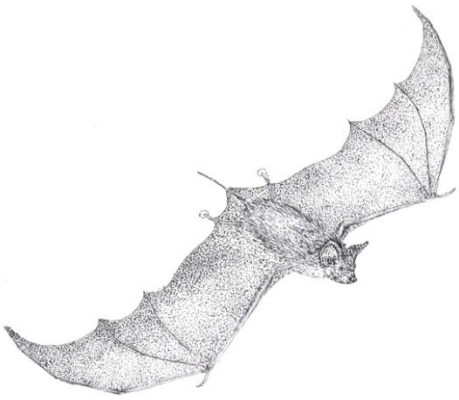
*BIOLOGY, LEGAL STATUS, CONTROL MATERIALS, AND DIRECTIONS FOR USE*

## Bats

**Families: Phyllostomatidae, Vespertilionidae, and Molossidae**



**Introduction:** Bats are one of the least studied and most misunderstood of mammals. They are considered to be among the most beneficially influential mammal species to humans, plants, and other wildlife.

Bats (order Chiroptera) are the second largest order of mammals in the world, and the only mammal capable of true flight (Depaepe and Schmidt 1994). There are nearly 925 species of bat known worldwide representing 25% of all species of mammals on earth. Some bat species have been in serious decline worldwide, mostly from shrinking habitat. Despite this bats hold critical importance in consuming insect pests, pollination and seed dispersal. In addition to their contribution to biodiversity, bats can play important roles in ecosystems and provide some economic benefits as consumers of agricultural and forest pest insects. Bats serve as pollinators and seed dispersers in deserts of the southwestern U.S. (see Fleming et al. 2003)

TABLE 3.

*Five species of bats that commonly form colonies or roosts in man-made structures in California*

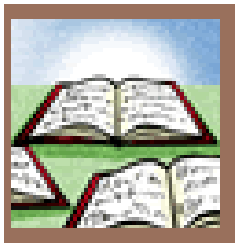
| NAME | WINGSPREAD | DESCRIPTION |
|---|---|---|
| big brown bat *(Eptesicus fuscus)* | 13–14 in (33.0–35.6 cm) | One of the largest bats found in buildings. Most are copper-colored. Each hair is bicolored: the basal half is blackish, the outer half brown. |
| little brown myotis *(Myotis lucifugus)* | 8.9–10.8 in (22.6–27.4 cm) | Fur is dense, fine, glossy, and rich brown in color. Ears and membranes are glossy dark brown. Of all small brown bat species, this is the one most often found in buildings. |
| Mexican free-tailed bat *(Tadarida brasiliensis)* | 11.3–13 in (28.7–33.0 cm) | A rather small bat with long, narrow wings, best identified by tail, which extends well beyond tail membrane. |
| pallid bat *(Antrozous pallidus)* | 13–14 in (33.0–35.6 cm) | A large bat with big eyes, ears, and broad wings. Piglike snout is distinctive. Hairs above are light yellow and tipped with brown or gray. Underparts are pale creamy color. Membranes tan. |
| Yuma myotis *(Myotis yumanensis)* | 8.7 in (22.1 cm) | Light tan to dark brown; under parts whitish to buff. Membranes darker than body. |

There are 45 species of bat in the US belonging to 4 different families (NRCS 1999). Of the 24 species of bat identified in California, 5 form colonies or roosts in structures, particularly in older buildings with many openings and gaps. Bats use structures to replace lost natural habitat. The health risk posed by bats to humans is low, but rabies is a concern that must be understood. In California all bats are insect foragers. The so called 'vampire' bat

which feeds on blood is not found in California. Where bat removal is necessary; non lethal methods can be very effective.

**Identification:** Bats are the only mammals that truly fly. They are nocturnal and live or roost during the daytime in tree foliage, cavities, under loose bark, in caves and crevices and consequently in structures, usually in older buildings, where there are many openings and gaps through which they can enter.

Bats are distinctive in appearance; looking like small rodents with webbed membrane wings. Their bodies are fur covered. They use sonar-like echolocation to navigate and hunt for food during nighttime hours.



**Legal Status:** Bats are subject to specific legislation. According to the USFWS of the 45 species of bat found in the US, 6 are on the endangered species list. Research and familiarity with appropriate Federal and State laws should be conducted before undertaking any nuisance management activities.

In California bats are classified as nongame mammals by the California Fish and Game Code. Nongame mammals which are found to be injuring growing crops or other property may be taken by the owner or tenant of the premises.

They may also be taken by officers or employees of the California Department of Food and Agriculture or by federal or county officers or employees when acting in their official capacities pursuant to the provisions of the Food and Agricultural Code pertaining to pests.

**Damage:** Unlike rodents, bats are not known to gnaw. Consequently, damage is limited to their physical presence and other nuisance activities. When present in and on buildings, bats can have several negative economic and aesthetic effects, as well as public health consequences (Frantz 1988).

Bats inhabiting buildings produce offensive odors and distracting noise. Bats can carry rabies. Transmission occurs when bitten by an infected bat; there is evidence that exposure of abraded skin to bat urine, or even inhalation of cave air may occur. At least eight of the 24 species in California are known to carry rabies. Being bitten by a bat is unlikely unless you are handling or otherwise disturbing bats.

Over time bat entryways to structures often have a smooth, polished appearance and this is due to oils from fur mixed with dust and other bodily fluids, as the bats pass repeatedly. This is usually an indication of heavy bat usage. There may also be staining at the entry which is slightly sticky, with bat hairs, and

yellow to blackish brown in color (Greenhill & Frantz 1986).

Noise can be a problem where large bat colonies are present. Bats make noise while at roost particularly on hot days in attics or similar spaces (Greenhill and Frantz 1986). Be aware that rustling sounds in walls and chimneys may also indicate the presence of other pests such as birds, raccoons, rats, mice or squirrels.

Guano and urine are problems encountered where bats roost inside buildings or other spaces. Sanitation can become an issue.

Brown bats are reservoir hosts for encephalitis which may also be transmitted to humans by mosquito's. Encephalitis can cause death, spasticity or mental retardation. Histoplasmosis, a systemic fungus disease of man, may be contracted by inhalation of dusty bat manure containing air-borne spores of the fungus.

When removing guano it is recommended that mesh respirators be used (Tuttle 1988). Hanks 1991 states that a professional bat excluder once removed 5000lbs of guano from a 19th century building. Guano is sometimes used as a fertilizer.

Other damage caused by bats is in the variety of nuisance complaints. Often grounded in myth and with no foundation historically people have objected to bats.

**Range:** The California myotis bat and the big brown bat are found throughout the state except in the high mountain zones. The hoary bat, the silver-haired bat, and the red bat migrate to the coast in winter, but other species are permanent residents. The other 22 bats found in California occupy various portions of the State, with considerable overlap of distribution. Find the ranges of the common bats roosting in structures in California through the following links.

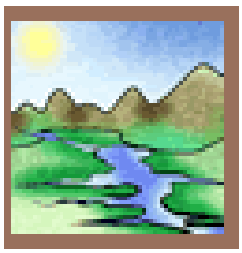
Big Brown Bat

California Myotis

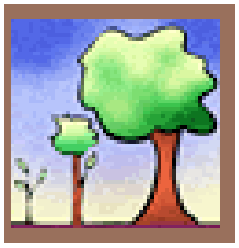
Hoary Bat

Silver-Haired Bat

Western Red Bat



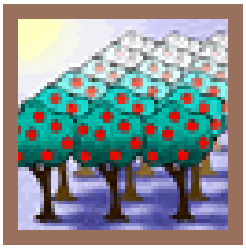
**Habitat:** All of the above bats are nocturnal, roosting in crevices, caves, tunnels, tree foliage or buildings during the day. Some species have a separate night roost to which they retire between feeding flights. Some species are more particular about the kind of roost they select than others; many hibernate in caves in winter, and may move from one cave to another several times. The most stationary species may inhabit the same roost throughout the year.



**Biology:** Bats are the only mammals which are true flyers, as opposed to gliders such as flying squirrels. Some bats migrate one thousand miles each way - these species are thought to have originally colonized the Hawaiian and Galapagos Islands.

Bats rely on reflection of high-pitched squeaks they emit to avoid collisions and to determine location of prey. Most bats live almost totally on insects captured and eaten on the wing, though two Southern California bats eat nectar, pollen and fruit as well. Bats in other parts of the world include blood eating vampires, small-fish catchers, day flyers, and large fruit eater ("flying foxes") with wingspans over five feet. Vampires and some mastiff bats can fold their wings and run about on all fours. Bats hang upside down when resting and many species conserve energy during the day by lowering body temperature (and hence metabolism) to near that of the surrounding air. Many bats hibernate in winter by a similar process.

Reproductive information on many bat species is limited. Generally, breeding occurs in autumn before hibernation, or at the winter roost, depending on the species. Mature males are recognizable at this time by the swelling of the testes in the abdomen. Ovulation occurs after winter dormancy is over, at which time the stored sperm fertilizes the egg. The young (usually only one or two, though a few species bear up to four) are born two to three months later, in May to July. The young are born naked and many cling to their mother for some time after birth; no nest is ever built. The young are able to fly at three to four weeks though some continue to nurse for several weeks longer. In many species the adults segregate when the young are born; each male lives alone through the summer while the females remain together. Most species of bats are colonial but some are solitary; both conditions may occur in some species. Bats have few enemies (owls, snakes). Bats have a lifespan up to 20 years.



**Damage Prevention and Control Methods**

**Exclusion:** The only permanent way to prevent bats from roosting in buildings is to physically exclude their entry. Bats are capable of entering openings as small as 3/8 inch. A careful inspection needs to be taken of any building suspected of containing them. It is recommended that if bats are suspected, two inspections are completed, one in daylight and one when it is dark.

When conducting the inspections look for loose flashing, vents, shingles, or siding; openings under eaves, corniches, louvers and doors, and cracks around windows, chimneys, outlet boxes or where piping/electrical wiring enters the structure. During the day, openings in dark enclosed areas such as attics may be detected more easily by light shining through the opening.

The best time for a nighttime inspection is a ½ hour before dusk, and for the following hour as this is when bats are likely to emerge.

Bat proofing (exclusion) is generally best undertaken during late fall, winter, or early spring when roost areas are naturally empty (Depaepe & Schmidt 1994). This approach avoids those periods when young and newly born bats are present. Certainly avoid mid May to mid August as this is when newly born bats are most likely to be present. It is important to note that trapped bats are likely to create unpleasant odors inside a building and may even crawl away from the roost and potentially bite children or pets who attempt to pick them up. Bat proofing may require use of a ladder and other devices. If you are unsure about how to proceed contact a professional pest control operator.

**Sealing:** Many materials can be used to seal access points, since bats do not gnaw like rodents. The following is a list of suggested materials and are discussed further later:

- Caulking, putty, duct tape, silicone, and other cements for cracks, holes and crevices
- Self expanding polyurethane foam for cracks etc
- Weather stripping for doors and windows
- Door sweeps under doors
- Flashing where joints occur in buildings
- Hardware cloth (¼ inch mesh), window screening, plastic bird netting (¼ inch mesh).
- Insulation for blowing into wall and roof spaces
- Rags, cotton, newspaper, and tape for temporary seals.

Two favored bat proofing techniques are suggested. One is a primarily nighttime activity. The second can be conducted during daylight hours.

1. Wait until early evening and watch for bats departing from your structure. Then seal all access points, including any principal openings. The following evening 'unplug' several major openings to allow any remaining bats to escape. Then reseal these openings before any bats return. Repeat this routine for several nights and if any bats are seen or heard within the structure release them.

2. An alternative method which can be done entirely during daylight is to plug all principal openings and install on them a device that acts as a one way exit point for any remaining bats. This device is relatively easy to construct and consists of a rigid 2 inch plastic pipe. At one end of the pipe attach a collapsible pliable tube, use plastic tarp or similar material. Attach the other end of the plastic tube to the principal bat exit point. This will allow bats inside a roost to exit but they are unable to reenter the collapsed end of the pliable tube (Hanks 1994, E. Pierson 1994, Tuttle 1988) also suggest a variation: locate all holes the bats are using and seal, leaving 3 or 4 exits. Next hang some form of

barrier material over the holes, e.g. plastic netting ¼ inch mesh, window screening, or plastic sheeting. Pierson suggests not using fruit tree bird netting as smaller bats can become entangled. Use duct tape or staples to secure the barrier material and allow it to extend 1 to 2 inches above the hole and 12 inch each side and about 1 to 22 feet below the holes. Ensure the barrier hangs loosely since the idea is to allow the bats to crawl below the barrier to fly off. When the bats return, they try to land directly at the hole which the barrier now prevents them from entering. Once again, check nightly to ensure all bats have exited the roost before sealing the holes.

Unlike rodents, bats will not gnaw their way through wood or building materials. Effective materials to exclude bats include caulking, flashing, screening and insulation. Weather stripping, stainless steel wool, or stainless steel rustproof scouring pads are excellent materials to block long, narrow cracks.

**Caulking:** Cracks and crevices develop in a structure as it ages and bats will take advantage of these openings. Caulking will seal the opening. Since wood expands and contracts with weather, it is best to apply the caulking during dry periods when the cracks will be their widest. Occasionally cracks enlarge and filler is necessary before a caulking compound is applied.

There are various caulks which may be applied with a caulking gun. Latex, butyl, and acrylic have a durability of about 5 years and can be painted. Elastomeric types such as silicone rubber and polysulphide rubber will last much longer. They expand and contract with the weather and do not dry or crack. They tolerate temperature extremes very well. Most come in color while others can be painted.

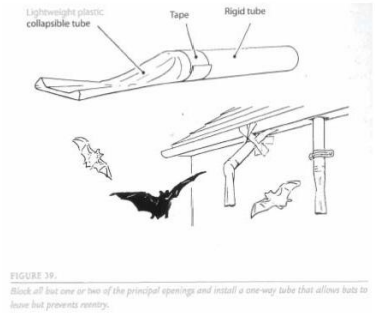


FIGURE 39.
*Block all but one or two of the principal openings and install a one-way tube that allows bats to leave but prevents reentry.*

Self-expanding urethane foams for caulking are available in local hardware stores in pressurized containers, and are dispensed similarly to shaving cream. When the material is placed in a hole, it will expand several times to fill the space. After it cures and hardens, it may be trimmed, sanded, and painted with any type of paint or stain.

**Netting:** Plastic bird netting will exclude bats from buildings. Attach netting with duct tape or staples above the bats entry or exit holes, the net should hang down about 3 feet. Attached weight to the bottom edge of the free-hanging netting to prevent wind from collapsing around the opening used by bats to exit. A 1" to 4" wide wood strip placed parallel to the bats exit hole will allow the net to hang straight down. At dusk the bats will find their way out and do not become entangled in the net. When the bats return at dawn they land on the net, but are unable to find their way around or under the net. After all bats have departed the building the entry and exit holes should be sealed.

**Weather stripping:** Where bats crawl under doors, the space between the floor and the door bottom may be sealed with weather stripping, a draft shield, or a gap stopper to close off the space between the bottom of the door and the door sill or threshold. Weather stripping is made of a variety of materials including natural fibers, aluminum, fine wire, felt, hard rubber, vinyl, and nylon.

**Flashing:** Flashing consists of strips of metal or other material to cover cracks, crevices, and holes. The materials most commonly used are galvanized metal, copper, aluminum, and stainless steel.

**Screening:** Where screening is necessary the openings must be small enough to prevent the access of bats, steel hardware cloth should have 1/4 inch mesh.

Bats may use an unused or old chimney because the rough surfaces of chimney walls offer suitable places

for bats to hang. To prevent bats from entering chimneys, spark arresters or bird screens should be installed. These should be of rust-resistant material and carefully attached. They should completely enclose the flue discharge area and be securely fastened to the top of the chimney. Except when in use, dampers should be closed.

**Insulation:** The use of insulation as a bat repellent was used several years ago when fiberglass insulation was blown into roof and wall spaces occupied by bats. Insulation includes materials made of fiberglass, rock wool, cellulose, urea-based foam, urethane, vermiculite, perlite, polystrene, and extruded polystyrene foam.

Insulation materials are manufactured in a number of forms and types. Each has advantages for specific uses. Materials and methods of application are rapidly changing and improving and no one type seems best for all applications. Effectiveness of this method is not known.

### Habitat Modification

Artificial roosts have been suggested as alternative dwellings for bats that have been excluded from buildings. There is little research to suggest this works. Most people who have tried this approach have had difficulty getting bats to occupy these structures (Salmon et al, 2008). Additionally, artificial roosts may lead to increased numbers of bats in an area where they are unwanted.

### Frightening

Frightening usually involves using sight and/or sound to scare animals away. It is not a recommended control method for bats. Ultrasonic devices that generate sounds are often touted as bat repellents. There is little evidence that these devices work and in some cases evidence that they may actually attract bats (Depaepe & Schmidt 1994).

### Fumigants

Not a recommended control method.

### Repellents

Two methods may alter roost conditions sufficiently to cause bats to leave. First, stringing electric lights for constant illumination may drive bats from roosts because they prefer dark places. Another possible repelling method is the use of electric fans to create breezes aimed at bats in roost. Neither of these methods has been tested for effectiveness.

### Toxic Bait

None registered.

### Trapping

Not recommended as a control method.

### Other Control Methods

There are no natural controls such as diseases or predators that control bats and keep them from roosting in structures.

Reproductive control of bats has drawn research attention as an alternative to anticoagulant treatment. However, tests are not conclusive and further research is necessary (Perez-Rivero et al. 2004).

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