

A PRODUCT OF THE WHITE-NOSE SYNDROME NATIONAL PLAN

Acceptable Management Practices For Bat Control Activities In Structures

A Guide for Nuisance Wildlife Control Operators

White-Nose Syndrome Conservation and Recovery Working Group

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Tailored and Revised by Pennsylvania Game Commission for State-Specific Information

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Minimum Acceptable Practices for Managing Bats in Structures

The purpose of this document is to provide minimum and consistent acceptable practices for nuisance wildlife control operators (NWCs), as well as homeowners, to reduce impacts on White-nose Syndrome (WNS)-affected or susceptible species and populations during bat control or removal activities in structures. These national guidelines were developed in response to recent catastrophic declines and changes to protective status in bat species due to WNS, but are recommended for use with all structure-dwelling bat species, regardless of their conservation or imperiled status. Because several of the bat species known to occupy human structures are state or federally listed species, these protocols provide NWCs and landowners a federally approved method that does not violate the Endangered Species Act and does not require species verification by a federally-approved bat contractor prior to performing any work as described within this document. **These guidelines here were tailored for use in Pennsylvania by the Pennsylvania Game Commission.**

Nuisance wildlife control operators regularly interface with the public and are an integral voice for bat conservation. NWCs are also an important resource for information on the size and geographical distribution of bat colonies and are thus encouraged to communicate with their [state biologists](#) to aid in management decisions, regardless of whether a colony is being evicted from a structure or not. State biologists, in turn, can provide additional resources and information on bats to homeowners and cooperating NWCs. In Pennsylvania, please contact Mike Scafani (mscafani@pa.gov) or Greg Turner (gturner@pa.gov) for specific questions, assistance, or to report large colonies that may improve our overall management of the species.

This document is designed to provide minimum practices for safely addressing human-bat conflicts, while minimizing disturbance to bats and promoting the stabilization and recovery of these highly impacted species. General background information is included on the significance of, threats to, and biology and behavior of bats in order to illustrate the context and justification for these standards. Please contact your [state wildlife agency](#) to determine if there are specific details about time-of-year restrictions, regulations, threatened and endangered species laws, and/or permits in the state where you conduct work.

Helpful Definitions:

- *Eviction/venting* refers to the use of one-way doors and exits to remove bats from a structure using their natural tendency to leave the roost at night.
- *Exclusion* refers to closing gaps and sealing holes to prevent bats from entering or re-entering a structure.

Significance of bats

A great deal of misinformation exists about bats. NWCOS have an opportunity to educate their clients on the significance of bats to humans and the environment, while dispelling common myths. The following talking points may be useful. *More resources can be found in **Appendix B**.*

- Bats have inspired scientific advancements for humans including navigational aids for the blind, blood-clot medications, low-temperature surgery, and military sonar.
- Bats play a significant role in our economy and ecosystem. Most bat species in the United States eat insects, including those insects that are agricultural, forest, and disease-spreading pests. During the summer a typical bat can eat half its body weight in insects each night. This has been estimated to be around 4,500 insects per night, or just under 1,000,000 insects per year for each adult bat.

Bat Myths and Truths

- Although bats (like other mammals) can contract rabies, the naturally occurring infection rate has been documented at 0.1-1.5% in common structure-dwelling species (Trimarchi, 1977) (Pybus, 1986). Even among sick-acting bats or those submitted for rabies exposure, the infection rate in the US and Canada has been reported at only 4.6-8.6% (Burnett, 1989) (Prins, 1988) (Rosatte, 1985).
- Bats are not rodents. In fact, unlike rodents, bats can live more than 30 years and most species produce only one or two young per year. Therefore, drastic population declines such as those caused by WNS are very difficult for bats to recover from.

Threats to Bats

Bats are faced with a variety of threats including habitat loss (e.g. loss of roost structures and foraging areas), pesticide use, and outright persecution by people. However, the most significant threat to hibernating North American bats in recent years is from a disease called White-nose Syndrome, first documented in 2007.

- WNS is named for the white fungus observed growing around the noses of affected bats (Blehert, 2008). This aggressive fungus attacks the exposed skin of bats while they hibernate, resulting in dehydration, unrest, and increased activity (Lorch, 2011) (Reeder, 2007).
- Affected bats quickly burn through stored energy and often die in the caves and mines where they hibernate, or out on the landscape (Turner, 2011).
- Since its discovery, WNS or the causative fungus (*Pseudogymnoascus destructans*) has been confirmed in 32 states and 5 Canadian provinces.
- Over 5.7 million bats have died as a result of this disease, which continues to spread (USFWS, 2012).
- Despite significant advances in understanding this deadly disease, much remains unknown about WNS, its spread, and the long-term consequences of losing significant numbers of bats.

- Federal and state agencies, as well as universities and private organizations, are working together to track and understand WNS. There is no evidence to suggest that WNS has any effect on humans.
- As a result of the drastic population declines caused by WNS, it has become increasingly important to reduce other sources of bat mortality.
- Aggregations of bats in human structures are almost exclusively females and their young. With few survivors due to WNS, negative impacts to those survivors or their young may significantly alter the rate of recovery.
- **NWCOs have an opportunity to contribute to the conservation of our remaining bats by following simple guidelines for dealing with bats encountered in structures.**

Bat Biology and Behavior:

For the purposes of this document, the following life history information pertains to hibernating bat species due to their susceptibility to WNS. Other types of bats, such as migratory species, may have differing life-histories but may also utilize structures.

The typical life-cycle for hibernating bat species includes an over-winter period of hibernation to conserve energy while temperatures are cold and food sources scarce, a spring emergence period when bats migrate to summer foraging and roosting areas, a summer maternity period when females gather in groups of up to hundreds or thousands to grow and raise young (males return to summer foraging areas but may be more transient and in much smaller groups), and a fall swarm period when bats gather at hibernation sites to breed and find shelter for the winter. These species use delayed fertilization and pregnancy is not initiated until the following spring (Whitaker, 1998).

Bats use structures as warm places to roost and raise young during the summer, for temporary shelter (night roosting), and sometimes as hibernation areas during colder months. As a result, they may come into direct contact with people, becoming a nuisance or a health concern.

Species Identification:

There is a great deal of behavioral variability among bat species. NWCOs are encouraged to become familiar with the species most commonly encountered in their area. **Appendix A** includes a list of bat species commonly found in structures, along with their current (2016) federal and state listing status and susceptibility to WNS.

Please contact your state wildlife agency for more information. As NWCOs don't always see bats for accurate species identification, they should err on the side of caution to protect listed species. Authority

to conduct evictions outside of the seasonal restriction time period is an activity that is permitted as it avoids conflicts such as the taking of federally listed species. Typically, there is a single, preferred location that bats use for ingress/egress of structure. Sealing of any secondary, smaller gaps (exclusion) and other preparation work prior to installation of one-way door for eviction may be performed during the seasonal restriction.

Seasonal Restrictions:

Bats emerge from hibernation in the spring. Females gather in maternity colonies to raise their pups (young) over the summer. Bats will return to the same location year after year and, if excluded, may go to an enormous amount of effort to get back into the roost. (Humphry, 1976) Therefore, careful and thorough evictions/venting and exclusions are advised and erecting alternate roost structures nearby (bat houses) is recommended. Most successful attempts to transfer a colony from a structure to a bat house occur over a longer period of time, where bat houses are installed in highly preferred locations close to the colony, and installed months or even a full season or more ahead of eviction. These can be temporary locations close to the main ingress/egress, and then moved during the winter months to a proximate location that is preferred by the landowner.

There is variation by species, but bat pups are generally born in early summer and are unable to fly and feed on their own until mid to late summer. (Whitaker, 1998) Bat-proofing or extermination during the maternity season resulted in the population loss of over 50% of little brown bats within a decade in an extensive study of this species in Indiana (Humphry, 1976). For these reasons, **evictions/venting should not be performed during the maternity season when flightless young are present.** Attempts to evict or exclude bats at this time can result in the death of flightless young (sometimes also resulting in insects and foul odors) as well as increase human/bat interactions as adult bats enter the living space trying to reunite with and rescue their trapped young (potentially increasing the resident's exposure to rabies).

Bats also occasionally hibernate in structures during the winter. At this time, bats don't regularly exit the roost because there is no food source available, so eviction/venting activities may be ineffective and exclusions may result in trapped bats dying inside or increasing contact with landowners. It is recommended that any over-winter work installs 1-way doors that remain in place until the time period in spring when daily bat activity has commenced.

Finally, in northern climates, bats found in buildings during the winter may not survive if released outside in below-freezing temperatures. **Contact your state wildlife agency or local wildlife rehabilitators for help if you encounter this situation.**

Effective Bat Evictions:

The only effective way to permanently get bats out of structures without harm and prevent re-entry is by performing a humane eviction and complete exclusion.

Materials and techniques for conducting bat evictions and exclusions are provided in the Professional Standards of Practice for Structural Management for Wildlife Control Operators, available through the [National Wildlife Control Operators Association](#). Methods that include poisoning, trapping, relocating, or in any other way harming, harassing, or killing bats are illegal in many states and **do not meet the minimum acceptable practices** outlined in this document. They may also result in loss of state-issued permits and fines levied by states.

One-way exit devices allow bats to leave the structure but not re-enter and are an acceptable and effective means of eviction. One-way exit devices must be constructed out of a material that does not have any sharp edges or parts that could damage a bat's wings or any spaces for bats to become tangled in.

Because not all bats will exit every night, one-way exits should be left in place for a **minimum** of five nights, including at least three consecutive nights of weather conducive to bat flight (temperatures above 50 degrees F, winds below 10 mph, and no sustained or heavy rains). If weather conditions are not conducive to bat flight while the devices are in place, the time period should be extended until at least three consecutive good weather nights are achieved. It is recommended that bats are counted as they emerge in evening prior to work to understand the size of the colony, and counted again several nights subsequent to the one-way door being installed. If a sizable number of bats still emerge nightly, watching the dawn return may quickly indicate where the colony has an ingress to the roost that remains and needs addressed. The final inspection watching the vents and not seeing bats emerge will verify none remain in the roost.

Time of Year Restrictions:

Exclusions should not be performed during the maternity season because this can result in the unnecessary death of flightless young and an increase in human-bat contact and rabies exposure when adult bats find their way into living spaces while trying to reunite with their trapped young. Maternity season varies by region and species. **In Pennsylvania, the maternity season is considered to be May 15 through Aug 1.**

In addition to the presence of maternity colonies, some species (the big brown bat in particular) may have portions of the colony overwinter in buildings. **Therefore, exclusions (sealing off exit points) should not be performed during the winter months.** As stated above, it is recommended that any over-winter work installs 1-way doors that remain in place until the time period in spring when daily bat activity has commenced.

Decontamination for WNS:

Spores of the fungus that causes WNS, *Pseudogymnoascus destructans*, can remain on materials and be transported from one location to another. Decontamination protocols should be followed to reduce the risk of transmission of the fungus to other bats and/or locations.

Anything that comes into contact with a bat should be disposed of in the trash or decontaminated according to the most recent national [decontamination protocols](http://whitenosesyndrome.org) available at whitenosesyndrome.org. The most common items that will require disposal or decontamination include cones, tubes, chutes, and mesh that are used to construct one-way doors.

Bat-Proofing the Living Space:

Bat-proofing the living space offers a NWCO the opportunity to temporarily relieve the homeowner's concerns of contact with bats during the maternity season and then schedule an eviction after pups are volant (flying) and able to survive on their own. During the maternity season, or when bats are suspected to be hibernating in the building, the best option for protecting concerned homeowners and public health is to bat-proof the living space, or provide "interior seals". This work consists of locating openings (typically areas where air flows) leading into the living space from attics, garages, walls, or any place that bats are roosting. Entry/exit points can be as small as 5/8-inch round or 3/8-inch wide and 3/4-inch long that open into the living space. Likely openings include:

- Attic hatch doors
- Chimneys
- Fireplaces
- Around piping or plumbing
- Open windows or loose windowsills
- Openings around air conditioners and ducts
- Louver fans
- Screens in disrepair
- Pet doors

Getting a Single Bat out of the Living Space:

Bats may occasionally find their way into a living space, especially during the summer months when young-of-the-year are becoming more independent. This is not necessarily an indication that a bat is rabid. Homeowners are responsible for contacting their physician or health department, or following the Center for Disease Control's guidelines to determine if a rabies exposure has occurred. See **Appendix B** for resources.

If no [rabies exposure](#) has occurred and weather conditions are appropriate (above 40 degrees F, no rain or high winds), a bat found in a living space can be safely removed and released outside. Close doors to contain the bat in one room then wait for the bat to land on wall or other surface. **Gloves** should always be worn for safety and a container such as a kitchen strainer or a clear plastic container with a piece of cardboard slid underneath can be used to safely contain and move the bat. A bat on the ground is vulnerable to predators so it should be placed up off the ground on a window sill or large tree branch, or released from at least 4 feet above the ground. An [illustrated guide to removing a bat from the living space](#) and a [video link](#) can be found in **Appendix B**.

Bat Houses:

Because bats naturally return to the same location year after year (Neilson, 1994), individuals may attempt to reenter the structure they have been excluded from or spend precious time and energy searching for a roost, thereby lowering reproductive output (producing fewer offspring) (Brigham, 1986). Young born earlier in the summer have a significantly higher probability of surviving their first year than those born later in the season (Frick, 2009). Therefore, bat houses and roosting chambers are recommended as alternative housing for displaced bats. Ideally, bat houses should be erected a few months to a year before a scheduled exclusion to give bats time to find and explore the new roosting option, and should be installed as close to the original roost entrance as possible to maximize the likelihood of bats finding the new habitat.

There is no guarantee that bats will use a bat house, but research has shown that bat houses can be successfully occupied during and after an eviction (Kiser, 1999) (Brittingham, 2000). Choosing the proper location, placement, design, color, and materials are all important factors for increased success (Tuttle, 2013). These attributes can vary by species and geographical region. The Pennsylvania Game Commission has spent decades researching suitable designs, and several plans suitable for this region can be found [here](#), and details regarding placement can be found in **Appendix B**.

Landowners interested in improving their property by enhancing natural roosting options such as large diameter trees, can **contact their regional office of the Pennsylvania Game Commission for forest best management practices** that will benefit local bat species.

This document is the product of the multi-agency WNS Conservation and Recovery Working Group established by the National WNS Plan ([A National Plan for Assisting States, Federal Agencies, and Tribes in Managing White-Nose Syndrome in Bats](#), finalized May 2011). Member of the Pennsylvania Game Commission are represented on this working group, and have added some state-specific information. This Minimum Acceptable Practices guidance document will be updated as necessary to include the most current information and guidance available www.whitenosesyndrome.org/NWCO (this is not a live link yet).

Appendix A – Structure-Dwelling Bat Species:

Bat species commonly found in structures, along with their current (2019) federal and state listing status and susceptibility to WNS. Common* indicates the species abundance and distribution prior to WNS, but have become quite rare in post WNS era

Common Name	Scientific Name	Confirmed/Known-Susceptible/Presumed Susceptible	Federal T&E Status (Jan 2014)	State T&E Status (Pennsylvania)
Arizona myotis	<i>Myotis occultus</i>			N/A
Big brown bat	<i>Eptesicus fuscus</i>	Known		common
Big free-tailed bat	<i>Nyctinomops macrotis</i>			N/A
Brazilian free-tailed bat	<i>Tadarida brasiliensis</i>			N/A
Californian myotis	<i>Myotis californicus</i>			N/A
Canyon bat	<i>Parastrellus hesperus</i>			N/A
Tri-colored bat	<i>Perymyotis subflavus</i>	Known		Endangered*
Eastern small-footed bat	<i>Myotis leibii</i>	Known		Threatened
Evening bat	<i>Nycticeus humeralis</i>			Uncommon
Florida bonneted bat	<i>Eumops floridanus</i>		Endangered	N/A
Fringed myotis	<i>Myotis thysanodes</i>			N/A
Greater bonneted	<i>Eumops perotis</i>			N/A
Indiana bat	<i>Myotis sodalis</i>	Known	Endangered	Endangered
Little brown bat/myotis	<i>Myotis lucifugus</i>	Known		Endangered*
Northern long-eared bat	<i>Myotis septentrionalis</i>	Known	Threatened	Endangered
Pallas's mastiff bat	<i>Molossus molossus</i>			N/A
Pallid bat	<i>Antrozous pallidus</i>			N/A
Rafinesque's big-eared bat	<i>Corynorhinus rafinesquii</i>			N/A
Southeastern myotis	<i>Myotis austroriparius</i>			N/A
Townsend's big-eared bat	<i>Corynorhinus townsendii</i>			N/A

Long-eared myotis	<i>Myotis evotis</i>			N/A
Western small-footed bat	<i>Myotis ciliolabrum</i>			N/A
Yuma myotis	<i>Myotis yumanensis</i>			N/A

Appendix B - Resources:

Contact your **state wildlife agency or partners for time of year guidelines** that apply to your geographic area. A list of contacts can be found at: <http://www.whitenosesyndrome.org/partners>

More information about bats:

- Animal Diversity
 - <http://animaldiversity.ummz.umich.edu/accounts/Chiroptera/>
- Bat Conservation International
 - www.batcon.org
 - <http://www.batcon.org/index.php/bats-a-people/bats-in-buildings.html>
- Organization for Bat Conservation
 - <http://www.batconservation.org/>
- US Geological Service
 - <http://www.usgs.gov/>
 - <http://www.npwrc.usgs.gov/resource/mammals/housebat/>
- US Fish and Wildlife Service
 - <http://www.fws.gov/>
 - <http://www.fws.gov/asheville/pdfs/beneficialbats.pdf>
- US Forest Service
 - <http://www.fs.fed.us/>
 - <http://www.fs.fed.us/biology/wildlife/bats.html>
- Save Lucy the Bat
 - <http://savelucythebat.org/>
- Conserve Wildlife NJ
 - <http://www.conservewildlifenj.org/protecting/projects/bat/>

Rabies and other health concerns:

- Your state or local Department of Health
 - http://www.healthguideusa.org/local_health_departments.htm
- Centers for Disease Control
 - <http://www.cdc.gov/rabies/>

Information about White-Nose Syndrome:

- US Fish and Wildlife Service White-nose Syndrome website
 - <http://whitenosesyndrome.org/>
- “Battle for Bats” video:
 - <http://vimeo.com/76705033>
 - Add WQED video here? Other?

Decontamination guidelines:

- <http://whitenosesyndrome.org/topics/decontamination>

General bat eviction/venting and exclusion techniques:

- National Wildlife Control Operators Association bat standards training course
 - http://nwcoa.com/bat_standards.html
- Bat Conservation International
 - <http://www.batcon.org/pdfs/binb/ExcludersGuidelines2014.pdf>
- Others?
- Removing a bat from the living space: Bat Conservation International
 - <http://www.batcon.org/index.php/resources/for-specific-issues/bats-in-buildings/there-s-a-bat-in-my-house>
 - Video: http://www.youtube.com/watch?v=mzax0V0DG_M
- Bat World Sanctuary
 - <http://batworld.org/bat-problems/>

Bat Rehabilitation:

- Link to our National Rehab BMP document when it is done!
 - <http://www.whitenosesyndrome.org/Rehab> (this will be a live link when the document is complete)
- Bat World
 - http://batworld.org/what-to-do-if-you-found_a_bat/
- International Wildlife Rehabilitation Council
 - <http://theiwrc.org/>
- National Wildlife Rehabilitator Association
 - <http://www.nwrawildlife.org/>

Bat house design and placement:

- Pennsylvania Game Commission Designs (Number of bats; life expectancy)
 - 7 chamber aluminum shell (~300 bats; decades)
 - 14-chamber aluminum shell (~600 bats; decades)
 - 7 chamber wooden (~300 bats; ~10 years)
 - 14 chamber wooden (~600 bats; ~10 years)
- Bat Conservation International
 - <http://www.batcon.org/index.php/resources/getting-involved/install-a-bat-house>
- Organization for Bat Conservation
 - <http://www.batconservation.org/bat-houses>
- Bat Conservation and Management
 - <http://www.batmanagement.com/Batcentral/batcentral.html>
- Bat World
 - <http://batworld.org/bat-house-information/>

References

- Bleher, D. S.-Z. (2008). Bat White-Nose Syndrome: An Emerging Fungal Pathogen? *Science Express*, 1-8. doi:10.1126/science.1163874
- Brigham, R. M. (1986). Canadian Journal of Zoology. *The influence of roost closure on the roosting and foraging behaviour of Eptesicus fuscus (Chiroptera: Vespertilionidae)*, 64, 1128-1133.
- Brittingham, M. C. (2000). Bat boxes as alternative roosts for displaced bat maternity colonies. *Wildlife Society Bulletin*, 28, 197-207.
- Burnett, C. D. (1989). Bat rabies in Illinois: 1965-1986. *Journal of Wildlife Diseases*, 25, 10-19.
- Frick, W. F. (2009). Influence of climate and reproductive timing on demography of little brown myotis, *Myotis lucifugus*. *Journal of Animal Ecology*, 1-9.
- Humphry, S. R. (1976). Population ecology of the little brown bat, *Myotis lucifugus*, in Indiana and North-Central Kentucky. *The American Society of Mammalogists Special Publications*, 1-81.
- Kiser, M. a. (1999). Bat houses and exclusions in British Columbia. *Bat House Researcher*, 7, 3-4.
- Lorch, J. M. (2011). Experimental infection of bats with *Geomyces destructans* causes white-nose syndrome. *Nature*, 1-4. doi:10.1038/nature10590
- Neilson, A. L. (1994). Responses of little brown myotis to exclusion and to bat houses. *Wildlife Society Bulletin*, 22, 8-14.
- Prins, B. a. (1988). Rabies in British Columbia 1971-1985. *Canadian Veterinary Journal*, 29, 41-44.
- Pybus, M. J. (1986). Rabies in insectivorous bats of western Canada, 1979-1983. *Journal of Wildlife Diseases*, 22, 307-313.

Reeder, D. M. (2007). Frequent arousal from hibernation and low pre-hibernation body mass explain mortality in little brown bats (*Myotis lucifugus*) with white-nose syndrome. *PLoS ONE*, 7, 1-10.

Rosatte, R. C. (1985). Bat Rabies in Alberta 1979-1982. *Canadian Veterinary Journal*, 26, 81-85.

Trimarchi, C. V. (1977). Naturally occurring rabies virus and neutralizing antibody in two species of insectivorous bats of New York state. *Journal of Wildlife Diseases*, 13, 366-369.

Turner, G. G. (2011). A five-year assessment of mortality and geographic spread of white-nose syndrome in North American bats and a look to the future. *Bat Research News*, 52, 13-27.

Tuttle, M. D. (2013). *The bat house builder's handbook*. Austin: Bat Conservation International.

Whitaker, J. O. (1998). *Mammals of the Eastern United States*. Ithaca: Comstock Publishing Associates.