Teachers Fact Sheet No 5
Cave Biology

Cave environment

Two factors make cave environments unique:

1. the absence of sunlight from the darker zone making photosynthesis impossible
2. the surrounding rock layer insulating the cave from the exterior weather conditions, making the cave microclimate very stable.

Caves are cool, relative to the ambient outside temperature in Tasmania, and usually have high humidity and little evaporation.

Caves 'breathe' as air currents change direction in response to changes in surface barometric pressure. With high air pressure, air enters the cave system; in low pressure it blows outwards.

Zones

Within the cave, four zones can be distinguished on the basis of the amount of light and variations in temperature and humidity.

1. The entrance is a moist, shaded habitat, where many surface-dwelling animals are likely to take refuge.
2. The twilight zone extends into the cave as far as unaided human vision is possible and is certainly the most hospitable portion. Temperatures are usually cool and humidity is high, but both fluctuate much as they do just outside the cave. A few ferns or other green plants that are typically found on the forest floor or in shady gullies may survive here, as well as surface invertebrates (animals without backbones).
3. The middle zone lies just beyond, and here begins the blackness. Temperature and humidity are relatively stable, although they vary somewhat. Inhabitants include cave crickets and millipedes.
4. Deep in the cave is the dark zone which stays at a nearly constant temperature (around 9°C in most caves in Tasmania), total darkness, and nearly 100% humidity. The blind and colourless members of the animal world – isopods, amphipods, pseudo-scorpions, and springtails – can usually live here and nowhere else.

Ecosystems

Caves have their own individual ecosystems. In this world of constant temperatures, high humidity and total darkness, animals, plants and fungi that live in caves must adapt if they are to survive.

It is also an environment with very few energy sources for animals to use for food. Inevitably therefore, the number of cave-dwelling animals is very low compared to life on the surface and the total animal biomass is very small. As a result, many cave animals are on the endangered species list as they are in danger of becoming extinct.

Cave food chain

Virtually all life on earth depends on sunlight, even in the darkest areas of a cave. No green plants grow here because they need light for photosynthesis.

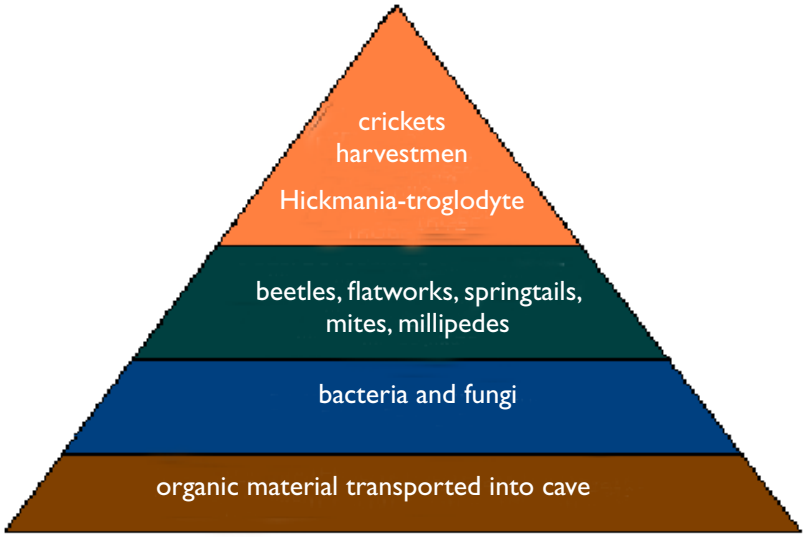
On the surface, green plants make food; but underground, cave animals must depend on occasional floods to wash organic matter into the cave.

Another food source is the droppings of animals that returned to the cave after feeding outside. Animals such as the cave cricket may provide the only major food source in some caves. Few animals can feed directly on these droppings. Instead, fungi and bacteria decompose these materials into nutrients and simple foods.

Fungus-eating insects such as beetles and mites feed on the bacteria and fungi that grow on animal droppings and organic material. These animals then become the food supply for larger predators such as harvestmen and spiders. The droppings of large cave animals replenish the food supply for fungus and bacteria. Thus the food chain continues.

In most of the wild caves at in the Hastings Reserve this organic material is naturally derived, but in Newdegate Cave much of the organic matter has been introduced to the cave by humans. The source of organic input is varied and includes the artificial introduction of exotic species in the form of tree trunks, rough-sawn timber and other plant matter used in the construction of stairs and fern-log pathways, plus the litter 'inadvertently' placed in caves by natural processes, carried in by humans (including skin flakes and fibres from clothing etc) or dumped as refuse in the course of the continuing development of caves for tourism.

An additional source of energy is the lights used to illuminate the cave. This energy is opportunistically used by algae growing on speleothems.



Types of cave life

Cave animals fit into three categories, based on the amount of time they actually spend in the cave.

- Troglophiles: from the Greek words troglos (cave) and phileo (love). These are temporary cave residents, which move freely in and out of the cave. They are cave visitors that seek out such a habitat from choice, and never complete their entire life cycle in the cave. The largest is the Tasmanian cave spider, which may have a leg span of up to 14cm and a web up to 1m across. It also occurs in other dark, damp places throughout Tasmania. One of the most spectacular troglophiles is the Tasmanian glow-worm, which may be observed in colonies above underground streams. Glow-worms are gnat larvae, who use their luminous abdomens to attract flying insects to their sticky threads.
- Trogloxenes: from the Greek words troglos(cave) and xenos (guest). These cave-loving animals can live in the dark zone or can also survive outside the cave. At times they will venture outside in search of food. Cave crickets, for example, do this. Bats are also trogloxenes but they do not live in Newdegate Cave.
- Troglobites: from the Greek words troglos (cave) and bios (life). These true cave dwellers spend their entire lives in caves. Living in the dark zone, these species are found only in caves and cannot survive outside, so are unable to move from area to area. As a result, each karst area often has its own troglobitic species, which occur nowhere else. For example, there are many species of troglobitic cave beetles. Some are confined to a single karst area, for example the Ida Bay cave beetle, which has very reduced eyes and, also in Ida Bay caves, the blind cave beetle, which has lost virtually all trace of its eyes.

Fungi

Detritus (organic debris such as animal manure, leaves and dead plants) enters the cave via water, air currents, or the bodies of animals. Detritus forms the bottom of the cave's food chain and is broken down by fungi and used for their food.

Adaptations

Troglobites have developed special adaptations to help them survive in caves. These changes enable them to find food, move around freely in the dark, reproduce and protect themselves, and to cope with the low temperatures. Since cave food sources are meagre, the sense organs and physical resources of troglobites are mainly devoted to finding food. Sense organs and physical adaptations that are beneficial to the animal's survival have been enhanced; sense organs that are not needed have degenerated.

Most troglobites are white to pinkish in colour. They lack colour because it is not needed for protection from the sun's rays, camouflage or visual sexual attraction. Many have no eyes, or eyes that are poorly developed. Energy in the form of food is required to maintain eyesight; with the same amount of food, an eyeless harvestman will survive longer than a harvestman with eyes.

Troglobites have had to adapt to find food; some such adaptations are longer legs, extended antennae, feelers and sensory hairs. They are able to go for long periods without food and, in some cases, they have reduced body size. Many change their reproductive behaviour by, for example, producing fewer but larger eggs. Some animals that have become completely cave adapted include beetles, Anaspidies, isopods, amphipods, millipedes, harvestmen and spiders. Many troglobites are *thigmotaxis*, meaning they like to hide under rocks.