Great Basin

National Park Service
U.S. Department of the Interior

Great Basin National Park

Cave Life

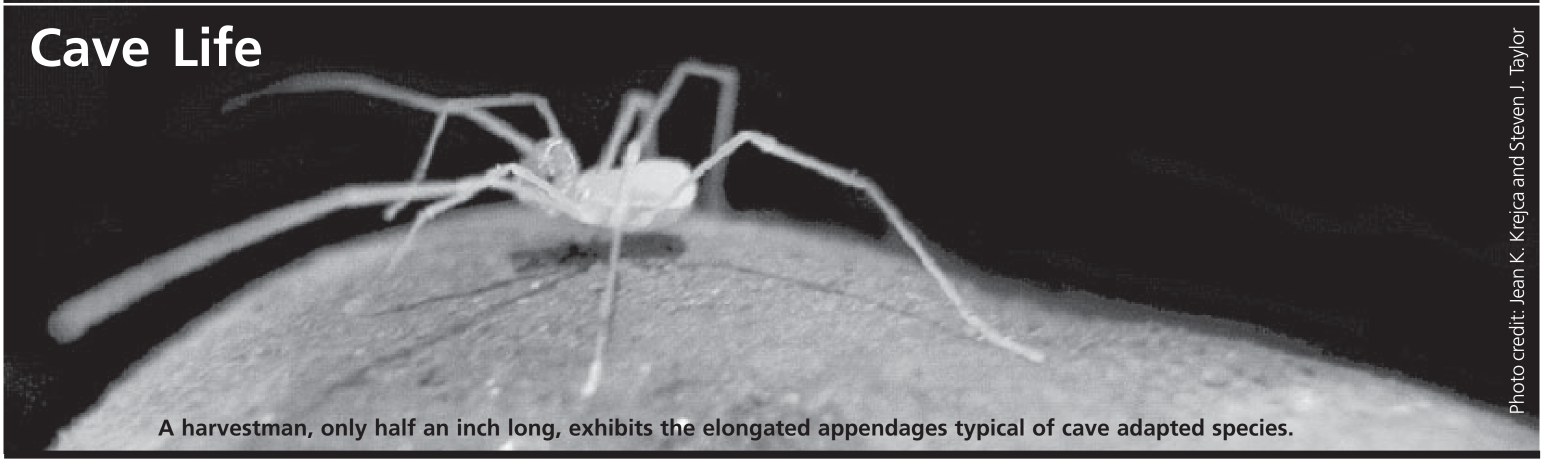


Photo credit: Jean K. Krejca and Steven J. Taylor

A harvestman, only half an inch long, exhibits the elongated appendages typical of cave adapted species.

Within the mountains of Great Basin National Park are 44 known caves (February 2004), ranging in elevation from 5,800 feet to 11, 200 feet, crossing a diversity of vegetation zones, and going as deep as 480 feet below the surface. Inhabiting these caves are intriguing life forms, adapted to the cold, damp darkness of the underground world.

Who Lives In A Cave?

Three categories of animals live in caves: trogloxenes, troglophiles, and troglobites.

Trogloxenes are part-time cave residents, such as bats and rodents. They use caves for nests, for hibernation, or for maternity roosts, but they must go outside for their food.

Troglophiles can spend their entire life in a cave, if they choose, but these same species can also survive on the surface. Examples of troglophiles are earthworms and spiders.

Troglobites are the most fascinating of cave creatures, as they are so adapted to the cave environment that theycan only survive underground. Over 1300 troglobitic, or cave-adapted, species have been documented in the United States, with insects, crustaceans, and arachnids making up the majority. Troglobitic species of flatworms, snails, millipeds, centipeds, fish, and amphibians also exist.

It's Dark In Here!

The cave environment poses many challenges to comfort and survival: perpetual darkness, high humidity (80-100%), poor and sporadic nutrient sources, a lack of environmental cues, and wet, slippery substrates. Many caves also contain stressful gas mixtures- air that is lethal to non-cave critters like ourselves.

But caves also exhibit essentially stable environmental conditions, with minimal variation in temperature, barometric pressure, and carbon dioxide levels. These relatively stable conditions are favorable for animals that cannot regulate their body temperatures.

Cave Food Web

In general, caves have little in the way of nutrients, or food, for the creatures that inhabit them. Some of the more common nutrient resources are guano, droppings, urine, and carcasses. Organic debris from the surface surrounding a cave can also add to the food sources.

Cave ecosystems interact dynamically with the physical and biological elements of the surface. Food, for the most part, comes from the outside. Trogloxenes, such as bats and rats, carry nutrients into caves and leave them behind. An unlucky creature can fall through a vertical shaft and die. Percolating water or underground streams will also bring in nutrients, and roots pushing down through the bedrock can reach a cave, supplying food. Even the air itself can provide sustenance as it carries in pollen and spores.

From the Surface to Caves

The majority of today's troglobites descended from species that originated during or before the last glaciation, approximately 10,000 years ago. They evolved from animals with pre-adaptations, or traits well-suited for the cave environment. Some moved into caves, as species will readily migrate to environments in which they can survive and reproduce. While they benefitted from decreased competition and predation, they were separated from their surface counterparts. This seperation, caused by migration of the surface population or by a physical barrier, is essential for the evolution of a new species. Once the cave population is isolated, regressive evolution takes place; some species actually lose features, such as eyesight or pigmentation.

The relationship between troglobites and their surface relatives can be demonstrated through intermediate forms. An example of this is found in Chica Cave in Mexico, where a cave fish is blind, its surface relative has fully functioning eyes, and the intermediate species in a nearby cave has defective but somewhat functional optical organs.

Adaptations

Many troglobites exhibit incredible adaptations to cave environments, such as tiny or non-existent eyes, increased sensory organs and elongated feelers and appendages, and reduced or non-existent pigmentation.

Troglobites conserve energy through decreased reproductive rates, but increase the chances of offspring survival by producing larger eggs. Life lived at a slow metabolic rate actually increases their longevity.

This cave mite, just 2 mm long, has minimal pigmentation.

PROPERTY	Cave Species	Surface Species
Female Carries Embryos	9-10 Months	3 Weeks
Juvenile Period	5 – 7 Years	3 Months
Adult Period	7 or More Years	6 – 8 Months
Juvenile Molts	Every 6 Months	Every 15 Days
Adult Molts	Only 1	Every 15 Days
Time Between Reproduction	2 Years	1 Month

Moore and Sullivan, 1997

This chart shows the differences in reproductive rates and longevity of two closely realted crustaceans -- a cave species its surface relative. Even with its much longer life, the cave species has fewer opportunities to reproduce.

What Have We Found?

Park staff and visiting cave biologists use a variety of tools and methods to inventory and learn about cave life. These include setting pit-fall and bait traps; hand collecting with aspirators, brushes, and forceps; setting up mesh nets and plankton nets for aquatic surveys; and core-sampling for water-dwelling species.

Trogloxenes and troglophiles documented in park caves include mammals (bats, chipmunks, mice, and packrats), arachnids (spiders, mites, pseudoscorpions, and opilionids), insects (springtails, beetles, and flies), millipedes, and centipedes. Potential troglobites (the truly cave-adapted species) have also been documented, including certain cave milipedes, centipedes, springtails, pseudoscorpions, harvestmen, and cave mites. Particularly exciting is that some of the individuals discovered may belong to new (previously undocumented) species and may be endemic (living nowhere else) to Great Basin National Park.

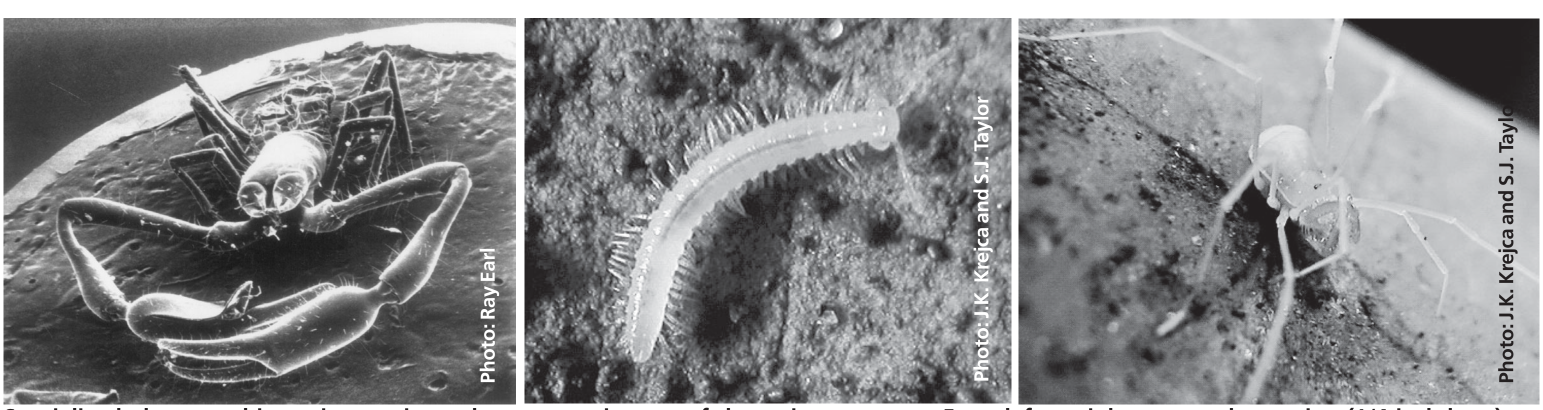
Management and Conservation

It is the goal of Great Basin National Park to manage the park's caves for the protection of cave resources, from the most magnificent cave formations to the tiniest cave critters.

The first step in managing a cave ecosystem is to know what lives there. Once baseline data is established, the cave can be monitored for changes. In this way, it can be determined what actions a cave ecosystem can or cannot tolerate. For example, rare visits from researchers who are meticulously careful may be OK, whereas frequent visits from recreational cavers would not be. Another cave may be less affected by recreational use, and a third cave may be so fragile that even the most careful research needs to be severely restricted.

Currently, there are 8 "permitted" wild caves in the park. Experienced recreational cavers can obtain permits to enter these caves during open seasons. The open dates are different for each cave, determined by the needs of each cave's wildlife. A cave used as a bat hibernation site will be closed in the winter, whereas a cave used for a bat maternity colony will be closed to protect the nursing mothers and their young.

Great Basin National Park was established to protect and interpret the natural resources within its boundaries. The more we learn about life in our caves, the better we can protect that life, interpret it for our visitors, and provide appropriate levels of access to these fragile underground worlds. Troglobites tend to be rare, and 95% of them are considered vulnerable or imperiled. Without proper study, the decline of cave communities over decades could go unnoticed. The ultimate survival of a cave community depends on the protection and science-based management of the cave ecosystem.



Specialized photographic equipment is used to capture images of these tiny creatures. From left to right:: a pseudoscorpion (1/4 inch long), a milipede (1 inch long), and a harvestman (1/2 inch long).