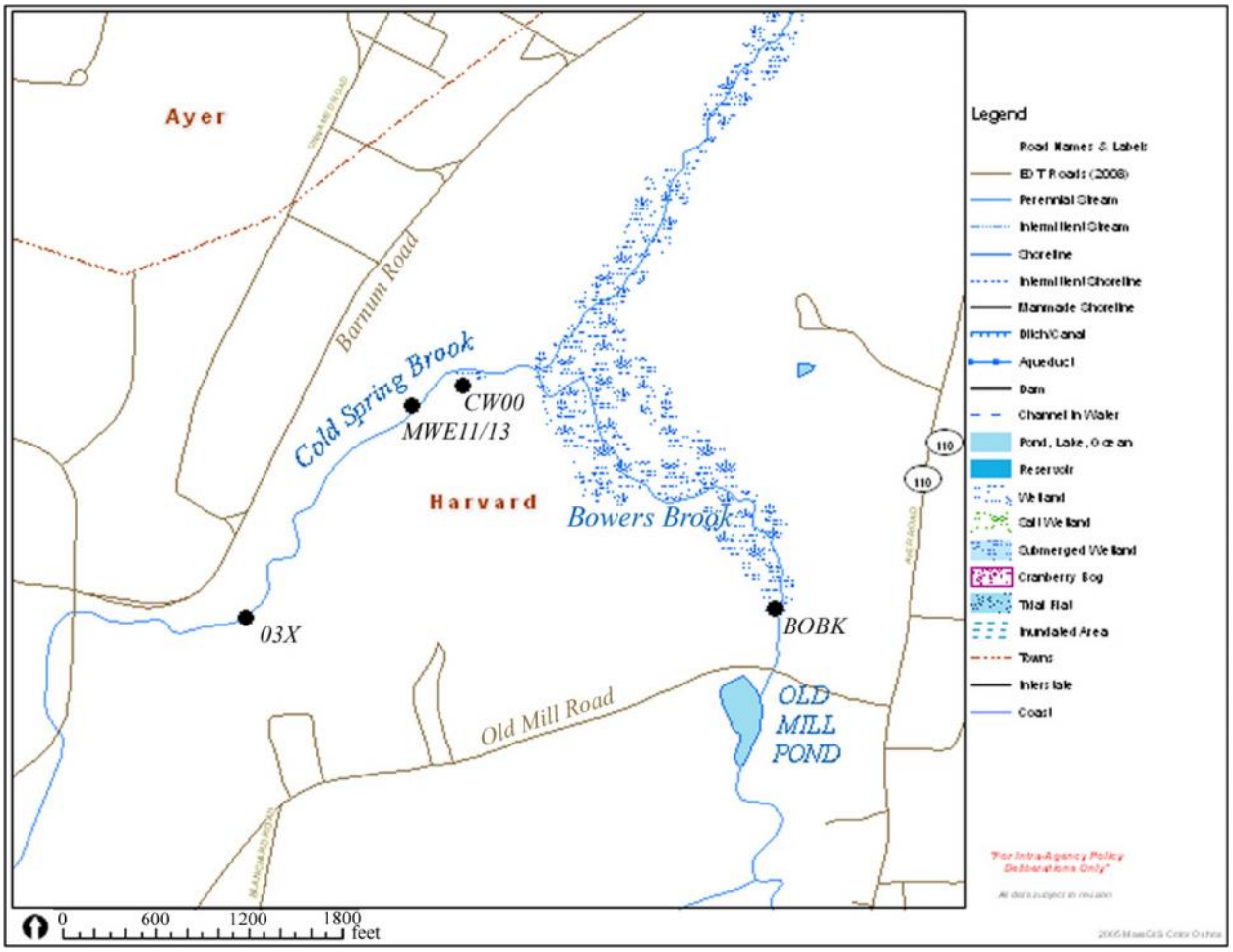

Figure 1. Macroinvertebrate sampling locations on Cold Spring Brook and Bowers Brook, Harvard, MA. Samples were collected on 19 May 2008.

CW00

This station was at the breach in the distal end of the causeway from "AOC57." The breach created a distinct channel that was a wadable depth, with enough firm sand across the bottom to allow samples to be collected at various points by wading into the channel. The bottom had pockets of soft sediments. It was vegetatively similar to MWE11/13 with both submergent and emergent vegetation.

BOBK

Bowers Brook (BOBK) was sampled as a reference comparison for the Cold Spring Brook sites. The sample site was approximately 200 m downstream from Old Mill Road, the first 50 m of which was fairly straight and dominated by riffle habitat. Beyond that, the current diminished and the brook began to meander through its bordering wetland. The site was roughly 1000 m upstream from the brook's confluence with Cold Spring Brook. The bank area was diffuse as water extended into the wetland flood plain along the sample reach, but the stream channel was always discernible. The bottom had enough firm sand to allow wading; there were also pockets of soft sediments and scattered beds of instream vegetation. The wetland had a few scattered trees but was mostly vegetated with grasses and shrubs.

Results and Discussion

Sampling was conducted at the four sites, three on Cold Spring Brook and one on Bowers Brook, on 19 May 2008. All Cold Spring Brook sites were upstream from its confluence with Bowers Brook. A summary of some key features of the macroinvertebrate community at each sampling location is presented in Table 1; the list of taxa can be found in Table 2.

Table 1. Summary of select macroinvertebrate community attributes at Bowers Brook and three sites on Cold Spring Brook, Harvard, MA.

	03X	MWE11/13	CW00	BOBK
Species Richness	34	32	26	44
Ephemeroptera taxa	3	3	1	6
Odonata taxa	1	3	0	3
Trichoptera taxa	5	0	3	2
EOT	**9**	**6**	**4**	**11**
Chironomidae taxa	7	9	10	12
Hemiptera taxa	1	2	1	3

Though these non-quantitative data cannot be used to estimate macroinvertebrate population densities, they demonstrated that the populations were not scarce at any of the sites. The results for CW00, however, stood out as being distinctly different from the Bowers Brook site (BOBK) and the other two Cold Spring Brook sites. Species richness at CW00 was only 59% of that at BOBK, no odonates were found, and the EOT index (richness of Ephemeroptera, Odonata, and Trichoptera taxa) was barely more than a third of the reference. The complete absence of Odonata at CW00 is particularly noteworthy because its physical habitat was comparable to MWE11/13 and BOBK and should have supported a robust population of at least one of the common wetland odonate taxa.

Conclusions

The data from Cold Spring Brook and Bowers Brook biomonitoring stations document the presence of aquatic macroinvertebrate communities. The Cold Spring Brook station, CW00, stands out as different from the other stations because of its lower total richness, lower EOT richness, and the complete absence of any Odonata in the sample. Together these suggest possible impairment of aquatic life at CW00, but to characterize the severity of the impairment a more quantitative wetland assessment will need to be conducted.

Table 2. List of macroinvertebrate taxa in samples collected 19 May 2008 from Cold Spring Brook and Bowers Brook, Harvard, MA.

TAXA	03X	MWE11/13	CW00	BOBK
Nematoda*	R***	R		
MOLLUSCA—MOLLUSKS				
Campeloma decisum			R	x
Fossaria sp.				x
Physidae				x
Physella integra	R	R		
Planorbella sp.				x
Planorbula armigera		R		x
Pisidiidae	R			x
ANNELIDA—SEGMENTED WORMS				
Naididae		x		x
Nais communis/variabilis			x	x
Tubificidae	x		x	x
Lumbriculidae	x	x		

TAXA	03X	MWE11/13	CW00	BOBK
Erpobdellidae		R		
Branchiobdellida	x			
CRUSTACEA—CRUSTACEANS				
Cladocera		x	x	x
Copepoda		x	x	x
Ostracoda			x	
Caecidotea communis			x	
Caecidotea r. racovitzai	x			
Crangonyctidae	x			
Crangonyx sp.			x	
Crangonyx r. richmondensis		x		
Hyalella azteca		x	x	x
Orconectes sp.		x		
Orconectes virilis	x			
ARACHNIDA—ARACHNIDS				
Hydrachnidia spp. (water mites)		x		x
INSECTA—INSECTS				
Ephemeroptera—Mayflies				
Arthroplea bipunctata				x
Baetidae (e.i.**)	x			
Acentrella parvula				x
Acerpenna macdunnoughi				x
Callibaetis sp.		x		
Caenis sp.		x	x	x
Maccaffertium sp.				x
Leptophlebia intermedia	x	x		
Siphlonurus typicus	x			x
Odonata—Dragonflies and Damselflies				
Boyeria vinosa	x			
Enallagma sp. (*daekii*?)		x		
Enallagma divagans				x
Ischnura ramburii		x		
Gomphus sp. (*descriptus*?)				x
Lestes inaequalis		x		x
Plecoptera—Stoneflies				
Perlidae (e.i.)	x			
Perlesta placida				x
Isoperla sp.	x			
Hemiptera—True Bugs				
Belostoma sp.	R			
Ramphocorixa sp.		x	x	x
Notonecta sp.		x		x
Neoplea sp.				x
Megaloptera—Hellgrammites and Alderflies				
Nigronia serricornis	R			
Sialis sp.		x	x	
Trichoptera—Caddisflies				
Cheumatopsyche sp.	x			

TAXA	03X	MWE11/13	CW00	BOBK
Hydropsyche betteni	x			
Triaenodes sp.			R	
Anabolia bimaculata			R	x
Pycnopsyche guttifer	x			
Molanna sp.			R	
Chimarra obscura	x			
Polycentropodidae (e.i.)				x
Neophylax sp.	x			
Coleoptera—Beetles				
Dytiscidae			R	
Agabus sp.		R		
Hydrocolus sp.		R		
Macronychus glabratus (A**)	R			
Stenelmis crenata (A)	R			
Haliplus immaculicollis (A)				x
Haliplus triopsis (A)	x			
Peltodytes muticus (A)				x
Diptera—True Flies				
Ceratopogonidae (damaged)				x
Malochohelia sp.		x		
—Chironomidae, non-biting midges—				
Chironomini (P & partial PE**)	x			
Chironomus sp.		x	x	x
Chironomus crassicaudatus		x		
Cryptotendipes sp.				x
Microtendipes pedellus gr.				x
Paratendipes sp.	x			
Polypedilum flavum	x			
Polypedilum halterale gr.				x
Stictochironomus sp.		x		
Tribelos sp.		x		
Tribelos jucundum			x	
Micropsectra dives gr.	x			
Paratanytarsus sp.		x	x	
Paratanytarsus dissimilis				x
Rheotanytarsus sp.				x
Tanytarsus sp.			x	x
Orthocladiinae (e.i.)				
Chaetocladius sp.	x			
Cricotopus bicinctus			x	x
Diplocladius cultriger	x			
Hydrobaenus sp.				x
Orthocladius annectans			x	x
Parametriocnemus sp.	x	x	x	
Thienemanniella xena			x	
Apsectrotanypus sp.		x		
Clinotanypus sp.		x	x	x
Conchapelopia sp.	x			

TAXA	03X	MWE11/13	CW00	BOBK
Procladius sp.		x		
Procladius (Holotanypus) sp. (P)		x		
Tanypus [carinatus]		x		
Thienemannimyia gr.			x	x
—Culicidae, mosquitoes—				
Anopheles punctipennis				x
—Simuliidae, blackflies—				
Simulium sp. (e.i.)				R
Simulium sp. (PE--NOT *vittatum*)	x			
Simulium vittatum	x			
Total species	34	32	26	44

* Not included in richness count
** (**e.i.**) = early instar; (**P**) = pupa; (**PE**) = pupal exuviae; (**A**) = adult
*** **R** = rare/infrequently encountered in sample; **X** = commonly encountered in sample

Literature Cited

ABB. 1995. Fort Devens Lower Cold Spring Brook Site Investigation. Prepared for the U.S. Army Environmental Center. ABB Environmental Services Inc.