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TAUNTON RIVER WATERSHED
2006 PERIPHYTON BIOASSESSMENT

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Introduction

Biological assessment was performed by personnel from the Massachusetts Department of Environmental Protection (MassDEP) at several stations in the Taunton River Basin during the summer of 2006. Samples were collected for the identification of periphyton, described here as including the attached microscopic and macroscopic algae. Estimates were made of the percent algal cover within the sampling reach. 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 *Massachusetts Surface Water Quality Standards* (MassDEP 2006), are being supported, threatened or lost in particular segments. Periphyton data can be used to help 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…" (MassDEP 2006). 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 important components of the food web, that are 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 can fill in the interstitial sites in the substrate and destroy this habitat for the benthic invertebrates and compromise the aquatic life use support.

The algal data are also used to determine if aesthetics have been impacted. Floating rafts of previously attached benthic algal mats can render a waterbody visually unappealing, as can large areas of the bottom substrates covered with long streamers of algae. This profuse growth can discourage waders and hinder fishermen by making the substrata slippery for walking. Fishermen can also snag their fishing lines on the filamentous algae. Nuisance amounts of algae, which can compromise aesthetics, can be determined by estimating the percent macroalgal cover in a particular habitat (e.g. riffles or pool) (Biggs 1996; Barbour et al. 1999). Macroalgal growth is generally considered to be at nuisance levels when the percent cover by filamentous green algae is greater than 40 % (Biggs 1996; Barbour et al. 1999).

Attached algae are typically sampled from first-, second- or third-order streams and rivers that are shallow and often fast-moving. At each of the stations an estimate of the percent cover of both the periphyton – the attached microscopic algae – and the attached, filamentous, macroscopic algae that is seen without a microscope is made and samples are collected for algal identification. Periphyton samples are typically scrapes of one type of substrata in the riffle zone. The algal scrapes are used in the qualitative microscopic examination to determine the presence and relative abundance of the phyla that contribute the most to the biomass in the riffle or pool habitats. The estimate of percent cover of the filamentous algae (macroalgae) is used, in conjunction with the microscopic examination, to determine if the designated uses of the river (i.e., Aquatic Life Support and Aesthetics) are lost or threatened because of excessive algal growth.

Materials and Methods

Periphyton samples were gathered along with the macroinvertebrate samples and habitat information using methods described in Barbour et al (1999) and in the periphyton procedure described in the unpublished protocol (Beskenis 2006). 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 and then added to labeled glass vials containing sample water. Table 1 contains descriptions of the station locations where periphyton was collected. The samples were transported to the lab at MassDEP-Worcester in one-liter plastic jars containing stream water to keep them cool. Once at the lab, they were refrigerated until identifications were completed. Samples held longer than a 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 to get uniform samples before subsampling. Filamentous algae were removed first, identified separately and then the remainder of the sample was examined. Samples from sites where the dominant substrate is moss and that include a fragment of moss in the vial are shaken to free diatoms and other benthic and planktonic algae. An Olympus BH2 compound microscope with Nomarski optics was used for the identifications. Appendix A contains the references used for identifications. Slides were typically examined under 200 power. A modified method for periphyton analysis developed by Bahls (1993) was used. The scheme developed by Bahls for determining abundance on a slide is 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 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) that may compromise the aesthetic quality of the stream.

Results

Habitat and watershed information from the macroinvertebrate field sheets were used in describing the locations and provided some insight into what could be influencing algal growth in the area. This information is included in Table 1. Table 2 presents the information from the algae sampling including taxonomic identifications and relative densities. Remarks follow for each station based on the information included in tables 1 and 2, particularly with regard to algal growth and issues pertaining to the presence/absence and abundance of the taxa present.

Station TR01 on the Canoe River is located ~ 400 m downstream/south from Willow St. in Foxboro. Field sheets indicated that 60% of the reach was covered by aquatic vegetation, 95% of which was moss. The 95% closed canopy in this reach is more conducive to the growth of moss than filamentous green algae, which favors sites with open canopies, and likely contributed to the algal cover of <5 % in the sampling reach.

Station TR03 on the Salisbury Pain River, E. Bridgewater had a 70% closed canopy and the vegetation was dominated by moss. Algae covered <5 % of the reach.

Station TR06, located on the Rumford River, Foxboro, exhibited a fine organic coating on all surfaces composed, in part, of diatoms. The filamentous cyanobacteria *Lyngbya* sp. was also present in the sample, but was not abundant in the reach.

Substrates at Station MDWBK01 Meadow Brook, E. Bridgewater consisted of 40% sand and 20% cobble with the remainder unconsolidated fines and organic matter, thus offering limited stable substrates for periphyton. The vegetation present was primarily moss which covered ~65% of the reach (notes from field sheets). Periphyton covered only ~1% of the reach.

Table 1. List of biomonitoring stations sampled during the 2006 Taunton River Wtershed survey, including station and unique identification numbers, sampling site descriptions, sampling dates, substrate sampled, % canopy cover and % algal cover within reach.

Station ID	Unique ID	Sampling Site Description	Sampling Date	Substrate	% canopy cover	% algal cover within reach
TR01	B0184	Canoe River ~ 400 m downstream/south from Willow St., Foxboro	Aug 1	Moss	95	<5
TR03	B0186	Salisbury Plain River ~ 300 m downstream/east from Belmont St (adjacent to Matfield Street), East Bridgewater-downstream Brockton WWTP	Aug 2	Moss	70	<5
TR06	B0189	Rumford River ~575 m downstream/south from Cocasset Street, Foxboro	Aug 1	Cobble	95	35
TRTBK00	B0329	Trout Brook ~100 m upstream/northeast from confluence with Salisbury Brook, Brockton	Aug 1	Cobble	90	60
SALBK00	B0609	Salisbury Brook ~ 50 m upstream from Otis Street, Brockton	Aug 1	Cobble	30	70
MDWBK01	B0607	Meadow Brook ~ 350 m upstream from Water Street, E. Bridgewater	Aug 2	Cobble	85	1
TH09	B0350	Threemile River downstream/south from Harvey St., Taunton	Aug 3	Cobble	40	0

Station TH09, located on the Threemile River downstream/south from Harvey St., Taunton, had only 40% canopy cover, and, although light was apparently available for algal growth, the observation on the field sheet was that there was none visible. Approximately 40% of the benthos was covered by moss.

Field sheets indicate that a 'sewage odor' was detected at Station TRTBK00 on Trout Brook, Brockton and sewage fungus was present - an indication of organic enrichment and degraded water quality. Periphyton covered ~60% of the surfaces, and was primarily composed of a brown floc of assorted diatoms which do better at lower light levels than the green algae and broken up sewage fungus. Because of the estimated 90 % canopy cover at this location, growth of the filamentous algae was likely light limited, but available light was sufficient for the diatoms.

Algal cover at Station SALBK00 at Salisbury Brook, Brockton (70%) was the highest of any station sampled during the 2006 periphyton bioassessment and the community was composed primarily of the filamentous green alga *Spirogyra* sp. Further study is recommended here to investigate the cause and extent of the abundant growth which may be affecting aesthetics and aquatic communities.

Table 2: Taunton River Watershed 2006 Periphyton Bioassessment: Station, Algal Identifications and Relative Density

Station ID	Unique ID	Sampling Date	Algal identifications*	Relative density
TR01	B0184	Aug 1	Various diatoms	All genera rare
TR03	B0186	Aug 2	*Mougeotia* sp.,Gr	Abundant
TR06	B0189	Aug 1	Various pennate diatoms-Di	Common
			Lyngbya sp., Cy	Common
TRTBK00	B0329	Aug 1	*Fragilaria* sp., Di	Rare
			Synedra sp., Di	Rare
			Coleochaete sp., Gr	Rare
SALBK00	B0609	Aug 1	*Spirogyra* sp., Gr	Abundant
MDWBK01	B0607	Aug 2	*Navicula* sp. , Di	Rare
			Synedra sp., Di	Rare
			Closterium sp. Gr	Rare
			Ulothrix sp., Gr	Abundant
TH09	B0350	Aug 3	No algae observed in field, no sample collected	

*Cy-cyanobacteria, Gr-green algae, Di-diatoms

References Cited

Bahls, L. L. 1993. *Periphyton Bioassessment Methods for Montana Streams*. Water Quality Bureau, Dept. of Health and Environmental Sciences. Helena, Montana.

Barbour, M., Gerritsen, J, Synder, B. D. and J. B. Stribling. 1999. *Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates and Fish*, 2nd edition. EPA 841-B-99-002. U.S. Environmental Protection Agency, Office of Water, Washington, D.C.

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Biggs, B. J. F. 1996. Patterns of benthic algae in streams. IN: *Algal Ecology: Freshwater Benthic Ecosystems*. R. J. Stevenson, M. Bothwell, and R. L. Lowe. Pp 31-55. Academic Press, San Diego, California.

MassDEP. 2006. *Massachusetts Surface Water Quality Standards (Revision of 314 CMR 4.00, effective December 29, 2006*. Massachusetts Department of Environmental Protection, Boston, MA.

Reinke, D. 1984. Algal Identification Workshop. Kansas Biological Survey, Kansas Dept of Health and Environment. Lawrence, Kansas.

Appendix A

Commonly Used Taxonomic Keys

Cronberg, G. and H. Annadotter. 2006. *Manual on Aquatic Cyanobacteria: A Photo Guide and a Synopsis of Their Toxicology.* Intergovernmental Oceanographic Commission of UNESCO, International Society for the Study of Harmful Algae. 106 p.

Prescott, G. W. 1982. *Algae of the Western Great Lakes Area*. Otto Koeltz Science Publishers. Koenigstein/West Germany. 977 p.

Smith, G. M. 1950. *The Fresh-water Algae of the United States*. 2nd edition McGraw Hill Publishers. New York. 719 p.

Prescott, G. W. 1982. *How to Know the Freshwater Algae*. Wm C. Brown. New York. 293 p.

VanLandingham, S. L. 1982. *Guide to the Identification, Environmental Requirements and Pollution Tolerance of Freshwater Blue-green Algae (Cyanophyta).* Environmental Monitoring and Support Laboratory. U.S. Environmental Protection Agency. Cincinnati.

Wehr, J. D. and R. G. Sheath. 2003. *Freshwater Algae of North America: Ecology and Classification*. J. H. Thorp, editor. Academic Press, Inc. 917 p.

Whitford, L. A. and G. J. Schumacher. 1984. *A Manual of Fresh-Water Algae*. Sparks Press. Raleigh. 337 p.