



Massachusetts Homeowner's Guide to Bats



ON THE COVER: A RED BAT PERCHED IN AUTUMN FOLIAGE IS ONE OF SEVERAL SPECIES OF BATS THAT MAKE ANNUAL MIGRATIONS. OTHER SPECIES ARE YEAR ROUND RESIDENTS THAT HIBERNATE IN CAVES, MINES AND BUILDINGS.



LIKE ALL MAMMALS, BATS GIVE BIRTH TO LIVE YOUNG AND NURSE THEM FROM MAMMARY GLANDS. THIS FEMALE HOARY BAT (LEFT) IS CRADLING A PAIR OF TWINS. BATS ARE THE ONLY MAMMALS THAT CAN TRULY FLY, AND AS THIS LITTLE BROWN BAT (TOP) AND BIG BROWN BAT (BELOW) ILLUSTRATE, THEY ARE VERY AGILE AND GRACEFUL IN FLIGHT. THEIR WINGS ARE ACTUALLY MEMBRANES OF SKIN STRETCHED BETWEEN ELONGATED FINGER BONES.



Massachusetts Homeowner's Guide To Bats



Illustrations by Matt Burne, Laszlo Meszoly and Bat Conservation Int'l.

Special thanks to David G. Gabriel, Ellie Horwitz, Thomas W. French, Peter G. Mirick, James E. Cardoza and Gwilym S. Jones, all of whom have contributed to various editions of this publication.

5TH Edition

Bat Conservation International applauds the Mass. Division of Fisheries & Wildlife for producing this booklet and hopes that readers will use this informative guide to better appreciate the many benefits bats provide to natural ecosystems and human economies and to overcome the myths and misinformation that have plagued these invaluable creatures.

— Bob Locke, Bat Conservation International



Massachusetts Division of Fisheries & Wildlife

An Agency of the Massachusetts Department of Fish & Game



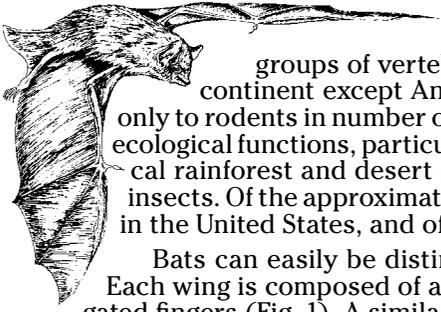
The Sudden and Unexpected Decline of Massachusetts Bats

White-nose Syndrome (WNS) is the descriptive term given to a condition first observed in bats hibernating in a cave near Albany, NY in February 2006. The term comes from the fact that some of the bats with this condition look as if they had dipped their faces in powdered sugar. The white powdery substance on their faces is a fungus. On closer examination, this white fungus can also be seen on their ears. This fungus was described as a newly discovered species in 2009 and named *Geomyces destructans*.

Some species of bats hibernate over the winter, many spending this time in caves. Ordinarily they have enough fat to last them through the winter, and when they emerge in late April and May, there are ample numbers of insects to eat so they can replenish their energy reserves. At caves and mines with WNS however, some of the hibernating bats run out of body fat by early February. They can then be seen flying outside in the daytime in a desperate attempt to find something to eat. Unfortunately, any bat that runs out of body fat too early, or leaves its hibernation site when night-time temperatures still fall below freezing, is doomed. At our largest bat hibernation site in a mine in Chester, MA, there were about 10,000 bats in early winter 2007/08, but by the end of winter 2008/09, nearly every bat had been killed by WNS.

White-nose Syndrome has spread rapidly and has caused a catastrophic mortality of bats that spend the winter in New England caves and mines. By 2009, nearly half a million bats are believed to have died from WNS in NY, VT, NH, MA, CT, NJ, PA, VA and WV. At this point no one knows how to stop or even slow the continuing spread of WNS. No one can predict just how far it will eventually spread or how many bats will die in the process.

To help us better understand WNS, please report observations of bats flying in the winter (January-March) and let us know if you have a summer colony of bats. If you have a summer colony, please report where it is, what kind of place it is in, and about how many bats are in the colony. Your help will be greatly appreciated. Reports of bats flying during winter months and/or on location of summer colonies, may be phoned in to 508-389-6300 or sent to mass.wildlife@state.ma.us.



Bats are among the most numerous and diverse groups of vertebrates inhabiting the planet, occurring on every continent except Antarctica. Among the mammals, they are second only to rodents in number of species worldwide. They perform many critical ecological functions, particularly as pollinators and seed distributors in tropical rainforest and desert ecosystems, and consume immense numbers of insects. Of the approximately 850 species of bats in the world, only 39 occur in the United States, and of those, only nine occur in Massachusetts.

Bats can easily be distinguished from all other animals by their wings. Each wing is composed of a membrane of skin stretched between four elongated fingers (Fig. 1). A similar membrane, called the interfemoral membrane, stretches between the hind limbs and tail of all North American bats. It is supported in part by a flexible spur, called the calcar, on the heel of each hind foot.

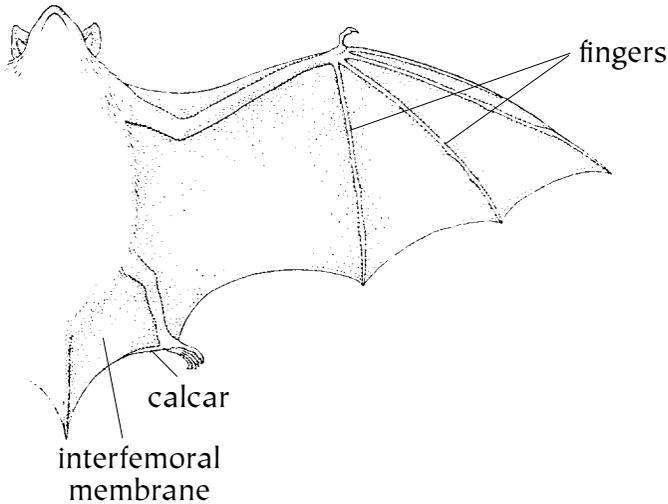


Figure 1. Illustration of a bat showing the four elongated fingers in the wing, the interfemoral membrane, and the calcar. At rest, bats typically hang upside down from the claws on their rear feet.

Natural History

The nine species of bats that live in Massachusetts are all insect eating (insectivorous) bats in the family Vespertilionidae. All are active at night and occasionally at dawn and dusk. They locate their insect prey by means of a “sonar-like” echolocation system. This ability permits them to capture tiny insects and avoid flying into objects in complete darkness. During the winter, when their insect prey is not available, bats either hibernate or migrate to warmer regions farther south.

Beneficial Aspect

Bats are of immense benefit to humankind in that they consume great quantities of noxious insects such as mosquitoes. Dr. Merlin Tuttle of Bat Conservation International reports that the gray bat, which is closely related to several species in Massachusetts, consumes as many as 3,000 small insects in a night. In the Boston area, Dr. Thomas Kunz of Boston University estimates that 14 to 15 tons of insects are consumed each summer by the 50,000 big brown bats that live within the bounds of Route 128. Among vertebrates, bats are the greatest nocturnal predators of flying insects.

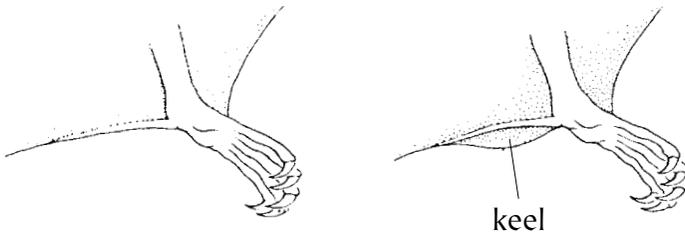


Figure 2. Examples of an unkeeled (left) and keeled (right) calcar on the feet of two bats. This character is important in identifying certain bat species.

Bats in the Home

During the warmer months, most bats found in buildings in the Commonwealth are either little brown bats or big brown bats. Occasionally, the northern long-eared bat may enter buildings; very rarely the eastern pipistrelle will do so. During the winter the big brown bat is the only bat that commonly inhabits buildings.

The presence of any wild animal in a home is an obvious indication that the house is not weather-tight. Finding the site(s) where bats enter the house may be as simple as locating an open chimney flue or cellar hatch, or as difficult as finding a narrow crack between a wall and a chimney or eave. The attention of a carpenter is often required to repair damaged wood or flashing that allows bats to enter a house.

How to Evict a Bat

The discovery of a bat flying through the house can create anything from excitement to hysteria within a family. Fortunately, a single bat can usually be dealt with quite easily. It will **not** become tangled in your hair or attack, although it may flutter by close enough for you to feel the light breeze from its wing tips. The best action is to put away the broom or tennis racket and open a window or door so the bat can fly out. If possible, close off the room containing the bat and open a window in that room. Using its “sonar,” a flying bat will usually circle the room several times until it locates the open window, whereupon it will immediately fly out. If possible, stay in the room with the lights on and watch to be sure the bat leaves. (For some people, leaving the bat alone to find its way out may be the preferred plan.) It is usually only a matter of a few minutes before the bat leaves the house.

A bat that flies into a room and then disappears has probably landed behind a curtain, picture frame or some other nook or cranny. In this event, open the window, turn out the lights, close the door and block the space under the door with towels. If it is nighttime, the bat should find its way out through the window almost immediately; if it is daytime, it will probably leave within an hour after dark. As long as the weather outside is not too cold, this method should do the trick.

A bat that has landed can be assisted out of a house in several ways. If it has landed on a curtain or wall, place a jar or coffee can over the bat. Carefully work the animal into the container, then slip the lid on quickly. A small box, with a sheet of cardboard for a temporary cover, can be used in a similar manner. A bat on the floor can be covered with a towel and picked up within the towel. No species of bat that occurs in Massachusetts can bite through a thick towel.

Another method is to use leather gloves and simply pick up the bat. Do not use thin cotton gloves and **never** pick up a bat with bare hands. Whatever method is used, the bat will open its mouth and squeak loudly when touched. Don't worry. After you have captured the bat, take it outdoors and release it. Do **not** call the local police or fire departments; they have more important duties to perform. Have a neighbor assist if you need moral support.

A Colony in the House

The attic is the area of a house in which bats are most likely to gather in a colony. In the summer, little brown bats and big brown bats commonly use buildings to raise their young. The heat of an attic keeps the babies warm and allows them to grow and develop more rapidly. In late summer, an attic may become too hot for the bats, forcing them into the living quarters as they search for cooler places to roost. On hot summer days, they may be found near the attic door, trying to escape the heat. At such times you might also see them flying around the yard in the daylight. Late summer is also the time of year when young bats are learning to fly. You might find these inexperienced young when they fall down a chimney, come down the attic stairway, fly through an open window or land on the ground.

As cold weather approaches, little brown bats travel great distances to caves and mines in which they spend the winter. One Massachusetts mine contains about 3,500 bats each winter; another in New York about 40,000. Bats come from all over the Northeast to use these sites. The big brown bat, however, often stays in buildings, spending the winter in closely packed colonies in unheated areas.

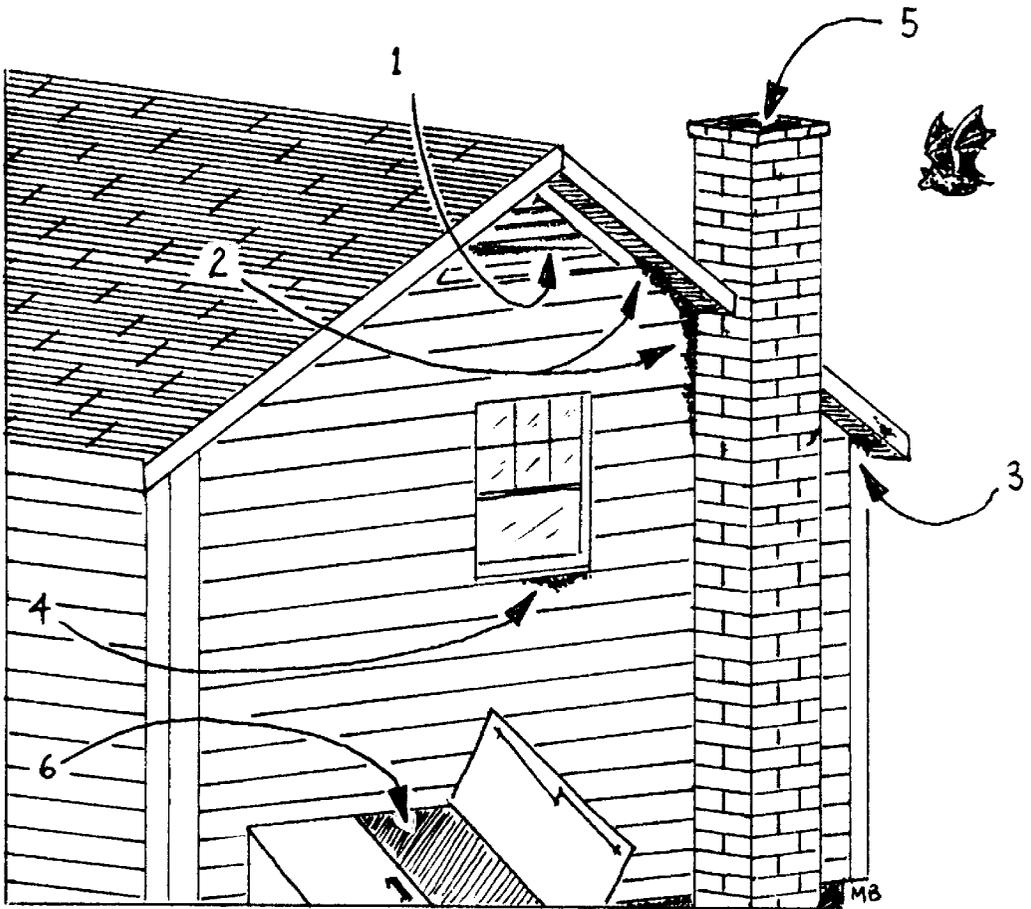


Figure 3. The most common entranceways for bats entering a home include (1) an un-screened attic vent, (2) a crack or separation where the chimney meets the house, (3) a hole or crack under a rotted eave, (4) rotted window sills or loose-fitting screens, (5) chimney flues, (6) an open cellar hatch (bulkhead). Other possible entrances include openings where pipes or wiring meet the house, and gaps in loose or warped siding.

How to Know When There is a Bat Colony in the House

The most obvious sign that a bat colony resides in your home is when you observe bats flying in and out of a hole in the house. If they become a nuisance, **discovering the entranceway(s) to the colony is the most important step in solving the problem.**

Other signs that indicate a bat colony is present include:

- (1) a single bat found in the living quarters on more than just one occasion.
- (2) squeaking and rustling noises, particularly at dusk or on hot summer days, in the ceiling or walls. (Mice or flying squirrels may also be responsible for such noises.)
- (3) a hole in the eaves with a dirty stain below it (see Fig. 4). As bats enter and leave a colony, they often urinate, creating a stain on the wall. Their droppings may also be splattered on the siding below the entrance hole. Be aware, however, that not all entrance holes will display a stain or splatters.

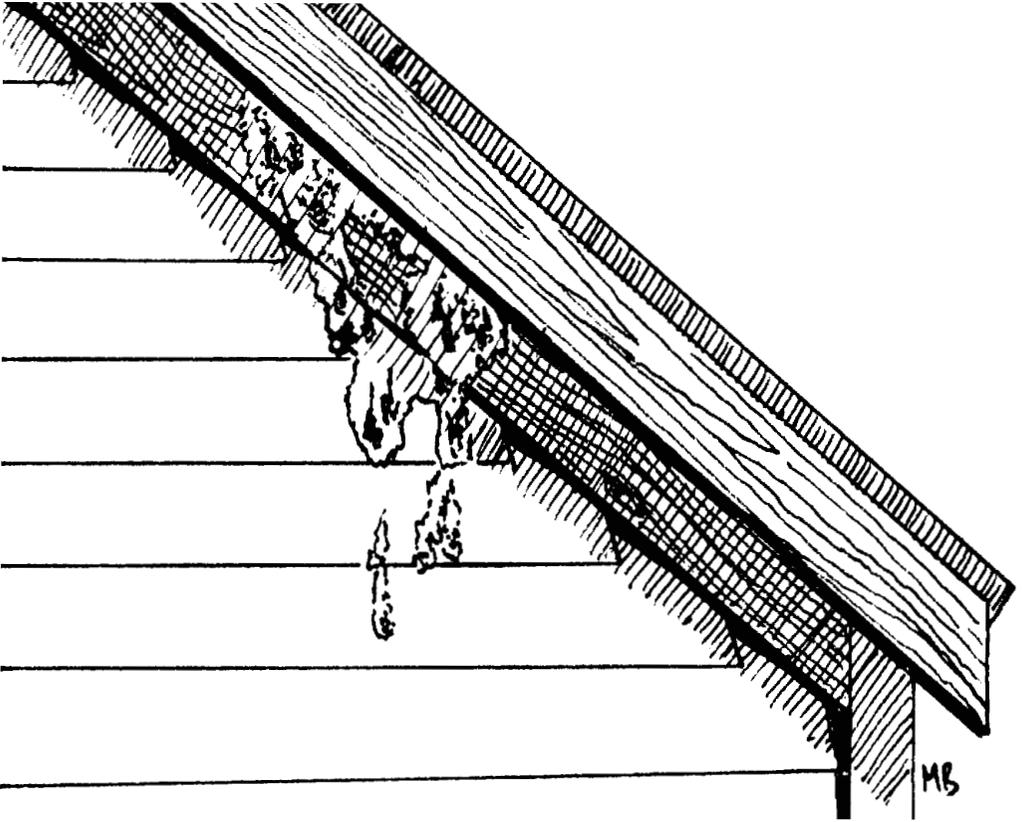


Figure 4. A typical bat colony entrance can often be recognized by a stain below it.

(4) a stain forming on the ceiling of older houses accompanied by an offensive odor. This generally occurs only with larger colonies and when there is no insulation protecting the attic floor. The problem is caused by a build-up of guano (feces) and urine under the roosting bats.

(5) droppings (guano) on the steps, sidewalk or patio beneath the exit hole. Guano is often pushed out of crevices and other openings where bats exit each evening.

Time of Year to Remove a Bat Colony

With few exceptions, attempts to evict a colony of bats from a building should be made only during the early spring, **during the month of May**, or late summer, **from the first of August to mid-October**. The only long-term solution once the eviction is accomplished is to bat-proof the building by blocking all possible entrances when all the bats are out. Even if the bats were killed, others would soon follow if the basic problem (holes in the house) is not resolved.

During spring and fall you can temporarily block roost entrances after the dusk emergence, opening the holes for an hour at dusk for a few evenings in a row to let any trapped bats out. Better yet, install one-way doors over the entrances (see Figure 5), eliminating the need to remove and replace the barriers those first few evenings.

At times other than early spring and late summer, it is unlikely that all of the bats will be away from the colony at the same time. During the summer, a colony may contain a large number of baby bats that are too young to fly. These young animals are left alone in the colony while their mothers are out feeding. From late fall through winter, some or all of the bats in a colony (see warning below) will be dormant because they hibernate through the cold months. If the entrances to a colony are blocked while bats are inside, they will search for ways out of the house and may end up in the living quarters. If they can't get out, they will eventually die and create an offensive odor in the house.

WARNING

Bat colonies in Massachusetts homes are usually composed of either big brown bats or little brown bats. While little brown bats leave buildings to hibernate in caves and mines during winter, big brown bats often hibernate right in buildings. Very seldom does a homeowner know for certain if a colony is little brown bats or big brown bats; it is important, therefore, to follow the guidelines for removing bat colonies **only in the early spring and late summer**. Only if a colony is **known** to be little brown bats should a homeowner attempt to seal up the entrances during the winter (November through March).

How to Evict a Bat Colony

The most important step in removing a bat colony is to discover where the bats are entering and exiting. There may be one or more such entrances in a house, and they may be quite small: a little brown bat can squeeze through a hole $5/8 \times 7/8$ of an inch, while a big brown bat can squeeze through a hole $1/2 \times 1-1/4$ inches! Since most bats leave their roost about 15 minutes after sunset, you should watch the outside of your house from 30 minutes before to 30 minutes after sunset. If possible, position yourself so that you can silhouette flying bats against an open view of the sky. Bats may be difficult to see if the area around the house is dense with foliage.

Once you have located all of the entrances, close each one **except** the primary entrance, using a good sealing material such as any of the following: caulking, screening, polyurethane foam, fiberglass insulation, polypropylene rope, flashing. Next, you should install a one-way door over the remaining hole so that bats are permitted to exit only. (Many effective designs are available; a good example is shown in Figure 5.)

For the next three or four nights, watch the bats as they leave. If the door is functioning properly, there should be no bats coming out by the third or fourth night. When you no longer see bats exiting the house, seal up the last hole. If you have sealed all of the holes, you will have no further problems.

If you discover that the bats are using another entrance of which you were not aware, move the one-way door to that entrance and repeat the process described above. During the first few days, returning bats that cannot get back into the attic may roost in the open under the eaves or on the side of the house, but they will soon abandon the area.

Designs for One-Way Doors

Many designs for one-way bat excluders have been created and tested and new designs could certainly be devised with a little imagination. In general, try to avoid using large mesh (greater than 1/6 inch mesh) and wire screen material in exclusion devices, as this type of screening can injure bats. Plastic, fine mesh screening works best when screening is required, and clear or translucent plastic material, such as that used to make garbage or grocery bags, can often be substituted for applications requiring screening.

Probably the easiest way to make a one-way door over a bat entrance is to use a plastic garbage bag. Slit the bottom of the bag open so that it creates a large plastic tube. Then tape or staple one of the open ends around the hole that the bats are using. As the bats fly out of the hole at night, they enter the plastic bag, flutter around and fall out of the bottom. Since the bag is hanging limp, there is no way they can fly back inside and re-enter the house.

Be aware, however, that if the bag hangs flat against the hole, the bats may not be able to get *out* of the house. To avoid this problem, tape or staple a bent piece of cardboard or aluminum flashing just above the hole (see Fig. 5) to hold the plastic slightly away from the hole. This technique utilizes inexpensive materials that are readily available, and it is easy to install over holes of various shape and location. It works well on an entrance in the form of a hole or a short crack, but it can also be adapted to cover a long open crack under the eaves or along a chimney. In these situations, most of the crack can be covered with a strip of fine mesh plastic screening, and the bag can be used to cover the short length of the crack which is left open. Designs and instructions for other simple excluder devices that can be adapted for almost any bat entryway can be found on pages 8-10.

Preventive Maintenance

Working to keep your house weather-tight and energy-efficient is the best way to prevent bat problems. Cracks, separations, rotted eaves, rusted ventilation screens and other openings should be repaired as soon as they are noticed.

Chimneys are another common avenue of entrance. Bats and many other animals, including flying squirrels, gray squirrels, starlings, screech owls, wood ducks and raccoons frequently enter houses through the chimney. This can be prevented by covering the chimney top with a commercially available chimney cap.

Summary

(1) If you strive to maintain a weather-tight home by insulating your attic and caulking all exterior cracks and holes as soon as they are detected, your house will probably be both energy-efficient and bat-proof.

(2) If a bat colony causes a nuisance in your home, discovering the entranceway(s) is the most important step in solving the problem.

(3) Bat colonies should be excluded from buildings only in the spring (May) and late summer (first of August to mid-October) when all individuals can be excluded.

(4) The best method for excluding a colony from a building is to seal all but the main entrance hole, place a one-way door over the main hole for several days so that bats can leave but not re-enter, then seal the last hole.

(5) Poisons are illegal to use against bats (and most other wildlife) and repellents have not been shown to be effective in evicting bats.

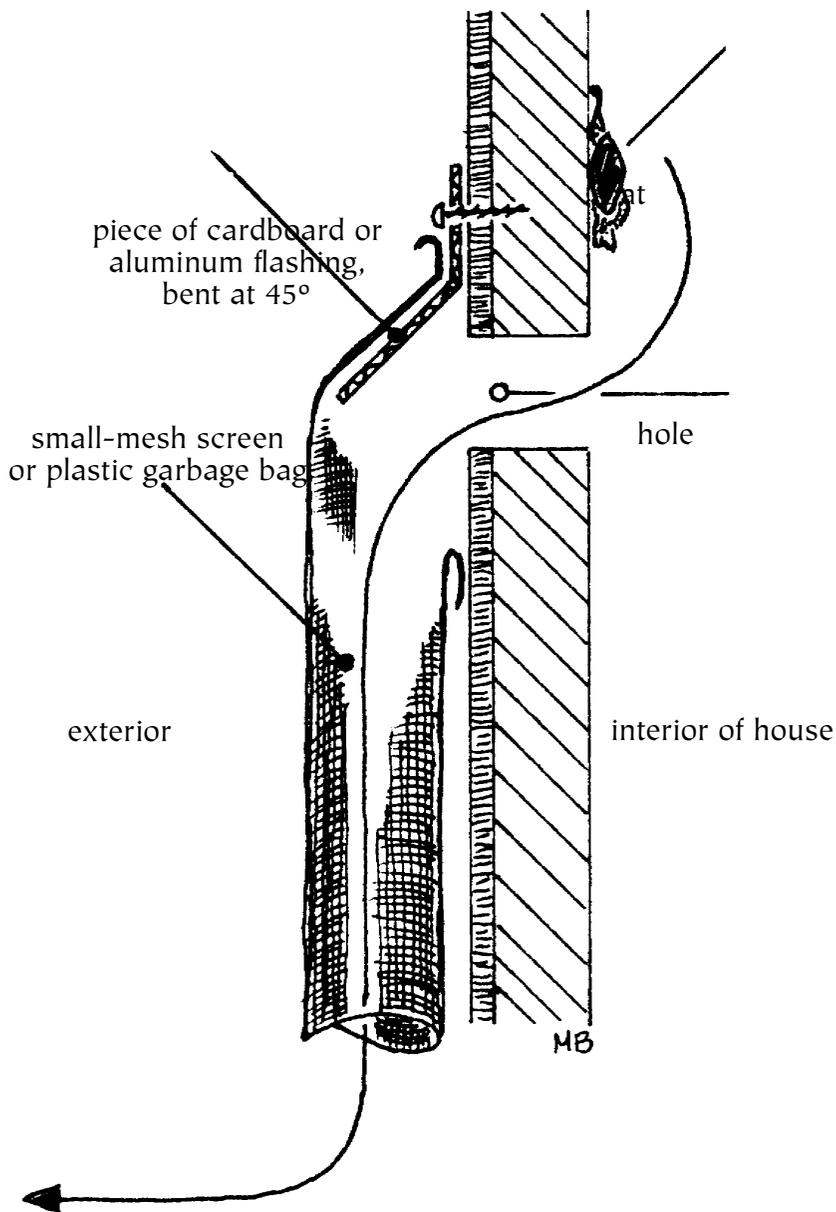
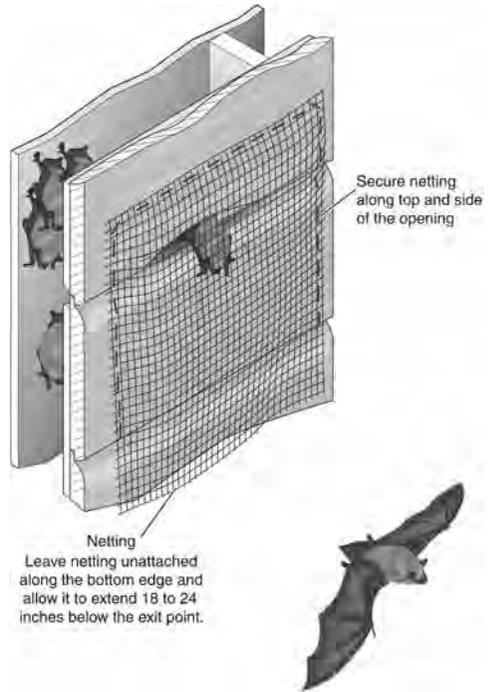


Figure 5. This highly effective, one-way bat excluder can be constructed with nothing more than a sheet of cardboard, a plastic garbage bag and a couple of screws or nails. This simple design is best for small entrances, but can be adapted to function on even large cracks or openings.

Using Netting to Exclude Bats

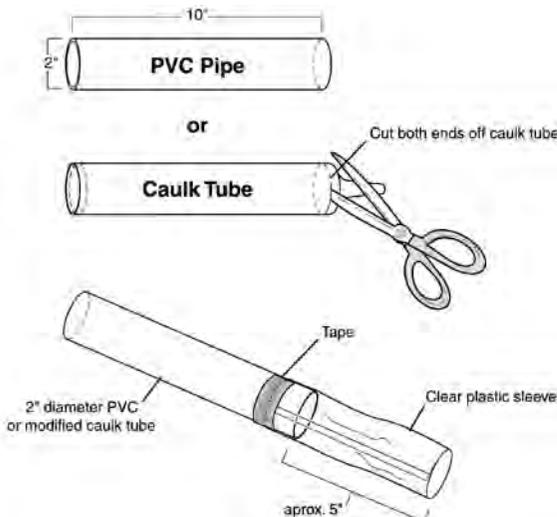
Bats sometimes enter buildings through openings on smooth surfaces of exterior walls or through louvers. In such cases, plastic or lightweight, flexible netting with 1/6 inch (0.4 cm) mesh or smaller, should be secured to the building along the top and sides of the opening as shown in the diagram. It should extend 18 to 24 inches (46 to 61 cm) below the bottom edge of the opening and should remain in place for a minimum of five to seven days to ensure all bats have exited. The openings should then be permanently sealed with silicone caulking, caulk backing rod, hardware cloth, or heavy-duty netting. In some cases, sealing may require repair or replacement of old, deteriorated wood. When bats are using multiple openings to exit and enter, exclusion material should be placed on each opening unless it can be determined with certainty that all areas used by the bats are connected. If so, some openings can be sealed as described above, and netting can be placed over the openings used by the most bats. Even when all roosting areas are connected, bats will sometimes refuse to use alternative exits. In this case, exclusion devices must be installed over all exits. After this has been done, watch to make sure the bats are able to exit safely. If they do not appear to be exiting, or appear to be having trouble doing so, make adjustments or add new "valves" as needed.



Illustrations © BCI

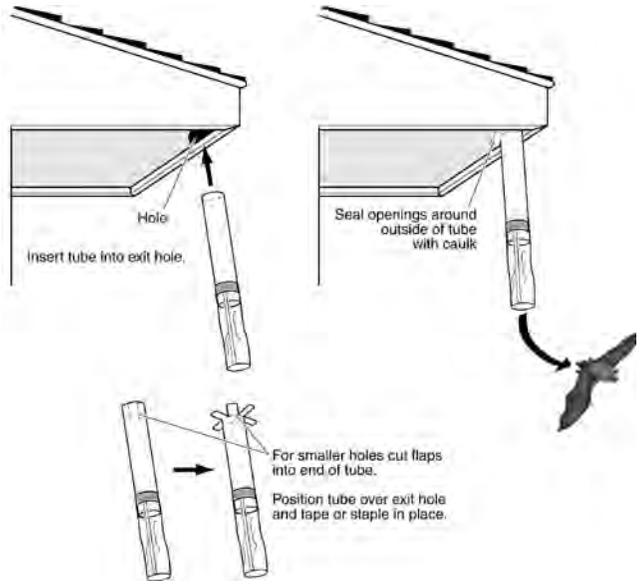
Using PVC pipe or Empty Caulking Tubes to Exclude Bats

There are a number of situations in which tubes work best as bat exclusion devices. Examples include openings used by bats on buildings constructed from materials that do not create smooth exterior walls, such as those found on brick or stone



houses, and log cabins. Tubes also work best for holes located at corners where walls meet, and on horizontal surfaces such as soffits. Exclusion tubes should have a 2-inch (5 cm) diameter and be approximately 10 inches (25.4 cm) in length. Exclusion devices can be made from PVC pipe or flexible plastic tubing. According to Laura Finn of Fly by Night, Inc., empty caulking tubes work well for this purpose. When using caulking tubes, both ends must be cut out. Use of a flexible plastic tube makes it easy to either squeeze one end of the tube so that it fits into a crevice, or cut one end of the tube into flaps that can be fit over an opening and stapled, nailed, or taped to the building (see diagram). Bats are unable to cling to

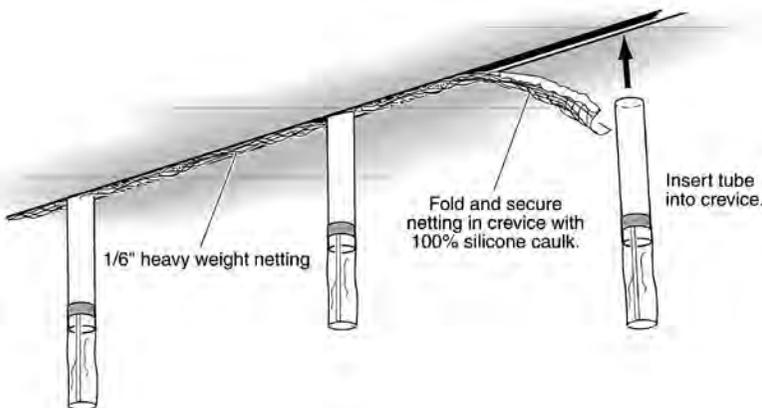
the smooth surface of these tubes. Do not let the tube project more than 1/4-inch (6 mm) into the opening, ensuring that bats can easily enter the tube to exit. Caulking tubes must be thoroughly cleaned before use to prevent bats from sticking to wet caulk and because dried caulk creates a roughened surface, making it possible for bats to re-enter. Once the tube has been inserted over the hole, a piece of light weight, clear plastic can be taped around the end of the tube that projects to the outside (see diagram) to further reduce the likelihood of bats reentering, though this is typically not necessary.



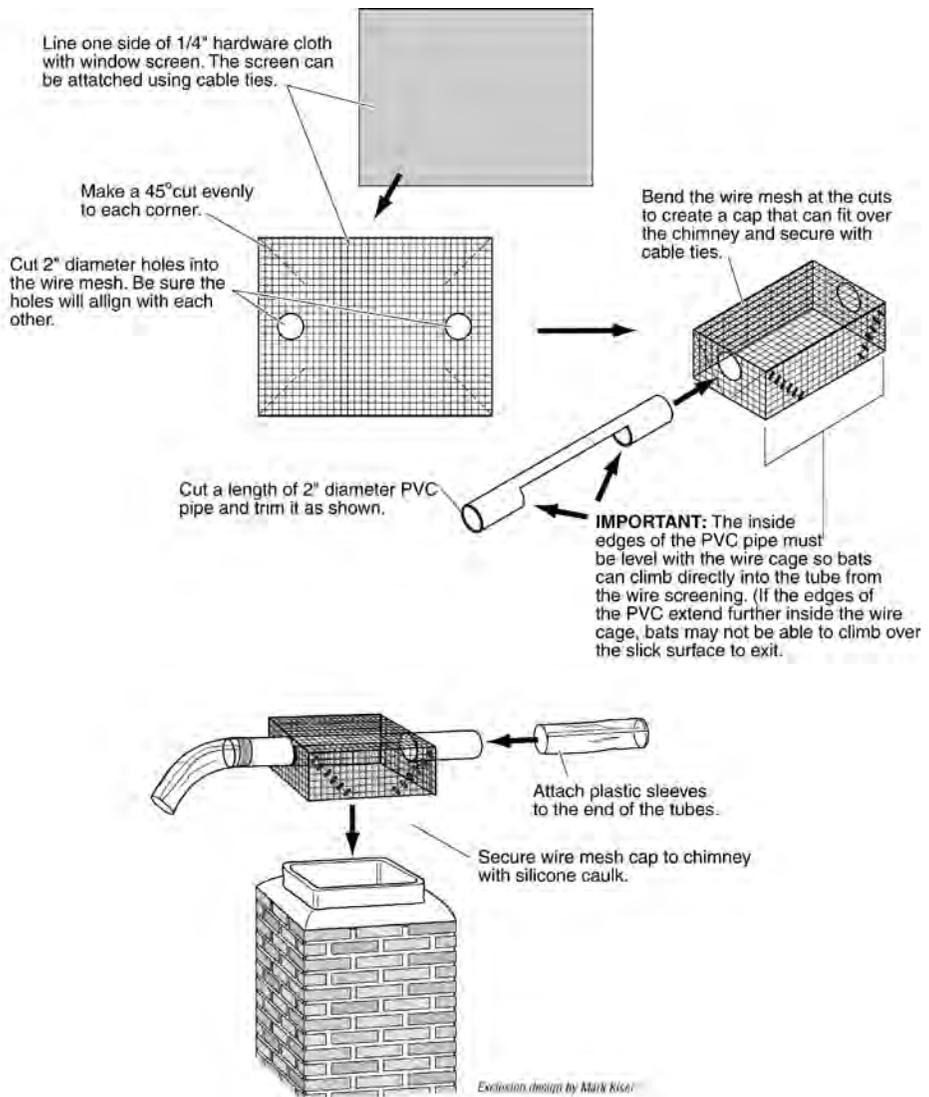
Plastic sleeves collapse on themselves, preventing bats from reentering once they have crawled out through the tube. After the tube has been inserted into or over the opening used by bats, any spaces between the outer rim of the tube and the building must be sealed shut. Be sure also to seal shut any other openings in the building that bats could use to reenter. Leave the tube in place for a minimum of five to seven days to ensure all bats have exited. After the bats have been excluded, the tube should be removed and the opening permanently sealed.

Some concrete parking garages have lengthy crevices used by bats. Multiple exclusion tubes will need to be placed every few feet along the length of each crevice; spaces between the tubes should be closed with heavy-weight (1/6 inch mesh) netting (see diagram). Fold the netting so that it fits into the crevice, and caulk it in place as shown in the diagram. The same procedure can be used in lengthy crevices created where flashing has pulled away from a wall.

Bats may also enter a building through spaces beneath corrugated or galvanized roofing sheets. These roofs can be sealed with a variety of materials such as caulk backing rod during months when bats are not present, or after they have been excluded from a building by use of exclusion tubes.



Special modifications may be needed when bats roost in chimneys or in separations between chimneys and roofs. If bats are roosting inside the chimney, construct a wire cage from 1/4-inch hardware cloth lined with window screen. A section of PVC pipe can be cut and then inserted through holes



cut into the sides of the wire cage (see diagram). Although bats are able to simply drop down and out of a vertically placed tube that extends below the roost, they are not able to grip the slick surface to crawl out if the tube extends upward above the roost. Therefore, the tubes should project horizontally or down. A collapsible plastic sleeve should be placed over the ends of all exclusion tubes used on chimneys. Once the bats have been excluded, a chimney cap should be installed.

Bats Roosting on Porches at Night

Bats sometimes roost on porches or under overhangs briefly during the night while they digest the insects they have eaten. Non-toxic aerosol dog or cat repellents may be used to discourage bats from roosting in these areas. The spray should be applied by day when bats are not present. (Aerosol repellents are not an adequate substitute for exclusion in the case of day roosts and should never be applied when bats are in a roost.) Mylar balloons or strips of aluminum foil hung from the porch ceiling and allowed to move in the breeze may also discourage bats from roosting in that area.

Disease and Public Safety

Two diseases are usually associated with bats: rabies and histoplasmosis. In Massachusetts, the first rabid bat was not documented until 1961. Between 1961 and the end of 2005, a total of 580 bats (about 13 per year) were found to be rabid by the Massachusetts Department of Public Health. The frequency of rabies in wild bats has been variously estimated from 0.1 to 0.5 percent, meaning one bat in 1,000 to one in 500 might be expected to have rabies. If we consider only bats that are found on the ground (and thus more likely to be sick) the percentage of diseased bats is higher. During a recent 11 year period, about one in 19 bats submitted to the Massachusetts Department of Public Health for testing was found to be rabid. In the United States and Canada, there have been 42 human cases of rabies due to bats since 1960. The only New England case occurred in Greenwich, Connecticut in 1995.

Since any bat may be carrying the rabies virus, **no bat should be handled without gloves or other protection**, and care should be taken to avoid bites. Note, however, that the teeth and claws of bats are so small that a bite or scratch may leave only a very small mark and the wound may not bleed or hurt. If a bat was physically present and it cannot be ruled out that a person was bitten or otherwise exposed (e.g. a sleeping person awakens to find a bat in the room; an adult witnesses a bat in the room with a previously unattended child, etc.) or if you or someone else is ever bitten by a bat, make sure that the bat is captured and submitted for examination to the Massachusetts Department of Public Health in Jamaica Plain, Massachusetts (617-983-6800). If the bat cannot be captured, contact your physician immediately.

Histoplasmosis is a fungus associated with the droppings of bats and birds. If dust containing the fungal spores is stirred up and inhaled, a lung infection may result. Symptoms of histoplasmosis include fever, congestion, and spots on the lungs that show up on x-rays. Mild cases are common, often going unnoticed; severe cases are rarely fatal. To guard against the disease, never sweep or vacuum guano from an attic floor or stir up guano dust unless wearing an adequate protective mask.

Bats are protected by law in Massachusetts and may not be killed or captured except under permit, when they are creating a risk to public health, or when they are damaging property. Although most bats should be evicted unharmed, any individual bat found in the house that might have had contact with a pet or person, particularly children, should be turned in to the Department of Public Health for rabies testing.

Bat Conservation

As the benefits of bats and the important ecological roles that they fill in a healthy environment have come to be understood, so has the importance of conserving these beautiful and interesting animals. Many individuals and organizations are now actively involved in helping bats to survive in our increasingly altered landscape. One of the best ways an individual can support bat conservation is to put up one or more bat houses in a location that bats will find attractive. Bat houses can be very useful in providing secure roosting sites for bats, and may be especially helpful in providing habitat for bats that are displaced from dwellings. A wide variety of designs are available from Bat Conservation International (see addresses at end of booklet). Figure 6 (page 13) shows one such design for a small nursery colony.

Suggestions for Building Bat Houses & Attracting Bats

Bat houses have been used successfully for a variety of bat species in Europe and North America. According to Bat Conservation International (BCI), bat houses should be at least 2 feet tall, have chambers at least 20 inches tall and 14 inches wide, and include a landing area extending below the entrance at least 3 to 6 inches. The width of the entry spaces should not exceed one inch, with the ideal width being only 3/4 of an inch. Regardless of the design of house built, all inner surfaces must be rough enough to permit the bats to climb on them with ease, and rough outer surfaces are preferred. Exterior grade plywood (but **not** pressure treated wood) should be used for bat house construction, and all screws and hardware should also be exterior grade.

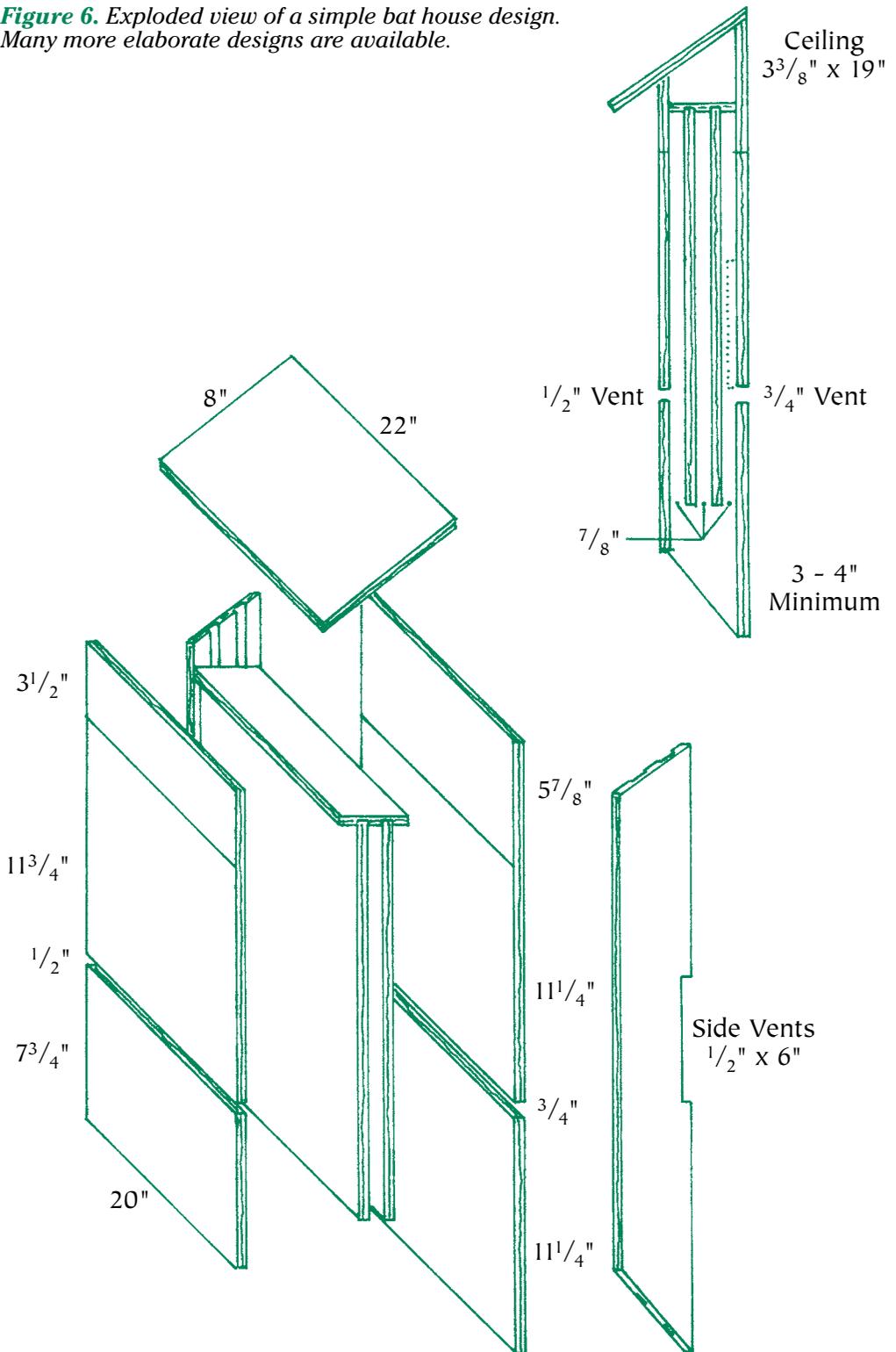
Young bats grow best where daytime temperatures are in the 80-90°F range. For this reason, maternity colonies are most likely to use bat houses that provide temperatures in this range for the longest possible period. This is best insured by placing boxes in sunny locations, painting them black, and making sure all seams are caulked and weathertight. Metal flashing, asphalt shingles or tar paper can be used over the roof area to increase the longevity of the house and prevent rain from entering. Bat houses in Massachusetts should always be painted black, using exterior grade, water-based paint or stain. Interiors can be painted with any dark, water-based stain. Roughen the wood (or apply screening) to give the bats purchase *after* painting or staining, or the surfaces may become too slippery for bats to use.

The location (placement) of any bat house is an important factor in determining whether or not it will be used. In Massachusetts, a bat house should be exposed to at least 8-10 hours of sun each day if the object is to create habitat where females can bear and raise their young. A bat house placed in a shady location may not generate enough warmth to support a maternity colony. Male bats do not live with the females while young are being reared, and these bachelor colonies may be attracted to more sheltered, cooler locations, but females seek houses that retain temperatures between 80-100°F for as long as possible. A vent in the lower portion of the box will provide air circulation and cooler temperatures if the upper portion of the box becomes too hot.

Bat houses should be fastened securely to a tall pole or the side of a building, roughly 12-20 feet above ground, and preferably where they will receive maximum sun exposure. They should not be located where the droppings which fall out of them will become a nuisance. Avoid sites that are illuminated by bright lights at night. It is important to note that bats can live only where local food supplies are adequate. For this reason, most colonial bats are found near places such as rivers, lakes, bogs or marshes where insect populations are high. The closer bat houses are to such places, the greater the probability that the houses will be used. Those located more than one-half mile from these habitats have a greatly reduced probability of being occupied. If the house is intended for bats being evicted from a building, the greatest success will be achieved if it is placed on the outside wall of the building from which the bats are being evicted (or as nearby as practical).

Sometimes bats occupy a bat house within a few weeks. Often, however, bats require a year or two to find the new house. Chances of early occupancy are probably increased if houses are hung before or by early April, and also if bats already live in barns or attics in adjacent areas. For more information on building or purchasing bat houses, contact Bat Conservation International, P.O. Box 162603, Austin, TX 78712 (phone 512-327-9721) or online at www.batcon.org. BCI offers for sale **The Bat House Builder's Handbook** and even a **Building Homes for Bats** video.

Figure 6. Exploded view of a simple bat house design.
 Many more elaborate designs are available.



Key to the Bats of Massachusetts

A key is the most effective tool for identifying a plant or animal, in this case a bat. If you have never used taxonomic keys, be assured that they are easy to use. Each number offers you a choice. Begin with Number 1. If the bat does not fit the description for 1a, then it will fit the description for 1b. If, for instance, it matches 1b, follow the directions which state “go to 4a.” Continue determining which description fits, 4a or 4b, et cetera, until you discover the common name of your particular bat.

- 1a. Upper surface of interfemoral membrane (See Fig. 1) either completely or half covered with hair; tips of many body hairs white, causing frosted appearance..... go to 2a
- 1b. Upper surface of interfemoral membrane without hair; body hairs do not have white tips..... go to 4a
- 2a. Except for white tips, hair is rusty in color..... RED BAT
- 2b. Except for white tips, hair is dark brown or black..... go to 3a
- 3a. Interfemoral membrane completely covered with hair; forearm 1-3/4 to 2-1/4 inches long..... HOARY BAT
- 3b. Only 1/2 of interfemoral membrane (nearest the body) covered with hair; forearm 1-1/2 to 1-3/4 inches long..... SILVER-HAIRED BAT
- 4a. Hairs on back tricolored — dark at base and tip, but lighter in the middle..... EASTERN PIPISTRELLE
- 4b. Hairs on back bicolored — dark at base and light at tip..... go to 5a
- 5a. Forearm greater than 1-3/4 inches long..... BIG BROWN BAT
- 5b. Forearm less than 1-3/4 inches long..... go to 6a
- 6a. Face with black mask; ears black; forearm less than 1-3/8 inches long..... SMALL-FOOTED BAT
- 6b. Face with no black mask; ears not black; forearm longer than 1-3/8 inches long..... go to 7a
- 7a. Ears very long, when laid forward extend 1/16 inch (4mm) beyond nose..... NORTHERN LONG-EARED BAT
- 7b. Ears relatively short, when laid forward do not extend beyond nose or as much as 1/16 inch..... go to 8a
- 8a. Hair glossy; calcar (see Fig. 2) not keeled..... LITTLE BROWN BAT
- 8b. Hair dull; calcar keeled..... INDIANA BAT

Massachusetts Bat Species

Species of bats that occur in Massachusetts with their habitats, distribution and status of the uncommon species noted.

COMMON NAME	SPECIES	RANGE IN MASSACHUSETTS		HABITAT		NOTES
		statewide	probably statewide	buildings, trees	buildings, caves, mines	
Big brown bat	<i>Eptesicus fuscus</i>	statewide	probably statewide	buildings, trees	buildings, caves, mines	
Little brown bat	<i>Myotis lucifugus</i>	statewide	probably statewide	buildings	caves, mines	
Northern long-eared bat	<i>Myotis septentrionalis</i>	probably statewide	probably statewide	trees, building exteriors, rarely inside buildings	caves, mines	
Indiana bat	<i>Myotis sodalis</i>	last recorded:1939. Berkshire, Hampden & Worcester Counties	probably statewide	caves, mines, hollow trees, beneath tree bark	caves, mines	ENDANGERED (Federal & State)
Small-footed bat	<i>Myotis leibii</i>	known only from Hampden County	probably statewide	beneath tree bark; occasionally in buildings	caves, mines	SPECIAL CONCERN
Eastern pipistrelle	<i>Pipistrellus subflavus</i>	statewide	probably statewide	trees, rarely in buildings	caves, mines, rock crevices	
Silver-haired bat	<i>Lasiomycteris noctivagans</i>	probably statewide	probably statewide	trees rock crevices	buildings, trees, (migratory)	
Red bat	<i>Lasiurus borealis</i>	statewide	statewide	tree foliage	migratory	
Hoary bat	<i>Lasiurus cinereus</i>	statewide	statewide	tree foliage	migratory	

For More Information...

For assistance in identifying a captured bat, you may wish to bring the bat or submit a photo to:

Dr. Thomas W. French
MassWildlife
Field Headquarters
One Rabbit Hill Rd.
Westboro, MA 01581
tom.french@state.ma.us

For information on submitting specimens to be tested for rabies, contact:

Department of Public Health
Diagnostic Laboratory
Jamaica Plain, MA 02130
(617) 983-6800

If you wish to learn more about bats, you can begin with the following list. Your town, city or local college or university library may have these or other useful references.

- Barbour, R.W. and W.H. Davis 1969. Bats of America. University Press of Kentucky, Lexington, 286pp.
- Fenton, M.B. 1983. Just Bats. University of Toronto Press, Toronto, 165pp.
- Graham, G.L. 1994. Bats of the world. Golden Press, N.Y., 160pp.
- Hill, J.E. and J.D. Smith. 1984. Bats: A Natural History. University of Texas Press, Austin, 243 pp.
- Kunz, T.H. (ed) 1982. Ecology of Bats. Plenum Publ. Corp., N.Y., 425pp.
- Mohr, C.E. 1976. The World of the Bat. J.B. Lippincott, Philadelphia, 162pp.
- Schober, W. 1984. The Lives of Bats. Arco Publishing, Inc., N.Y., 200pp.
- Tuttle, M.D. and S.J. Kern. 1981. Bats and Public Health. Milwaukee Public Museum Contributions in Biology and Geology. No. 48: 1-11.

Anyone interested in bat conservation should contact: Bat Conservation International, P.O. Box 162603, Austin, Texas 78712, phone (512) 327-9721. Their website is www.batcon.org. This organization offers the best and largest assortment of bat house plans available anywhere, and is continually developing and testing new designs.



Photos © Merlin D. Tuttle, Bat Conservation International

WITH THEIR EXTRAORDINARY FLYING AND ECHO-LOCATION ABILITIES, OUR BATS CAN ACCURATELY LOCATE, TRACK AND CATCH FLYING INSECTS ON THE WING. THIS BIG BROWN BAT (TOP) HAS JUST CAPTURED A BEETLE. WHEN ROOSTING (LEFT) ITS DELICATE WINGS ARE FOLDED AND IT HANGS UPSIDEOWN FROM ITS REAR FEET. UNLIKE THE MORE COLORFUL RED BAT (RIGHT, WITH TWIN YOUNG), WHICH COMMONLY ROOSTS IN TREES, BIG BROWNS OFTEN ROOST IN BUILDINGS AND SOMETIMES EVEN HIBERNATE IN LARGE COLONIES IN UNHEATED SECTIONS OF BUILDINGS.

www.batcon.org

For more information visit www.batcon.org. This website, provided by Bat Conservation International, provides accurate, up-to-date information about bats and bat habitats, describes BCI's programs of research, education and conservation on behalf of bats worldwide, and offers sound advice to help people live with bats without fear.



ALL BATS FOUND IN MASSACHUSETTS ARE INSECTIVORES, TAKING MOTHS, BEETLES, MOSQUITOES AND OTHER INSECTS WHILE ON THE WING LIKE THE **BIG BROWN BAT** AT THE TOP OF THE PAGE. THEY NAVIGATE AND CAPTURE THEIR PREY THROUGH A PROCESS CALLED ECHOLOCATION. THEIR SONAR SYSTEMS ARE HIGHLY SOPHISTICATED, AND EACH SPECIES HAS ITS OWN PARTICULAR FACE AND EAR CONFIGURATION FOR CREATING AND RECEIVING LOUD, HIGH FREQUENCY SOUNDS. MANY OF THESE SOUNDS ARE SO HIGH PITCHED THAT IT IS BEYOND THE ABILITY OF HUMANS TO DETECT THEM. CLOCKWISE FROM ABOVE WE HAVE THE **LITTLE BROWN BAT** (OUR MOST COMMON SPECIES), THE **HOARY BAT** AND THE **BIG BROWN BAT**.

Photos © Merlin D. Tuttle, Bat Conservation International



Massachusetts Division of Fisheries & Wildlife

Field Headquarters • One Rabbit Hill Road
Westboro, MA 01581 (508) 389-6300
www.mass.gov/masswildlife