

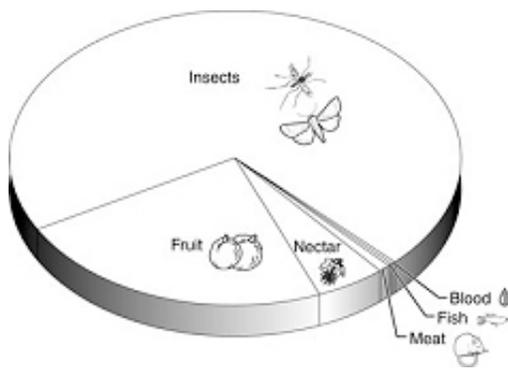
Bats!!!

There are over 1100 species of bats in the world, comprising almost 1/4 of all mammal species. Yes, that's right, bats are mammals - the only mammals to have attained powered flight. They are members of the *Chiroptera* order which comes from the Greek words *cheir* (χειρ) "hand" and *pteron* (πτερον) "wing." Bat populations can be found in virtually all environments except for the most extreme polar and desert regions. Forty seven species make their homes in the US and Canada (seven of them in danger of extinction) while the vast majority of global species occupy tropical forests where the total number of species can outnumber all other mammals combined. They range in size from weights of less than a penny (the bumblebee bat of Thailand) to wingspans of six feet.

Archaeologists have uncovered fossil evidence that supports the existence of bats 50 million years ago. Until relatively recent history, bat populations were extremely abundant with some believing that their populations were not unlike that of the passenger pigeons in the eastern United States - literally darkening the evening skies due to their sheer numbers. With 70% of all bat species subsisting on an insectivorous diet, bats have always served as a crucial biological check working to keep insect populations under control. Current declines in bat populations due to habitat loss and the mysterious white nose syndrome could therefore have significant effects on the stability of natural ecosystems.



Diet

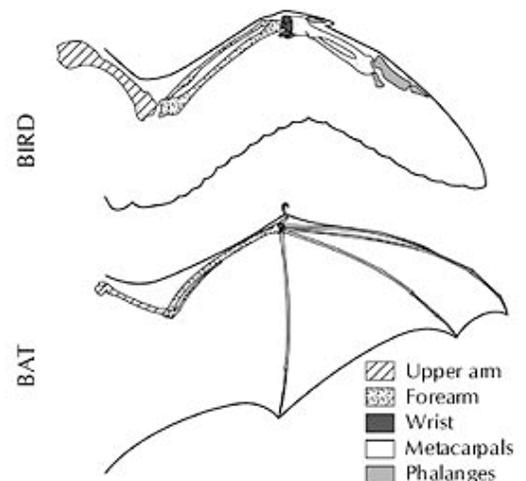


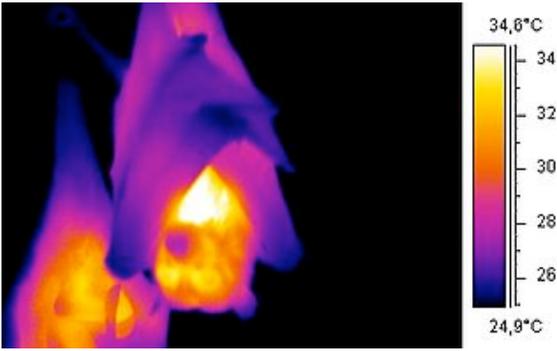
As mentioned, virtually 3/4 of bat species are insectivores (true of all but three nectar-feeding bats in the US and Canada). They have an extremely high metabolism and also expend considerable energy in flight. As a result, some of the smaller species consume up to 2000 'mosquito-sized' insects in a single night. Many tropical species feed on fruit or nectar and actually have well developed vision and scent senses, better enabling them to forage for ripe fruits. Some desert dwelling species, feed on nectar sources and as such, have developed long noses and tongues to better access their food source as well as special enzymes that enable them to digest the protein-rich pollen that accumulates on their faces. These fruit-eating species also play important ecological roles as pollinators and seed dispersal agents -

helping spread fruiting vegetation throughout the landscape. A small percentage of bat species are carnivorous, with sharp claws and teeth that enable them to catch small vertebrates including frogs, fish, rodents and birds. There are only three known 'Vampire bat' species, all of which take up residence in Latin America.

Anatomy

Unlike birds which flap wings, bats actually flap outstretched hands, with their long fingers covered by a thin membrane. This membrane is delicate, extremely elastic and remarkable in its ability to stretch. Due to its thinness, bats can maneuver more accurately and quickly than birds. It can be easily torn but is able to regrow and heal quickly. They have extremely flexible finger bones - the cartilage of which is devoid of calcium and other minerals near the tips, thereby allowing them to bend without splintering. With knees oriented to face backwards, bats are evolutionarily 'designed' to comfortably hang upside down by their feet. Unique tendons in their toes allow them to cling to roosts without expending any energy - it is only when they

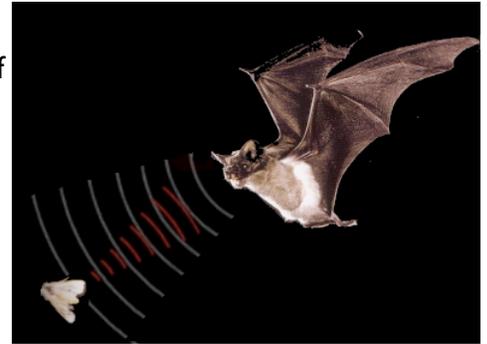




let go to drop into flight that they must flex their muscles. This upside-down roosting habit helps protect bats from predators in that it allows them to exploit spaces generally inaccessible to other animals. With lungs typical of all mammals, bats are believed to be more sensitive to sudden changes in air pressure than birds, which is believed to contribute to increased mortality in close proximity to wind turbines. As there are often no signs of external trauma amongst dead bats adjacent to wind towers, it is believed their lungs are more liable to rupture when exposed to sudden pressure fluctuations.

Senses

While all bats can see, many use a sonar system of sensation known as 'echo-location'. They literally send out high frequency calls through their mouths or noses and listen for the echo to return from objects in front of them. This collected information thereby enables them to form mental pictures of the surrounding landscape just like humans create with visual stimulation. They can literally detect everything but color, recognizing obstacles in total darkness as thin as a human hair. It is this echolocation system that allows bats to subsist nocturnally. This sensory ability is estimated to be literally billions of times more efficient than the most sophisticated human-designed sonar systems. Bats have been found to communicate with others through a range of sounds. Because rain interferes with their echolocation system, bats will rarely fly during storms.



Life-span and Population

Bats can regularly live for twenty years or more - for their size, they are the world's longest-lived mammals. The oldest bats ever found are reputed to be 34 and 41 years respectively. But despite their longevity, bat birth rates are very slow, with females generally birthing a single pup each year, thereby limiting population growth.

Migration and Habitat

Many bats migrate hundreds of miles (generally less than 300) annually to winter hibernation dens, while others pass into torpor during the winter months, rousing to feed when warm weather induces insect population emergence. Here in the northeast, most bats spend the winter hibernating, often in a cave or abandoned mine and surviving on stored fat reserves, though there are a several species which migrate from as far north as Canada to the Gulf states and even Mexico.

In general, bats are loyal to their hibernating sites and birth places, and science has yet to determine how they are capable of navigating the long distances between their summer and winter homes. Some believe they orient themselves visually - via mountain ranges and other guiding land features though some individuals have managed to even find their way blinded. It is believed that this specific and critical information is passed on intergenerationally.



While best known for habitating in caves, bats will live in almost any conceivable shelter. Species found living in buildings generally do so due to the acute lack of better-suited habitat. Tropical bat species enjoy a wider array of suitable roosting habitats, with some like the Honduran white bat (*Ectophylla alba*) chewing through the mid-ribs of large leaves, making tent-like roosts and others with suction discs on their wings and feet that allow them to live in slick-walled cavities. Evening bats (*Nycticeius humeralis*) raise their young under

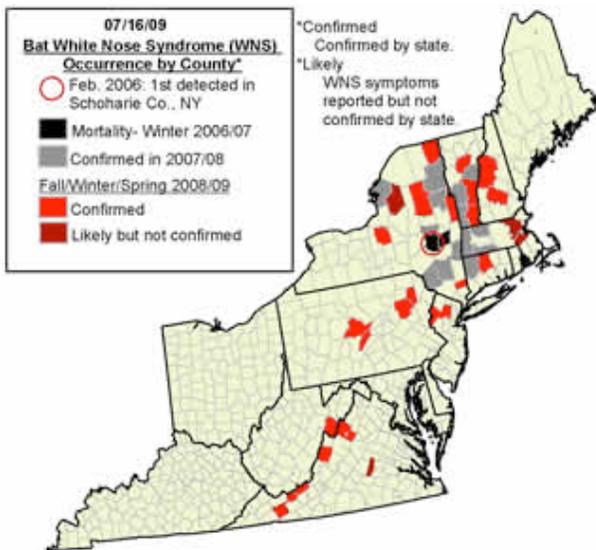
the bark of trees. Bats can also be found living in termite nests, animal burrows (like the big brown bat (*Eptesicus fuscus*) which occasionally lives in woodpecker holes in giant cacti), flowers and even large spider webs (the small woolly bat (*Kerivoula sp.*) of Africa)! Despite this broad range, many individual bat species have adapted to living in only a few habitats.

Social Structure and Mating

Bat social structure is variable - some lead solitary lives while others live in cave dwelling colonies that number more than a million. Several species exhibit the 'fission-fusion' social structure, with large numbers congregating together in one roosting area (fusion) and then breaking up and mixing into subgroups, switching roosts and exchanging 'roostmates' (fission).

Temperate bat species in this part of the world generally mate in the fall, prior to hibernation. Little is known about courtship rituals while some do wing displays and sing to attract mates. Often, sperm remains dormant in female reproductive tracts throughout the winter season with ovulation and fertilization occurring in the spring after emerging from hibernation. Once pregnant, females move from their hibernating site (hibernacula) to warmer roosts, forming nursery colonies. The gestation period is generally 1-2.5 months later. Like humans, bat young are poorly developed and are nursed by their mothers from a pair of pectoral breasts. The young grow rapidly and often learn to fly within three weeks. It is not uncommon for males and non-reproductive females to segregate into separate groups or 'bachelor colonies' during the rearing period.

Interestingly enough, some vampire bat species are known for adopting orphans, which is quite unusual amongst all wild animals.



White Nose Syndrome

The white nose syndrome was first discovered by a caver 40 miles west of Albany, NY in February 2006 who photographed hibernating bats with an unusual white substance on their muzzles. The next year, citizens reported dead bats, erratic behavior and white noses to the New York Department of Environmental Conservation who formally documented the syndrome in January 2007. As of May 2009, an estimated 500,000 hibernating bats have died in over 25 caves and mines from Vermont to Virginia, and the cause is still a mystery. In some hibernaculum, mortality rates of 90 to 100 percent have been discovered. The endangered Indiana bat is at greatest risk whose primary hibernaculum in New York has been affected. Additionally, deaths of eastern

pipstrelles, northern long-eared myotis and little brown bats are also attributed to the condition.

Symptoms of white nose syndrome include the white fungus on their muzzle, low body fat, a preference for cold areas within the hibernacula, and erratic behavior including daytime and winter flights when their food sources are unavailable. The recent identification of a cold loving fungus of the *Geomyces* genus is believed to be one possible cause, though it is still unknown. It may in fact be an opportunistic infection - the result of other influences that include the loss of winter fat stores, pneumonia, and warm and variable winter weather leading to the disruption of hibernating and feeding cycles. Also, human disturbance to hibernation and maternity colonies (sometimes caused by well-intentioned biologists and cavers) is already recognized as a major factor in the decline of bat species. When disturbed by visitors entering caves during hibernation, bats use up their stored fat reserves - their only sustenance for the winter months - which may cost them an amount of energy equivalent to the quantity needed to sustain two to three weeks of hibernation.

Long term this may lead to increasing insect populations and subsequent increases in crop damages. The Forest Service estimates that the die-off from white-nose syndrome means that at least 2.4 million pounds of insects will go uneaten.

Do Bats ‘Control’ Mosquito Populations?

Claims abound that bats serve as effective mosquito control, but this topic has been the subject of long and intense debate. While insectivorous bats do most certainly eat mosquitoes, their feeding habits and mosquito control potential may well have been exaggerated by incomplete controlled laboratory tests.

Bats are opportunistic feeders and will eat a range of insect species including beetles, wasps and moths - often whatever food source is available. Studies of gut contents of wild caught bats have generally found 1% mosquito composition, thereby implying that while bats do consume half their body weight or more in insects in a single night, they may not contribute significantly to a reduction in mosquito populations. A well known experiment in which bats were released into a laboratory room filled with mosquitoes led to claims of bats catching up to 10 mosquitoes per minute - thereby extrapolated to 600 per hour. This highly controlled study is obviously very incomplete and these claims should be taken with a grain of salt. Nevertheless, bats do eat mosquitoes, so regardless of the quantity of insects they consume, the simple act of creating intentional habitat can be an effective way to restore the ecological balance to areas that are otherwise completely imbalanced.

The Seven Endangered bat species in the US include:

Lesser long-nosed bat - nectar-feeding and insect eating bat of the Southwestern U.S.

Hawaiian hoary bat - only indigenous bat in Hawaii. Eats insects.

Greater (Mexican) long-nosed bat - nectar-feeding and insect eating bat - southwest Texas

Virginia big-eared bat - insect eating bat found in a few caves in VA, WV, NC and KY

Ozark big-eared bat - only found in some caves in Oklahoma, Missouri and Arkansas.

Indiana bat - insectivore inhabiting hollow trees in summer and in hibernaculum in nine caves in the US

Gray bat - eats insects and lives in a few caves in Alabama, Kentucky, Missouri, Arkansas & Tennessee.

Attracting Bats to your Batbox

- Temperature is a critical factor in roost selection. In cold climates bat houses should receive at least ten hours of direct sun each day - more is better.
- Mount bat houses on poles or on the side of a building at least 12 feet above the ground (the higher the better). Houses mounted on trees are more difficult for bats to find and more vulnerable to predators.
- Bats need to drink water every night, so houses located less than a quarter mile from a water source, such as a stream, river, or lake, have the greatest success in attracting bats.
- Bats like a clear swoop zone to get in and out of their roosts, so avoid placing the house in an area where there are a lot of obstacles, such as tree branches.
- Placing two or more houses in one location allows bats to better respond to changes in temperature by allowing them to move between the houses as needed.
- Do not mount houses close to bright lights.
- In cold climates, bat houses should be painted black or dark brown to increase the inside temperature. Use water-based paint or stain, not oil-based.
- The inside of bat houses must be roughened to allow bats to grip. Create horizontal scratches or grooves. Space cuts roughly ½ inch apart and 1/16 or 1/32 inch deep. An alternative is to attach plastic screening flat on the wood surface to avoid injury to the bats.
- Caulk all seams, especially around the roof, to prevent drafts and keep temperatures stable.
- Use exterior grade or galvanized screws rather than nails.
- If after two years your bat house has failed to attract occupants, try moving it to a new location.