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New Species Distribution Record for *Simpsonaias ambigua* (Say) (Salamander Mussel, Bivalvia: Unionidae) in the Harpeth River, Tennessee

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Abstract - *Simpsonaias ambigua* (Salamander Mussel) is the only North American freshwater mussel known to parasitize an amphibian for reproduction. Prior to this study, the only records of this species from the Cumberland River drainage were from the Stones and Caney Fork River systems, and all records from the Cumberland River drainage are from 1965 or earlier. In 2017, while conducting a survey for freshwater mussels in the Harpeth River, a direct tributary to the Cumberland River, we found 2 fresh-dead Salamander Mussels in Cheatham County, TN, representing the first record of this species from the Harpeth River drainage. Future surveys targeting the specific habit for the Salamander Mussel are recommended to accurately assess its status in the Harpeth River and elsewhere.

Simpsonaias ambigua (Say) (Salamander Mussel) is the only freshwater mussel that uses an amphibian host (*Necturus maculosus* (Rafinesque) [Common Mudpuppy]) (Howard 1951). The Salamander Mussel was historically widespread in the upper Mississippi drainage from the Cumberland River drainage in Tennessee north to the Great Lakes basin from Lake Michigan to Lake Erie (Clark 1980). The only records of the species from the Cumberland River drainage are from Tennessee: 1 location in the Stones River, Davidson County (1962); 1 location in the West Fork Stones River, Rutherford County (1962, 1965); 2 locations in the East Fork Stones River, (1965); and 1 location in Smith Fork of the Caney Fork River, Smith County (1961) (Clark 1980; J. Smith, North Carolina Museum of Natural Sciences, Raleigh, NC, pers. comm.). In 2003, a fresh dead shell of a Salamander Mussel was found along the shoreline of the Duck River in Humphreys County, TN, and additional dead shells were found at this same location in 2005 (Gangloff and Folkerts 2006). This was the first reported occurrence of the species in the Tennessee River drainage, although a specimen collected from this same general location in June 1986 is catalogued in the Eastern Kentucky University Mollusk Collection (Catalog No. 149.982). The Salamander Mussel has no official state designation in Tennessee, although Parmalee and Bogan (1998) considered the species to be extirpated from the state. In 2010 the Center for Biological Diversity petitioned the Secretaries of Interior and Commerce to list the Salamander Mussel as threatened or endangered, and currently the US Fish and Wildlife Service is conducting a species status assessment to determine if federal protection is warranted (CBD 2010).

The Salamander Mussel occurs in a wide range of stream sizes, from large rivers to small creeks, but it is restricted to streams that are occupied by its only known host, the Common Mudpuppy. There is a single record of the Common Mudpuppy in the Harpeth River, taken in 1960 from the confluence with the Cumberland River. There is a general

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lack of records of the Common Mudpuppy from middle Tennessee due, at least in part, to inadequate survey work in the system, but also possibly due to a decline in the population (F. Scott, Austin Peay State University, Clarksville, TN, pers. comm.). The Salamander Mussel is typically found under large, flat rocks and in patches of *Justicia* spp. (water willow), where it occupies the same microhabitat as its host (Haag and Cicerello 2016, Parmalee and Bogan 1998). We found 2 fresh-dead Salamander Mussels along the shoreline of the Harpeth River in Cheatham County, TN, on 24–25 September 2017 (Fig. 1). This represents the first record for the Salamander Mussel in the Harpeth River and the first reported occurrence of this species in the Cumberland River watershed since 1965. We collected 1 paired shell from Site 1 (36°6'12.6"N, 87°6'19.872"W; Fig. 2) and 1 unpaired shell from Site 2 (36°7'50.772"N, 87°6'15.084"W). Both specimens were collected from a gravel bar adjacent to a shallow pool during a visual bank survey. Substrate at both sites was primarily gravel intermixed with small amounts of cobble, sand, and flat boulders. Many of the boulders were large and slab-like and potentially could provide viable habitat for Salamander Mussels or Common Mudpuppies. Following the discovery of the fresh-dead Salamander Mussel, our survey efforts targeted large flat rocks and water willow beds, but no additional specimens were found.

We vouchered the speciments in the McClung Museum of Natural History and Culture (MMNHC): the paired shell from Site 1 is Catalogue No. 11667, and the single valve found at Site 2 is Catalogue No. 11668. The paired specimen is small (38 mm length) but within

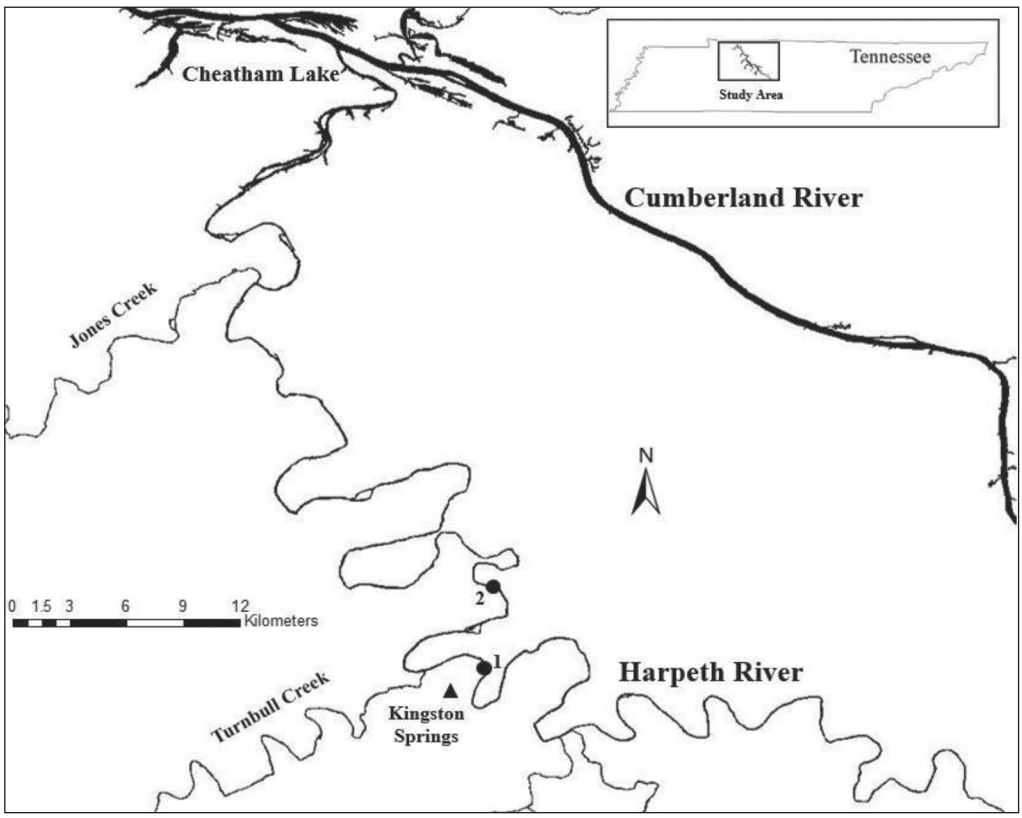

Figure 1. Map of the Harpeth River drainage in Tennessee and collection localities (black dot) where *Simpsonaias ambigua* (Salamander Mussel) specimens were collected in September 2017.

the range of other specimens in the MMNHC collection (Fig. 2). The specimen from Site 1 appears to be a female based on the description provided by Simpson (1914:324) in that females are "decidedly swollen behind, the posterior ridge being very full and widely rounded, the base line sometimes a little incurved in the middle and the hinder end of the shell broad." Our specimen possesses hinge teeth that are small and incomplete. The right valve has a single, small, narrow and slightly elongated pseudocardinal tooth arising from the shell wall just anteriorly to the umbo cavity. The pseudocardinal tooth in the left valve is similarly sized but arises below the umbo cavity. There are no articulating lateral teeth. The periostracum is brownish yellow and slightly eroded along the posterior slope. The umbos are eroded, but a faint double-looped beak structure is evident, and the beak cavities are relatively shallow. Both specimens were identified as Salamander Mussels at the time of collection, verified by Don Hubbs (Mollusk Recovery Program Coordinator, Tennessee Wildlife Resources Agency [TWRA], Camden, TN), and compared to specimens cataloged at MMNHC. The single valve from Site 2 was accidentally crushed soon after it was collected, but we made the identification in the field before the shell was damaged.

The Harpeth River rises in western Rutherford County, TN, and flows primarily westward for 201 km to the Cumberland River in Ashland City. According to historical data, 25 species of freshwater mussels have been reported in the drainage (Parmalee and Bogan 1998, Pilsbry and Rhoads 1896, Wilson and Clark 1914). Subsequent survey efforts did not reveal any additional species to the fauna (Hubbs et al. 2002). This lack of data inspired a watershed-wide study by the senior author, funded by the US Fish and Wildlife Service (USFWS) and TWRA, to assess the freshwater mussel fauna of the drainage. Irwin (2018) conducted visual and tactile timed searches at 20 sites on a 21-km reach of the Harpeth River along with 42 sites on 23 tributary streams in 2016–2017. Her survey yielded records of at least 46 species from the Harpeth River, almost doubling the previously reported diversity, indicating the mussel fauna in the drainage had been largely understudied. Additional

Figure 2. Specimen MMNHC11667, *Simpsonaias ambigua* (Salamander Mussel), Harpeth River, Cheatham County, TN, 27 September 2017, Gerald R. Dinkins collector, shell length = 38 mm. Photographed © Tom Schirtz, McClung Museum of Natural History and Culture.

survey efforts in the main channel of the Harpeth River are planned and will concentrate on habitats that are suitable for both Common Mudpuppies and Salamander Mussels.

The Salamander Mussel is generally considered rare, as evidenced by its localized occurrence where populations occur, although its apparent rarity may be an artifact of sampling effort. This is a small, cryptic species that can be difficult to distinguish from other young Anodontini, and its preference for large, flat rocks often limits the detection of live individuals during a visual survey, especially when sampling conditions are not optimal (e.g., high flows, turbid conditions). For example, a quantitative survey of a 20 m x 20 m area in the Licking River, KY, yielded 13 live Salamander Mussels, yet no dead specimens were found in or adjacent to the survey area or along the banks at the conclusion of the survey (Dinkins 2016). Salamander Mussels are often overlooked during typical survey efforts, which may explain why Haag and Cicerello (2016) concluded the population in the Licking River, KY, could be more abundant than previously reported. We feel this assessment applies not only to streams and rivers in Kentucky but also in Tennessee and perhaps across most of the species' historical distribution. We recommend future mussel surveys within the range of the Salamander Mussel target areas where large, slab-like rocks and aquatic vegetation are common to sufficiently evaluate the species' current status and distribution to inform the listing decision under the Endangered Species Act.

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