Technical Memorandum

2005 Buzzards Bay Coastal Drainage System Periphyton Study

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Introduction

Biological assessment (i.e., macroinvertebrates and/or periphyton) was performed by personnel from the Massachusetts Department of Environmental Protection (MassDEP) at several sites in the Buzzards Bay coastal drainage system during the summer of 2005. Periphyton samples were collected from two feeder streams to Buzzards Bay, Shingle Island River and East Branch Westport River (see Table 1). Buzzards Bay streams often exhibit limited periphyton growth because of the lack of suitable hard substrates, the bottom instead consisting of unconsolidated sand and silt. Water depth and "tea-stained" coloration produced by decaying organic matter reduce light penetration to the benthos – also contributing to the lack of periphyton growth. Thus, instead of sampling the periphyton, chlorophyll measurements from water column phytoplankton were obtained from other stream and pond sites included in the 2005 monitoring effort. Chlorophyll *a* is a pigment that is found in all plants and algae and provides an estimate of biomass as well as an indication of the biological production of the water body. These data will be reported separately.

The term periphyton is used to describe both the attached microscopic and macroscopic algae. Estimates were made of the percent periphyton cover within the riffle of the sampling reach and specimens were collected for taxonomic identification. Algal type and abundance were also recorded. Periphyton sampling was limited to sites chosen for macroinvertebrate/habitat investigations.

Objectives of the periphyton sampling were to provide additional information for assessment by adding another biological community to the macroinvertebrate and habitat information, and to examine temporal changes in the amount and type of algae present in the assemblage. The periphyton assessment provides information to aid in determining if the designated uses, as described in the Surface Water Quality Standards (MassDEP 2006), are being supported, threatened or lost in particular segments. Periphyton data can be used to evaluate two designated uses: *Aquatic Life* and *Aesthetics*.

Aquatic life evaluations determine if suitable habitat is available for "sustaining a native, naturally diverse, community of aquatic flora and fauna." Natural diversity and the presence of native species may not be sustained when there are dense growths of a monoculture of a particular alga. This alteration of the community structure may indicate that the aquatic life use support is lost or threatened. Loss of parts of the food web, which is vital for aquatic life use support, may result from this alteration. In addition, the die-off and decomposition of large amounts of biomass from macroalgae detrital material and exudates can fill in the interstitial sites in the substrate and destroy this habitat for the benthic invertebrates, further compromising aquatic life.

The algal data are also used to determine if the aesthetic quality of the waterbody has been impacted. Floating rafts of previously attached benthic algal mats can make a waterbody visually unappealing, as can large areas of the bottom substrates covered with long streamers of algae that can discourage waders and hinder fishermen by making the substrata slippery for walking. Fishermen can also snag their fishing lines on the filamentous algae. A determination of whether or not the aesthetic quality of a waterbody is compromised by algal growth can be made by measuring the percent macroalgal cover in a particular habitat (e.g. riffles or pool). Forty percent or greater coverage by filamentous green algae is typically considered a nuisance level of algae (Biggs 1996, Barbour et al. 1999).

Materials and Methods

Periphyton Identifications and Relative Abundance

Periphyton samples were gathered along with the macroinvertebrate samples and habitat information using methods described in Barbour et al (1999). Sampling was performed by the

macroinvertebrate sampling crew and consisted of randomly scraping rocks and cobble substrates, typically within the riffle area, but other habitats were occasionally sampled. Material was removed with a knife or by hand from rock substrata, added to labeled glass vials containing sample water, and transported to the laboratory at MassDEP-Worcester in one-liter plastic jars containing stream water to keep them cool. Once at the laboratory, samples were refrigerated until taxonomic identifications were completed. Samples held longer than one week were preserved using M^3 with a dose rate of 2 ml of preservative per 100 ml of sample (Reinke 1984).

Vials were shaken before subsampling. Filamentous algae were removed first, identified separately, and then the remainder of the sample was examined. An Olympus BH2 compound microscope with Nomarski optics was used for the identifications. (References used for the taxonomic identifications are listed at the end of this memorandum). Slides were typically examined under 200x power. A scheme developed by Bahls (1993) was employed to determining periphyton abundance on a microscope slide at 200x power as follows:

Rare – Fewer than one cell per field of view at 200x, on the average;
Common – At least one, but fewer than five cells per field of view;
Very common – Between 5 and 25 cells per field;
Abundant – More than 25 cells per field, but countable;
Very abundant – Number of cells per field too numerous to count.

A visual determination was also made of whether or not the algal covering was composed of micro or macroalgae, in particular, the green filamentous algae. The microalgae typically appear as a thin film, often green or blue-green, or as a brown floc. Macroalgal (green filamentous algae) that covers greater than 40% of the substrata in the riffle/run is considered to be indicative of organic enrichment (Barbour et al. 1999) and may indicate that the aesthetic quality of the stream is compromised.

Results

Table 1 presents descriptions of the periphyton collection sites along with estimates of the canopy cover as an indication of the exposure of the algae to ambient light. A taxonomic list of the periphyton collected, along with their relative abundance, can be found in Table 2.

Table 1. 2005 Buzzards Bay Drainage System Periphyton Study. Canopy cover (%) and within-reach algal cover (%).

Station No.	Station Description	Date	Canopy cover (%)	Within-reach algal cover (%)
NB14SHI	Shingle Island River ~100 m downstream from Old Fall River Road, Dartmouth	11 August	80	<1
EBW02	East Branch of the Westport River upstream from the inlet to Forge Pond, Westport	10 August	100	50

Observations

NB14SHI, on the Shingle Island River downstream from Old Fall River Road, Dartmouth, was a shaded site (Table 1). Within-reach algal cover was <1 % while aquatic vegetation (macrophytes), dominated by *Sparganium* sp. and *Potamogeton* sp., covered approximately 2% of the reach. The sampling reach, besides being shaded, was lacking in hard substrates suitable as attachment sites for periphyton. The available substrates were primarily aquatic macrophytes and fallen tree branches. The field sheets indicate that the water color was brown and turbidity rendered the water column opaque. These factors (i.e., lack of light caused by color and turbidity and lack of suitable substrates) would all limit benthic algal growth. The single algal sample

collected was from the mud in a pooled area. Pennate diatoms were present in this limited part of the reach.

EBW02, on the East Branch of the Westport River upstream from Forge Pond, was also a shaded site (Table 1). Although the field sheets indicate that the composition of the substrates here (i.e., 60% boulder, 20% cobble and 10% pebble) offered a more stable environment for the attachment and growth of periphyton than did NB14SHI, the completely closed canopy and tea-stained water color limited the light availability to the benthos. A thin brown film (Table 2) composed, in part, of unidentified Cyanophyceae cells and fungal hyphae covered about 50% of the substrates in the riffle. Shade-loving mosses were much in evidence and covered 75% of the reach.

Table 2. 2005 Buzzards Bay Drainage System Periphyton Study. Relative abundance of periphyton taxa

Station	Date	Habitat	Algal Class	Algal Genus or other particles	Relative Abundance
NB14SHI	11 August	Pool, mat	Bacillariophyceae	*Fragilaria* sp.	R
			Bacillariophyceae	*Frustilia* sp.	R
			Bacillariophyceae	*Pinnularia* sp.	R
			Bacillariophyceae	*Surirella* sp.	C
			Bacillariophyceae	Unidentified pennate diatoms	VA
EBW02	10 August	Film, boulder, riffle	Cyanophyceae	Coccoid balls	R
			--	Fungal hyphae	R

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