Distribution of the Ouachita Dusky Salamander *(Desmognathus brimleyorum)* in Southeastern Oklahoma

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We surveyed the status and distribution of the Ouachita Dusky Salamander *(Desmognathus brimleyorum)* in southeastern Oklahoma. To predict occurrence of *D. brimleyorum,* we used Geographic Information System (GIS) techniques to identify regions with appropriate habitat conditions. During June 1993-September 1994, 130 animals were observed at 18 of 57 sites in five counties. The species was absent from seven of 13 historic collection sites examined. *Desmognathus brimleyorum* was locally abundant given certain habitat conditions, such as, in and around seeps, springs, and high gradient streams. This species is likely sensitive to disturbances that disrupt the hydrology of these habitats.

INTRODUCTION

Stejneger (*1*) first described *Desmognathus brimleyorum* as a relatively large and robust plethodontid salamander that is often aquatic or semiaquatic. This salamander generally inhabits areas near streams, springs, and seeps where it is often found under submerged rocks, woody debris, or buried in wet gravel. Although *D. brimleyorum* is restricted to the Ouachita Mountains (*2*), there has been limited study of its status (*3-5*). Until recently, the range of this species was defined poorly, and its abundance was virtually unknown. Aside from our study, the most recent collections were made from 1977 to 1984 when Karlin et al, (*6*) obtained 861 individuals from 49 locations, 11 of which were in Oklahoma.

One factor of concern regarding *D. brimleyorum* is the overlap of its range with that of an intensive timber industry. Several timber companies in the Ouachita Mountains practice clearcutting, which may potentially alter hydrologic features around springs and seeps that are primary habitats for the species. For example, clearcutting can cause changes in soil structure, hydrology, and both horizontal and vertical vegetation structure that subsequently affects temperature and moisture regimes. These changes in turn affect microhabitats that are important to salamanders (*7-13*). The water quality of streams may be degraded by increased sedimentation. Both a deterioration of microclimatic conditions on the forest floor and a decrease in stream quality are facilitated by the removal of canopy, the elimination of the moisture-retaining forest floor litter, and soil compaction (*8,14,15*).

Our objectives were to determine the current status and distribution of *D. brimleyorum* in Oklahoma by reviewing museum records and sampling historic locations, and to document any changes in its distribution or abundance.

MATERIALS and METHODS

To evaluate the historical distribution of *D. brimleyorum* in Oklahoma, we compiled museum records from Oklahoma State University, University of Oklahoma, University of Kansas, University of Texas-Austin, and the American Museum of Natural History. From June 1993 to September 1994, streams, springs, and seeps were surveyed in Choctaw, Latimer, LeFlore, McCurtain, and Pushmataha Counties in southeastern Oklahoma. Thirteen of the 57 sample sites were selected based on historical collections of *D. brimleyorum;* the

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other 44 sites were selected opportunistically within the historic range for the species. Presence or absence of *D. brimleyorum* was determined by sampling salamanders at each site using aquatic dip nets, 3.6 × 1.8-m nylon seines (3.2-mm mesh), and by hand.

Each of the sample locations was plotted on 1:100,000 scale United States Geological Survey topographic quadrangle maps, which were digitized into a Geographic Information System (GIS) using GRASS 4.0 software (Geographical Resources Analysis Support System, U.S. Army Corps of Engineers, Construction Engineering Research Laboratory, Champaign, Illinois) and an Altek graphic digitizer. The GIS was then used to compare the presence or absence of *D. brimleyorum* with ancillary data layers to identify areas with appropriate habitat conditions. The ancillary data layers included land cover/use, soil mapping units, elevation, and percent slope. Data on land cover/use, soil mapping units, and percent slope were obtained from the Natural Resources Conservation Service (MIADS) database. Elevational data were derived from USGS digital elevation models. All data were georeferenced to a Universal Transverse Mercator projection, zone 15, North American Datum 1927.

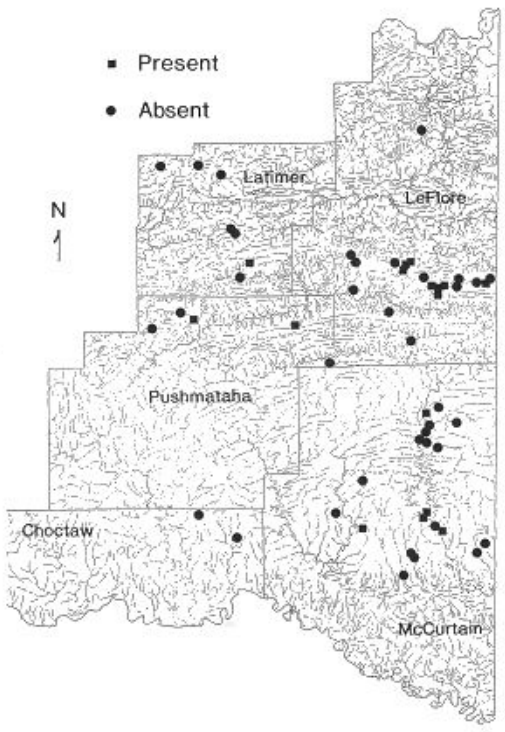

Figure 1. Sites sampled during a survey of the distribution of *Desmognathus brimleyorum* conducted during 1993–94 in five SE Oklahoma counties.

RESULTS

One hundred thirty *D. brimleyorum* were observed at 18 of 57 localities in five counties in southeastern Oklahoma (Table 1, Fig. 1). *D. brimleyorum* was absent from seven of 13 historic collection sites examined. At least one range extension was noted: we found *D. brimleyorum* at Goat Creek (T3N,R20E,S3), an isolated, upland stream in northern Latimer County. We believe this is the northwestern-most record for the species. We located populations at six sites in McCurtain County, nine in LeFlore County, one in Latimer County, and two in Pushmataha County. Populations were most dense in LeFlore County along the north-facing slopes of Winding Stair and Rich Mountains within the Ouachita National Forest. *D. brimleyorum* was most abundant at Horsethief Spring, LeFlore County.

TABLE 1. Sites surveyed and presence of *Desmognathus brimleyorum* by county.

	Sites	
County	No. surveyed	No. with *D. brim.*
McCurtain	20	6
LeFlore	21	9
Latimer	8	1
Pushmataha	6	2
Choctaw	2	0
Total	57	18

Overall, we found *D. brimleyorum* in riparian zones adjacent to and within high gradient streams, first- and second-order streams with depths ranging from 3 to 20 cm and widths from 0.2 to 5.0 m. Salamanders seemed to be associated with streams having a well developed, deciduous canopy. Water temperatures at sites where *D. brimleyorum* were present ranged from 4 to 21 ºC. *D. brimleyorum* were most often found in streams that contained coarse, rocky or gravel substrates

with at least some rocks > 10 cm in width, and where both pools and riffles existed. We never found *D. brimleyorum* in or near streams with sand or silt substrates. We found most adult salamanders under rocks in flowing water, and most larvae were observed on the bottom of partially shaded pools. Salamanders typically did not occur in streams that supported populations of predatory fish such as sunfish *(Lepomis),* bass *(Micropterus),* and catfish *(Ictalurus).*

Based on our GIS analysis, *D. brimleyorum* is most likely to be found within shortleaf pine-oak mixed forests with elevations of 152-666 m, and slopes ranging from 1 to 21%. *D. brimleyorum* was associated with the following soil mapping units: Carnasaw-Goldston association, Carnasaw-Octavia complex, Ceda-Rubble land complex, Clebit-Carnasaw-Pirum complex, Goldston-Carnasaw-Sacul association, Kenn-Ceda complex, and Octavia-Carnasaw complex. These soils tend to be well drained, shallow, and stony with relatively low fertility and are associated with steep upland areas (*16,17*). Using the results of the above analyses, we refined our predictive habitat criteria and used the GIS to produce a set of maps that estimate the occurrence of suitable habitat for the species. Our GIS analysis estimated the percentage of the total area of each county that was suitable habitat for *D. brimleyorum:* McCurtain, 10.7%; Pushmataha, 5.6%; LeFlore, 4.9%; Latimer, 1.8%; and Choctaw, 0.9%.

DISCUSSION

In Oklahoma, the Ouachita Dusky Salamander can be locally common under certain conditions. Although the species may attain relatively high densities in and around seeps, springs, and high gradient streams, we believe that it is sensitive to certain disturbances that could disrupt the hydrology of these habitats. We found the most productive sites within the Ouachita National Forest, places protected from intensive agriculture and silviculture. We found *D. brimleyorum* almost exclusively in upland areas that were geographically isolated by expanses of lowland habitat and river flood plains.

Our GIS analysis produced maps that predict the occurrence of *D. brimleyorum* in southeastern Oklahoma, but there are limitations to this methodology. Although the land use/cover categories produced by GIS were coarse, these categories possessed useful predictive power when linked to ancillary information such as soils and topography. The habitat may be more extensive than the metapopulation. That is, even though the correct set of habitat conditions may exist at a site, geographic isolation of this relatively immobile salamander may result in the local absence of a population, or the habitat patch may be too small or patches too fragmented to sustain a viable population. Extant populations should be monitored to insure minimal disturbance and their long-term viability.

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