

**Long-Term Use of Artificial Roosts by Maternity Colonies of Pallid Bat *Antrozous pallidus*
and Mexican free-tailed Bats *Tadarida brasiliensis*
Including Cautionary Notes**

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The installation of bat houses in California by two groups of people - homeowners and farmers - has become increasingly common. In the past, ten years of experience working with both groups of people providing wildlife damage control and wildlife habitat enhancement services, we have found that homeowners seem more likely to purchase mail-order or store-bought bat houses, while farmers are supplementing these sources with the use of custom-built houses such, or are building bat houses themselves, using plans available through an increasing variety of sources.

Because the majority of bat houses installed by homeowners and farmers are not usually larger than about 14" x 24" x 4", these bat houses are typically used by small numbers of bats, most often males. It has been unusual to attract maternity colonies to such bat houses. This is probably because small bat houses commonly available through garden shops and mail order companies fail to provide many of the elements important to bat species that adapt to living in man-made structures. A host of environmental factors are critical to bats looking for homes in structures: size, temperature, thermal stability, humidity, accessibility, disturbance levels, and others.

Beginning in 1994, our observations of these factors in building structures have been incorporated into a range of experimental bat house designs, one of which has attracted long-term use by sizeable maternity colonies of pallid bats (*Antrozous pallidus*) and Brazilian free-tailed bats (*Tadarida brasiliensis*). Most of these bat houses have been placed on or near winery buildings, some in vineyards, and some in suburban and rural residential areas. These bat houses have been used both to provide replacement roosting habitat following exclusion, and as new habitat where bat populations are desired.

Incorporated into these designs are vertical box sections, topped by angled roof box sections containing multiple baffles forming shelves, which allow the pups to cling to the substrate more easily in an attempt to limit mortality resulting from pups falling from the roost. Though this is not a new idea, a variety of internal baffling spacing and entrances are provided to maximize the potential temperature variations within the unit and provide several points of access to and from the roost box.

In January 1995, the author designed and built a bat house to be installed on the exterior wall of a two-story office building in Napa County. The building owners had evicted a colony of *T. brasiliensis* with partial success; ca 40 bats remained under the rubberized eviction flaps throughout the winter. The house was designed not only to attract *T. brasiliensis*; I knew *Antrozous pallidus*, *Eptesicus fuscus*, and several other species likely to use structures to be present in the region, so the baffle spacing and entrance apertures were varied in order to be attractive to these additional species.

Within a couple of weeks of being installed in February 1995, most of the *T. brasiliensis* had moved into the bat house. After six weeks, the colony expanded to an estimated 90 individuals as revealed by emergence counts. Unexpectedly, ca. 15 *A. pallidus* also emerged (pallid bats had not been present inside the building prior to eviction of the free-tailed colony). Subsequent visits showed a rapid increase in the population of *A. pallidus*. In late July, a CNN reporter and videographer, producing a story on our habitat enhancement work with winegrowers documented the emergence of ca. 60 adult *A. pallidus* and ca. 20 juveniles, in addition to 15-20 *T. brasiliensis*.

In 1997, an additional roost was constructed, and was occupied by both species within several weeks. From 1996 through 2000, emergence counts showed the population of *A. pallidus* had increased significantly; counts have ranged between 200 and 300 individuals. The population of *T. brasiliensis* had increased to between 400 and 600, with substantial seasonal fluctuations.

The success of these bat houses has led to the construction of several others of similar design, and several of varying designs, including 4' x 8' pole-barn-style houses adapted from other designs.

Though generally considered a successful bat house design, negative impacts have occurred as a result of increasing bat populations using the bat houses described above. During periods of elevated temperatures have resulted in three mass evacuations of the houses by infants and adults, followed by mortality of large numbers of infants. Unfortunately, no funding has been available for thermal dataloggers to be installed in the bat houses. These episodes have prompted several actions in response. First, entrances into the bat houses were enlarged to increase airflow. Later, front panels were extended to allow fecal matter to more easily drop from the boxes, and to permit added airflow. In the winter of 1998, the boxes were removed from the side of the building and placed back-to-back on metal poles in an area partially shaded by trees. Occupancy of the bat houses by *Tadarida* was reduced to ca. 100 individuals during the reproductive season of 1998, but the *Antrozous* population seemed only slightly reduced (ca. 200 individuals). Counts during the 1999 season showed ca. 150 *T. brasiliensis* and 200 *A. pallidus*. Modifications made in 2000 provided more complete drainage of fecal matter from the boxes.

Cautionary Notes; potential negative impacts from the use of bat houses

Some important questions arise from the use of bat houses, especially when located in sites for which no management or monitoring plan exists. For example: A) Can bat houses provide the long-term stability necessary for bat conservation considering their susceptibility to being removed, damaged or disturbed at a rate greater than that for natural roosts? B) Are bat houses being improperly recommended by wildlife consultants and managers to mitigate impacts to sensitive species resulting from development projects, considering some of these species have never been known to use bat houses? C) Could occasional impacts to local bat populations due to mortality as described earlier, accumulate - negatively impacting local populations via gene flow restrictions?

The author suggests that monitoring of bat houses is just as important as the design criteria. We have observed large numbers of bat houses that have not attracted bats several years after installation, and designs and/or installations that increase risks of predation on resident bats. We have observed situations where bat houses which attracted colonies were removed after a few years due to negative response to bat fecal matter, bat outflight activity, or change of property ownership.

We have seen bat houses being specified in mitigation plans for *Corynorhinus townsendii*, though the author has found no evidence this species will use bat houses (our recommendations to one client to relocate part of the residential structure being used by *C. townsendii* to another part of the property rather than installing a store-bought bat house and then remodeling the structure were not received enthusiastically).

Our own experiences with mortality due to overpopulation of bat houses not designed to handle the load of 600 – 800 bats occurred even with regular monitoring and rapid response to initial evidence of distress by occupants. Bat houses are often installed where they can not be monitored regularly, or in situations that do not permit response to casualties or mortality by the property owner.

Feedback-generating projects like the Bat Conservation International Bat House Project can help to provide important data on necessary design and installation modifications. Additionally, bat houses should be installed where they can be monitored with minimal disturbance, and where potential for vandalism is minimized. They should be installed only when there is a high likelihood they will remain in place for many years, or indefinitely; removing bat houses after they have become established roosts is no better than destruction or elimination of the original roost.

As bat house designs evolve, they will likely attract a greater number of bat species, so playing a greater role in the conservation of those species. However, bat houses can have negative impacts on bat colonies if they are not properly designed and *regularly monitored*. Long-term viability of breeding populations of bats using bat houses will depend upon good designs, rapid response to problems, and protection from disturbance.