

# Virginia Cave Owner's Newsletter

A Publication of the Virginia Cave Board, Department of Conservation and Recreation

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## Virginia Adopts "State Bat"

by Chris Hobson, DCR Natural Heritage Program

The Virginia Big-eared Bat (*Corynorhinus townsendii virginianus*) may not win any beauty contests, but it is one of the most unique and endangered bat species in North America. It also happens to be the official State Bat of Virginia as designated by a recent legislative gesture by state lawmakers and Governor Mark Warner. Texas is the only other state in the country with a bat designated as an official representative; the Mexican Free-tailed Bat (*Tadarida brasiliensis*) is the "state flying mammal" of Texas. Oddly enough, this species is rumored to have shown up once or twice in Virginia, blown to the north by powerful hurricane winds.



A Virginia Big-eared Bat Hangs Out on the Cave Wall.

Photo by Merlin Tuttle, Bat Conservation International

While there are millions of Mexican Free-tailed Bats scouring the skies of Texas nightly devouring untold numbers of flying insects, one would be hard pressed to find a Virginia Big-eared Bat in the Commonwealth. There are only about a thousand individuals known to occur in Virginia caves, and these are confined to sites in the westernmost regions of the state. The bat is also known from West Virginia, eastern Kentucky, and western North Carolina but is exceedingly rare throughout its range, with an estimated total number of less than 10,000 individuals. While 10,000 may seem like a lot, most of these animals hibernate in only a handful of sites, making them extremely vulnerable to disturbance. In contrast, some colonies of the Mexican Free-tailed Bat contain millions of individuals.

Our state bat is one of sixteen species in the Commonwealth, including two others (Gray bat, *Myotis grisescens*; Indiana bat, *Myotis sodalis*) that are listed as endangered federally and in Virginia. Eight of these species, including the three listed under the Endangered Species Act, commonly use Virginia's caves

during at least part of the year. The other bat species found in Virginia's caves are the Little Brown Bat (*Myotis lucifugus*), the Eastern Pipestrelle (*Pipistrellus subflavus*), the Big Brown Bat (*Eptesicus fuscus*), the Northern Long-eared Bat (*Myotis septentrionalis*), and the Eastern Small-footed Bat (*Myotis liebii*).

In addition to the Virginia Big-eared Bat, two other subspecies of *Corynorhinus townsendii* are recognized. One (*Corynorhinus townsendii ingens*) occurs in the Ozark region of Missouri and Arkansas, and the other (*Corynorhinus townsendii townsendii*) is fairly common west of the Rocky Mountains. Another member of the genus, the Southeastern Big-eared Bat (*Corynorhinus rafinesquii macrotis*), is not listed federally but is considered endangered in Virginia. It can be found in the swamps of southeastern Virginia.

Both male and female Virginia Big-eared Bats typically congregate in large groups for hibernation, but in summer females separate to form maternity colonies whereas males are usually solitary. Females typically give birth to one pup during June. The young pup grows rapidly and can be on the wing in as few as three weeks. They are typically weaned, nearly full grown, and feeding on their own at about seven to eight weeks. Several studies have shown that this bat feeds primarily on moths but may occasionally take other insects such as beetles, flies, and ants during its nocturnal wanderings.



A Virginia Big-eared Bat Drinks on the Fly.

Photo by Merlin Tuttle, Bat Conservation International

Can we expect our state bat to be a long-term survivor? Let's hope so! The main threat to their survival is disturbance at their caves. Fortunately, most of the important caves that the species

occupies have been gated thanks to the combined efforts of a number of state, federal, and private organizations, and individuals. These gates are designed to keep people out and maintain the appropriate conditions needed by the bats to hibernate or raise young. There are signs that these protection

efforts are having an effect. A cave in Highland County was recently discovered to host a newly established maternity colony of Virginia Big-eared Bats. This cave will be fitted with a bat friendly gate later this year (fall,2005)!

## The Biodiversity of Virginia's Caves

by Wil Orndorff, DCR Natural Heritage Karst Program

In a small cave in Tazewell County, amber colored beetles a few millimeters long scurry back and forth across mudbanks along a small stream. Eyeless and diminished in pigment (see picture), their other heightened senses allow them to navigate the lightless cave environment in search of food, water, shelter, and mates. The Maiden Spring Cave Beetle (*Pseudanophthalmus virginicus*) is known from this single cave and nowhere else. Even more amazingly, this species is not unique in its isolation. Of the more than 39 cave beetle species documented in Virginia, 23 are known from five or fewer locations globally, with an additional seven species known from 20 or fewer locations. Each species is confined to a single cave or small group of nearby caves which may be connected by beetle-sized passages through which human cavers won't fit.



**This half centimeter long cave beetle is one of dozens of cave beetle species found in the eastern United States.**

**Photo by Chip Clark**

Though the biodiversity represented by the eight bat species found in Virginia's caves (see previous article) is impressive, it pales in comparison to that found among invertebrates.

*Biodiversity* can be defined in many ways, and generally can be thought of as the variability among living organisms. Scientists describe biodiversity at different scales based on geographic distribution, habitat, and types of organisms (taxonomy). Beetles are one of several terrestrial invertebrate groups that exhibit great diversity in Virginia's caves. Other diverse subterranean terrestrial (land-dwelling) invertebrate groups include millipedes, springtails (insects), pseudoscorpions, diplurans (bristletails), and spiders. Subterranean aquatic species exhibit similar biodiversity, particularly among the crustacean amphipod and isopod groups. The following table summarizes some of the more diverse groups dwelling in Virginia's caves.

Habitat	Group	# of Species
Terrestrial	Beetles	39
	Springtails	18
	Pseudoscorpions	17
	Millipedes	16
	Spiders	6
	Diplurans (bristletails)	5
Aquatic	Amphipods (scuds)	21
	Isopods	13

The table does not take into account numerous undescribed species in several of the groups, especially beetles, millipedes, diplurans, and amphipods. Two of the biggest challenges faced by biologists studying the biodiversity of cave life are 1) the lack of qualified taxonomists\* to identify and describe species, and 2) the lack of funds to pay for identifications and descriptions. The second challenge may explain the first, at least in part.

Long-time Virginia Cave Board member and American University biology professor David Culver has spent his career studying cave life, specializing in the biodiversity of life below the earth. Dr. Culver compiled two U.S. maps that show the distribution of terrestrial and aquatic cave-dwelling invertebrates by county. Western Virginia stands out as having some of the highest cave biodiversity in the nation.

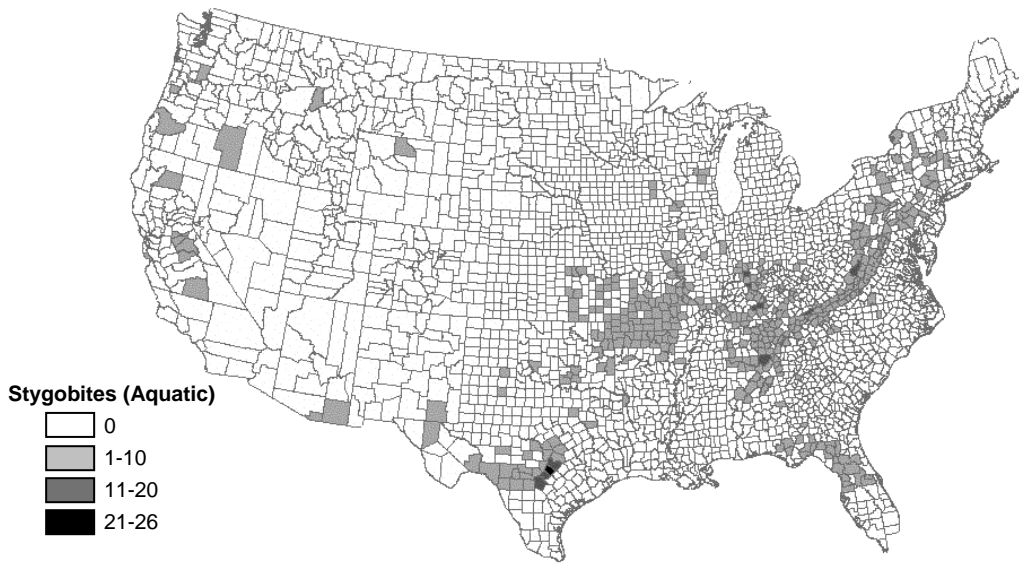
Why is there so much biodiversity in the subterranean realm? The best explanation is that many cave species share a broadly distributed surface ancestor but adapted uniquely to various isolated local cave environments, either as a result of environmental variables or differences in random mutations. Our knowledge of the biodiversity of Virginia's caves is very incomplete. The majority of caves have never been visited by

biologists, and new caves and cave passages leading to previously inaccessible habitats are discovered every year! If you wonder what is living in your cave, please contact the Virginia Karst Program at 540-831-4056 or email [Wil.Orndorff@dcr.virginia.gov](mailto:Wil.Orndorff@dcr.virginia.gov). We'd be happy to share any information about the known biology of a cave with the owner,

and can work with cave owners to arrange biological study of caves that have not been thoroughly investigated.

\* Taxonomist: a biologist specializing in the classification, identification, and anatomical description of organisms. Not to be confused with taxidermists, who would no doubt have a very difficult time working with these tiny organisms.

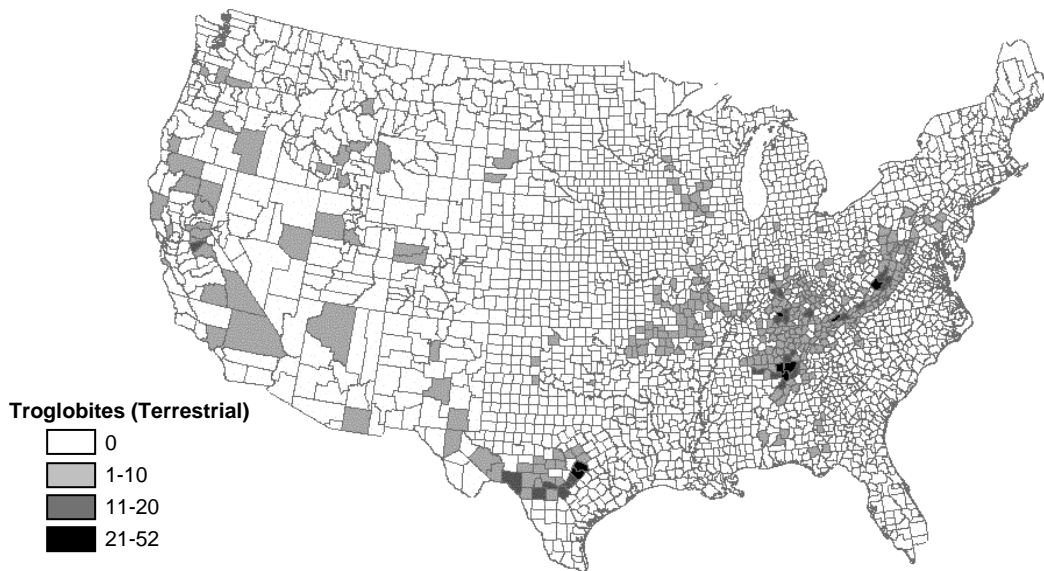
### Distribution of Aquatic Stygobitic Species and Subspecies by County



Biodiversity of Aquatic Cave Fauna (Stygobites) in Continental United States

Map by David Culver

### Distribution of Terrestrial Troglitic Species and Subspecies by County



Biodiversity of Terrestrial Cave Fauna (Troglites) in Continental United States

Map by David Culver

## Protecting Cave Animals through the Endangered Species Acts

by Wil Orndorff, DCR Natural Heritage Karst Program

Although the caves of Virginia are home to eight bat species and dozens of globally rare invertebrate species, only a handful of them receive any direct protection under state or federal law. Conservation of habitat for the remainder of these species depends on the collaborative effort of citizens, localities, state and federal agencies, conservation organizations, and developers. The Virginia Department of Conservation and Recreation (DCR) Environmental Project Review office screens thousands of proposed development projects each year for proximity to locations of rare plants, animals, and natural communities, and is very successful in avoiding or reducing impacts through education and negotiation.

The title of this article states “endangered species acts,” and that is not a typographical error. There are three endangered species acts that apply in Virginia: the U.S. Endangered Species Act of 1973, the Virginia Endangered Species Act of 1972, and the Virginia Endangered Plant and Insect Species Act of 1979. The U.S. Fish and Wildlife Service, the Virginia Department of Game and Inland Fisheries, and the Virginia Department of Agriculture and Consumer Services have respective jurisdictional authority, while the Virginia Natural Heritage Program in DCR maintains the most comprehensive database and provides technical expertise to the regulatory agencies. Because species listed under the federal law are automatically listed under state law, state and federal agencies work closely together on issues involving federally listed species. The common goal of the endangered species acts is the recovery and long-term protection of a species culminating in its removal from the list of protected species. To that end, experts have developed recovery plans for each species detailing what they believe is necessary for its survival.

Cave-dwelling species that receive legal protection are scattered throughout the karst of western Virginia (see table below). Lee County has the highest number of protected species, with three invertebrates known only from Lee County, and two bats listed. Flooded caves of the Shenandoah Valley are home to the Madison Cave Isopod, which has the broadest geographic range among listed cave invertebrates in Virginia.

Various factors have led to the listing of these species. Severe declines in bat population in the 1970's and 80's led to their listing, and it is hoped that protection of caves where they roost and hibernate will aid in their recovery. Aquatic cave animals such as the Lee County Cave Isopod (pictured) are listed in response to current or potential contamination of the watersheds of the streams where they live. Terrestrial cave animals like Holsinger's Cave Beetle, the newest (2004) cave animal added

to Virginia's list of protected species, are particularly vulnerable because of their limited geographic range and are sometimes listed because of proximity to development corridors or expanding urban areas.



**Two cave isopod species coexist in this Lee County Cave stream: *Caecidotea recurvata* (elongated) and *Lirceus usdagalun*, a smaller pill-shaped isopod known only from central Lee County and protected under the Endangered Species Act.**

**Photo by Wil Orndorff**

Protections afforded under the endangered species acts frequently cause controversy, because people perceive that the rights of humans are infringed upon in the process. In truth, this is rarely the case. When a proposed development project or existing land use is found to place at risk an individual or population of a listed species, regulatory agencies confer with other stakeholders including landowners, developers, conservation groups, and local officials. The goal is to come up with a solution that either avoids or mitigates (minimizes) the impact while respecting the rights of private property. In many cases, the result is a win-win situation. Protection of habitat for threatened and endangered species also protects the environment upon which humans depend. Ironically, the endangered species acts are sometimes the most powerful available tools for protection of the natural resources upon which human beings rely, even though *Homo sapiens* is not (yet) a listed species.

## Legally Protected Species of Virginia's Caves

Species	Legal Status	Distribution
Vertebrates		
Gray Bat ( <i>Myotis grisescens</i> )	Endangered	US and Virginia <i>Upper Tennessee River Basin</i>
Indiana Bat ( <i>Myotis sodalis</i> )	Endangered	US and Virginia <i>Valley and Ridge of Western Virginia</i>
Virginia Big-eared Bat ( <i>Corynorhinus townsendii Virginianus</i> )	Endangered	US and Virginia <i>Valley and Ridge of Western Virginia</i>
Troglobites – terrestrial, cave obligate invertebrates		
Ellett Valley Pseudotremia Millipede ( <i>Pseudotremia cavernarum</i> )	Threatened	Virginia <i>Ellett Valley near Blacksburg</i>
Holsinger's Cave Beetle ( <i>Pseudanophthalmus holsingeri</i> )*	Endangered	Virginia <i>Western Lee County</i>
Stygobites - aquatic, cave obligate invertebrates		
Lee County Cave Isopod ( <i>Lirceus usdagalun</i> )	Endangered	US and Virginia <i>Central Lee County</i>
Madison Cave Amphipod ( <i>Stygobromus stegorum</i> )	Threatened	Virginia <i>Augusta County near Grottos</i>
Madison Cave Isopod ( <i>Antrolana lira</i> )	Threatened	US and Virginia <i>Shenandoah Valley</i>
Unthanks Cave Snail ( <i>Holsingeria unthanksensis</i> )*	Endangered	Virginia <i>Central Lee County</i>
* It should be noted that two of the listed invertebrate species bear the name "Holsinger," a testimony to the career of Virginia Cave Board member and Old Dominion University Biology Professor John Holsinger who has been studying the life of Virginia's caves for over 40 years.		

## Shedding Light On A Dark World

by Judy Mulnar, Virginia Cave Board and Virginia Living Museum

Walking in the stream of a cave passage, my helmet light caught an elevated pool of water about waist high up on a ledge. Coming closer I saw small, white, cave isopods slowly walking at the bottom of the pool. Related to terrestrial pillbugs, these blind crustaceans reacted only to the ripples caused by my breaths on the water.

The animals that most people associate with caves – bats, pack rats, crickets – only use them as shelter for a portion of their life cycle, traveling in and out of the cave to find food. However, unknown to most people and unnoticed by many cavers are underground ecosystems populated by animals adapted exclusively for life in caves, where food is scarce and temperature is relatively constant. In adapting to life underground, surface species evolved over generations into "troglobites" – ghostly versions of their surface ancestors. Why?

In a world without light, photosynthesis cannot occur, leaving troglobites dependent on the outside world for food. This limited food supply has forced troglobites to evolve extreme energy conservation strategies. Traits not useful underground have disappeared while new traits have emerged. In the absence

of light, skin pigments that protect from sunlight or act as camouflage are a waste of metabolic energy so troglobites typically lack or exhibit reduced pigment. Equally useless underground, eyes are either absent or vestigial. Other senses, especially touch and smell, are more acute, with elongated antennae and bristles quite common. Limbs and body shapes have adapted as well both in scale and proportion to suit each troglobite's specific, subterranean niche. Compared to their surface ancestors, troglobites tend to be smaller, grow more slowly, live longer, produce fewer and larger offspring, and maintain smaller populations.

The cave food web starts with washed-in or blown-in plant material, dead animals, dissolved or suspended organic matter, and the waste of other cave inhabitants (guano). Bacteria and fungi grow on this material and are in turn eaten by small animals such as isopods, millipedes, and beetles. Nocturnal foraging by cave crickets near cave entrances is another significant source of nutrient input in the form of eggs they lay in cave mud banks. Many species are omnivorous. Larger predators and scavengers like spiders, salamanders, and crayfish

feed on the smaller animals that live in the cave or wander into it by accident.

Troglobites generally cannot survive outside of caves, making them very rare. While some other states have cave-adapted fish and salamanders, Virginia's troglobites are all invertebrates, most of which are smaller than the type on this page. Over 150 globally rare troglobites occur in Virginia caves, most known from only a single or small handful of caves. Numerous recently discovered species are new to science and still await proper scientific names! This diversity is due mostly to the isolated nature of cave environments. Most cave species within a group or genus represent separate adaptations of a common surface ancestor to the underground world.

Not often viewed as habitat, caves unfortunately suffer from the "out of sight, out of mind" syndrome. In some cases, the degradation of a single cave can jeopardize the continued existence of an entire species. Conservation of cave habitats requires protecting not only the cave passages, but also the overlying land and surrounding lands that contribute water or nutrients to the cave system.

Visit the Virginia Living Museum's *Virginia's Underground* exhibit to learn more about cave creatures. You can also attend Virginia Cave Board meetings. The Cave Board advises state agencies on cave related matters, identifies significant caves, and recommends conservation and preservation measures for Virginia caves. For more information, see <http://www.dcr.virginia.gov/dnh/karsthome1.htm>

## Virginia Cave Board 2005-2006 Members

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