2005 Deerfield River Watershed Fish Population Assessment

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Commonwealth of Massachusetts
Executive Office of Environmental Affairs
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Introduction

Fish population surveys were conducted in the Deerfield River Watershed during the late summer of 2005 using techniques similar to Rapid Bioassessment Protocol V as described originally by Plafkin et al.(1989) and later by Barbour et al. (1999). Standard Operating Procedures are described in MassDEP Method CN 075.1 Fish Population SOP. Surveys also included a habitat assessment component modified from that described in the aforementioned document (Barbour et al. 1999).

Fish populations were sampled by electrofishing using a Smith Root Model 12 battery 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 fish shocked 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, and released. Results of the fish population surveys can be found in Table 1. It should be noted that young of the year (yoy) fish from most species, with the exception of salmonids are not targeted for collection. Young-of-the-year fishes which are collected, either on purpose or inadvertently, are noted in Table 1.

Habitat Assessment

An evaluation of physical and biological habitat quality is critical to any assessment of ecological integrity (Karr et al. 1986; Barbour et al. 1999). Habitat assessment supports understanding of the relationship between physical habitat quality and biological conditions, identifies obvious constraints on the attainable potential of a site, assists in the selection of appropriate sampling stations, and provides basic information for interpreting biosurvey results (US EPA 1995). Before leaving the sample reach during the 2005 Deerfield River Watershed fish population surveys, habitat qualities were scored using a modification of the evaluation procedure in Barbour et al. (1999). The matrix used to assess habitat quality is based on key physical characteristics of the water body and the immediate riparian area. Most parameters evaluated are instream physical attributes often related to overall land use and are potential sources of limitation to the aquatic biota (Barbour et al. 1999). The ten habitat parameters are as follows: instream cover for fish, epifaunal substrate, embeddedness, sediment deposition, channel alteration, velocity/depth combinations, channel flow status, right and left (when facing downstream) bank vegetative protection, right and left bank stability, right and left bank riparian vegetative zone width. Habitat parameters are scored, totaled, and when appropriate compared to a reference station to provide relative habitat ranking (See Table 2).

Fish Sample Processing and Analysis

The RBP V protocol (Plafkin et al. 1989 and 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 Plafkin et al. (1989), 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 Meixler (1996) modified regionally following discussions with MassDEP 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).

Station Habitat Descriptions and Results

CP01 Chapel Brook upstream from Main Poland Road in Conway

The sampled reach was a series of high gradient riffles, pools, and runs. All except two habitat parameters scored in the “optimal” category. Channel flow status was rated “marginal” but this was mostly due to the time of the year and a lack of significant rainfall prior to the survey. Riparian vegetative zone widths were “sub-optimal” and “marginal” on the left and right banks (looking downstream) respectively, due to the presence of a camp on the left bank and a dirt road on the right. The final habitat score was 173 out of a possible 200. Fish sampling efficiency at CP01 was rated as good.

Fish species captured in order of abundance included slimy sculpin *Cottus cognatus*, brook trout *Salvelinus fontinalis*, blacknose dace *Rhinichthys atratulus*, creek chub *Semotilus atromaculatus*, Atlantic salmon *Salmo salar*, common shiner *Luxilus cornutus*, white sucker *Catostomus commersonii*, and longnose dace *Rhinichthys cataractae* (Table 1). The presence (and dominant numbers) of three intolerant species and multiple year classes (ages) of brook trout is indicative of excellent water and habitat quality. All species present are fluvial specialists/dependants which is indicative of a stable flow regime.

SO-4 South River upstream from Emmets Road in Ashfield

The South River upstream from Emmets Road is a moderate gradient reach with a balanced mix of riffle, run, and pool habitats with a large amount of relatively stable woody habitat in the form of blow downs and undercut banks. All but three habitat parameters were rated as being “optimal”. Channel flow status was rated “marginal”, but this was mostly due to the time of the year and a lack of significant rainfall prior to the survey. Bank stability was rated “sub-optimal” due to small areas of erosion on each bank. In addition, riparian vegetative zone widths scored “marginal” on the left bank (looking downstream) due to the presence of a hay field. The final habitat score was 166 out of a possible 200. Fish sampling efficiency at SO-4 was rated as fair (60% pickup) due to a couple of the aforementioned blowdowns which made sampling problematic in these areas.

Fish species captured in order of abundance included slimy sculpin, brook trout, brown trout *Salmo trutta*, and blacknose dace (Table 1). The presence (and numerical dominance) of three intolerant species, plus the presence of multiple year classes (ages) of both brook and brown trout is indicative of excellent water and habitat quality. In addition, all species present are fluvial specialists/dependants, which is indicative of a stable flow regime as well.

CE01 Creamery Brook upstream from Williamsburg Road in Ashfield

The sampled reach was a series of moderate gradient riffles, pools, and runs. All but three habitat parameters were rated as being “optimal”. Channel flow status was rated “marginal”, but this was mostly due to the time of the year and a lack of significant summer rainfall. Bank stability was rated “sub-optimal” due to areas of erosion on each bank. In addition the riparian vegetative zone width was “marginal” on the left bank (looking downstream) due to a residence. The final habitat score was 169 out of a possible 200. Fish sampling efficiency at CE01 was rated as good.

Fish species captured in order of abundance included slimy sculpin, brook trout, longnose dace *Rhinichthys cataractae*, blacknose dace, Atlantic salmon, and longnose sucker *Catostomus catostomus*. (Table 1). The presence (and dominant numbers) of four intolerants and multiple year classes (ages) of brook trout is indicative of excellent water and habitat quality. All species present are fluvial specialists/dependants which is indicative of a stable flow regime.

CK01 Clark Brook upstream from Route 112 Bridge in Buckland.

The sampled reach was a series of moderate gradient riffles, pools, and runs. Six habitat parameters were rated in the “optimal” category. Channel alteration was rated as “sub-optimal” due to evidence of channelization in conjunction with the bridge/road crossing. Bank vegetative protection was also rated “sub-optimal” on the right bank due to the presence of stone riprap and walls associated with the adjacent road. Bank stability was rated as “sub-optimal” on the left bank due to small areas of erosion. In addition the riparian vegetative zone width was “sub-optimal” on the left and “marginal” on the right bank (looking downstream) due to a clearing, and Route 112 respectively. The final habitat score was 158. Fish sampling efficiency at CK01 was rated as fair due to accumulations of leaves and debris in a few of the pools which resulted in reduced visibility in these locations.

Fish species captured in order of abundance included blacknose dace, white sucker, slimy sculpin, brook trout, creek chub, common shiner, longnose dace, and rainbow trout *Oncorhynchus mykiss*. (Table 1). Although the two dominant species are classified as moderately tolerant and tolerant, the presence of three intolerant species and multiple year classes (ages) of brook and rainbow trout is indicative of excellent water and habitat quality. All species present are fluvial specialists/dependants which is indicative of a stable flow regime.

SH01 Shingle Brook upstream and downstream from Hawks Road in Shelburne.

The sampled reach was a low gradient, straight (possibly channelized) stream which flows through inactive pasture. Downstream of the road, the stream was lined by riparian brush and young trees. Upstream of the road riparian vegetation was mostly grasses and herbaceous plants with a small amount of woody vegetation interspersed. The reach lacked deep-water runs or pools. Substrates were predominantly sand, gravel, and pebble. Five habitat parameters were rated in the “optimal” and “sub-optimal” categories and five were rated “marginal” or “poor”. Riparian vegetative zone and sediment deposition were rated as “poor”. Instream cover for fish, epifaunal substrate, and velocity depth combinations were all rated “marginal”. There was some evidence of livestock crossing on the downstream side of the road, but this did not appear to be recent activity. The final habitat score was 114, which was the lowest of the 2005 survey. Fish sampling efficiency at SH01 was rated as good on the downstream side of the road but only fair on the upstream side due to grasses hanging over and into the stream.

Fish species captured in order of abundance included blacknose dace, brook trout, and creek chub. (Table 1). Although the sample was heavily dominated by blacknose dace, a tolerant species, the presence of two year classes (ages) of brook trout, an intolerant species, is indicative of excellent water and habitat quality. The absence of adult brook trout is most likely due to the paucity of instream cover and rocky substrates. The majority of brook trout collected were young of the year with a few two year olds (1+).

Nutrients and sedimentation from the farming operations upstream and adjacent to Shingle Brook could be impacting the fish community at this location. Water quality continues to support brook trout spawning and nursery areas. Riparian plantings and exclusion of livestock from Shingle Brook are two management practices which will help to protect this reach from potential future degradation.

DG01 Dragon Brook downstream and upstream of Bassett Road Bridge in Shelburne

The sampled reach was a series of high gradient riffles, pools, and runs. All but three habitat parameters were rated as being “optimal”. Channel flow status was rated “marginal”, but this was mostly due to the time of the year and a lack of significant summer rainfall. Bank stability was rated “sub-optimal” due to small areas of erosion noted on each bank. In addition the riparian vegetative zone width was “marginal” on the left bank (looking downstream) due to the presence of Bassett Road. The final habitat score was 170.

Blacknose dace, a tolerant fluvial specialist, dominated the fish community at DG01. Multiple year classes (ages) of both brook and brown trout, both intolerant top carnivore/benthic invertivores were also present. The presence of two intolerant species and three fluvial specialists/dependants is indicative of excellent water quality and stable flow. There is a fair amount of cropland, pasture and low-density residential development in the upstream portions of the watershed, which, along with steep relatively unstable banks on both sides of this stream, could threaten this and/or downstream reaches of Dragon Brook in the future.

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Table 1. Fish population data collected by DWM at six biomonitoring stations in the Deerfield River watershed between 5 and 6 October 2005. Sampling stations were at: Chapel Brook (CP01); South River (SO-4); Creamery Brook (CE01); Clark Brook (CK01); Shingle Brook (SH01), and Dragon Brook (DG01). Young-of-the-year salmonids are noted in parentheses.

TAXON		Habitat Class[1]	Trophic Class[2]	Tolerance Class[3]	CP01	SO-4	CE01	CK01	SH01	DG01
common shiner	*Luxilus cornutus*	FDR	GF	M	6	-	-	13	-	-
blacknose dace	*Rhinichthys atratulus*	FS	GF	T	10	2	5	60	68	65
longnose dace	*Rhinichthys cataractae*	FS	BI	M	1	-	7	11	-	-
creek chub	*Semotilus atromaculatus*	FS	GF	M	10	-	-	22	7	-
white sucker	*Catostomus commersonii*	FDR	GF	T	3	-	-	35	-	-
longnose sucker	*Catostomus catostomus*	FS	BI	I	-	-	2	-	-	-
Atlantic salmon	*Salmo salar*	FS	TC	I	7	-	3	-	-	-
brown trout	*Salmo trutta*	FS	TC	I	-	12(4)	-	-	-	10(1)
brook trout	*Salvelinus fontinalis*	FDR	TC	I	15(10)	34(6)	27(14)	19(9)	8(10)	34(4)
rainbow trout	*Oncorhynchus mykiss*	FDR	TC	I	-	-	-	3	-	-
slimy sculpin	*Cottus cognatus*	FS	BI	I	29	35	73	30	-	-

[1] Habitat class modified for Massachusetts from Bain and Meixler 2000 *Macrohabitat Classification of Fishes*, FS (fluvial specialist), FDR (fluvial dependant reproduction), MG (macrohabitat generalist)

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

[3] Tolerance Classification - I (intolerant), M (moderately tolerant), T (tolerant). From Halliwell et al. as found in Simon (1999).

Table 2. Habitat assessment summary for fish population stations sampled during the 2005 Deerfield River watershed survey. For primary parameters, scores ranging from 16-20 = optimal; 11-15 = suboptimal; 6-10 = marginal; 0-5 = poor. For secondary parameters, 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.

Stations		**Chapel Brook**	**South River**	**Creamery Brook**	**Clark Brook**	**Shingle Brook**	**Dragon Brook**
Primary Habitat Parameters		**Score (0-20)**					
INSTREAM COVER (for Fish)		18	19	18	17	8	19
EPIFAUNAL SUBSTRATE		18	18	19	18	9	19
EMBEDDEDNESS		19	17	18	17	16	18
CHANNEL ALTERATION		19	18	18	14	13	19
SEDIMENT DEPOSITION		19	18	18	17	5	18
VELOCITY-DEPTH COMBINATIONS		19	17	17	16	9	18
CHANNEL FLOW STATUS		10	10	10	16	14	10
Secondary Habitat Parameters		**Score (0-10)**					
BANK VEGETATIVE PROTECTION	left bank	10	10	10	9	9	10
	right bank	10	10	10	8	9	10
BANK STABILITY	left bank	9	7	7	7	9	7
	right bank	9	7	7	9	9	7
RIPARIAN VEG ZONE WIDTH	left bank	8	5	8	6	2	5
	right bank	5	10	9	4	2	10
Total Score		**173**	**166**	**169**	**158**	**114**	**170**