

# Conserving an OZARK CAVE

Landowners  
and scientists  
restore the  
famous Tumbling  
Creek Cave.

*by William R. Elliott,  
Thomas J. Aley and  
Catherine L. Aley*

Steve Samoray at the weir in the Big Room in Tumbling Creek Cave. A weir is used to visually gauge stream flow. Sensors in the pool beyond the structure register water quality to a data logger.

**T**umbling Creek Cave in Taney County is a gorgeous cave with a gurgling stream. It also has the highest recorded biodiversity of any cave west of the Mississippi River. The cave has been featured in a *National Geographic* special and in other TV programs, as well as in scientific articles.

The cave harbors three endangered species: gray bats, Indiana bats and Tumbling Creek cavesnails; the last is nearly extinct. Among the 115 different species found in the cave are 12 species of troglobites (cave creatures with reduced or absent eyes and pigment). Two of these troglobite species are found only in this cave.

In addition to its biological wonders, 2-mile-long Tumbling Creek Cave is an important educational and research cave. Since 1969, more than 25,000 people have taken guided tours of the cave. Each college or professional group gets an introduction to karst (areas with caves, springs, sinkholes and losing streams), views sinkholes, then enters the artificial shaft entrance, which has two airlock doors to keep the cave from drying out. The visitors bring their own lights and follow a rudimentary trail with low environmental impact.

Tom and Cathy Aley have led most of the tours. The Aleys established and operate the Ozark Underground Laboratory, which is based on a 2,550-acre tract in southern Missouri. The nonprofit Tumbling Creek Cave Foundation owns 383 acres in the cave's recharge area and around the natural entrance, ensuring protection of the cave into the future.

The Ozark Underground Laboratory has sponsored many studies of the cave. These studies include dye tracing to map the cave's 9 square miles of recharge area that collects water to the cave, determining water infiltration rates into the cave and collecting water quality data from the cave stream.

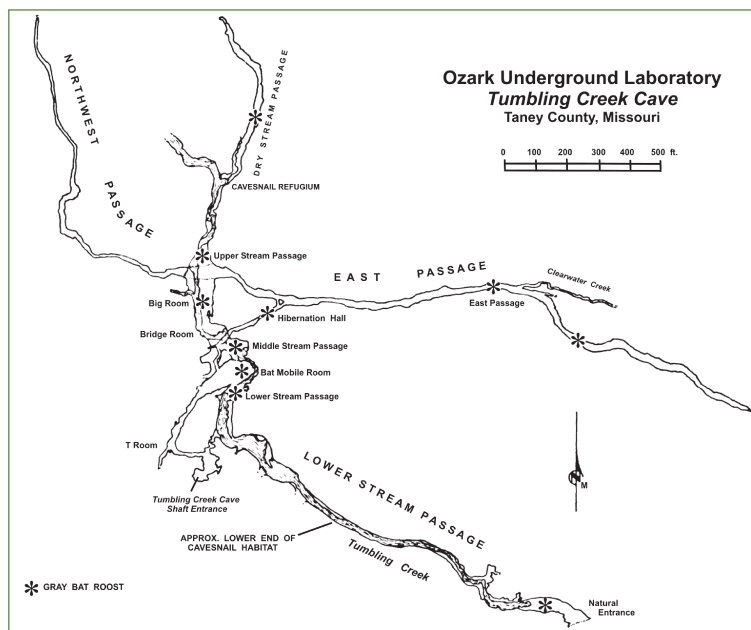
Other research conducted at Tumbling Creek Cave includes studies of cavesnails and stream fauna and bat censuses, as well as studies of bat guano, stalactite drippage and land-use effects on the cave.

Even though Tumbling Creek Cave has been well-protected for more than 40 years, something unexpected happened. Muck visibly built up in the cave stream, which is normally floored with cobbles. Some areas became so mucky that one could not pull up rocks that had been loose.

In addition, the Tumbling Creek cavesnail (*Antrobia culveri*) nearly went extinct. In 1972, a researcher had estimated that 15,000 cavesnails lived under the stream rocks. Fewer cavesnails were noticed by 1991. By 2001 only a few cavesnails could be found.

The Tumbling Creek Cavesnail Working Group brought together landowners and scientists to determine what had happened. We concluded that sediment from surface erosion was the most likely factor affecting the cavesnail population.

Twenty to 30 years ago, many forested areas in Missouri were cleared to create permanent pasture.



**Tumbling Creek Cave, Ozark Underground Laboratory, has 9,711 feet of mapped passages.**

## Troglobites

Twelve of Tumbling Creek Cave's 115 species are cave-adapted troglobites. Species in bold are found only in this cave.

### Scientific name

***Antrobia culveri***

*Arrhopalites clarus*

*Brackenridgia ashleyi*

*Caecidotea ancyla*

*Caecidotea antricola*

*Causeyella dendropus*

***Chaetaspis aleyorum***

*Eurycea spelaea*

*Islandiana* sp.

*Spelobia tenebrarum*

*Stygobromus onondagaensis*

*Stygobromus ozarkensis*

### Common name

**Tumbling Creek cavesnail**

Cave springtail

Trichoniscid isopod

Ancyla cave isopod

Antricola cave isopod

Causeyella cave millipede

**Aleys' cave millipede**

Grotto salamander

Cave spider

Cave dung fly

Onondaga cave amphipod

Ozark cave amphipod



Tumbling Creek cavesnail

DAVID CASHLEY



Causeyella cave millipede

WILLIAM R. ELLIOTT



Grotto salamander

WILLIAM R. ELLIOTT



Ozark cave amphipod

WILLIAM R. ELLIOTT

This increased soil erosion, especially on steeper slopes in the first year after clearing or following droughts. Although the cave has no upstream entrance, the sediments worked down through sinkholes and losing streams into the cave.

## A Working Group

Our group has worked on many fronts to restore or protect the cave's unique habitat and inhabitants. In 2005, scientists placed terra cotta tiles in a cavesnail refuge area. Cavesnails were recently found on those tiles, creating hope that they may use them for feeding on microbes and laying eggs. Tumbling Creek cavesnails may rescue themselves this way.

In 2006, we built a small cavesnail laboratory in the cave, where we have done preliminary tests. If necessary, cavesnails might be propagated in the lab and then stocked in Tumbling Creek.

We sampled the water with highly sensitive equipment that detects parts per quadrillion, but found only tiny amounts of a few chemicals that were of no concern. Working with the Missouri Department of Transportation to monitor a resurfacing project on Highway 160 in the recharge area, we determined that their "chip and seal" method using an asphalt-water emulsion did not introduce any detectable petroleum products into the road ditches or the groundwater.



Dr. David Ashley (second from right) leads a cavesnail census in 2007 with Eric Hertzler of the Ozark Underground Laboratory (left), Parisa Tourgoli (second from left) and Laura Rexroat (far right).

We also got help from the Conservation Department, which worked with the Ozark Underground Laboratory and the local community to help a school replace a sewage lagoon that was leaking most of its contents into the groundwater system feeding Tumbling Creek Cave (See *The School and the Cavesnail*; September 2006). A modern peat-filtration system was installed with the help of grants and substantial local contributions.

Because surface and subsurface are connected, caves cannot be protected without protecting the land that contributes water to them.

The Aleys bought nearby properties to help protect the cave and its critters. They used cost-share funds from the Conservation Department and the U.S. Fish & Wildlife Service to plant 70,000 trees to help restore the land.

Although some Ozark Underground Laboratory lands are used for raising cattle or growing hay, the overall goal is to create a landscape dominated by native species, including black oak, northern red oak, white oak, black gum, black walnut, green ash, dogwood, redbud, sycamore and short-leaf pines. Sassafras, hickories and persimmons should reestablish naturally from the surrounding areas.

Thanks to a cost-share project with the National Park Service and Fish and Wildlife Service, 20 farm dumps in sinkholes and in gullies that directly feed losing streams in the recharge area have been cleaned. Many of those dumps contained household chemicals, petroleum products, partially full paint cans, empty pesticide and oil containers with residues, used medical supplies and an unbelievable number of disposable diapers. Cavers from several Missouri groups helped with these cleanups.



## Bat Protection

Bats are extremely important to this and many other cave ecosystems. Most of the energy input to a cave might be from gray bat guano.

Eight species of bats have used Tumbling Creek Cave. The endangered Indiana bat (*Myotis sodalis*) sometimes hibernates in the chilly entrance passage. The endangered gray bat (*Myotis grisescens*) has had a large maternity colony here in the spring and summer.

To protect the bats and, ultimately, the entire cave community, a team of 18 conservationists, helped by a grant from the Conservation Department, built the world's largest chute gate on the cave's natural entrance. A chute gate keeps trespassers out of a cave but allows bats to fly in and out. The gate was completed in 2004.

Tumbling Creek Cave's gray bats were studied extensively because of their large numbers and the importance of the nutrient input provided by their guano. The earliest known population estimate in the cave peaked at 150,000 bats in 1969. In 1976 there were 36,000. Over the next 20 years the population generally remained below 15,000. The last out-flight count before the completion of the new gate was 12,400 in 1998.

We're not sure what caused the decline in the number of gray bats in the cave. There was a general decline

in the species. An internal cave gate might have somehow hindered the bats. Trespassers might have unduly disturbed hibernation sites in the region.

What we do know from internal visual surveys, guano checks and near-infrared video counts of outflights is that the number of gray bats at Tumbling Creek Cave has increased to about 35,000 since the chute gate was installed.

The Conservation Department has increased its efforts to help Missouri cave owners and to teach people about caves and karst.

It is disturbing that the most protected private cave in the Ozarks—in a rural area with little industry or row crops—still developed ecological problems. However, the methods we developed in dealing with those problems will be useful to others.

Through studies, short courses, TV shows and (we hope) articles like this one, the lessons learned at Tumbling Creek Cave have helped many people to better manage caves and groundwater. ▲

## Cave Gating and Education

Cave gates protect caves and wildlife from human intruders, but harm can come from improper designs. Designs have changed over the years, and now we know what works and what does not. To learn more, go to [www.utexas.edu/tmm/sponsored\\_sites/biospeleology/](http://www.utexas.edu/tmm/sponsored_sites/biospeleology/) and click on "Cave Gates We Have Known."

The Conservation Department's cave biologist can lend a technical hand and advice to landowners. The Department also provides educational resources on caves and karst. These include publications, guidance documents, teachers' cave trunks, groundwater models and training workshops. For more information, contact Bill Elliott at 573-522-4115 ext. 3194, or e-mail him at [Bill.Elliott@mdc.mo.gov](mailto:Bill.Elliott@mdc.mo.gov).



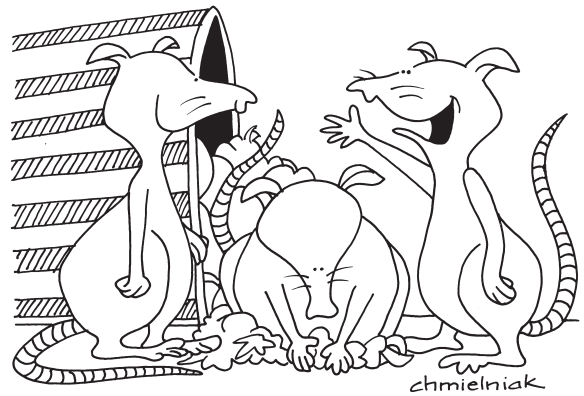
**A chute gate is used for low, wide entrances where there is not enough height to build the usual flyover gate for a gray bat maternity colony. This conservation work has allowed gray bats to increase in many protected caves, preventing their extinction.**

# Hunting and Fishing Calendar

FISHING	OPEN	CLOSE
Black Bass (certain Ozark streams, see the <i>Wildlife Code</i> )	5/26/07	2/29/08
impoundments and other streams year-round		
Bullfrog	Sunset	Midnight
	6/30/07	10/31/07
Gigging nongame fish	9/15/07	1/31/08
Trout Parks	3/1/07	10/31/07
HUNTING	OPEN	CLOSE
Common Snipe	9/1/07	12/16/07
Coyotes	5/7/07	3/31/08
Crow	11/1/07	3/3/08
Deer		
Archery	9/15/07	11/9/07
	11/21/07	1/15/08
Firearms		
Urban Counties (antlerless only)	10/5/07	10/8/07
Youth	10/27/07	10/28/07
November Portion	11/10/07	11/20/07
Muzzleloader	11/23/07	12/2/07
Antlerless	12/8/07	12/16/07
Dove	9/1/07	11/9/07
Furbearers	11/15/07	1/31/08
Groundhog	5/7/07	12/15/07
Pheasants		
North Zone	11/1/07	1/15/08
South Zone	12/1/07	12/12/07
Youth (north zone only)	10/27/07	10/28/07
Quail	11/1/07	1/15/08
Youth (statewide)	10/27/07	10/28/07
Rabbits	10/1/07	2/15/08
Ruffed Grouse	10/15/07	1/15/08
Sora and Virginia Rails	9/1/07	11/9/07
Squirrels	5/26/07	2/15/08
Teal	9/8/07	9/23/07
Turkey		
Fall Archery	9/15/07	11/9/07
	11/21/07	1/15/08
Fall Firearms	10/1/07	10/31/07
Waterfowl	please see the <i>Waterfowl Hunting Digest</i> or see <a href="http://www.missouriconservation.org/7573">www.missouriconservation.org/7573</a>	
Woodcock	10/15/07	11/28/07
TRAPPING	OPEN	CLOSE
Beaver and Nutria	11/15/07	3/31/08
Furbearers	11/15/07	1/31/08
Otters and Muskrats	11/15/07	see <i>Wildlife Code</i>

For complete information about seasons, limits, methods and restrictions, consult the *Wildlife Code* and the current summaries of *Missouri Hunting and Trapping Regulations* and *Missouri Fishing Regulations*, the *Fall Deer and Turkey Hunting Regulations and Information*, the *Waterfowl Hunting Digest* and the *Migratory Bird Hunting Digest*. For more information visit [www.missouriconservation.org/8707](http://www.missouriconservation.org/8707) or permit vendors.

The Department of Conservation's computerized point-of-sale system allows you to purchase or replace your permits through local vendors or by phone. The toll-free number is 800-392-4115. Allow 10 days for delivery of telephone purchases. To purchase permits online go to [www.wildlifelicense.com/mo/](http://www.wildlifelicense.com/mo/).



**"Help yourself to the garbage of the best recyclers in the neighborhood—no plastics, papers, cans or jars—just pure, rotten food!"**

## Contributors



CATHERINE L. ALEY is co-owner and biologist for the Ozark Underground Laboratory. She is an accomplished naturalist, conservationist, carpenter, gardener and chef.

THOMAS J. ALEY is a hydrologist, caver and forester. Director of the Ozark Underground Laboratory, he teaches college and professional groups above and below ground.



DR. WILLIAM R. ELLIOTT, Department cave biologist, recently received the National Speleological Society's Honorary Membership Award for contributions in science and conservation.

AARON HOLSAPPLE works in Linn as a resource forester. He and his wife, Lynne, enjoy camping with their two very curious daughters, ages 3 and 5. He also plays guitar and enjoys singing.



ERIC KURZEJESKI has worked on regulations issues for most of his 30 years with MDC, but come fall, you'll find him in a tree stand. His wife, Lori, suggested changing his name to "Sits-in-Tree."

TAMIE YEGGE manages Powder Valley CNC. She has always loved nature and grew up camping, hiking, canoeing and fishing with family, traditions she now shares with her own children.

