Alabama Department of Environmental Management

NPS Intensive Monitoring Program

Rivers and Streams Monitoring Program

2009 Monitoring Summary

Fair

Big Shoal Creek at Lawrence County Road 61 (34.48650/-87.14684)

BACKGROUND

Big Shoal Creek was placed on Alabama's 2002 Clean Water Act (CWA) §303(d) list of impaired waters for only partially meeting its *Fish & Wildlife (F&W)* water use classification. It was listed for organic enrichment and dissolved oxygen (OE/DO) impairment from pasture grazing.

The Alabama Department of Environmental Management (ADEM) monitored Big Shoal Creek in 2009 to document conditions prior to implementation of best management practices (BMPs). A watershed management plan is in development, and will include agricultural BMPs such as livestock fencing, alternative water sources, heavy use area protection, filter strips, and conservation tillage.

Figure 1. Big Shoal Creek at BSCL-1, May 25, 2009.

WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Big Shoal Creek is located north of the city of Five Points in Lawrence County. located in the Little Mountain sub-ecoregion of the Interior Plateau. Based on the 2006 National Land Cover Dataset, landuse within the watershed is primarily pasture/hay and forest (26%). The ADEM has issued seven NPDES discharge permits 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. Big Shoal Creek at BSCL-1 is a riffle-run stream with a diversity of substrate types. The riparian buffer was limited within the reach (Figure 1). Overall habitat quality was categorized as *sub-optimal* for supporting diverse aquatic macroinvertebrate communities.

Table 1. Summary of watershed characteristics.

Watershed Characteristics		
Basin		Tennessee R
Drainage Area (mi^2)		17
Ecoregion[a]		71j
% Landuse		
Open water		<1
Wetland	Woody	4
	Emergent herbaceous	<1
Forest	Deciduous	18
	Evergreen	4
	Mixed	4
Shrub/scrub		7
Grassland/herbaceous		1
Pasture/hay		49
Cultivated crops		3
Development	Open space	7
	Low intensity	2
	Moderate intensity	,1
	High intensity	<1
Barren		<1
Population/km^2[b]		62
# NPDES Permits[c]	**TOTAL**	7
Construction Stormwater		4
Municipal Individual		2
Underground Injection Control		1

a. Little Mountain

b. 2000 US Census

c. #NPDES permits downloaded from ADEM's NPDES Management System database, September 1, 2012.

Table 2. Physical characteristics of Big Shoal Creek at BSCL-1, June 30, 2009.

Physical Characteristics		
Width (ft)		25
Canopy Cover		Estimate 50/50
Depth (ft)		
	Riffle	0.8
	Run	3.5
	Pool	4
% of Reach		
	Riffle	25
	Run	45
	Pool	30
% Substrate		
	Bedrock	15
	Boulder	15
	Clay	15
	Cobble	10
	Gravel	8
	Sand	30
	Silt	1
	Organic Matter	6

Table 3. Results of the habitat assessment conducted on Big Shoal Creek at BSCL-1, June 30, 2009.

Habitat Assessment	% Maximum Score	Rating
Instream Habitat Quality	68	Sub-optimal (59-70)
Sediment Deposition	72	Optimal >70
Sinuosity	80	Sub-optimal (65-84)
Bank and Vegetative Stability	61	Sub-optimal (60-74)
Riparian Buffer	40	Poor <50
Habitat Assessment Score	**155**	
% Maximum Score	**65**	**Sub-optimal (59-70)**

Table 4. Results of the macroinvertebrate bioassessment conducted on Big Shoal Creek at BSCL-1, June 30, 2009.

Macroinvertebrate Assessment		
	Results	**Scores**
Taxa richness and diversity measures		**(0-100)**
# EPT taxa	15	48
Shannon Diversity	3.03	15
Taxonomic composition measures		
% EPT minus Baetidae and Hydropsychidae	39	86
% Non-insect taxa	17	29
Functional feeding group		
% Predator Individuals	2	0
Community tolerance		
% Tolerant taxa	40	26
WMB-I Assessment Score	**---**	**31**
WMB-I Assessment Rating		**Fair (29-43)**

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 each 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).

WATER CHEMISTRY

Results of water chemistry analyses are presented in Table 5. When possible, in situ measurements and water samples were collected monthly, semi-monthly (metals), or quarterly (pesticides, herbicides, and semi-volatile organics) from March through October of 2009 to identify any stressors to the biological community.

The maximum stream flow (90.0 cfs) was measured in April. Stream flow was higher in May, and could not be measured. Stream flows were <2.0 cfs in June, July, and September. Dissolved oxygen concentrations did not meet the *F&W* use classification criterion during these three sampling events. Median concentrations of specific conductivity, hardness, chlorides, nutrients (total Kjeldahl nitrogen, dissolved reactive phosphorus and total phosphorus), and metals (total and dissolved aluminum, iron, and manganese) were higher than expected based on comparison with least-impaired reference reach data collected in Ecoregion 71. Dissolved arsenic concentrations exceeded the human health criterion applicable to its *F&W* use classification during one out of four sampling events.

FOR MORE INFORMATION, CONTACT:
Brien Diggs, ADEM Environmental Indicators Section
1350 Coliseum Boulevard Montgomery, AL 36110
(334) 260-2750 lod@adem.state.al.us

Table 5. Summary of water quality data collected March-October, 2009. Minimum (Min) and maximum (Max) values calculated using minimum detection limits (MDL) when results were less than this value for non-metals parameters. 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	E
Physical							
Temperature (°C)	9	12.5	24.0	20.7	19.8	4.3	
Turbidity (NTU)	9	4.2	33.0	12.7	16.5	10.8	
[J]Total Dissolved Solids (mg/L)	8	92.0	164.0	109.5	113.4	22.1	
[J]Total Suspended Solids (mg/L)	8	1.0	121.0	7.0	22.4	40.4	
Specific Conductance (µmhos)	9	129.4	255.6	169.0[G]	174.5	42.1	
Hardness (mg/L)	4	60.0	119.0	79.0[G]	84.3	25.1	
Alkalinity (mg/L)	8	53.4	123.0	66.6	74.0	22.0	
Stream Flow (cfs)	8	1.1	90.0	13.6	21.9	29.7	
Chemical							
Dissolved Oxygen (mg/L)	9	3.8[C]	10.1	7.0	6.8	2.2	3
pH (su)	9	7.0	8.0	7.2	7.3	0.3	
[B]Ammonia Nitrogen (mg/L)	7	<0.006	0.060	0.023	0.022	0.021	
[J]Nitrate+Nitrite Nitrogen (mg/L)	8	<0.003	0.385	0.174	0.158	0.120	
[B]Total Kjeldahl Nitrogen (mg/L)	7	0.226	1.240	0.624[M]	0.595	0.351	
[JB]Total Nitrogen (mg/L)	7	0.002	1.434	0.814	0.775	0.373	
[J]Dissolved Reactive Phosphorus (mg/L)	8	0.017	0.075	0.033[M]	0.037	0.018	
[B]Total Phosphorus (mg/L)	7	0.053	0.130	0.066[M]	0.078	0.031	
CBOD-5 (mg/L)	8	<1	<2.0	1.0	0.9	0.2	
Chlorides (mg/L)	8	2.4	4.5	3.5[M]	3.5	0.6	
Atrazine (µg/L)	2	<0.06	<0.06	0.03	0.03	0.00	
Total Metals							
[J]Aluminum (mg/L)	4	0.172	0.981	0.344[M]	0.460	0.359	
Iron (mg/L)	4	0.396	1.150	0.582[M]	0.678	0.339	
Manganese (mg/L)	4	0.051	0.302	0.074[M]	0.125	0.119	
Dissolved Metals							
[J]Aluminum (mg/L)	4	<0.033	0.115	0.072[M]	0.069	0.046	
Antimony (µg/L)	4	<0.7	6.0	0.4	1.0	1.3	
[J]Arsenic (µg/L)	4	<0.4	0.6[H]	0.2	0.3	0.2	1
Cadmium (mg/L)	4	<0.002	<0.003	0.002	0.001	0.000	
Chromium (mg/L)	4	<0.007	<0.013	0.006	0.006	0.002	
Copper (mg/L)	4	<0.013	<0.200	0.006	0.030	0.047	
[J]Iron (mg/L)	4	<0.026	0.304	0.224[M]	0.192	0.128	
Lead (µg/L)	4	<1	<1.5	0.5	0.6	0.1	
[J]Manganese (mg/L)	4	0.030	0.058	0.045[M]	0.044	0.012	
[B]Mercury (µg/L)	3	<0.1	<0.1	0.0	0.0	0.0	
[J]Nickel (mg/L)	4	<0.004	<0.019	0.004	0.005	0.003	
Selenium (µg/L)	4	<0.4	<0.4	0.2	0.2	0.0	
Silver (mg/L)	4	<0.001	<0.002	0.001	0.001	0.000	
Thallium (µg/L)	4	<0.4	<0.4	0.2	0.2	0.0	
[J]Zinc (mg/L)	4	<0.003	0.060	0.008	0.012	0.013	
Biological							
Chlorophyll a (ug/L)	8	<0.10	4.27	1.47	1.67	1.41	
[J]Fecal Coliform (col/100 mL)	8	56	1500	330	475	482	

B= samples excluded due to laboratory QC concerns; C=*F&W* criterion exceeded; E=# samples that exceed criterion; G=value > median of all ecoregional reference reach data collected in ecoregion 71; H= *F&W* human health criterion exceeded; J=estimate; N=# samples; M=value > 90th percentile of all data collected within eco-region 71.

SUMMARY

Results of the 2009 bioassessment indicated the macroinvertebrate community in Big Shoal Creek at BSCL-1 to be in *fair* condition. However, conductivity, nutrients, and metals were higher than expected based on comparison with least impaired reference reaches in ecoregion 71. Biological and water quality conditions may have been affected by the extreme flows experienced in 2009. Monitoring should continue to ensure that water quality and biological conditions remain stable. Additional low-level arsenic sampling may also be necessary to determine if the criterion exceedance is due to natural conditions or anthropogenic sources.