

2008 Blackstone River Watershed Fish Population Assessment



Robert J. Maietta
Tim Prior
Jane Ryder
Watershed Planning Program
Worcester, MA

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Ian Bowles, Secretary
Department of Environmental Protection
Laurie Burt, Commissioner
Bureau of Resource Protection
Glenn Haas, Acting Assistant Commissioner
Division of Watershed Management
Glenn Haas, Director

Introduction

Fish population surveys were conducted in the Blackstone River Watershed at seven stations using techniques similar to Rapid Bioassessment Protocol V as described originally by Plafkin et al. (1989) and later by Barbour et al. (1999) (See Figure 1). Standard Operating Procedures are described in MassDEP Method CN 075.1 *Fish Collection Procedures for Evaluation of Resident Fish Populations*. 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 either a Smith Root Model 12 battery powered or a Coffelt Mark 18 CPS gas powered backpack electrofisher. A reach of between 70m and 150m 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 initial 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 that are collected, intentionally or not, are noted in Table 1.

Habitat Assessment

An evaluation of physical 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 2008 Blackstone 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 riparian zone. 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 used in high to moderate gradient streams 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. The ten habitat parameters used in low to moderate gradient streams are as follows: bottom substrate/available cover (fish and macroinvertebrates), pool substrate characterization, pool variability, sediment deposition, channel alteration, channel sinuosity, 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 (1996) modified regionally following discussions between MassDEP and MA Division of Fish and Game (DFG) fishery 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

W1775, Centerville Brook, downstream and upstream of West Street in Douglas.

Centerville Brook at West Street in Douglas is a second-order stream with a drainage area of approximately 9.7 Km². The brook was sampled both downstream and upstream of West Street. Four of the seven primary habitat parameters scored in the optimal category. Embeddedness, channel alteration, and sediment deposition scored suboptimal. For secondary parameters, bank vegetative protection and bank stability scored optimal and riparian vegetative zone width scored suboptimal and poor in the right and left zones respectively. Riparian vegetative zone width is impacted by a mowed lawn (associated with a Town of Douglas pumping station) in the left riparian zone and a condo complex in the right riparian zone. The final habitat score was 163 (See Table 2). The watershed upstream of the sampling station is a mix of forested, residential, and agricultural land uses.

Fish species captured in order of abundance included brook trout *Salvelinus fontinalis*, fallfish *Semotilus corporalis*, common shiner *Luxilus cornutus*, tessellated darter *Etheostoma olmstedii*, white sucker *Catostomus commersonii*, and chain pickerel *Esox niger* (See Table 1). The large numbers of (n=67) and heavy dominance by multiple age classes of wild brook trout, as well as the presence of fallfish, common shiner, tessellated darter, and white sucker (all fluvial dependents/specialists), are indicative of excellent water quality and a stable flow regime. Ponds located upstream are most likely the source of the one chain pickerel which was collected.

Centerville Brook is unlisted and therefore classified (by default) as Class B in the Massachusetts Surface Water Quality Standards (SWQS) (MassDEP 2006). The Massachusetts Department of Fisheries and Game (MA DFG) identifies Centerville Brook as a "Cold Water Fishery Resource" (MA DFG 2007). In light of the high numbers of "wild" brook trout present, MassDEP should consider listing Centerville Brook as a Class B Cold Water in the next revision of the SWQS.

W1774, Bacon Brook adjacent to Balm of Life Spring Road and just upstream of confluence with a small unnamed tributary in Uxbridge.

Bacon Brook is a small third-order stream with a drainage area of approximately 15.4 Km². It was sampled near its confluence with the Blackstone River and just upstream of its confluence with an unnamed tributary. The sampled reach was of moderate gradient, had a predominantly sand/gravel bottom, and flowed through a hardwood forest. It is located downstream of a small impoundment called Ironstone Reservoir. Six of the seven primary habitat parameters scored in the optimal category. Channel flow status scored suboptimal. For secondary habitat parameters, bank vegetative protection and riparian vegetative zone width scored optimal and bank stability scored marginal. The final habitat score was 174 (See Table 2). The watershed upstream of the sampling station is a mix of forested, agricultural, commercial, and mining (sand and gravel) landuses.

Fish species captured in order of abundance included fallfish *Semotilus corporalis*, white sucker *Catostomus commersonii*, common shiner *Luxilus cornutus*, bluegill *Lepomis macrochirus*, tessellated darter *Etheostoma olmstedii*, yellow bullhead *Ameiurus natalis*, largemouth bass *Micropterus salmoides*, and brook trout *Salvelinus fontinalis* (See Table 1). The heavy dominance by fallfish, white sucker, and common shiner (all fluvial dependents/specialists), is indicative of a stable flow regime. The impoundment located a short distance upstream, and the Blackstone River a short distance downstream, are the most likely sources of bluegill, largemouth bass, and bullhead (macrohabitat generalists). With the exception of one brook trout (classified intolerant) the rest of the fish present are classified as being either tolerant or moderately tolerant of pollution. It should be noted that we also electrofished the small un-named spring creek which enters into Bacon Brook just below our sampled reach and it was teeming with multiple age classes of brook trout. (See BLSB01).

Bacon Brook is unlisted and therefore classified (by default) as Class B in the Massachusetts Surface Water Quality Standards (SWQS) (MassDEP 2006). The Massachusetts Department of Fisheries and Game (MA DFG) identifies Bacon Brook as a "Cold Water Fishery Resource" (MA DFG 2007). In light of the fact that Bacon Brook flows through Ironstone Reservoir it is unclear how much "Cold Water" habitat is actually present in this segment. It is clear that the small un-named tributary (see below) is definitely a nursery area and refugia for wild brook trout.

BLSB01, Unnamed tributary (referred to as Balm of Life Spring Brook), from Balm of Life Spring to confluence with Bacon Brook adjacent to Balm of Life Spring Road in Uxbridge.

Balm of Life Spring Brook is a tiny first order brook resulting from a number of spring seeps which emerge from the forest floor adjacent to and in between Bacon Brook and Balm of Life Spring Road. The brook flows for approximately 100 Km from its source to its confluence with Bacon Brook. The entire length of the brook was sampled. The brook was a low to moderate gradient straight channel with sandy substrate and moderately thick aquatic vegetation, especially in its headwaters. Only one of the seven primary habitat parameters (channel flow status) scored in the optimal category. Pool substrate characterization, channel alteration, and sediment deposition scored suboptimal. Bottom substrate and pool variability scored marginal, and channel sinuosity scored poor. For secondary habitat parameters, bank vegetative protection scored optimal on both banks, and riparian vegetative zone width scored optimal and poor in the right and left zones respectively. In addition, bank stability scored suboptimal. The final habitat score was 123 (See Table 2). The watershed upstream of the sampling station is a mix of forested, agricultural, commercial, and mining (sand and gravel) landuses. It should be noted that in light of the fact that this is a very small spring fed feeder brook, the actual "watershed" is very small and includes Balm of Life Spring Road and a wooded landscape immediately adjacent to the brook.

Fish species captured in order of abundance included brook trout *Salvelinus fontinalis*, and white sucker *Catostomus commersonii* (See Table 1). The presence of multiple age classes of brook trout, an intolerant fluvial dependant species, is indicative of excellent water quality and a stable flow regime. While this population of brook trout may utilize habitat within Bacon Brook and the Blackstone River seasonally, it appears that Balm of Life Spring Brook is critical habitat in summer months and possibly for spawning as well.

Balm of Life Spring Brook (unnamed tributary to Bacon Brook) is not listed in the *Massachusetts Stream Classification Program Part I: Inventory of Rivers and Streams* (SARIS) (Halliwell et.al. 1984). In addition, Balm of Life Spring Brook (unnamed tributary to Bacon Brook) is unlisted and therefore classified (by default) as Class B in the Massachusetts Surface Water Quality Standards (SWQS) (MassDEP 2006). The Massachusetts Department of Fisheries and Game (MA DFG) does not identify Balm of Life Spring Brook (or unnamed tributary to Bacon Brook) as a "Cold Water Fishery Resource" (MA DFG 2007). In light of the fact that Balm of Life Spring Brook (or unnamed tributary to Bacon Brook) is clearly a nursery area and refugia for wild brook trout, this small stream should be considered for recognition in SARIS as well listing as a Class B Cold Water in the next revision of the SWQS.

W1773, Unnamed tributary to the Mumford River (Whitin Brook), Douglas, upstream of Constitution Drive.

Unnamed tributary to the Mumford River (Whitin Brook) upstream of Constitution Drive in Douglas is a third-order stream with a drainage area of approximately 24.5 Km². The reach consists of rocky high-gradient riffle, pool, and run habitat with very clear water. All habitat parameters scored in the optimal category. The final habitat score was 193 out of 200 (See Table 3). The watershed upstream of the sampling station is mostly forested, with a small amount of low density residential land use mixed in. It should be noted that this unnamed tributary flows through a 309 acre reservoir/pond (Whitin Reservoir) located a short distance upstream.

Fish species captured in order of abundance included fallfish *Semotilus corporalis*, tessellated darter *Etheostoma olmstedi*, white sucker *Catostomus commersonii*, brook trout *Salvelinus fontinalis*, common shiner *Luxilus cornutus*, and yellow bullhead *Ameiurus natalis* (See Table 1). It should be noted that large numbers of fallfish young of the year (YOY) were also observed. Total numbers of fish (excluding YOY) were low, however, sampling efficiencies were poor due to extremely high flows resulting from tropical storm Hanna.

The presence of mostly fluvial specialist/dependent species is indicative of a stable flow regime. Fish habitat was excellent. Unnamed tributary to Mumford River (Whitin Brook) is not listed in the *Massachusetts Stream Classification Program Part I: Inventory of Rivers and Streams* (SARIS) (Halliwell et.al. 1984). The stream is also unlisted and therefore classified (by default) as Class B in the Massachusetts Surface Water Quality Standards (SWQS) (MassDEP 2006). In light of the diverse assemblage of fluvial fish present in the segment, un-named tributary to Mumford River (Whitin Brook) should be considered for inclusion in SARIS, and listing as a Class B water in the next revision of the SWQS.

W1776, Dark Brook downstream and upstream of Berlin Street in Auburn.

Dark Brook at Berlin Street is a second order stream with a drainage area of approximately 7.5 Km². It is the outflow of Dark Brook Reservoir which is located approximately 1 Km upstream. The sampled reach was mostly low gradient with a sandy substrate. Only one (channel flow status) of the seven primary habitat parameters scored in the optimal category. Bottom substrate/available cover, pool substrate characterization, channel alteration, sediment deposition, and channel sinuosity scored suboptimal. Pool variability scored only marginal. For secondary parameters, bank vegetative protection and bank stability scored optimal while riparian vegetative zone width scored suboptimal and marginal in the right and left zone respectively. The final habitat score was 150 (See Table 3). The watershed upstream of the sampling station is a mix of forested, residential (medium to high density), commercial, and industrial landuses.

Fish species captured in order of abundance included mostly small white sucker *Catostomus commersonii*, and one each of largemouth bass *Micropterus salmoides*, bluegill *Lepomis macrochirus*, and pumpkinseed *Lepomis gibbosus*. It should be noted that the largemouth bass and pumpkinseed were young of the year fish. Although sampling efficiency was rated as good, total numbers of fish were extremely low. Flows were also noted as being high due to previous rainfall.

The overall low numbers of fish along with the presence of mostly smaller fish and young of the year (YOY) suggests that flow may be limiting factor at this location. It is unclear who manages the spillway at Dark Brook Reservoir which is located a short distance upstream. Management of the Dark Brook Reservoir outflow may be having direct effects on this brook. The brook is unlisted and therefore classified (by default) as Class B in the Massachusetts Surface Water Quality Standards (SWQS) (MassDEP 2006).

W1759, West River upstream of bridge on Moroney Road in Grafton,

West River at Moroney Road in Grafton is a second-order stream with a drainage area of approximately 16.4 Km². It originates as the outflow of Silver Lake which is located approximately 1.3 Km upstream. This short segment of the river is somewhat isolated as it passes through a wetland immediately after flowing out of Silver Lake and then flows into Wildwood Pond just a short distance downstream. The sampled reach was of moderate gradient and contained excellent riffle, run, and pool habitat. All habitat parameters scored in the optimal category and the final habitat score was 183 (See Table 2). The watershed upstream of the sampling station is a mix of forested and medium density residential landuses. There is a horse farm located a short distance upstream of the sampled reach.

Overall numbers of fish were very low. Species present in order of abundance included yellow bullhead *Ameiurus natalis*, white sucker *Catostomus commersonii*, and tessellated darter *Etheostoma olmstedii* (See Table 1). Given the excellent fish habitat, the overall low numbers of fish, and the dominance by yellow bullhead, a tolerant macrohabitat generalist, was unexpected. The upstream wetland and operations at Silver Lake may be affecting dissolved oxygen and habitat respectively, during the summer months. It is unclear who manages the spillway at Silver Lake.

This section of the West River is classified as Class B “Cold Water High Quality Water” in the Massachusetts Surface Water Quality Standards (SWQS) (MassDEP 2006). The Massachusetts Department of Fisheries and Game (MA DFG) also identifies West River as a “Cold Water Fishery Resource” (MA DFG 2007). Although coldwater fish were not collected or observed in 2008, additional monitoring should be conducted before considering any changes to current classification in the SWQS. In light of the current classification it would be interesting to review operations at the Silver Lake Dam.

W1432, West River downstream and upstream of Glen Avenue in Uxbridge.

West River at Glen Avenue in Upton is a third-order stream with a drainage area of approximately 31.8 Km². The sampling station is located approximately 0.5 Km downstream of Lake Wildwood. The sampled reach started just upstream from the confluence with Warren Brook and extended upstream approximately 140 meters to a point just below a small dilapidated dam located downstream of Williams Street. The sampled reach was of moderate to high gradient and contained excellent riffle, run, and pool habitat. Six of the seven primary habitat parameters scored in the optimal category. Channel alteration scored suboptimal. For secondary habitat parameters bank vegetative protection scored suboptimal, bank stability scored suboptimal and marginal on the right and left banks respectively, and riparian vegetative zone width scored marginal and poor in the right and left zones respectively. The final habitat score was 150 (See Table 2). The watershed upstream of the sampling station is a mix of forested and medium density residential landuses.

Fish species captured in order of abundance included common shiner *Luxilus cornutus*, yellow bullhead *Ameiurus natalis*, golden shiner *Notemigonus crysoleucas*, and one each of brown bullhead *Ameiurus nebulosus*, creek chubsucker *Erimyzon oblongus*, and tessellated darter *Etheostoma olmstedii*. (See Table 1). The dominance by common shiner as well as the presence of the other fluvial specialists/dependents (creek chubsucker and tessellated darter), suggests a stable flow regime. It should be noted that overall numbers of fish other than common shiners and bullhead were very low. The small impoundment and Wildwood Lake located a short distance upstream are most likely the sources of yellow bullhead and golden shiners (macrohabitat generalists) to this reach.

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Figure 1.
Location of sampling stations
Blackstone River Watershed
Fish Population Survey 2008

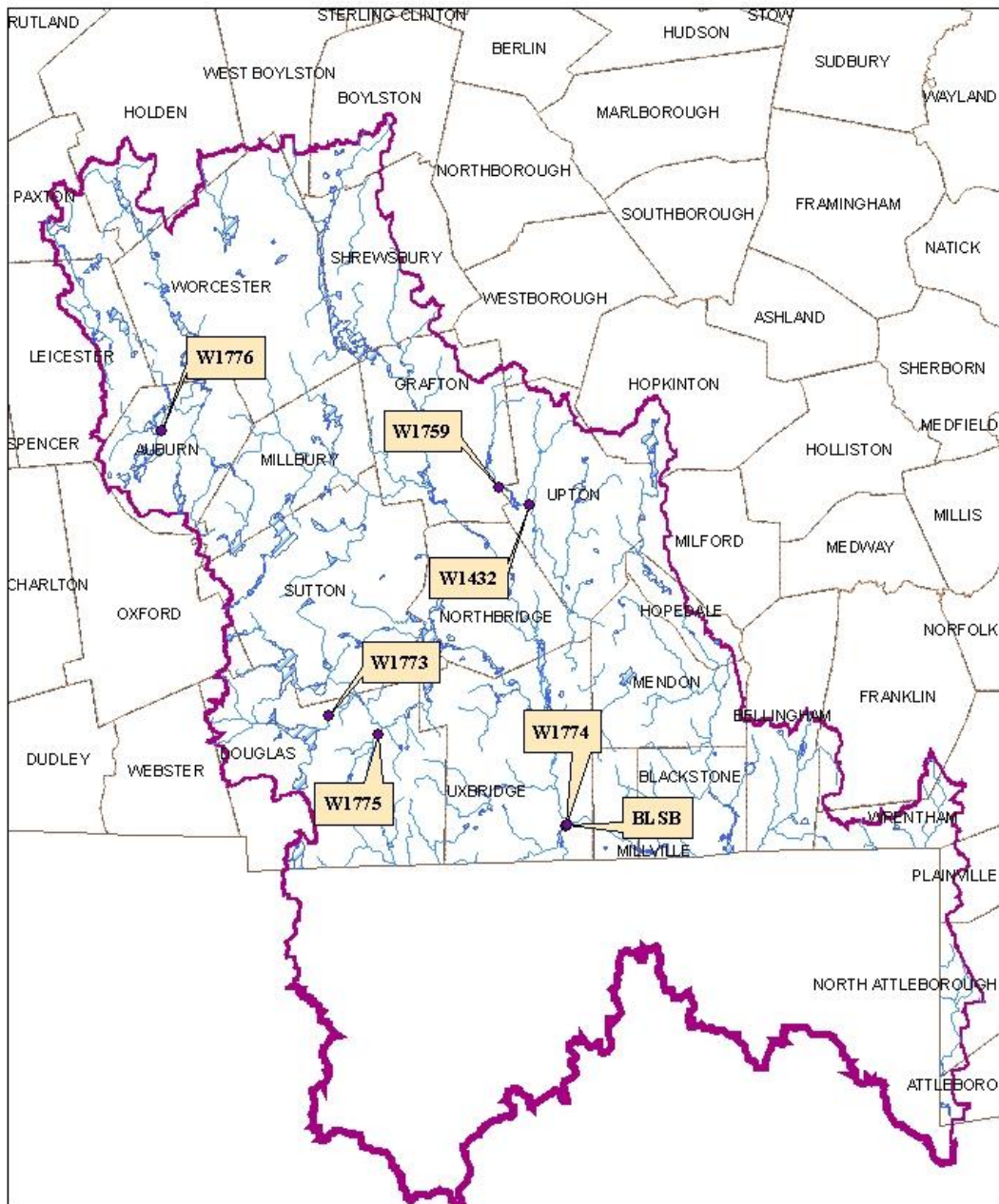
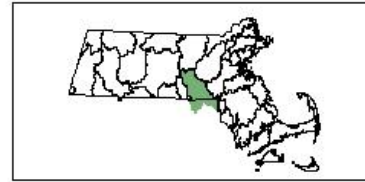


Table 1. List of fish population survey station locations and results from the 2008 Blackstone River Watershed survey.

Station Description	Date	Species Code ¹													Comments
		FF	CP	BB	CS	WS	EBT	LMB	CCS	TD	B	YB	GS	P	
W1775, Centerville Brook, Douglas, downstream to upstream of West St.	10 Sept. 2008	16	1	-	4	1	67(18)	-	-	2	-	-	-	-	EBT < 70 mm counted as young of year (YOY)
W1774, Bacon Brook, Uxbridge, adjacent to Balm of Life Spring Road and just upstream of confluence with unnamed tributary (Balm of Life Spring Brook)	10 Sept. 2008	21	-	-	16	19	1	5(4)	-	6	15	5	-	-	LMB < 75 mm considered YOY
BLSB01, Unnamed tributary (Balm of Life Spring Brook) from confluence with Bacon Brook adjacent to Balm of Life Spring Road in Uxbridge. Entire length of brook.	10 Sept. 2008	-	-	-	-	7	15	-	-	-	-	-	-	-	EBT ranged from 99 mm to 208 mm. It is unclear whether or not some of these were young of the year.
W1773, Unnamed tributary to Mumford River (Whitin Brook) Douglas, upstream of Conservation Drive.	11 Sept. 2008	29	-	-	2	4	3	-	-	5	-	2	-	-	numerous fallfish YOY were observed but not counted. High flows resulted in only a fair overall pick-up.
W1776, Dark Brook downstream and upstream of Berlin Street in Auburn.	11 Sept. 2008	-	-	-	-	10(1)	-	2(1)	-	-	1	-	-	1(1)	WS < 70mm counted as young of year (YOY) Pick-up good.
W1759, West River upstream of bridge on Moroney Road in Grafton	4 Nov. 2008	-	-	-	-	2	-	-	-	1	-	19(3)	-	-	YB < 60 mm counted as YOY
W1432, West River downstream and upstream of Glen Avenue in Uxbridge.	4 Nov. 2008	-	-	(1)	20	-	-	-	1	1	-	16(4)	12	-	YB < 70 mm counted as YOY

¹ SPECIES CODE	COMMON NAME	SCIENTIFIC NAME	TOLERANCE/MACROHABITAT CLASSIFICATION
FF	fallfish	<i>Semotilus corporalis</i>	moderately tolerant / fluvial specialist
CP	chain pickerel	<i>Esox niger</i>	tolerant / macrohabitat generalist
BB	brown bullhead	<i>Ameiurus nebulosus</i>	tolerant / macrohabitat generalist
CS	common shiner	<i>Luxilus cornutus</i>	moderately tolerant / fluvial dependent
WS	white sucker	<i>Catostomus commersonii</i>	tolerant / fluvial dependent
EBT	brook trout	<i>Salvelinus fontinalis</i>	intolerant / fluvial dependant
LMB	largemouth bass	<i>Micropterus salmoides</i>	tolerant / macrohabitat generalist
CCS	creek chubsucker	<i>Erimyzon oblongus</i>	moderately tolerant / fluvial specialist
TD	tessellated darter	<i>Etheostoma olmstedii</i>	moderately tolerant / fluvial specialist
B	bluegill	<i>Lepomis macrochirus</i>	tolerant / macrohabitat generalist
YB	yellow bullhead	<i>Ameiurus natalis</i>	tolerant / macrohabitat generalist
GS	golden shiner	<i>Notemigonus crysoleucas</i>	tolerant / macrohabitat generalist
P	pumpkinseed	<i>Lepomis gibbosus</i>	tolerant / macrohabitat generalist

² number in parentheses indicate the number of total which were young-of-the-year (YOY).

Table 2. Habitat assessment summary for fish population stations sampled during the 2008 Blackstone 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	Centerville Brook	Bacon Brook	Balm of Life Spring Brook ¹	Unnamed Tributary (Whitin Brook)	Dark Brook ¹	West River at Moroney Road	West River
Primary Habitat Parameters	Score (0-20)						
INSTREAM COVER (for Fish)	17	20		20		17	17
BOTTOM SUBSTRATE/ AVAILABLE COVER ¹			10		15		
EPIFAUNAL SUBSTRATE	17	19		20		18	18
POOL SUBSTRATE CHARACTERIZATION ¹			15		14		
EMBEDDEDNESS	14	17		17		17	18
POOL VARIABILITY ¹			7		10		
CHANNEL ALTERATION	14	20	11	20	15	17	15
SEDIMENT DEPOSITION	15	17	13	19	13	18	19
VELOCITY-DEPTH COMBINATIONS	18	19		20		19	17
CHANNEL SINUOSITY ¹			3		11		
CHANNEL FLOW STATUS	19	15	19	19	20	18	17
Secondary Habitat Parameters	Score (0-10)						
BANK VEGETATIVE							
left	10	9	9	10	10	10	6
PROTECTION							
right	10	9	9	10	10	10	8
BANK							
left	10	5	8	9	10	10	3
STABILITY							
right	10	5	8	9	10	10	6
RIPARIAN VEGETATIVE							
left	2	9	1	10	5	9	1
ZONE WIDTH							
right	7	10	10	10	7	10	5
Total Score	163	174	123	193	150	183	150

¹ low to moderate gradient assessment form