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PRESENT DISTRIBUTION OF A RARE TENNESSEE FISH

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ABSTRACT—Sixty-seven sites were sampled in the upper Caney Fork River system during 1994 for the rare Barrens darter (*Etheostoma forbesi*) which is a member of the *Etheostoma squamiceps* complex (subgenus *Catonotus*). Twenty-one of the 67 sites sampled contained darters that represented species from the *E. squamiceps* complex. The Barrens darter was collected at 11 sites, the fringed darter (*Etheostoma crossopterum*) was collected at eight sites, and hybrids were taken at two sites. The Barrens darter was found in eight streams in the upper Caney Fork River system and appeared to be restricted to the Barren Fork system with the exception of Charles Creek (lower Collins River) and possibly Perry Creek (upper Duck River); however, only hybrids were collected from Perry Creek. Sites where the Barrens darter was found had a mean width of 2.5 m, usually the substrate was bedrock with cobble or slabrocks, and aquatic vegetation was often present. Ninety-three Barrens darters were observed during the study; females were 3.7 times more abundant than were males. The continued existence of the Barrens darter is threatened by the limited availability of suitable habitat, pesticides, and siltation resulting from various landuse practices.

The Barrens darter (*Etheostoma forbesi*), a member of the *Etheostoma squamiceps* complex of the subgenus *Catonotus*, is a recently described fish endemic to the upper Caney Fork River system in central Tennessee (Page et al., 1992). The Barrens darter inhabits headwater streams of the Barrens Plateau where it is found in gently flowing riffles or pools with slabrock cobble substrates (Etnier and Starnes, 1993). During the breeding season (April through May), the male has a yellow-gold margin on its second dorsal fin which presumably resembles eggs to the female. It has been suggested that females in this species group are more likely to spawn with a male that is brooding eggs (Knapp and Sargent, 1989). Hence, the yellow-gold color may attract a female to the male's nest, which is located on the underside of a slabrock.

Some species of breeding males in the *E. squamiceps* complex have knobs on the second dorsal fin which also appear to mimic eggs. Consistent geographical differences in dorsal-fin patterns led to a recent revision of the *E. squamiceps* complex. Seventeen years ago only one species, *E. squamiceps*, was recognized. During 1978-1985, populations previously recognized as *E. squamiceps* were determined to be a complex of five species, and, by 1992, the complex was separated into 10 species. Thus, fish which would be recognized as the Barrens darter today previously may have been identified as spottail darters (*E. squamiceps*), fringed darters (*Etheostoma crossopterum*), or blackfin darters (*Etheostoma nigripinne*).

The first known specimens of the Barrens darter were taken from Duke and McMahan creeks (Cannon Co.) and their tributaries (Page et al., 1992). Additionally, Layman et al. (1993) collected it from Hayes Creek, Cannon Co., and also from Charles Creek, Warren Co. A review of museum holdings at the University of Alabama and The University of Tennessee revealed that the Barrens darter also occurred in Liberty Creek, Coffee Co.; West Fork Hickory Creek, Coffee and Warren counties; and Dog Branch and Witty Creek, Warren Co. (Layman et al., 1993; D. A. Etnier, pers. comm.). These creeks, except Charles Creek, are tributaries of the Barrens Fork system. Charles Creek is a tributary to the lower Collins River, and all of these creeks are within the upper Caney Fork River drainage. Hence, it is possible that other tributaries within the upper Caney Fork River system have populations of Barrens darters. This survey was conducted to determine the present distribution of the Barrens darter and to identify threats to its continued existence.

METHODS

All accessible streams on the Barrens Plateau of the eastern Highland Rim physiographic province were sampled using a backpack electroshocker. The length of the site shocked varied from 30 to 200 m based on the presence of suitable habitat (slabrocks or large cobble). When slabrocks were present, a small area around each rock was shocked, and then the rock was removed so that any stunned fish trapped underneath could be netted. Slabrocks then were replaced in approximately the same position as when found.

Sixty-seven sites were sampled during April and May 1994, and five of these sites were resampled in September 1994 to obtain males. Males were needed because the second-dorsal-fin pattern of nuptial males is diagnostic for species within the *E. squamiceps* complex (Page et al., 1992). Because the yellow-gold margin on the second dorsal fin which identifies male Barrens darters often was difficult to see, male specimens were retained of any species in the complex so they could be identified in the laboratory. When a species from the complex was present, most often females were collected first; however, shocking continued in an attempt to collect males. On occasion, shocking ceased without collecting males due to time constraints. At those sites, females were kept in order to verify the existence of some species from the *E. squamiceps* complex. Generally, less than three specimens were retained from each site because numbers collected were low. Voucher specimens were fixed in 10% formalin and preserved in 50% isopropyl alcohol.

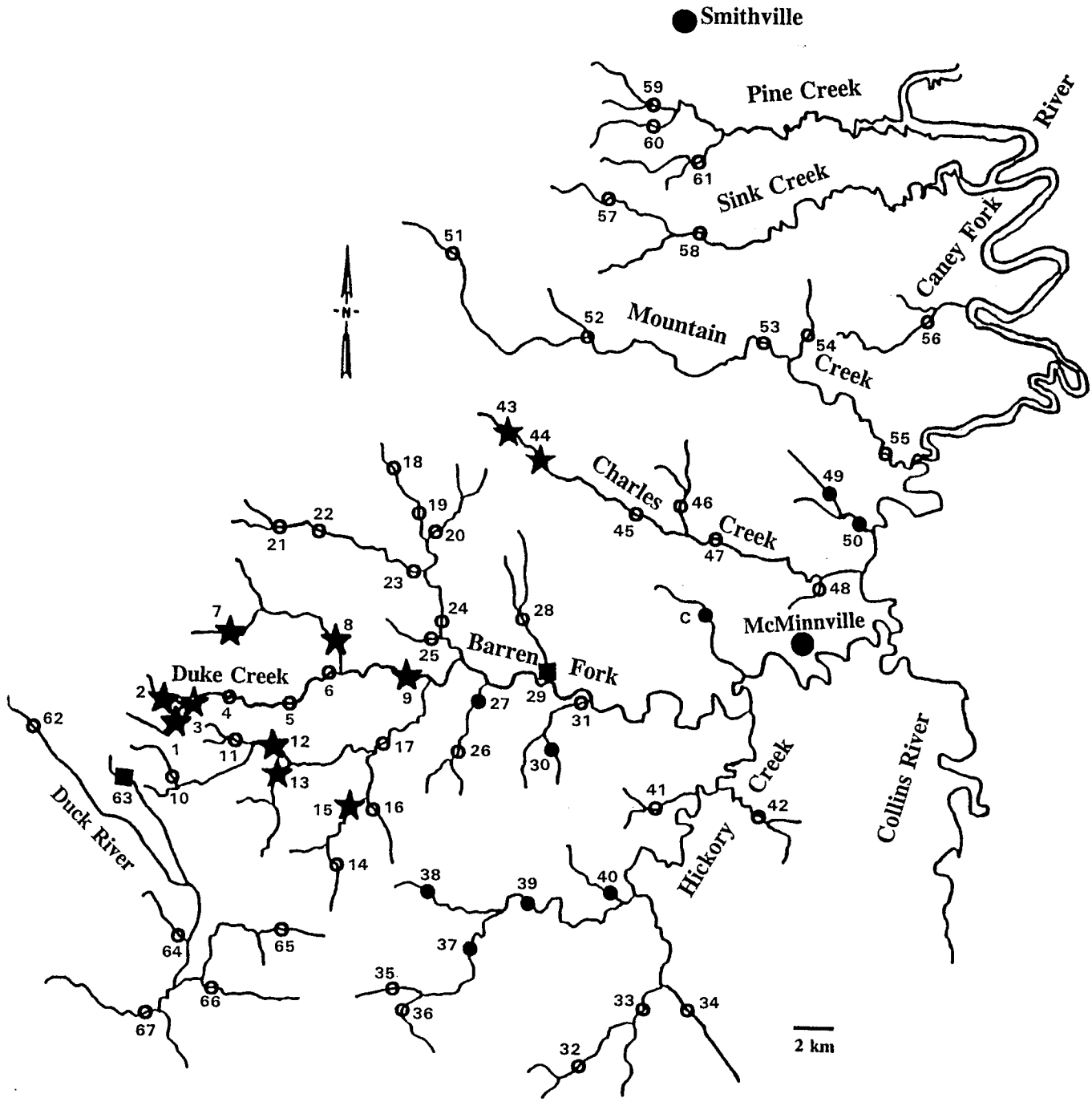

FIG. 1. Sites sampled for *Etheostoma forbesi* during 1994 (stars = *E. forbesi* present; squares = hybrids present; solid circles = *Etheostoma crossopterum* present; open circles = no species from the *Etheostoma squamiceps* complex were present). See Appendix I for descriptions of sites.

RESULTS

Twenty-one of the 67 sites sampled contained darters that represented species from the *E. squamiceps* complex (Fig. 1). *Etheostoma forbesi* was collected at 11 sites, *E. crossopterum* was collected at eight sites, and hybrids were taken at two sites. Site 29 yielded hybrids between *E. crossopterum* and *E. forbesi* (Barren Fork system), and site 63 contained hybrids between *E. forbesi* and *Etheostoma nigripinne* (upper Duck River system). An additional site, site C (Fig. 1), was not sampled in this study, but *E. crossopterum* was collected there in April 1992 by personnel of the Illinois Natural History Survey (P. A. Ceas, pers. comm.).

Sites where the Barrens darter was found ranged from 1 to 8 m wide with a mean width of 2.5 m; usually, the substrate was bedrock with cobble or slabrocks 10.0-15.0 cm in diameter and gravel 2.5-7.5 cm in diameter. Aquatic vegetation often was present. Species of benthic fishes commonly occurring with the Barrens darter included banded sculpins (*Cottus carolinae*), striped darters (*Etheostoma virgatum*), and redband darters (*Etheostoma luteovinctum*). Other benthic species occasionally occurring with the Barrens darter included spring cavefishes (*Forbesichthys agassizi*), fantail darters (*Etheostoma flabellare*), and greenside darters (*Etheostoma blennioides*).

Seventy-three female Barrens darters were collected from 11 sites while only 20 males were collected from eight sites (Table 1). One location on Charles Creek (site 44) was visited on three different dates, but males were never collected. Likewise, Mud Creek (site 15) and Witty Creek (site 9) were visited twice without collecting males. Four males were collected at site 1 on the initial visit, but males were not collected 19 days later. Two sites (8 and 9) were sampled twice before either sex was collected.

TABLE 1. Number of *Etheostoma forbesi* (excluding hybrids) collected at 11 of 67 sites surveyed during 1994. The number of females collected at site 1 was not recorded on 20 April 1994. See Appendix I for descriptions of sites.

Site	Date	Females	Males
1	20 April		4
	9 May	6	0
2	20 April	1	1
3	9 May	16	2
7	12 May	16	3
8	12 May	0	0
	20 September	1	1
9	22 April	0	0
	20 September	1	0
12	12 May	4	3
13	22 April	1	1
15	13 May	2	0
	20 September	3	0
43	11 May	8	5
44	20 April	1	0
	11 May	5	0
	20 September	8	0

DISCUSSION

The Barrens darter is believed to be one of the rarest North American freshwater fishes (Page et al., 1992) and the Tennessee Wildlife Resources Agency (1994) has declared the species endangered. During the present survey, the Barrens darter was collected at five of the seven historic sites. It was not collected at Hayes Creek where, previously, three specimens had been taken (Layman et al., 1993), and only fringed darters were collected from West Fork Hickory Creek. The Barrens darter was collected at only three new locations (Lewis Creek, Mud Creek, and Pocahontas Branch); these streams are in the Barren Fork system. Thus, it appears the Barrens darter is restricted to the Barren Fork with the exception of Charles Creek (lower Collins River) and possibly Perry Creek (upper Duck River); however, only hybrids were collected from Perry Creek. Other species endemic to the Barrens Plateau occur in the upper Caney Fork River drainage and the upper Duck River system. The proximity of these two drainages and the lack of topographic relief suggest past faunal exchanges between these two stream systems (Starnes and Etnier, 1986). Possibly, the Barrens darter occurs at a few additional sites but was not collected because of low densities coupled with apparently some instream movements during the spawning season.

The continued existence of the Barrens darter is threatened by the limited availability of suitable habitat, pesticides, and siltation resulting from various landuse practices. At some sites where the Barrens darter was not found, slabrocks were not available. These fish use slabrocks not only for cover but also for nest sites during the breeding season. Thus, recruitment may be restricted by limited spawning substrates.

The Barrens Plateau has many plant nurseries which could contribute large amounts of pesticides and silt to the tributaries of the surrounding area. Logging which is occurring in the Barren Fork drainage could increase sedimentation and turbidity levels of streams if best management practices are not followed (Pelren, 1990). At some sites, the heavy silt load observed appeared to result from destruction of the riparian zone by livestock which had unrestricted access to the stream.

To help maintain and possibly augment populations of *E. forbesi*, access to streams by livestock should be restricted and slabrocks should be added to some streams to increase habitat. Until these measures are taken, ichthyologists are urged to treat these tiny populations with the greatest respect.

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APPENDIX I. Locations surveyed for *Etheostoma forbesi* during 1994. Data for site C were provided by personnel of the Illinois Natural History Survey (INHS). Streams surveyed are tributaries to the Caney Fork River system unless otherwise noted. Names of roads and streams were taken from DeLorme Mapping Company (1992).

Site	Date	Stream	Location	County
1	20 April 9 May	Duke Creek	Hollow Springs Road (Mr. Roy Bush's yard), E of Hollow Springs	Cannon
2	20 April	Unknown tributary to Duke Creek	Sprytown Road, E of Hollow Springs	Cannon
3	9 May	Duke Creek	Sprytown Road (Mr. Herschel Trail's pasture), E of Hollow Springs	Cannon
4	22 April	Duke Creek	Hwy. 53, S of Sheybogan	Cannon
5	12 May	Duke Creek	Sissiom Road at Ivy Bluff	Cannon
6	12 May	Duke Creek	Parker Road, NE of Ivy Bluff	Cannon
7	12 May	Lewis Creek	Hwy. 53, S of Sheybogan	Cannon
8	12 May 20 September	McMahan Creek	Parker Road, NE of Ivy Bluff	Cannon
9	22 April 20 September	Witty Creek	Herman Lance Road, NE of Ivy Bluff	Warren
10	22 April	Cisco Branch	Floyd Road, W of Pocahontas	Coffee
11	22 April 20 September	Hayes Creek	Hwy. 53, S of Sheybogan	Cannon
12	12 May	Liberty Creek	Maple Springs Road, N of Pocahontas	Cannon and Coffee
13	22 April	Pocahontas Branch	Summitville Road at Pocahontas	Coffee
14	13 May	Mud Creek	Clark Road at Mud Creek	Coffee
15	13 May 20 September	Mud Creek	Teal Road and Shady Grove Road, W of Shady Grove	Coffee
16	25 April	McAfee Branch	Shady Grove Road, W of Shady Grove	Coffee
17	9 May	South Prong	Clancy Road, E of Pocahontas	Coffee and Warren
18	11 May	North Prong	Pleasant View Road, NE of Pleasant View	Cannon and Warren
19	22 April	North Prong	Ivy Bluff Road and Wade Road, E of Pleasant View	Warren
20	22 April	Miller Branch	Ayers Road, N of Oak Grove	Warren
21	12 May	Redman Branch	Red Hill Road, SE of Sheybogan	Cannon
22	22 April	Bullpen Creek	Bullpen Road, SE of Sheybogan	Cannon
23	11 May	Bullpen Creek	Ivy Bluff Road, N of Oak Grove	Warren
24	11 May	North Prong	Oak Grove Road, E of Oak Grove	Warren
25	11 May	Cates Branch	Ivy Bluff Road, S of Oak Grove	Warren
26	9 May	Dry Branch	Smoot Road, SW of Trousdale	Warren

APPENDIX I. Continued.

Site	Date	Stream	Location	County
27	11 May	Dry Branch	Jacksboro Road (Hwy. 287), S of Trousdale	Warren
28	11 May	Dog Branch	Pleasant Hill Road, SE of Centertown	Warren
29	21 April	Dog Branch	Petigap Road, SE of Centertown	Warren
30	9 May	Garner Branch	Comer Road, SW of Crisp Spring	Warren
31	9 May	Garner Branch	Henegar Road, W of Crisp Spring	Warren
32	25 April	Little Hickory Creek	Viola Road (Hwy. 127), SW of Viola	Coffee
33	25 April	Hickory Creek	Mt. Zion Road at Viola	Warren
34	25 April	Fultz Creek	Mt. Zion Road, E of Viola	Warren
35	25 April	West Fork Hickory Creek	Rock Road, S of Summitville	Coffee
36	25 April	Unknown tributary to West Fork Hickory Creek	Rock Road, S of Summitville	Coffee
37	13 May	West Fork Hickory Creek	Fountain Grove Road, E of Summitville	Coffee
38	25 April	Meadow Branch	Smith Road, SW of Morrison	Coffee
39	13 May	West Fork Hickory Creek	Phillip King Road, SE of Morrison	Warren
40	25 April	Keel Branch	Vervilla Road, S of Vervilla	Warren
41	25 April	Unknown tributary to Hickory Creek	Vervilla Road (below golf course dam), N of Vervilla	Warren
42	25 April	Locke Branch	Hwy. 108, S of McMinnville	Warren
43	11 May	Charles Creek	Green Hill Road (Hwy. 287) at Bratchers Crossroads	Warren
44	20 April 11 May 20 September	Charles Creek	Robert Wilson Road, SE of Bratchers Crossroads	Warren
45	21 April	Charles Creek	Daylight Road at Daylight	Warren
46	21 April	Hickory Grove Branch	Yager to Short Mountain Road, E of Daylight	Warren
47	21 April	Charles Creek	Judge Warren Road at Yager	Warren
48	21 April	Unknown tributary to Charles Creek	Red Road at Faulkner Springs	Warren
49	21 April	Dry Branch	Salem Road, W of Jessie	Warren
50	5 May	Dry Branch	Ford along Francis Ferry Road, S of Jessie	Warren
51	11 May	Mountain Creek	Short Mountain Road (Hwy. 146) at Short Mountain	Cannon
52	5 May	Mountain Creek and unknown tributary	Green Hill Road (Hwy. 287), NE of Flatwood	Warren
53	5 May	Mountain Creek	Hwy. 56 at Dibrell	Warren
54	5 May	Bluff Springs Branch	Roy Foster Road, NE of Dibrell	Warren
55	5 May	Mountain Creek	Francis Ferry Road, NE of Jessie	Warren
56	5 May	Barton Creek	Francis Ferry Road (Hwy. 288), N of Berea	Warren
57	5 May	Dry Branch	Jacobs Pillar Road, W of Blue Springs	Dekalb
58	21 April	Sink Creek	Davis Road, E of Bethel	Dekalb
59	5 May	Unknown tributary to Pine Creek	Jacobs Pillar Road, NW of Shining Rock	Dekalb
60	5 May	Turner Branch	Turner Road, W of Shining Rock	Dekalb
61	21 April	Cappy Springs Branch	Hendrixson Road, S of Shining Rock	Dekalb
62	26 April	Duck River	Ford along Frazier Road, NE of Hoodoo, Duck River system	Coffee
63	26 April	Perry Creek	Noah-Pocahontas Road (Hwy. 280), W of Pocahontas, Duck River system	Coffee
64	26 April	Boiling Spring Branch	Parker Road, NW of New Union, Duck River system	Coffee
65	26 April	Parks Creek	Maple Springs Road, NE of New Union, Duck River system	Coffee
66	26 April	Welker Branch	Pomroy Road, N of New Union, Duck River system	Coffee
67	26 April	Eaton Branch	Fredonia Road at Fredonia, Duck River system	Coffee
C	3 April	Grissom Branch	US Hwy. 70S, W of McMinnville (collected in 1992 by P. A. Ceas and J. W. Armbruster, INHS)	Warren