

A Herpetofaunal Survey of the Confluence of the Canadian and Arkansas Rivers: Constructing a Baseline Inventory for the Sequoyah National Wildlife Refuge

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Oklahoma has a long herpetological history, but there are still many gaps in our understanding of amphibian and reptile distribution in the state. From 2000 to 2002, we conducted baseline herpetofaunal inventories in the Sequoyah National Wildlife Refuge in Haskell, Muskogee, and Sequoyah counties. We observed 11 amphibian species and 35 reptile species on the refuge. Based on historic records, an additional 21 species of amphibians and reptiles occur in the three counties sampled. These additional species may still yet be observed on the refuge. When compared to historic observations, our inventory on the refuge could account for ≤ 37 county distributional records. Our results also indicate the importance of riparian corridors to maintaining herpetological diversity.

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INTRODUCTION

An important missing link in many land management agencies' arsenal is the availability of distributional data on species which occur there. Knowledge of the species composition of an area is an essential first step in understanding and conserving habitat. Species inventories and acquisition of voucher specimens are important, particularly when establishing monitoring programs and comparisons of distribution and abundance over a temporal scale (Heyer et al 1994). In light of recent declines in amphibian and reptile populations, Gibbons et al (2000) implores that herpetofaunal inventories should become a standard part of any environmental assessment. This is particularly important when one considers the new directions in federal funding of state activities through the implementation of individual states' long-range comprehensive wildlife conservation strategies.

Unfortunately not all states have had the foresight to implement statewide dis-

tributional surveys of their herpetofauna. Oklahoma does have a long herpetological history (Webb 1970, Carpenter and Krupa 1989, Sievert and Sievert 2005). That said, there are still many gaps in the distributional knowledge of Oklahoma amphibians and reptiles. From 2000 to 2002, we conducted baseline inventories for amphibians and reptiles in the Sequoyah National Wildlife Refuge (SNWR) in east-central Oklahoma. We had three goals in initiating this inventory: 1) establishing baseline data for management purposes in the SNWR, 2) obtaining valuable distributional information on Oklahoma herpetofauna, and 3) identifying areas in need of further study. It is our hope that these results add to the understanding of Oklahoma amphibians and reptiles over temporal and spatial scales.

STUDY AREA AND METHODS

Sequoyah National Wildlife Refuge is an 8,417.5-ha refuge lying at the confluence of the Canadian and Arkansas Rivers, on the

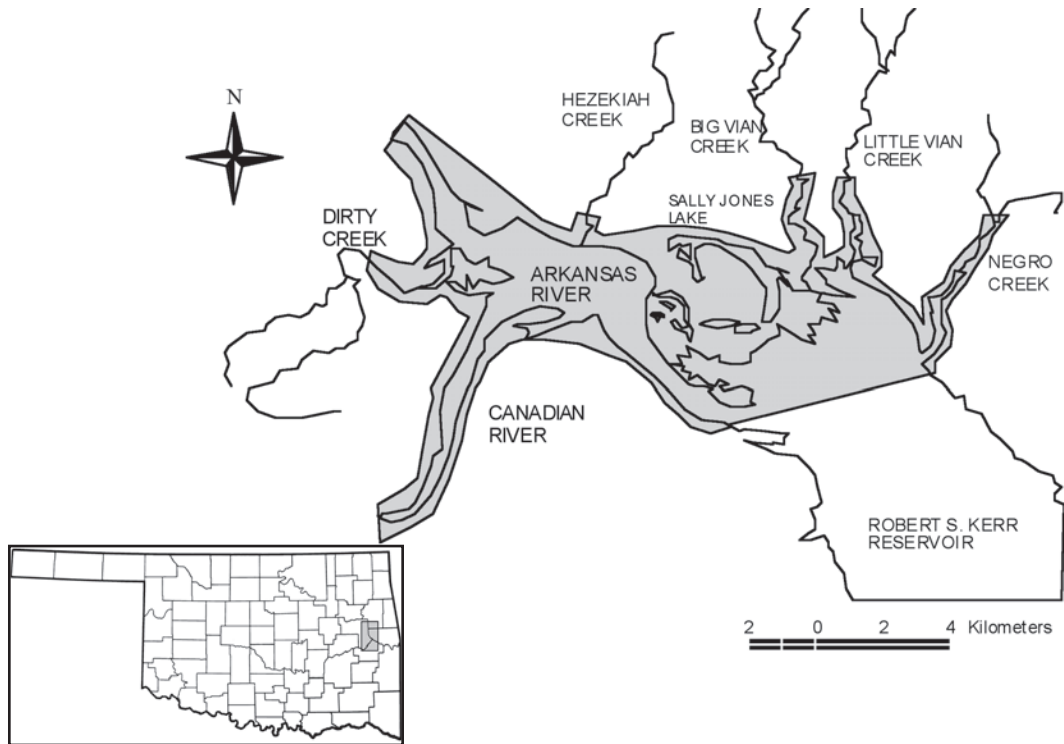


Figure 1. Location of Sequoyah National Wildlife Refuge. Shaded area denotes refuge boundary.

Robert S. Kerr Reservoir in Haskell, Muskogee, and Sequoyah Counties, Oklahoma (Figure 1). Roughly half of the refuge is comprised of aquatic habitats, including open water reservoir, large rivers, medium and small streams, oxbows, wooded and grassy sloughs, and seasonal and permanent wetlands. Terrestrial habitats consist of bottomland hardwoods, shrub-scrub grasslands, and agricultural fields. There is a small section of high bluff and hardwood forest along the Canadian River in the Haskell County unit of the refuge. The refuge is partially managed for migratory waterfowl. Roughly 1,255 ha of the SNWR are used for cooperative farming efforts and food plots for waterfowl. Other principal management practices include prescribed fire and water-level manipulations.

The Canadian and Arkansas Rivers constitute county boundaries between Haskell, Muskogee, and Sequoyah Counties, and occupy the juncture of the three counties. Considering the small radius of the refuge

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and the similarity in habitat among counties, for comparison purposes we considered all species encountered as occurring in all three counties.

A variety of methods were employed to adequately sample all species of amphibians and reptiles (Heyer et al 1994). Plywood cover boards (61 x 122 x 0.6 cm) were placed in all representative habitats throughout entire refuge. The number of cover boards used per year varied, because some were lost or removed between years. The number of cover boards used per year ranged from 49 to 66, with a total effort of 2,447 sampling nights (1 cover board checked on a single day = 1 sampling night). Eight screen funnel traps were placed along natural barriers near the refuge office in 2000 only. There were 224 sampling nights using funnel traps (1 funnel trap checked on a single day = 1 sampling night). Auditory surveys for anurans were used to identify breeding choruses. Finally, foot surveys and road cruising were also conducted. Total effort for foot searches was

94 person hours, and 254 hours were devoted to road cruising. Road cruising hours included drive time between sites in the refuge. Calling anuran surveys were done concurrently with the foot searches and road cruising. All surveys were conducted in mid-March, and May through August of all three years. An aquatic turtle survey was being conducted concurrently as part of a separate project, and data for those species were taken from Riedle (2001).

To better demonstrate possible range extensions and data gaps in our surveys, our results were compared to two sources of historical data on amphibian and reptile distribution in Oklahoma. The first was the *Reptiles of Oklahoma* (Webb 1970) and the second was the Oklahoma Biological Survey's Distribution of Oklahoma Amphibian and Reptiles by Recorded Sightings (DOKARRS) database. Both sources contained pertinent metadata (locale, observer, date, etc.) on species observations.

RESULTS

A total of 11 amphibian species (Table 1) and 35 reptile species were observed (Table 2). An additional 21 species of amphibians and reptiles have been documented in the three counties surveyed, but were not observed by us. By using shaded range maps in contemporary field guides instead of specific locales, we identified an additional seven species that may occur in the SNWR (Conant and Collins 1998, Sievert and Sievert 2005). The seven species included one salamander, *Plethodon albagula*; two frogs, *Pseudacris crucifer* and *Rana clamitans*; one turtle, *Sternotherus carinatus*; one lizard, *Eumeces anthracinus*; and two snakes, *Cemphora cocinea* and *Storeria occipitomaculata*.

Our observations could potentially account for 37 county distributional records for amphibians (Table 1) and reptiles (Table 2) in the SNWR. The majority of those records came from Haskell County (58%)

Table 1. Amphibian species list for Sequoyah National Wildlife Refuge.

Species	Haskell Co.	Muskogee Co.	Sequoyah Co.
<i>Necturus maculosus</i>		D*	
<i>Ambystoma texanum</i>	X	X, D	X
<i>Eurycea tynnerensis</i>			D
<i>E. longicauda</i>			D
<i>Plethodon ouachitae</i>			D
<i>Bufo charlesmithi</i>	X	X	X, D
<i>B. woodhousii</i>	X	X	X
<i>Spea bombifrons</i>		D	
<i>Gastrophryne carolinensis</i>	X	X	X, D
<i>G. olivacea</i>	D	D	D
<i>Acris crepitans</i>	X, D	X, D	X, D
<i>Hyla chrysocelis/versicolor</i>	X	X, D	X, D
<i>H. cinerea</i>	X	X	X
<i>Pseudacris feriarum</i>	X	X	X, D
<i>P. streckeri</i>	X	X	X
<i>Rana areolata</i>	D	D	
<i>R. catesbeiana</i>	X	X, D	X, D
<i>R. sphenoccephala</i>	X	X	X, D

*X = species observed during this study, D = species observations in DOKARRS.

Table 2. Reptile species list for Sequoyah National Wildlife Refuge.

Species	Haskell Co.	Muskogee Co.	Sequoyah Co.
<i>Chelydra serpentina</i>	X, R*	X, R, D, W	X, R, D, W
<i>Macrochelys temminckii</i>	X, R, D, W	X, R, D, W	X, R, D, W
<i>Kinosternon subrubrum</i>	X	X, D	X, R, D
<i>Sternotherus odoratus</i>	X, R	X, R, D	X, R, D, W
<i>Apalone mutica</i>		D	W
<i>A. spinifera</i>	X, R	X, R, D	X, R, D, W
<i>Graptemys ouachitensis</i>	X, R	X, R	X, R, D
<i>G. pseudogeographica</i>	X, R	X, R	X, R, D, W
<i>Pseudemys concinna</i>	X, R	X, R	X, R, W
<i>Trachemys scripta</i>	X, R	X, R, D, W	X, R, W
<i>Terrapene carolina</i>	X, D	X, D, W	X, D, W
<i>T. ornata</i>	X, D, W	X, D, W	X, D
<i>Crotaphytus collaris</i>	D, W	D, W	D, W
<i>Phrynosoma cornutum</i>		D, W	
<i>Sceloporus undulatus</i>	X, D, W	X, D, W	X, D, W
<i>Ophisaurus attenuatus</i>	X,	X, D, W	X, D, W
<i>Eumeces fasciatus</i>	X, D	X, W	X, D, W
<i>E. laticeps</i>	X	X	X, W
<i>E. septentrionalis</i>			D
<i>Scincella lateralis</i>	X, D	X, D, W	X, D, W
<i>Aspidocelis sexlineatus</i>	X, D, W	X, W	X, D, W
<i>Carphophis vermis</i>	X, D, W	X, D, W	X, D, W
<i>Diadophis punctatus</i>	X, D	X, D, W	X, D
<i>Heterodon platirhinos</i>	X, W	X	X, D, W
<i>Tantilla gracillis</i>	X, D	X, D, W	X, D
<i>Virginia striatula</i>	D	D	D, W
<i>V. valeriae</i>	D, W	D	D
<i>Storeria dekayi</i>	X	X	X, D, W
<i>Tropidoclonian lineatum</i>		D	
<i>Thamnophis proximus</i>	X	X	X, D, W
<i>T. sirtalis</i>	D, W	D, W	D, W
<i>Nerodia erythrogaster</i>	X	X	X, W
<i>N. rhombifer</i>	X, D, W	X	X, D, W
<i>N. sipedon</i>	X	X, D, W	X, W
<i>Regina grahamii</i>	X	X, W	X
<i>Opheodrys aestivus</i>	X	X, D, W	X, D, W
<i>Coluber constrictor</i>	X, D	X, D	X, D, W
<i>Masticophis flagellum</i>	X, D, W	X, D	X, D, W
<i>Pituophis catenifer</i>		D	
<i>Elaphe emoryi</i>			D
<i>E. obsoleta</i>	X, D, W	X, W	X, D, W
<i>Lampropeltis calligaster</i>	X	X, D, W	X, D
<i>L. getula</i>	X	X, D	X, D, W
<i>L. triangulum</i>			D
<i>Agkistrodon contortrix</i>	X, D, W	X, D	X, D, W
<i>A. piscivorus</i>	X	X	X, D, W
<i>Crotalus atrox</i>	D, W	D, W	D, W
<i>C. horridus</i>	D, W	D, W	D
<i>Sistrurus miliarius</i>	D, W	D, W	

* X = observations made during this study, R = species observations in Riedle (2001), D = species observations in DOKARRS, W = species observations in Webb (1970).

followed by Muskogee County (32%) and Sequoyah County (10%). Unfortunately, we were woefully remiss in collecting voucher specimens for these distributional records. Voucher specimens of *Hyla cinerea* were collected in Muskogee County (Oklahoma State University Vertebrate Collection Cat. # A7570) and Sequoyah County (Oklahoma State University Vertebrate Collection Cat. #A7569).

DISCUSSION

The SNWR lies within the Arkansas River Valley separating the Ozark and Ouachita Mountains. The herpetofaunal communities in these regions represent influences from the southeastern coastal plains, western plains, northern forests, and Appalachian Mountains (Dowling 1956). We would not expect to find several of the species listed in Table 1 in the lowlands of SNWR. *Eurycea longicauda*, *E. tynerensis* are representative of the Ozark highlands to the north, while *Plethodon ouachitae* is an endemic of the Ouachita Mountains to the south (Sievert and Sievert 2005).

Our sampling techniques may not have been adequate for the collection of *Necturus maculosus*, a neotenic salamander. This species may occur in the SNWR if adequate habitat is present. It was surprising that no specimens of *Plethodon albagula* were observed during our surveys, and no observations were recorded in DOKARRS. They occur on shaded slopes of rocky wooded hillsides (Trauth et al 2004), and adequate habitat may be present along the Canadian River. In Arkansas, *P. albagula* was the most commonly observed species and is fairly cosmopolitan in its use of available habitat (Fox et al 2004).

Further investigations into the occurrence and distribution of *Gastrophryne carolinensis* and *G. olivacea* are needed. During call surveys, it was thought that we might be hearing both species calling from the same grassy sloughs. Due to the similarity of the calls of both species, we were hesitant

to identify both as occurring in the SNWR without verification. All individuals captured by us were *G. carolinensis*, but more attention should be given to populations in this area because *G. olivacea* has been documented historically in all three counties (Table 1).

At first glance, observations of *H. cinerea* seem like a significant range extension for this species in Oklahoma. The nearest populations are in Pushmataha County in southeastern Oklahoma (Sievert and Sievert 2005). They do follow the Arkansas River across central Arkansas (Trauth et al 2004) and the SNWR populations are probably a natural extension of that distribution. *Pseudacris streckeri* is a denizen of central Oklahoma (Sievert and Sievert 2005), which extends its range westward along the flood plain of the Arkansas River drainage into Arkansas (Trauth et al 2004). The occurrence of this species in the SNWR helps bridge the distributional gap for *P. streckeri* between the Oklahoma and Arkansas populations.

Suitable habitat for several anuran species, such as *Spea bombifrons*, *Scaphiopus hurterii*, and *Rana areolata*, may occur in the SNWR. *Spea bombifrons* and *S. hurterii* occur in habitats with sandy soils, and *R. areolata* prefer heavily vegetated sloughs and marshes (Trauth et al 2004). Potentially, suitable habitat for these three species is present in the SNWR, but due to their secretive nature, and short breeding periods, they may be elusive enough to have avoided detection during our surveys.

The aquatic turtle fauna in the SNWR was extensively sampled previously (Riedle, 2001). *Kinosternon subrubrum* was rarely observed in lotic systems in the refuge, but was captured extensively during our surveys crossing roads near permanent wetlands. Sievert and Sievert (2005) show the distribution of *Sternotherus carinatus* reaching north of the Arkansas River into Sequoyah County. Riedle (2001) sampled eastern Oklahoma fairly extensively, but never captured the species north of McCurtain County. This species is restricted to the Ouachita Moun-

tains and Gulf Coastal Plains in Arkansas, with occurrences restricted to the Arkansas, Ouachita, and Saline River drainages in the southwestern corner of the state (Trauth et al 2004).

Because aquatic habitats did dominate the available habitat in the SNWR, aquatic and semi-aquatic snakes were well represented in the refuge. It was surprising that no specimens of *Thamnophis sirtalis*, a common, widespread species, were observed. In contrast, *Regina grahamii* is not well represented in eastern Oklahoma (Table 1; Sievert and Sievert 2005), so it was surprising that we observed them fairly frequently. Most individuals were gravid females basking in overhanging trees along smaller streams. Smaller, more secretive snakes, such as *Storeria occipitomaculata*, *Virginia striatula*, and *V. valeriae*, could also still be found in the SNWR. *Crotalus horridus* and *Sistrurus miliarius* were not observed by us, but are occasionally seen by refuge staff and visitors, although these observations can not be considered proof of occurrence without adequate verification.

The lack of open rocky glades may preclude some species of reptiles from occurring in the refuge. *Crotaphytus collaris*, *Phrynosoma cornutum*, *Pituophis catenifer*, and *Crotalus atrox* are species that are typically found in more open, arid habitats in western Oklahoma. They do trend east across Oklahoma into Missouri and Arkansas utilizing open glades (Johnson 1987, Trauth et al 2004, Sievert and Sievert 2005). There may be marginal habitat for these species available adjacent to the refuge.

As demonstrated in Tables 1 and 2, there is still much to be learned about the distribution of amphibians and reptiles in Oklahoma. It may be wise to tap into the ever-growing popularity of herping and herpetology in order to develop statewide monitoring programs. Recognizing this need, Kansas has developed statewide spring herp counts (Rundquist 1999) and microbiogeographical analyses of known species distributions (Riechard et al 1995).

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Tools such as these are essential in developing a baseline for future amphibian and reptile monitoring in Oklahoma. Recognizing our own shortsightedness, we emphasize that voucher photographs or specimens should be collected and deposited in the appropriate institutions.

Lastly, we would like to point out the importance of river corridors in relation to herpetological diversity and abundance. The distribution of several species, such as *H. cinerea* and *P. streckeri*, lay solely along the Arkansas River drainage throughout parts of their range. Two of the largest populations of *Macrochelys temminckii*, a state protected species, are located in the SNWR and in the smaller tributaries of Eufaula Reservoir (Riedle et al 2005) and are interconnected by the Arkansas and Canadian Rivers. These aquatic habitats are also used extensively by many terrestrial species as well. We observed *Terrapene carolina*, *Opheodrys aestivus*, and *Elaphe obsoleta* foraging, basking, and crossing the lake, streams, and marshes in the SNWR fairly frequently. Protection of these riparian corridors is essential for managing for the diversity of herpetofauna that occurs there.

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