

Massachusetts Homeowner's **Guide to Bats**



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Table of Contents

The sudden and unexpected decline of Massachusetts bats	1
Bat conservation.	1
Natural history	2
Common myths debunked.	3
Beneficial aspects	3
Bats in the home.	4
How to evict a single bat.	5
A colony in the house	6
Signs that a bat colony is in the house	6
Best times of year to remove a bat colony	7
How to evict a bat colony	7
Designs for one-way excluders.	9
Preventative maintenance	9
Disease and public safety	10
Using netting to exclude bats	11
Using PVC pipe or empty caulking tubes to exclude bats.	12
Bats roosting on porches at night.	14
Bat houses.	15
The importance of bat houses	15
Buy a bat house	15
Build a bat house	15
Build a four-chamber bat house	16
Materials and tools	16
Construction.	21
Optional modifications	21
Tips for installing a bat house.	23
More information	24
Key to bats of Massachusetts	25
Massachusetts bat species.	26

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, New York 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—as well as ears and forearms—in powdered sugar. The white powdery substance on their faces is a fungus. The fungus was described as a newly discovered species in 2009, and is known as *Pseudogymnoascus destructans*, or Pd for short. This fungus grows in cold, dark, damp places—like caves and mines—and attacks the bare skin of bats while they are hibernating.

Some species of bats hibernate in caves and mines over the winter. Ordinarily, bats have enough fat to last them through the winter. When they emerge in late April and May, there are ample numbers of insects to eat, so they can replenish their energy reserves. However, in areas with WNS, Pd causes some of the hibernating bats to become more active than usual, causing them to run out of body fat by early February. The largest bat hibernation site in Massachusetts housed roughly 10,000 bats in early winter 2007/08. By the end of winter 2008/09, nearly every bat had been killed by WNS.

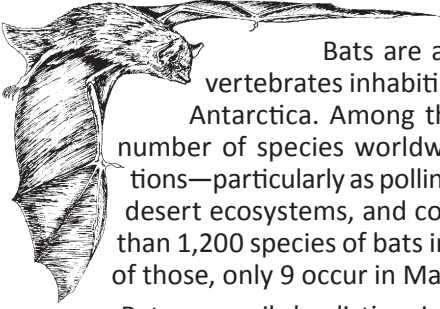
White-nose syndrome has spread rapidly and has caused a catastrophic mortality of bats that spend the winter in New England caves and mines. By 2012, over 6 million bats had died from WNS. By 2019, WNS had been found in 33 US states and seven Canadian provinces, spreading as far west as Texas and Wyoming—with a surprise outbreak in Washington. At this point no one knows how to stop, cure, or even slow the continuing spread of WNS. No one can predict how many more bats will die in the process. For more information on white-nose syndrome, visit whitenosesyndrome.org.

Bat conservation

Help MassWildlife with bat conservation efforts! To help assess where bat colonies are during the summer, report observations of bat colonies (10 or more bats) to **natural.heritage@mass.gov** or online at **bit.ly/batcolonies**. Please include the address, location, type of structure where the colony was found, approximately how many bats are in the colony, and how long the bats have been there. Your observations help MassWildlife better understand the bat populations that persist post-WNS, and will be used to guide conservation and management efforts in the future. Your help is greatly appreciated!

As the benefits of bats and the important ecological roles 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 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. See pages 15–23 for suggestions for building and installing bat houses and a simple bat house design.

Natural history



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 more than 1,200 species of bats in the world, only 47 occur in the United States, and of those, only 9 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 and a thumb (see below). 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.

The nine species of bats that live in Massachusetts are all insectivores (insect eaters) in the family Vespertilionidae. All bats within this family 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 insects are not available, bats either hibernate or migrate to warmer regions farther south.

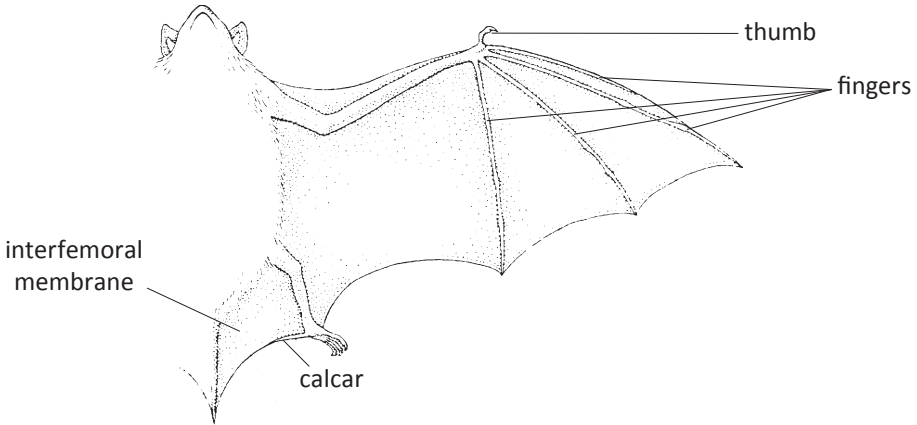


Illustration of a bat showing the thumb and four elongated fingers in the wing, the interfemoral membrane, and the calcar. At rest, bats typically hang upside down from the claws on their feet.



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

Common myths debunked

Bats make a lot of people uneasy. Most are active at night, a time when shadows and strange noises awaken the imagination. Throughout history, bats have collected a bad reputation based on folk lore and feeding on fear. Below are some common myths about bats, followed by truths that counter those myths. Learning a little bit about bats may help alleviate fear and anxiety towards these highly misunderstood and rather extraordinary animals.

Myth: Bats are blind.

Fact: Bats can see as well as most other mammals. Many bats have small eyes and sensitive vision, so they use echolocation to navigate and hunt for insects in the dark, making bats incredibly agile.

Myth: All bats have rabies.

Fact: Any mammal can contract rabies. Less than half of 1% of bats have rabies, which is a much lower rate of incidence than other mammals. Bats that do contract rabies are unlikely to come into contact with you and die fairly quickly from the virus.

Myth: Bats get tangled in your hair.

Fact: Bats are not interested in human hair and they do not build nests. Bat echolocation is highly sophisticated, enabling bats to detect obstacles as fine as human hair and easily avoid your head.

Myth: Bats attack people.

Fact: Bats do not attack people and are not purposely aggressive. Bats are afraid of humans and avoid people as best they can.

Myth: All bats suck blood.

Fact: Most bats are insect-eaters and help get rid of bloodsucking mosquitoes. Only three of the more than 1,200 bat species in the world are vampire bats. Vampire bats live in Mexico, Central America, and South America. They lick—not suck—blood from non-human animals.

Myth: Bats are dirty.

Fact: Bats are very clean and groom themselves regularly like cats. Some bats even groom each other.

Myth: Bats are just flying mice.

Fact: Bats are not rodents. They are classified as their own unique order of mammals called Chiroptera, which means *hand-wing*. Bats are more closely related to humans than they are to mice. Bats also do not nest, chew, or claw their way into a structure like mice do.

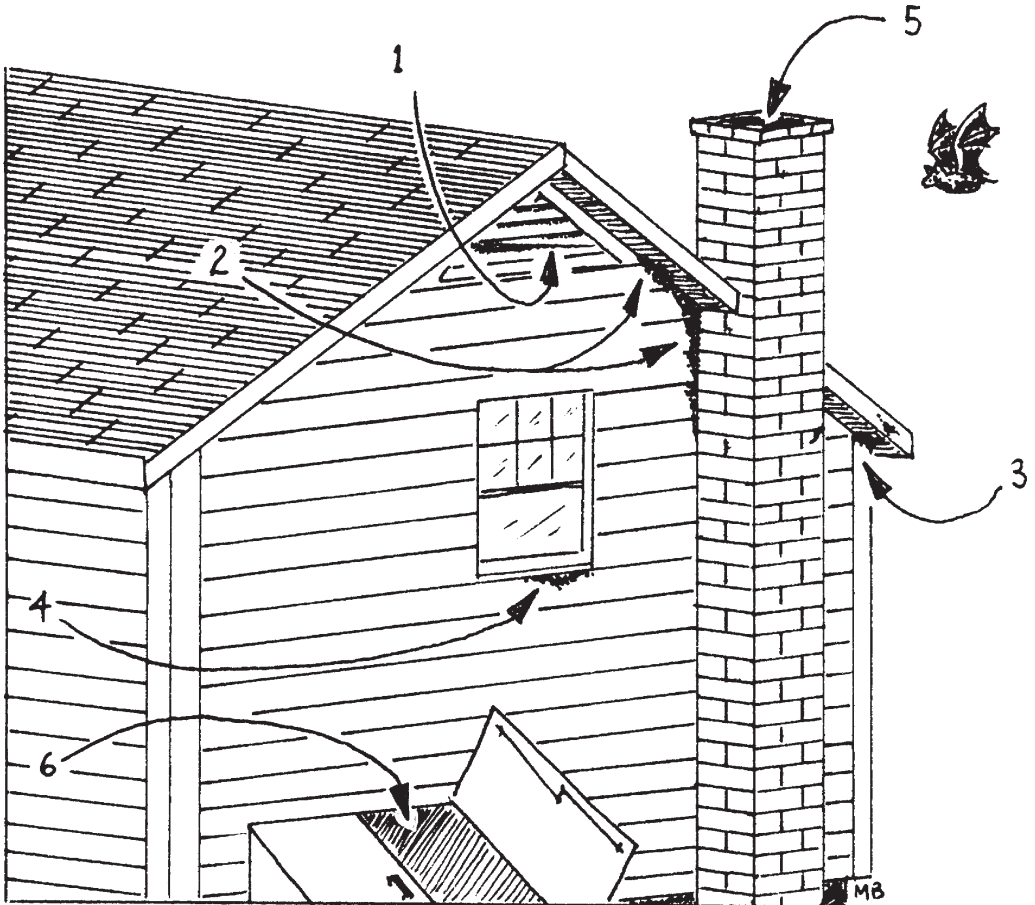
Beneficial aspects

Bats are of immense benefit to people. Among vertebrates, bats are the greatest nocturnal predators of flying insects, consuming 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—can consume as many as 3,000 small insects in a single night. In the Boston area, Dr. Thomas Kunz of Boston University estimated that 14 to 15 tons of insects are consumed each summer by the 50,000 big brown bats living within the bounds of Route 128.

Bats in the home

During the warmer months, most bats found in buildings in Massachusetts are either little brown bats or big brown bats. Two other species will occasionally be found inside buildings in the summer: northern long-eared bats, and very rarely tricolored bats. Big brown bats are the only bats in Massachusetts that commonly inhabit buildings during the winter season.

The presence of any wild animal in a home is an obvious indication that the house is not weather-tight. Finding the sites 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 an eave. The attention of a carpenter is often required to repair damaged wood or flashing that allows bats to enter a house. The following few pages describe how to evict and keep out these unwanted house guests in a safe and harmless manner.



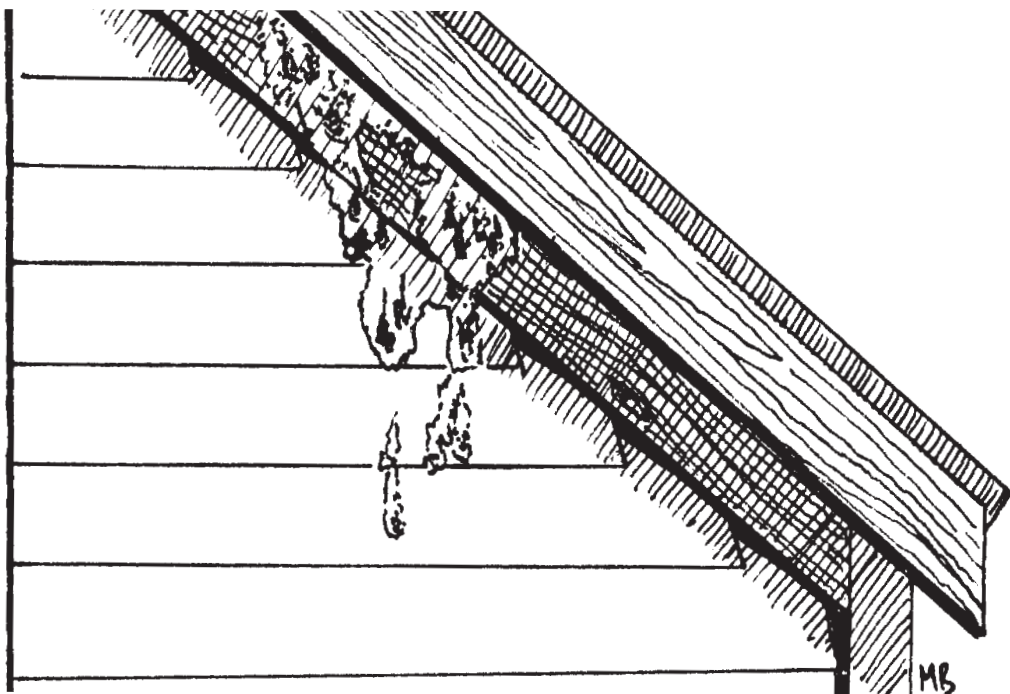
The most common ways for bats to enter a home include: (1) an unscreened attic vent; (2) a space where the chimney meets the house; (3) a space under a rotted eave; (4) rotted window sills or loose-fitting screens; (5) chimney flues; and (6) an open cellar hatch (bulkhead). Other possible entrances include pipes or wiring access to the house and gaps in loose or warped siding.

How to evict a single 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 you, 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 and screen in that room. A flying bat will usually circle the room several times until it locates the open window or door with its echolocation, 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 another nook or cranny. In this event, open a 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, the bat will probably leave within an hour after dark. As long as the weather outside is not too cold, rainy, or windy, this method typically works.

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.



A typical bat colony entrance can often be recognized by a stain or build-up of guano below it.

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 likely 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. All evictions must be non-lethal.

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 pups warm and allows them to grow and develop more rapidly. In late summer, an attic may become too hot for bats, forcing them into the living quarters of a house 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, travel 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. Prior to the onset of white-nose syndrome, one Massachusetts mine contained 8,000–10,000 bats each winter; another mine in New York had about 150,000. Bats come from all over the Northeast to use these sites. The big brown bat, however, often spends winter in closely packed colonies within the unheated areas of buildings.

Signs that a bat colony is in the house

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

Other signs that indicate a bat colony is present include:

- a single bat found in the living quarters on more than one occasion
- squeaking and rustling noises, particularly at dusk or on hot summer days, in the ceiling or walls—although mice or flying squirrels may also be responsible for such noises
- a hole in the eaves with a dirty stain below it (see illustration on page 5). 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. Make note that not all entrance holes will display a stain or splatters.
- 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 roosting bats.
- feces (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.

Best times 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 month of May, or from the first of August to mid-October**. The only long-term solution once the eviction is accomplished is to bat-proof the entire building by blocking all possible entrances when all of the bats are out. Even if the bats are removed, others will soon inhabit the space if openings to the house are not closed.

During spring and fall, you can install one-way doors over entrances. These allow bats to leave a space, but prevent them from being able to get back in (see page 8).

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 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 may 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 the winter, big brown bats often hibernate right in buildings. Very seldom does a homeowner know for certain if a colony is occupied by little brown bats or big brown bats. Therefore, it is important to follow the guidelines for removing bat colonies **only in the early spring and late summer**.

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 $\frac{5}{8} \times \frac{7}{8}$ of an inch wide. A big brown bat can squeeze through a hole $\frac{1}{2} \times 1 \frac{1}{4}$ inches wide! 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: caulking, screening, polyurethane foam, fiberglass insulation, polypropylene rope, or flashing. Next, 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 on page 8.

Since not all bats leave the roost every night, one-way doors should be left in place for 5–7 nights, including at least 3 consecutive nights of good weather. During this time, watch the bats as they leave. If the door is functioning properly and the weather is favorable to bats, there should be no bats exiting after the third night. When you no longer see bats leaving the house, seal the last entrance. If you have sealed all of the entrances, you will have no further problems.

If you discover that the bats are using another entrance, move the one-way door to that entrance, seal the original hole that had the one-way door, and repeat the process. During the first few days, returning bats that cannot get back into the attic may roost under the eaves or on the side of the house, but they should soon abandon the area.

Designs for one-way excluders (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 1/8 inch mesh) and wire screen material in exclusion devices, as these types of screening can injure bats. Fine, plastic mesh 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.

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 it creates a large plastic tube. 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 will 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.

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 page 8) to hold the plastic slightly away from the hole. This technique uses inexpensive materials that are readily available, and is easy to install over holes of various shapes and locations. 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 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 11–14.

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

- 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 be both more energy-efficient and bat-proof.
- If a bat colony causes a nuisance in your home, discovering the entranceway(s) is the most important step in solving the problem.
- Bat colonies should be evicted from buildings only in the spring (May) and late summer (first of August to mid-October), when all individuals can be excluded.

- 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.
- Poisons are illegal to use against bats (and most other wildlife) and repellents have not been shown to be effective in evicting bats. All evictions must be non-lethal.

Disease and public safety

Two diseases that are associated with bats and can be a concern for human health under certain circumstances are rabies and histoplasmosis. In Massachusetts, the first rabid bat was documented in 1961. Between 1961 and the end of 2016, a total of 686 bats were found to be rabid by the Massachusetts Department of Public Health—this averages to 25 rabid bats per year over the last 25 years. 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 72 human cases of rabies acquired from bats since 1950. Human infection with bat rabies remains rare; the only New England cases occurred in Greenwich, Connecticut in 1995 and in Barnstable, Massachusetts in 2011.

Even though the proportion of infected bats in a population is low, any individual bat can be carrying the rabies virus. The rabies virus is spread to a person if saliva from an infected bat gets through a person's skin by a bite or scratch. Because of this, **no bat should be handled without gloves or other protection** and special care should be taken to avoid bites. 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. This means that in specific circumstances, a person can be bitten or scratched by a bat and not realize it. If a bat is physically present and it cannot be ruled out that a person is 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 or mentally impaired adult, etc.), or if you or someone else is ever bitten by a bat, make sure that the bat is captured and submitted for rabies testing. Testing is done at the Massachusetts Department of Public Health in Jamaica Plain, Massachusetts (call (617) 983-6800, available 24/7) and submission is usually coordinated by the person's municipality. If the bat cannot be captured, contact your healthcare provider. Rabies in people can be prevented, even following an exposure, through the prompt administration of rabies post-exposure prophylaxis, which consists of a passive antibody and a series of 4–5 vaccinations.

Histoplasmosis is a fungus that grows particularly well in the droppings of bats and birds. If dust containing the fungal spores is stirred and consequently inhaled, a lung infection may result. Symptoms of histoplasmosis include fever, congestion, and spots on the lungs that are visible on x-rays. Mild cases are common and often go unnoticed; severe cases are rarely fatal. Although histoplasmosis is uncommon in Massachusetts, to help protect yourself against the disease, never sweep or vacuum guano from an attic floor or stir up guano dust unless wearing adequate respiratory protection, such as an N95 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 in an unharmed way (see page 5), any individual bat found in the house that might have had contact with a pet or person—particularly children and mentally impaired adults—should be turned in to the Department of Public Health for rabies testing.

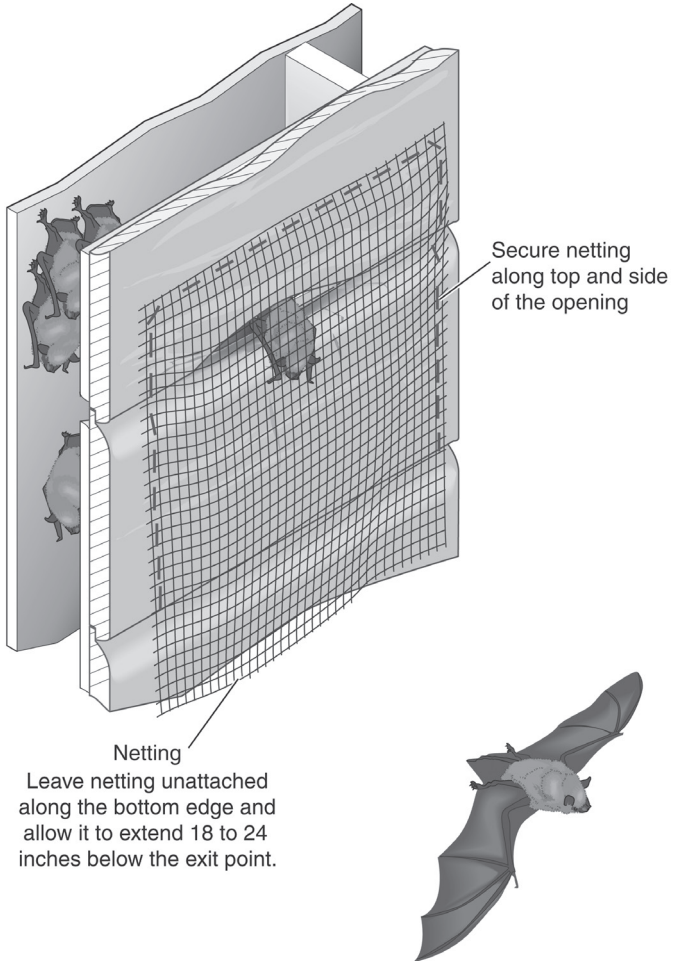
Using netting to exclude bats

Bats sometimes enter buildings through openings on smooth surfaces of exterior walls or through louvers. In such cases, plastic or lightweight, flexible netting with $\frac{1}{16}$ inch mesh or smaller, should be secured to the building along the top and sides of the opening as shown in the below diagram. It should extend 18–24 inches below the bottom edge of the opening and 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 the area 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.

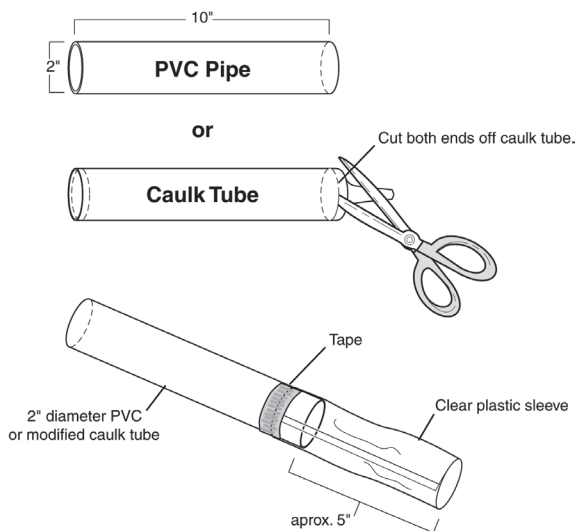
After this has been done, watch to make sure the bats are able to exit safely. If they do not appear to be exiting, or appear to be having trouble doing so, make adjustments or add netting areas as needed.



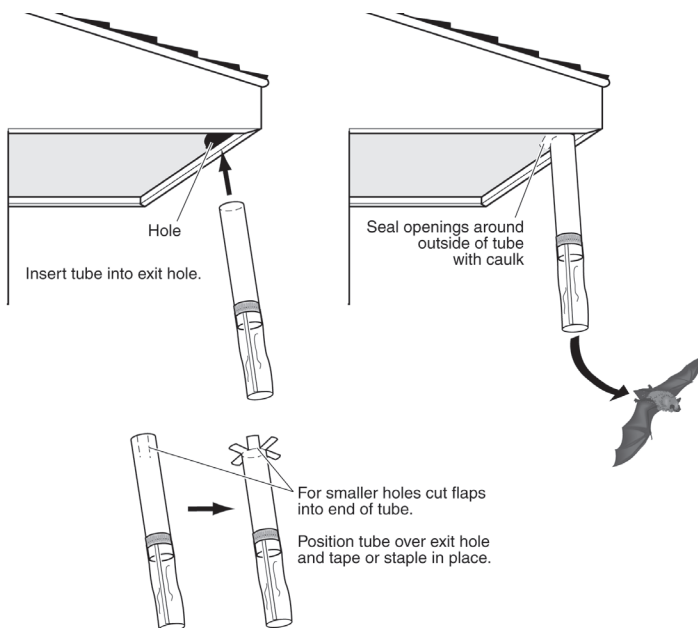
Using PVC pipe or empty caulking tubes to exclude bats

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 diameter and be approximately 10 inches 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 fit over an opening and stapled, nailed, or taped to the building (see diagram below). Bats are unable to cling to the smooth surface of these tubes. Do not let the tube project more than $\frac{1}{4}$ inch 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. Cleaning also ensures no rough caulk is left, which creates a roughened surface, making it possible for bats to re-enter. Once the tube has been inserted over the hole, a piece of clear, light-weight plastic can be taped around the end of the tube that projects to the outside (see diagram to the right) to further reduce the likelihood of bats reentering, though this is typically not necessary.

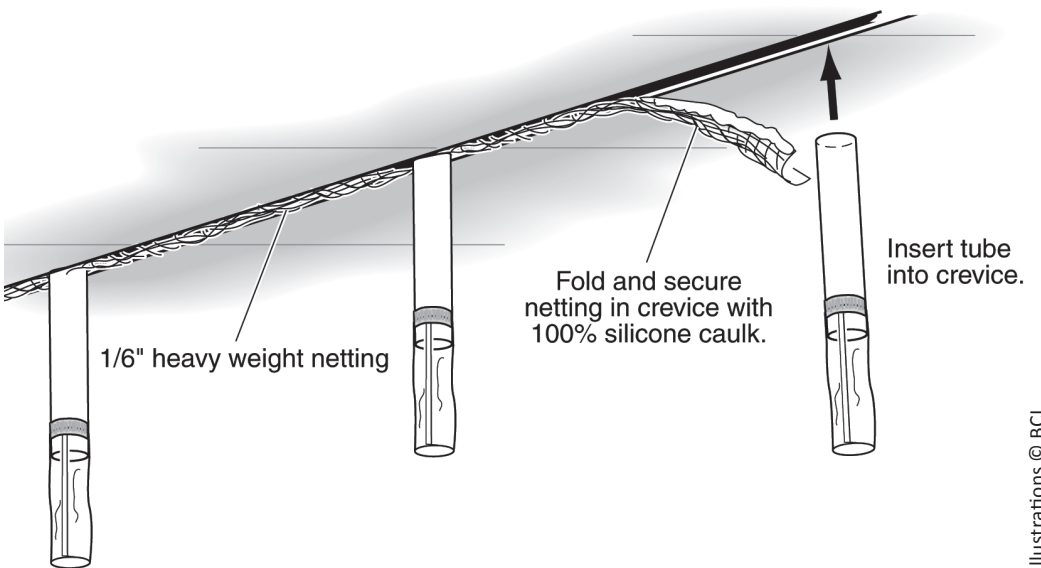
Plastic sleeves collapse on themselves, preventing bats from reentering once they have crawled out through the tube. After the tube has been inserted into or over the opening used by bats, any spaces between the outer rim of the tube and the building must be sealed shut. Be sure to also seal shut any 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.

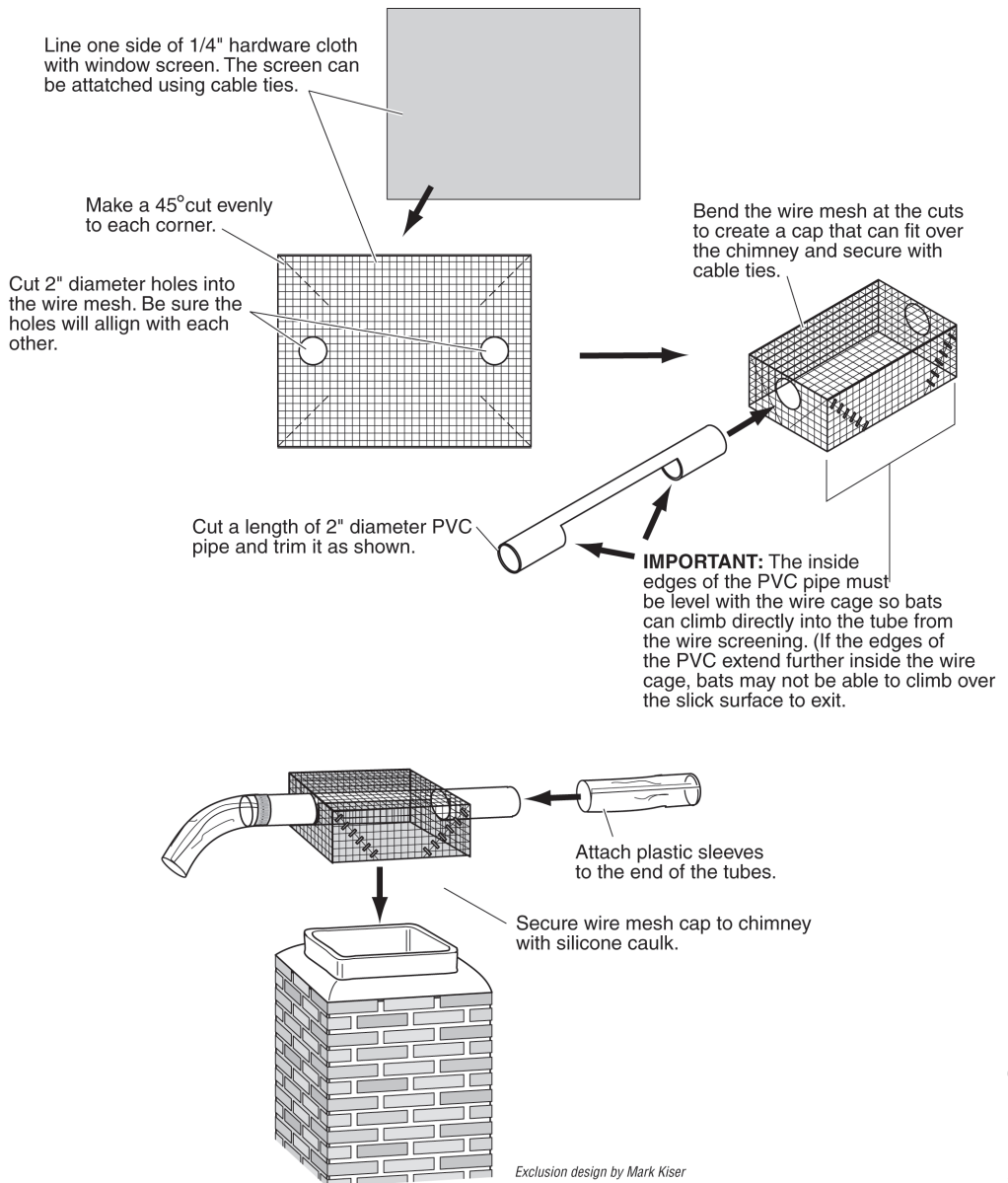
Some concrete parking garages have lengthy crevices used by bats. Multiple exclusion tubes should be placed every few feet along the length of each crevice; spaces between the tubes should be closed with heavy-weight ($\frac{1}{8}$ inch mesh) netting (see diagram below). Fold the netting so that it fits into the crevice and caulk it in place as shown. 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 a 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 a chimney, construct a wire cage from $\frac{1}{4}$ -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 as shown on page 14. 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. 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.

Bat houses

One of the best ways you can support bat conservation is to put up an artificial roost, like a bat house. Since bat populations have decreased significantly since 2008, bat houses are useful in providing secure roost sites where bats can rest. The structures are also good locations for females to birth and raise young bats safely.

The importance of bat houses

- Bat houses are particularly helpful in providing alternative roosting habitat for bats that are excluded from homes. In turn, this reduces the chance of human contact with bats.
- Installing a bat house on your property can provide a safe environment for bats, while protecting your yard from pest insects, like mosquitoes, moths, and beetles.
- Bat houses give females a safe, warm place to raise their young. Since most female bats only have one pup each year, bat populations grow very slowly. Additionally, due to habitat loss and degradation, it is becoming harder for bats to locate roost sites to raise their young. By installing a bat house, you can provide mothers and their pups with a safe home.

Buy a bat house

Bat houses range in size from single-chamber to larger multi-chamber bat condos. There are many kits available that provide all of the materials for you to build a bat house yourself, as well as ready-to-install preassembled bat houses. You can purchase bat houses online through a variety of retailers or at your local home improvement store.

Bat Conservation International (BCI) has a Bat Approved Certification Program with specific certification criteria for bat house design and construction. You can view a list of certified bat house vendors on the BCI website at batcon.org. Additionally, Bat Conservation & Management has bat house do-it-yourself kits, as well as preassembled bat houses, in a variety of sizes available for purchase on their website (batmanagement.com).

Build a bat house

Bat houses can be expensive to purchase, especially ones designed with multiple chambers for larger colonies. Building a bat house yourself can be a less-expensive alternative. The cost of materials can be dictated by the quality of wood and hardware you choose to use, as well as the size of bat house you choose to make. The following pages describe how to build a simple four-chamber bat house. All of the materials on page 16 can be purchased at your local home improvement store. For best results, use outdoor-grade plywood. Never use pressure-treated wood for projects that involve wildlife. Please email natural.heritage@mass.gov or visit mass.gov/bathouses for answers to questions you have regarding materials, building, or installing a bat house on your property.

Build a four-chamber bat house

Materials (makes two houses)

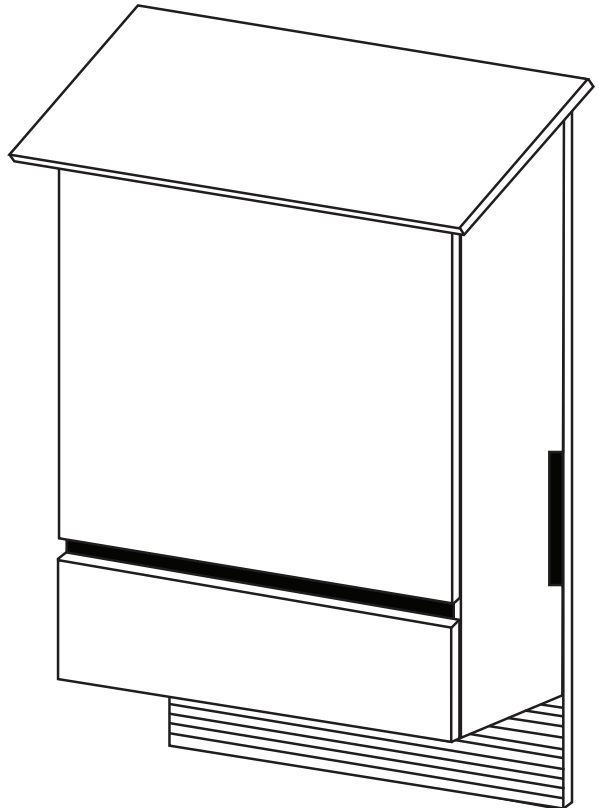
- 1/2 sheet (4' x 4') 1/2" AC, BC, or T1-11 (outdoor grade) plywood*
- 1/2 sheet (4' x 4') 3/8" AC or BC (outdoor grade) plywood
- 2 pieces 1" x 6" (3/4" x 5 1/2" finished) x 8' pine or cedar
- 1 lb. coated deck or exterior-grade screws, 1 5/8"
- 20–25 coated deck or exterior-grade screws, 1 1/4"
- 20–25 exterior-grade screws, 1"
- 1 qt. dark, water-based stain, exterior grade
- 1 qt. water-based primer, exterior grade
- 2 qt. flat water-based paint or stain, exterior grade
- 1 tube paintable latex caulk
- Black asphalt shingles or galvanized metal
- 12–20 roofing nails, 7/8"

Recommended tools

- Table saw or circular saw
- Variable-speed reversing drill
- Screwdriver bit for drill
- Tape measure or yardstick
- Caulking gun
- 1 1/2" hold saw or spade bit
- Paintbrushes

Optional tools

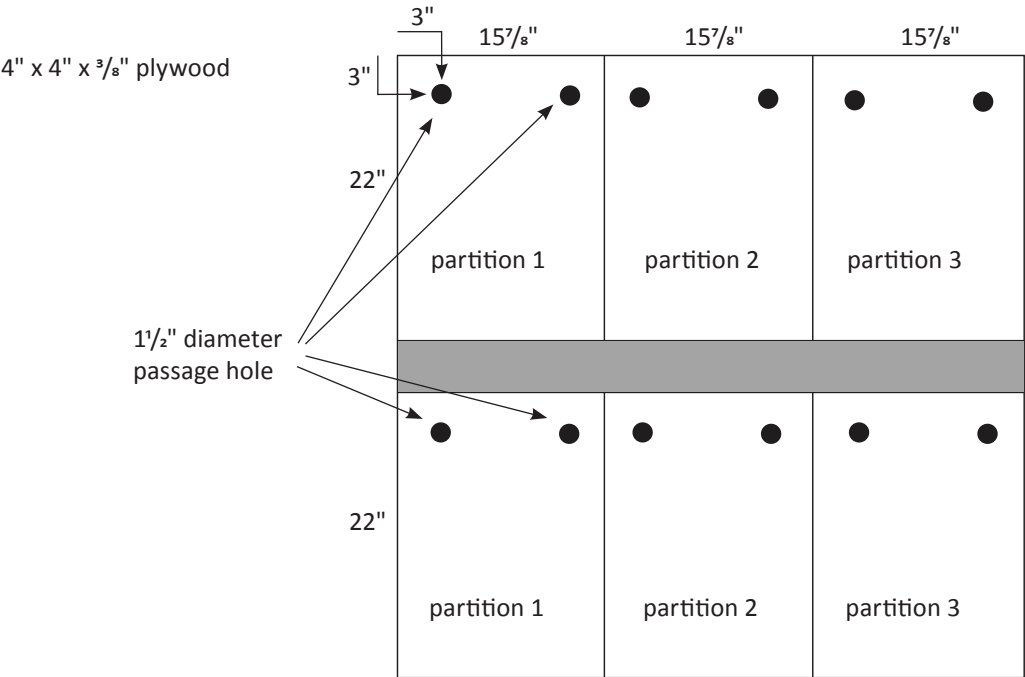
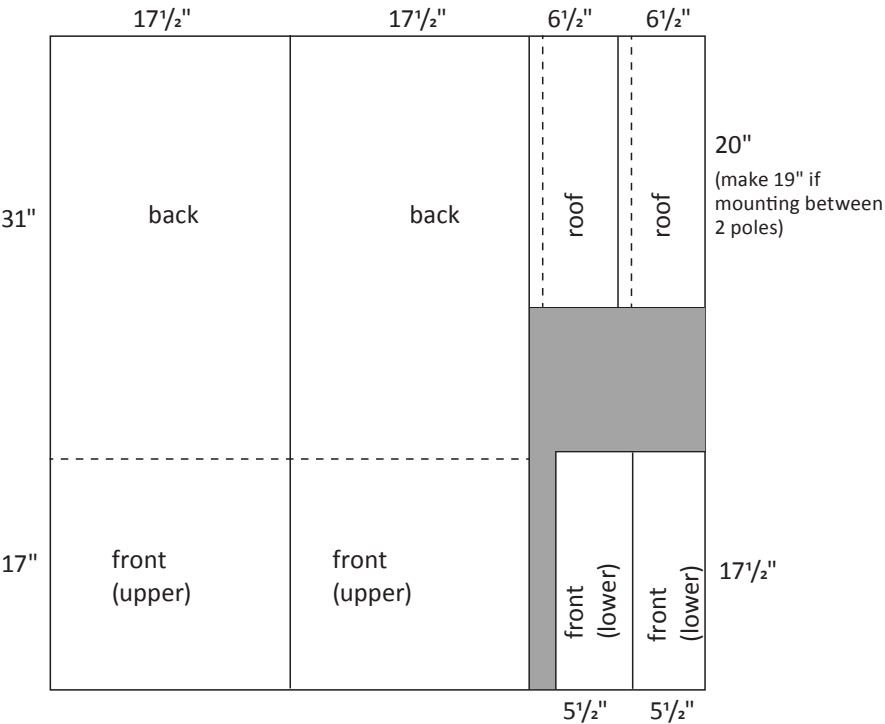
- Hammer
- Tinsnips
- Bar clamp
- Sander



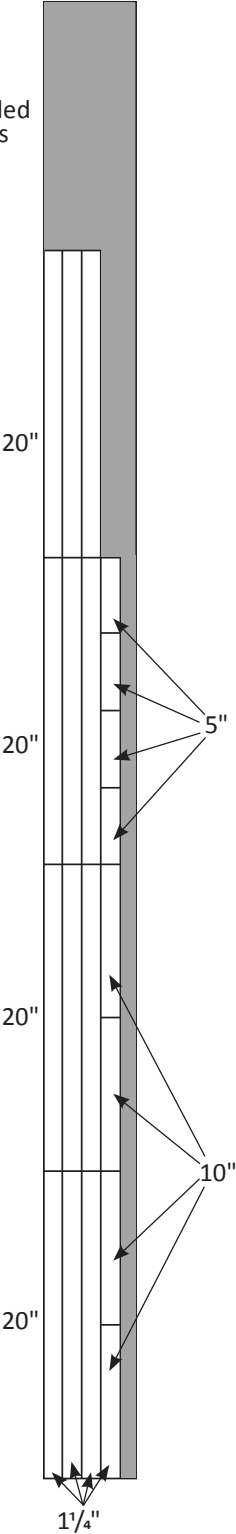
*Do not use pressure-treated wood, as this can harm bats and other wildlife.

These two pages show the dimensions to cut the materials to for each piece of the bat house.
Note that the gray portions are extra materials and the dotted lines indicate 25° bevel.

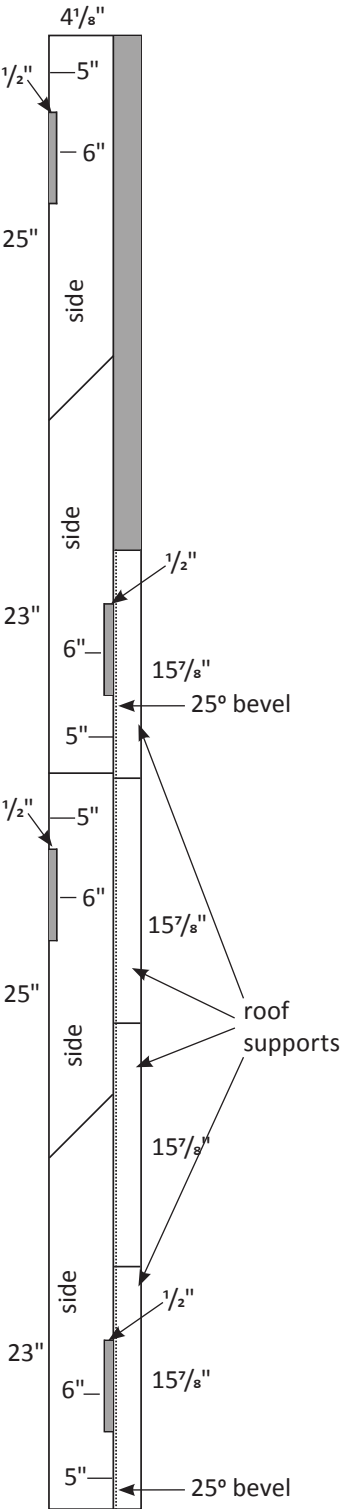
4" x 4" x 1/2" plywood

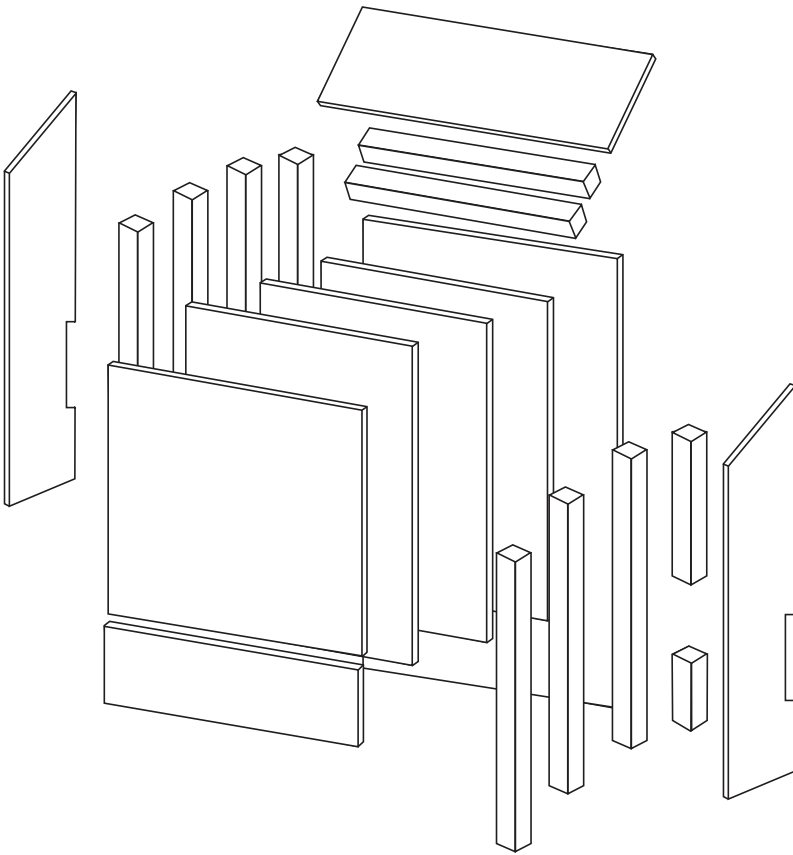


1" x 6" x 8'
board divided
into spacers

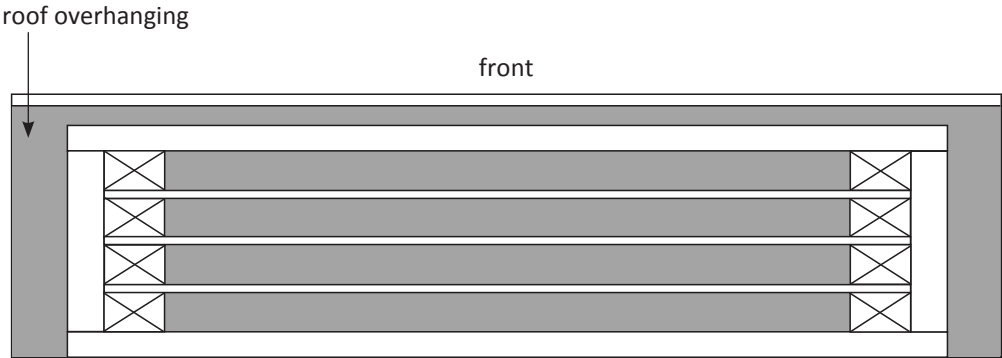


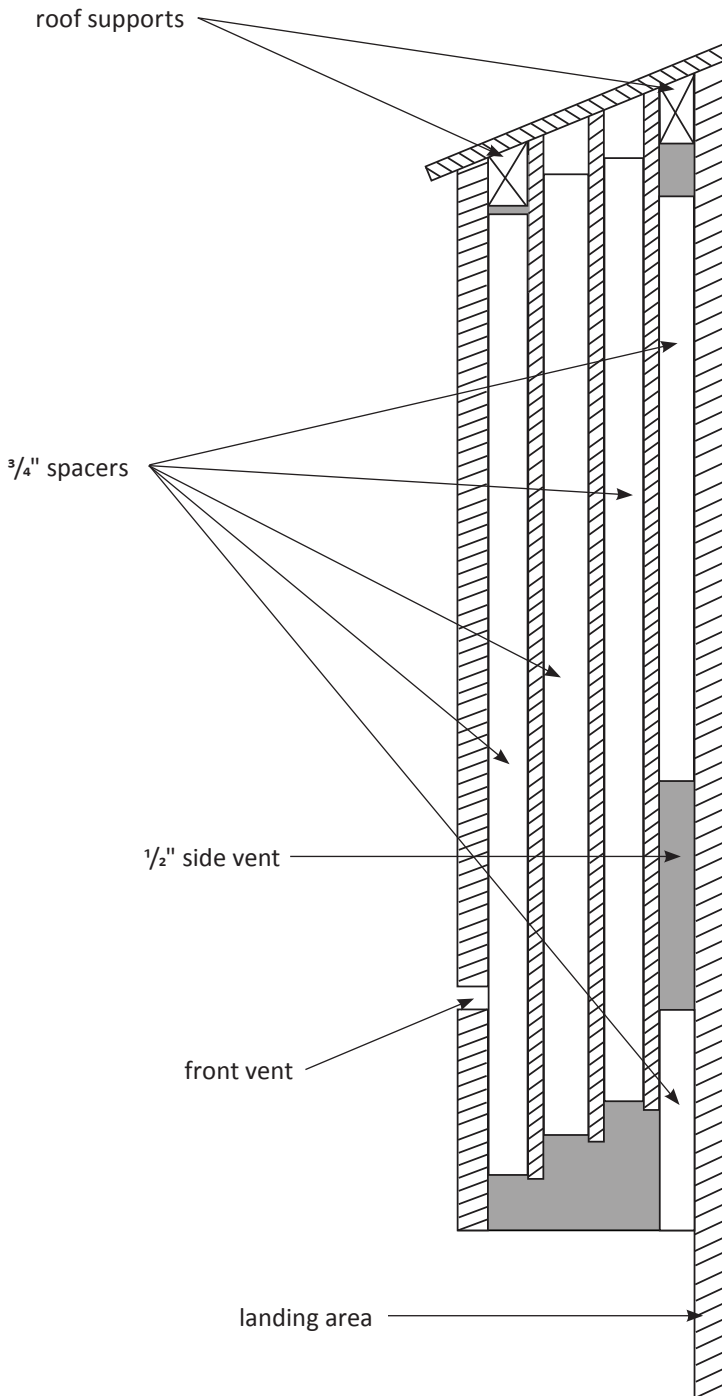
1" x 6" x 8'
board





Top: assembly diagram of a four-chamber bat house.
Right (page 20): view of an assembled bat house from the side.
Bottom: view of an assembled bat house from the bottom.





Construction

1. Measure, mark, and cut all wood pieces, including passage holes, according to the diagrams on pages 17 and 18. Passage holes should be 3" in from the top and sides.
2. Roughen interior and landing surfaces by cutting horizontal grooves with a sharp object or saw. Space the grooves roughly $\frac{1}{2}$ " to 1" apart and about $\frac{1}{16}$ " deep.
3. Apply 2 coats of dark, water-based stain to the interior surfaces.
4. Attach side pieces to the back, caulking first. Make sure the top angles match. Use the $1\frac{5}{8}$ " screws to secure.
5. Attach the 5" and 10" spacers to the inside corners using the 1" screws. This will create roost chamber spacing of about $\frac{3}{4}$ ". Do not block the side vents.
6. Place the first roosting partition on the spacers even with the bottom edge of the roof using the $1\frac{5}{8}$ " screws.
7. Place the 20" spacers on the partition and screw into the first spacers through the partition using the $1\frac{5}{8}$ " screws.
8. Repeat the last 2 steps for the remaining spacers and partitions.
9. Attach the front to the sides, top piece first, by caulking the seams. Sand the top angles so they match, if necessary. Leave $\frac{1}{2}$ " vent space between the top and bottom front pieces. A bar clamp may help to keep the pieces in place as they set.
10. Attach roof supports to the top inside of front and back pieces with the 1" screws. Be careful to not let the screws protrude into the roosting chambers; this could injure bats that use the house.
11. Caulk all of the top surfaces, sanding first if necessary to make sure all of the sides are level.
12. Attach the roof to the sides and roof support with the $1\frac{1}{4}$ " screws. Caulk around the roof and side joints to further guard against leaks and drafts. Don't let the screws protrude into the roosting chambers; this could injure bats that use the house.
13. Paint or stain the exterior surface 3 times using a primer for the first coat.
14. Cover the roof with roof shingles or galvanized metal for added protection.

Optional modifications

- These nursery-house dimensions were chosen to permit construction of two bat houses per half-sheet of plywood. Increasing the house width to 24" or more, or adding partitions may attract larger colonies. Additional spacers are needed to prevent warping of roost partitions for houses more than 24" wide.
- Taller bat houses provide improved temperature gradients and may be especially useful in climates where daily temperatures fluctuate widely. Bat houses 3' or taller should have the horizontal vent slot 12" from the bottom of the roosting chambers.
- Two bat houses can be placed back to back mounted on poles.
 - Before assembly, a horizontal $\frac{3}{4}$ " slot should be cut in the back of each house about 10" from the bottom edge of the back piece to permit movement of bats between houses.

- Two pieces of wood, 1" x 4" X 10³/₄" screwed horizontally to each side will join the two boxes. Leave a ³/₄" space between the two houses and roughen the wood surfaces or cover the back of each with plastic mesh. One 2" x 4" x 40" vertical piece, attached to each side, over the horizontal pieces, blocks light but allows bats and air to enter.
- Use a 2" x 6" vertical piece if securing houses with U-bolts to metal poles.
- A galvanized metal roof that covers both houses protects them and helps prevent overheating. Eaves should extend about 3" in front in southern areas and about 1¹/₂" in the north.
- Ventilation may not be necessary in cold climates. In that case, the front of the bat house should be a single, 23"-long piece. Bat houses in more northern areas may also benefit from a partial angle of 45° or greater to reduce guano build-up. Leave a ³/₄" entry gap at the back and be sure the bottom does not interfere with access to the front crevices. A hinged bottom is required to permit annual cleaning.
- Durable plastic mesh can be substituted for roughening. Attach mesh to backboard, landing area, and one side of each partition after staining the interior, but prior to assembly. Use ¹/₈" or ¹/₄" HDPE plastic mesh and attach every two inches with stainless steel staples.
- Make partitions removable by attaching small cleats with thumbscrews to the bottom of side pieces for support. Spacer strips are unnecessary if grooves for partitions are cut in the side pieces with a router or dado saw blade.



A large, multi-chamber bat house on the side of a barn.

Photo by Bill Byrne/MassWildlife

Tips for installing a bat house

Once you have purchased or built a bat house, the next step is to install it! The design, location, and temperature are all key factors in bat house occupancy. Below are some installation recommendations for the best chances of bats occupying your new bat house.

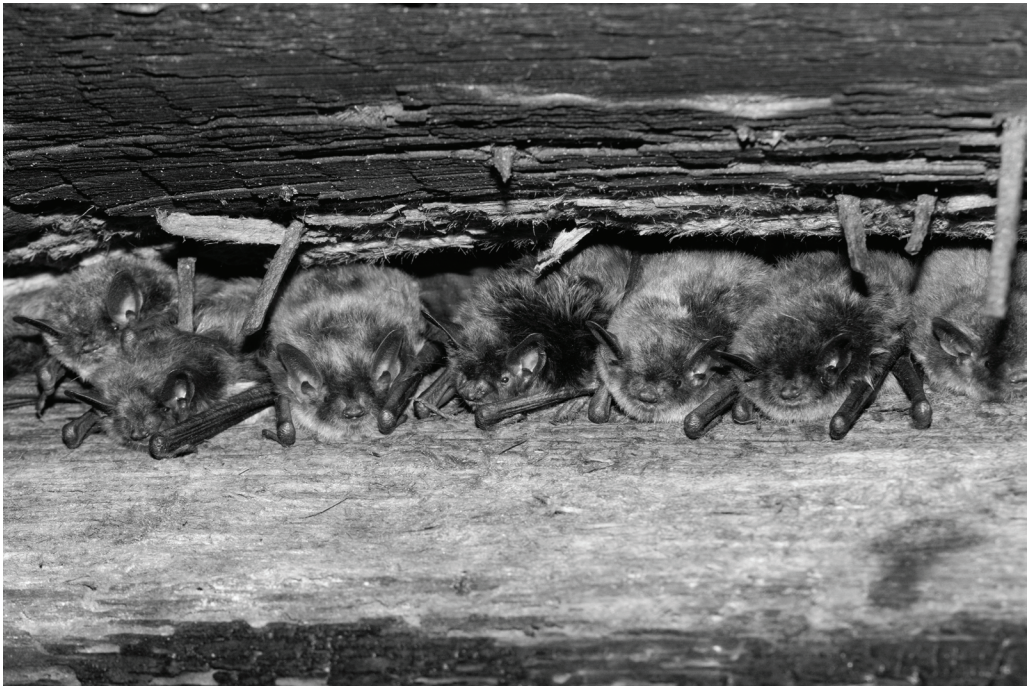
- Bat houses can be mounted on wooden posts, steel posts, or on the sides of buildings. They should never be mounted on trees. Trees receive less sun, make the bats more vulnerable to predators, and have branches that make it difficult for bats to drop into flight. Bat houses mounted under eaves on buildings are ideal locations. Here, bat houses are still exposed to the sun while being protected from rain and predators.
- If mounting to a wooden pole, a metal predator guard is suggested. Poles can be wrapped with an 18 inch piece of sheet metal 3 feet above the ground.
- The side of a house, garage, or barn is the best location for a single-chamber bat house. These buildings eliminate drafts on one side, provide a buffer from cool nighttime temperatures, and help the bat house heat up more quickly than when installed on a pole. Single-chamber bat houses should not be mounted to poles unless two are mounted back-to-back. If mounting two back-to-back, place the houses $\frac{3}{4}$ of an inch apart and cover both with a galvanized metal roof to protect the space in-between from rain.
- Bat houses should be 20–30 feet from tree branches, vegetation, and wires.
- Make sure bat houses are 12–20 feet above the ground for clearance when bats swoop into and out of the bat house.
- Bat houses located close to a source of water (i.e. along streams, creeks, ponds, rivers, lakes, etc.) are the most successful.
- Do not place a bat house on the top of a hill where it may be exposed to excessive winds.
- Install bat houses away from bright lights and avoid shiny and reflective objects on the ground under the bat house, as they may disorient bats.
- Bat houses can be installed at any time of the year, but they are more likely to be occupied during the summer if they are installed before bats emerge from hibernation in the spring.
- Warm temperatures are favorable to bats, so the temperature of your bat house will greatly affect whether bats take up residency. Bat house temperatures are influenced by a variety of factors, including exterior color, compass orientation, amount of sun exposure, how well the house is caulked and vented, and the mounting and construction materials. Below are a few recommendations to help maintain an ideal temperature inside your bat house.
 - Internal temperatures should be 80–100 °F in the summer for mothers to raise their young.
 - Mount your bat house in an area that gets 6–8 hours of direct sunlight every day.
 - Make sure your bat house faces south, east, or southeast to catch the heat of the sun as it rises.
 - If you live in the northeastern United States, paint your bat house black, dark brown, or a similar dark color to absorb heat from the sun.

More information

For help in identifying a captured bat, please send a photo to MassWildlife's Natural Heritage and Endangered Species Program at natural.heritage@mass.gov. You can also send a photo by mail or bring the bat with you to MassWildlife Field Headquarters at 1 Rabbit Hill Road, Westborough, Massachusetts 01581. Please make sure to secure the bat in a clear, plastic bag if bringing a specimen in person. Mailed specimens will not be processed.

Visit MassWildlife's website to learn more about bats, our conservation work with them, and how you can help. Below is a quick reference to our different website pages.

General information about bats	mass.gov/bats
Specific information about bat houses	mass.gov/bathouses
MassWildlife's Natural Heritage & Endangered Species Program	mass.gov/nhesp
Information on how you can support MassWildlife's work with bats	mass.gov/supportnhesp



Little brown bats roosting in the eaves of a barn in Massachusetts.

Photo by Troy Gipps/MassWildlife

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, etc., until you discover the common name of your particular bat.

- 1a. Upper surface of interfemoral membrane (see image on page 5) 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 $1\frac{3}{4}$ to $2\frac{1}{4}$ inches long hoary bat
- 3b. Only $\frac{1}{2}$ of interfemoral membrane (nearest the body) covered with hair; forearm $1\frac{1}{2}$ to $1\frac{3}{4}$ inches long silver-haired bat
- 4a. Hairs on back tricolored—dark at base and tip, but lighter in the middle tricolored bat
- 4b. Hairs on back bicolorous—dark at base and light at tip go to 5a
- 5a. Forearm greater than $1\frac{3}{4}$ inches long big brown bat
- 5b. Forearm less than $1\frac{3}{4}$ inches long go to 6a
- 6a. Face with black mask; ears black; forearm less than $1\frac{3}{8}$ inches long eastern small-footed bat
- 6b. Face with no black mask; ears not black; forearm longer than $1\frac{3}{8}$ inches long go to 7a
- 7a. Ears very long, when laid forward extend $\frac{1}{16}$ inch beyond nose northern long-eared bat
- 7b. Ears relatively short, when laid forward do not extend beyond nose or as much as $\frac{1}{16}$ inch go to 8a
- 8a. Hair glossy; calcar (see image on page 5) 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. This list was updated in 2019. For current listing information, visit www.mass.gov/dfw/mesa.

Common name	Species	Range in Massachusetts	Habitat			Status
			Summer	Winter		
Big brown bat	<i>Eptesicus fuscus</i>	Statewide	Buildings, trees	Buildings, caves, mines		Common
Little brown bat	<i>Myotis lucifugus</i>	Statewide	Buildings	Caves, mines		State endangered
Northern long-eared bat	<i>Myotis septentrionalis</i>	Statewide	Trees, building exteriors, rarely inside buildings	Caves, mines		State endangered, federally threatened
Indiana bat	<i>Myotis sodalis</i>	Last recorded in 1939, Berkshire and Hampden counties	Caves, mines, hollow trees, beneath tree bark	Caves, mines		State endangered, federally endangered
Eastern small-footed bat	<i>Myotis leibii</i>	Hampden and Berkshire counties	Beneath tree bark, in rock talus and deep fissures	Caves, mines		State endangered
Tricolored bat	<i>Perimyotis subflavus</i>	Statewide	Trees, rarely in buildings	Caves, mines, rock crevices		State endangered
Silver-haired bat	<i>Lasionycteris noctivagans</i>	Probably statewide	Trees, rock crevices	Buildings, trees, migratory		Common
Eastern red bat	<i>Lasiurus borealis</i>	Statewide	Tree foliage	Migratory		Common
Hoary bat	<i>Lasiurus cinereus</i>	Statewide	Tree foliage	Migratory		Common



HOW YOU CAN HELP BATS

Bats are among 400 different species of animals and plants that are protected within Massachusetts under the Massachusetts Endangered Species Act. Without your help, these species could disappear forever. Help comes in many forms: make a donation, report rare species observations, or continue the conversation about the rare species of Massachusetts with your friends and neighbors. Thank you for your support!

MassWildlife Natural Heritage &
Endangered Species Program

(508) 389-6360
mass.gov/supportnhesp

MASSACHUSETTS DIVISION OF
FISHERIES & WILDLIFE

1 Rabbit Hill Road | Westborough, MA 01581
p: (508) 389-6300 | e: mass.wildlife@mass.gov



MASS.GOV/MASSWILDLIFE