

Appendix D

2003 Connecticut River Watershed Fish Population Assessment

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The Massachusetts Division of Watershed Management (MA DWM) conducted fish population surveys on the Connecticut River and selected tributaries during September and October of 2003. Sampling was conducted as part of a comprehensive water quality monitoring project by MA DWM. Surveys of the resident fish populations were conducted at a total of six stations (Table 1). Surveys were conducted using techniques similar to Rapid Bioassessment Protocol V (fish) as described by Barbour et al (1999).

Fish Population Sample Collection, Processing, and Analysis

Fish populations were sampled by electrofishing using a Coffelt Mark 18 gas-powered backpack electrofisher. A reach of between 80m and 100m was sampled by passing a pole-mounted anode ring side to side through the stream channel and in and around likely fish holding cover. All stunned fish were netted and held in buckets. Sampling proceeded from an obstruction or constriction, upstream to an endpoint at another obstruction or constriction such as a waterfall or shallow riffle. Following completion of a sampling run, all fish were identified to species, measured, weighed, and released.

The RBP V protocol (Barbour et al. 1999) calls for the analysis of the data generated from fish collections using an established Index of Biotic Integrity (IBI) similar to that described by Karr et al. (1986). Since no formal IBI for Massachusetts currently exists, the data provided by this sampling effort were used to qualitatively assess the general condition of the resident fish population as a function of the overall abundance (number of species and individuals) and species composition classifications listed below.

1. Tolerance Classification - Classification of tolerance to environmental stressors similar to that provided in Barbour et al. (1999), and Halliwell et al. (1999). Final tolerance classes are those provided by Halliwell et al. (1999).
2. Macrohabitat Classification – Classification by common macrohabitat use as presented by Bain and Knight (1996) modified regionally following discussions with MA DEP and MA Division of Fisheries and Wildlife (DFW) biologists.
3. Trophic Classes- Classification which utilizes both dominant food items as well as feeding habitat type as presented in Halliwell et al.(1999).

For a more complete explanation of MA DWM fish collection procedures, please see CN75.1 “Fish Collection Procedures for Evaluation of Resident Fish Populations” (Mass DEP 2003). Tabulated results of the fish population surveys can be found in Table 3.

Habitat Assessment

These surveys also included a habitat assessment component modified from Rapid Bioassessment Protocols V (Barbour et al. 1999). Recording site characteristics and rating habitat qualities is important to the interpretation of biomonitoring data. The habitat data and assessments help distinguish between pollution impacts and habitat limitations. These data can also help identify causes of habitat destruction and loss.

Habitat assessment is accomplished by a visual-based method (Barbour et al. 1999) conducted at the time of sample collection. Each of ten habitat categories is rated from 0 (lowest, “poor”) to 20 (highest, “optimal”). The ten categories are: Instream cover (fish); Epifaunal substrate (in sampled portions of reach); Embeddedness; Channel alteration; Sediment deposition; Velocity-depth combinations; Channel flow status; Bank vegetative protection (each bank scored separately for a maximum of 10 points each); Bank stability (each bank scored separately for a maximum of 10 points each); Riparian vegetated zone width (each bank scored separately for a maximum of 10 points each). Descriptions of the considerations for scoring each habitat category can be found in Barbour et al. (1999). Tabulated results of this habitat assessment can be found in Table 2. For a more in-depth examination of habitat conditions, and benthic communities, see Connecticut River Watershed 2003 Biological Assessment (CN 105.3)(Mitchell 2006).

Results

The Connecticut River Watershed was affected by above-average rainfall during the time of sampling (MA DCR. Online). This condition resulted in slightly elevated water levels, decreased water temperatures, and an increase of available habitat as expressed by the high “channel flow status” habitat scores in Table 2.

Station Specific Conditions and Findings:

Cushman Brook

Most of the habitat measures were found to be within the “optimal” range. Channel Flow Status, Instream Fish Cover, Epifaunal Substrate, Channel Alteration, Velocity-Depth Combinations, and Bank Vegetative Protection were all within the “optimal” habitat range (see Table 2). The habitat parameters Embeddedness, Sediment Deposition, Bank Stability, and Riparian Vegetative Zone Width were rated as “suboptimal”. The reduction in these habitat parameters is most likely due to the abundance of sand and gravel in the surrounding area – as is evidenced by the sand and gravel pit across South Street from the sampled reach. This potentially unstable geologic condition leaves the stream banks prone to erosion and the substrates prone to embeddedness. The suboptimal rating of the Riparian Vegetative Zone Width was due to the proximity of State Street near the right bank, and frequently utilized trails along the left bank. The total habitat score arrived at for this fish population survey was 167/200. This represents the second best habitat score of all six stations examined within the Connecticut River Watershed in 2003.

Electro-fishing efficiency was rated as excellent. Five fish species were collected from this station. Intolerant, Fluvial Specialist / Dependant, Top Carnivore, Cold-water species dominated the 42 fish collected at this station (Halliwell et al. 1999, Bain and Meixler 2000). The collected 26 brown trout (*Salmo trutta*) and the one brook trout (*Salvelinus fontinalis*) represented cold-water species. The 26 brown trout (70mm – 210mm) seem to represent multiple age classes, as evidenced by the variety of fish lengths. Although brown trout are considered cold-water species, they have a higher thermal tolerance. (Wismer and Christie 1987, New Mexico Environment Department 1999, Brungs and Jones 1977). Although Cushman Brook appears to support a healthy, cold-water fish population, the abundance of brown trout may pose a competitive threat to sensitive native fishes, such as brook trout.

Falls River

As was the case with Cushman Brook, the Channel Flow Status here was rated as “optimal” (18/20). The river at this sampled reach flows through a sparsely populated valley, with old farms on either side. There is an extensive (> 18 meters – “optimal”) riparian buffer zone on river right, but an abbreviated buffer (< 6 meters – “marginal”) between the hay field and the river left bank. The fish population survey noted “optimal” habitat ratings for all parameters with exceptions regarding Bank Vegetative Protection on the left bank (“suboptimal”), and Bank Stability on the right bank (“suboptimal”). The overall habitat score was 175 / 200. This was the best habitat score of all six stations sampled in the Connecticut River Watershed in 2003.

Electro-fishing efficiency was rated as “excellent”. Seven fish species were collected during this survey. Blacknose dace (*Rhinichthys atratulus*, n=122) numerically dominated the 157 fish collected. The collected fish were dominated by tolerant, fluvial specialist / dependant, generalist feeding species. The 11 slimy sculpin (*Cottus cognatus*), 5 Atlantic salmon, and 5 brook trout made up the cold-water species collected at this site. The slimy sculpin appear to have a lower tolerance to heat than do any of the salmonids (Wismer and Christie, 1987). This reach appears to be capable of supporting a cold-water fishery.

Mill River - Hadley

Although located near the Amherst WWTF, the discharge from that plant is to the Connecticut River and not Mill River – Hadley. The Mill River – Hadley, at this reach, flows south, between Route 116 and the UMass/Amherst parking lots and ball fields. Upstream of this reach, the river receives the outfall from

Campus Pond and the storm water runoff from the Umass/Amherst coal-cinder parking lot. The reach is within the Connecticut River Valley floor. As such, the river is of relatively low gradient with a sandy bottom. As was the case at all stations examined during the 2003 Connecticut River Watershed fish population surveys, the abundance of rainfall placed the Channel Flow Status habitat parameter within the "optimal" range. The Epifaunal Substrate habitat parameter was rated as "poor" (3 / 20), due to the lack of any significant riffles, and the abundance of sand. Embeddedness and Sediment Deposition habitat parameters were rated as "marginal" (7/20 and 8/20 respectively). This was also due to the prevalence of sand. The Velocity-Depth Combinations habitat parameter was also rated as "marginal" (8/20), due to the lack of variety of conditions. The Channel Alteration was rated as "suboptimal", due to diversion created by Route 116. The Bank Stability was also rated as "suboptimal", due to the steep, and unstable, sand banks. The total habitat score for the Mill River – Hadley site was 112/200. This is the poorest score of all stations examined in the watershed in 2003.

Electro-fishing efficiency was rated as "poor". Due to the depth, and width, of the stream, some fish were not captured. Eight fish species were collected in this reach. The 15 individual fish collected were dominated by moderately tolerant, and fluvial specialist / dependant species. Only the one collected rainbow trout (*Oncorhynchus mykiss*) was considered to be a cold-water species. It appears that proximal warm water habitats are influencing the fish community within this reach.

East Branch Mill River - Northampton

The East Branch Mill River – Northampton flows, for the most part, through a sparsely populated, forested watershed. It is not until the stream enters the sampled reach that the surrounding area may be considered "thickly-settled".

The Channel Flow Status and Instream Cover were rated as "optimal". There were a great variety of snags, undercut banks, and stable habitat throughout the sampled reach. Sediment Deposition was rated as "suboptimal", with some noticeable increases of gravel and sand affecting the substrate. This may be due, in part, to the Bank Stability (rated as "marginal"). The banks were observed to be moderately unstable, with ~50% of the banks displaying signs of erosion. The Riparian Vegetative Zone Width was rated as "suboptimal" due to the proximity of lawns. The total habitat score for the East Branch Mill River – Northampton was 166 / 200.

Electro-fishing efficiency was rated as "excellent". Eight fish species were collected during this fish survey. The 60 individual fish collected during this survey were almost equally divided between "Intolerant" and "Tolerant" species. The collected fish were numerically dominated by Fluvial Specialist / Dependant species, Generalist Feeder species. Twelve salmonids (11 brook trout, and 1 brown trout) were collected at this station. The lengths of the collected brook trout ranged from 75mm to 190mm, and point towards a reproducing population of these fish. The 12 salmonids, and the 14 slimy sculpin, are representatives of cold-water species. The collected fish assemblage is indicative of excellent water and habitat quality.

West Branch Mill River - Northampton

Human development appears greater within the West Branch watershed than the East Branch watershed. The West Branch parallels and crosses Route 9 for much of its course. Aside from the increase in commercial and residential development along Route 9, sections of the stream banks have been stabilized in order to prevent damage to Route 9.

The Channel Alteration habitat parameter was rated as "suboptimal". Much of the river-right bank has been stabilized with large stone and rip-rap. The Velocity-Depth Combinations parameter was rated as "marginal". The West Branch displayed a lack of variety of flow regimes, and a uniform depth throughout the sampled reach. The proximity of Route 9 and the commercial development decreased the Riparian Vegetative Zone Width parameter rating along the right-bank to "marginal". A parking lot beyond the stone retaining wall has replaced a vegetated riparian zone. The total habitat score for the West Branch Mill River – Northampton was 162 / 200.

Electro-fishing efficiency was rated as “excellent”. Six fish species were collected during this survey. The thirty-one collected fish were numerically dominated by “Intolerant”, “Fluvial Specialist / Dependant”, “Benthic Insectivore” species. Included in the sample were eight Atlantic salmon (*Salmo salar*) and one brook trout. The nine collected salmonids and nine slimy sculpin are all cold-water species, and accounted for the majority of the collected fish. This stream appears capable of supporting a healthy fish community and indicates excellent habitat and water quality.

Stony Brook

Stony Brook begins its course in Granby, MA and is relatively low-gradient until after it emerges from the two ponds (Upper Pond and Lower Pond) on the Mount Holyoke College campus. After the two ponds, Stony Brook picks up gradient and then parallels Route 116. It then flows underneath Route 116 and enters the sampled reach.

As with the other sampled reaches, the Channel Flow Status was rated as “optimal”. However, the Instream Cover was rated as “marginal”. Only about 20% of the sampled reach had a mix of stable habitat, and the substrates appeared frequently disturbed. The Embeddedness and Sediment Deposition habitat parameters both were rated as “suboptimal”. The substrate was quite sandy, and the sand filled in around many of the larger stones and cobbles. The Velocity – Depth Combinations parameter was also rated as “suboptimal”. Aside from one high velocity pool at the top of the reach, the channel was relatively uniform in terms of depth and velocity. All other habitat parameters were within the “optimal” range.

Although electro-fishing efficiency was rated as “good”, it is possible that some fish escaped capture due to the width of the stream. The total number of fish collected was low ($n = 20$) and the species present included a number of macrohabitat generalists. These included redbreast sunfish, bluegill, smallmouth and largemouth bass, chain pickerel and pumpkinseed. Collected fluvial species included longnose dace, tessellated darter, Atlantic salmon, and white sucker. The variety of macrohabitat generalist species collected indicates that the sampled stream reach is well connected to lower gradient habitats. Slow, meandering stream habitats exist downstream of the sampled reach, and continue to the confluence with the Connecticut River. It is likely that macrohabitat generalists are entering the stream reach from these downstream habitats.

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Table 1: 2003 Connecticut Watershed Fish Population Station Locations

Waterbody	Location	Lat. / Lon.	Date
Cushman Brook	In Amherst Con-Com Park, south side of State Street, Amherst	42.24.56/ 72.30.41	17 September 2003
Falls River	Upstream of Bascom Road, Gill	42.38.42/ 72.32.32	17 September 2003
Mil River - Hadley	North of Amherst WWTP, east of Route 116, Amherst	42.23.18/ 72.32.20	17 September 2003
East Branch Mill River - Northampton	Left side of Mill Road, Williamsburg	42.23.32/ 72.43.38	23 October 2003
West Branch Mill River - Northampton	End of Mill Road, Williamsburg	42.23.31/ 72.43.40	23 October 2003
Stony Brook	West of Route 116, South Hadley	42.14.45/ 72.34.53	23 October 2003

Table 2: Habitat assessment summary for fish population stations sampled during the 2003 Connecticut River Watershed survey. For instream parameters, scores ranging from 16-20 = Optimal; 11-15 = Suboptimal; 6-10 = Marginal; 0-5 = Poor. For bank and riparian parameters, each bank was scored separately. Scores ranging from 9-10 = Optimal; 6-8 = Suboptimal; 3-5 = Marginal; 0-2 = Poor. Refer to Table 1 for a listing and description of sampling stations.

Habitat Parameter	Cushman Brook		Falls River		Mill River - Hadley		East Branch Mill River - Northampton		West Branch Mill River - Northampton		Stony Brook	
Instream Cover	19		18		11		19		18		7	
Epifaunal Substrate	18		18		3		18		18		18	
Embeddedness	13		19		7		17		18		12	
Channel Alteration	19		19		11		20		13		18	
Sediment Deposition	13		17		8		13		19		12	
Velocity-Depth Combination	18		20		8		19		10		12	
Channel Flow Status	17		18		18		19		18		16	
Bank Vegetative Protection	9(L)	9(R)	7	9	9	9	9	9	9	7	9	9
Bank Stability	8	8	9	8	6	6	4	4	9	9	9	9
Riparian Vegetative Zone - Width	8	8	4	9	7	9	8	7	9	5	10	10
TOTAL SCORE	167		175		112		166		162		151	

(L) = Left Bank

(R) = Right Bank

Table 3. Fish population data collected by DWM at six biomonitoring stations in the Connecticut River Watershed on 17 September and 23 October 2003. Refer to Table 1 for a listing and description of sampling stations.

TAXON (SORTED BY FAMILY)	Habitat Class ¹	Trophic Class ²	Tolerance Class ³	Cushman Brook	Falls River	Mill River - Hadley	Stony Brook	East Branch Mill River - Northampton	West Branch Mill River - Northampton
American eel <i>Anguilla rostrata</i>	MG	TC	T	--	--	--	1	--	--
common shiner <i>Luxilus cornutus</i>	FD	GF	M	--	--	--	--	9	1
Eastern blacknose dace <i>Rhinichthys atratulus</i>	FS	GF	T	13	122	--	--	12	8
longnose dace <i>Rhinichthys cataractae</i>	FS	BI	M	1	9	1	6	--	4
creek chub <i>Semotilus atromaculatus</i>	FS	GF	T	--	4	--	--	9	--
fallfish <i>Semotilus corporalis</i>	FS	GF	M	--	--	4	--	--	--
slimy sculpin <i>Cottus cognatus</i>	FS	BI	I	--	11	--	--	14	9
white sucker <i>Catostomus commersonii</i>	FD	GF	T	1	--	1	1	3	--
tessellated darter <i>Etheostoma olmstedi</i>	FS	BI	M	--	--	4	1	--	--
Atlantic salmon <i>Salmo salar</i>	FD	TC	I	--	5	--	2	--	8
rainbow trout <i>Oncorhynchus mykiss</i>	FD	TC	I	--	--	1	--	--	--
brown trout <i>Salmo trutta</i>	FD	TC	I	26	--	--	--	1	--
brook trout <i>Salvelinus fontinalis</i>	FD	TC	I	1	5	--	--	11	1
yellow bullhead <i>Ameiurus natalis</i>	MG	GF	T	--	--	2	--	--	--
chain pickerel <i>Esox niger</i>	MG	TC	M	--	--	--	2	1	--
redbreast sunfish <i>Lepomis auritus</i>	MG	GF	M	--	--	--	1	--	--
bluegill <i>Lepomis macrochirus</i>	MG	GF	T	--	--	1	1	--	--
smallmouth bass <i>Micropterus dolomieu</i>	MG	TC	M	--	--	--	2	--	--
largemouth bass <i>Micropterus salmoides</i>	MG	TC	M	--	--	--	1	--	--
pumpkinseed <i>Lepomis gibbosus</i>	MG	GF	M	--	1	--	2	--	--
Central mudminnow <i>Umbra limi</i>	FD	GF	T	--	--	1	--	--	--
Total Number of Fish Collected	-	-	-	42	157	15	20	60	31

¹Habitat Class - FS (fluvial specialist), FDR (fluvial dependant reproduction), MG (macrohabitat generalist). From Bain and Meixler (2000), modified for Massachusetts

²Trophic Class - GF (generalist feeder), BI (benthic invertivore), TC (top carnivore), WC (water column invertivore). From Halliwell et al. (1999)

³Tolerance Classification - I (intolerant), M (moderately tolerant), T (tolerant). From Halliwell et al. (1999) Classification described as tolerance to "environmental perturbation".