

Reminder to Owners of Unsuccessful Bat Houses

IF AFTER AT LEAST ONE active season, your bat house remains unoccupied, try moving it to a new location where it receives more or less sun. Reports thus far indicate that most successful bat houses are occupied within the first year, and that most failure results from too little exposure to sun. A house that fails at first, but is occupied after a move, may provide especially enlightening information on what local bats need.

If your houses are mounted on poles, try rotating them from a north/south exposure to sun to east/west. Since houses seem to be too cool more often than too warm, this may help. If your houses are insulated and empty, try removing the insulation to permit greater heat gain. You also can try painting houses a different color, most often darker. Attaching nursery houses back-to-back on poles may reduce extremes of temperature fluctuations. Such houses in the hottest climates may benefit from tin roofs with enough overhang on the east and west sides to reduce solar heating during mid-day. Ventilation slots, like those used by Lisa Williams, are also a good idea.

Advice Summary

CAREFULLY CAULK AND ADD two or three coats of paint to all houses. The objective is to provide a seal against moisture and to prevent drafts at the top where bats roost. Best colors in the South are light brown, possibly white or medium brown, ranging to dark brown or black in the North, probably black in Canada. Provision of at least a five-inch extension of the back board for a vertical landing platform, horizontally grooved at half-inch intervals, will help returning bats.

Most occupied houses face east or west, but additional experimentation with dark brown versus black, facing south, is recommended in the coolest climates. An overlapping tin roof may provide additional protection in the hottest areas. Our tests last summer showed that houses with at least partial sloping bottoms are more stable in temperature. This could prove useful, especially in the North, but be sure to allow enough slope to permit droppings to fall out.

We strongly encourage paired comparisons of differently treated houses, changing only one variable at a time, such as the amount of time or direction of sun exposure, color of house, closed or open bottom, internal roost space dimensions, construction materials, or habitat placement. After you have attracted your first bats, we encourage you to try your own unique designs, varying materials, color, and sun exposure.

How Bats Find New Homes

When planning where to mount your bat house, remember that bats, like us, are creatures of habit. Most North American bats that don't live in caves search for nursery roost sites by investigating traditional locations: along the trunks of leafless snags, at the broken ends of dead branches high above ground, or along cliff faces. Additionally, a large proportion now have become accustomed to searching the eaves of buildings.

It seems likely, then, that artificial roosts placed in such locations would be the first to be found. We could also hypothesize that, given their apparent preference for height, bats may be less likely to find houses mounted on the lower trunks of live trees, and more likely to find houses high on poles.

To test these hypotheses, we checked 1993 Research Associate reports to see if houses in differing locations also differed in the amount of time required for bats to find them. We compared houses mounted on the sides of buildings, poles, and trees, selecting only those houses that were eventually occupied and that received at least four hours of daily sun. We also omitted houses that were located near where bats had been excluded from buildings and houses that had not been regularly checked for occupancy. The sample was thus restricted to eliminate most biases, especially those that might be introduced if poorly designed houses were included, or if some houses profited from local evictions. The resulting sample size was 28: 13 houses on buildings, 5 on poles, and 10 on tree trunks. It took bats an average of 71 days to find the houses on buildings and 73 to find those on poles. But it took an average of 255 days to find the houses mounted on tree trunks, meaning that success didn't come until the second year. Although this sample was small and needs to be corroborated by additional data, it is consistent with the suggestion that the location of houses relative to bat search behavior is probably important.

Success Reminders

The vast majority of unused bat houses are mounted on trees where they receive less than seven hours of daily sun, are not painted dark enough for the area, or provide roosting chambers more than 3/4-inch wide. Smooth roosting surfaces and failure to carefully caulk and paint also contribute to failure. Locations on the sunny sides of buildings or on poles 25-50 feet from the nearest trees seem to be preferred, especially near lakes, streams, or rivers. Rough-surfaced landing areas, extending three to six inches below the entrance, also are helpful. All bat houses should be mounted at least 10-12 feet, preferably 15-20 above ground.

Frequently Asked Questions about Bat Houses

Q. What constitutes an adequate water source for a bat colony?

A. This varies by species, but bats usually need open freshwater at least 10-15 feet across. Rivers, streams, irrigation ditches, lakes, ponds, and marshes are all good water sources. Saltwater and brackish water are not, nor are swimming pools and birdbaths. Bats drink in flight and require open space.

Q. What time should I install my bat house?

A. Anytime, but if you install it before bats return in the spring, you have a much greater chance of it being occupied the first year. When bats are excluded from buildings, houses should be installed several weeks before the exit holes are plugged.

Q. Can I mount my bat house on a light pole?

A. Yes, provided the light does not shine into the bat house. Of course, height, solar exposure, etc. must still be correct. We also do not know if the ultrasonic frequencies emitted by some high intensity lights affect bats. An alternate location, if available, would be preferable.

Q. Do “bug zappers” interfere with my bat house?

A. Probably not, but we still recommend that your bat house be located away from the “bug zapper” if possible. The frequencies emitted by the light could disturb the bats (see above).

Q. Can I place my bat house near a doorway or other busy area?

A. It is best to locate them where disturbance is minimal, though some such houses have been successful, as bats have gradually adapted.

Q. Will my bats produce a lot of guano?

A. A bat will only produce a dozen or so droppings daily that fall beneath the roost. The rest is dispersed during its feeding flights.

Q. Can I move my bat house once bats move in?

A. You can move it a short distance, say from your house to a pole in your yard, but it should only be moved in the winter when the bats are absent. Longer moves should be done in steps over several years.

Bat Houses and Temperature

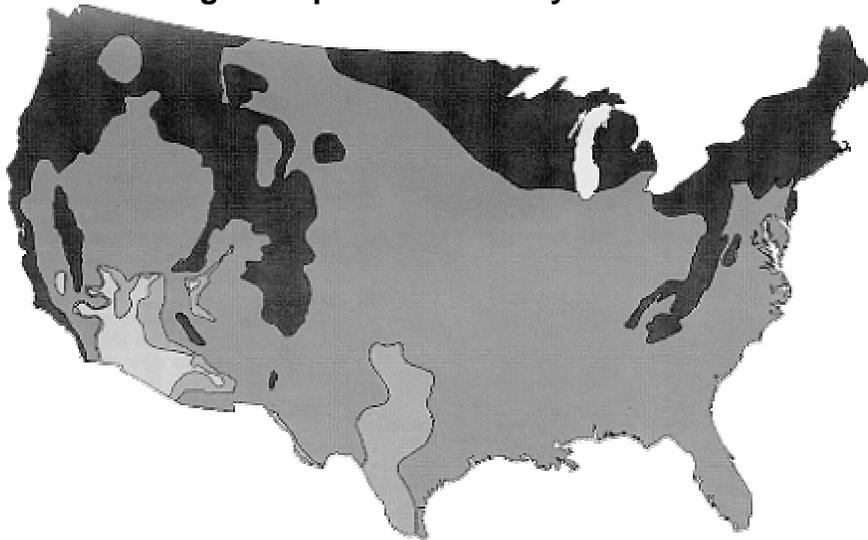
Temperature is one of the most important ingredients in bat house success, and probably the least understood. Unpainted bat houses and those mounted in the shade are seldom warm enough, and thus are rarely used. Many bat house

owners needlessly worry that their bat houses will get too warm. Available evidence suggests the opposite. Unless you live in an exceptionally hot climate, you can help an under heated bat house by moving it to a sunnier spot and painting it a darker color after carefully caulking all exterior joints.

Actual bat house color is less important than darkness. Dark houses absorb more solar radiation, thus warming them better. The ambient, or outside, temperature is affected by factors such as cloud cover, prevailing winds, elevation, latitude, and topography, making earlier painting suggestions based solely on latitude too simplistic. Our latest recommendations are based on the average high temperature in July for your area. Because temperatures are averaged, the value may be lower than you expected. You can obtain specific information from your local weather bureau or university, or use a published reference such as the *Climatic Atlas of the United States*. The map to the left, while not very detailed, provides a good starting point.

Bat houses may overheat, especially in the south, but the latest BCI designs, with roofs and vents, are designed to greatly reduce that possibility. It is probably better to err on the side of warmth when painting and locating a bat house. Later you can extend the roof, add more vents, or paint the bat house lighter if needed.

Bat House Color Recommendations and Average Daily High Temperatures in July in the U.S.



Black areas = less than 85° F. -- Recommend black paint.

Dark areas = 85°-95° F. -- Recommend dark shade of paint.

Medium areas = 95°-100° F. -- Recommend medium shade of paint.

Light areas = 100° F or greater. -- Recommend light shade of paint.

GRAPHIC BY JIM KENNEDY

Meet *Myotis evotis* (Western Long eared bat)

Mark Kiser

Thanks to Dr. Patricia Otto, a Research Associate since 1995, the western long-eared myotis (*Myotis evotis*) can be added to the growing list of bat house tenants. When she moved to her 90-acre (36 ha) property in northwestern Washington in 1988 and started to conduct wildlife projects, she had already been a fan of bats for many years. "It was only natural to add bat houses to my various bird nest box programs," said Patricia. She began installing bat houses on five acres (2 ha) of open fields surrounding her house and outbuildings. The fields are bordered by 85 acres (34 ha) of mature second-growth forest, and there are three ponds and a stream present, making the habitat ideal for bats. In 1993, she attended one of BCI's Bat Conservation and Management workshops [BATS, Fall 1998] in Portal, Arizona, where she became "smitten" after seeing bats up close and personal. That same year she purchased a bat detector. "I was amazed by the bats I could find and identify flying on my property," she said. "Now I rarely leave home without my bat detector." The big brown bat (*Eptesicus fuscus*) is one species she has been able to confirm in her bat houses with the use of her detector.

That same year (1993) she also first noticed 20 to 30 bats (later confirmed as western long-eared myotis) in the attic and under the cedar shake shingles of her house. The bats were regular guests in the attic and roof from May until September each year through 1999 when she noticed increased activity in some of her bat houses. Convincing bats to voluntarily move from a building, or from underneath cedar shingles, into bat houses require the latter to be quite attractive.

Among the early designs Patricia tried were a Missouri-style house and various nursery and single-chambered models attached to snags, live trees, poles, and a barn, but most of these attracted only a few bachelor bats, if any. Until 2000, her most successful houses had been a group of three plywood panels [single chamber, 1/2" spacing (13 mm)] fastened to a dark brown barn wall in 1995. Each faced southeast and received about eight hours of sun. From 1997 to 1999, the 42-inch (1.1 m) tall by 24-inch (61 cm) wide panels gradually lured more of the bats away from her attic and roof each year, with 20 to 50 bats (including at least one big brown bat) alternating among them in 1999. After experimenting with rocket boxes [*The Bat House Researcher*, Spring 1997], however, her enthusiasm about bat houses really peaked.

Her first rocket box, built in March 1998, followed Dan Dourson's and John MacGregor's original design, except given the cool climate, she omitted the vents and caulked and painted the three-foot (0.9 m) tall box dark blue. To her delight, bats moved in that August.

After they departed, she put up four more identical boxes beside the first, and all but one were occupied by one to 10 bats the next summer (after cleaning out a wasp nest, the last box also attracted bats in 2000).

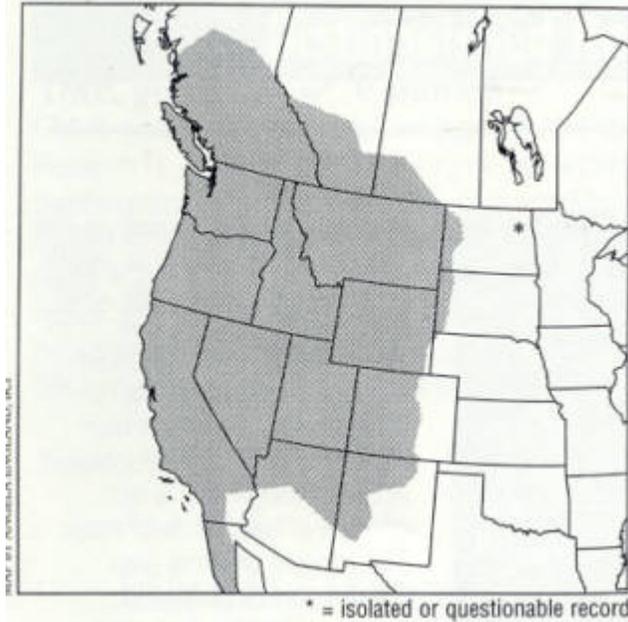
In 2000, Patricia observed that bats overwhelmingly preferred her rocket boxes to their previous roosts, including the panels, attic, and roof. In June, she added a sixth rocket box [four feet (1.2 m) tall and painted black] to the cluster, which bats used within 20 days. Interestingly, the bats frequently switched among all the rocket boxes (sometimes staying only days, but more often two to three weeks) throughout the summer, with no apparent preference. On some occasions, all the myotis roosted in one box, although most of the time they used two simultaneously. A lone big brown bat roosted in one of the temporarily vacant blue boxes for 35 days, and after it departed, 53 myotis moved in two weeks later. Patricia believes the myotis' roost-switching behavior was not related to temperature (most likely it was parasite avoidance), because five of the six boxes were identical, with each receiving seven to eight hours of daily sun exposure. Bats consistently roosted on the south and east sides of all the boxes, even on summer days when temperatures reached 80° to 82° F (26.7°-27.8° C), which she considered hot for her area.

Patricia's experience illustrates the point that like people, bats will readily move to new homes that better meet their needs. This summer, Patricia is testing three new, plastic, rocket boxes (dark-, medium-, and light-colored "Belfry Tower II" models) built by Maberry Centre Bat Homes (page 7) to compare with her wooden boxes. She received the new houses through the North American Bat House Research Project's small grants program. How will the bats respond to their new roosting opportunities? Stay tuned!



The western long-eared myotis can be identified by its nearly one-inch (2.5 cm) long, dark ears, the longest of any American myotis. It is most similar to Keen's

myotis (*Myotis keenii*), which has slightly smaller, lighter colored ears, although this is not always a reliable field mark. The ranges of these two species overlap only in western Washington, British Columbia, and the extreme southern coast of Alaska. The western long-eared myotis is found in a variety of habitats but most often in coniferous forests. Small colonies of 12 to 30 individuals roost in tree hollows, underneath loose bark, in rock crevices, caves, mines, and abandoned buildings. Prey includes moths, beetles, flies, net-winged insects, and true bugs.



Range of the western long-eared myotis.



Carol Kilgore assembles and paints rocket boxes for Patricia Otto's field tests in northwestern Washington. Western long-eared myotis preferred Patricia's rocket boxes to their former roost in her buildings and other kinds of bat houses.

Pole-Mounting Tips

Mark Kiser

“What type of pole should I use?” “Does my bat house sway too much?” Not surprisingly, BCI receives many questions like these. Pole mounting can sometimes be challenging, but offers several advantages, including back-to-back pairing and the ability to face houses in any direction in full sunlight. Before setting up your next bat house, consider the following suggestions.

Many kinds of wooden and metal poles are available. Pole size, strength, weight and cost are important considerations, as are available labor and equipment. Wind affects all poles, even utility poles, to some degree. A few inches of sway is to be expected and is not a concern for bats. Most single bat houses can be installed on one pole and will not require additional support. If in doubt, use two poles for extra stability.

Metal poles

Metal poles are generally stronger and longer lasting than wooden poles. For most applications, 2-inch (5.1 cm) or larger inside diameter steel poles are best. With few exceptions, smaller steel poles are not recommended due to their lower strength and stability. The thicker the wall (measured by its Schedule rating number), and the larger the diameter, the stronger (and heavier) the metal pole will be. Lance Wood, a purple martin landlord, reported that during a storm, 90-mile (144 km) per hour winds snapped an inexpensive, thin-walled steel pipe, resulting in the house's destruction, while a 1/4-inch (6 mm) thick, Schedule 80 steel pipe was not damaged. A slightly thinner Schedule 40 steel pole bent, but did not break, sparing the houses (Purple Martin Update, vol. 7 (2), 1996). Plumbing or pipe supply companies are good sources for steel poles. Bat houses can be attached with hex or carriage bolts, which require cutting or drilling holes into metal. U-bolts, however, can be used and require no special tools, but remember to substitute 2 x 6-inch (5.1 x 15.2 cm) lumber for the vertical mounting boards to avoid splitting the wood.

Wooden poles

Wooden 4 x 4-inch (10.2 x 10.2 cm) posts are economical choices for many homeowners. However, even pressure-treated posts often warp. For this reason, 4 x 6-inch (10.2 x 15.2 cm) posts are better. Round wooden poles (use 6-inch [15.2 cm] or larger diameter) are also available at specialty lumber stores and farm supply centers. Unused utility poles make great mounting sites, although back-to-back pairing is difficult. Attaching bat houses to wooden poles is typically easier than for metal poles, as no special equipment is necessary. Lag screws, hex bolts or carriage bolts can be used to secure houses to poles.

Length

The length of the pole is another important factor. A good rule of thumb is that poles should be five to six feet (1.5 to 1.8 m) longer than the desired installation height, depending on the size of the bat house. Remember, the distance from the ground to the bottom of the bat house (not the top) is what's important. Don't forget to factor in the depth of the hole. Metal poles are available in 20- and 21-

foot (6.1 and 6.4 m) lengths, making them excellent choices. Sixteen-foot (4.9 m) poles are the longest wooden poles that most home improvement and hardware centers carry, and these usually provide finished installation heights less than BCI's 12-foot (3.7 m) minimum recommendation. However, extra height can be gained by the use of pivot mounts [TBHR, Fall 1997]. Bolting a long pole to a pivot point on a stationary base anchored in the ground allows the full length of the pole to be utilized.

Installation

For most single and paired houses, pivot-pole systems are the easiest method of raising and lowering for maintenance. If pivot mounts are not used, it's generally easier to attach bat houses to poles first and then raise them together. Use mounting hardware appropriate for the type of pole and for the size and weight of the bat house (see above for suggestions).

Your soil type will determine how deep the hole can be dug, but three feet (0.9 m) or more is recommended for stability. Make the hole wide enough to allow several inches of clearance around the pole. This will enable you to pour and mix the concrete in the hole. After digging, line the bottom of the hole with several inches of gravel to allow drainage, which reduces deterioration. Depending on your skill, equipment, and the type of house(s) you wish to install, you will probably need the help of three or more people to raise the pole. Once poles are set in place and are vertical (check with a level), secure them with several bags of concrete mix, depending on the size of the hole. Always brace poles with boards and stakes to keep them straight while the concrete cures.

Multiple houses

When using two or more poles to mount back-to-back pairs or extra-large bat houses, some builders attach braces between poles to add stability. Temporary braces between poles are useful when erecting houses, as they provide rigidity, making installation easier. Permanent braces can cause problems, however, including increased difficulty for bats when entering and exiting. In addition, bats are most vulnerable to aerial predators at this time, when flight speed is slowest. Braces underneath or adjacent to bat houses make convenient perches from which hawks and owls can grab an easy meal. When attaching multiple houses side by side on pole frameworks, minimize spaces between houses to discourage perching by raptors. If braces must be used, place them at least 10 feet (3 m) below bat house entrances. Guy wires or cables are unnecessary and should not be attached to poles, as young bats may strike the wires and be injured or killed. Avoid hanging bat houses from chains or cables, as they tend to sway too much, potentially scaring bats away.

If you wish to share any of your installation tips with other Research Associates, please write to us so that we may include them in a future issue of The Bat House Researcher.



Concrete can be mixed directly in the hole (use several bags of mix per hole). While mixing, check the poles frequently with a level to ensure they are vertical.



Project Assistant Selena Kiser checks a pair of nursery houses with a level to ensure the poles are vertical. Temporary braces and stakes were used to hold poles in place while the concrete mix dried.



Eagle Scout Will Reimer positions a nursery house on an unused utility pole at Hornsby Bend Wastewater Treatment Plant in Austin, TX. A rope and pulley was used to lift the house into place, which enables one person to perform the entire installation. Thanks to Honorary Research Associate Kent Borcharding for contributing this idea.

Bats, Man-Made Roosts, and Mosquito Control

Merlin D. Tuttle

Bats are primary predators of vast numbers of insects that fly at night, and some species consume large numbers of mosquitoes. However, mosquito control is a complex problem that rarely can be solved by a single approach, be it bat houses or pesticides.

A variety of options should be considered, though existing chemical pesticides typically cause more long-term problems than they solve. Chemical poisons kill natural mosquito predators more effectively than mosquitoes. Over time, predators such as fish, mosquito-eating insects and bats die out, while mosquitoes develop resistance, enabling them to multiply in ever-larger numbers in a losing battle often referred to as “the pesticide treadmill.”

Individuals of some bat species can capture from 500 to 1,000 mosquitoes in a single hour^{1, 2} and large colonies can consume enormous quantities. For example, a Florida colony of 30,000 southeastern bats (*Myotis austroriparius*) was estimated to consume 50 tons (45 t) of insects annually, including over 15 tons (13.5 t) of mosquitoes,³ and from 77.4% to 84.6% of little brown bats (*M. lucifugus*) living in the northern U.S. and Canada eat mosquitoes.^{4,5} Nursing mothers of these species eat up to their body weight in insects nightly,⁶ and often can be attracted to live in bat houses.⁷

However, despite the numbers of mosquitoes that bats eat, simple provision of additional roosts should not be promoted as more than one step in the right direction toward solving mosquito problems. In some cases bat houses may help and in others, they may not. Bats are just one of several groups of animals that naturally prey on mosquitoes. Their relative importance appears to vary from none to high in different locations. In some areas, such as in the far northern tundra or in the Florida Keys, habitats are relatively simple and cannot support more than a few bats or other insectivorous animals, largely precluding natural control. In other locations human activities have converted once-diverse biological communities into much simpler farm and yard conditions. Such simple habitats may produce huge hatches of mosquitoes and other insect pests on an occasional basis, while providing insufficient other insect species (such as harmless mayflies) to feed insectivorous animals between hatches of pests. As a result, once-abundant predators that help keep nature in balance are lost. Additional roosts alone may not bring them back.

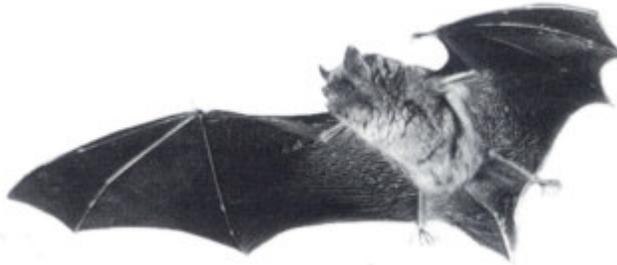
In some areas, bats may never have been significant predators of mosquitoes, while in others they may have been important. Certainly, in areas like Chautauqua, New York, where bats apparently still play an essential role, all possible precautions should be taken to ensure their continued presence. And where bats are known to have declined, their recovery should be encouraged. Providing additional bat roosts is just one aspect of bat conservation, and saving bats is just one aspect of enhancing natural control of mosquitoes.

It is impossible in most cases, either chemically or naturally, to completely eliminate mosquitoes, though their numbers can be substantially reduced, and in the long run, this is best done by non-chemical means, especially by draining unnatural sources of standing water. Putting up bat houses may help in places where bats can be attracted, but even successful bat houses do not always attract a species that feeds on mosquitoes. Bat houses are most likely to succeed where bats are already known to use old buildings, barns or bridges. Such roosting habitat typically is being replaced by structures that are unsuitable for bats, forcing them to find new roosts or die. Participants in the North American Bat House Research Project have attracted many thousands of bats to new locations using bat houses, but success is not certain in all areas. In some, simply using bat-friendly bridge designs can attract tens or hundreds of thousands of bats. In other places, loss of hibernation caves hundreds of miles away may preclude further use of an area by a bat species that feeds on mosquitoes. Other species that eat primarily beetles or moths, but do not require caves for hibernation, may still be abundant, with little impact on mosquitoes. All American bats are beneficial, though their diets vary considerably. While mosquitoes may bother us most directly, many beetles, moths and other insects consumed by bats are important pests of yards and gardens. Building bat houses can help in many ways, though not always in mosquito control.

Although no single approach to mosquito control is appropriate for all locations, encouraging natural predators should be an important element in long-term planning wherever possible. Anything that can be done to encourage predation

from aquatic insects, fish or bats may be important in reducing mosquito numbers.

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4. Anthony, E.L.P, and T.H. Kunz. 1977. Feeding strategies of the little brown bat, *Myotis lucifugus*, in southern New Hampshire. *Ecology*, 58:775-786.
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The southeastern myotis, which often forages over water, is just one of several North American species known to feed frequently on mosquitoes. Little brown bats, found throughout most of the U.S. and Canada, and Yuma myotis (M. yumanensis), found in the western U.S. and Canada, are also substantial predators of these pesky insects. These species all consistently use bat houses.

**The Pacific Northwest
is home to the Yuma bat and the Little Brown Bat.**
