

NATURE'S LABORATORY

*"Now air is hush'd, save where the weak-ey'd bat,
With short shrill shriek flits by on leathern wing..."*
-- William Collins "Ode to Evening"

Bats (order Chiroptera) are one of the most prolific animal species on Earth, second only to rodents in the number of individuals populating our planet. Nonetheless, their claim to fame lies in the fact that bats are the only mammals capable of true flight. Much like birds, the feathered masters of the heavens, bats have wings that enable them to soar the night skies. And unlike rodents, bats are relatively long-lived, a span of anywhere from 5 to 30 years. Bats can be found on every continent except Antarctica, and excluding polar regions and some isolated oceanic islands.

The Chiropterans [from the Greek roots *cheir* (hand) and *pteron* (wing)] are so named for their elongated finger and forelimb bones which provide the structural support for the elastic membranes that make up the wing. The membranes extend from the hind limbs to the forearm (the plagiopatagium), between the fingers (the chiropatagium), from the thumb to the shoulders (the propatagium), and in some species between the hind limbs (the uropatagium), including some or all of the tail.

To generate lift (resisting gravity) and thrust (propulsion) in flight, bats beat their wings like a bird, rotating their wrists during the upstroke so their elastic wings can fold or collapse as they complete the wing-beat cycle in anticipation of their next wing-beat.

Flight enables bat to exploit any number of resources and enjoy a diverse diet, including insects (insectivorous), fruits and flowers (frugivorous), leaves (folivorous), nectar (nectarivorous), pollen (pollenivorous), fish or other vertebrates (carnivorous), and blood (sanguinivorous).

It's often cited that an individual bat can eat its weight in insects nightly, suggesting bats play an important role in controlling particularly troublesome insects like mosquitoes. More so, insectivorous bats also prey on agricultural pest species like cucumber beetles, June bugs, corn borers, and Jerusalem crickets, which can wreak havoc on important crops such as corn, cotton, and potatoes.

More than half of the approximately 900 bat species use echolocation to navigate and capture their prey, as well as to detect obstacles and seek out roost sites. As these brief, ultrasonic calls scatter into the night, bats utilize their highly specialized sense of hearing,

as well as modified noses and/or ears, to capture and "read" those calls that are deflected, allowing them to hone in on prey items or maneuver obstacles. Nonetheless, bats also have well-developed vision, taste, and smell.

Flight also enables bats to take advantage of an array of locales as roost sites, including foliage, caves, rock crevices, hollow trees, crevices beneath exfoliating bark, and human-made structures (mines, attics, bridges). Bridges, for example, provide optimal habitat for night roosts, providing protection from terrestrial predators like snakes and skunks for as many as fifteen of California's approximately 24 bat species. Unfortunately, many traditional roost sites have become obsolete due to mining activities, urbanization, deforestation, and recreational caving.

Come winter, some bats migrate anywhere from a few miles to more distant locales with warmer climates. Those bats that instead hibernate underground in caves and mines are known as cavernicolous or troglomorphic. When the cold sets in, bats enter their roost sites, or hibernaculum, to overwinter. Prior to hibernation, bats build up fat stores to survive the long winter, and undergo a state of torpor wherein their metabolism slows down and their body temperatures drop to match that of their surroundings.

In such a state, bats are sensitive to disturbances of any sort. When bats are aroused from torpor, their bodies automatically wake up, increasing their body temperature in preparation for flight. This awakening can be costly, eating into fat reserves that are often limited to begin with. Some bats emerge after an uninterrupted winter with a mere 5 percent of their fat stores remaining, leaving little margin for repeated arousals.

Bats breed before they begin to hibernate, but actual fertilization is postponed until springtime. Then, females undergo a gestation period of about two months while roosting in nursery or maternity roosts. Young are born in the summer, but are unable to fly until they are three weeks old.

Some bats common to California include the pallid bat (*Antrozous pallidus*) and the big brown bat (*Eptesicus fuscus*). Both species use mines, caves and trees as day and night roosts, oftentimes sharing roost sites with each other. Pallid bats prefer ground-dwelling Jerusalem crickets, beetles, moths, and grasshoppers, while the big brown bat dines on beetles and caddis flies. Other common species include the silver-haired bat (*Lasionycteris noctivagans*), the hoary bat (*Lasiurus cinereus*), and the western red bat (*Lasiurus blossevillii*).

Hands On: Bats are nothing to be afraid of, so why not invite them into your backyard? Properly situated with consideration to the bats' environmental needs, a hand-made bat box or one purchased from a specialty store can attract a cloud of bats in as little as a year or two. Blueprints and instructions for an economy bat house are available at: <http://www.batcon.org/bhra/economyhouse.html>, while certified bat house models are listed at: <http://www.batcon.org/bhra/economyhouse.html>.

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