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SUMMER MICROHABITAT OF THE ENDANGERED BLUEMASK DARTER *ETHEOSTOMA (DORATION)* SP.

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ABSTRACT—The bluemask darter *Etheostoma (Doration)* sp. is an endangered species endemic to the Caney Fork River drainage upstream of Great Falls, in central Tennessee. We determined microhabitat use of bluemask darters from June through September 2000 by underwater observation in 3 streams. Nearly all (99%) of the 273 fish observed were found in areas where near-bottom water velocity was < 5 cm/sec, and 95% of the fish were found over sand-dominated substrate at depths between 27 and 84 cm. The low availability of clean sand substrate may limit availability of summer habitat for bluemask darters. Land-use practices that increase siltation, and the increasing demand for offstream uses of water could further reduce available habitat and jeopardize the continued existence of bluemask darters.

The bluemask darter *Etheostoma (Doration)* sp. was once considered a subspecies of *E. stigmaeum* (Howell, 1968). Layman (1994) reevaluated the subgenus *Doration* and concluded that the bluemask darter is a distinct species. Bluemask darters have been collected only from five streams; all five streams are located in the upper Caney Fork River system above Great Falls Dam in central Tennessee. Completion of the Great Falls Dam in 1916 isolated these populations and may have eliminated other, unrecorded populations in this area. The Collins River contains the largest population of bluemask darters (Layman et al., 1993). In 1993, the United States Fish and Wildlife Service listed the bluemask darter as an endangered species because of the extirpation of one of the five populations, the presumed reduction in range and population isolation following construction of the Great Falls Dam, and the continuing threats to the remaining populations caused by nonpoint source pollution and water withdrawals (US Fish and Wildlife Service, 1997). A flourishing plant nursery industry and other developments are exerting an increasing demand for offstream water use. Demand for irrigation is greatest during the summer and early fall when stream discharge is lowest. The potential effects of reduced stream flow on bluemask darters are unknown because limited information is available on their life history and microhabitat requirements. The objective of our study was to determine microhabitats used by bluemask darters during the summer low-flow period.

METHODS

From June 30 to September 7, 2000, we snorkeled selected reaches of the four streams (Cane Creek, Caney Fork River, Collins River, and Rocky River) known to contain extant populations of bluemask darters; however, sampling was concentrated on the Collins River to ensure a large number of observations on habitat use. On one occasion, we used SCUBA gear to sample a pool > 1.5 m deep. The upper and lower limits of each site were bound by pools with depths > 90 cm. All sampling occurred between

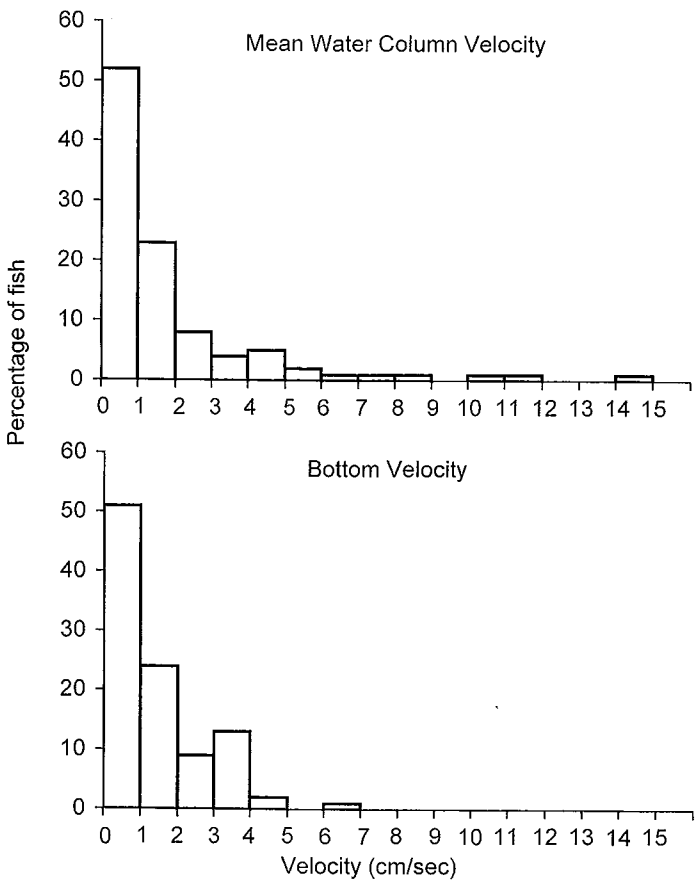

FIG. 1. Percentage of bluemask darters (n = 208) observed at various water velocities.

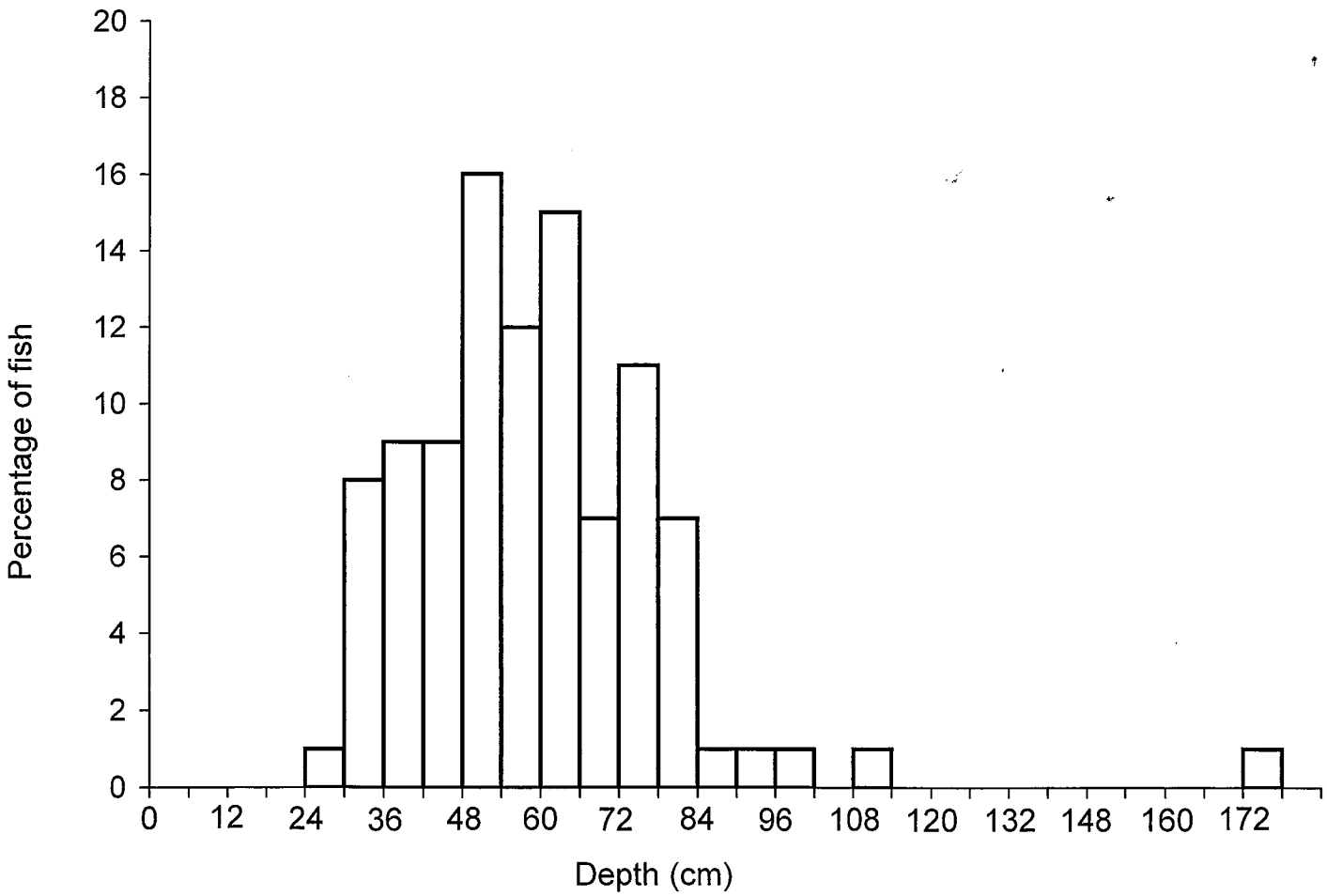

FIG. 2. Percentage of bluemask darters (n = 273) observed in each depth category. Depths are grouped into 6 cm intervals.

the hours of 1000 and 1600 h. At each site, snorkelers proceeded slowly in an upstream direction to minimize disturbance of fish, and snorkeling continued until all habitats in the stream section were surveyed. When a bluemask darter was observed, a weighted marker was placed on the substrate at the location where the fish was first seen. Movement of the fish was monitored to reduce the possibility of marking their new location. No marker was placed if a fish was not seen until it moved since their original location was not observed. After completing all snorkeling on a site, physical microhabitat variables were measured at each marker. Water depth was measured to the nearest 3 cm with a top-setting wading rod. Water velocity was measured with a Marsh-McBirney flow meter at 0.6 of the depth from the water surface, and also at the substrate surface (near-bottom velocity). Dominant and subdominant substrate particle sizes were visually estimated within a 30-cm diameter circle centered on the fish location, and classified as fines (< 0.1 mm), sand (0.1–2 mm), small gravel (2–25 mm), large gravel (26–75 mm), small cobble (76–150 mm), large cobble (151–250 mm), and boulder (> 250 mm).

RESULTS

A total of 273 observations of bluemask darters were made in three of the four streams surveyed; bluemask darters were not seen at the one site sampled in the Rocky River. Most bluemask darters (92%) were observed in areas where mean water column velocity was ≤ 5 cm/sec, and 99% of the bluemask darters observed were in areas where near bottom velocity was also ≤ 5 cm/sec (Fig. 1). Bluemask darters occurred mainly on sandy substrates; 93% of the darters were observed in areas where sand was the dominant substrate and 63% were observed over an all-sand substrate. No bluemask darters were observed on a silt-dominated substrate. Most bluemask darters (95%) were found in areas 27–84 cm deep (Fig. 2).

DISCUSSION

True microhabitat preference was not determined because we did not quantify available microhabitats sampled at each site. Nonetheless, we estimated that substrate dominated by sand comprised a small percentage (< 10%) of the total area snorkeled; yet most fish were observed over sand. Farzaad (1991) quantified dominant substrate type on a portion of one of our sampling sites on the Collins River and found that sand dominated only 6% of the streambed. Similarly, the predominate use of low-water velocity areas likely reflects the true preference of bluemask darters because there was a broad range of velocities available at all sites. Seemingly, bluemask darters preferred intermediate depths. No fish were found at depths < 27 cm; however, because most of our sampling occurred at depths < 90 cm, their entire preferred depth range cannot be completely defined. The preferred

microhabitat of bluemask darters may change seasonally. The closely related speckled darter (*Etheostoma stigmaeum*) prefers near zero velocity areas during the summer and fall, but prefers considerably higher velocities during the winter and spring (Madison, 1993). Adults of all members of the *E. stigmaeum* complex use swifter areas and coarser substrates for spawning in the spring (Etnier and Starnes, 1993).

The preference for areas with little or no flow should not be interpreted to mean that bluemask darters would not be affected by a reduction in stream discharge; areas with a clean sand substrate and near zero flow are likely maintained free of silt deposits (fines) during higher flow periods. Because substrate type is the most important factor influencing the distribution of darters (Page, 1983), degradation of sandy areas in the upper Caney Fork River drainage would reduce bluemask darter habitat.

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