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BAT HOUSES: THE SECRETS OF SUCCESS
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by Merlin D. Tuttle and Donna Hensley

Since Bat Conservation International first popularized bat houses in the early 1980s, thousands have been erected in backyards, parks, and forests all across America. Yet nothing in the history of bat conservation efforts has generated more controversy. Claims and counterclaims over whether bat houses work too often have been based only on limited local observations. As a result, many erroneous conclusions have been reached about the overall success or failure of bat houses. Now, thanks to the many BCI members and friends who tested and reported bat house use under a wide variety of conditions and geographical locations, we know a great deal more.

To evaluate the rate of bat house occupancy and why bats prefer some houses over others, BCI recently conducted a comprehensive survey of hundreds of people in the United States and Canada who had built or purchased one or more bat houses. Some of the results were surprising and open the door for further experimentation. But the most encouraging news is how successful bat houses really are: 52 percent of the houses in our survey attracted bats [the full study methods, criteria, and results begin on page 4]. The survey also enabled us to quantify roosting preferences over broad geographical areas for the first time.

It is clear from this study that when bat houses are placed to meet bat needs, occupancy success is high. Taking the survey results for the northern third of the United States, where we found bat houses are most used and are now best understood, we checked to see what the success rate was for houses that met just two of the most important criteria. We looked at all that were located a quarter of a mile or less from a stream or river, or a lake larger than three acres, *and* that received at least four or more hours of daily sun. The occupancy rate for these houses, without consideration of other factors, was 83 percent. When we further limited the sample by adding houses stained or painted dark, occupancy rose to 92 percent. (This proved important for heat gain in northern latitudes.) When we added another condition□ houses located in areas of mixed agriculture (mostly orchards)□100 percent of the 13 houses meeting all four criteria were occupied. For reasons as yet unknown, bats seemed to be especially attracted to such areas.

Two bat house builders from different parts of the country illustrate the high occupancy rates that can be expected when bat needs are met. Both locations are near large rivers and are surrounded by a mixture of orchards, other agriculture, and woodlands. Tony Koch of Oregon has had 23 of 24 bat houses occupied by more than 600 little brown bats [see "Bats: A Farmer's Best Friend," page 21, for more on this remarkable success story]. Koch's houses are stained or painted dark brown or black and are exposed to at least six hours of daily sun. His only failure was a shaded house on a tree, illustrating the importance of solar heating in the North.

In the South, Baxter and Carol Adams of Texas have attracted approximately 300 Mexican free-tailed bats and several big brown bats, which occupy all four of their bat houses. As expected for a southern location, three houses hung on the southeast side of their home□where they receive only one to two hours of daily sun□ are used all summer by free-tails, while another house on the west side, receiving six to seven hours of sun, is occupied only in winter by big brown bats that hibernate there.

Most bat houses surveyed were either purchased from BCI or patterned after BCI designs, but several innovative people developed modifications that will substantially improve our ability to attract larger colonies. The fact that bat houses only 24 inches tall and wide, and 5 or 6 inches deep, can attract nursery colonies of as many as 200 to 300 bats is very good news. Since such houses require far less time and expense to build, and on the average attract more bats than the much larger Missouri-style houses,* it is no longer necessary to build these costly houses to provide for large colonies.

Although rough wood is always recommended for the interior of bat houses, as well as horizontal grooving of partitions, several new innovations enable bats, especially babies, to hold on better. Tony Koch has documented that tilting his houses at about a 10-degree angle reduces the frequency with which babies fall out, though the tilt may necessitate periodic cleaning. Another probably more important innovation has been used very successfully by the Adamses. They lined the vertical partitions with fiberglass insect (or window) screening, a material bats find especially easy to cling to. Perhaps this explains why two of their houses, with interior dimensions of only about 16 inches by 7-1/2 inches by 5-1/2 inches, each shelter up to 150 Mexican free-tailed bats. The screening is still intact after five years.

Quarter-inch hardware cloth has been used successfully by Dr. Stephen Frantz, a research scientist for the New York Department of Health. He noticed that nursery colonies in attics showed a distinct preference for roosting on hardware cloth. Frantz believes that, in some bat houses, it could be used instead of wood partitions to increase roosting space and permit a colony to remain in closer contact. He attracted over 300 little brown bats to a house he constructed of this design. Frantz also built another successful house by covering wooden partitions with tar paper held in place by hardware cloth. The tar paper was added to help absorb and retain heat.

All available evidence suggests that most of America's crevice-roosting bats prefer crevice widths of 3/4 to 1-1/2 inches when using open-bottomed houses. However, they also routinely use bat houses with a single 2-inch chamber and a 3/4-inch entry. Koch reported that wasps were less attracted to 3/4-inch roosting crevices, which he now uses exclusively. Lisa Williams, a Pennsylvania graduate student conducting research on bat houses in collaboration with Cal Butchkoski of the Pennsylvania Game Commission, has one house occupied by both bats and wasps. The bats use the smaller crevices, leaving wasps to the wider spaces.

In an attempt to attract bats faster, some people painted new bat houses with a mixture of bat guano and water, but there is no clear documentation that this increased success. Koch used guano from the same species and vicinity and consistently attracted bats the first season, while houses made of new, untreated wood were twice ignored until the second season. But other builders, who did not treat with guano, also attracted bats the first season, some immediately. To treat their houses, people sometimes buy bat guano and or obtain it from caves. This, however, could prove counterproductive because droppings from one species may not attract, and might even repel, another species. Since bats in this study were shown to prefer aged wood, it is possible that merely filling the inside of a house with slightly damp earth or a rich humus and then pouring it out after a few days would work just as well.

The study also revealed that the higher a bat house is located, the greater the occupancy success. Mounting houses on poles can help accommodate bat preferences for roosts 15 to 20 feet or higher and offers ideal opportunities to take advantage of solar heating, especially in northern areas. A further advantage of poles is predator protection. Predation at bat houses was not included in the scope of this study, but instinctual fear of predators may explain bat preferences for higher roosting sites. Dr. Frantz notes that, where climbing predators are a problem, poles can be wrapped with an 18-inch piece of sheet metal three feet above the ground. Even in the wild, bats often have difficulty finding safe roosts. We recently checked thousands of desert rock crevices for roosting bats and found that despite an abundance of cliff-face crevices, bats often found very few they could use. Their consistent preference was for places unreachable by snakes or small mammal predators.

The most successful bat house builders we surveyed erected their houses in groups of three or more. Some observed nursery colonies move their young among the different houses. This was especially well documented by Williams

and Butchkoski. They placed bat houses in groups of three, just a few feet apart on the sides of buildings, and carefully monitored internal temperatures. The bats moved their young into the coolest houses on hot days and into the warmest houses on cool days. In addition, mothers sometimes moved young back and forth even when temperature seemed not to be a factor, a phenomenon also observed by Tony Koch in his nine nursery roosts. Occasional moves may also help bats evade parasites.

Robert Ginn places his Georgia bat houses in groups of three on trees, one facing south and one each facing northwest and northeast. Twenty-six of his 29 houses are occupied. The three that remain empty are mounted just one to a tree. Placement of two or three houses close together, which have been painted either dark or light or positioned to absorb varying amounts of solar heat, appears to help attract nursery colonies and also provides excellent opportunities for studying bat temperature needs. Such groupings may prove ideal in areas where temperature requirements are poorly understood [see "Designing Better Bat Houses," page 16, for experiments you can conduct].

In the hottest climates bats typically roost in rock or concrete crevices, which act as heat sinks to help keep them cool. Bat biologist Dr. Patricia Brown reports that lowland desert bats seldom roost in buildings, meaning that they also may not occupy bat houses in areas of intense heat. Both pallid and free-tailed bats have used bat houses mounted on the shaded sides of stone buildings, which may act as cooling heat sinks. Free-tailed bats have been attracted to shaded places on the sides of wooden buildings as far south as the Texas-Mexico border.

The considerable success that some people in our survey had with multiple bat houses was not without patient observation and experimentation before they put up large numbers of houses. Much of the controversy over whether bat houses work is stimulated by well-intentioned but premature large-scale projects. Many of these have a high probability of failure largely because of poor placement and lack of prior testing to evaluate bat roosting needs in a particular area.

Several large projects in our sampling were carried out by parks, nature centers, and golf courses. Bat houses can be valuable tools for educating the public about bat conservation, but when such projects fail, they do little to inspire confidence in park biologists or the public that bat houses can and do work. In our study, large projects on public lands were the least likely to be monitored, and little or no effort was made to modify or move the houses to achieve success. In several parks where small numbers of houses were carefully placed and monitored, occupancy success was good.

Many people experiment with bat houses out of a desire to find a natural means of reducing local populations of mosquitos and other insect pests, and certainly the experience of Tony Koch documents this value [see also "Bats, Beetles, and Bugs," page 23]. Nevertheless, simply erecting large numbers of bat houses to solve a town's mosquito problems is unlikely to succeed. No mosquito control is 100 percent effective, and a pesticide-free approach most often requires a broad range of treatment, including elimination of artificial breeding sites, and use of a variety of natural predators, from small fish and aquatic insects to bats.

Bat biologist Dr. Elizabeth Pierson voiced concern that large-scale bat house projects might be considered by forestry personnel as adequate mitigation for proposed destruction of natural habitats. While there is certainly great potential in developing artificial roosts for more bats, we currently know little about the needs of most American species and cannot yet assume that existing houses meet the needs of more than a relative few.

Since BCI first marketed bat houses in 1986, many other vendors have followed suit.** While some are reputable and have done much to increase public interest in bat conservation, others pay far more attention to competitive pricing than to bat needs. Such vendors rarely provide mounting instructions or other accurate information and often market poorly constructed houses, which are unlikely to be used even under the best of circumstances. As a result, genuine bat conservation efforts suffer.

Recent national publicity claiming categorically that bat houses do not work (based on a single study from one

location) is obviously not true, as the many successful bat house owners across the country will certainly attest. By putting up bat houses and carefully observing the results, we have an excellent opportunity to help bats and to learn more about their needs. If your bat house is unoccupied, experiment! Based on what we now know, many unoccupied houses could quickly become successful if they were moved only a few feet to receive more or less sun, stained or painted to absorb or reflect heat, or merely raised. Occupancy of previously unsuccessful houses, after modification, could provide especially enlightening insights into bat needs.

If, despite providing ideal conditions, a bat house remains unoccupied, there could be other reasons why. Most properly placed houses in our survey were occupied, but others may fail because local bats already have all the roosts they need. Distances to undisturbed hibernating sites, local pollution levels, and food base are also important factors. With the possible exception of lowland desert areas, we know of no evidence suggesting that any geographic region is unsuitable for successful bat house use.

The value of building artificial roosts is already well documented for birds. The U.S. population of purple martins grew by more than 25 percent from 1966 to 1986, while almost all other insectivorous songbirds suffered significant declines. Bluebirds, for which a major nest box program was also established, were the single exception. The largest songbird losses were among cavity nesters, especially those that, like bats, do not make their own nest holes.

Some of our most endangered bats, such as the tree-roosting Indiana bat, may be helped by simple use of metal, tar paper, or even fiberglass or plastic collars around tree trunks. In addition, we now know that the big brown bat, one of North America's most agriculturally valuable species, can live year-round in some bat houses. With experimentation, such as using insulation, we may be able to increase the odds of providing year-round roosts for this and other species.

Bat Conservation International's new North American Bat House Research Project will provide invaluable observations and stimulate the experiments required to better understand bat roosting preferences [see page 15]. As bats increasingly lose their traditional roosts, such studies become all the more critical.

(bio)
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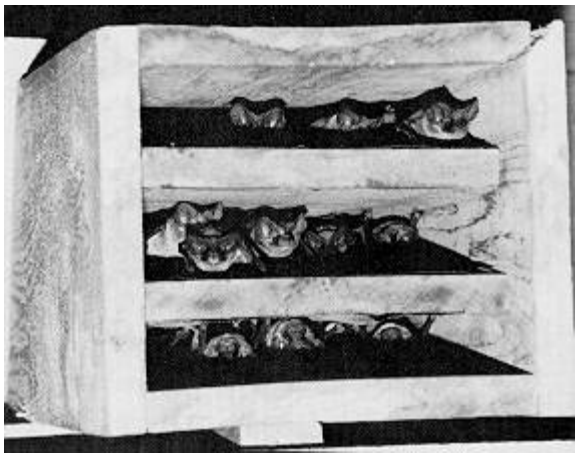
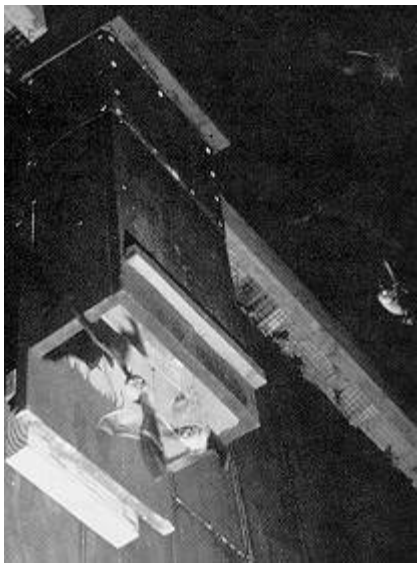
(Footnote 1)
* A very large free-standing bat house developed by the Missouri Department of Conservation in the early 1980s. Because of its size and cost, it has been built mostly by parks and nature centers.

(Footnote 2)
* The only commercial bat house on the U.S. market today that directly benefits BCI's bat conservation efforts is sold through Plow and Hearth of Orange, Virginia, and the BCI catalogue. This house was designed in partnership with BCI and was among the more successful designs tested.

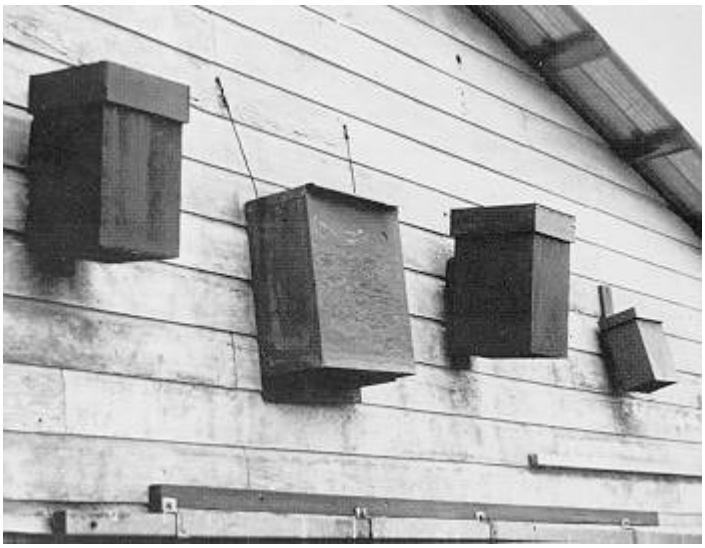


This Texas bat house receives only about two hours of morning sun each day, which in hotter regions is as much as needed. In the study, free-tailed bats were a dominant species in southern bat houses.

In bat houses where the species could be positively identified, little brown bats were by far the most common.



After a night of feeding, little brown bats circle and re-enter one of Lisa Williams' bat houses. The outside of this Pennsylvania house is covered with tar paper to absorb heat. In northern climates, dark houses proved to be significantly more successful than others.



Owners of multiple bat houses reported that their bats often switched between warmer or cooler houses when temperatures became extreme. These four designs are on the outside of Tony Koch's barn in Oregon. They are the first among his 21 houses to be occupied each spring. Note how some are tilted to reduce the possibility of young falling out. Farther south, a mix of dark to light-colored houses would best meet bat temperature needs.

Pallid bats were among those found in bat houses in the Southwest. Although bat houses in lowland desert regions may become too hot for most bats, those placed against shaded buildings, especially stone, have had some success.

Big brown bats were found hibernating in bat houses as far north as New York. Such use may be increased with the addition of insulation in bat houses.