

# **2011 Monitoring** Summary



Hammar Creek in Mobile County at Padgett Switch Road (30.42820/-88.23050)

#### BACKGROUND

The Alabama Department of Environmental Management (ADEM) selected the Escatawpa River watershed for biological and water quality monitoring as part of the 2011 EMT Basin Assessment. The objectives of the project were to assess the biological integrity of each monitoring site and to estimate overall water quality within the Escatawpa River Basin.



Figure 1. Hammar Creek at HMC-1, June 14, 2011.

#### WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Hammar Creek is a Fish & Wildlife (F&W) stream located in the Gulf Coast Flatwoods ecoregion (75a). Based on the 2011 National Land Cover Dataset, landuse within the watershed is predominantly pasture/hay. Population is low with little development in the area. As of April 1, 2016, ADEM's NPDES Management System database showed 15 discharges located within the watershed. within the 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. Hammar Creek at HMC-1 is a low-gradient, glide-pool stream with substrate composed primarily of sand, organic matter, and hard pan clay (Figure 1). Overall habitat quality and availability was rated as optimal for supporting diverse aquatic macroinvertebrate communities.

#### **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. The overall WMB-I scored HMC-1 with a fair community condition (Table 4).

Table 1. Summary of watershed characteristics. Watershed Characteristics

vv ater si	ieu Characteristics	
Basin		Escatawpa R
Drainage Area (mi²)		18
<b>Ecoregion</b> <sup>a</sup>		75A
% Landuse <sup>b</sup>		
Open water		<1%
Wetland	Woody	15%
	Emergent herbaceous	<1%
Forest	Deciduous	1%
	Evergreen	9%
	Mixed	1%
Shrub/scrub		11%
Grassland/herbaceous		7%
Pasture/hay		37%
Cultivated crops		6%
Development	Open space	9%
	Low intensity	3%
	Moderate intensity	<1%
	High intensity	<1%
Barren		<1%
Population/km <sup>2c</sup>		126
# NPDES Permits <sup>d</sup>	TOTAL	15
Construction		8
Industrial General		3
Mining		1
Small Mining		1
Underground Injection	n Control	2
a Gulf Coast Flatwoods		

- a. Gulf Coast Flatwoods
- b. 2011 National Land Cover Dataset
- c. 2010 US Census

Table 2. Physical characteristics of Hammar Ck at HMC-1 Amoust 30 2011

Physical Charac	cte ristics
Canopy Cover	Mostly Shaded
Width (ft)	16.0
Depth (Ft)	
Ron	4.0
Pool	7.0
% of Reach	
Rom	45
Pool	55
% Substrate	
Boulder	1
Clay	5
Mud/Muck	10
Hard Pan Clay	35
Sand	30
Silt	3
Organic Matter	16

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

Table 3. Results of the habitat assessment conducted on Hammar Ck at HMC-1, Aug 30, 2011.

Habitat Assessment	% Maximum Score	Rating
Instream Habitat Quality	62	Sub-Optimal (53-65)
Sediment Deposition	74	Optimal (>65)
Sinuosity	75	Sub-Optimal (65-<85)
Bank Vegetative Stability	75	Optimal (>=75)
Riparian Buffer	88	Sub-Optimal (70-90)
Habitat Assessment Score	147	
% of Maximum Score	74	Optimal (>65)

**Table 4.** Results of the macroinvertebrate bioassessment conducted in Hammar Creek at HMC-1, August 30, 2011.

Macroinvertebrate Assessment	
	Results
Taxa richness and diversity measures	
# EPT taxa	14
Taxonomic composition measures	
% Non-insect taxa	9
% Plecoptera	0
% Dominant taxon	27
Functional feeding group	
% Predators	15
Community tolerance	
Becks community tolerance index	15
% Nutrient tolerant individuals	41
WMB-I Assessment Score	52
WMB-I Assessment Rating	Fair (37-55)

## 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 2011 to help identify any stressors to the biological communities.

## **SUMMARY**

Bioassessment results indicated the macroinvertebrate community to be in *fair* condition. Habitat assessment results and intensive water quality sampling suggested habitat degradation and nutrient enrichment as potential impacts to biological condition. Diversity of the macroinvertebrate community may also be slightly lower in late August as a result of insect emergence. Monitoring should continue to ensure that conditions at the site remain stable.

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**Table 5.** Summary of water quality data collected March-October, 2011. 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.

Physical   Temperature (*C)	Parameter	N	Min	Max	Med	Avg	SD E
Turbidity (NTU) Total Dissolved Solids (mg·L) Total Conductance (µmhos) Total Conductance (µmhos) Total Kips (mg·L) Total Kip	Physical						
Turbidity (NTU)	Temperature (°C)	9	16.3	24.5	22.6	21.7	3.0
Total Suspended Solids (mg/L) 7 < 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0		8	2.0	5.5	2.8	3.3	1.4
Total Suspended Solids (mg/L) 7 < 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0	Total Dissolved Solids (mg L)	7	38.0	72.0	43.0	47.7	11.3
Specific Conductance (µmhos)         9         47.8         71.0         54.0         54.1         7.1         4.1         2.25         2.8         2.8         4.1         4.1         11.2         12.5         2.8         2.8         3.1         4.1         12.5         2.8         2.8         3.1         7.7         3.0         5.0         5.4         1.7         1.7         3.0         3.0         5.2         1.2         1.2         1.7         3.0         3.0         1.2         1.7         3.0         3.0         1.0         3.0         <	· •	7 <	5.0				
J Hardness (mg/L)         6         10.4         17.0         11.2         12.5         2.8           J Alkalinity (mg/L)         7 <         4.0         7.0         6.0         5.4         1.7           Stream Flow (cfs)         9         7.9         23.0         12.8         14.8         4.7           Chemical           University (mg/L)         9         5.2         8.2         6.8         6.7         0.8         Ph           J Ammonia Nitrogen (mg/L)         7          0.014         <0.014		9	47.8	71.0	54.0		
J Alkalinity (mg/L)         7 < 4.0         7.0         6.0         5.4         1.7           Stream Flow (cfs)         9         7.9         23.0         12.8         14.6         4.7           Chemical           Use of the image of t		6	10.4		11.2	12.5	2.8
Stream Flow (cfs)         9         7.9         23.0         12.8         14.6         4.7           Chemical         Usion of the pill of the pi	. = .	7 <					
Chemical   Dissolved Oxygen (mg/L)   9   5.2   8.2   6.8   6.7   0.8   pH (su)   9   5.0   6.9   5.9   5.9   0.6   0.8   0.7   0.000   0.00		9	7.9	23.0	12.8	14.6	
pH (su)         9         5.0         6.9         5.9         5.9         0.6           J Ammonia Nitrogen (mg/L)         7 < 0.014	30.00						
pH (su)         9         5.0         6.9         5.9         5.9         0.6           J Ammonia Nitrogen (mg/L)         7 < 0.014	Dissolved Oxygen (mg/L)	9	5.2	8.2	6.8	6.7	0.8
J Ammonia Nitrogen (mg/L)         7 <		9	5.0	6.9	5.9	5.9	0.6
J Nitrate+Nitrice Nitrogen (mg/L)         7         0.132         0.380         0.300         0.280         0.083           J Total Kjeldahl Nitrogen (mg/L)         7         0.190         1.100         0.340         0.491         0.302           J Total Nitrogen (mg/L)         7         0.557         1.418         0.672         0.771         0.304           J Dissolved Reactive Phosphorus (mg/L)         7         0.004         0.017         0.013         0.012         0.005           J CBOD-5 (mg/L)         7         1.0         <1		7 <		<0.014			
J Total Kjeklahl Nitrogen (mg/L)         7         0.190         1.100         0.340         0.491         0.302           J Total Nitrogen (mg/L)         7         0.557         1.418         0.672         0.771         0.304           J Dissolved Reactive Phosphorus (mg·L)         7         0.004         0.017         0.013         0.012         0.005           J CBOD-5 (mg/L)         7         1.0         <1		7					
J Total Nitrogen (mg/L)         7         0.557         1.418         0.672         0.771         0.304           J Dissolved Readtive Phosphorus (mg/L)         7         0.007         0.200         0.007         0.036         0.072           J Total Phosphorus (mg/L)         7 < 0.004							
J Dissolved Reactive Phosphorus (mg·L)         7         0.007         0.200         0.007         0.036         0.072           J Total Phosphorus (mg·L)         7 < 0.004							
J Total Phosphorus (mg/L)         7 < 0.004							
J CBOD-5 (mg/L)         7 <         1.0         <1         0.5         0.5         0.0           J Chlorides (mg/L)         7         7.3         9.8         8.5         8.5         0.8           J Atrazine (μg·L)         3 <         0.02         0.08         0.01         0.03         0.04           Total Metals           J Ruminum (mg·L)         6         0.153         0.412         0.196         0.244         0.108           J Manganese (mg/L)         6         0.460         0.973         0.782         0.747         0.194           J Manganese (mg/L)         6         0.026         0.094         0.036         0.045         0.026           Dissolved Metals         J         Aluminum (mg·L)         6 <         0.044         0.292         0.142         0.147         0.101         0.14         0.14         0.14         0.14         0.14         0.01         0.026         0.026         0.026         0.026         0.024         0.021         0.021         0.021         0.021         0.021         0.021         0.021         0.021         0.021         0.021         0.021         0.021         0.021         0.022         0.022         0.022         0.022							
J Chlorides (mg/L) 7 7.3 9.8 8.5 8.5 0.8 J Atrazine (μg'L) 3 < 0.02 0.08 0.01 0.03 0.04  Total Metals  J Aluminum (mg'L) 6 0.460 0.973 0.762 0.747 0.194 J Iron (mg/L) 6 0.026 0.094 0.036 0.045 0.026  Dissolved Metals  J Aluminum (mg'L) 6 0.044 0.292 0.142 0.147 0.101 J Antimony (μg/L) 6 0.004 0.292 0.142 0.147 0.101 J Antimony (μg/L) 6 1.9 <2.3 1.2 1.1 0.1 Arsenic (μg/L) 6 1.4 <2.8 1.2 1.1 0.3 J Cadmium (mg'L) 6 < 0.0002 <0.0013 0.000 0.000 J Chromium (mg'L) 6 < 0.0006 <0.006 0.003 0.003 0.000 J Chromium (mg'L) 6 < 0.0006 <0.006 0.003 0.003 0.000 Copper (mg/L) 6 < 0.005 <0.005 0.002 0.002 0.000 J Iron (mg/L) 6 < 0.005 <0.005 0.002 0.002 0.000 J Iron (mg/L) 6 < 0.08 <0.09 0.4 0.4 0.0 J Head (μg/L) 6 < 0.8 <0.9 0.4 0.4 0.0 J Manganese (mg/L) 6 < 0.018 0.077 0.030 0.038 0.022 J Lead (μg/L) 6 < 0.072 0.165 0.052 0.072 0.053 * J Nickel (mg/L) 6 < 0.007 <0.007 0.004 0.004 0.000 Selenium (μg/L) 6 < 0.8 <1.3 0.4 0.5 0.1 Silver (mg'L) 6 < 0.00015 <0.002 0.000 0.000 J Thalllum (μg'L) 6 < 0.003 <0.002 0.000 0.000 Biological Chlorophyll a (ug'L) 6 < 1.00 1.40 0.50 0.65 0.37	, , , ,	-					
J Atrazine (μg·L)         3 < 0.02         0.08         0.01         0.03         0.04           Total Metals           J Aluminum (mg·L)         6         0.153         0.412         0.196         0.244         0.108           J Iron (mg·L)         6         0.460         0.973         0.782         0.747         0.194           J Manganese (mg/L)         6         0.026         0.094         0.036         0.045         0.026           Dissolved Metals         User (mg·L)         6 < 0.044         0.292         0.142         0.147         0.101           J Aluminum (mg·L)         6 < 0.044         0.292         0.142         0.147         0.101           J Antimony (μg·L)         6 < 1.9         <2.3         1.2         1.1         0.1           J Arsenic (μg·L)         6 < 1.4         <2.8         1.2         1.1         0.1           J Arsenic (μg·L)         6 < 0.000022         <0.0013         0.000	, <del>,</del> ,	-					
Total Metals  J Aluminum (mg1) 6 0.153 0.412 0.196 0.244 0.108  J Iron (mg/L) 6 0.460 0.973 0.782 0.747 0.194  J Manganese (mg/L) 6 0.026 0.094 0.036 0.045 0.026  Dissolved Metals  J Aluminum (mg1) 6 < 0.044 0.292 0.142 0.147 0.101  Antimony (μg/L) 6 < 1.9 <2.3 1.2 1.1 0.1  Arsenic (μg/L) 6 < 1.4 <2.8 1.2 1.1 0.3  J Cadmium (mg1) 6 < 0.000022 <0.0013 0.000 0.000 0.000  J Chromium (mg1) 6 < 0.0006 <0.006 0.003 0.003 0.000  Copper (mg/L) 6 < 0.005 <0.005 0.002 0.002 0.000  J Iron (mg4.) 6 < 0.284 0.401 0.306 0.328 0.052  J Lead (μg/L) 6 < 0.8 <0.9 0.4 0.4 0.0  Manganese (mg/L) 6 < 0.018 0.077 0.030 0.038 0.022  J Mercury (μg1) 5 < 0.072 0.165 0.052 0.072 0.053 *  Mercury (μg1) 6 < 0.007 <0.007 0.004 0.004 0.000  Selenium (μg/L) 6 < 0.8 <1.3 0.4 0.5 0.1  Silver (mg1) 6 < 0.000 <0.000 0.000  T Thallum (μg/L) 6 < 0.032 <0.032 0.000 0.000  Biological  Chlorophyll a (μg1) 6 < 1.00 1.40 0.50 0.65 0.37	, <del>, ,</del>						
J Iron (mg/L)         6         0.460         0.973         0.782         0.747         0.194           J Manganese (mg/L)         6         0.026         0.094         0.036         0.045         0.026           Dissolved Metals           J Aluminum (mg·L)         6 < 0.044							
J Manganese (mg/L)       6       0.026       0.094       0.036       0.045       0.026         Dissolved Metals         J Aluminum (mg·L)       6 < 0.044	J Aluminum (mg·L)	6	0.153	0.412	0.196	0.244	0.108
Dissolved Metals   Jaluminum (mg \( \)	J Iron (mg/L)	6	0.460	0.973	0.782	0.747	0.194
J Aluminum (mg·L)         6 < 0.044	J Manganese (mg/L)	6	0.026	0.094	0.036	0.045	0.026
J Antimony (μg/L)       6 < 1.9	Dissolved Metals						
F Arsenic (μg/L) 6 < 1.4 <2.8 1.2 1.1 0.3  J Cadmium (mg/L) 6 < 0.000022 <0.0013 0.000 0.000 0.000  J Chromium (mg/L) 6 < 0.006 <0.006 0.003 0.003 0.000 0.000  Copper (mg/L) 6 < 0.005 <0.005 0.002 0.002 0.000  J Iron (mg/L) 6 < 0.08 0.09 0.00 0.328 0.052  J Lead (μg/L) 6 < 0.8 <0.9 0.4 0.4 0.0  J Manganese (mg/L) 6 < 0.018 0.077 0.030 0.038 0.022  J Mercury (μg/L) 5 < 0.072 0.165 0.052 0.072 0.053 1  J Nickel (mg/L) 6 < 0.007 <0.007 0.004 0.004 0.000  Selenium (μg/L) 6 < 0.8 <1.3 0.4 0.5 0.1  Silver (mg/L) 6 < 0.00015 <0.0002 0.000 0.000 0.000  J Thaillium (μg/L) 8 < 0.9 <1.2 0.5 0.5 0.1  J Zinc (mg/L) 6 < 0.032 <0.032 0.016 0.016 0.000  Biological  Chlorophylia (ug/L) 6 < 1.00 1.40 0.50 0.65 0.37	J Aluminum (mg·L)	6 <	0.044	0.292	0.142	0.147	0.101
J Cadmium (mg/L)       6 < 0.000022	. Antimony (µg/L)	6 <	1.9	<23	1.2	1.1	0.1
J Chromium (mg·L)       6 < 0.006	F Arsenic (µg/L)	6 <	1.4	<2.8	1.2	1.1	0.3
Copper (mg/L)         6 <         0.005         <0.005         0.002         0.002         0.000           J Iron (mg/L)         6         0.284         0.401         0.308         0.328         0.052           J Lead (μg/L)         6 <	J Cadmium (mg/L)	6 <	0.000022	<0.0013	0.000	0.000	0.000
J Iron (mg/L)         6         0.284         0.401         0.308         0.328         0.052           J Lead (μg/L)         6 < 0.8	J Chromium (mg·L)	6 <	0.006	<0.006	0.003	0.003	0.000
J Lead (μg/L)         6 < 0.8	Copper (mg/L)	6 <	0.005	<0.005	0.002	0.002	0.000
J Manganese (mg/L)         6         0.018         0.077         0.030         0.038         0.022           J Mercury (μg·L)         5 < 0.072	<sup>1</sup> Iron (mg/L)	6	0.284	0.401	0.306	0.328	0.052
J Mercury (μg·L)         5 <         0.072         0.165         0.052         0.072         0.053         *           J Nickel (mg/L)         6 <	J Lead (µg/L)	6 <	8.0	<0.9	0.4	0.4	0.0
J Nickel (mg/L)         6 < 0.007         <0.007         0.004         0.004         0.000           Selenium (μg/L)         6 < 0.8	. Manganese (mg/L)	6	0.018	0.077	0.030	0.038	0.022
Selenium (µg/L)         6 <         0.8         <1.3         0.4         0.5         0.1           Silver (mg·L)         6 <	J Mercury (µg·L)	5 <	0.072	0.165	0.052	0.072	0.053 *
Silver (mg L)       6 < 0.000015	J Nickel (mg/L)	6 <	0.007	<0.007	0.004	0.004	0.000
J Thailium (µg/L)     8 < 0.9	Selenium (µg/L)	6 <	8.0	<1.3	0.4	0.5	0.1
J Zinc (mg/L)     6 <     0.032     <0.032     0.016     0.016     0.000       Biological       Chlorophyll a (ug/L)     6 <	Silver (mg·L)	6 <	0.000015	<0.0002	0.000	0.000	0.000
Biological Chiorophyll a (ug·L) 6 < 1.00 1.40 0.50 0.65 0.37	J Thaillum (µg·L)	8 <	0.9	<1.2	0.5	0.5	0.1
Chiorophyll a (ug·L) 6 < 1.00 1.40 0.50 0.65 0.37	J Zinc (mg/L)	6 <	0.032	< 0.032	0.016	0.016	0.000
	Biological						
	Chlorophyll a (ug L)	6 <	1.00	1.40	0.50	0.65	0.37
<sup>J</sup> E. coli (col/100mL) 7 10 530 140 173 176	J E. coli (col/100mL)	7		530	140		

E=# samples that exceeded criteria; J=estimate; M=value >90% of all verified ecoregional reference reach data collected in the ecoregion 68; N=# samples.