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Bats

Information and Management Techniques for Wyoming Homeowners

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UNIVERSITY
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Bats:
Information and Management Techniques for Wyoming Homeowners

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Brief Summary: Bat Management Techniques

- Use exclusion techniques such as sealing cracks and holes in buildings and homes with insulation, caulking material, flashing, screening, and weather stripping to eliminate bat problems. This is best done during late fall or early spring or at night during summer after bats leave the roost.
- Commercial or home-built one-way bat excluder devices are effective when installed at major exit passageways after sealing other building cracks and openings.
- Repellents such as "mothballs," household ammonia, dog and cat sprays, and Para dichlorobenzene are effective when used with exclusion techniques. Use 5 pounds of naphthalene (mothballs) per 2,000 cubic feet for best results.
- Floodlights or 150-watt spotlights are effective when placed in traditionally dark roosting sites.
- Other types of repellants used with limited success include dog whistles, ultrasonic devices, recorded distress cries of bats, electric fans, and contact sticky-type bird repellants.
- Traps, tunnel nets, and plastic cylinders are effective for trapping and releasing bats when used over exit passageways in conjunction with other exclusion techniques.
- Toxicants and fumigants are not recommended as bat control measures as they are strictly controlled by federal and state laws, pose public health hazards, affect non-targeted animals, and do not permanently control bats or prevent reinfestation.

Introduction

Bats have been associated with witchcraft and sorcery for many years. This has been sensationalized through Hollywood movies and inaccurate media accounts, resulting in an exaggerated fear of bats instilled in humans. Few animals are as misunderstood as the bat. Contrary to popular beliefs, bats do not make calculated attacks on humans. They do not swoop down to entangle themselves in women's long hair, nor do they sneak into homes to bite babies. Most bats are not rabid. Less than one-half to one percent of seemingly normal bats are infected with rabies. Wyoming bats do not bite people's necks to suck blood. The vampire bat, which is not even found in the United States, does suck blood but almost exclusively utilizes wild and domestic mammals, not humans.

Unwarranted fear of bats and emotional apprehension has prompted the use of potentially dangerous chemicals to kill bats in buildings. This has resulted in declining bat populations over the past 20 years as well as the creation of public health hazards by increasing contacts between humans and sick bats and exposing people to dangerous pesticides. Insecticides have further reduced bat populations through ingestion of contaminated insects and reduction of the insect supply, a major food item in the bat diet. In addition, thousands of bats die annually from people disturbing maternity or hibernation roosts in caves, mines, buildings, or trees.

Bats are interesting animals. They are the only mammals that truly fly. Bats are highly beneficial, consuming a tremendous number of insects, especially mosquitoes. This bulletin was prepared to emphasize population declines of bats due to unwarranted fear, the beneficial feed habits of bats, and the need for using more effective non-lethal methods for managing problem bats.

Species Description

These warm-blooded, furry mammals nurse their young and belong to the order Chiropteran, which means "handwing" and refers to their membrane-covered appendages. Bat wings are formed from thin membranes connecting a greatly elongated forearm and fingers with the hind limbs and body. This anatomical feature permits great maneuverability, which enables bats to avoid obstacles and catch insects in flight.

Unlike most nocturnal animals, bats have very small eyes. They rely instead on a sophisticated echolocation (similar to radar detection) system for navigating at night. The average life span is long, up to 30 years for some species. Wyoming bats average 3 to 5 inches in body length with a wing spread of 10 to 15 inches.

There are about 900 species of bats worldwide. Most live in tropical regions. About 40 species are found north of Mexico from coast to coast and into the mountains. In the United States, bats are most abundant in the Southwest.

Sixteen species of bats have been documented in Wyoming, according to Wyoming Game and Fish Department records (appendix A). However, because observations of Yuma myotis (*Myotis yumanensis*) in Wyoming are somewhat questionable, research is currently underway to further document the presence of this species. Bats are categorized as either colonial or solitary, depending on whether they live in groups or alone. In Wyoming, the only true colonial species is the Brazilian free-tailed bats (*Tadarida brasiliensis*). Most female bats gather in maternity colonies for the birthing period in June and July. Also, many species congregate in tight clusters in winter hibernation sites. However, these activities are not considered true colonial behavior. In Wyoming, the bats most commonly encountered by humans include the little brown (*Myotis lucifugus*), small-footed (*Myotis ciliolabrum)*,

long-legged (*Myotis volans*), and big brown (*Eptesicus fuscus*) bats. The little brown bat is commonly found in nursery colonies as large as 2,000 animals in buildings during the summer. Both adults and their young migrate south for the winter to hibernate in caves or mines. In contrast, the big brown bat uses buildings for both raising young and hibernating. Congregations are small, ranging from about 12 to 200 individuals. Both the small-footed and long-legged bats are commonly found in buildings and rock crevices across Wyoming.

General Biological Characteristics

Habitat Requirements

Bats are commonly found near water, forests, and buildings where insects are abundant for foraging. Their natural day roosts are dark, secluded areas in trees, caves, mines, and some buildings. They hang head down from curved rigid claws on the hind feet. After spending the daylight hours in secluded retreats, they become restless toward evening and fly to a water source to drink before feeding on insects during night hours. There is a wide variety in the feeding times among the different species. As cooler temperatures prevail in the fall, bats migrate and / or hibernate in caves, mines, and abandoned buildings.

All bats in Wyoming, except the pallid bat (*Antrozous pallidus)*, feed upon small flying insects, sometimes consuming up to one-half their body weight per night. The little brown bat, for example, typically feeds on mosquitoes, midges, caddis flies, moths, and beetles. Researchers have found that the little brown bat consumes an average of 600 mosquitoes per hour. The big brown bat can fill its stomach in one hour with beetles, stinkbugs, and other insects potentially harmful to man. Some researchers have demonstrated that 500 bats can easily capture 500,000 flying insects per night.

Reproductive Life History

Bats mate in the fall and winter prior to hibernation. The female retains sperm in the uterus until spring when ovulation and fertilization occur. Pregnant females gather in maternity colonies in caves, mines, buildings, or other dark retreats. After a gestation period of two to three months, birth occurs from April through July. Most species produce a single offspring. However, some have twins, and two species produce litters of three or four. Mother bats nurse and carry their young until they are able to fly when about three weeks old. Nursery colonies disperse after weaning in July and August.

Behavior Patterns

Near the time of the first fall frost, bats either migrate to warmer climates in the South or enter hibernation in colder northern areas. Some species migrate short distances in pursuit of abundant insect supplies or "swarm" in large numbers prior to hibernation. Bats have impressive homing abilities and return to the same winter and summer residences each year. In the colder northern climates, bats hibernate from October or November through April or May. Hibernation in the warmer southern climates may be shorter or sporadic with some species flying during warm winter weather.

Bats in flight are able to avoid obstacles and capture flying insects by emitting high-frequency sounds and detecting the reflection of these sounds from solid objects. This echolocation system, similar to sonar and undetected by the human ear, accounts for their agility in flying through dense tree growth and openings in buildings. Bats also emit audible sounds used for communication between individuals.

Economic values

Almost all bats provide some type of economic value. In warmer tropical climates there are specific species of bats

adapted to feed on fruit, nectar, blood, insects, frogs, and fish. Fruit-eating bats are important for dispersing seeds while nectar bats serve as plant pollinators. Without these specialized bats, many crops and plant-based products such as bananas, mangoes, figs, avocados, cashews, tequila, balsa wood, manila, sisal fibers, and latex for chewing gum would not be possible.

In the American Southwest, accumulated bat droppings called "guano" were commercially mined for fertilizer due to the high nitrogen content. Declining bat populations and the development of inorganic fertilizer have reduced mining efforts for guano.

In Wyoming towns, cities, and rural areas, bats provide economic value by controlling population explosions of mosquitoes and other insect pests. Their voracious appetite for insects provides savings to city and county insect control programs such as mosquito spraying. They also reduce the effect of mosquitoes on humans and livestock. In agricultural areas, bats consume large numbers of insects that cause damage to cropland.

Problems Associated with Bats

Inside Buildings

In many cases, homeowners are not aware of or bothered by small numbers of bats in their houses and buildings. However, large numbers of bats can cause problems. Squeaking, scratching, scrambling, and crawling noises from bats in attics, walls, and chimneys often become a nuisance to homeowners. Fecal droppings, brown stains from urine and glandular body secretions, and pungent odors are sometimes found near eaves, beneath entrance holes, and below roosts in buildings occupied by a large number of bats. In old, loosely constructed buildings with attic areas, bat excreta

may eventually seep through ceiling cracks, causing unsightly stains on walls and ceilings.

Nuisance sounds in attics, walls, and chimneys may not necessarily indicate the presence of bats. For example, twittering and rustling sounds in old chimneys may be birds such as sparrows or chimney swifts. Scratching and thumping sounds in attics and walls may be rats, mice, or squirrels. The easiest way to determine the presence of bats is by examining droppings. Droppings from insectivorous bats are easily crushed by rubbing between the fingers, revealing shiny pieces of undigested insects. In contrast, rodent droppings are unsegmented, harder, and more fibrous. Birds and lizards that feed on insects excrete droppings that contain white chalky material unlike bats whose excrement is brownish-black.

Finding one or two bats in the living quarters of a house is a common occurrence, especially during early fall when animals are dispersing from maternity areas. Bats usually enter through the overhang of the roof (eaves), especially when the eaves are ventilated for fresh air exchange. Other entry areas include open windows, unscreened fireplaces, open chimney dampers during summer, crevices between outer walls and chimneys, cracks around windows, and holes in loose boards or bricks. Old wood frame structures where boards shrink, warp, or become loosened are attractive entryways. Common places for roosting are attics, between roofs and ceilings, in walls, chimneys, cornices, and fascias, around drainpipes, crawl spaces, behind rafters and sheathing in open barns, and other crevices around the roof, walls, and chimneys.

Most bats can squeeze through tiny narrow slits and cracks; the small species only require an opening about the size of a dime. For example, the little brown bat can enter a space 5 / 8 inches while the big brown bat can negotiate an opening 1¼ by ½ inches.

A lone bat in a house will usually find a way out by detecting fresh air movement, so keep all doors and windows open to encourage departure of unwanted visitors. If an uninvited guest is still present by nightfall, turn off all light inside the house. Light will force bats to hide behind drapes, curtains, pictures, and other objects to seek darkness rather than encourage them to find open doors and windows. If the bat is still inside, try catching it in a net, small box or can, or a leather-gloved hand for release outside.

One of the biggest problems with a large concentration of bats inside a building is accumulated guano and urine that attracts roaches and produces pungent odors. Even after a bat roost is eliminated inside a building, the persistent odor may attract new bat colonies. In addition, bats can carry ectoparasites into the home such as ticks, mites, fleas, and bat bedbugs. These arthropods may become a nuisance after bars are eliminated. Fumigation may be required to kill the associated arthropods, especially where large bat colonies previously existed.

Outside Buildings

Similar problems of brown stains on exterior home finishes and pungent odors from fecal droppings, urine, and body secretions exist around bat roosts located outside buildings. Popular outside bat roosts include: shutters, wood shingles, roofing, drain gutters, awnings, overhang trim, flashing separated from solid structures, garages, patios, porches, breezeways, and livestock shelters.

Bats are commonly attracted to swimming pools and may become a nuisance in their quest for water and insects. Likewise, street and porch lights attract flying insects, which in turn attract bats.

Health Hazards

People commonly associate rabies with all bats. While bats do contract the disease, the believed incidence of rabies is greatly exaggerated. Sensational, exaggerated, and inaccurate news coverage of bat bites elicit emotional public reaction and often perpetuate the unfounded fears that rabies runs rampant in bats. Also, data on rabies in bats is misleading because the figures reflect primarily sick animals examined in a laboratory situation rather than random samples of wild populations.

In reality, population surveys indicate that only one in 200 or more bats is likely to be infected with rabies. Furthermore, infected bats usually die rather quickly and do not become permanent carriers of the disease. Only 10 human deaths due to rabid bats have been verified in the United States and Canada during a period from 1953, when bat rabies was first reported in this country, until 1983. Two of these people contracted rabies by breathing air in a cave environment containing the urine mist of infected bats. More people die annually from dog attacks, bee stings, lightning, and household accidents than from bat-transmitted rabies.

Unlike other mammalian carriers of rabies, infected bats are less aggressive at attacking people or other animals. Sick bats become partially paralyzed and usually fall from their roosts within reach of children and pets where direct bites can occur. Rabies can also be transmitted to humans and animals by aerosol transmission of the virus in urine or sputum, almost exclusively in a “dead air” situation such as a cave, mine, or tightly closed attic.

Most rabies exposure can be avoided by not handling bats. Any bat acting in an abnormal manner or fluttering on the ground should be approached with caution. Never handle

sick or dead bats with bare hands. They should be picked up with gloves, forceps, tongs, or a stick for examination.

A bat bite should always be treated as a potential exposure to rabies that requires immediate medical attention. The most effective first aid treatment for a bat bite is thorough washing with soap and water. Rabies shots are administered to persons suffering from bat bites unless the offending animal is collected and laboratory tests show the bat to be disease free. Bitten pets that have not received a rabies vaccination are either quarantined or destroyed.

If possible, a bat that has bitten a person or pet should be captured with the head (the brain is necessary for rabies testing) placed in a container under refrigeration and shipped to the nearest health laboratory for rabies testing. In Wyoming, contact the Wyoming State Veterinary Laboratory in Laramie (Telephone: 307-742-6638) or a county extension educator for further information about testing suspected rabid bats.

Another health hazard to humans from bats is histoplasmosis. This is a disease of the lungs caused by inhaling airborne spores of a microscopic fungus found growing in accumulated excreta from birds or bats and also from soils containing excreta. When dry soil or accumulated excreta containing the fungus is disturbed, the spores become airborne in the dust generated. There is a potential risk for histoplasmosis infection to people inhaling the dust.

Fortunately, places that have housed bats long enough for excreta to accumulate are generally not readily accessible to humans. This minimizes exposure to histoplasmosis infection. However, in situations where guano clean-up is necessary, dry guano should first be dampened with water and respirators should be worn to reduce the potential of dust inhalation.

Managing Problem Bats

Considering the beneficial insectivorous feeding habits of Wyoming bats, damage prevention and control techniques may not be necessary in some situations. However, where bats pose potential health hazards or create property damage, some type of management program is required. Non-lethal damage prevention and control techniques are recommended, especially because pesticides, pollution, people, and habitat loss have already reduced existing populations. Currently, the Wyoming Game and Fish Department lists bats as unprotected non-game wildlife. However, the spotted bat (*Euderma maculatum*) can be taken only with a scientific collecting permit issued by the stated. Non-lethal exclusion techniques will usually solve bat problems, maintain protection of rare or endangered species, and preserve the insect control benefits provided by all species.

Exclusion

The most reliable, long-term solution to eliminate and deter bats from buildings is through exclusion techniques. All passageways, both obvious and obscure, must be effectively sealed to prevent bats from entering buildings. Sealing cracks and holes in occupied homes with insulation, caulking, or weather-stripping will also improve energy efficiency.

On old wood-framed buildings, bat entrances occur where wood has warped, shrunk, or decayed over time. On newer buildings, entry locations include loose vents, cracks under loose flashing, eaves, cornices, louvers, space under corrugated roofing, spaces under doors and around windows, and openings around electrical outlet boxes and water pipes entering the house. Cracks only 3/8-inch wide will allow bats to crawl through. Because bats cannot chew open new holes or reopen old sealed holes, repaired passageways will be effective in deterring bat establishment in buildings.

Sometimes inconspicuous openings that permit bat entry are hard to locate. One way to detect obscure cracks is to put a bright light in the building's attic on a dark night and look for light from outside. Or, on a bright, sunny day crawl into the attic and look for light entering. Another technique is to position several observers around the building and watch for bats emerging in the evening.

Several simple homemade devices can be fashioned to detect air moving through cracks in a building. Bathroom tissue or very thin plastic bags (from dry cleaners or grocery store produce departments) attached to clothes hangers by clothespins will flutter when held near a crack emitting air currents (Figure 1). Observing the flame of a lighted candle held around window frames and door sashes will indicate where caulking and weather stripping are needed. Observations of smoke from cigarettes, pipes, and cigars inside a house

Figure 1. Clothes hanger with bathroom tissue or thin plastic attached to locate potential bat passageways from air currents.

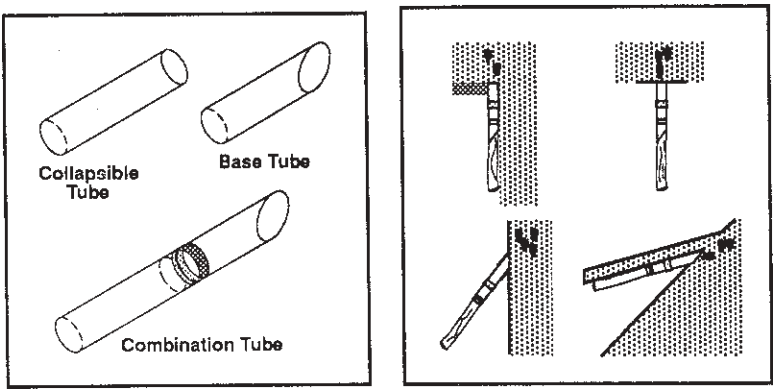

Figure 2. Constantine's valve-like bat-proofing device and diagrams depicting various installations. Bats in the house interior are about to enter the tube.

on a windy day will indicate air leaks. Smoke generators such as smoke bombs and smoke sticks can be ignited inside a building to detect openings in the floor, ceiling, attic, and walls. This is not a desirable technique for occupied homes due to potential damage to furnishings and personal possessions.

Once bat passages are located, wait until all bats have left the building before sealing the openings. In Wyoming, most bats migrate south for the winter, so the best time for bat-proofing is during late fall (November) or early spring (April). Avoid trapping bats inside a building without an escape route. Otherwise, they will quickly starve and there will be a serious odor problem.

If bat-proofing is impossible during late fall or early spring, passageways can be sealed during late summer after observing bats leaving the roost or by waiting an hour or so after sundown when bats are out feeding. All bats usually leave the roost within 15-20 minutes after the first bat flies out. Avoid sealing passageways during June, July, and early August when flightless, young bats are likely to be present. If there are a number of openings, seal all but two or three major passageways. Once bats are accustomed to the restricted

access about two to three days later, seal the remaining openings after dark. In about two days, unplug one of the major passageways after dark for a couple of hours to ensure that any trapped bats have an opportunity to escape.

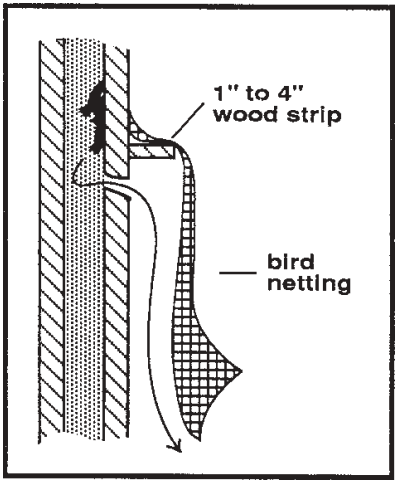

Figure 3. Diagram of a one-way bat excluder device constructed from plastic bird netting available at most garden shops and hardware stores.

Often, sealing bat openings in the dark is difficult. A one-way valve-like tube, called the Constantine batproofing device, permits bats to leave after dark but prevents reentry (Figure 2). This device can be installed during daylight hours over major passageways and removed to seal openings after all bats are excluded from the building.

Other commercial bat excluders are also available. One-way excluders can be made from plastic bird netting available at most garden shops and hardware stores. Attach the netting over the exit passageway so that it hangs a few inches away from the opening and extends several feet below it (Figure 3). This allows bats to drop down and fly under the material to leave but blocks direct access to the hole when returning. Again, avoid using these devices from June through August when young flightless bats may be present and dependent on parents for food.

Methods for sealing bat passageways include caulking, weather stripping, flashing, insulation, and screening. Caulking is best used for smaller cracks and crevices that develop as a house ages. A variety of caulking material is available, with

the best choice depending on the location and size of the opening. For smaller cracks, caulks such as latex, butyl, and acrylic applied with a caulking gun work well and last for about five years. Silicone rubber and polysulphide rubber caulks expand and contract with temperature changes, do not dry or crack, tolerate extreme temperature fluctuations, and last indefinitely. Another caulk for small cracks is oakum. This is a hemp fiber that is treated with tar or creosote to bind the fibers. This treatment may also serve as a bat repellent. For larger openings, other materials that work well to block passageways include cotton, sponge rubber, fiberglass insulation, quick-setting putty, and expanding urethane foams applied from pressurized containers. Weather-stripping material, stainless steel wool, or rust-proofing scouring pads can be used to seal long, narrow cracks. All materials are best applied during dry periods when wood cracks are widest.

Weather stripping can be used to seal the space between a door bottom and door sill or large openings around windows and garage doors. Weather-stripping materials include natural fibers, aluminum, fine wire, felt, hard rubber, vinyl, and nylon. All these materials are fine for sealing bat passageways.

Flashing is made of thin metal sheets of material. It is used to keep a building watertight wherever joints occur in a house such as outside walls joining with the roof or a chimney passing through the roof. Flashing materials are most commonly galvanized metal, copper, aluminum, and stainless steel.

Insulation material not only serves to block bat passageways but also reduces heat loss or gain in a house. Inorganic materials used for insulation include fiberglass, rock wool, urethane, vermiculite, perlite, polystyrene, and extruded polystyrene foam. Cellulose fiber, an organic material, is sometimes used as insulation. However, it tends to break down in hot attics. Fiberglass is the safest of all insulation materials.

Screening should be used on soffit (underside of overhanging eaves) ventilators, chimneys, and other major openings providing entrance to a home. Ideal screening material is hardware cloth with ¼-inch mesh or less to prevent bat access. On chimneys, rust-resistant spark arresters or bird screens with appropriate mesh size should completely enclose the flue discharge areas and be secured adequately to the chimney top. Fireplace dampers should be closed during the non-heating season.

After bat-proofing, clean all feces, urine, and dead bats as completely as possible from accessible roosts. Heavy, lingering odor will continue to attract other bats if they are not eliminated. Spraying the roost area with Lysol or other types of disinfects will eliminate odor after cleaning. Again, if there is a large amount of droppings, wear a respirator or surgical mask to avoid breathing the dust during clean-up.

Repellants

None of the bat-repellent techniques in the following discussion are completely successful in eliminating problem bats. However, these methods can be quite effective when used together with the exclusion techniques discussed earlier.

Chemical repellants may be effective when used at high concentrations in relatively closed-in areas. However, chemicals dissipate rapidly with air contact, requiring frequent repeated applications to discourage bat colonization. One of the more popular chemicals used for repelling bats is naphthalene crystals or flakes, commonly known as “mothballs.” This chemical, registered as safe by the Environmental Protection Agency for indoor use, should be spread on the floor, suspended from rafters in loose-mesh cloth bags, or placed between walls to vaporize. Recommended application rates are about 5 pounds of naphthalene per 2,000 cubic feet of space for average situations. Dosages of 10 pounds per 2,000 cu-

bic feet will force bats to leave during daylight hours; however, they will return when the odor dissipates.

Para dichlorobenzene, another chemical used as a moth or insect repellent, has been used to repel bats when applied at a rate of 3-5 pounds per 2,000 cubic feet. People sometimes use household ammonia as a repellent, placing pans of the cleaning solution in various locations around the roosting area. Commercial dog and cat repellent sprays are also used on beams and in crevices where bats roost.

Floodlights placed in an attic to illuminate traditionally dark roosting sites may be effective in repelling bats. Large roosting areas may require four or more 100-watt bulbs or 150-watt spotlights. Fluorescent bulbs, although not as effective, may also be used. Lighting can be costly and difficult to set up in some situations.

Dog whistles that produce high frequency sounds when attached to oxygen cylinders or large aquarium pumps have been used to repel bats. Commercially manufactured ultrasonic devices have also been used. Recorded and rebroadcast distress cries of bats have been used to attract bats to nets or traps. However, they are not effective as a repellent. Other types of repellents used with limited success include creating strong drafts from electric fans and contact sticky-type bird repellents painted on roosting and passageway surfaces.

Toxicants

The only toxicant federally registered by the Environmental Protection Agency for bat control is DDT. However, special approval for its use must be obtained from the U.S. Public Health Service Center for Disease Control, Atlanta, Georgia, and then only when rabid bats are involved. DDT has been found to be a health hazard to humans through direct contact, inhalation, or ingestion of contaminated food from the spray, dust, or powder treatment.

Residues of DDT are highly poisonous to bats but require several days to kill targeted animals. Sick bats affected by DDT may fall in areas where curious pets, children, and adults can be bitten. Long-range mortality has been documented in treated bat colonies for up to six years due to the residual effects. This toxicant and other chlorinated hydrocarbons are not recommended as a means to control problem bats.

Fumigants

No fumigant is currently registered for bat control. At one time, methyl bromide was the standard approach. However, this chemical was dangerous to humans, expensive, and often ineffective. Fumigants may be considered for bat control by state or city health officials only in a real public health emergency and after all other control measures are tried. None of these lethal chemical approaches permanently controls bats because reinfestation usually occurs. Chemical control just serves to destroy an ecologically valuable group of wild mammals.

Traps

Bats may be trapped alive and released some distance away from the roost before passageways are sealed. Numerous ideas on traps, tunnel nets, and plastic cylinders are discussed in Greenhall and Paradiso (1968) and Barbour and David (1969). Constantine (1958) designed a harp-like trap made of steel piano wire to snare bats and catch them in a smooth-sided container that prohibited them from crawling out (Figure 4). This type of trap has been modified several times to improve efficiency (Kunz and Anthony 1977).

Another type of trap, the hopper trap, can be located under a bat passageway with a plastic shield covering the opening (Figure 5). As bats leave the opening, they strike the plastic shield and fall into the hopper netting to become entangled and unable to escape.

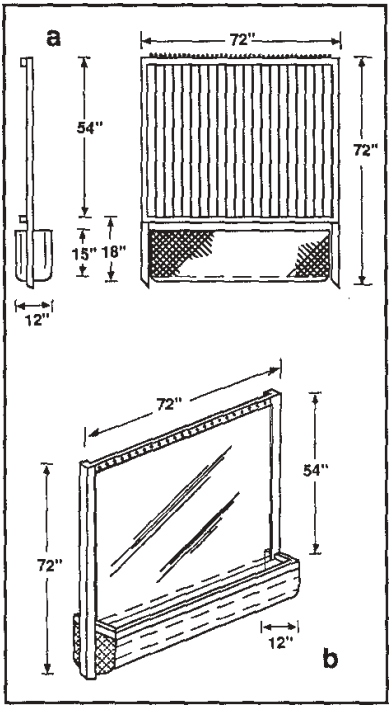

Figure 4. Constantine's harp traps (a) made of steel piano wire to snare bats and catch them in a smooth-sided container. Below (b), a variation of the Constantine trap made of plastic.

A simple, effective trap can be constructed from sheer curtain material, a piece of galvanized dryer vent tube, and a plastic garbage bag (Figure 6). A piece of sheer curtain material 1½ square yards in area is sewn into a funnel shape wide enough at one end to fit over a 5-inch diameter piece of dryer vent pipe approximately 1 foot long. Fasten the curtain material securely to the other end of the dryer vent tube. Staple the top of the curtain material funnel to the bat opening. This trap works on the principle that bats must drop out of the opening far enough to spread their wings before flying. The galvanized dryer vent tube is too slippery for bats to climb and too narrow for them to fly through. Bats fall down the funnel, through the dryer pipe, and into the plastic garbage bag where they can be transported some distance away and released.

Constructing Artificial Roosts

Bats that are displaced or excluded from buildings will be attracted to artificial roosts if they are properly constructed and located. Increasing numbers of people are building artificial bat roosts to attract and watch bats. With artificial roosts,

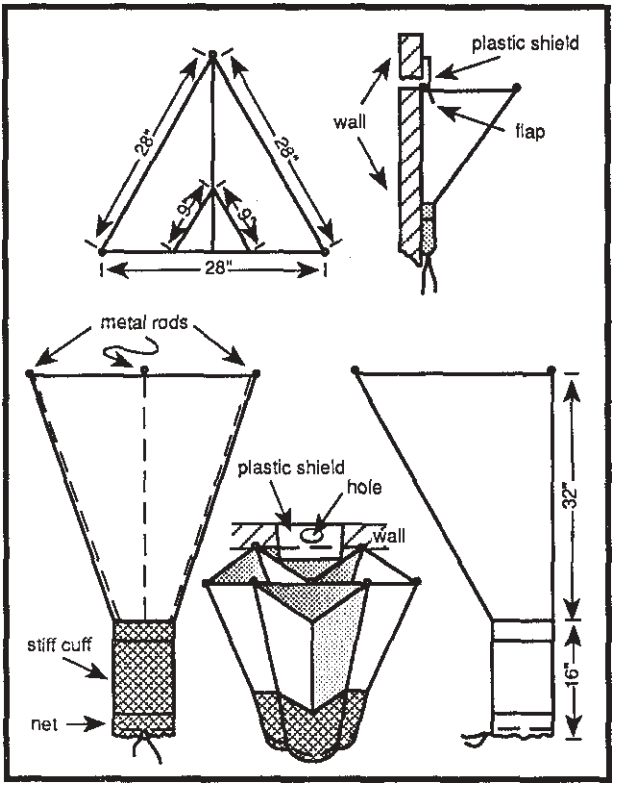

Figure 5. Specifications for constructing and locating a hopper trap to catch bats.

one can enjoy the advantages of having bats without trying to exclude them from the attic. Plans for constructing artificial bat roosts are available from the non-game mammal biologists, Wyoming Game and Fish Department, 260 Buena Vista Drive, Lander, Wyoming 82520 or the Rangeland Habitat Extension Specialist, Department of Renewable Resources, University of Wyoming, Laramie, 82071. Additional information on bat conservation, public health issues, and suggestions for building bat houses is available from Bat Conservation International, PO Box 162603, Austin, Texas 78716

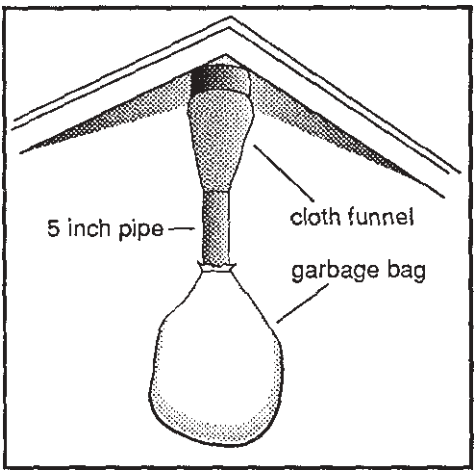

Figure 6. Diagram of a simple, effective bat trap made from sheer curtain material, a piece of galvanized dryer vent pipe, and a plastic garbage bag.

Summary

Unwarranted fears, misconceptions, and emotional apprehension have resulted in declining bat populations over the past 20 years due to relentless and unjustified persecution by humans.

Increased use of insecticides has contributed to further declines in bat populations through ingesting of contaminated insects and reduction of insect populations, a major food source in the bat diet. Additionally, thousands of bats die each year when people disturb maternity or hibernation roosts in caves, mines, buildings, or trees. Better public information and education programs on bat conservation are needed including the use of safe, non-lethal methods to manage problem bats. Lethal approaches to bat management will not permanently control bat problems and will only destroy an ecologically valuable wild animal. The best and only long-term solution to managing bat problems is through bat-proofing or exclusion techniques.

Appendix A. Common, Uncommon, and Rare Bats of Wyoming

Common Bats:

1. Little brown bat (*Myotis lucifugus*) – A brown, mouse-sized bat; very common throughout Wyoming, frequent resident of attics in old buildings; most probably migrates south for winter and hibernates in caves or other retreat areas.

2. Small-footed bat (*Myotis ciliolabrum*) – Smallest of the *Myotis* species; distinguished by having long, silky yellowish fur, black ears, and distinct black mask across face; common across Wyoming; found in caves, mine tunnels, rock crevices, and buildings.

3. Big brown bat (*Eptesicus fuscus*) – A large bat, almost twice the size of the little brown bat; brown to dark brown, with black membranes; large size and color distinguishes this species from others; one of the most common and widely distributed bats in North America, including Wyoming; found in caves, tunnels, crevices, hollow trees, buildings, and wooded areas; roosts singly or in small clusters; some migrate, others winter (hibernate) in Wyoming; common in buildings over winter.

4. Long-legged bat (*Myotis volans*) – Slightly larger than the little brown bat; distinguished from other species of *Myotis* by short rounded ears, large feet, well-developed keel on calcar, presence of hair on the underarm and femoral membrane of the elbow and knee; common across Wyoming; found in buildings and crevices in rock ledges; migration and hibernation habits unknown.

Uncommon bats

1. Long-eared bat (*Myotis evotis*) – Similar in size to the little brown bat; pale brown color; distinguished from other species by light body color and large black ears which extend beyond nose when flattened forward against the head; occasionally common in localized areas; found in thinly forested areas, buildings, trees, occasionally caves. NOTE: Keen's Myotis's ears also extend beyond the nose.

2. Townsend's big-eared bat (*Plecotus townsendii*) – Smaller than the big brown bat but larger than the little brown bat; fur is clove-brown in color, extremely large ears (over 1 inch long) joined across forehead, two prominent bumps on nose in front of eyes, tail membrane naked; widely distributed in western U. S. but uncommon in Wyoming; found in caves, mine tunnels, and buildings for roosts; colonial in nurseries and hibernation, solitary part of the year, hangs in tight clusters; probably migrates south for winter.

3. Silver-haired bat (*Lasionycteris noctivagans*) – Slightly larger than the little brown bat but noticeably smaller than the big brown bat; fur is blackish-brown with white-tipped hairs, distinguished from all other species by this feature; not as common in Wyoming as other species; found around forested areas in buildings and caves; migrates south and hibernates over winter.

4. Hoary bat (*Lasiurus cinereus*) – Larger than the big brown bat and about twice the weight; fur color is yellowish brown to mahogany brown with white-tipped hairs, throat buffy, tail membrane heavily furred on top to edges, ears rounded; widely distributed across North America but uncommon in Wyoming; prefers wooded areas, commonly hangs in trees; migrates south in fall.

Rare Bats

1. Keen's bat (*Myotis keenii*) – Similar in size and appearance to the little brown bat except ears extend beyond nose when flattened forward against head, and the tragus is thick and long compared to a short and rounded tragus on the little brown bat; dark brown color; rare in Wyoming and then only in eastern tier of counties; found in caves, buildings hollow trees, mine tunnels; may spend winter in hibernation in Wyoming, seasonal habits unknown.

2. Fringed bat (*Myotis thysanodes*) – Slightly smaller than the little brown bat; buffy brown in color; distinguished by presence of a conspicuous fringe of stiff hairs along the free edge of the tail membrane, relatively large ears; rare in Wyoming with main distribution west and southwest of Wyoming; found in caves an attics of old buildings; seasonal habits unknown.

3. Pallid bat (*Antrozous palllidus*) – A large bat about the size of the hoary bat; fur is yellowish drab in color; distinguished by large ears like the Townsend's bat (over 1 inch long) except ears are not joined across the forehead; rare in Wyoming with main distribution south and west of Wyoming, specimens have been collected in Wyoming from the Flaming Gorge, Torrington, and Big Horn Basin areas; found in caves, mine tunnels, rock crevices, buildings, and trees for roosting, night roosting areas are different from day roosting areas; migration and hibernation habits unknown. This is the only Wyoming species that forages almost entirely on the ground.

4. Red bat (*Lasiurus borealis*) – Slightly smaller than the big brown bat; brick-red to rusty-red fur with white-tipped hairs; tail membrane fully furred; very rare in Wyoming, only two collected in the state; found in wooded areas,

normally roosting in trees; migrates south in the fall to hibernate.

5. Spotted bat (*Euderma maculatum*) – Very rare species in North America and Wyoming, only one specimen collected from Big Horn County, considered for listing as a threatened species for the Federal Endangered Species Act; distinguished by huge ears, white spot on the rump and another on each shoulder, the only bat with these contrasting colors; found in arid country, occasionally entering buildings and caves; migration and hibernation habits unknown. The echo-location call of this species is one of the few audible to the human ear.

6. California myotis (*Myotis californicus*) – One of the smaller "mouse-eared" bats, less than 4 inches long at maturity; color varies from light buff to rich brown; rare in Wyoming although recent specimens have been collected in the Big Horn Canyon and Powell areas; found in crevices of rock-walled canyons in lowland areas from desert to juniper woodlands; migration and hibernation habits unknown.

7. Yuma myotis (*Myotis yumanensis*) – Another smaller bat less than 4 inches long at maturity; light tan to dark brown, the underparts whitish to buffy in color, membranes are darker than the body; rare in Wyoming, recent specimens collected from the Sheridan area; more closely associated with water (streams, wetlands, or lakes) than any other Wyoming bat, feeds almost exclusively just above the water surface; found in caves, tunnels, or buildings near open water; migration and hibernation habits unknown.

8. Brazilian free-tailed bat (*Tadarida brasiliensis*) – Small, with uniform chocolate brown, short velvety fur, dark

brown membranes; long narrow wings, the lower half of the tail free from the tail membrane, face and ears sparsely haired, ears almost meet at the midline but are not joined and have a series of wart like structures on the anterior rims, upper lips are wrinkled; common in the southwest but rare in Wyoming, only one specimen documented from Laramie County; the only true colonial species of bat in Wyoming; roosts in caves and buildings; migrates south for the winter.

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Figure 4: Courtesy of A. M. Greenhall

Figure 5: Courtesy of A. M. Greenhall

Figure 6: Courtesy of The Old House Journal adapted by Jill Sack Johnson.

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