Alabama Department of Environmental Management

Ecological Reference Reach

Rivers and Streams Monitoring Program

2019 Monitoring Summary

Larkin Fork at Alabama Highway 65 in Jackson County (34.86590/-86.20796)

BACKGROUND

Larkin Fork is among the least-disturbed watersheds within the Plateau Escarpment ecoregion, based on landuse, road density, and population density. Larkin Fork, is being monitored by the Alabama Department of Environmental Management (ADEM) as a candidate "high quality" reference watershed for comparison with other streams within the ecoregion. Data from reference watersheds are used to characterize natural or background conditions expected in different ecoregions throughout the state. Larkin Fork was sampled in 2019 to provide high-quality reference reach data for Tennessee Valley streams.

Larkin Fork is within one of 50 Strategic Habitat Units (SHU) by the U.S. Fish and Wildlife Service (USFWS) and the Alabama Rivers & Streams Network (ARSN). SHUs are recognized as high quality habitats occupied by federally listed and state imperiled species.

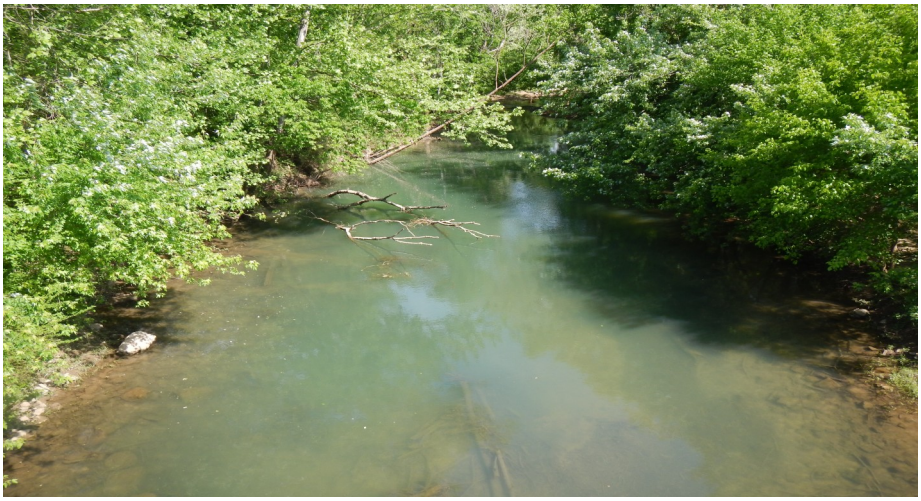

Figure 1. Larkin Fork at LRKJ-1, May 1, 2019.

Table 1. Summary of general watershed characteristics: LRKJ-1 (2018)

Watershed Characteristics	
Basin	Tennessee
Drainage Area (mi²)	40.2
Ecoregion°	68c
Assessment Unit	AL06030002-0102-100
Use Class	
AU Category	
12-digit Hydrologic Unit Code (HUC)†	060300020102
Conservation Status	
Strategic Habitat Unit	9 Paint Rock River
Landuse Categories (2011 National Land Cover Dataset)	
Forested, Total (%)	88.5
Forested, Deciduous (%)	84.1
Forested, Evergreen (%)	1.9
Forested, Mixed (%)	2.4
Shrub/Scrub (%)	2.3
Grassland/Herbaceous (%)	0.7
Pasture/Hay (%)	6.7
Crops, Cultivated (%)	0.4
Developed, Total (%)	1.5
Developed, Open Space (%)	1.4
Population/km (2010 US Census)	2
Roads	
Road Density	0.7
# Road Crossings per Stream km	0.4
Watershed Disturbance Score*	**46**
Watershed Disturbance Category*	**2**

° Plateau Escarpment

† 12-digit HUC located in a Strategic Habitat Unit.

* Measure of watershed disturbance based on landuse, population, and road density summarized in this table.

WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Larkin Fork is a *Fish and Wildlife (F&W)* stream located in Jackson county near Larkin, Alabama. According to the 2011 National Land Cover Dataset, the watershed is over 88% forested with no permitted outfalls. It is very sparsely populated with very few roads. It is located within a Strategic Habitat Unit that supports federally listed threatened or endangered aquatic species and other aquatic species listed to be of the *Highest* or *High Conservation Concern* by the state of Alabama.

REACH CHARACTERISTICS

General observations (Figure 1, Table 2) and a habitat survey (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. Like other streams in ecoregion 68c, Larkin Ford at LRKJ-1 is a medium-high gradient stream characterized predominantly by a cobble and gravel substrate. Overall habitat quality was categorized as *marginal/sub-optimal* for supporting the biological communities in this stream type.

Table 2. Physical characteristics of Larkin Fork at LRKJ-1, May 29, 2019.

Physical Characteristics	
Width (ft)	45
Canopy Cover	Mostly Shaded
Depth (ft)	
Riffle	0.3
Run	1.0
Pool	4.0
% of Reach	
Riffle	2
Run	48
Pool	50
% Substrate	
Boulder	5
Cobble	30
Gravel	25
Sand	15
Silt	10
Organic Matter	15

BIOASSESSMENT RESULTS

The benthic macroinvertebrate community was sampled using ADEM's Intensive Multi-habitat Bioassessment methodology (WMB-I). Measures of taxonomic richness, community composition and pollution tolerance were used to assess the overall health of the macroinvertebrate community in comparison to conditions expected in north Alabama streams and rivers. Each site is placed in one of six levels ranging from 1, or *natural*, to 6, or *highly altered*. Macroinvertebrate community was rated as *Good*. There are evident changes in structure due to loss of some rare, highly sensitive taxa (Attribute 2) and shifts in relative abundance to ubiquitous, sensitive taxa (Attribute 3). 67 total taxa were found during the assessment, 34% of the total taxa collected were classified as rare and highly sensitive or sensitive. (Table 4a).

The fish community in Larkin Fork at LRKJ-1 was sampled using Alabama's Fish Community Index of Biotic Integrity (AL-IBI), developed through a multi-agency (GSA, ADCNR, ADEM) project to establish a comprehensive fish community bioassessment tool for wadeable streams and rivers across the state. The data collected during this survey were to score the overall health of the fish community, based on conditions expected for wadeable streams and rivers in the Tennessee Valley Ichthyoregion. The AL-IBI uses twelve measures of species richness and diversity, tolerance/intolerance, and abundance, condition, and reproduction to assess the overall health of the fish community. The final IBI score is the sum of all individual metrics on a 60 point scale. The IBI score for Larkin Fork at LRKJ-1 was 54, indicating the fish community to be in *Excellent* condition (Table 4b).

Table 3. Results of the habitat assessment survey conducted on Larkin Fork at LRKJ-1, May 29, 2019.

Habitat Survey	% Max Score	Rating
Instream Habitat Quality	62	Sub-optimal (55-74.999)
Sediment Deposition	33	Marginal (30-49.999)
Riffle Frequency	38	Marginal (30-49.999)
Bank Vegetative Stability	35	Marginal (30-49.999)
Riparian Zone Measurements	71	Sub-optimal (55-74.999)
Habitat Assessment Score	**100**	
% Maximum Score	**50**	**Marginal/Sub-optimal (40-54.999)**

Table 4a. Results of the Macroinvertebrate survey conducted on Larkin Fork at LRKJ-1, May 29, 2019.

Macroinvertebrate Assessment	Results
Taxonomic richness and diversity metrics	
Total # taxa	67
# rare and highly sensitive taxa	7
# sensitive taxa	23
# sensitive EPT taxa	12
Percent taxon metrics	
% sensitive EPT taxa	18
% sensitive taxa	34
% rare and highly sensitive taxa	10
% tolerant taxa	12
Percent individual metrics	
% rare and highly sensitive individuals	5
% sensitive individuals	14
% sensitive EPT individuals	5
% tolerant individuals	9
WMB-I Survey Score	**3.0**
WMB-I Survey Rating	**Good**

Table 4b. Results of the Fish survey conducted on Larkin Fork at LRKJ-1, April 30, 2019.

Fish Assessment	Results	Scores
Taxonomic richness and diversity metrics		
Total Native Species	38	5
Number of shiner species	10	5
Number of Sucker Species	3	5
Number of darter+madtom species	9	5
Tolerance metrics		
Number of intolerant species	6	5
Percent of tolerant species	25	3
Percent Lepomis	5	5
Trophic metrics		
Percent invertivores	12	5
Percent omnivores	20	3
Percent top carnivores	1	3
Abundance, condition, and reproductive metrics		
Percent DELT+hybrids	0	5
Number of lithophilic spawners	24	5
IBI Survey Score		**54**
IBI Survey Rating		**Excellent**

WATER CHEMISTRY

Results of water chemistry are presented in Table 5. In situ measurements and water samples were collected monthly from March to October of 2019 to help identify any stressors to the biological communities.

Dissolved oxygen and pH exceeded the criterion established for the *F&W* water use classification during the sampling period. Median specific conductance, total suspended solids, hardness values were higher than the median concentration of all verified ecoregional reference reach data collected in ecoregion 68c. Individual values of ammonia, total nitrogen, dissolved arsenic, and dissolved selenium were higher greater than 90% of all verified ecoregional reference reach data collected in 68c. E. coli exceeded the *F&W* human health criteria for two sampling events.

Table 5. Summary of water quality data collected monthly March through October, 2019. 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.

	LRKJ-1 AL06030002-0102-100	N	Min	Max	Med	Avg	SD	E	10thP	90thP
	Physical									
	Temperature (°C)	10	8.4	25.1	19.6	18.6	5.4		10.3	24.9
	Turbidity (NTU)	10	1.8	5.6	3.8	3.7	1.5		1.8	5.5
	Total Dissolved Solids (mg/L)	7	155.0	215.0	183.0	187.1	20.5		155.0	215.0
J	Total Suspended Solids (mg/L)	7	<1.0	9.0	7.0[M]	5.9	2.9		0.5	9.0
	Specific Conductance (µmhos/cm)	10	272.0	365.0	321.0[G]	322.4	28.5		285.1	364.0
	Hardness (mg/L)	4	159.0	201.0	168.0[G]	174.0	19.1		159.0	201.0
	Alkalinity (mg/L)	8	135.0	177.0	156.5	158.6	12.7		135.0	177.0
	Measured Stream Flow (cfs)	11	0.3	173.4	5.7	25.9	50.2		0.4	104.0
	Chemical									
	Dissolved Oxygen (mg/L)	10	3.1[C]	11.9	6.2	7.2	2.8	1	4.1	11.7
	pH (SU)	10	7.3[D]	8.0[D]	7.6	7.7	0.2	3	7.4	8.0
J	Ammonia Nitrogen (mg/L)	8	<0.004	0.201[D]	0.022	0.044	0.066		0.002	0.201
	Nitrate+Nitrite Nitrogen (mg/L)	8	<0.008	0.577	0.180	0.209	0.187		0.004	0.577
J	Total Kjeldahl Nitrogen (mg/L)	8	<0.075	2.680	0.113	0.479	0.904		0.038	2.680
J	Total Nitrogen (mg/L)	8	<0.066	2.813	0.422	0.688	0.900		0.066	2.813
J	Dis Reactive Phosphorus (mg/L)	8	<0.006	0.020	0.014	0.012	0.005		0.003	0.020
	Total Phosphorus (mg/L)	8	0.013	0.038	0.027	0.025	0.009		0.013	0.038
J	TOC (mg/L)	8	1.2	3.0	1.9	1.9	0.5		1.2	3.0
J	CBOD-5 (mg/L)	8	<2.0	<2.0	1.0	1.0	0.0		1.0	1.0
J	COD (mg/L)	8	<1.2	15.6	3.3	4.6	4.7		0.6	15.6
J	Chlorides (mg/L)	8	0.9	2.1	1.2	1.3	0.4		0.9	2.1
	Sulfate (mg/L)	8	6.03	12.20	10.14	9.80	1.93		6.03	12.20
	Total Metals									
J	Aluminum (T) (mg/L)	4	0.077	0.269	0.116	0.144	0.085		0.077	0.269
J	Iron (T) (mg/L)	4	<0.063	0.266	0.124	0.136	0.097		0.032	0.266
J	Manganese (T) (mg/L)	4	<0.004	0.035	0.026	0.022	0.016		0.002	0.035
	Dissolved Metals									
J	Aluminum (mg/L)	4	<0.023	0.079	0.027	0.036	0.032		0.012	0.079
	Antimony (µg/L)	4	<1.480	<1.480	0.740	0.740	0.000		0.740	0.740
J	Arsenic (µg/L)	4	<0.689	0.728[D]	0.344	0.440	0.192		0.344	0.728
	Cadmium (µg/L)	4	<0.726	<0.726	0.363	0.363	0.000		0.363	0.363
	Chromium (µg/L)	4	<0.793	<0.793	0.396	0.396	0.000		0.396	0.396
	Copper (µg/L)	4	<1.190	<1.190	0.595	0.595	0.000		0.595	0.595
	Iron (mg/L)	4	<0.063	<0.063	0.032	0.032	0.000		0.032	0.032
	Lead (µg/L)	4	<0.697	<0.697	0.348	0.348	0.000		0.348	0.348
J	Manganese (mg/L)	4	<0.004	0.029	0.010	0.012	0.013		0.002	0.029
	Nickel (µg/L)	4	<1.960	<1.960	0.980	0.980	0.000		0.980	0.980
J	Selenium (µg/L)	4	<1.900	2.500[D]	0.950	1.338	0.775		0.950	2.500
	Silver (µg/L)	4	<1.350	<1.350	0.675	0.675	0.000		0.675	0.675
	Thallium (µg/L)	4	<0.641	<0.641	0.320	0.320	0.000		0.320	0.320
	Zinc (µg/L)	4	<2.340	<2.340	1.170	1.170	0.000		1.170	1.170
	Biological									
	Chlorophyll a (mg/m³)	8	<1.00	7.21	0.78	1.69	2.30		0.50	7.21
	E. coli (MPN/DL)	8	15.6	920.8[H]	252.2	290.3	297.3	2	15.6	920.8

C=*F&W* criterion violated; D=an individual value >90% of all verified ecoregional reference reach data collected in the ecoregion 68c; E=# samples that exceeded criteria; G= value higher than median concentration of all verified ecoregional reference reach data collected in the ecoregion 68c; J=estimate; M=value >90% of all verified ecoregional reference reach data collected in the ecoregion 68c; H=*F&W* human health criterion exceeded; N=# samples.

SUMMARY

The ADEM monitors Larkin Fork at LRKJ-1 as a candidate "high-quality" reference reach for comparison with other Plateau Escarpment streams. Larkin Fork at LRKJ-1 is typical of streams in the region, characterized by moderate to high gradient riffles with boulder, bedrock and cobble substrates. Water temperature, dissolved oxygen and pH exceeded the criterion established for the *F&W* water use classification. Median specific conductance, total suspended solids, hardness, ammonia, total nitrogen, dissolved arsenic, dissolved selenium values were higher than the median concentration of all verified ecoregional reference reach data collected in ecoregion 68c. E. coli exceeded the *F&W* human health criteria for two sampling events. Macroinvertebrate diversity and taxa richness are *good* and the fish community was found to be in *excellent* condition.

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