

# Bat Notes



## What are bats?

Bats are mammals, like humans. They are warm-blooded, their bodies are covered with fur and feed their young with milk produced by the mothers. Bats represent 20% of all mammals, with over 950 species recognised worldwide. They bear live young, as do all mammals except monotremes (echidna and platypus). Although some mammals such as gliders can soar from tree to tree, bats are the only mammals capable of true flight. Bats are divided into Megachiroptera (flying foxes) and Microchiroptera (the rest).

Australia has about 75 species of bats. This has been changing in recent years as bats undergo taxonomic revision. (A re-evaluation of the number of species within a genus or family.)

## Can bats see?

Microchiropteran bats have small eyes because echolocation is their major system of orientation, but all bats have the function of sight. The common misconception is that bats cannot see, hence the expression "as blind as a bat". The level of sight is not well understood, but most species use sight to some degree if there is sufficient light.

## How well do bats hear?

Bats have extraordinary hearing, having evolved to use echolocation as a means of navigation.

## How do bats differ from birds?

Bats and birds belong to two different groups, birds to the class Aves and bats are part of the class Mammalia. They share the ability of flight, but have evolved this independently. Birds rely on vision to navigate and find food, have hollow bones and most obviously have feathers.

## What is Echolocation?

Echolocation is the system of high frequency sounds and their echoes used by most bats to navigate and to locate their food. Bats emit pulses of sound, mostly at frequencies inaudible to humans, and analyse the echoes to see their surroundings and find their food. These ultrasonic sounds are produced in the larynx (voice box) and emitted through either the nose or mouth. The size of the prey the bat feeds on dictates the frequency of the echolocation sounds. The higher the frequency, the smaller the prey and other objects that can be identified. A call of 5 kHz (kilohertz) corresponds to a wavelength of 68 mm and is not useful for locating insects. A call of 50 kHz corresponds to a wavelength of 6.8 mm and is much more ideal for locating insects.

Different species of bats have different calls, which can be used to identify species. Calls can be defined by their duration, as short as one millisecond (1/100<sup>th</sup> of a second), their rate of repetition (up to 200 calls per second) and whether the call is a constant frequency or frequency modulated. *Miniopterus bassanii* has a call frequency of about 50 kHz.

### **How do bats fly?**

The speed a bat flies is somewhat dictated by where it feeds and what its prey is. Bats that fly in and around the treetops are necessarily slower in flight, with those that feed in open areas such as *Miniopterus bassanii* fly at speeds of 50 kph.

### **Do bats sleep?**

Bats undergo daily periods of inactivity and also become torpid or hibernate for much of the winter. Bats can allow their body temperature to decrease if the external temperature drops below that of their body temperature. This results in considerable energy savings as mammals expend considerable amounts of energy maintaining a constant body temperature. So when we see *Miniopterus bassanii* hanging on the wall without movement, we know they have allowed their body to cool to conserve energy. When we see them shake as though nervous, they are burning up fat reserves to lift their body temperature to a level that allows them to become active again. Jonathon Codd of Flinders University studied the behaviour of our bats using the cameras and determined that almost half of the "day" (dawn to dusk) quite actively grooming, crawling over the cave walls, drinking and flying and the rest of the day "asleep".

### **The sounds bats make**

Bats make a variety of sounds, as we can hear using the microphones on the cameras. These audible sounds are communications between mothers and their young (called pups), alarm cries and social "chatter". The echolocation sounds of most species are inaudible to humans. At 50 kHz, the echolocation sounds of *Miniopterus bassanii* is way out of the human hearing range.

### **What are the smallest and largest bats?**

Bats range in size from tiny hog-nosed bats of Latin America that weigh only a gram or two to the largest flying foxes that can weigh up to 750 grams. *Miniopterus bassanii* weighs 1215 grams.

### **How long do bats live?**

Bats are amazingly long lived for small mammals, with the record being 33 years for a little brown bat *Myotis lucifugus*. The greatest age recorded for *Miniopterus bassanii* is a little over 20 years. Much less banding is done today as this can be quite distressing for the bat, both during capture and then trying to rid itself of the band.

### **Do all bats live in caves?**

Bats live in a wide variety of habitats, on every continent except the Antarctica. Some bats such as *Miniopterus bassanii* are exclusive cave residents, but bats may live in tree hollows, shelter under leaves, in old mines, buildings and a whole host of other habitats.

### **Why do bats hang upside down?**

This requires some speculation. The habit may have developed as a response to developing flight. Most bats need to take off from a high point and drop before taking flight. If bats began as gliding animals then this is a plausible scenario. *Miniopterus bassanii* has been observed to take off from ground level on the cameras. Hanging upside down also has other advantages such as the fact that there are no predators on the cave ceiling and that the area is warmer than on the ground.

Bats' feet allow them to hang on with no effort, in fact they have to use muscles to allow them to let go. Such is the locking nature of their feet that dead bats are often observed hanging from the ceiling long after the bat has died.

### **Do they have predators?**

In tropical areas pythons are a major predator of bats but at Naracoorte the main predator is owls and other birds of prey that catch bats that leave the cave before total darkness. The main threats to bats are pesticides that can accumulate in their systems reducing their fertility and also causing death. They are also most vulnerable during winter when disturbance during torpor requires them to unnecessarily burn energy reserves, which can lead to death by starvation. Some wintering caves have also been filled in or have had gates placed on them making them inaccessible for bats.

### **How do bats reproduce?**

Being mammals, bat reproduction is similar to that of other mammals. They give birth to live young that the mother suckles. The important difference with *Miniopterus bassanii* is the delaying of implantation of the embryo after mating. The embryo is held loose in the uterus until food resources increase in spring, when implantation takes place and the pregnancy resumes. So even though mating takes place in autumn and birth in late November, the actual gestation period is only about 60-80 days.

### **Giving birth**

The breeding season of 2001 was the first time the birthing process was observed on the cameras. The mother bat hangs by her feet and thumbs, although one was observed only hanging by her feet. "Bats in Question" by Don Wilson states pups are born feet first and assist in the birth by grasping the mother's fur and pulling themselves out. The vision on the tapes does not show this clearly but it is a reasonable assumption that this is the case.

### **How long do pups rely on their mothers?**

The pups are placed in a creche at a very early age. The cameras showed images of the creche with pups with placenta still attached without any adult bats in sight. Previously it was assumed they stayed with their mother for several days before being placed in the creche with the mother then leaving the cave to feed again. The mothers feed their pups before leaving the cave and appear to return to find their pup to feed it during the night. By dawn, all mothers return to the creche to suckle their pup during the daylight hours. The pups may hang on the wall and suckle or may attach to their mother and be flown to a different part of the cave for feeding. The cluster of pups remains noisy for the entire night. By 6-7 weeks of age the pups are able to fly and spend some days flying about the cave before leaving the cave to feed themselves. Flying bats have been observed feeding from their mothers. Many species of bats give birth to twins but *Miniopterus bassanii* has just one pup per year.

### **What do they eat?**

Different species of bats feed on a wide range of different foods. They can be divided into six groups:

- Insectivorous (insect-eating, such as *Miniopterus bassanii*)
- Carnivorous (eat other vertebrates)
- Nectarivorous (nectar-eating)
- Frugivorous (fruit-eating)
- Piscivorous (fish-eating)
- Sanguivorous (eats blood)

### **How far do they fly to feed?**

Research shows that *Miniopterus* will fly up to 50 kms away from the cave to feed. Given that Bool Lagoon and several other substantial wetlands are close by it is reasonable to suspect that the Naracoorte population would not need to range so far.

### **Do they only breed in the Bat Cave?**

Bat Cave provides the environment necessary for the bent-winged bats to successfully breed in that the chambers away from the entrance are a very warm relative to the average cave temperature at Naracoorte (17 degrees Celsius). The roof temperatures in the chambers where cameras #3 and #5 are have been recorded at over 30 degrees Celsius. The heat is generated mostly by the decomposing bat guano (the bats droppings) but also generated by the bats own body heat. The only other maternity site for *Miniopterus bassanii* is Starlight Chamber near Warrnambool, where about 10,000 bats gather each summer.

### **How many bats are in the Bat Cave?**

During the 1960's a count of the bats using a mark and recapture method returned a count of 100,000-200,000. This shows the difficulty in ascertaining the true population. The counts of 2000-1 show the number is now probably nearer 50,000 so the population appears to have declined

considerably. Researchers are now developing a computerised counting method so that the population can be monitored to determine if it is in danger. *Miniopterus bassanii* is regarded as an endangered species. The numbers of 300,000 and 400,000 that were quoted for many years are gross exaggerations of the true numbers of bats that live and breed in the cave.

### **How many species are at Naracoorte?**

Four different kinds of bats have been recorded in Bat Cave, although the wattled bats and the White striped Mastiff Bat are infrequent visitors. There are 14 species that have been recorded in the Naracoorte area.

### **How did bats evolve?**

The oldest known fossils of bats come from the early Eocene deposits in Wyoming (about 55 million years ago). There are also some very well-preserved examples from the Messel Pits World Heritage area in Germany dating to about Middle Eocene (about 50 million years).

It is presumed that bats had a tree-climbing shrew-like ancestor but the fossils of such a creature have yet to be found.

The earliest bat fossils in Australia come from Riversleigh, World Heritage Area, North Queensland and date to 25 million years (Early Miocene). The fossil record of Riversleigh's bats is particularly extensive and has revealed much about the early bats that inhabited Australia. Naracoorte Cave's fossil record of bats only includes two species, *Miniopterus bassanii* and *Nyctophyllis geoffroyi*. This may be a factor of a lack of research into the small material in the caves, that most species of bats do not live in caves at Naracoorte or the owls that accumulated the small mammal deposits do not feed on bats.

### **Where do they go in Winter?**

During winter Bat Cave may be completely empty of bats. They move to cooler caves or sometimes-cooler parts of Bat Cave. The caves they use over winter include Blanche, Cathedral, Robertson and a host of other caves in the lower southeast and western Victoria. Many of these caves are on private property and are unprotected and where the bats are exposed to greatest threat of disturbance.

### **What else lives in the Bat Cave?**

The Bat Cave is an ecosystem in itself, with about 40 species of invertebrates living in it. Some of these leave the cave to feed such, as the cave cricket to feed on vegetation while others are guanophyllic. This means they rely on the bat guano as a food source. Some invertebrates feed on the guano, others on the fungi that grow on the guano and others are tiny predators, feeding on other invertebrates. These are all very susceptible to pesticides that the bats may bring into the cave and pass through the bats system and into the guano.

**Further reading (all in guides' library)**

*Bats of South Australia* -Reardon and Flavell *Australian Bats* -Churchill

*Bats in Question* -Wilson *Riversleigh* -Archer,Hand and Godthelp

**Book a visit to the Bat Observation Centre**

To find out more about booking a visit to the Bat Observation Centre contact Naracoorte Caves National Park

Phone: (08) 8762 2340

Email: [NaracoorteCaves@sa.gov.au](mailto:NaracoorteCaves@sa.gov.au)