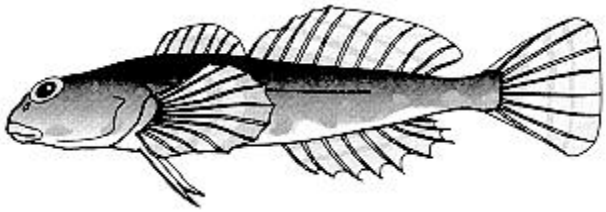
2006 South Coastal Watershed (Eel River sub-watershed) Fish Population Assessment



Robert J. Maietta

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Executive Office of Environmental Affairs
Ian Bowles, Secretary
Department of Environmental Protection
Arleen O'Donnell, Acting 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 Eel River Sub-watershed using techniques similar to Rapid Bioassessment Protocol V as described originally by Plafkin et al. (1989) and later by Barbour et al. (1999). Sration locations can be found in Figure 1. 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 in the South Coastal watershed (Eel River Sub-watershed) were sampled by electrofishing during the late summer of 2006 using a Smith Root Model 12 battery powered backpack electrofisher. The "standard" survey covered a reach of between 80m and 100m and 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, either on purpose or inadvertently, are noted in Table 1. In addition to the standard survey a number of "reconnaissance" surveys were conducted in an effort to describe the distribution of slimy sculpin *Cottus cognatus* within the Eel River watershed. We were also noting the presence or absence of bridle shiner *Notropis bifrenatus* (a special concern species in Massachusetts that has been historically documented in the Eel River system) during the "reconnaissance" surveys.

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 2006 South Coastal Charles River "standard" 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 riverfront 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 follow: 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

ER01 Eel River - Adjacent to cranberry bog downstream from Long Pond Road (Plymouth)

The Eel River (ER01) was sampled a short distance downstream of Long Pond Road and just upstream from the Nature Conservancy's driveway, adjacent to an inactive cranberry bog in Plymouth (See Figure 1). The 100-meter moderate gradient reach was mostly comprised of shallow run habitat. There were a couple of small pools present a short distance upstream from the terminal end of the reach near the Nature Conservancy's driveway. Only two habitat parameters (channel flow status and bank vegetative protection) scored in the "optimal" category. Five were scored as "suboptimal" (epifaunal substrate, embeddedness, channel alteration, sediment deposition, and riparian vegetative zone width), and three were scored as "marginal" (instream cover for fish, velocity-depth combinations, and bank stability). Most habitat parameters that rated "sub-optimal" or "marginal" scored very low in those categories. Although the relatively low gradient of this reach may be responsible for some of the habitat problems, it appears that the presence of the adjacent cranberry bog also accounts for some of them. The final habitat score was 118 (of a possible 200). Fish sampling efficiency at ER01 was rated as excellent.

The fish sample included only two American eel *Anguilla rostrata*. Three golden shiner *Notemigonus crysoleucas* were observed just downstream of the sampled reach.

Although the cranberry bog is currently inactive and flows were excellent on the date of the survey, it appears that historic bog management may have impacted the fish community at this location. It should also be noted that the watershed upstream from the sampling location is an extensive network of cranberry bogs (which also appear to be inactive).

Reconnaissance surveys conducted upstream at ER01A and ER00 (See Figure 1) were problematic in that the stream substrates were composed of very fine sand that proved to be very deep and dangerous to walk upon. A small amount of sampling at each location resulted in the collection and observation of only golden shiners.

ER015 Eel River – Approximately 100 meters upstream from Russell Millpond (Plymouth)

The sampled reach was of moderate to high gradient and contained a mix of riffle/pool/run habitat. Nine of the ten habitat parameters scored (at least one side of stream) in the "optimal" category. Sediment deposition scored in the sub-optimal category. Habitat concerns in this reach include fine sediments coming from a small drained impoundment located just upstream (there appears to be a small breached dam) and erosion from dirt bike and all terrain vehicle (ATV) activities taking place both instream, and on the right (east) bank within the riparian zone within the reach itself. The final habitat score was 172 (of a possible 200). Fish sampling efficiency at ER015 was rated as good.

Fish species captured in order of abundance included brook trout *Salvelinus fontinalis*, white sucker *Catostomus commersonii*, American eel, chain pickerel *Esox niger*, and golden shiner (See Table 1). The presence and numerical dominance of multiple age classes of brook trout, an intolerant fluvial specialist, is indicative of excellent water and habitat quality as well as a stable flow regime.

Efforts to stop dirt bike and ATV use within the riparian zone and stabilization of currently affected areas will help to protect this excellent coldwater fishery.

ER02 Eel River downstream of Russell Millpond (Plymouth)

The sampled reach was of moderate to high gradient and contained a mix of riffle/pool/run habitat.

Six of the ten habitat parameters evaluated scored in the "optimal" category on at least one side of the stream. Epifaunal substrate, embeddedness, and sediment deposition scored sub-optimal and velocity-depth combinations scored marginal. The streambank on the left hand side was partially cleared of vegetation and showed a fair amount of erosion. Instream cover for fish was scored "optimal" due to the presence of fairly stable habitat in the form of boulders, logs and undercut banks. The final habitat score was 158 (of a possible 200) and fish sampling efficiency was rated as fair.

The fish population was dominated by yellow perch *Perca flavescens*, brown bullhead *Ameuirus nebulosus*, and white sucker. All three species are considered tolerant of low dissolved oxygen and high temperatures; however, five brown trout *Salmo trutta*, and an individual rainbow trout *Oncorynchus mykiss* were also collected. Although all trout captured were of similar size and were considered to be "stocked" or possibly "hatchery escapees" (there is a private hatchery located nearby) they are still considered intolerant of low dissolved oxygen and high temperatures. Other species

included American eel and golden shiner as well as individual black crappie *Pomoxis nigromaculatus*, pumpkinseed *Lepomis gibbosus*, and largemouth bass *Micropterus salmoides*.

The numerical dominance by macrohabitat generalists (brown and yellow bullhead), and fluvial dependants (white suckers) that are tolerant of low dissolved oxygen (and high temperatures) may be a result of warming and diurnal dissolved oxygen fluctuations taking place in the impoundment located just upstream. The presence of trout, however, indicates that the water quality at the time of the survey was excellent. Streambank stabilization on the left bank would help protect this and downstream reaches of the Eel River from potential future sedimentation.

A reconnaissance survey conducted downstream at ER03 (See Figure 1) resulted in the documentation (collection and observation) of large numbers of bridled shiner *Notropis bifrenatus* (a special concern species in Massachusetts that has been historically documented in the Eel River system); however, no slimy sculpin were observed or collected.

ER06 Un-named tributary to the Eel River downstream of Forge Pond, Plymouth

The sampled reach was of moderate gradient and contained a diverse mix of riffles, runs and pools. Seven of the ten habitat parameters evaluated scored in the "optimal" category on at least one side of the stream. Epifaunal substrate, sediment deposition, and bank stability (left bank) scored sub-optimal. Bank vegetative protection and bank stability on the right side of the stream scored only "marginal". Riparian vegetative zone width on the right side of the stream scored "poor". Instream cover for fish was scored "optimal" due to a diverse mix of snags, pools, and undercut banks, however, the presence of large amounts of aquatic macrophytes and algae made fish sampling difficult at times. The final habitat score was 150 (of a possible 200). Fish sampling efficiency at ER06 was rated as fair.

The fish sample included more than twenty-five American eel, seven brook trout, four brown bullhead, three brown trout, three pumpkinseed, two golden shiner, and individual largemouth bass, chain pickerel, and yellow perch. Overall fish numbers seemed very low for the amount of habitat present but this may have been due in part to fish hiding out in the lush growth of aquatic vegetation. The trout were all large and healthy and are presumed to have been stocked or of hatchery origin. Many of the macrohabitat generalist fish species present are most likely originating in the impoundment upstream (Forge Pond). There is also a chance that these fish could be migrating up from the downstream impoundment (Howland Pond).

Nutrient enrichment and sedimentation appear to be major influences on habitat in this reach. The presence of a horse farm and management practices associated with its operation (such as cleared and grazed riparian zone extending all the way to the stream bank and ponds edge on the right bank) appear to be influencing these two waterbodies. Fencing to keep the horses out of the immediate riparian zone and restoration of stream side vegetation would help to protect both the pond and the stream from further eutrophication.

A reconnaissance survey conducted downstream at ER04A (See Figure 1) resulted in the documentation (collection and observation) of large numbers of bridled shiner *Notropis bifrenatus* (a special concern species in Massachusetts that has been historically documented in the Eel River system), however, no slimy sculpin were observed or collected.

ER08 Un-named tributary to the Eel River 125 meters downstream from dirt road in OS development or 500 meters upstream of Forge Pond in Plymouth

The sampled reach was a series of moderate to low gradient riffles, pools, and runs. Five of ten habitat parameters were rated in the "optimal" category. Four of the ten scored "sub-optimal" and sediment deposition scored "marginal". Instream cover for fish scored high within the "sub-optimal" category and was mostly in the form of woody snags. Aquatic vegetation also provided habitat at least seasonally. The aquatic macrophytes, thick canopy cover, and subsequent shading made it very tough to spot slimy sculpin *Cottus cognatus* in particular. Therefore, slimy sculpin numbers may have been underestimated. The final habitat score was 159 (of a possible 200) and fish sampling efficiency at ER08 was rated as good.

Fish collected, in order of abundance, included multiple age classes of brook trout (n=53), slimy sculpin (n=9), American eel *Anguilla rostrata* (n=5), young of the year brown trout *Salmo trutta* (n=4) and brown bullhead *Ameiurus nebulosus* (n=4). The presence of multiple age classes of brook trout (including young of the year), young of the year brown trout, and slimy sculpin, all of which are coldwater fluvial specialists/dependants, is indicative of excellent water and habitat quality. The presence of slimy sculpin is particularly noteworthy as they are mostly

limited to drainages west of the Connecticut River and they had never been documented in the South Coastal River watershed.

The habitat assessment noted what appeared to be fresh sedimentation in the form of sand. Although the predominant substrates in this un-named tributary are sand and gravel, there was evidence of erosion and failed (buried) silt fences at the dirt road crossing. It appeared that the dirt road had recently been rebuilt and/or graded.

An additional "reconnaissance" electrofishing survey conducted at ER07 (located a short distance downstream) resulted in the collection of large numbers of slimy sculpin and many brook trout. Multiple age classes and young of the year specimens of both species were collected.

Summary

The headwaters of the Eel River and its un-named tributary located to the east obviously provide an excellent source of high quality cold water as is evidenced by the robust populations of brook trout found in both locations. Unfortunately, these populations appear to be isolated. This is most likely due to flow regime and habitat problems associated with historic cranberry bog operation in the headwaters of the Eel River and impoundments and/or land use practices currently present in the un-named tributary.

The good news is that a consortium of local, federal and non-profit groups including Plymouth's Community Preservation Committee, The Nature Conservancy, The Wildlands Trust of Southeastern Massachusetts, the U.S. Department of Agriculture, and the Cape Cod Cranberry Growers Association have recently purchased much of the headwaters of the Eel River and announced the protection of 95 acres which will be known as the Eel River Preserve. Plans include restoration of streamside vegetation and habitat that will have a direct benefit on biological communities in and around the Eel River.

The discovery of slimy sculpin in the Eel River watershed was a very pleasant surprise. Hartel et al. in the book *Inland Fishes of Massachusetts* report "small, geographically isolated populations in the Millers, Chicopee and Nashua river basins." They also report that sculpin were found in the "lower Merrimack near Lawrence" in 1861, but are last reported there in 1953. The Merrimack River population is considered extirpated. It is unclear as to the origin of slimy sculpin in this un-named tributary, however it should be noted that it is reported (Withington 2006) that there was a historic private fish hatchery (circa 1900) located upstream from Forge Pond. This hatchery was certainly in the vicinity of the stations where the sculpin were collected. It is possible that trout (and sculpins) from other areas of Massachusetts or other states may have been imported and that the present slimy sculpin originated from these transplants. Slimy sculpin, like brook trout, are cold water fluvial specialists that require cold water in summer in order to survive and prosper. Wise land use practices within this tributary watershed will ultimately determine the fate of this truly unique biological community.

Although a conversation with Mettie Whipple of the Eel River Watershed Association seemed to indicate that bridle shiner might be on the decline in the river, we had no problem finding them in good abundance at two locations (ER03 and ER04A) that had appropriate habitat. They appear to prefer slow moving broad stretches of the Eel River with aquatic vegetation.

Follow-up surveys are planned during 2007 in order to investigate the unnamed tributary upstream of the road crossing in the OS development (ER07), as well as one remaining un-named tributary located upstream of the cranberry bog approximately 400-500 meters west of station ER07. Fish population monitoring should also be conducted in conjunction with any restoration that might be conducted in the headwaters as part of the Eel River Preserve project.

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Table 1. List of fish biomonitoring station locations and fish population data from the 2006 South Coastal Watershed (Eel River sub-watershed) survey.

Station Description	Collection Date	Species Code[1, 2]													Comments
		AE	GS	WS	BB	CP	RT	BT	EBT	SC	P	LMB	BC	YP	
ER01 Eel River, Plymouth, Adjacent to bog just upstream of Nature Conservancy's driveway and downstream of Long Pond Road	24 Aug. 2006	2	-	-	-	-	-	-	-	-	-	-	-	-	No other fish collected or observed. Golden shiner were observed just downstream from end of reach
ER015 Eel River, Plymouth, Approximately 100 meters upstream from Russell Millpond	24 Aug. 2006	10	1	32(5)	-	1	-	-	42(3)	-	-	-	-	-	Brook trout less than 86 mm considered young-of-year White sucker less than 61 mm considered young-of-year
ER02 Eel River, Plymouth. Approximately 125 meters downstream from Russell Millpond in Plymouth	7 Sept 2006	3	4	11	12	-	1	5	4	-	1	(1)	1	18	Additional American eel were observed but not collected. All trout appeared to be stocked fish Sampling efficiency poor at approx 50% or less
ER06 Un-named Tributary to Eel River, Plymouth 120 meters downstream of Forge Pond in Plymouth	13 Sept. 2006	~25	2	-	4	-	-	3	7	-	3	1	-	1	American eel were noted and estimated but not collected. A range of sizes were observed. All trout appeared to be stocked or holdovers, no young of the year ot parr were observed. Sampling efficiency was only fait due to aquatic macrophytes and high flow.
ER08 Un-named Tributary to Eel River, Plymouth 125 meters downstream from dirt road in OS development in Plymouth or .500 meters upstream of Forge Pond	24 Aug. 2006	5	-	-	4	-	-	(4)	46(7)	9	-	-	-	-	Fish sampling efficiency rated as fair. Aquatic macrophytes and shdy conditions made collection of sculpin difficult. This species most likely under-represented in sample. Brown trout less than 86 mm considered to be young-of-year Brook trout less than 86 mm considered young-of-year

Table 1. List of fish biomonitoring station locations and fish population data from the 2006 South Coastal Watershed (Eel River sub-watershed) survey (continued).

[1]SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
AE	American eel	*Anguilla rostrata*
GS	golden shiner	*Notemigonus crysoleucas*
WS	white sucker	*Catostomus commersonii*
BB	brown bullhead	*Ameiurus nebulosus*
CP	chain pickerel	*Esox niger*
RT	rainbow trout	*Oncorhynchus mykiss*
BT	brown trout	*Salmo trutta*
EBT	brook trout	*Salvelinus fontinalis*
SC	slimy sculpin	*Cottus cognatus*
P	pumpkinseed	*Lepomis gibbosus*
LMB	largemouth bass	*Micropterus salmoides*
BC	black crappie	*Pomoxis nigromaculatus*
YP	yellow perch	*Perca flavescens*

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

Table 2. Habitat assessment summary for fish population stations sampled during the 2006 South Coastal Watershed (Eel River sub-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		Eel River ER01	Eel River ER015	Eel River ER02	Un-named Trib ER06	Un-named Trib ER08
Primary Habitat Parameters						
INSTREAM COVER (for Fish)		8	19	17	17	15
EPIFAUNAL SUBSTRATE		11	17	12	14	12
EMBEDDEDNESS		11	17	14	16	13
CHANNEL ALTERATION		11	16	19	18	20
SEDIMENT DEPOSITION		11	15	12	11	10
VELOCITY-DEPTH COMBINATIONS		8	19	10	19	12
CHANNEL FLOW STATUS		18	18	20	19	17
Secondary Habitat Parameters						
BANK VEGETATIVE PROTECTION	left	10	10	8	9	10
	right	9	6	10	4	10
BANK STABILITY	left	5	10	7	8	10
	right	5	6	10	5	10
RIPARIAN VEGETATIVE ZONE WIDTH	left	5	10	9	9	10
	right	6	9	10	1	10
Total Score		**118**	**172**	**158**	**150**	**159**

Figure 1. Fish biomonitoring station locations from the 2006 South Coastal Watershed (Eel River sub-watershed) survey.