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A Survey of the Fishes in Streams Draining the Jack Mountain Area, Hot Spring and Garland Counties, Arkansas, with Notes on the Ouachita Madtom (*Noturus lachneri*)

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Introduction

The Ross Foundation, which manages timber resources on certain lands in southwestern Arkansas, recently acquired approximately 27,000 acres of land in the Jack Mountain area of Hot Spring and Garland counties. The elevated terrain is drained to the north, south, and east by several isolated creeks. Little was known of the fishes that inhabit these streams, and the nature of forest management will determine the fish species that continue to exist in them. Much of the area has been gated to limit access, and the primary effect on ichthyofaunal diversity will be restricted to forest development and harvest.

Loss of canopy and substrate alterations have been associated with declines in fish populations (Ebert and Filipek, 1988; Sewell, 1981). Ouachita Mountains region streams are dominated by fish habitat provided by substrate (Keith, 1987), and many fish species are intolerant of changes in water quality or habitat (Jester et al., 1992). Therefore, a detailed survey of fishes and habitats occurring in the various drainages of the Jack Mountain area was undertaken to provide baseline data on the species composition and relative abundance of fishes. These data, compared with future evaluations of the sites, can be used in planning forest resource management and utilization strategies.

The drainages surveyed provide water to two rivers (Ouachita and Caddo) and three lakes (DeGray, Catherine, and Hamilton). Lands controlled by the Ross Foundation typically contain only the upper reaches of most of the drainage systems; therefore, lake effects should have a minimal contribution to species composition.

Study Area

Foundation-owned sites were examined on several drainages in the Jack Mountain area. Blakely Creek drains southern slopes eastward and enters the Ouachita River about 9.5 km south of Lake Catherine. Prairie Bayou

drains southern slopes eastward and enters the Ouachita River about 13 km south of Lake Catherine. This watershed includes Sanders Creek and Curl Creek and drains the largest portion of the central Jack Mountain area. Mount Carmel Creek drains the northcentral slopes of Foundation lands into Lake Hamilton on the Ouachita River. Cooper Creek drains northeastern slopes into the Ouachita River between Lakes Hamilton and Catherine. Only the extreme northern headwaters of DeRoche Creek were part of the study area, draining some southern slopes on the western side of Jack Mountain southward and eventually into the Ouachita River near Caddo Valley. Part of the headwater reaches of Fourche a'Loupe Creek occurs on Foundation lands in the western Jack Mountain area. This creek drains water from northern slopes of the area into Lake Hamilton.

Big Hill Creek drains southern slopes in the western parts of Jack Mountain southward into DeGray Lake (Caddo River). Valley Creek drains the southern slopes of the far western reaches of Foundation lands southward into DeGray Lake (Caddo River). Only the headwater reaches of Valley Creek and one of its major tributaries occur on Foundation lands.

Cooper Creek occurs in Garland County, all other watersheds are located in Hot Spring County. Specific sample locations are described below and illustrated in Figure 1.

Cooper Creek: site C1 - tributary on access road near jct. of Hwys. 290 and 171, NW1/4 S5 T4S R18W; site C2 - along access road near jct. of Hwys. 290 and 171, boarder between S5 and S6 T4S R18W; site C3 - at low water bridge, SE1/4 S6 T4S R18W; site C4 - access road crossing, SE1/4 S6 T4S R18W.

Mount Carmel Creek: Site MC1 - along Hwy 128, NE1/4 S17 T4S R19W; site MC2 - at Hwy 128 bridge and along access road, SE1/4 S17 T4S R19W.

Sanders Creek (trib. to Prairie Bayou): site S1 - Hwy 128 bridge, NE1/4 S33 T4S R19W; site S2 - on Files Ranch Road 1.6 Km W of Hwy 128, central S20 T4S R19W.

Prairie Bayou: site PB1 - tributary on Files Ranch Road, 3.2 Km W of Hwy 128, SE1/4 S19 T4S R19W; site

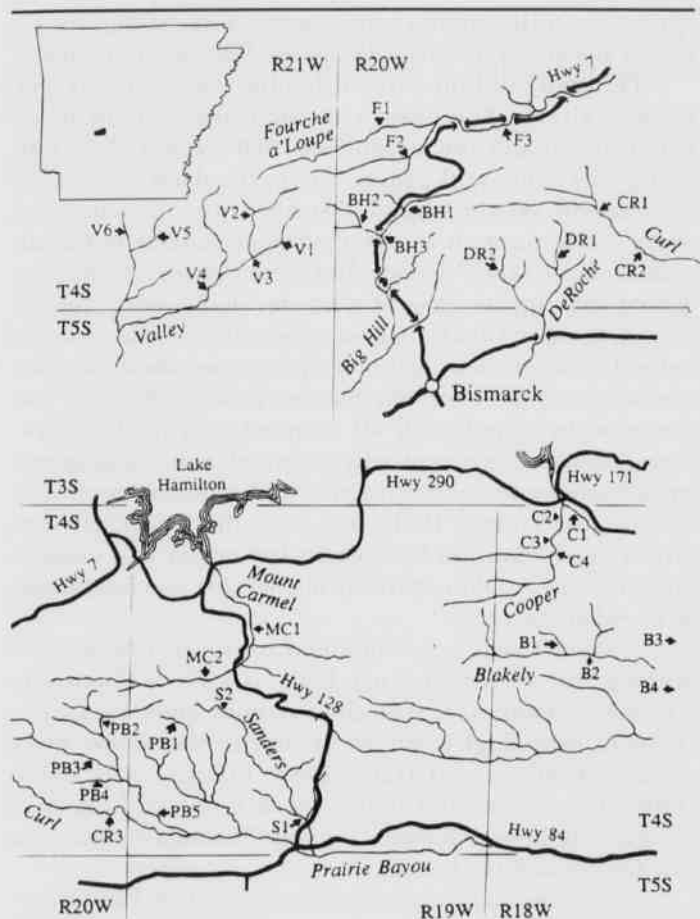


Fig. 1. Sampling sites in the western (upper) and eastern (lower) part of Ross Foundation lands in the Jack Mountain area. Legal descriptions of sites provided in text.

PB2 - tributary about 4.8 Km W of Hwy 128 off Files Ranch Road, Tisdale Gorge, SE1/4 S24 T4S R20W; site PB3 - tributary 4.8 Km W of Hwy 128 on Files Ranch Road and 1.6 Km S on access road; central S25 T4S R20W; site PB4 - tributary 5.2 Km W of Hwy 128 on Land Camp Road and 0.8 Km N on access road, south-central S25 T4S R20W; site PB5 - at Land Camp Road 3.6 Km W of Hwy 128, central S31 T4S R19W (sampled also off southbound access road in S32).

Curl Creek (trib. to Prairie Bayou): site CR1 - intersection of Dishroom Drive and Turkey Trail Road, east-central S27 T4S R20W; site CR2 - 6.4 Km W of Hwy 128 on Land Camp Road, north-central S25 T4S R20W; site CR3 - about 5.2 Km W of Hwy 128 on Land Camp Road, NE1/4 S36 T4S R20W (sampled 3 locations - 1 just off access road S of Land Camp Road and 2 where Curl Creek crosses Land Camp Road).

Fourche a'Loupe Creek: site F1 - across Baker Hollow Road, north-central S19 T4S R20W; site F2 - tributary

across Needles Eye Road, central between S19 and S20 T4S R20W; site F3 - along Hwy 7, NW1/4 S21 T4S R20W.

Valley Creek: site V1 - tributary SW1/4 S25 T4S R21W; site V2 - tributary NE1/4 S26 T4S R21W; site V3 - tributary NE1/4 S35 T4S R21W; site V4 - tributary at bridge crossing on N-S facing road, SW1/4 S35 T4S R21W; site V5 - tributary at bridge crossing near Old Needles Eye Road, SW1/4 S27 T4S R21W; site V6 - upper reaches of Valley Creek, SE1/4 S28 T4S R21W.

Blakely Creek: site B1 - tributary 0.8 Km S of O'Neal Trail, west central S17 T4S R18W; site B2 - tributary 0.8 Km S and 0.8 Km E of O'Neal Trail along access road, central S17 T4S R18W; site B3 - tributary SW1/4 S15 T4S R18W; site B4 - tributary, south central S15 T4S R18W.

DeRoche Creek: site DR1 - headwaters along Land Camp Road, NW1/4 S34 T4S R20W; site DR2 - headwaters along Land Camp Road, central S33 T4S R20W.

Big Hill Creek: site BH1 - Tower Road, east-central S30 T4S R20W; site BH2 - tributary off Section 25 Tram, SE1/4 S30 T4S R20W; site BH3 - off Hwy 7 near Section 25 Tram, SE1/4 S30 T4S R20W.

Materials and Methods

Sites were sampled in an hierarchical manner during July through September 1995. First, fish species and abundances were evaluated by observation. This allowed an accounting for the visible presence and abundance of certain species that may be less susceptible to seining techniques. Drag seining, in which the seine was pulled through the stream (most often in pools) to isolate fish and force them to rush into the net, was performed next. Subsequently, we kick-seined by placing the seine downstream of the area to be sampled, set the lead line, then stirred up stones and debris under which fishes might seek refuge. This technique is most effective in riffle areas and against the bank when roots or vegetation may serve as escape cover. Finally, larger stones were turned by hand in search of species not already sampled by other techniques. All available habitats at each site were sampled intensively. At each site where feasible, the stream was evaluated over a stretch of about 50 meters upstream and downstream of the road intersection.

Relative abundance was estimated based on somewhat subjective criteria applied consistently across the study area. In general, the Cyprinidae, Catostomidae, Fundulidae, and Atherinidae were considered uncommon if <5 individuals were found, common if 5-15 were found, and abundant if >15 were found at a site. Criteria for stonerollers (*Campostoma anomalum*) and brook silversides (*Labidesthes sicculus*) were higher due to their schooling behavior. Criteria for the Esocidae, Ictaluridae,

A Survey of the Fishes in Streams Draining the Jack Mountain Area, Hot Spring and Garland Counties, Arkansas, with Notes on the Ouachita Madtom (*Noturus lachneri*)

Aphredoderidae, Centrachidae, and Percidae were lower: uncommon if <3 individuals were found, common if 3-6 were found, and abundant if >6 were found. Criteria for longear sunfish (*Lepomis megalotis*) and orangebelly darters (*Etheostoma radiosum*) were higher due to their being common in the region.

Results and Discussion

Headwater areas supported predictably few species of fishes. If only one species was found in these reaches, it invariably was the creek chub (*Semotilus atromaculatus*), which typically is abundant at such sites. Larger individuals often attained a length of 20-25 cm in areas where only small pools existed. Slightly farther downstream where other species occurred with the creek chub, the most common species was the orangebelly darter (*Etheostoma radiosum*), then the stoneroller (*Camptostoma anomalum*). These latter two species also were common to abundant in all other stretches of surveyed sites, although the creek chub declined in abundance farther downstream.

Species diversity increased with an increase in habitat complexity, stream size and flow rate, and the distance downstream and number of feeder creeks. The greatest diversity in each drainage was found at sampling stations located farther downstream. The greatest number of species encountered was on the largest stream (Prairie Bayou at site PB5) with a total of 17 species (20, if species collected at other times and represented in the HSU Collection of Fishes are included). Most of the other drainages produced about 14 species at their most diverse sites. Those sites had similar characteristics of stream width and depth, flow, and diversity of substrate. However, the particular species found varied among the creeks.

Twenty-four species were found during the study, but some species were found in only one or two drainages. For example, the brook silverside (*Labidesthes sicculus*) was found only in Prairie Bayou, the pirate perch (*Aphredoderus sayanus*) was found only in Curl Creek (although an historic record placed it in Prairie Bayou, into which Curl Creek drains), and the Ouachita madtom (*Noturus lachneri*) was found abundantly but exclusively in Cooper Creek. For convenience of comparison, data for each site are presented in Table 1.

Seasonal variations in numbers of taxa present are effected by reproduction, flow based on amount of rainfall, and from human uses of the drainage basin. Higher abundances, likely due to reproduction, were noted at several sites in which numerous juveniles were found. Other species such as redhorse suckers (*Moxostoma* sp.) may occur in larger streams on a seasonal basis due to spawning runs, and lampreys may not be caught except in early

spring when the ammocoetes mature and mating occurs nearer the substrate surface of gravel-bottomed streams.

The most unique stream habitat encountered was Cooper Creek. The basin consisted primarily of hardwood forest, and the stream was well shaded. The substrate of cobble and gravel was particularly open (low embeddedness) which allowed smaller organisms to move more freely through a protected microhabitat not available at most other stream sites. Field observations suggested that aquatic insects were decidedly more numerous in Cooper Creek than in other streams surveyed (a subjective assessment as no samples were taken for comparison), and the Ouachita madtom (*Noturus lachneri*) was common to abundant at all sampled sites in the creek. This madtom feeds primarily on zooplankton, dipterans, ephemeropterans, plecopterans, and other invertebrates (Patton and Zornes, 1991). It is likely that basin activities which cause runoff of fine particulate matter that embeds the substrate would negatively impact this species endemic to Arkansas.

Cooper Creek was examined on several occasions during the survey because little is known about the Ouachita Madtom. It typically occupies quiet backwater areas of clear, high-gradient streams of the Saline River system (Robison and Harp, 1985; Robison and Allen, 1995). Its presence in Cooper Creek is unique because it is the only known location of the Ouachita madtom in the Ouachita River system.

Adult Ouachita madtoms were found by lifting cobble. Searches for 30 minutes at site C3 produced 20-30 adults (up to 55 mm SL) on 29 July. Most were found by lifting cobble of 15-45 cm diameter in slow to moderate current at depths between 10-25 cm. Often, two adults could be located under the same stone.

Robison and Buchanan (1988) noted that no data were available on reproductive biology, but that young-of-the-year specimens (16-25 mm SL) were taken on 1 August from a small stream (0.6-1.2 m wide). They hypothesized that the species might seek smaller tributaries for spawning. Juveniles (approximately 20 mm SL) were first encountered on 15 July at site C2. This site had little shading and specimens were discovered where the stream was 3-4 m wide, in unembedded gravel near the bank.

Farther upstream at sites C3 and C4, juveniles were more commonly found on 29 July. Searches for 30 minutes produced 30-40 juveniles (approximately 15 mm SL). These specimens were found in the same area as adults but with microhabitat differences. Juveniles were located in smaller gravel (<70 mm diameter) and in more shallow water (25-75 mm depth). Typically, they were encountered where shallow water flowed slowly among the numerous stones that protruded from the substrate and above the water surface.

Foraging reportedly begins between 20-90 minutes

Renn Tumilson and Creed Tumilson

Table 1. Abundance of fish species at each sampling site on Ross Foundation lands in the Jack Mountain area. U = uncommon, C = common, A = abundant. * indicates historic records for species not collected during the present study (present in HSU fish collections).

Fish Species	Cooper Creek				Sampling Location Mt. Carmel Creek		Sanders Creek		Prairie Bayou				
	C1	C2	C3	C4	MC1	MC2	S1	S2	PB1	PB2	PB3	PB4	PB5
Esocidae													
<i>Esox americanus</i>	U	-	-	-	-	-	U	-	-	A	-	-	*
Cyprinidae													
<i>Camptostoma anomalum</i>	A	A	C	A	A	A	A	-	-	C	C	U	A
<i>Notropis boops</i>	C	C	-	-	-	-	U	-	-	-	-	-	C
<i>Luxilus chrysocephalus</i>	C	C	A	A	C	C	C	-	-	C	C	-	C
<i>Lythrurus umbratilis</i>	C	C	U	-	A	A	A	-	-	C	-	-	A
<i>Pimephales notatus</i>	U	U	-	-	-	-	C	-	-	-	-	-	C
<i>Semotilus atromaculatus</i>	C	C	A	C-A	U	C-A	U	A	A	C	A	A	U
Catostomidae													
<i>Erimyzon oblongus</i>	C	C	-	-	-	*	C	-	-	U	-	-	-
<i>Hypentelium nigricans</i>	-	-	-	-	U	U	U	-	-	-	-	-	U
Aphredoderidae													
<i>Aphredoderus sayanus</i>	-	-	-	-	-	-	-	-	-	-	-	-	*
Ictaluridae													
<i>Ameiurus natalis</i>	-	-	C	-	C	U	-	-	-	-	-	-	C
<i>Noturus lachneri</i>	C	C	A	A	-	-	-	-	-	-	-	-	-
<i>Noturus nocturnus</i>	-	-	-	-	-	-	-	-	-	-	-	-	*
Fundulidae													
<i>Fundulus catenatus</i>	C	C	U-C	C	C	C-A	C	-	-	-	-	-	U
<i>Fundulus olivaceus</i>	C	C	C	-	C	C	A	-	-	-	-	-	C
Atherinidae													
<i>Labidesthes sicculus</i>	-	-	-	-	-	-	-	-	-	-	-	-	C
Centrarchidae													
<i>Lepomis megalotis</i>	C	C	C	-	C	C	C	-	-	C	C	-	C
<i>Lepomis cyanellus</i>	C	C	U	-	U	U	C	-	-	U	-	U	U
<i>Micropterus dolomieu</i>	-	-	-	-	-	-	-	-	-	-	-	-	U
<i>M. punctulatus/salmoides</i>	-	-	-	-	U	-	-	-	-	-	-	-	U
Percidae													
<i>Etheostoma radiosum</i>	C	C	A	A	C	C-A	C	-	-	C	C	-	C
<i>Etheostoma blennioides</i>	-	-	-	-	U	C	-	-	-	-	-	-	U
<i>Percina caprodes</i>	-	-	*	-	C	C	-	-	-	-	-	-	-

Fish Species	Curl Creek			Sampling Location Fourche a'Loupe Creek			Valley Creek					
	CR1	CR2	CR3	F1	F2	F3	V1	V2	V3	V4	V5	V6
Esocidae												
<i>Esox americanus</i>	-	-	-	-	-	-	-	-	-	-	-	-
Cyprinidae												
<i>Camptostoma anomalum</i>	-	A	A	U	-	A	-	C	C	A	C	A
<i>Notropis boops</i>	-	-	C	-	-	-	-	-	-	-	-	-
<i>Luxilus chrysocephalus</i>	-	C	C	C	-	C	-	C	C	C	U	A
<i>Lythrurus umbratilis</i>	-	-	A	-	-	A	-	-	-	-	-	-
<i>Pimephales notatus</i>	-	-	U	-	-	U	-	-	-	-	-	-
<i>Semotilus atromaculatus</i>	A	U	C	U	A	U	A	A	C-A	C	A	A
Catostomidae												
<i>Erimyzon oblongus</i>	-	-	-	-	-	-	-	-	-	-	-	-
<i>Hypentelium nigricans</i>	-	-	C	-	-	C	-	-	-	-	-	-
Aphredoderidae												
<i>Aphredoderus sayanus</i>	-	-	C	-	-	-	-	-	-	-	-	-
Ictaluridae												
<i>Ameiurus natalis</i>	-	U	-	-	-	U	-	-	-	-	U	*
<i>Noturus lachneri</i>	-	-	-	-	-	-	-	-	-	-	-	-
<i>Noturus nocturnus</i>	-	-	-	-	-	C	-	-	-	-	-	-
Fundulidae												
<i>Fundulus catenatus</i>	-	U	U	-	-	C	-	-	-	U	-	-
<i>Fundulus olivaceus</i>	-	-	C	-	-	A	-	-	-	C	-	-
Atherinidae												

A Survey of the Fishes in Streams Draining the Jack Mountain Area, Hot Spring and Garland Counties, Arkansas, with Notes on the Ouachita Madtom (*Noturus lachneri*)

<i>Labidesthes sicculus</i>	-	-	-	-	-	-	-	-	-	-	-	-	
Centrarchidae													
<i>Lepomis megalotis</i>	-	A	C		C	-	C-A	-	U	-	C	-	A
<i>Lepomis cyanellus</i>	-	-	-		-	-	-	-	-	-	-	-	*
<i>Micropterus dolomieu</i>	-	-	U		-	-	-	-	-	-	-	-	-
<i>M. punctulatus/salmoides</i>	-	-	-		-	-	C	-	-	-	-	-	-
Percidae													
<i>Etheostoma radiosum</i>	C	C	C		U	C-A	C	-	C	A	A	A	A
<i>Etheostoma blennioides</i>	-	-	U		-	-	U	-	-	-	-	-	-
<i>Percina caprodes</i>	-	-	-		-	-	-	-	-	-	U	-	-

Fish Species	Sampling Location								
	Blakely Creek				DeRoche Creek		Big Hill Creek		
	B1	B2	B3	B4	DR1	DR2	BH1	BH2	BH3
Esocidae									
<i>Esox americanus</i>	C	C	-	-	-	-	-	-	-
Cyprinidae									
<i>Camptostoma anomalum</i>	-	A	A	A	-	U	A	U	A
<i>Notropis boops</i>	-	-	C	A	-	-	-	-	-
<i>Luxilus chrysocephalus</i>	C	A	A	C	-	-	A	-	C
<i>Lythrurus umbratilis</i>	U	A	A	C	-	-	-	-	-
<i>Pimephales notatus</i>	-	U	-	A	-	-	-	-	-
<i>Semotilus atromaculatus</i>	C	U	U	U	A	A	C	A	C
Catostomidae									
<i>Erimyzon oblongus</i>	U	U	-	U	-	-	U	-	-
<i>Hypentelium nigricans</i>	-	C	U	C	-	-	-	-	-
Aphredoderidae									
<i>Aphredoderus sayanus</i>	-	-	-	-	-	-	-	-	-
Ictaluridae									
<i>Ameiurus natalis</i>	-	A	C	-	-	-	C	-	-
<i>Noturus lachneri</i>	-	-	-	-	-	-	-	-	-
<i>Noturus nocturnus</i>	-	-	-	-	-	-	-	-	-
Fundulidae									
<i>Fundulus catenatus</i>	-	-	U	-	-	-	U	-	C
<i>Fundulus olivaceus</i>	-	C	U	C	-	-	-	-	-
Atherinidae									
<i>Labidesthes sicculus</i>	-	-	-	-	-	-	-	-	-
Centrarchidae									
<i>Lepomis megalotis</i>	-	C	A	A	-	-	A	-	A
<i>Lepomis cyanellus</i>	U	-	-	-	-	-	C	-	C
<i>Micropterus dolomieu</i>	-	-	-	-	-	-	-	-	-
<i>M. punctulatus/salmoides</i>	-	-	-	A	-	-	-	-	A
Percidae									
<i>Etheostoma radiosum</i>	-	A	A	U	C-A	C	C	-	C
<i>Etheostoma blennioides</i>	-	-	-	U	-	-	-	-	-
<i>Percina caprodes</i>	-	-	-	-	-	-	-	-	-

after sunset (Robison and Buchanan, 1988), but foraging was observed during morning and afternoon. Although individuals which encountered direct sunlight would actively seek shelter, those in quiet and well-shaded waters would move about the stones and detritus in search of food. Feeding behavior was noted repeatedly. Madtoms observed cruising against the substrate would suddenly become almost perpendicular while rapid muscle contractions of the tail pushed the head between stones or through detritus. Our first observation of these madtoms was while relaxing after seining (which had produced no madtom specimens). Madtoms were observed to emerge from cobble in an unsampled pool area, and they foraged until disturbed by our renewed activity. Daytime foraging was observed only in heavily shaded sections of streams.

With the exception of the Ouachita madtom, the species found during this survey are common in the Ouachita Mountains physiographic region of Arkansas and reflect a rather typical species assemblage for the streams of the area.

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Renn Tumlison and Creed Tumlison

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