GEOLOGICAL SURVEY OF ALABAMA

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ECOSYSTEMS INVESTIGATIONS PROGRAM

A SURVEY OF FISHES IN THE PAINT ROCK RIVER SYSTEM, ALABAMA

OPEN-FILE REPORT 1213

by

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Prepared in cooperation with the U.S. Fish and Wildlife Service and the Alabama Department of Conservation and Natural Resources

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A SURVEY OF FISHES IN THE PAINT ROCK RIVER SYSTEM, ALABAMA

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ABSTRACT

A total of 70 species of fishes were collected in the Paint Rock River system from 19 stations during September 27-30, 2010. Four species of greatest conservation need in Alabama (Mirarchi, 2004) were collected in the Paint Rock including the Palezone Shiner (*Notropis albizonatus*), Snail Darter (*Percina tanasi*), Blotchside Logperch (*Percina burtoni*), and Streamline Chub *(Erimystax dissimilis*). Biological condition at the sampled sites was among some of the best observed in Alabama streams with 12 of the 19 stations (63 percent) scoring Excellent biological condition and 7 stations (27percent) scoring Good biological condition.

INTRODUCTION

The Paint Rock River watershed is, for its size, one of the most biologically diverse aquatic regions in Alabama. It harbors approximately 100 species of freshwater fishes, several of which are globally imperiled, federally protected as endangered, threatened, or candidate species under the Endangered Species Act (ESA), and(or) considered species of conservation concern by the state of Alabama. About 50 species of mussels are found in the watershed with nine listed as federally endangered and 19 as highest (P1) to high (P2) conservation concern.

Ortmann (1925) reported 46 species of freshwater mussels (of which six are now federally protected under the ESA) from the Paint Rock River system based on examination of collections made by other researchers. Ahlstedt (1991) reported forty-one species in a follow-up study that included several tributary streams. In a brief survey, McGregor and Shelton (1995) reported 20 species as alive or fresh dead and an additional seven species collected as relic (weathered) shells only. Godwin (2003) reported 24 species as live, fresh dead, and weathered dead and an additional six species as relic shells only. Two mussel species that historically occurred in the system

are now considered extinct: the Angled Riffleshell (*Epioblasma biemarginata*) and Narrow Catspaw (*Epioblasma lenoir*) (Turgeon, 1988). Nine mussel species are listed as endangered under the ESA: the Shiny Pigtoe (*Fusconaia cor*), Fine-Rayed Pigtoe (*Fusconaia cuneolus*), Rough Pigtoe (*Pleurobema plenum*), Pale Lilliput (*Toxolasma cylindrellus*), Pink Mucket (*Lampsilis abrupta*), Alabama Lampmussel (*Lampsilis virescens*), snuffbox (*Epioblasma triquetra*), oystermussel (*Epioblasma capsaeformis*), and the Cumberland Bean (*Villosa trabalis*). Several other mussel species, both uncommon and unprotected, that are indicative of good water quality occur in the Paint Rock River system including the Tennessee Clubshell (*Pleurobema oviforme*), Tennessee Heelspliter (*Lasmigona holstonia*), and the Purple Lilliput (*Toxolasma lividus*).

Mettee and others (1996) documented 98 fish species from the Paint Rock River system including the endangered Palezone Shiner (*Notropis albizonatus*) and the threatened Snail Darter (*Percina tanasi*). The presence of the Blotchside Logperch (*Percina burtoni*), the undescribed “Sawfin Shiner” (*Notropis* sp. cf. *spectrunculus*), Streamline Chub (*Erimystax dissimilis*), Blotched Chub (*Erimystax insignis*), and the Tennessee Shiner (*Notropis leuciodus*) also indicate waters of exceptional quality.

The rich aquatic biodiversity of the Paint Rock River system has stimulated conservation initiatives by the U.S. Fish and Wildlife Service (USFWS), The Nature Conservancy (TNC), the Alabama Department of Conservation and Natural Resources (ADCNR), the Forever Wild program of ADCNR, and the Natural Resources Conservation Service (NRCS) aimed at restoration, recovery, and conservation of aquatic habitat and imperiled species. The Nature Conservancy has established a significant presence in the watershed and completed many projects to restore natural stream channels, improve bottomland forests, restore aquatic habitat, and reduce the effects of agricultural nonpoint source pollution. Land under conservation ownership and management in the Paint Rock watershed includes preserves maintained by TNC, tracts protected by the Forever Wild Land Trust, the Skyline Wildlife Management area, the Fern Cave National Wildlife Refuge, and private land under NRCS easements and programs. The ADCNR is working cooperatively with TNC, NRCS, and USFWS to

identify and remediate structures that are barriers to fish passage and to reintroduce populations of imperiled mollusks in the system. Habitat fragmentation by fish barriers (dams, road crossings, stream blockages) is recognized as one of the most pervasive habitat issues facing freshwater organisms. Removal of barriers and restoring connectivity to fragmented aquatic habitats is a priority conservation action for managing and restoring aquatic biodiversity.

The purpose of conducting fish surveys in the Paint Rock River system was to document the presence of federally listed species and species of greatest conservation need, determine fish biodiversity in selected parts of the system, and establish baseline biological condition, using fish community indices, in locations where several fish barrier removal projects have been proposed. In 2012 some of these projects moved forward with fish barriers removed and stream channels restored to more natural configurations.

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- *The Nature Conservancy* - Paul Freeman
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STRATEGIC HABITAT AND RIVER REACH UNITS

The USFWS in cooperation with the ADCNR-Alabama Aquatic Biodiversity Center (AABC) and the Geological Survey of Alabama (GSA) have selected watersheds and river segments in the five major HUC 4 subregions in Alabama (fig. 1)

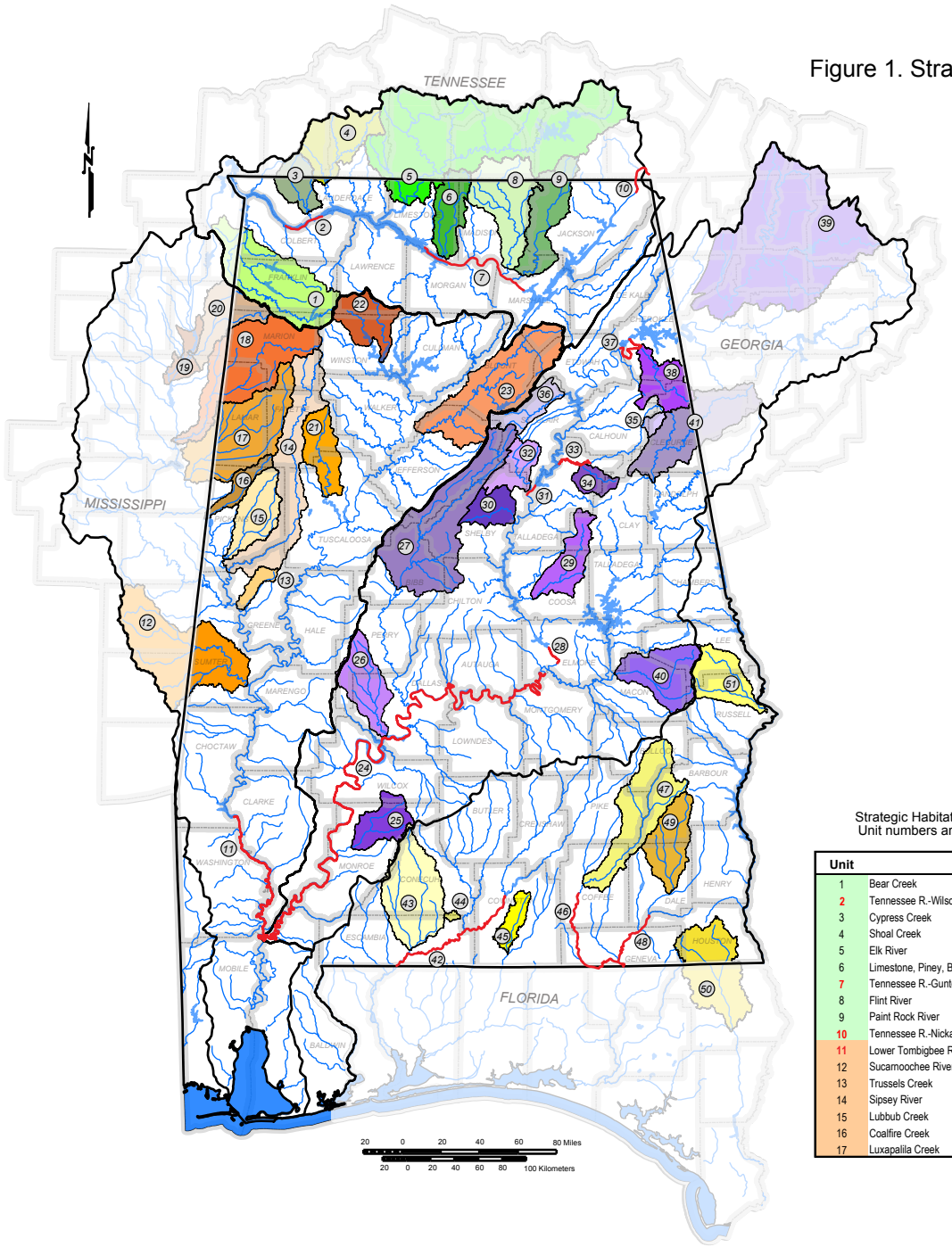
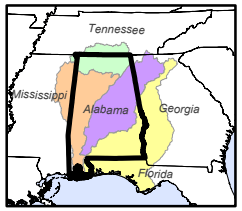


Figure 1. Strategic habitat and river reach units for aquatic species of conservation concern in Alabama.

Explanation

- Rivers and streams
- Open water
- County lines
- Hydrologic Unit Code (HUC) subregion boundary
- Strategic Habitat Unit (SHU)
- Strategic River Reach Unit (SRRU)

National Hydrologic Dataset HUC 4 Subregions in Alabama



Index map of HUC4 subregions in Alabama and neighboring states

- Middle Tennessee - Elk (0603) strategic units no. 1 - 10
- Mobile-Tombigbee (0316) strategic units no. 11 - 23
- Alabama River (0315) strategic units no. 24 - 41
- Choctawhatchee-Escambia (0314) and Apalachicola (0313) strategic units no. 42 - 51

Strategic Habitat Units (SHUs) and Strategic River Reach Units (SRRUs) in Alabama and associated HUC subregions. Unit numbers are grouped by the color of the HUC subregion in which they are located. Units in red font are SRRUs.

Unit	Name	Unit	Name	Unit	Name
1	Bear Creek	18	Buttahatchee River	35	Shoal Creek
2	Tennessee R.-Wilson dam tailwater	19	East Fork Tombigbee River	36	Big Canoe Creek
3	Cypress Creek	20	Bull Mountain Creek	37	Weiss Lake bypass (Dead River)
4	Shoal Creek	21	North River	38	Terrapin Creek
5	Elk River	22	Upper Sipsey Fork	39	Upper Coosa River tributaries
6	Limestone, Piney, Beaverdam Creeks	23	Locust Fork	40	Uphapee Creek
7	Tennessee R.-Guntersville dam tailwater	24	Lower Alabama River	41	Tallapoosa River
8	Flint River	25	Big Flat Creek	42	Conecuh River
9	Paint Rock River	26	Bogue Chitto Creek	43	Murder Creek
10	Tennessee R.-Nickajack dam tailwater	27	Upper Cahaba River	44	Amos Mill Creek
11	Lower Tombigbee River	28	Coosa R.-Jordan dam tailwater	45	Five Runs Creek
12	Sucarnoochee River	29	Hatchet Creek	46	Pea River
13	Trussels Creek	30	Yellowleaf Creek	47	Upper Pea River
14	Sipsey River	31	Coosa R.-Logan Martin dam tailwater	48	Choctawhatchee River
15	Lubbub Creek	32	Kelly Creek	49	West Fork Choctawhatchee River
16	Coalfire Creek	33	Lower Choccolocco Creek	50	Chipola River
17	Luxapalila Creek	34	Cheaha Creek	51	Uchee Creek

to focus conservation activities for managing, recovering, and restoring populations of rare fishes, mussels, snails, and crayfishes (Wynn and others, 2012). These Strategic Habitat Units (SHUs) and Strategic River Reach Units (SRRUs) include a substantial part of Alabama's remaining high-quality water courses and reflect the variety of aquatic habitats occupied by these species historically and presently. The Paint Rock River watershed is one of 51 units selected for management of aquatic biodiversity. The SHUs were selected based on the presence of federally listed and state imperiled species, potential threats to the species, designation of critical habitat, and the best available information about the essential habitat components required by these aquatic species to survive. The habitat components include areas with: (1) geomorphically stable stream and river channels; (2) stream flow regimes that support normal behavior, growth, and survival of the animals; (3) acceptable water-quality conditions necessary for normal behavior, growth, and viability of all life stages of the animals; (4) a diversity of channel substrate types with minimal amounts of fine sediment and filamentous algae; (5) for mussels, the presence of fish hosts with adequate living, foraging, and spawning areas; and (6) few or no competitive or predaceous nonnative species. The SRRUs were selected based on habitat features listed above and the presence of imperiled species and include river reaches where species restoration and recovery actions are planned or already underway.

The basis for restoration and recovery within a designated SHU is the development of SHU-specific watershed assessment information similar to that presented in this report. For species recovery to proceed systematically and with some reasonable expectation of success, watersheds must be understood from a biological, water quality, land use, and habitat threat perspective. The type of watershed information developed for each SHU is unique and depends on the type and intensity of threats that imperiled species face. This assessment information can include, but is not limited to: additional biological surveys to refine species distributions; surveys to determine water-quality and habitat threats that may affect listed species; a landscape analysis to determine land cover and land use patterns, SHU watershed characteristics and land cover changes through time; studies to elucidate poorly understood biological

phenomena (reproduction periods, migration routes, breeding habitats, etc.) that are important for managing and recovering species; hydrogeologic studies to determine groundwater characteristics and recharge areas for spring and cave-dwelling species; and biomonitoring studies using multi-metric procedures like the Index of Biotic integrity (IBI) to assess stream biological conditions throughout a SHU for identifying impaired stream reaches.

The next step is to use the assessment data developed during the watershed surveys to identify stream reaches that need protection, management, or restoration. Linking the location of critically imperiled species with threats is a critical part of this process. Linking can only be done by conducting SHU-specific assessment studies. Broad understanding of threats and species distributions is good information but is not sufficient for recovery purposes.

Once threats are linked with species and an action plan for recovery has been developed then species restoration can begin. This takes place through a cooperative partnership of local landowners, organizations, and agencies including watershed partnerships, local and county governments, local businesses and farmers, state and federal agencies, and other interested parties using a variety of means including: protecting stream habitat through land purchase or landowner conservation agreements; management of habitat and water quality by eliminating polluted runoff sources and by reducing pollutant loads through more aggressive best management practice (BMP) implementation; conducting actual riparian improvement or physically restoring a substantially degraded stream reach; and restoration of biodiversity with culture-raised species. The USFWS, ADCNR, and GSA have teamed with the Alabama Clean Water Partnership (ACWP) and other local water stakeholders to implement watershed restoration activities when possible in selected SHUs. This core group of agencies, organizations, and stakeholders, is informally organized into the Alabama Rivers and Streams Network (ARSN) which has a mission to study, manage, and develop our water resources in a scientific and comprehensive way to minimize their degradation, maximize their availability for all users, and restore and recover aquatic species.

STUDY AREA

The Paint Rock River originates in Franklin County, Tennessee, and flows south-southwest until its confluence with the Tennessee River (Wheeler Reservoir) between Guntersville and Huntsville, Alabama. Headwater tributaries are typically high gradient while the main channel near the mouth is sluggish or may have reversed flows at times from river operations in Wheeler Reservoir. The watershed is located in the Jackson County Mountains district of the Cumberland Plateau physiographic section (fig. 2). The Jackson County Mountains district is a high relief plateau characterized by mesa-like mountaintops of sandstone and stream valleys cut into limestone. The Paint Rock Valley has numerous springs, originating from the underlying limestone, which significantly influences natural water-quality conditions in the watershed. Upland tributaries are typically clear, shallow, and dominated by cobble substrates with discharge quickly returning to base flow following storm events. The main channel of the Paint Rock and lower gradient tributaries are dominated by sand-silt-cobble substrates and are generally not as clear as headwater tributaries. Most of the slopes and mountaintops in the watershed are forested while the valley is used for pasture, farmed for corn, soybeans, and cotton, and used for animal production. Nineteen sampling stations were established in the Paint Rock River watershed (fig. 3, table 1) for this survey.

METHODS

Fishes were collected using the GSA 30+2 method ,which is calibrated for use with the Alabama Index of Biotic Integrity (IBI) (O'Neil and others, 2006). The GSA 30+2 method recommends that sampling be stratified over four habitat types (riffles, runs, pools, and shorelines) with a minimum of 10 sampling efforts within each of the riffle, run, and pool habitat types with two additional sampling efforts along stream shorelines. This sampling regime, termed the "30+2" method, has proven to be sufficient to yield a fish community sample acceptable for calculating an IBI in wadeable streams.

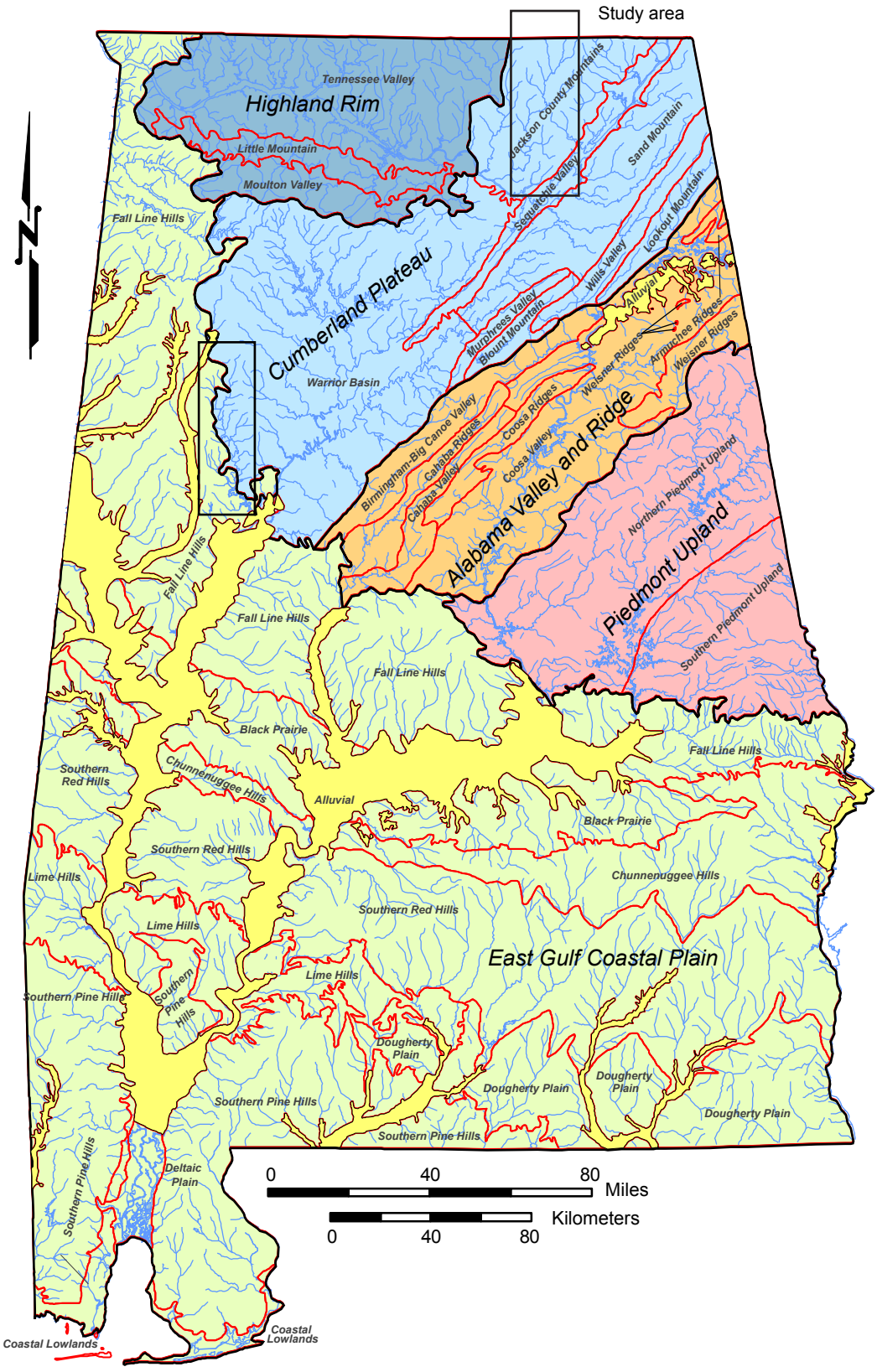


Figure 2. Physiographic map of Alabama.

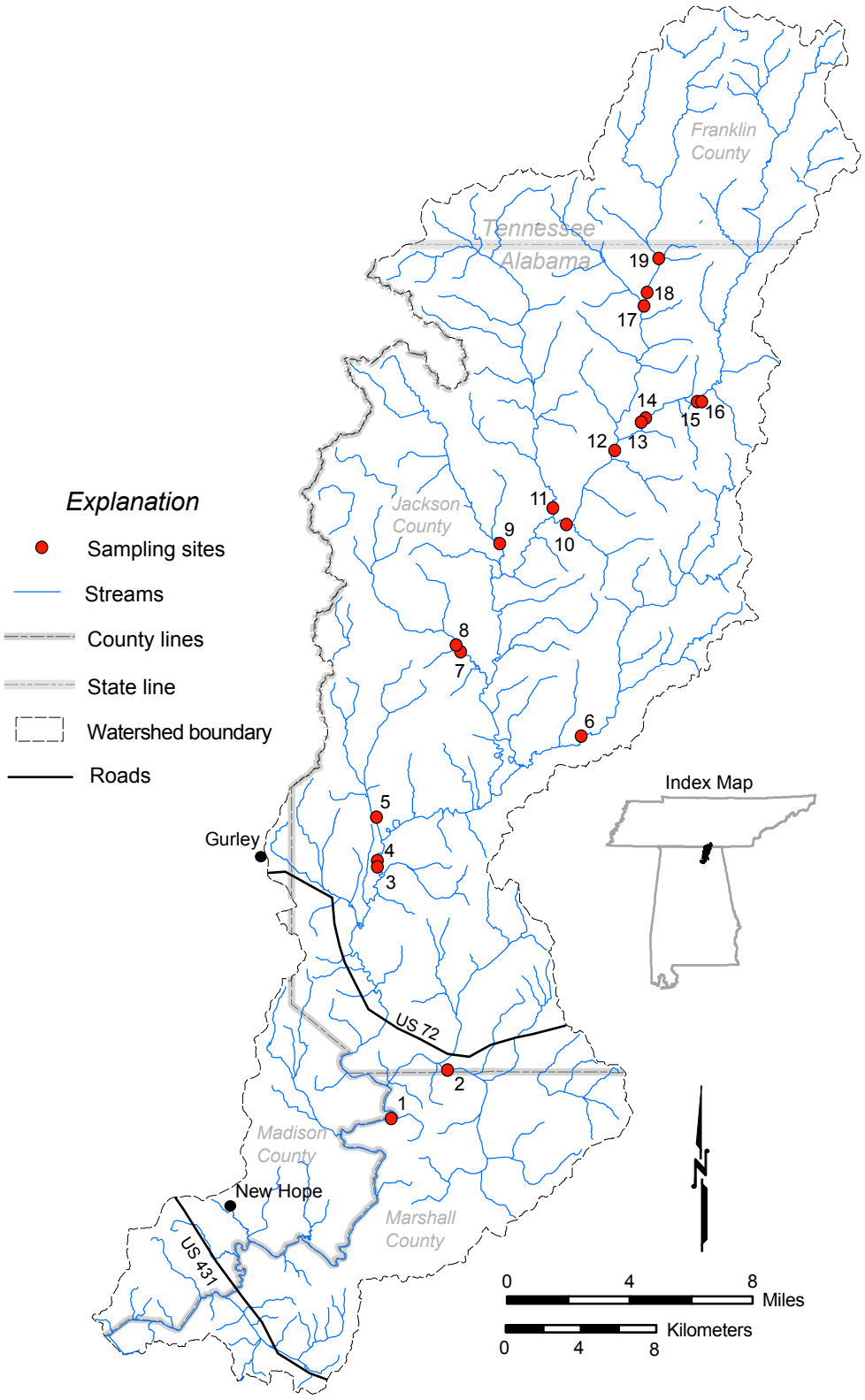


Figure 1. Location map for sampling sites in the Paint Rock River system.

Table 1. Fish sampling stations in the Paint Rock River system, Alabama

Station	County	Latitude	Longitude	section, township, range,	Ecoregion [1]	GSA No.	Sample date	Drainage area (mi^2)
1. Paint Rock River at Butler Mill	Marshall	34.5794	-86.3016	sec. 27, T. 5 S., R. 3 E.	71g	1710	27-Sep-10	387
2. Little Paint Rock at Co. Hwy. 5	Jackson	34.6013	-86.2695	sec. 13, T. 5 S., R. 3 E.	71g	1709	27-Sep-10	35.6
3. Paint Rock River at Jones Crossing, downstream	Jackson	34.6989	-86.3082	sec. 16, T. 4 S., R. 3 E.	71g	1849	29-Sep-10	292
4. Paint Rock River at Jones Crossing, upstream	Jackson	34.7010	-86.3086	sec. 16, T. 4 S., R. 3 E.	71g	1848	29-Sep-10	291
5. Clear Creek at Ala. Hwy. 65	Jackson	34.7223	-86.3079	sec. 30, T. 4 S., R. 3 E.	71g	1847	29-Sep-10	17.5
6. Guess Creek near Co. Hwy. 20 downstream of Blue Spring	Jackson	34.7595	-86.1909	sec. 27, T. 3 S., R. 4 E.	71g	1700	30-Sep-10	27.8
7. Dry Creek downstream of ford	Jackson	34.7992	-86.2621	sec. 12, T. 3 S., R. 3 E.	71g	1703	28-Sep-10	22.2
8. Dry Creek upstream of ford	Jackson	34.8015	-86.2630	sec. 12, T. 3 S., R. 3 E.	71g	1702	28-Sep-10	22.1
9. Lick Fork at Co. Hwy. 540 at Princeton	Jackson	34.8506	-86.2371	sec. 19, T. 2 S., R. 4 E.	71g	1701	30-Sep-10	17.5
10. Paint Rock River at Hellum's property	Jackson	34.8592	-86.1983	sec. 22, T. 2 S., R. 4 E.	68c	1711	30-Sep-10	114
11. Larkin Fork at Ala. Hwy. 65	Jackson	34.8663	-86.2085	sec. 16, T. 2 S., R. 4 E.	68c	1708	30-Sep-10	40.1
12. Paint Rock River at Henshaw Cove	Jackson	34.8926	-86.1736	sec. 2, T. 2 S., R. 4 E.	68c	1896	29-Sep-10	99.8
13. Hurricane Creek at Prince Crossing, downstream	Jackson	34.9084	-86.1541	sec. 36, T. 1 S., R. 4 E.	68c	1706	28-Sep-10	48.5
14. Hurricane Creek at Prince Crossing, upstream	Jackson	34.9084	-86.1541	sec. 36, T. 1 S., R. 4 E.	68c	1707	28-Sep-10	48.4
15. Hurricane Creek at Bell Collins, downstream	Jackson	34.9193	-86.1216	sec. 29, T. 1 S., R. 5 E.	68c	1705	29-Sep-10	42.7
16. Hurricane Creek at Bell Collins, upstream	Jackson	34.9193	-86.1216	sec. 29, T. 1 S., R. 5 E.	68c	1704	29-Sep-10	42.6
17. Estill Fork downstream Co. Hwy. 140	Jackson	34.9633	-86.1537	sec. 12, T. 1 S., R. 4 E.	68c	1897	28-Sep-10	26.7
18. Estill Fork upstream Co. Hwy. 140	Jackson	34.9672	-86.1539	sec. 12, T. 1 S., R. 4 E.	68c	1898	28-Sep-10	26.6
19. Estill Fork at Co. Hwy. 547	Jackson	34.9839	-86.1471	sec. 6, T. 1 S., R. 4 E.	68c	1899	29-Sep-10	22.5

[1] 68c-Plateau Escarpment, 71g-Eastern Highland Rim

Small-mesh minnow seines are used in conjunction with a backpack electroshocker to catch, scoop, or dip stunned fishes and to trap fishes in sloughs and backwaters. At other times, seines are used as the primary gear for capturing fishes in pools and runs and along shoals. Each sampling team had a variety of seine lengths for different size streams. The standard nylon minnow seine used was 10 to 15 feet wide and 6 feet deep with a delta weave of 3/16 inch. An 8-foot-wide seine was sometimes necessary for very narrow streams, while a 15-foot seine was used in larger streams and rivers.

An effective sampling technique was to use the backpack shocker in combination with the seine. In riffles, runs, and glides the seine was set in shallow, rocky areas or deeper, swifter chutes; the backpacker then walked upstream for 15 to 20 feet outside of the area to be sampled and shocked downstream through the habitat, walking toward the seine while disturbing the bottom. Stunned fishes in the water column were washed into the net, while benthic fishes were dislodged from the bottom by kicking the substrate. A variation of this technique involved a crew member walking behind the backpacker and skating his feet from side to side to disturb the bottom and dislodge stunned benthic fishes. Most Paint Rock River microhabitats in riffles and runs were sampled because they are quite often very productive areas. Vegetated shorelines along riffle and shoal margins were usually very productive areas as were areas where stream flow became turbulent when entering or leaving runs and riffles. Plunge pools, where runs and riffles transition to pools, often yielded a diverse catch of species.

Deeper stream runs and glides between pools were also productive and were sampled by either seining downstream or by moving from bank to bank across the stream in a downstream direction with the seine, either alone or following the backpack shocker, trapping fishes against the shore or in a slough at the end of a seine haul. Deep pools with structure were sampled by blocking the downstream end with the seine and working the upstream area for a few minutes with a shocker and dip nets. The shoreline sampling technique consisted of a crew member working the electroshocker in an upstream direction along a shoreline reach for about 150 feet, shocking around all habitat features. The field crew followed closely, scooping the stunned individuals with

dip nets. Distance was measured with a forestry-type hip chain. A minimum of two 150-foot shoreline samples were collected per station.

A rapid habitat assessment was completed for each IBI sample collected. The visual riffle-run assessment procedure used in this study was originally reported in Plafkin and others (1989) and modified by Barbour and others (1999). Stream habitat assessments entail evaluating the structure of the surrounding physical habitat that influences water resource quality and thus the condition of the resident biological community (Barbour and others, 1999). Generally, three habitat characteristics contribute to the maintenance and health of aquatic biological communities: the availability and quality of the habitat-substrate components and instream cover, morphology of the instream channel, and structure of the bank and riparian vegetation zone (Plafkin and others, 1989). Barbour and others (1999) developed two sets of habitat metrics, one for evaluating upland stream habitat dominated by riffle-run microhabitats and hard substrates and the other for evaluating lowland and Coastal Plain streams that are dominated by glide-pool and run-pool habitats with unconsolidated sandy substrates. The 11 habitat metrics of the glide-pool index and 12 metrics of the riffle/run index are individually scored on a scale of 0 (poor quality) to 20 (optimal quality) then summed to give a final score. The maximum possible habitat score is 220 for the glide-pool method and 240 for the riffle-run method. Final habitat scores are sometimes compared to reference streams that are minimally, or least, impaired in the area. Habitat quality is also sometimes taken as a percentage of the maximum habitat score possible as was done for this study.

The biological condition IBIs were calculated using metrics and scoring criteria established in O'Neil and Shepard (2010) for the Tennessee Valley ichthyoregion in Alabama. The Tennessee Valley IBI is comprised of twelve metrics quantifying biodiversity, trophic structure, tolerance/intolerance, and fish health: number of native species, number of shiner species, number of sucker species, number of darter+madtom species, number of intolerant species, proportion of tolerant species, proportion of *Lepomis* species, proportion of invertivores, proportion of omnivores and herbivores, proportion of top carnivores, proportion with DELT+hybrids

(DELT=deformities, eroded fins, lesions, tumors) and number of lithophilic spawning species.

RESULTS AND DISCUSSION

A total of 15,716 individuals in 70 species were collected in the Paint Rock River system from 19 stations (fig. 3) during September 27-30, 2010 (table 2). The Largescale Stoneroller (*Campostoma oligolepis*) was the most abundant species collected with 2,236 individuals (14.23 percent of total catch) followed by the Striped Shiner (*Luxilus chrysocephalus*) with 1,966 individuals (12.51 percent), the Spotfin Shiner (*Cyprinella spiloptera*) with 1,209 individuals (7.69 percent), the Tennessee Darter (*Etheostoma tennesseense*) with 1,045 individuals (6.65 percent), and the Redline Darter (*Etheostoma rufilineatum*) with 929 individuals (5.91 percent) (table 2). The number of species captured at individual stations ranged from 28 (station 6) to 42 (stations 3 and 4). Catch ranged from 484 individuals (station 6) to 1,163 individuals (station 12). The IBI ranged from 44-*Good* (station 2) to 54-*Excellent* (stations 13 and 15). Twelve of the 19 stations (63percent) scored *Excellent* biological condition while 7 stations (27percent) scored *Good* biological condition (table 3).

Four species of highest (P1) to high (P2) conservation concern in Alabama were collected in the Paint Rock River system: the Palezone Shiner (*Notropis albizonatus*) [P1, endangered USFWS] with 26 individuals found at three stations (12, 13, 14); the Snail Darter (*Percina tanasi*) [P1, threatened USFWS] with 21 individuals found at two stations (3, 4); the Blotchside Logperch (*Percina burtoni*) [P1] with 16 individuals found at eight stations (5, 10, 12, 13, 14, 15, 17, 18); and the Streamline Chub *(Erimystax dissimilis*) [P2], with 29 individuals found at four stations (1, 3, 4, 13). Two other species of uncommon occurrence in Alabama and ranked as species of moderate conservation concern were the Blotched Chub (*Erimystax insignis*) [P3] with 155 individuals found at five stations (1, 3, 4, 10, 12), and the undescribed “Sawfin Shiner” (*Notropis sp.* cf. *spectrunculus*) [P3] with 29 individuals found at eight stations (10, 11, 12, 13, 14, 15, 16, 19).

Table 2. List of fishes collected in the Paint Rock River system, Alabama, September 2010.

Species	Station no.						
	1	2	3	4	5	6	7
Lepisosteidae-gars							
Lepisosteus osseus	--	--	--	1	--	--	--
Amiidae-bowfins							
Amia calva	--	1	--	--	--	--	--
Clupeidae-shads							
Dorosoma cepedianum	3	--	--	4	--	--	--
Cyprinidae-minnows and carps							
Campostoma oligolepis	221	68	617	177	87	3	32
Cyprinella galactura	--	--	--	--	--	--	--
Cyprinella spiloptera	101	10	738	305	16	--	1
Erimystax dissimilis	2	--	4	22	--	--	--
Erimystax insignis	39	--	92	20	--	--	--
Hemitremia flammea	--	--	--	--	18	15	2
Hybopsis amblops	26	67	48	71	168	--	7
Luxilus chrysocephalus	1	2	47	21	77	17	227
Lythrurus fasciolaris	--	13	1	--	95	3	196
Lythrurus lirus	6	5	1	2	--	24	111
Notemigonus crysoleucas	1	--	--	2	--	--	--
Notropis albizonatus	--	--	--	--	--	--	--
Notropis boops	1	2	1	1	--	--	--
Notropis leuciodus	--	--	--	--	--	--	--
Notropis telescopus	--	2	9	--	--	9	11
Notropis volucellus	40	2	2	57	--	--	--
Notropis sp. cf. *spectrunculus*	--	--	--	--	--	--	--
Pimephales notatus	1	44	3	7	124	2	20
Pimephales promelas	--	--	--	--	--	--	--
Pimephales vigilax	2	--	--	2	--	--	--
Rhinichthys atratulus	--	--	--	--	24	175	--
Semotilus atromaculatus	--	--	--	--	--	6	18
Catostomidae-suckers							
Catostomus commersoni	--	--	--	--	--	3	--
Hypentelium nigricans	16	7	80	13	28	3	12
Minytrema melanops	--	--	2	--	--	3	--
Moxostoma anisurum	1	--	1	--	--	--	--
Moxostoma breviceps	--	--	--	1	--	--	--
Moxostoma duquesnei	--	1	--	--	--	--	6
Moxostoma erythrurum	1	--	1	8	3	--	19
Ictaluridae - North American catfishes							
Ameiurus natalis	--	--	--	--	--	--	3
Ictalurus punctatus	--	1	--	--	--	--	--
Pylodictis olivaris	--	--	1	--	--	--	--
Atherinopsidae - new world silversides							
Labidesthes sicculus	11	9	25	45	3	--	--

Table 2. List of fishes collected in the Paint Rock River system, Alabama, September 2010.

Species	Station no.						
	1	2	3	4	5	6	7
Fundulidae-topminnows							
Fundulus catenatus	--	--	4	1	13	--	7
Fundulus notatus	2	3	8	25	5	--	--
Fundulus olivaceus	9	4	2	--	6	3	23
Poeciliidae-livebearers							
Gambusia affinis	2	8	4	16	7	1	12
Cottidae-sculpins							
Cottus bairdi	--	--	--	--	--	38	--
Cottus carolinae	2	14	--	--	41	26	2
Centrarchidae-sunfishes							
Ambloplites rupestris	4	1	4	2	1	7	3
Lepomis auritus	10	33	1	1	1	5	24
Lepomis cyanellus	7	22	--	1	2	6	--
Lepomis gulosus	--	1	--	1	--	--	1
Lepomis macrochirus	27	20	7	5	1	--	33
Lepomis megalotis	26	16	59	55	27	1	33
Lepomis microlophus	5	--	--	2	--	--	--
Lepomis miniatus	1	1	--	2	1	--	--
Micropterus dolomieu	--	--	--	--	--	--	--
Micropterus punctulatus	3	1	2	2	1	--	2
Micropterus salmoides	2	--	1	5	1	--	--
Pomoxis nigromaculatus	2	--	--	--	--	--	--
hybrid centrarchid	1	1	--	--	--	--	--
Percidae-perches and darters							
Etheostoma blennioides	73	7	52	41	5	6	1
Etheostoma caeruleum	--	1	20	8	26	5	4
Etheostoma duryi	2	14	3	--	19	63	7
Etheostoma flabellare	--	--	--	--	--	--	4
Etheostoma jessiae	3	--	54	25	27	1	16
Etheostoma kennicotti	--	16	5	3	28	31	9
Etheostoma nigripinne	1	10	6	--	2	--	--
Etheostoma nigrum	--	3	1	4	30	23	--
Etheostoma rufilineatum	155	33	265	39	16	--	2
Etheostoma tennesseense	11	16	126	87	55	4	13
Etheostoma zonale	14	9	41	13	--	--	--
Percina burtoni	--	--	--	--	1	--	--
Percina caprodes	23	1	27	5	8	1	5
Percina sciera	5	--	27	5	1	--	--
Percina tanasi	--	--	20	1	--	--	--
Sciaenidae-drums							
Aplodinotus grunniens	1	--	1	--	--	--	--
Catch	864	469	2,413	1,108	968	484	866
Total species	41	37	42	42	36	28	33

Table 2. List of fishes collected in the Paint Rock River system, Alabama, September 2010.

Species	Station no.						
	8	9	10	11	12	13	14
Lepisosteidae-gars							
Lepisosteus osseus	--	--	--	--	--	--	--
Amiidae-bowfins							
Amia calva	--	--	--	--	--	--	--
Clupeidae-shads							
Dorosoma cepedianum	--	--	--	--	--	--	--
Cyprinidae-minnows and carps							
Campostoma oligolepis	86	70	49	68	260	107	105
Cyprinella galactura	--	--	1	1	4	9	2
Cyprinella spiloptera	--	--	2	8	15	5	--
Erimystax dissimilis	--	--	--	--	--	1	--
Erimystax insignis	--	--	2	--	2	--	--
Hemitremia flammea	8	2	1	--	1	4	--
Hybopsis amblops	2	1	9	4	5	9	2
Luxilus chrysocephalus	116	79	119	191	74	218	260
Lythrurus fasciolaris	44	40	73	137	2	47	7
Lythrurus lirus	11	6	2	2	113	27	10
Notemigonus crysoleucas	--	--	--	--	--	--	--
Notropis albizonatus	--	--	--	--	2	2	20
Notropis boops	--	--	5	4	25	--	27
Notropis leuciodus	--	1	26	5	--	4	--
Notropis telescopus	5	53	89	18	102	91	55
Notropis volucellus	--	--	12	2	--	3	2
Notropis sp. cf. *spectrunculus*	--	--	10	6	2	2	5
Pimephales notatus	12	21	2	11	12	10	19
Pimephales promelas	--	3	--	--	--	--	--
Pimephales vigilax	--	--	--	--	--	--	--
Rhinichthys atratulus	5	6	--	--	2	--	--
Semotilus atromaculatus	3	2	2	1	--	--	--
Catostomidae-suckers							
Catostomus commersoni	2	--	--	--	--	--	--
Hypentelium nigricans	26	11	56	11	38	66	35
Minytrema melanops	--	--	--	--	--	--	--
Moxostoma anisurum	--	--	--	--	--	2	--
Moxostoma breviceps	--	--	--	--	--	--	--
Moxostoma duquesnei	20	--	--	3	--	--	--
Moxostoma erythrurum	16	--	--	4	--	2	5
Ictaluridae - North American catfishes							
Ameiurus natalis	--	--	--	--	--	--	--
Ictalurus punctatus	--	--	--	--	--	--	--
Pylodictis olivaris	--	--	--	--	--	--	--
Atherinopsidae - new world silversides							
Labidesthes sicculus	--	--	--	--	--	--	--

Table 2. List of fishes collected in the Paint Rock River system, Alabama, September 2010.

Species	Station no.						
	8	9	10	11	12	13	14
Fundulidae-topminnows							
Fundulus catenatus	28	9	8	9	--	7	3
Fundulus notatus	--	--	--	--	--	4	--
Fundulus olivaceus	4	21	11	11	6	--	--
Poeciliidae-livebearers							
Gambusia affinis	17	13	--	8	7	1	2
Cottidae-sculpins							
Cottus bairdi	--	--	--	--	--	--	--
Cottus carolinae	29	25	11	12	65	23	8
Centrarchidae-sunfishes							
Ambloplites rupestris	1	12	1	3	4	2	2
Lepomis auritus	3	9	1	12	2	2	6
Lepomis cyanellus	4	7	--	--	4	--	3
Lepomis gulosus	--	--	--	1	--	1	--
Lepomis macrochirus	23	9	--	3	24	3	4
Lepomis megalotis	21	52	37	18	23	22	45
Lepomis microlophus	--	--	--	1	--	--	--
Lepomis miniatus	--	4	--	--	--	1	--
Micropterus dolomieu	--	1	--	--	--	--	2
Micropterus punctulatus	4	3	2	3	--	1	--
Micropterus salmoides	--	--	--	--	--	--	--
Pomoxis nigromaculatus	--	--	--	--	--	--	--
hybrid centrarchid	--	--	--	--	--	--	1
Percidae-perches and darters							
Etheostoma blennioides	--	1	41	--	25	25	7
Etheostoma caeruleum	16	10	4	12	8	2	--
Etheostoma duryi	22	18	77	34	13	--	--
Etheostoma flabellare	--	21	--	--	18	10	5
Etheostoma jessiae	43	1	24	41	24	26	27
Etheostoma kennicotti	33	15	1	5	13	14	17
Etheostoma nigripinne	--	--	--	--	--	--	3
Etheostoma nigrum	--	4	--	--	--	9	5
Etheostoma rufilineatum	6	9	60	25	133	79	21
Etheostoma tennesseense	31	35	131	67	114	69	92
Etheostoma zonale	--	--	37	2	17	2	2
Percina burtoni	--	--	1	--	2	4	2
Percina caprodes	--	1	--	--	2	--	2
Percina sciera	--	--	--	--	--	--	--
Percina tanasi	--	--	--	--	--	--	--
Sciaenidae-drums							
Aplodinotus grunniens	--	--	--	--	--	--	--
Catch	641	575	907	743	1,163	916	813
Total species	30	35	33	35	35	39	34

Table 2. List of fishes collected in the Paint Rock River system, Alabama, September 2010.

Species	Station no.					Total
	15	16	17	18	19	
Lepisosteidae-gars						
Lepisosteus osseus	--	--	--	--	--	1
Amiidae-bowfins						
Amia calva	--	--	--	--	--	1
Clupeidae-shads						
Dorosoma cepedianum	--	--	--	--	--	7
Cyprinidae-minnows and carps						
Campostoma oligolepis	134	76	25	45	6	2,236
Cyprinella galactura	1	1	--	--	--	19
Cyprinella spiloptera	--	--	--	--	8	1,209
Erimystax dissimilis	--	--	--	--	--	29
Erimystax insignis	--	--	--	--	--	155
Hemitremia flammea	5	--	--	--	--	56
Hybopsis amblops	2	2	--	6	44	473
Luxilus chrysocephalus	119	175	64	90	69	1,966
Lythrurus fasciolaris	48	91	20	46	30	893
Lythrurus lirus	33	25	35	5	21	439
Notemigonus crysoleucas	--	--	--	--	--	3
Notropis albizonatus	--	--	--	--	2	26
Notropis boops	42	--	24	4	4	140
Notropis leuciodus	3	7	--	2	8	56
Notropis telescopus	50	6	31	18	13	562
Notropis volucellus	1	3	--	--	--	124
Notropis sp. cf. *spectrunculus*	1	2	--	--	1	29
Pimephales notatus	2	9	36	9	11	355
Pimephales promelas	--	--	--	--	--	3
Pimephales vigilax	--	--	--	--	--	4
Rhinichthys atratulus	--	--	--	--	--	212
Semotilus atromaculatus	--	--	--	--	--	32
Catostomidae-suckers						
Catostomus commersoni	--	--	--	--	--	5
Hypentelium nigricans	28	3	11	5	11	460
Minytrema melanops	--	--	--	--	--	5
Moxostoma anisurum	--	--	--	--	--	4
Moxostoma breviceps	--	--	--	--	--	1
Moxostoma duquesnei	2	2	1	--	--	35
Moxostoma erythrurum	--	4	--	1	4	68
Ictaluridae - North American catfishes						
Ameiurus natalis	1	1	--	--	--	5
Ictalurus punctatus	--	--	--	--	--	1
Pylodictis olivaris	--	--	--	--	--	1
Atherinopsidae - new world silversides						
Labidesthes sicculus	1	--	1	--	--	95

Table 2. List of fishes collected in the Paint Rock River system, Alabama, September 2010.

Species	Station no.					Total
	15	16	17	18	19	
Fundulidae-topminnows						
Fundulus catenatus	16	--	3	19	9	136
Fundulus notatus	--	--	8	4	2	61
Fundulus olivaceus	6	9	17	12	7	151
Poeciliidae-livebearers						
Gambusia affinis	4	5	--	--	--	107
Cottidae-sculpins						
Cottus bairdi	--	--	--	--	--	38
Cottus carolinae	37	19	11	16	17	358
Centrarchidae-sunfishes						
Ambloplites rupestris	33	--	5	2	9	96
Lepomis auritus	13	8	14	8	25	178
Lepomis cyanellus	--	--	2	--	1	59
Lepomis gulosus	--	2	--	--	--	7
Lepomis macrochirus	17	6	34	27	16	259
Lepomis megalotis	26	13	35	38	22	569
Lepomis microlophus	--	--	1	--	4	13
Lepomis miniatus	--	--	--	--	--	10
Micropterus dolomieu	4	--	1	--	--	8
Micropterus punctulatus	--	--	2	1	3	30
Micropterus salmoides	--	--	--	--	--	9
Pomoxis nigromaculatus	1	--	--	--	--	3
hybrid centrarchid	--	--	--	--	--	3
Percidae-perches and darters						
Etheostoma blennioides	22	4	13	--	--	323
Etheostoma caeruleum	1	--	9	9	12	147
Etheostoma duryi	3	10	3	6	14	308
Etheostoma flabellare	24	9	7	5	--	103
Etheostoma jessiae	22	25	5	2	4	370
Etheostoma kennicotti	4	16	21	13	18	262
Etheostoma nigripinne	--	--	--	3	5	30
Etheostoma nigrum	--	--	--	11	10	100
Etheostoma rufilineatum	47	13	11	6	9	929
Etheostoma tennesseense	75	34	41	18	26	1,045
Etheostoma zonale	--	--	--	1	3	141
Percina burtoni	3	--	2	1	--	16
Percina caprodes	1	--	--	--	--	76
Percina sciera	--	--	--	--	--	38
Percina tanasi	--	--	--	--	--	21
Sciaenidae-drums						
Aplodinotus grunniens	--	--	--	--	--	2
Catch	832	580	493	433	448	15,716
Total species	37	29	31	31	34	70

Table 3. Habitat and IBI scores for stations in the Paint Rock River system, Alabama, September 2010.

	Station no.						
	1	2	3	4	5	6	7
	Habitat metric scores						
Instream cover	16	16	18	14	12	16	8
Epifaunal surface condition	16	11	14	9	8	15	4
Embeddedness	14	11	15	15	16	14	8
Velocity/depth regimes	17	13	16	13	10	16	2
Man-Made Channel Alteration	16	13	15	15	12	14	17
Sediment deposition	13	9	10	15	15	15	8
Riffle frequency	15	15	17	10	8	16	0
Channel status	14	15	14	19	17	14	10
Bank condition	14	10	8	14	14	16	10
Bank vegetative protection	12	12	11	14	16	13	12
Disruptive pressure	14	16	16	14	16	13	11
Riparian vegetative cover	13	16	11	15	8	12	12
Total habitat score	174	157	165	167	152	174	102
Percent of maximum habitat score	72.5	65.42	68.75	69.58	63.33	72.5	42.5
	IBI metric values						
1. Total native species	41	37	42	42	36	28	33
2. Number shiner species	6	7	7	6	3	4	5
3. Number sucker species	3	2	4	3	2	3	3
4. Number of darter+madtom species	9	10	13	11	12	8	9
5. Number of intolerant species	4	3	4	4	1	1	2
6. Percent of tolerant species	5.09	20.47	2.61	5.32	24.28	43.39	36.14
7. Percent *Lepomis*	8.8	19.83	2.78	6.05	3.31	2.48	10.51
8. Percent invertivores	10.65	18.12	4.27	10.83	7.54	6.2	16.97
9. Percent omnivores	25.93	23.88	25.69	16.79	21.8	1.03	6
10. Percent top carnivores	1.04	0.64	0.33	0.9	0.31	1.45	0.58
11. Percent DELT+hybrids	0.12	0.21	0	0	0	0	0
12. Number of lithophilic spawners	22	20	24	25	21	19	21
	IBI metric scores						
1. Total native species	5	5	5	5	5	5	5
2. Number shiner species	3	5	5	3	3	3	5
3. Number sucker species	3	3	5	3	3	5	5
4. Number of darter+madtom species	3	5	5	5	5	5	5
5. Number of intolerant species	5	5	5	5	3	3	5
6. Percent of tolerant species	5	3	5	5	3	1	1
7. Percent Lepomis	5	3	5	5	5	5	3
8. Percent invertivores	5	3	5	5	5	5	3
9. Percent omnivores	3	3	3	3	3	5	5
10. Percent top carnivores	3	1	1	3	1	3	1
11. Percent DELT+hybrids	5	3	5	5	5	5	5
12. Number of lithophilic spawners	3	5	3	5	5	5	5
IBI score	48	44	52	52	46	50	48
Biological condition [1]	Good	Good	Excellent	Excellent	Good	Excellent	Good

[1] Very poor <=21, Poor 22-28, Fair 29-40, Good 41-49, Excellent >=50

Table 3. Habitat and IBI scores for stations in the Paint Rock River system, Alabama, September 2010.

	Station no.						
	8	9	10	11	12	13	14
	Habitat metric scores						
Instream cover	10	15	12	12	16	18	13
Epifaunal surface condition	5	16	11	10	17	13	12
Embeddedness	8	15	13	12	16	17	16
Velocity/depth regimes	3	16	18	8	17	14	11
Man-Made Channel Alteration	17	16	14	16	16	15	17
Sediment deposition	8	16	11	13	16	15	16
Riffle frequency	1	15	3	9	16	13	10
Channel status	10	14	14	11	17	18	17
Bank condition	10	13	10	14	16	16	12
Bank vegetative protection	12	13	15	16	19	16	12
Disruptive pressure	12	13	12	16	14	18	16
Riparian vegetative cover	12	13	12	16	17	16	15
Total habitat score	108	175	145	153	197	189	167
Percent of maximum habitat score	45	72.92	60.42	63.75	82.08	78.75	69.58
	IBI metric values						
1. Total native species	30	34	33	35	35	39	34
2. Number shiner species	4	5	10	10	9	10	9
3. Number sucker species	4	1	1	3	1	3	2
4. Number of darter+madtom species	6	10	9	7	11	10	11
5. Number of intolerant species	2	3	5	5	5	6	5
6. Percent of tolerant species	28.08	24.35	13.56	28.8	10.58	25.33	35.42
7. Percent *Lepomis*	7.96	14.09	4.19	4.71	4.56	3.17	7.13
8. Percent invertivores	19.5	18.43	6.39	8.21	4.82	4.69	7.75
9. Percent omnivores	15.29	16.35	5.62	10.63	23.39	12.77	15.25
10. Percent top carnivores	0.78	2.78	0.33	0.81	0.34	0.33	0.49
11. Percent DELT+hybrids	0	0	0	0	0	0	0.12
12. Number of lithophilic spawners	22	23	21	24	23	25	23
	IBI metric scores						
1. Total native species	5	5	5	5	5	5	5
2. Number shiner species	3	5	5	5	5	5	5
3. Number sucker species	5	3	1	5	1	5	3
4. Number of darter+madtom species	3	5	3	3	5	5	5
5. Number of intolerant species	5	5	5	5	5	5	5
6. Percent of tolerant species	3	3	5	3	5	3	1
7. Percent Lepomis	5	3	5	5	5	5	5
8. Percent invertivores	3	3	5	5	5	5	5
9. Percent omnivores	3	3	5	5	3	5	3
10. Percent top carnivores	3	5	1	3	1	1	1
11. Percent DELT+hybrids	5	5	5	5	5	5	5
12. Number of lithophilic spawners	5	5	5	5	5	5	5
IBI score	48	50	50	54	50	54	48
Biological condition [1]	Good	Excellent	Excellent	Excellent	Excellent	Excellent	Good

[1] Very poor <=21, Poor 22-28, Fair 29-40, Good 41-49, Excellent >=50

Table 3. Habitat and IBI scores for stations in the Paint Rock River system, Alabama, September 2010.

	Station no.				
	15	16	17	18	19
	Habitat metric scores				
Instream cover	13	15	16	19	18
Epifaunal surface condition	13	6	15	18	17
Embeddedness	11	13	14	18	16
Velocity/depth regimes	11	3	15	18	17
Man-Made Channel Alteration	18	18	15	17	16
Sediment deposition	13	11	14	17	16
Riffle frequency	11	1	13	16	14
Channel status	10	13	16	18	16
Bank condition	11	12	16	18	16
Bank vegetative protection	12	9	13	17	15
Disruptive pressure	16	10	13	17	15
Riparian vegetative cover	16	11	13	17	15
Total habitat score	155	122	173	210	191
Percent of maximum habitat score	64.58	50.83	72.08	87.5	79.58
	IBI metric values				
1. Total native species	37	29	31	31	34
2. Number shiner species	9	8	5	6	9
3. Number sucker species	2	3	2	2	2
4. Number of darter+madtom species	10	7	9	11	9
5. Number of intolerant species	5	4	2	4	6
6. Percent of tolerant species	17.19	33.79	27.59	29.1	21.65
7. Percent *Lepomis*	6.73	5	17.44	16.86	15.18
8. Percent invertivores	10.34	7.24	21.5	24.25	19.42
9. Percent omnivores	16.35	14.66	12.37	12.47	3.79
10. Percent top carnivores	4.45	0	1.62	0.69	2.68
11. Percent DELT+hybrids	0	0	0	0	0
12. Number of lithophilic spawners	23	18	21	20	23
	IBI metric scores				
1. Total native species	5	5	5	5	5
2. Number shiner species	5	5	5	5	5
3. Number sucker species	3	5	3	3	3
4. Number of darter+madtom species	5	3	5	5	5
5. Number of intolerant species	5	5	5	5	5
6. Percent of tolerant species	3	3	3	3	3
7. Percent Lepomis	5	5	3	3	3
8. Percent invertivores	5	5	3	3	3
9. Percent omnivores	3	5	5	5	5
10. Percent top carnivores	5	1	3	1	5
11. Percent DELT+hybrids	5	5	5	5	5
12. Number of lithophilic spawners	5	5	5	5	5
IBI score	54	52	50	48	52
Biological condition [1]	Excellent	Excellent	Excellent	Good	Excellent

[1] Very poor <=21, Poor 22-28, Fair 29-40, Good 41-49, Excellent >=50

The relatively high fish biodiversity and biological condition scores observed in this study is indicative of a highly functional watershed supportive of diverse aquatic biological communities. Paint Rock River, particularly the middle and upper reaches, remains one of Alabama's premier conservation areas for the protection and preservation of freshwater aquatic fauna and is considered a refuge for aquatic biodiversity in the Tennessee River drainage. The Paint Rock River is also useful as a reference for monitoring long-term water quality and biological conditions as affected by changing land use patterns in the region and for monitoring the hydrological and biological uncertainties associated with changing climate patterns.

Zoogeographical factors that contribute to the Paint Rock's unique biology include the watersheds geographic location in the Tennessee River drainage, relatively unaltered stream hydrology and high level of connectivity between tributaries and the main channel, and low pollutant levels due to its isolation in the Jackson County Mountains. Nonpoint source pollution and habitat degradation is, however, occurring in the valley and does have some affect on the Paint Rock's unique character. Godwin (1995) noted that lack of riparian vegetation was common along the main channel while tributaries typically had more canopy cover. Localized stream degradation due to poor land management practices was also affecting habitat, as observed in some of the habitat scores for the present study, but the degree to which this is true throughout the watershed is unknown.

Previous studies found nonpoint source pollutants contributing to water quality impairment and potentially threatening biological diversity (Ahlstedt 1991, Godwin 1995, O’Neil and Mettee 1997). O'Neil and Mettee (1997) noted that certain streams in the Paint Rock had water quality issues during the low-flow sampling period. One problem identified was eutrophication mitigated by elevated concentrations of nutrients, warm temperatures, and lack of stream flow. They reported that ammonia was elevated at Lick, Dry, Tremble, and Hurricane Creeks, nitrate was elevated at Cole Spring Branch, Tremble Creek, and upper Larkin Fork, while phosphorus was elevated at three of the five main channel sites. Carlson's trophic state index (TSI) indicated that all main channel sites were eutrophic as well as the tributary sites Little Paint Rock Creek, Pond

Creek, Cole Spring Branch, and Clear Creek. Many tributaries in the middle and lower reaches of the watershed, including the main channel, had relatively dense algal growths on the substrate. The upper tributaries Larkin and Estill Forks, Hurricane Creek, Dry Creek, Lick Fork, and Guess Creek were clear and scored oligotrophic according to the TSI. A more in-depth water-quality study by the Alabama Department of Environmental Management (ADEM 2000) in the Paint Rock corroborated these facts that nonpoint source pollutants were contributing to nutrient enrichment and other water-quality degradation in the watershed.

It is interesting to note that although water quality and habitat degradation were documented in the system almost 20 years ago, all of the sites sampled in 2010 rated in the *Good* to *Excellent* IBI condition. The observations of this study may also testify to the resilience of aquatic communities to the documented stressors and(or) that the stressors themselves may not have reached critical levels to initiate widespread biological degradation. Whatever the cause, these results may provide evidence that 15 years of conservation activities in the Paint Rock are having positive results and that conservation practices should be continued and perhaps expanded. Continued implementation of best management practices to reduce the water quality impacts of animal production and agriculture will have lasting benefits to the native aquatic fauna and ensure their continued success in the watershed.

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