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Herpetological Diversity of Stemler Cave Nature Preserve, St. Clair County, Illinois

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ABSTRACT

Stemler Cave is a biologically diverse ecosystem located in southwestern St. Clair County, IL. The primary entrance to the cave and the surrounding wooded sinkhole is a dedicated Illinois nature preserve. Here I report the results of ten years of observations on the herpetological diversity of Stemler Cave Nature Preserve, which include 26 species of amphibians and reptiles. Seventeen species were recorded from the entrance or interior of the cave. The most diverse group were frogs and toads with 11 documented species. Two salamander species, four turtle species, one lizard species, and eight species of snakes were recorded in Stemler Cave Nature Preserve.

INTRODUCTION

Stemler Cave Nature Preserve (SCNP) is a privately-owned, dedicated Illinois nature preserve in southwestern St. Clair County. Located in the larger Stemler Karst Illinois Natural Areas Inventory site (Figure 1) of southwestern Illinois, the preserve consists of an approximately 0.35 ha steep-sided wooded sinkhole that includes the primary entrance to Stemler Cave and a short section of the cave passage (Figure 2). The cave passage sumps immediately upstream of the entrance but air-filled passage continues downstream (north) for about 2 km before it again becomes impassable to humans. Several biological surveys of Stemler Cave have been conducted, primarily focused on the invertebrate fauna (Peck and Lewis 1978; Webb et al. 1993; Lewis et al. 2003; Soto-Adames and Taylor 2010). Approximately 50 invertebrate species are known from the cave, including the state endangered Enigmatic Cavesnail (*Fontigens antroecetes*) and the federally endangered Illinois Cave Amphipod (*Gammarus acherondytes*). The herpetological record for Stemler Cave includes only two taxa of amphibians, *Eurycea* sp. and *Rana* (*Lithobates*) sp. (Webb et al. 1993), and no records are known for the sinkhole portion of the preserve. The purpose of this study is to present a more complete list of amphibians and reptiles from both the surface and subterranean portions of SCNP based on 10 years of observations.

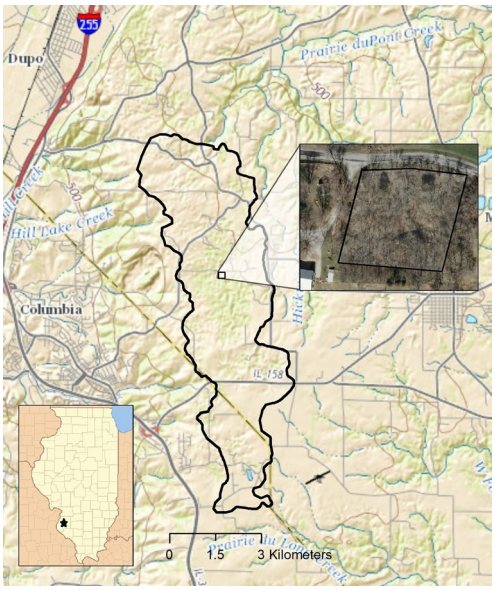

Figure 1. Topographic map showing the Stemler Karst Natural Area (black boundary), which is defined by the watershed boundary of Stemler Cave. The location of Stemler Cave Nature Preserve is indicated by the black square. Inset aerial photo shows the preserve boundary in black. The wooded area south of SCNP is Stemler Cave Woods Nature Preserve. The lower left inset map of Illinois indicates the location of the region with a star. Base map by ESRI.

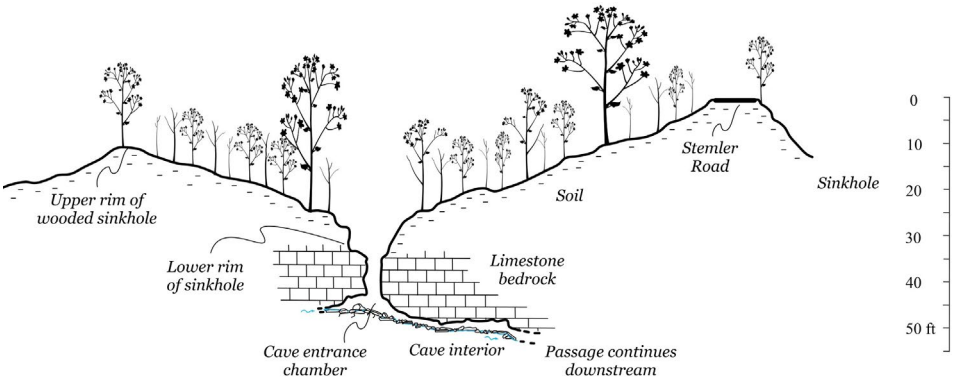

Figure 2. Cross section of Stemler Cave Nature Preserve, facing west. Surveyed by Derik Holtmann, Dan Lamping and Joe Sikorski, Illinois Speleological Survey. Drawn by Dan Lamping.

METHODS

An informal visual survey of the amphibians and reptiles of SCNP was conducted between 10 April 2004 and 28 September 2013. I am the owner of SCNP and live adjacent to the site, thus I had the potential to actively search for and opportunistically observe organisms on an almost daily basis for 10 years. Herpetological observations were recorded on 41 different dates during the study period. Observations on 20 dates were made during the process of entering or leaving the property or on short excur-

sions while engaged in unrelated outdoor activities on site. Subterranean observations were made on 21 dates, mostly during field work to study the Enigmatic Cavesnail in Stemler Cave, and during survey work with the Illinois Speleological Survey to map Stemler Cave. Specimens observed within an approximately 10 meter wide area outside of the preserve (perimeter) and in-cave sections downstream of the subterranean portions of the nature preserve boundary were included. Common and scientific names of amphibians and reptiles follow Crother (2012). Voucher specimens for select species are housed in the Illinois Natural History Survey (INHS) collection.

Table 1. Amphibian and reptile species observed in Stemler Cave Nature Preserve, St. Clair County, IL between 10 April 2004 and 28 September 2013.

Species	Cave Entrance	Cave Interior	Wooded Sinkhole	Perimeter Area
Blanchard's Cricket Frog	X		X	X
American Toad	X	X	X	X
Fowler's Toad				X
Gray Treefrog complex	X		X	X
Plains Leopard Frog	X	X	X	X
American Bullfrog	X	X	X	X
Pickerel Frog	X	X	X	X
Southern Leopard Frog	X	X		X
Spring Peeper	X	X	X	X
Western Chorus Frog			X	X
Eastern Spadefoot	X	X		X
Long-tailed Salamander	X	X		X
Northern Slimy Salamander		X		X
Copperhead			X	X
North American Racer			X	X
Milksnake				X
Common Watersnake				X
Rough Greensnake				X
Western Ratsnake		X	X	X
Dekay's Brownsnake				X
Common Gartersnake	X		X	X
Broad-headed Skink			X	X
Painted Turtle		X		X
Common Snapping Turtle	X			
Eastern Box Turtle	X			X
Pond Slider	X			
Total (26)	**14**	**11**	**13**	**24**

RESULTS

Twenty-six species of amphibians and reptiles were observed in SCNP. Table 1 lists each species by common name and indicates whether it was observed within the cave entrance, cave interior, wooded sinkhole portion of the preserve or within the perimeter area. Seventeen species were recorded from the entrance or interior of the cave. Five species were observed only in the perimeter area. The most diverse group were frogs and toads with 11 documented species. Two salamander species, four turtle species, one lizard species and eight species of snakes were recorded in SCNP. Following is a brief account of each taxon observed.

Frogs and Toads

Blanchard's Cricket Frog (*Acris blanchardi*) – Cricket Frogs were frequently encountered in the wooded sinkhole surrounding Stemler Cave and rarely within the entrance. The species is common around sinkhole ponds in the area.

American Toad (*Anaxyrus americanus*) – American Toads are common in the area and have been observed on numerous occasions in the wooded sinkhole, in the cave entrance, and occasionally in downstream regions of the cave.

Fowler's Toad (*Anaxyrus fowleri*) – Fowler's Toad seems to be less common in the Stemler Cave area than the American Toad. A single specimen was observed on the perimeter of the preserve on 30 July 2004.

Gray Tree Frog complex (*Hyla versicolor/ Hyla chrysoscelis*) – Gray Treefrogs were occasionally seen at the bottom of the cave entrance. Males were heard calling within the wooded sinkhole in summer and were tentatively identified as *H. versicolor* based on calls.

Plains Leopard Frog (*Lithobates blairi*) – Plains Leopard Frogs were seen occasionally in the cave interior in late summer and more regularly on the surface in the Stemler Cave area.

American Bullfrog (*Lithobates catesbeianus*) – Adults were commonly encountered within the cave, and on the surface. Large tadpoles with hind legs were seen in the cave stream on 30 August 2008 and newly metamorphic individuals in the cave stream at the entrance on 9 October 2004. Tadpoles were likely washed into the cave stream via pond or lake outlets that drain into open sinkholes or by collapse of sinkhole ponds within the Stemler Cave recharge area.

Pickerel Frog (*Lithobates palustris*) – Pickerel Frogs were observed regularly within the cave in all seasons, and on the surface during spring and summer. Pickerel Frogs are associated with caves in western Illinois and throughout the Ozarks ecoregion (Schaaf and Smith, 1970). The distribution of Pickerel Frogs in St. Clair County is likely restricted to the karst areas.

Southern Leopard Frog (*Lithobates sphenocephalus*) – Southern Leopard Frogs have been found both within the entrance and interior of the cave, and on the perimeter of the preserve. Southern Leopard Frogs were encountered less frequently than the Plains Leopard Frog in the Stemler Cave area.

Spring Peeper (*Pseudacris crucifer*) – Spring Peepers were recorded once within the cave interior (7 October 2007) and once in the entrance (7 October 2011). The species was occasionally encountered in the sinkhole and perimeter areas, but was commonly heard calling in spring from the same local sinkhole ponds utilized by Chorus Frogs.

Western Chorus Frog (*Pseudacris triseriata*) – Adults are occasionally observed in the wooded sinkhole, but have not been observed within the cave. Chorus frogs commonly breed in small sinkhole ponds in the Stemler Cave area.

Eastern Spadefoot (*Scaphiopus holbrookii*) – The Eastern Spadefoot was first recorded in the Stemler Cave area on 30 July 2004 (Weck 2006a, INHS 19542) when eight juvenile individuals were observed in the perimeter area of the preserve following heavy rains. Juveniles were observed in the cave entrance on 9 August 2004 and 30 October 2008. An adult was observed in Stemler Cave on 12 July 2006, far downstream (circa 1 km) of the preserve. I have heard Spadefoot choruses following heavy rains on several occasions within the Stemler Karst (March 2008, May 2008, April 2011, April 2012, April 2013).

Salamanders

Long-tailed Salamander (*Eurycea longicauda*) – Individual Long-tailed Salamander adults and larvae were observed in the stream within the cave entrance chamber on several occasions (INHS photo voucher 42870), and under a rock on the wooded perimeter of the preserve on 22 May 2011.

Northern Slimy Salamander (*Plethodon glutinosus*) – Two Northern Slimy Salamanders were observed in the study area; an adult under a log on the perimeter of the preserve (26 May 2004) and an adult within the cave interior (2 April 2011). Northern Slimy Salamanders are widespread but uncommon in the wooded karst portion of St. Clair County (Weck 2006b).

Snakes

Copperhead (*Agkistrodon contortrix*) – Copperheads have been observed at the north edge of the sinkhole, along Stemler Road. Two specimens were found dead-on-road (DOR) on 31 August 2005 and 30 September 2011 and a large specimen emerged from the preserve and crossed the road on 11 Sept 2009. Copperheads are widely distributed in the larger Stemler Cave area. The only vouchered Copperhead from St. Clair County was collected near Stemler Cave (Weck 2006c; INHS 19540) and the species is likely restricted to the karst areas of St. Clair County.

North American Racer (*Coluber constrictor*) – One adult North American Racer was observed in the wooded sinkhole on 20 April 2004, and the species was occasionally seen in the surrounding area.

Milksnake (*Lampropeltis triangulum*) – Milksnakes were seen regularly in the larger Stemler Karst Natural Area. Specimens were observed in the perimeter of SCNP on 21 May 2004 and 28 August 2007 (DOR juvenile).

Common Watersnake (*Nerodia sipedon*) – On 8 May 2004, a juvenile Common Watersnake was observed exiting the western edge of the preserve.

Rough Greensnake (*Opheodrys aestivus*) – A pair adult of Rough Greensnakes (one male, one female) was found dead on Stemler Road at SCNP on 5 September 2005. The snakes were crossing the road a few meters from the preserve boundary. A third DOR Rough Green Snake was seen on Stemler Road just east of the preserve on 30 May 2013.

Western Ratsnake (*Pantherophis obsoletus*) – Western Ratsnakes have been observed moving in and out of the wooded sinkhole on numerous occasions and road-killed juveniles are common on Stemler Road. A large adult was seen in the twilight zone of the cave interior on 7 October 2007.

Dekay's Brownsnake (*Storeria dekayi*) – Brownsnakes are common in the area, though the only observation of a specimen associated with the preserve was a DOR specimen found on 26 October 2005.

Common Gartersnake (*Thamnophis sirtalis*) – This species is common in the area and individual Gartesnakes were frequently encountered in the wooded sinkhole and perimeter area. A single adult Common Gartersnake was observed in the entrance chamber of Stemler Cave on 9 October 2014.

Lizards

Broad-headed Skink (*Plestiodon laticeps*) – Broad-headed Skinks were frequently observed in the perimeter area. An adult female was killed by a cat in the sinkhole on 25 May 2005. Broad-headed Skinks are common in the area.

Turtles

Painted Turtle (*Chrysemys picta*) – An adult female Painted Turtle was observed as it emerged from the preserve and crossed Stemler Road on 12 May 2007. A deceased adult specimen was seen at the entrance of a side passage, deep in the interior of the cave on 12 July 2006. Painted Turtles are common in sinkhole ponds in the area.

Snapping Turtle (*Chyledra serpentina*) – An adult was observed at the bottom of the cave entrance on 7 June 2013.

Eastern Box Turtle (*Terrapene carolina*) – A female Box Turtle was observed at the bottom of the cave entrance on 4 July 2005. A sub-adult specimen was seen crossing the road at the northeast corner of the preserve on 22 May 2011 and an adult female crossed the same spot on 2 May 2013. Eastern Box Turtles are occasionally encountered in wooded sinkholes in the area.

Pond Slider (*Trachemys scripta*) – An adult was observed at the bottom of the cave entrance on 6 June 2013. Pond Sliders are common in sinkhole ponds in the area.

DISCUSSION

The frog diversity observed during the course of this study includes the first record of the Eastern Spadefoot, *Scaphiopus holbrookii*, in St. Clair County, Illinois (Weck 2006a) and the first known record of the species within a cave. Given the known biology of this species, the occurrence of the Eastern Spadefoot in the cave is surely accidental. Other species observed in the cave entrance or within the cave interior that should be classified as accidentals include American Toad, Western Ratsnake, Common Gartersnake, Snapping Turtle, Eastern Box Turtle, Painted Turtle, and Pond Slider.

Three amphibians recorded in SCNP are known to be cave-associated species in Illinois; the Pickerel Frog, the Long-tailed Salamander, and the Northern Slimy Salamander. The Pickerel Frog is a "species in greatest need of conservation" (Illinois Wildlife Action Plan, Illinois Department of Natural Resources 2005) and both the Pickerel Frog and Long-tailed Salamander are indicator taxa for high quality cave communities in the Ozark Natural Division under the Illinois Wildlife Action Plan (Illinois Department of Natural Resources 2005). The Long-tailed Salamander is a troglophile, a species that can complete its entire life cycle in a cave (Durand 2005). Northern Slimy Salamanders have been known to successfully reproduce in a south-

ern Illinois cave (Phillips et al. 1999). The species has only recently been discovered in St. Clair County, at a site near Stemler Cave (Weck 2006b) and also seem to be limited to the karst portion of the county. I have observed Northern Slimy Salamanders at four other sites within the Stemler Karst Natural Area, twice inside small caves.

Given the small area of the study site, SCNP appears to have a rich herpetological fauna. When compared to the herpetological diversity of St. Clair County, IL (Phillips et al. 1999) this 0.35-ha parcel and its perimeter area includes 43% of the 60 recorded species known from the entire county; 2 of 9 salamander (22.2%), 11 of 13 frogs and toads (85%), 4 of 8 turtle (50%), 1 of 4 lizard (25%), 8 of 26 (30.7%) snake species. A few factors likely contribute to the high number of amphibians and reptiles recorded at this site:

1. The sinkhole and cave entrance are situated within the heart of a much larger complex of natural areas, the 1,837-ha Stemler Karst Natural Area (Figure 1) which, I have observed, has a rich herpetological fauna. The larger area contains all five currently used criteria for inclusion in the Illinois Natural Areas Inventory: high quality natural communities, specific suitable habitat for state-listed species, state dedicated Nature Preserves (including the 48.6-ha Stemler Cave Woods), outstanding geological features, and unusual concentrations of flora or fauna, and high quality streams (Illinois Department of Natural Resources 2013). Being moderately mobile creatures, amphibians and reptiles move from one suitable location to another within the region and some were merely crossing the preserve when detected during the course of this survey. Species I have recorded in the larger Stemler Karst Natural Area that were not detected in SCNP include Spotted Salamander (*Ambystoma maculatum*), Eastern Tiger Salamander (*Ambystoma tigrinum*), Prairie Kingsnake (*Lampropeltis calligaster*), Smooth Earthsnake (*Virginia valeriae*) and Eastern Musk Turtle (*Sternotherus odoratus*).

2. The preserve is a steep-sided sinkhole which leads to the pit-like cave entrance (Figure 2). The topography here acts as a giant pitfall trap, concentrating animals at the cave entrance and allowing for easy detection. Seventeen of the 26 species observed were in the bottom of the entrance or within the cave interior (Table 1).

3. Some species may utilize the humid, moist and thermally stable cave as a refuge during extreme surface weather conditions, increasing the likelihood of observing specimens in conditions where surface work would yield low diversity. The four highest species counts per single cave visit (5-7 species per date) occurred on dates between August and early October, when surface conditions were typically hot and dry. Organisms that visit caves opportunistically are classified as trogloxenes and include most of the frog species reported here.

4. Two of the preserve boundaries are adjacent to a section of Stemler Road and my driveway (Figure 1). The inclusion of these area in the 10 meter wide "perimeter" allowed for many opportunistic observations. Five of the species reported here were only seen in the perimeter areas (Table 1).

This study represents the first extensive single-site examination of karst and cave-related amphibian and reptile diversity in Illinois. Indeed, the herpetological record for Illinois caves is generally sparse. Webb et al. (1993) conducted a survey of cave biodiversity in all of Illinois' karst regions. Twenty eight caves in the Sinkhole Plain Karst (SHPK) of Monroe and St. Clair Counties in Illinois, including Stemler Cave, were included in the survey. Most caves were visited once. No reptiles were observed in the SHPK caves but 10 sites contained at least one amphibian species. A total of nine amphibian taxa were seen, seven identified to species level. A maximum of four amphibian taxa were seen in one cave. The maximum number of species I encountered in Stemler Cave on a single date was seven (30 August 2012), with a mean of 2.9 species per cave trip. One species Webb et al. (1993) reported to be present in two caves, the Northern Zigzag Salamander (*Plethodon dorsalis*) is not otherwise known from the SHPK. Its presence in Monroe or St. Clair counties would represent a significant range extension for *P. dorsalis* in Illinois. It is likely the researchers mistakenly recorded *P. dorsalis* instead of *P. glutinosus*, which they did not report from the area but would be expected in SHPK caves. Larval E*urycea* were the most commonly encountered amphibian in the SHPK, observed in seven caves (with adult *E. lucifuga* in one cave and adult *E. longicauda* in another cave). Adult *E. longicauda* were observed in two additional caves. Two amphibians were reported from Stemler Cave (*Rana* [*Lithobates*] sp. and *Eurycea* sp.). Based on the fact that I did not detect *E. lucifuga* on 21 visits to the cave, the *Eurycea* species reported by Webb et al. (1993) in Stemler Cave was likely *E. longicauda*.

Elliott (2007) summarized the biodiversity of Missouri karst and cave habitats. The amphibian and reptile diversity for Missouri's top three "biocaves" varies widely. Two of the caves report low diversity (Tumbling Creek Cave = 1 species, Mystery Cave = 4 species). However, the amphibian and reptile list for Devil's Icebox Cave in Boone County, MO includes 17 species. Important similarities exist between Stemler Cave and Devil's Icebox Cave. Both caves are situated in large karst groundwater basins (Stemler = 18.4 km^2; Devil's Icebox = 34 km^2) and have sinkhole entrances (Aley et al. 2000; Lerch 2011). The herpetological diversity of both regions is similar. St. Clair County, IL has 60 recorded species and Boone County, MO has 55 species (Daniel and Edmond 2014), with 40 species shared between the two counties. Devil's Icebox is situated within Rock Bridge Memorial State Park, where park rangers have recorded species encountered on guided cave tours since 1982 (Roxie Campbell, pers. comm. February 2014). Thus, both caves have been visited frequently by naturalists who keep records of observed biodiversity. These data suggest that the 17 species observed in the entrance or interior of Stemler Cave may represent typical herpetological diversity for a Midwestern cave ecosystem. This study highlights the importance of long-term studies in the understanding of regional and site-specific biodiversity.

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