

2012 Monitoring Summary



Locust Fork at US Highway 231 in Blount County (34.02369/-86.57334)

BACKGROUND

The Locust Fork drainage encompasses 1,209 mi² in north central Alabama, spanning five counties—Blount, Marshall, Etowah, Walker, and Jefferson. The variety of distinct habitats within this river system has produced very diverse biological communities. Several threatened and endangered species inhabit the river, including five species of mussels and four species of fish.

During 2011 and 2012, the Alabama Department of Conservation and Natural Resources (ADCNR) conducted a survey of aquatic snails in the Black Warrior River basin. Thirteen sites were sampled on the Locust Fork, and at least thirteen different species of snails were identified. One of the snail species was *Leptoxis plicata*, a federally endangered species found only in Alabama.

A 75 mile stretch of the Locust Fork, from Alabama Highway 269 near Short Creek in Jefferson County upstream to Blount County Road 30, has been on Alabama’s Clean Water Act (CWA) §303(d) list of impaired waters since 1998. It was listed for nutrients and siltation/habitat alteration from agricultural and abandoned surface mining sources.

The Alabama Department of Environmental Management (ADEM) conducted an intensive survey of the Locust Fork watershed in 2012. The objective of the survey was to collect data to develop nutrient and siltation Total Maximum Daily Loads (TMDLs) for the impaired segments. The intensive survey included a total of seven stations on the mainstem of Locust Fork (Figure 1). Macroinvertebrate assessments were conducted at five of these locations. Seventy-two hour surveys of dissolved oxygen, temperature, pH, and conductivity were also conducted at six of the seven sites. Parameters included monthly in-situ measurements, flow, and water samples for lab analysis. The purpose of this report is to summarize the results of the macroinvertebrate assessment conducted at LFKB-1.

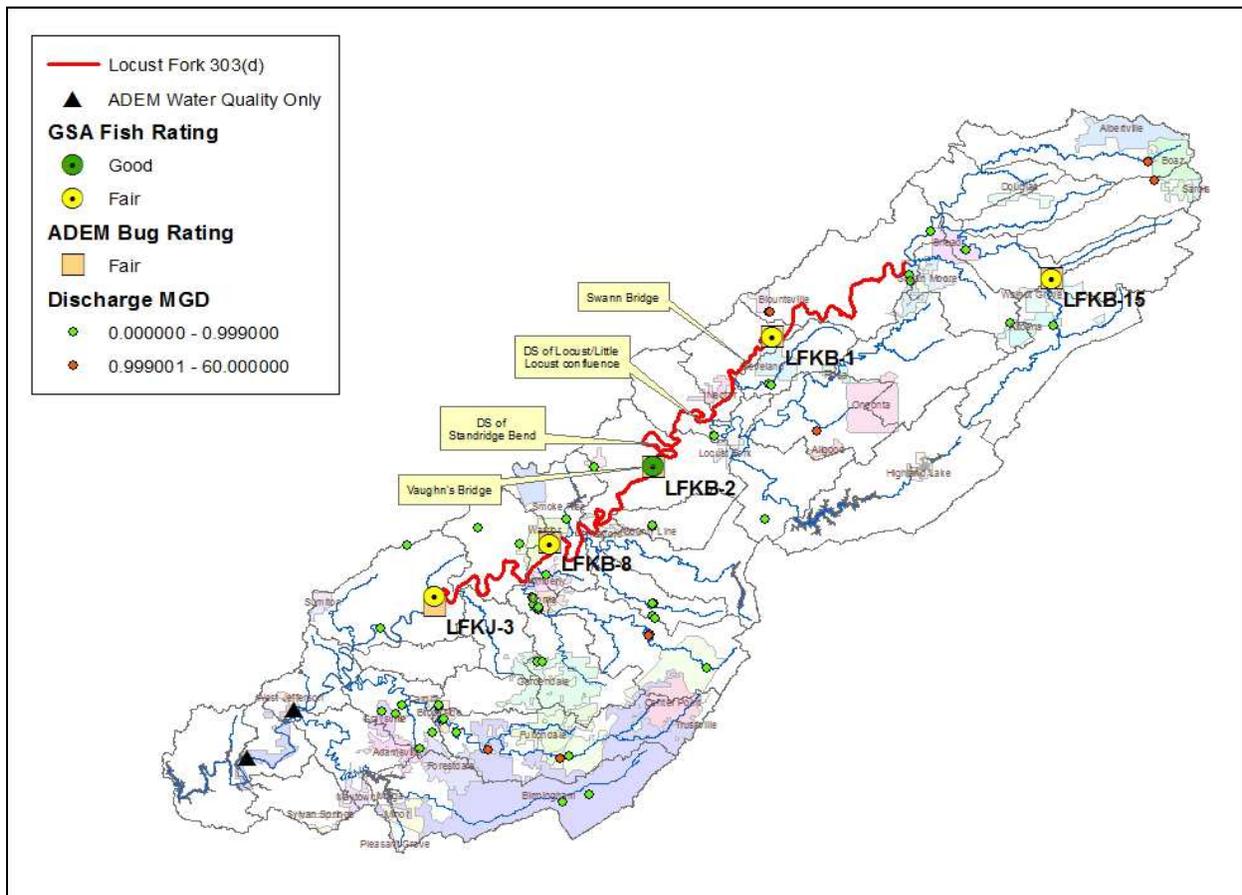


Figure 1. The locations of the five RSMP sampling stations on the mainstem of Locust Fork. The 303(d) listed segments of the Locust Fork are shown in red. Results of fish IBI surveys conducted by the Geological Survey of Alabama (GSA) and macroinvertebrate bioassessments conducted by ADEM are also shown (modified from ADEM Water Quality).

WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Locust Fork at LFKB-1 is classified as a *Fish & Wildlife (F&W)* stream located in Blount County. Based on the 2006 National Land Cover Dataset, landuse within the watershed is predominantly forest (38%) and pasture land (Figure 2). About eight percent of the area is developed. As of June 6, 2013, a total of 134 NPDES permits have been issued in the watershed, most of which are construction stormwater permits.

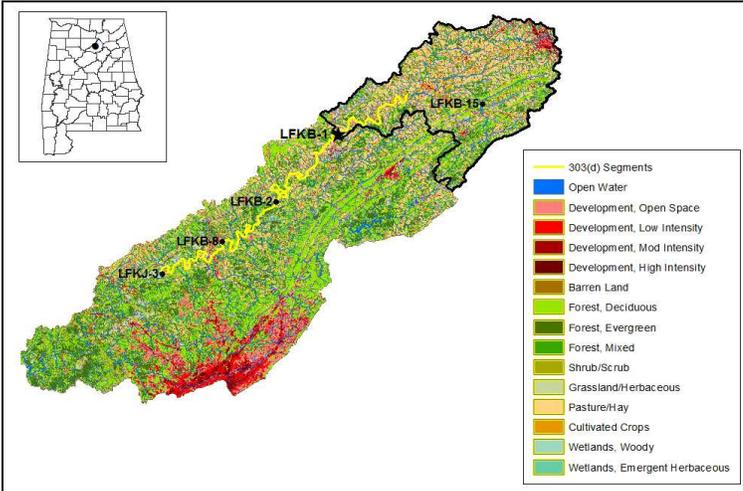


Figure 2. Sampling locations and landuse within the Locust Fork watershed. The 303 (d) listed segments of the Locust Fork are shown in yellow.

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. Locust Fork at LFKB-1 is a riffle-run stream located in the Southern Table Plateaus (68d) ecoregion (Figure 3). Benthic substrate consists primarily of boulder, with some bedrock and sand. Overall habitat quality was rated as *optimal* for supporting biological communities.



Figure 3. Locust Fork at LFKB-1, August 16, 2012.

Table 1. Summary of watershed characteristics.

Watershed Characteristics		Black Warrior River
Basin		
Drainage Area (mi²)		303
Ecoregion^a		68d
Ichthyoregion^b		PLA
% Landuse		
Open water		<1
Wetland	Woody	1
	Emergent herbaceous	<1
Forest	Deciduous	22
	Evergreen	7
	Mixed	9
Shrub/scrub		5
Grassland/herbaceous		2
Pasture/hay		38
Cultivated crops		8
Development	Open space	5
	Low intensity	2
	Moderate intensity	1
	High intensity	<1
Barren		<1
Population/km^{2c}		38
# NPDES Permits^d	TOTAL	134
Construction Stormwater		96
Mining		6
Industrial General		13
Industrial Individual		4
Municipal Individual		12
Underground Injection Control		3

a. Southern Table Plateaus

b. Plateau

c. 2000 US Census

d. #NPDES permits downloaded from ADEM's NPDES Management System database, June 6, 2013.

Table 2. Physical characteristics of Locust Fork at LFKB-1, June 21, 2012.

Physical Characteristics	
Width (ft)	113
Canopy Cover	Open
Depth (ft)	
	Riffle 0.5
	Run 2.4
	Pool 2.6
% of Reach	
	Riffle 7
	Run 70
	Pool 23
% Substrate	
	Bedrock 27
	Boulder 43
	Gravel 4
	Sand 23
	Organic Matter 3

PERIPHYTON RESULTS

Excessive algal growth can indicate nutrient enrichment. Benthic substrate covered by filamentous algae causes habitat degradation and habitat smothering. Periphyton assessments were conducted in accordance with ADEM's 2005 Revised Periphyton Protocol. Results of periphyton sampling in relationship to stream flow are presented in Figure 4. Percent filamentous algae cover was 16%. However, the substrate may have been scoured. Mean daily discharge data from the USGS gage station at the site suggest stream flow peaked during the week preceding sampling.

MACROINVERTEBRATE RESULTS

Benthic macroinvertebrate communities were sampled using ADEM's Nonwadeable Multi-habitat Bioassessment methodology (NWM-I). The NWM-I measures taxonomic richness, community composition, and community tolerance to assess the overall health of the macroinvertebrate community. Each score is based on a six point scale in comparison to least-impaired reference reaches characterized by similar drainage areas, gradient, and habitat. The final score is the sum of all metric scores, with a maximum score of 30. The metric results indicated the macroinvertebrate community to be in *fair* condition (Table 4).

Table 4. Results of the macroinvertebrate bioassessment conducted in Locust Fork at LFKB-1 on June 21, 2012.

Macroinvertebrate Assessment			
	Results	Scores	
Taxa richness and diversity measures			
# EPT taxa	26	4	
Taxonomic composition measures			
# Clinger taxa	22	4	
Tolerance measures			
Beck's community tolerance index	16	4	
% Nutrient tolerant organisms	21	6	
% Tolerant taxa	29	4	
WMB-I Assessment Score	---	22	
WMB-I Assessment Rating		Fair (12-24)	

FISH RESULTS

The Geological Survey of Alabama (GSA) conducted fish IBI assessments of the Locust Fork in 2010 and 2011. These data provide information about the species richness and diversity, tolerance level, trophic system, and abundance of the fish community. Each score is a five-point scale in comparison to least-impaired reference reaches in the same ichthyoregion. The final score is the sum of all metric scores, with a maximum score of 60. Metric results indicated the fish community to be in *fair* condition (Table 5).

Table 3. Results of the habitat assessment conducted in Locust Fork at LFKB-1 on June 21, 2012.

Habitat Assessment	% Maximum Score	Rating
NW		
Instream Habitat Quality	69	Sub-optimal (59-70)
Sediment Deposition	76	Optimal (>70)
Sinuosity	30	Poor (<45)
Bank and Vegetative Stability	76	Optimal (>75)
Riparian Buffer	90	Sub-optimal (70-90)
Habitat Assessment Score	177	
% Maximum Score	74	Optimal (>70)

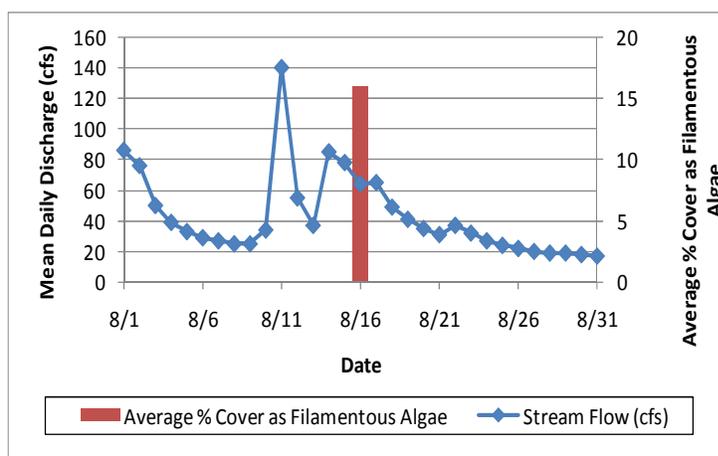


Figure 4. Results of periphyton sampling at LFKB-1 conducted August 16, 2012. The blue line indicates mean daily stream flow during the month of August 2012.

Table 5. Results of the fish IBI assessment conducted in Locust Fork at LFKB-1 on August 2, 2011 (GSA 2013).

Fish IBI Assessment	Results	Score
Species richness and diversity		
Total native species	17	3
Number cyprinid species	4	1
Number sucker species	3	3
Number <i>Lepomis</i> species	4	3
Number darter+madtom species	3	1
Tolerance and intolerance		
Percent dominant species	54	1
Percent of tolerant species	2	5
Percent <i>Lepomis</i>	4	5
Trophic Measures		
Percent omnivores	2	5
Percent carnivores	5	5
Abundance, condition, and reproduction		
Percent DELT+hybrids	0	5
Percent simple lithophils	34	3
Total IBI Score		40
IBI Assessment Rating		Fair (33-40)

WATER CHEMISTRY

Results of water chemistry analyses are presented in Table 6. When possible, in situ measurements and water samples were collected monthly during April through November 2012 to help identify any stressors to the biological communities. The median concentrations of total dissolved solids, alkalinity, nitrate-nitrite nitrogen, total nitrogen, dissolved reactive phosphorus, total phosphorus, and chlorides were higher than expected for streams in the Southern Table Plateaus ecoregion. Specific conductance was also higher than expected for the area. Ammonia-nitrogen was above the minimum detection limit in one of eight samples collected. However, the median ammonia-nitrogen concentration was below values expected for the ecoregion.

Dissolved oxygen (DO) and pH met *F&W* criteria during all monthly sampling visits. In addition, DO and pH concentrations did not violate these criteria during a 72-hour diurnal study conducted July 23-26, 2012. Dissolved oxygen, water temperature, pH, and conductivity were measured every fifteen minutes for 72 hours. Results of the study are shown in Figure 5. On average, DO in the water column changed approximately 2-2.5 mg/L in a diurnal cycle, similar to the patterns observed at least-disturbed reference reaches.

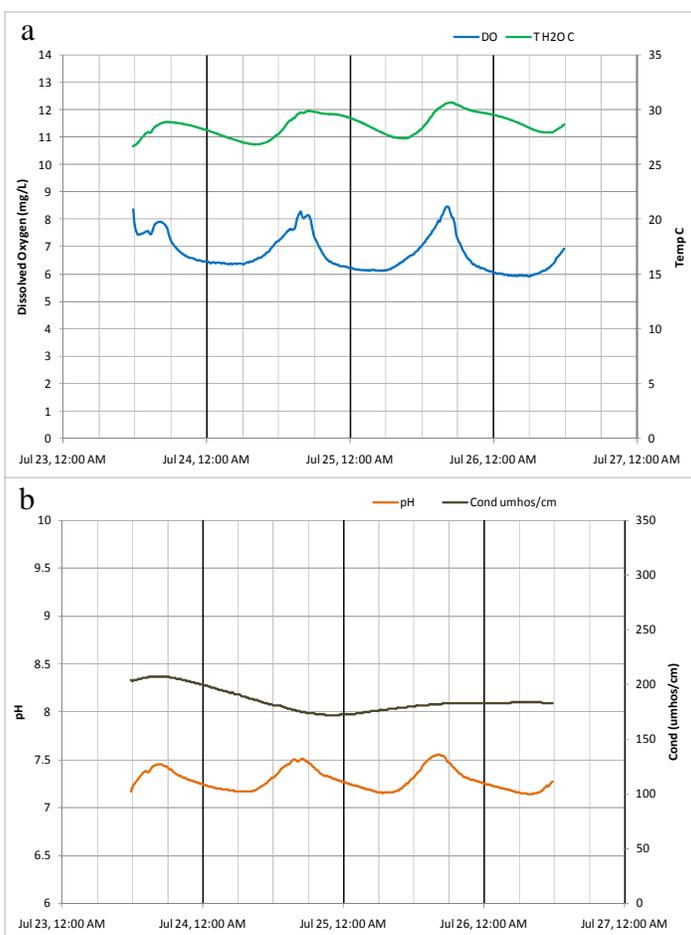


Figure 5. Results of 72-hour diurnal study conducted July 23-26, 2012. Lines indicate changes in DO and water temperature (a) and pH and conductivity (b) over time (courtesy of ADEM Water Quality).

Table 6. Summary of water quality data collected April-November, 2012. 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
Physical						
Temperature (°C)	9	9.8	27.2	23.5	21.2	5.9
Turbidity (NTU)	9	<	2.0	9.5	3.9	4.9
Total Dissolved Solids (mg/L)	8	<	86.0	198.0	123.0 ^M	131.2
Total Suspended Solids (mg/L)	8	<	1.0	12.0	1.0	3.1
Specific Conductance (umhos)	9	107.0	242.2	202.0 ^G	190.7	40.6
Alkalinity (mg/L)	8	41.2	63.5	50.5 ^M	50.8	8.1
Stream Flow (cfs)	9	51.3	180.3	101.1	100.6	40.3
Chemical						
Dissolved Oxygen (mg/L)	9	6.8	11.8	8.2	8.8	1.7
pH (su)	9	7.2	8.0	7.7	7.6	0.3
Ammonia Nitrogen (mg/L)	8	<	0.007	0.049	0.004	0.010
Nitrate+Nitrite Nitrogen (mg/L)	8	1.817	5.311	2.540 ^M	2.854	1.230
^J Total Kjeldahl Nitrogen (mg/L)	8	0.081	0.653	0.410	0.410	0.166
^J Total Nitrogen (mg/L)	8	2.189	5.964	2.794 ^M	3.264	1.318
Dissolved Reactive Phosphorus (mg/L)	8	0.238	0.911	0.478 ^M	0.511	0.205
Total Phosphorus (mg/L)	8	0.267	0.967	0.528 ^M	0.548	0.212
^J CBOD-5 (mg/L)	8	<	2.0	2.5	1.0	1.4
Chlorides (mg/L)	8	6.2	14.9	9.3 ^M	9.9	2.6
Biological						
Chlorophyll a (ug/L)	8	<	0.10	1.07	0.66	0.61

G=value higher than median concentration of all verified ecoregional reference reach data collected in the ecoregion 68d; J=estimate; M=value >90% of all verified ecoregional reference reach data collected in the ecoregion 68d; N= # samples.

DISCUSSION

Four segments of the Locust Fork are currently classified as impaired according to §303(d) of the Clean Water Act. The segments are impaired by nutrients, siltation, and other habitat alteration caused by unknown sources.

Overall habitat quality was categorized as *optimal* for supporting macroinvertebrate communities. Results of the macroinvertebrate bioassessment conducted at LFKB-1 indicated the aquatic insect community to be in *fair* condition. These results support the findings of a 2011 fish IBI survey conducted by the Geological Survey of Alabama (GSA).

Water chemistry analyses showed concentrations of total dissolved solids, alkalinity, nitrate-nitrite nitrogen, total nitrogen, dissolved reactive phosphorus, total phosphorus, and chlorides were elevated as compared to data from ADEM's least-impaired reference reaches in ecoregion 68d. Specific conductance was also higher than expected for the ecoregion. DO and pH concentrations consistently met *F&W* criteria during the study period. Results of a 72-hour study showed diurnal changes in DO and pH were consistent with patterns observed in least-impaired reference reaches.

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