

2009 Monitoring Summary



Kirby Creek at Jackson County Road 38 (34.53260/-85.95097)

BACKGROUND

The Alabama Department of Environmental Management (ADEM) selected the Kirby Creek watershed for biological and water quality monitoring as part of the 2009 Assessment of the Tennessee (TN) River Basin. The objectives of the Tennessee River Basin Assessments were to assess the biological integrity of each monitoring site and to estimate overall water quality within the Tennessee River basin. Habitat and macroinvertebrate assessments were conducted at Kirby Creek at KBYJ-1 on June 9, 2009.



Figure 1. Kirby Creek at KBYJ-1, June 9, 2009.

WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Kirby Creek at KBYJ-1 is a *Fish & Wildlife (F&W)* stream located in Jackson County. Based on the 2006 Land Cover Dataset, landuse within the watershed is 55% pasture and cropland and 28% forest. Population density is relatively low, and less than 10% of the area is developed. As of September 1, 2012, ADEM has issued two NPDES 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. Kirby Creek at KBYJ-1 is a medium-gradient, riffle-run stream located in the Southern Table Plateaus ecoregion (Figure 1). The benthic substrate consists primarily of bedrock, which contributed to its *sub-optimal* habitat assessment rating. Solid bedrock naturally limits available habitat and refuge from scouring during high flow events. The riparian buffer, which protects the stream from run-off, was also limited.

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 that the biological community at KBYJ-1 to be in *fair* condition (Table 4).

Table 1. Summary of watershed characteristics.

Watershed Characteristics		
Basin		Tennessee R
Drainage Area (mi ²)		22
Ecoregion ^a		68d
% Landuse		
Open water		<1
Wetland	Woody	<1
	Emergent herbaceous	<1
Forest	Deciduous	15
	Evergreen	3
	Mixed	10
Shrub/scrub		7
Grassland/herbaceous		2
Pasture/hay		35
Cultivated crops		20
Development	Open space	5
	Low intensity	2
	Moderate intensity	<1
	High intensity	<1
Barren		<1
Population/km ^{2b}		60
# NPDES Permits ^c	TOTAL	2
	Construction Stormwater	2

a. Southern Table Plateaus

b. 2000 US Census

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

Table 2. Physical Characteristics of Kirby Creek at KBYJ-1, June 9, 2009.

Physical Characteristics		
Width (ft)		40
Canopy Cover		Mostly Open
Depth (ft)		
	Riffle	0.3
	Run	1.5
	Pool	3.5
% of Reach		
	Riffle	5
	Run	65
	Pool	30
% Substrate		
	Bedrock	70
	Boulder	5
	Cobble	2
	Gravel	3
	Sand	10
	Silt	5
	Organic Matter	5

Table 3. Results of the habitat assessment conducted on Kirby Creek at KBYJ-1, June 9, 2009.

Habitat Assessment	% Maximum Score	Rating
Instream Habitat Quality	65	Sub-optimal (59-70)
Sediment Deposition	75	Optimal >70
Sinuosity	70	Sub-optimal (65-84)
Bank and Vegetative Stability	74	Sub-optimal (60-74)
Riparian Buffer	40	Poor <50
Habitat Assessment Score	160	
% Maximum Score	67	Sub-optimal (59-70)

Table 4. Results of the macroinvertebrate bioassessment of Kirby Creek at KBYJ-1 conducted on June 9, 2009.

Macroinvertebrate Assessment		
	Results	Scores
Taxa richness measures		(0-100)
# EPT taxa	14	43
Taxonomic composition measures		
% Non-insect taxa	16	35
% Dominant taxon	11	103
% EPC taxa	22	24
Functional feeding group measures		
% Predators	8	27
Tolerance measures		
% Taxa as Tolerant	39	28
WMB-I Assessment Score	---	43
WMB-I Assessment Rating		Fair (39-58)

WATER CHEMISTRY

Results of water chemistry analyses are presented in Table 5. In-situ measurements and water samples were collected monthly, semi-monthly (metals), or quarterly (pesticides, atrazine, and semi-volatile organics) during March through October of 2009 to help identify any stressors to the biological communities. Dissolved mercury, arsenic, and copper concentrations were above criteria applicable to the stream's *F&W* use classification on June 9th, Aug. 13th, and Oct. 15th, respectively. Median specific conductance and hardness were higher than background levels for the Southern Table Plateaus ecoregion. Median concentrations of nitrate+nitrite-nitrogen and dissolved reactive phosphorus were also higher than expected based on the 90th percentile of ecoregional reference reach data for the ecoregion.

SUMMARY

Bioassessment results indicated the macroinvertebrate community in Kirby Creek at KBYJ-1 to be in *fair* condition. However, a limited riparian buffer and higher than expected nutrient concentrations indicate that monitoring should continue to ensure that biological and chemical conditions remain stable.

Table 5. Summary of water quality data collected March-October, 2009. Minimum (Min) and maximum (Max) values calculated using minimum detection limits (MDL). 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)	10	11.3	24.0	19.2	18.0	4.9	
Turbidity (NTU)	10	2.1	47.1	3.2	7.9	13.8	
J Total Dissolved Solids (mg/L)	8	52.0	96.0	64.5	69.6	15.1	
J Total Suspended Solids (mg/L)	8	< 1.0	48.0	1.5	7.6	16.4	
Specific Conductance (µmhos)	10	75.4	109.8	89.0 ^G	90.2	9.6	
Hardness (mg/L)	4	30.6	37.2	33.2 ^G	33.5	3.3	
Alkalinity (mg/L)	8	9.2	39.2	15.6	21.2	12.1	
Stream Flow (cfs)	8	3.5	88.1	19.9	34.9	34.8	
Chemical							
Dissolved Oxygen (mg/L)	10	6.4	10.5	8.1	8.4	1.3	
pH (su)	10	6.5	7.3	6.9	6.9	0.2	
J Ammonia Nitrogen (mg/L)	8	< 0.006	< 0.014	0.005	0.004	0.001	
J Nitrate+Nitrite Nitrogen (mg/L)	8	< 0.003	7.038	1.316 ^M	2.059	2.500	
J Total Kjeldahl Nitrogen (mg/L)	8	< 0.089	1.793	0.636	0.747	0.571	
J Total Nitrogen (mg/L)	8	< 0.080	8.831	2.184	2.806	2.980	
J Dissolved Reactive Phosphorus (mg)	8	0.007	0.147	0.028 ^M	0.052	0.051	
J Total Phosphorus (mg/L)	8	0.019	0.431	0.032	0.082	0.141	
J CBOD-5 (mg/L)	8	< 1.0	< 2.0	0.8	0.8	0.3	
Chlorides (mg/L)	8	3.3	6.2	4.9	4.8	1.1	
Atrazine (µg/L)	2	< 0.06	2.54	1.28	1.28	1.78	
Total Metals							
J Aluminum (mg/L)	4	< 0.060	0.205	0.100	0.108	0.092	
J Iron (mg/L)	4	0.173	0.372	0.334	0.303	0.089	
J Manganese (mg/L)	4	< 0.001	0.081	0.041	0.041	0.034	
Dissolved Metals							
J Aluminum (mg/L)	4	< 0.033	< 0.060	0.030	0.030	0.011	
Antimony (µg/L)	4	< 0.7	< 6.0	1.7	1.7	1.5	
J Arsenic (µg/L)	4	< 0.4	< 1.6 ^H	0.5	0.5	0.4	1
Cadmium (mg/L)	4	< 0.002	< 0.003	0.001	0.001	0.000	
Chromium (mg/L)	4	< 0.007	< 0.013	0.005	0.005	0.002	
J Copper (mg/L)	4	< 0.013	< 0.200 ^S	0.061	0.057	0.050	1
J Iron (mg/L)	4	< 0.026	0.210	0.134	0.122	0.102	
Lead (µg/L)	4	< 0.6	< 1.5	0.6	0.6	0.2	
J Manganese (mg/L)	4	< 0.001	0.077	0.036	0.037	0.032	
Mercury (µg/L)	3	< 0.1	0.5 ^{AH}	0.0	0.2	0.2	1
Nickel (mg/L)	4	< 0.004	< 0.019	0.004	0.005	0.003	
Selenium (µg/L)	4	< 0.4	< 1.5	0.2	0.3	0.3	
Silver (mg/L)	4	< 0.001	< 0.002	0.001	0.001	0.000	
Thallium (µg/L)	4	< 0.4	< 0.5	0.2	0.2	0.0	
Zinc (mg/L)	4	< 0.003	< 0.060	0.022	0.019	0.014	
Biological							
Chlorophyll a (ug/L)	8	< 0.53	4.45	1.20	1.64	1.43	
J Fecal Coliform (col/100 mL)	8	29	2,000 ^H	64	326	681	1

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

FOR MORE INFORMATION, CONTACT:

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