

## Megafauna – Mammalia, Reptilia and Amphibia

### Morphology

Although the soil animals considered as megafauna are not actually large on a human scale, and rarely exceed 1 kg in weight, they are exceptionally 'huge' (usually more than 10 cm long) compared to other soil organisms. These animals often have a morphology adapted to digging and life underground (fossorial life style): e.g. long claws, short tail and/or hair (sometimes hairless) for mammals and a flat, slender, or limbless body to creep in soil/litter for amphibians and reptiles. They sometimes have very tiny eyes or have even lost them altogether. The latter animals develop special organs, such as sensory hair/tentacles, bioelectric receptors, sensitive noses and even echo-location systems like bats, in order to detect their prey in darkness. [74]



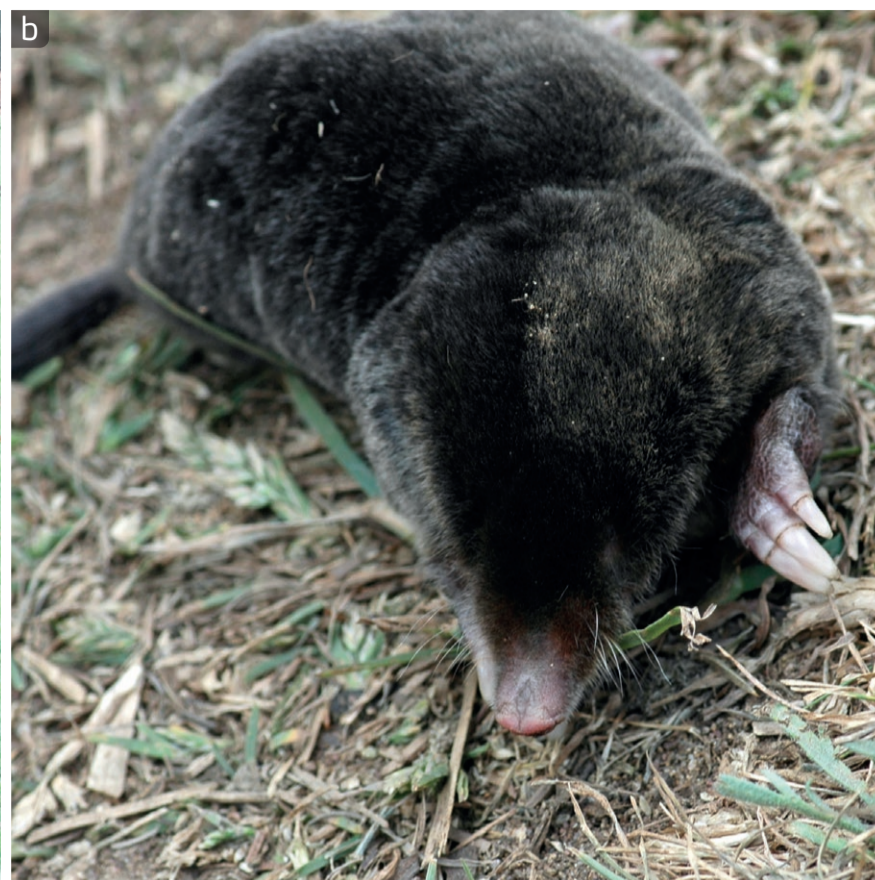
••• Mole claws are apt for digging and, thus, life belowground. (DH)

### Taxonomy

Almost all mega soil animals are vertebrates; therefore, 'soil megafauna' is nearly equal to 'soil vertebrate'. Vertebrates are animals that are members of the subphylum Vertebrata, meaning that they have backbones. Small mammals (class Mammalia), such as moles (family Talpidae), shrews (family Soricidae) and some rodents (like the naked mole-rat) are regarded as soil megafauna as are adult salamanders, caecilians (class Amphibia), and blind snakes and limbless lizards (reptiles, class Reptilia) that superficially resemble earthworms or snakes. These vertebrates utilise litter and soil as both habitat and feeding site. Some mammals, such as hares, rabbits, hedgehogs and foxes may build their dens in soil, but are not part of the soil megafauna. Vertebrates that can be included in soil megafauna are only those that use underground space as both habitat and feeding site.

### The golden moles

- Golden moles are small burrowing mammals native to sub-Saharan Africa.
- Their fur colour varies from black to pale tawny-yellow, hence their nickname.
- There are 21 different species of golden moles, and more than half of them are threatened with extinction.
- They are taxonomically distinct from true moles and are regarded as rather 'primitive' creatures.



••• (a) Molehills indicate the presence of moles in the soil. Several species of moles (family Talpidae) exist, for example: (b) the European mole (*Talpa europea*). Their fur is usually dark grey and their eyes are very small and hidden; (c) the Japanese mole (*Mogera imaizumii*) lives exclusively in Japan and was discovered in 1957; (d) the American shrew mole (*Neurotrichus gibbsii*) is the smallest North American mole; (e) the star-nosed mole (*Condylura cristata*) is another North American species. The specimen shown here is from Canada and uses soil, ponds and streams as feeding grounds. (TR, BK, MAI, SC, CA, KC)

## Microhabitat

Moles are known for denning in soil; they continuously build on underground tunnel systems as they burrow in search of food. Moles dig two basic types of tunnel: shallow, surface runways, and deep, more permanent tunnels. In addition, moles construct nest and rest chambers. Surface runways may be used only once; others are used frequently as main travel lanes, called main runways, and may be used for many years. Tunnels occur generally from 15 to 60 centimetres underground – deep enough to be below the winter frost line and to remain cool during summer heat. They are used regularly during the mole's travels between its nest and rest chambers and surface runways. A molehill is built of dirt excavated from these deep tunnels, deposited on the surface in a volcano-shaped mound through a lateral tunnel. Nest and rest chambers are enlargements of a deep tunnel. Nests are made of coarse grass and/or leaves and are often located in protected areas underneath boulders or trees. Soil is also the perfect source of food for megafauna. Both moles and shrews have great appetites for soil invertebrates due to their high metabolic rate. Earthworms, termites, ants, insect larvae, centipedes and isopods (see pages 54-60) are the main prey for soil vertebrates. In addition, they often eat caterpillars and terrestrial snails. An exception is the naked mole-rat that mainly feeds on the tubers of plants [75]. Therefore, predation pressure of moles and shrews on populations of soil invertebrates seems not to be negligible, with an important role in soil food webs (see page 96). Furthermore, the carcasses and feces of soil vertebrates are a high-quality source of nutrients and energy for invertebrates and microorganisms in the soil. Soil megafauna potentially affect the community structure of soil invertebrates not only through their predation, carrion and feces, but also through modification of soil structure by digging activity (typical of moles). In the soil food web, soil vertebrates are tertiary consumers, sometimes also known as apex predators, as they are usually at the top of the food chain. In the aboveground food chain, soil vertebrates are preyed upon by predatory vertebrates, such as carnivorous and omnivorous mammals, raptors, owls and larger reptiles.



Some shrews can be considered as soil-dwellers. For example, the short-tailed shrew (*Blarina brevicauda*) prefers to tunnel belowground, contrary to other shrews. It is also known as one of the few venomous mammals. (SDR)

## The pocket gophers

- Pocket gophers are burrowing rodents of the family Geomyidae, including 35 species. They live only in Central and North America.
- They create networks of tunnels that provide protection and a place for food collection.
- They are solitary animals, herbivores (they only eat roots, bulbs and other fleshy portions of plants). Some species are considered agricultural pests.



A Botta's pocket gopher (*Thomomys bottae*). They inhabit a range of habitats, including woodlands, shrublands and agricultural land. (CAB)



The only two mammal species known for their eusocial behaviour are soil-inhabiting rodents. Eusocial means that they live in colonies with a division of labour into reproductive (queen) and non-reproductive (workers) groups. (a) The naked mole-rat is extraordinarily long-lived (up to 31 years) for a rodent of its size (8-10 cm). (b) The Damaraland mole-rat has a body covered by hairs. (SNZ, FWA)

## Diversity, abundance and biomass

The family Talpidae includes 17 genera and 46 species. The 385 shrew species are divided into 26 genera. Each species has its own area of distribution. For example, the nine mole species of the genus *Talpa* live in Europe and western Asia. A particular lifestyle influencing the abundance of a soil-dwelling animal, is that of the naked mole-rat (*Heterocephalus glaber*), the first known eusocial mammal. The only other known eusocial mammal is the Damaraland mole-rat (*Cryptomys damarensis*). Naked mole-rats live in colonies like ants and termites (see pages 54-55), with members responsible for different roles. Only one female (the queen) and one to three males reproduce, while the other members of the colony function as sterile workers. Smaller workers focus on collecting food and maintaining tunnels, while the larger workers are more reactive in case of attacks. Colonies range in size from 20 to 300 individuals, with an average of 75 to 80 individuals. They live together in complex systems of burrows in arid African deserts. The tunnel systems built by naked mole-rats can stretch up to three to five kilometres in length.



Some amphibians and reptiles can be considered as soil megafauna. (a) A caecilian (*Gymnopsis multiplicata*) from South America. Caecilians are amphibians that superficially resemble earthworms or snakes. (b) The worm lizards are a group of legless lizards (reptiles) that have also adapted to living in the soil. Although the Mexican mole lizard (*Bipes biporus*) has a pair of legs used to burrow, all other genera are limbless. (ACK, DAR)

## The star 'nose'

- The star-shaped nose is a unique organ only found on the star-nosed mole (*Condylura cristata*).
- The star-nosed mole's 'nose' is not an olfactory organ (i.e. used for smell), but a skin surface that mediates touch. It is ringed by 22 fleshy appendages, called rays, which are engorged with blood and in a constant flurry of motion when the animal searches for food.
- Innervated by more than 100,000 sensory neurons, the star is probably the most sensitive and highly acute touch organ found on any mammal.
- The key to making sense of the star-nosed mole is the habitat where the animal lives, wetlands. In this environment they compete with other animals, especially shrews, for food, so having a prey category to themselves would be especially useful. The star likely evolved as a means to better find and handle small prey quickly.



Star-nosed mole pups showing the star nose. (HIL)



Several animals have a strict relationship with soil as they build their nests in it or use it as a hunting-ground. (a) Armadillos (family Dasypodidae) and (b) the burrowing owl (*Athene cucularia*) are two good examples. (DC, MK)