



**Distribution, Status and Species-Habitat Relationships of the Rare Barrens Darter,
*Etheostoma forbesi***

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The Barrens Plateau region of middle Tennessee harbors a number of unique and endemic aquatic species, including two fishes: the Barrens topminnow (*Fundulus julisia*) and the Barrens darter (*Etheostoma forbesi*) (Page et al., 1992; Etnier and Starnes, 1993; Johnson and Bettoli, 2003; Hansen et al., 2006). Both species have a restricted distribution and are of conservation concern, but neither species is Federally listed at this time.

Regular monitoring of populations is a key element of species conservation and recovery. Tennessee Technological University biologists have assisted Federal and State agency biologists with monitoring populations of wild and reintroduced Barrens topminnows in recent years. Rangewide monitoring has taken place annually since approximately 2002. In the past four years, monitoring activities have been conducted during January-March 2006, January 2007, January-February 2008, and November 2008-March 2009 to document topminnow abundance, evidence of natural reproduction and recruitment, and population size structure (Watts and Mattingly, 2008, 2009). It remains vital to topminnow conservation efforts for biologists to have current, reliable quantitative data upon which to make management decisions. One goal of the proposed study is to provide labor, technical assistance, and written reports for two additional years (early 2010, early 2011) of population monitoring for wild and reintroduced topminnow populations. Another goal is to produce a monitoring plan for the topminnow that will allow agency biologists to quantitatively track population status through time, and to detect population trends early enough to take appropriate management actions.

Barrens topminnows have been reintroduced into 22 sites in the Barrens plateau region (Figure 1). In addition, three or four wild populations remain extant in this area. An effort will be made to sample all 25 sites in the late winter or early spring of each year (2010 and 2011), but this may be restricted at a few sites due to private lands accessibility or other problems beyond our control. The standardized monitoring data sheets given in Watts and Mattingly (2009) will be employed in 2010 and 2011 sampling. The protocol calls for a specific number of seine hauls per site, depending on site characteristics and numbers of topminnows encountered. Topminnows will be counted and released back into the site, whereas mosquitofish will be placed into a graduated cylinder and volumetrically enumerated. Lengths of Barrens topminnows will be recorded and length-frequency histograms will be constructed for each site and compared to previous years' data and stocking histories. Assessment of natural reproduction and recruitment of topminnows will be aided by length-frequency analysis and stocking histories.

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Water temperature and weather conditions will also be recorded on each monitoring day. Annual monitoring reports will be submitted in June 2010 and June 2011 to summarize results of monitoring efforts. Trends in population status, structure, and reproductive success will be noted and recommendations will be made where appropriate. Presentation of monitoring results will be given at the annual Rare Fishes Meeting held during the spring of each year, 2010 and 2011.

The Barrens darter's range is even more restricted than the Barrens topminnow. Status surveys conducted in 1994 (Madison 1995) and 2004 (Hansen et al. 2006) showed a small but tentatively stable number of individuals in fewer than 10 occupied streams. Current research in progress at Tennessee Technological University is evaluating (1) the potential threat of hybridization between the Barrens darter and its local congener, the fringed darter (*Etheostoma crossopterum*), (2) the environmental associations of the Barrens darter at two spatial scales, and (3) Barrens darter distribution and abundance at historically occupied and new potential sites across its range. For items (2) and (3) above, we are also documenting electrofishing gear efficiency to aid in the design of monitoring protocols. Therefore, a further goal of the proposed study is to use information garnered from recent and current research projects to design a monitoring plan for the Barrens darter. The Barrens topminnow and Barrens darter monitoring plans could be merged to allow efficient use of agency resources (personnel, travel funds) to conduct the regular monitoring activities in the field, thereby facilitating more of an ecosystem-level approach to conservation efforts in the Barrens region.

As mentioned above, Barrens topminnows have been captively bred and then released into a number of sites across its range. These reintroduction efforts have had mixed success, in terms of topminnows (1) persisting in their stocking location, and (2) showing evidence of natural recruitment post-stocking. At certain sites, very few topminnows have been detected despite the release of large numbers of captive-bred individuals. For example, only 17 topminnows were observed during 2007 annual monitoring activities at Rose Creek, Hasy, Merkle, Herndon, Murphy, and Crooks sites, despite the fact that more than 5,000 topminnows were stocked there in the previous two years (Table 1). It should be emphasized, however, that the reintroduction program has been successful at other sites, with the net result of reducing the risk of extinction of this species.

It remains unknown whether stocked individuals rapidly succumb to various sources of mortality, or whether some number survive to disperse to other suitable habitats within the watershed. Goldsworthy and Bettoli (2006) assumed that all dispersing individuals were mortalities, based on their sampling efforts in the vicinity of stocking locations where topminnows were not persisting. However, at least one topminnow (67 mm TL female) dispersed approximately 0.5 km away from its stocking location through the mainstem of Hickory Creek into a neighboring tributary stream at the Murphy site in August 2002 (HTM, personal observation). Several months had elapsed since the individual was stocked.

Here we propose to determine if topminnows dispersing from stocking sites have established new populations in locally suitable habitats, such as springs or spring runs within several kilometers of stocking locations. These suitable habitats will be identified using maps and local reconnaissance in the vicinity of two or more sites, most likely including the Crooks sites. The sites will be selected through consultation with agency biologists, and by evaluation of accessibility of adjoining private landowner properties. If no new topminnow populations are discovered, then this suggests that most dispersing topminnows are waifs that offer little contribution to overall species viability. Alternatively, if one or more new populations are discovered, then this suggests that stocking certain sites could offer a mechanism of

establishing new populations if suitable habitats are available in the vicinity. However, it should be noted that new populations established by this dispersal approach are susceptible to founder effects.

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Table 1. The percentage of Barrens topminnows collected in 2007 as a function of the number stocked at 12 selected locations in the Barrens region of middle Tennessee.

Site	Number of BTMs stocked in previous two years	Number of BTMs collected in 2007	% of stocked fish collected
Verville	344	276	80
Clayborne and Sain	375	124	33
Cunningham Barn	250	46	18
Smithville Pond	1,398	204	15
Faris Springs	944	46	5
Rose Creek (Gibson)	495	4	0.8
Hasty	635	4	0.6
Merkle	1,388	5	0.4
Herndon (Blue Springs)	1,592	4	0.2
Murphy	219	0	0
Hancock	0	0	0
Crooks	775	0	0
TOTAL	8,415	714	8



Figure 1. Locations of the three native and 22 reintroduction sites for the Barrens topminnow on the Barrens Plateau, Tennessee. One site is not visible because of overlapping symbols. The four major watersheds are based on USGS 8-digit HUCs. Map prepared by Jacob T. Westhoff.