2024-2025 Winter Subterranean Bio-Monitoring Report

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With over 8,000 caves and an unknown number of abandoned underground mines/quarries, railroad tunnels, storm sewers, and culverts, Missouri provides a vast amount of cave, karst, and like features to support a wide variety of subterranean life. While in the past, single taxa (i.e. hibernating bats) monitoring surveys took place, more recent efforts have involved multitaxa monitoring to get a rough idea of species present and what species may need more monitoring.

A wide group of biologists meet in the fall every year to go over winter subterranean monitoring priorities. We meet to discuss number of sites to visit, purpose of visit, frequency of visit, and to ensure all subterranean life is monitored to the best of everyone's ability. The following is a short summary of the 2024-2025 winter cave bio-monitoring season, mainly revolving around hibernating bats (specifically focusing on tricolored bat (*Perimyotis subflavus*) sites that haven't been visited in many years); however, all life was documented as best to our abilities. We also took note of any illegal intrusion, graffiti, and other signs of vandalism (gate breaches included). All data was gathered from the Missouri Speleological Survey's Missouri Cave Database.

2024-2025 Winter Cave and Underground Mine Bio-Monitoring Summary:

• 278 site visits were surveyed between November 9, 2024, and March 31, 2025.

• 9 sites were visited more than once (mainly for mapping purposes), for a total of 269 unique sites visited. For this report purpose, all species encountered were counted at all 278 site visits, even if some sites were repeated.

• Surveys were conducted in November (19 surveys), December (41), January (85), February (74), and March (59). Ideally winter bio-monitoring efforts start December 1 and end March 15th, however, due to weather issues as well as people being sick, some efforts were started earlier (November) and went later (end of March). Figure 1.

• 7,664 total bats of 11 species were counted (two species present skeletal remains-including skulls). Figure 2. Table 1.

• No bats were encountered at 105 (38%) of the 278 site visits.

• 112 total species (non-bats) were counted (18 herp species, 18 gastropod and crustacean species, 11 arachnid species, 26 insect species, 9 generic invertebrate species (millipedes, centipedes, planaria worms), 8 fish species, 17 mammal species (non-bat), and 5 bird species. Tables 2-9.

• At least one subterranean feature (for this purpose, either cave or underground mine) was surveyed in 44 (39 %) of Missouri's 114 counties (Figure 3).

• Shannon County had the most site visits with 49 sites visited, followed by McDonald County with 23 sites visited. (Figure 4).

• Many unique species were found during the 2024-2025 surveys. Just a few highlights are listed below. (Figure 5).

• These surveys were conducted by at least 221 people from various agencies, NGOs, and private individuals.

We would like to thank the Missouri Speleological Survey (MSS) for coordinating all of our data entry and access (through MDC/MSS Cooperative Agreement). Many thanks to all of the people who conducted the monitoring across the state. There are too many individuals to name on this report, we want to thank everyone for their continued assistance with this important monitoring work. The personnel represented (but not limited to) were the Missouri Department of Conservation, the Missouri Department of Natural Resources-Division of State Parks, the Ozarks Operation of the Cave Research Foundation, Meramec Valley Grotto, SEMO Grotto, Springfield Plateau Grotto, Chouteau Grotto, Middle Mississippi Valley Grotto, Stygian Grotto, Kansas City Area Grotto, Greene County Parks and Recreation, Clay County Parks and Recreation, City of Perryville, St Charles County Parks and Recreation, Mark Twain National Forest-United States Forest Service, National Park Service (Ozark Scenic Riverways), Leo-A Drey (LAD) Foundation, Tumbling Creek Cave Foundation, Missouri Bat Census, Missouri Department of Transportation, United States Fish and Wildlife Service, the City of Hannibal, MO, the City of Kansas City, Missouri, and Fort Leonard Wood. We especially want to thank many private landowners for allowing us access.

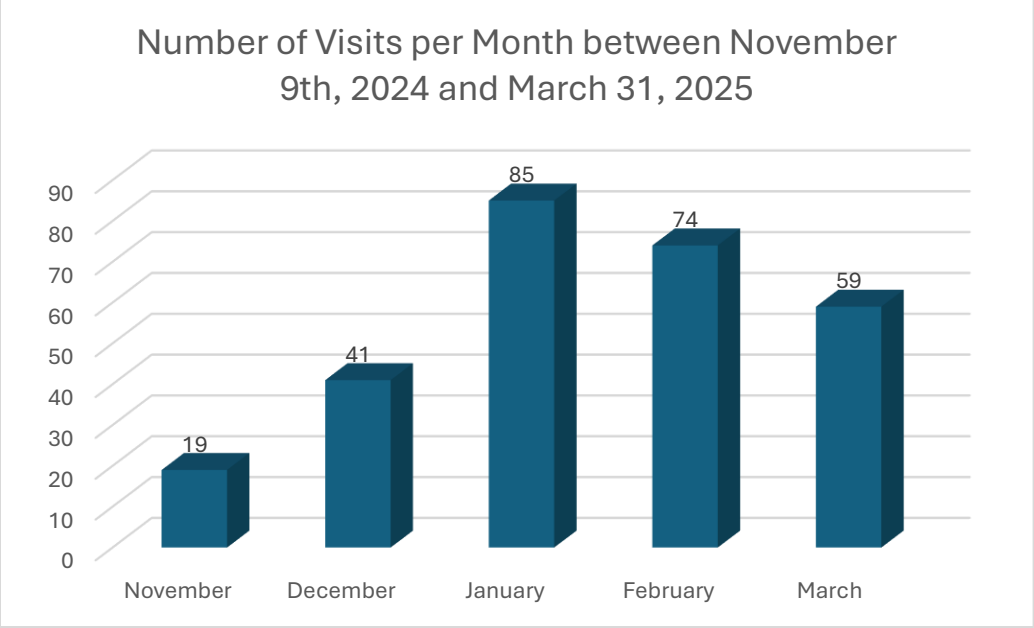


Figure 1. Number of subterranean visits per month. January and February are the best months to conduct hibernating bat surveys.

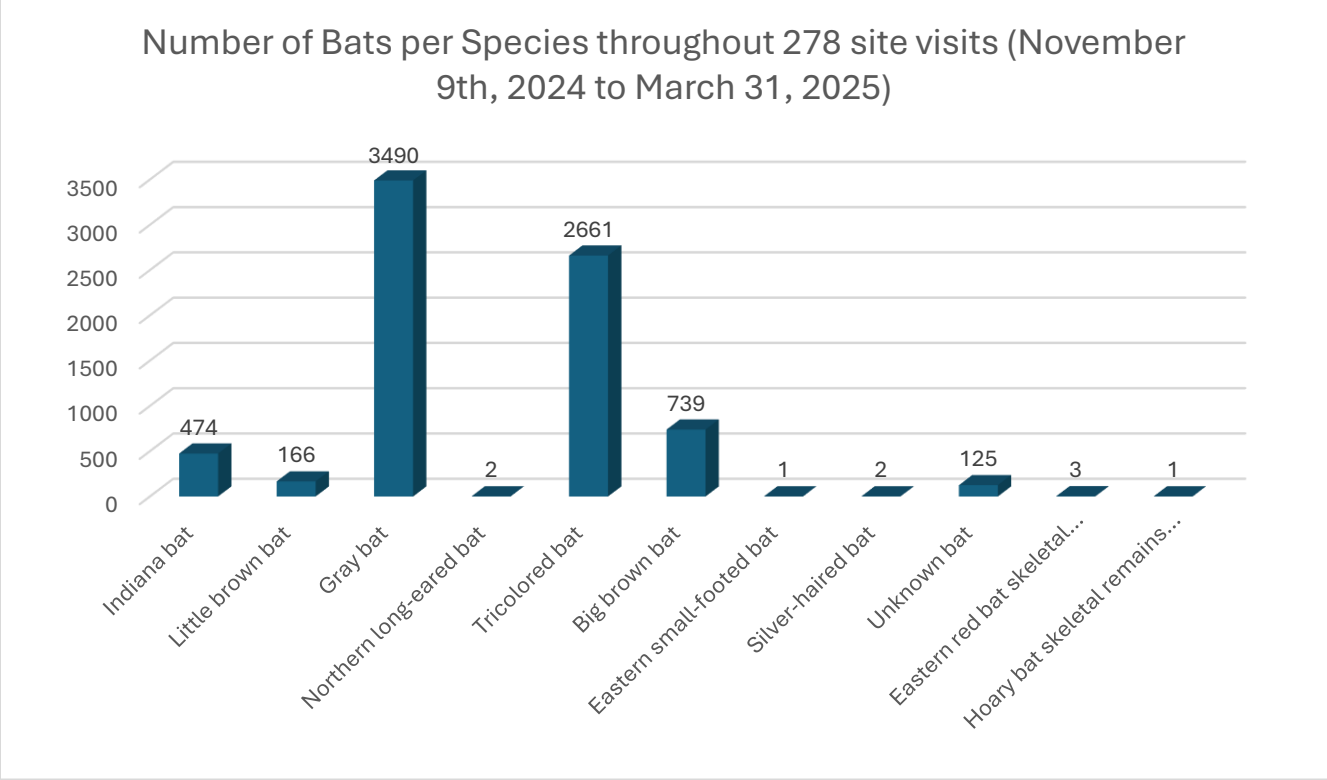


Figure 2. Number of Bats Per Species at all 278 site visits. These include skeletal remains (including skulls) of the eastern red bat and the hoary bat; two species not normally found in subterranean features.

Bat Species Encountered	Number of individuals out of 278 site visits	Number of Sites Present (and % of Sites Present out of 278 site visits)
Indiana bat	474	10 (4)
Little brown bat	166	13 (5)
Gray bat	3490	26 (9)
Northern long-eared bat	2	2 (0.7)
Tricolored bat	2661	159 (57)
Big brown bat	739	73 (26)
Eastern small-footed bat	1	1 (0.4)
Silver-haired bat	2	1 (0.4)
Unknown bat	125	16 (6)
Eastern red bat skeletal remains (including skull)	3	1 (0.4)
Hoary bat skeletal remains (including skull)	1	1 (0.4)

Table 1. Number of bat species present among the 278 sites visited during the winter of 2024-2025. Tricolored bats were present at just over half of the sites visited.

Herp Species Encountered	Number of individuals out of 278 site visits	Number of Sites Present (and % of Sites Present- out of 278 site visits)
Black rat snake	5	2 (0.7)
Flathead snake	1	1 (0.4)
Snake skeletons	3	3 (1.1)
Pickerel frog	306	44 (16)
Green frog	7	6 (2.2)
Leopard frog	2	2 (0.7)
Wood frog	2	1(0.4)
Unknown frog	7	2 (0.7)
Grotto salamander	174	32 (12)
Dark-sided salamander	73	21 (8)
Cave salamander	367	71 (26)
Long-tailed salamander	8	7 (3)
Slimy salamander	94	31 (11)
Oklahoma salamander	13	3 (1)
Larval salamander (or unknown juvenile salamander)	2,424	56 (20)
Ozark zigzag salamander	2	1 (0.4)
Unknown adult salamander	3	1 (0.4)
Box turtle remains	3	1 (0.4)

Table 2. Reptile and amphibian (herp) species encountered at sites visited during winter 2024-2025. Grotto salamanders (cave adapted salamander) are highly associated with gray bat sites.

Gastropods, Mollusks, and Crayfish Species Encountered	Number of individuals out of 278 site visits	Number of Sites Present (and % of Sites Present- out of 278 site visits)
Generic slug	19	1(0.4)
Generic copepod	2,001	2 (0.7)
Physid snail	40	1 (0.4)
Generic aquatic snail	25	8 (3)
Generic terrestrial snail	40	14 (5)
Generic terrestrial snail shells		2 (0.7)
Unknown crayfish	6	4 (1.4)
Spot handed crayfish	3	1 (0.4)
Bristly cave crayfish	30	7 (3)
Salem cave crayfish	26	4 (1.4)
Aquatic troglobitic isopods	361	16 (6)
Pigmented aquatic isopod	1	1 (0.4)
Generic aquatic isopod	185	14 (5)
Lirceus aquatic isopod	120	2 (0.7)
Generic terrestrial isopod	58	9 (3.2)
Generic pigmented amphipod	172	12 (4)
Generic troglobitic amphipod	382	14 (5)
Bacturus sp (amphipod)	50	1 (0.4)

Table 3. Gastropods, Mollusks, and Crayfish species encountered during winter 2024-2025. Due to the complexity of identification, unless the exact species was known, they were lumped into the generic category.

Arachnid Species Encountered	Number of individuals out of 278 site visits	Number of Sites Present (and % of Sites Present- out of 278 site visits)
Dolomedes sp. (fishing spider)	72	31 (11)
Dolomedes vittatus	1	1 (0.4)
Cave orb weaver (*Meta ovalis*)	544	38 (14)
Troglobitic spider	4	1 (0.4)
Generic spider webbing		9 (3)
Generic spider	120	29 (10)
Brown recluse	1	1 (0.4)
Generic wolf spider	13	6 (2)
General harvestman	55	5 (1.8)
Generic tick	1	1 (0.4)
General pseudoscorpion	32	3 (1)

Table 4. Arachnid species encountered during winter 2024-2025. Two known species of troglobitic spiders are known from MO, but for this purpose we kept as generic.

Insect Species Encountered	Number of individuals out of 278 site visits	Number of Sites Present (and % of Sites Present- out of 278 site visits)
Hellgrammite	2	2 (.7)
Generic camel cricket	16,651	168 (60)
Herald moth	321	45 (16)
Generic moth	54	11 (4)
Heleomyzid (red-eyed) flies	735	29 (10)
Generic fly	2101	22 (8)
Speleobia (dung fly)	512	5 (2)
Generic Mycet gnat	52,954	108 (39)
Generic mosquito	9,156	34 (12)
Paper wasp nests		6 (2.2)
Paper wasp	1	1 (0.4)
Crane Fly	2	2 (0.7)
Generic gnat	1	1 (0.4)
Generic wasp	5	4 (1.4)
Generic water strider	20	5 (2)
Cave dipluran	4	3 (1)
Webworm	165	12 (4.3)
Generic midge	500	1(0.4)
Generic rove beetle	92	5 (2)
Asian lady beetle	830	2 (0.7)
Generic ground beetle	21	9 (3)
Cave Leiodid beetle	100	1 (0.4)
Necrophilus pettitii	1	1 (0.4)
Generic springtail	39	10 (3.6)
Generic ant	1	1 (0.4)
Generic caddisfly	1	1 (0.4)

Table 5. Insect species encountered during winter 2024-2025. Camel crickets were the most commonly insect encountered with them being found at 60% of the sites visited.

Invertebrate Species Encountered	Number of individuals out of 278 site visits	Number of Sites Present (and % of Sites Present- out of 278 site visits)
Troglobitic millipede	54	10 (3.6)
Generic millipede	50	14 (5)
House centipede	8	2 (0.7)
Generic centipede	22	8 (3)
Generic planaria	4	4 (1.4)
Tubificid worm	1	1 (0.4)
Generic earthworm	17	12 (4.3)
Horsehair worm	4	1 (0.4)
Troglobitic planaria	5	2 (0.7)

Table 6: Invertebrates (those that are not listed in above categories) encountered during winter 2024-2025. The troglobitic planaria are either new species or a species range extension.

Mammal Species Encountered (non-bats)	Number of individuals out of 278 site visits	Number of Sites Present (and % of Sites Present- out of 278 site visits)
Raccoon (live)	3	3 (1)
Raccoon sign		80 (29)
Mink sign	1	1 (0.4)
Bob cat (live)	1	1 (0.4)
Bobcat sign		1 (0.4)
Coyote (dead)		1 (0.4)
Armadillo (dead)		1 (0.4)
White-tailed deer bones		1 (0.4)
Virginia opossum (dead)		3 (1)
Bear sign/remains		3 (1)
Red fox (live)	1	1 (0.4)
Norwegian/black rat	1	1 (0.4)
Eastern cottontail rabbit	1	1 (0.4)
Generic mice	7	4 (1.4)
River otter sign		2 (0.7)
Woodrat sign		55 (20)
Beaver sign		1 (0.4)

Table 7. Mammal species (non-bats) encountered during winter 2024-2025. Raccoon sign was very common with signs being found in at least 29% of sites.

Fish Species Encountered	Number of individuals out of 278 site visits	Number of Sites Present (and % of Sites Present- out of 278 site visits)
Grotto sculpin	9	2 (0.7)
Generic fish	62	10 (3.6)
Generic creek chub	3	2 (0.7)
Generic darter	2	1 (0.4)
Bluegill	3	2 (0.7)
Largemouth bass	2	1 (0.4)
Yellow bullhead	2	1 (0.4)
Eigenmann's (southern) cavefish	60	5 (2)

Table 8. Fish species encountered during winter 2024-2025. Generic fish were mostly Cyprinidae species that were not identified to species.

Bird Species Encountered	Number of individuals out of 278 site visits	Number of Sites Present
Domestic pigeon	17	5 (2)
Eastern screech owl	1	1 (0.4)
Generic owl	1	1 (0.4)
Phoebe nests	45	39 (14)
Turkey vulture (live)	2	1 (0.4)
Turkey vulture sign		5 (2)

Table 9. Bird species encountered during winter 2024-2025. Phoebe nests were the most commonly encountered bird sign.

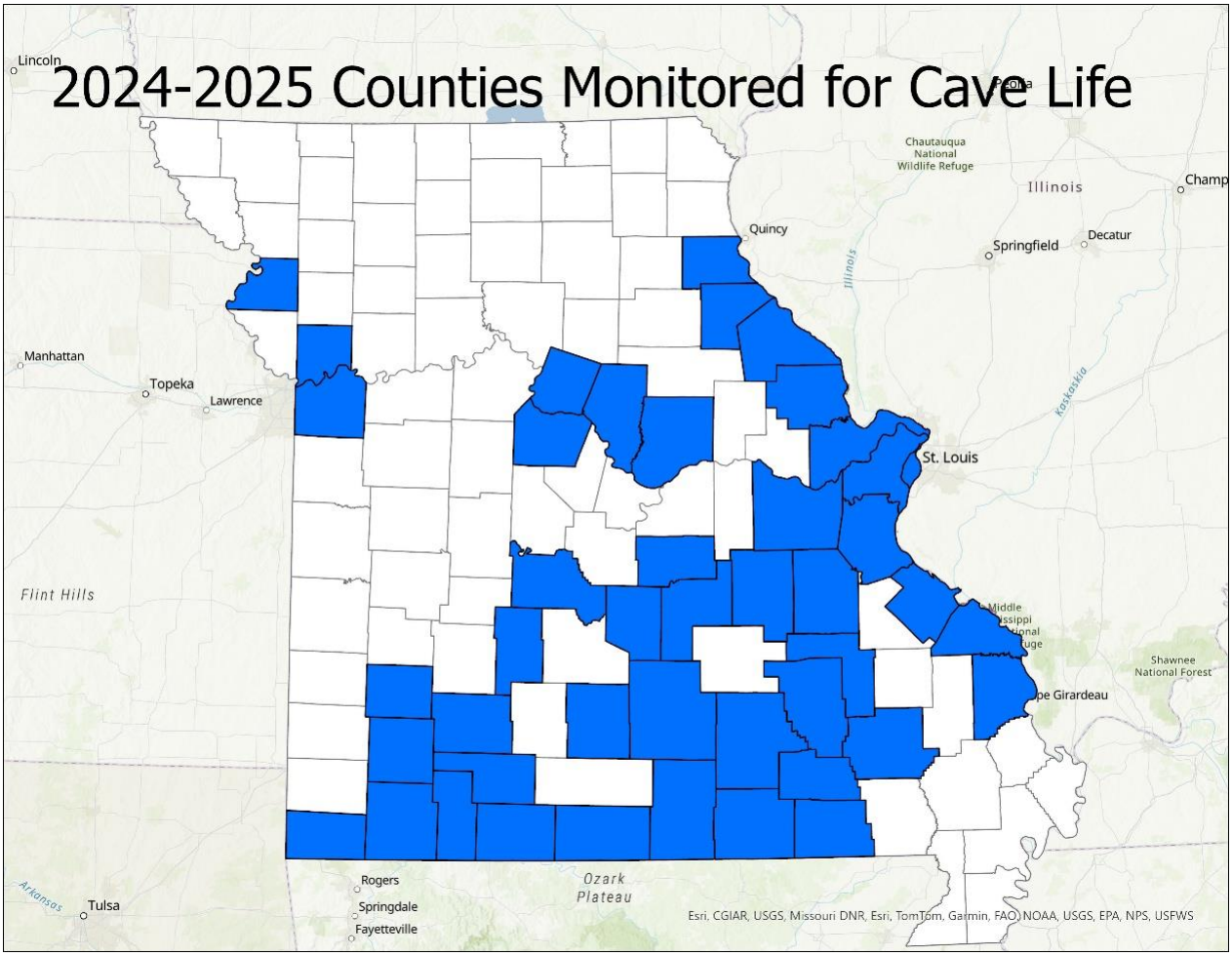


Figure 3. 141 Missouri counties were monitored for cave life during winter 2024-2025. The Kansas City, MO and St. Joseph, MO areas do not contain natural caves (or very few), however, there are many abandoned underground mines/quarries that contain hibernating bat populations among other subterranean life.

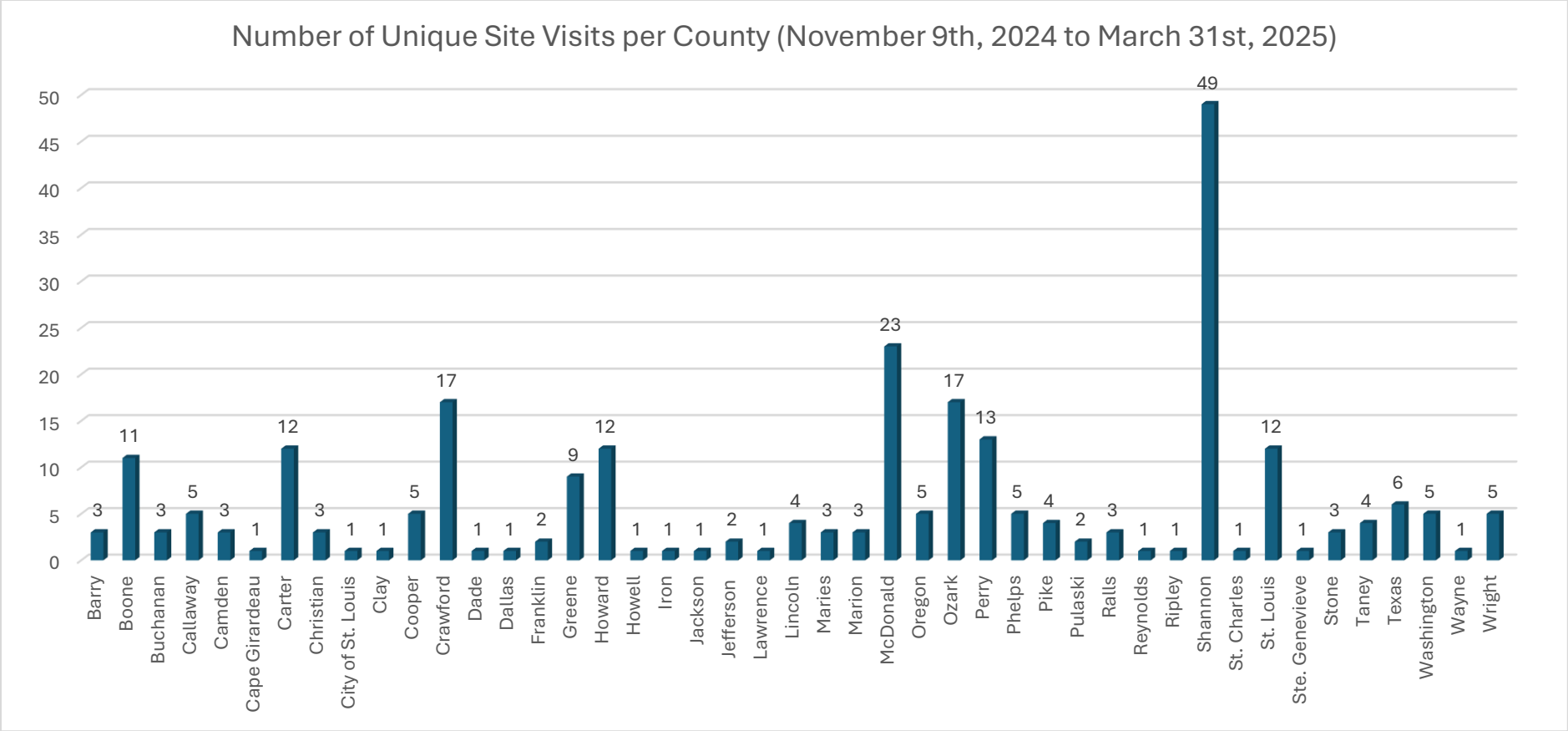
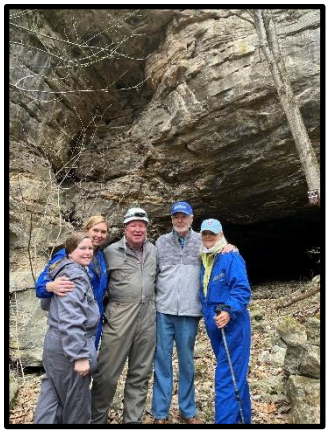


Figure 4. Number of unique site visits per county from November 9th, 2024, to March 31st, 2025. Shannon County leads as the top county site visited.

Figure 4. Unique cave life encountered during the winter 2024-2025 visits. From top left to bottom right: northern long-eared bat from Washington County, Shelly Colatskie looking at a northern long-eared bat in Franklin County-picture by Ron Colatskie, bear skeletal remains from a Washington County, MO, *Tingupa* millipede from Washington County-picture by Dillon Freiburger, slimy salamander from Crawford County, Indiana bats from Perry County-Pic by Josh Cooper, pseudoscorpion from Oregon County, unknown cave adapted planaria from Pike County-picture by Kirsten Alvey.






We thank all of the individuals for their efforts during the 2024-2025 season. Some highlights; from top left to bottom right:

1.Original owner and his family taking a tour of Rocheport (Boone) Cave. Thank you to Vona and Kyle for helping them get back to their old show cave! 2. We experimented with foldable kayaks in caves, they work great! 3. Cave monitoring team at Stinson (Wilson) Cave. 4. It sure was cold this winter, many ice cycles in Tyson (Minke) Quarry. 5. It is important to involve the next generation in cave work; Lucy Colatskie spends her winter break helping with monitoring work! 6. Multi-agency cooperative efforts for monitoring Onondaga Cave.