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# DISTRIBUTION AND HABITAT UTILIZATION OF THE FOUR-TOED SALAMANDER, *HEMIDACTYLIUM SCUTATUM*, IN THE OUACHITA MOUNTAINS OF ARKANSAS

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## ABSTRACT

Four-toed salamanders in Arkansas represent a disjunct population separated from their main range in the eastern United States and Canada. Until recently, the distribution of this species was documented by a few individual specimens collected or observed from widely spaced localities which has resulted in its being considered rare and vulnerable. Recent investigations of distribution and habitat utilization indicate this species may be more common than previously believed, but also reaffirms the need to protect riparian habitat, springs, ponds, woodland seeps and other preferred, moist habitats containing mossy areas used as primary egg deposition sites.

## INTRODUCTION

The four-toed salamander, *Hemidactylum scutatum*, is one of Arkansas' disjunct amphibians, separated from its primary range in the eastern United States and Canada (Conant, 1975). *Hemidactylum* is considered rare by the Arkansas Natural Heritage Commission (ANHC) and is considered a sensitive species by the United States Forest Service (USDA-Forest Service 1990a). Extensive statewide investigations of the herpetofauna within state parks by the Arkansas Herpetological Society (Heath *et al.*, 1988) and intensive herpetofaunal investigations in the Ozark National Forest (Schuier *et al.*, 1972) and Coastal Plain (Bacon and Anderson, 1976) failed to document this species. Until 1986, when Trauth and Caldwell reported a single specimen from Cleburne County in the Ozark Mountain region, the range of this species in Arkansas was thought to be restricted to the Ouachita Mountains (Reagan, 1974; Smith, 1984).

The presence of *Hemidactylum* within the Ouachita Mountains was first reported by Hurter and Strecker (1909) when two specimens were collected from the general vicinity of Hot Springs in Garland County. Black and Dellinger (1938) reported one additional specimen collected by Hurter from Hot Springs between 1909-1912 but no new localities. Nineteen years later, Dowling (1957) reported specimens had been collected in Hot Spring, Howard and Polk counties, but Reagan (1974) described the localities in Hot Spring and Howard counties as erroneous. The Polk county location was verified with a specimen deposited in the University of Arkansas Department of Zoology collection. Reagan (1974) gave the range for *Hemidactylum* as Garland, Clark, and Polk counties but did not provide a location or disposition of the Clark County record. Reagan (1974) reported the collection of a single specimen from a boggy area adjacent to the Cossatot River below Duckett Ford in Howard County, an area now inundated by Gilham Lake. Smith (1984) reported the range of *Hemidactylum* as Garland, Howard, Montgomery, and Polk counties. The addition of Montgomery County was based on two, unpublished 1983 observations of individual specimens recorded in the ANHC database. No explanation was given for the removal of Clark County. Interestingly, during the 80 year period between 1909 and 1989, only 18 specimens of *Hemidactylum* had been reported in the literature or their locations documented in the Arkansas Natural Heritage Commission database. In 1990, Trauth *et al.* discussed reproduction in *Hemidactylum* and reported 42 specimens collected from Garland and Montgomery counties. Many of the specimens reported by Trauth *et al.* (1990) were collected during this study. And recently Trauth and Cochran (1991) recorded a specimen from southwestern Garland County.

From October, 1983 through March, 1991 we conducted a general survey of salamander species distributions in the Ouachita Mountain region of west-central Arkansas. One of the species of specific interest was *Hemidactylum*. The purposes of the present study were to locate additional specimens of *Hemidactylum* in an effort to better define distribution within the Ouachita Mountains of Arkansas and to more precisely determine habitat utilization in an effort to provide resource managers better information with which to make decisions.

## STUDY AREA

The Ouachita Mountains have been folded, vaulted, and uplifted through geologic time, and exhibit an east-west, ridge and valley landscape with elevations ranging from 80 to 860 m above sea level. The soils, developed from sandstone, shale, novaculite and chert, are dry to droughty and range in texture from loam to clay (Pell, 1983). Second-growth (50-70 years old) mixed hardwoods (*Quercus/Carya*) occur on more mesic north slopes with dryer south slopes vegetated by second growth shortleaf pine (*Pinus echinata*) forest types, particularly on Ouachita National Forest lands. Interspersed among National Forest lands are a number of small communities, timber company lands primarily vegetated with second and third growth loblolly pine (*Pinus taeda*) and mixed hardwood forest types, and private residences and cattle and poultry farming operations with much land in pasture. Timber harvest activities have created a very diverse landscape, both horizontally and vertically, ranging from early successional seral stages to areas of older growth. The result of this intermingled land ownership has been to create a habitat mosaic.

The region contains a significant number of rivers and streams, several thousand wildlife waterholes and ponds of various sizes, and numerous lakes with associated riparian habitat. Most first and second order streams and some third and fourth order streams may have occasional periods of intermittent flow during dryer summer and fall months; however, most third and fourth order streams are perennial. South of the Ouachita River, many streams of all orders are perennial due to springs in their upper reaches. Many streams (both perennial and intermittent), wildlife ponds, spring runs and catch basins, and some unique communities such as woodland acid seeps, contain pools and segments heavily vegetated with mosses (USDA-Forest Service, 1990b).

## MATERIALS AND METHODS

Most observations/collections of *Hemidactylum* were made while road cruising paved highways during rainy periods in fall, winter and spring months. A majority of state highways in Garland, Montgomery, Perry, northern Pike, Polk, Scott and Yell counties were cruised at least once during the study period. Two sites, one in Garland County and one in Polk County, were particularly productive and were road cruised on more than one occasion and in different years. Salamanders were captured by hand, placed in zip-loc bags with moist paper towels, and retained in ice chests until road cruising activities for the evening ceased so that specimens could be refrigerated awaiting transport.

Ground search activities were concentrated in flood plains of perennial and intermittent streams, spring and spring runs, mossy areas in other moist conditions, and beneath structural habitat components such as logs and rocks. Specimens were processed as previously described.

*Hemidactylum* retained as specimens were transported alive to Arkansas State University and the University of Arkansas-Little Rock, where nearly all were processed within 48 hours after capture. Individuals

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served in 70% ethanol for use in associated studies of life history and reproductive biology.

## RESULTS

A total of 45 *Hemidactylium* was collected/observed at 18 new locations in Garland, Montgomery and Polk counties (Fig. 1). Nineteen animals were observed during road cruising activities in October (16) and November (3), and 18 animals were observed during February (14) and March (4). Eight specimens were located during ground search activities (Table 1).

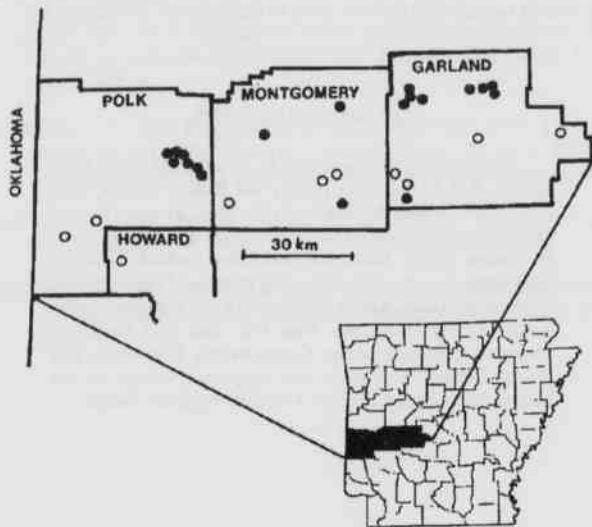


Figure 1. Distribution of *Hemidactylium* within the study areas. Closed circles represent locations from this study. Open circles represent previously known locations.

Table 1. Summary of locations where specimens of the four-toed salamander, *Hemidactylium scutatum*, were located during this study, and locations found in the Arkansas Natural Heritage Commission database (denoted by asterisk).

COUNTY	LOCATION	NO. OBSERVED	DATE	RC/GS
Garland	T1N-R19W-S31	3	10/22/86	RC
	T1N-R20W-S27	2	10/08/83	GS
	T1S-R19W-S18	1	10/22/86	RC
	T1S-R20W-S01	1	10/23/86	RC
	T1S-R22W-S10	1	07/02/90	RC
	T1S-R22W-S15	6	02/03/86	RC
		4	02/17/86	RC
	T1S-R22W-S16	1	03/21/91	GS
	T1S-R22W-S22	4	03/11/86	RC
	T2S-R17W-S18*	1	03/83	GS
	T2S-R20W-S13*	1	05/79	GS
	T3S-R22W-S06*	4	07/21/86	GS
	T3S-R22W-S17*	1	09/20/86	GS
	T6S-R30W-S09*	1	02/73	GS
Howard	T2S-R24W-S09	1	10/17/86	RC
	T2S-R26W-S27	4	02/13/86	GS
Montgomery	T3S-R14W-S10*	1	05/03/85	GS
	T3S-R24W-S17*	1	02/83	GS
	T4S-R74W-S06	1	07/09/90	GS
	T4S-R27W-S04*	1	10/15/83	GS
	T2S-R29W-S36	1	10/12/84	RC
	T3S-R28W-S06	1	10/12/84	RC
		2	10/18/85	RC
		1	02/02/90	RC
	T3S-R28W-S07	1	10/12/84	RC
		1	11/11/85	RC
T3S-R28W-S08	2	10/12/84	RC	
	1	10/18/85	RC	
	1	11/11/85	RC	
T3S-R28W-S09	1	11/11/85	RC	
T3S-R28W-S16	1	10/19/85	RC	
T3S-R30W-S23	1	10/19/85	RC	
T4S-R11W-S25*	1	04/53	GS	
T5S-R32W-S02*	1	06/81	GS	

Denotes method of collection: GS= Ground Search, RC= Road Cruising

Other species of salamanders observed during road cruising activities on nights when four-toed salamanders were observed included *Ambystoma annulatum*, *A. maculatum*, *A. opacum*, *A. texanum*, *Eurycea multiplicata*, *Notophthalmus viridescens*, *Plethodon albagula*, and *P. serratus*. Species captured from leaf litter and beneath logs along with *Hemidactylium* during ground search activities included *Desmognathus brimleyorum*, *E. multiplicata*, and *P. albagula*.

## DISCUSSION

Ground search activities were conducted in numerous locations throughout the study area with four sites yielding eight *Hemidactylium*. For example, on 8 October 1983, a male and female were found together beneath a flat rock in a sand and small gravel portion of Blakely Creek (Garland County) where stream depth was approximately 7 cm. The pair was located a few m from a small spring-run vegetated with mosses. The riparian area containing the stream was composed of a narrow strip of vegetation 25 m wide bounded by roads on two sides, fields intermingled with pine and hardwood timber, common in the area, and a residence within 75 m. Four-toed salamanders breed in the fall which may account for the occurrence of both sexes at this site (Johnson, 1987).

Three *Hemidactylium* were discovered beneath moss growing on a decayed portion of a shortleaf pine branch partially submerged in a small seepage pool (45 cm sq. X 10 cm deep) in an upland intermittent drain vegetated by oak and hickory tree species. The timber stand surrounding the pool was relatively open and composed of hardwood and shortleaf pine trees 65 years old. This stand had been thinned during timber harvest activities two years earlier but had received no further silvicultural treatments. Further examination of the general area did not yield additional pools. A lack of suitable nest sites has been suggested as a possible factor influencing communal nesting among female *Hemidactylium* (Breitenbach, 1982). An additional specimen was discovered in the same timber stand about 150 m away among hardwood leaves at the bottom of a small pool in a boggy area containing mosses, hardwoods, and overgrown with greenbrier (*Smilax*). This partially shaded site was located within 5 m of a major county road bordered by extensive private pastures-lands.

Two other specimens discovered during ground search activities were both found in timber stands with a predominant shortleaf pine overstory. At one site, a salamander was found beneath a log in a stand with an extremely dense hardwood midstory. The other salamander was collected from hardwood/pine leaf litter accumulated behind a large shortleaf pine branch at the edge of a small seepage pool in an intermittent upland drain. The seepage area and pool were at the head of a road drainage tile and were within 5 m of a major forest road. The surrounding timber stand was 56 years old and very open as the result of commercial timber harvest to thin the stand (1983) and wildlife stand improvement-midstory removal harvest (1987).

Ten of the occurrence records for *Hemidactylium* contained in the ANHC database include some information on the habitat in which the animals were observed. Virtually all reported animals were found beneath logs or beneath moss mats growing on the surfaces of logs, in the floodplain of a stream, or adjacent to a spring or creek. Similar observations have been made regarding habitat use by *Hemidactylium* throughout its range (Bleakney and Cook, 1957; Carter, 1968; Martof, 1955). Most of the nests observed by Johnson (1987) in Missouri have been along small, fishless creeks in thick mats of mosses. Examination of moss mats in fishless streams in the Ouachita Mountains has shown these sites to support large populations of isopods which may provide a significant prey resource.

Use of small ponds with abundant logs and shallow areas with moss mats and thick grasses and rushes along the shore appear to be a significant nesting habitat for *Hemidactylium* in the northern portion of its range (Harris and Gill, 1980; Wallace, 1984). None of the specimens from the Ouachita Mountains have been collected from ponds.

Road cruising activities have provided for the bulk of localities reported in this study. Two sites, one each in Garland and Polk counties, have been particularly productive. The Garland County location lies

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along the county road leading to the community of Buckville. On four separate occasions, a total of 17 live *Hemidactylium* was observed or collected within a one mile segment of road. Six salamanders were observed on each of two occasions within a nine day period, and one month later, four salamanders were seen. In addition to these live animals, several carcasses and tails, victims of automobile traffic, were observed. Examination of aerial photographs reveal a habitat mosaic consisting of many acres of open fields, seedling/sapling stands of loblolly and short-leaf pine, intermingled hardwood riparian habitat, a few stands of older pine and pine/hardwood mixed forest types, and homes or businesses. The topography of the general area within one mile of the collection site is relatively flat and contains at least 13 small ponds. The pond adjacent to the county road to which the observed specimens were moving is the result of beaver (*Castor canadensis*) activity which has created a small wetland by retaining water on the previously timbered site. Tree death from inundation and beaver foraging activity have opened up the forest canopy and resulted in an accumulation of logs, dense herbaceous plant growth, and extensive growth of mosses. Orientation of salamanders at the time of capture indicated they had traveled crosscountry through a loblolly pine plantation about 10 years old, or had traveled through the plantation using small stream channels and wet areas with abundant moss mats.

The Polk County location lies along Highway 8 near the Big Fork community. Between 1984 and 1990, a total of 14 live salamanders was collected on four separate nights in October, November and February. In addition to live specimens, numerous carcasses and severed tails were observed on the roadway indicating a considerable number of animals were moving in the area. Most of the land along Highway 8 where these collections have occurred is privately owned, and portions are grazed by livestock or maintained in hay pasture. The land is relatively flat and broken by wooded riparian strips bordering tributaries to Big Fork and Mill Creeks and contains many springs and seeps in and adjacent to the floodplain. Mosses, dense herbaceous vegetation, and decaying logs of various diameters are abundant and well distributed in the area. Adjacent Forest Service lands are, for the most part, relatively steep uplands vegetated by species characteristic of mesic north slope forest types (*Quercus/Carya*) and xeric south slopes (*Pinus/Quercus/Carya*) dissected by intermittent flow streams characterized by hardwood species typical of the Ouachita Mountain region.

*Hemidactylium* apparently is not adverse to traversing habitat conditions not typically considered preferred habitat. Bleakney and Cool (1957) reported brooding females in a pond isolated by railroad tracks, highways, and a cemetery, and LaPointe (1953) collected a specimen from a highway during rainy weather.

## HABITAT MANAGEMENT

Habitat considerations for salamanders, including *Hemidactylium*, were included as forest management goals and objectives with standards and guidelines established to help meet these goals in the Amended Land and Resource Management Plan for the Ouachita National Forest (USDA-Forest Service, 1990b). Goals include protecting and improving habitat for sensitive species with emphasis placed on providing sensitive species habitat not found on private lands. In the case of *Hemidactylium*, forest wide standards and guides providing for the development of a mature growth pine and hardwood component, retention and/or creation of logs on a per acre basis during timber harvest activities to enhance forest floor structural diversity, and non-harvest buffer strips adjacent to intermittent and perennial streams, springs, wetlands and lakes – all important habitat components for this species. In addition, unique community types, such as woodland acid seeps that typically contain extensive areas of mosses suitable for egg deposition, are fully protected. Wildlife waterholes (ponds) are prescribed at a rate of one per 160 acres (4 per square mile) with ponds less than one-half surface acre which are not stocked with fish to provide suitable breeding habitat for native amphibians.

These proactive habitat enhancement and protection actions were developed to ensure the viability of *Hemidactylium* and other salamander

species and to preclude trends toward endangerment that would result in the need for Federal listing (USDA-Forest Service, 1990b; 1990c).

Recommendations to further enhance habitat for *Hemidactylium* include: (1) prohibiting the collection of mosses from all aquatic habitats. Mosses have clearly been demonstrated to be a critical component of breeding habitat and are necessary to maintain viability for this sensitive species; (2) modification of pond construction. Ponds should be constructed to provide areas of shallow water where mosses and other dense shoreline vegetation may become established. In addition, because use of logs by this salamander indicates a need for this structural component near aquatic situations, some of the trees removed from pond excavation sites should be placed in shallow areas to facilitate use by salamanders.

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