Technical Memorandum

Ipswich and Shawsheen River Watersheds
2005
Fish Population Monitoring and Assessment

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Introduction

Fish population surveys were conducted in the Ipswich and Shawsheen River Watersheds during September 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 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 Table1. 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, 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 2005 Ipswich and Shawsheen River watersheds 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 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 (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 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

GB01   Gravelly Brook upstream and downstream from Topsfield Road in Ipswich

The sampled reach was a series of moderate gradient riffles and small pools. There was one large deep pool just downstream of the road crossing and two culverts under the road which could not be sampled effectively.

All except four habitat parameters scored in the "optimal" category. Channel Flow Status was scored at the low end of the "marginal" category, but, this appears to be the result of normal summer low flow and a lack of significant rainfall prior to the survey. Channel Alteration, Velocity-Depth Combinations and Riparian Vegetative Zone Width (right zone looking downstream) each scored "sub-optimal". The presence of a cart road on the right side of the brook was responsible for the less than "sub-optimal" channel alteration and riparian vegetative zone width scoring. The final habitat score was 163 (of 200). Fish sampling efficiency at GB01 was rated as fair.

Fish species captured in order of abundance included, brook trout *Salvelinus fontinalis*, redfin pickerel *Esox americanus*, banded sunfish *Enneacanthus obesus*, American eel *Anguilla rostrata*, sea lamprey *Petromyzon marinus*, yellow bullhead *Ameiurus natalis*, and white sucker *Catostomus commersoni*. (Table 1).

Although most species present are considered tolerant or moderately tolerant macrohabitat generalists, the presence and abundance of multiple year classes (ages) of brook trout (an intolerant fluvial specialist/dependant) is indicative of excellent water and habitat quality. White sucker (a single individual) although tolerant are also classified as a fluvial dependant species. Gravelly Brook is obviously susceptible to very low flow conditions such as those documented in 2005. In light of the fact that this brook is currently supporting a reproducing population of brook trout (very rare in the Ipswich River Watershed), watershed protection and specifically protection of instream flows should be a top priority in this sub-watershed.

RB01A   Rogers Brook just upstream from confluence with the Shawsheen River in Andover

Rogers Brook contains a balanced mix of moderate to high gradient riffle, run, and pool habitats with a fair amount of relatively stable habitat in the form of boulders and undercut banks. Six of the habitat parameters were scored as "optimal", however, bank stability was scored "poor", sediment deposition and channel flow status scored "marginal" and embeddedness scored "suboptimal". Although instream cover for fish scored "optimal" and looked plentiful there is evidence of both extremely high flows (bank erosion and sedimentation) and extremely low flows such as those seen on the day of the fish survey. Even lower flows were observed on other survey dates during water quality and thermal surveys. High flows threaten bank stability and carry sediments into and through Rogers Brook, and ultimately into the Shawsheen River. Although the surveyed reach of Rogers Brook is located within a mature forested ravine with no riparian development, upstream sections are heavily developed and channelized. Rogers Brook is actually culverted underground through downtown Andover just upstream from the sampled segment.

Fish species captured in order of abundance included American eel, pumpkinseed *Lepomis gibbosus*, largemouth bass *Micropterus salmoides*, and redfin pickerel. (Table 1). All fish species collected are macrohabitat generalists. In addition, all are considered tolerant to pollution. Numbers were extremely low given the amount of available habitat. The absence of fluvial specialists/dependants suggests that the flow regime in Rogers Brook has been compromised. It is unclear whether or not this brook actually dries up completely, however, it had not dried up completely as of late September 2005.

References

Bain, M. B., and M. S. Meixler. 2000. Defining a target fish community for planning and evaluating enhancement of the Quinebaug River in Massachusetts and Connecticut. Final report by the New York Cooperative Fish and Wildlife Research Unit, Cornell University, Ithaca, NY to the New England Interstate Water Pollution Control Commission, Lowell, MA. 51 p.

Barbour, M. T., J. Gerritsen, B. D. Snyder, and J. B. Stribling. 1999. Rapid Bioassessment Protocols for Use in Streams and Rivers: Periphyton, Benthic Macroinvertebrates, and Fish. Second Edition. EPA 841-B-99-002. Office of Water, US Environmental Protection Agency, Washington, DC. 151 p. + appendices

Halliwell, D.B, Langdon, R.W., Daniels, R.A., Kurtenbach, J.P., and R.A. Jacobson. 1999. Classification of Freshwater Fish Species of the Northeastern United States for Use in the Development of Indices of Biological Integrity, with Regional Applications. pp. 301-338 in T. P. Simon (ed.). Assessing the Sustainability and Biological Integrity of water Resources Using Fish Communities. CRC Press, Boca Raton, FL. 671 p.

Hartel, K. E., D.B. Halliwell, and A. E. Launer. 2002. Inland fishes of Massachusetts. Massachusetts Audubon Society. Lincoln, Massachusetts.

Karr, J. R., K. D. Fausch, P. L. Angermeier, P. R. Yant, and I. J. Schlosser. 1986. Assessing Biological Integrity in Running Waters: A Method and Its Rationale. Special Publication 5. Illinois Natural History Survey. Champaign, IL. 28 p.

Nelson, J. S., E. J. Crossman, H. Espinosa-Perez, L. T. Findley, C. R. Gilbert, R. N. Lea, and J. D. Williams. 2004. Common and scientific names of fishes from the United States, Canada, and Mexico. American Fisheries Society. Special Publication 29, Bethesda, Maryland

Plafkin, J. L., M. T. Barbour, K. D. Porter, S. K. Gross, and R. M. Hughes. 1989. Rapid Bioassessment Protocols for Use in Streams and Rivers: Benthic Macroinvertebrates and Fish. EPA/440/4-89-001. Office of Water, US Environmental Protection Agency, Washington, DC.

Tetra Tech, Inc. 1995. Massachusetts DEP Preliminary Biological Monitoring and Assessment Protocols for Wadeable Rivers and Streams. Method 003: Preliminary biological monitoring and assessment protocols for pulsed DC electrofishing. Prepared for Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA. 7 p.

US EPA. 1995. Generic Quality Assurance Project Plan Guidance for Programs Using Community Level Biological Assessment in Wadeable Streams and Rivers. U.S. Environmental Protection Agency, Office of Water. 71 p.

Table 1. Fish population data collected by DWM at two biomonitoring stations in the Ipswich and Shawsheen River watersheds on 20 September 2005. Sampling stations were at: Gravelly Brook in Topsfield (GB01) and Rogers Brook in Andover (RG01A). Young-of-the-year salmonids are noted in parentheses.

TAXON	Habitat Class[1]	Trophic Class[2]	Tolerance Class[3]	GB01	RB01A
sea lamprey *Petromyzon marinus*	MG	PF	M	3	-
American eel *Anguilla rostrata*	MG	TC	T	3	31
white sucker *Catostomus commersoni*	FDR	GF	T	1	-
yellow bullhead *Ameiurus natalis*	MG	GF	T	1	-
redfin pickerel *Esox americanus*	MG	TC	M	14	1
brook trout *Salvelinus fontinalis*	FDR	TC	I	28(2)	-
banded sunfish *Enneacanthus obesus*	MG	WC	I	4	-
pumpkinseed *Lepomis gibbosus*	MG	GF	M	-	10
largemouth bass *Micropterus salmoides*	MG	TC	M	-	1

[1] Habitat class modified for Massachusetts from Bain *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. as found in Simon (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 Ipswich and shawsheen River watersheds 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	Gravelly Brook	Rogers Brook
Primary Habitat Parameters		
INSTREAM COVER (for Fish)	19	19
EPIFAUNAL SUBSTRATE	16	16
EMBEDDEDNESS	18	12
CHANNEL ALTERATION	15	19
SEDIMENT DEPOSITION	19	9
VELOCITY-DEPTH COMBINATIONS	15	19
CHANNEL FLOW STATUS	6	6
Secondary Habitat Parameters		
BANK VEGETATIVE PROTECTION left right	10 9	9 9
BANK STABILITY left right	9 9	2 2
RIPARIAN VEGETATIVE ZONE WIDTH left right	10 8	9 9
Total Score	**163**	**140**