

2013 Monitoring Summary



Shoal Creek at Marshall County Road 240 (34.38910/-86.42502)

BACKGROUND

The Alabama Department of Environmental Management (ADEM) selected the Shoal Creek watershed for biological and water quality monitoring as part of the 2013 Assessment of the Tennessee (TN) River Basin. The objectives of the TN Basin Assessments were to assess the biological integrity of each monitoring site and to estimate overall water quality within the TN basin group.



Figure 1. Shoal Creek at SHLM-1, October 17, 2013.

WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Shoal Creek is a small *Fish & Wildlife (F&W)* stream located approximately eight miles west of Gunterville in the Tennessee River basin. Based on the 2006 National Land Cover Dataset, landuse within the watershed is primarily pasture/hay with some forest (27%). As of May 13, 2013, ADEM has issued seven NPDES discharge permits within 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. Shoal Creek at SHLM-1 is characterized by a bedrock, boulder, and cobble bottom (Figure 1). Overall habitat quality was categorized as *marginal* due to poor sinuosity and riparian buffers.

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. The final score is the average of all individual metric scores. Metric results indicated the macroinvertebrate community to be in *poor* (Table 4).

Table 1. Summary of watershed characteristics.

Watershed Characteristics		Tennessee River
Basin		Tennessee River
Drainage Area (mi²)		27
Ecoregion^a		68d
% Landuse		
Open water		<1
Wetland	Woody	1
	Emergent herbaceous	<1
Forest	Deciduous	17
	Evergreen	3
	Mixed	7
Shrub/scrub		6
Grassland/herbaceous		2
Pasture/hay		45
Cultivated crops		8
Development	Open space	6
	Low intensity	4
	Moderate intensity	1
	High intensity	<1
Barren		<1
Population/km^{2b}		76
# NPDES Permits^c	TOTAL	7
	401 Water Quality Certification	1
	Construction Stormwater	4
	Industrial General	1
	Industrial Individual	1

a.Southern Table Plateaus

b.2000 US Census

c.#NPDES permits downloaded from ADEM's NPDES Management System database, May 13, 2013.

Table 2. Physical characteristics of Shoal Creek at SHLM-1, May 22, 2013.

Physical Characteristics		Estimate 50/50
Canopy cover		Estimate 50/50
Width (ft)		50
Depth (ft)	Run	2
	Pool	1.8
% of Reach	Run	80
	Pool	20
% Substrate	Bedrock	30
	Boulder	20
	Cobble	20
	Gravel	13
	Sand	10
	Silt	5
	Organic Matter	2

Table 3. Results of the habitat assessment conducted on Shoal Creek at SHLM-1, May 22, 2013.

Habitat Assessment	% Maximum Score	Rating
Instream Habitat Quality	63	Sub-optimal (59-70)
Sediment Deposition	68	Sub-optimal (59-70)
Sinuosity	40	Poor (<45)
Bank and Vegetative Stability	49	Marginal (35-59)
Riparian Buffer	44	Poor (<50)
Habitat Assessment Score	126	
% Maximum Score	57	Marginal (41-58)

Table 4. Results of the macroinvertebrate bioassessment conducted in Shoal Creek at SHLM-1, May 22, 2013.

Macroinvertebrate Assessment		
	Results	Scores
Taxa richness measures		(0-100)
# EPT taxa	9	22
Taxonomic composition measures		
% Non-insect taxa	17	30
% Dominant taxon	38	23
% EPC taxa	25	46
Functional feeding group measures		
% Predators	7	22
Tolerance measures		
% Taxa as Tolerant	50	0
WMB-I Assessment Score	---	24
WMB-I Assessment Rating		Poor (20-38)

WATER CHEMISTRY

Results of water chemistry analyses are presented in Table 5. In situ measurements and water samples were collected in April, June, August, and October of 2013, and organics were collected on July of 2013 to help identify any stressors to the biological communities.

All organics collected, with the exception of atrazine, were below the minimum detection limits. Median values of specific conductance, hardness, alkalinity, total iron and dissolved iron were above concentrations expected in this ecoregion. The measured concentrations of dissolved arsenic and chromium exceeded criteria applicable to Shoal Creek's *F&W* use classification; however, the values are estimates and the exceedances are uncertain. Although it is uncertain if samples of total dissolved arsenic exceeded human health criteria in Shoal Creek, 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 Shoal Creek will be reassessed for arsenic violations.

SUMMARY

The habitat assessment indicated SHLM-1 to be in *marginal* condition due to poor sinuosity and a poor riparian buffer. Macroinvertebrate sampling indicated the macroinvertebrate community to be in *poor* condition. Median values of specific conductance, hardness, alkalinity, total iron and dissolved iron were above concentrations expected in this ecoregion. Due to an estimated value of dissolved arsenic and chromium, it is uncertain if the criteria applicable to Shoal Creek's *F&W* use classification is exceeded. Based on this data, it appears the habitat condition and the water chemistry are negatively impacting the stream. Shoal Creek should be reassessed for arsenic violations once the studies on prevalence and areal distribution of dissolved trivalent arsenic to total arsenic in the state are concluded.

Table 5. Summary of water quality data collected April, June, July, August, and October, 2013. Minimum (Min) and maximum (Max) values calculated using minimum detection limits (MDL) when results were less than this value. Median, 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	17.6	22.3	20.2	20.0	2.1	
Turbidity (NTU)	5	2.0	16.5	6.0	7.2	5.5	
Total Dissolved Solids (mg/L)	4	4.0	94.0	77.5	63.2	40.4	
Total Suspended Solids (mg/L)	4	< 1.0	3.0	1.2	1.5	1.2	
Specific Conductance (µmhos)	5	75.2	112.5	92.4 ^G	92.5	14.8	
Hardness (mg/L)	4	24.9	43.5	34.4 ^G	34.3	7.7	
Alkalinity (mg/L)	4	22.5	45.8	34.3 ^M	34.2	9.8	
Stream Flow (cfs)	4	1.5	25.7	20.7	17.1	10.8	
Chemical							
Dissolved Oxygen (mg/L)	5	5.2	8.2	6.4	6.6	1.1	
pH (su)	5	6.1	7.0	6.8	6.7	0.4	
Ammonia Nitrogen (mg/L)	4	< 0.004	< 0.018	0.006	0.006	0.004	
Nitrate+Nitrite Nitrogen (mg/L)	4	0.084	0.817	0.514	0.482	0.306	
Total Kjeldahl Nitrogen (mg/L)	4	0.335	0.900	0.506	0.562	0.249	
Total Nitrogen (mg/L)	4	0.674	1.354	1.074	1.044	0.287	
^J Dissolved Reactive Phosphorus (mg/L)	4	0.004	0.013	0.009	0.009	0.004	
Total Phosphorus (mg/L)	4	0.025	0.062	0.041	0.042	0.018	
CBOD-5 (mg/L)	4	< 2.0	< 2.0	1.0	1.0	0.0	
Chlorides (mg/L)	4	3.5	5.2	4.0	4.2	0.8	
Atrazine (µg/L)	1				0.21		
Total Metals							
^J Aluminum (mg/L)	4	< 0.076	0.401	0.088	0.154	0.171	
Iron (mg/L)	4	0.551	1.080	0.845 ^M	0.830	0.274	
Manganese (mg/L)	4	0.065	0.158	0.131	0.121	0.044	
Dissolved Metals							
^J Aluminum (mg/L)	4	< 0.076	0.113	0.038	0.057	0.038	
Antimony (µg/L)	4	< 0.1	< 2.6	0.1	0.4	0.6	
^J Arsenic (µg/L)	4	0.5	1.5 ^A	0.7	0.8	0.5	4
Cadmium (µg/L)	4	< 0.046	< 0.170	0.085	0.070	0.031	
^J Chromium (µg/L)	4	0.466	< 32.000 ^S	0.794	4.514	7.660	3
^J Copper (mg/L)	4	< 0.000	< 0.031	0.001	0.004	0.007	
Iron (mg/L)	4	0.340	0.696	0.556 ^M	0.537	0.149	
^J Lead (µg/L)	4	< 0.1	< 1.1	0.1	0.2	0.2	
Manganese (mg/L)	4	0.058	0.118	0.101	0.094	0.029	
Mercury (µg/L)	1			<	0.057		
^J Nickel (mg/L)	4	0.001	< 0.016	0.001	0.003	0.004	
Selenium (µg/L)	4	< 0.2	< 1.4	0.1	0.3	0.3	
Silver (µg/L)	4	< 0.215	< 2.120	1.060	0.822	0.476	
Thallium (µg/L)	4	< 0.1	< 1.1	0.1	0.2	0.2	
^J Zinc (mg/L)	4	0.002	< 0.017	0.003	0.004	0.003	
Biological							
Chlorophyll a (ug/L)	4	0.89	4.81	1.20	2.03	1.86	
E. coli (col/100mL)	4	78	816	163	305	344	

J=estimate; N=# samples; M=value > 90% of all data collected within ecoregion 68d; Q=uncertain exceedance; G=value higher than median concentration of all verified ecoregional reference reach data collected in ecoregion 68d; A=*F&W* aquatic life use criterion exceeded; S=*F&W* hardness-adjusted aquatic life use criterion exceeded.

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