



BATS

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Introduction

Bats are mammals of the order Chiroptera (Latin for “hand-wing”), making them the only mammals naturally capable of true and sustained flight. Bats are the second largest order of mammals (after the rodents), with about 1,240 species of bats worldwide. About 70% of bat species are insectivores. They provide valuable pest management service to our cities and natural areas through the predation of nighttime flying insects, including adult mosquitoes. Most of the rest are fruit eaters: some bats are important pollinators and make it possible for us to harvest certain fruits and flowers. A few species feed on animals other than insects, such as the vampire bats that feed on blood.

Arizona has an amazing diversity of bats with at least 28 species representing four families. They can be found statewide, in all habitats including: desert, grassland, woodland, and urban habitats. The smallest bat, Western pipistrelle (*Parastrellus hesperus*), also known as the canyon bat, measures only 2.5 inches long; while the largest bat, Western mastiff (*Eumops perotis californicus*), is up to 7.5 inches long. As the human population in Arizona increases, so does the wildland / urban interface. This leads to increased human encounters with wild bats.

This document provides a general overview of bat biology and behavior with emphasis on urban environments, use of integrated pest management (IPM) techniques that are in keeping with bat conservation guidelines, and disease awareness and prevention efforts. A more detailed description for each of Arizona bat species is available within the Arizona Game and Fish Department bat conservation web pages: http://www.gf.state.az.us/w_c/bat_conservation.shtml.

Biology and Behavior of Bats

Echolocation

Bats are not blind. In fact they can see almost as well as humans. However, most bats use “echolocation” to help them find prey, shelter, etc., during their nighttime activities (Figure 1). 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.

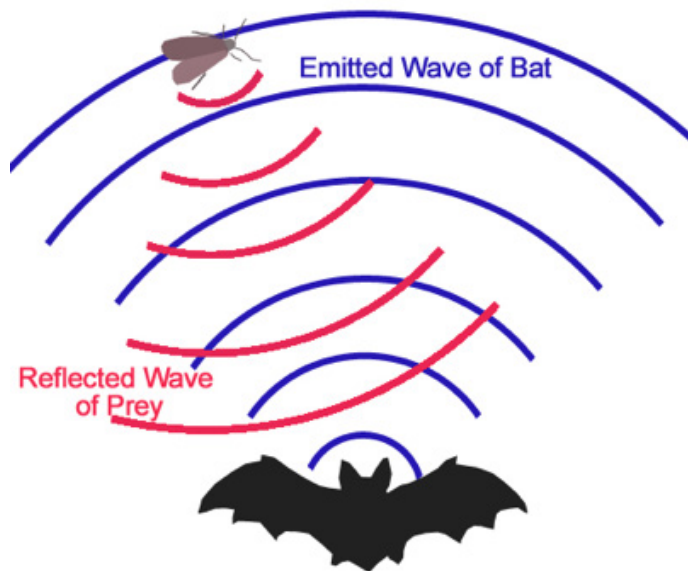


Figure 1. Bats rely on echolocation to reveal the position of objects, including prey. Image by Shung.

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 can be used to convert the higher frequency vocalizations emitted by bats to within range of our hearing abilities. To hear an example of this, visit <http://news.sciencemag.org/plants-animals/2014/06/listen-bats-sing>.

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.

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 1,240 species). In Arizona there are bats that feed on a variety of insects and other arthropods (“insectivores”), and those that feed on pollen and nectar (“nectivores”).

“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>

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 yerbabuenae* (an endangered species), and the Mexican long-tongued bat, *Choeronycteris mexicana*. These bats give birth and raise their young in southern Arizona from early spring through summer. In the fall, they migrate south to overwinter 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. Their diet is supplemented by the many hummingbird feeders in southern Arizona that are “robbed” each night by these hungry bats.

Life Cycle

There is a great 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 few species 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 sometimes 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! 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.

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.

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 (Hinman and Snow, 2003). Throughout Arizona solitary tree-roosting species may overwinter in tree cavities, cliff face cavities, abandoned buildings and attics. Depending where the bats are located in Arizona, their hibernation period may be very short, whereas others may enter a hibernation state for several months during which their body uses fat reserves very sparingly (Hinman and Snow, 2003). 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.

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.

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.

White-Nose Syndrome (WNS)

White-Nose Syndrome (WNS) is an emerging disease affecting hibernating bats, and is named WNS because the white fungus infects the skin of the muzzle, ears, wings and other parts of bats. First documented in New York in the



Figure 2. Little brown bat with white-nose syndrome in Greeley Mine, Vermont, March 26, 2009. Photo by Marvin Moriarty/USFWS.

winter of 2006-2007, WNS has spread from the northeastern to the central United States at an alarming rate. Millions of bats in 25 U.S. states and 5 Canadian provinces have died from this devastating disease.

WNS causes bats to awaken more often during hibernation and use up the stored fat reserves that are needed to get them through the winter. Infected bats often emerge too soon from hibernation and are often seen flying around during winter. These bats usually freeze or starve to death.

Symptoms of WNS can include a visible white fungal growth on the bat’s muzzle and/or wing tissue (Figure 2), but this is not a completely reliable indicator. In the eastern U.S., infected bats may display abnormal behaviors in their hibernation sites (hibernacula), such as movement toward the mouth of caves and daytime flights during winter. These abnormal behaviors may contribute to the untimely consumption of stored fat reserves causing emaciation, a characteristic documented in a portion of the bats that die from WNS. Western bats behave differently and may not exhibit the same behaviors.

WNS has not been found in Arizona yet, but could exist in the deeper cooler caves in higher elevations in the state. Report suspected WNS observations to the Arizona Game and Fish Department, the U.S. Fish and Wildlife Service or the USGS National Wildlife Health Center.

Roosting Behavior

Bats use roosts for different reasons based on the time of day and year. Roost types include the day roost, night roost, maternity roost, bachelor 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 feet above ground, and can be as many as 30 miles away from foraging grounds and water sources. At night, however, bats feed and roost intermittently so they choose roosts that are in convenient proximity to their foraging grounds. The purpose of night roosts includes socializing, digesting food, and resting. Trees, barns, and ramadas 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.

Some bats will aggregate seasonally to form maternity colonies in spring (the largest groupings of bats). In all types of roosts, bats seek dark, climate-controlled environments (Table 1). Females will select a maternity roost based on high temperature conditions: upper 70s to 95 degree 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”)

Table 1.

Common locations for maternity colonies (spring to fall)	
Natural or rural environments	Urban environments
Caves	Attics
Cavities and crevices created in trees and saguaro cacti	Barns and sheds
Mines	Bridges
Palm tree fronds	Culverts
Rock crevices	Palm fronds
Tree foliage	Roofing tiles
	Tunnels

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 organism including plants and animals. IPM draws on simple and effective principles to address the source of pest problems and prevent them from recurring. IPM techniques include education, inspection, monitoring, structural exclusion, sanitation, and modification of cultural practices, among others. While IPM strategies aimed at insect and weed species may involve the use of pesticides, this is **not** an option for bats. When used correctly, IPM techniques help reduce human-bat encounters around homes, schools, and offices, while protecting human health, the environment and bat populations.

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

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.

1. 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.
2. 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.

3. Finally, **inspect buildings** for bat activity at any time of year, especially prior to any maintenance or exclusion activities. Note entry/exit points that need sealing outside of maternity season.

Exclusion is closing gaps and sealing holes to prevent bats from entering or reentering a structure; eviction is using one-way doors and exits to remove bats from a structure as they leave.

Inspections: What to Look For and When

Please Note: It is against Arizona state law to practice pest management practices 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 the Arizona Administrative Code R12-4-421. For further information on the Wildlife Service License, please visit the Arizona Game and Fish Department website at: <https://azgfdportal.az.gov/license/speciallicense/wildlifeservice>. 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) (Figure 3). Rub marks are dark or oily smudges where body oils rub off, and may look similar to those left by mice and rats along frequently traveled pathways.




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 is friable if rubbed gently with gloved hands. In the case of insectivorous bats, the guano consists almost entirely of arthropod



Figure 3. A bat colony will often leave stains at entry/exit points. Photo by Nancy Renison.

(insects, arachnids, etc.) fragments; a flashlight will illuminate the shiny exoskeleton pieces. Presence of guano is often a direct indication that bats are roosting or emerging from an area directly above.

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 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.

Evening Inspections

Begin inspection at dusk and continue after dark.





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 Note bat activity overhead, bats that appear to enter or exit the building, and any exploitable openings that can be seen with a flashlight (Figure 4).
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 Be alert for activity underneath building tiles or roofing sheets.
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 Wear gloves and use a flashlight to thoroughly inspect the interior of a potential roost for bat activity.
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 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. There are ways to discourage night roosting bats – when they appear seasonally, it is typically short term, but night roosting can also be a longer-term issue that homeowners want addressed. Mylar strips, creating a false ceiling with netting, or turning a fan on to create airflow, are a few ways to discourage bats from areas.



Figure 4. Inspect the buildings for entry points and roosting areas (@Bat Conservation International).

Exclusion Maintenance

*Exclusions should be done outside of the maternity season only: November through January are the safest months, 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 childcare 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.*

Unless there is an imminent public health threat, do not attempt to exclude bats during the maternity season, which begins as early as February in some parts of Arizona and may run as late as October for some species (Western Bat Working Group Species Accounts, <http://wbwg.org/western-bat-species/>). 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. **Obtain detailed information from the homeowner. Perform a day or night inspection** of the building first (as explained above).
2. **Begin exclusion maintenance after sunset** to minimize an encounter with a bat.



Figure 5. A one-way cover over holes allows bats to leave a structure but keeps them from getting back in. Photo by Nancy Renison.

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 installed by hanging a lightweight wire screen (1/6" mesh or smaller) or hardware cloth over the hole, crack, etc. (Figure 5).

Leave the bottom and sides of the material unsecured. Any hidden bats will crawl out, but will be unable to re-enter. 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 instructions on how to install exclusion devices from Figs. 6-10 on this website: <http://wdfw.wa.gov/living/bats.html>).

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 – if possible – 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 high spots, and if they cannot access the upper recesses of a potential roost they will likely go elsewhere.

7. **For help or advice** about excluding bats from your house or property, contact the Arizona Game and Fish Department, or other 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 information).

8. **Install one or more off-site bat houses** to offset displacing the bats. Bat houses are most successful in upper elevations in Arizona 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").

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 building exterior should follow to determine whether additional bats are using the building. If possible (and if there has been no human or pet exposure to the bat), open doors and try to get the bat to fly out.

Steps to capturing a bat indoors (Figure 6):

1. Wear thick gloves; never attempt to handle a bat with your bare hands.
2. Locate and isolate the bat by closing all windows and doors, and turning on the lights.

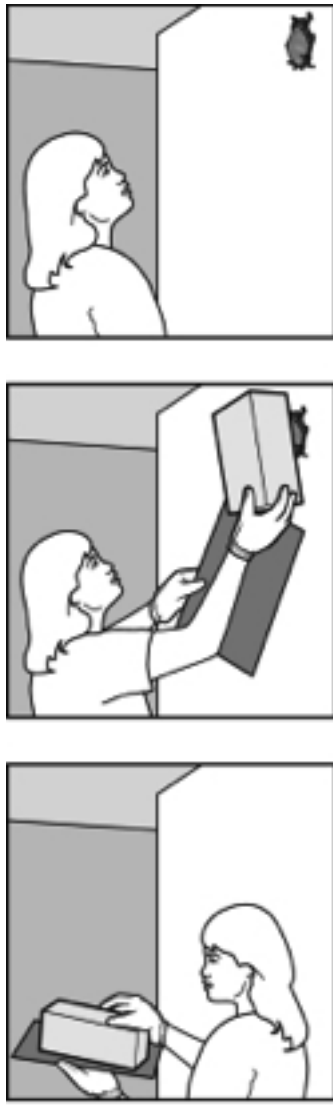


Figure 6. Capturing a bat indoors can be as simple as “boxing a bat” (@ Bat Conservation International).

3. Wait for the bat to land and settle (this may take 15 minutes to an hour).
4. Use a coffee can, shoebox, or similar container to cover the bat.
5. 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 bare 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.

If a human 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 unprotected 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, scratch 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.

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.

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 called histoplasmosis, typically associated with guano accumulation in humid caves. 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. When guano droppings are scattered or in small piles around outside porches, use common sense hygienic clean-up methods (and small amounts can simply be swept into yard – oftentimes callers are overly concerned about the health risks of a few droppings on a porch, when they can safely just be swept away).

Steps for safely cleaning enclosed spaces 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.
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 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 them 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 disease caused by a virus that attacks the nervous system. It is transmitted by direct contact with infected host 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. Bats are increasingly implicated as important wildlife reservoirs for variants of the rabies virus transmitted to humans. Recent data suggest that transmission of rabies virus can occur from minor, seemingly unimportant, or unrecognized bites from bats. Human and domestic animal contact with bats should be minimized, and bats should never be handled by untrained and unvaccinated persons or be kept as pets. For further information on rabies, please visit <http://www.cdc.gov/rabies/exposure/animals/bats.html>.

As the wildland/urban interface grows, so do encounters with wild bats in our homes, offices, and schools. Encounters with bats are interesting 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 preventable – avoid handling bats with ungloved hands and teach children that bats are wildlife and should never be touched, if found on the ground, children should be encouraged to report the find without investigating in person. Good management of buildings helps to keep bats outside and pet vaccination is legally required. 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; a bat on the ground or low on the wall is abnormal behavior for the bat and may be an indication it is sick. Rabid bats are

more prone to daytime activity, lying on the ground, and are generally less likely to flee at the approach of a human. A healthy bat would rarely be in a position where it could be picked up. The behaviors described are not always present in rabid bats, but they do increase the potential for human encounters with sick bats. This is particularly true when it comes to children, who are naturally curious and want to touch.

Rabies symptoms in bats vary greatly, from pronounced to unnoticeable. Bats may be unable to fly or may fly during daylight hours, they may be lethargic, paralyzed, or die.

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 chance of being infected with rabies.

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 on the ground in a school, childcare facility, home, or park.

Teaching Children about Bats: Children need to be shown what a real bat looks like, since most people have only seen bats either in cartoons or flying in the air from a distance at dusk. When a bat is on the ground, it is difficult for both children and adults to recognize it as a bat, because the wings may be folded inward. Children should be taught to not touch a bat and to immediately tell an adult. Adults should know the safe way of dealing with grounded bats found where they pose a hazard.

2. Do not contact the bat with your bare skin. If a situation requires contact with the bat (such as removal from the ground, indoors or capture for rabies testing), wear thick gloves, long sleeves, and minimize handling.
3. Carefully avoid the following rabies exposure routes:
 - 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, physically limited, or incapacitated.

If direct physical contact with a wild bat (as in 3.a – 3.f above) does occur, wash the exposed area with soap and water immediately.

Follow up with a medical doctor as soon as possible.

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 with 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...
(928) 432-9500
- Coconino County Animal Management
(928) 226-2717
- Gila County Rabies and Animal Control...
(928) 425-5882
- Graham County Animal Control...
(928) 348-6676
- Greenlee Animal Control...
(928) 865-2720
- La Paz County Animal Control...
(928) 669-8774
- Maricopa County Animal Care and Control...
(602) 506-7387
- Mohave County Sheriff’s Office...
(928) 753-0753
- Navajo County Animal Care and Control...
(928) 524-4266, ext. 15
- Pima County Animal Care Center...
(520) 243-5900
- Pinal County Animal Care and Control...
(520) 866-7609
- Santa Cruz County Animal Control...
(520) 761-7860
- Yavapai County Animal Control...
(928) 771-3294
- 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://www.azdhs.gov/phs/oids/vector/rabies/animalcontrol.htm> 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.

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 (Figure 7). The installation of an off-site bat house may help reduce the use of structures for roosting and

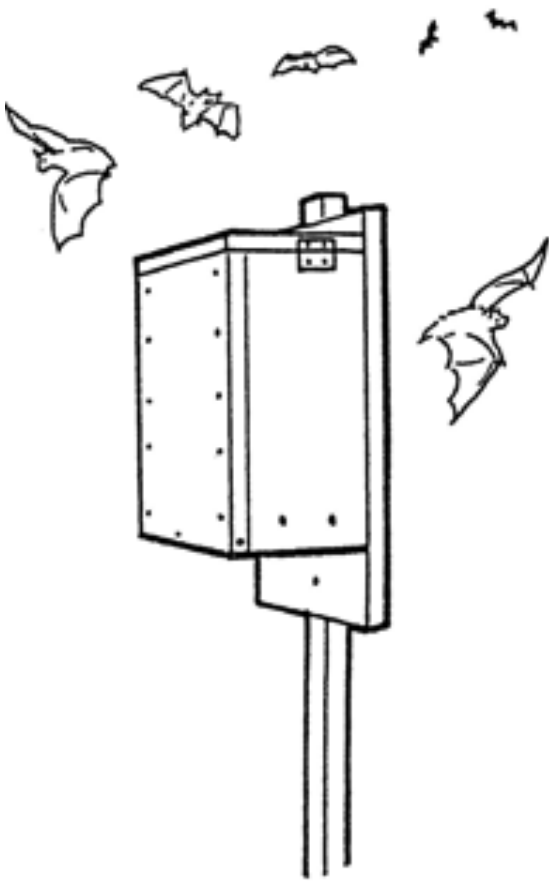


Figure 7. An example of a standard bat house. Image from “Building a Bat House” (www.fs.usda.gov).

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.

Bat houses are available from on-line retailers and may be 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 childcare grounds.

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 efforts.

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. If established bat colonies exist on school grounds or surrounding areas, the campus should have an assertive bat and rabies education and awareness program.

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.


Resources

Information on bat biology and management


-  The ADHS “Bats and Rabies at Schools” website: <http://www.azdhs.gov/phs/oids/vector/rabies/bats-at-schools/index.htm>
-  Arizona Game and Fish Department bat conservation website: http://www.gf.state.az.us/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/>
-  USDA NRCS Natural Resources Conservation Service, Wildlife Habitat Management Institute, Fish and Wildlife Habitat Management Leaflet, 1999. Number 5. Bats (Order Chiroptera).
-  Hinman, K.E. and T.K. Snow, eds. 2003. Arizona Bat Conservation Strategic Plan. Nongame and Endangered Wildlife Program Technical Report 213. Arizona Game and Fish Department, Phoenix, AZ.


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.aaanimalcontrol.com/professional-trapper/state/Arizona.htm>

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U.S. Centers for Disease Control and Prevention, Division of Foodborne, Bacterial and Mycotic Diseases: <http://www.cdc.gov/ncezid/dfwed/>

Acknowledgments

We thank the following individuals for critical review and contributions in this document: Nancy Renison, Arizona Game and Fish (Retired); Elizabeth Lawaczek, Director of Public Health at Ouray County, CO; Jennifer Snyder, Integrated Plant Protection Center, Oregon State University; Carl A. Olson, Department of Entomology, University of Arizona; Ronnie Sidner, Department of Ecology and Evolutionary Biology, University of Arizona; Holly Ober, North Florida Research and Education Center, University of Florida; Craig Levy, Arizona Department of Health Services; Angela McIntire, Arizona Game and Fish Department.

This material is based upon work that is supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the authors and do not necessarily reflect the view of the U.S. Department of Agriculture.



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Issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Jeffrey C. Silvertooth, Associate Dean & Director, Extension & Economic Development, College of Agriculture Life Sciences, The University of Arizona.

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