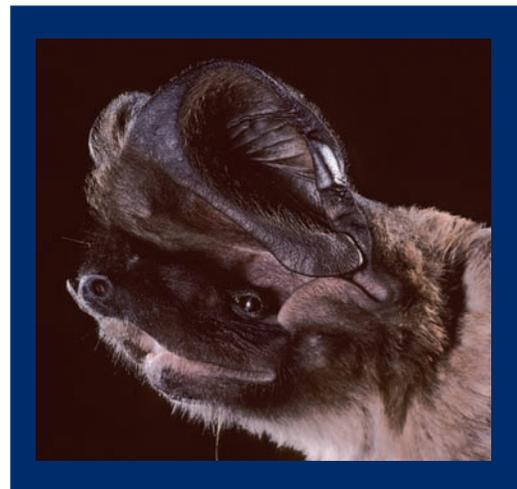


BATTY ABOUT BATS



AZ 1456
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Myotis, yumanensis. Yuma myotis. A group of Yuma myotis roosts in an abandoned mine.

Cover photos:

Top: Allen's big-eared bat, *Idionycteris phyllotis*, ©Bat Conservation International
 Bottom left: Hoary bat, *Lasiurus cinereus*, ©Bat Conservation International
 Bottom right: Greater bonneted bat, *Eumops perotis*, ©Bat Conservation International

Order Chiroptera

Families: • Mormoopidae • Vespertilionidae
• Phyllostomidae • Molossidae



Bats along with fox, skunks, and raccoons are the reservoir hosts for the rabies virus. Rabies virus (family Rhabdoviridae, genus *Lyssavirus*.) is transmitted between mammals, including bats, primarily through the bite inoculation of rabies virus present in the saliva of infected individuals. Most cases of indigenously acquired human rabies in the United States are caused by bat-associated variants of rabies virus. The average of 1 or 2 human cases per year over the past 2 decades is due to the combination of the rarity of these events and the effective post-exposure vaccination available for humans exposed to rabies. However, the presence of bats in a human environment may pose an imminent human health risk, and extreme care should be taken.

Biology of Bats

Bats belong to an order of animals called Chiroptera (Latin for “hand-wing”). There are more than 1100 species of bats worldwide. The majority provide a valuable pest management service to our cities and natural areas through the predation of night-time flying insects, including adult mosquitoes. Other types of bats are important pollinators and make it possible for us to harvest certain foods and flowers. If you eat bananas, avocados, papayas, mangoes, or dates you are reaping the benefits of bat pollination!

Arizona has 28 recorded species of bats, with populations in desert, grassland, woodland, and urban habitats. The smallest (Western pipistrelle, *Pipistrellus hesperus*) measures just 2.5 inches long, while the largest (Western Mastiff, *Eumops perotis californicus*) is up to 7.5 inches long. As Arizona’s population grows, so does the urban-wildlife interface, leading to increased encounters with bats. This document provides a general overview of bat biology and behavior with emphasis on urban environments, use of integrated pest management techniques that are in keeping with bat conservation guidelines, and disease awareness

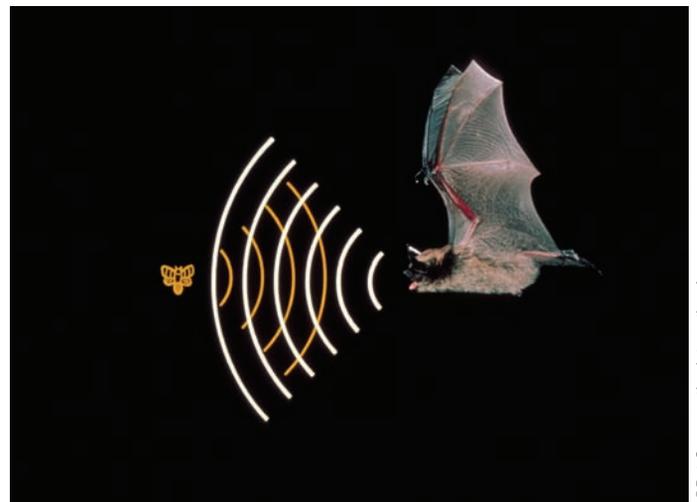
and prevention. More detailed biological information on each of Arizona’s bats is available from Arizona Game and Fish Department’s bat conservation web pages: http://www.azgfd.gov/w_c/bat_conservation.shtml.

Senses

Contrary to popular belief, bats are not blind. Most bats, however, employ “echolocation” to help them find prey, shelter, etc., during their nighttime activities. Echolocation involves emitting a sound and listening to the echo of that sound as it “bounces” off objects. This ultrasonic ability helps bats interpret the distance, size, speed, and even texture of an object. Echolocation is particularly useful to bats for locating small, flying insect prey at night, such as moths and gnats.

Most bats hear and vocalize at frequencies well beyond that of humans. While we hear sounds ranging from 15 Hz to 20,000 Hz, bat calls range from 9,000 Hz to 200,000 Hz. Ultrasonic equipment converts the higher frequency vocalizations emitted by bats to within range of our hearing abilities. To hear an example of this, visit http://www.museumca.org/caves/onli_echo.html.

Most species of bats also have an acute sense of smell, which is helpful for species that rear their young in large maternity colonies. These mothers rely on olfactory and spatial cues to help zero in on their baby amidst millions of other young bats.



Bats rely on echolocation to reveal the position of objects, including prey.

“A colony of 150 Big Brown Bats (*Eptesicus fuscus*) can protect local farmers from 33 million root worms in a single summer.”

– Bat Conservation International
<http://www.batcon.org>

Food

Seventy percent of the world's bats feed on insects; the remainder feed on fruit, nectar, meat, and fish. Less than 0.01% of the world's bats feed on blood (that's just three out of 1100 species). None of the "vampire" bat species (sanguivores) occur in the United States. In Arizona there are bats which feed on a variety of insects and other arthropods (insectivores), and those that feed on pollen and nectar (nectivores).



A large colony of Mexican Free-tailed bats (*Tadarida brasiliensis*) emerge from under a bridge in Austin, TX to the delight of spectators. These bats are known for their precision as aerial feeders of moths and other flying insects.

Aerial insectivorous bats capture prey while flying. They begin their feeding at dusk and are often seen flying over open areas, such as parks. One aerial feeding bat can capture *hundreds* of mosquito-sized insects in just **ONE HOUR!** Aerial insectivorous bats may also be drawn to insects, such as moths, flying around lights. Alternatively, some bats are insectivorous gleaners, and hunt by capturing insects off the ground or from vegetation. The prey of **insectivorous gleaners** includes crawling arthropods (centipedes, scorpions, beetles, etc.), grasshoppers, katydids and the larvae of certain crop pests. Regardless of their feeding style, there can be no understating the fact that insectivorous bats are a benefit to pest management programs!

Nectivorous bats feed on pollen and nectar. As they move from one plant to the next they provide valuable pollination services (similar to bees). Two of the three species of nectivorous bats in the United States are found in Arizona: the Lesser long-nosed bat, *Leptonycteris curasoae yerbabuena* (an endangered species), and the Mexican long-tongued bat, *Choeronycteris mexicana*. These bats birth and raise their young in southern Arizona from early spring through summer. In the fall, they migrate south to over winter in Mexico. They feed on pollen and nectar, and are critical to the pollination of columnar cacti (saguaro, organ pipe) and agaves. In Mexico they also feed on the fruit of these plants, ultimately aiding seed dispersal by transporting seeds in their feces. Biologists calculate that the pollination of agaves and various cacti would drop approximately 97% without our nectivorous bats!



A Pallid bat (*Antrozous pallidus*) detects and seizes a Common Desert centipede (*Scolopendra polymorpha*).



The Lesser long-nosed bat (*Leptonycteris curasoae yerbabuena*), an important pollinator, feeds on nectar from a Saguaro cactus flower. Their spring migration from Mexico to Arizona is timed according to columnar cacti blooms.

Most bats living in temperate latitudes (which includes Arizona) produce just one offspring per year, making it difficult for populations to rebound quickly following a loss in numbers.

Life Cycle

There is a great deal of variation in the mating and rearing behaviors of bats. Most bats mate during the fall, with fertilization of the egg delayed until the spring. Bats are the only mammals in which delayed fertilization occurs. Alternatively, a minority of bats wait until spring to mate. Beginning in April, many bats form maternity colonies consisting of adult females and their offspring; in the warmer, lower elevations of Arizona maternity colonies have been reported as starting as early as March. In some cases, maternity colonies also include non-reproducing yearling females who participate in the rearing duties. These colonies can be quite large, depending on the particular species of bat. Maternity colonies of Mexican free-tailed bats in Arizona may contain tens of thousands of individual bats (one maternity colony in Texas contains upwards of 20 million individuals!). Alternatively, a small number of bat species in Arizona are solitary or roost in small groups of fewer than five.

Compared to other mammals of the same size, bats are the slowest to reproduce; they do not bear as many young at a time, nor do they undergo as many reproductive cycles in their lifetime. Most bat species produce just one baby, called a “pup”, per year following a gestation period that may last anywhere from 60 days to eight months in Arizona. The young are fed milk produced by the mother until four to six weeks of age, and are typically flight-ready by one month of age. Maternity colonies will begin dispersing late summer to early fall. Bats reach maturity anywhere from one to two years of age.



©Bat Conservation International

Two Big brown bats (*Eptesicus fuscus*) hibernating in a cave. These bats depend on sufficient fat reserves to make it through winter hibernation in high elevations of southern Arizona. Favorite food: beetles.

Most bat species will either migrate or hibernate with the onset of cool fall temperatures. In northern Arizona and higher elevations in the south, some bats ride out the colder months by congregating in caves and mines to overwinter. These bats enter a hibernation state for five to eight months during which their body uses fat reserves very sparingly. Research has shown that for each instance of disturbance from hibernation, a bat may expend up to 67 hibernation days of fat (Tuttle, 1991). Without enough fat to survive the winter, bats may succumb to starvation or the cold. It is very important not to disturb hibernating bats such as those found in caves, mines, rock crevices, hollow trees, and buildings.

In the lower elevations of central and southern Arizona, it remains warm enough that some bat species neither migrate south nor hibernate. These bats remain active throughout the winter months.

Bats are extremely vulnerable when roosting as colonies and should **not** be disturbed. Bats are best observed from a distance when they are emerging from a roost.

Roosting Behavior

Bats use roosts for different reasons based on the time of day and the time of year. Roost types include the day roost, night roost, maternity roost, and hibernation roost.

During the day, bats typically want protected roosts that are free of disturbances and predators, and which provide dark, quiet conditions where they can rest for several hours. Day roosts are usually 10-15' above ground, and can be as many as 30 miles away from foraging grounds and water sources. At night, however, bats feed and roost



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A nursery colony of Yuma myotis (*Myotis yumanensis*) in an Arizona attic. These bats copulate in the fall and sequester the sperm for fertilization in the spring. They are colonial, and nursery colonies may reach into the thousands.



A Silver haired bat (*Lasiorycteris noctivagans*) emerging from its day roost: a tree. Little is known about these bats. Their conservation depends on the availability of multi-age forests and the retention of snags 6.5 ft and taller.



A *Myotis* sp. bat finds rest from migration on a quiet wall on the Hopi Reservation. Such stop-overs are not uncommon during late summer and fall.

intermittently so they choose roosts that are in convenient proximity to their foraging grounds. Trees, porches, and even abandoned bird nests are common examples of the temporary roosts used by bats while feeding at night. Where bats forage may change as weather conditions and insect populations change; hence, these fleeting nighttime roosts are easily abandoned for more convenient ones.

Bats will aggregate seasonally to form maternity colonies in spring (the largest groupings of bats) and winter colonies for hibernation. In both types of roosts, bats seek dark, climate-controlled environments. Females will select a maternity roost based on high temperature conditions: upper 70s to 95 deg. F. Roost temperatures higher than this may cause death of the young. **Bats have a very high fidelity to their maternity roost. Like pigeons and doves, they will return to the exact location each spring to rear their young** (see section “Integrated Pest Management: Educate—Inspect—Prevent—Exclude”).

After the maternity colonies disperse – late summer to early fall – bats may be found roosting on protected or quiet exterior walls of buildings. These are migratory

or transient bats, and their presence does not necessarily indicate a permanent colony. The presence of these bats is usually short term. As the season progresses and food sources change, they will move on. Similar sightings of bats on building walls may also occur following inclement weather (i.e., rain and wind). Often these bats are simply disoriented and in need of rest; they likewise move on within a matter of days.

Integrated Pest Management: Educate—Inspect—Prevent—Exclude

Integrated Pest Management (IPM) is a strategy for managing pests – a pest being defined as any unwelcome visitor, including plants and animals. IPM draws on simple and effective principals to address the source of pest problems and prevent them from recurring. IPM techniques include education, inspection, monitoring, structural exclusion, sanitation, and modifying cultural practices, among others. While IPM strategies aimed at insect and weed species may involve the use of reduced-risk pesticides,

Table1.

Common locations for maternity colonies (spring to fall)	
<p>Natural or rural environments</p> <ul style="list-style-type: none"> Caves Cavities and crevices created in trees and saguaro cacti Mines Palm tree fronds Rock crevices Tree foliage 	<p>Urban environments</p> <ul style="list-style-type: none"> Attics Barns and sheds Bridges Culverts Palm fronds Roofing tiles Tunnels

this is not an option for bats. When used correctly, IPM techniques help reduce human-bat encounters around homes, schools, and offices, while protecting environmental and human health.

Measures to exclude bats from a building should be done September through February, well outside of the maternity season. However, many forms of bat management can be done at any time of year. To **avoid attracting bats**, turn off unnecessary outside lights at night. Consider replacing outside light bulbs with yellow “bug” bulbs to discourage insects, which in turn will discourage bats that prey on them. You can also **prevent bats from coming indoors** by maintaining window screens and keeping doors without screens closed, particularly during evening hours when bats are active. Finally, **inspect buildings** for bat activity at any time of year, especially prior to any maintenance or exclusion activities.

If there is an imminent public health threat, bat management steps must be undertaken immediately, and by professionals licensed by Arizona Game and Fish Department.

All bat species are protected in Arizona and cannot be collected or killed by members of the general public, unless there is human or pet contact/exposure. If contact or exposure occurs the bat should be collected and sent for rabies testing.

Bats on a Building During the Day

Migratory “pit-stops” and inclement weather conditions often involve bats on the side of a building or utilizing the cover of a porch area during the day. Consider allowing these bats to move along on their own if they are **not inside** a building or in areas which students access. Schools that receive frequent or seasonal visits from bats should have an on-going education program for students and staff (*see section “Rabies Prevention”*).

Steps for deterring bats from day-roosting on the exterior of buildings:

1. **Disrupt the calm.** Bats prefer to roost in undisturbed areas. A permanent ceiling fan in porch areas works well if left on a short period each day. Alternatively, place several mylar balloons (silver works best) in the immediate area of a suspected roost, and position a floor fan to blow on the balloons. Either approach will create sufficient disturbance that the bats will not want to roost there.
2. **Create a “slick” surface.** Cover the substrate of a rough wall (brick, stucco, etc.) with saran wrap or smooth wall coverings. This will make it difficult for the bat to attach and roost. Maintain for **several weeks** and monitor the area thereafter to determine if the bats have indeed decided to move on.

3. **Non-toxic aerosol repellents.** These are typically used for cats and dogs, and can be used to discourage bats from roosting on eaves and overhangs. Apply to the roosting substrate when bats are not present. Note: spraying repellents directly on bats is not recommended because it is inhumane and also ineffective; it may result in the bats flopping on the ground, or simply moving to another part of the same structure.
4. **Consider installing an off-site bat house** (*see section “Bat Houses”*). Bat houses provide an alternative location for bats to roost, and their use augments deterrent and exclusion methods discussed in this document. In some of Arizona’s low elevation areas, including the Phoenix metropolitan area, bat houses are not recommended as the high summer temperatures make them an unattractive alternative, particularly for maternity roosts.

Inspections: What to Look For and When

Please Note: It is against Arizona state law to practice these and any other pest management techniques without proper licensing, with the exception of doing so on your own private property. Companies that provide bat removal and exclusion services must have a current Wildlife Service License from the Arizona Game and Fish Department, as provided in Arizona Administrative Code R12-4-421. For further information on the Wildlife Service License, please visit the Arizona Game & Fish Department website at: http://www.azgfd.gov/eservices/special_licenses/wildlife_service.shtml. Check with your regional Arizona Game and Fish Department office to find out which companies in your area have such a license and experience with bat exclusion practices.

Inspections should be done year round at lower (warmer) elevations, and during spring and summer months at higher elevations (this is when the bats are most likely to be present). Bat inspections will reveal where exclusion maintenance should be done. Inspections can be done day or night, though evening inspections are recommended for a more thorough understanding of bat activity around a building.

Day Inspections

Pairing daytime bat inspections with other types of building inspections makes it convenient enough to conduct three to four daytime bat inspections per year. Suspected bat activity should be followed up with a nighttime inspection to observe exact locations where bats enter and exit buildings; this is necessary for efficient, targeted exclusion.

- Note rub marks around entrance holes (cracks or holes 3/8 inch and larger) or roosting sites (walls, eaves, high corners). Rub marks are dark or oily stained edges where body oils rub off, and may look similar to those left by mice and rats along frequently traveled pathways.

Exclusions should be done outside of the maternity season only: September through February, unless there is an **imminent public health threat**. Bat colonies that may pose an imminent public health threat include: bat colonies on school grounds or child care facilities, if a colony is entering the interior of a building where people sleep, or a colony with potential exposure to children or pets. Potential exposure to children or pets can occur if a colony is roosting in an area where a sick bat can fall to the ground or other surface where pets or children can access.

- Be alert for accumulations of guano (bat feces). Guano appears similar to mouse feces in size and shape, but guano has a musky smell and will turn to dust if rubbed gently with gloved hands. Also, guano consists almost entirely of arthropods (insects, arachnids, centipedes, etc.); a flashlight will illuminate the shiny exoskeleton pieces.
- In addition to rub marks, you may see urine stains on walls. Urine stains are approximately the size of a bat and look translucent to milky. If very old, urine stains may crystallize into an amber color. Rub marks may also create a dark halo around urine stains.



A halo-like rub mark around an entrance hole reveals a bat roost; guano accumulates below a frequented roosting site; a white urine stain in a corner beneath a roost.

Nancy Renison

- Areas under porches, eaves, and other unenclosed locations are often temporary night roosts – adopted while digesting or resting – and do not necessarily indicate an infestation in the building. These bats will move on.



©Bat Conservation International

Figure 1. Bats may gain access to a structure through a variety of entry points in their attempt to roost.

Disturbing a colony of bats where babies are present can result in dead bats and large fines. Bat exclusion efforts need to be carried out appropriately.

Exclusion Maintenance

Unless there is imminent public health threat, do not attempt to exclude bats during the maternity season, which begins as early as March in some parts of Arizona and runs through August. Excluding bats from structures during these months could result in non-flying, young, bats being trapped indoors and dying, and/or bats escaping deeper into the interior of a building (classrooms, offices, bedrooms, etc.). If you witness several bats exiting a building during maternity season, it could be females temporarily leaving their young to forage.

Proper exclusion methods are as follows:

1. **Perform a day or night inspection** of the building first (as explained here).
2. **Begin exclusion maintenance after sunset** to minimize an encounter with a bat.
3. **Apply a temporary, one-way valve** to all entrances and exits of the roost and entry points into a building found during an inspection. One-way valves for holes on the side of a structure can be made by hanging a lightweight wire



Open-bottom screens and self-made sleeves are effective and affordable tools that prevent re-entry to the roost, while also allowing interior bats to exit.

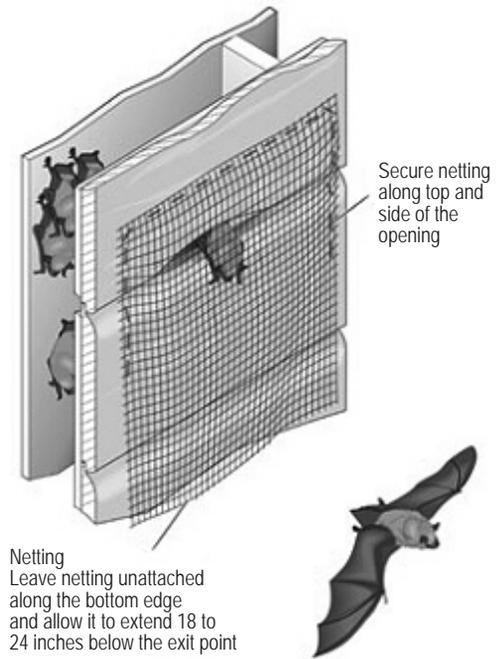


Figure 2. A temporary, one-way cover over holes allows bats to get out, but not back in.

screen (1/6" mesh or smaller) or hardware cloth over the hole, crack, etc. **Leave the bottom and sides of the material unsecured.** Any hidden bats will crawl out, but will be unable to re-enter (Figure 3). For holes in eaves, tiles, and other down-facing locations, it is often easier to install a temporary **one-way exit tube**.

Online or over-the-counter products designed for this purpose may be used. Equally as effective are do-it-yourself products: begin with a clean caulking tube, or a 10"x2" section of PVC pipe or similar plastic tubing; attach a clear plastic sleeve or similar collapsible material to one end of the tubing, which will allow the bats to exit the tube or pipe but not re-enter (see Figures 3-5.)

4. **Remove the one-way valve** (i.e., the flat screen cover or tube) after one full week (allow three weeks in winter) and well after dark to ensure the roost has emptied. Conduct a final visual inspection of the roost with a flashlight.
5. **Install permanent exclusions** to all entrances and exits of the roost. Heavy duty wire mesh (1/6" mesh or smaller) should be used, followed by caulking. Note: expanding urethane foam does not work well in the Arizona climate; the material cannot contract and expand with fluctuating temperatures.
6. **For open recessed areas** such as ceilings, porches, and alcoves, screening or netting (1/6" mesh or smaller) can be used. Attach the exclusion material to the walls just above the level of the nearest door. Bats prefer to be high, and if they cannot access the upper recesses of a potential roost they will likely go elsewhere.

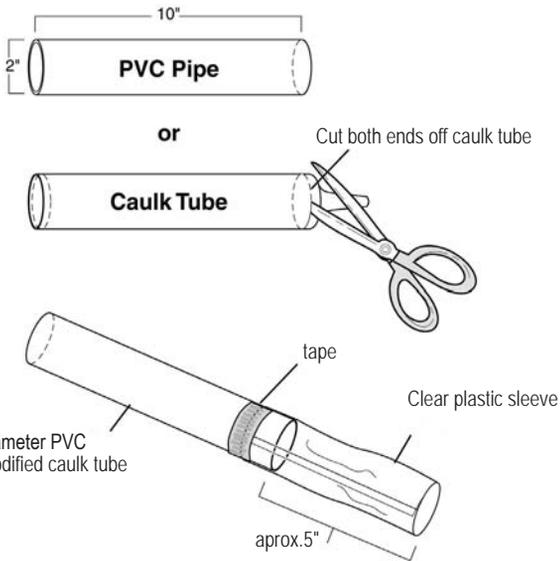


Figure 3

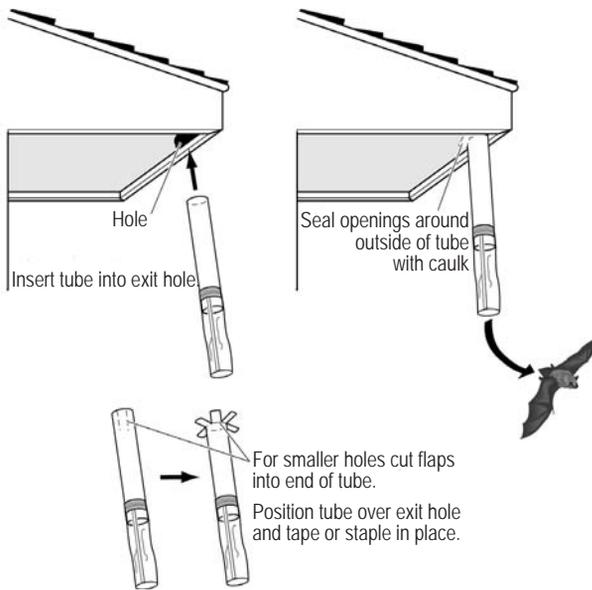


Figure 4

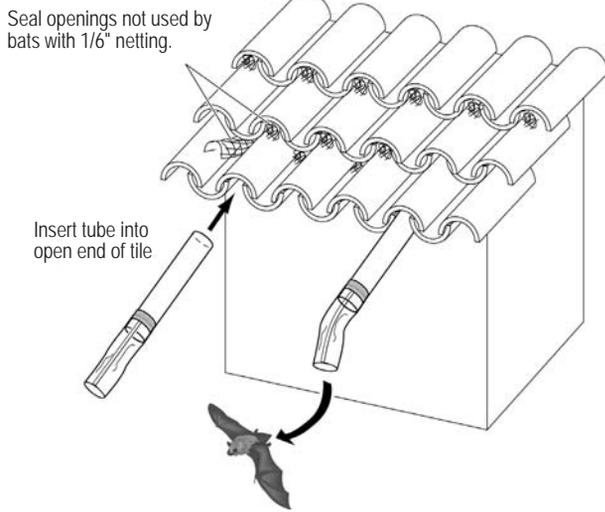


Figure 5

Figures 3-5. To create a temporary one-way exit tube, cut the ends off a cleaned caulk tube, tape a clear plastic sleeve (such as those used in office settings) to the base of the tube, and insert the tube into the entrance hole with PVC end up. Secure with tape or staples.

- For help or advice about excluding bats from your house or property, contact an expert who is licensed and knowledgeable about wildlife. If a bat is found on the ground or inside a home, contact your local animal control office (see section "Rabies Prevention" for contact information).
- Install one or more off-site bat houses to off-set displacing the bats. Bat houses are most successful in Arizona's upper elevations and positioned in a low-use area where accumulations of bat guano will not create either an aesthetic issue or a health concern. A bat house will encourage bats to remain in the area and continue to provide valuable insect-eating benefits (see section "Bat Houses").

NEVER USE MOTHBALLS OR MOTH CRYSTALS TO EXCLUDE OR DISCOURAGE BATS.

These products contain one of two active ingredients: paradichlorobenzene (also written as 1,4-dichlorobenzene) or naphthalene. Mothball and moth crystals emit pungent vapors that are highly pervasive throughout a structure; they should **not** be used or stored indoors. They also act as an irritant to mucous membranes and the lungs. Mothballs are highly toxic to humans and other animals. Paradichlorobenzene, in particular, is known to cause cancer and damage the liver and kidneys.

For additional information on excluding bats, please visit the website for Bat Conservation International, Inc. (See section "Resources".)

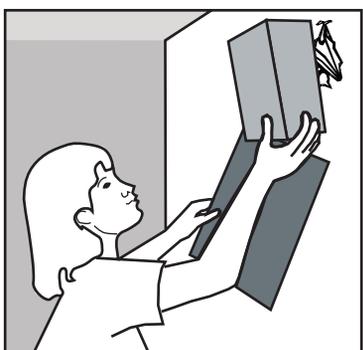
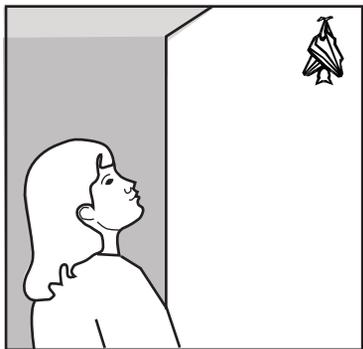
Bats Indoors

If a bat is found indoors, try to determine how the bat entered (e.g., an open door, window, missing ceiling tile, etc.). This may require a careful inspection of the room. If a bat is suspected to have entered through an opening in the wall or ceiling, an evening inspection of the structure exterior should follow to determine whether additional bats are using the building.

Steps to capture a bat indoors (also see Figure 6):

- Wear thick gloves; never attempt to handle a bat with your bare hands.
- Locate and isolate the bat by closing all windows and doors, and turning on the lights.
- Wait for the bat to land and settle (this may take 15 minutes to an hour).
- Use a coffee can, shoe box, or similar container to cover the bat.
- Trap the bat in the container by sliding a piece of cardboard, stiff envelope, etc., between the wall or floor and the container opening.

6. Use this material as a lid and tape it to the container.
7. Avoid touching the bat with your skin or allowing any material that has touched the bat to come into contact with your mucous membranes. Handle the bat as little as possible.



©Bat Conservation International

Figure 6. Capturing a bat indoors can be as simple as “boxing a bat”.

Cleaning Up After Bats

Histoplasmosis is a disease caused by a fungal pathogen, *Histoplasma capsulatum*, which can be contracted from bat guano. When the spores from *H. capsulatum* are disturbed, they become airborne and may be inhaled, possibly resulting in an acute or chronic respiratory infection of histoplasmosis. While there have been no confirmed cases of histoplasmosis contracted from bat guano in Arizona, individuals are nevertheless encouraged to safeguard their health when cleaning areas contaminated with guano.

If exposure or suspected exposure to a bat occurs with any person or pet, follow the guidelines in the section “Rabies Prevention”. Suspected exposure includes: any direct contact between a human (or pet) and a bat, or finding a bat in the same room as a person who might be unaware that a bite or direct contact had occurred (e.g., a sleeping person awakens to find a bat in the room or an adult witnesses a bat in the room with a previously unattended child, mentally disabled person, or intoxicated person), or finding a bat on the ground in the same room or confined area as a pet. Because of the complexity of some of these situations, your local animal control agency should be called and consultation with state and local health departments should always be sought.

Steps for safely cleaning areas contaminated with bat guano:

1. Begin by making sure the area is well-ventilated.
2. Wear a respirator such as an N-95, and latex or nitrile gloves. A painter’s mask does not protect the airways from inhaling small particles such as spores from fungus.
3. Carefully avoid stirring up dust either from the guano or surrounding area.

Bats, fox, skunks, and raccoons serve as reservoir hosts for the rabies virus in the U.S.

4. Spray guano generously with a 10% bleach solution (one part bleach, nine parts water) and allow the guano to soak up the bleach solution for 10 - 15 minutes. Apply enough to saturate the guano.
5. Clean guano away with shovels or paper towels, spraying additional bleach solution as needed to minimize dust from guano or surrounding area. It is recommended that floors and surrounding surfaces be cleaned by wiping down with bleach solution as well; steam clean upholstered surfaces and carpets that have come into contact with the guano or dust from guano.
6. Use hot water and soap to clean any items that will be reused before putting them away.
7. Gloves should also be cleaned before taking them off, and immediately disposed of along with the guano or paper towel garbage.

Rabies Prevention

Rabies is a virus that attacks the nervous system. It is transmitted by direct contact with an infected host's saliva or central nervous system (brain or spinal cord) tissue or fluid. Human infection with the rabies virus almost always results in death. According to the U.S. Centers for Disease Control and Prevention, all species of mammals are susceptible to the rabies virus, and a few serve as important reservoirs for the disease. Several variants of the rabies virus have been identified in terrestrial mammals, including raccoons, skunks, foxes, coyotes, and bats. In the United States, bats are the principal vector by which humans contract the rabies virus, in part due to the fact that a bite from a bat may go unnoticed.

Rabies symptoms in bats vary greatly, from pronounced to unnoticeable. When rabies symptoms in bats are present, they often include the inability to fly or flying during daylight hours, lethargy, paralysis, and death. As a general rule, a bat found on the ground or in a weakened state is probably a sick bat, and therefore has a higher risk of being infected with rabies.

As the urban-wildlife interface grows, so do encounters with wild bats in our homes, offices, and schools. Encounters with bats are increasing and rewarding, they are incredible creatures to watch and learn about. However, it is very important to treat these creatures with a great deal of respect and caution. Bat-contracted rabies is highly preventable through education, and good management. On average, less than 0.5% of bats are infected with the rabies virus; however, human encounters with wild bats are often not treated with the same degree of caution as encounters with larger mammals (such as fox, skunk, or coyote). People are more likely to attempt to handle a wild bat. Rabid bats are more prone to daytime activity, lying on the ground, and are generally less likely to flee at the approach of humans. These types of behaviors are not always present in rabid bats, but they do increase the potential for human encounters. This is particularly true when it comes to children, who are naturally curious.

If direct physical contact with a wild bat (as in 3.a – 3.f) does occur, wash the exposed area with soap and water immediately. Follow up with a medical doctor as soon as possible.

Minimize the Risk

Minimize the risk of contracting rabies from bats and take appropriate action when exposure does occur.

1. Educate children on the importance of never touching a bat or any wild animal, and emphasize the need to contact an adult if a bat is discovered in a school environment or on the ground at home.

2. **Do not** contact the bat with your bare skin. If a situation requires contact with the bat (such as removal from indoors or capture for rabies testing), wear thick gloves, long sleeves, and minimize handling.
3. Carefully avoid the following means of rabies exposure:
 - a. A bat coming into contact with a person's mucous membranes (eyes, mouth, nose).
 - b. Bat, or bat secretions, contacting a person's open wounds or mucous membranes.
 - c. Human contact with bat saliva, brain or spinal cord tissue.
 - d. A bite or scratch from a bat.
 - e. Unsupervised children around bats.
 - f. A bat in the room with a child or adult who is asleep, unconscious, sensory-impaired, or incapacitated.
4. If it is safe to do so, contain the bat (as explained here in the section "Bats Indoors") and submit it for rabies testing to the Arizona State Laboratory (Arizona Department of Health Services). Other situations in which a rabies test would be suggested include when a pet or other domestic mammal encounters a sick or dead bat on the ground.
5. If you cannot safely containerize a bat found in a structure, cordon off the area so the bat cannot gain further access to the interior (e.g. close doors, etc., leading into the interior) and immediately contact your city or county Animal Control Department for assistance. County Animal Control offices in Arizona:
 - Apache County Sheriff's Office----- (928) 337-4321
 - Cochise County Animal Control----- (520) 432-9500
 - Coconino County Animal Management
----- (928) 679-8576
 - Gila County Rabies and
Animal Control ----- (928) 468-1216
 - Graham County Animal Control----- (928) 348-6676
 - Greenlee Animal Control----- (928) 865-2720
 - La Paz Country Animal Control----- (928) 669-8774
 - Maricopa County Rabies and Animal Control
----- (602) 506-2738
 - Mohave County Animal Control----- (928) 753-2727
 - Navajo County Animal Contro
----- (928) 524-4750, ext. 15
 - Pima County Animal Control----- (520) 743-7550
 - Pinal County Animal Care and Control
----- (520) 866-7600
 - Santa Cruz County Animal Control
----- (520) 761-7860
 - Yavapai County Animal Control----- (928) 567-6238
 - Yuma County: Humane Society of Yuma
----- (928) 782-1621, ext. 106

For a more comprehensive list of animal control resources, go to the Arizona Department of Health Services rabies website (<http://azdhs.gov/phs/oids/vector/rabies> and see the Resources section). You can also call your local law enforcement agency for assistance in locating the animal control agency for your area.

6. In cases of human *exposure or suspected exposure* to a bat, rabies vaccinations are necessary for a person when:
 - a. The captured bat tests positive for rabies.
 - b. The bat was unable to be captured for rabies testing to verify it is not rabid.
7. In the event of a dog or cat exposure to a bat that is unavailable for testing or is positive for rabies, the following will be required:
 - a. If currently vaccinated for rabies: a rabies vaccination booster and 45 day observation at home.
 - b. If not currently vaccinated for rabies: a six month quarantine at an animal control or veterinary facility, at the expense of the owner.
8. **VACCINATE PET DOGS, CATS, AND FERRETS. THE RABIES VACCINATION IS INEXPENSIVE AND SAFEGUARDS YOUR PETS AND FAMILY.**

To locate the nearest rabies testing lab, contact the Arizona State Department of Health, Zoonotic and Vector-Borne Diseases Division (602) 364-4562. If you have not received pre-vaccination for rabies and are not a trained professional in bat removal, **DO NOT** attempt to remove or manage bat colonies found in a structure. If action must be taken, call a licensed wildlife professional or your local animal control as listed above.

Not a Potential Bat Rabies Exposure

Bat rabies exposure is less likely in the following situations:

- A coherent, awake adult simply in the vicinity of a rabid bat;
- Touching an object that has had contact with a rabid animal does not constitute an exposure, **UNLESS** saliva or central nervous system (brain or spinal cord) tissue or fluid from the animal contacted a person's fresh wound or mucous membrane.

Bats submitted for rabies testing must be euthanized. You can lessen your risk of rabies exposure and also save a bat's life simply by avoiding contact with wild bats.

Bat Houses

Bats are the number one predator of nighttime flying insects. Bat houses encourage bats to roost *away* from buildings, while still remaining in the area to provide valuable pest control and pollination. The installation of an **off-site** bat house may help reduce the use of structures for roosting and therefore encounters with humans. Bat houses also provide learning opportunities for students and homeowners by demonstrating how wildlife can be accommodated in our urban environments.

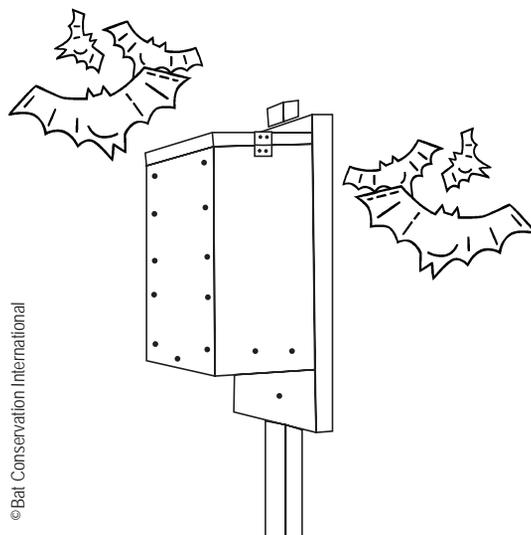


Figure 7. Example of a standard bat house.

Contact the Arizona Game and Fish Department office to see if free bat houses are available and appropriate for your area. You can even monitor your bat house to help state biologists determine how to make these structures more effective. Bat house construction steps are also available online at Bat Conservation International (*see section "Resources"*).

We **do not** recommend the installation of bat houses or boxes on school or child care grounds.



A large bat house on the grounds at the University of Florida educates visitors and residents alike. It houses more than ten thousand Brazilian Free-tailed bats, a southeast species which commonly attempts to roost in urban structures.

A NOTE OF CAUTION FOR SCHOOLS:

Bat boxes are not recommended for most schools. Schools with established bat houses should have an assertive bat and rabies education and awareness program. Bat boxes should be located in a fenced in area, remote to the school buildings, with no access by children to the ground underneath the bat box.

Bats are wild animals, which are capable of contracting rabies and transmitting this deadly virus to humans through contact.

Students and staff should be aware of the presence and benefits of bats, but cautioned to

NEVER ATTEMPT TO TOUCH OR HANDLE A LIVE OR DEAD WILD ANIMAL.



A Pallid bat eating a scorpion. Pallid bats are known for their consumption of ground-dwelling arthropods. They eat up to half their weight (about half a pound) each night.

Bats provide valuable pest control and are an important part of the natural environment. But as with any wild animal, bats should be respected. Encounters with these animals in structures should be dealt with using correct procedures as discussed here. This will ensure your safety as well as support bat conservation.

Resources

Information on bat biology and management

The ADHS "Bats and Rabies at Schools" website:
<http://www.azdhs.gov/batsatschools/>

- Arizona Game and Fish Department bat conservation website: http://www.azgfd.gov/w_c/bat_conservation.shtml
- Arizona Department of Health Services, Vector Borne and Zoonotic Disease, rabies information website: <http://azdhs.gov/phs/oids/vector/rabies>
- Bat Conservation International, Inc. <http://www.batcon.org/>
- Wildlife Control Supplies: <http://www.wildlifecontrolsupplies.com/>

Rabies testing

- Arizona Department of Health Services, Arizona State Health Laboratory (virology section). Rabies testing and animal submission information. <http://www.azdhs.gov/phs/oids/vector/rabies/> Bats have been documented to survive rabies infection. The only way of telling whether or not a bat has rabies is by testing the bat.
- Arizona Game and Fish Department. Ask to speak with a bat biologist or Wildlife Center Coordinator (623) 582-9806. Contact this number ONLY for help in evaluating whether a bat is sick.

Wildlife control and regulation

- Arizona Department of Agriculture. State licensing information for businesses, all forms of pest control (including wild animals), etc. 1-602-255-3664, or <http://www.sb.state.az.us/>
- Arizona Animal Control and Wildlife Removal. <http://www.aanimalcontrol.com/professional-trapper/state/Arizona.htm>

References

Arizona Department of Health Services, Vector Borne and Zoonotic Disease. Rabies in the United States and Arizona. <http://azdhs.gov/phs/oids/vector/rabies/>

Bat Conservation and Management: Mammal Abstracts, Distribution Maps and Illustrations. Arizona Game & Fish Department. http://www.azgfd.gov/w_c/bat_conserv_az_bats.shtml

Bat Conservation International. <http://www.batcon.org/home/default.asp>

Guidelines for Bat Related Calls. Arizona Game and Fish Department, Bat Conservation Project. October 2007. http://www.azgfd.gov/w_c/bat_conservation.shtml

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U.S. Centers for Disease Control and Prevention. Bats and Rabies. <http://www.cdc.gov/rabies/bats.html>

U.S. Centers for Disease Control and Prevention, Division of Foodborne, Bacterial and Mycotic Diseases: http://www.cdc.gov/nczved/dfbmd/disease_listing/histoplasmosis_gi.html

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Antrozous pallidus, pallid bat. A pallid bat is perched on a rock.



Tadarida brasiliensis, Mexican free-tailed bat. A mother Mexican free-tailed bat rests with her newborn baby in Ney Cave, Texas.



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Tadarida, brasiliensis, Mexican free-tailed bat. Mexican free-tailed bats emerge at sunset from the Frio Cave in Texas.



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