

2013 Monitoring Summary



Estill Fork at Jackson County Road 140 (34.96529/-86.15370)

BACKGROUND

The Alabama Department of Environmental Management (ADEM) selected the Estill Fork watershed for biological and water quality monitoring as part of the 2013 Assessment of the Tennessee (TN) River Basin. The Estill Fork watershed was also requested for candidate reference reach monitoring. The objectives of the Tennessee River Basin Assessments were to assess the biological integrity of each monitoring location and to estimate overall water quality within the TN basin. A habitat and macroinvertebrate assessment were conducted on Estill Fork at ESTL-1 on June 26, 2013.

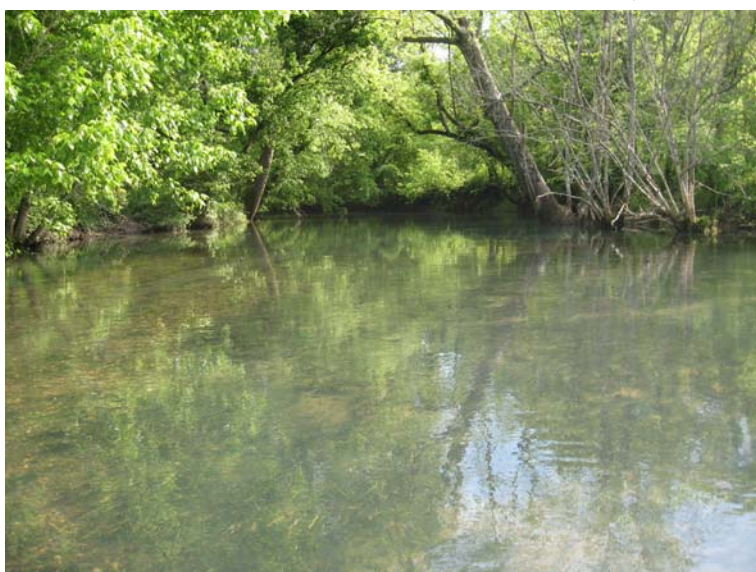


Figure 1. Estill Fork at ESTL-1, May 9, 2013.

WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Estill Fork is a *Fish and Wildlife (F&W)* stream located near of the city of Estill Fork, Alabama, and flows into Paint Rock River. At ESTL-1, the stream drains approximately 26 square miles and has little disturbance within the watershed. Based on the 2006 National Land Cover Dataset, landuse within the watershed is primarily forest (94%) areas. No NPDES permits have been issued in this watershed.

REACH CHARACTERISTICS

General observations (Table 2) and a habitat assessment (Table 3) were completed during the macroinvertebrate assessment. In comparison with reference reaches in the same ecoregion, they give an indication of the physical condition of the site and the quality and availability of habitat. Estill Fork at ESTL-1 is a riffle-run stream characterized primarily by gravel and cobble (Figure 1). Overall habitat quality was categorized as *sub-optimal* due to poor channel morphology.

BIOASSESSMENT RESULTS

Benthic macroinvertebrate communities were sampled using ADEM's Intensive Multi-habitat Bioassessment methodology (WMB-I). The WMB-I uses measures of taxonomic richness, community composition, and community tolerance to assess the overall health of the macroinvertebrate community. Each metric is scored on a 100 point scale in comparison to least-impaired reference reaches in the same ecoregion. The final score is the average of all individual metric scores. Metric results indicated the macroinvertebrate community to be in *fair* condition (Table 4).

Table 1. Summary of watershed characteristics.

Watershed Characteristics		
Basin	Tennessee River	
Drainage Area (mi²)	26	
Ecoregion^a	68c	
% Landuse		
Open water		<1
Wetland	Woody	<1
Forest	Deciduous	92
	Evergreen	1
	Mixed	1
Shrub/scrub		2
Grassland/herbaceous		<1
Pasture/hay		4
Cultivated crops		<1
Development	Open space	1
	Low intensity	<1
Population/km^{2b}	<1	

a. Plateau Escarpment

b. 2000 US Census

Table 2. Physical characteristics of Estill Fork at ESTL-1, June 26, 2013.

Physical Characteristics		
Width (ft)	70	
Canopy Cover	Mostly Shaded	
Depth (ft)	Riffle	0.3
	Run	2.5
	Pool	4.0
% of Reach	Riffle	5
	Run	30
	Pool	65
% Substrate	Boulder	2
	Cobble	20
	Mud/Muck	2
	Gravel	31
	Hard Pan Clay	10
	Sand	15
	Silt	3
	Organic Matter	17

Table 3. Results of the habitat assessment conducted on Estill Fork at ESTL-1, June 26, 2013.

Habitat Assessment	%Maximum Score	Rating
Instream Habitat Quality	68	Sub-optimal (59-70)
Sediment Deposition	80	Optimal (>70)
Sinuosity	20	Poor (<45)
Bank and Vegetative Stability	73	Sub-optimal (60-74)
Riparian Buffer	58	Marginal (50-69)
Habitat Assessment Score	161	
% Maximum Score	67	Sub-optimal (59-70)

Table 4. Results of the macroinvertebrate bioassessment conducted in Estill Fork at ESTL-1, June 26, 2013.

Macroinvertebrate Assessment		
	Results	Scores
Taxa richness measures		(0-100)
# EPT taxa	19	65
Taxonomic composition measures		
% Non-insect taxa	8	72
% Dominant taxon	21	73
% EPC taxa	32	61
Functional feeding group measures		
% Predators	4	8
Tolerance measures		
% Taxa as Tolerant	26	68
WMB-I Assessment Score	---	58
WMB-I Assessment Rating		Fair (39-58)

WATER CHEMISTRY

Results of water chemistry samples are presented in Table 5. In situ measurements and water samples were collected monthly, or semi-monthly (metals) during May through September of 2013 to help identify any stressors to the biological communities. Chromium and arsenic concentrations were higher than values expected for F&W use criteria. Median concentrations of specific conductance, hardness, total dissolved solids, alkalinity, and cadmium were higher than values expected based on data collected at reference reaches within the Southwestern Appalachians ecoregion (68). Plateau Escarpment ecoregion (68c) is a level IV ecoregion within the level III Southwestern Appalachians ecoregion (68).

SUMMARY

Results of ADEM's 2013 macroinvertebrate bioassessment indicated the macroinvertebrate community to be in *fair* condition. Estill Fork at ESTL-1 had poor channel morphology but good instream habitat quality, resulting in a *sub-optimal* habitat quality score. Intensive water chemistry results indicated chromium and arsenic concentrations were higher than expected for streams within the reach. Although samples of total dissolved arsenic did exceed human health criteria in Estill Fork, ADEM criteria for arsenic are expressed as dissolved trivalent arsenic (arsenite - As III). Presently studies are being conducted in order to provide a better understanding of the prevalence and areal distribution of dissolved trivalent arsenic to total arsenic in the State of Alabama. Upon conclusion of the studies Estill Fork will be reassessed for arsenic violations.

Table 5. Summary of water quality data collected May-September, 2013. Minimum (Min) and maximum (Max) values calculated using minimum detection limits (MDL). Median (Med), average (Avg), and standard deviations (SD) values were calculated by multiplying the MDL by 0.5 when results were less than this value.

Parameter	N	Min	Max	Med	Avg	SD	Q
Physical							
Temperature (°C)	5	11.6	24.6	21.7	18.8	5.9	
Turbidity (NTU)	5	2.0	11.9	3.3	4.7	4.1	
Total Dissolved Solids (mg/L)	4	164.0	178.0	172.0 ^M	171.5	6.6	
Total Suspended Solids (mg/L)	4	< 1.0	2.0	0.8	1.0	0.7	
Specific Conductance (µmhos)	5	271.1	363.9	322.5 ^G	314.2	40.8	
Hardness (mg/L)	4	139.0	192.0	156.5 ^G	161.0	24.8	
^J Alkalinity (mg/L)	4	143.0	179.2	153.0 ^M	157.0	16.8	
Stream Flow (cfs)	2	61.5	141.1	101.3	101.3	56.3	
Chemical							
Dissolved Oxygen (mg/L)	5	5.5	10.6	8.6	8.1	2.2	
pH (su)	5	7.3	7.9	7.6	7.6	0.3	
Ammonia Nitrogen (mg/L)	4	< 0.008	0.020	0.009	0.010	0.007	
Nitrate+Nitrite Nitrogen (mg/L)	4	0.046	0.131	0.111	0.100	0.037	
^J Total Kjeldahl Nitrogen (mg/L)	4	< 0.041	0.190	0.069	0.087	0.078	
^J Total Nitrogen (mg/L)	4	< 0.078	0.301	0.184	0.187	0.095	
^J Dissolved Reactive Phosphorus (mg/L)	4	0.004	0.005	0.004	0.004	0.000	
^J Total Phosphorus (mg/L)	4	0.006	0.013	0.009	0.009	0.003	
CBOD-5 (mg/L)	4	< 2.0	< 2.0	1.0	1.0	0.0	
Chlorides (mg/L)	4	1.0	1.6	1.2	1.2	0.2	
Total Metals							
^J Aluminum (mg/L)	4	< 0.076	0.958	0.136	0.317	0.430	
^J Iron (mg/L)	4	0.093	0.533	0.158	0.236	0.202	
^J Manganese (mg/L)	4	< 0.009	0.051	0.014	0.021	0.021	
Dissolved Metals							
Aluminum (mg/L)	4	< 0.076	< 0.076	0.038	0.038	0.000	
Antimony (µg/L)	4	< 0.1	< 2.6	0.7	0.7	0.7	
^J Arsenic (µg/L)	4	< 0.2	< 1.4 ^H	0.4	0.4	0.2	1
^J Cadmium (µg/L)	4	< 0.046	< 0.170	0.067 ^M	0.060	0.030	
^J Chromium (µg/L)	4	1.040	< 32.000 ^S	8.750	8.635	8.506	2
^J Copper (mg/L)	4	< 0.0003	< 0.031	0.008	0.008	0.009	
^J Iron (mg/L)	4	< 0.018	0.086	0.046	0.047	0.032	
Lead (µg/L)	4	< 0.1	< 1.1	0.3	0.3	0.3	
^J Manganese (mg/L)	4	< 0.009	0.037	0.009	0.015	0.015	
Mercury (µg/L)	1			< 0.057			
^J Nickel (mg/L)	3	0.0002	< 0.016	0.0002	0.003	0.004	
Selenium (µg/L)	4	< 0.2	< 1.4	0.4	0.4	0.3	
Silver (µg/L)	4	< 0.215	< 2.120	0.584	0.584	0.550	
Thallium (µg/L)	4	< 0.1	< 1.1	0.3	0.3	0.3	
^J Zinc (mg/L)	4	< 0.002	< 0.017	0.005	0.005	0.004	
Biological							
Chlorophyll a (µg/L)	4	< 0.10	2.67	0.20	0.78	1.27	
E. coli (col/100mL)	4	66	167	80	99	47	

J=estimate; N=# samples; G=value greater than median concentration of all verified reference data collected in ecoregion 68; H=F&W human health criterion exceeded; M=value >90% of all verified ecoregional reference reach data collected in the ecoregion 68; S=F&W hardness-adjusted aquatic life use criteria exceeded; Q=uncertain exceedance.

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