BATS

I. INTRODUCTION

Bats are the only mammals capable of true flight. They belong to the Order Chiroptera, which means "winged hand". Although often mistaken for rodents, they are more closely related to primates. Bats first appeared in the Eocene epoch about 58 million years ago.

There are nearly 900 species of bats in the world, accounting for one-quarter of all mammal species. These are grouped into two suborders: the Megachiroptera and the Microchiroptera. The Mega- chiroptera (130 species in 39 genera) are fruit- or nectar-feeding bats that are found only in the Old World tropics. The Microchiroptera (700 species in 138 genera) are found worldwide primarily in tropical and temperate zones and feed on a variety of plants (fruit & nectar) and animals (arthropods, vertebrates, blood).

The U.S. is home to about 42 species of bats. Twenty-five of these species occur in New Mexico. Most New Mexico species belong to the Vespertilionidae family (common bats). They feed primarily on insects and other small invertebrates. Two species belong to the Phyllostomatidae family (leaf-nosed bats). In New Mexico, they are found only in Hidalgo County and feed on nectar. Finally, four species belong to the Molossidae family (free-tailed bats). Free-tailed bats are insectivorous and known for long-range foraging flights. An example is the colony of Brazilian free-tailed bats that inhabits Carlsbad Caverns from April through September.

Despite their numbers, bats are among the least known and most misunderstood animals. Their ability to fly, their secretiveness, and their nocturnal habits have contributed to bat folklore, superstition, and fear. This in turn has led to eradication and serious endangerment of many species of bats. In truth, they are intelligent, gentle creatures of great ecological and economic value. Protection measures based on education are having a profound impact on bat populations, reversing declines in many areas.

II. BIOLOGY, ECOLOGY AND BEHAVIOR

Bats are either colonial or solitary. Colonial bats congregate in caves, mines, and sometimes buildings. Solitary bats live primarily in trees, but may enter buildings during spring and fall migration. Bats roost in buildings when their natural habitats may no longer be available to them. In temperate regions where winters are cold, bats either migrate to warmer climates or hibernate in caves, mines or other structures. They are especially vulnerable to disturbance at this time. If they are aroused from hibernation, they may lose 10 to 30 days' worth of fat reserves, possibly resulting in death.

Bats roost during the daytime in dark and secluded places, emerging at dusk to feed. Most U.S. species are insectivorous; only three southwestern species feed on nectar. Bats have a highly sophisticated echolocation system by which they are able to navigate in complete darkness, avoid obstacles, and catch their prey. Although the high- frequency sounds they emit are inaudible to the human ear, they do emit audible sounds when communicating with other bats. Contrary to the popular misconception, bats are not blind but can see well in such dimly lit places as caves, mines, attics, etc.

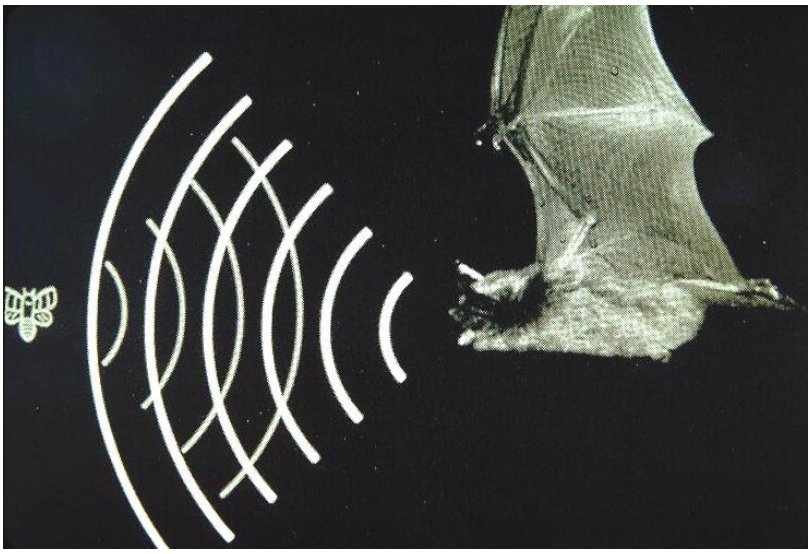

Figure 1. High frequency sounds are emitted from the bat's mouth. Echoes returning from obstacles or flying insects inform the bat of its surroundings.

Figure 2. The bat's elaborate ear structure assists in echolocation.

Bats are important predators of a great variety of night-flying insects, including mosquitoes, moths and beetles. Little brown bats may capture 500 to 600 mosquitoes per hour. It has been estimated that the colony of 20 million free-tailed bats living in Bracken Cave in Texas may consume 250,000 pounds of insects each night.

Bats in the tropics are important pollinators of many plants vital to the survival of rain forests. At least 200 economically important species of plants depend on bats for pollination, including bananas, avocados, dates, peaches, figs, mangoes, and many trees harvested for timber. Arizona's state flower, the saguaro cactus, is pollinated by Sanborn's long-nosed bat. In Mexico, as many as 45 species of giant columnar cacti depend on about nine bat species for pollination, fruit production and seed dispersal. In Africa, the passage of the seeds of certain trees through bats' digestive tracts actually improves the germination and growth of the trees, in addition to increasing the distribution and variety of tree species into new habitats.

Normal bat behavior is often misunderstood, adding to people's fears and superstitions. For instance, in day roosts, bats may enter a deep sleep called torpor. Awakened unexpectedly, the bats may be incapable of flight for several minutes and if knocked to the ground are often immobile, thus appearing to be sick. Bats do not attack humans. Outdoors, a bat that flies by someone's head is probably chasing an insect. It is not unusual for bats to enter houses through an open door or window, but these are often lost individuals. The bat will try to find its way out again, but each time it comes to a wall, it must turn and swoop down to regain speed. Therefore, if you were standing in the middle of the room, it would appear as though the bat is "attacking". Bats do not get tangled in people's hair.

Bats mate in the fall, but the female retains the sperm until spring when ovulation and fertilization take place. Pregnant females form maternity/nursery colonies in caves, mines, or other shelters. They do not build nests. Usually just one pup (young bat) is born, although some species may have twins or even a litter of three or four. Born blind, naked and helpless, the young are usually able to fly within three to five weeks. It is not uncommon for bats to live ten years or more. Two little brown bats were recaptured 29 and 30 years after being banded.

III. BATS AND PUBLIC HEALTH

Rabies is the most important public health hazard associated with bats. Bats are increasingly implicated as important wildlife reservoirs for variants of rabies virus transmitted to people. During 1990-2000, a total of 24 (75%) of 32 U.S. human rabies cases were caused by bat-associated rabies virus variants. Most (71%) of these infections were associated with the virus variant found among silver-haired and eastern pipistrelle bats. However it is inaccurate to say that most bats are rabid. Current infection rates in bats in North America are very low, usually less than 0.5%. Misleadingly high figures are the result of sampling biases, such as testing only bats that appear sick.

Recent data suggest that rabies transmission can occur through minor bites from bats. Limited injury caused by the bat bite (compared to wounds resulting from bites by carnivores) and situations in which the exact exposure history is unavailable may make determination of the risk for rabies following a bat encounter more difficult. Proper administration of the rabies vaccine to those actually or potentially exposed to a rabid animal is hindered by misidentification of the individual animal involved, exaggerating the extent of human exposure, or mishandling and damaging the bat. Rabies is confirmed by finding rabies-specific Negri bodies in the animal's brain tissue; therefore, submission of a good specimen is of prime importance.

All potential exposures involving bats should be reported to the local animal control and the New Mexico Department of Health (DOH) Epidemiology and Response Division (505-827-0006). The risk of rabies and need for postexposure prophylaxis (rabies vaccine) is determined in consultation with the person’s own physician and DOH. In all cases in which bat-human contact has occurred, the local animal control officer should safely collect the bat in question (if possible) and submit it through the local public health office for testing at the Scientific Laboratory Division in Albuquerque. Postexposure prophylaxis is recommended for all persons who have sustained bite, scratch or mucous membrane exposures to a bat, unless the bat has been tested and is negative for rabies.

Postexposure prophylaxis is also appropriate even in the absence of demonstrable exposure. Because bats have small teeth, a bite might go undetected or be minor. Situations in which an exposure might have occurred in the absence of an obvious bite wound include awakening and observing a bat in the room, finding a bat in the room of an unattended child, or seeing a bat near a mentally impaired or intoxicated person. Many of the recent rabies cases associated with bats are of this latter type of exposure. In 22 of 24 human cases associated with bat rabies during 1990-2000, no documentation of a bite existed. Persons cannot become infected with rabies from having contact with bat guano (feces), blood, or urine or from touching a bat on its fur.

Aerosol transmission of rabies is extremely rare. The two known cases in the U.S. occurred in a unique cave environment where millions of bats were living. Thousands of people explore bat caves each year without harm. Aerosol transmission does not seem to occur with bats occupying houses, either as individuals or as roosting colonies.

Because bat rabies has been documented in the 49 states in the continental U.S. and reduction of bat populations is not a feasible, practical, or desirable strategy for rabies control in bats, human and domestic animal contact with bats should be minimized. Bats should be physically excluded from houses and surrounding structures by sealing potential entrances. In addition, bats should never be handled by untrained and unvaccinated persons without safety precautions and should never be kept as pets.

Another important disease known to be spread from bats to humans is histoplasmosis. *Histoplasma capsulatum* is a fungus found in soils enriched by bird or bat droppings. When soil containing the fungus is disturbed, the spores become airborne and may be inhaled. If it is necessary to remove guano from an attic, respirators designed for nuisance dusts may be used. Dampening the guano first will reduce the hazard of dust inhalation by workers and people nearby.

IV. BAT EXCLUSION

Bat-proofing is the best long-term solution for excluding bats from buildings. Bats can enter holes as small as one-half inch in diameter. They do not chew their way through insulation or make new holes. Make sure doors have tight-fitting weather stripping, windows are screened, and chimneys are covered with hardware cloth screens. A colony inhabiting an attic or wall should be observed at dusk to locate the entry/exit holes. These holes may also be found from the accumulation of bat droppings below, or stains around the holes or crevices.

Common points of entry include open windows or doors, broken or poorly-fitted screens, loose or missing shingles or tiles, places where flashing or boards have come loose and locations where pipes or wiring enter buildings. Openings often occur where walls meet the eaves at the gable ends of an attic, where vigas extend through the wall, where porches attach to the main part of a house, or where dormers meet the roof. Other points of entry are associated with siding. For example, cracks and crevices are often created where siding forms corners, or at places where it meets windows, doors or chimneys. Broken stucco or cracks and crevices from ill-fitting building materials may also provide entry points.

Figure 3. Common entry points on home and buildings.

Caulking, flashing, screening or insulation can be used to seal most openings on the inside to prevent bats from entering living quarters. If it is necessary to evict bats from a building, netting or tubes that function as one-way valves must be placed over the openings bats use to enter and exit. These one-way valves allow bats to leave, but not reenter the building. A simple method is a piece of bird netting of 1/16 inch or smaller mesh, at least two feet wide, taped or stapled above the bat entry extending at least two feet below the exit. (See figure below).

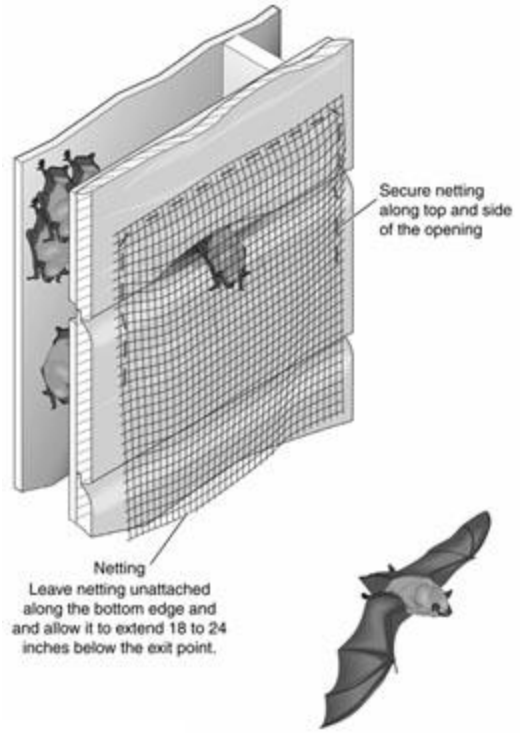

Figure 4.

These exclusion devices should be left in place for five to seven days to ensure all bats have exited. Do not simply wait for bats to fly out at night and then seal openings. Not all of the bats leave at the same time, and some bats may remain inside all night. **Do not attempt to exclude bats when flightless young may be present in the roost (May through August).** The best time for exclusion is in the early spring or fall. The bats will likely leave during winter to seek better hibernation sites or to migrate to warmer areas. After the bats have been excluded, permanently seal bat entry holes with caulking, hardware cloth, insulation or heavy-duty netting.

Repellents (e.g., naphthalene in mothballs) usually only give temporary relief and are not effective in open areas. Ultrasonic devices are not effective. No toxicants are registered for use against bats, and in any case because of their great ecological value, bats and bat colonies should not be killed.

Bats sometimes temporarily roost outside on porches or under overhangs of porches, patios or awnings. This is usually not a problem, but if exclusion is desired, non-toxic aerosol dog or cat repellents may be applied (when bats are not present) to discourage bats from roosting in these areas.

On occasion a solitary bat may accidentally fly into a home or other building through an open door or window. Under these circumstances, doors to other parts of the house should be closed and the outside doors opened. The bat will usually find its way out by detecting air currents and through its echolocation skills. If the bat fails to exit, wait until it lands, then cover it with a small box or can. Slip a piece of cardboard between the wall and box, slide the bat into the box, and then release the bat outside. You can also catch it by hand, wearing thick leather gloves. Make sure that all other doors, windows and vents are closed before releasing the bat, or it may just fly back inside. Never handle a bat with your bare hands.

Much of this information about bat exclusion and biology was obtained from Bat Conservation International. They also have information about building bat houses. Their contact information is:
P.O. Box 162603, Austin, TX 78716, (512) 327-9721, www.batcon.org