BAT EXCLUSION METHODS

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ABSTRACT: This publication is intended to serve as a review of currently accepted methods of bat exclusion. Inappropriate house bat control methods are destructive to our decreasing bat populations and often cause additional problems for the building's owner or occupant. These problems include odor from dead bats, infestations of carrion-feeding flies, and increasing human and pet exposure to bats. Appropriate exclusion methods like winter structure modification for cave hibernating bats or one-way excluders using hardware cloth, plastic sheeting, or plastic birdnetting are the best ways to protect these beneficial wildlife species and correct situations where humans and bats come into conflict.

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Bat biologists and the pest control industry have long known that exclusion is the best method of dealing with nuisance bat colonies in buildings. While the pest control industry used toxicants on bats in the past, first DDT dust and later chlorophacinone tracking powder (RoZol), it was always recognized as only a temporary solution that could cause more problems than the original bat colony. Sick and dying bats were often found on the ground throughout the neighborhood of the building that was treated with pesticides, thereby increasing human and pet exposure to the bats. This is an important consideration when toxicants are discussed to eradicate a colony where an individual bat was found to be rabid. Poisons would be more likely to increase the risk of human exposure to rabies than eliminate it, while killing numerous rabies-free bats. Poisoned bats very often died in inaccessible parts of the building and created an odor and fly problem for the residents of the building. For these reasons, since 1991 there are no longer any toxicants registered in the United States for bat control (Greenhall and Frantz 1994).

Silver (1935) recommended a procedure for excluding bats from buildings. His procedure involved closing most of the openings except for a few main exits. He recognized that disturbance of the roost caused the bats to delay and increase the duration of their emergence from the colony. He, therefore recommended that the final exclusion be delayed two or three days until the bats had re-accustomed themselves to the new situation. He stated that all the bats would leave the roost within 15-20 min. of when the emergence began. This is a dangerous generalization. The duration and timing of emergence depends on temperature, disturbances, and precipitation. On rainy nights, for example, it might take 2 hours for all the bats to emerge. After the bats had exited the building, this method called for the closing of the final exits thereby excluding the colony. The description of this technique has been repeated in numerous publications including the National Research Council (1970: 101-104), U. S. Fish and Wildlife Service (1962), and Mallis (1969: 1009-1012). Any method of bat exclusion must take into account the fact that newborn and young bats remain in the roost when their mothers leave the roost to feed. Exclusions conducted without consideration of season will trap any non-volent pups present in the roost and cause them to die. In fact, absolutely no exclusions should be conducted during the summer birthing season (May through August).

METHODS

It is important to remember that there are two phases to exclusions of nuisance bat colonies. The natural seasonal exodus or human-mediated eviction of the bats from the structure must be followed by permanent modification of the structure so the bats cannot return. When excluding a bat colony from a building, it is important to identify all the entry points so they may be closed. A bat watch is useful in locating these openings. A bat watch is simply watching the structure at dusk with several observers or one observer on several nights and noting all the locations where bats exit the building. It is also important to conduct a close inspection of the rest of the structure to find and close structural defects that the bats may use as alternate roosting sites when the exclusion is begun.

Winter Exclusions

In northern states, the easiest method of exclusion is to identify the openings the bats are using to enter the building in the summer and seal them up in the winter when the bats have left to hibernate in caves, mines, or tunnels. The time of the fall migration to the hibernacula varies with latitude, species, and weather conditions. With experience, local bat exclusion personnel learn when the different species of bats in their area leave buildings.

Big brown bats (*Eptesicus fuscus*) will occasionally hibernate under insulation in attics. This behavior makes it difficult to inspect for them in winter. On warm winter days these bats may wake up and fly around the attic and make their way into the living quarters if their exit was blocked while they were hibernating. For this reason it may be advisable to install one-way excluders, described below, on winter exclusions when big brown bats are involved.

A wide variety of materials can be used for sealing entrance openings. Sheet metal, expanded metal, wood, ¼- or ½- inch hardware cloth, wire or fiberglass window screening, silicon caulk, copper mesh or expandable foam can all be used because bats cannot gnaw through soft material like rodents can. Rodent-proofing methods are effective and useful for bat exclusions. Information on rodent-proofing methods are available in numerous pest control and extension publications.

Birdnetting

The use of birdnetting to create one-way check valves was described in Olkowski's(1984) description of Frantz's method and in Frantz (1986). This method is simple to use and is very adaptable to a wide variety of circumstances (Figure 1). This is the method usually recommended to homeowners by Bat Conservation International, Inc., Austin, Texas, an organization dedicated to the education about and conservation of bats. The birdnetting method is recommended for homeowner use because it is simple and effective.

Materials used in this type of exclusion are ½ inch by ½ inch (1.25 x 1.25 cm) industrial plastic birdnetting and materials to secure the netting over the roost opening such as duct tape, silicon caulk, staples, modeling clay, Velcro® tabs, etc. The size of the netting is important because mesh size larger than ½ x ½ inch allows the bats to get their heads and wings tangled in the netting resulting in accidental deaths. Mesh size finer than this, especially window screen, allows the bats to easily crawl over the surface of the excluder and back into the roost entrance.

Once the roost entrance is found, a piece of plastic netting is cut to cover the entire entrance and extend 60-90 cm (2-3 ft) below it. The netting is secured to the building along the top and side edges with the bottom edge left open for the bats to escape. The bottom edge may be secured at intervals of 60 to 90 cm (2-3 ft) to keep the netting from being blown out of position. It should be possible to easily slide a hand under the bottom of the net. If the netting is held too tightly to the wall of the structure, the bats will have great difficulty escaping from the roost. When properly installed, the birdnetting check valve will allow the bats to easily escape out the bottom of the net, but when they return to the roost opening, they land on the net and are unable to find the entrance. This method can be improved by tightly securing a sheet of heavy plastic to the wall below the roost before installing the netting. The bats slide over the plastic and under the netting. If any individuals find the bottom edge of the birdnetting excluder, they are unable to climb up the plastic to the roost entrance. This method can be used in most situations including netting entire tile roofs or walls with shake or clapboard siding. For tile roofs (Spanish, S-, or barrel tile) with numerous points of entry this may be the only cost effective option for exclusion. Birdnetting can be used on vertical crevices by using two pieces of netting, one secured to each side of the crevice. The bats exit between the two sections of netting and are excluded.

In northern states where big brown bats (*Eptesicus fuscus*) are the dominant house bat species, French et al (1986) and Williams-Whitmer and Brittingham (1995) recommended using ¼- or ½- inch (0.75 or 1.25 cm) hardware cloth to make the excluder device (Figure 2). This is because big brown bats have been known to chew through the plastic netting to regain entry to the roost. The wire of the hardware cloth prevents this. The principal is the same. A hardware cloth cage is placed over the roost opening and is secured along the top and side edges with the bottom left open. The bats escape out the bottom but return to the roost entrance where they encounter the wire cage.

The birdnetting or the hardware cloth excluder should be kept in place until all the bats have left the roost. In warm weather this may be after 1-3 nights but, during cold or rainy weather, it may take 5-7 nights. In the southeastern United States, during cold conditions associated with winter fronts, all the bats may not leave a roost for more than 10 days and nights. The sounds of colony chatter at dusk will usually indicate that bats are still present, but not always. If the colony is small or the bats are deep in the structure, colony chatter may not be noticeable. Only when the entire colony is gone, should one bat-proof the entrances to the roost.

Plastic Sleeves

The use of a collapsible tube or sleeve is effective in situations where the roost entrance is small or confined. Constantine's bat excluding device (Constantine 1982) consisted of a rigid base tube and a collapsible tube secured to the end of the base tube. The base tube was secured over the roost entrance. The bats moved through the base tube and the collapsible sleeve to leave the roost and were then unable to find the opening on their return (Figure 3).

A similar but simpler excluder can be made with a sheet of heavy plastic rolled into a cylinder, taped, and cut to fit over the opening (Figure 4). The end to be attached to the roost entrance should be cut at a 45° angle so it will hang well and allow the bats easy escape. This collapsible sleeve is cheap, simple to make and allows the bats to leave and not return to the roost. However, there are some drawbacks with this method. Wind can interfere with the sleeve and may dislodge it. If a large colony of bats is located in an area of limited air flow, the plastic sleeve over the entrance could cause the bats to suffocate, especially if wind keeps the sleeve closed. For this reason plastic collapsible sleeves should be installed just prior (within an hour) to evening emergence. The sleeve should be left in place until all the bats have left (3-10 days depending on weather conditions) and then the roost entrance permanently closed to the bats.

Hanks' Excluder

The Hanks' excluder was developed by Marshall Hanks, a private bat-proofing specialist from Sturgeon Bay, WI. Early versions of the Hanks' excluder are described in French et al (1986). The current version is an oval cylinder of hardware cloth that is attached to the restricted colony entrance and extends outward (Figure 5). The dimensions of the cylinder are dictated by the species of bats to be excluded. For the Brazilian free-tailed bat (*Tadarida brasiliensis*) the dimensions are 2.5 cm (1 inch) high, 5 cm (2 inches) wide, and 15 cm (6 inches) long. This size will also accommodate *Myotis sp.* and evening bats (*Nycticeius humeralis*). Big brown bats would require a larger excluder tube. Shallow cuts are made in the four corners of the end of the cylinder to be attached to the roost entrance. The wire is bent outward to facilitate installation. If the colony is located in a crevice, then the crevice is closed, except for a two-inch gap. A strip of hardware cloth 5-7.5 cm (2-3 inches) wide and almost the length of the crevice to be closed is folded in half longitudinally. It is then forced into the crevice with a putty knife and held in place with strategically placed silicon caulk. The edges of the hardware cloth should be just at the edge of the crevice. From below, the wire is hidden by the shadows of the crevice. The excluder tube is then installed over the two-inch gap with staples on wood or silicon caulk on concrete or brick. The far end of the excluder tube should be suspended in space and not in contact with the wall. The bats may land on the tube but are unable to rotate their shoulder to reach inside the tube and pull themselves into it. This method approaches a one-step bat exclusion process because, after the bats have been evicted, the tubes just need to be pinched shut to complete the exclusion process. This is desirable for large exclusion jobs.

Lights, Fans, and Other Repellents

Lights have been used to evict bats from attics and warehouses where other methods would have been impractical. It is important to flood all areas of the roost structure with light so the bats are not just being forced from one part of the attic to the shadows in another part. Be aware of potential fire hazards created by hot lights close to wood, plastic or paper materials.

Bats seek warm areas with little air movement for their roosts, especially for maternity colonies. The use of fans to create drafts may make some structures less desirable as roost sites. The air currents need to prevent warm air from rising to the roost location. Like the use of lights, creating drafts may work in some situations, but realize that the site fidelity of many bat colonies is very strong and these methods may require time to work.

The use of ultrasonic devices do not appear to be effective at repelling bats from established roosts (Greenhall and Frantz 1994). There is no data supporting assertion that these devices keep bats from occupying a building. Bats should be able to find the ultrasonic sound shadows and roost in those areas. It is known that the distress calls of bats will attract others of their species to investigate, so recorded or microchip-generated distress calls would be counterproductive in repelling bats.

Naphthalene is the only active ingredient registered as a bat repellent by the Environmental Protection Agency. Greenhall and Frantz (1994) report that 2.5 lbs. of naphthalene /1000 ft^3 (1.2 kg / 30 m^3) will repel bats from a roost and twice that concentration will drive bats from a roost in daylight. Repellents are less effective when young are present in the roost due to maternal instinct.

CONCLUSION

The resolution of bat vs. human conflict is achievable with appropriate exclusion techniques conducted at the appropriate time of year. Exclusion is the best means of removing bats from buildings and other manmade structures. When an exclusion has to be postponed due to the bat birthing season, take the time to educate the homeowner as to why the delay is necessary. Trapping bats in the structure can cause odor problems, fly infestations, and staining problems of walls or ceilings as the dead bats decompose. As more and more bat colonies are excluded, the use of artificial bat roosts or bat houses may become more important as both a bat management tool and pest control service. It is apparent that bat colonies are often being moved from house to house within a neighborhood. The use of well-designed bat houses, installed in appropriate locations, may be the best means of protecting populations of these beneficial native mammals while stopping the continuous game of bats-in-the-attic tag.

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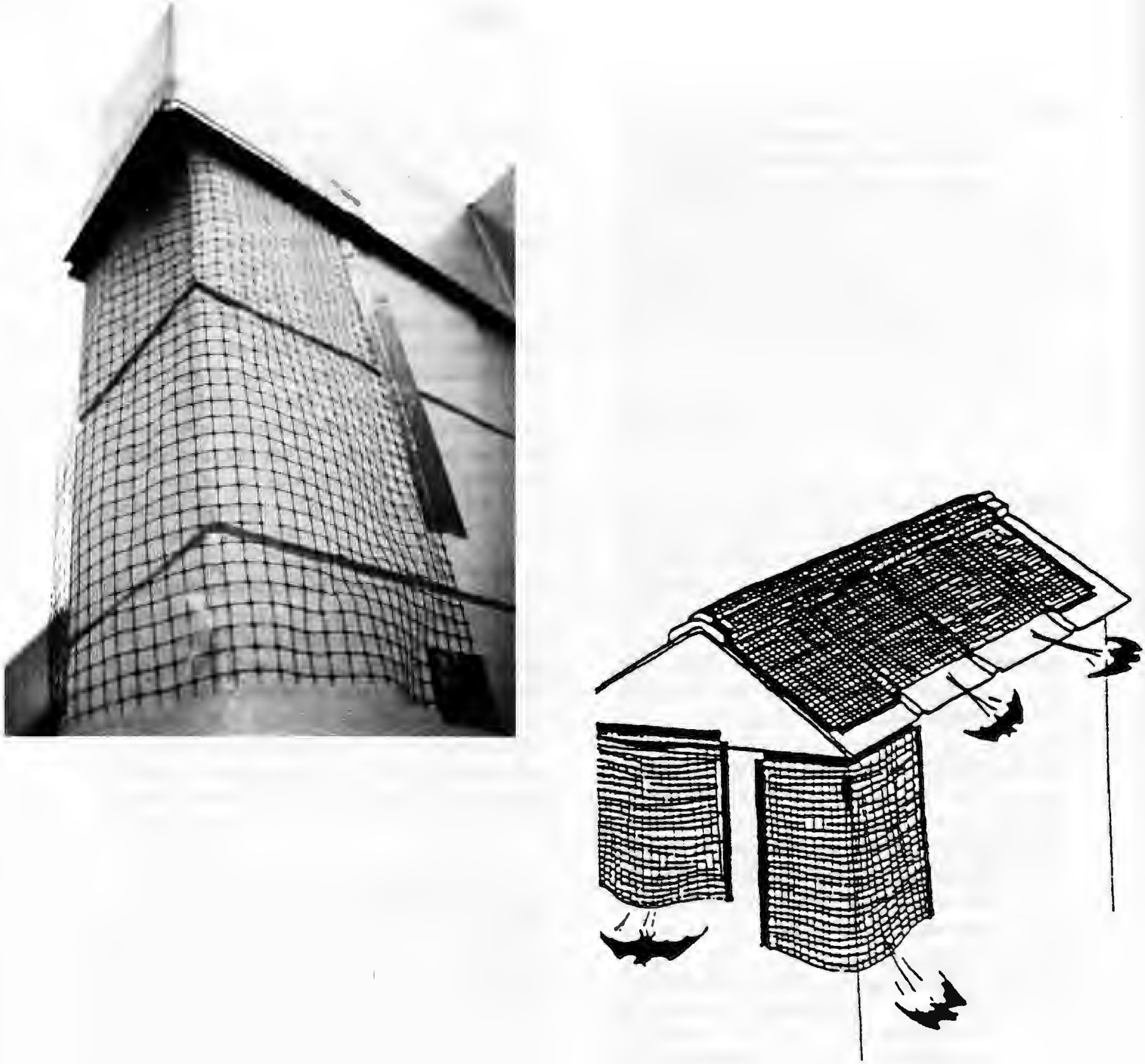

Figure 1. Plastic industrial birdnetting (½ x ½ inch mesh size) used to exclude bats from buildings (a) can be used in many situations (b).

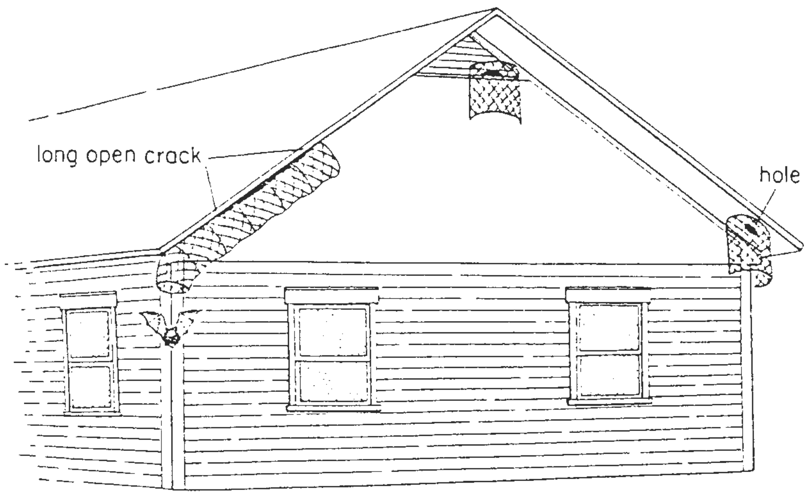

Figure 2. Hardware cloth excluder devices are used when big brown bats (*Eptesicus fuscus*) are being excluded because these bats can chew through plastic netting. The bats can escape out the bottom of the device, but land on the wire when they try to return to the roost opening. (Reproduced from French et al. 1986).

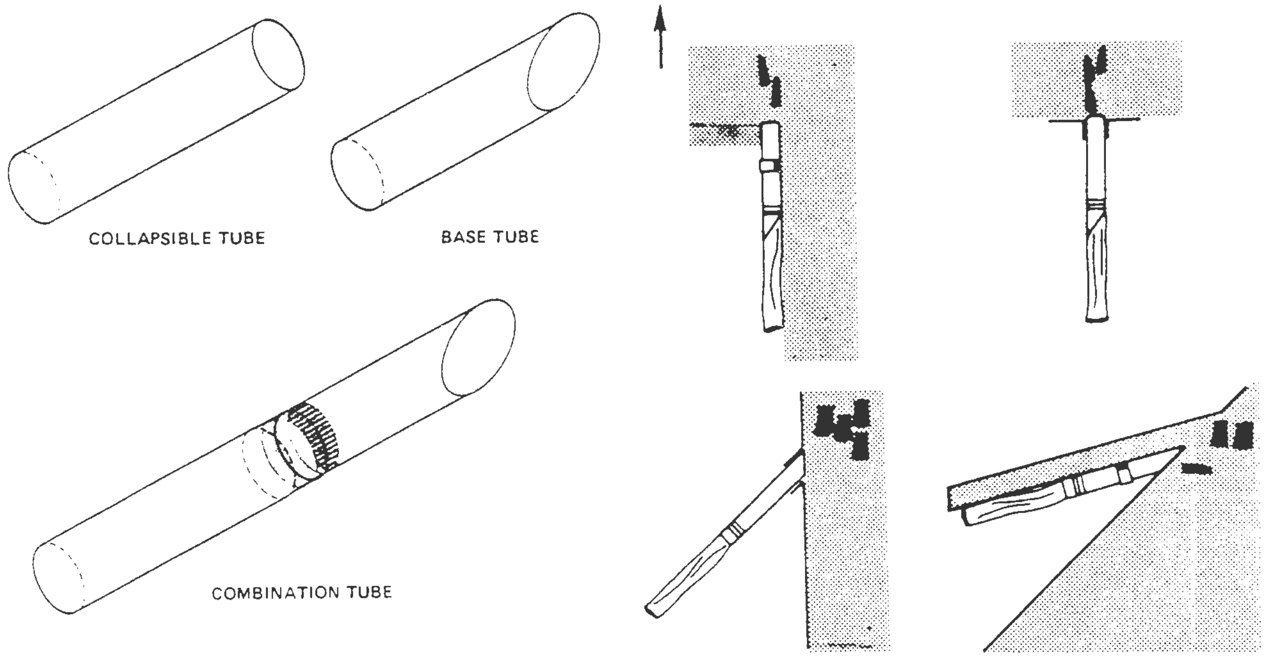

Figure 3. Constantine's bat excluding device includes a rigid base tube which attaches to the roost opening and a pliable, collapsible tube attached to the distal end. The excluder can be attached in different configurations for different situations. (Reproduced from Greenhall 1982).

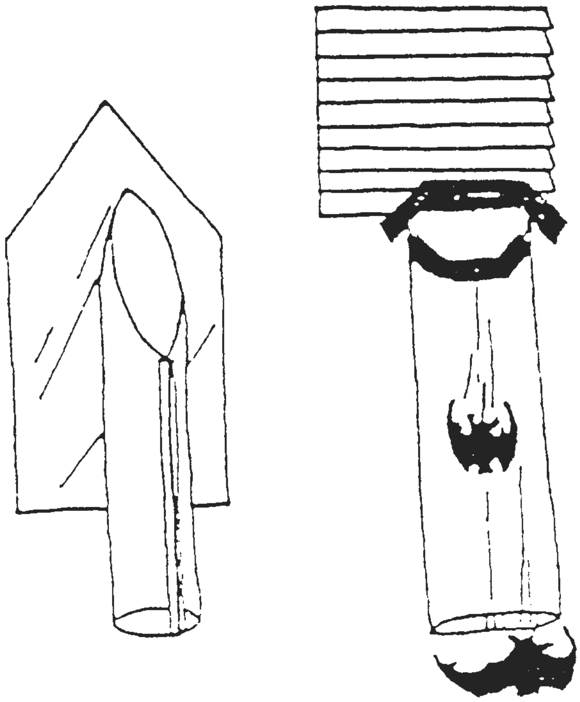

Figure 4. Collapsible sleeves made from a sheet of heavy plastic can be used to exclude colonies that use small roost exits. This inexpensive excluder works best when there is little or no wind. To prevent suffocation of bats in tight roosts, this device should be installed just before dusk.

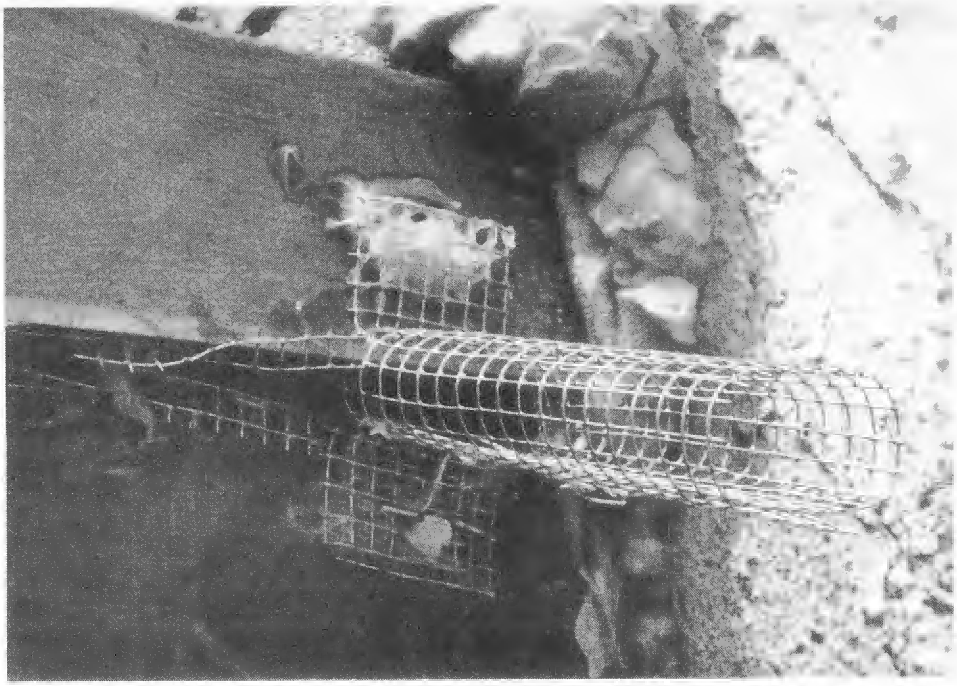

Figure 5. The Hanks' excluder device is a hardware cloth oval cylinder that extends the opening of the roost away from the building. The dimensions of the device are dictated by the species of bat being evicted.