

Technical Memorandum

**Nashua River Watershed 2008
Fish Population
Monitoring and Assessment**



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Commonwealth of Massachusetts
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Introduction

Fish population surveys were conducted in the Nashua 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 the Evaluation of Resident Fish Populations*. Surveys also included a habitat assessment component modified from that described in the aforementioned document (Barbour et al 1999). In addition, stream reconnaissance surveys looking specifically for brook trout or other salmonids were conducted at four additional locations. These surveys were intended to cover large areas in an attempt to document the presence or absence of salmonid populations only.

Fish populations were sampled by electrofishing using a Smith Root Model 12 battery powered backpack electrofisher. A reach of between 70m 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 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, 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

Stillwater River downstream and upstream of Crowley Road in Sterling

The Stillwater River downstream of Crowley Road is a large third order stream with a drainage area of approximately 41 Km². There are a number of small ponds and impoundments located on upstream tributaries. Only two of the six primary habitat parameters (embeddedness and velocity depth combinations) scored in the optimal category (epifaunal substrate was not scored). Instream cover for fish, channel alteration, and sediment deposition scored suboptimal. Channel flow status scored marginal. For secondary parameters, riparian vegetative zone width scored optimal, bank vegetative protection scored optimal and suboptimal on the right and left bank respectively, and bank stability scored suboptimal and marginal on the right and left banks respectively. The final habitat score was 129 of a possible 180 (See Table 2). The watershed upstream of the sampling station is primarily forested with a mix of medium density residential and agricultural landuses as well.

Fish species captured in order of abundance included longnose dace *Rhinichthys cataractae*, fallfish *Semotilus corporalis*, common shiner *Luxilus cornutus*, white sucker *Catostomus commersonii*, tessellated darter *Etheostoma olmstedii*, eastern blacknose dace *Rhinichthys atratulus*, Atlantic salmon *Salmo salar*, largemouth bass *Micropterus salmoides*, chain pickerel *Esox niger*, and yellow bullhead *Ameiurus natalis* (See Table 1). The heavy dominance by moderately tolerant fluvial dependent/specialists and the presence of multiple age classes of Atlantic salmon is indicative of a stable flow regime and good water quality. The few macrohabitat generalists present are most likely originating in the upstream impoundments. Atlantic salmon residing in Wachusett Reservoir, which is located approximately three kilometers downstream, enter the Stillwater River to spawn each fall. The river is tributary to Wachusett Reservoir and is therefore classified a Class A Public Water Supply in the Massachusetts Surface Water Quality Standards (SWQS) (MassDEP 2006). The Massachusetts Department of Fish and Game (MA DFG) identifies the Stillwater River as a "Cold Water Fishery Resource" (MA DFG 2007).

Quinapoxet River in West Boylston

Originating as the discharge from a number of drinking water reservoirs, the Quinapoxet River adjacent to River Street in West Boylston is a fourth-order stream with a drainage area of approximately 144 Km². The sampled reach was of moderate gradient. All six primary habitat parameters scored optimal within this reach. For secondary parameters, bank vegetative protection and bank stability scored optimal and riparian vegetative zone width scored optimal and marginal in the left and right zones, respectively. The marginal score in the right riparian zone was due to the presence of River Road on the right embankment. Large boulders used for stabilization of the embankment appear to have been placed there many years ago. The final habitat score was 163 of a possible 180 (See Table 2). The watershed upstream of the sampling station is a mix of forested, protected open space, medium density residential, commercial, industrial, and agricultural land uses.

Fish species captured in order of abundance included longnose dace *Rhinichthys cataractae*, eastern blacknose dace *Rhinichthys atratulus*, brown trout *Salmo trutta*, white sucker *Catostomus commersonii*, common shiner *Luxilus cornutus* and Atlantic salmon *Salmo salar* (See Table 1). Relatively few fish were collected, however, as sampling efficiency was rated as very poor due to high flows and less than optimal sampling equipment for this stream size. While both the dominance by fluvial dependents/specialists and the presence of brown trout (which are classified as intolerant to pollution) are generally indicative of a stable flow regime and good water quality, sampling inefficiencies make precise assessment difficult. The Quinapoxet River, a tributary to Wachusett Reservoir, is classified a Class A Public Water Supply in the Massachusetts Surface Water Quality Standards (SWQS) (MassDEP 2006). The Massachusetts Department of Fish and Game (MA DFG) identifies the Quinapoxet River as a "Cold Water Fishery Resource" (MA DFG 2007).

Malden Brook upstream of Thomas Street in West Boylston

Malden Brook is a small second-order stream with a drainage area of approximately 3.2 Km². It flows through two small impoundments before emptying into the Thomas Basin of Wachusett Reservoir just downstream from the sampling location. The sampled reach was low-gradient with a sand and silt type substrate, terminated just downstream from an active beaver dam and appears to have been impacted by beavers in the recent past. Only one (channel flow status) of the seven primary habitat parameters scored in the "optimal" category. Pool substrate characterization, channel alteration, and sediment deposition, scored suboptimal. Bottom substrate/available cover, pool variability, and channel sinuosity scored only marginal. All secondary parameters scored optimal and the final habitat score was 133 out of 200 (See Table 2). The watershed upstream of the sampling station is a mix of forested and residential (medium to low density) with a small amount of crop land mixed in.

Fish species captured in order of abundance included white sucker *Catostomus commersonii*, eastern blacknose dace *Rhinichthys atratulus*, common shiner *Luxilus cornutus*, longnose dace *Rhinichthys cataractae*, and chain pickerel *Esox niger* (See Table 1). The heavy dominance by moderately tolerant fluvial dependents/specialists is indicative of a stable flow regime and good water quality. The only macrohabitat generalist present (an individual chain pickerel) most likely originated in an upstream impoundment or the beaver pond located just upstream. Malden Brook, a tributary to Wachusett Reservoir is classified a Class A Public Water Supply in the Massachusetts Surface Water Quality Standards (SWQS) (MassDEP 2006). Although coldwater fish were not collected in this reach, the Massachusetts Department of Fish and Game (MA DFG) identifies the Quinapoxet River as a "Cold Water Fishery Resource" (MA DFG 2007).

Fall Brook downstream of Central Street in Leominster

Originating on the south side of Bayberry Hill, Fall Brook flows through Fall Brook Reservoir and Lake Samoset and then turns to the northeast and flows to the south of downtown Leominster before emptying into the Nashua River. At the sampling location, Fall Brook is a second-order stream of moderate gradient with a drainage area of approximately 10.3 Km². Four of the seven primary habitat parameters scored optimal within this reach. Channel alteration and velocity depth combinations scored sub-optimal, and channel flow status scored marginal. For secondary parameters, bank vegetative protection scored suboptimal, bank stability scored marginal, and riparian vegetative zone width scored marginal and poor in the right and left zones, respectively. The marginal and poor scores with regard to the streambank and riparian zones were due to channelized reinforcement of the streambanks and the presence of a large trailer park which encompasses the majority of the riparian zone. The final habitat score was 134 of a possible 200 (See Table 2). The watershed upstream of the sampling station is a mix of forested, medium and high density residential, commercial, mining, and agricultural land uses. The headwaters are mostly forested, but there is a golf course as well.

Fish species captured in order of abundance included eastern blacknose dace *Rhinichthys atratulus*, brook trout *Salvelinus fontinalis*, fallfish *Semotilus corporalis*, white sucker *Catostomus commersonii*, common shiner *Luxilus cornutus*, and largemouth bass *Micropterus salmoides* (See Table 1). The heavy dominance by moderately tolerant fluvial dependents/specialists and the presence of multiple age classes of reproducing brook trout are indicative of a stable flow regime and excellent water quality. The presence of a robust population of brook trout downstream of a lake (Samoset), and in such a heavily developed area suggests potential groundwater contributions which should be identified and protected.

At this sampling location, Fall 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 Fish and Game (MA DFG) identifies Fall River as a "Cold Water Fishery Resource" (MA DFG 2007). MassDEP should consider listing Fall Brook as a Class B coldwater in the next revision of the SWQS.

Unnamed tributary to the Still River downstream of Forbush Mill Road crossing in Bolton

Unnamed tributary to the Still River is a small second order stream with a drainage area of approximately 1.2 Km². This brook is formed by a number of smaller tributaries each of which originates from a very small pond. These smaller tributaries flow through small impoundments before converging just upstream from the sampling location. The sampling location is just downstream of a very small impoundment (pool). The sampled reach was of moderate gradient with a cobble, pebble, and gravel type substrates. All seven of the primary habitat parameters scored in the optimal category. For secondary parameters, bank vegetative protection and bank stability scored suboptimal, and riparian vegetative zone width scored optimal and marginal in the left and right zones respectively. The presence of Forbush Mill Road encroaches upon the right riparian zone. The final habitat score was 164 out of 200 (See Table 2). The watershed upstream of the sampling station is a mix of forested and residential (medium to low density) landuses but also contains a landfill and a large apple orchard.

Fish species captured in order of abundance included brook trout *Salvelinus fontinalis*, brown bullhead *Ameiurus nebulosus*, eastern blacknose dace *Rhinichthys atratulus*, chain pickerel *Esox niger*, and pumpkinseed *Lepomis gibbosus* (See Table 1). The dominance by wild brook trout, an intolerant fluvial dependent species is indicative of a stable flow regime and excellent water quality. The few brown bullhead, chain pickerel and pumpkinseed that were present most likely originated in one of the many small ponds/impoundments located upstream.

The Still River (from source to Route 117) is classified as a Coldwater (Fishery) in the Massachusetts Surface Water Quality Standards (SWQS) (MassDEP 2006). In addition, the Massachusetts Department of Fish and Game (MA DFG) identifies the Still River as a “Cold Water Fishery Resource” (MA DFG 2007). The unnamed tributary however is not listed in the SWQS and is therefore considered Class B (by default). MA DFG considers this tributary to be part of the Still River. In light of the presence of reproducing brook trout and the location of this tributary, it should be considered for listing as a Cold Water during the next revision to the SWQS.

Phillips Brook below and above Fred Smith Road in Westminster

Phillips Brook downstream of Fred Smith Road in Westminster, is a large third-order stream that originates as the outlet of Winnekeag Lake and drains an area of approximately 26 Km². The brook flows through downtown Ashburnham and then into Factory Village Pond (a small impoundment), which is located approximately 3.2 km upstream from the sampling location. The sampled reach was of moderate gradient with rocky and gravelly substrates and an open canopy. Three of the seven primary habitat parameters (instream cover for fish, sediment deposition, and channel flow status) scored in the optimal category. The four remaining primary parameters scored suboptimal. For secondary parameters bank vegetative protection and bank stability scored optimal, and riparian vegetative zone width scored suboptimal. It was noted that there was a large amount of green filamentous algae present. The final habitat score was 158 of a possible 200 (See Table 2). The watershed upstream of the sampling station is mostly forested with a mix of medium to low density residential, and agricultural landuse mixed in. There is a small amount of commercial landuse in downtown Ashburnham.

Fish species captured in order of abundance included eastern blacknose dace *Rhinichthys atratulus*, white sucker *Catostomus commersonii*, common shiner *Luxilus cornutus*, fallfish *Semotilus corporalis*, brook trout *Salvelinus fontinalis*, brown trout *Salmo trutta*, and brown bullhead *Ameiurus nebulosus* (See Table 1). The heavy dominance by moderately tolerant fluvial dependents/specialists as well as the presence of reproducing brown and brook trout (although numbers were low) are indicative of a stable flow regime and good water quality. The very large numbers of moderately tolerant fishes and the presence of green filamentous algae suggest moderate nutrient enrichment.

This segment of Phillips 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 Fish and Game (MA DFG) identifies Phillips Brook as a “Cold Water Fishery Resource” (MA DFG 2007) and in light of the presence of reproducing brown and brook trout, MassDEP should consider listing Phillips Brook as a Class B Coldwater in the next revision of the SWQS.

Gates Brook beginning at Wachusett Reservoir in West Boylston

Gates Brook is a second-order stream with a drainage area of approximately 8.2 Km². The brook originates between Department of Conservation and Recreation (DCR) land and Route 190 in West Boylston and then flows through the most developed section of town before once again entering DCR property and ultimately discharging to the Wachusett Reservoir. It is a free-flowing brook throughout its length and of moderate to high gradient at the sampling location just upstream of the Reservoir. Substrates at this location are primarily rocky and gravelly and the canopy was mostly closed. All seven primary habitat parameters scored optimal. Secondary parameters also scored optimal. The only riparian threat to this reach is an DCR fire/access road which crosses the brook. The final habitat score was 184 of a possible 200 (See Table 2). The watershed upstream of the sampling station is a mix of forested, protected open space, recreation (golf course) commercial, medium to high density residential, and multifamily residential landuses.

Fish species captured in order of abundance included longnose dace *Rhinichthys cataractae*, brook trout *Salvelinus fontinalis*, eastern blacknose dace *Rhinichthys atratulus*, yellow bullhead *Ameiurus natalis*,

common shiner *Luxilus cornutus*, tessellated darter *Etheostoma olmstedii*, Atlantic salmon *Salmo salar*, and white sucker *Catostomus commersonii* (See Table 1). The heavy dominance by moderately tolerant fluvial dependents/specialists and the abundance of reproducing brook trout is indicative of a stable flow regime and excellent water quality. Gates Brook is a tributary to Wachusett Reservoir and, although it's not listed in the Massachusetts Surface Water Quality Standards (SWQS), it's classified a Class A Public Water Supply (Wachusett Reservoir and "tributaries thereto"). The Massachusetts Department of Fish and Game (MA DFG) identifies Gates Brook as a "Cold Water Fishery Resource" (MA DFG 2007).

Additional Sampling Stations (Coldwater Fishery Reconnaissance only)

The following stations were sampled to document the presence or absence of reproducing cold water fishes (primarily brook trout *Salvelinus fontinalis*, brown trout *Salmo trutta*, rainbow trout *Oncorhynchus mykiss*, lake trout *Salvelinus namaycush*, Atlantic salmon *Salmo salar*, slimy sculpin *Cottus cognatus*, or longnose sucker *Catostomus catostomus*). Surveys entailed electrofishing long reaches and simply documenting the fish species present. Notes were taken with regard to what types of fish were present, however, fish were not enumerated, measured, or weighed. All waterbodies sampled are currently listed by the Massachusetts Division of Fisheries and Wildlife on the Massachusetts Coldwater Fishery Resource List (MA DFG 2007). The list includes waters known to have coldwater fisheries resources (CFR's).

A CFR is defined by MA DFG as "a water that meets at least one of the following criteria:"

1. Brook, brown, or rainbow trout reproduction has been determined;
2. Slimy sculpin or longnose sucker are present;
3. The water is part of the Atlantic salmon restoration effort or is stocked with Atlantic salmon fry, parr, or smolts

"Any water not listed here may be either: 1) warmwater, 2) undetermined, or 3) unsampled. The Division should be contacted before decisions concerning water quality are made."

Mulpus Brook upstream from Holman street in Lunenburg

There was very little flow in this reach and most fish were collected from the pool just downstream of the road. Species present included tessellated darter *Etheostoma olmstedii*, white sucker *Catostomus commersonii*, eastern blacknose dace *Rhinichthys atratulus*, and yellow bullhead *Ameiurus natalis*. Although the entire length of

Mulpus Brook is listed as a "Coldwater" in the Massachusetts Surface Water Quality Standards (SWQS) it should be noted that there is no "Class" listed and coldwater species were not observed or collected during the 2008 survey. As was previously mentioned, the Massachusetts Department of Fish and Game (MA DFG) identifies Mulpus Brook as a "Cold Water Fishery Resource" (MA DFG 2007).

Mulpus Brook just upstream from confluence with Nashua River in Oxbow National Wildlife Refuge (NWR) in Shirley

Fish species collected included eastern blacknose dace *Rhinichthys atratulus*, longnose dace *Rhinichthys cataractae*, white sucker *Catostomus commersonii*, fallfish *Semotilus corporalis*, yellow bullhead *Ameiurus natalis*, common shiner *Luxilus cornutus*, and largemouth bass *Micropterus salmoides*. Although the entire length of

Mulpus Brook is listed as a "Coldwater" in the Massachusetts Surface Water Quality Standards (SWQS) it should be noted that there is no "Class" listed and coldwater species were not observed or collected during the 2008 survey. As was previously mentioned the Massachusetts Department of Fish and Game (MA DFG) identifies Mulpus Brook as a "Cold Water Fishery Resource" (MA DFG 2007).

Nissitissit River downstream from Mill Street in Pepperell

Fish species collected included eastern blacknose dace *Rhinichthys atratulus*, tessellated darter *Etheostoma olmstedii*, longnose dace *Rhinichthys cataractae*, fallfish *Semotilus corporalis*, common shiner *Luxilus cornutus*, and largemouth bass *Micropterus salmoides*.

Although the entire length of the Nissitissit River in Massachusetts is classified as a "Class B Cold Water Outstanding Resource Water" in the Massachusetts Surface Water Quality Standards (SWQS) coldwater fish species were not observed or collected during the 2008 reconnaissance survey. As was previously mentioned the Massachusetts Department of Fish and Game (MA DFG) identifies the Nissitissit River "Cold Water Fishery Resource" (MA DFG 2007).

Nissitissit River at Prescott Street in Pepperell

Fish species collected included eastern blacknose dace *Rhinichthys atratulus*, longnose dace *Rhinichthys cataractae*, fallfish *Semotilus corporalis*, common shiner *Luxilus cornutus*, and American eel *Anguilla rostrata*.

Although the entire length of the Nissitissit River in Massachusetts is classified as a "Class B Cold Water Outstanding Resource Water" in the Massachusetts Surface Water Quality Standards (SWQS) coldwater fish species were not observed or collected during the 2008 reconnaissance survey. As was previously mentioned the Massachusetts Department of Fish and Game (MA DFG) identifies the Nissitissit River "Cold Water Fishery Resource" (MA DFG 2007).

Squannacook River downstream of South Street in Townsend Harbor

No fish were collected or observed. The river was wide and flows were high which made electrofishing with a backpack unit in-effective. Although the upper portion of the Squannacook River is classified as a "Class B Cold Water Outstanding Resource Water" in the Massachusetts Surface Water Quality Standards (SWQS) coldwater fish species were not observed or collected during the 2008 reconnaissance survey. As was previously mentioned the Massachusetts Department of Fish and Game (MA DFG) identifies the Nissitissit River as a "Cold Water Fishery Resource" (MA DFG 2007).

Although no coldwater fishes were collected during reconnaissance surveys, it should be noted that the sampled reaches make up only a small portion of the total length of any one of these "Cold Water" segments.

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

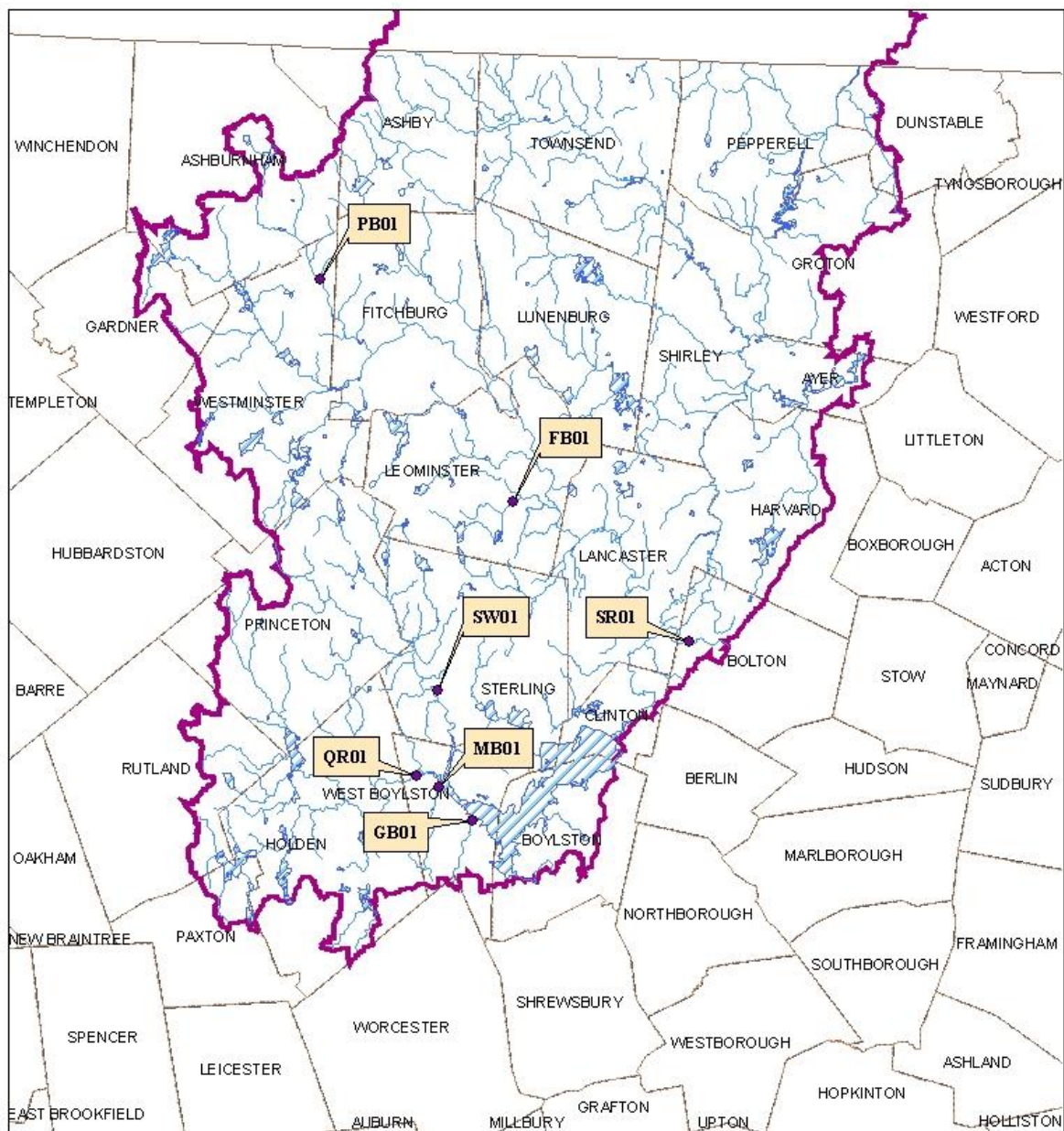
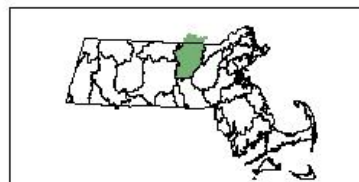


Table 1. List of fish population survey station locations and results from the 2008 Nashua River Watershed survey.

Station Description	Date	Species Code ¹															Comments
		FF	CP	BB	CS	WS	EBT	LMB	LND	TD	AS	YB	BT	GS	P	BND	
SWR01, Stillwater River, Sterling, reach beginning 40 m downstream of Crowley Road. and ending 40 m upstream of road.	29 Aug. 2008	38(2) ²	1	-	29	12(2)	-	2(1)	39	9	3	(1)	-	-	-	4	WS and FF ≤50 mm considered YOY, LMB <65 mm considered YOY, YB<43 mm considered YOY
QR01, Quinapoxet River adjacent to River Street in West Boylston. Reach beginning at automobile pull off and ending upstream at ledges.	29 Aug. 2008	-	-	-	1	1	-		53(1)	-	1	-	2	-	-	35	LND< 45 mm considered YOY, BT most likely stocked fish
MB01, Malden Brook, West Boylston, beginning at Thomas St. and extending upstream approximately 80 meters.	29 Aug. 2008	-	1	-	14	33	-	-	2	-	-	-	-	-	-	24(3)	BND ≤ 40mm considered YOY
FB01, Fall Brook, Leominster, beginning approximately 70 meters downstream of Central St. and extending upstream to approximately 10 meters above the Central St. bridge.	4 Sept. 2008	24	-	-	2	9	38(1)	(1)	-	-	-	-	-	-	-	133	Estimated pick-up 60-70%. LMB<60mm considered YOY
SR01, Unamed tributary to the Still River, Bolton, beginning adjacent to the soccer field on Forbush Mill Road and extending 80 m upstream to a small dam..	4 Sept. 2008	-	1	4	-	-	35(6)	-	-	-	-	-	-	-	1	2	Landfill located approximately 0.2 miles upstream of sampled reach. EBT ≤ 62 mm considered YOY
PB01, Phillips Brook, Fitchburg, beginning approximately 40 meters downstream of bridge and extending to 40 meters upstream of bridge on Fred Smith Road.	4 Sept. 2008	20	-	1	36	46(2)	3	-	-	-	-	-	2	-	-	191(2)	Between 200-300 BND collected and/or observed. BND < 33mm considered YOY. All EBT appeared to be native, BT definitely a stocked fish.. WS < 45mm considered YOY
GB01, Gates Brook, West Boylston, reach beginning at mouth (Wachusett Reservoir) and extending approximately 100 meters upstream.	5 Sept 2008	-	-	-	2	(1)	27	-	30(1)	2	1	11(1)	-	-	-	27	LND < 40 mm considered YOY, WS ≤ 50mm considered YOY, YB< 50mm considered 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 commersoni</i>	tolerant / fluvial dependent
EBT	brook trout	<i>Salvelinus fontinalis</i>	intolerant / fluvial dependant
LMB	largemouth bass	<i>Micropterus salmoides</i>	tolerant / macrohabitat generalist
LND	longnose dace	<i>Rhinichthys cataractae</i>	moderately tolerant / fluvial specialist
TD	tessellated darter	<i>Etheostoma olmstedii</i>	moderately tolerant / fluvial specialist
AS	Atlantic salmon	<i>Salmo salar</i>	intolerant / fluvial specialist
YB	yellow bullhead	<i>Ameiurus natalis</i>	tolerant / macrohabitat generalist
BT	brown trout	<i>Salmo trutta</i>	intolerant / fluvial Dependent
GS	golden shiner	<i>Notemigonus crysoleucas</i>	tolerant / macrohabitat generalist
P	pumpkinseed	<i>Lepomis gibbosus</i>	tolerant / macrohabitat generalist
BND	blacknose dace	<i>Rhinichthys atratulus</i>	moderately tolerant /fluvial specialist

² number in parentheses indicate young-of-the-year

Table 2. Habitat assessment summary for fish population stations sampled during the 2008 Nashua 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	Stillwater River	Quinapoxet River	Malden Brook	Fall Brook	Unnamed tributary to Still River	Phillips Brook	Gates Brook
Primary Habitat Parameters	Score (0-20)						
INSTREAM COVER (for Fish)	15	19		18	18	17	18
BOTTOM SUBSTRATE/ AVAILABLE COVER ¹			8				
EPIFAUNAL SUBSTRATE	N/A	N/A		18	18	14	19
POOL SUBSTRATE CHARACTERIZATION ¹			13				
EMBEDDEDNESS	16	19		16	17	15	18
POOL VARIABILITY ¹			8				
CHANNEL ALTERATION	15	18	15	13	17	15	19
SEDIMENT DEPOSITION	13	20	11	17	17	17	19
VELOCITY-DEPTH COMBINATIONS							
CHANNEL SINUOSITY ¹	17	19	6	14	18	14	19
CHANNEL FLOW STATUS	10	18	18	10	16	16	16
Secondary Habitat Parameters	Score (0-10)						
BANK VEGETATIVE PROTECTION	left right	6 9	9 9	7 7	8 7	9 9	9 9
BANK STABILITY	left right	4 6	9 9	4 4	7 7	9 9	9 9
RIPARIAN VEGETATIVE ZONE WIDTH	left right	9 9	10 4	9 9	2 4	10 4	7 7
Total Score		129*	163*	133[#]	134	164	158
				184			

¹ low to moderate gradient habitat sheet
N/A not assessed
* of a possible 180
of a possible 200