Karst Invertebrates

Scientific Name: Bee Creek Cave Harvestman – *Texella reddelli,* Bone Cave Harvestman – *Texella reyesi,* Tooth Cave Pseudoscorpion – *Tartarocreagris texana,* Tooth Cave Spider – *Neoleptoneta myopica,* Tooth Cave Ground Beetle – *Rhadine persephone,* Kretschmarr Cave Mold Beetle – *Texamaurops reddelli,* Coffin Cave Mold Beetle – *Batrisodes texanus*

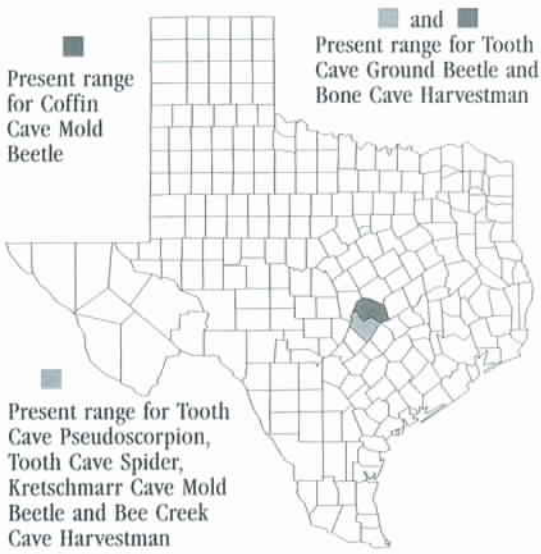
Federal Status: Endangered, 9/16/88 • State Status: Endangered

Description of Species and Life History

Of these species, three are insects (one ground beetle and two mold beetles) and four are arachnids (one pseudoscorpion, one spider, and two harvestmen). All are troglobites, which are animals that are specially adapted to subterranean existence and spend their entire lives underground. Troglobites usually have small eyes or lack eyes entirely, long appendages, reduced pigmentation and other adaptations to a subterranean environment.

Bone Cave Harvestman
© USFWS Wyman Meinzer

Tooth Cave Pseudoscorpion
© USFWS Wyman Meinzer



Most of the endangered karst invertebrates are believed to be predators of microarthropods (tiny insects). They also feed on well-decomposed organic matter. Most troglobites eat a variety of foods (food generalists), although some degree of prey specialization probably exists in some species. There is little information on the biology or life cycles of these karst species. Collections made throughout the year suggest that, unlike their surface-dwelling relatives, cave species do not have distinct seasonal cycles.

The **Bee Creek Cave Harvestman**, or daddy-longlegs, has a body about 2 to 3 mm in length and relatively long legs. Its body color is light yellowish-brown, and it has no eyes. It is found under rocks in darkness or in dim light, and preys on tiny, hopping insects called collembolans. This species, like other small harvestmen, tend to walk rather slowly and deliberately, unlike spiders, which tend to move faster.

The **Bone Cave Harvestman** is a long-legged, blind, pale orange harvestman, with a body length of about 1.4 to 2.7 mm. This species is especially sensitive to humidities below saturation. They are most often found under large rocks, but are occasionally seen walking on moist floors. In the hottest part of the summer when small caves warm up and become drier, they can be found only in the coolest, dampest spots.

The **Tooth Cave Pseudoscorpion** grows to about 4 mm and resembles a tiny, tailless scorpion without eyes. Pseudoscorpions use their pinchers to catch prey, and are thought to be predators of microarthropods. Usually found under rocks, this species is quite rare and little is known of its habits.

The **Tooth Cave Spider** is the smallest of the listed invertebrates, about 1.6 mm in length. It is a pale cream-colored spider with relatively long legs. Although it is restricted entirely to caves, it does possess rudimentary eyes. A minute and delicate predator of microarthropods, the Tooth Cave spider is a sedentary aerial spider that hangs from a small tangle or sheet web on long, thin legs.

The **Tooth Cave Ground Beetle** is a slender, reddish-brown beetle with reduced eyes. It attains a length of 7 to 8 mm at maturity. This is the largest, most visible, and

most active of the karst species. It is usually found under rocks, but has been seen walking on damp rocks and silt when conditions are favorable. It runs rapidly as it searches the cave floor for prey. This species appears to be restricted to areas of deep, uncompacted silt, where it digs holes to feed on cave cricket eggs deposited into the silt.

The **Kretschmarr Cave Mold Beetle** has short wings and long legs, and is less than 3 mm long. It is dark brown and eyeless. This mold beetle is found in total darkness under and among rocks and organic debris and buried in silt. Although food preferences are unknown, it is believed to be a predator.

The **Coffin Cave Mold Beetle** is a small, long-legged beetle with short wings. Its body length is about 2.6 to 2.9 mm and it is eyeless. This species is also found in total darkness under rocks. Its food preferences are unknown. The Coffin Cave mold beetle is the only one of the endangered invertebrates found exclusively in Williamson County.

Habitat

"Karst" is a term used by geologists to describe a type of terrain formed when calcium carbonate from limestone bedrock is slowly dissolved by mildly acidic groundwater. This process creates numerous caves, sinkholes, fractures, and interconnections so that in places the bedrock resembles a honeycomb. Many of the karst features occupied by the listed species were formed at or below the water table, and thus were once filled with water. As the water table lowered, these features dried out and are now air-filled. The lowering of the groundwater table led to ceiling collapse in some cavities, forming caves and sinkholes. Some karst features act as important recharge structures to underground streams and aquifers.

During the course of climatic changes during the Pleistocene epoch (2 million to 10 thousand years ago), the ancestors of these animals retreated from the soil surface and mulch into the more stable cave environments. Subsequently, these animals became adapted to cave environments.

Through faulting and downcutting by water in stream channels, the karst terrain along the Balcones Fault Zone became increasingly dissected, creating "islands" of karst that are barriers to dispersal of the troglobites. This led to increasing isolation of troglobite populations and the subsequent evolution of distinct species.

Troglobites require high humidities (near saturation) and are very susceptible to drying. Most also require stable temperatures. Cold, dry air entering a cave causes the animals to retreat to more humid, warmer areas. During these times, some troglobites may be found in small ceiling pockets where the conditions are probably warmer and damper than on the cave floor. During hot, dry periods, these animals may retreat into the cave soil or small cracks and fissures in the walls or ceiling where environmental conditions are more stable.

Because there is little light and limited capacity for photosynthesis by plants, karst ecosystems depend almost entirely on surface plant and animal communities for nutrients and energy. Caves receive nutrients from the surface in the form of leaf mulch, plant roots, and other organic debris that washes or falls into the cave. Cave crickets are especially important because many invertebrates are known to feed on their eggs, feces, nymphs, and dead body parts. Cave crickets roost and lay eggs in caves during the day and leave the cave at night to feed on the surface. Raccoons and other small mammals are also important in many cave communities because their feces provide a rich medium for the growth of fungi and, subsequently, tiny insects that become prey for troglobites.

Most of the caves inhabited by the listed species were not significant bat roosts in the past. Studies indicate that although most karst systems containing the listed ani-

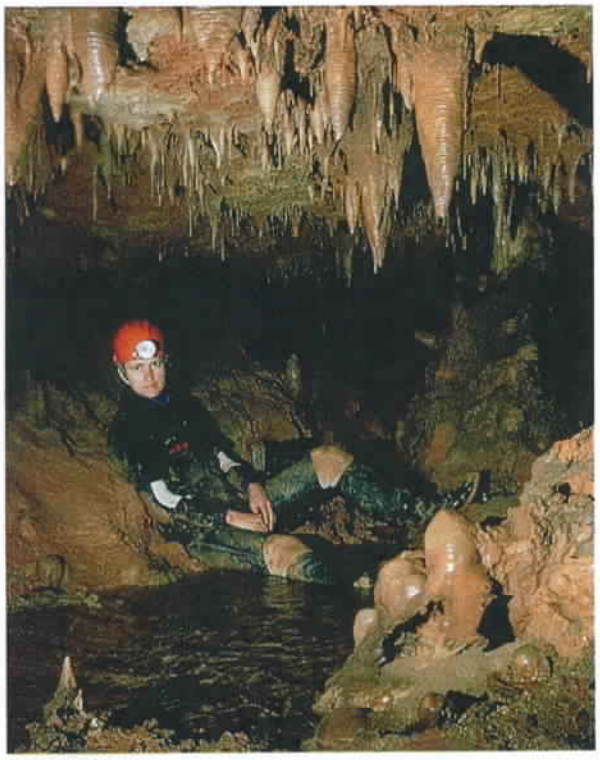
Tooth Cave Spider © USFWS Wyman Meinzer

Tooth Cave Ground Beetle © USFWS Wyman Meinzer

Kretschmarr Cave Mold Beetle © USFWS R. W. Mitchell

Cave Cricket © USFWS Wyman Meinzer

Limestone cave in Travis county
© USFWS Wyman Meinzer



Cave formations
© George Veni

mals do not depend on bats for nutrient input, some of these invertebrates can live in caves with small bat colonies and may benefit from the increased input of nutrients found in bat guano.

Surface plant communities around karst features range from pastureland to mature oak-juniper woodland. In addition to providing nutrients to the karst system, maintaining adequate plant cover is important in minimizing temperature fluctuations, drying, and groundwater contamination.

Threats and Reasons for Decline

The primary threat to the listed species is loss of habitat due to urban development. The continued urban expansion in Travis and Williamson counties has negatively impacted numerous caves. Most of the species are located in areas adjacent to or near residential subdivisions, schools, golf courses, roads, and commercial and industrial facilities. Threats from urban development include filling in or collapse of caves, alteration of drainage patterns, alteration of surface plant and animal communities, contamination by pollutants, and detrimental impacts caused by human visitation.

The introduction of non-native predators and competitors also poses a major threat to the karst invertebrates. For example, the Red Imported Fire Ant is an increasingly serious threat. Fires ants eat the invertebrates directly, or impact cave systems by preying on other species that are important for nutrient input.

Recovery Efforts

A number of surveys and research projects are underway to better define the taxonomy and distribution of karst fauna in Travis and Williamson counties. Many of these studies are associated with areas proposed for development. Fire ant control studies have also been conducted to determine the effectiveness of various treatments on fire ants. Efforts are also underway to protect many of the caves known to contain endangered invertebrates.

How You Can Help

Individuals and private groups can support efforts in Travis and Williamson counties to conserve and manage habitat for endangered species, and prevent ground and surface water pollution.

Conservation organizations can provide additional information, and they welcome your support.

For More Information Contact

Texas Parks and Wildlife Department
Endangered Resources Branch
4200 Smith School Road
Austin, Texas 78744
(512) 912-7011 or (800) 792-1112
or
U.S. Fish and Wildlife Service
Ecological Services Field Office
10711 Burnet Road, Suite 200
Austin, Texas 78758
(512) 490-0057

Management guidelines are available from Texas Parks and Wildlife Department and the U.S. Fish and Wildlife Service for landowners and managers interested in protecting karst ecosystems underlying their property.

References

Slack, Doug et al. 1990. *Austin Regional Habitat Conservation Plan.* Comprehensive Report of the Biological Advisory Team.

U.S. Fish and Wildlife Service. 1993. *Draft Recovery Plan for Endangered Karst Invertebrates in Travis and Williamson Counties, Texas.* 133 pp.

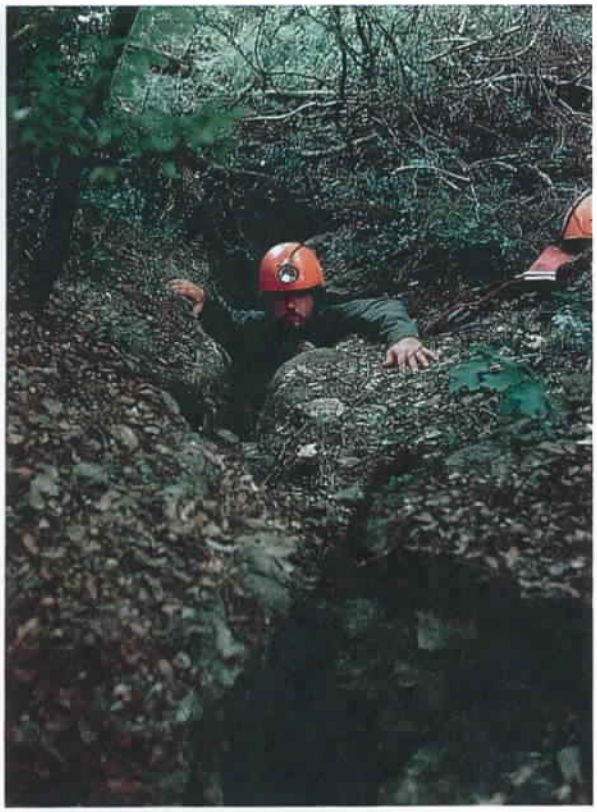
Funds for the production of this leaflet were provided by the U.S. Fish and Wildlife Service, under Section 6 of the Endangered Species Act.

Management Guidelines for Karst Invertebrates

Preserve Known Cave Sites

The karst features inhabitated by these species and the ecosystems on which they depend have evolved slowly over millions of years. Once destroyed, they cannot be recreated. Protection of these ecosystems will require maintaining moist, humid conditions and stable temperatures in the air spaces; maintaining an adequate nutrient supply; preventing contamination of the water entering the system; and preventing or controlling invasion of exotic species, such as fire ants.

Cave entrance
© USFWS Ruth Stanford



Cave entrance
© George Veni

Preservation of known caves, fissures, and other karst features is important to maintaining this unique ecosystem and the animals that live there. Building and road construction should be avoided in the vicinity of known caves and cave entrances. These entrances should not be filled because input of nutrients and surface water is important in maintaining the system. Where cave entrances are large enough to pose a hazard to humans or livestock, they can be fenced or gated to restrict access by large animals yet allow movement of raccoons, small mammals, insects, and water into the cave.

Avoid Altering Surface Drainage Patterns

Landowners should avoid altering surface drainage patterns in the vicinity of known caves. Because karst ecosystems depend on air spaces with some water infiltration, diverting water away from a cave could result in drying and death for the cave and for many cave animals. Also, too much water can lead to flooding and loss of air-breathing species. Altering the quantity of water inflow can also result in changes in the nutrient input.

Preserve Native Vegetation

Maintaining native vegetation in areas containing karst features is important. When native vegetation is destroyed or replaced by introduced plants, the overall species diversity declines. Many of these plants and animals may be critical to the nutrient regime of the karst ecosystem, and their loss could lead to nutrient depletion. By maintaining native surface vegetation in the vicinity of karst features, landowners can help minimize temperature fluctuations, maintain moisture regimes, reduce potential for contamination, and reduce sedimentation from soil erosion.

Prevent Groundwater Contamination

Because karst is highly susceptible to groundwater contamination, the proper use and disposal of chemicals such as pesticides, motor oil, and household chemicals is very important. The use of broadcast pesticides, either liquid or granular, should be avoided in areas near known cave entrances or other karst features.

Restrict Human Visitation

Landowners can protect cave systems by restricting access and thereby reducing human visitation and impacts. Detrimental human impacts include habitat disturbance or loss due to soil compaction, changes in temperature and humidity, vandalism, abandonment of the cave by associated surface animals, and accumulation of toxic trash such as alkaline batteries.

Control Fire Ants

Although the full impact of fire ants on the karst ecosystems is not known, fire ants are believed to be a serious and increasingly important threat to the karst fauna. Controlling fire ants in areas surrounding cave entrances may help minimize their impact on the cave fauna. Effective treatments include hot water and commercial fire ant baits.

At present, there is little information available on the impacts that chemical methods of fire ant control used on the surface have on species that live exclusively underground. Because of this lack of information, the U.S. Fish and Wildlife Service (USFWS) recommends that only boiling water treat-

ments be used on fire ant mounds within 35 feet of the cave entrance. This treatment involves pouring 1 to 4 gallons of hot water directly on the mound. The colony should be drenched with enough liquid so that the mound caves in on top of itself. Drenching is most effective during mid-morning, when the sun has started to warm up the mound. At this time, the colony should be located just under the upper crust on the side of the mound facing the sun. Do not in any way disturb the mound prior to treatment, since this causes the colony to take the queens to safety deep down in the mound or to a satellite mound.

For areas between 35 and 300 feet from the cave opening, the USFWS recommends treatment with boiling water or small amounts of fire ant bait. Since commercial fire ant baits such as Logic and Amdro may be harmful if ingested by other arthropods, they should be applied in a controlled manner to minimize effects on non-target species.

Bait should be placed only near fire ant mounds and not near the mounds of native ant species. The bait should be applied before noon if possible to allow time for the ants to gather most of it before nightfall, when cave crickets come out to forage. Care should be taken to prevent excess bait from remaining on the ground after allowing time for the ants to forage. It is important that the ground be dry (no morning dew) and the weather be clear and dry, with no forecast of rain in the next few hours. Also, bait is more effective if the ants are actively foraging. To test for this, put out a little bit of cheese, tuna fish, or peanut butter, and go back and check it in 15 to 20 minutes. If it is covered with fire ants, they are foraging and it is a good time to treat. By following these recommendations, you can help prevent the active ingredients in fire ant control chemicals from entering the food chain either directly or through cave crickets foraging on the surface at night.

The USFWS recommends the above strategy for treatment of fire ants near endangered species caves. In addition, any significant karst features in the vicintity of a cave with listed species, or that lie over the subterranean extent of a cave with listed species, should be treated according to the above recommendations. The USFWS recognizes that there may be instances where more intensive treatment is needed. Landowners and managers who believe more intensive treatment is necessary should contact the USFWS before proceeding, since permits may be required.

More information concerning management to protect caves and karst systems is available from the Texas Parks and Wildlife Department, U.S. Fish and Wildlife Service, or Texas Cave Management Association.