

2014 Monitoring Summary



Reference Reach Site

Bottle Creek at Conecuh County Road 43 (31.26863/-86.76373)

BACKGROUND

In 2008, the Alabama Department of Environmental Management (ADEM) identified Bottle Creek at BOTC-1 as a candidate reference station potentially representing “best attainable condition” for the Southeastern Floodplains and Low Terraces ecoregion (65p). To more fully evaluate this potential, macroinvertebrate and habitat assessments were conducted at the site in 2014, along with the collection of monthly water chemistry samples.

The Bottle Creek watershed was also selected for biological and water quality monitoring as part of the 2014 Southeastern Alabama (SEAL) River Basin Assessment Monitoring Program. The objectives of the SEAL River Basin Assessments were to assess the biological integrity of each monitoring site and to estimate overall water quality within the basin.

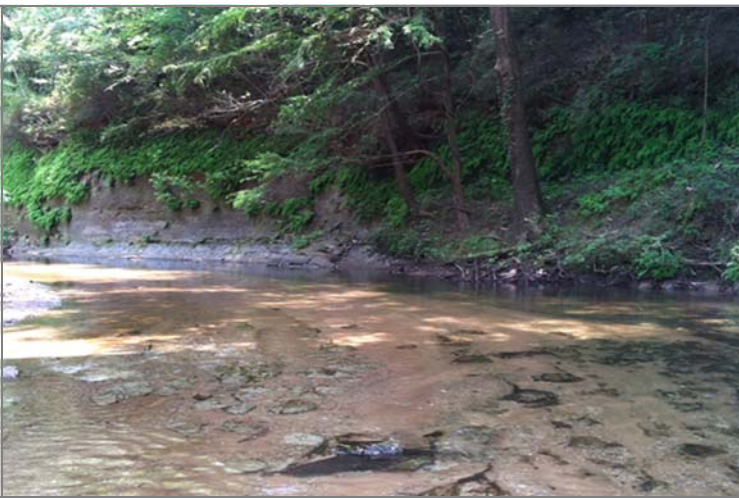


Figure 1. Bottle Creek at BOTC-1, July 7, 2014.

WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Bottle Creek at BOTC-1 is a *Fish & Wildlife (F&W)* stream located in Conecuh County. The reach is located within the Southeastern Floodplains and Low Terraces sub-ecoregion, but the majority of the watershed drains the Southern Hilly Gulf Coastal Plain (65d) sub-ecoregion. Based on the 2011 National Land Cover Dataset, land use within the watershed is predominantly forest (62%), with wetland (<10%), agriculture (12%), and urban (<5%) areas. As of April 1, 2016, three NPDES outfalls were active in the watershed (ADEM NPDES Management System).

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. Bottle Creek at BOTC-1 is a low gradient, riffle-run stream characterized by clay and sand substrates (Figure 1). Overall habitat quality was rated as *sub-optimal* for supporting the macroinvertebrate community.

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 community tolerance were used to assess the overall health of the macroinvertebrate community in comparison to conditions expected in south Alabama streams and rivers. Each site is placed in one of six levels, ranging from 1, or *natural*, to 6, or *highly altered*. The macroinvertebrate survey conducted at BOTC-1 rated the site as a 4+, or *Fair/Good*. Relative abundance and numbers of pollution-sensitive taxa are lower than expected, and a few taxa appear to dominate the macroinvertebrate community (Table 4).

Table 1. Summary of watershed characteristics.

| Watershed Characteristics | | Conecuh River |
|----------------------------------|---------------------|---------------|
| Basin | | |
| Drainage Area (mi ²) | | 41 |
| Ecoregion ^a | | 65P |
| % Landuse ^b | | |
| Open water | | <1 |
| Wetland | Woody | 9 |
| | Emergent herbaceous | <1 |
| Forest | Deciduous | 17 |
| | Evergreen | 32 |
| | Mixed | 13 |
| Shrub/scrub | | 8 |
| Grassland/herbaceous | | 6 |
| Pasture/hay | | 7 |
| Cultivated crops | | 5 |
| Development | Open space | 3 |
| | Low intensity | <1 |
| | Moderate intensity | <1 |
| Barren | | <1 |
| Population/km ^{2c} | | 4 |
| # NPDES Permits ^d | | |
| | TOTAL | 3 |
| Construction | | 3 |

a.Southeastern Floodplains & Low Terraces

b.2011 National Land Cover Dataset

c.2010 US Census

d.#NPDES outfalls downloaded from ADEM’s NPDES Management System database, April 1, 2016.

Table 2. Physical characteristics of Bottle Creek at BOTC-1, May 6, 2014.

| Physical Characteristics | | |
|--------------------------|----------------|---------------|
| Width (ft) | | 25 |
| Canopy Cover | | Mostly Shaded |
| Depth (ft) | Riffle | 1.0 |
| | Run | 1.2 |
| | Pool | 2.0 |
| % of Reach | Riffle | 10 |
| | Run | 80 |
| | Pool | 10 |
| % Substrate | Boulder | 1 |
| | Cobble | 5 |
| | Gravel | 13 |
| | Hard Pan Clay | 20 |
| | Sand | 50 |
| | Silt | 5 |
| | Organic Matter | 6 |

Table 3. Results of the habitat assessment conducted on Bottle Creek at BOTC-1, May 6, 2014.

| Habitat Assessment | % Maximum Score | Rating |
|---------------------------------|-----------------|----------------------------|
| Instream Habitat Quality | 48 | Marginal (31-55) |
| Sediment Deposition | 60 | Sub-Optimal (55-79) |
| Riffle frequency | 50 | Marginal (31-55) |
| Bank Vegetative Stability | 46 | Marginal (31-58) |
| Riparian Buffer | 85 | Optimal (>84) |
| Habitat Assessment Score | 116 | |
| % Maximum Score | 58 | Sub-Optimal (57-80) |

Table 4. Results of the macroinvertebrate bioassessment conducted in Bottle Creek at BOTC-1, May 6, 2014.

| Macroinvertebrate Assessment | | Results |
|---|--|-----------|
| Taxa richness and diversity measures | | |
| Total # Taxa | | 61 |
| # EPT taxa | | 14 |
| # Highly-sensitive and Specialized Taxa | | 4 |
| Taxonomic composition measures | | |
| % EPC taxa | | 38 |
| % Trichoptera & Chironomidae Taxa | | 30 |
| % EP Individuals | | 13 |
| % Chironomidae Individuals | | 15 |
| % Individuals in Dominant 5 Taxa | | 57 |
| Functional feeding group | | |
| % Collector-Filterer Individuals | | 8 |
| % Tolerant Filterer Taxa | | 7 |
| Community tolerance | | |
| # Sensitive EPT | | 6 |
| % Sensitive taxa | | 30 |
| % Nutrient Tolerant individuals | | 50 |
| WMB-I Assessment Score | | 4+ |
| WMB-I Assessment Rating | | Fair-Good |

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 once (pesticides, atrazine and semi-volatile organics) from March through October of 2014 to help identify any stressors to the biological communities. Median conductivity was higher than the median of all reference reach data for the ecoregion (65p). Also, median concentrations of total dissolved solids, hardness, alkalinity, nitrate+nitrite nitrogen, total kjedahl nitrogen, total nitrogen, total and dissolved aluminum, and dissolved chromium were higher than expected based on the 90th percentile of reference reaches in this ecoregion. Samples collected for the analyses of pesticides, and semi-volatile organics in April were below detection limits while atrazine was detected.

SUMMARY

Habitat assessment results scored Bottle Creek at BOTC-1 as *sub-optimal* for supporting the macroinvertebrate community, and bioassessment results indicated the community to be in *fair/good* condition. Specific conductance, total dissolved solids, hardness, alkalinity, nitrogen, aluminum, and chromium were higher than expected compared to data from ADEM's least-impaired reference reaches in ecoregion 65p. Monitoring should continue to ensure that water quality and biological conditions remain stable.

Table 5. Summary of water quality data collected March-October 2014. 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 | E |
|--|----|------------------|-----------------|--------------------|--------|----|---|-----|
| Physical | | | | | | | | |
| Temperature (°C) | 9 | 18.1 | 28.8 | 21.2 | 22.4 | | | |
| Turbidity (NTU) | 10 | 1.2 | 26.4 | 3.8 | 7.5 | | | |
| Total Dissolved Solids (mg/L) | 8 | 93.0 | 157.0 | 142.5 ^H | 137.1 | | | |
| Total Suspended Solids (mg/L) | 8 | < 1.0 | 14.0 | 1.5 | 3.7 | | | |
| Specific Conductance (µmhos) | 9 | 28.4 | 272.0 | 210.4 ^G | 188.0 | | | |
| Hardness (mg/L) | 4 | 80.8 | 129.0 | 107.8 ^G | 106.3 | | | |
| Alkalinity (mg/L) | 8 | 45.4 | 134.0 | 109.5 ^H | 101.0 | | | |
| Stream Flow (cfs) | 5 | 5.2 | 76.2 | 47.8 | 38.0 | | | |
| Chemical | | | | | | | | |
| Dissolved Oxygen (mg/L) | 9 | 8.8 | 10.0 | 9.3 | 8.6 | | | |
| pH (su) | 9 | 4.9 ^C | 8.2 | 8.0 | 7.6 | | | 1 |
| Ammonia Nitrogen (mg/L) | 8 | < 0.008 | 0.021 | 0.004 | 0.006 | | | |
| - Nitrate + Nitrite Nitrogen (mg/L) | 8 | 0.014 | 0.475 | 0.189 ^H | 0.207 | | | |
| - Total Kjeldahl Nitrogen (mg/L) | 8 | 0.138 | 0.955 | 0.241 ^H | 0.389 | | | |
| - Total Nitrogen (mg/L) | 8 | 0.229 | 1.072 | 0.538 ^H | 0.576 | | | |
| - Dissolved Reactive Phosphorus (mg/L) | 8 | 0.003 | 0.007 | 0.006 | 0.005 | | | |
| Total Phosphorus (mg/L) | 8 | 0.010 | 0.058 | 0.014 | 0.022 | | | |
| - CBOD-5 (mg/L) | 8 | < 2.0 | < 2.0 | 1.0 | 1.0 | | | |
| COU (mg/L) | 8 | < 1.6 | 14.0 | 9.8 ^H | 8.7 | | | |
| TOC (mg/L) | 8 | 1.9 | 10.7 | 2.7 | 4.2 | | | |
| Chlordane (mg/L) | 8 | 2.4 | 4.5 | 4.1 | 3.9 | | | |
| Atrazine (µg/L) | 1 | | | | 0.21 | | | |
| Total Metals | | | | | | | | |
| Aluminum (mg/L) | 4 | < 0.050 | 0.230 | 0.054 ^H | 0.091 | | | |
| - Iron (mg/L) | 4 | < 0.037 | 0.556 | 0.259 | 0.273 | | | |
| - Manganese (mg/L) | 4 | 0.012 | 0.034 | 0.020 | 0.022 | | | |
| Dissolved Metals | | | | | | | | |
| Aluminum (mg/L) | 4 | < 0.050 | 0.215 | 0.025 ^H | 0.072 | | | |
| - Antimony (µg/L) | 4 | < 0.2 | < 0.2 | 0.1 | 0.1 | | | |
| - Arsenic (µg/L) | 4 | 0.5 | 10 ¹ | 0.8 | 0.7 | | | 4 |
| Cadmium (µg/L) | 4 | < 0.248 | < 0.248 | 0.123 | 0.123 | | | |
| - Chromium (µg/L) | 4 | 0.480 | 1.429 | 0.641 ^H | 0.798 | | | |
| - Copper (mg/L) | 4 | < 0.0003 | 0.001 | 0.0003 | 0.0005 | | | |
| - Iron (mg/L) | 4 | < 0.037 | 0.523 | 0.120 | 0.196 | | | |
| Lead (µg/L) | 4 | < 0.2 | < 0.2 | 0.1 | 0.1 | | | |
| - Manganese (mg/L) | 4 | < 0.008 | 0.022 | 0.012 | 0.012 | | | |
| - Nickel (mg/L) | 4 | < 0.0004 | 0.0006 | 0.0004 | 0.0004 | | | |
| Selenium (µg/L) | 4 | < 0.4 | < 0.4 | 0.2 | 0.2 | | | |
| Silver (µg/L) | 4 | < 0.252 | < 0.252 | 0.126 | 0.126 | | | |
| Thallium (µg/L) | 4 | < 0.2 | < 0.2 | 0.1 | 0.1 | | | |
| - Zinc (mg/L) | 4 | 0.003 | 0.007 | 0.004 | 0.005 | | | |
| Biological | | | | | | | | |
| Chlorophyll a (µg/L) | 8 | < 0.10 | 21.36 | 0.78 | 4.42 | | | 772 |
| - E. coli (col/100mL) | 8 | 17 | 821 | 88 | 186 | | | 267 |

C= F&W criterion violated; E= # of samples that exceeded criteria; G= value > median of all ecoregion-1 reference reach data collected in ecoregion 65p; H=F&W human health criteria exceeded; J=estimate; M=value >90% of collected samples in ecoregion 65p; N=# samples; Q=# of uncertain exceedances.

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