Some Interesting Facts About Bats

Bats are the only true flying mammals. They are not flying mice (rodents), but belong to their own taxonomic order - Chiroptera (Ancient Greek meaning "hand-wing"). A biologist that studies bats is technically referred to as a Chiroptologist (pronounced " ky-rop-tal-e-gist"), but "Batman" is always easier to say and remember.

Anatomy

Figure 1 shows the anatomy of a typical bat. The bat wing consists of a thin, double membrane of skin stretched over the arms, hands and fingers, which are greatly elongated. These bones provide the internal support for the wing, while associated muscles control the shape and position during flight. The membranes are richly supplied with blood vessels that provide nourishment and are important in thermoregulation. Another flight membrane, the uropatagium [tail membrane], stretches between the hind legs and tail. The surfaces of the wings and uropatagium of most species are largely devoid of hair to reduce drag during flight. When at rest, the bat draws its finger bones together and holds it arms against its body. Most bats hang upside down while resting, using specialized, sharply clawed feet to grip the perch site surface. The tragus is a fleshy projection that covers the opening to the ear canal. It is important in directing and filtering incoming sounds for vertical localization of prey.

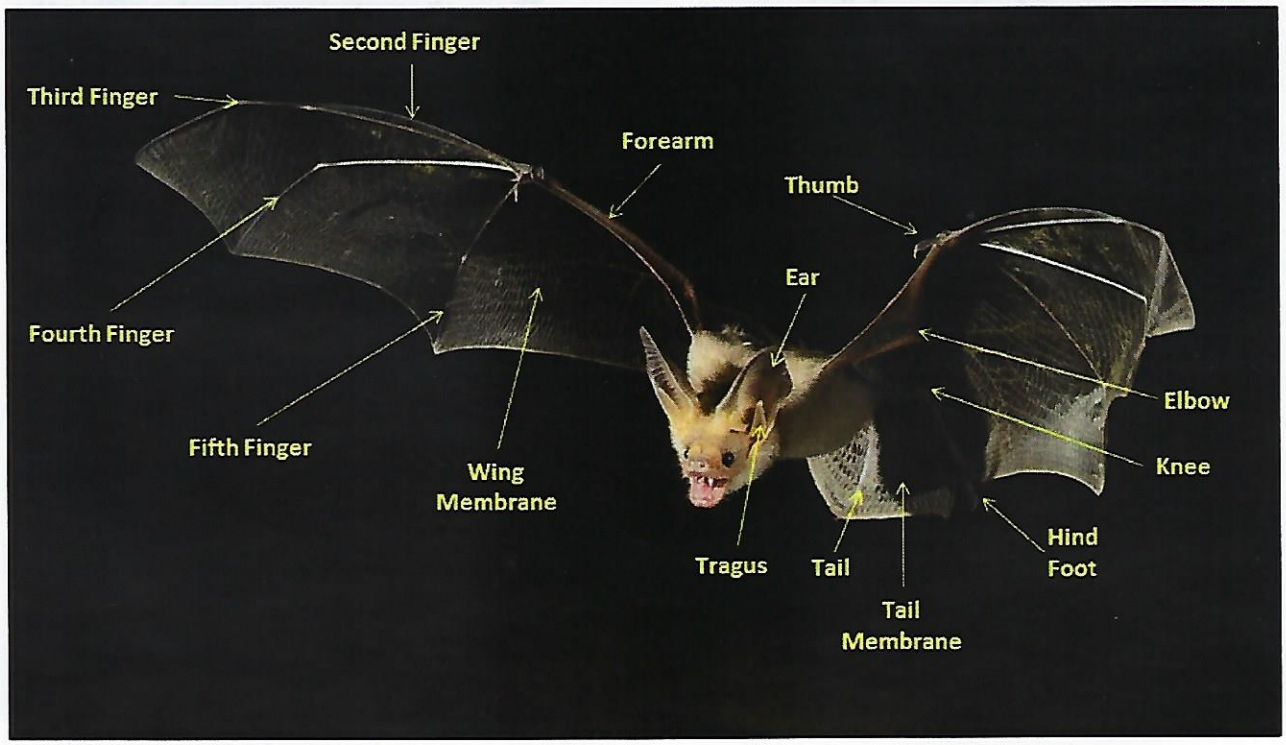


Figure 1. Anatomy of a flying pallid bat (*Antrozous pallidus*). Adapted from photo by Jared Hobbs.

General Activity

Bats are active mostly at night (nocturnal). They generally emerge from their day roosts to search for food (forage) shortly after sunset. They will usually forage for a couple hours then retreat to a night roost where they hang out to digest their food, rest and socialize. Night roosts often are in different locations than their day roosts. Commonly night roosting bats will go out for a second foraging before they return to their day roost shortly before sunrise.

Roosts

Roosts provide secure sites for bats to rest, sleep, mate, socialize, raise young, and hibernate. They also usually provide good microclimates for optimal thermoregulation. Most bat species use multiple roosts, including day roosts, night roosts, and hibernacula (see description below). Daily, seasonal and yearly fidelity to individual roosts can be high, but bats regularly change roosts as reproductive, social, microclimate and other conditions (e.g. parasite load) change. In general, maternity colonies form in the spring and remain together until the young are independent in the late summer or early fall. Males commonly use separate roosts, either singly or in bachelor groups during this period. In leaf-nosed bats and vesper bats breeding occurs in the fall when aggregations of males and females gather together at favored roost sites. Free-tailed bats more commonly breed in late winter or early spring.

Day roosts provide protected locations from sunrise to sunset and are usually well hidden. They may be used collectively by all age and gender groups (Figure 2) or separately by maternity colonies, male bachelor groups, or a mix of non-breeding females and males. During the breeding season males often segregate from maternity colonies and use cooler roost sites where they can enter torpor daily to conserve energy. These alternate roosts can be within the same structure if the microclimate is spatially variable enough, or at distant locations. Male bats will often move to higher elevations to find suitable day roosts, commuting back to lower elevation foraging areas at night. Pregnant and lactating females generally do not enter torpor in order to maintain active body temperatures required for optimal gestation and lactation. They require warm roosts more commonly found at lower elevations. Day roosts can be used by multiple species, spatially mixed or segregated.

Figure 2. Day roost of Brazilian free-tailed bats (*Tadarida brasiliensis*). Photo ©Merlin Tuttle.org.

Night roosts (Figure 3) are mostly safe and warm resting sites used between foraging bouts, with the bats returning to their day roost before sunrise. At these sites bats gather together while they digest their food to share body warmth and socialize. Some day roosts may also be used as night roosts when they are close to the foraging areas.

Figure 3. Night roost of pallid bats at WHSNP. Photo by J. Aliperti.

Hibernacula are roost sites (Figure 4) that have temperatures cold and stable enough to allow the bats to enter a hibernation state for extended periods. These sites are usually located at higher elevations. In the many areas in California where hibernation conditions do not exist,

bats may over winter, entering daily torpor but emerging to forage when temperatures rise and insects become available. Over-wintering bats may use the same day and night roost sites they do during other times of the year if food resources are comparably available.

Figure 4. A little brown bat (*Myotis lucifugus*) hibernating in an historic abandoned mine. It is covered in moisture condensation from the humid air in the old mine. Photo ©Merlin Tuttle.org

Feeding

All bat species at WNSNP are insectivorous, foraging on various flies, mosquitoes, gnats, moths, spiders, beetles, and other insects common to the Preserve. They can often be seen at dusk rapidly flying over the ponds and streams, grasslands, in and around trees, and high overhead (Figure 5). They will go wherever there is food.

Figure 5. Spatial areas used by bats while foraging. 1= above canopy; 2 = open spaces between canopies; 3= over open water; 4 = close to and within foliage; 5 = between trees; 6 = amongst foliage; 7 = ground foraging. Image from West (2016) Technical Guidance for the Assessment and Mitigation of the Effects of Traffic Noise and Road Construction Noise on Bats. California Department of Transportation.

Interestingly, different bat species are often morphologically and acoustically specially adapted to their preferred habitat. Species that feed in the open (i.e. above the forest canopy, e.g. Brazilian free-tailed bats,) are usually fast fliers with long, narrow wings and have powerful echolocation calls that can detect insects at great distances.

Echolocation: Feeding in the dark

Echolocation, also called bio sonar, is the use of acoustic signals to determine where objects are in space. It is used by bats, toothed whales and dolphins, some shrews and a number of cave-dwelling birds. The key functions of echolocation signals are to generate echoes that provide precise information about a bat's 3-dimensional environment and where to find prey. Differences in the structural and temporal characteristics of the emitted signal and the returning echoes are used by bats to detect, identify, and characterize (size, shape, movement etc.) their physical environment and to determine the location, type and movement patterns of prey and other species (e.g. other bats and/or potential predators). Using echolocation, bats can detect objects as thin as a human hair in complete darkness. But fear not, bats are not interested in your hair and will not bump into you. (See the Bat Questions and Answers section for additional information.)

Bat echolocation pulses are usually quite loud (>100 dB [e.g. truck horn]10 cm in front of the bat) and are emitted at rates of about 2 - 20 pulses/s when bats are in search mode or during commuting flight. During the approach phase of prey capture (Figure 6) the call repetition rate is increased significantly to provide fine-tuned details on the location of the prey item.

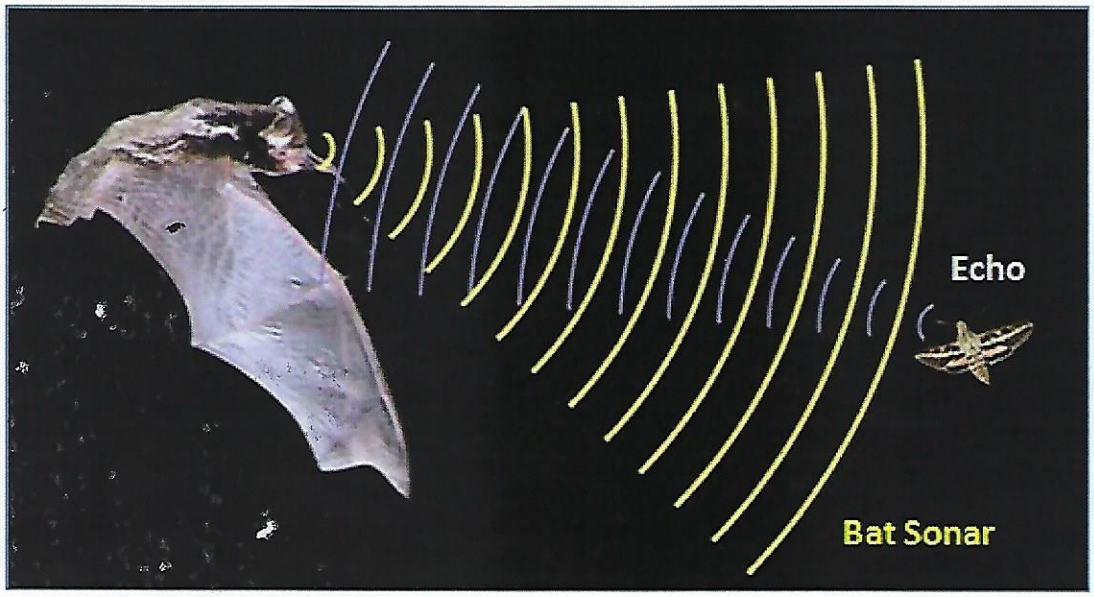


Figure 6. Echolocation in bats. Image adapted from https://askabiologist.asu.edu/echolocation

Bat Questions and Answers

Are bats blind?

No, bats are not blind. Most bats can see as well as humans, if not better. Many Old World fruit bats (they do not occur in North America) have very large eyes (see Figure 7) that enable them to see their food - flowers and fruit, at night. They also see color. All North American bats have smaller eyes (e.g. see species photos above) that provide normal mammalian vision, but most of these bats need echolocation to navigate in the dark.

Figure 7. An Old World Fruit bat showing its large eyes. Photo ©Merlin Tuttle.org

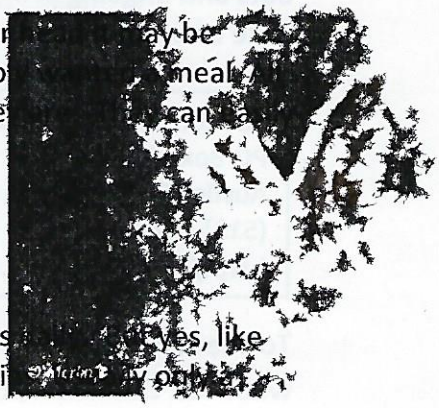
Do bats at WHSNP vant to suck your blood?

There are vampire bats that feed on blood, but **not** at WHSNP. They only live in tropical Central and South America. While vampire bats may occasionally bite a person while sleeping, they do not attack humans (or turn them into vampires). They mostly feed on the blood of farm animals or wild mammals. Actually they do not suck blood; instead they make a small incision with their razor sharp teeth on a sleeping animal and then lap up the blood. The animal usually doesn't even wake up or feel the bite.

Figure 8. A common vampire bat (*Desmodus rotundus*) feeding on a chicken in French Guiana. Photo ©Merlin Tuttle.org.

Vampire bats have actually helped people - saliva from these bats contains chemicals called *anticoagulants* that keep blood from clotting. From their research on vampire bats, scientists have developed a medicine to help heart patients. Guess what it is called? Draculin!

Do bats get stuck in your hair?



Bats do not try to become tangled in hair. If a bat has ever flown near your [illegible]ay be because you had a mosquito or moth is hovering nearby, and the bat simp[illegible] meal. WHSNP bats use highly precise echolocation to determine where their pre[illegible] can detect where you are and avoid any encounters. Relax, be happy.

What about rabies?

Like many wild species, bats are very clean animals that groom themselves[illegible] yes, like many wild animals such as skunks, raccoons, and foxes, bats can carry rabi[illegible]

very small percentage (less than half of 1% of the almost 1,000 different species of bats) are affected. Because humans seldom come in contact with bats, the chances of being bitten by a rabid bat are extremely small. However, the best advice is never to touch a bat. The bats heed the same advice about humans.

Why are bats important?

Bats are ecologically important in many ways. Insect-feeding throughout California, including those at WHSNP, literally eat tons of insects every night, including many nuisance species of moths, flies, bugs, beetles, and mosquitoes. While this natural form of pest control makes for very relaxing and enjoyable evenings in the outdoor spas at WHS it also helps our economy by preventing millions of economically damaging agricultural pests from damaging the crops in the Central Valley and other rich farming areas throughout the state.

Elsewhere in the world (e.g. the American Southwest and tropical rain forests) fruit-eating bats also perform invaluable ecological services in dispersing seeds of many of the plants they eat and nectivorous bats aid in pollination of many species. Bats are also increasingly important in natural reforestation of cleared or burned areas. Seed dispersal and pollination by bats are very important in maintenance of many plants used by humans including balsa wood, mangos, carob, figs, tequila, cashews, guavas, bananas, hemp for rope fibers. Bat guano is also one of the world's best fertilizers. Bat guano is also a major source of nutrients for maintaining ecosystem structure and function in some rare cave ecosystems.

How can I help?

Unfortunately, many bat populations – in California, across North America and around the world – are in critical decline due to loss of habitat, misinformation on their importance, and fear-based extermination. One of the most important ways to help with bat conservation is simply to become informed about bats and promote their values among friends and other people who make decisions regarding preservation of habitat that may be used by bats. There are a number of good bat conservation organizations that can provide great information on bats and ongoing programs in bat conservation, both locally and nationally. Two of particular note are:

Bat Conservation International
PO Box 162603
Austin, TX 78716
(512) 327-9721
http://www.batcon.org/

and

Merlin Tuttle's Bat Conservation
https://www.merlintuttle.com/

To see some incredible photos of bats and learn a lot about their biology log on to these websites. Donations, of course, are always welcome.