

Discovery of the Salamander Mussel (*Simpsonaias ambigua*) and Spectaclecase (*Cumberlandia monodonta*) in the Buffalo River, Tennessee

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Abstract - *Simpsonaias ambigua* (Salamander Mussel) occurs in medium creeks to large rivers and is restricted to waterbodies that support a population of its only known host, *Necturus maculosus* (Common Mudpuppy). Prior to this study, the only record of the Salamander Mussel in the Tennessee River drainage was from the Duck River. *Cumberlandia monodonta* (Spectaclecase) is a federally endangered species that in Tennessee was last collected alive in the Duck River in the early 2000s and in the lower Tennessee River in 1998. In 2025, while diving in a deep pool of the lower Buffalo River, Humphreys County, TN, we discovered a robust population of the Salamander Mussel and 1 live Spectaclecase. Future surveys using diving equipment while targeting habitat identified in our study are recommended to assess the status of both species in the Buffalo River and elsewhere.

Introduction. *Simpsonaias ambigua* (Salamander Mussel) is a small, thin-shelled freshwater mussel and a member of the family Unionidae. It is currently found in portions of 14 US states and 1 Canadian province (USFWS 2023a). The species rarely exceeds 40 mm in length, has a life span of ~10 years (Watson et al. 2001), and is the only mussel known to use an amphibian host (*Necturus maculosus* (Rafinesque) [Common Mudpuppy]; Howard 1951). The age at sexual maturity is unknown, but the species spawns in the spring and is bradyctictic (i.e., a long-term brooder in which the female holds the glochidia in its marsupial gills over the winter until they are released the following spring or summer; Watson et al. 2001).

The earliest record of the Salamander Mussel from Tennessee was a specimen collected by S.M. Edgar from an unspecified location in Middle Tennessee in the mid-1800s (National Museum of Natural History, Smithsonian Institution; InvertBase 2025). Over 100 years passed until the next Tennessee records: a single valve from Smith Fork (Caney Fork Drainage), Smith County, collected in June 1961 and 2 single valves collected by Herb Athearn in May 1962 from West Fork Stones River, Rutherford County (Fig. 1). Athearn reported in his field notes that, “many flat rocks were turned over and the area beneath examined, but no live specimens could be located” (North Carolina Museum of Natural Sciences; InvertBase 2025). The species was next reported in Tennessee by D. Stansbery, curator of malacology at The Ohio State University, who found dead shells at 2 locations in the East Fork Stones River, Rutherford County (August and September 1965) and 2 locations in the Stones River, Davidson County (September and October 1965). Based on the condition of the shells and a review of Stansbery’s field notes, he found only dead shells (N. Shoobs, The Ohio State University, Columbus, OH, pers. comm.). In 2017, two fresh-dead Salamander Mussels were found in the Harpeth River, Cheatham County (Womble et al. 2020), the first and only records from the drainage. The Caney Fork, Stones, and Harpeth Rivers are tributaries to the Cumberland River.

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In 2003, the Salamander Mussel was reported for the first time from the Tennessee River drainage when a single fresh-dead specimen was found in the Duck River, Humphreys County. A subsequent visit to the site produced another complete shell and fragments of 3 valves, but no live individuals were found (Gangloff and Folkerts 2006). Several years later, the Center for Biological Diversity (CBD) petitioned the US Fish and Wildlife Service (USFWS) to list the Salamander Mussel as an endangered or threatened species under the Endangered Species Act of 1973, as amended (CBD 2010). In response, USFWS prepared a species status assessment for the Salamander Mussel and concluded the species had declined across its range: of the 110 known populations, only 66 were still viable, while 44 were either extirpated or significantly restricted (USFWS 2023a). In August 2023, USFWS proposed to list the Salamander Mussel as endangered under the Endangered Species Act (USFWS 2023b), and a decision on the listing is currently pending.

Cumberlandia monodonta (Spectaclecase) is a large, moderately heavy-shelled mussel and the only member of the family Margaritiferidae occurring in Tennessee (Parmalee and Bogan 1998). It is listed as endangered by USFWS, and its range includes the Mississippi, Missouri, and Ohio river basins with historical and recent records in 11 states (USFWS 2012). In the Tennessee River drainage, the Spectaclecase inhabits medium to large rivers in moderate to swift current and is generally found under large flat rocks (Williams et al.

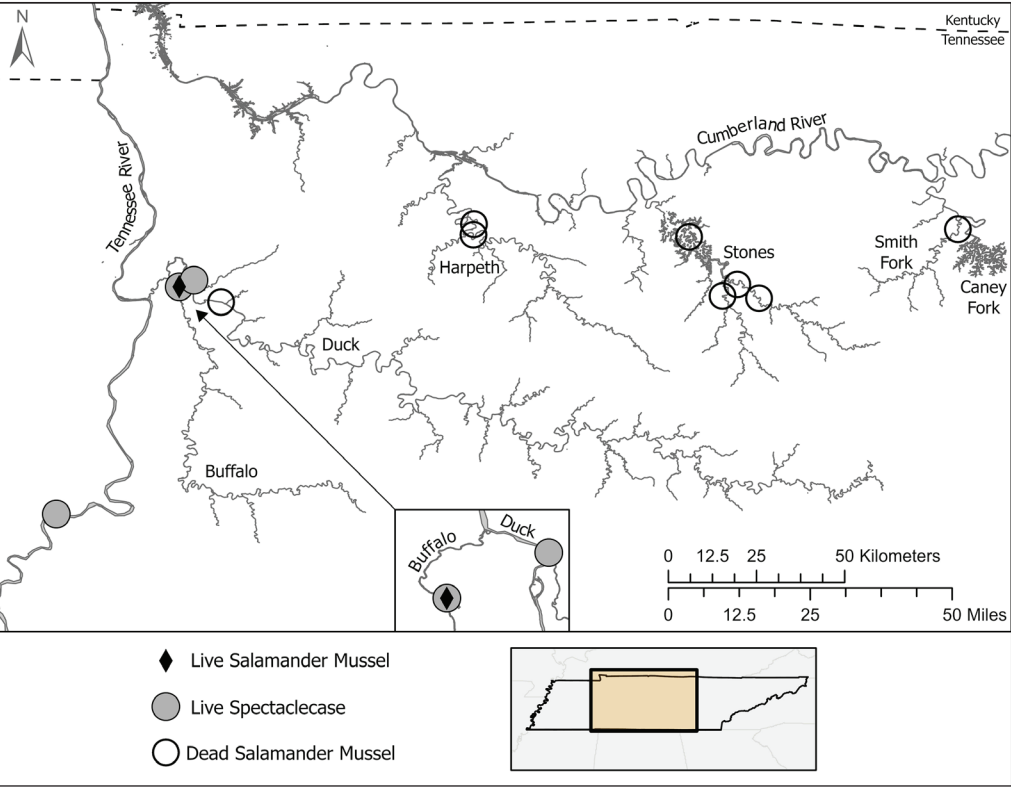


Figure 1. Map of the Buffalo, Duck, Harpeth, Stones, and Caney Fork river drainages and mainstem Tennessee River. Black diamond indicates where live Salamander Mussels were found in the Buffalo River in 2025. Open circles indicate where dead shells of Salamander Mussels were found in the Duck River in 2003 and 2005; Harpeth River in 2017; East Fork, West Fork and Stones Rivers in 1962–1965, and Smith Fork in 1961. Grey circles indicate where live Spectaclecase were found in Buffalo River in 2025, Tennessee River in 1998, and Duck River in early 2000s.

2008). The species can also occur in horizontal and angled bedrock outcrops where it occupies gravel-filled crevices (G. Dinkins, pers. observ.). Haag and Cicerello (2016) speculated that its rarity in historical collections may be due to its specialized habitat, which is often overlooked by conventional survey methods. Two live individuals were found in 1998 in the lower Tennessee River at river km (TRK) 273.6, approximately 97 km upstream of the mouth of the Duck River (Hubbs and Jones 2000), and a single live individual was found in the early 2000s in the Duck River at DRK 27.4 (Ahlstedt et al. 2017, USFWS 2012). There have been no subsequent reports of live *Spectaclecase* in the lower Tennessee or Duck rivers (G. Dinkins, unpubl. data; Womble and Rosenberger 2025). The first record of the species in the Buffalo River was a single, weathered valve found in 2011 by a field crew with the Tennessee Valley Authority (TVA) on an exposed gravel bar at BRK 5.3 (Reed et al. 2019). Since 2011, a few more dead shells of the *Spectaclecase* have been found at BRK 5.3 by the University of Tennessee's malacology class on the same gravel bar where the species was first documented in 2011; however, the source population for these shells was unknown but was suspected to be the unexplored, deep pool a few hundred meters upstream.

Methods. The Buffalo River is the largest tributary to the Duck River and is unimpounded. The lower 19.3 km of the Duck River is impounded by Kentucky Lake Dam, a hydroelectric dam operated by the TVA at TRK 35.8. On 25 August 2025, we used a surface supplied air system and SCUBA and 3 divers to investigate the deep pool at the base of the bluff along the right descending bank immediately upstream of BRK 5.3 (Fig. 2). We repeated the search effort on 29 August, and our dive team included 2 people investigating the shallow water along the edge of the bluff using masks and snorkels. Bottom time in the 2 efforts totaled 3.8 person hours. Time spent searching shallow habitats totaled 1 person

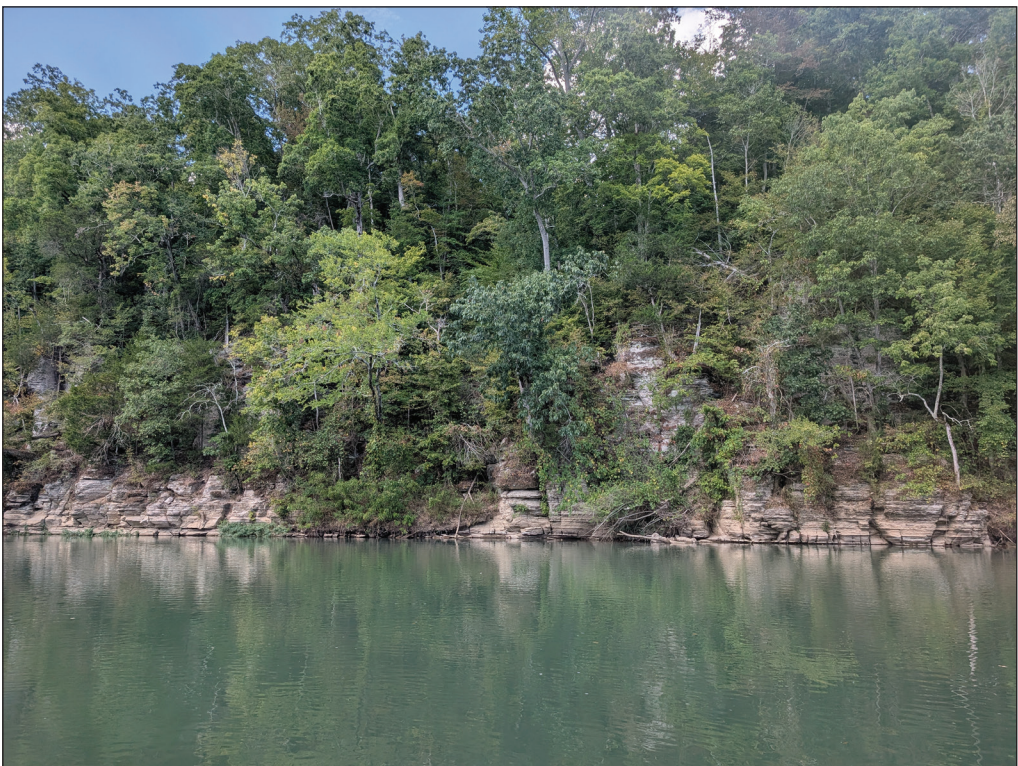


Figure 2. Buffalo River at BRK 5.4, Humphreys County, TN, 29 August 2025.

hour. Maximum depths in the pool at the base of the bluff varied between 3 and 6 m, and underwater visibility averaged ~0.3 m. We began at the downstream end of the bluff and made several passes through the search area, primarily staying in the vicinity of the thalweg where the substrate was dominated by medium–large, flat rocks and bedrock. We carefully lifted large, flat rocks and set them to the side. After several seconds, we fanned the area underneath and around each moved rock to sweep away the silt under where the rock had been. Once visibility improved, we visually searched the newly exposed substrate and manually probed for mussels. We placed all live mussels and dead shells into a mesh bag and brought them to the surface where we identified and counted them. We recorded length measurement (nearest mm, long axis) of selected species using vernier calipers. Live mussels were kept in a submerged mesh bag until we identified and measured them, after which we reinserted them underneath large rocks on the substrate where we had collected them. We brought dead shells of most species to the McClung Museum of Natural History and Culture, where they were cleaned and stored for future cataloging. Live mussels and dead shells were collected and handled under the authority of a Scientific Collecting Permit issued to G. Dinkins by the Tennessee Wildlife Resources Agency (TWRA Permit No. 1698) and a Threatened and Endangered Species Recovery Permit (No. ES069754) issued by the US Fish and Wildlife Service. We tested length frequency of the most common mussel species for normality with the Shapiro–Wilk test using R v. 4.4.2 (R Core Team 2024).

Results. The search of the deep pool at the base of the limestone bluff resulted in 126 live mussels and dead shells of 14 species (Table 1). Included were 1 live (length = 152 mm) and 23 dead Spectaclecase, 76 live and 2 fresh dead Salamander Mussels (Fig. 3), and 2 fresh dead *Pleuroaia dolabelloides* (Slabside Pearlymussel) (lengths = 68 and 74 mm) (Table 1). All Salamander Mussels and Spectaclecases were found underneath large, flat rocks at depths of 2–6 m. Before being moved for the surveys, these rocks were lying relatively flat on the stream bed and had along their edge 1 or more openings into the rock’s underside. The sediment under most of the larger rocks had a fine silt/clay consistency, and all Salamander Mussels were found on or in sediment underneath large, flat rocks. Size

Table 1. Freshwater mussels and their conservation status as designated by USFWS and found in the Buffalo River (BRK 5.4), Humphreys County, TN, on 25 and 29 August 2025. Number of live individuals followed by fresh and weathered dead in parentheses and brackets, respectively. LE = listed endangered, PE = proposed endangered.

Scientific name	Common name	Number	Status
<i>Amblema plicata</i> (Say)	Threeridge	[1]	
<i>Cambarunio dactylus</i> (Lea)	Cumberland Rainbow	1	
<i>Cumberlandia monodonta</i> (Say)	Spectaclecase	1 (5) [18]	LE
<i>Cyclonaias tuberculata</i> (Rafinesque)	Purple Wartyback	2 [2]	
<i>Elliptio crassidens</i> (Lamarck)	Elephantear	(1)	
<i>Eurynia dilatata</i> (Rafinesque)	Spike	3 (2)	
<i>Lasmigona costata</i> (Rafinesque)	Flutedshell	1 [2]	
<i>Leaunio vanuxemensis</i> (Lea)	Mountain Creekshell	1 (1)	
<i>Pleuroaia dolabelloides</i> (Lea)	Slabside Pearlymussel	(2)	LE
<i>Potamilus alatus</i> (Say)	Pink Heelsplitter	1 (2)	
<i>Potamilus fragilis</i> (Rafinesque)	Fragile Papershell	(2)	
<i>Simpsonaias ambigua</i> (Say)	Salamander Mussel	76 (2)	PE
<i>Toxolasma lividum</i> Rafinesque	Purple Lilliput	2 (3)	
<i>Tritogonia verrucosa</i> (Rafinesque)	Pistolgrip	1 [3]	
Total		89(20)[26]	

distribution of the live Salamander Mussels ($n = 76$) deviated significantly from a normal distribution, with evidence of recruitment ($W = 0.846, P < 0.001$)(Fig. 4). Given the limited underwater visibility, it is likely that with clearer water our effort would have produced a better representation of smaller size classes of the Salamander Mussel. We took tissue clips from 6 live Salamander Mussels and archived them at the University of Tennessee’s McClung Museum malacology collection (Catalogue Number 27526).



Figure 3. Live Salamander Mussel (length 32 mm) found in Buffalo River at BRK 5.4, Humphreys County, TN, 29 August 2025.

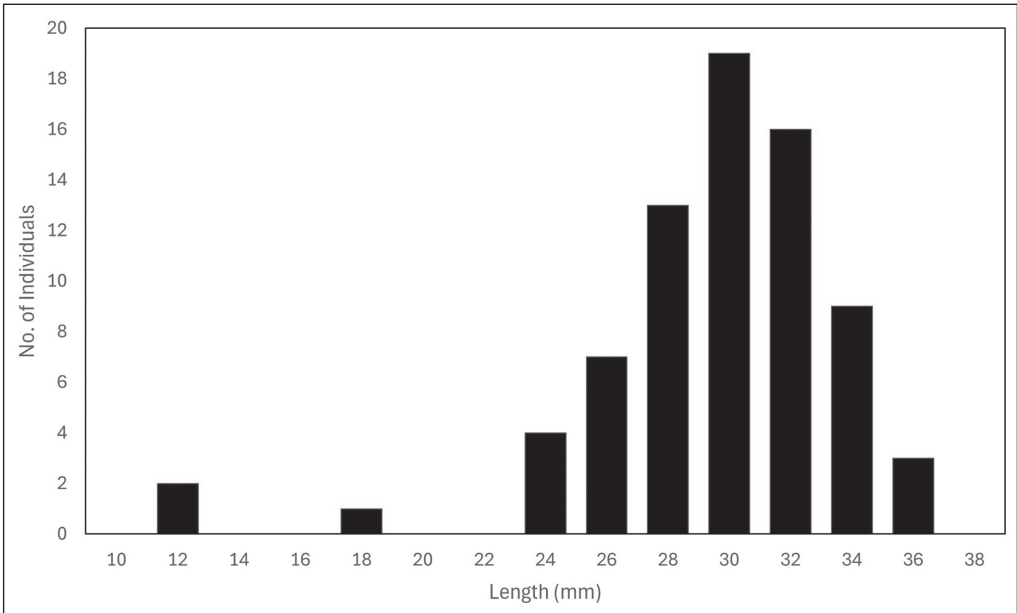


Figure 4. Length distribution (maximum shell length) of live Salamander Mussels ($n = 76$) found in Buffalo River, BRK 5.4, Humphreys County, TN, 25 and 29 August 2025.

Discussion. Although live Salamander Mussels were relatively common, we found only a single live Spectaclecase. Twelve large, weathered dead Spectaclecases were discovered under a single rock, and the remaining dead were found individually. Our discovery represents the first collection of live Salamander Mussels in Tennessee, the first live Spectaclecase from the Buffalo River, and the first live Spectaclecase collected in the Duck River drainage in ~25 years (USFWS 2012).

Tennessee's State Wildlife Action Plan considers the Common Mudpuppy to be demonstrably widespread and secure within the state, with 30 records of occurrence between 1974 and 2008 in the upper main channel Buffalo River and 3 tributaries (Grinders Creek, Chief Creek, and Little Buffalo River; TWRA 2025). However, in the Buffalo River drainage, all records of occurrence are in the upper drainage (i.e., upstream of BRK 152) and are within a 4.2-km radius. The discovery of the Salamander Mussel in the pool upstream of BRK 5.3 suggests that the Common Mudpuppy is also present in the lower Buffalo River and may be more widespread in the drainage than indicated by amphibian surveys. A review of topographical maps and aerial photographs of the middle and lower Buffalo River reveals numerous reaches where a limestone bluff borders pool habitat, indicating there may be other locations upstream of BRK 5.3 occupied by the Salamander Mussel, Spectaclecase, or both. Further, it is unlikely that live individuals of either species would have been discovered unless a novel method had been employed, as suggested by Haag and Cicerello (2016). For this reason, we recommend underwater sampling equipment be used to investigate other locations where these species have been reported only as dead shells.

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