and as the areas "recover," the habitat could potentially be altered enough to eliminate them. This is an area where life history information could be useful in determining beneficial habitat maintenance.

*Spiranthes ovalis* has been reported in only two other Tennessee counties besides Anderson and Roane. It has been included as a species of special concern on the State list and is listed by USDA Soil Conservation Service (1975) as rare in Tennesseesee.

***Tomanthera auriculata***

Auricled gerardia, *Tomanthera auriculata,* is an annual herb growing 30 to 60 cm tall. The opposite leaves are lanceolate or ovate-lanceolate, mostly rounded at the base. It has solitary sessile, purple flowers in the upper axiles. The species is believed to be a root parasite (TSA 1982). The recorded habitat of the gerardia is moist, open soil (Gleason 1952). One population of the auricled gerardia was found in a cedar barren where, based on habitat and/or historical records, it was not expected to occur. Auricled gerardia is a prairie species believed to have been introduced into Alabama and Tennessee (Small 1933). Prior to discovery on the Reservation, the only known Tennessee locations were Madison and Carroll counties (TSA 1982). It is included on the State list as endangered in Tennessee.

## SPECIES AND HABITAT PRESERVATION

It has been recommended that the preservation of critical habitats be adopted as a major management practice to ensure the survival of endangered and threatened plant species (USDI 1976). One of the purposes of the Endangered Species Act of 1973 (U.S. Congress 1973), as stated in Section 2, is ". . . to provide a means whereby the ecosystems upon which Endangered species and Threatened species depend may be conserved." Section 7 of the Act states that ". . . Federal departments and agencies shall, in consultation with and with the assistance of the Secretary (Secretary of Commerce and/or Secretary of Interior), utilize their authorities in furtherance of the purposes of this Act by carrying out programs for the conservation of endangered species and threatened species . . . and by taking such action necessary to insure that actions authorized, funded, or carried out by them do not jeopardize the continued existence of such endangered species and threatened species or result in the destruction or modification of habitat of such species which is determined by the Secretary, after consultation as appropriate with the affected States, to be critical."

Indiscriminant modification or destruction of habitat could not only cause a reduction of the population but could also result in a restriction of the population's expansion and recovery. Many species, however, are rare because they occupy unusual, often temporary habitats and may be dependent on some types of interference. Natural history studies and propagation of sensitive species are important in determining the plants' environmental requirements. Careful management of the habitat might be necessary to maintain the species, but before any habitat can be managed to protect a species, it is necessary to determine whether the species is reproducing and its reproductive potential. Once propagules are dispersed, it is essential to know the processes active in establishing the species. Thus, the species autecology information must be evaluated to plan for scientific and beneficial management of the habitats where the species survive (Parr and Taylor 1978).

Specific recommendations for effective protection of endangered and threatened plant species occurring on the Reservation include four major actions: (1) Increased reconnaissance to verify species that have been seen at one time but not supported by voucher specimens and increased efforts to locate species whose habitat requirements suggest there is a high probability they occur on the Reservation, (2) Species autecology evaluations through a review of information available on the species combined with field studies and controlled experiments (including propagation techniques), (3) Initial habitat preservation through establishment of natural areas, (4) Determination of habitat maintenance requirements based on autecology information and, if beneficial, management of the habitat. These actions would not only provide protection and information necessary for species and habitat preservation, they would lead to assessment guidelines important for interaction with various land-use practices.

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# DISTRIBUTION OF UNCOMMON FISHES OF THE BIG SOUTH FORK OF THE CUMBERLAND RIVER TENNESSEE AND KENTUCKY

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## ABSTRACT

A recent survey of fishes of 16 tributaries of the Big South Fork of the Cumberland River resulted in range extensions for the mountain brook lamprey (*Ichthyomyzon greeleyi* Hubbs and Trautman), warmouth (*Lepomis gulosus* (Cuvier)), and the freshwater drum (*Aplodinotus grunniens* Rafinesque). Another 10 species were infrequently collected and appeared to have very restricted ranges within the drainage. Most notable among these were the arrow darter, *Etheostoma sagitta* (Jordan and Swain), speckled darter, *Etheostoma stigmaeum* (Jordan), and bigeye chub, *Hybopsis amblops* (Rafinesque). The limited ranges of the ten species within the drainage would appear to make them susceptible to man-induced disturbances. This susceptibility seemed evident with the apparent restriction of the southern redbelly dace (*Phoxinus erythrogaster* (Rafinesque)) in one of the three sites it was known to inhabit.

## INTRODUCTION

The Big South Fork of the Cumberland River (BSFCR) is part of the Cumberland River system of Tennessee and Kentucky. The river is formed by the confluence of the New and Clear Fork Rivers in north-central Tennessee and flows approximately 65 kilometers until it empties into Lake Cumberland, Pulaski County, Kentucky. The river flows through a deep gorge surrounded by numerous limestone and sandstone bluffs. The majority of the tributaries originate on the Cumberland Plateau and flow into the gorge. Geologically, the drainage consists of Pennsylvanian Age formation in the Cumberland Plateau region and Mississippian Age formation in the gorge area.

The drainage has long been of ichthyological interest due to its variety of habitats and geographic location. Early fish collections included those of Cope (1870), Kirsch (1893) and Fowler (1906, 1924). Two species of interest reported by Kirsch (1893) were the harelip sucker (*Lagochila lacera* Jordan and Brayton) and the bigeye chub (*Hybopsis amblops* Rafinesque). The harelip sucker has not been collected since and is believed to be extinct. The bigeye chub was believed to be extirpated from the system (Comiskey and Etnier 1972), but was recently collected in Rock Creek (Harker et al. 1979, 1980; O'Bara et al. 1982). Additional studies concerned with the ichthyofauna of the drainage include Shoup and Peyton (1940), Riddle (1975), Winger et al. (1977), and Branson and Schuster (1982).

## METHODS AND MATERIALS

Fish collections were made during the spring, summer, and fall of 1981, 1982, and 1983 at 49 sites throughout the BSFCR and Clear Fork drainage. Collection techniques included the use of 120-volt backpack electrofishing equipment and seines. Voucher specimens are located in the Tennessee Technological University fish collection. All scientific and common names follow that of Robins et al. (1980).

## RESULTS

Specific collection locations and dates of collections for the infrequently collected species appear in Table 1. An annotated list including each species follows.

### PETROMYZONTIDAE-LAMPREYS

*Ichthyomyzon greeleyi* Hubbs and Trautman-mountain brook lamprey: This species was previously reported from the Little South Fork of the Cumberland River (LSFCR) by Comiskey and Etnier (1972). Ammocoetes (identification confirmed by D. A. Etnier) were collected from 10 sites at the mouth or at sluggish reaches of tributaries. Other streams in the area with similar habitats and physical characteristics were found to be adversely affected by acid mine drainage, oil and natural gas runoff, and other man-induced disturbances. O'Bara et al. (1982) reported iron and aluminum concentrations exceeding 0.4 mg/1 and 0.9 mg/1, respectively, in these streams, which did not contain the mountain brook lamprey.

### CYPRINIDAE-CARPS AND MINNOWS

*Hybopsis amblops* (Rafinesque)-bigeye chub: The bigeye chub was collected in Rock Creek in association with *Etheostoma obeyense* Kirsch. Comiskey and Etnier (1972) reported that the bigeye chub was absent from Rock Creek, LSFCR, and Kennedy Creek. They believed that the species was extirpated from the drainage. Harker et al. (1979, 1980) collected the bigeye chub in Rock Creek and the LSFCR.

*Phoxinus erythrogaster* (Rafinesque)-southern redbelly dace: The southern redbelly dace was collected only from the headwaters of Laurel Fork of North White Oak Creek. Comiskey and Etnier (1972) reported this species from Crooked Creek (Fentress County, Tennessee) and the LSFCR. Bridge construction immediately upstream of the collection site has destroyed preferred habitat and apparently eliminated this species from this section, but the species was collected upstream of the construction site. It appears that the degradation of habitat has restricted the southern redbelly dace in one of three known sites in the BSFCR drainage.

### CATOSTOMIDAE-SUCKERS

*Catostomus commersoni* (Lacepede)-white sucker: Comiskey and Etnier (1972) reported the white sucker from two tributaries of the New River and White Oak

TABLE 1. *Specific locations, number of specimens collected (in parenthesis), and collection dates for ten uncommon fishes encountered in the Big South Fork of the Cumberland River drainage.*

| Species | Locations of Collections | Dates |
|---|---|---|
| *Ichthyomyzon greeleyi* | 1. No Business Creek | |
| | a. mouth, Scott Co., TN (5) | Aug. 17, 1981 |
| | b. at Anderson Cave Branch Scott Co., TN (1) | Aug. 17, 1981 |
| | 2. Station Camp Creek | |
| | a. mouth, Scott Co., TN (14) | Aug. 14, 1981 |
| | b. 5.6 km upstream, Scott Co., TN (3) | Aug. 14, 1981 |
| | c. 1.6 km upstream, Scott Co., TN (1) | April 9, 1982 |
| | 3. Grassy Fork—Williams Creek | |
| | a. mouth, Scott Co., TN (1) | July 15, 1981 |
| | 4. Rock Creek | |
| | a. Wright's Camp, Scott Co., TN (6) | July 23, 1981 |
| | 5. Laurel Fork-Station Camp Creek | |
| | a. mouth, Scott Co., TN (1) | Aug. 14, 1981 |
| | b. mouth, Scott Co., TN (1) | Aug. 10, 1982 |
| | 6. Laurel Fork-North White Oak Creek | |
| | a. mouth, Scott Co., TN (2) | Aug. 11, 1981 |
| | 7. North White Oak Creek | |
| | a. Oneida and Western Railroad Crossing, Scott Co., TN (1) | Oct. 4, 1981 |
| *Hybopsis amblops* | 1. Rock Creek | |
| | a. Wright's Camp, Scott Co., TN (22) | July 23, 1981 |
| *Phoxinus erythrogaster* | 1. Laurel Fork—North White Oak Creek | |
| | a. Rt. 154 Bridge, Fentress Co., TN (2) | Aug. 6, 1981 |
| | b. Rt. 154 Bridge, Fentress Co., TN (2) | Sept. 8, 1981 |
| | c. Rt. 154 Bridge, Fentress Co., TN (4) | Oct. 10, 1981 |
| *Castostomus commersoni* | 1. Williams Creek | |
| | a. near Williams Creek School, Scott Co., TN (2) | July 16, 1981 |
| | 2. Station Camp Creek | |
| | a. 5.6 km upstream, Scott Co., TN (4) | April 9, 1982 |
| | b. 1.6 km upstream, Scott Co., TN (1) | Oct. 7, 1983 |
| | c. 5.6 km upstream, Scott Co., TN (2) | Oct. 7, 1983 |
| *Lepomis gulosus* | 1. North White Oak Creek | |
| | a. Oneida and Western Railroad Crossing, Scott Co., TN (1) | Oct. 4, 1981 |
| *Etheostoma obeyense* | 1. Rock Creek | |
| | a. Wright's Camp, Scott Co., TN (24) | July 23, 1981 |
| | b. Pickett State Forest, Pickett Co., TN (11) | July 30, 1981 |
| *Etheostoma sagitta* | 1. Roaring Paunch Creek | |
| | a. Barthell, McCreary Co., KY (10) | Sept. 25, 1981 |
| | b. Rt. 742 Bridge, McCreary Co., KY (6) | Sept. 25, 1981 |
| *Etheostoma stigmaeum* | 1. Williams Creek | |
| | a. mouth of Puncheoncamp Creek, Scott Co., TN (8) | Sept. 9, 1981 |
| | 2. Station Camp Creek | |
| | a. 0.8 km upstream, Scott Co., TN (7) | April 1, 1983 |
| | b. headwaters, Scott Co., TN (6) | April 1, 1983 |
| *Percina squamata* | 1. Pine Creek | |
| | a. mouth, Scott Co., TN (6) | Aug. 11, 1981 |
| | 2. North White Oak Creek | |
| | a. Oneida and Western Railroad Crossing, Scott Co., TN (2) | Oct. 4, 1981 |
| *Aplodinotus grunniens* | 1. North White Oak Creek | |
| | a. Oneida and Western Railroad Crossing, Scott Co., TN (1) | Oct. 4, 1981 |
| | 2. Laurel Fork-Station Camp Chreek | |
| | a. mouth to 1.6 km upstream, Scott Co., TN (2) | May 31, 1982 |
| | b. mouth to 1.6 km upstream, Scott Co., TN (1) | June 23, 1982 |

Creek. We have collected the species from Williams Creek and Station Camp Creek. It appears that the species is spottily distributed, being collected in only three of 64 sites sampled by Comiskey and Etnier (1972) and in just two of 49 sites sampled during the present study.

### CENTRARCHIDAE-SUNFISHES

*Lepomis gulosus* (Cuvier)-warmouth: The warmouth has not previously been reported from the system upstream of Lake Cumberland. We collected a single specimen in North White Oak Creek just upstream of the confluence with the BSFCR. It is believed that this was a recruit from Lake Cumberland.

### PERCIDAE-PERCHES

*Etheostoma obeyense* Kirsch-barcheek darter: Within the BSFCR drainage, the range of the barcheek darter is restricted to Rock Creek and the LSFCR (Comiskey and Etnier 1972; Harker et al. 1979, 1980). We collected the species at two locations in Rock Creek.

*Etheostoma sagitta* (Jordan and Swain)-arrow darter: Comiskey and Etnier (1972) reported the arrow darter from Perkins Creek, a tributary of Roaring Paunch Creek, and theorized that its distribution was due to stream piracy as a result of railroad construction. The species was thought to be endemic to the Cumberland River system upstream of Cumberland Falls (Bailey 1948) and in the Kentucky River drainage (Branson and Batch 1983). We collected the arrow darter at two sites in Roaring Paunch Creek.

*Etheostoma stigmaeum* (Jordan)-speckled darter: The Speckled darter was reported from Rock Creek, Kennedy Creek, Station Camp Creek, BSFCR, and the LSFCR (Comiskey and Etnier 1972; Harker et al. 1980). We collected it in Williams Creek as well as Station Camp Creek.

*Percina squamata* (Gilbert and Swain)-olive darter: Comiskey and Etnier (1972) reported this species to be the dominant percid of deep channels in the BSFCR, and they also collected it in the Clear Fork and North White Oak Creek. We found the olive darter in Pine Creek, where it was the only percid collected, and North White Oak Creek. Pine Creek was adversely affected by acid mine drainage, domestic pollution, and channelization (O'Bara et al. 1982).



### SCIAENIDAE-DRUMS

*Aplodinotus grunniens* Rafinesque-freshwater drum: Our collection of the freshwater drum is the first record in the BSFCR drainage. It was collected in North White Oak Creek and Laurel Fork of Station Camp Creek.

## DISCUSSION

The ranges of infrequently collected species within the drainage were primarily restricted to the western tributaries of the BSFCR. The poor habitat caused by man-induced disturbances in eastern tributaries have eliminated or reduced many fish and benthic macroinvertebrate communities (O'Bara et al. 1982). The main disturbances in the drainage has been the surface mining of coal resulting in acid mine drainage and siltation. Abandoned mines (surface and deep) have also contributed to the overall decline in environmental quality. Other factors reported to have limited fish communities in the drainage include agricultural runoff, oil and natural gas drilling runoff, domestic and industrial pollution, and low water discharge during dry periods. All of these factors have been reported to be of greater magnitude in eastern tributary watersheds (O'Bara et al. 1982).

Increased environmental degradation in the drainage could eliminate some species, especially those with rigid habitat requirements. The reduced fish communities in heavily impacted eastern tributaries indicate that this problem is evident. The elimination of an uncommonly occurring species such as the southern redbelly dace is also likely if man-induced disturbances are allowed to occur. Additional man-induced disturbances can only escalate the likelihood of the reduction of other species. The establishment of the Big South Fork National River and Recreation Area administrated by the U.S. National Park Service should provide some environmental protection but the area does not include the entire watershed of some important tributaries. Entire watershed control or management may be essential if species with restricted populations are to exist in the BSFCR drainage.

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# BLOOD CHEMISTRY PROFILES IN BURSECTOMIZED AND INTACT CHICKENS

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## ABSTRACT

Blood chemistry profiles were conducted on bursectomized and normal Hubbard chickens at age 4 weeks through 8 weeks. The bursectomized chickens revealed a trend toward lower levels of blood components in sixteen of the nineteen assays. The lower levels detected could not account for the mortality in the bursectomized chickens.

## INTRODUCTION

Chicken thrombocytes and mammalian platelets play similar roles in clotting of the blood and in defense of the organism by their phagocytic ability. The chicken thrombocyte is an oval, nucleated cell (5 x 10 micrometers) (Lucas and Jamroz 1961) and the mammalian platelet is a small fragment (1.5 micrometers) of a much larger cell har-